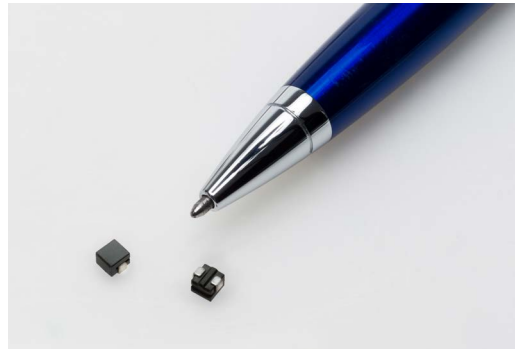


# FP0404

## High frequency, high current power inductors



### Description

- High current carrying capacity
- Low core loss
- Frequency range up to 2 MHz
- Inductance Range from 22 nH to 110 nH
- Current range from 14 A to 40 A
- 4.0 mm x 4.0 mm footprint surface mount package in 3.0 mm and 4.0 mm heights
- Ferrite core material

### Applications

- Multi-phase and Vcore regulators
- Voltage Regulator Modules (VRMs)
- Server and desktop VRMs and EVRDs
- Laptop and notebook regulators
- Data networking and storage systems
- Graphics cards and battery power systems
- Point-of-Load modules

### Environmental Data

- Storage temperature range (component): -40 °C to +125 °C
- Operating temperature range: -40 °C to +125 °C (ambient plus self-temperature rise)
- Solder reflow temperature: J-STD-020 (latest revision) compliant



**Product Specifications**

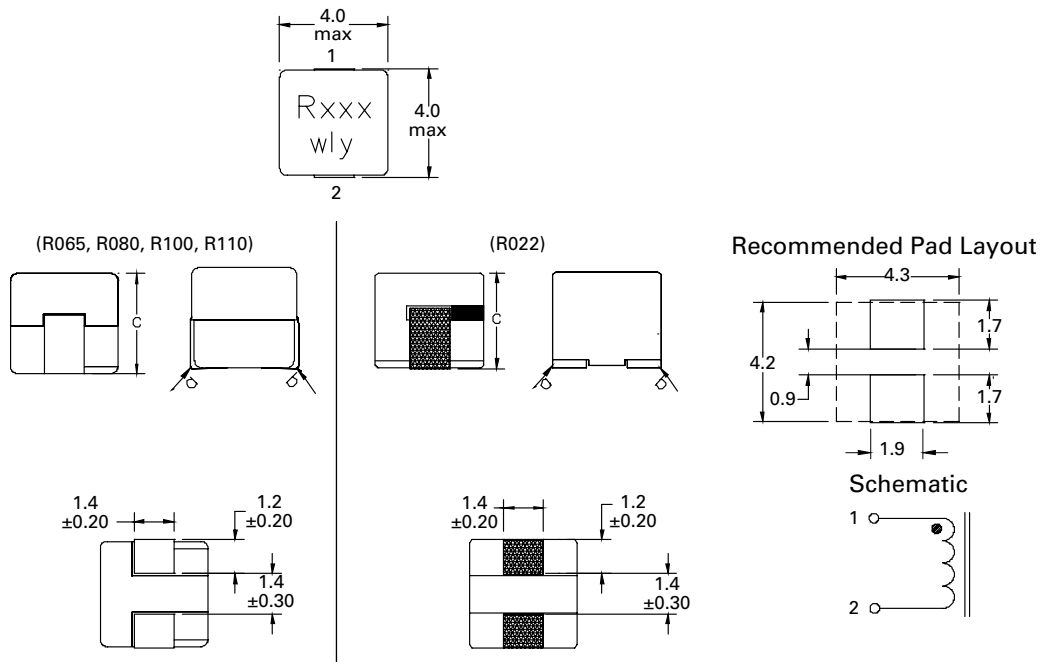
Part Number <sup>8</sup>	OCL <sup>1</sup> (nH) ±15%	FLL <sup>2</sup> (nH) minimum	I <sub>avg</sub> <sup>3</sup> (A)	I <sub>avg</sub> <sup>14</sup> (A)	I <sub>avg</sub> <sup>25</sup> (A)	I <sub>avg</sub> <sup>36</sup> (A)	DCR (mΩ) @ +20 °C ±25%	K-factor <sup>7</sup>
FP0404R1-R022-R	22 ±20%	15	19	40	34	32	0.32 ± 15%	2351
FP0404R1-R065-R	65	44	19	24	22	20	0.32	2248
FP0404R1-R080-R	80	54	19	20	18	16	0.32	2248
FP0404R1-R100-R	100	68	19	16	14	13	0.32	2248
FP0404R1-R110-R	110	74	19	14	13	12	0.32	2248

