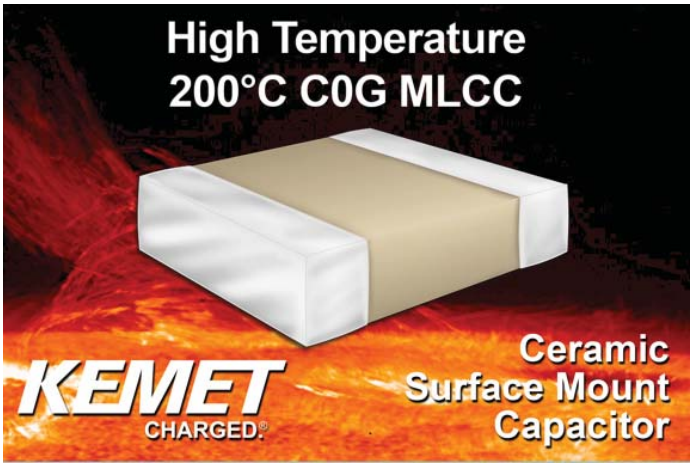
The Capacitance Company
KEMET CHARGED®

Product Bulletin

Surface Mount Ceramic Chip Capacitors
High Temperature 200ºC C0G MLCC



Benefits and Features:

No piezoelectric properties.
Extremely low ESR and ESL.
High thermal stability.
High ripple current capability.
Preferred capacitance solution at line frequencies and into the MHz range.
No capacitance change with respect to applied rated DC voltage.
No capacitance change with respect to temperature from -55 to +200ºC.
No capacitance decay with time.
Non - polar device.

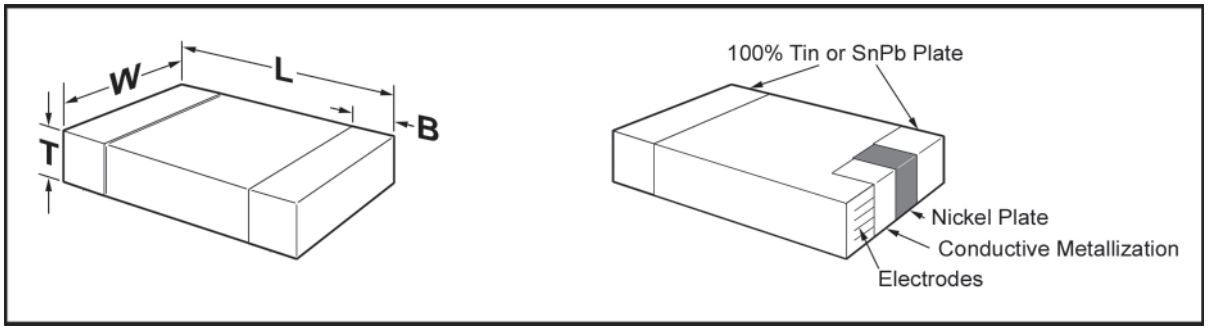
Applications:

Typical applications include timing, tuning, decoupling, by-pass, filtering, transient voltage suppression, blocking and energy storage for use in extreme environments coupled with down-hole exploration, aerospace engine compartments and geophysical probes.

KEMET's High Temperature Surface Mount C0G MLCC's features a robust and proprietary base metal dielectric system that offers Ultra-High Capacitance and unsurpassed performance in extreme temperatures up to +200ºC. This new platform promotes downsizing opportunities of existing High Temperature C0G technology, and allows replacement of virtually all existing X7R/BX/BR technology.

Standard capacitance ratings for these devices range from 0.5pF up to 0.22µF in capacitance tolerance offerings of ±0.25pF, ±0.5pF, ±1%, ±2%, ±5%, ±10%, or ±20%. Temperature Coefficient of Capacitance (TCC) is ±30ppm/°C from -55°C to +200°. Devices are available in DC voltage ratings of 10V, 16V, 25V, 50V and 100V, with a dissipation factor of 0.10%. EIA standard case sizes options include 0603, 0805, 1206, 1210, and 1812 with either nickel barrier/tin or tin/lead terminations.

