

# High Current, High Frequency, Power Inductors

## FLAT-PAC™ FP1109 Series



### Description:

- Halogen free
- 125°C maximum total temperature operation
- 11.2 x 11.2 x 9.0mm maximum surface mount package
- Ferrite core material
- High current carrying capacity, low core losses
- Controlled DCR tolerance for sensing circuits
- Inductance range from 205nH to 950nH
- Current range from 11.5 to 69 amps
- Frequency range up to 2MHz
- RoHS compliant

### Applications:

- Multi-phase regulators
- Voltage Regulator Module (VRM)
- Desktop and server VRMs and EVRDs
- Data networking and storage systems
- Graphics cards and battery power systems
- Point-of-load modules
- DCR sensing
- Notebook regulators

### Environmental Data:

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

### Packaging:

- Supplied in tape and reel packaging, 350 parts per reel, 13" diameter reel

### Product Specifications

| Part Number <sup>7</sup> | OCL <sup>1</sup> ± 20% (nH) | FLL <sup>2</sup> Min. (nH) | I <sub>rms</sub> <sup>3</sup> (Amps) | I <sub>sat</sub> <sup>14</sup> @ 25°C (Amps) | I <sub>sat</sub> <sup>25</sup> @ 125°C (Amps) | DCR (mΩ) @ 20°C | K-factor <sup>6</sup> |
|--------------------------|-----------------------------|----------------------------|--------------------------------------|----------------------------------------------|-----------------------------------------------|-----------------|-----------------------|
| FP1109-R20-R             | 205                         | 122                        | 35                                   | 69                                           | 52                                            | 0.42 ±10%       | 233                   |
| FP1109-R23-R             | 247                         | 147                        |                                      | 55                                           | 41                                            |                 | 233                   |
| FP1109-R27-R             | 270                         | 160                        |                                      | 51                                           | 38                                            |                 | 233                   |
| FP1109-R33-R             | 311                         | 185                        |                                      | 44                                           | 33                                            |                 | 233                   |
| FP1109-R47-R             | 463                         | 275                        |                                      | 27                                           | 20                                            |                 | 233                   |
| FP1109-R58-R             | 548                         | 325                        |                                      | 22.5                                         | 17                                            |                 | 233                   |
| FP1109-1R0-R             | 950                         | 565                        |                                      | 11.5                                         | 8.5                                           |                 | 233                   |

1 Open Circuit Inductance (OCL) Test Parameters: 100kHz, 0.10V<sub>rms</sub>, 0.0Adc

2 Full Load Inductance (FLL) Test Parameters: 100kHz, 0.1V<sub>rms</sub>, I<sub>sat</sub><sup>1</sup>

3 I<sub>rms</sub>: DC current for an approximate temperature rise of 40°C without core loss. Derating is necessary for AC currents. PCB pad layout, trace thickness and width, air-flow and proximity of other heat generating components will affect the temperature rise. It is recommended the part temperature not exceed 125°C under worst case operating conditions verified in the end application.

4 I<sub>sat</sub><sup>1</sup>: Peak current for approximately 30% rolloff at +25°C.

5 I<sub>sat</sub><sup>2</sup>: Peak current for approximately 30% rolloff at +125°C.

6 K-factor: Used to determine B<sub>p-p</sub> for core loss (see graph). B<sub>p-p</sub> = K \* L \* ΔI \* 10<sup>-3</sup>, B<sub>p-p</sub>: (Gauss), K: (K-factor from table), L: (inductance in nH), ΔI (peak-to-peak ripple current in amps).

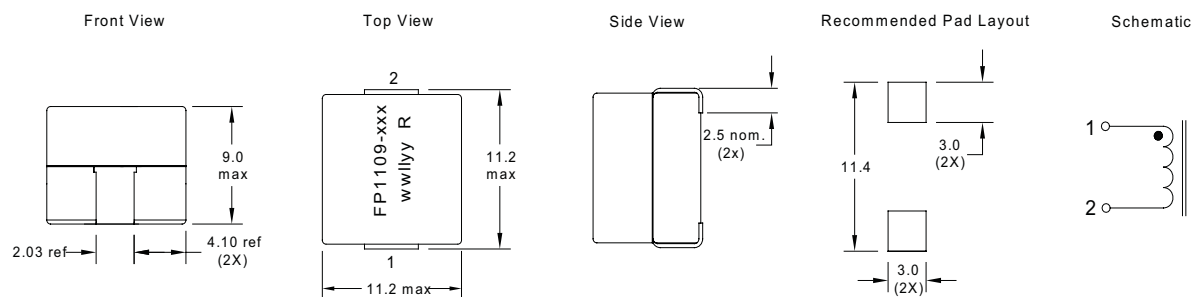
7 Part Number Definition: FP1109-xxx-R

• FP1109 = Product code and size

• xxx= Inductance value in μH, R = decimal point. If no "R" is present, then third character = # of zeros

