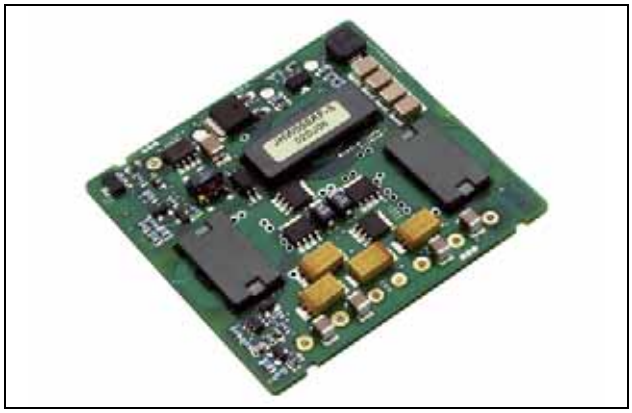
Data Sheet
April 2008

JHW050 Dual Positive Output-Series Power Modules: dc-dc Converter: 36 Vdc to 75 Vdc Input, Dual Positive Outputs; 50W



Applications

- Distributed power architectures
- Wireless Networks
- Access and Optical Network Equipment
- Enterprise Networks
- Latest generation IC's (DSP, FPGA, ASIC) and Microprocessor powered applications.

Options

- Positive Remote On/Off logic
- Basic Insulation (-B)
- SeqFET - external sequencing FET drive supply (–F)

Features

- Flex load – Power trading between V_{O1} and V_{O2}
- Wide output voltage adjustment range – V_{O2} adjustment range +5%/-55%
- High efficiency – 89% typical for AF
- Low Output Voltage – supports migration to future IC supply voltages
- Cost efficient open frame design
- Surface mount or through hole
- Low Profile – 8.5mm maximum
- Two tightly regulated outputs
- Remote On/Off
- Output overcurrent protection
- Output overvoltage protection
- Overtemperature protection
- Meets the voltage isolation requirements for ETSI 300-132-2 and complies with, and is approved per EN60950 Basic Insulation (-B option)
- Wide operating temperature range
- *UL** 60950 Recognised, *CSA*† C22.2 No. 60950-00 Certified, and E N60950 (*VDE*‡ 0805):2001-12 Licensed
- *CE*§ Mark meets 73/23/EEC and 93/68/EEC directives
- Available in 4 Output voltage variants:

	V_{O1}	V_{O2}
AF	5.0V	3.3V
FG	3.3V	2.5V
FY	3.3V	1.8V
GY	2.5V	1.8V

Description

The JHW050 Dual Series comprises a family of low profile, open frame modules with an industry standard, half-brick footprint. The modules have a maximum power rating of 50W, with a typical efficiency up to 89%, and cover the 36Vdc to 75Vdc voltage range. The circuit architecture provides for power to be traded between the two independently regulated outputs, whilst still maintaining a high efficiency.

* 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 the required procedures for CE marking of end-user equipment should be followed. (The CE mark is placed on selected products.)

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	Symbol	Min	Max	Unit
Input Voltage Continuous Transient (100ms)	 V_I $V_{I,\,trans}$	 –0.5 –0.5	 80 100	 Vdc Vdc
Operating Ambient Temperature (see Thermal Considerations section)	T_A	–40	85	°C
Storage Temperature	T_{stg}	–55	125	°C
I/O Isolation Voltage	—	—	1500	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	$V_{I,min}$ $V_{I,nom}$ $V_{I,max}$	36	54	75	Vdc
Maximum Input Current (V_I = 0V to 75V, I_O = $I_{O,max}$)	$I_{I,max}$	—	—	2.0	Adc
Inrush Transient	—	—	—	1.0	A^2s
Input Reflected Ripple Current, peak-to-peak (5Hz to 20MHz, 12µH source impedance; see Figure 12)	—	—	—	20	mApk-pk
Input Ripple Rejection (100—120Hz)	—	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 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 normal-blow fuse with a maximum rating of 5A (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.

Electrical Specifications (continued)

Parameter	Output	Symbol	Min	Typ	Max	Unit
Output Voltage Set-point (V_I = $V_{I,nom}$, I_O = $I_{O,max}$, T_{ref} = 25 °C)	All All	$V_{O1,set}$ $V_{O2,set}$	–1.6 –1.6	— —	+1.6 +1.6	%$V_{O1,nom}$ %$V_{O2,nom}$
Output Voltage (Over all operating input voltage, resistive load, and temperature conditions until end of life)	All All	V_{O1} V_{O2}	–4.0 –4.0	— —	+4.0 +4.0	%$V_{O1,nom}$ %$V_{O2,nom}$
Adjustment Range Independent for each output. Selected by external resistor	All AF FG FY GY	V_{O1} V_{O2} V_{O2} V_{O2} V_{O2}	–5.0 1.50 1.50 1.00 1.00	— 3.30 2.50 1.80 1.80	+5.0 3.47 2.63 1.89 1.89	%$V_{O1,nom}$ Vdc Vdc Vdc Vdc
Output Regulation Line (V_I = $V_{I,min}$ to $V_{I,max}$) 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 0.30	 0.20 0.20 1.00	 % % %
Output Ripple and Noise on nominal output (V_I = $V_{I,nom}$ and I_O = $I_{O,min}$ to $I_{O,max}$) RMS (5Hz to 20MHz bandwidth) Peak-to-Peak (5Hz to 20MHz bandwidth) 	 V_O≥3.3V V_O<3.3V V_O≥3.3V V_O<3.3V	 — — — —	 — — — —	 — — — —	 35 25 100 75	 mVrms mVrms mVpk-pk mVpk-pk
External Capacitance (Electrolytic, Tantalum and Ceramic) E.S.R.	 All All	 C_O —	 0 10	 — —	 470[#] —	 µF mΩ
Output Current NOTE: The maximum combined output current must not exceed 12A for the AF and 16A for FG, FY, GY	AF FG,FY, GY 	I_{O1} I_{O2} I_{O1} I_{O2}	0.0 0.0 0.0 0.0	— — — —	8.0 8.0 12.0 12.0	Adc Adc Adc Adc
Output Current Limit Inception (V_O≤90% $V_{O,nom}$, with 4A on the other output)	AF FG,FY, GY	$I_{O, cli}$ $I_{O, cli}$	— —	11 15	14 18	Adc Adc
Average Output Short-Circuit Current (V_O≤250mV)	All	$I_{O, s/c}$	—	15	—	% $I_{O,max}$
Efficiency V_I = $V_{I,nom}$, T_A = 25 °C I_{O1} = I_{O2} = 6A for AF I_{O1} = I_{O2} = 8A for FG, FY and GY V_{O1} and V_{O2} set to nominal	 AF FG FY GY	 η η η η	 — — — —	 89.0 88.0 87.0 84.0	 — — — —	 % % % %
Switching Frequency	All	f_{sw}	—	200	—	kHz

[#] The value of additional external output capacitance is not limited to this value. However, it is recommended, in order to avoid possible issues, consult your Lineage Power technical representative if higher values wish to be used.

