# MPI40-V2

## High current, low profile, miniature power inductors

### Product features

- High current carrying capacity
- Magnetically shielded, Low EMI
- Rugged flexible construction
- Self resonant frequency (SRF) greater than 9.5 MHz
- Inductance range from 0.1 µH to 22 µH
- Current range from 1.2 A to 22 A
- 4.75 mm x 4.45 mm footprint surface mount package in 1.2 mm, 1.5 mm, and 2.0 mm heights
- Moisture Sensitivity Level (MSL): 1

### Applications

- Handheld/mobile devices
- Portable media players
- Notebook/netbook/laptop regulators
- Tablets/smartbooks
- Battery operated devices
- LED drivers
- LCD displays
- Point-of-load (POL) converters

### Environmental data

- Storage temperature range (Component): -55 °C to +125 °C
- Operating temperature range: -55 °C to +125 °C (ambient plus self-temperature rise)
- Solder reflow temperature: J-STD-020 (latest revision) compliant
- Halogen free, lead free, RoHS compliant

Pb HALOGEN HF FREE RoHS

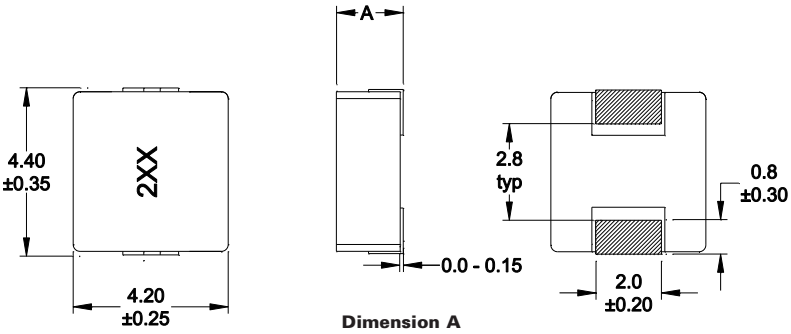
Powering Business Worldwide

## Product specifications

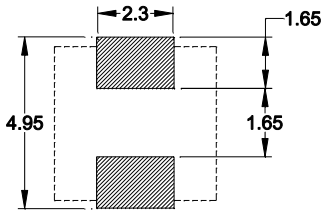
| Part Number[5] | OCL[1] (µH) ±20% | Part marking designator | $I_{rms}$[2] (A) | $I_{sat}$[3] (A) | DCR (mΩ) typical @ +20 °C | DCR (mΩ) maximum @ +20 °C | SRF (MHz) typical | K-factor[4] |
|---|---|---|---|---|---|---|---|---|
| **1.2 mm height** | | | | | | | | |
| MPI4012V2-R33-R | 0.33 | A | 7.5 | 11 | 11 | 13.5 | 128 | 2480 |
| MPI4012V2-R47-R | 0.47 | B | 5.6 | 6.8 | 19 | 23 | 106 | 2470 |
| MPI4012V2-R68-R | 0.68 | C | 4.5 | 6.7 | 28 | 33.5 | 98 | 2223 |
| MPI4012V2-1R0-R | 1.0 | D | 4.3 | 6.5 | 38.5 | 46.5 | 64 | 1477 |
| MPI4012V2-1R5-R | 1.5 | E | 3.3 | 4.3 | 55 | 66 | 63 | 1264 |
| MPI4012V2-2R2-R | 2.2 | F | 2.9 | 4.2 | 75 | 90 | 35 | 1143 |
| MPI4012V2-4R7-R | 4.7 | G | 1.8 | 2.8 | 175 | 210 | 29 | 890 |
| **1.5 mm height** | | | | | | | | |
| MPI4015V2-R22-R | 0.22 | A | 10.5 | 14 | 6.0 | 7.5 | 153 | 2649 |
| MPI4015V2-R33-R | 0.33 | B | 9.5 | 11 | 7.0 | 8.5 | 120 | 2158 |
| MPI4015V2-R47-R | 0.47 | C | 7.8 | 9.0 | 11 | 14 | 98 | 1991 |
| MPI4015V2-R56-R | 0.56 | D | 7.5 | 8.3 | 12 | 14 | 84 | 1942 |
| MPI4015V2-R68-R | 0.68 | E | 6.8 | 8.0 | 16 | 19 | 81 | 1437 |
| MPI4015V2-1R0-R | 1.0 | F | 5.5 | 6.0 | 23 | 27 | 56 | 1382 |
| MPI4015V2-1R5-R | 1.5 | G | 4.2 | 4.6 | 48 | 58 | 48 | 1468 |
| MPI4015V2-2R2-R | 2.2 | H | 2.9 | 4.5 | 65 | 78 | 42 | 920 |
| MPI4015V2-3R3-R | 3.3 | I | 3.0 | 3.2 | 77 | 92 | 31 | 854 |
| MPI4015V2-4R7-R | 4.7 | J | 2.2 | 3.0 | 108 | 130 | 22 | 791 |
| MPI4015V2-6R8-R | 6.8 | K | 2.0 | 2.3 | 172 | 207 | 21 | 609 |
| MPI4015V2-100-R | 10 | L | 1.8 | 2.1 | 245 | 294 | 14 | 766 |
| **2.0 mm height** | | | | | | | | |
| MPI4020V2-R10-R | 0.10 | A | 16 | 22 | 3.5 | 4.5 | 343 | 2692 |
| MPI4020V2-R22-R | 0.22 | B | 13 | 17 | 5.5 | 6.6 | 165 | 2036 |
| MPI4020V2-R33-R | 0.33 | C | 9.5 | 12 | 7.5 | 9.0 | 113 | 1268 |
| MPI4020V2-R47-R | 0.47 | D | 8.5 | 11 | 10.5 | 13 | 95 | 1219 |
| MPI4020V2-R56-R | 0.56 | E | 8.0 | 10 | 12 | 15 | 87 | 1205 |
| MPI4020V2-R68-R | 0.68 | F | 7.5 | 9.0 | 12.5 | 16 | 80 | 1201 |
| MPI4020V2-1R0-R | 1.0 | G | 6.5 | 7.0 | 20 | 24 | 65 | 1168 |
| MPI4020V2-1R2-R | 1.2 | H | 6.5 | 6.8 | 23 | 28 | 52 | 1110 |
| MPI4020V2-1R5-R | 1.5 | I | 5.0 | 6.0 | 25 | 30 | 45 | 1038 |
| MPI4020V2-2R2-R | 2.2 | J | 3.8 | 5.5 | 40 | 48 | 33 | 711 |
| MPI4020V2-3R3-R | 3.3 | K | 3.3 | 4.0 | 71 | 85 | 25 | 643 |
| MPI4020V2-4R7-R | 4.7 | L | 2.7 | 3.2 | 98 | 118 | 24 | 453 |
| MPI4020V2-6R8-R | 6.8 | M | 2.0 | 2.6 | 167 | 192 | 23 | 482 |
| MPI4020V2-100-R | 10 | N | 1.7 | 2.2 | 245 | 281 | 17 | 307 |
| MPI4020V2-150-R | 15 | O | 1.5 | 1.8 | 320 | 384 | 13 | 257 |
| MPI4020V2-220-R | 22 | P | 1.2 | 1.65 | 350 | 402 | 9.5 | 215 |

1. Open Circuit Inductance (OCL) Test Parameters: 100 kHz, 1.0 Vrms, 0.0 Adc, +25 °C.
2. $I_{rms}$: 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 under worst case operating conditions verified in the end application.
3. $I_{sat}$ : Peak current for approximately 30% rolloff @ +25 °C.
4. K-factor: Used to determine Bp-p for core loss (see graph). Bp-p = K * L * ΔI. Bp-p :(Gauss), K: (K-factor from table), L: (Inductance in uH), ΔI (Peak to peak ripple current in Amps).
5. Part Number Definition: MPI40xxV2-xxx-R
   MPI40 = Product code
   xx= Height indicator
   V2=Version indicator
   xxx= inductance value in µH, R= decimal point,
   If no R is present then last character equals number of zeros
   -R suffix = RoHS compliant

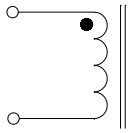
**Dimensions (mm)**




**Recommended Pad Layout**




**Schematic**



| Dimension A | |
|---|---|
| MPI4012V2 | 1.00 ±0.20 |
| MPI4015V2 | 1.30 ±0.20 |
| MPI4020V2 | 1.80 ±0.20 |

Part marking: 2xx (2 = version, x = inductance value per "Part marking designator" listed in Product specification table, x = bi-weekly date code)

All soldering surfaces to be coplanar within 0.10 millimeters

Tolerances are ±0.3 millimeters unless stated otherwise

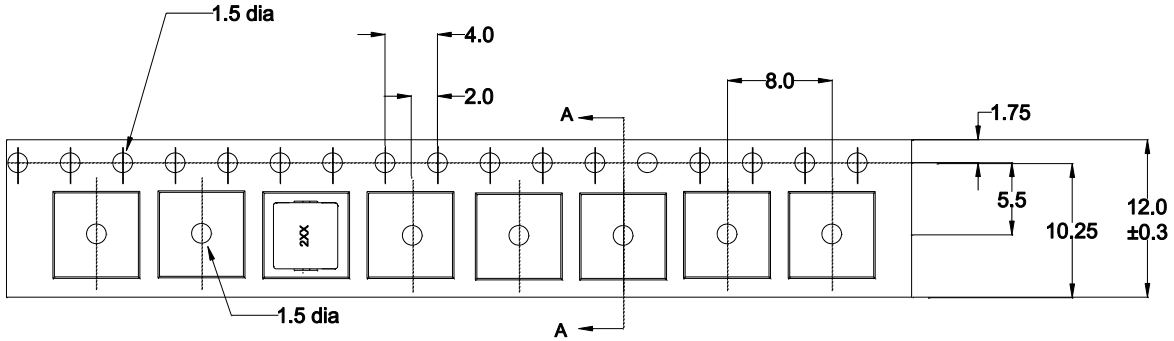
Pad layout tolerances are ±0.1 millimeters unless stated otherwise

