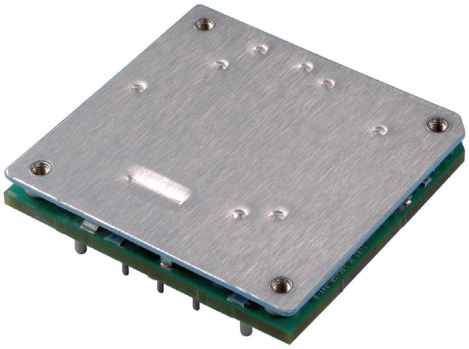
JPW200S52R5-BH Power Module; dc-dc Converter
38 Vdc - 75 Vdc Input, 52.5 Vdc Output; 200W

RoHS Compliant



Applications

- Enterprise Networks
- Distributed power architectures
- Voice Over IP
- Local Area Networks
- Isolated Bus Voltage applications.

Options

- Choice of Remote On/Off option

Features

- Compatible with RoHS EU Directive 2002/95/EC (-Z Versions)
- Compatible in RoHS EU Directive 2002/95/EC with lead solder exemption (non -Z versions)
- High efficiency: 92.5% typical
- Industry standard Half Brick:
  61.0mm x 57.9 mm x 12.7 mm
  (2.4 in x 2.28 in x 0.43 in)
- Industry standard pinout
- Isolation voltage:2250 Vdc
- Open-frame construction
- 2:1 input voltage range
- Remote Sense/Remote On/Off
- Auto restart after fault shutdown
- Constant switching frequency
- Output overvoltage and Overcurrent protection
- Overtemperature protection
- Adjustable output voltage (trim)
- Meets the voltage and current requirements for ETSI 300-132-2 and complies with and is approved for Basic Insulation rating per EN60950-1
- *UL** 60950 Recognized, *CSA*† C22.2 No. 60950-00 Certified, and VDE‡ 0805 (IEC60950, 3rd edition) Licensed
- CE mark meets 73/23/EEC and 93/68/EEC directives§
- ISO** 9001 certified manufacturing facilities

Description

The JPW200S52R5-BH Power Module is a dc-dc converter that operates over an input voltage range of 38 Vdc to 75 Vdc and provides a precisely regulated dc output. The output is fully isolated from the input, allowing versatile polarity configurations and grounding connections. The module has a maximum power rating of 200 W at a typical full-load efficiency of 92.5%.

The open-frame module offers direct cooling of dissipative components for excellent thermal performance. The optional baseplate is offered to provide easy mounting of a heat sink, for high-temperature applications. The standard feature set includes remote sensing, output trim, and remote on/off for convenient flexibility in distributed power applications.

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* *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-use equipment. All the required procedures for CE marking of end-use equipment should be followed. (The CE mark is placed on selected products.)
** ISO is a registered trademark of the Internation 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 reliabiltiy.

Parameter	Device	Symbol	Min	Max	Unit
Input Voltage:Continuous	All	VI	—	75	Vdc
Operating Ambient Temperature (See Thermal Considerations section)	All	TA	–40	85	°C
Storage Temperature	All	Tstg	–55	125	°C
I/O Isolation Voltage	—	—	—	2250	Vdc

Electrical Specifications

Unless otherwise indicated, specifications apply over all operating input voltage, resistive load, and temperature conditions.

Parameter	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	VIN	38	52	75	Vdc
Under Voltage Lock-out			—		
turn on	VITON	36.5	—	37.9	Vdc
turn off	VITOFF	34.6		36	Vdc
Maximum Input Current (VI = 0 V to 75 V; IO = IO, max)		—	—	7.0	Adc
Inrush Transient	I^2t			2	A^2s
Input Current @ No Output Load (VI = 52 Vdc; Io = 0A; TA = 25° C; on/off pin enabled	Iin, no load	—	140	—	mA
Input Reflected Ripple Current, peak-peak (5 Hz to 20 MHz, 12 µH source impedance See Test configuration section)		—	5	—	mAp-p
Input Ripple Rejection (120 Hz)@Vin=52V			34		dB

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 stand-alone operation to an integrated part of a sophisticated 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 10 A (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 for further information.

Electrical Specifications (continued)

