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High Q and Low ESR Capacitors

HOW TO ORDER

HH	15	N	100	G	500	L	Т
<u>Series</u>	<u>Size</u>	Dielectric	Capacitance	Tolerance	Rated voltage	Termination	Packaging
HH= High Q/ Low ESR	15=0402 (1005) 18=0603 (1608)	N=NPO (COG)	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: R47=0.47pF 0R5=0.5pF 1R0=1.0pF 100=10x10° =10pF	$\begin{array}{l} B=\pm 0.1 p F \\ C=\pm 0.25 p F \\ D=\pm 0.5 p F \\ F=\pm 1\% \\ G=\pm 2\% \\ J=\pm 5\% \end{array}$	Two significant digits followed by no. of zeros. And R is in place of decimal point. 160=16 VDC 250=25 VDC 500=50 VDC 101=100 VDC	L=Ag/Ni/Sn	B=Bulk C=Bulk cassette T=7" reeled G=13" reeled

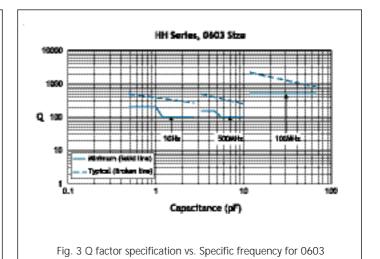
PACKAGING DIMENSION AND QUANTITY

ELECTRICAL CHARACTERISTICS

Size			Paper	tape
5120	Thickness (mm)/Symbol		7" reel	13" reel
0402	0.50±0.05	Ν	10K	20K
0603	0.80±0.07	S	4K	10K

