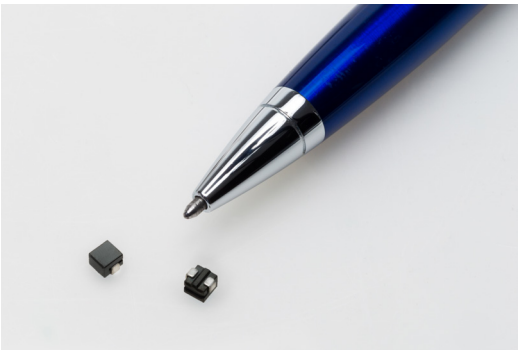
FP0404

High frequency, high current power inductors



Product features

- High current carrying capacity
- Low core loss
- DC-DC converter applications up to 2 MHz
- Filtering applications see inductance vs frequency and impedance vs frequency curves on page 5
- Inductance Range from 22 nH to 170 nH
- Current range up to 40 A
- 4.0 mm x 4.0 mm footprint surface mount package in 3.0 mm and 4.0 mm heights
- Moisture sensitivity level (MSL): 1
- 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

Pb HALOGEN HF FREE RoHS

Powering Business Worldwide

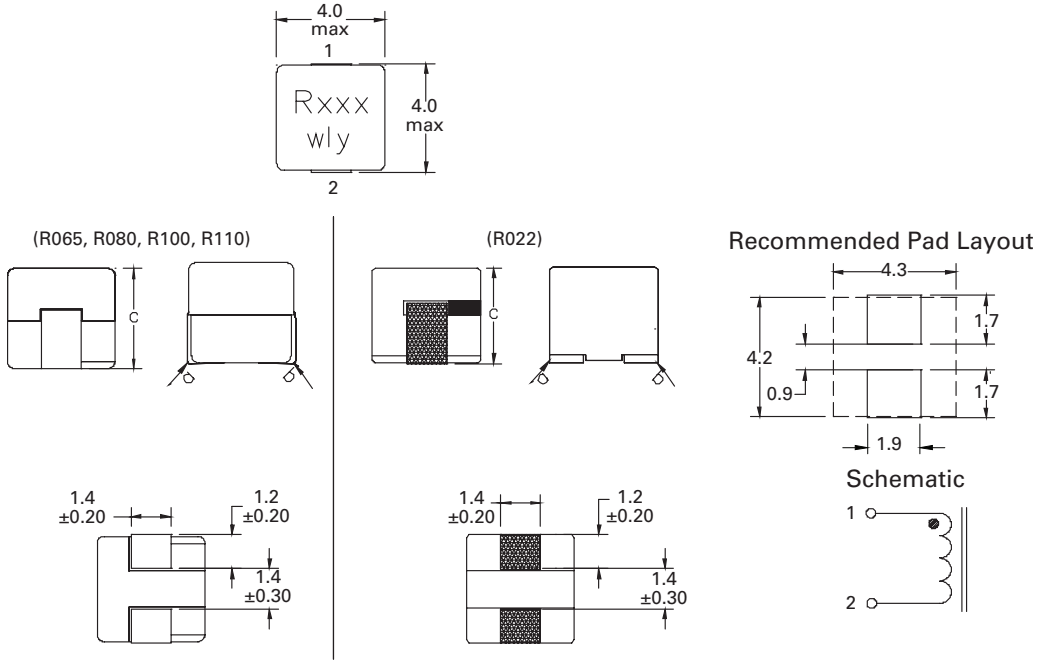
Product specifications

Part number[5]	OCL[1] (nH) ±15%	FLL[2] (nH) minimum	I_{rms}[3] (A)	$I_{sat}1$[4] (A)	$I_{sat}2$[5] (A)	$I_{sat}3$[6] (A)	DCR (mΩ) @ +20 °C ±25%	K-factor[7]
FP0404R1-R022-R	22 ±20%	15	40	40	34	32	0.32 ± 15%	2351
FP0404R1-R065-R	65	44	40	24	22	20	0.32	2248
FP0404R1-R080-R	80	54	40	19.5	18	16	0.32	2248
FP0404R1-R100-R	100	68	40	15.6	14	13	0.32	2248
FP0404R1-R110-R	110	74.5	40	14.2	13	11.8	0.32	2248
FP0404R1-R170-R	170	116	40	9.0	7.8	7.6	0.32	2248

