

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)



Product specifications

Part number ⁸	OCL ¹ (nH) ±15%	FLL ² (nH) minimum	I _{DC} ³ (A)	I _{pk1} ⁴ (A)	I _{pk2} ⁵ (A)	I _{pk3} 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_{DC}³, +25 °C
3. I_{DC}³: 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.

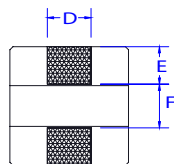
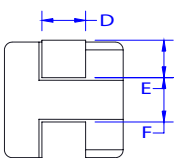
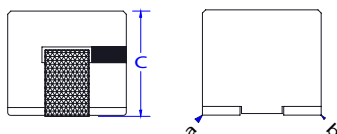
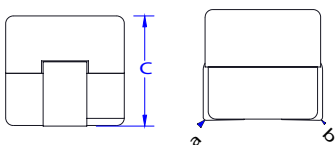
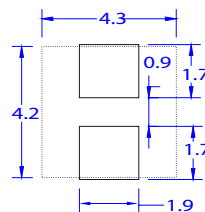
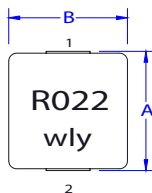
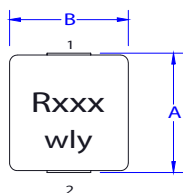
4. I_{pk1}⁴: Peak current for approximately 20% rolloff @ +25 °C
5. I_{pk2}⁵: Peak current for approximately 20% rolloff @ +100 °C
6. I_{pk3}⁶: Peak current for approximately 20% rolloff @ +125 °C
7. K-factor: Used to determine Bp-p for core loss (see graph). Bp-p = K * L * ΔI * 10⁻³. Bp-p:(Gauss), K: (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)

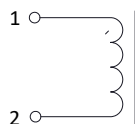
R065, R080, R100, R110, R170

R022

Recommended pad layout



SCHMATIC



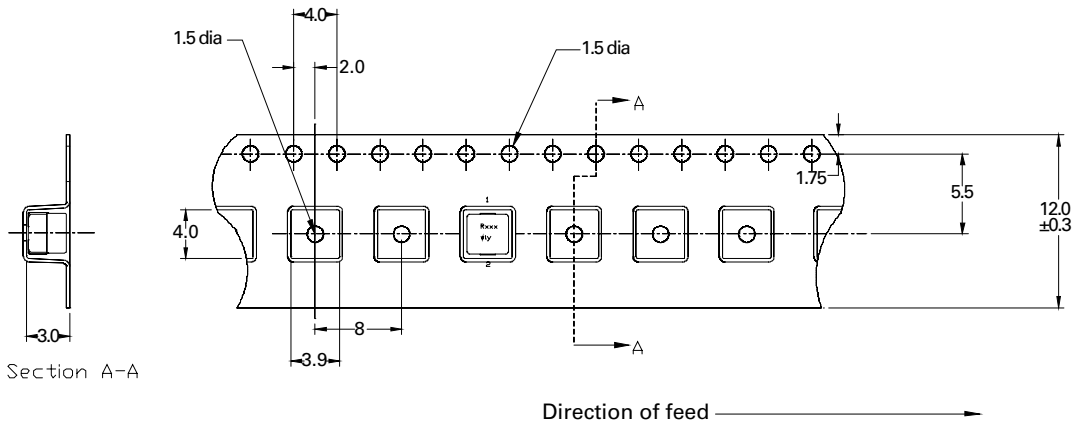
Part number	A	B	C	D	E	F
R022-R	4.0 maximum	4.0 maximum	3.0 maximum	1.4 ±0.20	1.2 ±0.2	1.4 ±0.3
R065-R	3.7 ±0.30	3.7 ±0.30	3.5 ±0.50	1.4 ±0.20	1.2 ±0.2	1.4 ±0.3
R080-R	3.7 ±0.30	3.7 ±0.30	3.5 ±0.50	1.4 ±0.20	1.2 ±0.2	1.4 ±0.3
R100-R	3.7 ±0.30	3.7 ±0.30	3.5 ±0.50	1.4 ±0.20	1.2 ±0.2	1.4 ±0.3
R110-R	3.7 ±0.30	3.7 ±0.30	3.5 ±0.50	1.4 ±0.20	1.2 ±0.2	1.4 ±0.3
R170-R	3.7 ±0.30	3.7 ±0.30	3.5 ±0.50	1.4 ±0.20	1.2 ±0.2	1.4 ±0.3

