

# MPIA40V3

## Automotive grade high current, low profile, miniature power inductors



Photo is representative

### Product features

- AEC-Q200
- High current carrying capacity
- Magnetically shielded, low EMI
- Filtering applications up to Self resonant frequency (SRF) [See product specification table]
- Inductance range from 0.10  $\mu$ H to 22  $\mu$ H
- Current range from 1.43 A to 22 A
- 4.75 mm x 4.45 mm footprint surface mount package in a 2.0 mm height
- Alloy powder core material
- Moisture sensitivity level (MSL): 1

### Applications

- Body electronics
  - Central body control module
  - Vehicle access control system
  - Headlamps, tail lamps and interior lighting and LED lighting
  - Doors, window lift and seat control
- Advanced driver assistance systems
  - 77 GHz radar system
  - Basic and smart surround, and rear and front-view camera
  - Adaptive cruise control (ACC)
  - Automatic parking control
  - Collision avoidance system/ 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 compliance and general specifications

- Storage temperature (component): -55 °C to +125 °C
- Operating temperature range: -55 °C to +125 °C (ambient plus self-temperature rise)



Powering Business Worldwide

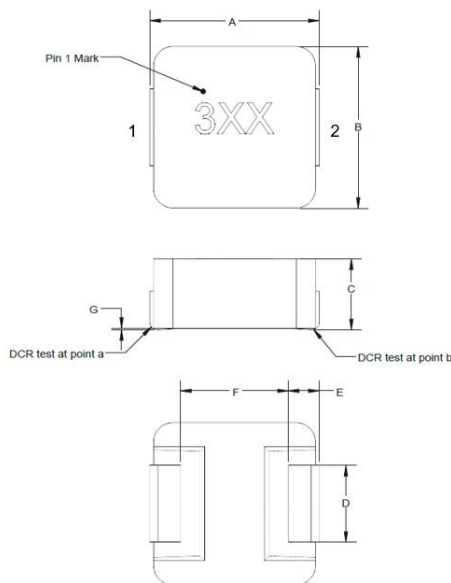
**Product specifications**

Part number <sup>6</sup>	Part marking designator	OCL <sup>1</sup> (μH) ±20%	FLL <sup>2</sup> (μH) minimum	I <sub>rms</sub> <sup>3</sup> (A)	I <sub>sat</sub> <sup>4</sup> (A)	DCR (mΩ) typical @ +20 °C	DCR (mΩ) maximum @ +20 °C	SRF (MHz) typical	K-factor <sup>5</sup>
MPIA4020V3-R10-R	A	0.10	0.056	16	22	3.5	4.5	330	3107
MPIA4020V3-R22-R	B	0.22	0.123	13	17	5.5	6.6	190	1986
MPIA4020V3-R33-R	C	0.33	0.185	9.5	12	7.5	9.0	135	2025
MPIA4020V3-R47-R	D	0.47	0.263	8.5	11	10.5	13	117	1661
MPIA4020V3-R56-R	E	0.56	0.314	8.0	10	12.0	15	113	1893
MPIA4020V3-R68-R	F	0.68	0.381	7.5	9.0	12.5	16	90	1790
MPIA4020V3-1R0-R	G	1.0	0.56	6.5	7.0	20	24	70	1750
MPIA4020V3-1R2-R	H	1.2	0.67	6.5	6.8	23	28	65	1556
MPIA4020V3-1R5-R	I	1.5	0.84	5.0	6.0	25	30	52	1306
MPIA4020V3-2R2-R	J	2.2	1.23	3.8	5.5	40	48	50	1193
MPIA4020V3-3R3-R	K	3.3	1.85	3.3	4.0	71	85	37	763
MPIA4020V3-4R7-R	L	4.7	2.63	2.7	3.2	98	118	28	859
MPIA4020V3-6R8-R	M	6.8	3.8	2.0	2.6	167	192	25	692
MPIA4020V3-100-R	N	10	5.6	1.7	2.2	245	281	22	352
MPIA4020V3-150-R	O	15	8.4	1.5	1.8	320	384	18	484
MPIA4020V3-220-R	P	22	12.3	1.43	1.65	350	402	12	525

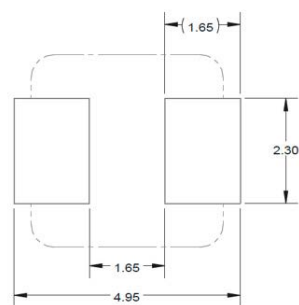
- Open circuit inductance (OCL) test parameters: 100 kHz, 1.0 Vrms, 0.0 Adc, +25 °C
- Full load inductance (FLL) test parameters: 100 kHz, 1.0 Vrms, Isat, , +25 °C
- Irms: DC current for an approximate temperature rise of 40 °C without core loss. Derating is necessary for AC currents. PCB layout, trace 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.

- Isat: Peak current for approximately 30% rolloff @ +25 °C
- 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).
- Part Number Definition: MPIA40xxV3-xxx-R  
MPIA40= Product code  
xx= Height indicator  
V3=Version indicator  
xxx= Inductance value in μH, R= decimal point, if no R is present last digit indicates number of zeros  
-R = RoHS compliant

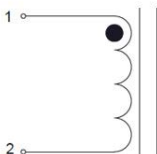
**Dimensions- (mm)**



**Recommended pad layout**



**Schematic**



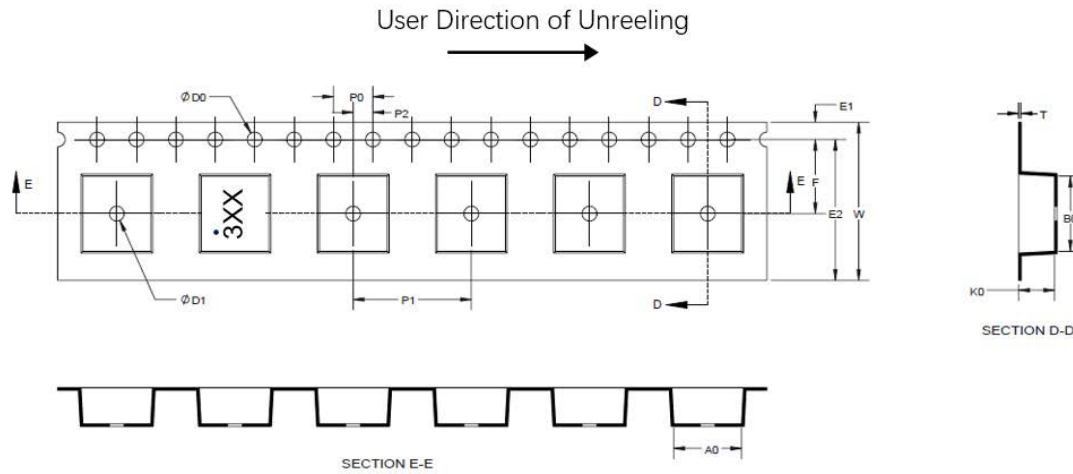
Part marking: Pin 1 indicator dot, 3XX, 3= V3 version, first X= inductance value per "Part marking designator" listed in Product specification table, second X = bi-weekly date code  
All soldering surfaces to be coplanar within 0.1 millimeters  
Tolerances are ±0.15 millimeters unless stated otherwise  
DCR measured from point "a" to point "b"  
Traces or vias underneath the inductor is not recommended

