

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: 0kHz to 10MHz
- Inductance range from 0.001μH 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



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	8.50	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††	10.0	H	1.50	3.10	240	271

- 1 Open Circuit Inductance (OCL) Test Parameters: 100kHz, 0.10V_{rms}, 0.0A dc
- 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 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_{sat}: Peak current for approximately 30% rolloff at +25°C.

- 4 K-factor: Used to determine B_{pp} for core loss (see graph). B_{pp} = 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	235	213
MPIA4040R3-220-R ^{††}	22.0	K	1.10	2.20	408	174
R4 -- 2.1mm 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	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 ^{††}	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

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

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

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

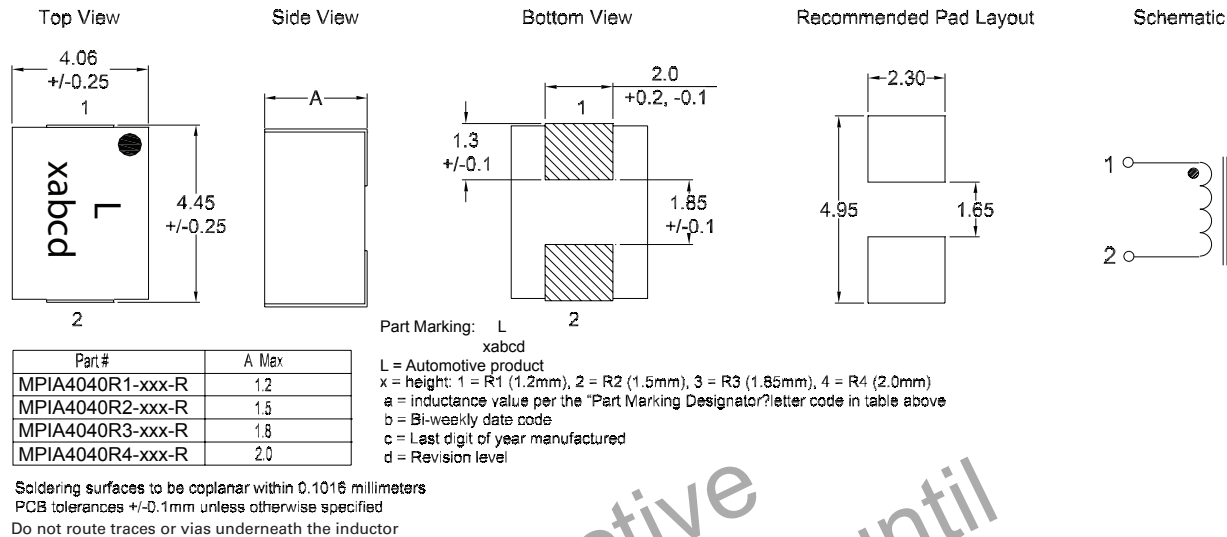
5 Part Number Definition: MPIA4040RX-XXX-R

- 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

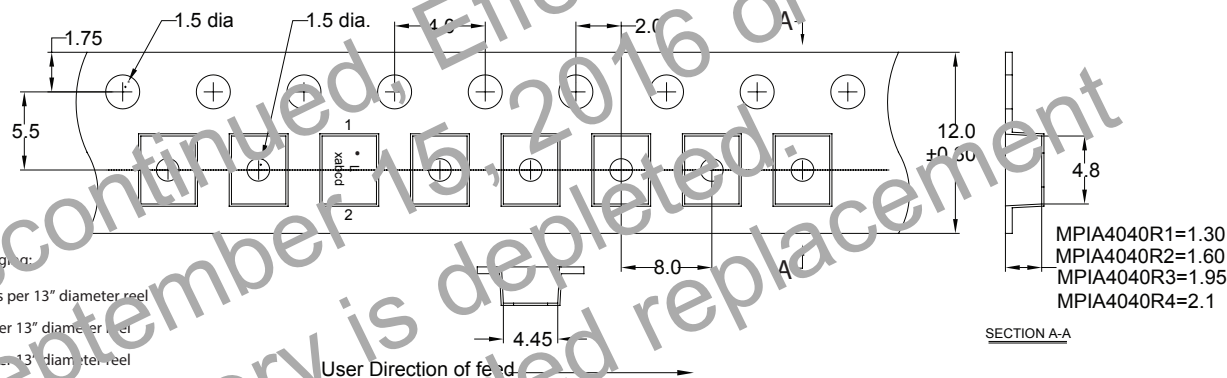
† Transient pulse not to exceed 1 millisecond.

