High Voltage Surface Mount MLCCs 250 - 6,000 VDC

These high voltage capacitors feature a special internal electrode design which reduces voltage concentrations by distributing voltage gradients throughout the entire capacitor.
This unique design also affords increased capacitance values in a given case size and voltage rating. The capacitors are designed and manufactured to the general requirement of EIA198 and are subjected to a 100% electrical testing making them well suited for a wide variety of telecommunication, commercial, and industrial applications.

Applications

- Analog & Digital Modems
- Lighting Ballast Circuits
- DC-DC Converters
- LAN/WAN Interface
- Voltage Multipliers
- Back-lighting Inverters

Polyterm® soft termination option for demanding environments & processes available on select parts, please contact the factory.

Case Size

JDI /EIA		INCHES	(MM)
R15/0805	L	.080 ±.010	(2.03 ±.25)
	W	.050 ±.010	(1.27 ±.25)
	T	.055 Max.	(1.40)
	E/B	.020 ±.010	(0.51±.25)
R18/1206	L	.125 ±.010	(3.18 ±.25)
	W	.062 ±.010	(1.57 ±.25)
	T	.067 Max.	(1.70)
	E/B	.020 ±.010	(0.51±.25)
S41/1210	L	.125 ±.010	(3.18 ±.25)
	W	.095 ±.010	(2.41 ±.25)
	T	.080 Max.	(2.03)
	E/B	.020 ±.010	(0.51±.25)
R29/1808	L	.185 ±.020	(4.70 ±.51)
	W	.080 ±.010	(2.03 ±.25)
	T	.085 Max.	(2.16)
	E/B	.020 ±.010	(0.51±.25)

Capacitance Selection

RATED VOLTAGE	NP0 DIELECTRIC		X7R DIELECTRIC	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
250 VDC	-	-	1000 pF	0.022 µF
500 VDC	10 pF	680 pF	1000 pF	0.010 µF
630 VDC	10 pF	560 pF	1000 pF	6800 pF
1000 VDC	10 pF	390 pF	100 pF	2700 pF
250 VDC	-	-	1000 pF	0.068 µF
500 VDC	10 pF	1500 pF	1000 pF	0.033 µF
630 VDC	10 pF	1200 pF	1000 pF	0.027 µF
1000 VDC	10 pF	1000 pF	100 pF	0.010 µF
2000 VDC	10 pF	220 pF	100 pF	4700 pF
3000 VDC	10 pF	82 pF	100 pF	1000 pF
250 VDC	-	-	1000 pF	0.150 µF
500 VDC	10 pF	3900 pF	1000 pF	0.068 µF
630 VDC	10 pF	2700 pF	1000 pF	0.047 µF
1000 VDC	10 pF	1800 pF	100 pF	0.015 µF
2000 VDC	10 pF	560 pF	100 pF	4700 pF
3000 VDC	10 pF	220 pF	100 pF	1000 pF
500 VDC	10 pF	4700 pF	1000 pF	0.100 µF
630 VDC	10 pF	3300 pF	1000 pF	0.047 µF
1000 VDC	1.0 pF	2200 pF	100 pF	0.022 µF
2000 VDC	1.0 pF	820 pF	100 pF	0.010 µF
3000 VDC	1.0 pF	470 pF	100 pF	3300 pF
4000 VDC	1.0 pF	180 pF	100 pF	1800 pF
5000 VDC	1.0 pF	75 pF	47 pF	390 pF
6000 VDC	1.0 pF	75 pF	47 pF	150 pF

Available cap. values include these significant retma values and their multiples: 1.0 1.2 1.5 1.8 2.2 2.7 3.3 3.9 4.7 5.6 6.8 8.2
(1.0 = 1.0, 10, 100, 1000, etc.) Consult factory for non-retma values and sizes or voltages not shown.

