

# MPIA4040

Automotive Grade

High Current, High Frequency, Miniature Power Inductors



**Product description:**

- AEC-Q200 Grade 3 qualified
- Handles high transient inrush current spikes
- Magnetically shielded
- Frequency range: 10kHz to 10MHz
- Inductance range from 0.02µH to 22µH
- Current range from 1.1A to 3.2A
- 4.7 x 4.31 footprint surface mount package in 1.2, 1.5, 1.75 or 2.0mm heights
- Rugged construction
- Halogen free, lead free, RoHS compliant

**Applications:**

- Body electronics
    - Central body control module
    - Vehicle access control system
    - Headlamps, tail lamps and interior lighting
    - Door control
  - Advanced driver assistance systems
    - 77GHz radar systems
    - Automatic parking control
    - Collision avoidance system
  - Basic and smart surround, and rear and front view camera
    - Adaptive Cruise Control (ACC)
    - Car black box system
  - Infotainment and cluster electronics
    - Active noise cancellation (ANC)
    - Audio subsystem: head unit and trunk amp
    - Digital instrument cluster
  - In-vehicle infotainment (IVI) and navigation
    - Port power/USB hub for front and rear passengers
  - Chassis and safety electronics
    - Airbag control unit
- 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-020D compliant

Discontinued, Effective September 15, 2016  
inventory is depleted. Recommended replacement MPIA40-V1



Product specifications

Part Number <sup>5</sup>	OCL <sup>1</sup> ± 20% (µH)	Part Marking Designator	I <sub>rms</sub> <sup>2</sup> (Amps)	I <sub>sat</sub> <sup>3</sup> @ 25°C (Amps)	DCR (mΩ) ± 20% @ 20°C	K-factor <sup>4</sup>
<b>R1 -- 1.2mm Height</b>						
MPIA4040R1-R10-R	0.09	A	8.00	32.0†	8.50	1401
MPIA4040R1-R15-R	0.15	B	7.00	26.0†	11.0	989
MPIA4040R1-R22-R	0.23	C	5.50	21.0	18.0	814
MPIA4040R1-R33-R	0.33	D	4.40	17.0	28.0	659
MPIA4040R1-R47-R	0.47	E	5.20	11.5	20.0	1295
MPIA4040R1-R68-R	0.68	F	3.30	9.00	51.0	461
MPIA4040R1-1R0-R	1.0	G	3.70	7.70	40.0	990
MPIA4040R1-1R5-R	1.5	H	3.00	6.50	60.0	732
MPIA4040R1-2R2-R	2.2	I	2.60	5.90	80.0	623
MPIA4040R1-3R3-R	3.3	J	2.20	5.10	115	481
MPIA4040R1-4R7-R	4.7	K	1.80	3.80	180	411
MPIA4040R1-6R8-R <sup>††</sup>	6.8	L	1.50	3.20	250	344
MPIA4040R1-100-R <sup>††</sup>	10.0	M	1.20	2.80	370	276
<b>R2 -- 1.5mm Height</b>						
MPIA4040R2-R47-R	0.47	A	6.40	12.2	13.0	1403
MPIA4040R2-1R0-R	1.0	B	4.60	8.50	25.0	935
MPIA4040R2-1R5-R	1.5	C	3.80	7.60	37.0	701
MPIA4040R2-2R2-R	2.2	D	3.30	5.70	58.0	647
MPIA4040R2-3R3-R	3.3	E	2.60	5.40	76.0	495
MPIA4040R2-4R7-R	4.7	F	2.20	4.30	105	421
MPIA4040R2-6R8-R	6.8	G	1.80	3.40	158	351
MPIA4040R2-100-R <sup>††</sup>	10.0	H	1.50	3.10	240	271

1 Open Circuit Inductance (OCL) Test Parameters: 10kHz, 0.10V<sub>rms</sub>, 0.0A dc

2 I<sub>rms</sub>: DC current for an approximate temperature rise of 40°C without core loss. De-rating is necessary for AC currents. Temperature rise is dependent upon several factors, including the PCB pad layout, trace thickness and width, air-flow and proximity to other heat generating components. It is recommended the part temperature not exceed 25°C under worst case operating conditions and therefore, the temperature rise should be verified in the end use application. Irms testing was performed on a 19.05mm long x 6.35mm wide x 0.070mm thick copper trace in still air.

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

4 K-factor: Used to determine B<sub>p-p</sub> for core loss (see graph). B<sub>p-p</sub> = K \* L \* DI. Bp-p : (Gauss), K: (K-factor from table), L: (inductance in µH), DI (peak-to-peak ripple current in amps).

5 Part Number Definition: MPIA4040RX-XXX-R

- MPIA4040X = product code and size
- XXX = inductance value in all, "R" = decimal point  
- If no "R" is present, then third digit equals the number of zeros
- "-R" suffix = RoHS compliant

† Transient pulse not to exceed 1 millisecond.

†† Maximum operating frequency less than 10MHz, consult factory for application specific values.

Part Number <sup>5</sup>	OCL <sup>1</sup> ± 20% (µH)	Part Marking Designator	I <sub>rms</sub> <sup>2</sup> (Amps)	I <sub>sat</sub> <sup>3</sup> @ 25°C (Amps)	DCR (mΩ) ± 20% @ 20°C	K-factor <sup>4</sup>
<b>R3 -- 1.85mm Height</b>						
MPIA4040R3-R22-R	0.22	A	8.00	20.0	5.8	1870
MPIA4040R3-R47-R	0.47	B	5.80	17.0	10.3	1530
MPIA4040R3-1R2-R	1.2	C	4.00	9.40	32.0	732
MPIA4040R3-1R5-R	1.5	D	3.80	8.20	36.0	673
MPIA4040R3-2R2-R	2.2	E	3.40	7.90	48.0	543
MPIA4040R3-3R3-R	3.3	F	3.00	6.60	60.0	432
MPIA4040R3-4R7-R	4.7	G	2.30	4.80	92.0	374
MPIA4040R3-6R8-R	6.8	H	2.00	4.50	120	306
MPIA4040R3-100-R	10.0	I	1.50	3.80	213	251
MPIA4040R3-150-R	15.0	J	1.30	3.00	235	213
MPIA4040R3-220-R <sup>††</sup>	22.0	K	1.10	2.20	408	174
<b>R4 -- 2.0mm Height</b>						
MPIA4040R4-R22-R	0.22	A	10.1	15.0	5.3	2405
MPIA4040R4-R33-R	0.33	B	9.50	12.8	6.0	1870
MPIA4040R4-R47-R	0.45	C	8.10	11.5	8.2	1530
MPIA4040R4-1R0-R	1.0	D	5.70	7.20	17.0	990
MPIA4040R4-1R5-R	1.5	E	4.90	6.90	23.0	802
MPIA4040R4-2R2-R	2.2	F	3.90	5.70	35.0	673
MPIA4040R4-3R3-R <sup>††</sup>	3.3	G	3.30	4.50	49.0	510
MPIA4040R4-4R7-R <sup>††</sup>	4.7	H	2.90	3.90	67.0	455
MPIA4040R4-6R8-R <sup>††</sup>	6.8	I	2.40	3.20	91.0	374
MPIA4040R4-100-R <sup>††</sup>	10.0	J	1.90	2.60	148	306
MPIA4040R4-220-R <sup>††</sup>	22.0	K	1.30	1.80	316	203

1 Open Circuit Inductance (OCL) Test Parameters: 10kHz, 0.10V<sub>rms</sub>, 0.0A dc

2 I<sub>rms</sub>: DC current for an approximate temperature rise of 40°C without core loss. De-rating is necessary for AC currents. Temperature rise is dependent upon several factors, including the PCB pad layout, trace thickness and width, air-flow and proximity to other heat generating components. It is recommended the part temperature not exceed 25°C under worst case operating conditions and therefore, the temperature rise should be verified in the end use application. Irms testing was performed on a 19.05mm long x 6.35mm wide x 0.070mm thick copper trace in still air.

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

4 K-factor: Used to determine B<sub>pp</sub> for core loss (see graph). B<sub>pp</sub> = K \* L \* DI. B<sub>p-p</sub> : (Gauss), K: (K-factor from table), L: (inductance in µH), DI (peak-to-peak ripple current in amps).