Part number	A	B	C	D	E	F	G
MPIA4020V3-R	4.40 ±0.35	4.20 ±0.25	1.80 ±0.20	2.0 ±0.20	0.8 ±0.30	2.8 Typ.	0 to 0.15

**Packaging information (mm)**

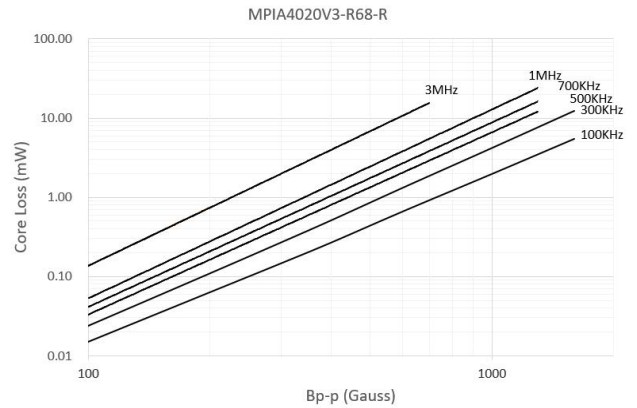
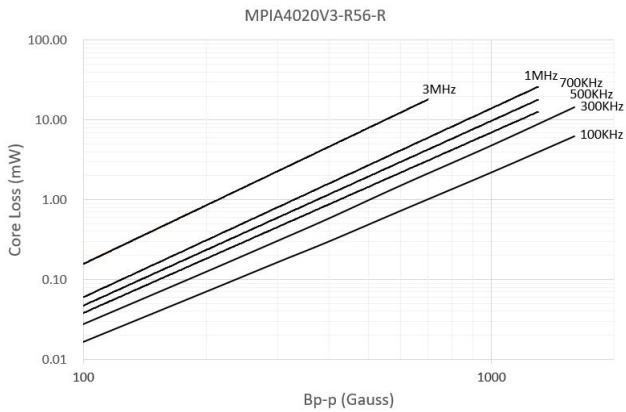
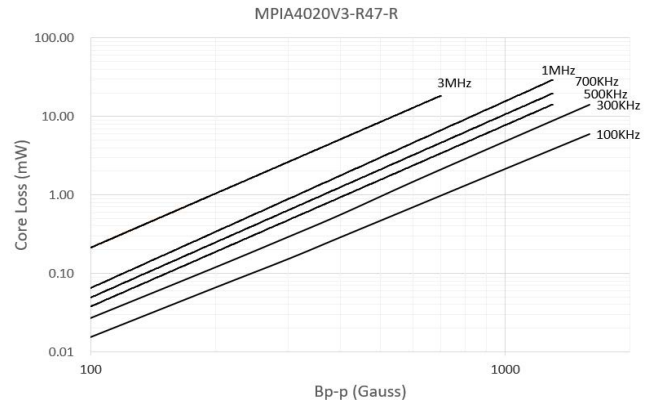
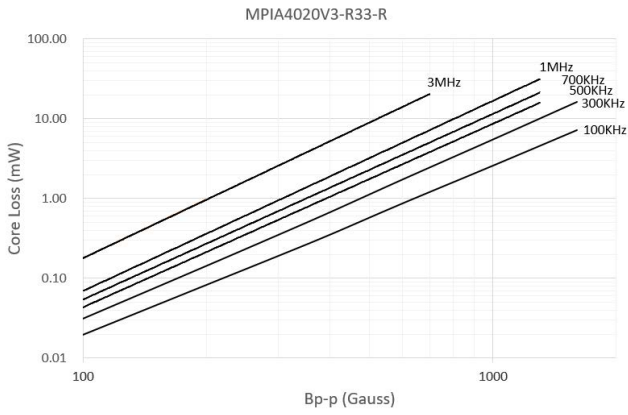
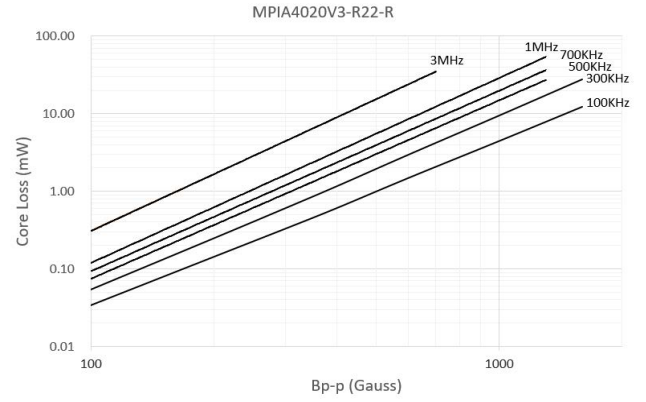
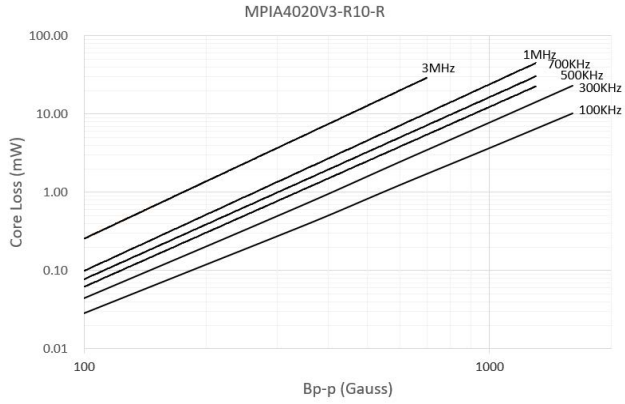
Drawing not to scale

