Table 1: Bill of Materials

Schematic: noise_r1.sch Tue Aug 22 20:23:04 2006
BOM: noise_r1.bom Wed Aug 23 20:06:46 2006

Qty	Reference	Value	Footprint	Mfg PN	Notes
1	C1	1uF	1206	TDK C3216X7R1H105K	
1	C2	0.01uF	0805	Kemet C0805C103K5RACTU	
1	C3	3300pF	0603	BC VJ0603Y332KXACW1BC	
2	C4, C5	0.1uF	0805	Kemet C0805C104K5RACTU	
1	J1		CON_HDR..	Mill-Max 800-10-005-20-001	
1	Q1		SOT23..	On-Semiconductor BC817-40LT1	
1	R1	100K	0805	Yageo 9C08052A1003FKHFT	
2	R3, R4	4.7M	0805	Yageo RC0805FR-074M7L	
1	R5	1K	0805	Yageo RC0805FR-071KL	
1	R6	3.3K	0805	Rohm MCR10EZHF3301	
1	U1		SOIC..	On-Semiconductor MC33078D	

Table 2: Component List

Schematic: noise_r1.sch Tue Aug 22 20:23:04 2006
BOM: noise_r1.bom Wed Aug 23 20:06:46 2006

Reference	Value	Footprint	Mfg PN	Notes
C1	1uF	1206	TDK C3216X7R1H105K	
C2	0.01uF	0805	Kemet C0805C103K5RACTU	
C3	3300pF	0603	BC VJ0603Y332KXACW1BC	
C4	0.1uF	0805	Kemet C0805C104K5RACTU	
C5	0.1uF	0805	Kemet C0805C104K5RACTU	
J1		CON_HDR..	Mill-Max 800-10-005-20-001	
Q1		SOT23..	On-Semiconductor BC817-40LT1	
R1	100K	0805	Yageo 9C08052A1003FKHFT	
R3	4.7M	0805	Yageo RC0805FR-074M7L	
R4	4.7M	0805	Yageo RC0805FR-074M7L	
R5	1K	0805	Yageo RC0805FR-071KL	
R6	3.3K	0805	Rohm MCR10EZHF3301	
U1		SOIC..	On-Semiconductor MC33078D	

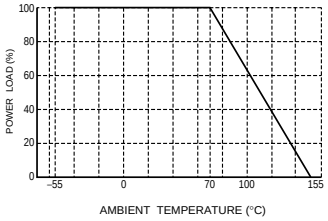
Thick film rectangular

MCR10 (2012 size : 1 / 8W)

●Features

1) Power rating of 1 / 8W
2) Highly reliable chip resistor
   Ruthenium oxide dielectric offers superior resistance to the elements.
3) Electrodes not corroded by soldering
   Thick film makes the electrodes very strong.
4) Leading the world in development and mass production.
   Since start of production in 1982 (first in the wold), this component has established a solid reputation as a general–purpose chip resistor.
5) ROHM resistors have approved ISO–9001 certification.
   Design and specifications are subject to change without notice. Carefully check the specification sheet before using or ordering it.

●Ratings

Item	Conditions	Specifications
Rated power	Power must be derated according to the power derating curve in Figure 1 when ambient temperature exceeds 70°C.  Fig.1	0.125W (1 / 8W) at 70°C
Rated voltage	The voltage rating is calculated by the following equation. If the value obtained exceeds the limiting element voltage, the voltage rating is equal to the maximum operating voltage. $E=\sqrt{P\times R}$ E: Rated voltage (V) P: Rated power (W) R: Nominal resistance (Ω)	Limiting element voltage 150V
Nominal resistance	See Table 1.	
Operating temperature		–55°C to + 155°C

Resistors

Jumper type

Resistance	Max. 50mΩ
Rated current	2A
Operating temperature	–55°C to +155°C

Table 1

Resistance tolerance	Resistance range (Ω)	Resistance temperature coefficient (ppm/°C)
F (±1%)	10 ≤ R ≤ 2.2M (E24,96)	±100
J (±5%)	1.0 ≤ R < 10 (E24)	±400
	10 ≤ R ≤ 10M (E24)	±200

●Before using components in circuits where they will be exposed to transients such as pulse loads (short–duration, high– level loads), be certain to evaluate the component in the mounted state. In addition, the reliability and performance of this component cannot be guaranteed if it is used with a steady state voltage that is greater than its rated voltage.

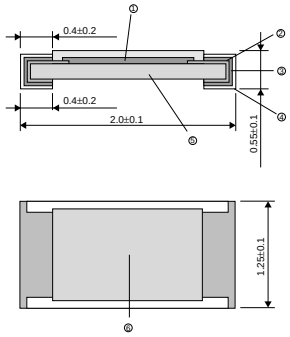
●Characteristics

Item	Guaranteed value		Test conditions (JIS C 5201-1)
	Resistor type	Jumper type	
Resistance	J : ±5% F : ±1%	Max. 50mΩ	JIS C 5201-1 4.5
Variation of resistance with temperature	See Table.1		JIS C 5201-1 4.8 Measurement : –55 / +25 / +125°C
Overload	± (2.0%+0.1Ω)	Max. 50mΩ	JIS C 5201-1 4.13 Rated voltage (current) ×2.5, 2s. Maximum overload voltage : 200V
Solderability	A new uniform coating of minimum of 95% of the surface being immersed and no soldering damage.		JIS C 5201-1 4.17 Rosin·Ethanol (25%WT) Soldering condition : 235±5°C Duration of immersion : 2.0±0.5s.
Resistance to soldering heat	± (1.0%+0.05Ω)	Max. 50mΩ No remarkable abnormality on the appearance.	JIS C 5201-1 4.18 Soldering condition : 260±5°C Duration of immersion : 10±1s.
Rapid change of temperature	± (1.0%+0.05Ω)	Max. 50mΩ	JIS C 5201-1 4.19 Test temp. : –55°C to +125°C 5cyc
Damp heat, steady state	± (3.0%+0.1Ω)	Max. 100mΩ	JIS C 5201-1 4.24 40°C, 93%RH Test time : 1,000h to 1,048h
Endurance at 70°C	± (3.0%+0.1Ω)	Max. 100mΩ	JIS C 5201-1 4.25.1 Rated voltage (current), 70°C 1.5h : ON – 0.5h : OFF Test time : 1,000h to 1,048h
Endurance	± (3.0%+0.1Ω)	Max. 100mΩ	JIS C 5201-1 4.25.3 155°C Test time : 1,000h to 1,048h
Resistance to solvent	± (1.0%+0.05Ω)	Max. 50mΩ	JIS C 5201-1 4.29 23±5°C, Immersion cleaning, 5±0.5min. Solvent : 2-propanol
Bend strength of the end face plating	± (1.0%+0.05Ω)	Max. 50mΩ Without mechanical damage such as breaks.	JIS C 5201-1 4.33

MCR10

Resistors

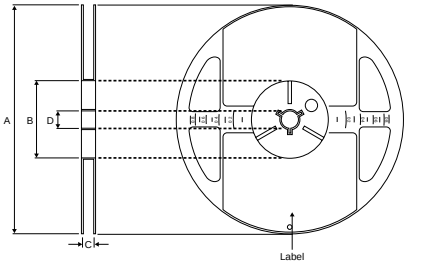
●**External dimensions** (Unit : mm)



No.	Material
①	Resistive element (Oxide metal thick film)
②	Silver thick film electrode
③	Nickel electrode
④	Sn electrode
⑤	Alumina substrate
⑥	Overcoating (Resin)

●**Packaging**

Reel

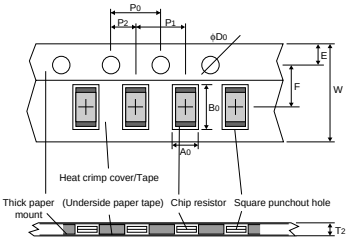


EIAJ ET-7200B compliant

(Unit: mm)

A	B	C	D
$\phi 180^{\ 0}_{-1.5}$	$\phi 60^{+1}_{\ 0}$	$9^{+1.0}_{\ 0}$	$\phi 13 \pm 0.2$

Taping



(Unit: mm)

W	F	E	A0	B0
8.0±0.3	3.5±0.05	1.75±0.1	$1.65^{+0.2}_{-0.1}$	$2.4^{+0.2}_{-0.1}$
D0	P0	P1	P2	T2
$\phi 1.5^{+0.1}_{\ 0}$	4.0±0.1	4.0±0.1	2.0±0.05	Max. 1.1

●Part designation

M	C	R	1	0	E	Z	P	J	□	□	□	□

Part No.

Resistance tolerance

F	±1%
J	±5%

Nominal resistance

Resistance code, 3 or 4 digits.
000 denotes jumper type.

Resistance tolerance		Resistance code
F	:	4 digits
J	:	3 digits

Packaging Specifications Code

Part No.	Code	Resistance tolerance		Packaging specifications	Reel	Basic ordering unit(pcs)
		J(±5%)	F(±1%)			
MCR10	EZP	◎	◎	Paper tape (4mm Pitch)	ϕ180mm (7in.)	5,000

Reel (ϕ180mm) : Compatible with JEITA standard "EIAJ ET-7200B"
◎: Standard product

●Dimensions

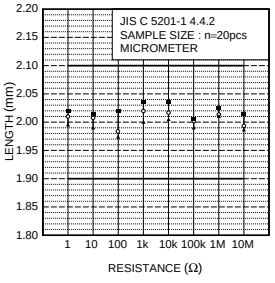


Fig.2 Dimensions (length)

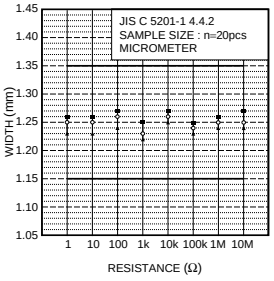


Fig.3 Dimensions (width)

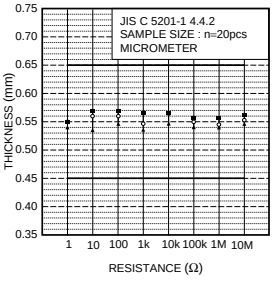


Fig.4 Dimensions (thickness)

●Electrical characteristics

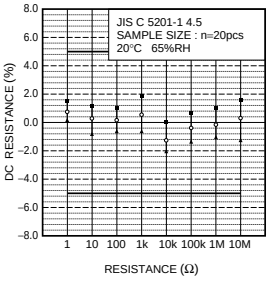


Fig.5 Resistance

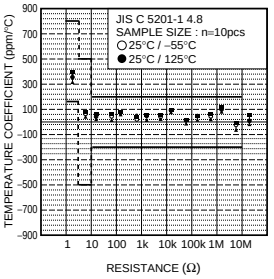


Fig.6 Variation resistance with temperature

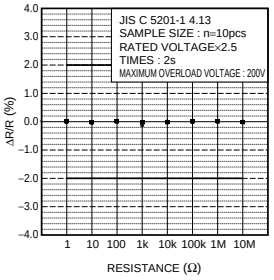


Fig.7 Overload

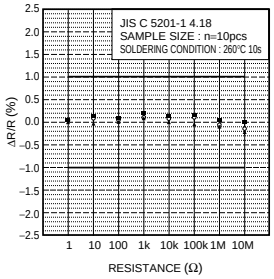


Fig.8 Resistance to soldering heat

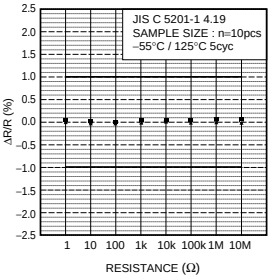


Fig.9 Rapid change of temperature

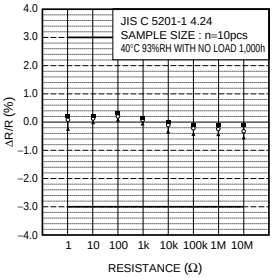


Fig.10 Damp heat, steady state

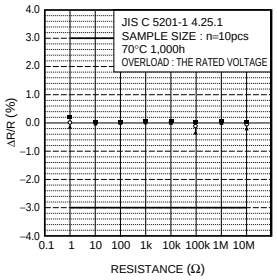


Fig.11 Endurance at 70°C

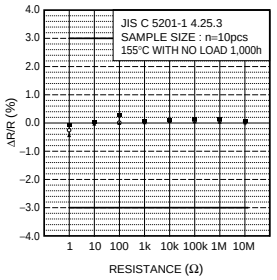


Fig.12 Endurance

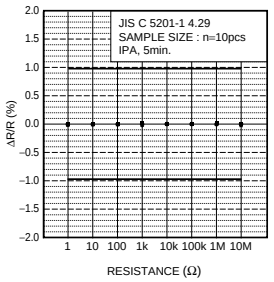


Fig.13 Resistance to solvents

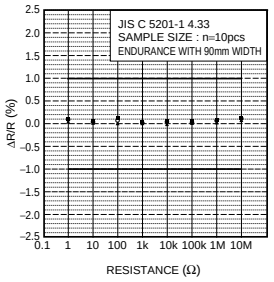


Fig.14 Bend strength of the end face plating

Appendix

Notes

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Class 2 X7R 10/16/25/50/100 V

Vishay BCcomponents

Surface Mount Multilayer Chip Capacitors

FEATURES

- Stable class 2 dielectric
- Four standard sizes
- High capacitance per unit volume
- Supplied in tape on reel
- For high frequency applications
- Ni-barrier with 100 % tin terminations.

APPLICATIONS

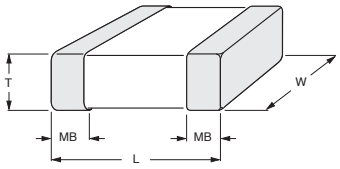
- Consumer electronics
- Telecommunications
- Data processing

GENERAL SPECIFICATIONS

NOTE: Electrical characteristics values - temperature at 20 ± 1 °C, pressure at 86 to 106 Kpa and humidity at 63 to 67 % unless otherwise stated
Rated Voltage U_R (DC): 10 V; 16 V; 25 V; 50 V; 100 V
Capacitance Range: 100 pF to 1.0 µF
Tolerance on Capacitance:
After 1000 hours; ± 5; ± 10, ± 20

Tan δ:
50 V ≤ 2.5 %
25 V and 16 V ≤ 3.5 %
10 V ≤ 5 %
Temperature Coefficient: ± 15 %
Insulation Resistance after 120 seconds at U_R (DC):
R_{ins}10 GΩ minimum or 500ΩF minimum, whichever is less
Climatic Category (IEC 68): 55/125/56

DIMENSIONS in inches [millimeters]



SIZE CODE	L	W	T MAX.	MB
0402	0.040 ± 0.002 [1.0 ± 0.05]	0.020 ± 0.002 [0.5 ± 0.05]	0.022 [0.55]	0.010 + 0.002/- 0.004 [0.25 +0.05/– 0.1]
0603	0.063 ± 0.004 [1.6 ± 0.10]	0.030 ± 0.004 [0.8 ± 0.07]	0.035 [0.87]	0.015 ± 0.006 [0.40 ± 0.15]
0805	0.080 ± 0.006 [2.0 ± 0.15]	0.050 ± 0.006 [1.25 ± 0.15]	0.053 [1.35]	0.020 ± 0.008 [0.50 ± 0.20]
1206	0.125 ± 0.006 [3.2 ± 0.15]	0.063 ± 0.006 [1.6 ± 0.15]	0.069 [1.80]	0.025 ± 0.008 [0.60 ± 0.20]

ORDERING INFORMATION

VJ0402	Y	101	J	X	Q	C	W1BC
SIZE CODE	DIELECTRIC	CAPACITANCE	TOLERANCE	TERMINATION	VOLTAGE	PACKAGING	TECHNOLOGY
0402 0603 0805 1206	Y = X7R	two significant digits followed by the number of zeros: 101 = 100 102 = 1000 152 = 1500 103 = 10000	J = ± 5 % K = ± 10 % M = ± 20 %	X = Ni Barrier	Q = 10 V J = 16 V X = 25 V A = 50 V B = 100 V	C = 7 inch reel/paper P = 13 inch reel/paper T = 7 inch reel/blister R = 13 inch reel/blister	

Class 2 X7R 10/16/25/50/100 V

Vishay BCcomponents Surface Mount Multilayer Chip Capacitors

SELECTION CHART FOR 10/16/25/50 AND 100 V																					
DIELECTRIC		X7R																			
EIA CAP	SIZE	0402					0603					0805					1206				
CODE	VDC W	10 V	16 V	25 V	50 V	100 V	10 V	16 V	25 V	50 V	100 V	10 V	16 V	25 V	50 V	100 V	10 V	16 V	25 V	50 V	100 V
101	100 pF	N	N	N	N		S	S	S	S	S	B	B	B	B	B					
121	120	N	N	N	N		S	S	S	S	S	B	B	B	B	B					
151	150	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B*	B*	B*	B*	B*
181	180	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B*	B*	B*	B*	B*
221	220	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B*	B*	B*	B*	B*
271	270	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B*	B*	B*	B*	B*
331	330	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B*	B*	B*	B*	B*
391	390	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B*	B*	B*	B*	B*
471	470	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B*	B*	B*	B*	B*
561	560	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B*	B*	B*	B*	B*
681	680	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B*	B*	B*	B*	B*
821	820	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
102	1000 pF	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
122	1200	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
152	1500	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
182	1800	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
222	2200	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
272	2700	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
332	3300	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
392	3900	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
472	4700	N	N	N	N		S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
562	5600	N	N	N			S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
682	6800	N	N	N			S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
822	8200	N	N	N			S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
103	0.01 µF	N	N	N			S	S	S	S	S	B	B	B	B	B	B	B	B	B	B
123	0.012	N	N				S	S	S	S		B	B	B	B	B	B	B	B	B	B
153	0.015	N	N				S	S	S	S		B	B	B	B	B	B	B	B	B	B
183	0.018	N	N				S	S	S	S		B	B	B	B	B	B	B	B	B	B
223	0.022	N	N				S	S	S	S		B	B	B	B	B	B	B	B	B	B
273	0.027	N					S	S	S	S		B	B	B	B	D	B	B	B	B	B
333	0.033	N					S	S	S			B	B	B	B	D	B	B	B	B	B
393	0.039	N					S	S	S			B	B	B	B		B	B	B	B	B
473	0.047	N					S	S	S			B	B	B	B		B	B	B	B	B
563	0.056						S	S	S			B	B	B	B		B	B	B	B	B
683	0.068						S	S	S			B	B	B	B		B	B	B	B	B
823	0.082						S	S				B	B	B	D		B	B	B	B	D
104	0.1 µF						S	S				B	B	B	D		B	B	B	B	D
124	0.12						S					B	B	B	D		B	B	B	B	
154	0.15						S					D	D	D	D		C	C	C	C	
184	0.18						S					D	D	D			C	C	C	C	
224	0.22						S					D	D	D			C	C	C	C	
274	0.27											D	D	D			C	C	C		
334	0.33											D	D	D			C	C	C		
394	0.39											D	D				C	C			
474	0.47											D	D				D	D			
564	0.56											D	D				D	D			
684	0.68											D					D	D			
824	0.82											D					D	D			
105	1 µF											D					D	D			

Note

1. * Items are made by NME (Nobel Metal Electrode)

PACKAGING QUANTITIES					
THICKNESS CLASSIFICATION (mm)		AMOUNT PER REEL			
		Δ180 mm; 7 inch			
		0402	0603	0805	1206
A =	0.6 ± 0.1	-	-	Paper 4 Kp/Reel	-
B =	0.8 ± 0.1	-	-	Paper 4 Kp/Reel	Paper 4 Kp/Reel
C =	0.95 ± 0.1	-	-	-	Plastic 3 Kp/Reel
D =	1.25 ± 0.1	-	-	Plastic 3 Kp/Reel	Plastic 3 Kp/Reel
G =	1.60 ± 0.2	-	-	-	Plastic 2 Kp/Reel
S =	0.8 ± 0.07	-	Paper 4 Kp/Reel	-	-
N =	0.50 ± 0.05	Paper 10 Kp/Reel	-	-	-
K =	2.00 ± 0.2	-	-	-	-
M =	2.5 ± 0.30	-	-	-	-

PACKAGING QUANTITIES					
THICKNESS CLASSIFICATION (mm)		AMOUNT PER REEL			
		Δ330 mm; 13 inch			
		0402	0603	0805	1206
A =	0.6 ± 0.1	-	-	Paper 15 Kp/Reel	-
B =	0.8 ± 0.1	-	-	Paper 15 Kp/Reel	Paper 15 Kp/Reel
C =	0.95 ± 0.1	-	-	-	Plastic 10 Kp/Reel
D =	1.25 ± 0.1	-	-	Plastic 10 Kp/Reel	Plastic 10 Kp/Reel
G =	1.60 ± 0.2	-	-	-	-
S =	0.8 ± 0.07	-	Paper 15 Kp/Reel	-	-
N =	0.50 ± 0.05	Paper 50 Kp/Reel	-	-	-
K =	2.00 ± 0.2	-	-	-	-
M =	2.5 ± 0.30	-	-	-	-

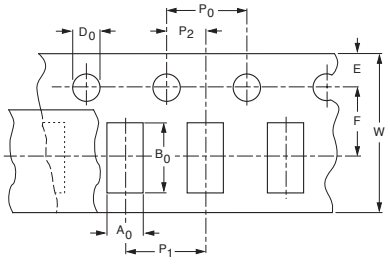
COVER TAPE (POLYESTER - ANTISTATIC)

PROPERTIES OF COVER TAPE	
PARAMETER	WIDTH
	5.5 ± 0.1 mm
Breaking force	≥ 10.7 N
Elongation at break	≥ 63 %
Surface resistance	< 10^{10} Ω /sq.
Softening point	71 ± 5 °C
Thickness	62 µm

CARRIER TAPE (POLYCARBONATE)

PROPERTIES OF CARRIER TAPE	
PARAMETER	WIDTH
	8.1 ± 0.2 mm
Thickness	190 to 280 µm
Tensile strength at break	> 60 N /mm^2
Elongation at break	100 to 150 %
Surface resistance	> 10^{12} Ω /sq.