Unit: pieces

HH Series, 0402 Stee 100 0 100 0 100 0 100 1 10





High Q and Low ESR Capacitors

CAPACITANCE RANGE

Stop 0402 0603 0.5F(06) 16 5 5 0.5F(06) N S 5 0.3F(06) N S 5 0.3F(06) N S 5 0.3F(06) N S 5 0.4F(08) N S 5 0.4F(08) N S 5 1.4F(18) N S 5 2.3F(242) N S 5 3.4F(38) N S 5 4.7F(47) N S 5 5.9F(860) N S 5 1.4F(160) N S 5 1.4F(160) N S 5		Dielectric			N	PO							
N S S 0.090 (960) N N S S 0.010 (960) N N S S 1.010 (960) N S S S 2.29 (920) N N S S 3.39 (920) N N S S 5.49 (960) N S S S 1.020 (960) N S S S 1.020 (960) N S S S 1.020 (960) N S S S <th colspan="2"></th> <th></th> <th>0402</th> <th></th> <th></th> <th>0603</th> <th></th>				0402			0603						
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Org/f (08) N S S 0.0pf (08) N S S 1.0pf (18) N S S 1.5pf (18) N S S 1.5pf (18) N S S 1.5pf (18) N S S 2.2pf (22) N S S 2.2pf (27) N S S 3.3pf (183) N S S 3.3pf (283) N S S 3.3pf (283) N S S 6.3pf (08) N S S 6.3pf (08) N S S 1.3pf (10) N S S 1.3pf (12) N <													
0 %pf (key) N S S 1.0pf (1R0) N N S S 1.5pf (1R2) N S S 1.5pf (1R3) N S S 2.2pf (2R2) N S S 3.3pf (1R3) N S S 3.3pf (2R7) N S S 3.3pf (2R7) N S S 3.3pf (2R7) N S S 4.7pf (4R7) N S S 5.5pf (6R0) N S S 6.8pf (6R2) N S S 1.0pf (100) N S S 1.3pf (180) N S S 1.3pf (18					N		S	S					
I 0.0F (180) N S S 1.2µF (182) N S S 1.5µF (186) N S S 1.5µF (186) N S S 2.7µF (287) N S S 3.3µF (380) N S S 3.3µF (380) N S S 4.7µF (487) N S S 5.6µF (586) N S S 5.6µF (586) N S S 1.0µF (100) N S S 1.0µF (101) <t< td=""><td></td><td>0.8pF (0R8)</td><td></td><td></td><td>N</td><td></td><td>S</td><td>S</td></t<>		0.8pF (0R8)			N		S	S					
I 12pf (182) N S S 15pf (18) N N S S 22pf (28) N S S 23pf (28) N S S 33pf (38) N S S 33pf (38) N S S 47pf (487) N S S 56pf (586) N S S 92pf (28) N S S 10pf (100) N S S 11pf (150) N S S 11pf (150) N S S 11pf (160) N S S 12pf (120) N S S 13pf (160) N S S 12pf (120) N S S 13pf (160) N S S 13pf (160) N S S 13pf (170) N S S 13pf (170)		0.9pF (0R9)			N		S	S					
N N S S 1.3pr (18) N N S S 2.7pr (2R7) N S S 3.3pr (38) N N S S 4.1pr (4R) N N S S 5.666 (680 N N S S 1.3pr (120) N N S S 2.3pr (220) N N S S 2.3pr (430) N N S S		1.0pF (1R0)			N								
N N S S 2 2pr (2R2) N N S S 3 3pr (2R3) N N S S 3 3pr (2R3) N N S S 3 3pr (2R3) N N S S 4 Jpr (4R7) N N S S 5 par (5R6) N N S S 5 par (5R6) N N S S 1 0pt (100) N N S S 1 0pt (20) N N S<		1.2pF (1R2)			N		S	S					
Vertical N S S 2.7 (r/ (2R7) N N S S 3.3 (r) (38) N S S 3.3 (r) (38) N S S 3.3 (r) (38) N S S 4.7 (r) (47) N S S 6.6 (r) (68) N S S 0.6 (r) (100) N S S 1.3 (r) (100) N S S 2.2 (r) (220) N S S 3.3 (r) (101) N S S 3.4 (r) (101) N S S 3.5 (r) (101) N S S 1.0 (0) (101) N N S		1.5pF (1R5)			N		S	S					
Vert No. N S S 3.367 (38) N N S S 4.367 (38) N N S S 4.367 (38) N N S S 4.367 (38) N N S S 5.667 (380) N S S S 6.697 (380) N S S S 1000 (100) N S S S 11267 (120) N S S S 11267 (120) N S S S 12267 (270) N S S S 2267 (270) N S S S 3476 (380) N S S S 4707 (470) N S S S 4707 (470) N S S S 4707 (470) N N S S 10007 (101) N N S <td></td> <td>1.8pF (1R8)</td> <td></td> <td></td> <td>N</td> <td></td> <td>S</td> <td>S</td>		1.8pF (1R8)			N		S	S					
