

# High Temperature High Voltage Ceramic Capacitors

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F-3106G 3/10

The Capacitance Company  
**KEMET**  
CHARGED.™

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**HIGH TEMPERATURE CERAMIC CAPACITORS**

HT/HP - Standard Series - (+200°C) Ceramic Capacitors C0G (NP0), X7R Dielectric .....7-9

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**HIGH VOLTAGE CERAMIC CAPACITORS**

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# High Temperature, High Voltage Performance Characteristics

## GENERAL SPECIFICATIONS

### Working Voltage:

C0G	50, 100, 200, 500, 1k, 2k, 3k, 4k, 5k, 7.5k, 10k, 15k, 20k
X7R	50, 100, 200, 500, 1k, 2k, 3k, 4k, 5k, 7.5k, 10k, 15k, 20k, 30k, 40k, 50k
X5U	3k, 4k, 5k, 7.5k, 10k, 15k, 20k

### Temperature Characteristics:

C0G	0 + 30 PPM / °C from -55°C to +125°C (1)
X7R	+15% from -55°C to +125°C
X5U	+22%, -56% from -55°C to +85°C

### Capacitance Tolerance:

C0G	+0.5pF, +1%, +2%, +5%, +10%
X7R	±5%, ±10%, ±20%, +80% / -20%, +100% / -0%
X5U	±5%, ±10%, ±20%, +80% / -20%, +100% / -0%

### Construction:

- Epoxy encapsulated - meets flame test requirements of UL Standard 94V-0.
- High-temperature solder - meets EIA RS-198, Method 302, Condition B (260°C for 10 seconds)

### Termination Material:

- Check individual Series: Part Number and Ordering Information for Termination Materials offered in each series.

### Solderability:

- MIL-STD 202, Method 208  
(Test Method: ANSI/J-STD-002)
- Test A for through-hole mount and surface mount leaded.
- Test B for surface mount leadless components.

### Terminal Strength:

- MIL-STD 202, Method 208, Condition A (2.3kg or 5 lbs)

### Resistance to Solvents:

- MIL-STD 202, Method 215

### Resistance to Soldering Heat:

- MIL-STD 202, Method 210, Test Condition C

## ELECTRICAL

### Capacitance @ 25°C:

- Within specified tolerance and following test conditions per MIL-STD 202, Method 305.  
C0G, X7R & X5U  
> 100pF with 1.0 vrms @ 1 kHz with 1.0 vrms  
< 100pF with 1.0 vrms @ 1 MHz with 1.0 vrms

### Dissipation Factor @ 25°C:

- Same test conditions as capacitance.  
C0G - 0.15% maximum  
X7R - 2.5% maximum  
X5U - 2.5% maximum

### Insulation Resistance @25°C:

- MIL-STD 202, Method 302  
C0G & X7R:  
100 gigohm or 1 gigohm x uF, whichever is less.  
<500V test @ rated voltage, >1kV test @ 500V.
- X5U:  
10 gigohm or 100 megohm x uF, whichever is less.  
<500V test @ rated voltage, >1kV test @ 500V.

### Dielectric Withstanding Voltage:

- MIL-STD 202, Method 301  
<200V test @ 250% of rated voltage  
500V to 1250V test @ 150% of rated voltage  
>1251V test @ 120% of rated voltage

## ENVIRONMENTAL

### Vibration:

- MIL-STD 202, Method 204, Condition D (20g)

### Shock:

- MIL-STD 202, Method 213, Condition I (100g)

### Life Test:

- MIL-STD 202, Method 108

### <200V

- C0G - 200% rated voltage @ +125°C  
X7R - 200% rated voltage @ +125°C

### >500V

- C0G - rated voltage @ +125°C  
X7R - rated voltage @ +125°C  
X5U - rated voltage @ +85°C

### Post Test Limits @ 25°C are:

#### Capacitance Change:

- C0G (< 200V) - +3% or 0.25pF, whichever is greater.
- C0G (> 500V) - +3% or 0.50pF, whichever is greater.
- X7R - +20% of initial value (2)

#### Dissipation Factor:

- C0G - 0.25% maximum  
X7R & X5U - 3.0% maximum

#### Insulation Resistance:

- C0G & X7R:  
100 gigohm or 1 gigohm x uF, whichever is less.  
<500V test @ rated voltage, >1kV test @ 500V.

#### X5U:

- 10 gigohm or 100 megohm x uF, whichever is less.  
<500V test @ rated voltage, >1kV test @ 500V.

### Moisture Resistance:

- MIL-STD 202, Method 106

#### Post Test Limits @ 25°C are:

#### Capacitance Change:

- C0G (< 200V) - +3% or 0.25pF, whichever is greater.
- C0G (> 500V) - +3% or 0.50pF, whichever is greater.
- X7R - +20% of initial value (2)

#### Dissipation Factor:

- C0G - 0.25% maximum  
X7R & X5U - 3.0% maximum

#### Insulation Resistance:

- C0G & X7R:  
100 gigohm or 1 gigohm x uF, whichever is less.  
<500V test @ rated voltage, >1kV test @ 500V.

#### X5U:

- 10 gigohm or 100 megohm x uF, whichever is less.  
<500V test @ rated voltage, >1kV test @ 500V.

### Thermal Shock:

- MIL-STD 202, Method 107, Condition A

- C0G & X7R: -55°C to 125°C

- X5U: -55°C to 85°C

- (1) +53 PPM -30 PPM/ °C from +25°C to -55°C, +60 PPM below 10pF.
- (2) X7R & X5U dielectrics exhibit aging characteristics; therefore, it is highly recommended that capacitors be deaged for 2 hours at 150°C and stabilized at room temperature for 48 hours before capacitance measurements are made.

	HIGH TEMPERATURE	HIGH VOLTAGE
<b>MILITARY &amp; AEROSPACE</b>		
Avionics	X	X
Radar Systems	X	X
Telemetry, Data Tx/Rx		X
Control Systems	X	
<b>MEDICAL</b>		
.5 to 1.5 Tesla MR1 &		X
NM1 Tuning Coils		X
1 to 3 Tesla MR1 Gradient		X
Coils & Magnetic Rings		X
CT-Scanner		X
Medical MRI		X
X-Ray Generator	X	X
<b>SEMICONDUCTOR</b>		
RF Tuning Networks		X
RF Power Supplies		X
Semiconductor Manufacturing	X	
<b>SECURITY</b>		
Handheld Scanners		X
Intruder Detection Systems		X
Luggage Scanners		X
Metal/Explosive Detector		X
<b>OTHER</b>		
LCD Backlight Inverter		X
Electric Ballast for CFL	X	X
Electric Ballast for Fluorescent Lamp	X	X
Measurement Equipment	X	X
Microwave/Convection Ovens	X	X
<b>POWER SUPPLY</b>		
HV Power Supply	X	X
Power Station Equipment		X
Power Supply for Air Conditioner, Washing Machine		X
Inverter Power Supply-AC	X	
<b>TELECOM</b>		
Base Station Power amps		X
Broadcasting Equipment		X
<b>MODEM</b>		
DAA Modem		X
xDSL Modem		X
LAN, Router, HUB, Switches		X
RF Power Amplifiers		X
<b>INDUSTRIAL</b>		
Oil Rigging, Down Hole, Mining	X	X

# KEMET High Voltage Technical Summary

	ELECTRICAL			ENVIRONMENTAL	MECHANICAL
	Voltage Range	Capacitance Range	Dissipation Factor	Operating Temperature Range	Configuration
<b>HIGH VOLTAGE</b>					
Radial Conformally Coated					
Std	C0G/X7R: 500 to 10k VDC	C0G:12 pF - .330µF X7R: 220 pF - 5.6 µF	C0G: 0.15% max X7R: 2.5% max	C0G: -55°C to + 125°C X7R: -55°C to + 125°C	Radial
Mil-PRF-49467 Equivalent	C0G/X7R: 600 to 5k VDC	C0G: 12 pF - .68 µF X7R: 27 pF - .47 µF	C0G: 0.15% max X7R: 2.5% max	C0G/X7R: -55°C to + 125°C	Radial
Space Quality	C0G/X7R: 500 to 10k VDC	C0G/X7R: 560 pF - 2.20µF	C0G: 0.15% max X7R: 2.5% max	C0G/X7R: -55°C to + 125°C	Radial
Ceramic Surface Mount Chip					
Military	C0G/X7R: 500 to 5k VDC	C0G: 12 pF - .10 µF X7R: 270 pF -2.50 µF	C0G: 0.15% max X7R: 2.5% max	C0G/X7R: -55°C to + 125°C	Chip
Leaded Chips J or L lead	C0G/X7R: 500 to 10k VDC	C0G: 12 pF-.330 µF X7R: 220 pF-5.6 µF	C0G: 0.15% max X7R: 2.5% max	C0G/X7R: -55°C to + 125°C	Leaded Chip J or L Lead
Disc	C0G/X5U: 3k to 20k VDC, X7R:3k to 50k VDC	C0G: 1.2 pF-236 pF X7R: 10 p -7400 pF X5U: 80 pF-17300 pF	C0G: 0.15% max X7R: 2.5% max X5U: 2.5% max	C0G/X7R: -55°C to + 125°C X5U: -55°C to + 85°C	Disc
Disc Stack	C0G/X7R/X5U: 5k to 20k VDC	C0G: 1.2 pF-141 pF X7R: 37 pF-4400 pF X5U: 80 pF-10400 pF	C0G: 0.15% max X7R: 2.5% max X5U: 2.5% max	C0G/X7R: -55°C to + 125°C X5U: -55°C to + 85°C	Disc Stack

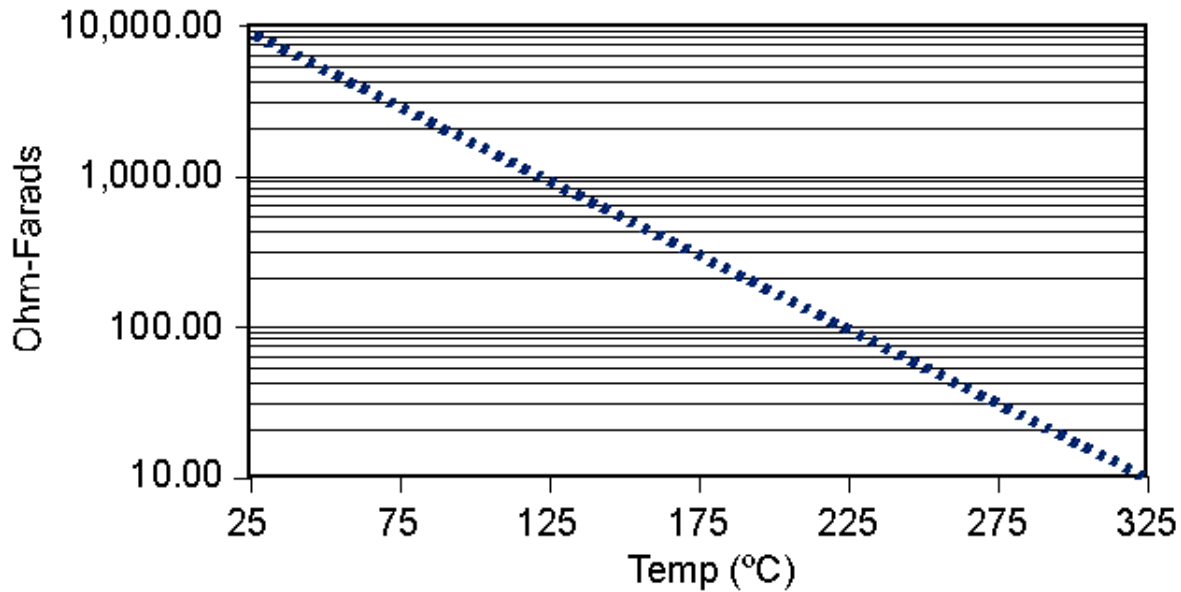
## HIGH TEMPERATURE

Hi Temp (HT/HP)	100 to 200 VDC	-C0G: 22 pF-.100 µF X7R:1000 pF-1.0µF	C0G 0.15% X7R Type 2.0% X7R 2.50%	-55°C to + 200°C	Axial/Radial
Hi Temp Hi Volt (HV)	500 to 4000 VDC	C0G: 390 pF-.015 µF X7R:1400 pF- .270 µF	C0G 0.15% X7R Type 2.0% X7R 2.50%	-55°C to + 200°C	Radial
Ceramic Cased Capacitor					
Std 125°C (SCR/SRR/SCA/SRA)	50 to 200 VDC	C0G: 1.0 pF- .12 µF X7R:100 pF- 6.8 µF	C0G 0.15% X7R 2.50%	-55°C to + 125°C	Axial/Radial
200°C (ACR/ARR/ACA/ARA)	50 to 100 VDC	C0G: 1.0 pF- .12 µF X7R:100 pF- 3.3 µF	C0G 0.15% X7R 2.50%	-55°C to + 200°C	Axial/Radial
260°C (TCR/TRR/TCA/TRA)	50 to 100 VDC	C0G: 1.0 pF- .12 µF X7R:100 pF- 3.3 µF	C0G 0.15% X7R 2.50%	-55°C to + 260°C	Axial/Radial
Hi Temp Hi Volt (VCR/VRR)	500 to 5000 VDC	C0G: 10 pF-.056 µF X7R:330 pF-1.2µF	C0G 0.15% X7R 2.50%	-55°C to + 200°C	Radial