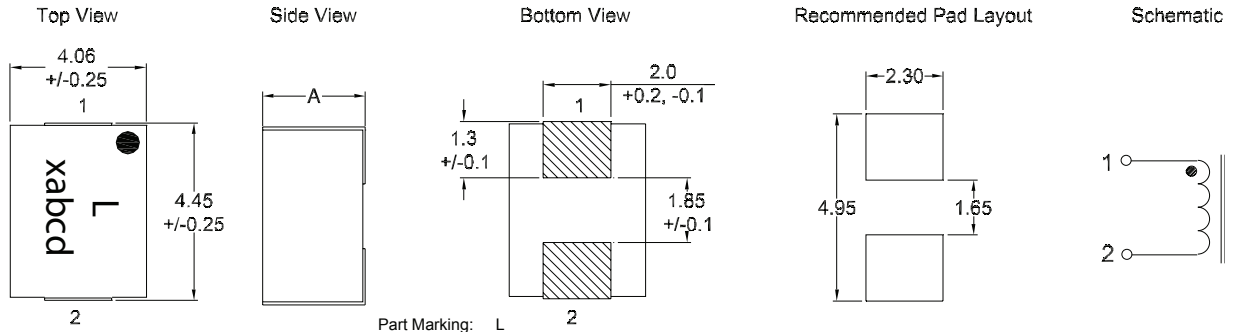
5 Part Number Definition: MPIA4040RX-XXX-R

- MPIA4040X = product code and size
- XXX = inductance value in all, "R" = decimal point
- If no "R" is present, then third digit equals the number of zeros
- "-R" suffix = RoHS compliant

† Transient pulse not to exceed 1 millisecond.

†† Maximum operating frequency less than 10MHz, consult factory for application specific values.

**Dimensions - mm**

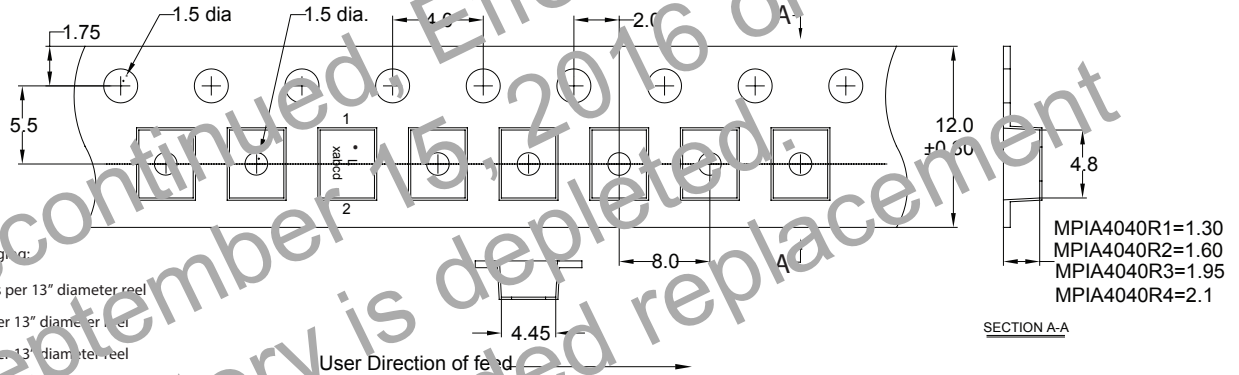


Part #	A Max
MPIA4040R1-xxx-R	1.2
MPIA4040R2-xxx-R	1.5
MPIA4040R3-xxx-R	1.8
MPIA4040R4-xxx-R	2.0

Part Marking: L xabcd  
 L = Automotive product  
 x = height: 1 = R1 (1.2mm), 2 = R2 (1.5mm), 3 = R3 (1.85mm), 4 = R4 (2.0mm)  
 a = inductance value per the "Part Marking Designator" letter code in table above  
 b = Bi-weekly date code  
 c = Last digit of year manufactured  
 d = Revision level

Soldering surfaces to be coplanar within 0.1016 millimeters  
 PCB tolerances +/- 0.1mm unless otherwise specified  
 Do not route traces or vias underneath the inductor

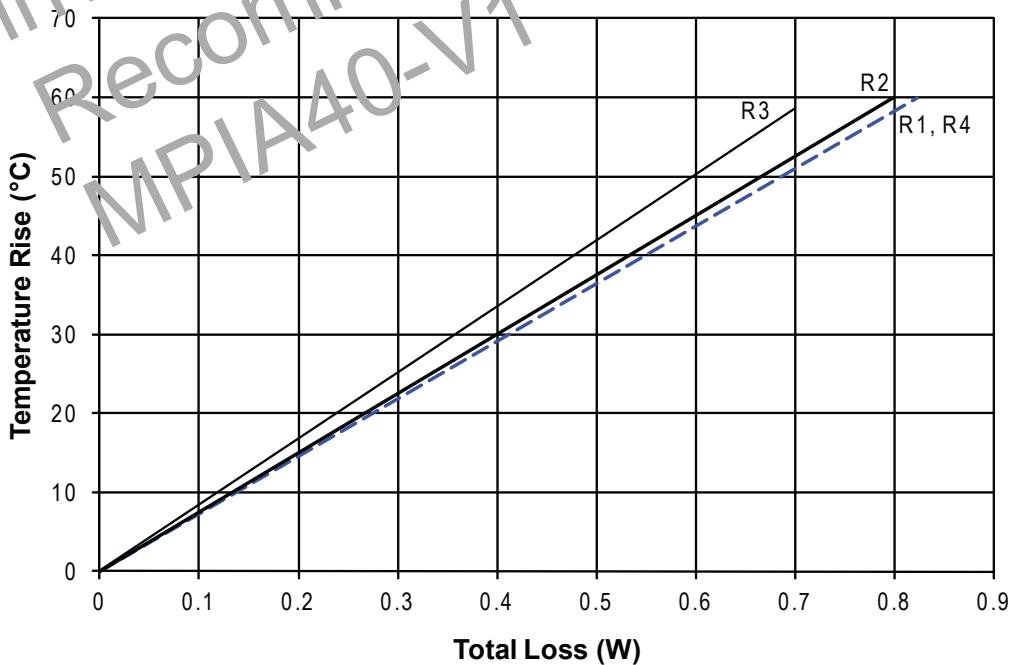
**Packaging information - mm**



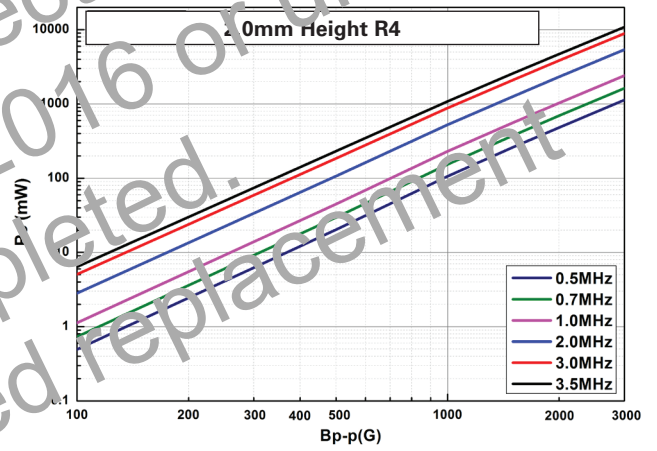
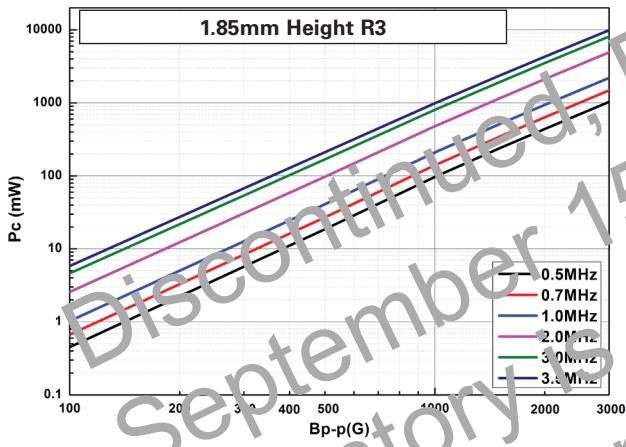
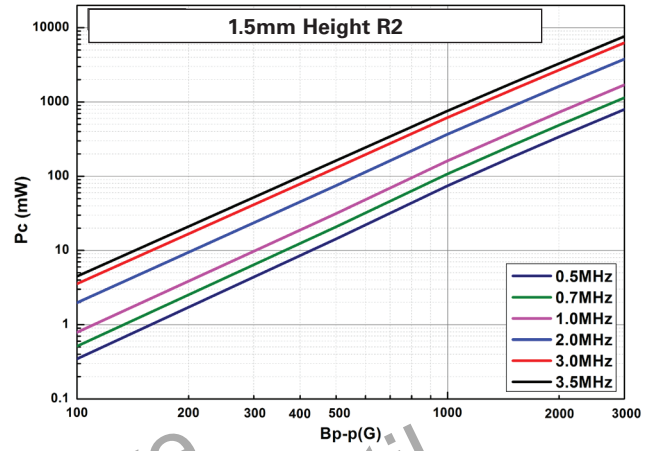
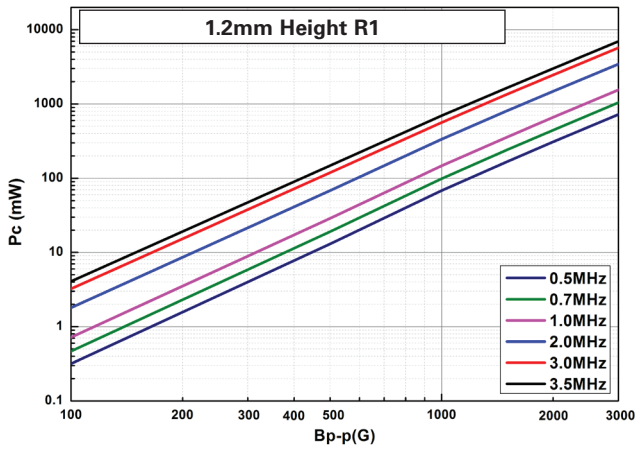
Supplied in tape and reel packaging:

