MLCC

High Power RF Surface Mount & Ribbon Leaded MLC Capacitors

knowles
DLI•Novacap•Syfer•Voltronics

High Power RF MLCC Ranges (inc. Ribbon)

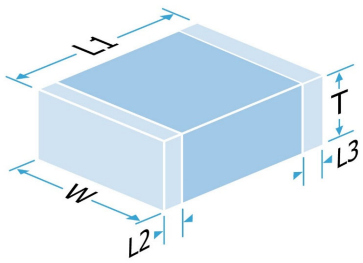
A range of ultra-low loss High Q ceramic capacitors with C0G / NP0 characteristics suitable for high power applications where minimal power loss and very low self-heating is demanded.

Common applications include high performance power supplies and wireless charging systems operating in the kHz and MHz frequencies.
To meet high temperature 260ºC soldering reflow profiles as detailed in J-STD-020, the high Q dielectrics are supplied with sintered termination, over-plated with tin over a nickel undercoat

Ribbon lead terminations for optimum mechanical performance are offered on larger case sizes

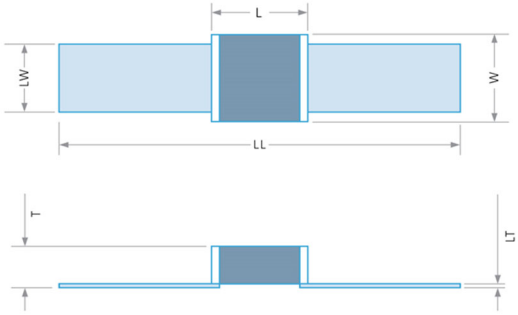
Electrical Details		
Capacitance Range		1pF to 27nF
Temperature Coefficient of Capacitance (TCC)	C0G/NP0 HiQ	0 ± 30ppm/°C
Dissipation Factor (Q)	C0G/NP0 HiQ	≤ 0.0005 (2000) @ 1MHz
Insulation Resistance (IR)		100GΩ or 1000secs (whichever is less)
Dielectric Withstand Voltage (DWV)		Voltage applied for 5 ±1 seconds, 50mA charging current maximum
Ageing Rate	C0G/NP0 & HiQ	Zero

Surface Mount MLCC Dimensions



Size	Length (L1) mm/inches	Width (W) mm/inches	Max. Thickness (T) mm/inches	Termination Band (L2) mm/inches	
				Min	max
2225	5.7 ± 0.4 0.225 ± 0.016	6.3 ± 0.4 0.25 ± 0.016	4.2 0.16	0.25 0.01	1 0.04
4040	10.2 ± 0.5 0.402 ± 0.020	10.2 ± 0.5 0.402 ± 0.020	4.2 0.16	0.5 0.02	1.5 0.06

Ribbon Leaded MLCC Dimensions



Silver plated copper ribbon attached with HMP solder (MP greater than 260°C)

Size	Length (L) mm/inches	Width (W) mm/inches	Thickness (T) mm/inches	Lead Length (LL) mm/in	Lead Width (LW) mm/in	Lead Thickness (LT) mm/in
1111	3.75 max 0.148 max	2.2 max 0.087 max	2.5 max 0.098 max	16 typ 0.63 typ	2.36 ± 0.15 0.093 ± 0.006	0.1 ± 0.02 0.004 ± 0.0008
2225	9.3 max 0.366 max	7.5 max 0.30 max	4.4 max 0.173 max	35 typ 1.378 typ	5.5 ± 0.5 0.22 ± 0.02	0.25 +0.10/-0.05 0.01 +0.004/-0.002
4040	12.0 max 0.473 max	11.5 max 0.45 max	5.0 Max 0.220 Max	50 typ 1.97 typ	8.9 ± 0.5 0.35 ± 0.02	0.25 +0.10 / -0.05 0.01 +0.004/-0.002

