

Automotive Soft Termination Multilayer Ceramic Chip Capacitors

AMTS Category (Automotive Grade Surface Mount MLCCs with Soft Termination)

1. Introduction:

AMTS automotive grade capacitors are designed, manufactured, and screened to ensure the high level of product quality by using X7R / X7S /COG (NPO) dielectrics and have high electrical precision, stability and reliability. They feature a special termination material (Ultra Buffer) between ceramic body and Ni-barrier that can absorb mechanical stress to prevent cracks in application. AMTS series MLCCs are in tighten quality control to meet automotive application requirements and is AEC-Q200 qualified.

2. Features:

- A wide selection of sizes is available (from 0603 to 2220)
- High capacitance in given case size
- Capacitor with lead-free termination (pure Tin)
- The AMTS Soft termination series meet AEC-Q200 requirement
- RoHS Compliant

3. Applications:

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

4. Production Identification:

AMTS	0805	X	R47	J	251	P	I	E
Production 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

Table1 Production Identification	
Code	Description
AMTS	Automotive Grade MLCC with Soft Termination)

Table2 Size, Inch (mm)		
Description	Description	Description
0603 (1608)	1210 (3225)	2220 (5750)
0805 (2012)	1808 (4520)	
1206 (3216)	1812 (4532)	

Table3 Dielectric Material Characteristics			
Code	Description	Code	Description
X	X7R	A	X7S
N	COG (NPO)		

Table4 Capacitance Rule Code			
Code	Chip Capacitance	Code	Chip Capacitance
R47	0.47pF	102	102=10x10 ² =1000pF
OR5	0.5pF	104	104=10x10 ⁴ =100nF
100	100=10x10 ⁰ =10pF	106	106=10x10 ⁶ =10μF

Table5 Capacitance Tolerance					
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		

Table6 Rated Voltage					
Code	Description	Code	Description	Code	Description
100	10 Vdc	101	100 Vdc	102	1000 Vdc
160	16 Vdc	251	250 Vdc	202	2000 Vdc
250	25 Vdc	501	500 Vdc	302	3000 Vdc

Table7 Packaging Type			
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

Table8 Thickness Description (mm)					
Code	Description	Code	Description	Code	Description
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

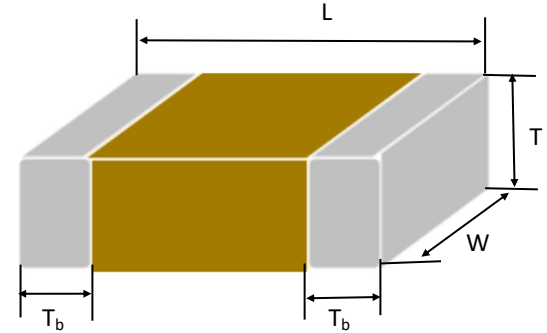
Table9 Special Control Code	
Code	Description
E	Soft Termination

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5. Shape and Dimensions:

Size, Inch (mm)	Length L (mm)	Width W (mm)	Code / T (mm)	Termination bandwidth T _b (mm)
0603 (1608)	1.60±0.20	0.80±0.10	S	0.40±0.15
	1.60±0.30	0.80±0.30	B	
0805 (2012)	2.10±0.20	1.25±0.20	See Thickness Description	0.50±0.20
1206 (3216)	3.30±0.30	1.60±0.20 +0.3/-0.1#		0.60±0.20
1210 (3225)	3.30±0.40	2.50±0.30		0.75±0.35
1812 (4532)	4.60±0.50	3.20±0.30		0.75±0.35
2220 (5750)	5.70±0.50	5.00±0.40		0.85±0.35
				0.85±0.35



*" for ≥ 1KV products. "# for P thickness products.

6. General Electrical Specification:

Dielectric Material	C0G (NPO)	X7R/X7S						
Chip Size	1206, 1210	0603, 0805, 1206, 1210, 1812, 2220						
Rated Voltage (WVDC)	630V, 1000V	10V, 16V, 25V, 50V, 100V, 250V, 630V						
Capacitance Range*	1.5pF ~ 22nF	220pF ~ 4.7μF						
Capacitance Tolerance	Reference to Table 5							
Tan δ	<table border="1"> <thead> <tr> <th>Capacitance Range</th> <th>Q Specification</th> </tr> </thead> <tbody> <tr> <td>Cap.<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	Follow No.17 of 8. reliability test conditions and requirements
	Capacitance Range	Q Specification						
	Cap.<30pF	Q≥400+20C						
Cap.≥30pF	Q≥1000							
Measured at the condition of 30~70% related humidity								
For 25°C at ambient temperature								
Capacitance & Tan δ Test Condition	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.>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%							
Insulation Resistance at Ur		≥10GΩ or RxC≥500Ω-F, whichever is smaller						
Operating Temperature	-55°C to +125°C							
Capacitance Characteristic	±30ppm/°C	X7R : ±15% X7S : ±22%						
Insulation Resistance at Ur	≥10GΩ or RxC≥500Ω-F, whichever is smaller							
Termination	Cu/Ag polymer/Ni/Sn (lead-free termination)							

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7. Relationship Between Capacitance and Thickness at Rated Voltage