- MPIA4040R1 = 5,000 parts per 13" diameter reel
- MPIA4040R2 = 4,500 parts per 13" diameter reel
- MPIA4040R3 = 3,500 parts per 13" diameter reel
- MPIA4040R4 = 3,000 parts per 13" diameter reel

**Temperature rise vs. total loss**



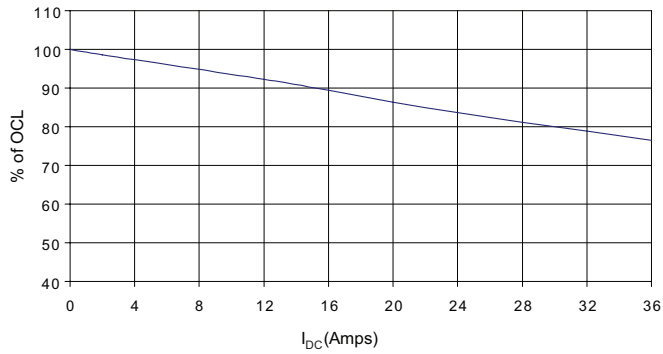
Core loss



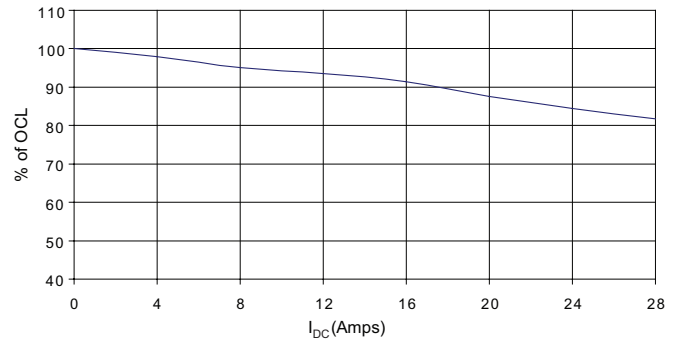
Discontinued, Effective  
September 15, 2016 or until  
inventory is depleted.  
Recommended replacement  
MPIA40-V1