Output Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage Set Point (VI = 52 V; IO = IO, max; TA= 25 °C)	VO, set	51.19	52.5	53.55	Vdc
Output Voltage (Over all operating input voltage, resistive load, and temperature conditions until end of life. See Figure 11.)	VO	50.90	—	54.08	Vdc
Output Regulation:					
Line (VI = 38 V to 75 V)	—	—	0.01	0.2	%VO
Load (IO = IO, min to IO, max)	—	—	0.05	0.4	%VO
Temperature (TA = –40 °C to +85 °C)	—	—	100	300	mV
Output Ripple and Noise Voltage (See Figure 10.):					
RMS	—	—	—	115	mVrms
Peak-to-peak (5 Hz to 20 MHz)	—	—	—	345	mVp-p
External Load Capacitance (ESR ≤ 150 mohm)	—	200	—	1000	µF
Output Current	IO	0	—	3.81	A
Output Current-limit Inception (VO = 90% of VO, nom)	IO, cli	4.0	—	5.5	A
Output Short-circuit Current (VO = 250 mV)	—	—	170	—	%IO, max
Efficiency (VI = 52 V; IO = IO, max; TA = 25 °C)	h	—	92.5	—	%
Switching Frequency	All	—	300	—	kHz
Dynamic Response (DIO/Dt = 1 A/µs, VI = 52 V, TA = 25 °C; tested with a 200 µF aluminum and a 1.0 µF ceramic capacitor across the load):					
Load Change from IO = 50% to 75% of IO, max:					
Peak Deviation	—	—	165	200	mV
Settling Time (VO < 10% of peak deviation)	—	—	2	4	mS
Load Change from IO = 50% to 25% of IO, max:					
Peak Deviation	—	—	165	200	mV
Settling Time (VO < 10% of peak deviation)	—	—	2	4	mS

Isolation Specifications

Parameter	Min	Typ	Max	Unit
Isolation Capacitance	—	6000	—	pF
Isolation Resistance	10	—	—	MΩ

General Specifications

Parameter	Min	Typ	Max	Unit
Calculated MTBF (IO = 80% of IO, max TA = 40 °C,standard half brick 0.75 inch heatsink)		1,260,000		Hours
Weight	—	71(2.5)	—	g (oz.)

Feature Specifications

Unless otherwise indicated, specifications apply over all operating input voltage, resistive load, and temperature conditions. See Feature Descriptions for additional information.

Parameter	Symbol	Min	Typ	Max	Unit
Remote On/Off Signal Interface (VI = 38 V to 75 V; open collector or equivalent compatible; signal referenced to VI(–) terminal; see Figure 12 and Feature Descriptions.): JPW200S52R51-BH Preferred Logic: Logic Low—Module On Logic High—Module Off JPW200S52R5-BH Optional Logic: Logic Low—Module Off Logic High—Module On Logic Low:					
At Ion/off = 1.0 mA	Von/off	0	—	0.3	V
At Von/off = 0.0 V	Ion/off	—	—	1.0	mA
Logic High:					
At Ion/off = 0.0 µA	Von/off	—	—	5V	V
Leakage Current	Ion/off	—	—	50	µA
Turn-On Delay and Rise Times (IO=IO, max)					
Tdelay = Time until VO = 10% of VO,set from either application of Vin with Remote On/Off set to On or operation of Remote On/Off from Off to On with Vin already applied for at least one second.	Tdelay, on/off Trise, on/off	— —	12 25	— —	ms ms
Trise = time for VO to rise from 10% of VO,set to 90% of VO,set.	Tdelay, Vin Trise, Vin	— —	25 25	— —	ms ms
Output Voltage Adjustment (See Feature Descriptions.):					
Output Voltage Remote-sense Range	—	—	—	0.5	V
Output Voltage Set-point Adjustment Range (trim) **Note:** Ensure that the combination of remote sense and trim do not exceed 56.5 V on the output.	—	95	—	104	%VO, nom
Output Overvoltage Protection	VO, clamp	56.5	—	58.5	V
Overtemperature Protection (shutdown)	TC	—	100	—	°C

Characteristic Curves

The following figures provide typical characteristics curves for the power module at room temperature (TA = 25 °C).The figures are identical for both on/off configurations.

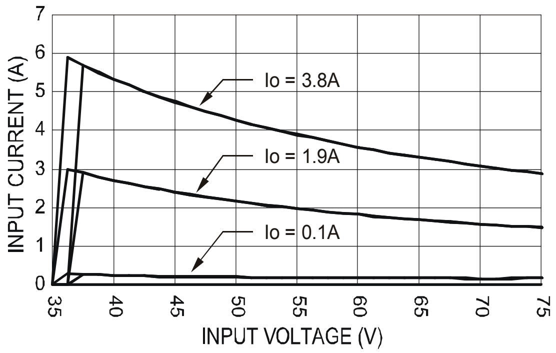


Figure 1. **Input Voltage and Current Characteristics.**

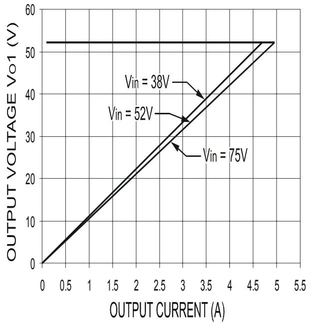
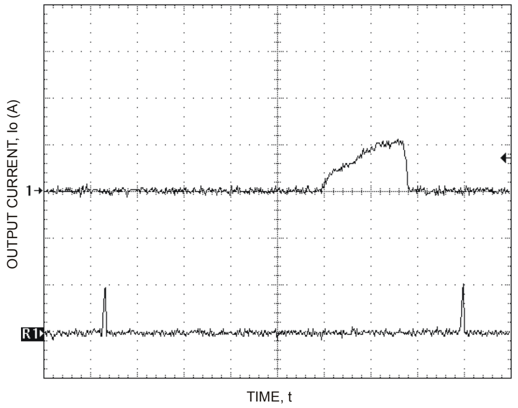


Figure 2. **Typical Output Characteristics.**



Note: R1 = Ref1 curve; 5A/div; 500mS/div : Trace 1: Zoom detail of current pulse : 5A/div; 20 mS/div;Vin = 52Vdc; Cout = 200uF

Figure 2a. Typical Current limit Hic-cup Characteristics.

