MPIA4040

Automotive Grade
High Current, High Frequency, Miniature Power Inductors



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

Product description:

- AEC-Q200 Grade 3 qualified
- Handles high transient inrush current spikes
- Magnetically shielded
- Frequency range 100kHz to 10MHz
- Inductance range from 0.09uH to 2.2uH
- Current range from 1.1A to 12.0A
- 4.7 x 4.31 footprint surface mount package in 1.2, 1.5, 1.85 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

Powering Business Worldwide

Product specifications

Part Number[5]	OCL[1] ± 20% (µH)	Part Marking Designator	I_{rms}[2] (Amps)	I_{sat}[3] @ 25°C (Amps)	DCR (mΩ) ± 20% @ 20°C	K-factor[4]
R1 -- 1.2mm Height						
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††	6.8	L	1.50	3.20	250	344
MPIA4040R1-100-R††	10.0	M	1.20	2.80	370	276
R2 -- 1.5mm Height						
MPIA4040R2-R47-R	0.47	A	6.40	12.2	13.0	1403
MPIA4040R2-1R0-R	1.0	B	4.60	8.90	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††	10.0	H	1.50	3.10	240	271

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

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

2 I_{rms}: 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 125°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_{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 * 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[5]	OCL[1] ± 20% (µH)	Part Marking Designator	I_{rms}[2] (Amps)	I_{sat}[3] @ 25°C (Amps)	DCR (mΩ) ± 20% @ 20°C	K-factor[4]
R3 -- 1.85mm Height						
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	285	213
MPIA4040R3-220-R††	22.0	K	1.10	2.20	408	174
R4 -- 2.8mm Height						
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	9.20	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††	3.3	G	3.30	4.50	49.0	510
MPIA4040R4-4R7-R††	4.7	H	2.90	3.90	67.0	455
MPIA4040R4-6R8-R††	6.8	I	2.40	3.20	91.0	374
MPIA4040R4-100-R††	10.0	J	1.90	2.60	148	306
MPIA4040R4-220-R††	22.0	K	1.30	1.80	316	203

Discontinued, Effective September 15, 2016 or until inventory is depleted. Recommended replacement MPIA4040-V1

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

2 I_{rms}: 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 125°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_{sat}: Peak current for approximately 30% rolloff at +25°C.

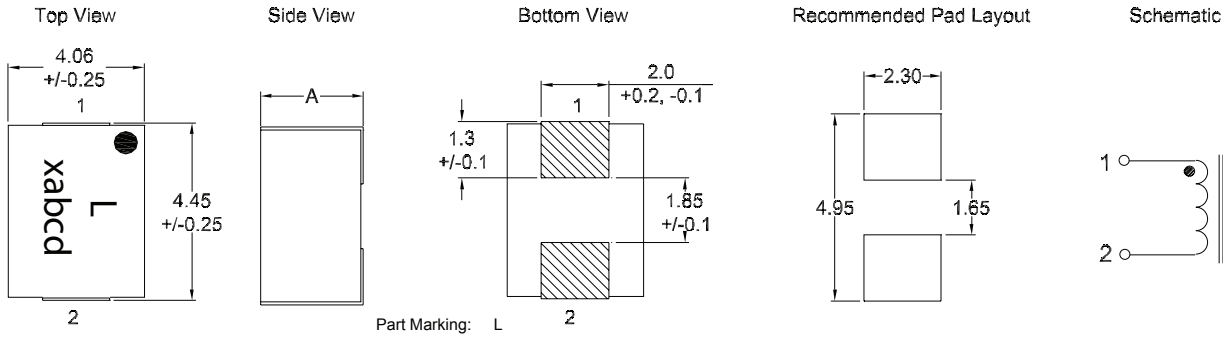
4 K-factor: Used to determine B_{p-p} for core loss (see graph). B_{p-p} = K * L * DI. Bp-p : (Gauss), K: (K-factor from table), L: (inductance in µH), DI (peak-to-peak ripple current in amps).

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.

Dimensions - mm



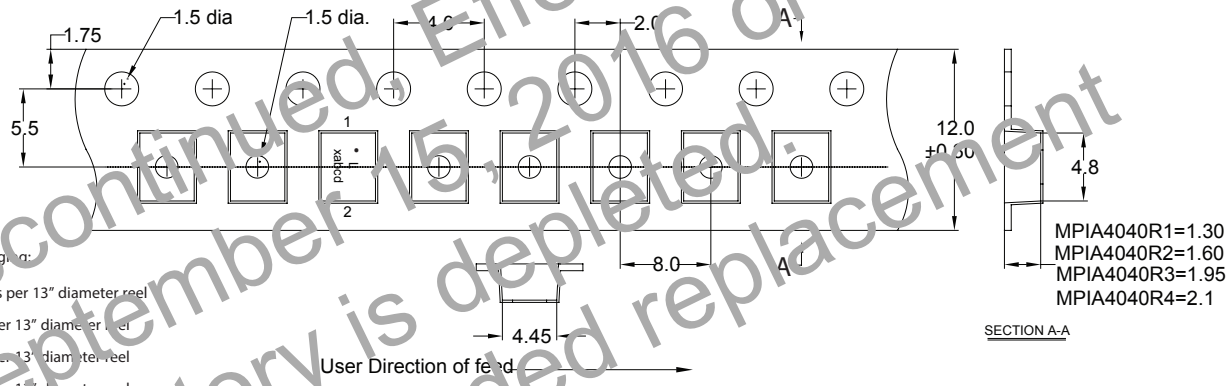
Part #	A Max
MPIA4040R1-xxx-R	1.2
MPIA4040R2-xxx-R	1.5
MPIA4040R3-xxx-R	1.8
MPIA4040R4-xxx-R	2.0