Outline Drawing



Dimensions - Millimeters (Inches)

EIA SIZE CODE	METRIC SIZE CODE	L LENGTH	W WIDTH	B BANDWIDTH	S SEPARATION minimum
0603	1608	1.6 (.063) ± .15 (.006)	0.8 (.032) ± .15 (.006)	0.35 (.014) ± .15 (.006)	0.7 (.028)
0805	2012	2.0 (.079) ± .20 (.008)	1.25 (.049) ± .20 (.008)	0.50 (.020) ± .25 (.010)	0.75 (.030)
1206	3216	3.2 (.126) ± .20 (.008)	1.6 (.063) ± .20 (.008)	0.50 (.020) ± .25 (.010)	N/A
1210	3225	3.2 (.126) ± .20 (.008)	2.5 (.098) ± .20 (.008)	0.50 (.020) ± .25 (.010)	N/A
1812	4532	4.5 (.177) ± .30 (.012)	3.2 (.126) ± .30 (.012)	0.60 (.024) ± .35 (.014)	N/A

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Ordering Information

C	1210	H	124	J	5	G	A	C	TU
Ceramic	Case Size (L"x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Dielectric	Failure Rate/ Design	End Metallization (Plated)	Packaging/Grade (C-Spec)*
	0603	H = High Temp (200ºC)	2 Sig. Digits +	B = ±0.10pF	8 = 10V	G = C0G	A = N/A	C = 100% Matte Sn	Blank = Commercial
	0805		Number of	C = ±0.25pF	4 = 16V			L = SnPb (5% min)	Grade Bulk
	1206		Zeros*	D = ±0.5pF	3 = 25V				TU = 7" Reel Unmarked
	1210		*Use 9 for 1.0 - 9.9pF	F = ±1%	6 = 35V				TM = 7" Reel Marked
	1812		*Use 8 for 0.5 - .99pF	G = ±2%	5 = 50V				
			ex. 2.2pF = 229	J = ±5%	1 = 100V				
			ex. 0.5pF = 508	K = ±10%	2 = 200V				
				M = ±20%					

*Please contact KEMET for ordering details if you require larger reel sizes or other packaging options.

Electrical Parameters/Characteristics

Operating Temperature Range:	-55°C to +200°C
Temperature Coefficient of Capacitance (TCC) up to 200ºC:	±30PPM/ºC
Aging Rate (Max % Cap Loss/Decade Hour):	0%
Dielectric Withstanding Voltage:	250%
Dissipation Factor (DF) @ 25ºC:	.001 (0.10%) Max
Insulation Resistance (IR) Limit @ 25°C:	1000 megohm microfarads or 100GΩ
Insulation Resistance (IR) Limit @ 200°C:	10 megohm microfarads or 1GΩ
Capacitance and Dissipation Factor (DF) measured under the following conditions:	1kHz and 1 Vrms if capacitance >1000pF 1MHz and 1 Vrms if capacitance ≤1000pF

Qualification/Certification

RoHS-PRC (6/6) - 100% matte Sn termination

Product Qualification Test Plan	
RELIABILITY/ ENVIRONMENTAL TESTS per MIL-STD-202/JESD22	
High Temperature Life	200ºC, Rated Voltage, 2000 Hours
Load Humidity	85ºC /85%RH, Rated Voltage, 1000 Hours
Low Voltage Humidity	85ºC /85%RH, 1.5V, 1000 Hours
Temperature Cycling	-55ºC to +200ºC, 50 Cycles
Thermal Shock	-55ºC to +150ºC, 20s transfer, 15 min dwell, 300 Cycles
Moisture Resistance	Cycled Temp / RH. 0V, 10 cycles @ 24 Hrs each
PHYSICAL, MECHANICAL & PROCESS TESTS per MIL-STD 202/JIS-C-6429	
Resistance to Solvents	Include Aqueous wash chemical - OKEM Clean or equivalent
Mechanical Shock and Vibration	Method 213: Figure 1, Condition F Method 204: 5 gs for 20 min,12 cycles
Restistance to Soldering Heat	Condition B, no pre-heat of samples, Single Wave Solder
Terminal Strength	Force of 1.8 kg for 60 seconds
Board Flex	2mm minimum for all except 3 mm min for Class I

