COILTRONICS®

# High Frequency, High Current Miniature Power Inductors

## MPI4040 Series


### Description

- Halogen free
- RoHS compliant
- 125°C maximum total temperature operation
- 4.7x4.31x1.2, 1.5, 1.85mm maximum surface mount package
- Magnetically shielded
- Handles high transient inrush current spikes
- Rugged construction
- Inductance range from 0.09µH to 22µH
- Current range from 1.0A to 32.0A
- Frequency range 20kHz to 10MHz

### Applications

- Handheld/mobile devices
- GPS/PDAs
- Battery operated devices
- Tablets/smartbooks
- LED Drivers
- Portable media players
- MP3 Players
- Notebook/netbook
- LCD Displays
- POL Converters

### 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:
  - MPI4040R1 = 5500 parts per 13" diameter reel
  - MPI4040R2 = 4500 parts per 13" diameter reel
  - MPI4040R3 = 3500 parts per 13" diameter reel

**Product Specifications**

| Part Number[5] | OCL[1] ± 15% (µH) | Part Marking Designator | $I_{rms}$[2] (Amps) | $I_{sat}$[3] (Amps) | DCR (mΩ) @ 20°C ± 15% | K-factor[4] |
|---|---|---|---|---|---|---|
| **R1 Version** | | | | | | |
| MPI4040R1-R10-R | 0.09 | A | 7.40 | 32† | 8.5 | 2372 |
| MPI4040R1-R15-R | 0.15 | B | 6.50 | 26† | 11.0 | 1694 |
| MPI4040R1-R22-R | 0.22 | C | 5.10 | 21 | 18.0 | 1318 |
| MPI4040R1-R33-R | 0.33 | D | 4.08 | 17 | 28.0 | 1130 |
| MPI4040R1-R47-R | 0.47 | E | 3.75 | 11 | 35.0 | 912 |
| MPI4040R1-R68-R | 0.68 | F | 3.10 | 9.0 | 51.0 | 790 |
| **R2 Version** | | | | | | |
| MPI4040R2-R47-R | 0.47 | G | 4.30 | 13 | 28.0 | 912 |
| MPI4040R2-1R0-R | 1.0 | H | 3.80 | 2.25 | 38.0 | 760 |
| MPI4040R2-1R5-R | 1.5 | I | 2.75 | 1.80 | 60.0 | 600 |
| MPI4040R2-2R2-R | 2.2 | J | 2.30 | 1.50 | 82.0 | 506 |
| MPI4040R2-3R3-R | 3.3 | K | 1.96 | 1.25 | 113 | 430 |
| MPI4040R2-4R7-R | 4.7 | L | 1.60 | 1.10 | 175 | 368 |
| **R3 Version** | | | | | | |
| MPI4040R3-R22-R | 0.22 | W | 8.00 | 20 | 8.0 | 1318 |
| MPI4040R3-R47-R | 0.47 | U | 5.80 | 17 | 12.0 | 912 |
| MPI4040R3-1R2-R | 1.2 | V | 4.00 | 9.40 | 32.0 | 700 |
| MPI4040R3-1R5-R | 1.5 | M | 3.80 | 8.20 | 36.0 | 600 |
| MPI4040R3-2R2-R | 2.2 | N | 3.40 | 7.90 | 48.0 | 506 |
| MPI4040R3-3R3-R | 3.3 | O | 3.00 | 6.60 | 60.0 | 430 |
| MPI4040R3-4R7-R | 4.7 | P | 2.30 | 4.80 | 92.0 | 350 |
| MPI4040R3-6R8-R | 6.8 | Q | 2.00 | 4.50 | 140 | 290 |
| MPI4040R3-100-R | 10.0 | R | 1.50 | 3.80 | 213 | 240 |
| MPI4040R3-150-R | 15.0 | S | 1.30 | 3.00 | 285 | 200 |
| MPI4040R3-220-R | 22.0 | T | 1.10 | 2.20 | 408 | 160 |

1 Open Circuit Inductance (OCL) Test Parameters: 100kHz, 0.10$V_{rms}$, 0.0Adc

2 $I_{rms}$: 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 use application.

