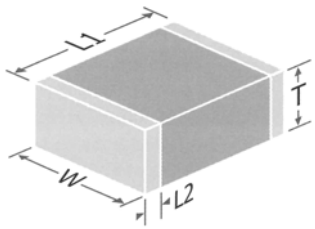
X7R

TCC / VCC Capacitor Range



Size	Length (L1)	Width (W)	Max Thickness (T)	Band (L2)
0603	1.6 ± 0.2	0.8 ± 0.2	0.8	0.10 - 0.04
0805	2.0 ± 0.3	1.25 ± 0.2	1.3	0.13 – 0.75
1206	3.2 ± 0.3	1.6 ± 0.2	1.6	0.25 – 0.75
1210	3.2 ± 0.3	2.5 ± 0.3	2.0	0.25 – 0.75
1808	4.5 ± 0.35	2.0 ± 0.3	2.0	0.25 – 1.0
1812	4.5 ± 0.35	3.2 ± 0.3	2.5	0.25 – 1.0
2220	5.7 ± 0.4	5.0 ± 0.4	4.2	0.25 – 1.0
2225	5.7 ± 0.4	6.3 ± 0.4	4.2	0.25 – 1.0

Note: All dimensions in mm

Electrical Details	
Capacitance Range	270pF to 1.8µF
Temperature Coefficient of Capacitance (TCC)	±15% from -55°C to +125°C
Dissipation Factor	≤ 0.025
Insulation Resistance (IR)	100GΩ or 1000secs (whichever is the less)
Dielectric Withstand Voltage (DWV)	Voltage applied for 5 ±1 seconds, 50mA charging current maximum
Ageing Rate	<2% per decade (typical)

X7R capacitors are available from Syfer with a defined capacitance variation under applied dc voltage, across the full operating temperature range. Whilst the capacitance of C0G/NP0 chips does not vary with applied voltage, standard X7R capacitors exhibit capacitance fluctuation but with no specified limit. For applications where a limit is required, Syfer is able to offer either a 'B' code dielectric (conforms to MIL 'BX' dielectric and IECQ-CECC '2X1') or 'R' code dielectric (conforms to MIL 'BZ' dielectric and IRCQ-CECC '2C1')

TCC / VCC Capacitors – 2C1 (BZ)

Capacitance	Code	0603	0805	1206	1210	1808	1812	2220	2225	Capacitance	Code
100pF	101	50V 100V	50V 100V 200V							100pF	101
120	121									120	121
150	151									150	151
180	181									180	181
220	221									220	221
270	271									270	271
330	331									330	331
390	391									390	391
470	471									470	471
560	561									560	561
680	681			50V 100V 200V						680	681
820	821									820	821
1.0nF	102				50V 100V 200V					1.0nF	102
1.2	122									1.2	122
1.5	152									1.5	152
1.8	182									1.8	182
2.2	222									2.2	222
2.7	272					50V 100V 200V				2.7	272
3.3	332									3.3	332
3.9	392									3.9	392
4.7	472						50V 100V 200V			4.7	472
5.6	562									5.6	562
6.8	682									6.8	682
8.2	822									8.2	822
10	103									10	103
12	123							50V 100V 200V		12	123
15	153									15	153
18	183									18	183
22	223				X	X				22	223
27	273									27	273
33	333									33	333
39	393			X						39	393
47	473									47	473
56	563						X			56	563
68	683									68	683
82	823				X	X				82	823
100	104					X		X		100	104
120	124									120	124
150	154									150	154
180	184									180	184
220	224									220	224
270	274									270	274
330	334									330	334
390	394							X		390	394
470	474							X		470	474
560	564								X	560	564
680	684									680	684
820	824									820	824
1.0µF	105									1.0µF	105
1.2µF	125							X		1.2µF	125
1.5µF	155									1.5µF	155

(X) =non RoHS compliant and FlexiCap™ termination only. Other values available in J, Y (FlexiCap™) and F terminations.