**DIELECTRIC COMPARISONS**

Features	Ultra Stable	Semi-Stable High Voltage	Semi-Stable Hi-Temp	Temp/Volt Dependent
Dielectric Type	C0G (NP0)	X7R	X7R type	X5U
Temperature Coefficient	0 ±30ppm/°C	±15%	+15/-40%	+22-56%
Operating Temp. Range	-55 to +200°C	-55 to +125°C	-55 to +200°C	-55 to +125°C
Dissipation Factor	0.1% max.	2.5% max.	2.0% max.	2.5% max.
Aging Rate	None	-2.0% max/dec. hour	-2.0% max/dec. hour	-2.0% max/dec. hour
Voltage Range	25 to 20k VDC	50 to 50k VDC	25 to 4k VDC	Up to 20K VDC
Standard Tolerance	J, K, M	K, M, P, Z	K, M, P, Z	M, P, Z
Coefficient of Thermal Expansion @ 25°C	9 X 10-6 IN/IN °C	11 X 10-6 IN/IN °C	11 X 10-6 IN/IN °C	11 X 10-6 IN/IN °C

**TYPICAL INSULATION RESISTANCE VS. TEMP (°C)  
FOR C0G, NP0 & X7R DIELECTRICS**



# High Temperature (+200°C) Axial and Radial Ceramic Capacitors

## HT/HP Series

### FEATURES

The HT/HP Series is used in robust applications

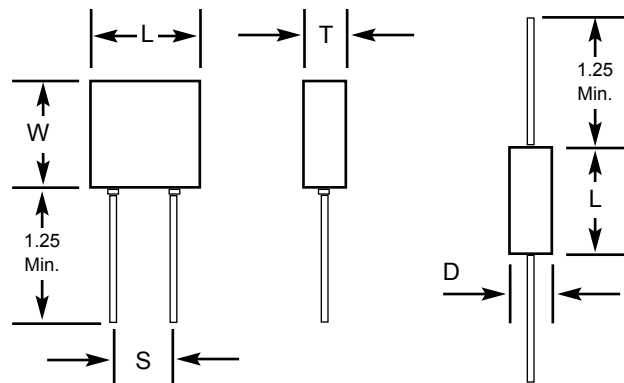
- Down Hole
- Industrial
- Harsh Environments

Where a Radial/Axial coated capacitor can withstand high temperatures (200°C).

#### NOTE:

Other tolerances, higher capacitance values, voltages, or special package configurations are available upon request.

### CAPACITOR OUTLINE DRAWING



### DIMENSIONS

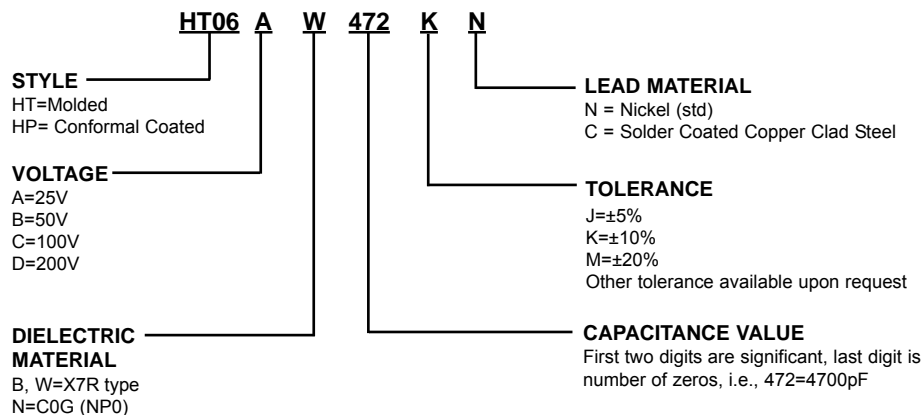
Molded (HT) and Conformal Coated (HP), Radial Lead Types

Style	Sizes in Inches (mm) max			Lead Spacing ±0.030 (S)
	Length (L)	Width (W)	Thickness (T)	
HT05	.200 (5.08)	.200 (5.08)	.100 (2.54)	.100 (2.54)
HT55	.200 (5.08)	.200 (5.08)	.100 (2.54)	.200 (5.08)
HT06	.300 (7.62)	.300 (7.62)	.150 (3.81)	.200 (5.08)
HT08	.500 (12.70)	.500 (12.70)	.250 (6.35)	.400 (10.16)
HT09	.700 (17.78)	.400 (10.16)	.200 (5.08)	.500 (12.70)

Tubular Case, Axial Lead Types

Style	Sizes in Inches (mm) max	
	Length (L)	Diameter (D)
HT11	.170 (4.32)	.100 (2.54)
HT13	.260 (6.60)	.135 (3.43)
HT14	.400 (10.16)	.155 (3.94)
HT15	.500 (12.70)	.200 (5.08)
HT16	.750 (19.05)	.375 (9.52)

### PART NUMBER AND ORDERING INFORMATION



**MARKING**  
(HT05, HT55, HT11)  
472K  
KEC

(All other sizes)  
HT06AW472K  
KEC  
Date Code

For CONFORMAL COATED types, change style number to HPXX. HP dimensions will be reduced slightly.

## COG & X7R DIELECTRIC

COG RADIAL																
STYLE		HT/HP 05			HT/HP 55			HT/HP 06			HT/HP 08			HT/HP 09		
Cap	Cap Code	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200
		L MAX	.200 (5.08)			.200 (5.08)			.300 (7.62)			.500 (12.70)			.700 (17.78)	
	W MAX	.200 (5.08)			.200 (5.08)			.300 (7.62)			.500 (12.70)			.400 (10.16)		
	T MAX	.100 (2.54)			.100 (2.54)			.150 (3.81)			.250 (6.35)			.200 (5.08)		
	S± .030	.100 (2.54)			.200 (5.08)			.200 (5.08)			.400 (10.16)			.500 (12.70)		
	Lead Dia.	.025 (.635)			.025 (.635)			.025 (.635)			.025 (.635)			.025 (.635)		
	Cap Code	WVDC			WVDC			WVDC			WVDC			WVDC		
22pF	220															
27	270															
33	330															
39	390															
47	470															
56	560															
68	680															
82	820															
100	101															
120	121															
150	151															
180	181															
220	221															
270	271															
330	331															
390	391															
470	471															
560	561															
680	681															
820	821															
1000	102															
1200	122															
1500	152															
1800	182															
2200	222															
2700	272															
3300	332															
3900	392															
4700	472															
5600	562															
6800	682															
8200	822															
.010 uF	103															
0.012	123															
0.015	153															
0.018	183															
0.022	223															
0.027	273															
0.033	333															
0.039	393															
0.047	473															
0.056	563															
0.068	683															
0.082	823															
0.10	104															
0.12	124															

X7R RADIAL																
STYLE		HT/HP 05			HT/HP 55			HT/HP 06			HT/HP 08			HT/HP 09		
Cap	Cap Code	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200
		L MAX	.200 (5.08)			.200 (5.08)			.300 (7.62)			.500 (12.70)			.700 (17.78)	
	W MAX	.200 (5.08)			.200 (5.08)			.300 (7.62)			.500 (12.70)			.400 (10.16)		
	T MAX	.100 (2.54)			.100 (2.54)			.150 (3.81)			.250 (6.35)			.200 (5.08)		
	S± .030	.100 (2.54)			.200 (5.08)			.200 (5.08)			.400 (10.16)			.500 (12.70)		
	Lead Dia.	.025 (.635)			.025 (.635)			.025 (.635)			.025 (.635)			.025 (.635)		
	Cap Code	WVDC			WVDC			WVDC			WVDC			WVDC		
1000pF	102															
1200	122															
1500	152															
1800	182															
2200	222															
2700	272															
3300	332															
3900	392															
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0.056	563															
0.068	683															
0.082	823															
0.10	104															
0.12	124															
0.15	154															
0.18	184															
0.22	224															
0.27	274															
0.33	334															
0.39	394															
0.47	474															
0.56	564															
0.68	684															
0.82	824															
1.0	105															
1.2	125															
1.5	155															
1.8	185															
2.2	225															
2.7	275															
3.3	335															
3.9	395															
4.7	475															
5.6	565															



# High Temperature (+200°C) Axial and Radial Ceramic Capacitors HT/HP Series

## COG & X7R DIELECTRIC

COG AXIAL																
STYLE		HT/HP 11			HT/HP 13			HT/HP 14			HT/HP 15			HT/HP 16		
Cap	L MAX	.170 (4.32)			.260 (6.60)			.400 (10.16)			.500 (12.70)			.750 (19.05)		
	D MAX	.100 (2.54)			.135 (3.43)			.155 (3.94)			.200 (5.08)			.375 (9.52)		
	Lead Dia.	.025 (.635)			.025 (.635)			.025 (.635)			.025 (.635)			.025 (.635)		
	Cap Code	WVDC			WVDC			WVDC			WVDC			WVDC		
		50	100	200	50	100	200	50	100	200	50	100	200	50	100	200
5.6pF	569															
6.8	689															
8.2	829															
10	100															
12	120															
15	150															
18	180															
22	220															
27	270															
33	330															
39	390															
47	470															
56	560															
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82	820															
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0.027	273															
0.033	333															
0.039	393															
0.047	473															
0.056	563															
0.068	683															
0.082	823															
0.10	104															

X7R AXIAL																
STYLE		HT/HP 11			HT/HP 13			HT/HP 14			HT/HP 15			HT/HP 16		
Cap	L MAX	.170 (4.32)			.260 (6.60)			.400 (10.16)			.500 (12.70)			.750 (19.05)		
	D MAX	.100 (2.54)			.135 (3.43)			.155 (3.94)			.200 (5.08)			.375 (9.52)		
	Lead Dia.	.025 (.635)			.025 (.635)			.025 (.635)			.025 (.635)			.025 (.635)		
	Cap Code	WVDC			WVDC			WVDC			WVDC			WVDC		
		50	100	200	50	100	200	50	100	200	50	100	200	50	100	200
100pF	101															
120	121															
150	151															
180	181															
220	221															
270	271															
330	331															
390	391															
470	471															
560	561															
680	681															
820	821															
1000	102															
1200	122															
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3300	332															
3900	392															
4700	472															
5600	562															
6800	682															
8200	822															
.010uF	103															
0.012	123															
0.015	153															
0.018	183															
0.022	223															
0.027	273															
0.033	333															
0.039	393															
0.047	473															
0.056	563															
0.068	683															
0.082	823															
0.1	104															
0.12	124															
0.15	154															
0.18	184															
0.22	224															
0.27	274															
0.33	334															
0.39	394															
0.47	474															
0.56	564															
0.68	684															
0.82	824															
1.0	105															
1.2	125															
1.5	155															
1.8	185															
2.2	225															
2.7	275															

### FEATURES

The HV series not only withstands high temperatures (200°C), but also offers high voltage (500-4000 VDC)

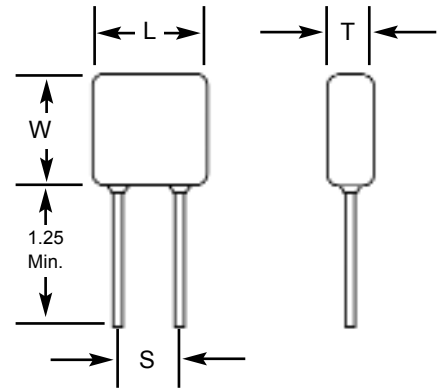
To be used in robust applications

- Down Hole
- Industrial
- Harsh Environments

**NOTE:**

Other tolerances, higher capacitance values, voltages, or special package configurations are available upon request.

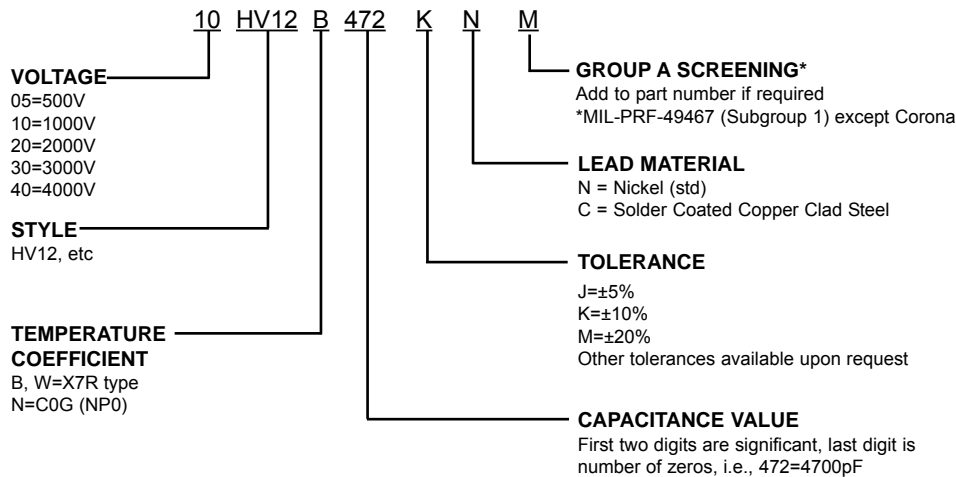
### CAPACITOR OUTLINE DRAWING



### DIMENSIONS

Style	Sizes in Inches (mm) max.			Lead Spacing ±0.030 (S)
	Length (L)	Width (W)	Thickness (T)	
HV10	.250 (6.35)	.220 (5.59)	.150 (3.81)	.170 (4.32)
HV11	.320 (8.13)	.300 (7.62)	.250 (6.35)	.200 (5.08)
HV12	.420 (10.67)	.400 (10.16)	.250 (6.35)	.300 (7.62)
HV13	.520 (13.21)	.500 (12.70)	.300 (7.62)	.400 (10.16)
HV14	.620 (15.75)	.500 (12.70)	.300 (7.62)	.500 (12.70)
HV15	.720 (18.29)	.700 (17.78)	.300 (7.62)	.600 (15.24)
HV16	.820 (20.83)	.700 (17.78)	.350 (8.89)	.700 (17.78)

