HCM1A0503V2
Automotive grade high current power inductors

Product features
- AEC-Q200 qualified
- High current carrying capacity
- Magnetically shielded, low EMI
- DC-DC converter applications up to 1 MHz
- Filtering applications up to Self Resonant Frequency (SRF) [See product specification table]
- Inductance range from 0.20 μH to 10 μH
- Current range from 2.3 A to 20.5 A
- 5.7 mm x 5.4 mm footprint surface mount package in a 3.0 mm height
- Moisture Sensitivity Level (MSL): 1
- Alloy powder core material

Applications
- Body electronics
  - Central body control module
  - Vehicle access control system
  - Headlamps, tail lamps and interior lighting and LED 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
  - Port power/USB HUB for front and rear passengers
- Chassis and safety electronics
  - Airbag control unit
- Engine and Powertrain Systems
  - Electric pumps, motor control and auxiliaries
  - 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
Technical Data 10910
Effective April 2019

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Product specifications

<table>
<thead>
<tr>
<th>Part numbera</th>
<th>OCLb (μH) ± 20%</th>
<th>FLLc (μH) minimum</th>
<th>Irm (A)</th>
<th>Isat (A)</th>
<th>DCR (mΩ) typical @ +20 °C</th>
<th>DCR (mΩ) maximum @ +20 °C</th>
<th>SRF (MHz) typical</th>
<th>K-factora</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCM1A0503V2-R20-R</td>
<td>0.20</td>
<td>0.128</td>
<td>20.5</td>
<td>20</td>
<td>1.6</td>
<td>2.0</td>
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<td>HCM1A0503V2-R22-R</td>
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<td>0.141</td>
<td>15.8</td>
<td>23</td>
<td>2.1</td>
<td>2.3</td>
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<td>HCM1A0503V2-R33-R</td>
<td>0.33</td>
<td>0.211</td>
<td>14</td>
<td>16</td>
<td>2.9</td>
<td>3.4</td>
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<td>1167</td>
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<td>0.224</td>
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<td>2.9</td>
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<td>0.30</td>
<td>11</td>
<td>12</td>
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<td>0.435</td>
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<td>672</td>
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<td>0.64</td>
<td>8.4</td>
<td>8.5</td>
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<td>11.4</td>
<td>53</td>
<td>631</td>
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<tr>
<td>HCM1A0503V2-1R5-R</td>
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<td>0.96</td>
<td>6.2</td>
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<td>17.7</td>
<td>40</td>
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<td>HCM1A0503V2-2R2-R</td>
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<td>1.4</td>
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<td>6.4</td>
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<td>23</td>
<td>33</td>
<td>407</td>
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<td>HCM1A0503V2-3R3-R</td>
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<td>HCM1A0503V2-4R7-R</td>
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<td>HCM1A0503V2-5R6-R</td>
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<td>3.6</td>
<td>3.6</td>
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<td>6.8</td>
<td>4.35</td>
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<td>4.0</td>
<td>61</td>
<td>70</td>
<td>16</td>
<td>220</td>
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<td>6.4</td>
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<td>2.3</td>
<td>90</td>
<td>108</td>
<td>13</td>
<td>235</td>
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</tbody>
</table>

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, Isat, +25 °C
3. Irm: 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.
4. Isat: 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 * ΔI. Bp-p: (Gauss), K: (K-factor from table), L: (Inductance in μH), ΔI: (Peak to peak ripple current in Amps).
6. Part Number Definition: HCM1A0503V2-xxx-R
   HCM1A0503V2 = Product code and size
   xxx= inductance value in μH, R= decimal point,
   If no R is present then last character equals number of zeros
   -R suffix = RoHS compliant

Dimensions (mm)

Recommended pad layout

Part marking: 1AxxxxV2, xxxx=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 ±0.3 millimeters unless stated otherwise
Pad layout tolerances are ±0.1 millimeters unless stated otherwise
DCR measured from point “a” to point “b”
Do not route traces or vias underneath the inductor
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Packaging information (mm)
Drawing not to scale
Supplied in tape and reel packaging, 2000 parts per 13” diameter reel

Core loss vs $B_{p-p}$

HCM1A0503V2-R20-R

HCM1A0503V2-R22-R

HCM1A0503V2-R33-R

HCM1A0503V2-R35-R
Core loss vs $B_{p-p}$

HCM1A0503V2-R47-R

HCM1A0503V2-R68-R

HCM1A0503V2-R75-R

HCM1A0503V2-1R0-R

HCM1A0503V2-1R5-R

HCM1A0503V2-2R2-R
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Core loss vs $B_{pp}$
Inductance and impedance vs. frequency