1. Open Circuit Inductance (OCL) Test parameters: 100 kHz (1 MHz for R022), 0.1 Vrms, 0.0 Adc, +25 °C
2. Full Load Inductance (FLL) Test parameters: 100 kHz (1 MHz for R022), 0.1 Vrms, $I_{sat}1$, +25 °C
3. I_{rms}: 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 underworst case operating conditions verified in the end application.
4. $I_{sat}1$: Peak current for approximately 20% rolloff @ +25 °C
5. $I_{sat}2$: Peak current for approximately 20% rolloff @ +100 °C
6. $I_{sat}3$: Peak current for approximately 20% rolloff @ +125 °C
7. K-factor: Used to determine Bp-p for core loss (see graph). Bp-p = K * L * ΔI * 10^{-3}. Bp-p:(Gauss), K: (K-factor from table), L: (Inductance in nH), ΔI (Peak to peak ripple current in Amps).
8. Part Number Definition: FP0404Rx-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
R170-R	4.0

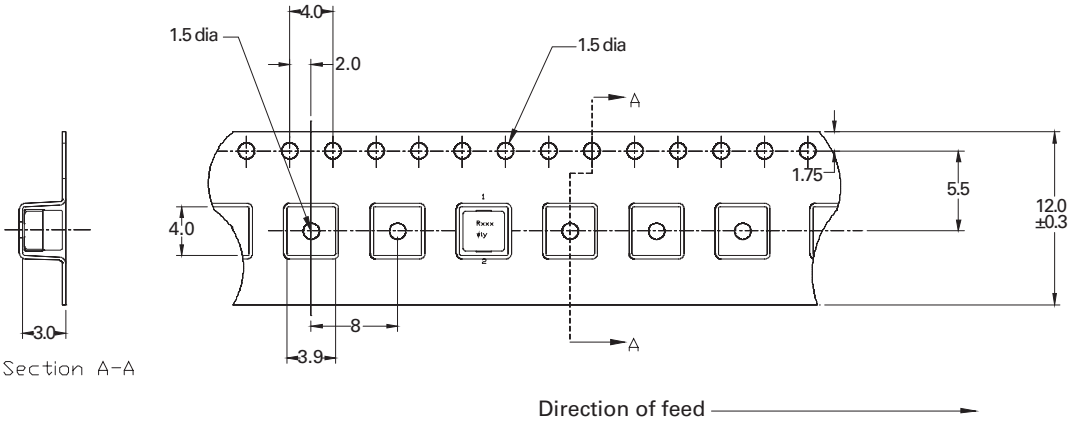


Part marking: Rxxx xxx=inductance value in uH, R=decimal point, wly= date code
All soldering surfaces to be coplanar within 0.1 millimeters
DCR is measured from point “a” to point “b”
Do not route traces or vias underneath the inductor

Packaging information (mm)

FP0404R1-R022-R

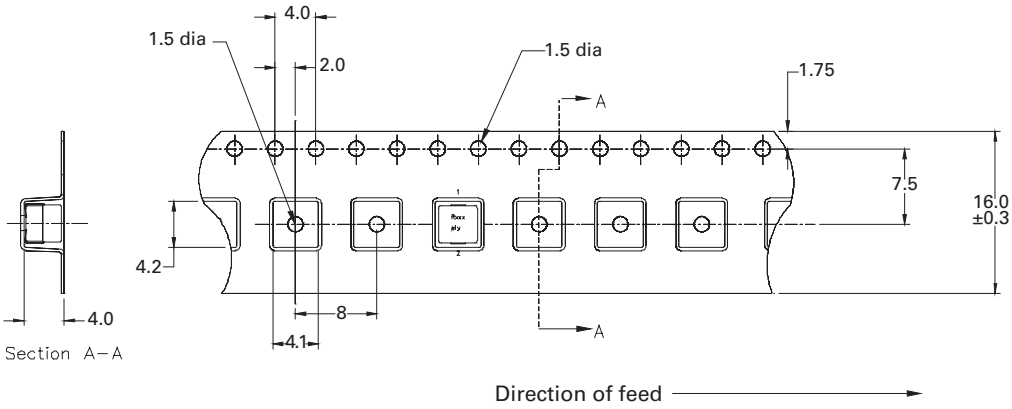
Supplied in tape and reel packaging, 1,800 parts per 13" diameter reel