Do not route traces or vias underneath the inductor

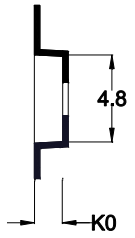
**Packaging information (mm)**

Drawing not to scale

Supplied in tape and reel packaging , 3000 parts per 13" diameter reel

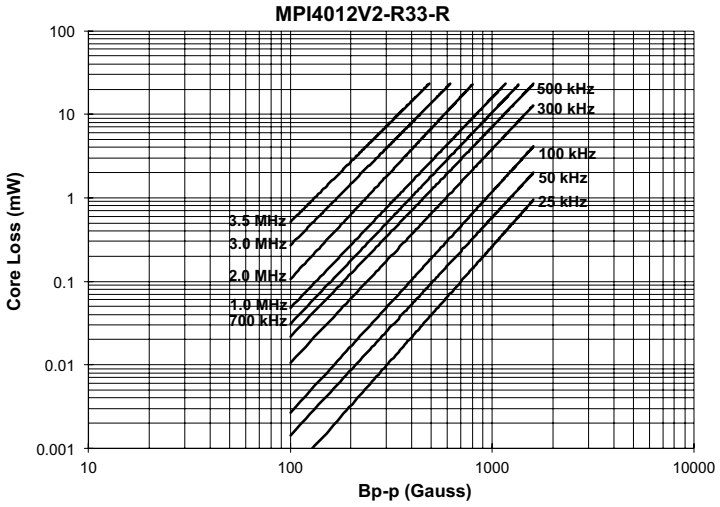


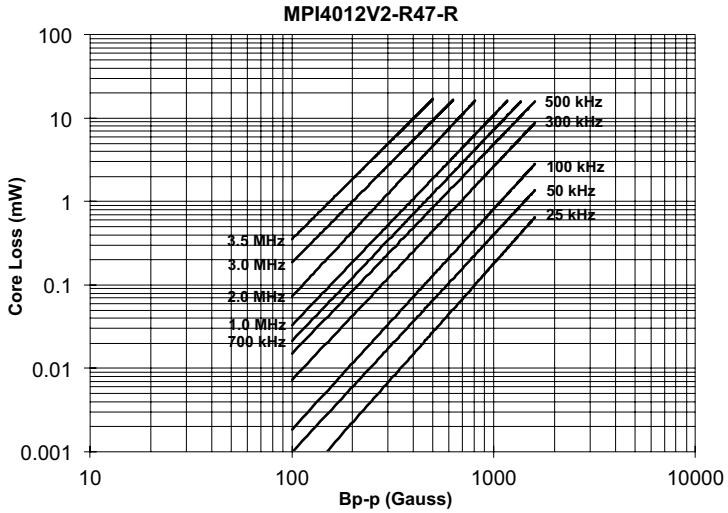

| KO | |
|---|---|
| MPI4012V2 | 1.4 |
| MPI4015V2 | 1.8 |
| MPI4020V2 | 2.5 |

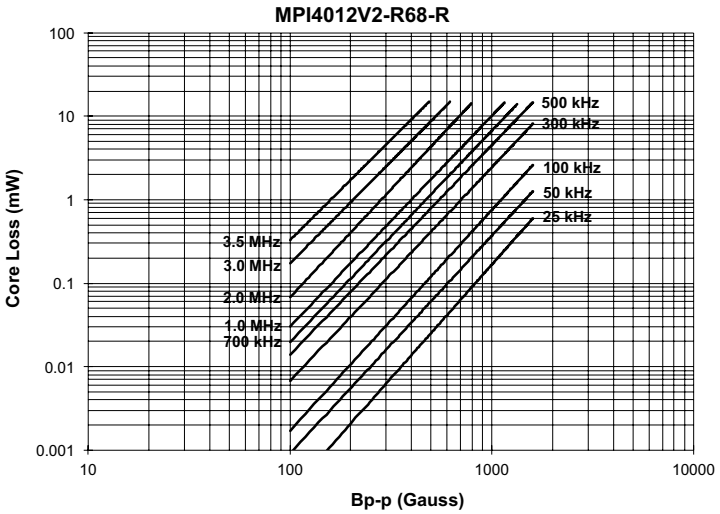



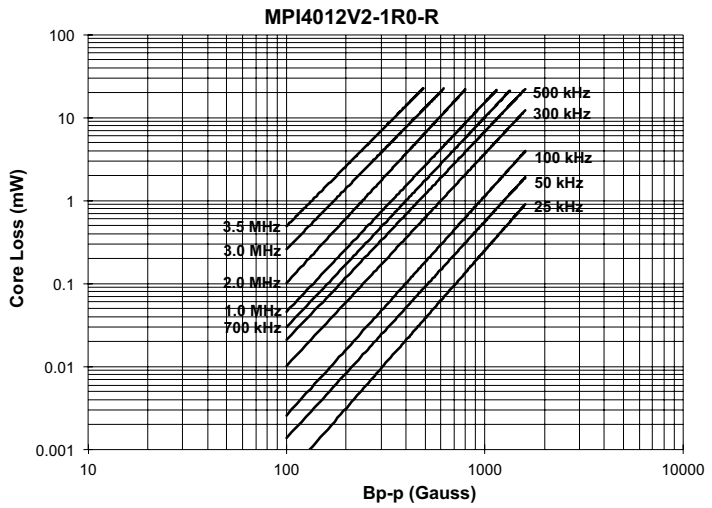

Section A-A

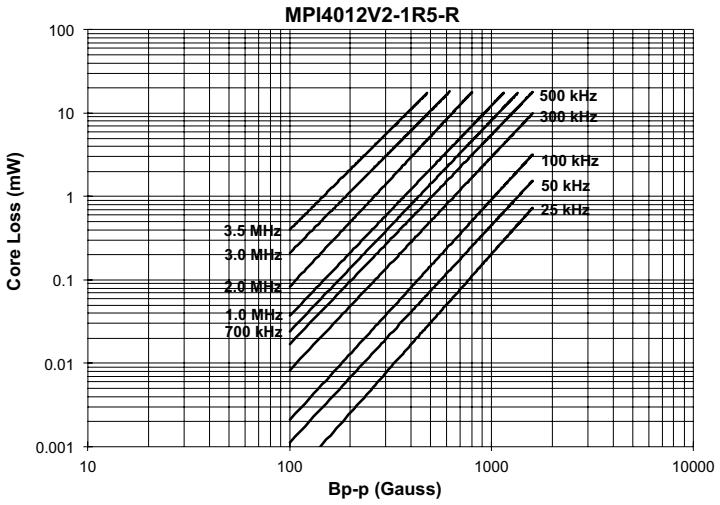
**Core loss vs Bp-p**

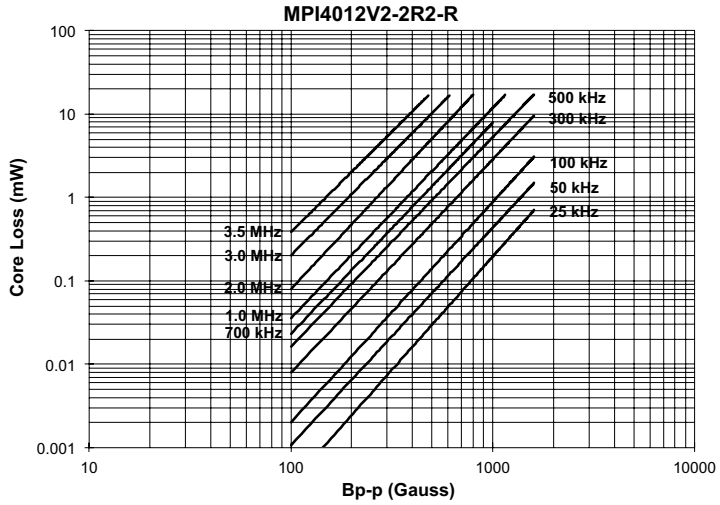


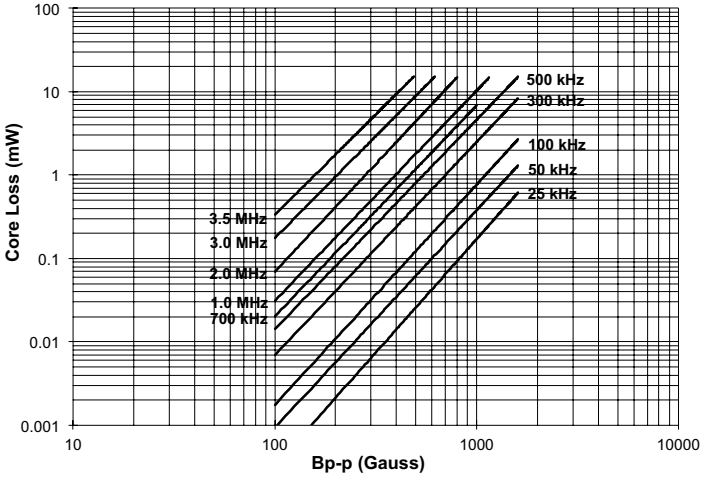



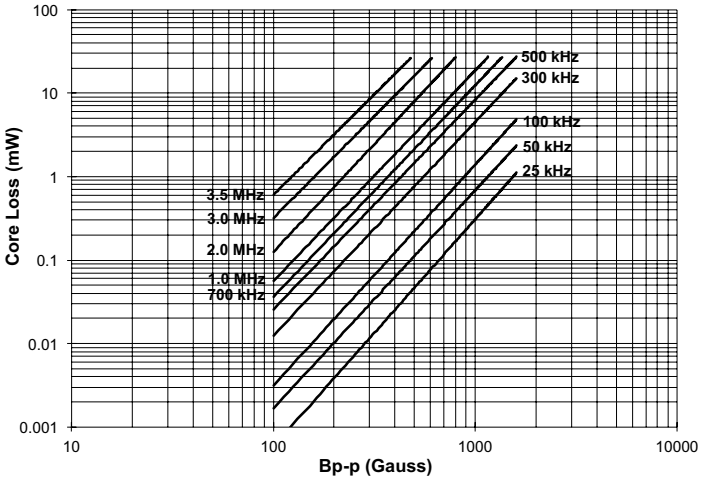



**Core loss vs Bp-p**

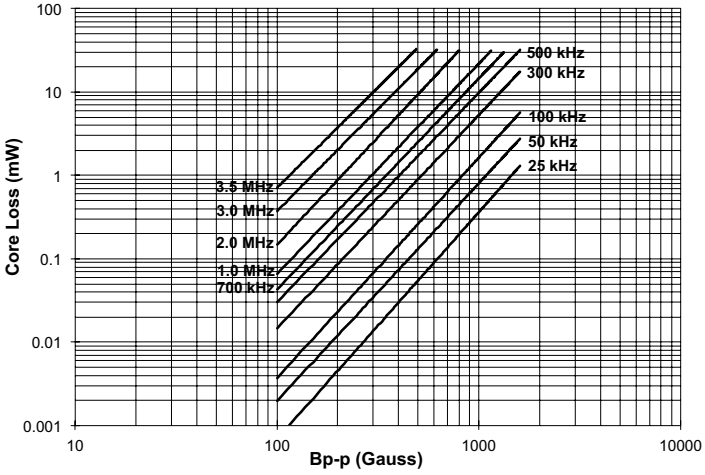
**MPI4012V2-4R7-R**



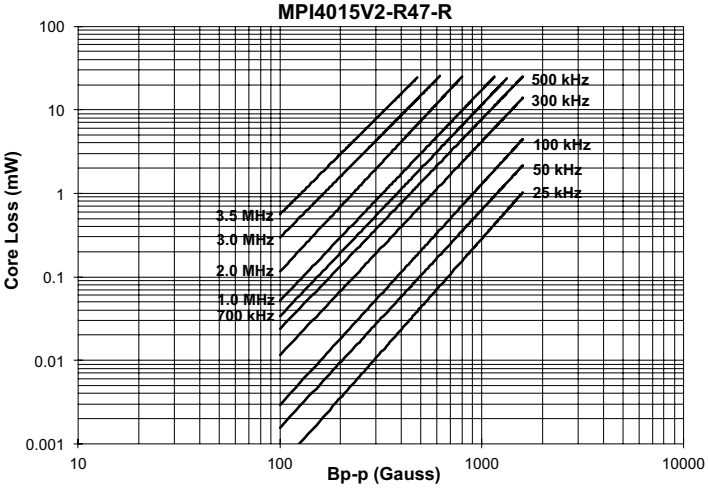

**MPI4015V2-R22-R**



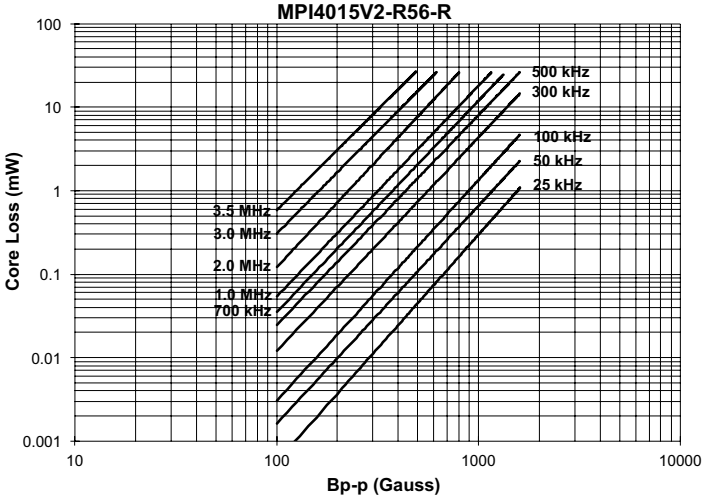

**MPI4015V2-R33-R**



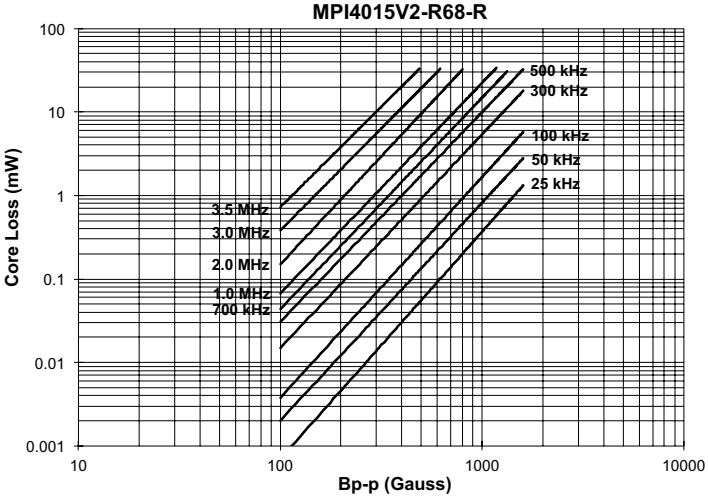

**MPI4015V2-R47-R**




**MPI4015V2-R56-R**

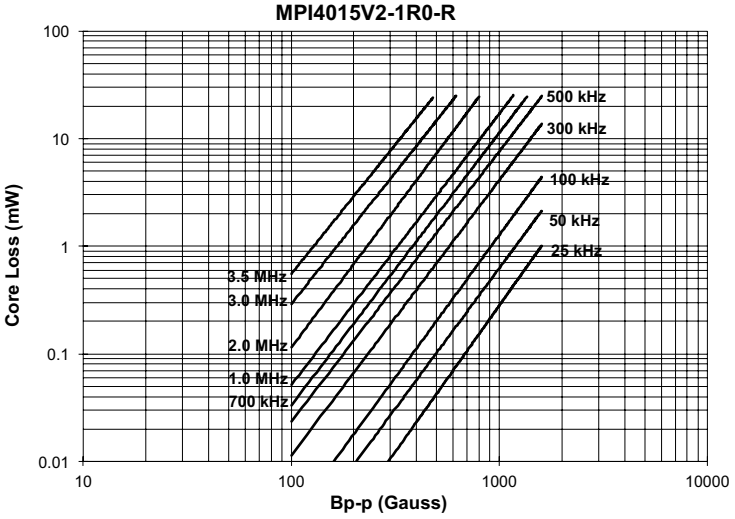



**MPI4015V2-R68-R**

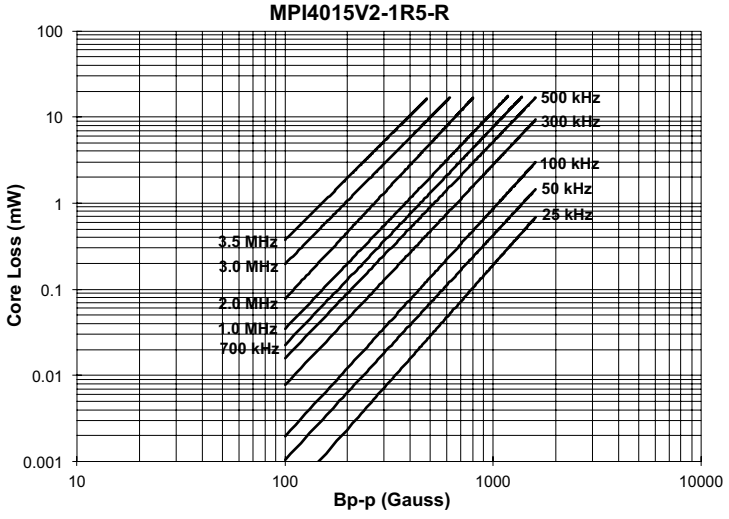


**Core loss vs Bp-p**

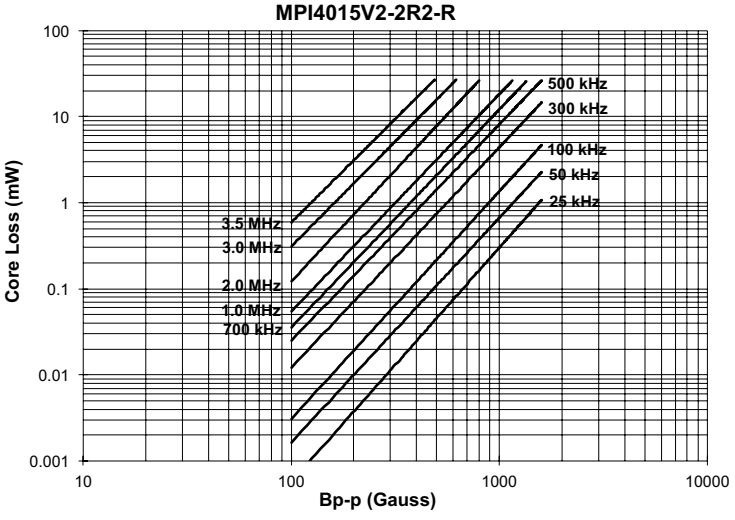
