

MULTILAYER CERAMIC CAPACITORS

High Capacitance Series



1. DESCRIPTION

MLCC consists of a conducting material and electrodes. To manufacture a chip-type SMT and achieve miniaturization, high density and high efficiency, ceramic condensers are used.

WTC high capacitance MLCC offers low ESR and excellent frequency characteristics to be suited for coupling and decoupling applications in circuit. The high dielectric constant material X7R, X5R and Y5V are used for this series product.

2. FEATURES

- Small size with high capacitance.
- Capacitor with lead-free termination (pure Tin).

3. APPLICATIONS

- Digital circuit coupling or decoupling applications.
- For high frequency and high-density type power suppliers.
- For bypassing.

4. HOW TO ORDER

<u>1206</u>	<u>F</u>	<u>106</u>	<u>Z</u>	<u>100</u>	<u>C</u>	<u>I</u>
<u>Size</u>	<u>Dielectric</u>	<u>Capacitance</u>	<u>Tolerance</u>	<u>Rated voltage</u>	<u>Termination</u>	<u>Packaging</u>
Inch (mm) 0402 (1005) 0603 (1608) 0805 (2012) 1206 (3216) 1210 (3225) 1812 (4532)	B=X7R X=X5R F=Y5V	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 106=10x10 ⁶ =10μF	K=±10% M=±20% Z=-20/+80%	Two significant digits followed by no. of zeros. And R is in place of decimal point. 6R3=6.3 VDC 100=10 VDC 160=16 VDC 250=25 VDC 500=50 VDC	C=Cu/Ni/Sn	T=7" reeled G=13" reeled

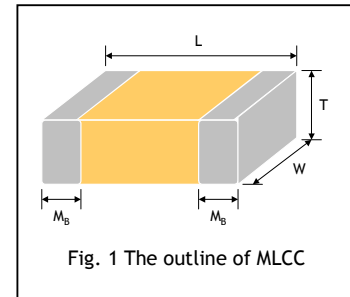
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High Capacitance Series



5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Remark	M _b (mm)	
0402 (1005)	1.00±0.05	0.50±0.05	0.50±0.05	N	0.25 +0.05/-0.10	
0603 (1608)	1.60±0.10	0.80±0.10	0.80±0.07	S	0.40±0.15	
	1.60+0.15/-0.10	0.80+0.15/-0.10	0.80+0.15/-0.10	X		
0805 (2012)	2.00±0.15	1.25±0.10	0.80±0.10	B	0.50±0.20	
			1.25±0.10	D		#
	2.00±0.20	1.25±0.20	1.25±0.20	I		#
1206 (3216)	3.20±0.15	1.60±0.15	0.95±0.10	C	0.60±0.20	
			1.25±0.10	D		#
	3.20±0.20	1.60±0.20	1.60±0.20	G		#
			1.15±0.15	J		#
3.20+0.30/-0.10	1.60+0.30/-0.10	1.60+0.30/-0.10	P	#		
1210 (3225)	3.20±0.30	2.50±0.20	0.95±0.10	C	0.75±0.25	
			1.25±0.10	D		#
	3.20±0.40	2.50±0.30	1.60±0.20	G		#
			2.00±0.20	K		#
		2.50±0.30	M	#		
1812 (4532)	4.50±0.40	3.20±0.30	1.25±0.10	D	0.75±0.25	
			2.00±0.20	K		#
			2.50±0.30	M		#



Reflow soldering only is recommended.

6. GENERAL ELECTRICAL DATA

Dielectric	X7R	X5R	Y5V
Size	0402, 0603, 0805, 1206, 1210, 1812		
Capacitance range*	100nF to 10µF	27nF to 22µF	150nF to 100µF
Capacitance tolerance**	K (±10%), M (±20%)		Z (-20/+80%)
Rated voltage (WVDC)	6.3V, 10V, 16V, 25V, 50V		
Tan δ*	Note 1		
Insulation resistance at U _r	R _x C≥500ΩxF		
Operating temperature	-55 to +125 °C	-55 to +85 °C	-25 to +85 °C
Capacitance characteristic	±15%		+30/-80%
Termination	Ni/Sn (lead-free termination)		

* Measured at 1.0±0.2V_{rms}, 1.0kHz±10% for C≤10µF; 0.5±0.2V_{rms}, 120Hz±20% for C>10µF, 30-70% related humidity, 25 °C ambient temperature for X7R, X5R and at 20 °C for Y5V.