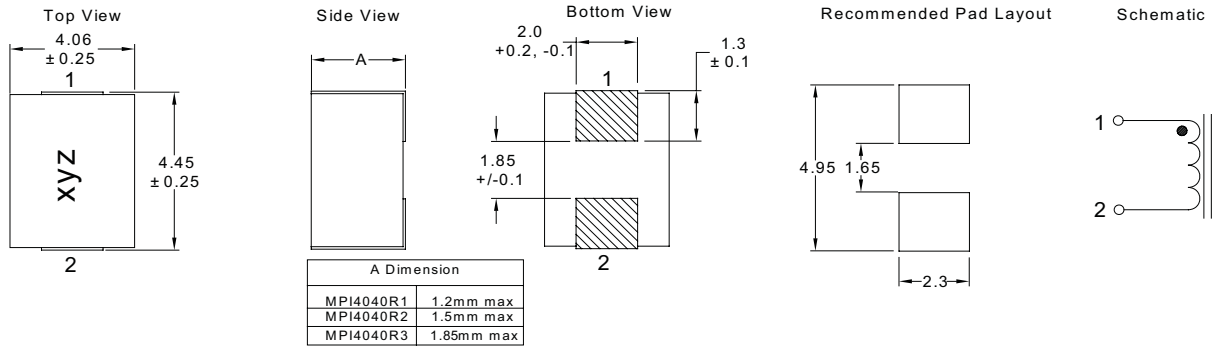
3 $I_{sat}$: Peak current for approximately 30% rolloff at +25°C.

4 K-factor: Used to determine $B_{p-p}$ for core loss (see graph). $B_{p-p} = K * L * \Delta I$. $B_{p-p}$ : (Gauss), K: (K-factor from table), L: (inductance in µH), ΔI (peak-to-peak ripple current in amps).

5 Part Number Definition: MPI4040RX-xxx-R
- MPI4040Rx = Product code and size
- xxx= Inductance value in µH, R = decimal point. If no "R" is present, then 3rd digit equals number of zeros.
- "-R" suffix = RoHS compliant

† Transient pulse not to exceed 1 millisecond.

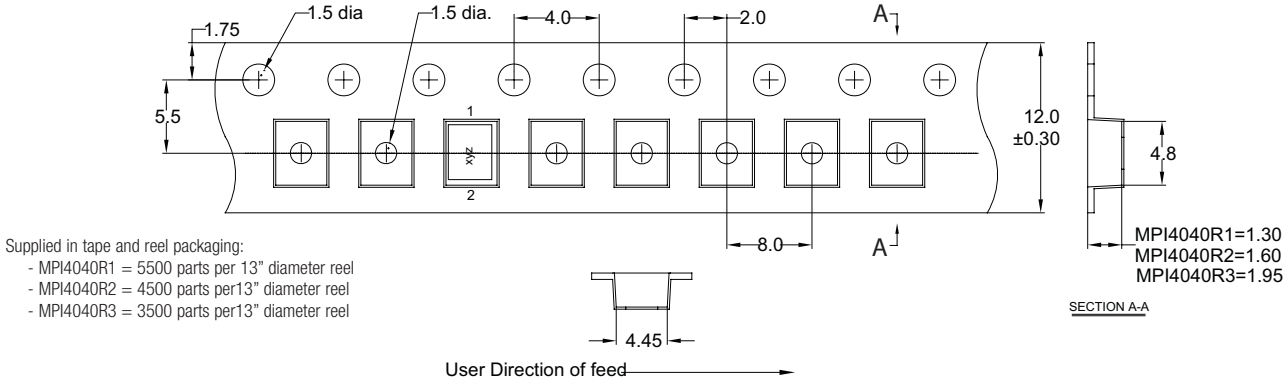
## Dimensions - mm




| A Dimension | |
|---|---|
| MPI4040R1 | 1.2mm max |
| MPI4040R2 | 1.5mm max |
| MPI4040R3 | 1.85mm max |