High Q, C0G/NP0 High Power RF capacitors - minimum/maximum capacitance values

Chip Size	1111 Ribbon leaded only†		2225		4040	
Min Cap Tolerance	±0.10pF (<10pF) and ±1% (≥10pF)					
	Min	Max	Min	Max	Min	Max
100V	1.6nF	2.2nF	-	-	-	-
150V	1.1nF	1.5nF	-	-	-	-
200V	-	-	-	-	-	-
250V	750pF	1.0nF	6.2nF	10nF	16nF	27nF
300V	620pF	680pF	-	-	-	-
500V	510pF	560pF	5.1nF	5.6nF	13nF	15nF
630V	240pF	470pF	3.6nF	4.7nF	11nF	12nF
1000V	110pF	220pF	1.1nF	3.3nF	5.6nF	10nF
1500V	75pF	100pF	-	-	-	-
2000V	2.2pF	68pF	510pF	1.0nF	1.6nF	5.1nF
3000V	-	-	110pF	470pF	910pF	1.5nF
3600V	-	-	51pF	100pF	-	-
3600V / 2500Vac 30MHz	-	-	1.0pF	47pF*	-	-
4000V	-	-	-	-	620pF	820pF
5000V	-	-	-	-	360pF	560pF
6000V	-	-	-	-	160pF	330pF
7000V	-	-	-	-	62pF	150pF
7000V / 7200V / 5000Vac 30MHz	-	-	-	-	1.0pF	56pF**

**2225 3.6kV: Values up to 47pF max. are dual rated 3.6kVdc / 2.5kVac @ 30MHz*
***4040 7kV/7.2kV: Values up to 56pF max. are dual rated 7.0kV(7.2kV)dc / 5kVac @ 30MHz*

A range of ultra-low loss High Q ceramic capacitors with C0G/NP0 characteristics suitable for high power applications where minimal power loss and very low self-heating is demanded.

Common applications include MRI body coils and wireless charging systems operating in the kHz and MHz frequencies.

2225 & 4040 available in chip or ribbon leaded format.

1111 available in ribbon leaded only.

†For 1111 surface mount chip, see 'U' range family data sheet.

Ordering Information – Surface Mount High Power Range

4040	J	7K0	470	G	Q	B	AF7
Chip Size	**Termination**	**Rated Voltage**	**Capacitance in Picofarads (pF)**	**Capacitance Tolerance**	**Dielectric Codes**	**Packaging**	**Suffix Code**
2225 **4040**	**J =** Nickel Barrier, Sn Plated Solder (RoHS compliant) **A =** Nickel Barrier, Sn/Pb Plated Solder (Min 10% Lead, non RoHS) **6 =** Nickel Barrier, Sn/Pb Plated Solder (5-20% Lead, non RoHS)	**100** = 100V **150** = 150V **200** = 200V **250** = 250V **500** = 500V **630** = 630V **1K0** = 1000V **2K0** = 2000V **3K0** = 3000V **3K6** = 3600V **3K6** = 3600V / 2500Vac 30MHz (2225 parts up to 47pF) **4K0** = 4000V **5K0** = 5000V **6K0** = 6000V **7K0** = 7000V/7200V **7K0 =** 7000V / 7200V / 5000Vac 30MHz (4040 parts up to 56pF)	**<10pF** Insert a P for the decimal point as the second character. e.g., **P300** = 0.3pF **8P20** = 8.2pF **≥10pF** 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., **0103** = 10000 pF **Values <1pF** in 0.1pF steps, above this values are E24 series	**<10pF** **B**: ± 0.10pF **C**: ± 0.25pF **D**: ± 0.5pF **≥10pF** **F**: ± 1% **G**: ± 2% **J**: ± 5% **K**: ± 10%	**Q** = High Q	**T** = 178mm (7") reel (Available for 2225 parts only) **R** = 330mm (13") reel **B** = Bulk pack – tubs or trays	**AF7** = SM standard Also used for specific customer requirements

Ordering Information –Ribbon Leaded

2225	B	3K0	6P80	G	Q	B	R	W001
Chip Size	**Termination**	**Rated Voltage**	**Capacitance in Picofarads (pF)**	**Capacitance Tolerance**	**Dielectric Codes**	**Packaging**	**Lead Option**	**Suffix Code**
1111 **2225** **4040**	**B** = Uncoated **V** = Coated with modified silicone lacquer	**100** = 100V **150** = 150V **200** = 200V **250** = 250V **500** = 500V **630** = 630V **1K0** = 1000V **2K0** = 2000V **3K0** = 3000V **3K6** = 3600V **3K6** = 3600V / 2500Vac 30MHz (2225 parts up to 47pF) **4K0** = 4000V **5K0** = 5000V **6K0** = 6000V **7K0** = 7000V/7200V **7K0 =** 7000V / 7200V / 5000Vac 30MHz (4040 parts up to 56pF)	**<10pF** Insert a P for the decimal point as the second character. e.g., **P300** = 0.3pF **8P20** = 8.2pF **≥10pF** 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., **0103** = 10000 pF **Values <1pF** in 0.1pF steps, above this values are E24 series	**<10pF** B: ± 0.10pF C: ± 0.25pF D: ± 0.5pF **≥10pF** F: ± 1% G: ± 2% J: ± 5% K: ± 10%	**Q** = High Q	**B** = Bulk pack – tubs or trays	**R** = Ribbon Lead	**W001** = leaded / not marked (standard) Also used for specific customer requirements