** 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.

Note 1:

X7R/X5R

Rated vol.	D.F.	Exception of D.F.
≥50V	≤2.5%	≤3% 0603≥0.047µF; 0805≥0.18µF; 1206≥0.47µF
25V	≤3.5%	≤5% 0805≥1µF; 1210≥10µF
		≤7% 0603≥0.33µF; 1206≥4.7µF
16V	≤3.5%	≤10% 0402≥0.10µF; 0603≥0.47µF; 0805≥2.2µF; 1206≥6.8µF
		≤5% 0402≥0.033µF; 0603≥0.15µF; 0805≥0.68µF; 1206≥2.2µF; 1210≥4.7µF
10V	≤5.0%	≤10% 0603≥0.68µF; 0805≥2.2µF; 1206≥4.7µF; 1210≥22µF
		≤15% 0402≥1µF
6.3V	≤10%	≤15.0% 0603≥10µF; 0805≥4.7µF; 1210≥100µF
		≤20.0% 0402≥2.2µF

Y5V

Rated vol.	D.F.	Exception of D.F.
≥50V	≤5.0%	≤7% 0603≥0.1µF; 0805≥0.47µF
35V	≤7%	---
25V	≤5.0%	≤7% 0402≥0.068µF; 0603≥0.1µF; 0805≥0.33µF; 1206≥1µF; 1210≥4.7µF
		≤9% 0402≥0.068µF; 0603≥0.47µF; 1206≥4.7µF
16V (C<1.0µF)	≤7.0%	≤9% 0402≥0.068µF; 0603≥0.68µF
16V (C≥1.0µF)	≤9.0%	≤12.5% 0805≥3.3µF; 1206≥10µF; 1210≥22µF; 1812≥47µF
10V	≤12.5%	---
6.3V	≤20%	---

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High Capacitance Series



7. CAPACITANCE RANGE

7-1 X7R Dielectric

Dielectric		X7R																			
Size		0603				0805			1206				1210				1812				
Rated Voltage		10	16	25	50	10	16	25	10	16	25	50	10	16	25	50	10	16	25	50	100
Capacitance	0.10μF (104)	S	S	S	X																
	0.15μF (154)	S	S	X																	
	0.22μF (224)	S	S	X																	
	0.33μF (334)	X	X	X																	
	0.47μF (474)	X	X	X																	
	0.68μF (684)	X																			
	1.0μF (105)	X				D	D	D	J	J	J	P	D	D	D	D	D	D	D	K	K
	1.5μF (155)					I			J	J											K
	2.2μF (225)					I	I	I	J	J	P			K	G						M
	3.3μF (335)								P	P	P										
	4.7μF (475)								P	P	P										
	10μF(106)																				

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

7-2 X5R Dielectric

Dielectric		X5R																
Size		0402			0603				0805				1206				1210	
Rated Voltage (VDC)		6.3	10	16	6.3	10	16	25	6.3	10	16	25	6.3	10	16	25	10	16
Capacitance	0.027μF (273)			N														
	0.033μF (333)			N														
	0.039μF (393)			N														
	0.047μF (473)			N														
	0.056μF (563)		N															
	0.068μF (683)		N	N														
	0.082μF (823)	N	N															
	0.10μF (104)	N	N	N														
	0.15μF (154)																	
	0.22μF (224)	N					X	X										
	0.33μF (334)	N				X	X	X										
	0.47μF (474)	N				X	X	X										
	0.68μF (684)	N				X	X	X										
	1.0μF (105)	N				X	X	X	X									
	1.5μF (155)					X				I	I			J	J		K	K
	2.2μF (225)					X				I	I	I	I	J	J	J	K	K
	3.3μF (335)									I	I	I	I	P	P	P		
	4.7μF (475)									I	I	I	I	P	P	P	P	K
6.8μF (685)													P	P				
10μF (106)									I				P	P	P	P	K	K
22μF(226)													P					

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

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High Capacitance Series



7-3 Y5V Dielectric

DIELECTRIC		Y5V									
SIZE		0402		0603				0805			
RATED VOLTAGE (VDC)		6.3	10	10	16	25V	50	10	16	25	50
Capacitance	0.15μF (154)		N	S	S	S	S				
	0.22μF (224)	N	N	S	S	S	S				
	0.33μF (334)	N	N	S	S	S					
	0.47μF (474)	N	N	S	S						
	0.68μF (684)	N		S	X						
	1.0μF (105)	N		S	X			B	B	D	D
	1.5μF (155)			S				D	D		
	2.2μF (225)			S				D	D		
	3.3μF (335)							D	D		
	4.7μF (475)							D	D		
	6.8μF (685)							I			
	10μF (106)							I			
22μF (226)											