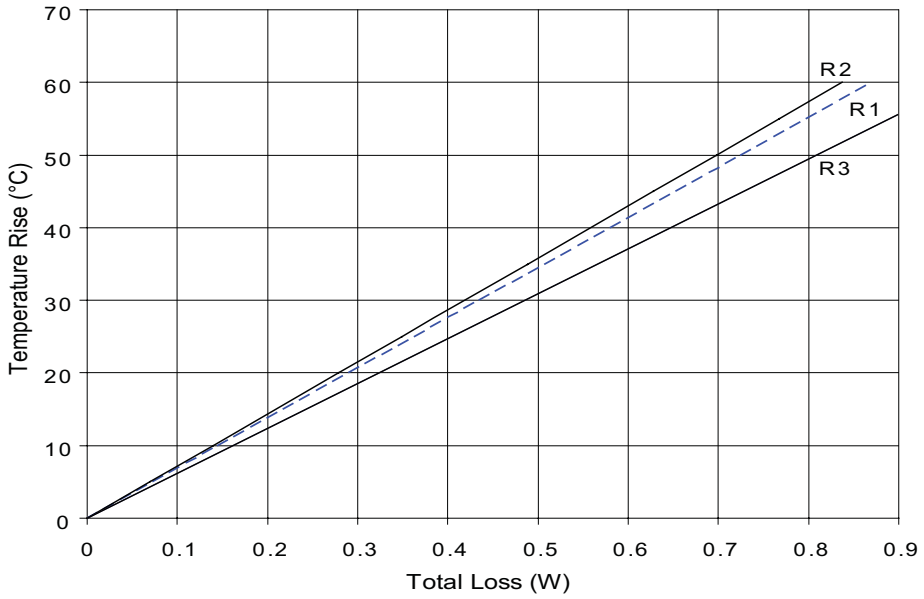
Part marking: x= Inductance and size per part marking designator table, y= Year of manufacture (i.e. A=2009, B=2010 etc.), z= Revision Level
Soldering surfaces to be coplanar within 0.1016 millimeters

## Packaging Information - mm

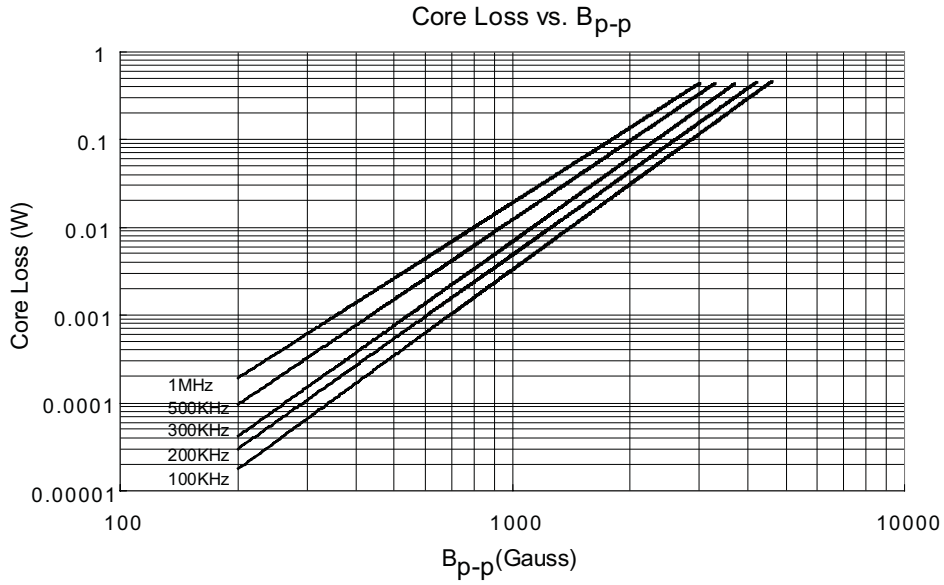



Supplied in tape and reel packaging:
- MPI4040R1 = 5500 parts per 13" diameter reel
- MPI4040R2 = 4500 parts per13" diameter reel
- MPI4040R3 = 3500 parts per13" diameter reel