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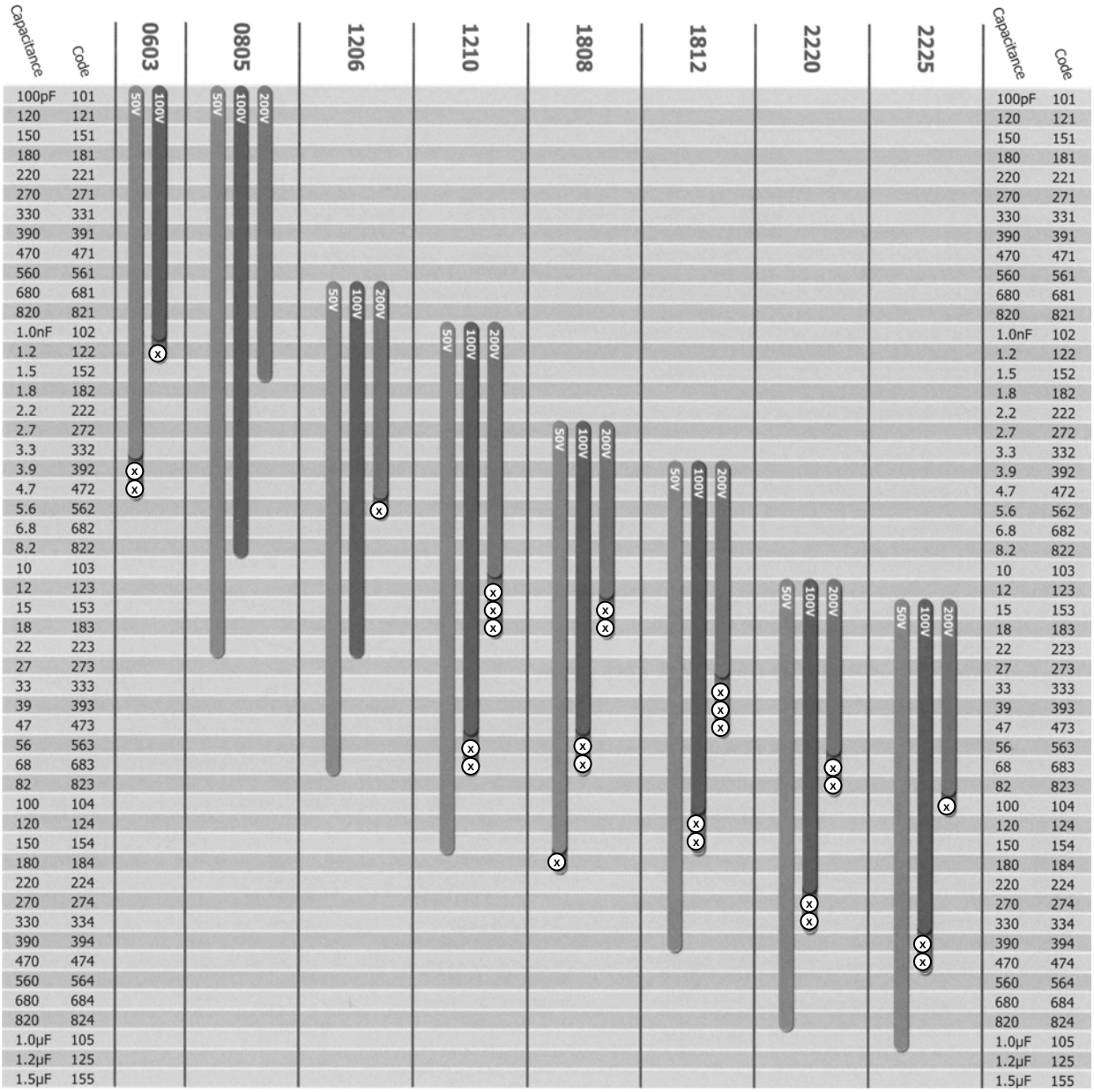
TCC/VCC Capacitors – 2X1 (BX)



(x) =non RoHS compliant and FlexiCap™ termination only. Other values available in J, Y (FlexiCap™) and F terminations.

