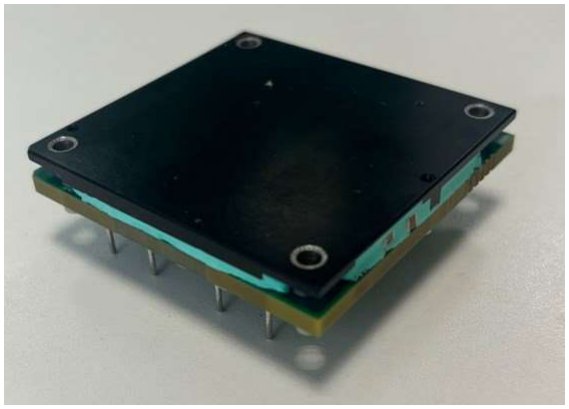
DATASHEET

JRCW1300U Orca* Series; DC-DC Converter Power Modules

36 – 75 V_{dc} Input; 50V_{dc} Output; 1300W Output

RoHS Compliant



Description

The OmniOn Power™ JRCW1300U Orca series of dc-dc converters are a new generation of isolated, very high efficiency DC/DC power modules providing up to 1300W output power in an industry standard, DOSA compliant half-brick size footprint, which makes it an ideal choice for high voltage and high-power applications. The output is fully isolated from the input, allowing versatile polarity configurations and grounding connections.

Applications

- RF Power Amplifier
- Wireless Networks
- Switching Networks

Options

- Output OCP/OVP auto restart
- Shorter pins
- Parallelable with Droop Load Share (DLS)

Features

- Compliant to RoHS Directive 2011/65/EU and amended Directive (EU) 2015/863 (-Z versions)
- Compliant to REACH Directive (EC) No 1907/2006
- High power density: - W/in^3
- Very high efficiency: 97% Typ at Full Load
- Industry standard half-brick pin-out
- Low output ripple and noise
- Industry standard, DOSA compliant half-brick footprint 57.9mm x 61mm x 12.7mm (2.28” x 2.40” x 0.5”)
- Remote Sense
- 2:1 input voltage range
- Single tightly regulated output
- Constant switching frequency
- Constant Current Overcurrent Limit
- Auto-restart after a short circuit fault shutdown
- Over temperature protection auto restart
- Output voltage adjustment trim, 25.0V_{dc} to 55.0V_{dc}
- Wide operating case temperature range (-40°C to 100°C)
- CE mark meets 2006/95/EC directives§
- ANSI/UL* 62368-1 and CAN/CSA† C22.2 No. 62368-1 Recognized, DIN VDE‡ 0868-1/A11:2017 (EN62368- 1:2014/A11:2017)
- ISO** 9001 and ISO 14001 certified manufacturing facilities
- Compliant to IPC-9592A, Category 2, Class I .

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	80	V_{dc}
Transient, operational (≤100 ms)	All	$V_{IN,trans}$	-0.3	100	V_{dc}
Operating Ambient Temperature	All	T_A	-40	85	°C
Operating Case Temperature (See Thermal Considerations section, Figure 16)	All	T_C	-40	100	°C
Storage Temperature	All	T_{stg}	-55	125	°C
I/O Isolation Voltage (Current trip point = 5mA): Input to Case, Input to Output	All	—	—	2250	V_{dc}
Output to Case	All	—	—	750	V_{dc}

Electrical Specifications

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

Parameter	Device	Symbol	Min	Typ	Max	Unit
Operating Input Voltage (see Figure 12 for $V_{IN,MIN}$ when using trim-up feature)	All	V_{IN}	36	48	75	V_{dc}
Maximum Input Current (V_{IN}=36V to 75V, I_O=$I_{O,max}$)	All	$I_{IN,max}$			39.5	A_{dc}
Inrush Transient	All	I^2t			2	A^2s
Input Reflected Ripple Current, peak-to-peak (5Hz to 20MHz, 12µH source impedance; V_{IN}=0V to 75V, I_O= I_{Omax} ;see Figure 7)	All				1200	mA_{p-p}

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 an integrated part of complex power architecture. To preserve maximum flexibility, internal fusing is not included. Always use an input line fuse, to achieve maximum safety and system protection. The safety agencies require a time-delay or fast-acting fuse with a maximum rating of 65A in the ungrounded input connection (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	Device	Symbol	Min	Typ	Max	Unit
Output Voltage Set-point (V_{IN}=$V_{IN,nom}$, I_O=$I_{O,max}$, T_C =25°C)	w/o -P -P option	$V_{O,set}$	49	50	52	V_{dc}
Output Voltage Total Tolerance (Over all operating input voltage, resistive load, and temperature conditions until end of life)	w/o -P -P option	V_O	49	—	52	V_{dc}
Output Regulation						
Line (V_{IN}=$V_{IN,min}$ to $V_{IN,max}$)	w/o -P – P option		— —	0.4 0.4	— —	%$V_{o,set}$ %$V_{o,set}$
Load (I_O=$I_{O,min}$ to $I_{O,max}$)	w/o -P -P option	V_O	— —	0.4 2.2	1 —	%$V_{o,set}$ %$V_{o,set}$
Temperature (T_C = -40°C to +100°C)	All		—	2.2	—	%$V_{o,set}$
Output Ripple and Noise on nominal output (V_{IN}=$V_{IN,nom}$ and I_O=$I_{O,min}$ to $I_{O,max}$) RMS (5Hz to 20MHz bandwidth) Peak-to-Peak (5Hz to 20MHz bandwidth)	 All All	 V_O	 — —	 46 80	 345 500	 mV_{rms} mV_{pk-pk}
External Capacitance (ESR > 2.5 mΩ)[1]	All	C_O	680		3300	µF
Output Power (V_O=50V to 55v)	All	$P_{O,max}$	—		1300	W
Output Current	All	Io	0		26	A_{dc}
Output Current Limit Inception (Constant current until V_O<$V_{trim,MIN}$,duration <4s)	All	$I_{O,lim}$	28	—	35	A_{dc}
Output Short Circuit Current (V_O≤ 0.25V_{dc})	All	$I_{O,sc}$			30	A_{rms}
Efficiency V_{IN}=$V_{IN,nom}$, T_C=25°C I_O=$I_{O,max}$, V_O= $V_{O,set}$	All	η	—	97	—	%
Switching Frequency		f_{sw}	—	120	—	kHz
Dynamic Lo Response ($\Delta I_O/\Delta t$=1A/10µs; V_{IN}=$V_{IN,nom}$; T_C=25°C; Tested with a 1600 µF aluminum caps and a 10 µF ceramic capacitor across the load.) Load Change from I_O= 50% to 75% of $I_{O,max}$: Peak Deviation Settling Time (V_O<10% peak deviation) Load Change from I_O= 25% to 50% of $I_{O,max}$: Peak Deviation Settling Time (V_O<10% peak deviation)	 All	 V_{pk} T_S V_{pk} T_S	 — — — —	 2 1.5 2 1.5	 3 — 3 —	 %$V_{O,set}$ ms %$V_{O,set}$ ms
Current sharing Accuracy (Difference in average output current across paralleled modules) at 50V output		I_{diff}	-10		+10	%

[1] 680µF/100V. If the ambient temperature is less than -20°C, use more than 3 of recommended minimum capacitors.