## Temperature Rise vs.Total Loss

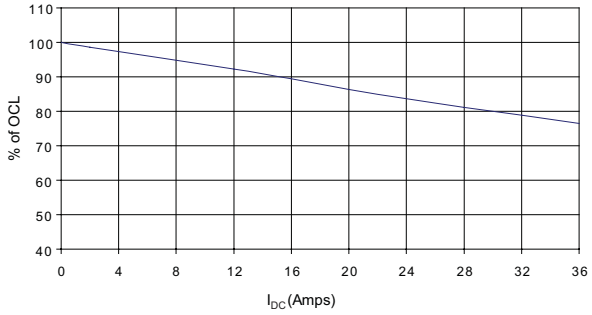



## Core Loss

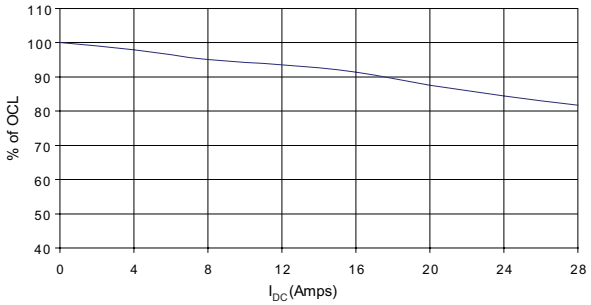


## Inductance Characteristics - % of OCL vs. $I_{DC}$

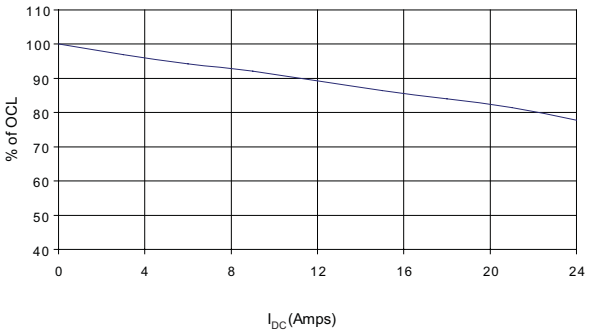
MPI4040R1-R10-R



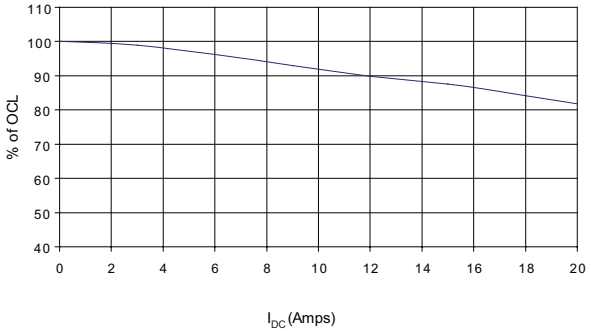

MPI4040R1-R15-R



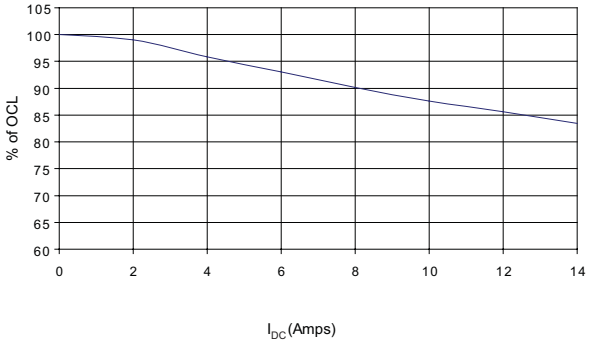

MPI4040R1-R22-R



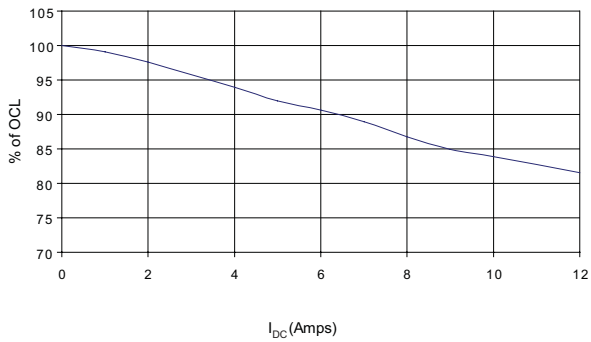

MPI4040R1-R33-R




MPI4040R1-R47-R

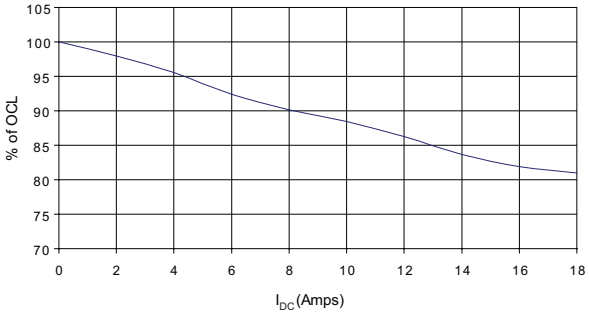



MPI4040R1-R68-R