		X7R		
Dielectric characteristics		Stable		
	IECQ-CECC	2C1	2R1	2X1
	EIA	-	X7R	-
	MIL	BZ	-	BX
Rated temperature range		-55˚C to +125˚C		
Maximum capacitance change over temperature range No DC voltage applied		±20%	±15%	±15%
Rated DC voltage applied		+20% -30%	-	+15% -25%
Syfer dielectric ordering code		**R**	**X**	**B**

For part numbering, the 'X' denoting the X7R dielectric code needs to be replaced by either 'B' or 'R'.
Please contact the Sales Office for full range information

Ordering Information – TCC/VCC Range

1210	Y	100	0103	J	X	T	□□□
Chip Size	**Termination**	**Voltage d.c. (marking code)**	**Capacitance in Pico farads (pF)**	**Capacitance Tolerance**	**Dielectric Codes**	**Packaging**	**Suffix Code**
0603 **0805** **1206** **1210** **1808** **1812** **2220** **2225**	**Y** = FlexiCap™ termination base with nickel barrier (100% matte tin plating). RoHS compliant. **H** = FlexiCap™ termination base with nickel barrier (tin/lead plating with min. 10% lead). Not RoHS compliant. **F** = Silver Palladium. RoHS compliant **J** = Silver base with nickel barrier (100% matte tin plating). RoHS compliant **A** = Silver base with nickel barrier (tin/lead plating with min. 10% lead). Not RoHS compliant	**050** = 50V **100** = 100V **200** = 200V	First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is the number of zeros following. e.g., **0101** = 100 pF Values are E12 series	**J**: ± 5% **K**: ± 10% **M**: ± 20%	**R** = 2C1/BZ **B** = 2X1/BX	**T** = 178mm (7") reel **R** = 330mm (13") reel **B** = Bulk pack – tubs or trays	Used for specific customer requirements

Soldering Information

Syfer MLCCs are compatible with all recognised soldering/mounting methods for chip capacitors. A detailed application note is available at syfer.com

Reflow Soldering

Syfer recommend reflow soldering as the preferred method for mounting MLCCs. Syfer MLCCs can be reflow soldered using a reflow profile generally defined in IPC/FEDEC J-STD-020. Sn plated termination chip capacitors are compatible with both conventional and lead free soldering with peak temperatures of 260 to 270°C acceptable.

The heating ramp rate should be such that components see a temperature rise of 1.5 to 4°C per second to maintain temperature uniformity through the MLCC.

The time for which the solder is molten should be maintained at a minimum, so as to prevent solder leaching. Extended times above 230°C can cause problems with oxidation of Sn plating. Use of an inert atmosphere can help if this problem is encountered. Palladium/Silver (Pd/Ag) terminations can be particularly susceptible to leaching with free lead, tin rich solders and trials are recommended for this combination.

Cooling to ambient temperature should be allowed to occur naturally, particularly if larger chip sizes are being soldered. Natural cooling allows a gradual relaxation of thermal mismatch stresses in the solder joints. Forced cooling should be avoided as this can induce thermal breakage.

Wave Soldering

Wave soldering is generally acceptable, but the thermal stresses caused by the wave have been shown to lead to potential problems with larger or thicker chips. Particular care should be taken when soldering SM chips larger than size 1210 and with a thickness greater than 1.0mm for this reason.

Maximum permissible wave temperature is 270°C for SM chips.

The total immersion time in solder should be kept to a minimum. It is strongly recommended that Sn/Ni plated terminations are specified for wave soldering applications.

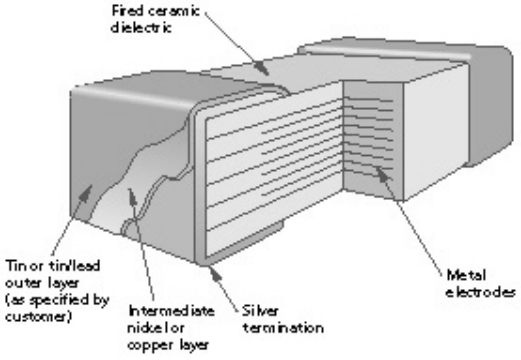
Solder Leaching

Leaching is the term for the dissolution of silver into the solder causing a failure of the termination system which causes increased ESR, tan δ and open circuit faults, including ultimately the possibility of the chip becoming detached.

Leaching occurs more readily with higher temperature solders and solders with a high tin content. Pb free solders can be very prone to leaching certain termination systems. Ro prevent leaching, exercise care when choosing solder allows and minimize both maximum temperature and dwell time with the molten solder.