Electrical Specifications (continued)

Parameter	Output	Symbol	Min	Typ	Max	Unit
Dynamic Response V_{O1} ($\Delta I_O/\Delta t$ = 1A/µs, V_I = 54V, I_{O2} = 2A, T_{ref} = 25 °C)						
I_{O1} = 4A - 6A - 4A or 4A - 2A - 4A for AF	AF	V_{pk}	—	120	—	mV
		t_s	—	100	—	µs
I_{O1} = 6A - 9A - 6A or 6A - 3A - 6A for FG,FY and GY	FG, FY, GY	V_{pk}	—	180	—	mV
		t_s	—	100	—	µs
Dynamic Response V_{O2} ($\Delta I_O/\Delta t$ = 1A/µs, V_I = 54V, I_{O1} = 2A, T_{ref} = 25 °C)						
I_{O2} = 4A - 6A - 4A or 4A - 2A - 4A for AF	AF	V_{pk}	—	120	—	mV
		t_s	—	100	—	µs
I_{O2} = 6A - 9A - 6A or 6A - 3A - 6A for FG,FY and GY	FG, FY, GY	V_{pk}	—	180	—	mV
		t_s	—	100	—	µs

Isolation Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Isolation Capacitance	C_{iso}	—	330	—	pF
Isolation Resistance	R_{iso}	10	—	—	MΩ

General Specifications

Parameter	Min	Typ	Max	Unit
Calculated MTBF (I_O = 80% of $I_{O,max}$, T_A = 20 °C)		3,000,000		Hours
Weight	—	38 (1.34)	—	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	Output	Symbol	Min	Typ	Max	Unit
Remote On/Off interface						
Logic Low						
At $I_{on/off}$ = 1.0mA	All	$V_{on/off}$	0.0	—	0.8	V
At $V_{on/off}$ = 0.0V	All	$I_{on/off}$	—	—	1.0	mA
Logic High						
At $I_{on/off}$ = 0.0µA	All	$V_{on/off}$	—	—	15	V
At $V_{on/off}$ = 15V	All	$I_{on/off}$	—	—	50	µA
Turn-on Time						
From application of Input Supply V_I = 54V	All	—	—	140	—	ms
From application of Remote On/Off Switch	All	—	—	30	—	ms
Rise Time	All	—	—	25	—	ms
(I_{O1} = I_{O2} = 8A for FG, FY & GY, I_{O1} = I_{O2} = 6A for AF) (V_{O1} and V_{O2}>90% of steady state; see Figure 1)						
Output Overvoltage Protection	AF	V_{O1}	—	6.0	6.5	V
(See Feature Description)	FG & FY	V_{O1}	—	4.2	4.6	V
	GY	V_{O1}	—	3.5	3.8	V
Overtemperature Protection		T_{ref}	—	120	—	°C
SeqFET						
Output Voltage (Open Circuit)	AF	—	10.0	11.4	12.8	V
	FG & FY	—	10.0	11.4	12.8	V
	GY	—	8.0	9.4	10.7	V
Output Impedance	All	—	—	1.0	—	kΩ

Characteristic Curves – AF

The following figures provide typical characteristics for the JHW050AF. The figures are identical for either positive or negative Remote On/Off logic.

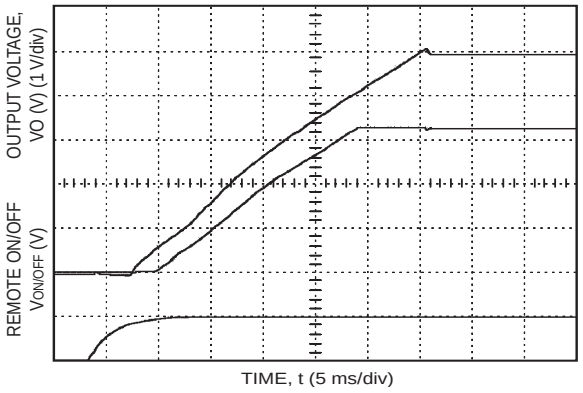


Figure 1. Typical Start-Up Using Remote On/Off.

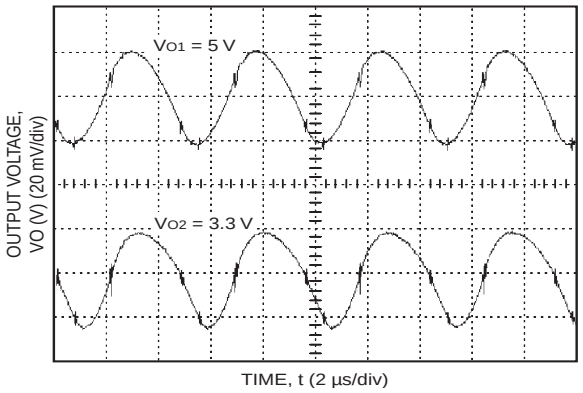


Figure 2. Typical Output Ripple and Noise.

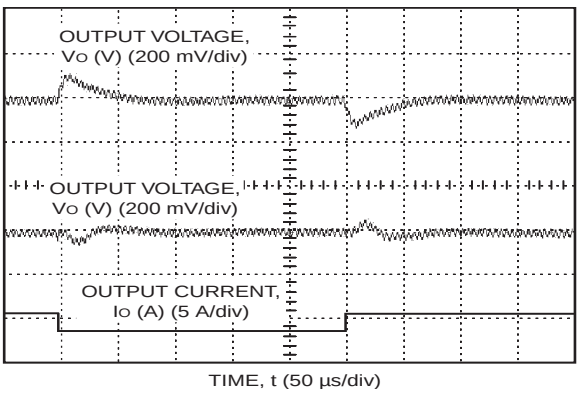


Figure 3. Typical V_{O1} Transient Response at 54V_{IN}, Nominal Output Voltages, I_{O1} = 6A to 4A to 6A, and I_{O2} = 4A.

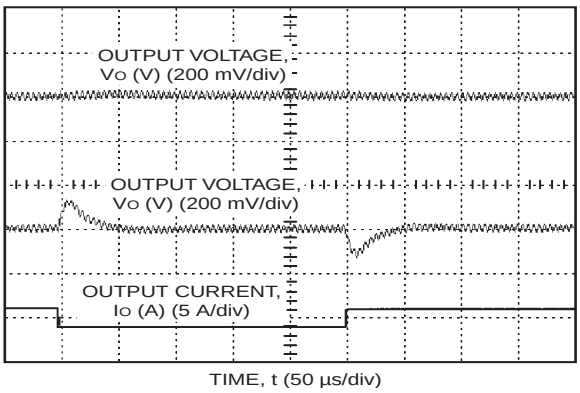


Figure 4. Typical V_{O2} Transient Response at 54 VIN, Nominal Output Voltages, I_{O2} = 6A to 4A to 6A, and I_{O1} = 4A

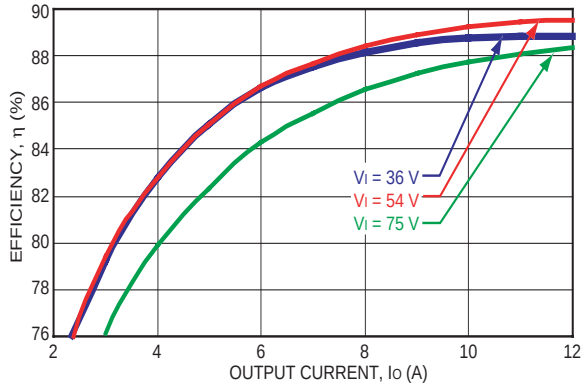


Figure 5. Converter Efficiency vs. Total Output Current I_{O1} = I_{O2}

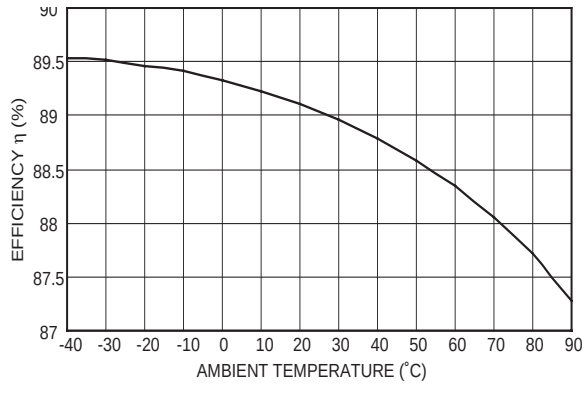


Figure 6. Converter Efficiency vs. Ambient Temperature 54 V_{IN}, I_{O1} = I_{O2} = 6A

Characteristic Curves – FG & FY

The following figures provide typical characteristics for the JHW050FG & FY. The figures are identical for either positive or negative Remote On/Off logic.

