

# Automotive General Multilayer Ceramic Capacitors

## AMT Category (Automotive Grade Surface Mount MLCCs)

### 1. Introduction:

AMT automotive grade capacitors are designed, manufactured, and screened to ensure the high level of product quality by using COG/X7R dielectrics and have high electrical precision, stability and reliability. They feature series connection of multi-layer capacitor units in a MLCC to realize high voltage performance. This special design can distribute voltage gradients throughout the entire capacitor, so as to prevent short circuit failure. AMT series MLCCs are in tight quality control to meet automotive application requirements and is AEC-Q200 qualified.

### 2. Features:

- A wide selection of sizes is available (from 0201 to 1210)
- High capacitance at given case size
- Capacitor with Lead-free termination (pure Tin)
- The AMT series meet AEC-Q200 requirement

### 3. Applications:

- Navigation & Information equipment
- Entertainment equipment
- Electric vehicle – BMS , On-Board Charger ,DC-DC converter and Inverter
- Automotive infotainment systems

### 4. Production Identification:

AMT	1206	N	R47	J	201	P	I	C
Product Category Code	Size	Dielectric	Capacitance	Tolerance	Rated Voltage	Packaging	Thickness	Control Code
Table 1	Table 2	Table 3	Table 4	Table 5	Table 6	Table 7	Table 8	Table 9

Code	Description
AMT	Automotive Grade Surface Mount MLCCs

Description	Description
0201 (0603)	0805 (2012)
0402 (1005)	1206 (3216)
0603 (1608)	1210 (3225)

Code	Description	Code	Description
N	COG	X	X7R

Code	Chip Capacitance	Code	Chip Capacitance
R47	0.47pF	102	102=10x10 <sup>2</sup> =1000pF
OR5	0.5pF	104	104=10x10 <sup>4</sup> =100nF
100	100=10x10 <sup>0</sup> =10pF	106	106=10x10 <sup>6</sup> =10μF

Code	Tolerance	Code	Tolerance	Code	Tolerance
A	±0.05 pF	I	-10% ~ 0%	Q	±0.03 pF
B	±0.10 pF	J	±5 %	Z	-20% ~ +80%
C	±0.25 pF	K	±10 %	X	+10%~+20%
D	±0.50 pF	L	0% ~ +10%		
F	±1 %	M	±20 %		
G	±2 %	N	-5% ~ +10%		
H	±3 %	P	±0.02 pF		

Code	Voltage	Code	Voltage	Code	Voltage
6R3	6.3Vdc	500	50Vdc	401	400Vdc
100	10Vdc	101	100Vdc	501	500Vdc
160	16Vdc	201	200Vdc	631	630Vdc
250	25Vdc	251	250Vdc	102	1000Vdc

Code	Package Description	Code	Package Description
B	Bulk	T	Tray package
E	Tape and 7" Reel, Embossed Tape	P	Tape and 7" Reel, Paper Tape
K	Tape and 10" Reel, Embossed Tape	D	Tape and 10" Reel, Paper Tape
L	Tape and 13" Reel, Embossed Tape	G	Tape and 13" Reel, Paper Tape

Code	Thickness, mm	Code	Thickness, mm	Code	Thickness, mm
A	0.60 ± 0.10	I	1.25 ± 0.20	Q	0.50+0.02/-0.05
B	0.8 + 0.15/-0.10	J	1.15 ± 0.15	R	3.10 ± 0.30
C	1.25 ± 0.10	K	0.50 ± 0.20	S	0.80 ± 0.07
D	1.40 ± 0.15	L	0.30 ± 0.03	T	0.85 ± 0.10
E	1.60 ± 0.20	M	0.95 ± 0.10	U	0.50 ± 0.10
F	2.00 ± 0.20	N	0.50 ± 0.05	V	0.20 ± 0.02
G	2.50 ± 0.30	O	3.50 ± 0.20	X	0.80 ± 0.10
H	2.80 ± 0.30	P	1.60 +0.3/-0.10	Z	0.25 ± 0.03

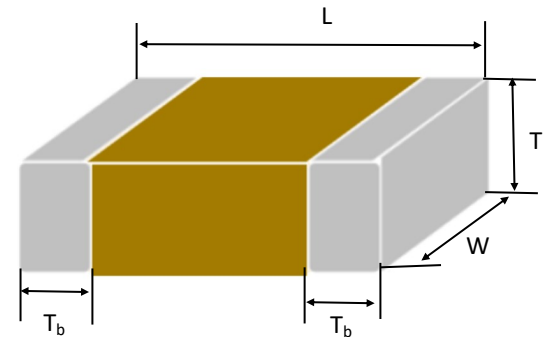
Code	Description
C	RoHS Compliant
Q	Surface Coating (size 1206~2225)

## Automotive General Multilayer Ceramic Capacitors

### AMT Category (Automotive Grade Surface Mount MLCCs)

#### 5. Shape and Dimensions:

Size, Inch (mm)	Length L (mm)	Width W (mm)	Termination Bandwidth T <sub>b</sub> (mm)
0201 (0603)	0.60±0.03	0.30±0.03	0.15±0.05
0402 (1005)	1.00±0.10	0.50±0.10	0.25 +0.05/0.10
0603 (1608)	1.60±0.15	0.80±0.15	0.40±0.15
0805 (2012)	2.00±0.20	1.25±0.20	0.50±0.20
1206 (3216)	3.20±0.20 3.30±0.30*	1.60±0.20 1.60 +0.3/-0.1 <sup>#</sup>	0.60±0.20
1210 (3225)	3.20±0.30 3.30±0.40*	2.50±0.30	0.75±0.35
1808 (4520)	4.50±0.40	2.00±0.25	0.75±0.35
1812 (4532)	4.50±0.40	3.20±0.30	0.75±0.35



“\*” for ≥ 1KV products. “#” for P thickness products.

#### 6. General Electrical Specification:

Dielectric Material	COG	X7R						
Chip Size	0201, 0402, 0603, 0805, 1206, 1210	0402, 0603, 0805, 1206, 1210						
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V, 200V, 250V, 500V, 630V, 1000V							
Capacitance Range*	0.1pF ~ 47nF	100pF ~ 10μF						
Tan δ	<table border="1"> <thead> <tr> <th>Capacitance Range</th> <th>Q Specification</th> </tr> </thead> <tbody> <tr> <td>Cap.&lt;30pF</td> <td>Q≥400+20C</td> </tr> <tr> <td>Cap.≥30pF</td> <td>Q≥1000</td> </tr> </tbody> </table>	Capacitance Range	Q Specification	Cap.<30pF	Q≥400+20C	Cap.≥30pF	Q≥1000	Refer to No.17 of 8. reliability test conditions and requirements
Capacitance Range	Q Specification							
Cap.<30pF	Q≥400+20C							
Cap.≥30pF	Q≥1000							
Capacitance & Tan δ	Measured at the condition of 30~70% related humidity							
Test Condition	For 25°C at ambient temperature	Preconditioning for Class II MLCC: Perform a heat treatment at 150±10°C for 1 hour, then leave in ambient condition for 24±2 hours before measurement						
	<table border="1"> <thead> <tr> <th>Capacitance Range</th> <th>Test Condition</th> </tr> </thead> <tbody> <tr> <td>Cap.≤1000pF</td> <td>1.0±0.2Vrms, 1.0MHz±10%</td> </tr> <tr> <td>Cap.&gt;1000pF</td> <td>1.0±0.2Vrms, 1.0KHz±10%</td> </tr> </tbody> </table>	Capacitance Range	Test Condition	Cap.≤1000pF	1.0±0.2Vrms, 1.0MHz±10%	Cap.>1000pF	1.0±0.2Vrms, 1.0KHz±10%	1.0±0.2Vrms, 1.0KHz±10%, at 25°C ambient temperature
Capacitance Range	Test Condition							
Cap.≤1000pF	1.0±0.2Vrms, 1.0MHz±10%							
Cap.>1000pF	1.0±0.2Vrms, 1.0KHz±10%							
Operating temperature	-55°C to +125°C							
Capacitance Characteristic	±30ppm/°C	±15%						
Insulation Resistance at Ur	≥10GΩ or RxC≥500Ω-F, whichever is smaller	Refer to No.17 of 8. reliability test conditions and requirements						
Termination	Cu/Ni/Sn (lead-free termination)							