Plated terminations with nickel or copper anti-leaching barrier layers are available in a range of top coat finishes to prevent leaching occurring. These finishes also include Syfer FlexiCap™ for improved stress resistance post soldering.

Multilayer ceramic chip with nickel or copper barrier termination



Rework of Chip Capacitors

Syfer recommend hot air/gas as the preferred method of applying heat for rework. Apply even heat surrounding the component to minimise internal thermal gradients. Soldering irons or other techniques that apply direct heat to the chip or surrounding area should not be used as these can result in micro cracks being generated.

Minimise the rework heat duration and allow components to cool naturally after soldering.

Use of Silver Loaded Epoxy Adhesives

Chip capacitors can be mounted to circuit boards using silver loaded adhesive provided the termination material of the capacitor is selected to be compatible with the adhesive. This is normally PdAg. Standard tin finishes are often not recommended for use with silver loaded epoxies as there can be electrical and mechanical issues with the joint integrity due to material mismatch.

Handling & Storage

Components should never be handled with fingers; perspiration and skin oils can inhibit solderability and will aggravate cleaning.

Chip capacitors should never be handled with metallic instruments. Metal tweezers should never be used as theses can chip the product and leave abraded metal tracks on the product surface. Plastic or plastic coated metal types are readily available and recommended – these should be used with an absolute minimum of applied pressure.

Incorrect storage can lead to problems for the user. Rapid tarnishing of the terminations, with an associated degradation of solderability, will occur if the product comes into contact with industrial gases such as sulphur dioxide and chlorine. Storage in free air, particularly moist or polluted air, can result in termination oxidation.

Packaging should not be opened until the MLCs are required for use. If opened, the pack should be re-sealed as soon as practicable. Alternatively, the contents could be kept in a sealed container with an environmental control agent.

Long term storage conditions, ideally, should be temperature controlled between -5 and +40°C and humidity controlled between 40% and 60% R.H.

Taped product should be stored out of direct sunlight, which might promote deterioration in tape or adhesive performance.

Product, stored under the conditions recommended above, in its "as received" packaging, has a minimum shelf life of 2 years.

SM Pad Design

Syfer conventional 2-terminal chip capacitors can generally be mounted using pad designs in accordance with IPC-7351, Generic Requirements for Surface Mount Design and Land Pattern Standards, but there are some other factors that have been shown to reduce mechanical stress, such as reducing the pad width to less than the chip width. In addition, the position of the chip on the board should also be considered.

3-terminal components are not specifically covered by IPC-7351, but recommended pad dimensions are included in the Syfer catalogue/website for these components.

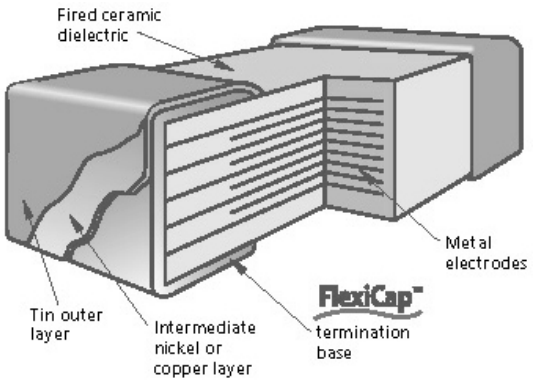
FlexiCap™ Termination

FlexiCap™ has been developed as a result of listening to customer's experiences of stress damage to MLCCs from many manufacturers, often caused by variations in production processes.

Our answer is a proprietary flexible epoxy polymer termination material, that is applied to the device under the usual nickel barrier finish. FlexiCap™ will accommodate a greater degree of board bending than conventional capacitors.

All ranges are available with FlexiCap™ termination material offering increased reliability and superior mechanical performance (board flex and temperature cycling) when compared with standard termination materials. Refer to Syfer application note reference AN0001. FlexiCap™ capacitors enable the board to be bent almost twice as much as before mechanical cracking occurs. Refer to application note AN0002.

FlexiCap™ is also suitable for space applications having passed thermal vacuum outgassing tests. Refer to Syfer application note reference AN0026.



