

# HCM1A0503

## Automotive grade High current power inductors



### Product features

- AEC-Q200 Grade 1 qualified
- High current carrying capacity
- Magnetically shielded, low EMI
- Frequency range up to 1 MHz
- Inductance range from 0.2  $\mu$ H to 10  $\mu$ H
- Current range from 2.3 A to 24 A
- 5.5 mm x 5.3 mm footprint surface mount package in a 3.0 mm height
- Alloy powder core material
- Moisture Sensitivity Level (MSL): 1
- Halogen free, lead free, RoHS compliant

### Applications

- Body electronics
  - Central body control module
  - Vehicle access control system
  - Headlamps, tail lamps and interior lighting
  - Heating ventilation and air conditioning controllers (HVAC)
  - 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
- Chassis and safety electronics
  - Airbag control unit
- Engine and Powertrain Systems
  - Powertrain control module (PCU)/Engine Control unit (ECU)
  - Transmission Control Unit (TCU)

### Environmental Data

- Storage temperature range (Component): -55 °C to +155 °C
- Operating temperature range: -55 °C to +155 °C (ambient plus self-temperature rise)
- Solder reflow temperature: J-STD-020 (latest revision) compliant



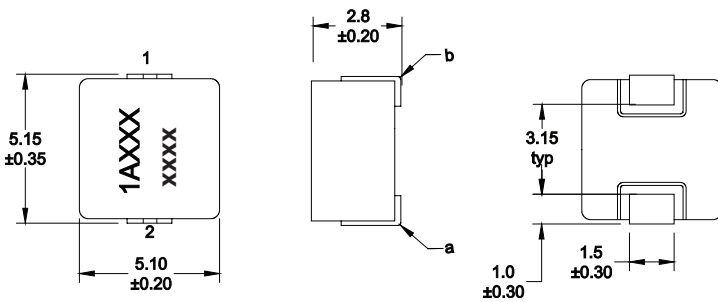
Product Specifications

Part Number <sup>6</sup>	OCL <sup>1</sup> ( $\mu\text{H}$ ) $\pm 20\%$	FLL <sup>2</sup> ( $\mu\text{H}$ ) minimum	$I_{\text{rms}}^3$ (A)	$I_{\text{sat}}^4$ (A)	DCR (m $\Omega$ ) typical @ +20 °C	DCR (m $\Omega$ ) maximum @ +20 °C	K-factor <sup>5</sup>
HCM1A0503-R20-R	0.20	0.128	15.8	18	2.1	2.3	1601
HCM1A0503-R22-R	0.22	0.141	15.8	24	2.1	2.3	1004
HCM1A0503-R33-R	0.33	0.211	11.8	16	3.9	4.3	918
HCM1A0503-R35-R	0.35	0.224	11.8	15	3.9	4.3	914
HCM1A0503-R47-R	0.47	0.300	9.2	12	6.5	7.2	835
HCM1A0503-R68-R	0.68	0.435	8.0	12	8.2	9.1	713
HCM1A0503-R75-R	0.75	0.48	7.8	12	8.5	9.4	590
HCM1A0503-1R0-R	1.0	0.64	7.1	8.5	10.4	11.4	569
HCM1A0503-1R5-R	1.5	0.96	5.2	6.8	17.1	18.5	450
HCM1A0503-2R2-R	2.2	1.4	4.5	6.4	22.5	25.0	411
HCM1A0503-3R3-R	3.3	2.1	3.8	5.6	36.4	40.4	332
HCM1A0503-4R7-R	4.7	3.0	3.1	4.2	54	60.0	239
HCM1A0503-5R6-R	5.6	3.6	2.8	4.0	63	70.6	235
HCM1A0503-6R8-R	6.8	4.4	2.3	3.8	81	97.2	212
HCM1A0503-100-R	10	6.4	2.4	2.3	90	108	191

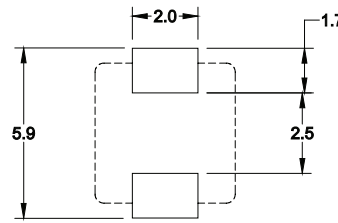
- Open Circuit Inductance (OCL) Test Parameters: 100 kHz, 0.25 V<sub>max</sub>, 0.0 Adc, +25 °C
- Full Load Inductance (FLL) Test Parameters: 100 kHz, 0.25 V<sub>max</sub>, I<sub>sat</sub>, +25 °C
- I<sub>rms</sub>: DC current for an approximate temperature rise of 30 °C without core loss. Derating is 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 155 °C under worst case operating conditions verified in the end application.

- I<sub>sat</sub>: Peak current for approximately 20% rolloff @ +25 °C
- K-factor: Used to determine B<sub>pp</sub> for core loss (see graph). B<sub>p-p</sub> = K \* L \*  $\Delta$ I. B<sub>pp</sub>: (Gauss), K: (K-factor from table), L: (Inductance in  $\mu\text{H}$ ),  $\Delta$ I (Peak to peak ripple current in Amps).
- Part Number Definition: HCM1A0503-xxx-R  
HCM1A0503 = Product code and size  
xxx= inductance value in  $\mu\text{H}$ , R= decimal point,  
If no R is present then last character equals number of zeros  
-R suffix = RoHS compliant

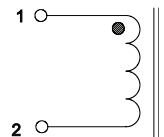
Dimensions (mm)



Recommended Pad Layout



Schematic



Part marking: 1Axxx=1A=Automotive grade, xxx=inductance value in uH, R=decimal point. If no R is present then last character equals number of zeros  
xxxx= Lot code

All soldering surfaces to be coplanar within 0.1 millimeters

Tolerances are ±0.2 millimeters unless stated otherwise

DCR measured from point "a" to point "b"