PAPER TAPE SPECIFICATIONS

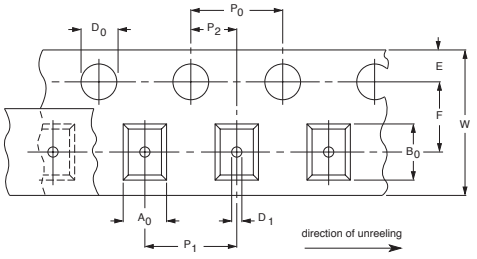


DIMENSIONS OF PAPER TAPE in millimeters								
SYMBOL	PRODUCT SIZE CODE							
	0402		0603		0805		1206	
	SIZE	TOL.	SIZE	TOL.	SIZE	TOL.	SIZE	TOL.
A_0	0.62	± 0.05	1.02	± 0.05	1.50	± 0.10	2.00	± 0.15
B_0	1.12	± 0.05	1.82	± 0.05	2.30	± 0.10	3.50	± 0.15
W	8.00	± 0.10	8.00	± 0.10	8.00	± 0.10	8.00	± 0.10
E	1.75	± 0.10	1.75	± 0.10	1.75	± 0.10	1.75	± 0.10
F	3.50	± 0.05	3.50	± 0.05	3.50	± 0.05	3.50	± 0.05
D_0	1.55	± 0.05	1.55	± 0.05	1.55	± 0.05	1.55	± 0.05
P_0	4.00	± 0.10	4.00	± 0.10	4.00	± 0.10	4.00	± 0.10
P_1	2.00	± 0.05	4.00	± 0.10	4.00	± 0.10	4.00	± 0.10
P_2	2.00	± 0.05	2.00	± 0.05	2.00	± 0.05	2.00	± 0.05

Class 2 X7R 10/16/25/50/100 V

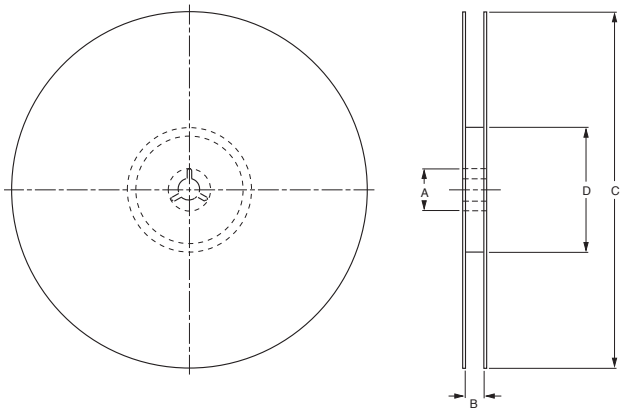
Vishay BCcomponents Surface Mount Multilayer Chip Capacitors

BLISTER TAPE SPECIFICATIONS



DIMENSIONS OF BLISTER TAPE in millimeters			
DIMENSION	PRODUCT		TOLERANCE
	0805	1206	
A_0	< 1.55	< 2.00	-
B_0	< 2.45	< 3.60	-
W	8.00	8.00	± 0.20
E	1.75	1.75	± 0.10
F	3.50	3.50	± 0.05
D_0	1.50	1.50	+ 0.10/- 0
D_1	1.00	1.00	± 0.10
P_0	4.00	4.00	± 0.05
P_1	4.00	4.00	± 0.10
P_2	2.00	2.00	± 0.05

REEL SPECIFICATIONS



REEL DIMENSIONS AND TAPE WIDTH in millimeters		
	Ø 180 mm; 7 inch	Ø 330 mm; 13 inch
A	13.0 ± 1.0	13.0 ± 0.5
B	9.0 ± 1.0	9.0 ± 0.5
C	178.0 ± 1.0	330.0 ± 1.0
D	60.5 ± 1.0	100.0 ± 1.0

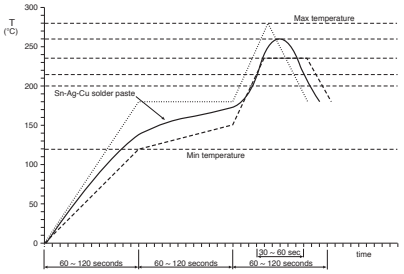
METHOD OF MOUNTING AND DIMENSIONS OF SOLDER LANDS

For normal use the capacitors may be mounted on printed-circuit boards or ceramic substrates by applying wave soldering and reflow soldering.

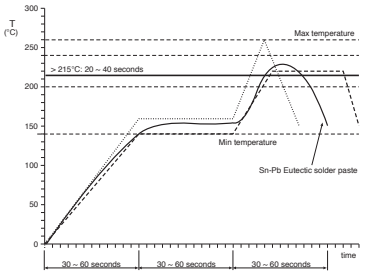
An improper combination of soldering, substrate and chip size can lead to a damaging of the component. The risk increases with the chip size and with temperature fluctuations (> 100 °C) Therefore, it is advised to use the smallest possible size and follow the dimensional recommendations given.

SOLDERING GRAPHS

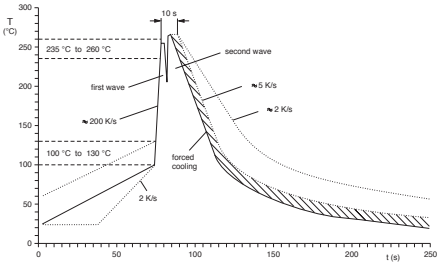
IR REFLOW WITH SnAgCu SOLDER



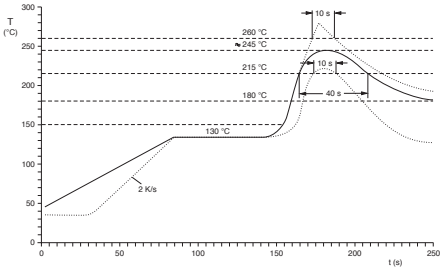
IR REFLOW WITH SnPb SOLDER



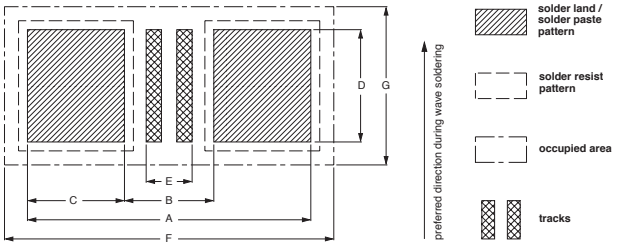
WAVE SOLDERING



REFLOW SOLDERING



RECOMMENDED DIMENSIONS OF SOLDER LANDS in millimeters



Class 2 X7R 10/16/25/50/100 V

Vishay BCcomponents Surface Mount Multilayer Chip Capacitors

REFLOW SOLDERING									
SIZE CODE	FOOTPRINT DIMENSIONS in mm							PROCESSING REMARKS	PLACEMENT ACCURACY
	A	B	C	D	E	F	G		
0402	1.50	0.50	0.50	0.50	0.10	1.75	0.95	IR or hot plate soldering	± 0.15
0603	2.30	0.70	0.80	0.80	0.20	2.55	1.40		± 0.25
0805	2.80	1.00	0.90	1.30	0.40	3.08	1.85		± 0.25
1206	4.00	2.20	0.90	1.60	1.60	4.25	2.25		± 0.25

WAVE SOLDERING									
SIZE CODE	FOOTPRINT DIMENSIONS in mm							PROPOSED NUMBER AND DIMENSIONS OF DUMMY TRACKS (mm)	PLACEMENT ACCURACY (mm)
	A	B	C	D	E	F	G		
0603	2.40	1.00	0.70	0.80	0.20	3.10	1.90	1 x (0.2 x 0.8)	± 0.10
0805	3.20	1.40	0.90	1.30	0.36	4.10	2.50	1 x (0.3 x 1.3)	± 0.15
1206	4.80	2.30	1.25	1.70	1.25	5.90	3.20	3 x (0.25 x 1.7)	± 0.25

TEST CONDITIONS IN STATIC SOLDER BATH	
PARAMETER	DESCRIPTION
SOLDERABILITY	
95 % covered with smooth and bright solder coating	CECC requirement: 235 ± 5 °C for 2 ± 0.5 seconds
	IEC requirement: 215 ± 3 °C for 3 ± 0.3 seconds
RESISTANCE TO LEACHING	
10 % of the metallization of the edges of the head face may be missing (inner electrodes are not visible)	260 ± 5 °C for 30 ± 1 second

TESTS AND REQUIREMENTS

TEST PROCEDURES AND REQUIREMENTS		
TEST	PROCEDURE	REQUIREMENTS
Visual and mechanical		no visible damage dimensions in accordance with specification
Capacitance	C ≤ 10 µF; 1.0 ± 0.2 Vrms; 1 kHz ± 10 % C > 10 µF; 0.5 ± 0.2 Vrms; 120 kHz ± 20 %	shall not exceed the limits given in the detailed specification
Dissipation factor	C ≤ 10 µF; 1.0 ± 0.2 Vrms; 1 kHz ± 10 % C > 10 µF; 0.5 ± 0.2 Vrms; 120 kHz ± 20 %	≤ 2.5 % UR: 50 V ≤ 3.5 % UR: 25 V, 16 V ≤ 5.0 % UR: 10 V
Dielectric strength	250 % of rated voltage for 1 to 5 seconds, charge and discharge current less than 50 mA	no visible damage or flash-over during test
Insulation resistance	at UR (DC) for max. 120 seconds	10 GΩ minimum or 500 ΩF minimum, whichever is less
Temperature coefficient	with no electrical load: – 55 to 125 °C at T_{amb} = 25 °C	within ± 15 %
Bending test	the middle part of the substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5 ± 1 second; measurement after 24 ± 2 hours at room temperature	no visible damage ΔC/C: ≤ ± 12.5 % this capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test

TEST PROCEDURES AND REQUIREMENTS		
TEST	**PROCEDURE**	**REQUIREMENTS**
Solderability	230 ± 5 °C for 2 ± 0.5 seconds; Solder: SN63A	95 % minimum coverage of entire metallized area
Resistance to soldering heat	Solder temperature: 260 ± 5 °C Dipping time: 10 ± 1 seconds Solder: SN63A Before initial measurement: Perform 150 + 0/-10 °C for 1 hour and then set for 48 ± 4 hours at room temperature. Preheating: 120 to 150 °C for 1 minute before immerse the capacitor in a eutectic solder. Measurement to be made after 48 ± 4 hrs at room temperature	no visible damage ΔC/C: ≤ ± 7.5 % DF, R_{ins} and dielectric strength to meet initial requirements
Temperature cycle	Test temperature – 55 to 85 °C: – 55 °C – 3/+ 0 °C for 30 ± 3 minutes; Room temperature for 2 to 3 minutes; X5R: 85 °C + 3/– 0 °C for 30 ± 3 minutes; Room temperature for 2 to 3 minutes Measurement to be made after 48 ± 4 hours at room temperature	no visible damage ΔC/C: ≤ ± 7.5 % DF, R_{ins} and dielectric strength to meet initial requirements
Humidity test (damp heat steady state)	Test temperature: 40 ± 2 °C Humidity: 90 to 95 % RH Test time: 500 + 24/– 0 hours Measurement to be made after 48 ± 4 hours at room temperature	no visual damage ΔC/C: ≤ ± 12.5 % DF: ≤ 3.0 % UR: 50 V ≤ 5.0 % UR: 25 V, 16 V ≤ 7.5 % UR: 10 V R_{ins}: 1 GΩ minimum or 50 ΩF minimum, whichever is less
Humidity load (damp heat)	Test temperature: 40 ± 2 °C Humidity: 90 to 95 % RH Test time: 500 + 24/– 0 hours To apply voltage: rated voltage Measurement to be made after 48 ± 2 hours at room temperature	no visual damage ΔC/C: ≤ ± 12.5 % DF: ≤ 3.0 % UR: 50 V ≤ 5.0 % UR: 25 V, 16 V ≤ 7.5 % UR: 10 V R_{ins}: 500 MΩ minimum or 25 ΩF minimum, whichever is less
Adhesive strength of termination	Pressurizing force 5 N (≤ 0603) and 10 N (> 0603) Test time 10 ± 1 second	no visible damage
Vibration resistance	Vibration frequency: 10 to 55 Hz/minute; Total amplitude: 1.5 mm Test time: 6 hours (2 hours each in 3 mutually perpendicular directions)	no visible damage or removal of the terminations
High temperature load (endurance)	Test temperature:125 ± 3 °C; To apply voltage: 200 % of rated voltage Test time1000 + 24/– 0 hours; Measurement after 48 ± 4 hours at room temperature	no visual damage ΔC/C: ≤ ± 12.5 % DF: ≤ 3.0 % UR: 50 V ≤ 5.0 % UR: 25 V, 16 V ≤ 7.5 % UR: 10 V R_{ins}: 1 GΩ minimum or 50 ΩF minimum, whichever is less

U1

MC33078, MC33079

Low Noise Dual/Quad Operational Amplifiers

The MC33078/9 series is a family of high quality monolithic amplifiers employing Bipolar technology with innovative high performance concepts for quality audio and data signal processing applications. This family incorporates the use of high frequency PNP input transistors to produce amplifiers exhibiting low input voltage noise with high gain bandwidth product and slew rate. The all NPN output stage exhibits no deadband crossover distortion, large output voltage swing, excellent phase and gain margins, low open loop high frequency output impedance and symmetrical source and sink AC frequency performance.

The MC33078/9 family offers both dual and quad amplifier versions and is available in the plastic DIP and SOIC packages (P and D suffixes).

Features

- Dual Supply Operation: ±5.0 V to ±18 V
- Low Voltage Noise: 4.5 nV/$\sqrt{Hz}$
- Low Input Offset Voltage: 0.15 mV
- Low T.C. of Input Offset Voltage: 2.0 μV/°C
- Low Total Harmonic Distortion: 0.002%
- High Gain Bandwidth Product: 16 MHz
- High Slew Rate: 7.0 V/μs
- High Open Loop AC Gain: 800 @ 20 kHz
- Excellent Frequency Stability
- Large Output Voltage Swing: +14.1 V/ −14.6 V
- ESD Diodes Provided on the Inputs
- Pb−Free Packages are Available

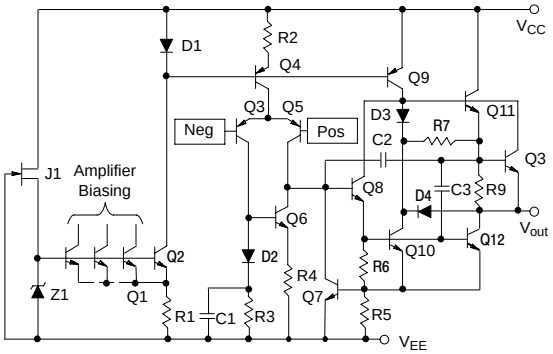


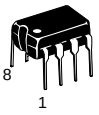
Figure 1. Representative Schematic Diagram
(Each Amplifier)

ON Semiconductor®

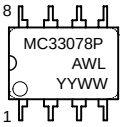
http://onsemi.com

MARKING DIAGRAMS

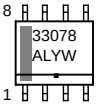
DUAL



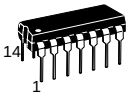
PDIP−8
P SUFFIX
CASE 626



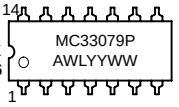
SOIC−8
D SUFFIX
CASE 751



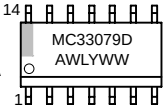
QUAD



PDIP−14
P SUFFIX
CASE 646



SOIC−14
D SUFFIX
CASE 751A



A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week
▪ = Pb−Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 10 of this data sheet.

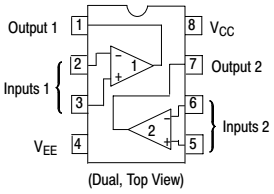
U1

MC33078, MC33079

PIN CONNECTIONS

DUAL

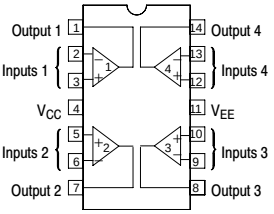
CASE 626/751



(Dual, Top View)

QUAD

CASE 646/751A



(Quad, Top View)

MAXIMUM RATINGS

Rating		Symbol	Value	Unit
Supply Voltage (V_{CC} to V_{EE})		V_S	+36	V
Input Differential Voltage Range		V_{IDR}	Note 1	V
Input Voltage Range		V_{IR}	Note 1	V
Output Short Circuit Duration (Note 2)		t_{SC}	Indefinite	sec
Maximum Junction Temperature		T_J	+150	°C
Storage Temperature		T_{stg}	−60 to +150	°C
ESD Protection at any Pin		V_{esd}		V
MC33078	− Human Body Model		600	
	− Machine Model		200	
MC33079	− Human Body Model		550	
	− Machine Model		150	
Maximum Power Dissipation		P_D	Note 2	mW
Operating Temperature Range		T_A	−40 to +85	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. Either or both input voltages must not exceed the magnitude of V_{CC} or V_{EE}.
2. Power dissipation must be considered to ensure maximum junction temperature (T_J) is not exceeded (see Figure 2).

U1

DC ELECTRICAL CHARACTERISTICS (V_{CC} = +15 V, V_{EE} = −15 V, T_A = 25°C, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Input Offset Voltage (R_S = 10 Ω, V_{CM} = 0 V, V_O = 0 V) (MC33078) T_A = +25°C T_A = −40° to +85°C (MC33079) T_A = +25°C T_A = −40° to +85°C	$\|V_{IO}\|$	 – – – –	 0.15 – 0.15 –	 2.0 3.0 2.5 3.5	mV
Average Temperature Coefficient of Input Offset Voltage R_S = 10 Ω, V_{CM} = 0 V, V_O = 0 V, T_A = T_{low} to T_{high}	$\Delta V_{IO}/\Delta T$	–	2.0	–	μV/°C
Input Bias Current (V_{CM} = 0 V, V_O = 0 V) T_A = +25°C T_A = −40° to +85°C	I_{IB}	 – –	 300 –	 750 800	nA
Input Offset Current (V_{CM} = 0 V, V_O = 0 V) T_A = +25°C T_A = −40° to +85°C	I_{IO}	 – –	 25 –	 150 175	nA
Common Mode Input Voltage Range (ΔV_{IO} = 5.0 mV, V_O = 0 V)	V_{ICR}	±13	±14	–	V
Large Signal Voltage Gain (V_O = ±10 V, R_L = 2.0 kΩ) T_A = +25°C T_A = −40° to +85°C	A_{VOL}	 90 85	 110 –	 – –	dB
Output Voltage Swing (V_{ID} = ±1.0V) R_L = 600 Ω R_L = 600 Ω R_L = 2.0 kΩ R_L = 2.0 kΩ R_L = 10 kΩ R_L = 10 kΩ	 V_O+ V_O− V_O+ V_O− V_O+ V_O−	 – – +13.2 – +13.5 –	 +10.7 −11.9 +13.8 −13.7 +14.1 −14.6	 – – – −13.2 – −14	V
Common Mode Rejection (V_{in} = ±13V)	CMR	80	100	–	dB
Power Supply Rejection (Note 3) V_{CC}/V_{EE} = +15 V/ −15 V to +5.0 V/ −5.0 V	PSR	80	105	–	dB
Output Short Circuit Current (V_{ID} = 1.0 V, Output to Ground) Source Sink	I_{SC}	 +15 −20	 +29 −37	 – –	mA
Power Supply Current (V_O = 0 V, All Amplifiers) (MC33078) T_A = +25°C T_A = −40° to +85°C (MC33079) T_A = +25°C T_A = −40° to +85°C	I_D	 – – – –	 4.1 – 8.4 –	 5.0 5.5 10 11	mA

3. Measured with V_{CC} and V_{EE} differentially varied simultaneously.

AC ELECTRICAL CHARACTERISTICS (V_{CC} = +15 V, V_{EE} = −15 V, T_A = 25°C, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Slew Rate (V_{in} = −10 V to +10 V, R_L = 2.0 kΩ, C_L = 100 pF A_V = +1.0)	SR	5.0	7.0	–	V/μs
Gain Bandwidth Product (f = 100 kHz)	GBW	10	16	–	MHz
Unity Gain Bandwidth (Open Loop)	BW	–	9.0	–	MHz
Gain Margin (R_L = 2.0 kΩ) C_L = 0 pF C_L = 100 pF	A_m	 – –	 −11 −6.0	 – –	dB
Phase Margin (R_L = 2.0 kΩ) C_L = 0 pF C_L = 100 pF	ϕ_m	 – –	 55 40	 – –	Deg
Channel Separation (f = 20 Hz to 20 kHz)	CS	–	−120	–	dB
Power Bandwidth (V_O = 27 V_{pp}, R_L = 2.0 kΩ, THD ± 1.0%)	BW_p	–	120	–	kHz
Total Harmonic Distortion (R_L = 2.0 kΩ, f = 20 Hz to 20 kHz, V_O = 3.0 V_{rms}, A_V = +1.0)	THD	–	0.002	–	%
Open Loop Output Impedance (V_O = 0 V, f = 9.0 MHz)	$\|Z_O\|$	–	37	–	Ω
Differential Input Resistance (V_{CM} = 0 V)	R_{in}	–	175	–	kΩ
Differential Input Capacitance (V_{CM} = 0 V)	C_{in}	–	12	–	pF
Equivalent Input Noise Voltage (R_S = 100 Ω, f = 1.0 kHz)	e_n	–	4.5	–	nV/$\sqrt{Hz}$
Equivalent Input Noise Current (f = 1.0 kHz)	i_n	–	0.5	–	$\overline{Hz}\sqrt{}$ pA/