Reeled Quantities (SM only)

Chip Size	2225	4040
7" Reel	500	-
13" Reel	2000	500

Note: Other capacitance values may become available, please contact our Sales Office if you need values other than those shown in the above tables.
For dimensions and soldering information, please go to our website (www.knowlescapacitors.com/syfer) or see our MLC catalogue.

Product Marking

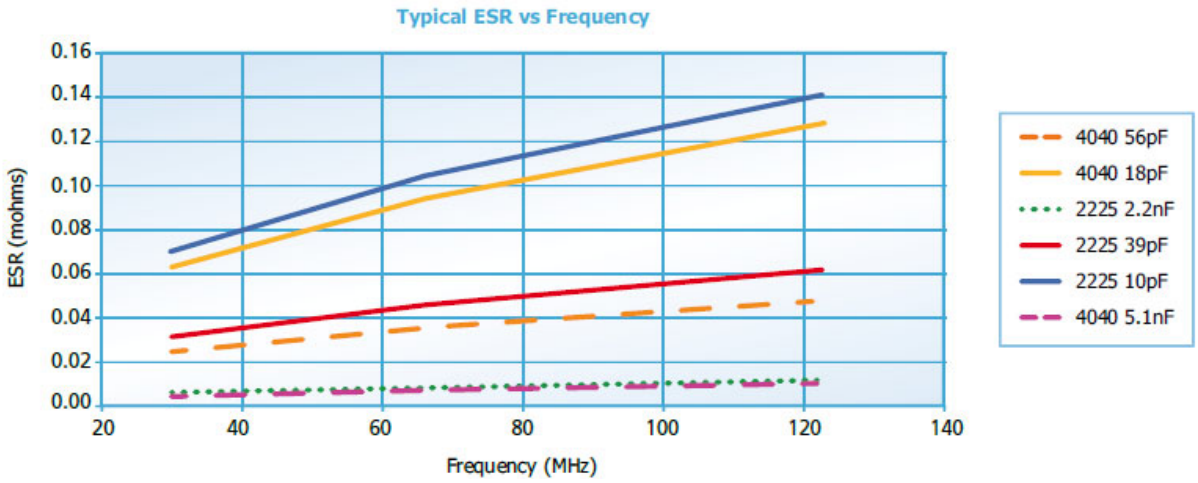
Product marking is available on request for most parts by the addition of a suffix code – refer to sales if required

Marking is applied using either military grade solvent resistant ink or by laser etching the MLCC surface.

Marking will include capacitance value and tolerance. Marking will be applied to either both top and bottom, or the top side of chip and will be visible when the component is mounted.

Please refer to the sales office for more information.

Typical ESR - High power range and ribbon leaded



ESR Measurement

All ESR figures for high power and ribbon components are measured using a VNA and 2m copper resonant tube and extrapolating to 30MHz by ratio. Measured data can be supplied on request.

Measurement of ESR can vary with test method and components should only be compared when tested back-to-back on the same equipment under controlled conditions.

Performance and Testing

	Hi Q	
	Ultra-stable	
IECQ-CECC	1B/CG	
EIA	C0G/NP0	
MIL	CG (BP)	
Rated temperature range	-55ºC to +125ºC	
Maximum capacitance change over temperature range	0 ± 30 ppm/ºC	
Rated DC voltage applied		
Knowles / Syfer dielectric ordering code	Q	
Tangent of loss angle (tan δ)	≤ 0.0005 @ 1MHz (Cr ≤ 1nF) or 1kHz (Cr > 1nF)	
Insulation resistance (IR)	Minimum IR (GΩ) = 100 or (1000/Cap in nF) (whichever is less) IR Test Voltage: R_V < 100V, Test Voltage = R_V R_V ≥ 100V, Test Voltage = 100V	
Capacitance tolerance **(ordering code)**	Cr <10pF	± 0.10pF (B) ± 0.25pF (C) ± 0.50pF (D)
	Cr ≥10pF	± 1% (F) ± 2% (G) ± 5% (J) ± 10% (K) ± 20% (M)*
Voltage Proof (VP) *Also known as Dielectric Withstand Voltage (DWV)*	R_V (rated voltage) ≤ 200V VP = 2.5 x R_V 200V < R_V < 500V VP = R_V + 250V 500V ≤ R_V ≤ 1kV VP = 1.5 x R_V 1kV < R_V ≤ 1.2kV VP = 1.25 x R_V R_V > 1.2kV VP = 1.2 x R_V	
Climatic Category	55/125/56	
Ageing characteristic (Typical)	Zero	