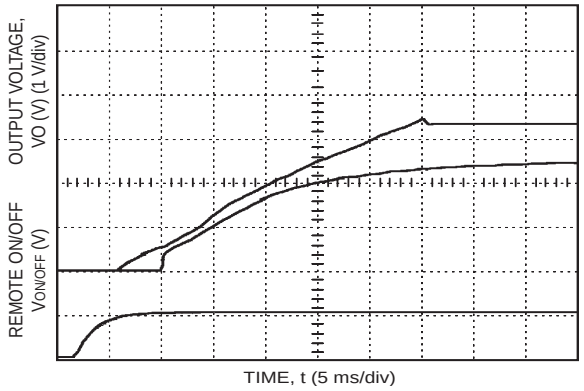


Figure 7. Typical Start-up Using Remote On/Off JHW050FG

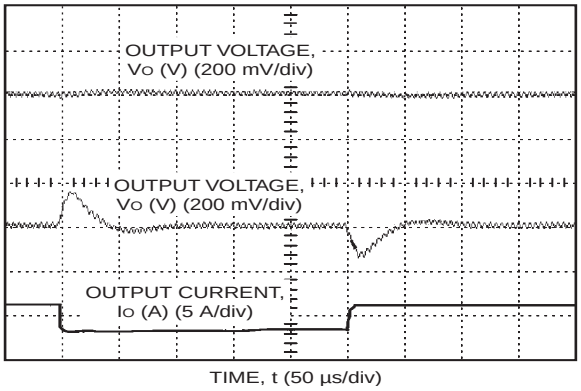


Figure 10. Typical V_{O2} Transient Response at 54V_{IN}, Nominal Output Voltages, I_{O2} = 6A to 3A, to 6A and I_{O1} = 3A JHW050FG.

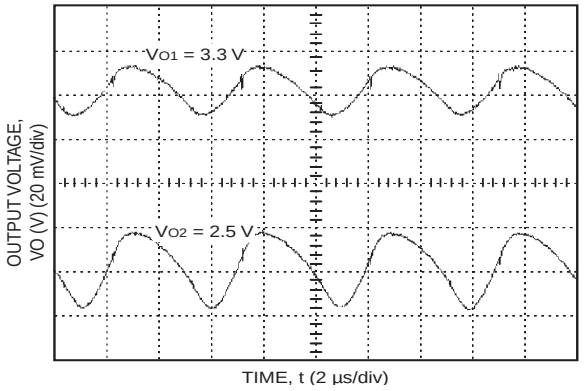


Figure 8. Typical Output Ripple and Noise JHW050FG

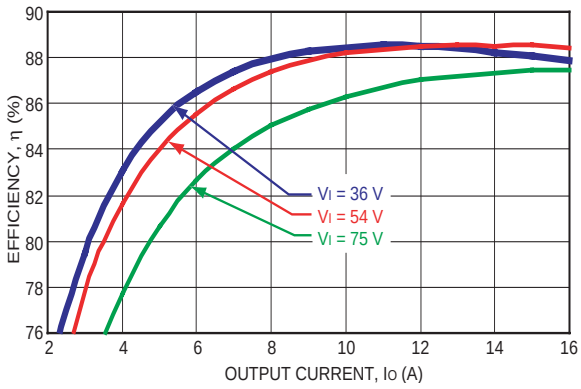


Figure 11. Converter Efficiency vs. Total Output Current I_{O1} = I_{O2} JHW050FG

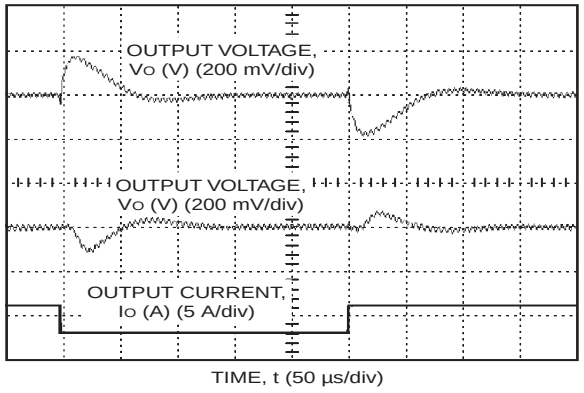
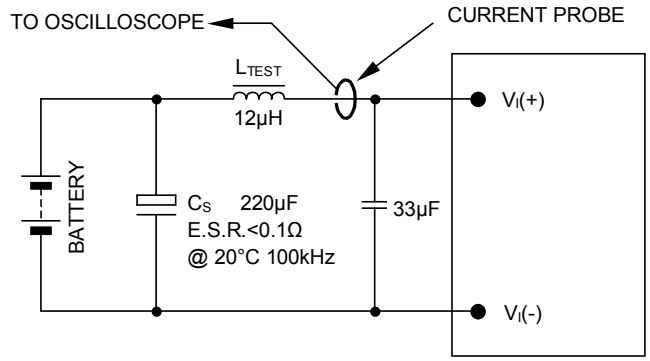


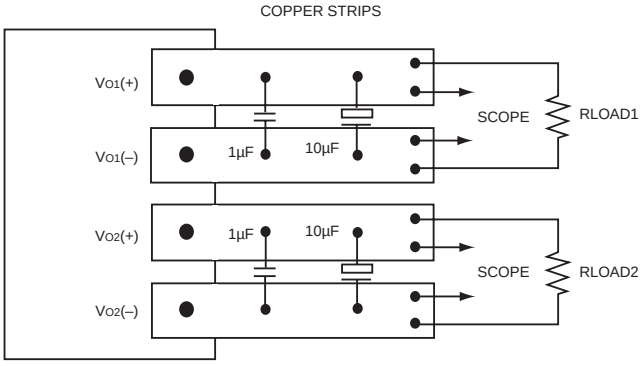
Figure 9. Typical V_{O1} Transient Response at 54V_{IN}, Nominal Output Voltages, I_{O1} = 6A to 3A, to 6 A and I_{O2} = 3A JHW050FG.

Test Configurations



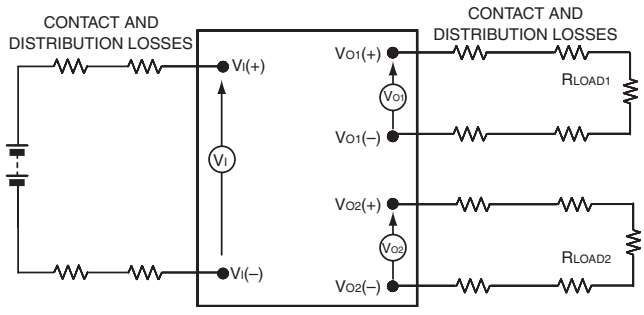
Note: Measure input reflected ripple current with a simulated source inductance (L_{TEST}) of 12 µH. Capacitor C_S offsets possible battery impedance. measure current as shown above.