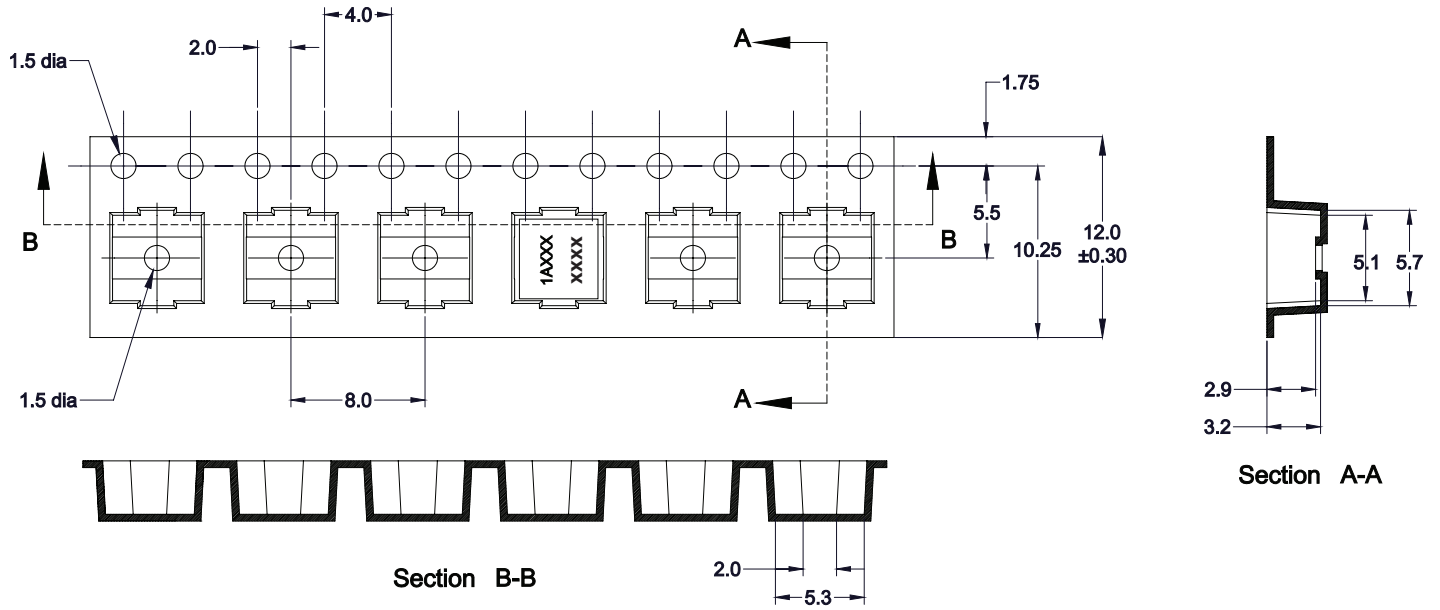
Color: Grey

Do not route traces or vias underneath the inductor

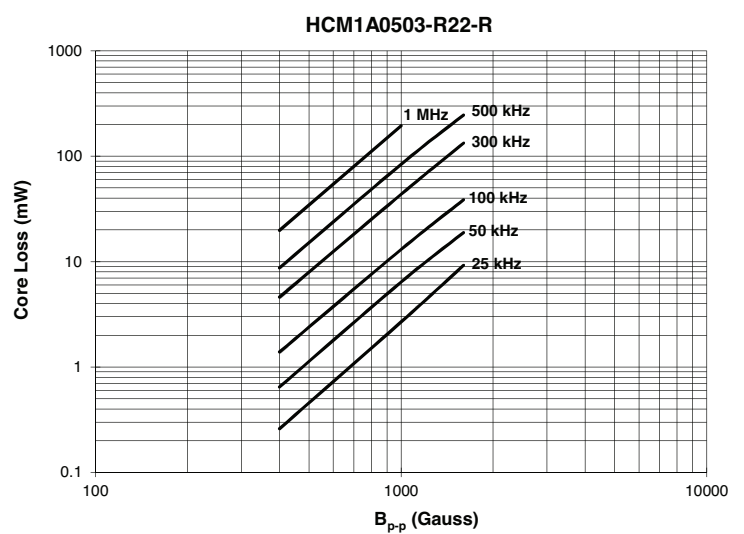
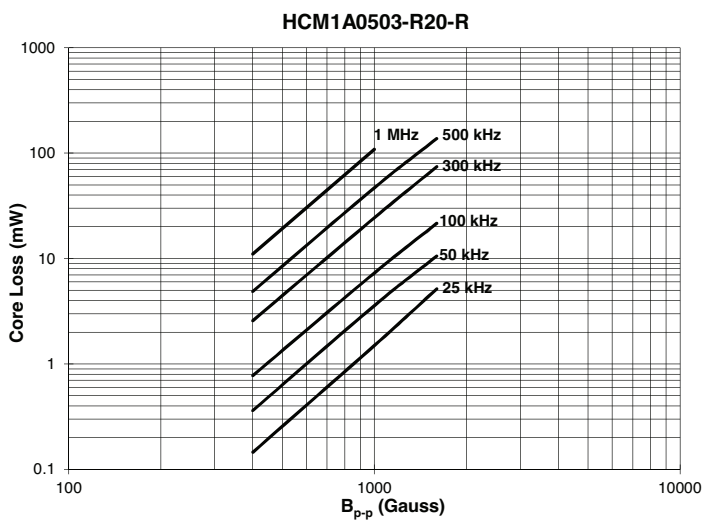
**Packaging information (mm)**