### PART NUMBER AND ORDERING INFORMATION



**MARKING**

(HV10, HV11)  
472M  
KEC  
Date Code

(All other sizes)  
HV12B472M  
1kV  
KEC  
Date Code

# High Temperature (+200°C), High Voltage Radial Ceramic Capacitors HV Series

## COG DIELECTRIC

STYLE		HV10			HV11				HV12				HV13				HV14					HV15					HV16				
Cap	L MAX	.250 (6.35)			.320 (8.13)				.420 (10.67)				.520 (13.21)				.620 (15.75)					.720 (18.29)					.820 (20.83)				
	W MAX	.220 (5.59)			.300 (7.62)				.400 (10.16)				.500 (12.70)				.500 (12.70)					.700 (17.78)					.700 (17.78)				
	T MAX	.150 (3.81)			.250 (6.35)				.250 (6.35)				.300 (7.62)				.300 (7.62)					.300 (7.62)					.350 (8.89)				
	S ± .030	.170 (4.32)			.200 (5.08)				.300 (7.62)				.400 (10.16)				.500 (12.70)					.600 (15.24)					.700 (17.78)				
	Lead Dia. +0.004/-0.002	.025 (.635)			.025 (.635)				.025 (.635)				.025 (.635)				.025 (.635)					.025 (.635)					.025 (.635)				
	Cap Code	WVDC			WVDC				WVDC				WVDC				WVDC					WVDC					WVDC				
	500	1k	2k	500	1k	2k	3k	500	1k	2k	3k	500	1k	2k	3k	500	1k	2k	3k	4k	500	1k	2k	3k	4k	500	1k	2k	3k	4k	
12pF	120																														
15	150																														
18	180																														
22	220																														
27	270																														
33	330																														
39	390																														
47	470																														
56	560																														
68	680																														
82	820																														
100	101																														
120	121																														
150	151																														
180	181																														
220	221																														
270	271																														
330	331																														
390	391																														
470	471																														
560	561																														
680	681																														
820	821																														
1000	102																														
1200	122																														
1500	152																														
1800	182																														
2200	222																														
2700	272																														
3300	332																														
3900	392																														
4700	472																														
5600	562																														
6800	682																														
8200	822																														
0.01uF	103																														
0.012	123																														
0.015	153																														

X7R DIELECTRIC

STYLE		HV10			HV11			HV12			HV13				HV14				HV15				HV16					
Cap	L MAX	.250 (6.35)			.320 (8.13)			.420 (10.67)			.520 (13.21)				.620 (15.75)				.720 (18.29)				.820 (20.83)					
	W MAX	.220 (5.59)			.300 (7.62)			.400 (10.16)			.500 (12.70)				.500 (12.70)				.700 (17.78)				.700 (17.78)					
	T MAX	.150 (3.81)			.250 (6.35)			.250 (6.35)			.300 (7.62)				.300 (7.62)				.300 (7.62)				.350 (8.89)					
	S± .030	.170 (4.32)			.200 (5.08)			.300 (7.62)			.400 (10.16)				.500 (12.70)				.600 (15.24)				.700 (17.78)					
	Lead Dia. +0.004/-0.002	.025 (.635)			.025 (.635)			.025 (.635)			.025 (.635)				.025 (.635)				.025 (.635)				.025 (.635)					
	Cap Code	WVDC			WVDC			WVDC			WVDC				WVDC				WVDC				WVDC					
	500	1k	2k	500	1k	2k	500	1k	2k	500	1k	2k	3k	500	1k	2k	3k	4k	500	1k	2k	3k	4k	500	1k	2k	3k	4k
270pF	271																											
330	331																											
390	391																											
470	471																											
560	561																											
680	681																											
820	821																											
1000	102																											
1200	122																											
1500	152																											
1800	182																											
2200	222																											
2700	272																											
3300	332																											
3900	392																											
4700	472																											
5600	562																											
6800	682																											
8200	822																											
0.01uF	103																											
0.012	123																											
0.015	153																											
0.018	183																											
0.022	223																											
0.027	273																											
0.033	333																											
0.039	393																											
0.047	473																											
0.056	563																											
0.068	683																											
0.082	823																											
0.10	104																											
0.12	124																											
0.15	154																											
0.18	184																											
0.22	224																											
0.27	274																											
0.33	334																											
0.39	394																											
0.47	474																											

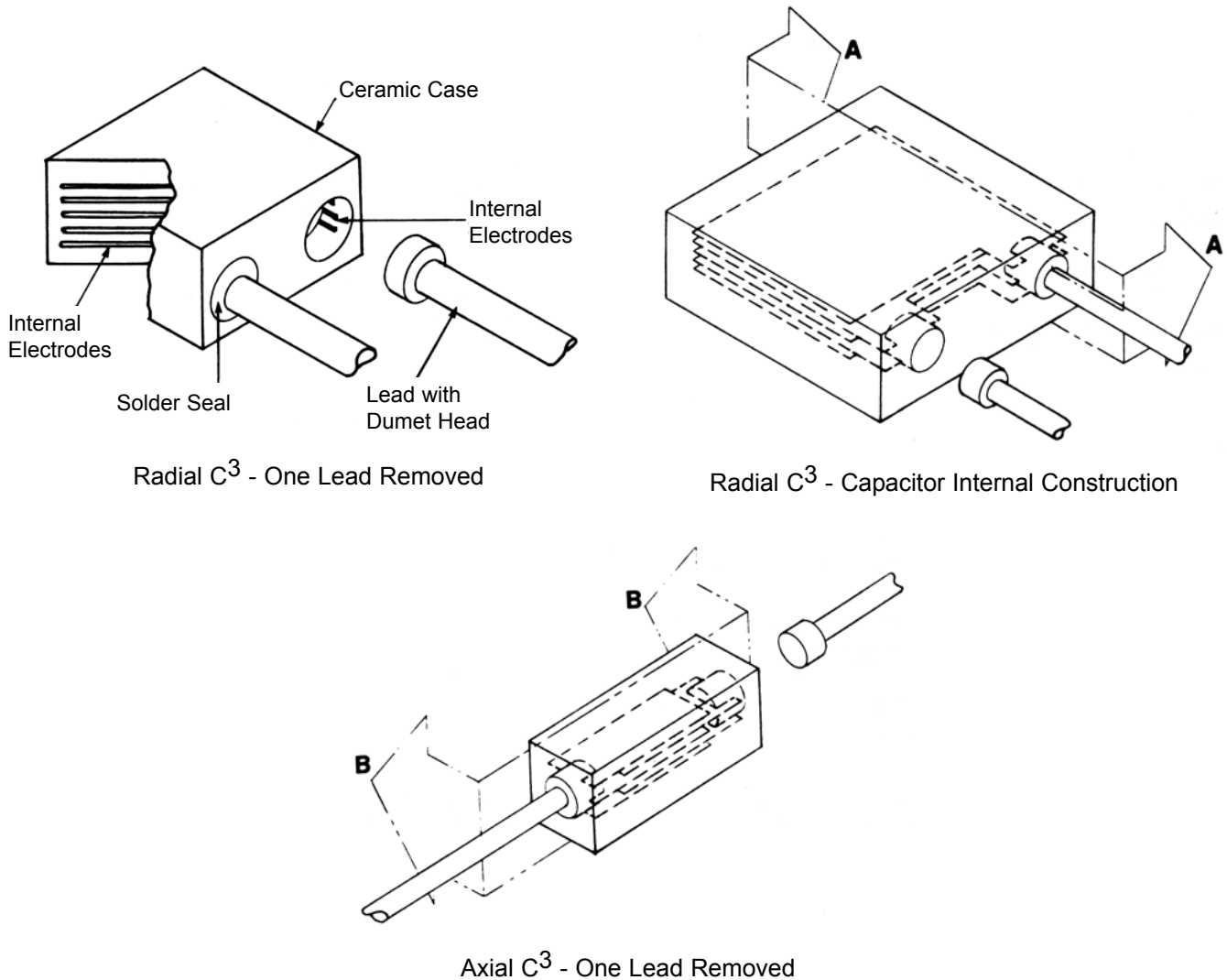
# High Temperature Ceramic Cased Capacitors C<sup>3</sup>

## C3 GENERAL INFORMATION

Monolithic ceramic capacitors are capable of withstanding and operating at temperatures up to +260°C when properly designed and manufactured for this application. A design has been developed which is ideal for operation at these high temperatures. This design is a Ceramic Cased Capacitor (C<sup>3</sup>) as described in PATENT #4,931,899.

The advantages of the C<sup>3</sup> construction at 125°C, 200°C and 260°C are:

- Uniform coefficient of linear expansion eliminates chip cracking during thermal shock.
- No "pull-away" of epoxy potting from epoxy case at elevated temperatures.
- Resistant to moisture penetration.
- Superior volumetric efficiency



**COG**

COG (NP0) capacitors which exhibit little change in capacitance with variations in temperature, are used in RF oscillators, precision timing circuits, wave filters and other circuits requiring a predictable linear temperature coefficient.

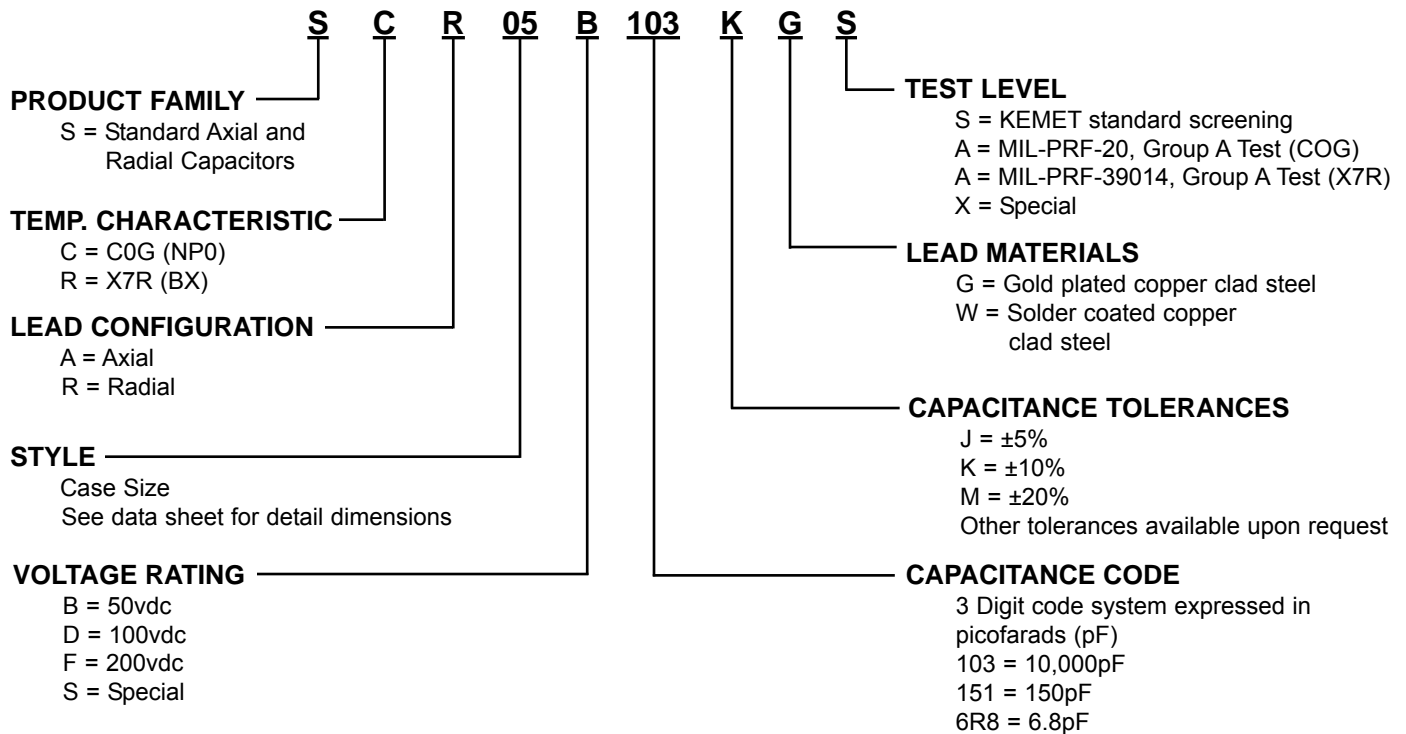
**X7R**

BX and X7R capacitors are used in coupling circuits (IF and RF); for bypassing and decoupling in computers and stereo systems; power supply line filtering and frequency discrimination.

**INSTALLATION:**

Parts should be soldered using a heat sink between the soldering point and the part using a soldering iron rated between 18-30 watts. Soldering temperature should not exceed +300°C. For wave soldering, the parts should be slowly heated to +150°C and, after soldering, be allowed to cool down slowly to +90°C to preclude thermal shocking of the parts.

**PART NUMBER AND ORDERING INFORMATION**



<b>MARKING</b>	
Manufacturer's ID	KEC
Capacitance	106J
Voltage	50V
Date Code	123

Note: Solderability testing is not required for gold leaded parts.







# High Temperature Standard (+200°C) Axial and Radial Ceramic Cased Capacitors (C<sup>3</sup>) ACR/ARR/ACA/ARA Series

High temperature ceramic cased capacitors, with a new, unique design concept, are ideally suited for continuous operation up to +200°C. Problems associated with epoxy cased/epoxy potted capacitors, such as material deterioration, cracks in cases and potted areas, are nonexistent, even at +200°C.