Supplied in tape and reel packaging, 3000 parts per 13" diameter reel

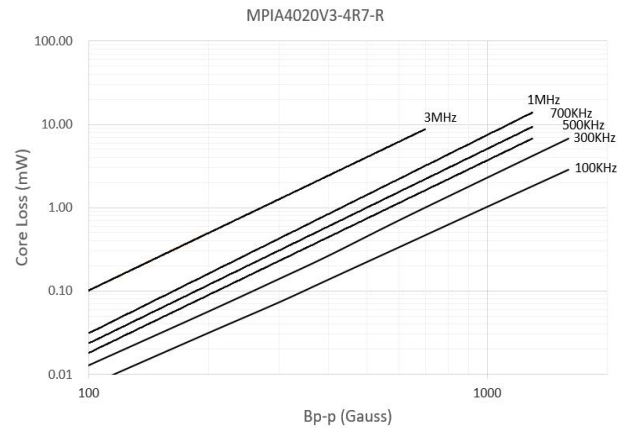
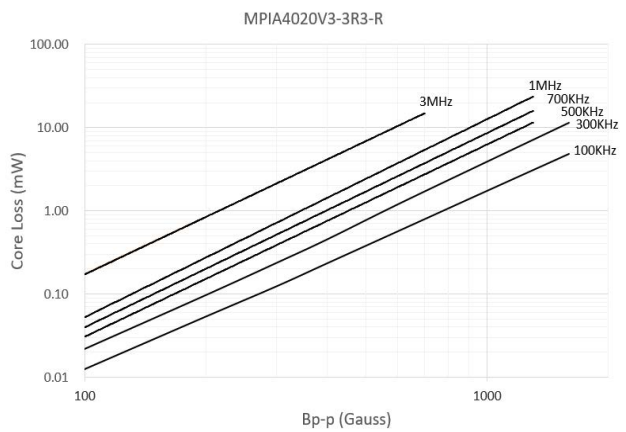
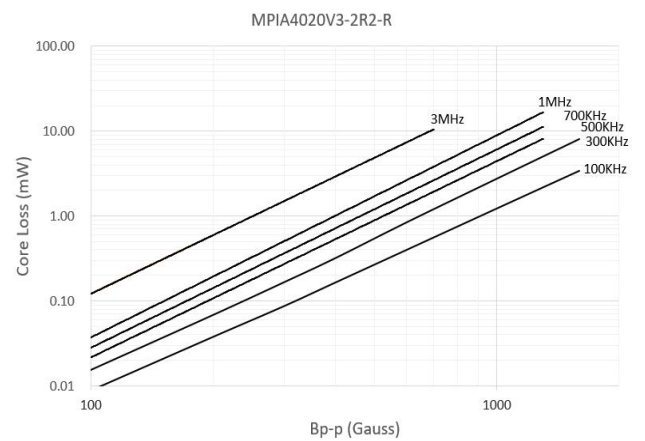
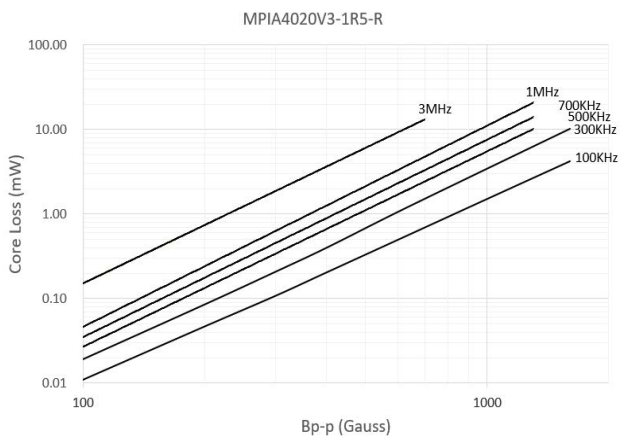
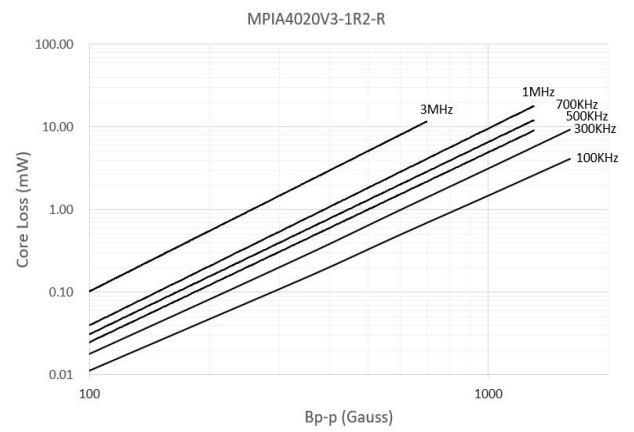
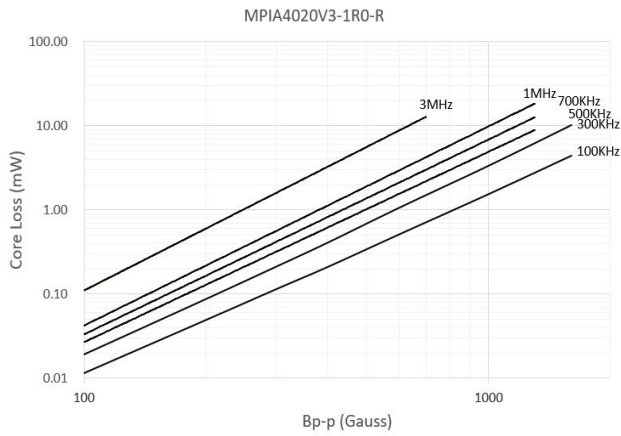


Dimension	Value
$W \pm 0.30$	12.0
$F \pm 0.10$	5.5
$E1 \pm 0.10$	1.75
$E2 \text{ Min}$	10.25
$P0 \pm 0.10$	4.0
$P1 \pm 0.10$	8.0
$P2 \pm 0.05$	2.0
$D0 +0.10/-0$	1.5
$D1 +0.10/-0$	1.5
$A0$	$4.5 \pm 0.10$
$B0$	$4.8 \pm 0.10$
$K0$	$2.5 \pm 0.15$
$T$	$0.35 \pm 0.05$

