

# 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  $\mu$ H to 22  $\mu$ H
- 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



## Product specifications

| Part Number <sup>5</sup> | OCL <sup>1</sup><br>(μH) ±20% | Part marking<br>designator | I <sub>rms</sub> <sup>2</sup><br>(A) | I <sub>sat</sub> <sup>3</sup><br>(A) | DCR (mΩ)<br>typical @ +20 °C | DCR (mΩ)<br>maximum @<br>+20 °C | SRF<br>(MHz)<br>typical | K-factor <sup>4</sup> |
|--------------------------|-------------------------------|----------------------------|--------------------------------------|--------------------------------------|------------------------------|---------------------------------|-------------------------|-----------------------|
| <b>1.2 mm height</b>     |                               |                            |                                      |                                      |                              |                                 |                         |                       |
| 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                   |
| <b>1.5 mm height</b>     |                               |                            |                                      |                                      |                              |                                 |                         |                       |
| 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                   |
| <b>2.0 mm height</b>     |                               |                            |                                      |                                      |                              |                                 |                         |                       |
| 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<sub>rms</sub>: 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<sub>sat</sub>: 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 μH), 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

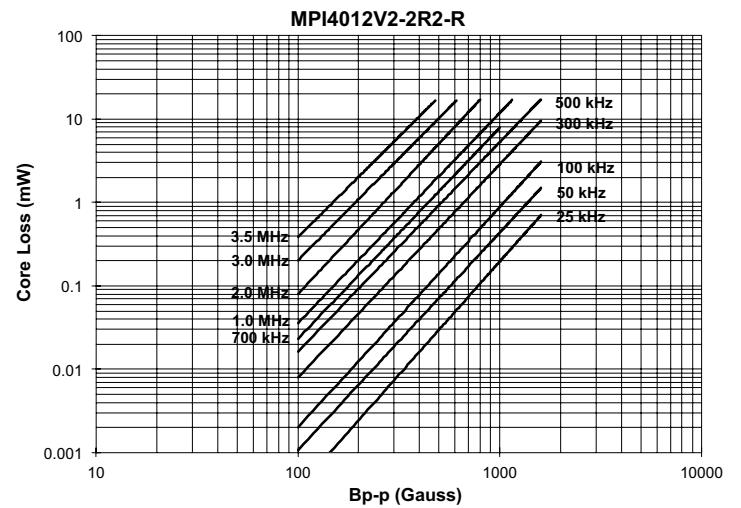
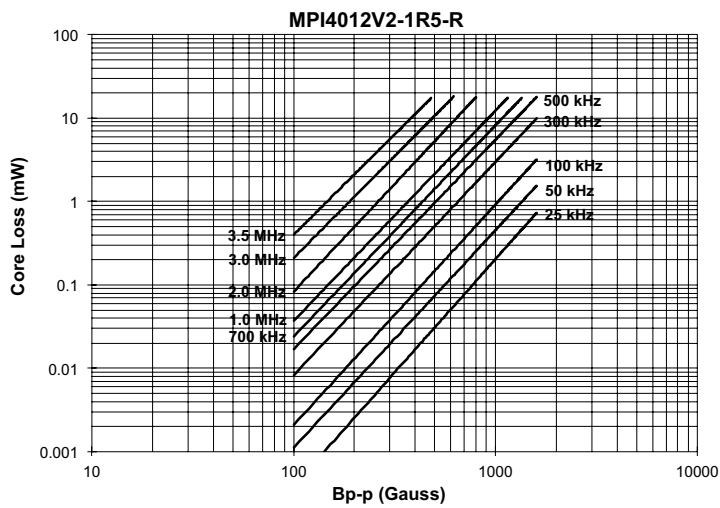
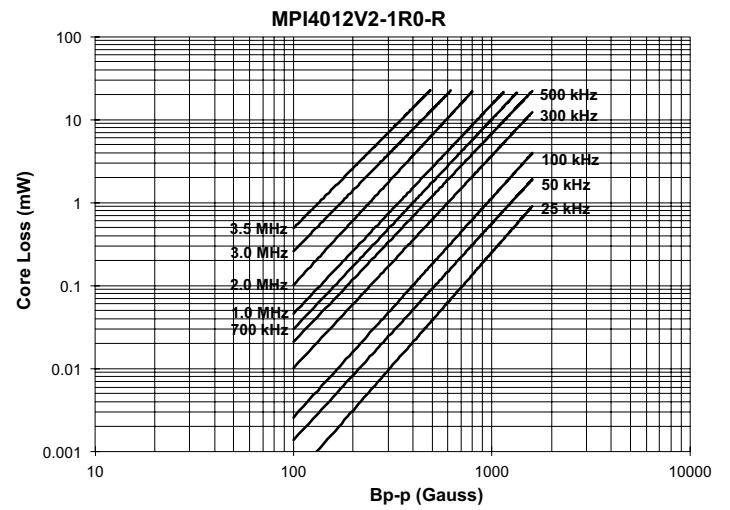
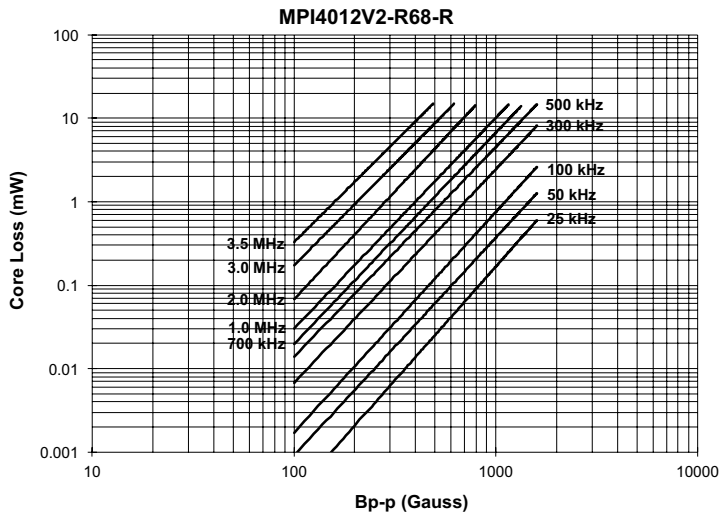
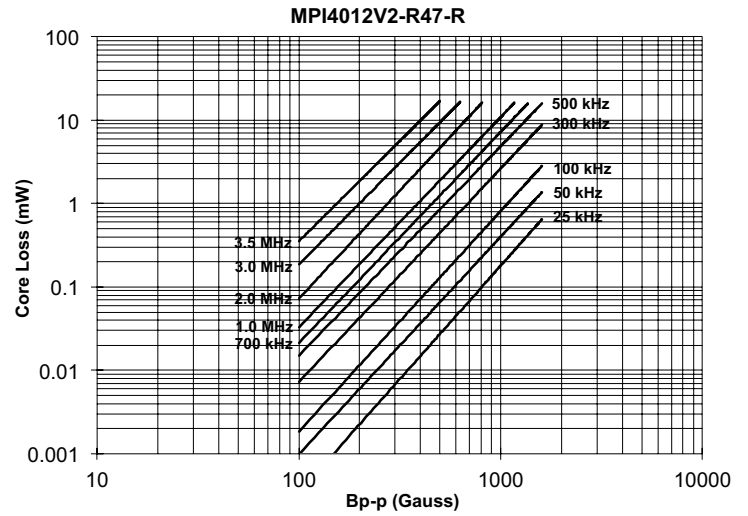
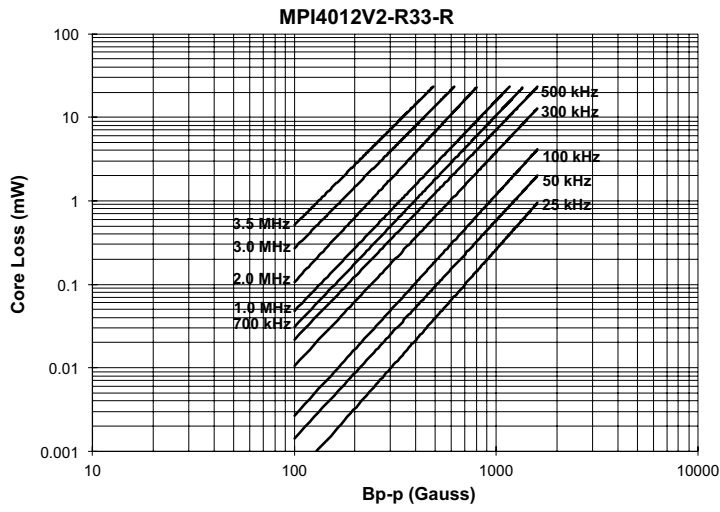
**Dimension A**

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

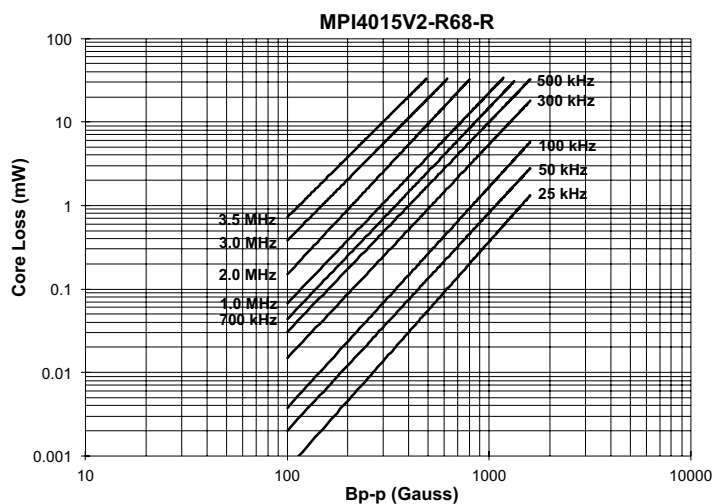
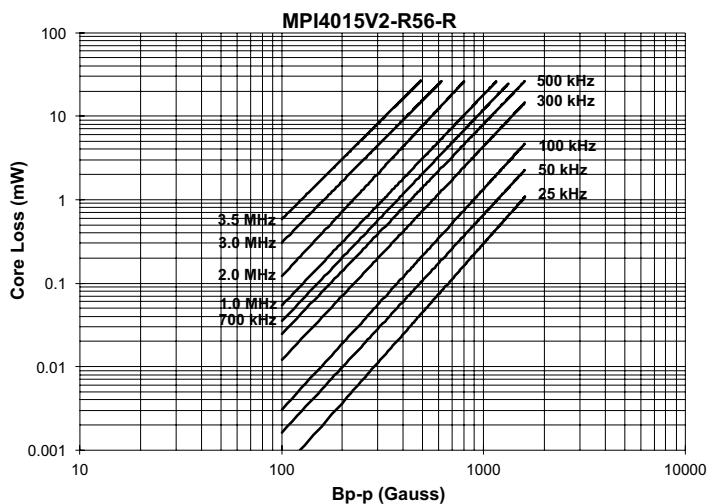
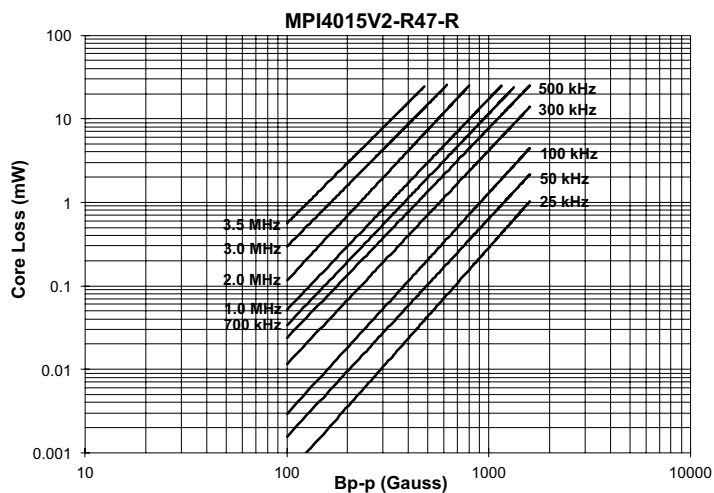
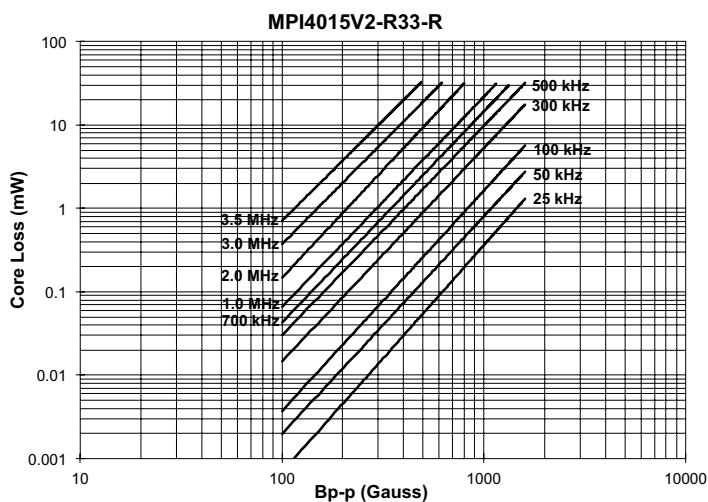
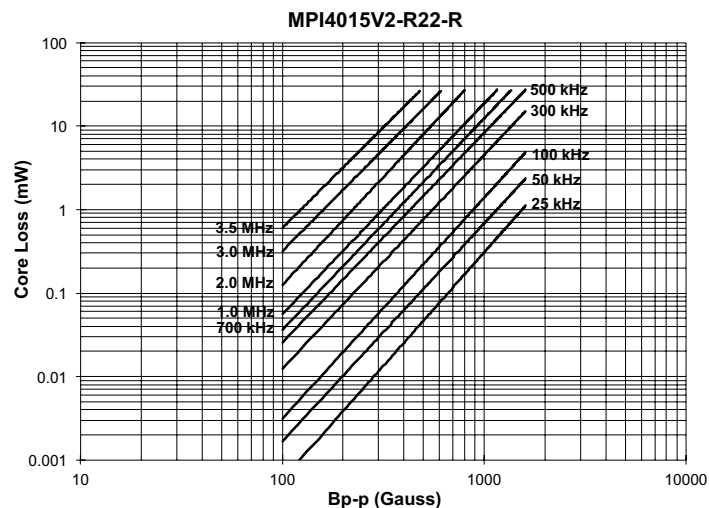
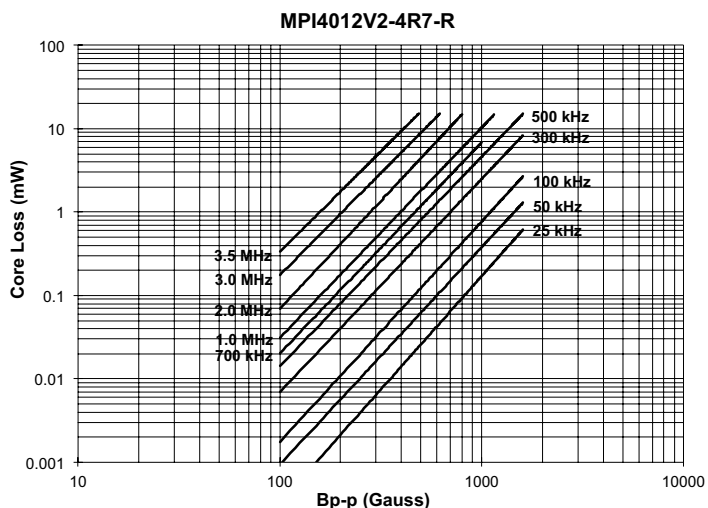
Technical drawing of the MPI4012V2, MPI4015V2, and MPI4020V2 components. The drawing includes a top view with dimensions: 1.5 dia for hole diameter, 4.0 for hole pitch, 2.0 for hole offset, 8.0 for hole pitch, 1.75 for hole offset, 5.5 for hole offset, 10.25 for hole offset, 12.0 ±0.3 for total height, and 2x for hole diameter. A section line A-A is shown. A side view shows a cross-section with a 4.5 width. A table lists the part numbers and their corresponding dimensions: MPI4012V2 (1.4), MPI4015V2 (1.8), and MPI4020V2 (2.5). The direction of feed is indicated by an arrow pointing right.