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

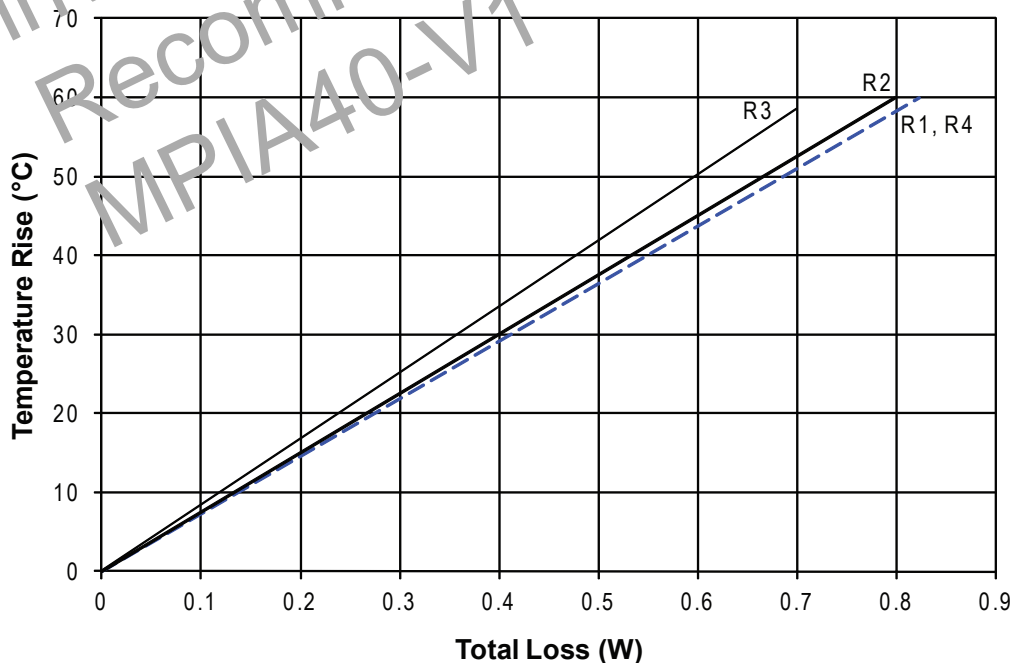
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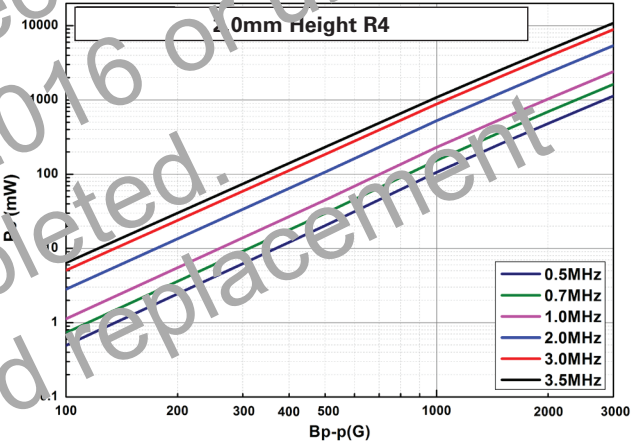
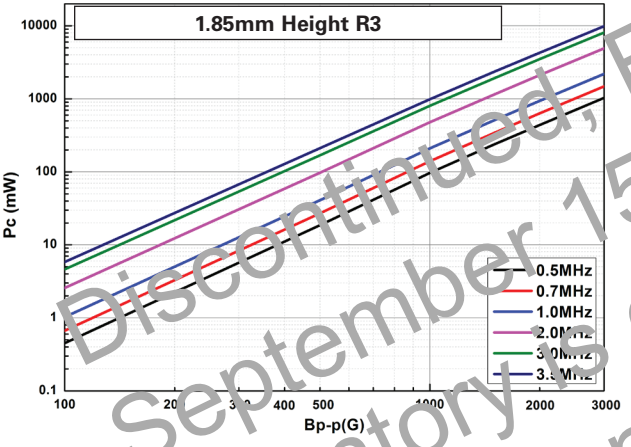
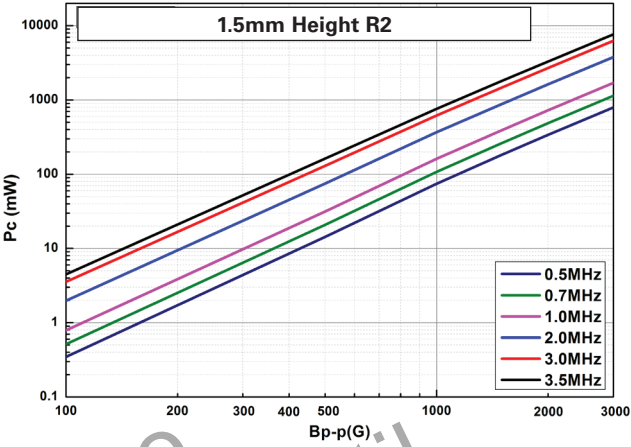
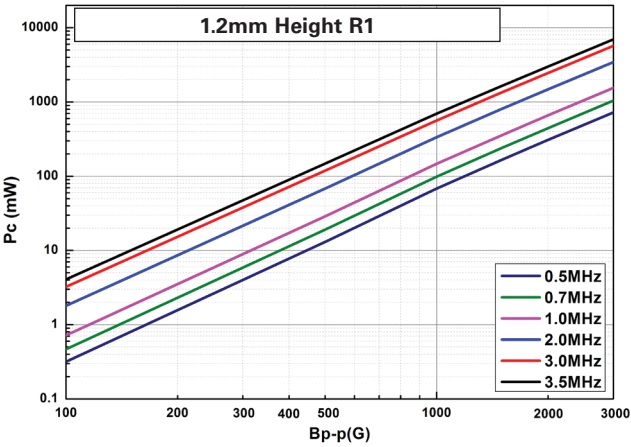