Isolation Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Isolation Capacitance	C_{iso}	—	15	—	nF
Isolation Resistance	R_{iso}	10	—	—	MΩ

General Specifications

Parameter	Device	Symbol	Min	Typ	Max	Unit
Case 3 (I_O=80%$I_{O,max}$, T_A=40°C, airflow = 200 lfm, 90% confidence)	All	MTBF		TBD		Hours
Weight	All		TBD	TBD	TBD	goz

Feature Specifications

Unless otherwise indicated, specifications apply over all operating input voltage, resistive load, and temperature 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	All	$I_{on/off}$	—	—	1.0	mA
Logic Low - On/Off Voltage	All	$V_{on/off}$	0	—	0.8	V_{dc}
Logic High Voltage – (Typ = Open Collector)	All	$V_{on/off}$	—		5	V_{dc}
Logic High maximum allowable leakage current	All	$I_{on/off}$	—	—	50	µA
Turn-On Delay and Rise Times (V_{IN}=$V_{IN,nom}$, I_O=$I_{O,max}$, 25°C)						
Case 1: T_{delay} = Time until V_O = 10% of $V_{O,set}$ from application of V_{IN} with Remote On/Off set to ON	All	T_{delay}		310		ms
Case 2: T_{delay} = Time until V_O = 10% of $V_{O,set}$ from application of Remote On/Off from Off to On with V_{IN} already applied for atleast one second.	All	T_{delay}	—	305		ms
Trise = time for V_O to rise from 10% of $V_{O,set}$ to 90% of $V_{O,set}$.	All,	T_{rise}	—	100	—	ms
Output Voltage Overshoot (I_O=80% of $I_{O,max}$, T_A=25°C)					3	% $V_{O,set}$
Output Voltage Adjustment (See Feature Descriptions):						
Output Voltage Remote-sense Range (only for No Trim or Trim down application)	All	V_{sense}	—	—	2	%$V_{O,nom}$
Output Voltage Set-point Adjustment Range (trim)	All	V_{trim}	25	—	55	V_{dc}
Output Overvoltage Protection	All	$V_{O,limit}$	—	59	—	V_{dc}
Over Temperature Protection (See Feature Descriptions, Figure 17)	All	T_{ref}	—	110	—	°C
Input Under Voltage Lockout						
Turn-on Threshold	All	$V_{IN,UVLO}$		35	36	V_{dc}
Turn-off Threshold	All		31	32		V_{dc}
Hysteresis	All			3		V_{dc}
Input Over voltage Lockout						
Turn-on Threshold	All	$V_{IN,OVLO}$	—	79.5	81	V_{dc}
Turn-off Threshold	All		81	83	—	V_{dc}
Hysteresis	All		—	3	—	V_{dc}
Measurement System Characteristics						
Output current reading accuracy at Vin=48V -40°C ≤ TA < 85°C	6A< IO <26A	IOUT(ACC)		±10		%
VOUT reading accuracy		VOUT(ACC)		±2		%
VIN reading accuracy		VIN(ACC)		±5		%
Temperature reading accuracy		T(ACC)		±5		°C

Characteristic Curves

The following figures provide typical characteristics for the JRCW1300U at 25°C. The figures are identical for either positive or negative Remote On/Off logic.

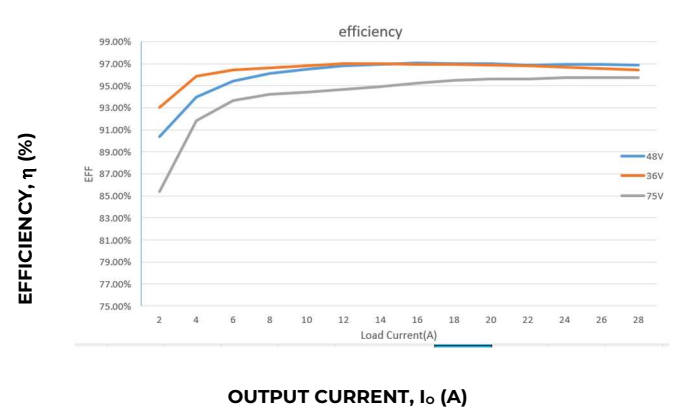


Figure 1. Converter Efficiency versus Output Current.

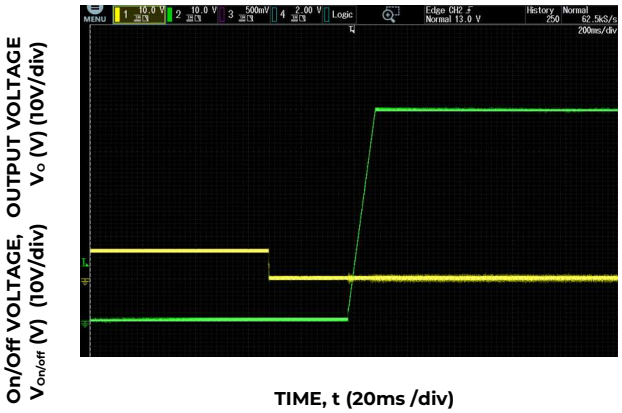


Figure 4. Typical Start-Up Using negative Remote On/Off, C_{oext}= 1650µf.

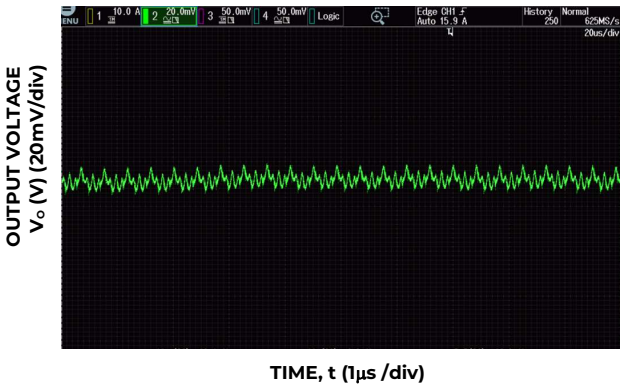


Figure 2. Typical output ripple and Noise at Room Temperature and 48V_{IN}; I_o = $I_{o,max}$; $C_{o,ext}$ = 740µF.

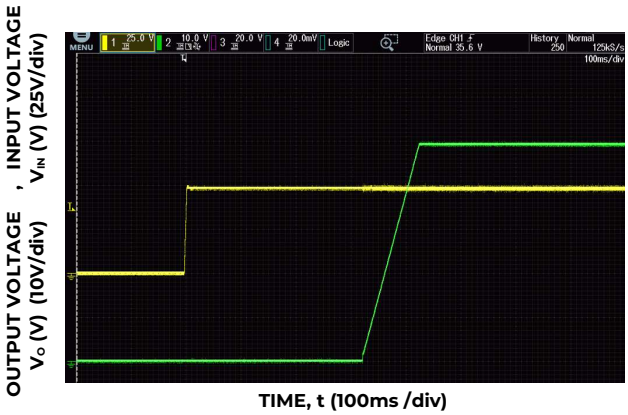


Figure 5. Typical Start-Up from V_{IN}, on/off enabled prior to V_{IN} step; $C_{o,ext}$ = 1650µf.

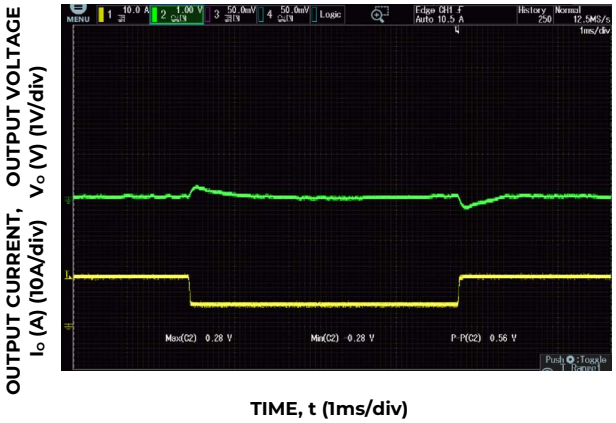


Figure 3. Dynamic Load Change Transient Response from 25% to 50% to 25% of Full Load at Room Temperature and 48 V_{IN}; 0.1A/uS, $C_{o,ext}$ = 1650µF.