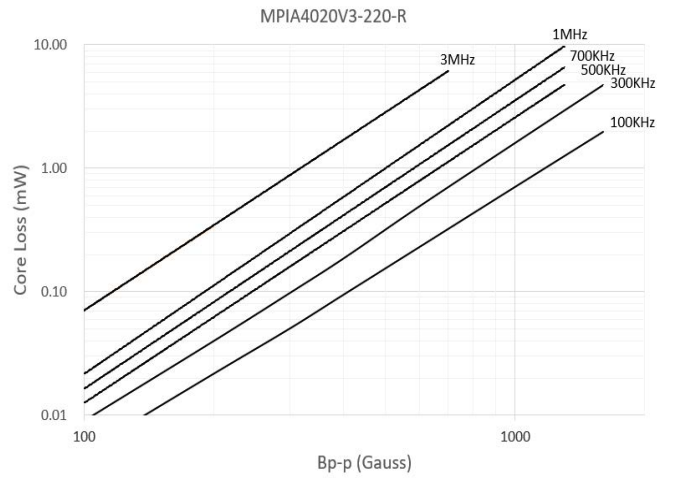
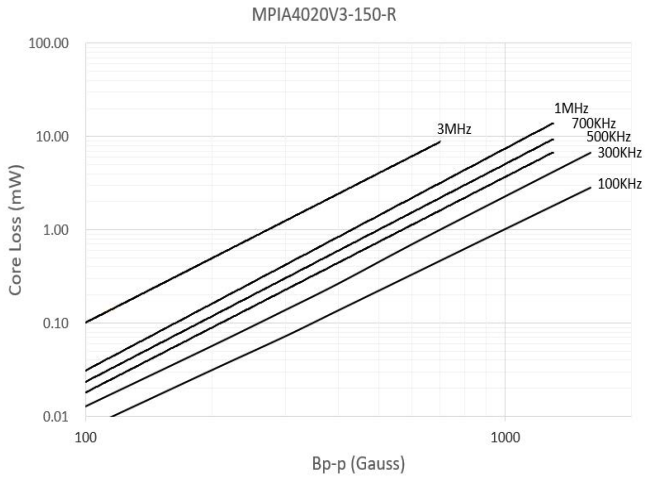
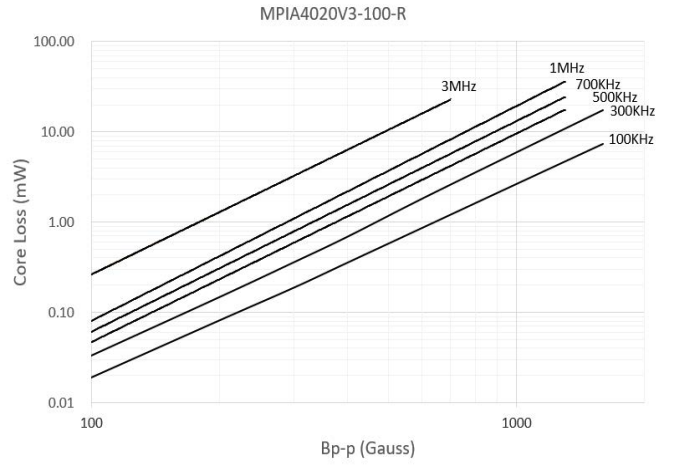
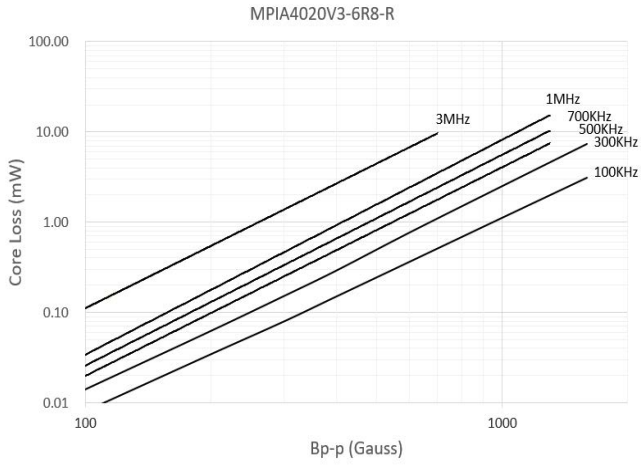
Core loss vs. Bp-p



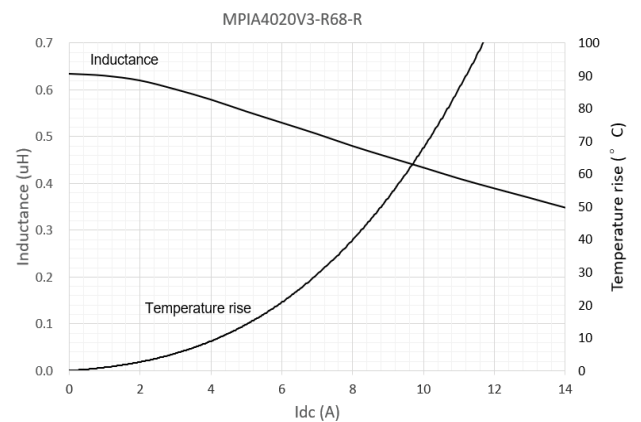
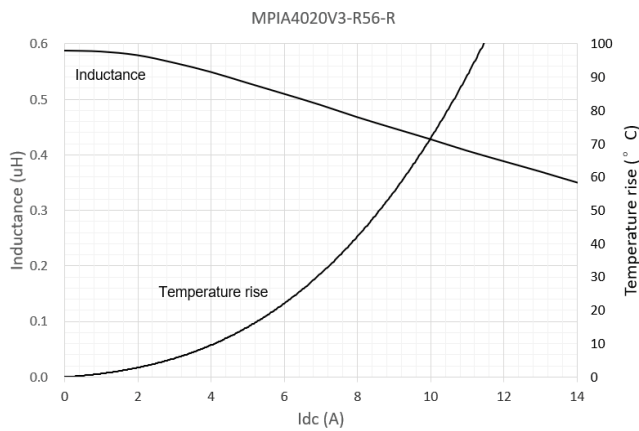
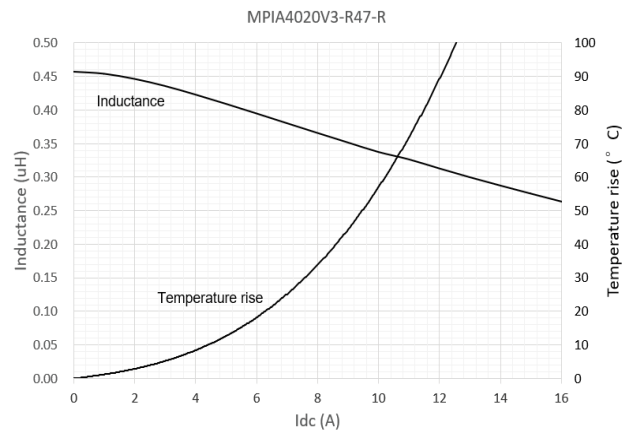
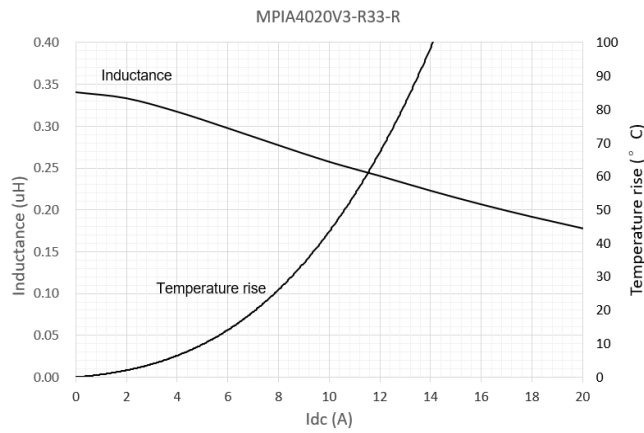
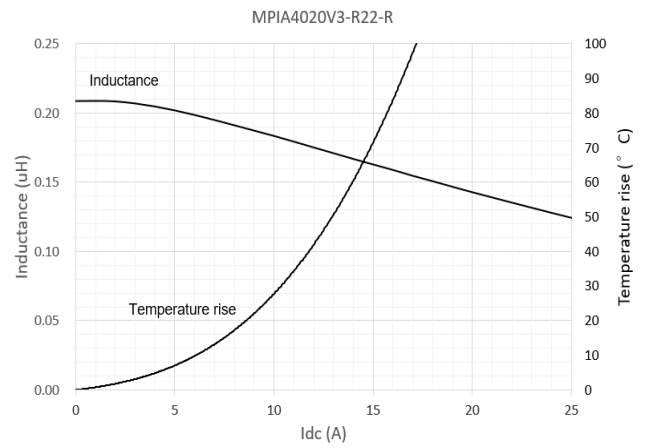
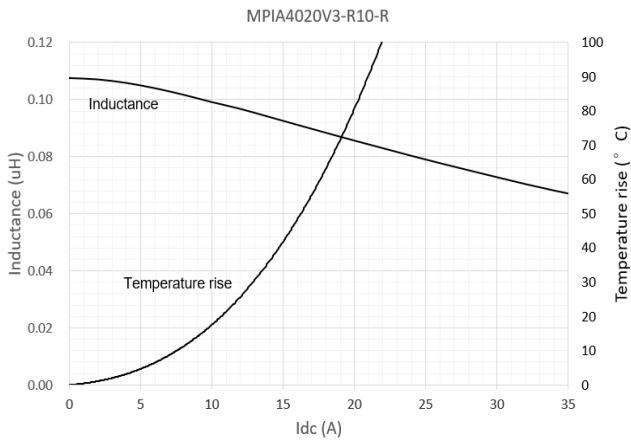
Core loss vs. Bp-p