| Part Number | Dimension |
|-------------|-----------|
| MPI4012V2   | 1.4       |
| MPI4015V2   | 1.8       |
| MPI4020V2   | 2.5       |

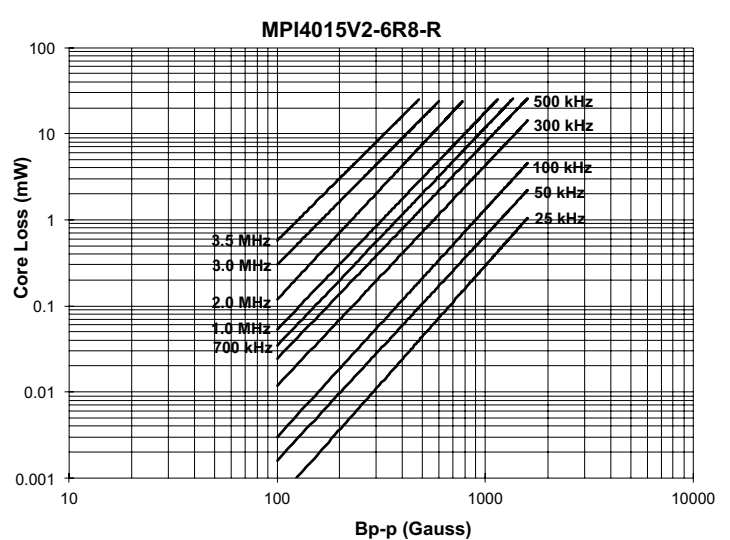
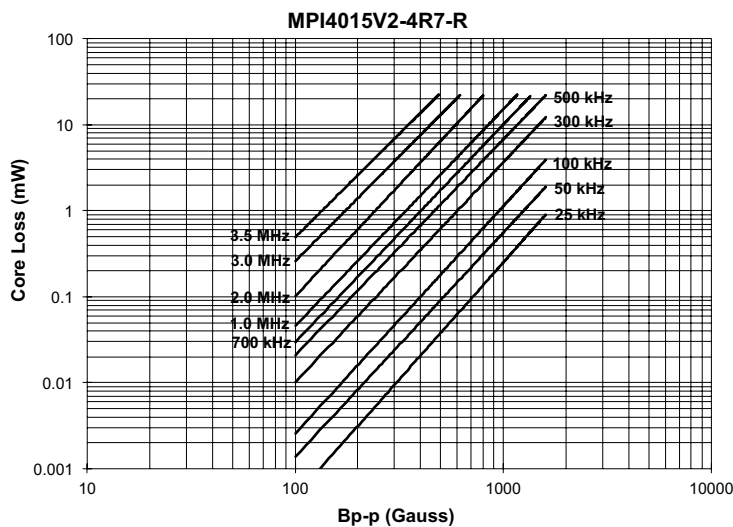
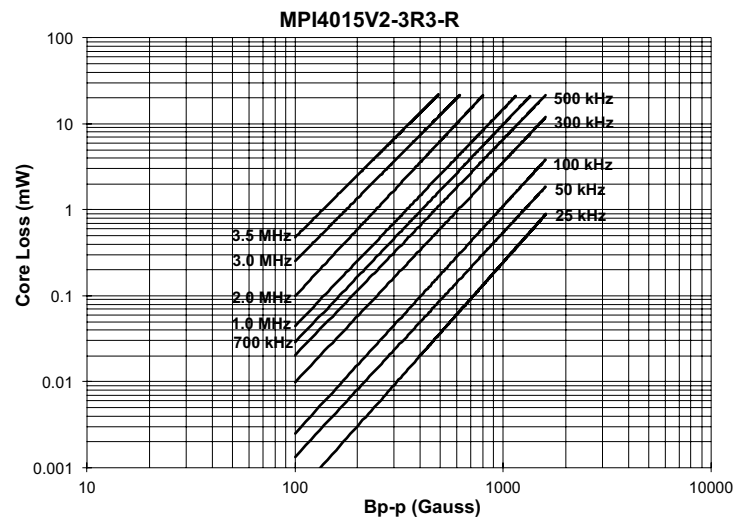
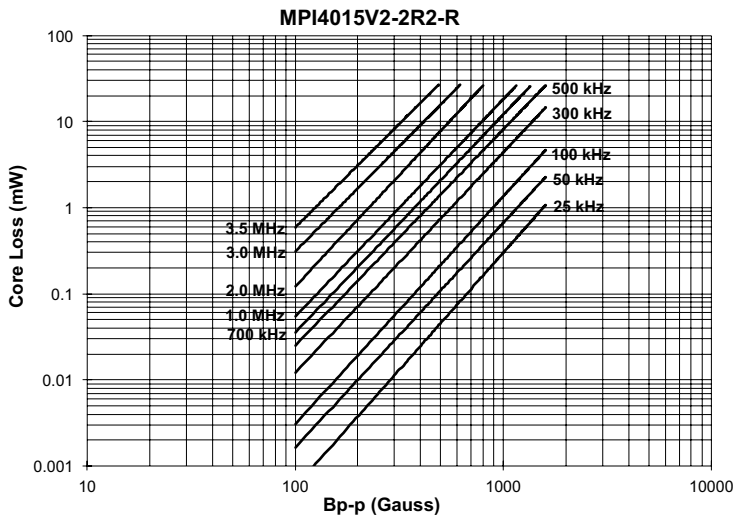
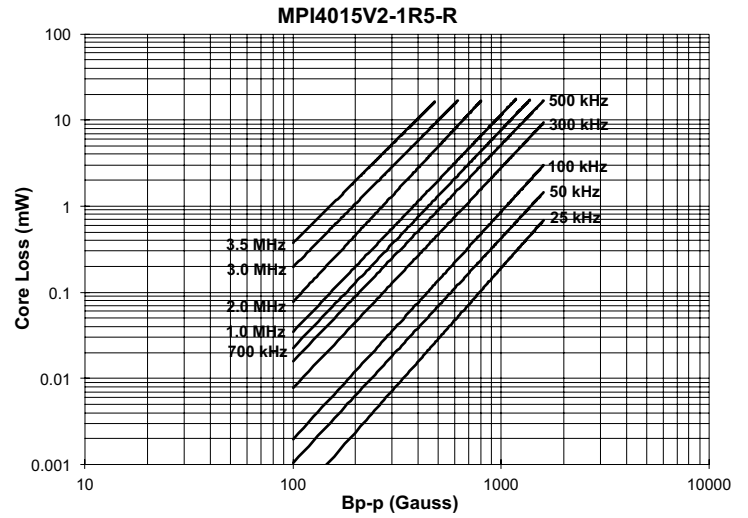
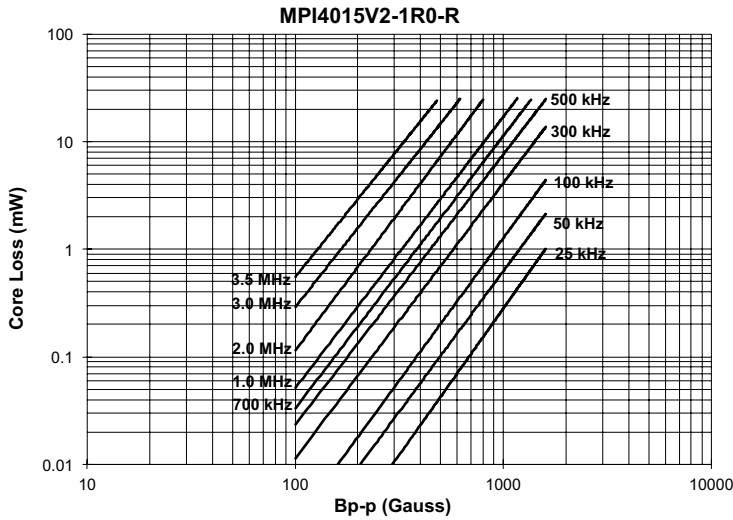
Core loss vs Bp-p



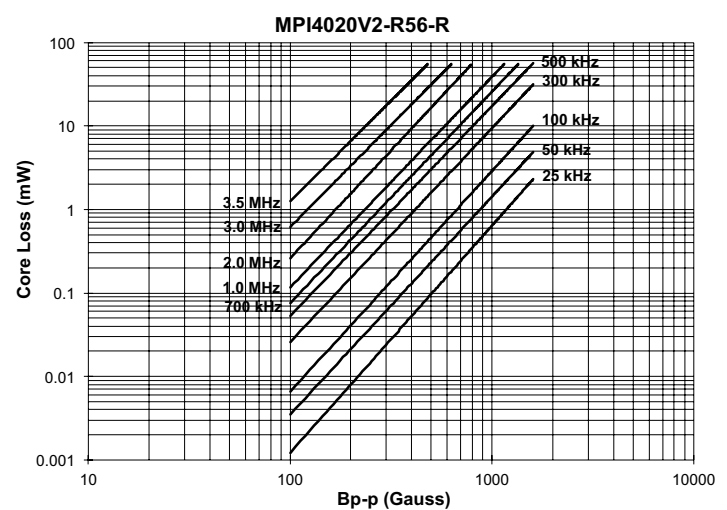
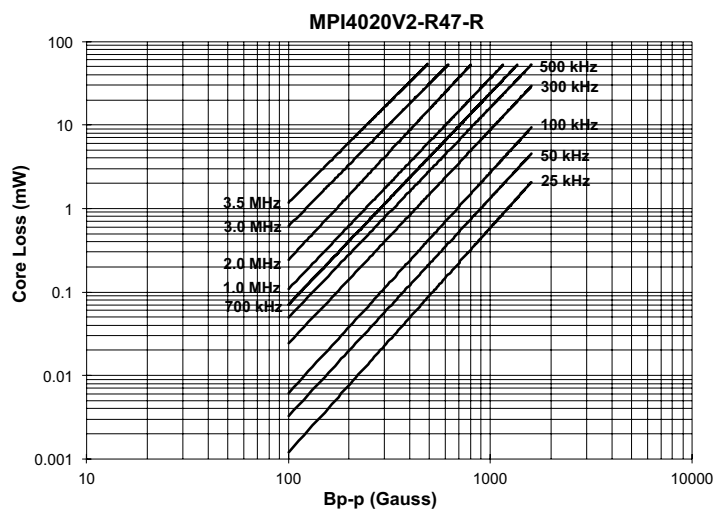
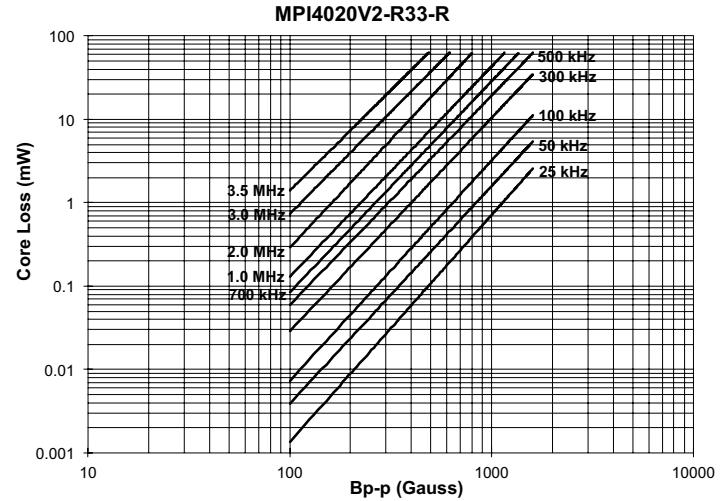
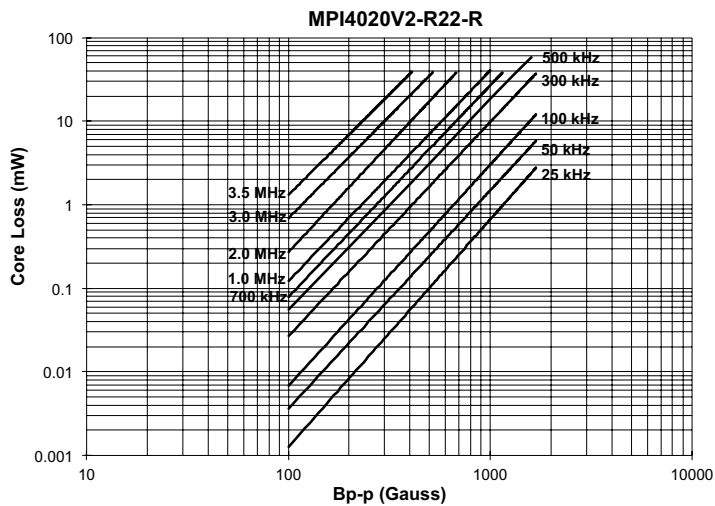
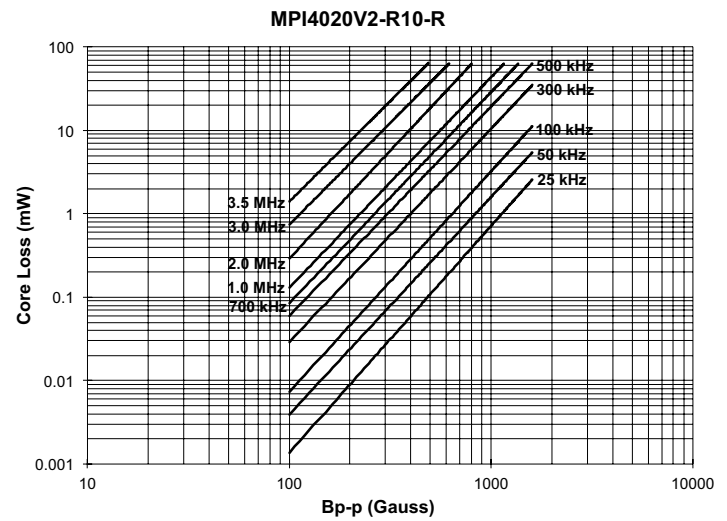
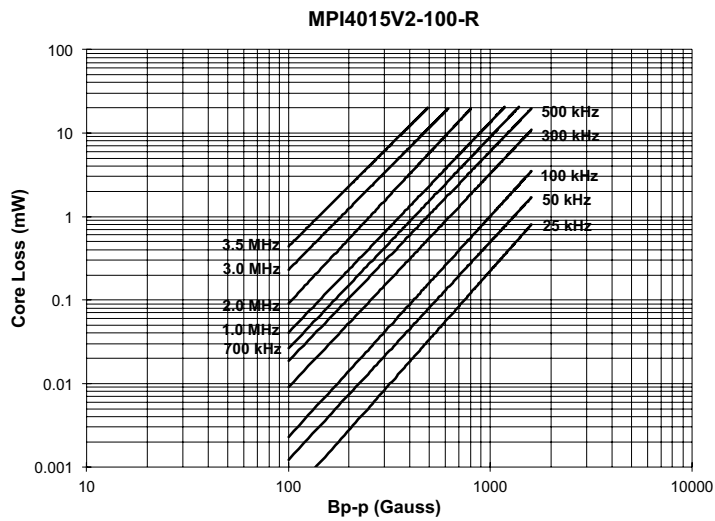
Core loss vs Bp-p