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

Packaging information (mm)

FP0404R1-R022-R

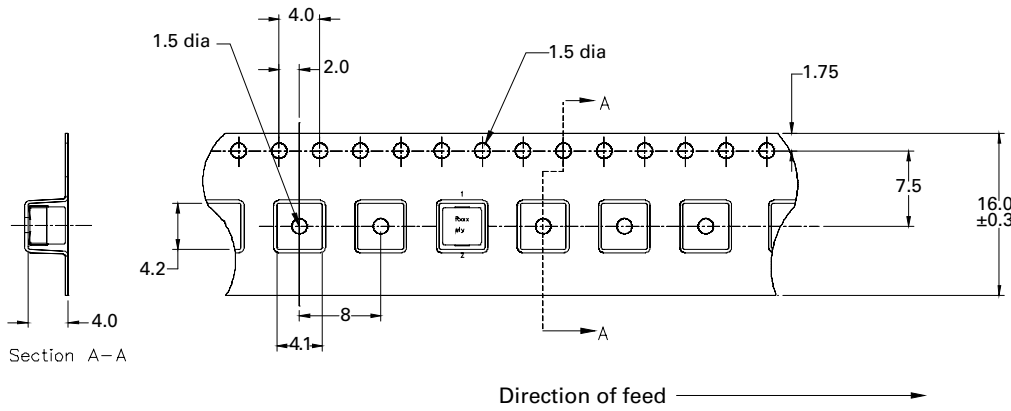
Supplied in tape and reel packaging, 1,800 parts per 13" diameter reel



Packaging information (mm)

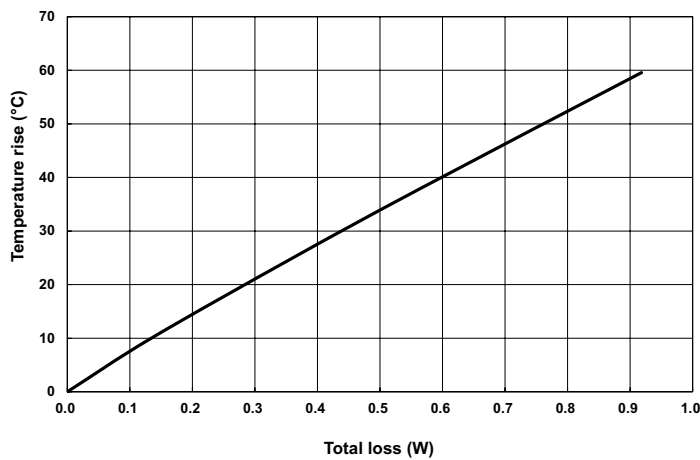
FP0404R1-R065-R, R080-R, R100-R, R110-R, R-170