FlexiCap™ MLCC cross section

Syfer has delivered millions of FlexiCap™ components and during that time has collected substantial test and reliability data, working in partnership with customers world wide, to eliminate mechanical cracking.

An additional benefit of FlexiCap™ is that MLCCs can withstand temperature cycling from -55 to 125°C in excess of 1,000 times without cracking.

FlexiCap™ termination has no adverse effect on any electrical parameters, nor affects the operation of the MLCC in any way.

Application Notes

FlexiCap™ may be handled, stored and transported in the same manner as standard terminated capacitors. The requirements for mounting and soldering FlexiCap™ are the same as for standard SMD capacitors.

For customers currently using standard terminated capacitors there should be requirement to change the assembly process when converting to FlexiCap™.

Based upon the board bend tests in accordance with IEC 60384-1 the amount of board bending required to mechanically crack a FlexiCap™ terminated capacitor is significantly increased compared with standard terminated capacitors.

Product: X7R	Typical bend performance under AEC-Q200 test conditions
Standard Termination	2mm to 3mm
FlexiCap™	Typically 8mm to 10mm

REACH (Registration, Evaluation, Authorisation and restriction of Chemicals) Statement

The main purpose of REACH is to improve the protection of human health and the environment from the risks arising from the use of chemicals.

Syfer Technology Ltd maintains both ISO 14001, Environmental Management System and OHSAS 18001 Health & Safety Management System approvals that require and ensure compliance with corresponding legislation such as REACH.

For further information, please contact the sales office at SyferSales@knowles.com

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RoHS Compliance

Syfer routinely monitors world wide material restrictions (e.g., EU/China and Korea RoHS mandates) and is actively involved in shaping future legislation.

All standard C0G/NPO, X7R, X5R and High Q Syfer MLCC products are compliant with the EU RoHS directive (see below for special exemptions) and those with plated terminations are suitable for soldering common lead free solder alloys (refer to 'Soldering Information' for more details on soldering limitations). Compliance with EU RoHS directive automatically signifies compliance with some other legislation (e.g., Korea RoHS). Please refer to the Sales Office for details of compliance with other materials legislation.

Breakdown of material content, SGS analysis reports and tin whisker test results are available on request.

Most Syfer MLCC components are available with non-RoHS compliant tin/lead (SnPb) Solderable termination finish for exempt applications and where pure tin is not acceptable. Other tin free termination finishes may also be available – please refer to the Sales Office for further details.

X8R ranges <250Vdc are not RoHS 2011/65/EU compliant.

115Vac 400Hz ranges are not RoHS 2011/65/EU compliant.

Check the website, www.knowlescapacitors.com/syfer for latest RoHS update.

Export Controls and Dual-use Regulations

Certain Syfer catalogue components are defined as 'dual-use' items under international export controls – those that can be used for civil and military purposes which meet certain specified technical standards.

The defining criteria for a dual-use component with respect to Syfer products is one with a voltage rating of >750V and a capacitance value >250nF and a series inductance <10nH.

Components defined as 'dual-use' under the above criteria automatically require a licence for export outside the EU, and may require a licence for export with the EU.

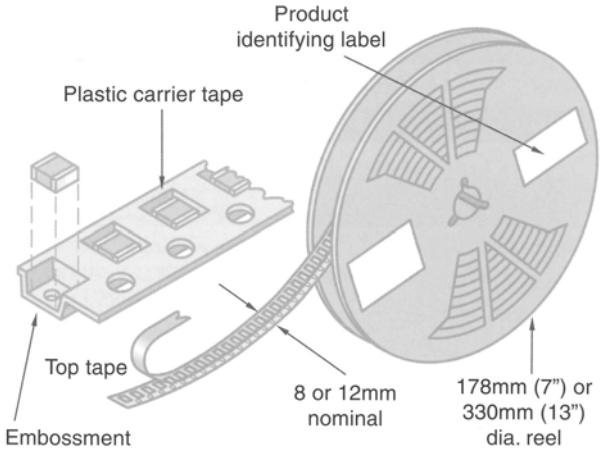
The application for a licence is routine, but customers for these products will be asked to supply further information.

Please refer to the sales office if you require any further information on export restrictions.