1.2mm Height R1 inductance characteristics — % of OCL vs.  $I_{DC}$

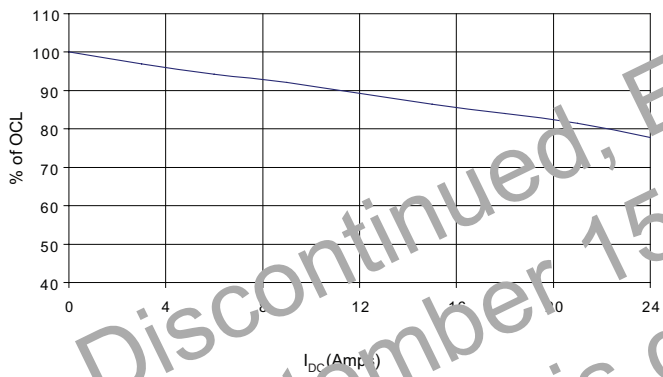
MPIA4040R1-R10-R



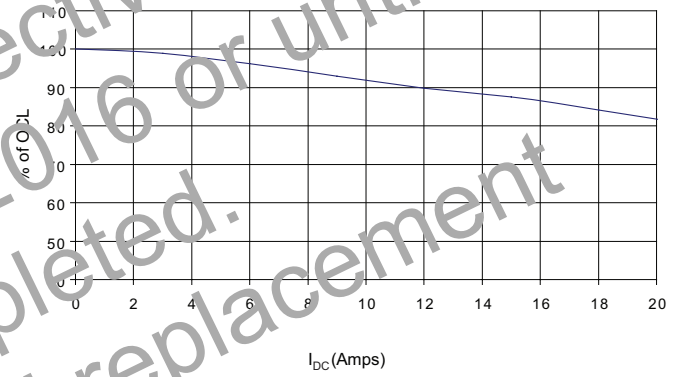
MPIA4040R1-R15-R



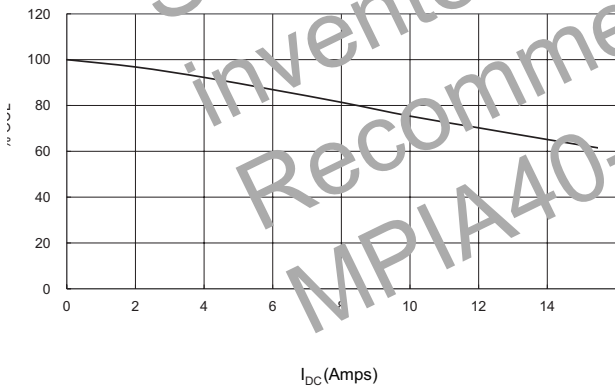
MPIA4040R1-R22-R



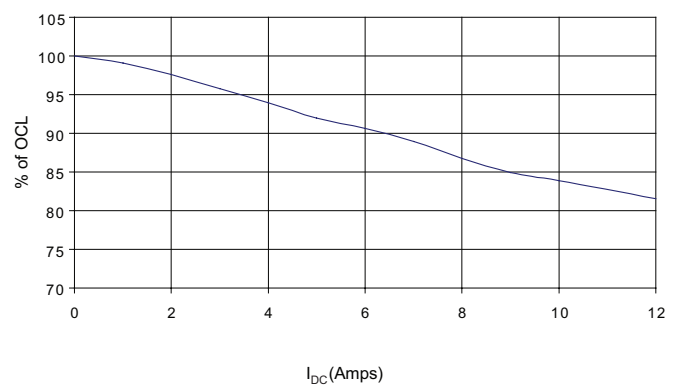
MPIA4040R1-R33-R



MPIA4040R1-R47-R

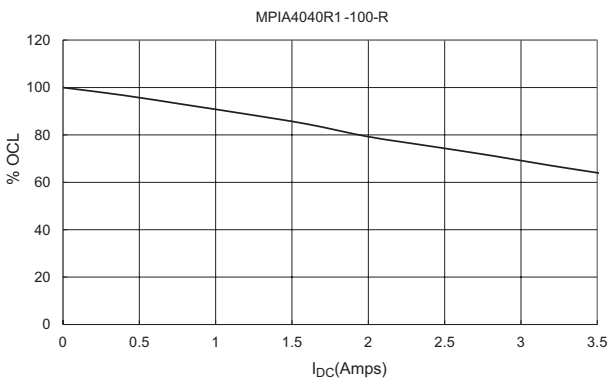
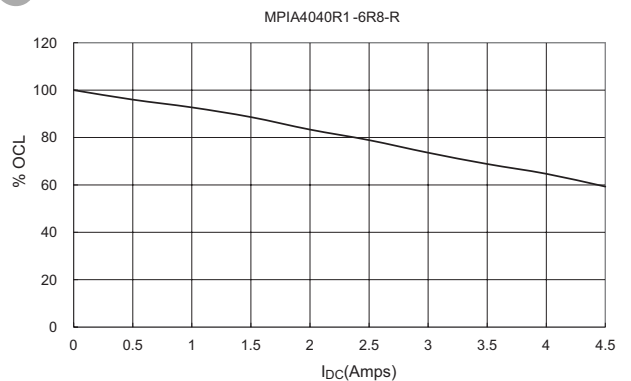
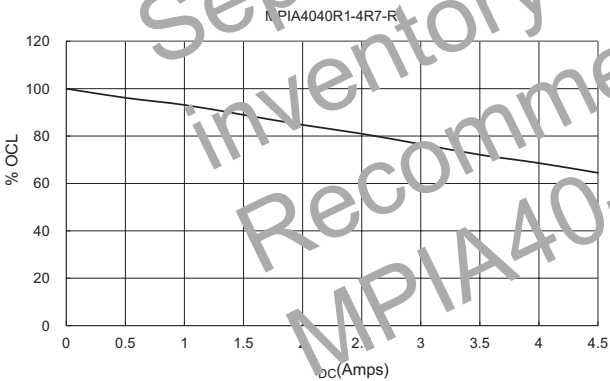
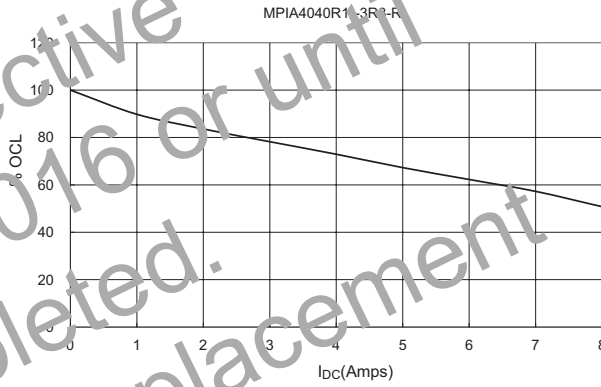
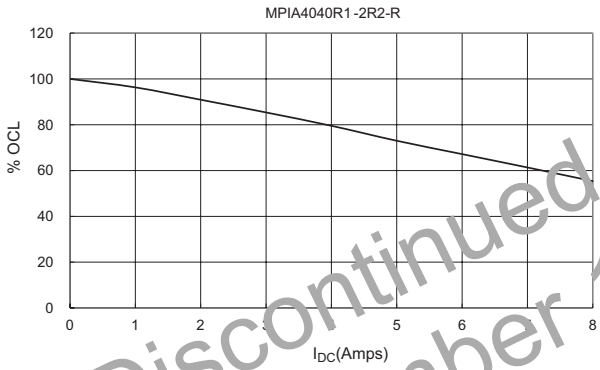
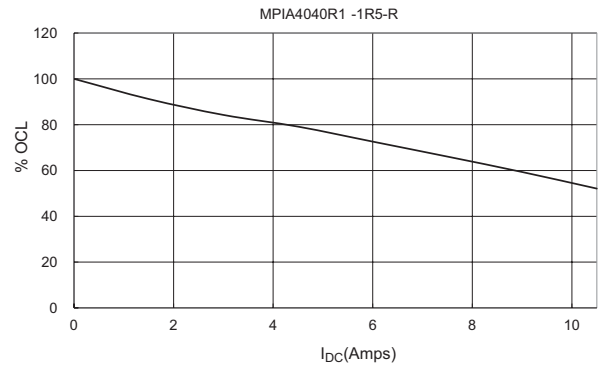
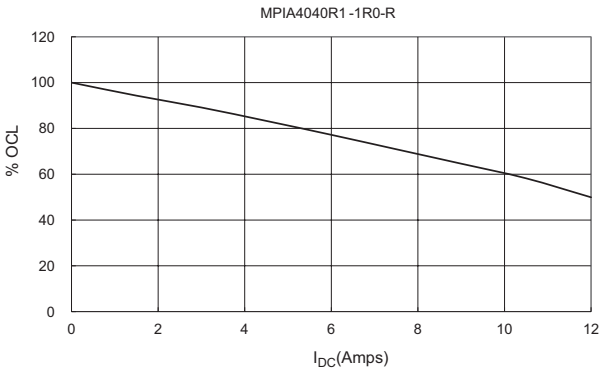


