

# HCMA0703

## Automotive grade High current power inductors



### Product features

- Automotive grade 3 qualified
- High current carrying capacity, low core losses
- Magnetically shielded, low EMI
- Frequency range up to 5 MHz
- Inductance range from 0.15  $\mu$ H to 33  $\mu$ H
- Current range from 1.8 A to 52 A
- 7.4 mm x 7.0 mm footprint surface mount package in a 3.0 mm height
- Iron powder core material

### 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 systems
  - 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
  - Electronic Stability Control System (ESC)

### 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-020 (Latest revision) compliant



## Product Specifications

| Part Number <sup>6</sup> | OCL <sup>1</sup><br>( $\mu$ H) $\pm$ 20% | FLL <sup>2</sup> ( $\mu$ H)<br>minimum | I <sub>rms</sub> <sup>3</sup><br>(A) | I <sub>sat</sub> <sup>4</sup><br>(A) | DCR (m $\Omega$ )<br>typical<br>@ +20 °C | DCR (m $\Omega$ )<br>maximum<br>@ +20 °C | K-factor <sup>5</sup> |
|--------------------------|------------------------------------------|----------------------------------------|--------------------------------------|--------------------------------------|------------------------------------------|------------------------------------------|-----------------------|
| HCMA0703-R15-R           | 0.15                                     | 0.09                                   | 26                                   | 52                                   | 1.9                                      | 2.5                                      | 1044                  |
| HCMA0703-R22-R           | 0.22                                     | 0.13                                   | 23                                   | 40                                   | 2.5                                      | 2.8                                      | 986                   |
| HCMA0703-R47-R           | 0.47                                     | 0.28                                   | 17.5                                 | 26                                   | 4.0                                      | 4.2                                      | 580                   |
| HCMA0703-R68-R           | 0.68                                     | 0.41                                   | 15.5                                 | 25                                   | 5.0                                      | 5.5                                      | 455                   |
| HCMA0703-R82-R           | 0.82                                     | 0.49                                   | 13                                   | 24                                   | 6.7                                      | 8.0                                      | 439                   |
| HCMA0703-1R0-R           | 1.0                                      | 0.60                                   | 11                                   | 22                                   | 9.0                                      | 10                                       | 374                   |
| HCMA0703-1R5-R           | 1.5                                      | 0.90                                   | 9.0                                  | 18                                   | 14                                       | 15                                       | 366                   |
| HCMA0703-2R2-R           | 2.2                                      | 1.32                                   | 8.0                                  | 14                                   | 18                                       | 20                                       | 281                   |
| HCMA0703-3R3-R           | 3.3                                      | 1.98                                   | 6.0                                  | 13.5                                 | 28                                       | 30                                       | 252                   |
| HCMA0703-4R7-R           | 4.7                                      | 2.82                                   | 5.5                                  | 10                                   | 37                                       | 40                                       | 210                   |
| HCMA0703-6R8-R           | 6.8                                      | 4.08                                   | 4.5                                  | 8.0                                  | 54                                       | 60                                       | 151                   |
| HCMA0703-8R2-R           | 8.2                                      | 4.92                                   | 4.0                                  | 7.5                                  | 64                                       | 68                                       | 142                   |
| HCMA0703-100-R           | 10                                       | 6.00                                   | 3.2                                  | 7.0                                  | 71                                       | 78                                       | 132                   |
| HCMA0703-220-R           | 22                                       | 14.1                                   | 2.3                                  | 3.0                                  | 135                                      | 149                                      | 83                    |
| HCMA0703-330-R           | 33                                       | 19.8                                   | 1.8                                  | 2.2                                  | 220                                      | 242                                      | 76                    |

1. Open Circuit Inductance (OCL) Test Parameters: 100kHz, 0.25 Vrms, 0.0 Adc, +25 °C

2. Full Load Inductance (FLL) Test Parameters: 100 kHz, 0.25 Vrms, Isat, +25 °C

3. I<sub>rms</sub>: 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.

4. I<sub>sat</sub>: Peak current for approximately 20% rolloff @ +25 °C

5. K-factor: Used to determine Bp-p for core loss (see graph). Bp-p = K \* L \*  $\Delta$ I. Bp-p: (Gauss), K: (K-factor from table), L: (Inductance in  $\mu$ H),  $\Delta$ I (Peak to peak ripple current in Amps).