Drawing not to scale

Supplied in tape and reel packaging , 2000 parts per 13" diameter reel

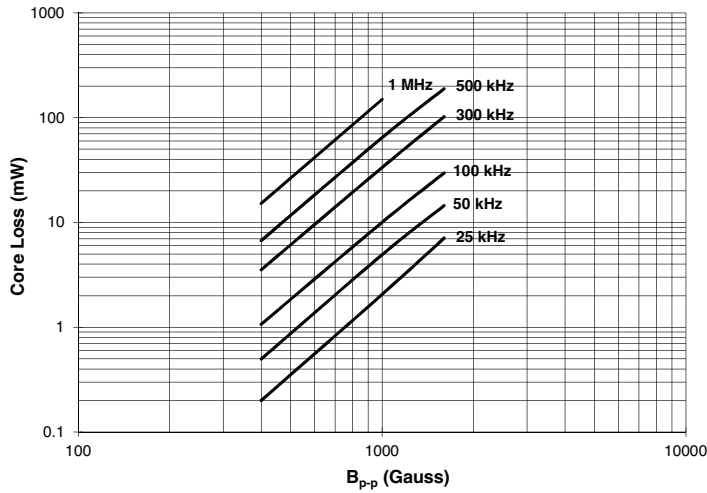


**Core loss vs  $B_{p-p}$**

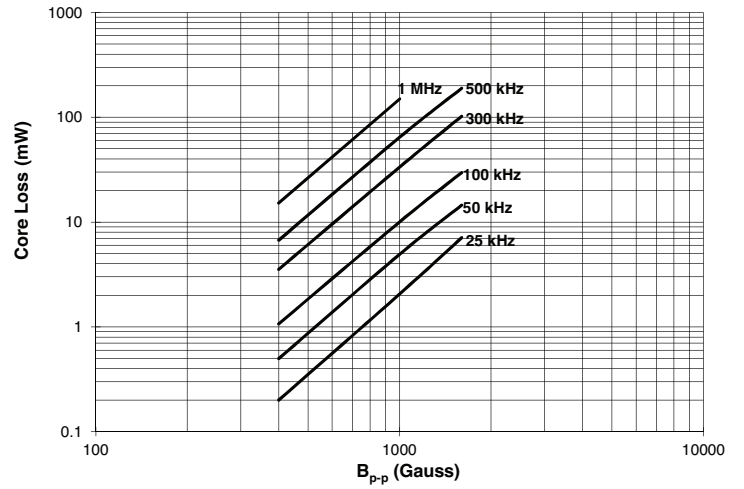


Core loss vs  $B_{p-p}$

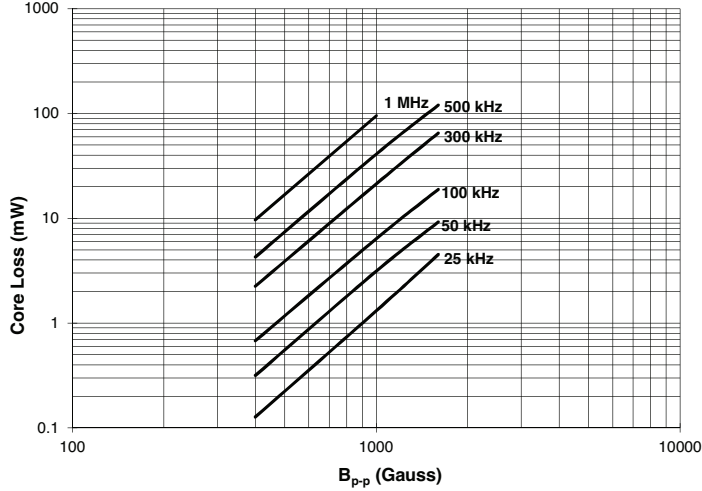
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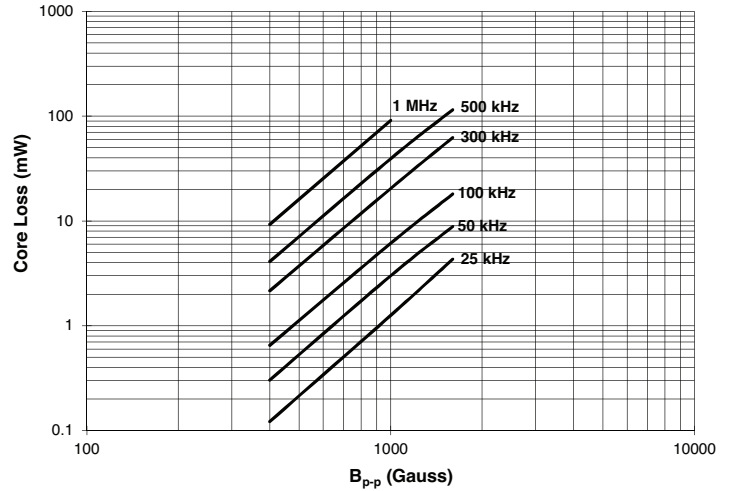
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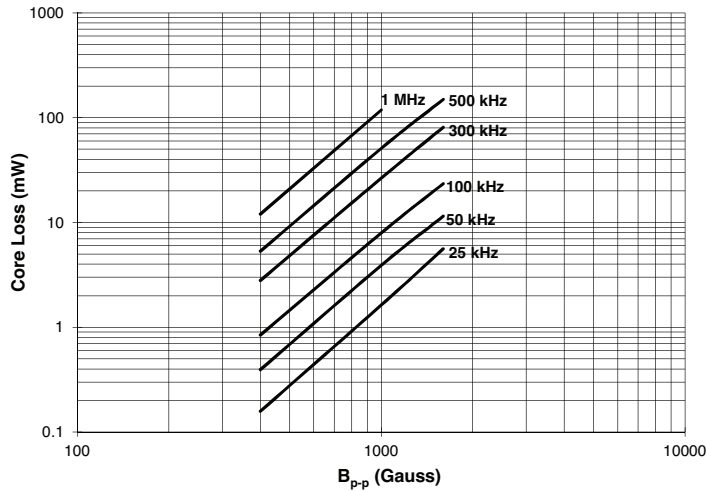
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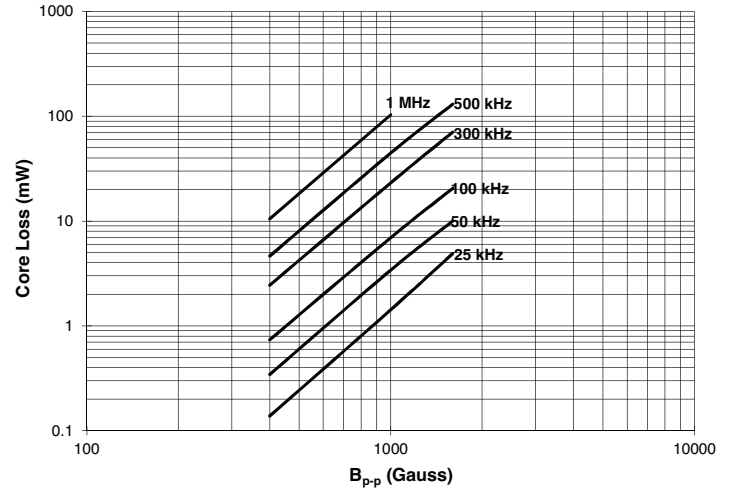