Figure 12.Input Reflected Ripple Current Test Setup



Note: Use a 1µF ceramic capacitor and a 10µF aluminium or tantalum capacitor. The scope measurement should be made using a BNC socket. Position the load 50mm to 75mm (2” to 3”) from the moudle.

Figure 13.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 14.Output Voltage and Efficiency Test Setup

$$\text{Efficiency} \qquad \eta = \frac{V_{O1}I_{O1} + V_{O2}I_{O2}}{V_I I_I}$$

Design Considerations

Input Source Impedance

The power module should be connected to a low ac-impedance source. A highly inductive sourceimpedance can affect the stability of the power module. For the test configuration in Figure 12, 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., UL60950, CSA C22.2 No. 60950-00, and EN 60950 (VDE 0805): 2001-12.

If the input source in non-SELV (ELV or a hazardous voltage greater than 60 Vdc and less than or equal to 75 Vdc), for the modules’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 hazardous voltages, including the ac mains.
- One V_I pin and one V_O 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, as reauired by the safety agencies, on the combination of supply source and subject module 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. (–B option only)

The input to these units is to be provided with a maximum 5A normal-blow fuse in the ungrounded lead.

Feature Descriptions

Flexible Power Trading

The full rated output current can be drawn from either output within the limits shown in Figure 15.

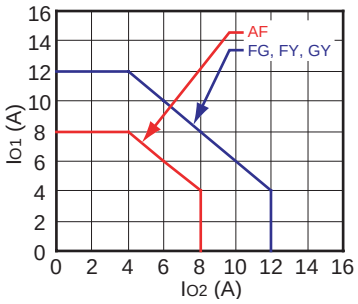


Figure 15.Current Sharing Between Outputs

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. The unit operates normally once the output current is brought back into its specified range. The average output current during hiccup is 15% $I_{O,max}$.

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 turns the module off during a logic high and on during a logic low. Negative logic, device code suffix “1”, is the factory-preferred configuration.

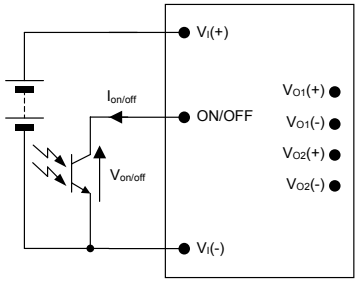


Figure 16.Remote On/Off Implementation

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 $V_I(-)$ terminal (see Figure 16). Logic low is $0V \leq V_{on/off} \leq 0.8V$. The maximum $I_{on/off}$ during a logic low is 1mA, the switch should be maintain a logic low level whilst sinking this current.

During a logic high, the maximum $V_{on/off}$ generated by the module is 15V, and the maximum allowable leakage current at $V_{on/off}$ = 15V is 50µA.

If not using the remote on/off feature:

For negative logic, short the ON/OFF pin to $V_I(-)$.

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

Output Overvoltage Protection

The main output voltage is limited by an internal clamp. This provides protection from excessive overvoltage. If an accurate overvoltage limit is required this should be implemented externally via the remote On/Off function.

Figure 17 shows a basic circuit for a 5V output unit with positive remote On/Off logic. In an overvoltage condition the unit will shut down and then restart.

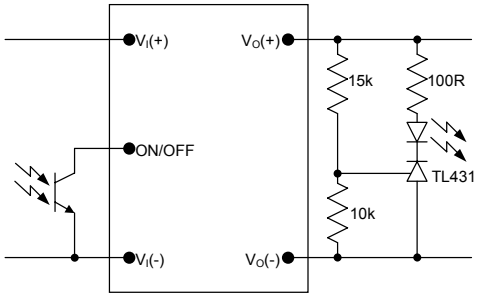


Figure 17.Overvoltage Circuit

Overtemperature Protection

To provide protection in a fault condition, the unit is equipped with a thermal shutdown circuit. the unit will shutdown if the overtemperature threshold is exceeded, it will then wait for the unit to cool before attempting to restart.

The unit will typically enter thermal shutdown when the temperatures measured at the thermal reference points (see Figures 20 and 21) reach 120 °C.

SeqFET Drive Supply – Optional (–F)

The SeqFET function provides a DC voltage above the main output suitable for driving an external FET in series with V_{O1} and/or V_{O2}. This allows for flexibility in sequencing turn-on and turn-off of the module outputs.

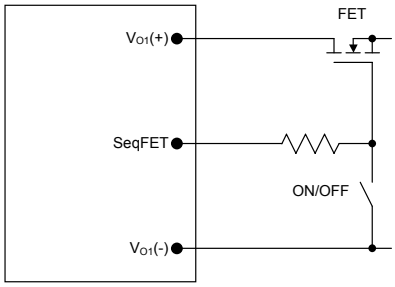


Figure 18.SeqFET Application

Note: SeqFET pin 8 is an optional pin. Standard modules will not have this pin fitted.

Feature Descriptions (continued)

Output Voltage Set-Point Adjustment (Trim)

Trimming allows the output voltage set point to be increased or decreased, this accomplished by connecting an external resistor between the TRIM pin and either the $V_O(+)$ pin or the COM pin (see Figure 19).

To maintain set point accuracy, the trim resistor tolerance should be ± 0.1%.

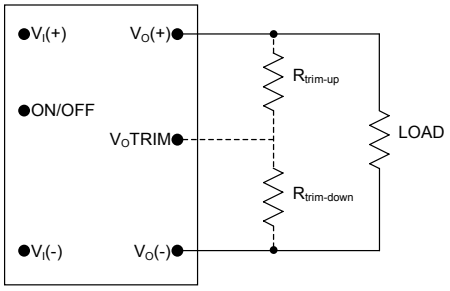


Figure 19.Circuit Configuration to Trim Output Voltage

V_{O1} Set-Point Adjustment (Trim)

The Trim equations shown below can be used for all module variants V_{O1}.
$\Delta\%$ is the desired % change in V_{O1}.
V_{O1} refers to the nominal output voltage for the output being trimmed.
V_{ref} = 2.5 for JHW050AF, and 1.225 for all others.

$$V_{O1}\_R_{trim\_down}: = \left(\frac{511}{\Delta\%} - 10.22\right)K\Omega$$

$$V_{O1}\_R_{trim\_up}: = \left[\frac{5.11 \cdot V_{O1} \cdot (100 + \Delta\%)}{V_{ref} \cdot \Delta\%} - \frac{511}{\Delta\%} - 10.22\right]K\Omega$$

Example: For JHW050AF, to trim up to 5.25 V, $\Delta\%$ = 5, nominal V_{O1} = 5.0, use V_{ref} = 2.5.

Hence Rtrim_up = 102.2 KΩ.

V_{O2} Set-Point Adjustment (Trim)

Due to internal component values within each JHW050 variant, the V_{O2} trim laws are different for each type. Care should be taken to ensure that the correct law as shown below is being used.

