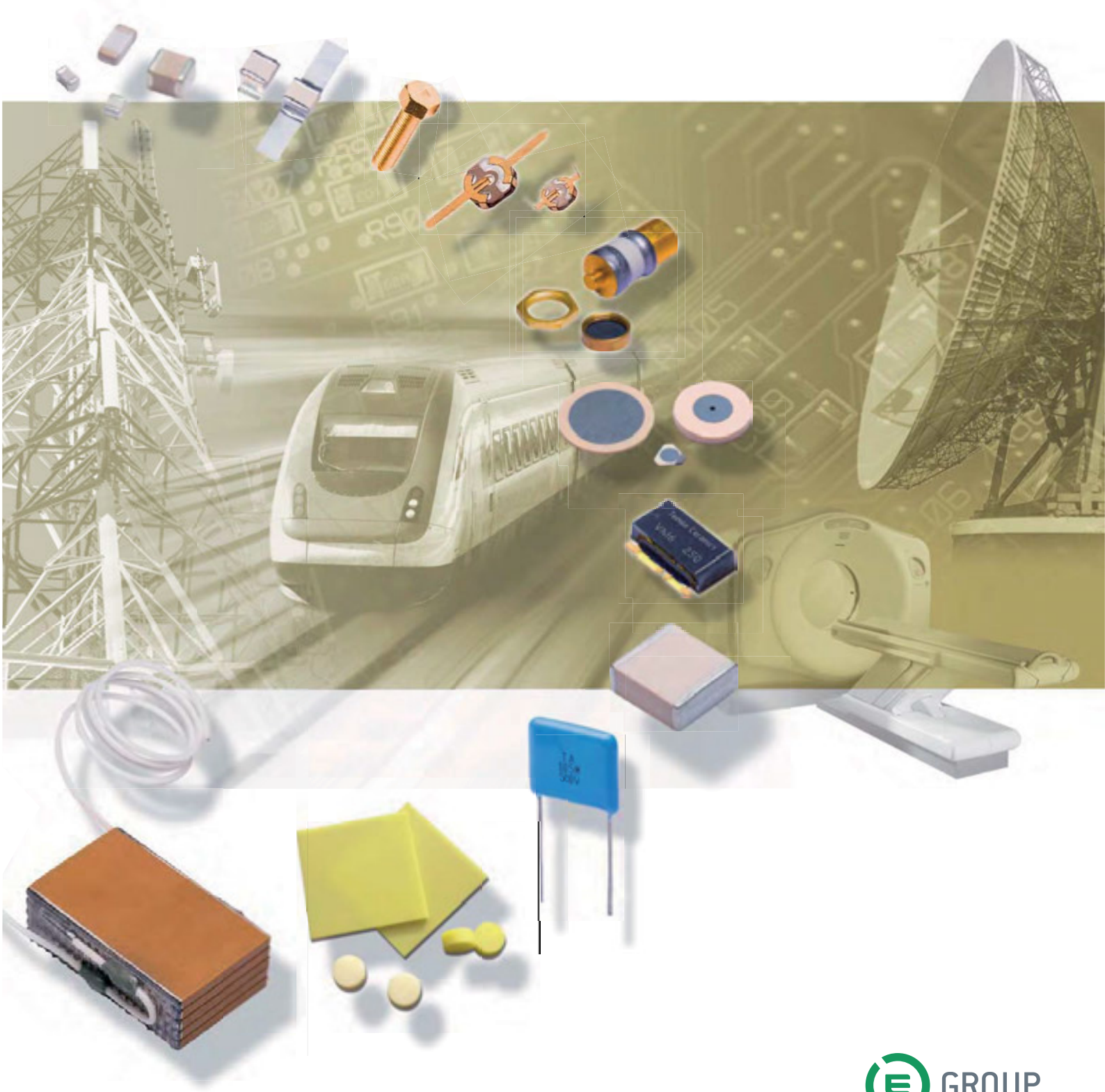
Microwave Components

Ceramic Capacitors, Materials & Tuning Components



GROUP

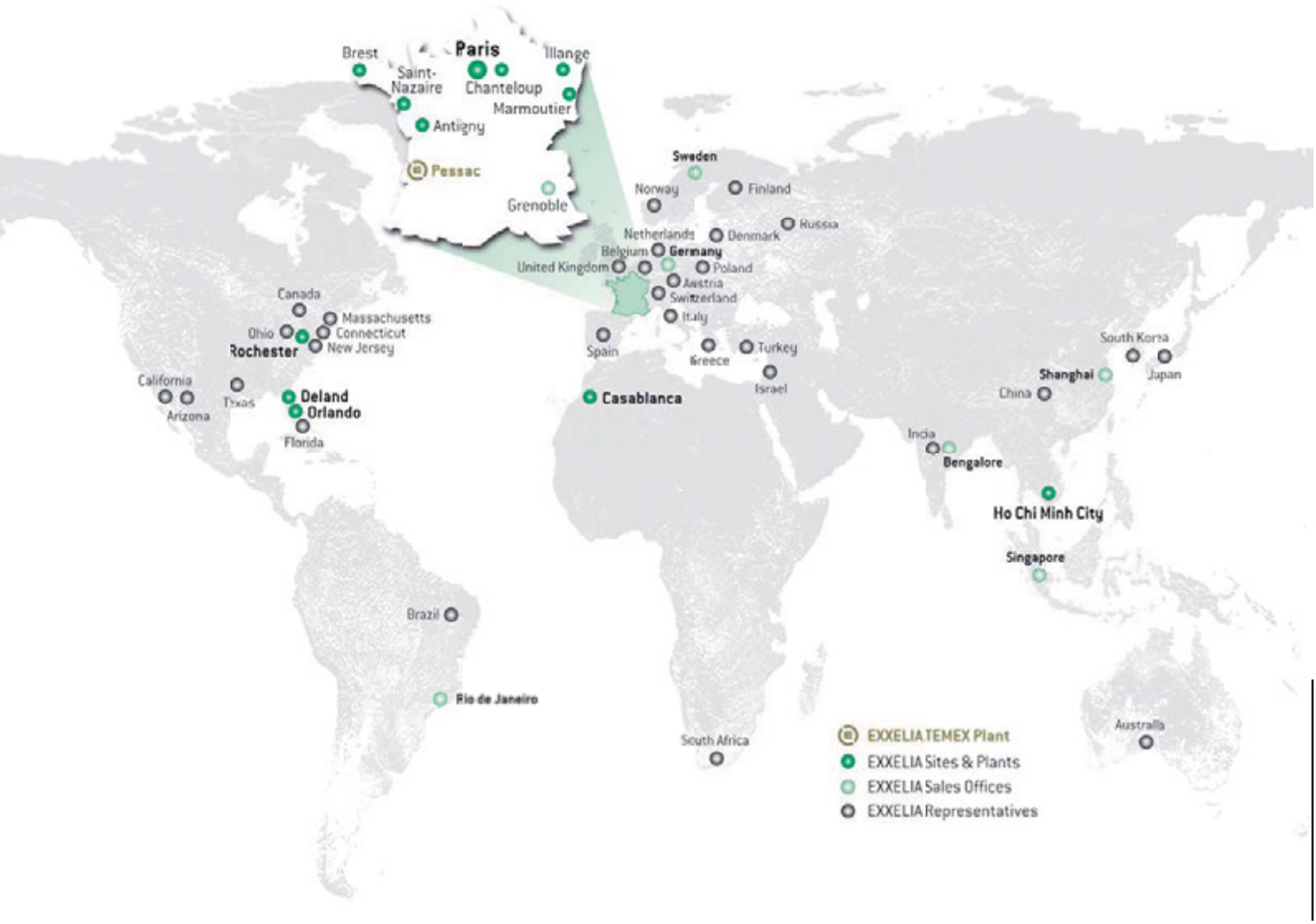
EXXELIA

Microwave Components

Ceramic Capacitors, Materials & Tuning Components

EXXELIA TEMEX

A Worldwide presence



SUMMARY

RF & Microwave Capacitors

Ceramic Capacitors

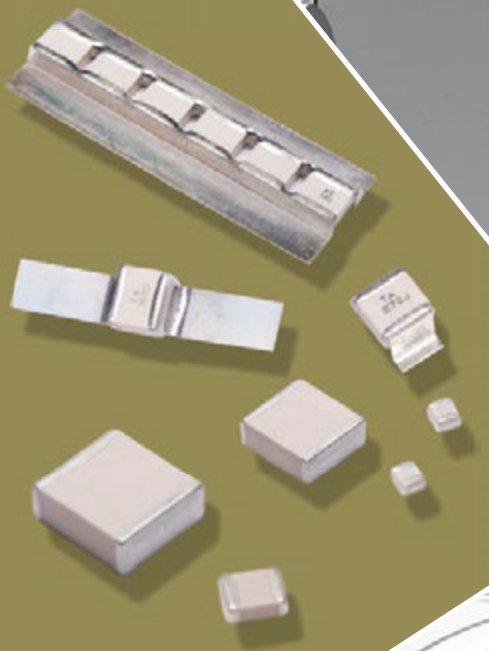
Voltage Multipliers

Ceramic Materials

Frequency Tuning Components

RF & MICROWAVE CAPACITORS

HiQ Series, High Power & RF Power, low ESR, low ESL



EXXELIA TEMEX

CLASSIC - HiQ SERIES, LOW ESR
RF & MICROWAVE CAPACITORS

RoHS COMPLIANT

Description

Low ESR, Ultra High-Q
Highest working voltage in class - 1'500V
Porcelain Capacitors
Laser Marked (optional)
High Self-Resonance Frequencies

Applications

- Cellular Base Station Amplifiers
- Industrial
- Medical (MRI)
- Scientific

Circuit applications

- DC to RF Conversion
- Matching Networks
- Tuning, Coupling and DC Blocking

I. Electrical Specifications

Parameter	Value
Capacitance	0.1 to 1'000 pF
Tolerances	B, C, D below 10 pF (A up to 3.3pF) F, G, J, K above 10 pF
Working Voltage (WVDC)	see Capacitance Value chart
Temperature Coefficient	100 +/-30ppm/°C, -55°C to +125°C
Insulation Resistance	10^6 MΩ min
Dielectric Withstanding (test voltage applied for 5 seconds)	2.5 x WVDC for WVDC ≤ 500V 1.5 x WVDC for WVDC > 500V
Aging	none
Piezo Effects	none

NB: the temperature range for the CHB up to 100pF is upgraded from +125°C to +175°C.

II. Mechanical specifications

Parameter	Value	Comment
Case Size	A B	0505 1111

For each case size, the recommended terminations are listed below.

NB:
- all the terminations are backward compatible and lead-free.
- the non-magnetic terminations are all Magnetism-free Rated.

MR certified®

ITAR Free®

Termination Type	Code	CHA	CHB
Standard (tin-plated nickel)	S	**AVAILABLE**	**AVAILABLE**
Non-magnetic (tin-plated copper)	C	**AVAILABLE**	**AVAILABLE**

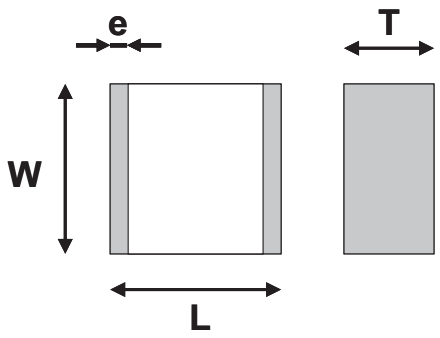
RoHS COMPLIANT

III. Environmental specifications

Parameter	Value
Life Test	2'000 hours, +125°C at 2.0 x WVDC (standard WVDC range) And CHB up to 100pF : 1'000 hours, +175°C at 500V
Moisture Resistance Test 1	240 hours, 85% relative humidity at +85°C (ESA/SCC n°3009)
Moisture Resistance Test 2	56 days, 93% relative humidity at +40°C 0V, 5V, WVDC

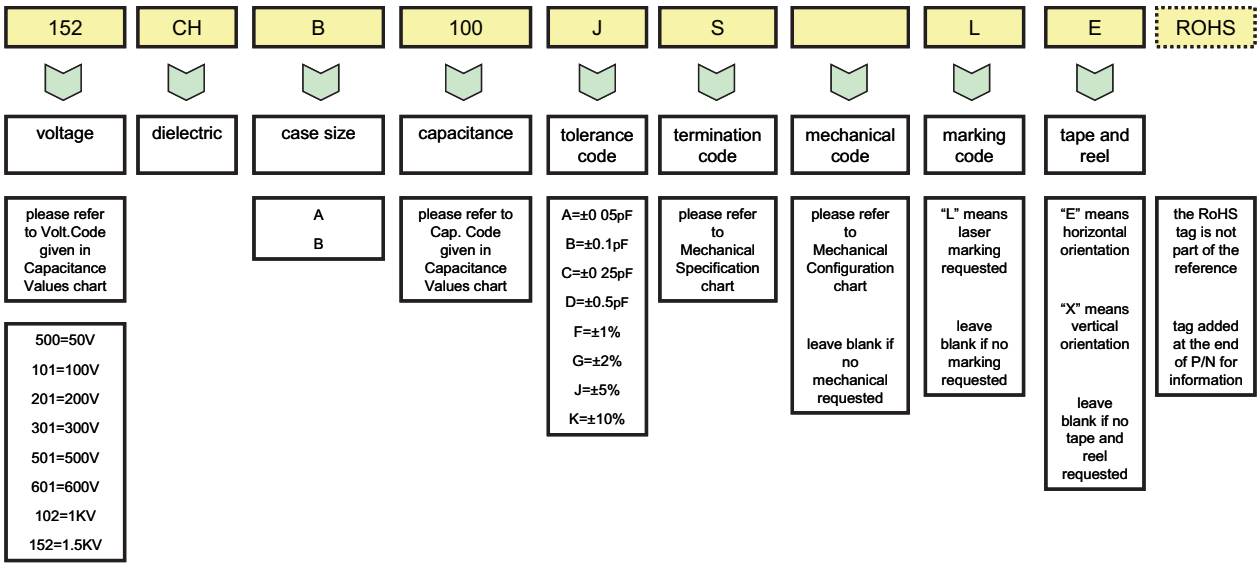
IV. Outline dimensions

Parameter	A (0505)	B (1111)
Length (L)	1.40 ±0.25mm	2.80 ±0.40mm
Width (W)	1.40 ±0.25mm	2.80 ±0.40mm
Thickness (T)	1.40 mm (max.)	2.60 mm (max.)
End-Band (e)	0.25 ±0.15mm	0.40 ±0.25mm



RoHS COMPLIANT

V. How to order



NB:

- For capacitance values lower than 10pF, tolerances B, C and D apply and A Tolerance also applies for :
  A case for capacitance values lower or equal to 4,7pF.
  B case for capacitance values lower or equal to 3.3pF.

- For capacitance values equal to or higher than 10pF, tolerances F, G, J, K and M apply.

Please consult us for specific requirements.

VI. Tape and Reel

The following chart gives the standard number of components per reel.

	CHA	CHB
Parts per Reel	3'000	1'000

RoHS COMPLIANT

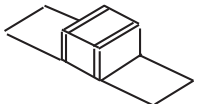
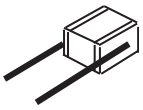
VII. Capacitance values

Value (pF)	Cap. Code	A (0505)	B (1111)		Value (pF)	Cap. Code	A (0505)	B (1111)	
			Standard	Extended				Standard	Extended
0,1	0R1	250V	500V	1500V	18	180	250V	500V	1500V
0,2	0R2				20	200			
0,3	0R3				22	220			
0,4	0R4				24	240			
0,5	0R5				27	270			
0,6	0R6				30	300			
0,7	0R7				33	330			
0,8	0R8				36	360			
0,9	0R9				39	390			
1,0	1R0				43	430			
1,1	1R1				47	470			
1,2	1R2				51	510	200V		
1,3	1R3				56	560			
1,4	1R4				62	620			
1,5	1R5				68	680			
1,6	1R6				75	750			
1,7	1R7				82	820			
1,8	1R8				91	910			
1,9	1R9				100	101			
2,0	2R0				110	111			
2,1	2R1				120	121		300V	1000V
2,2	2R2				130	131			
2,4	2R4				150	151			
2,7	2R7				160	161			
3,0	3R0				180	181			
3,3	3R3				200	201			
3,6	3R6				220	221			
3,9	3R9				240	241		200V	600V
4,3	4R3				270	271			
4,7	4R7				300	301			
5,1	5R1				330	331			
5,6	5R6				360	361			
6,2	6R2				390	391			
6,8	6R8				430	431			
7,5	7R5				470	471			
8,2	8R2				510	511		100V	300V
9,1	9R1				560	561			
10	100				620	621			
11	110				680	681		50V	
12	120				750	751			
13	130				820	821			
15	150				910	911			
16	160				1 000	102			

NB: special values, tolerances, higher WVDC and matching available, please consult factory. Dielectric withstanding test is done at 1.8 x WVDC for Extended Range values ≥ 820pF.

VIII. Mechanical Configurations

Lead/Ribbon and Wire Types

Configuration Type	Code	Description
	1	Micro-strip Ribbon
	6	Radial Wire

NB: when coding ribbons or wires for the description of the part, the termination has to be mentioned for $MR_{certified}$ types to ensure that only non-magnetic materials are used.

Examples: 501 CHB 470 J1L — any termination material could be used
501 CHB 470 JC1L — only non-magnetic termination materials could be used

For other specific configuration, please ask our factory.
Lead/Ribbon and Wire Matrix

Termination Type	Code	CHA	CHB
Micro-strip Ribbon	1		**AVAILABLE**(2)
Radial Wire	6		**AVAILABLE**(1)

(1) values 0R1, 0R2 and 0R3 non available with this termination. Non ROHS terminations.
(2) value 0R1 non available with this termination

Lead/Ribbon and Wire Dimensions

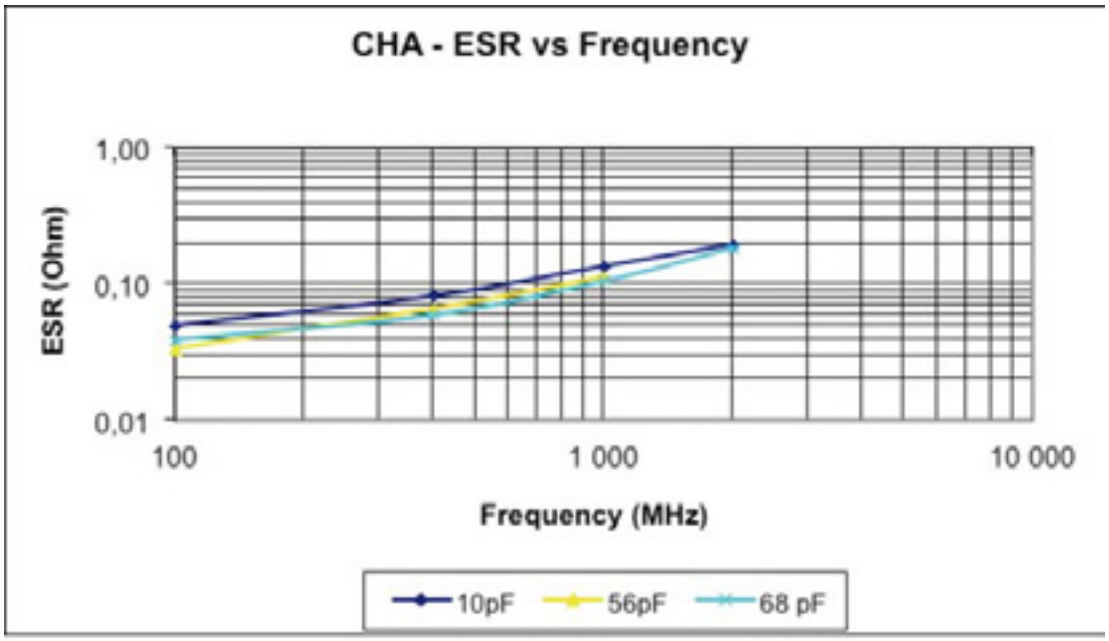
Within each cell, first the length and then the width/diameter of any single ribbon or wire are given.

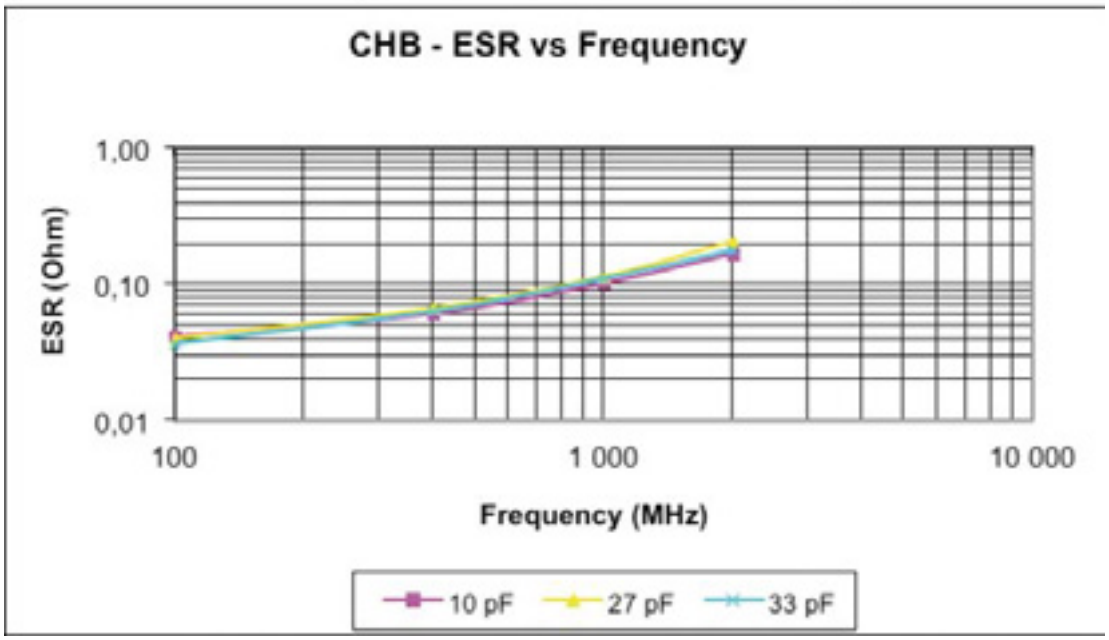
Termination Type	Code	CHA	CHB
Micro-strip Ribbon	1		8.00 2.40
Radial Wire	6		20.00 0.60

NB: dimensions are in mm, length is the minimum value.

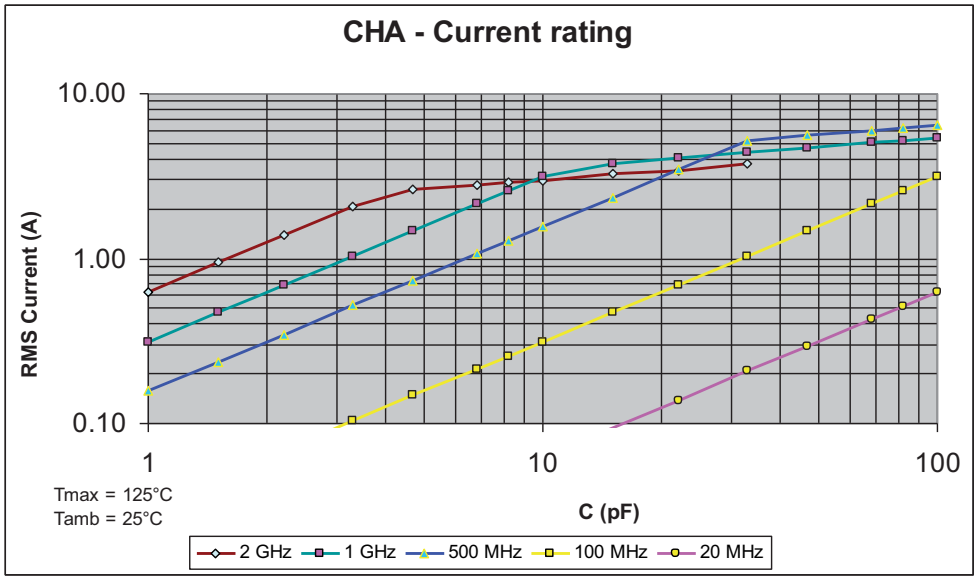
IX. Performance Data

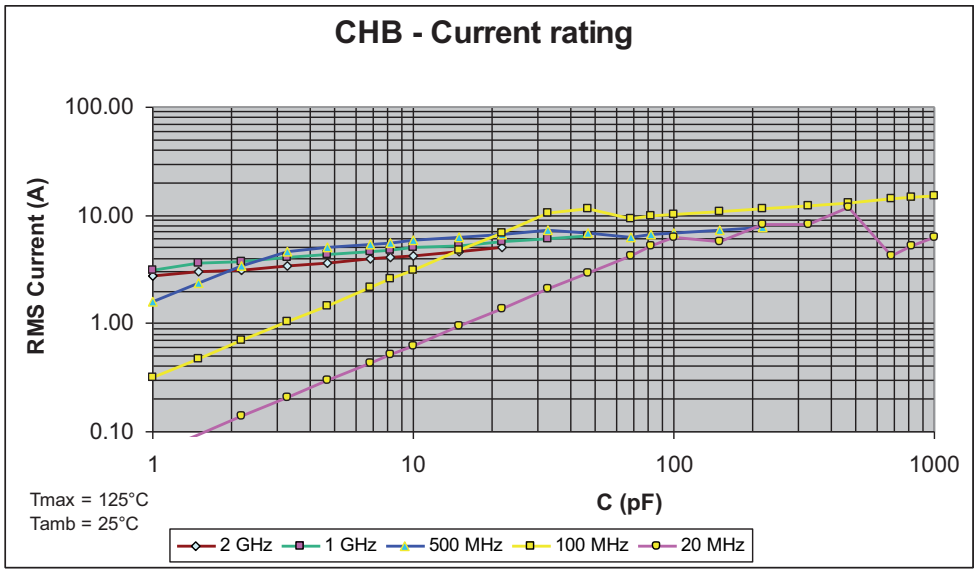
1. ESR



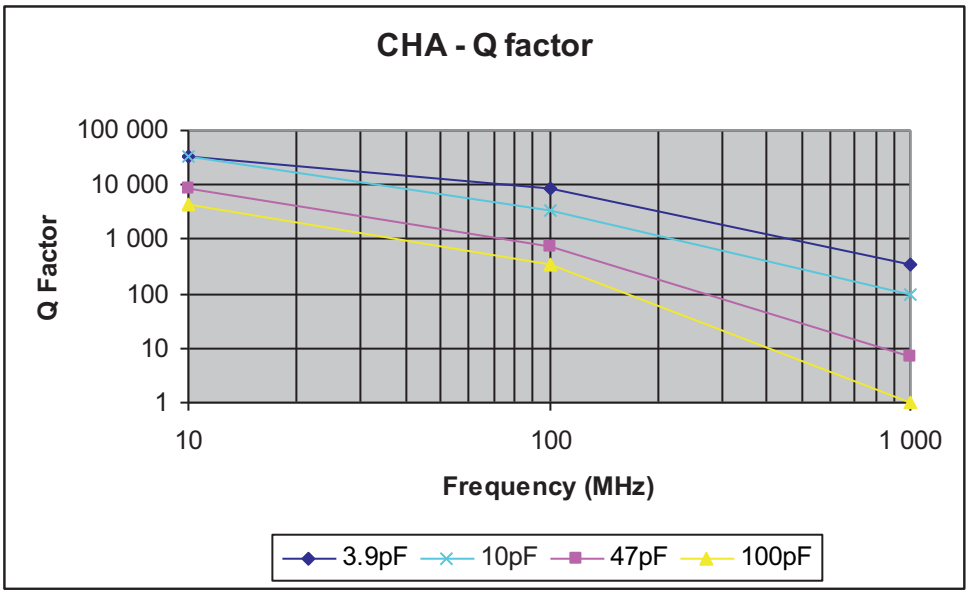


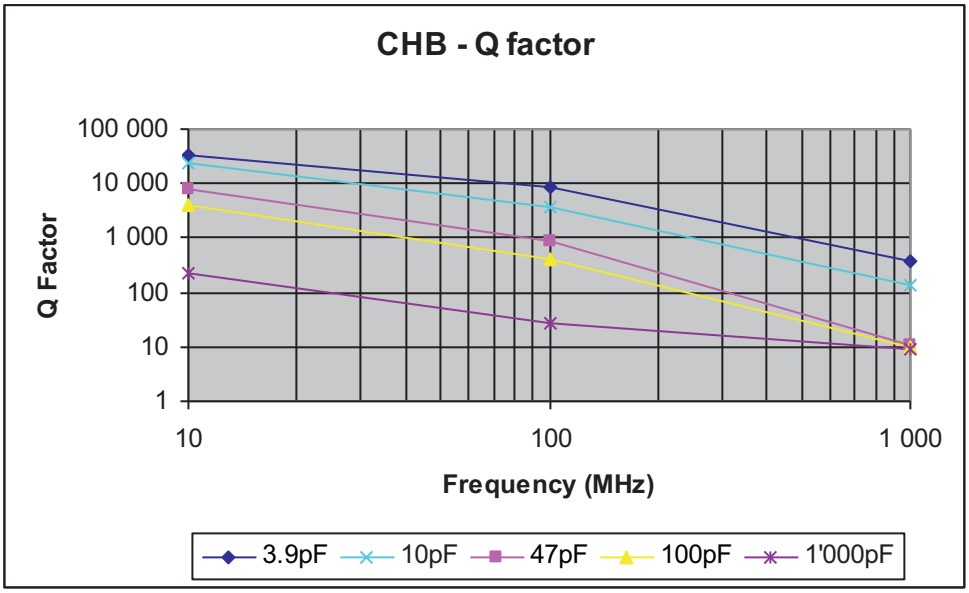
2. Current Rating



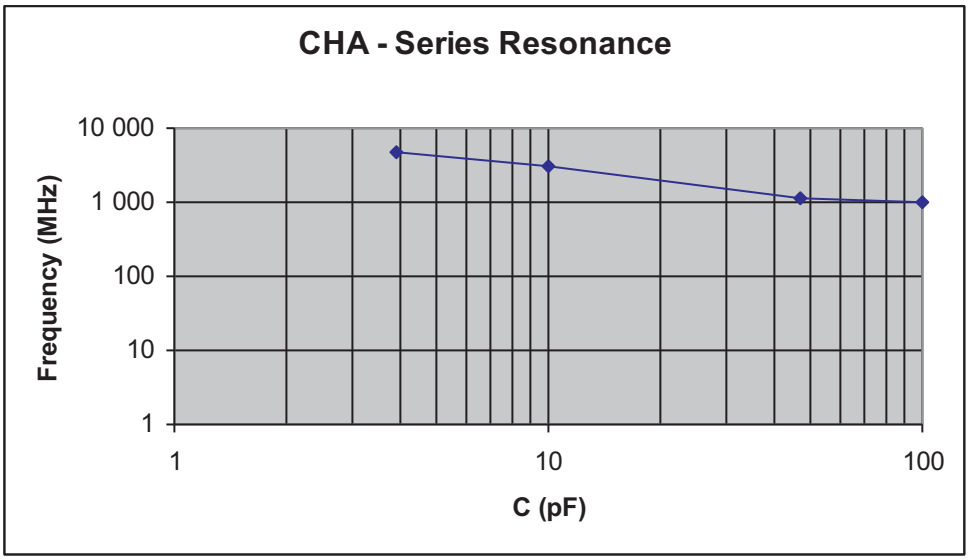


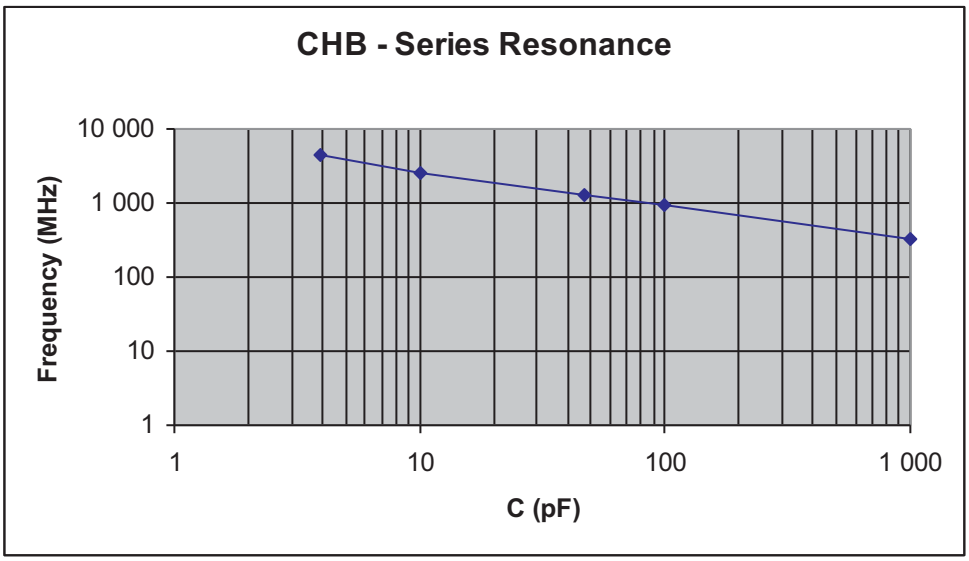
3. Q- Factor





4. Series Resonance Frequency





SUPER-HIQ SERIES
ULTRA LOW ESR, NP0

RF CAPACITORS, ROHS & REACH COMPLIANT

DESCRIPTION

Lowest ESR in class
Highest working voltage in class – 1'500V
Standard EIA sizes
Laser Marked (optional)
High Self Resonance Frequencies

APPLICATIONS

- Cellular Base Station Equipment
- Broadband Wireless Service
- Point to Point/Multipoint Radios
- RF Generators (NMR...)

CIRCUIT APPLICATIONS

- Filter Networks
- Matching Networks
- Tuning, Coupling and DC Blocking

I. Electrical specifications

Parameter	Value
Capacitance	0.2 to 1'000 pF
Tolerances	B, C, D below 10 pF (A up to 3.3pF) F, G, J, K above 10 pF
Working Voltage (WVDC)	see Capacitance Value chart
Temperature Coefficient	0 +/-30ppm/°C, -55°C to +125°C
Insulation Resistance	10^5 MΩ min
Dielectric Withstanding (test voltage applied for 5 seconds)	2.5 x WVDC for WVDC ≤ 500V 1.5 x WVDC for WVDC > 500V
Aging	none
Piezo Effects	none

NB: the temperature range for the SHB up to 100pF is upgraded from +125°C to +175°C.

II. Mechanical specifications

Parameter	Value	Comment
Case Size	L	0402
	A	0505
	S	0603
	F	0805
	N	1206
	T	1210
	B	1111

For each case size, the recommended terminations are listed below.

NB:
- all the terminations are backward compatible and lead-free.
- the non-magnetic terminations are all Magnetism-free Rated.

MR certified®

ITAR Free®

SUPER-HIQ SERIES
ULTRA LOW ESR, NP0

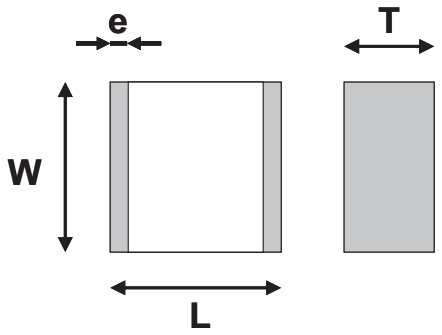
RF CAPACITORS, ROHS & REACH COMPLIANT

Termination Type	Code	SHL	SHS	SHA-SHF SHN-SHT	SHB
Standard (tin-plated nickel)	S	**AVAILABLE**	**AVAILABLE**	**AVAILABLE**	**AVAILABLE**
Non-magnetic (silver-palladium)	A			**AVAILABLE** (1)	
Non-magnetic (tin-plated copper)	C		**AVAILABLE**	**AVAILABLE** for SHA only	**AVAILABLE**

(1): limited range between 0.5pF and 150pF for SHF with silver-palladium terminations. For higher capacitance values, please consult factory.

III. Outline dimensions

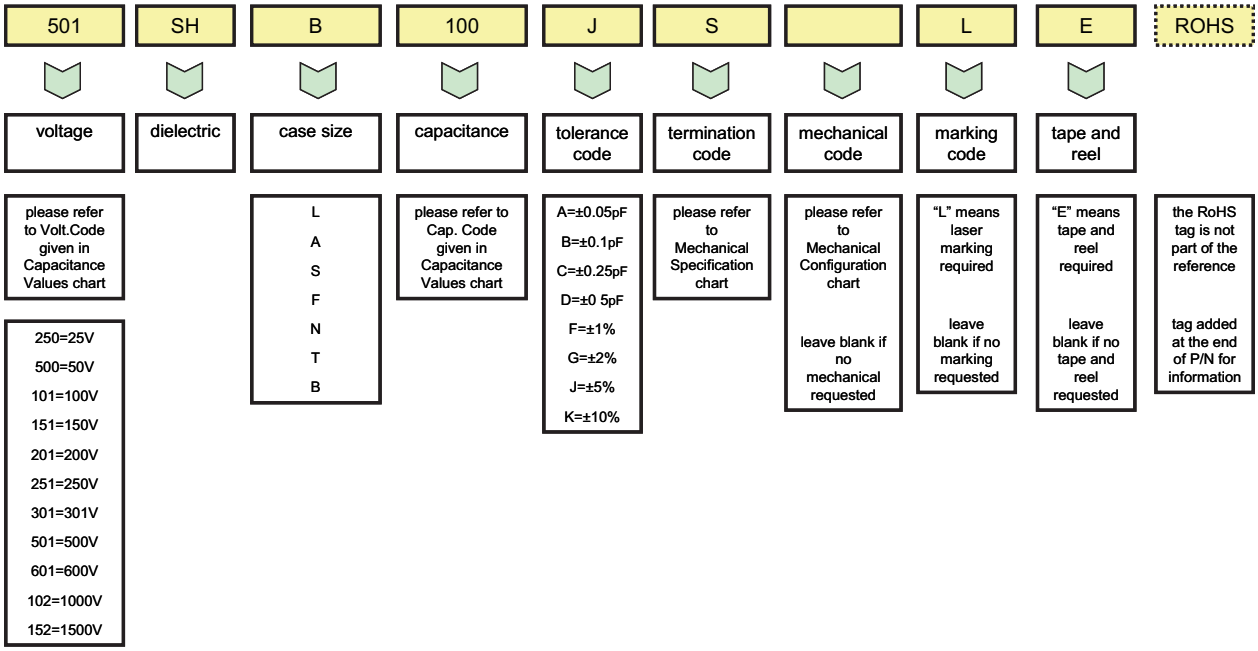
Parameter	L (0402)	A (0505)	S (0603)	F (0805)	N (1206)	T (1210)	B (1111)
Length (L)	1.00 ±0.15mm	1.40 ±0.25mm	1.60 ±0.25mm	2.03 ±0.25mm	3.18 ±0.25mm	3.18 ±0.25mm	2.80 ±0.40mm
Width (W)	0.50 ±0.15mm	1.40 ±0.25mm	0.80 ±0.25mm	1.27 ±0.25mm	1.58 ±0.25mm	2.41 ±0.25mm	2.80 ±0.40mm
Thickness (T)	0.51 mm ±0.1mm	1.40 mm (max.)	0.90 mm (max.)	1.27 mm (max.)	1.27 mm (max.)	1.52 mm (max.)	2.60 mm (max.)
End-Band (e)	0.25 ±0.15mm	0.25 ±0.15mm	0.35 ±0.20mm	0.50 ±0.30mm	0.50 ±0.25mm	0.50 ±0.25mm	0.40 ±0.25mm



IV. Environmental specifications

Parameter	Value
Life Test	2'000 hours, +125°C at 2.0 x WVDC for SHB up to 100pF : 1'000 hours, +175°C at 500V
Moisture Resistance Test 1	240 hours, 85% relative humidity at +85°C (ESA/SCC n°3009)
Moisture Resistance Test 2	56 days, 93% relative humidity at +40°C 0V, 5V, WVDC

V. How to order



NB:

- For capacitance values lower than 10pF, tolerances B, C and D apply and A Tolerance also applies for :
  - L case for capacitance values lower or equal to 1.9pF.
  - A case for capacitance values lower or equal to 4,7pF.
  - S case for capacitance values lower or equal to 9.1pF.
  - F case for capacitance values lower or equal to 2.2pF.
  - N case for capacitance values lower or equal to 1.8pF.
  - B case for capacitance values lower or equal to 3.3pF.

- For capacitance values equal to or higher than 10pF, tolerances F, G, J and K apply.

Please consult us for specific requirements.

- Marking is only available on A and B case sizes.

VI. Tape and Reel

The following chart gives the number of components per reel.

	SHL	SHA	SHS	SHF	SHN	SHT	SHB
Parts per Reel	10'000	3'000	4'000	4'000	3'000	3'000	1'000

SUPER-HIQ SERIES
ULTRA LOW ESR, NP0

RF CAPACITORS, ROHS & REACH COMPLIANT

VII. Capacitance values

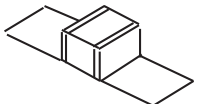
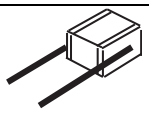
Value (pF)	Cap. Code	A (0505)	B (1111) Standard	B (1111) Extended
0,2	0R2	250V	500V	1500V
0,3	0R3			
0,4	0R4			
0,5	0R5			
0,6	0R6			
0,7	0R7			
0,8	0R8			
0,9	0R9			
1,0	1R0			
1,1	1R1			
1,2	1R2			
1,3	1R3			
1,4	1R4			
1,5	1R5			
1,6	1R6			
1,7	1R7			
1,8	1R8			
1,9	1R9			
2,0	2R0			
2,1	2R1			
2,2	2R2			
2,4	2R4			
2,7	2R7			
3,0	3R0			
3,3	3R3			
3,6	3R6			
3,9	3R9			
4,3	4R3			
4,7	4R7			
5,1	5R1			
5,6	5R6			
6,2	6R2			
6,8	6R8			
7,5	7R5			
8,2	8R2			
9,1	9R1			
10	100			
11	110			
12	120			
15	150			
16	160			
18	180			
20	200			
22	220			
24	240			
27	270			
30	300			
33	330			
36	360	150V		
39	390			
43	430			
47	470			
51	510			
56	560			
62	620			
68	680			
75	750			
82	820			
91	910			
100	101		200V	1000V
110	111			
120	121			
130	131			
150	151			
160	161			
180	181			
200	201			
220	221			
240	241			
270	271			600V
300	301			
330	331			
360	361			
390	391			
430	431			
470	471			
510	511		100V	300V
560	561			
680	681		50V	
750	751			
850	851			
920	921			
1 000	102			

Value (pF)	Cap. Code	L (0402)	S (0603)	F (0805)	N (1206)	T (1210)
0,2	0R2	50V	250V	250V	500V	500V
0,3	0R3					
0,4	0R4					
0,5	0R5					
0,6	0R6					
0,7	0R7					
0,8	0R8					
0,9	0R9					
1,0	1R0					
1,1	1R1					
1,2	1R2					
1,3	1R3					
1,4	1R4					
1,5	1R5					
1,6	1R6					
1,7	1R7					
1,8	1R8					
1,9	1R9					
2,0	2R0					
2,1	2R1					
2,2	2R2					
2,4	2R4					
2,7	2R7					
3,0	3R0					
3,3	3R3					
3,6	3R6					
3,9	3R9					
4,3	4R3					
4,7	4R7					
5,1	5R1					
5,6	5R6					
6,2	6R2					
6,8	6R8					
7,5	7R5					
8,2	8R2					
9,1	9R1					
10	100					
11	110					
12	120					
15	150					
16	160					
18	180					
20	200					
22	220					
24	240					
27	270					
30	300	25V				
33	330					
36	360					
39	390					
43	430					
47	470					
51	510				200V	
56	560					
62	620					
68	680					
75	750					
82	820					
91	910					
100	101					
110	111				100V	200V
120	121					
130	131					
150	151					
160	161					
180	181					
200	201					
220	221					
240	241					
270	271					
300	301					
330	331					
360	361					
390	391					
430	431					
470	471					100V
510	511					
560	561					
620	621					
680	681					
750	751					
820	821					
910	911					
1 000	102					

NB: special values, tolerances, higher WVDC and matching available, please consult factory.

VIII. Mechanical Configurations

VIII.1. Lead/Ribbon and Wire Types for 1111 case size (SHB)

Configuration Type	Code	Description
	1	Micro-strip Ribbon (2)
	6	Radial Wire

NB: when coding ribbons or wires, for the designation of the part, the termination has to be mentioned for $MR_{certified}$ types to make sure only non-magnetic materials are used.

Examples: 501 SHB 470 J1L — any termination material could be used
501 SHB 470 JC1L — only non-magnetic termination materials could be used

For specific configuration, please ask our factory.

VIII.2. Lead/Ribbon and Wire Matrix

Termination Type	Code	SHL/SHA/SHS SHF/SHN/SHT	SHB
Micro-strip Ribbon	1		**AVAILABLE**
Radiall wire	6		**AVAILABLE**(1)

(1) Value 0R3 non available with this termination. Non ROHS terminations.

VIII.3. Lead/Ribbon and Wire Dimensions

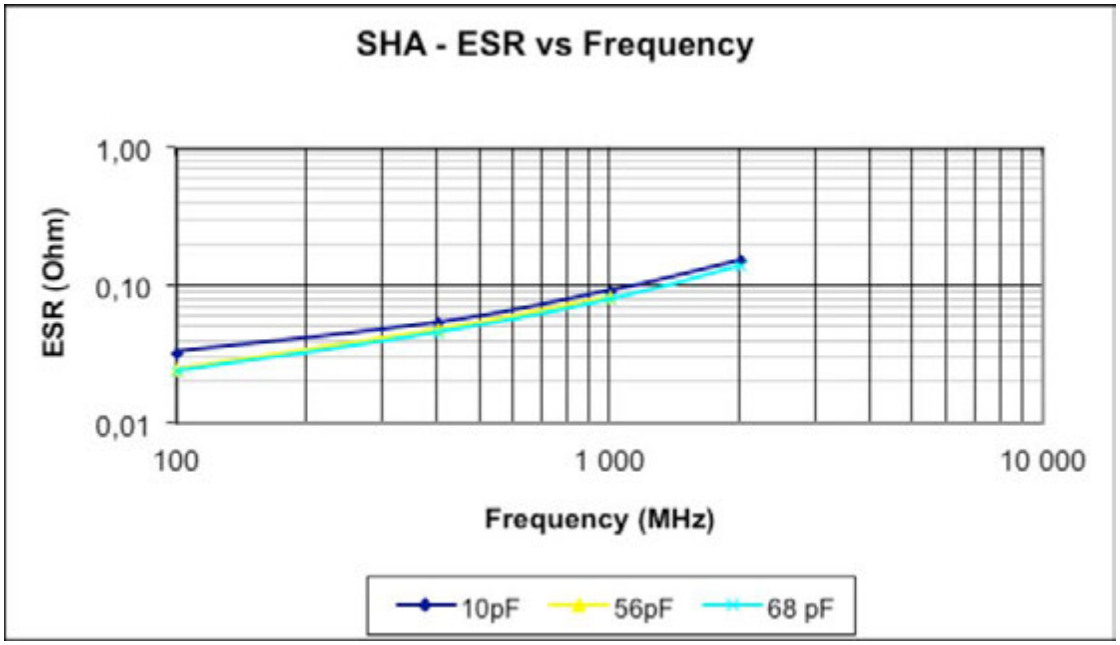
Within each cell, first the length and then the width/diameter of any single ribbon or wire are given.

Termination Type	Code	SHL/SHA/SHS SHF/SHN/SHT	SHB
Micro-strip Ribbon	1		8.00 2.40
Radiall wire	6		20.00 0.60

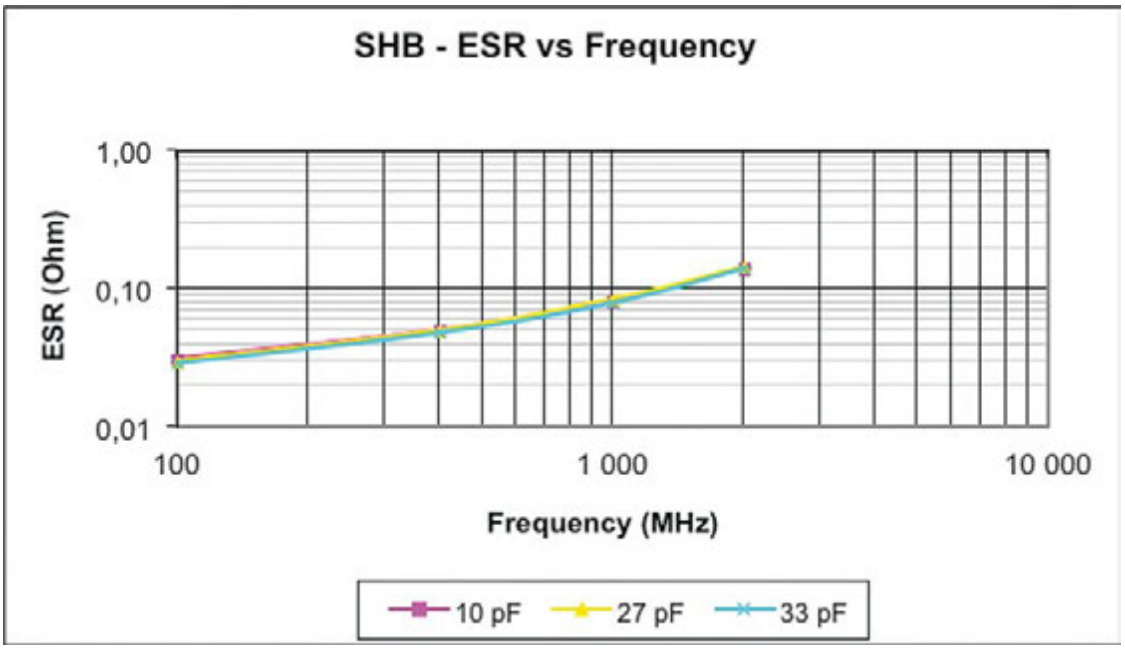
NB: dimensions are in mm, length is the minimum value.

IX. Typical performance data

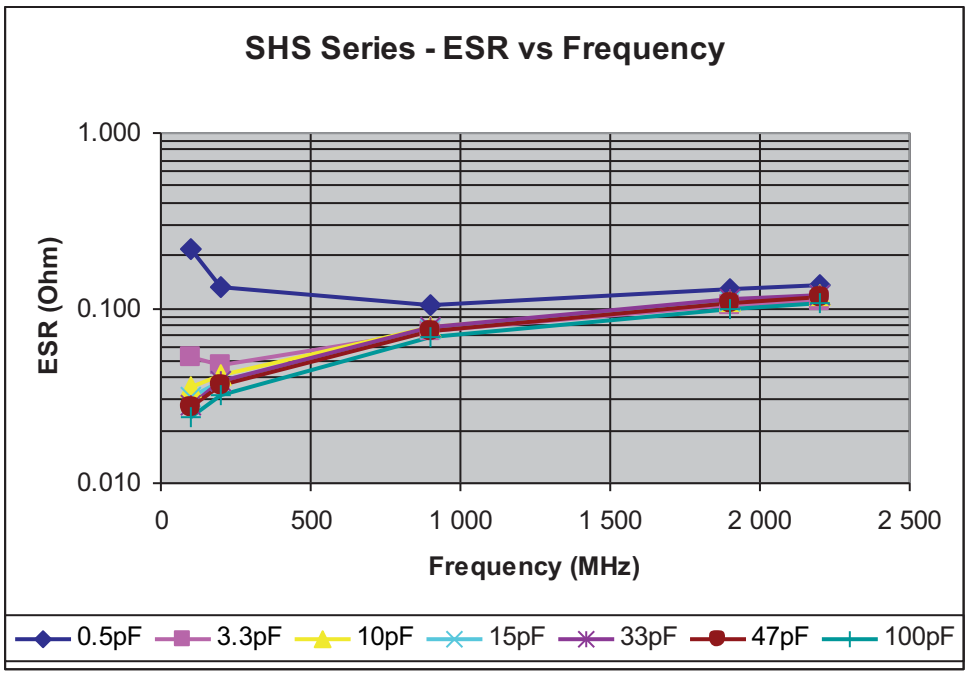
IX.1. CAPACITANCE IN A SIZE (0505): SUPER-HIQ SERIES

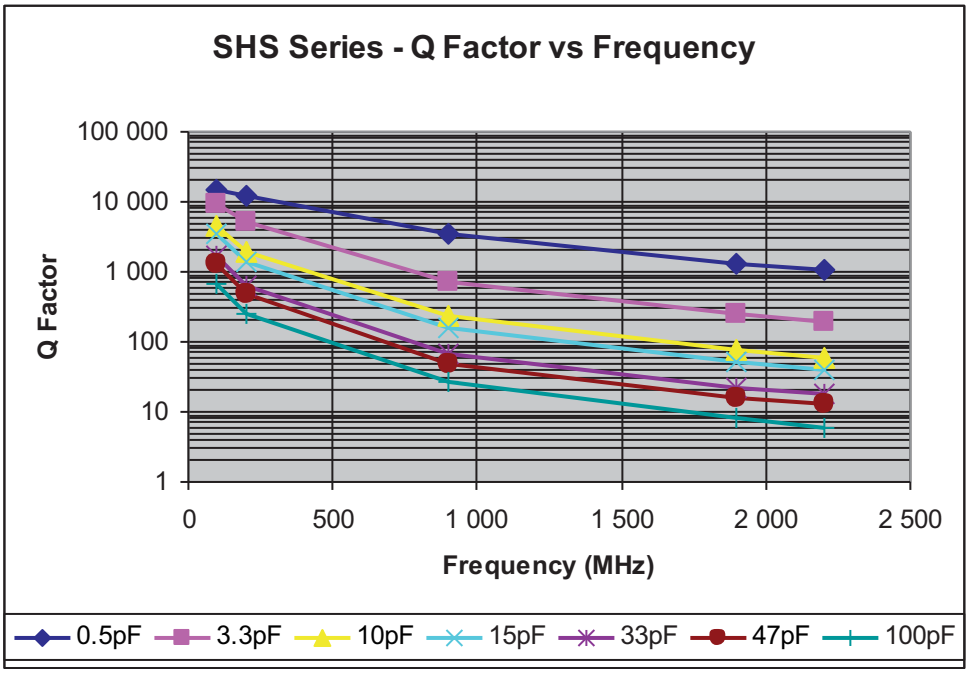


IX.2. CAPACITANCE IN B SIZE (1111): SUPER-HIQ SERIES

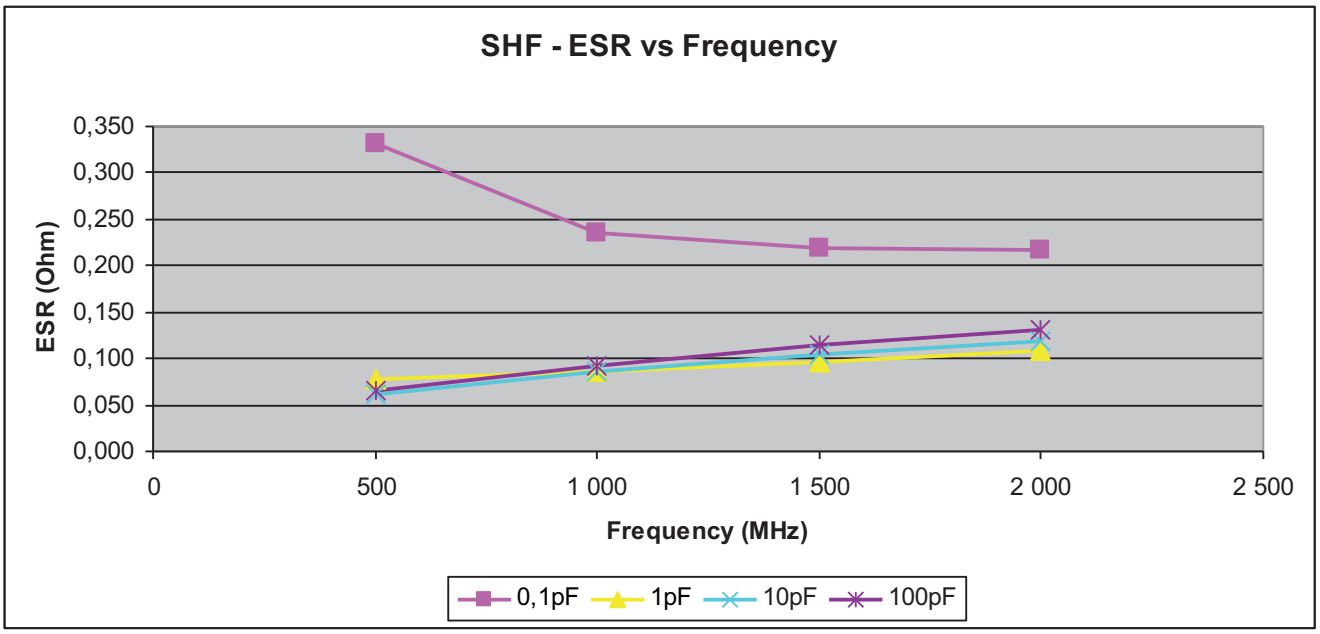


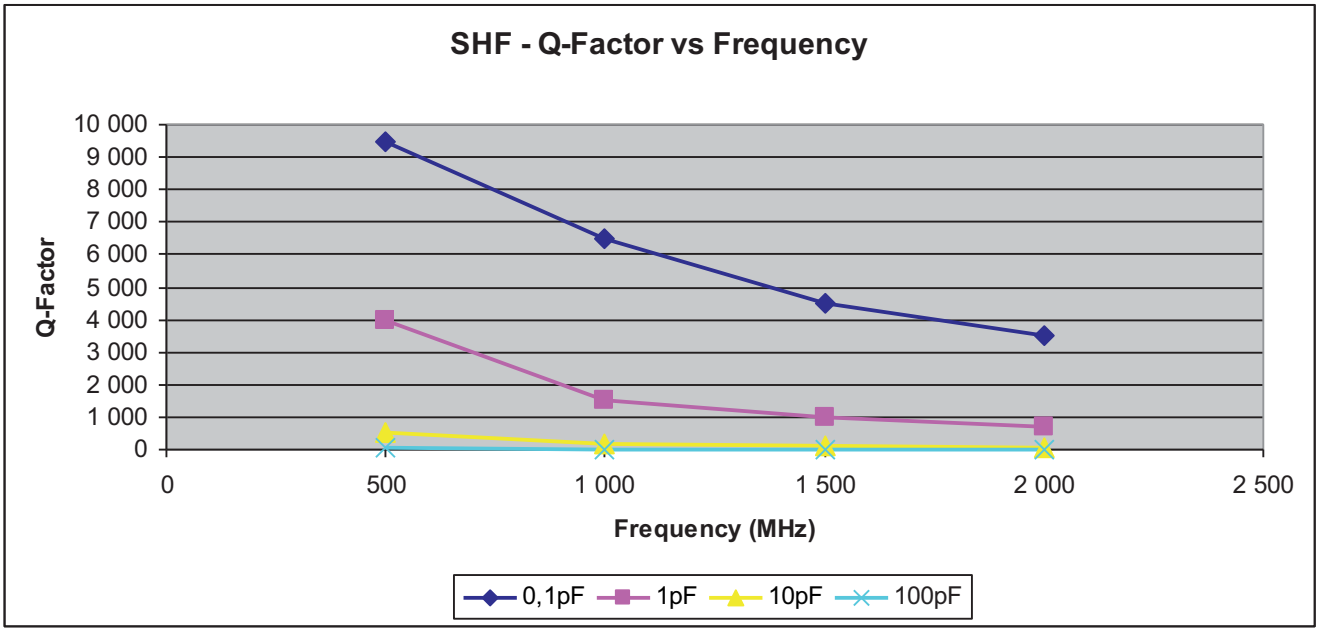
IX.3. CAPACITANCE IN S SIZE (0603): SUPER-HIQ SERIES





IX.5. CAPACITANCE IN F SIZE (0805): SUPER-HIQ SERIES





NHB - HIGH SELF RESONANT FREQUENCY ULTRA LOW ESR, HIGH RF POWER

RF & MICROWAVE CAPACITORS, RoHS COMPLIANT

Description

High RF Power MLCC
Lowest ESR in class
Highest working voltage in class - 500V
Laser Marked (optional)
Very High Self Resonance Frequencies

Applications

- Cellular Base Station Equipment
- Broadband Wireless Service
- Point to Point/Multipoint Radios
- Broadcasting Equipment

Circuit applications

- Impedance Matching
- Bypass, Feedback
- Tuning, Coupling and DC Blocking

I. Electrical specifications

Parameter	Value
Capacitance	0.3 to 100 pF
Tolerances	B, C, D below 10 pF (A up to 3.3pF) F, G, J, K, M above 10 pF
Working Voltage (WVDC)	See Capacitance Value chart
Temperature Coefficient	0 +/-30ppm/°C, -55°C to +175°C
Insulation Resistance	10^5 MΩ min
Dielectric Withstanding (test voltage applied for 5 seconds)	2.5 x WVDC for WVDC ≤ 500V
Aging	none
Piezo Effects	none

NB: the temperature range for the NHB is upgraded from +125°C to +175°C.

II. Mechanical specifications

Parameter	Value	Comment
Case Size	B	1111

NB: all the terminations are backward compatible and lead-free.

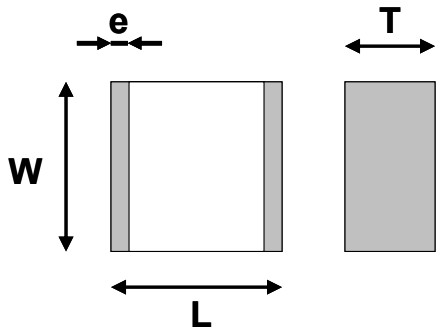
Termination Type	Code	NHB
Standard (tin-plated nickel)	S	**AVAILABLE**

III. Environmental specifications

Parameter	Value
Life Test	1'000 hours, +175°C at 500V 2'000 hours, +125°C at 1000V
Moisture Resistance Test 1	240 hours, 85% relative humidity at +85°C (ESA/SCC n°3009)
Moisture Resistance Test 2	56 days, 93% relative humidity at +40°C 0V, 5V, WVDC

IV. Outline dimensions

Parameter	B (1111)
Length (L)	2.80 ±0.40mm
Width (W)	2.80 ±0.40mm
Thickness (T)	2.60 mm (max.)
End-Band (e)	0.40 ±0.25mm



V. How to order

501	NH	B	100	J	S	L	E	ROHS
voltage	dielectric	case size	capacitance	tolerance code	termination code	marking code	tape and reel	
please refer to Volt.Code given in Capacitance Values chart			please refer to Cap. Code given in Capacitance Values chart	A=±0 05pF B=±0.1pF C=±0 25pF D=±0.5pF F=±1% G=±2% J=±5% K=±10% M=±20%		"L" means laser marking required leave blank if no marking requested	"E" means tape and reel required leave blank if no tape and reel requested	the RoHS tag is not part of the reference tag added at the end of P/N for information
500=50V 101=100V 201=200V 501=500V								

NB: for capacitance values lower than 10pF, tolerances B, C and D apply. For capacitance values lower or equal to 3,3pF, tolerance A also applies. For capacitance values equal to or higher than 10pF, tolerances F, G, J, K and M apply.

VI. Tape and Reel

The following chart gives the number of components per reel.