High Voltage Surface Mount MLCCs 250 - 6,000 VDC

RoHS

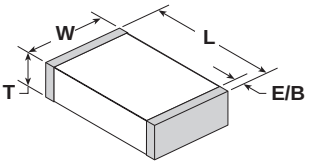
Case Size

JDI /EIA		INCHES	(MM)
S43 / 1812	L	.177 ±.012	(4.50 ±.30)
	W	.125 ±.010	(3.18 ±.25)
	T	.110 Max.	(2.80)
	E/B	.025 ±.015	(0.64±.38)
S49 / 1825	L	.180 ±.010	(4.57 ±.25)
	W	.250 ±.010	(6.35 ±.25)
	T	.140 Max.	(3.56)
	E/B	.025 ±.015	(0.64±.38)
S47 / 2220	L	.225 ±.015	(5.72 ±.38)
	W	.200 ±.015	(5.08 ±.38)
	T	.150 Max.	(3.81)
	E/B	.025 ±.015	(0.64±.38)
S48 / 2225	L	.225 ±.010	(5.72 ±.25)
	W	.255 ±.015	(6.48 ±.38)
	T	.160 Max.	(4.06)
	E/B	.025 ±.015	(0.64±.38)

Capacitance Selection

RATED VOLTAGE	NP0 DIELECTRIC		X7R DIELECTRIC	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
250 VDC	-	-	0.010 µF	0.470 uF
500 VDC	100 pF	8200 pF	1000 pF	0.330 uF
630 VDC	100 pF	6800 pF	1000 pF	0.120 µF
1000 VDC	10 pF	5600 pF	1000 pF	0.100 µF
2000 VDC	10 pF	1800 pF	100 pF	0.010 µF
3000 VDC	10 pF	1000 pF	100 pF	4700 pF
4000 VDC	10 pF	390 pF	100 pF	1200 pF
5000 VDC	10 pF	150 pF	100 pF	820 pF
6000 VDC	10 pF	150 pF	10 pF	330 pF
500 VDC	100 pF	0.018 µF	0.01 µF	0.390 µF
630 VDC	100 pF	0.015 µF	0.01 µF	0.270 µF
1000 VDC	10 pF	0.012 µF	1000 pF	0.180 µF
2000 VDC	10 pF	5600 pF	100 pF	0.039 µF
3000 VDC	10 pF	2200 pF	100 pF	8200 pF
4000 VDC	10 pF	1200 pF	100 pF	2200 pF
5000 VDC	10 pF	390 pF	100 pF	1500 pF
6000 VDC	10 pF	390 pF	100 pF	820 pF
500 VDC	1000 pF	0.018 µF	0.01 µF	0.470 µF
630 VDC	1000 pF	0.018 µF	0.01 µF	0.270 µF
1000 VDC	100 pF	0.015 µF	1000 pF	0.120 µF
2000 VDC	100 pF	5600 pF	1000 pF	0.039 µF
3000 VDC	10 pF	2700 pF	100 pF	0.010 µF
4000 VDC	10 pF	1500 pF	100 pF	2700 pF
5000 VDC	10 pF	470 pF	100 pF	1500 pF
6000 VDC	10 pF	470 pF	100 pF	820 pF
500 VDC	1000 pF	0.027 µF	0.01 µF	0.560 µF
630 VDC	1000 pF	0.022 µF	0.01 µF	0.390 µF
1000 VDC	100 pF	0.018 µF	1000 pF	0.180 µF
2000 VDC	100 pF	8200 pF	1000 pF	0.056 µF
3000 VDC	10 pF	3300 pF	100 pF	0.012 µF
4000 VDC	10 pF	1800 pF	100 pF	3300 pF
5000 VDC	10 pF	470 pF	100 pF	2700 pF
6000 VDC	10 pF	470 pF	100 pF	1200 pF

Available cap. values include these significant retma values and their multiples: 1.0 1.2 1.5 1.8 2.2 2.7 3.3 3.9 4.7 5.6 6.8 8.2
(1.0 = 1.0, 10, 100, 1000, etc.) Consult factory for non-retma values and sizes or voltages not shown.