• "-R" suffix = RoHS compliant

## Dimensions - mm



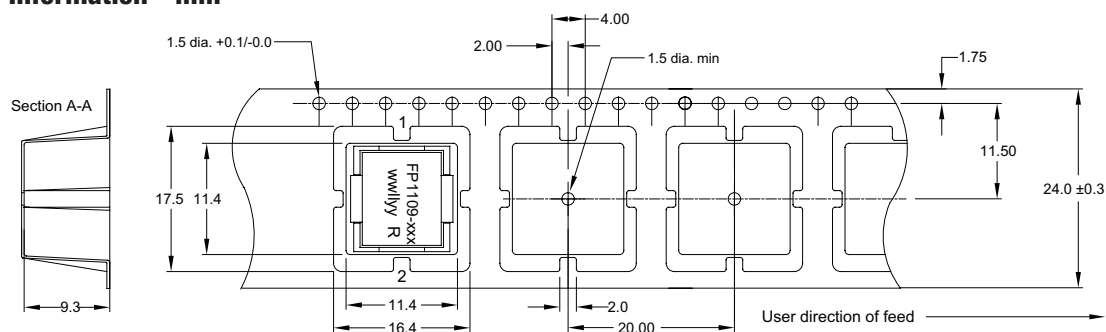
Part Marking: FP1109

xxx = Inductance value in  $\mu\text{H}$ . (R = Decimal point). If no "R" is present, then last character is # of zeros

wwlllyy = Date code

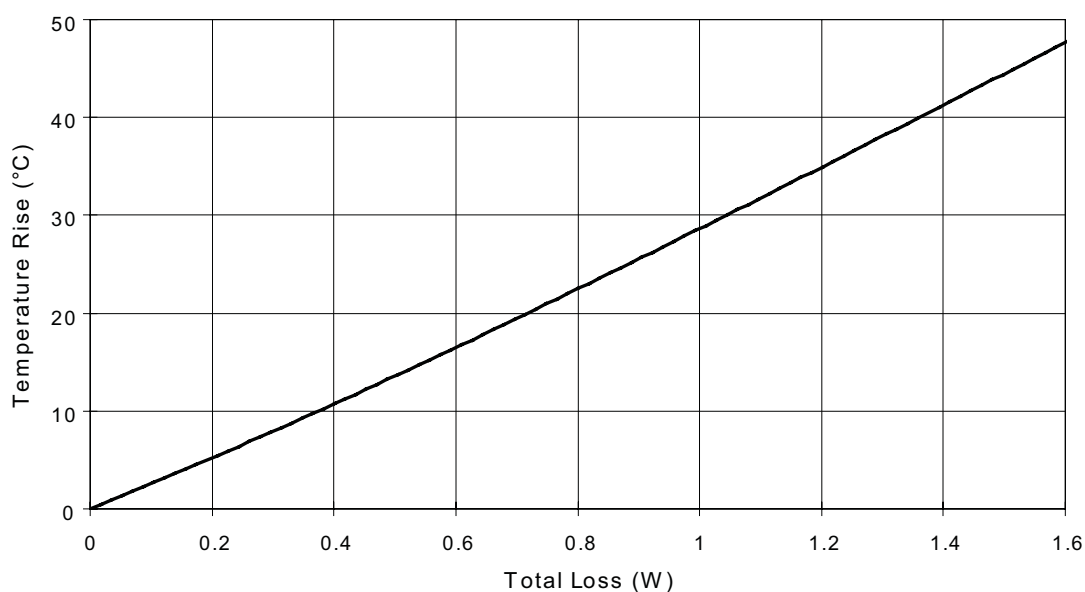
R = Revision level

## Packaging Information - mm



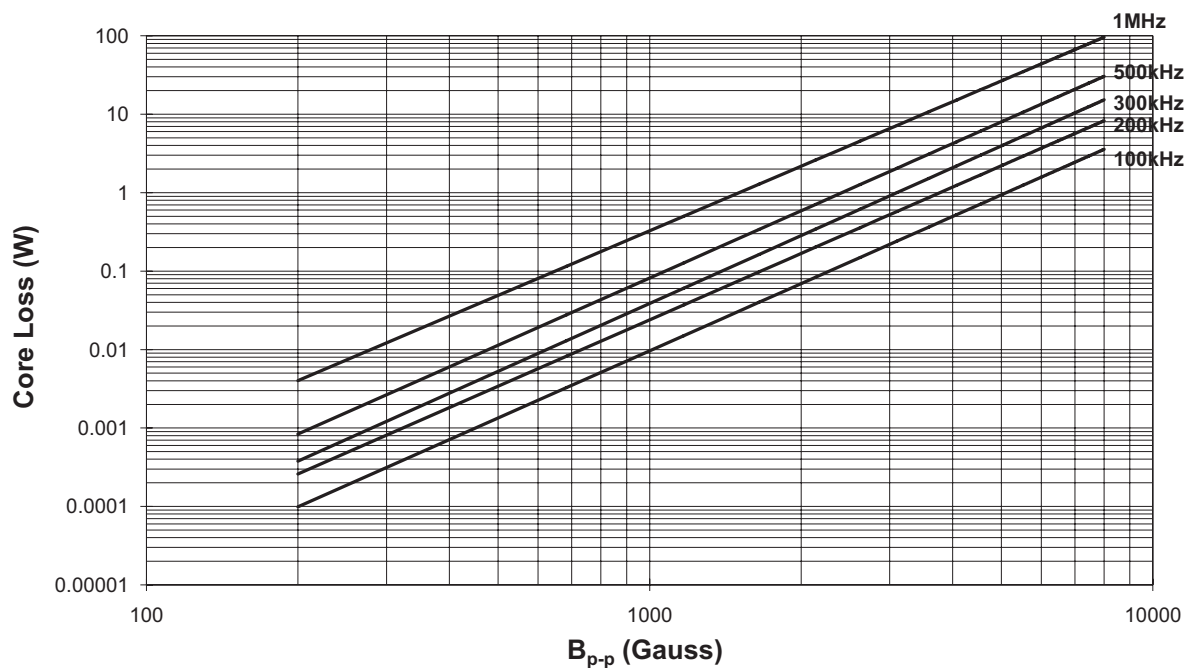
Supplied in tape-and-reel packaging, 350 parts per reel, 13" diameter reel.