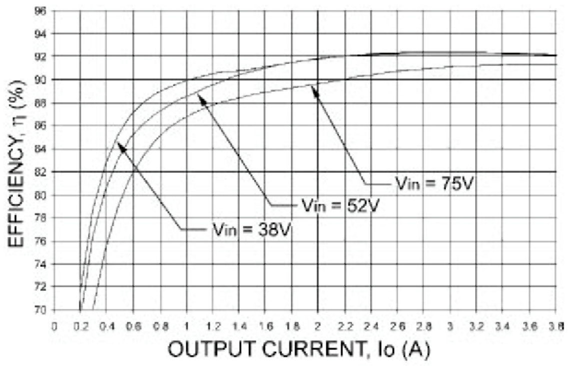
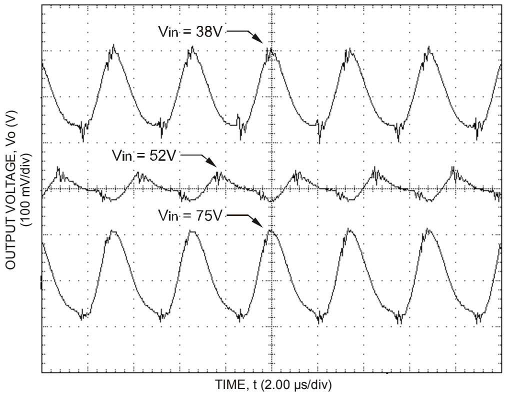
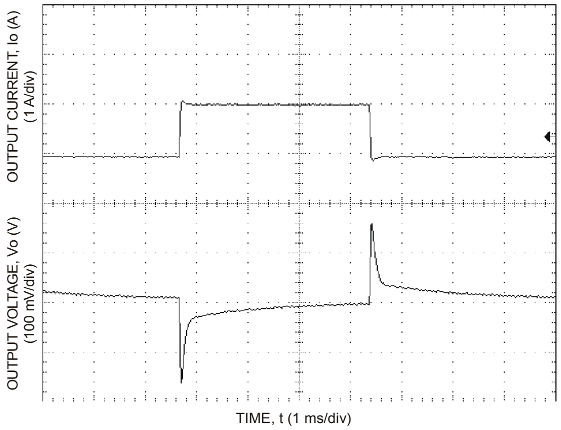


Figure 3. **Typical Converter Efficiency vs. Ouput Current.**



Note: Tested with a 200 μF aluminum and a 1.0 μF ceramic capacitor across the load

Figure 4. **Typical Output Ripple at Io=Io,max.**

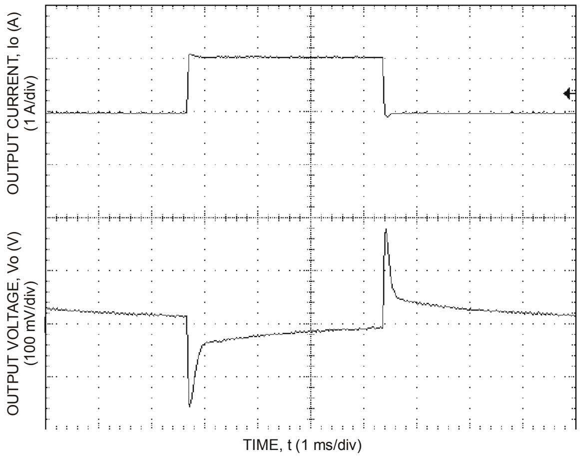


Note: Tested with a 200 μF aluminum and a 1.0 μF ceramic capacitor across the load

Figure 5. **Typical Transient Response to Step Change in Load from 25% to 50% to 25% of Full Load at VI = 52V.**