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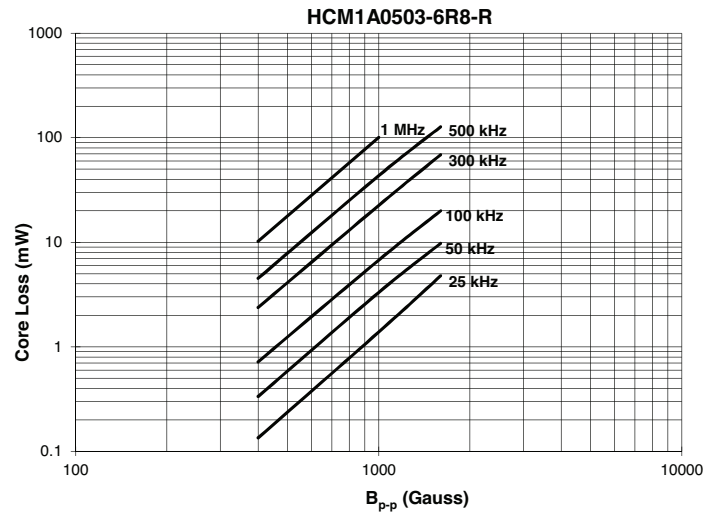
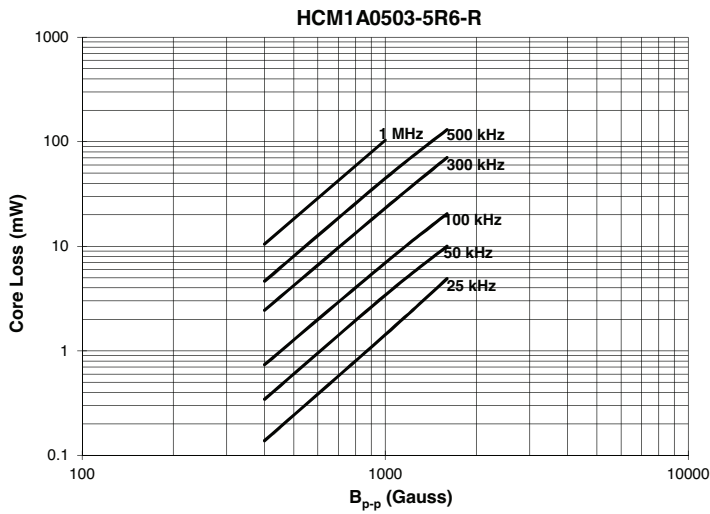
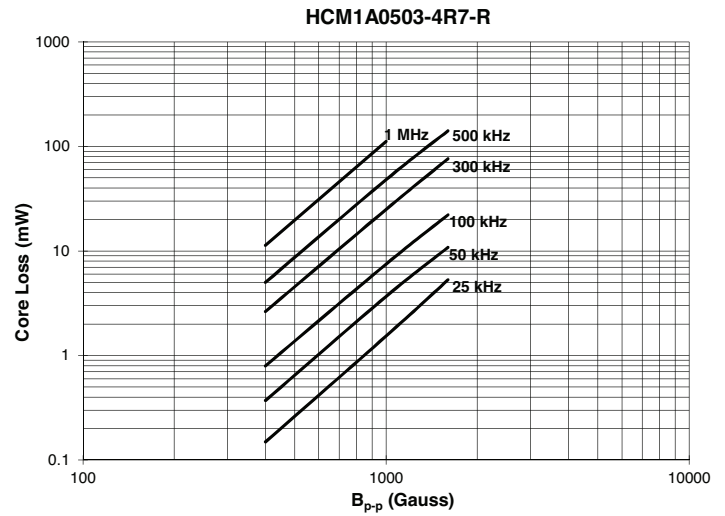
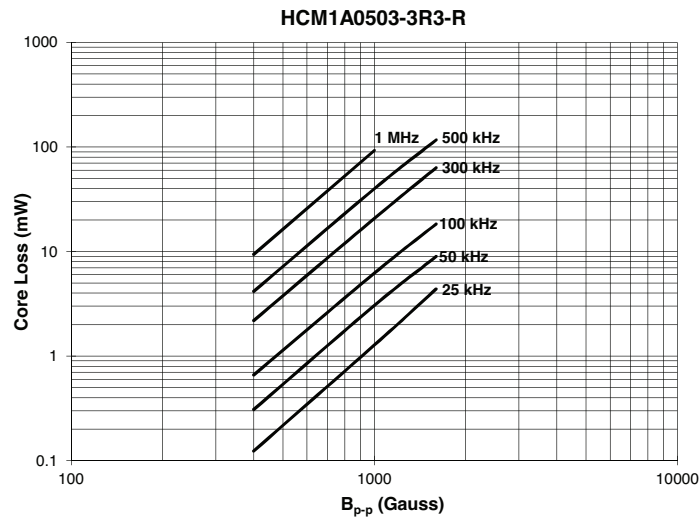
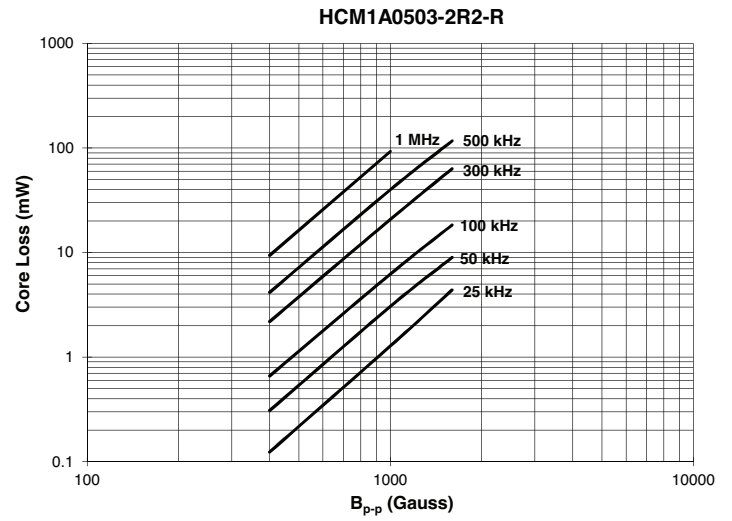
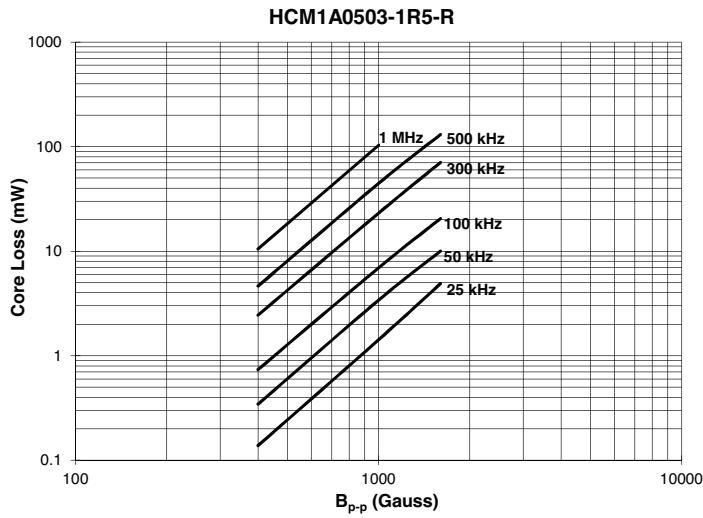
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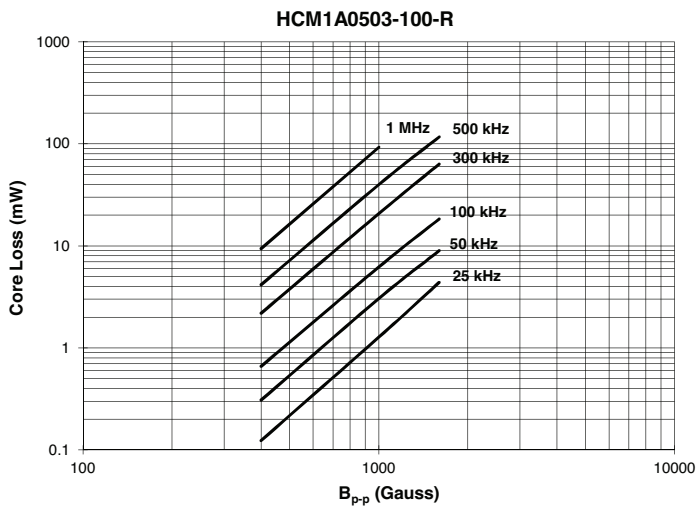
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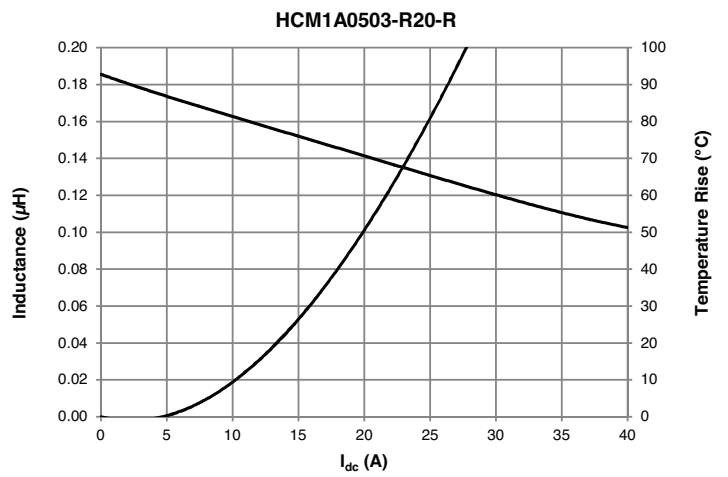
Core loss vs  $B_{p-p}$