JHW050AF V_{O2} Trim

The following equations apply only to the JHW050AF V_{O2}.

$$V_{o2}\_R_{trim\_down}: = \left(\frac{511}{\Delta\%} - 6.11\right)K\Omega$$

$$V_{O2}\_R_{trim\_up}: = \left[\frac{5.11 \cdot V_{O2} \cdot (100 + \Delta\%)}{V_{ref} \cdot \Delta\%} - \frac{511}{\Delta\%} - 6.11\right]K\Omega$$

JHW050FG V_{O2} Trim

the following equations apply only to the JHW050FG V_{O2}.

$$V_{O2}\_R_{trim\_down}: = \left[\frac{40.87 \cdot V_{O2} \cdot (100 - \Delta\%) + 2026}{929.5 - 3.715 \cdot V_{O2} \cdot (100 - \Delta\%)}\right]K\Omega$$

$$V_{O2}\_R_{trim\_up}: = \left[\frac{62.85 \cdot V_{O2} \cdot (100 + \Delta\%) + 2955}{3.715 \cdot V_{O2} \cdot (100 + \Delta\%) - 929.5}\right] - 1\ K\Omega$$

JHW050FY V_{O2} Trim

The following equations apply only to the JHW050FY V_{O2}.

$$V_{O2}\_R_{trim\_down}: = \left[\frac{51.91 \cdot V_{O2} \cdot (100 - \Delta\%) + 2904}{849.6 - 4.719 \cdot V_{O2} \cdot (100 - \Delta\%)}\right]K\Omega$$

$$V_{O2}\_R_{trim\_up}: = \left[\frac{52.81 \cdot V_{O2} \cdot (100 + \Delta\%) - 3753}{4.719 \cdot V_{O2} \cdot (100 + \Delta\%) - 849.6}\right] - 1\ K\Omega$$

If not using the trim feature, leave each TRIM pin unconnected.

The table below shows trim resistance values to adjust V_{O2} down to a range of popular nominal voltages.

AF - Nom V_{O2} = 3.3V		FG - Nom V_{O2} = 2.5V		FY - Nom V_{O2} = 1.8V	
V_{O2} Trim		V_{O2} Trim		V_{O2} Trim	
2.50	14.97kΩ	2.00	54.69kΩ	1.5	75.42kΩ
2.00	6.86kΩ	1.80	35.98kΩ	1.40	53.84kΩ
1.80	5.13kΩ	1.50	21.91kΩ	1.20	32.24kΩ
1.50	3.26kΩ	—	—	1.00	21.43kΩ

Thermal Considerations

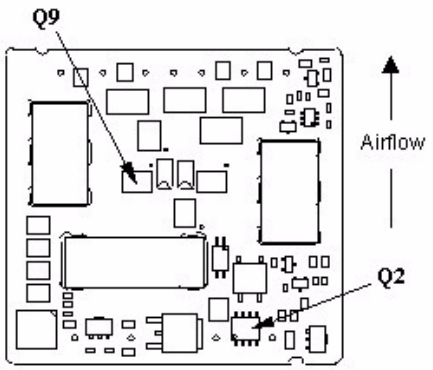
The power module can operate in a variety of thermal environments, however, sufficient cooling should be provided to help ensure reliable operation.

Considerations include Ambient temperature, airflow, module power dissipation, and 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 measurements taken in a wind tunnel using the test setup shown in Figure 22.

Note that the orientation of the module with respect to the airflow affects thermal performance. Two orientations are shown below in Figure 20 and 21.

Note: Proper cooling can be verified by measuring the temperature at the top center of the case of the two T_{ref} components Q9 and Q2. For reliable operation neither temperature measured should exceed 110 °C.



1-0865

Figure 20.Worst Orientation (Top View)

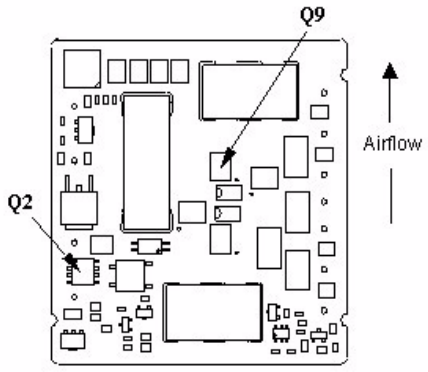


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Figure 21.Best Orientation (Top View)

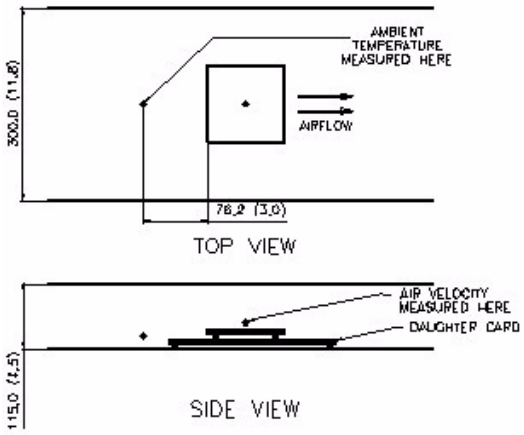

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Figure 22.Thermal Test Setup

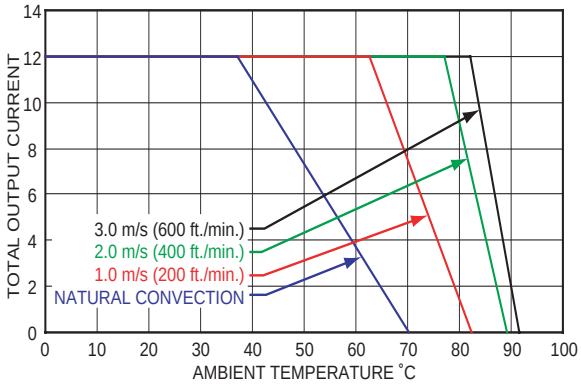

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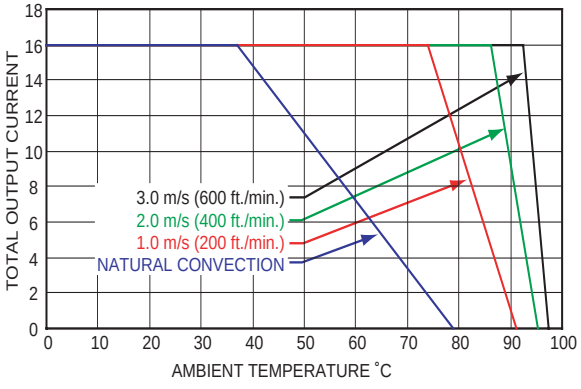
Figure 23.JHW050AF Typical Maximum total Output Current vs. Local Ambient Temperature and Air Velocity; Worst case orientation

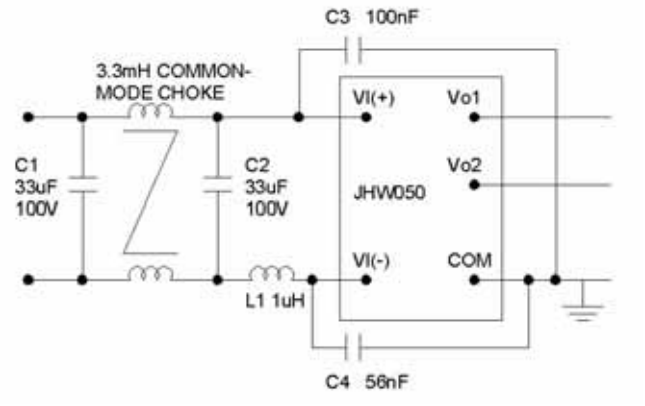


1-0869

Figure 24.JHW050FG &FY typical Maximum total Output Current vs. Local Ambient Temperature and Air Velocity; Worst case orientation

EMC Considerations

The Figure 25 shows a suggested configuration to meet the conducted emission limits of EN55022 Class B.