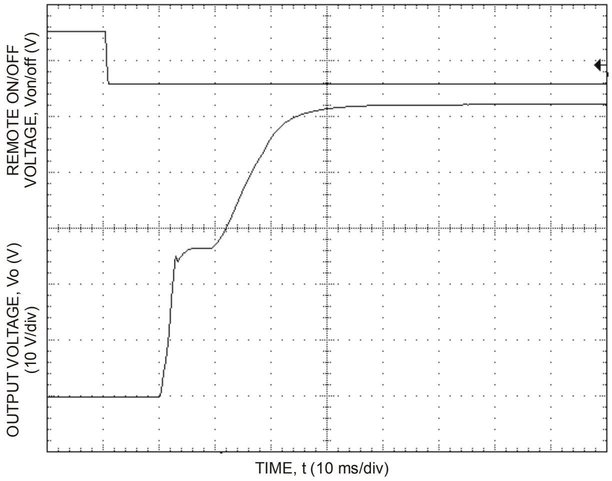
Characteristic Curves

The following figures provide typical characteristics curves for the power module at room temperature (TA = 25 °C)



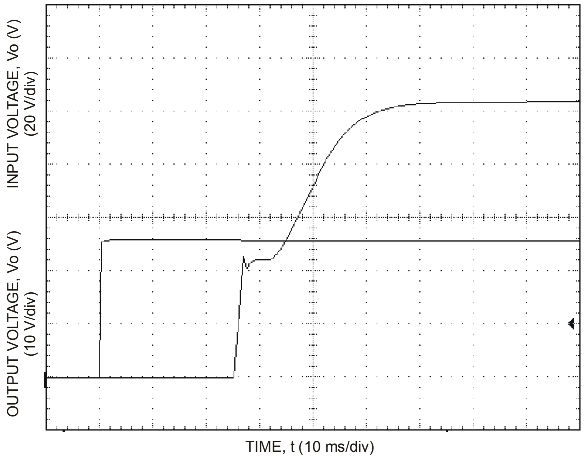
Note: Tested with a 200 μF aluminum and a 1.0 μF ceramic capacitor across the load.

Figure 6. Typical Transient Response to Step Change in Load from 50% to 75% to 50% of Full Load at VI = 52V.



Note: Tested with a 200 μF aluminum and a 1.0 μF ceramic capacitor across the load.

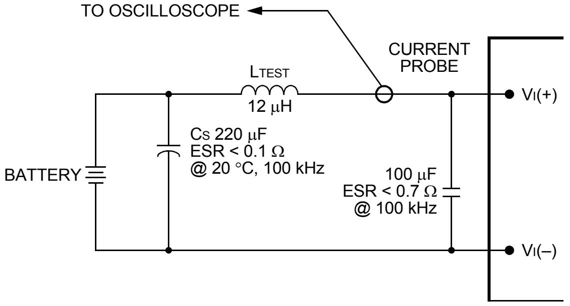
Figure 7. Typical Start-Up from Remote On/Off at Io=Io,max.



Note: Tested with a 200 μF aluminum and a 1.0 μF ceramic capacitor across the load.

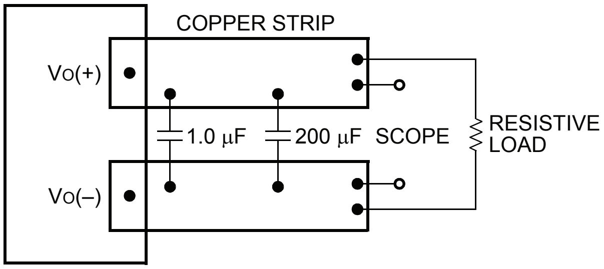
Figure 8. Typical Start-Up from Vin(IO = IO, max).

Test Configurations



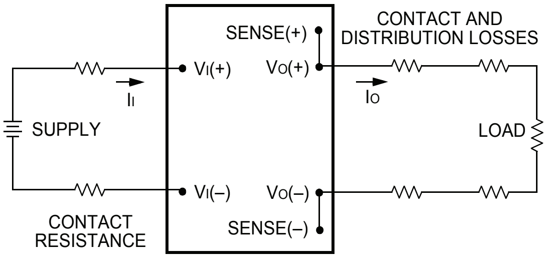
Note: Measure input reflected-ripple current with a simulated source inductance (LTEST) of 12 µH. Capacitor CS offsets possible battery impedance. Measure current as shown above.

Figure 9. Input Reflected-Ripple Test Setup.



Note: The use of a 200 µF aluminum capacitor is needed for stability. Use a 1.0 µF ceramic capacitor on the output. Scope measurement should be made using a BNC socket. Position the load between 51 mm and 76 mm (2 in. and 3 in.) from the module.

Figure 10. Peak-to-Peak Output Noise Measurement Test Setup.



Note: All measurements are taken at the module terminals. When socketing, place Kelvin connections at module terminals to avoid measurement errors due to socket contact resistance.

$$\eta = \left(\frac{[V_O(+) - V_O(-)]I_O}{[V_I(+) - V_I(-)]I_I}\right) \times 100\ \%$$

Figure 11. Output Voltage and Efficiency Measurement.

Design Considerations

Input Source Impedance

The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. For the test configuration in 9, a 100 μF electrolytic capacitor (ESR < 0.7 W at 100 kHz) mounted close to the power module helps ensure stability of the unit. For other highly inductive source impedances, 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., UL60950, CSA C22.2 No. 60950-00, and EN 60950 (VDE 0805):2001-12.