Electrical Characteristics

Meets the standard NP0 & X7R dielectric specifications listed on page 78

DIELECTRIC WITHSTANDING VOLTAGE — DWV = 1.5 X rated WVDC for ratings 500-999 WVDC,
DWV = 1.2 X rated WVDC for ratings ≥ 1,000 WVDC

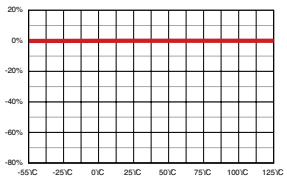
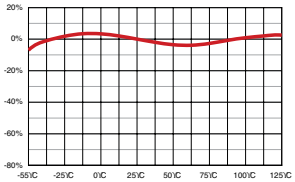
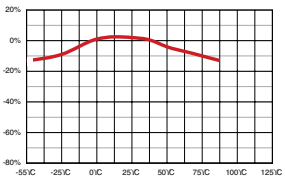
NOTE: Capacitors may require a surface coating to prevent external arcing. Solder mask should not be used beneath capacitors. For more information see JDI Tech Note "Surface Arc Season"

How to Order High Voltage Surface Mount

P/N written: 202R18W102KV4E

202	R18	W	102	K	V	4	E
VOLTAGE	SIZE	DIELECTRIC	CAPACITANCE	TOLERANCE	TERMINATION	MARKING	PACKING
501 = 500 V 631 = 630 V 102 = 1000 V 202 = 2000 V 302 = 3000 V 402 = 4000 V 502 = 5000 V 602 = 6000 V	R15 = 0805 R18 = 1206 R29 = 1808 S41 = 1210 S43 = 1812 S47 = 2220 S48 = 2225 S49 = 1825	N = NP0 W = X7R	1st two digits are significant; third digit denotes number of zeros. 102 = 1000 pF 104 = 0.10 µF	J = ± 5% K = ± 10% M = ± 20%	V = NI Barrier with 100% Sn Plating (Matte) F = Polyterm flexible termination T = SnPb	4 = Unmarked 6 = EIA Code	E = Embossed 7" T = Punched 7" No code = bulk Tape specs. per EIA RS481

ELECTRICAL CHARACTERISTICS

PARAMETER	NPO		X7R		X5R	
TEMPERATURE COEFFICIENT:	0± 30 ppm/°C	-55 to +125°C	± 15%	-55 to +125°C	± 15%	-55 to +85°C
						
DISSIPATION FACTOR:	.001 (0.1%) max		WVDC ≥ 50 VDC, DF = 2.5% max WVDC = 25 VDC, DF = 3.0% max WVDC = 16 VDC, DF = 3.5% max		For Vrated ≥ 50 VDC, DF = 5% max For Vrated ≤ 25 VDC: DF = 10% max	
AGING:	None		2.5% / decade hour		2.5 % / decade hour	
INSULATION RESISTANCE:	1000ΩF or 100GΩ whichever is less @ 25°C, WVDC		500ΩF or 50GΩ whichever is less @ 25°C, WVDC		100ΩF or 10GΩ whichever is less @ 25°C, WVDC	
DIELECTRIC STRENGTH:	For Vrated = 6 - 200 VDC, DWV = 2.5 X WVDC, 25°C, 50mA max. For Vrated = 201 - 499 VDC, DWV = 2.0 X WVDC, 25°C, 50mA max. For Vrated = 500 - 999 VDC, DWV = 1.5 X WVDC, 25°C, 50mA max. For Vrated = 1000+ VDC, DWV = 1.2 X WVDC, 25°C, 50mA max.				DWV = 2.5 X WVDC, 25°C, 50mA max.	
TEST PARAMETERS:	C > 100 pF; 1kHz ±50Hz;1.0±0.2 VRMS C ≤ 100 pF 1Mhz ±50kHz; 1.0±0.2 VRMS		1kHz ±50Hz;1.0±0.2 VRMS		1kHz ±50Hz; 0.5±0.2 VRMS	
NOTES:	Tanceram IR = 100 ΩF or 10 GΩ Tanceram DF for Vrated ≥ 50 VDC = 5% max. Tanceram DF for Vrated ≤ 25 VDC, DF = 10% max					