6. Part Number Definition: HCMA0703-xxx-R

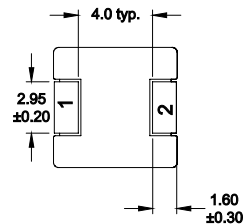
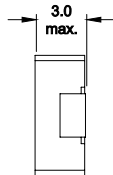
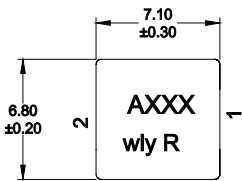
HCMA0703 = Product code and size

-xxx= inductance value in  $\mu$ H, R= decimal point,

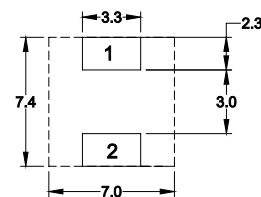
If no R is present then last character equals number of zeros

-R suffix = RoHS compliant

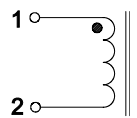
## Dimensions (mm)



### Recommended Pad Layout



### Schematic



Part marking: A= Automotive grade, xxx= inductance value in  $\mu$ H, R= decimal point. If no R is present then last character equals number of zeros

wly= date code, R=revision level

All soldering surfaces to be coplanar within 0.1 millimeters.

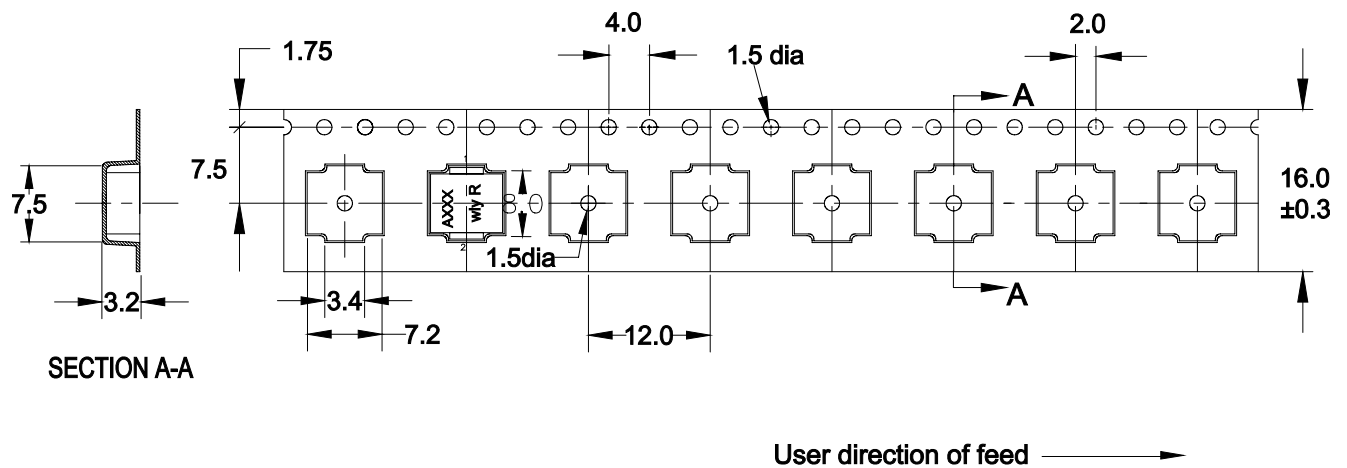
Tolerance are  $\pm$ 0.3 millimeters unless stated otherwise.

