

KHHD004A2S8R0 Hammerhead™ Series; DC-DC Converter Power Modules

18-60Vdc Input; 8Vdc, 4.2A, 34W Output



RoHS Compliant

Applications

- Wireless Networks
- Hybrid power architectures
- Optical and Access Network Equipment
- Enterprise Networks including Power over Ethernet (PoE)
- Industrial markets

Options

- Negative Remote On/Off logic (preferred)
- Auto-restart Over current/Over voltage protections (preferred)
- Shorter through hole pin trim

Description

The KHHD004A2S8R0 series of Power Input Modules are identical in form, fit and function to the parent KHHD004A2B Hammerhead™ Series; DC-DC Converter Power Modules with the noted exceptions.

Features

- Compliant to RoHS EU Directive 2002/95/EC (-Z versions)
- Input Voltage Range, 18V_{dc} to 60V_{dc}
- No minimum load
- High efficiency – 90% at full load (V_{IN}=48V_{dc})
- Constant switching frequency
- Low output ripple and noise
- Small Size and low profile, follows DOSA standard 1/16th footprint
33.0 mm x 22.9 mm x 9.3mm
(1.30 in x 0.9 in x 0.37in)
- Reflow process compliant
- Positive Remote On/Off logic
- Output overcurrent/voltage protection (hiccup)
- Over-temperature protection
- Output Voltage adjust: 80% to 110% of V_{o,nom}
- Wide operating temperature range (-40°C to 80°C)
- UL*Recognized to UL60950-1, CAN/CSA† C22.2 No.60950-1, and EN60950-1(VDE ‡ 0805-1) Licensed
- CE mark meets 2006/95/EC directive§
- Meets the voltage and current requirements for ETSI 300-132-2 and complies with and licensed for Basic insulation rating per EN60950-1
- 2250 Vdc Isolation tested in compliance with IEEE 802.3[¶] PoE standards
- ISO** 9001 and ISO 14001 certified manufacturing facilities

* UL is a registered trademark of Underwriters Laboratories, Inc.

† CSA is a registered trademark of Canadian Standards Association.

‡ VDE is a trademark of Verband Deutscher Elektrotechniker e.V.

§ This product is intended for integration into end-user equipment. All of the required procedures of end-use equipment should be followed.

¶ IEEE and 802 are registered trademarks of the Institute of Electrical and Electronics Engineers, Incorporated.

** ISO is a registered trademark of the International Organization of Standards.

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Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only, functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect the device reliability.

Parameter	Device	Symbol	Min	Max	Unit
Input Voltage (Continuous)	All	V_{IN}	-0.3	60	Vdc
Transient (100ms)	All	$V_{IN,trans}$	-0.3	80	Vdc
Operating Ambient Temperature (see Thermal Considerations section)	All	T_A	-40	80	°C
Storage Temperature	All	T_{stg}	-55	125	°C
Altitude*	All			4000	m
I/O Isolation Voltage (100% factory Hi-Pot tested)	All	—	—	2250	Vdc

* For higher altitude applications, contact your GE Sales Representative for alternative conditions of use.

Electrical Specifications

Unless otherwise indicated, specifications apply at $V_{IN} = 48V_{dc}$, resistive load, and $T_A = 25^\circ C$ conditions.

Parameter	Device	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	All	V_{IN}	18	24/48	60	V _{dc}
Input No Load Current ($I_O = 0A$, module enabled)	All	$I_{IN,No\ load}$		40	50	mA
Input Stand-by Current ($V_{IN} = 24$ to $48V_{dc}$, module disabled)	All	$I_{IN,stand-by}$		8		mA
Maximum Input Current ($V_{IN}=18V_{dc}$, $I_O=I_{O,MAX}$)	All	$I_{IN,MAX}$			2.2	A _{dc}
Inrush Transient	All	I^2t			0.05	A ² s
Input Reflected Ripple Current, peak-to-peak (5Hz to 20MHz, 12μH source impedance; $V_{IN}=0V$ to $75V_{dc}$, $I_O=I_{O,max}$; see Test configuration section)	All			30		mA _{p-p}
Input Ripple Rejection (120Hz)	All			60		dB
EMC, EN55022			See EMC Considerations section			

CAUTION: This power module is not internally fused. An input line fuse must always be used.

This power module can be used in a wide variety of applications, ranging from simple standalone operation to being part of complex power architecture. To preserve maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse. The safety agencies require a fast-acting fuse with a maximum rating of 6A (see Safety Considerations section). Based on the information provided in this data sheet on inrush energy and maximum dc input current, the same type of fuse with a lower rating can be used. Refer to the fuse manufacturer's data sheet for further information.

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Electrical Specifications (continued)

Unless otherwise indicated, specifications apply at $V_{IN} = 48V_{dc}$, resistive load, and $T_A = 25^\circ C$ conditions.

