EXV, +105°C

Overview

The KEMET EXV aluminum electrolytic surface mount

impedance and a low profle vertical chip.

Applications

Typical applications include audio/visual (AV), computer/monitor, communications, and switch mode power supplies (SMPS).

Benefits

- Low profle vertical chip
- +105°C/3,000 – 5,000 hours

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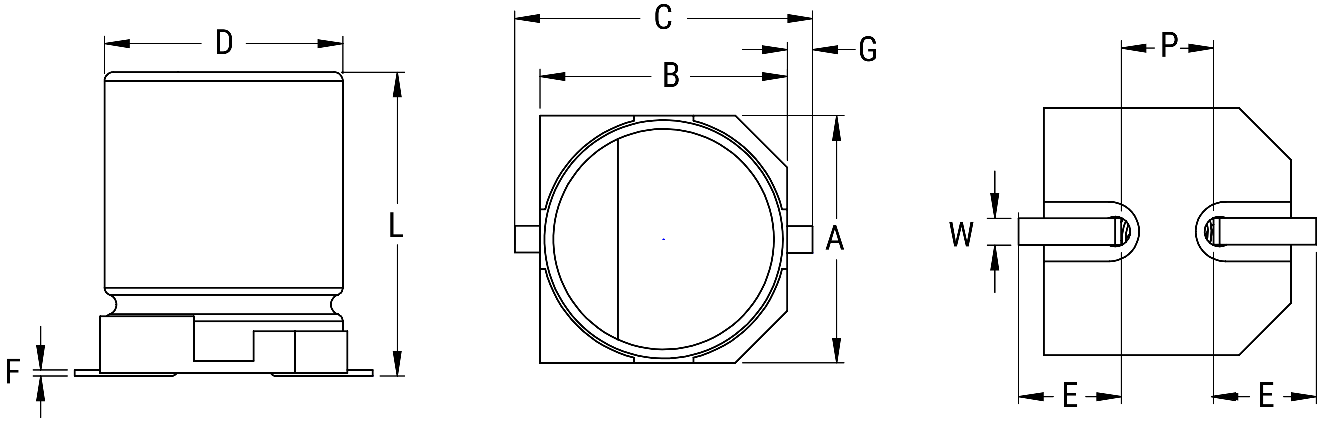
Part Number System

EXV	226	M	6R3	A	9B	AA
	(pF)		(VDC)			
Electrolytic	First two digits signifcant fgures specifes the				See Dimension	

Dimensions – Millimeters



Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. In Europe (RoHS Directive) and in some other geographical areas like China, legislation has been put in place to prevent the use of some hazardous materials, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and fulfill these legislative requirements. The only material of concern in our products has been lead (Pb), which has been removed from all designs to fulfill the requirement of containing less than 0.1% of lead in any homogeneous material. KEMET will closely follow any changes in legislation world wide and make any necessary changes in its products, whenever needed.

Some customer segments such as medical, military and automotive electronics may still require the use of lead in electrode coatings. To clarify the situation and distinguish products from each other, a special symbol is used on the packaging labels

Due to customer requirements, there may appear additional markings such as lead free (LF) or lead-free wires (LFW) on the

Performance Characteristics

Item	Performance Characteristics
	1 – 1,000 µF
	6.3 – 50 VDC
	3,000 – 5,000 hours (see conditions in Test Method & Performance)
	−55°C to +105°C
	I ≤ 0.01 CV or 3 µA C = rated capacitance (µF), V = rated voltage (VDC). Voltage

Impedance Z Characteristics at 120 Hz

Test Method & Performance

Conditions	Load Life Test		Shelf Life Test
Test Duration		3,000 hours	1,000 hours
		5,000 hours	
	Maximum ripple current specifed at 120 Hz 105°C		
	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor.		
Performance	**The following specifications will be satisfied when the capacitor is restored to 20°C:**		
Capacitance Change	Within ±30% of the initial value		
Dissipation Factor	Does not exceed 200% of the specifed value		
	Does not exceed specifed value		

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change signifcantly after extended storage periods, however, the leakage current will very slowly increase.