7.1 X7R (Capacitance vs. thickness, refer to table 8 for the thickness code):

Size, Inch (mm)	0603 (1608)					0805 (2012)			
	10/16/25	50	10	16	25	50	100	250	630
100pF (101)									
120pF (121)									
150pF (151)									
180pF (181)									
220pF (221)	S	S	X/C	X/C	X/C	X/C	X	X	X
270pF (271)	S	S	X/C	X/C	X/C	X/C	X	X	X
330pF (331)	S	S	X/C	X/C	X/C	X/C	X	X	X
390pF (391)	S	S	X/C	X/C	X/C	X/C	X	X	X
470pF (471)	S	S	X/C	X/C	X/C	X/C	X	X	X
560pF (561)	S	S	X/C	X/C	X/C	X/C	X	X	X
680pF (681)	S	S	X/C	X/C	X/C	X/C	X	X	X
820pF (821)	S	S	X/C	X/C	X/C	X/C	X	X	X
1,000pF (102)	S	S	X/C	X/C	X/C	X/C	X	X	X
1,200pF (122)	S	S	X/C	X/C	X/C	X/C	X	X	
1,500pF (152)	S	S	X/C	X/C	X/C	X/C	X	X	
1,800pF (182)	S	S	X/C	X/C	X/C	X/C	X	X	
2,200pF (222)	S	S	X/C	X/C	X/C	X/C	X	X	
2,700pF (272)	S	S	X/C	X/C	X/C	X/C	X	X	
3,300pF (332)	S	S	X/C	X/C	X/C	X/C	X	X	
3,900pF (392)	S	S	X/C	X/C	X/C	X/C	X	X	
4,700pF (472)	S	S	X/C	X/C	X/C	X/C	X	X	
5,600pF (562)	S	S	X/C	X/C	X/C	X/C	X	M	
6,800pF (682)	S	S	X/C	X/C	X/C	X/C	X	C	
8,200pF (822)	S	S	X/C	X/C	X/C	X/C	X	C	
0.010μF (103)	S	S	X/C	X/C	X/C	X/C	X	C	
0.012μF (123)	S	S	X/C	X/C	X/C	X/C	X	C	
0.015μF (153)	S	S	X/C	X/C	X/C	X/C	X	C	
0.018μF (183)	S	S	X/C	X/C	X/C	X/C	X	C	
0.022μF (223)	S	S	X/C	X/C	X/C	X/C	X	C	
0.027μF (273)	S	S	X/C	X/C	M/C	M/C			
0.033μF (333)	S	B	X/C	X/C	M/C	M/C			
0.039μF (393)	S	B	X/C	X/C	M/C	M/C			
0.047μF (473)	S	B	X/C	X/C	M/C	M/C			
0.056μF (563)	S	B	X/C	X/C	M/C	M/C			
0.068μF (683)	S	B	X/C	X/C	M/C	M/C			
0.082μF (823)	S	B	X/C	X/C	M/C	M/C			
0.10μF (104)	S	B	X/C	X/C	C	C			
0.12μF (124)	B		X	X	C	C			
0.15μF (154)	B		X	X	C	C			
0.18μF (184)	B		X	X	C	C			
0.22μF (224)	B		X	X	C	C			
0.27μF (274)			C	C	C	C			
0.33μF (334)			C	C	C	C			
0.39μF (394)			C	C	C	C			
0.47μF (474)			C	C	C	C			
0.56μF (564)			C	C					
0.68μF (684)			C	C					
0.82μF (824)									
1.0μF (105)									
1.2μF (125)									
1.5μF (155)									
1.8μF (185)									
2.2μF (225)									
2.7μF (275)									
3.3μF (335)									
3.9μF (395)									
4.7μF (475)									

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

Size, Inch (mm)	1206 (3216)									
	10	16	25	50	100	250	500	630	1000	2000
Rated Voltage (V)										
100pF (101)										
120pF (121)										
150pF (151)										
180pF (181)										
220pF (221)	X	X	X	X	X	X	X	X	X	
270pF (271)	X	X	X	X	X	X	X	X	X	
330pF (331)	X	X	X	X	X	X	X	X	X	
390pF (391)	X	X	X	X	X	X	X	X	X	
470pF (471)	X	X	X	X	X	X	X	X	X	
560pF (561)	X	X	X	X	X	X	X	X	X	
680pF (681)	X	X	X	X	X	X	X	X	M	C*
820pF (821)	X	X	X	X	X	X	X	X	M	C*
1,000pF (102)	X	X	X	X	X	X	X	X	C	C*
1,200pF (122)	X	X	X	X	X	X	X	X	E	
1,500pF (152)	X	X	X	X	X	X	X	X	E	
1,800pF (182)	X	X	X	X	X	X	X	X	E	
2,200pF (222)	X	X	X	X	X	X	X	X	E	
2,700pF (272)	X	X	X	X	X	X	X	X	E	
3,300pF (332)	X	X	X	X	X	X	X	X	E	
3,900pF (392)	X	X	X	X	X	X	X	X	E	
4,700pF (472)	X	X	X	X	X	X	X	X	E	
5,600pF (562)	X	X	X	X	X	X	M	X		
6,800pF (682)	X	X	X	X	X	X	M			
8,200pF (822)	X	X	X	X	X	X	M			
0.010μF (103)	X	X	X	X	X	M	M			
0.012μF (123)	X	X	X	X	X	C	C			
0.015μF (153)	X	X	X	X	X	C	E			
0.018μF (183)	X	X	X	X	X	C	E			
0.022μF (223)	X	X	X	X	X	E	E			
0.027μF (273)	X	X	X	X	X	E				
0.033μF (333)	X	X	X	X	X	E				
0.039μF (393)	X	X	X	X	X	E				
0.047μF (473)	X	X	X	X	X	E				
0.056μF (563)	X	X	X	X	M					
0.068μF (683)	X	X	X	X	C					
0.082μF (823)	X	X	X	X	C					
0.10μF (104)	X	X	X	X	E					
0.12μF (124)	X	X	X	X						
0.15μF (154)	X	X	X	X						
0.18μF (184)	X	X	M	M						
0.22μF (224)	X	X	M	M						
0.27μF (274)	X	X	C	C						
0.33μF (334)	X	X	C	C						
0.39μF (394)	C	C	E	E						
0.47μF (474)	C	C	E	E						
0.56μF (564)	C	C	P	P						
0.68μF (684)	C	C	P	P						
0.82μF (824)	E	E	P	P						
1.0μF (105)	P	P	P	P						
1.2μF (125)	P	P								
1.5μF (155)	P	P								
1.8μF (185)	P	P								
2.2μF (225)	P	P								
2.7μF (275)										
3.3μF (335)										
3.9μF (395)										
4.7μF (475)										

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

Size, Inch (mm)	1210 (3225)							
	10	16	25	50	100	250	630	1000
Rated Voltage (V)								
100pF (101)								
120pF (121)								
150pF (151)								
180pF (181)								
220pF (221)	M	M	M	M	M	M	M	M
270pF (271)	M	M	M	M	M	M	M	M
330pF (331)	M	M	M	M	M	M	M	M
390pF (391)	M	M	M	M	M	M	M	M
470pF (471)	M	M	M	M	M	M	M	M
560pF (561)	M	M	M	M	M	M	M	M
680pF (681)	M	M	M	M	M	M	M	M
820pF (821)	M	M	M	M	M	M	M	M
1,000pF (102)	M	M	M	M	M	M	M	C
1,200pF (122)	M	M	M	M	M	M	M	E
1,500pF (152)	M	M	M	M	M	M	M	E
1,800pF (182)	M	M	M	M	M	M	M	E
2,200pF (222)	M	M	M	M	M	M	M	F
2,700pF (272)	M	M	M	M	M	M	M	F
3,300pF (332)	M	M	M	M	M	M	M	F
3,900pF (392)	M	M	M	M	M	M	M	G
4,700pF (472)	M	M	M	M	M	M	M	G
5,600pF (562)	M	M	M	M	M	M	C	G
6,800pF (682)	M	M	M	M	M	M	C	G
8,200pF (822)	M	M	M	M	M	M	G	
0.010μF (103)	M	M	M	M	M	M	G	
0.012μF (123)	M	M	M	M	M	M	G	
0.015μF (153)	M	M	M	M	M	M	G	
0.018μF (183)	M	M	M	M	M	C	E	
0.022μF (223)	M	M	M	M	M	C	E	
0.027μF (273)	M	M	M	M	M	C	E	
0.033μF (333)	M	M	M	M	M	E	E	
0.039μF (393)	M	M	M	M	M	E	F	
0.047μF (473)	M	M	M	M	M	E	G	
0.056μF (563)	M	M	M	M	M	E		
0.068μF (683)	M	M	M	M	M	F		
0.082μF (823)	M	M	M	M	M	F		
0.10μF (104)	M	M	M	M	M	F		
0.12μF (124)	M	M	C	C	E			
0.15μF (154)	M	M	C	C	E			
0.18μF (184)	M	M	E	E	E			
0.22μF (224)	M	M	E	E	E			
0.27μF (274)	M	M	M	M	F			
0.33μF (334)	M	M	M	M	F			
0.39μF (394)	M	M	F	F	G			
0.47μF (474)	M	M	F	F	G			
0.56μF (564)	M	M	F	F	G			
0.68μF (684)	M	M	F	F	G			
0.82μF (824)	C	C	F	F	G			
1.0μF (105)	C	C	F	F	G			
1.2μF (125)	F	F	F	F	G			
1.5μF (155)	F	F	F	F	G			
1.8μF (185)	G	G	G	G	G			
2.2μF (225)	G	G	G	G	G			
2.7μF (275)	G	G	G	G	G			
3.3μF (335)	G	G	G	G	G			
3.9μF (395)	G	G	G	G	G			
4.7μF (475)	G	G	G	G	G			
5.6μF (565)	G	G	G	G				
6.8μF (685)	G	G	G	G				
8.2μF (825)	G	G	G	G				
10μF (106)	G	G	G	G				