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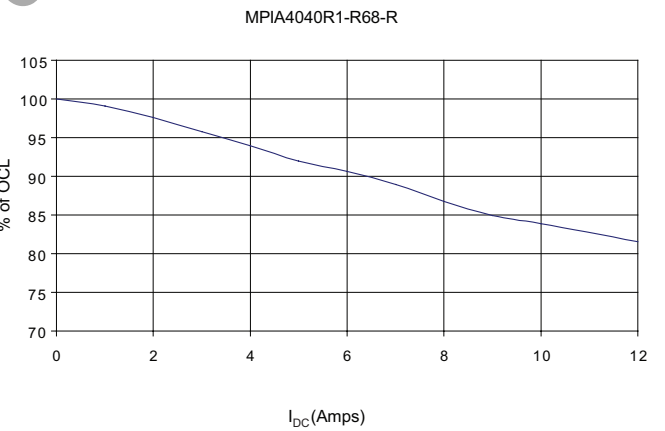
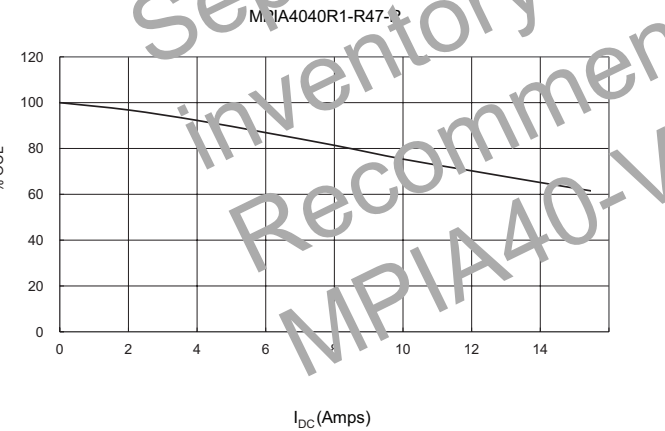
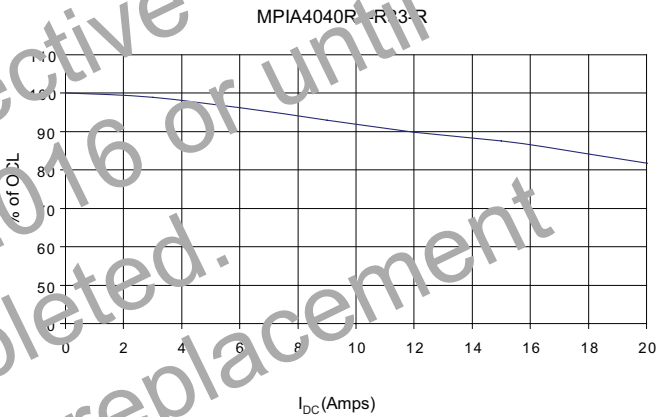
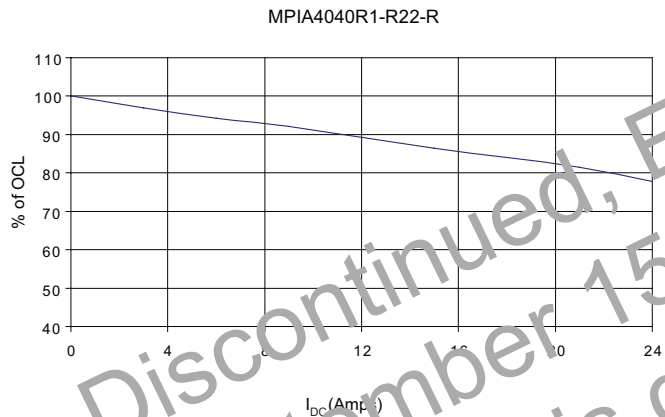
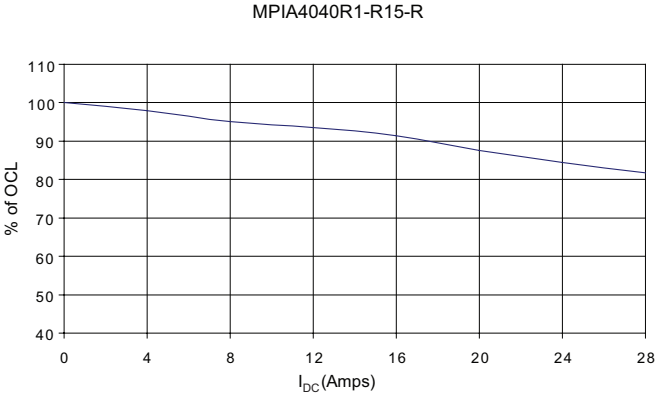
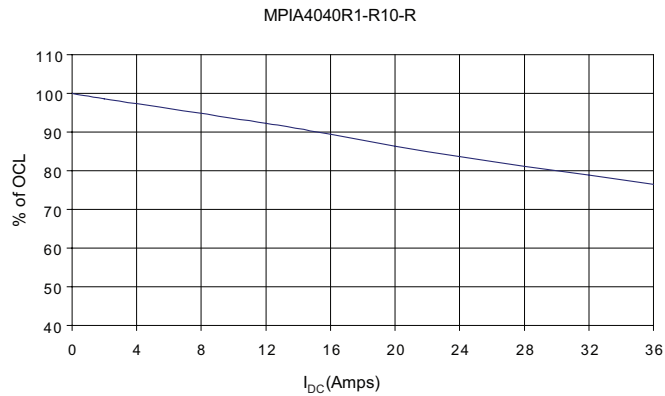
Temperature rise vs. total loss