# Automotive General Multilayer Ceramic Capacitors

## AMT Category (Automotive Grade Surface Mount MLCCs)

### 7.1 COG (Capacitance vs. thickness, refer to table 8 for the thickness code), Continue

Cap (pF)	Size, Inch (mm)	1206 (3216)										1210 (3225)										
		Cap Code	10V	16V	25V	50V	100V	200V	250V	500V	630V	1000V	10V	16V	25V	50V	100V	200V	250V	500V	630V	1000V
1.2	1R2	X	X	X	X	X	X	X	X	X	X											
1.5	1R5	X	X	X	X	X	X	X	X	X	X											
1.8	1R8	X	X	X	X	X	X	X	X	X	X											
2.2	2R2	X	X	X	X	X	X	X	X	X	X											
2.7	2R7	X	X	X	X	X	X	X	X	X	X											
3.3	3R3	X	X	X	X	X	X	X	X	X	X											
3.9	3R9	X	X	X	X	X	X	X	X	X	X											
4.7	4R7	X	X	X	X	X	X	X	X	X	X											
5.6	5R6	X	X	X	X	X	X	X	X	X	X											
6.8	6R8	X	X	X	X	X	X	X	X	X	X											
8.2	8R2	X	X	X	X	X	X	X	X	X	X											
10	100	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	M
12	120	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	M
15	150	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	M
18	180	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	M
22	220	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M	M
27	270	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M	M
33	330	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M	M
39	390	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M	M
47	470	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M	M
56	560	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M	M
68	680	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M	M
82	820	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M	M
100	101	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M	C
120	121	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M	C
150	151	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M	C
180	181	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	M	C
220	221	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	M	E
270	271	X	X	X	X	X	X	M	M	M	E	M	M	M	M	M	M	M	M	M	M	E
330	331	X	X	X	X	X	X	M	M	M	E	M	M	M	M	M	M	M	M	M	M	E
390	391	X	X	X	X	X	X	M	M	M	E	M	M	M	M	M	M	M	M	M	M	E
470	471	X	X	X	X	X	M	M	M	M	E	M	M	M	M	M	M	M	M	M	M	E
560	561	X	X	X	X	X	M	C	C	C	E	M	M	M	M	M	M	M	M	M	M	E
680	681	X	X	X	X	X	M	C	C	C	E	M	M	M	M	M	M	M	M	M	M	E
820	821	X	X	X	X	X	M	E	E	E	E	M	M	M	M	M	M	M	M	M	M	E
1,000	102	X	X	X	X	X	M	E	E	E	E	M	M	M	M	M	C	C	C	C	C	E
1,200	122	X	X	X	X	X	M	E	E	E		M	M	M	M	M	C	C	C	C	C	F
1,500	152	X	X	X	X	X	C	E	E	E		M	M	M	M	M	C	C	C	C	C	F
1,800	182	X	X	X	X	X	C	E	E	E		M	M	M	M	M	C	C	C	C	C	F
2,200	222	X	X	X	X	X	C	E	E	E		M	M	M	M	M	C	C	C	C	C	F
2,700	272	X	X	X	X	X	C	E	E	E		M	M	M	M	M	C	C	C	C	C	F
3,300	332	X	X	X	X	X	C	E	E	E		M	M	M	M	M	C	C	C	C	C	F
3,900	392	X	X	X	X	X	C	E	E	E		M	M	M	M	M	C	C	C	C	C	F
4,700	472	X	X	X	X	X	C	E	E	E		M	M	M	M	M	E	E	E	E	E	F
5,600	562	X	X	X	X	X	E	E				M	M	M	M	M	E	E	E	E	E	F
6,800	682	M	M	M	M	M	E	E				M	M	M	M	M	E	E	E	E	E	F
8,200	822	C	C	C	C	C	E	E				M	M	M	M	M	E	E	E	E	E	F
10,000	103	C	C	C	C	C	E	E				M	M	M	M	M	E	E	F	F	F	G
12,000	123											C	C	C	C	C	F	F	G	G	G	G
15,000	153											C	C	C	C	C	F	F	G	G	G	G
18,000	183											F	F	F	F	F						
22,000	223											F	F	F	F	F						
27,000	273											F	F	F	F	F						
33,000	333											F	F	F	F	F						
39,000	393											F	F	F	F	F						
47,000	473											F	F	F	F	F						
56,000	563																					
68,000	683																					
82,000	823																					
100,000	104																					

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## AMT Category (Automotive Grade Surface Mount MLCCs)

### 7.2 X7R (Capacitance vs. thickness, refer to table 8 for the thickness code)

Cap (pF)	Size, Inch (mm)	0201 (0603)				0402 (1005)				0603 (1608)					0805 (2012)									
		Cap Code	10V	16V	25V	50V	10V	16V	25V	50V	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	200V	250V	500V	630V
100	101	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
120	121	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
150	151	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
180	181	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
220	221	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
270	271	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
330	331	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
390	391	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
470	471	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
560	561	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
680	681	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
820	821	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
1,000	102	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
1,200	122	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
1,500	152	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
1,800	182	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
2,200	222	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
2,700	272	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
3,300	332	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
3,900	392	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X	X
4,700	472	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	C	C
5,600	562	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	C	C	C	C
6,800	682	L				N	N	N	N	S	S	S	S	S	X	X	X	X	X	C	C	C	C	C
8,200	822	L				N	N	N	N	S	S	S	S	S	X	X	X	X	X	C	C	C	C	C
10,000	103	L				N	N	N	N	S	S	S	S	S	X	X	X	X	X	C	C	C	C	C
12,000	123					N	N	N		S	S	S	S	B	X	X	X	X	X	C	C			
15,000	153					N	N	N		S	S	S	S	B	X	X	X	X	X	C	C			
18,000	183					N	N	N		S	S	S	S	B	X	X	X	X	X	C	C			
22,000	223					N	N	N		S	S	S	S	B	X	X	X	X	X/C	C	C			
27,000	273					N	N	N		S	S	S	S	B	X	X	X	X	C					
33,000	333					N	N	N		S	S	S	B	B	X	X	X	X	C					
39,000	393					N	N	N		S	S	S	B	B	X	X	X	X	C					
47,000	473					N	N	N		S	S	S	B	B	X	X	X	X	C					
56,000	563					N	N	N		S	S	S	B		X	X	X	X	C					
68,000	683					N	N	N		S	S	S	B		X	X	X	X	C					
82,000	823					N	N	N		S	S	S	B		X	X	X	C	C					
100,000	104					N	N	N		S	S	S	B		X	X	X	C	C					
120,000	124									B	B	B			X	X	X	C	C					
150,000	154									B	B	B	B		C	C	C	C						
180,000	184									B	B	B			C	C	C	C						
220,000	224									B	B	B	B		C	C	C	I						
270,000	274														C	C	C	I						
330,000	334									B	B	B	B		C	C	C	I						
390,000	394														C	C	C	I						
470,000	474														C	C	C	I						
560,000	564														C	C	C							
680,000	684														C	C	C	I						
820,000	824														C	C	C							
1,000,000	105														C	C	C	I						

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### AMT Category (Automotive Grade Surface Mount MLCCs)

#### 7.2 X7R (Capacitance vs. thickness, refer to table 8 for the thickness code), Continue

Cap (pF)	Size, Inch (mm)	1206 (3216)									1210 (3225)							
		Cap Code	10V	16V	25V	50V	100V	200V	250V	500V	630V	10V	16V	25V	50V	100V	250V	500V
100	101						C	C	C	C						C	C	C
120	121						C	C	C	C						C	C	C
150	151	X	X	X	X	X	C	C	C	C						C	C	C
180	181	X	X	X	X	X	C	C	C	C						C	C	C
220	221	X	X	X	X	X	C	C	C	C						C	C	C
270	271	X	X	X	X	X	C	C	C	C						C	C	C
330	331	X	X	X	X	X	C	C	C	C						C	C	C
390	391	X	X	X	X	X	C	C	C	C						C	C	C
470	471	X	X	X	X	X	C	C	C	C						C	C	C
560	561	X	X	X	X	X	C	C	C	C						C	C	C
680	681	X	X	X	X	X	C	C	C	C						C	C	C
820	821	X	X	X	X	X	C	C	C	C						C	C	C
1,000	102	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	C
1,200	122	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	C
1,500	152	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	C
1,800	182	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	C
2,200	222	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	C
2,700	272	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	C
3,300	332	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	C
3,900	392	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	E
4,700	472	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	E
5,600	562	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	E
6,800	682	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	E
8,200	822	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	E
10,000	103	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	E
12,000	123	X	X	X	X	X	C	C			M	M	M	M	M	M	C	
15,000	153	X	X	X	X	X	C	C			M	M	M	M	M	M	C	
18,000	183	X	X	X	X	X	C	C			M	M	M	M	M	M	C	
22,000	223	X	X	X	X	X	C	C			M	M	M	M	M	M	C	
27,000	273	X	X	X	X	X					M	M	M	M	M	M		
33,000	333	X	X	X	X	X					M	M	M	M	M	M		
39,000	393	X	X	X	X	X					M	M	M	M	M	M		
47,000	473	X	X	X	X	X					M	M	M	M	M	C		
56,000	563	X	X	X	X	X					M	M	M	M	M			
68,000	683	X	X	X	X	X					M	M	M	M	M			
82,000	823	X	X	X	X	C					M	M	M	M	M			
100,000	104	X	X	X	X	C					M	M	M	M	M			
120,000	124	X	X	X	X	C					M	M	M	M				
150,000	154	M	M	M	M	E					M	M	M	M				
180,000	184	M	M	M	M	E					M	M	M	M				
220,000	224	M	M	M	M	E					M	M	M	M				
270,000	274	M	M	M	C	P					M	M	M	M				
330,000	334	M	M	M	C	P					M	M	M	C				
390,000	394	M	M	J	P	P					M	M	M	C				
470,000	474	J	J	J	P	P					M	M	M	C				
560,000	564	J	J	J	P	P					C	C	C	C				
680,000	684	J	J	J	P	P					C	C	C	C				
820,000	824	J	J	J	P	P					C	C	C	C				
1,000,000	105	J	J	J	P	P					C	C	C	C				
1,500,000	155				P	P						F						
2,200,000	225				P	P						F		G	G			
4,700,000	475										G	G	G	G	G			
10,000,000	106										G	G	G	G				