The KEMET E aluminum electrolytic capacitors should not be stored in high temperatures or where there is a high level of humidity. The suitable storage condition for KEMET's E aluminum electrolytic capacitors is +5 to +35°C and less than 75% in relative humidity. KEMET's E aluminum electrolytic capacitors should not be stored in damp conditions such as water, saltwater spray or oil spray. KEMET's E aluminum electrolytic capacitors should not be stored in an environment full of hazardous gas (hydrogen sulphide, sulphurous acid gas, nitrous acid, chlorine gas, ammonium, etc.) KEMET's E aluminum electrolytic capacitors should not be stored under exposure to ozone, ultraviolet rays or radiation.

If a capacitor has been stored for more than 18 months under these conditions and it shows increased leakage current, then a treatment by voltage application is recommended.

Re-Age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specifed limit. During re-aging a maximum charging current of twice the specifed leakage current or 5 mA (whichever is greater) is suggested.

Table 1 – Ratings & Part Number Reference

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)	RC 100 kHz 105°C (mA)	Z 100 kHz 20°C (Ω)	LC 20°C 2 Minutes (µA)	Part Number
								EXV226M6R3(1)9BAA
								EXV336M6R3(1)9BAA
								EXV476M6R3(1)9DAA
								EXV107M6R3(1)9GAA
								EXV157M6R3(1)9HAA
								EXV227M6R3(1)9HAA
								EXV337M6R3(1)9MAA
								EXV477M6R3(1)9MAA
								EXV687M6R3(1)9PAA
								EXV108M6R3(1)9PAA
								EXV226M010(1)9BAA
								EXV336M010(1)9DAA
								EXV476M010(1)9GAA

(1) Insert Electrical Parameters code. See Part Number System for available options.

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)	RC 100 kHz 105°C (mA)	Z 100 kHz 20°C (Ω)	LC 20°C 2 Minutes (µA)	Part Number
								EXV335M050(1)9BAA
								EXV475M050(1)9DAA
								EXV106M050(1)9GAA
								EXV226M050(1)9HAA
								EXV336M050(1)9MAA
								EXV476M050(1)9PAA
								EXV686M050(1)9PAA
								EXV107M050(1)9PAA
								EXV157M050(1)9PAA
								EXV227M050(1)9PAA
VDC	VDC Surge	Rated Capacitance	Case Size	DF	RC	Z	LC	Part Number

(1) Insert Electrical Parameters code. See Part Number System for available options.

Mounting Positions (Safety Vent)

In operation, electrolytic capacitors will always conduct a leakage current that causes electrolysis. The oxygen produced by electrolysis will regenerate the dielectric layer but, at the same time, the hydrogen released may cause the internal pressure of the capacitor to increase. The overpressure vent (safety vent) ensures that the gas can escape when the pressure reaches a certain value. All mounting positions must allow the safety vent to work properly.

Installing

- A general principle is that lower-use temperatures result in a longer, useful life of the capacitor. For this reason, it should be ensured that electrolytic capacitors are placed away from heat-emitting components. Adequate space should be allowed between components for cooling air to circulate, particularly when high ripple current loads are applied. In any case, the maximum category temperature must not be exceeded.
- Do not deform the case of capacitors or use capacitors with a deformed case.
- Verify that the connections of the capacitors are able to insert on the board without excessive mechanical force.
- If the capacitors require mounting through additional means, the recommended mounting accessories shall be used.
- Verify the correct polarization of the capacitor on the board.
- Verify that the space around the pressure relief device is according to the following guideline:

Case Diameter	Space Around Safety Vent
≤ 16 mm	
> 16 to ≤ 40 mm	

It is recommended that capacitors always be mounted with the safety device uppermost or in the upper part of the capacitor.