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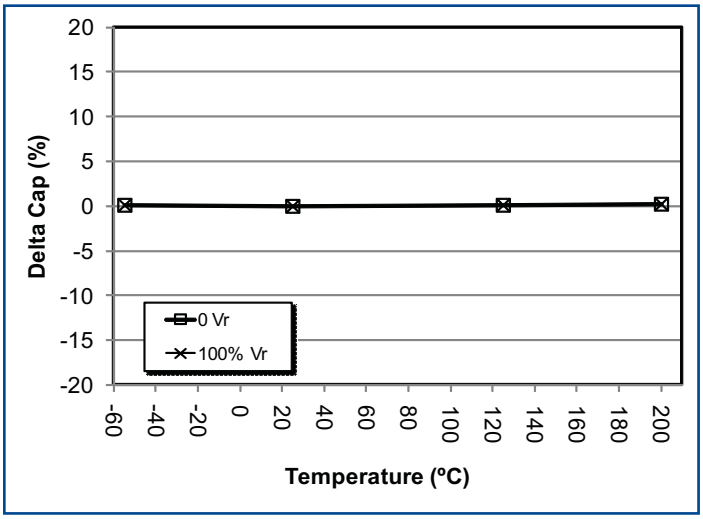
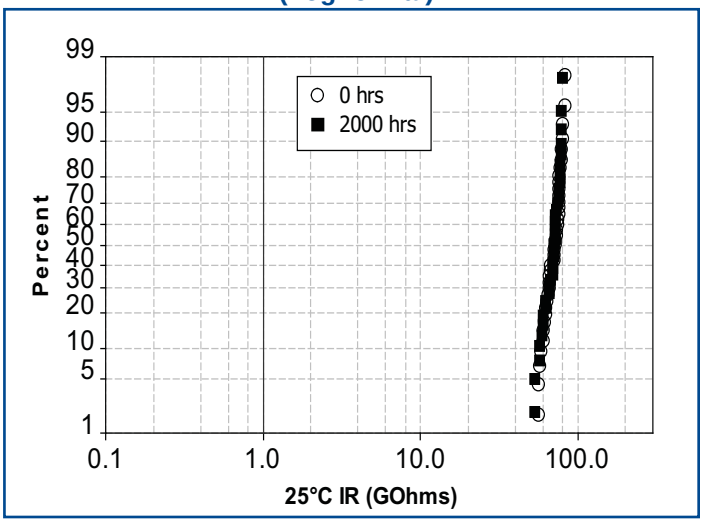
Electrical Characteristics

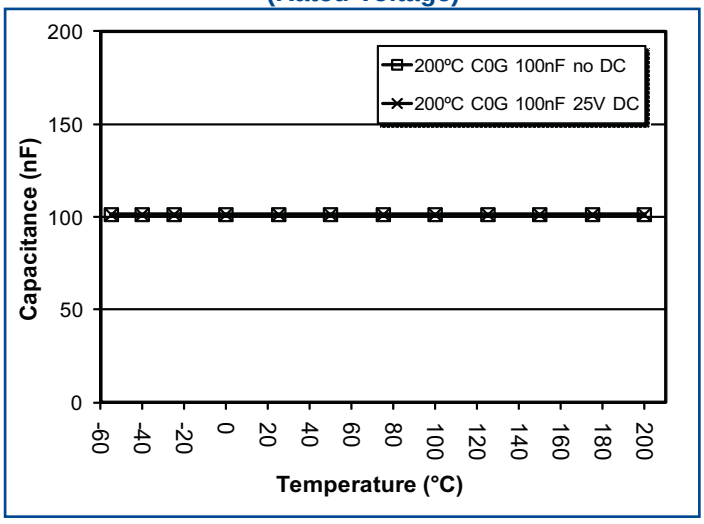
Delta Cap vs. Temperature (Typical)