## Temperature Rise vs.Total Loss



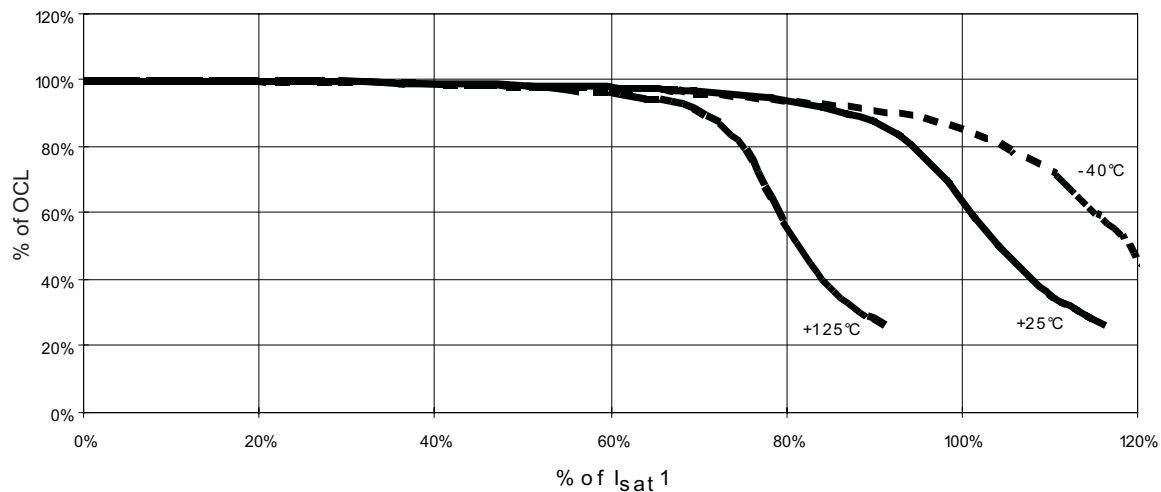
## Core Loss

Core Loss vs.  $B_{p-p}$



## Inductance Characteristics

% of OCL vs. % of  $I_{sat1}$



## Solder Reflow Profile

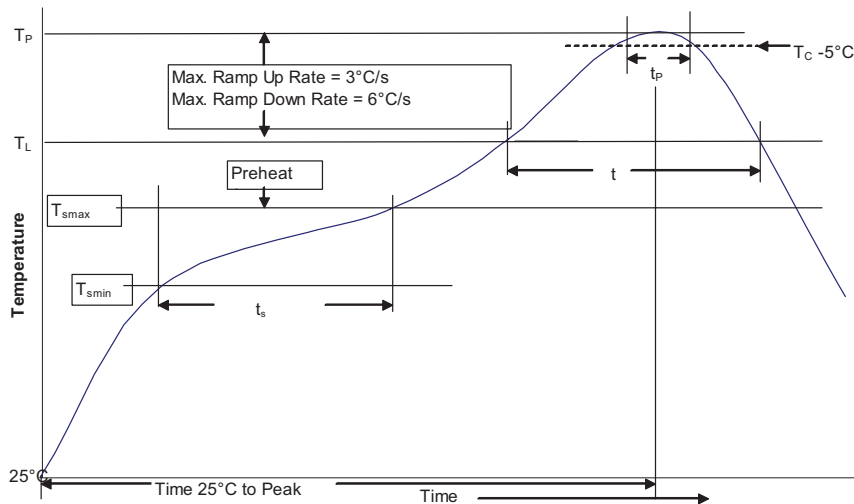


Table 1 - Standard SnPb Solder ( $T_c$ )

| Package Thickness | Volume $\text{mm}^3$ <350 | Volume $\text{mm}^3$ >350 |
|-------------------|---------------------------|---------------------------|
| <2.5mm            | 235°C                     | 220°C                     |
| ≥2.5mm            | 220°C                     | 220°C                     |

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

| Package Thickness | Volume $\text{mm}^3$ <350 | Volume $\text{mm}^3$ 350 - 2000 | Volume $\text{mm}^3$ >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-020D

| 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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