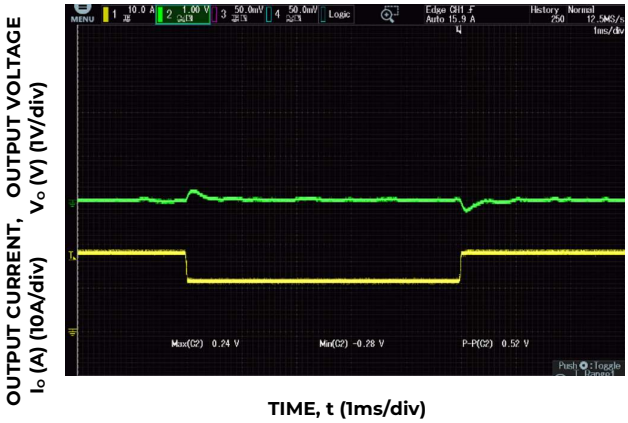


Figure 6. Dynamic Load Change Transient Response from 50 % to 75% to 50% of Full Load at Room Temperature and 48 V_{IN}; 0.1A/uS, $C_{o,ext}$ = 1650µF.

Test Considerations

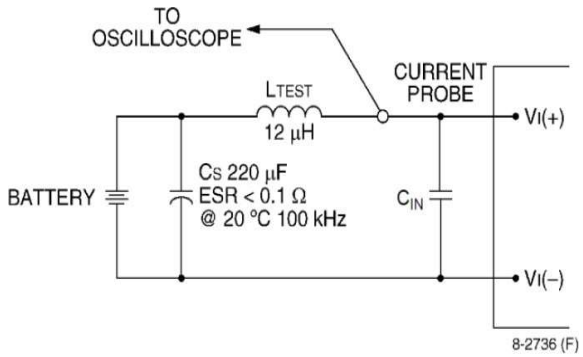


Figure 7. Input Reflected Ripple Current Test Setup.

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

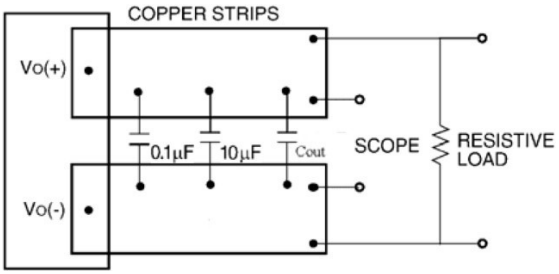


Figure 8. Output Ripple and Noise Test Setup

Note: Use a C_{out} (740 µF Low ESR aluminum or tantalum capacitor typical), a 0.1 µF ceramic capacitor and a 10 µF ceramic capacitor, and 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.

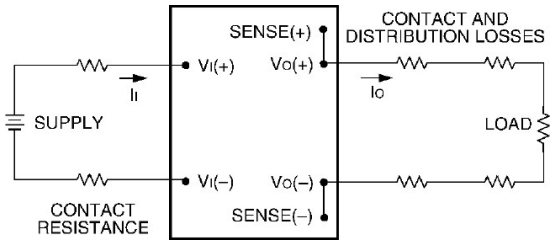


Figure 9. Output Voltage and Efficiency Test Setup.

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.

$$\eta = \left(\frac{[Vo(+) - Vo(-)]\, Io}{[Vi(+) - Vi(-)]\, Ii}\right) \times 100$$

Design Considerations

Input Source Impedance

The power module should be connected to a low ac-impedance source. A highly inductive source impedance can affect the stability of the power module. For the test configuration in Figure 7, a 680µF Low ESR aluminum capacitor, C_{IN} , mounted close to the power module helps ensure the stability of the unit. Consult the factory for further application guidelines.

Output Capacitance

The JRCW1300U power module requires a minimum output capacitance of 680µF Low ESR aluminum capacitor, C_{out} to ensure stable operation over the full range of load and line conditions, see Figure 8. If the ambient temperature is under - 20°C, it is required to use at least 3 pcs of minimum capacitors in parallel. In general, the process of determining the acceptable values of output capacitance and ESR is complex and is load-dependent.

Safety Considerations

For safety agency approval the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standards, i.e., UL ANSI/UL* 62368-1 and CAN/CSA C22.2 No. 62368-1 Recognized, DIN VDE 0868- 1/ A11:2017 (EN62368-1:2014/A11:2017)

For end products connected to -48V_{dc}, or -60V_{dc} 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/ES1. Output voltages will remain within SELV/ES1 limits even with internally generated non-SELV/ES1 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/ES1 limits. However, SELV/ES1 will not be maintained if V_I(+) and V_O(+) are grounded simultaneously.

Safety Considerations (continued)

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/ES1:

- 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/ES1 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.

All flammable materials used in the manufacturing of these modules are rated 94V-0, or tested to the UL60950 A.2 for reduced thickness.

The input to these units is to be provided with a maximum 25 A fast-acting or time-delay fuse in the ungrounded input connection.

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.

To turn the power module on and off, the user must supply a switch (open collector or equivalent) to control the voltage (Von/off) between the ON/OFF terminal and the V_{IN}(-) terminal (see Figure 10). Logic low is 0V ≤ Von/off ≤ 0.8V. The maximum Ion/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 typical maximum Von/off generated by the module is 5V, and the maximum allowable leakage current at Von/off = 5V is 50µA.

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}(-).

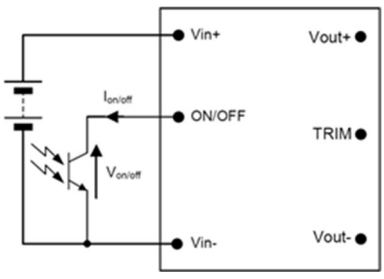


Figure 10. Circuit configuration for using Remote On/Off Implementation.

Overcurrent Protection

To provide protection in a fault output overload condition, the module is equipped with internal current limiting protection circuitry, and can endure continuous overcurrent by providing constant current output, for up to 4 seconds, as long as the output voltage is greater than VtrimMIN. If the load resistance is too low to support VtrimMIN in an overcurrent condition or a short circuit load condition exists, the module will shut down immediately.

A latching shutdown option is standard. Following shutdown, the module will remain off until the module is reset by either cycling the input power or by toggling the on/off pin for one second.

An auto-restart option (4) is also available in a case where an auto recovery is required. If overcurrent greater than 19A persists for few milli-seconds, the module will shut down and auto restart until the fault condition is corrected. If the output overload condition still exists when the module restarts, it will shut down again. This operation will continue indefinitely, until the overcurrent condition is corrected.

Over Voltage Protection

The output overvoltage protection consists of circuitry that monitors the voltage on the output terminals. If the voltage on the output terminals exceeds the over voltage protection threshold, then the module will shut down and latch off. The overvoltage latch is reset by either cycling the input power for one second or by toggling the on/off signal for one second. The protection mechanism is such that the unit can continue in this condition until the fault is cleared.

An auto-restart option (4) is also available in a case where an auto recovery is required.

Remote Sense

Remote sense minimizes the effects of distribution losses by regulating the voltage at the remote-sense connections (see Figure 11). For No Trim or Trim down application, 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(-)] ≤ 2% of Vo,nom

The voltage between the Vo(+) and Vo(-) terminals must not exceed the minimum output overvoltage shut-down value indicated in the Feature Specifications table. This limit includes any increase in voltage due to remote-sense compensation and output voltage set-point adjustment (trim). See Figure 11. 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.

Feature Description (continued)

Remote Sense (continued)

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.

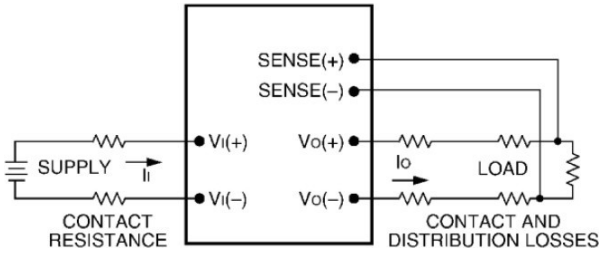


Figure 11. Effective Circuit Configuration for Single-Module Remote-Sense Operation Output Voltage.