	NHB
Parts per Reel	1'000

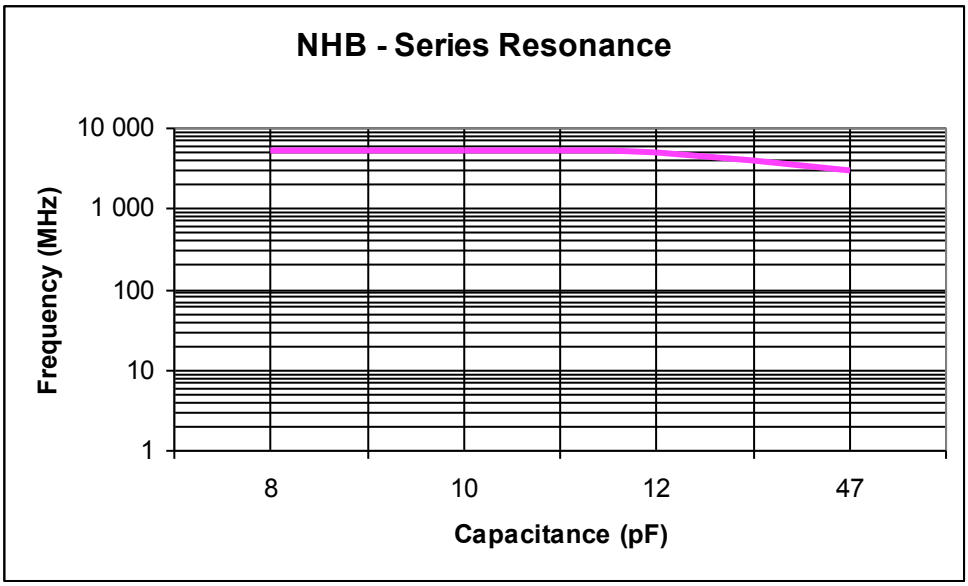
VII. Capacitance values

Value (pF)	Cap. Code	B (1111)
0.3	0R3	
0,4	0R4	
0,5	0R5	
0,6	0R6	
0,7	0R7	
0,8	0R8	
0,9	0R9	
1,0	1R0	
1,1	1R1	
1,2	1R2	
1,3	1R3	
1,4	1R4	
1,5	1R5	
1,6	1R6	
1,7	1R7	
1,8	1R8	
1,9	1R9	
2,0	2R0	
2,1	2R1	
2,2	2R2	
2,4	2R4	
2,7	2R7	
3,0	3R0	
3,3	3R3	
3,6	3R6	
3,9	3R9	
4,3	4R3	
4,7	4R7	500V
5,1	5R1	
5,6	5R6	
6,2	6R2	
6,8	6R8	
7,5	7R5	
8,2	8R2	
9,1	9R1	
10	100	
11	110	
12	120	
15	150	
16	160	
18	180	
20	200	
22	220	
24	240	
27	270	
30	300	
33	330	
36	360	
39	390	
43	430	
47	470	
56	560	
68	680	
82	820	
100	101	

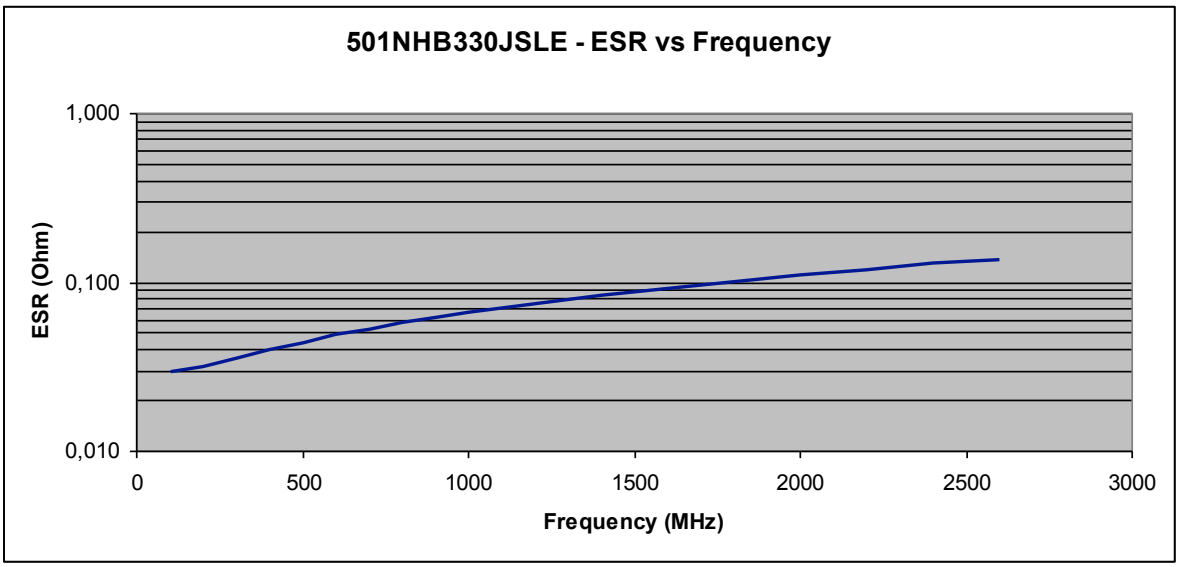
NB: special values, tolerances, higher WVDC and matching available, please consult factory.

VIII. Typical performance data

VIII.1. CAPACITANCE IN B SIZE (1111): SERIES RESONANCE FREQUENCY



VIII.2. CAPACITANCE IN B SIZE (1111): EQUIVALENT SERIES RESISTANCE



REVERSE-GEOMETRY, ULTRA LOW ESL, NPO

RF & MICROWAVE CAPACITORS, RoHS COMPLIANT

Description

Reverse-Geometry MLCC
Lowest ESR in class
Highest working voltage in class - 500V
Laser Marked (optional)
Very High Self Resonance Frequencies

Applications

- Cellular Base Station Equipment
- Broadband Wireless Service
- Point to Point/Multipoint Radios
- Broadcasting Equipment

Circuit applications

- Impedance Matching
- Bypass, Feedback
- Tuning, Coupling and DC Blocking

I. Electrical specifications

Parameter	Value
Capacitance	0.5 to 100 pF
Tolerances	B, C, D below 10 pF (A up to 3.3pF) G, J, K, M above 10 pF
Working Voltage (WVDC)	see Capacitance Value chart
Temperature Coefficient	0 +/-30ppm/°C, -55°C to +175°C
Insulation Resistance	10^5 MΩ min
Dielectric Withstanding (test voltage applied for 5 seconds)	2.5 x WVDC for WVDC ≤ 500V
Aging	none
Piezo Effects	none

II. Mechanical specifications

Parameter	Value	Comment
Case Size	R	0709

NB: all the terminations are backward compatible and lead-free.

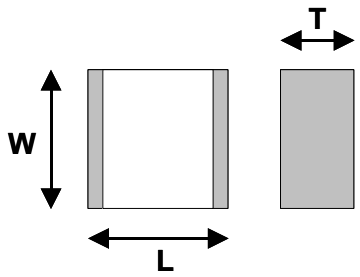
Termination Type	Code	SHR
Standard (tin-plated nickel)	S	**AVAILABLE**

III. Environmental specifications

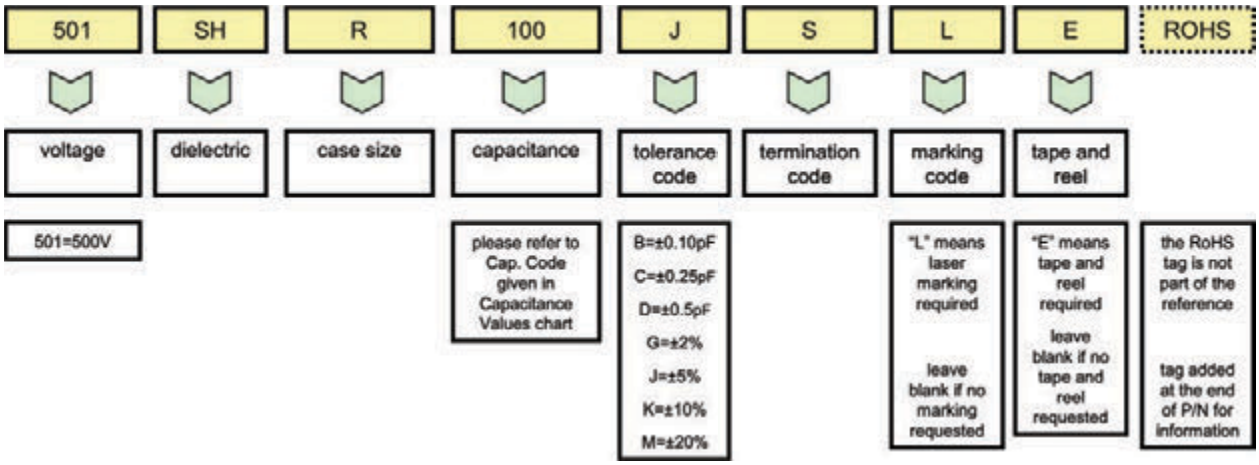
Parameter	Value
Life Test	1'000 hours, +175°C at 500V 2'000 hours, +125°C at 1000V
Moisture Resistance Test 1	240 hours, 85% relative humidity at +85°C (ESA/SCC n°3009)
Moisture Resistance Test 2	56 days, 93% relative humidity at +40°C 0V, 5V, WVDC

IV. Outline dimensions

Parameter	R (0709)
Length (L)	1.78 ±0.38mm
Width (W)	2.29 ±0.25mm
Thickness (T)	2.67 mm (max.)
End-Band (e)	0.25 + 0.2 mm / - 0.15 mm



V. How to order



NB: for capacitance values lower than 10pF, tolerances B, C and D apply. For capacitance values lower or equal to 3,3pF, tolerance A also applies. For capacitance values equal to or higher than 10pF, tolerances F, G, J, K and M apply.

VI. Tape and Reel

The following chart gives the number of components per reel.

	SHR
Parts per Reel	1'000

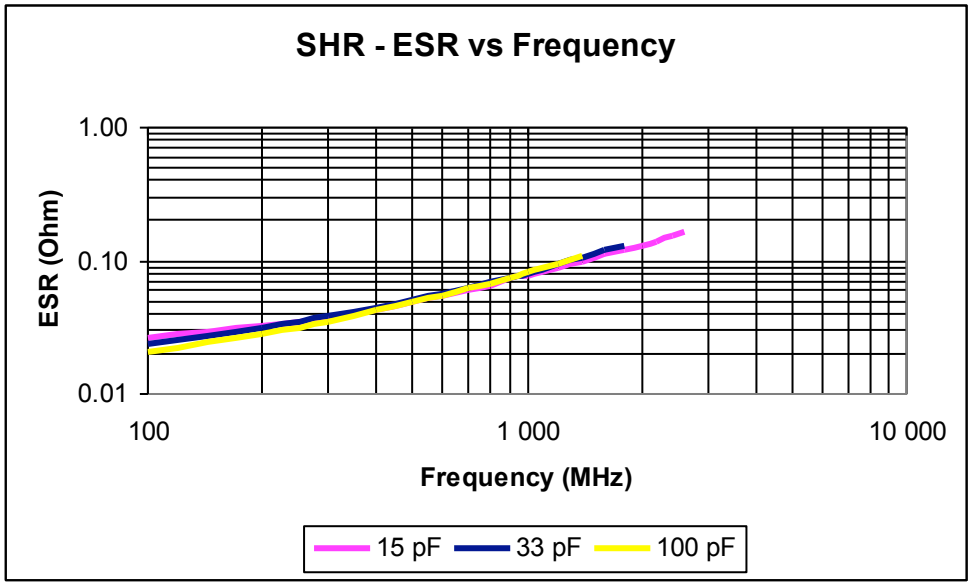
VII. Capacitance values

Value (pF)	Cap. Code	R (0709)
0.5	0R5	
0.6	0R6	
0.7	0R7	
0.8	0R8	
0.9	0R9	
1.0	1R0	
1.1	1R1	
1.2	1R2	
1.3	1R3	
1.4	1R4	
1.5	1R5	
1.6	1R6	
1.7	1R7	
1.8	1R8	
1.9	1R9	
2.0	2R0	
2.1	2R1	
2.2	2R2	
2.4	2R4	
2.7	2R7	
3.0	3R0	
3.3	3R3	
3.6	3R6	
3.9	3R9	
4.3	4R3	
4.7	4R7	
5.1	5R1	
5.6	5R6	
6.2	6R2	500V
6.8	6R8	
7.5	7R5	
8.2	8R2	
9.1	9R1	
10	100	
11	110	
12	120	
15	150	
16	160	
18	180	
20	200	
22	220	
24	240	
27	270	
30	300	
33	330	
36	360	
39	390	
43	430	
47	470	
51	510	
56	560	
62	620	
68	680	
75	750	
82	820	
91	910	
100	101	

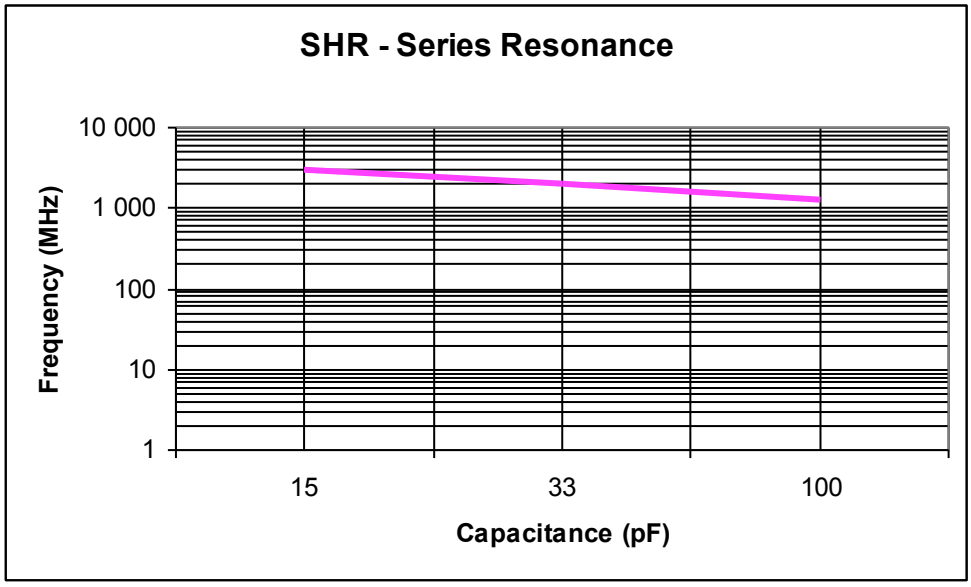
NB: special values, tolerances, higher WVDC and matching available, please consult factory.

VIII. Typical performance data

VIII.1. Capacitance in R size (0709): Equivalent Series Resistance



VIII.2. Capacitance in R size (0709): Series Resonance Frequency



REVERSE-GEOMETRY, ULTRA LOW ESL, NPO

RF & MICROWAVE CAPACITORS, RoHS COMPLIANT

Description

Reverse-Geometry MLCC
Lowest ESR in class
Highest working voltage in class - 500V
Laser Marked (optional)
Very High Self Resonance Frequencies

Applications

- Cellular Base Station Equipment
- Broadband Wireless Service
- Point to Point/Multipoint Radios
- Broadcasting Equipment

Circuit applications

- Impedance Matching
- Bypass, Feedback
- Tuning, Coupling and DC Blocking

I. Electrical specifications

Parameter	Value
Capacitance	0.5 to 100 pF
Tolerances	B, C, D below 10 pF (A up to 3.3pF) G, J, K, M above 10 pF
Working Voltage (WVDC)	see Capacitance Value chart
Temperature Coefficient	0 +/-30ppm/°C, -55°C to +175°C
Insulation Resistance	10^5 MΩ min
Dielectric Withstanding (test voltage applied for 5 seconds)	2.5 x WVDC for WVDC ≤ 500V
Aging	none
Piezo Effects	none

II. Mechanical specifications

Parameter	Value	Comment
Case Size	D	0711

NB: all the terminations are backward compatible and lead-free.

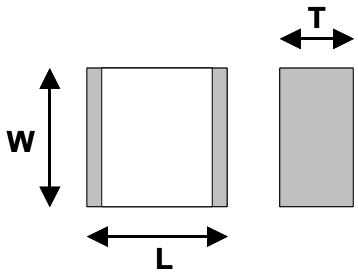
Termination Type	Code	SHD
Standard (tin-plated nickel)	S	**AVAILABLE**

III. Environmental specifications

Parameter	Value
Life Test	1'000 hours, +175°C at 500V 2'000 hours, +125°C at 1000V
Moisture Resistance Test 1	240 hours, 85% relative humidity at +85°C (ESA/SCC n°3009)
Moisture Resistance Test 2	56 days, 93% relative humidity at +40°C 0V, 5V, WVDC

IV. Outline dimensions

Parameter	D (0711)
Length (L)	1.78 ±0.38mm
Width (W)	2.67 ±0.25mm
Thickness (T)	2.29 mm (max.)
End-Band (e)	0.25 + 0.2 mm / - 0.15 mm



V. How to order

501	SH	D	100	J	S	L	E	ROHS
voltage	dielectric	case size	capacitance	tolerance code	termination code	marking code	tape and reel	
501=500V			please refer to Cap. Code given in Capacitance Values chart	B=±0.10pF C=±0.25pF D=±0 5pF G=±2% J=±5% K=±10% M=±20%		"L" means laser marking required leave blank if no marking requested	"E" means tape and reel required leave blank if no tape and reel requested	the RoHS tag is not part of the reference tag added at the end of P/N for information

NB: for capacitance values lower than 10pF, tolerances B, C and D apply. For capacitance values equal to or higher than 10pF, tolerances F, G, J, K and M apply.

VI. Tape and Reel

The following chart gives the number of components per reel.

	SHD
Parts per Reel	1'000

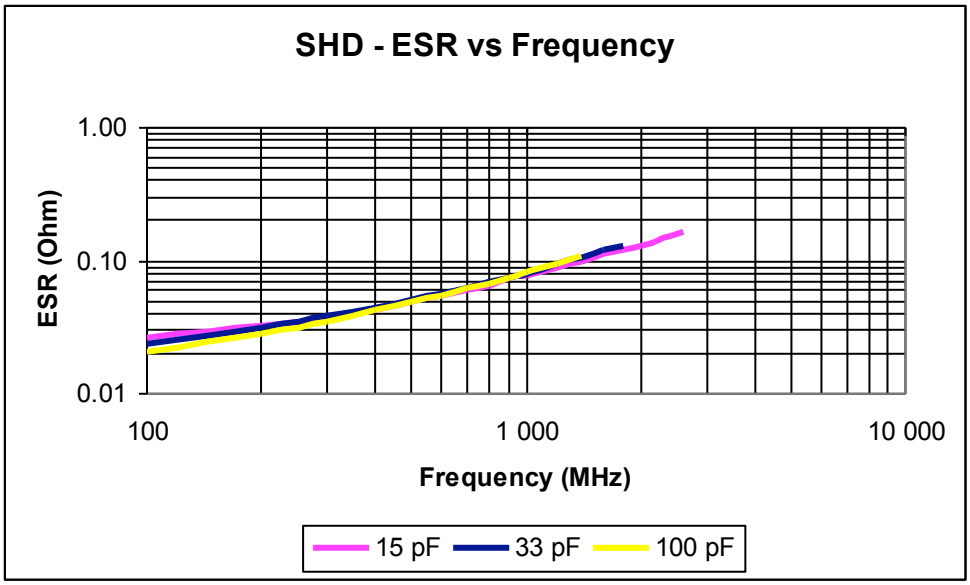
VII. Capacitance values

Value (pF)	Cap. Code	D (0711)
0.5	0R5	
0.6	0R6	
0.7	0R7	
0.8	0R8	
0.9	0R9	
1.0	1R0	
1.1	1R1	
1.2	1R2	
1.3	1R3	
1.4	1R4	
1.5	1R5	
1.6	1R6	
1.7	1R7	
1.8	1R8	
1.9	1R9	
2.0	2R0	
2.1	2R1	
2.2	2R2	
2.4	2R4	
2.7	2R7	
3.0	3R0	
3.3	3R3	
3.6	3R6	
3.9	3R9	
4.3	4R3	
4.7	4R7	
5.1	5R1	
5.6	5R6	
6.2	6R2	500V
6.8	6R8	
7.5	7R5	
8.2	8R2	
9.1	9R1	
10	100	
11	110	
12	120	
15	150	
16	160	
18	180	
20	200	
22	220	
24	240	
27	270	
30	300	
33	330	
36	360	
39	390	
43	430	
47	470	
51	510	
56	560	
62	620	
68	680	
75	750	
82	820	
91	910	
100	101	

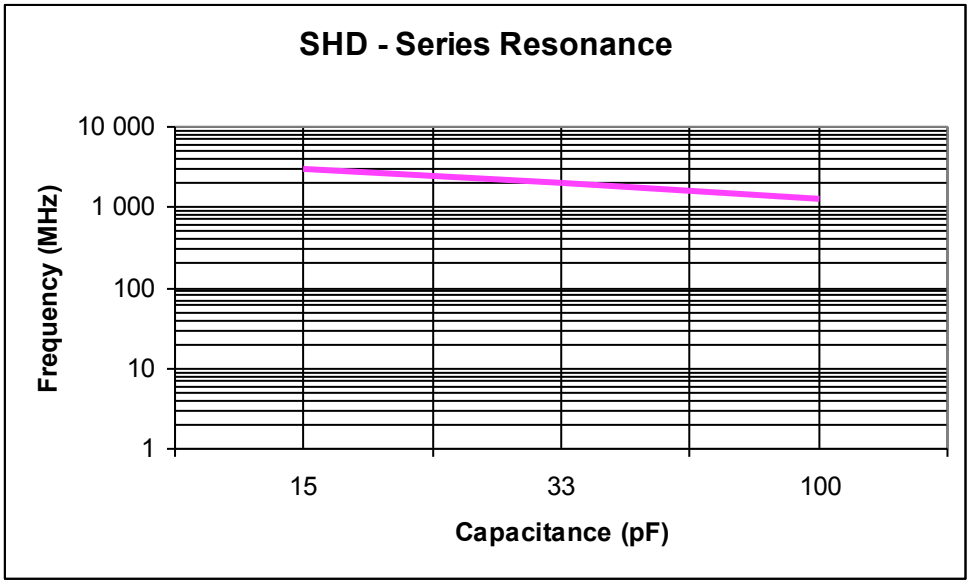
NB: special values, tolerances, higher WVDC and matching available, please consult factory.

VIII. Typical performance data

VIII.1. Capacitance in D size (0711): Equivalent Series Resistance



VIII.2. Capacitance in D size (0711): Series Resonance Frequency

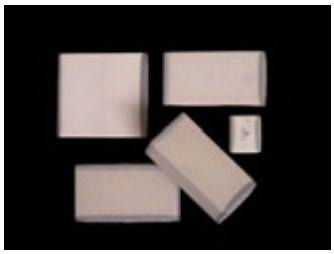


CP - HIGH POWER, HIGH Q

RF POWER CAPACITORS, RoHS COMPLIANT

Description

Low ESR/ESL
Porcelain Capacitors
Excellent characteristics in current, voltage and power with high Q factor
Highest working voltage in class – 7'000V



Applications

- RF Power Amplifiers
- Industrial (Plasma Chamber)
- Medical (MRI Coils)

Circuit applications

- DC Blocking
- Matching Networks
- Tuning and Coupling

I. Electrical specifications

Parameter	Value
Capacitance	0.5 to 10'000 pF
Tolerances	B, C, D below 10 pF F, G, J, K above 10 pF
Working Voltage (WVDC)	see Capacitance Value chart
Temperature Coefficient	100 +/-30ppm/°C, -55°C to +125°C
Insulation Resistance	10^5 MΩ min @ 25°C at rated WVDC 10^4 MΩ min @ 125°C at rated WVDC
Dielectric Withstanding (test voltage applied for 5 seconds)	2.0 x WVDC for WVDC ≤ 500V 1.5 x WVDC for 500V < WVDC ≤ 2'500V 1.3 x WVDC for WVDC > 2'500V
Aging	none
Piezo Effects	none

II. Mechanical specifications

Parameter	Value	Comment
Case Size	X E	2225 4040

For each case size, the recommended terminations are listed below.

NB:
- all the terminations are backward compatible and lead-free.
- the non-magnetic terminations are all Magnetism-free Rated.

MR certified®

ITAR Free®

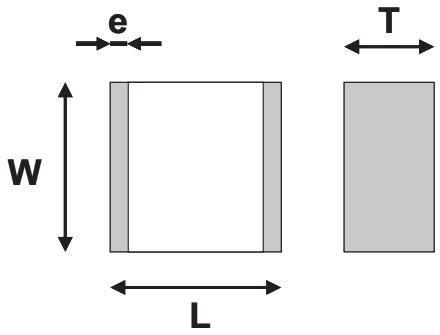
Termination Type	Code	CPX	CPE
Standard (tin-plated nickel)	S	**AVAILABLE**	**AVAILABLE**
Non-magnetic (tin-plated copper)	C	**AVAILABLE**	**AVAILABLE**

III. Environmental specifications

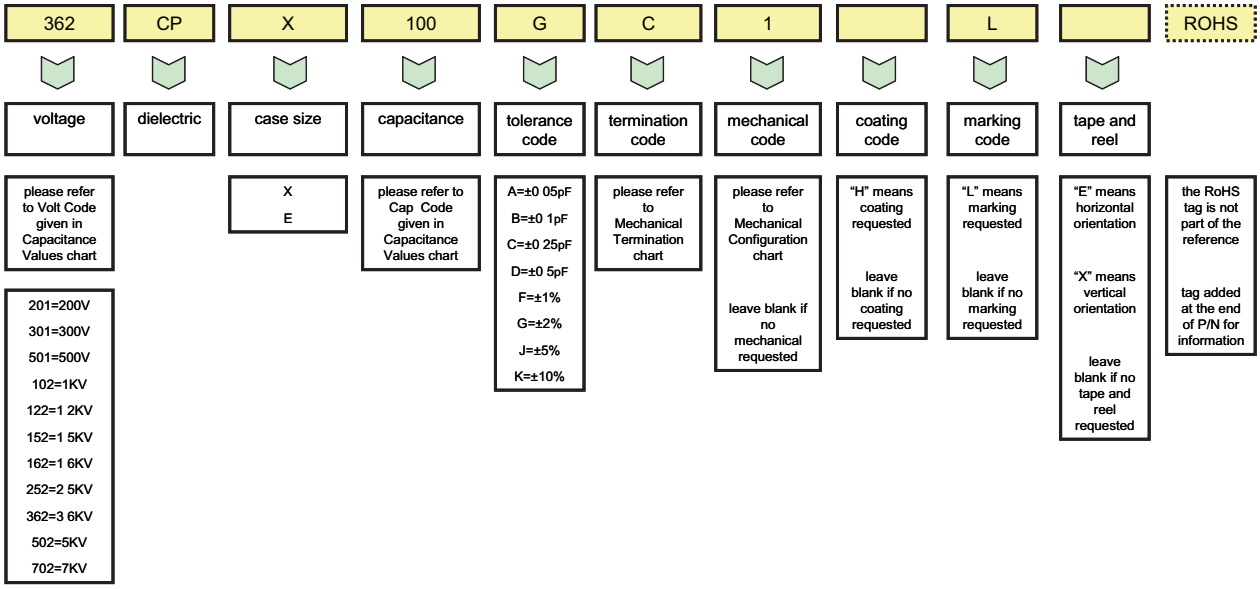
Parameter	Value
Life Test	2'000 hours, +125°C at 1.5 x WVDC (WVDC≤500V) at 1.3 x WVDC (500V<WVDC<1'250V) at 1.0 x WVDC (1'250V≤WVDC)
Moisture Resistance Test 1	240 hours, 85% relative humidity at +85°C (ESA/SCC n°3009)
Moisture Resistance Test 2	56 days, 93% relative humidity at +40°C 0V, 5V, 500V max.

IV. Outline dimensions

Parameter	X (2225)	E (4040)
Length (L)	6.20 mm + 0.30 / - 0.70 mm	10.50 mm + 0.30 / - 0.70 mm
Width (W)	6.60 ±0.50 mm	9.50 ±0.50 mm
Thickness (T)	3.80 mm (max.)	4.50 mm (max.)
End-Band (e)	0.80 ±0.60mm	0.80 ±0.60mm



V. How to order



NB: for capacitance values lower than 10pF, tolerances B, C and D apply. For capacitance values equal to or higher than 10pF, tolerances F, G, J and K apply.

VI. Tape and Reel

The following chart gives the number of components per reel.

	CPX	CPE
Parts per Reel	500	500 or 700

NB: the vertical orientation of product (letter code X) is only available on CPE. In this case, the quantity per reel is 350 pieces.

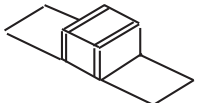
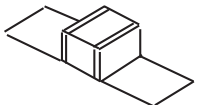
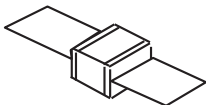
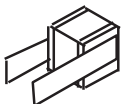
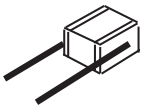
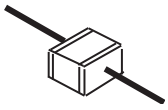
VII. Capacitance Values

Value (pF)	Cap. Code	X (2225)		E (4040)		Value (pF)	Cap. Code	X (2225)		E (4040)	
		Standard	Extended	Standard	Extended			Standard	Extended	Standard	Extended
1,0	1R0	2500V	3600V	3600V	7000V	56	560	2500V	3600V	3600V	7000V
1,1	1R1					62	620				
1,2	1R2					68	680				
1,3	1R3					75	750				
1,4	1R4					82	820				
1,5	1R5					91	910				
1,6	1R6					100	101				
1,7	17R					110	111				
1,8	1R8					120	121				
1,9	1R9					130	131				
2,0	2R0					150	151				5000V
2,1	2R1					160	161				
2,2	2R2					180	181				
2,4	2R4					200	201				
2,7	2R7					220	221				
3,0	3R0					240	241				
3,3	3R3					270	271				
3,6	3R6					300	301	1500V			
3,9	3R9					330	331				
4,3	4R3					360	361				
4,7	4R7					390	391				
5,1	5R1					430	431				
5,6	5R6					470	471				2500V
6,2	6R2					510	511	1200V			
6,8	6R8					560	561				
7,5	7R5					620	621				
8,2	8R2					680	681				
9,1	9R1					750	751				
10	100					820	821				1600V
11	110					910	911				
12	120					1 000	102				
13	130					1 100	112				
15	150					1 200	122				1000V
16	160					1 500	152	500V			
18	180					1 800	182				
20	200					2 200	222	300V			
22	220					2 700	272				500V
24	240					3 000	302				
27	270					3 300	332				
30	300					3 900	392				
33	330					4 700	472				
36	360					5 100	512				
39	390					5 600	562				200V
43	430					6 800	682				
47	470					8 200	822				
51	510					10 000	103				

NB: special values, tolerances, higher WVDC and matching available, please consult factory.

VIII. Mechanical Configurations

VIII.1. Lead/Ribbon and Wire Types

Configuration Type	Code	Description
	1	Micro-strip Ribbon
	1S	Short-strip Ribbon
	2	Axial Ribbon
	3	Radial Ribbon
	6	Radial Wire
	7	Axial Wire

NB: when coding ribbons or wires for the description of the part, the termination has to be mentionned for $MR_{certified}$ types to ensure that only non-magnetic materials are used.

Examples : 362 CPE 470 J1L — any termination material could be used
362 CPE 470 JC1L — only non-magnetic termination materials could be used

VIII.2. Lead/Ribbon and Wire Matrix

Termination Type	Code	CPX	CPE
Micro-strip Ribbon	1	**AVAILABLE**	**AVAILABLE**
Short Micro-strip Ribbon	1S		**AVAILABLE**
Axial Ribbon	2		**AVAILABLE**
Radial Ribbon	3		**AVAILABLE**
Radial Wire	6	**AVAILABLE**(1)	**AVAILABLE**(1)
Axial Wire	7	**AVAILABLE**(1)	**AVAILABLE**(1)

(1): these termination types are non ROHS.

VIII.3. Lead/Ribbon and Wire Dimensions

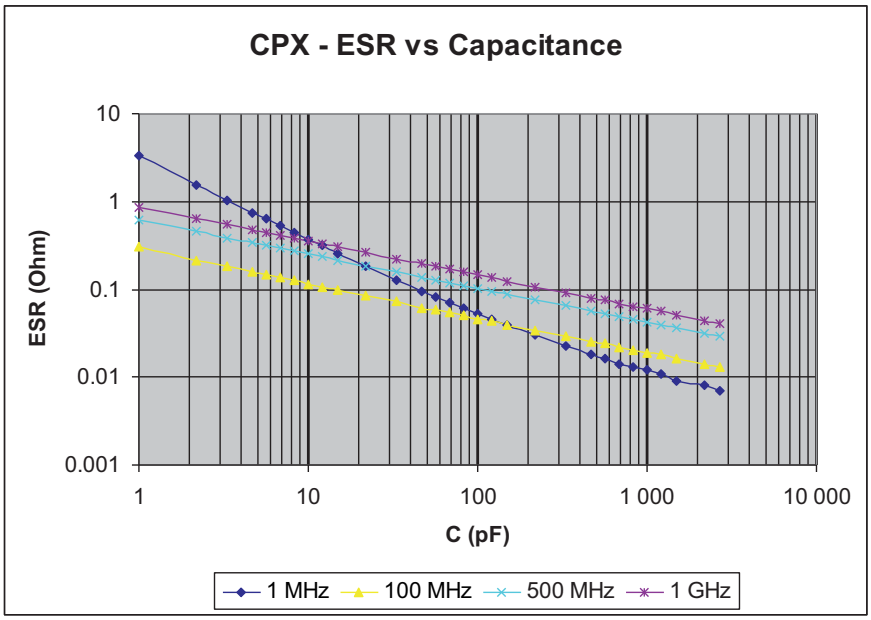
Within each cell, first the length and then the width/diameter of any single ribbon or wire are given.

Termination Type	Code	CPX	CPE
Micro-strip Ribbon	1	12.00 5.40	16.00 8.90
Short Micro-strip Ribbon	1S		8.50 8.90
Axial Ribbon	2		16.00 8.90
Radial Ribbon	3		19.00 8.90
Radial Wire	6	30.00 0.60	30.00 0.90
Axial Wire	7	30.00 0.60	30.00 0.90

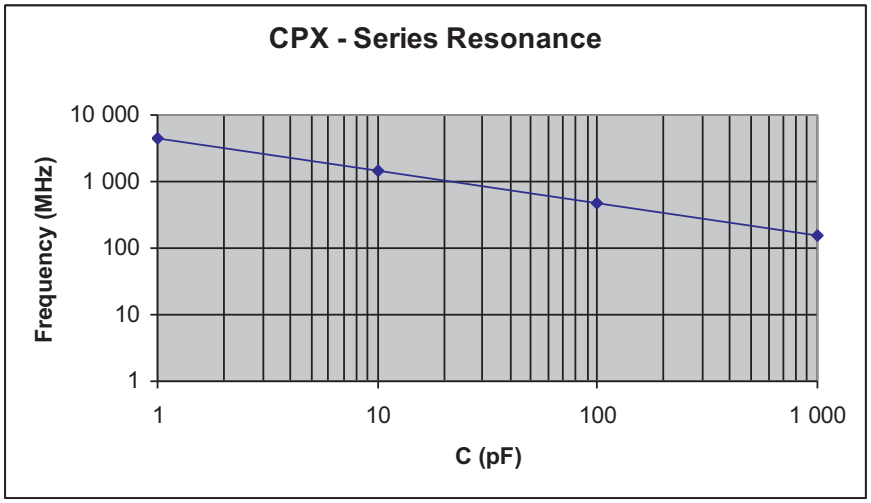
NB: dimensions are in mm.

IX. Performance Data

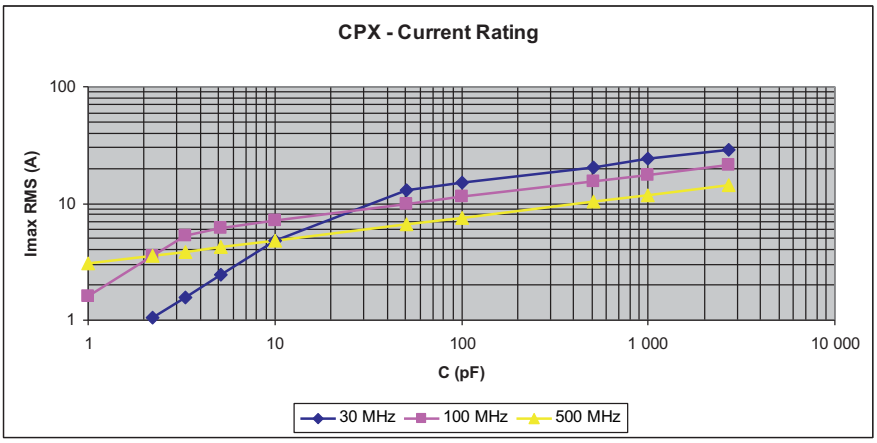
IX.1. ESR

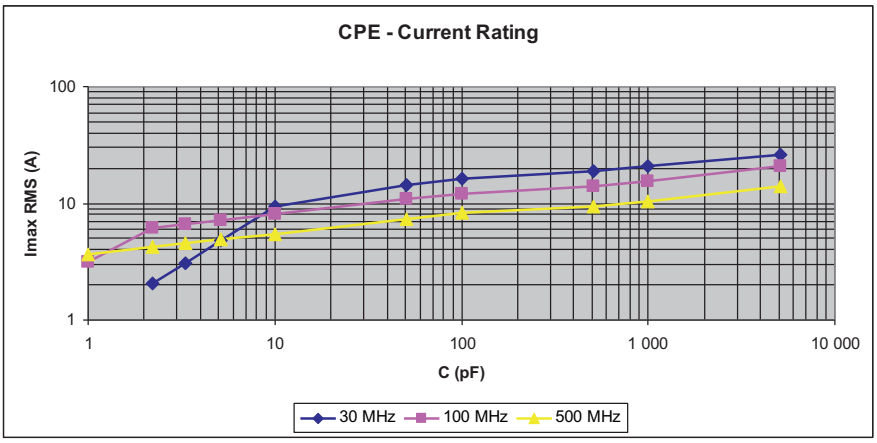


IX.2. Series Resonance Frequency

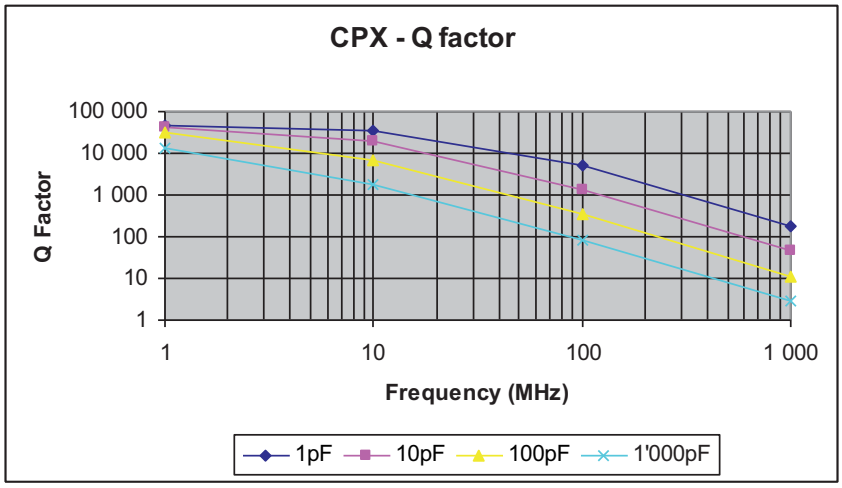


IX.3. Current Rating





IX.4. Q Factor



CL - HIGH POWER, HIGH Q, NP0

RF POWER CAPACITORS, ULTRA STABILITY, RoHS COMPLIANT

Description

Low ESR/ESL
NP0 Porcelain Capacitors
Excellent characteristics in current, voltage and power with high Q factor
Highest working voltage in class – 7'000V

Applications

- RF Power Amplifiers
- Industrial (Plasma Chamber)
- Medical (MRI Coils)

Circuit applications

- DC Blocking
- Matching Networks
- Tuning and Coupling

I. Electrical specifications

Parameter	Value
Capacitance	1 to 10'000 pF
Tolerances	B, C, D below 10 pF F, G, J, K, M above 10 pF
Working Voltage (WVDC)	see Capacitance Value chart
Temperature Coefficient	0 +/-30ppm/°C, -55°C to +125°C
Insulation Resistance	10^5 MΩ min @ 25°C at rated WVDC 10^4 MΩ min @ 125°C at rated WVDC
Dielectric Withstanding (test voltage applied for 5 seconds)	2.0 x WVDC for WVDC ≤ 500V 1.5 x WVDC for 500V < WVDC ≤ 2'500V 1.3 x WVDC for WVDC > 2'500V
Aging	none
Piezo Effects	none

II. Mechanical specifications

Parameter	Value	Comment
Case Size	X E F	2225 4040 7065

For each case size, the recommended terminations are listed below.

NB:
- all the terminations are backward compatible and lead-free.
- the non-magnetic terminations are all Magnetism-free Rated.

MR certified®

ITAR Free®

CL - HIGH POWER, HIGH Q, NP0

RF POWER CAPACITORS, ULTRA STABILITY, RoHS COMPLIANT

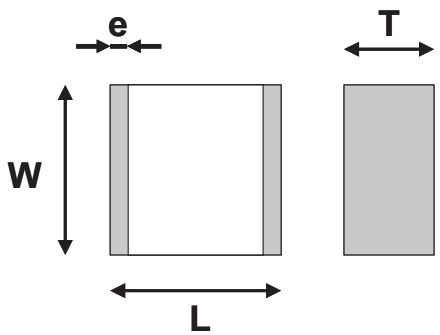
Termination Type	Code	CLX	CLE	CLF
Standard (tin-plated nickel)	S	AVAILABLE	AVAILABLE	AVAILABLE
Non-magnetic (silver-palladium)	A			AVAILABLE
Non-magnetic (tin-plated copper)	C	AVAILABLE	AVAILABLE	

III. Environmental specifications

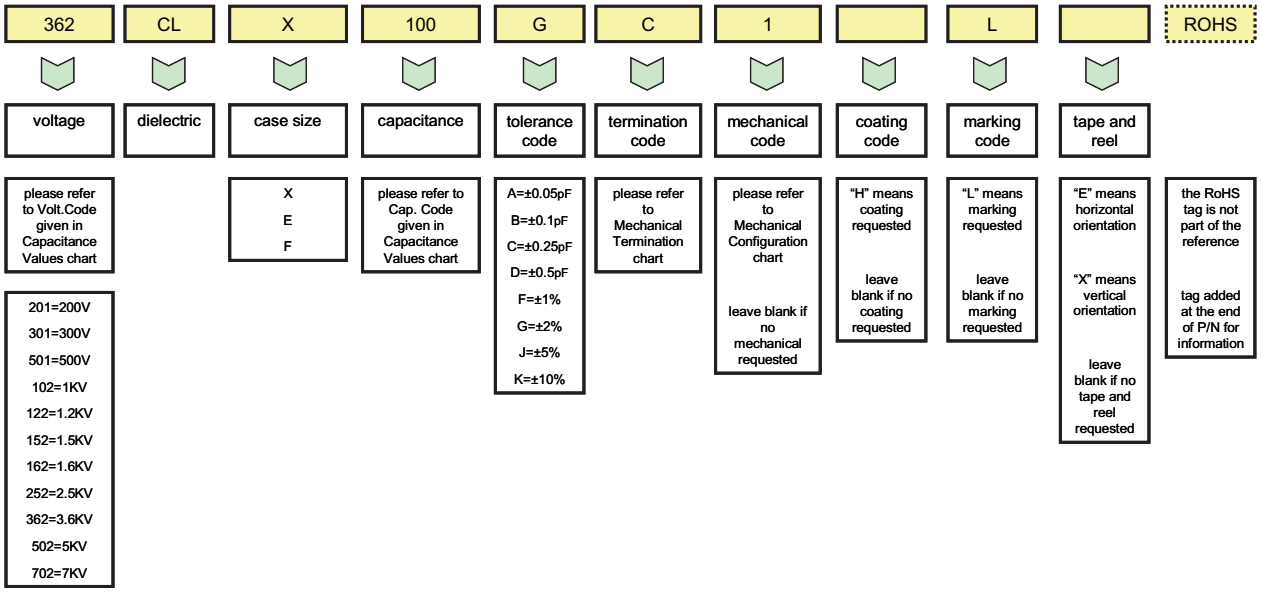
Parameter	Value
Life Test	2'000 hours, +125°C at 1.5 x WVDC (WVDC≤500V) at 1.3 x WVDC (500V<WVDC<1'250V) at 1.0 x WVDC (1'250V≤WVDC)
Moisture Resistance Test 1	240 hours, 85% relative humidity at +85°C (ESA/SCC n°3009)
Moisture Resistance Test 2	56 days, 93% relative humidity at +40°C 0V, 5V, 500V max.

IV. Outline dimensions

Parameter	X (2225)	E (4040)	F (7065)
Length (L)	6.20 mm + 0.30 / - 0.70 mm	10.50 mm + 0.30 / - 0.70 mm	17.80 ±0.50 mm
Width (W)	6.60 ±0.50 mm	9.50 ±0.50 mm	16.00 ±0.50 mm
Thickness (T)	3.80 mm (max.)	4.50 mm (max.)	4.00 mm (max.)
End-Band (e)	0.80 ±0.60mm	0.80 ±0.60mm	0.80 ±0.60mm



V. How to order



NB:
- For capacitance values lower than 10pF, tolerances B, C and D apply. For capacitance values equal to or higher than 10pF, tolerances F, G, J and K apply.
- Only CLX and CLE case size capacitor chips could be supply with tape and reel.

VI. Tape and Reel

The following chart gives the number of components per reel.

	CLX	CLE
Parts per Reel	500	500 or 700

NB: the vertical orientation of product (letter code X) is only available on CLE. In this case, the quantity per reel is 350 pieces.

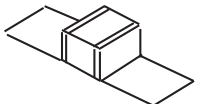
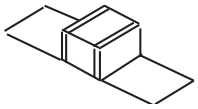
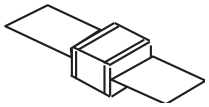
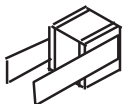
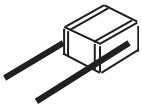
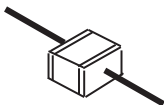
VII. Capacitance Values

Value (pF)	Cap. Code	X (2225)		E (4040)		Value (pF)	Cap. Code	X (2225)		E (4040)		F (7065)
		Standard	Extended	Standard	Extended			Standard	Extended	Standard	Extended	
1,0	1R0	2500V	3600V	3600V	7000V	56	560	2500V	3600V	3600V	7000V	1000V
1,1	1R1					62	620					
1,2	1R2					68	680					
1,3	1R3					75	750					
1,4	1R4					82	820					
1,5	1R5					91	910					
1,6	1R6					100	101					
1,7	17R					110	111					
1,8	1R8					120	121					
1,9	1R9					130	131					
2,0	2R0					150	151					
2 1	2R1					160	161					
2,2	2R2					180	181					
2 4	2R4					200	201					
2,7	2R7					220	221					
3 0	3R0					240	241					
3,3	3R3					270	271					
3 6	3R6					300	301	1500V				
3,9	3R9					330	331					
4 3	4R3					360	361					
4,7	4R7					390	391					
5 1	5R1					430	431					
5,6	5R6					470	471					
6 2	6R2					510	511	1200V				
6,8	6R8					560	561					
7,5	7R5					620	621					
8,2	8R2					680	681					
9,1	9R1					750	751					
10	100					820	821					
11	110					910	911					
12	120					1 000	102					
13	130					1 100	112					
15	150					1 200	122					
16	160					1 500	152	500V				
18	180					1 800	182					
20	200					2 200	222	300V				
22	220					2 700	272					
24	240					3 000	302					
27	270					3 300	332					
30	300					3 900	392					
33	330					4 700	472					
36	360					5 100	512					
39	390					5 600	562					
43	430					6 800	682					
47	470					8 200	822					
51	510					10 000	103					

NB: special values, tolerances, higher WVDC and matching available, please consult factory.

VIII. Mechanical Configurations

VIII.1. Lead/Ribbon and Wire Types

Configuration Type	Code	Description
	1	Micro-strip Ribbon
	1S	Short-strip Ribbon
	2	Axial Ribbon
	3	Radial Ribbon
	6	Radial Wire
	7	Axial Wire

NB: when coding ribbons or wires for the description of the part, the termination has to be mentioned for $MR_{certified}$ types to ensure that only non-magnetic materials are used.

Examples : 362 CLE 470 J1L — any termination material could be used
362 CLE 470 JC1L — only non-magnetic termination materials could be used

VIII.2. Lead/Ribbon and Wire Matrix

Termination Type	Code	CLX	CLE	CLF
Micro-strip Ribbon	1	**AVAILABLE**	**AVAILABLE**	**AVAILABLE**
Short Micro-strip Ribbon	1S		**AVAILABLE**	
Axial Ribbon	2		**AVAILABLE**	
Radial Ribbon	3		**AVAILABLE**	
Radial Wire	6	**AVAILABLE**(1)	**AVAILABLE**(1)	**AVAILABLE**(1)
Axial Wire	7	**AVAILABLE**(1)	**AVAILABLE**(1)	

.
(1): these termination types are non ROHS.

VIII.3. Leads/Ribbons and Wires Dimensions

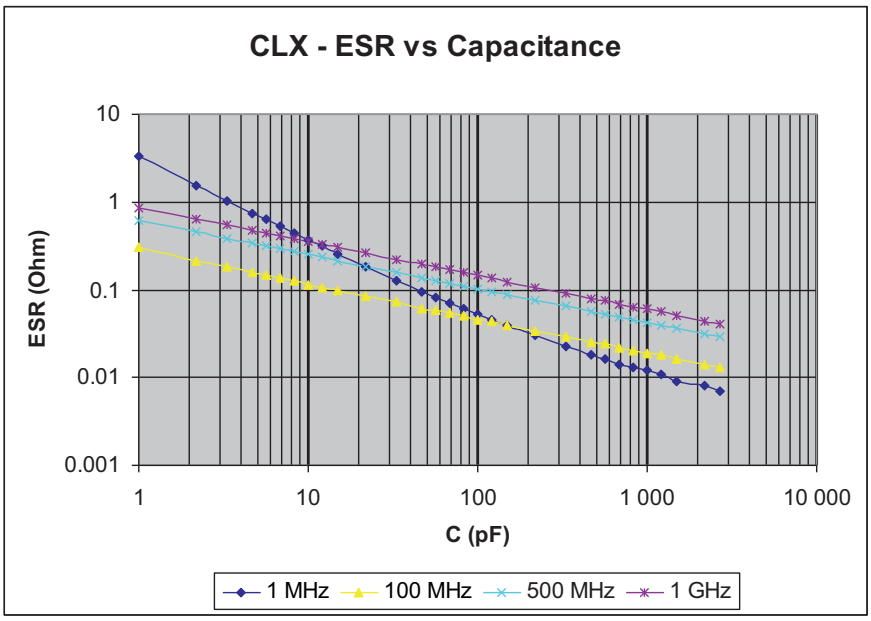
Within each cell, first the length and then the width/diameter of any single ribbon or wire are given.

Termination Type	Code	CLX	CLE	CLF
Micro-strip Ribbon	1	12.00 5.40	16.00 8.90	6.00 15.00
Short Micro-strip Ribbon	1S		8.50 8.90	
Axial Ribbon	2		16.00 8.90	
Radial Ribbon	3		19.00 8.90	
Radial Wire	6	30.00 0.60	30.00 0.90	30.00 0.90
Axial Wire	7	30.00 0.60	30.00 0.90	

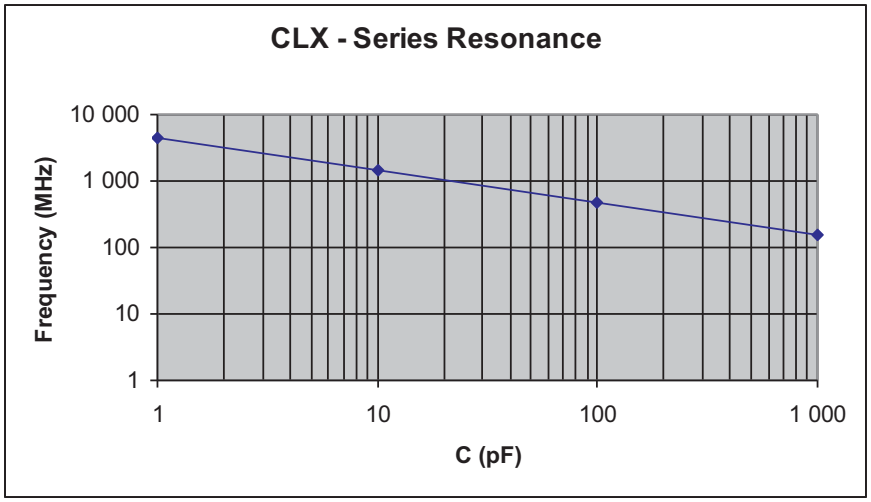
NB: dimensions are in mm.

IX. Performance Data

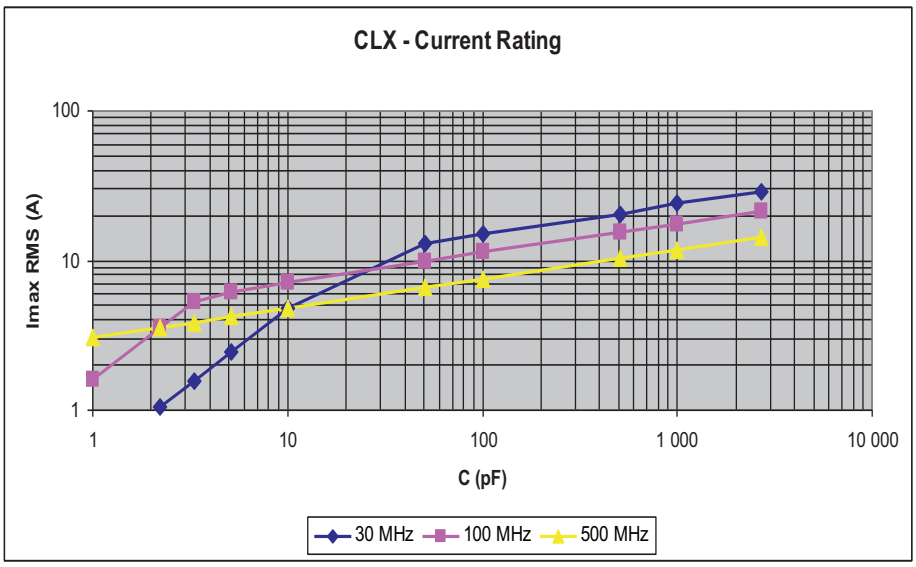
IX.1. ESR

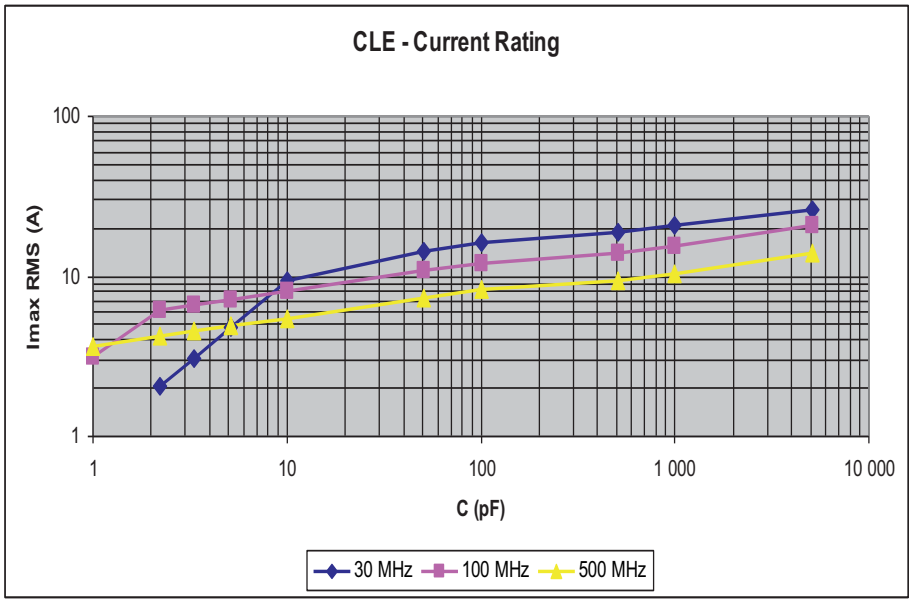


IX.2. Series Resonance Frequency

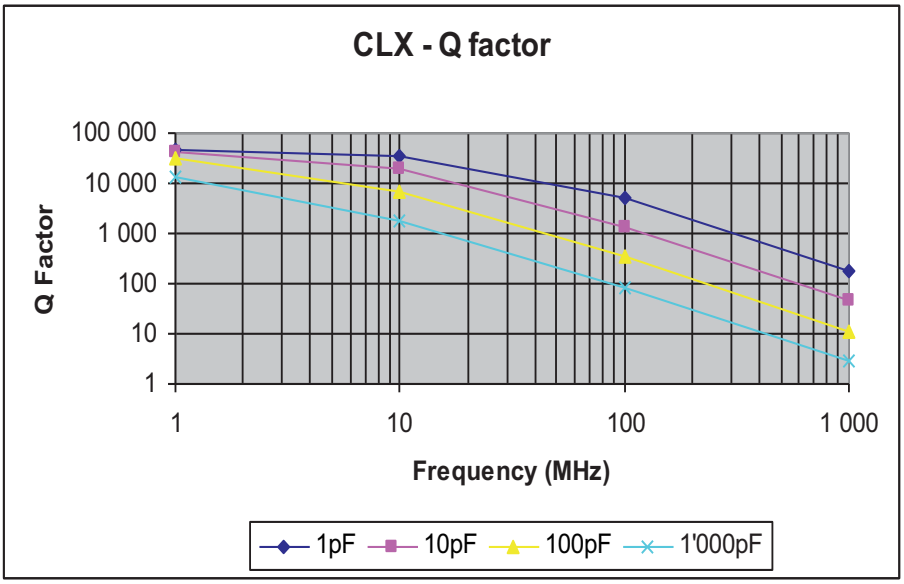


IX.3. Current Rating





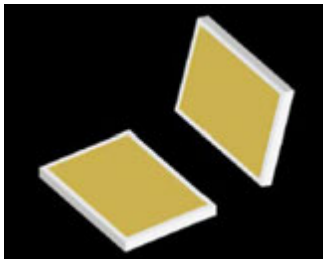
IX.4. Q Factor



SINGLE LAYER - MICROWAVE CERAMIC CAPACITORS

Description

Ceramic capacitor
Thin film technology
Very HiQ , Low insertion loss
High Self-Resonance Frequency up to 50GHz



Applications

- Military infrastructure
- Industrial
- Telecom
- Space

Circuit applications

- Ga-As Integrated circuit's decoupling
- RF/Microwave applications
- DC block, Bypass, tuning
- Line adjustment

I. Dielectric characteristics

Description of available dielectrics for SLC.