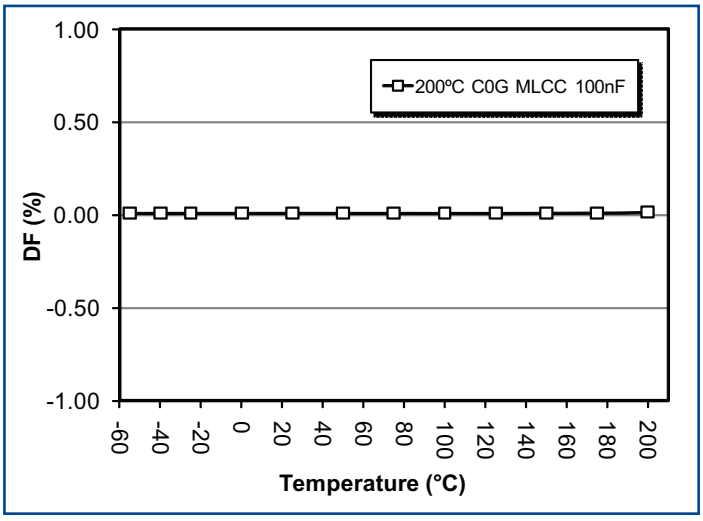
C1210H104J1GAC - Life Test IR Distribution (Lognormal)



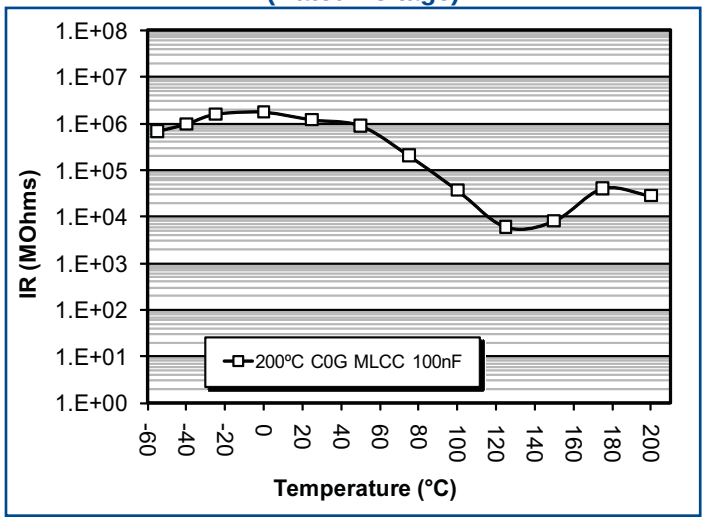
Capacitance vs. Temperature with 25V DC bias (Rated Voltage)



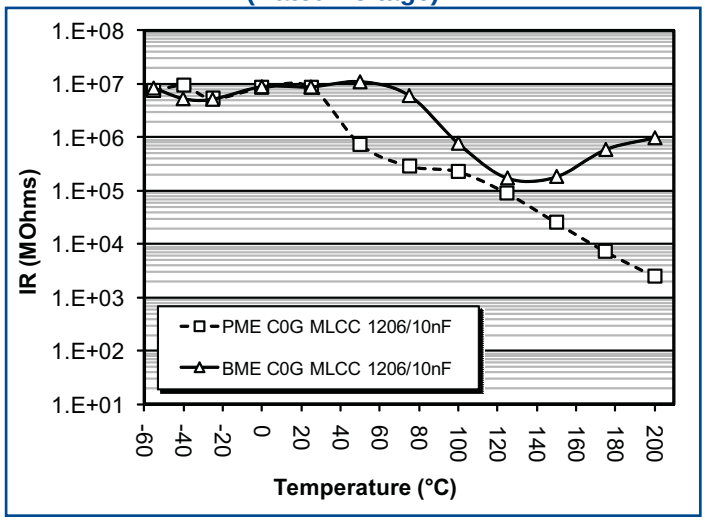
DF vs. Temperature without DC bias.