## Automotive General Multilayer Ceramic Capacitors

### AMT Category (Automotive Grade Surface Mount MLCCs)

#### 8. Reliability Test Conditions and Requirements:

No.	Item	AEC-Q200 Test Condition	Requirements																																																																
1	Pre- and Post-Stress Electrical Test	Refer to general electrical data	Refer to general electrical data																																																																
2	High Temperature Exposure (Storage) MIL-STD-202, Method 108	* Test temp.: 150±3°C. * Unpowered. * Test time: 1000 +24/-0 hrs. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Capacitance change: COG within ±2.5% or ±0.25pF, whichever is larger. X7R within ±12.5%. * Q/D.F. value: COG: Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF. X7R: D.F.≤200% of initial requirement. * I.R.: ≥10GΩ or RxC≥500Ω-F, whichever is smaller. X7R <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th>Rated</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥100V</td> <td rowspan="3">≤3%</td> <td>≤6%</td> <td>1206≥0.47μF</td> </tr> <tr> <td>≤7.5%</td> <td>0805&gt;0.1μF, 0603≥0.068μF, 1206≥1μF, 1210≥2.2μF</td> </tr> <tr> <td>≤20%</td> <td>0805&gt;0.22μF, 1210≥3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤3%</td> <td>≤6%</td> <td>0201(50V), 0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.01uF, 1210≥3.3μF</td> </tr> <tr> <td>≤20%</td> <td>0402≥0.012μF, 0603&gt;0.1μF, 0805/X7R≥0.47μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>35V</td> <td>≤5%</td> <td>≤20%</td> <td>0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td rowspan="4">25V</td> <td rowspan="4">≤5%</td> <td>≤10%</td> <td>0201≥0.01μF, 0805≥1μF, 1210≥10μF</td> </tr> <tr> <td>≤14%</td> <td>0603≥0.33μF</td> </tr> <tr> <td>≤15%</td> <td>0201≥0.1μF, 0402≥0.056μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF</td> </tr> <tr> <td>≤20%</td> <td>0402≥0.47μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤5%</td> <td>≤10%</td> <td>0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF</td> </tr> <tr> <td>≤15%</td> <td>0201≥0.022uF, 0402≥0.033uF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤7.5%</td> <td>≤15%</td> <td>0201≥0.012μF, 0402≥0.22μF, 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF</td> </tr> <tr> <td>≤20%</td> <td>0201≥0.1μF, 0402≥1μF</td> </tr> <tr> <td>6.3V</td> <td>≤15%</td> <td>≤30%</td> <td>0201≥0.1uF, 0402≥1uF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF</td> </tr> <tr> <td>4V</td> <td>≤20%</td> <td>—</td> <td>—</td> </tr> </tbody> </table> Class II (X7R) <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th>Rated Voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>≥100V: All X7R;1210≥3.3μF</td> <td rowspan="7" style="text-align: center; vertical-align: middle;">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402&gt;0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0201&gt;0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td>6.3V;4V:Size≥1812</td> </tr> </tbody> </table>	Rated	D.F.≤	Exception of D.F.≤		≥100V	≤3%	≤6%	1206≥0.47μF	≤7.5%	0805>0.1μF, 0603≥0.068μF, 1206≥1μF, 1210≥2.2μF	≤20%	0805>0.22μF, 1210≥3.3μF	50V	≤3%	≤6%	0201(50V), 0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF	≤10%	0201≥0.01uF, 1210≥3.3μF	≤20%	0402≥0.012μF, 0603>0.1μF, 0805/X7R≥0.47μF, 1206≥2.2μF, 1210≥10μF	35V	≤5%	≤20%	0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V	≤5%	≤10%	0201≥0.01μF, 0805≥1μF, 1210≥10μF	≤14%	0603≥0.33μF	≤15%	0201≥0.1μF, 0402≥0.056μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF	≤20%	0402≥0.47μF	16V	≤5%	≤10%	0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF	≤15%	0201≥0.022uF, 0402≥0.033uF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF	10V	≤7.5%	≤15%	0201≥0.012μF, 0402≥0.22μF, 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF	≤20%	0201≥0.1μF, 0402≥1μF	6.3V	≤15%	≤30%	0201≥0.1uF, 0402≥1uF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF	4V	≤20%	—	—	Rated Voltage	I.R.	≥100V: All X7R;1210≥3.3μF	≥1GΩ or RxC≥10Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0201>0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF	6.3V;4V:Size≥1812
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3	Destructive Physical Analysis EIA-469	Per EIA-469.	* No defects or abnormalities.																																																																
4	Temperature Cycling JESD22, Method JA-104	* Conduct 1000 cycles according to the temperatures and time. <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">-55°C +0/-3</td> <td style="text-align: center;">30±1</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">+125°C +3/-0</td> <td style="text-align: center;">30±1</td> </tr> </tbody> </table> * Before initial measurement (X7R only) : Perform 150 +0/-10°C for 1 hr and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.	Step	Temp. (°C)	Time (min.)	1	-55°C +0/-3	30±1	2	+125°C +3/-0	30±1	* No remarkable damage. * Capacitance change: COG within ±2.5% or 0.25pF, whichever is larger. X7R within ±10.0%. * Q/D.F. value: COG: Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF. X7R: D.F.≤200% of initial requirement. * I.R.: ≥10GΩ or RxC≥500Ω-F, whichever is smaller. Class II (X7R) <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th>Rated Voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R;1210≥3.3μF</td> <td rowspan="7" style="text-align: center; vertical-align: middle;">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402&gt;0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0201&gt;0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td>6.3V;4V:Size≥1812</td> </tr> </tbody> </table>	Rated Voltage	I.R.	100V: All X7R;1210≥3.3μF	≥1GΩ or RxC≥10Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0201>0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF	6.3V;4V:Size≥1812																																													
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## Automotive General Multilayer Ceramic Capacitors

### AMT Category (Automotive Grade Surface Mount MLCCs)

No.	Item	AEC-Q200 Test Condition	Requirements																				
5	<b>Moisture Resistance</b> MIL-STD-202, Method 106	* Test temp. 25~65°C. * Humidity: 80~100% RH. * Test time: 10 cycles, t=24hrs/cycle. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Cap. change: COG within ±3.0% or 0.30pF, whichever is larger. X7R within ±12.5%. * Q/D.F. value: COG: Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF, Q≥200+10C for Cap.<10pF. X7R: D.F.≤200% of initial requirement. * I.R.: ≥10GΩ or RxC≥500Ω-F, whichever is smaller. Class II (X7R) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Rated Voltage</th> <th style="text-align: center;">I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R; 1210≥3.3μF</td> <td rowspan="7" style="text-align: center; vertical-align: middle;">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402&gt;0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0201&gt;0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td>6.3V;4V: Size≥1812</td> </tr> </tbody> </table>	Rated Voltage	I.R.	100V: All X7R; 1210≥3.3μF	≥1GΩ or RxC≥10Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0201>0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF	6.3V;4V: Size≥1812										
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6	<b>Biased Humidity</b> MIL-STD-202, Method 103	* Test temp.: 85±3°C. * Humidity: 85±5%RH. * Test time: 1000 +24/-0 hrs. * To apply voltage: Rated voltage (max. 100Vdc) and 1.3~1.5Vdc (add 100k ohm resistor). * Before initial measurement (Class II only): To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Cap. change: COG within ±3.0% or 0.30pF, whichever is larger. X7R within ±12.5%. * Q/D.F. value: COG: Q≥200 for Cap.≥30pF, Q≥100+10/3C for Cap.<30pF. X7R: D.F.≤200% of initial requirement. * I.R.: ≥1GΩ or RxC≥50Ω-F, whichever is smaller. Class II (X7R) for rated voltage test <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Rated Voltage</th> <th style="text-align: center;">I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R; 1210≥3.3μF</td> <td rowspan="7" style="text-align: center; vertical-align: middle;">≥500GΩ or RxC≥5Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402&gt;0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0201&gt;0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td>6.3V;4V: Size≥1812</td> </tr> </tbody> </table> Class II (X7R) for 1.3~1.5Vdc test <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Rated Voltage</th> <th style="text-align: center;">I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R; 1210≥3.3μF</td> <td rowspan="7" style="text-align: center; vertical-align: middle;">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402&gt;0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0201&gt;0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td>6.3V;4V: Size≥1812</td> </tr> </tbody> </table>	Rated Voltage	I.R.	100V: All X7R; 1210≥3.3μF	≥500GΩ or RxC≥5Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0201>0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF	6.3V;4V: Size≥1812	Rated Voltage	I.R.	100V: All X7R; 1210≥3.3μF	≥1GΩ or RxC≥10Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0201>0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF	6.3V;4V: Size≥1812
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7	<b>External Visual</b> MIL-STD-883, Method 2009	* Visual inspection.	* No remarkable defect.																				
8	<b>Physical Dimension</b> JESD22, Method JB-100	* Using by calipers.	* Within the specified dimensions.																				