## COG

COG (NPO) capacitors, which exhibit little change in capacitance with variations in temperature, are used in RF oscillators, precision timing circuits, wave filters, and other circuits requiring a predictable linear temperature coefficient.

## X7R

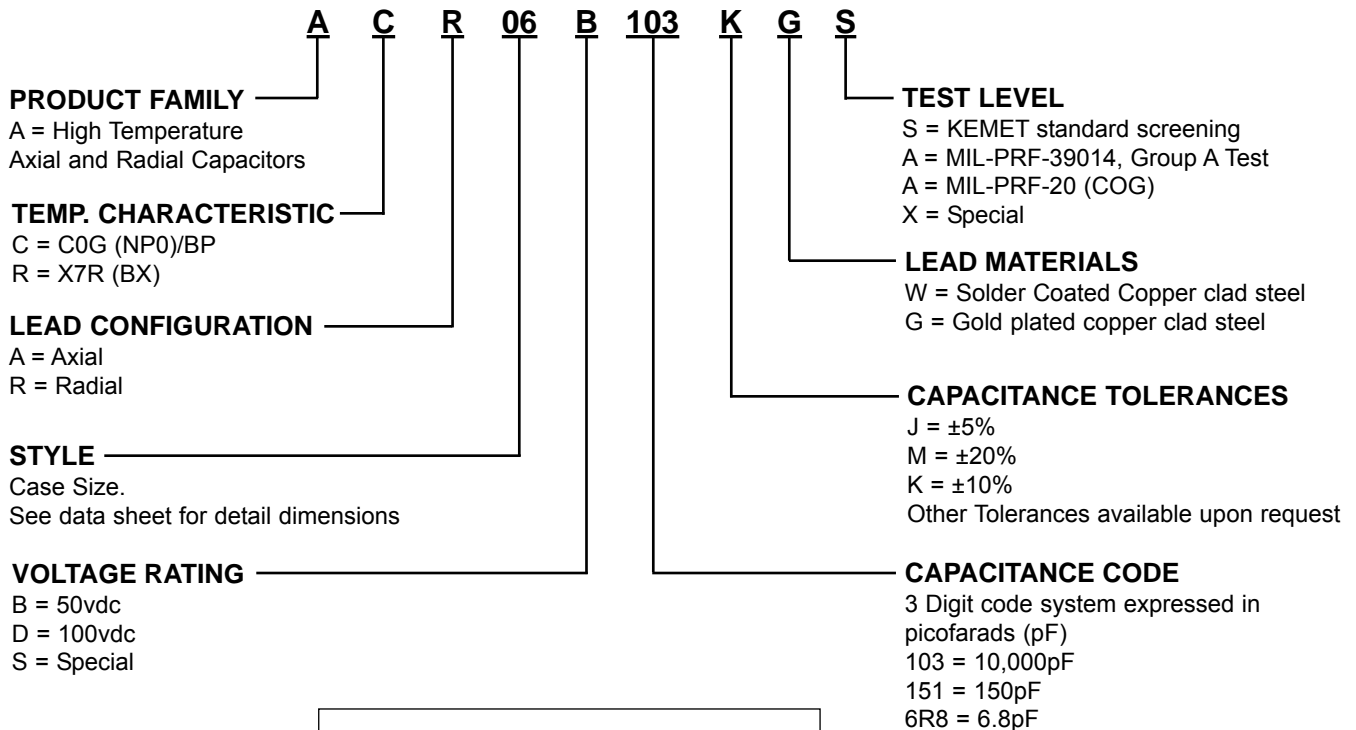
Specially formulated X7R ceramic materials result in a retention of 40% of the +25°C capacitance. Dissipation factor drops from 1.25% at +25°C to 0.1% at +200°C. At +120°C the ceramic undergoes a transformation (crystalline inversion) resulting in the material changing from ferroelectric to paraelectric - no piezoelectric behavior.

Typical applications include oil well logging (down hole), jet engine controls and geophysical pressure probes.

## INSTALLATION:

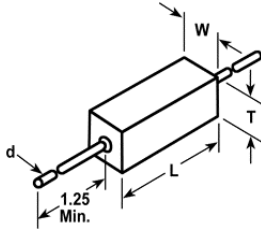
Parts should be soldered using a heat sink between the soldering point and the part using a soldering iron rated between 18-30 watts. Soldering temperature should not exceed +300°C.

## PART NUMBER AND ORDERING INFORMATION

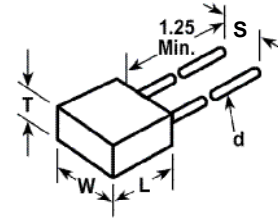


MARKING	
Manufacturer's ID	KEC
Capacitance	106J
Voltage	50V
Date Code	123

AXIAL  
All Dimensions  
in Inches (mm)



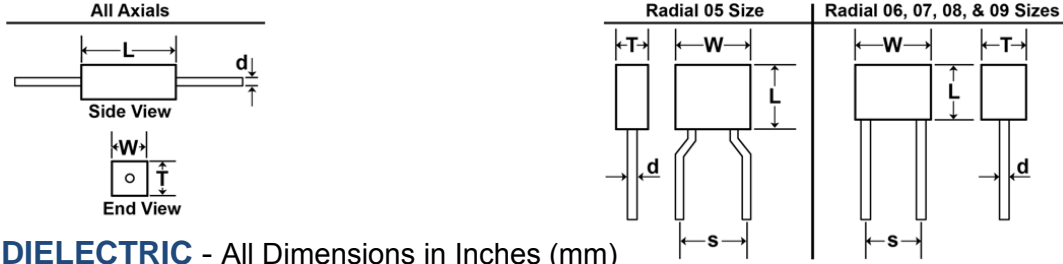
RADIAL  
All Dimensions  
in Inches (mm)



COG DIELECTRIC

		AXIAL					RADIAL				
STYLE		16	25	39	50	69	05	06	07	08	09
Cap	L <sub>MAX</sub>	.170 (4.32)	.270 (6.86)	.400 (10.16)	.520 (13.21)	.720 (18.29)	.200 (5.08)	.300 (7.62)	.300 (7.62)	.500 (12.70)	.500 (12.70)
	W <sub>MAX</sub>	.080 (2.03)	.100 (2.54)	.150 (3.81)	.265 (6.73)	.370 (9.40)	.200 (5.08)	.300 (7.62)	.300 (7.62)	.500 (12.70)	.500 (12.70)
	T <sub>MAX</sub>	.080 (2.03)	.100 (2.54)	.150 (3.81)	.160 (4.06)	.160 (4.06)	.100 (2.54)	.100 (2.54)	.150 (3.81)	.100 (2.54)	.150 (3.81)
	s	---	---	---	---	---	.200 ± .030 (5.08 ± .76)	.200 ± .030 (5.08 ± .76)	.200 ± .030 (5.08 ± .76)	.400 ± .030 (10.16 ± .76)	.400 ± .030 (10.16 ± .76)
	d	.020 ± .002 (.508 ± .051)	.020 ± .002 (.508 ± .051)	.025 ± .002 (.635 ± .051)	.025 ± .002 (.635 ± .051)	.025 ± .002 (.635 ± .051)	.020 ± .002 (.508 ± .051)	.020 ± .002 (.508 ± .051)	.020 ± .002 (.508 ± .051)	.025 ± .002 (.635 ± .051)	.025 ± .002 (.635 ± .051)
	Cap Code		WVDC 50 100	WVDC 50 100	WVDC 50 100	WVDC 50 100	WVDC 50 100	WVDC 50 100	WVDC 50 100	WVDC 50 100	WVDC 50 100
5.6pF	569										
6.8	689										
8.2	829										
10	100										
12	120										
15	150										
18	180										
22	220										
27	270										
33	330										
39	390										
47	470										
56	560										
68	680										
82	820										
100	101										
120	121										
150	151										
180	181										
220	221										
270	271										
330	331										
390	391										
470	471										
560	561										
680	681										
820	821										
1000	102										
1200	122										
1500	152										
1800	182										
2200	222										
2700	272										
3300	332										
3900	392										
4700	472										
5600	562										
6800	682										
8200	822										
0.01 μF	103										
0.012	123										
0.015	153										
0.018	183										
0.022	223										
0.027	273										
0.033	333										
0.039	393										
0.047	473										
0.056	563										
0.068	683										
0.082	823										
0.10	104										
0.12	124										
0.15	154										

# High Temperature Standard (+200°C) Axial and Radial Ceramic Cased Capacitors (C<sup>3</sup>) ARR/ARA Series



**X7R DIELECTRIC** - All Dimensions in Inches (mm)

		AXIAL										RADIAL									
STYLE		16		25		39		50		69		05		06		07		08		09	
Cap	L MAX	.170 (4.32)	.270 (6.86)	.400 (10.16)	.520 (13.21)	.720 (18.29)	.200 (5.08)	.300 (7.62)	.300 (7.62)	.500 (12.70)	.500 (12.70)	.200 (5.08)	.300 (7.62)	.300 (7.62)	.500 (12.70)	.500 (12.70)	.300 (7.62)	.500 (12.70)	.500 (12.70)	.500 (12.70)	.500 (12.70)
	W MAX	.080 (2.03)	.100 (2.54)	.150 (3.81)	.265 (6.73)	.370 (9.40)	.200 (5.08)	.300 (7.62)	.300 (7.62)	.500 (12.70)	.500 (12.70)	.200 (5.08)	.300 (7.62)	.300 (7.62)	.500 (12.70)	.500 (12.70)	.300 (7.62)	.500 (12.70)	.500 (12.70)	.500 (12.70)	.500 (12.70)
	T MAX	.080 (2.03)	.100 (2.54)	.150 (3.81)	.160 (4.06)	.160 (4.06)	.100 (2.54)	.100 (2.54)	.150 (3.81)	.100 (2.54)	.150 (3.81)	.100 (2.54)	.100 (2.54)	.150 (3.81)	.100 (2.54)	.150 (3.81)	.100 (2.54)	.100 (2.54)	.150 (3.81)	.100 (2.54)	.150 (3.81)
	s	---	---	---	---	---	.200 ± .030 (5.08 ± .76)	.200 ± .030 (5.08 ± .76)	.200 ± .030 (5.08 ± .76)	.400 ± .030 (10.16 ± .76)	.400 ± .030 (10.16 ± .76)	.200 ± .030 (5.08 ± .76)	.200 ± .030 (5.08 ± .76)	.200 ± .030 (5.08 ± .76)	.200 ± .030 (5.08 ± .76)	.400 ± .030 (10.16 ± .76)	.400 ± .030 (10.16 ± .76)	.400 ± .030 (10.16 ± .76)	.400 ± .030 (10.16 ± .76)	.400 ± .030 (10.16 ± .76)	
	d	.020 ± .002 (.508 ± .051)	.020 ± .002 (.508 ± .051)	.025 ± .002 (.635 ± .051)	.025 ± .002 (.635 ± .051)	.025 ± .002 (.635 ± .051)	.020 ± .002 (.508 ± .051)	.020 ± .002 (.508 ± .051)	.020 ± .002 (.508 ± .051)	.025 ± .002 (.635 ± .051)	.025 ± .002 (.635 ± .051)	.020 ± .002 (.508 ± .051)	.020 ± .002 (.508 ± .051)	.020 ± .002 (.508 ± .051)	.020 ± .002 (.508 ± .051)	.020 ± .002 (.508 ± .051)	.025 ± .002 (.635 ± .051)	.025 ± .002 (.635 ± .051)	.025 ± .002 (.635 ± .051)	.025 ± .002 (.635 ± .051)	.025 ± .002 (.635 ± .051)
	Cap Code		WVDC		WVDC		WVDC		WVDC		WVDC		WVDC		WVDC		WVDC		WVDC		WVDC
		50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100
100pF	101																				
	120																				
	150																				
	180																				
	220																				
	270																				
	330																				
	390																				
	470																				
	560																				
	680																				
	820																				
	1000																				
	1200																				
	1500																				
	1800																				
	2200																				
	2700																				
	3300																				
	3900																				
	4700																				
	5600																				
	6800																				
	8200																				
0.01 μF	103																				
	0.012																				
	0.015																				
	0.018																				
	0.022																				
	0.027																				
	0.033																				
	0.039																				
	0.047																				
	0.056																				
	0.068																				
	0.082																				
	0.10																				
	0.12																				
	0.15																				
	0.18																				
	0.22																				
	0.27																				
	0.33																				
	0.39																				
	0.47																				
	0.56																				
	0.68																				
	0.82																				
	1.0																				
	1.2																				
	1.5																				
	1.8																				
	2.2																				
	2.7																				
	3.3																				
	3.9																				

High temperature ceramic cased capacitors, with a new, unique design concept, are ideally suited for continuous operation up to +260°C. Problems associated with epoxy cased/epoxy potted capacitors, such as material deterioration, cracks in cases and potted areas, are nonexistent, even at +260°C.

**COG**

COG (NP0) capacitors, which exhibit little change in capacitance with variations in temperature, are used in RF oscillators, precision timing circuits, wave filters, and other circuits requiring a predictable linear temperature coefficient.