DIELECTRIC		Y5V															
SIZE		1206					1210					1812					
RATED VOLTAGE (VDC)		10	16	25	35	50	6.3	10	16	25	35	50	6.3	10	16	25	50
Capacitance	1.0μF (105)	C	C	C		C		C	C	C		C		D	D	D	D
	1.5μF (155)	C	C	C				C	C	C				D	D	D	D
	2.2μF (225)	C	C	C		J		C	C	C		G		D	D	D	D
	3.3μF (335)	J	J	J				C	C	C				D	D	D	D
	4.7μF (475)	J	J	J	J			C	C	D		G		D	D	D	D
	6.8μF (685)	J	J					C	C	D				D	D	D	D
	10μF (106)	J	J					D	D	D	K			D	D	D	
	22μF (226)	P						K	K								
	47μF (476)							K							M		
	100μF (107)						M										

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

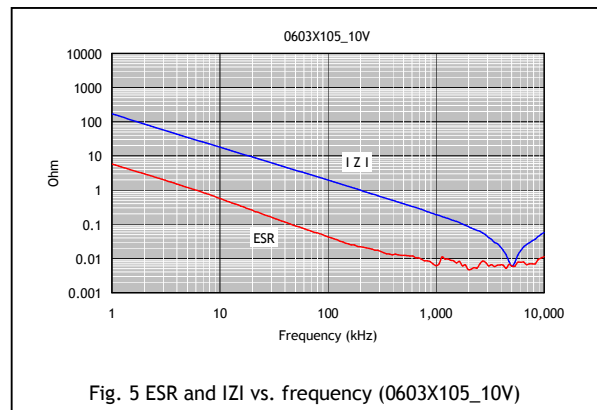
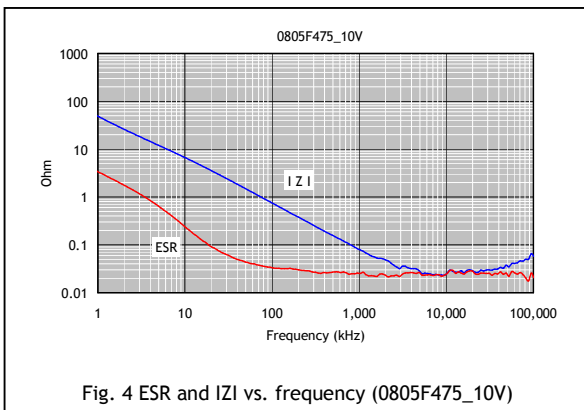
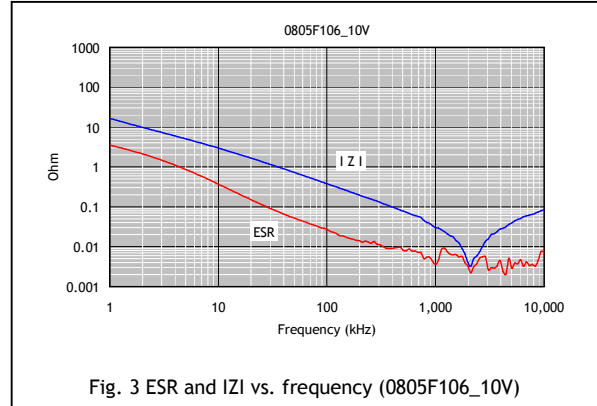
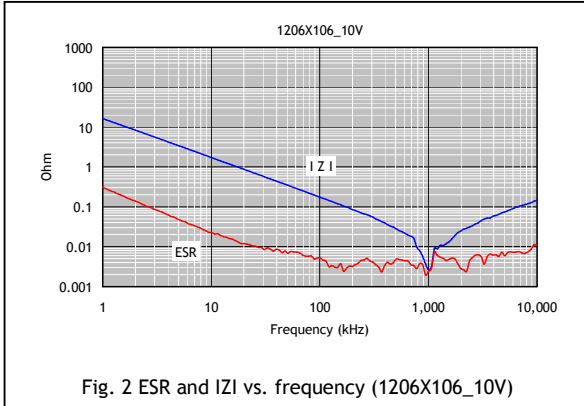
8. PACKAGING STYLE AND QUANTITY