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

Size, Inch (mm)	1812 (4532)									
	10	16	25	50	100	250	630	1000	2000	3000
100pF (101)										
120pF (121)										
150pF (151)										
180pF (181)										
220pF (221)										
270pF (271)	C	C	C	C	C	C	C	C	C	F*
330pF (331)	C	C	C	C	C	C	C	C	C	F*
390pF (391)	C	C	C	C	C	C	C	C	C	F*
470pF (471)	C	C	C	C	C	C	C	C	C	F*
560pF (561)	C	C	C	C	C	C	C	C	C	F*
680pF (681)	C	C	C	C	C	C	C	C	C	F*
820pF (821)	C	C	C	C	C	C	C	C	C	F*
1,000pF (102)	C	C	C	C	C	C	C	C	E	F*
1,200pF (122)	C	C	C	C	C	C	C	C	F	G*
1,500pF (152)	C	C	C	C	C	C	C	C	F	G*
1,800pF (182)	C	C	C	C	C	C	C	C	G*	G*
2,200pF (222)	C	C	C	C	C	C	C	C	G*	
2,700pF (272)	C	C	C	C	C	C	C	C	G*	
3,300pF (332)	C	C	C	C	C	C	C	E	G*	
3,900pF (392)	C	C	C	C	C	C	C	F	G*	
4,700pF (472)	C	C	C	C	C	C	C	F		
5,600pF (562)	C	C	C	C	C	C	C	G		
6,800pF (682)	C	C	C	C	C	C	C	G		
8,200pF (822)	C	C	C	C	C	C	C	G		
0.010μF (103)	C	C	C	C	C	C	C	G		
0.012μF (123)	C	C	C	C	C	C	C			
0.015μF (153)	C	C	C	C	C	C	C			
0.018μF (183)	C	C	C	C	C	C	E			
0.022μF (223)	C	C	C	C	C	C	E			
0.027μF (273)	C	C	C	C	C	C	F			
0.033μF (333)	C	C	C	C	C	C	F			
0.039μF (393)	C	C	C	C	C	C	G			
0.047μF (473)	C	C	C	C	C	C	G			
0.056μF (563)	C	C	C	C	C	E	G			
0.068μF (683)	C	C	C	C	C	E	G			
0.082μF (823)	C	C	C	C	C	E	G			
0.10μF (104)	C	C	C	C	C	E	G			
0.12μF (124)	C	C	C	C	C	F				
0.15μF (154)	C	C	C	C	C	F				
0.18μF (184)	C	C	C	C	C	G				
0.22μF (224)	C	C	C	C	E	G				
0.27μF (274)	C	C	C	C	E	G				
0.33μF (334)	C	C	C	C	F	G				
0.39μF (394)	C	C	C	C	F	G				
0.47μF (474)	C	C	C	C	G	G				
0.56μF (564)	C	C	C	C	G					
0.68μF (684)	C	C	C	C	G					
0.82μF (824)	C	C	C	C	G					
1.0μF (105)	C	C	C	C	G					
1.2μF (125)	C	C	C	C						
1.5μF (155)	C	C	C	C						
1.8μF (185)	E	E	E	E						
2.2μF (225)	E	E	E	E						
2.7μF (275)	F	F	F	F						
3.3μF (335)	F	F	F	F						
3.9μF (395)	F	F	F	F						
4.7μF (475)	F	F	F	F						
5.6μF (565)	G	G	G	G						
6.8μF (685)	G	G								
8.2μF (825)	G	G								
10.0μF (106)	G	G								

Automotive Soft Termination Multilayer Ceramic Chip Capacitors

AMTS Category (Automotive Grade Surface Mount MLCCs with Soft Termination)

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

Size, Inch (mm)	2220 (5750)									
	10	16	25	50	100	250	630	1000	2000	3000
100pF (101)										
120pF (121)										
150pF (151)										
180pF (181)										
220pF (221)										
270pF (271)										F*
330pF (331)										F*
390pF (391)										F*
470pF (471)										F*
560pF (561)										F*
680pF (681)										F*
820pF (821)										F*
1,000pF (102)	F	F	F	F	F	F	F	F	F	F*
1,200pF (122)	F	F	F	F	F	F	F	F	F	G*
1,500pF (152)	F	F	F	F	F	F	F	F	F	G*
1,800pF (182)	F	F	F	F	F	F	F	F	F*	G*
2,200pF (222)	F	F	F	F	F	F	F	F	F*	
2,700pF (272)	F	F	F	F	F	F	F	F	F*	
3,300pF (332)	F	F	F	F	F	F	F	F	F*	
3,900pF (392)	F	F	F	F	F	F	F	F	F*	
4,700pF (472)	F	F	F	F	F	F	F	F	F*	
5,600pF (562)	F	F	F	F	F	F	F	F	F*	
6,800pF (682)	F	F	F	F	F	F	F	F	G*	
8,200pF (822)	F	F	F	F	F	F	F	G	G*	
0.010μF (103)	F	F	F	F	F	F	F	G	G*	
0.012μF (123)	F	F	F	F	F	F	F	G	H*	
0.015μF (153)	F	F	F	F	F	F	F	G	H*	
0.018μF (183)	F	F	F	F	F	F	F	H	H*	
0.022μF (223)	F	F	F	F	F	F	F	H		
0.027μF (273)	F	F	F	F	F	F	F	H		
0.033μF (333)	F	F	F	F	F	F	F	H		
0.039μF (393)	F	F	F	F	F	F	F	H		
0.047μF (473)	F	F	F	F	F	F	F	H		
0.056μF (563)	F	F	F	F	F	F	F	H		
0.068μF (683)	F	F	F	F	F	F	F			
0.082μF (823)	F	F	F	F	F	F	G			
0.10μF (104)	F	F	F	F	F	F	G			
0.12μF (124)	F	F	F	F	F	F	H			
0.15μF (154)	F	F	F	F	F	F	H			
0.18μF (184)	F	F	F	F	F	F	H			
0.22μF (224)	F	F	F	F	F	F				
0.27μF (274)	F	F	F	F	F	F				
0.33μF (334)	F	F	F	F	F	F				
0.39μF (394)	F	F	F	F	F	F				
0.47μF (474)	F	F	F	F	F	F				
0.56μF (564)	F	F	F	F	F	F				
0.68μF (684)	F	F	F	F	F	F				
0.82μF (824)	F	F	F	F	F	F				
1.0μF (105)	F	F	F	F	F					
1.2μF (125)	F	F	F	F	G					
1.5μF (155)	F	F	F	F	G					
1.8μF (185)	F	F	F	F	G					
2.2μF (225)	F	F	F	F	G					
2.7μF (275)	F	F	F	F						
3.3μF (335)	F	F	F	F						
3.9μF (395)	F	F	F	F						
4.7μF (475)	F	F	F	F						
5.6μF (565)	F	F	F	F						
6.8μF (685)	F	F	F	F						
8.2μF (825)	G	G	G	G						
10.0μF (106)	G	G	G	G						
12.0μF (126)	H	H								
15.0μF (156)	H	H								
18.0μF (186)	H	H								
22.0μF (226)	H	H								