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

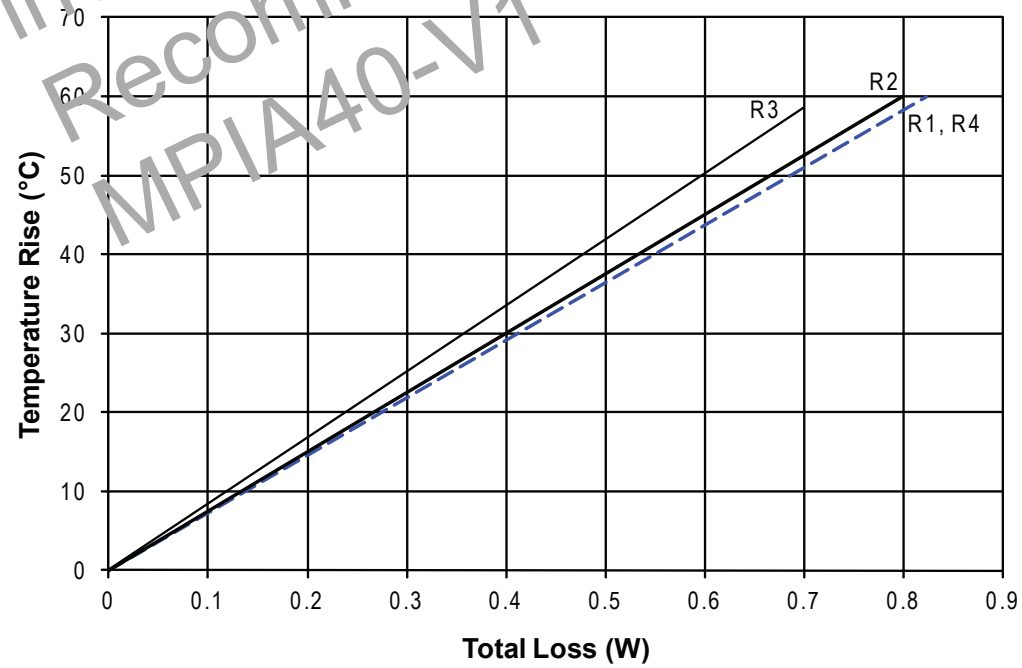
Packaging information - mm



Supplied in tape and reel packaging:

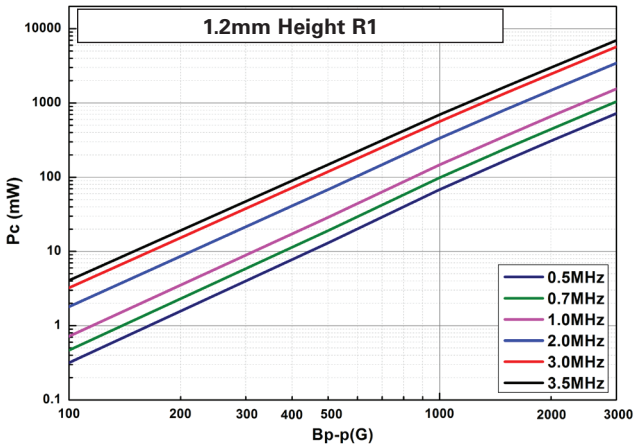
- MPIA4040R1 = 5,000 parts per 13" diameter reel
- MPIA4040R2 = 4500 parts per 13" diameter reel
- MPIA4040R3 = 3500 parts per 13" diameter reel
- MPIA4040R4 = 3,000 parts per 13" diameter reel

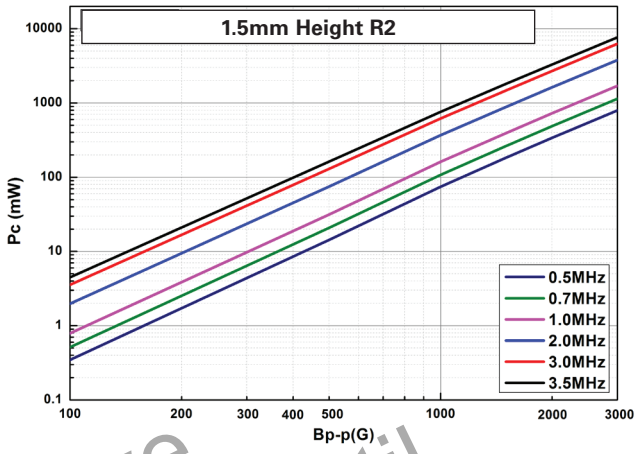
Temperature rise vs. total loss

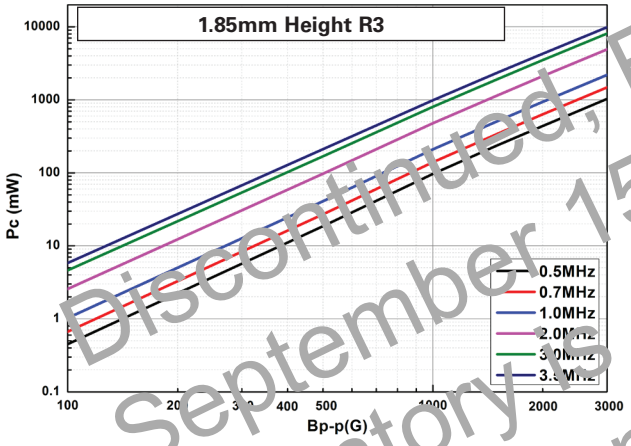


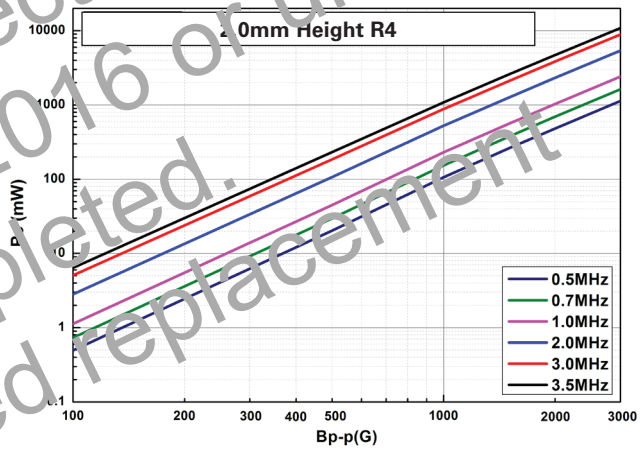
Discontinued. Effective September 15, 2016 or until inventory is depleted. Recommended replacement MPIA40-V1

Core loss





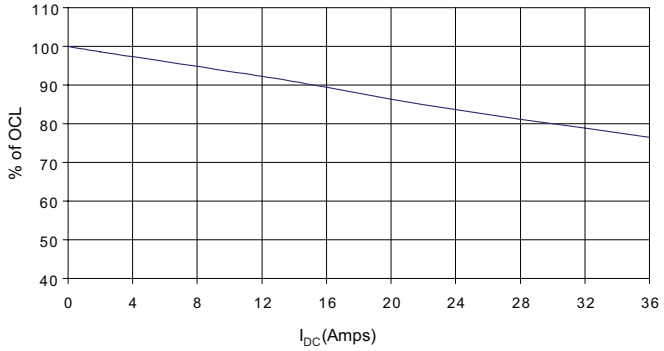




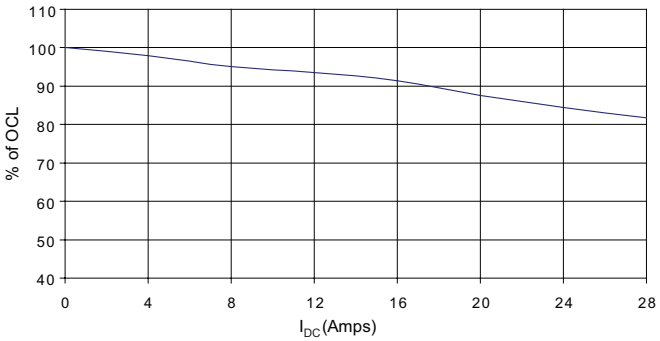
Discontinued, Effective September 15, 2016 or until inventory is depleted. Recommended replacement MPIA40-V1