Parameter	Device	Symbol	Min	Typ	Max	Unit
Output Voltage Set-point ($V_{IN}=24$ to $48V_{dc}$, $I_O=I_{O,max}$)	All	$V_{O,set}$	7.88	8.00	8.12	V_{dc}
Output Voltage (Over all operating input voltage, resistive load, and temperature conditions until end of life)	All	V_O	-3.0 (7.76)	—	+3.0 (8.24)	% $V_{O,set}$
Adjustment Range Selected by external resistor	All	$V_{O,adj}$	-20		+10	% $V_{O,set}$
Remote Sense Range	All				+10	% $V_{O,set}$
Output Regulation Line ($V_{IN}=V_{IN,min}$ to $V_{IN,max}$) Load ($I_O=I_{O,min}$ to $I_{O,max}$) Temperature ($T_{ref}=T_{A,min}$ to $T_{A,max}$)	All All All		— — —	0.05 0.05 —	0.2 0.2 1.0	% $V_{O,set}$ % $V_{O,set}$ % $V_{O,set}$
Output Ripple and Noise on nominal output Measured with 10uF Tantalum 1uF ceramic ($V_{IN}=24$ to $48V_{dc}$, $I_O=80\%I_{O,max}$) RMS (5Hz to 20MHz bandwidth) Peak-to-Peak (5Hz to 20MHz bandwidth)	All		— —	25 100	40 150	mV_{rms} mV_{pk-pk}
External Capacitance (see Note 1 in Feature Specifications)	All	$C_{O,max}$	0	—	2200	μF
Output Current (over temperature range)	All	I_O	0	—	4.2	A_{dc}
Output Current Limit Inception (Hiccup Mode)	All	$I_{O,lim}$	4.62	—	5.88	A_{dc}
Output Short-Circuit Current ($V_O \leq 250$ mV)	All	$I_{O,s/c}$	—	2.5	—	A_{rms}
Efficiency ($V_{IN}=24V_{dc}$, $I_O=I_{O,max}$)	All	η	89.0	90.0	—	%
Efficiency ($V_{IN}=48V_{dc}$, $I_O=I_{O,max}$)	All	η	89.0	90.0	—	%
Switching Frequency (Fixed) $V_{IN}=24$ to $48V_{dc}$, $I_O=I_{O,max}$	All	f_{sw}	—	300	—	kHz
Dynamic Load Response ($\Delta I_O/\Delta t=0.1A/\mu s$, $V_{IN}=24$ to $48V_{dc}$) Load Change from $I_O=50\%$ to 75% or 25% to 50% of $I_{O,max}$: Peak Deviation Settling Time ($V_O < 10\%$ peak deviation)	All All	V_{pk} t_s	— —	3.0 400	— —	% $V_{O,set}$ μs

Isolation Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Isolation Capacitance	C_{iso}	—	1000	—	pF
Isolation Resistance	R_{iso}	10	—	—	$M\Omega$
I/O Isolation Voltage	All	—	—	2250	Vdc

General Specifications

Parameter		Min	Typ	Max	Unit
Calculated Reliability based upon Telcordia SR-332 Issue 2: Method I Case 3 ($I_O=80\%I_{O,max}$, $T_A=40^\circ C$, airflow = 200 lfm, 90% confidence)	FIT		261.1		10^9 /Hours
	MTBF		3,829,239		Hours
Weight		—	13 (0.46)	—	g (oz.)

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Feature Specifications

Unless otherwise indicated, specifications apply at $V_{IN} = 48V_{dc}$, resistive load, and $T_A = 25^{\circ}C$ conditions. See Feature Descriptions for additional information.

Parameter	Device	Symbol	Min	Typ	Max	Unit
Remote On/Off Signal Interface ($V_{IN}=V_{IN, min}$ to $V_{IN, max}$; open collector or equivalent, Signal referenced to V_{IN-} terminal) Negative Logic: device code suffix "1" Logic Low = module On, Logic High = module Off Positive Logic: No device code suffix required Logic Low = module Off, Logic High = module On Logic Low - Remote On/Off Current ($V_{on/off} = -0.7V_{dc}$) Logic Low - On/Off Voltage (Module On) Logic High Voltage ($I_{on/off} = 0A_{dc}$) (Module Off) Logic High maximum allowable leakage current	All	$I_{on/off}$	—	—	0.15	mA
	All	$V_{on/off}$	-0.7	—	0.8	V_{dc}
	All	$V_{on/off}$	2.4	—	7	V_{dc}
	All	$I_{on/off}$	—	—	25	μA
Turn-On Delay and Rise Times ($I_o=80\%$ of $I_{o, max}$) Case 1: Input power is applied for at least 1second, and then the On/Off input is set from OFF to ON ($T_{delay} =$ on/off pin transition until $V_o = 10\%$ of $V_{o, set}$) Case 2: On/Off input is set to Module ON, and then input power is applied ($T_{delay} = V_{IN}$ reaches $V_{IN, min}$ until $V_o = 10\%$ of $V_{o, set}$) Output voltage Rise time (time for V_o to rise from 10% of $V_{o, set}$ to 90% of $V_{o, set}$)	All	T_{delay} Case1	—	30	50	ms
	All	T_{delay} Case2	—	20	50	ms
	All	T_{rise}	—	5	10	ms
Output Voltage Overshoot ($I_o=80\%$ of $I_{o, max}$, $V_{IN}= 24$ to $48V_{dc}$)					3	% $V_{o, set}$
Output Overvoltage Protection ¹	All	$V_{o, limit}$	9.6	—	12.0	V_{dc}
Input Undervoltage Lockout Turn-on Threshold	All	$V_{uv/on}$	16	17	18	V_{dc}
Turn-off Threshold	All	$V_{uv/off}$	15	16	17	V_{dc}
Hysteresis	All	V_{hyst}	—	1.0	—	V_{dc}

Note: 1.The module requires a minimum of 220 μF external output capacitor to avoid exceeding the OVP maximum limits during startup into open loop fault conditions.

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Characteristic Curves

The following figures provide typical characteristics at 25°C. The figures are identical for either positive or negative remote On/Off logic.

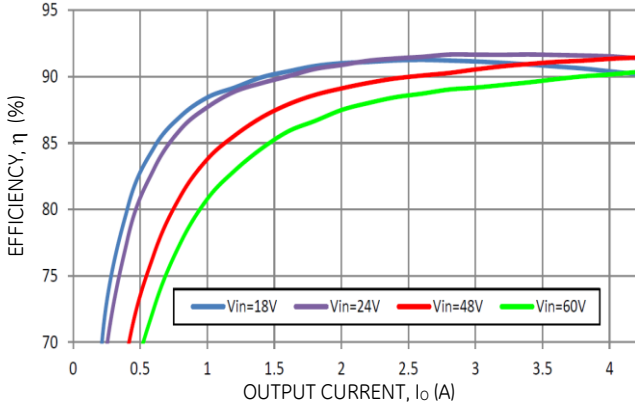


Figure 1. Converter Efficiency versus Output Current.