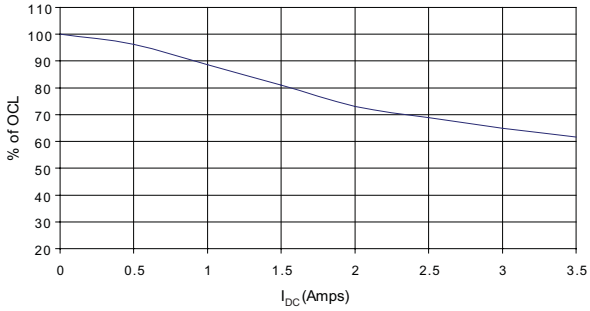


## Inductance Characteristics - % of OCL vs. $I_{DC}$

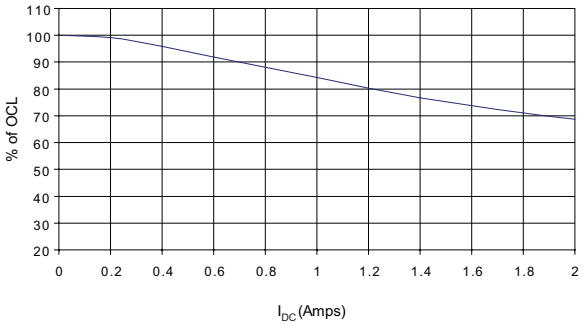
MPI4040R2-R47-R



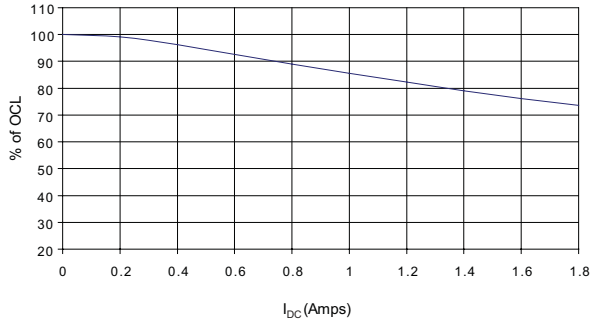

MPI4040R2-1R0-R



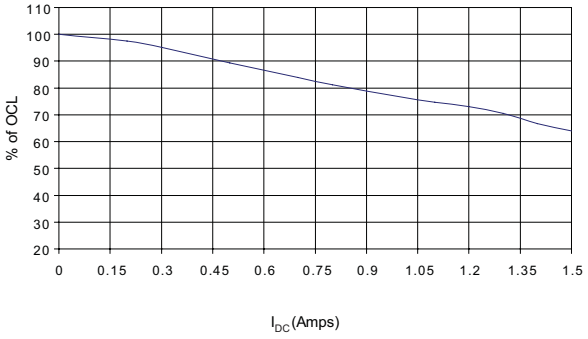

MPI4040R2-1R5-R



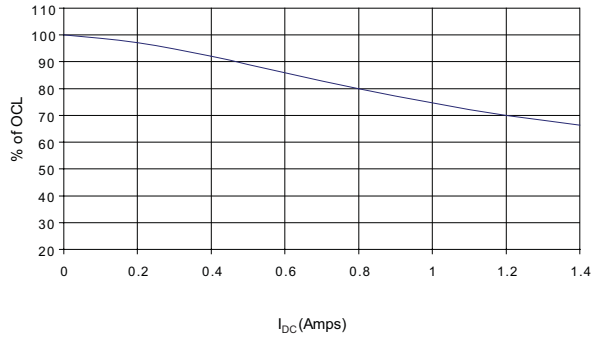

MPI4040R2-2R2-R




MPI4040R2-3R3-R

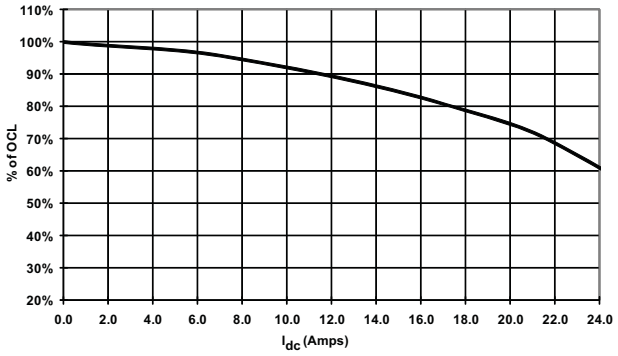



MPI4040R2-4R7-R

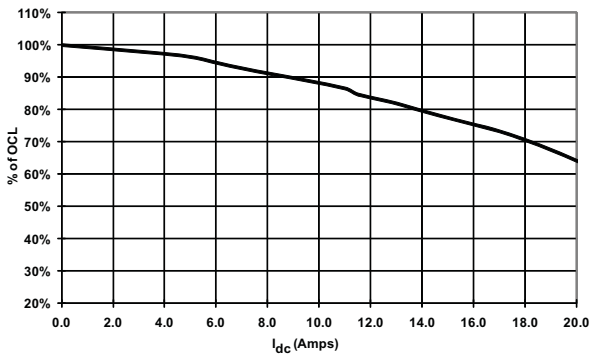


## Inductance Characteristics - % of OCL vs. $I_{DC}$

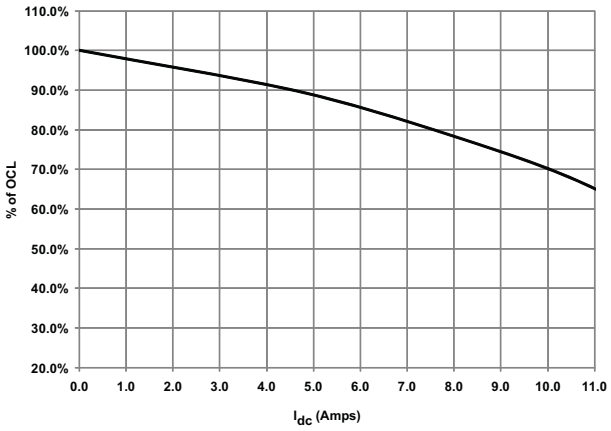