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

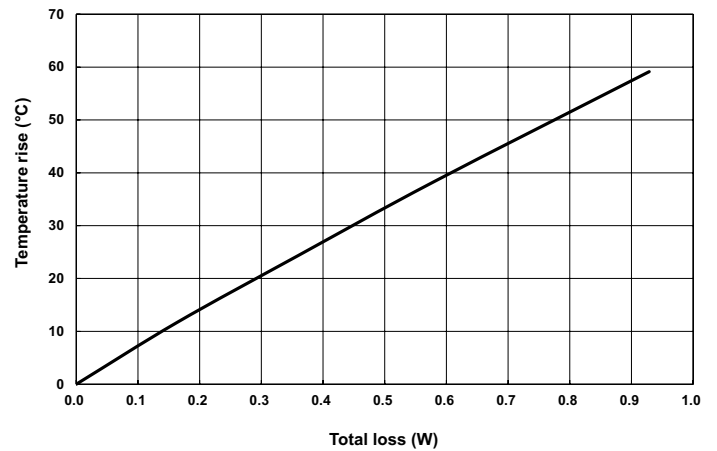


Temperature rise vs. total loss

FP0404R1-R022-R

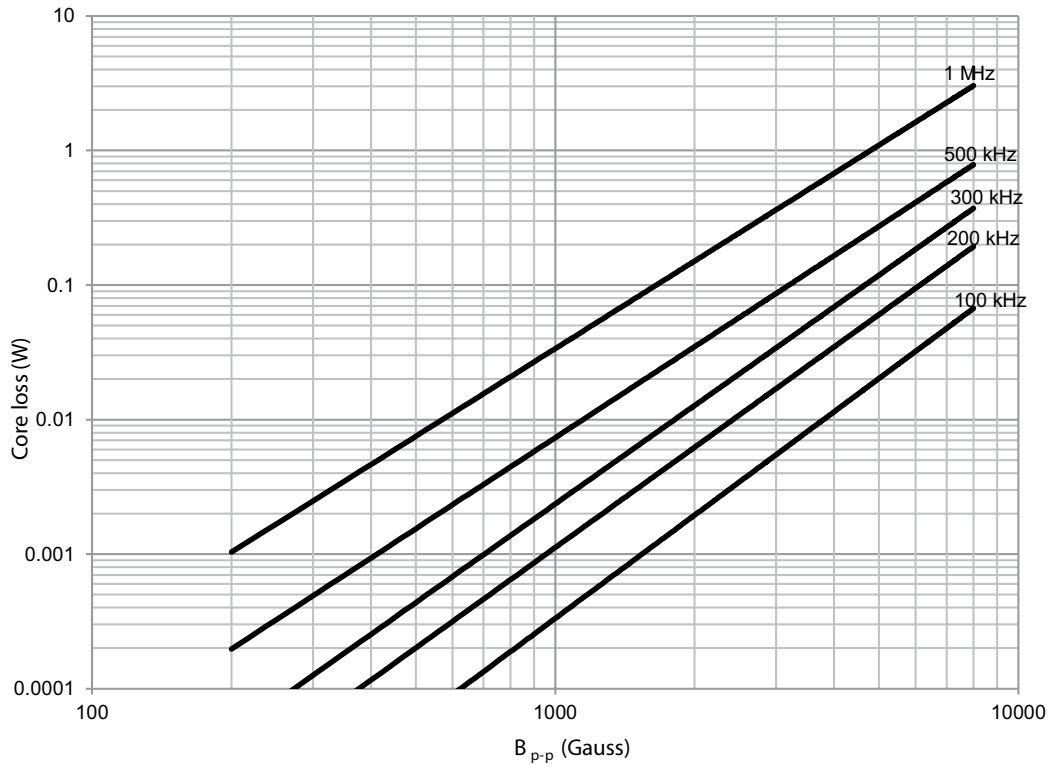


FP0404R1-R065-R, R080-R, R100-R, R110-R, R170

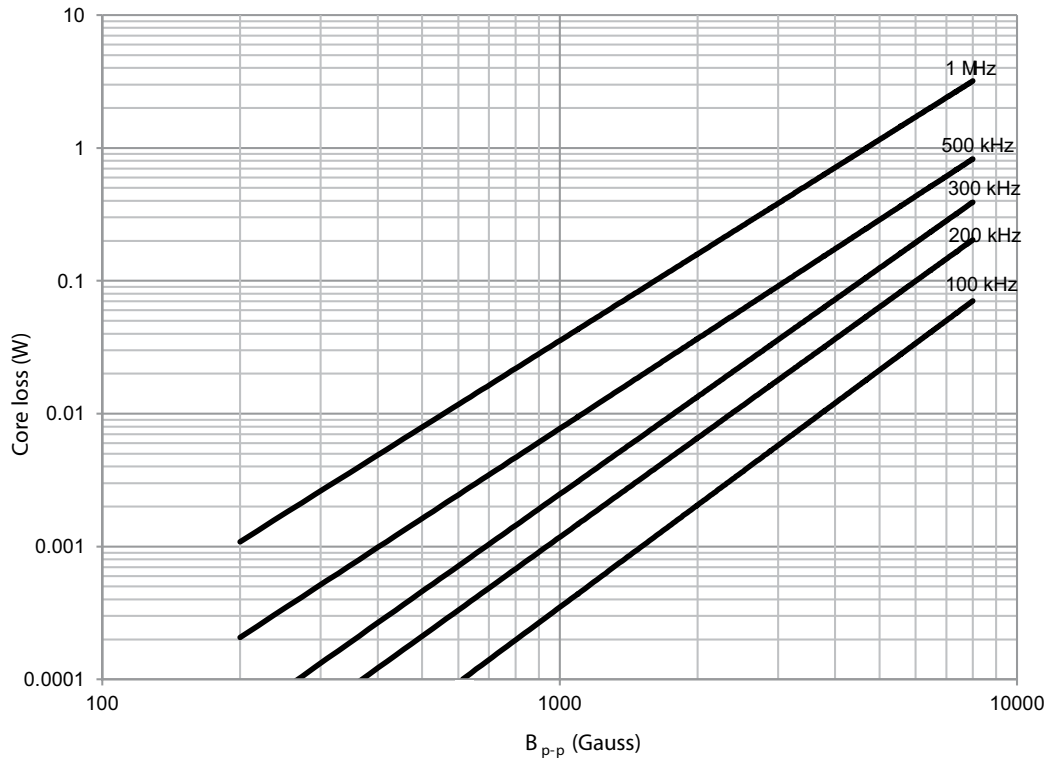