**MPI4015V2-1R0-R**



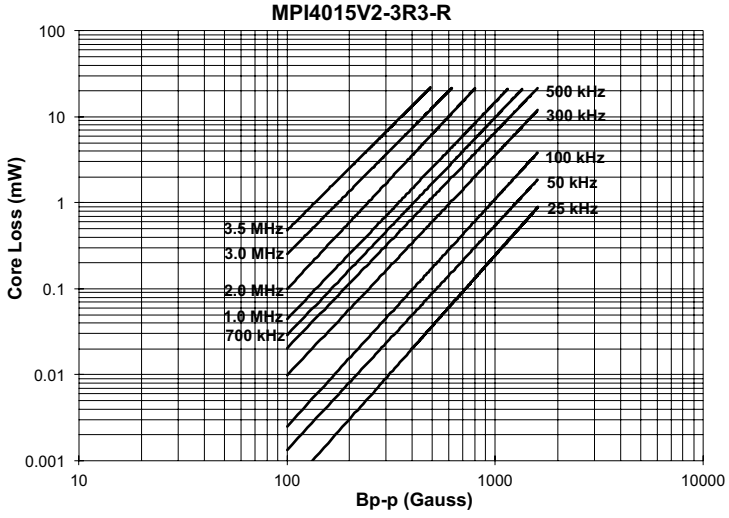

**MPI4015V2-1R5-R**



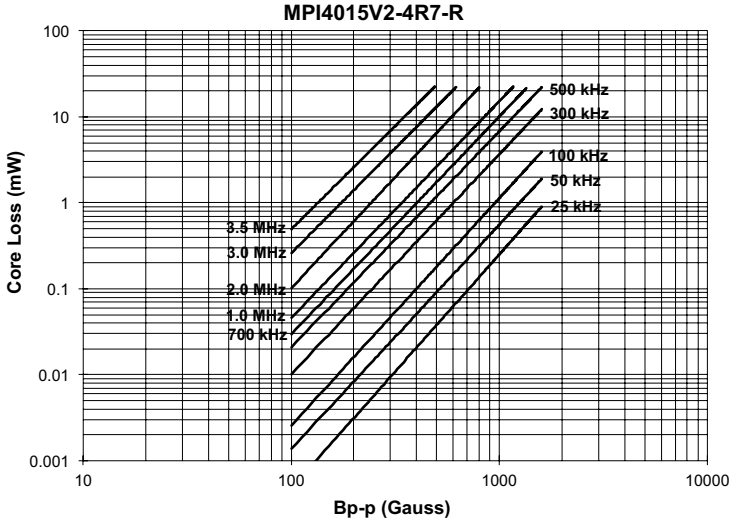

**MPI4015V2-2R2-R**



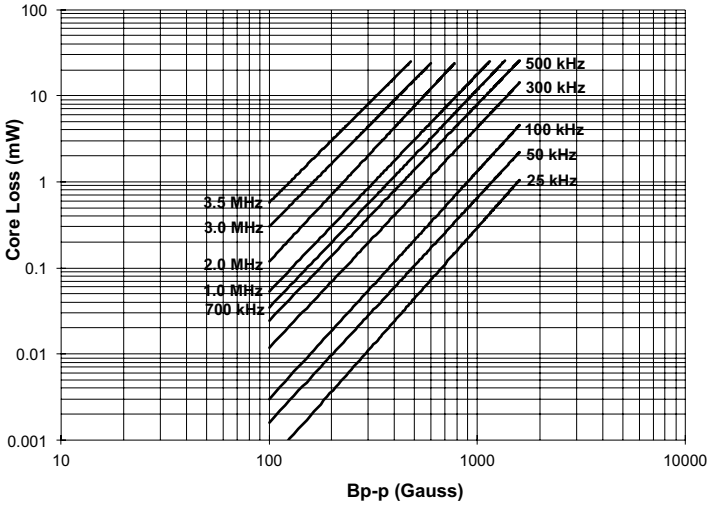

**MPI4015V2-3R3-R**




**MPI4015V2-4R7-R**

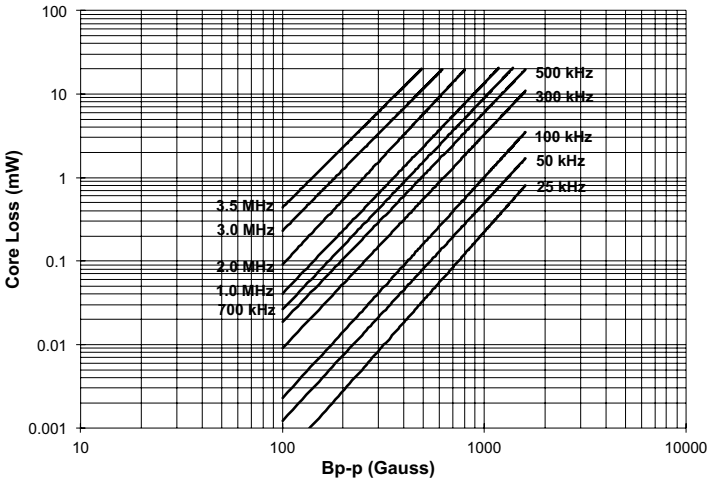



**MPI4015V2-6R8-R**

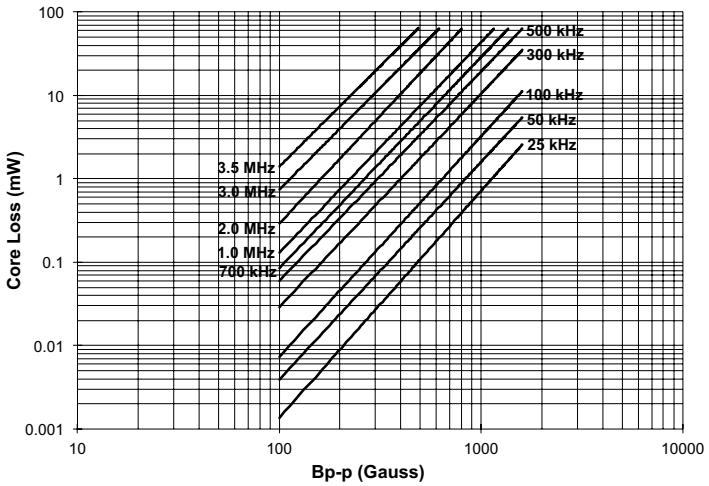


**Core loss vs Bp-p**

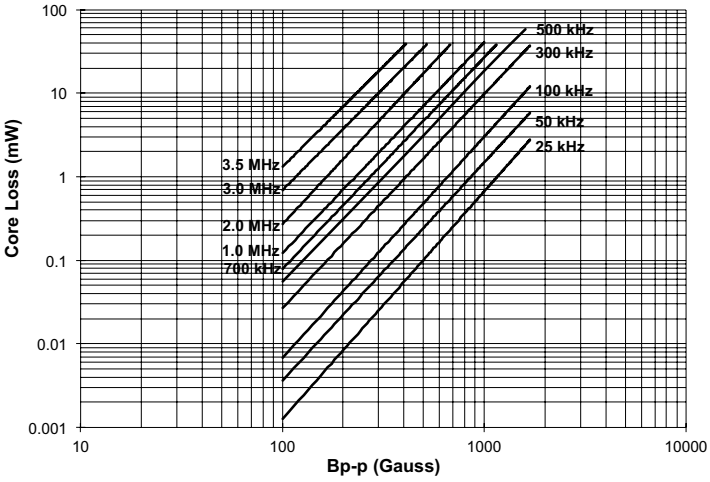
**MPI4015V2-100-R**



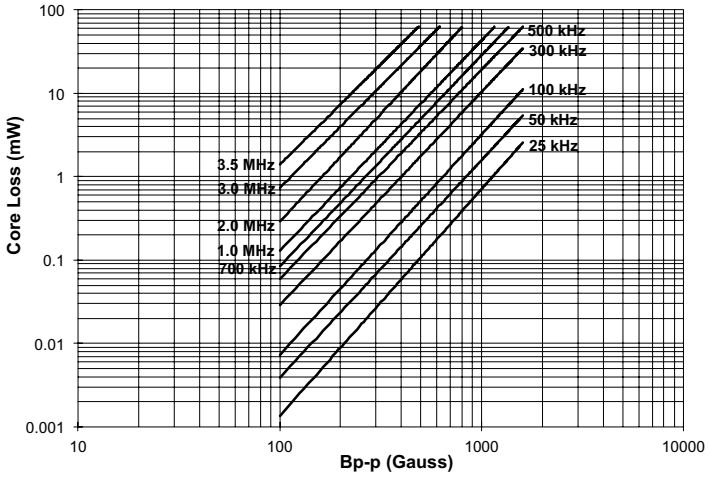

**MPI4020V2-R10-R**



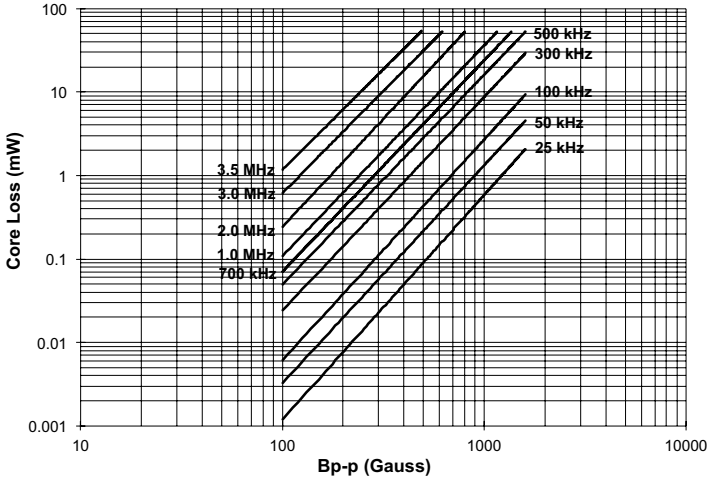

**MPI4020V2-R22-R**



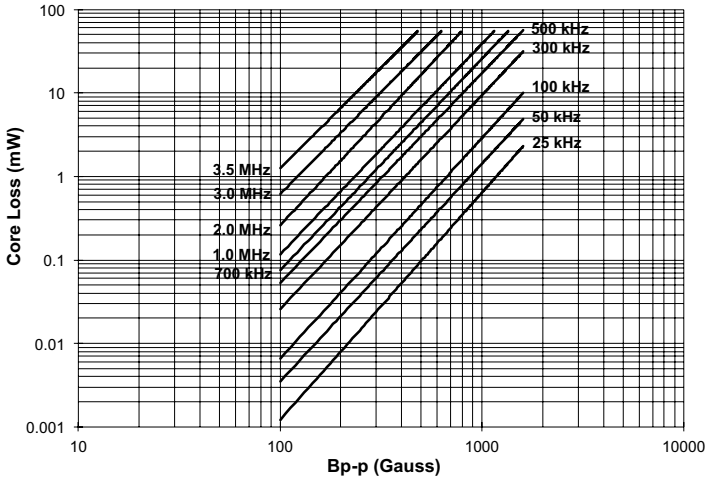

**MPI4020V2-R33-R**



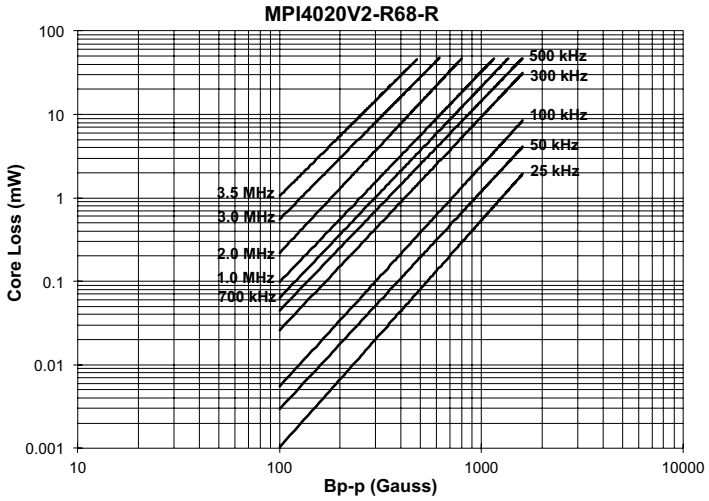

**MPI4020V2-R47-R**

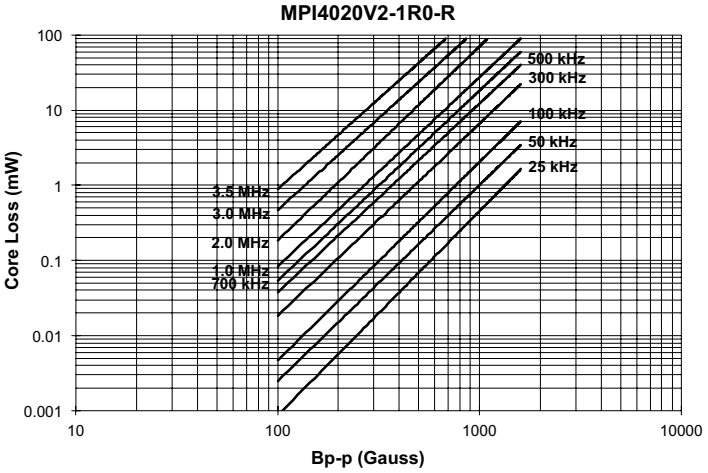


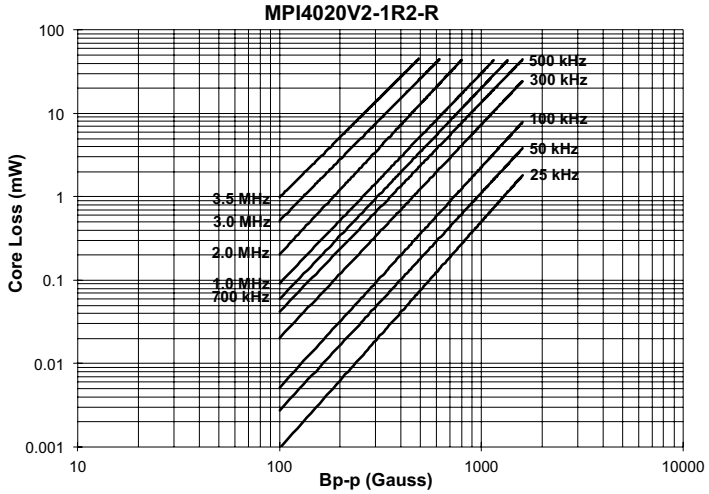

**MPI4020V2-R56-R**

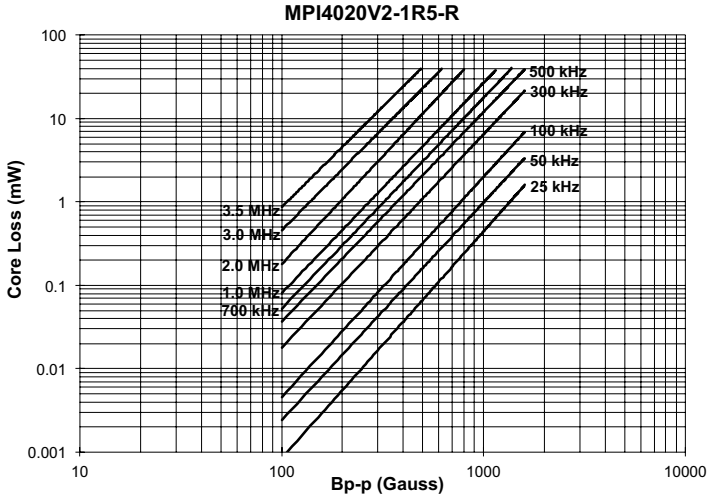


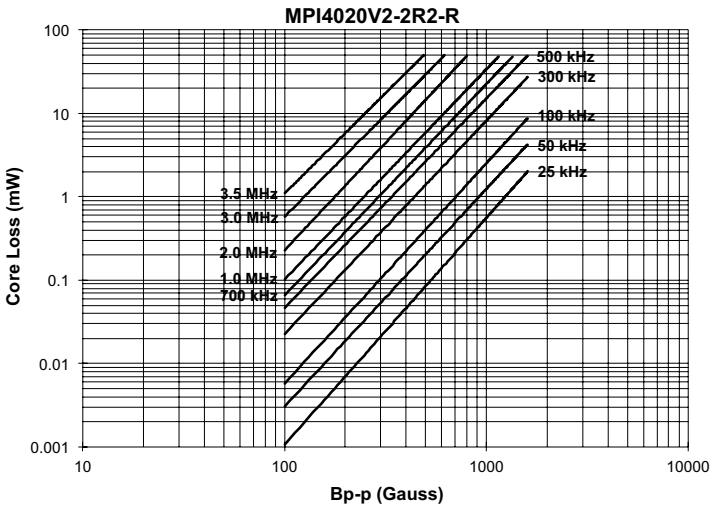
**Core loss vs Bp-p**

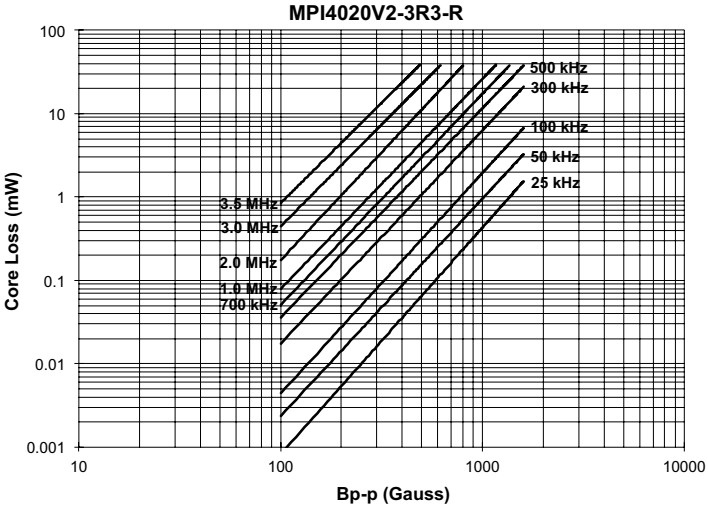


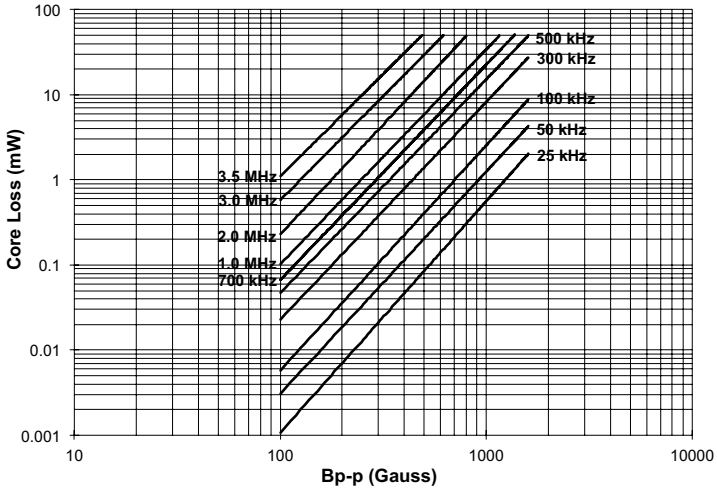



**Core loss vs Bp-p**

**MPI4020V2-4R7-R**

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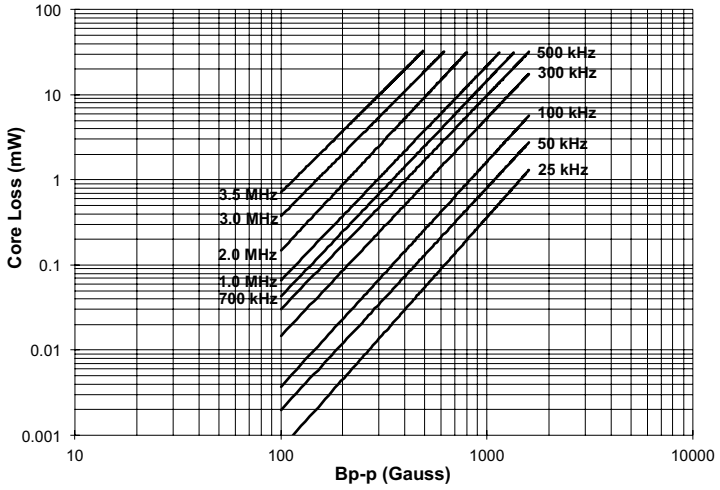
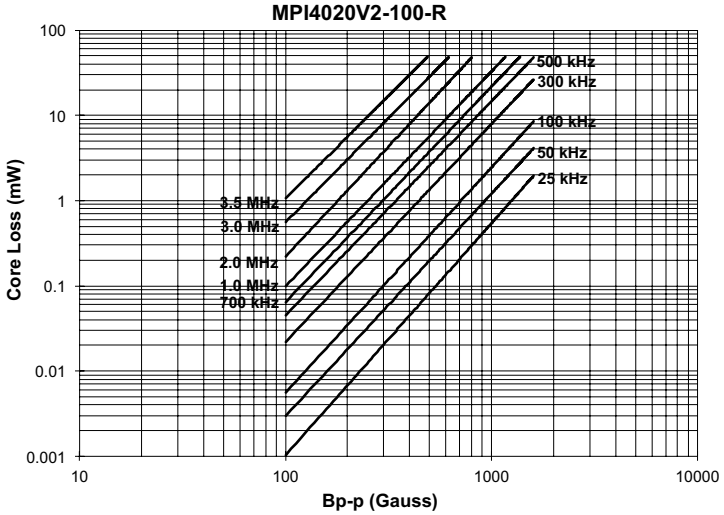