Color: Grey

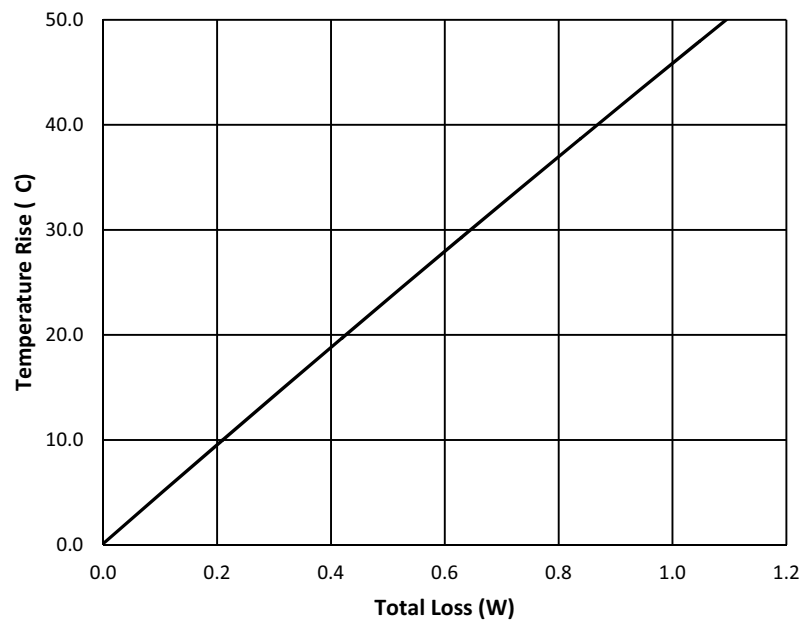
Do not route traces or vias underneath the inductor

### Packaging information (mm)

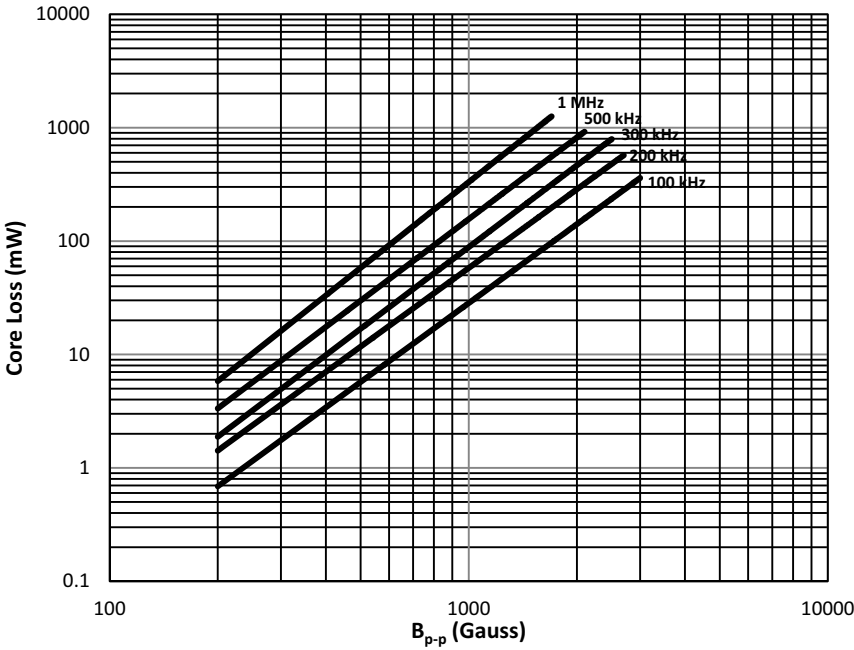
Supplied in tape and reel packaging , 1500 parts per 13" diameter reel