Output Voltage Programming

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

Trim Down – Decrease Output Voltage

With an external resistor (Radj_down) between the TRIM and SENSE(-) pins, the output voltage set point (Vo,adj) decreases (see Figure 13). The following equation determines the required external-resistor value to obtain a percentage output voltage change of Δ%.

For output voltages: VO,nom = 50V

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

Where,

$$\Delta\% = \left| \frac{V_{o,nom} - V_{desired}}{V_{o,nom}} \right| x100$$

$V_{desired}$ = Desired output voltage set point (V).

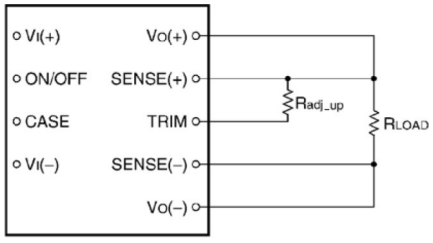


Figure 12. Circuit Configuration to Decrease Output Voltage

Trim Up – Increase Output Voltage

With an external resistor (Radj_up) connected between the SENSE(+) and TRIM pins, the output voltage set point (Vo,adj) increases (see Figure 14).

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

For output voltages: $V_{O,nom}$ = 50V

$$R_{adj\text{-}up} = \left[\frac{V_{o,nom} \times (100+\Delta\%)}{1.225 \times \Delta\%} - \frac{(100+(2 \times \Delta\%))}{\Delta\%} \right] K\Omega$$

Where,

$$\Delta\% = \left| \frac{V_{desired} - V_{o,nom}}{V_{o,nom}} \right| x100$$

$V_{desired}$ = Desired output voltage set point (V).

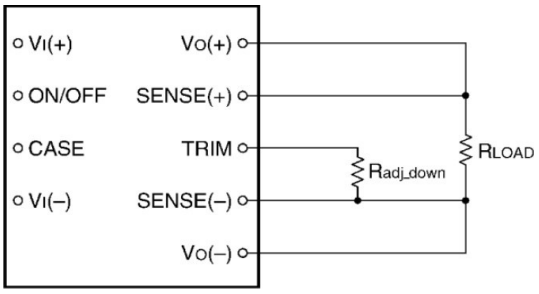


Figure 13. Circuit Configuration to Increase Output Voltage.

The voltage between the Vo(+) and Vo(-) terminals must not exceed the minimum output overvoltage shut-down value indicated in the Feature Specifications table. This limit includes any increase in voltage due to remote- sense compensation and output voltage set-point adjustment (trim). See Figure 11.

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 the same output current would increase the power output of the module.

Feature Description (continued)

Load sharing (paralleling)

For applications requiring higher power, these modules offer an optional parallel-operation feature (-P option code) using Droop Load Sharing (DLS). This feature provides a precise, forced output-voltage droop characteristic to achieve effective current sharing. The output-voltage set point and droop slope are factory-calibrated to ensure optimal matching of load-regulation behavior among multiple modules.

To implement load sharing, the following requirements must be met:

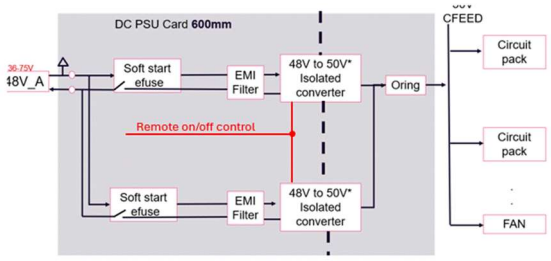
- All Vout(+) pins of all paralleled modules must be connected together.
- All Vout(–) pins of all paralleled modules must be connected together.
- The trace resistance from each module to the output power planes should be balanced to achieve proper current sharing and thermal balance.
- The input voltage (V_{IN}) must be between 52 V_{dc} and 60 V_{dc} for droop sharing to operate correctly.

It is permissible to use a common Remote On/Off signal to start all modules simultaneously. However, if spurious shutdowns occur during startup due to very low impedance between module outputs, the modules should instead be started sequentially, waiting at least the Turn-On Delay Time (Tdelay) + Rise Time before enabling the next module.

These modules include internal circuitry to block reverse-current flow at startup when bus voltage is already present from other paralleled modules. This eliminates the need for external output OR-ing devices.

Modules with the -P option may automatically extend the Turn-On Delay (Tdelay)—as specified in the Feature Specifications table—if output voltage is already present on the output bus during startup.

Here is an example of the most common scenario, paralleling two modules:[1]



[1]For the JRCW1300 module, the maximum power at startup is 1300W in parallel operation.

Power Good, PG (option)

The **JRCW1300U** module provides a Power Good (PG) option, which compares the module's output voltage to the module's POWER_GOOD_ON and POWER_GOOD_OFF values. The PG signal is implemented with an open-drain node, need be pulled up via a 10kΩ resistor to 3.3V outside. For Negative Logic PG (default), the PG signal is LO, when PG is asserted, and HI, when the PG is de-asserted.

PG is de-asserted if any condition such as overtemperature, overcurrent or loss of regulation occurs that would result in the output voltage going below the POWER_GOOD_OFF value.

If not using the Power Good feature, the pin may be left N/C.

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 case. Heat is removed by conduction, convection, and radiation to the surrounding environment. Proper cooling can be verified by measuring the case temperature. Peak temperature (TREF) occurs at the position indicated in Figure 14.

For reliable operation this temperature should not exceed 1000C at TREF for cold plate applications. 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 TREF temperature of the power modules is discussed above, you can limit this temperature to a lower value for extremely high reliability.

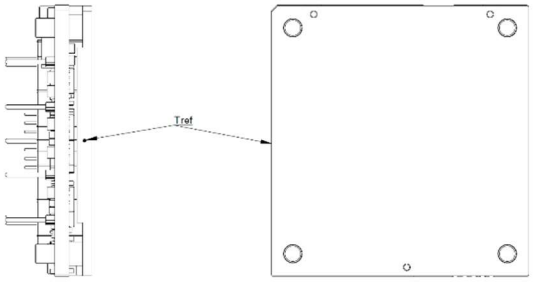


Figure 14. Application of thermos couple at side of base plate for (TREF1) Temperature Measurement Location

Thermal Derating

Thermal derating is presented in Figure 15, the JRCW1300U module is thermally coupled to a cold plate inside a sealed clamshell chassis, without any internal air circulation. The module is cooled entirely by conduction of heat from the module primarily through the top surface to a cold plate, with some conduction through the module's pins to the power layers in the system board.

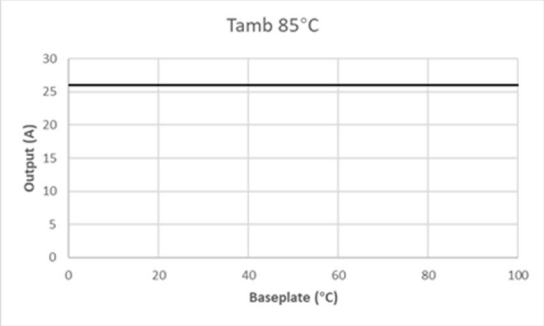


Figure 15. Output Power Derating for JRCW1300U in Conduction cooling (cold plate) applications;V_{IN} = $V_{IN,NOM}$

Digital Feature Descriptions

PMBus Interface Capability

The JRCW1300U series is equipped with a digital PMBus interface to allow the module to be configured and communicate with system controllers. Detailed timing and electrical characteristics of the PMBus can be found in the PMB Power Management Protocol Specification, Part 1, revision 1.2, available at http://pmbus.org. The JRCW1300U supports both the 100kHz and 400kHz bus timing requirements. The QBDS125A10R4 shall stretch the clock, as long as it does not exceed the maximum clock LO period of 35ms. The power module will check the Packet Error Checking scheme (PEC) byte, if provided by the PMBus master, and include a PEC byte in all responses to the master. However, the power module does not require a PEC byte from the PMBus master.