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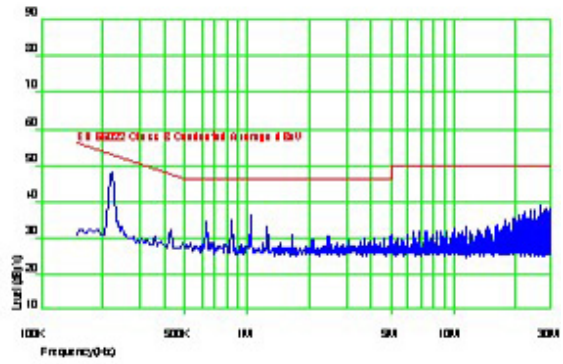
Note: Inductor L1 must not be > 1 uH to ensure stability C1, C2 should be low impedance type, ESR < 0.7Ω

Figure 25.Suggested Configuration for EN55022 Class B



1-0871

Figure 26.Typical EMC signature using Figure 25 filter.

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

Layout Considerations

Though the external filter components are important in achieving a good EMC result, equally important is the PCB layout and system grounding configuration.

The JHW050 power module is 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.

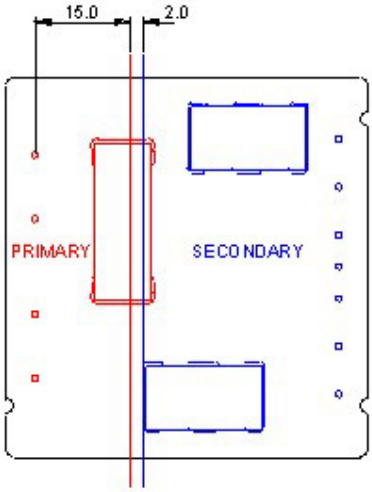


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Figure 27. Suggested Primary to Secondary Power Planes

The following recommendations should ensure reliable operation of the power module:

- Due to the limited component clearance avoid placing copper areas on the outer layer directly underneath the power module. Also avoid placing via interconnects underneath the power module. If this is not possible, any vias should be situated away from the three main magnetic components, as shown above. These components are the highest on the power module bottom side and hence provide the least clearance to the system card.
- Two planes should be provided beneath the power module to minimize radiated emissions. The ‘Input Plane’ should be sized to cover the primary-side circuits of the power module, and it should be connected to either of the input power pins e.g. VI(+). The ‘Output Plane’ should be sized to cover the secondary-side circuits and it should be connected to either of the output power pins e.g. 0V. Proper separation, in accordance with safety agency standards should be provided between these two planes. the spacing distance of 2mm shown above preserves the maximum Basic Insulation classification of these power modules.
- Under no circumstances should unconnected or ‘Floating ‘copper areas be placed underneath the power module as these can transmit noise signals, which could reduce module stability.
- Avoid routing sensitive data signals beneath the power module. If this is not possible, these signal traces should be shielded by use of ground planes.

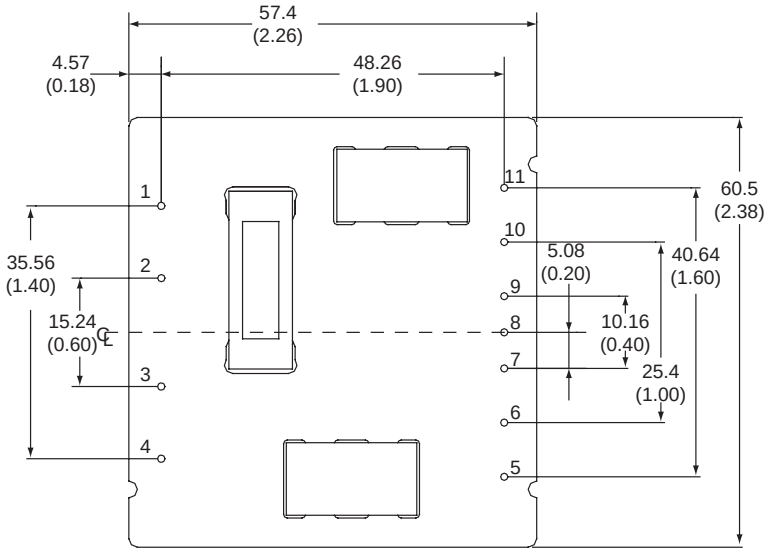
For additional layout guidelines, please refer to the FLTR100V10 data sheet (FDS01-043EPS).

Mechanical Details

Dimensions are in millimeters and (inches).

Tolerances: x.x mm ± 0.5 mm (x.xx in. ± 0.02 in.)
x.xx mm ± 0.25 mm (x.xxx in. ± 0.010 in.)

Top View



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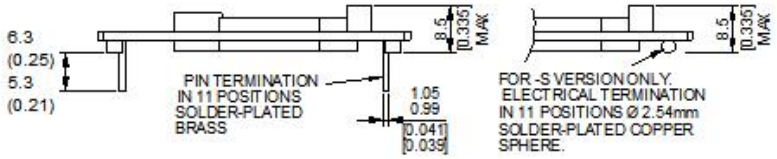
Side View



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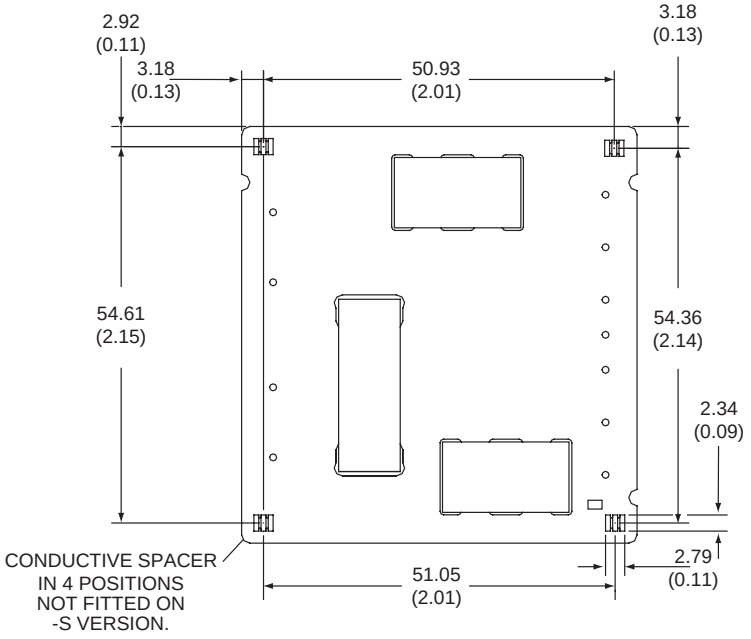
Bottom View

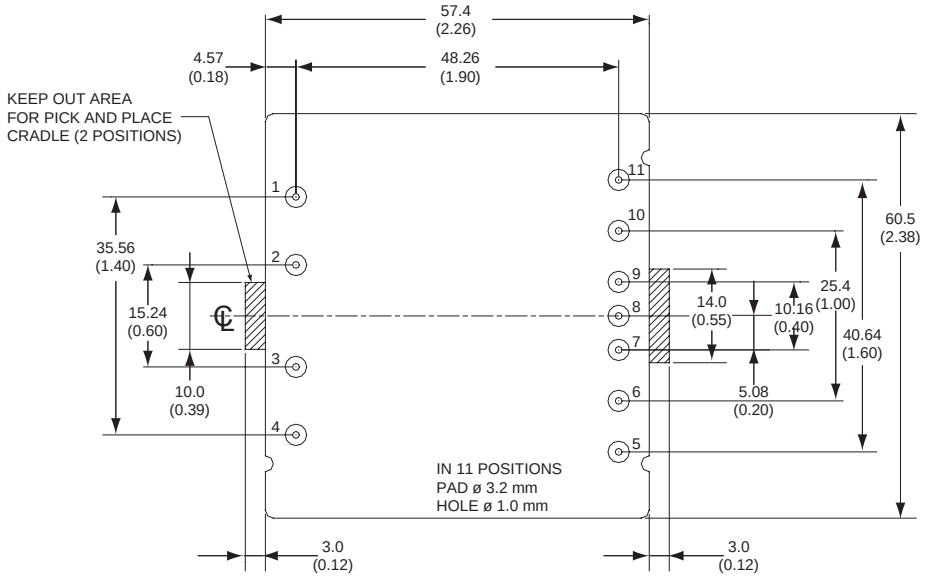


Recommended Footprint Details

Dimensions are in millimeters and (inches).