Core loss vs Bp-p

FP0404R1-R022-R

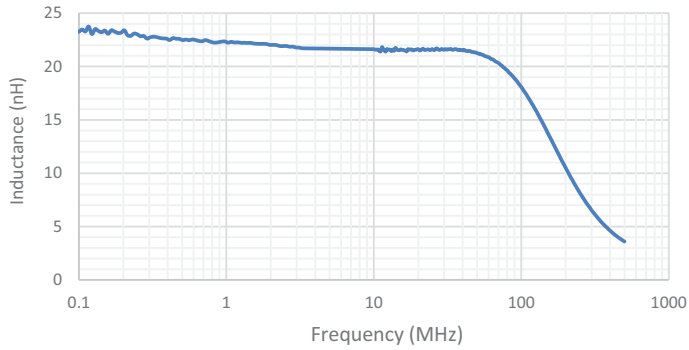


FP0404R1-R065-R, R080-R, R100-R, R110-R, R-170

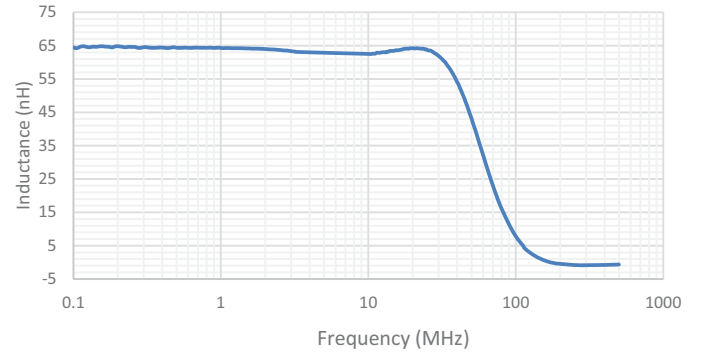


Inductance vs frequency

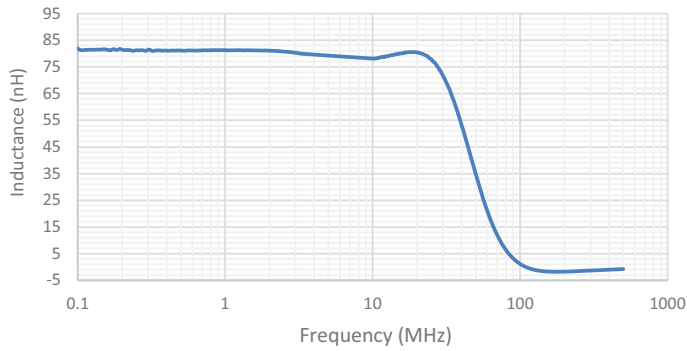