IR vs. Temperature with 25V DC bias (Rated Voltage)



BME vs. PME/IR vs. Temperature with 25V DC bias (Rated Voltage)



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High Temperature 200ºC (0603 - 1812 Case Sizes) C0G DIELECTRIC

Cap pF	Cap Code	Series	C0603						C0805						C1206						C1210						C1812	
		Voltage	10V	16V	25V	50V	100V	200V	10V	16V	25V	50V	100V	200V	10V	16V	25V	50V	100V	200V	10V	16V	25V	50V	100V	200V	50V	100V
		Voltage Code	8	4	3	5	1	2	8	4	3	5	1	2	8	4	3	5	1	2	8	4	3	5	1	2	5	1
		Cap Tolerance	Product Availability and Chip Thickness Codes - See Page 78 for Chip Thickness Dimensions																									
0.50-0.75	508-759	C	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC														
1.0-2.4	109-249	C	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	FB	FB	FB	FB	FB	FB		
2.7	279	C	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	FB	FB	FB	FB	FB	FB		
3.0	309	C	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	FB	FB	FB	FB	FB	FB		
3.3	339	C	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	FB	FB	FB	FB	FB	FB		
3.6	369	C	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	FB	FB	FB	FB	FB	FB		
3.9	399	C	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	FB	FB	FB	FB	FB	FB		
4.3	439	C	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	FB	FB	FB	FB	FB	FB		
4.7	479	C	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	FB	FB	FB	FB	FB	FB		
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5.6	569	C J K M	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	FB	FB	FB	FB	FB	FB		
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15	150	C G J K M	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	FB	FB	FB	FB	FB	FB		
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24	240	C G J K M	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	FB	FB	FB	FB	FB	FB		
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5,100	512	F G J K M	CB	CB	CB	CB			DE	DE	DE	DE	DC		ED	ED	ED	ED	ED		FB	FB	FB	FB	FG	FG		
5,600	562	F G J K M	CB	CB	CB	CB			DC	DC	DC	DC	DC		ED	ED	ED	ED	ED		FB	FB	FB	FB	FG	FG		
6,200	622	F G J K M	CB	CB	CB	CB			DC	DC	DC	DC	DC		EB	EB	EB	EB	EB		FB	FB	FB	FB	FG			
6,800	682	F G J K M	CB	CB	CB	CB			DC	DC	DC	DC	DC		EB	EB	EB	EB	EB		FB	FB	FB	FB	FG			
7,500	752	F G J K M	CB	CB	CB				DC	DC	DC	DC	DC		EB	EB	EB	EB	EB		FC	FC	FC	FC	FC			
8,200	822	F G J K M	CB	CB	CB				DC	DC	DC	DC	DC		EC	EC	EC	EC	EB		FC	FC	FC	FC	FC			
9,100	912	F G J K M	CB	CB	CB				DC	DC	DC	DC	DC		EC	EC	EC	EC	EB		FE	FE	FE	FE	FE			
10,000	103	F G J K M	CB	CB	CB				DC	DC	DC	DC	DD		ED	ED	ED	ED	EB		FF	FF	FF	FF	FF			
12,000	123	F G J K M							DC	DC	DC	DC	DE		EB	EB	EB	EB	EB		FG	FG	FG	FG	FF			
15,000	153	F G J K M							DC	DC	DC	DD	DG		EB	EB	EB	EB	EB		FG	FG	FG	FG	FB		GB	GB
18,000	183	F G J K M							DC	DC	DC	DD			EB	EB	EB	EB	EB		FB	FB	FB	FB	FB		GB	GB
22,000	223	F G J K M							DD	DD	DD	DF			EB	EB	EB	EB	EC		FB	FB	FB	FB	FB		GB	GB
27,000	273	F G J K M							DF	DF	DF				EB	EB	EB	EB	EE		FB	FB	FB	FB	FB		GB	GB
33,000	333	F G J K M							DG	DG	DG				EB	EB	EB	EB	EE		FB	FB	FB	FB	FB		GB	GB
47,000	473	F G J K M													EC	EC	EC	EE	EH		FB	FB	FB	FB	FE		GB	GB
56,000	563	F G J K M													ED	ED	ED	EF			FB	FB	FB	FB	FF		GB	GB
68,000	683	F G J K M													EF	EF	EF	EH			FB	FB	FB	FC	FG		GB	GB
82,000	823	F G J K M													EH	EH	EH	EH			FC	FC	FC	FF	FH		GB	GB
100,000	104	F G J K M													EH	EH	EH				FE	FE	FE	FG	FM		GB	GD
120,000	124	F G J K M																			FG	FG	FG	FH			GB	GH
150,000	154	F G J K M																			FH	FH	FH	FM			GD	GN
180,000	184	F G J K M																									GH	
220,000	224	F G J K M																									GK	
270,000	274	F G J K M																										
Cap pF	Cap Code	Voltage Code	8	4	3	5	1	2	8	4	3	5	1	2	8	4	3	5	1	2	8	4	3	5	1	2	5	1
		Voltage	10V	16V	25V	50V	100V	200V	10V	16V	25V	50V	100V	200V	10V	16V	25V	50V	100V	200V	10V	16V	25V	50V	100V	200V	50V	100V
		Series	C0603						C0805						C1206						C1210						C1812	