N S S 3.3pf (383) N N S S 3.3pf (384) N S S 4.3pf (487) N S S 5.6pf (586) N S S 6.6pf (688) N S S 10pf (180) N S S 11pf (180) N S S 12pf (120) N S S 13pf (180) N S S 12pf (120) N S S 13pf (180) N S S 13pf (190) N S S 13pf (190) N S S 10pf (101) N S S 10pf (101) N S S 10pf (101) N S <td></td> <td>2.2pF (2R2)</td> <td></td> <td></td> <td>N</td> <td></td> <td>S</td> <td>S</td>		2.2pF (2R2)			N		S	S					
3.9pf (389) N S S 4.7pf (4R7) N N S S 5.6pf (5R6) N S S 6.8pf (688) N S S 10pf (100) N S S 12pf (120) N S S 13pf (150) N S S 12pf (120) N S S 13pf (150) N S S 13pf (160) N S S 22pf (220) N S S 33pf (330) N S S 247hf (470) N S S 33pf (330) N S S 47pf (470) N S S 5dept (560) N S S 100pf (101) N S S 100pf (101) N S S 120pf (21) N S S 120pf (131)		2.7pF (2R7)			N		S	S					
4.7pf (4R) N S S 5.6pf (6R) N N S S 6.8pf (6R) N N S S 10pf (100) N N S S 12pf (120) N S S S 13pf (160) N S S S 22pf (220) N N S S 33pf (330) N N S S 33pf (330) N N S S 668pf (600) N S S S 668pf (600) N S S S 120pf (121) N N S S 120pf (121) N N S S 130pf (131) N N S </td <td></td> <td>3.3pF (3R3)</td> <td></td> <td></td> <td>N</td> <td></td> <td>S</td> <td>S</td>		3.3pF (3R3)			N		S	S					
S 6.6pf (586) N S S 6.8pf (688) N N S S 10pf (100) N N S S 112pf (120) N S S S 12pf (120) N S S S 13pf (130) N S S S 22pf (220) N S S S 22pf (220) N S S S 33pf (330) N S S S 33pf (300) N S S S 47pf (470) N S S S 47pf (270) N S S S 33pf (330) N N S S 47pf (470) N N S S 100pf (101) N N S S 120pf (121) N N S S 120pf (131) N N		3.9pF (3R9)			N		S	S					
N S S 8.2pf (682) N N S S 10pf (100) N S S 11pf (120) N S S 12pf (120) N S S 13pf (130) N S S 31pf (330) N S S 31pf (330) N S S 31pf (320) N S S 31pf (320) N S S 32pf (320) N S S 32pf (320) N S S 32pf (320) N S S 100pf (101) N N S S 120pf (121) N N S S 120pf (121) N N S S		4.7pF (4R7)			N		S	S					
8.2pf (8R2) N S S 10pf (100) N N S S 12pf (120) N S S S 13pf (180) N S S S 13pf (180) N S S S 22pf (220) N S S S 33pf (330) N N S S 33pf (330) N N S S 33pf (330) N N S S 33pf (300) N N S S 33pf (330) N N S S 56pf (560) N N S S 100pf (101) N N S S 120pf (121) N N S S 120pf (121) N N S S 120pf (131) N N S S 120pf (121) N N S<		5.6pF (5R6)			N		S	S					
10pf (100) N S S 12pf (120) N N S S 15pf (150) N N S S 12pf (120) N N S S 12pf (120) N N S S 12pf (20) N N S S 22pf (220) N N S S 33pf (330) N N S S 33pf (330) N N S S 41pf (470) N N S S 42pf (820) N N S S 100pf (101) N N S S 120pf (121) N N S </td <td></td> <td>6.8pF (6R8)</td> <td></td> <td></td> <td>N</td> <td></td> <td>S</td> <td>S</td>		6.8pF (6R8)			N		S	S					
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2,200pF (222) S													
2,700pF (272) S													
3,300pF (332) S													