Dielectric constant (K)	Dielectric code	Dielectric class	Temperature coefficient	Temperature range	Maximum dissipation factor (Tg δ) / frequency	Minimum Insulation Resistance	Measured Voltage @25°C
23	C	1	0 ± 30ppm/°C	[-55°C;+125°C]	<0.15% @ 1 MHz	>1000 GΩ	1±0.2 Vrms @ 1 MHz (all cap. value)
37	K	1					
80	N	1					
120	U	1	-750 ± 120ppm/°C		<0.25% @ 1 MHz		
160	V	1	-1500 ± 300ppm/°C				
280	R	1	-2200 ± 500ppm/°C				
350	L	1	-3300 ± 500ppm/°C		<1.50% @ 1 MHz		
600	D	2	ΔC/C = ± 10%		<2.50% @ 1 KHz	>100 GΩ	1±0.2 Vrms @ 1 MHz (cap. Value ≤100pF) or 1±0.2 Vrms @ 1 KHz (cap. Value >100pF)
1200	B	2					
2000	W	2	ΔC/C = ± 15%				
2700	X	2					
4000	T	2					
8000	Z	2	ΔC/C = +22% -56%	[+10°C;+85°C]	<4.00% @ 1 KHz	>10 GΩ	
12000	Y	2	ΔC/C = +22% -82%	[-30°C;+85°C]	<0.15% @ 1 KHz		

II. Mechanical characteristics

Version type	U (standard)	B (single border)	V (dual border)
drawings	top & bottom view side view	top view side view	top & bottom view side view

SINGLE LAYER - MICROWAVE CERAMIC CAPACITORS

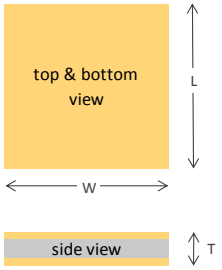
III. Terminations types

Type of metallization	Titanium-Tungsten / Gold TiW/Au	Titanium-Tungsten / Nickel / Gold TiW/Ni/Au
Termination code	T	N
Attachment connection	Wire bonding Au/Ge or Au/Si eutectic preform Silver or gold conductive epoxy Non suitable for Pb/Sn or Au/Sn soldering Good high temp. resistance : 400°C	Au/Sn eutectic preform Pb/Sn or Au/Sn soldering Moderate high temp. resistance : 325°C (*)

(*) Long term high temperature exposure may cause Ni diffusion and wire bonds issues on Au/Ge

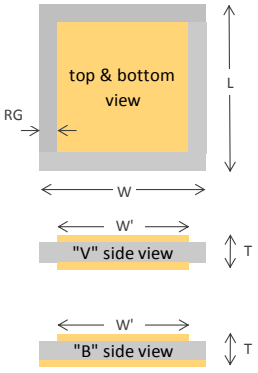
IV. Outline dimensions

U version



Parameter	Meas. Unit	Tol	Size									
			U10	U12	U15	U20	U25	U30	U35	U50	U70	U90
Width (W)	mm	+0.025 -0.076	0.25	0.30	0.38	0.51	0.64	0.76	0.89	1.27	1.78	2.29
	inch	±0.001	0.01	0.012	0.015	0.02	0.025	0.03	0.035	0.05	0.07	0.09
Length (L max)	mm	Nom.	0.30	0.38	0.51	0.64	0.76	0.89	1.02	1.52	2.03	2.54
	inch		0.012	0.015	0.02	0.025	0.03	0.035	0.04	0.06	0.08	0.10
Thickness (T)	mm	±0.050	Nominal 0.10 to 0.20									
	inch	±0.002	Nominal 0.004 to 0.008									

B & V versions



Parameter	Meas. Unit	Tolerance	Size							
			B/V10	B/V12	B/V15	B/V20	B/V25	B/V30	B/V40	B/V50
Length (L & W)	mm	±0.025	0.25	0.30	0.38	0.51	0.64	0.76	0.89	1.27
	inch	±0.001	0.01	0.012	0.015	0.02	0.025	0.03	0.035	0.05
Width nom. (W')	mm	nominal	0.17	0.2	0.28	0.41	0.51	0.66	0.91	1.12
	inch		0.007	0.008	0.011	0.016	0.02	0.026	0.036	0.044
(RG)	mm	±0.025	0.025*	0.025*	0.51	0.51	0.51	0.51	0.51	0.076
	inch	±0.001	0.001**	0.001**	0.002	0.002	0.002	0.002	0.002	0.003
Thickness (T)	mm	±0.050	Nominal 0.10 to 0.20							
	inch	±0.002	Nominal 0.004 to 0.008							

* Minimum 0.127mm
** Minimum 0.005 inch

V. Capacitance values

U version - capacitance range vs case size & dielectric type

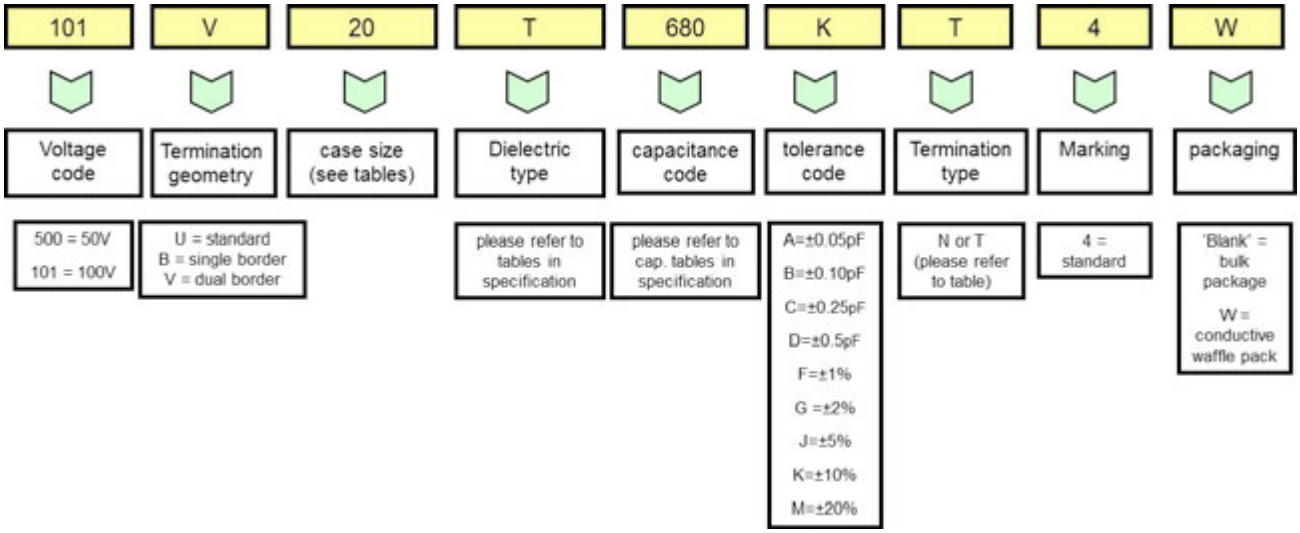
rated voltage		U10	U12	U15		U20		U25		U30		U35		U50	U70	U90
Cap. Value (pF)	Cap. Code	50V	50V	50V	100V	50V	100V	50V	100V	50V	100V	50V	100V	100V	100V	100V
0.1	0R1	C														
0.2	0R2	K	C		C											
0.3	0R3	N	K	C	K		C									
0.4	0R4	N	N	K	K	C	C		C							
0.5	0R5	U	N	K	N	C	K		C							
0.6	0R6	V	N	K	N	C	K	C	C				C			
0.7	0R7	V	N	N	N	K	K	C	K		C		C			
0.8	0R8	V	U	N	N	K	N	C	K		C		C			
0.9	0R9	R	V	N	U	K	N	C	K	C	C		C			
1.0	1R0	R	V	N	U	K	N	K	K	C	K		C	C		
1.1	1R1	R	V	N	V	K	N	K	K	C	K	C	C	C		
1.2	1R2	R	V	N	V	N	N	K	N	C	K	C	C	C		
1.3	1R3	R	V	N	V	N	N	K	N	C	K	C	K	C		
1.4	1R4	L	V	U	V	N	N	K	N	K	K	C	K	C		
1.5	1R5	L	V	U	V	N	N	K	N	K	K	C	K	C		
1.6	1R6	L	R	U	V	N	U	K	N	K	N	C	K	C		
1.7	1R7	L	R	U	V	N	U	K	N	K	N	C	K	C		
1.8	1R8	L	R	U	R	N	U	N	N	K	N	K	K	C		
1.9	1R9	L	R	V	R	N	U	N	N	K	N	K	K	C		
2.0	2R0	D	R	V	R	N	U	N	N	K	N	K	K	K		
2.1	2R1	D	L	V	R	N	V	N	N	K	N	K	K	K	C	
2.2	2R2	D	L	V	R	U	V	N	U	K	N	K	N	K	C	
2.4	2R4	D	L	V	R	U	V	N	U	K	N	K	N	K	C	
2.7	2R7	D	L	R	L	U	V	N	U	N	N	K	N	K	C	C
3.0	3R0	D	L	R	L	U	V	N	U	N	N	K	N	K	C	C
3.3	3R3	D	L	R	L	V	R	N	V	N	U	K	N	K	C	C
3.6	3R6	D	D	R	L	V	R	U	V	N	U	K	N	K	C	C
3.9	3R9	B	D	R	L	V	R	U	V	N	U	N	N	N	C	C
4.3	4R3	B	D	R	D	V	R	U	V	N	V	N	N	N	C	C
4.7	4R7	B	D	L	D	R	R	U	R	N	V	N	N	N	K	C
5.1	5R1	B	D	L	D	R	R	V	R	U	V	N	U	N	K	C
5.6	5R6	B	D	L	D	R	L	V	R	U	V	N	U	N	K	K
6.2	6R2	B	D	D	D	R	L	V	R	U	V	N	V	N	K	K
6.8	6R8	B	B	D	D	R	L	R	R	V	R	N	V	N	K	K
7.5	7R5	W	B	D	D	R	D	R	L	V	R	U	V	N	K	K
8.2	8R2	W	B	D	B	L	D	R	L	V	R	U	V	N	N	K
9.1	9R1	W	B	D	B	L	D	R	L	V	R	U	R	N	N	N
10	100	X	B	D	B	L	D	R	L	R	L	V	R	V	N	N
12	120	X	W	B	B	D	D	L	D	R	L	V	R	V	N	N
15	150	T	W	B	W	D	B	L	D	R	L	R	L	V	N	N
18	180	T	W	B	W	D	B	D	D	L	D	R	L	V	V	N
20	200	T	X	W	W	D	B	D	D	L	D	R	D	R	V	N
22	220	T	X	W	X	B	B	D	B	L	D	R	D	R	V	N
27	270	Z	T	W	X	B	W	D	B	D	D	L	D	R	V	U
33	330	Z	T	X	T	B	W	B	B	D	B	L	D	L	R	U
39	390	Z	T	X	T	W	X	B	W	D	B	D	B	L	R	V
47	470	Y	Z	T	T	W	X	B	W	D	B	D	B	D	R	V
50	500	Y	Z	T	Z	W	X	B	W	B	B	D	B	D	R	V
51	510	Y	Z	T	Z	W	X	B	W	B	B	D	B	D	R	R
56	560	Y	Z	T	Z	X	T	B	X	B	W	D	B	D	R	R
68	680		Z	Z	Z	X	T	W	X	B	W	B	W	D	L	R
82	820		Y	Z	Y	T	Z	W	T	B	X	B	X	B	D	R
100	101		Y	Z	Y	T	Z	X	T	W	X	B	X	B	D	L
120	121			Y	Y	T	Z	T	T	W	T	W	X	B	D	D
150	151			Y		Z	Y	T	Z	X	T	W	X	B	B	D
180	181			Y		Z	Y	T	Z	T	T	W	T	W	B	D
200	201					Z	Y	Z	Z	T	Z	X	T	W	B	B
220	221					Y	Y	Z	Z	T	Z	X	T	W	B	B
270	271					Y		Z	Y	T	Z	T	Z	X	W	B
330	331					Y		Y	Y	Z	Z	T	Z	X	W	W
390	391							Y		Z	Y	T	Z	T	X	W
470	471							Y		Z	Y	Z	Y	T	X	W
560	561							Y		Y		Z	Y	T	T	X
680	681									Y		Z	Y	Z	T	X
820	821											Y		Z	T	X
1000	102											Y		Z	T	T
1200	122													Y	Z	T
1500	152													Y	Y	Z
1800	182														Y	Z
2000	202														Y	Z
2500	252														Y	Y
4000	402															Y

SINGLE LAYER - MICROWAVE CERAMIC CAPACITORS

B & V versions - capacitance range vs case size & dielectric type

rated voltage		100V							
Cap. Value (pF)	Cap. Code	B/V10	B/V12	B/V15	B/V20	B/V25	B/V30	B/V40	B/V50
0.1	0R1	C	C	C					
0.2	0R2	N	K	C	C				
0.3	0R3	N	N	K	C	C			
0.4	0R4	V	N	N	K	C			
0.5	0R5	V	N	N	K	C	C		
0.6	0R6	V	V	N	K	K	C		
0.7	0R7	V	V	V	N	K	C		
0.8	0R8	R	V	V	N	K	C		
0.9	0R9	R	V	V	N	K	C	C	
1.0	1R0	R	V	V	N	K	K	C	
1.1	1R1	R	R	V	N	N	K	C	
1.2	1R2	L	R	V	N	N	K	C	
1.3	1R3	L	R	R	N	N	K	C	
1.4	1R4	L	R	R	N	N	K	C	C
1.5	1R5	L	R	R	V	N	K	C	C
1.6	1R6	D	R	R	V	N	K	K	C
1.7	1R7	D	R	R	V	N	K	K	C
1.8	1R8	D	L	R	V	N	K	K	C
1.9	1R9	D	L	L	V	N	N	K	C
2.0	2R0	D	L	L	V	N	N	K	C
2.1	2R1	D	L	L	V	N	N	K	C
2.2	2R2	D	L	L	V	V	N	K	C
2.4	2R4	D	L	L	V	V	N	K	K
2.7	2R7	D	D	L	V	V	N	K	K
3.0	3R0	B	D	D	L	V	N	K	K
3.3	3R3	B	D	D	L	V	N	N	K
3.6	3R6	B	D	D	L	V	N	N	K
3.9	3R9	B	D	D	L	V	V	N	K
4.3	4R3	B	D	D	L	R	V	N	K
4.7	4R7	B	B	D	L	R	V	N	K
5.1	5R1	B	B	D	L	R	V	N	K
5.6	5R6	B	B	B	L	R	V	N	N
6.2	6R2	W	B	B	D	R	V	V	N
6.8	6R8	W	B	B	D	R	V	V	N
7.5	7R5	W	B	B	D	L	R	V	N
8.2	8R2	W	W	B	D	L	R	V	N
9.1	9R1	W	W	B	D	D	R	V	N
10	100	X	W	W	D	D	L	V	V
12	120	X	W	W	B	D	L	R	V
15	150	T	X	W	B	D	L	R	V
18	180	T	X	X	B	D	D	R	R
20	200	T	T	X	B	B	D	L	R
22	220	Z	T	X	B	B	D	L	R
27	270	Z	T	T	W	B	D	D	L
33	330	Y	Z	T	W	B	B	D	L
39	390	Y	Z	Z	X	W	B	D	L
47	470	Y	Z	Z	X	W	B	D	D
50	500	Y	Y	Z	X	W	B	D	D
51	510	Y	Y	Z	T	X	B	D	D
56	560	Y	Y	Z	T	X	B	B	D
68	680		Y	Y	T	X	W	B	D
82	820		Y	Y	Z	T	W	B	D
100	101			Y	Z	T	X	W	B
120	121				Z	T	X	W	B
150	151				Y	Z	T	X	W
180	181				Y	Z	T	T	W
200	201				Y	Z	T	T	X
220	221				Y	Y	Z	T	X
270	271					Y	Z	T	X
330	331					Y	Y	Z	T
390	391						Y	Z	T
470	471						Y	Z	T
560	561						Y	Y	Z
680	681							Y	Z
820	821								Y
1000	102								Y
1200	122								Y

VI. How to order



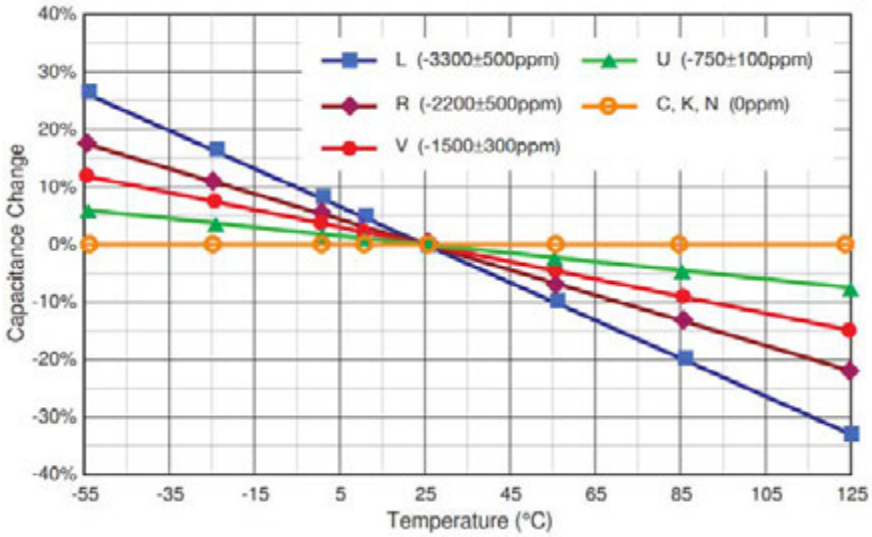
Note :

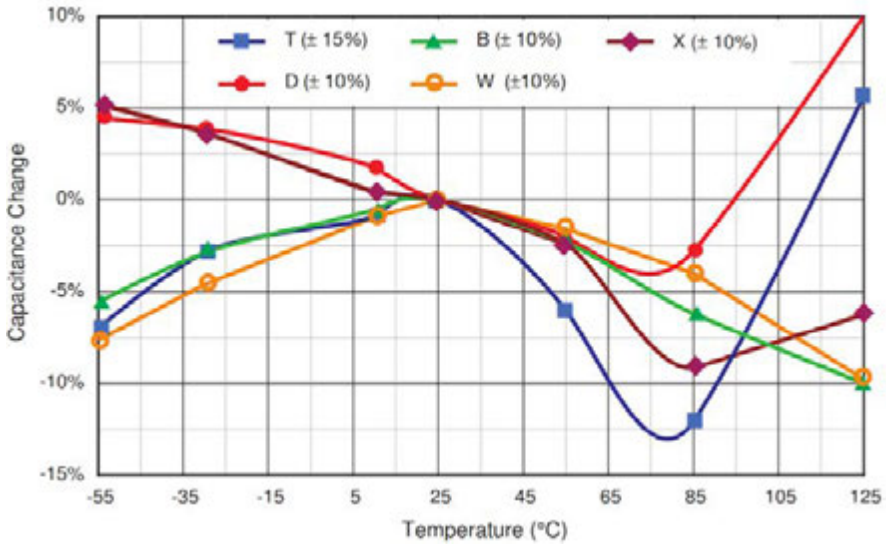
Tolerances A, B, C and D apply for C ≤ 2pF
Tolerances B, C and D apply for 2pF < C ≤ 10pF
Tolerances F, G, J and K apply for C > 10pF

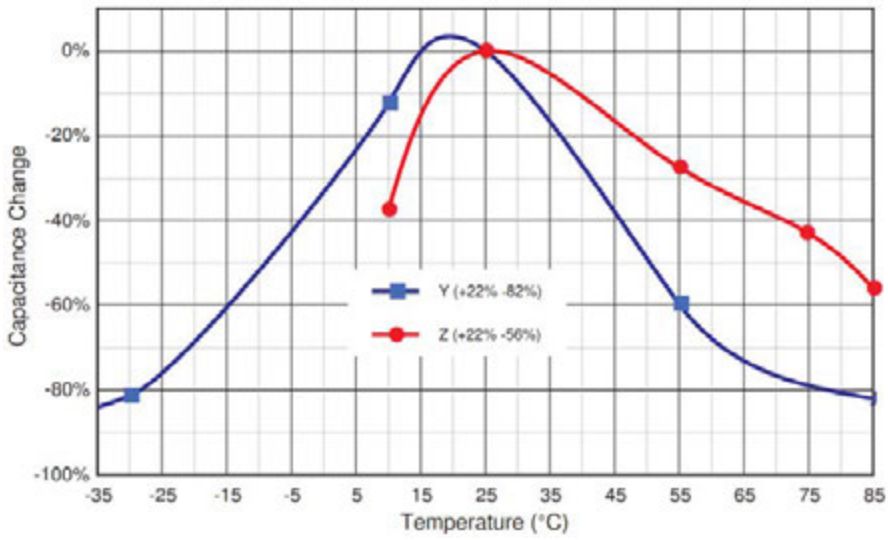
VII. Environmental Specifications

Requirements	Specifications
Bond Strength	MIL-S-883, Meth. 2011
Shear Strength	MIL-S-883, Meth. 2019
Solder Heat Resistance	MIL-S-202, Meth. 210-C, (260 ± 5°C, 5 sec.)
Solderability	MIL-S-202, Meth. 208, (245 ± 5°C, 5 sec.)
Shock	MIL-S-202, Meth. 213-I, (100g, 6 msec.)
Thermal Shock	MIL-S-202, Meth. 107, A, (-55 to +125°C)
Vibration	MIL-S-202, Meth. 204-G, (30g, 10-2000 Hz)
Burn-In/Life Test	MIL-S-202, Meth. 108, A/F
Low Voltage Humidity	Mil-C-49464, Para. 3.17
Barometric Pressure	MIL-S-202, Meth. 105, B
Immersion/Salt Spray	MIL-S-202, Meth. 104, B
Moisture Resistance	MIL-S-202, Meth. 106

VIII. SLC temperature characteristics







CERAMIC CAPACITORS

High Capacitance, High & Low Voltage, Standard

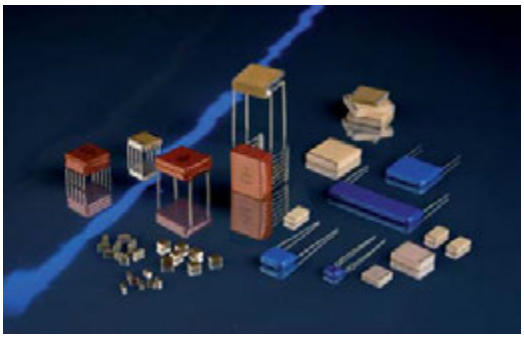
EXXELIA TEMEX

HIGH CAPACITANCE MULTILAYER CERAMIC CAPACITORS

DESCRIPTION:

RoHS compliant (*)
Capacitance range 0.1µF to 100 µF
Rated voltage 50V to 500V
Dielectric Type II
SMD (2225 to 45107), Radial & Stack versions

** Non RoHS version still maintained for current applications.*



I. Foreword

These capacitors have been developed in response to demand from switched mode power supply (S.M.P.S.) and DC-DC converters manufacturers. They are particularly suitable for filtering, smoothing and decoupling purpose in Hi-Rel equipments. The capacitors utilize advanced ceramic technology to achieve Hi-Rel long operating life and small size. They are designed for hybrid assemblies and low profile printed circuit applications.

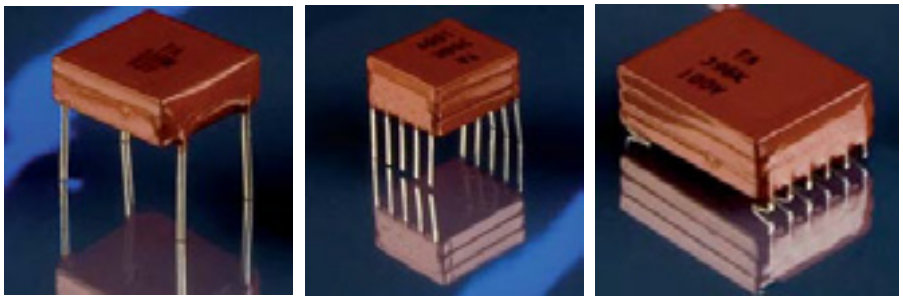
Customized assemblies may be achieved with standard bare chip sizes mentioned in the following chapters.

II. General description

The capacitors here mentioned concern the voltage equal or higher than 50V, in bare chips or leaded devices. Two dielectrics are proposed in X7R Class: the “X” series and the “T” series. Each of them has it own characteristics in between the “X7R” Class limitations.

Bare chips (SMD):

Leaded devices on assemblies (examples):



III. Chips

III-1 Features

The SMD or chips components are the basis capacitors of all the leaded assemblies. Generally not used as chips especially for the sizes above 2229 for soldering reasons (cf the soldering recommendation), the tables hereunder are given for the capacitance range and the thickness of these basis capacitors.

III-2 Capacitance range

Cr	Cr	R2225 / R2229				R3033				R3740				R5440			
Code	(µF)	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V
104	0.10			18	30 23				25 26								
124	0.12			18	30 23				25 26								
154	0.15			20	23				25 26								
184	0.18			20	26				32 26				30 26				
224	0.22			25	28				32 26				30 26				30 27
274	0.27			25 23	31			20	35 26				30 26				30 27
334	0.33	18	18	30 23				20	28			20	33 26			25	35 27
394	0.39	18	18	30 23				20	31			20	35 26			25	35 27
474	0.47	18	18	23				20 23	35			20	40 26			25	35 27
564	0.56	20	20	25				25 23				20	29	20	20	25 26	38 27
684	0.68	20 23	20 23	28		20	20	30 23				25	34	20	20	25 26	40 27
824	0.82	20 23	20 23			20	20	35 24				25 23	38	20	20	30 26	42 27
105	1.0	22 23	22 23			25	25	26		20	20	30 23		20	20	30 26	27
125	1.2	25 23	25 23			25	25	29		20	20	3,5 23		20	20	35 26	33
155	1.5	30 23	30 23			28 23	28 23	34		20 23	20 23	40 26		20	20	35 26	39
185	1.8	23	23			28 23	28 23			25 23	25 23	28		20	20	40 26	
225	2.2	26	26			28 23	28 23			25 23	25 23	32		25 26	25 26	40 26	
275	2.7	29	29			33 24	33 24			28 23	28 23	36		25 26	25 26	26	
335	3.3					38 25	38 25			28 23	28 23			30 26	30 26	33	
395	3.9					28	28			33 23	33 23			30 26	30 26	37	
475	4.7					31	31			35 23	35 23			30 26	30 26		
565	5.6									26	26			35 26	35 26		
685	6.8									30	30			35 26	35 26		
825	8.2									36	36			38 26	38 26		
106	10													28	28		
126	12													32	32		
156	15																
186	18																
226	22																
276	27																

"X" series in green cells "T" series in blue cells The thickness (Tmax in mm) is indicated in the cells.

HIGH CAPACITANCE MULTILAYER CERAMIC CAPACITORS

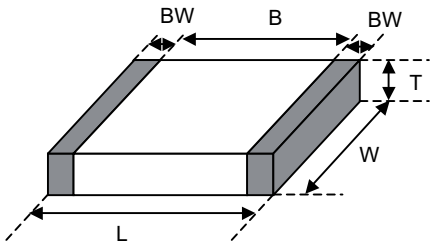
Cr Code	Cr (µF)	R5550 50V	R5550 100V	R5550 200V	R5550 500V	R6560 50V	R6560 100V	R6560 200V	R6560 500V	R6080 / R8060 50V	R6080 / R8060 100V	R6080 / R8060 200V	R6080 / R8060 500V	R45107 50V	R45107 100V	R45107 200V	R45107 500V
104	0.10																
124	0.12																
154	0.15																
184	0.18																
224	0.22																
274	0.27				25 26				25 26								
334	0.33				25 26				25 26								
394	0.39				25 26				25 26								
474	0.47				30 26				25 26								
564	0.56				30 26			20	25 26								
684	0.68				30 26			20	25 26				30 26				35 31
824	0.82			30	35 26			20	30 26				30 26			30 30	35 31
105	1.0			30	42 28	20	20	20 26	30 26				30 26	30	30	30 30	38 31
125	1.2			30 26	33	20	20	20 26	35 26				35 26	30	30	30 30	38 31
155	1.5			30 26	36	20	20	25 26	40 30			30	40 26	30 30	30 30	30 30	31
185	1.8	25	25	30 26	41	20	20	25 26	45 30			30	45 26	30 30	30 30	30 30	31
225	2.2	25	25	30 26		20	20	25 26	33			30 26	26	30 30	30 30	35 30	31
275	2.7	25	25	35 26		20 26	20 26	30 26	38			30 26	33	30 30	30 30	38 30	31
335	3.3	25 26	25 26	40 28		20 26	20 26	30 26	43			30 26	39	30 30	30 30	40 30	
395	3.9	25 26	25 26	31		20 26	20 26	35 26		30	30	35 26	44	30 30	30 30	30	
475	4.7	30 26	30 26	35		20 26	20 26	40 26		30	30	40 26		30 30	30 30	30	
565	5.6	30 26	30 26			25 26	25 26	29		30	30	26		30 30	30 30	30	
685	6.8	30 26	30 26			25 26	25 26	33		30 26	30 26	30		30 30	30 30		
825	8.2	35 26	35 26			30 26	30 26	38		30 26	30 26	36		30 30	30 30		
106	10	38 26	38 26			30 26	30 26			35 26	35 26			35 30	35 30		
126	12	28	28			35 26	35 26			35 26	35 26			35 30	35 30		
156	15	32	32			40 26	40 26			35 26	35 26			30	30		
186	18					26	26			26	26			30	30		
226	22					30	30			28	28			30	30		
276	27					36	36			33	33			33	33		

"X" series in green cells "T" series in blue cells

The hickness (Tmax in mm) is indicated in the cells.

III-3 Dimensions

All dimensions in mm



The thickness is indicated in the capacitance range tables

Size	L	Tol ±	W	Tol ±	BW (min)	BW (max)
2229	5.7	0.4	6.4	0.4	0.25	1.4
2229	5.7	0.4	7.0	0.4	0.25	1.4
3033	7.4	0.5	8.0	0.5	0.5	2.0
3740	9.6	0.5	9.8	0.5	0.5	2.0
5440	13.7	0.5	10.2	0.5	0.5	2.0
5550	13.7	0.5	12.3	0.5	0.5	2.0
6080	15	0.8	19.8	0.8	0.5	2.0
6560	16.9	0.8	15.5	0.8	0.5	2.0
8060	19.8	0.8	14.9	0.8	0.5	2.0
45107	10.8	0.5	27.5 max		0.5	2.0

IV. Radial leaded capacitors

IV-1 Features

Connected by 2 wires, these components have only one basis chips. This 2 wires termination makes the parts perfectly suitable to any design capable to withstand severe environmental conditions (chocks, bumps, vibrations…). An epoxy coating is applied to protect the parts, the parts are marked.

IV-2 Capacitance range

Cr Code	Cr (µF)	R2225				R3033				R3740				R5440			
		50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V
104	0.10			31	43 35				38 39								
124	0.12			31	43 35				38 39								
154	0.15			33	37				38 39								
184	0.18			33	39				45 39				43 39				
224	0.22			38	42				45 39				43 39				43 40
274	0.27			38 35	46			33	48 39				43 39				43 40
334	0.33	31	31	38 35				33	41			33	46 39			38	48 40
394	0.39	31	31	43 35				33	44			33	48 39			38	48 40
474	0.47	31	31		37			33 36	48			33	53 39			38	48 40
564	0.56	33	33		39			38 36				33	42	33	33	38 39	51 40
684	0.68	33 35	33 35		39	33	33	43 36				38	47	33	33	38 39	53 40
824	0.82	33 35	33 35			33	33	48 37				38 36	51	33	33	43 39	55 40
105	1.0	35 35	35 35			38	38	39		33	33	43 36		33	33	43 39	40
125	1.2	38 35	38 35			38	38	42		33	33	48 36		33	33	48 39	46
155	1.5	38 35	43 35			41 36	43 36	47		33 36	33 36	53 39		33	33	48 39	52
185	1.8	35	35			41 36	43 36			38 36	38 36	41		33	33	53 39	
225	2.2	40	40			41 36	43 36			38 36	38 36	45		38 39	38 39	53 39	
275	2.7	43	43			46 37	46 37			41 36	41 36	49		38 39	38 39	39	
335	3.3					51 38	51 38			41 36	41 36			43 39	43 39	46	
395	3.9					41	41			46 36	46 36			43 39	43 39	50	
475	4.7					44	44			48 36	48 36			43 39	43 39		
565	5.6									39	39			48 39	48 39		
685	6.8									43	43			48 39	48 39		
825	8.2									49	49			51 39	51 39		
106	10													41	41		
126	12													45	45		
156	15																
186	18																
226	22																
276	27																

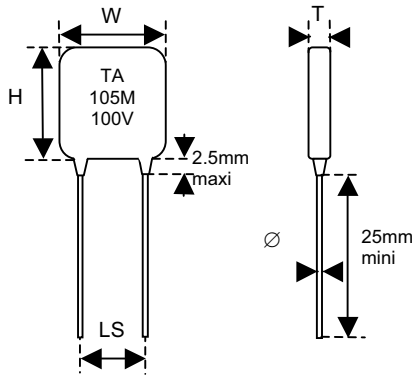
"X" series in green cells "T" series in blue cells The thickness (Tmax in mm) is indicated in the cells.

HIGH CAPACITANCE MULTILAYER CERAMIC CAPACITORS

Cr Code	Cr (µF)	R5550				R6560				R6080/R8060			
		50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V
104	0.10												
124	0.12												
154	0.15												
184	0.18												
224	0.22												
274	0.27				38 39				38 39				
334	0.33				38 39				38 39				
394	0.39				38 39				38 39				
474	0.47				43 39				38 39				
564	0.56				43 39			33	38 39				
684	0.68				43 39			33	38 39				43 39
824	0.82			43	43 39			33	43 39				43 39
105	1.0			43	55 41	33	33	33 39	43 39				43 39
125	1.2			43 39	46	33	33	33 39	48 39				48 39
155	1.5			43 39	49	33	33	38 39	53 43			43	53 39
185	1.8	38	38	43 39	54	33	33	38 39	58 43			43	58 39
225	2.2	38	38	43 39		33	33	38 39	46			43 39	39
275	2.7	38	38	48 39		33 39	33 39	43 39	51			43 39	46
335	3.3	38 39	38 39	53 41		33 39	33 39	43 39	56			43 39	52
395	3.9	38 39	38 39	44		33 39	33 39	48 39		43	43	48 39	57
475	4.7	43 39	43 39	48		33 39	33 39	53 39		43	43	53 39	
565	5.6	43 39	43 39			38 39	38 39	39		43	43	39	
685	6.8	43 39	43 39			38 39	38 39	46		43 39	43 39	43	
825	8.2	48 39	48 39			43 39	43 39	51		43 39	43 39	49	
106	10	51 39	51 39			43 39	43 39			48 39	48 39		
126	12	41	41			48 39	48 39			48 39	48 39		
156	15	45	45			53 39	53 39			48 39	48 39		
186	18					39	39			39	39		
226	22					43	43			41	41		
276	27					49	49			46	46		

"X" series in green cells "T" series in blue cells The hickness (Tmax in mm) is indicated in the cells.

IV-3 Dimensions



The thickness is indicated in the capacitance range tables

All dimensions in mm

Size	W max	H max	LS ±0.5	D ±10%
2225	7.6	9.8	5.08	0.5
3033	11.0	11.0	5.08	0.5
3740	12.7	12.3	10.2	0.6
5440	17.2	12.7	15.24	0.9
5550	17.2	14.8	15.24	0.9
6080	18.8	22.6	15.24	0.9
6560	20.3	18.3	17.8	0.9
8060	23.6	17.7	20.3	0.9

IV-4 Marking

Size	Marking codes	Example
≤ 2229	Cap Code + Tolerance Code Rated voltage value	105M 100V
> 2229	« TA » logo Cap Code + Tolerance Code Rated voltage value	TA 105M 100V

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V. "CNC" Series

V-1 Features

These products are derived from the standard R5440 and R6560 basis chips. This family has the same performance than the radial lead components family. Other capacitances versus rated voltages is completing the range of the radial lead components family Also connected with 2 wires, the coating and the marking are applied.. The "X" dielectric only is available at the moment.

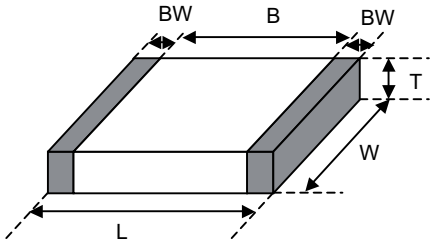
V-2 Capacitance range

		CHIPS								RADIAL LEADED DEVICES							
Cr Code	Cr (µF)	CNC5440				CNC6560				CNC5440				CNC6560			
		63V	100V	250V	400V	63V	100V	250V	400V	63V	100V	250V	400V	63V	100V	250V	400V
104	0.10																
124	0.12																
154	0.15																
184	0.18																
224	0.22				25								38				
274	0.27				25				20				38				33
334	0.33			25	25				20			38	38				33
394	0.39			25	30				20			38	43				33
474	0.47			25	30				20			38	43				33
564	0.56		20	25	30			20	20		33	38	43			33	33
684	0.68		20	30	35			20	25		33	43	48			33	38
824	0.82		20	30	40			20	30		33	43	53			33	43
105	1.0		20	30	44		20	20	30		33	43	57		33	33	43
125	1.2		20	35			20	20	35		33	48			33	33	48
155	1.5	20	20	35		20	20	25	40	33	33	48		33	33	38	53
185	1.8	25	25	40		20	20	25	50	33	38	53		33	33	38	63
225	2.2	25	25	40		20	20	25		38	38	53		33	33	38	
275	2.7	25	25			20	20	30		38	38			33	33	43	
335	3.3	30	30			20	20	30		43	43			33	33	43	
395	3.9	30	30			20	20	35		43	43			33	33	48	
475	4.7	30	30			20	20			43	43			33	33		
565	5.6	35	35			25	25			48	48			38	38		
685	6.8	35	35			25	25			48	48			38	38		
825	8.2	38	38			30	30			51	51			43	43		
106	10					30	30							43	43		
126	12					35	35							48	48		
156	15					40	40							53	53		

"X" series in green cells

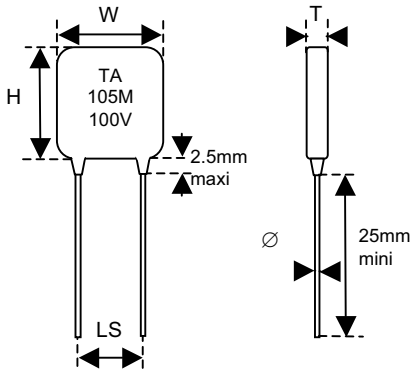
The hickness (Tmax in mm) is indicated in the cells.

V-3 Dimensions



All dimensions in mm

Size	L	Tol ±	W	Tol ±	BW (min)	BW (max)
CNC5440	13.7	0.5	10.2	0.5	0.5	2.0
CNC6560	16.9	0.8	15.5	0.8	0.5	2.0



All dimensions in mm

Size	W max	H max	LS ±0.5	D ±10%
CNC5440	17.2	12.7	15.24	0.9
CNC6560	20.3	18.3	17.8	0.9

Note: products in 100V can also be order under "R5440" or "R6560" case codes since there is no technical differences between both designations

V-4 Marking

Size	Marking codes	Example
CNC5440 CNC6560	« TA » logo Cap Code + Tolerance Code Rated voltage value	TA 105M 100V

VI. “SC” and “SV” Series

VI-1 Features

The « SV » Series looks like the radial 2 wires components Series except the assemblies are made with 2 to 4 basis chips. This allows to extend the 2 wires family.

The “SC” Series offer 4 wires (W4), Dual In Line (DIL) or ribbons terminations making them perfectly suitable to any design (ceramic substrate, epoxy board…) capable to withstand severe environmental conditions (shocks, bumps, vibrations…) as the “SV” Series.

VI-2 Capacitance range

Cr Code	Cr (µF)	SC00 (2229)				SC01/SV01 (3033)				SC02/SV02 (3740)				SC03/SV03 (5440)			
		50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V
104	0.10																
124	0.12																
154	0.15				32												
184	0.18				64												
224	0.22				64												
274	0.27				96												
334	0.33				96 64				61								
394	0.39				128 64				61								
474	0.47			54	128 64				69								
564	0.56			54	64				105				67				
684	0.68			81	97				105 63				70				
824	0.82			81 58	97				139 66				99				
105	1.0			108 58	130			44	148 74				103				46
125	1.2			108 58				54	99				140 62				74
155	1.5			128 58				66	111				160 76				79
185	1.8	48	48	88				88 65	148			59	80				88 58
225	2.2	48	48	88				108 65	160			64	108				92 64
275	2.7	54	54	118				140 65				64	144			69	142 76
335	3.3	54 60	54 60	118				15 93				96 58	16			74	142 99
395	3.9	81 60	81 60			60	62	10				96 64				96	180 10
475	4.7	81 60	81 60			60	64	124				128 72				112 56	134
565	5.6	108 60	108 60			70 52	72 52	136		60	60	160 76				126 63	158
685	6.8	128 91	128 91			80 54	82 54			60	60	106				130 74	
825	8.2	91	91			110 60	112 60			72	90	114				168 84	
106	10	122	122			120 81	122 81			74 50	90 50	148		64	66	105	
126	12	122	122			140 90	144 90			105 56	120 56			74	76	133	
156	15					120	120			111 78	125 78			101 56	103 56	156	
186	18					132	132			148 88	150 88			128 58	130 58		
226	22									102	102			148 64	150 64		
276	27									112	112			148 88	150 88		
336	33									150	150			16 98	160 98		
396	39													120	120		
476	47													120	120		
566	56																
686	68																
826	82																
107	100																

“X” series in green cells “T” series in blue cells

The hickness (Tmax in mm) for SC Series or he Height (Hmax in mm) for the SV Series is indicated in the cells.

HIGH CAPACITANCE MULTILAYER CERAMIC CAPACITORS

Cr Code	Cr (µF)	SC04/SV04 (5550)				SC05/SV05 (6560)				SC06/SC07 SV06/SV07 (6080/8060)				SC10 (45107)			
		50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V
104	0.10																
124	0.12																
154	0.15																
184	0.18																
224	0 22																
274	0 27																
334	0 33																
394	0 39																
474	0.47																
564	0 56																
684	0.68																
824	0 82																
105	1.0																
125	1.2				64												
155	1.5				96												64
185	1.8				96												64
225	2.2				96 65				69				69				64
275	2.7				128 73				79				96				74
335	3.3				148 81				84				101				96
395	3.9			64	168 111				111 67				128			54	128
475	4.7			96	114				126 75				148 63			59	148
565	5.6			96 56	149			59	168 85			64	148 70			64	148
685	6.8			110 60	167			64	208 90			64	168 81			81	168
825	8.2			111 64				91	120			96	98			96	
106	10			126 94				96 59	135			96 56	123			96	
126	12	64	64	160 99				128 66	175			128 60	151			128	
156	15	72	81	132				148 75				128 70	184	64	64	128	
186	18	77 56	108 56	144		64	64	101		37	37	160 88		64	64		
226	22	80 58	128 58			64	64	110		64	74	92		96	96		
276	27	117 62	128 62			79	96	140		64	82	128		96	96		
336	33	120 86	148 86			84 56	96 56	160		71 56	105 56	152		128	128		
396	39	160 94	168 94			116 60	128 60			96 58	112 58			128	128		
476	47	120	120			126 70	128 70			96 65	118 65			160	160		
566	56	136	136			168 88	170 88			116 88	120 88						
686	68					96	96			148 90	150 90						
826	82					128	128			118	118						
107	100					146	146			135	135						

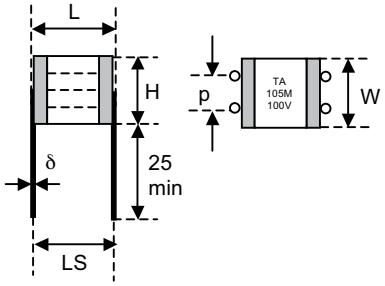
"X" series in green cells "T" series in blue cells

The hickness (Tmax in mm) for SC Series or the Height (Hmax in mm) for the SV Series is indicated in the cells.

VI-3 Dimensions

SC Series

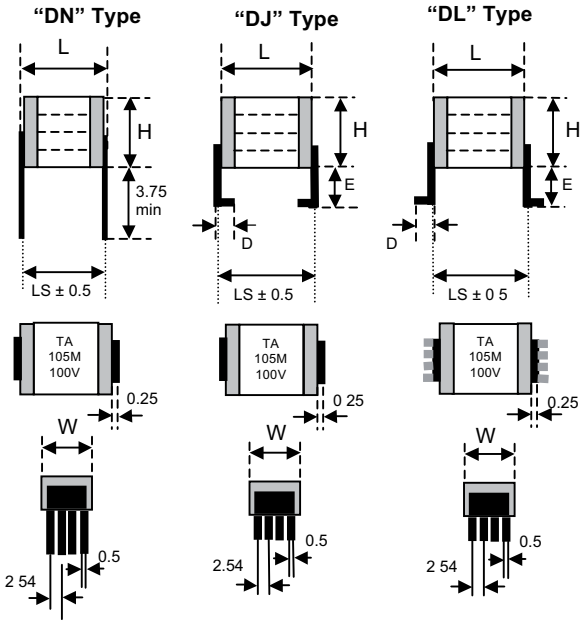
4 wires « W4 » terminations



All dimensions in mm

Size	L max	W max	LS ± 0,5	p ± 0,5	δ ± 10%	H max
SC02	11,9	11,4	10,16	7,62	0,6	
SC03	17,0	12,0	15,24	10,16	0,9	
SC04	16,5	14,0	15,24	10,16	0,9	Please, consult the tables of capacitance range
SC05	20,0	16,6	17,80	10,16	0,9	
SC06	17,8	21,6	15,24	10,16	0,9	
SC07	22,7	16,6	20,32	10,16	0,9	

Dual In Line « DIL » termination

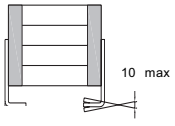


Note: the marking shown here is just given as an example

All dimensions in mm

Size	L max	W max	LS ± 0,5*	E ± 0,3	D ± 0,5	Nb pins**	H max
SC00	7,4	8,5	6,35	2,0	2,0	3	
SC01	10,2	9,6	7,62	1,5	2,5	3	
SC02	11,9	11,4	10,16	1,5	2,5	4	
SC03	15,5	11,5	14,00	1,5	2,5	4	Please, consult the tables of capacitance range
SC04	16,5	14,0	13,70	1,5	2,5	5	
SC05	18,5	17,0	17,78	1,5	2,5	6	
SC06	17,8	21,6	15,24	1,5	2,5	7	
SC07	22,7	16,6	20,32	1,5	2,5	6	
SC10	13,2	27,5	11,50	2,1	2,6	10	

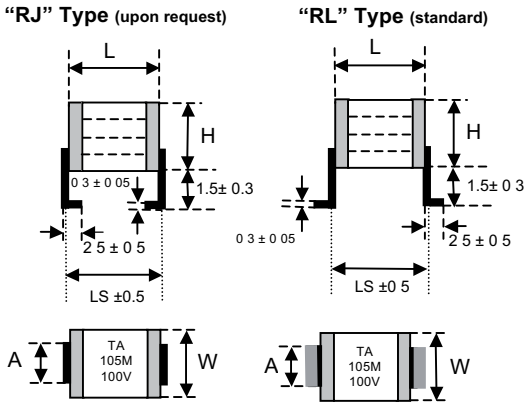
* Except for the SC07, tolerance = ± 0.8 mm
* * Number de pins per side



Wires bending: 10° max

HIGH CAPACITANCE MULTILAYER CERAMIC CAPACITORS

Ribbons “R” terminations

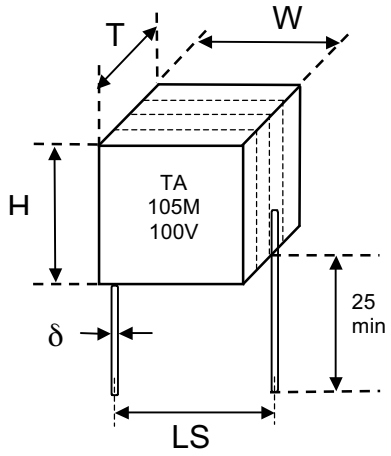


All dimensions in mm

Size	L max	W max	LS Max	A ± 0,2	H max
SC01	10,2	9,6	10.55	8,0	
SC02	11,9	11,4	12.25	8,0	
SC03	15,5	11,5	15.85	8,0	Please, consult the tables of capacitance range
SC04	16,5	14,0	16.85	8,0	
SC05	18,5	17,0	18.85	15,0	
SC06	17,8	21,6	18.15	15,0	
SC07	22,7	16,6	23.05	15,0	

Note: the marking shown here is just given as an example. For the ‘RJ’ version, please consult us.

SV Series



All dimensions in mm

Size	W max	H max	LS ±0.5	δ ±10%	T max
SV01	10,2	9,6	10,16	0,6	
SV02	11,9	11,4	10,16	0,6	
SV03	17,0	12,0	15,24	0,9	Please consult the tables of capacitance range
SV04	16,5	14,0	15,24	0,9	
SV05	20,0	16,6	17,80	0,9	
SV06	17,8	21,6	15,24	0,9	
SV07	22,7	16,6	20,32	0,9	

VI-4 Marking

Size	Marking codes	Example
All sizes	« TA » logo Cap Code + Tolerance Code Rated voltage value	TA 105M 100V

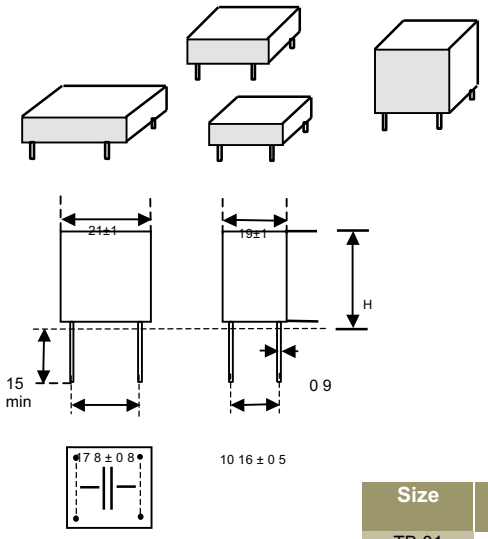
VII. "TB" Series

VII-1 Features

This series features have the same electrical parameters than the "SC" series with only 4 wires variants, the capacitor being molded in a plastic housing making it perfectly impervious to all external agents.

VII-2 Capacitance range and dimensions

Cr Code	Cr (µF)	TB Series			
		63V	100V	250V	400V
684	0.68			TB01	TB01
824	0 82			TB01	TB01
105	1.0			TB01	TB01
125	1.2			TB01	TB01
155	1.5			TB01	TB02
185	1.8			TB01	TB02
225	2.2		TB01	TB01	TB03
275	2.7		TB01	TB01	TB03
335	3.3		TB01	TB01	TB03
395	3.9		TB01	TB02	TB03
475	4.7		TB01	TB02	TB03
565	5.6	TB01	TB01	TB02	TB04
685	6.8	TB01	TB01	TB02	TB04
825	8.2	TB01	TB01	TB03	
106	10	TB01	TB01	TB03	
126	12	TB01	TB01	TB03	
156	15	TB01	TB01		
186	18	TB02	TB02		
226	22	TB03	TB03		
276	27	TB03	TB03		
336	33	TB03	TB03		
396	39	TB03	TB03		
476	47	TB03	TB03		
566	56	TB04	TB04		
686	68	TB04			
826	82	TB05			
107	100	TB05			



Size	H max (mm)
TB 01	6.5
TB 02	8.0
TB 03	12.5
TB 04	20.0
TB 05	30.0

"X" series in green cells

VII-3 Marking

Size	Marking codes	Example
All sizes	« TA » logo Cap Code + Tolerance Code Rated voltage value	TA 105M 100V

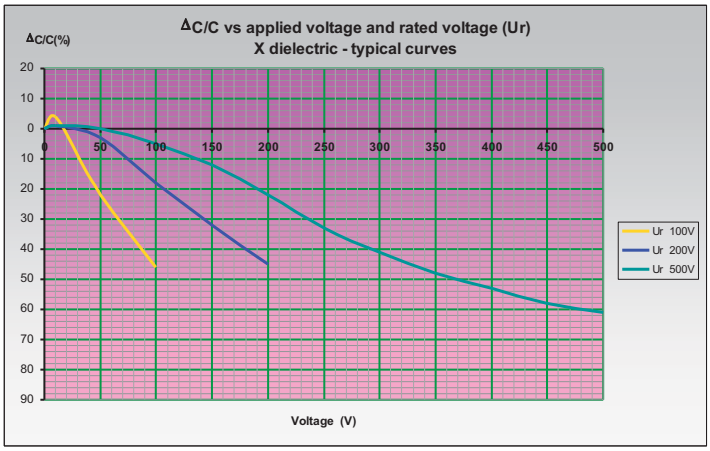
The marking is applied on the top of the TB capacitors

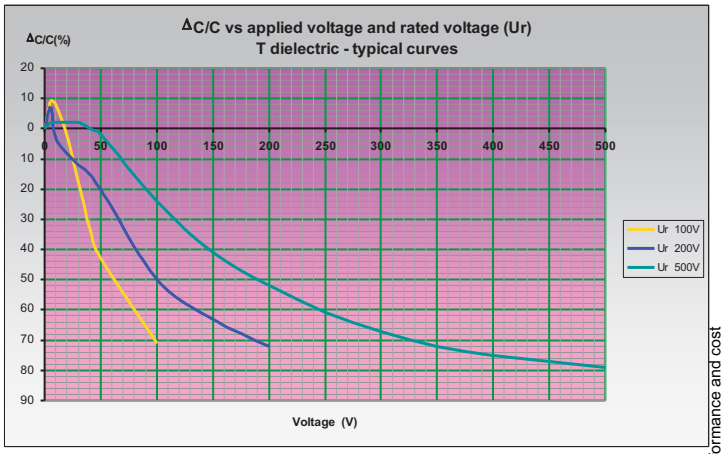
VIII. Dielectric characteristics

Description	"X" Series (class 2)	"T" Series (class 2)
CECC	**2R1**	**2R1**
EIA	**X7R**	**X7R**
Temex Ceramics Code	**X**	**T**
Operating temperature range	-55°C / +125°C	-55°C / +125°C
Storage temperature range	-55°C / +125°C	-55°C / +125°C
Maximun ΔC/C over Temperature range without voltage applied	± 15%	± 15%
Ageing	≤2.5% per decade hour	≤2.5% per decade hour
Dissipation Factor (D.F.)	≤ 2.5%	≤ 2.5%
Voltage proof	All Series except TB **Ur ≤ 200V:** 2.5 x Ur **Ur > 200V:** 2.0 x Ur TB Series **Ur ≥ 50V:** 2.0 x Ur	All Series except TB **Ur ≤ 200V:** 2.5 x Ur **Ur > 200V:** 2.0 x Ur TB Series **Ur ≥ 50V:** 2.0 x Ur
Insulation Resistance (IR) @ 25°C (Under Ur)	100GΩ or 1000Ω.F*	100GΩ or 1000Ω.F*
Insulation Resistance (IR) @ 125°C (Under Ur)	10GΩ or 100Ω.F*	10GΩ or 100Ω.F*
Measurement Conditions for C and D.F. @ 20°C	**≤ 100pF:** 1MHz / 1Vrms (no bias) **> 100pF:** 1KHz / 1Vrms (no bias)	**≤ 100pF:** 1MHz / 1Vrms (no bias) **> 100pF:** 1KHz / 1Vrms (no bias)
Capacitance versus applied Voltage and Temperature	Cf the following page	Cf the following page

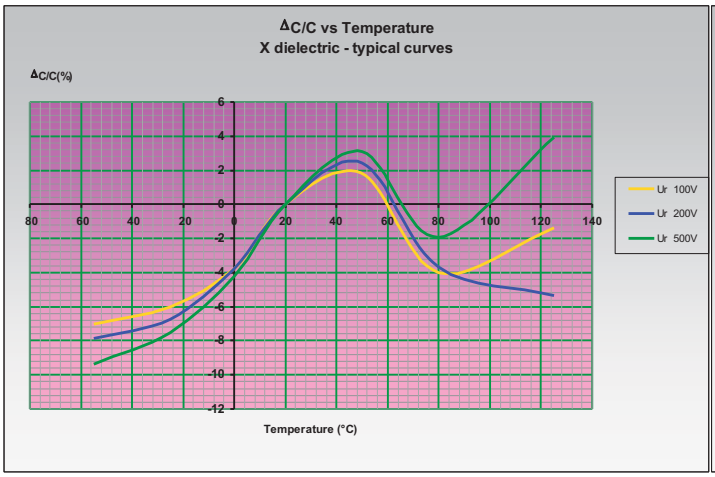
(*): whichever is the less.

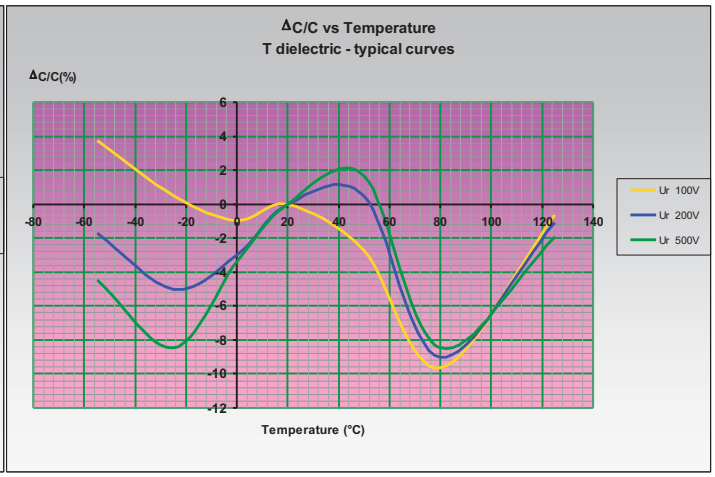
Curves of capacitance behaviour versus applied voltage @25°C (for all sizes)



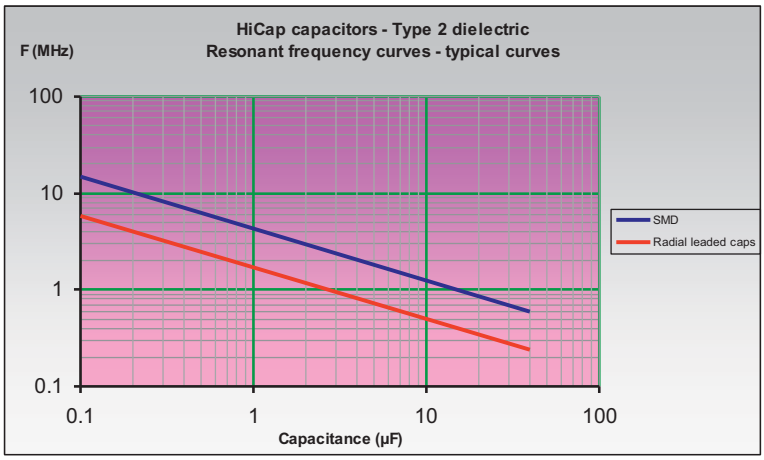


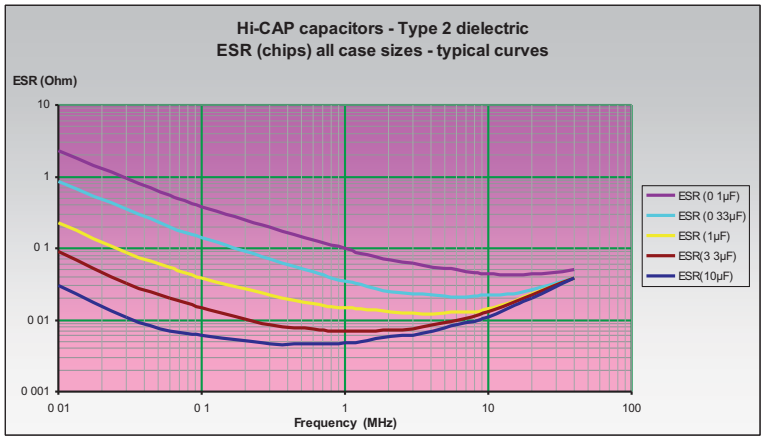
Curves of capacitance behaviour versus temperature (for all sizes), without voltage





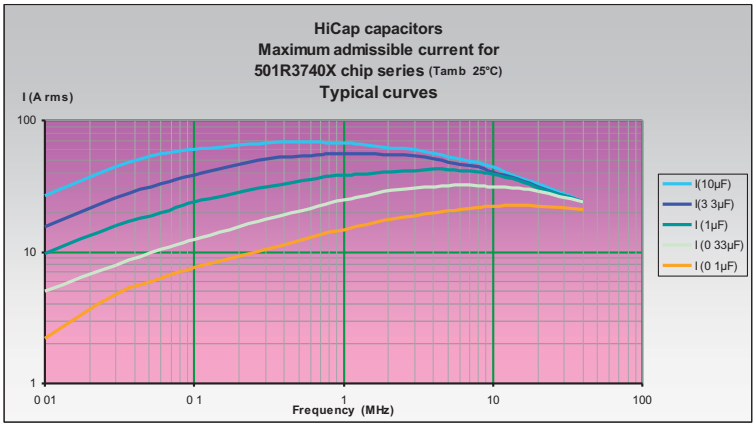
IX. Electrical characteristics





The ESR (Equivalent Serial Resistance) curves are given here for SMD (chips) capacitors. Regarding the curves for the leaded capacitors, they are rather the same.

Indeed, due to the resistivity of the raw material used and the wire diameters, the resistance of the wires is much lower than the ESR of the chips. So, in a first approach, their influence can be considered as negligible.



These typical curves are an example of admissible currents for one family of chip capacitors. For other curves and products or for further information, please contact us.

Note: for the calculations, we have considered that the terminations are directly connected to an infinite heat sink. In other words, the thermal resistance of the circuit itself which depends of its type and design has not been taken into account. Moreover, the ambient temperature taken is 25°C.

X. Termination types

Description	P (RoHS)	T (non RoHS)	R / W2 / W4 (RoHS)	R / W2 / W4 (non RoHS)	DIL (RoHS)	DIL (non RoHS)	RL / RJ (RoHS)
Chip (SMD)	✓	✓	-	-	-	-	-
Leaded caps	-	-	✓	✓	✓	✓	✓
Materials	**All sizes:** Ag 100%	**P** termination with SnPbAg solder dipping	100% tinned Copper	Sn(70%) Pb(30%) plated Copper	100% tinned phosphor bronze	Sn(60%) Pb(40%) plated phosphor bronze	100% tinned Copper
Magnetic status	Non magnetic	Non magnetic	Non magnetic	Non magnetic	Non magnetic	Non magnetic	Non magnetic
Lead status (% of Pb)	0%	36%	0%	30% of the plated layer	0%	40% of the plated layer	0%

XI. Special products

As standard products can't meet all the specificities of all applications, special applications may require special features (higher voltage, burn-in, dimensions, coating, leading, marking…) not described in this catalogue.

Based on the "state of the Art", and our knowledge of the technology, our Engineers may study at your request all special components to meet your application.
Please, consult us for more information.

HIGH CAPACITANCE MULTILAYER CERAMIC CAPACITORS

XII. How to order

501	R	6560	X	105	K	P		RoHS
Rated Voltage 1st two digits are significant; third digit denotes number of zeros Examples: 500 = 50V 101 = 100V 201= 200V 501 = 500V	**Family** R CNC	**Size** 2229 3033 3740 5440 5550 6560 6080 8060 45107	**Dielectric** X = X7R T = X7R	**Capacitance** 1st two digits are significant; third digit denotes number of zeros Exemples: 101=100pF 472= 4.7nF 683 = 68nF 104 = 0.1µF	**Tolerance** K (±10%) M (±20%)	**Termination** P: chip T: chip R: radial 2 wires	**Coating** Not applicable for chips and radial leaded	**RoHS Compliancy (**)** If left blank non RoHS compliant
	Family SC SV	**Size** 00 (SC only) 01 02 03 04 05 06 07 10 (SC only)				**Termination** **SC Series** DN: DIL 'N' type DJ: DIL 'J type DL: DIL 'L' type RL: ribbon 'L' type RJ: ribbon 'J' type W4: radial 4 wires **SV Series** W2: radial 2 wires	**Coating** If left blank Uncoated and No marking U Uncoated and marked C Coated and marked	
	Family TB	**Size** 01 02 03 04 05				**Termination** W4: 4 wires	**Coating** Not applicable for TB caps	

(**): For leaded capacitors, both RoHS and non-RoHS versions exist. This is due to the wishes of some customers who still need non-RoHS components in their applications. This suffix must be required for RoHS compliancy.

For "P" terminations, only the RoHS version exists. The RoHS suffix can be added for information.

XIII. Packaging

"Blister" Boxes (SMD and leaded components):

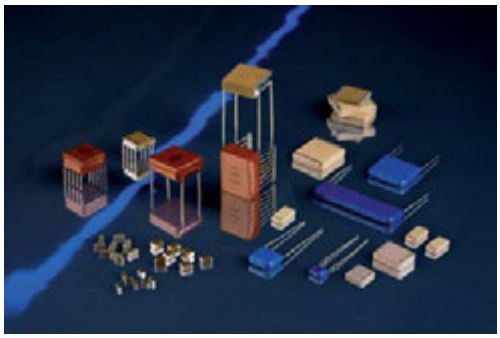
For all products, special "blister" boxes are used to optimise the protection of the parts during the carriage and the storage. Depending upon the termination (with or without connection) and the size, the number of the parts in each box is defined. Please, consult us for more details.

HIGH VOLTAGE MULTILAYER CERAMIC CAPACITORS

DESCRIPTION:

RoHS compliant (*)
Capacitors 0805 to 6560
Rated voltage 1000V to 10KV
Dielectric Type I and II
SMD and leaded versions

** Non RoHS version still maintained for current applications.*



I. Foreword

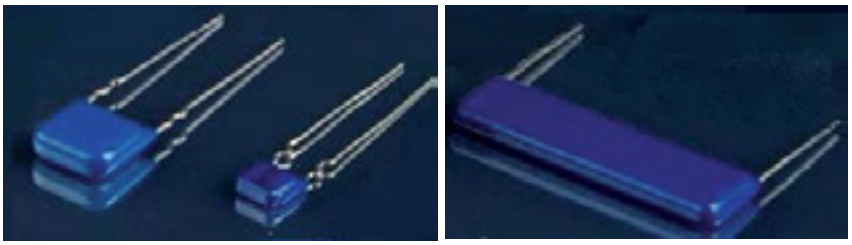
The High voltage series is intended for such typical application as high voltage power supplies and high voltage multiplier circuits. Available in bare chips, they can be used in surface mounting or hybrid circuit applications. Their multilayer construction offers significant size and space saving advantage. Combination of standard case sizes may be obtained for special applications. They are suited for use in commercial, industrial and High-Rel military circuits.

II. Description

The capacitors here mentioned concern the voltage equal or higher than 1KV, in bare chips or leaded devices. The dielectrics used are from 2 types: ultra stable NP0 and X7R dielectrics.

Bare chips:

Radial leaded devices:



The standard wires are straight but on special request they can be bended to meet customer specification. Ask us for specific demand!

