

APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Safety Certified X1/Y2 Series

1808 to 2220 Sizes

NP0 & X7R Dielectrics

RoHS Compliance

*Contents in this sheet are subject to change without prior notice.



1. INTRODUCTION

WTC's SAFETY CERTIFIED CAPACITORS are designed for surge or lightning immunity in modem facsimile and other equipments. The capacitors of series S2 are class X1/Y2 compliant respectively.

The green type capacitors in S2 and S3 series are manufactured by using environmentally friendly materials without lead or cadmium.

The terminations are composed of plated nickel and pure tin to feature the superior leaching resistance during soldering.

2. FEATURES

- a. High reliability and stability.
- b. Small size and high capacitance
- c. RoHS compliant
- d. Safety standard approval by EN 60384-14:2005, IEC 60384-14:2005, UL 60384-14
- e. Certificate number:

TUV: R50021351, R50118359, R50195920,

UL: E250427, E182369

f. HALOGEN compliant

3. APPLICATIONS

- a. Modem.
- b. Facsimile.
- c. Telephone.
- d. Other electronic equipment for lighting or surge protection and isolation.





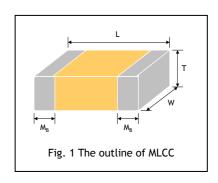
4.HOW TO ORDER

<u>S2</u>	<u>42</u>	N	<u>100</u>	<u>J</u>	302	<u>L</u>	I
<u>Series</u>	<u>Size</u>	<u>Dielectric</u>	<u>Capacitance</u>	Tolerance	Rated voltage	Termination	<u>Packaging</u>
S2 =X1/Y2	42 =1808 (4520) 43 =1812 (4532) 52 =2211 (5728) 55 =2220 (5750)	N =NP0 B =X7R	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 0R5=0.5pF 1R0=1.0pF 100=10x10 ⁰ =10pF		Two significant digits followed by no. of zeros. And R is in place of decimal point. 202: 2000VDC 302: 3000VDC 502: 5000 Impulse Voltage 602: 6000 Impulse Voltage	C =Cu/Ni/Sn L =Ag/Ni/Sn	T=7" reeled



5. EXTERNAL DIMENSIONS & STRUCTURE

Size Inch (mm)	L (mm)	W (mm)	T (mm)	M _B (mm)
1808 (4520)	4.50±0.50	2.03±0.25		0.75±0.35
1812 (4532)	4.50±0.50	3.20±0.40	1.25±0.10 (D) 1.40±0.15 (F) 1.60±0.20 (G)	0.75±0.35
2211 (5728)	5.70±0.40	2.80±0.30	2.00±0.20 (K) 2.50±0.30 (M) 2.80±0.30 (U)	0.75±0.35
2220 (5750)	5.70±0.40	5.00±0.40	(-)	0.85±0.35



6.GENERAL ELECTRICAL DATA

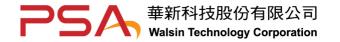
Dielectric	NP0 X7R				
Size	1808, 1812, 2211 1808, 1812, 2211, 2220				
Capacitance	4pF to 680pF	100pF to 4700pF			
Capacitance tolerance	J (±5%), K (±10%)				
Rated voltage (WVAC)	250Vac				
Q/ DF(Tan δ)	Cap<30pF: Q≥400+20C DF≤2.5%				
Insulation resistance at Ur	≥10GΩ				
Peak impulse voltage	5000V ~ 6000V				
Operating temperature	-55 to +125°C				
Capacitance characteristic	±30ppm ±15%				
Termination	Ni/Sn (lead-free termination)				
Certified number	TUV: R500021351,R50118359, R50195920,UL: E250427, E182369				
Test standard	EN 60384-14:2005, IEC 60384-14:2005, EN 6	60384-14:2005, UL 60950:2000, UL 60384-14			

^{*} NP0 : Apply 1.0±0.2Vrms, 1.0MHz±10%, at 25°C ambient temperature X7R: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 25°C ambient temperature.