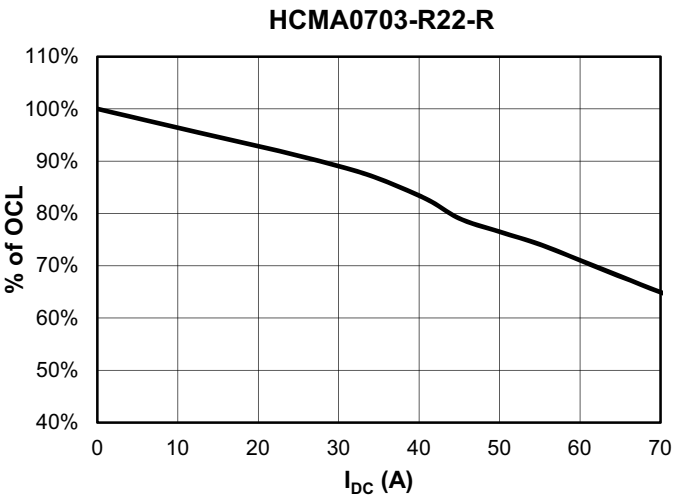
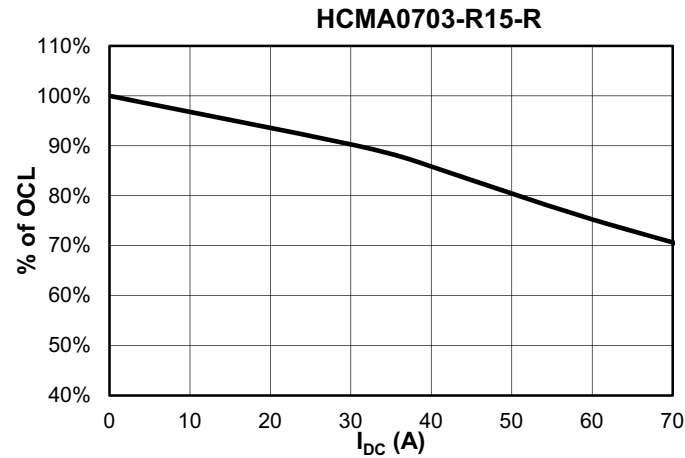
### Temperature rise vs. total loss