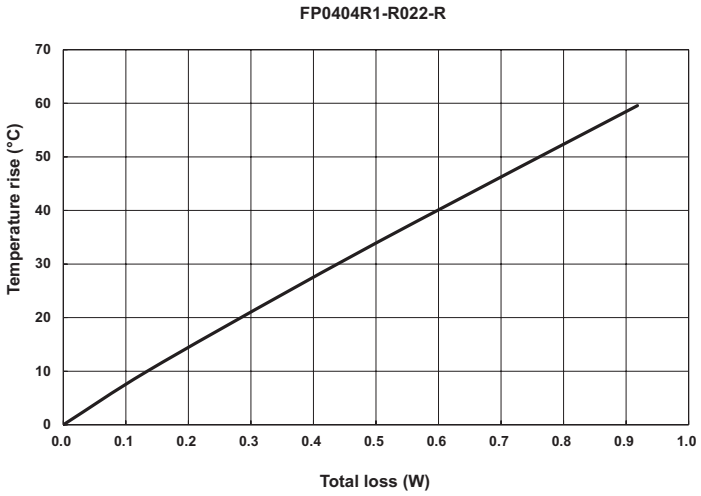
Packaging information (mm)

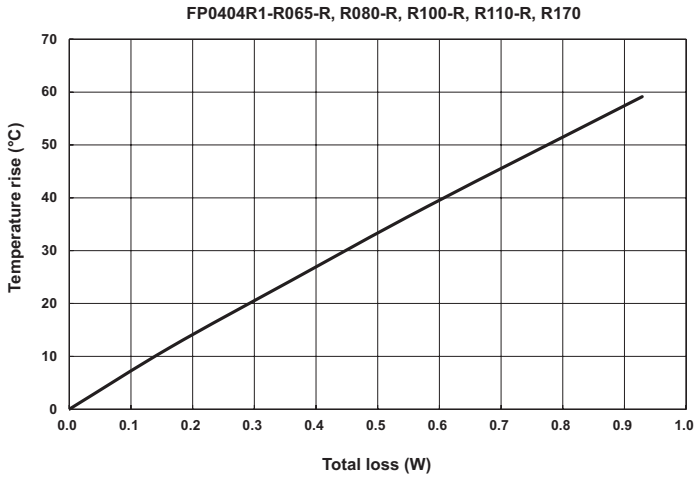
FP0404R1-R065-R, R080-R, R100-R, R110-R, R-170