* M tolerance is available for ribbon leaded parts only

Soldering Information

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

Reflow Soldering

Knowles recommend reflow soldering as the preferred method for mounting MLCCs. Knowles 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 260º to 270ºC acceptable.

The heating ramp rate should be such that components see a temperature rise of 1.5º to 4ºC 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 230ºC can cause problems with oxidation of Sn plating. Use of an inert atmoshere 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 permissable wave temperature is 270ºC for SM chips.

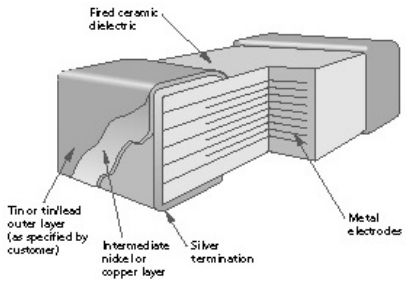
The total immersion time in solder should be kept to a minimum. It is strongly recommended that Sn/Ni plated terminations are specified for wave soldering applications.

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 Knowles FlexiCap™ for improved stress resistance post soldering.



Multilayer ceramic chip with nickel or copper barrier termination

Rework of Chip Capacitors

Knowles 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. Plastice 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 envirinmental control agent.

Long term storage conditions, ideally, should be temperature controlled between -5º and +40ºC 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, store under the conditions recommended above, in its "as received" packaging, has a minimum shelf life of 2 years.

SM Pad Design

Knowles 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 Knowles catalogue/website for these components.

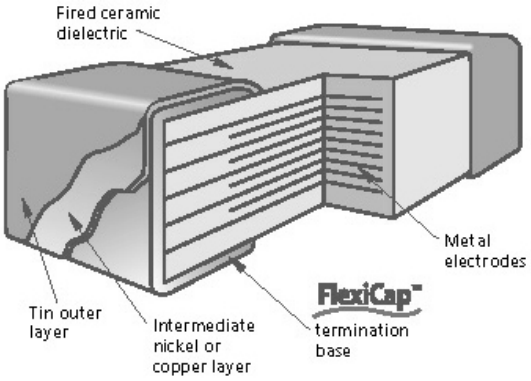
FlexiCap™ Termination

FlexiCap™ has been developed as a result of listening to customer's experiences of stress damage to MLCCs fom 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 boardbending 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 Knowles 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 Knowles application note reference AN0026.



FlexiCap™ MLCC cross section

Knowles 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.

Knowles monitors the REACH legislation to ensure compliance. All products made by Knowles are 'articles' under the definition of REACH and a certificate of compliance is maintained on our website www.knowlescapacitors.com/syfer.

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

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RoHS Compliance

Knowles 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 Knowles 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 Knowles 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.

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

Export Controls and Dual-use Regulations

Certain Knowles 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 Knowles 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.

Ageing of Ceramic Capacitors

Capacitor ageing is a term used to describe the negative, logarithmic capacitance change which takes place in ceramic capacitors with time. The crystalline structure for barium titanate based ceramics changes on passing through its Curie temperature (known as the Curie Point) at about 125ºC. The domain structure relaxes with time and in doing so, the dielectric constant reduces logarithmically; this is known as the ageing mechanism of the dielectric constant. The more stable dielectrics have the lowest ageing rates.

The ageing process is reversible and repeatable. Whenever the capacitor is heated to a temperature above the Curie Point the ageing process starts again fromzero.

The ageing constant, or ageing rate, is defined as the percentage loss of capacitance due to the ageing process of the dielectric which occurs during a decade of time (a tenfold increase in age) and is expressed as percent per logarithmic decade of hours. As the law of decrease of capacitance is logarithmic, this means that a capacitor with an ageing rate of 1% per decade of time, the capacitance will decrease at a rate of:

a) 1% between 1 and 10 hours

b) An additional 1% between the following 10 and 100 hours

c) An additional 1% between the following 100 and 1000 hours

d) An additional 1% between the following 1000 and 10000 hours

e) The ageing rate continues in this manner throughout the capacitor's life.