JOHANSON DIELECTRICS SOLDER REFLOW RECCOMENDATIONS FOR LEAD FREE ASSEMBLY

Christopher England Applications Engineer/HVS products

General:

Soldering temperature profiles used must provide adequate temperature rise time and cool-down time to prevent damage due to thermal shock. These guidelines are emphasized because cracking or other damage caused by handling or thermal shock is not necessarily apparent under ordinary visual inspection techniques. The damage can be very small (micro-cracks) and can occur under the terminations where even high magnification cannot detect them. The problem is further complicated by the fact that these micro-cracks may not be initially detectable by standard electrical testing. Once initiated, the cracks can grow with time and cause latent failures. Attention to these details will aid in the successful use of the inherently reliable multilayer ceramic capacitor.

Ceramic capacitors larger then EIA size 1812 are known to be very susceptible to thermal shock damage due to their large ceramic mass. These large parts require more care during installation than smaller surface mount devices. Higher temperatures are now required for "Lead Free" solder profiles. The attached diagram from J-STD-020C shows both standard and lead free profiles.

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average Ramp-Up Rate (Ts_{max} to Tp)	3 °C/second max.	3° C/second max.
Preheat – Temperature Min (Ts_{min}) – Temperature Max (Ts_{max}) – Time (ts_{min} to ts_{max})	 100 °C 150 °C 60-120 seconds	 150 °C 200 °C 60-180 seconds
Time maintained above: – Temperature (T_L) – Time (t_L)	 183 °C 60-150 seconds	 217 °C 60-150 seconds
Peak/Classification Temperature (Tp)	See Table 4.1	See Table 4.2
Time within 5 °C of actual Peak Temperature (tp)	10-30 seconds	20-40 seconds
Ramp-Down Rate	3 °C/second max	3 °C/second max.
Time 25 °C to Peak Temperature	6 minutes max.	8 minutes max.

Note 1: All temperatures refer to topside of the package, measured on the package body surface.

Table 1

Solder Pre-Heat Cycle:

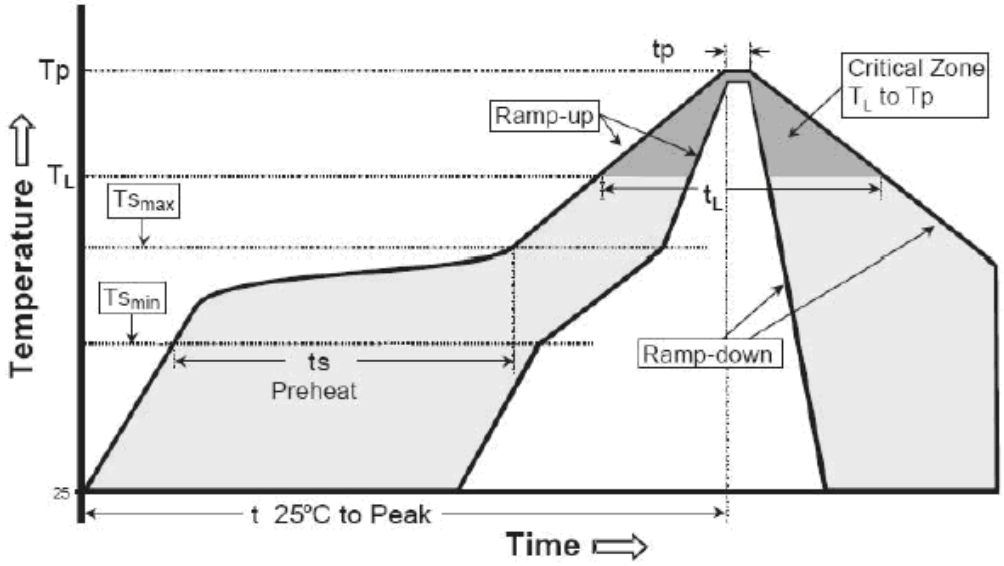
Proper preheating is essential to prevent thermal shock cracking of the capacitor. The circuit assembly should be preheated as shown in the recommended profiles at a rate of 1.0 to 3.0°C per second to within 75 to 125°C of the maximum soldering temperature. Temperature change should be distributed as evenly as possible throughout large capacitor bodies as applying heat or cold to a localized spot within the device may result in thermal gradients great enough to cause cracking.