Size	Thickness (mm)/Symbol	Paper tape		Plastic tape	
		7" reel	13" reel	7" reel	13" reel
0402 (1005)	0.50±0.05 N	10k	50k	-	-
0603 (1608)	0.80±0.07 S	4k	15k	-	-
	0.80+0.15/-0.10 X	4k	15k	-	-
0805 (2012)	0.80±0.10 B	4k	15k	-	-
	1.25±0.10 D	-	-	3k	10k
	1..25±0.20 I	-	-	3k	10k
1206 (3216)	0.95±0.10 C	-	-	3k	10k
	1.15±0.15 J	-	-	3K	10K
	1.25±0.10 D	-	-	3k	10k
	1.60±0.20 G	-	-	2k	-
	1.60+0.30/-0.10 P	-	-	2k	-
1210 (3225)	0.95±0.10 C	-	-	3k	10k
	1.25±0.10 D	-	-	3k	10k
	1.60±0.20 G	-	-	2k	-
	2.00±0.20 K	-	-	2k	-
	2.50±0.30 M	-	-	1k	-
1812 (4532)	1.25±0.10 D	-	-	1k	-
	2.00±0.20 K	-	-	1k	-
	2.50±0.30 M	-	-	0.5k	-

Unit: pieces

9. ELECTRICAL CHARACTERISTICS

Typical Impedance/ESR vs. Frequency



10. APPENDIXES

10.1 Tape & reel dimensions

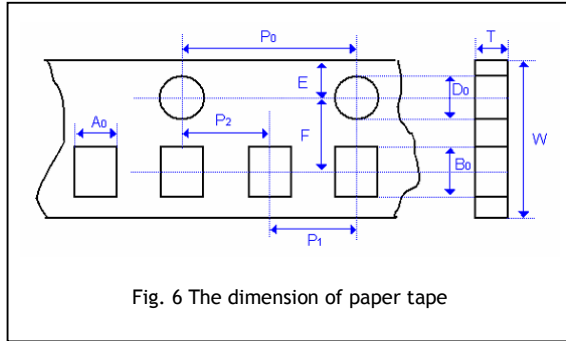


Fig. 6 The dimension of paper tape

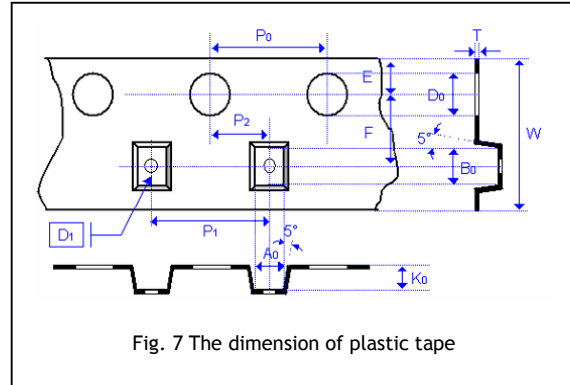


Fig. 7 The dimension of plastic tape

Size	0402	0603	0805			1206			1210			1812	
Thickness	N	S, X	A	B	C, D, I	B	C, J, D	G, P	C, D	G, K	M	D, K	M
A ₀	0.62±0.05	1.02±0.05	1.50±0.10	1.50±0.10	<1.57	2.00±0.10	<1.85	<1.95	<2.97	<2.97	<2.97	<3.81	<3.81
B ₀	1.12±0.05	1.80±0.05	2.30±0.10	2.30±0.10	<2.40	3.50±0.10	<3.46	<3.67	<3.73	<3.73	<3.73	<5.30	<5.30
T	0.60±0.05	0.95±0.05	0.75±0.05	0.95±0.05	0.23±0.05	0.95±0.05	0.23±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 ₀	-	-	-	-	<2.50	-	<2.50	<2.50	<2.50	<2.50	<3.00	<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	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	12.0±0.20	12.0±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	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	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10
P ₁	2.00±0.05	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	4.00±0.10	4.00±0.10	4.00±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	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	1.55±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05
D ₁	-	-	-	-	1.00±0.10	-	1.00±0.10	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±0.05	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	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	3.50±0.05	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