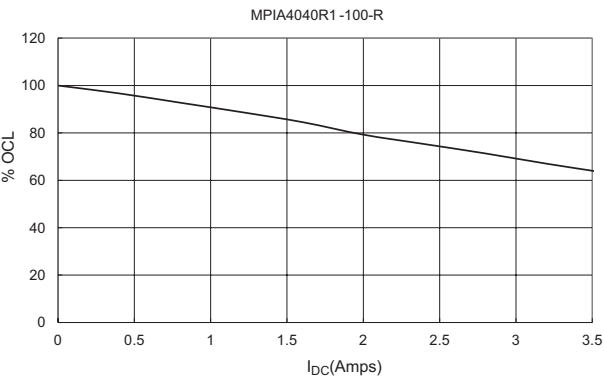
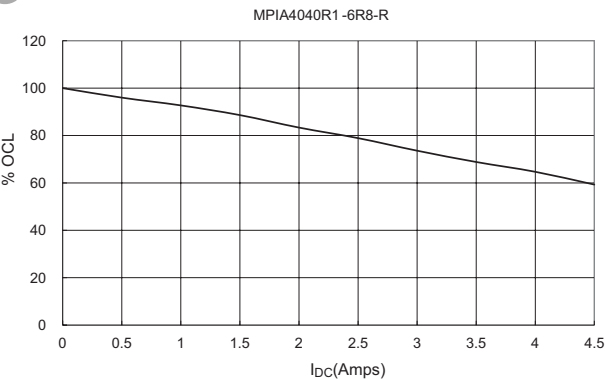
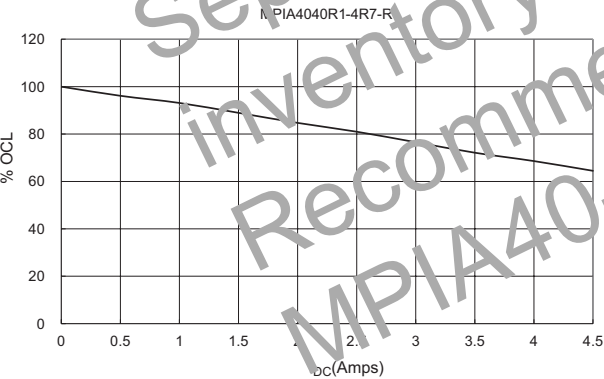
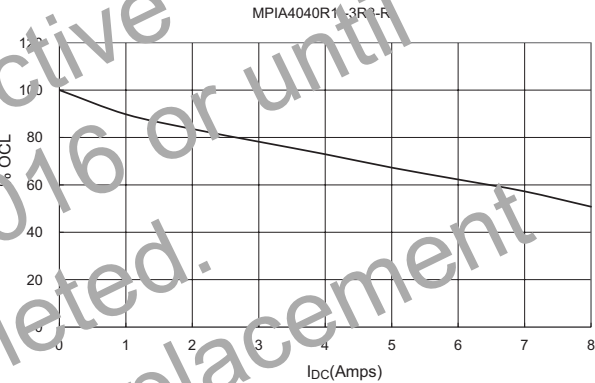
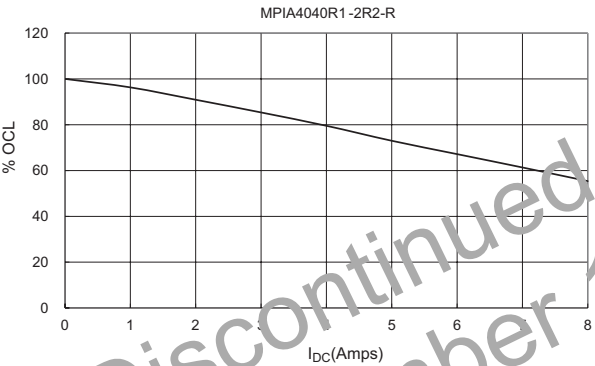
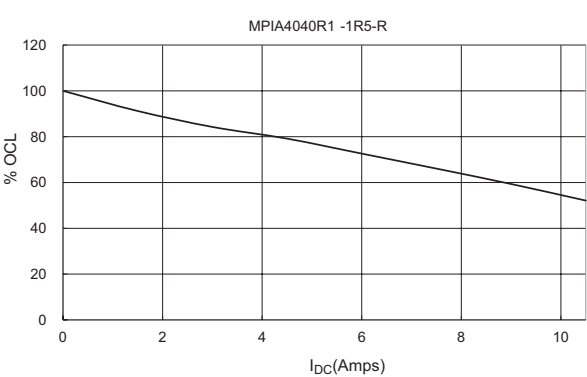
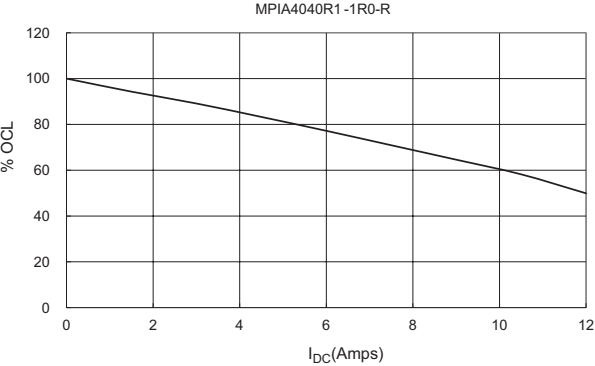
Core loss