SMT Reflow Soldering Temperature:

Solders typically utilized in SMT Reflow Solders have melting points between 179°C and 217°C. Activation of rosin fluxes occurs at about 200°C. Based on these facts reflow temperatures between 210 to 260°C should be adequate in most circumstances. Use of thermal profiling is advised for accurate characterization of circuit heat absorption and maximum component temperature conditions that occur during the soldering process.

Solder Reflow:

Recommended temperature profiles for reflow soldering are shown in Table 1 and Figure 1 from J-STD-020C

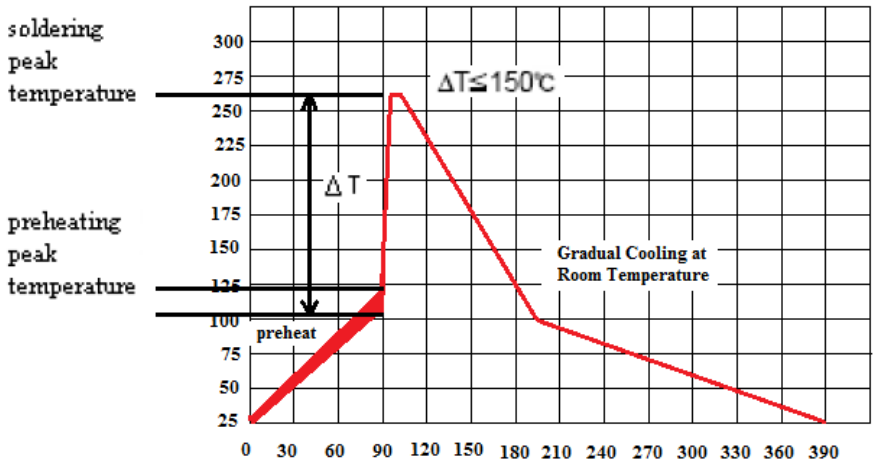


Solder Wave:

Solders typically utilized in the solder wavehave melting points between 179°C and 227°C. Wave soldering can be utilized for lead free assembly, but the preheat requirements generally make this process very difficult to accomplish as peak temperatures may reach 260°C . It is important that the preheat temperature is within 150°C of the solder wave peak temperature. And the maximum time at peak temperature should not be greater than 5 seconds. Wave soldering is not recommended for ceramic MLCCs larger then 1206 and thicker than 1.2mm size due to the incompatibility of the chip's mass with the steep temperature gradient typically present in this process. Cool down after solder wave requires rate control <2°C/sec.

Land patterns should be 2/3 narrower than the chip width to control solder fillet volume and minimize local Coefficient of Thermal Expansion (CTE) mismatch between the capacitor, solder and board.

figure 3 wave soldering guidelines



PREHEATING PEAK TEMPEATURE	100-120 C
SLDERING PEAK TEMPEATURE	250-260 C

Soldering Iron:

Ceramic capacitor attachment with a soldering iron is discouraged due to the inherent process control limitations. In the event that a soldering iron must be employed the following precautions are recommended.