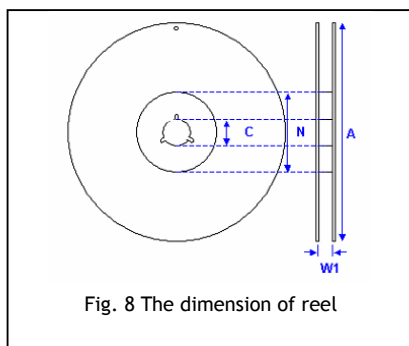


Fig. 8 The dimension of reel

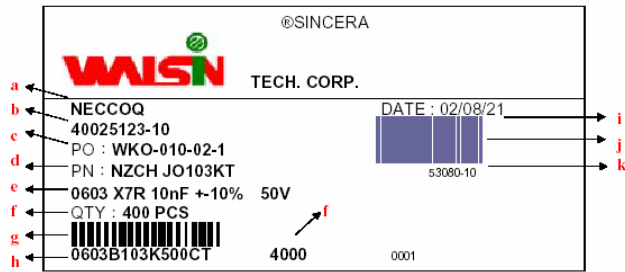
Size	0402, 0603, 0805, 1206, 1210			1812
Reel size	7"	10"	13"	7"
C	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2
W ₁	8.4+1.5/-0	8.4+1.5/-0	8.4+1.5/-0	12.4+2.0/-0
A	178.0±0.10	250.0±1.0	330.0±1.0	178.0±0.10
N	60.5±1.0	100.0±1.0	100±1.0	60.5±1.0

MULTILAYER CERAMIC CAPACITORS

High Capacitance Series



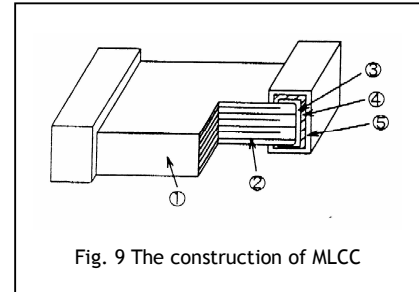
Description of customer label



- a. Customer name
- b. WTC order series and item number
- c. Customer P/O
- d. Customer P/N
- e. Description of product
- f. Quantity
- g. Bar code including quantity & WTC P/N or customer
- h. WTC P/N
- i. Shipping date
- j. Order bar code including series and item numbers
- k. Serial number of label

Constructions

No.	Name	X7R, X5R, Y5V
①	Ceramic material	BaTiO ₃ based
②	Inner electrode	Ni
③	Termination	Inner layer
④		Middle layer
⑤		Outer layer
		Sn (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.

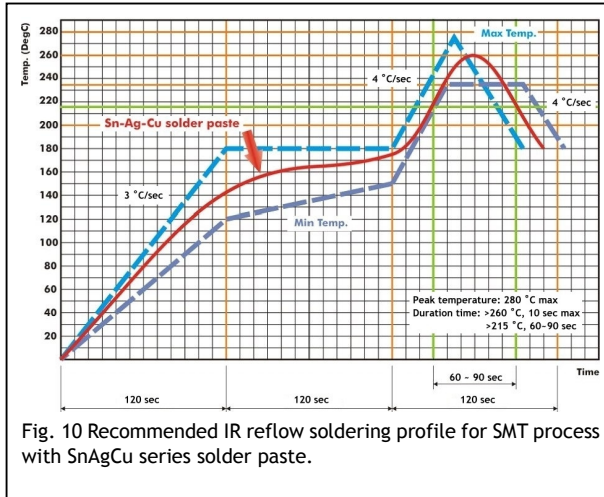


Fig. 10 Recommended IR reflow soldering profile for SMT process with SnAgCu series solder paste.

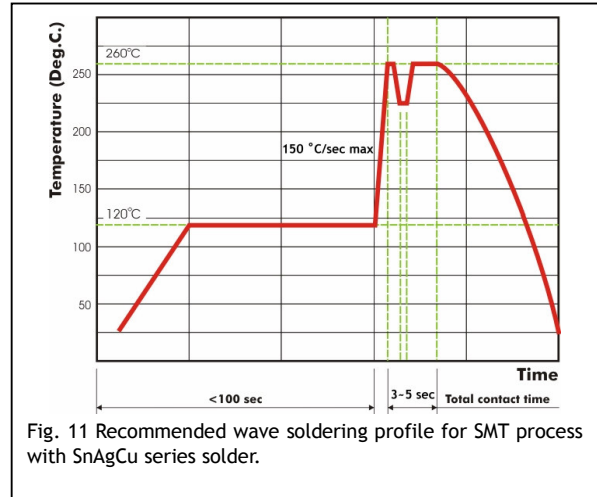


Fig. 11 Recommended wave soldering profile for SMT process with SnAgCu series solder.