These converters have been evaluated to the spacing requirements for Basic Insulation per the above safety standards. For Basic Insulation models, 2250 Vdc is applied from Vi to Vo to 100% of outgoing production.

For end products connected to –48V dc, or –60Vdc nominal DC MAINS (i.e. central office dc battery plant), no further fault testing is required. *Note: -60V dc nominal battery plants are not available in the U.S. or Canada.

For all input voltages, other than DC MAINS, where the input voltage is less than 60V dc, if the input meets all of the requirements for SELV, then:

- The output may be considered SELV. Output voltages will remain within SELV limits even with internally-generated non-SELV voltages. Single component failure and fault tests were performed in the power converters.
- One pole of the input and one pole of the output are to be grounded, or both circuits are to be kept floating, to maintain the output voltage to ground voltage within ELV or SELV limits.

For all input sources, other than DC MAINS, where the input voltage is between 60 and 75V dc (Classified as TNV-2 in Europe), the following must be meet, if the converter's output is to be evaluated for SELV:

- The input source is to be provided with reinforced insulation from any hazardous voltage, including the ac mains.
- One Vi pin and one Vo pin are to be reliably earthed, or both the input and output pins are to be kept floating. Another SELV reliability test is conducted on the whole system, as required by the safety agencies, on the combination of supply source and the subject module to verify that under a single fault, hazardous voltages do not appear at the module's output.

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

All flammable materials used in the manufacturing of these modules are rated 94V-0.

The input to these units is to be provided with a maximum 10 A fast-acting (or time-delay) fuse in the unearthed lead.

Feature Descriptions

Overcurrent Protection

To provide protection in an overcurrent fault condition, the module is equipped with internal current-limiting circuitry and can endure current limiting for an unlimited duration. Upon current limit inception threshold, the module enters a “hic-cup” mode of operation, whereby it shutdown and automatically attempts to restart. While the overcurrent fault condition persist, the module will remain in the hic-cup mode until the overcurrent fault is cleared. See Figure 2a.

Remote On/Off

Two remote on/off options are available. Positive logic remote on/off 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 turns the module off during a logic high and on during a logic low. Negative logic (code suffix “1”) is the factory-preferred configuration.

To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal (Von/off) and the VI(–) terminal . The switch can be an open collector or equivalent (see Figure 12). A logic low is Von/off = 0 V to 0.3 V. The maximum Ion/off during a logic low is 1 mA. The switch should maintain a logic-low voltage while sinking 1 mA.

During a logic high, the maximum Von/off generated by the power module is 5 V. The maximum allowable leakage current of the switch at Von/off = 5 V is 50 µA.

If not using the remote on/off feature, do one of the following:

- For negative logic, short ON/OFF pin to VI(–).
- For positive logic, leave ON/OFF pin open.

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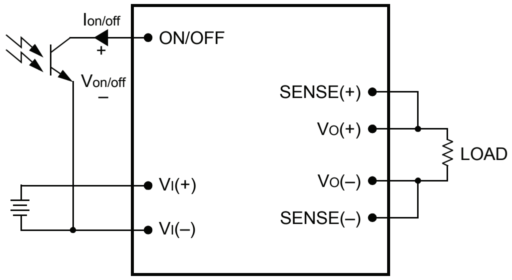


Figure 12. Remote On/Off Implementation.

Remote Sense

Remote sense minimizes the effects of distribution losses by regulating the voltage at the remote-sense connections. The voltage between the remote-sense pins and the output terminals must not exceed the output voltage sense range given in the Feature Specifications table, i.e.:

[VO(+) – VO(–)] – [SENSE(+) – SENSE(–)] = 0.5 V

The voltage between the VO(+) and VO(–) terminals must not exceed 56.5 V. This limit includes any increase in voltage due to remote-sense compensation and output voltage set-point adjustment (trim). See Figure 13.

If not using the remote-sense feature to regulate the output at the point of load, then connect SENSE(+) to VO(+) and SENSE(–) to VO(–) at the module.

Although the output voltage can be increased by both the remote sense and by the trim, the maximum increase for the output voltage is not the sum of both. The maximum increase is the larger of either the remote sense or the trim.

The amount of power delivered by the module is defined as the voltage at the output terminals multiplied by the output current. When using remote sense and trim, the output voltage of the module can be increased, which at the same output current would increase the power output of the module. Care should be taken to ensure that the maximum output power of the module remains at or below the maximum rated power.

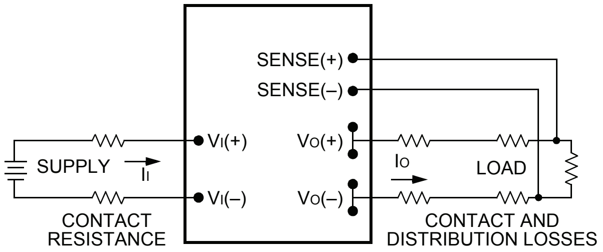


Figure 13. Effective Circuit Configuration for Single-Module Remote-Sense Operation Output Voltage.