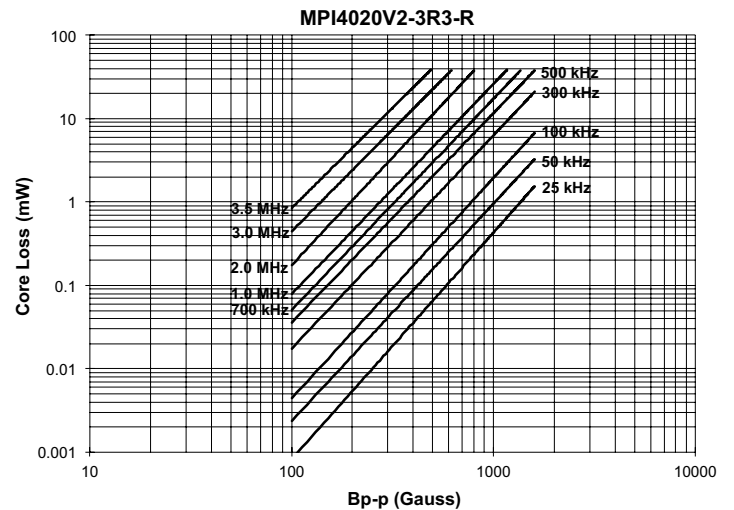
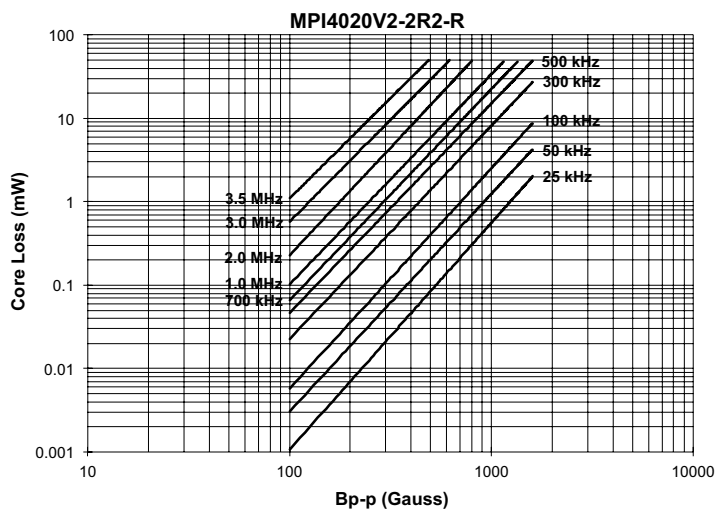
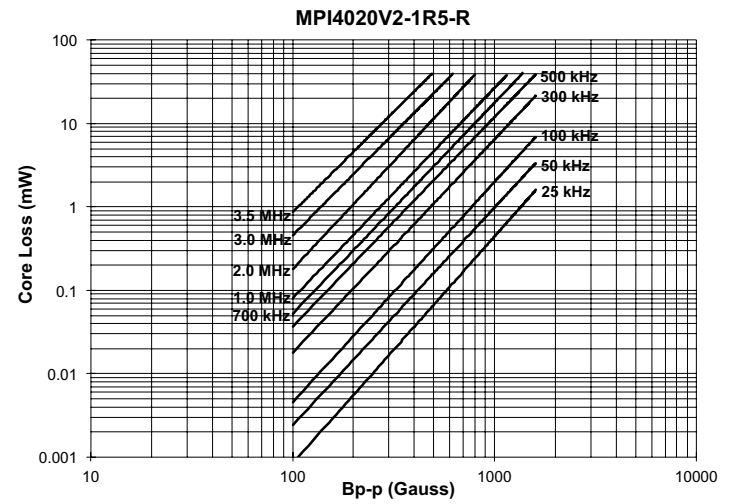
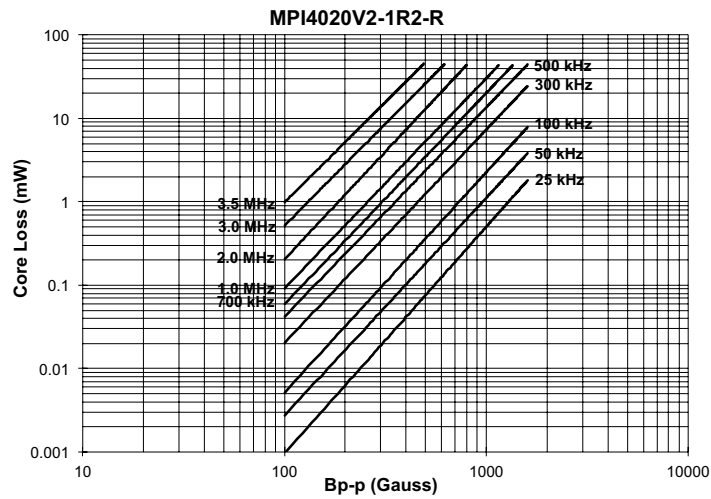
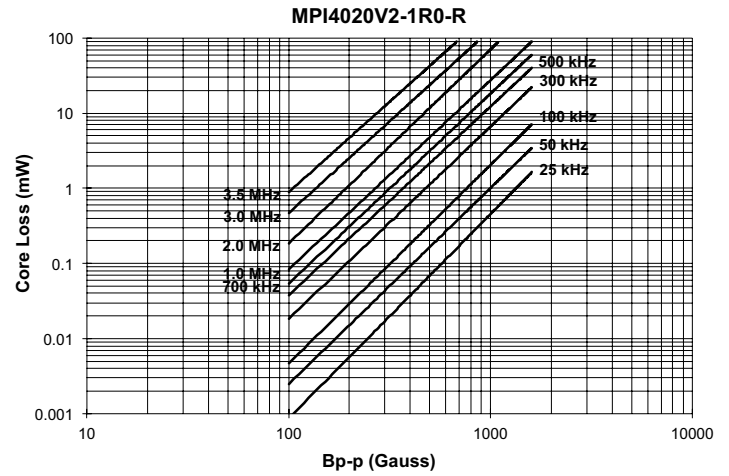
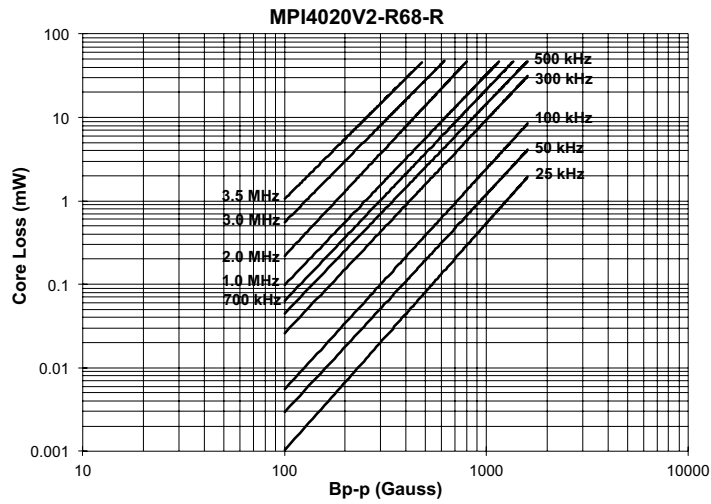
## Core loss vs Bp-p



Core loss vs Bp-p

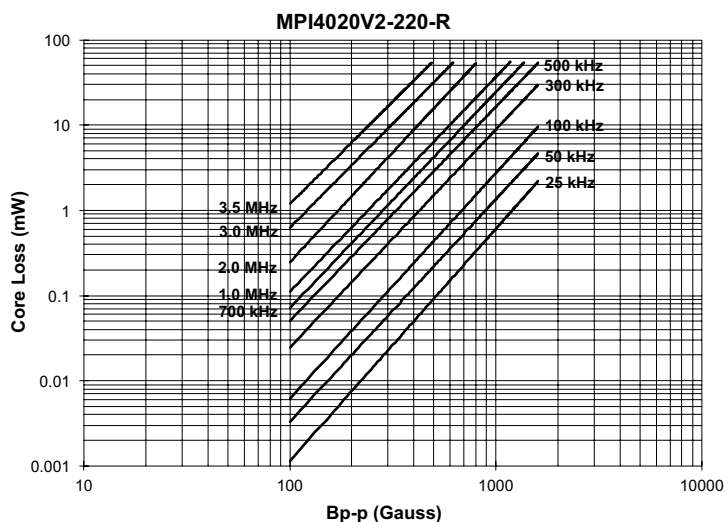
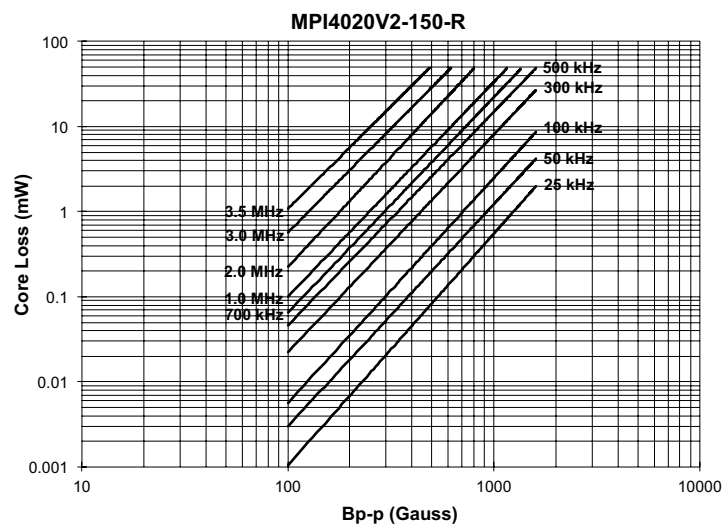
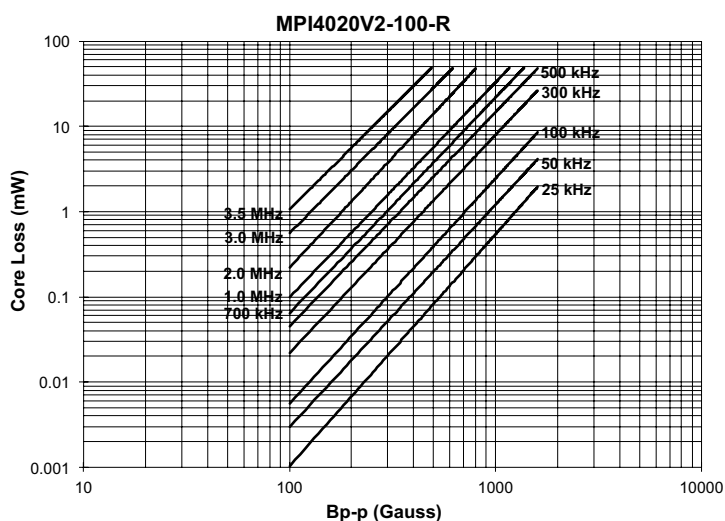
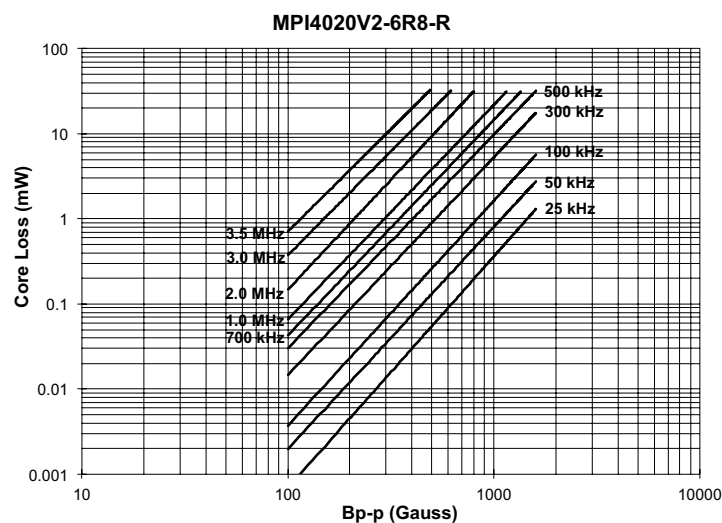
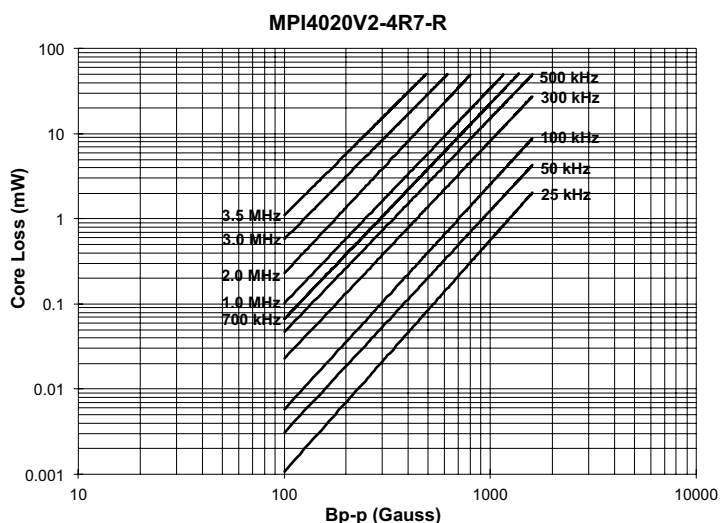


## Core loss vs Bp-p

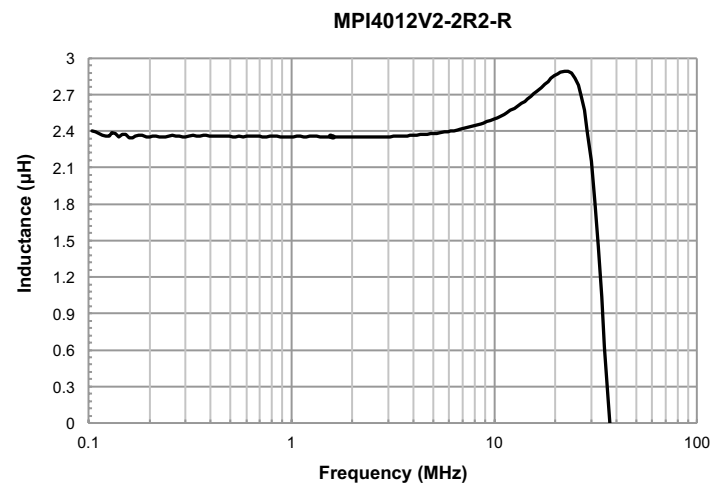
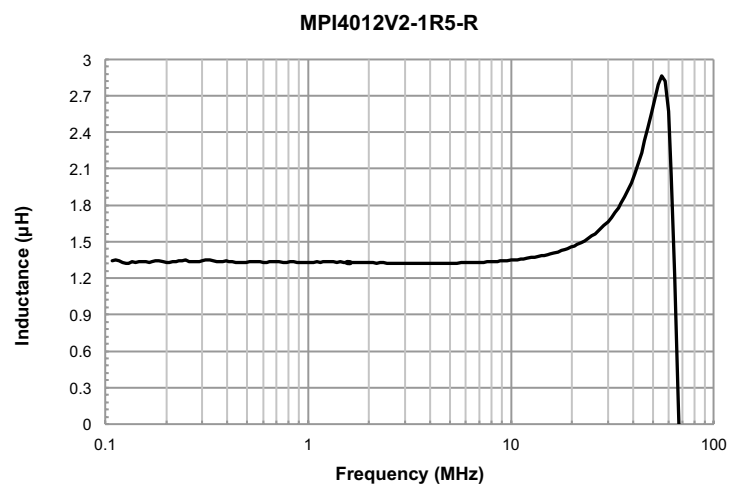
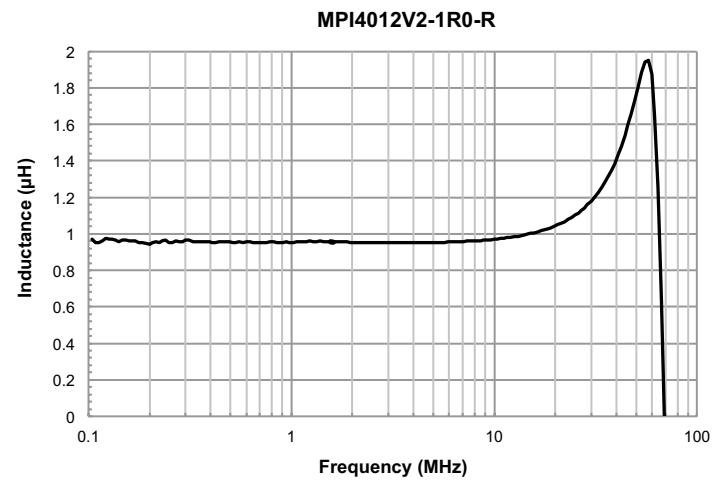
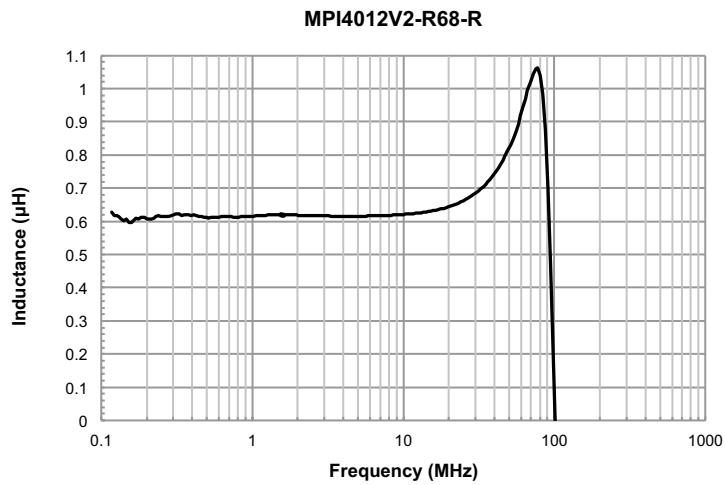
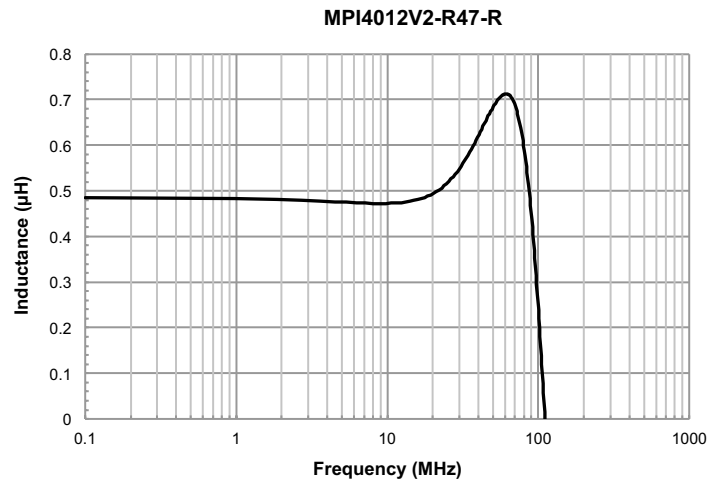
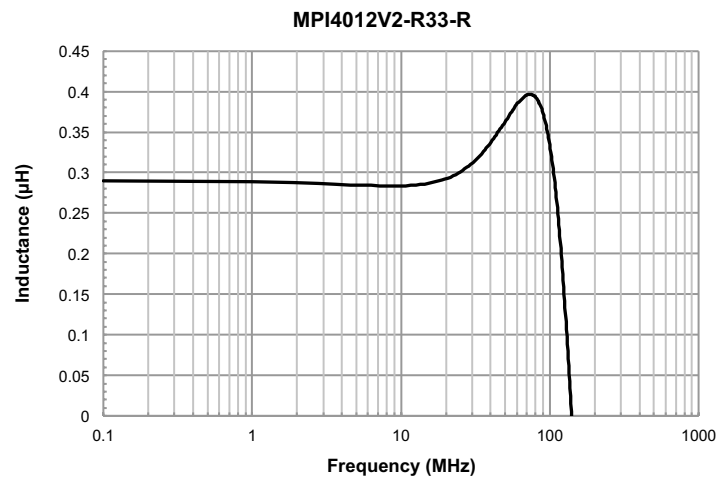