7.PACKAGE DIMENSION AND QUANTITY

Size	Thickness (mm)/\$v	mbol	Plastic tape		
Size	Thickness (IIIII//Sy	Thickness (mm)/Symbol		13" reel	
	1.40±0.15	F	2k	-	
1808 (4520)	1.60±0.20	G	2k	8k	
	2.00±0.20	K	1k	6k	
	1.60±0.20	G	1k		
1812 (4532)	2.00±0.20	K	1k	-	
	2.50±0.30	М	0.5k	3k	
	1.60±0.20	G	1k	-	
2244 (5720)	2.00±0.20	K	1k	-	
2211 (5728)	2.50±0.30	М	0.5k	-	
	2.80±0.30	U	0.5k	-	
2220 (5750)	2.00±0.20	K	1k	-	
2220 (5750)	2.50±0.30	М	0.5k	-	

Unit: pieces



8-1.CAPACITANCE RANGE-NME TYPE

DIELECTRIC			NP0	
	SIZE	1808 1812		2211
RA	TED VOLTAGE (VDC)		3000	
PEA	K IMPULSE VOLTAGE		5000	
	4pF (4R0)	F*		K*
	5pF (5R0)	F*		K*
	10pF (100)		D*	K*
	12pF (120)		D*	K*
	15pF (150)	F*	D*	K*
	18pF (180)	F*	D*	K*
	22pF (220)		D*	K*
	27pF (270)		D*	K*
	33pF (330)	F*	D*	K*
	39pF (390)		D*	K*
ဗ	47pF (470)	G*	D*	K*
g	56pF (560)		D*	K*
Ğ	68pF (680)		D*	K*
Capacitance	82pF (820)		D*	K*
ပိ	100pF (101)	K*	D*	K*
	120pF (121)	K*	D*	M*
	150pF (151)	K*	D*	M*
	180pF (181)		D*	M*
	220pF (221)		K*	M*
	270pF (271)		K*	M*
	330pF (331)		K*	M*
	390pF (391)		K*	M*
	470pF (471)		K*	M*
	560pF (561)			M*
	680pF (681)	and at a familiar the the the same		M*

- 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.
- 3. The letter in cell with "*" mark is expressed product with Ag/Ni/Sn terminations.

	DIELECTRIC)	(7R		
	SIZE	1808	1812	2211	2220	
RA	TED VOLTAGE (VDC)		3	3000		
PEA	K IMPULSE VOLTAGE		5	000		
	56pF (560)					
	68pF (680)					
	82pF (820)					
	100pF (101)	G*				
	120pF (121)					
	150pF (151)		G*	G*		
	180pF (181)	G*	G*	G*	K*	
	220pF (221)		G*	G*	K*	
	270pF (271)	K*	G*	G*	K*	
ဗ္	330pF (331)	K*	G*	G*	K*	
tan	390pF (391)		G*	G*	K*	
Capacitance	470pF (471)	K*	G*	K*	K*	
ap	560pF (561)	K*	G*	K*	K*	
Ö	680pF (681)	K*	K*	K*	K*	
	820pF (821)		K*	K*	K*	
	1,000pF (102)	K*	M*	M*	K*	
	1,200pF (122)			M*	M*	
	1,500pF (152)			M*	M*	
	1,800pF (182)			M*	M*	
	2,200pF (222)			M*	M*	
	2,700pF (272)				M*	
	3,300pF (332)				M*	
	4,700pF (472)				M*	

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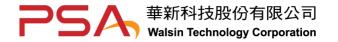
8-2.CAPACITANCE RANGE-BME TYPE

	DIELECTRIC	NP0				
	SIZE	1808	1812	22	11	
RA	TED VOLTAGE (VDC)	3000	3000	30	00	
PEA	K IMPULSE VOLTAGE	5000	5000	5000	6000	
	4pF (4R0)	F		K	K	
	5pF (5R0)	F		K	K	
	10pF (100)	F	D	K	K	
	12pF (120)	F	D	K	K	
	15pF (150)	F	D	K	K	
	18pF (180)	F	D	K	K	
	22pF (220)	F	D	K	K	
	27pF (270)	F	D	K	K	
	33pF (330)	F	D	K	K	
	39pF (390)	G	D	K	K	
ဥ	47pF (470)	G	D	K	K	
Capacitance	56pF (560)	G	D	K	K	
SC.	68pF (680)	G	D	K	M	
abi	82pF (820)	G	D	K	M	
Ö	100pF (101)		D	K	U	
	120pF (121)		D			
	150pF (151)		K			
	180pF (181)					
	220pF (221)					
	270pF (271)					
	330pF (331)					
	390pF (391)					
	470pF (471)					
	560pF (561)					
	680pF (681)					

