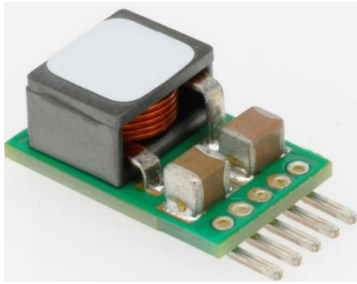


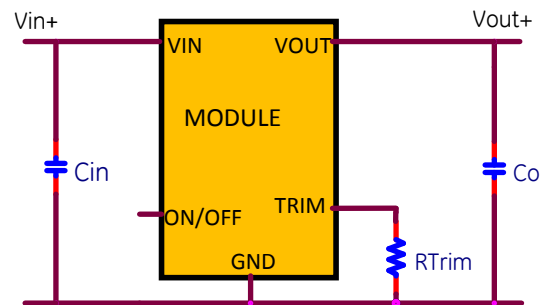
# IND060SIP Hornet: Non-Isolated DC-DC Voltage Regulator Modules

12Vdc input; 0.6Vdc to 5.5Vdc output; 60W Max Power



## Applications

- ✓ Industrial Equipment
- ✓ Control Boards
- ✓ Test Equipment



## Electrical Features

- 12V Input voltage with wide Tolerance
- Output voltage programmable from 0.59Vdc to 5.5Vdc via external resistor
- Remote On/Off for optional external control
- Fixed switching frequency
- Output overcurrent protection (non-latching)

## Mechanical Features

- Small size: 10.4 mm x 16.5 mm x 8.4 mm (0.41 in x 0.65 in x 0.33 in)
- Operating range: -40°C to 85°C ambient

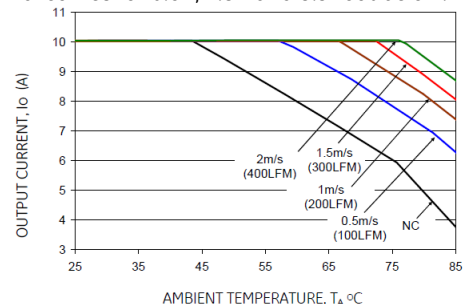
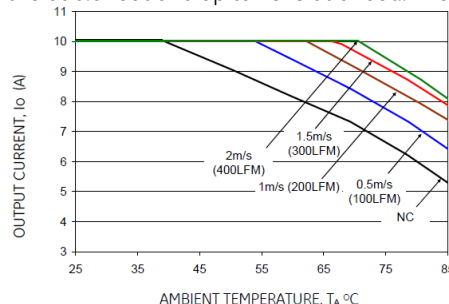
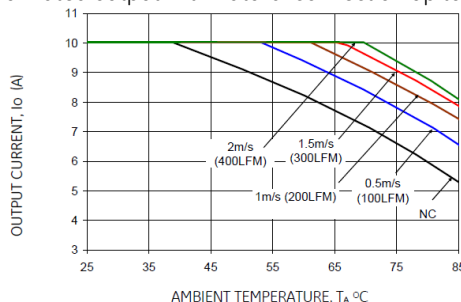
## Process and Safety

- ANSI/UL# 60950-1 2nd Revised October 14, 2014, CSA# C22.2 No. 60950-1-07, Second Ed. + A2:2014 (MOD) Recognized, DIN EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011, + A2:2013 (VDE# 0805-1) Licensed
- ISO\*\* 9001 and ISO 14001 certified manufacturing facilities
- Compliant to RoHS II EU "Directive 2011/65/EU"
- Compatible in a Pb-free or SnPb reflow environment.
- Suitable for aqueous clean.
- Suitable for conformal coating with dip and vapor deposition. Conformal coating can provide the protection to meet Salt Fog Test per IEC 60068-2-52 (Severity 3) and Mixed Gas Flow test per Telcordia GR-3108 Outdoor Levels.
- 3 year warranty

| Device Code | Input Voltage | Output Voltage | Output Current (Max.) | On/Off Logic | Comcode     |
|-------------|---------------|----------------|-----------------------|--------------|-------------|
| IND060SIP   | 9.6 – 14Vdc   | 0.59 – 5.5Vdc  | 10A                   | Positive     | 1600102908A |

## Thermal Performance

Full rated output with natural convection up to 40°C at 0.6Vout and up to 45°C at 6Vout.. Thermal curves for 0.6V, 1.8V and 5.5Vout below.