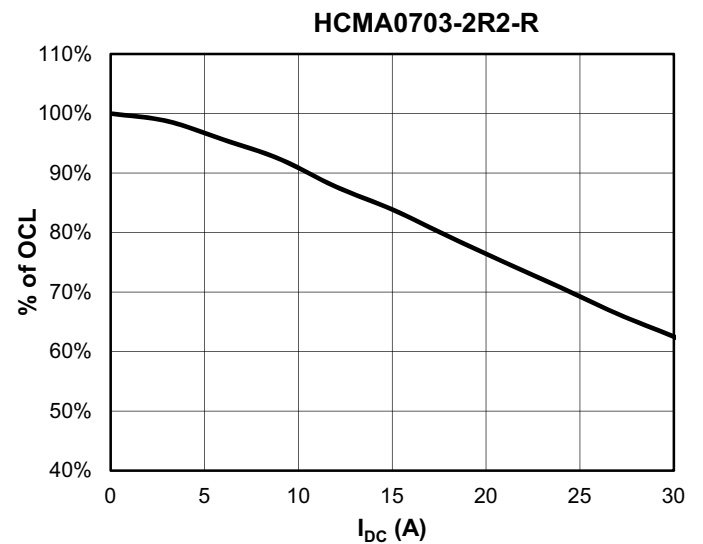
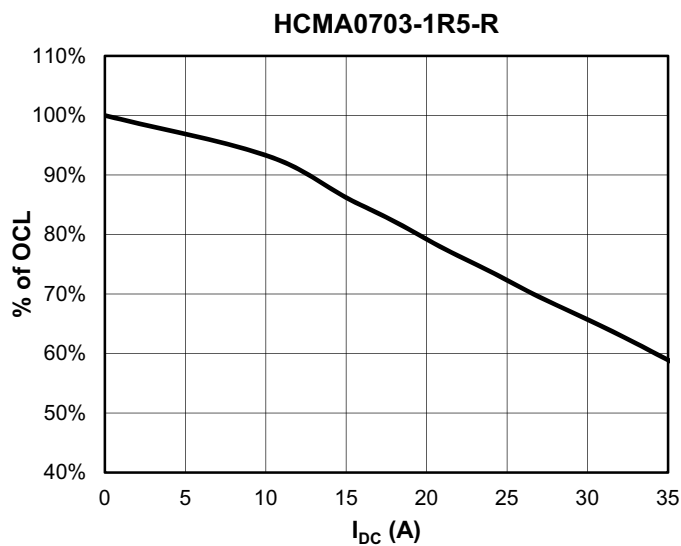
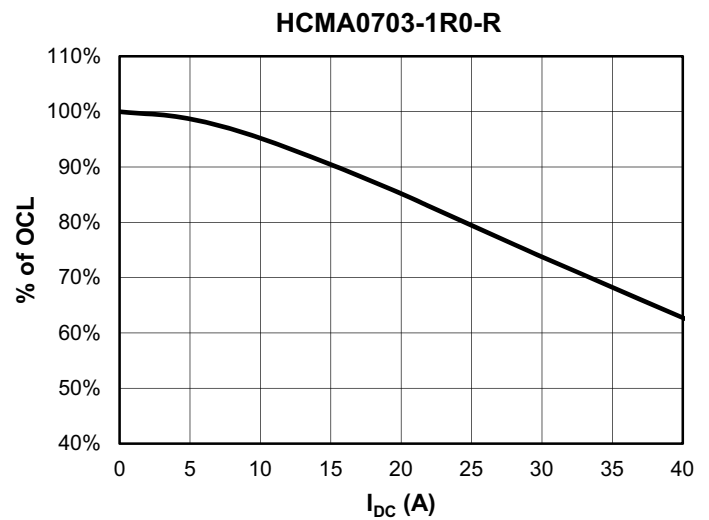