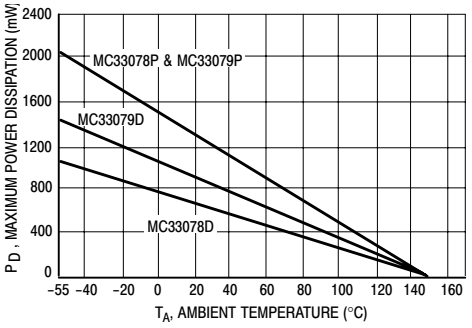


Figure 2. Maximum Power Dissipation versus Temperature

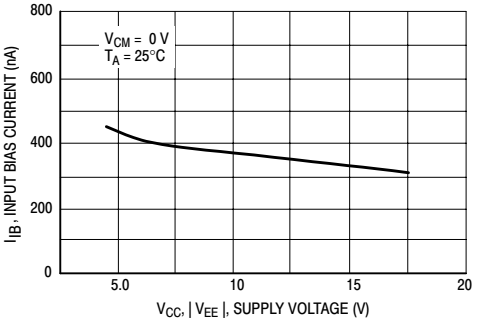


Figure 3. Input Bias Current versus Supply Voltage

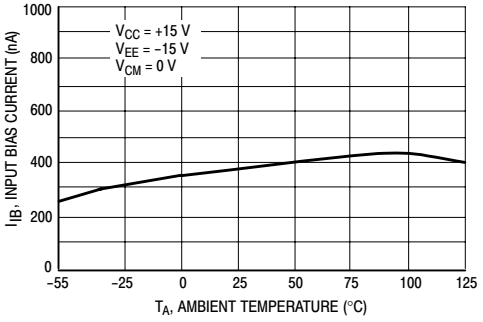


Figure 4. Input Bias Current versus Temperature

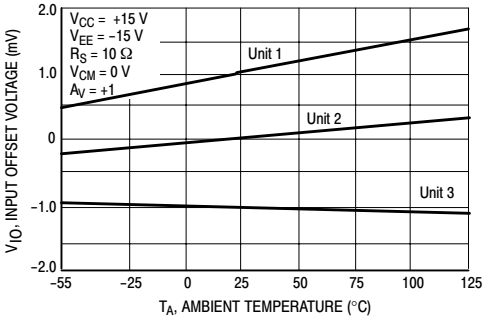


Figure 5. Input Offset Voltage versus Temperature

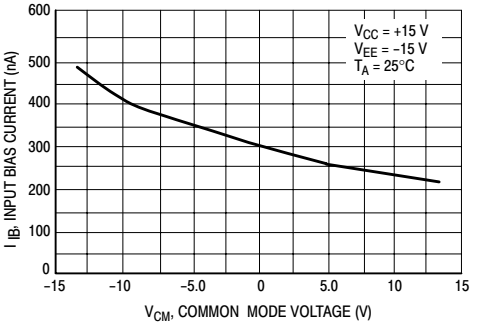


Figure 6. Input Bias Current versus Common Mode Voltage

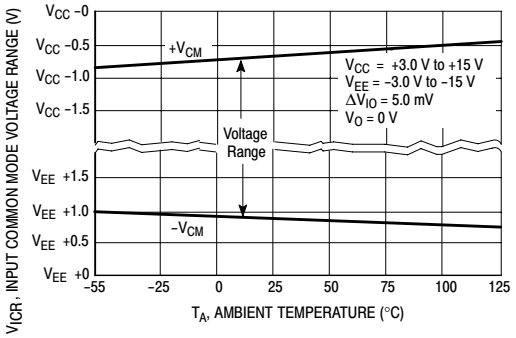


Figure 7. Input Common Mode Voltage Range versus Temperature

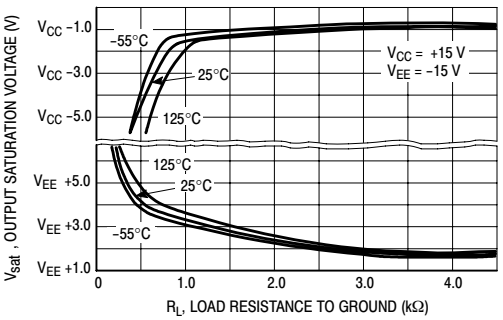


Figure 8. Output Saturation Voltage versus Load Resistance to Ground

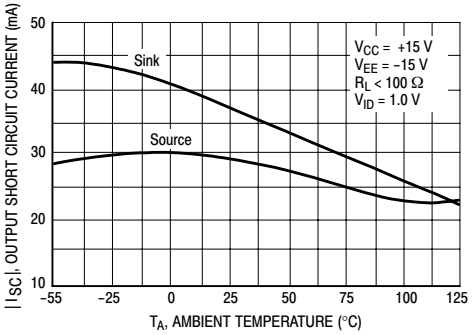


Figure 9. Output Short Circuit Current versus Temperature

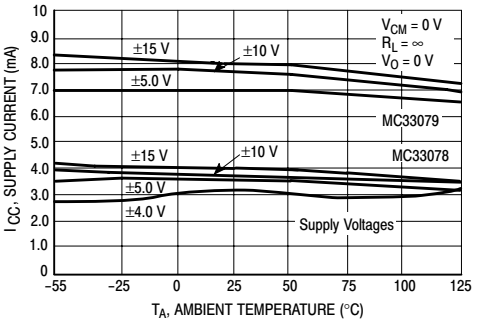


Figure 10. Supply Current versus Temperature

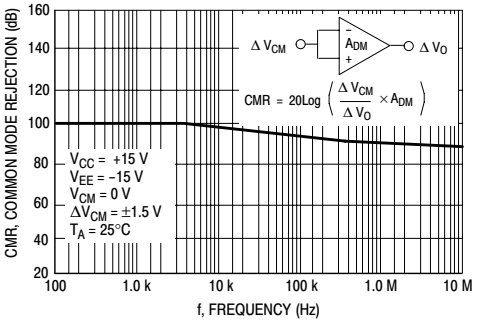


Figure 11. Common Mode Rejection versus Frequency

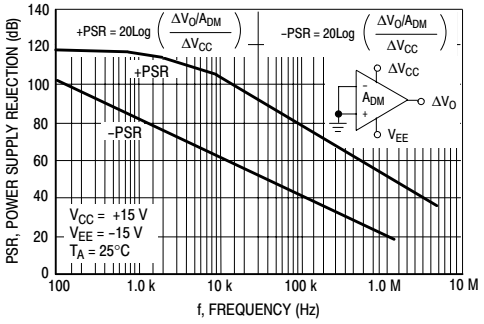


Figure 12. Power Supply Rejection versus Frequency

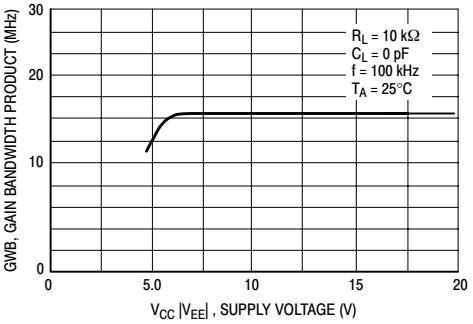


Figure 13. Gain Bandwidth Product versus Supply Voltage

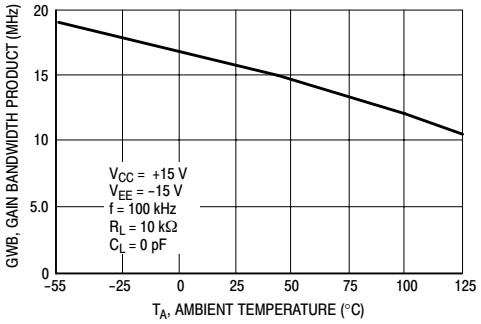


Figure 14. Gain Bandwidth Product versus Temperature

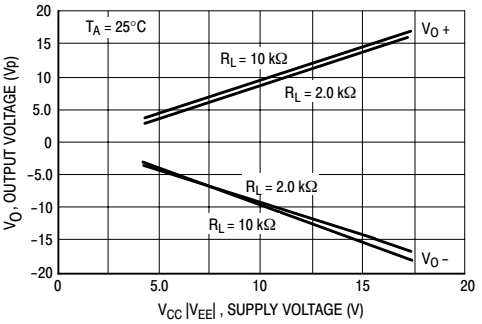


Figure 15. Maximum Output Voltage versus Supply Voltage

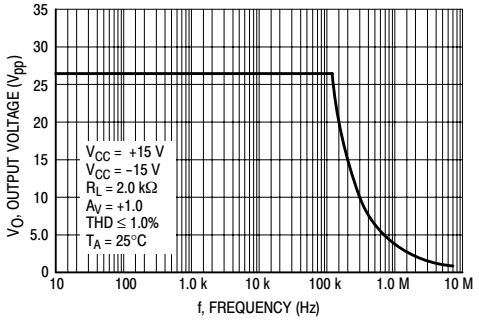


Figure 16. Output Voltage versus Frequency

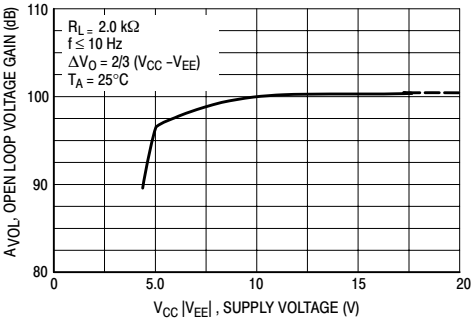


Figure 17. Open Loop Voltage Gain versus Supply Voltage

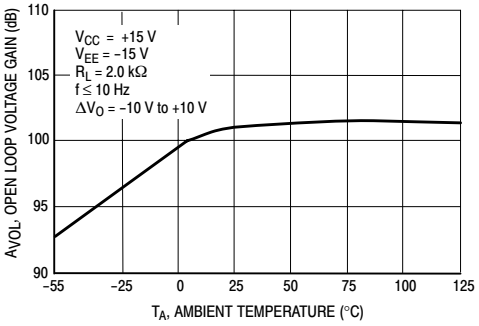


Figure 18. Open Loop Voltage Gain versus Temperature

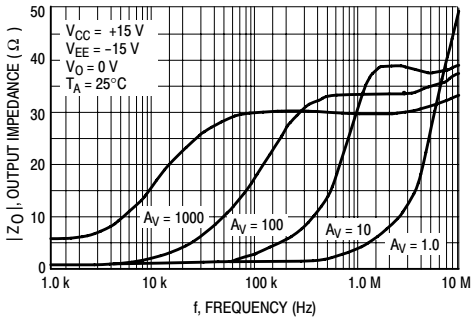


Figure 19. Output Impedance versus Frequency

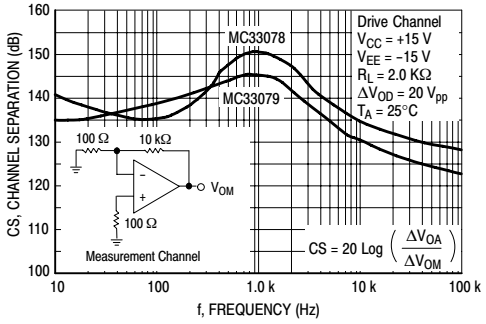


Figure 20. Channel Separation versus Frequency

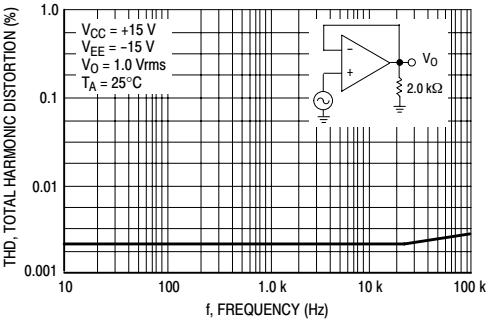


Figure 21. Total Harmonic Distortion versus Frequency

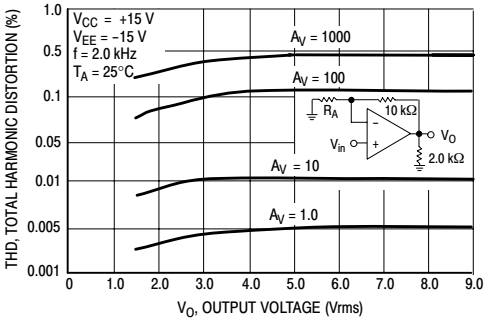


Figure 22. Total Harmonic Distortion versus Output Voltage

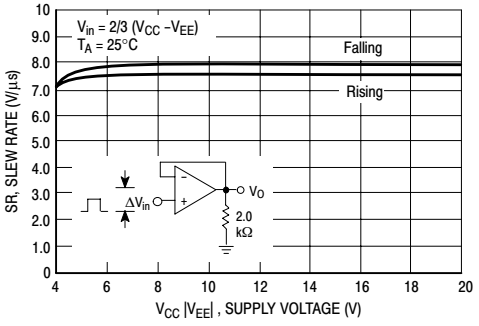


Figure 23. Slew Rate versus Supply Voltage

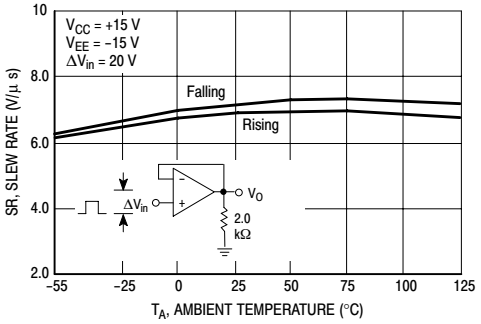


Figure 24. Slew Rate versus Temperature

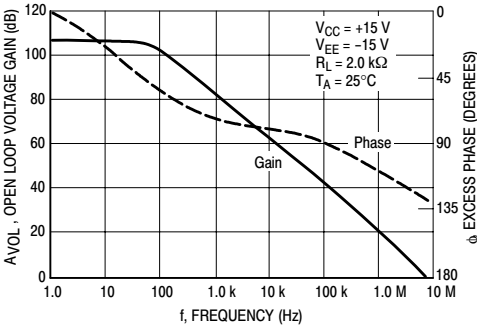


Figure 25. Voltage Gain and Phase versus Frequency

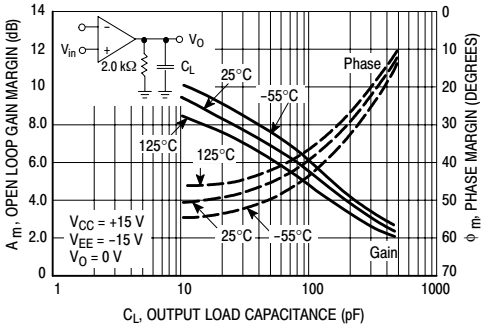


Figure 26. Open Loop Gain Margin and Phase Margin versus Load Capacitance

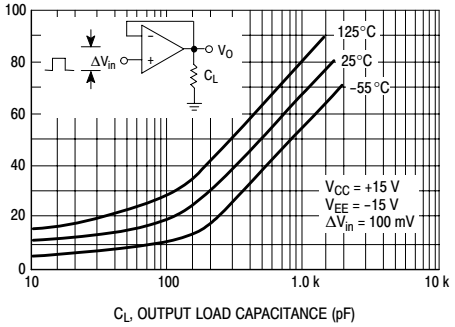


Figure 27. Overshoot versus Output Load Capacitance

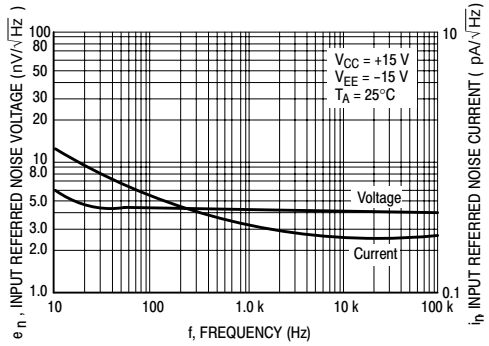


Figure 28. Input Referred Noise Voltage and Current versus Frequency

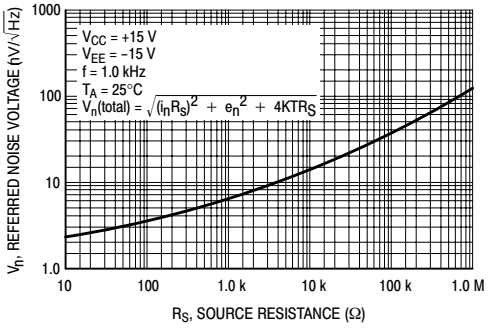


Figure 29. Total Input Referred Noise Voltage versus Source Resistance

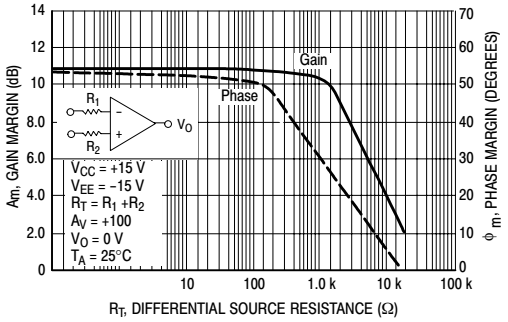


Figure 30. Phase Margin and Gain Margin versus Differential Source Resistance

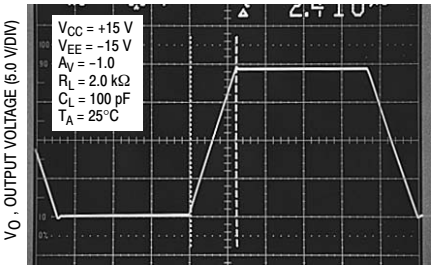


Figure 31. Inverting Amplifier Slew Rate

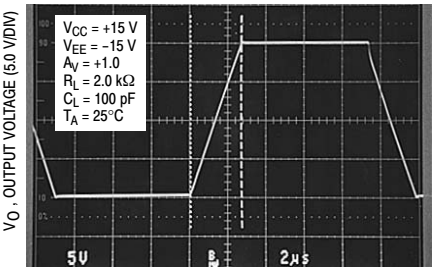


Figure 32. Non−inverting Amplifier Slew Rate

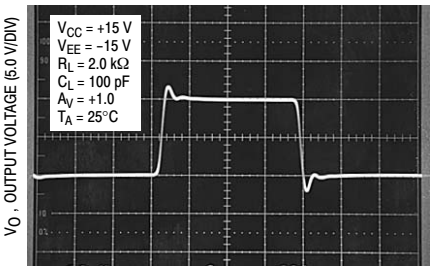


Figure 33. Non−inverting Amplifier Overshoot

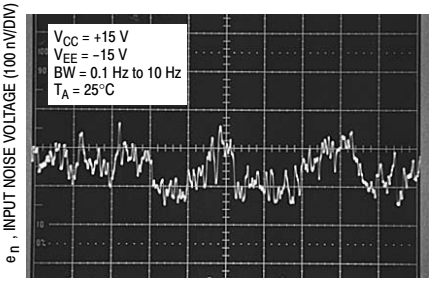
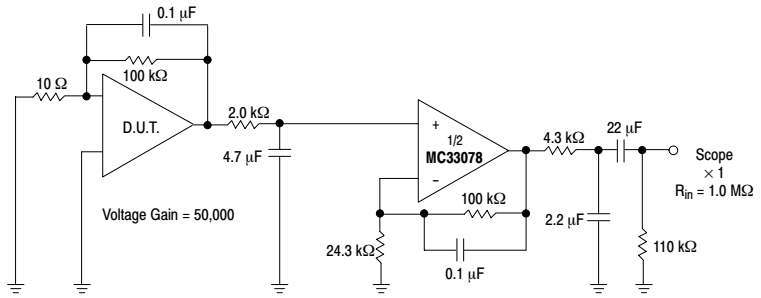


Figure 34. Low Frequency Noise Voltage versus Time

U1



Note: All capacitors are non−polarized.

Figure 35. Voltage Noise Test Circuit (0.1 Hz to 10 Hz_{p-p})

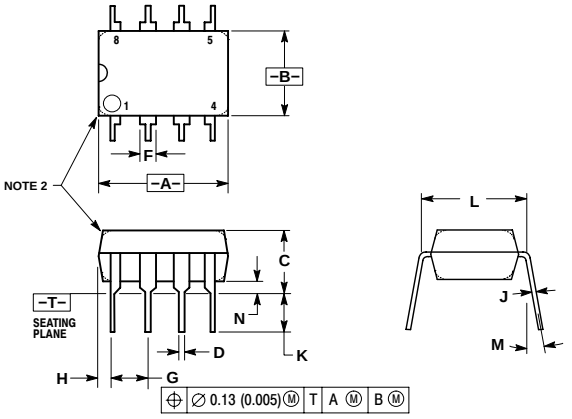
ORDERING INFORMATION

Device	Package	Shipping†
MC33078D	SOIC−8	98 Units / Rail
MC33078DG	SOIC−8 (Pb−Free)	
MC33078DR2	SOIC−8	2500 Tape & Reel
MC33078DR2G	SOIC−8 (Pb−Free)	
MC33078P	PDIP−8	50 Units / Rail
MC33078PG	PDIP−8 (Pb−Free)	
MC33079D	SOIC−14	55 Units / Rail
MC33079DG	SOIC−14 (Pb−Free)	
MC33079DR2	SOIC−14	2500 Tape & Reel
MC33079DR2G	SOIC−14 (Pb−Free)	
MC33079P	PDIP−14	25 Units / Rail
MC33079PG	PDIP−14 (Pb−Free)	

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

PACKAGE DIMENSIONS

PDIP−8
P SUFFIX
CASE 626−05
ISSUE L

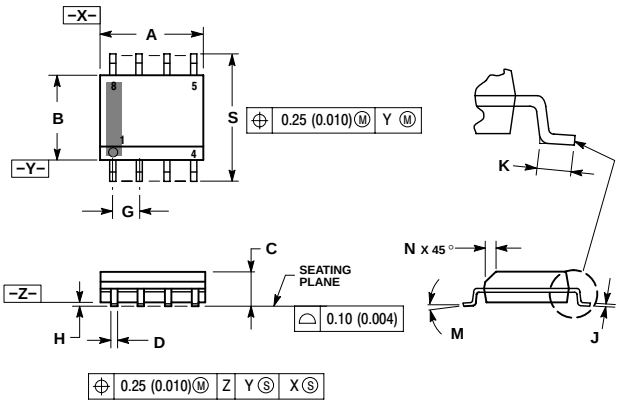


NOTES:
1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	---	10°	---	10°
N	0.76	1.01	0.030	0.040

PACKAGE DIMENSIONS

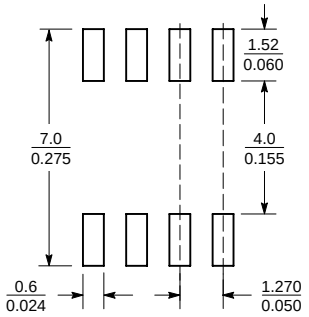
SOIC−8
D SUFFIX
CASE 751−07
ISSUE AG



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751−01 THRU 751−06 ARE OBSOLETE. NEW STANDARD IS 751−07.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0 °	8 °	0 °	8 °
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

SOLDERING FOOTPRINT*

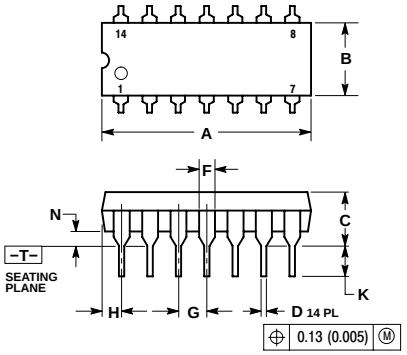


SCALE 6:1 (mm / inches)

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PACKAGE DIMENSIONS

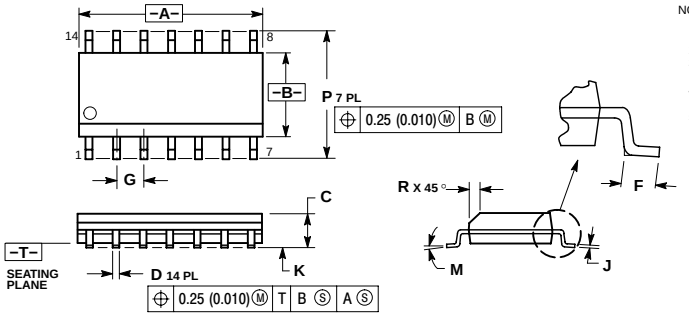
PDIP−14
N SUFFIX
CASE 646−06
ISSUE N



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.715	0.770	18.16	18.80
B	0.240	0.260	6.10	6.60
C	0.145	0.185	3.69	4.69
D	0.015	0.021	0.38	0.53
F	0.040	0.070	1.02	1.78
G	0.100 BSC		2.54 BSC	
H	0.052	0.095	1.32	2.41
J	0.008	0.015	0.20	0.38
K	0.115	0.135	2.92	3.43
L	0.290	0.310	7.37	7.87
M	----	10 °	----	10 °
N	0.015	0.039	0.38	1.01

SOIC−14
D SUFFIX
CASE 751A−03
ISSUE G



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	8.55	8.75	0.337	0.344
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0 °	7 °	0 °	7 °
P	5.80	6.20	0.228	0.244
R	0.25	0.50	0.010	0.019

U1

MC33078, MC33079

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 61312, Phoenix, Arizona 85082−1312 USA
Phone: 480−829−7710 or 800−344−3860 Toll Free USA/Canada
Fax: 480−829−7709 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada

Japan: ON Semiconductor, Japan Customer Focus Center
2−9−1 Kamimeguro, Meguro−ku, Tokyo, Japan 153−0051
Phone: 81−3−5773−3850

ON Semiconductor Website: http://onsemi.com

Order Literature: http://www.onsemi.com/litorder

For additional information, please contact your local Sales Representative.

MC33078/D

Q1

BC817-16LT1, BC817-25LT1, BC817-40LT1

General Purpose Transistors

NPN Silicon

Features

- Pb−Free Packages are Available

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector − Emitter Voltage	V_{CEO}	45	V
Collector − Base Voltage	V_{CBO}	50	V
Emitter − Base Voltage	V_{EBO}	5.0	V
Collector Current − Continuous	I_C	500	mAdc

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR−5 Board, (Note 1) T_A = 25°C Derate above 25°C	P_D	225 1.8	mW mW/°C
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	556	°C/W
Total Device Dissipation Alumina Substrate, (Note 2) T_A = 25°C Derate above 25°C	P_D	300 2.4	mW mW/°C
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	417	°C/W
Junction and Storage Temperature	T_J, T_{stg}	−55 to +150	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. FR−5 = 1.0 x 0.75 x 0.062 in.
2. Alumina = 0.4 x 0.3 x 0.024 in 99.5% alumina.

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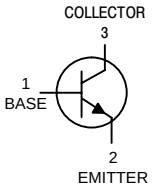
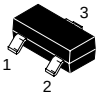
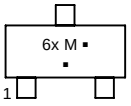




SOT−23
CASE 318
STYLE 6

MARKING DIAGRAM



6x = Device Code
x = A, B, or C
M = Date Code*
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*Date Code orientation and/or overbar may vary depending upon manufacturing location.