- Preheat circuit and capacitors to within 100°C of soldering temperature
- Never contact the capacitor with the iron tip
- 20 watt iron output (max)
- 350°C tip temperature (max)
- 1.0 mm tip diameter (max)
- Limit soldering time to 3 sec..

Cool Down Cycle:

After the solder reflows properly the assembly should be allowed to cool gradually, again maintaining the thermal gradient of 3°C/sec. maximum at room ambient conditions. Attempts to speed this cooling process or immediate exposure of the circuit to cold cleaning solutions increase the possibility of thermal shock cracking of the ceramic capacitor.

Ceramic capacitor attachment with a soldering iron is discouraged due to the inherent process control limitations. In the event that a soldering iron must be employed the following precautions are recommended.

IPC 7351 Land Pattern Guidelines:

Appropriate pad design, solder application, and component orientation are all ingredients of a quality, defect-free soldering process. The Institute for Interconnecting and Packaging Electronic Circuits (IPC) has developed and published IPC 7351 "Surface Mount Design and Land Pattern Standard ". This standard presents industry consensus on optimum dimensions based on empirical knowledge of fabricated land patterns. The standard also contains an excellent analysis of solder joints and their relation to component, PCB, and placement tolerances. A summary of the IPC land pattern design recommendations for solder reflow and solder wave processes are listed in table below. It is highly recommended that the PCB designer/SMT process engineer obtain the complete IPC 7351 standard (http://www.ipc.org)

Tomb Stoning / Chip Movement:

Tomb-stoning or draw bridging is illustrated in figure 2. Tomb-stoning or other undesirable chip movements may result if unequal surface tension forces exist as the molten solder wets the MLCC terminations and mounting pads. This tendency can be minimized by insuring that all factors at both solder joints are equal, namely; pad size, solder mass, termination size, component position and heating. Tomb-stoning is easily avoided through proper design, material selection, control of solder mass and proofing of the process.

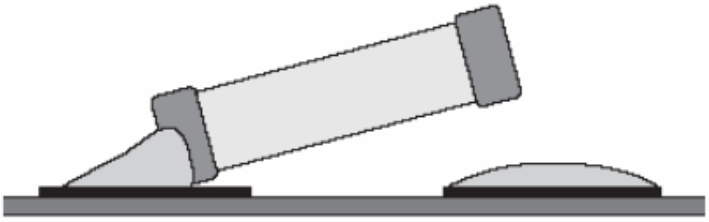
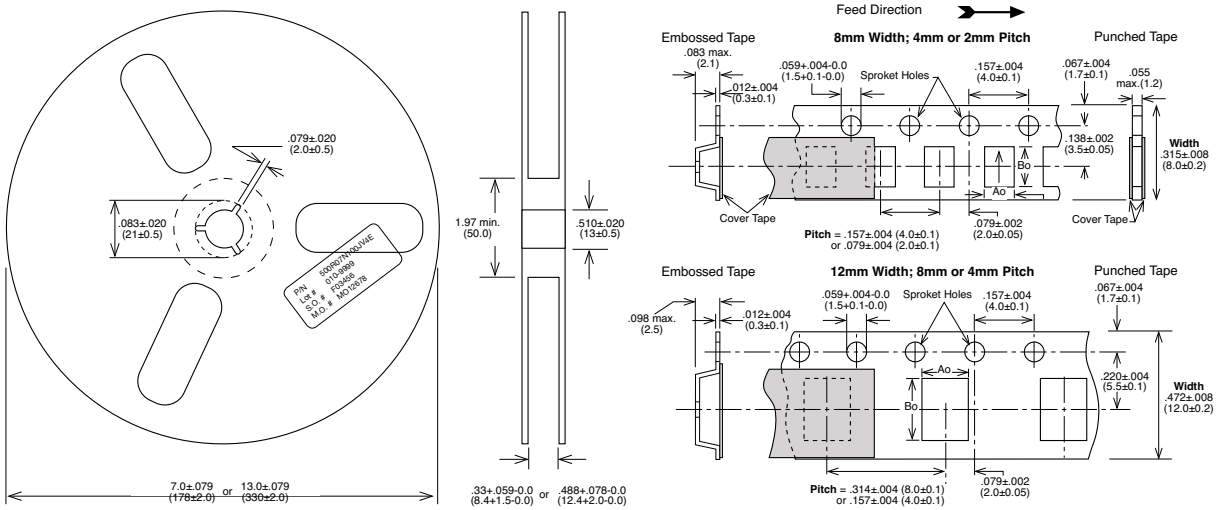