MPIA4040R1-R68-R



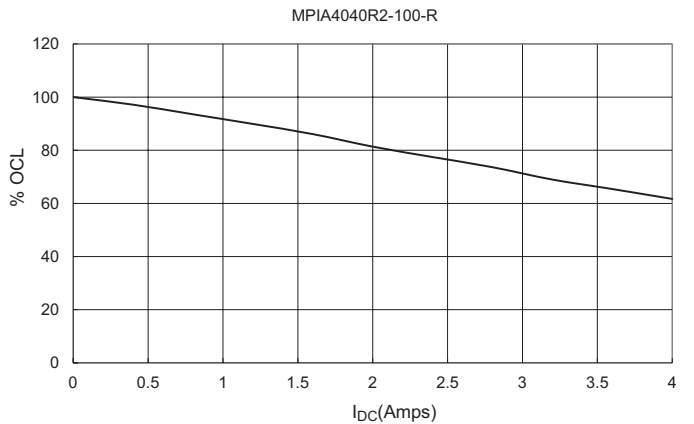
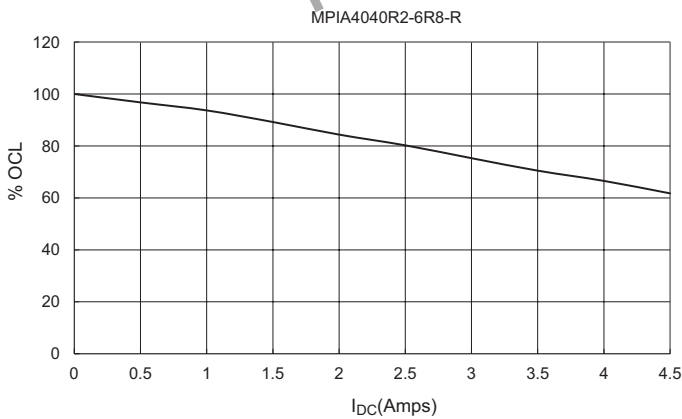
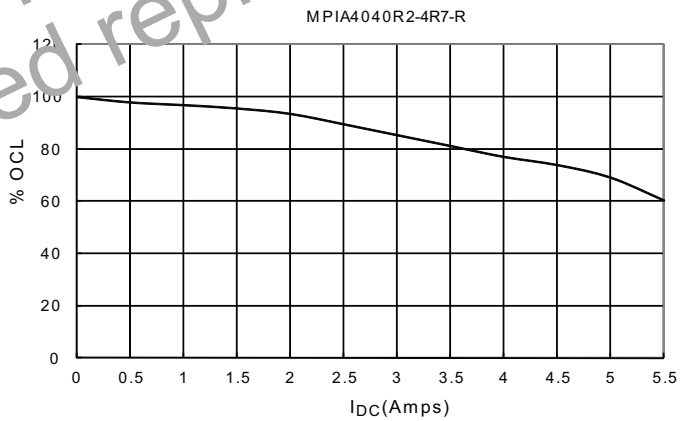
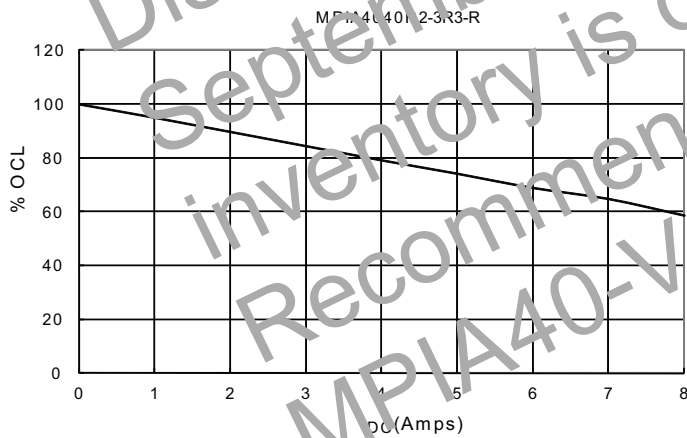
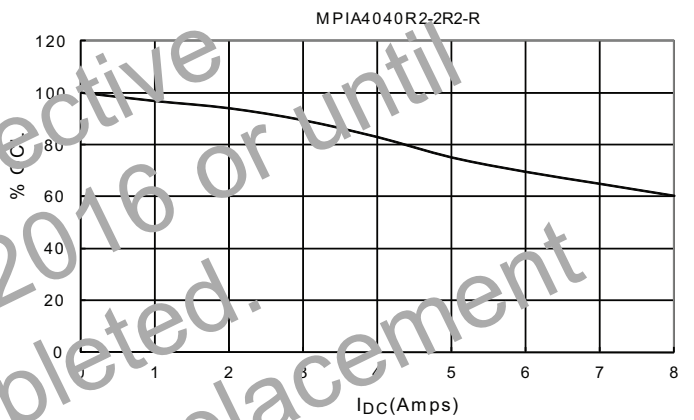
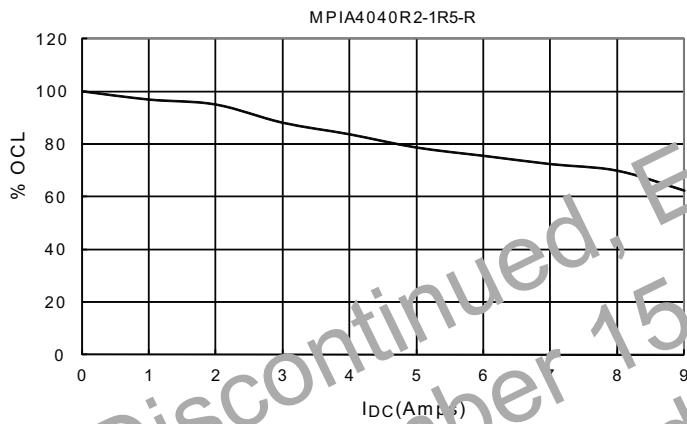
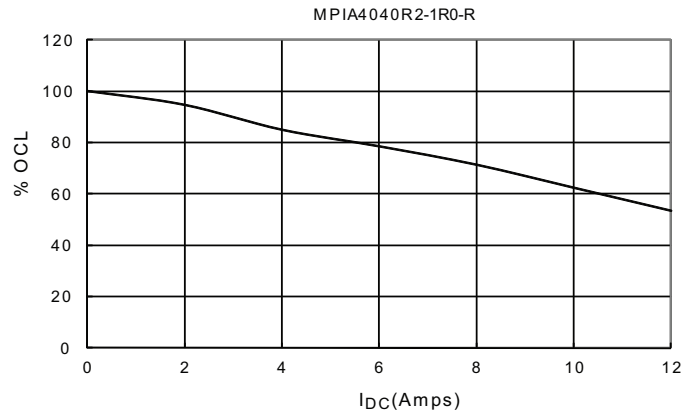
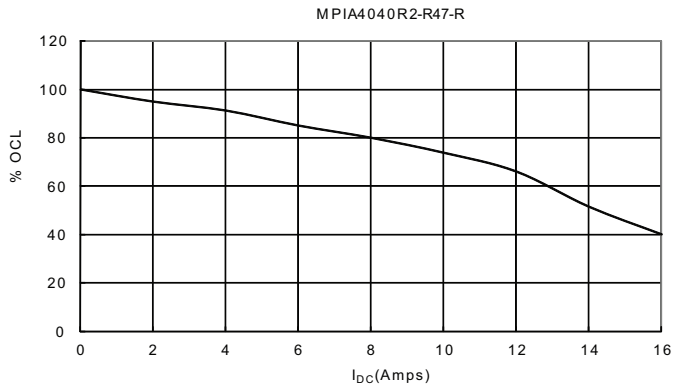
Discontinued, Effective  
 September 15, 2016 or until  
 inventory is depleted.  
 Recommended replacement  
 MPIA40-V1

**1.2mm Height R1 inductance characteristics — % of OCL vs.  $I_{DC}$**



Discontinued, Effective September 15, 2016 or until inventory is depleted. Recommended replacement MPIA40-V1

1.5mm Height R2 inductance characteristics — % of OCL vs.  $I_{DC}$

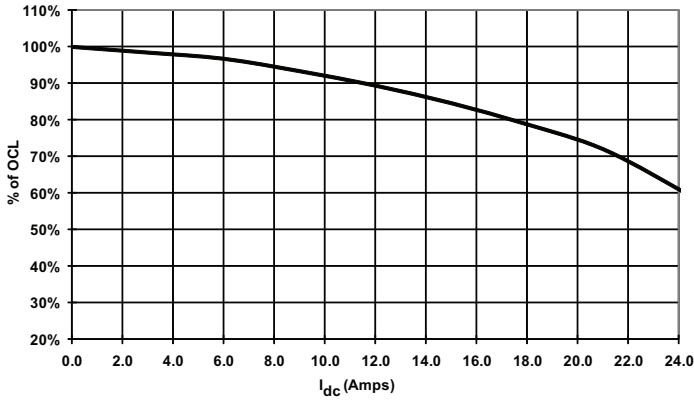


Discontinued, Effective September 15, 2016 or until inventory is depleted. Recommended replacement MPIA40-V1