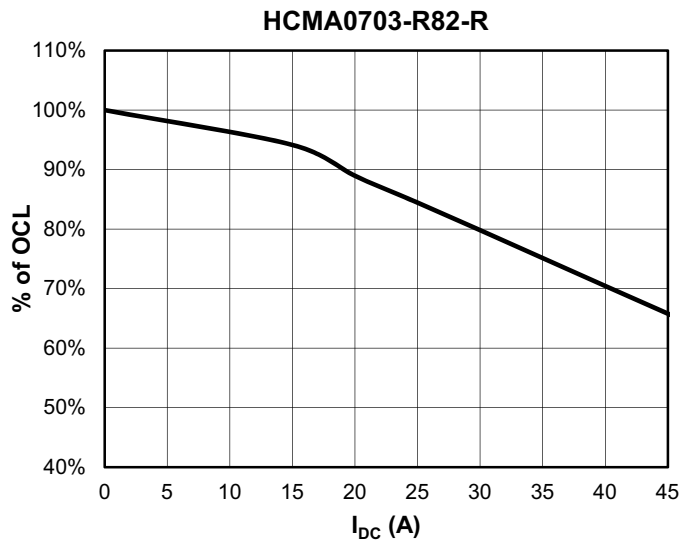
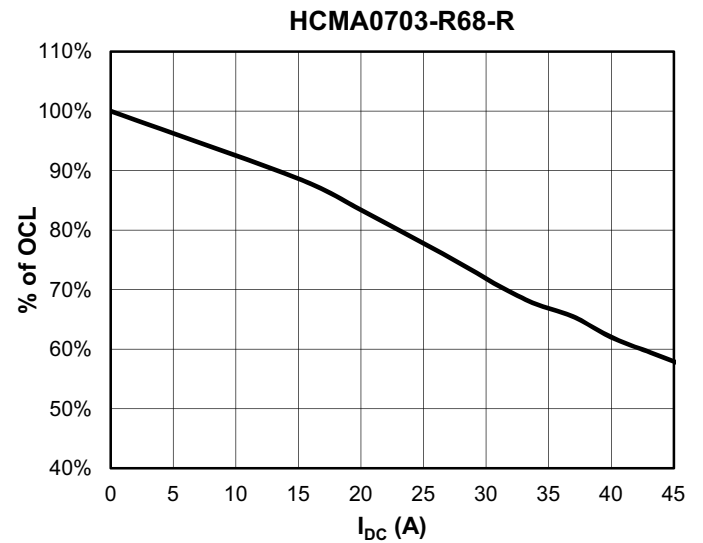
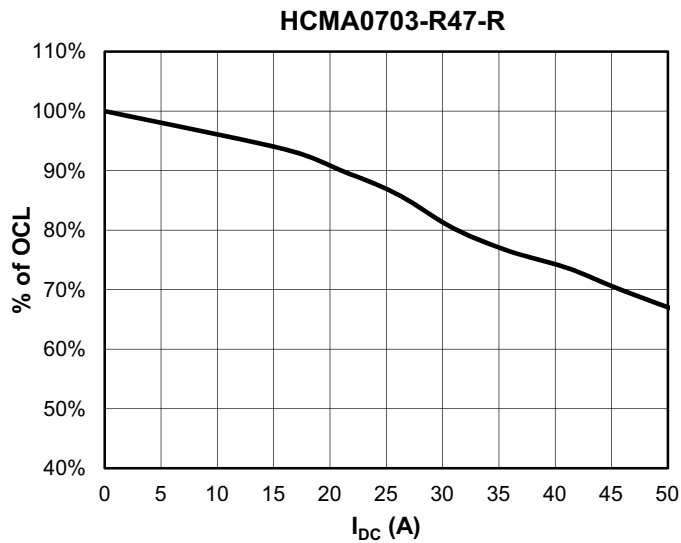
Core loss vs.  $B_{p-p}$