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

Q1

BC817−16LT1, BC817−25LT1, BC817−40LT1

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector−Emitter Breakdown Voltage (I_C = −10 mA)		$V_{(BR)CEO}$	45	−	−	V
Collector−Emitter Breakdown Voltage (V_{EB} = 0, I_C = −10 μA)		$V_{(BR)CES}$	50	−	−	V
Emitter−Base Breakdown Voltage (I_E = −1.0 μA)		$V_{(BR)EBO}$	5.0	−	−	V
Collector Cutoff Current (V_{CB} = 20 V) (V_{CB} = 20 V, T_A = 150°C)		I_{CBO}	− −	− −	100 5.0	nA μA
ON CHARACTERISTICS						
DC Current Gain (I_C = 100 mA, V_{CE} = 1.0 V) (I_C = 500 mA, V_{CE} = 1.0 V)	BC817−16 BC817−25 BC817−40	h_{FE}	 100 160 250 40	 − − − −	 250 400 600 −	−
Collector−Emitter Saturation Voltage (I_C = 500 mA, I_B = 50 mA)		$V_{CE(sat)}$	−	−	0.7	V
Base−Emitter On Voltage (I_C = 500 mA, V_{CE} = 1.0 V)		$V_{BE(on)}$	−	−	1.2	V
SMALL−SIGNAL CHARACTERISTICS						
Current−Gain − Bandwidth Product (I_C = 10 mA, V_{CE} = 5.0 Vdc, f = 100 MHz)		f_T	100	−	−	MHz
Output Capacitance (V_{CB} = 10 V, f = 1.0 MHz)		C_{obo}	−	10	−	pF

ORDERING INFORMATION

Device	Specific Marking	Package	Shipping†
BC817−16LT1	6A	SOT−23	3000/Tape & Reel
BC817−16LT1G		SOT−23 (Pb−Free)	3000/Tape & Reel
BC817−16LT3		SOT−23	10,000/Tape & Reel
BC817−16LT3G		SOT−23 (Pb−Free)	10,000/Tape & Reel
BC817−25LT1	6B	SOT−23	3000/Tape & Reel
BC817−25LT1G		SOT−23 (Pb−Free)	3000/Tape & Reel
BC817−25LT3		SOT−23	10,000/Tape & Reel
BC817−25LT3G		SOT−23 (Pb−Free)	10,000/Tape & Reel
BC817−40LT1	6C	SOT−23	3000/Tape & Reel
BC817−40LT1G		SOT−23 (Pb−Free)	3000/Tape & Reel
BC817−40LT3		SOT−23	10,000/Tape & Reel
BC817−40LT3G		SOT−23 (Pb−Free)	10,000/Tape & Reel
SBC817−40LT1		SOT−23	3000/Tape & Reel
SBC817−40LT1G		SOT−23 (Pb−Free)	3000/Tape & Reel
SBC817−40LT3		SOT−23	10,000/Tape & Reel
SBC817−40LT3G		SOT−23 (Pb−Free)	10,000/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Q1

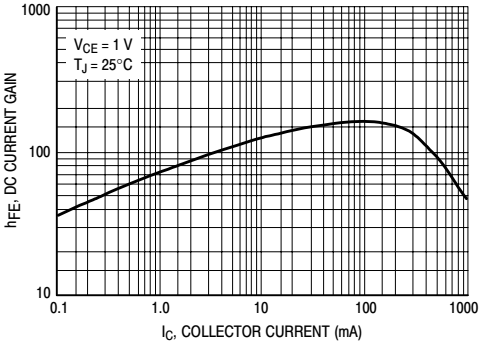


Figure 1. DC Current Gain

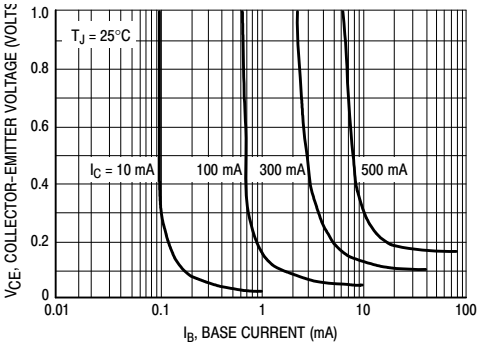


Figure 2. Saturation Region

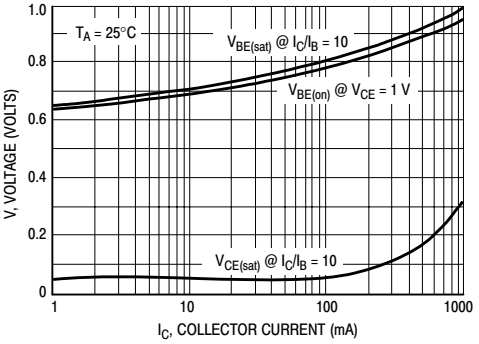


Figure 3. “On” Voltages

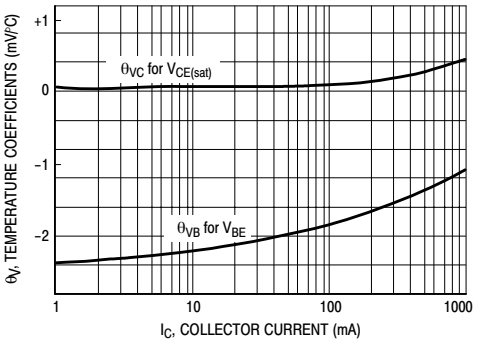


Figure 4. Temperature Coefficients

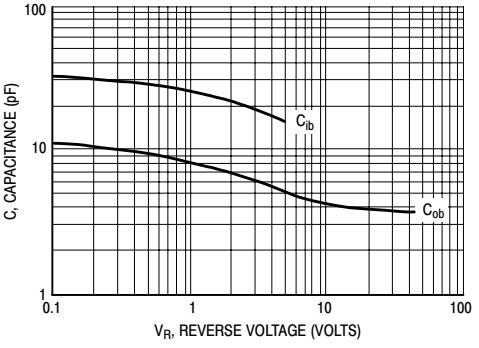


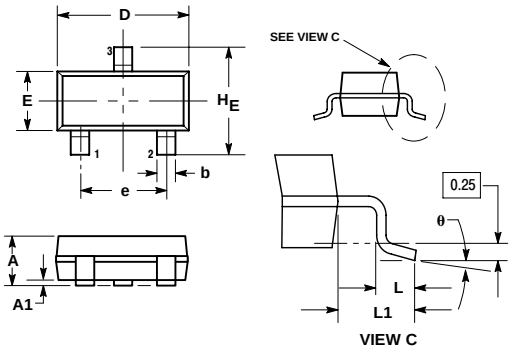
Figure 5. Capacitances

Q1

BC817−16LT1, BC817−25LT1, BC817−40LT1

PACKAGE DIMENSIONS

SOT−23 (TO−236)
CASE 318−08
ISSUE AN

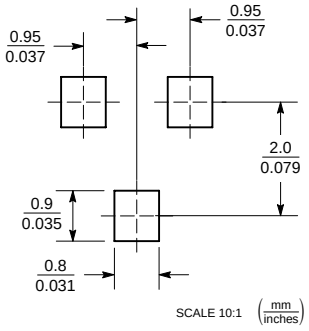


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318−01 THRU −07 AND −09 OBSOLETE, NEW STANDARD 318−08.

	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.040	0.044
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.37	0.44	0.50	0.015	0.018	0.020
c	0.09	0.13	0.18	0.003	0.005	0.007
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.081
L	0.10	0.20	0.30	0.004	0.008	0.012
L1	0.35	0.54	0.69	0.014	0.021	0.029
H_E	2.10	2.40	2.64	0.083	0.094	0.104

STYLE 6:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

SOLDERING FOOTPRINT*



*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 61312, Phoenix, Arizona 85082−1312 USA
Phone: 480−829−7710 or 800−344−3860 Toll Free USA/Canada
Fax: 480−829−7709 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada

Japan: ON Semiconductor, Japan Customer Focus Center
2−9−1 Kamimeguro, Meguro−ku, Tokyo, Japan 153−0051
Phone: 81−3−5773−3850

ON Semiconductor Website: http://onsemi.com

Order Literature: http://www.onsemi.com/litorder

For additional information, please contact your local Sales Representative.

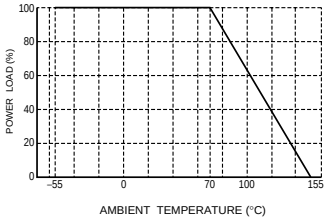
Thick film rectangular

MCR10 (2012 size : 1 / 8W)

●Features

1) Power rating of 1 / 8W
2) Highly reliable chip resistor
   Ruthenium oxide dielectric offers superior resistance to the elements.
3) Electrodes not corroded by soldering
   Thick film makes the electrodes very strong.
4) Leading the world in development and mass production.
   Since start of production in 1982 (first in the wold), this component has established a solid reputation as a general–purpose chip resistor.
5) ROHM resistors have approved ISO–9001 certification.
   Design and specifications are subject to change without notice. Carefully check the specification sheet before using or ordering it.

●Ratings

Item	Conditions	Specifications
Rated power	Power must be derated according to the power derating curve in Figure 1 when ambient temperature exceeds 70°C.  Fig.1	0.125W (1 / 8W) at 70°C
Rated voltage	The voltage rating is calculated by the following equation. If the value obtained exceeds the limiting element voltage, the voltage rating is equal to the maximum operating voltage. $E=\sqrt{P\times R}$ E: Rated voltage (V) P: Rated power (W) R: Nominal resistance (Ω)	Limiting element voltage: 150V
Nominal resistance	See Table 1.	
Operating temperature		–55°C to + 155°C

Resistors

Jumper type

Resistance	Max. 50mΩ
Rated current	2A
Operating temperature	–55°C to +155°C

Table 1

Resistance tolerance	Resistance range (Ω)	Resistance temperature coefficient (ppm/°C)
F (±1%)	10 ≤ R ≤ 2.2M (E24,96)	±100
J (±5%)	1.0 ≤ R < 10 (E24)	±400
	10 ≤ R ≤ 10M (E24)	±200

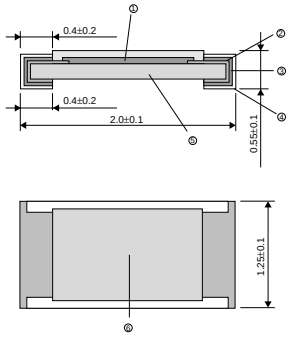
●Before using components in circuits where they will be exposed to transients such as pulse loads (short–duration, high– level loads), be certain to evaluate the component in the mounted state. In addition, the reliability and performance of this component cannot be guaranteed if it is used with a steady state voltage that is greater than its rated voltage.

●Characteristics

Item	Guaranteed value		Test conditions (JIS C 5201-1)
	Resistor type	Jumper type	
Resistance	J : ±5% F : ±1%	Max. 50mΩ	JIS C 5201-1 4.5
Variation of resistance with temperature	See Table.1		JIS C 5201-1 4.8 Measurement : –55 / +25 / +125°C
Overload	± (2.0%+0.1Ω)	Max. 50mΩ	JIS C 5201-1 4.13 Rated voltage (current) ×2.5, 2s. Maximum overload voltage : 200V
Solderability	A new uniform coating of minimum of 95% of the surface being immersed and no soldering damage.		JIS C 5201-1 4.17 Rosin·Ethanol (25%WT) Soldering condition : 235±5°C Duration of immersion : 2.0±0.5s.
Resistance to soldering heat	± (1.0%+0.05Ω)	Max. 50mΩ No remarkable abnormality on the appearance.	JIS C 5201-1 4.18 Soldering condition : 260±5°C Duration of immersion : 10±1s.
Rapid change of temperature	± (1.0%+0.05Ω)	Max. 50mΩ	JIS C 5201-1 4.19 Test temp. : –55°C to +125°C 5cyc
Damp heat, steady state	± (3.0%+0.1Ω)	Max. 100mΩ	JIS C 5201-1 4.24 40°C, 93%RH Test time : 1,000h to 1,048h
Endurance at 70°C	± (3.0%+0.1Ω)	Max. 100mΩ	JIS C 5201-1 4.25.1 Rated voltage (current), 70°C 1.5h : ON – 0.5h : OFF Test time : 1,000h to 1,048h
Endurance	± (3.0%+0.1Ω)	Max. 100mΩ	JIS C 5201-1 4.25.3 155°C Test time : 1,000h to 1,048h
Resistance to solvent	± (1.0%+0.05Ω)	Max. 50mΩ	JIS C 5201-1 4.29 23±5°C, Immersion cleaning, 5±0.5min. Solvent : 2-propanol
Bend strength of the end face plating	± (1.0%+0.05Ω)	Max. 50mΩ Without mechanical damage such as breaks.	JIS C 5201-1 4.33

Resistors

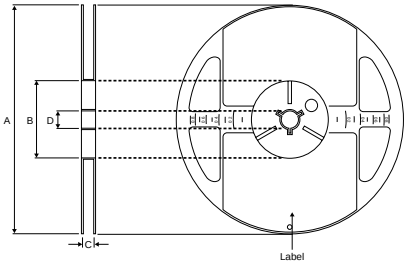
●External dimensions (Unit : mm)



No.	Material
①	Resistive element (Oxide metal thick film)
②	Silver thick film electrode
③	Nickel electrode
④	Sn electrode
⑤	Alumina substrate
⑥	Overcoating (Resin)

●Packaging

Reel

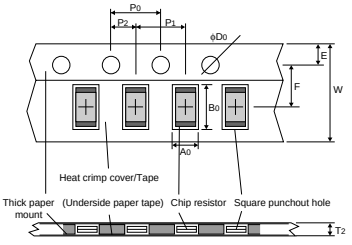


EIAJ ET-7200B compliant

(Unit: mm)

A	B	C	D
$\phi180^{\ 0}_{-1.5}$	$\phi60^{+1}_{\ 0}$	$9^{+1.0}_{\ 0}$	$\phi13\pm0.2$

Taping



(Unit: mm)

W	F	E	A0	B0
8.0±0.3	3.5±0.05	1.75±0.1	$1.65^{+0.2}_{-0.1}$	$2.4^{+0.2}_{-0.1}$
D0	P0	P1	P2	T2
$\phi1.5^{+0.1}_{\ 0}$	4.0±0.1	4.0±0.1	2.0±0.05	Max. 1.1

●Part designation

M C R 1 0 E Z P J □ □ □ □

Part No.

Resistance tolerance

F	±1%
J	±5%

Nominal resistance

Resistance code, 3 or 4 digits.
000 denotes jumper type.

Resistance tolerance		Resistance code
F	:	4 digits
J	:	3 digits

Packaging Specifications Code

Part No.	Code	Resistance tolerance		Packaging specifications	Reel	Basic ordering unit(pcs)
		J(±5%)	F(±1%)			
MCR10	EZP	◎	◎	Paper tape (4mm Pitch)	ϕ180mm (7in.)	5,000

Reel (ϕ180mm) : Compatible with JEITA standard "EIAJ ET-7200B"
◎ : Standard product

●Dimensions

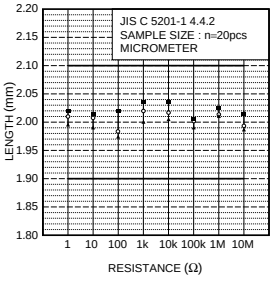


Fig.2 Dimensions (length)

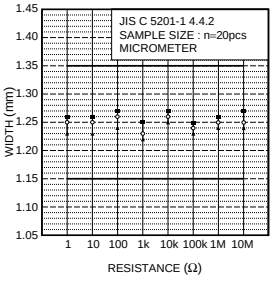


Fig.3 Dimensions (width)

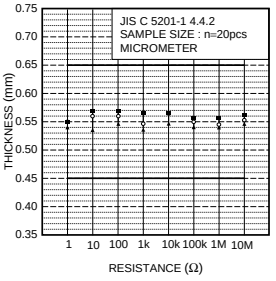


Fig.4 Dimensions (thickness)

●Electrical characteristics

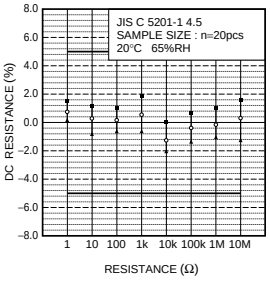


Fig.5 Resistance

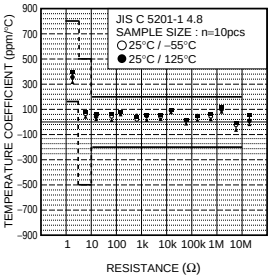


Fig.6 Variation resistance with temperature

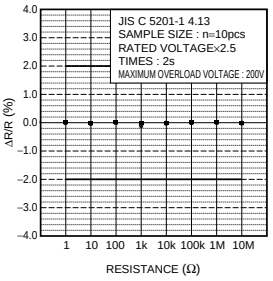


Fig.7 Overload

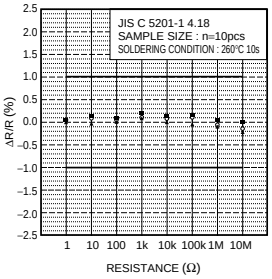


Fig.8 Resistance to soldering heat

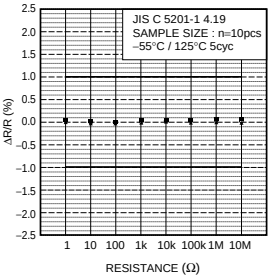


Fig.9 Rapid change of temperature

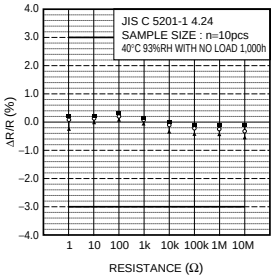


Fig.10 Damp heat, steady state

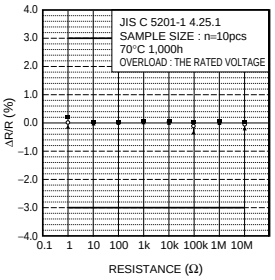


Fig.11 Endurance at 70°C

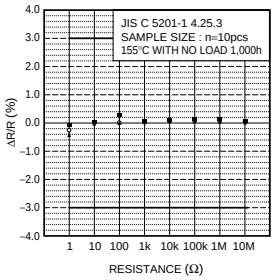


Fig.12 Endurance

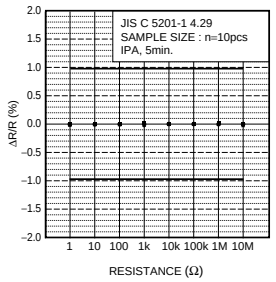


Fig.13 Resistance to solvents

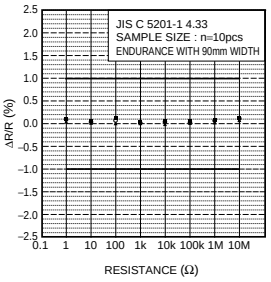


Fig.14 Bend strength of the end face plating

Appendix

Notes

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- ROHM CO., LTD. is granted to any such buyer.
- Products listed in this document are no antiradiation design.

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Should you intend to use these products with equipment or devices which require an extremely high level of reliability and the malfunction of with would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), please be sure to consult with our sales representative in advance.

About Export Control Order in Japan

Products described herein are the objects of controlled goods in Annex 1 (Item 16) of Export Trade Control Order in Japan.
In case of export from Japan, please confirm if it applies to "objective" criteria or an "informed" (by MITI clause) on the basis of "catch all controls for Non-Proliferation of Weapons of Mass Destruction.

MILL-MAX®

INTERCONNECTS
.030" dia. Pins, Straight and Right Angle
Single Row

Series 800, 801

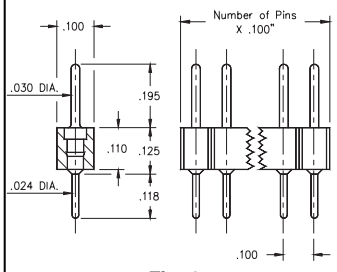


Fig. 1

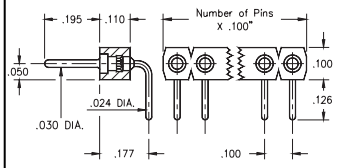


Fig. 2

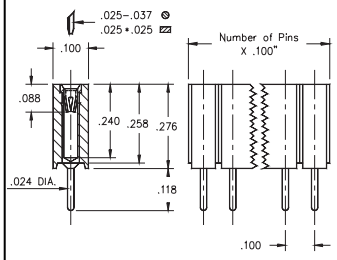


Fig. 3

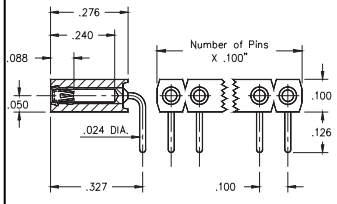
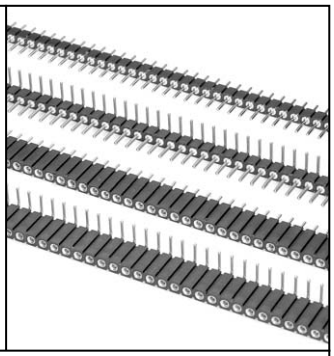


Fig. 4

- Receptacles accept .030" diameter and .025" square pins such as Series 890 and 892 pin headers.
- Pin interconnects available with straight (MM# 7007) or right angle (MM# 5005) solder tails. (See page 173 for details)
- Sockets are available with straight (MM# 1304) or right angle (MM# 1305) solder tails. (See pages 146 & 147 for details)



Ordering Information

Fig. 1 — **Series 800...10-001 Straight Pin Header**

800-XX-0_ _-10-001

Specify # of pins → 01-64

Fig. 2 — **Series 800...20-001 Right Angle Pin Header**

800-XX-0 _ _-20-001

Specify # of pins → 01-64

XX= Plating Code See Below

SPECIFY PLATING CODE XX=	10	90		
Pin Plating	10µ" Au	200µ" Sn/Pb		

Fig. 3 — **Series 801...10-001 Straight Socket**

801-XX-0_ _-10-001

Specify # of pins → 01-50

Fig. 4 — **Series 801...20-001 Right Angle Socket**

801-XX-0 _ _-20-001

Specify # of pins → 01-50

XX= Plating Code See Below

SPECIFY PLATING CODE XX=			93	99
Sleeve (Pin)			200µ" Sn/Pb	200µ"Sn/Pb
Contact (Clip)			30µ" Au	200µ"Sn/Pb

TDK

General Multilayer Ceramic Chip Capacitors
C Series

FEATURES

- High capacitance has been achieved through precision technologies that enable the use of multiple thinner ceramic dielectric layers.
- A monolithic structure ensures superior mechanical strength and reliability.
- High-accuracy automatic mounting is facilitated through the maintenance of very precise dimensional tolerances.
- Composed of only ceramics and metals, these capacitors provide extremely dependable performance, exhibiting virtually no degradation even when subjected to temperature extremes.
- Low stray capacitance ensures high conformity with nominal values, thereby simplifying the circuit design process.
- Low residual inductance assures superior frequency characteristics.
- Because electrostatic capacity has been obtained up to the electrolytic capacitor range, these capacitors offer long service life and are optimally suited for power supply designs that require high levels of reliability.
- Owing to their low ESR and excellent frequency characteristics, these products are optimally suited for high frequency and high-density type power supplies.

PRODUCT IDENTIFICATION

C	0603	CH	1H	100	D	□
(1)	(2)	(3)	(4)	(5)	(6)	(7)

(1) Series name

(2) Dimensions L×W

0603	0.6×0.3mm
1005	1.0×0.5mm
1608	1.6×0.8mm
2012	2.0×1.25mm
3216	3.2×1.6mm
3225	3.2×2.5mm
4532	4.5×3.2mm
5750	5.7×5.0mm

(3) Capacitance temperature characteristics

Class 1 (Temperature compensation)

Temperature characteristics	Capacitance change	Temperature range
CH	0±60ppm/°C	–25 to +85°C
C0G	0±30ppm/°C	–55 to +125°C
SL	+350 to –1000ppm/°C	+20 to +85°C

Class 2

Temperature characteristics	Capacitance change	Temperature range
B(JB*)	±10%	–25 to +85°C
F(JF*)	+30, –80%	–25 to +85°C
X7R	±15%	–55 to +125°C
X5R	±15%	–55 to +85°C
Y5V	+22, –82%	–30 to +85°C

*JB(JIS: BJ), JF(JIS: FJ)

(4) Rated voltage Edc

0J	6.3V
1A	10V
1C	16V
1E	25V
1H	50V

(5) Nominal capacitance

The capacitance is expressed in three digit codes and in units of pico farads (pF).

The first and second digits identify the first and second significant figures of the capacitance.

The third digit identifies the multiplier.

R designates a decimal point.