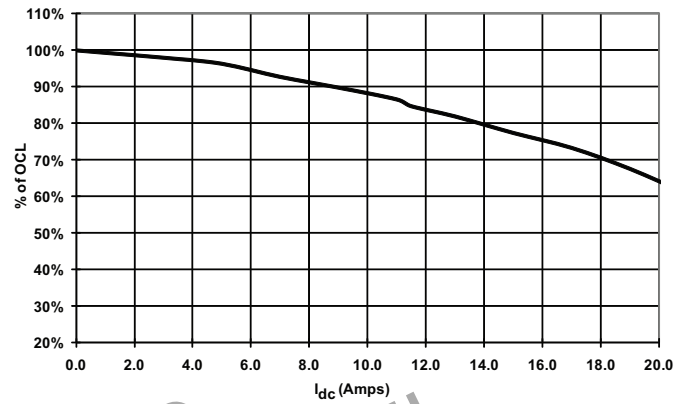


1.85mm Height R3 inductance characteristics — % of OCL vs.  $I_{DC}$

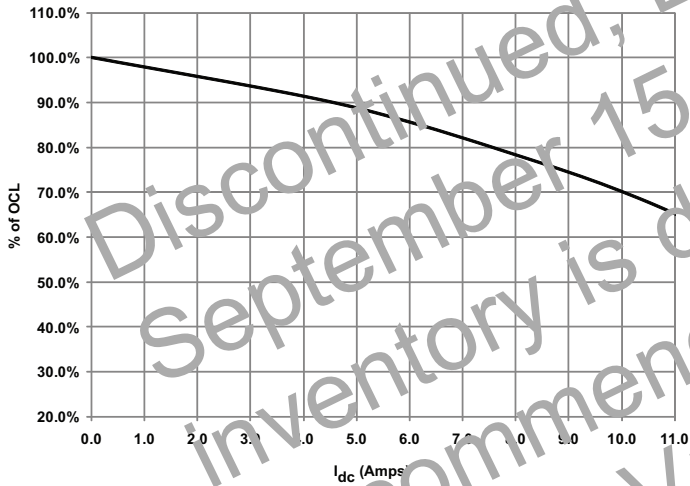
MPIA4040R3-R22-R



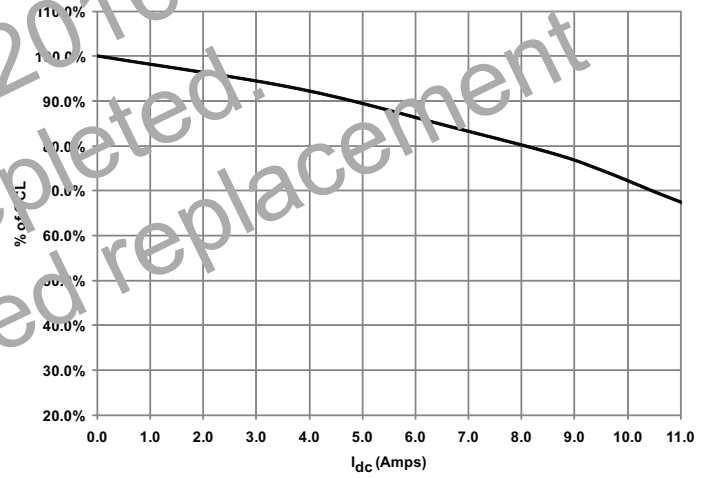
MPIA4040R3-R47-R



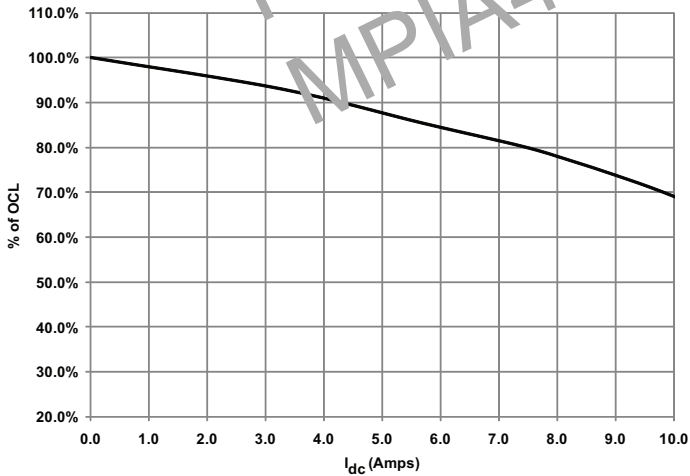
MPIA4040R3-1R2-R



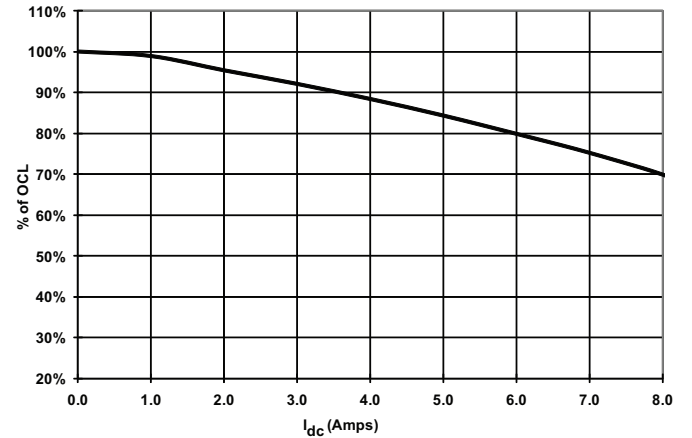
MPIA4040R3-1R5-R



MPIA4040R3-2R2-R



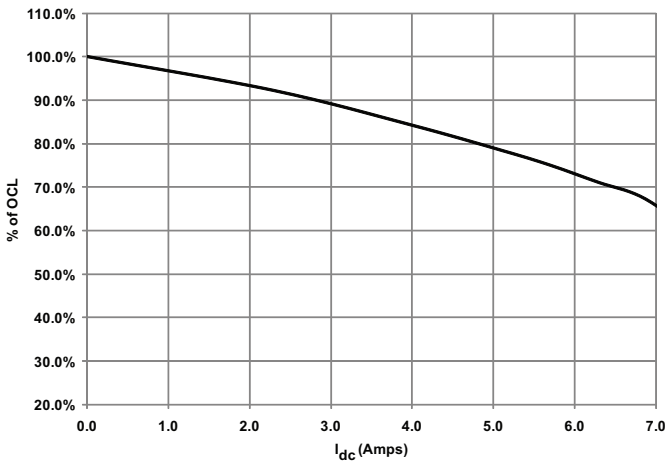
MPIA4040R3-3R3-R



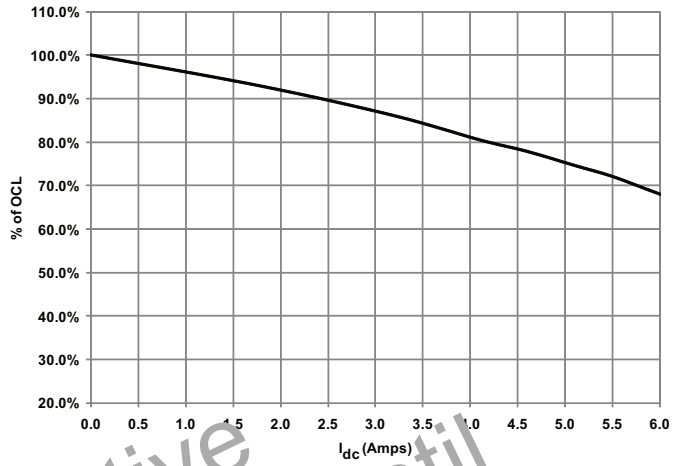
Discontinued, Effective September 15, 2016 or until inventory is depleted. Recommended replacement MPIA40-V1