- If the capacitors are stored for a long time, the leakage current must be verifed. If the leakage current is superior to the value listed in this catalog, the capacitors must be reformed. In this case, they can be reformed by application of the rated voltage through a series resistor approximately 1 kΩ for capacitors with V ≤ 160 V (5 W resistor) and 10 kΩ for the other

- In the case of capacitors connected in a series, a suitable voltage sharing must be used.
  In the case of balancing resistors, the approximate resistance value can be calculated as: R = 60/C.

KEMET recommends, nevertheless, to ensure that the voltage across each capacitor does not exceed its rated voltage.

Application and Operation Guidelines

Electrical Ratings:
Capacitance (ESC)

Simplified equivalent circuit diagram of an electrolytic capacitor

The capacitive component of the equivalent series circuit, (equivalent series capacitance - ESC), is determined by applying an alternate voltage of ≤ 0.5 V at a frequency of 120 or 100 Hz and 20°C (IEC 384-1, 384-4).

Temperature Dependence of the Capacitance
Capacitance of an electrolytic capacitor depends upon temperature: with decreasing temperature the viscosity of the electrolyte increases, thereby reducing its conductivity.
Capacitance will decrease if temperature decreases. Furthermore, temperature drifts cause armature dilatation and, therefore, capacitance changes (up to 20% depending on the series considered, from 0 to 80°C). This phenomenon is more evident for electrolytic capacitors than for other types.

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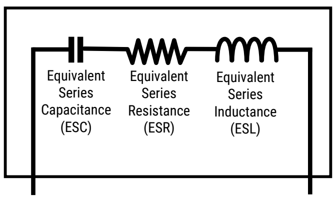
Equivalent Series Inductance (ESL)

Equivalent series inductance or self inductance results from the terminal configuration and internal design of the capacitor.

Capacitor Equivalent Internal Circuit



Equivalent Series Resistance (ESR)

Equivalent series resistance is the resistive component of the equivalent series circuit. ESR value depends on frequency and temperature, and is related to the tan δ by the following equation:

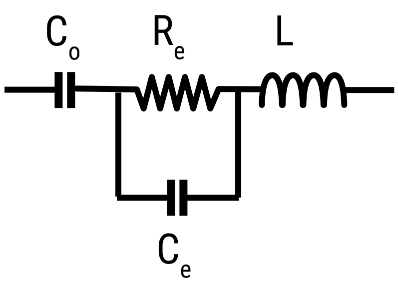
$$\frac{\tan\delta}{2\pi f\ ESC}$$

ESR = Equivalent series resistance (Ω)
tan δ = Dissipation factor
ESC = Equivalent series capacitance (F)
f = Frequency (Hz)

Tolerance limits of the rated capacitance must be taken into account when calculating this value.

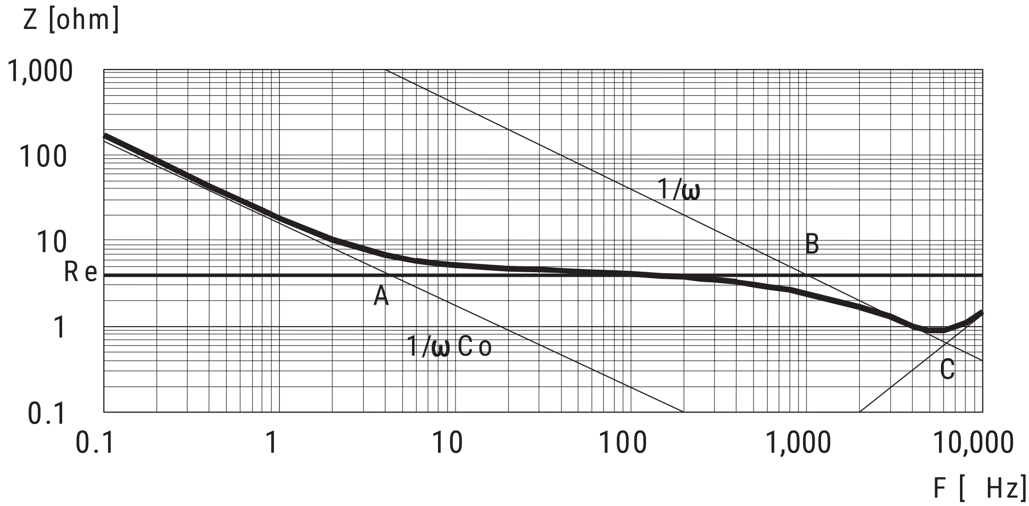
Impedance (Z)