III. Capacitance Ranges

		S Termination		Radial Leaded version Avail.
Case size	Rated Voltage	NPO Dielectric	X7R Dielectric	
R15 = 0805	1000V		150pF to 1.0nF	
R18 = 1206	1000V	10pF to 1nF	220pF to 18nF	
	2000V	2pF to 390pF	150pF to 6.8nF	
	3000V	2pF to 39pF	150pF to 1nF	
S41 = 1210	1000V	10pF to 2.2nF	220pF to 47nF	
	2000V		150pF to 6.8nF	
S43 = 1812	1000V	68pF to 6.8nF	220pF to 150nF	
	2000V	68pF to 1.5nF	270pF to 15nF	
	3000V	2pF to 1.2nF	150pF to 10nF	
S47 = 2220	1000V	1nF to 12nF	10nF to 220nF	
	2000V	2pF to 120pF	1nF to 58nF	
	3000V	2pF to 120pF	150pF to 15nF	
	4000V	2pF to 120pF	150pF to 10nF	
	5000V	2pF to 120pF		

Available capacitance series (cf end of this chapter):
NP0 dielectric: Epsilon 12 in standard, Epsilon 24 upon request
X7R dielectric: Epsilon 6 in standard, Epsilon 12 upon request

HIGH VOLTAGE MULTILAYER CERAMIC CAPACITORS

Case size	Rated Voltage	P Termination		Radial Leaded version Avail.
		NPO Dielectric	X7R Dielectric	
1515	1000V	470pF to 820pF	330pF to 12nF	✓
	2000V	240pF to 470pF	220pF to 2.7nF	✓
	3000V	100pF to 220pF	150pF to 1nF	✓
	4000V	12pF to 150pF	120pF to 470pF	✓
2020	1000V		680pF to 22nF	✓
	2000V		470pF to 6.8nF	✓
	3000V		390pF to 2.7nF	✓
	4000V		390pF to 2.2nF	✓
2520	1000V		1nF to 33nF	✓
	2000V		680pF to 10nF	✓
	3000V		330pF to 3.9nF	✓
	4000V		220pF to 1.8nF	✓
	5000V		120pF to 1.5nF	✓
3333	1000V	2.7nF to 5.6nF	22nF to 100nF	✓
	2000V	1.2nF to 4.7nF	4.7nF to 27nF	✓
	3000V	560pF to 1.8nF	2.2nF to 12nF	✓
	4000V	470pF to 1nF	1.5nF to 8.2nF	✓
	5000V	330pF to 680pF	820pF to 3.3nF	✓
	6000V	220pF to 470pF	470pF to 2.2nF	✓
4020	5000V		1.2nF to 5.6nF	✓
	6000V		470pF to 1.5nF	✓
	7000V		330pF to 1.2nF	✓
	8000V		470pF to 820pF	✓
	9000V		390pF to 680pF	✓
	10 000V		270pF to 560pF	✓
4040	1000V	4.7nF to 10nF	39nF to 120nF	✓
	2000V	3.3nF to 5.6nF	10nF to 47nF	✓
	3000V	1.8nF to 2.7nF	3.3nF to 18nF	✓
	4000V	1nF to 1.8nF	2.7nF to 8.2nF	✓
	5000V	680pF to 1nF	1.2nF to 5.6nF	✓
	6000V	390pF to 820pF	560pF to 3.3nF	✓
	7000V		560pF to 1nF	✓
	8000V		270pF to 820pF	✓
	9000V		240pF to 620pF	✓
	10 000V		220pF to 470pF	✓

Available capacitance series (cf end of this chapter):
NP0 dielectric: Epsilon 12 in standard, Epsilon 24 upon request
X7R dielectric: Epsilon 6 in standard, Epsilon 12 upon request

HIGH VOLTAGE MULTILAYER CERAMIC CAPACITORS

Case size	Rated Voltage	P Termination		Radial Leaded version Avail.
		NPO Dielectric	X7R Dielectric	
5440	1000V	8.2nF to 12nF	82nF to 220nF	✓
	2000V	4.7nF to 8.2nF	15nF to 68nF	✓
	3000V	2.2nF to 3.3nF	6.8nF to 27nF	✓
	4000V	1.5nF to 2.7nF	4.7nF to 12nF	✓
	5000V	1.nF to 1.8nF	2.7nF to 10nF	✓
	6000V	470pF to 1.2nF	330pF to 5.6nF	✓
6560	1000V		150nF to 390nF	✓
	2000V		39nF to 150nF	✓
	3000V		18nF to 56nF	✓
	4000V		8.2nF to 22nF	✓
	5000V		4.7nF to 18nF	✓
	6000V		2.7nF to 12nF	✓
	7000V		2.7nF to 6.8nF	✓
	8000V		2.7nF to 3.9nF	✓

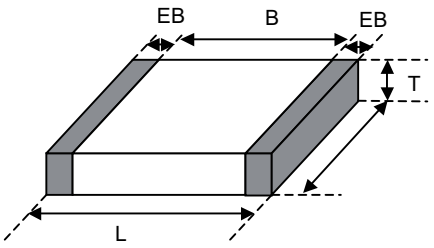
Available capacitance series (cf end of this chapter):
NP0 dielectric: Epsilon 12 in standard, Epsilon 24 upon request
X7R dielectric: Epsilon 6 in standard, Epsilon 12 upon request

These hereinabove tables define the standard products, other components may be built, don't hesitate to contact us (cf chapter VIII).

Capacitance series:
Epsilon 6: 10, 15, 22, 33, 47, 68
Epsilon 12: 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82
Epsilon 24: 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91
Are included their multiples and sub multiples of 10.

IV. Dimensions

SMD components



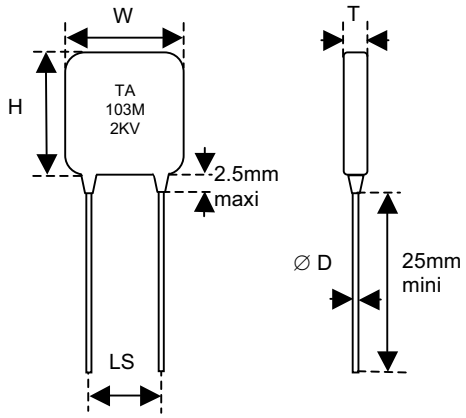
All dimensions in mm

Case size	S termination						
	L	Tol. (±)	W	Tol (±)	T maxi	EB min	B min
R15 = 0805	2.0	0.2	1.25	0.2	1.45	0.2	0.7
R18 = 1206	3.2	0.3	1.6	0.2	1.8	0.3	1.5
S41 = 1210	3.2	0.3	2.5	0.2	2.6	0.3	1.6
S43 = 1812	4.6	0.3	3.2	0.3	3.0	0.3	2.5
S47 = 2220	5.7	0.4	5.0	0.4	3.0	0.3	3.5

Case size	L	Tol. (±)	W	Tol. (±)	Thickness maxi (T) Voltage (kV) 1	2	3	4	5	6	7	8	9	10	EB min	B Min
1515	3.8	0.38	3.8	0.38	3.9	3.9	3.9	3.9							0.3	2.22
2020	5.1	0.51	5.1	0.51	3.9	3.9	3.9	3.9							0.3	3.19
2520	6.4	0.64	5.1	0.51	3.9	3.9	4.5	4.5	4.5						0.3	4.36
3333	8.4	0.84	8.4	0.84	4.5	4.5	4.5	4.5	5.9	5.9					0.5	5.56
4020	10.2	1	5.1	0.51					4.5	4.5	5.1	5.1	5.1	5.1	0.5	7.2
4040	10.2	1	10.2	1	3.9	4.5	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	0.5	7.2
5440	13.7	1.4	10.2	1	4.5	5.1	5.1	5.1	6.4	6.4					0.5	10.3
6560	16.5	1.7	15.2	1.5	4.5	5.1	5.1	5.1	6.4	6.4	6.4	6.4			0.5	12.8

Regarding the thickness for exact values for each part number, please consult us.

Radial leaded components



Case size	W	H	L.S.	D	Thickness maxi (T) Voltage (KV)									
	maxi	maxi	±0.5	±10%	1	2	3	4	5	6	7	8	9	10
1515	6.3	5.8	5.08	0.6	5.2	5.2	5.2	5.2						
2020	7.6	7.1	5.08	0.6	5.2	5.2	5.2	5.2						
2520	8.9	7.1	7.62	0.6	5.2	5.2	5.8	5.8	5.8					
3333	11.4	10.4	10.16	0.9	5.8	5.8	5.8	5.8	7.2	7.2				
4020	13.2	7.1	12.7	0.9					5.8	5.8	6.4	6.4	6.4	6.4
4040	13.2	12.2	12.7	0.9	5.2	5.8	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
5440	16.7	12.2	15.24	0.9	5.8	6.4	6.4	6.4	7.7	7.7				
6560	19.5	17.2	17.78	0.9	5.8	6.4	6.4	6.4	7.7	7.7	7.7	7.7		

All dimensions in mm
For exact values regarding the thickness, please consult us.

V. Marking

Note: the marking is only available for leaded capacitors.

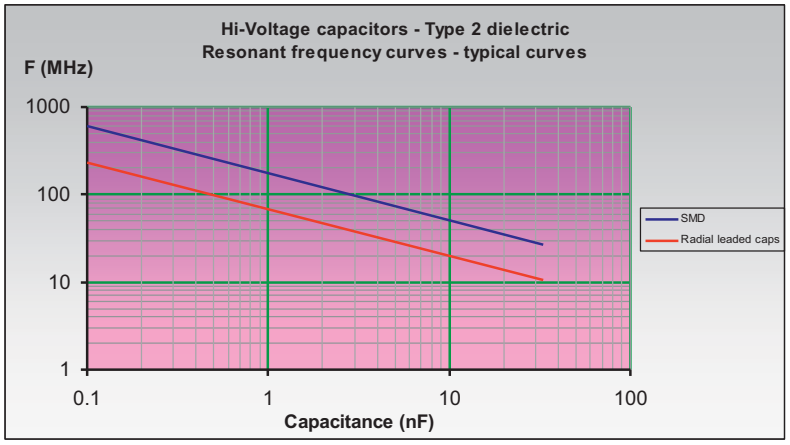
Size	Marking codes	Example
1515 **2020**	Cap Code Tolerance Code	103 M
2520 **4020**	Cap Code + Tolerance Code Rated voltage value	103M 1KV
Other sizes	« TA » logo Cap Code + Tolerance Code Rated voltage value	TA 103M 2KV

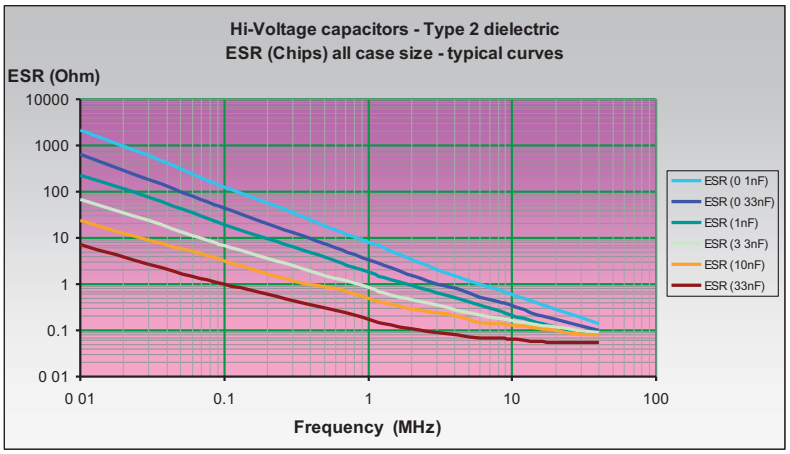
VI. Dielectric characteristics

Description	NP0 dielectric (class 1)	X7R dielectric (class 2)
CECC	**1B CG**	**2R1**
EIA	**COG**	**X7R**
Temex Ceramics Code	**N**	**X**
Operating temperature range	-55°C / +125°C	-55°C / +125°C
Storage temperature range	-55°C / +125°C	-55°C / +125°C
Temperature coefficient	0 ± 30ppm / °C	NA
Maximum ΔC/C over Temperature range without voltage applied	NA	± 15%
Ageing	None	≤2.5% per decade hour
Dissipation Factor (D.F.)	≤ 0.15%	≤ 2.5%
Voltage proof	**Ur ≥ 1000V:** 1.2 x Ur	**Ur ≥ 1000V:** 1.2 x Ur
Insulation Resistance (IR) @ 25°C (Under Ur or under 1000V DC if Ur > 1000V DC)	**> 1000V:** 100GΩ or 1000Ω.F*	**> 1000V:** 100GΩ or 1000Ω.F*
Insulation Resistance (IR) @ 125°C (Under Ur or under 1000V DC if Ur > 1000V DC)	**> 1000V:** 10GΩ or 100Ω.F*	**> 1000V:** 10GΩ or 100Ω.F*
Measurement Conditions for C and D.F. @ 20°C	**≤ 1000pF:** 1MHz / 1Vrms (no bias) **> 1000pF:** 1KHz / 1Vrms (no bias)	**≤ 100pF:** 1MHz / 1Vrms (no bias) **> 100pF:** 1KHz / 1Vrms (no bias)

(*): whichever is the less.

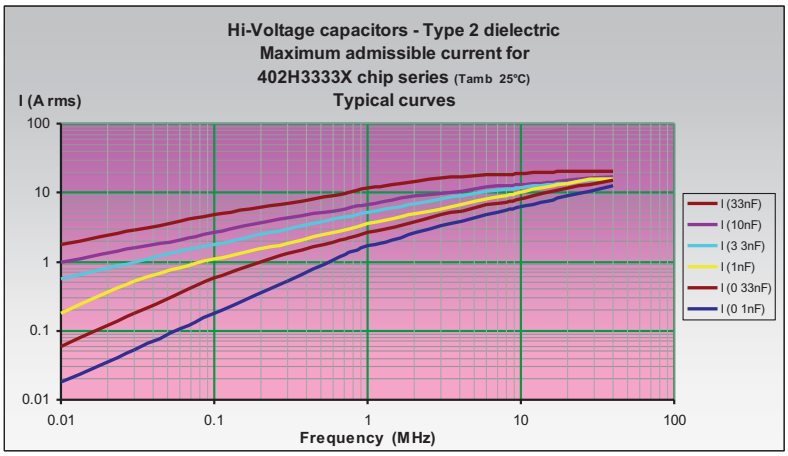
VII. Electrical characteristics





The ESR (Equivalent Serial Resistance) curves are given here for SMD (chips) capacitors. Regarding the curves for the leaded capacitors, they are rather the same.

Indeed, due to the resistivity of the raw material used and the wire diameters, the resistance of the wires is much lower than the ESR of the chips. So, in a first approach, their influence can be considered as negligible.



These typical curves are an example of admissible currents for one family of chip capacitors. For other curves and products or for further information, please contact us.

Note: for the calculations, we have considered that the terminations are directly connected to an infinite heat sink. In other words, the thermal resistance of the circuit itself which depends of its type and design has not been taken into account. Moreover, the ambient temperature taken is 25°C.

VIII. Termination types

Description	P (RoHS)	S (RoHS)	R (RoHS)	R (non RoHS)
Chip (SMD)	✓	✓	-	-
Radial wires	-	-	✓	✓
Materials	Pure Ag **Or** AgPd	100% tinned Nickel barrier	100% tinned Copper	Sn(70%) Pb(30%) plated Copper
Magnetic status	Non magnetic	Magnetic	Non magnetic	Non magnetic
Lead status (% of Pb)	0%	0%	0%	30% of the plated layer

IX. Special products

As standard products can't meet all the specificities of all applications, special applications may require special features (higher voltage, burn-in, dimensions, coating, leading, marking…) not described in this catalogue.

Based on the "state of the Art", and our knowledge of the technology, our Engineers may study at your request all special components to meet your application.
Please, consult us for more information.

HIGH VOLTAGE MULTILAYER CERAMIC CAPACITORS

X. How to order

802	H	6560	X	182	K	P	E	-RoHS

Rated Voltage	Family	Size	Dielectric	Capacitance	Tolerance (*)	Termination	Packaging	RoHS Compliancy (**)
1st two digits are significant; third digit denotes number of zeros Exemples: 201= 200V 501 = 500V 102 = 1000V 202 = 2000V	Left blank	R15 R18 S41 S43 S47	N = NP0 X = X7R	1st two digits are significant; third digit denotes number of zeros Exemples: 101=100pF 472= 4.7nF 683 = 68nF 104 = 0.1µF	For N dielectric A (±0.05pF) B (±0.1pF) C (±0.25pF) D (±0.5pF) J (±5%) K (±10%) M (±20%) For X dielectric K (±10%) M (±20%)	S	**Left blank:** Blister boxes **E:** Tape and reel for chips	If left blank non RoHS compliant
	Family H	**Size** 1515 2020 2520 3333 5440 6560				**Termination** P R		

(*): capacitance values lower than 10pF, tolerances A, B, C and D apply. For capacitance values equal or higher than 10pF, tolerances F, G, J and K apply.

(**): For "Radial Leaded (R)" capacitors, both RoHS and non-RoHS versions exist. This is due to the wishes of some customers who still need non-RoHS components in their applications. This suffix must be required for RoHS compliancy.

For "P", "A" and "S" terminations, only the RoHS version exists. The RoHS suffix can be added for information.

XI. Packaging

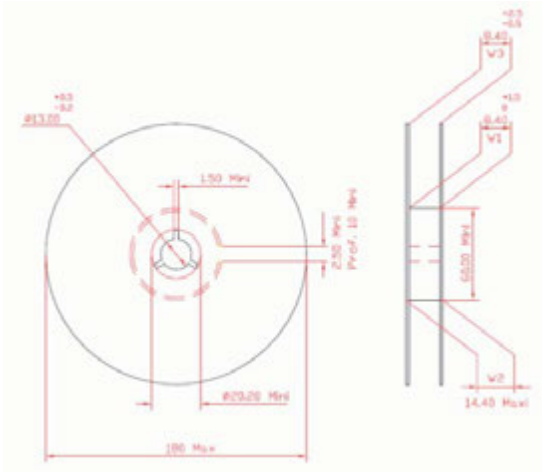
According to their dimensions, the components can be delivered in tape or individually protected in "blister" boxes. Please, refer to the following table:

Tape and reel (SMD components):

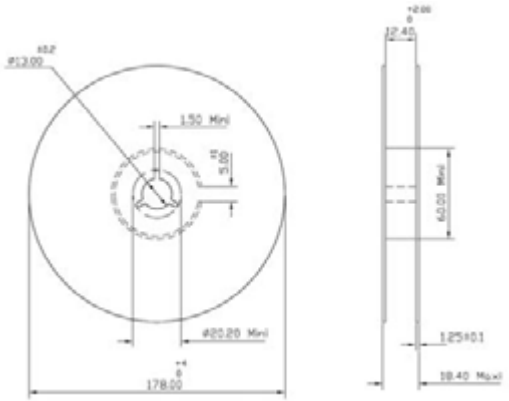
Case size	Qty per reel *	Tape type
0805 R15	3000 4000	8mm
1206 R18	3000 4000	8mm
1210 S41	2000 4000	8mm
1812 S43	500 1000	12mm
2220 S47	500 1000	12mm
H1515	500	12mm
H2020	500 1000	12mm
H2520	400	12mm

** Depending upon the thickness of the components, please consult us.*

Dimensions diameter reel (in mm)



Tape type: 8mm



Tape type: 12mm

Regarding the reels and tape dimensions, they are compliant to the IEC 60286 3 standard.

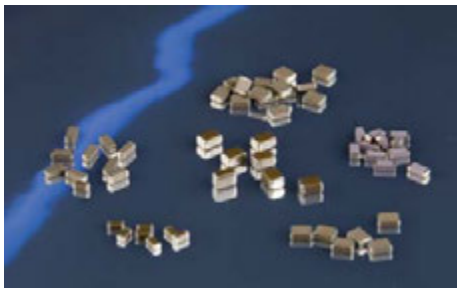
"Blister" Boxes (SMD and leaded components):

Case sizes for 1515 and above can be delivered with plastic "blister" boxes especially designed to protect the components which could be large and quite heavy. Depending upon the termination (with or without connection) and the size, the number of the parts in each box is defined. Please, consult us for more details.

LOW VOLTAGE MULTILAYER CERAMIC CAPACITORS (6.3 V to 35 V)

DESCRIPTION:

RoHS compliant
Case sizes: 0603 to 2220
Rated voltage: 6.3V to 35V
Dielectric Type I and II
Pure tin over nickel barrier termination (S code)



I. Capacitance range

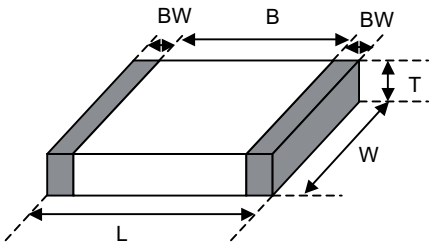
		NP0 (N series)											
Cr	Cr	R14 (0603)		R15 (0805)		R18 (1206)		S41 (1210)		S43 (1812)		S47 (2220)	
Code	(nF)	16V	25V	16V	25V	16V	25V	16V	25V	16V	25V	16V	25V
102	1.0	0.95	0.95	0.95	0.95	0.95	0.95	1.10	1.10	1.45	1.45	1.45	1.45
122	1.2	0.95	0.95	0.95	0.95	0.95	0.95	1.10	1.10	1.45	1.45	1.45	1.45
152	1.5	0.95	0.95	0.95	0.95	0.95	0.95	1.10	1.10	1.45	1.45	1.45	1.45
182	1.8	0.95	0.95	0.95	0.95	0.95	0.95	1.10	1.10	1.45	1.45	1.45	1.45
222	2.2	0.95	0.95	1.45	1.45	0.95	0.95	1.10	1.10	1.45	1.45	1.45	1.45
272	2.7	0.95	0.95	1.45	1.45	0.95	0.95	1.10	1.10	1.45	1.45	1.45	1.45
332	3.3	0.95	0.95	1.45	1.45	0.95	0.95	1.10	1.10	1.45	1.45	1.45	1.45
392	3.9			1.45	1.45	0.95	0.95	1.10	1.10	1.45	1.45	1.45	1.45
472	4.7			1.45	1.45	0.95	0.95	1.10	1.10	1.45	1.45	1.45	1.45
562	5.6			1.45	1.45	1.10	1.10	1.10	1.10	1.45	1.45	1.45	1.45
682	6.8			1.45	1.45	1.45	1.45	1.10	1.10	1.45	1.45	1.45	1.45
822	8.2			1.45	1.45	1.45	1.45	1.10	1.10	1.45	1.45	1 80	1.80
103	10			1.45	1.45	1.80	1.80	1.10	1.10	1.45	1.45	1 80	1.80
123	12			1.45	1.45	1.80	1.80	1.45	1.45	1.45	1.45	1 80	1.80
153	15					1.80	1.80	1.80	1.80	1.45	1.45	1 80	1.80
183	18					1.80	1.80	1.80	1.80	1.45	1.45	1 80	1.80
223	22					1.80	1.80	2.20	2.20	1.80	1.80	1 80	1.80
273	27					1.80	1.80	2.20	2.20	1.80	1.80	1 80	1.80
333	33					1.80	1.80	2.20	2.20	1.80	1.80	2 20	2.20
393	39					1.80	1.80	2.20	2.20	1.80	1.80	2 20	2.20
473	47					1.80	1.80	2.20	2.20	1.80	1.80	2 20	2.20
563	56					1.80	1.80	2.20	2.20	1.80	1.80	2 20	2.20
683	83					1.80	1.80	2.20	2.20	1.80	1.80	2 20	2.20
823	82					1.80	1 80	2.20	2.20	2.20	2.20	2 20	2.20
104	100					1.80	1 80	2.20	2.20	2.20	2.20	2 20	2.20
124	120									2.20	2.20	2 20	2.20
154	150												
224	220												

Maximum thickness of each component in the cells

		X7R (X series)																
Cr	Cr	R14 (0603)				R15 (0805)				R18 (1206)			S41 (1210)			S43 (1812)	S47 (2220)	
Code	Value	6.3V	10V	16V	25V	6.3V	10V	16V	25V	10V	16V	25V	10V	16V	25V	25V	35V	
101	100pF																	
151	150pF			0 95	0 95													
221	220pF			0 95	0 95													
331	330pF			0 95	0 95			0 95	0 95									
471	470pF			0 95	0 95			0 95	0 95									
681	680pF			0 95	0 95			0 95	0 95									
102	1nF			0 95	0 95			0 95	0 95									
152	1.5nF			0 95	0 95			0 95	0 95									
222	2.2nF			0 95	0 95			0 95	0 95									
332	3.3nF			0 95	0 95			0 95	0 95									
472	4.7nF			0 95	0 95			0 95	0 95									
682	6.8nF			0 95	0 95			0 95	0 95									
103	10nF			0 95	0 95			0 95	0 95									
153	15nF			0 95	0 95			0 95	0 95									
223	22nF			0 95	0 95			0 95	0 95									
333	33nF			0 95	0 95			0 95	0 95									
473	47nF			0 95	0 95			0 95	0 95									
683	68nF			0 95	0 95			0 95	0 95									
104	100nF		0.95	0 95	0 95			0 95	0 95		0.95	0.95						
154	150nF		0.95	0 95	0 95			0 95	0 95		0.95	0.95						
224	220nF		0.95	0 95	0 95			1.10	1.10		0.95	0.95						
334	330nF		0.95	0 95	0 95			1.10	1.10		0.95	1.10						
474	470nF		0.95	0 95	0 95			1.45	1.45		0.95	1.45						
684	680nF		0.95	0 95	0 95			1.45	1.45		0.95	1.45						
105	1.0µF	0.95	0.95	0 95	0 95	1.45	1.45	1 80	1 80	1.45	1.80	1.80	1.40	1.40	1.40	2.20	2 20	
225	2.2µF	0.95	0.95			1.45	1.45	1 80	1 80	1.80	1.80	1.80	2.20	2.20	2 20	2.20	2 20	
475	4.7µF					1.45	1.45			1.80	1.80		2.20	2.20	2.20	2.20	2 20	
685	6.8µF					1.45	1.45			1.80	1.80		2.20	2.20	2 20			
106	10µF					1.45	1.45			1.80	1.80		2.20	2.20	2 20	2.60	2 60	

Maximum thickness of each component in the cells

II. Dimensions



Sizes	L	W	T (max)	B (min)	BW (min)
R14 (0603)	1.60±0.10	0.80±0.10	0.90	0.4	0.15
R15 (0805)	2.00±0.20	1.25±0.20	1.40	0.7	0.2
R18 (1206)	3.20±0.30	1.60±0.20	1.80	1.5	0.3
S41 (1210)	3.20±0.30	2.50±0.20	2.60	1.6	0.3
S43 (1812)	4.60±0.30	3.20±0.30	2.20	2.5	0.3
S47 (2220)	5.70±0.40	5.00±0.40	2.60	3.5	0.3

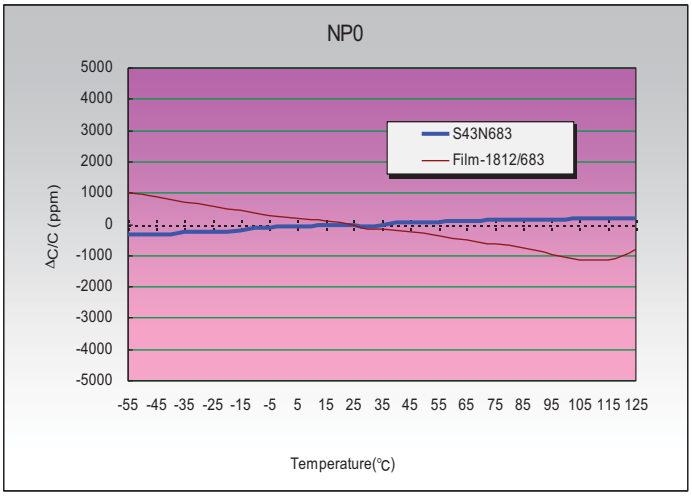
All dimensions in mm.

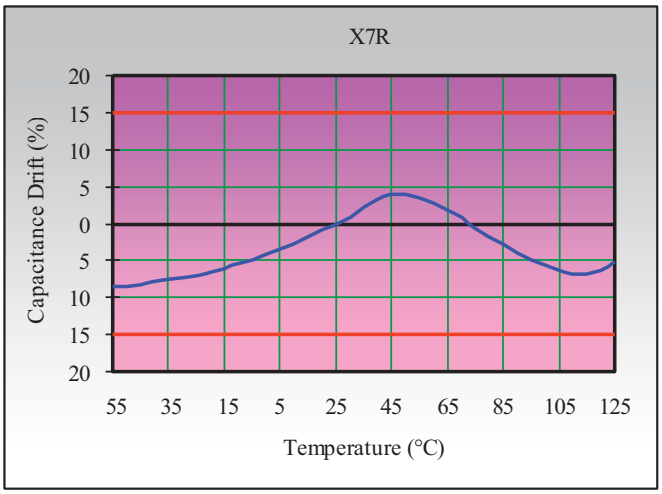
III. Dielectric characteristics

Designation EXXELIA Temex Series	NP0 N	X7R X
EIA Class	Class I	Class II
Temperature range	55°C to +125°C	55°C to +125°C
Temperature coefficient	≤ 30ppm/°C	NA
Maximun ΔC/C over Temperature range without voltage applied	NA	± 15%
Voltage proof	250% rated voltage	250% rated voltage
Insulation resistance	10GΩ or 500ΩF * > 100ΩF **	10GΩ or 500ΩF * > 100ΩF **
Aging	None	≤ 2.5% (per decade hour)

(*): whichever is the less, for Ur > 10 volts
(**): for Ur ≤ 10 volts

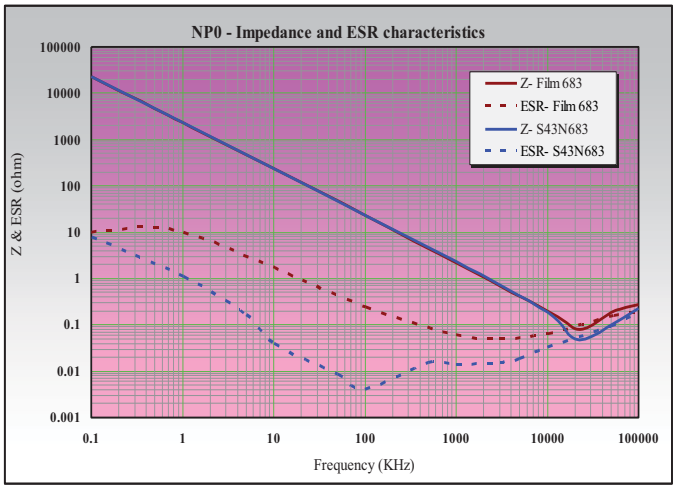
Temperature capacitance coefficient

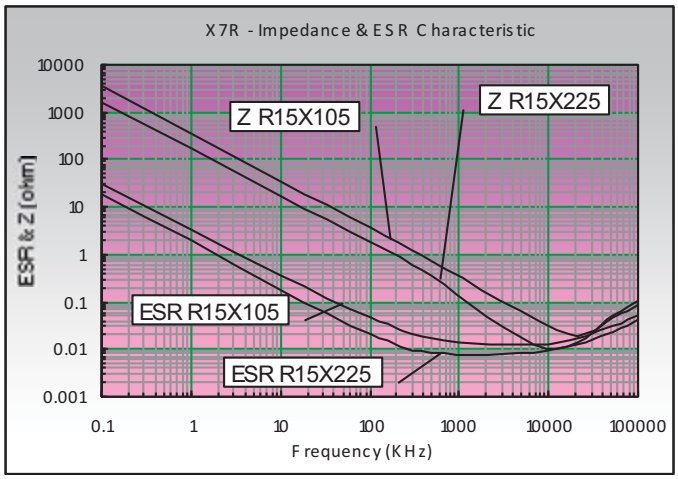




The NPO products can be use for the replacement of film capacitors. Here is a comparison of the temperature coefficients.

IV. Electrical characteristics





V. Packaging

Tape and reel

Sizes	Thickness (mm)	Paper Tape (parts/reel)	Plastic Tape (parts/reel)
R14 (0603)	T ≤ 0.95	4000	-
R15 (0805)	T ≤ 1.25 T > 1.40	4000 -	- 3000
R18 (1206)	T ≤ 0.90 0.90 <T ≤ 1.25 T > 1.25	4000 - -	- 3000 2000
S41 (1210)	T ≤ 1.25 T > 1.25	- -	3000 2000
S43 (1812)	T ≤ 2.20 T > 2.20	- -	1000 700
S47 (2220)	T ≤ 2.20 T > 2.20	- -	1000 700

Diameter of the reel: 180mm.

VI. How to order

160	S41	B	106	K	S	E
Rated Voltage	**Family**	**Dielectric**	**Capacitance**	**Tolerance**	**Termination**	**Packaging**
Ur < 10V The voltage value is got by dividing by 10 the voltage code **Ur ≥ 10V** 1st two digits are significant; third digit denotes number of zeros Exemples: 063=6.3V 100=10V 160=16V 250=25V 350=35V	R14 R15 R18 S41 S43 S47	N = NP0 X = X7R	1st two digits are significant; third digit denotes number of zeros Exemples: 101=100pF 472= 4.7nF 683 = 68nF 104 = 0.1µF 106 = 10µF	**Class1 diel.** F (±1%) G (±2%) J (±5%) **Class2 diel.** K (±10%) M (±20%)	S (Nickel barrier covered by 100% Matte tin plating)	E (tape & reel)

STANDARD CAPACITORS
NICKEL BARRIER TERMINATION

DESCRIPTION:

RoHS compliant
Case sizes: 0603 to 2220
Rated voltage: from 50V to 500V
Dielectric Type I and II
Pure tin over nickel barrier termination (S code)

I. Capacitance range

Dielectric	Case Size	Rated Voltage 50V	Rated Voltage 100V	Rated Voltage 200V	Rated Voltage 500V
NPO	R14 (0603)	5pF to 3.3nF	2pF to 680pF	2pF to 680pF	2pF to 680pF
	R15 (0805)	10pF to 12nF	2pF to 6.8nF	2pF to 3.9nF	2pF to 680pF
	R18 (1206)	1nF to 100nF	2pF to 12nF	2pF to 10nF	10pF to 5.6nF
	S41 (1210)	1nF to 100nF	10pF to 39nF	10pF to 10nF	10pF to 6.8nF
	S43 (1812)	1nF to 120nF	68pF to 100nF	68pF to 18nF	68pF to 8.2nF
	S47 (2220)	1nF to 120nF	1nF to 100nF	1nF to 47nF	1nF to 39nF

Dielectric	Case Size	Rated Voltage 50V	Rated Voltage 100V	Rated Voltage 200V	Rated Voltage 500V
X7R	R14 (0603)	150pF to 1µF	150pF to 100nF	-	-
	R15 (0805)	330pF to 2.2µF	150pF to 100nF	150pF to 68nF	150pF to 22nF
	R18 (1206)	330pF to 4.7µF	180pF to 1µF	180pF to 220nF	180pF to 68nF
	S41 (1210)	22nF to 10µF	220pF to 4.7µF	220pF to 680nF	220pF to 100nF
	S43 (1812)	22nF to 10µF	220pF to 4.7µF	220pF to 1µF	220pF to 220nF
	S47 (2220)	68nF to 10µF	10nF to 10µF	10nF to 3.3µF	10nF to 270nF

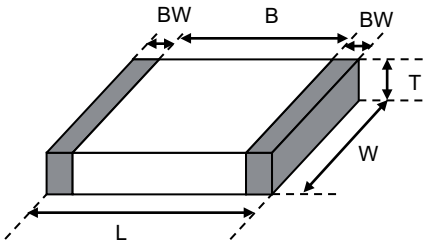
Note: some capacitance values in these tables may not be proposed for small quantities. Please, contact us for confirmation.

II. Dielectrics

Designation	NP0	X7R
Temex Ceramics Series	N	X
EIA Class	Class I	Class II
Temperature range	55°C to +125°C	55°C to +125°C
Temperature coefficient	0 +/ 30ppm/°C	NA
Maximum ΔC/C over Temperature range without voltage applied	N/A	± 15%
Voltage proof	250% rated voltage	250% rated voltage
Insulation resistance	10GΩ or 500ΩF * > 100ΩF **	10GΩ or 500ΩF * > 100ΩF **
Aging	None	≤ 2.5% (per decade hour)

Note: N/A = not applicable.
(*): whichever is the less, for Ur > 10 volts
(**): for Ur ≤ 10 volts

III. Dimensions



Sizes	L	W	T (max)	B (min)	BW (min)
R14 (0603)	1.60 ± 0.10	0.80 ± 0.10	0.95	0.40	0.15
R15 (0805)	2.00 ± 0.20	1.25 ± 0.20	1.45	0.70	0.20
R18 (1206)	3.20 ± 0.30	1.60 ± 0.20	1.80	1.50	0.30
S41 (1210)	3.20 ± 0.30	2.50 ± 0.20	2.60	1.60	0.30
S43 (1812)	4.60 ± 0.30	3.20 ± 0.30	3.00	2.50	0.30
S47 (2220)	5.70 ± 0.40	5.00 ± 0.40	3.00	3.50	0.30

Note: all dimensions in mm.

IV. Packaging

Tape and reel

Sizes	Thickness (mm)	Paper Tape (parts/reel)	Plastic Tape (parts/reel)
R14 (0603)	T ≤ 0.95	4000	-
R15 (0805)	T ≤ 1.25	4000	-
	T > 1.25	-	3000
R18 (1206)	T ≤ 0.90	4000	-
	0.90 < T ≤ 1.25	-	3000
	T > 1.25	-	2000
S41 (1210)	T ≤ 1.25	-	3000
	T > 1.25	-	2000
S43 (1812)	T ≤ 2.20	-	1000
	T > 2.20	-	700
S47 (2220)	T ≤ 2.20	-	1000
	T > 2.20	-	700

Diameter of the reel: 180mm.

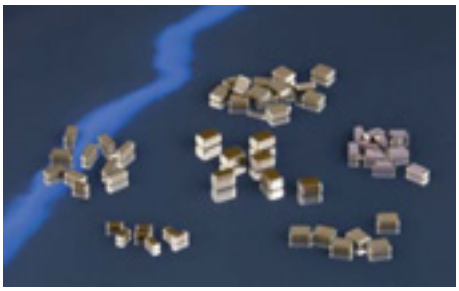
V. How to order

500	R15	X	104	K	S	E
Rated Voltage	**Family**	**Dielectric**	**Capacitance**	**Tolerance**	**Termination**	**Packaging**
1st two digits are significant; third digit denotes number of zeros Exemples: 500=50V 101=100V 201=200V 501=500V	R14 (0603) R15 (0805) R18 (1206) S41 (1210) S43 (1812) S47 (2220)	N = NP0 X = X7R	**C<10pF** 'R' is the decimal point Exemple: 4R7=4.7pF **C≥10pF** 1st two digits are significant; third digit denotes number of zeros Exemples: 101=100pF 472= 4.7nF 683 = 68nF 104 = 0.1µF	**NPO** F (±1%) G (±2%) J (±5%) **X7R** K (±10%) M (±20%)	S (Nickel barrier covered by 100% Matte tin plating)	E (tape & reel)

STANDARD CAPACITORS
Non magnetic

DESCRIPTION:

RoHS compliant
Non magnetic
Standard capacitors: from 0603 up to 2220
Rated voltage: from 63V up to 500V
Dielectrics: Type I and II
Copper or Silver-Palladium termination



I. Capacitance range

N SERIES (NPO)

Cr Code	Cr	R14 (0603)			R15 (0805)			R18 (1206)			S41 (1210)			S43 (1812)			S47 (2220)		
		100V	200V	500V	100V	200V	500V	100V	200V	500V	100V	200V	500V	100V	200V	500V	100V	200V	500V
100	10 pF																		
150	15 pF																		
220	22 pF																		
330	33 pF																		
470	47 pF																		
680	68 pF																		
101	100 pF																		
151	150 pF																		
181	180 pF														R	R			
221	220 pF														R	R			
271	270 pF														R	R			
331	330 pF														R	R			
471	470 pF														R	R			
561	560 pF														R	R			
681	680 pF														R	R		R	R
102	1.0 nF														R	R		R	R
152	1.5 nF														R	R		R	R
182	1.8 nF													R	R	R		R	R
222	2.2 nF													R	R	R		R	R
272	2.7 nF													R	R			R	R
332	3.3 nF													R	R			R	R
472	4.7 nF													R	R			R	R
572	5.6 nF													R	R			R	
682	6.8 nF																R	R	
103	10 nF																R	R	

Cu Termination AgPd Termination Cu or AgPd Termination R Radial available

STANDARD CAPACITORS
Non magnetic

X SERIES (X7R)

Cr Code	Cr	R14 (0603)			R15 (0805)			R18 (1206)			S41 (1210)			S43 (1812)			S47 (2220)		
		63V	200V	500V	63V	200V	500V	63V	200V	500V	63V	200V	500V	63V	200V	500V	63V	200V	500V
101	100 pF																		
151	150 pF																		
181	180 pF																		
221	220 pF																		
271	270 nF																		
331	330 pF																		
471	470 pF																		
561	560 pF																		
681	680 pF																		
102	1 0 nF																		
122	1 2 nF																		
152	1 5 nF																		
222	2 2 nF																		
272	2.7 nF														R	R			
332	3 3 nF														R	R			
472	4.7 nF														R	R			
572	5.6 nF														R	R			
682	6 8 nF														R	R		R	R
103	10 nF														R	R		R	R
153	15 nF														R	R		R	R
223	22 nF														R	R		R	R
333	33 nF														R	R		R	R
473	47 nF														R	R		R	R
683	68 nF														R			R	R
823	82 nF														R			R	R
104	100 nF														R			R	R
124	120 nF																	R	
154	150 nF													R				R	
224	220 nF													R				R	
334	330 nF													R			R		
394	390 nF													R			R		
474	470 nF													R			R		
564	560 nF													R			R		
684	680 nF													R			R		
105	1 µF													R			R		

Cu Termination | AgPd Termination | Cu or AgPd Termination | R Radial available

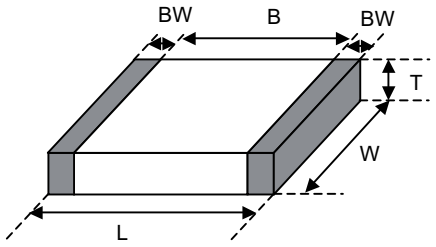
Note: some capacitance values in these tables may not be proposed for small quantities. Please, contact us for confirmation.

II. Dielectric Characteristics

Designation	NP0	X7R
Temex Ceramics Series	N	X
CECC Class	1B/CG	2R1
EIA Class	Class I	Class II
Temperature range	55°C to +125°C	55°C to +125°C
Temperature Coefficient	0 +/ 30ppm/°C	NA
Maximun ΔC/C over Temperature range without voltage applied	NA	± 15%
Voltage proof	250% rated voltage	250% rated voltage
Insulation resistance	100GΩ or 1000ΩF *	100GΩ or 1000ΩF *
Aging	None	≤ 2.5% (per decade hour)

Note: NA = non applicable *(*): whichever is the less*

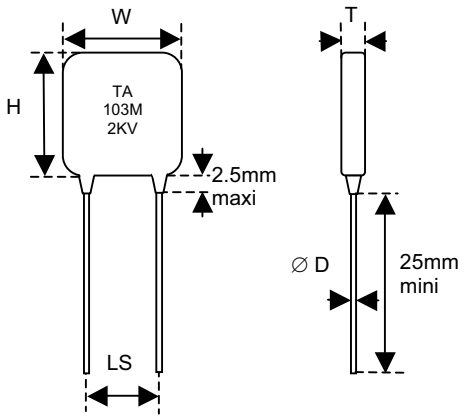
III. Dimensions



	AgPd Termination					Cu Termination				
Sizes	L	W	T (max)	B (min)	BW (min)	L	W	T (max)	B (min)	BW (min)
R14 (0603)	1.60 ± 0.30	0.80 ± 0.20	0.95	0.4	0.15	1.60 ± 0.30	0.80 ± 0.20	0.95	0.4	0.15
R15 (0805)	2.00 ± 0.30	1.25 ± 0.30	1.45	0.5	0.13	2.00 ± 0.30	1.25 ± 0.30	1.45	0.7	0.2
R18 (1206)	3.20 ± 0.30	1.60 ± 0.30	1.80	1.4	0.25	3.20 ± 0.30	1.60 ± 0.30	1.80	1.5	0.3
S41 (1210)	3.20 ± 0.40	2.50 ± 0.30	2.50	1.4	0.25	3.20 ± 0.40	2.50 ± 0.30	2.60	1.6	0.3
S43 (1812)	4.50 ± 0.50	3.20 ± 0.40	3.00	2.2	0.25					
S47 (2220)	5.70 ± 0.50	5.00 ± 0.50	3.00	2.9	0.25					

Note: all dimensions in mm

Radial leaded components



Case size	W	H	L.S.	D	Thickness maxi (T) Voltage (V)		
	maxi	maxi	±0.5	±10%	63	200	500
S43 = 1812=	7.1	6.6	5.08	0.6	3.7	3.7	3.7
S47 = 2220	8.3	8.5	5.08	0.6	3.7	3.7	3.7

All dimensions in mm
For exact values regarding the thickness, please consult us.

IV. Packaging

Tape and reel

Sizes	AgPd Termination Parts / reel (*)	Cu Termination Parts / reel (*)
R14 (0603)	3000 / 4000	3000 / 4000
R15 (0805)	3000 - 4000	3000
R18 (1206)	3000 - 4000	3000
S41 (1210)	2000 - 4000	1000-2000-3000
S43 (1812)	500 - 1000	-
S47 (2220)	500 - 1000	-

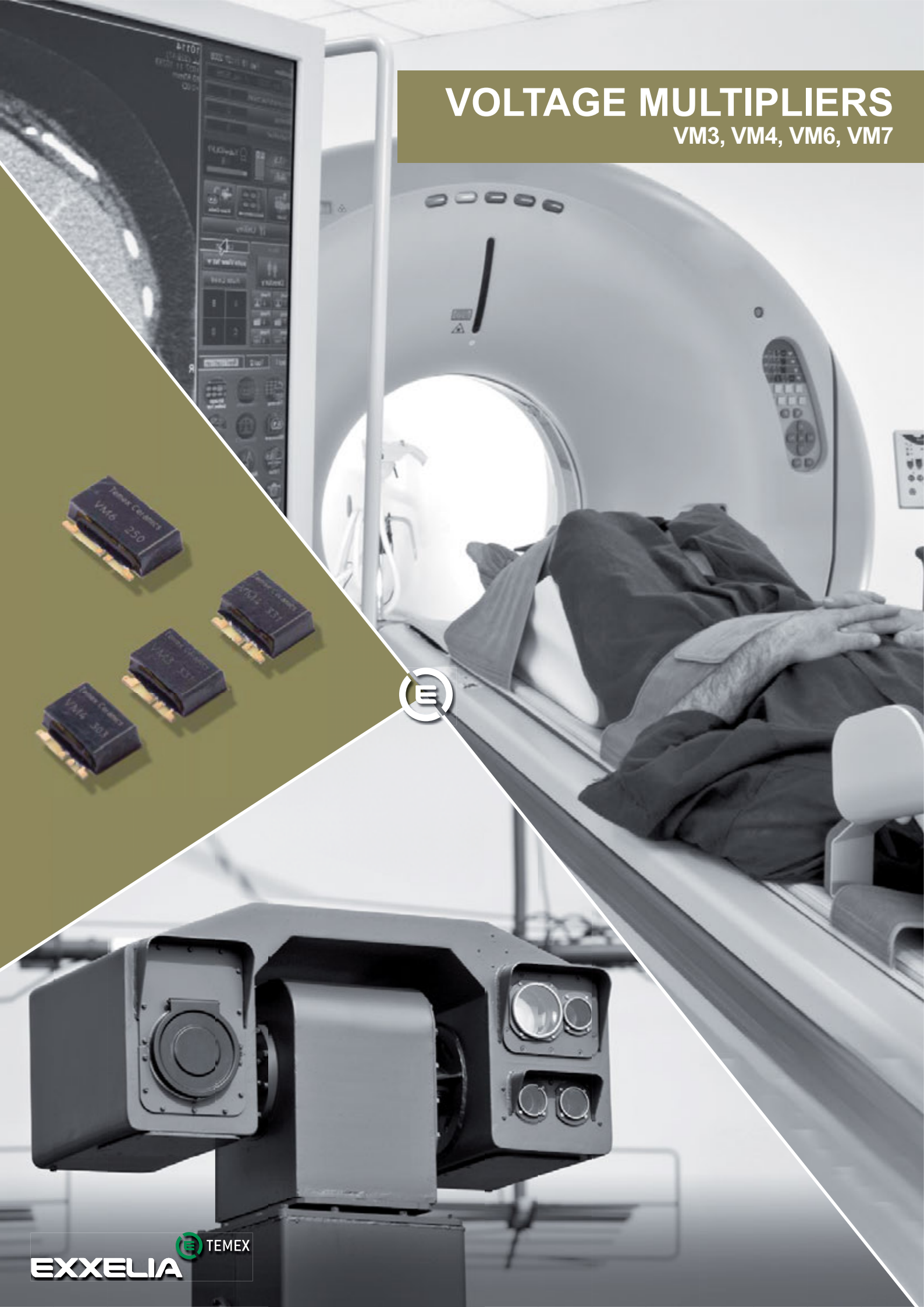
** Note: the quantity of parts in a reel depends upon their thicknesses. Please, consult us for more accurate data.*

V. How to order

101	S41	N	472	J	C	E
Rated Voltage	**Family**	**Dielectric**	**Capacitance**	**Tolerance**	**Termination**	**Packaging**
1st two digits are significant; third digit denotes number of zeros Exemples: 630=63V 101=100V 201=200V 501=500V	R14=0603 R15=0805 R18=1206 S41=1210 S43=1812 S47=2220	N = NP0 X = X7R	**C ≥ 10pF** 1st two digits are significant; third digit denotes number of zeros Exemples: 101=100pF 472= 4.7nF 683 = 68nF 104 = 0.1µF	**NPO** F (±1%) G (±2%) J (±5%) K (±10%) M (±20%) **X7R** K (±10%) M (±20%)	C (Pure Tin plated Copper Barrier on Pure Silver termination) A (Silver Palladium Platinum termination) R (Radial 2 wires)	E (tape & reel) Blank (Bulk)

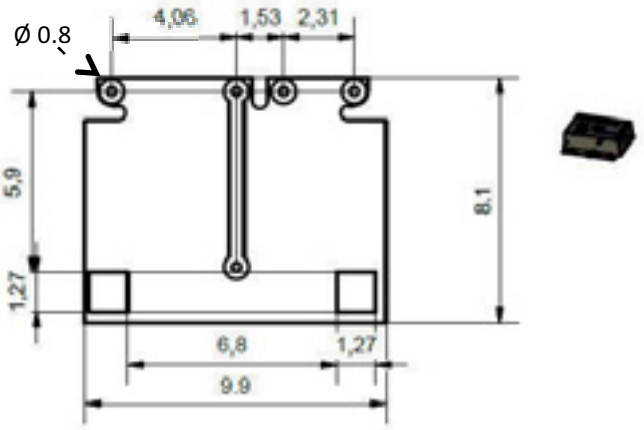
VOLTAGE MULTIPLIERS

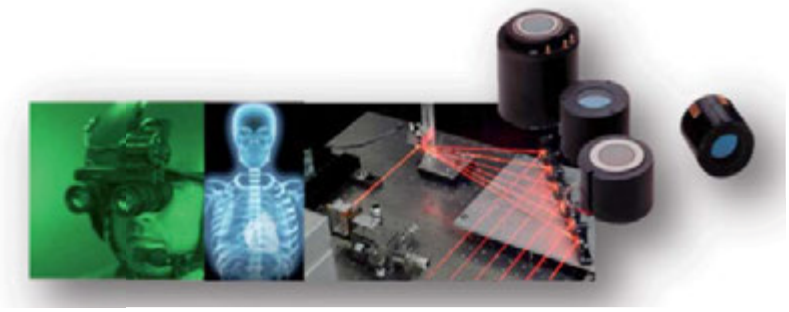
VM3, VM4, VM6, VM7



EXXELIA TEMEX

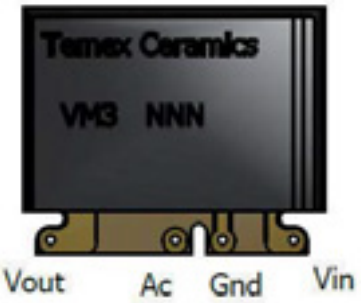
VOLTAGE MULTIPLIERS
VM3 (-1500 Vdc)

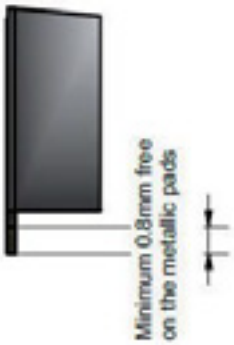




Miniaturized Half Wave Voltage Multiplier

- Ultra small size
- Highly Efficient
- ITAR free
- Uniform stress on diodes





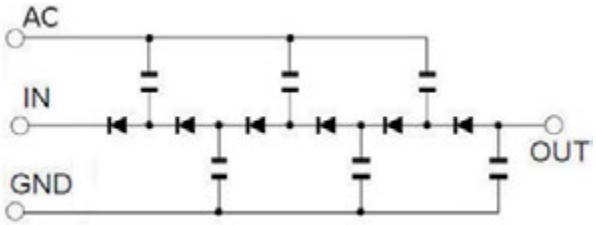
Tolerance: ± 0.25mn
Unit: Millimeters

Plating: Electroless Nickel / Immersion Gold (ENIG)

Part Number	152 VM3 G2
Maximum A.C. Input Voltage	500 Vpp
Maximum D.C. Output Voltage	-1500 Vdc
Typical Output Current Range	0 to 100 µA
Typical Frequency	10 to 100 Khz
Number of Stages	3
Operating and storage Temperatures	-55°C to +125°C
Pin finish	ENIG Gold
Peak wave solder temperature	260°C 2mn
Peak reflow temperature	260°C
Floor Life	MSL/JDEC 2

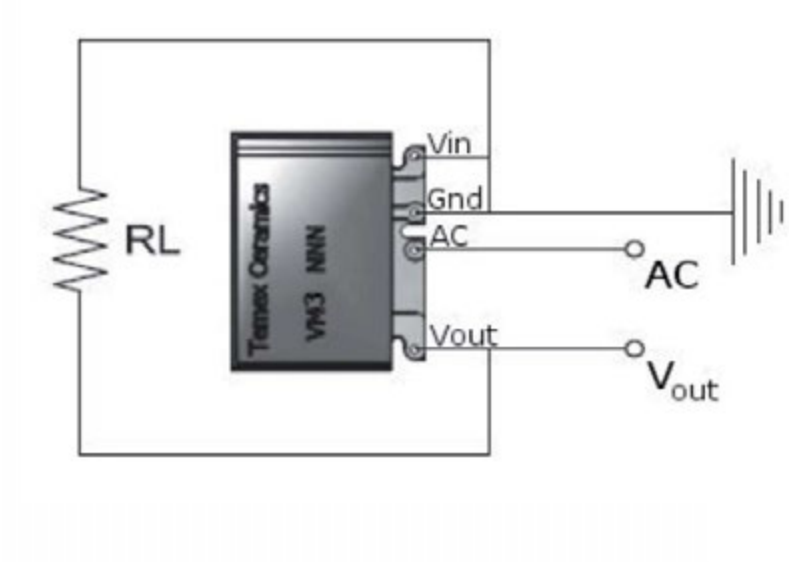
The component must be coated on the board to prevent electrical arcs

- Electrical equivalent circuit

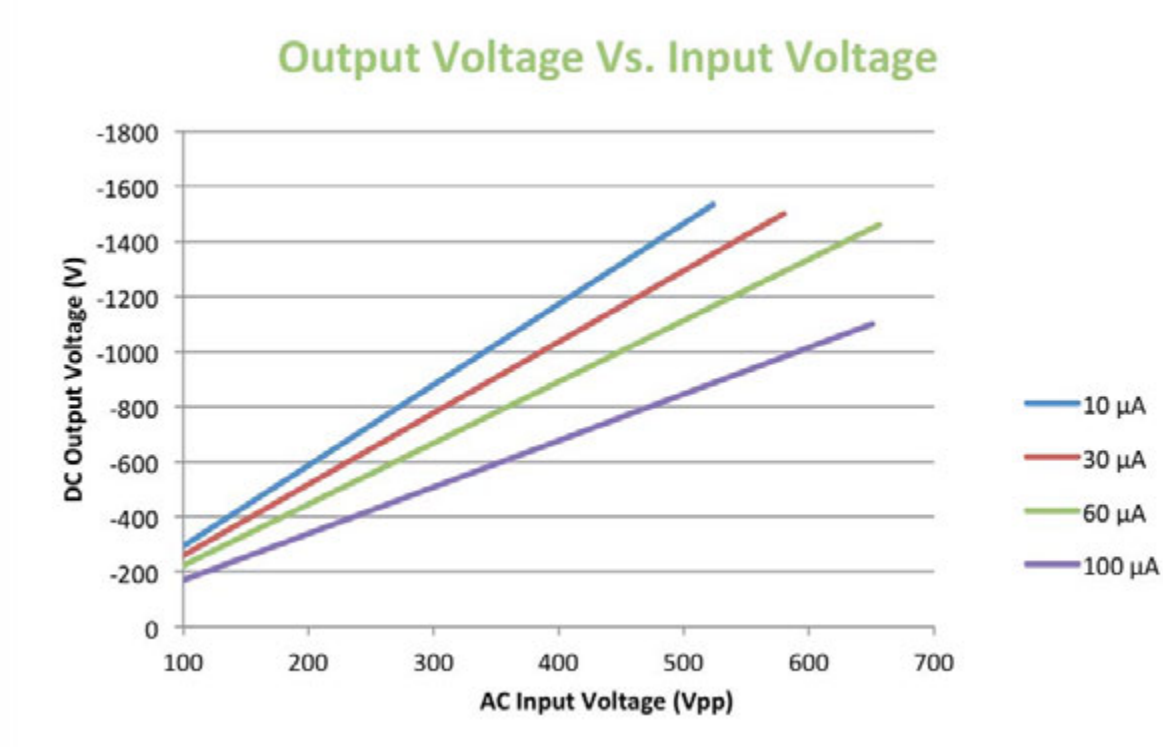


VOLTAGE MULTIPLIERS
VM3 (-1500 Vdc)

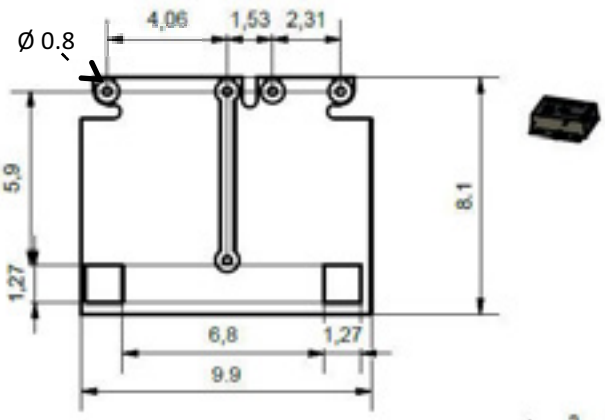
- **Typical multiplier circuit**

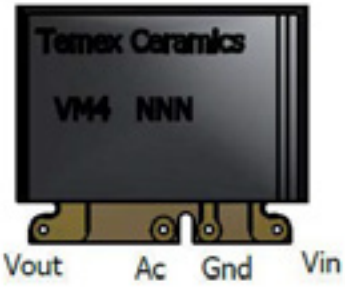


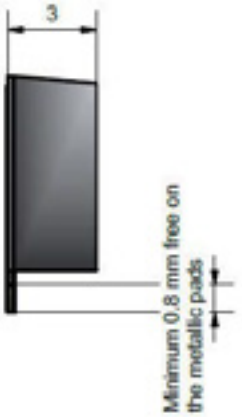
2 Multipliers can be mounted in Series for a DC output up to -3000V.



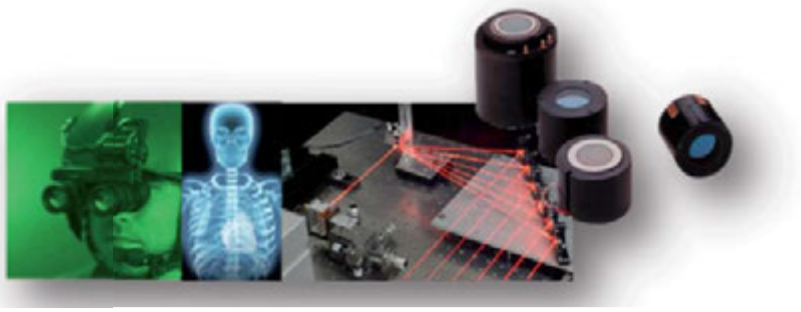
VOLTAGE MULTIPLIERS
VM4 (3000 Vdc)







Tolerance: ± 0.25mn
Unit: Millimeters



Miniaturized Half Wave Voltage Multiplier

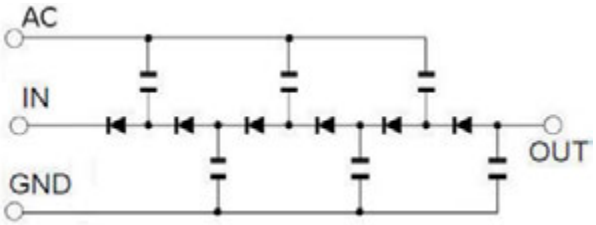
- Ultra small size
- Highly Efficient
- ITAR free
- Uniform stress on diodes

Plating: Electroless Nickel / Immersion Gold (ENIG)

Part Number	302 VM4 G2
Maximum A.C. Input Voltage	800 Vpp
Maximum D.C. Output Voltage	3000 Vdc
Typical Output Current Range	0 to 50 µA
Typical Frequency	10 to 100 Khz
Number of Stages	4
Operating and storage Temperatures	-55°C to +125°C
Pin finish	ENIG Gold
Peak wave solder temperature	260°C 2mn
Peak reflow temperature	260°C
Floor Life	MSL/JDEC 2

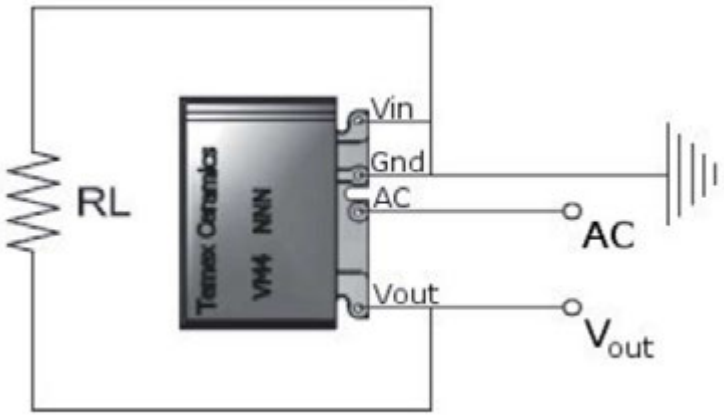
The component must be coated on the board to prevent electrical arcs

- Electrical equivalent circuit

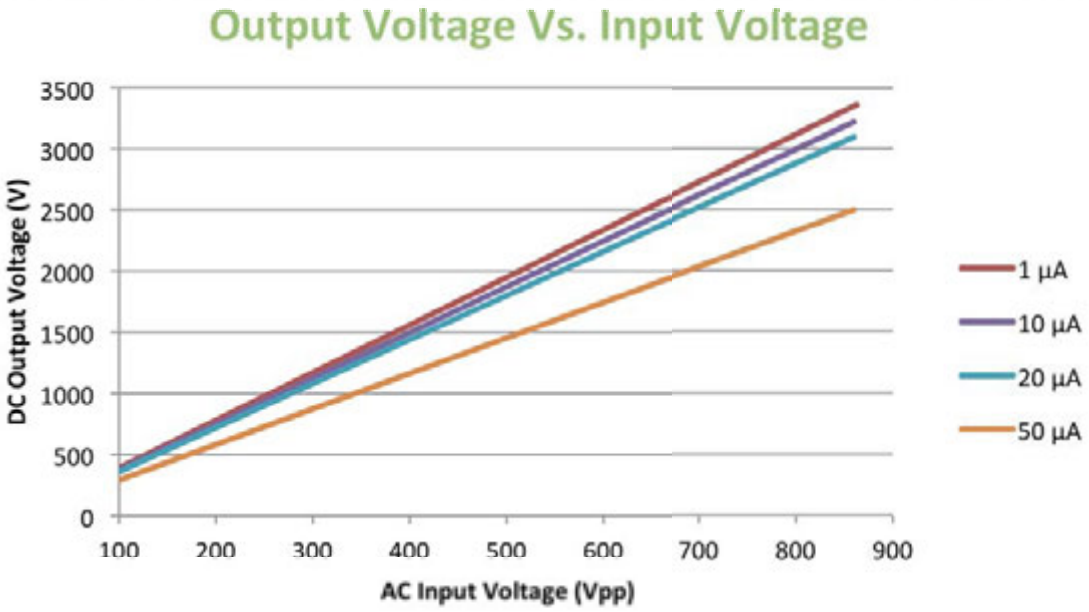


VOLTAGE MULTIPLIERS
VM4 (3000 Vdc)

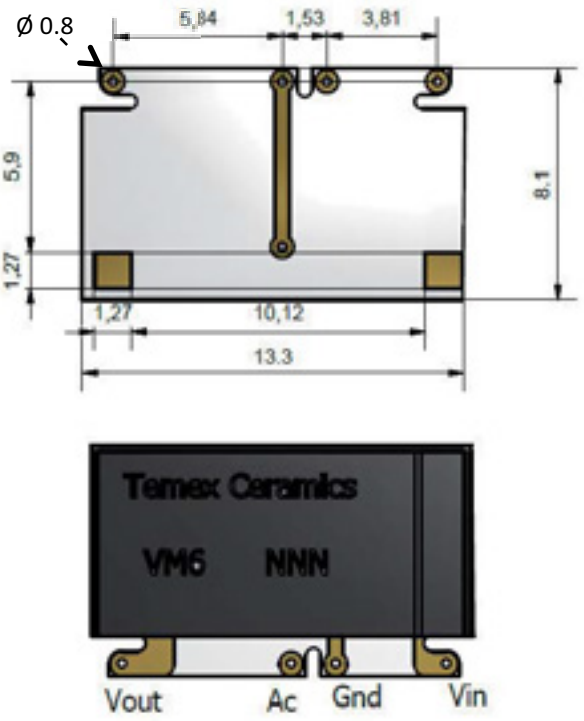
- **Typical multiplier circuit**



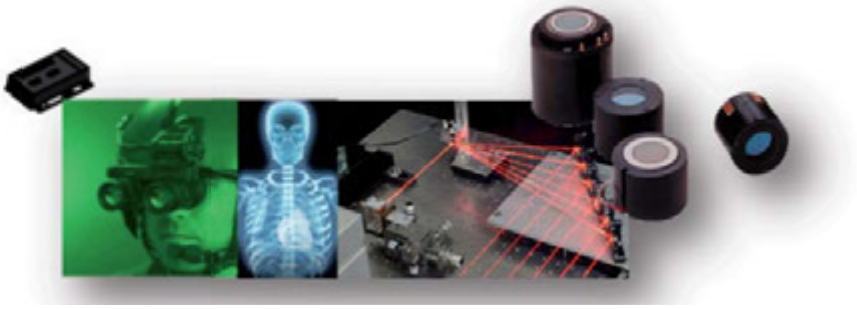
2 Multipliers can be mounted in Series for a DC output up to 6000V.