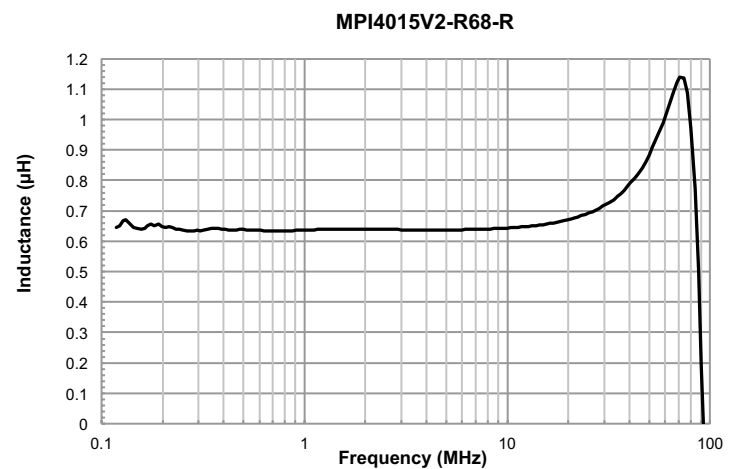
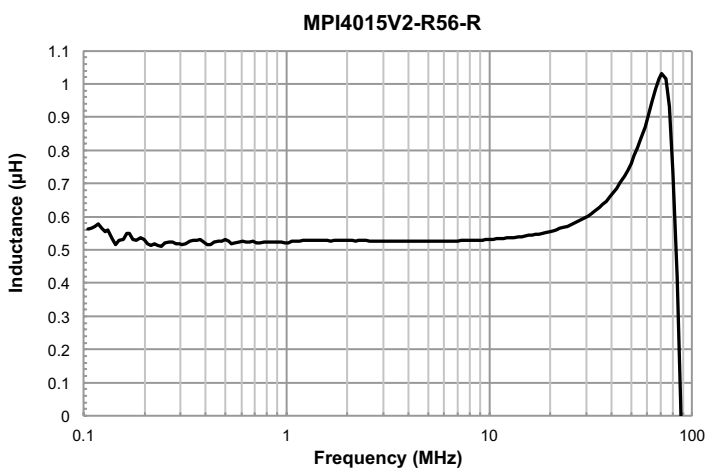
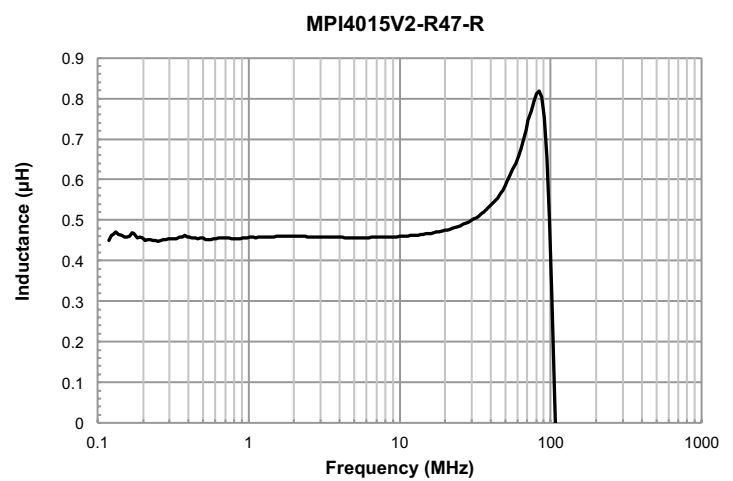
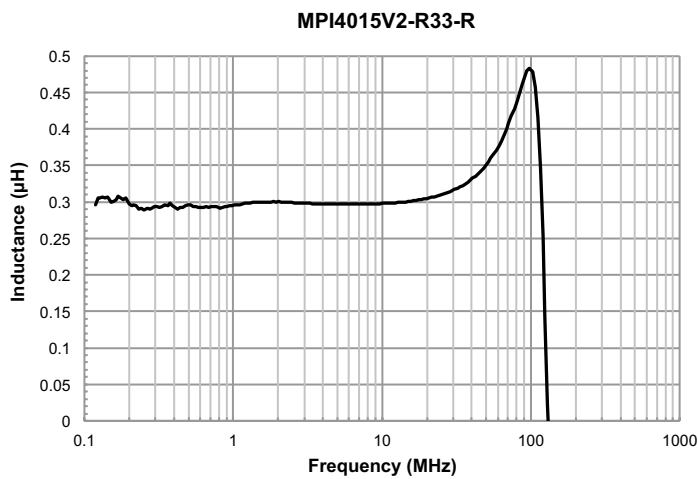
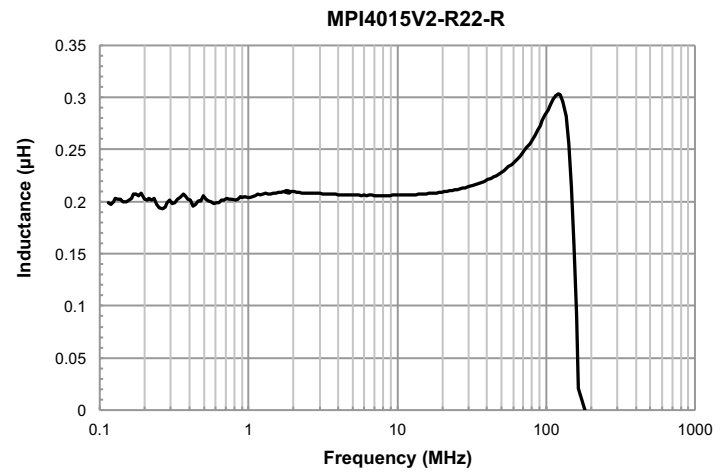
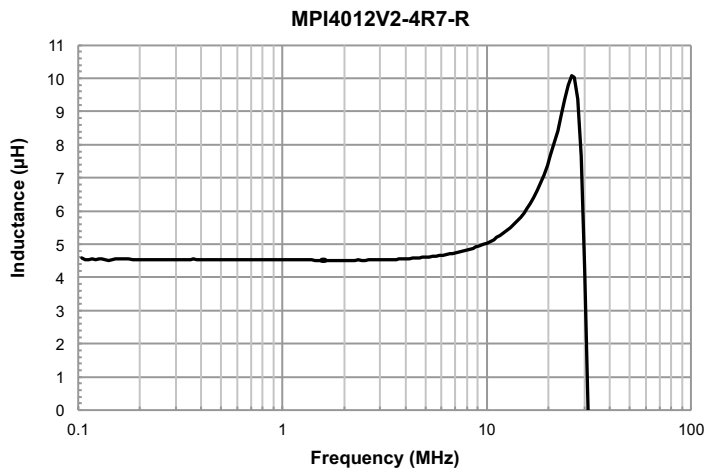
# Core loss vs Bp-p



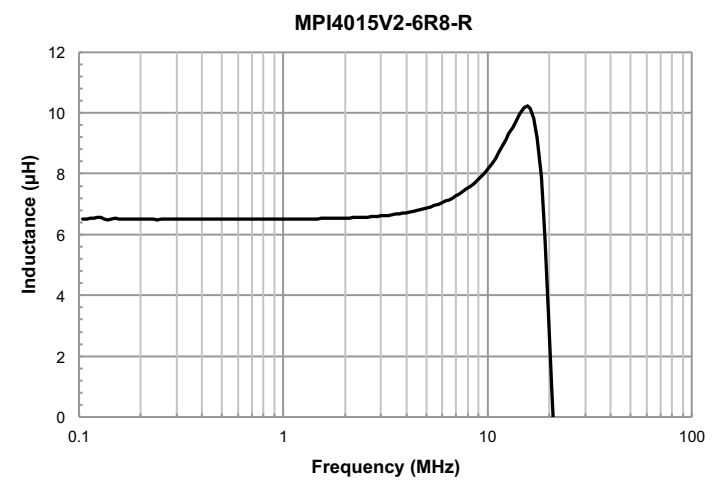
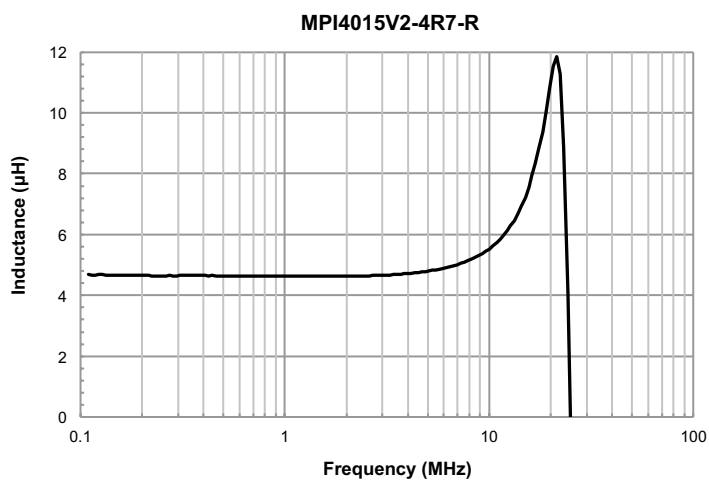
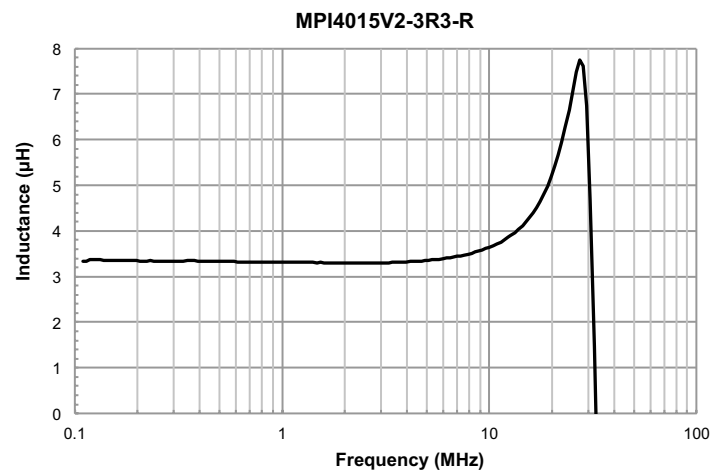
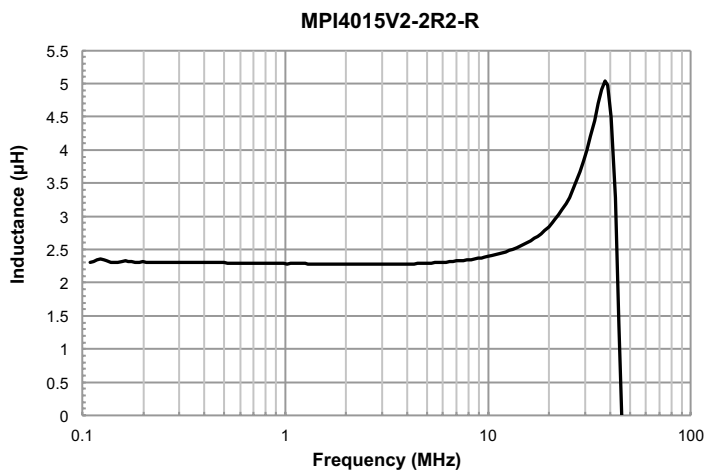
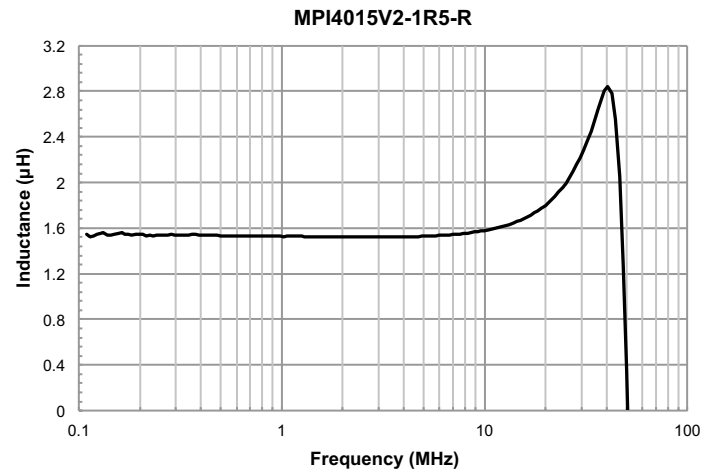
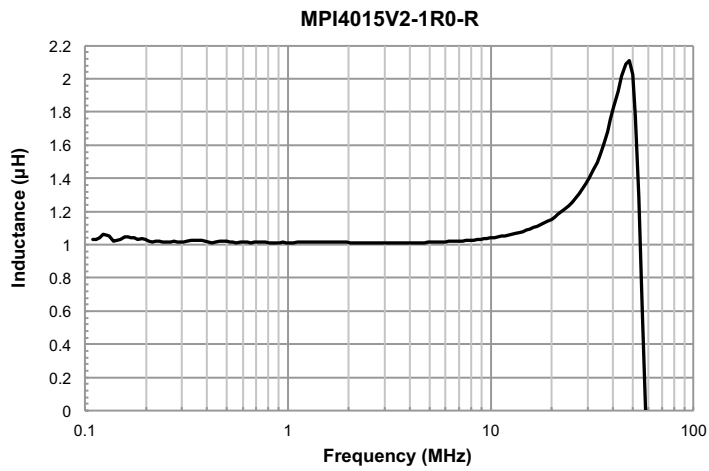
Inductance vs. Frequency