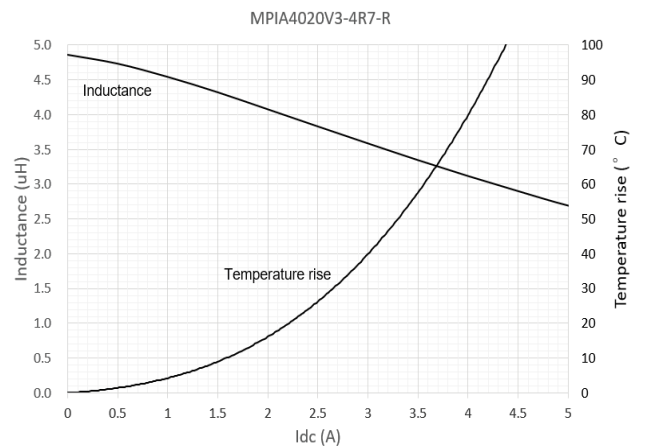
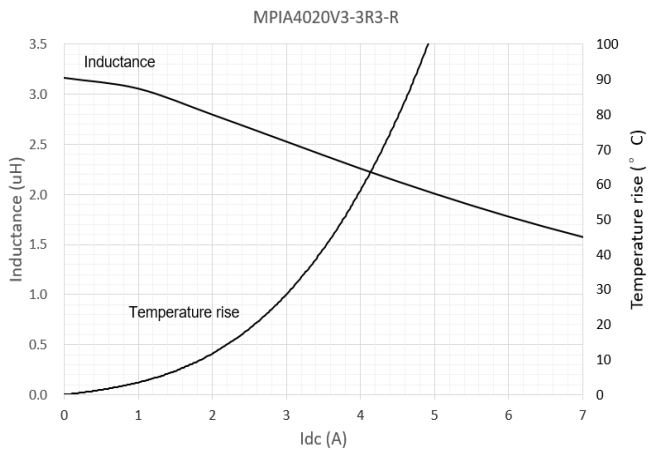
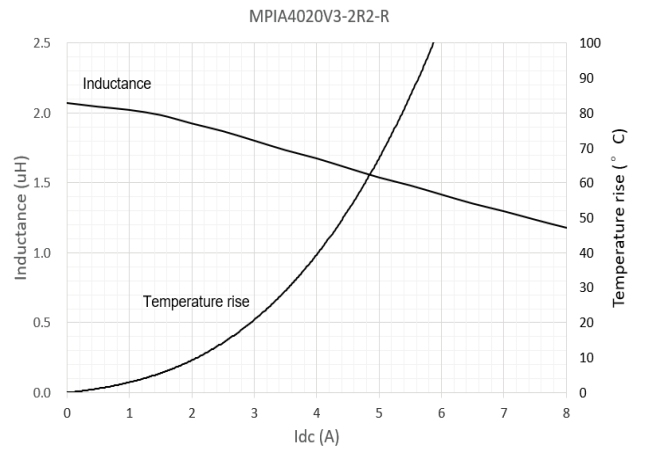
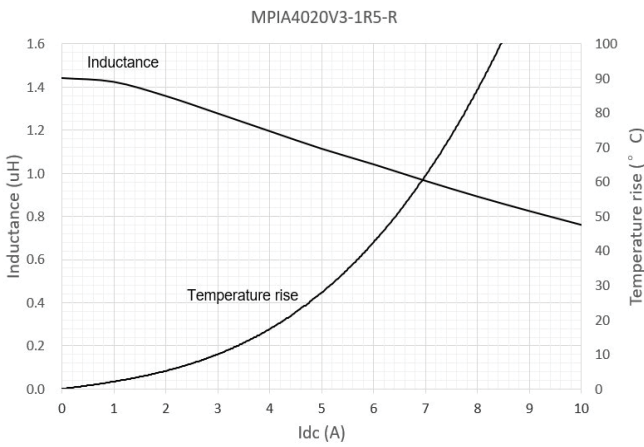
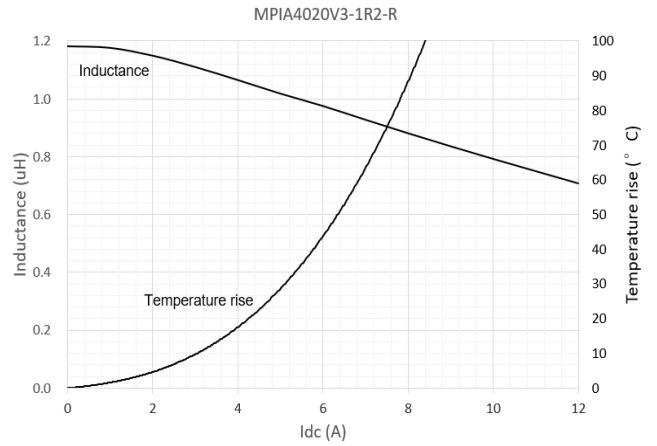
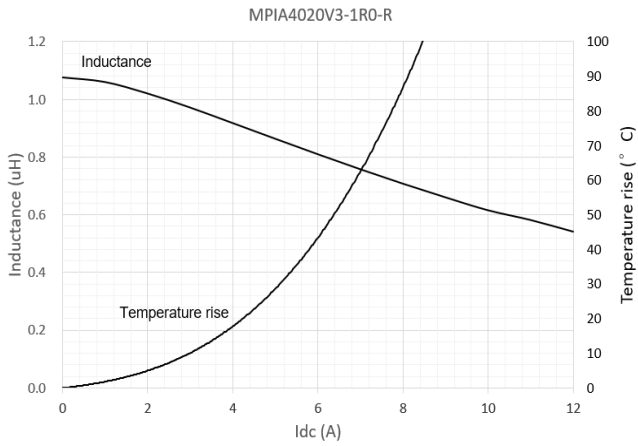
Core loss vs. Bp-p