Typical values of the ageing constant for our MLCCs are

Dielectric Class	Typical Values
Ultra Stable C0G/NP0	Negligible capacitance loss through ageing
Stable X7R	<2% per decase of time

Capacitance Measurements

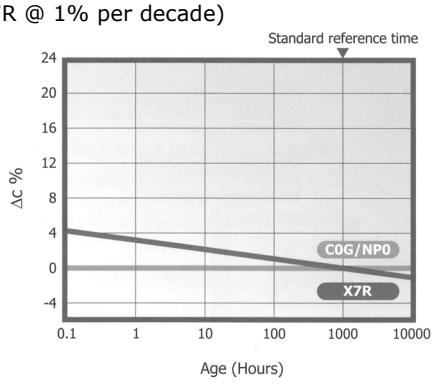
Because of ageing it is necessary to specify an age for reference measurements at which the capacitance shall be within the prescribed tolerance. This is fixed at 1000 hours, since for all practical purposes there is not much further loss of capacitance after this time.

All capacitors shipped are within their specified tolerance at the standard reference age of 1000 hours after having cooled through their Curie temperature.

The ageing curve for any ceramic dielectric is a straight line when plotted on semi-log paper.

Capacitance vs Time

(Ageing X7R @ 1% per decade)



Tight Tolerance

One of the advantages of Knowles's unique 'wet process' of manufacture is the ability to offer capacitors with exceptionally tight capacitance tolerances.

The accuracy of the printing screens used in the fully automated, computer controlled manufacturing process allows for tolerance as close as ± 1% on C0G/NP0 parts greater than or equal to 10pF. For capacitance value less than 4.7pF tolerances can be as tight as ± 0.05pF.

Periodic Tests Conducted and Reliability Data

For standard surface mount capacitors components are randomly selected on a sample basis and the following routine tests conducted:

- Load Test. 1,000 hours @ 125ºC (150oOC for X8R). Applied voltage depends on components tested
- Humidity Test. 168 hours @ 85ºC/85%RH
- Board Deflection (bend test)

Test results are available on request.

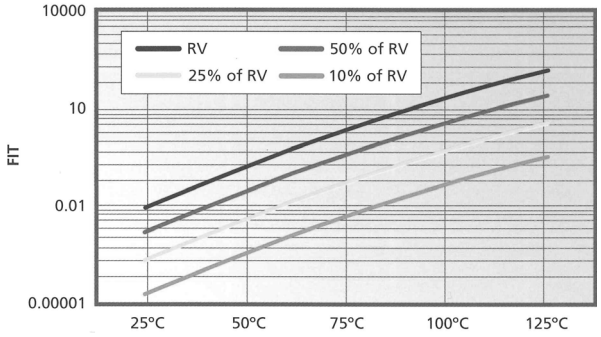
Conversion Factors

From	To	Operation
FITs	MTBF (hours)	$10^9 \div$ FITs
FITs	MTBF (years)	$10^9 \div$ (FITs × 8760)

FIT = Failures In Time. 1 FIT = 1 failure in 10^9 hours

MTBF = Mean Time Between Failure

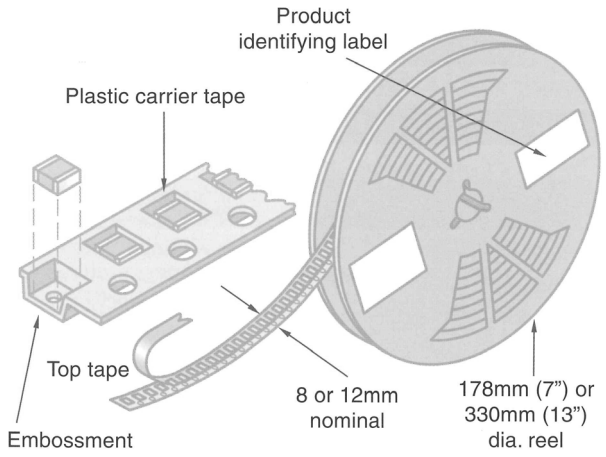
Example of FIT Data Available



Component type:	0805 (C0G/NP0 and X7R)
Testing Location:	Knowles reliability test department
Results based on:	16,622,000 component test hours