## Automotive General Multilayer Ceramic Capacitors

### AMT Category (Automotive Grade Surface Mount MLCCs)

No.	Item	AEC-Q200 Test Condition	Requirements																						
9	<b>Operational Life</b> MIL-STD-202, Method 108	* Test temp.: 125±3°C. * To apply voltage: Full rated voltage. * Test time: 1000 +24/-0 hrs. * Before initial measurement (X7R only): Apply rated voltage for 1 hr at 125°C. Remove and let set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Cap. change: COG within ±3.0% or ±0.3pF, whichever is larger. X7R within ±12.5%. * Q/D.F. value: COG: Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF, Q≥200+10C for Cap.<10pF. X7R: D.F.≤200% of initial requirement. I.R.: ≥1GΩ or RxC≥500Ω-F, whichever is smaller. Class II (X7R) <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th style="width: 80%;">Rated Voltage</th> <th style="width: 20%;">I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R;1210≥3.3μF</td> <td rowspan="8" style="text-align: center; vertical-align: middle;">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402&gt;0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0201&gt;0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0201&gt;0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td>6.3V;4V:Size≥1812</td> </tr> <tr> <td>6.3V;4V:Size≥1812</td> </tr> </tbody> </table>	Rated Voltage	I.R.	100V: All X7R;1210≥3.3μF	≥1GΩ or RxC≥10Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0201>0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0201>0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF	6.3V;4V:Size≥1812	6.3V;4V:Size≥1812											
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10	<b>Resistance to Solvents</b> MIL-STD-202, Method 215	* Temperature: 25±5°C. * Time: 3 +0.5/-0 min. * Solvent: Iso-propyl alcohol.	* No remarkable damage. * Cap.: Within the specified tolerance. * Q/D.F. value: COG: Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF. X7R: D.F.≤100% of initial requirement. * I.R.: ≥10GΩ or RxC≥500Ω-F, whichever is smaller. Class II (X7R) <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th style="width: 80%;">Rated Voltage</th> <th style="width: 20%;">I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R;1210≥3.3μF</td> <td rowspan="8" style="text-align: center; vertical-align: middle;">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402&gt;0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0201&gt;0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td>6.3V;4V:Size≥1812</td> </tr> <tr> <td>6.3V;4V:Size≥1812</td> </tr> </tbody> </table>	Rated Voltage	I.R.	100V: All X7R;1210≥3.3μF	≥1GΩ or RxC≥10Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0201>0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF	6.3V;4V:Size≥1812	6.3V;4V:Size≥1812											
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11	<b>Mechanical Shock</b> MIL-STD-202, Method 213	* Peak value: 1500g's. * Wave: 1/2 sine. * Velocity: 15.4 ft/sec. * Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks).	* No remarkable damage. * Cap.: Within the specified tolerance. * Q/D.F. value: COG: Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF. X7R: D.F.≤100% of initial requirement. * I.R.: ≥10GΩ or RxC≥500Ω-F, whichever is smaller. Class II (X7R) <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th style="width: 80%;">Rated Voltage</th> <th style="width: 20%;">I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R;1210≥3.3μF</td> <td rowspan="8" style="text-align: center; vertical-align: middle;">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402&gt;0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0201&gt;0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td>6.3V;4V:Size≥1812</td> </tr> <tr> <td>6.3V;4V:Size≥1812</td> </tr> </tbody> </table> <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th style="width: 80%;">Rated Voltage</th> <th style="width: 20%;">I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: 1210≥3.3μF</td> <td rowspan="8" style="text-align: center; vertical-align: middle;">RxC≥50Ω-F</td> </tr> <tr> <td>50V: 0402≥0.1μF, 0603≥2.2μF, 0805≥10μF, 1206≥10μF,</td> </tr> <tr> <td>35V: 0603≥1μF</td> </tr> <tr> <td>25V: 0201&gt;0.1μF, 0402≥2.2μF, 0603≥10μF, 0805≥10μF, 1206≥22μF</td> </tr> <tr> <td>16V: 0201≥0.22μF, 0402≥1μF, 0603≥10μF</td> </tr> <tr> <td>10V: 0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥47μF</td> </tr> <tr> <td>6.3V:0201≥0.1μF, 0402≥1μF, 0603≥4.7μF, 0805≥47μF, 1206≥10μF</td> </tr> <tr> <td>4V:0603≥22μF, 0805≥47μF, 1206≥100μF</td> </tr> </tbody> </table>	Rated Voltage	I.R.	100V: All X7R;1210≥3.3μF	≥1GΩ or RxC≥10Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0201>0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF	6.3V;4V:Size≥1812	6.3V;4V:Size≥1812	Rated Voltage	I.R.	100V: 1210≥3.3μF	RxC≥50Ω-F	50V: 0402≥0.1μF, 0603≥2.2μF, 0805≥10μF, 1206≥10μF,	35V: 0603≥1μF	25V: 0201>0.1μF, 0402≥2.2μF, 0603≥10μF, 0805≥10μF, 1206≥22μF	16V: 0201≥0.22μF, 0402≥1μF, 0603≥10μF	10V: 0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥47μF	6.3V:0201≥0.1μF, 0402≥1μF, 0603≥4.7μF, 0805≥47μF, 1206≥10μF	4V:0603≥22μF, 0805≥47μF, 1206≥100μF
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## Automotive General Multilayer Ceramic Capacitors

### AMT Category (Automotive Grade Surface Mount MLCCs)

No.	Item	AEC-Q200 Test Condition	Requirements																						
12	<b>Vibration</b> MIL-STD-202, Method 204	* Vibration frequency: 10~2000 Hz/min. (5g's for 20 min.). * Total amplitude: 1.5mm. * 12 cycles each of 3 orientations (36 times).	* No remarkable damage. * Cap.: Within the specified tolerance. * Q/D.F. value: COG: $Q \geq 1000$ for Cap. $\geq 30\text{pF}$ , $Q \geq 400+20C$ for Cap. $< 30\text{pF}$ . X7R: D.F. $\leq 100\%$ of initial requirement. * I.R.: $\geq 10G\Omega$ or $RxC \geq 500\Omega\text{-F}$ , whichever is smaller. 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13	<b>Resistance to Soldering Heat</b> MIL-STD-202, Method 210		* Solder temperature: $260 \pm 5^\circ\text{C}$ . * Dipping time: $10 \pm 1$ sec. * Before initial measurement (X7R only): Perform $150 \pm 0/-10^\circ\text{C}$ for 1 hr and then set for $24 \pm 2$ hrs at room temp. * Measurement to be made after keeping at room temp. for $24 \pm 2$ hrs.	* No remarkable damage. * Cap. change: COG within $\pm 2.5\%$ or $0.25\text{pF}$ , whichever is larger. X7R within $\pm 7.5\%$ . * Q/D.F. value: COG: $Q \geq 1000$ for Cap. $\geq 30\text{pF}$ , $Q \geq 400+20C$ for Cap. $< 30\text{pF}$ . X7R: D.F. $\leq 100\%$ of initial requirement. * I.R.: $\geq 10G\Omega$ or $RxC \geq 500\Omega\text{-F}$ , whichever is smaller. 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## Automotive General Multilayer Ceramic Capacitors

