

# HCMA1 104

## Automotive grade

### High current power inductors



#### Product features

- AEC-Q200 qualified
- High current carrying capacity
- Magnetically shielded, low EMI
- Frequency range up to 5 MHz
- Inductance range from 0.2  $\mu$ H to 22  $\mu$ H
- Current range from 5 A to 45 A
- 11.5 mm x 10.3 mm footprint surface mount package in a 4.0 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
  - Adaptive cruise control (ACC)
  - Automatic parking control
  - Collision avoidance system
  - Car black box system
- Infotainment and cluster electronics
  - Audio subsystem: head unit and trunk amp
  - Digital instrument cluster
  - In-vehicle infotainment (IVI) and navigation
- Chassis and safety electronics
  - Airbag control unit
  - Electronic stability control system (ESC)
  - Electric parking brake Voltage Regulator Module (VRM)

#### Environmental data

- Storage temperature range (Component): -55 °C to +125 °C
- Operating temperature range: -55 °C to +125 °C (ambient + self-temperature rise)
- Solder reflow temperature: J-STD-020 (latest revision) compliant



## Product Specifications

| Part Number <sup>7</sup> | OCL <sup>1</sup><br>( $\mu$ H) $\pm$ 20% | FLL <sup>2</sup> ( $\mu$ H)<br>minimum | $I_{rms}$ <sup>3</sup><br>(A) | $I_{sat}$ <sup>4,5</sup><br>(A) | DCR (m $\Omega$ )<br>typical @<br>+20 °C | DCR (m $\Omega$ )<br>maximum @<br>+20 °C | K-factor <sup>6</sup> |
|--------------------------|------------------------------------------|----------------------------------------|-------------------------------|---------------------------------|------------------------------------------|------------------------------------------|-----------------------|
| HCMA1104-R20-R           | 0.20                                     | 0.13                                   | 32                            | 45                              | 0.63                                     | 0.72                                     | 411                   |
| HCMA1104-R36-R           | 0.36                                     | 0.23                                   | 30                            | 42                              | 1.04                                     | 1.20                                     | 269                   |
| HCMA1104-R45-R           | 0.45                                     | 0.29                                   | 29                            | 36                              | 1.07                                     | 1.23                                     | 219                   |
| HCMA1104-R56-R           | 0.56                                     | 0.36                                   | 25                            | 32                              | 1.56                                     | 1.80                                     | 230                   |
| HCMA1104-R90-R           | 0.90                                     | 0.58                                   | 22                            | 28                              | 2.17                                     | 2.50                                     | 236                   |
| HCMA1104-1R0-R           | 1.0                                      | 0.56                                   | 18                            | 28                              | 3.0                                      | 3.3                                      | 378                   |
| HCMA1104-1R5-R           | 1.5                                      | 0.84                                   | 16                            | 32                              | 3.8                                      | 4.2                                      | 310                   |
| HCMA1104-2R2-R           | 2.2                                      | 1.23                                   | 12                            | 18                              | 6.0                                      | 7.0                                      | 253                   |
| HCMA1104-3R3-R           | 3.3                                      | 1.85                                   | 10                            | 16                              | 10.8                                     | 11.8                                     | 220                   |
| HCMA1104-4R7-R           | 4.7                                      | 2.63                                   | 8.5                           | 15                              | 17                                       | 20                                       | 175                   |
| HCMA1104-100-R           | 10                                       | 5.60                                   | 7.5                           | 8.5                             | 27                                       | 30                                       | 116                   |
| HCMA1104-220-R           | 22                                       | 12.3                                   | 5.0                           | 5.5                             | 60                                       | 66                                       | 92                    |

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

2. Full Load Inductance (FLL) Test Parameters: 100 kHz, 0.25 Vrms, @  $I_{sat}$ , @ +25 °C

3.  $I_{sat}$ : 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.  $I_{sat}$ : Peak current for approximately 20% rolloff @ +25 °C- HCM1104-R20-R to HCM1104-R90-R

5.  $I_{sat}$ : Peak current for approximately 30% rolloff @ +25 °C HCM1104-1R0-R to HCM1104-220-R