Automotive Soft Termination Multilayer Ceramic Chip Capacitors

AMTS Category (Automotive Grade Surface Mount MLCCs with Soft Termination)

7.2 COG (NPO) (Capacitance vs. thickness, refer to table 8 for the thickness)

Cap (pF)	Size, Inch (mm)	1206 (3216)	1210 (3225)	
	Chip Code	630V	630V	1000V
0.1	OR1			
0.2	OR2			
0.3	OR3			
0.4	OR4			
0.5	OR5			
1.0	1R0			
1.2	1R2			
1.5	1R5	X		
1.8	1R8	X		
2.2	2R2	X		
2.7	2R7	X		
3.3	3R3	X		
3.9	3R9	X		
4.7	4R7	X		
5.6	5R6	X		
6.8	6R8	X		
8.2	8R2	X		
10	100	X	M	M
12	120	X	M	M
15	150	X	M	M
18	180	X	M	M
22	220	X	M	M
27	270	X	M	M
33	330	X	M	M
39	390	X	M	M
47	470	X	M	M
56	560	X	M	M
68	680	X	M	M
82	820	X	M	M
100	101	X	M	M
120	121	X	M	M
150	151	X	M	M
180	181	X	M	M
220	221	X	M	M
270	271	X	M	M
330	331	X	M	M
390	391	X	M	M
470	471	X	M	M
560	561	X	M	C
680	681	X	M	C
820	821	X	M	C
1,000	102	X	M	E/F
1,200	122		M	E/F
1,500	152		M	F
1,800	182		M	F
2,200	222		M	F
2,700	272		M	G
3,300	332		M	G
3,900	392		C	G
4,700	472		C	G
5,600	562		C	G
6,800	682		E	G
8,200	822		E	G
10,000	103		E	G
12,000	123			G
15,000	153			G
18,000	183			G
22,000	223			G
27,000	273			
33,000	333			
39,000	393			
47,000	473			
56,000	563			
68,000	683			
82,000	823			
100,000	104			

Automotive Soft Termination Multilayer Ceramic Chip Capacitors

AMTS Category (Automotive Grade Surface Mount MLCCs with Soft Termination)

7.3 X7S (Capacitance vs. thickness, refer to table 8 for the thickness code):

Dielectric Material	X7S			
	0805 (2012)		1206 (3216)	
Size, Inch (mm)				
Rated Voltage (V)	10	16	10	16
0.10μF (104)				
0.12μF (124)				
0.15μF (154)				
0.18μF (184)				
0.22μF (224)				
0.27μF (274)				
0.33μF (334)				
0.39μF (394)				
0.47μF (474)				
0.56μF (564)				
0.68μF (684)				
0.82μF (824)	I	I		
1.0μF (105)	I	I		
1.2μF (125)				
1.5μF (155)				
1.8μF (185)				
2.2μF (225)			P	P
2.7μF (275)				
3.3μF (335)				
3.9μF (395)				
4.7μF (475)				

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	Solderability J-STD-002, JESD22-B102E	* Condition A Un-mounted chips 4hrs / 155°C*dry then completely immersed for 5±0.5 sec in solder bath at 245±5°C. * Condition B Un-mounted chips steam 8 hrs then completely immersed for 10±1sec in solder bath at 220 +5/-0°C. * Condition C Un-mounted chips steam 8 hrs then completely immersed for 10±1 sec. in solder bath at 260 +0/-5°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.
3	Board Flex 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 3mm and then the pressure shall be maintained for 60±1 sec. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Capacitance within the specified tolerance. * D.F.: ≤100% of initial requirement. * I.R.: ≥100% of initial requirement. (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)
4	Terminal Strength AEC-Q200-006	* Pressurizing force: 2N (0402), 5N (0603), 10N (0805), 17.7N(≥1206). * Test time: 60±1 sec.	* No remarkable damage or removal of the terminations. * Capacitance within the specified tolerance. * Q/D.F. value : To meet the initial requirement. * I.R. : To meet the initial requirement.
5	Beam Load Test AEC-Q200-003	* Break strength test. * Beam speed: 2.5±0.25 mm/sec.	* The chip endure following force: Chip length ≤2.5mm: Thickness >0.5mm (20N), ≤0.5mm (8N). Chip length ≥3.2mm: Thickness ≥1.25mm (54.5N), <1.25mm (15N).