**X7R**

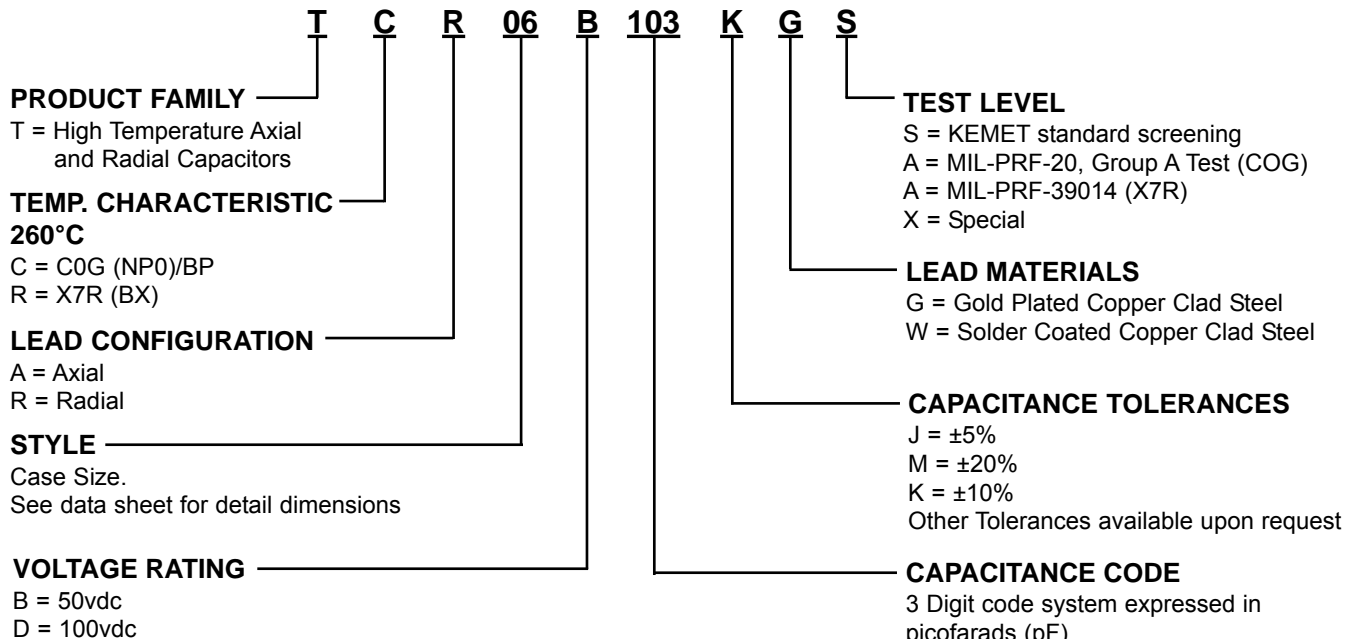
Conventional X7R materials lose up to 75% of the +25°C capacitance. Dissipation factor drops from 1.25% at +25°C to 0.2% at +260°C. At +120°C the ceramic undergoes a transformation (crystalline inversion) resulting in the material changing from ferroelectric to paraelectric - no piezoelectric behavior.

Typical applications include oil well logging (down hole), jet engine controls and geophysical pressure probes.

**INSTALLATION:**

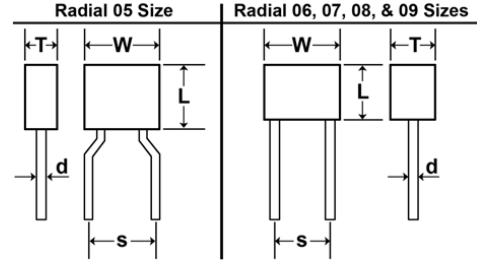
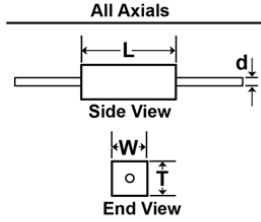
Parts should be soldered using a heat sink between the soldering point and the part using a soldering iron rated 18-30 watts. Remove all traces of flux or other contamination resulting from the soldering operation. An intermittent conducting path between the leads, at high voltage, could cause breakdown. Soldering temperature should not exceed +300°C.

**PART NUMBER AND ORDERING INFORMATION**



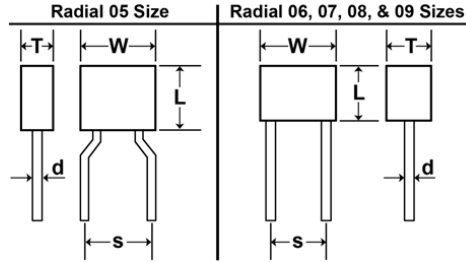
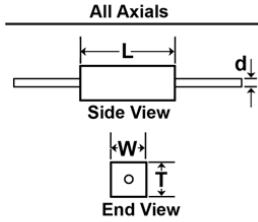
MARKING	EXAMPLE
Manufacturer's ID	KEC
Capacitance	106J
Voltage	50V
Date Code	123
Red dot = +260°C	•

# High Temperature (+260°C) Axial and Radial Ceramic Cased Capacitors (C<sup>3</sup>) TCR/TCA Series



## COG DIELECTRIC

		AXIAL					RADIAL				
STYLE		16	25	39	50	69	05	06	07	08	09
Cap	L <sub>MAX</sub>	.170 (4.32)	.270 (6.86)	.400 (10.16)	.520 (13.21)	.720 (18.29)	.200 (5.08)	.300 (7.62)	.300 (7.62)	.500 (12.70)	.500 (12.70)
	W <sub>MAX</sub>	.080 (2.03)	.100 (2.54)	.150 (3.81)	.265 (6.73)	.370 (9.40)	.200 (5.08)	.300 (7.62)	.300 (7.62)	.500 (12.70)	.500 (12.70)
	T <sub>MAX</sub>	.080 (2.03)	.100 (2.54)	.150 (3.81)	.160 (4.06)	.160 (4.06)	.100 (2.54)	.100 (2.54)	.150 (3.81)	.100 (2.54)	.150 (3.81)
	s	---	---	---	---	---	.200 ± .030 (5.08 ± .76)	.200 ± .030 (5.08 ± .76)	.200 ± .030 (5.08 ± .76)	.400 ± .030 (10.16 ± .76)	.400 ± .030 (10.16 ± .76)
	d	.020 ± .002 (.508 ± .051)	.020 ± .002 (.508 ± .051)	.025 ± .002 (.635 ± .051)	.025 ± .002 (.635 ± .051)	.025 ± .002 (.635 ± .051)	.020 ± .002 (.508 ± .051)	.020 ± .002 (.508 ± .051)	.020 ± .002 (.508 ± .051)	.025 ± .002 (.635 ± .051)	.025 ± .002 (.635 ± .051)
	Cap Code		50 100	50 100	50 100	50 100	50 100	50 100	50 100	50 100	50 100
5.6pF	569										
6.8	689										
8.2	829										
10	100										
12	120										
15	150										
18	180										
22	220										
27	270										
33	330										
39	390										
47	470										
56	560										
68	680										
82	820										
100	101										
120	121										
150	151										
180	181										
220	221										
270	271										
330	331										
390	391										
470	471										
560	561										
680	681										
820	821										
1000	102										
1200	122										
1500	152										
1800	182										
2200	222										
2700	272										
3300	332										
3900	392										
4700	472										
5600	562										
6800	682										
8200	822										
0.01 μF	103										
0.012	123										
0.015	153										
0.018	183										
0.022	223										
0.027	273										
0.033	333										
0.039	393										
0.047	473										
0.056	563										
0.068	683										
0.082	823										
0.10	104										
0.12	124										
0.15	154										



**X7R DIELECTRIC**

		AXIAL										RADIAL										
STYLE		16		25		39		50		69		05		06		07		08		09		
Cap	L <sub>MAX</sub>	.170 (4.32)		.270 (6.86)		.400 (10.16)		.520 (13.21)		.720 (18.29)		.200 (5.08)		.300 (7.62)		.300 (7.62)		.500 (12.70)		.500 (12.70)		
	W <sub>MAX</sub>	.080 (2.03)		.100 (2.54)		.150 (3.81)		.265 (6.73)		.370 (9.40)		.200 (5.08)		.300 (7.62)		.300 (7.62)		.500 (12.70)		.500 (12.70)		
	T <sub>MAX</sub>	.080 (2.03)		.100 (2.54)		.150 (3.81)		.160 (4.06)		.160 (4.06)		.100 (2.54)		.100 (2.54)		.150 (3.81)		.100 (2.54)		.150 (3.81)		
	S	---		---		---		---		---		.200 ± .030 (5.08 ± .76)		.200 ± .030 (5.08 ± .76)		.200 ± .030 (5.08 ± .76)		.400 ± .030 (10.16 ± .76)		.400 ± .030 (10.16 ± .76)		
	d	.020 ± .002 (.508 ± .051)		.020 ± .002 (.508 ± .051)		.025 ± .002 (.635 ± .051)		.025 ± .002 (.635 ± .051)		.025 ± .002 (.635 ± .051)		.020 ± .002 (.508 ± .051)		.020 ± .002 (.508 ± .051)		.020 ± .002 (.508 ± .051)		.025 ± .002 (.635 ± .051)		.025 ± .002 (.635 ± .051)		
	Cap Code	WVDC		WVDC		WVDC		WVDC		WVDC		WVDC		WVDC		WVDC		WVDC		WVDC		
		50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	
	100pF																					
	120																					
	150																					
180																						
220																						
270																						
330																						
390																						
470																						
560																						
680																						
820																						
1000																						
1200																						
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1800																						
2200																						
2700																						
3300																						
3900																						
4700																						
5600																						
6800																						
8200																						
0.01 μF																						
0.012																						
0.015																						
0.018																						
0.022																						
0.027																						
0.033																						
0.039																						
0.047																						
0.056																						
0.068																						
0.082																						
0.10																						
0.12																						
0.15																						
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0.22																						
0.27																						
0.33																						
0.39																						
0.47																						
0.56																						
0.68																						
0.82																						
1.0																						
1.2																						
1.5																						
1.8																						
2.0																						
2.2																						
2.7																						
3.3																						
3.9																						

# High Temperature (+200°C), High Voltage Radial Ceramic Cased Capacitors (C<sup>3</sup>)

## VCR/VRR Series

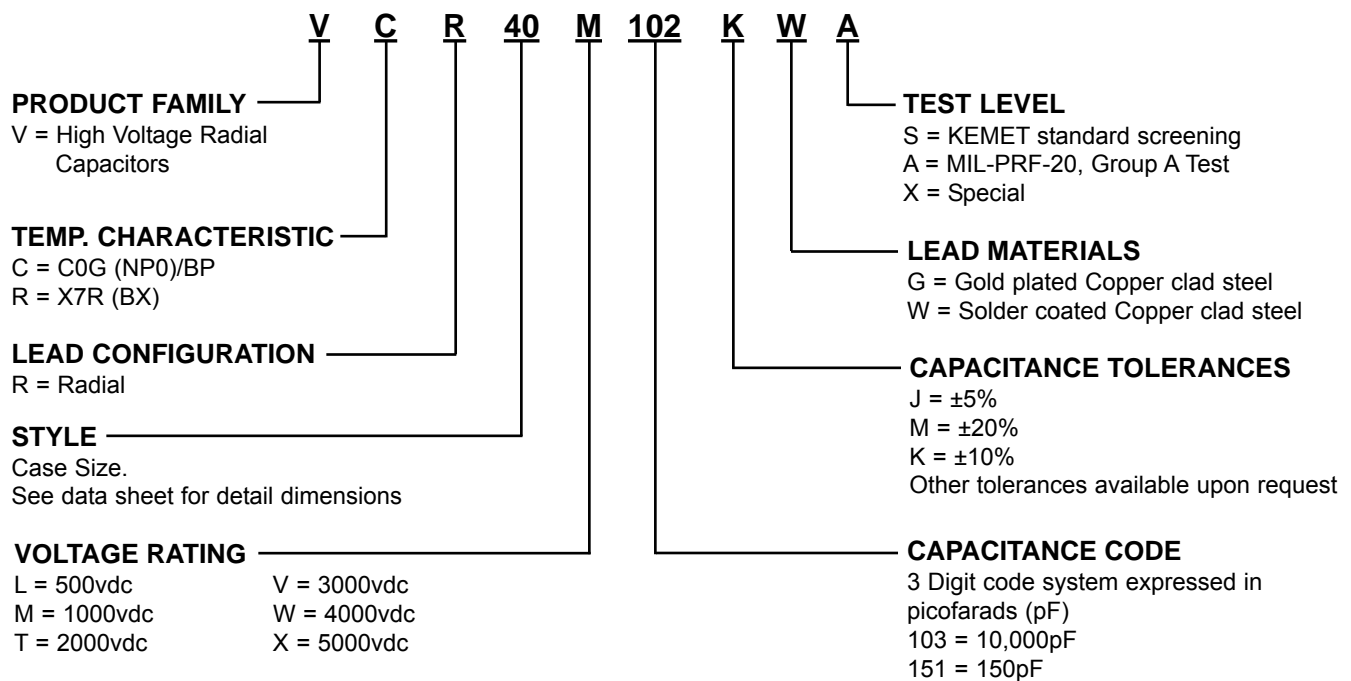
Ceramic cased capacitors, with a new, unique design concept which eliminates potential problems associated with conventional epoxy cased epoxy potted capacitors.

Major application is high voltage power supplies. High voltage capacitors are also utilized on high voltage meter multiplier and RF circuits.

### INSTALLATION:

Parts should be soldered using a heat sink between the soldering point and the part using a soldering iron rated 18-30 watts. Remove all traces of flux or other contamination resulting from the soldering operation. An intermittent conducting path between the leads, at high voltage, could cause breakdown. Soldering temperature should not exceed +300°C.