Other special components may additionally need to comply with export regulations.

Packaging Information

Tape and reel packing of surface mounting chip capacitors for

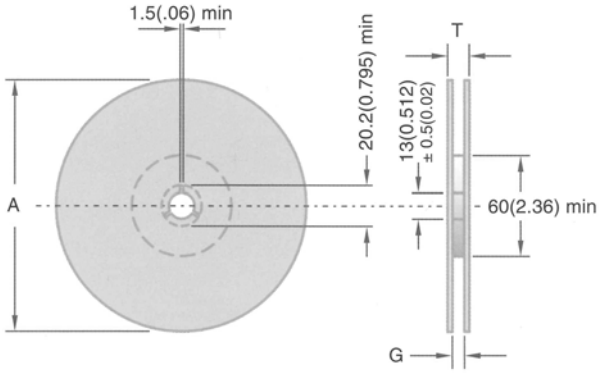


automatic placement are in accordance with IEC60286-3.

Peel Force

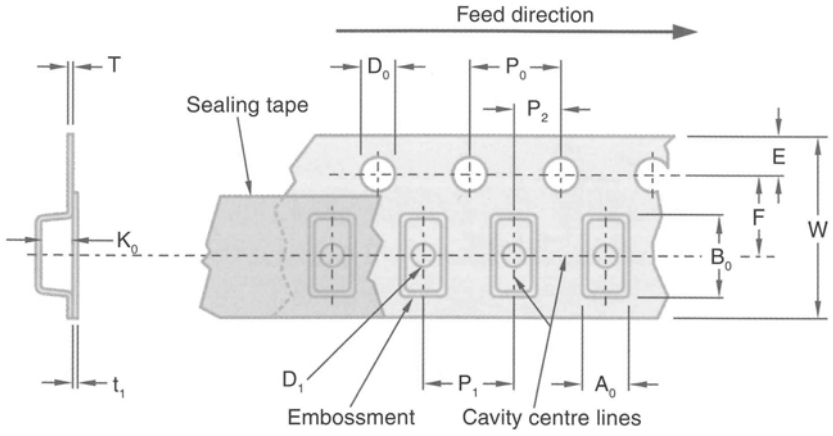
The peel force of the top sealing tape is between 0.2 and 1.0 Newton at 180º. The breaking force of the carrier and sealing tape in the direction of unreeling is greater than 10 Newton.

Reel Dimensions



Symbol	Description	178mm Reel	330mm Reel
A	Reel diameter	178 (7)	330 (13)
G	Reel inside width	8.4 (0.33)	12.4 (0.49)
T	Reel outside width	14.4 (0.56) max	18.4 (0.72) max

Tape Dimensions



		Dimensions mm (inches)	
Symbol	**Description**	**8mm Tape**	**12mm Tape**
A_0 B_0 K_0	Width of cavity Length of cavity Depth of cavity	Dependent on chip size to minimize rotation	
W	Width of tape	8.0 (0.315)	12.0 (0.472)
F	Distance between drive hole centres and cavity centres	3.5 (0.138)	5.5 (0.213)
E	Distance between drive hole centres and tape edge	1.75 (0.069)	
P_1	Distance between cavity centres	4.0 (0.156)	8.0 (0.315)
P_2	Axial distance between drive hole centres and cavity centres	2.0 (0.079)	
P_0	Axial distance between drive hole centres	4.0 (0.156)	
D_0	Drive hole diameter	1.5 (0.059)	
D_1	Diameter of cavity piercing	1.0 (0.039)	1.5 (0.059)
XT	Carrier tape thickness	0.3 (0.012) ±0.1 (0.04)	0.4 (0.016) ±0.1 (0.04)
Xt_1	Top tape thickness	0.1 (0.004) max	

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Packing Information

Missing Components

The number of missing components in the tape may not exceed 0.25% of the total quantity with not more than three consecutive components missing. This must be followed by at least six properly placed components

Identification

Each reel is labelled with the following information: manufacturer, chip size, capacitance, tolerance, rated voltage, dielectric type, batch number, date code and quantity of components.