Impedance of an electrolytic capacitor results from a circuit formed by the following individual equivalent series components:



= Aluminum oxide capacitance (surface and thickness of the dielectric.)
= Resistance of electrolyte and paper mixture (other resistances not depending on the frequency are not considered: tabs, plates, etc.)
= Electrolyte soaked paper capacitance.
L = Inductive reactance of the capacitor winding and terminals.
Impedance of an electrolytic capacitor is not a constant quantity that retains its value under all conditions; it changes depending on frequency and temperature.
Impedance as a function of frequency (sinusoidal waveform) for a certain temperature can be represented as follows:

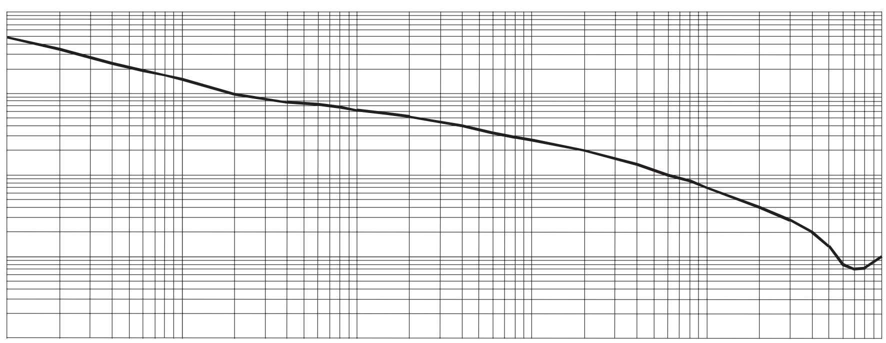
Impedance (Z) cont'd



- With increasing frequency, capacitive reactance Xc = 1/ωC decreases until it reaches the order of magnitude of electrolyte resistance R (A)
- At even higher frequencies, resistance of the electrolyte predominates: Z = R (A - B)
- When the capacitor's resonance frequency is reached (ω), capacitive and inductive reactance mutually cancel each other 1/ωC = ωL, ω = 1/SQR(LC)
- Above this frequency, inductive reactance of the winding and its terminals (XL = Z = ωL) becomes effective and leads to

Generally speaking, it can be estimated that C ≈ 0.01 C

Impedance as a function of frequency (sinusoidal waveform) for different temperature values can be represented as follows (typical values):



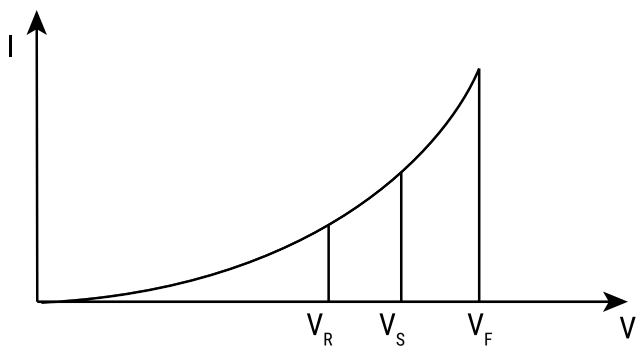
Leakage Current (LC)

Due to the aluminum oxide layer that serves as a dielectric, a small current will continue to flow even after a DC voltage has been applied for long periods. This current is called leakage current.