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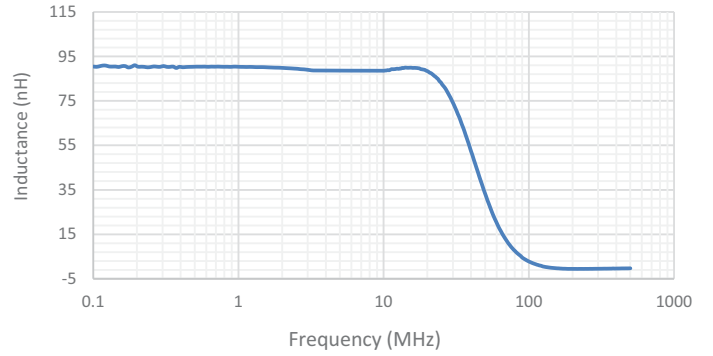
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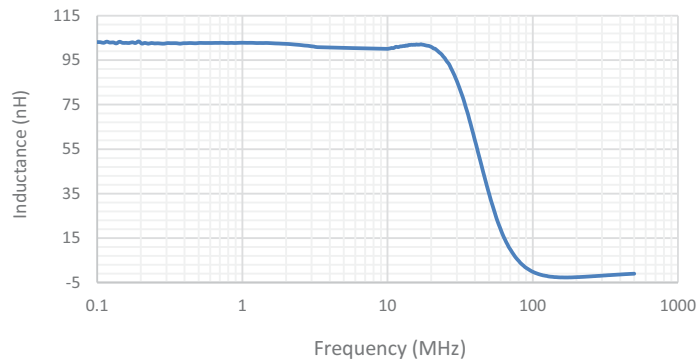
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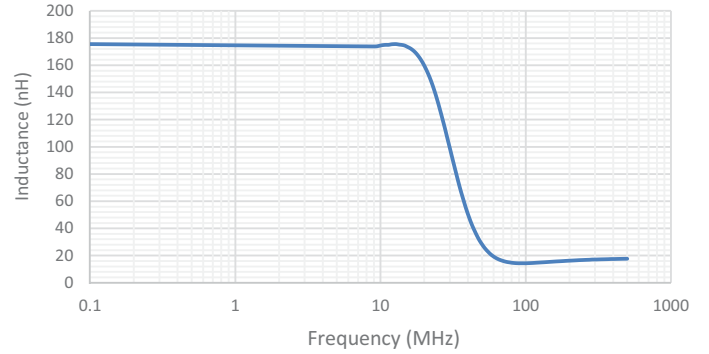
