HCM1A1305V2
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 0.10 μH to 33 μH
- Current range from 4.5 A to 80 A
- 13.8 mm x 12.9 mm footprint surface mount package in a 5.0 mm height
- Moisture Sensitivity Level (MSL): 1
- Alloy powder core material

Applications
- Body electronics
  - Central body control module
  - 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
  - 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
  - Electronic power steering (EPS)
- 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

Eaton
Powering Business Worldwide
## Product specifications

<table>
<thead>
<tr>
<th>Part number(^a)</th>
<th>OCL(^1) (μH) ± 20%</th>
<th>FLL(^2) (μH) minimum</th>
<th>I(^{\text{rms}}) (A)</th>
<th>I(^{\text{sat}}) (A)</th>
<th>DCR (mΩ) typical @ +20 °C</th>
<th>DCR (mΩ) maximum @ +20 °C</th>
<th>SRF (MHz) typical</th>
<th>K-factor(^5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCM1A1305V2-R10-R</td>
<td>0.10</td>
<td>0.064</td>
<td>43</td>
<td>80</td>
<td>0.33</td>
<td>0.59</td>
<td>234</td>
<td>908</td>
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<tr>
<td>HCM1A1305V2-R22-R</td>
<td>0.22</td>
<td>0.14</td>
<td>48</td>
<td>60</td>
<td>0.53</td>
<td>0.61</td>
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<td>449</td>
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<tr>
<td>HCM1A1305V2-R33-R</td>
<td>0.33</td>
<td>0.21</td>
<td>46</td>
<td>50</td>
<td>0.59</td>
<td>0.69</td>
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<td>HCM1A1305V2-R56-R</td>
<td>0.56</td>
<td>0.36</td>
<td>29.5</td>
<td>50</td>
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<td>HCM1A1305V2-R68-R</td>
<td>0.68</td>
<td>0.44</td>
<td>30</td>
<td>45</td>
<td>1.15</td>
<td>1.33</td>
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<tr>
<td>HCM1A1305V2-R82-R</td>
<td>0.82</td>
<td>0.52</td>
<td>27</td>
<td>36</td>
<td>1.40</td>
<td>1.61</td>
<td>45</td>
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<tr>
<td>HCM1A1305V2-1R0-R</td>
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<td>0.64</td>
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<td>35</td>
<td>1.78</td>
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<td>0.96</td>
<td>19</td>
<td>27</td>
<td>2.60</td>
<td>3.00</td>
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<tr>
<td>HCM1A1305V2-1R8-R</td>
<td>1.8</td>
<td>1.15</td>
<td>17</td>
<td>26</td>
<td>3.25</td>
<td>3.74</td>
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<td>HCM1A1305V2-2R2-R</td>
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<td>1.41</td>
<td>15</td>
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<td>HCM1A1305V2-3R3-R</td>
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<td>HCM1A1305V2-4R7-R</td>
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<td>HCM1A1305V2-5R6-R</td>
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<td>12.7</td>
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<tr>
<td>HCM1A1305V2-6R8-R</td>
<td>6.8</td>
<td>4.35</td>
<td>9.5</td>
<td>15</td>
<td>12.1</td>
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<td>82</td>
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<tr>
<td>HCM1A1305V2-7R8-R</td>
<td>7.8</td>
<td>4.99</td>
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<td>15</td>
<td>17.3</td>
<td>17.3</td>
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<tr>
<td>HCM1A1305V2-8R2-R</td>
<td>8.2</td>
<td>5.25</td>
<td>7.5</td>
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<td>18.5</td>
<td>18.5</td>
<td>9</td>
<td>59</td>
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<td>HCM1A1305V2-100-R</td>
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<td>6.40</td>
<td>7.5</td>
<td>13</td>
<td>20.9</td>
<td>20.9</td>
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<td>HCM1A1305V2-120-R</td>
<td>12.0</td>
<td>7.68</td>
<td>7.0</td>
<td>9.0</td>
<td>23.0</td>
<td>23.0</td>
<td>6</td>
<td>59</td>
</tr>
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<td>HCM1A1305V2-150-R</td>
<td>15.0</td>
<td>9.60</td>
<td>6.5</td>
<td>9.5</td>
<td>27.1</td>
<td>27.1</td>
<td>6</td>
<td>50</td>
</tr>
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<td>HCM1A1305V2-220-R</td>
<td>22.0</td>
<td>14.1</td>
<td>5.0</td>
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<td>40.0</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>HCM1A1305V2-330-R</td>
<td>33.0</td>
<td>21.1</td>
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<td>5.2</td>
<td>58.0</td>
<td>58.0</td>
<td>3</td>
<td>37</td>
</tr>
</tbody>
</table>