### PART NUMBER AND ORDERING INFORMATION



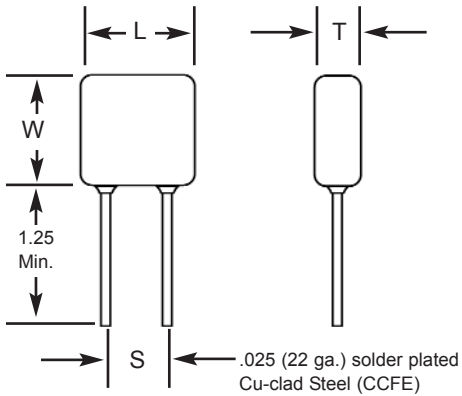
MARKING	EXAMPLE
Manufacturer's ID	KEC
Capacitance	106J
Voltage	500V
Date Code	123







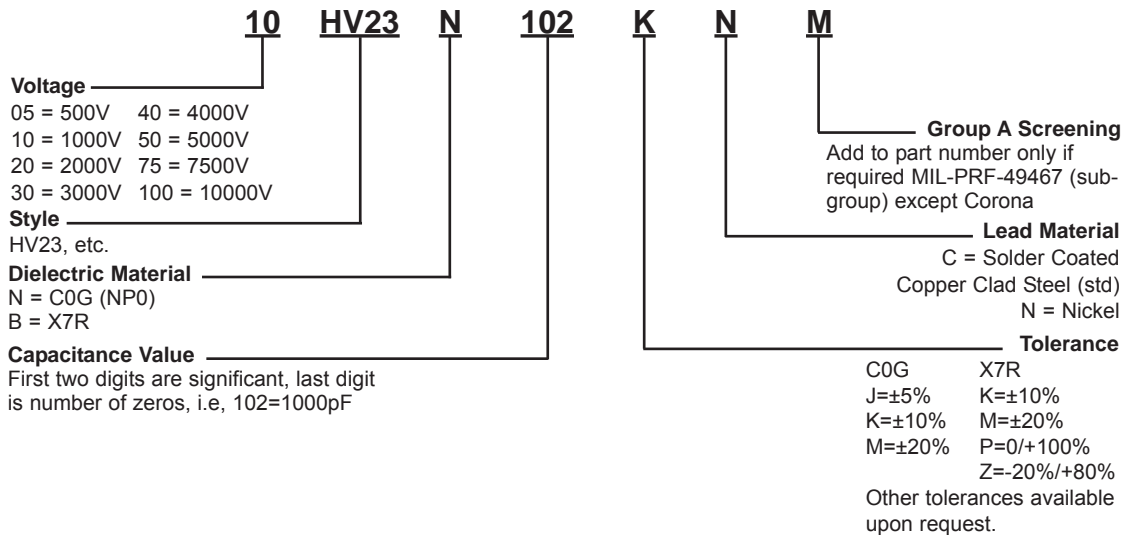
**CAPACITOR OUTLINE DRAWING**



**DIMENSIONS**

Style	Sizes in Inches (mm) max.			Lead Spacing ±0.030 (S)
	Length (L)	Width (W)	Thickness (T)	
HV20	.250 (6.35)	.220 (5.59)	.200 (5.08)	.170 (4.32)
HV21	.320 (8.13)	.280 (7.11)	.250 (6.35)	.220 (5.59)
HV22	.370 (9.40)	.300 (7.62)	.250 (6.35)	.275 (6.98)
HV23	.470 (11.94)	.400 (10.16)	.270 (6.89)	.375 (9.52)
HV24	.570 (14.48)	.500 (12.70)	.270 (6.89)	.475 (12.06)
HV25	.670 (17.02)	.600 (15.24)	.270 (6.89)	.575 (14.60)
HV26	.770 (19.56)	.720 (18.29)	.270 (6.89)	.675 (17.14)
HV30	.450 (11.43)	.220 (5.59)	.200 (5.08)	.300 (7.62)
HV31	.550 (13.97)	.280 (7.11)	.250 (6.35)	.400 (10.16)
HV33	.850 (21.59)	.400 (10.16)	.270 (6.89)	.700 (17.78)
HV34	1.050 (26.67)	.500 (12.70)	.270 (6.89)	.975 (24.76)
HV35	1.250 (31.75)	.600 (15.24)	.270 (6.89)	1.175 (29.84)
HV36	1.450 (36.83)	.720 (18.29)	.270 (6.89)	1.375 (34.92)

**PART NUMBER AND ORDERING INFORMATION**



**MARKING**

(HV20, HV21)	(All Other Sizes)
103K	HV24A103K
1 kV	1 kV
KEC	KEC
Date Code	Date Code







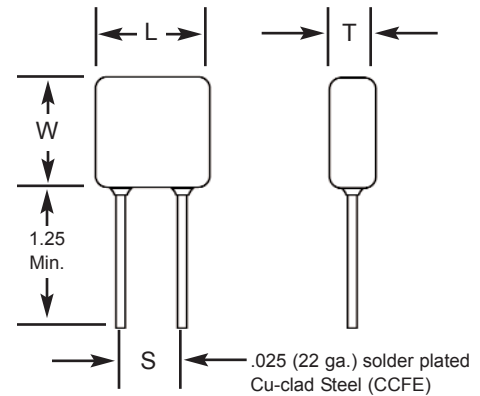


# High Voltage MIL-PRF-49467 (Equivalent) HV Series

## FEATURES

1. Electrical characteristics and environmental information on these parts may be obtained by referring to MIL-PRF-49467.
2. All parts are conformal coated multilayer ceramic.
3. Designed to provide excellent long-term reliability.
4. Parts are Group A screened per MIL-PRF-49467 which includes 100% Corona testing and meet all other specification requirements.
5. Designed for surface, sea and airborne military and commercial high-reliability applications.
6. No IR degradation over life.
7. BR (X7R) V/TC is -40% at rated voltage and BZ (X7R) V/TC is -40% at 60% rated voltage.
8. BX characteristic (-25%) on BR parts is approximately 52% rated voltage.
9. 100% Non-destructive test by means of CSAM inspection available.

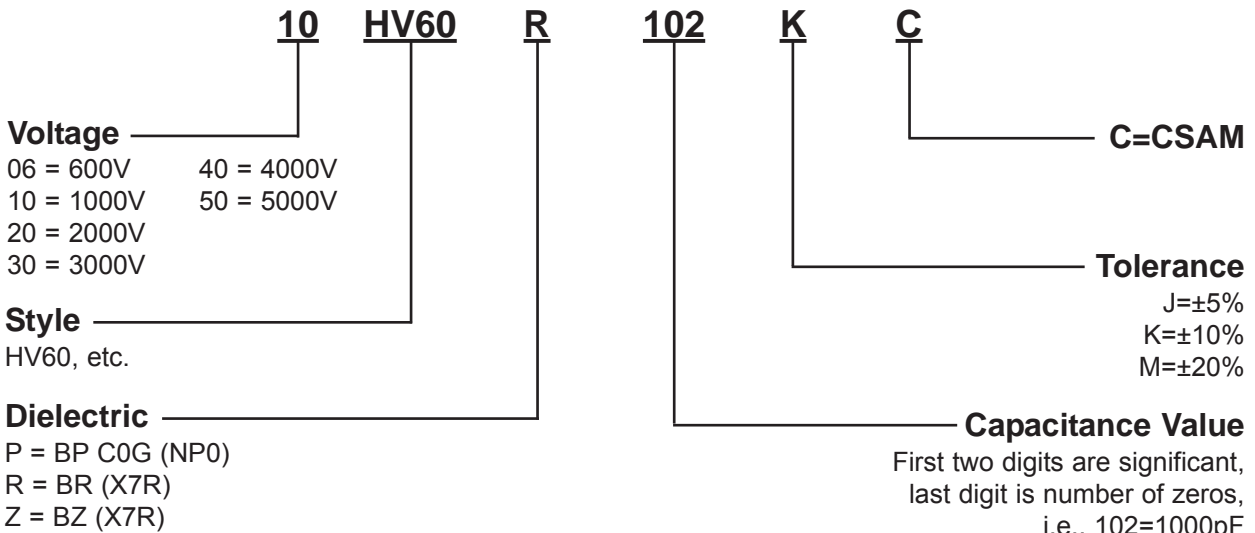
## CAPACITOR OUTLINE DRAWING



## DIMENSIONS

Style	Sizes in Inches (mm) max.			Lead Spacing ±0.030 (S)
	Length (L)	Width (W)	Thickness (T)	
HV60	.250 (6.35)	.220 (5.59)	.200 (5.08)	.170 (4.32)
HV61	.320 (8.13)	.280 (7.11)	.250 (6.35)	.220 (5.59)
HV62	.370 (9.40)	.300 (7.62)	.250 (6.35)	.275 (6.98)
HV63	.470 (11.94)	.400 (10.16)	.270 (6.86)	.375 (9.52)
HV64	.570 (14.48)	.500 (12.70)	.270 (6.86)	.475 (12.06)
HV65	.670 (17.02)	.600 (15.24)	.270 (6.86)	.575 (14.60)
HV66	.770 (19.56)	.720 (18.29)	.270 (6.86)	.675 (17.14)
HV68	1.300 (33.02)	.600 (15.24)	.270 (6.86)	1.175 (29.84)
HV69	1.500 (38.10)	.720 (18.29)	.270 (6.86)	1.375 (34.92)

## PART NUMBER AND ORDERING INFORMATION



MARKING	
(HV60, HV61)	(All Other Sizes)
102K	HV63R102K
1 kV	1 kV
KEC	KEC
Date Code	Date Code





# High Voltage MIL-PRF-49467 (Equivalent) HV Series

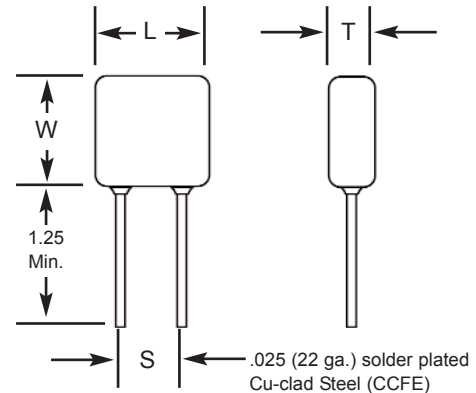
## X7R DIELECTRIC

STYLE		HV60			HV61			HV62			HV63				HV64				HV65				HV66				HV 68			HV 69									
Cap	L MAX	.250 (6.35)			.320 (8.13)			.370 (9.40)			.470 (11.94)				.570 (14.48)				.670 (17.02)				.770 (19.56)				1.300 (33.02)			1.500 (38.10)									
	W MAX	.220 (5.59)			.280 (7.11)			.300 (7.62)			.400 (10.16)				.500 (12.70)				.600 (15.24)				.720 (18.29)				.600 (15.24)			.720 (18.29)									
	T MAX	.200 (5.08)			.250 (6.35)			.250 (6.35)			.270 (6.86)				.270 (6.86)				.270 (6.86)				.270 (6.86)				.270 (6.86)			.270 (6.86)									
S± .030		.170 (4.32)			.220 (5.59)			.275 (6.98)			.375 (9.52)				.475 (12.06)				.575 (14.60)				.675 (17.14)				1.175 (29.84)			1.375 (34.92)									
Lead Dia. +0.004/-0.002		.025 (.635)			.025 (.635)			.025 (.635)			.025 (.635)				.025 (.635)				.025 (.635)				.025 (.635)				0.025 (.635)			0.025 (.635)									
		WVDC			WVDC			WVDC			WVDC				WVDC				WVDC				WVDC				WVDC			WVDC									
Cap Code		600	1k	2k	600	1k	2k	3k	600	1k	2k	3k	600	1k	2k	3k	4k	600	1k	2k	3k	4k	5k	1k	2k	3k	4k	5k	1k	2k	3k	4k	5k	3k	4k	5k	3k	4k	5k
270pF	271																																						
330	331																																						
390	391																																						
470	471																																						
560	561																																						
680	681																																						
820	821																																						
1000	102																																						
1200	122																																						
1500	152																																						
1800	182																																						
2200	222																																						
2700	272																																						
3300	332																																						
3900	392																																						
4700	472																																						
5600	562																																						
6800	682																																						
8200	822																																						
0.01uF	103																																						
0.012	123																																						
0.015	153																																						
0.018	183																																						
0.022	223																																						
0.027	273																																						
0.033	333																																						
0.039	393																																						
0.047	473																																						
0.056	563																																						
0.068	683																																						
0.082	823																																						
0.10	104																																						
0.12	124																																						
0.15	154																																						
0.18	184																																						
0.22	224																																						
0.27	274																																						
0.33	334																																						
0.39	394																																						
0.47	474																																						

### FEATURES

1. Conforms to MIL-PRF-49467. (Group A Screening, Subgroup 1)
2. 100% Corona tested.
3. No IR degradation over life.
4. High density, low DF ceramic.
5. Conservative and proven design is recommended for non-repairable applications such as spacecraft.
6. CSAM inspection is available and is recommended for space applications.
7. Burn-in in a non-contaminating inert fluid is standard for  $\geq 2\text{KV}$ ; optional for 500V or 1 KV parts.