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

7. Part Number Definition: HCM1104-xxx-R

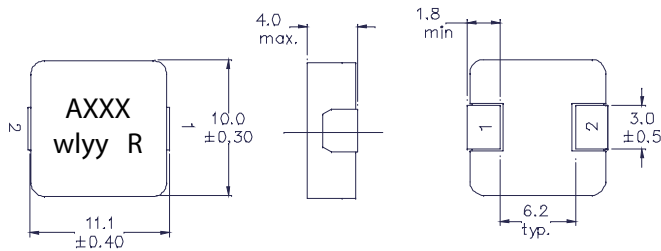
HCM1104 = Product code and size

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

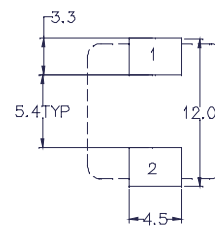
If no R is present then last character equals number of zeros

-R suffix = RoHS compliant

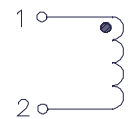
## Dimensions (mm)



## 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.  
wlyy=date code, R=revision level

All soldering surfaces to be coplanar within 0.1 millimeters

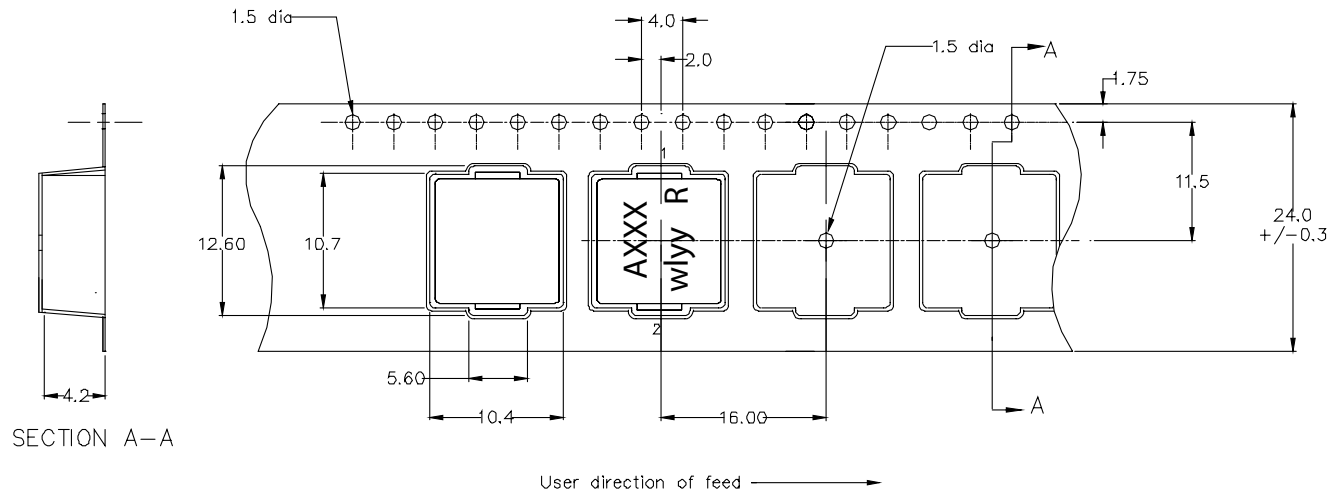
Tolerances are  $\pm$ 0.3 millimeters unless stated otherwise