010	1pF
100	10pF
102	1,000pF
0R5	0.5pF

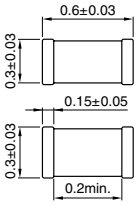
(6) Capacitance tolerance

Symbol	Tolerance	Applicable capacitance range
C	±0.25pF	10pF or less
D	±0.5pF	
J	±5%	Over 10pF
K	±10%	
M	±20%	
Z	+80, –20%	

(7) Packaging style

T	Taping (reel)
B	Bulk

C0603 (EIA CC0201) TYPE
SHAPES AND DIMENSIONS



Dimensions in mm

CAPACITANCE RANGES: CLASS 1
TEMPERATURE CHARACTERISTICS:
JIS CH(0±60ppm/°C), EIA C0G(0±30ppm/°C)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
0.5	±0.25pF	0.3±0.03	C0603CH1H0R5C
0.75	±0.25pF	0.3±0.03	C0603CH1HR75C
1	±0.25pF	0.3±0.03	C0603CH1H010C
1.5	±0.25pF	0.3±0.03	C0603CH1H1R5C
2	±0.25pF	0.3±0.03	C0603CH1H020C
3	±0.25pF	0.3±0.03	C0603CH1H030C
4	±0.25pF	0.3±0.03	C0603CH1H040C
5	±0.25pF	0.3±0.03	C0603CH1H050C
6	±0.5pF	0.3±0.03	C0603CH1H060D
7	±0.5pF	0.3±0.03	C0603CH1H070D
8	±0.5pF	0.3±0.03	C0603CH1H080D
9	±0.5pF	0.3±0.03	C0603CH1H090D
10	±0.5pF	0.3±0.03	C0603CH1H100D
12	±5%	0.3±0.03	C0603CH1H120J
15	±5%	0.3±0.03	C0603CH1H150J
18	±5%	0.3±0.03	C0603CH1H180J
22	±5%	0.3±0.03	C0603CH1H220J
27	±5%	0.3±0.03	C0603CH1H270J
33	±5%	0.3±0.03	C0603CH1H330J
39	±5%	0.3±0.03	C0603CH1H390J
47	±5%	0.3±0.03	C0603CH1H470J
56	±5%	0.3±0.03	C0603CH1H560J
68	±5%	0.3±0.03	C0603CH1H680J
82	±5%	0.3±0.03	C0603CH1H820J
100	±5%	0.3±0.03	C0603CH1H101J

- Part number for temperature characteristic C0G
  Please substitute "C0G" for "CH" in the part number when ordering.

CAPACITANCE RANGES: CLASS 2
TEMPERATURE CHARACTERISTICS:
JIS B(BJ)(±10%), EIA X5R/X7R(±15%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
100	±10%	0.3±0.03	C0603JB1H101K
150	±10%	0.3±0.03	C0603JB1H151K
220	±10%	0.3±0.03	C0603JB1H221K
330	±10%	0.3±0.03	C0603JB1H331K
470	±10%	0.3±0.03	C0603JB1H471K

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
680	±10%	0.3±0.03	C0603JB1E681K
1,000	±10%	0.3±0.03	C0603JB1E102K
1,500	±10%	0.3±0.03	C0603JB1E152K
2,200	±10%	0.3±0.03	C0603JB1E222K

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
3,300	±10%	0.3±0.03	C0603JB1C332K
4,700	±10%	0.3±0.03	C0603JB1C472K

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
6,800	±10%	0.3±0.03	C0603JB1A682K
10,000	±10%	0.3±0.03	C0603JB1A103K

- Part number for temperature characteristic X5R or X7R
  Please substitute "X5R" or "X7R" for "JB" in the part number when ordering.

TEMPERATURE CHARACTERISTICS:
JIS B(BJ)(±10%), EIA X5R(±15%)

RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
22,000	±10%	0.3±0.03	C0603JB0J223K
47,000	±10%	0.3±0.03	C0603JB0J473K
68,000	±10%	0.3±0.03	C0603JB0J683K
100,000	±10%	0.3±0.03	C0603JB0J104K

- Part number for temperature characteristic X5R
  Please substitute "X5R" for "JB" in the part number when ordering.

TEMPERATURE CHARACTERISTICS:
JIS F(FJ)(+30, –80%), EIA Y5V(+22, –82%)

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
1,000	+80, –20%	0.3±0.03	C0603JF1E102Z

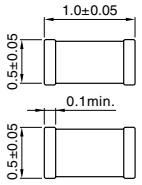
RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
10,000	+80, –20%	0.3±0.03	C0603JF1C103Z

- Part number for temperature characteristic Y5V
  Please substitute "Y5V" for "JF" in the part number when ordering.

- For more information about the products of other capacitance or data, please contact us.

C1005 (EIA CC0402) TYPE
SHAPES AND DIMENSIONS



Dimensions in mm

CAPACITANCE RANGES: CLASS 1
TEMPERATURE CHARACTERISTICS:
JIS CH(0±60ppm/°C), EIA C0G(0±30ppm/°C)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
0.5	±0.25pF	0.5±0.05	C1005CH1H0R5C
0.75	±0.25pF	0.5±0.05	C1005CH1HR75C
1	±0.25pF	0.5±0.05	C1005CH1H010C
1.5	±0.25pF	0.5±0.05	C1005CH1H1R5C
2	±0.25pF	0.5±0.05	C1005CH1H020C
3	±0.25pF	0.5±0.05	C1005CH1H030C
4	±0.25pF	0.5±0.05	C1005CH1H040C
5	±0.25pF	0.5±0.05	C1005CH1H050C
6	±0.5pF	0.5±0.05	C1005CH1H060D
7	±0.5pF	0.5±0.05	C1005CH1H070D
8	±0.5pF	0.5±0.05	C1005CH1H080D
9	±0.5pF	0.5±0.05	C1005CH1H090D
10	±0.5pF	0.5±0.05	C1005CH1H100D
12	±5%	0.5±0.05	C1005CH1H120J
15	±5%	0.5±0.05	C1005CH1H150J
18	±5%	0.5±0.05	C1005CH1H180J
22	±5%	0.5±0.05	C1005CH1H220J
27	±5%	0.5±0.05	C1005CH1H270J
33	±5%	0.5±0.05	C1005CH1H330J
39	±5%	0.5±0.05	C1005CH1H390J
47	±5%	0.5±0.05	C1005CH1H470J
56	±5%	0.5±0.05	C1005CH1H560J
68	±5%	0.5±0.05	C1005CH1H680J
82	±5%	0.5±0.05	C1005CH1H820J
100	±5%	0.5±0.05	C1005CH1H101J
120	±5%	0.5±0.05	C1005CH1H121J
150	±5%	0.5±0.05	C1005CH1H151J
180	±5%	0.5±0.05	C1005CH1H181J
220	±5%	0.5±0.05	C1005CH1H221J
270	±5%	0.5±0.05	C1005CH1H271J
330	±5%	0.5±0.05	C1005CH1H331J
390	±5%	0.5±0.05	C1005CH1H391J
470	±5%	0.5±0.05	C1005CH1H471J

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
560	±5%	0.5±0.05	C1005CH1E561J
680	±5%	0.5±0.05	C1005CH1E681J
820	±5%	0.5±0.05	C1005CH1E821J
1,000	±5%	0.5±0.05	C1005CH1E102J

- Part number for temperature characteristic C0G
  Please substitute "C0G" for "CH" in the part number when ordering.

TEMPERATURE CHARACTERISTICS:
JIS SL(+350 to –1000ppm/°C)

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
1,200	±5%	0.5±0.05	C1005SL1A122J
1,500	±5%	0.5±0.05	C1005SL1A152J
1,800	±5%	0.5±0.05	C1005SL1A182J
2,200	±5%	0.5±0.05	C1005SL1A222J
2,700	±5%	0.5±0.05	C1005SL1A272J
3,300	±5%	0.5±0.05	C1005SL1A332J
3,900	±5%	0.5±0.05	C1005SL1A392J

CAPACITANCE RANGES: CLASS 2
TEMPERATURE CHARACTERISTICS:
JIS B(BJ)(±10%), EIA X5R/X7R(±15%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
220	±10%	0.5±0.05	C1005JB1H221K
330	±10%	0.5±0.05	C1005JB1H331K
470	±10%	0.5±0.05	C1005JB1H471K
680	±10%	0.5±0.05	C1005JB1H681K
1,000	±10%	0.5±0.05	C1005JB1H102K
1,500	±10%	0.5±0.05	C1005JB1H152K
2,200	±10%	0.5±0.05	C1005JB1H222K
3,300	±10%	0.5±0.05	C1005JB1H332K
4,700	±10%	0.5±0.05	C1005JB1H472K
6,800	±10%	0.5±0.05	C1005JB1H682K

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
10,000	±10%	0.5±0.05	C1005JB1E103K
15,000	±10%	0.5±0.05	C1005JB1E153K
22,000	±10%	0.5±0.05	C1005JB1E223K
33,000	±10%	0.5±0.05	C1005JB1E333K
47,000	±10%	0.5±0.05	C1005JB1E473K

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
33,000	±10%	0.5±0.05	C1005JB1C333K
47,000	±10%	0.5±0.05	C1005JB1C473K
68,000	±10%	0.5±0.05	C1005JB1C683K
100,000	±10%	0.5±0.05	C1005JB1C104K

- Part number for temperature characteristic X5R or X7R
  Please substitute "X5R" or "X7R" for "JB" in the part number when ordering.

- For more information about the products of other capacitance or data, please contact us.

TEMPERATURE CHARACTERISTICS:
JIS B(BJ)(±10%), EIA X5R(±15%)

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
100,000	±10%	0.5±0.05	C1005JB1A104K

RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
150,000	±10%	0.5±0.05	C1005JB0J154K
	±20%	0.5±0.05	C1005JB0J154M
220,000	±10%	0.5±0.05	C1005JB0J224K
	±20%	0.5±0.05	C1005JB0J224M
330,000	±10%	0.5±0.05	C1005JB0J334K
	±20%	0.5±0.05	C1005JB0J334M
470,000	±10%	0.5±0.05	C1005JB0J474K
	±20%	0.5±0.05	C1005JB0J474M
680,000	±10%	0.5±0.05	C1005JB0J684K
	±20%	0.5±0.05	C1005JB0J684M
1,000,000 [1µF]	±10%	0.5±0.05	C1005JB0J105K
	±20%	0.5±0.05	C1005JB0J105M

- Part number for temperature characteristic X5R
  Please substitute "X5R" for "JB" in the part number when ordering.

TEMPERATURE CHARACTERISTICS:
JIS F(FJ)(+30, –80%), EIA Y5V(+22, –82%)

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
100,000	+80, –20%	0.5±0.05	C1005JF1C104Z

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
220,000	+80, –20%	0.5±0.05	C1005JF1A224Z
470,000	+80, –20%	0.5±0.05	C1005JF1A474Z

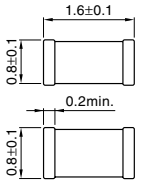
RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
1,000,000 [1µF]	+80, –20%	0.5±0.05	C1005JF0J105Z

- Part number for temperature characteristic Y5V
  Please substitute "Y5V" for "JF" in the part number when ordering.

- For more information about the products of other capacitance or data, please contact us.

C1608 (EIA CC0603) TYPE
SHAPES AND DIMENSIONS



Dimensions in mm

CAPACITANCE RANGES: CLASS 1
TEMPERATURE CHARACTERISTICS:
JIS CH(0±60ppm/°C), EIA C0G(0±30ppm/°C)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
0.5	±0.25pF	0.8±0.1	C1608CH1H0R5C
0.75	±0.25pF	0.8±0.1	C1608CH1HR75C
1	±0.25pF	0.8±0.1	C1608CH1H010C
1.5	±0.25pF	0.8±0.1	C1608CH1H1R5C
2	±0.25pF	0.8±0.1	C1608CH1H020C
3	±0.25pF	0.8±0.1	C1608CH1H030C
4	±0.25pF	0.8±0.1	C1608CH1H040C
5	±0.25pF	0.8±0.1	C1608CH1H050C
6	±0.5pF	0.8±0.1	C1608CH1H060D
7	±0.5pF	0.8±0.1	C1608CH1H070D
8	±0.5pF	0.8±0.1	C1608CH1H080D
9	±0.5pF	0.8±0.1	C1608CH1H090D
10	±0.5pF	0.8±0.1	C1608CH1H100D
12	±5%	0.8±0.1	C1608CH1H120J
15	±5%	0.8±0.1	C1608CH1H150J
18	±5%	0.8±0.1	C1608CH1H180J
22	±5%	0.8±0.1	C1608CH1H220J
27	±5%	0.8±0.1	C1608CH1H270J
33	±5%	0.8±0.1	C1608CH1H330J
39	±5%	0.8±0.1	C1608CH1H390J
47	±5%	0.8±0.1	C1608CH1H470J
56	±5%	0.8±0.1	C1608CH1H560J
68	±5%	0.8±0.1	C1608CH1H680J
82	±5%	0.8±0.1	C1608CH1H820J
100	±5%	0.8±0.1	C1608CH1H101J
120	±5%	0.8±0.1	C1608CH1H121J
150	±5%	0.8±0.1	C1608CH1H151J
180	±5%	0.8±0.1	C1608CH1H181J
220	±5%	0.8±0.1	C1608CH1H221J
270	±5%	0.8±0.1	C1608CH1H271J
330	±5%	0.8±0.1	C1608CH1H331J
390	±5%	0.8±0.1	C1608CH1H391J
470	±5%	0.8±0.1	C1608CH1H471J
560	±5%	0.8±0.1	C1608CH1H561J
680	±5%	0.8±0.1	C1608CH1H681J
820	±5%	0.8±0.1	C1608CH1H821J
1,000	±5%	0.8±0.1	C1608CH1H102J
1,200	±5%	0.8±0.1	C1608CH1H122J
1,500	±5%	0.8±0.1	C1608CH1H152J
1,800	±5%	0.8±0.1	C1608CH1H182J
2,200	±5%	0.8±0.1	C1608CH1H222J
2,700	±5%	0.8±0.1	C1608CH1H272J
3,300	±5%	0.8±0.1	C1608CH1H332J

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
3,900	±5%	0.8±0.1	C1608CH1E392J
4,700	±5%	0.8±0.1	C1608CH1E472J
5,600	±5%	0.8±0.1	C1608CH1E562J
6,800	±5%	0.8±0.1	C1608CH1E682J
8,200	±5%	0.8±0.1	C1608CH1E822J
10,000	±5%	0.8±0.1	C1608CH1E103J

- Part number for temperature characteristic C0G
  Please substitute "C0G" for "CH" in the part number when ordering.

TEMPERATURE CHARACTERISTICS:
JIS SL(+350 to –1000ppm/°C)

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
15,000	±5%	0.5±0.05	C1608SL1A153J
22,000	±5%	0.5±0.05	C1608SL1A223J

- For more information about the products of other capacitance or data, please contact us.

CAPACITANCE RANGES: CLASS 2

TEMPERATURE CHARACTERISTICS:

JIS B(BJ)(±10%), EIA X5R/X7R(±15%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
220	±10%	0.8±0.1	C1608JB1H221K
330	±10%	0.8±0.1	C1608JB1H331K
470	±10%	0.8±0.1	C1608JB1H471K
680	±10%	0.8±0.1	C1608JB1H681K
1,000	±10%	0.8±0.1	C1608JB1H102K
1,500	±10%	0.8±0.1	C1608JB1H152K
2,200	±10%	0.8±0.1	C1608JB1H222K
3,300	±10%	0.8±0.1	C1608JB1H332K
4,700	±10%	0.8±0.1	C1608JB1H472K
6,800	±10%	0.8±0.1	C1608JB1H682K
10,000	±10%	0.8±0.1	C1608JB1H103K
15,000	±10%	0.8±0.1	C1608JB1H153K
22,000	±10%	0.8±0.1	C1608JB1H223K
33,000	±10%	0.8±0.1	C1608JB1H333K
47,000	±10%	0.8±0.1	C1608JB1H473K
68,000	±10%	0.8±0.1	C1608JB1H683K
100,000	±10%	0.8±0.1	C1608JB1H104K

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
100,000	±10%	0.8±0.1	C1608JB1E104K
150,000	±10%	0.8±0.1	C1608JB1E154K
	±20%	0.8±0.1	C1608JB1E154M
220,000	±10%	0.8±0.1	C1608JB1E224K
	±20%	0.8±0.1	C1608JB1E224M

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
330,000	±10%	0.8±0.1	C1608JB1C334K
	±20%	0.8±0.1	C1608JB1C334M
470,000	±10%	0.8±0.1	C1608JB1C474K
	±20%	0.8±0.1	C1608JB1C474M
680,000	±10%	0.8±0.1	C1608JB1C684K
	±20%	0.8±0.1	C1608JB1C684M
1,000,000 [1μF]	±10%	0.8±0.1	C1608JB1C105K
	±20%	0.8±0.1	C1608JB1C105M

- Part number for temperature characteristic X5R or X7R
  Please substitute "X5R" or "X7R" for "JB" in the part number when ordering.

TEMPERATURE CHARACTERISTICS:

JIS B(BJ)(±10%), EIA X5R(±15%)

RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
1,500,000 [1.5μF]	±10%	0.8±0.1	C1608JB0J155K
	±20%	0.8±0.1	C1608JB0J155M
2,200,000	±10%	0.8±0.1	C1608JB0J225K
	±20%	0.8±0.1	C1608JB0J225M
3,300,000	±10%	0.8±0.1	C1608JB0J335K
	±20%	0.8±0.1	C1608JB0J335M
4,700,000	±10%	0.8±0.1	C1608JB0J475K
	±20%	0.8±0.1	C1608JB0J475M

- Part number for temperature characteristic X5R
  Please substitute "X5R" for "JB" in the part number when ordering.

TEMPERATURE CHARACTERISTICS: EIA X5R(±15%)

RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
1,500,000 [1.5μF]	±10%	0.8±0.1	C1608X5R0J155K
	±20%	0.8±0.1	C1608X5R0J155M
2,200,000	±10%	0.8±0.1	C1608X5R0J225K
	±20%	0.8±0.1	C1608X5R0J225M

TEMPERATURE CHARACTERISTICS:

JIS F(FJ)(+30, –80%), EIA Y5V(+22, –82%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
100,000	+80, –20%	0.8±0.1	C1608JF1H104Z
220,000	+80, –20%	0.8±0.1	C1608JF1H224Z

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
470,000	+80, –20%	0.8±0.1	C1608JF1E474Z

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
1,000,000 [1μF]	+80, –20%	0.8±0.1	C1608JF1C105Z

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
2,200,000 [2.2μF]	+80, –20%	0.8±0.1	C1608JF1A225Z

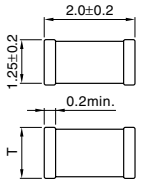
RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
4,700,000 [4.7μF]	+80, –20%	0.8±0.1	C1608JF0J475Z

- Part number for temperature characteristic Y5V
  Please substitute "Y5V" for "JF" in the part number when ordering.

- For more information about the products of other capacitance or data, please contact us.

C2012 (EIA CC0805) TYPE
SHAPES AND DIMENSIONS



Dimensions in mm

CAPACITANCE RANGES: CLASS 1
TEMPERATURE CHARACTERISTICS:
JIS CH(0±60ppm/°C), EIA C0G(0±30ppm/°C)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
2,700	±5%	0.6±0.1	C2012CH1H272J
3,300	±5%	0.6±0.1	C2012CH1H332J
3,900	±5%	0.85±0.15	C2012CH1H392J
4,700	±5%	0.85±0.15	C2012CH1H472J
5,600	±5%	0.85±0.15	C2012CH1H562J
6,800	±5%	1.25±0.2	C2012CH1H682J
8,200	±5%	1.25±0.2	C2012CH1H822J
10,000	±5%	1.25±0.2	C2012CH1H103J

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
3,900	±5%	0.6±0.1	C2012CH1E392J
4,700	±5%	0.6±0.1	C2012CH1E472J
5,600	±5%	0.6±0.1	C2012CH1E562J
6,800	±5%	0.6±0.1	C2012CH1E682J
8,200	±5%	0.6±0.1	C2012CH1E822J
10,000	±5%	0.6±0.1	C2012CH1E103J
15,000	±5%	0.85±0.15	C2012CH1E153J
22,000	±5%	1.25±0.2	C2012CH1E223J
33,000	±5%	1.25±0.2	C2012CH1E333J

- Part number for temperature characteristic C0G
  Please substitute "C0G" for "CH" in the part number when ordering.

TEMPERATURE CHARACTERISTICS:
JIS SL(+350 to −1000ppm/°C)

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
33,000	±5%	0.6±0.1	C2012SL1A333J
47,000	±5%	0.85±0.15	C2012SL1A473J
68,000	±5%	1.25±0.2	C2012SL1A683J
100,000	±5%	1.25±0.2	C2012SL1A104J

- For more information about the products of other capacitance or data, please contact us.

CAPACITANCE RANGES: CLASS 2
TEMPERATURE CHARACTERISTICS:
JIS B(BJ)(±10%), EIA X5R/X7R(±15%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
150,000	±10%	1.25±0.2	C2012JB1H154K
	±20%	1.25±0.2	C2012JB1H154M
220,000	±10%	1.25±0.2	C2012JB1H224K
	±20%	1.25±0.2	C2012JB1H224M
330,000	±10%	1.25±0.2	C2012JB1H334K
	±20%	1.25±0.2	C2012JB1H334M

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
470,000	±10%	1.25±0.2	C2012JB1E474K
	±20%	1.25±0.2	C2012JB1E474M
680,000	±10%	1.25±0.2	C2012JB1E684K
	±20%	1.25±0.2	C2012JB1E684M
1,000,000 [1μF]	±10%	1.25±0.2	C2012JB1E105K
	±20%	1.25±0.2	C2012JB1E105M

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
1,500,000 [1.5μF]	±10%	1.25±0.2	C2012JB1C155K
	±20%	1.25±0.2	C2012JB1C155M
2,200,000	±10%	1.25±0.2	C2012JB1C225K
	±20%	1.25±0.2	C2012JB1C225M

- Part number for temperature characteristic X5R or X7R
  Please substitute "X5R" or "X7R" for "JB" in the part number when ordering.

TEMPERATURE CHARACTERISTICS:
JIS B(BJ)(±10%), EIA X5R(±15%)

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
3,300,000 [3.3μF]	±10%	1.25±0.2	C2012JB1A335K
	±20%	1.25±0.2	C2012JB1A335M
4,700,000	±10%	1.25±0.2	C2012JB1A475K
	±20%	1.25±0.2	C2012JB1A475M

RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
6,800,000 [6.8μF]	±10%	1.25±0.2	C2012JB0J685K
	±20%	1.25±0.2	C2012JB0J685M
10,000,000	±10%	1.25±0.2	C2012JB0J106K
	±20%	1.25±0.2	C2012JB0J106M
15,000,000	±20%	1.25±0.2	C2012JB0J156M
22,000,000	±20%	1.25±0.2	C2012JB0J226M

- Part number for temperature characteristic X5R
  Please substitute "X5R" for "JB" in the part number when ordering.

TEMPERATURE CHARACTERISTICS: EIA X5R/X7R(±15%)

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
1,000,000 [1μF]	±10%	1.25±0.2	C2012X5R1E105K
	±20%	1.25±0.2	C2012X5R1E105M
1,500,000	±10%	1.25±0.2	C2012X5R1E155K
	±20%	1.25±0.2	C2012X5R1E155M

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
1,000,000 [1μF]	±10%	0.85±0.15	C2012X5R1C105K
	±20%	0.85±0.15	C2012X5R1C105M
1,500,000	±10%	1.25±0.2	C2012X5R1C155K
	±20%	1.25±0.2	C2012X5R1C155M
2,200,000	±10%	1.25±0.2	C2012X5R1C225K
	±20%	1.25±0.2	C2012X5R1C225M

- Part number for temperature characteristic X7R
  Please substitute "X7R" for "X5R" in the part number when ordering.