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

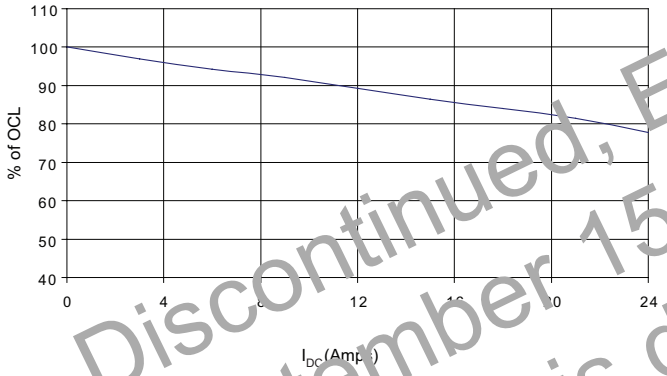
MPIA4040R1-R10-R



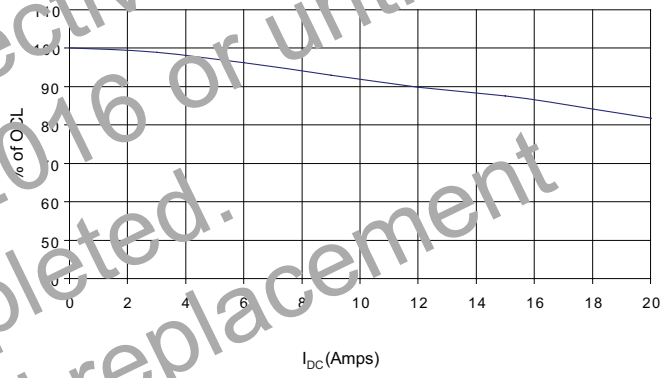
MPIA4040R1-R15-R



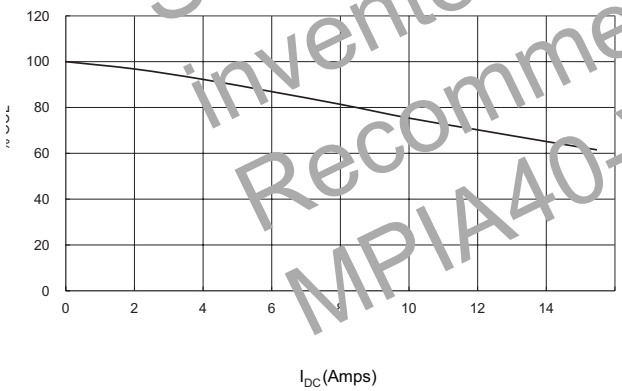
MPIA4040R1-R22-R



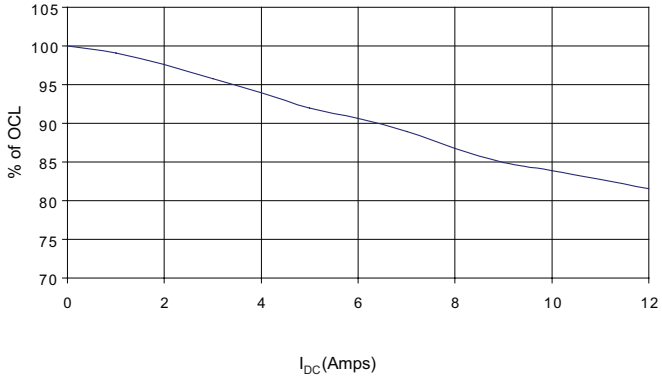
MPIA4040R1-R33-R



MPIA4040R1-R47-R

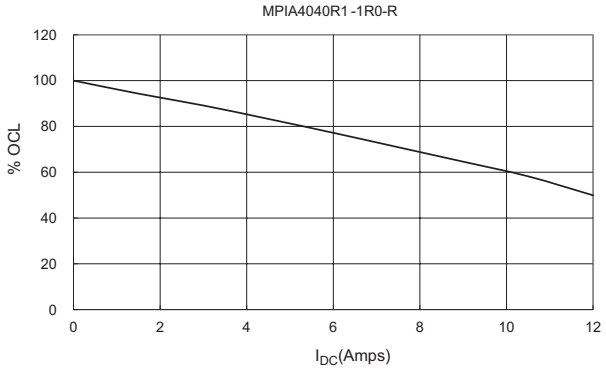


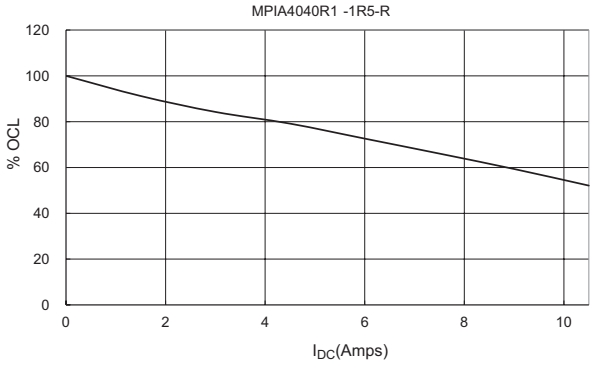
MPIA4040R1-R68-R

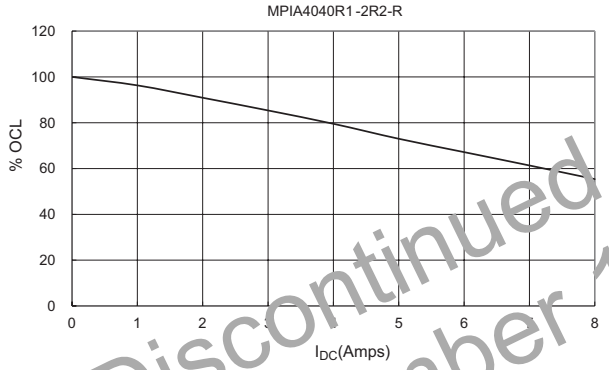


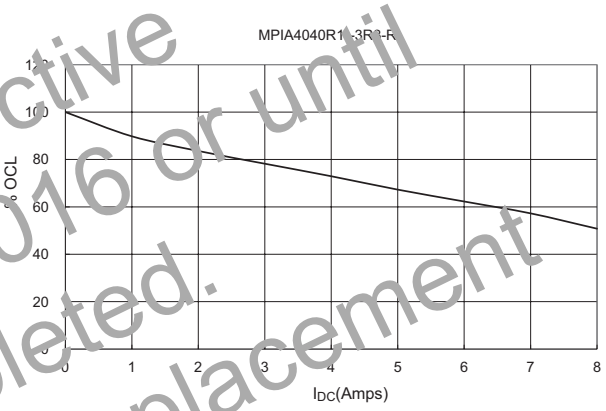
Discontinued, Effective September 15, 2016 or until inventory is depleted. Recommended replacement MPIA40-V1