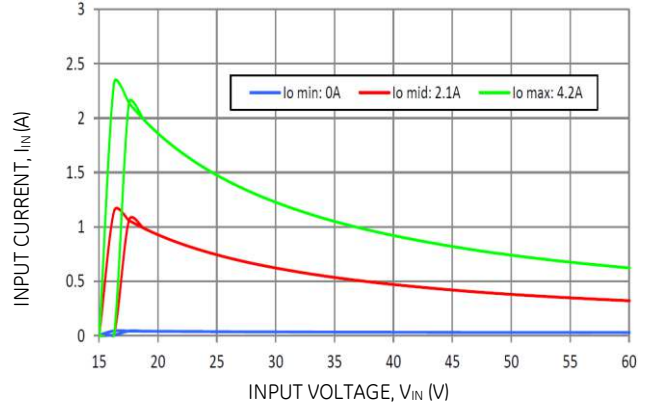


Figure 2. Converter Input Current versus Input Voltage.

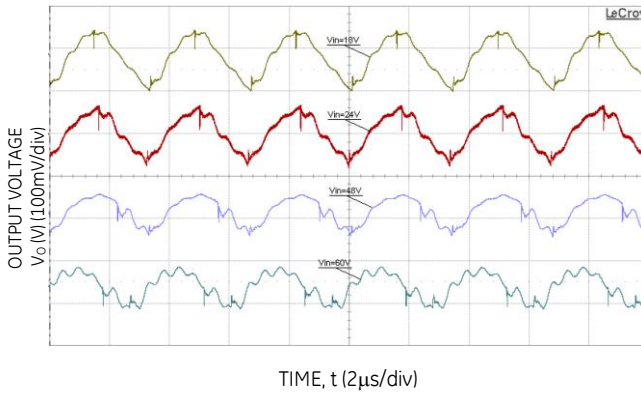


Figure 3. Typical output ripple and noise ($I_o = I_{o,max}$).

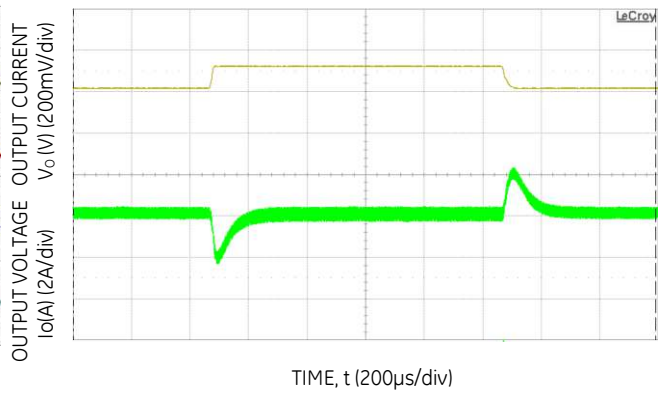


Figure 4. Transient Response to 0.1A/µs Dynamic Load Change from 50% to 75% to 50% of full load, $V_{in}=48V$, $C_o>100\mu F$

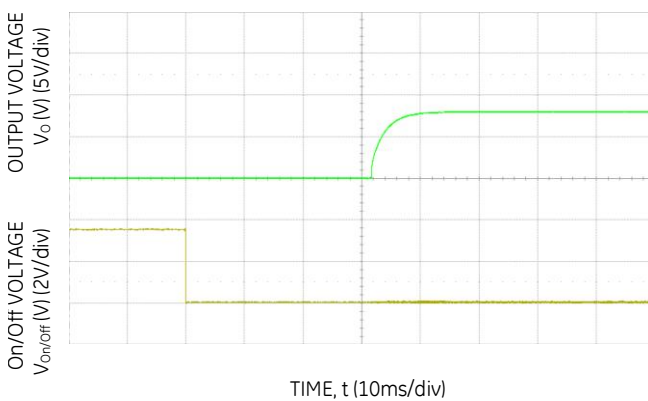


Figure 5. Typical Start-up Using Remote On/Off, negative logic version shown ($V_{in} = 48V$, $I_o = I_{o,max}$).

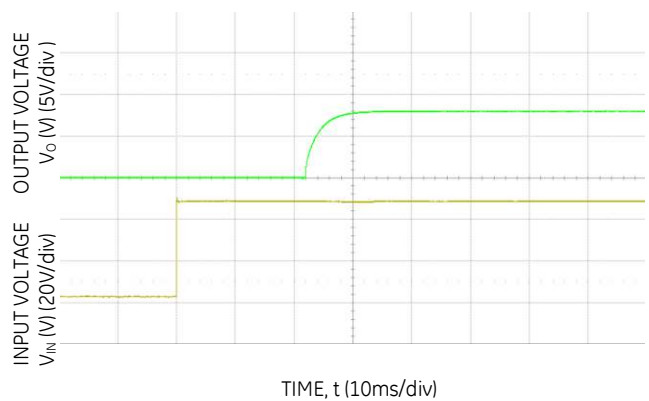
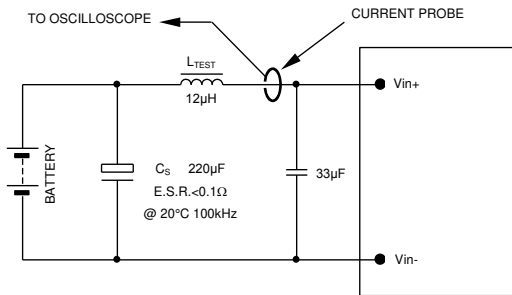


Figure 6. Typical Start-up Using Input Voltage ($V_{in} = 48V$, $I_o = I_{o,max}$).