- Open Circuit Inductance (OCL) Test Parameters: 100 kHz (1 MHz for R022), 0.1 Vrms, 0.0 Adc, +25 °C
- Full Load Inductance (FLL) Test Parameters: 100 kHz (1 MHz for R022), 0.1 Vrms, I<sub>avg</sub><sup>1</sup>, +25 °C
- I<sub>avg</sub><sup>3</sup>: DC current for an approximate temperature rise of 40 °C without core loss. Derating is necessary for AC currents. PCB layout, trace thickness and width, air-flow, and proximity of other heat generating components will affect the temperature rise. It is recommended that the temperature of the part not exceed +125 °C under worst case operating conditions verified in the end application.

- I<sub>avg</sub><sup>1</sup>: Peak current for approximately 20% rolloff @ +25 °C
- I<sub>avg</sub><sup>2</sup>: Peak current for approximately 20% rolloff @ +100 °C
- I<sub>avg</sub><sup>3</sup>: Peak current for approximately 20% rolloff @ +125 °C
- K-factor: Used to determine Bp-p for core loss (see graph). Bp-p = K \* L \* ΔI \* 10<sup>-3</sup>. Bp-p:(Gauss), K: (K-factor from table), L: (Inductance in nH), ΔI (Peak to peak ripple current in Amps).
- Part Number Definition: FP0404-Rxxx-R  
FP0404 = Product code and size  
Rx= DCR indicator  
Rxxx=Inductance value in μH, R=decimal point  
-R suffix = RoHS compliant

**Dimensions (mm)**

Part Number	C max
R022-R	3.0
R065-R	4.0
R080-R	4.0
R100-R	4.0
R110-R	4.0

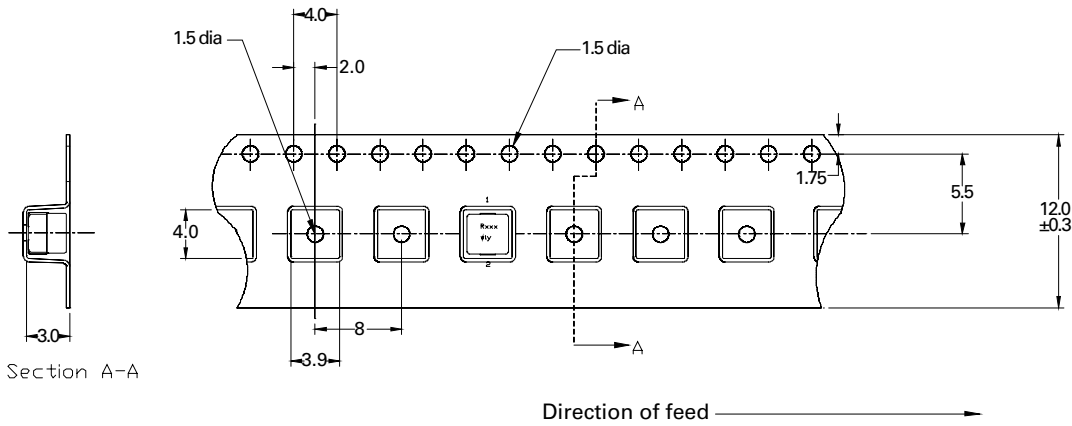


Part marking: Rxxx xxx=inductance value in uH, R=decimal point, wly= date code  
All soldering surfaces to be coplanar within 0.1 millimeters  
DCR is measured from point "a" to point "b"  
Do not route traces or vias underneath the inductor