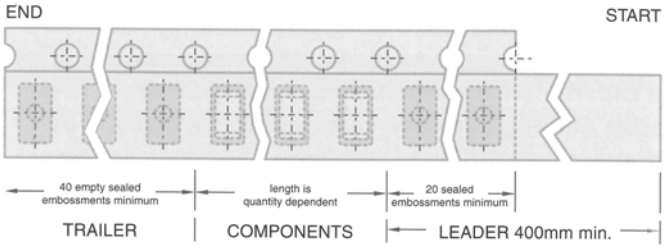
Component Orientation

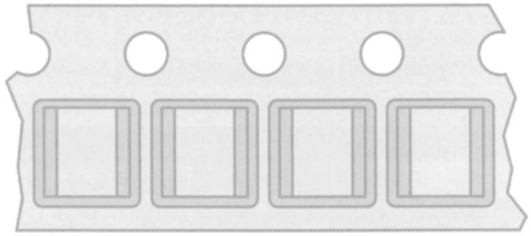
Tape and reeling is in accordance with IEC 60286 part 3, which defines the packaging specifications for leadless components on continuous tapes.

Notes: 1) IEC60286-3 states A0 <B0

2) Regarding the orientation of 1825 and 2225 components, the termination bands are right to left, NOT front to back. Please see diagram.

Leader Trailer



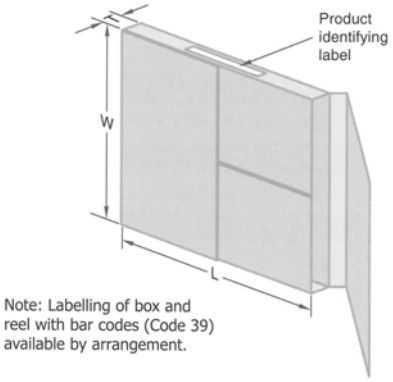


Orientation of 1825 & 2225 components

Outer Packaging

Outer carton dimensions mm (inches) max

Reel Size	No. of Reels	L	W	T
178 (7)	1	185 (7.28)	185 (7.28)	25 (0.98)
178 (7)	4	190 (7.48)	195 (7.76)	75 (2.95)
330 (13)	1	335 (13.19)	335 (13.19)	25 (0.98)



Note: Labelling of box and reel with bar codes (Code 39) available by arrangement.

Reel Quantities

Chip Size		0402	0505	0603	0805	1111	1206	1210	1410	1808	1812	1825	2211	2215	2220	2225
Max. Chip Thickness		0.5mm	1.3mm	0.8mm	1.3mm	2.0mm	1.6mm	2.0mm	2.0mm	2.0mm	2.5mm	2.5mm	2.5mm	2.5mm	2.5mm	2.5mm
		0.02"	0.05"	0.03"	0.05"	0.08"	0.06"	0.08"	0.08"	0.08"	0.1"	0.1"	0.1"	0.1"	0.1"	0.1"
Reel Quantities	178mm (7")	5000	2500	4000	3000	1000	2500	2000	2000	1500	500/ 1000	500	750	500	500/ 1000	500/ 1000
	330mm (13")	-	-	16000	12000	-	10000	8000	8000	6000	2000/ 4000	2000	-	4000	2000/ 4000	2000/ 4000

Notes:

1) The above quantities per reel are for the maximum manufactured chip thickness. Thinner chips can be taped in larger quantities per reel.

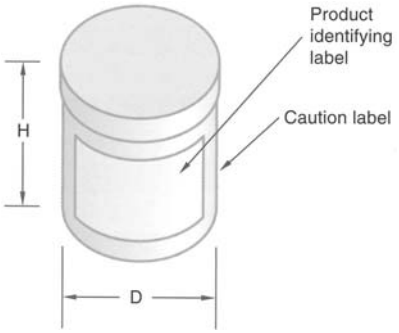
2) Where two different quantities are shown for the same case size, please contact the sales office to determine the exact quantity for any specific part number.

Bulk Packing – Tubs

Chips are supplied in rigid re-sealable plastic tubs together with impact cushioning wadding. Tubs are labelled with the details: chip size, capacitance, tolerance, rated voltage, dielectric type, batch number, date code and quantity of components.

Dimensions mm (inches)

H	60mm (2.36")
D	50mm (1.97")



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