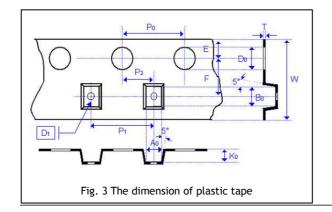
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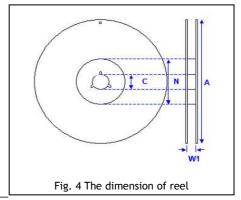
	DIELECTRIC		X7R
	SIZE	2211	2220
RA	TED VOLTAGE (VDC)		3000
PEA	K IMPULSE VOLTAGE		5000
	56pF (560)		
	68pF (680)		
	82pF (820)		
	100pF (101)		
	120pF (121)		
	150pF (151)	G	IZ.
	180pF (181)	G G	K K
	220pF (221) 270pF (271)	G G	K
Φ	330pF (331)	G	K
ž	390pF (391)	G	K
詩	470pF (471)	K	K
Capacitance	560pF (561)	K	K
Sa	680pF (681)	K	K
	820pF (821)	K	K
	1,000pF (102)	M	K
	1,200pF (122)		
	1,500pF (152)		
	1,800pF (182)		
	2,200pF (222)		
	2,700pF (272)		
	3,300pF (332)		
	4,700pF (472)		

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EMBOSSED TAPE DIMENSIONS





Size	18	08	18	12	22	11	2:	220
Chip Thickness	1.25±0.10 1.40±0.15 1.60±0.20	2.00±0.20	1.25±0.10 1.60±0.20 2.00±0.20	2.50±0.30	1.60±0.20 2.00±0.20	2.50±0.30 2.80±0.30	2.00±0.20	2.50±0.30
A ₀	<2.50	<2.50	<3.90	<3.90	<3.30	<3.30	<3.30	<3.30
B ₀	<5.30	<5.30	<5.30	<5.30	<6.50	<6.50	<6.50	<6.50
Т	0.25±0.05	0.25±0.05	0.25±0.05	0.25±0.05	0.30±0.10	0.30±0.10	0.30±0.10	0.30±0.10
K _o	<2.50	<2.50	<2.50	<3.00	<2.50	<3.10	<2.50	<3.10
W	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	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
10xP₀	40.0±0.20	40.0±0.20	40.0±0.20	40.0±0.20	40.0±0.20	40.0±0.20	40.0±0.20	40.0±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	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
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	1.50+0.10/-0	1.50+0.10/-0
D_1	1.50±0.10	1.50±0.10	1.50±0.10	1.50+/-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+/-0.1	1.75±0.1	1.75±0.10	1.75±0.1	1.75±0.10
F	5.50±0.05	5.50±0.05	5.50±0.05	5.50+/-0.05	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05

Size	1808, 1812, 2211, 2220
Reel size	7"
С	13.0+0.5/-0.2
W_1	12.4+2.0/-0
Α	178.0±0.10
N	80.0±1.0



9. APPLICATION NOTES

Storage

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 capacitors should be used within 6 months and checked the solderability before use.

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.

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 4°C per second and the final preheat temperature should be within 100°C of the soldering temperature for small chips such as 0402, 0603, 0805 and 1206, within 50°C of the soldering temperature for bigger chips such as 1210, 1808, 1812, 1825, 2220 and 2225, etc.

Soldering

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.

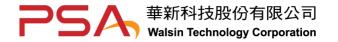
Hand soldering with temperature-controlled iron not exceeding 30 watts and diameter of tip less than 1.2 mm is recommended, tip of iron should not contact the ceramic body directly, and the temperature of iron should be set to not more than 260°C.

For bigger chips such as 1210, 1808, 1812, 2220 and 2225, etc. wave soldering and hand soldering are no recommended.

Refer IPC/JEDEC J-STD-020D Method recommended soldering profiles:

Reflow not sooner than 15 minutes and not longer than 4 hrs after removal from the temperature/humidity chamber, subject the sample to 3 cycle of the appropriate reflow conditions as defined as blow Table description.