HCM1A0503V2-R20-R

HCM1A0503V2-R22-R

HCM1A0503V2-R33-R

HCM1A0503V2-R35-R

HCM1A0503V2-R47-R

HCM1A0503V2-R68-R
Inductance and impedance vs. frequency

HCM1A0503V2-R75-R

HCM1A0503V2-1R0-R

HCM1A0503V2-1R5-R

HCM1A0503V2-2R2-R

HCM1A0503V2-3R3-R

HCM1A0503V2-4R7-R
Inductance and impedance vs. frequency

HCM1A0503V2-5R6-R

HCM1A0503V2-6R8-R

HCM1A0503V2-100-R
Inductance and temperature rise vs. current

HCM1A0503V2-R20-R

HCM1A0503V2-R22-R

HCM1A0503V2-R33-R

HCM1A0503V2-R35-R

HCM1A0503V2-R47-R

HCM1A0503V2-R68-R
Inductance and temperature rise vs. current

HCM1A0503V2-R75-R

HCM1A0503V2-1R0-R

HCM1A0503V2-1R5-R

HCM1A0503V2-2R2-R

HCM1A0503V2-3R3-R

HCM1A0503V2-4R7-R
Inductance and temperature rise vs. current

HCM1A0503V2-5R6-R

HCM1A0503V2-6R8-R

HCM1A0503V2-100-R
Solder reflow profile

![Solder reflow profile diagram]

Table 1 - Standard SnPb solder ($T_c$)

<table>
<thead>
<tr>
<th>Package thickness</th>
<th>Volume mm³ &lt;350</th>
<th>Volume mm³ ≥350</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2.5 mm</td>
<td>235 °C</td>
<td>220 °C</td>
</tr>
<tr>
<td>≥2.5 mm</td>
<td>220 °C</td>
<td>220 °C</td>
</tr>
</tbody>
</table>

Table 2 - Lead (Pb) free solder ($T_c$)

<table>
<thead>
<tr>
<th>Package thickness</th>
<th>Volume mm³ &lt;350</th>
<th>Volume mm³ 350 - 2000</th>
<th>Volume mm³ &gt;2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1.6 mm</td>
<td>260 °C</td>
<td>260 °C</td>
<td>260 °C</td>
</tr>
<tr>
<td>1.6 – 2.5 mm</td>
<td>260 °C</td>
<td>250 °C</td>
<td>245 °C</td>
</tr>
<tr>
<td>≥2.5 mm</td>
<td>250 °C</td>
<td>245 °C</td>
<td>245 °C</td>
</tr>
</tbody>
</table>

Reference J-STD-020

<table>
<thead>
<tr>
<th>Profile feature</th>
<th>Standard SnPb solder</th>
<th>Lead (Pb) free solder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preheat and soak</td>
<td>100 °C</td>
<td>150 °C</td>
</tr>
<tr>
<td>Preheat and soak</td>
<td>150 °C</td>
<td>200 °C</td>
</tr>
<tr>
<td>Preheat and soak</td>
<td>60-120 seconds</td>
<td>60-120 seconds</td>
</tr>
<tr>
<td>Average ramp up rate $T_{max}$ to $T_P$</td>
<td>3 °C/ second max.</td>
<td>3 °C/ second max.</td>
</tr>
<tr>
<td>Liquidous temperature ($T_L$)</td>
<td>183 °C</td>
<td>217 °C</td>
</tr>
<tr>
<td>Time at liquidous ($t_L$)</td>
<td>60-150 seconds</td>
<td>60-150 seconds</td>
</tr>
<tr>
<td>Peak package body temperature ($T_P$)*</td>
<td>Table 1</td>
<td>Table 2</td>
</tr>
<tr>
<td>Time ($t_P$)** within 5 °C of the specified classification temperature ($T_c$)</td>
<td>20 seconds**</td>
<td>30 seconds**</td>
</tr>
<tr>
<td>Average ramp-down rate ($T_P$ to $T_{max}$)</td>
<td>6 °C/ second max.</td>
<td>6 °C/ second max.</td>
</tr>
<tr>
<td>Time 25 °C to Peak temperature</td>
<td>6 minutes max.</td>
<td>8 minutes max.</td>
</tr>
</tbody>
</table>

* 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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