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

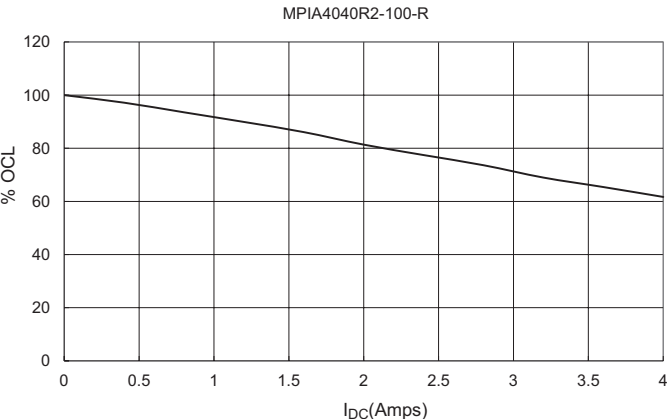
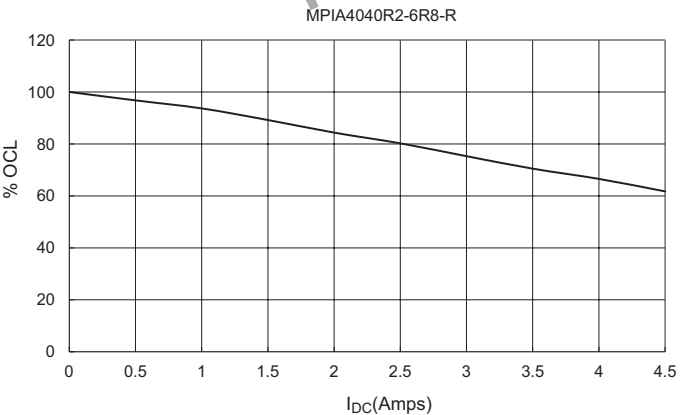
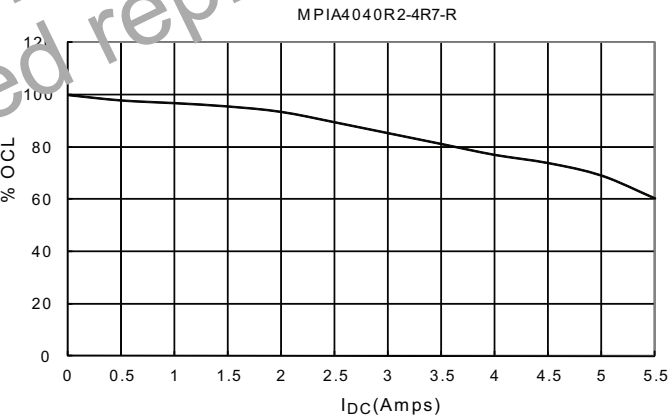
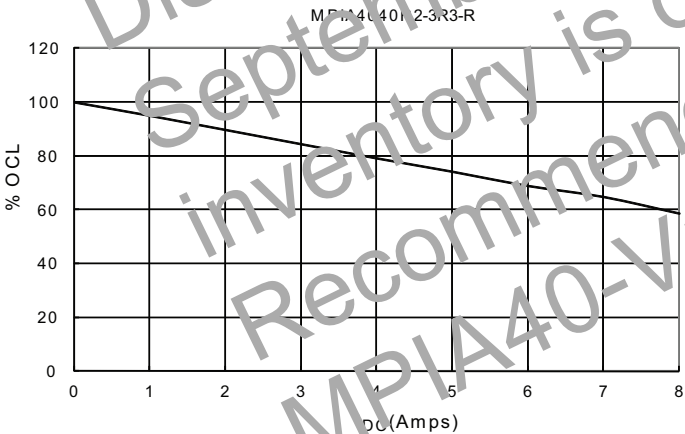
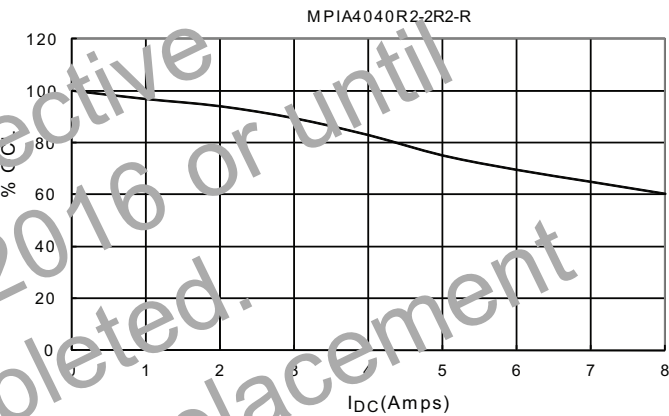
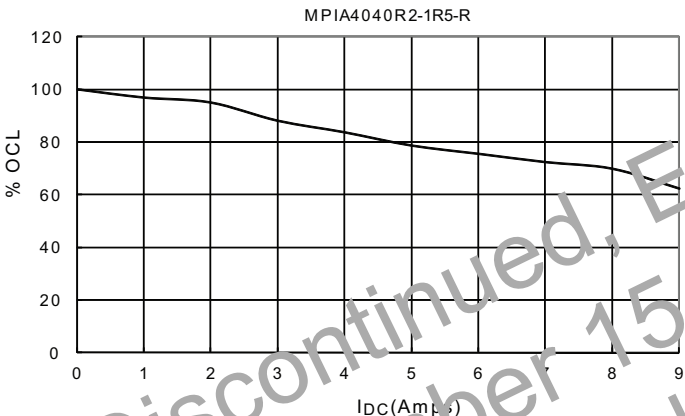
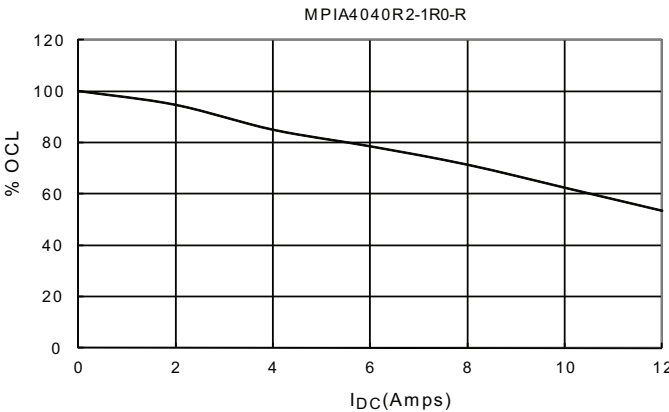
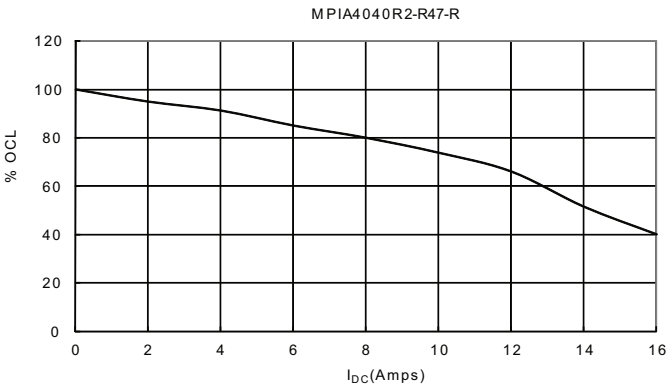