Output Overvoltage Protection

The output overvoltage clamp consists of control circuitry, independent of the primary regulation loop, that monitors the voltage on the output terminals. The over voltage clamp circuit has a higher voltage set point than the primary loop (see Feature Specifications table). This provides a redundant voltage control that reduces the risk of output overvoltage. If the output voltage exceeds the overvoltage threshold, the module enters a “hic-cup” mode of operation, whereby it shutdown and automatically attempts to restart. While the fault condition exists, the module will remain in the hic-cup mode until the overvoltage fault is cleared.

Feature Descriptions (Continued)

Overtemperature Protection

This module features an overtemperature protection circuit to safeguard against thermal damage. The protection circuit will shutdown the module when the maximum case temperature is exceeded. The module will restart automatically when the case temperature falls below shutdown threshold.

Output Voltage Set-Point Adjustment (Trim)

Output voltage trim allows the user to increase or decrease the output voltage set point of a module. This is accomplished by connecting an external resistor between the TRIM pin and either the SENSE(+) or SENSE(–) pins. The trim resistor should be positioned close to the module.

If not using the trim feature, leave the TRIM pin open.

With an external resistor between the TRIM and SENSE(–) pins (Radj-down), the output voltage set point (VO, adj) decreases (see Figure 14). The following equation determines the required external-resistor value to obtain a percentage output voltage change of Δ%.

$$R_{adj\text{-}down} = \left(\frac{100}{\Delta\%} - 2\right) \quad k\Omega$$

With an external resistor connected between the TRIM and SENSE(+) pins (Radj-up), the output voltage set point (VO, adj) increases (see Figure 15).

Note: Do not exceed 56.5 V between the VO(+) and VO(–) terminals.

The following equation determines the required external-resistor value to obtain a percentage output voltage change of ý%.

$$R_{adj\text{-}up} = \left(\frac{V_O(100 + \Delta\%)}{1.225\Delta\%} - \frac{(100 + 2\Delta\%)}{\Delta\%}\right) \quad k\Omega$$

The voltage between the VO(+) and VO(–) terminals must not exceed the minimum output voltage clamp value as indicated in the Feature Specifications table.

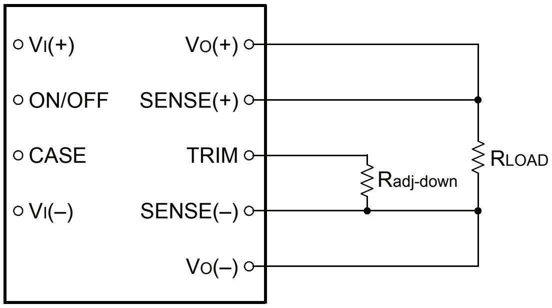


Figure 14. Circuit Configuration to Decrease Output Voltage.

This limit includes any increase in voltage due to remote-sense compensation and output voltage set-point adjustment (trim). See Figure 13.

Although the output voltage can be increased by both the remote sense and by the trim, the maximum increase for the output voltage is not the sum of both. The maximum increase is the larger of either the remote sense or the trim.

The amount of power delivered by the module is defined as the voltage at the output terminals multiplied by the output current. When using remote sense and trim, the output voltage of the module can be increased, which at the same output current would increase the power output of the module. Care should be taken to ensure that the maximum output power of the module remains at or below the maximum rated power.

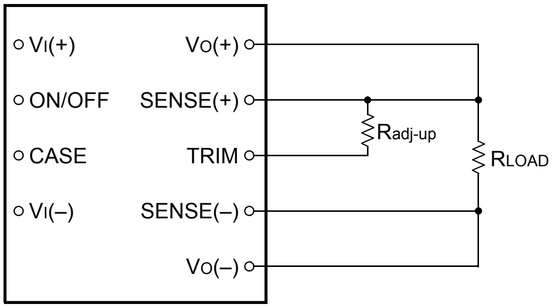
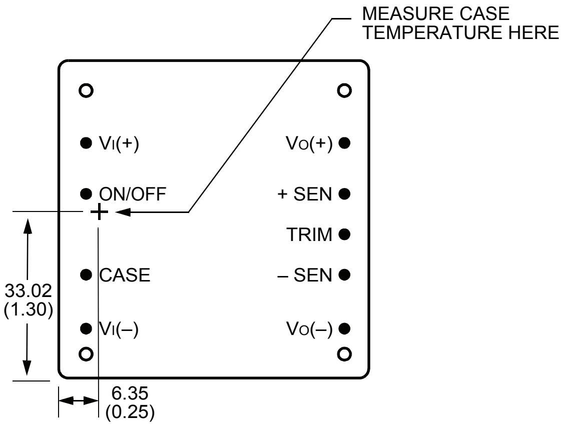


Figure 15. Circuit Configuration to Increase Output Voltage.