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Chip Thickness / Packaging Quantities

Thickness Code Reference Chart
Packaging Quantity Based on Finished Chip Thickness Specifications

Thickness Code	Chip Size	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	01005	0.20 ± 0.02	--	--	15000	--	--
AB	0201	0.30 ± 0.03	--	--	15000	--	--
BB	0402	0.50 ± 0.05	--	--	10000	50000	50000
CB	0603	0.80 ± 0.07	--	--	4000	10000	15000
CC	0603	0.80 ± 0.10	--	--	4000	10000	--
CD	0603	0.80 ± 0.15	--	--	4000	10000	--
DB	0805	0.60 ± 0.10	--	--	4000	10000	10000
DC	0805	0.78 ± 0.10	--	--	4000	10000	--
DD	0805	0.90 ± 0.10	--	--	4000	10000	--
DE	0805	1.00 ± 0.10	2500	10000	--	--	--
DF	0805	1.10 ± 0.10	2500	10000	--	--	--
DG	0805	1.25 ± 0.15	2500	10000	--	--	--
DH	0805	1.25 ± 0.20	2500	10000	--	--	--
DL	0805	0.95 ± 0.10	4000	10000	--	--	
EB	1206	0.78 ± 0.10	4000	10000	4000	10000	--
EC	1206	0.90 ± 0.10	4000	10000	--	--	--
ED	1206	1.00 ± 0.10	2500	10000	--	--	--
EE	1206	1.10 ± 0.10	2500	10000	--	--	--
EF	1206	1.20 ± 0.15	2500	10000	--	--	--
EG	1206	1.60 ± 0.15	2000	8000	--	--	--
EH	1206	1.60 ± 0.20	2000	8000	--	--	--
EJ	1206	1.70 ± 0.20	2000	8000	--	--	--
EK	1206	0.80 ± 0.10	2000	8000	--	--	--
EM	1206	1.25 ± 0.15	2500	10000	--	--	--
EN	1206	0.95 ± 0.10	4000	10000	--	--	--
FB	1210	0.78 ± 0.10	4000	10000	--	--	--
FC	1210	0.90 ± 0.10	4000	10000	--	--	--
FD	1210	0.95 ± 0.10	4000	10000	--	--	--
FE	1210	1.00 ± 0.10	2500	10000	--	--	--
FF	1210	1.10 ± 0.10	2500	10000	--	--	--
FG	1210	1.25 ± 0.15	2500	10000	--	--	--
FH	1210	1.55 ± 0.15	2000	8000	--	--	--
FJ	1210	1.85 ± 0.20	2000	8000	--	--	--
FK	1210	2.10 ± 0.20	2000	8000	--	--	--
FL	1210	1.40 ± 0.15	2000	8000	--	--	--
FM	1210	1.70 ± 0.20	2000	8000	--	--	--
FN	1210	1.85 ± 0.20	2000	8000	--	--	--
FO	1210	1.50 ± 0.20	2000	8000	--	--	--
FP	1210	1.60 ± 0.20	2000	8000	--	--	--
FR	1210	2.25 ± 0.20	2000	8000	--	--	--
FS	1210	2.50 ± 0.20	1000	4000	--	--	--
FT	1210	1.90 ± 0.20	1500	4000	--	--	--
GB	1812	1.00 ± 0.10	1000	4000	--	--	--
GC	1812	1.10 ± 0.10	1000	4000	--	--	--
GD	1812	1.25 ± 0.15	1000	4000	--	--	--