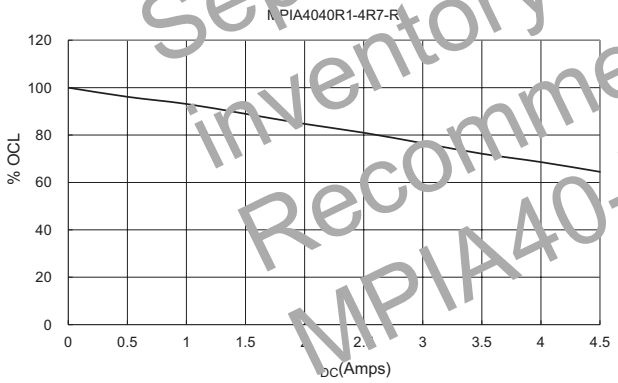
1.2mm Height R1 inductance characteristics — % of OCL vs. I_{DC}

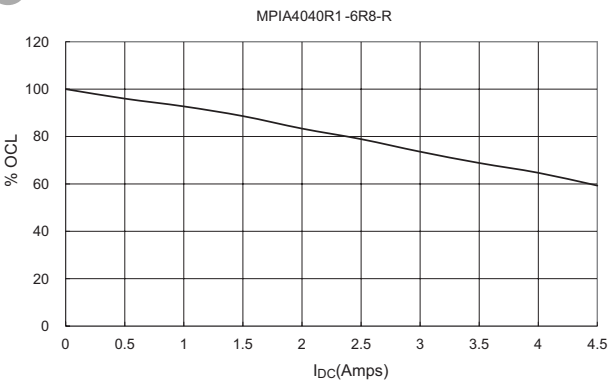


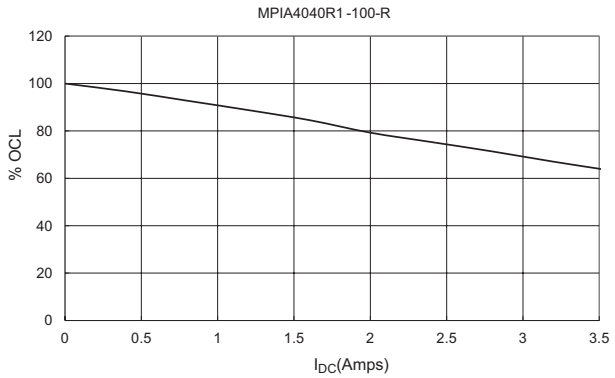








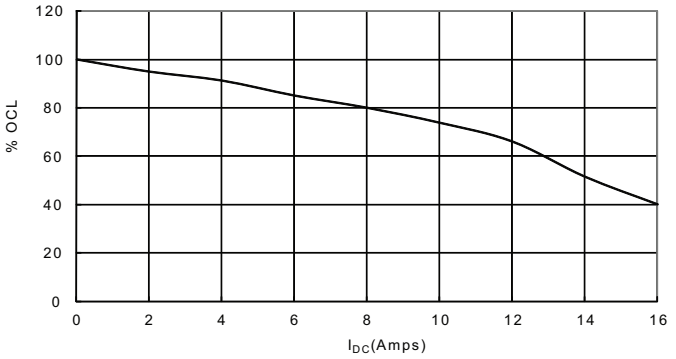




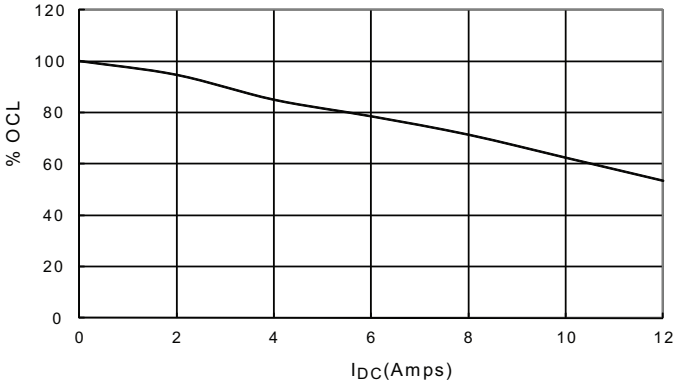
Discontinued, Effective September 15, 2016 or until inventory is depleted. Recommended replacement MPIA40-V1