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



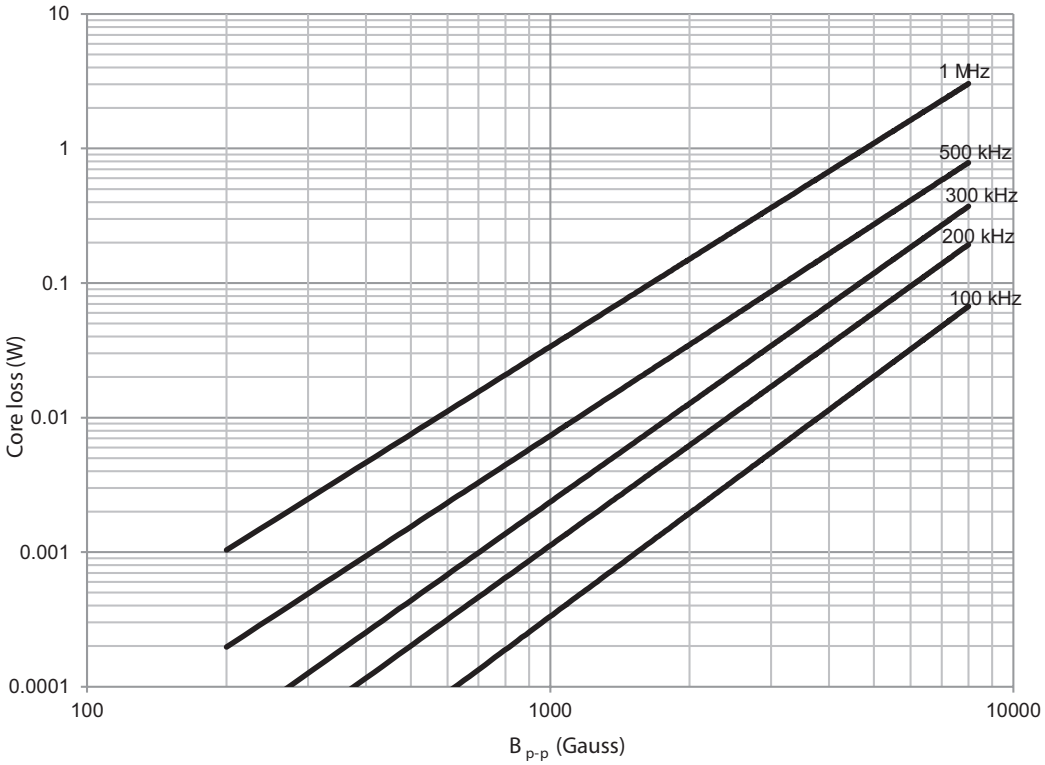
Temperature rise vs. total loss



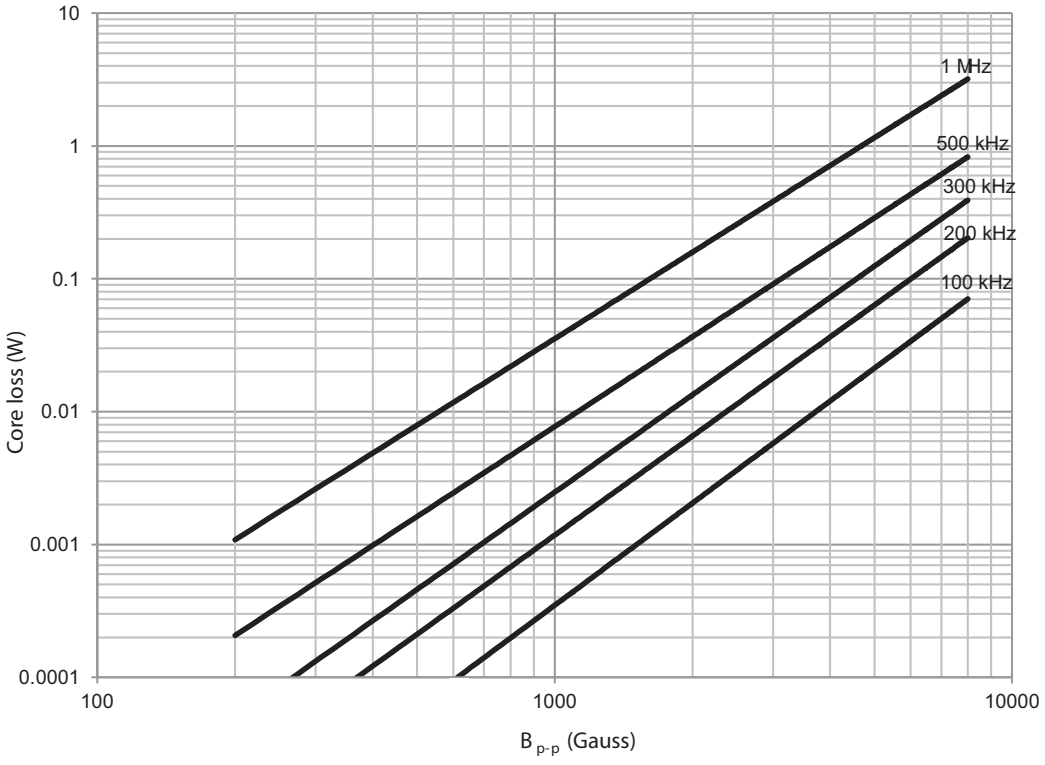


Core loss vs Bp-p