# Inductance vs. Frequency

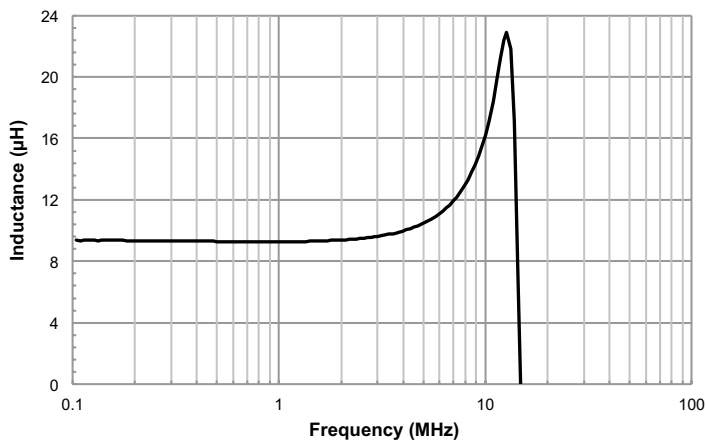


### Inductance vs. Frequency

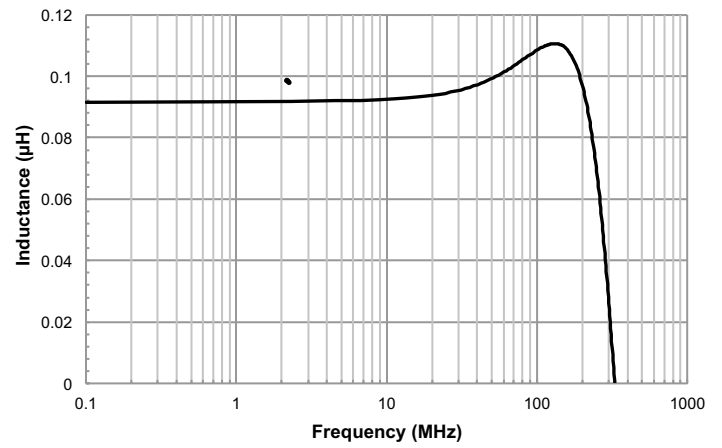


# Inductance vs. Frequency

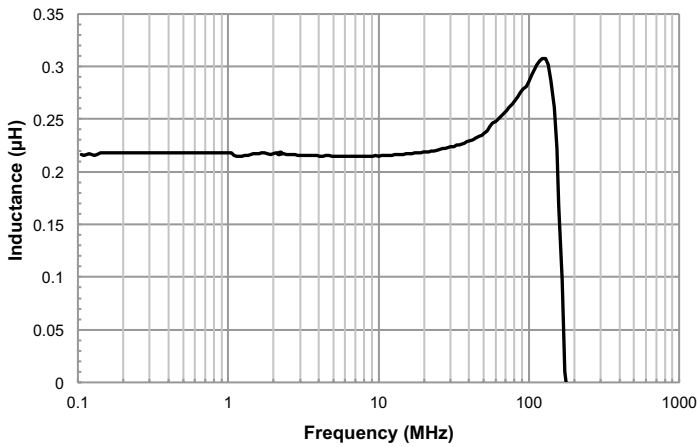
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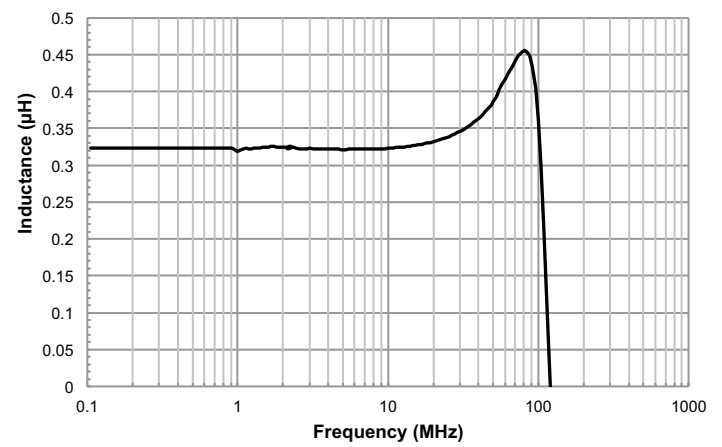
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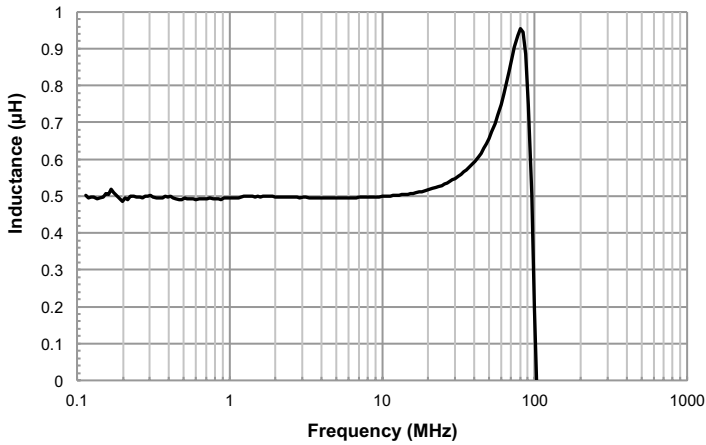
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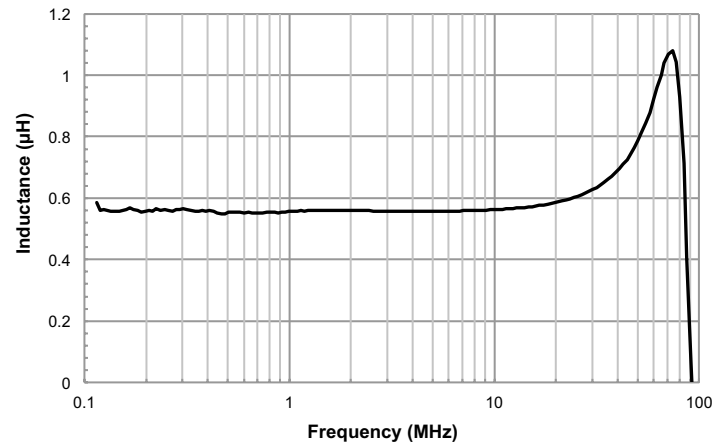
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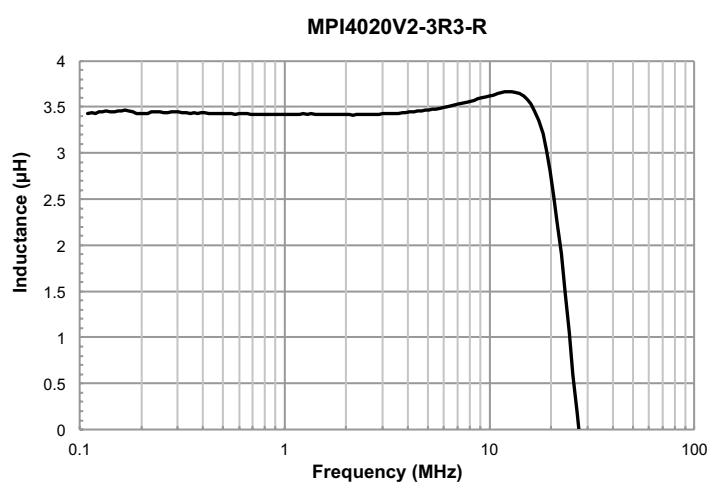
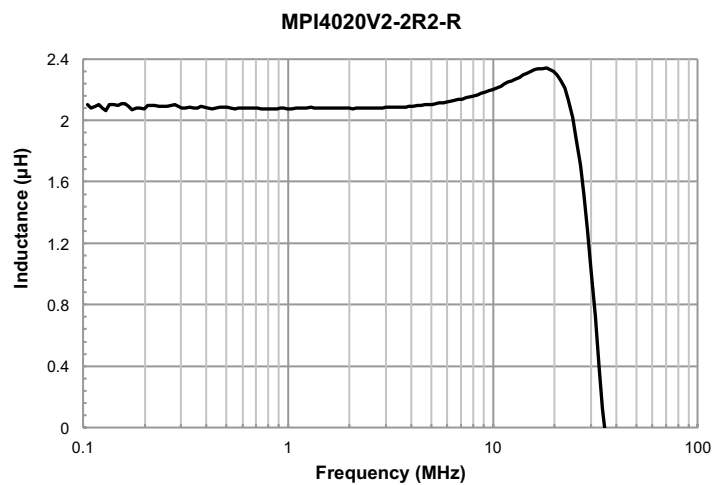
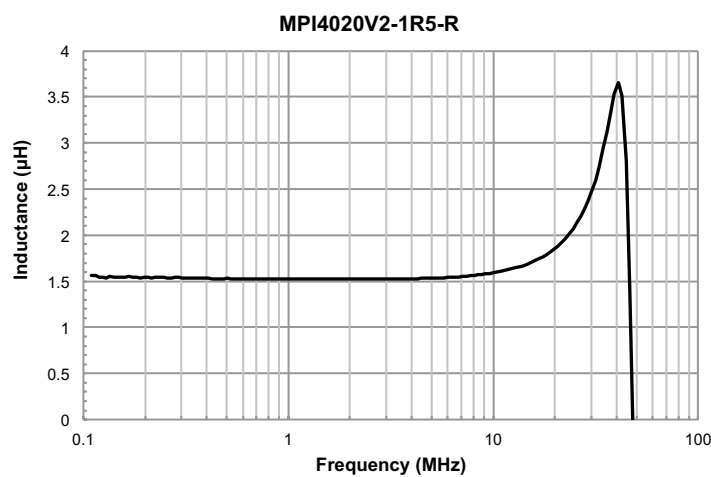
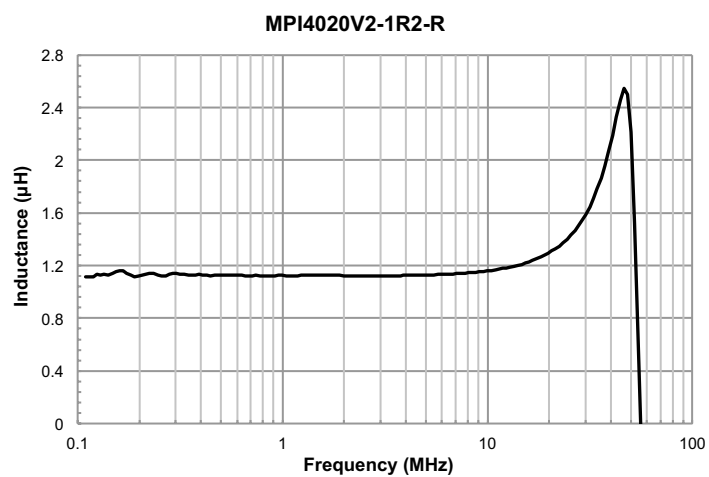
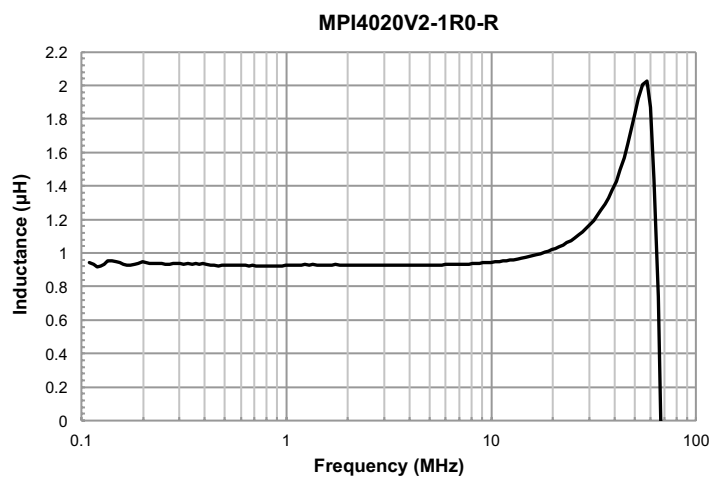
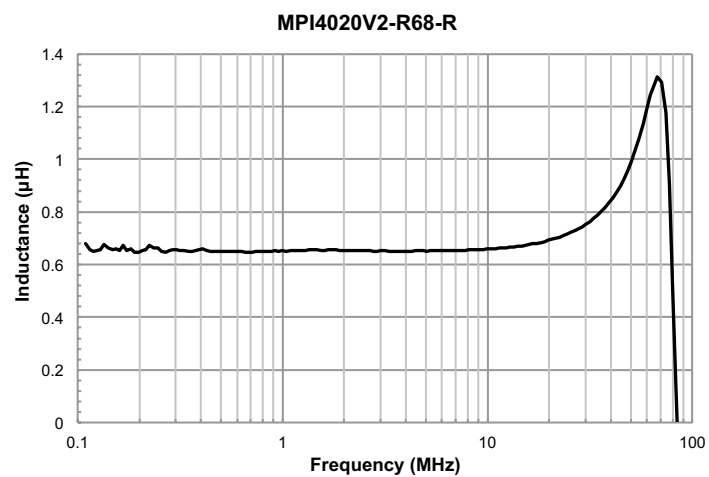
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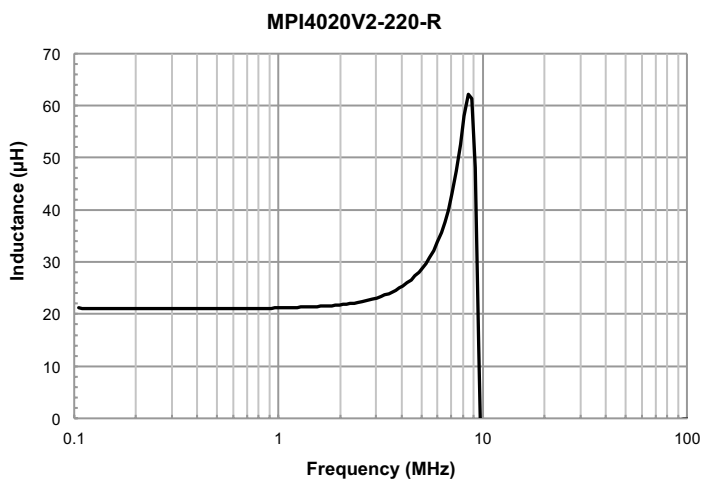
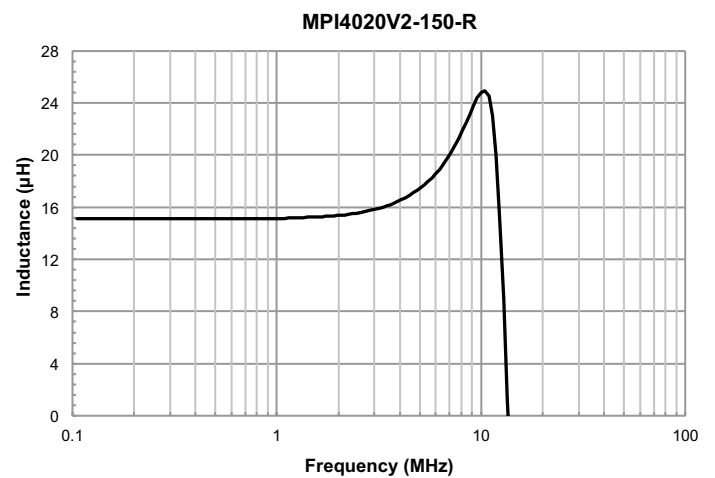
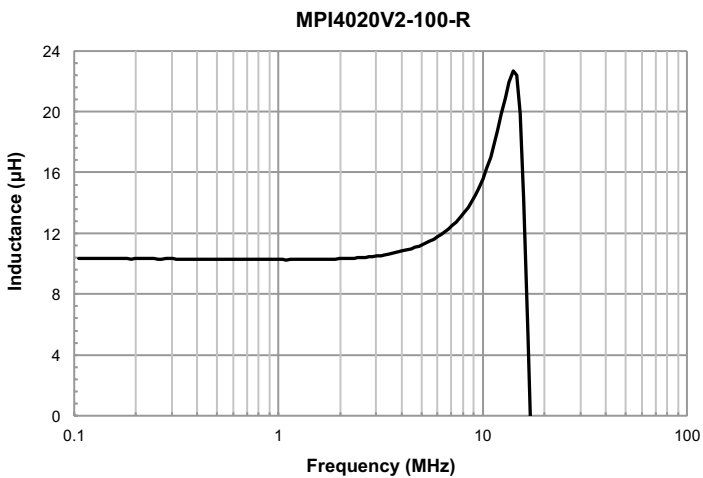
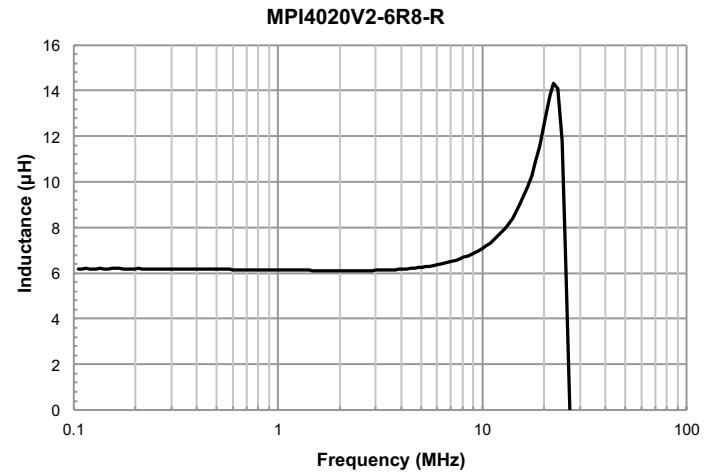
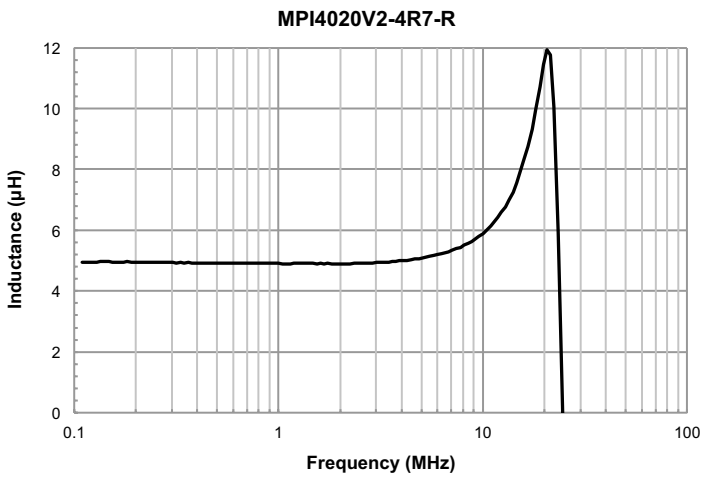
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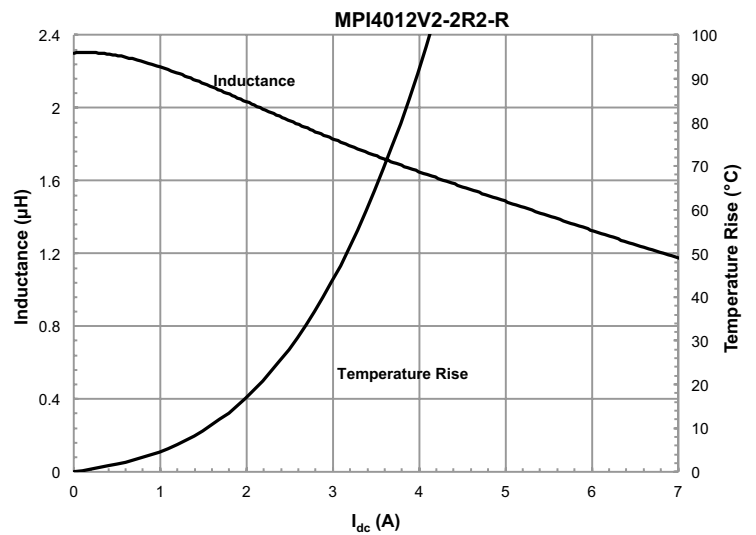
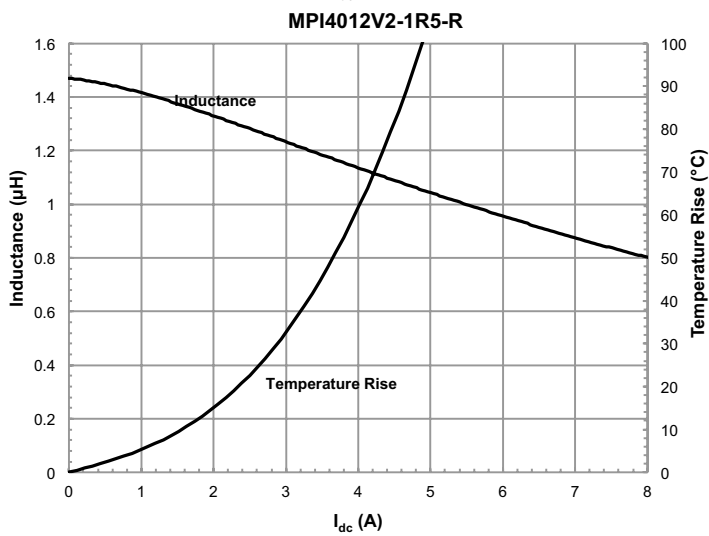
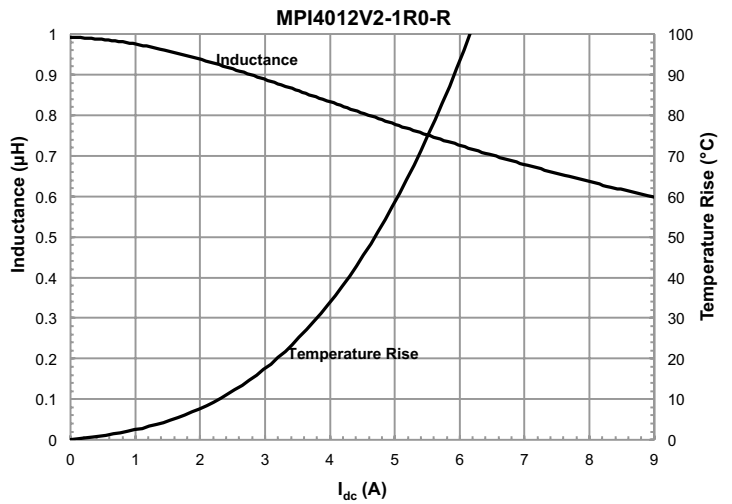
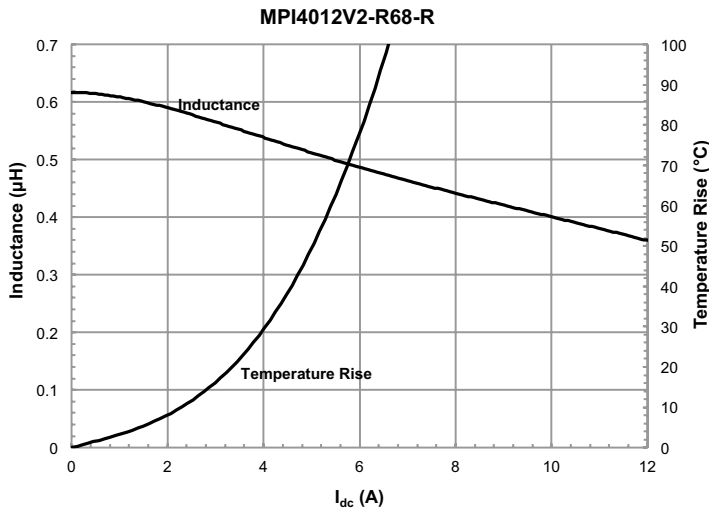
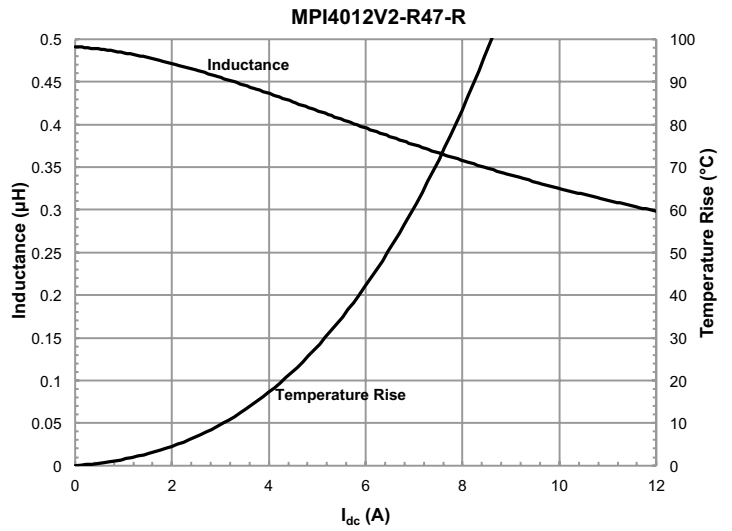
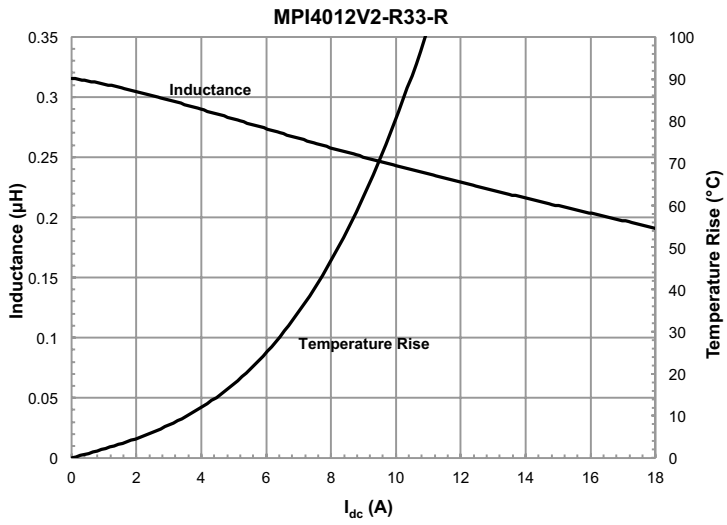
## Inductance vs. Frequency