Tolerances: x.x mm ± 0.5 mm (x.xx in. ± 0.02 in.)
x.xx mm ± 0.25 mm (x.xxx in. ± 0.010 in.)

Pin	Function
1	Vin+
2	ON/OFF
3	N/C
4	Vin-
5	Vo2+
6	Vo2-
7	Vo2Trim
8	STANDARD = NO PIN OPTIONAL = SeqFet
9	Vo1+
10	Vo1-
11	Vo1Trim



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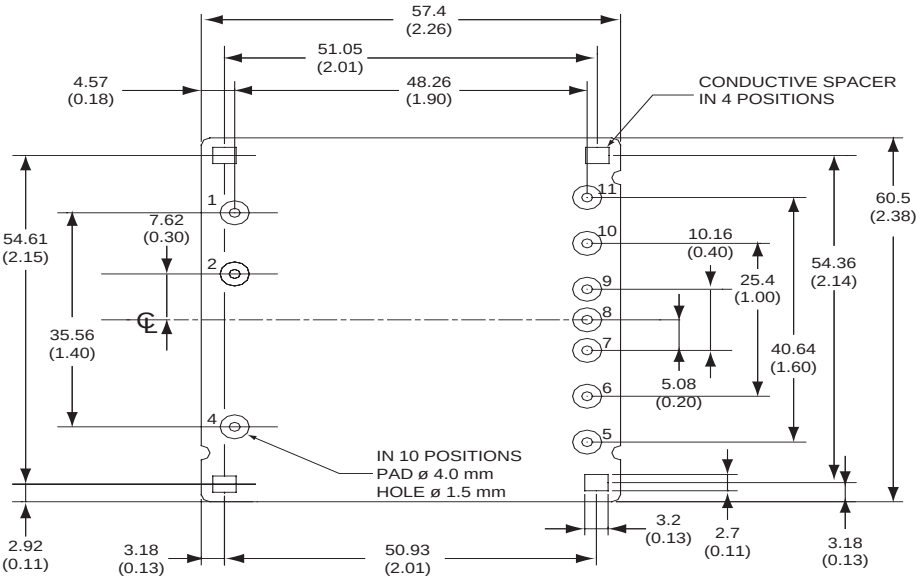
Top View – Component Side Surface Mount Footprint JHW050XX-S

Pin	Function
1	Vin+
2	ON/OFF
3	NO PIN
4	Vin-
5	Vo2+
6	Vo2-
7	Vo2Trim
8	STANDARD = NO PIN OPTIONAL = SeqFet
9	Vo1+
10	Vo1-
11	Vo1Trim



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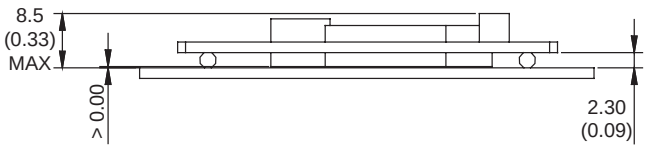
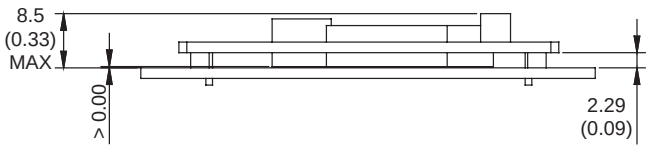
Top View – Component Side Through Hole Footprint JHW050XX



Surface Mount Assembly X-Section



1-0888

Through Hole Assembly X-Section

Surface Mount Information

Packaging Details

The surface mount version, JHW050XX-S power modules are supplied as standard in the plastic tray shown in Figure 28. The tray has external dimensions of 234mm (W) x 334mm (L) x 21.5mm (H). The tray is designed to allow the use of either vacuum pick up or mechanical grippers to automatically place the power module.

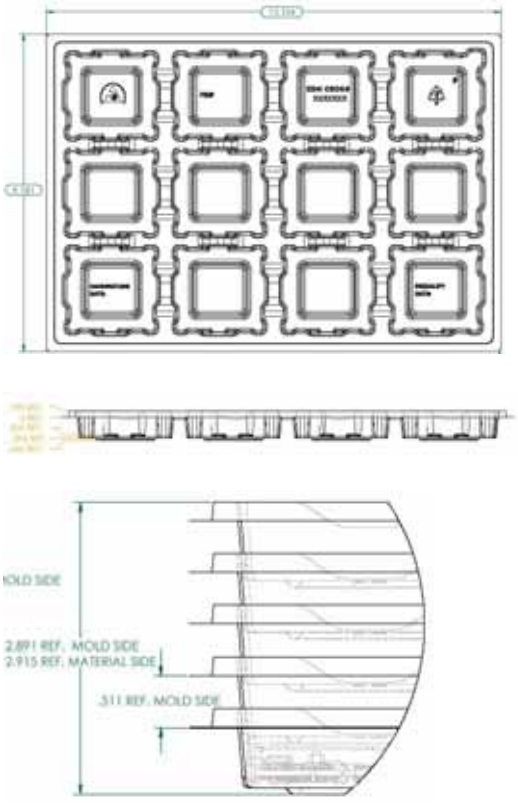


Figure 28.Surface Mount Packaging Tray

Tray Specification

Material	Antistatic coated PVC
Max temperature	65 °C
Max surface resistivity	$10^{12}\Omega$/sq
Colour	Clear
Capacity per tray	12 power modules
Stacking pitch	12.98mm (0.511”)
Min order quantity	48 pcs (1box of 4 full trays)

Each tray contains a total of 12 power modules. The trays are self-stacking and each shipping box will contain 4 full trays plus one empty hold down tray giving a total number of 48 power modules.

Pick and Place

All JHW050-S power modules come assembled with a clip-on, removable “Cradle” which has a large flat surface in its center to serve as a pick and place point for automated vacuum equipment.