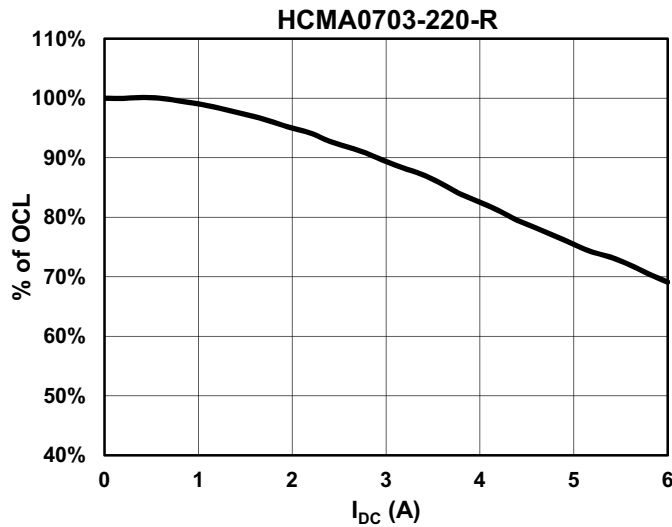
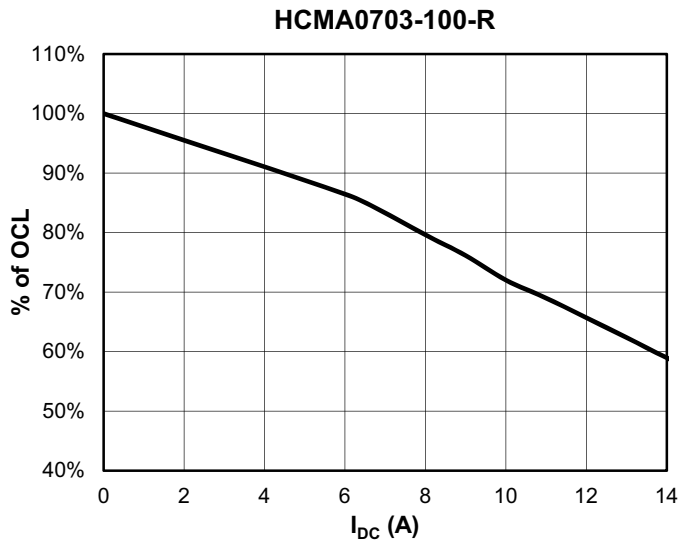
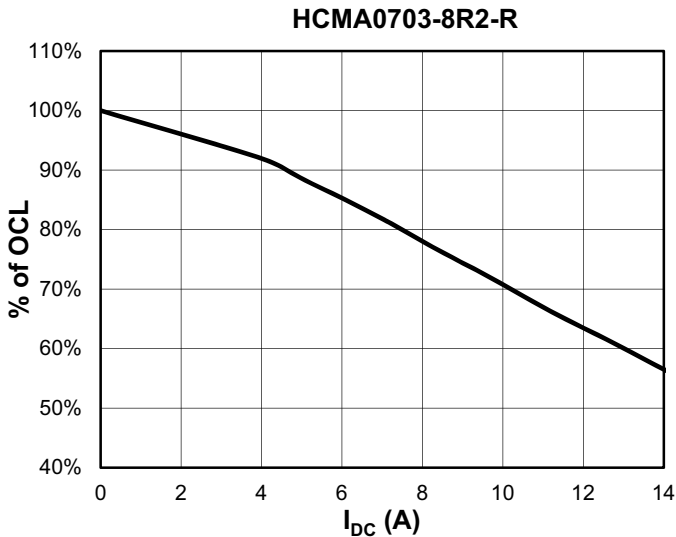
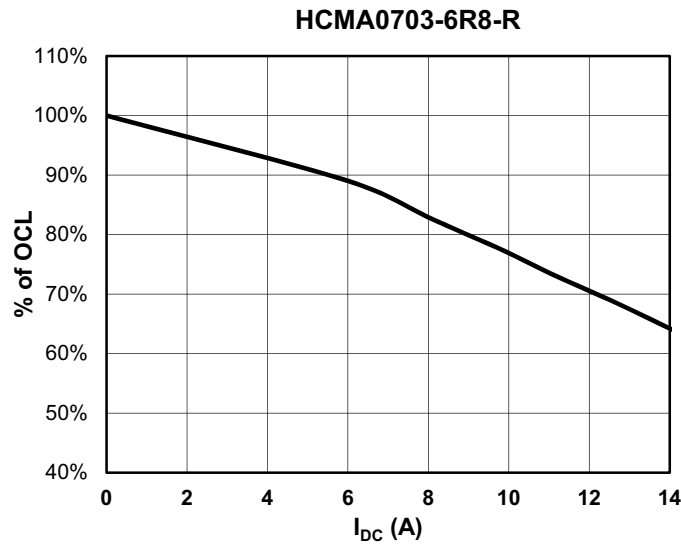
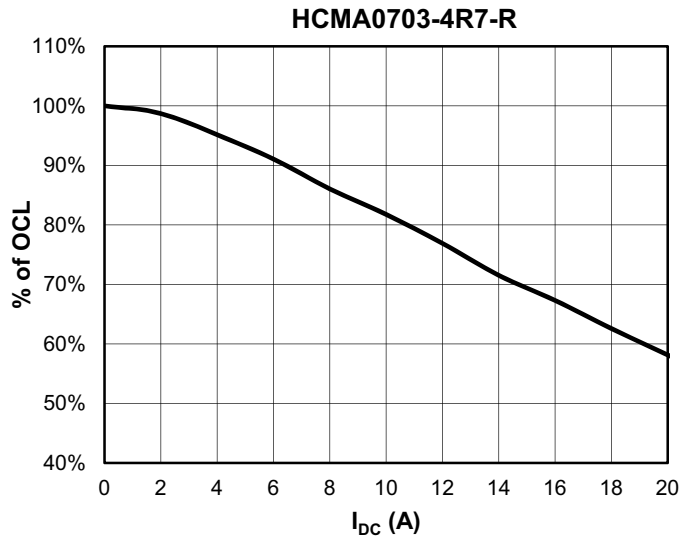
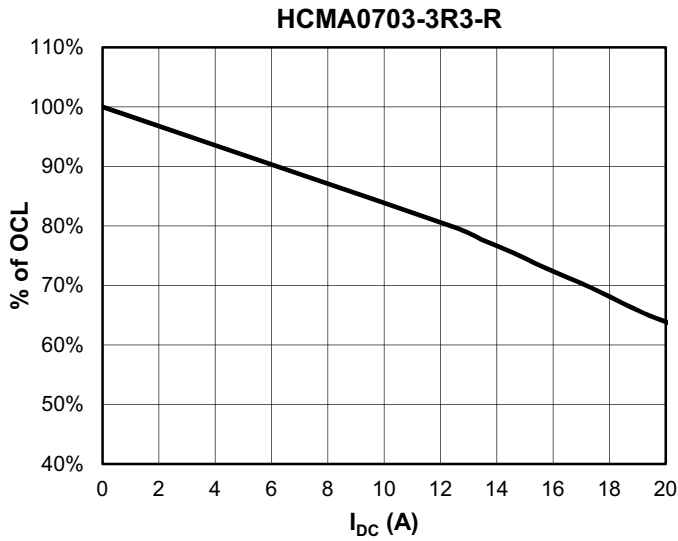
Inductance characteristics