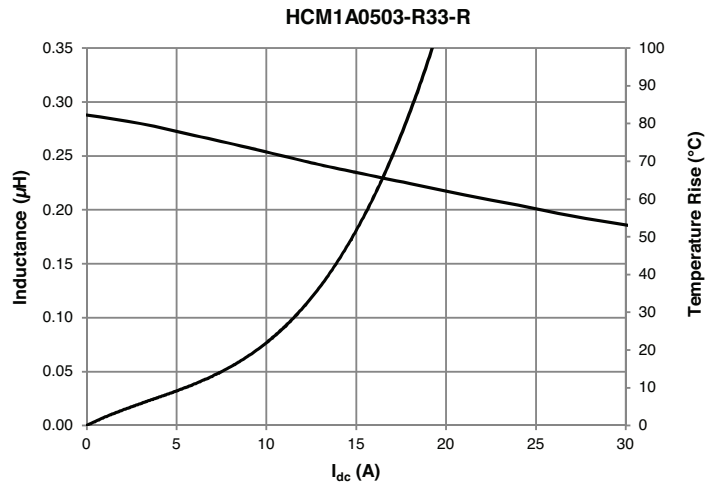
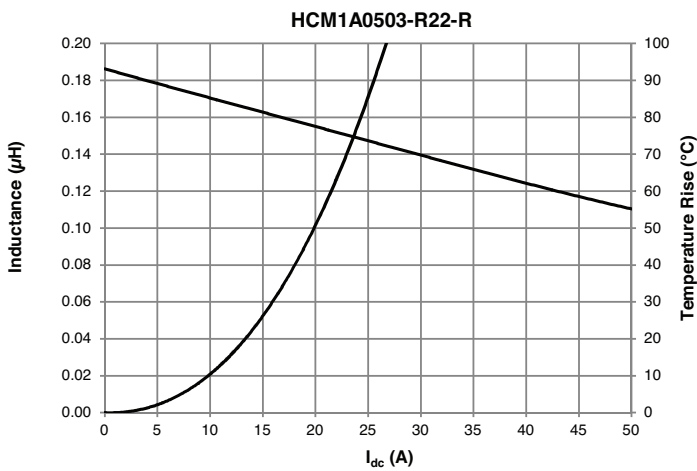
Core loss vs  $B_{p-p}$