### AMT Category (Automotive Grade Surface Mount MLCCs)

No.	Item	AEC-Q200 Test Condition	Requirements																			
14	<b>ESD</b> AEC-Q200-002	* Per AEC-Q200-002.	* No remarkable damage. * Cap.: Within the specified tolerance. * Q/D.F. value: COG: $Q \geq 1000$ for Cap. $\geq 30\text{pF}$ , $Q \geq 400+20C$ for Cap. $< 30\text{pF}$ . X7R: D.F. $\leq 100\%$ of initial requirement. * I.R.: $\geq 10G\Omega$ or $RxC \geq 500\Omega\text{-F}$ , whichever is smaller. Class II (X7R) <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th style="width: 80%;">Rated Voltage</th> <th style="width: 20%;">I.R.</th> </tr> </thead> <tbody> <tr> <td><math>\geq 100V</math>: All X7R; <math>1210 \geq 3.3\mu\text{F}</math></td> <td rowspan="7" style="text-align: center; vertical-align: middle;"><math>\geq 1G\Omega</math> or <math>RxC \geq 10\Omega\text{-F}</math>, whichever is smaller</td> </tr> <tr> <td>50V: 0402 <math>&gt; 0.01\mu\text{F}</math>, 0603 <math>\geq 1\mu\text{F}</math>, 0805 <math>\geq 1\mu\text{F}</math>, 1206 <math>\geq 4.7\mu\text{F}</math>, 1210 <math>\geq 4.7\mu\text{F}</math></td> </tr> <tr> <td>35V: 0603 <math>\geq 1\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 2.2\mu\text{F}</math>, 1210 <math>\geq 10\mu\text{F}</math></td> </tr> <tr> <td>25V: 0201 <math>&gt; 0.1\mu\text{F}</math>, 0402 <math>\geq 1\mu\text{F}</math>, 0603 <math>\geq 2.2\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 10\mu\text{F}</math>, 1210 <math>\geq 10\mu\text{F}</math></td> </tr> <tr> <td>16V: 0201 <math>\geq 0.1\mu\text{F}</math>, 0402 <math>\geq 0.22\mu\text{F}</math>, 0603 <math>\geq 1\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 10\mu\text{F}</math>, 1210 <math>\geq 47\mu\text{F}</math></td> </tr> <tr> <td>10V: 0201 <math>\geq 0.047\mu\text{F}</math>, 0402 <math>\geq 0.47\mu\text{F}</math>, 0603 <math>\geq 0.47\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 4.7\mu\text{F}</math>, 1210 <math>\geq 47\mu\text{F}</math></td> </tr> <tr> <td>6.3V; 4V; Size <math>\geq 1812</math></td> </tr> </tbody> </table>	Rated Voltage	I.R.	$\geq 100V$ : All X7R; $1210 \geq 3.3\mu\text{F}$	$\geq 1G\Omega$ or $RxC \geq 10\Omega\text{-F}$ , whichever is smaller	50V: 0402 $> 0.01\mu\text{F}$ , 0603 $\geq 1\mu\text{F}$ , 0805 $\geq 1\mu\text{F}$ , 1206 $\geq 4.7\mu\text{F}$ , 1210 $\geq 4.7\mu\text{F}$	35V: 0603 $\geq 1\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 2.2\mu\text{F}$ , 1210 $\geq 10\mu\text{F}$	25V: 0201 $> 0.1\mu\text{F}$ , 0402 $\geq 1\mu\text{F}$ , 0603 $\geq 2.2\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 10\mu\text{F}$ , 1210 $\geq 10\mu\text{F}$	16V: 0201 $\geq 0.1\mu\text{F}$ , 0402 $\geq 0.22\mu\text{F}$ , 0603 $\geq 1\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 10\mu\text{F}$ , 1210 $\geq 47\mu\text{F}$	10V: 0201 $\geq 0.047\mu\text{F}$ , 0402 $\geq 0.47\mu\text{F}$ , 0603 $\geq 0.47\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 4.7\mu\text{F}$ , 1210 $\geq 47\mu\text{F}$	6.3V; 4V; Size $\geq 1812$									
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15	<b>Solderability</b> J-STD-002, JESD22-B102E	* Condition A Un-mounted chips 4hrs / 155°C*dry then completely immersed for $5 \pm 0.5$ sec in solder bath at $245 \pm 5^\circ\text{C}$ . * Condition B Un-mounted chips steam 8 hrs then completely immersed for $10 \pm 1$ sec in solder bath at $220 +5/-0^\circ\text{C}$ . * Condition C Un-mounted chips steam 8 hrs then completely immersed for $10 \pm 1$ sec. in solder bath at $260 +0/-5^\circ\text{C}$ .	* All terminations shall exhibit a continuous solder coating free from defects from a minimum of 95% of the critical surface area of any individual termination.																			
16	<b>Board Flex</b> AEC-Q200-005	* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 2mm and then the pressure shall be maintained for $60 \pm 1$ sec. * Measurement to be made after keeping at room temp. for $24 \pm 2$ hrs.	* No remarkable damage. * Cap. change: COG within $\pm 5\%$ or $0.5\text{pF}$ , whichever is larger. X7R within $\pm 12.5\%$ . (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)																			
17	<b>Terminal Strength</b> AEC-Q200-006	* Pressurizing force: 2N (0402), 5N(0603), 10N(0805), 17.7N ( $\geq 1206$ ). * Test time: $60 \pm 1$ sec.	* No remarkable damage or removal of the terminations. * Capacitance within the specified tolerance. * Q/D.F. value: COG: $Q \geq 1000$ for Cap. $\geq 30\text{pF}$ , $Q \geq 400+20C$ for Cap. $< 30\text{pF}$ . X7R: D.F. $\leq 100\%$ of initial requirement.																			
18	<b>Beam Load Test</b> AEC-Q200-003	* Break strength test. * Beam speed: $2.5 \pm 0.25$ mm/sec.	* The chip endure following force: Chip length $\leq 2.5\text{mm}$ : Thickness $> 0.5\text{mm}$ (20N), $\leq 0.5\text{mm}$ (8N). Chip length $\geq 3.2\text{mm}$ : Thickness $\geq 1.25\text{mm}$ (54.5N), $< 1.25\text{mm}$ (15N).																			
19	<b>Thermal Shock</b> MIL-STD-202, Method 107	* Conduct 300 cycles according to the temperatures and time. <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th style="width: 15%;">Step</th> <th style="width: 45%;">Temp. (<math>^\circ\text{C}</math>)</th> <th style="width: 40%;">Time (min.)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;"><math>-55^\circ\text{C} +0/-3</math></td> <td style="text-align: center;"><math>15 \pm 3</math></td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;"><math>+125^\circ\text{C} +3/-0</math></td> <td style="text-align: center;"><math>15 \pm 3</math></td> </tr> </tbody> </table> * Max. transfer time: 20 sec. * Before initial measurement (X7R only): Perform $150 +0/-10^\circ\text{C}$ for 1 hr and then set for $24 \pm 2$ hrs at room temp. * Measurement to be made after keeping at room temp. for $24 \pm 2$ hrs.	Step	Temp. ( $^\circ\text{C}$ )	Time (min.)	1	$-55^\circ\text{C} +0/-3$	$15 \pm 3$	2	$+125^\circ\text{C} +3/-0$	$15 \pm 3$	* No remarkable damage. * Cap. change: COG within $\pm 2.5\%$ or $0.25\text{pF}$ , whichever is larger. X7R within $\pm 10.0\%$ . * Q/D.F. value: COG: $Q \geq 1000$ for Cap. $\geq 30\text{pF}$ , $Q \geq 400+20C$ for Cap. $< 30\text{pF}$ . X7R: D.F. $\leq 200\%$ of initial requirement. * I.R.: $\geq 10G\Omega$ or $RxC \geq 500\Omega\text{-F}$ , whichever is smaller. Class II (X7R) <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th style="width: 80%;">Rated Voltage</th> <th style="width: 20%;">I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R; <math>1210 \geq 3.3\mu\text{F}</math></td> <td rowspan="7" style="text-align: center; vertical-align: middle;"><math>\geq 10G\Omega</math> or <math>RxC \geq 100\Omega\text{-F}</math>, whichever is smaller</td> </tr> <tr> <td>50V: 0402 <math>&gt; 0.01\mu\text{F}</math>, 0603 <math>\geq 1\mu\text{F}</math>, 0805 <math>\geq 1\mu\text{F}</math>, 1206 <math>\geq 4.7\mu\text{F}</math>, 1210 <math>\geq 4.7\mu\text{F}</math></td> </tr> <tr> <td>35V: 0603 <math>\geq 1\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 2.2\mu\text{F}</math>, 1210 <math>\geq 10\mu\text{F}</math></td> </tr> <tr> <td>25V: 0201 <math>&gt; 0.1\mu\text{F}</math>, 0402 <math>\geq 1\mu\text{F}</math>, 0603 <math>\geq 2.2\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 10\mu\text{F}</math>, 1210 <math>\geq 10\mu\text{F}</math></td> </tr> <tr> <td>16V: 0201 <math>\geq 0.1\mu\text{F}</math>, 0402 <math>\geq 0.22\mu\text{F}</math>, 0603 <math>\geq 1\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 10\mu\text{F}</math>, 1210 <math>\geq 47\mu\text{F}</math></td> </tr> <tr> <td>10V: 0201 <math>\geq 0.047\mu\text{F}</math>, 0402 <math>\geq 0.47\mu\text{F}</math>, 0603 <math>\geq 0.47\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 4.7\mu\text{F}</math>, 1210 <math>\geq 47\mu\text{F}</math></td> </tr> <tr> <td>6.3V; 4V; Size <math>\geq 1812</math></td> </tr> </tbody> </table>	Rated Voltage	I.R.	100V: All X7R; $1210 \geq 3.3\mu\text{F}$	$\geq 10G\Omega$ or $RxC \geq 100\Omega\text{-F}$ , whichever is smaller	50V: 0402 $> 0.01\mu\text{F}$ , 0603 $\geq 1\mu\text{F}$ , 0805 $\geq 1\mu\text{F}$ , 1206 $\geq 4.7\mu\text{F}$ , 1210 $\geq 4.7\mu\text{F}$	35V: 0603 $\geq 1\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 2.2\mu\text{F}$ , 1210 $\geq 10\mu\text{F}$	25V: 0201 $> 0.1\mu\text{F}$ , 0402 $\geq 1\mu\text{F}$ , 0603 $\geq 2.2\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 10\mu\text{F}$ , 1210 $\geq 10\mu\text{F}$	16V: 0201 $\geq 0.1\mu\text{F}$ , 0402 $\geq 0.22\mu\text{F}$ , 0603 $\geq 1\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 10\mu\text{F}$ , 1210 $\geq 47\mu\text{F}$	10V: 0201 $\geq 0.047\mu\text{F}$ , 0402 $\geq 0.47\mu\text{F}$ , 0603 $\geq 0.47\mu\text{F}$ , 0805 $\geq 2.2\mu\text{F}$ , 1206 $\geq 4.7\mu\text{F}$ , 1210 $\geq 47\mu\text{F}$	6.3V; 4V; Size $\geq 1812$
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## Automotive General Multilayer Ceramic Capacitors