1.2mm Height R1 inductance characteristics — % of OCL vs. I_{DC}

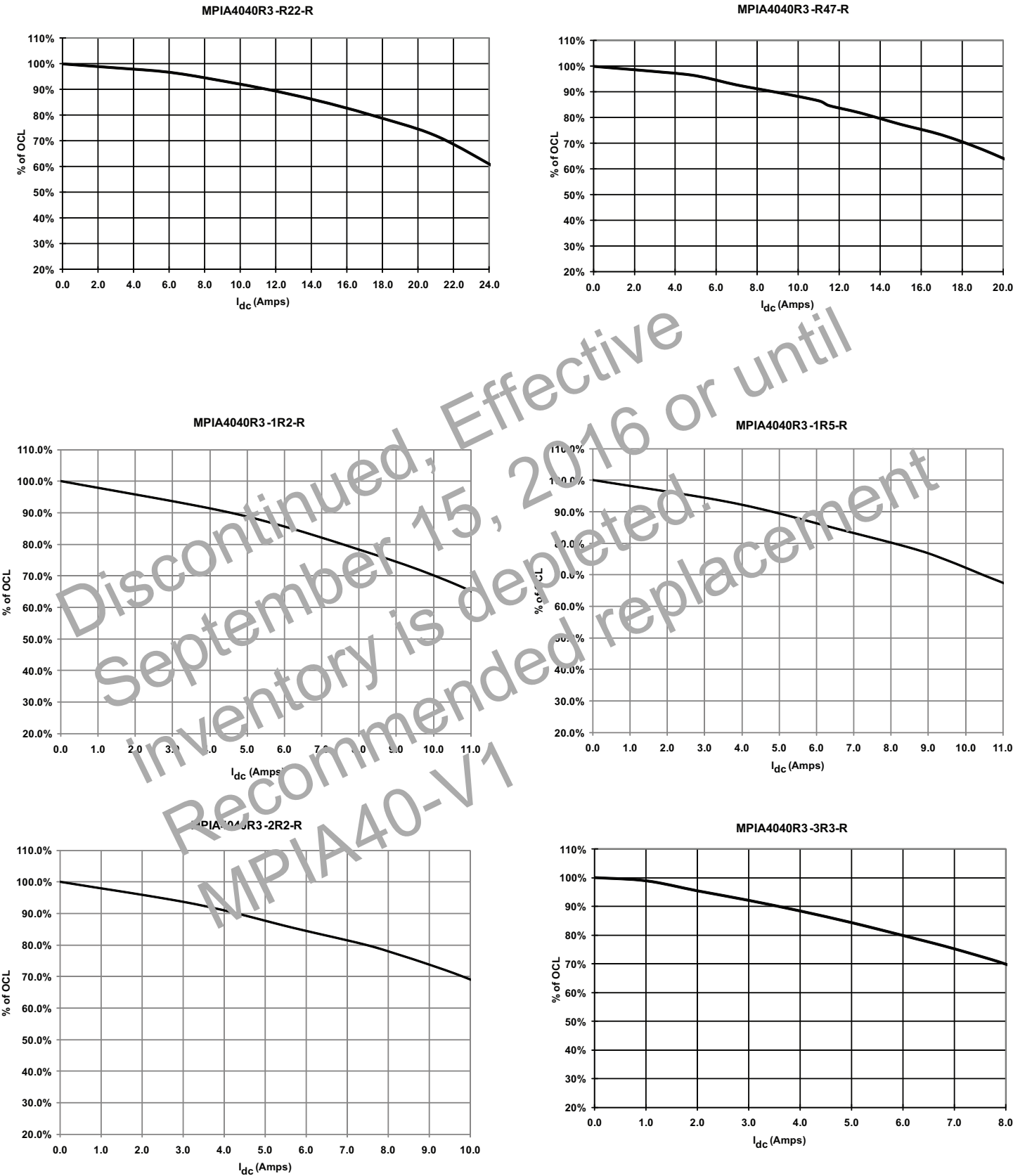


Discontinued, Effective
September 15, 2016 or until
inventory is depleted.
Recommended replacement
MPIA40-V1

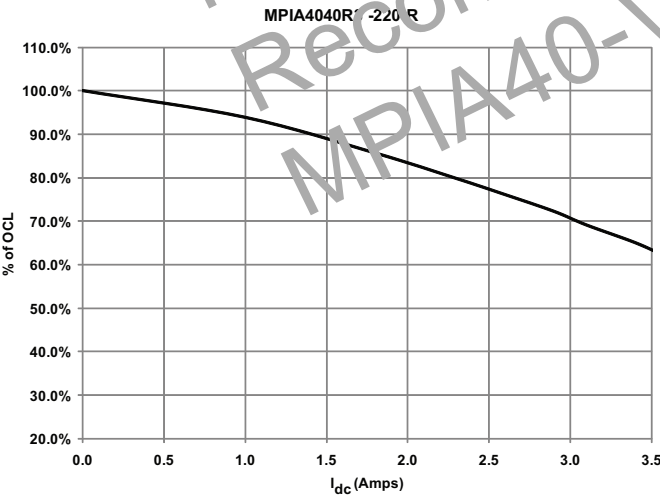
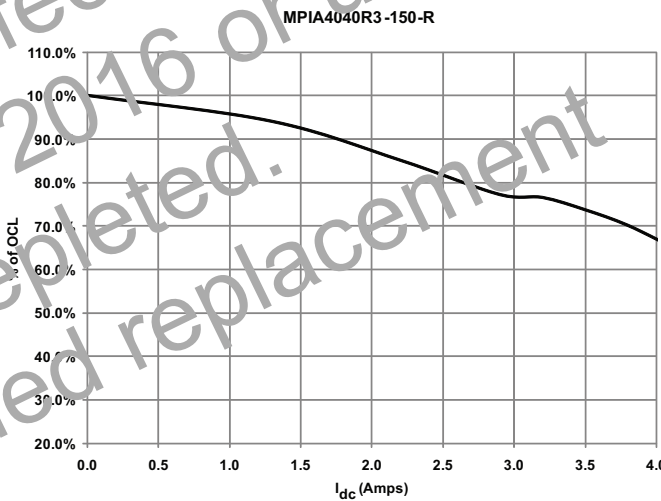
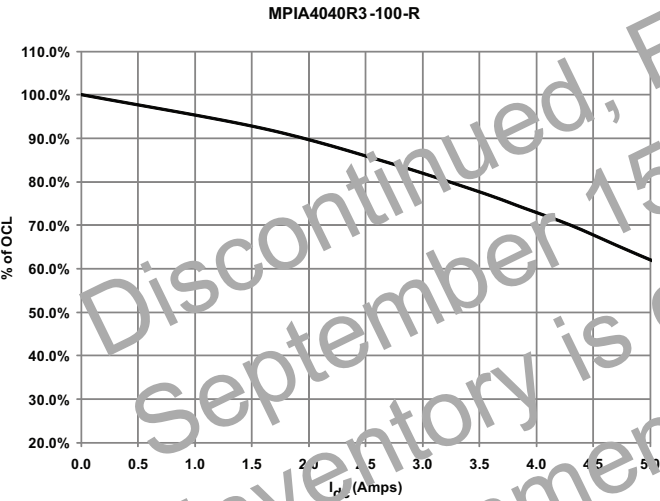
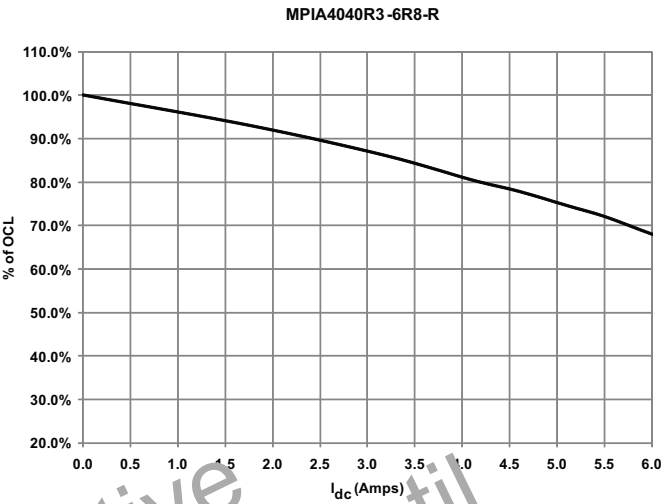
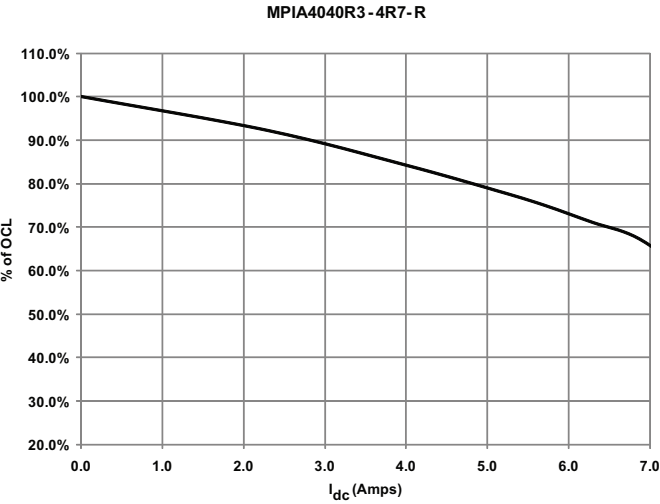
1.5mm Height R2 inductance characteristics — % of OCL vs. I_{DC}