Automotive Soft Termination Multilayer Ceramic Chip Capacitors

AMTS Category (Automotive Grade Surface Mount MLCCs with Soft Termination)

Reliability Test Conditions and Requirements:

No.	Item	AEC-Q200 Test Condition	Requirements																																																					
5	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. * Cap. change: COG within ±2.5% or ±0.25pF, whichever is larger. X7R/X7S within ±10.0%. * D.F. value: COG: To meet the initial requirement * X7R/X7S: <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 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" style="text-align: center;">≥100V</td> <td rowspan="3" style="text-align: center;">≤2.5%</td> <td style="text-align: center;">≤3.5%</td> <td>1206≥0.47μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF</td> </tr> <tr> <td style="text-align: center;">≤5%</td> <td>0603≥0.068μF, 0805>0.1μF, 1206>1μF, 1210≥2.2μF</td> </tr> <tr> <td style="text-align: center;">≤10%</td> <td>0805>0.22μF, 1210≥3.3μF</td> </tr> <tr> <td rowspan="3" style="text-align: center;">50V</td> <td rowspan="3" style="text-align: center;">≤2.5%</td> <td style="text-align: center;">≤3.5%</td> <td>0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF, 1210≥2.2μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF</td> </tr> <tr> <td style="text-align: center;">≤5%</td> <td>1210≥4.7μF</td> </tr> <tr> <td style="text-align: center;">≤10%</td> <td>0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td style="text-align: center;">35V</td> <td style="text-align: center;">≤3.5%</td> <td style="text-align: center;">≤10%</td> <td>0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td rowspan="2" style="text-align: center;">25V</td> <td rowspan="2" style="text-align: center;">≤3.5%</td> <td style="text-align: center;">≤5%</td> <td>0805≥1μF, 1210≥10μF</td> </tr> <tr> <td style="text-align: center;">≤7%</td> <td>0603≥0.33μF</td> </tr> <tr> <td rowspan="2" style="text-align: center;">16V</td> <td rowspan="2" style="text-align: center;">≤3.5%</td> <td style="text-align: center;">≤5%</td> <td>0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF</td> </tr> <tr> <td style="text-align: center;">≤10%</td> <td>0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF</td> </tr> <tr> <td style="text-align: center;">10V</td> <td style="text-align: center;">≤5%</td> <td style="text-align: center;">≤10%</td> <td>0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF</td> </tr> <tr> <td style="text-align: center;">6.3V</td> <td style="text-align: center;">≤10%</td> <td style="text-align: center;">≤15%</td> <td>0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF</td> </tr> </tbody> </table> * I.R.: To meet the initial requirement. Class II (X7R/X7S) <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R/X7S</td> <td rowspan="6" style="text-align: center; vertical-align: middle;">≥1GΩ or RxC≥10Q-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> </tbody> </table>	Rated	D.F.≤	Exception of D.F.≤		≥100V	≤2.5%	≤3.5%	1206≥0.47μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF	≤5%	0603≥0.068μF, 0805>0.1μF, 1206>1μF, 1210≥2.2μF	≤10%	0805>0.22μF, 1210≥3.3μF	50V	≤2.5%	≤3.5%	0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF, 1210≥2.2μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF	≤5%	1210≥4.7μF	≤10%	0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF	35V	≤3.5%	≤10%	0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V	≤3.5%	≤5%	0805≥1μF, 1210≥10μF	≤7%	0603≥0.33μF	16V	≤3.5%	≤5%	0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF	≤10%	0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF	10V	≤5%	≤10%	0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF	6.3V	≤10%	≤15%	0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF	Rated voltage	I.R.	100V: All X7R/X7S	≥1GΩ or RxC≥10Q-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF
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6	Destructive Physical Analysis EIA-469	Per EIA-469.	* No defects or abnormalities.																																																					
7	Temperature Cycling JEESD22, Method JA-104	* Conduct 1000 cycles according to the temperatures and time. <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 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: 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. * Cap. change: COG within ±2.5% or ±0.25pF, whichever is larger. X7R/X7S within ±10.0% * D.F. value: COG: To meet the initial requirement X7R/X7S: D.F.≤200% of initial requirement. * I.R.: To meet the initial requirement. Class II (X7R/X7S) <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R/X7S</td> <td rowspan="6" style="text-align: center; vertical-align: middle;">≥1GΩ or RxC≥10Q-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> </tbody> </table>	Rated voltage	I.R.	100V: All X7R/X7S	≥1GΩ or RxC≥10Q-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF																																			
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Automotive Soft Termination Multilayer Ceramic Chip Capacitors

AMTS Category (Automotive Grade Surface Mount MLCCs with Soft Termination)

No.	Test Item	AEC-Q200 Test Condition	Requirements																		
8	Moisture Resistance 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 ±2.5% or ±0.25pF, whichever is larger. X7R/X7S within ±10.0% * D.F. value: COG : Q≥350 for Cap.>30pF. Q≥275+2.5C for 10pF≤Cap.≤30pF. Q≥200+10C for Cap. <10pF X7R/X7S: D.F.≤200% of initial requirement. * I.R.: ≥1GΩ or RxC≥50Ω-F, whichever is smaller. Class II (X7R/X7S) <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R/X7S</td> <td rowspan="6" style="text-align: center;">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> </tbody> </table>	Rated voltage	I.R.	100V: All X7R/X7S	≥1GΩ or RxC≥10Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF									
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9	Biased Humidity 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 ±0.3pF, whichever is larger. X7R/X7S within ±12.5% * D.F. value: COG : Q≥200 for Cap.>30pF. Q≥100+10/3C for Cap. <30pF X7R/X7S: D.F.≤200% of initial requirement. * I.R.: ≥500MΩ or RxC≥25Ω-F, whichever is smaller. Class II (X7R/X7S) for rated voltage test <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R/X7S</td> <td rowspan="6" style="text-align: center;">≥500MΩ or RxC≥25Ω-F, which-ever is smaller</td> </tr> <tr> <td>50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> </tbody> </table> Class II (X7R/X7S) for 1.3~1.5Vdc test <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R/X7S</td> <td rowspan="6" style="text-align: center;">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> </tbody> </table>	Rated voltage	I.R.	100V: All X7R/X7S	≥500MΩ or RxC≥25Ω-F, which-ever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF	Rated voltage	I.R.	100V: All X7R/X7S	≥1GΩ or RxC≥10Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF
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10	Operational Life 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: 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/X7S within ±12.5% * D.F. value: COG : Q≥350 for Cap.>30pF. Q≥275+2.5C for 10pF≤Cap.≤30pF. Q≥200+10C for Cap. <10pF X7R/X7S: D.F.≤200% of initial requirement. * I.R.: ≥1GΩ or RxC≥50Ω-F, whichever is smaller. Class II (X7R/X7S) (See table above)																		
11	External Visual MIL-STD-883, Method 2009	* Visual inspection.	* No remarkable defect.																		