## Electrical Specifications

| Parameter                                                                                                    | Device                      | Symbol            | Min                         | Typ | Max  | Unit          |
|--------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------|-----------------------------|-----|------|---------------|
| Operating Input Voltage                                                                                      | All                         | $V_{IN}$          | 9.6                         | 12  | 14   | Vdc           |
| Input No Load Current<br>( $V_{IN} = 12.0\text{Vdc}$ , $I_O = 0$ , module enabled)                           | $V_{O,set} = 0.6\text{Vdc}$ | $I_{IN,No\ load}$ |                             | 29  |      | mA            |
|                                                                                                              | $V_{O,set} = 5\text{Vdc}$   | $I_{IN,No\ load}$ |                             | 58  |      | mA            |
| External Capacitance, Ceramic ESR $\geq 1\text{m}\Omega$                                                     | All                         | $C_{O,max}$       | 100                         | —   | 1500 | $\mu\text{F}$ |
| Efficiency 12V <sub>INDC</sub> , $T_A=25^\circ\text{C}$ , $I=12\text{A}$ , $V_O=0.6\text{ to }3.3\text{Vdc}$ |                             | $\eta$            | 73(0.59V), 87(1.8V), 95(6V) |     |      | %             |
| Switching Frequency                                                                                          | All                         | $f_{sw}$          | —                           | 600 | —    | kHz           |
| Output Voltage (Over all line, load, and temperature conditions)                                             | All                         | $V_O, set$        | -3.0                        | —   | +3.0 | % $V_O, set$  |
| On/Off Logic High (MODULE ON) Input High Voltage                                                             | All                         | $V_{IH}$          | 1                           | —   | 14   | Vdc           |
| On/ Off Logic Low (MODULE OFF) Input Low Voltage                                                             | All                         | $V_{IL}$          | -0.3                        | —   | 0.4  | Vdc           |

## Characteristic Curves

The following figures provide typical characteristics for the 10A Hornet at 25°C.

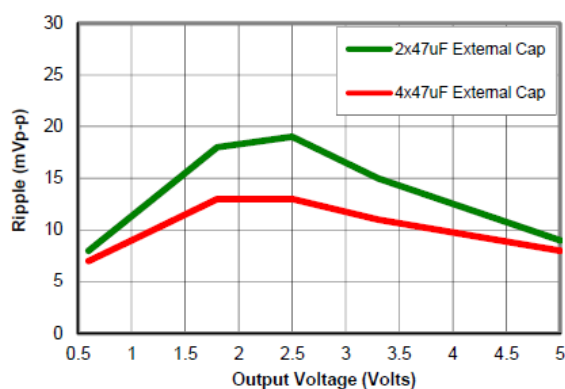


Figure 1. Output Ripple Voltage (20MHz BW) for various output voltages and external caps @12Vin. Additional Decoupling cap of 0.1uF used on input and output side

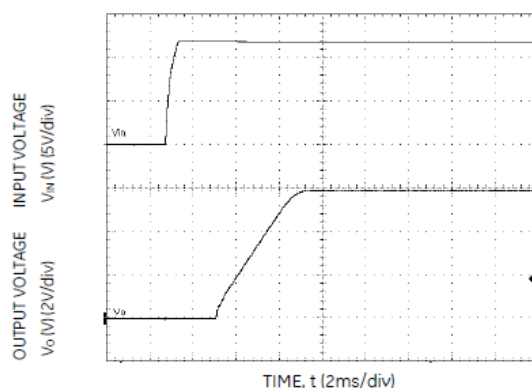


Figure 2. Typical Start-up using Input Voltage ( $V_{in}=12\text{V}$ ,  $V_{out} = V_{out, max}$ ,  $I_{out} = I_{out, max}$ )

## Trim

Without an external resistor between Trim and GND pins, the output of the module will be 0.6Vdc.  $R_{trim}$  for a desired output voltage, should be as per the following table. The formula in the last column helps determine  $R_{trim}$  for other voltages.

| $V_O$ (V)                | 0.59 | 1.0  | 1.2   | 1.5 | 1.8   | 2.5   | 3.3   | 5.0   | $R_{trim} = \left[ \frac{1.182}{(V_O - 0.591)} \right] k\Omega$ |
|--------------------------|------|------|-------|-----|-------|-------|-------|-------|-----------------------------------------------------------------|
| $R_{trim}$ (k $\Omega$ ) | Open | 2.89 | 1.941 | 1.3 | 0.978 | 0.619 | 0.436 | 0.268 |                                                                 |