**MPI4020V2-100-R**

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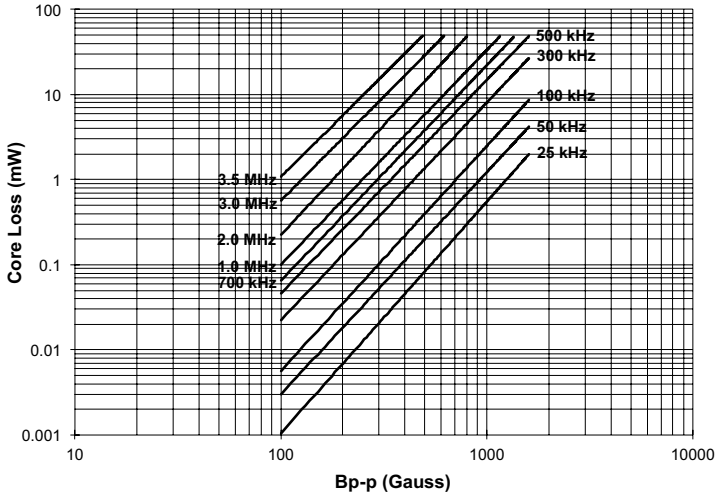
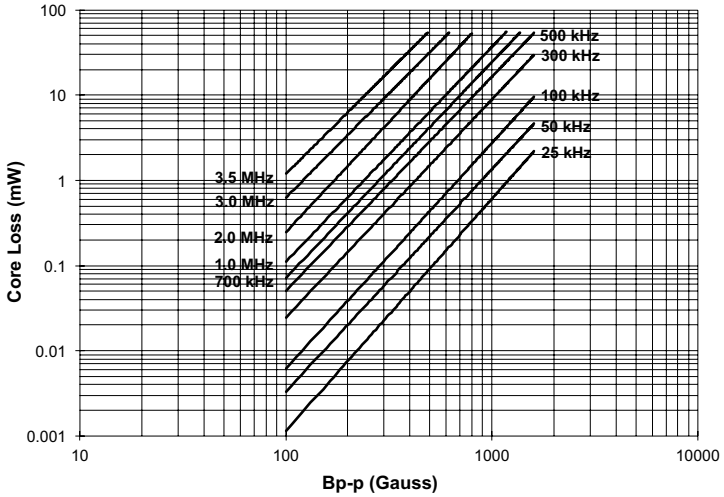
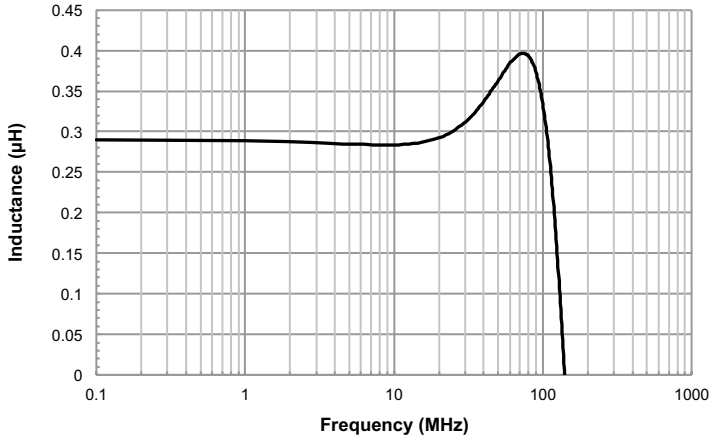



