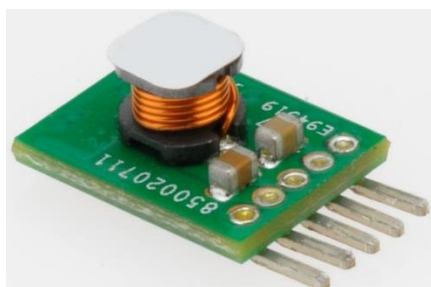


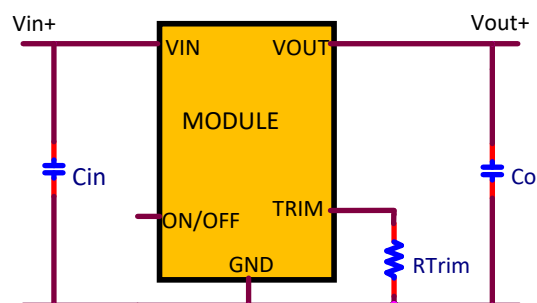
# IND011SIP Hornet: Non-Isolated DC-DC Voltage Regulator Modules

12Vdc input; 0.6Vdc to 5.5Vdc output; 11W Max Power



## Applications

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



## Electrical Features

- 12V Input voltage with adequate Tolerance
- Output voltage programmable from 0.6Vdc 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 13.5 mm x 8.1 mm (0.41 in x 0.53 in x 0.32 in)
- Operating range: -40°C to 85°C ambient

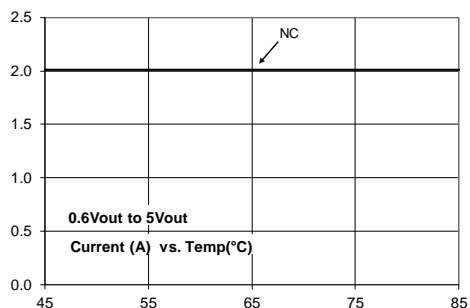
## Process and Safety

- ANSI/UL\* 62368-1 and CAN/CSA† C22.2 No. 62368-1 Recognized, DIN VDE‡ 0868-1/A11:2017 (EN62368-1:2014/A11:2017)
- ISO\*\* 9001 and ISO 14001 certified manufacturing facilities
- Compliant to RoHS Directive 2011/65/EU and amended Directive (EU) 2015/863
- Compliant to REACH Directive (EC) No 1907/2006
- 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
IND011SIP	9.6 – 14Vdc	0.6 – 5.5Vdc	2A	Positive	1600102909A

## Thermal Performance

Full rated output with natural convection up to 85°C for all output voltages.



## Electrical Specifications

Parameter	Device	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	All	$V_{IN}$	9.6	12	14	Vdc
Input No Load Current ( $V_{IN} = 12.0\text{Vdc}$ , $I_O = 0$ , module enabled)	$V_{O,set} = 0.6\text{Vdc}$	$I_{IN,No\ load}$		20		mA
	$V_{O,set} = 5\text{Vdc}$	$I_{IN,No\ load}$		48		mA
External Capacitance, Ceramic $ESR \geq 1\text{ m}\Omega$	All	$C_{O,max}$	22	—	47*	$\mu\text{F}$
Efficiency 12V <sub>INDC</sub> , $T_A=25^\circ\text{C}$ , $I=12\text{A}$ , $V_O=0.6\text{ to }3.3\text{Vdc}$		$\eta$	69.2(0.6V), 85.5(1.8V), 93.3(5V)			%
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	$V_{IH}$	3	—	14	Vdc
On/ Off Logic Low (MODULE OFF) Input Low Voltage	All	$V_{IL}$	-0.3	—	0.3	Vdc

\*Additional External Capacitance possible using Tunable Loop

## Characteristic Curves

The following figures provide typical characteristics for the 2A Hornet at  $25^\circ\text{C}$ .