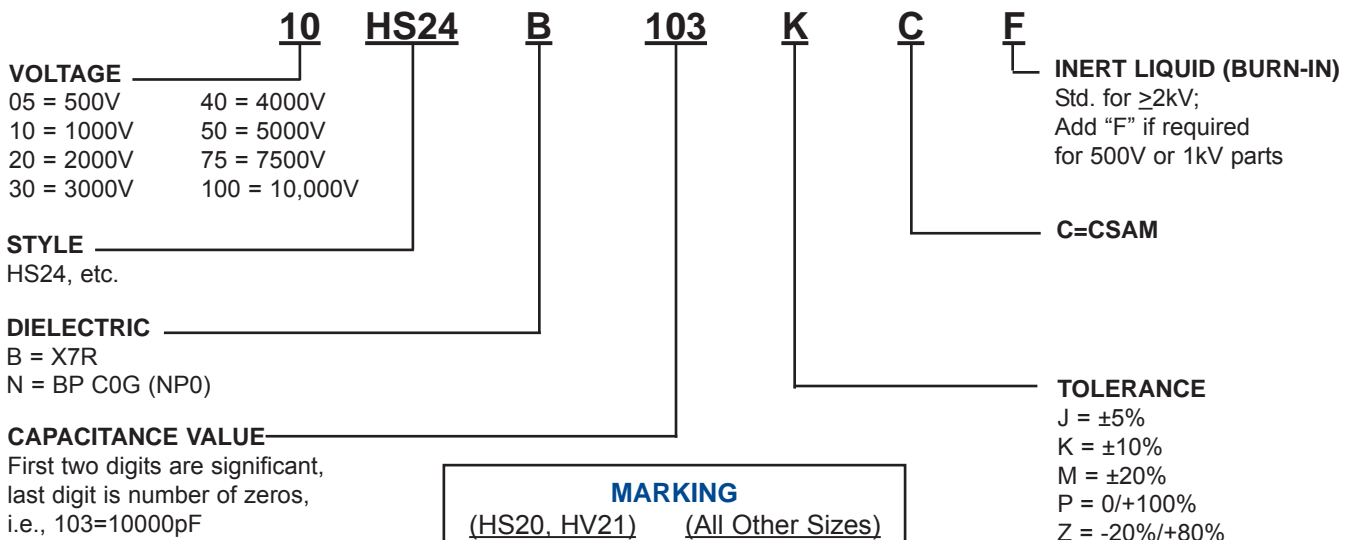
### CAPACITOR OUTLINE DRAWING



### DIMENSIONS

Style	Sizes in Inches (mm) max.			Lead Spacing $\pm 0.030$ (S)
	Length (L)	Width (W)	Thickness (T)	
HS20	.250 (6.35)	.220 (5.59)	.200 (5.08)	.170 (4.32)
HS21	.320 (8.13)	.280 (7.11)	.250 (6.35)	.220 (5.59)
HS22	.370 (9.40)	.300 (7.62)	.250 (6.35)	.275 (6.98)
HS30	.450 (11.43)	.220 (5.59)	.200 (5.08)	.300 (7.62)
HS23	.470 (11.94)	.400 (10.16)	.270 (6.89)	.375 (9.52)
HS31	.550 (13.97)	.280 (7.11)	.250 (6.35)	.400 (10.16)
HS24	.570 (14.48)	.500 (12.70)	.270 (6.89)	.475 (12.06)
HS25	.670 (17.02)	.600 (15.24)	.270 (6.89)	.575 (14.60)
HS26	.770 (19.56)	.720 (18.29)	.270 (6.89)	.675 (17.14)
HS33	.850 (21.59)	.400 (10.16)	.270 (6.89)	.700 (17.78)
HS34	1.050 (26.67)	.500 (12.70)	.270 (6.89)	.975 (24.76)
HS35	1.250 (31.75)	.600 (15.24)	.270 (6.89)	1.175 (29.84)
HS36	1.450 (36.83)	.720 (18.29)	.270 (6.89)	1.375 (34.92)

### PART NUMBER AND ORDERING INFORMATION



MARKING	
(HS20, HV21)	(All Other Sizes)
103K	HS24B103K
1 kV	1 kV
KEC	KEC
Date Code	Date Code

# High Voltage Space Quality MLC (-55° to +125°C) HS Series

## COG DIELECTRIC

STYLE		HS 20			HS 21			HS 22			HS 23				HS 24					HS 25					HS 26							
Cap	L MAX	.250 (6.35)			.320 (8.13)			.370 (9.40)			.470 (11.94)				.570 (14.48)					.670 (17.02)					.770 (19.56)							
	W MAX	.220 (5.59)			.280 (7.11)			.300 (7.62)			.400 (10.16)				.500 (12.70)					.600 (15.24)					.720 (18.29)							
	T MAX	.200 (5.08)			.250 (6.35)			.250 (6.35)			.270 (6.86)				.270 (6.86)					.270 (6.86)					.270 (6.86)							
S± .030		.170 (4.32)			.220 (5.59)			.275 (6.98)			.375 (9.52)				.475 (12.06)					.575 (14.60)					.675 (17.14)							
Lead Dia. +0.004/-0.002		.025 (.635)			.025 (.635)			.025 (.635)			.025 (.635)				.025 (.635)					.025 (.635)					.025 (.635)							
		WVDC			WVDC			WVDC			WVDC				WVDC					WVDC					WVDC							
Cap Code		500	1k	2k	500	1k	2k	500	1k	2k	500	1k	2k	3k	500	1k	2k	3k	4k	5k	500	1k	2k	3k	4k	5k	500	1k	2k	3k	4k	5k
12pF	120																															
15	150																															
18	180																															
22	220																															
27	270																															
33	330																															
39	390																															
47	470																															
56	560																															
68	680																															
82	820																															
100	101																															
120	121																															
150	151																															
180	181																															
220	221																															
270	271																															
330	331																															
390	391																															
470	471																															
560	561																															
680	681																															
820	821																															
1000	102																															
1200	122																															
1500	152																															
1800	182																															
2200	222																															
2700	272																															
3300	332																															
3900	392																															
4700	472																															
5600	562																															
6800	682																															
8200	822																															
0.010uF	103																															
0.012	123																															
0.015	153																															
0.018	183																															
0.022	223																															
0.027	273																															
0.033	333																															
0.039	393																															
0.047	473																															
0.056	563																															
0.068	683																															
0.082	823																															
0.10	104																															
0.12	124																															
0.15	154																															



# High Voltage Space Quality MLC (-55° to +125°C) HS Series

## X7R DIELECTRIC

STYLE		HS 20			HS 21			HS 22			HS 23				HS 24					HS 25					HS 26						
Cap	L MAX	.250 (6.35)			.320 (8.13)			.370 (9.40)			.470 (11.94)				.570 (14.48)					.670 (17.02)					.770 (19.56)						
	W MAX	.220 (5.59)			.280 (7.11)			.300 (7.62)			.400 (10.16)				.500 (12.70)					.600 (15.24)					.720 (18.29)						
	T MAX	.200 (5.08)			.250 (6.35)			.250 (6.35)			.270 (6.86)				.270 (6.86)					.270 (6.86)					.270 (6.86)						
S± .030		.170 (4.32)			.220 (5.59)			.275 (6.98)			.375 (9.52)				.475 (12.06)					.575 (14.60)					.675 (17.14)						
Lead Dia. +0.004/-0.002		.025 (.635)			.025 (.635)			.025 (.635)			.025 (.635)				.025 (.635)					.025 (.635)					.025 (.635)						
		WVDC			WVDC			WVDC			WVDC				WVDC					WVDC					WVDC						
Cap Code		500	1k	2k	500	1k	2k	500	1k	2k	500	1k	2k	3k	500	1k	2k	3k	4k	500	1k	2k	3k	4k	5k	500	1k	2k	3k	4k	5k
270pF	271																														
330	331																														
390	391																														
470	471																														
560	561																														
680	681																														
820	821																														
1000	102																														
1200	122																														
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4700	472																														
5600	562																														
6800	682																														
8200	822																														
0.010uF	103																														
0.012	123																														
0.015	153																														
0.018	183																														
0.022	223																														
0.027	273																														
0.033	333																														
0.039	393																														
0.047	473																														
0.056	563																														
0.068	683																														
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0.33	334																														
0.39	394																														
0.47	474																														
0.56	564																														
0.68	684																														
0.82	824																														
1.0	105																														
1.2	125																														
1.5	155																														
1.8	185																														
2.2	225																														
2.7	275																														

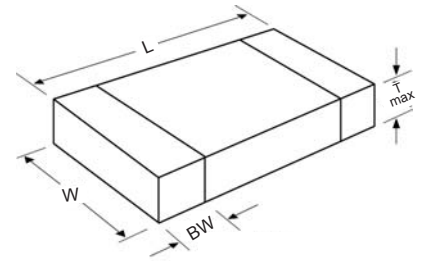


# High Voltage Ceramic Chip (+125°C) Military Equivalent

## FEATURES

1. The ceramic chip capacitors described in this section are the types used in our other high voltage ceramic multilayer product lines.
2. Types BP available as described in MIL-PRF-49467.
3. Group A and B screening per MIL-PRF-49467 available. - TCVC exceptions apply.
4. Ceramic chip capacitors are extremely sensitive to thermal shock damage during installation. Wherever possible, processes involving infrared or vapor phase soldering systems should be utilized.
5. Higher voltages available upon request.
6. Where nickel barrier termination is required, bandwidth dimensions may exceed the standard dimension listed.

## CERAMIC CHIP OUTLINE DRAWING

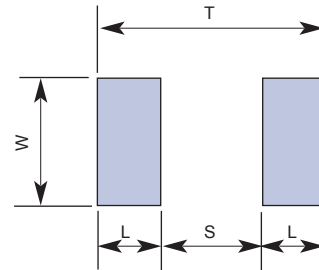


## DIMENSIONS

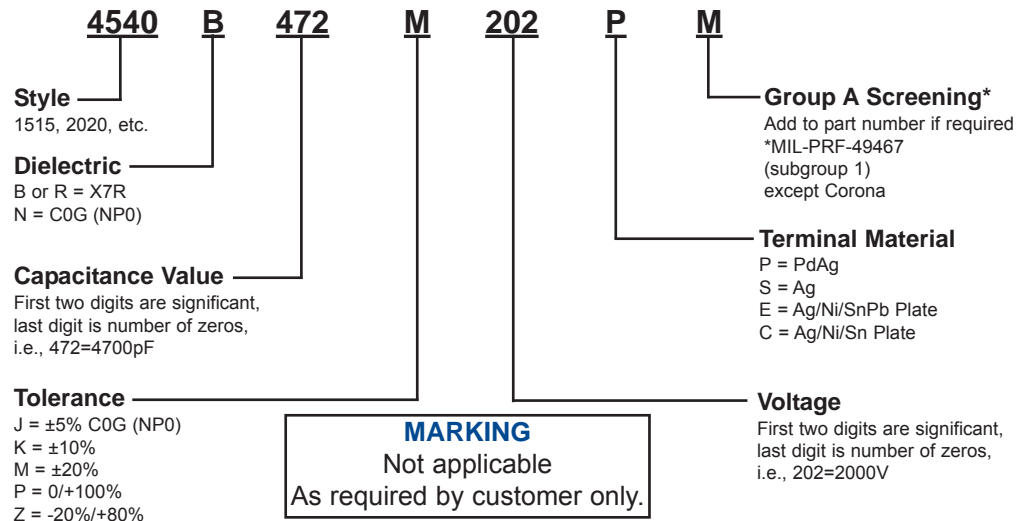
Style	Length (L) Inches (mm)	Width (W) Inches (mm)	Thickness (T) max Inches (mm)	Bandwidth (BW) Inches
1515	.150 ±.015 (3.81 ±.38)	.150 ±.015 (3.81 ±.38)	.140 (3.55)	.010 - .030"
1812	.180 ±.020 (4.57 ±.51)	.120 ±.015 (3.05 ±.38)	.100 (2.54)	.010 - .040"
1825	.180 ±.020 (4.57 ±.51)	.250 ±.020 (6.35 ±.51)	.160 (4.07)	.010 - .040"
2020	.200 ±.020 (5.08 ±.51)	.200 ±.020 (5.08 ±.51)	.180 (3.55)	.010 - .040"
2225	.220 ±.020 (5.59 ±.51)	.250 ±.020 (6.35 ±.51)	.200 (5.08)	.010 - .040"
2520	.250 ±.020 (6.35 ±.51)	.200 ±.020 (5.08 ±.51)	.180 (4.57)	.030 - .060"
3333	.330 ±.030 (8.38 ±.76)	.330 ±.030 (8.38 ±.76)	.220 (5.59)	.030 - .060"
3530	.350 ±.030 (8.89 ±.76)	.300 ±.030 (7.62 ±.76)	.220 (5.59)	.030 - .060"
4040	.400 ±.030 (10.2 ±.76)	.400 ±.030 (10.2 ±.76)	.220 (5.59)	.030 - .060"
4540	.450 ±.030 (11.43 ±.76)	.400 ±.030 (10.2 ±.76)	.220 (5.59)	.030 - .060"
5440	.540 ±.030 (13.7 ±.76)	.400 ±.030 (10.2 ±.76)	.220 (5.59)	.030 - .060"
5550	.550 ±.030 (14.0 ±.76)	.500 ±.030 (12.7 ±.76)	.220 (5.59)	.030 - .060"
6560	.650 ±.030 (16.5 ±.76)	.600 ±.030 (15.2 ±.76)	.220 (5.59)	.030 - .060"