**Packaging information (mm)**

**FP0404R1-R022-R**

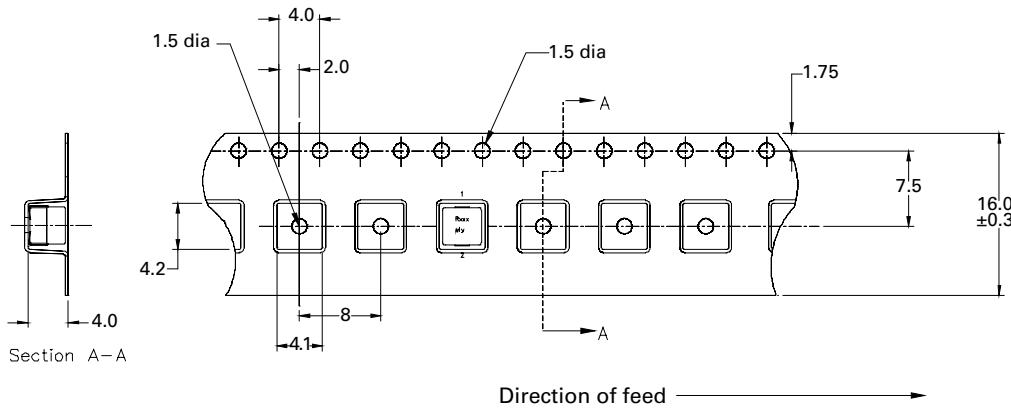
Supplied in tape and reel packaging, 1,800 parts per 13" diameter reel



**Packaging information (mm)**

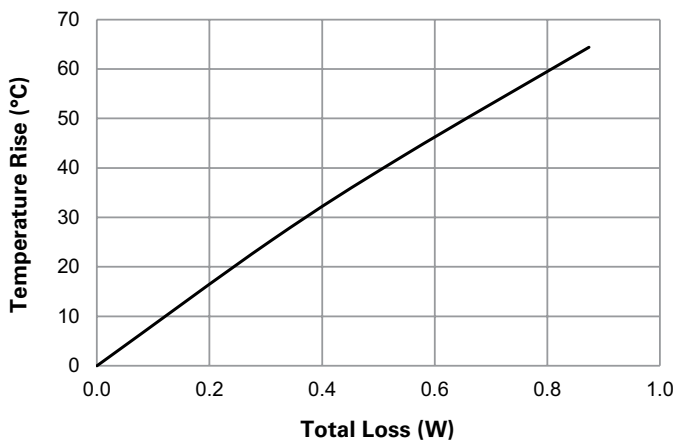
**FP0404R1-R065-R, R080-R, R100-R, R110-R**