# Inductance vs. Frequency

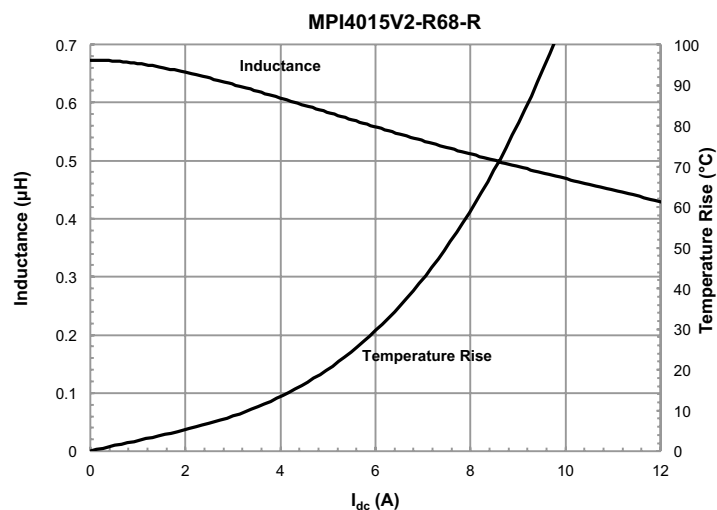
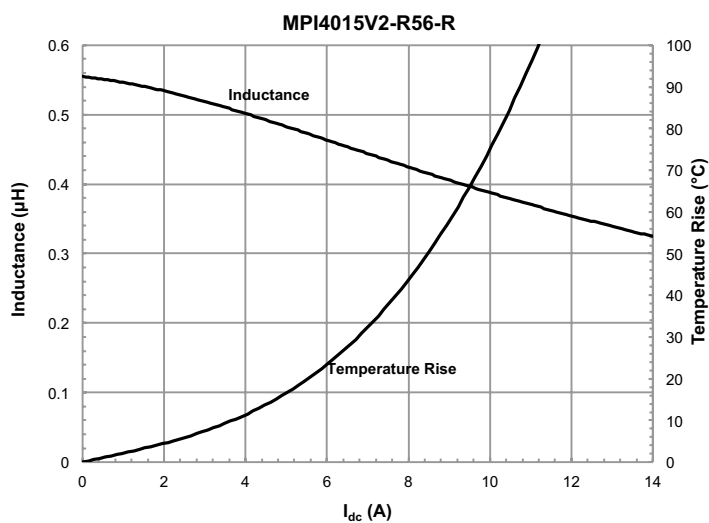
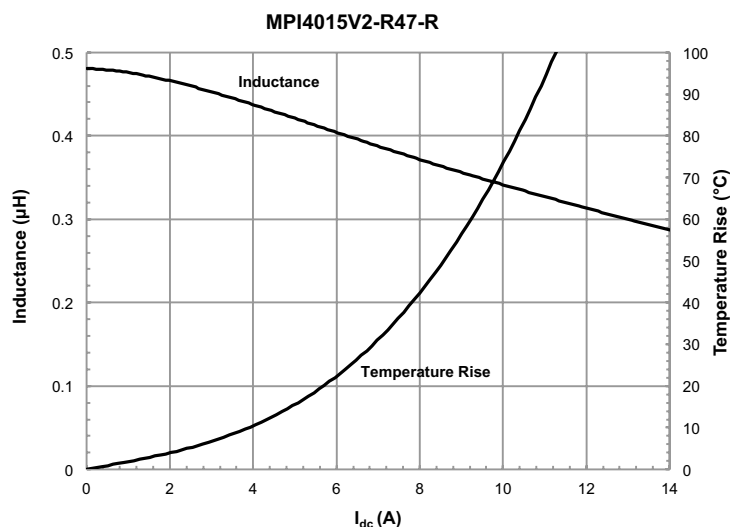
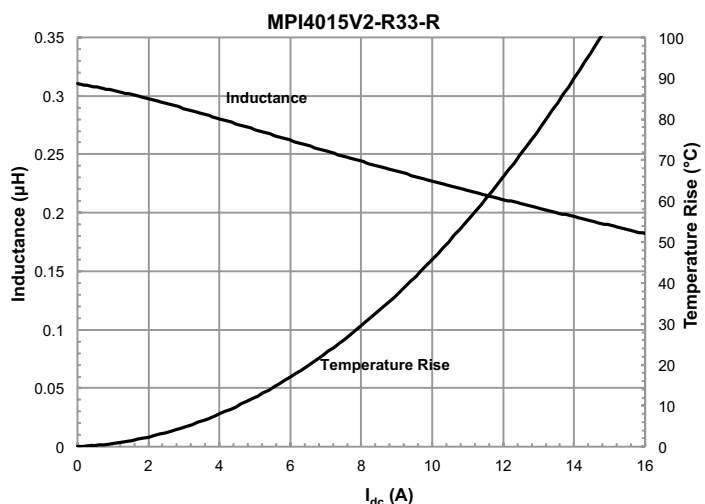
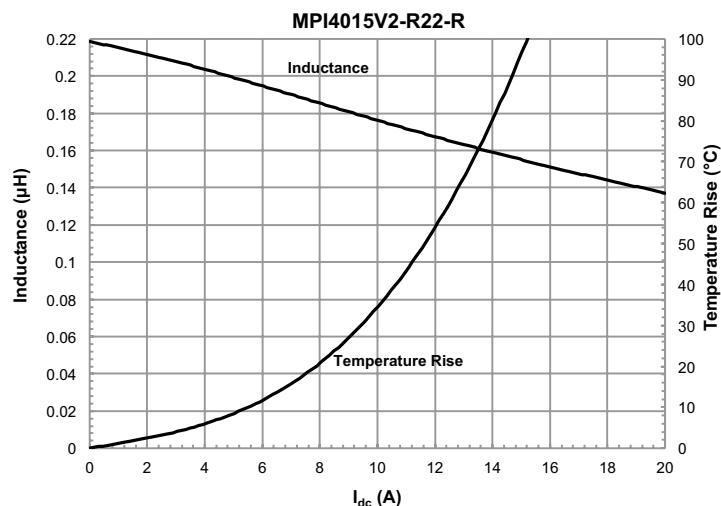
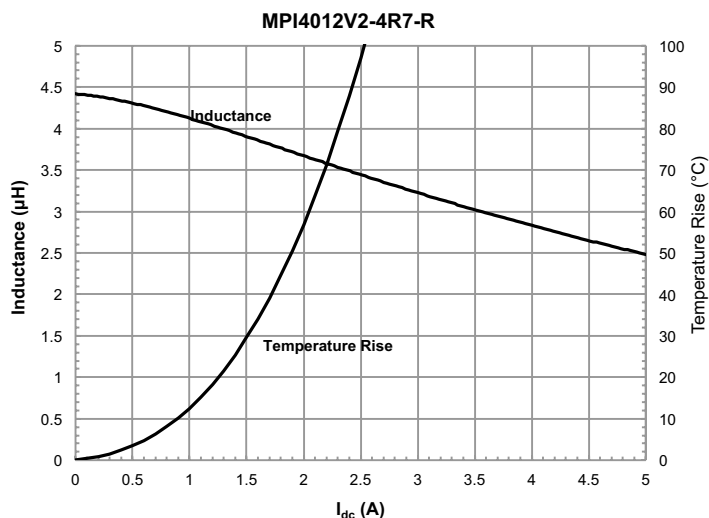