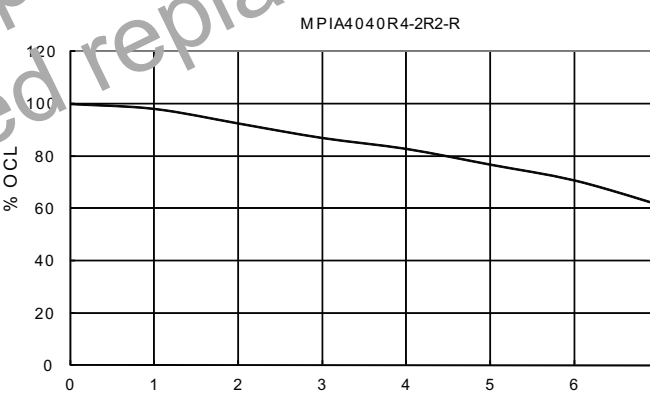
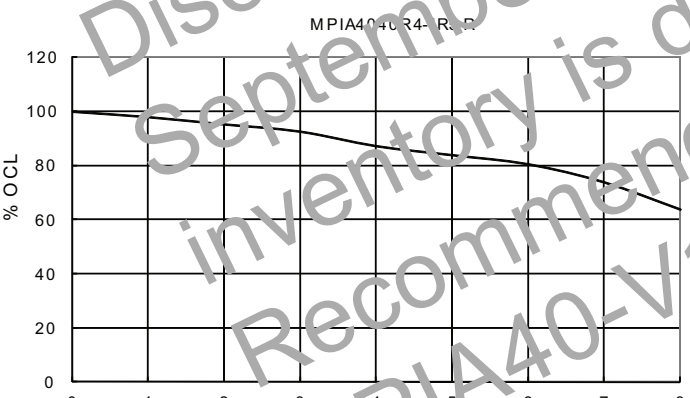
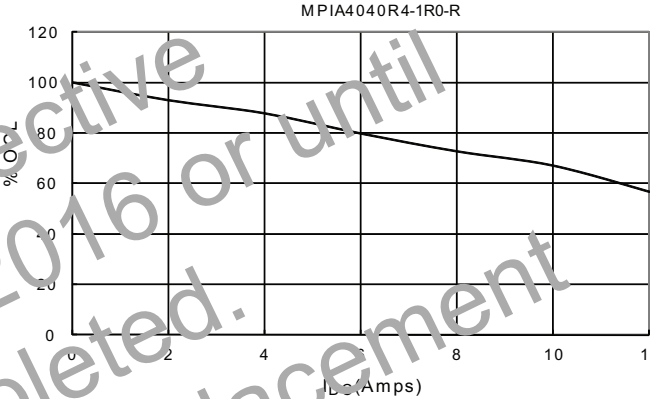
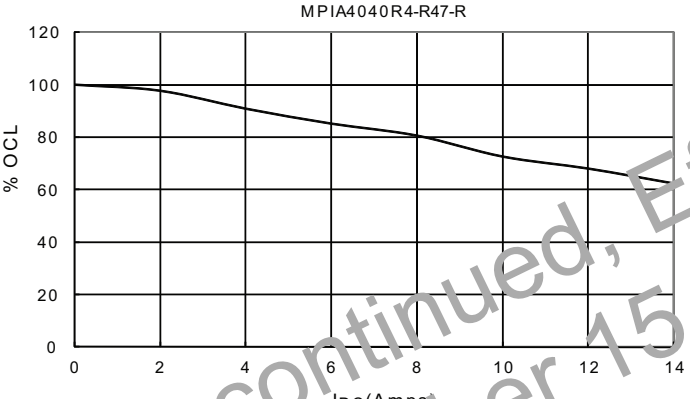
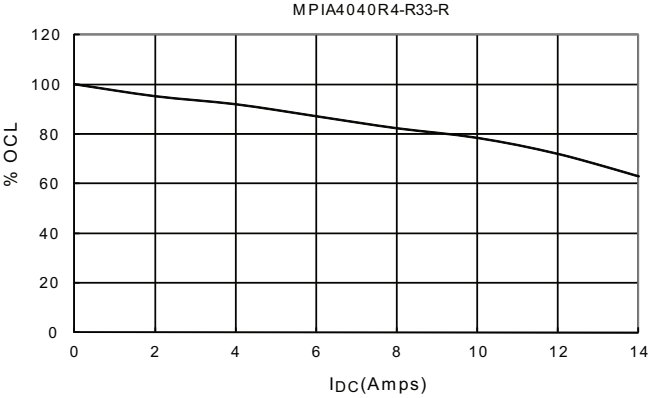
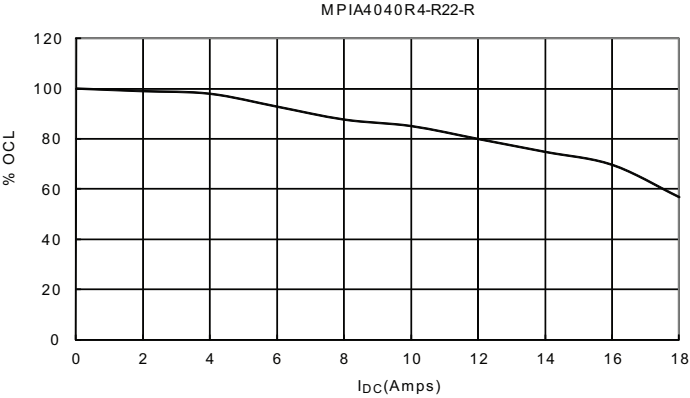
1.85mm Height R3 inductance characteristics — % of OCL vs. I_{dc}