The power module supports a subset of the commands in the PMBus 1.2 specification. Most all of the controller parameters can be programmed using the PMBus and stored as defaults for later use. All commands that require data input or output use the linear format. The exponent of the data words is fixed at a reasonable value for the command and altering the exponent is not supported. Direct format data input or output is not supported by the power module. The supported commands are described in greater detail below.

The power module contains non-volatile memory that is used to store configuration settings and scale factors. The settings programmed into the device are not automatically saved into this non-volatile memory though. The STORE_DEFAULT_ALL command must be used to commit the current settings to non-volatile memory as device defaults. The settings that are capable of being stored in non-volatile memory are noted in their detailed descriptions.

SMBALERT Interface Capability

The power module also supports the SMBALERT response protocol. The SMBALERT response protocol is a mechanism through which the power module can alert the PMBus master that it has an active status or alarm condition via pulling the SMBALERT pin to an active low.

PmBus Addressing

The power module has flexible PMBUS addressing capability. By connecting different resistors from Addr1 pin to GND pin, 14 possible addresses can be acquired. The 7bit PMBUS address is defined by the value of the resistor as shown in the table below, and +/-1% resistor accuracy is acceptable. If there is any resistance exceeding the requested range, address 127 will be returned. The address in the table below is in decimal.

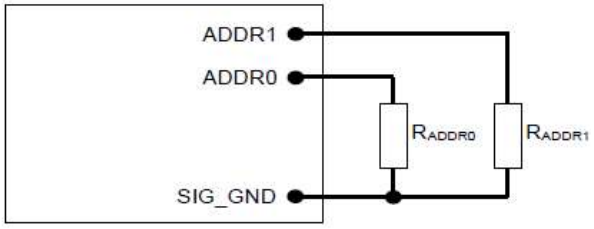


Figure 16. Circuit showing connection of resistors used to set the PMBus address of the module

PMBUS address (PA0 & PA1)	Resistors (Khom)
0	10
1	22
2	33
3	47
4	68
5	100
6	150
7	220

PMBus Address(decimal)=8 x PA0 + PA1

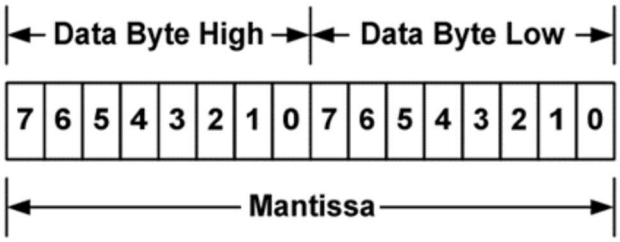
PM bus Address (decimal)=8 xPA0+PA1

The user must know which I^2C addresses are reserved in a system for special functions and set the address of the module to avoid interfering with other system operations. Both 100kHz and 400kHz bus speeds are supported by the module. Connection for the PMBus interface should follow the High Power DC specifications given in section 3.1.3 in the SMBus specification V2.0 for the 400kHz bus speed or the Low Power DC specifications in section 3.1.2. The complete SMBus specification is available from the SMBus web site, smbus.org.

Digital Feature Descriptions (continued)

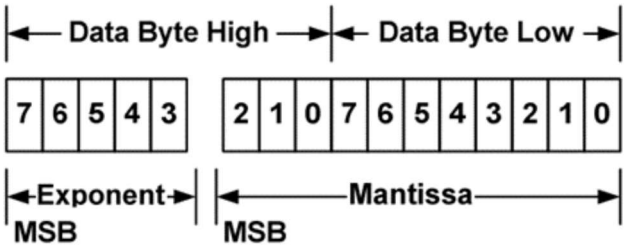
PMBus Data Formats

For commands that set or report any voltage thresholds related to output voltage (including VOUT_COMMAND, VOUT_MARGIN), the module supports the “VOUT linear” data format consisting of a two-byte value with a 16-bit, unsigned mantissa, and a fixed exponent of -10. The format of the two data bytes is shown below.



The value of the number is then given by
Value = Mantissa x 2^{-10}

For commands that set all other thresholds, voltages or report such quantities, the module supports the “linear” data format consisting of a two byte value with an 11-bit, two’s complement mantissa and a 5-bit, two’s complement exponent. The format of the two data bytes is shown below:



The value is of the number is then given by
Value = Mantissa x 2^{Exponent}
For both formats, the “low” byte is transmitted first according to the PMBus and SMBus specifications.

Write Protection

Write protection is enabled by default, to prevent accidentally changing settings. The MFR_DEVICE_TYPE (0xD0) command is used to disable or enable write protection as described below. To keep changes beyond the next removal of input voltage, the STORE_DEFAULT_ALL (0x11) command is used to save all settings to non-volatile memory.

PMBus Enabled On/Off

The module can also be turned on and off via the PMBus interface. The OPERATION command is used to actually turn the module on and off via the PMBus, while the ON_OFF_CONFIG command configures the combination of analog ON/OFF pin input and PMBus commands needed to turn the module on and off. Bit [7] in the OPERATION command data byte enables the module, with the following functions:

0 : Output is disabled

1 : Output is enabled

This module uses the lower five bits of the ON_OFF_CONFIG data byte to set various ON/OFF options as follows:

Bit Position	4	3	2	1	0
Access	r	r/w	r	r	r
Function	PU	CMD	CPR	POL	CPA
Default Value	1	1	1	1	1

PU: Factory set to 1. JRCW1300 requires On/Off(i) pin to be connected to proper input rail for module to power up. This bit is used together with the CMD, CPR and ON bits to determine startup.

Bit Value	Action
1	Module does not power up until commanded by the analog ON/OFF pin and the OPERATION command as programmed in bits [2:0] of the ON_OFF_CONFIG register.

CMD: The CMD bit controls how the device responds to the OPERATION command.

Bit Value	Action
0	Module ignores the ON bit in the OPERATION command
1	Module responds to the ON bit in the OPERATION command

CPR: Factory set to 1. JRCW1300 requires On/Off(i) pin to be connected to proper input rail for module to power up. This bit is used together with the CMD and ON bits to determine startup.

Bit Value	Action
1	Module requires the analog ON/OFF pin to be asserted to start the unit

PMBus Adjustable Input Undervoltage Lockout

The module allows adjustment of the input under voltage lockout and hysteresis. The command VIN_ON allows setting the input voltage turn on threshold, while the VIN_OFF command sets the input voltage turn off threshold. The VIN_ON and VIN_OFF commands, possible values range from 32.000to 36.00V for VIN_ON in 0.25V steps and VIN_OFF possible values range from 30.00to 32.00V

Both the VIN_ON and VIN_OFF commands use the "Linear" format with two data bytes. The upper five bits [7:3] of the high data byte form the two's complement representation of the exponent, which is fixed. The remaining 11 bits are used for two's complement representation of the mantissa, with the 11th bit fixed at zero since only positive numbers are valid. The data associated with VIN_ON and VIN_OFF can be stored to non-volatile memory using the STORE_DEFAULT_ALL command.