1. The letter in cell is expressed the symbol of product thickness.

2. For more information about products with special capacitance or other data, please contact WTC local representative.

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Appendix I : Reliability Test Conditions and Requirements

NO.	Item	Test Condition				Re	auire	ments		
1.	Visual and		Requirements * No remarkable defect.							
	Mechanical		* Dimensions to confirm to individual specification sheet.							
2.	Capacitance	Class I : NPO	* Shall not exceed the limits given in the detailed spec.					n the detailed spec.		
3.	Q/ D.F.	Cap 1000pF 1.0±0.2Vrms, 1MHz±10% Cap>1000pF 1.0±0.2Vrms, 1KHz±10%		NP0: Cap 30pF, Q 1000; Cap<30pF, Q 400+20				DpF, Q 400+20C		
	(Dissipation Factor)			X7R, X5R: Rated vol.	ed vol. D.F.		Exception of D.F.			
		Class II : X7R, X5R, Y5V Cap 10µF, 1.0±0.2Vrms, 1KHz±10%		50V	2.5%		3.0% All 0201;0603 0.047µF;0805 0.18µF;			
		Cap>10μF, 0.5±0.2Vrms, 120Hz±20%				5.0%	ο 0.47μF 5 1μF, 1210 10μF			
				25V	3.5%	7.0%		0.33µF;TT series & Cap 1µF		
					0.50/	5.0%	0402	2 0.033µF;0603 0.15µF;		
				16V	3.5%	10%		0805 0.68µF;1206 2.2µF TT series & Cap 1µF		
				10V	5.0%	-	10.0% TT series & Cap 1µF 10.0% TT series & Cap 1µF;0805 10µF			
				6.3V	10.0%	15.09	6 0805	5 22μF;1210 100μF		
				Y5V:						
				Rated vol. 50V		F. 0%	Except	ion of D.F.		
				35V		0%				
				051/	_		7.0%	0603 0.1µF; 0805 0.33µF;		
				25V	5.	0%	9.0%	1206 1µF; 1210 4.7µF 0402 0.068µF		
				16V (C<1		0%	9.0%	0402 0.068µF; 0603 0.68µF		
				16V (C 1. 10V		0% 2.5%	12.5%	0805 4.7µF;1206 10µF;1210 22µF		
				6.3V		0.0%				
4-	Diala atria Ctara a ath	* Ta analysis (50) 0 2500/	*	Ne suider	6 -1		flash a	· · · · · · · · · · · · · · · · · · ·		
4a.	Dielectric Strength	* To apply voltage (50V) 250%. * Duration : 1 to 5 sec.		NO eviden	ce or dar	nage of	nash c	ver during test.		
		* Charge & discharge current less than 50mA.								
		* To apply voltage :								
		100V 3 times V DC 200V ~ 300V 2 times V DC								
		200V ~ 300V 2 times V DC 500V ~ 999V 1.5 times V DC								
		1000V ~ 3000V 1.2 times V DC								
		* Cut-off, set at 10mA * TEST= 15 sec.								
		* RAMP=0								
4b.	Dielectric Strength	* To apply 1500 VAC voltage.	* No evidence of damage or flash over during test.					ver durina test.		
	(for X1/Y2 & X2/Y3)		No evidence of damage of hash over during test.					J		
5.	Insulation	To apply rated voltage for max. 120 sec.	10G or RxC 500 -F whichever is smaller.					s smaller		
	Resistance	Dated voltage:								
		Kated voltage.To apply rated voltage for 60 sec.100 ~ 500VTo apply rated voltage for 60 sec.		10G						
		Rated voltage: To apply 500V for 60 cos		10G						
		> 500V To apply 500V for 60 sec.								
6.	Temperature	With no electrical load.								
	Coefficient	T.C. Operating Temp	T.C. Capacitance Change NP0 (COG) Within ±30ppm/°C							
		NP0 (COG) -55~125°C at 25°C NP0 (COJ) -55~125°C at 25°C		NPO (COG NPO (COJ)	,		30ppm/ 120ppm			
		X7R -55~125°C at 25°C		X7R		ithin ±				
		X5R -55~85°C at 25°C		X5R		ithin ±				
		Y5V -25~85°C at 20°C		Y5V	W	ithin +3	30%/-8	0%		
7.	Adhesive Strength	* Pressurizing force:	* No remarkable damage or remo		remova	al of the terminations.				
	of Termination	0201: 2N								
		0402 & 0603: 5N >0603: 10N								
		* Test time: 10±1 sec.								
8.	Vibration	* Vibration frequency: 10~55 Hz/min.	* No remarkable damage.							
Resistance * Total amplitude: 1.5mm * Cap of			* Cap change and Q/D.F.: To meet initial spec.							
		 * Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.) 								