Color: Grey

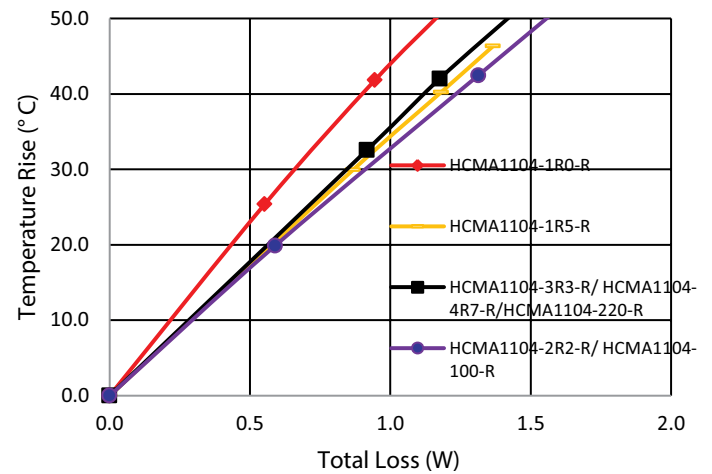
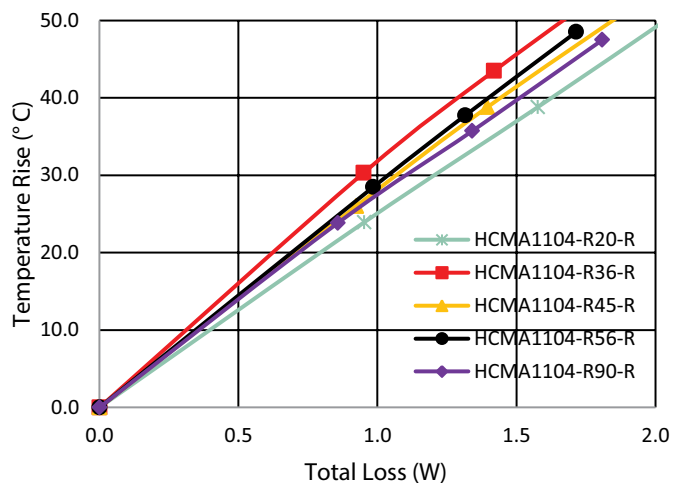
Do not route traces or vias underneath the inductor