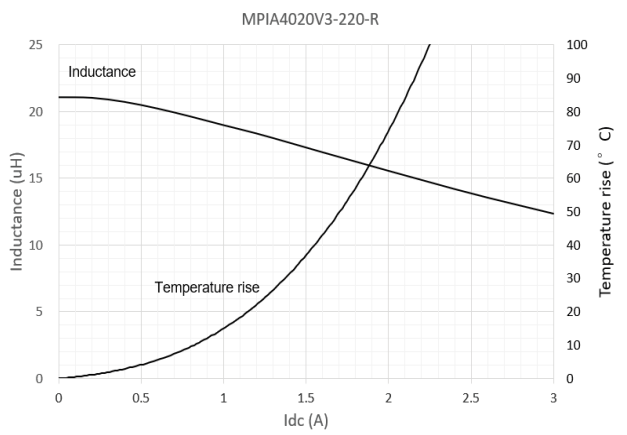
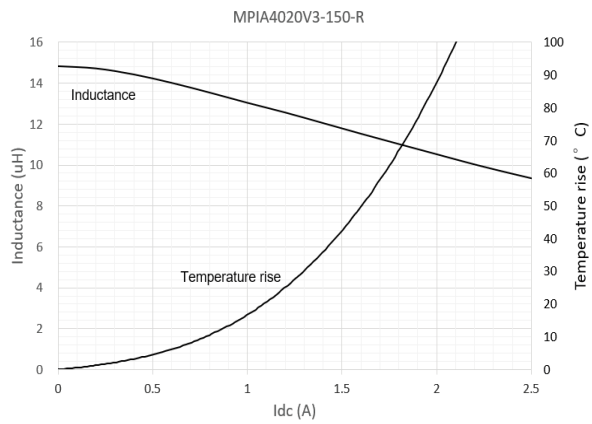
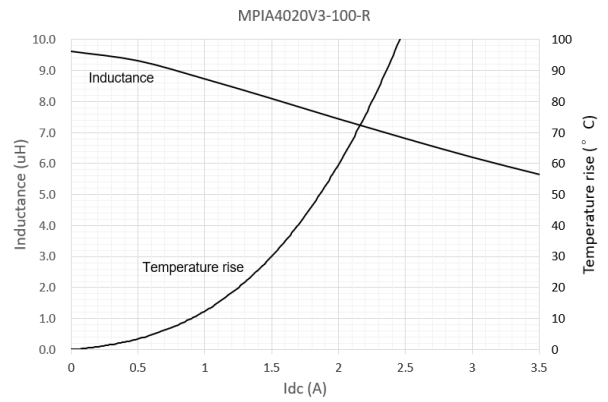
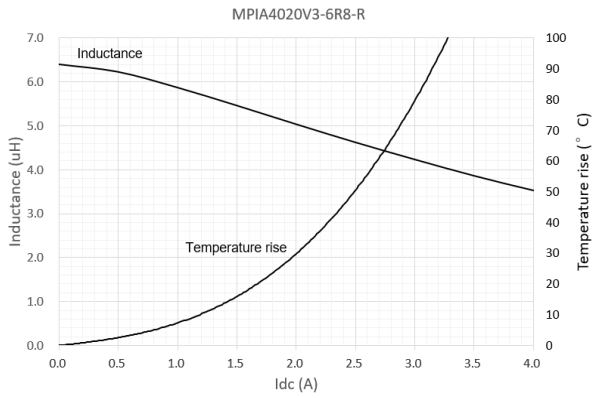
Inductance and temperature rise vs. Idc



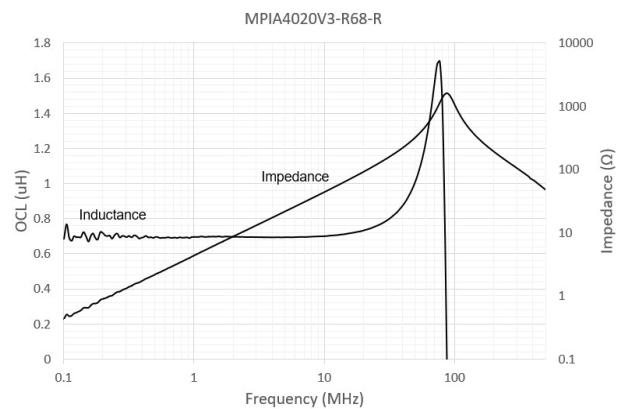
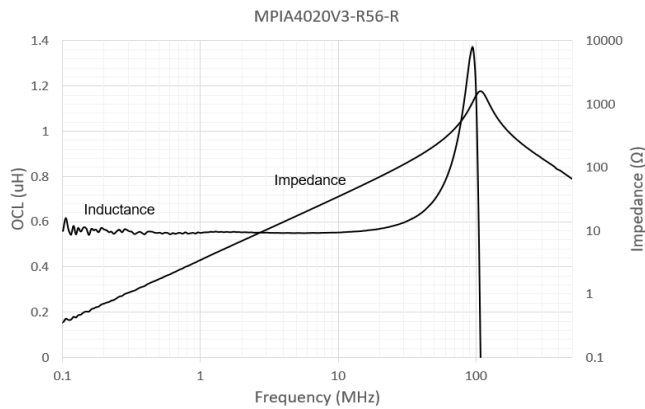
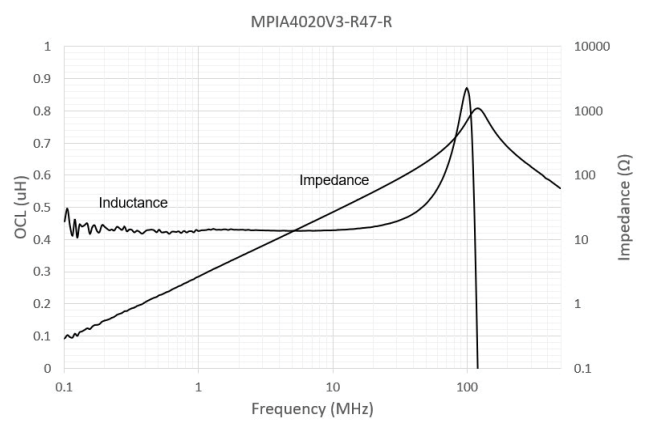
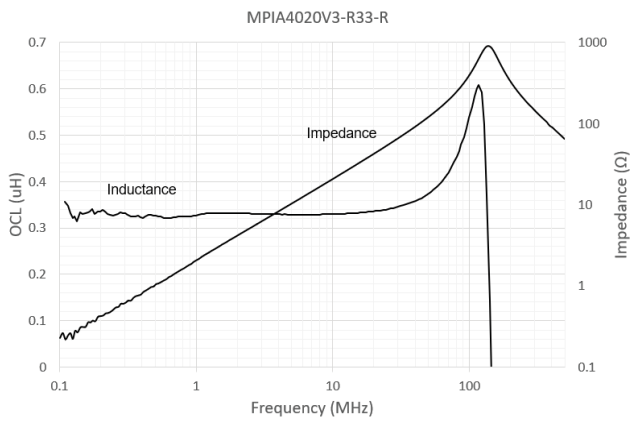
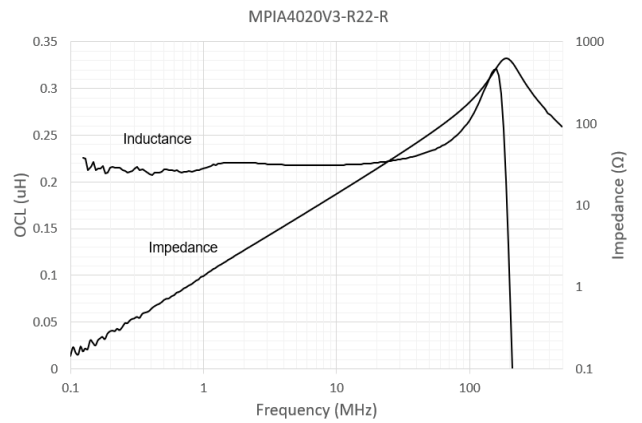
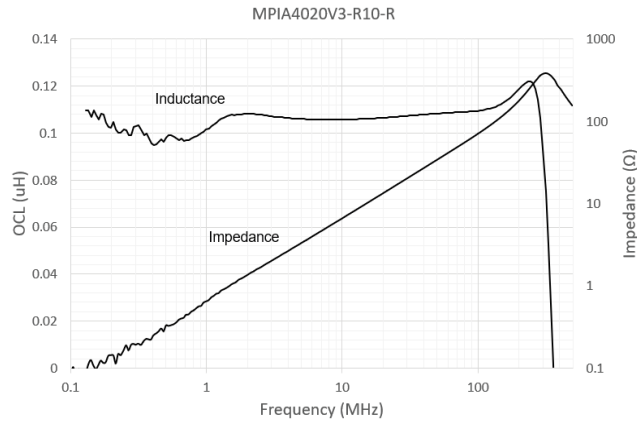
Inductance and temperature rise vs. I<sub>dc</sub>