Inductance and temperature rise vs. Current

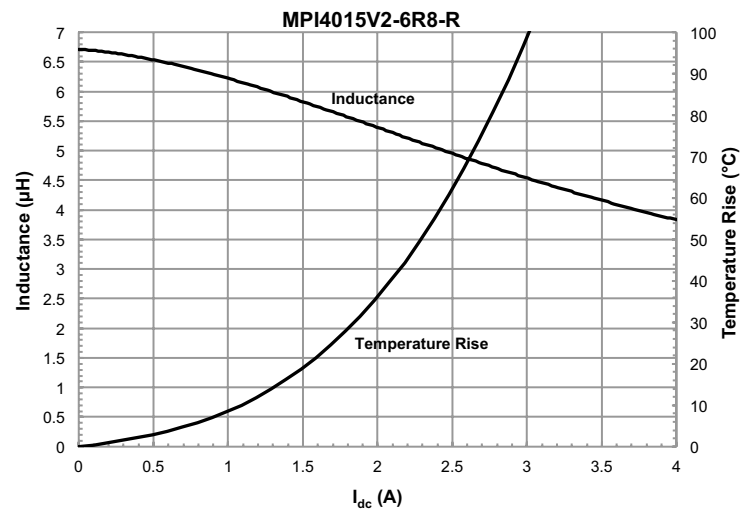
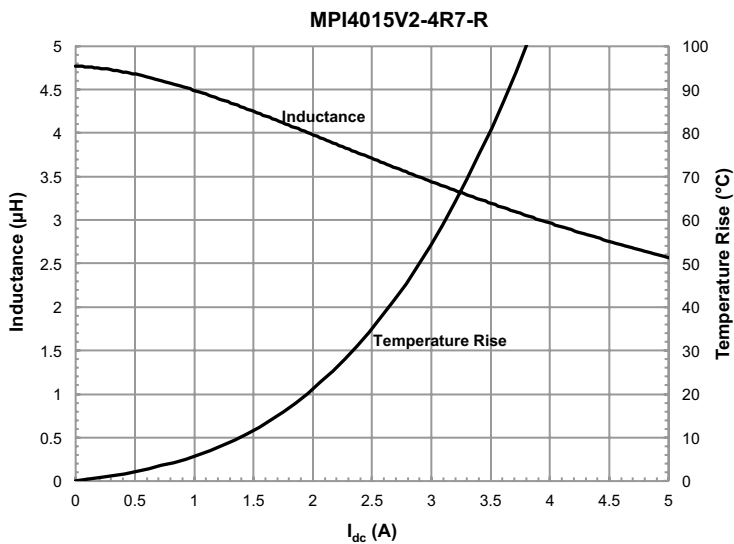
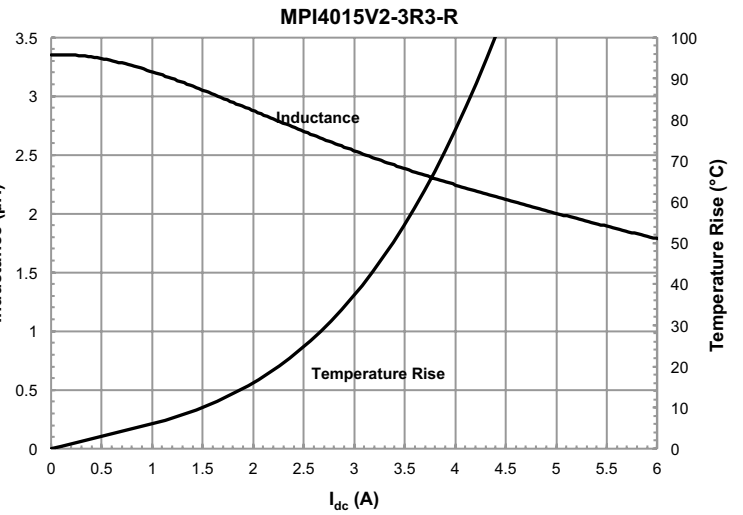
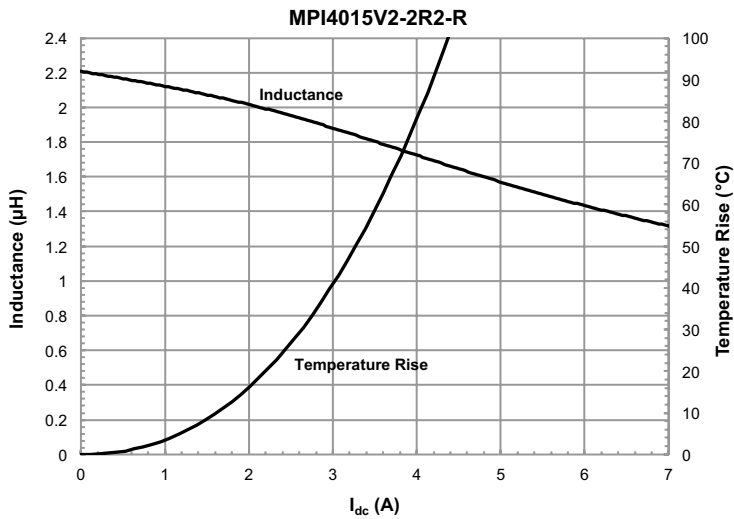
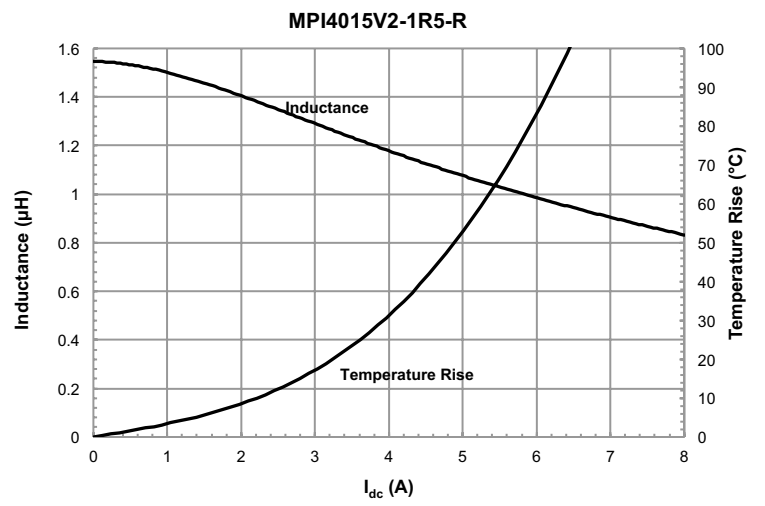
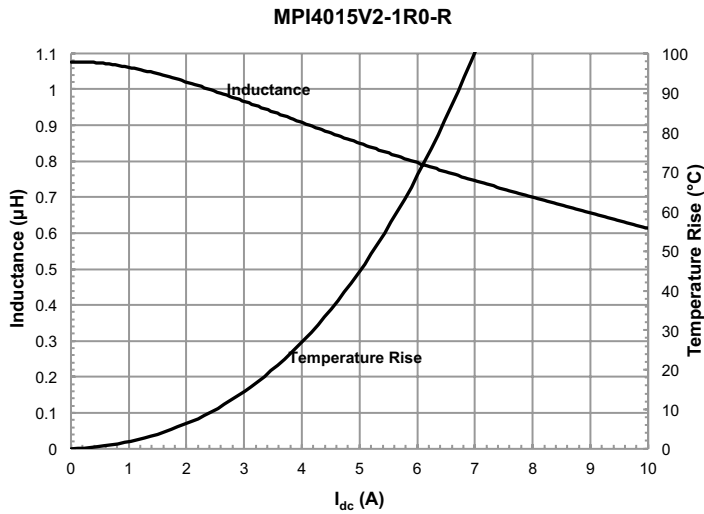




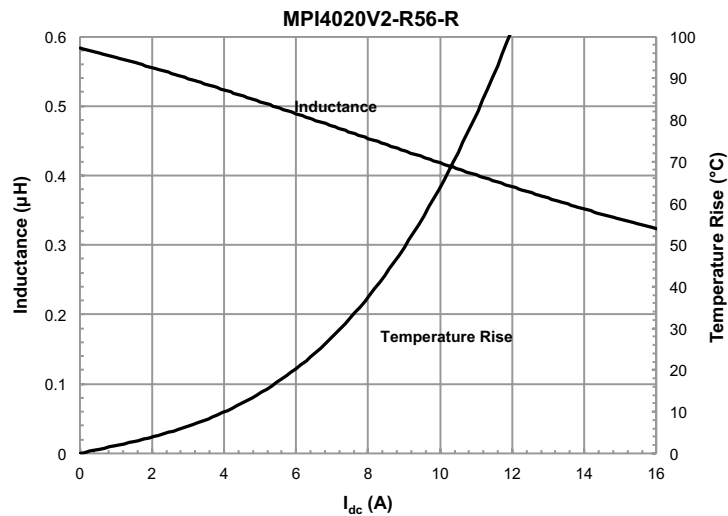
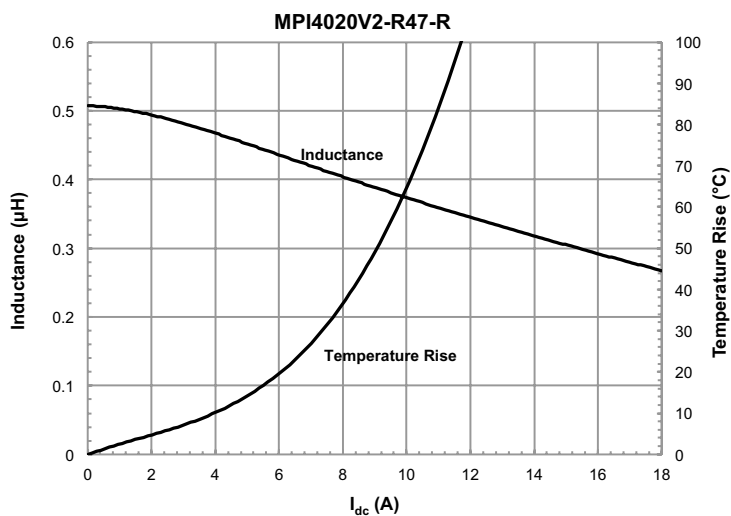
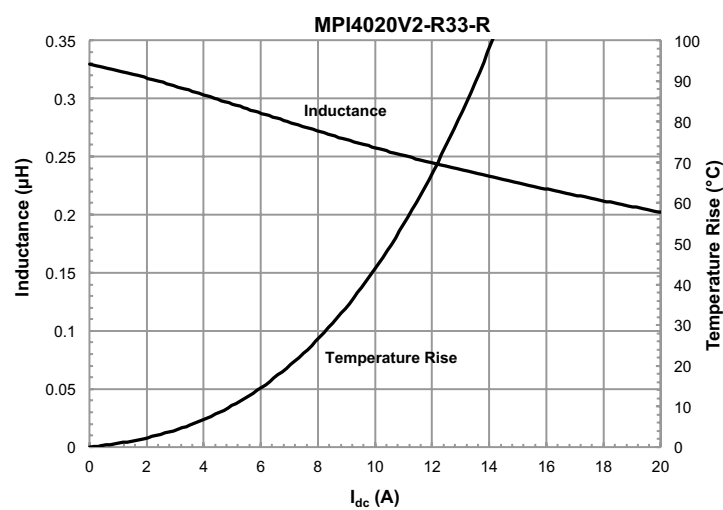
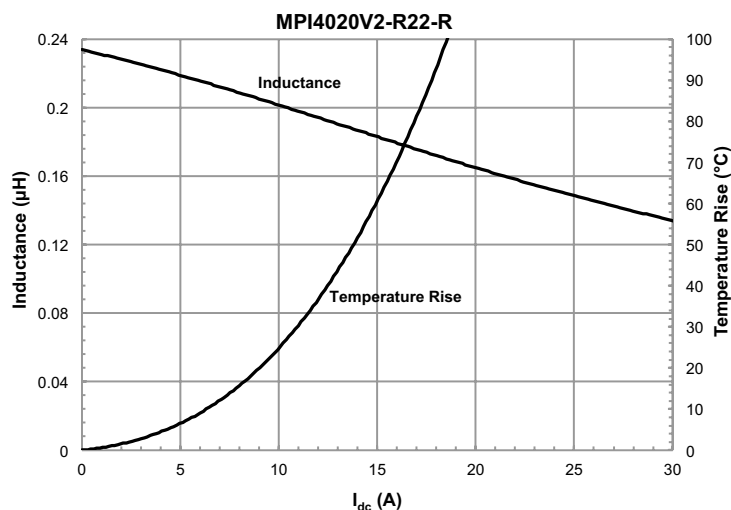
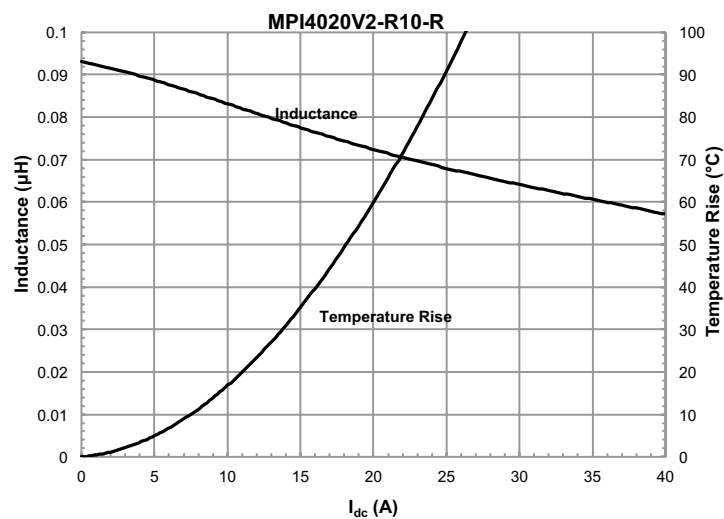
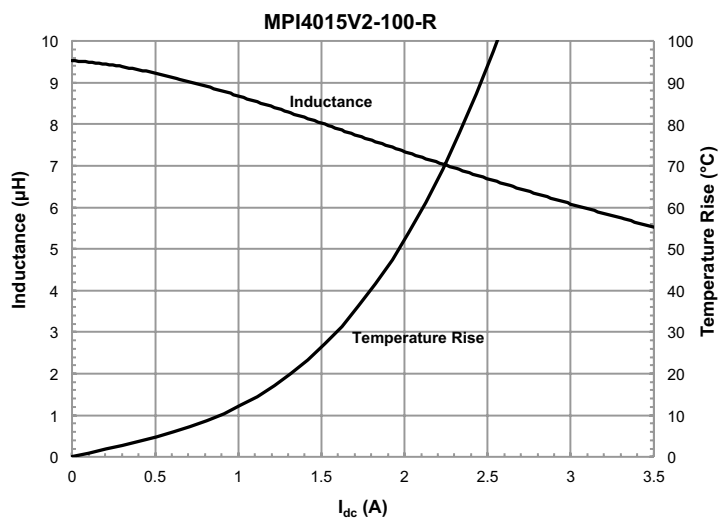
Inductance and temperature rise vs. Current