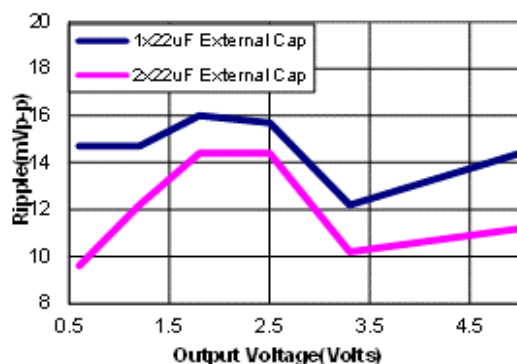


Figure 1. Output Ripple Voltage (20MHz BW) for various output voltages and external caps @12Vin. Additional Decoupling cap of 0.1uF used on input and output side

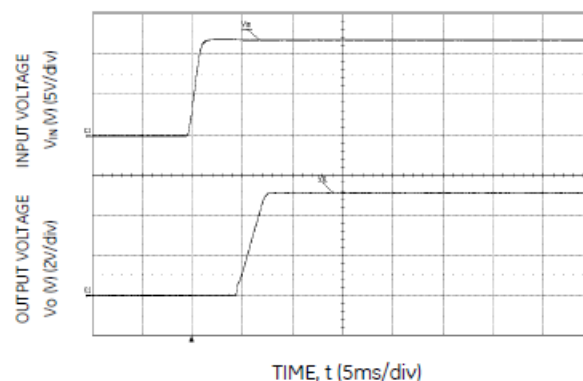


Figure 2. Typical Start-up using Input Voltage ( $V_{IN}=12\text{V}$ ,  $V_{out} = V_{out, max}$ ,  $I_{out} = I_{out, max}$ )

## 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)	0.6	0.9	1.0	1.2	1.5	1.8	2.5	3.3	5.0	$R_{trim} = \left[ \frac{12}{(V_O - 0.6)} \right] k\Omega$
$R_{trim}$ (k $\Omega$ )	Open	40	30	20	13.3	10	6.316	4.4	2.727	

## 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) or ES1, the input must meet SELV/ES1 requirements. The power module has extra-low voltage (ELV) outputs when all inputs are ELV. An input fuse for the module is recommended. Due to the wide input voltage and output voltage ranges of the module, a 4A, 125Vdc fast acting fuse is recommended.

## Tunable Loop

The module is designed for 200 $\mu$ F capacitor on its output. For applications where more than 47 $\mu$ F capacitors would be used on the output, an additional Resistor ( $R_{TUNE}$ ) and Capacitor ( $C_{TUNE}$ ) would be required in the circuit schematic to compensate for the additional capacitance. The placement is between the Sense+ pin and Trim pin as per figure below:

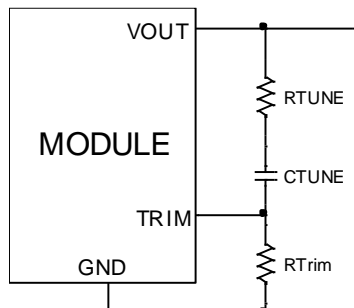


Figure. 3. Circuit diagram showing connection of  $R_{TUNE}$  and  $C_{TUNE}$  to tune the control loop of the module

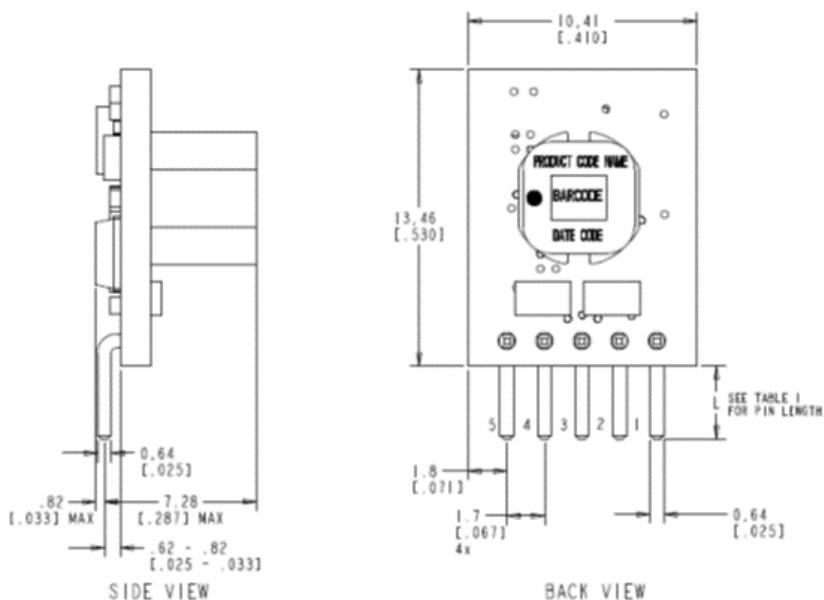
The recommended values for  $R_{TUNE}$  and  $C_{TUNE}$  for different amounts of external capacitance are as per the table below:

Co	2x47 $\mu$ F	3x47 $\mu$ F	4x47 $\mu$ F	10x47 $\mu$ F
$R_{TUNE}$	150	100	100	100
$C_{TUNE}$	10nF	18nF	18nF	22nF

## 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.)

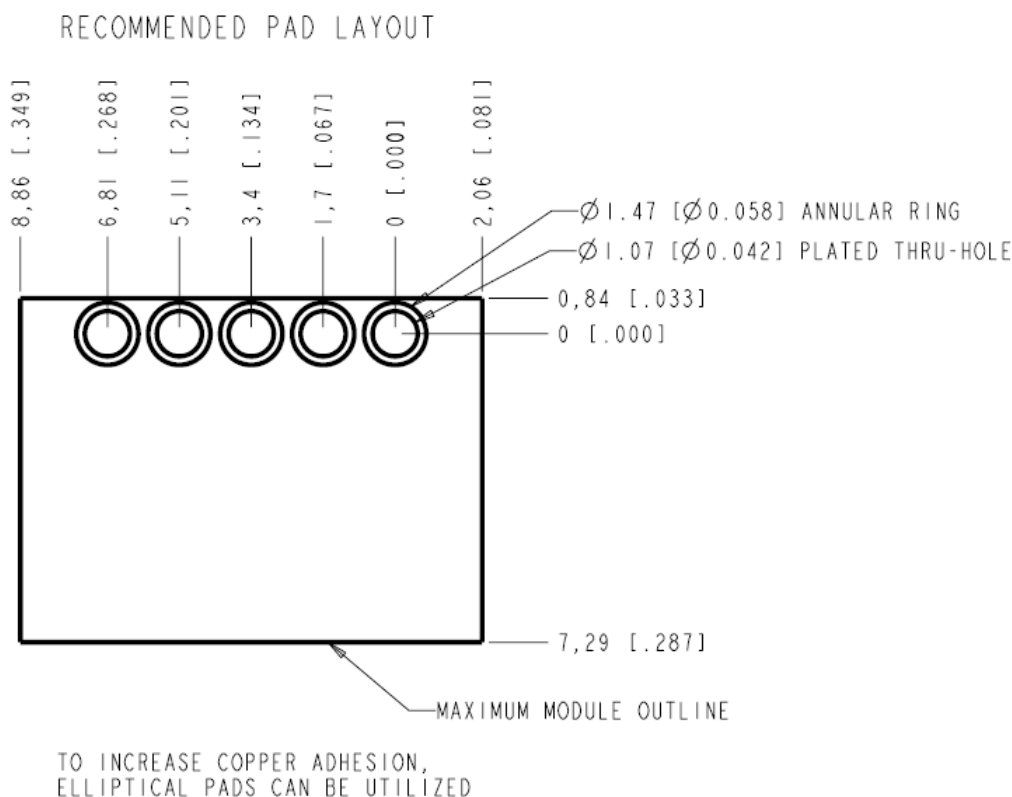


Pin Out

PIN	Function
1	On/Off
2	Vin
3	GND
4	Vout
5	Trim+

TABLE I

PRODUCT OPTION	PIN LENGTH "L" MM [INCH]
STANDARD	3.29 [.130]
OPTION - 6	2.85 [.112]
OPTION - 54	5.08 [.200]



### 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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