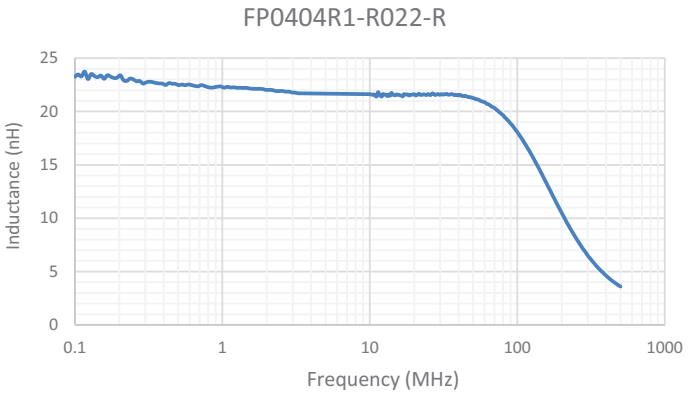
FP0404R1-R022-R

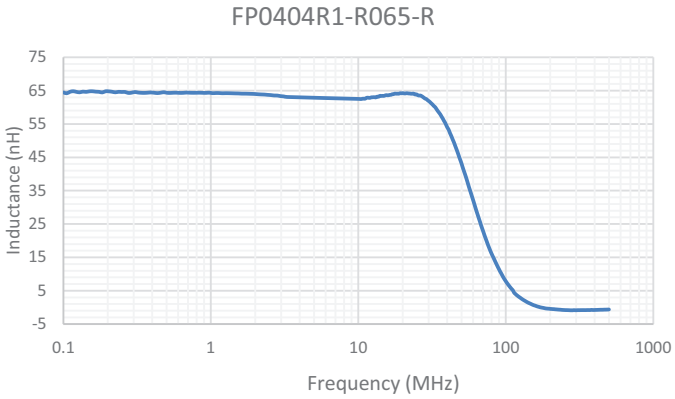


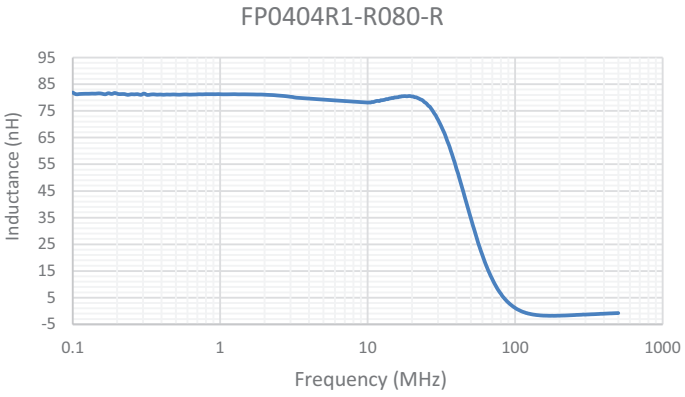
FP0404R1-R065-R, R080-R, R100-R, R110-R, R-170