1. Open Circuit Inductance (OCL) Test Parameters: 100 kHz, 0.25 V\(_{\text{rms}}\), 0.0 A\(_{\text{dc}}\), +25 °C
2. Full Load Inductance (FLL) Test Parameters: 100 kHz, 0.25 V\(_{\text{rms}}\), I\(_{\text{sat}}\), +25 °C
3. I\(_{\text{rms}}\): 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. I\(_{\text{sat}}\): Peak current for approximately 20% rolloff @ +25 °C
5. K-factor: Used to determine B\(_{\text{pp}}\) for core loss (see graph). B\(_{\text{pp}}\) = K \* L \* \(\Delta I\), B\(_{\text{pp}}\) (Gauss), K (K-factor from table), L (Inductance in μH), \(\Delta I\) (Peak to peak ripple current in Amps).
6. Part Number Definition: HCM1A1305V2-xxx-R
   - HCM1A1305V2 = 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
HCM1A1305V2
Automotive grade high current power inductors

Dimensions (mm)

Recommended pad layout

<table>
<thead>
<tr>
<th>Dimension A</th>
<th>HCM1A1305V2-R10</th>
<th>HCM1A1305V2-R56</th>
<th>HCM1A1305V2-3R3 through 330-R</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.4 ±0.3</td>
<td>3.68 ±0.3</td>
<td>4.7 ±0.3</td>
</tr>
</tbody>
</table>

Part marking: 1AxxxV2, 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 ±0.3 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

Packaging information (mm)

Drawing not to scale

Supplied in tape and reel packaging, 250 parts per 13” diameter reel
Automotive grade high current power inductors

Core loss vs $B_{p-p}$

**HCM1A1305V2-R10-R**

- 700 kHz
- 500 kHz
- 300 kHz
- 100 kHz
- 50 kHz

**HCM1A1305V2-R22-R**

- 700 kHz
- 500 kHz
- 300 kHz
- 100 kHz
- 50 kHz

**HCM1A1305V2-R33-R**

- 700 kHz
- 500 kHz
- 300 kHz
- 100 kHz
- 50 kHz

**HCM1A1305V2-R47-R**

- 700 kHz
- 500 kHz
- 300 kHz
- 100 kHz
- 50 kHz

**HCM1A1305V2-R56-R**

- 700 kHz
- 500 kHz
- 300 kHz
- 100 kHz
- 50 kHz

**HCM1A1305V2-R68-R**

- 700 kHz
- 500 kHz
- 300 kHz
- 100 kHz
- 50 kHz
HCM1A1305V2
Automotive grade high current power inductors

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

**HCM1A1305V2-4R7-R**

- Core Loss (mW) vs $B_{p-p}$ (Gauss)
- Frequency Options: 50 kHz, 100 kHz, 300 kHz, 500 kHz, 700 kHz

**HCM1A1305V2-5R6-R**

- Core Loss (mW) vs $B_{p-p}$ (Gauss)
- Frequency Options: 50 kHz, 100 kHz, 300 kHz, 500 kHz, 700 kHz

**HCM1A1305V2-6R0-R**

- Core Loss (mW) vs $B_{p-p}$ (Gauss)
- Frequency Options: 50 kHz, 100 kHz, 300 kHz, 500 kHz, 700 kHz

**HCM1A1305V2-6R8-R**

- Core Loss (mW) vs $B_{p-p}$ (Gauss)
- Frequency Options: 50 kHz, 100 kHz, 300 kHz, 500 kHz, 700 kHz

**HCM1A1305V2-7R8-R**

- Core Loss (mW) vs $B_{p-p}$ (Gauss)
- Frequency Options: 50 kHz, 100 kHz, 300 kHz, 500 kHz, 700 kHz

**HCM1A1305V2-8R2-R**

- Core Loss (mW) vs $B_{p-p}$ (Gauss)
- Frequency Options: 50 kHz, 100 kHz, 300 kHz, 500 kHz, 700 kHz
HCM1A1305V2
Automotive grade high current power inductors

Core loss vs $B_{pp}$

HCM1A1305V2-100-R

HCM1A1305V2-120-R

HCM1A1305V2-150-R

HCM1A1305V2-220-R

HCM1A1305V2-330-R

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Inductance and impedance vs. frequency