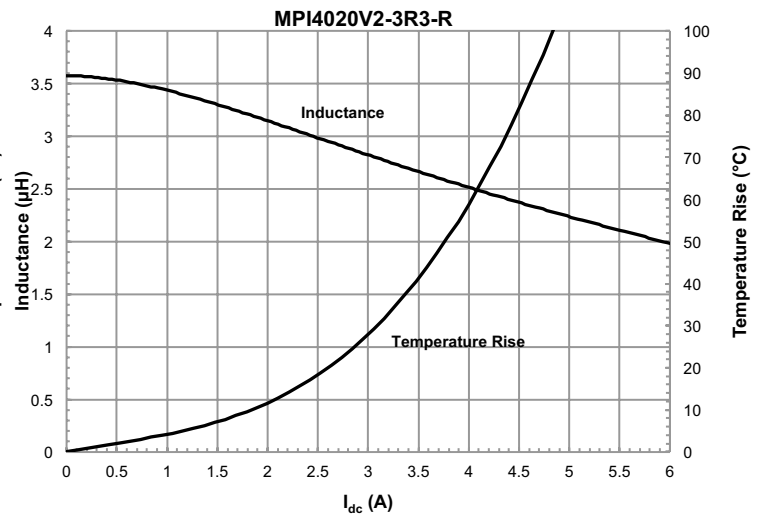
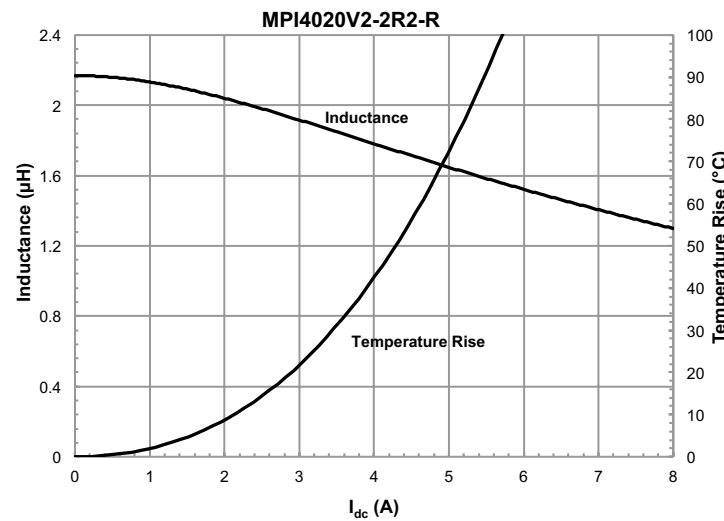
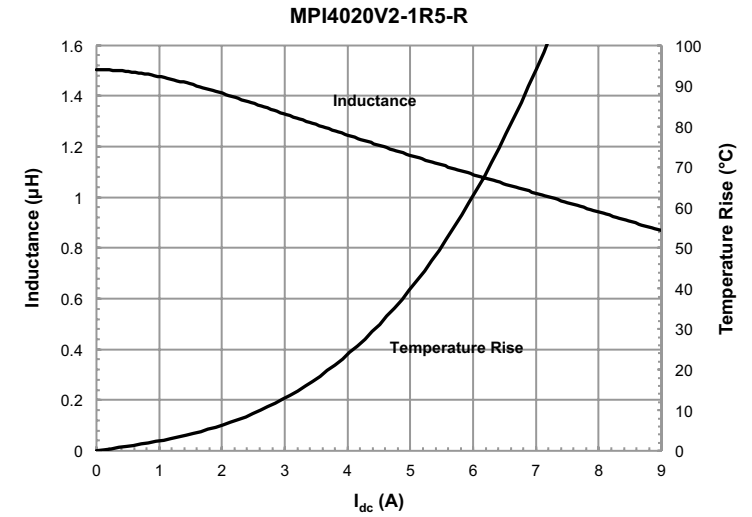
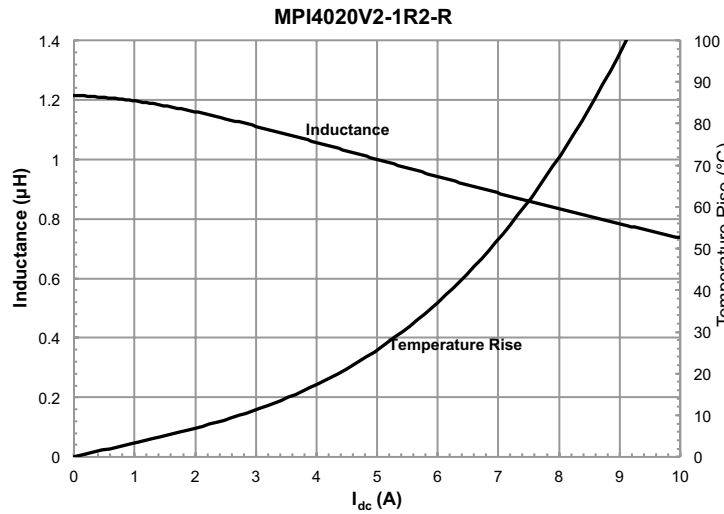
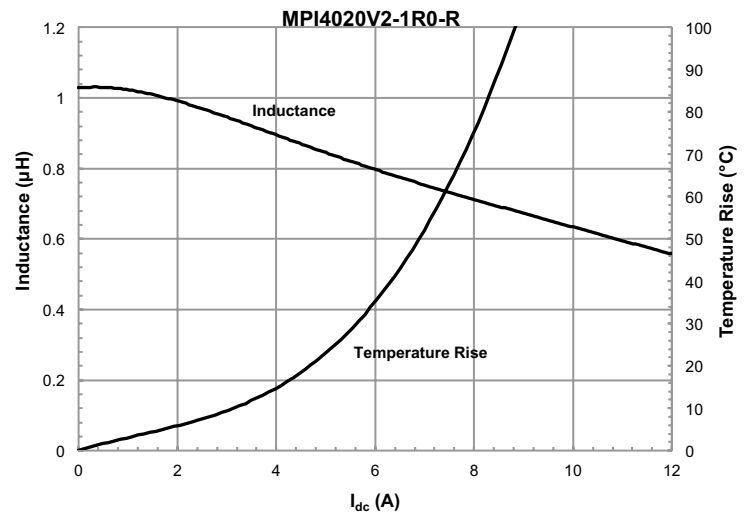
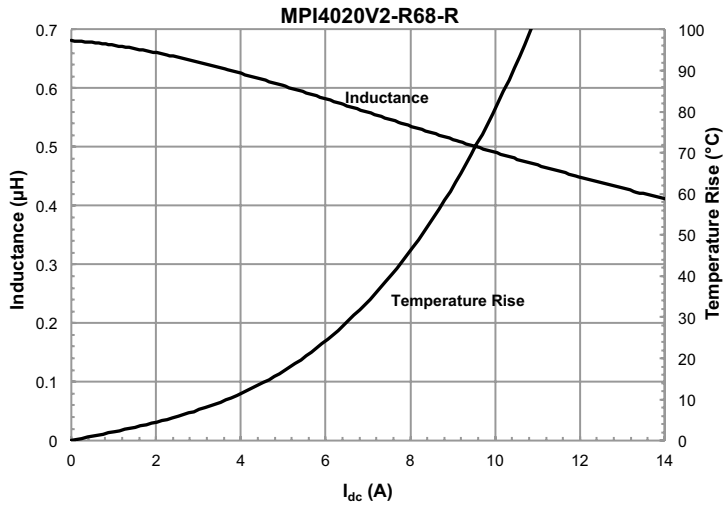
Inductance and temperature rise vs. Current



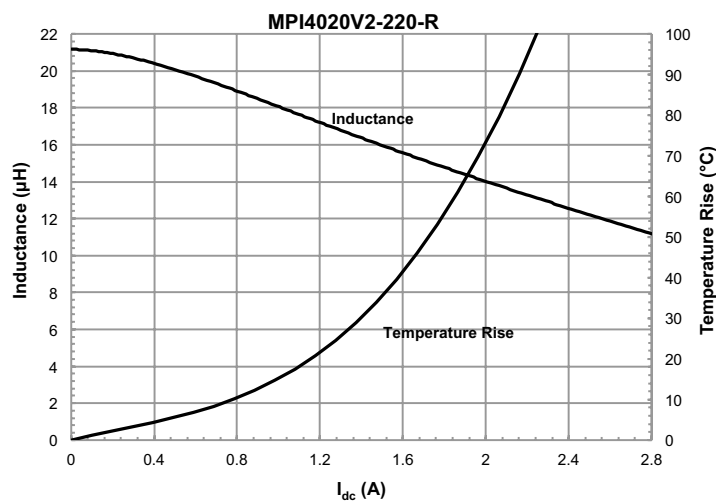
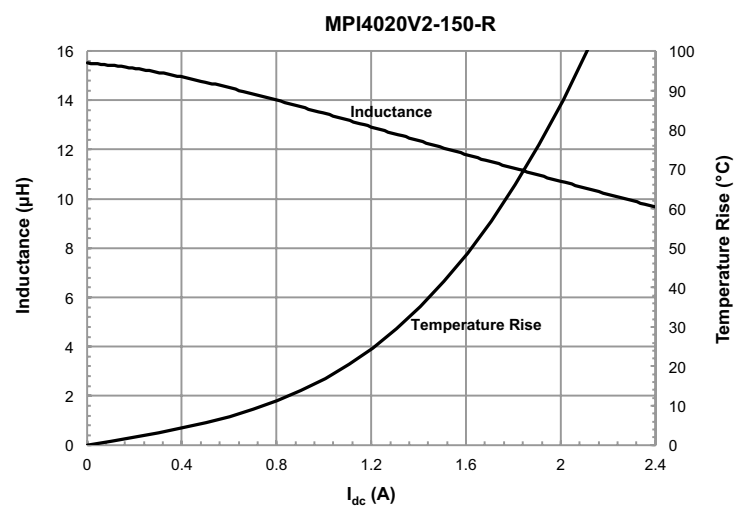
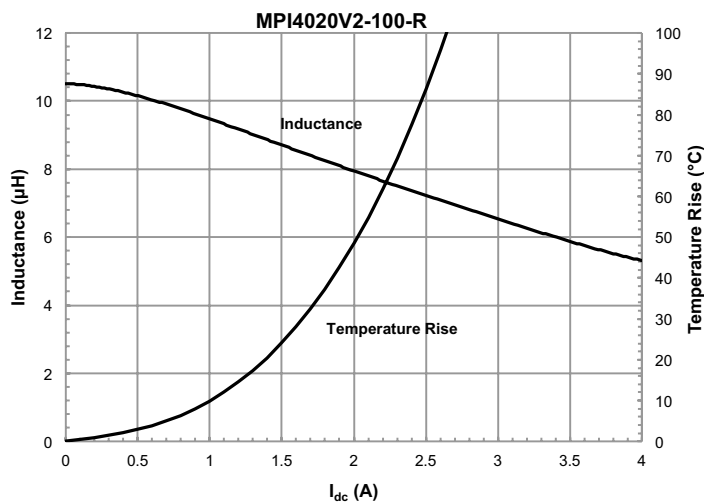
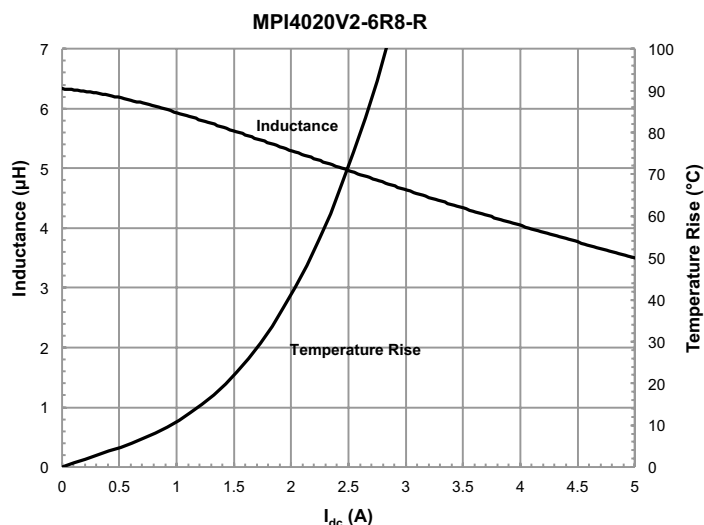
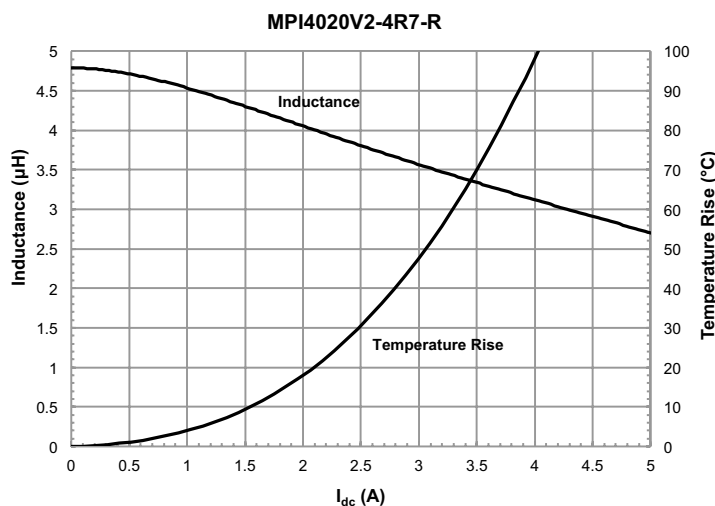
Inductance and temperature rise vs. Current



Inductance and temperature rise vs. Current



Inductance and temperature rise vs. Current



## Solder reflow profile

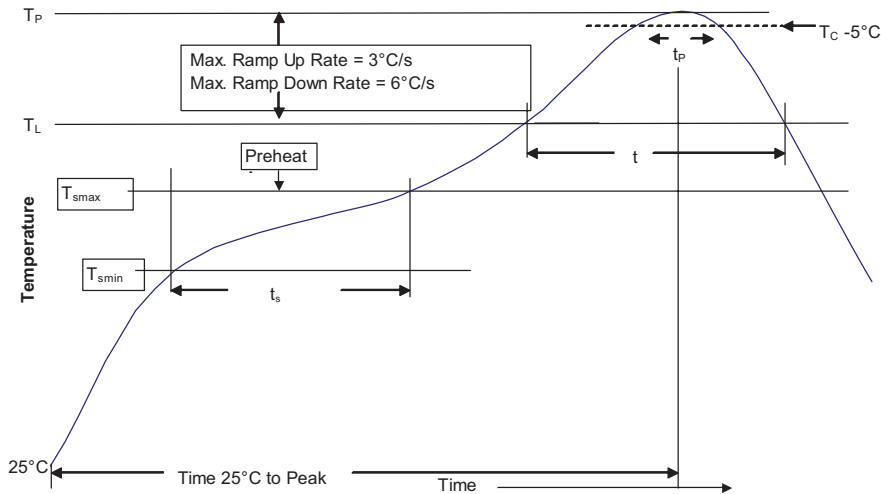


Table 1 - Standard SnPb Solder ( $T_C$ )

| Package Thickness | Volume mm <sup>3</sup> <350 | Volume mm <sup>3</sup> ≥350 |
|-------------------|-----------------------------|-----------------------------|
| <2.5mm)           | 235 °C                      | 220 °C                      |
| ≥2.5mm            | 220 °C                      | 220 °C                      |

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

| Package Thickness | Volume mm <sup>3</sup> <350 | Volume mm <sup>3</sup> 350 - 2000 | Volume mm <sup>3</sup> >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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Publication 10651 BU-MC17023  
April 2017

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