Thermal Considerations

The power modules operate in a variety of thermal environments; however, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat-dissipating components inside the unit are thermally coupled to the base plate. Heat is removed by conduction, convection, and radiation to the surrounding environment. Proper cooling can be verified by measuring the base plate temperature. Peak temperature (TC) occurs at the position indicated in Figure 16.



Note:Top view, pin locations are for reference only.

Figure 16. Case Temperature Measurement Location.

The temperature at this location should not exceed 100 °C. The output power of the module should not exceed the rated power for the module as listed in the Ordering Information table.

Although the maximum case temperature of the power modules is 100 °C, you can limit this temperature to a lower value for extremely high reliability.

Heat Transfer Without Heat Sinks

Increasing airflow over the module enhances the heat transfer via convection. Figure 17 shows the maximum output current that can be delivered by the module without exceeding the maximum case temperature versus local ambient temperature (TA) for natural convection through 3 m/s (600 ft./min.).

Note that the natural convection condition was measured at 0.05 m/s to 0.1 m/s (10 ft./min. to 20 ft./min.); however, systems in which these power modules may be used typically generate natural convection airflow rates of 0.3 m/s (60 ft./min.) due to other heat dissipating components in the system. The use of Figure 17 is shown in the following example.

Example

What is the minimum airflow necessary for the JPW200S52R5-BH operating at VI = 52 V, an output current of 3.5 A, and a maximum ambient temperature of 40 °C?

Solution

Given: VI = 52 V
IO = 3.5 A
TA = 40 °C

Determine airflow (v) (Use Figure 17.):

v = 1.0 m (200 ft/min)

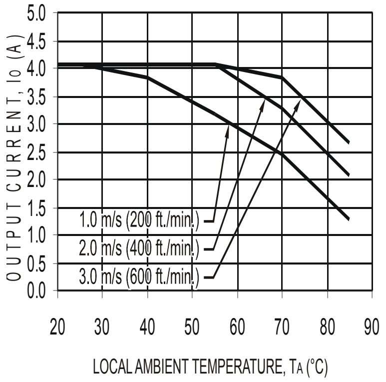


Figure 17. Derating Curve for JPW200S52R5-BH (Vo = 52.5V) with base plate; Vin = 52V.

EMC Considerations

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

Layout Considerations

Copper paths must not be routed beneath the power module mounting inserts. For additional layout guidelines, refer to the FLTR100V10 data sheet (DS98-152EPS).

Through-Hole Lead-Free Soldering Information

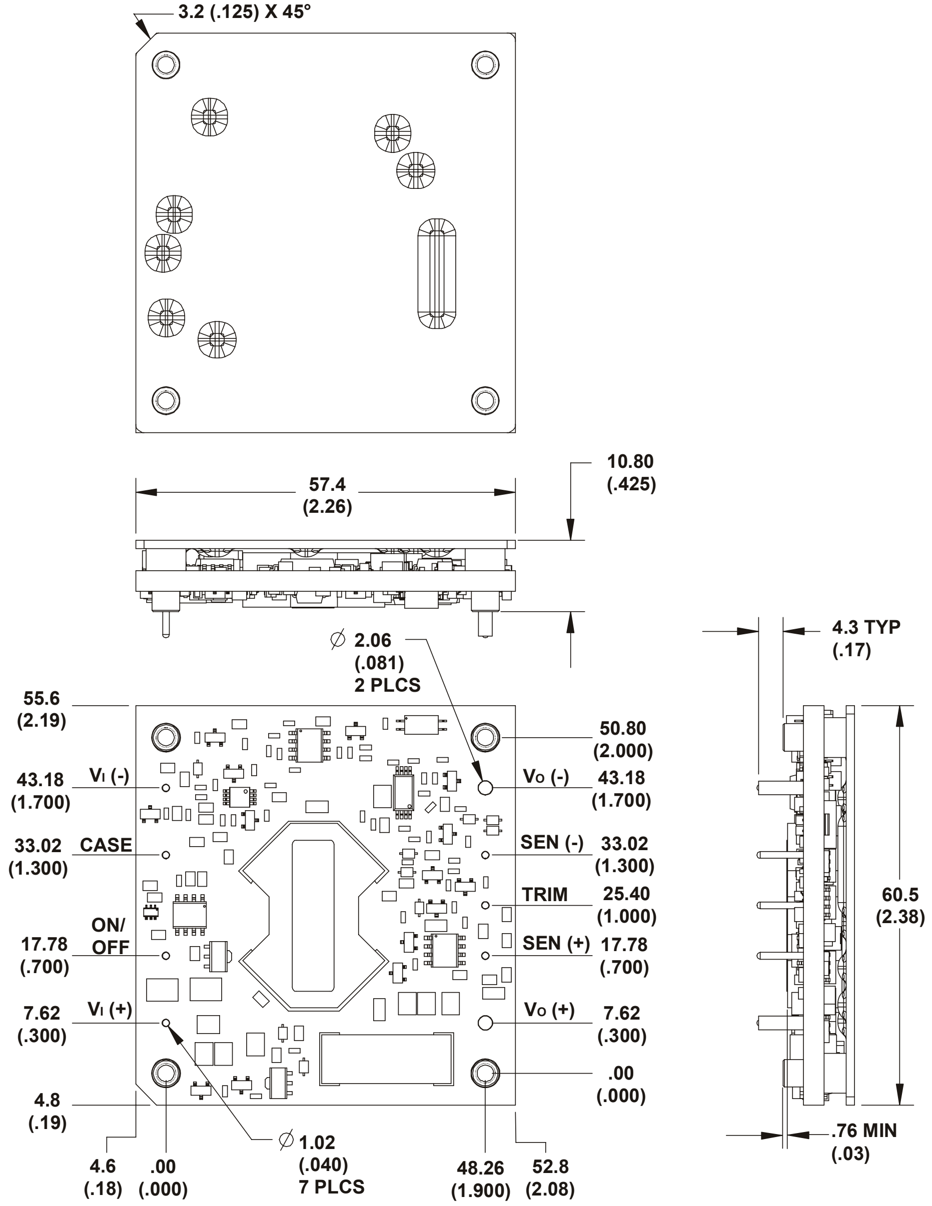
The RoHS-compliant through-hole products use the SAC (Sn/Ag/Cu) Pb-free solder and RoHS-compliant components. They are designed to be processed through single or dual wave soldering machines. The pins have an RoHS-compliant finish that is compatible with both Pb and Pb-free wave soldering processes. 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. If additional information is needed, please consult with your Tyco Electronics Power System representative for more details.