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Appendix I : Reliability Test Conditions and Requirements

NO.	Item	Test Condition Requirements					
9.	Solderability	* Solder temperature: 235±5°C * Dipping time: 2±0.5 sec.	95% min. coverage of all metalized area.				
10.	Bending Test	 * 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 1 mm and then the pressure shall be maintained for 5±1 sec. * Measurement to be made after keeping at room temp. for 24±2 hrs. 	 * No remarkable damage. * Cap change: NP0: within ±5.0% or ±0.5pF whichever is larger. X7R, X5R: within ±12.5% Y5V: within ±30% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.) 				
11.	Resistance to Soldering Heat	 * Solder temperature: 270±5°C * Dipping time: 10±1 sec * Preheating: 120 to 150°C for 1 minute before immerse the capacitor in an eutectic solder. * Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 48±4 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs. (Class I) or 48±4 hrs. (Class II). 	 * No remarkable damage. * Cap change: NP0: within ±2.5% or ±0.25pF whichever is larger. X7R, X5R: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements. * 25% max. leaching on each edge. 				
12.	Temperature Cycle	 * Conduct the five cycles according to the temperatures and time. <u>Step</u> Temp. (°C) Time (min.) Min. operating temp. +0/-3 30±3 Room temp. 2-3 Max. operating temp. +3/-0 30±3 Room temp. * Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 48±4 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs. (Class I) or 48±4 hrs. (Class II). 	 * No remarkable damage. * Cap change: NP0: within ±2.5% or ±0.25pF whichever is larger. X7R, X5R: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements. 				
13.	Humidity (Steady State)	 * Test temp.: 40±2°C * Humidity: 90-95% RH * Test time: 500+24/-0hrs. * Measurement to be made after keeping at room temp. for 24±2 hrs. (Class I) or 48±4 hrs. (Class II). 	 * No remarkable damage. * Cap change: NPO: within ±5.0% or ±0.5pF whichever is larger. X7R, X5R: 10V, within ±12.5% 6.3V, within ±25% Y5V: within ±30% * O/D.F. value: NPO: Cap 30pF, Q 350; 10pF Cap<30pF, Q 275+2.5C Cap<10pF; Q 200+10C X7R, X5R: Rated vol. D.F. Exception of D.F. 50V 3.0% 6.0% 0603 0.047µF; 0805 0.18µF; 1206 0.47µF 25V 5.0% 10.0% 0805 1µF, 1210 10µF 16V 5.0% 10.0% 0805 0.33µF; 0603 0.15µF; 0805 0.68µF; 1206 2.2µF 0402 0.056µF; 0603 0.33µF; 10V 7.5% 15.0% 0805 10µF; 1210 100µF Y5V: Rated vol. D.F. Exception of D.F. 50V 7.5% 35V 10.0% 35V 10.0% 25V 7.5% 10.0% 0603 0.1µF; 1210 4.7µF 16V (C<1.0µF) 10.0% 12.5% 0402 0.068µF 16V 15.0% 30.0% 10V 15.0% 				

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Appendix I : Reliability Test Conditions and Requirements