A high leakage current flows after applying voltage to the capacitor then decreases in a few minutes, for example, after prolonged storage without any applied voltage. In the course of continuous operation, the leakage current will decrease and reach an almost constant value.

After a voltage-free storage the oxide layer may deteriorate, especially at a high temperature. Since there are no leakage currents to transport oxygen ions to the anode, the oxide layer is not regenerated. The result is that a higher than normal leakage current will flow when voltage is applied after prolonged storage.

As the oxide layer is regenerated in use, the leakage current will gradually decrease to its normal level.
The relationship between the leakage current and voltage applied at constant temperature can be shown schematically as follows:



Where:
${}_F$ = Forming voltage
If this level is exceeded, a large quantity of heat and gas will be generated and the capacitor could be damaged.

This level represents the top of the linear part of the curve.

This lies between V ${}_F$. The capacitor can be subjected to V for short periods only.

Electrolytic capacitors are subjected to a reforming process before acceptance testing. The purpose of this preconditioning is to ensure that the same initial conditions are maintained when comparing different products.

Ripple Current (RC)

The maximum ripple current value depends on:

- Surface area of the capacitor (heat dissipation area)
  tan δ or ESR
- Frequency

The capacitor’s life depends on the thermal stress.

Frequency Dependence of the Ripple Current

ESR and, thus, the tan δ depend on the frequency of the applied voltage. This indicates that the allowed ripple current is also a function of the frequency.

Temperature Dependence of the Ripple Current

The data sheet speci f es maximum ripple current at the upper category temperature for each capacitor.

Expected Life Calculation

Expected life depends on operating temperature according to the following formula: $L = Lo \times 2^{(To-T)/10}$

Where:

L: Expected life

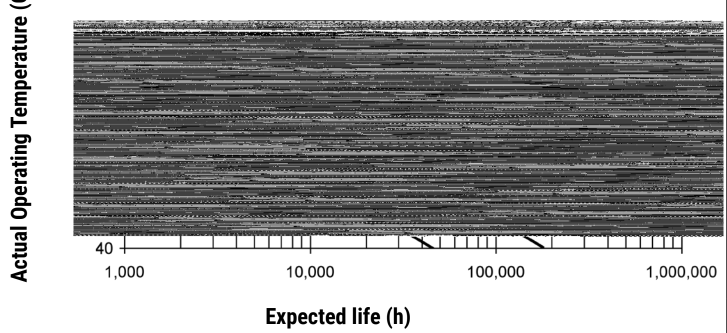
Lo: Load life at a maximum permissible operating