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

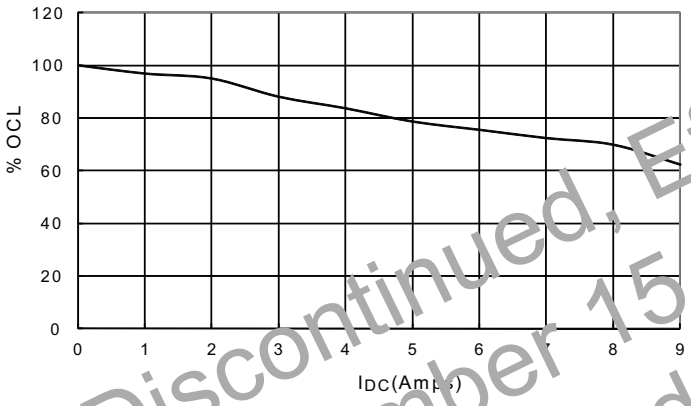
MPIA4040R2-R47-R



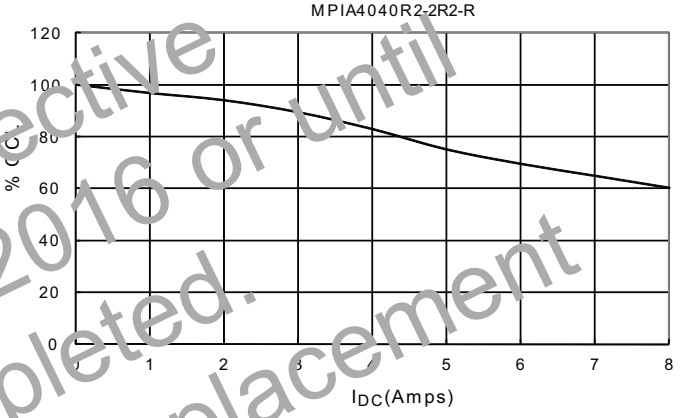
MPIA4040R2-1R0-R



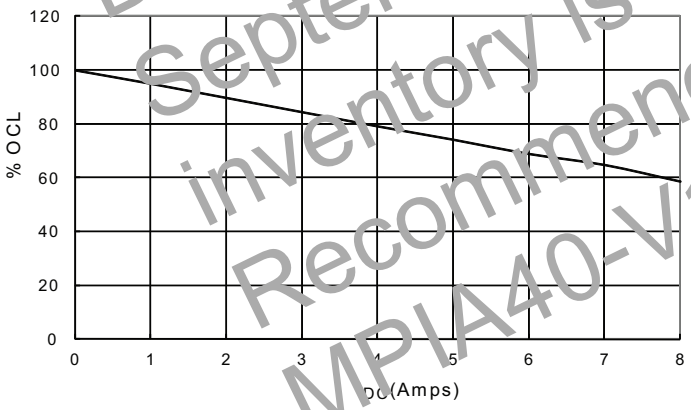
MPIA4040R2-1R5-R



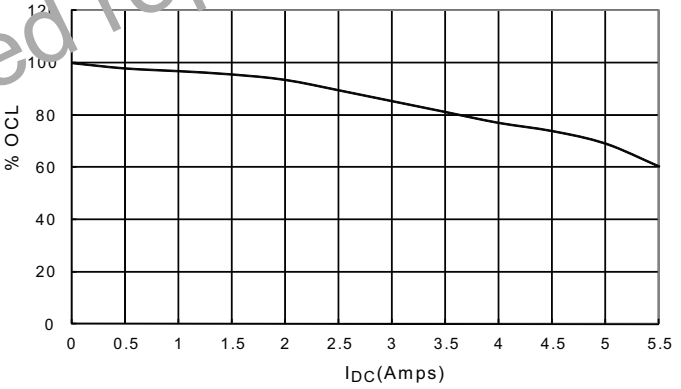
MPIA4040R2-2R2-R



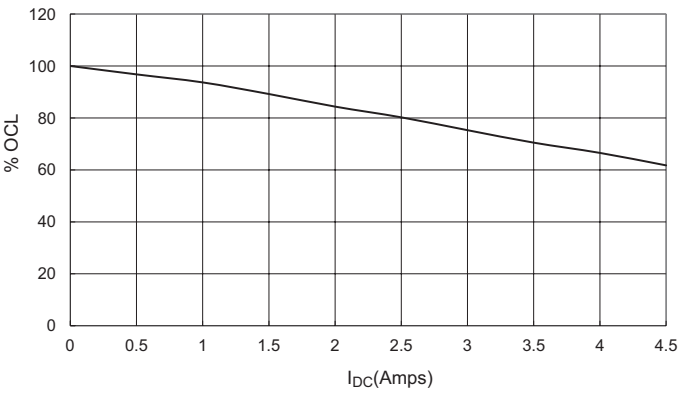
MPIA4040R2-3R3-R



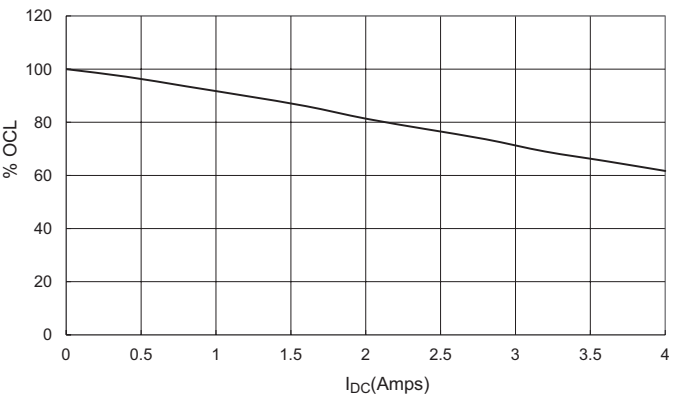
MPIA4040R2-4R7-R



MPIA4040R2-6R8-R



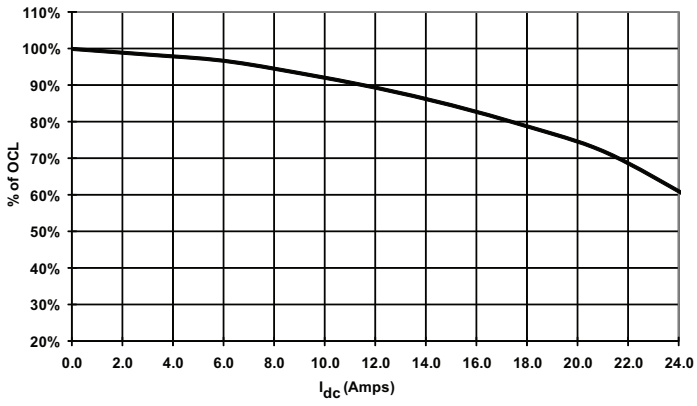
MPIA4040R2-100-R



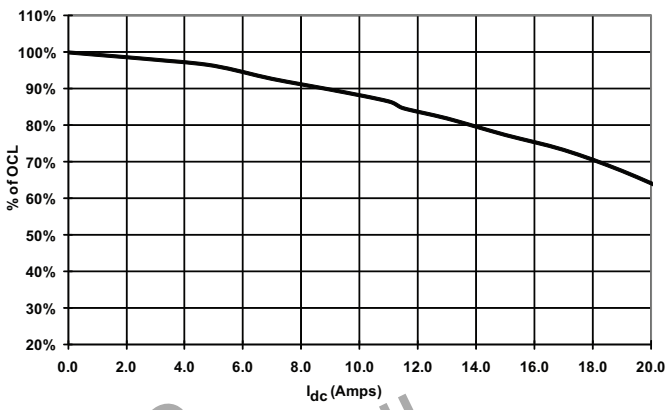
Discontinued, Effective September 15, 2016 or until inventory is depleted. Recommended replacement MPIA40-V1