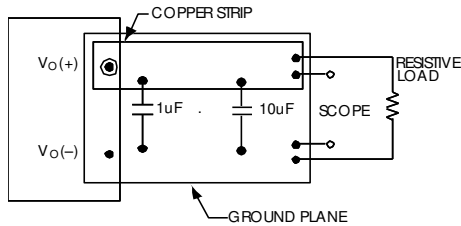
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Test Configurations



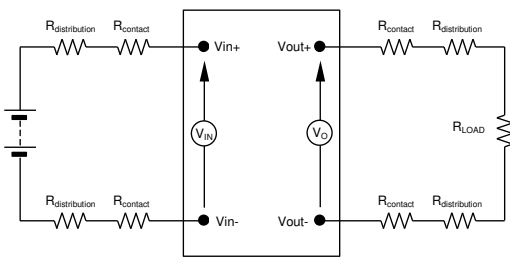
NOTE: Measure input reflected ripple current with a simulated source inductance (L_{TEST}) of 12µH. Capacitor C_s offsets possible battery impedance. Measure current as shown above.

Figure 7. Input Reflected Ripple Current Test Setup.



NOTE: All voltage measurements to be taken at the module terminals, as shown above. If sockets are used then Kelvin connections are required at the module terminals to avoid measurement errors due to socket contact resistance.

Figure 8. Output Ripple and Noise Test Setup.



NOTE: All voltage measurements to be taken at the module terminals, as shown above. If sockets are used then Kelvin connections are required at the module terminals to avoid measurement errors due to socket contact resistance.

Figure 9. Output Voltage and Efficiency Test Setup.

$$\text{Efficiency } \eta = \frac{V_o \cdot I_o}{V_{IN} \cdot I_{IN}} \times 100 \%$$

Design Considerations

Input Source Impedance

The power module should be connected to a low ac-impedance source. Highly inductive source impedance can affect the stability of the power module. For the test configuration in Figure 7, a 33µF electrolytic capacitor (ESR<0.7Ω at 100kHz), mounted close to the power module helps ensure the stability of the unit. Consult the factory for further application guidelines.

Safety Considerations

For safety-agency approval of the system in which the power module is used, the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standard, i.e., UL 60950-1-3, CSA C22.2 No. 60950-00, and VDE 0805 (IEC60950, 3rd Edition).

If the input source is non-SELV (ELV or a hazardous voltage greater than 60 Vdc and less than or equal to 75Vdc), for the module's output to be considered as meeting the requirements for safety extra-low voltage (SELV), all of the following must be true:

- The input source is to be provided with reinforced insulation from any other hazardous voltages, including the ac mains.
- One V_{IN} pin and one V_{OUT} pin are to be grounded, or both the input and output pins are to be kept floating.
- The input pins of the module are not operator accessible.
- Another SELV reliability test is conducted on the whole system (combination of supply source and subject module), as required by the safety agencies, to verify that under a single fault, hazardous voltages do not appear at the module's output.

Note: Do not ground either of the input pins of the module without grounding one of the output pins. This may allow a non-SELV voltage to appear between the output pins and ground.

The power module has extra-low voltage (ELV) outputs when all inputs are ELV.

For input voltages exceeding -60 Vdc but less than or equal to -75 Vdc, these converters have been evaluated to the applicable requirements of BASIC INSULATION between secondary DC MAINS DISTRIBUTION input (classified as TNV-2 in Europe) and unearthed SELV outputs.

The input to these units is to be provided with a maximum 6A fast acting fuse in the ungrounded lead.

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Feature Description

Remote On/Off

Two remote on/off options are available. Positive logic turns the module on during a logic high voltage on the on/off pin, and off during a logic low. Negative logic remote on/off, device code suffix "1", turns the module off during a logic high and on during a logic low.

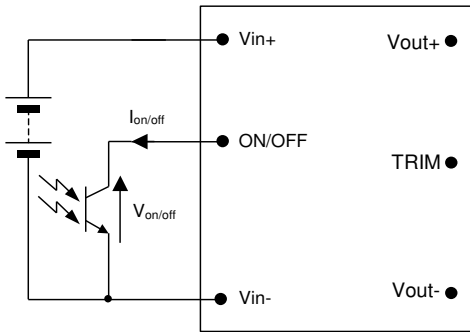


Figure 10. Circuit configuration for using Remote On/Off Implementation.

To turn the power module on and off, the user must supply a switch (open collector or equivalent) to control the voltage ($V_{on/off}$) between the ON/OFF terminal and the $V_{IN(-)}$ terminal. Logic low is $0V \leq V_{on/off} \leq 0.8V$. The maximum $I_{on/off}$ during a logic low is 0.15mA, the switch should maintain a logic low level whilst sinking this current.

During a logic high, the typical $V_{on/off}$ generated by the module is 4.0V, and the maximum allowable leakage current at $V_{on/off} = 4.0V$ is 25 μ A.

If not using the remote on/off feature:

For positive logic, leave the ON/OFF pin open.

For negative logic, short the ON/OFF pin to $V_{IN(-)}$.

Overcurrent Protection

To provide protection in a fault (output overload) condition, the unit is equipped with internal current-limiting circuitry and can endure current limiting continuously. At the point of current-limit inception, the unit enters hiccup mode. If the unit is not configured with auto-restart, then it will latch off following the over current condition. The module can be restarted by cycling the dc input power or by toggling the remote on/off signal. If the unit is configured with the auto-restart option (4), it will remain in the hiccup mode as long as the overcurrent condition exists; it operates normally, once the output current is brought back into its specified range.