Automotive Soft Termination Multilayer Ceramic Chip Capacitors

AMTS Category (Automotive Grade Surface Mount MLCCs with Soft Termination)

No.	Test Item	AEC-Q200 Test Condition	Requirements									
12	Physical Dimension JESD22, Method JB-100	* Using by calipers.	* Within the specified dimensions.									
13	Resistance to Solvents 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: To meet the initial requirement. * I.R.: To meet the initial requirement. Class II (X7R/X7S) <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>≥100V: All X7R/X7S</td> <td rowspan="6" style="text-align: center;">≥10GΩ or RxC≥100Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> </tbody> </table>	Rated voltage	I.R.	≥100V: All X7R/X7S	≥10GΩ or RxC≥100Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF
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14	Mechanical Shock 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. * D.F. value: To meet the initial requirement. * I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller .Class II (X7R/X7S) <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R/X7S</td> <td rowspan="6" style="text-align: center;">≥10GΩ or RxC≥100Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> </tbody> </table>	Rated voltage	I.R.	100V: All X7R/X7S	≥10GΩ or RxC≥100Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF
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15	Vibration 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. * D.F. value: To meet the initial requirement. * I.R.: ≥10GΩ or RxC≥500Ω-F, whichever is smaller Class II (X7R/X7S) <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R/X7S</td> <td rowspan="6" style="text-align: center;">≥10GΩ or RxC≥100Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> </tbody> </table>	Rated voltage	I.R.	100V: All X7R/X7S	≥10GΩ or RxC≥100Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF
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Automotive Soft Termination Multilayer Ceramic Chip Capacitors

AMTS Category (Automotive Grade Surface Mount MLCCs with Soft Termination)

No.	Test Item	AEC-Q200 Test Condition	Requirements																			
16	Resistance to Soldering Heat MIL-STD-202, Method 210	* Solder temperature: 260±5°C. * Dipping time: 10±1 sec. * 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.	* No remarkable damage. * Cap. change: X7R/X7S within ±7.5%. * D.F. value: COG : Within ±2.5% or ±0.25pF, whichever is larger X7R/X7S: D.F.≤100% of initial requirement. * I.R.: ≥10GΩ or RxC≥500Ω-F, whichever is smaller. Class II (X7R/X7S) <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/X7S</td> <td rowspan="5" style="text-align: center; vertical-align: middle;">≥10GΩ or RxC≥100Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> <td></td> </tr> </tbody> </table>	Rated voltage	I.R.	100V: All X7R/X7S	≥10GΩ or RxC≥100Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF										
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17	Thermal Shock 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: 35%;">Temp. (°C)</th> <th style="width: 50%;">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;">15±3</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;">15±3</td> </tr> </tbody> </table> * Max. transfer time: 20 sec. * Before initial measurement: 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	15±3	2	+125°C +3/-0	15±3	* No remarkable damage. * Cap. change: COG within ±2.5% or ±0.25pF, whichever is larger. X7R/X7S within ±10.0% * D.F. value: COG : To meet the initial requirement X7R/X7S: D.F.≤200% of initial requirement. * I.R.: ≥10GΩ or RxC≥500Ω-F, whichever is smaller Class II (X7R/X7S) <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/X7S</td> <td rowspan="5" style="text-align: center; vertical-align: middle;">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> <td></td> </tr> </tbody> </table>	Rated voltage	I.R.	100V: All X7R/X7S	≥1GΩ or RxC≥10Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF	
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18	ESD AEC-Q200-002	* Per AEC-Q200-002.	* No remarkable damage. * Cap. : Within the specified tolerance. * D.F. value: To meet the initial requirement. X7R/X7S: D.F.≤100% of initial requirement. * I.R.: To meet the initial requirement. Class II (X7R/X7S) <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/X7S</td> <td rowspan="5" style="text-align: center; vertical-align: middle;">≥10GΩ or RxC≥100Ω-F, whichever is smaller</td> </tr> <tr> <td>50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> <td></td> </tr> </tbody> </table>	Rated voltage	I.R.	≥100V: All X7R/X7S	≥10GΩ or RxC≥100Ω-F, whichever is smaller	50V: 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V: 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V: 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V: 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V: 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF										
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Automotive Soft Termination Multilayer Ceramic Chip Capacitors

AMTS Category (Automotive Grade Surface Mount MLCCs with Soft Termination)

No.	Test Item	AEC-Q200 Test Condition	Requirements																																														
19	Electrical Characterization	<p>* Capacitance. D.F. (Dissipation Factor). X7R/X7S : Cap.≤10μF: 1.0±0.2Vrms, 1KHz±10%. Cap.>10μF: 0.5±0.2Vrms, 120Hz±20%.</p>	<p>* Capacitance within the specified tolerance. * D.F. value : To meet the initial requirement. X7R/X7S:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Rated</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3" style="text-align: center;">≥100V</td> <td rowspan="3" style="text-align: center;">≤2.5%</td> <td style="text-align: center;">≤3%</td> <td>1206≥0.47μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF</td> </tr> <tr> <td style="text-align: center;">≤5%</td> <td>0805>0.1μF, 0603≥0.068μF, 1206>1μF, 1210≥2.2μF</td> </tr> <tr> <td style="text-align: center;">≤10%</td> <td>0805>0.22μF, 1210≥3.3μF</td> </tr> <tr> <td rowspan="3" style="text-align: center;">50V</td> <td rowspan="3" style="text-align: center;">≤2.5%</td> <td style="text-align: center;">≤3.5%</td> <td>0201(50V), 0603≥0.047μF, 0805≥0.18μF, 10201(50V), 0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF, 1210≥3.3μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF 206≥0.47μF</td> </tr> <tr> <td style="text-align: center;">≤5%</td> <td>0201≥0.01μF, 1210≥4.7μF</td> </tr> <tr> <td style="text-align: center;">≤10%</td> <td>0402≥0.012μF, 0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td style="text-align: center;">35V</td> <td style="text-align: center;">≤3.5%</td> <td style="text-align: center;">≤10%</td> <td>0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td rowspan="4" style="text-align: center;">25V</td> <td rowspan="4" style="text-align: center;">≤3.5%</td> <td style="text-align: center;">≤5%</td> <td>0201≥0.01μF, 0805≥1μF, 1210≥10μF</td> </tr> <tr> <td style="text-align: center;">≤7%</td> <td>0603≥0.33μF, 1206≥4.7μF</td> </tr> <tr> <td style="text-align: center;">≤10%</td> <td>0201≥0.1μF, 0402≥0.056μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥6.8μF, 1210≥22μF</td> </tr> <tr> <td style="text-align: center;">≤12.5%</td> <td>0402≥0.47μF</td> </tr> <tr> <td rowspan="2" style="text-align: center;">16V</td> <td rowspan="2" style="text-align: center;">≤3.5%</td> <td style="text-align: center;">≤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 style="text-align: center;">≤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" style="text-align: center;">10V</td> <td rowspan="2" style="text-align: center;">≤5%</td> <td style="text-align: center;">≤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 style="text-align: center;">≤15%</td> <td>0201≥0.1μF, 0402≥1μF</td> </tr> </tbody> </table>	Rated	D.F.≤	Exception of D.F.≤		≥100V	≤2.5%	≤3%	1206≥0.47μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF	≤5%	0805>0.1μF, 0603≥0.068μF, 1206>1μF, 1210≥2.2μF	≤10%	0805>0.22μF, 1210≥3.3μF	50V	≤2.5%	≤3.5%	0201(50V), 0603≥0.047μF, 0805≥0.18μF, 10201(50V), 0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF, 1210≥3.3μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF 206≥0.47μF	≤5%	0201≥0.01μF, 1210≥4.7μF	≤10%	0402≥0.012μF, 0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF	35V	≤3.5%	≤10%	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
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Automotive Soft Termination Multilayer Ceramic Chip Capacitors