### Packaging information (mm)

Supplied in tape and reel packaging, 850parts per 13" diameter reel

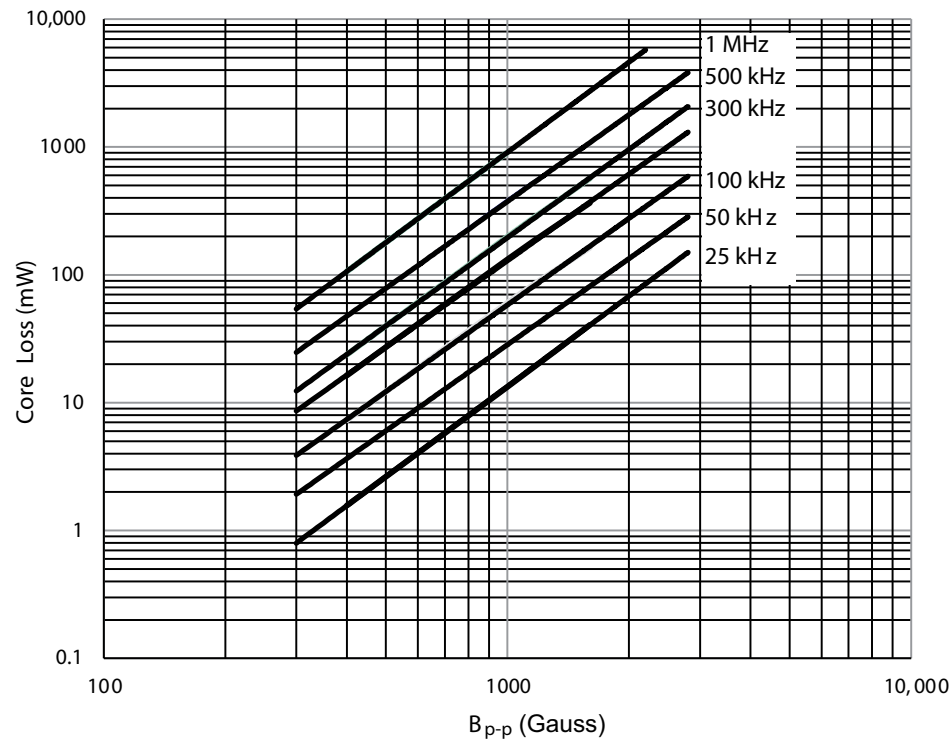


### Temperature rise vs. total loss

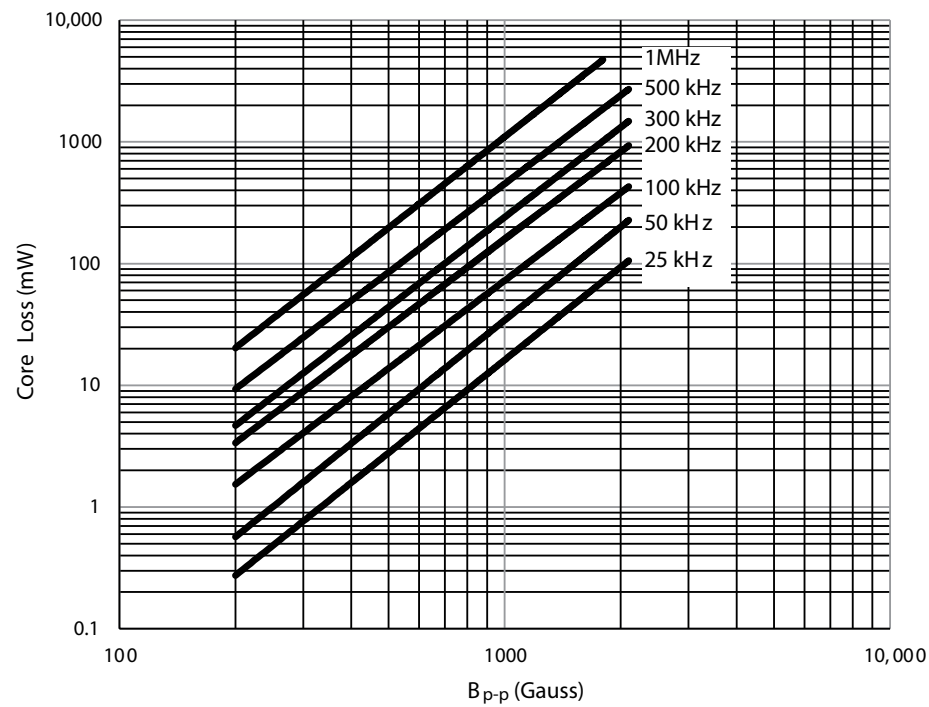


Core loss vs.  $B_{p-p}$