Overtemperature Protection

To provide protection under certain fault conditions, the unit is equipped with a thermal shutdown circuit. The unit will shut down if the thermal reference point T_{ref} (Figure 16), exceeds 135°C (typical), but the thermal shutdown is not intended as a guarantee that the unit will survive temperatures beyond its rating. The module will automatically restart upon cool-down to a safe temperature.

Input Undervoltage Lockout

At input voltages below the input undervoltage lockout limit, the module operation is disabled. The module will only begin to operate once the input voltage is raised above the undervoltage lockout turn-on threshold, $V_{UV/ON}$.

Once operating, the module will continue to operate until the input voltage is taken below the undervoltage turn-off threshold, $V_{UV/OFF}$.

Over Voltage Protection

The output overvoltage protection shall consist of circuitry that independently monitors the output voltage, and shuts the module down if the output voltage exceeds specified limits. This protection feature latches in the event of over voltage across the output. Cycling the on/off pin or input voltage resets the latching protection feature. If the auto-restart option (4) is ordered, the module will automatically restart upon an internally programmed time elapsing.

Output Voltage Programming

Trimming allows the user to increase or decrease the output voltage set point of the module. This is accomplished by connecting an external resistor between the TRIM pin and either the V_{out+} pin or the V_{out-} pin.

Trim Down – Decrease Output Voltage

By connecting an external resistor between the TRIM pin and $V_{out(-)}$ pin ($R_{adj-down}$), the output voltage set point decreases (see figure 11). The following equation determines the external resistor value to obtain an output voltage change from $V_{o,set}$ to the desired $V_{o,desired}$:

$$R_{adj-down} = \left[\frac{511}{\Delta\%} - 10.22 \right] k\Omega$$

$$\text{Where } \Delta\% = \left(\frac{V_{o,set} - V_{o,desired}}{V_{o,set}} \right) \times 100$$

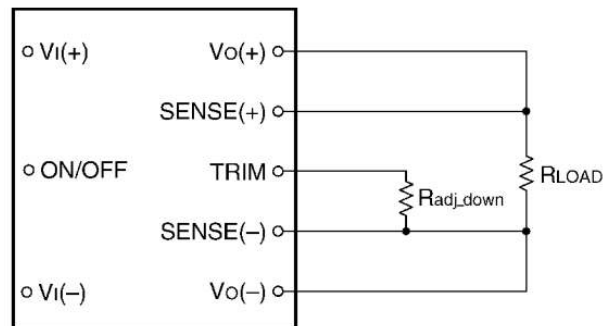


Figure 11. Circuit Configuration to Decrease Output Voltage.

Trim Up – Increase Output Voltage

By connecting an external resistor between the TRIM pin and $V_{out(+)}$ pin (R_{adj-up}), the output voltage set point increases (see figure 12). The following equation determines the external resistor value to obtain an output voltage change from $V_{o,set}$ to the desired $V_{o,desired}$:

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Feature Descriptions (continued)

$$R_{adj-up} = \left[\frac{5.11 \times V_{o,set} \times (100 + \Delta\%) - 511}{1.225 \times \Delta\%} - \frac{511}{\Delta\%} - 10.22 \right] k\Omega$$

Where $\Delta\% = \left(\frac{V_{o,desired} - V_{o,set}}{V_{o,set}} \right) \times 100$

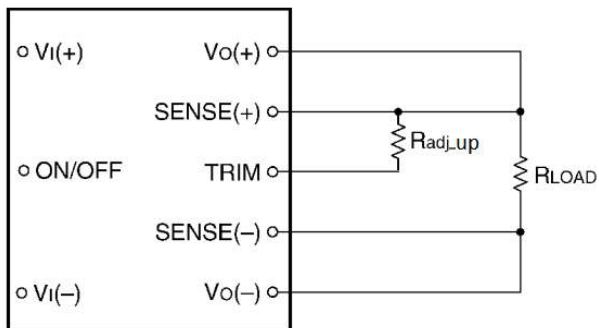


Figure 12. Circuit Configuration to Increase Output Voltage.

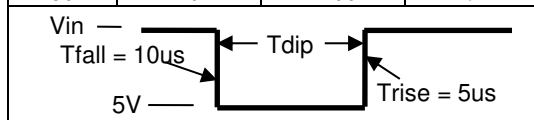
The combination of the output voltage adjustment and the output voltage initial tolerance must not exceed the allowable trim range of 80% to 110% of the nominal output voltage as measured between the Vout+ and Vout- pins.

The power modules have a fixed current-limit set point. Therefore, as the output voltage is adjusted down, the available output power is reduced.

Pre-bias Vin Under Voltage Test

The module shall recover from UVLO [Under Voltage Lock Out] without protective shutdown from OCP or OVP or hard failure, when subjected to Vin Under Voltage transients with the following conditions:

Vin(V)	Tdip (ms)	Co (uF)	Load (A)
48	5	0	0
48	5	2200	0
48	10	0	0
48	10	2200	0
48	5	0	4.2
48	5	2200	4.2
48	10	0	4.2
48	10	2200	4.2
60	5	0	0
60	5	2200	0
60	10	0	0
60	10	2200	0
60	5	0	4.2
60	5	2200	4.2
60	10	0	4.2
60	10	2200	4.2



Thermal Considerations

The power modules operate in a variety of thermal environments; however, sufficient cooling should be provided to help ensure reliable operation.

Considerations include ambient temperature, airflow, module power dissipation, and the need for increased reliability. A reduction in the operating temperature of the module will result in an increase in reliability.