Inductance and temperature rise vs. current

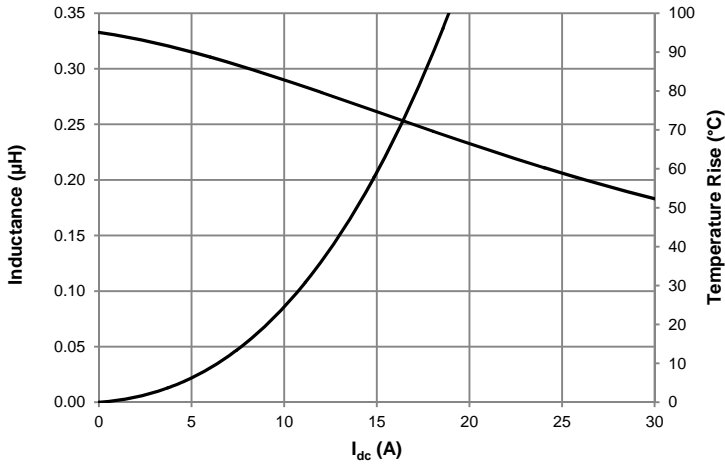


Inductance and temperature rise vs. current

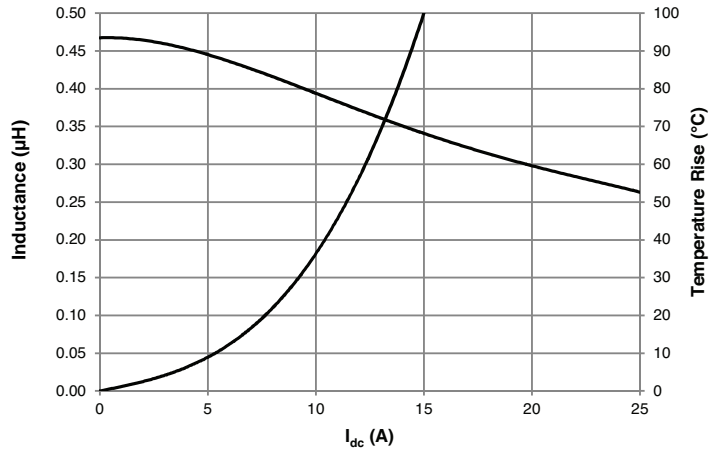


Inductance and temperature rise vs. current

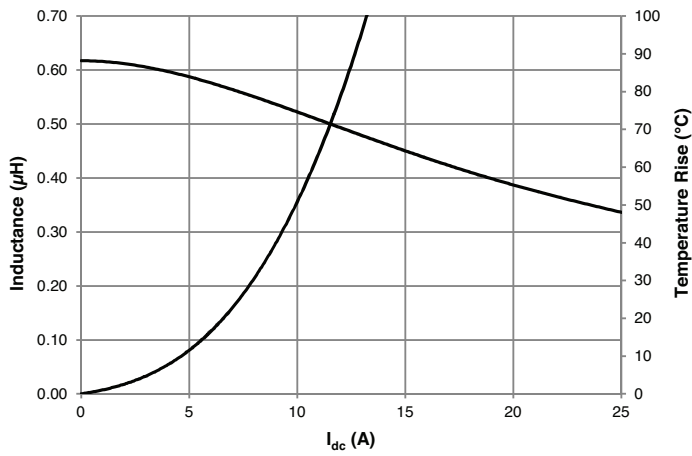
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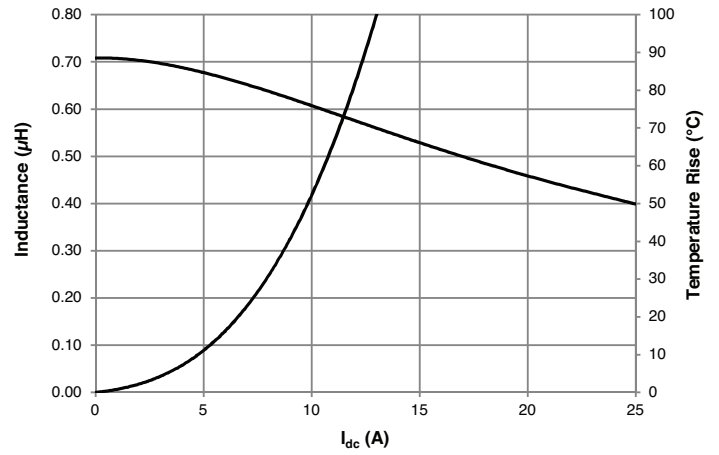
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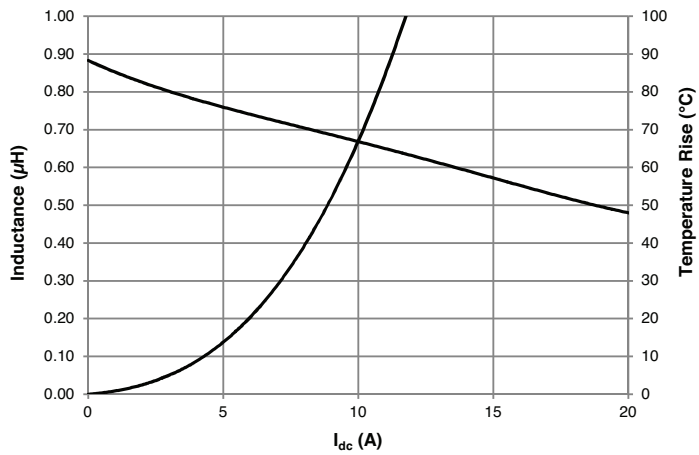