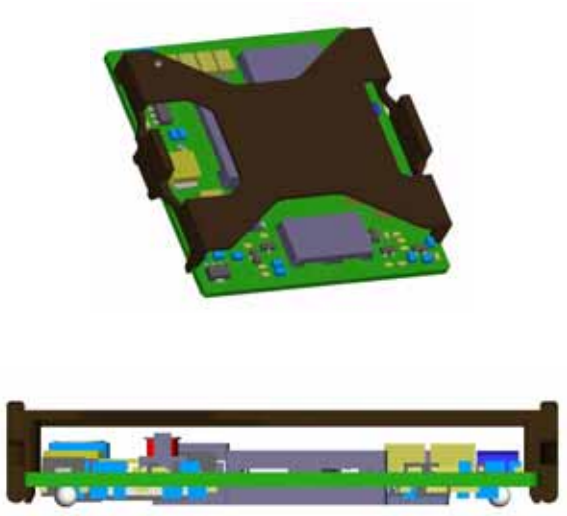


Figure 29.Removable Pick and Place Cradle

The cradle is molded out of high temperature plastic, which is able to withstand the reflow process. Once soldered onto the end-board assembly the cradle should simply be removed by compressing the two edge clips. The cradle material is electrically insulative. Hence, standard-handling methods for ESD prevention, such as specified in JEDEC JESD625-A, should be followed while removing the cradle.

The module weight has been kept to a minimum be using open frame construction. Even so, these modules have a large mass when compared with conventional smt components. Variables such as nozzle size, tip style, vacuum pressure and placement speed should be considered to optimize this process.

The power module can also be automatically handled using odd form placement equipment such as mechanical grippers. the parallel edges of the modules PCB offer suitable gripping points.

Pick and Place Cradle Specification

Material	Questra™ EA 535
Vicat softening point	260 °C
Dielectric const IEC250	3.2
Volume resistivity	$1.3x10^{18}$
Colour	Black
Recycling designation	7, sPS

Reflow Soldering Information

The JHW050 Family of power modules is available for either trough hole or Surface Mount (SMT) soldering. These power modules are large mass, low thermal resistance devices and typically heat up slower than other SMT components. It is recommended that the customer review data sheets in order to customize the solder reflow profile for each application board assemble.

The following instructions must be observed when SMT soldering these units. Failure to observe these instructions may result in the failure of or cause damage to the modules, and can adversely affect long-term reliability.

It is recommended that the reflow profile be characterized for the module on each application board assembly. The power modules Ball connections are plated with tin/lead (Sn/Pb) solder to prevent corrosion and ensure good solderability. Typically, the eutectic solder melts at 183 °C, wets the land, and subsequently wicks the device connection. Sufficient time must be allowed to fuse the plating on the connection to ensure a reliable solder joint.

There are several types of SMT reflow technologies currently used in the industry. These surface mount power modules can be reliable soldered using natural forced convection, IR (radiant infrared), or a combination of convection/IR. For reliable soldering the solder reflow profile should be established by accurately measuring the modules Ball connector temperatures.

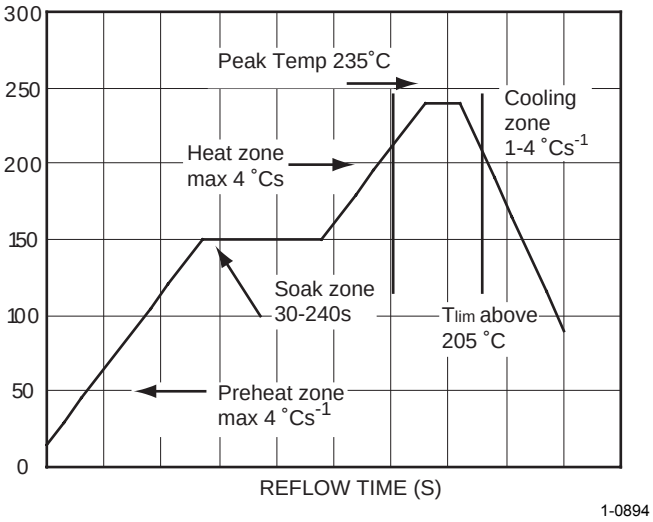


Figure 30.Recommended Reflow Profile

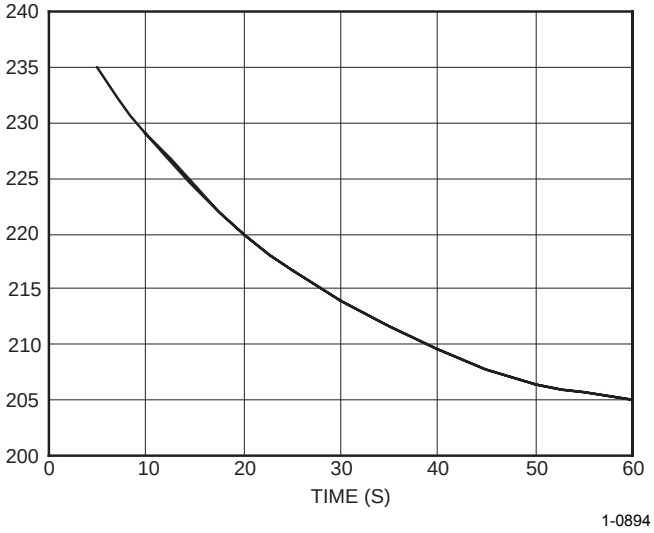


Figure 31.Time Limit Curve Above 205 °C Reflow

Lead Free Soldering

Standard JHW050-S power modules are designed to be used in a conventional Tin/Lead (Sn/Pd) solder process where peak reflow temperatures are limited to less than 235 °C. Users who wish to assemble these modules in a Lead Free solder process which, it is expected, will require the use of higher peak reflow temperatures should contact your local Lineage Power technical representative for more information.

Solder Ball and Cleanliness Requirements

The open frame (no case or potting) power module will meet the solder ball requirements per J-STD-001B. These requirements state that solder balls must neither be loose nor violate the power module minimum electrical spacing.

The cleanliness designator of the open frame power module is C00 (per J specification).

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's *Board Mounted Power Modules: Soldering and Cleaning* Application Note (AP01-56EPS)

Ordering Information

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

Product codes[#]	Input Voltage	Output Voltage(s)	Output Current	Mounting	Remote On/Off Logic	Comcode
JHW050AF1	48V (36V-75V)	5.0V & 3.3V	12A (total)	Through Hole (Pinned)	Negative	108968785
JHW050FG1		3.3V & 2.5V	16A (total)			108968249
JHW050FY1		3.3V & 1.8V	16A (total)			108966367
JHW050GY1		2.5V & 1.8V	16A (total)			TBD
JHW050AF1-S		5.0V & 3.3V	12A (total)	Surface Mount		108966375
JHW050FG1-S		3.3V & 2.5V	16A (total)			TBD
JHW050FY1-S		3.3V & 1.8V	16A (total)			108968660
JHW050GY1-S		2.5V & 1.8V	16A (total)			TBD
JHW050AF	48V (36V-75V)	5.0V & 3.3V	12A (total)	Through Hole (Pinned)	Positive	108961566
JHW050FG		3.3V & 2.5V	16A (total)			108959354
JHW050FY		3.3V & 1.8V	16A (total)			108959362
JHW050GY		2.5V & 1.8V	16A (total)			108963968
JHW050AF-S		5.0V & 3.3V	12A (total)	Surface Mount		108965724
JHW050FG-S		3.3V & 2.5V	16A (total)			108969031
JHW050FY-S		3.3V & 1.8V	16A (total)			108965732
JHW050GY-S		2.5V & 1.8V	16A (total)			TBD

Optional features can be ordered using the suffixes shown below. The suffixes follow the last letter of the device code and are placed in descending alphanumerical order.

Option	Suffix
Negative Remote On/Off Logic	1
Surface Mountable	–S
SeqFET Supply - pin8 fitted	–F
Tested for Basic Insulation	–B

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April 2008
FDS02-044EPS (Replaces FDS02-043EPS)