VOLTAGE MULTIPLIERS
VM6 (6000 Vdc by using two in series)



Tolerance: ± 0.25mn
Unit: Millimeters



Miniaturized Half Wave Voltage Multiplier

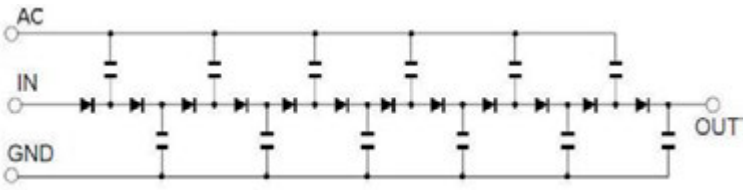
- Ultra small size
- Highly Efficient
- ITAR free
- Uniform stress on diodes

Plating: Electroless Nickel / Immersion Gold (ENIG)

Part Number	302 VM6 G2
Maximum A.C. Input Voltage	600 Vpp
Maximum D.C. Output Voltage	6000 VDc
Typical Output Current Range	0 to 50 µA
Typical Frequency	10 to 100 Khz
Number of Stages	6
Operating and storage Temperatures	-55°C to +125°C
Pin finish	ENIG Gold
Peak wave solder temperature	260°C 2mn
Peak reflow temperature	260°C
Floor Life	MSL/JDEC 2

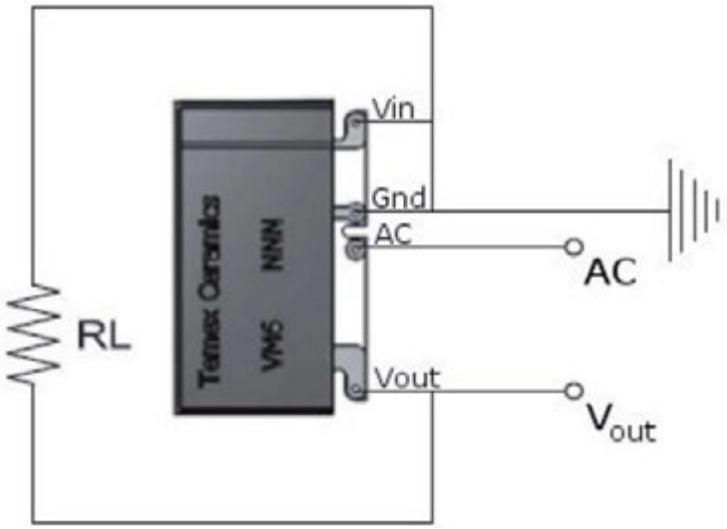
The component must be coated on the board to prevent electrical arcs

- Electrical equivalent circuit

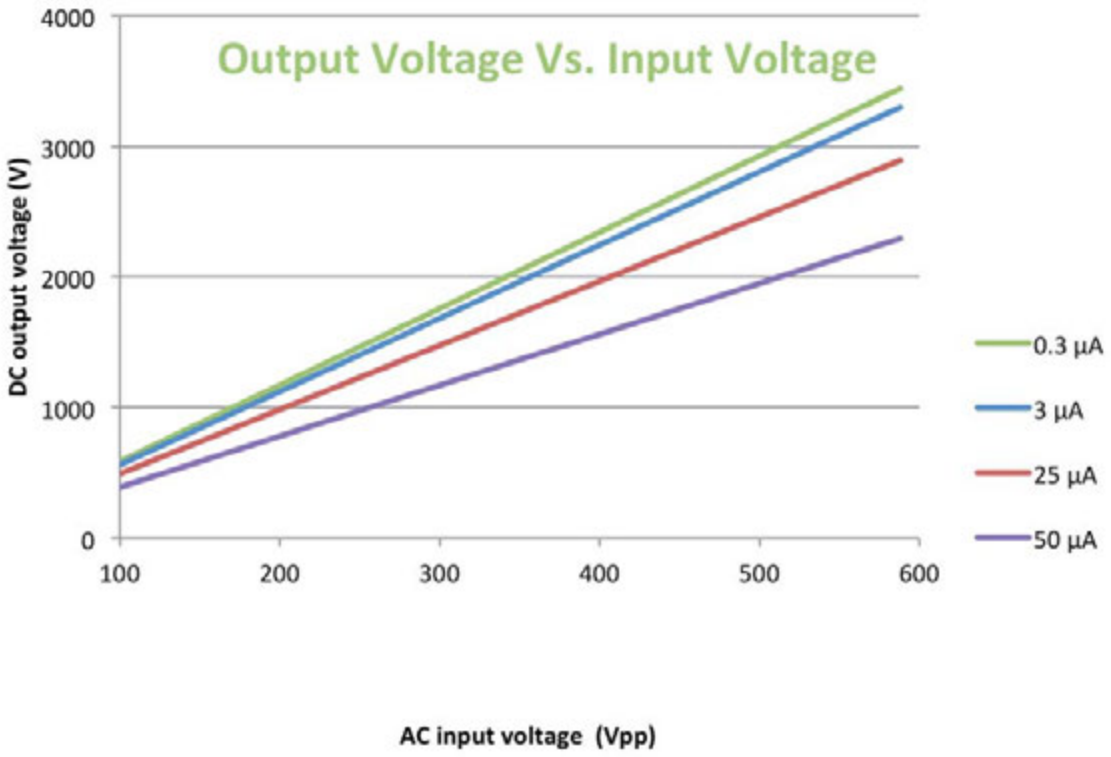


VOLTAGE MULTIPLIERS
VM6 (6000 Vdc by using two in series)

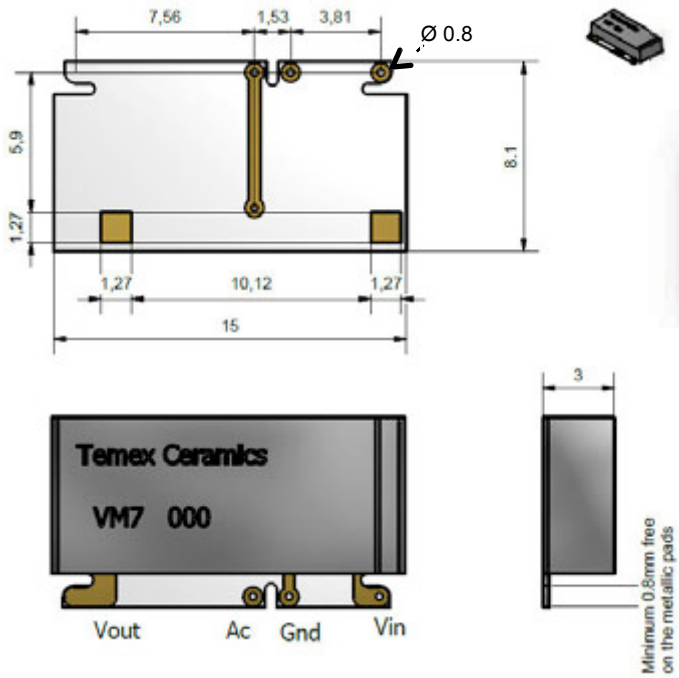
- **Typical multiplier circuit**

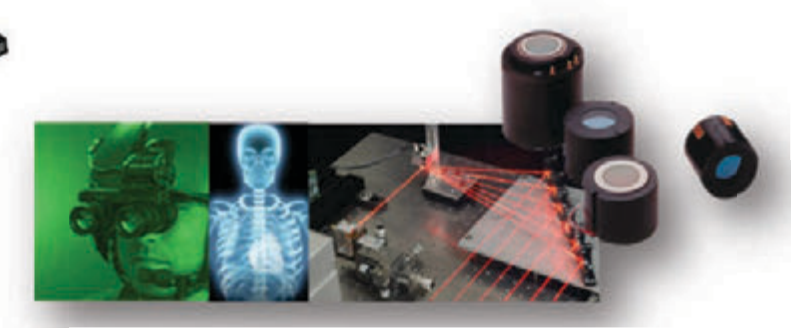


2 Multipliers can be mounted in Series for a DC output up to 6000V.



VOLTAGE MULTIPLIERS
VM7 (7000 Vdc)





Miniaturized Half Wave Voltage Multiplier

- Ultra small size
- Highly Efficient
- ITAR free
- Uniform stress on diodes

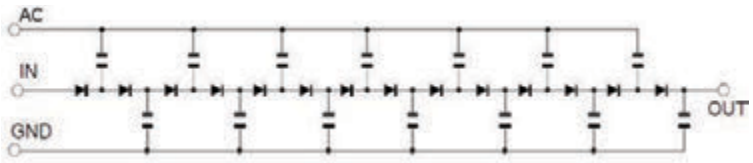
Tolerance: ± 0.25mn
Unit: Millimeters

Plating: Electroless Nickel / Immersion Gold (ENIG)

Part Number	702 VM7 G2
Maximum A.C. Input Voltage	1000 Vpp
Maximum D.C. Output Voltage	7000 Vdc
Typical Output Current Range	0 to 25 µA
Typical Frequency	10 to 100 Khz
Number of Stages	7
Operating and storage Temperatures	-55°C to +125°C
Pin finish	ENIG Gold
Peak wave solder temperature	260°C 2mn
Peak reflow temperature	260°C
Floor Life	MSL/JDEC 2

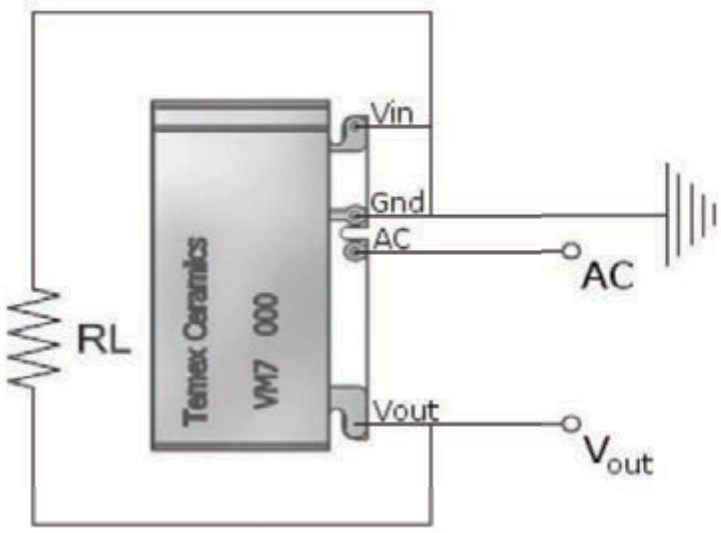
The component must be coated on the board to prevent electrical arcs

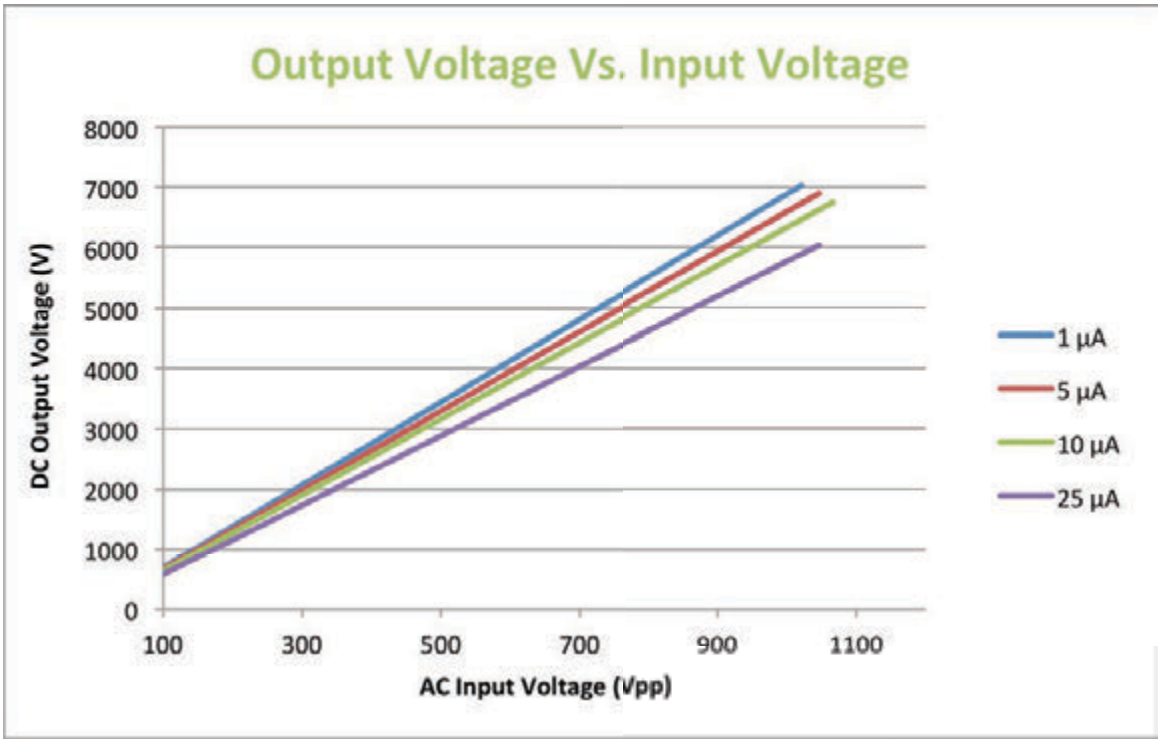
Electrical equivalent circuit



VOLTAGE MULTIPLIERS
VM7 (7000 Vdc)

- **Typical multiplier circuit**





NOTES

CERAMIC MATERIALS

Microwave Ferrites, Dielectric & Coaxial Resonators

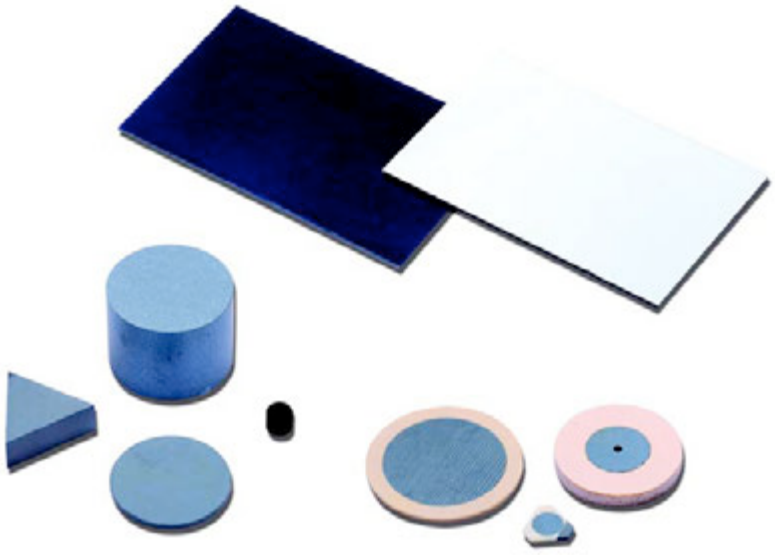
TEMEX

EXXELIA

MICROWAVE FERRITES & FDA

EXXELIA TEMEX offers a wide range of ferrite materials, yttrium garnets (“Y” series or “D” series), magnesium (“U” series), nickel (“N” series) and lithium (“A” series) ferrites, as a result of their own developments on inheritage of the formerly companies CSF, LTT, Thomson. The offer covers need at frequencies from 0.1 to more than 30 GHz, high power, with temperature exigencies as well.

EXXELIA TEMEX manufactures their own ferrite powders from simple oxides or carbonates raw materials, then produce pressed and fired ceramics, machine them at tight tolerances and surface finishing up to polishing. Temex ceramics also supply assemblies of ferrite surrounded with dielectric, silver thick film metallized pieces, complex shapes.



Symbols / Units

Magnetism parameters

Great letters: time constant (DC) / Small letters: frequency, time dependant (RF)

Symbol	Parameter	MKSA system	CGS system
B Br M ($4pM_s$ or M_s), m	Magnetic induction Remnant induction Volume magnetization (saturation)	Tesla (T)	Gauss ($=10^{-4}$ Tesla)
H, H_r H_a H_c h, h_c DH DH_{eff} DH_K	Magnetic field (magnetizing force), resonance Anisotropy field Coercive force Magnetic wave field, critical wave field Ferromagnetic resonance line width Effective resonance line width Spin wave line width	A/m	Oersted (Oe) ($=10^3/4p$ A/m)
μ_0	Vacuum permeability	$4p10^{-7}$H/m $B = \mu_0 (H+M)$	1 B = H+4pM
$\mu = \mu_0 \mu_r$	Permeability	$B = \mu_0.\mu_r.H$	$B = \mu_r.H$
c	Magnetic susceptibility = M/H, m/h	-	-
μ_r	Relative permeability	$\mu_r = 1 + c$	$\mu_r = 1 + 4pc$ (or 1+c)
a	Magnetization temperature coefficient: $\frac{\Delta M_S}{M_S \Delta T}$	$10^{-3}.K^{-1}$	$10^{-3}.°C^{-1}$
f	Wave frequency	MHz	MHz
g	Gyromagnetic ratio: $f = g H_r$	~35 10^{-3} MHz. m / A	~2.8 MHz / Oe
g_{eff}	Lande factor ~ 2	= g / 0.0176	= g / 1.4

In the below text, CGS system is mainly used with simplified expression (without the factor 4p).

Dielectric

Symbol	Parameter
e'	Relative permittivity (real part)
e''	Relative permittivity (imaginary part)
e_r	Relative complex permittivity
tand	Dielectric loss tangent: tand = e''/e'

Miscellaneous

Symbol	Parameter	Unit
T,Tc	Temperature, Curie temperature	K
Ra	Surface roughness	µm

I. Basic Properties

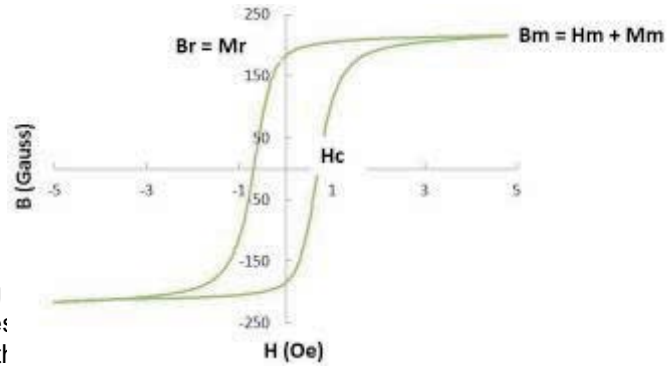
Ferrite materials are used in microwave applications to perform various non-reciprocal devices such as isolators, circulators, diplexers, filters, phase shifters etc. They have dielectric and magnetic properties due to the presence of magnetic ions such as iron within the composition.

I.1 Magnetic properties

Magnetization Ms

This property is based on the alignment of the spins of electrons parallel to an applied magnetic field H. Because the material is a "soft magnetic material", a small field (close to coercive force H_c) of about 1 to few Oe is enough to get its magnetization value (Mm =B_m - Hm) close to its saturated maximum M_s (values in the range 290 to 5000 Gauss). This is shown on the curves of the hysteresis loop. However this Ms value is really obtained at much higher field, the measurement is made with a 8000 Oe magnet.

The hysteresis loop also shows, how for the null H field, the material can be in a remnant state with an induced field Br different from zero. This is used in phase shifters to monitor phase shift through the ferromagnetic resonance at Mr.



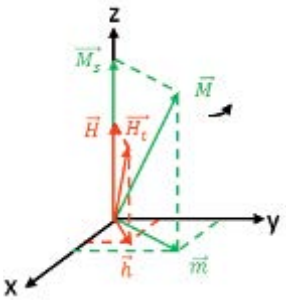
By increasing temperature of the ferrite, the aligning
due to thermal agitation. The magnetization becomes
120 to 650°C. The evolution of the magnetization with

$$\alpha = \frac{\Delta M_s}{M_s \Delta T}$$ in the common range of T: -20 to +60°C

Gyromagnetic resonance – Lande factor g_{eff}

The gyromagnetic resonance, and so the non-reciprocal effect, is created in ferrite devices isolators, circulators, phase shifters, switches under a static magnetic field $\vec{H}$.

In case of saturation of the ferrite to M_s, and in case of a wave propagating parallel to the z axis, the microwave field $\vec{h}$ is in a plane "x y" perpendicular to the z axis and rotating at a frequency f magnetization $\vec{M}$ discloses a precession motion about the field $\vec{H}$ at the frequency f. There is a resonance for $\|\vec{H}\| = H_r$ given by:



$$H_r = \frac{f}{\gamma}$$

- g is the gyromagnetic ratio and is related to the effective Lande factor g_{eff} as
- $g = 1.4 \cdot g_{eff}$.MHz/Oe. g_{eff} is about 2 depending on the material: $2 \le g_{eff} \le 2.3$

Permeability, gyro-resonance line width DH, non-reciprocal effect

The magnetization $\vec{m}$ is related to the microwave magnetic field $\vec{h}$ with the tensor of susceptibility $\bar{\bar{\chi}}$: $\vec{m} = \bar{\bar{\chi}} \times \vec{h}$. This tensor (named Polder tensor) owns two eigenvalues associated respectively to a positive (+) circularly polarized wave and to a negative (-) circularly polarized wave. Thus in a system of coordinates rotating about H axis at the frequency f, the magnetization $\vec{m}$ is described with two components only, m_+ and m_- :

$m_+ = c_+ h_+$ $\quad$ $m_- = c_- h_-$

The susceptibilities c_+ and c_- are complex numbers. The real and the imaginary part of each of these values are noted c'_+, c'_-, c''_+, c''_-. The imaginary parts represent the loss. Complex permeability μ is related to susceptibility:

$$\mu_\pm = 1 + c_\pm,\ \mu_\pm = \mu'_\pm - j\,\mu''_\pm,\ \mu'_\pm = 1 + c'_\pm,\ \mu''_\pm = c''_\pm$$

Permeability can be expressed as a function of frequency or magnetic field H, or normalized to H_r, thus fig.1

$$\mu'_\pm = 1 + \frac{M_s}{H_r}\frac{\left(\frac{H}{H_r} \mp 1\right)}{\left(\frac{H}{H_r} \mp 1\right)^2 + \left(\frac{\Delta H}{2H_r}\right)^2} \qquad \mu''_\pm = \frac{M_s}{H_r}\frac{\frac{\Delta H}{2H_r}}{\left(\frac{H}{H_r} \mp 1\right)^2 + \left(\frac{\Delta H}{2H_r}\right)^2}$$

H is the internal static magnetic field
H_r is the resonance field
M_s is the saturated magnetization
ΔH/Hr is the midpoint width of the Lorentz curve
ΔH gyromagnetic line width
g is the gyromagnetic ratio

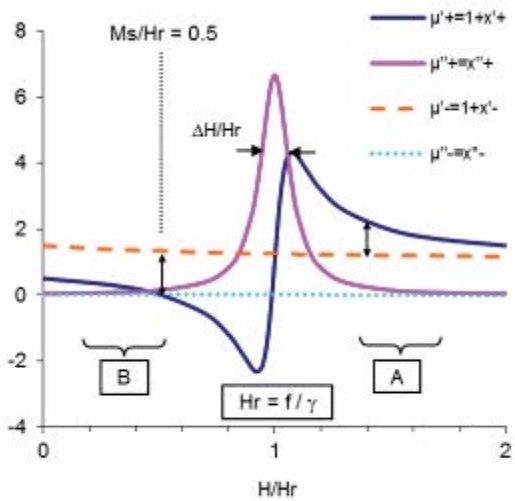


Figure 1 μ'+ , μ'- , μ''+ , μ''- , as a function of H/H_r
"B": below H_r resonance field (low field H)
"A": above H_r resonance field (high field H)

Within a given magnetic field range, it is possible to find values of H such that the permeabilities μ'_+ and μ'_- are different, while μ''_+ and μ''_- have very low values (fig 1). .This property has for consequence, the non-reciprocity of devices behavior: the greater the difference Δμ between μ'+ and μ'-, the more efficient the device. The field H can be either lower or higher than the resonant field H_r

Operation below resonance (zone B in fig 1)

The difference Δμ is greater than in the case of high field (B zone in fig 1) and more constant over the H field locally. Moreover the external field required is lower, and so the magnet strength too so that smaller magnets are required.

Nevertheless magnetization of the ferrite should be lower than a certain limit and is a limiting factor for the difference Δμ since magnetization is a multiplicative factors in all terms of the susceptibility. The limit is due to the phenomenon of natural resonance in unsaturated materials. This leads to "low magnetic field loss" (fig 2). Consequently, for a given frequency f, the material selected must have a magnetization lower than the field of resonance Hr, so lower than f/g , unless it is to be used above the resonance.
Finally at low field H, the magnetisation should be chosen according to:

$$\frac{1}{3} < \frac{\gamma M_s}{f} < \frac{3}{4}$$

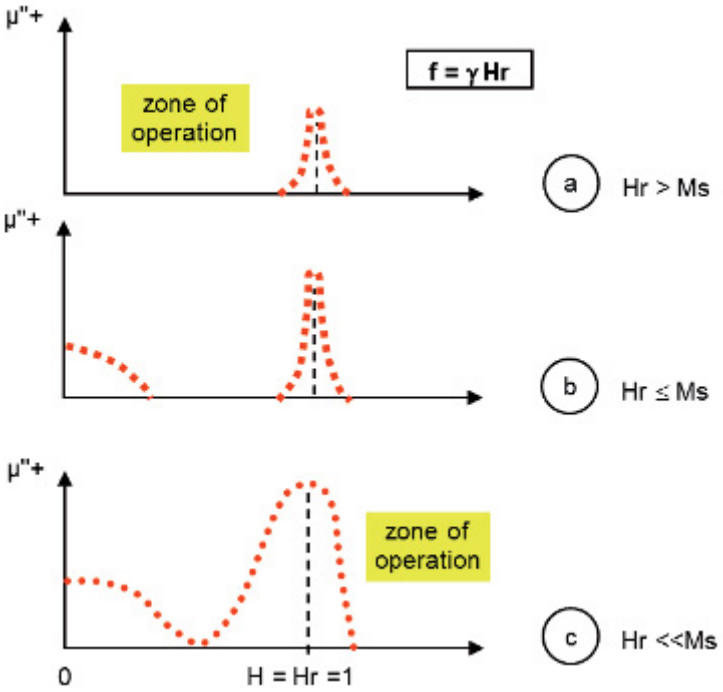


Figure 2 : permeability μ + versus static field H

Operation above resonance (zone A in fig 1)

In that case the magnetization may be greater than the limit of f/g and so efficiency is improved as a consequence of a larger difference in Δμ. This case should be applied as soon as magnet conditions for H field are fulfilled (strength, temperature behaviour linked to the ferrite's one, etc.). Another advantage is seen in the case of power losses as indicated forward.

Effective line width DH_{eff}

The magnetic losses in the ferrites affect the insertion loss of the device. It is related to the imaginary part of the permeability of the positive polarization μ''_+, which increases with the gyromagnetic line width DH (fig.1).

Experiment shows that the curve $\mu''_+(H)$ far away from the resonance is a Lorentz curve with an effective line width denoted DH_{eff} smaller than DH. Near the resonant frequency, the line width is broadening by several phenomena such as porosity, magneto crystalline anisotropy.

There is much practical interest involved in the concept of effective line width DH_{eff} than line width DH, far from resonance.

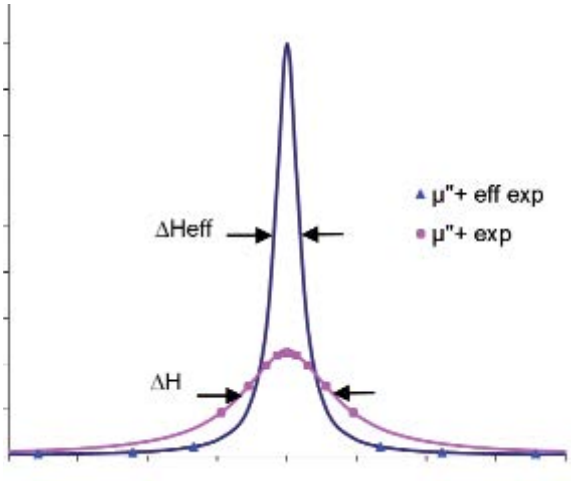


Figure 3 : ΔH, ΔH_{eff}

The imaginary parts of permeability μ_+ represent losses in the material:
- At the vicinity of the resonance, μ''_+ describes a Lorentz curve the half width of which, denoted DH
- From the values of μ''_+ far from resonance, a Lorentz curve can be extrapolated the half width of which, denoted DH_{eff}, corresponds to the off resonance magnetic losses.

Depending on their compositions, the ferrites have line width ΔH in the range 10 to 500 and ΔH_{eff} in the range 4 to 50.

Spin wave line width DH_k

Above a certain microwave power level, nonlinear phenomena take place resulting in additional magnetic loss which rapidly becomes prohibitive in the devices.

The critical magnetic microwave field h_c, from which such effects appear, depends on the applied static field. The nonlinear effects are associated with the excitation of the spin waves, the attenuation of which is described by DH_k.

For a certain static magnetic field H denoted Hsub, there is a minimum of the microwave magnetic field hc related to DH_k

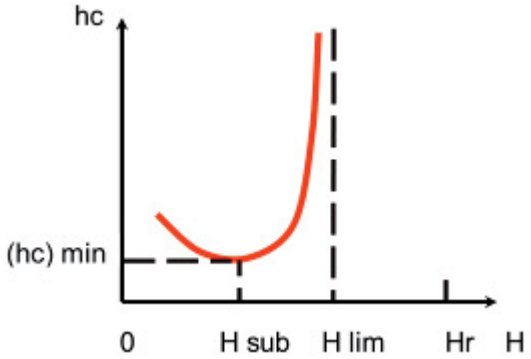


Figure 4: non-linear effect critical field hc versus static field

$$h_c \min = \frac{2 f \Delta H_k}{\gamma M_S}$$

The higher the value of ΔH_k, the better the high power behavior.

For a static magnetic field higher than H lim, there is no effect of the power on losses: this is the case for devices operating at high static field (above resonance).

The ferrites have ΔH_k from 1 to more than 20. The relation between the line widths is $\Delta H_k < \Delta H_{eff} < \Delta H$

I.2 Dielectric properties

The dielectric properties of the ferrites are also of importance in the applications. The relative real permittivity e' is within the range of about 12 to 16 and affects the wave length in the material and the impedance. The relative imaginary part of the permittivity e'' or the dielectric loss tangent $tg\delta = \frac{\varepsilon''}{\varepsilon'}$ affects the insertion losses. Ferrites, depending on their compositions have dielectric loss tangent at 10 GHz between 10^{-4} and 10^{-3}. In this range, the insertion loss of the device is more affected by the magnetic losses.

I.3 Characterization

Four parameters are tested in standard production. The result of test is compared with the values in the tables at the end: Ms, ΔH, e', tand

The Landé factor g_{eff} and the hysteresis cycle parameters are given on request.

Others parameters such as Tc, ΔH_{eff} , ΔH_k and a are not tested but the values are given in the tables, considered as heritage.

Saturation Magnetization M_s

Saturation magnetization is measured at room temperature by the Weiss method. A sample of one gram typically is moved through the air gap of a magnet delivering a magnetic field of 8000 Oe. A flux variation is produced through Helmholtz bobbins fixed on the magnet poles and read on an integrator: the signal of a material is compared to a pure nickel's one with admitted value is 54.56 Gauss.cm^3/g

Gyromagnetic line width DH and effective Lande Factor

The effective Landé factor g_{eff} and line width ΔH are measured in a rectangular cavity at 9.3 GHz and at room temperature. The test sample is a sphere of about 1mm in diameter. The test complies with the IEC 60556 publication.

Relative dielectric constant ε' and dielectric loss tangent tand

The permittivity is measured using a rod of about 1mm in diameter in a rectangular cavity at 8.2 GHz.

Hysteresis parameters

Temex Ceramics offers the possibility to perform hysteresis on request and give remnant induction Br, coercive field Hc, temperature dependence. Values are given for the Axx families and NZ50 material.

A toroidal sample is double winded and used as a transformer. The primary winding magnetizes the sample through a 50 Hz frequency signal. The applied field H is proportional to the primary current; the signal induced in the secondary winding is proportional to the magnetic flux variation and is integrated to obtain the magnetic induction B.

The induction value Bm is obtained for an applied field of 5 Hc.

II. User Guide

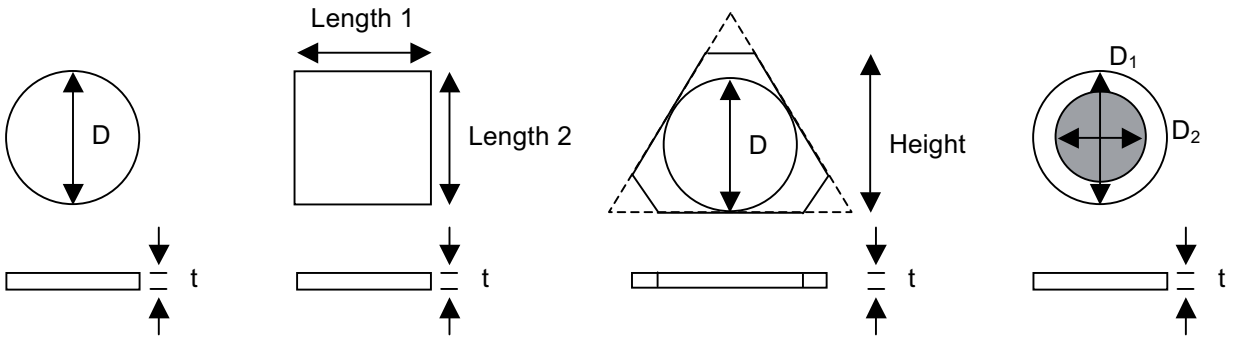
Material properties synthesis

Table below summarizes the properties of materials in term of magnetization, stability of magnetization, line widths.

Ferrite family	Chemical composition	Frequency range (GHz) (below resonance)	Magnetic losses DH_{eff} (Oe)	Power behaviour DH_k (Oe)	Temperature stability a (10^{-3}/°C)
Y1xx	Y-Gd	1.55 ~ 10.9	3 ~ 45	1.5 ~ 13	0.9~2.2
Y2xx	Ca-V-Y (CVG)	1.55 ~ 10.9	2	1	2.6~3.7
Y3xx	Y-Al	0.34~6.2	4	2	2.6~5
Y4xxx	CVG-Gd	1.55~6.2	12~18	9~12	0.8~1.4
Y7xx	Y-Gd-Al	0.34~6.2	6~15	5~10	0.5~3.4
Y9xx	Y-Gd-Al Co-doped	0.34~10.9	9~15	25~46	0.3~1.3
Dx	Y-Gd-Al Dy-doped	0.34~10.9	29~63	10~20	0.5~3
Uxx	Mn-Mg	1.55~36	6	4	2.2~3.3
Axxx	Li	6.2~40	4~9	3~10	0.9~1.6
Nxxx	Ni	1.55~40	30~50	12~25	0.7~2

Shapes

Typical range of shapes which can be produced including single ferrite (F), assembly (FDA) with typical dielectric constant 16, others on request



Dimensioning (mm)

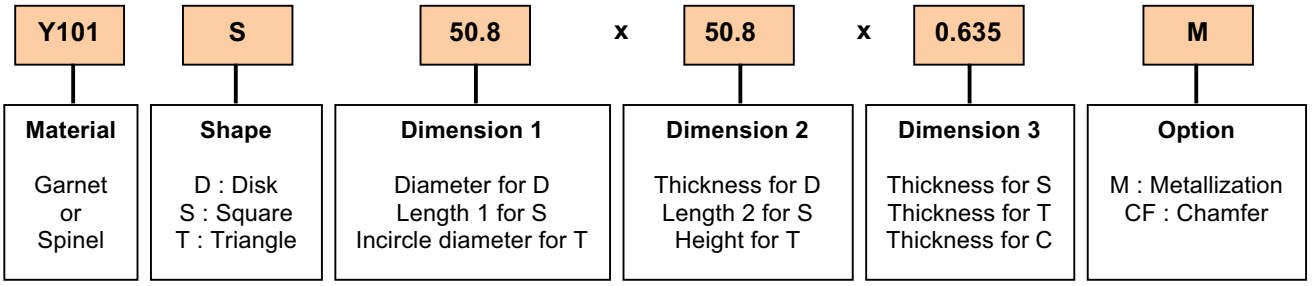
A wide range of dimensions can be made based on customer specifications

- Disks: diameter 1.5 up to 55 mm (typical value)
- Square: max length 50.8 x 50.8 mm / Thickness 0.5 mm up to 3 mm (typical value)
- Triangle: in-circle diameter up to 50 mm (typical value)

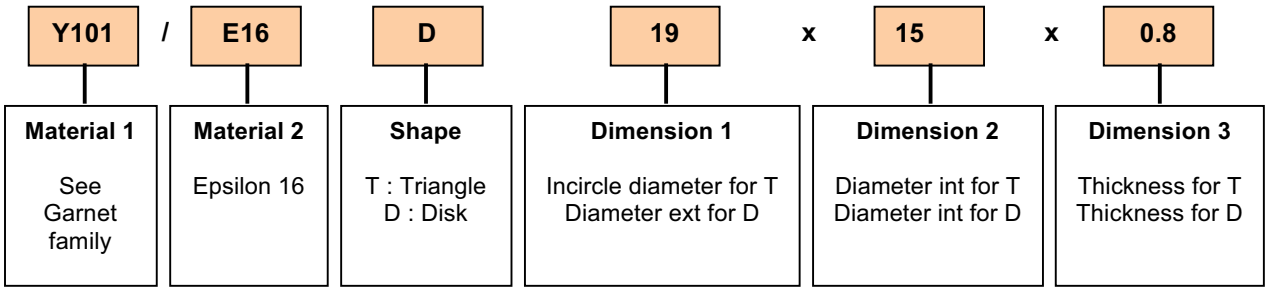
Tolerances on dimensions (mm)

- Standard tolerances are +/-0.05 mm on both diameter and thickness.
- As-fired parts (no machining requested => lower cost) are available for +/-1% tolerance.
- Smaller tolerances can be considered on request.

How to order



Example for ferrite: Y101 S50.8x50.8x0.63 M



Example for FDA: Y101/E16 D19x15x0.8

Surface finishing

As-fired parts can be grinded, lapped or polished.
Standard average peak-to-valley height (Ra) is specified here below.

Surface finishing	Ra (micrometer)	Ra (micro-inch)	Remarks
Standard	0.8	24	All ferrites
Lapped	0.4	16	All ferrites
Polished	0.1	4	All ferrites except A or U family

Metallization

Thick film: Silver
Thin film: on request

Chamfer

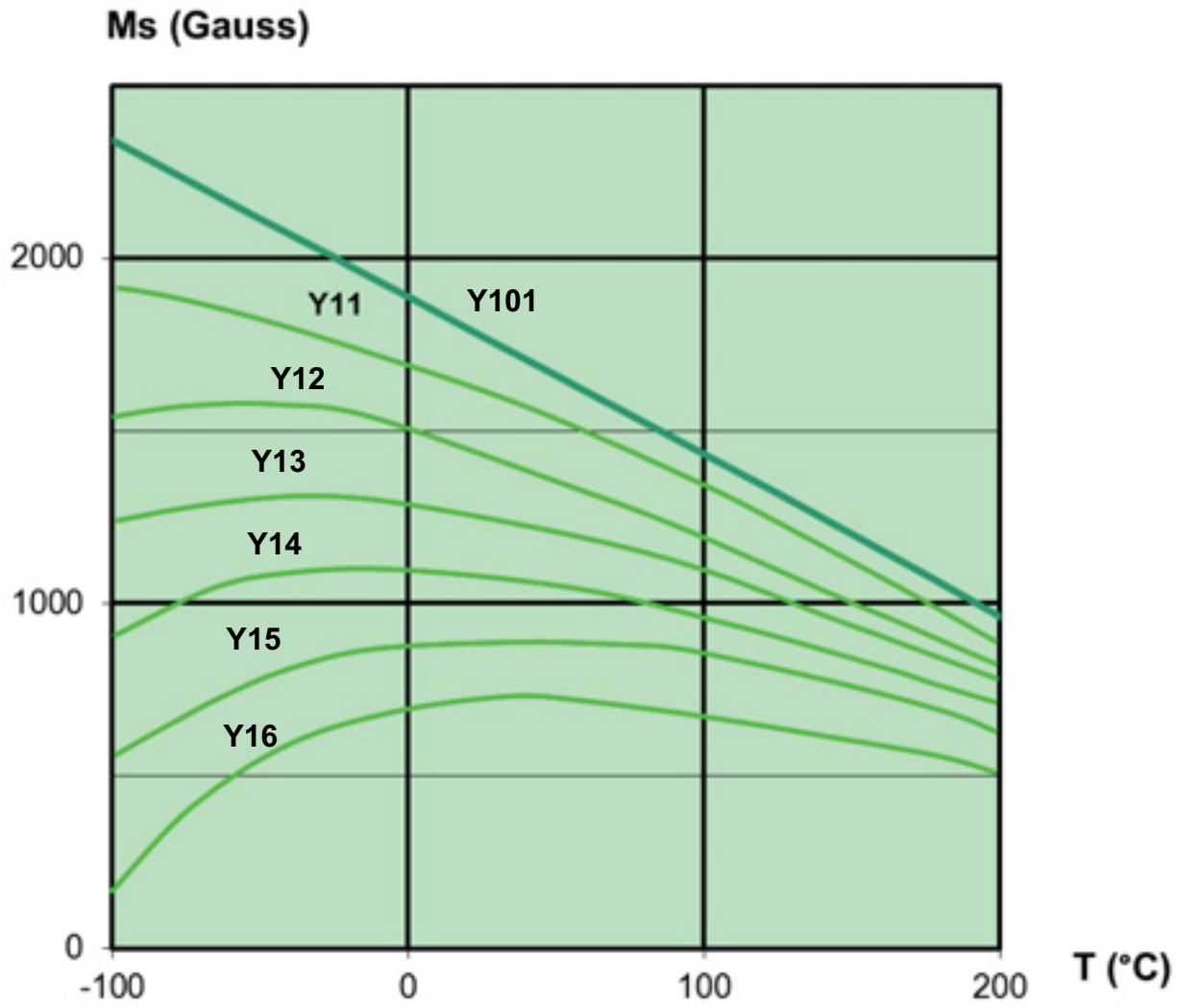
As per customer specification.

Y - Gd

Yttrium - Gadolinum

Type	Ms (Gauss) ±5%	Tc (°C)	g_{eff}	ΔH (Oe) +20%	ΔH_{eff} (Oe)	ΔH_k (Oe)	ε ±5%	tgδ 10^{-4} max	α 10^{-3}/°C ±0.2
Y101*	1820	280	2.02	18	3	1.5	15	2	2.2
Y11	1600	280	2.00	50	8	3	15.3	2	1.8
Y12	1420	280	2.01	60	14	5	15.3	2	1.5
Y13	1250	280	2.01	75	21	7	15.3	2	1
Y14	1100	280	2.02	95	28	9	15.4	2	0.5
Y15	900	280	2.03	130	36	11	15.4	2	0.7
Y16	750	280	2.02	170	45	13	15.4	2	0.9

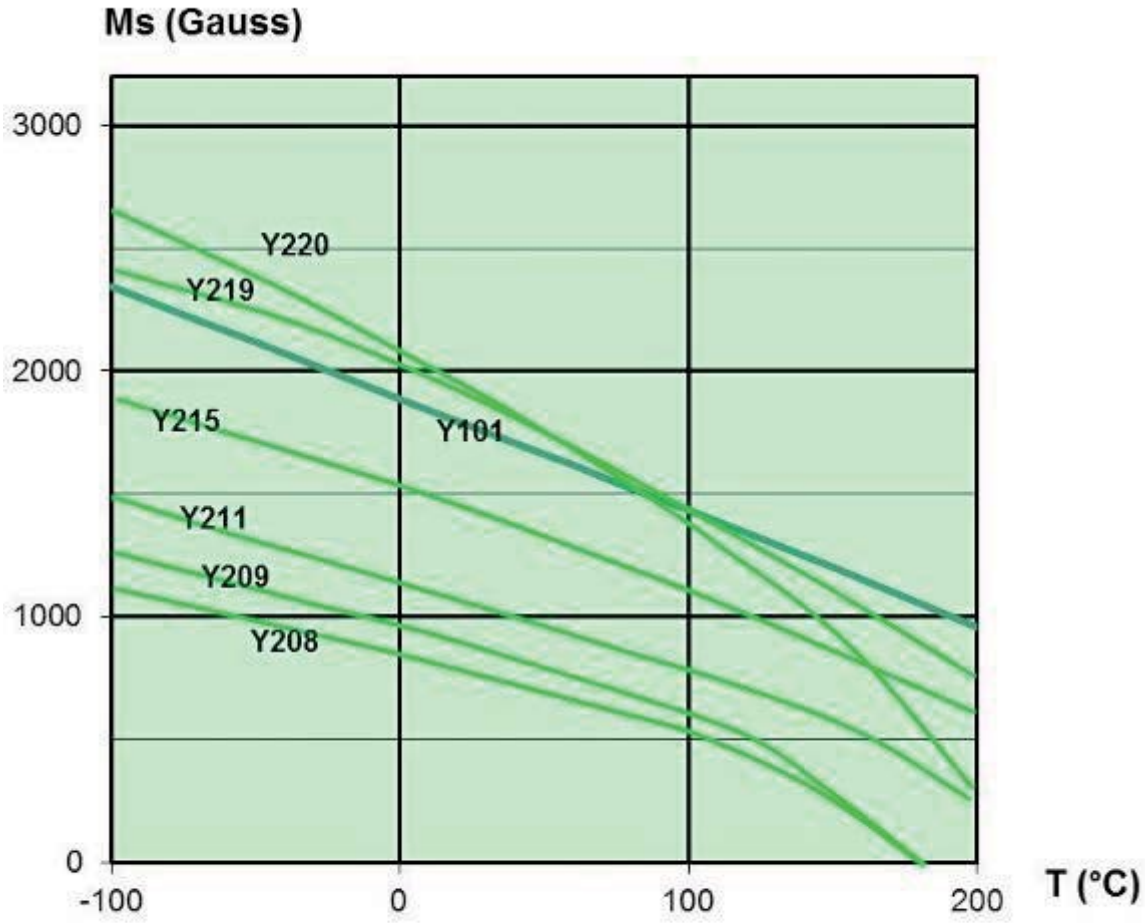
* Pure Yttrium iron garnet



Y - Ca - V - In or Zr

Yttrium - Calcium - Vanadium - Indium or Zirconium

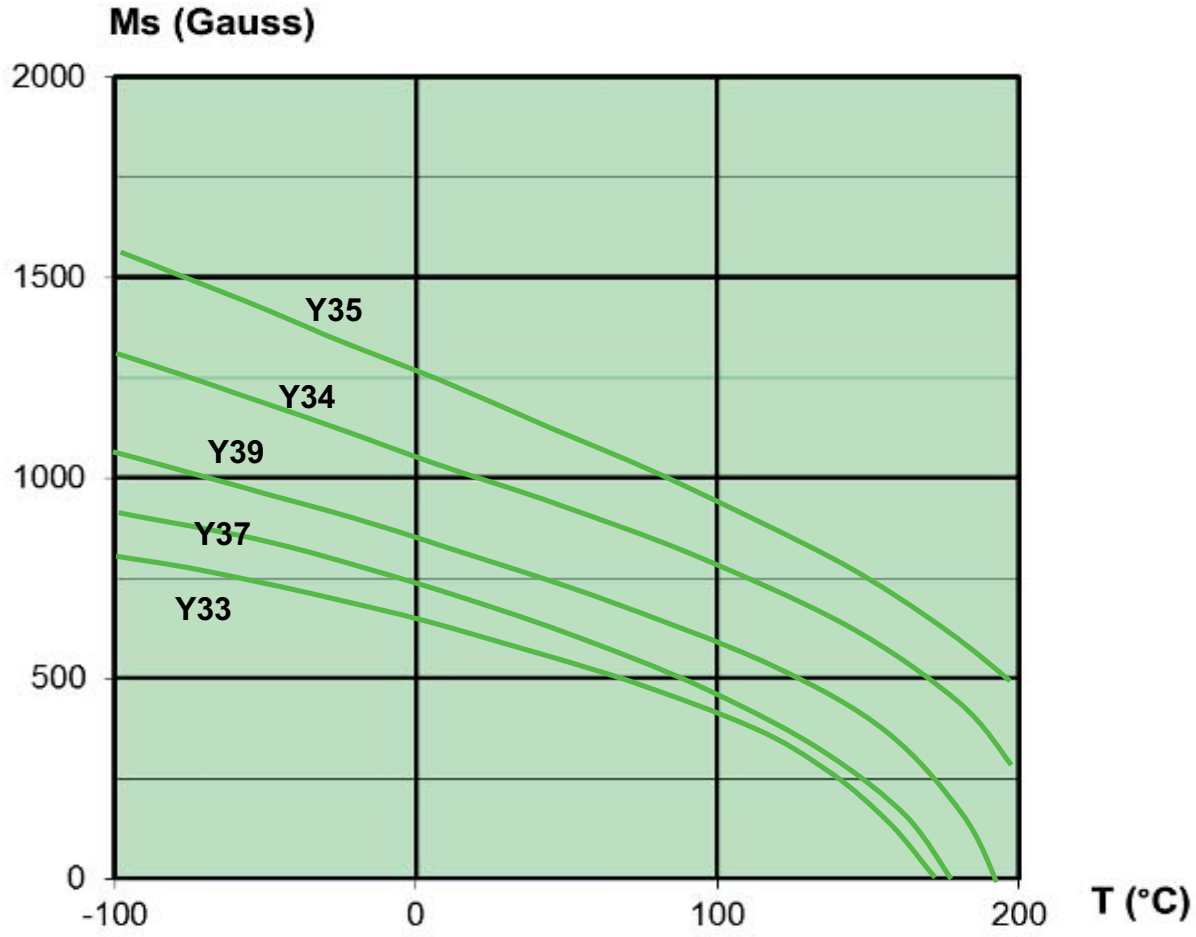
Type	Ms (Gauss) ±5%	Tc (°C)	g_{eff}	ΔH (Oe) +20%	ΔH_{eff} (Oe)	ΔH_k (Oe)	ε ±5%	tgδ 10^{-4} max	α 10^{-3}/°C ±0.2
Y220	1950	205	2.01	10	2	1	15.4	2	3.1
Y219	1900	240	2.02	15	3	1.5	15.2	2	2.6
Y218	1850	215	2.01	10	2	1	14.8	2	2.8
Y216	1600	218	2.01	10	2	1	14.8	2	2.6
Y215	1450	215	2.01	10	2	1	14.7	2	2.7
Y212	1200	209	2.01	10	2	1	14.5	2	2.9
Y211	1100	205	2.01	10	2	1	14.2	2	3
Y210	1000	200	2.01	10	2	1	14.2	2	3.3
Y209	900	180	2.01	10	2	1	14.1	2	3.5
Y208	800	177	2.01	10	2	1	14	2	3.7



Y - Al

Yttrium - Aluminum

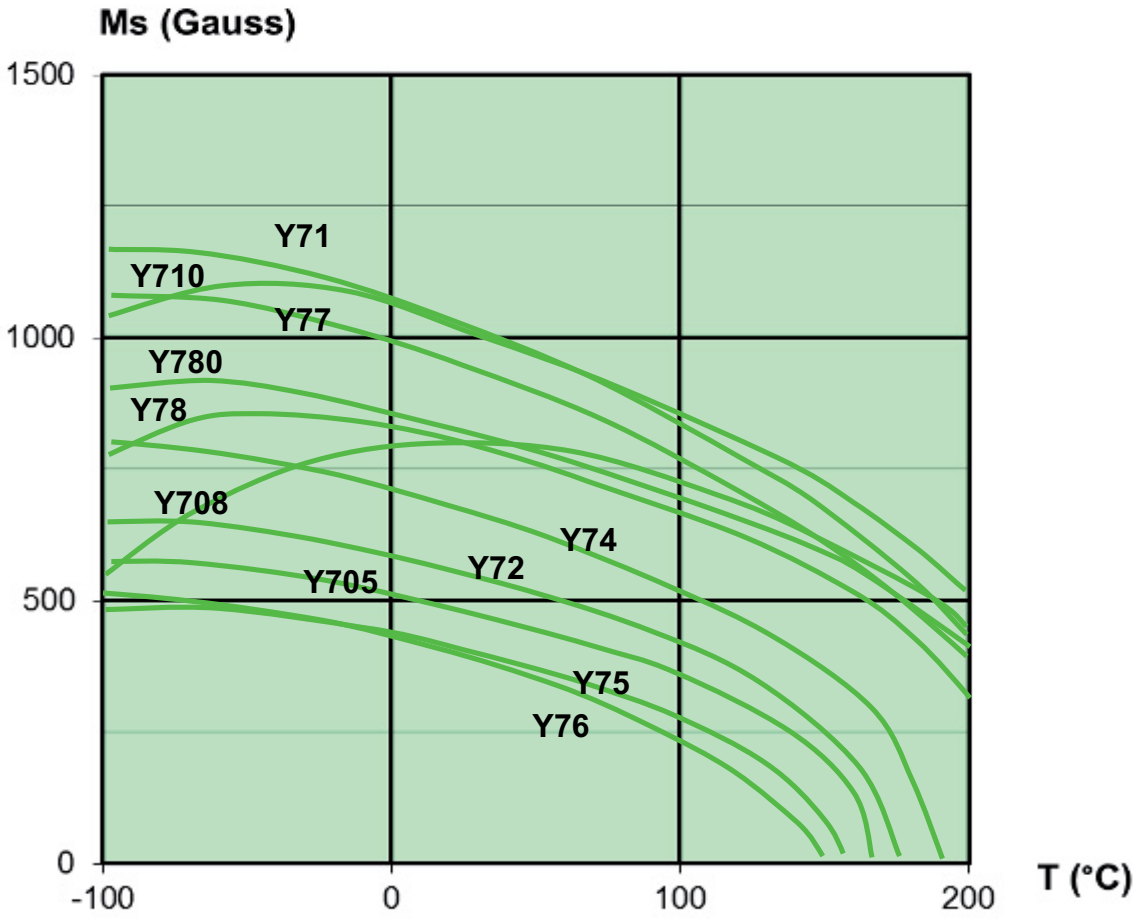
Type	Ms (Gauss) ±5%	Tc (°C)	g_{eff}	ΔH* (Oe) +20%	ΔH_{eff} (Oe)	ΔH_k (Oe)	ε ±5%	tgδ 10^{-4} max	α 10^{-3}/°C ±0.2
Y35	1200	225	2.01	40	4	2	14.9	2	2.6
Y34	1030	210	2.01	40	4	2	14.9	2	2.7
Y39	800	195	2.01	40	4	2	14.6	2	2.9
Y38	760	190	2.01	40	4	2	14.5	2	2.9
Y37	680	180	2.01	40	4	2	14.5	2	2.9
Y33	615	175	2.01	40	4	2	14.5	2	3.2
Y30	565	160	2.01	30	4	2	14.4	2	3.4
Y32	420	135	2.01	30	4	2	14.4	2	3.8
Y31	370	125	2.01	30	4	2	14.1	2	4.1
Y36	290	115	2.01	25	4	2	14	2	4.6



Y - Al - Gd

Yttrium - Aluminum - Gadolinum

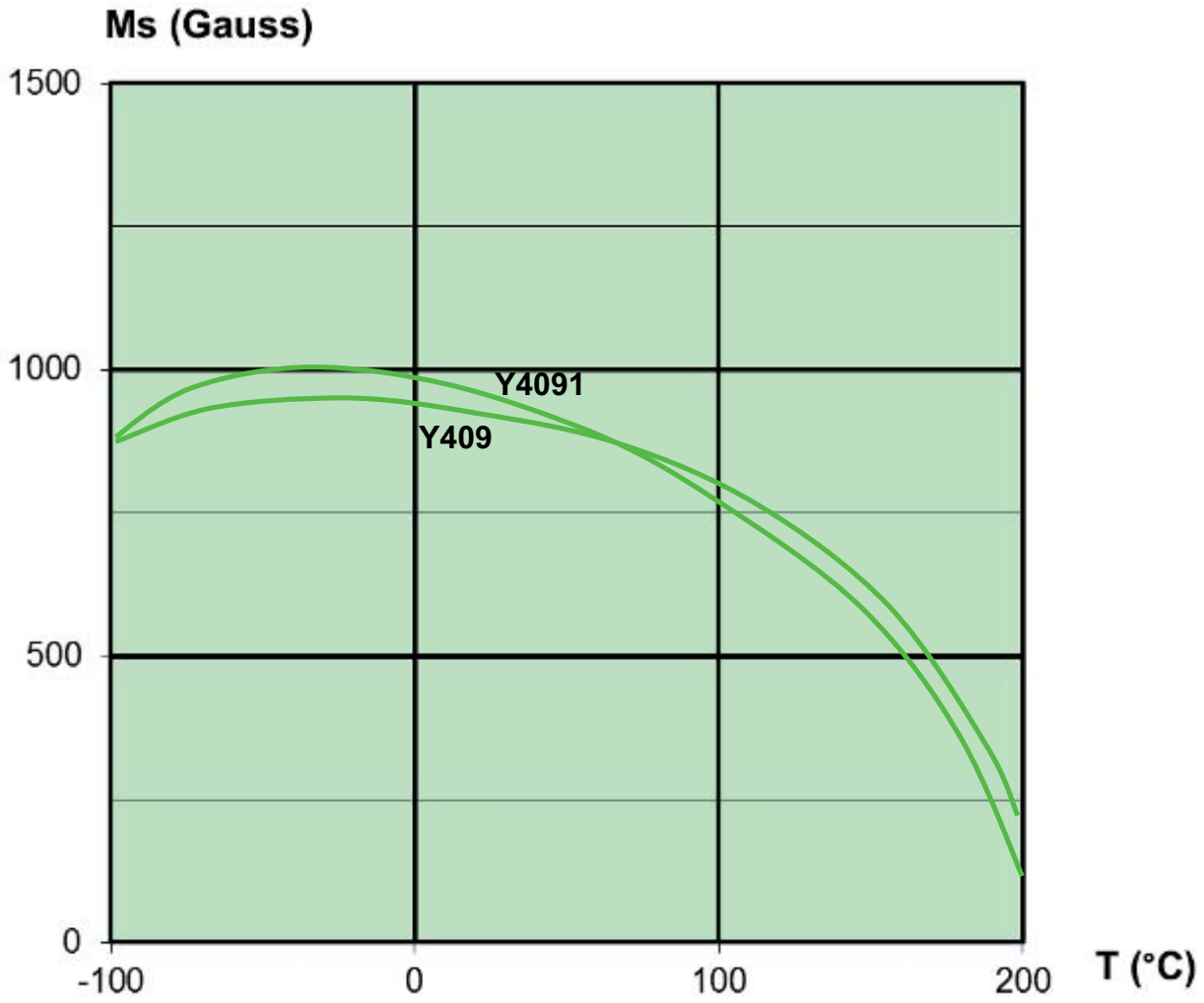
Type	Ms (Gauss) ±5%	Tc (°C)	g_{eff}	ΔH (Oe) +20%	ΔH_{eff} (Oe)	ΔH_k (Oe)	ε ±5%	tgδ 10^{-4} max	α 10^{-3}/°C ±0.2
Y71	1020	235	2.01	60	7	5	15	2	2.2
Y710	1020	240	2.02	75	9	7	15	2	1.7
Y77	950	230	2.01	60	6	5	14.9	2	2
Y780	830	235	2.02	60	6	5	14.8	2	1.6
Y78	800	220	2	80	8	7	15	2	1.3
Y708	800	260	2.04	140	15	10	15.2	2	0.5
Y74	570	190	2.01	60	6	5	14.9	2	2.3
Y72	540	175	2.01	60	6	5	14.6	2	2.3
Y705	470	170	2.02	65	6	5	14.3	2	2.8
Y75	400	160	2.03	65	6	5	14.3	2	2.7
Y76	390	150	2.02	50	6	5	14.2	2	3.4