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

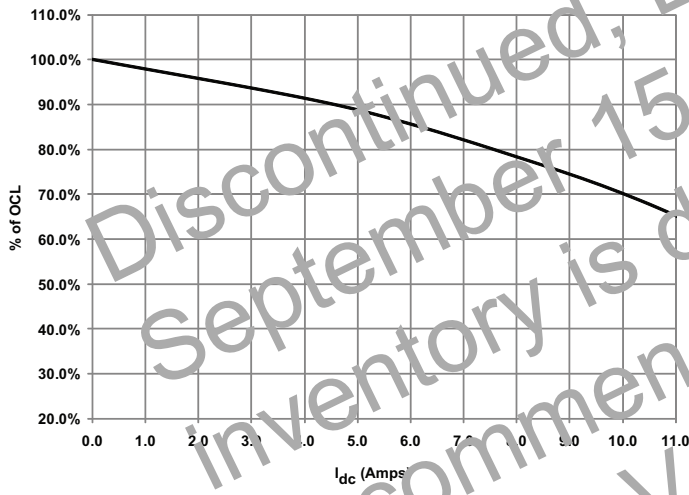
MPIA4040R3-R22-R



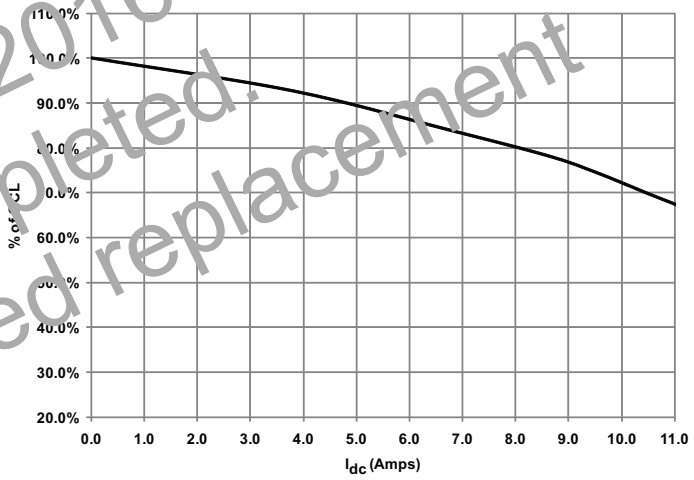
MPIA4040R3-R47-R



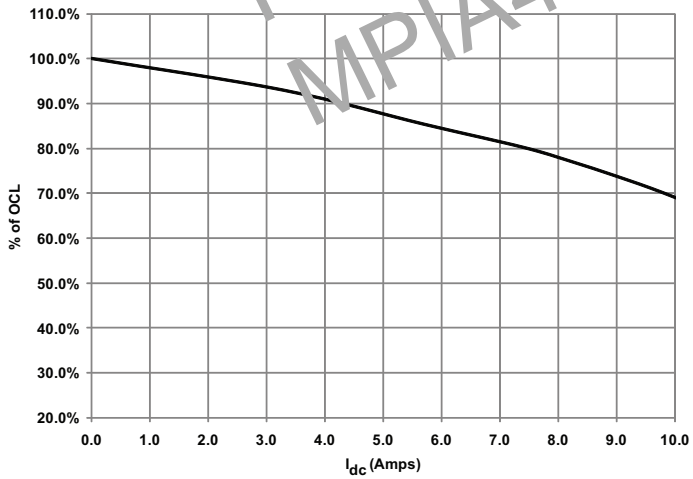
MPIA4040R3-1R2-R



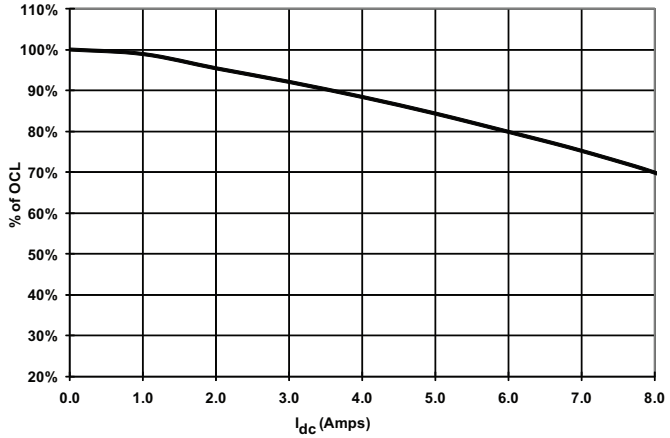
MPIA4040R3-1R5-R



MPIA4040R3-2R2-R

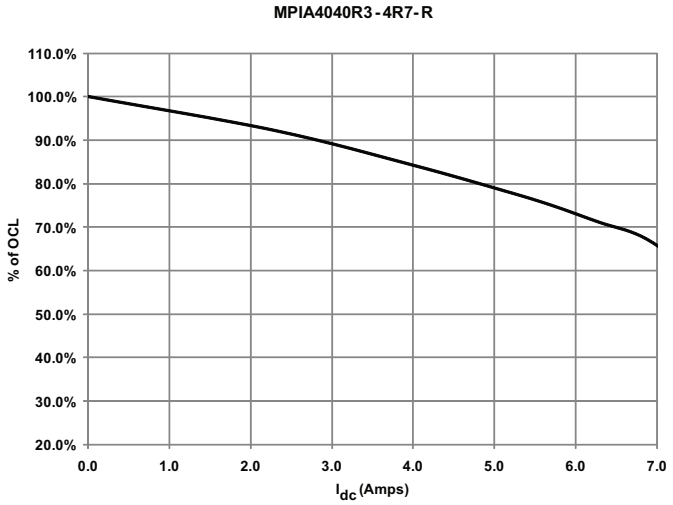


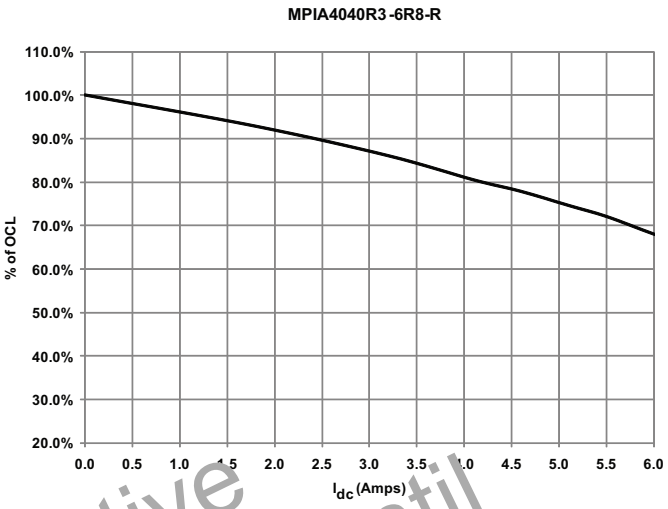
MPIA4040R3-3R3-R

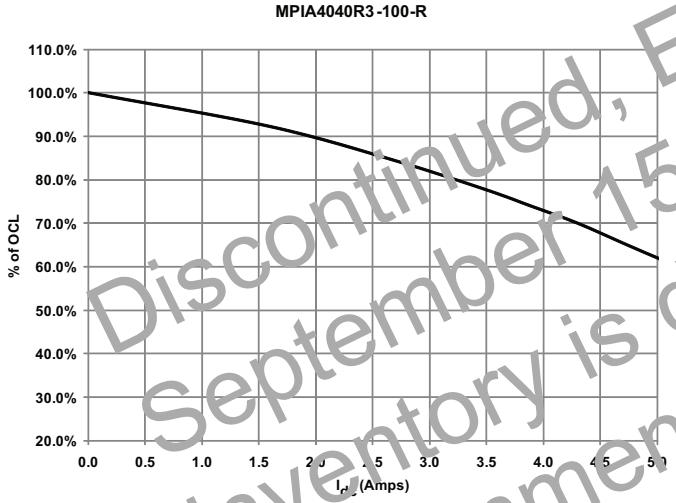


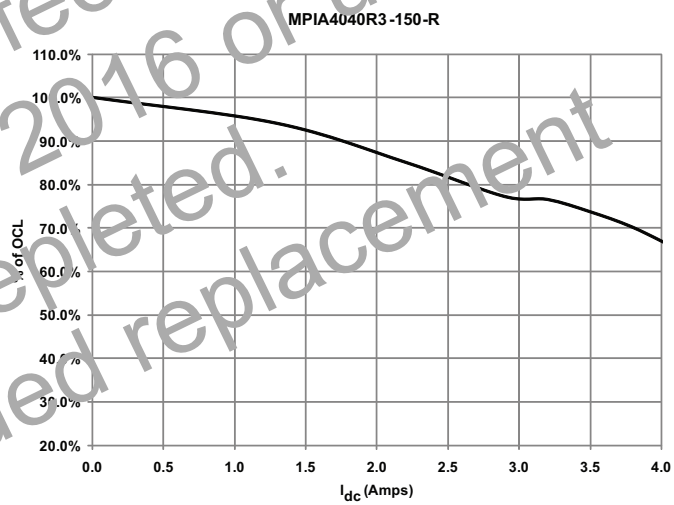
Discontinued, Effective September 15, 2016 or until inventory is depleted. Recommended replacement MPIA40-V1