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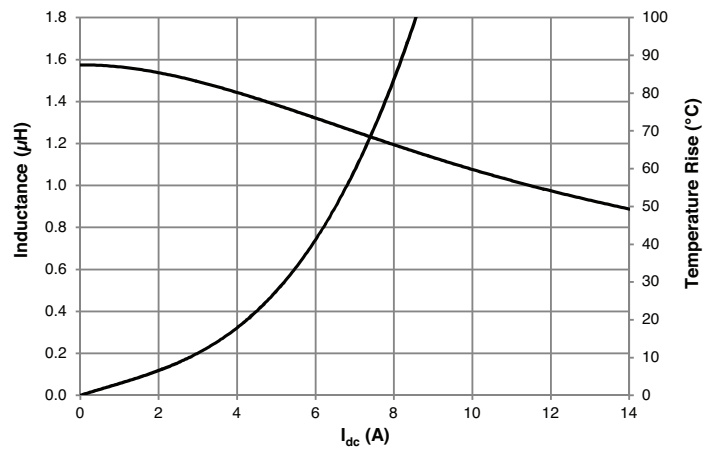
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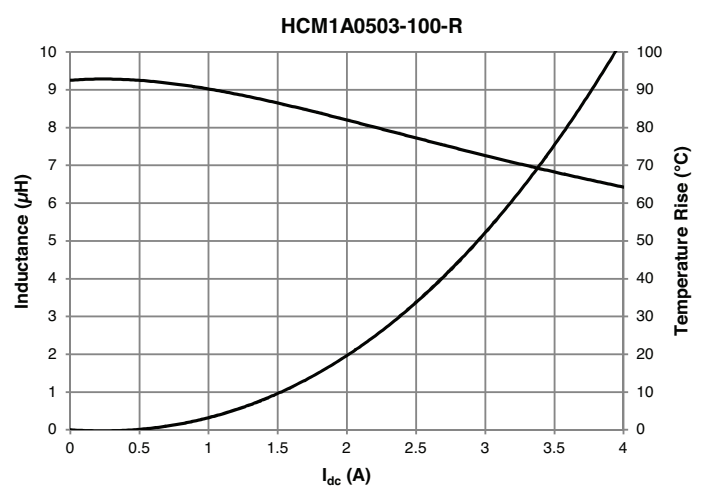
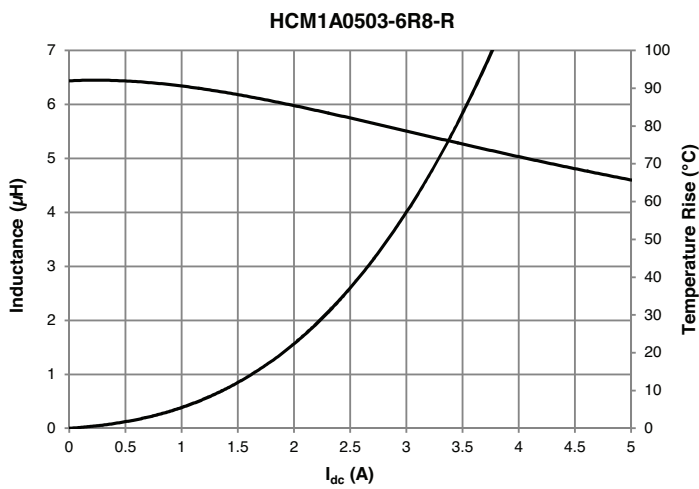
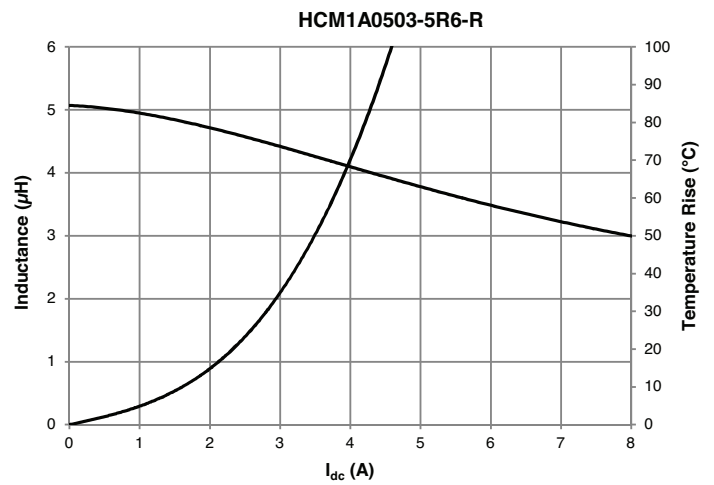
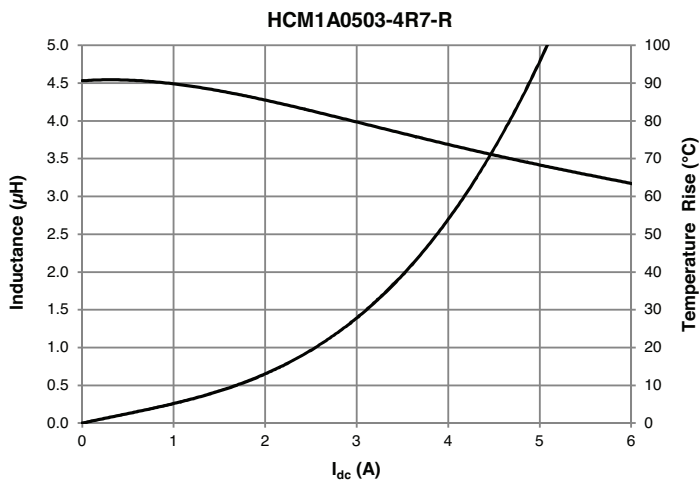
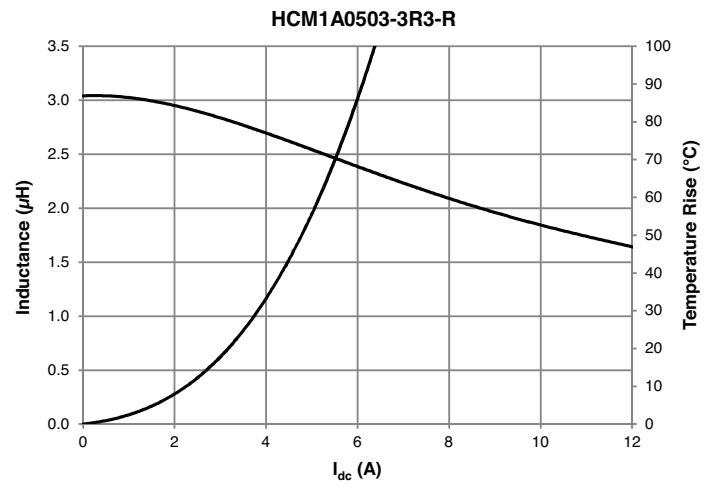
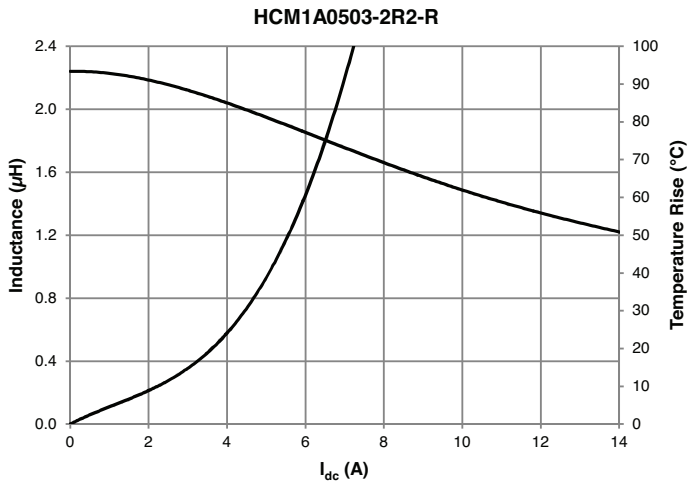
HCM1A0503-1R0-R