HCM1A1305V2-R10-R

HCM1A1305V2-R22-R

HCM1A1305V2-R33-R

HCM1A1305V2-R47-R

HCM1A1305V2-R56-R

HCM1A1305V2-R68-R
Inductance and impedance vs. frequency

HCM1A1305V2-R82-R

HCM1A1305V2-1R0-R

HCM1A1305V2-1R5-R

HCM1A1305V2-1R8-R

HCM1A1305V2-2R2-R

HCM1A1305V2-3R3-R
Autotive grade high current power inductors

Inductance and impedance vs. frequency

HCM1A1305V2-4R7-R

HCM1A1305V2-5R6-R

HCM1A1305V2-6R0-R

HCM1A1305V2-6R8-R

HCM1A1305V2-7R8-R

HCM1A1305V2-8R2-R
Inductance and impedance vs. frequency

HCM1A1305V2-100-R

HCM1A1305V2-120-R

HCM1A1305V2-150-R

HCM1A1305V2-220-R

HCM1A1305V2-330-R
Inductance and temperature rise vs. current

HCM1A1305V2-R10-R

Inductance

Temperature rise

HCM1A1305V2-R22-R

Inductance

Temperature rise

HCM1A1305V2-R33-R

Inductance

Temperature rise

HCM1A1305V2-R47-R

Inductance

Temperature rise

HCM1A1305V2-R56-R

Inductance

Temperature rise

HCM1A1305V2-R68-R

Inductance

Temperature rise
Inductance and temperature rise vs. current

HCM1A1305V2-R82-R

HCM1A1305V2-1R0-R

HCM1A1305V2-1R5-R

HCM1A1305V2-1R8-R

HCM1A1305V2-2R2-R

HCM1A1305V2-3R3-R
Inductance and temperature rise vs. current

- **HCM1A1305V2-4R7-R**
  - Inductance: OCL (uH)
  - Temperature rise: ℃
  - Current: Idc (A)

- **HCM1A1305V2-5R6-R**
  - Inductance: OCL (uH)
  - Temperature rise: ℃
  - Current: Idc (A)

- **HCM1A1305V2-6R0-R**
  - Inductance: OCL (uH)
  - Temperature rise: ℃
  - Current: Idc (A)

- **HCM1A1305V2-6R8-R**
  - Inductance: OCL (uH)
  - Temperature rise: ℃
  - Current: Idc (A)

- **HCM1A1305V2-7R8-R**
  - Inductance: OCL (uH)
  - Temperature rise: ℃
  - Current: Idc (A)

- **HCM1A1305V2-8R2-R**
  - Inductance: OCL (uH)
  - Temperature rise: ℃
  - Current: Idc (A)
Inductance and temperature rise vs. current

- **HCM1A1305V2-100-R**
- **HCM1A1305V2-120-R**
- **HCM1A1305V2-150-R**
- **HCM1A1305V2-220-R**
- **HCM1A1305V2-330-R**

OCL (μH) vs. Temperature rise (°C) vs. Idc (A) for each inductor variant.
Solder reflow profile

Table 1 - Standard SnPb solder ($T_c$)

<table>
<thead>
<tr>
<th>Package thickness</th>
<th>Volume $&lt;350$ mm$^3$</th>
<th>Volume $\geq350$ mm$^3$</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>
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</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Package thickness</th>
<th>Volume $&lt;350$ mm$^3$</th>
<th>Volume $350 - 2000$ mm$^3$</th>
<th>Volume $&gt;2000$ mm$^3$</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>&gt;2.5 mm</td>
<td>250 °C</td>
<td>245 °C</td>
<td>245 °C</td>
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</tbody>
</table>

Reference J-STD-020

<table>
<thead>
<tr>
<th>Profile feature</th>
<th>Standard SnPb solder $T_c$</th>
<th>Lead (Pb) free solder $T_c$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preheat and soak</td>
<td>• Temperature min. ($T_{s\min}$)</td>
<td>100 °C</td>
</tr>
<tr>
<td></td>
<td>• Temperature max. ($T_{s\max}$)</td>
<td>150 °C</td>
</tr>
<tr>
<td></td>
<td>• Time ($T_{s\min}$ to $T_{s\max}$) ($t_s$)</td>
<td>60-120 seconds</td>
</tr>
<tr>
<td>Average ramp up rate ($T_{s\max}$ 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 $T_{s\max}$)</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>
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</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.