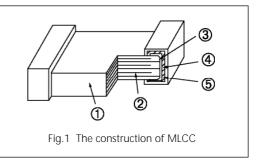
NO.	Item	Test Condition				Re	quirem	pents
							quiren	
14.	Humidity Load (Damp Heat)	 * Test temp.: 40±2°C * Humidity: 90-95%RH * Test time: 500+24/-0 hrs. * To apply voltage: rated voltage (Max. 500V) * Measurement to be made after keeping at room temp. for 24±2 hrs. (Class I) or 48±4 hrs. (Class II). 	* Q/D.F. val	ge: NI X7 YE 30pF 5.09 5.09 7.59 15.0	PO: wi 7R, X5 5V: 1 6.3 5, Q 2 6 6 6 7 6 6 7 6 6 7 6 6 7 6 6 7 6 7	ithin ± 1 6.3 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7	0V, within 3V, with ± ithin ±30' thin ±30' thin ±30' ap<30pF, 0	% to -40% Q 100+10/3C E D:047µF;0805 0.18µF;1206 0.47µ µF, 1210 10µF D:033µF D:033µF; 0603 0.15µF; D:056µF; 0603 0.33µF; D:056µF; 0603 0.33µF; D:2µF; 1206 2.2µF, Iss & Cap 1µF I0µF;1210 100µF
			25V <u>16V (C<1</u> <u>10V</u> <u>6.3V</u> * I.R.: 10V <u>6.3V</u> , 5 -F	.0μF) ,500N	12.5 15.0 30.0	% % % %	10.0% 12.5% 12.5% F whichev	1206 1μF; 1206 1μF; 0402 0.068μF 0.003 0.68μF 0402 0.068μF; 0603 0.68μF
15.	High Temperature Load (Endurance)	nperature NP0, X7R: 125±3°C id X5R, Y5V: 85±3°C	* Q/D.F. valı NPO: Cap 10pł	ge: NI X YE ue: 30pF Cap	PO: wi 7R, X! 5V: 1 6.3	ithin ± 5R: 1 6.: 0V, w 3V, wi 550 F, Q 2	10V, withi 3V, with ± ithin ±30 thin +30 † 275+2.5C	% to -40%
			Rated vol	. D.F.	E	Except	tion of D.F	
			50V	3.09		6.0%	1206 C	0.047µF; 0805 0.18µF, 0.47µF µF, 1210 10µF
			25V 16V	5.09	/0 ·		6 0603 0 0402 0	
			10V	7.59	% .	15.0%	0402 0 6 0805 2	0.056µF; 0603 0.33µF; 2.2µF; 1206 2.2µF
			6.3V	15.0	10%	30.0%		es & Cap 1µF 10µF; 1210 100µF
				110.0		50.070		τομι, τετο τουμι
			Y5V:		_			
			Rated vol		D.F.		Exception	
			50V 35V		7.5%			
			25V		7.5%		10.0% 12.5%	 0603 0.1μF; 0805 0.33μF; 1206 1μF; 1210 4.7μF 0402 0.068μF
			16V (C<1 16V (C 1 10V			%	12.5% 	0402 0.068µF; 0603 0.68µF
			6.3V		30.0			
			* I.R.: 10V	,1G				
			6.3V, 10					
				_				



Appendix II: General Information

Constructions

No.	Na	me	NPO/X7R X7R/X5R/Y5						
1	Ceramic	material	BaTiO₃ based						
2	Inner el	lectrode	AgPd alloy	Ni					
3		Inner layer	Ag	Cu					
4	Termination	Middle layer	Ν	Ji					
5		Outer layer	Sn (N	Matt)					



Storage and handling conditions

- (1) To store products at 5 to 40°C ambient temperature and 20 to 70%. related humidity conditions.
- (2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

Cautions:

- a. Don't store products in a corrosive environment such as sulfide, chloride gas, or acid. It may cause oxidization of electrode, which easily be resulted in poor soldering.
- b. To store products on the shelf and avoid exposure to moisture.
- c. Don't expose products to excessive shock, vibration, direct sunlight and so on.

Recommended soldering conditions

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N₂ within oven are recommended.

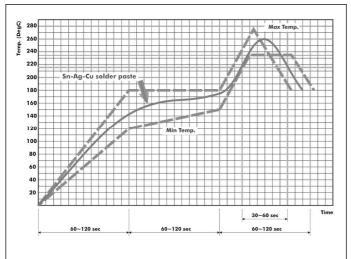


Fig. 2 IR reflow soldering profile for SMT process with SnAgCu series solder paste.

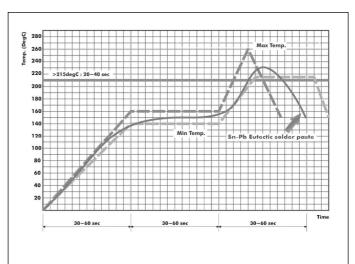


Fig. 3 IR reflow soldering profile for SMT process with eutectic SnPb solder paste.