### AMT Category (Automotive Grade Surface Mount MLCCs)

No.	Item	AEC-Q200 Test Condition	Requirements																																																				
<b>20</b>	<b>Electrical Characterization</b>	* Capacitance. * Q/D.F. (Dissipation Factor). COG: Cap.≤1000pF: 1.0±0.2Vrms, 1MHz±10%. Cap.>1000pF: 1.0±0.2Vrms, 1KHz±10%. X7R: Apply 1.0±0.2Vrms, 1.0KHz±10%, at 25°C ambient temperature.	* Capacitance within the specified tolerance. * Q/D.F. value: COG: Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF. X7R: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <thead> <tr> <th>Rated</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">≥100V</td> <td rowspan="2">≤2.5%</td> <td>≤3%</td> <td>1206≥0.47μF</td> </tr> <tr> <td>≤5%</td> <td>0805&gt;0.1μF, 0603≥0.068μF, 1206&gt;1μF, 1210≥2.2μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤2.5%</td> <td>≤10%</td> <td>0805&gt;0.22μF, 1210≥3.3μF</td> </tr> <tr> <td>≤3%</td> <td>0201(50V), 0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF</td> </tr> <tr> <td>≤5%</td> <td>0201≥0.01μF, 1210≥4.7μF</td> </tr> <tr> <td rowspan="2">35V</td> <td rowspan="2">≤3.5%</td> <td>≤10%</td> <td>0402≥0.012μF, 0603&gt;0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>≤5%</td> <td>0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td rowspan="4">25V</td> <td rowspan="4">≤3.5%</td> <td>≤5%</td> <td>0201≥0.01μF, 0805≥1μF, 1210≥10μF</td> </tr> <tr> <td>≤7%</td> <td>0603≥0.33μF, 1206≥4.7μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.1μF, 0402≥0.056μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥6.8μF, 1210≥22μF</td> </tr> <tr> <td>≤12.5%</td> <td>0402≥0.47μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤3.5%</td> <td>≤5%</td> <td>0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.1μF(0201/X7R≥0.022μF), 0402≥0.22μF, 0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤5%</td> <td>≤10%</td> <td>0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF</td> </tr> <tr> <td>≤15%</td> <td>0201≥0.1μF, 0402≥1μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤10%</td> <td>≤15%</td> <td>0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF</td> </tr> <tr> <td>≤20%</td> <td>0402≥2.2μF</td> </tr> </tbody> </table>	Rated	D.F.≤	Exception of D.F.≤		≥100V	≤2.5%	≤3%	1206≥0.47μF	≤5%	0805>0.1μF, 0603≥0.068μF, 1206>1μF, 1210≥2.2μF	50V	≤2.5%	≤10%	0805>0.22μF, 1210≥3.3μF	≤3%	0201(50V), 0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF	≤5%	0201≥0.01μF, 1210≥4.7μF	35V	≤3.5%	≤10%	0402≥0.012μF, 0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF	≤5%	0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V	≤3.5%	≤5%	0201≥0.01μF, 0805≥1μF, 1210≥10μF	≤7%	0603≥0.33μF, 1206≥4.7μF	≤10%	0201≥0.1μF, 0402≥0.056μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥6.8μF, 1210≥22μF	≤12.5%	0402≥0.47μF	16V	≤3.5%	≤5%	0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF	≤10%	0201≥0.1μF(0201/X7R≥0.022μF), 0402≥0.22μF, 0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF	10V	≤5%	≤10%	0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF	≤15%	0201≥0.1μF, 0402≥1μF	6.3V	≤10%	≤15%	0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF	≤20%	0402≥2.2μF
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		* Insulation Resistance. To apply rated voltage for max. 120 sec.	* I.R.:≥10GΩ or RxC≥500Ω-F, whichever is smaller. Class II (X7R) <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <thead> <tr> <th>Rated Voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R;1210≥3.3μF</td> <td rowspan="7" style="text-align: center; vertical-align: middle;">≥10GΩ or RxC≥100Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402&gt;0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0201&gt;0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td>6.3V;4V:Size≥1812</td> </tr> </tbody> </table> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <thead> <tr> <th>Rated Voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: 1210≥3.3μF</td> <td rowspan="8" style="text-align: center; vertical-align: middle;">RxC≥50Ω-F</td> </tr> <tr> <td>50V: 0402&gt;0.1μF, 0603≥2.2μF, 0805≥10μF, 1206≥10μF</td> </tr> <tr> <td>35V: 0603≥1μF</td> </tr> <tr> <td>25V: 0201&gt;0.1μF, 0402≥2.2μF, 0603≥10μF, 0805≥10μF, 1206≥22μF</td> </tr> <tr> <td>16V: 0603≥10μF, 0402≥1μF, 0201≥0.22μF</td> </tr> <tr> <td>10V: 0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥47μF</td> </tr> <tr> <td>6.3V:0201≥0.1μF, 0402≥1μF, 0603≥4.7μF, 0805≥47μF,1206≥10μF</td> </tr> <tr> <td>4V: 0603≥22μF, 0805≥47μF,1206≥100μF</td> </tr> </tbody> </table>	Rated Voltage	I.R.	100V: All X7R;1210≥3.3μF	≥10GΩ or RxC≥100Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0201>0.1μF, 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF	6.3V;4V:Size≥1812	Rated Voltage	I.R.	100V: 1210≥3.3μF	RxC≥50Ω-F	50V: 0402>0.1μF, 0603≥2.2μF, 0805≥10μF, 1206≥10μF	35V: 0603≥1μF	25V: 0201>0.1μF, 0402≥2.2μF, 0603≥10μF, 0805≥10μF, 1206≥22μF	16V: 0603≥10μF, 0402≥1μF, 0201≥0.22μF	10V: 0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥47μF	6.3V:0201≥0.1μF, 0402≥1μF, 0603≥4.7μF, 0805≥47μF,1206≥10μF	4V: 0603≥22μF, 0805≥47μF,1206≥100μF																															
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## Automotive General Multilayer Ceramic Capacitors

### AMT Category (Automotive Grade Surface Mount MLCCs)

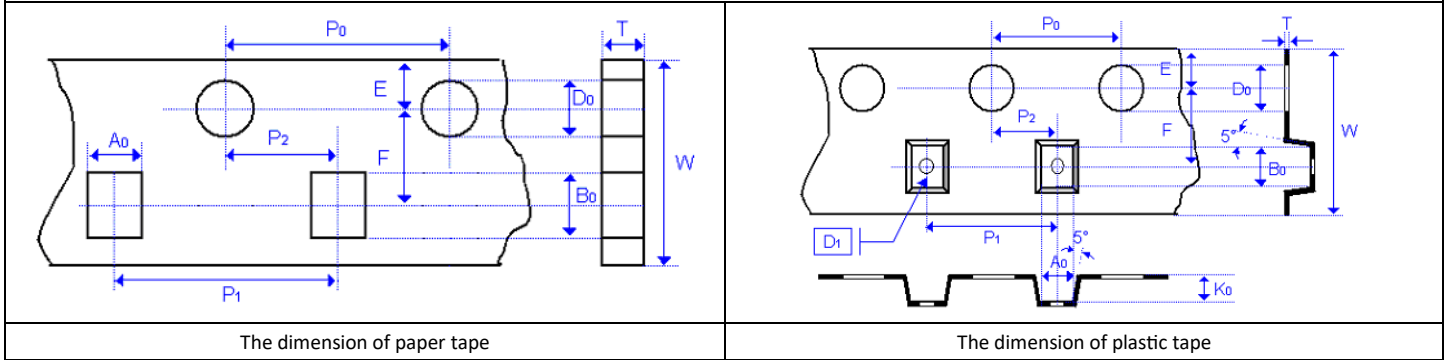
#### 9. Package Dimension and Quantity:

Size, Inch (mm)	Thickness (mm)	Paper tape		Plastic tape	
		7" reel	13" reel	7" reel	13" reel
0201 (0603)	0.30±0.03	15k	70k	-	-
	0.30±0.05	15k	-	-	-
	0.30±0.09	15k	-	-	-
0402 (1005)	0.50±0.05	10k	50k	-	-
	0.50 +0.02/-0.05	10k	50k	-	-
	0.50±0.20	10k	-	-	-
0603 (1608)	0.50±0.10	4k	-	-	-
	0.80±0.07	4k	15k	-	-
	0.80 +0.15/-0.10	4k	15k	-	-
0805 (2012)	0.50±0.10	4k	15k	-	-
	0.60±0.10	4k	15k	-	-
	0.80±0.10	4k	15k	-	-
	0.85±0.10	4k	15k	-	-
	1.25±0.10	-	-	3k	10k
	1.25±0.20	-	-	3k	10k
1206 (3216)	0.80±0.10	4k	15k	-	-
	0.85±0.10	4k	15k	-	-
	0.95±0.10	-	-	3k	10k
	1.15±0.15	-	-	3k	10k
	1.25±0.10	-	-	3k	10k
	1.60±0.20	-	-	2k	10k
	1.60 +0.30/-0.10	-	-	2k	9k
1210 (3225)	0.85±0.10	-	-	3k	10k
	0.95±0.10	-	-	3k	10k
	1.25±0.10	-	-	3k	10k
	1.60±0.20	-	-	2k	-
	2.00±0.20	-	-	1k	6k
	2.50±0.30	-	-	1k	6k
1808 (4520)	1.25±0.10	-	-	2k	10k
	1.60±0.20	-	-	2k	8k
	2.00±0.20	-	-	1k	6k
1812 (4532)	1.25±0.10	-	-	1k	5k
	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	3k
	2.80±0.30	-	-	0.5k	-
1825 (4563)	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
	2.80±0.30	-	-	0.5k	-
2220 (5750)	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
	2.80±0.30	-	-	0.5k	-
2225 (5763)	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
	2.80±0.30	-	-	0.5k	-

## Automotive General Multilayer Ceramic Capacitors

### AMT Category (Automotive Grade Surface Mount MLCCs)

#### 9.1 Tape Dimension



Size, Inch (mm)	0201 (0603)	0402 (1005)	0603 (1608)		0805 (2012)	
Chip Thickness	0.30±0.03	0.50±0.10	0.80±0.07	0.80 +0.15/-0.1	0.80±0.10	1.25±0.10 1.25±0.20
A <sub>0</sub>	0.39±0.07	0.70±0.20	1.00 +0.05/-0.1	1.02 +0.05/-0.1	1.50±0.10	<1.65
B <sub>0</sub>	0.69±0.07	1.20±0.20	1.80±0.10	1.80±0.10	2.30±0.10	<2.40
T	≤0.50	≤0.80	0.95±0.05	0.97±0.05	0.95±0.05	0.23±0.05
K <sub>0</sub>	-	-	-	-	-	<2.50
W	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10
P <sub>0</sub>	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
10xP <sub>0</sub>	40.00±0.10	40.00±0.10	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20
P <sub>1</sub>	2.00±0.05	2.00±0.05	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
P <sub>2</sub>	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05
D <sub>0</sub>	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.50 +0.10/-0
D <sub>1</sub>	-	-	-	-	-	1.00±0.10
E	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.10
F	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05
Unit :	mm	mm	mm	mm	mm	mm

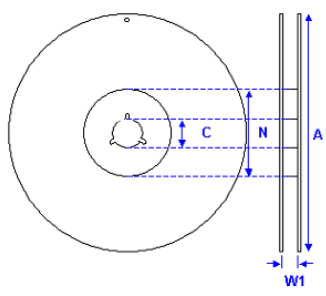
Size, Inch (mm)	1206 (3216)			1210 (3225)		1812 (4532)	
Chip Thickness	0.80±0.10	0.95±0.10 1.25±0.10	1.60±0.20 1.60+0.3/-0/1	0.95±0.10 1.25±0.10 1.60±0.20	2.50±0.30	1.25±0.10 1.60±0.20 2.00±0.20	2.50±0.30
A <sub>0</sub>	2.00±0.10	<2.00	<2.00	<3.05	<3.10	<3.90	<3.90
B <sub>0</sub>	3.50±0.10	<3.60	<3.70	<3.80	<4.00	<5.30	<5.30
T	0.95±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.25±0.05	0.25±0.05
K <sub>0</sub>	-	<2.50	<2.50	<2.50	<3.50	<2.50	<3.00
W	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	12.00±0.20	12.00±0.20
P <sub>0</sub>	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
10xP <sub>0</sub>	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20
P <sub>1</sub>	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	8.00±0.10	8.00±0.10
P <sub>2</sub>	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05
D <sub>0</sub>	1.55±0.05	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0
D <sub>1</sub>	-	1.00±0.10	1.00±0.10	1.00±0.10	1.00±0.10	1.50±0.10	1.50±0.10
E	1.75±0.10	1.75±0.10	1.75±0.10	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	3.50±0.05	5.50±0.05	5.50±0.05
Unit :	mm	mm	mm	mm	mm	mm	mm

## Automotive General Multilayer Ceramic Capacitors

### AMT Category (Automotive Grade Surface Mount MLCCs)

#### 9.1 Reel Dimensions:

Size	0201, 0402, 0603, 0805, 1206, 1210	
Reel size	7"	13"
C	13.0 +0.5/-0.2	13.0 +0.7/-0.3
W <sub>1</sub>	8.4 +1.5	8.4 +1.5
W	14.4max	14.4max
A	178.0 ±0.10	330.0 ±1.0
N	60.0 ±1.0/-0	100 ±1.0



The dimension of reel

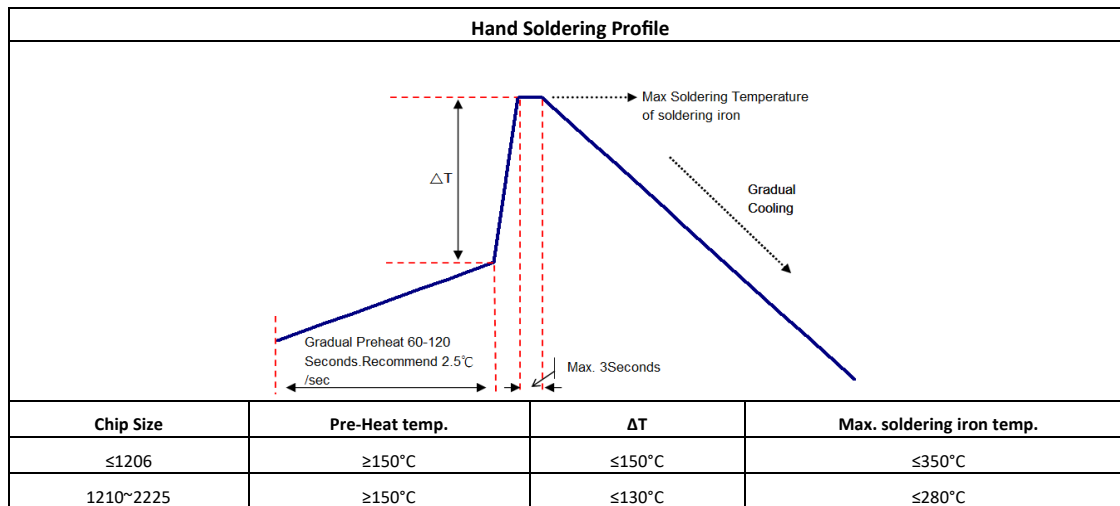
#### 10. Recommended Soldering Conditions:

Use middy activated rosin RA and RMA fluxes do not use activated flux. The amount of solder in each solder joint should be controlled to prevent the damage of chip capacitors caused by the stress between solder, chips, and substrate.

##### 10.1 Preheat:

In order to minimize the risk of thermal shock during soldering, a carefully controlled preheat is required. The rate of preheat should not exceed 3°C per second.