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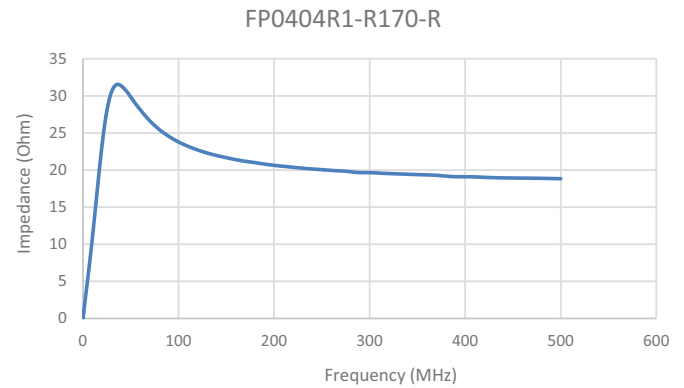
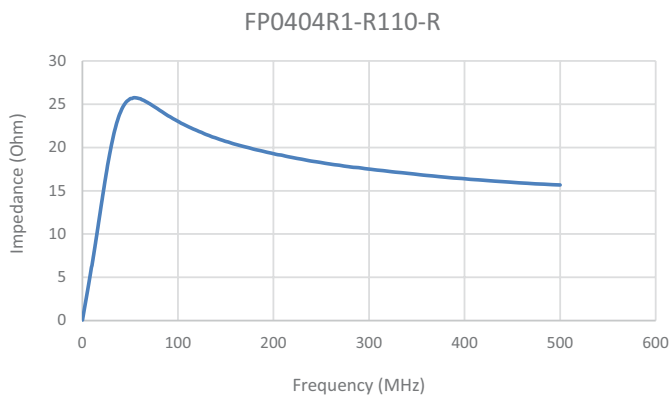
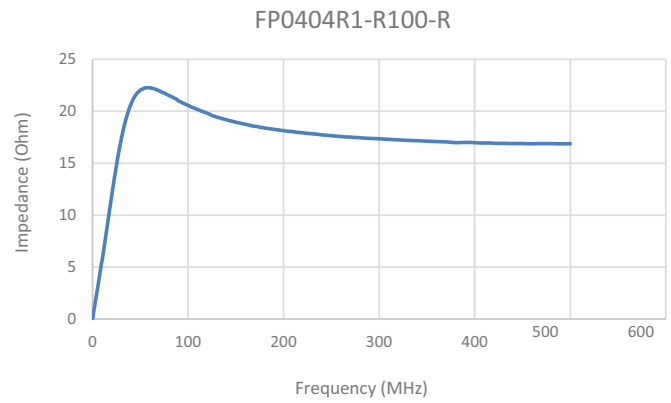
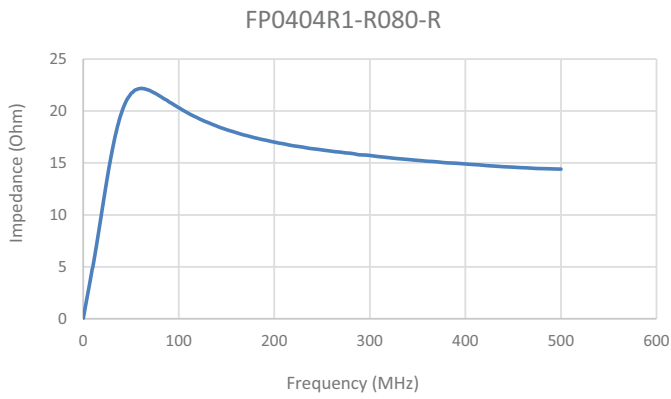
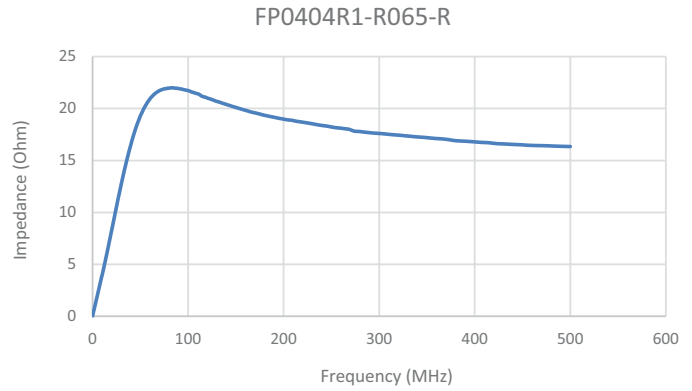
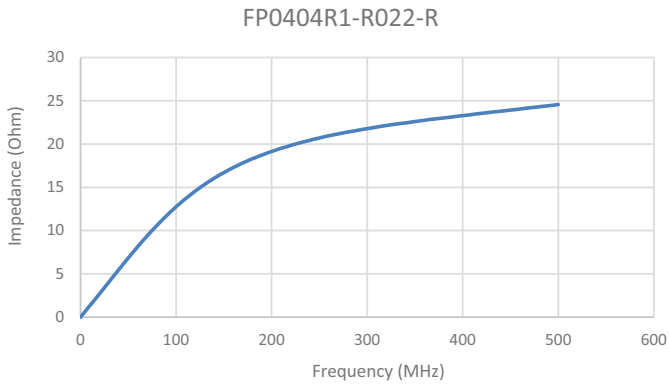
FP0404R1-R110-R