TEMPERATURE CHARACTERISTICS: EIA X5R(±15%)

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
1,500,000 [1.5μF]	±10%	0.85±0.15	C2012X5R1A155K
	±20%	0.85±0.15	C2012X5R1A155M
2,200,000	±10%	1.25±0.2	C2012X5R1A225K
	±20%	1.25±0.2	C2012X5R1A225M
3,300,000	±10%	1.25±0.2	C2012X5R1A335K
	±20%	1.25±0.2	C2012X5R1A335M

RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
2,200,000 [2.2μF]	±10%	0.85±0.15	C2012X5R0J225K
	±20%	0.85±0.15	C2012X5R0J225M
3,300,000	±10%	0.85±0.15	C2012X5R0J335K
	±20%	0.85±0.15	C2012X5R0J335M
4,700,000	±10%	0.85±0.15	C2012X5R0J475K
	±20%	0.85±0.15	C2012X5R0J475M
6,800,000	±10%	1.25±0.2	C2012X5R0J685K
	±20%	1.25±0.2	C2012X5R0J685M
10,000,000	±10%	1.25±0.2	C2012X5R0J106K
	±20%	1.25±0.2	C2012X5R0J106M

TEMPERATURE CHARACTERISTICS:
JIS F(FJ)(+30, –80%), EIA Y5V(+22, –82%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
470,000	+80, –20%	0.85±0.15	C2012JF1H474Z
1,000,000 [1μF]	+80, –20%	1.25±0.15	C2012JF1H105Z

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
2,200,000 [2.2μF]	+80, –20%	1.25±0.15	C2012JF1E225Z

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
4,700,000 [4.7μF]	+80, –20%	1.25±0.2	C2012JF1C475Z

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
10,000,000 [10μF]	+80, –20%	1.25±0.2	C2012JF1A106Z

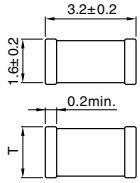
RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
22,000,000 [22μF]	+80, –20%	1.25±0.2	C2012JF0J226Z

- Part number for temperature characteristic Y5V
  Please substitute "Y5V" for "JF" in the part number when ordering.

- For more information about the products of other capacitance or data, please contact us.

C3216 (EIA CC1206) TYPE
SHAPES AND DIMENSIONS



Dimensions in mm

CAPACITANCE RANGES: CLASS 1
TEMPERATURE CHARACTERISTICS:
JIS CH(0±60ppm/°C), EIA C0G(0±30ppm/°C)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
3,900	±5%	0.6±0.1	C3216CH1H392J
4,700	±5%	0.6±0.1	C3216CH1H472J
5,600	±5%	0.6±0.1	C3216CH1H562J
6,800	±5%	0.6±0.1	C3216CH1H682J
8,200	±5%	0.85±0.15	C3216CH1H822J
10,000	±5%	0.85±0.15	C3216CH1H103J
15,000	±5%	1.15±0.15	C3216CH1H153J
22,000	±5%	1.15±0.15	C3216CH1H223J
33,000	±5%	1.6±0.2	C3216CH1H333J

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
8,200	±5%	0.6±0.1	C3216CH1E822J
10,000	±5%	0.6±0.1	C3216CH1E103J
15,000	±5%	0.6±0.1	C3216CH1E153J
22,000	±5%	0.6±0.1	C3216CH1E223J
33,000	±5%	0.85±0.15	C3216CH1E333J
47,000	±5%	1.15±0.15	C3216CH1E473J
68,000	±5%	1.6±0.2	C3216CH1E683J
100,000	±5%	1.6±0.2	C3216CH1E104J

- Part number for temperature characteristic C0G
  Please substitute "C0G" for "CH" in the part number when ordering.

TEMPERATURE CHARACTERISTICS:
JIS SL(+350 to −1000ppm/°C)

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
150,000	±5%	1.15±0.15	C3216SL1A154J
220,000	±5%	1.6±0.2	C3216SL1A224J

- For more information about the products of other capacitance or data, please contact us.

CAPACITANCE RANGES: CLASS 2
TEMPERATURE CHARACTERISTICS:
JIS B(BJ)(±10%), EIA X5R/X7R(±15%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
470,000	±10%	1.6±0.2	C3216JB1H474K
	±20%	1.6±0.2	C3216JB1H474M
680,000	±10%	1.6±0.2	C3216JB1H684K
	±20%	1.6±0.2	C3216JB1H684M
1,000,000 [1μF]	±10%	1.6±0.2	C3216JB1H105K
	±20%	1.6±0.2	C3216JB1H105M

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
1,000,000 [1μF]	±10%	1.6±0.2	C3216JB1E105K
	±20%	1.6±0.2	C3216JB1E105M
1,500,000	±10%	1.6±0.2	C3216JB1E155K
	±20%	1.6±0.2	C3216JB1E155M
2,200,000	±10%	1.6±0.2	C3216JB1E225K
	±20%	1.6±0.2	C3216JB1E225M
3,300,000	±10%	1.6±0.2	C3216JB1E335K
	±20%	1.6±0.2	C3216JB1E335M
4,700,000	±10%	1.6±0.2	C3216JB1E475K
	±20%	1.6±0.2	C3216JB1E475M

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
6,800,000 [6.8μF]	±10%	1.6±0.2	C3216JB1C685K
	±20%	1.6±0.2	C3216JB1C685M
10,000,000	±10%	1.6±0.2	C3216JB1C106K
	±20%	1.6±0.2	C3216JB1C106M

- Part number for temperature characteristic X5R or X7R
  Please substitute "X5R" or "X7R" for "JB" in the part number when ordering.

TEMPERATURE CHARACTERISTICS:
JIS B(BJ)(±10%), EIA X5R(±15%)

RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
33,000,000 [33μF]	±20%	1.6+0.3,−0.1	C3216JB0J336M
47,000,000	±20%	1.6+0.3,−0.1	C3216JB0J476M

- Part number for temperature characteristic X5R
  Please substitute "X5R" for "JB" in the part number when ordering.

TEMPERATURE CHARACTERISTICS: EIA X5R/X7R(±15%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
1,000,000 [1μF]	±10%	1.6±0.2	C3216X5R1H105K
	±20%	1.6±0.2	C3216X5R1H105M

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
2,200,000 [2.2μF]	±10%	0.85±0.15	C3216X5R1C225K
	±20%	0.85±0.15	C3216X5R1C225M
3,300,000	±10%	1.10±0.15	C3216X5R1C335K
	±20%	1.10±0.15	C3216X5R1C335M
4,700,000	±10%	1.6±0.2	C3216X5R1C475K
	±20%	1.6±0.2	C3216X5R1C475M

- Part number for temperature characteristic X7R
  Please substitute "X7R" for "X5R" in the part number when ordering.

TEMPERATURE CHARACTERISTICS: EIA X5R(±15%)

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
3,300,000 [3.3μF]	±10%	0.85±0.15	C3216X5R1A335K
	±20%	0.85±0.15	C3216X5R1A335M
4,700,000	±10%	1.15±0.15	C3216X5R1A475K
	±20%	1.15±0.15	C3216X5R1A475M
6,800,000	±10%	1.6±0.2	C3216X5R1A685K
	±20%	1.6±0.2	C3216X5R1A685M
10,000,000	±10%	1.6±0.2	C3216X5R1A106K
	±20%	1.6±0.2	C3216X5R1A106M

RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
4,700,000 [4.7μF]	±10%	0.85±0.15	C3216X5R0J475K
	±20%	0.85±0.15	C3216X5R0J475M
6,800,000	±10%	0.85±0.15	C3216X5R0J685K
	±20%	0.85±0.15	C3216X5R0J685M
10,000,000	±10%	0.85±0.15	C3216X5R0J106K
	±20%	0.85±0.15	C3216X5R0J106M
15,000,000	±20%	1.6±0.2	C3216X5R0J156M
22,000,000	±20%	1.6±0.2	C3216X5R0J226M

TEMPERATURE CHARACTERISTICS: JIS F(FJ)(+30, –80%), EIA Y5V(+22, –82%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
2,200,000 [2.2μF]	+80, –20%	1.15±0.2	C3216JF1H225Z

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
4,700,000 [4.7μF]	+80, –20%	1.15±0.2	C3216JF1E475Z

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
10,000,000 [10μF]	+80, –20%	1.6±0.2	C3216JF1C106Z

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
22,000,000 [22μF]	+80, –20%	1.6±0.2	C3216JF1A226Z

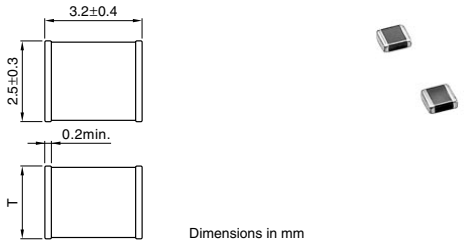
RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
47,000,000 [47μF]	+80, –20%	1.6±0.2	C3216JF0J476Z

- Part number for temperature characteristic Y5V
  Please substitute "Y5V" for "JF" in the part number when ordering.

- For more information about the products of other capacitance or data, please contact us.

C3225(EIA CC1210) TYPE
SHAPES AND DIMENSIONS



Dimensions in mm

CAPACITANCE RANGES: CLASS 1
TEMPERATURE CHARACTERISTICS:
JIS CH(0±60ppm/°C), EIA C0G(0±30ppm/°C)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
33,000	±5%	1.25±0.2	C3225CH1H333J
47,000	±5%	2.0±0.2	C3225CH1H473J
68,000	±5%	2.0±0.2	C3225CH1H683J
100,000	±5%	2.5±0.3	C3225CH1H104J

- Part number for temperature characteristic C0G
  Please substitute "C0G" for "CH" in the part number when ordering.

CAPACITANCE RANGES: CLASS 2
TEMPERATURE CHARACTERISTICS:
JIS B(BJ)(±10%), EIA X5R/X7R(±15%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
1,000,000 [1μF]	±10%	1.6±0.2	C3225JB1H105K
	±20%	1.6±0.2	C3225JB1H105M
1,500,000	±10%	2.0±0.2	C3225JB1H155K
	±20%	2.0±0.2	C3225JB1H155M
2,200,000	±10%	2.0±0.2	C3225JB1H225K
	±20%	2.0±0.2	C3225JB1H225M
3,300,000	±10%	2.5±0.3	C3225JB1H335K
	±20%	2.5±0.3	C3225JB1H335M

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
3,300,000 [3.3μF]	±10%	1.6±0.2	C3225JB1E335K
	±20%	1.6±0.2	C3225JB1E335M
4,700,000	±10%	2.0±0.2	C3225JB1E475K
	±20%	2.0±0.2	C3225JB1E475M
6,800,000	±10%	2.0±0.2	C3225JB1E685K
	±20%	2.0±0.2	C3225JB1E685M
10,000,000	±10%	2.5±0.3	C3225JB1E106K
	±20%	2.5±0.3	C3225JB1E106M

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
6,800,000 [6.8μF]	±10%	2.0±0.2	C3225JB1C685K
	±20%	2.0±0.2	C3225JB1C685M
10,000,000	±10%	2.0±0.2	C3225JB1C106K
	±20%	2.0±0.2	C3225JB1C106M
15,000,000	±20%	2.5±0.3	C3225JB1C156M
22,000,000	±20%	2.5±0.3	C3225JB1C226M

- Part number for temperature characteristic X5R or X7R
  Please substitute "X5R" or "X7R" for "JB" in the part number when ordering.

TEMPERATURE CHARACTERISTICS:
JIS B(BJ)(±10%), EIA X5R(±15%)

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
15,000,000 [15μF]	±20%	2.3±0.2	C3225JB1A156M

RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
22,000,000 [22μF]	±20%	2.0±0.2	C3225JB0J226M
68,000,000	±20%	2.0±0.3	C3225JB0J686M
100,000,000	±20%	2.5±0.3	C3225JB0J107M

- Part number for temperature characteristic X5R
  Please substitute "X5R" for "JB" in the part number when ordering.

TEMPERATURE CHARACTERISTICS: EIA X5R/X7R(±15%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
2,200,000 [2.2μF]	±10%	2.0±0.2	C3225X5R1H225K
	±20%	2.0±0.2	C3225X5R1H225M
3,300,000	±10%	2.5±0.3	C3225X5R1H335K
	±20%	2.5±0.3	C3225X5R1H335M

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
6,800,000 [6.8μF]	±10%	2.5±0.3	C3225X5R1E685K
	±20%	2.5±0.3	C3225X5R1E685M
10,000,000	±10%	2.5±0.3	C3225X5R1E106K
	±20%	2.5±0.3	C3225X5R1E106M

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
10,000,000 [10μF]	±10%	2.0±0.2	C3225X5R1C106K
	±20%	2.0±0.2	C3225X5R1C106M
15,000,000	±20%	2.5±0.3	C3225X5R1C156M
22,000,000	±20%	2.5±0.3	C3225X5R1C226M

- Part number for temperature characteristic X7R
  Please substitute "X7R" for "X5R" in the part number when ordering.

- For more information about the products of other capacitance or data, please contact us.

TEMPERATURE CHARACTERISTICS: EIA X5R(±15%)

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
15,000,000	±20%	2.5±0.3	C3225X5R1A156M
22,000,000	±20%	2.3±0.2	C3225X5R1A226M

RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
22,000,000 [22µF]	±20%	1.6±0.2	C3225X5R0J226M
33,000,000	±20%	2.0±0.2	C3225X5R0J336M
47,000,000	±20%	2.5±0.3	C3225X5R0J476M

TEMPERATURE CHARACTERISTICS:
JIS F(FJ)(+30, –80%), EIA Y5V(+22, –82%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
4,700,000 [4.7µF]	+80, –20%	1.6±0.2	C3225JF1H475Z

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
10,000,000 [10µF]	+80, –20%	1.6±0.2	C3225JF1E106Z

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
22,000,000 [22µF]	+80, –20%	2.0±0.2	C3225JF1C226Z

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
47,000,000 [47µF]	+80, –20%	2.0±0.2	C3225JF1A476Z

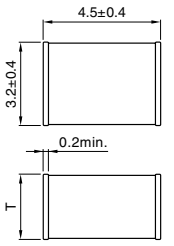
RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
100,000,000 [100µF]	+80, –20%	2.5±0.3	C3225JF0J107Z

- Part number for temperature characteristic Y5V
  Please substitute "Y5V" for "JF" in the part number when ordering.

- For more information about the products of other capacitance or data, please contact us.

C4532(EIA CC1812) TYPE
SHAPES AND DIMENSIONS



Dimensions in mm

CAPACITANCE RANGES: CLASS 1
TEMPERATURE CHARACTERISTICS:
JIS CH(0±60ppm/°C), EIA C0G(0±30ppm/°C)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
47,000	±5%	1.60±0.2	C4532CH1H473J
68,000	±5%	1.60±0.2	C4532CH1H683J
100,000	±5%	2.0±0.2	C4532CH1H104J
150,000	±5%	2.5±0.3	C4532CH1H154J
220,000	±5%	3.2±0.3	C4532CH1H224J

- Part number for temperature characteristic C0G
  Please substitute "C0G" for "CH" in the part number when ordering.

CAPACITANCE RANGES: CLASS 2
TEMPERATURE CHARACTERISTICS:
JIS B(BJ)(±10%), EIA X5R/X7R(±15%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
1,500,000 [1.5μF]	±10%	1.6±0.2	C4532JB1H155K
	±20%	1.6±0.2	C4532JB1H155M
2,200,000	±10%	1.6±0.2	C4532JB1H225K
	±20%	1.6±0.2	C4532JB1H225M
3,300,000	±10%	2.0±0.2	C4532JB1H335K
	±20%	2.0±0.2	C4532JB1H335M
4,700,000	±10%	2.3±0.2	C4532JB1H475K
	±20%	2.3±0.2	C4532JB1H475M
6,800,000	±10%	2.5±0.3	C4532JB1H685K
	±20%	2.5±0.3	C4532JB1H685M

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
4,700,000 [4.7μF]	±10%	1.6±0.2	C4532JB1E475K
	±20%	1.6±0.2	C4532JB1E475M
6,800,000	±10%	2.0±0.2	C4532JB1E685K
	±20%	2.0±0.2	C4532JB1E685M
10,000,000	±10%	2.5±0.3	C4532JB1E106K
	±20%	2.5±0.3	C4532JB1E106M
15,000,000	±20%	2.5±0.3	C4532JB1E156M
22,000,000	±20%	2.5±0.3	C4532JB1E226M

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
22,000,000 [22μF]	±20%	2.5±0.3	C4532JB1C226M
33,000,000	±20%	2.5±0.3	C4532JB1C336M

- Part number for temperature characteristic X5R or X7R
  Please substitute "X5R" or "X7R" for "JB" in the part number when ordering.

TEMPERATURE CHARACTERISTICS: EIA X5R/X7R(±15%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
4,700,000 [4.7μF]	±10%	2.0±0.2	C4532X5R1H475K
	±20%	2.0±0.2	C4532X5R1H475M
6,800,000	±10%	2.5±0.3	C4532X5R1H685K
	±20%	2.5±0.3	C4532X5R1H685M

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
15,000,000 [15μF]	±20%	2.8±0.3	C4532X5R1E156M
22,000,000	±20%	2.5±0.3	C4532X5R1E226M

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
15,000,000 [15μF]	±20%	2.0±0.2	C4532X5R1C156M
22,000,000	±20%	2.3±0.3	C4532X5R1C226M
33,000,000	±20%	2.5±0.3	C4532X5R1C336M

- Part number for temperature characteristic X7R
  Please substitute "X7R" for "X5R" in the part number when ordering.

TEMPERATURE CHARACTERISTICS: EIA X5R(±15%)

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
33,000,000 [33μF]	±20%	2.0±0.2	C4532X5R1A336M
47,000,000	±20%	2.8±0.3	C4532X5R1A476M

RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
68,000,000 [68μF]	±20%	2.8±0.3	C4532X5R0J686M
100,000,000	±20%	2.8±0.3	C4532X5R0J107M

- For more information about the products of other capacitance or data, please contact us.

TEMPERATURE CHARACTERISTICS:
JIS F(FJ)(+30, –80%), EIA Y5V(+22, –82%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
10,000,000 [10µF]	+80, –20%	2.0±0.2	C4532JF1H106Z

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
22,000,000 [22µF]	+80, –20%	2.0±0.2	C4532JF1E226Z

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
47,000,000 [47µF]	+80, –20%	2.5±0.3	C4532JF1C476Z

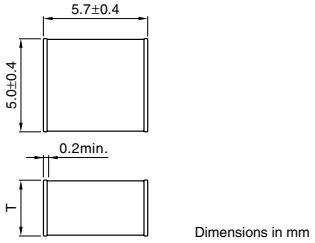
RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
100,000,000 [100µF]	+80, –20%	2.5±0.3	C4532JF1A107Z

- Part number for temperature characteristic Y5V
  Please substitute "Y5V" for "JF" in the part number when ordering.

- For more information about the products of other capacitance or data, please contact us.

C5750(EIA CC2220) TYPE
SHAPES AND DIMENSIONS



Dimensions in mm

CAPACITANCE RANGES: CLASS 2
TEMPERATURE CHARACTERISTICS:
JIS B(BJ)(±10%), EIA X5R/X7R(±15%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
4,700,000 [4.7μF]	±10%	2.0±0.2	C5750JB1H475K
	±20%	2.0±0.2	C5750JB1H475M
6,800,000	±10%	2.5±0.3	C5750JB1H685K
	±20%	2.5±0.3	C5750JB1H685M

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
10,000,000 [10μF]	±10%	2.0±0.2	C5750JB1E106K
	±20%	2.0±0.2	C5750JB1E106M
15,000,000	±20%	2.3±0.2	C5750JB1E156M
22,000,000	±20%	2.5±0.2	C5750JB1E226M

- Part number for temperature characteristic X5R or X7R
  Please substitute "X5R" or "X7R" for "JB" in the part number when ordering.

TEMPERATURE CHARACTERISTICS: EIA X5R/X7R(±15%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
10,000,000 [10μF]	±10%	2.3±0.2	C5750X5R1H106K
	±20%	2.3±0.2	C5750X5R1H106M

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
10,000,000 [10μF]	±10%	2.0±0.2	C5750X5R1E106K
	±20%	2.0±0.2	C5750X5R1E106M
15,000,000	±20%	2.3±0.2	C5750X5R1E156M
22,000,000	±20%	2.3±0.2	C5750X5R1E226M

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
33,000,000 [33μF]	±20%	2.0±0.2	C5750X5R1C336M
47,000,000	±20%	2.3±0.2	C5750X5R1C476M

- Part number for temperature characteristic X7R
  Please substitute "X7R" for "X5R" in the part number when ordering.

TEMPERATURE CHARACTERISTICS: EIA X5R(±15%)

RATED VOLTAGE Edc: 10V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
68,000,000 [68μF]	±20%	2.3±0.2	C5750X5R1A686M

RATED VOLTAGE Edc: 6.3V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
100,000,000 [100μF]	±20%	2.8±0.3	C5750X5R0J107M

TEMPERATURE CHARACTERISTICS:
JIS F(FJ)(+30, –80%), EIA Y5V(+22, –82%)

RATED VOLTAGE Edc: 50V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
22,000,000 [22μF]	+80, –20%	2.0±0.2	C5750JF1H226Z

RATED VOLTAGE Edc: 25V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
47,000,000 [47μF]	+80, –20%	2.0±0.2	C5750JF1E476Z

RATED VOLTAGE Edc: 16V

Capacitance (pF)	Tolerance	Thickness T (mm)max.	Part number
100,000,000 [100μF]	+80, –20%	2.5±0.3	C5750JF1C107Z

- Part number for temperature characteristic Y5V
  Please substitute "Y5V" for "JF" in the part number when ordering.

- For more information about the products of other capacitance or data, please contact us.

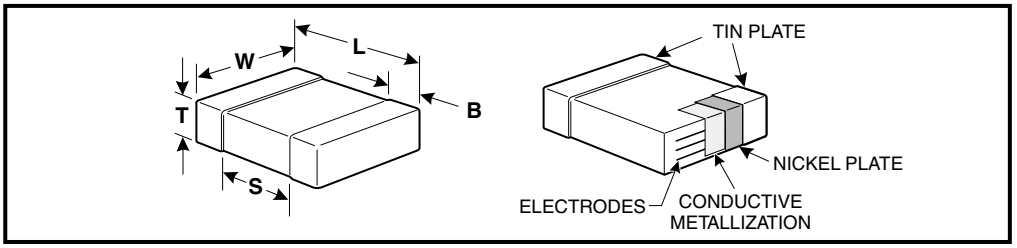
CERAMIC CHIP CAPACITORS

KEMET

FEATURES

- C0G (NP0), X7R, X5R, Z5U and Y5V Dielectrics
- 10, 16, 25, 50, 100 and 200 Volts
- Standard End Metalization: Tin-plate over nickel barrier
- Available Capacitance Tolerances: ±0.10 pF; ±0.25 pF; ±0.5 pF; ±1%; ±2%; ±5%; ±10%; ±20%; and +80%-20%
- Tape and reel packaging per EIA481-1. (See page 92 for specific tape and reel information.) Bulk Cassette packaging (0402, 0603, 0805 only) per IEC60286-6 and EIAJ 7201.
- RoHS Compliant

CAPACITOR OUTLINE DRAWINGS



DIMENSIONS—MILLIMETERS AND (INCHES)

EIA SIZE CODE	METRIC SIZE CODE (Ref only)	L # LENGTH	W # WIDTH		B BANDWIDTH	S MIN. SEPARATION	MOUNTING TECHNIQUE
0402*	1005	1.0 (.04) ± .05(.002)	0.5 (.02) ± .05 (.002)		0.20 (0.008)-0.40 (0.016)	0.3 (.012)	Solder Reflow
0603*	1608	1.6 (.063) ± 0.15 (.006)	0.8 (.032) ± 0.15 (.006)		0.35 (.014) ±0.15 (.006)	0.7 (.028)	
0805*	2012	2.0 (.079) ± 0.2 (.008)	1.25 (.049) ± 0.2 (.008)		0.5 (.02) ±.25 (.010)	0.75 (.030)	Solder Wave † or Solder Reflow
1206*	3216	3.2 (.126) ± 0.2 (.008)	1.6 (.063) ± 0.2 (.008)		0.5 (.02) ±.25 (.010)	N/A	
1210*	3225	3.2 (.126) ± 0.2 (.008)	2.5 (.098) ± 0.2 (.008)		0.5 (.02) ±.25 (.010)	N/A	
1812	4532	4.5 (.177) ± 0.3 (.012)	3.2 (.126) ± 0.3 (.012)		0.6 (.024) ±.35 (.014)	N/A	
1825*	4564	4.5 (.177) ± 0.3 (.012)	6.4 (.252) ± 0.4 (.016)		0.6 (.024) ±.35 (.014)	N/A	Solder Reflow
2220	5650	5.6 (.220) ± 0.4 (.016)	5.0 (.197) ± 0.4 (.016)		0.6 (.024) ±.35 (.014)	N/A	
2225	5664	5.6 (.220) ± 0.4 (.016)	6.3 (.248) ± 0.4 (.016)		0.6 (.024) ±.35 (.014)	N/A	

See page 77 for thickness dimensions.