The thermal data presented here is based on physical measurements taken in a wind tunnel, using automated thermo-couple instrumentation to monitor key component temperatures: FETs, diodes, control ICs, magnetic cores, ceramic capacitors, opto-isolators, and module pwb conductors, while controlling the ambient airflow rate and temperature. For a given airflow and ambient temperature, the module output power is increased, until one (or more) of the components reaches its maximum derated operating temperature, as defined in IPC-9592A. This procedure is then repeated for a different airflow or ambient temperature until a family of module output derating curves is obtained.

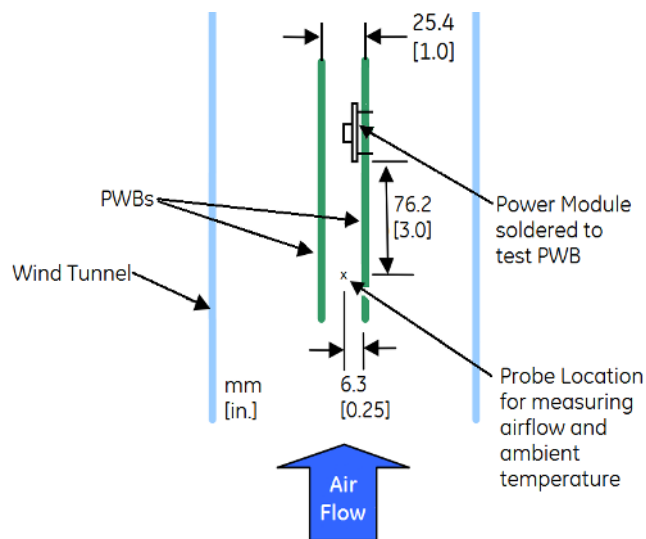


Figure 13. Thermal Test Setup.

Heat Transfer via Convection

Increased airflow over the module enhances the heat transfer via convection. Derating figures showing the maximum output current that can be delivered by each module versus local ambient temperature (TA) for natural convection.

Please refer to the Application Note "Thermal Characterization Process For Open-Frame Board-Mounted Power Modules" for a detailed discussion of thermal aspects including maximum device temperatures.

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Thermal Considerations (continued)

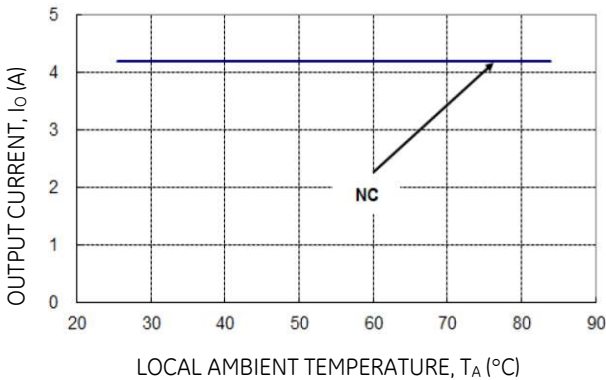


Figure 14. Output Current Derating in the Transverse Orientation; Airflow Direction from Vin(-) to Vin(+); Vin = 24V.

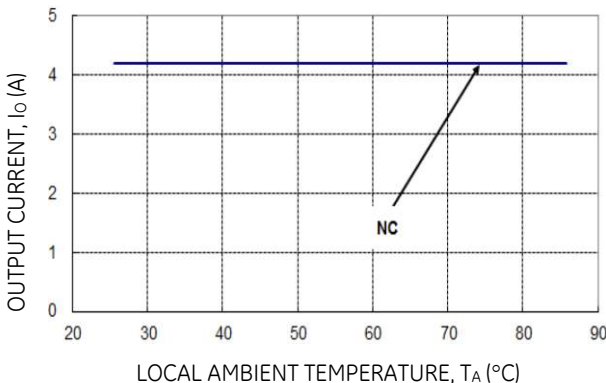


Figure 15. Output Current Derating in the Transverse Orientation; Airflow Direction from Vin(-) to Vin(+); Vin = 48V.

The thermal reference point, T_{ref} , used in the specifications is shown in Figure 16. For reliable operation this temperature should not exceed 119°C.

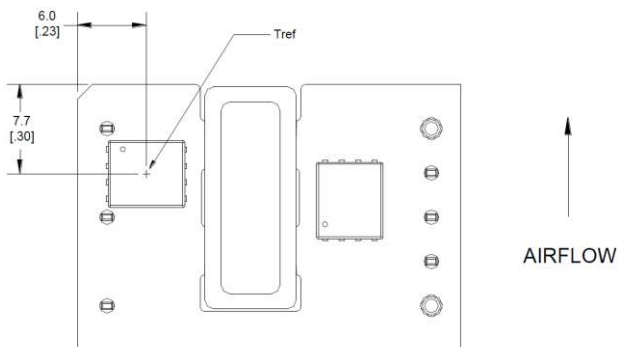
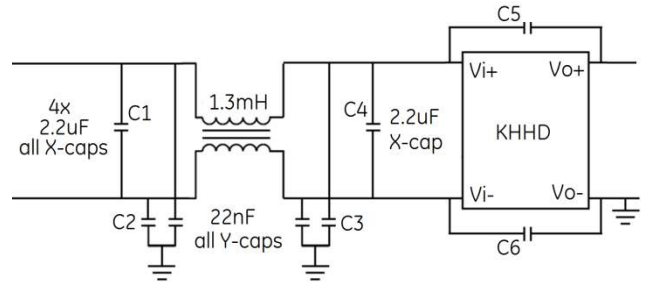


Figure 16. T_{ref} Temperature Measurement Location.

EMC Requirements

Figure 17 shows a maximum filter configuration to meet the conducted emission limits of EN55022 Class B.

Notes: C1 and C4 are low impedance SMT ceramics.