PMBus Adjustable Soft Start Delay and Rise Time

The soft start delay and rise time can be adjusted in the module via PMBus. The TON_DELAY command sets the delay time in ms, and allows choosing delay times between 0ms and 500ms, with resolution of 0.5ms. The TON_RISE command sets the rise time in ms, and allows choosing soft start times between 12ms and 300ms, with resolution of 0.5ms. When setting TON_RISE, make sure that the charging current for output capacitors can be delivered by the module in addition to any load current to avoid nuisance tripping of the overcurrent protection circuitry during startup. Both the TON_RISE and TON_DELAY commands use the "Linear" format with two data bytes. The upper five bits [7:3] of the high data byte form the two's complement representation of the exponent, which is fixed. The remaining 11 bits are used for two's complement representation of the mantissa, with the 11th bit fixed at zero since only positive numbers are valid. The data associated with TON_RISE and TON_DELAY can be stored to non-volatile memory using the STORE_DEFAULT_ALL command.

Output Voltage Adjustment Using the PMBus

The power module output voltage set point is adjusted using the VOUT_COMMAND. The output voltage setting uses the Linear data format, with the 16 bits of the VOUT_COMMAND formatted as an unsigned mantissa, and a fixed exponent of -10 (decimal) (read from VOUT_MODE).

$$VOUT = Mantissa \times 2^{-10}$$

The range limits for VOUT_COMMAND are 25V to 55V, and the resolution is 0.977mV.

The data associated with VOUT_COMMAND can be stored to non-volatile memory using the STORE_DEFAULT_ALL command.

Measuring Output Voltage Using the PMBus

The module can provide output voltage information using the READ_VOUT command. The command returns two bytes of data in the linear format, with the 16 bits of the READ_VOUT formatted as an unsigned mantissa, and a fixed exponent of -10 (decimal).

During module manufacture, an offset correction value is written into the non-volatile memory of the module to null errors in the tolerance and A/D conversion of VOUT. The command MFR_VOUT_READ_CAL_OFFSET can be used to read the offset - two bytes consisting of a signed 16-bit mantissa in two's complement format, using a fixed exponent of -12 (decimal). The resolution is 0.244mV. The corrected Output voltage reading is then given by:

Measuring Input Voltage Using the PMBus

The module can provide input voltage information using the READ_VIN command. The command returns two bytes of data in the linear format. The upper five bits [7:3] of the high data byte form the two's complement representation of the exponent, which is fixed. The remaining 11 bits are used for two's complement representation of the mantissa, with the 11th bit fixed at zero since only positive numbers are valid.

V_{IN}(Read)=

[V_{IN}*(A/D)*(MFR_VIN_READ_CAL_GAIN*_8192)]

+MFR_VIN_READ_CAL_OFFSET

Measuring Output Current Using the PMBus

The module measures output current by using the output filter inductor winding resistance as a current sense element. The module can provide output current information using the READ_IOUT command. The command returns two bytes of data in the linear format. The upper five bits [7:3] of the high data byte form the two's complement representation of the

exponent, which is fixed. The remaining 11 bits are used for two's complement representation of the mantissa, with the 11th bit fixed at zero since only positive numbers are valid. Output current readings are blanked below 1.65A

I_{OUT}(Read)=

[I_{OUT}*(A/D)*(MFR_IOUT_CAL_GAIN*/8192)]

+MFR_IOUT_CAL_OFFSET

Note: That the current reading provided by the module is corrected for temperature.

Digital Feature Descriptions (continued)

Measuring the Temperature using the PMBus

The module can provide temperature information using the READ_TEMPERATURE_1 command. The command returns two bytes of data in the linear format. The upper five bits [7:3] of the high data byte

form the two's complement representation of the exponent, which is fixed. The remaining 11 bits are used for two's complement representation of the mantissa.

Note: That the module's temperature sensor is located close to the module hot spot TH1 (see Thermal Considerations) and is subjected to temperatures higher than the ambient air temperature near the module. The temperature reading will be highly influenced by module load and airflow conditions

Reading the Status of the Module using the PMBus

The module supports a number of status information commands implemented in PMBus. However, not all features are supported in these commands. A X in the FLAG cell indicates the bit is not supported.

STATUS_WORD : Returns two bytes of information with a summary of the module's fault/warning conditions.

High Byte

Bit Position	Flag	Default Value
15	VOUT fault	0
14	IOUT fault or warning	0
13	Input Voltage fault	0
12	X	0
11	POWER_GOOD# (is negated)	0
10	X	0
9	X	0
8	X	0

Low Byte

Bit Position	Flag	Default Value
7	X	0
6	OFF	0
5	VOUT Overvoltage	0
4	IOUT Overcurrent	0
3	VIN Undervoltage	0
2	Temperature	0
1	CML (Comm. Memory Fault)	0
0	X	0

STATUS_VOUT: Returns one byte of information relating to the status of the module's output voltage related faults

Bit Position	Flag	Default Value
7	VOUT OV Fault	0
6	X	0
5	X	0
4	X	0
3	X	0
2	X	0
1	X	0
0	X	0

STATUS_IOUT : Returns one byte of information relating to the status of the module's output current related faults.

Bit Position	Flag	Default Value
7	IOUT OC Fault	0
6	X	0
5	IOUT OC Warning	0
4	X	0
3	X	0
2	X	0
1	X	0
0	X	0

STATUS_INPUT : Returns one byte of information relating to the status of the module's input voltage related faults

Bit Position	Flag	Default Value
7	VIN OV Fault	0
6	X	0
5	X	0
4	VIN UV Fault	0
3	Module Off (Low VIN)	0
2	X	0
1	X	0
0	X	0

Digital Feature Descriptions (continued)

STATUS_TEMPERATURE: Returns one byte of information relating to the status of the module's temperature related faults.

Bit Position	Flag	Default Value
7	OT Fault	0
6	OT Warning	0
5	X	0
4	X	0
3	X	0
2	X	0
1	X	0
0	X	0

STATUS_CML: Returns one byte of information relating to the status of the module's communication related faults.

Bit Position	Flag	Default Value
7	Invalid/Unsupported Command	0
6	Invalid/Unsupported Data	0
5	Packet Error Check Failed	0
4	X	0
3	X	0
2	X	0
1	X	0
0	X	0

Detailed Description of Supported PMBus Commands

This section outlines the PMBus command support for the JRCW1300 bus converters. Each supported command is outlined in order of increasing command codes with a quick reference table of all supported commands included at the end of the section.
Each command will have the following basic information.

Command Name [Code]

Definition
Data format
Factory default
Additional information may be provided if necessary.

OPERATION (0x01)

Command support: On/Off Immediate. Soft off with sequencing not supported and Margins (Ignore Fault) not supported. Therefore bits 6, 3, 2, 1 and 0 set as read only at factory defaults.

Format	8 bit unsigned (bit field)							
Bit Position	7	6	5	4	3	2	1	0
Access	r/w	r	r/w	r/w	r	r	r	r
Function	ON/OFF		Bits[5:4]		Bits[3:2]		N/A	
Default Value	1	0	0	0	0	0	0	0

ON_OFF_CONFIG (0x02)

Command support: Bit 1 polarity will be set based upon module code [0=Negative on/off logic, 1=positive on/off logic to allow customer system to know hardware on/off logic.

Format	8 bit unsigned (bit field)							
Bit Position	7	6	5	4	3	2	1	0
Access	r	r	r	r	r	r	r	r
Function	(reserved)			Bit 4 pu	Bit 3 cmd	Bit 2 cpr	Bit 1 pol	Bit 0 cpa
Default Value	0	0	0	1	1	1	module code	1

CLEAR_FAULTS (0x03)

Command support: All functionality

STORE_DEFAULT_ALL (0x11)

Command support: All functionality – Stores operating parameters to EEPROM memory.
Command requires ≤ 500ms to execute. Delay any additional commands to module for sufficient time to complete execution.