GE	1812	1.30 ± 0.10	1000	4000	--	--	--
GF	1812	1.50 ± 0.10	1000	4000	--	--	--
GG	1812	1.55 ± 0.10	1000	4000	--	--	--
GH	1812	1.40 ± 0.15	1000	4000	--	--	--
GJ	1812	1.70 ± 0.15	1000	4000	--	--	--
GK	1812	1.60 ± 0.20	1000	4000	--	--	--
GL	1812	1.90 ± 0.20	1000	4000	--	--	--
GM	1812	2.00 ± 0.20	1000	4000	--	--	--
GN	1812	1.70 ± 0.20	1000	4000	--	--	--
GO	1812	2.50 ± 0.20	500	2000	--	--	--
HB	1825	1.10 ± 0.15	1000	4000	--	--	--
HC	1825	1.15 ± 0.15	1000	4000	--	--	--
HD	1825	1.30 ± 0.15	1000	4000	--	--	--
HE	1825	1.40 ± 0.15	1000	4000	--	--	--
HF	1825	1.50 ± 0.15	1000	4000	--	--	--
HG	1825	1.60 ± 0.20	1000	4000	--	--	--
JB	2220	1.00 ± 0.15	1000	4000	--	--	--
JC	2220	1.10 ± 0.15	1000	4000	--	--	--
JD	2220	1.30 ± 0.15	1000	4000	--	--	--
JE	2220	1.40 ± 0.15	1000	4000	--	--	--
JF	2220	1.50 ± 0.15	1000	4000	--	--	--
JG	2220	1.70 ± 0.15	1000	4000	--	--	--
JH	2220	1.80 ± 0.15	1000	4000	--	--	--
JO	2220	2.40 ± 0.15	500	2000	--	--	--
JP	2220	1.60 ± 0.20	1000	4000	--	--	--
KB	2225	1.00 ± 0.15	1000	4000	--	--	--
KC	2225	1.10 ± 0.15	1000	4000	--	--	--
KD	2225	1.30 ± 0.15	1000	4000	--	--	--
KE	2225	1.40 ± 0.15	1000	4000	--	--	--
KF	2225	1.60 ± 0.20	1000	4000	--	--	--
LA	1808	1.40 ± 0.15	1000	4000	--	--	--
LB	1808	1.60 ± 0.15	1000	4000	--	--	--
LC	1808	2.00 ± 0.15	1000	4000	--	--	--
LD	1808	0.90 ± 0.10	2500	10000	--	--	--
MA	1632	0.80 ± 0.10	4000	10000	--	--	--

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Soldering Process

All parts incorporate the standard KEMET barrier layer of pure nickel, with an overplate of pure tin to provide excellent solderability as well as resistance to leaching.

HMP solders ,e.g., Pb94, are recommended for high temperature applications.

Marking

These chips will be supplied unmarked. If required, they can be laser-marked as an extra option. Details on the marking format are included in KEMET Surface Mount catalog F3102.

In general, the information in the KEMET Surface Mount catalog F3102 applies to these capacitors. The information in this bulletin supplements that in the catalog.

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