T: Actual operating temperature

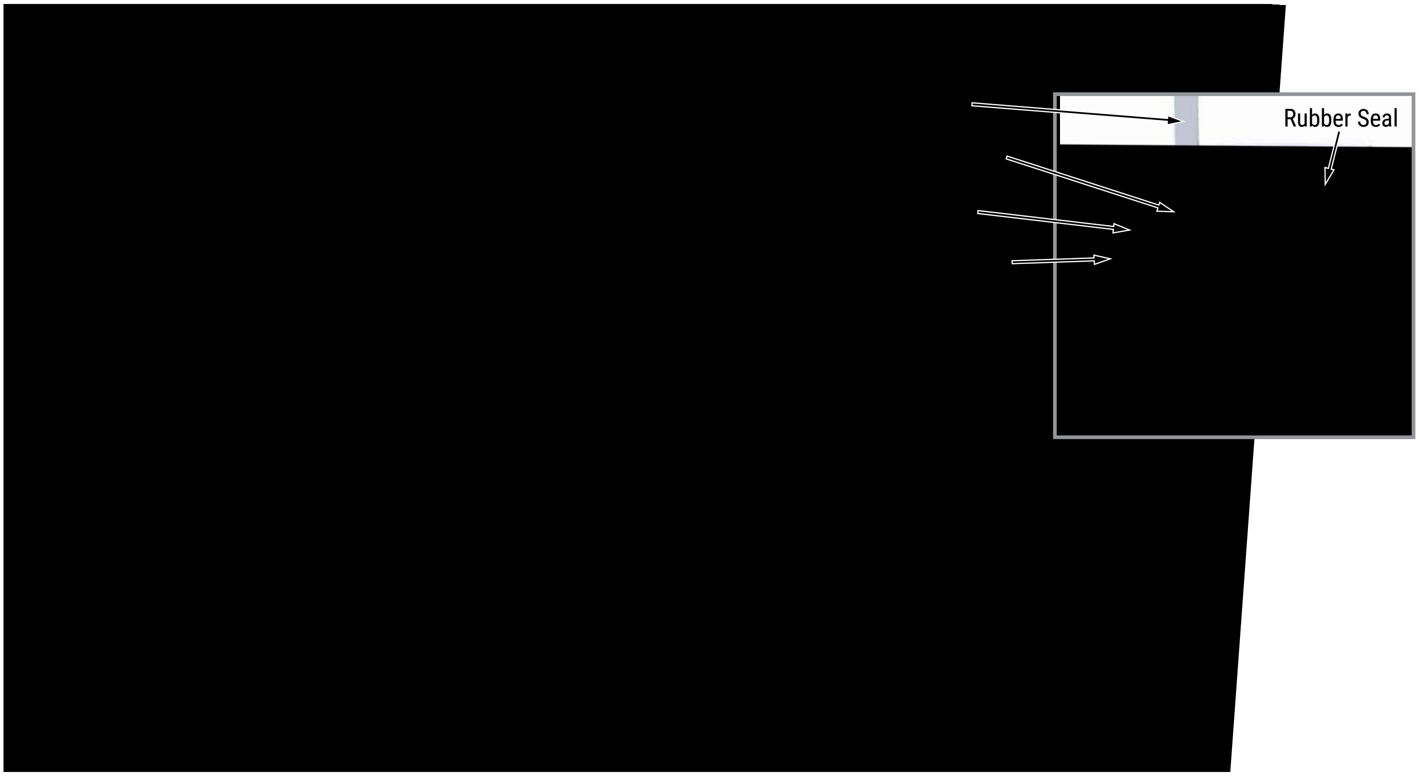
To: Maximum permissible operating temperature

This formula is applicable between 40°C and To.

Expected Life Calculation Chart



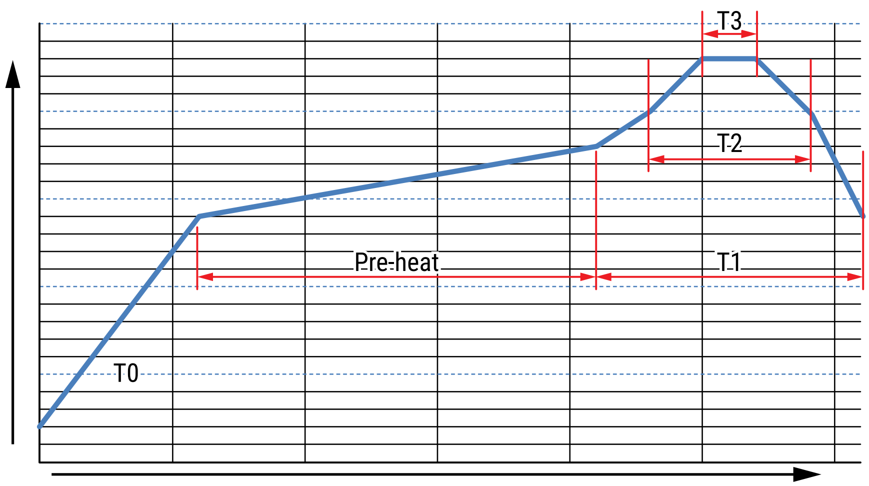
Construction



Soldering Process

The soldering conditions should be within the specifed conditions below:

Do not dip the capacitors body into the melted solder. Flux should only be applied to the capacitors terminals



Vapor heat transfer systems are not recommended. The system should be thermal, such as infra-red radiation or hot blast

Observe the soldering conditions as shown below.