**MPI4020V2-220-R**

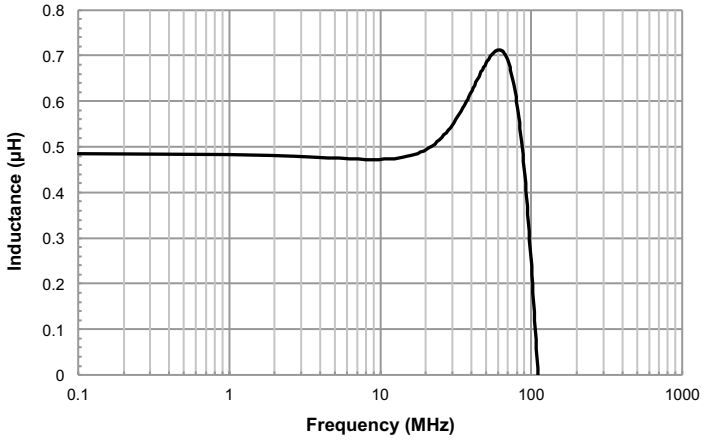


**Inductance vs. Frequency**

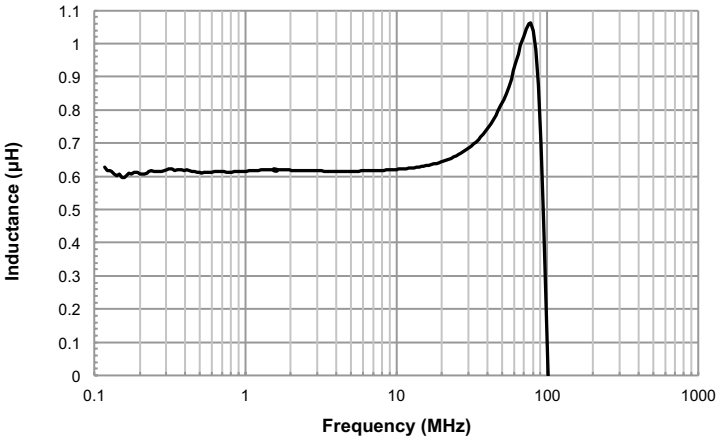
MPI4012V2-R33-R



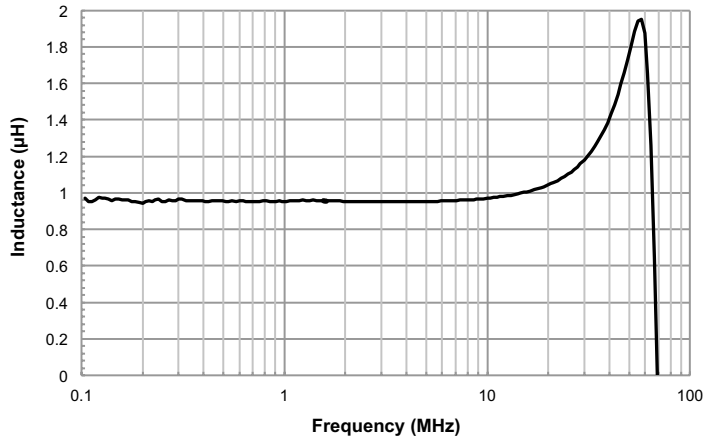

MPI4012V2-R47-R



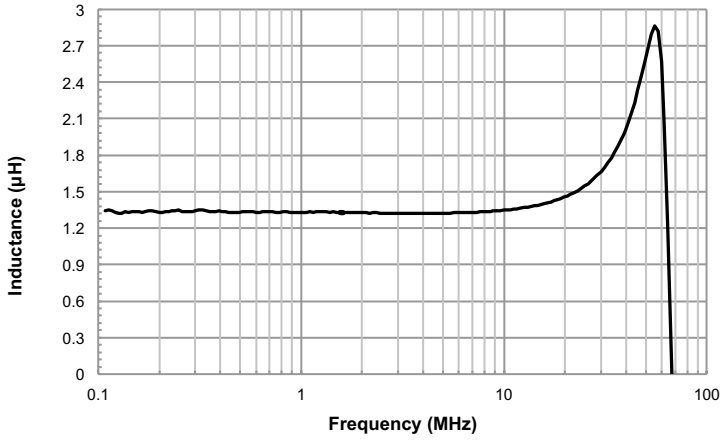

MPI4012V2-R68-R



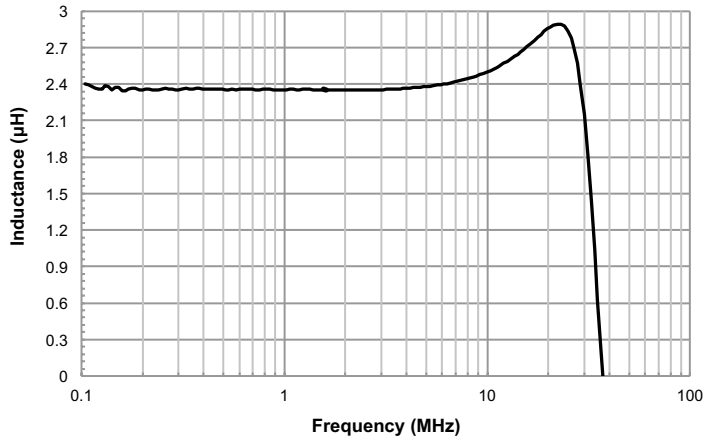

MPI4012V2-1R0-R




MPI4012V2-1R5-R

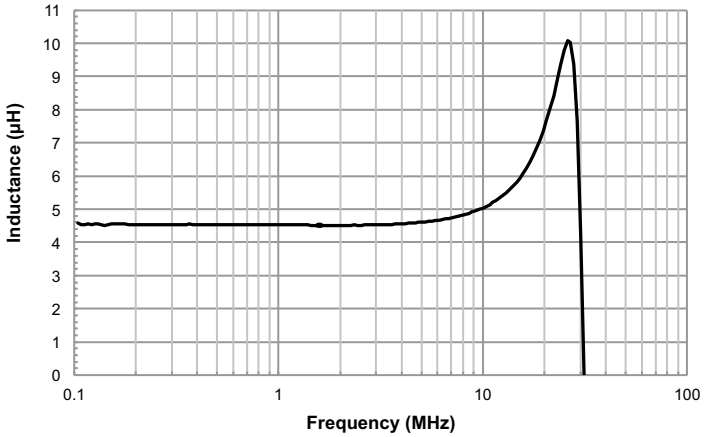



MPI4012V2-2R2-R

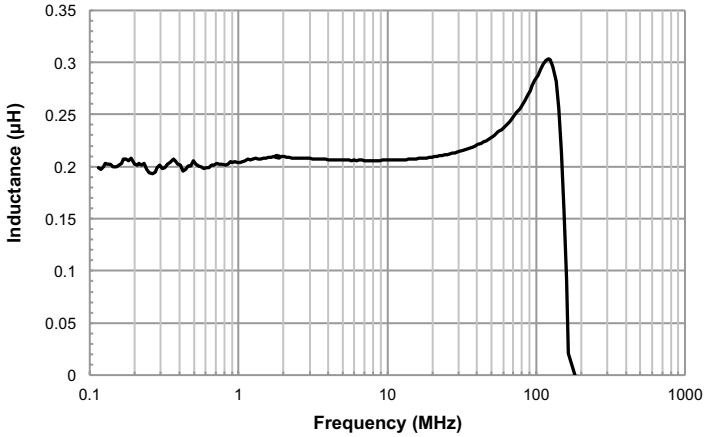


**Inductance vs. Frequency**

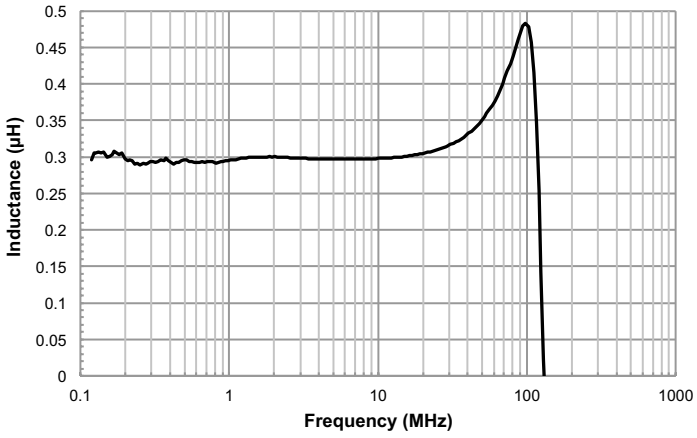
**MPI4012V2-4R7-R**



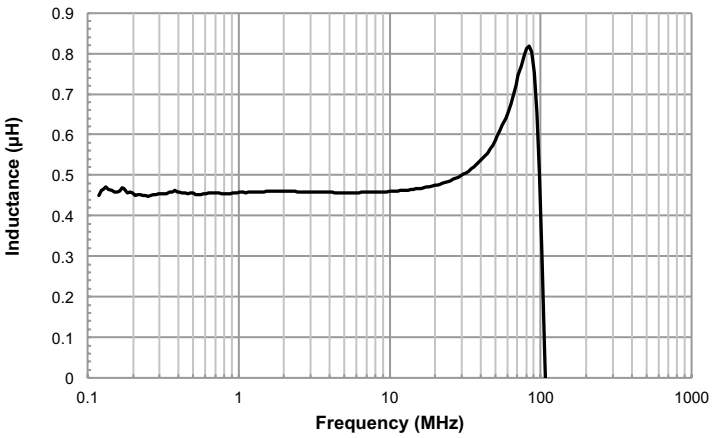

**MPI4015V2-R22-R**



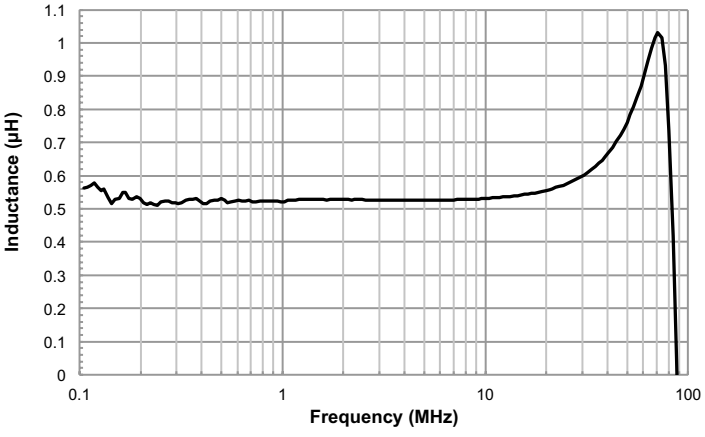

**MPI4015V2-R33-R**



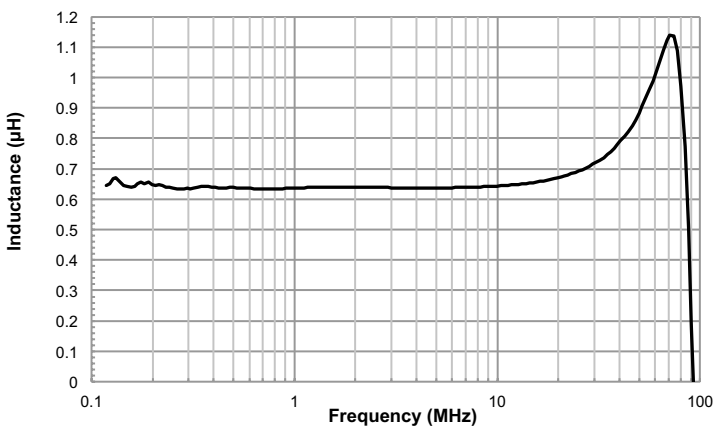

**MPI4015V2-R47-R**




**MPI4015V2-R56-R**

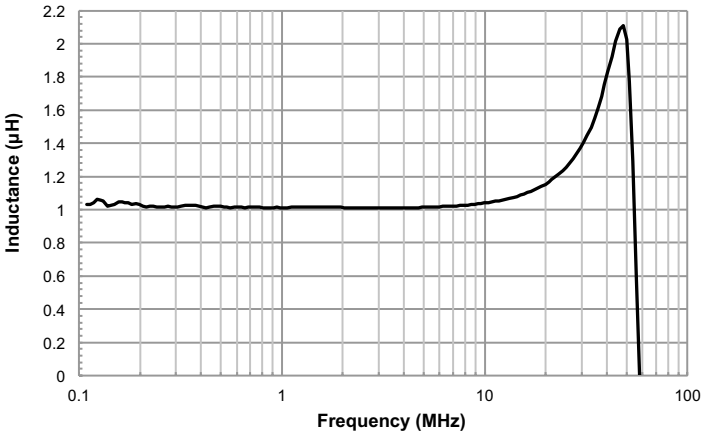



**MPI4015V2-R68-R**

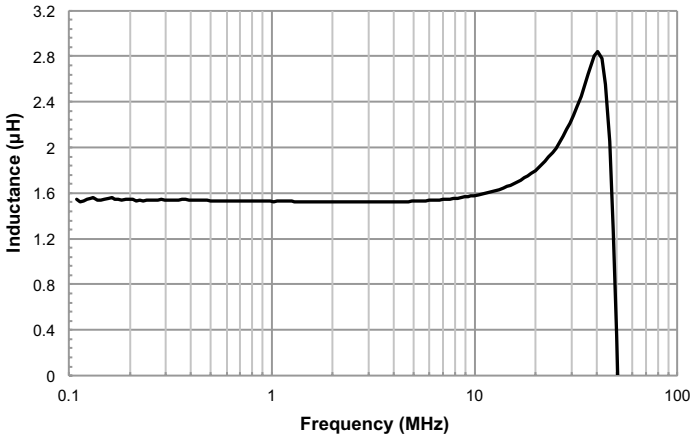


**Inductance vs. Frequency**

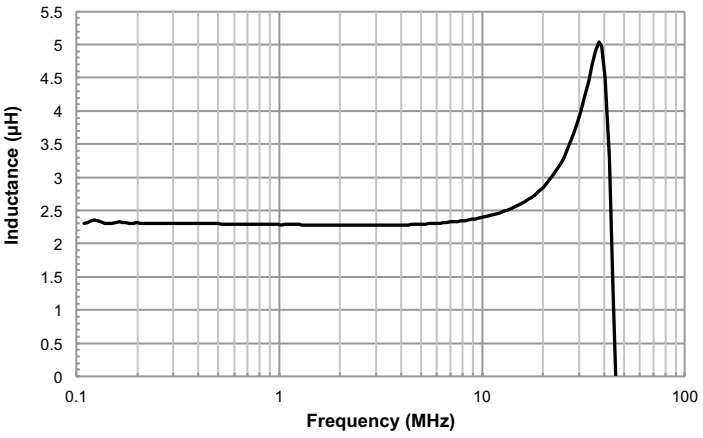
**MPI4015V2-1R0-R**



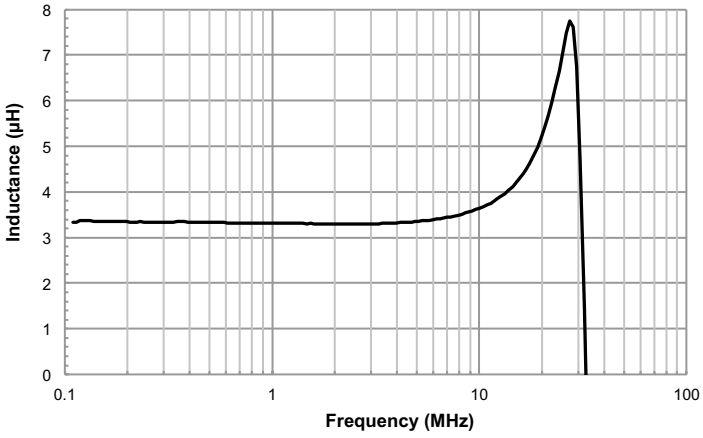

**MPI4015V2-1R5-R**



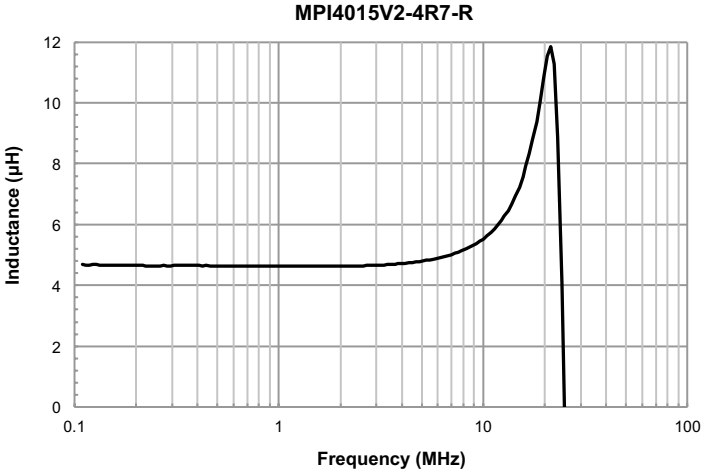

**MPI4015V2-2R2-R**



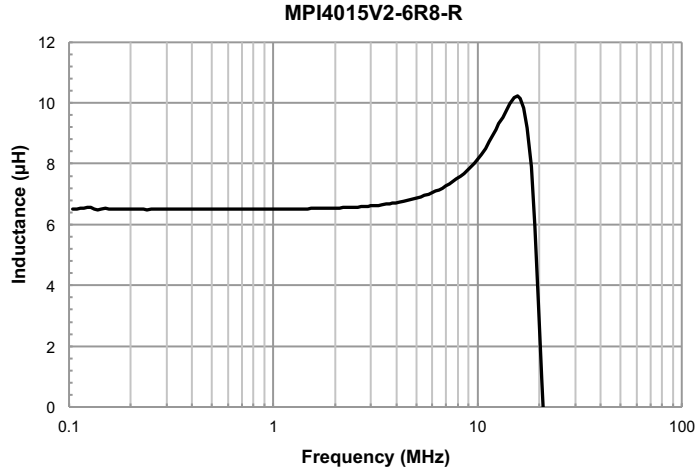

**MPI4015V2-3R3-R**




**MPI4015V2-4R7-R**

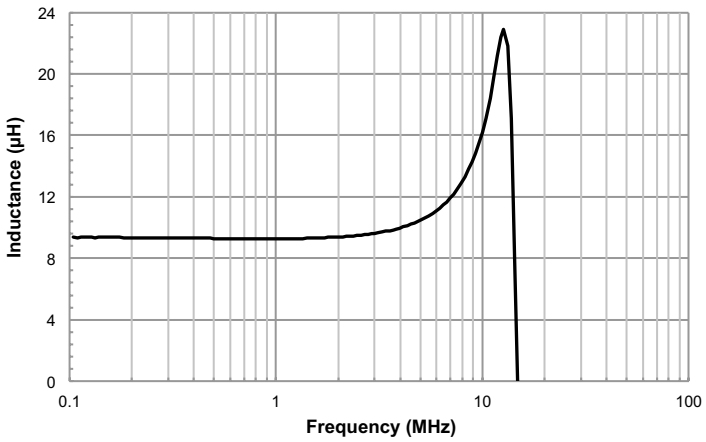



**MPI4015V2-6R8-R**

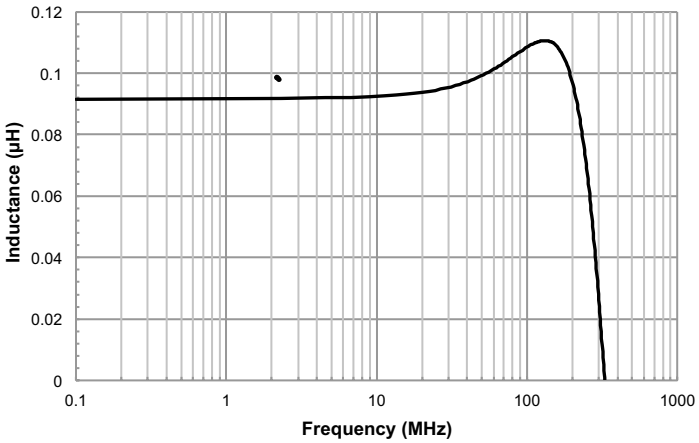


**Inductance vs. Frequency**

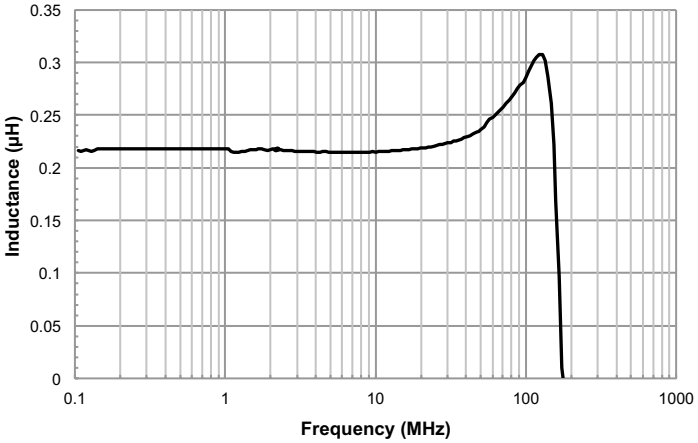
**MPI4015V2-100-R**



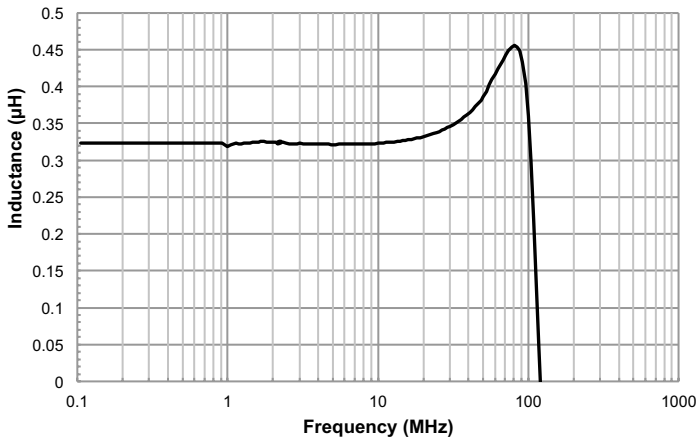

**MPI4020V2-R10-R**



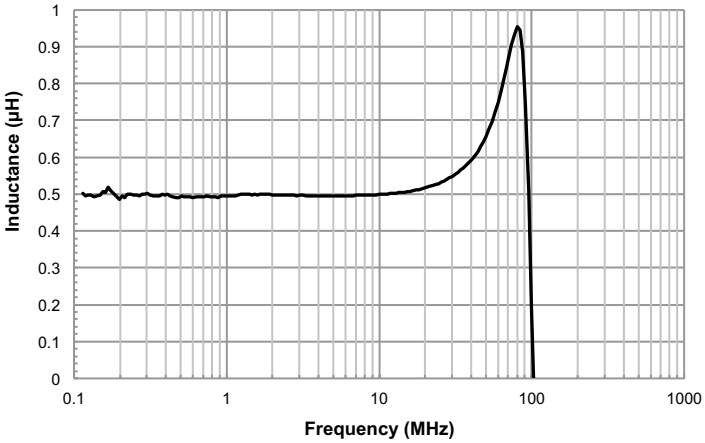