Supplied in tape and reel packaging, 1,800 parts per 13" diameter reel

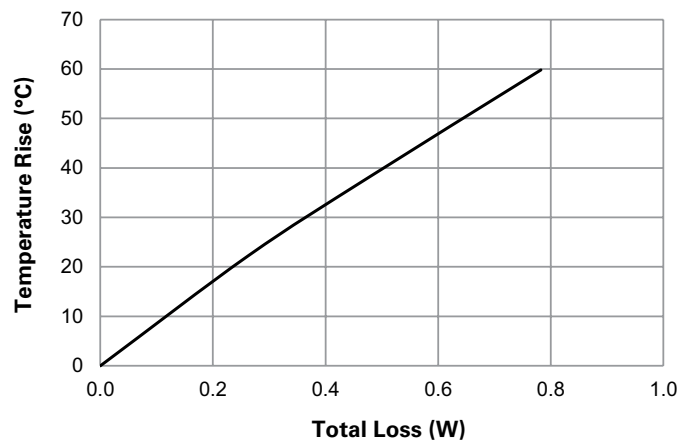


**Temperature rise vs. total loss**

**FP0404R1-R022-R**

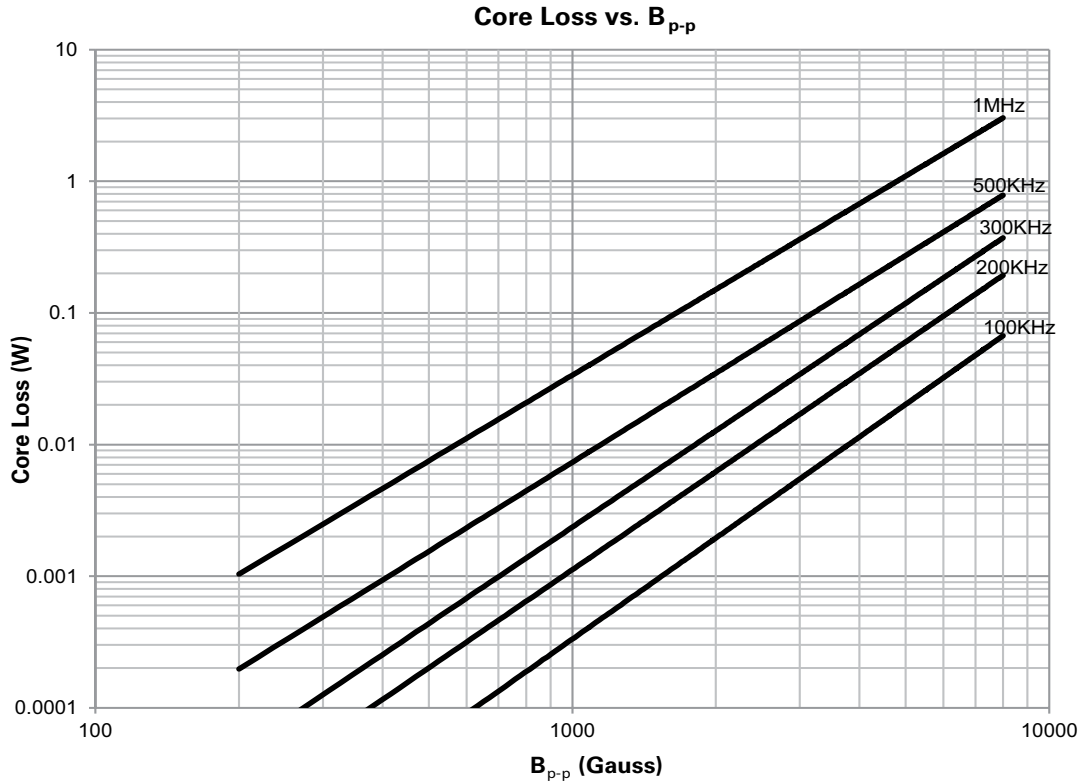


**FP0404R1-R065-R, R080, R100-R, R110-R**

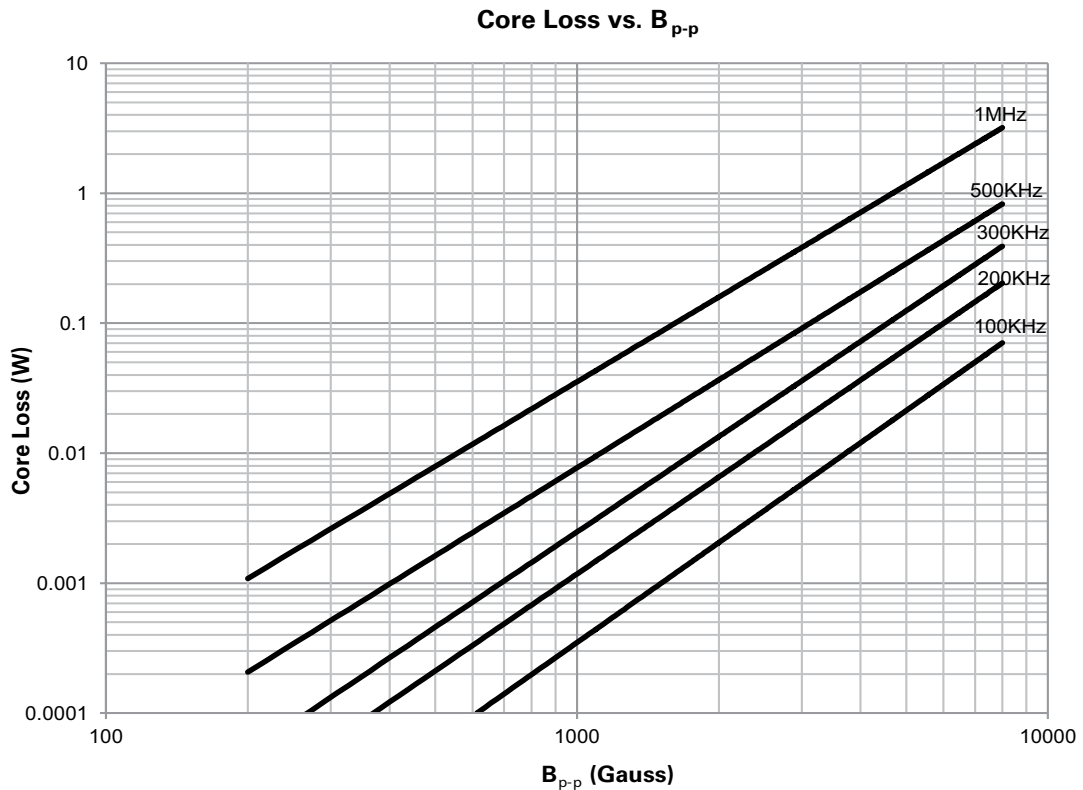


Core loss

FP0404R1-R022-R

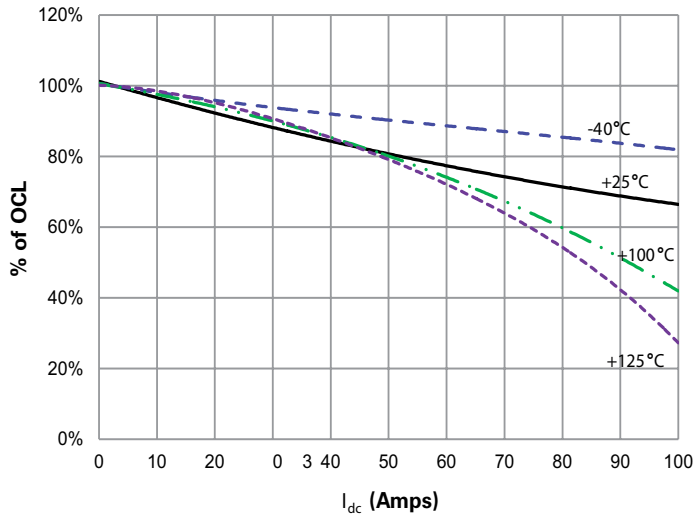


FP0404R1-R065-R, R080-R, R100-R, R110-R

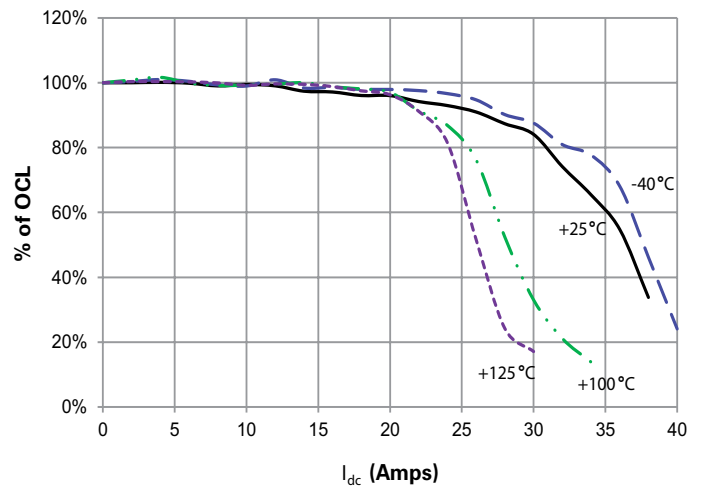


Inductance characteristics

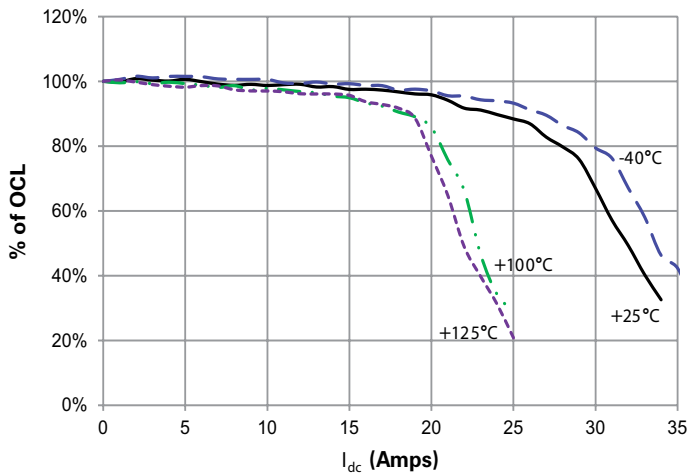
FP0404R1-R022-R