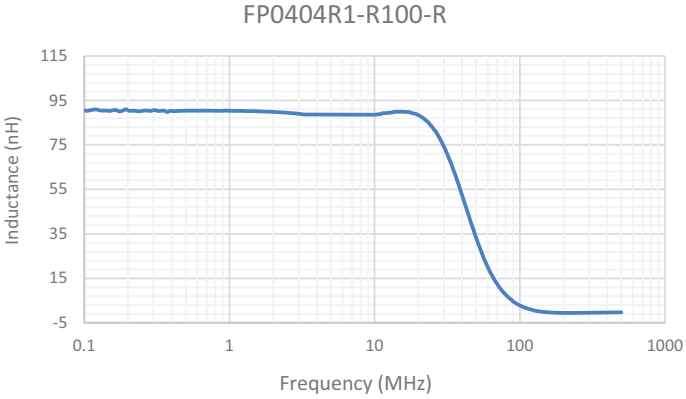


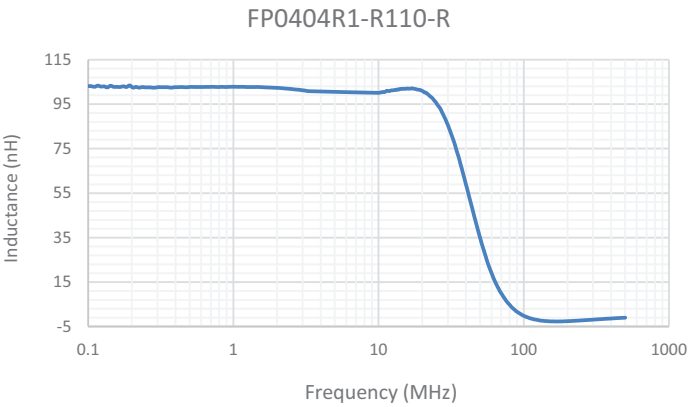
Inductance vs frequency

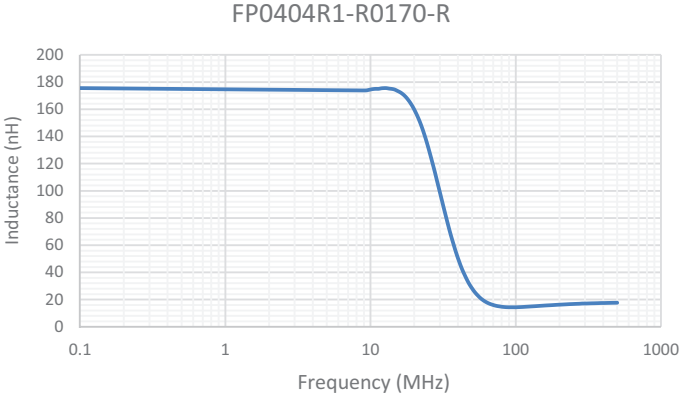




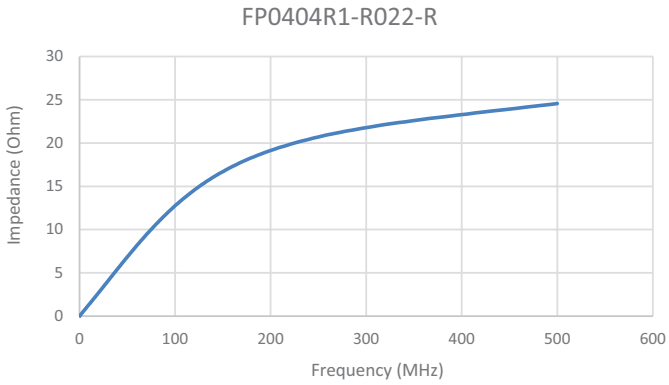


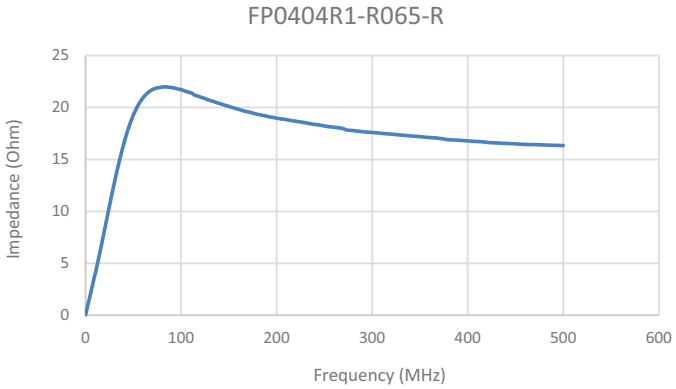


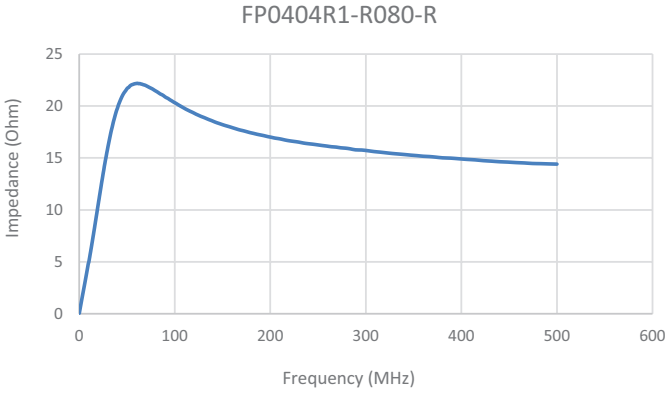


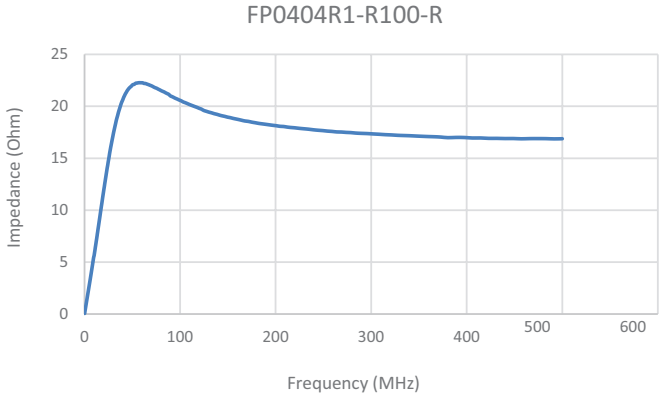


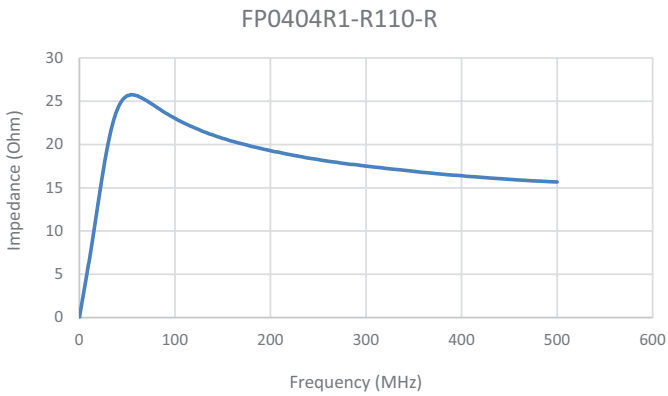
Impedance vs frequency

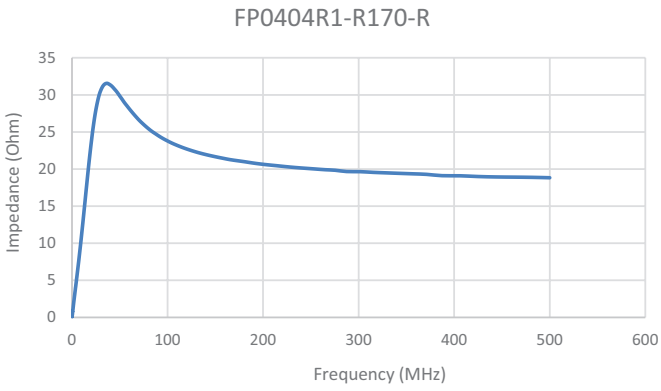






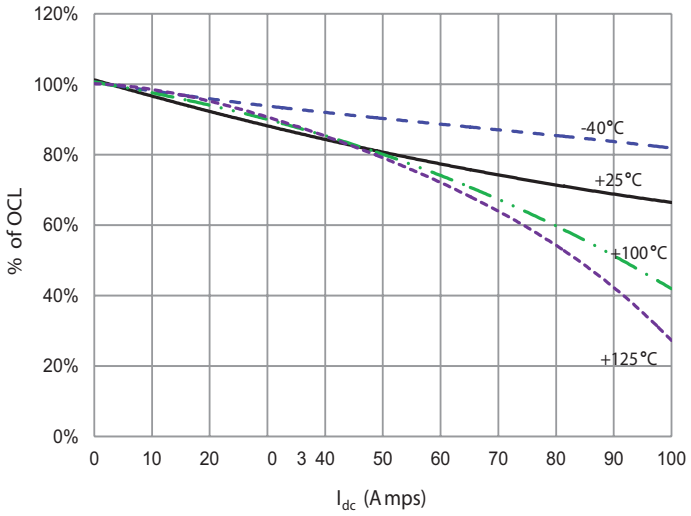