##### 10.2 Hand soldering:

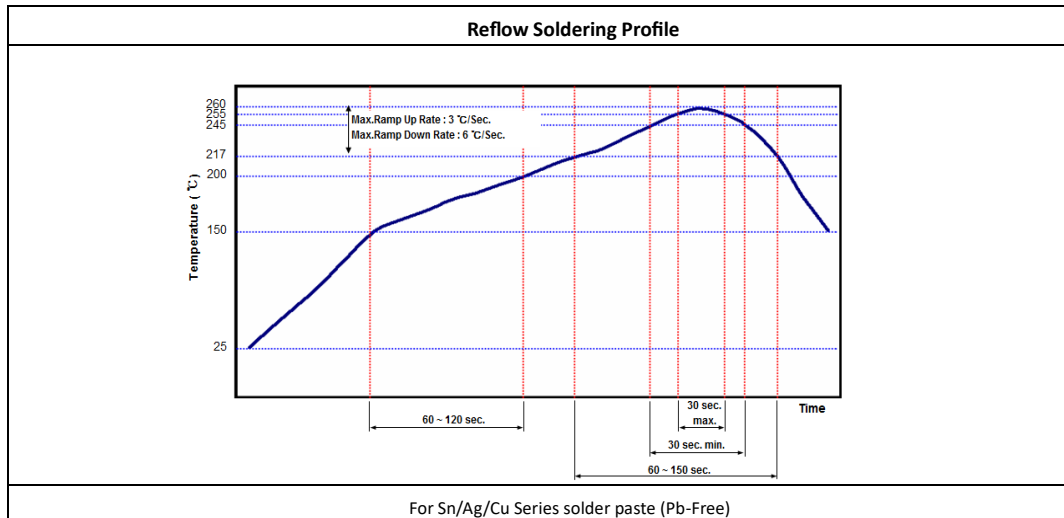


- \* Soldering iron tip diameter ≤1.0 mm and wattage max. 20W.
- \* The Capacitors shall be pre-heated and that the temperature gradient between the devices and the tip of the soldering iron.
- \* The required amount of solder shall be melted on the soldering tip.
- \* The tip of iron should not contact the ceramic body directly.
- \* The Capacitors shall be cooled gradually at room temperature after soldering.
- \* Forced air cooling is not allowed.

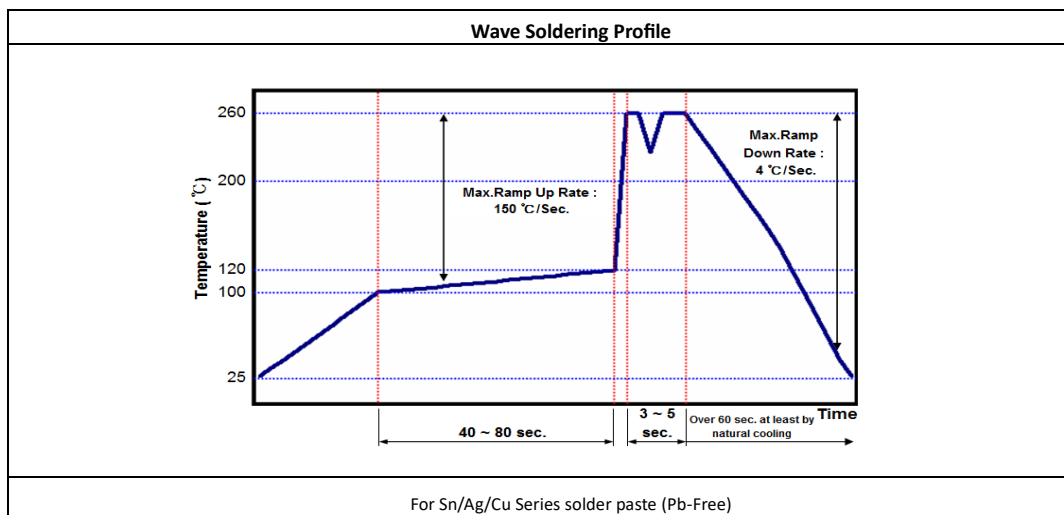
## Automotive General Multilayer Ceramic Capacitors

### AMT Category (Automotive Grade Surface Mount MLCCs)

#### 10.3 Reflow soldering:



#### 10.4 Wave soldering:



#### 10.5 Soldering conditions:

##### 10.5.1 Class I:

Size, Inch (mm)	Temperature Characteristics	Capacitance	Condition	
			Wave	Reflow
≤0402 (1005)	Class I	All	X	O
0603 (1608)	Class I	All	O	O
0805 (2012)	Class I	All	O	O
1206 (3216)	Class I	All	O	O
		Thickness >0.95mm	X	O
≥1210 (3225)	Class I	All	X	O
Coating Products	All	All	X	O

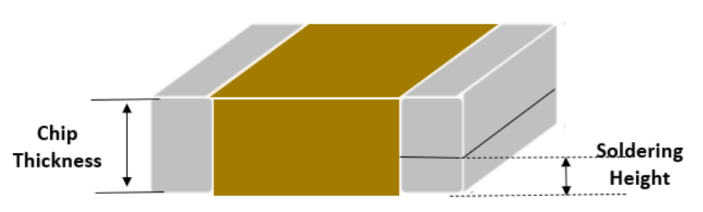


## Automotive General Multilayer Ceramic Capacitors AMT Category (Automotive Grade Surface Mount MLCCs)

### 10.5.2 Class II:

Size, Inch (mm)	Temperature Characteristics	Capacitance	Condition	
			Wave	Reflow
≤0402 (1005)	Class II	All	X	O
0603 (1608)	Class II	Cap. <2.2μF	O	O
		Cap. ≥2.2μF	X	O
0805 (2012)	Class II	Thickness ≤ 0.95mm	O	O
		Thickness > 0.95mm	X	O
1206 (3216)	Class II	Thickness ≤ 0.95mm	O	O
		Thickness > 0.95mm	X	O
≥1210 (3225)	Class II	All	X	O
Coating Products	All	All	X	O

### 10.6 Soldering height:

<p>The solder climbing minimum height is suggesting to 25% of chip thickness or 500um whichever is less. (Reference from IPC-610E)</p>	
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### 10.7 Recommended cooling condition:

After soldering, cool the chips and the substrate gradually to room temperature. Natural cooling in air is recommended to minimize stress in the solder joint.

### 10.8 Cleaning after soldering:

All flux residues must be removed by using suitable electronic-grade vapor-cleaning solvents to eliminate contamination that could cause electrolytic surface corrosion. Good results can be obtained by using ultrasonic cleaning of the solvent. The choice of the proper system is depends upon many factors such as component mix, flux, and solder paste and assembly method. The ability of the cleaning system to remove flux residues and contamination from under the chips is very important.

## 11. Handling:

Chip capacitors are dense, hard, brittle, and abrasive materials. They are liable to suffer mechanical damage, in the form of cracks or chips. Chip Capacitors should be handled with care to avoid contamination or damage. To use vacuum or plastic tweezers to pick up or plastic tweezers is recommended for manual placement. Tape and reeled packages are suitable for automatic pick and placement machine.

## 12. Recommended Storage Condition:

To prevent the damage of solderability of terminations, the following storage conditions are recommended :

Indoors under 5 ~ 40°C and 20% ~ 70% RH.

No harmful gases containing sulfuric acid, ammonia, hydrogen sulfide or chlorine.

Packaging should not be opened until the capacitors are required for use. If opened, the pack should be re-sealed as soon as is practicable. Taped product should be stored out of direct sunlight, which might promote deterioration in tape or adhesion performance. The product is recommended to be used within 12 months after shipment and checked the solderability before use.

## 13. Notice of MT Series:

The standard AEC-Q200 series capacitors are mainly used on general automotive equipment without safety considerations. Please select SAFETY concern type or contact our company in advanced if you intend to use capacitor for designing the equipment which may damage itself and the safety of third party. If necessary, please consider to add the protect circuit in devising process and obtaining fully safety evaluation. The contents of the acknowledgments only used for our parent company, marketing subsidiaries and official marketing agents who purchase our products. Not applicable for the other nonofficial channels.

## Automotive General Multilayer Ceramic Capacitors

### AMT Category (Automotive Grade Surface Mount MLCCs)

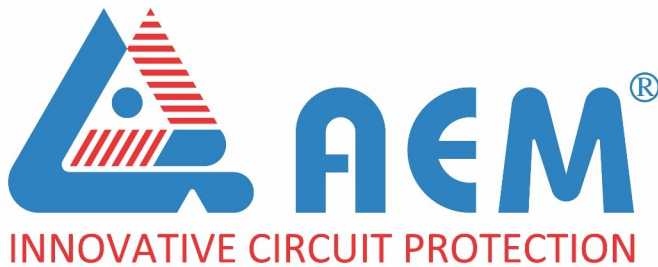
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Revision of Jul. 2023

**Automotive General Multilayer Ceramic Capacitors**  
**AMT Category (Automotive Grade Surface Mount MLCCs)**



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