## RECOMMENDED SOLDER PAD PATTERN DIMENSIONS

Chip Size	T (Total Length)		S (Separation)		W (Pad Width)		L (Pad Length)	
	mm	in.	mm	in.	mm	in.	mm	in.
1515	5.20	0.205	1.90	0.075	4.34	0.171	1.65	0.065
1812	5.390	0.232	2.30	0.091	3.70	0.146	1.80	0.071
1825	5.90	0.232	2.30	0.091	6.90	0.272	1.80	0.071
2020	6.50	0.256	2.80	0.110	5.62	0.221	1.85	0.073
2225	7.00	0.276	3.30	0.130	6.80	0.268	1.85	0.073
2520	8.68	0.342	4.98	0.196	5.62	0.221	1.85	0.073
3333	10.91	0.430	7.11	0.280	9.27	0.365	1.90	0.075
3530	11.51	0.453	7.61	0.300	8.51	0.335	1.95	0.077
4040	12.88	0.507	8.88	0.350	11.05	0.435	2.00	0.079
4540	14.21	0.559	10.15	0.400	11.05	0.435	2.03	0.080
5440	16.51	0.650	10.41	0.410	11.05	0.435	3.05	0.120
5550	18.92	0.745	12.82	0.505	13.59	0.535	3.05	0.120
6560	19.80	0.780	13.20	0.520	16.13	0.635	3.30	0.130



## PART NUMBER AND ORDERING INFORMATION







# High Voltage Ceramic Chip (+125°C) Military Equivalent

## COG DIELECTRIC

STYLE		4040					4540					5440					5550					6560						
Cap	L	.400 ± .030 (10.16 ± .76)					.450 ± .030 (11.43 ± .76)					0.540 ± .030 (13.72 ± .76)					.550 ± .030 (13.97 ± .76)					.650 ± .030 (16.51 ± .76)						
	W	.400 ± .030 (10.16 ± .76)					.400 ± .030 (10.16 ± .76)					.400 ± .030 (10.16 ± .76)					.500 ± .030 (12.70 ± .76)					.600 ± .030 (15.20 ± .76)						
	T MAX	.220 (5.59)					.220 (5.59)					.220 (5.59)					.220 (5.59)					.220 (5.59)						
	Band Width	0.030 - 0.060					0.030 - 0.060					0.030 - 0.060					0.030 - 0.060					0.030 - 0.060						
	Cap Code	WVDC					WVDC					WVDC					WVDC					WVDC						
		500	1k	2k	3k	4k	500	1k	2k	3k	4k	5k	500	1k	2k	3k	4k	500	1k	2k	3k	4k	5k	500	1k	2k	3k	4k
15pF	150																											
18	180																											
22	220																											
27	270																											
33	330																											
39	390																											
47	470																											
56	560																											
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820	821																											
1000	102																											
1200	122																											
1500	152																											
1800	182																											
2200	222																											
2700	272																											
3300	332																											
3900	392																											
4700	472																											
5600	562																											
6800	682																											
8200	822																											
0.010uF	103																											
0.012	123																											
0.015	153																											
0.018	183																											
0.022	223																											
0.027	273																											
0.033	333																											
0.039	393																											
0.047	473																											
0.056	563																											
0.068	683																											
0.082	823																											
0.10	104																											



# High Voltage Ceramic Chip (+125°C) Military Equivalent

## X7R DIELECTRIC

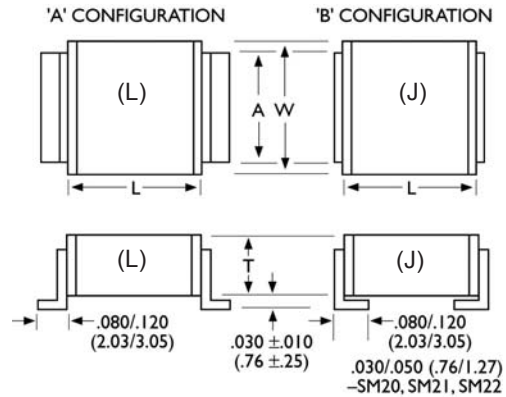
STYLE		4040					4540					5440					5550					6560							
Cap	L	.400 ± .030 (10.16 ± .76)					.450 ± .030 (11.43 ± .76)					.540 ± .030 (13.72 ± .76)					.550 ± .030 (13.97 ± .76)					.650 ± .030 (16.51 ± .76)							
	W	.400 ± .030 (10.16 ± .76)					.400 ± .030 (10.16 ± .76)					.400 ± .030 (10.16 ± .76)					.500 ± .030 (12.70 ± .76)					.600 ± .030 (15.20 ± .76)							
	T MAX	.220 (5.59)					.220 (5.59)					.220 (5.59)					.220 (5.59)					.220 (5.59)							
	Band Width	0.030 - 0.060					0.030 - 0.060					0.030 - 0.060					0.030 - 0.060					0.030 - 0.060							
	Cap Code	WVDC					WVDC					WVDC					WVDC					WVDC							
		500	1k	2k	3k	4k	500	1k	2k	3k	4k	5k	500	1k	2k	3k	4k	500	1k	2k	3k	4k	5k	500	1k	2k	3k	4k	5k
470pF	471																												
560	561																												
680	681																												
820	821																												
1000	102																												
1200	122																												
1500	152																												
1800	182																												
2200	222																												
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0.015	153																												
0.018	183																												
0.022	223																												
0.027	273																												
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0.039	393																												
0.047	473																												
0.056	563																												
0.068	683																												
0.082	823																												
0.10	104																												
0.12	124																												
0.15	154																												
0.18	184																												
0.22	224																												
0.27	274																												
0.33	334																												
0.39	394																												
0.47	474																												
0.56	564																												
0.68	684																												
0.82	824																												
1.0	105																												
1.2	125																												
1.5	155																												
1.8	185																												
2.2	225																												
2.7	275																												

## FEATURES

1. Silver plated copper alloy terminal for easy soldering.
2. Mounting tabs are designed to minimize the effect of thermal stress introduced by the differences in coefficient of thermal expansion between the capacitor and the mounting surface.
3. Low ESR.
4. High current discharge capability.
5. Group A and B screening per MIL-PRF-49467 available .
6. Standard lead configuration is 'B'.(J) If lead configuration is left out of part number the lead style is assumed to be 'B'.

## CAPACITOR OUTLINE DRAWING

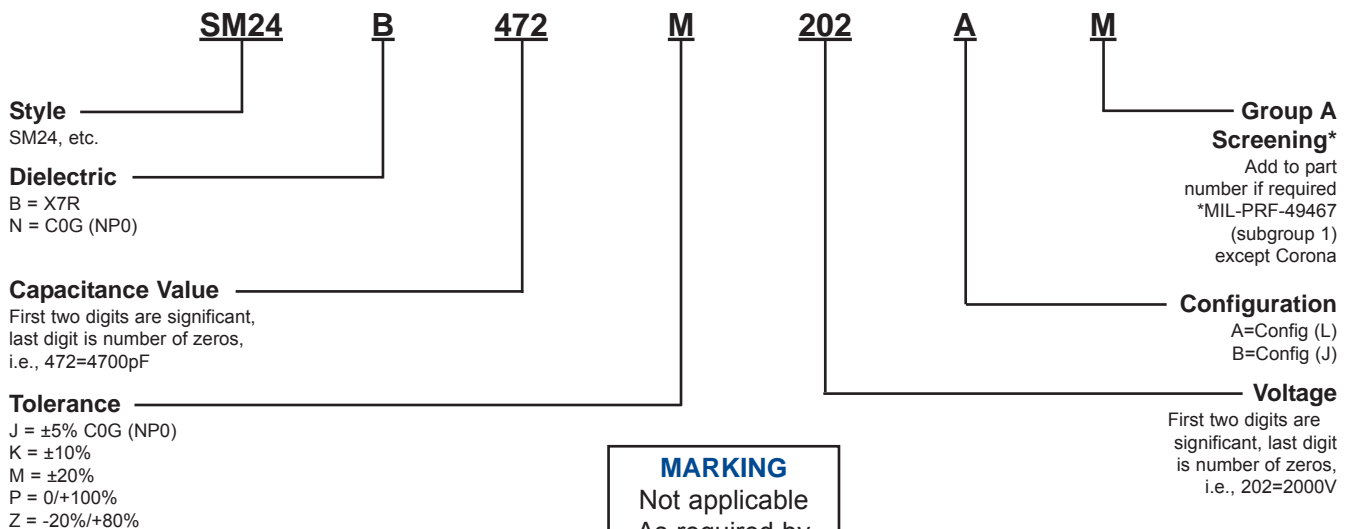
### STANDARD



## DIMENSIONS

Style	Length (L) Inches (mm)	Width (W) Inches (mm)	Thickness (T) max Inches (mm)	Tab (A) max Inches (mm)
SM20	.150 ±.015 (3.81 ±.38)	.150 ±.015 (3.81 ±.38)	.130 (3.30)	.100 (2.54)
SM21	.200 ±.020 (5.08 ±.51)	.200 ±.020 (5.08 ±.51)	.180 (4.57)	.100 (2.54)
SM22	.250 ±.020 (6.35 ±.51)	.200 ±.020 (5.08 ±.51)	.180 (4.57)	.100 (2.54)
SM23	.350 ±.030 (8.89 ±.76)	.300 ±.030 (7.62 ±.76)	.220 (5.59)	.200 (5.08)
SM24	.450 ±.030 (11.43 ±.76)	.400 ±.030 (10.20 ±.76)	.220 (5.59)	.300 (7.62)
SM25	.550 ±.030 (14.00 ±.76)	.500 ±.030 (12.70 ±.76)	.220 (5.59)	.400 (10.2)
SM26	.650 ±.030 (16.50 ±.76)	.600 ±.030 (15.20 ±.76)	.220 (5.59)	.500 (12.7)
SM30	.300 ±.030 (7.62 ±.76)	.150 ±.015 (3.81 ±.38)	.140 (3.55)	.100 (2.54)
SM31	.400 ±.030 (10.20 ±.76)	.200 ±.020 (5.08 ±.51)	.130 (3.30)	.100 (2.54)
SM33	.700 ±.030 (17.08 ±.76)	.300 ±.030 (7.62 ±.76)	.180 (4.57)	.200 (5.08)
SM34	.900 ±.030 (22.90 ±.76)	.400 ±.030 (10.20 ±.76)	.220 (5.59)	.300 (7.62)
SM35	1.100 ±.030 (27.90 ±.76)	.500 ±.030 (12.70 ±.76)	.220 (5.59)	.400 (10.2)
SM36	1.350 ±.030 (33.00 ±.76)	.600 ±.030 (15.20 ±.76)	.220 (5.59)	.500 (12.7)

## PART NUMBER AND ORDERING INFORMATION



**MARKING**  
Not applicable  
As required by customer only.



**COG DIELECTRIC**

STYLE		SM30	SM31	SM33	SM34	SM35	SM36																															
Cap	L	.300 ± .030 (7.62 ± .76)	.400 ± .030 (10.20 ± .76)	.700 ± .030 (17.08 ± .76)	.900 ± .030 (22.90 ± .76)	1.100 ± .030 (27.90 ± .76)	1.350 ± .030 (33.00 ± .76)																															
	W	.150 ± .015 (3.31 ± .38)	.200 ± .020 (5.08 ± .51)	.300 ± .030 (10.20 ± .76)	.400 ± .030 (10.20 ± .76)	.500 ± .030 (12.70 ± .76)	.600 ± .030 (15.20 ± .76)																															
	T <sub>MAX</sub>	.140 (3.55)	.130 (3.30)	.180 (4.57)	.220 (5.59)	.220 (5.59)	.220 (5.59)																															
	Tab A max	.100 (2.54)	.100 (2.54)	.200 (5.08)	.300 (7.62)	.400 (10.20)	.500 (12.70)																															
	Cap Code	WVDC		WVDC		WVDC		WVDC																														
	500	1k	2k	3k	4k	5k	500	1k	2k	3k	4k	5k	500	1k	2k	3k	4k	5k	7.5k	10k	500	1k	2k	3k	4k	5k	7.5k	10k	500	1k	2k	3k	4k	5k	7.5k	10k		
10pF	100																																					
12	120																																					
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0.082	823																																					
0.10	104																																					
0.12	124																																					
0.15	154																																					
0.18	184																																					
0.22	224																																					
0.27	274																																					

# High Voltage L and J Leaded Ceramic Capacitor SM Series

## X7R DIELECTRIC

STYLE		SM20			SM21			SM22			SM23			SM24			SM25			SM26									
Cap	L	.150 ± .015 (3.31 ± .38)			.200 ± .020 (5.08 ± .51)			.250 ± .020 (6.35 ± .51)			.350 ± .030 (8.89 ± .76)			.450 ± .030 (11.43 ± .76)			.550 ± .030 (14.00 ± .76)			.650 ± .030 (16.50 ± .76)									
	W	.150 ± .015 (3.31 ± .38)			.200 ± .020 (5.08 ± .51)			.200 ± .020 (5.08 ± .51)			.300 ± .030 (7.62 ± .76)			.400 ± .030 (10.20 ± .76)			.500 ± .030 (12.70 ± .76)			.600 ± .030 (15.20 ± .76)									
	T <sub>MAX</sub>	.130 (3.30)			.180 (4.57)			.180 (4.57)			.220 (5.59)			.220 (5.59)			.220 (5.59)			.220 (5.59)									
	Tab A max	.100 (2.54)			.100 (2.54)			.100 (2.54)			.200 (5.08)			.300 (7.62)			.400 (10.20)			.500 (12.70)									
	Cap Code	WVDC			WVDC			WVDC			WVDC			WVDC			WVDC			WVDC									
		500	1k	2k	500	1k	2k	3k	500	1k	2k	3k	500	1k	2k	3k	4k	500	1k	2k	3k	4k	5k	500	1k	2k	3k	4k	5k
270pF	271																												
	330																												
	390																												
	470																												
	560																												
	680																												
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	6800																												
	8200																												
0.01uF	103																												
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	1.5																												
	1.8																												
	2.2																												
	2.7																												







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