1.85mm Height R3 inductance characteristics — % of OCL vs.  $I_{DC}$

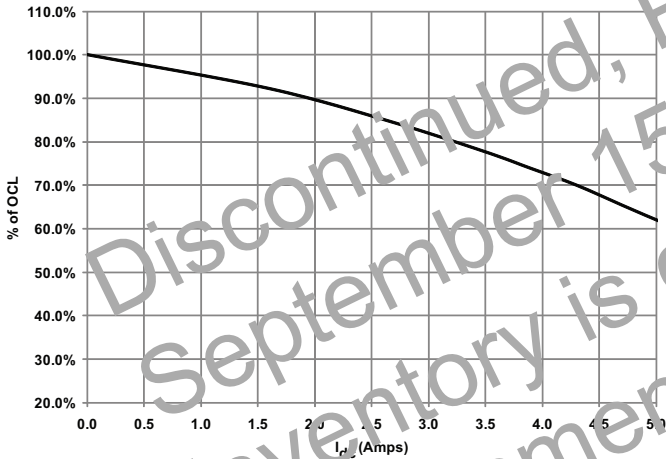
MPIA4040R3-4R7-R



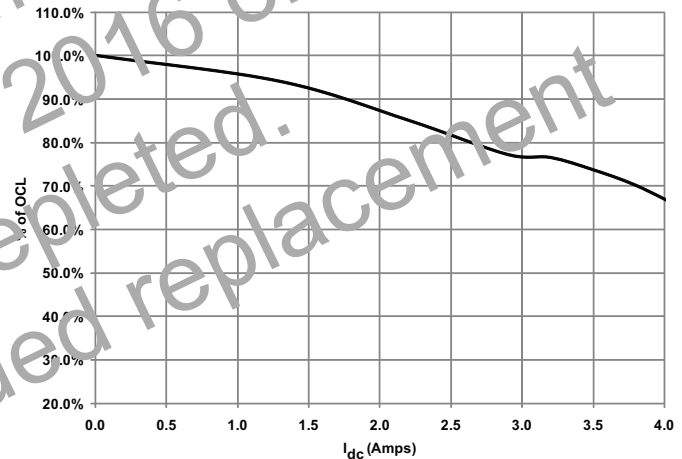
MPIA4040R3-6R8-R



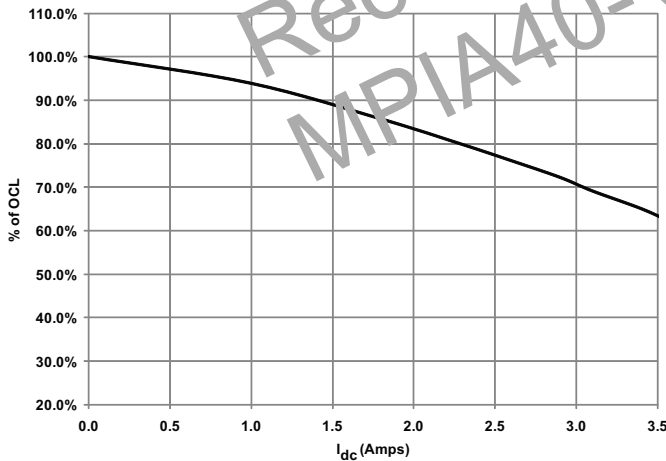
MPIA4040R3-100-R



MPIA4040R3-150-R

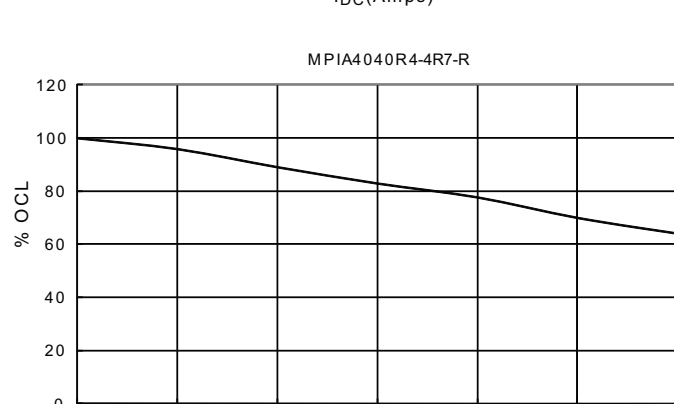
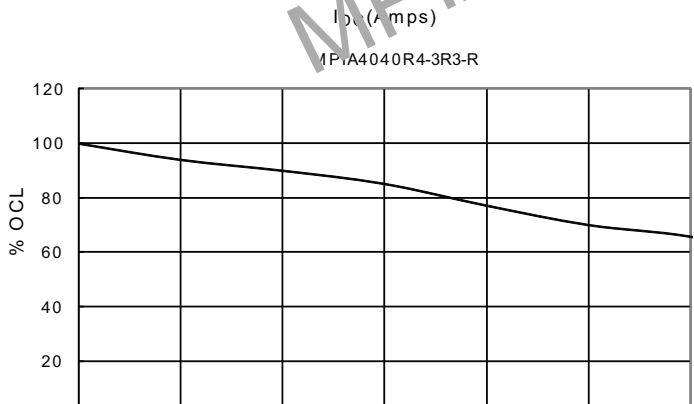
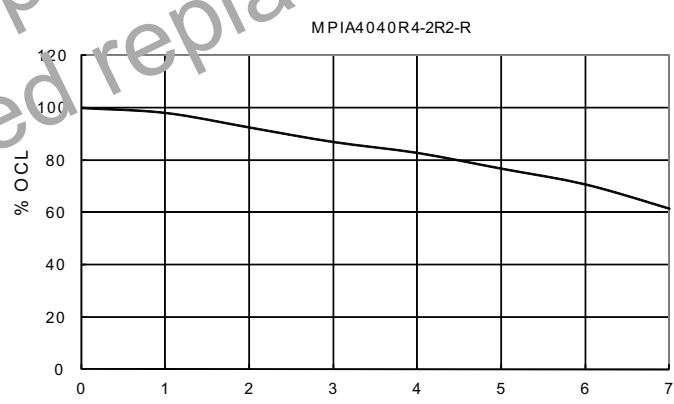
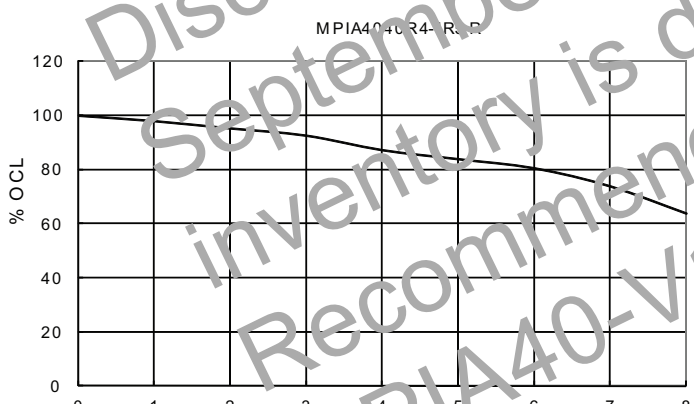
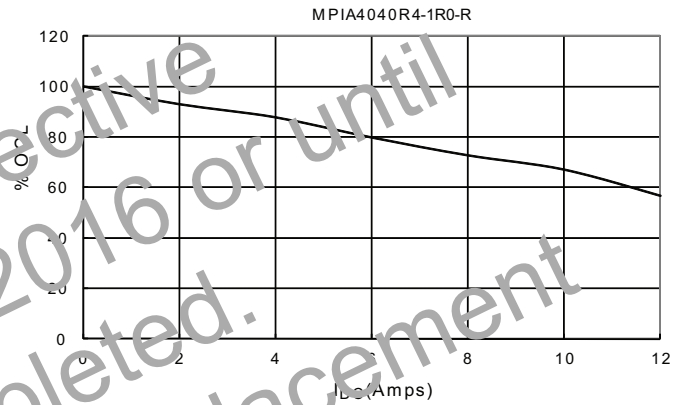
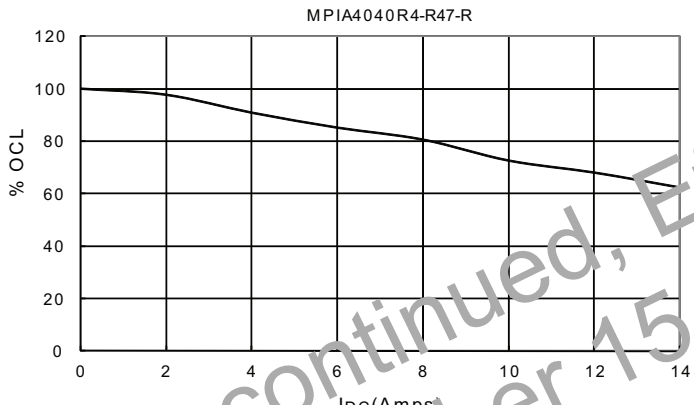
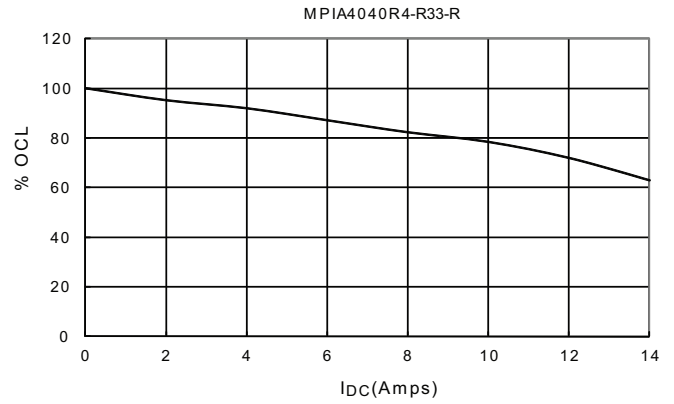
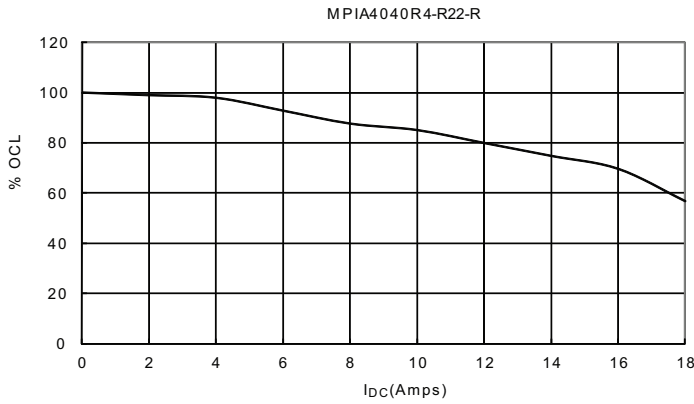