VOUT_MODE[0x20]

Command support: Supported. Factory default: 0x16 – indicates linear mode with exp = -10

Format	8 bit unsigned (bit field)							
Bit Position	7	6	5	4	3	2	1	0
Access	r	r	r	r	r	r	r	r
Function	Mode (linear)			2's complement exponent				
Default Value	0	0	0	1	0	1	1	0

Detailed Description of Supported PMBus Commands (continued)

VOUT_COMMAND [0x21]

Data format: 16 bit unsigned mantissa (implied exponent per VOUT_MODE)
Factory default: 50.00V (50.00/2-10 → 51,200 = 0xC800) [standard code]
Range limits (max/min): 55.00/25.00V
Units: volt
Command support: Read/write support, lockout per MFR_DEVICE_TYPE and disabled if register "VOUT_DROOP" is not zero

VIN_ON [0x35]

Range limits (max/min): 36/32V ,Default: 34V
Units: volt
Command support: All functionality
Note: Special interlock checks between VIN_ON and VIN_OFF maintain a hysteresis gap of 2V minimum and do not allow the OFF level to be higher than and ON level.

VIN_OFF [0x36]

Range limits (max/min): 32/30 , Default : 31.5V
Units: volt
Command support: All functionality
Note: Special interlock checks between VIN_ON and VIN_OFF maintain a hysteresis gap of 2V minimum and do not allow the OFF level to be higher than and ON level.

VOUT_OV_FAULT_LIMIT [0x40]

Range limits (max/min): 60/55 (Default : 58.5)
Units: volt
Command support: All functionality
Note:
1. Range cross- check – value must be greater than VOUT_COMMAND value.

VOUT_OV_FAULT_RESPONSE [0x41]

Command support: lockout per MFR_DEVICE_TYPE

- Response settings (bits RSP0:1) – only a setting of 10, unit shuts down and responds according to the retry settings below, is supported.
- Retry settings (bits RS0:2) – only settings of 000 (unit does not attempt to restart on fault) and 111 unit continuously restarts (normal startup) while fault is present until commanded off, bias power is removed or another fault condition causes the unit to shutdown.
- Delay time setting (bits 0-2) – only DT0:2 = 0 (no delay) supported.

Default Settings: The default settings for the VOUT_OV_FAULT_RESPONSE command are;

- The unit shuts down in response to a VOUT over voltage condition.
- The unit will continuously restart (normal startup) while the VOUT over voltage condition is present until it is commanded off, bias power is removed or another fault condition causes the unit to shut down.
- The shutdown delay is set to 0 delay cycles.

Format	8 bit unsigned (bit field)							
Bit Position	7	6	5	4	3	2	1	0
Access	r	r	r/w	r/w	r/w	r	r	r
Function	RSP[1]	RSP[0]	RS[2]	RS[1]	RS[0]	DT[2]	DT[1]	DT[0]
Default Value	1	0	1	1	1	0	0	0

IOUT_OC_FAULT_LIMIT [0x46]

Range limits (max/min): 34/28 , Default: 31A
Units: amp
Command support: All functionality, lockout per MFR_DEVICE_TYPE
Note: Range cross-check – value must be greater than IOUT_OC_WARN_LIMIT value.

OUT_OC_FAULT_RESPONSE [0x47]

Command support: lockout per MFR_DEVICE_TYPE

- Response settings (bits RSP0:1) – only settings of 11, unit shuts down and responds according to the retry settings below, is supported.
- Retry settings (bits RS0:2) – only settings of 000 (unit does not attempt to restart on fault) and 111 unit continuously restarts (normal startup) while fault is present until commanded off, bias power is removed or another fault condition causes the unit to shut down.
- Delay time setting (bits 0-2) – only DT0:2 = 0 (no delay) supported.

Default Settings: The default settings for the IOUT_OC_FAULT_RESPONSE command are;

- The unit shuts down in response to an IOUT over current condition.
- The unit will continuously restart (normal startup) while the IOUT over current condition is present until it is commanded off, bias power is removed, or another fault condition causes the unit to shut down.
- The shutdown delay is set to 0 delay cycles

Format	8 bit unsigned (bit field)							
Bit Position	7	6	5	4	3	2	1	0
Access	r	r	r/w	r/w	r/w	r	r	r
Function	RSP[1]	RSP[0]	RS[2]	RS[1]	RS[0]	DT[2]	DT[1]	DT[0]
Default Value	1	1	1	1	1	0	0	0

IOUT_OC_WARN_LIMIT [0x4A]

Range limits (max/min): 34/27 , Default: 28A
Units: amp
Command support: read/write support, functionality complete, lockout per MFR_DEVICE_TYPE
Note: Range cross-check – value must be less than IOUT_OC_FAULT_LIMIT value.

OT_FAULT_LIMIT [0x4F]

Range limits (max/min): 140/25, Default: 108°C
Units: degrees C
Command support: All functionality, lockout per MFR_DEVICE_TYPE
Note: Range cross-check – value must be greater than OT_WARN_LIMIT value.

OT_FAULT_RESPONSE [0x50]

Command support: lockout per MFR_DEVICE_TYPE

- Response settings (bits RSP0:1) – only setting of 10, unit shuts down and responds according to the retry settings below.
- Retry settings (bits RS0:2) – only settings of 000 (unit does not attempt to restart on fault) and 111 unit continuously restarts (normal startup) while fault is present until commanded off, bias power is removed or another fault condition causes the unit to shut down.
- Delay time setting (bits 0-2) – only DT0:2 = 0 (no delay) supported.

Default Settings: The default settings for the OT_FAULT_RESPONSE command are;

- The unit shuts down in response to an over-temperature condition.
- The unit will continuously restart (normal startup) while the over-temperature condition is present until it is commanded off, bias power is removed or another fault condition causes the unit to shut down.
- The shutdown delay is set to 0 delay cycles.

Format	8 bit unsigned (bit field)							
Bit Position	7	6	5	4	3	2	1	0
Access	r	r	r/w	r/w	r/w	r	r	r
Function	RSP[1]	RSP[0]	RS[2]	RS[1]	RS[0]	DT[2]	DT[1]	DT[0]
Default Value	1	0	1	1	1	0	0	0

OT_WARN_LIMIT [0x51]

Range limits (max/min): 140/25 , Default: 103C°
Units: degrees C
Command support: All functionality, lockout per MFR_DEVICE_TYPE
Note: Range cross-check – value must be less than OT_FAULT_LIMIT value.

VIN_OV_FAULT_LIMIT [0x55]

Range limits (max/min): 120/48, Default: 83V
Units: volt
Command support: All functionality, lockout per MFR_DEVICE_TYPE

TON_DELAY [0x60]

Range limits (max/min): 500/0, Default: 300ms
Units: milliseconds
Command support: full support, lockout per MFR_DEVICE_TYPE

TON_RISE [0x61]

Range limits (max/min): 300/12 , Default: 100
Units: milliseconds
Command support: full support, lockout per MFR_DEVICE_TYPE

STATUS_WORD [0x79]

Command support: full implementation for supported functions (note: Fans, MFR_SPECIFIC, Unknown not supported)

Format	8 bit unsigned (bit field)							
Bit Position	15	14	13	12	11	10	9	8
Access	r	r	r	r	r	r	r	r
Function	VOUT	I/POUT	INPUT	MFR_SPEC1	#PWR_GOOD	FANS1	OTHER1	UNKNOWN1

Format	8 bit unsigned (bit field)							
Bit Position	7	6	5	4	3	2	1	0
Access	r	r	r	r	r	r	r	r
Function	BUSY1	OUTPUT _OFF	VOUT_OV _FAULT	IOUT_OC _FAULT	VIN_UV _FAULT	TEMP	CML	NONE OF ABOVE1

(1) Not supported

STATUS_IOUT [0x7B]

Command support: IOUT_OC_FAULT support, all bit reset supported

Format	8 bit unsigned (bit field)							
Bit Position	7	6	5	4	3	2	1	0
Access	r/ reset(1)	r/ reset	r/ reset	r/ reset	r/ reset	r/ reset	r/ reset	r/ reset
Function	IOUT_OC _FAULT	IOUT_OC _LV _FAULT1	IOUT_OC _WARN	IOUT_UC _FAULT1	Current Share Fault1	In Power Limiting Mode1	POUT_OP _FAULT1	POUT_OP _WARN1