**MPI4020V2-R22-R**



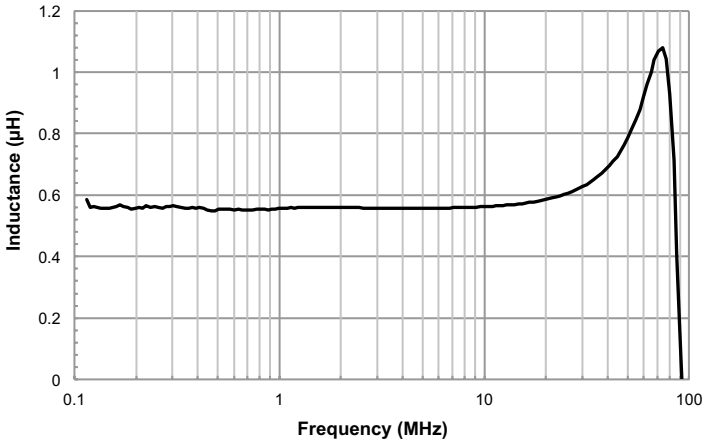

**MPI4020V2-R33-R**




**MPI4020V2-R47-R**

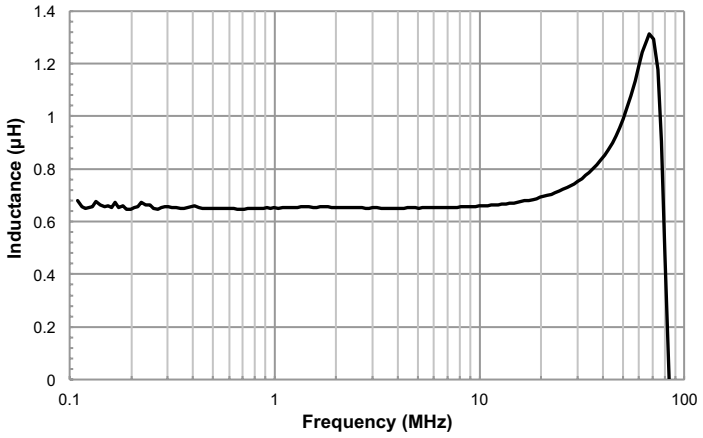



**MPI4020V2-R56-R**

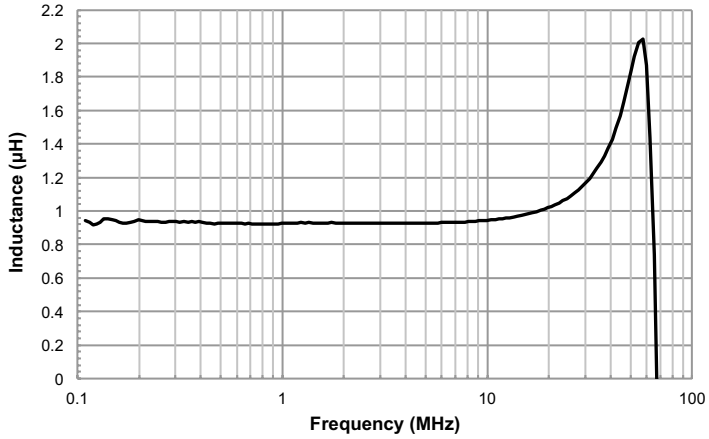


**Inductance vs. Frequency**

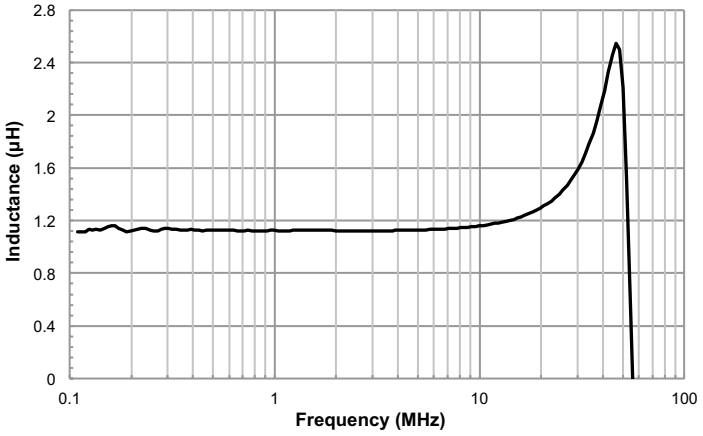
**MPI4020V2-R68-R**



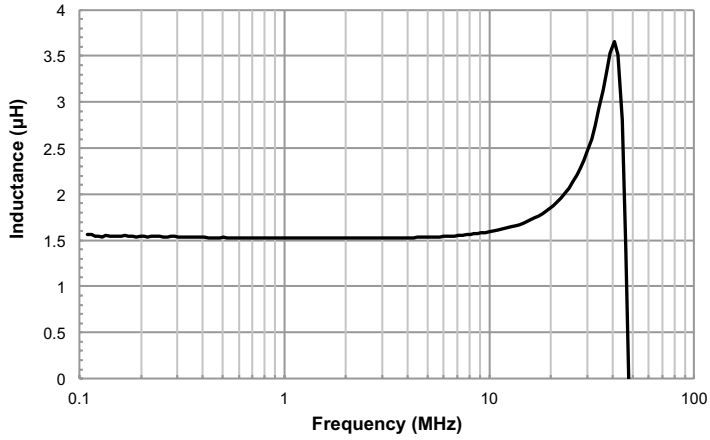

**MPI4020V2-1R0-R**



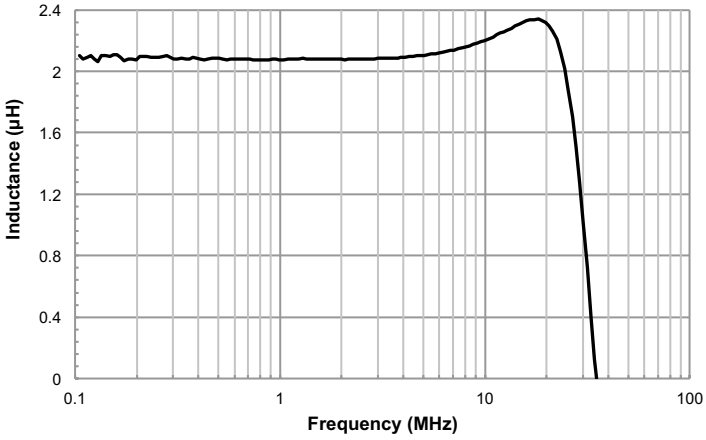

**MPI4020V2-1R2-R**



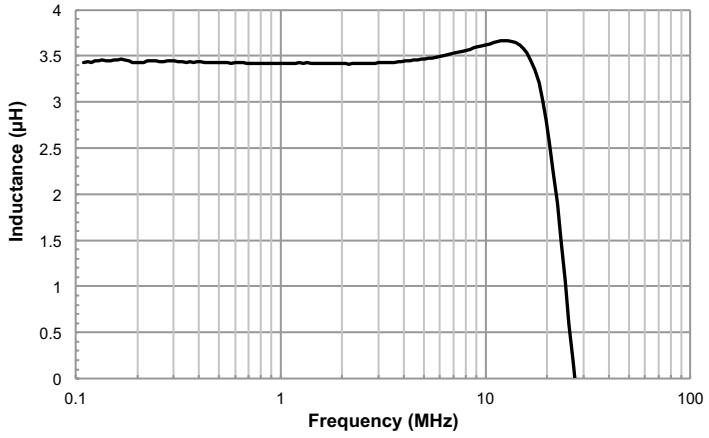

**MPI4020V2-1R5-R**




**MPI4020V2-2R2-R**

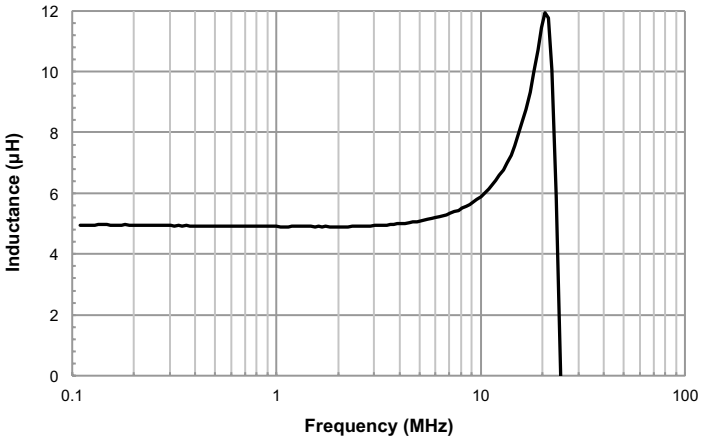



**MPI4020V2-3R3-R**

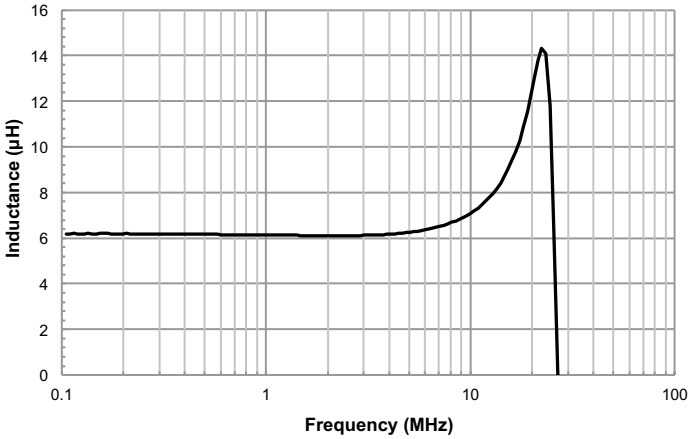


**Inductance vs. Frequency**

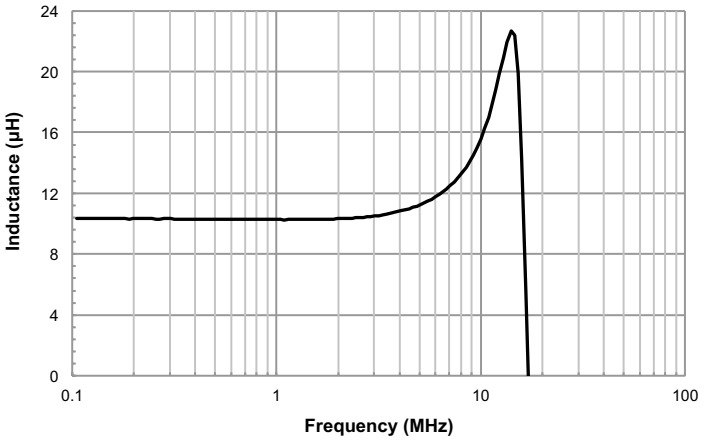
**MPI4020V2-4R7-R**



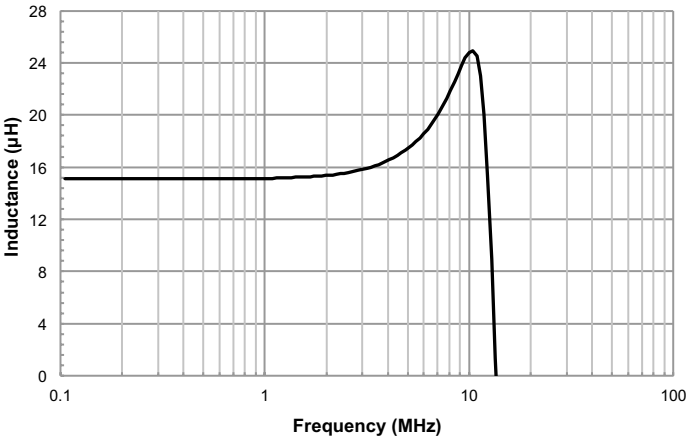

**MPI4020V2-6R8-R**



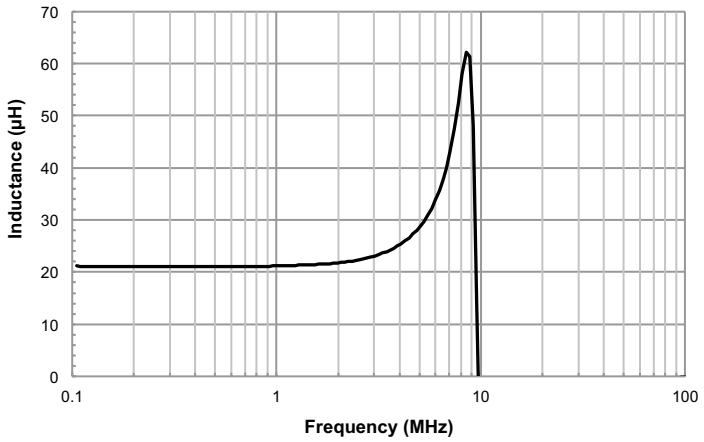

**MPI4020V2-100-R**



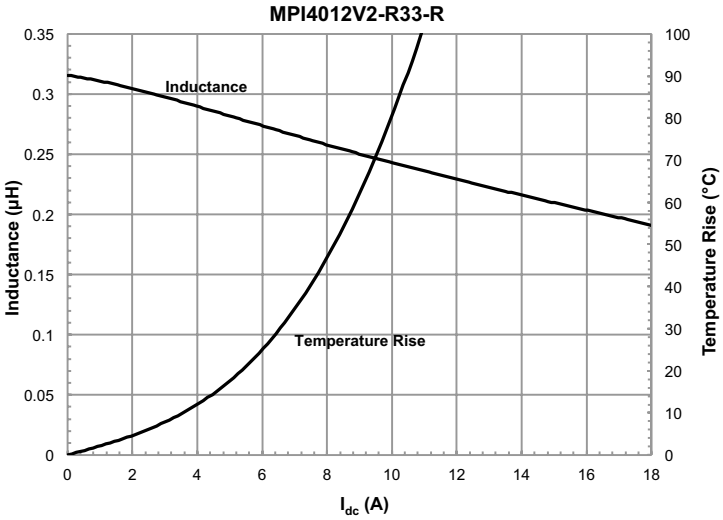

**MPI4020V2-150-R**

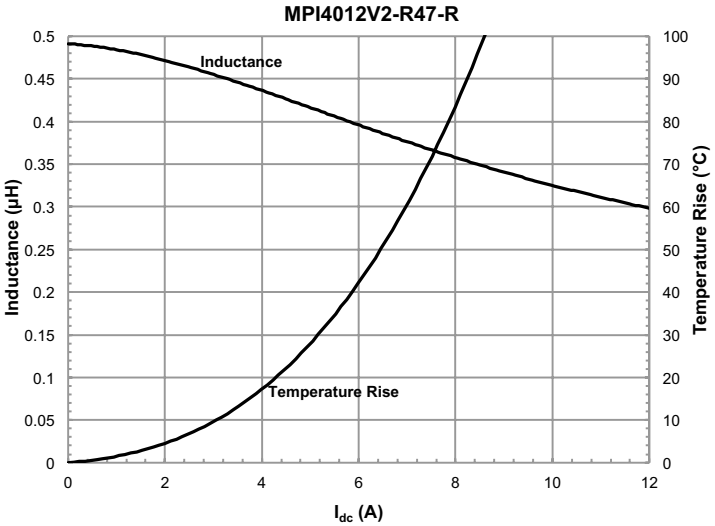


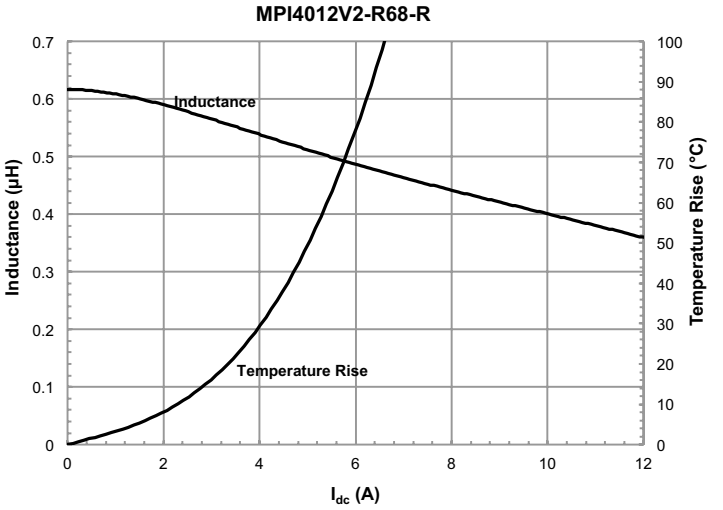

**MPI4020V2-220-R**

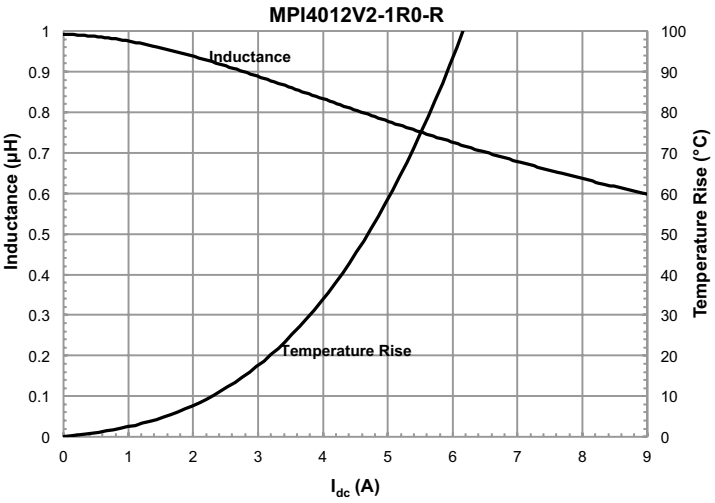


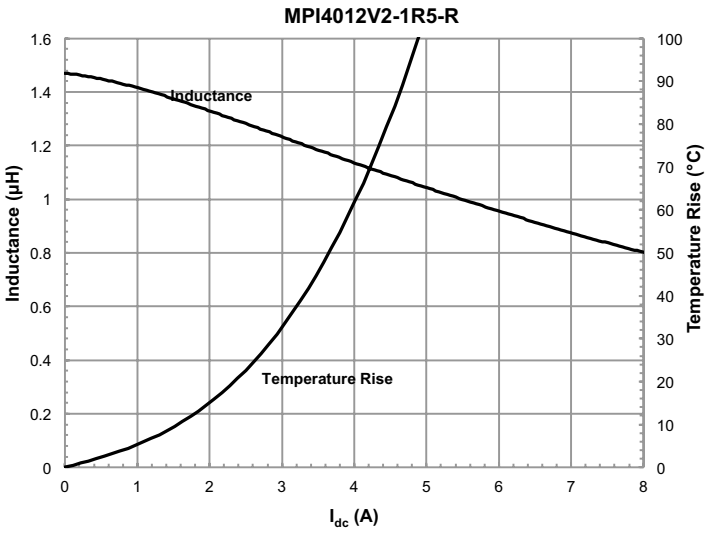
**Inductance and temperature rise vs. Current**

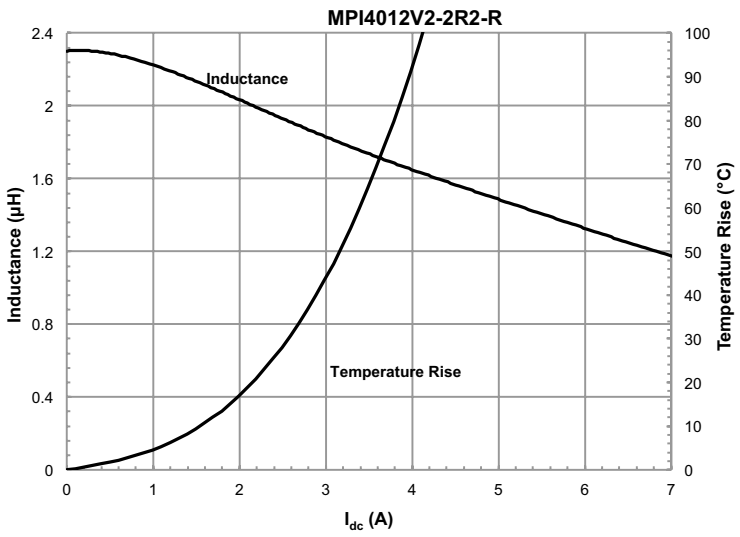


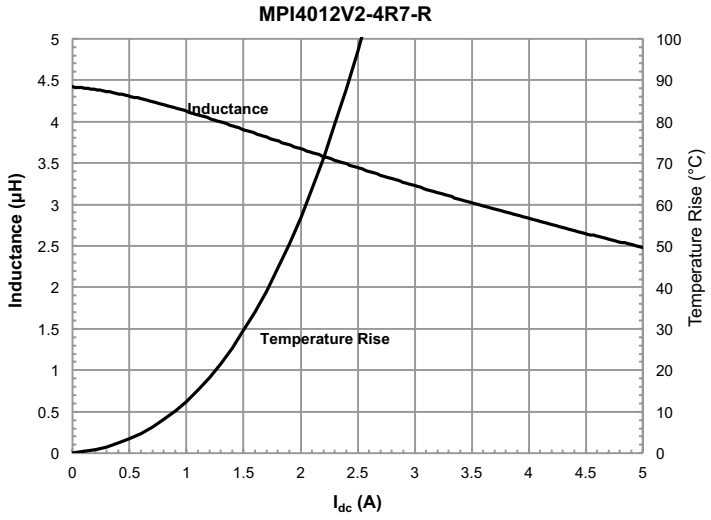



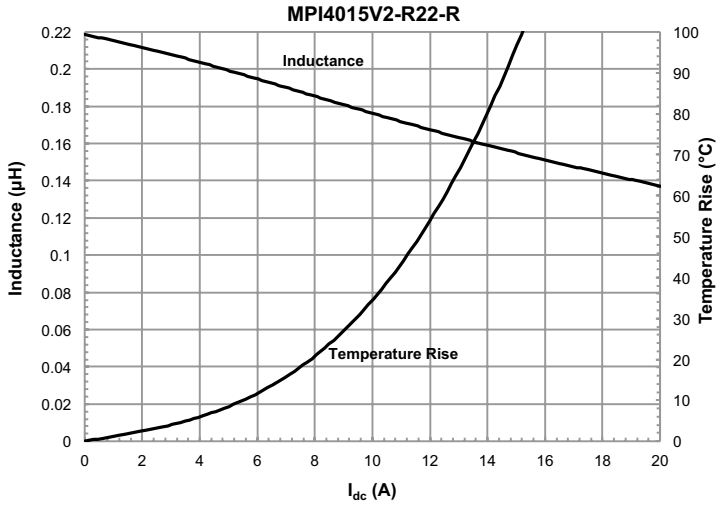



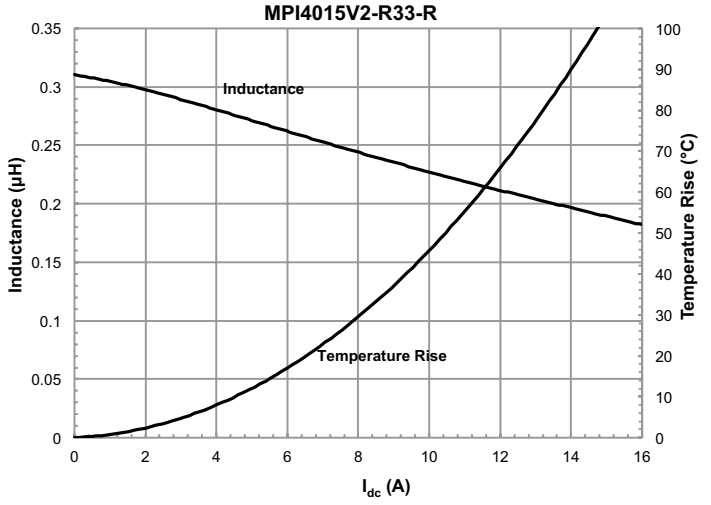



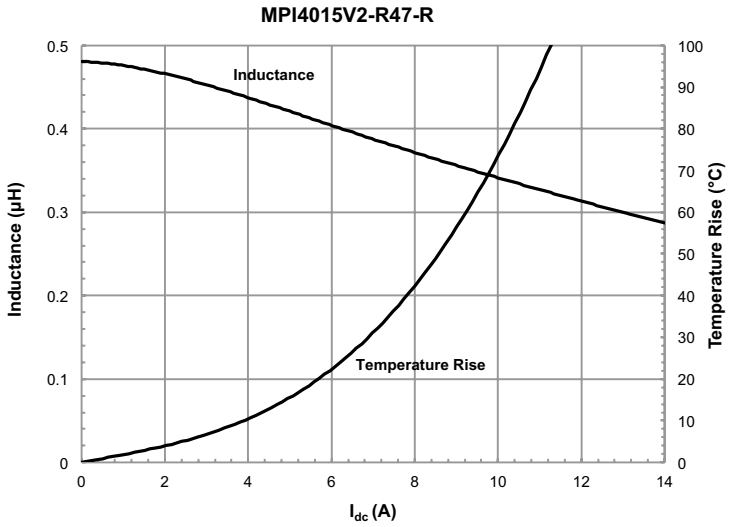



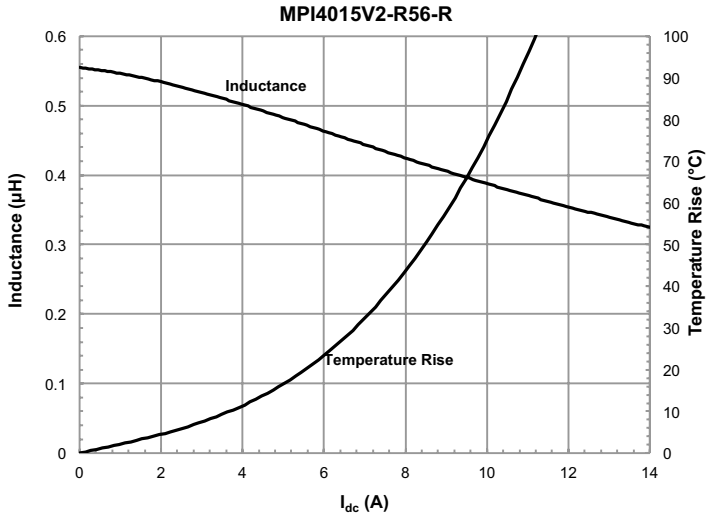
**Inductance and temperature rise vs. Current**