- C1, C4 2.2uF, 100V, 1210
- C2, C3 1210Y1K50103KXTDWV, 10nF, 1500V (*2)
- RDHX223K302HKT, 22nF, 3kv
- C5, C6 RDHX333K302HKT, 33nF, 3000V (Holystone)
- 202S48W334KT, 33nF, 2000V (Johanson)

Figure 17. Suggested Configuration for EN55022 Class B.

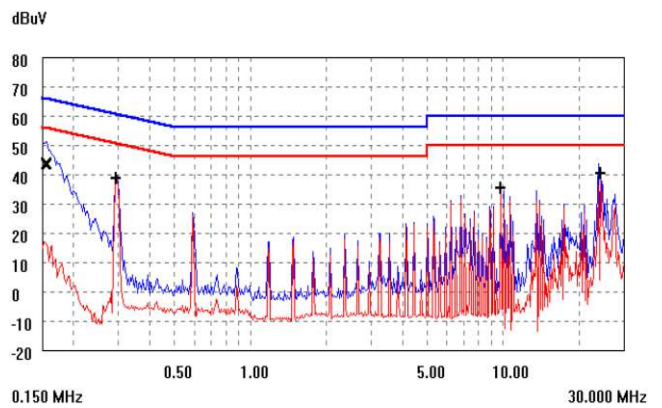


Figure 18. Vin+ Line EMC signature using above filter, Vin=48V, Blue=Quasi Peak, Red=Average.

For further information on designing for EMC compliance, please refer to the FLTR100V10 data sheet (FDS01-043EPS).

Layout Considerations

The power module are low profile in order to be used in fine pitch system card architectures. As such, component clearance between the bottom of the power module and the mounting board is limited. Avoid placing copper areas on the outer layer directly underneath the power module. Also avoid placing via interconnects underneath the power module.

For additional layout guide-lines, refer to the FLTR100V10 data sheet.

Soldering Information

The RoHS-compliant (Z codes) 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

KHHD004A2S8R0 Hammerhead™ Series; DC-DC Converter Power 18-60Vdc Input; 8Vdc, 4.2A, 34W Output

Layout Considerations (continued)

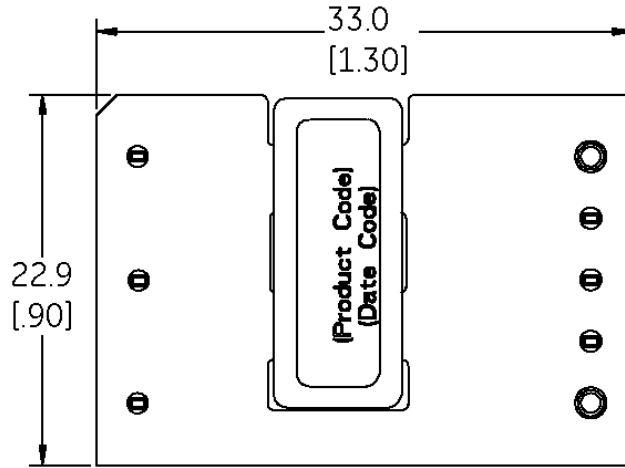
260°C, while the Pb-free solder pot is 270°C max. Not all RoHS-compliant through-hole products can be processed with paste-through-hole Pb or Pb-free reflow process. If additional information is needed, please consult with your GE representative for more details.

KHHD004A2S8R0 Hammerhead™ Series; DC-DC Converter Power
 18-60Vdc Input; 8Vdc, 4.2A, 34W, Output

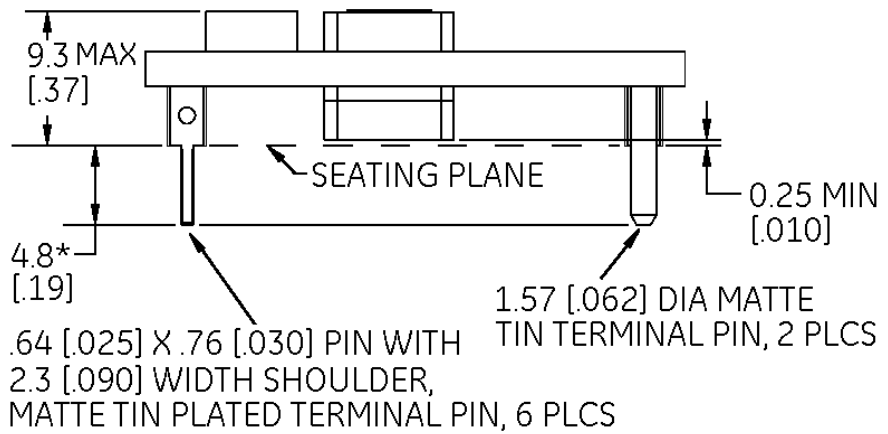
Mechanical Outline

Dimensions are in millimeters and [inches].
 Tolerances: x.x mm ± 0.5 mm [x.xx in. ± 0.02 in.] (Unless otherwise indicated)
 x.xx mm ± 0.25 mm [x.xxx in ± 0.010 in.]