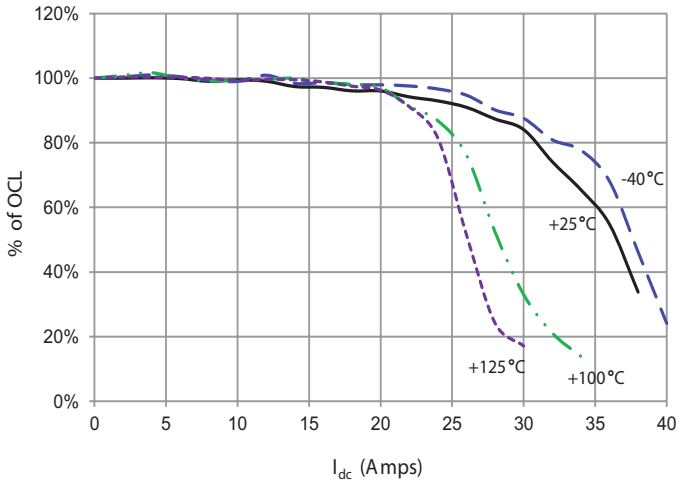


Inductance characteristics

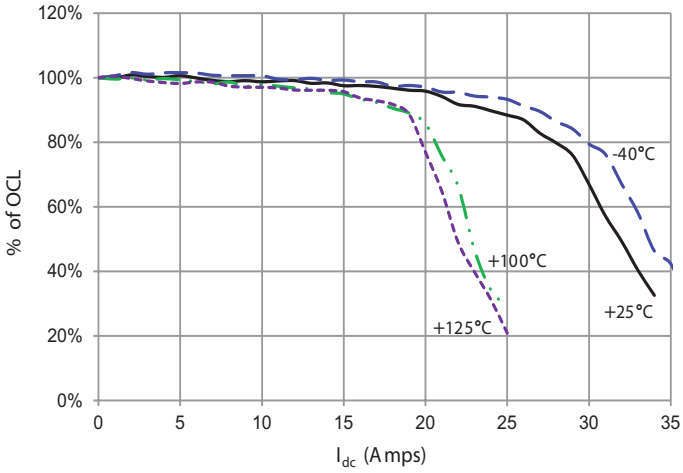
FP0404R1-R022-R



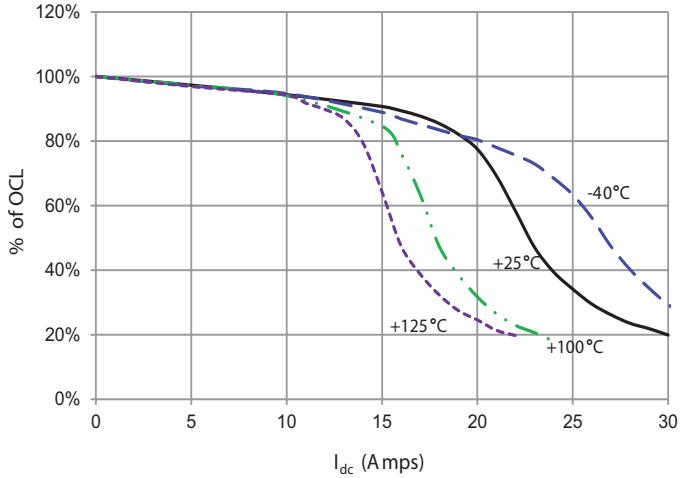
FP0404R1-R065-R



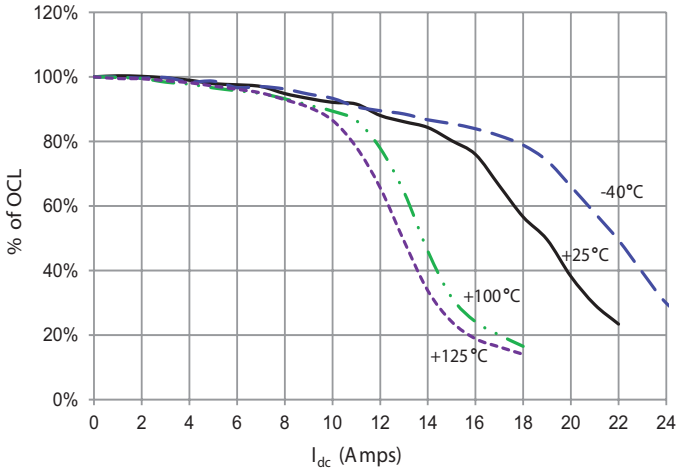
FP0404R1-R080-R



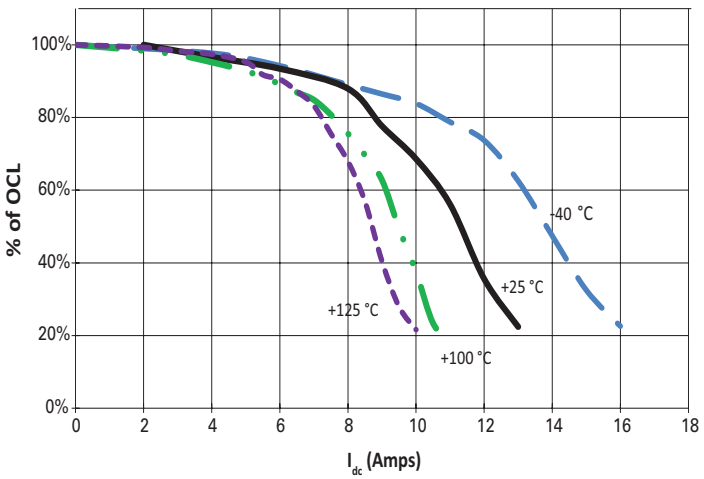
FP0404R1-R100-R



FP0404R1-R110-R



FP0404R1-R170-R



Solder reflow profile

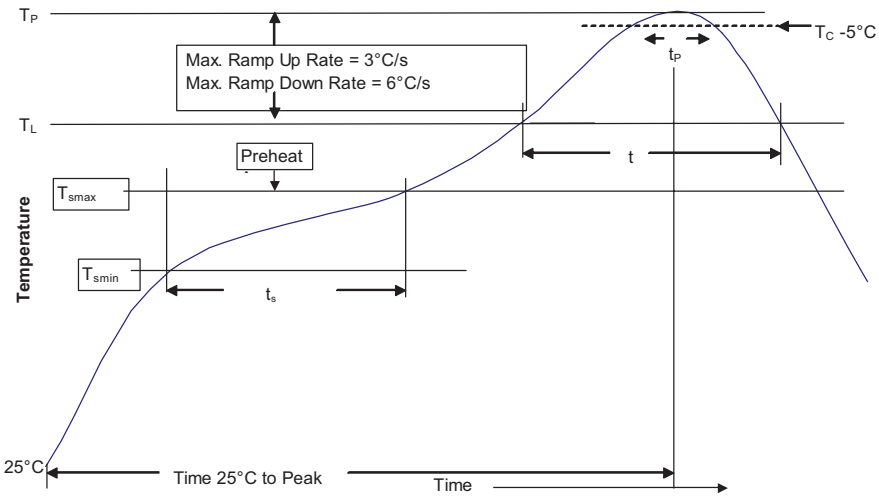


Table 1 - Standard SnPb solder (T_C)

Package thickness	Volume mm3 <350	Volume mm3 ≥350
<2.5 mm)	235 °C	220 °C
≥2.5 mm	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
<1.6 mm	260 °C	260 °C	260 °C
1.6 – 2.5 mm	260 °C	250 °C	245 °C
>2.5 mm	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) Time at liquidous (t_L)		183 °C 60-150 seconds	217 °C 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.

Eaton
Electronics Division
1000 Eaton Boulevard
Cleveland, OH 44122
United States
www.eaton.com/electronics

Printed in USA
Publication No. 4373 PCN19008
June 2019

Powering Business Worldwide