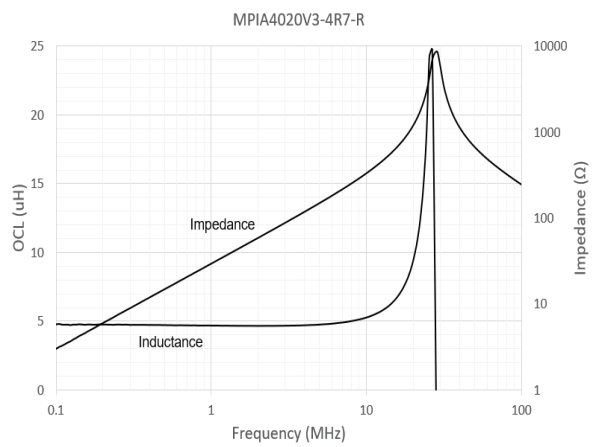
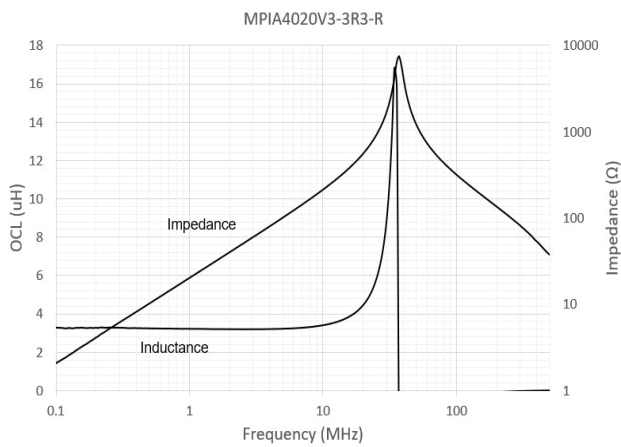
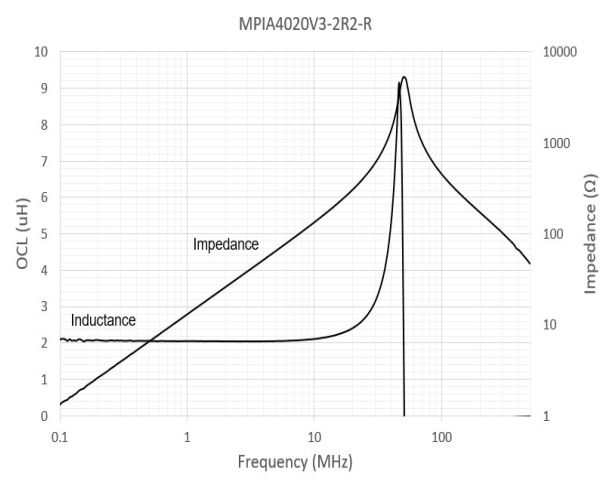
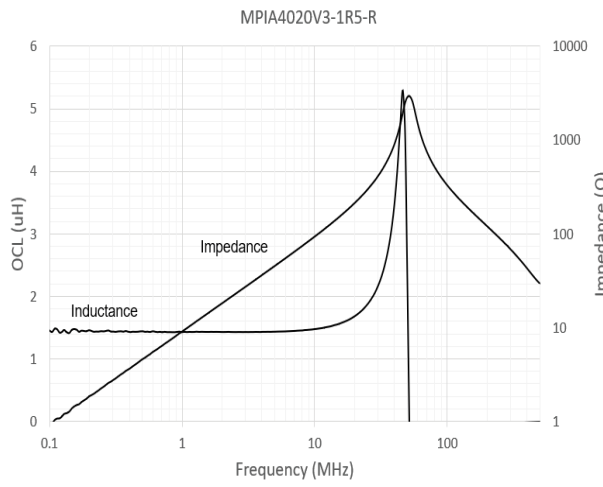
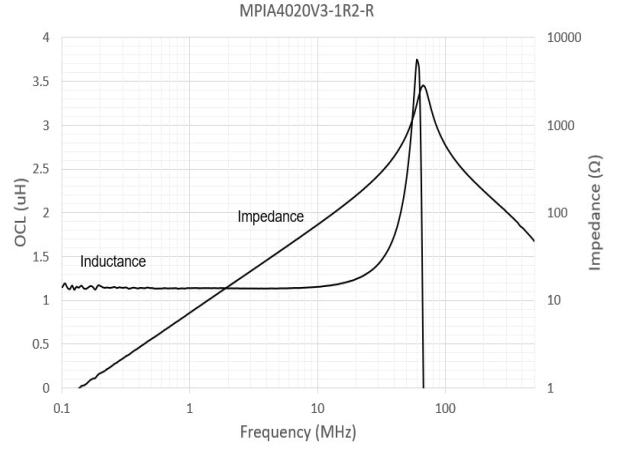
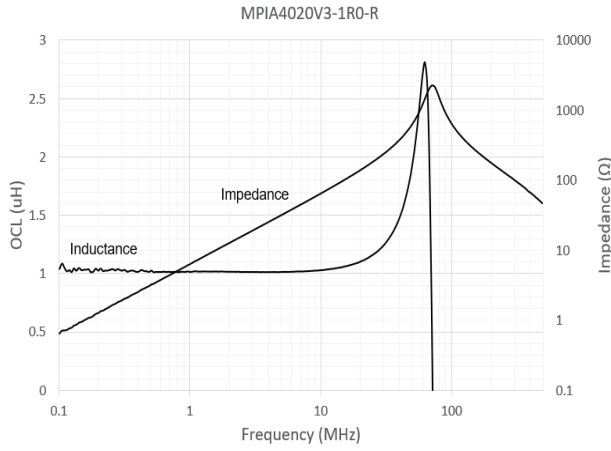
**Inductance and temperature rise vs. Idc**