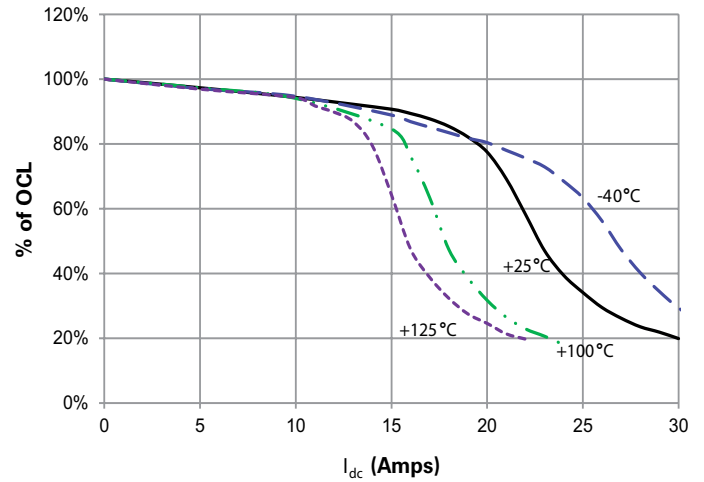
FP0404R1-R065-R



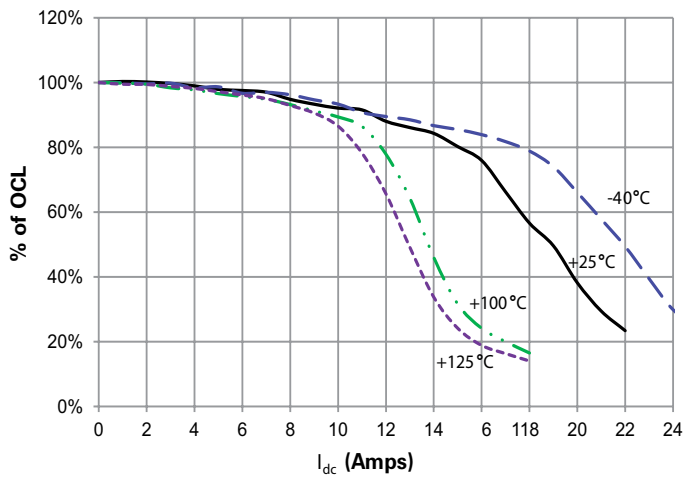
FP0404R1-R080-R



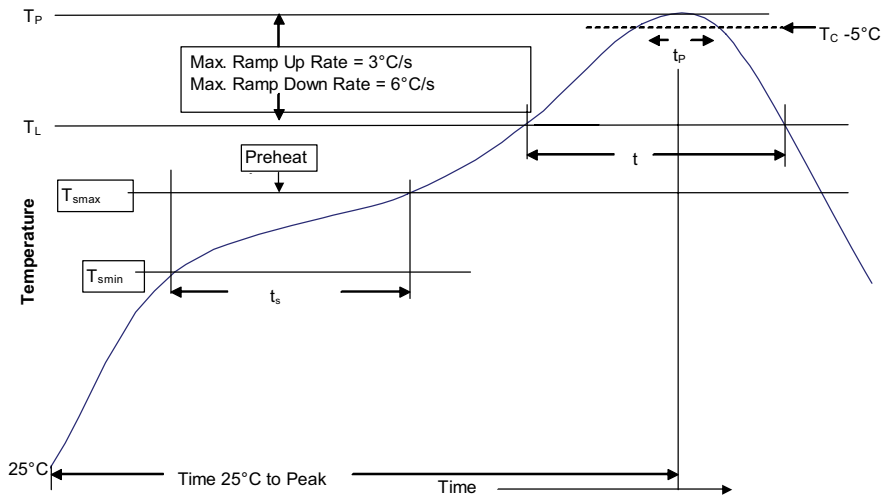
FP0404R1-R100-R



FP0404R1-R110-R



**Solder reflow profile**



**Table 1 - Standard SnPb Solder ( $T_c$ )**

Package Thickness	Volume $mm^3$ <350	Volume $mm^3$ $\geq$ 350
<2.5mm)	235°C	220°C
$\geq$ 2.5mm	220°C	220°C

**Table 2 - Lead (Pb) Free Solder ( $T_c$ )**

Package Thickness	Volume $mm^3$ <350	Volume $mm^3$ 350 - 2000	Volume $mm^3$ >2000
<1.6mm	260°C	260°C	260°C