Top View



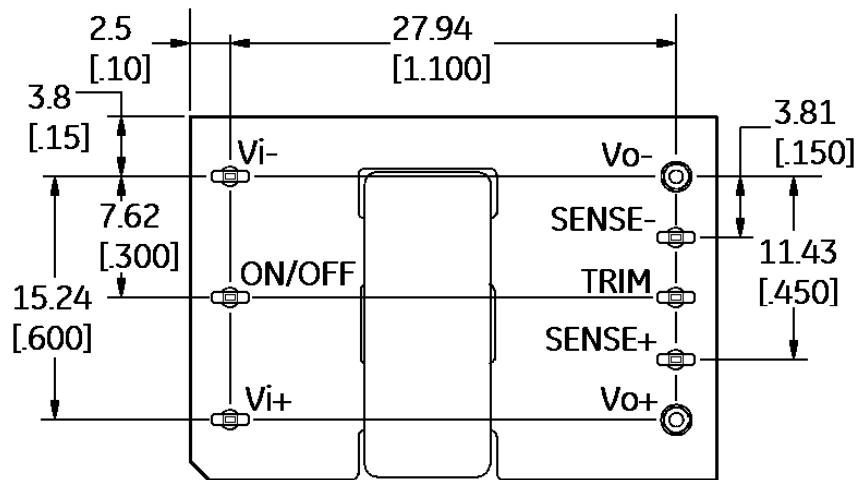
Side View



* Optional PIN Lengths shown In Device Option Table

Bottom View

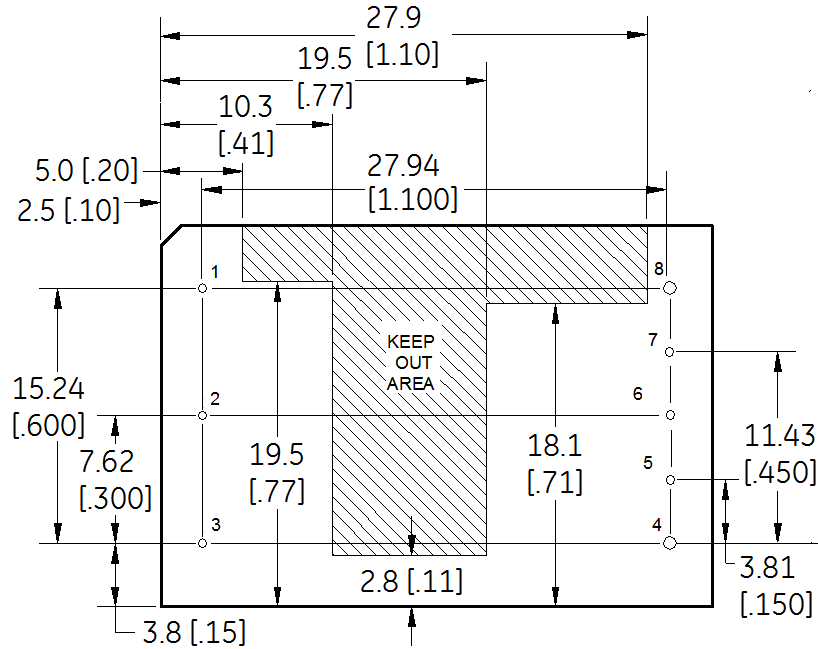
PIN	FUNCTION
1	VIN(+)
2	On/Off
3	VIN(-)
4	Vo(-)
5	Sense(-)
6	Trim
7	Sense(+)
8	Vo(+)



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Recommended Pad Layout

Dimensions are in millimeters and [inches].
 Tolerances: x.x mm ± 0.5 mm [x.xx in. ± 0.02 in.] (Unless otherwise indicated)
 x.xx mm ± 0.25 mm [x.xxx in ± 0.010 in.]



Pad Layout

For .025 x .030 rectangular pin, use a .050 diameter plated through hole
 For .062 diameter pin, use a .076 diameter plated through hole.

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Packaging Details

Tray Dimensions

The modules are supplied in trays as standard. Details of tray dimensions are shown below. Modules are shipped in quantities of 75 modules per box.

Dimensions are in millimeters.

Tolerances: x.x mm ± 0.5 mm (unless otherwise indicated)

x.xx mm ± 0.25 mm



Material	PET (1mm)
Max surface resistivity	10 ⁹ -10 ¹¹ Ω/PET
Color	Clear
Capacity	25power modules
Min order quantity	75pcs (1 box of 3 full trays + 1 empty top tray)

KHHD004A2S8R0 Hammerhead™ Series; DC-DC Converter Power

18-60Vdc Input; 8Vdc, 4.2A, 34W Output

Ordering Information

Please contact your GE Sales Representative for pricing, availability and optional features.

Table 1. Device Codes

Product codes	Input Voltage	Output Current	Output Voltage	Remote On/Off Logic	Connector Type	Comcodes
KHHD004A2S8R0841Z	24V/48V (18-60Vdc)	4.2A	8.0V	Negative	Through hole	150036224

Table 2. Device Options

	Characteristic	Character and Position	Definition
Ratings	Form Factor	K	K = Sixteenth Brick
	Family Designator	HH	HH = Hammerhead Series
	Input Voltage	D	D = Ultra Wide Range, 18V-75V
	Output Current	004A2	004A2 = 004.2 Amps Maximum Output Current
	Output Voltage	S8R0	S8R0 = Special 8.0V nominal
Options	Pin Length	6 8	Omit = Default Pin Length shown in Mechanical Outline Figures 6 = Pin Length: 3.68 mm ± 0.25mm , (0.145 in. ± 0.010 in.) 8 = Pin Length: 2.79 mm ± 0.25mm , (0.110 in. ± 0.010 in.)
	Action following Protective Shutdown	4	Omit = Latching Mode 4 = Auto-restart following shutdown (Overcurrent/Overvoltage)
	On/Off Logic	1	Omit = Positive Logic 1 = Negative Logic
	Customer Specific	XY	XY = Customer Specific Modified Code, Omit for Standard Code
	Mechanical Features	SR	Omit = Standard open Frame Module SR = Surface mount connections & tape/reel package
	RoHS	Z	Omit = RoHS 5/6, Lead Based Solder Used Z = RoHS 6/6 Compliant, Lead free

Contact Us

For more information, call us at

USA/Canada:

+1 888 546 3243, or +1 972 244 9288

Asia-Pacific:

+86.021.54279977*808

Europe, Middle-East and Africa:

+49.89.878067-280

India:

+91.80.28411633

www.ge.com/powerelectronics