* Note: Indicates EIA Preferred Case Sizes (Tightened tolerances apply for 0402, 0603, and 0805 packaged in bulk cassette, see page 96.)
† For extended value 1210 case size – solder reflow only.

CAPACITOR ORDERING INFORMATION (Standard Chips - For Military see page 90)

C 0805 C 103 K 5 R A C*

CERAMIC

SIZE CODE

SPECIFICATION
C - Standard

CAPACITANCE CODE
Expressed in Picofarads (pF)
First two digits represent significant figures.
Third digit specifies number of zeros. (Use 9 for 1.0 through 9.9pF. Use 8 for 0.5 through 0.99pF)
(Example: 2.2pF = 229 or 0.50 pF = 508)

CAPACITANCE TOLERANCE

B – ±0.10pF	J – ±5%
C – ±0.25pF	K – ±10%
D – ±0.5pF	M – ±20%
F – ±1%	P – (GMV) – special order only
G – ±2%	Z – +80%, -20%

VOLTAGE

1 - 100V	3 - 25V
2 - 200V	4 - 16V
5 - 50V	8 - 10V
	9 - 6.3V

TEMPERATURE CHARACTERISTIC
Designated by Capacitance Change Over Temperature Range
G – C0G (NP0) (±30 PPM/°C)
R – X7R (±15%) (-55°C + 125°C)
P– X5R (±15%) (-55°C + 85°C)
U – Z5U (+22%, -56%) (+10°C + 85°C)
V – Y5V (+22%, -82%) (-30°C + 85°C)

FAILURE RATE LEVEL
A- Not Applicable

END METALLIZATION
C-Standard (Tin-plated nickel barrier)

*** Part Number Example: C0805C103K5RAC (14 digits - no spaces)**

CERAMIC CHIP/STANDARD

KEMET

C0G CAPACITANCE RANGE – 1210, 1812, 1825, 2220, 2225

Cap pF	Cap Code	Cap Tol.	C1210*			C1812*			C1825*			C2220			C2225		
			50V	100V	200V	50V	100V	200V	50V	100V	200V	50V	100V	200V	50V	100V	200V
10	100	D J,K,M	FB	FB	FB												
12	120	D J,K,M	FB	FB	FB												
15	150	D G,J,K,M	FB	FB	FB												
18	180	D G,J,K,M	FB	FB	FB												
22	220	D G,J,K,M	FB	FB	FB												
27	270	D,F,G,J,K,M	FB	FB	FB												
33	330	D,F,G,J,K,M	FB	FB	FB												
39	390	D,F,G,J,K,M	FB	FB	FB												
47	470	D,F,G,J,K,M	FB	FB	FB												
56	560	F,G,J,K,M	FB	FB	FB												
68	680	F,G,J,K,M	FB	FB	FB												
82	820	F,G,J,K,M	FB	FB	FB												
100	101	F,G,J,K,M	FB	FB	FB												
120	121	F,G,J,K,M	FB	FB	FB												
150	131	F,G,J,K,M	FB	FB	FB												
180	181	F,G,J,K,M	FB	FB	FB												
220	221	F,G,J,K,M	FB	FB	FB												
270	271	F,G,J,K,M	FB	FB	FB												
330	331	F,G,J,K,M	FB	FB	FB												
390	391	F,G,J,K,M	FB	FB	FB												
470	471	F,G,J,K,M	FB	FB	FB	GB	GB	GB									
560	561	F,G,J,K,M	FB	FB	FB	GB	GB	GB									
680	681	F,G,J,K,M	FB	FB	FB	GB	GB	GB									
820	821	F,G,J,K,M	FB	FB	FB	GB	GB	GB									
1,000	102	F,G,J,K,M	FB	FB	FB	GB	GB	GB									
1,200	122	F,G,J,K,M	FB	FB	FB	GB	GB	GB									
1,500	152	F,G,J,K,M	FB	FB	FE	GB	GB	GB									
1,800	182	F,G,J,K,M	FB	FB	FE	GB	GB	GB									
2,200	222	F,G,J,K,M	FB	FC	FG	GB	GB	GB									
2,700	272	F,G,J,K,M	FB	FC	FC	GB	GB	GB									
3,300	332	F,G,J,K,M	FB	FF	FF	GB	GB	GB									
3,900	392	F,G,J,K,M	FB	FF		GB	GB	GB	HB	HB	HB						
4,700	472	F,G,J,K,M	FF	FF		GB	GB	GD	HB	HB	HB				KB	KB	KB
5,600	562	F,G,J,K,M	FB	FF		GB	GB	GH	HB	HB	HB				KB	KB	KB
6,800	682	F,G,J,K,M	FB	FG		GB	GB	GJ	HB	HB	HB	JB	JB		KB	KB	KB
8,200	822	F,G,J,K,M	FC			GB	GB		HB	HB	HB	JB	JB		KB	KB	KB
10,000	103	F,G,J,K,M	FF			GB	GD		HB	HB	HE	JB	JB		KB	KB	KB
12,000	123	F,G,J,K,M	FG			GB	GD		HB	HB	HE	JB	JB		KB	KB	KB
15,000	153	F,G,J,K,M							HB	HB		JB	JB		KB	KB	KE
18,000	183	F,G,J,K,M							HB	HB		JB	JB		KB	KB	
22,000	223	F,G,J,K,M							HB	HE		JB			KB	KB	
27,000	273	F,G,J,K,M							HB	HE		JB			KB	KB	
33,000	333	F,G,J,K,M													KB		

X7R CAPACITANCE RANGE – 0402, 0603, 0805, 1206

Cap pF	Cap Code	Cap Tol.	C0402					C0603							C0805							C1206						
			6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	100V	200V	6.3V	10V	16V	25V	50V	100V	200V	6.3V	10V	16V	25V	50V	100V	200V
150	151	K,M,J	BB	BB	BB	BB	BB																					
180	181	K,M,J	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB														
220	221	K,M,J	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
270	271	K,M,J	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
330	331	K,M,J	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
390	391	K,M,J	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
470	471	K,M,J	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
560	561	K,M,J	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
680	681	K,M,J	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
820	821	K,M,J	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
1,000	102	K,M,J	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
1,200	122	K,M,J	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CC	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
1,500	152	K,M,J	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CC	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
1,800	182	K,M,J	BB	BB	BB	BB#	BB	CB	CB	CB	CB	CB	CB	CC	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
2,200	222	K,M,J	BB	BB	BB	BB#	BB#	CB	CB	CB	CB	CB	CB	CC	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
2,700	272	K,M,J	BB	BB	BB	BB#	BB#	CB	CB	CB	CB	CB	CB	CC	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
3,300	332	K,M,J	BB	BB	BB	BB#	BB#	CB	CB	CB	CB	CB	CB	CC	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
3,900	392	K,M,J	BB	BB	BB	BB#	BB#	CB	CB	CB	CB	CB	CB	CC	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
4,700	472	K,M,J	BB	BB	BB	BB#	BB#	CB	CB	CB	CB	CB	CB	CC	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
5,600	562	K,M,J	BB	BB	BB	BB	BB#	CB	CB	CB	CB	CB	CB	CC	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
6,800	682	K,M,J	BB	BB	BB	BB	BB#	CB	CB	CB	CB	CB	CB	CC	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
8,200	822	K,M,J	BB	BB	BB	BB	BB#	CB	CB	CB	CB	CB	CB	CC	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
10,000	103	K,M,J	BB	BB	BB	BB	BB#	CB	CB	CB	CB	CB	CB	CC	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
12,000	123	K,M,J**	BB	BB	BB			CB	CB	CB	CB	CB	CC		DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
15,000	153	K,M,J**	BB	BB	BB			CB	CB	CB	CB	CB	CC		DC	DC	DC	DC	DC	DD	DC	EB	EB	EB	EB	EB	EB	EB
18,000	183	K,M,J**	BB	BB	BB			CB	CB	CB	CB	CB	CC		DC	DC	DC	DC	DC	DD	DC	EB	EB	EB	EB	EB	EB	EB
22,000	223	K,M,J**	BB	BB	BB	BB*	BB*	CB	CB	CB	CB	CB	CC		DC	DC	DC	DC	DC	DD	DC	EB	EB	EB	EB	EB	EB	EB
27,000	273	K,M,J**	BB	BB	BB			CB	CB	CB	CB	CB	CC		DC	DC	DC	DC	DC	DD	DE	EB	EB	EB	EB	EB	EB	EB
33,000	333	K,M,J**	BB	BB	BB			CB	CB	CB	CB	CB	CC		DC	DC	DC	DC	DC	DD	DE	EB	EB	EB	EB	EB	EB	EB
39,000	393	K,M,J**	BB	BB	BB			CB	CB	CB	CB	CB	CC		DC	DC	DC	DC	DC	DD	DE	EB	EB	EB	EB	EB	EC	EB
47,000	473	K,M,J**	BB	BB	BB	BB*		CB	CB	CB	CB	CB			DC	DC	DC	DC	DC	DE	DG	EB	EB	EB	EB	EB	EC	ED
56,000	563	K,M,J**	BB	BB	BB			CB	CB	CB	CB	CC			DD	DD	DD	DD	DD#	DE	DG	EB	EB	EB	EB	EB	EB	ED
68,000	683	K,M,J**	BB	BB	BB			CB	CB	CB	CB	CC			DD	DD	DD	DD	DD#	DE		EB	EB	EB	EB	EB	EB	ED
82,000	823	K,M,J**	BB	BB	BB			CB	CB	CB	CB	CC			DD	DD	DD	DD	DD#	DE		EB	EB	EB	EB	EB	EB	ED
100,000	104	K,M,J**	BB	BB	BB			CB#	CB#	CB#	CB#	CC#			DD	DD	DD	DD	DD#	DE		EB	EB	EB	EB	EB	EB	EM
120,000	124	K,M,J**						CB#	CB#	CB#					DC	DC	DC	DC	DD#	DG		EC	EC	EC	EC	EC	EC	EM
150,000	154	K,M,J**						CB#	CB#	CB#		CD*			DC	DC	DC	DC	DD#			EC	EC	EC	EC	EC	EC	EG
180,000	184	K,M,J**						CB#	CB#	CB#					DC	DC	DC	DC	DD#			EC	EC	EC	EC	EC#	EC#	
220,000	224	K,M,J**						CB#	CB#	CB#	CD*				DC	DC	DC	DC	DD#			EC	EC	EC	EC	EC#	EC#	
270,000	274	K,M,J**						CB	CB	CB					DD	DD	DD	DD				EB	EB	EB	EB	EC#	EM	
330,000	334	K,M,J**						CB	CB	CB					DE	DE	DE	DE				EB	EB	EB	EB	EC#	EG	
390,000	394	K,M,J**						CB	CB	CB					DG	DG	DG	DG				EB	EB	EB	EB	EG#	EG	
470,000	474	K,M,J**						CB	CB	CB					DG	DG	DG	DG	DE*			EC	EC	EC	EC	EC#		
560,000	564	K,M,J**													DG	DG	DG	DG				ED	ED	ED	ED	EC#		
680,000	684	K,M,J**													DG	DG	DG		DJ*			EE	EE	EE	EE	ED#		
820,000	824	K,M,J*													DG	DG	DG					EF	EF	EF	EF			
1,000,000	105	K,M,J**								CD*					DG	DG	DG	DJ*				EE	EE	EF	EG	ED*		
1,200,000	125	K,M,J**													DE	DE	DE					ED	ED	ED	EG			
1,500,000	155	K,M,J**													DG	DG	DG					EF	EF	EF	EG			
1,800,000	185	K,M,J**													DG	DG	DG					EF	EF	EF				
2,200,000	225	K,M,J**													DG	DG	DG					EG	EG	EG	EF*	EH*+		
2,700,000	275	K,M,J**																				EN	EN	EK				
3,300,000	335	K,M,J**																				ED	ED	ED				
3,900,000	395	K,M,J**																				EL	EL	EL				
4,700,000	475	K,M,J**																				EM*+	EM*+	EM*+	EH*+			
5,600,000	565	K,M,J**																				EH*+	EH*+	EH*+				
6,800,000	685	K,M,J**																				EH*+	EH*+	EH*+				
8,200,000	825	K,M,J**																				EH*+	EH*+	EH*+				
10,000,000	106	K,M,J**																				EH*+	EH*+	EH*+				

* Capacitance K or M. ontact KEMET Sales Rep for J tolerance availability. + Reflow Only.
NOTE: For non-standard capacitance values or voltages, contact your local KEMET sales representative.
X7R dielectric - Extended Range Values - Cap and DF measured @ 0.5 Vrms.

Improved product with higher ratings and tighter capacitance tolerance product may be substituted within the same size (length, width, and thickness) at KEMET's option.
Reels with such substitutions will be marked with the improved KEMET part numbers.

See page 77 for Thickness Code Reference Chart.

KEMET

CERAMIC CHIP/STANDARD

X7R CAPACITANCE RANGE – 1210, 1812, 1825, 2220, 2225

Cap pF	Cap Code	Cap Tol.	C1210							C1812			C1825			C2220			C2225		
			6.3V	10V	16V	25V	50V	100V	200V	50V	100V	200V	50V	100V	200V	50V	100V	200V	50V	100V	200V
2,200	222	K,M,J	FB	FB	FB	FB	FB	FB	FB												
2,700	272	K,M,J	FB	FB	FB	FB	FB	FB	FB												
3,300	332	K,M,J	FB	FB	FB	FB	FB	FB	FB												
3,900	392	K,M,J	FB	FB	FB	FB	FB	FB	FB												
4,700	472	K,M,J	FB	FB	FB	FB	FB	FB	FB												
5,600	562	K,M,J	FB	FB	FB	FB	FB	FB	FB												
6,800	682	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB									
8,200	822	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB									
10,000	103	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB									
12,000	123	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB									
15,000	153	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB									
18,000	183	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB									
22,000	223	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB	HB	HB	HB						
27,000	273	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB	HB	HB	HB						
33,000	333	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB	HB	HB	HB						
39,000	393	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB	HB	HB	HB						
47,000	473	K,M,J	FB	FB	FB	FB	FB	FB	FC	GB	GB	GB	HB	HB	HB				KC	KC	KC
56,000	563	K,M,J	FB	FB	FB	FB	FB	FB	FC	GB	GB	GB	HB	HB	HB				KC	KC	KC
68,000	683	K,M,J	FB	FB	FB	FB	FB	FB	FC	GB	GB	GB	HB	HB	HB				KC	KC	KC
82,000	823	K,M,J	FB	FB	FB	FB	FC	FC	FF	GB	GB	GB	HB	HB	HB				KC	KC	KC
100,000	104	K,M,J	FB	FB	FB	FB	FB	FD	FG	GB	GB	GB	HB	HB	HB				KC	KC	KC
120,000	124	K,M,J	FB	FB	FB	FB	FB	FD		GB	GB	GB	HB	HB	HB				KC	KC	KC
150,000	154	K,M,J	FC	FC	FC	FC	FC	FD		GB	GB	GE	HB	HB	HB				KC	KC	KC
180,000	184	K,M,J	FC	FC	FC	FC	FC	FD		GB	GB	GG	HB	HB	HB				KC	KC	KC
220,000	224	K,M,J	FC	FC	FC	FC	FC	FD		GB	GB		HB	HB	HB				KC	KC	KC
270,000	274	K,M,J	FC	FC	FC	FC	FC#	FD#		GB	GH		HB	HB	HB	JC	JC	JC	KB	KC	KC
330,000	334	K,M,J	FD	FD	FD	FD	FD#	FD#		GB	GH		HB	HB	HB	JC	JC	JC	KB	KC	KC
390,000	394	K,M,J	FD	FD	FD	FD	FD#			GB	GG		HB	HB	HD	JC	JC	JC	KB	KC	KC
470,000	474	K,M,J	FD	FD	FD	FD	FD#			GB	GG		HB	HB		JC	JC		KB	KC	KD
560,000	564	K,M,J	FD	FD	FD	FD	FD#			GC	GG		HB	HD		JC	JC		KB	KC	
680,000	684	K,M,J	FD	FD	FD	FD	FD#			GC	GG		HB	HD		JC	JD		KB	KC	
820,000	824	K,M,J	FF	FF	FF	FF	FF#			GE	GG		HB			JC	JF		KB	KC	
1,000,000	105	K,M,J	FH	FH	FH	FH	FH#			GE	GG		HB			JC			KB	KD	
1,200,000	125	K,M,J	FH	FH	FH	FH							HB			JC			KB		
1,500,000	155	K,M,J	FH	FH	FH	FH							HB			JC			KC		
1,800,000	185	K,M,J	FH	FH	FH	FH							HD			JD			KD		
2,200,000	225	K,M,J				FJ	FG*+						HF			JF			KD		
2,270,000	275	K,M,J																			
3,300,000	335	K,M,J					FM*+														
3,900,000	395	K,M,J																			
4,700,000	475	K,M,J	FC*+	FC*+	FC*+	FG*+															
5,600,000	565	K,M,J																			
6,800,000	685	K,M,J																			
8,200,000	825	K,M,J																			
10,000,000	106	K,M,J	FH*+	FH*+	FH*+																
12,000,000	126	K,M,J																			
15,000,000	156	K,M,J																			
18,000,000	186	K,M,J																			
22,000,000	226	K,M,J																			

*** Capacitance tolerance K or M. Contact your local KEMET Sales Rep for J tolerance availablity. + Reflow Only**
NOTE: For non-standard capacitance values or voltages, contact your local KEMET sales representative.
50 Volt Ceramic Chips can be used for 63 volt applications.
Extended Range Values – Cap and DF measured @ 0.5 Vrms.

Improved product with higher ratings and tighter capacitance tolerance product may be substituted within the same size (length, width, and thickness) at KEMET's option.
Reels with such substitutions will be marked with the improved KEMET part numbers.

Y5V CAPACITANCE RANGE

Cap pF	Cap Code	Cap Tol.	C0402*			C0603*				C0805*					C1206*					C1210*				
			6.3V	10V	16V	6.3V	10V	16V	25V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V
22,000	223	Z												DC					EB					
33,000	333	Z												DC					EB					
47,000	473	Z	BB	BB	BB									DD					EB					
68,000	683	Z	BB	BB	BB									DD					EB					
100,000	104	Z	BB	BB	BB	CB	CB	CB	CB					DD					EB					
150,000	154	Z				CB	CB	CB	CB	DC	DC	DC	DC						EC					
220,000	224	Z				CB	CB	CB	CB	DC	DC	DC	DC						EC			FD+	FD+	
330,000	334	Z				CB	CB	CB	CB	DC	DC	DC	DC					EB				FD+	FD+	
470,000	474	Z				CC	CC			DC	DC	DC	DC					EC				FD+	FD+	
680,000	684	Z				CC	CC			DE	DE	DE	DE					EB				FD+	FD+	
1,000,000	105	Z				CC	CC			DG	DG	DG	DG					EB				FH+	FH+	
1,500,000	155	Z								DG	DG	DG			EC	EC	EC					FD+		
2,200,000	225	Z								DG	DG	DG			ED	ED	ED					FD+		
3,300,000	335	Z								DE	DE				EF	EF	EF					FE+		
4,700,000	475	Z								DG	DG				EJ	EJ	EJ			FG+	FG+	FG+		
6,800,000	685	Z													EJ	EJ				FH+	FH+	FH+		
10,000,000	106	Z								DH					EJ	EJ				FH+	FH+	FH+		
15,000,000	156	Z																		FD+	FD+			
22,000,000	226	Z													EJ					FH+	FH+			

NOTE: For non-standard capacitance values or voltages, contact your local KEMET sales representative.
50 Volt Ceramic Chips can be used for 63 volt applications.
*** EIA preferred chip sizes**

+ Reflow only

See page 77 for Thickness Code Reference Chart

CERAMIC CHIP CAPACITORS

KEMET

THICKNESS CODE REFERENCE CHART

PACKAGING QTY BASED ON FINISHED CHIP THICKNESS SPECIFICATIONS

Thickness Code	Chip Size	Chip Thickness Range (mm)	Qty per Reel 7" Plastic	Qty per Reel 13" Plastic	Qty per Reel 7" Paper	Qty per Reel 13" Paper	Qty per Bulk Cassette
AA	0201	.30 ± .03	N/A	N/A	15,000	N/A	N/A
BB	0402	.50 ± .05	N/A	N/A	10,000	50,000	50,000
CB	0603	.80 ± .07	N/A	N/A	4,000	10,000	15,000
CC	0603	.80 ± .10	N/A	N/A	4,000	10,000	N/A
CD	0603	.80 ± .15	N/A	N/A	4,000	10,000	N/A
DB	0805	.60 ± .10	N/A	N/A	N/A	N/A	10,000
DC	0805	.78 ± .10	4,000	10,000	4,000	10,000	N/A
DD	0805	.90 ± .10	4,000	10,000	N/A	N/A	N/A
DE	0805	1.00 ± .10	2,500	10,000	N/A	N/A	N/A
DF	0805	1.10 ± .10	2,500	10,000	N/A	N/A	N/A
DG	0805	1.25 ± .15	2,500	10,000	N/A	N/A	N/A
DH	0805	1.25 ± .20	2,500	10,000	N/A	N/A	N/A
DJ	0805	1.25 ± .20	3,000	10,000	N/A	N/A	N/A
EB	1206	.78 ± .10	4,000	10,000	4,000	10,000	N/A
EC	1206	.90 ± .10	4,000	10,000	N/A	N/A	N/A
ED	1206	1.00 ± .10	2,500	10,000	N/A	N/A	N/A
EE	1206	1.10 ± .10	2,500	10,000	N/A	N/A	N/A
EF	1206	1.20 ± .15	2,500	10,000	N/A	N/A	N/A
EG	1206	1.60 ± .15	2,000	8,000	N/A	N/A	N/A
EH	1206	1.60 ± .20	2,000	8,000	N/A	N/A	N/A
EJ	1206	1.70 ± .20	2,000	8,000	N/A	N/A	N/A
EK	1206	.80 ± .10	2,000	8,000	N/A	N/A	N/A
EL	1206	1.15 ± .15	2,000	8,000	N/A	N/A	N/A
EM	1206	1.25 ± .15	2,500	10,000	N/A	N/A	N/A
EN	1206	0.95 ± .10	4,000	10,000	N/A	N/A	N/A
FB	1210	.78 ± .10	4,000	10,000	N/A	N/A	N/A
FC	1210	.90 ± .10	4,000	10,000	N/A	N/A	N/A
FD	1210	.95 ± .10	4,000	10,000	N/A	N/A	N/A
FE	1210	1.00 ± .10	2,500	10,000	N/A	N/A	N/A
FF	1210	1.10 ± .10	2,500	10,000	N/A	N/A	N/A
FG	1210	1.25 ± .15	2,500	10,000	N/A	N/A	N/A
FH	1210	1.55 ± .15	2,000	8,000	N/A	N/A	N/A
FJ	1210	1.85 ± .20	2,000	8,000	N/A	N/A	N/A
FK	1210	2.10 ± .20	2,000	8,000	N/A	N/A	N/A
FL	1210	1.40 ± .15	2,000	8,000	N/A	N/A	N/A
FM	1210	1.70 ± .20	2,000	8,000	N/A	N/A	N/A
FN	1210	1.85 ± .20	2,000	8,000	N/A	N/A	N/A
FO	1210	1.50 ± .20	2,000	8,000	N/A	N/A	N/A
FP	1210	1.60 ± .20	2,000	8,000	N/A	N/A	N/A
FQ	1210	2.5 ± .20	1,500	8,000	N/A	N/A	N/A
FR	1210	2.25 ± .20	2,000	8,000	N/A	N/A	N/A
FS	1210	2.1 ± .20	1,000	4,000	N/A	N/A	N/A
GB	1812	1.00 ± .10	1,000	4,000	N/A	N/A	N/A
GC	1812	1.10 ± .10	1,000	4,000	N/A	N/A	N/A
GD	1812	1.25 ± .15	1,000	4,000	N/A	N/A	N/A
GE	1812	1.30 ± .10	1,000	4,000	N/A	N/A	N/A
GF	1812	1.50 ± .10	1,000	4,000	N/A	N/A	N/A
GG	1812	1.55 ± .10	1,000	4,000	N/A	N/A	N/A
GH	1812	1.40 ± .15	1,000	4,000	N/A	N/A	N/A
GJ	1812	1.70 ± .15	1,000	4,000	N/A	N/A	N/A
GK	1812	1.60 ± .20	1,000	4,000	N/A	N/A	N/A
GL	1812	1.90 ± .20	1,000	4,000	N/A	N/A	N/A
GM	1812	2.00 ± .20	1,000	4,000	N/A	N/A	N/A
GN	1812	1.70 ± .20	1,000	4,000	N/A	N/A	N/A
HB	1825	1.10 ± .15	1,000	4,000	N/A	N/A	N/A
HC	1825	1.15 ± .15	1,000	4,000	N/A	N/A	N/A
HD	1825	1.30 ± .15	1,000	4,000	N/A	N/A	N/A
HE	1825	1.40 ± .15	1,000	4,000	N/A	N/A	N/A
HF	1825	1.50 ± .15	1,000	4,000	N/A	N/A	N/A
JB	2220	1.00 ± .15	1,000	4,000	N/A	N/A	N/A
JC	2220	1.10 ± .15	1,000	4,000	N/A	N/A	N/A
JD	2220	1.30 ± .15	1,000	4,000	N/A	N/A	N/A
JE	2220	1.40 ± .15	1,000	4,000	N/A	N/A	N/A
JF	2220	1.50 ± .15	1,000	4,000	N/A	N/A	N/A
KB	2225	1.00 ± .15	1,000	4,000	N/A	N/A	N/A
KC	2225	1.10 ± .15	1,000	4,000	N/A	N/A	N/A
KD	2225	1.30 ± .15	1,000	4,000	N/A	N/A	N/A
KE	2225	1.40 ± .15	1,000	4,000	N/A	N/A	N/A