FIGURE 2

Capacitor Packaging

Johanson capacitors are available taped per EIA standard 481. Tape options include 7" and 13" diameter reels. Johanson uses high quality, dust free, punched 8mm paper tape and plastic embossed 8mm tape for thicker MLCCs. Quantity per reel ranges are listed in the tables below and are dependent on chip thickness.



	7" DIAMETER REEL				13" DIAMETER REEL			
COMPONENT	REEL QTY	TAPE TYPE	WIDTH / PITCH	CODE	REEL QTY	TAPE TYPE	WIDTH / PITCH	CODE
R05 / 0201 MLCC	15000	Paper	8mm/2mm	T	N/A	N/A		N/A
R07 / 0402 MLCC	10000	Paper	8mm/2mm	T	N/A	N/A		N/A
R14 / 0603 MLCC	4000	Paper	8mm/4mm	T	10000	Paper	8mm/4mm	R
R15 / 0805 MLCC	4000 / 3000	Paper / Embossed	8mm/4mm	T / E	10000	Paper / Embossed	8mm/4mm	R / U
R18 / 1206 MLCC	4000 / 3000	Paper / Embossed	8mm/4mm	T / E	10000	Paper / Embossed	8mm/4mm	R / U
S41 / 1210 MLCC	2000 - 4000	Embossed	8mm/4mm	E	5000-10000	Embossed	8mm/4mm	U
R29 / 1808 MLCC	2000	Embossed	12mm/4mm	E	5000 - 8000	Embossed	12mm/4mm	U
R30 / 2211 MLCC	1000 - 2000	Embossed	12mm/4mm	E	2000 - 5000	Embossed	12mm/4mm	U
S43 / 1812 MLCC	500 - 1000	Embossed	12mm/8mm	E	3000 - 5000	Embossed	12mm/8mm	U
S47 / 2220 MLCC	250 - 1000	Embossed	12mm/8mm	E	2000 - 5000	Embossed	12mm/8mm	U
S49 / 1825 MLCC	250 - 1000	Embossed	12mm/8mm	E	2000 - 4000	Embossed	12mm/8mm	U
S48 / 2225 MLCC	250 - 1000	Embossed	12mm/8mm	E	2000 - 4000	Embossed	12mm/8mm	U
X07 / 0402 X2Y	4000	Paper	8mm/2mm	T	10000	Paper	8mm/2mm	R
X14 / 0603 X2Y	4000	Paper	8mm/4mm	T	10000	Paper	8mm/4mm	R
X15 / 0805 X2Y	4000	Embossed	8mm/4mm	E	10000	Embossed	8mm/4mm	U
X18 / 1206 X2Y	3000 - 4000	Embossed	8mm/4mm	E	10000	Embossed	8mm/4mm	U
X41 / 1210 X2Y	2000 - 3000	Embossed	8mm/4mm	E				
X44 / 1410 X2Y	1000 - 2000	Embossed	8mm/4mm	E				
X43 / 1812 X2Y	1000	Embossed	12mm/8mm	E				

Actual reel quantities based on part thickness and tape type. Contact sales for reel quantities of specific part numbers.