Y - Ca - V - Zr - Gd

Yttrium - Calcium – Vanadium - Zirconium - Gadolinum

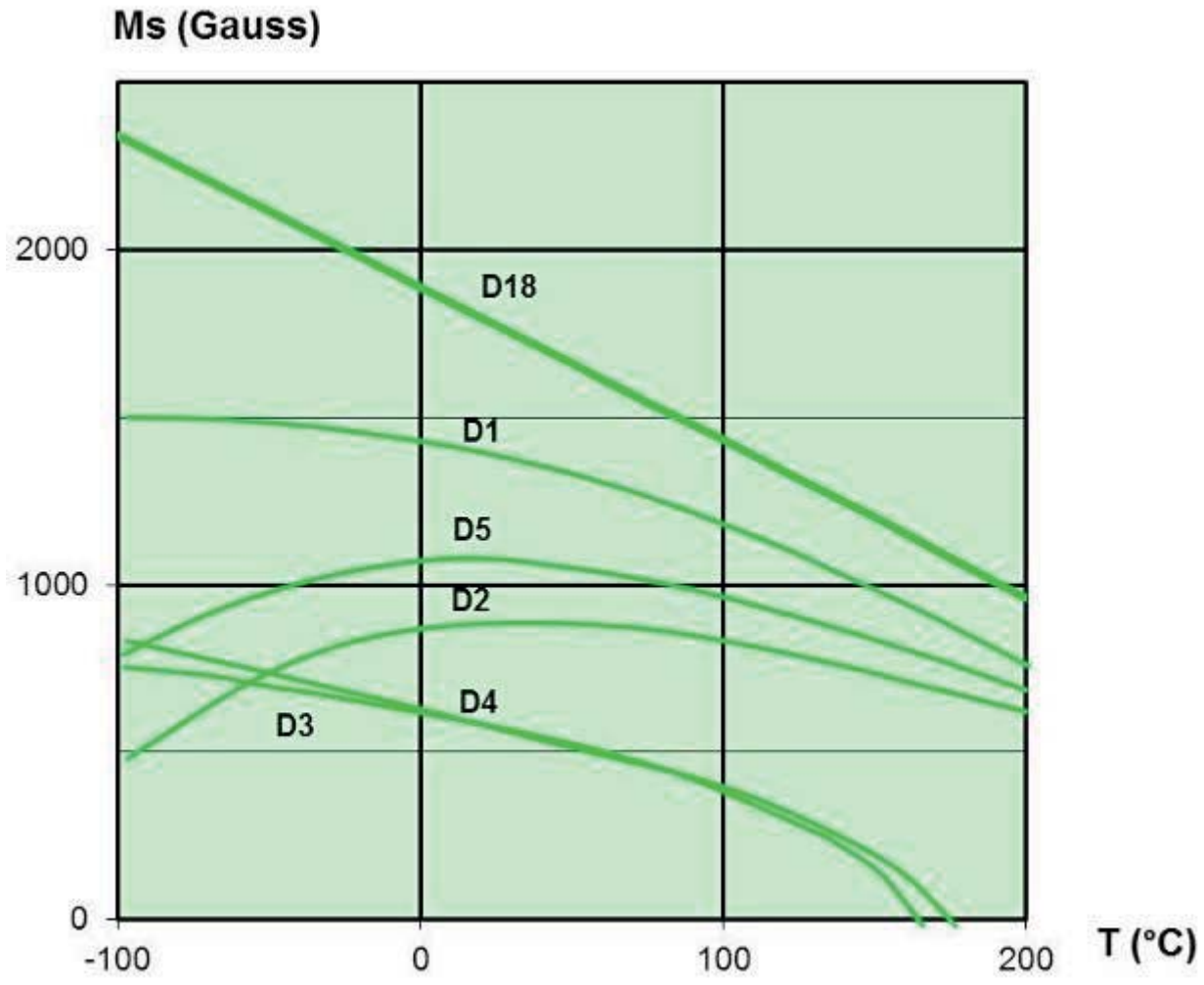
Type	Ms (Gauss) ±5%	Tc (°C)	g_{eff}	ΔH (Oe) +20%	ΔH_{eff} (Oe)	ΔH_k (Oe)	ε ±5%	tgδ 10^{-4} max	α 10^{-3}/°C ±0.2
Y4091	960	195	2.02	35	12	9	15.2	2	1.4
Y409	920	223	2.02	50	18	12	15.2	2	0.8



Y- Gd - Dy - Al

Yttrium-Dysprosium or Gadolinum-Dysprosium or Aluminum-Dysprosium

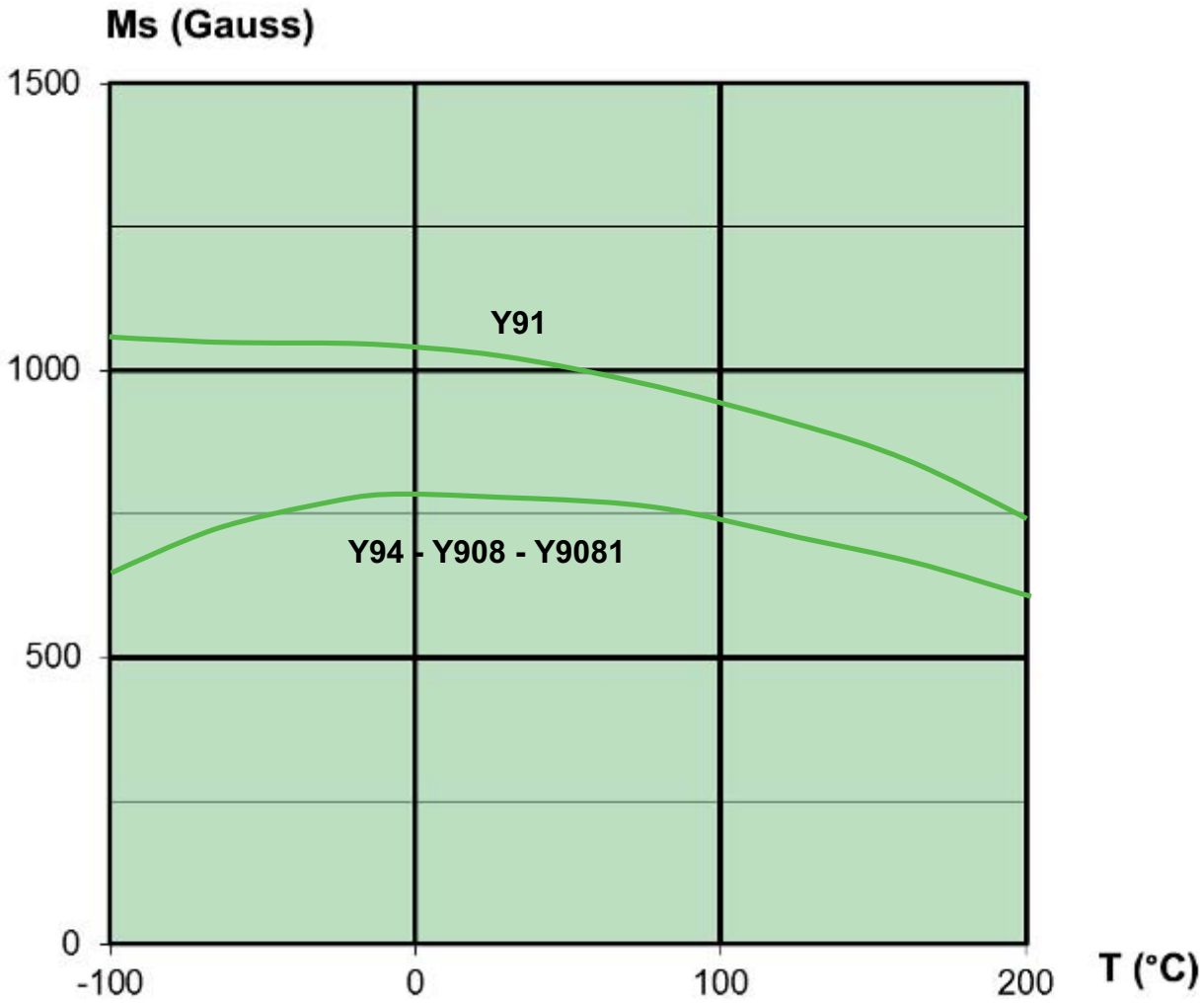
Type	Ms (Gauss) ±5%	Tc (°C)	g_{eff}	ΔH (Oe) +20%	ΔH_{eff} (Oe)	ΔH_k (Oe)	ε ±5%	tgδ 10^{-4} max	α 10^{-3}/°C ±0.2
D18	1760	280	2.02	85	54	18	15	2	2.2
D1	1400	270	2	110	41	14	15.5	2	1.4
D5	1070	270	2.02	150	55	18	15.5	2	0.5
D2	900	270	2.01	185	63	20	15.5	2	0.8
D3	590	175	2	85	29	10	14.5	2	3.5
D4	580	170	2	140	56	19	14.4	2	3



Y - Gd - Al - Co

Yttrium - Gadolinum - Aluminum - Cobalt

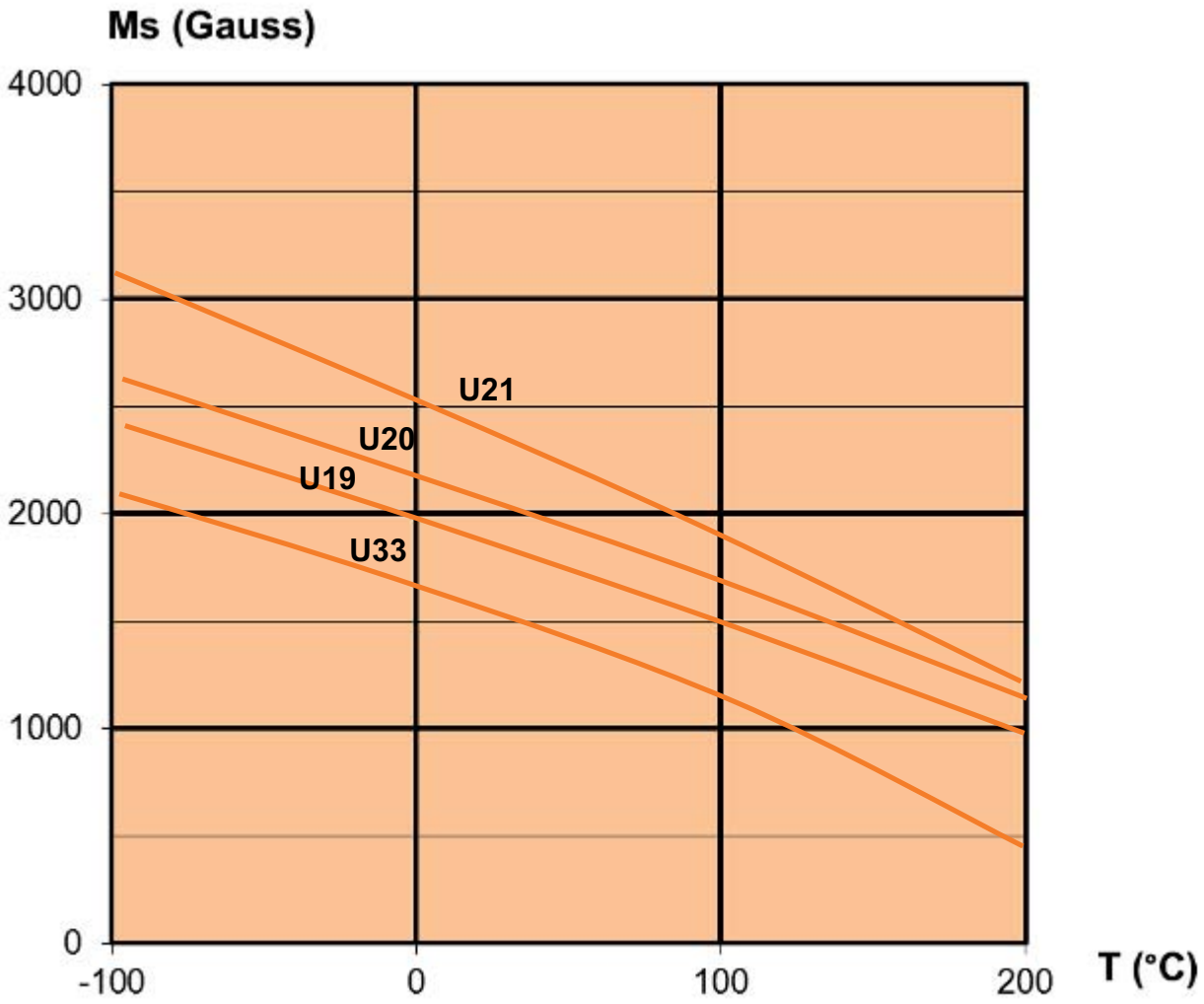
Type	Ms (Gauss) ±5%	Tc (°C)	g_{eff}	ΔH (Oe) +20%	ΔH_{eff} (Oe)	ΔH_k (Oe)	ε ±5%	tgδ 10^{-4} max	α 10^{-3}/°C ±0.2
Y91	1020	240	2.02	60	25	9	15.1	2	1.3
Y94	780	250	2.02	75	40	13	15.2	2	0.3
Y908	780	250	2.02	85	43	14	15.2	2	0.3
Y9081	780	250	2.02	120	46	15	15.2	2	0.3



Mg - Mn - Al

Magnesium-Manganese or Magnesium-Manganese-Aluminum

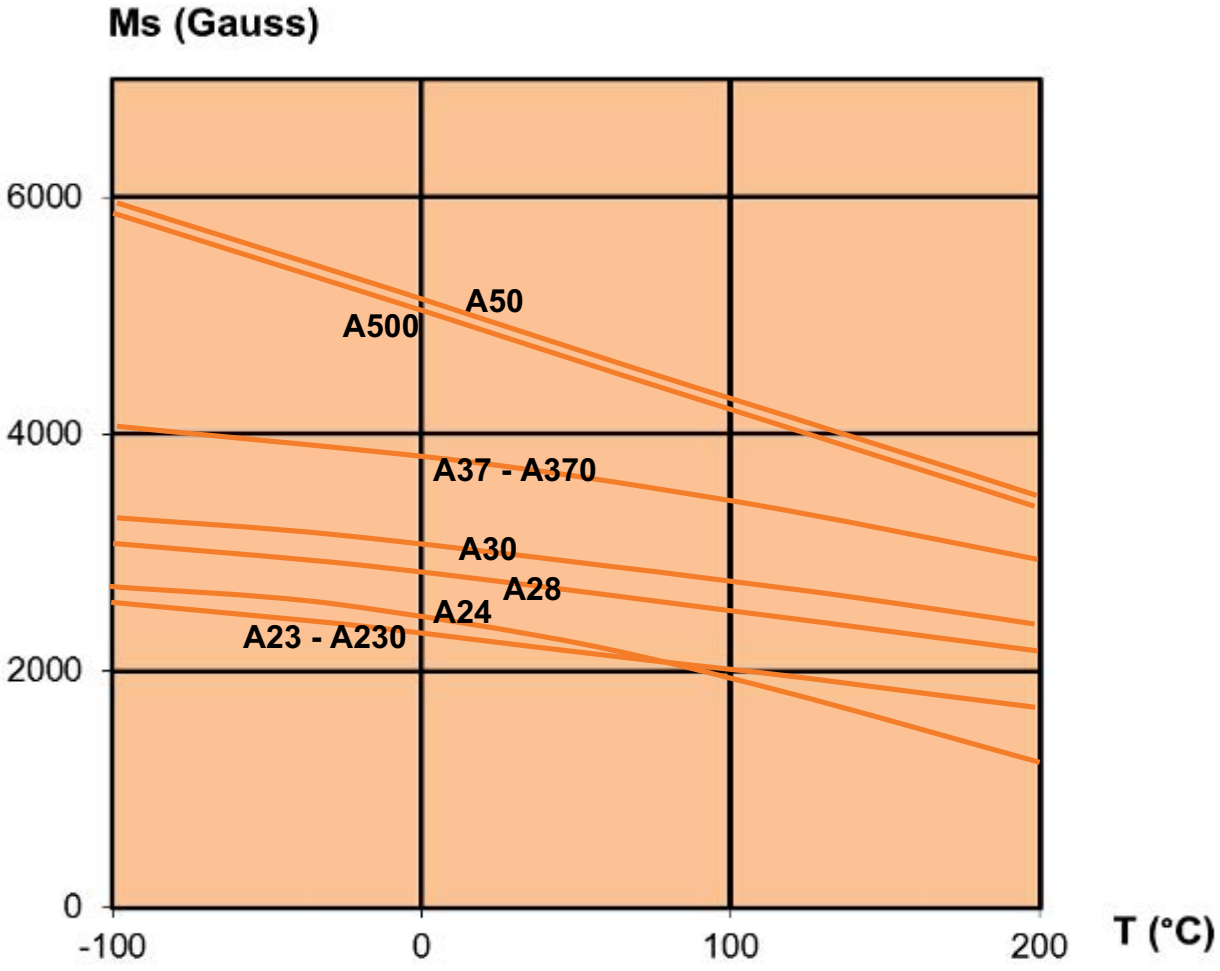
Type	Ms (Gauss) ±5%	Tc (°C)	g_{eff}	ΔH (Oe) +20%	ΔH_{eff} (Oe)	ΔH_k (Oe)	ε ±5%	tgδ 10^{-4} max	α 10^{-3}/°C ±0.2
U21	2400	275	2.03	290	6	4	13	3	2.7
U20	2100	300	2.01	360	6	4	13	3	2.3
U19	1900	280	2.01	350	6	4	13	3	2.2
U33	1600	230	2.02	290	8	4	12.4	3	3.3



Li – Zn - Ti - Mn - (Co)

Lithium - Zinc - Titanium – Manganese - (Cobalt)

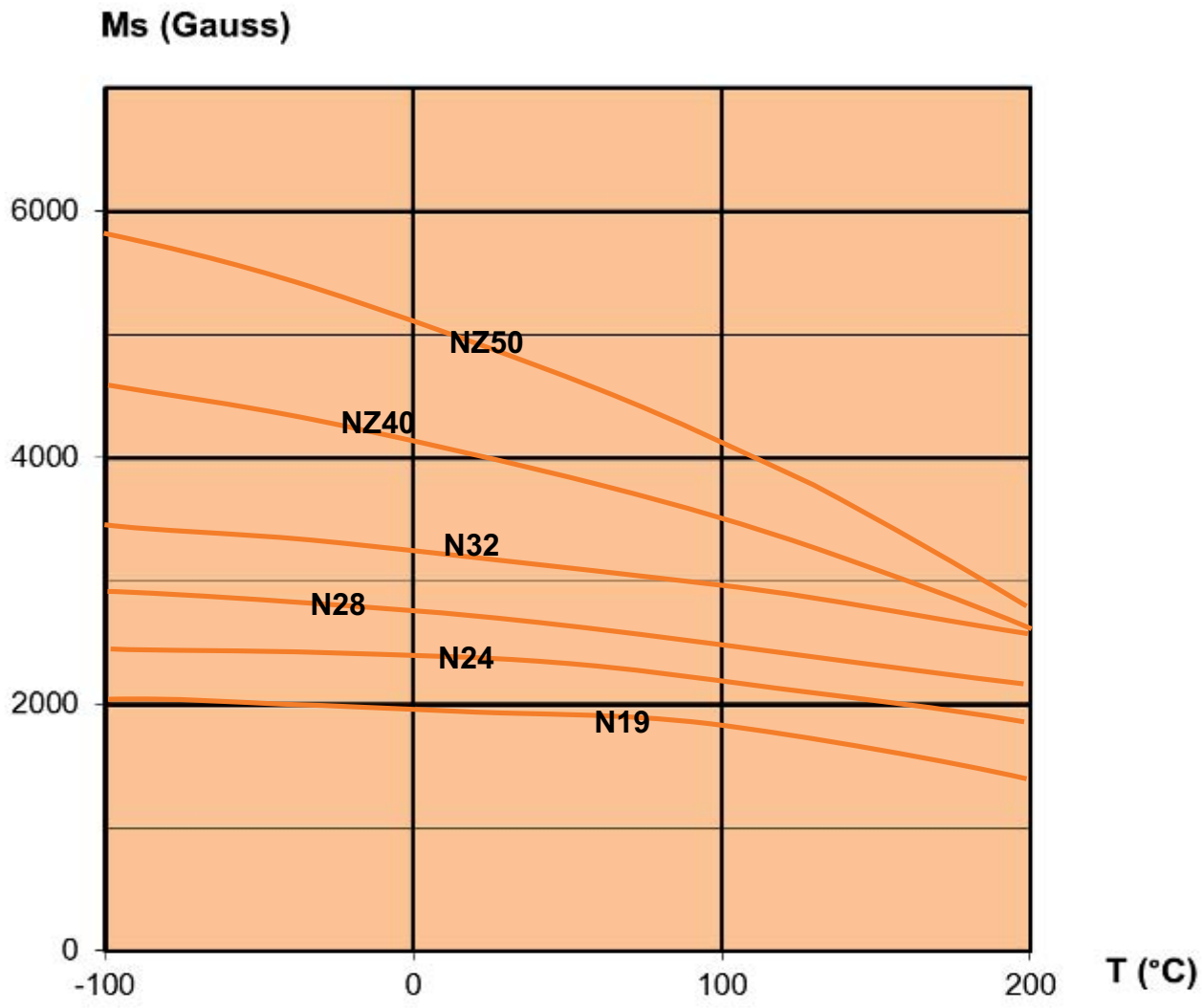
Type	Ms (Gauss) ±5%	Tc (°C)	g_{eff}	ΔH (Oe) +20%	ΔH_{eff} (Oe)	ΔH_k (Oe)	ε ±5%	tgδ 10^{-4} max	α 10^{-3}/°C ±0.2	Br (Gauss)
A50	5000	450	2.06	170	4	3	15.3	5	1.6	3300
A500	4900	450	2.06	200	20	10	15.3	5	1.6	3200
A37	3700	565	2.08	400	4	3	16	5	1	2500
A370	3700	565	2.07	400	7	6	15.9	5	1	2500
A30	3000	555	2.08	450	4	3	16.4	5	0.8	2000
A28	2800	540	2.08	450	4	3	16.6	5	0.9	1900
A24	2450	390	2.08	250	4	3	16.8	5	1.6	1700
A23	2300	505	2.08	450	4	3	16.8	5	1.2	1600
A230	2300	505	2.08	450	9	8	16.7	5	1.2	1600



Ni - Zn - Al

Nickel or Nickel-Zinc or Nickel-Aluminum (with Cobalt - Manganese - Copper)

Type	Ms (Gauss) ±5%	Tc (°C)	g_{eff}	ΔH (Oe) +20%	ΔH_{eff} (Oe)	ΔH_k (Oe)	ε ±5%	tgδ 10^{-4} max	α 10^{-3}/°C ±0.2	Br (Gauss)
NZ50	5000	375	2.1	125	30	12	13.7	5	2	3650
NZ40	4000	470	2.2	200	40	15	13.4	5	1.7	-
N32	3200	560	2.3	200	50	25	13.2	6	1	-
N28	2800	550	2.3	200	50	25	13	6	0.8	-
N24	2400	520	2.3	200	50	25	12.7	6	0.7	-
N19	1900	480	2.3	200	50	25	12.4	6	0.7	-



DIELECTRIC RESONATORS

Operating frequencies in wireless communications have shifted towards high frequency band, and thus frequencies higher than 1 GHz are now commonly utilized. In addition, the microwave frequency spectrum becoming severely crowded and sub-divided into many different frequency bands, designers are systematically looking for resonators giving them a narrow bandwidth with smaller size. But selecting the right dielectric material for a given microwave application is a difficult challenge.

EXXELIA TEMEX, being one of only a few manufacturers producing its own raw materials, is definitely the right partner to support designers at the early stage of development.

This also enables us to be independent from outside sources and flexible enough to rapidly adapt technologies to the changing needs of the market.

I. Basic Properties

Dielectric resonators are designed to replace resonant cavities in microwave functions such as filters and oscillators. The use of dielectric resonator inside these functions allows designers to get at low cost more compact devices with higher Q factor and temperature stability.

Dielectric resonators are generally fully “customized” and dedicated to very specific applications requiring Temex Ceramics early involvement in the design. The choice of the appropriate structure depends on various parameters which are listed below.

Resonance effect origins

The most commonly used mode in many applications is the TE_{01d} (Transverse Electric Field).
Dielectric resonator traps microwave energy in an extremely small band of frequencies within the confines of the resonator volume. This energy is reflected back into the resonator due to the big gap in permittivity at the boundary of the resonator (air with e = 1).

Nevertheless, a small part of this energy is distributed in the air around the resonator. These leakage magnetic fields do extend beyond the resonator structure and then can be used to provide coupling or adjusting the frequency with a loop or a stripline (Figure 1).

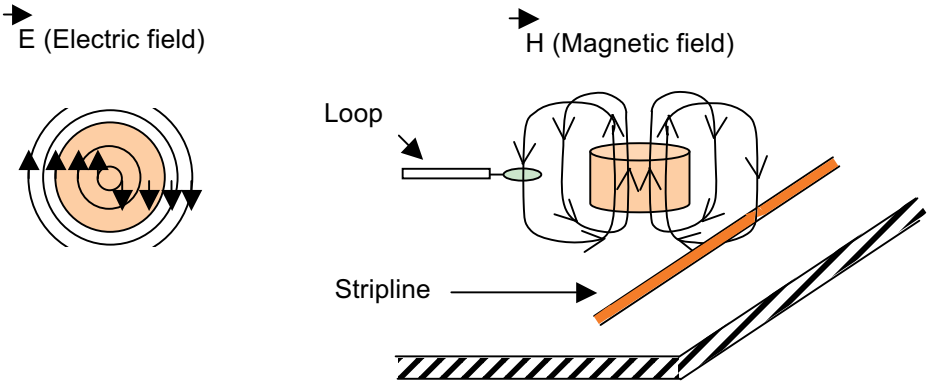


Figure 1

Resonant frequency: f

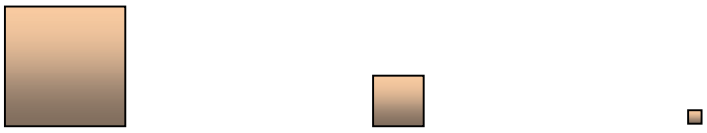
An isolated dielectric resonator is characterized by its resonant frequency which corresponds to a minimum of dielectric losses. This frequency f is primarily determined by the material dielectric constant (e_r) and the volume V (mm^3) of the resonator and can be approximated by:

$$f \approx \frac{233}{\sqrt{\varepsilon_r} \cdot V^{1/3}}$$

This formula can be used to give a preliminary determination (within 5 to 10%) of the size. Nevertheless, it is worth to point that a frequency correlation between the customer's test jig and the Temex Ceramics one has to be made according to the former sampling results.

Dielectric constant: e_r

The key reason for choosing a dielectric resonator is the size reduction afforded by a high e_r compared to a cavity air filter. It indeed appears according to the above formula, that the dielectric constant determines the resonator dimension at a given frequency. The higher the dielectric constant, the smaller the space within which the fields are concentrated, the lower the dimension at a defined frequency.



Air (ε_r = 1) E2000 (ε_r = 37) E5000 (ε_r = 78)

Quality Factor: Q

The Q value of a dielectric resonator is the ratio between the energy stored within the resonator to the energy dissipated in the air per cycle. It defines the losses in the material which are represented by :

$$tg(\delta) = \frac{\varepsilon''}{\varepsilon'}$$

where d is the loss angle, e' the dielectric constant and e'' the dielectric losses.

The Q factor equals to: $$Q = \frac{1}{tg(\delta)} = \frac{\varepsilon'}{\varepsilon''}$$

The higher the Q factor, the better the material.

A common way for expressing losses, as they are linear with the frequency, is to use the "Q times frequency" factor, also specified by Q x f where f is the measurement frequency.

Typical values for E4000 family: Q = 15 000, f = 10 GHz } Q x f = 150 000 GHz

Temperature coefficient: t_f

The resultant frequency of a microwave system typically decreases as temperature increases. This system is then said having a negative temperature coefficient. But usually, a system is required to be stable with temperature in the whole operating range of temperature (-55°C/+125°C for example). Then this frequency shift with temperature can be compensated using a dielectric resonator with a positive temperature coefficient.

The temperature coefficient of a resonator is defined by: $$\tau_f = \frac{\Delta f}{f} \bullet \frac{1}{\Delta T}$$

where f is the resonant frequency (MHz) at ambient temperature, Df the frequency variation (MHz) among the DT temperature range (°C).

II. User Guide

How to order

Example for dielectric resonator in dimension: E2036 C 11.00x4.00x5.35

E2036	C	11.00	x	4.00	x	5.35
Material See our dielectric families	**Shape** D : Disk S : Square C : Cylinder	**Dimension 1** Diameter for D Length 1 for S Outer diameter for C		**Dimension 2** Length 2 for S Inner diameter for C		**Dimension 3** Thickness for D Thickness for S Thickness for C

Example for dielectric resonator in frequency: E2036 C 11.00x4.00 F5000+/-50

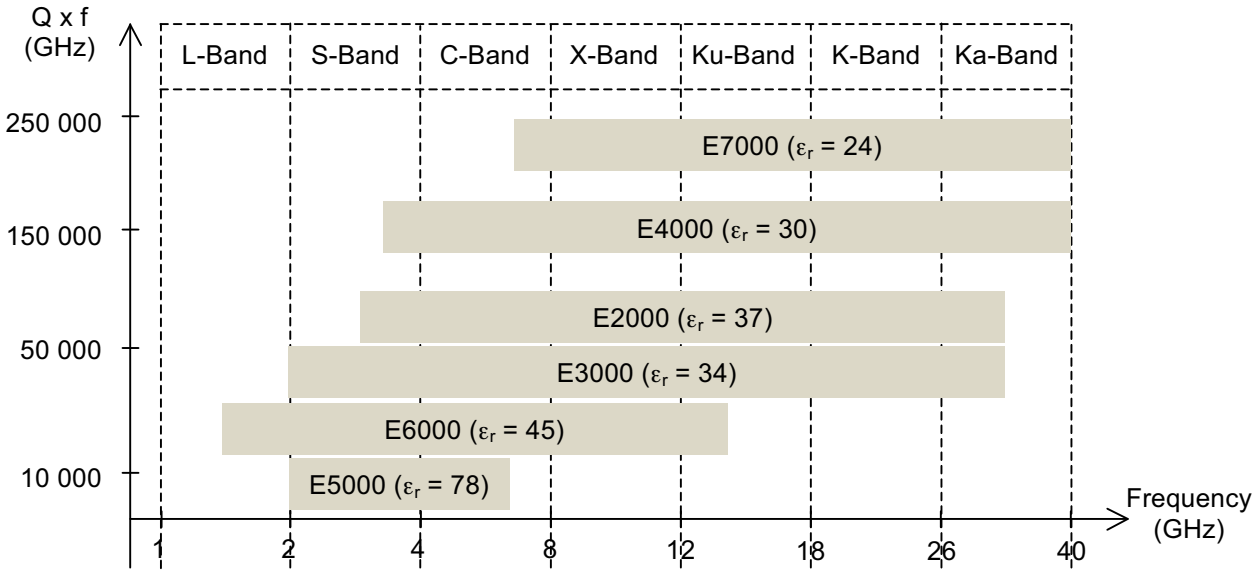
E2036	C	11.00	x	4.00	F5000	+/-	50
Material See our dielectric families	**Shape** D : Disk C : Cylinder	**Dimension 1** Diameter for D Diameter ext for C		**Dimension 2** Inner diameter for C	**Frequency**		**Tolerance in frequency** 1% or 0.5% (ask for others)

Example for dielectric resonator with spacer in dimension: E2036/AL C 11.00x4.00x5.35

E2036	/	AL	C	11.00	x	4.00	x	5.35
Material See our dielectric families		**Spacer** In AL2O3	**Shape** D : Disk S : Square C : Cylinder	**Dimension 1** Diameter for D Length 1 for S Outer diameter for C		**Dimension 2** Length 2 for S Inner diameter for C		**Dimension 3** Thickness for D Thickness for S Thickness for C

Materials and applications

Dielectric resonator applications are wide and the right material choice has to be done taking into account the size and Q factor requirements. Below figures and tables are useful to identify the right candidates. The frequency range from 1.5 up to 40 GHz is covered through different materials.

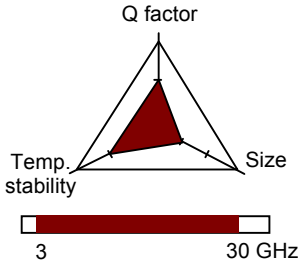


	PROPERTIES	APPLICATIONS
E2000 serie	High Q factor for high stability DRO designs. Mass-production capacity	- Alarm-detection systems, door openers - Anti-collision radar for automotive - Communication equipments - Low Noise Block (LNB) converters for DBS
E3000 serie	High linearity of frequency with temperature	- DRO for military and space applications
E4000 serie	Very high Q factor for filter designs	- Satellite multiplexing filter devices - Radio-links for communication systems (LMDS) - Anti-collision radar for automotive - Military radars
E5000 serie	High dielectric constant for reduced dimension systems	- Duplexers, filters - Cellular base stations
E6000 serie	High Q factor for low frequency applications	- Low Noise Block (LNB) converters for DBS - Security systems, detectors - Filters
E7000 serie	Ultra High Q factor for filter designs	- Satellite multiplexing filter devices - Radio-links for communication systems (LMDS) - Military radars

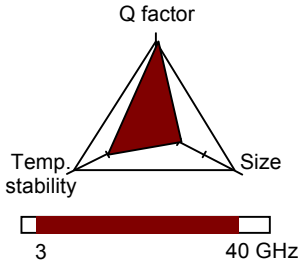
DIELECTRIC RESONATORS

Electrical and physical characteristics are listed in below table.

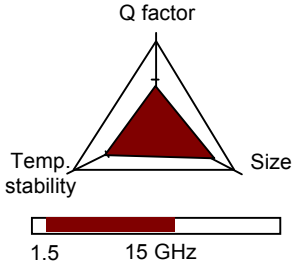
	E2000	E3000	E4000	E5000	E6000	E7000
Dielectric constant	37	34	30	78	45	24
Typical Q factor	5000 @ 10 GHz	4000 @ 10 GHz	15000 @ 10 GHz	1600 @ 5 GHz	8000 @ 5 GHz	23000 @ 10 GHz
Recommended frequency range	3 to 30	2 to 30	3 to 40	2 to 5	1.5 to 15	10 to 24
Available t_r (ppm/°C)	0 to 15	0 to 10	0 to 10	0	-6 to 12	0 to 6
Thermal expansion (ppm/°C)	6	5	10	8	6.5	10
Insulation resistivity (Wm^{-1}) (25°C)	10^{15}	10^{15}	10^{15}	10^{14}	10^{15}	10^{15}
Thermal conductivity ($Wm^{-1}°K^{-1}$) (25°C)	2.1	1.7	2.5	2.9	2.1	3.2
Water absorption (%)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Density	5.2	5.3	7.6	5.6	4.9	7.5
Oxide composition	Zr Sn Ti	Zr Sn Ti	Ba Zn Ta	Ba Sm Ti	Ti Zr Nb Zn	Ba Mg Ta



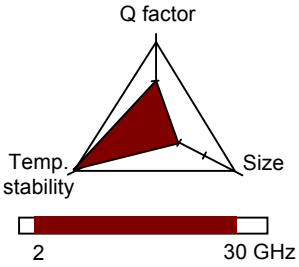
E2000



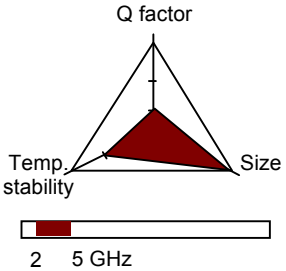
E4000



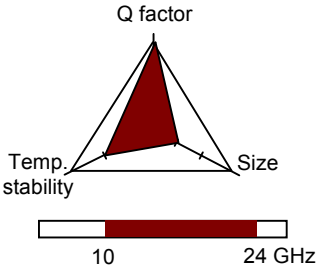
E6000



E3000



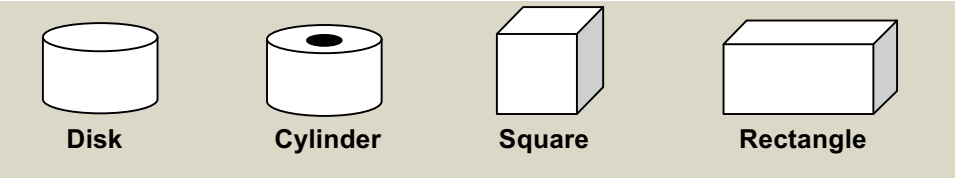
E5000



E7000

Shape and metallization

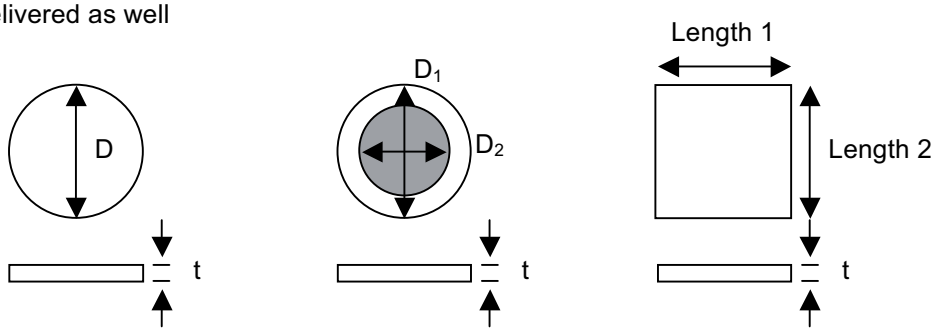
Various shapes and metallization are available (custom shape on request).



Dimensioning

A wide range of dimensions can be made based on customer specifications:
Disk: diameter 1 up to 55 mm (typical value)
Cylinder: diameter 1 up to 55 mm (typical value)
Square / Rectangle: max length 50.8 x 50.8 mm / Thickness 0.5 mm up to 3 mm (typical value)

Remarks:
- Standard tolerances are +/-0.05 mm on both diameter and thickness.
- As-fired parts (no machining requested => lower cost) are available for +/-1% tolerance.
- Smaller tolerances can be considered on request.
- Rods can be delivered as well



Spacer:

In some specific designs, customers might require spacers.

In filters, there are metal sidewalls and the dielectric resonator is usually placed on the bottom of the cavity, directly on the metal. This one is then dependent upon not just the ceramic, but also on its surroundings. The nominal frequency as well as the Q factor, are then affected. A common practice for achieving a higher Q factor is to glue a spacer with low dielectric loss (made of Alumina AL2O3) to our dielectric resonator. Thus magnetic fields are taken away from the metal wall (Figure 1).

In a microstrip circuit, the resonator is coupled by being located near a microstrip line. This magnetic coupling is adjusted by varying the distance between the resonator and the line. A better coupling can be achieved by adding a spacer so that the resonator can overhang the line (Figure 2).

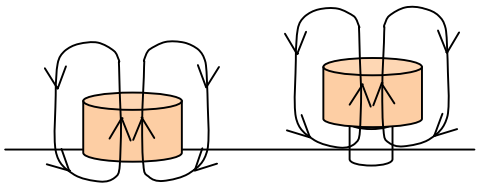


Figure 1

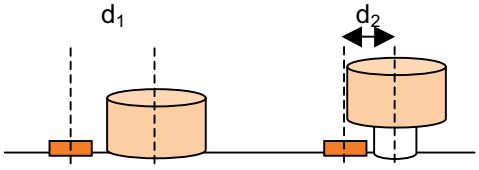
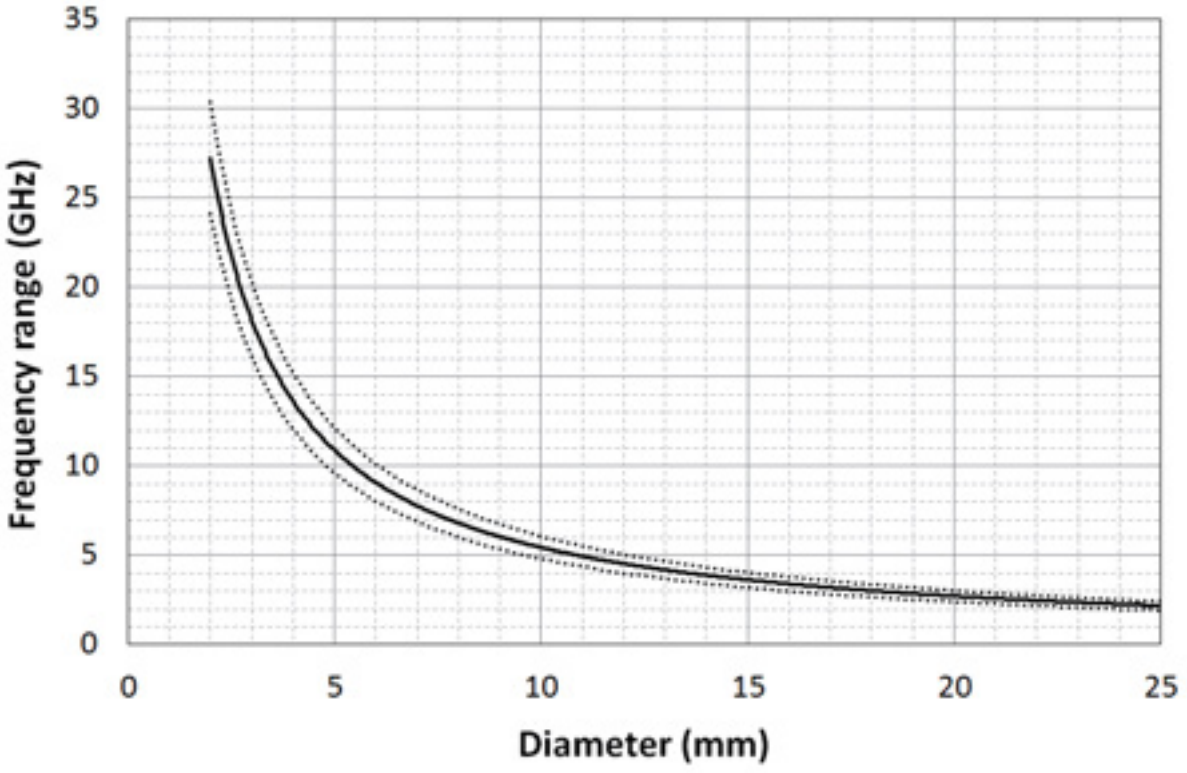


Figure 2

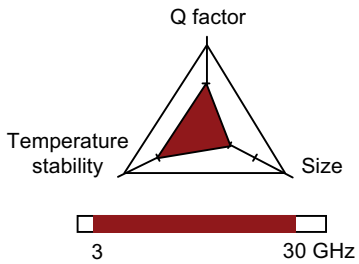
III. Dielectric materials

E2000 SERIE



Frequency (MHz)	Diameter range (mm)
$1930 \leq F \leq 30350$	$D_{min} = \frac{48200}{F}$ $D_{typ} = \frac{54400}{F}$ $D_{max} = \frac{60700}{F}$
	$2 \leq D \leq 25$

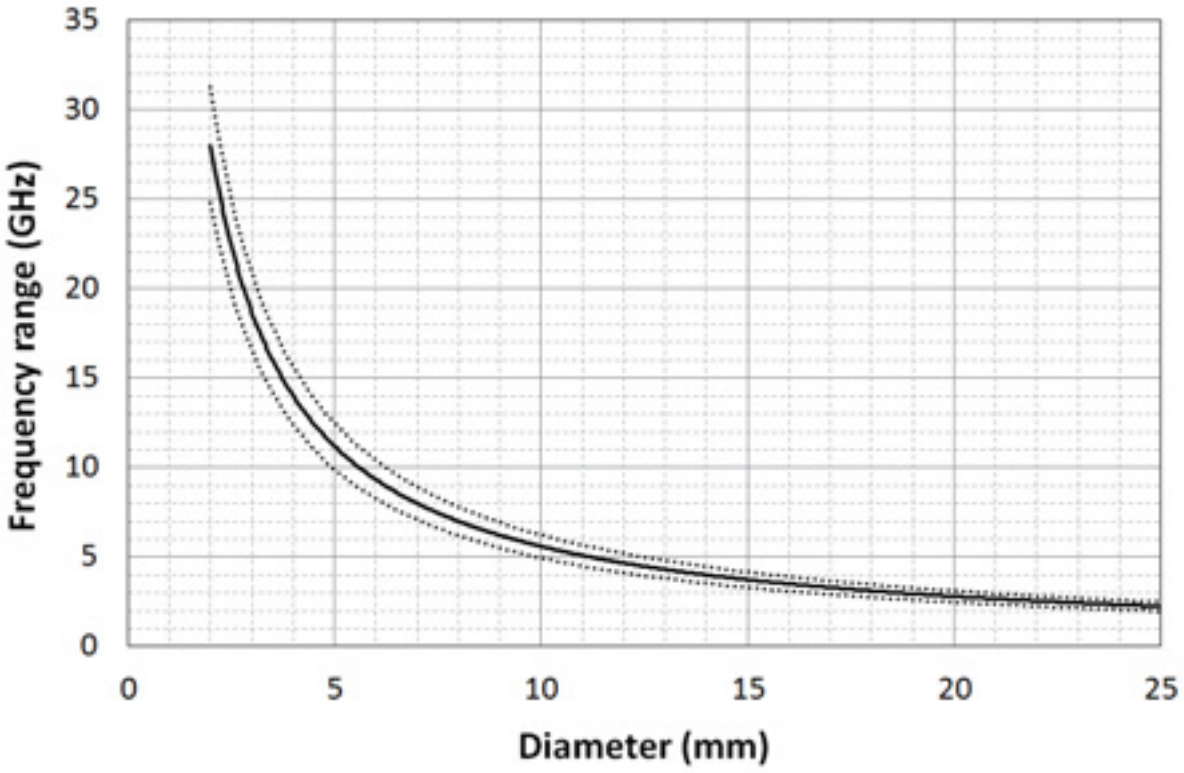
Notes: Custom sizes available on request



Material	t_f (ppm/°C) +/-2ppm/°C	Typical Q factor @ 10GHz	Dielectric Constant e_r +/-1
E2336N	-3	5 000	37.1
E2036	0	5 000	37.2
E2336	+3	5 000	37.3
E2636	+6	5 000	37.4
E2936	+9	5 000	37.4
E21236	+12	5 000	37.6
E21536	+15	5 000	37.6
E21836	+18	5 000	37.6

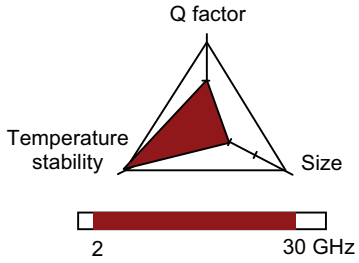
Notes: Tighter tolerance available on request

E3000 SERIE



Frequency (MHz)	Diameter range (mm)		
$1980 \leq F \leq 31230$	$D_{min} = \frac{49500}{F}$	$D_{typ} = \frac{56000}{F}$	$D_{max} = \frac{62500}{F}$
	$2 \leq D \leq 25$		

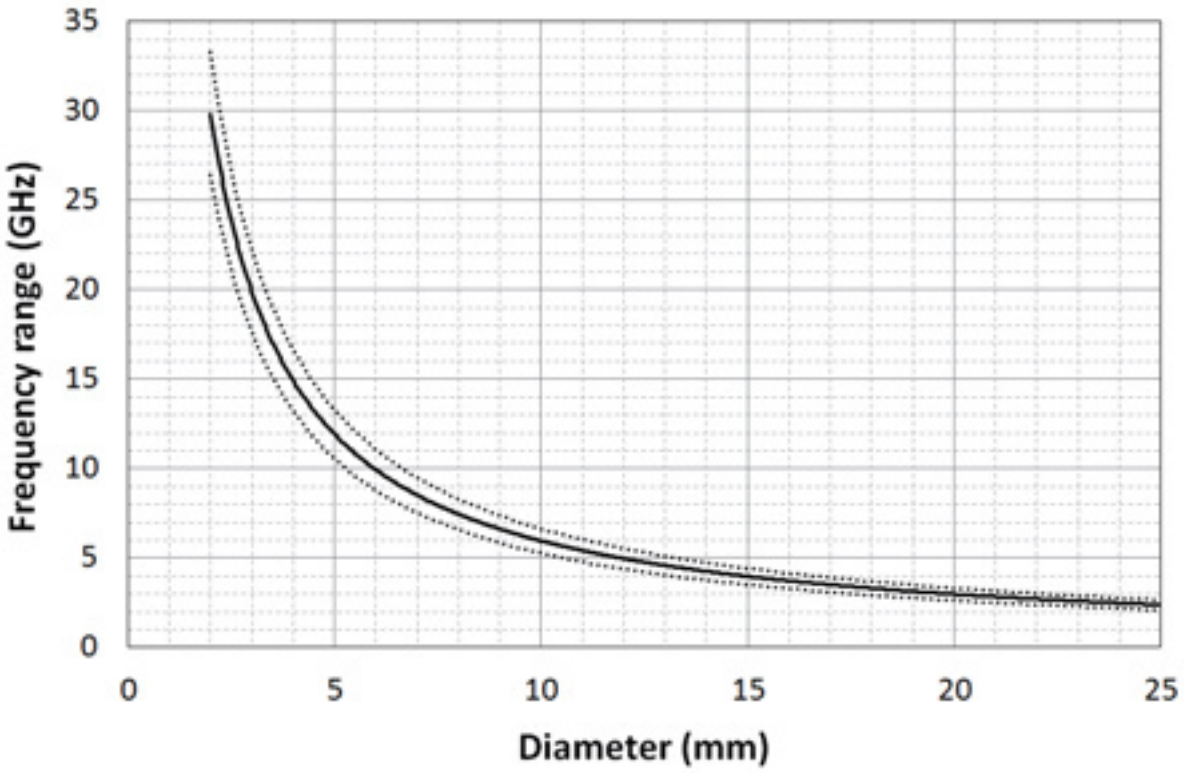
Notes: Custom sizes available on request



Material	t_f (ppm/°C) +/-2ppm/°C	Typical Q factor @ 10GHz	Dielectric Constante$_r$ +/-1
E3434N	-4	4 000	33.5
E3234N	-2	4 000	33.8
E3034	0	4 000	34.0
E3234	+2	4 000	34.2
E3434	+4	4 000	34.4
E3634	+6	4 000	34.7
E3834	+8	4 000	35.0
E31034	+10	4 000	35.3

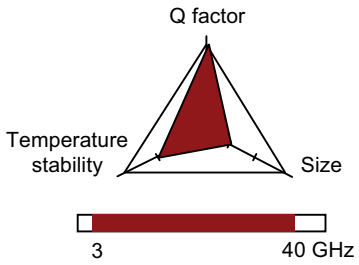
Notes: Tighter tolerance available on request

E4000 SERIE



Frequency (MHz)	Diameter range (mm)		
$2110 \leq F \leq 33250$	$D_{min} = \frac{52800}{F}$	$D_{typ} = \frac{59600}{F}$	$D_{max} = \frac{66500}{F}$
	$2 \leq D \leq 25$		

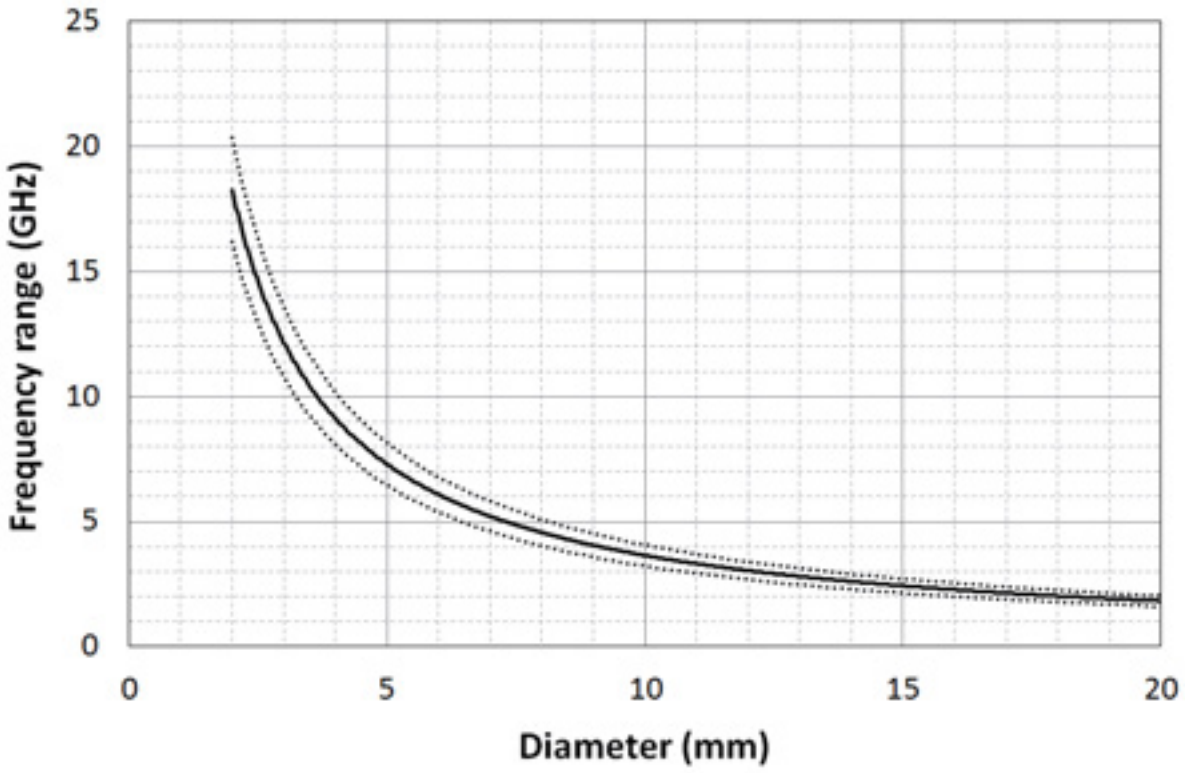
Notes: Custom sizes available on request



Material	t_f (ppm/°C) +/-2ppm/°C	Typical Q factor @ 10GHz	Dielectric Constant e_r +/-1
E4030	0	15 000	29.5
E4230	+2	15 000	30.0
E4330	+3	15 000	30.3
E4430	+4	15 000	30.5
E4630	+6	15 000	31.0
E4830	+8	15 000	31.5
E41030	+10	15 000	32.0

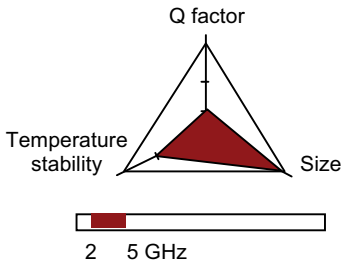
Notes: Tighter tolerance available on request

E5000 SERIE



Frequency (MHz)	Diameter range (mm)		
$1620 \leq F \leq 20360$	$D_{min} = \frac{32300}{F}$	$D_{typ} = \frac{36500}{F}$	$D_{max} = \frac{40700}{F}$
	$2 \leq D \leq 20$		

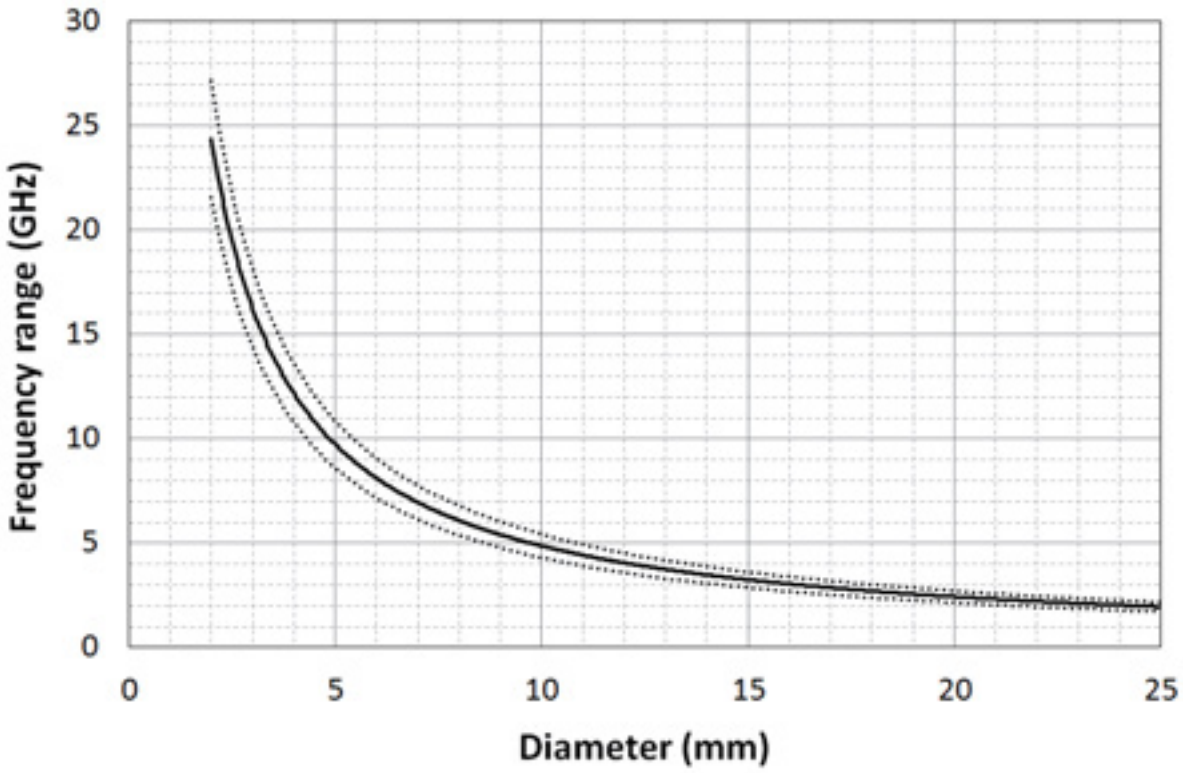
Notes: Custom sizes available on request



Material	t_f (ppm/°C) +/-2ppm/°C	Typical Q factor @ 5GHz	Dielectric Constant e_r +/-2
E5080	0	1 600	78.0
E5380	+3	1 600	78.0
E5680	+6	1 600	78.0
E5980	+9	1 600	78.0

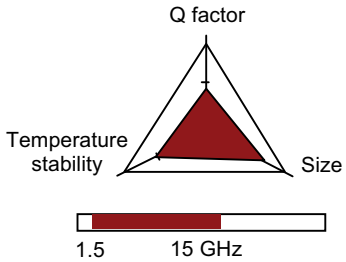
Notes: Tighter tolerance available on request

E6000 SERIE



Frequency (MHz)	Diameter range (mm)		
$1720 \leq F \leq 27150$	$D_{min} = \frac{43100}{F}$	$D_{typ} = \frac{48700}{F}$	$D_{max} = \frac{54300}{F}$
	$2 \leq D \leq 25$		

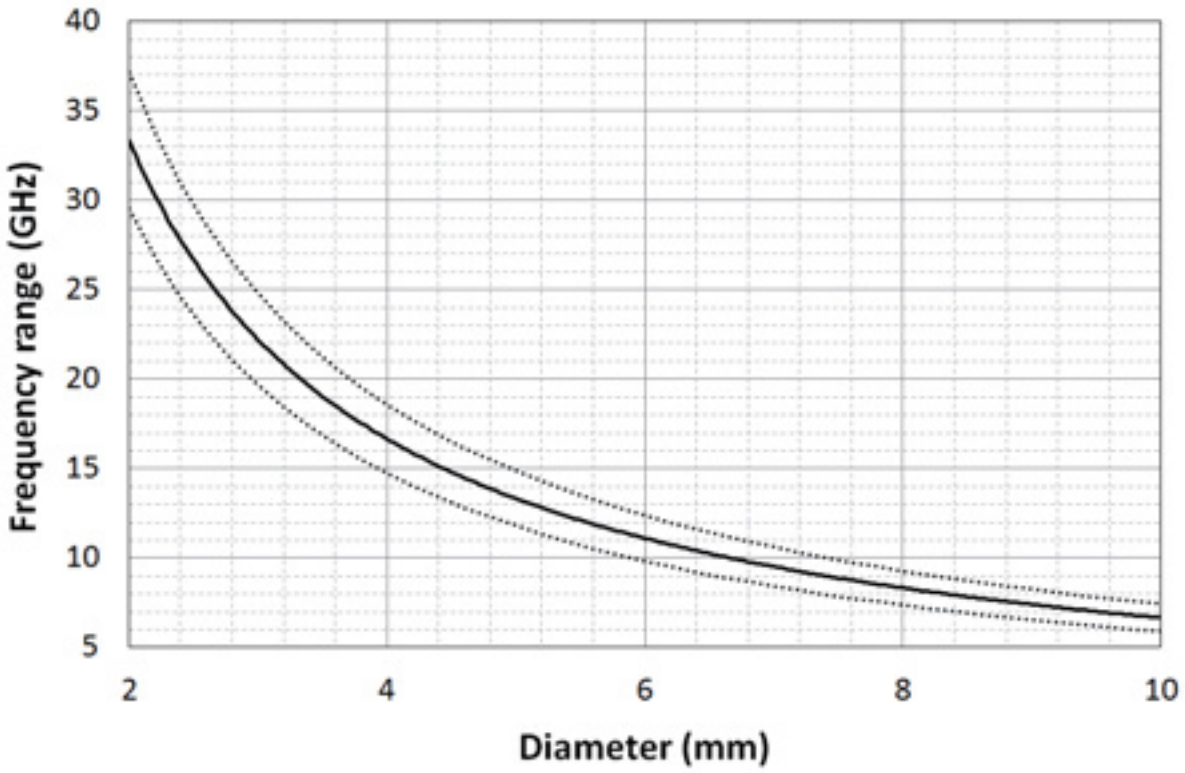
Notes: Custom sizes available on request



Material	t_f (ppm/°C) +/-2ppm/°C	Typical Q factor @ 5GHz	Dielectric Constant e_r +/-1
E6645N	-6	8 000	43.9
E6345N	-3	8 000	44.3
E6045	0	8 000	44.5
E6345	3	8 000	45.0
E6645	6	8 000	45.3
E6945	9	8 000	45.5
E61245	12	8 000	46.0

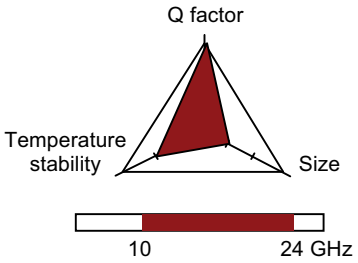
Notes: Tighter tolerance available on request

E7000 SERIE



Frequency (MHz)	Diameter range (mm)		
$5900 \leq F \leq 37150$	$D_{min} = \frac{59000}{F}$	$D_{typ} = \frac{66700}{F}$	$D_{max} = \frac{74400}{F}$
	$2 \leq D \leq 10$		

Notes: Custom sizes available on request



Material	t_f (ppm/°C) +/-2ppm/°C	Typical Q factor @ 10GHz	Dielectric Constant e_r +/-1
E7024	0	20 000	24.2
E7224	+2	21 000	24.3
E7424	+4	22 000	24.4
E7624	+6	23 000	24.5

Notes: Tighter tolerance available on request

IV. Hi-Rel products

Being involved with all key worldwide space customers, Temex Ceramics has definitely a strong space heritage with its dielectric resonators on this market segments.

Several dielectric materials providing High Q characteristics are available for high-end communication devices (sitcom filters).

E7000 → *Qxf 250 000 @ 10GHz*

E4000 → *Qxf 150 000 @ 10GHz*

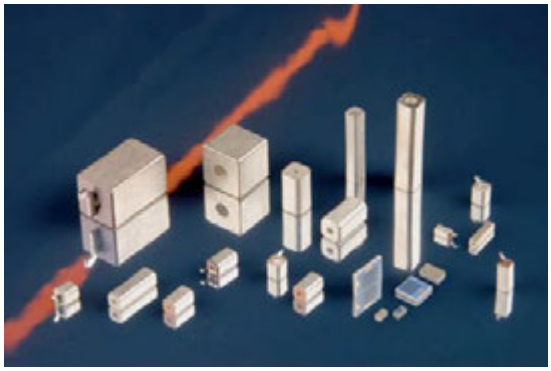
LAT tests available for Hi-rel models

Withstand strong environmental conditions
Thermal cycling: 50 cycles -55°C/+125°C
Life test: 1000 hours at 125°C

COAXIAL RESONATORS

Thanks to its high know-how in ceramic material manufacturing, **EXXELIA TEMEX** has developed its own coaxial resonator product line. These products are the poles of filter, oscillator and duplexer functions for Telecom, Military & Space, Industrial and Wireless applications.

Coaxial resonators are designed to use the size-reducing effect of high dielectric constant materials in microwave functions such as VCOs (Voltage Controlled Oscillators), CROs (Coaxial Resonator Oscillators) and filters. Their use allows designers to get more compact devices.