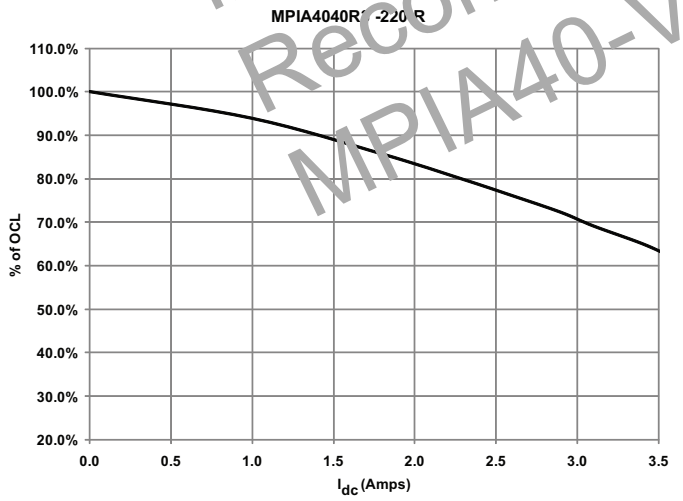
1.85mm Height R3 inductance characteristics — % of OCL vs. I_{DC}







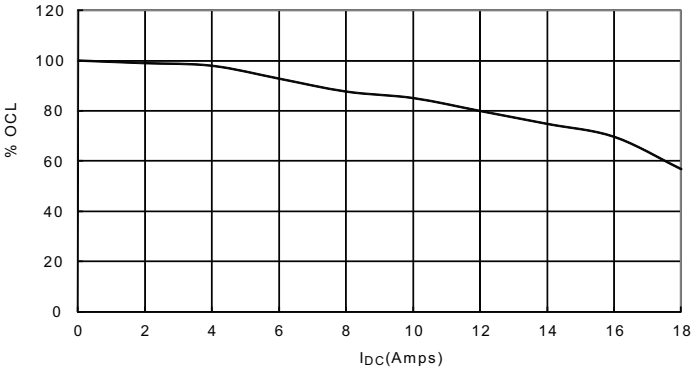




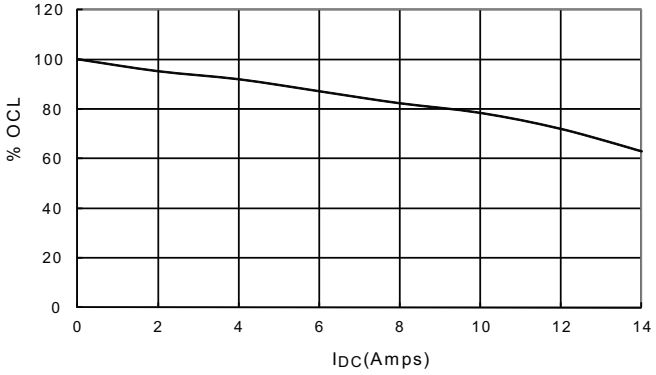
Discontinued, Effective September 15, 2016 or until inventory is depleted. Recommended replacement MPIA40-V1