MPIA4040R3-220-R



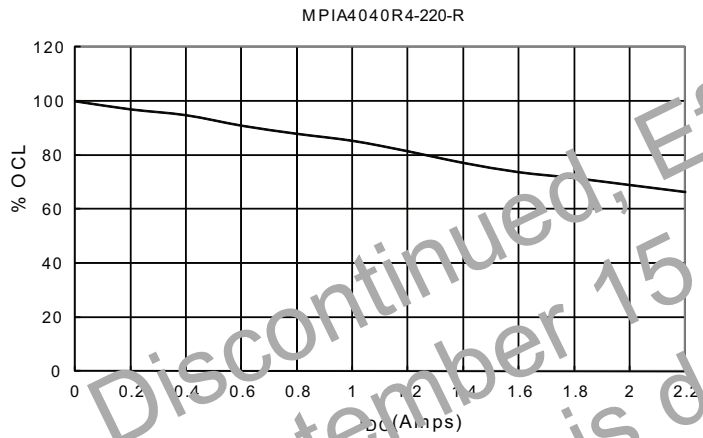
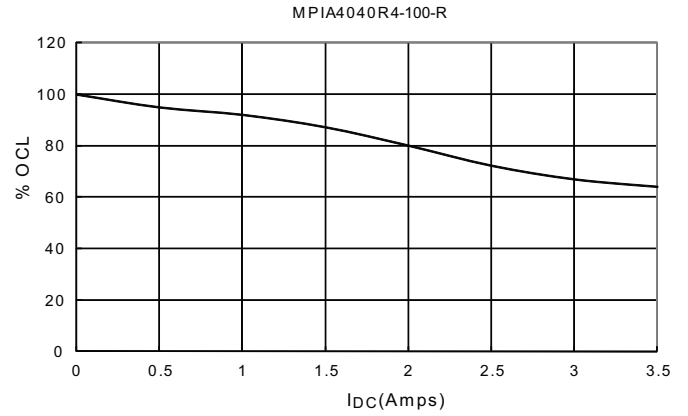
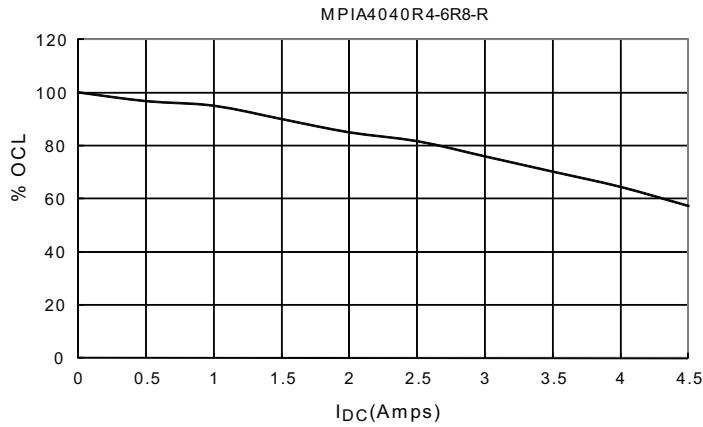
Discontinued, Effective September 15, 2016 or until inventory is depleted. Recommended replacement MPIA40-V1

**2.0mm Height R4 inductance characteristics — % of OCL vs.  $I_{DC}$**



Discontinued, Effective September 15, 2016 or until inventory is depleted. Recommended replacement MPIA40-V1

**2.0mm Height R4 inductance characteristics — % of OCL vs.  $I_{DC}$**



Discontinued, Effective  
September 15, 2016 or until  
inventory is depleted.  
Recommended replacement  
MPIA40-V1

**Solder reflow profile**

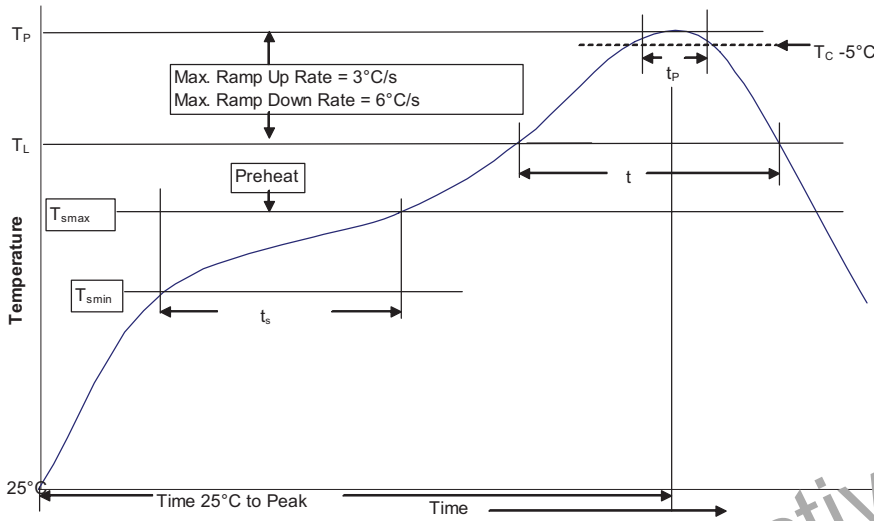


Table 1 - Standard SnPb Solder (T<sub>c</sub>)

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

Table 2 - Lead (Pb) Free Solder (T<sub>c</sub>)

Package Thickness	Volume <350 mm <sup>3</sup>	Volume 350 - 2000 mm <sup>3</sup>	Volume >2000 mm <sup>3</sup>
<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	<ul style="list-style-type: none"> <li>Temperature min. (T<sub>smm</sub>)</li> <li>Temperature max. (T<sub>smax</sub>)</li> <li>Time (T<sub>smm</sub> to T<sub>smax</sub>) (t<sub>s</sub>)</li> </ul>	<ul style="list-style-type: none"> <li>100°C</li> <li>150°C</li> <li>200°C</li> <li>60-120 Seconds</li> <li>60-120 Seconds</li> </ul>
Average ramp up rate T <sub>smax</sub> to T <sub>n</sub>	3°C/Second Max.	3°C/Second Max.
Liquidous temperature (T <sub>L</sub> )	183°C	217°C
Time at liquidous (t <sub>L</sub> )	60-150 Seconds	60-150 Seconds
Peak package body temperature (T <sub>p</sub> )*	Table 1	Table 2
Time (t <sub>p</sub> )** within 5 °C of the specified classification temperature (T <sub>c</sub> )	20 Seconds**	30 Seconds**
Average ramp-down rate (T <sub>p</sub> to T <sub>smax</sub> )	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<sub>p</sub>) is defined as a supplier minimum and a user maximum.

\*\* Tolerance for time at peak profile temperature (t<sub>p</sub>) is defined as a supplier minimum and a user maximum.

Life Support Policy: Eaton does not authorize the use of any of its products for use in life support devices or systems without the express written approval of an officer of the Company. Life support systems are devices which support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

Eaton reserves the right, without notice, to change design or construction of any products and to discontinue or limit distribution of any products. Eaton also reserves the right to change or update, without notice, any technical information contained in this bulletin.

Eaton  
Electronics Division  
1000 Eaton Boulevard  
Cleveland, OH 44122  
United States  
www.eaton.com/elx



Powering Business Worldwide

© 2014 Eaton  
All Rights Reserved  
Publication No. 10230 – BU-SB14178  
August 2014

Eaton is a registered trademark.

All other trademarks are property of their respective owners.

## X-ON Electronics

Largest Supplier of Electrical and Electronic Components

*Click to view similar products for [Fixed Inductors](#) category:*

*Click to view products by [Eaton](#) manufacturer:*

Other Similar products are found below :

[CR43NP-680KC](#) [CR54NP-820KC](#) [CR54NP-8R5MC](#) [CTX32CT-100](#) [70F224AI](#) [MGDQ4-00004-P](#) [MHL1ECTTP18NJ](#) [MHL1JCTTD12NJ](#)  
[PE-51506NL](#) [PE-53601NL](#) [PE-53602NL](#) [PE-53630NL](#) [PE-53824SNLT](#) [PE-92100NL](#) [PG0434.801NLT](#) [PG0936.113NLT](#) [9310-16](#) [PM06-2N7](#) [PM06-39NJ](#) [A01TK](#) [1206CS-471XJ](#) [HC2-2R2TR](#) [HC2LP-R47-R](#) [HC3-2R2-R](#) [1206CS-151XG](#) [RCH664NP-140L](#) [RCH664NP-4R7M](#)  
[RCH8011NP-221L](#) [RCP1317NP-332L](#) [RCP1317NP-391L](#) [RCR1010NP-470M](#) [RCR110DNP-331L](#) [DH2280-4R7M](#) [DS1608C-106](#) [ASPI-4020HI-R10M-T](#) [B10TJ](#) [B82477P4333M](#) [B82498B3101J000](#) [B82498B3680J000](#) [ELJ-RE27NJF2](#) [1812CS-153XJ](#) [1812CS-183XJ](#) [1812CS-223XJ](#) [1812LS-104XJ](#) [1812LS-105XJ](#) [1812LS-124XJ](#) [1812LS-154XJ](#) [1812LS-223XJ](#) [1812LS-224XJ](#) [1812LS-563XJ](#)