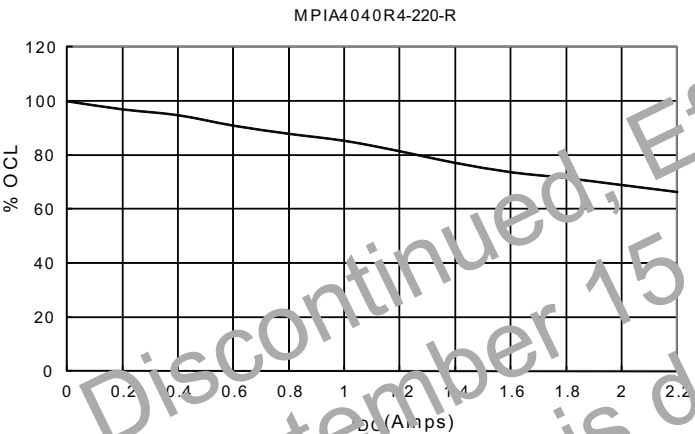
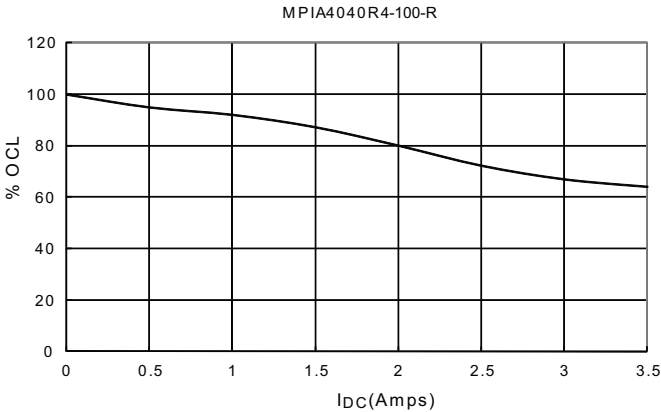
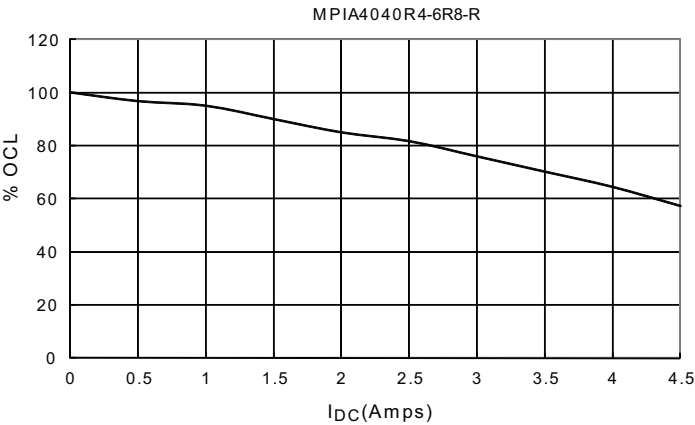
1.85mm Height R3 inductance characteristics — % of OCL vs. I_{DC}



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



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

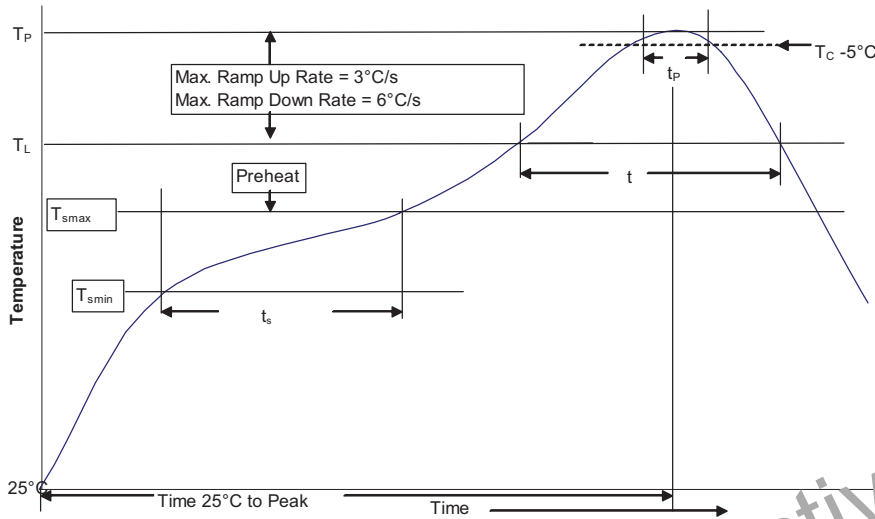


Table 1 - Standard SnPb Solder (T_c)

Package Thickness	Volume mm^3 <350	Volume mm^3 ≥ 350
<2.5mm	235°C	220°C
$\geq 2.5\text{mm}$	220°C	220°C

Table 2 - Lead (Pb) Free Solder (T_c)

Package Thickness	Volume mm^3 <350	Volume mm^3 350 - 2000	Volume mm^3 >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 JEDEC 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.

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Eaton:

<u>MPIA4040R4-100-R</u>	<u>MPIA4040R3-4R7-R</u>	<u>MPIA4040R1-3R3-R</u>	<u>MPIA4040R1-R10-R</u>	<u>MPIA4040R1-R15-R</u>
<u>MPIA4040R4-R22-R</u>	<u>MPIA4040R4-1R0-R</u>	<u>MPIA4040R2-3R3-R</u>	<u>MPIA4040R1-1R5-R</u>	<u>MPIA4040R3-R47-R</u>
<u>MPIA4040R3-1R2-R</u>	<u>MPIA4040R4-4R7-R</u>	<u>MPIA4040R4-R33-R</u>	<u>MPIA4040R2-2R2-R</u>	<u>MPIA4040R4-1R5-R</u>
<u>MPIA4040R1-R47-R</u>	<u>MPIA4040R4-2R2-R</u>	<u>MPIA4040R1-R22-R</u>	<u>MPIA4040R3-100-R</u>	<u>MPIA4040R2-4R7-R</u>
<u>MPIA4040R1-R33-R</u>	<u>MPIA4040R2-R47-R</u>	<u>MPIA4040R3-2R2-R</u>	<u>MPIA4040R2-100-R</u>	<u>MPIA4040R2-1R5-R</u>
<u>MPIA4040R4-220-R</u>	<u>MPIA4040R1-2R2-R</u>	<u>MPIA4040R3-220-R</u>	<u>MPIA4040R1-1R0-R</u>	<u>MPIA4040R3-1R5-R</u>
<u>MPIA4040R1-4R7-R</u>	<u>MPIA4040R2-1R0-R</u>	<u>MPIA4040R1-R68-R</u>	<u>MPIA4040R3-150-R</u>	<u>MPIA4040R3-R22-R</u>
<u>MPIA4040R4-3R3-R</u>				