Profile Feature	Pb-Free Assembly
Preheat/Soak	
Temperature Min.(T _{S min})	150°C
Temperature Max.(T _{S max})	200°C
Time(t_S) from ($T_{S min}$ to $T_{S max}$)	60 to 120 seconds
Ramp-up rate(T _L to T _P)	3°C/second max.
Liquidous temperature(T _L)	217°C
Time(t _L) maintained above T _L	60 to 150 seconds
Peak package body temperature(T _P)	For user T _P must not exceed the Classification temp 260°C For suppliers T _P must equal or exceed the
	Classification temp 260°C
$Time(T_P)^*$ within 5°C of the specified classification temperature(T_C)	30* second
Ramp-down rate (T _P to T _L)	6°C/second max.
Time 25°C to peak temperature 260°C	8 minutes max.

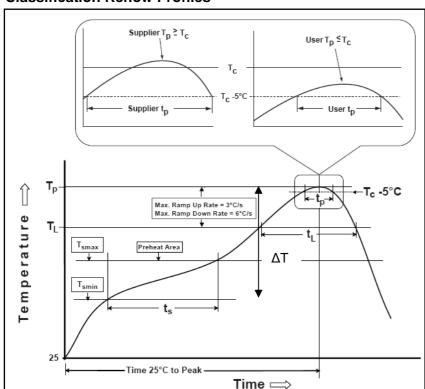


Lead-free: Soldering temperature = 235 to 260°C, depending on product.

Maximum temperature = Minimum temperature (235°C)+ Δ T+ Tolerance for oven process and measurement(5 ~ 7°C)

Time at peak temperature = 10sec, Dwell above 217°C = 90sec, Ramping rate = 3°C/sec (heating) and 6°C/sec (heating).

Classification Reflow Profiles



Chip Size	ΔΤ
0805,1206	100 °C
1210, 1808, 1812, 1825, 2211, 2220, 2225	50°C

Soldering	Solder Temp.(T _C)	Soldering Time (t _P)
Reflow	235 – 260 °C	< 15 sec.

Note: For example, T_C is 260°C and time t_P is 15 seconds.

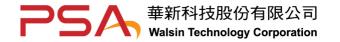
For user: The peak temperature must not exceed 260°C. The time above 255°C must not exceed 15 seconds.

Cooling

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. A cooling rate not exceeding 4°C per second should be used when forced cooling is necessary.

Cleaning

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.



10.RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Standard Method	Test Condition	Requirements	
1.	Visual	IEC 60384-1		* No remarkable defect.	
	examination	4.1		* Dimensions to confirm to individual specification sheet.	
	and				
	Dimensions				
2.	Capacitance	IEC 60384-1	Class I (C0G/NPO): 1.0±0.2Vrms,	* Capacitance is within specified tolerance	
		4.2.2	1MHz±10% For $C_R \le 100$ pF	* C _R means rated capacitance for conform to the E6 series of	
			1KHz±10% For C _R > 100pF	preferred values given in IEC 60063.	
3.	D.F.	IEC 60384-1		Class I (C0G/NPO): Cap≥30pF, D.F≤0.1%;	
	(Dissipation	4.2.3	Class II (X7R): 1.0±0.2Vrms, 1KHz±10%	Cap<30pF, D.F≤1/(400+20C)	
	Factor)			Class II (X7R): ≤2.5%	
	Tangent of				
	loos angle				
4.	Temperature		With no electrical load.	TO Occasitance Observe	
	Coefficient	60384-21/22	T.C. Operating Temp C0G(NPO) -55~125°C at 25°C	T.C. Capacitance Change C0G(NPO) Within ±30ppm/°C	
		4.6	X7R -55~125°C at 25°C	X7R Within ±15%	
5.	Insulation	IEC	* To apply voltage at 500VDC for 60 sec.	Class I (NP0): $\geq 100G\Omega$ or RxC $\geq 1000 \Omega$ -F whichever is smaller.	
٥.		60384-21/22	* The charge current shall not exceed	Class II (X7R): $\geq 10G\Omega$ or RxC $\geq 500 \Omega$ -F whichever is smaller.	
		4.5.3	0.05A.		
6.	Voltage	IEC 60384-14	* To apply voltage:	* No evidence of damage or flashover during test.	
	proof	4.2.1	X Capacitor: 1075Vdc (4.3U _R)	* The voltage shall be raised from the near zero to the	
	(Dielectric		Y Capacitor: 1500Vac	test voltage a rate not exceeding 150V(r.m.s.)/sec.	
	Strength)		* Duration: 60 sec.		
	0 ,		* The charge current shall not exceed		
			0.05A.		
7.	Solderability	IEC	* Solder temperature: 245±5°C	75% min. coverage of all metalized area.	
		60384-21/22	* Dipping time: 2±0.2 sec.		
		4.10			
8.	Resistance	IEC 60384-14	* Solder temperature: 260±5°C		
	to Soldering Heat	4.4 IEC	* Dipping time: 10±1 sec * Preheating: 120 to 150°C for 1 minute		
	ricat	60384-21/22	before immerse the capacitor in a		
		4.9	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.	I.R: More than 1GΩ	
			* Measurement to be made after keeping at		
			room temp. for 24±2 hrs (Class I) and		
	11	IEO 0000111	48±4 hrs (Class II)	* No second able days as	
9.	Humidity (Damp Heat)	IEC 60384-14	* Test temp.: 40±2°C * Humidity: 90~95% RH	* No remarkable damage. * Cap change:	
	Steady State	7.14	* Test time: 500+24/-0hrs.	NP0 within ±5% or ±0.5pF whichever is larger	
	•		* Applied Voltage:250Vac	X7R within ±15%	
			* Measurement to be made after keeping	* D.F Value:	
			at room temp. for 24±2 hrs (Class I) and 48±4 hrs (Class II)	NP0 ≤ 0.25% X7R: ≤5.0%	
			7017 IIIS (Class II)	* I.R. ≥1GΩ	
				* Dielectric strength satisfies the specified initial value	