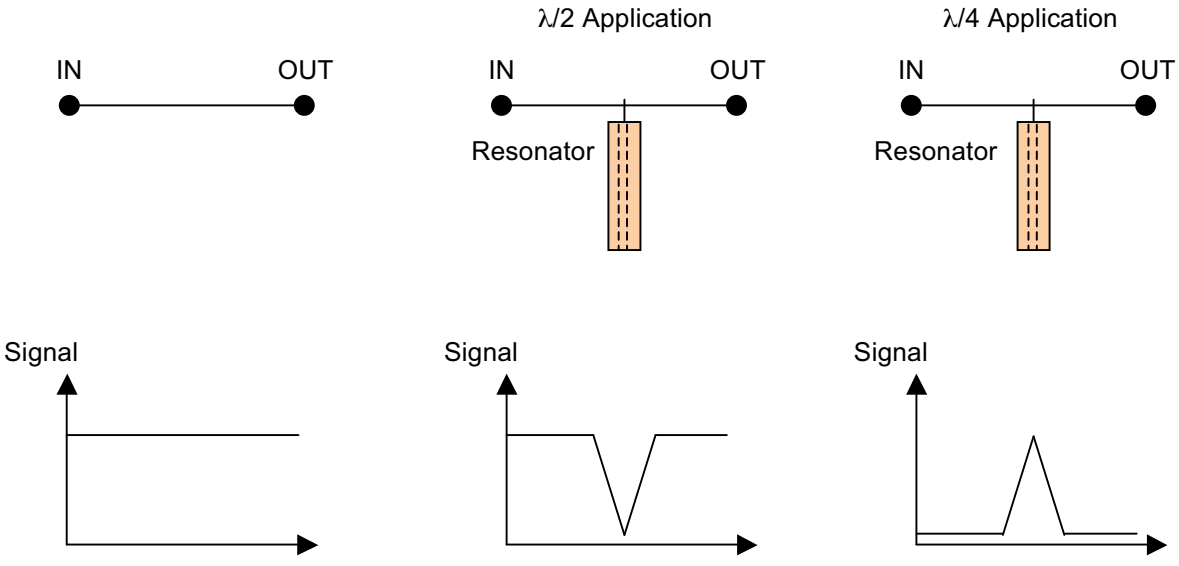


I. Basic Properties

Resonance effect origins

The most commonly used mode in many applications is the TEM (Transverse Electro-Magnetic) mode. Such mode has neither electric nor magnetic field in the direction of propagation. They are contained primarily within the metallized ceramic.

Let's consider a line in which a signal is sent through "IN" and received in "OUT". When a coaxial resonator is connected, this one allows or blocks (whether it is l/2 or l/4 configurations) microwave energy corresponding to its resonant frequency (see Figure 1).

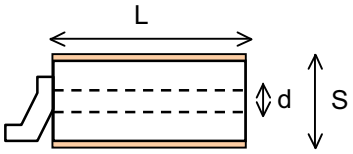


Resonant frequency: f

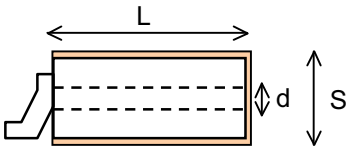
The frequency is governed by the length of the coaxial resonator. This length is usually close to a quarter or half wavelength of the required frequency. Resonators are then defined as either quarter or half wavelength type.

Quarter wavelength resonators have only one end metallized to “short-circuit” the center conductor to the outer conductor, whereas both ends are non-metallized on half wavelength types. Frequency is given by:

- l/2 applications : $$f = \frac{300}{2L\sqrt{\varepsilon_r}}$$



- l/4 applications : $$f = \frac{300}{4L\sqrt{\varepsilon_r}}$$



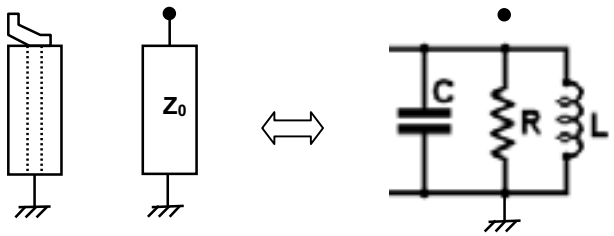
where f is the resonant frequency (GHz), L the resonator length (mm) and e_r the dielectric constant.

Useful simplified formulas are given in below table to determine the resonator length.

	l/4 application	l/2 application
e_r = 21	$L = \frac{16.37}{f}$	$L = \frac{32.73}{f}$
e_r = 38.5	$L = \frac{12.09}{f}$	$L = \frac{24.17}{f}$
e_r = 90	$L = \frac{7.91}{f}$	$L = \frac{15.81}{f}$

Impedance: Z_0

The coaxial resonator impedance is directly linked to the section, the inner hole diameter and the dielectric constant of the material. An equivalent circuit is given by a common RLC circuit.



For a l/4 coaxial resonator, having a nominal frequency f (MHz), a section S (mm), an inner hole diameter d (mm) and a dielectric constant e_r, the lumped elements are given by:

$$L = \frac{2Z_0}{\pi^2 f} \qquad C = \frac{1}{8Z_0 f} \qquad R = \frac{4Z_0 Q}{\pi}$$

with

$$Z_0 = \frac{60}{\sqrt{\varepsilon_r}} \cdot Ln\left(1.079 \cdot \frac{S}{d}\right)$$

$$Q = 60 \cdot \frac{S\sqrt{f}}{25.4}$$

Quality factor: Q

What is essentially required by designers is the lowest bandwidth at 3dB giving a more selective frequency. This performance is directly given by the Q factor which is essentially determined by the metallization. A thick film silver coating is then realized for excellent Q. Let's note that a low loss dielectric material does not influence at the first order the Q factor.

$$Q = 60 \cdot \frac{S\sqrt{f}}{25{,}4}$$

II. User Guide

How to order "Commercial Models"

CRS	06	T	Q	1500	F	S	1	E	Rohs
Type Coaxial resonator	**Size** See table	**Material** V (ε_r 21) T (ε_r 38.5) N (ε_r 90)	**Application** Q : λ/4 H : λ/2	**Frequency (MHz)** See range in table	**Frequency tolerance** F = ± 1% D = ± 0.5% 5 = ± 5 MHz 1 = ± 1MHz	**Metallization** S : Silver	**Connection** 0 : none 1 : one 2 : wire 4 : ribbon	**T&R** E : T&R Blank :none	**Rohs compliant**

How to order "Flight Models"

CRS	06	T	Q	1500	F	S	0	TRFxxx	Rohs
Type Coaxial resonator	**Size** See table	**Material** V (ε_r 21) T (ε_r 38.5) N (ε_r 90)	**Application** Q : λ/4 H : λ/2	**Frequency (MHz)** See range in table	**Frequency tolerance** F = ± 1% D = ± 0.5%	**Metallization** S : Silver	**Connection** 0 : none	**Hi-Rel**	**Rohs compliant**

Note: flight models are delivered with tab separately

Materials and applications

Our portfolio is designed to offer the highest degree of freedom to electronic engineers. Several dielectric constants are available (21/38.5/90) allowing the best trade-off between impedance, Q factor and resonant frequency.
Operating temperature range: -40°C / +85°C

Frequency range and general characteristics

Quarter wavelength applications

Applications	Dielectric constant	t_f (ppm/°C)	Section (mm)	Without tab Frequency range (MHz)	With tab Frequency range (MHz)
I/4	21	0 ± 15	2	2135 - 6000	2135 - 6000
			3	1335 - 6000	1335 - 4190
			4	870 - 5520	870 – 4190
			6	650 - 3310	650 – 3140
			8	915 - 3000	915 - 2870
			10	915 - 3000	N/A
			12	670 - 2500	670 - 1940
	38.5	0 ± 15	2	1575 - 6000	1575 - 4470
			3	1005 - 4560	1005 - 3090
			4	660 - 4140	660 - 3090
			6	490 - 2430	490 - 2320
			8	690 - 3000	690 - 2120
			10	690 - 3000	N/A
			12	505 - 2500	505 - 1430
	90	0 ± 15	2	1040 - 3970	1040 - 2920
			3	650 - 2940	650 - 2020
			4	410 - 2650	410 - 2020
			6	305 - 1590	305 - 1520
			8	410 - 1800	410 - 1380
			10	445 - 1800	N/A
			12	330 - 1500	330 - 940

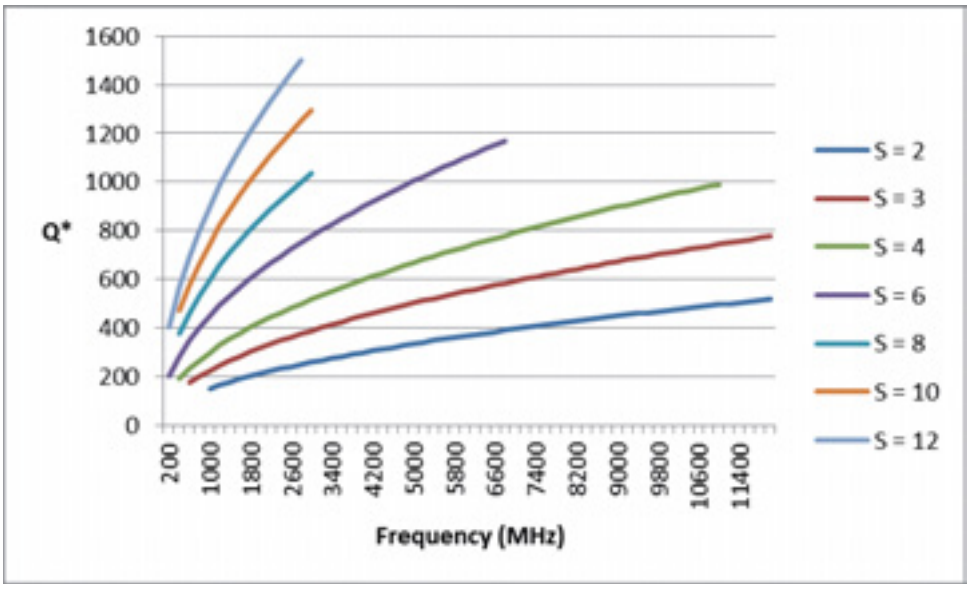
Others frequencies on request

Half wavelength applications

Applications	Dielectric constant	t_f (ppm/°C)	Section (mm)	Without tab Frequency range (MHz)	With tab Frequency range (MHz)
I/2	21	0 ± 15	2	4305 - 12000	4305 - 12000
			3	2730 - 12000	2730 - 8390
			4	1735 - 11000	1735 - 8390
			6	1365 – 6625	1365 - 6290
			8	1890 - 3000	1890 - 3000
			10	1890 - 3000	N/A
			12	1365 - 3000	1365 - 3000
	38.5	0 ± 15	2	3100 - 12000	3100 - 8950
			3	2050 - 9130	2050 - 6190
			4	1315 - 8280	1315 - 6190
			6	1000 - 4965	1000 - 4640
			8	1420 - 3000	1420 - 3000
			10	1420 - 3000	N/A
			12	1050 - 2500	1050 - 2500
	90	0 ± 15	2	2100 - 7940	2100 - 5850
			3	1315 - 5880	1315 - 4050
			4	840 - 5300	840 - 4050
			6	630 - 3180	630 - 3040
			8	840 - 3000	840 - 2770
			10	895 - 3000	N/A
			12	685 - 2500	685 - 1880

Others frequencies on request

Q factor



* Typical values

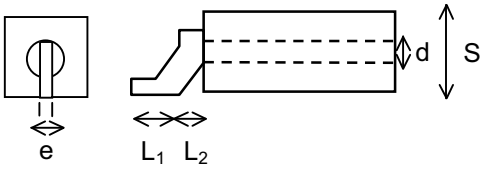
Dimensions and impedance

Section (± 0.2 mm)	Inner hole diameter (± 0.1 mm)	Impedance (ohm)			Temex Ceramics Reference
		e_r = 21	e_r = 38.5	e_r = 90	
2	0.65	15,7	11.6	7.6	CRS02
	0.80	13.0	9.6	6.3	CRS22
3	0.95	15.6	11.9	7.6	CRS03
4	1.20	16.8	12.4	8.1	CRS14
	1.50	13.8	10.2	6.7	CRS04
	2.00	10.1	7.4	4.9	CRS24
6	2.00	15.4	11.4	7.4	CRS06
	2.20	14.1	10.4	6.8	CRS16
	2.40	13.0	9.6	6.3	CRS26
	2.50 *	12.5	9.2	6.0	CRS36
8	2.80	14.7	10.9	7.1	CRS08
10	3.50 *	14.7	10.9	7.1	CRS10
12	3.50	17.1	12.6	8.3	CRS12
	4.00 *	15.4	11.4	7.4	CRS412

* Connection not available

Connection dimensions

Section	2	3	4	6	8	10	12
L1 (mm) +/- 0.1	0.65	0.70	0.80	1.20	1.50	N/A	2.00
L2 (mm) +/- 0.2	1.00	1.30	1.30	1.80	1.80	N/A	2.50
e (mm) +/- 0.1	0.40	0.50	0.60	0.80	0.80	N/A	1.00



FREQUENCY TUNING COMPONENTS

Trimmer Capacitors & Tuning Elements

EXXELIA TEMEX

MICROWAVE TUNING ELEMENTS

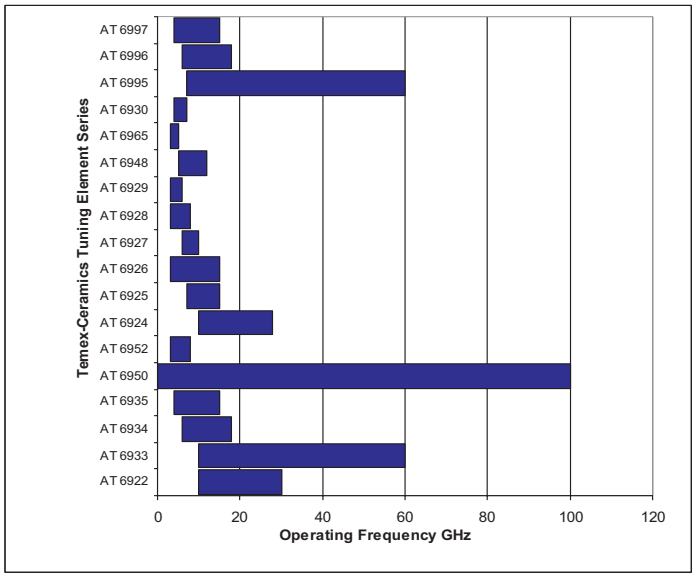
RoHS COMPLIANT

Description

Economical means of introducing a variable reactance to microwave circuits such as waveguides, filters, cavities and other resonant structures
High resolution tuning
Self-locking constant torque drive mechanism
Excellent tuning stability
Low dynamic noise
One handed adjusting/tuning, no need for locking nut
Available with Gold, Silver plating and chromate finish
Metallic, dielectric, resistive types available
Adjustments in applications from L to Ka band and beyond
High Reliability versions are available on special order
Custom design upon request
ROHS compliant

Applications

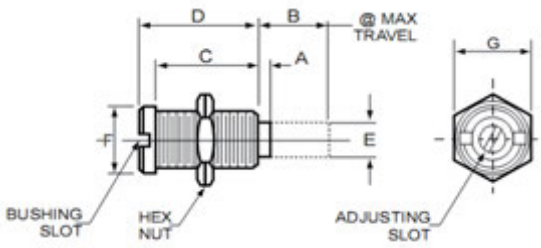
Comb-line and inter-digital filters
Coaxial structures
Waveguide circuitry
Gunn oscillators



Impedance transformersSpace applications

I. Microwave tuning elements

Tuning Elements consist of a brass mounting bushing with a rotor of the same material including a tuning rod made of metallic or dielectric or absorbent material and a nut.



MICROWAVE TUNING ELEMENTS

RoHS COMPLIANT

I.1 Metallic tuning elements

Metallic Tuning Elements consist of a brass mounting bushing with an integral tuning rotor of the same material and a nut. Bushing is gold plated, rotor and nut are passivated.
Optional materials and plating are available upon request.

Models and dimensions in mm

P/N	Frequency Band	Bushing Thread UNS	A	B	C	D	Φ E	Φ F	G
AT 6924-0 SL ROHS	X to K	.120-80	0	3.8	5.1	6.0	1.8	3.4	4.0
AT 6924-1 SL ROHS			1.2	1.9	2.2	3.1			
AT 6924-2 SL ROHS			0	1.9	5.1	6.0			
AT 6924-3 SL ROHS			0	0.8	2.2	3.1			
AT 6925-0 SL ROHS	C and X	.190-64	0	3.8	5.4	6.4	3.2	5.3	5.5
AT 6925-1 SL ROHS			0	0.6	2.2	3.2			
AT 6925-3 SL ROHS			3.3	7.1	5.4	6.4			
AT 6925-7 SL ROHS			1.1	4.9	5.4	6.4			
AT 6925-8 SL ROHS			0.2	2.0	3.2	4.3			
AT 6925-9 SL ROHS			0	2.3	6.5	7.5			
AT 6926-0 SL ROHS		.234-64	0	2.7	4.6	5.3	4.1	6.8	7.0
AT 6926-1 SL ROHS			0	0.7	2.4	3.2			
AT 6926-4 SL ROHS			2.3	8.8	5.5	9.1			
AT 6926-5 SL ROHS			0.6	2.7	4.0	4.8			
AT 6926-6 SL ROHS			2.6	11.5	5.4	11.5			
AT 6926-7 SL ROHS			1.9	4.6	4.6	5.3			
AT 6926-9 SL ROHS			0	2.7	5.5	9.1			
AT 6926-10 SL ROHS			0	4.6	5.5	9.1			
AT 6927-0 SL ROHS	C and X	.234-64	0	6.5	5.5	9.1	4.1	6.8	7.0
AT 6928-0 SL ROHS	C		0	8.8	5.4	11.5	4.1	6.8	7.0
AT 6928-2 SL ROHS	C		6.1	8.8	4.6	5.3	4.1	6.8	7.0
AT 6929-0 SL ROHS	C	.190-64	0	11.4	13	14	3.2	5.3	5.5
AT 6948-0 SL ROHS	C and X	.312-64	0	5.9	8.2	9.2	5.3	9.5	10.0
AT 6965-0 SL ROHS	L and S	.469-32	0	12.7	17.3	18.3	8.8	13.5	14.3

Custom dimensions are available upon request

I.2 Dielectric tuning elements

Dielectric Tuning Elements are used whenever the lowest loss tuning for high frequency applications is required. When dielectric rod is introduced into a cavity, the self resonant frequency is lowered due to the cavity “appearing” larger.

The basic dielectrics used in Temex-Ceramics Microwave Tuning Elements are sapphire, quartz and alumina.

MICROWAVE TUNING ELEMENTS

RoHS COMPLIANT

Electrical properties of each dielectric material are:

Dielectric Material	Approximate Dielectric Constant @ 10 GHz	Approximate Dissipation Factor @ 10 GHz
Sapphire	9.9	0.0001
Quartz	3.8	0.0001
Alumina	9.7	0.0002

Models and dimensions in mm

P/N	Rod Material	Frequency Band	Bushing Thread UNS	A	B	C	D	ΦE	ΦF	G
AT 6933-0 SL ROHS	Sapphire	X and K	.120-80	0.6	4.3	5.1	6.0	1.6	3.4	4.0
AT 6933-1 SL ROHS	Sapphire			0	3.3	5.1	6.0	0.9		
AT 6933-2 SL ROHS	Quartz	K		0.6	4.3	5.1	6.0	1.6		
AT 6934-0 SL ROHS	Sapphire	C, X and K	.234-64	0.3	3.0	4.6	5.3	3.9	6.8	7.0
AT 6935-0 SL ROHS	Sapphire	X and K		0.3	6.8	5.5	9.1	3.9		

Custom dimensions are available upon request

I.3 Resistive tuning elements

Resistive Tuning Elements provide a consistent and accurate means of attenuating microwave energy. Rod made of magnetically loaded epoxy exhibits broadband lossy properties.

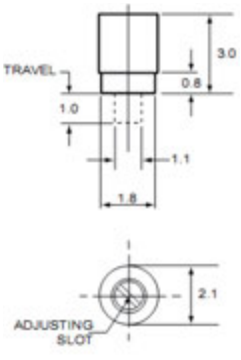
Models and dimensions in mm

P/N	Frequency Band	Bushing Thread UNS	A	B	C	D	ΦE	ΦF	G
AT 6950-0 SL ROHS	Broad Band	.120-80	0.6	4.3	5.1	6.0	1.6	3.4	4.0
AT 6950-1 SL ROHS			0	3.3	5.1	6.0	2.0	3.4	4.0
AT 6952-0 SL ROHS		.234-64	0	6.4	5.5	9.1	3.9	6.8	7.0

Custom dimensions are available upon request

I.4 mm Wave tuning elements

The millimeter Wave Tuning Elements are higher frequency versions of both Tuning Elements described in this data sheet.
Part number: **AT 6922 ROHS**. Bushing and rotor are made of brass gold plated.
Usage in the frequency bands X to K. Bushing can be mounted with solder, epoxy or press-fit.



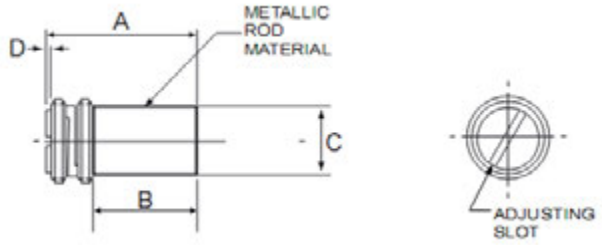
RoHS COMPLIANT

Recommended rotor tuning tool AT 8762

II. Tuning rotors

Extended range metallic and dielectric rotors are used where direct insertion of the tuning element is desired.
Taps designed specifically to insure proper fit are available.

II.1 Metallic tuning rotors



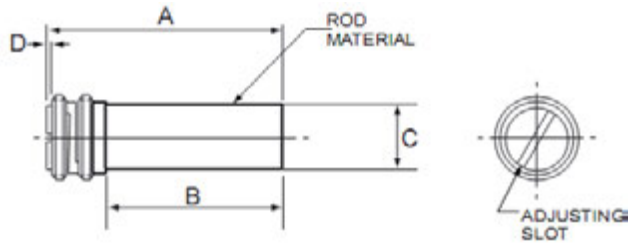
Models made of brass and dimensions in mm

P/N	Thread	A	B	Φ C	D	Slot W x L
AT 6501-3 ROHS	M 1.5 x 0.25	4.4	2.3	1.1	0.4	0.25 x 1.1
AT 6501-0 ROHS	M 2.5 x 0.25	5.4	3.3	2.1		0.4 x 1.9
AT 6501-1 ROHS		4.4	2.3			
AT 6501-2 ROHS		7.7	5.6			
AT 6995-0 ROHS	.094-80 UNS	3.1	0.8	1.8	0.5	0.4 x 1.5
AT 6995-1 ROHS		4.2	1.9			
AT 6995-2 ROHS		6.1	3.8			
AT 6996-1 ROHS	.156-64 UNS	6.4	3.8	3.2	0.25	0.5 x 3.0
AT 6996-2 ROHS		9.7	7.1			
AT 6996-3 ROHS		14.0	11.4			
AT 6996-4 ROHS		3.2	0.6			
AT 6996-5 ROHS		7.5	4.9			
AT 6996-6 ROHS		4.6	2.0			
AT 6996-8 ROHS		4.9	2.3			
AT 6997-0 ROHS	.190-64 UNS	14.1	11.5	4.1	0.25	0.5 x 3.7
AT 6997-1 ROHS		5.3	2.7			
AT 6997-2 ROHS		9.1	6.5			
AT 6997-3 ROHS		11.4	8.8			
AT 6997-4 ROHS		3.3	0.7			
AT 6997-5 ROHS		7.2	4.6			

Custom dimensions are available upon request

RoHS COMPLIANT

II.2 Dielectric tuning rotors



Models with dielectric rod and dimensions in mm

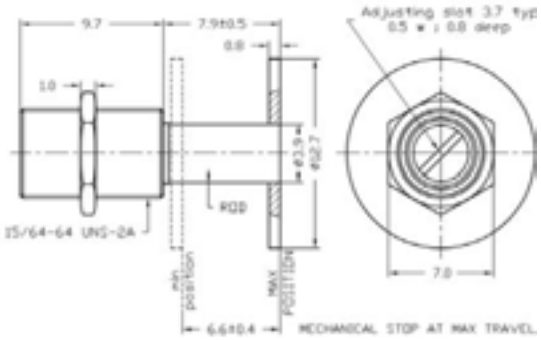
P/N	Rod material	Thread	A	B	Φ C	D	Slot W x L
AT 6930-4 ROHS	Sapphire	.094-80 UNS	5.8	2.5	0.9	0.5	0.4 x 1.5
AT 6930-8 ROHS			6.6	3.5	1.6	0.5	

Custom models and dimensions are available upon request.

III. DRO tuners

DRO tuners are precision components designed exclusively for tuning dielectric resonator devices such as filters and oscillators.

Rod is made of Invar silver plated and disk made of brass silver plated. Different disk diameters are available.



Models and dimensions in mm

P/N	Nominal Frequency	Disk diameter
AT 4010-1 ROHS	2 GHz	24.6
AT 4011-1 ROHS	3 GHz	19.0
AT 4012-1 ROHS	4 GHz	12.7
AT 4012-2 ROHS		15.9

Custom dimensions are available upon request

RoHS COMPLIANT

IV. Mechanical and general specifications

SERIES	Bushing Thread	Tap P/N	Recommended Tap Drill (mm)	Rotational Rotor Torque (cm.N)	Max Mounting Torque (cm.N)	Max Nut Mounting Torque (cm.N)
AT 6924 ROHS	.120- 80 UNS	**AT 7060**	2.75	0.2 to 2.0	7.0	10.0
AT 6925 ROHS	.190-64 UNS	**AT 7061**	4.45	0.3 to 2.8	21.0	30.0
AT 6926 ROHS	.234-64 UNS	**AT 7062**	5.50	0.7 to 3.5	35.0	50.0
AT 6927 ROHS	.234-64 UNS	**AT 7062**	5.50	0.7 to 3.5	35.0	50.0
AT 6928 ROHS	.234-64 UNS	**AT 7062**	5.50	0.7 to 3.5	35.0	50.0
AT 6929 ROHS	.190-64 UNS	**AT 7061**	4.45	0.3 to 2.8	21.0	30.0
AT 6933 ROHS	.120- 80 UNS	**AT 7060**	2.75	0.2 to 2.0	7.0	10.0
AT 6934 ROHS	.234-64 UNS	**AT 7062**	5.50	0.7 to 3.5	35.0	50.0
AT 6935 ROKS	.234-64 UNS	**AT 7062**	5.50	0.7 to 3.5	35.0	50.0
AT 6948 ROHS	.312-64 UNS	**AT 7065**	7.55	0.7 to 5.0	84.0	70.0
AT 6950 ROHS	.120- 80 UNS	**AT 7060**	2.75	0.2 to 2.0	7.0	10.0
AT 6952 ROHS	.234-64 UNS	**AT 7062**	5.50	0.7 to 3.5	35.0	50.0
AT 6965 ROHS	.469-32 UNS	**AT 7066**	11.1	0.7 to 5.6	168.0	140.0

Recommended rotor tuning tool: AT 8777

SERIES	Rotor Thread	Tap P/N	Recommended Tap Drill (mm)	Recommended Tuning Tool P/N
AT 6501-3 ROHS	M1.5 x 0.25	**AT 7071**	1.25	**AT 8762**
AT 6501-0, -1, -2 ROHS	M2.5 x 0.25	**AT 7070**	2.25	**AT 8777**
AT 6995 ROHS	.094-80 UNS	**AT 7064**	2.05	
AT 6996 ROHS	.156-64 UNS	**AT 7059**	3.55	
AT 6997 ROHS	.190-64 UNS	**AT 7061**	4.45	

Precautions to use rotor tunings:
Typical drilling diameter is the tap core diameter + 0.1 mm
Flange of machined threads has to be perfect, very smooth, without metallic burrs.
Use recommended tuning tool.
Before screwing the rotor, find the first thread by turning the anti-clockwise.

RoHS COMPLIANT

V. Packaging

Parts are delivered in bulk.

VI. How to order

Tuning elements

	Reference	ROHS
Examples	**AT 6924-3 SL**	**ROHS**
	AT 6922	**ROHS**

Tuning rotors

	Reference	ROHS
Examples	**AT 6995-2**	**ROHS**
	AT 6501-3	**ROHS**

DRO tuners

	Reference	ROHS
Example	**AT 4011-1**	**ROHS**

HIGH FREQUENCY NARROW BANDWIDTH INVAR SCREW

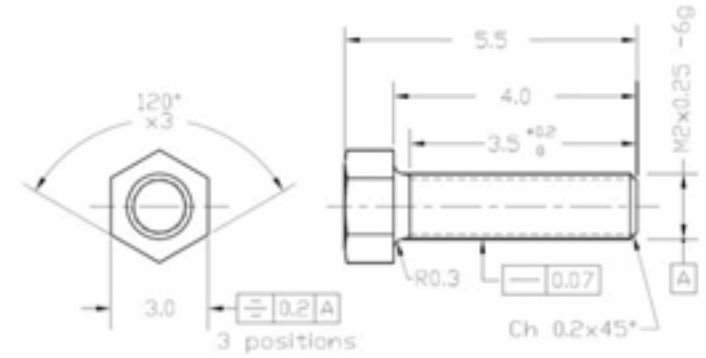
RoHS COMPLIANT

Description

High precision
High resolution tuning
Very low coefficient of thermal expansion
Available with Gold plating
Available with locking nut or “self locking system”
Adjustments in applications from Ka, KU, Q band and beyond
High Reliability versions are available on special order
Custom design upon request
ROHS compliant

Applications

Comb-line and inter-digital filters
Coaxial structures
Waveguide circuitry
Space applications



I. Invar (alloy 36) Tuning elements

The performance of a microwave filter over temperature is becoming more and more important, especially for narrow bandwidth high frequency filters.

Invar alloy offers very good Coefficient of Thermal Expansion (CTE) and can achieve the desired temperature characteristics.

This alloy can become difficult to machine especially with fine pitch threads. With more than 40 years experience, Temex Ceramics offers a complete range of standard products and is particularly able to work on specific request for custom designs with its prototyping dedicated team and R&D equipment.

EXELIA TEMEX has designed several types of invar screws in order to answer to specific request from customers. These screws are now “space” qualified as flight model for KA and Ku band filters. In some cases, the fine pitch resolution has halved the technician tuning time.

HIGH FREQUENCY NARROW BANDWIDTH INVAR SCREW

RoHS COMPLIANT

I.1 Invar 36 tuning screws

Invar tuning elements consist of an Invar screw and its brass nut. Screw can be gold plated.We can offer different size, style and types of head (hex, slotted, pan). The array below is an example of Invar tuning elements already designed and qualified for space applications.

Models and dimensions in mm

metric screws			
Φ diameter	thread	length	tolerances
M1,5	0,25	up to 5mm	6G
M2	0,25	up to 9 mm	6G
M2	0,4	up to 9mm	6G
M2,5	0,25	up to 11mm	6G
M2,3	0,25	up to 11mm	6H
M2,5	0,45	up to 11mm	6H
M3,5	0,35	up to 12mm	6H

Custom dimensions are available upon request

UNS Screws		
thread	length	tolerances
3/32-80	up to 11mm	2A
.120-80	up to 11mm	2A
5/32-80	up to 15mm	2A

II. Packaging

Parts are delivered in bulk.

AIR TRIMMER CAPACITORS
MINIATURE, STANDARD & HIGH VOLTAGE

AIR DIELECTRIC TRIMMER CAPACITORS, RoHS COMPLIANT

Description

Air dielectric
Rated voltage 250 VDC (500 VDC for AT 5300's)
Low temperature coefficient
Low capacitance drift
Very stable over time
Terminations gold plated
High Q factor
Multi-turn, high resolution
Self-locking constant torque drive mechanism
Compliant to MIL-C-14409 and ESA/SCC 3010
ROHS compliant
High Reliability versions available on special order
Maximum Soldering Temperature 260°C, 3 s Max

Applications

RF amplifiers and oscillators
Impedance matching
Crystal trimming
Filter tuning
Interstage coupling
Space applications

Air trimmers series

SERIES	FAMILIES	CAPACITANCE RANGE	MIN Q @ 100 MHz	WORKING VOLTAGE
MINIATURE AIR TRIMMER	AT 5800's ROHS	0.35 to 3.5 pF > 9 turns	> 10000	250 VDC
	AT 5850's ROHS	0.5 to 5 pF > 12 turns	> 7500	
	AT 5700's ROHS	0.8 to 6 pF > 7 turns	> 10000	
	AT 5750's ROHS	0.8 to 10 pF > 6 turns	> 7500	
STANDARD AIR TRIMMER	AT 5200's ROHS	0.8 to 10 pF > 6 turns	> 5000	250 VDC
	AT 5400's ROHS	1 to 14 pF > 6 turns	> 3000	
	AT 5450's ROHS	1 to 16 pF > 6 turns	> 3000	
	AT 5500's ROHS	1 to 20 pF > 12 turns	> 1500	
	AT 5600's ROHS	1 to 30 pF > 20 turns	> 800	
HIGH VOLTAGE AIR TRIMMER	AT 5300's ROHS	1 to 10 pF > 10 turns	> 2000	500 VDC

AIR TRIMMER CAPACITORS
MINIATURE, STANDARD & HIGH VOLTAGE

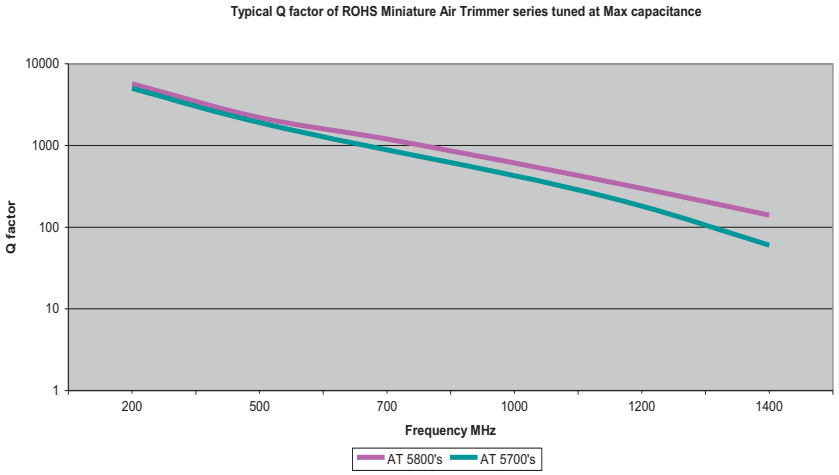
AIR DIELECTRIC TRIMMER CAPACITORS, RoHS COMPLIANT

I. Miniature air trimmer series

P/N	AT 5800 ROHS AT 5801 ROHS AT 5802 ROHS AT 8051 ROHS	AT 5850 ROHS AT 5851 ROHS AT 5852 ROHS AT 5853 ROHS	AT 5700 ROHS AT 5701 ROHS AT 5702 ROHS AT 8050 ROHS	AT 5750 ROHS AT 5751 ROHS AT 5752 ROHS AT 5753 ROHS
Capacitance range	0.35 to 3.5 pF >10 turns	0.5 to 5 pF >12 turns	0.8 to 6.0 pF pF >6 turns	0.8 to 10 pF >9 turns
Working voltage	250 VDC			
Test voltage	500 VDC			
Working Temp. range	-55°C to +125°C			
Temp. Coefficient	0+/-50 ppm/°C	0+/-50 ppm/°C	0+/-15 ppm/°C	0+/-50 ppm/°C
Q factor @ Max Capacitance	>10000	>7500	> 10000	> 7500
Insulation Resistance	$>10^6$ MΩ min			

Capacitance change is linear versus rotation of mobile rotor.

I.1 Miniature air trimmer series: quality factor



AIR DIELECTRIC TRIMMER CAPACITORS, RoHS COMPLIANT

I.2 Miniature air trimmer series: Mechanical and general specifications

P/N	AT 5800 ROHS AT 5801 ROHS AT 5802 ROHS AT 8051 ROHS	AT 5850 ROHS AT 5851 ROHS AT 5852 ROHS AT 5853 ROHS	AT 5700 ROHS AT 5701 ROHS AT 5702 ROHS AT 8050 ROHS	AT 5750 ROHS AT 5751 ROHS AT 5752 ROHS AT 5753 ROHS
Rotating torque	22 to 220 g.cm		30 to 290 g.cm	
Max torque on rotor stop	300 g.cm		400 g.cm	
Nut mounting torque	1000 g.cm		3000 g.cm	
Seal cap assembly torque	300 g.cm		600 g.cm	
Vibrations	60g, 10-2000 Hz			
Shocks	1500g, 0.5 ms			
Brass and Invar structure				
Glazed alumina insulation				
306°C solder used in assembly				
Silicone rubber seal washer				
Gold, silver and chromate finish				

I.3 Miniature air trimmer series : models

Figure 1

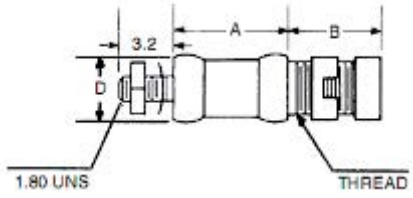


Figure 2

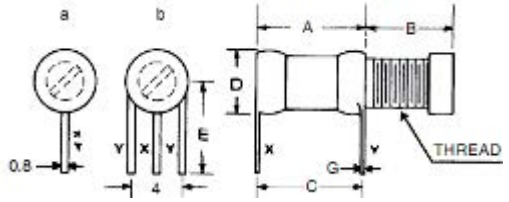


Figure 3

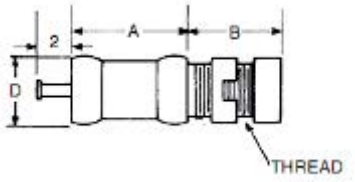


Figure 4

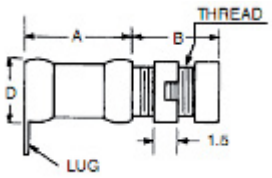
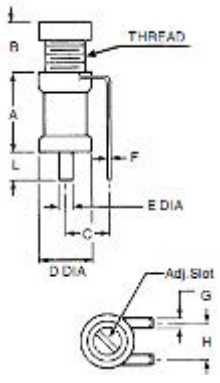


Figure 5

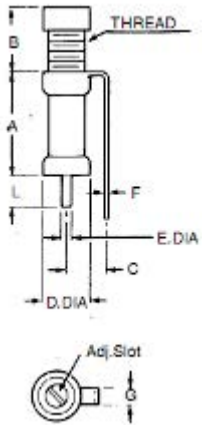


Terminals are gold plated

Others models available upon request

Custom designs available upon request

Figure 6

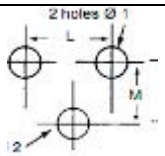
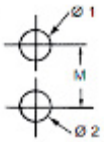


AIR DIELECTRIC TRIMMER CAPACITORS, RoHS COMPLIANT

I.4 Miniature air trimmer series: DIMENSIONS IN MM

P/N	Fig	A	B	C	D	E	F	G	H	L	Thread
AT 5800 ROHS	1	6.7	5.9		4.6						
AT 5801 ROHS	2a	7.0	5.7	6.5	4.6	5.4		0.25			.120-80
AT 5802 ROHS	3	6.7	5.9		4.6						UNS
AT 8051 ROHS	6	7.0	5.6	3.2	4.6	0.8	0.25	0.5		2.8	
AT 5850 ROHS	1	6.7	6.8		4.6						
AT 5851 ROHS	2a	7.0	6.6	6.5	4.6	5.4		0.25			.120-80
AT 5852 ROHS	3	6.7	6.8		4.6						UNS
AT 5853 ROHS	6	7.0	6.6	3.2	4.6	0.8	0.25	0.5		2.8	
AT 5700 ROHS	4	7.0	5.6		6.2						
AT 5701 ROHS	2b	7.3	5.1	6.7	6.2	6.3		0.4			.190-64
AT 5702 ROHS	3	6.9	5.6		6.2						UNS
AT 8050 ROHS	6	7.3	5.1	4.0	6.2	1.1	0.4	0.8		3.0	
AT 5750 ROHS	4	7.0	6.3		6.2						
AT 5751 ROHS	2b	7.3	6.0	6.7	6.2	6.3		0.4			.190-64
AT 5752 ROHS	3	6.9	6.3		6.2						UNS
AT 5753 ROHS	5	7.3	5.8	4.0	6.2	1.1	0.4	0.8	4.0	3.0	

I.5 Miniature air trimmer series: Sugggested Mounting Holes

Figure A	Figure B	Figure C
		

P/N	Figure	Φ1	Φ2	L	M
AT 5800 ROHS, AT 5802 ROHS, AT 5850 ROHS, AT 5852 ROHS	A	3.2			
AT 5801 ROHS, AT 5851 ROHS	C	1.3	1.3		6.5
AT 8051 ROHS, AT 5853 ROHS	C	1.3	1.3		3.2
AT 5700 ROHS, AT 5702 ROHS, AT 5750 ROHS, AT 5752 ROHS	A	4.9			
AT 5701 ROHS, AT 5751 ROHS	B	1.3	1.3	4.0	6.7
AT 8050 ROHS	C	1.3	1.3		4.0
AT 5753 ROHS	B	1.3	1.3	4.0	4.0

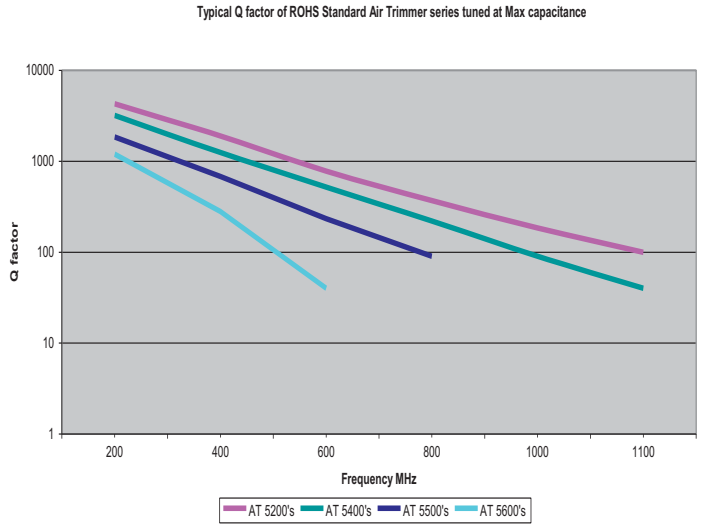
AIR DIELECTRIC TRIMMER CAPACITORS, RoHS COMPLIANT

II. Standard air trimmer series

P/N	AT 5200 ROHS AT 5201 ROHS AT 5202 ROHS AT 8052 ROHS	AT 5400 ROHS AT 5401 ROHS AT 5402 ROHS AT 8053 ROHS	AT 5450 ROHS AT 5451 ROHS AT 5452 ROHS AT 5453 ROHS	AT 5500 ROHS AT 5501 ROHS AT 5502 ROHS AT 8054 ROHS	AT 5600 ROHS AT 5601 ROHS AT 5602 ROHS
Capacitance range	0.8 to 10 pF > 6 turns	1 to 14 pF > 6 turns	1 to 16 pF > 6 turns	1 to 20 pF > 14 turns	1 to 30 pF >20 turns
Working voltage	250 VDC				
Test voltage	500 VDC				
Working Temp. range	- 55°C to + 125°C				
Temp. Coefficient	0+/-15 ppm/°C	0+/-25 ppm/°C	0+/-50 ppm/°C	0+/-30 ppm/°C	0+/-30 ppm/°C
Q factor @ Max Cap.	> 5000	> 3000	> 3000	> 1000	> 800
Insulation Resistance	>106 MΩ min				

Capacitance change is linear versus rotation of mobile rotor.

II.1 Standard air trimmer series: quality factor



AIR DIELECTRIC TRIMMER CAPACITORS, RoHS COMPLIANT

II.2 Standard air trimmer series: Mechanical and general specifications

P/N	AT 5200 ROHS AT 5201 ROHS AT 5202 ROHS AT 8052 ROHS	AT 5400 ROHS AT 5401 ROHS AT 5402 ROHS AT 8053 ROHS	AT 5450 ROHS AT 5451 ROHS AT 5452 ROHS AT 5453 ROHS	AT 5500 ROHS AT 5501 ROHS AT 5502 ROHS AT 8054 ROHS	AT 5600 ROHS AT 5601 ROHS AT 5602 ROHS
Rotating torque	70 to 350 g.cm				
Max torque on rotor stop	500 g.cm				
Nut mounting torque	5000 g.cm				
Seal cap assemb. torque	800 g.cm				
Vibrations	60g, 10-2000 Hz				
Shocks	1500g, 0.5 ms				
Brass and Invar structure					
Glazed alumina insulation					
306°C solder used in assembly					
Silicone rubber seal washer					
Gold, silver and chromate finish					

II.3 Standard air trimmer series : Models

Figure 1

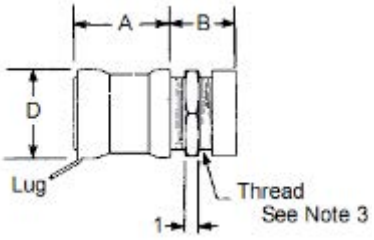


Figure 2

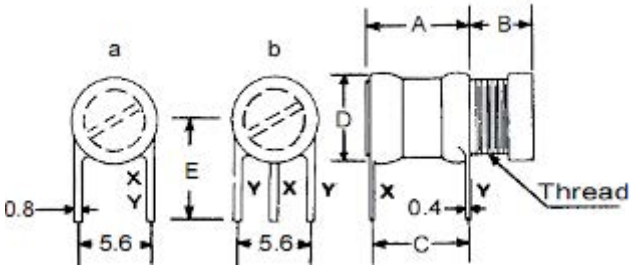


Figure 3

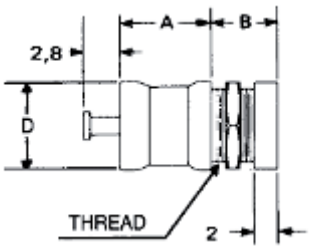


Figure 4

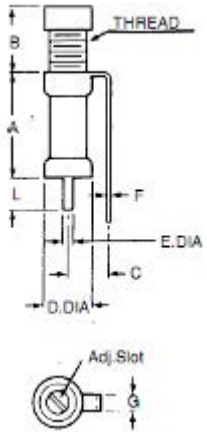
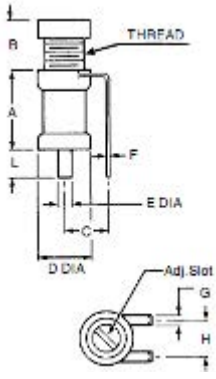


Figure 5



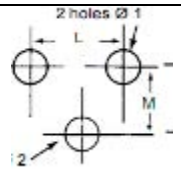
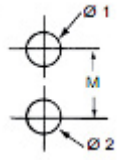
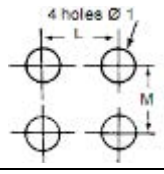
Terminals are gold plated. Others models available upon request. Custom design available upon request

AIR DIELECTRIC TRIMMER CAPACITORS, RoHS COMPLIANT

II.4 Standard air trimmer series: Dimensions in mm

P/N	Figure	A	B	C	D	E	F	G	H	L	Thread
AT 5200 ROHS	1	7.7	5.8		7.6						
AT 5201 ROHS	2b	8.0	5.4	7.2	7.6	7.9					
AT 5202 ROHS	3	7.2	5.8		7.6						
AT 8052 ROHS	4	7.5	5.6	5.2	7.6	1.6	0.4	1.0		2.8	
AT 5400 ROHS	1	7.7	5.8		7.6						
AT 5401 ROHS	2b	8.0	5.4	7.2	7.6	12.0					
AT 5402 ROHS	3	7.2	5.8		7.6						
AT 8053 ROHS	4	7.5	5.6	5.2	7.6	1.6	0.4	1.0		2.8	
AT 5450 ROHS	1	7.7	5.8		7.6						
AT 5451 ROHS	2b	8.0	5.4	7.2	7.6	12.0					.234-64
AT 5452 ROHS	3	7.2	5.8		7.6						UNS
AT 5453 ROHS	5	7.5	5.6	5.2	7.6	1.6	0.4	1.0	5.6	2.8	
AT 5500 ROHS	1	12.5	6.7		8.0						
AT 5501 ROHS	2b	14.7	4.3	14.2	8.0	12.0					
AT 5502 ROHS	3	12.4	6.7		8.0						
AT 8054 ROHS	4	14.7	4.4	5.2	8.0	1.6	0.4	1.0		2.8	
AT 5600 ROHS	1	17.3	6.6		8.0						
AT 5601 ROHS	2a	19.4	4.4	18.8	8.0	12.0					
AT 5602 ROHS	3	17.3	6.6		8.0						

II.5 Standard air trimmer series:

Figure A	Figure B	Figure C	Figure D
			

AIR TRIMMER CAPACITORS
MINIATURE, STANDARD & HIGH VOLTAGE

AIR DIELECTRIC TRIMMER CAPACITORS, RoHS COMPLIANT

Models	Fig.	Φ1	Φ2	L	M
AT 5200 ROHS, AT 5202 ROHS, AT 5400 ROHS, AT 5402 ROHS, AT 5450 ROHS, AT 5452 ROHS, AT 5500 ROHS, AT 5502 ROHS, AT 5600ROHS,AT 5602 ROHS	A	6.2			
AT 5201 ROHS, AT 5401 ROHS, AT 5451 ROHS,	B	1.3	1.3	5.6	7.2
AT 5501 ROHS,	B	1.3	1.3	5.6	14.2
AT 5601 ROHS	D	1.3	1.3	5.6	18.8
AT 8052 ROHS, AT 8053 ROHS, AT 8054 ROHS	C	1.3	1.3		5.2
AT 5453 ROHS	B	1.3	1.7	5.6	5.2

III. High voltage air trimmer series

P/N	AT 5301 ROHS AT 5302 ROHS
Capacitance range	0.8 to 10 pF > 10 turns
Working voltage	500 VDC
Test voltage	1000 VDC
Working Temp. range	-55°C to +125°C
Temp. Coefficient	0+/-20 ppm/°C
Q factor @ Max Cap.	> 2000
Insulation Resistance	> 10^6 MΩ

III.1 High voltage air trimmer series: Mechanical and general specifications

P/N	AT 5301 ROHS AT 5302 ROHS
Rotating torque	70 to 420 g.cm
Max torque on rotor stop	600 g.cm
Nut mounting torque	7000 g.cm
Seal cap assembly torque	1000 g.cm
Vibrations	60g, 10-2000 Hz
Glazed alumina insulation	
306°C solder used in assembly	
Silicone rubber seal washer	
Gold, silver and chromate finish	

AIR DIELECTRIC TRIMMER CAPACITORS, RoHS COMPLIANT

III.2 High voltage air trimmer series : Models

Figure 1

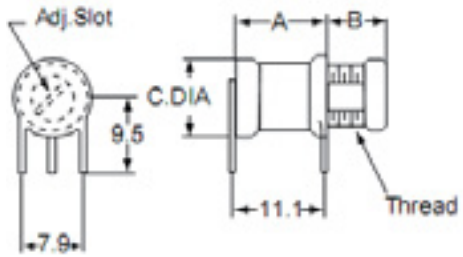
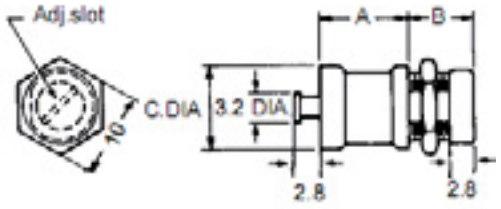


Figure 2

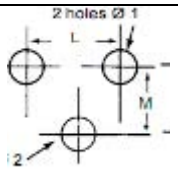


Terminals are gold plated
Others models available upon request

III.3 High voltage air trimmer series : Dimensions in mm

P/N	Figure	A	B	C	Thread
AT 5301 ROHS	1	11.1	8.3	9.8	.312-64 UNS
AT 5302 ROHS	2	10.7	7.8	9.8	

III.4 High voltage air trimmer series: Sugggested Mounting Holes

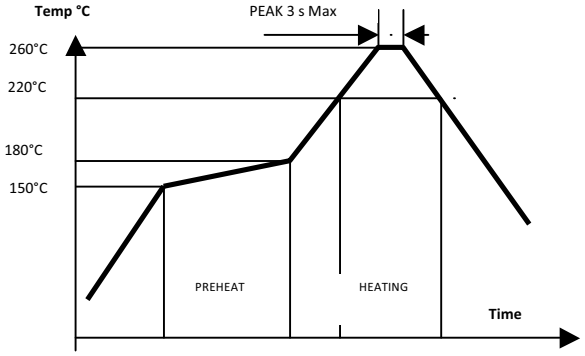
Figure A	Figure B
	

P/N	Figure	Φ1	Φ2	L	M
AT 5301 ROHS	B	1.3	1.3	11.1	7.9
AT 5302 ROHS	A	8.1			

IV. Soldering and mounting

Recommended reflow solder temperature profile

Maximum Soldering Temperature 260°C MAX



Hand soldering: Use a temperature controlled 40 watts iron set at 260°C maximum. The solder joint should be made on 3 seconds or less.
For panel mounting Air Trimmer capacitors (using a nut) minimum circuit thickness is 0.8 mm.

V. Recommendations for cleaning

Air Trimmer capacitors are compatible with a wide variety of cleaning process including those that utilize aqueous or semi-aqueous solutions, alcohol solutions, de-ionized water and numerous other cleaners. However, due to the large variety of such processes, the customer through cleaning process evaluation in conjunction with EXXELIA TEMEX product purchased must determine actual compatibility. Capacitors without sealing caps should be protected from intrusion of cleaning solutions in the internal bushing thread. It is recommended these units be installed after circuit boards have been cleaned. Units with seal caps may be immersed in liquid, vapour and ultrasonic system.

VI. Packaging

Parts are delivered in bulk and with a standard sealing cap
Special sealing caps with screwdriver slot are available except for AT 5300 series

AIR DIELECTRIC TRIMMER CAPACITORS, RoHS COMPLIANT

VII. How to order

Air trimmer capacitors with standard sealing cap

	Reference	ROHS
Examples	**AT 5202**	**ROHS**
	AT 5301	**ROHS**

Air trimmer capacitors with special sealing cap with screwdriver slot

	Reference	S	ROHS
Examples	**AT 5702**	**S**	**ROHS**
	AT 5801	**S**	**ROHS**

VIII. Tuning tools

Recommended Tuning Tools references:

AT 8766 for AT 5800 ROHS and AT 5850 ROHS series
AT 8777 for all others series

Improper screwdriver may damage the internal bushing thread causing rotor binding.

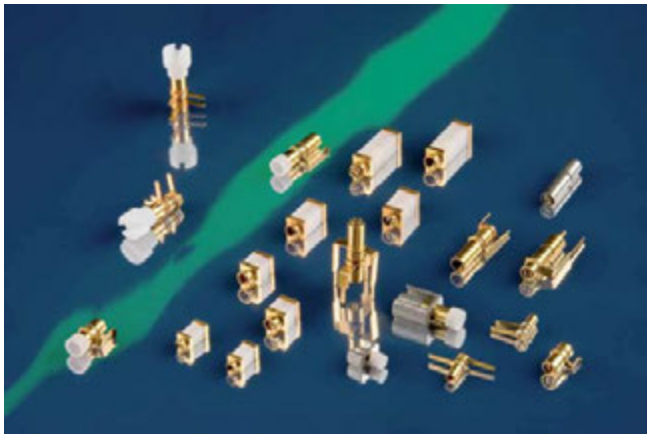
IX. Adjusting

The maximum torque on rotor stop value should not be exceeded or damage to capacitor may result. Always use the recommended tuning tool.

GIGAHERTZ SAPPHIRE TRIMMER CAPACITORS

RoHS COMPLIANT

Description



Sapphire dielectric
High self resonance frequency and very good Q
Rated voltage 500 VDC
Multi-turn, very fine resolution
Low temperature coefficient
Low capacitance drift and very stable over time
Self-locking constant torque drive mechanism
Surface mount models available on tape and reel
Meet MIL-C-144409
Compliant to ESA/SCC 3010
Terminations are **gold plated**
Non magnetic model
ROHS compliant
High Reliability versions available on special order
Custom design upon request
Maximum Soldering Temperature 260°C, 3 s Max

Applications

RF power amplifier	Impedance matching
Filter tuning	Low power amplifiers
Crystal trimming	Medical applications

Dielectric constant of sapphire does not change with frequency and temperature. Sapphire is inert crystal, moisture resistant and mechanically strong.

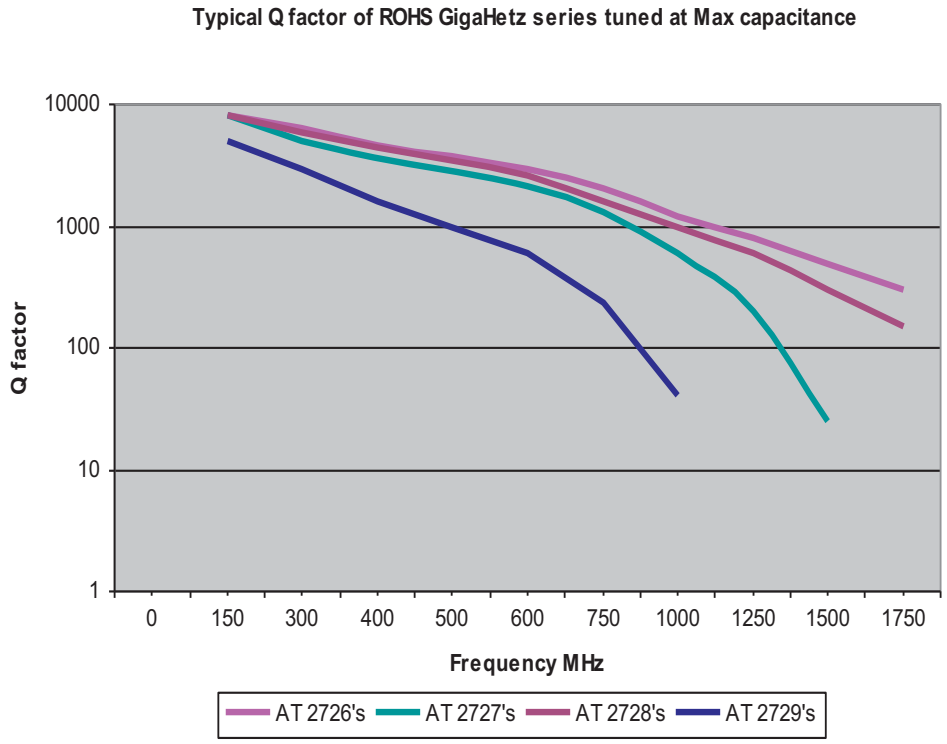
I. Electrical specifications

P/N	AT 2726X ROHS AT SM260 ROHS	AT 2727X ROHS AT SM270 ROHS	AT 2728X ROHS AT SM280 ROHS	AT 2729X ROHS AT SM290 ROHS
Capacitance range Standard models AT 272X8 models	0.3 to 1.2 pF 0.35 to 1.2 pF > 4 turns	0.6 to 4.5 pF 0.65 to 4.5 pF > 8 turns	0.4 to 2.5 pF 0.45 to 2.5 pF > 4 turns	0.8 to 8.0 pF 0.85 to 8.0 pF > 16 turns
Working Voltage	500 VDC			
Test Voltage	1000 VDC			
Working Temp. range	-55°C to + 125°C			
Temp. Coeff. Standard models AT 272X8 models	0+/-50 ppm/°C -50+/-75 ppm/°C	0+/-50 ppm/°C -50+/-75 ppm/°C	0+/-50 ppm/°C -50+/-75 ppm/°C	0+/-75 ppm/°C -50+/-75 ppm/°C
Q factor @ Max Capacitance	>5000 @250 MHz	>3000 @250 MHz	>4000 @250 MHz	>3000 @100 MHz
Insulation Resistance	>10000 MΩ min @ 500 VDC			

GIGAHERTZ SAPPHIRE TRIMMER CAPACITORS

RoHS COMPLIANT

II. Quality factor



III. Mechanical and general specifications

P/N	AT 2726X ROHS AT SM260 ROHS	AT 2727X ROHS AT SM270 ROHS	AT 2728X ROHS AT SM280 ROHS	AT 2729X ROHS AT SM290 ROHS
Rotating Torque	7 to 60 g.cm	10 to 100 g.cm	10 to 100 g.cm	10 to 100 g.cm
Max Torque on rotor stop	80 g.cm	150 g.cm	120 g.cm	150 g.cm
Rotational life	> 800 revolutions			
Vibration	60g, 10-2000 Hz			
Shock	100g, 6ms			

GIGAHERTZ SAPPHIRE TRIMMER CAPACITORS

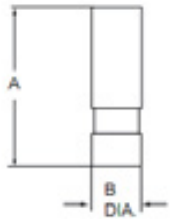
RoHS COMPLIANT

IV. Self resonant frequency

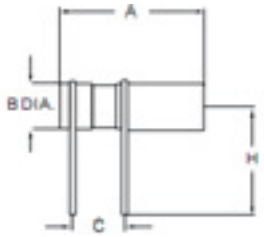
For surface mount version, self resonant frequency is improving when width of terminal is increasing. With more width terminal, Equivalent Serial Resistance (ESR) is lower.As example for the same capacity range, self resonant frequency of model 8 is higher than for model 3.

V. Models

Model 0

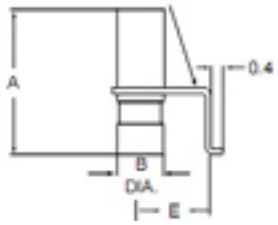


Model 1



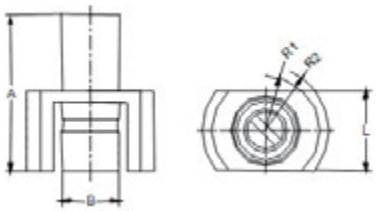
Terminal 1.0 mm width x 0.2 mm thickness

Model 3

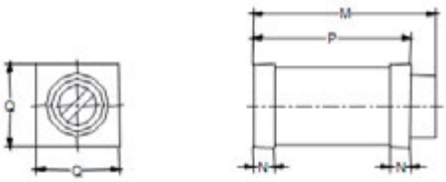


Terminal 1.0 mm width x 0.2 mm thickness

Model 8



AT SM series



Terminals are gold plated

Others models available upon request. Custom designs available upon request

VI. Dimensions in mm

X is the model

P/N	A	B	C	E	H	L	R1	R2
AT 2726X ROHS	5.8	1.9	2.0	1.9	5.9	3.1	2.3	2;8
AT 2727X ROHS	8.0	3.0	3.2	2.8	5.9	4.1	2.8	3.3
AT 2728X ROHS	5.8	3.0	2.0	2.8	5.9	4.1	2.8	3.3
AT 2729X ROHS	12.3	3.0	6.4	2.8	5.9	4.1	2.8	3.3

P/N	M	N	P	Q
AT SM260 ROHS	6.4	0.8	5.1	3.0
AT SM270 ROHS	8.8	1.0	7.6	4.0
AT SM280 ROHS	6.6	1.0	5.1	4.0
AT SM290 ROHS	13.1	1.0	11.4	4.0

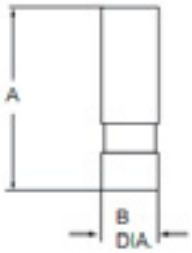
GIGAHERTZ SAPPHIRE TRIMMER CAPACITORS

RoHS COMPLIANT

VII. Non magnetic model

AT 57290 ROHS is a Non Magnetic RoHS GigaHertz trimmer capacitor with a very low magnetic signature, made of non magnetic alloy and silver plated, specially designed for medical applications such as MRI, NMR and spectroscopy.