1.6 - 2.5mm	260°C	250°C	245°C
>2.5mm	250°C	245°C	245°C

**Reference JDEC J-STD-020**

Profile Feature	Standard SnPb Solder	Lead (Pb) Free Solder
Preheat and Soak		
• Temperature min. ( $T_{smin}$ )	100°C	150°C
• Temperature max. ( $T_{smax}$ )	150°C	200°C
• Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ )	60-120 Seconds	60-120 Seconds
Average ramp up rate $T_{smax}$ to $T_p$	3°C/ Second Max.	3°C/ Second Max.
Liquidous temperature ( $T_L$ )	183°C	217°C
Time at liquidous ( $t_L$ )	60-150 Seconds	60-150 Seconds
Peak package body temperature ( $T_p$ )*	Table 1	Table 2
Time ( $t_p$ )** within 5 °C of the specified classification temperature ( $T_c$ )	20 Seconds**	30 Seconds**
Average ramp-down rate ( $T_p$ to $T_{smax}$ )	6°C/ Second Max.	6°C/ Second Max.
Time 25°C to Peak Temperature	6 Minutes Max.	8 Minutes Max.

\* Tolerance for peak profile temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum.

\*\* Tolerance for time at peak profile temperature ( $t_p$ ) is defined as a supplier minimum and a user maximum.

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