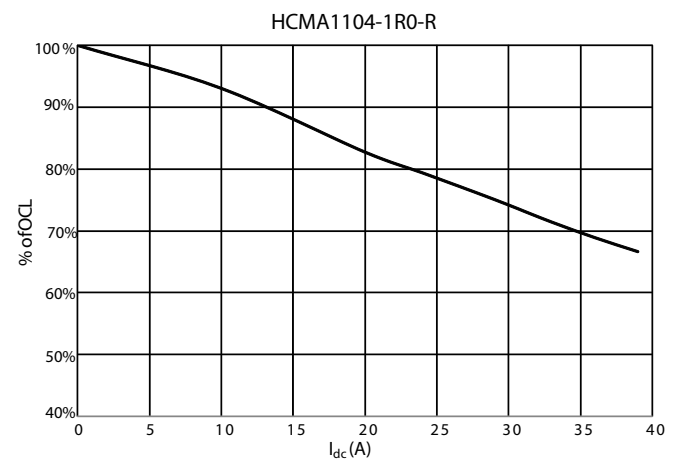
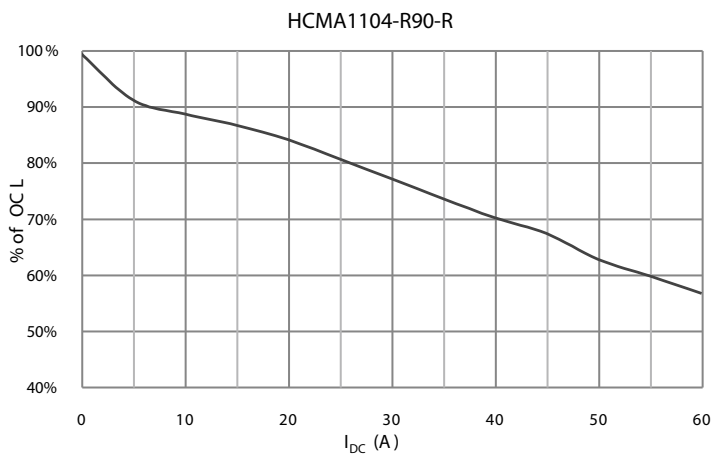
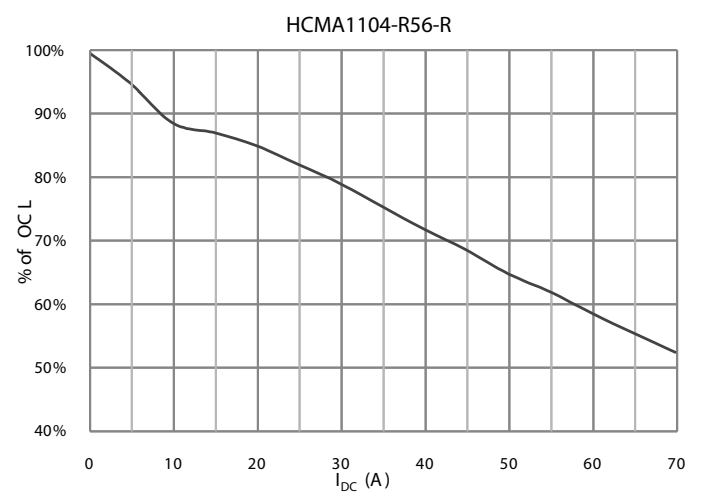
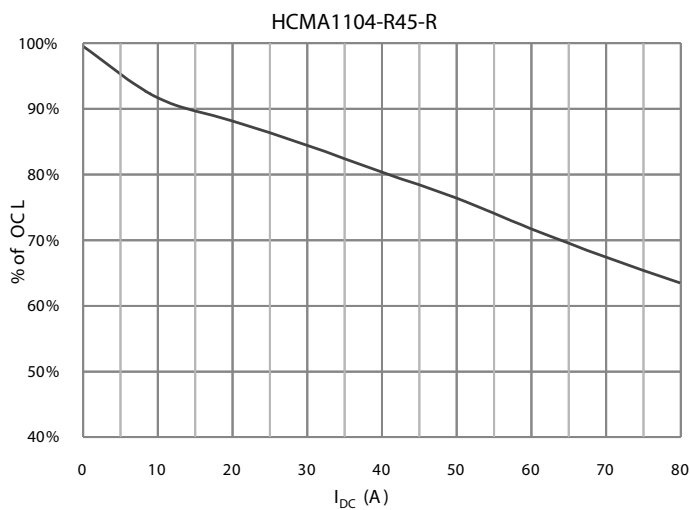
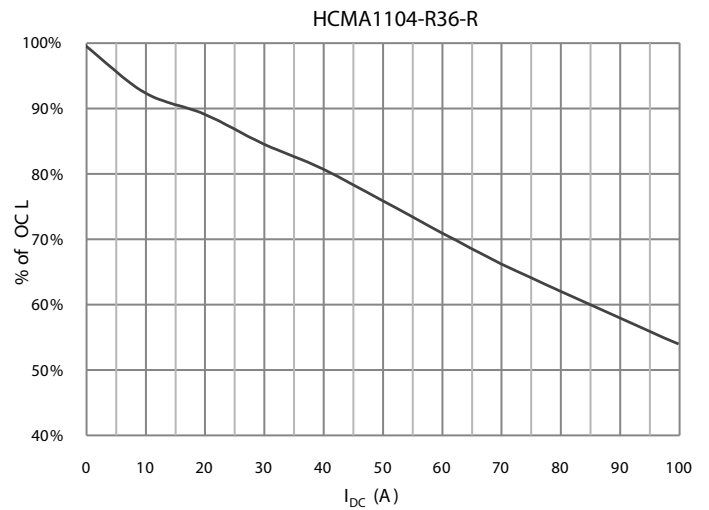
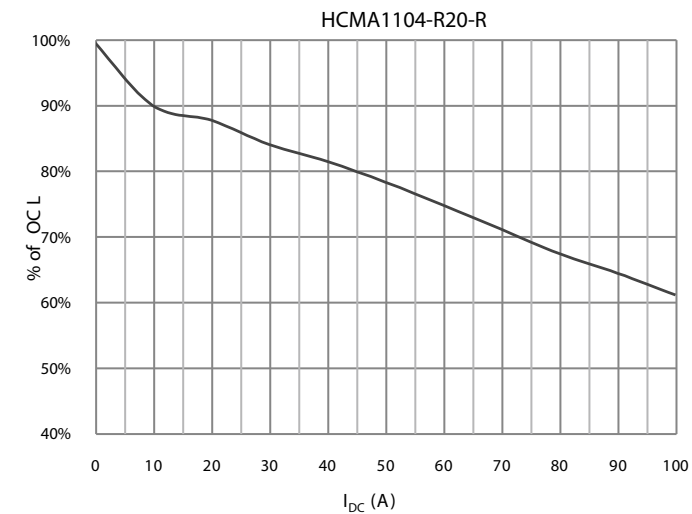
HCMA1104-R20-R to HCMA1104-R90-R