FP0404R1-R0170-R

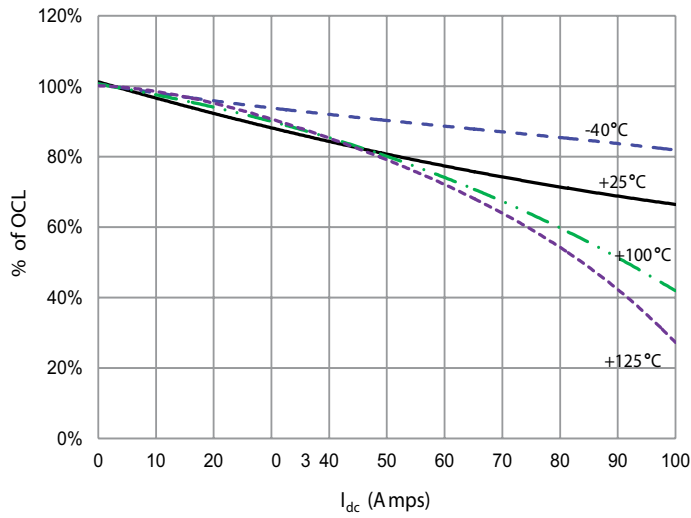


Impedance vs frequency

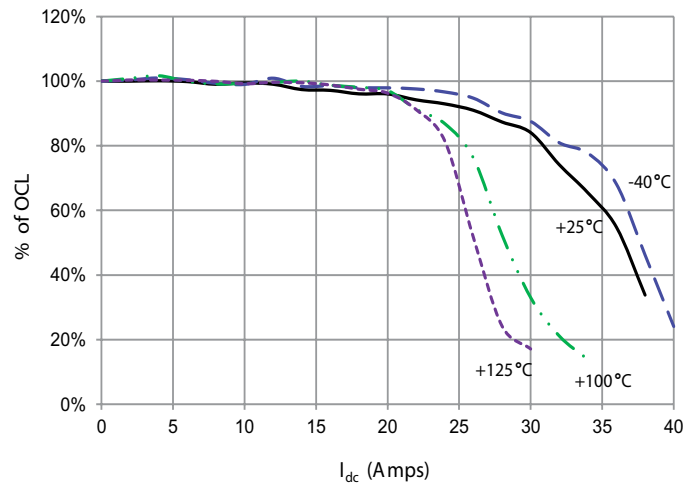


Inductance characteristics

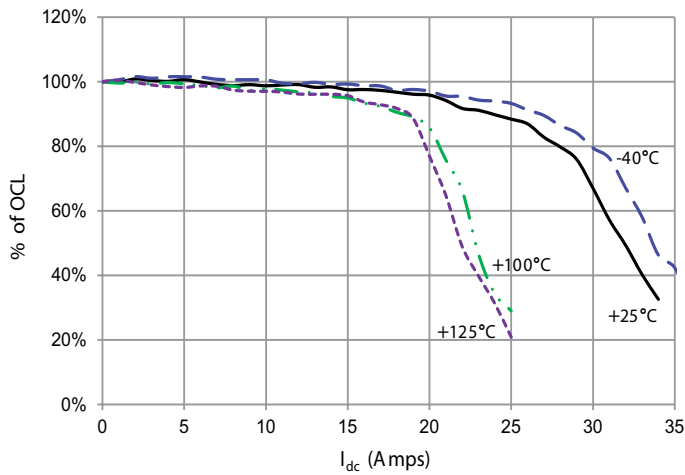
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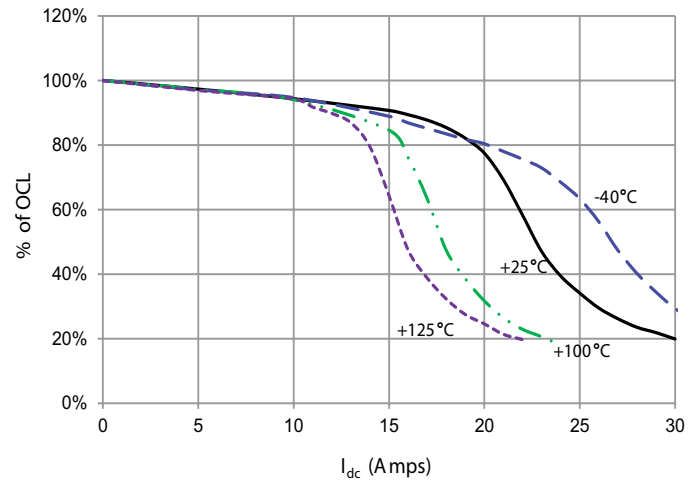
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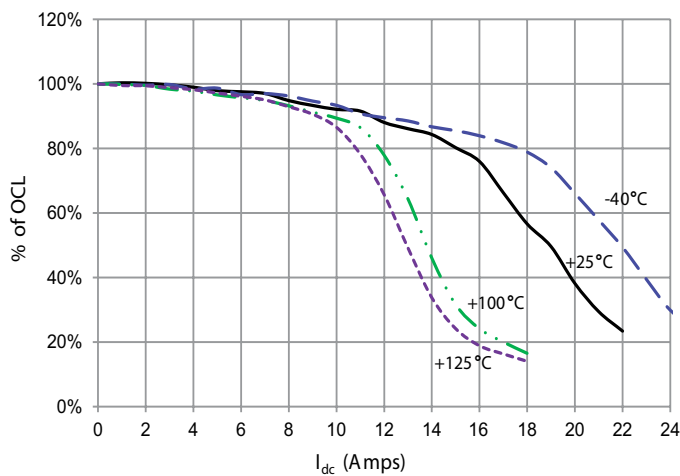
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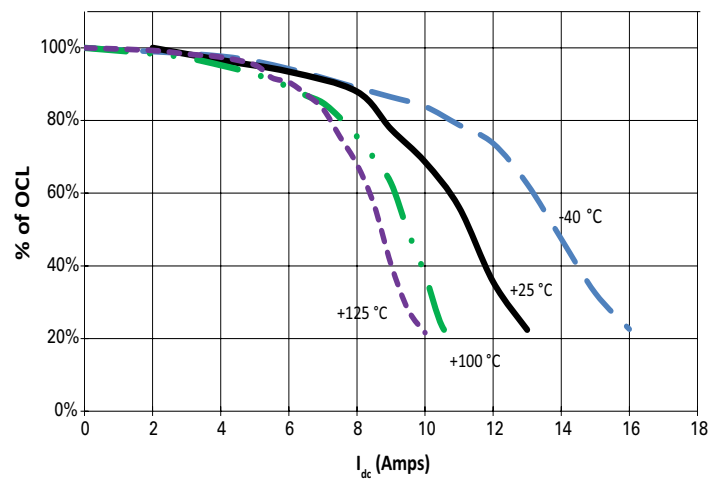
FP0404R1-R100-R