Post Solder Cleaning and Drying Considerations

Post solder cleaning is usually the final circuit-board assembly process prior to electrical board testing. The result of inadequate cleaning and drying can affect both the reliability of a power module and the testability of the finished circuit-board assembly. For guidance on appropriate soldering, cleaning and drying procedures, refer to Lineage Power *Board Mounted Power Modules: Soldering and Cleaning* Application Note (AP01-056EPS).

Outline Diagram

Dimensions are in millimeters and (inches)
Tolerences: x.x mm 0.5 mm (x.xx in. 0.02 in.)
x.xx mm 0.25 mm (x.xxx in. 0.010 in.)



*Bottom Side label includes Lineage Power name, product designation, and data code.

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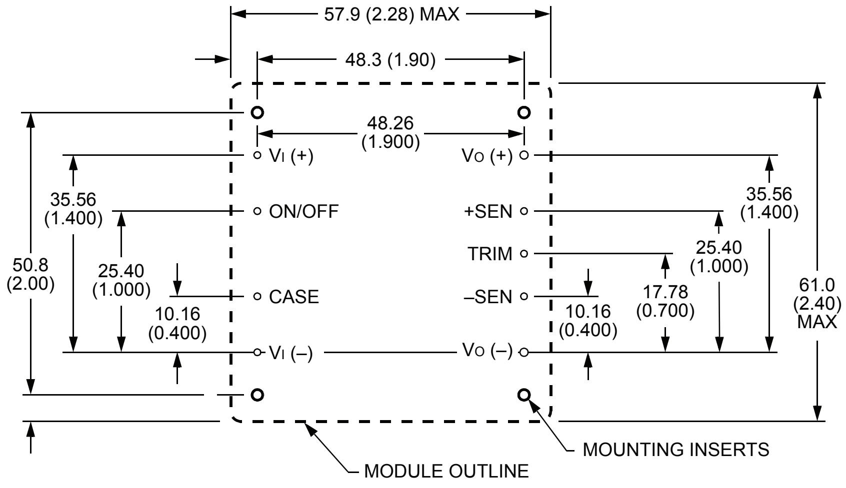
Recommended Hole Pattern

Component side footprint.

Dimensions are in millimeters and (inches).



Ordering Information

For assistance in ordering, please contact your Lineage Power Account Manager or Field Application Engineer for pricing and availability.

Input Voltage	Output Voltage	Output Current	Remote On/Off Logic	Connector Type	Device Code	Comcodes
48V	52.5V	200W	Negative	Through hole	JPW200S52R51-BH	108982851
48V	52.5V	200W	Negative	Through hole	JPW200S52R51-BHZ	CC109121456

Optional features can be ordered using the suffixes shown in table below. The suffixes follow the last letter of the device code and are placed in descending order. For example, the device codes for a JPW200S52R5-BH module with the following options are shown below:

Negative Logic remote on/off JPW200S52R51-BH

Option	Suffix
Negative Logic remote on/off	1
Base plate version for Heat Sink attachment	–H
Pin Length: 3.68 mm ± 0.25 mm (0.145 in. ± 0.010 in)	6
RoHS compliant	–Z

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