Outline Drawing, Electrical Characteristics, Mechanical Specifications and Dimensions

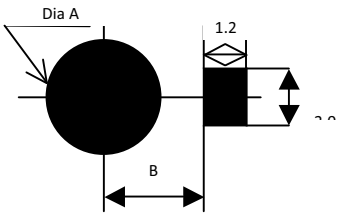


Capacitance range (pF)	0.8 to 8.0
Working Voltage (VDC)	500
Withstanding Voltage (VDC)	1000
Working Temp. range	-55°C to + 125°C
Temp. Coeff. (ppm/°C)	375+/-75
Q factor @ Max Capacitance	>3000 @100 MHz
Insulation Resistance (MΩ)	10000 min @ 500 VDC
Rotating Torque g.cm	10 to 100
Max Torque on rotor stop g.cm	150
A in mm	12.3
B in mm	3.0

VIII. Soldering

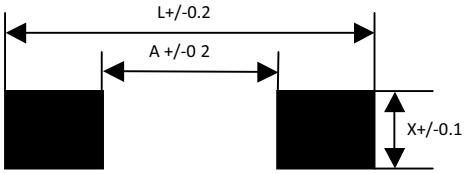
Typical solder pad layout

AT 27263 ROHS, AT 27273 ROHS, AT 27283 ROHS, AT 27293 ROHS models



Dim in mm	AT 27263 ROHS	AT 27273 ROHS AT 27283 ROHS AT 27293 ROHS
Dia A	2.4	3.6
B	1.7	2.3

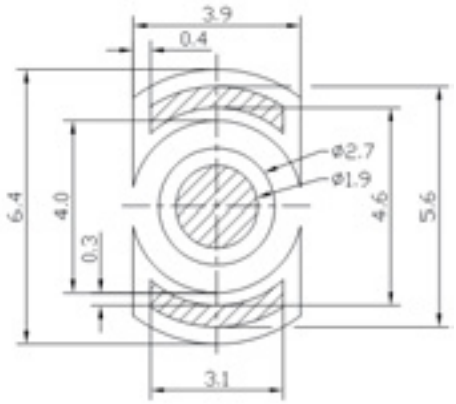
AT SM Models



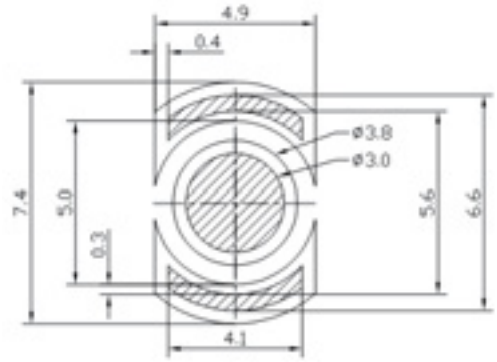
Dim in mm	AT SM 260 ROHS	AT SM 270 ROHS	AT SM 280 ROHS	AT SM 290 ROHS
L	6.2	8.7	6.2	12.5
A	3.2	5.2	2.8	9.0
X	3.4	4.4	4.4	4.4

RoHS COMPLIANT

AT 27268 ROHS

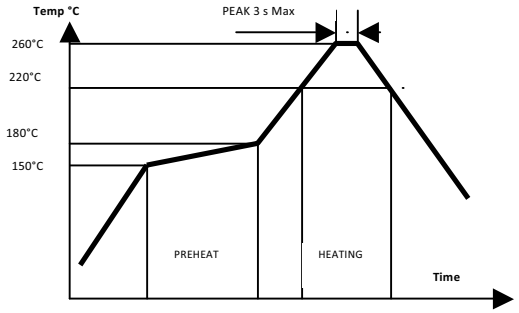


AT 27278 ROHS, AT 27288 ROHS, AT 27298 ROHS



Recommended reflow solder temperature profile

Maximum Soldering Temperature 260°C MAX



Hand soldering : Use a temperature controlled 40 Watts iron set at 260°C maximum. The solder joint should be made on 3 seconds or less.

IX. Recommendations for cleaning

GigaHertz Trimmer capacitors are compatible with a wide variety of cleaning process including those that utilize aqueous or semi-aqueous solutions, alcohol solutions, de-ionized water and numerous other cleaners. However, due to the large variety of such processes, the customer through cleaning process evaluation in conjunction with TEMEX-CERAMICS product purchased must determine actual compatibility. Capacitors without sealing caps should be protected from intrusion of cleaning solutions in the internal bushing thread. It is recommended these units be installed after circuit boards have been cleaned. Units with seal caps may be immersed in liquid, vapour and ultrasonic system.

X. Packaging

Parts are delivered in bulk for quantity lower than 500 p.
GigaHertz trimmers AT 27263 ROHS, AT 27273 ROHS, AT 27283 ROHS, AT 27268 ROHS, AT 27278 ROHS, AT 27288 ROHS, AT SM 270 ROHS and AT SM 280 ROHS are available on tape and reel, quantity per reel 500p.
Models 0 and 1, trimmers AT 27293 ROHS, AT 27298 ROHS and AT SM 290 ROHS are not available on tape.

GIGAHERTZ SAPPHIRE TRIMMER CAPACITORS

RoHS COMPLIANT

When delivered on tape, GigaHertz trimmers include a permanent sealing cap which is moisture proof and resists intrusion of dirt, dust, solder flux and cleaning agents, and allows easy access, accurate tuning after assembly and cleaning. References of sealing caps are AT 69600 for AT 2726X ROHS family and AT 69700 for AT 2727X ROHS, AT 2728X ROHS and AT 2729X ROHS families. For sealing caps of AT SM series, contact TEMEX-CERAMICS.
Use of permanent sealing cap increases total length of the GigaHertz trimmer by 0.2 mm.

XI. How to order

Parts in quantity < 500 p and for models 0 and 1, trimmers AT 27293 ROHS, AT 27298 ROHS and AT SM 290 ROHS

	Reference	RoHS
Examples	**AT 27293**	**ROHS**
	AT SM 270	**ROHS**
	AT 27261	**ROHS**
	AT 57290	**ROHS**

Parts with sealing cap, in quantity < 500 p

	Reference	+ CAP	ROHS
Example	**AT 27273**	**+ CAP**	**ROHS**

	Reference	R1	ROHS
Parts on tape and reel : (500p/reel) Examples	**AT 27283**	**R1**	**ROHS**
	AT SM 260	**R1**	**ROHS**

XII. Tuning tools

Recommended Tuning Tools references:

AT 8762 for AT 2726X ROHS part numbers and AT SM 260 ROHS

AT 8777 for AT 2727X ROHS, AT 2728X ROHS and AT 2729X ROHS part numbers and AT SM 270 ROHS, AT SM 280 ROHS and AT SM 290 ROHS as well for AT 57290 ROHS.

Improper screwdriver may damage the internal bushing thread causing rotor binding.

XIII. Adjusting

Sealing caps, available on GigaHertz trimmers delivered on tape and reel, are designed so that after assembly is complete they may be penetrated by the Temex-Ceramics tuning tool and left in place.
The maximum torque on rotor stop value should not be exceeded or damage to the capacitor may result.
Always use the recommended tuning tool

NON MAGNETIC, SAPPHIRE DIELECTRIC TRIMMER CAPACITORS

SAPPHIRE DIELECTRIC TRIMMER CAPACITORS, RoHS COMPLIANT

Description

Sapphire dielectric
Non Magnetic structure
Rated voltage 500 VDC to 1500 VDC
Low magnetic signature, less than 10^{-12} Tesla
Low temperature coefficient
Very stable over time
High Q factor
Multi-turn, high resolution
Self-locking constant torque drive mechanism
Silver and chromate finish
ROHS compliant
Maximum Soldering Temperature 260°C, 3 s Max

Applications

Magnetic Resonance Imaging
Nuclear Magnetic Resonance
Medical Applications
Non magnetic probes

I. Electrical specifications

P/N	AT 57290 ROHS	AT 57250 ROHS	TG 091 ROHS	TG 092 ROHS
Capacitance range	0.8 to 8.0 pF >16 turns	1.0 to 13 pF > 8 turns	0.5 to 8.0 pF > 28 turns	0.5 to 10 pF > 28 turns
Working Voltage	500 VDC	1500 VDC	1500 VDC	1000 VDC
Test Voltage	1000 VDC	2250 VDC	2500 VDC	1600 VDC
Working Temp. range	-55°C to + 125°C			
Temp. Coefficient	350+/-75 ppm/°C	350+/-75 ppm/°C	350+/-75 ppm/°C	350+/-75 ppm/°C
Q factor	>3000@100 MHz	>1500@100 MHz	>2500@100 MHz	>2000@100 MHz
Insulation Resistance	$>10^4$ MΩ			

Capacitance change is linear versus rotation of mobile rotor.

NON MAGNETIC, SAPPHIRE DIELECTRIC TRIMMER CAPACITORS

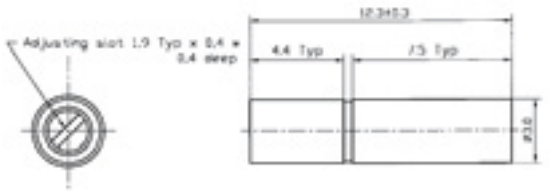
SAPPHIRE DIELECTRIC TRIMMER CAPACITORS, RoHS COMPLIANT

II. Mechanical and general specifications

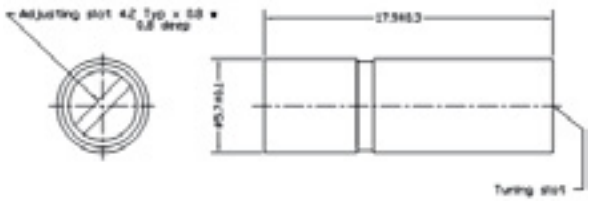
P/N	AT 57290 ROHS TG 091 ROHS TG 092 ROHS	AT 57250 ROHS
Rotating torque	10 to 100 g.cm	50 to 500 g.cm
Max torque on rotor stop	150 g.cm	700 g.cm
Rotational life	> 400 revolutions	> 400 revolutions
Vibrations	60g, 10-2000 Hz	60g, 10-200 Hz
Shocks	100g, 6 ms	100g, 6 ms

IV. Models and dimensions in mm

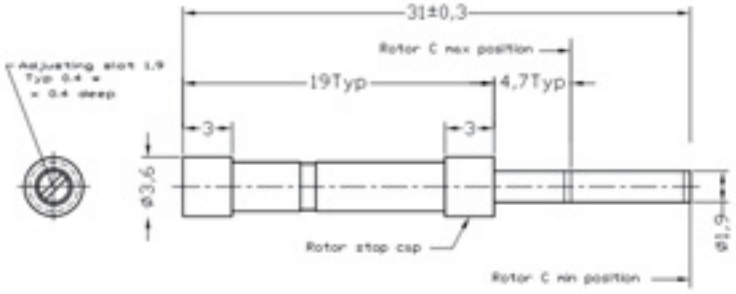
AT 57290 ROHS



AT 57250 ROHS



TG 091 ROHS
TG 092 ROHS



NOTA: AT 57290 ROHS and AT 57250 ROHS can be delivered with extended shaft upon request.

V. Soldering

Hand soldering: Use a temperature controlled 40 watts iron set at 260°C maximum. The solder joint should be made on 3 seconds or less.

SAPPHIRE DIELECTRIC TRIMMER CAPACITORS, RoHS COMPLIANT

VI. Recommendations for cleaning

Delivered without sealing cap, these Trimmer Capacitors have to be installed after circuit board have been cleaned.

VII. Packaging

Parts are delivered in bulk.

VIII. How to order

Non Magnetic High Voltage Sapphire Dielectric trimmer capacitors

	Reference	RoHS
Examples	**AT 57290**	**ROHS**
	AT 57250	**ROHS**

IX. Tuning tool

Recommended Tuning Tool reference is **AT 8777**
Improper screwdriver size will cause internal thread damage.

X. Adjusting

The maximum torque on rotor stop value should not be exceeded or damage to capacitor may result.
Always use the recommended tuning tool.

NON MAGNETIC, HIGH VOLTAGE PTFE DIELECTRIC TRIMMER CAPACITORS

PTFE DIELECTRIC TRIMMER CAPACITORS, RoHS COMPLIANT

Description

PTFE dielectric
Non Magnetic structure
Rated voltage 1000 VDC to 1250 VDC
Low temperature coefficient
Very stable over time
High Q factor
Multi-turn, high resolution
Self-locking constant torque drive mechanism
Gold, silver and chromate finish
ROHS compliant
Maximum Soldering Temperature 260°C, 3 s Max

Applications

Magnetic Resonance Imaging
Nuclear Magnetic Resonance
Medical Applications

I. Electrical specifications

P/N	AT 52H01 AT 52H02	AT 55H01 AT 55H02
Capacitance range	1.5 to 10 pF >18 turns	1.5 to 19 pF > 18 turns
Working Voltage	1250 VDC	1000 VDC
Test Voltage	2500 VDC	2000 VDC
Working Temp. range	-55°C to + 125°C	
Temp. Coefficient	50+/-40 ppm/°C	0+/-50 ppm/°C
Q factor	>1400@195 MHz	>1000@175 MHz
Insulation Resistance	$>10^6$ MΩ	

Capacitance change is linear versus rotation of mobile rotor.

III. Mechanical and general specifications

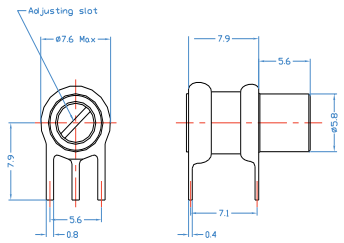
P/N	AT 52H01 AT 52H02	AT 55H01 AT 55H02
Rotating torque	70 to 350 g.cm	
Max torque on rotor stop	500 g.cm	
Rotational life	> 600 revolutions	
Vibrations	60g, 10-2000 Hz	
Shocks	100g, 6ms	

NON MAGNETIC, HIGH VOLTAGE PTFE DIELECTRIC TRIMMER CAPACITORS

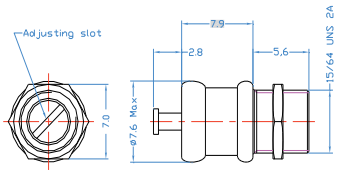
PTFE DIELECTRIC TRIMMER CAPACITORS, RoHS COMPLIANT

IV. Models and dimensions in mm

AT 52H01-AT 55H01

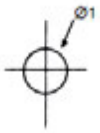
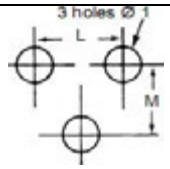


AT 52H02-AT55H02 ROHS



Terminal with two legs is in contact with tuning rotor

V. Sugggested mounting holes and soldering

Figure A	Figure B
	

Models	Figure	Φ1	L	M
AT 52H01 ROHS, AT 55H01 ROHS	B	1.3	5.6	7.1
AT 52H02 ROHS, AT 55H02 ROHS	A	6.2		

Hand soldering: Use a temperature controlled 40 watts iron set at 260°C maximum. The solder joint should be made on 3 seconds or less.

VI. Recommendations for cleaning

Delivered without sealing cap, these Trimmer Capacitors have to be installed after circuit board have been cleaned.

PTFE DIELECTRIC TRIMMER CAPACITORS, RoHS COMPLIANT

VII. Packaging

Parts are delivered in bulk.

VIII. How to order

Non Magnetic High Voltage PTFE Dielectric trimmer capacitors

	Reference	RoHS
Examples	**AT 52H01**	**ROHS**
	AT 55H01	**ROHS**

IX. Tuning tool

Recommended Tuning Tool reference is **AT 8777**
Improper screwdriver size will cause internal thread damage.

X. Adjusting

The maximum torque on rotor stop value should not be exceeded or damage to capacitor may result.
Always use the recommended tuning tool.

CHIP TRIM CERAMIC TRIMMER CAPACITORS AT 0300 Ro HS & AT 1300 Ro HS

SURFACE MOUNT TRIMMER CAPACITORS, RoHS COMPLIANT

Description

Very compact package type
Ceramic dielectric
Special design for reflow soldering use
Rated voltage 100 VDC
Low temperature coefficient
Low capacitance drift
Very stable over time
Terminals are pure tin plated
ROHS compliant
High resonance frequency and very good Q
Special design for easy vacuum pickup
Delivered on 12 mm tape and reel
Maximum Soldering Temperature 265°C, 3 s Max

Applications

Mobile and Radio communications equipments :
Filters, Oscillators
TCXO, VCO
Control remote
Security systems
Low power amplifiers

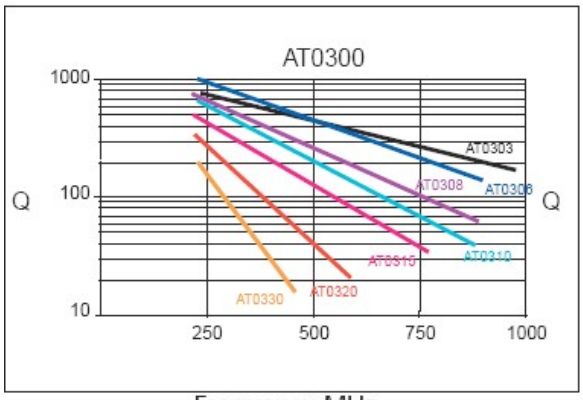
I. Electrical specifications

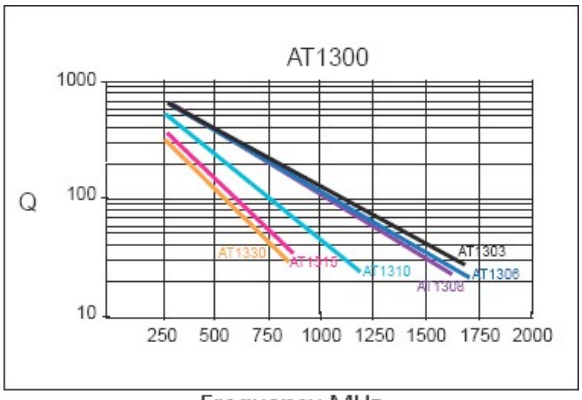
P/N	AT 0303 AT 1303	AT 0306 AT 1306	AT 0310 AT 1310	AT 0315 AT 1315	AT 0320 AT 1320	AT 0330 AT 1330	AT 0340 AT 1340
From below	1.5	2.0	2.0	3.0	4.5	5.5	8.0
Capacitance range (pF)	+50%	+50%	+50%	+50%	+50%	+50%	+50%
To above +50%/-0	3.0_{-0}	6.0_{-0}	10.0_{-0}	15.0_{-0}	20.0_{-0}	30.0_{-0}	40.0_{-0}
Working Voltage (VDC)	100						
Withstanding Voltage (VDC)	220						
Working Temp. range	-40°C to +85°C						
Temp. Coeff. (ppm/°C)	0+/-200	0+/-300	0+/-300	0+/-300	0+/-500	-750+/-500	-750+/-500
Capacitance drift (pF)	0.1	Max	0.3 Max	0.4 Max	0.5 Max	1.0 Max	1.2 Max
Setting drift	< 1%						
Typical Self-Resonance Frequency at CMax (GHz)							
AT 0300 series	2.0	1.4	1.1	0.9	0.8	0.6	0.4
AT 1300 series	2.3	1.6	1.2	1.0	0.9	0.7	0.5
Insulation Resistance (MΩ)	10000 min						

CHIP TRIM CERAMIC TRIMMER CAPACITORS AT 0300 Ro HS & AT 1300 Ro HS

SURFACE MOUNT TRIMMER CAPACITORS, RoHS COMPLIANT

II. Quality factor

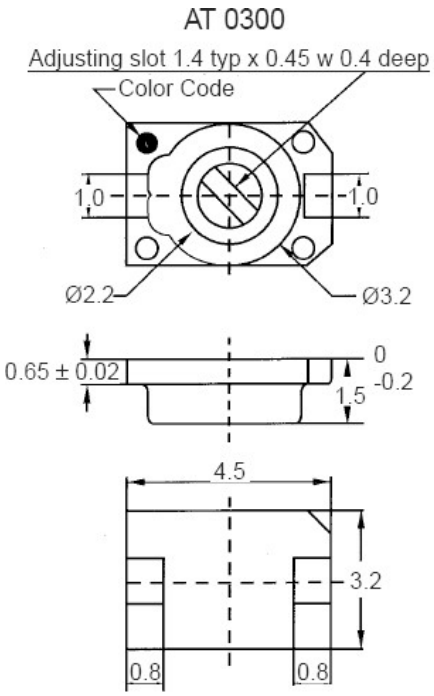


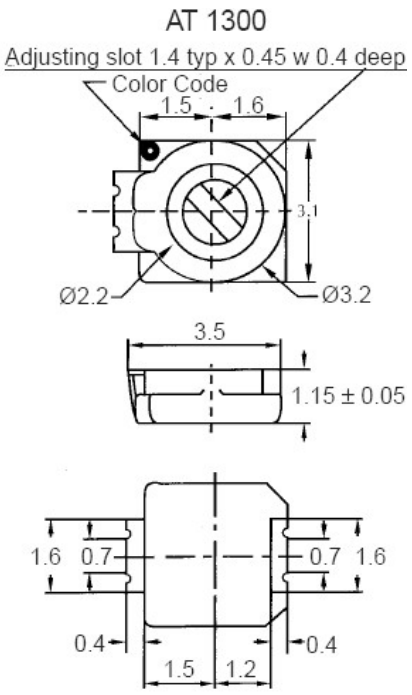


III. Mechanical and general specifications

P/N	AT 1303 AT 0303	AT1306 AT0306	AT 1310 AT 0310	AT 1315 AT 0315	AT 1320 AT 0320	AT 1330 AT 0330	AT 1340 AT 0340
Color Code	Black	Blue	White	Pink	Red	Orange	Yellow
Rotating Torque	10 to 70 g.cm						
Tensile strength of terminal	500 g						
Resistance to axial load	250 g min						

IV. Outline dimensions





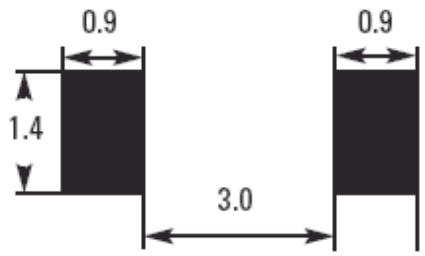
CHIP TRIM CERAMIC TRIMMER CAPACITORS AT 0300 RoHS & AT 1300 RoHS

SURFACE MOUNT TRIMMER CAPACITORS, RoHS COMPLIANT

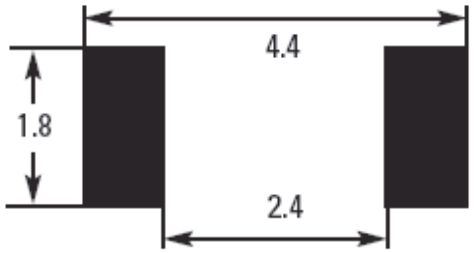
V. Soldering

Typical solder pad layout

AT0300
Tolerance ± 0.2 mm



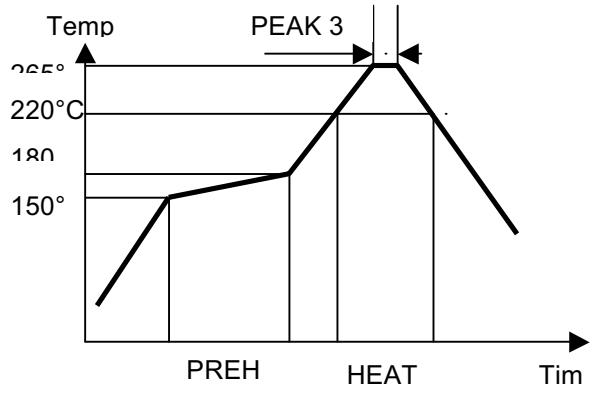
AT1300
Tolerance ± 0.1 mm



Thickness of printed solder: 0.15 mm

Recommended reflow solder temperature profile

Maximum Soldering Temperature 265°C MAX



VI. Packaging

Parts are delivered
- in bulk for quantity lower than 1 kp
- on tape and reel in 12 mm width carrier tape in quantities of 1 kp on 7 inches reel

VII. How to order

Parts in quantity < 1 kp

	Reference	ROHS
Example	**AT 1310**	**RoHS**

Parts on tape and reel :

	Reference	R2	ROHS
Example	**AT 0303**	**R2**	**ROHS**

VIII. Tuning

Recommended Tuning Tool reference: AT 8777
When tuning, do not apply an axial force higher than 1.5 N (150 g)

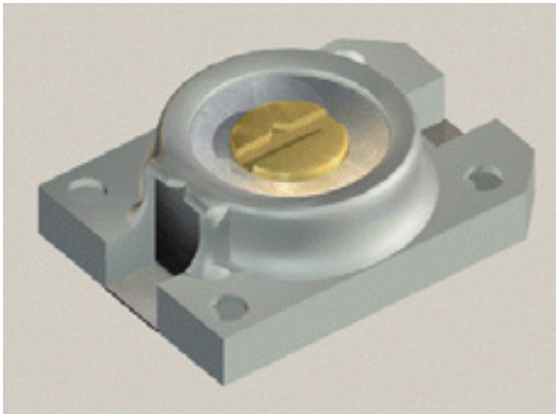
VIII. Storage conditions

Do not store components under direct sunlight or in dewy environment, and in corrosive condition.
Before use, store components under condition of -10°C to +40°C and humidity of 75% RH Max.
It is recommended to use components within 6 months after delivery

HIGH VOLTAGE CHIP TRIM CERAMIC TRIMMER CAPACITORS AT 03HV00 SERIES

SURFACE MOUNT TRIMMER CAPACITORS, RoHS COMPLIANT

Description



Very compact package type
Ceramic dielectric
Special design for reflow soldering use
Rated voltage **350 VDC** (test **770 VDC**)
Low temperature coefficient
Low capacitance drift
Very stable over time
Terminals are **pure tin plated**
High resonance frequency and very good Q
Special design for easy vacuum pickup
Delivered on 12 mm tape and reel
RoHS compliant
Maximum Soldering Temperature 265°C, 3 s Max

Applications

High power radio transmission
Power amplifier for cellular base station
Amplifier for cable TV

I. Electrical specifications

P/N	AT 03HV03 RoHS	AT 03HV06 RoHS	AT 03HV08 RoHS	AT 03HV10 RoHS	AT 03HV15 RoHS	AT 03HV20 RoHS
From below	1.5	2.0	3.0	2.0	3.0	4.5
Capacitance range (pF)	+50%	+50%	+50%	+50%	+50%	+50%
To above	3.0_{-0}	6.0_{-0}	8.0_{-0}	10.0_{-0}	15.0_{-0}	20.0_{-0}
Working Voltage(VDC)	350					
WithstandingVoltage(VDC)	770					
Working Temp. range	-40°C to +85°C					
Temp. Coeff. (ppm/°C)	0+/-200	0+/-300	-750+/-500	0+/-300	0+/-500	0+/-500
Capacitance drift (pF)	0.1 Max	0.1 Max	0.2 Max	0.3 Max	0.4 Max	0.5 Max
Setting drift	<1%					
Typical Self-Resonance Frequency at CMax (GHz)	2.0	1.4	1.2	1.1	0.9	0.8
Insulation Resistance (MΩ)	10000 min					
Q @ 1 Mz, Cmax	500 min					

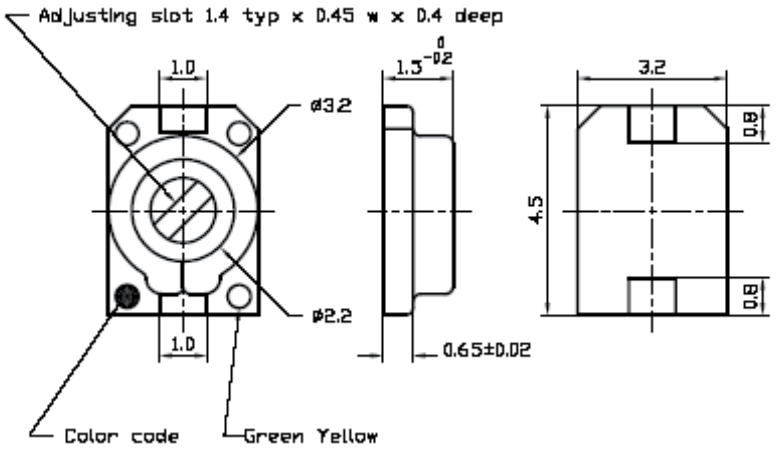
II. Mechanical and general specifications

P/N	AT 03HV03 RoHS	AT 03HV06 RoHS	AT 03HV08 RoHS	AT 03HV10 RoHS	AT 03HV15 RoHS	AT 03HV20 RoHS
Color Code	Black	Blue	Violet	None	Pink	Red
Rotating Torque	10 to 70 g.cm					
Tensile strength of terminaison	250 g					
Resistance to axial load	500 g					

HIGH VOLTAGE CHIP TRIM CERAMIC TRIMMER CAPACITORS AT 03HV00 SERIES

SURFACE MOUNT TRIMMER CAPACITORS, RoHS COMPLIANT

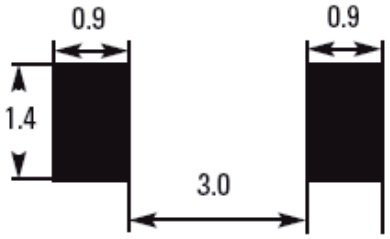
III. outline dimensions



Green Yellow dot means AT 03HV00 ROHS series, and color dot indicates reference of the model

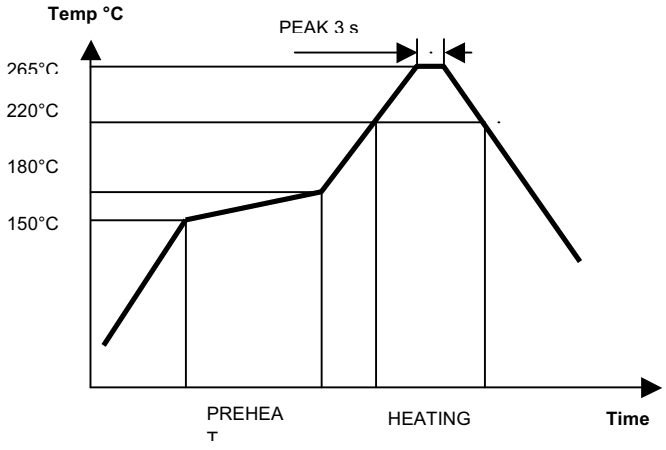
IV. soldering

AT 03HV00 ROHS Series Typical solder pad layout
Tolerance ± 0.2 mm



Thickness of printed solder: 0.15 mm

Recommended reflow solder temperature profile
Maximum Soldering Temperature 265°C MAX



V. Packaging

Parts are delivered :

- on tape and reel in 12 mm width carrier tape in quantities of 1 kp on 7 inches reel
- in bulk for quantity lower than 1 kp

VI. How to order

Parts on tape and reel :	Reference	R2	RoHS
Example	**AT 03HV03**	**R2**	**RoHS**
Parts in quantity < 1 kp	Reference		RoHS
Example	**AT 03HV10**		**RoHS**

VII. Tuning

Recommended Tuning Tool reference: AT 8777
When tuning, do not apply an axial force higher than 1.5 N (150 g)

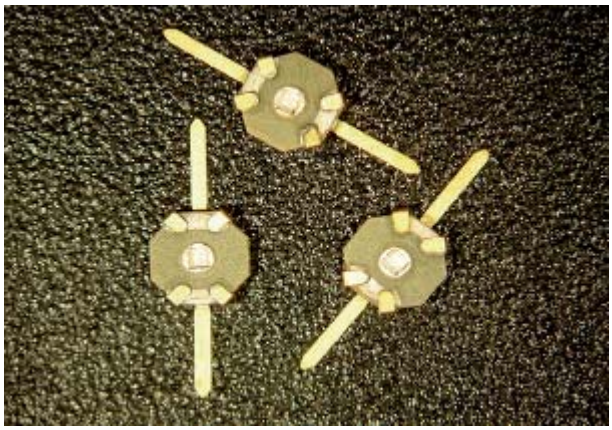
VIII. Storage conditions

Do not store components under direct sunlight or in dewy environment, and in corrosive condition.
Before use, store components under condition of -10°C to +40°C and humidity of 75% RH Max.
It is recommended to use components within 6 months after delivery

THIN CERAMIC TRIMMER CAPACITORS AT 9401G RoHS SERIES

SURFACE MOUNT TRIMMER CAPACITORS, RoHS COMPLIANT

Description



Miniaturized trimmers
Performance up to 2 GHz and beyond
Very small size and weight
Ceramic dielectric
Rated voltage 250 VDC
Low capacitance drift , very stable over time
Extremely low ERS and ESL
High resonance frequency and very good Q
Terminations are **gold plated**
Delivered on tape and reel (SL1 version)
ROHS compliant
Max Soldering Temperature 260°C, 10s Max

Applications

RF amplifier, Filter networks
Military and Avionics equipment
Medical devices
DR/Crystal Oscillators
Broadband wireless LAN, Antenna tuning
Telemetry

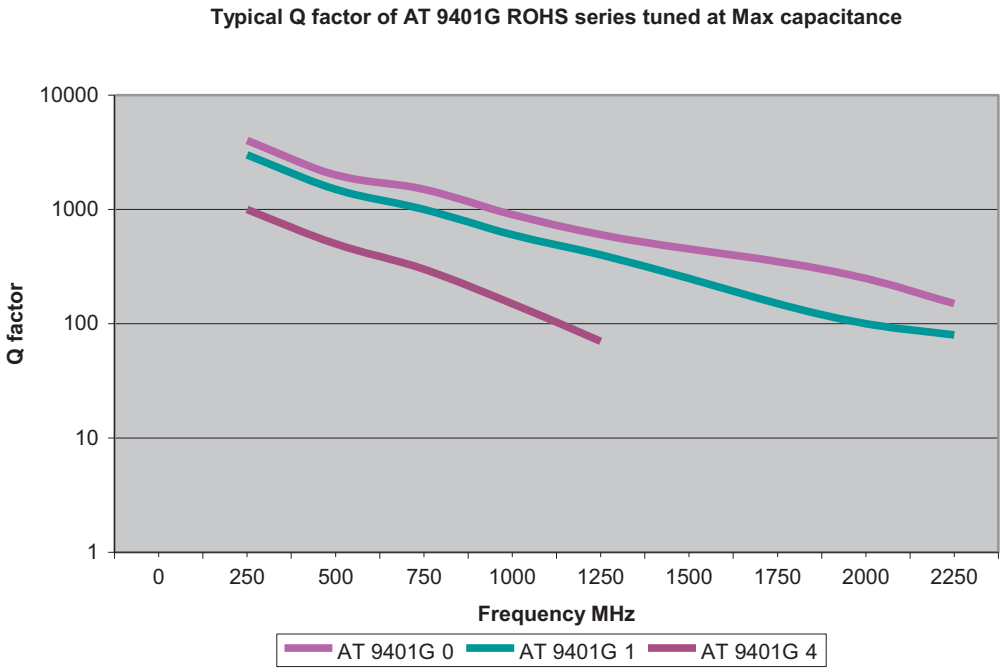
I. Electrical Specifications

P/N	AT 9401G-0 RoHS AT 9401G-0 SL1 RoHS	AT 9401G-1 RoHS AT 9401G-1 SL1RoHS	AT 9401G-2 RoHS AT 9401G-2 SL1 RoHS	AT 9401G-4 RoHS AT 9401G-4 SL1 RoHS
Capacitance range (pF)	0.25 => 0.7	0.5 => 1.3	0.6 => 2.0	1.5 => 4.0
Working Voltage (Vdc)	250			
Withstanding Voltage (Vdc)	500			
Working Temp. range	–55°C to +125°C			
Temp. Coeff. (ppm/°C)	50±50	NPO±100	–400±200	–1100±300
Setting drift	< 1%			
Typical Q @ 100 MHz, CMax	>1000	>1000	>1000	>500
Insulation Resistance (MΩ)	10000 min			

THIN CERAMIC TRIMMER CAPACITORS
AT 9401G RoHS SERIES

SURFACE MOUNT TRIMMER CAPACITORS, RoHS COMPLIANT

II. Typical Q factor



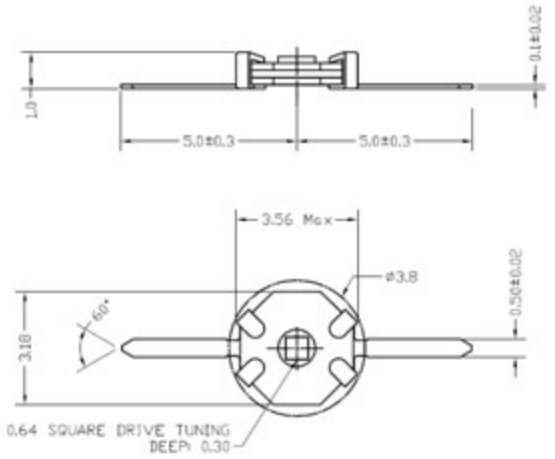
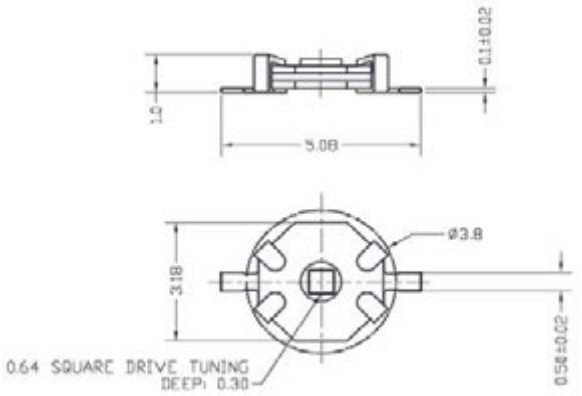
III. Mechanical and general specifications

P/N	AT 9401G-0 RoHS AT 9401G-0 SL1 RoHS	AT 9401G-1 RoHS AT 9401G-1 SL1 RoHS	AT 9401G2 RoHS AT 9401G-2 SL1 RoHS	AT 9401G-4 RoHS AT 9401G-4 SL1RoHS
Rotating torque (cN.cm)	5 to 70			
Shock	100g @ 6 ms			
Vibration	15g @ 10-2000 Hz			
Moisture resistance	MIL-STD-202, Method 106			

THIN CERAMIC TRIMMER CAPACITORS AT 9401G RoHS SERIES

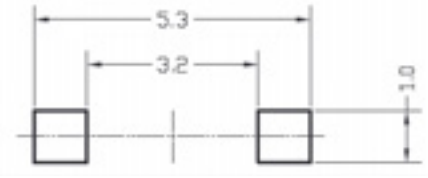
SURFACE MOUNT TRIMMER CAPACITORS, RoHS COMPLIANT

IV. Outline dimensions

Standard model	SL1 model
	

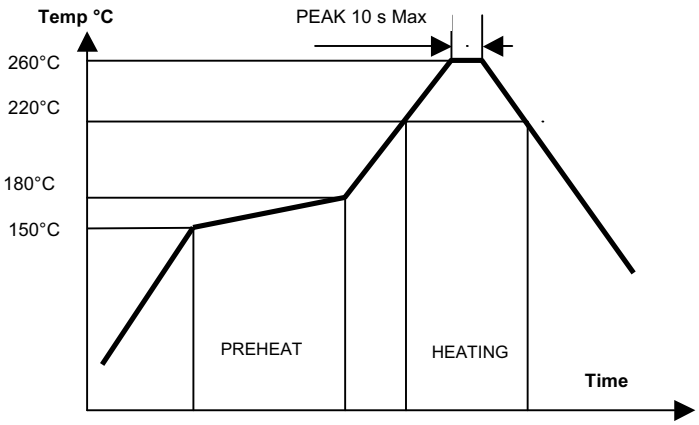
V. Soldering

Typical solder pad layout for SL1 model



Recommended reflow solder temperature profile

Maximum Soldering Temperature 260°C MAX



SURFACE MOUNT TRIMMER CAPACITORS, RoHS COMPLIANT

VI. Packaging

Parts delivered :

Standard model: in bulk

SL1 model: in bulk for quantity lower than 1.5 kp
on tape and reel in 12 mm width carrier tape in quantities of 1500 p on 7 inches reel

VII. How to order

Standard model and SL1 model in qty < 1.5 kp

	Reference	ROHS
Examples	**AT 9401G-1**	**ROHS**
	AT 9401G-0 SL1	**ROHS**

	Reference	R3	ROHS	
SL1 model on tape and reel :				
Example	**AT 9401G-4 SL1**	**R3**	**ROHS**	Qty 1.5 kp

VIII. Tuning tool

Tuning Tool reference: AT 4192

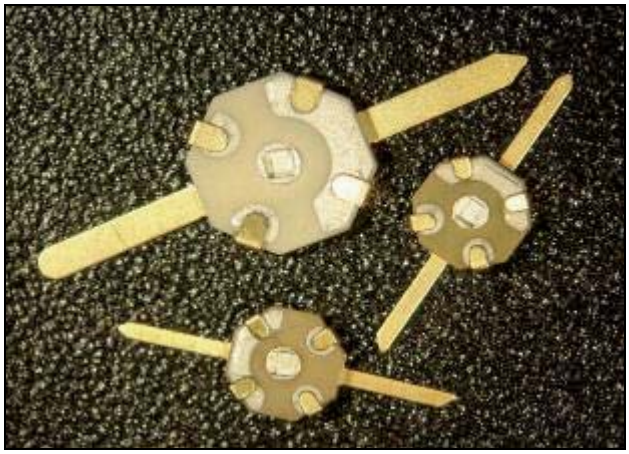
IX. Recommendation for cleaning

SMD Thin AT 9401G ROHS series are compatible with a wide variety of cleaning process including those that utilize aqueous or semi-aqueous solutions, alcohol solutions, de-ionized water and numerous other cleaners. However, due to the large variety of such processes, the customer through cleaning process evaluation in conjunction with TEMEX-CERAMICS product purchased must determine actual compatibility. SMD Thin AT 9401G ROHS series capacitors should be cleaned in contamination free solution. If rough torque occurs after cleaning, re-clean in fresh solution.

SMD THIN CERAMIC TRIMMER CAPACITORS AT 9402G & AT 9410G RoHS SERIES

SURFACE MOUNT TRIMMER CAPACITORS, RoHS COMPLIANT

Description



Miniaturized trimmers
Thin profile
Very small size and weight
Ceramic dielectric
Rated voltage 250 VDC
Low capacitance drift, very stable over time
Very good Q
Terminations are **gold plated**
Delivered on tape and reel (SL1 version)
ROHS compliant
Non magnetic models
Max Soldering Temperature 260°C, 10s Max

Applications

RF amplifier, Filter networks
DR/Crystal Oscillators
Military and Avionics equipment
Broadband wireless LAN, Antenna tuning
Medical devices
Telemetry

I. Electrical specifications

I.1 AT 9402G ROHS series

P/N	AT 9402G-0 ROHS AT 9402G-0 SL1 ROHS	AT 9402G-1 ROHS AT 9402G-1 SL1 ROHS	AT 9402G-2 ROHS AT 9402G-2 SL1 ROHS	AT 9402G-4 ROHS AT 9402G-4 SL1 ROHS	AT 9402G-6 ROHS AT 9402G-6 SL1 ROHS	AT 9402G-8 ROHS AT 9402G-8 SL1 ROHS	AT 9402G-9 ROHS AT 9402G-9 SL1 ROHS
From below Capacitance range (pF)	0.5	1.0	2.5	3.0	8.0	5.0	7.0
To above	2.5	5.0	10.0	12.0	25.0	15.0	18.0
Working Voltage (VDC)	250 VDC						
Test Voltage (VDC)	500 VDC						
Working Temp. range	55°C to +125°C						
Temp. Coeff. (ppm/°C)	100+/ 100	100+/ 200	50+/ 100	1100+/ 300	1100+/ 300	300+/ 300	450+/ 300
Setting drift	< 1%						
Typical Q@100 MHz, CMax	3000	1000	1000	500	300	750	500
Insulation Resistance (MΩ)	10000 min						

SMD THIN CERAMIC TRIMMER CAPACITORS AT 9402G & AT 9410G RoHS SERIES

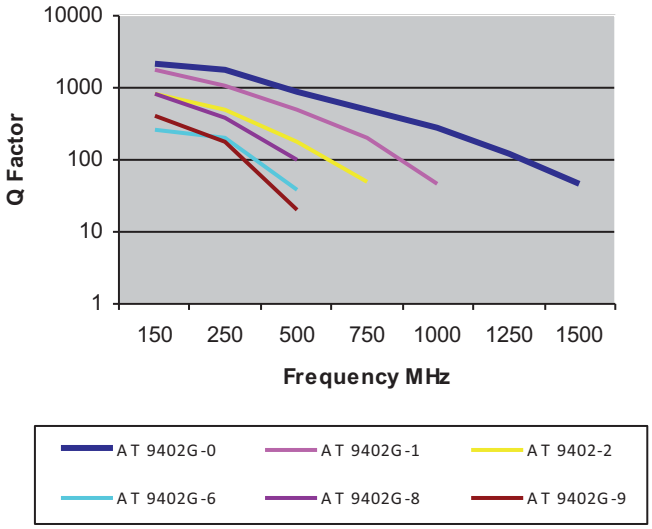
SURFACE MOUNT TRIMMER CAPACITORS, RoHS COMPLIANT

I.2 AT 9410G ROHS series

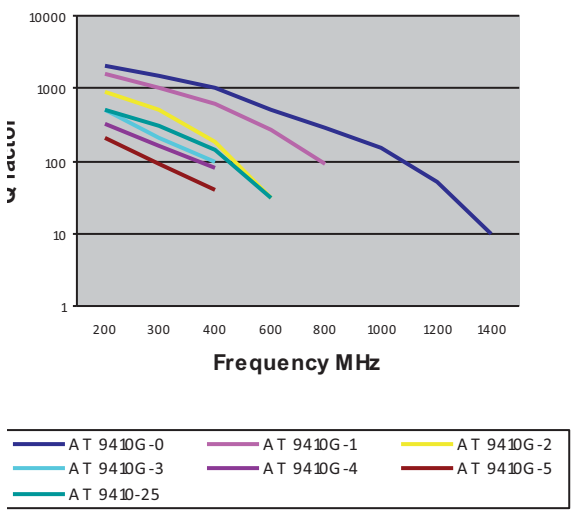
P/N	AT 9410G-0 ROHS AT 9410G-0 SL1 ROHS	AT 9410G-1 ROHS AT 9410G-1 SL1 ROHS	AT 9410G-2 ROHS AT 9410G-2 SL1 ROHS	AT 9410G-3 ROHS AT 9410G-3 SL1 ROHS	AT 9410G-4 ROHS AT 9410G-4 SL1 ROHS	AT 9410G-5 ROHS AT 9410G-5 SL1 ROHS	AT 9410G-25 ROHS AT 9410G-25 SL1 ROHS
From below Capacitance range (pF)	1.0	2.5	4.0	6.0	7.0	10.0	5.0
To above	4.5	10.0	18.0	35.0	40.0	50.0	25.0
Working Voltage (VDC)	250 VDC						
Test Voltage (VDC)	500 VDC						
Working Temp. range	55°C to +125°C						
Temp. Coeff. (ppm/°C)	50+/ 50	100+/ 200	400+/ 200	1100+/ 300	1100+/ 300	1500+/ 500	NPO+/ 150
Setting drift	< 1%						
Typical Q@100 MHz,CMax	1000	1000	700	200	200	200	200
Insulation Resistance (MΩ)	10000 min						

II. Typical Q factor

Typical Q factor of AT 9402G ROHS series tuned at Max capacitance



Typical Q factor of AT 9410G ROHS series tuned at Max capacitance



SMD THIN CERAMIC TRIMMER CAPACITORS AT 9402G & AT 9410G RoHS SERIES

SURFACE MOUNT TRIMMER CAPACITORS, RoHS COMPLIANT

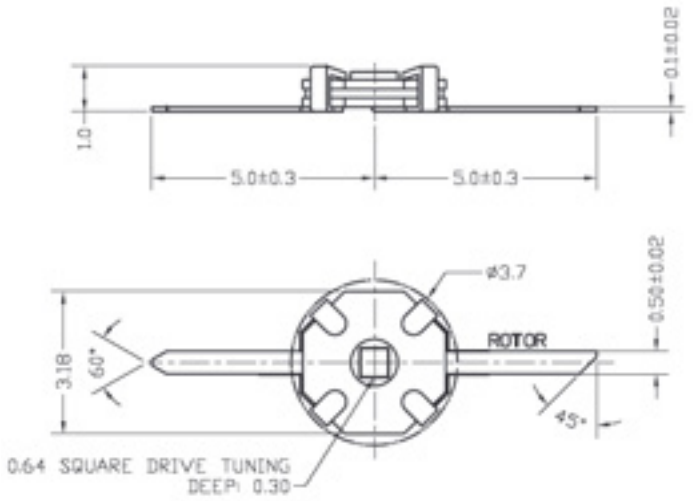
III. Mechanical and general specifications

P/N	AT 9402G ROHS Series	AT 9410G ROHS Series
Rotating torque (cN.cm)	5 to 70	14 to 140
Shock	100g @ 6ms	
Vibration	15g @ 10 200 Hz	
Moisture resistance	MIL STD 202, Method 106	

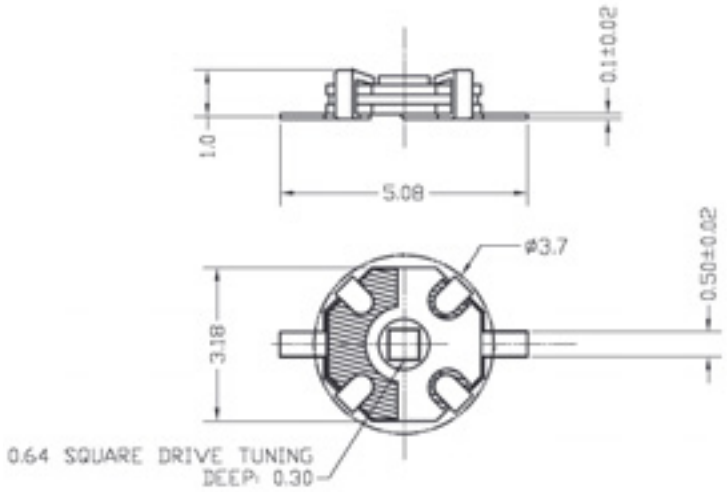
IV. Outline Dimensions

IV-1. AT 9402G series

Standard model

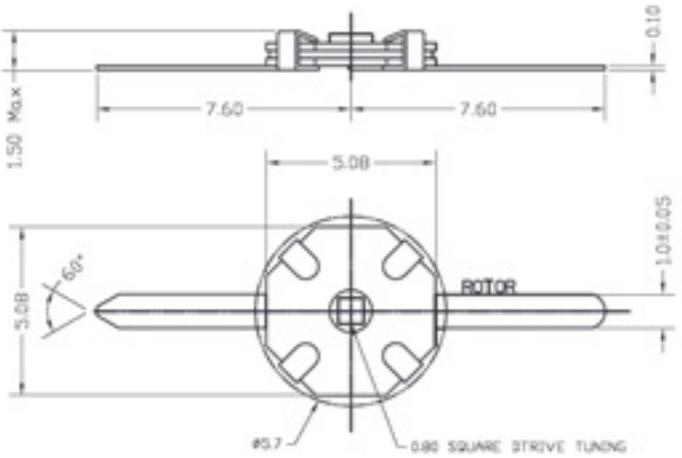


SL1 model

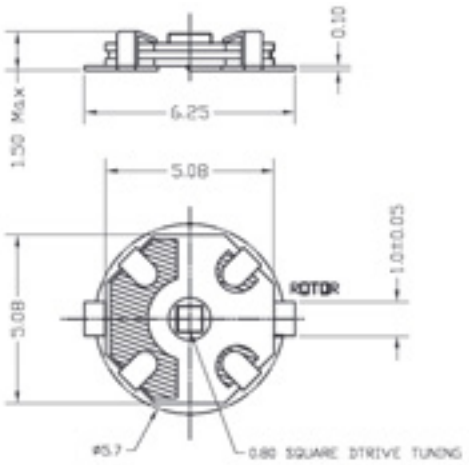


IV-2. AT 9410G series

Standard model

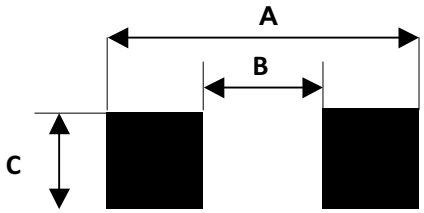


SL1 model



V. Soldering

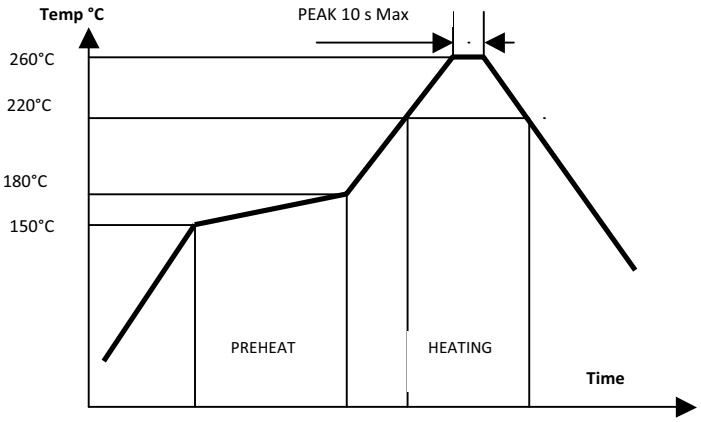
Typical solder pad layout for SL1 model



Dim in mm	AT 9402G SL1	AT 9410G SL1
A	5.3	6.6
B	3.2	5.3
C	1.0	1.5

Recommended reflow solder temperature profile

Maximum Soldering Temperature 260°C MAX



VI. Packaging

VI-1. AT 9402G series

Standard model: in bulk

SL1 model: in bulk for quantity lower than 1.5 kp
on tape and reel in 12 mm width carrier tape in quantities of 1500 p on 7 inches reel

VI-2. AT 9410G series

Standard model: in bulk

SL1 model: in bulk for quantity lower than 3.0 kp
on tape and reel in 24 mm width carrier tape in quantities of 3000 p on 13 inches reel

SMD THIN CERAMIC TRIMMER CAPACITORS AT 9402G & AT 9410G RoHS SERIES

SURFACE MOUNT TRIMMER CAPACITORS, RoHS COMPLIANT

VII. How to order

Standard model and SL1 model in qty < 1.5 kp for AT 9402G SL1 and qty < 3.0 kp for AT 9410G SL1

	Reference	ROHS
Examples	**AT 9402G-1**	**ROHS**
	AT 9410G-5 SL1	**ROHS**

	Reference	R3	ROHS
AT 9402G SL1 model on tape and reel :			
Example for Qty 1.5 kp	**AT 9402G-4 SL1**	**R3**	**ROHS**
AT 9410G SL1 model on tape and reel :			
Example for Qty 3.0 kp	**AT 9410G-2 SL1**	**R7**	**ROHS**

VIII. Tuning tool

Tuning Tool reference: AT 4192 for AT 9402G series
AT 4193 for AT 9410G series

IX. Recommendations for cleaning

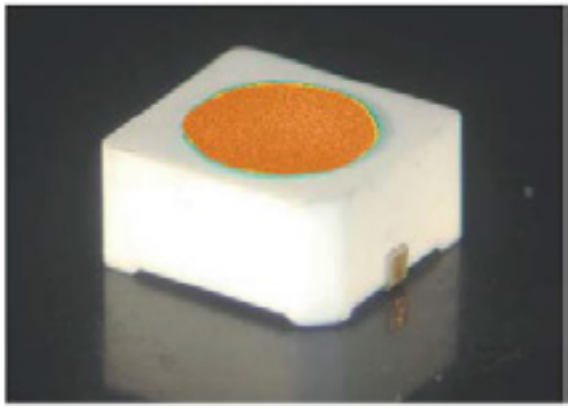
SMD Thin AT 9402G ROHS and AT 9410G ROHS series are compatible with a wide variety of cleaning process including those that utilize aqueous or semi-aqueous solutions, alcohol solutions, de-ionized water and numerous other cleaners. However, due to the large variety of such processes, the customer through cleaning process evaluation in conjunction with EXXELIA TEMEX product purchased must determine actual compatibility. SMD Thin AT 9401G ROHS and AT 9410G ROHS series capacitors should be cleaned in contamination free solution. If rough torque occurs after cleaning, re-clean in fresh solution.

HERMETIC CERAMIC TRIMMER CAPACITORS AT 23XXG SERIES

SURFACE MOUNT TRIMMER CAPACITORS, RoHS COMPLIANT

Description

Ceramic dielectric
Very compact package type (alumina housing)
Withstand harsh environments
Resistant to penetration of solder fluxes and cleaning solvents
Rated voltage 250 VDC
Low capacitance drift, very stable over time
Terminations are **gold plated**
RoHS compliant
High resonance frequency and very good Q
Non magnetic component
Delivered on 12 mm tape and reel
Max Soldering Temperature 260°C, 10s Max



Applications

RF power amplifier, LC filters
Military and Avionics equipment
Medical devices
DR/Crystal Oscillators
Broadband wireless LAN
Telemetry
Medical devices

I. Electrical specifications

P/N	AT 2320G-0 ROHS	AT 2320G-1 ROHS	AT 2320G-2 ROHS	AT 2320G-3 ROHS	AT 2340G-4 ROHS
From below Capacitance range (pF)	0.6	1.0	2.5	7.5	8.5
To above	2.5	5.0	10.0	18.0	22.0
Working Voltage (VDC)	250				
Withstanding Voltage (VDC)	500				
Working Temp. range	-55°C to +125°C				
Temp. Coeff. (ppm/°C)	100+/-200	100+/-200	100+/-200	-450+/-300	-1100+/-300
Setting drift	< 1%				
Typical Q @ 100 MHz, CMax	>3000	>1000	>1000	>500	>300
Insulation Resistance (MΩ)	10000 min				

II. Mechanical and general specifications

P/N	AT 2320G-0 ROHS	AT 2320G-1 ROHS	AT 2320G-2 ROHS	AT 2320G-3 ROHS	AT 2340G-4 ROHS
Rotating torque	4 to 70 cN.cm				
Shock	100g @ 6 ms				
Vibration	15g @ 10-2000 Hz				
Moisture resistance	MIL-STD-202, Method 106				

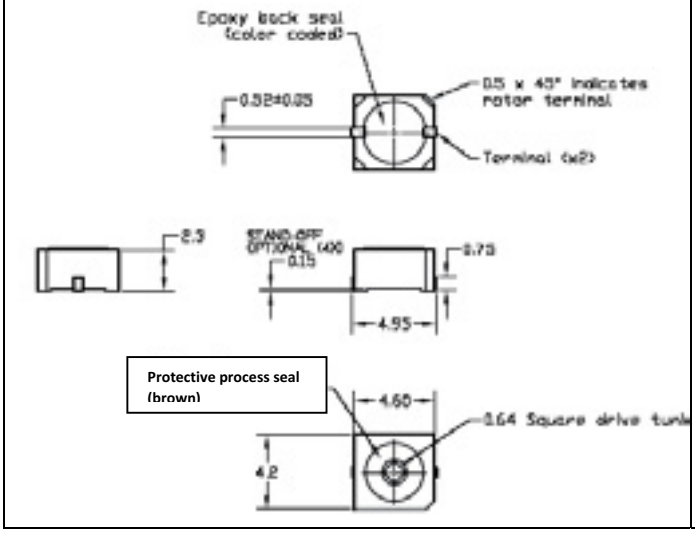
HERMETIC CERAMIC TRIMMER CAPACITORS AT 23XXG SERIES

SURFACE MOUNT TRIMMER CAPACITORS, RoHS COMPLIANT

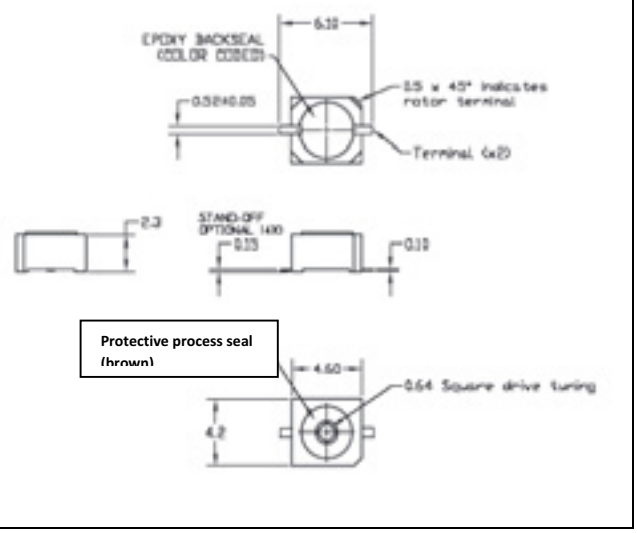
Color of epoxy back seal, on bottom side, is the color code

III. Outline dimensions

Standard model

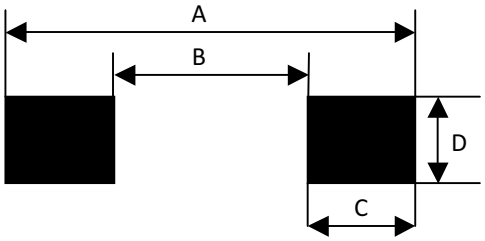


SL1 model



IV. Soldering

Typical solder pad layout



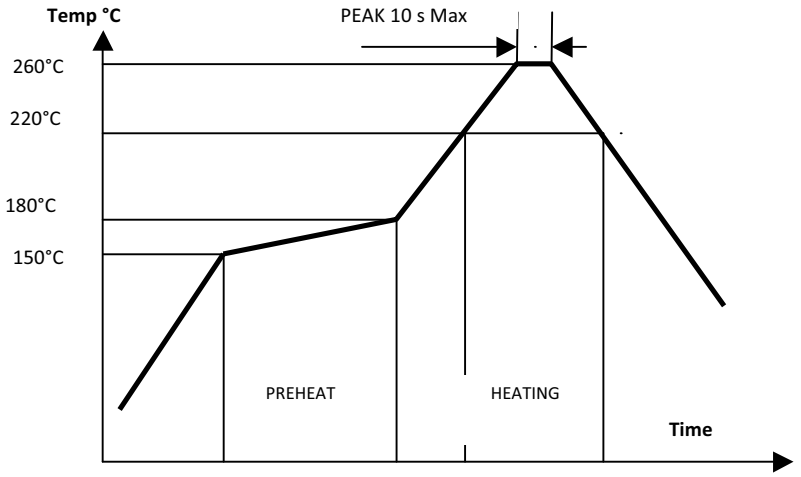
Dim in mm	Standard model	SL model
A	5.6	6.8

Recommended reflow solder temperature profile

HERMETIC CERAMIC TRIMMER CAPACITORS AT 23XXG SERIES

SURFACE MOUNT TRIMMER CAPACITORS, RoHS COMPLIANT

Maximum Soldering Temperature 260°C MAX



V. Packaging

Parts delivered :

- in bulk for quantity lower than 500 p
- on tape and reel in 12 mm width carrier tape in quantities of 500 p on 7 inches reel 7

VI. How to order

Parts in quantity < 500 p	Reference RoHS
Example	**AT 2320G-1 RoHS**
Parts on tape and reel :	Reference R1 ROHS
Examples	**AT 2320G-2 R1 ROHS** **AT 2320G-1 SL R1 ROHS**

VII. Tuning tool

Tuning Tool reference: AT 4192-1

VIII. Storage instructions

Hermetic Ceramic Trimmer Capacitors are packed with a 1/6 unit of dessicant and must remain in their original packing as long as possible before soldering. Care should be taken to make sure the re-sealable outer bag is completely sealed after each use.
All Hermetic Ceramic Trimmer Capacitors should be stored in a temperature and humidity controlled environment.
If Hermetic Ceramic Trimmer Capacitors need to be re-packed then they must be packed in a re-sealable poly/metal anti-static bag with a fresh 1/6 unit of dessicant.
If Hermetic Ceramic Trimmer Capacitors have been inadvertently left exposed to ambient humidity, then dry the units per the following procedure:

For units that are **not** in tape & reel packaging
Place units in an oven at 35°C for 8 hours minimum or faster drying may be done at 120°C-150°C for 60 to 90 minutes. Re-pack using fresh dessicant packs after drying.
For units that are in tape & reel packaging
Place units in an oven at 35°C for 8 hours minimum. Re-pack using fresh dessicant packs after drying

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