FP0404R1-R110-R



FP0404R1-R170-R



Solder reflow profile

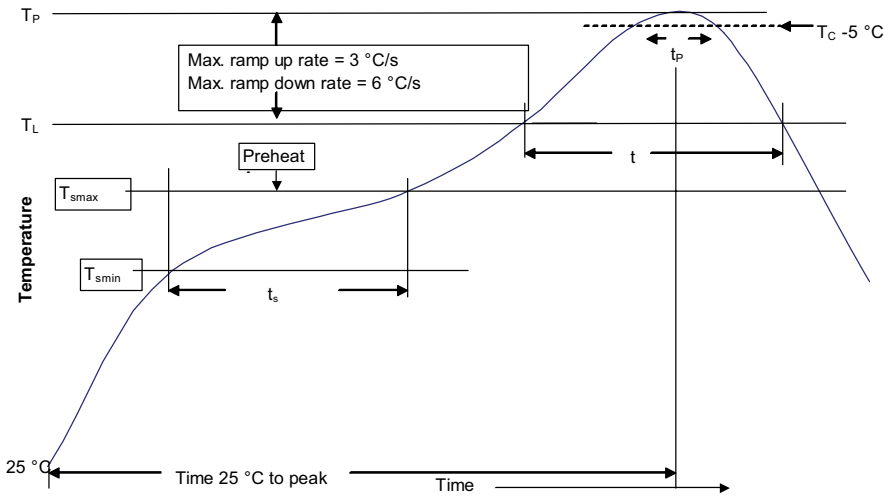


Table 1 - Standard SnPb solder (T_C)

Package thickness	Volume mm ³ <350	Volume mm ³ ≥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 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
Ramp up rate T_L to T_p	3 °C/ second max.	3 °C/ second max.
Liquidous temperature (T_L)	183 °C	217 °C
Time (t_L) maintained above 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*
Ramp-down rate (T_p to T_L)	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.

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