Packaging Information

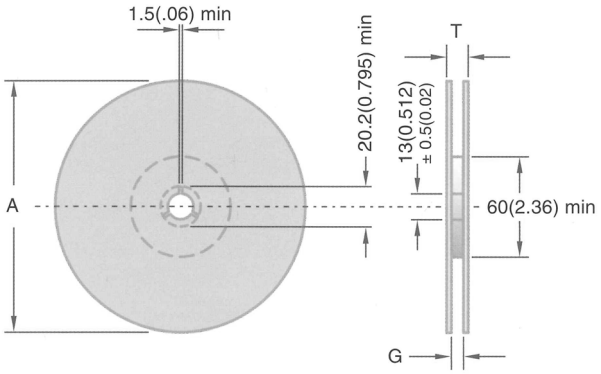
Tape and reel packing of surface mounting chip capacitors for automatic placement are in accordance with IEC60286-3.



Peel Force

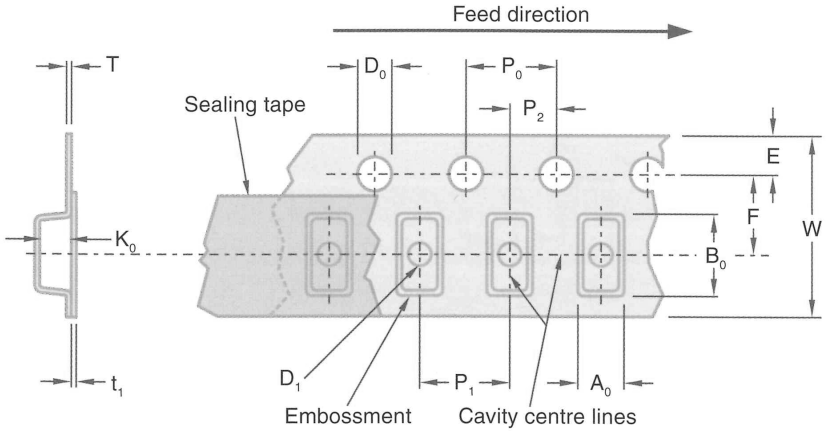
The peel force of the top sealing tape is between 0.2 and 1.0 Newton at 180º. The breaking force of the carrier and sealing tape in the direction of unreeling is greater than 10 Newtons.

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	

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, dilectric type, batch number, date code and quantity of components.

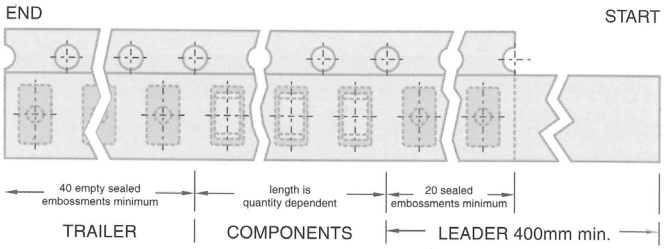
Component Orientation

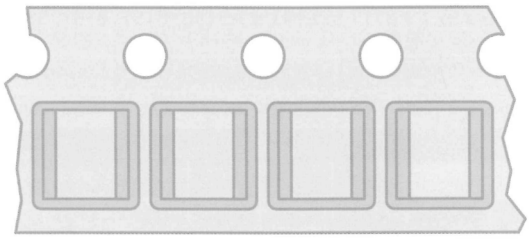
Tape and reeling is in accordance with IEC 60286 part 3, which defines the packaging specifications for leadless components on continuous tapes.

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



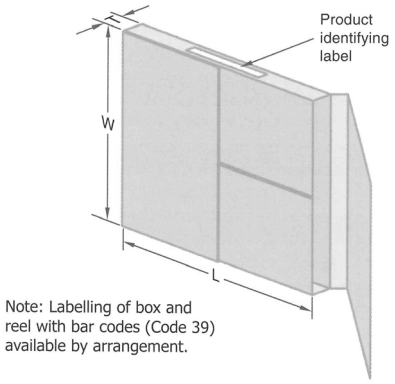


Orientation of 1825 & 2225 components

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 Tickness		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")	10000	2500	4000	3000	1000	2500	2000	2000	2000	500	500	750	500	500	500
	330mm (13")	15000	10000	16000	12000	5000	10000	8000	8000	8000	2000	2000	-	4000	2000	2000

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")