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

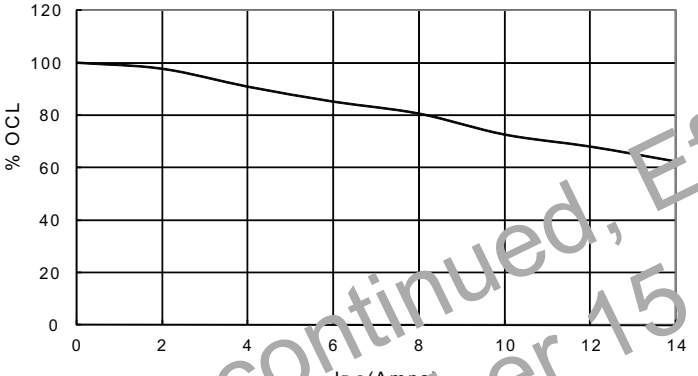
MPIA4040R4-R22-R



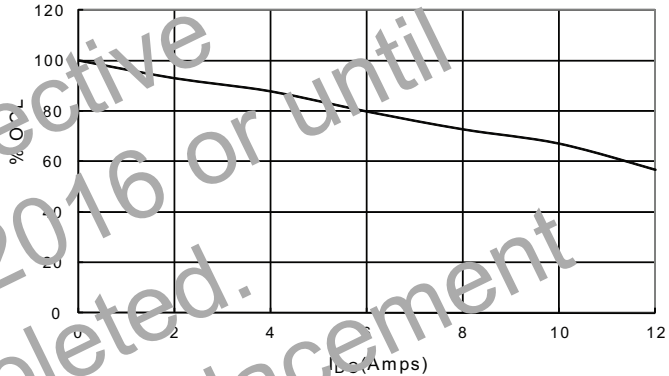
MPIA4040R4-R33-R



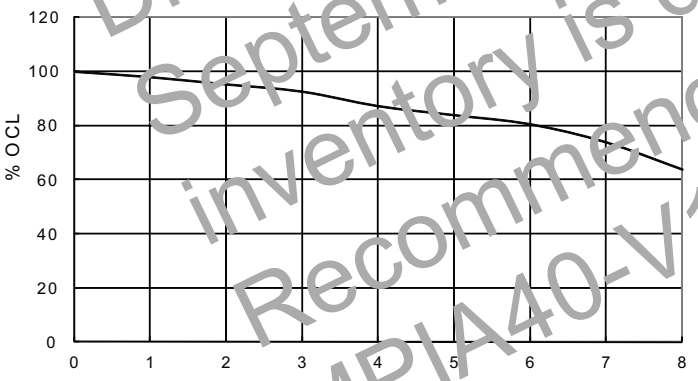
MPIA4040R4-R47-R



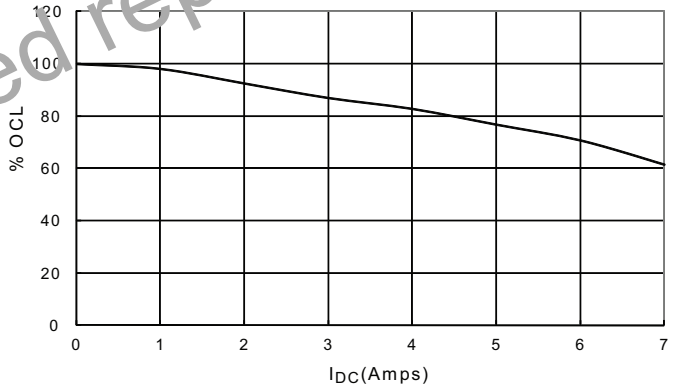
MPIA4040R4-1R0-R



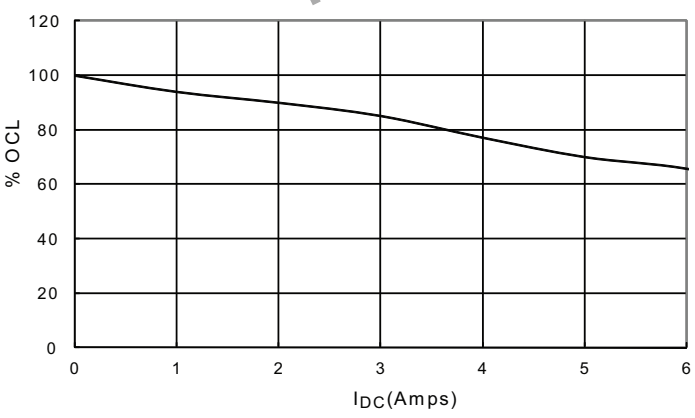
MPIA4040R4-[illegible]



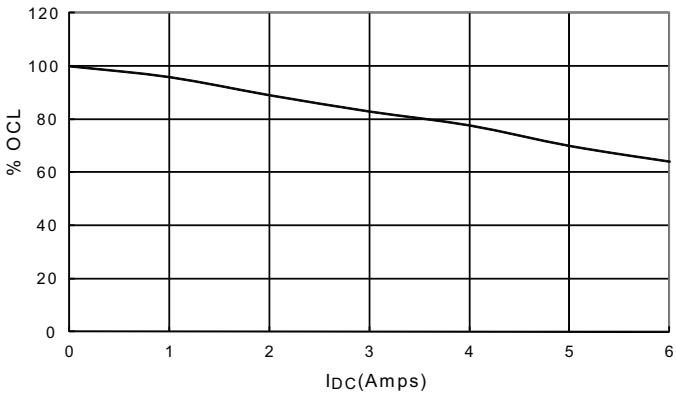
MPIA4040R4-2R2-R



MPIA4040R4-3R3-R



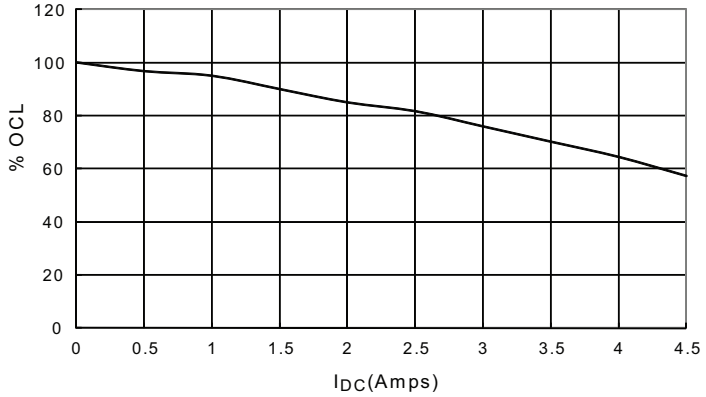
MPIA4040R4-4R7-R



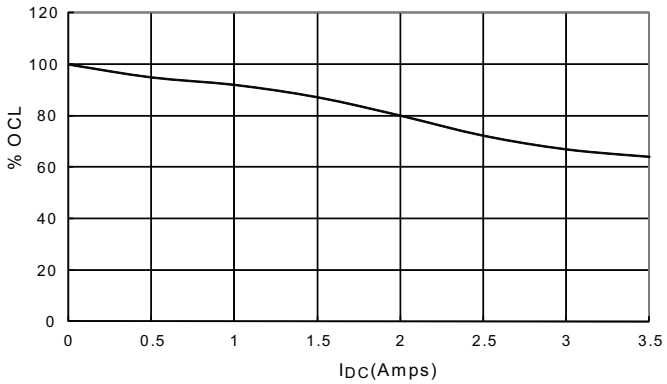
Discontinued, Effective September 15, 2016 or until inventory is depleted. Recommended replacement MPIA40-V1

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

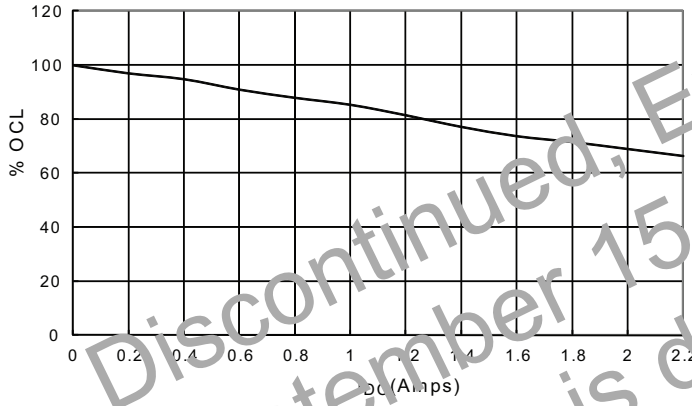
MPIA4040R4-6R8-R



MPIA4040R4-100-R



MPIA4040R4-220-R



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

Solder reflow profile

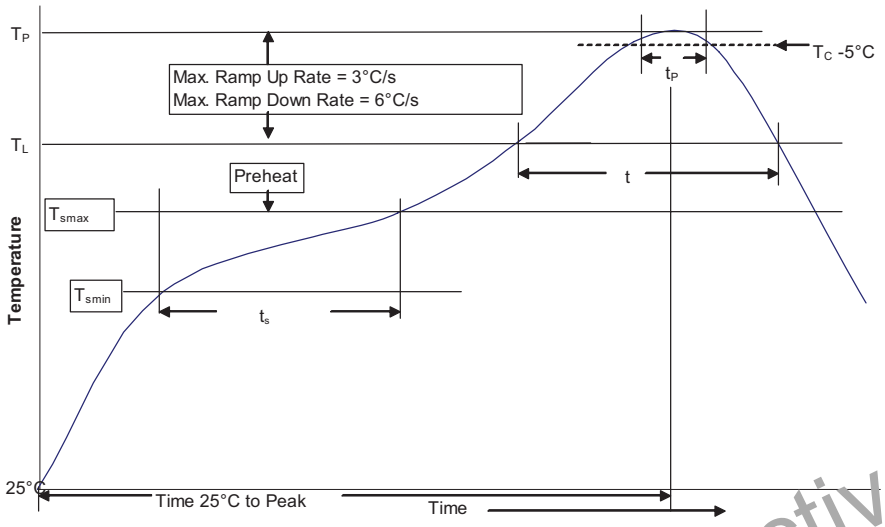


Table 1 - Standard SnPb Solder (T_C)

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)		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.

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

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.