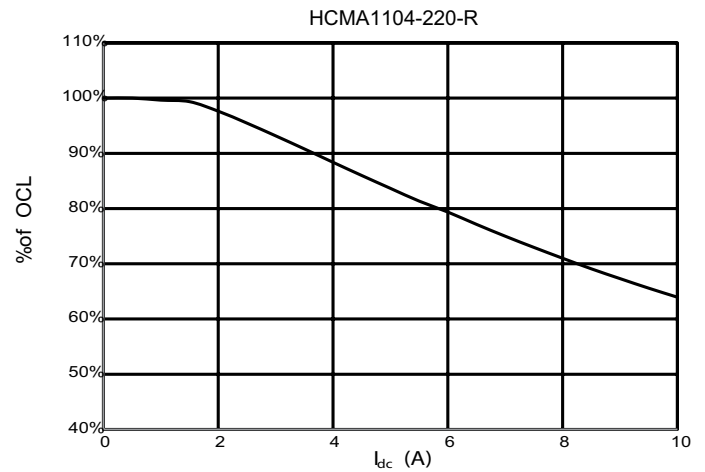
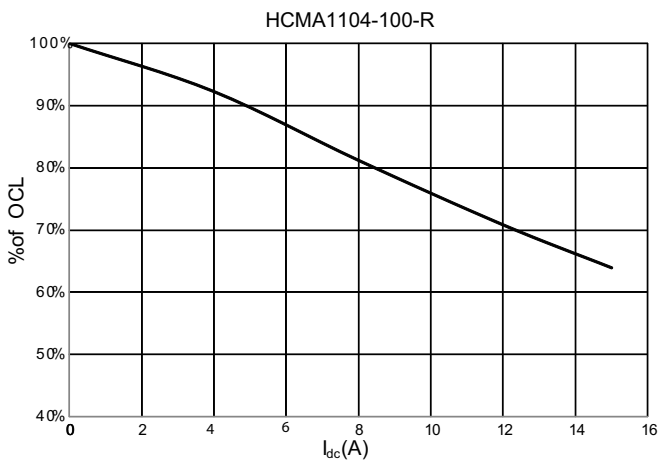
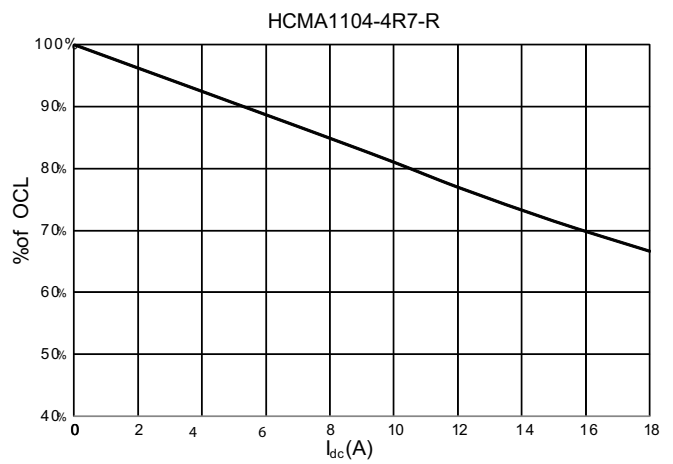
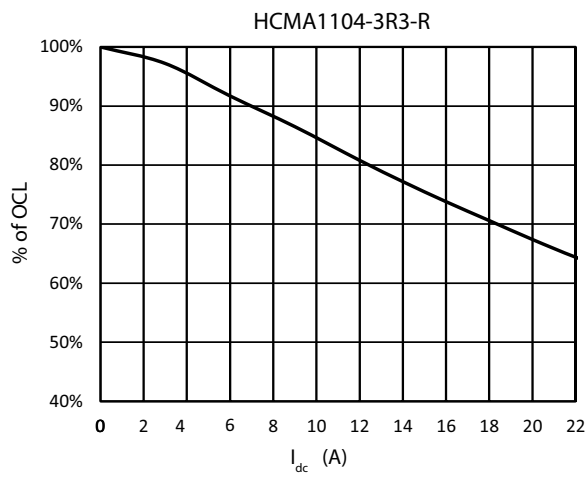
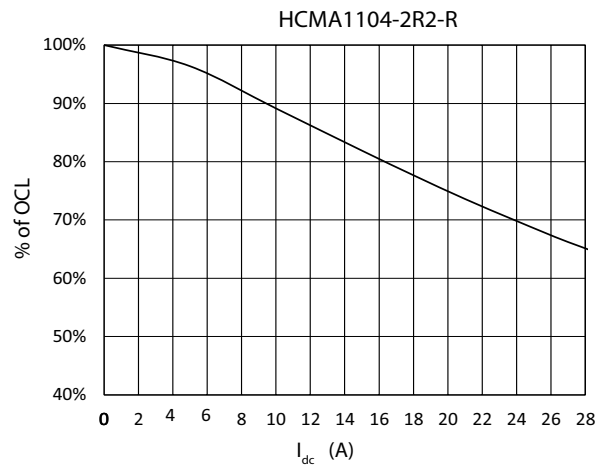
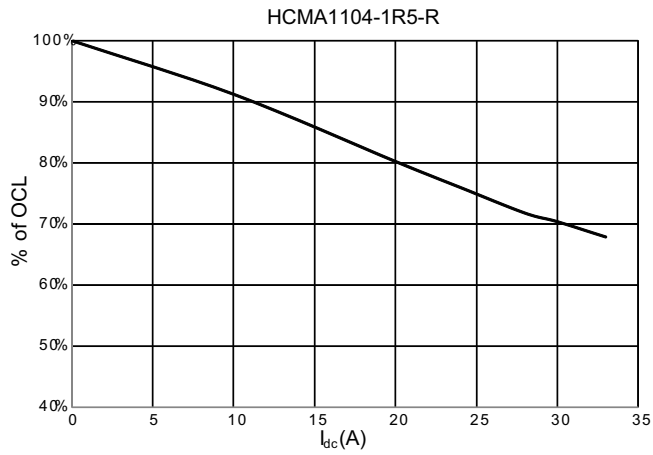
HCMA1104-1R0-R to HCMA1104-220-R