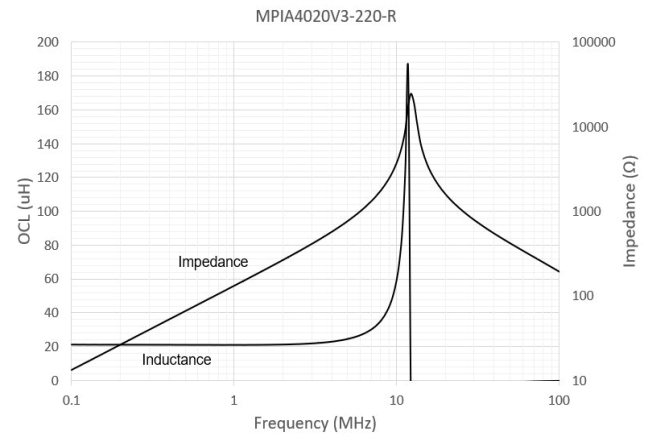
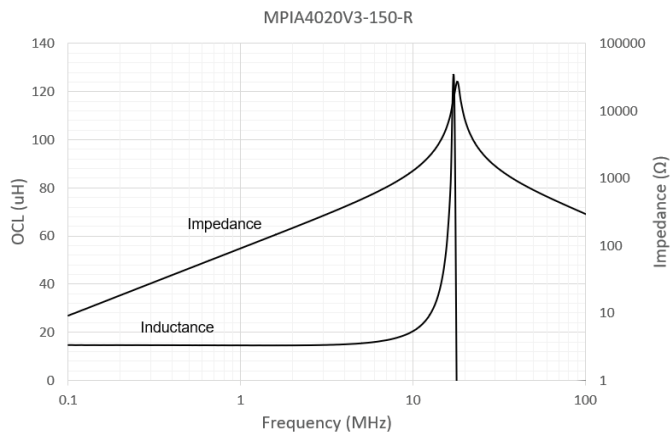
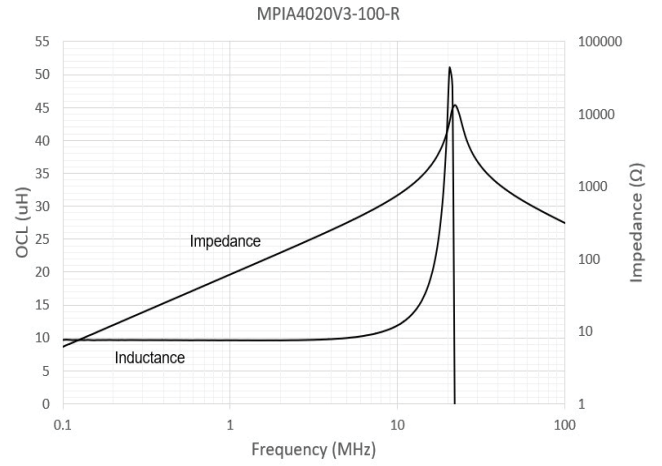
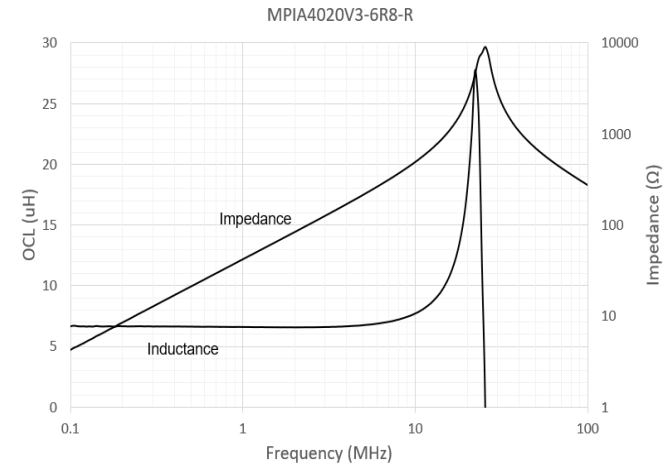
Inductance and impedance vs. frequency



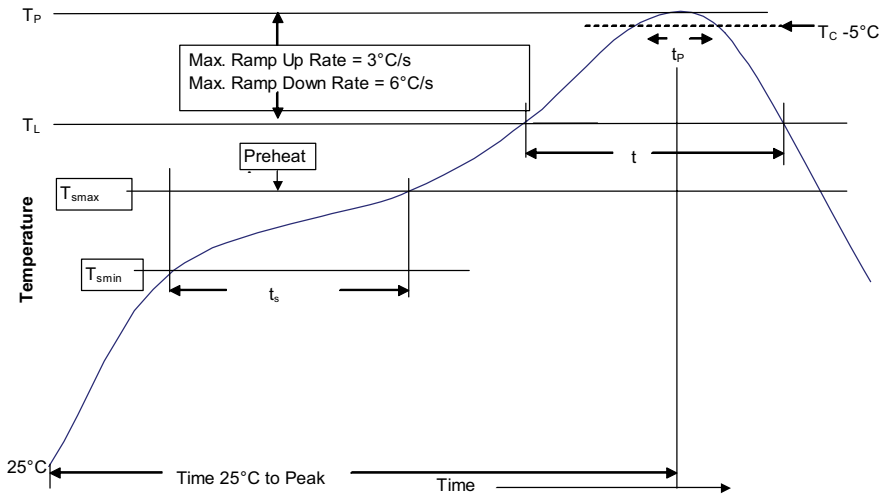
**Inductance and impedance vs. frequency**



Inductance and impedance vs. frequency



**Solder reflow profile**



**Table 1 - Standard SnPb solder ( $T_C$ )**

Package thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	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
<1.6 mm	260 °C	260 °C	260 °C
1.6 – 2.5 mm	260 °C	250 °C	245 °C
>2.5 mm	250 °C	245 °C	245 °C

**Reference 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
Ramp up rate $T_L$ to $T_p$	3 °C/ second max.	3 °C/ second max.
Liquidous temperature ( $T_L$ )	183 °C	217 °C
Time ( $t_L$ ) maintained above $T_L$	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*
Ramp-down rate ( $T_p$ to $T_L$ )	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.

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