MPI4040R3-R22-R



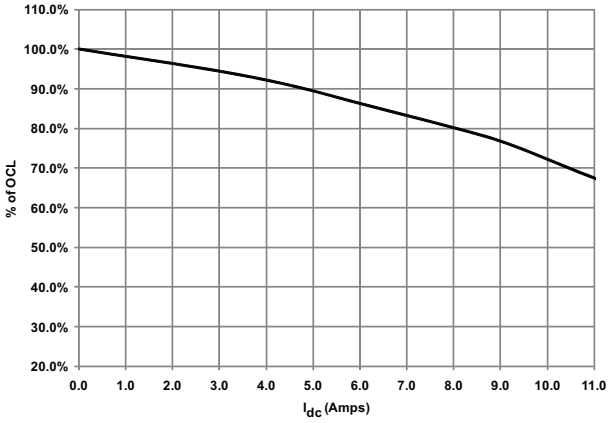

MPI4040R3-R47-R



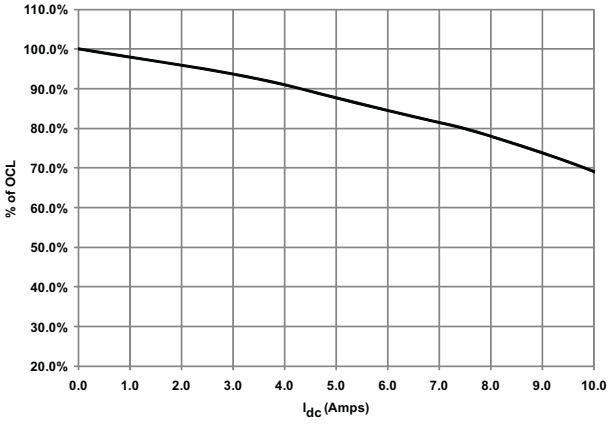

MPI4040R3-1R2-R



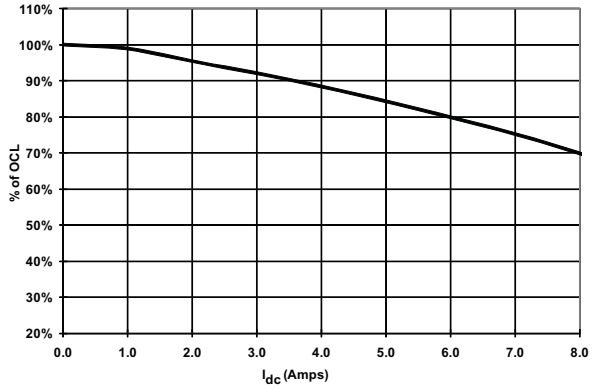

MPI4040R3-1R5-R




MPI4040R3-2R2-R

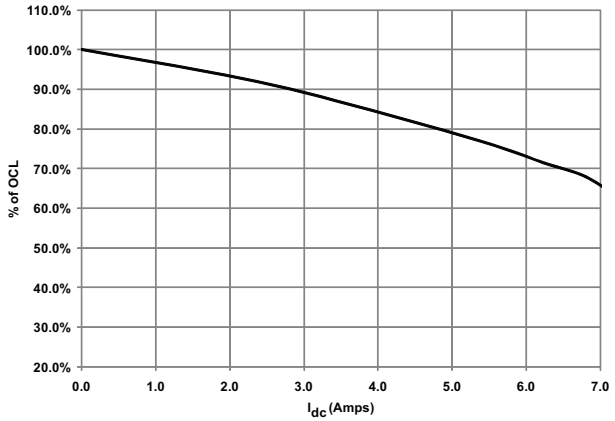



MPI4040R3-3R3-R

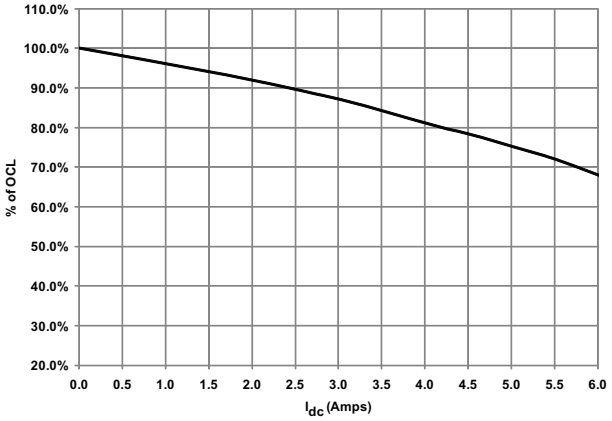


## Inductance Characteristics - % of OCL vs. $I_{DC}$

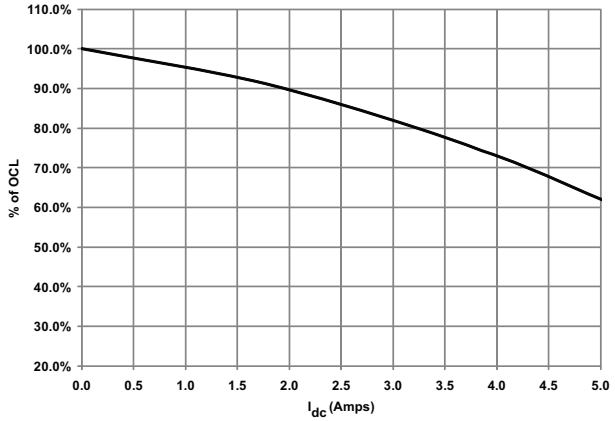
MPI4040R3-4R7-R



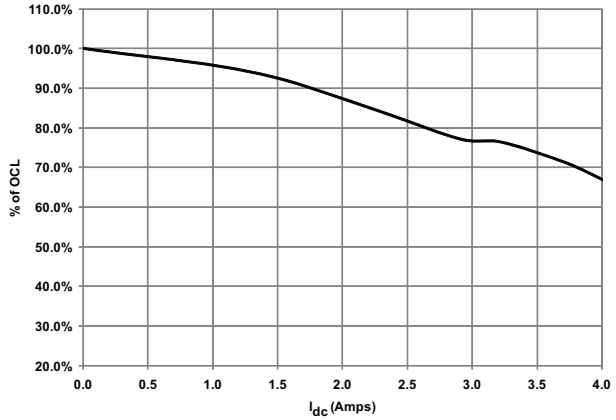

MPI4040R3-6R8-R