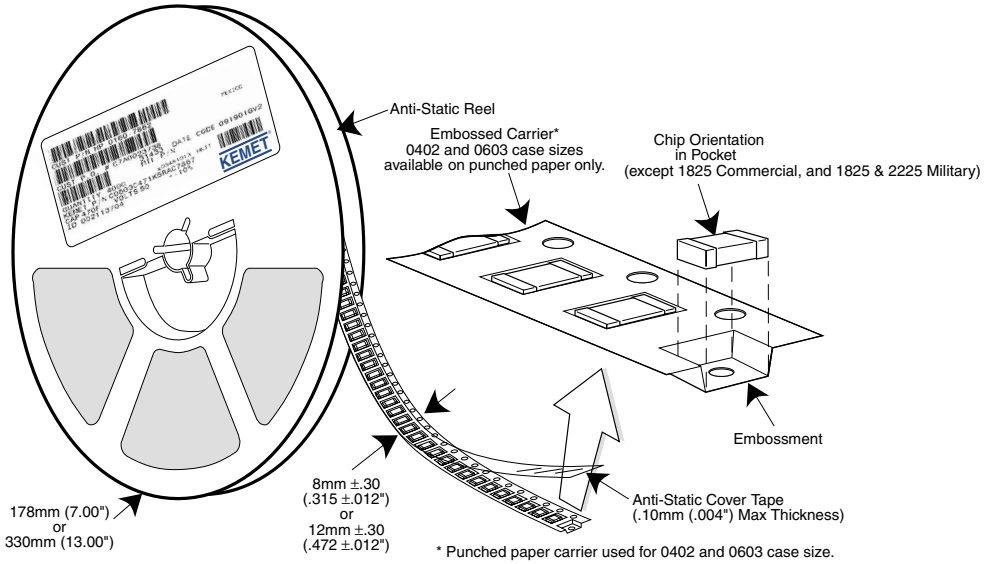
This chart refers to ceramic chip thickness codes on pages 72-75.

CERAMIC CHIP CAPACITORS

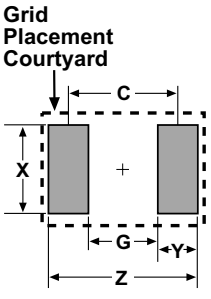
Packaging Information

Tape & Reel Packaging

KEMET offers Multilayer Ceramic Chip Capacitors packaged in 8mm and 12mm plastic tape on 7" and 13" reels in accordance with EIA standard 481-1: Taping of surface mount components for automatic handling. This packaging system is compatible with all tape fed automatic pick and place systems. See page 77 for details on reeling quantities for commercial chips and page 90 for MIL-PRF-55681 chips.



SURFACE MOUNT LAND DIMENSIONS - CERAMIC CHIP CAPACITORS - MM



	Reflow Solder					Wave Solder				
Dimension	**Z**	**G**	**X**	**Y(ref)**	**C(ref)**	**Z**	**G**	**X**	**Y(ref)**	**Smin**
0402	2.14	0.28	0.74	0.93	1.21	Not Recommended				
0603	2.78	0.68	1.08	1.05	1.73	3.18	0.68	0.80	1.25	1.93
0805	3.30	0.70	1.60	1.30	2.00	3.70	0.70	1.10	1.50	2.20
1206	4.50	1.50	2.00	1.50	3.00	4.90	1.50	1.40	1.70	3.20
1210	4.50	1.50	2.90	1.50	3.00	4.90	1.50	2.00	1.70	3.20
1812	5.90	2.30	3.70	1.80	4.10	Not Recommended				
1825	5.90	2.30	6.90	1.80	4.10					
2220	7.00	3.30	5.50	1.85	5.15					
2225	7.00	3.30	6.80	1.85	5.15					

Calculation Formula
Z = Lmin + 2Jt + Tt
G = Smax - 2Jh -Th
X = Wmin + 2Js + Ts
Tt, Th, Ts = Combined tolerances

TANTALUM, CERAMIC AND ALUMINUM CHIP CAPACITORS

KEMET

Packaging Information

Performance Notes

1. **Cover Tape Break Force:** 1.0 Kg Minimum.
2. **Cover Tape Peel Strength:** The total peel strength of the cover tape from the carrier tape shall be:

Tape Width	Peel Strength
8 mm	0.1 Newton to 1.0 Newton (10g to 100g)
12 mm	0.1 Newton to 1.3 Newton (10g to 130g)

   The direction of the pull shall be opposite the direction of the carrier tape travel. The pull angle of the carrier tape shall be 165° to 180° from the plane of the carrier tape. During peeling, the carrier and/or cover tape shall be pulled at a velocity of 300 ±10 mm/minute.
3. **Reel Sizes:** Molded tantalum capacitors are available on either 180 mm (7") reels (standard) or 330 mm (13") reels (with C-7280). Note that 13" reels are preferred.
4. **Labeling:** Bar code labeling (standard or custom) shall be on the side of the reel opposite the sprocket holes. Refer to EIA-556.

Embossed Carrier Tape Configuration: Figure 1

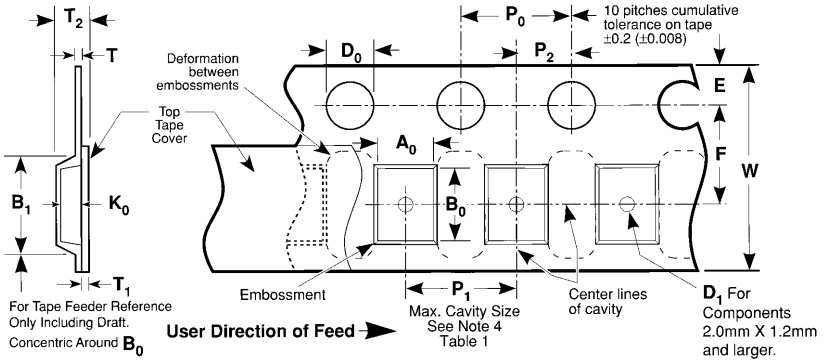


Table 1 — EMBOSSED TAPE DIMENSIONS (Metric will govern)

Constant Dimensions — Millimeters (Inches)							
Tape Size	**D_0**	**E**	**P_0**	**P_2**	**T Max**	**T_1 Max**	
8 mm and 12 mm	1.5 +0.10 -0.0 (0.059 +0.004, -0.0)	1.75 ±0.10 (0.069 ±0.004)	4.0 ±0.10 (0.157 ±0.004)	2.0 ±0.05 (0.079 ±0.002)	0.600 (0.024)	0.100 (0.004)	

Variable Dimensions — Millimeters (Inches)									
Tape Size	**Pitch**	**B_1 Max. Note 1**	**D_1 Min. Note 2**	**F**	**P_1**	**R Min. Note 3**	**T_2 Max**	**W**	**$A_0B_0K_0$ Note 4**
8 mm	Single (4 mm)	4.4 (0.173)	1.0 (0.039)	3.5 ±0.05 (0.138 ±0.002)	4.0 ±0.10 (0.157 ±0.004)	25.0 (0.984)	2.5 (0.098)	8.0 ±0.30 (.315 ±0.012)	
12 mm	Double (8 mm)	8.2 (0.323)	1.5 (0.059)	5.5 ±0.05 (0.217 ±0.002)	8.0 ±0.10 (0.315 ±0.004)	30.0 (1.181)	4.6 (0.181)	12.0 ±0.30 (0.472 ±0.012)	

NOTES

1. B1 dimension is a reference dimension for tape feeder clearance only.
2. The embossment hole location shall be measured from the sprocket hole controlling the location of the embossment. Dimensions of embossment location and hole location shall be applied independent of each other.
3. Tape with components shall pass around radius "R" without damage (see sketch A). The minimum trailer length (Fig. 2) may require additional length to provide R min. for 12 mm embossed tape for reels with hub diameters approaching N min. (Table 2)
4. The cavity defined by A_o, B_o, and K_o shall be configured to surround the part with sufficient clearance such that the chip does not protrude beyond the sealing plane of the cover tape, the chip can be removed from the cavity in a vertical direction without mechanical restriction, rotation of the chip is limited to 20 degrees maximum in all 3 planes, and lateral movement of the chip is restricted to 0.5 mm maximum in the pocket (not applicable to vertical clearance.)

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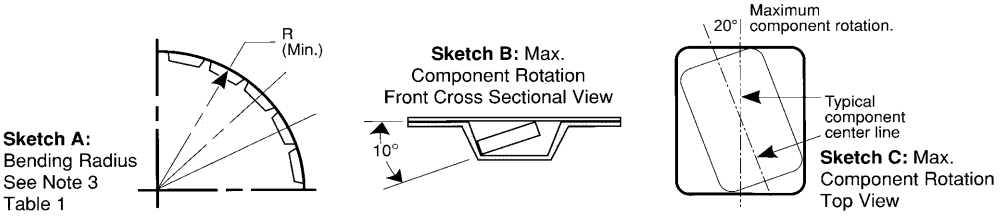
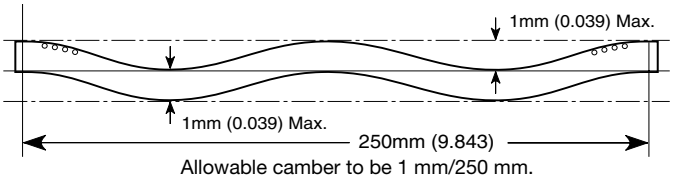
TANTALUM, CERAMIC AND ALUMINUM CHIP CAPACITORS

Packaging Information

Embossed Carrier Tape Configuration (cont.)



Sketch D: Tape Camber (Top View)



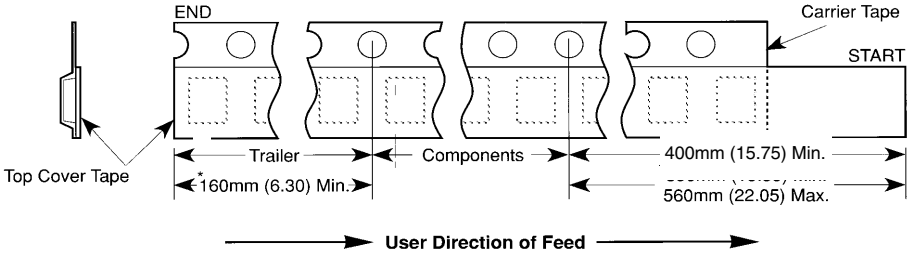


Figure 2: Tape Leader & Trailer Dimensions (Metric Dimensions Will Govern)

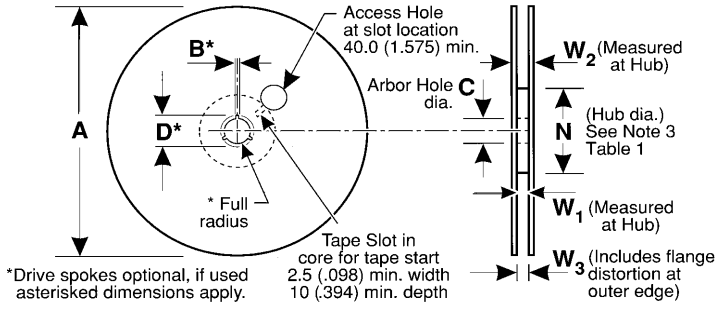


Figure 3: Reel Dimensions (Metric Dimensions will govern)

Table 2 – REEL DIMENSIONS (Metric will govern)

Tape Size	A Max	B* Min	C	D* Min	N Min	W_1	W_2 Max	W_3
8 mm	330.0 (12.992)	1.5 (0.059)	13.0 ± 0.20 (0.512 ± 0.008)	20.2 (0.795)	50.0 (1.969) See Note 3 Table 1	8.4 +1.5, -0.0 (0.331 +0.059, -0.0)	14.4 (0.567)	7.9 Min (0.311) 10.9 Max (0.429)
12 mm	330.0 (12.992)	1.5 (0.059)	13.0 ± 0.20 (0.512 ± 0.008)	20.2 (0.795)		12.4 +2.0, -0.0 (0.488 +0.078, -0.0)	18.4 (0.724)	11.9 Min (0.469) 15.4 Max (0.606)

CERAMIC CHIP CAPACITORS

Packaging Information

KEMET

Punched Carrier (Paper Tape) Configuration (Ceramic Chips Only):

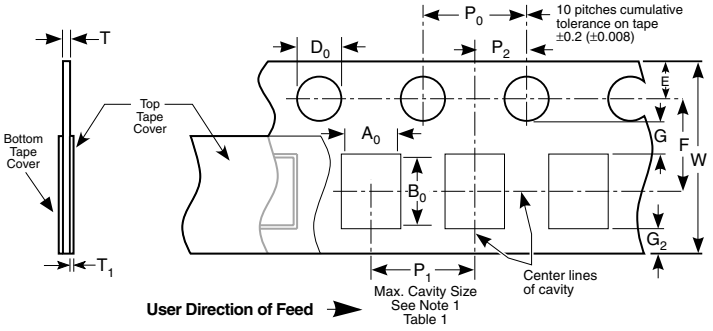


Table 1: 8 & 12mm Punched Tape
(Metric Dimensions Will Govern)

Constant Dimensions - Millimeters (Inches)

Tape Size	D_0	E	P_0	P_2	T_1	G_1	G_2	R Min.
8mm and 12mm	1.5 +0.10, -0.0 (.059 +0.004, -0.0)	1.75 ±0.10 (.069 ±0.004)	4.0 ± 0.10 (.157 ± 0.004)	2.0 ± 0.05 (.079 ± 0.002)	0.10 (.004) Max.	0.75 (.030) Min.	0.75 (.030) Min.	25 (.984) See Note 2 Table 1

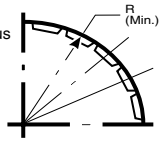
Table 1: 8 & 12mm Punched Tape
(Metric Dimensions Will Govern)

Variable Dimensions - Millimeters (Inches)

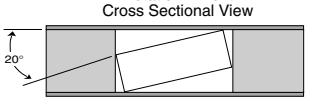
Tape Size	P_1	F	W	A_0B_0	T
8mm 1/2 Pitch	2.0 ± 0.10 (.079 ±.004) See Requirements Section 3.3 (d)	3.5 ± 0.05 (.138 ± .002)	8.0 ± 0.3 (.315 ± 0.012)	See Note 1 Table 1	1.1mm (.043) Max. for Paper Base Tape and 1.6mm (.063) Max. for Non-Paper Base Compositions. See Note 3.
8mm	4.0 ± 0.10 (0.157 ± .004)				
12mm	4.0 ± 0.10 (0.157 ± .004)	5.5 ± 0.05 (.217 ± .002)	12.0 ± 0.3 (.472 ± .012)		
12mm Double Pitch	8.0 ± 0.10 (0.315 ± .004)				

Note:
1. A_0, B_0 and T determined by the maximum dimensions to the ends of the terminals extending from the body and/or the body dimensions of the component. The clearance between the ends of the terminals or body of the component to the sides and depth of the cavity (A_0, B_0 and T) must be within 0.05mm (.002) minimum and 0.50mm (.020) maximum. The clearance allowed must also prevent rotation of the component within the cavity of not more than 20 degrees (see sketches A and B).
2. Tape with components shall pass around radius "R" without damage.
3. KEMET nominal thicknesses are: 0402 = 0.6mm and all others 0.95mm minimum.

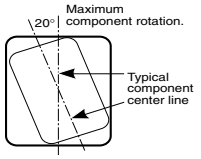
Sketch A:
Bending Radius
See Note 2
Table 1



Sketch B:
Max. Component Rotation - Front Cross Sectional View



Sketch C:
Component Rotation - Top View



CERAMIC CHIP CAPACITORS

Packaging Information

Bulk Cassette Packaging (Ceramic Chips only)

(Meets Dimensional Requirements IEC-286-6 and EIAJ 7201)

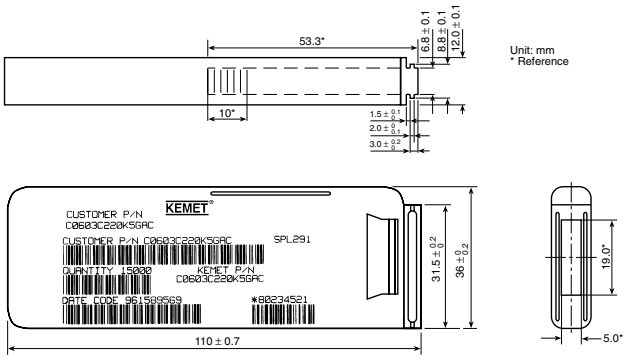


Table 2 – Capacitance Values Available In Bulk Cassette Packaging

Case Size	Dielectric	Voltage	Min. Cap Value	Max. Cap Value
0402	All	All	All	All
0603	All	All	All	All
0805	C0G	200 100 50	109 109 109	181 331 102
	X7R	200 100 50 25 16	221 221 221 221 221	392 103 273 104 104
	Y5V	25 16	104 104	224 224

Table 1 – Capacitor Dimensions for Bulk Cassette Packaging – Millimeters

Metric Size Code	EIA Size Code	Length L	Width W	Thickness T	Bandwidth B	Minimum Separation S	Number of Pcs/Cassette
1005	0402	1.0 ± 0.05	0.5 ± 0.05	0.5 ± .05	0.2 to 0.4	0.3	50,000
1608	0603	1.6 ± 0.07	0.8 ± 0.07	0.8 ± .07	0.2 to 0.5	0.7	15,000
2012	0805	2.0 ± 0.10	1.25 ± 0.10	0.6 ± .10	0.5 to 0.75	0.75	10,000

Terminations: KEMET nickel barrier layer with a tin overplate.

CAPACITOR MARKING TABLE (Marking Optional - Not Available for 0402 Size or Y5V Dielectric)

Alpha Character \ Numeral	Capacitance (pF) For Various Numeral Identifiers								
	9	0	1	2	3	4	5	6	7
A	0.10	1.0	10	100	1000	10,000	100,000	1,000,000	10,000,000
B	0.11	1.1	11	110	1100	11,000	110,000	1,100,000	11,000,000
C	0.12	1.2	12	120	1200	12,000	120,000	1,200,000	12,000,000
D	0.13	1.3	13	130	1300	13,000	130,000	1,300,000	13,000,000
E	0.15	1.5	15	150	1500	15,000	150,000	1,500,000	15,000,000
F	0.16	1.6	16	160	1600	16,000	160,000	1,600,000	16,000,000
G	0.18	1.8	18	180	1800	18,000	180,000	1,800,000	18,000,000
H	0.20	2.0	20	200	2000	20,000	200,000	2,000,000	20,000,000
J	0.22	2.2	22	220	2200	22,000	220,000	2,200,000	22,000,000
K	0.24	2.4	24	240	2400	24,000	240,000	2,400,000	24,000,000
L	0.27	2.7	27	270	2700	27,000	270,000	2,700,000	27,000,000
M	0.30	3.0	30	300	3000	30,000	300,000	3,000,000	30,000,000
N	0.33	3.3	33	330	3300	33,000	330,000	3,300,000	33,000,000
P	0.36	3.6	36	360	3600	36,000	360,000	3,600,000	36,000,000
Q	0.39	3.9	39	390	3900	39,000	390,000	3,900,000	39,000,000
R	0.43	4.3	43	430	4300	43,000	430,000	4,300,000	43,000,000
S	0.47	4.7	47	470	4700	47,000	470,000	4,700,000	47,000,000
T	0.51	5.1	51	510	5100	51,000	510,000	5,100,000	51,000,000
U	0.56	5.6	56	560	5600	56,000	560,000	5,600,000	56,000,000
V	0.62	6.2	62	620	6200	62,000	620,000	6,200,000	62,000,000
W	0.68	6.8	68	680	6800	68,000	680,000	6,800,000	68,000,000
X	0.75	7.5	75	750	7500	75,000	750,000	7,500,000	75,000,000
Y	0.82	8.2	82	820	8200	82,000	820,000	8,200,000	82,000,000
Z	0.91	9.1	91	910	9100	91,000	910,000	9,100,000	91,000,000
a	0.25	2.5	25	250	2500	25,000	250,000	2,500,000	25,000,000
b	0.35	3.5	35	350	3500	35,000	350,000	3,500,000	35,000,000
d	0.40	4.0	40	400	4000	40,000	400,000	4,000,000	40,000,000
e	0.45	4.5	45	450	4500	45,000	450,000	4,500,000	45,000,000
f	0.50	5.0	50	500	5000	50,000	500,000	5,000,000	50,000,000
m	0.60	6.0	60	600	6000	60,000	600,000	6,000,000	60,000,000
n	0.70	7.0	70	700	7000	70,000	700,000	7,000,000	70,000,000
t	0.80	8.0	80	800	8000	80,000	800,000	8,000,000	80,000,000
y	0.90	9.0	90	900	9000	90,000	900,000	9,000,000	90,000,000

Laser marking is available as an extra-cost option for most KEMET ceramic chips. Such marking is two sided, and includes a $\overline{K}$ to identify KEMET, followed by two characters (per EIA-198 - see table below) to identify the capacitance value. Note that marking is not available for size 0402 nor for any Y5V chip. In addition, the 0603 marking option is limited to the $\overline{K}$ only.

	$\overline{K}$A3	

Example shown is 1,000 pF capacitor.