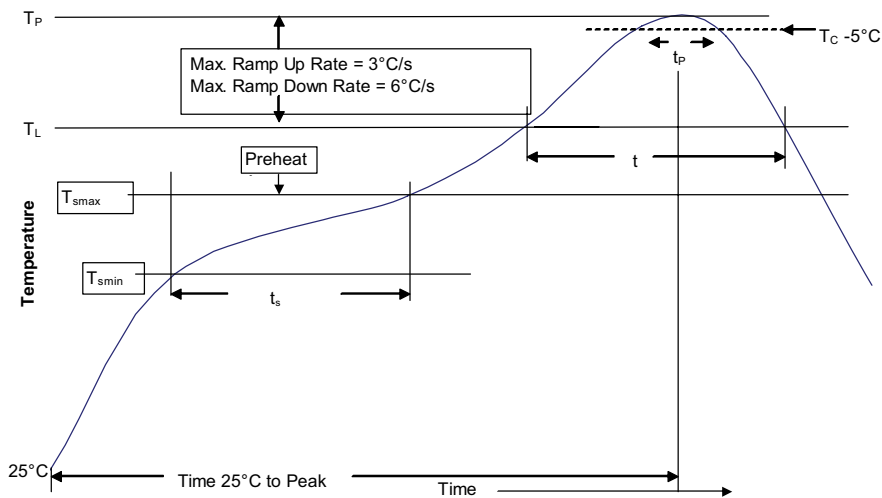
## Inductance characteristics



## 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 |
|-------------------|-----------------------------|-----------------------------|
| <2.5mm)           | 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 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.

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