Do not exceed these limits and avoid repeated refowing

Reflow Soldering

	Temperature (°C)	Maximum Time (Seconds)
Pre-heat		

Lead-Free Reflow Soldering

	Temperature (°C)	Maximum Time (Seconds)
Pre-heat		

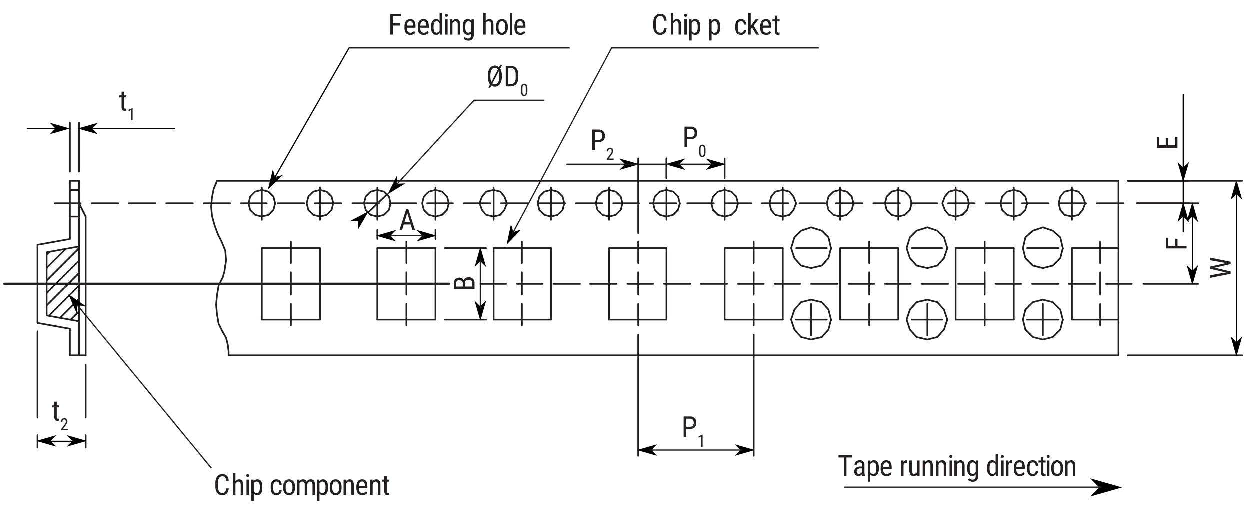
Lead-Free Reflow Soldering cont'd.

	Size	Temperature (C)	Maximum Time (Seconds)
	Φ4 ~ Φ5 (4 – 50		

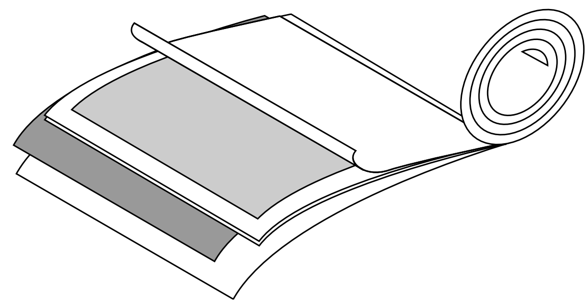
Lead Taping & Packaging

Case Size (mm)	Reel		
	D	H	W

Taping for Automatic Insertion Machines



Dimensions (mm)	W	A	B	P_0	P_1	P_2	F	D_0	E	t_1	t_2



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