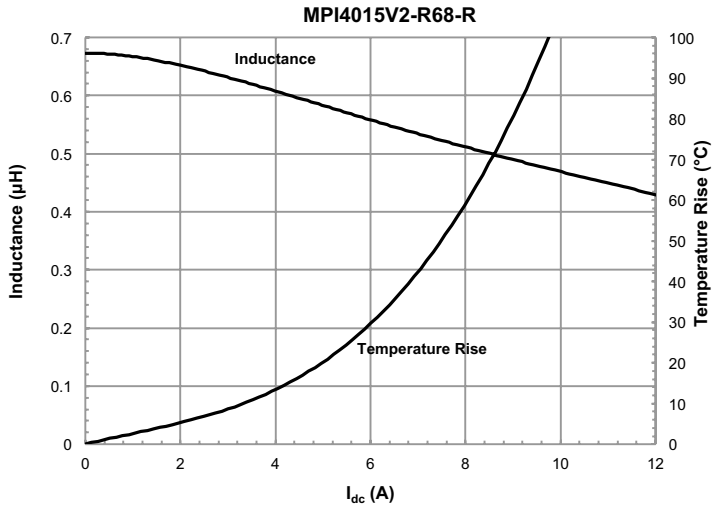


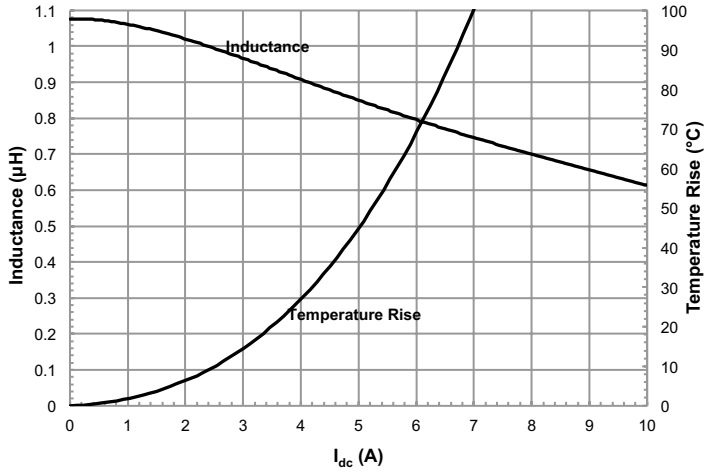



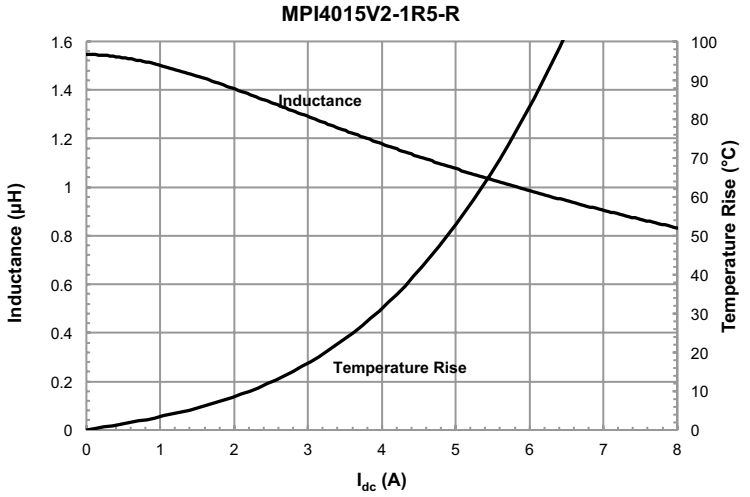



**Inductance and temperature rise vs. Current**

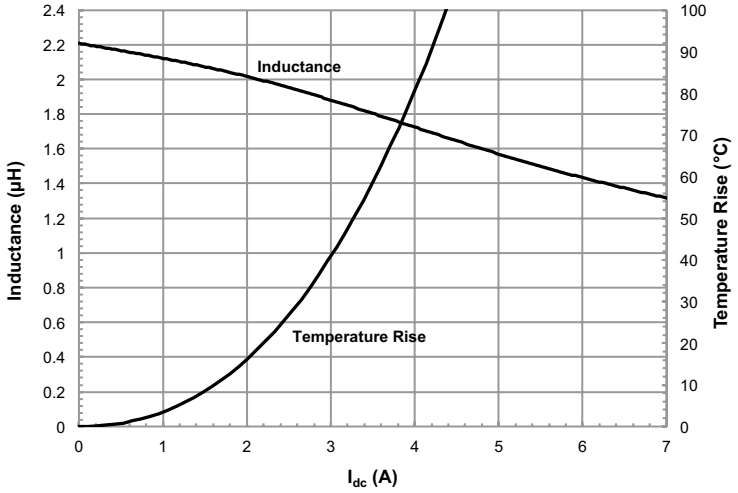
**MPI4015V2-1R0-R**



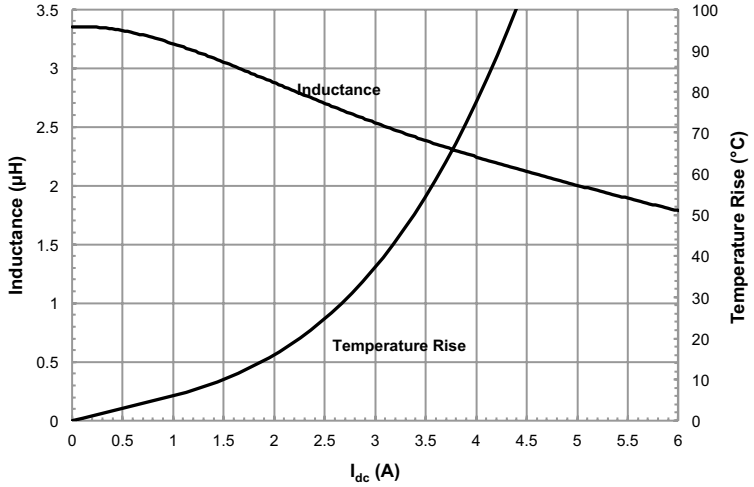

**MPI4015V2-1R5-R**



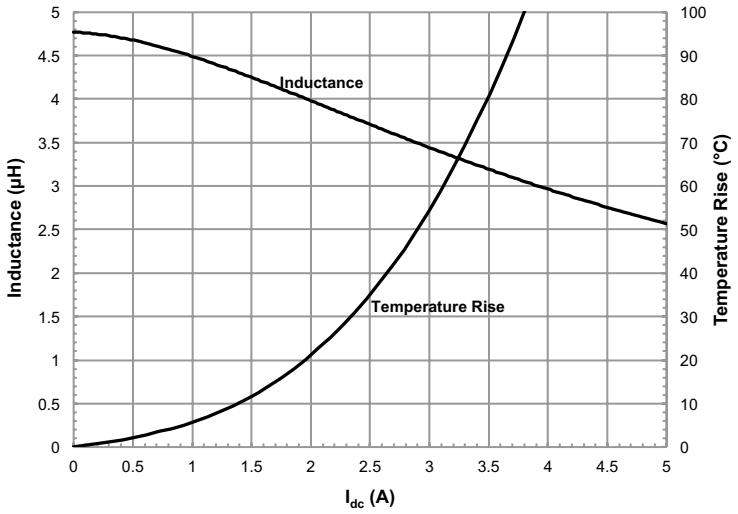

**MPI4015V2-2R2-R**



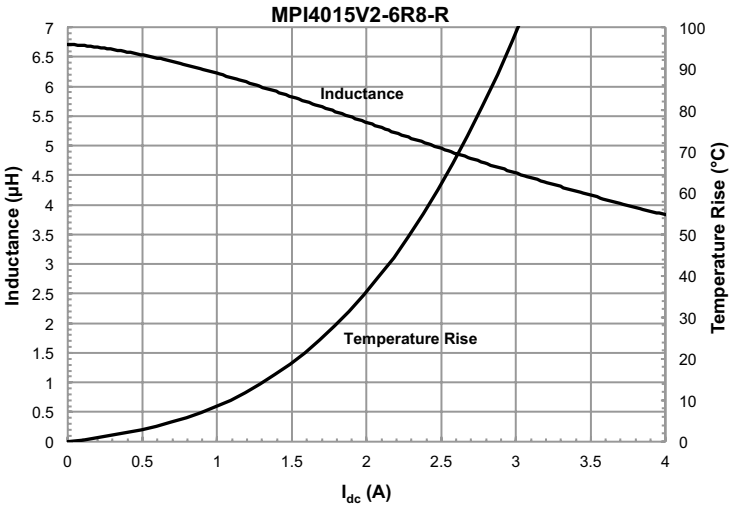

**MPI4015V2-3R3-R**



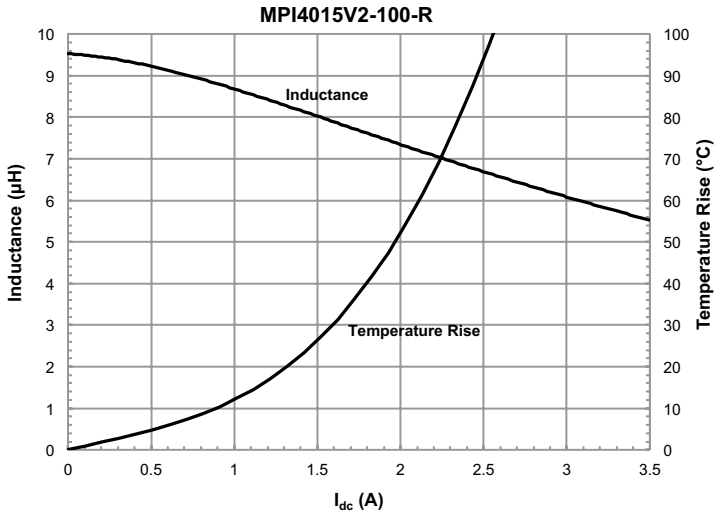

**MPI4015V2-4R7-R**

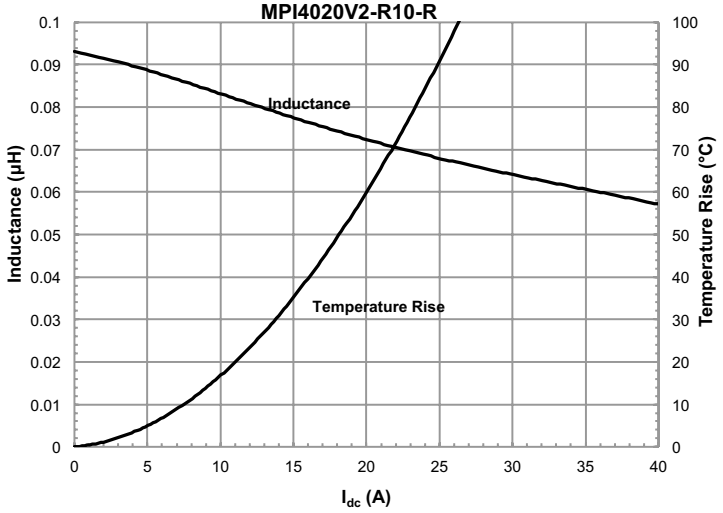


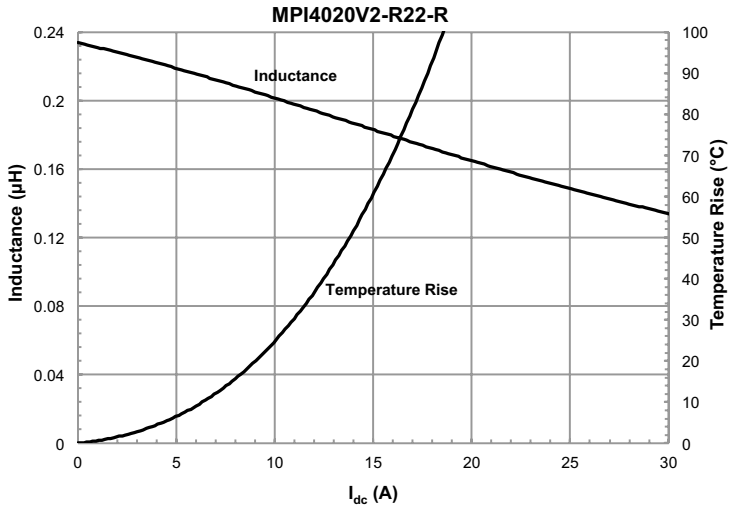

**MPI4015V2-6R8-R**

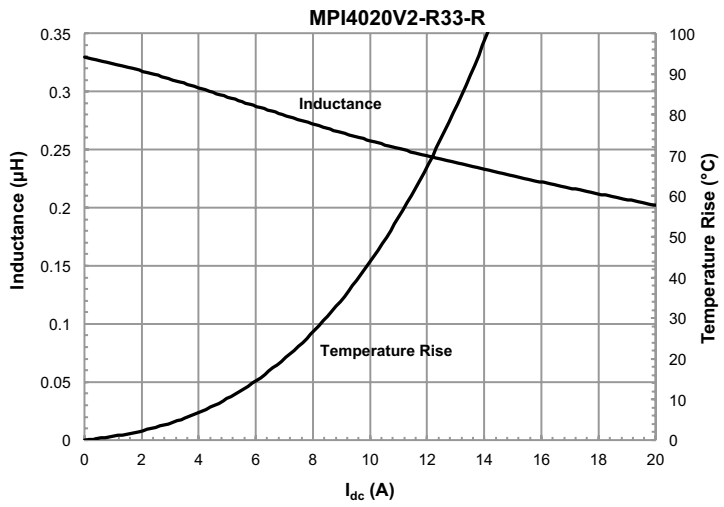


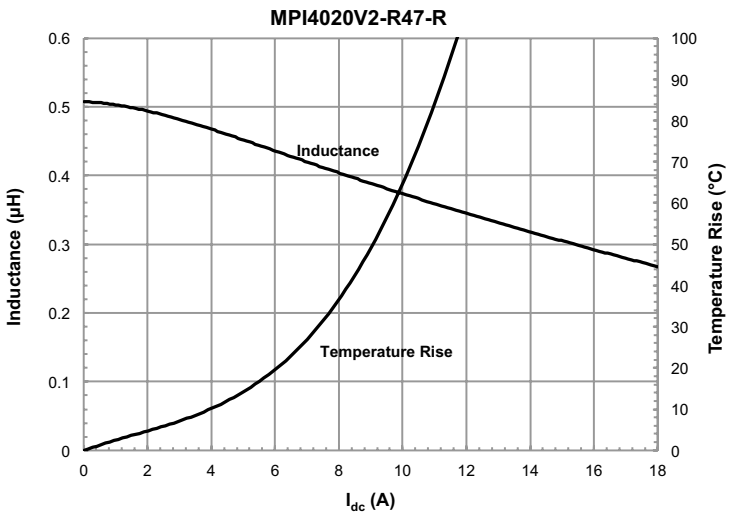
**Inductance and temperature rise vs. Current**