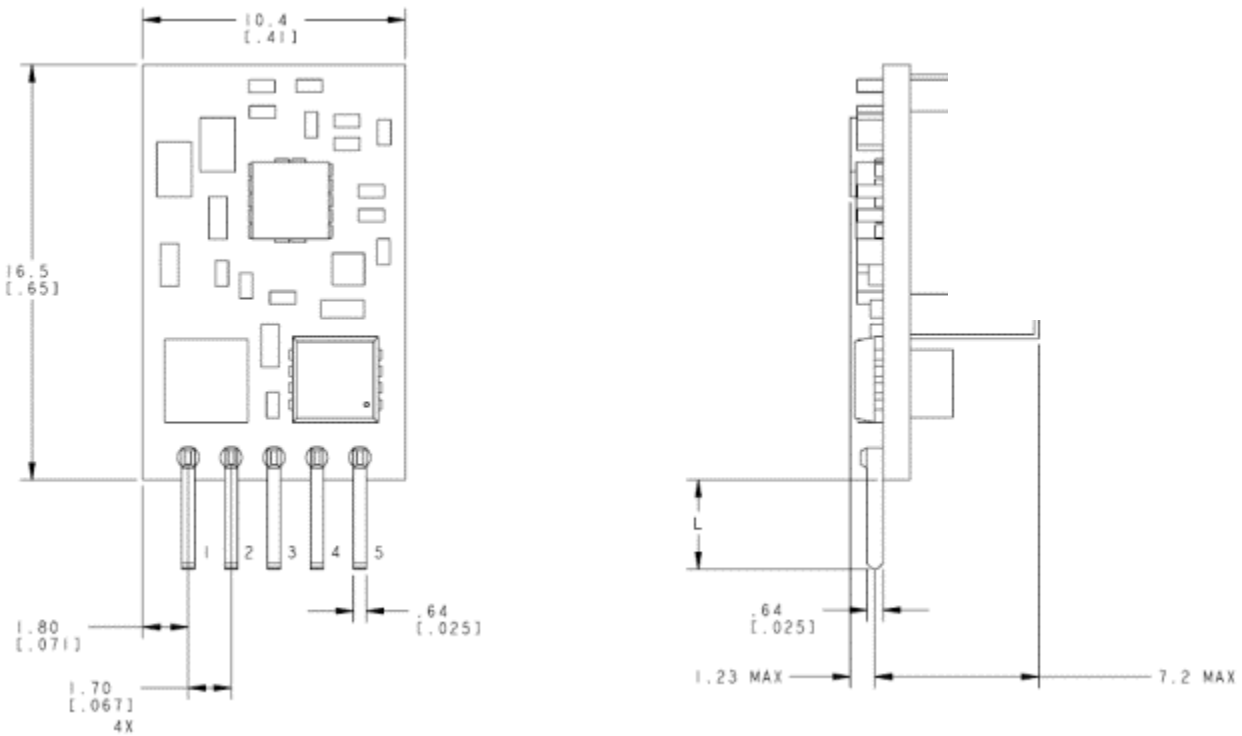
## Safety Considerations

For safety agency approval, the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standards listed on the first page of this document. For the converter output to be considered meeting the requirements of safety extra-low voltage (SELV), the input must meet SELV requirements. The power module has extra-low voltage (ELV) outputs when all inputs are ELV. A 15A quick acting input fuse for the module is required.

## Recommended Pad Layout

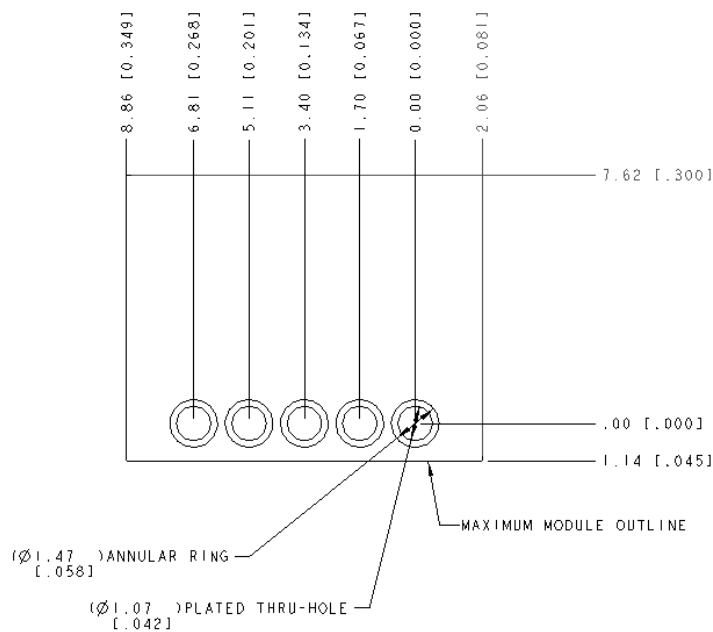
Dimensions are in millimeters and (inches).

Tolerances: x.x mm  $\pm$  0.5 mm (x.xx in.  $\pm$  0.02 in.) [unless otherwise indicated] x.xx mm  $\pm$  0.25 mm (x.xxx in  $\pm$  0.010 in.)



$$L = 3.29 [0.13] \pm 0.25 [0.112 \pm 0.01]$$

| Pin | Function         |
|-----|------------------|
| 1   | On/Off           |
| 2   | V <sub>IN</sub>  |
| 3   | GND              |
| 4   | V <sub>out</sub> |
| 5   | Trim+            |



## Through-Hole Lead-Free Soldering Information

These RoHS-compliant through-hole products use the SAC (Sn/Ag/Cu) Pb-free solder and RoHS-compliant components. They are designed to be processed through single or dual wave soldering machines. The pins have an RoHS-compliant finish that is compatible with both Pb and Pb-free wave soldering processes. A maximum preheat rate of 3°C/s is suggested. The wave preheat process should be such that the temperature of the power module board is kept below 210°C. For Pb solder, the recommended pot temperature is 260°C, while the Pb-free solder pot is 270°C max. Not all RoHS-compliant through-hole products can be processed with paste-through-hole Pb or Pb-free reflow process.

## Contact Us

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