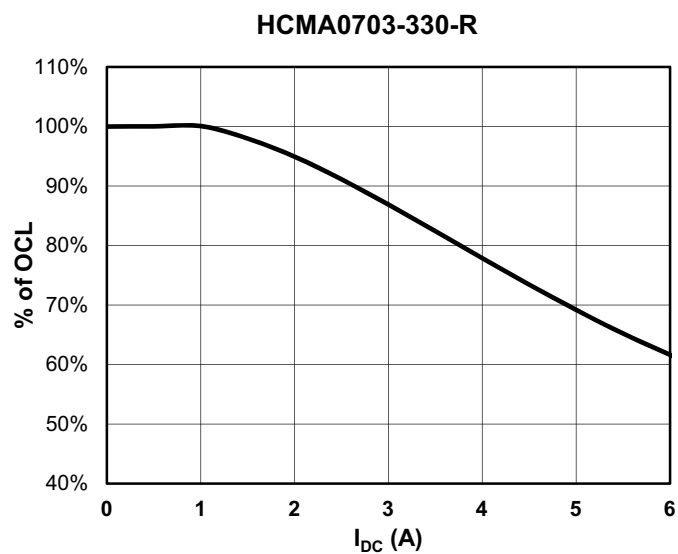
Inductance characteristics



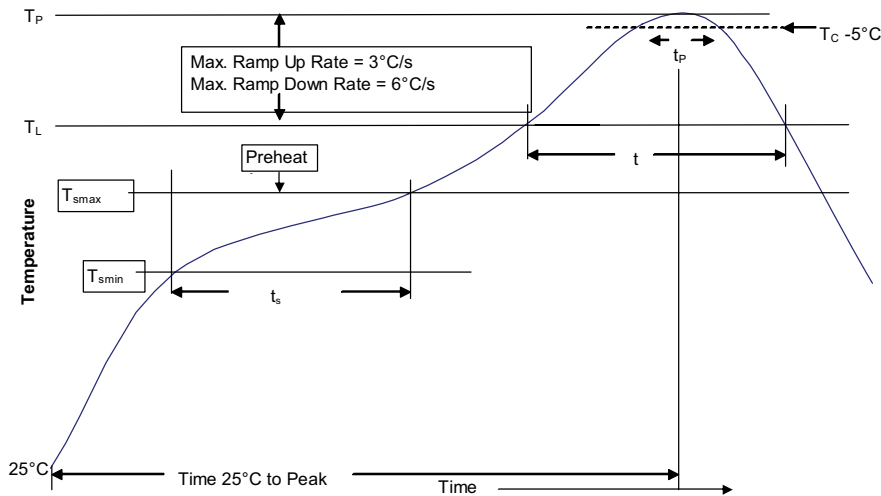
Inductance characteristics



Inductance characteristics



## 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 JEDEC 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.

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/electronics

© 2016 Eaton  
All Rights Reserved  
Printed in USA  
Publication No. 10282 BU-SB14566  
April 2016