HCM1A0503-1R5-R

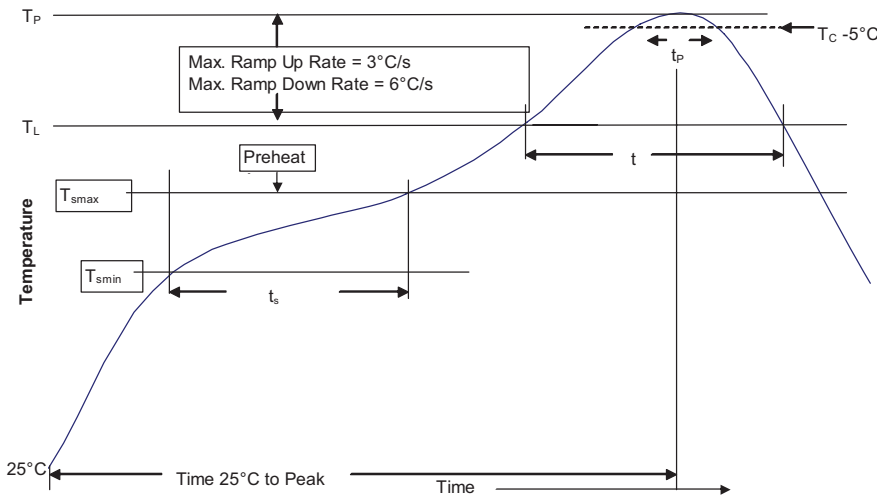


Inductance and temperature rise vs. current





**Solder reflow profile**



**Table 1 - Standard SnPb Solder ( $T_c$ )**

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> ≥350
<2.5mm)	235°C	220°C
≥2.5mm	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
<1.6mm	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-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
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**  
**Electronics Division**  
 1000 Eaton Boulevard  
 Cleveland, OH 44122  
 United States  
[www.eaton.com/electronics](http://www.eaton.com/electronics)

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