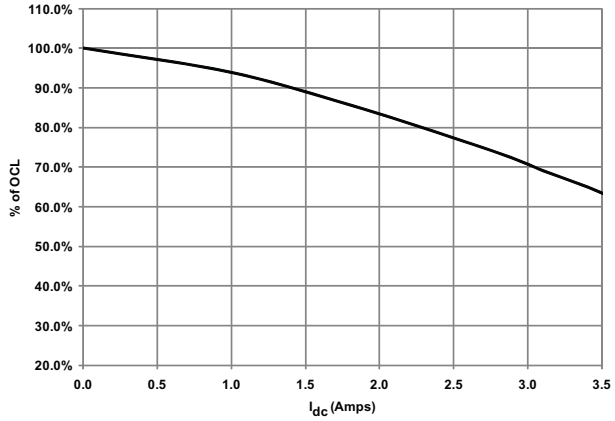

MPI4040R3-100-R



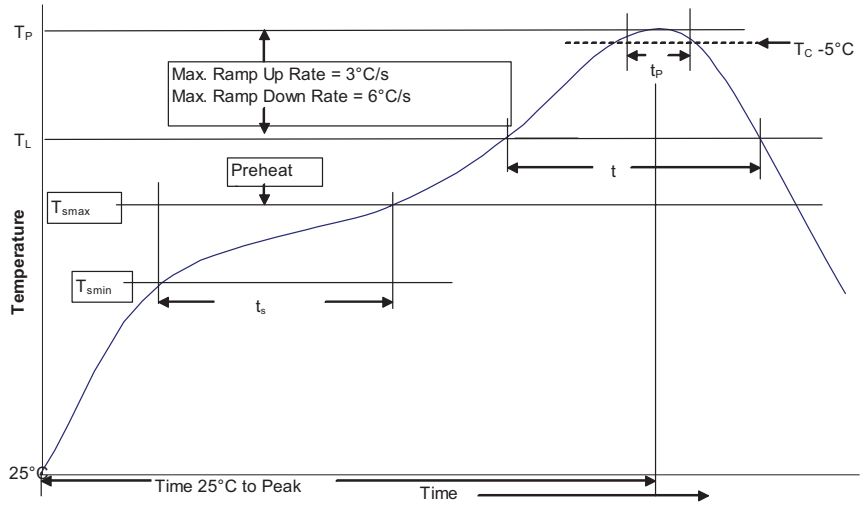

MPI4040R3-150-R




MPI4040R3-220-R



## 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-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 ($T_L$)<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.

**North America**
Cooper Electronic Technologies
1225 Broken Sound Parkway NW
Suite F
Boca Raton, FL 33487-3533
Tel: 1-561-998-4100
Fax: 1-561-241-6640
Toll Free: 1-888-414-2645

Cooper Bussmann
P.O. Box 14460
St. Louis, MO 63178-4460
Tel: 1-636-394-2877
Fax: 1-636-527-1607

**Europe**
Cooper Electronic Technologies
Cooper (UK) Limited
Burton-on-the-Wolds
Leicestershire • LE12 5TH UK
Tel: +44 (0) 1509 882 737
Fax: +44 (0) 1509 882 786

Cooper Electronic Technologies
Avda. Santa Eulalia, 290
08223
Terrassa, (Barcelona), Spain
Tel: +34 937 362 812
+34 937 362 813
Fax: +34 937 362 719

**Asia Pacific**
Cooper Electronic Technologies
1 Jalan Kilang Timor
#06-01 Pacific Tech Centre
Singapore 159303
Tel: +65 278 6151
Fax: +65 270 4160