No.	Item	Standard Mathod	Test Condition	Requirements
10.	Endurance	IEC 60384-14 4.14	* Impulse Voltage: Each individual capacitor shall be subjected to a Vp = 5.0KV (X1Y2 Class Impulse 5KV) & Vp = 6.0KV (X1Y2 Class Impulse 6KV) impulse for three times before applied to endurance test. Additional pulse test 10/700µs before endurance test for Y3 class (IEC60950) *Test Temp.: 125±3°C * Test time:: 1000+48/-0 hrs. * Applied Voltage: X capacitor: 1.25U _R (312.5Vac) Y capacitor: 1.70U _R (425Vac) Once every hour the voltage shall be increased to 1000Vrms for 0.1 sec. * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) and 48±4 hrs (Class II)	* Appearance : No mechanical damage. * Cap change: NP0 within ±5% or ±0.5pF whichever is larger. X7R within ±20% * D.F Value: NP0 ≤ 0.25% X7R: ≤5.0% * I.R. ≥1GΩ * Dielectric strength satisfies the specified initial value
12.	Resistance to Flexure of Substrate Robustness of terminations (Adhesive Strength of Termination)	IEC 60384-21/22 4.8 IEC 60384-21/22 4.15 IEC 60384-1 4.13	* Capacitors mounted on a substrate. The board shall be bent 1mm with a rate of 1mm/sec. 20 45±1 * Capacitors mounted on a substrate. A force of 10N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10±1 sec.	* Cap change is less than 10%. (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.) * No remarkable damage or removal of the terminations.
_	Passive Flammability	IEC 60384-14 4.17 IEC 60384-1 4.38	* Volume sample: 21.56 mm ³ * Flame exposure time: 5 sec Max. * Category of flammability : C.	* Capacitor didn't burn at all.
	Active Flammability	IEC 60384-21/22 4.18	* The capacitors applied UR (250Vac). Then each sample shall be subjected to 20 discharges from a tank capacitor, charge to a voltage that, when discharged, plase Ui 2500V for X2Y3, Ui 5000V for X1Y2 across the capacitor under test. The interval between successive discharges shall be 5 sec.	* The cheese cloth shall not burn with a flame.
15.	Impulse Voltage	IEC 60384-14 4.13	* X1 : 4.0KV, X2 : 2.5KV. * Y2 : 5.0KV, Y3 : None. * Number of impulse : 24 max.	*There shall be no permanent breakdown or flashover.