AMTS Category (Automotive Grade Surface Mount MLCCs with Soft Termination)

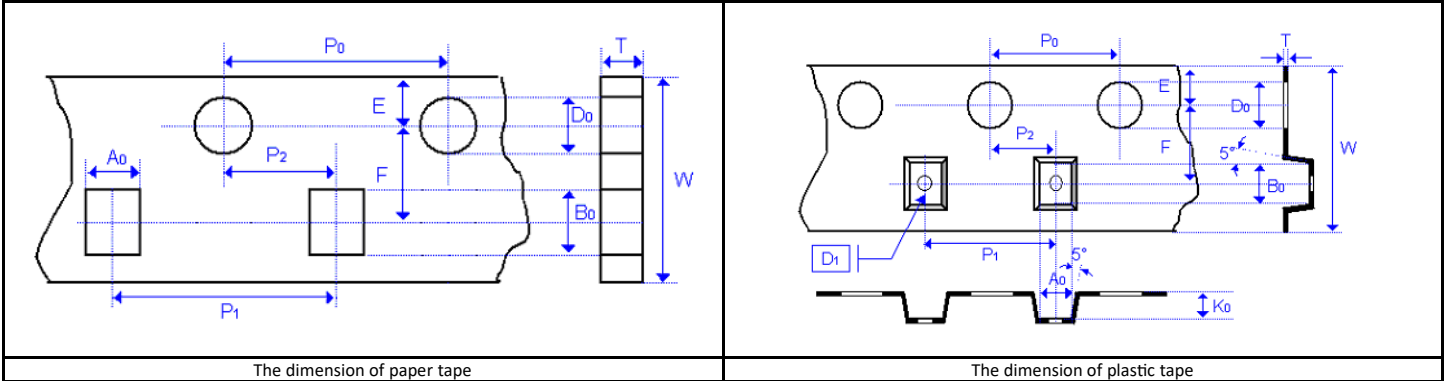
9. Package Dimension and Quantity:

Size, Inch (mm)	Thickness (mm)	Paper Tape		Plastic Tape	
		7" reel	13" reel	7" reel	13" reel
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±0.10	-	-	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	-
2220 (5750)	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
	2.80±0.30	-	-	0.5k	-

Automotive Soft Termination Multilayer Ceramic Chip Capacitors

AMTS Category (Automotive Grade Surface Mount MLCCs with Soft Termination)

9.1 Tape Dimension



Size, Inch (mm)	0603 (1608)		0805 (2012)		1206 (3216)		
Chip Thickness	0.80±0.07	0.80 +0.15/-0.1	0.80±0.10	1.25±0.10 1.25±0.20	0.80±0.10	0.95±0.10 1.25±0.10	1.60±0.20 1.60±0.3/-0/1
A ₀	1.00 +0.05/-0.1	1.02 +0.05/-0.1	1.50±0.10	<1.65	2.00±0.10	<2.00	<2.00
B ₀	1.80±0.10	1.80±0.10	2.30±0.10	<2.40	3.50±0.10	<3.60	<3.70
T	0.95±0.05	0.97±0.05	0.95±0.05	0.23±0.05	0.95±0.05	0.23±0.05	0.23±0.05
K ₀	-	-	-	<2.50	-	<2.50	<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	8.00±0.10
P ₀	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 ₀	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 ₁	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
P ₂	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 ₀	1.55±0.05	1.55±0.05	1.55±0.05	1.50 +0.10/-0	1.55±0.05	1.50 +0.10/-0	1.50 +0.10/-0
D ₁	-	-	-	1.00±0.10	-	1.00±0.10	1.00±0.10
E	1.75±0.05	1.75±0.05	1.75±0.05	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	3.50±0.05	3.50±0.05
Unit :	mm	mm	mm	mm	mm	mm	mm

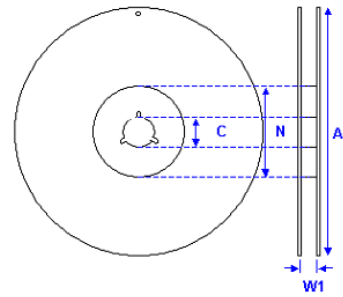
Size, Inch (mm)	1210 (3225)		1812 (4532)		2220 (5750)	
Chip Thickness	0.95±0.10 1.25±0.10 1.60±0.20 2.00±0.20	2.50±0.30	1.25±0.10 1.60±0.20 2.00±0.20	2.50±0.30	1.40±0.15 1.60±0.20 2.00±0.20	2.50±0.30 2.80±0.30
A ₀	<3.05	<3.10	<3.90	<3.90	<5.80	<6.80
B ₀	<3.80	<4.00	<5.30	<5.30	<6.50	<6.50
T	0.23±0.05	0.23±0.05	0.25±0.05	0.25±0.05	0.30±0.10	0.30±0.10
K ₀	<2.50	<3.50	<2.50	<3.00	<2.50	<3.10
W	8.00±0.10	8.00±0.10	12.00±0.20	12.00±0.20	12.00±0.20	12.00±0.20
P ₀	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 ₀	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 ₁	4.00±0.10	4.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10
P ₂	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 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	1.50 +0.10/-0
D ₁	1.00±0.10	1.00±0.10	1.50±0.10	1.50±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
F	3.50±0.05	3.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05
Unit :	mm	mm	mm	mm	mm	mm

Automotive Soft Termination Multilayer Ceramic Chip Capacitors

AMTS Category (Automotive Grade Surface Mount MLCCs with Soft Termination)

9.2 Reel Dimensions

Size	0603, 0805, 1206, 1210		1808, 1812, 2220
Reel size	7"	13"	7"
C	13.0 +0.5/-0.2	13.0 +0.7/-0.3	13.0 +0.5/-0.2
W ₁	8.4 +1.5/-0	8.4 +2.0/-0	12.4 +2.0/-0
A	178.0 ±0.10	330.0 ±1.0	178.0 ±0.10
N	60.0 +1.0/-0	100 ±1.0	60.0 +1.0/-0



The dimension of reel

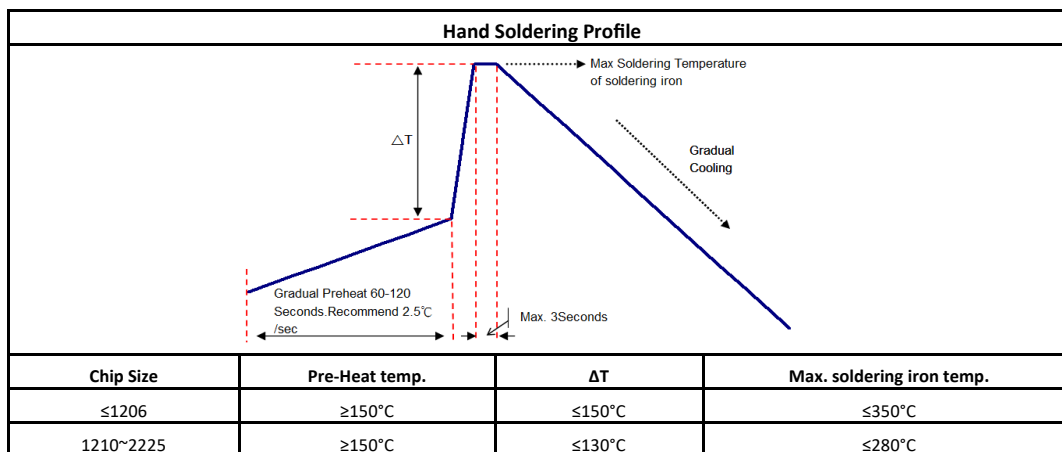
10. Recommended Soldering Conditions:

Use mildly 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:

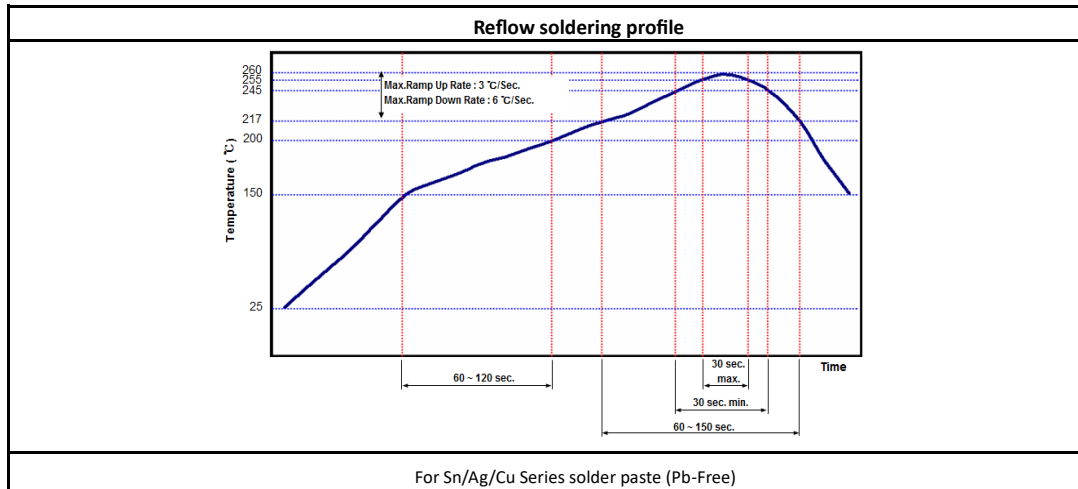


- * Soldering iron tip diameter ≤1.0 mm and wattage max. 20W.
- * The Capacitors shall be pre-heated and that the temperature gradient between the devices and the tip of the soldering iron.
- * The required amount of solder shall be melted on the soldering tip.
- * The tip of iron should not contact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

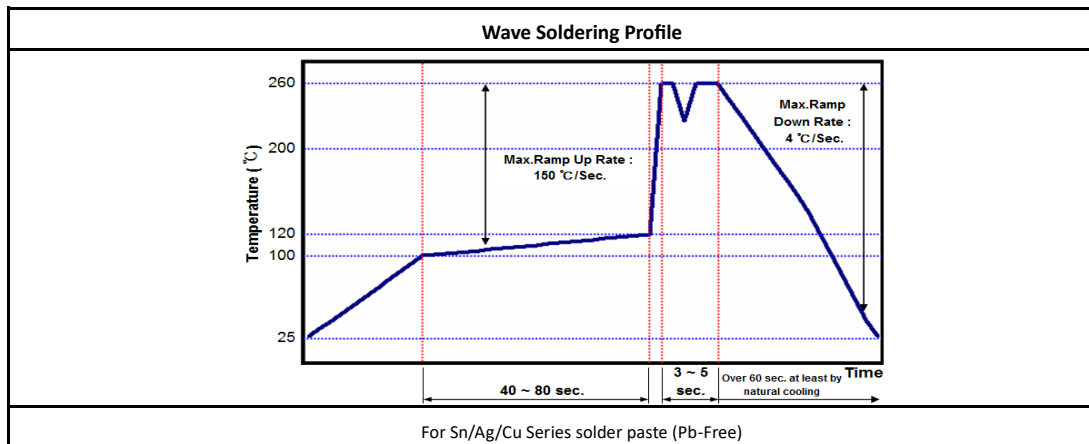
Automotive Soft Termination Multilayer Ceramic Chip Capacitors

AMTS Category (Automotive Grade Surface Mount MLCCs with Soft Termination)

10.3 Reflow soldering:



10.4 Wave soldering:



10.5 Soldering conditions:

10.5.1 Class I:

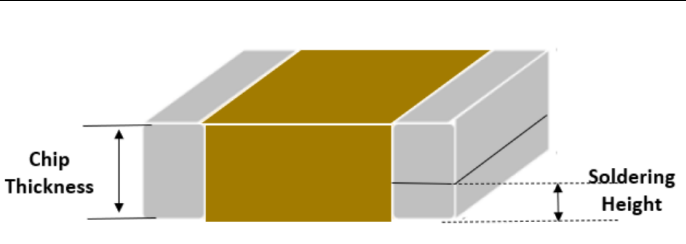
Size, Inch (mm)	Temperature Characteristics	Capacitance	Condition	
			Wave	Reflow
≤0402 (1005)	All Class I	All	X	O
0603 (1608)	All Class I	All	O	O
0805 (2012)	All Class I	All	O	O
1206 (3216)	All Class I	All	O	O
		Thickness > 0.95mm	X	O
≥1210 (3225)	All Class I	All	X	O
Coating Products	All	All	X	O

Automotive Soft Termination Multilayer Ceramic Chip Capacitors AMTS Category (Automotive Grade Surface Mount MLCCs with Soft Termination)

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 AMTS 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. Surface coating products are not suitable cleaning/washing by solvent.

Automotive Soft Termination Multilayer Ceramic Chip Capacitors AMTS Category (Automotive Grade Surface Mount MLCCs with Soft Termination)

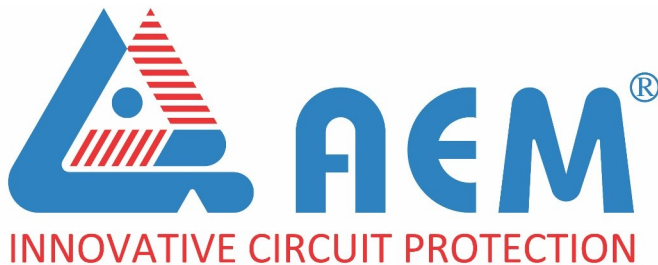
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Revision of Jul. 2023

Automotive Soft Termination Multilayer Ceramic Chip Capacitors AMTS Category (Automotive Grade Surface Mount MLCCs with Soft Termination)



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