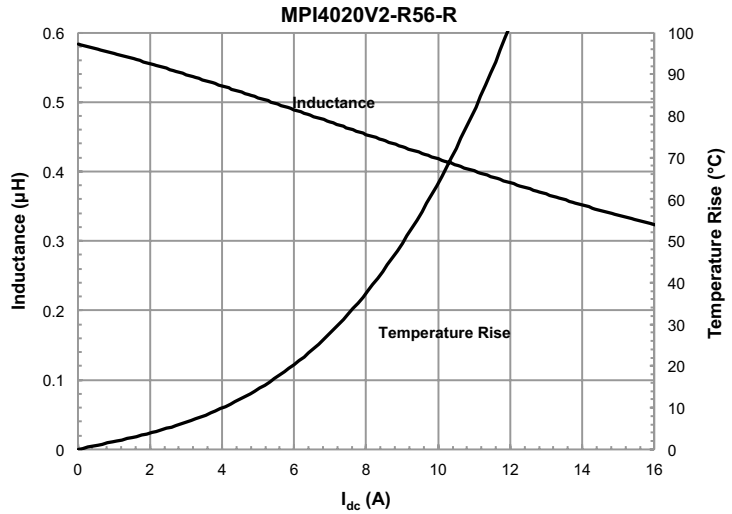


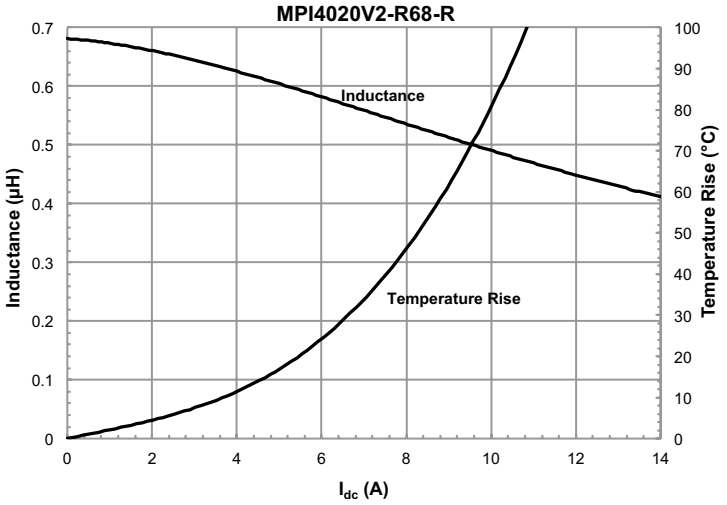



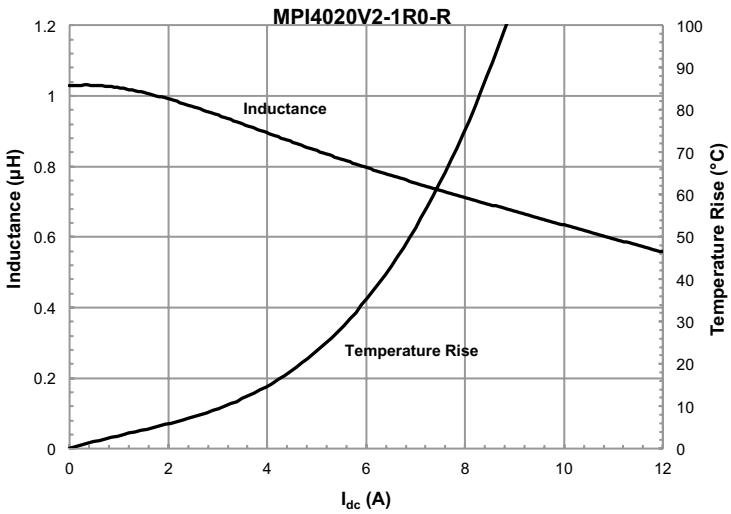



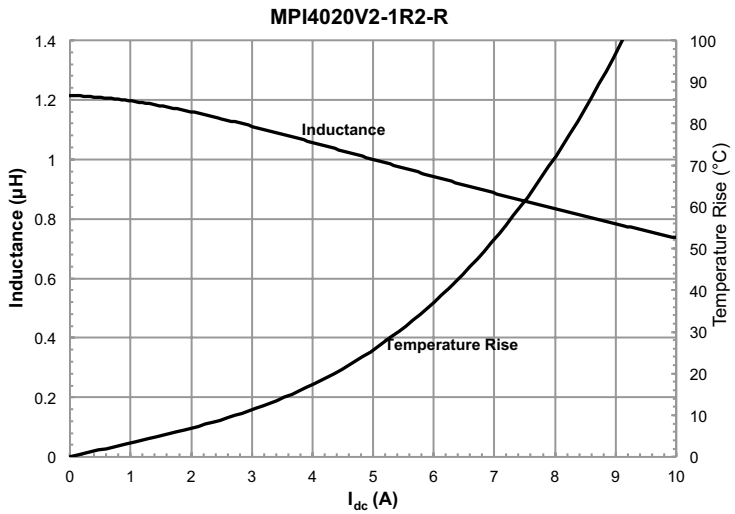



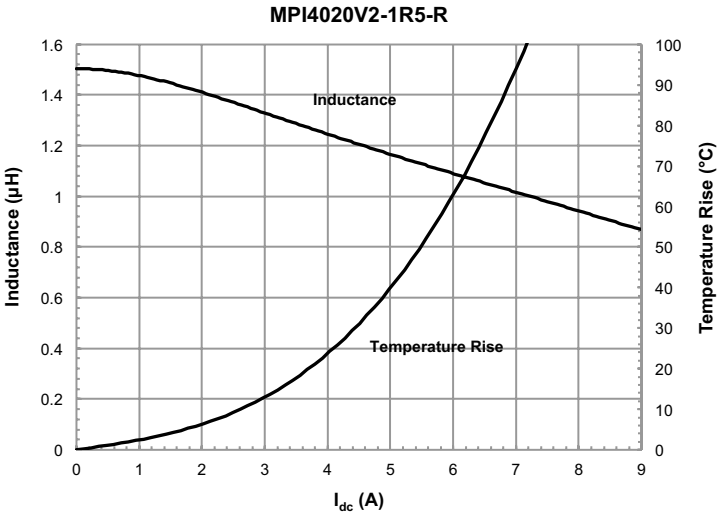



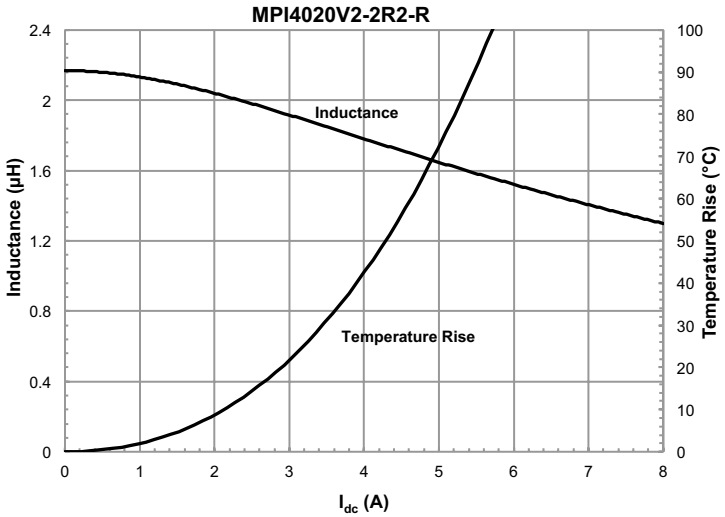
**Inductance and temperature rise vs. Current**

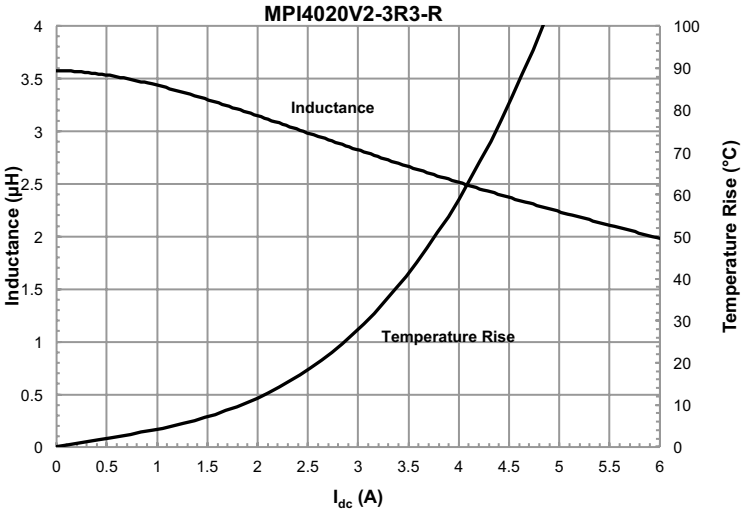


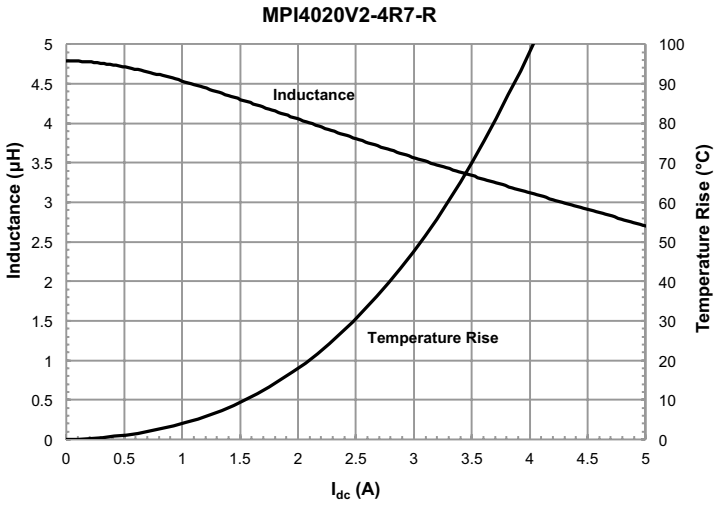



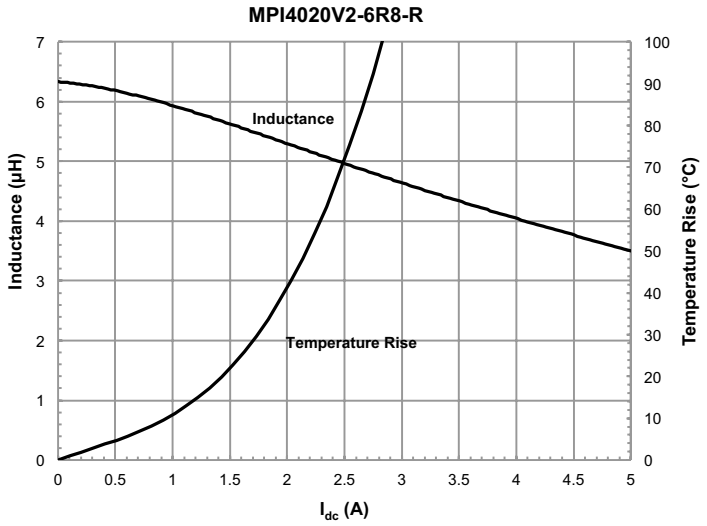



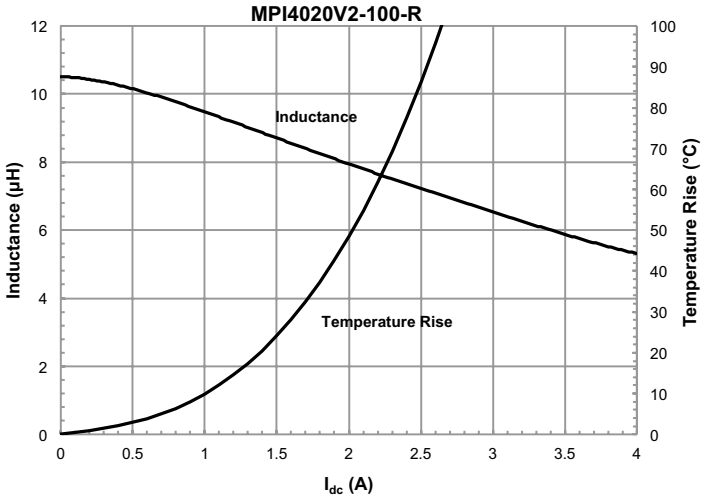



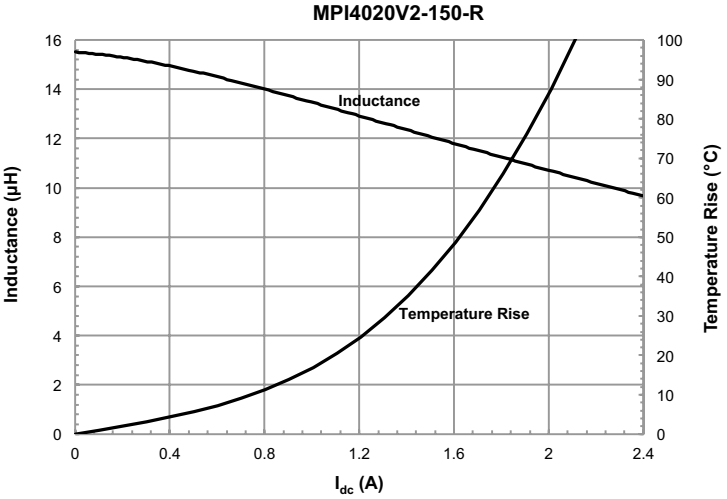



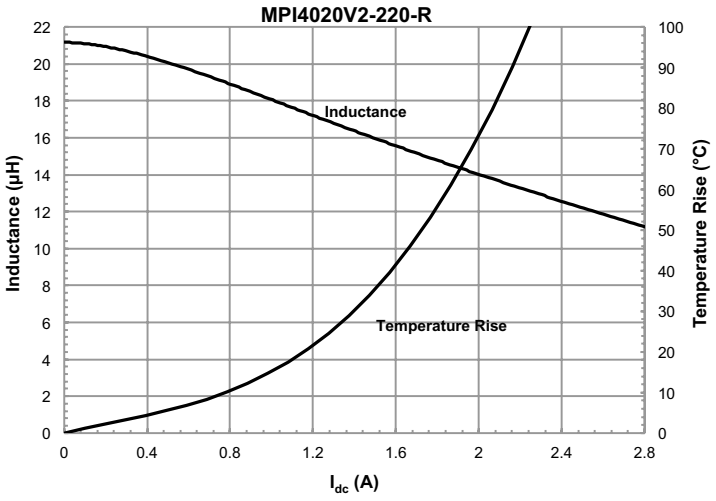
**Inductance and temperature rise vs. Current**



## Solder reflow profile

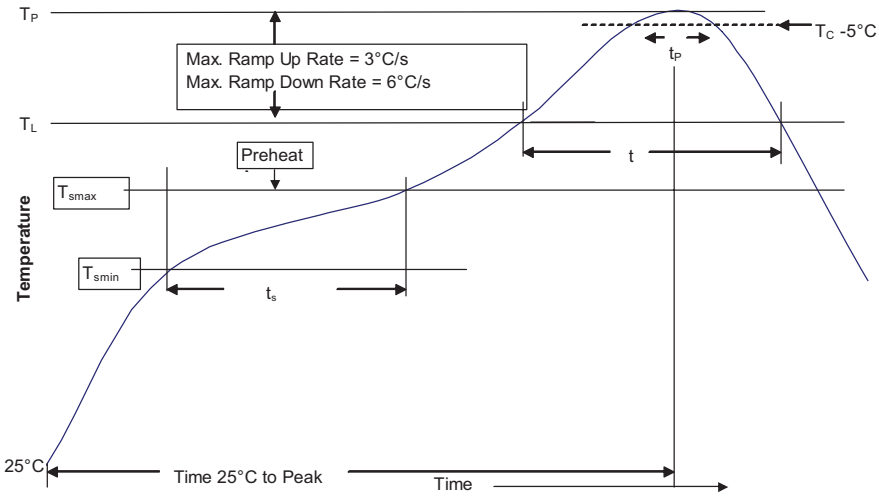



**Table 1 - Standard SnPb Solder ($T_C$)**

| Package Thickness | Volume mm3 <350 | Volume mm3 ≥350 |
|---|---|---|
| <2.5mm) | 235 °C | 220 °C |
| ≥2.5mm | 220 °C | 220 °C |

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

| Package Thickness | Volume mm³ <350 | Volume mm³ 350 - 2000 | Volume mm³ >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 ($T_L$)<br>Time at liquidous ($t_L$) | | 183 °C<br>60-150 Seconds | 217 °C<br>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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