(1) Not supported

STATUS_IOUT [0x7B]

Command support: IOUT_OC_FAULT support, all bit reset supported

Format	8 bit unsigned (bit field)							
Bit Position	7	6	5	4	3	2	1	0
Access	r/ reset(1)	r/ reset	r/ reset	r/ reset	r/ reset	r/ reset	r/ reset	r/ reset
Function	IOUT_OC _FAULT	IOUT_OC _LV _FAULT1	IOUT_OC _WARN	IOUT_UC _FAULT1	Current Share Fault1	In Power Limiting Mode1	POUT_OP _FAULT1	POUT_OP _WARN1

(1) Not supported

Detailed Description of Supported PMBus Commands (continued)

STATUS_TEMPERATURE [0x7D]

Command support: OT_WARN, OT_FAULT supported, all bit reset supported

Format	8 bit unsigned (bit field)							
Bit Position	7	6	5	4	3	2	1	0
Access	r/ reset(1)	r/ reset	r/ reset	r/ reset	r/ reset	r/ reset	r/ reset	r/ reset
Function	OT_ FAULT	OT_ WARN	UT_ WARN1	UT_ FAULT1	reserved	reserved	reserved	reserved

(1) Not supported

STATUS_CML [0x7E]

Command support: PEC_FAULT, INVALID_DATA, INVALID_CMD supported, all bit reset supported

Format	8 bit unsigned (bit field)							
Bit Position	7	6	5	4	3	2	1	0
Access	r/ reset(1)	r/ reset	r/ reset	r/ reset	r/ reset	r/ reset	r/ reset	r/ reset
Function	INVALID CMD	INVALID DATA	PEC FAILED	MEMORY FAULT1	PROC FAULT1	reserved	COM FAULT (other)1	Memory/ Logic fault (other)1

(1) Not supported

READ_VIN [0x88]

Command support: full support

READ_VOUT [0x8B]

Command support: full support

READ_IOUT [0x8C]

Command support: full support

READ_TEMPERATURE_1 [0x8D]

Command support: full support

PMBUS_REVISION [0x98]

Command support: full support

Format	8 bit unsigned (bit field)							
Bit Position	7	6	5	4	3	2	1	0
Access	r	r	r	r	r	r	r	r
Function	Part I Revision				Part II Revision			
Default Value	0	0	1	reserved	0	0	1	0

*See Table below:

PMBus Revision Data Byte Contents				
Bits [7:5]	**Part I Revision**	**Bit [4]**	**Bits [3:0]**	**Part II Revision**
000	1.0	Not used	0000	1.0
001	1.1	Not used	0001	1.1
010	1.2	Not used	0010	1.2

MFR_FW_REV [0xDB]

Range limits (max/min): 9999/0000
Units: N/A
Command support: full read support
Format: 4 hex characters: Major revision_H, Major revision_L, Minor revision_H, Minor revision_L
Example: 0x0022 indicates firmware revision 0.22.

MFR_PGOOD_POLARITY [0xE2]

Command support: lockout per MFR_DEVICE_TYPE, full support (bit 0) as follows:
Bit 0: 0 = Negative PGOOD logic (module PGOOD asserted when pin is LO, PGOOD de-asserted when pin is HI)
1 = Positive PGOOD logic (module PGOOD de-asserted when pin is LO, PGOOD asserted when pin is HI)

MFR_PGOOD_POLARITY

Format	8 bit unsigned (bit field)							
Bit Position	7	6	5	4	3	2	1	0
Access	r	r	r	r	r	r	r	r/w
Function	Reserved							Logic
Default Value	0	0	0	0	0	0	0	0

MFR_MODULE_DATE_LOC_SN [0xF0]

Command support: read/write support for 12 byte block, lockout per MFR_DEVICE_TYPE

PMBus Command Summary and Factory Default Values of Standard Configuration

Detailed Description of Supported PMBus Commands (continued)

PMBus Command Quick Reference Table

Pmbus cmd	Cmd code	Data bytes	Data format	Data units	Transfer type*	Default value
OPERATION	0x01	1	Bit field	N/A	R/W byte	0x80
ON_OFF_CONFIG	0x02	1	Bit field	N/A	Read byte	0x1D (Neg Logic) 0x1F (Pos Logic)
CLEAR_FAULTS	0x03	0	N/A	N/A	Send byte	none
STORE_DEFAULT_ALL	0x11	0	N/A	N/A	Send byte	none
RESTORE_DEFAULT_ALL	0x12	0	N/A	N/A	Send byte	none
VOUT_MODE	0x20	1	mode + exp	N/A	Read byte	0x16
VOUT_COMMAND	0x21	2	VOUT linear	Volts	R/W word	50V (Std code) 50.5v(PHZ)
VIN_ON	0x35	2	linear	V	R/W word	34 V
VIN_OFF	0x36	2	linear	V	R/W word	31.5 V
VOUT_OV_FAULT_LIMIT	0x40	2	VOUT linear	V	R/W word	58.5V
VOUT_OV_FAULT_RESPONSE	0x41	1	Bit field	N/A	R/W byte	0xB8
IOUT_OC_FAULT_LIMIT	0X46	2	Linear	Amps	R/W word	31A
IOUT_OC_FAULT_RESPONSE	0x47	1	Bit field	N/A	R/W byte	0xF8
IOUT_OC_WARN_LIMIT	0x4A	2	linear	Amps	R/W word	28A
OT_FAULT_LIMIT	0x4F	2	linear	Deg. C	R/W word	108C
OT_FAULT_RESPONSE	0x50	1	Bit field	N/A	R/W byte	0xB8
OT_WARN_LIMIT	0x51	2	linear	Deg. C	R/W word	103C
VIN_OV_FAULT_LIMIT	0x55	2	linear	V	R/W word	83V
VIN_OV_FAULT_RESPONSE	0x56	1	Bit field	N/A	R/W byte	0xC0
POWER_GOOD_ON	0x5E	2	VOUT linear	V	Read word	80%*Vout_setpoint
POWER_GOOD_OFF	0x5F	2	VOUT linear	V	Read word	60%*Vout_setpoint
TON_DELAY	0x60	2	linear	msec	R/W word	300ms
TON_RISE	0x61	2	linear	msec	R/W word	100ms (with and without –P)
STATUS_WORD	0x79	2	Bit field	N/A	Read word	N/A
STATUS_VOUT	0x7A	1	Bit field	N/A	Read byte	N/A
STATUS_IOUT	0x7B	1	Bit field	N/A	Read byte	N/A
STATUS_INPUT	0x7C	1	Bit field	N/A	Read byte	N/A
STATUS_TEMPERATURE	0x7D	1	Bit field	N/A	Read byte	N/A
STATUS_CML	0x7E	1	Bit field	N/A	Read byte	N/A
READ_VIN	0x88	2	linear	v	Read word	N/A
READ_VOUT	0x8B	2	VOUT linear	v	Read word	N/A
READ_IOUT	0x8C	2	linear	Amps	Read word	N/A
READ_TEMP1	0x8D	2	linear	Deg. C	Read word	N/A
PMBUS_REVISION	0x98	1	Bit Field	n/a	Read byte	1.2
MFR_DEVICE_TYPE	0xD0	2	Custom	N/A	R/W word	0x00E2
MFR_FW_REV	0xDB	2	16 bit unsigned	N/A	Read byte	Current version
MFR_PGOOD _POLARITY	0xE2	1	Bit field	N/A	R/W byte	0x00
MFR_MOD_DATE_LOC_SN	0xF0	12	8 bit char	N/A	R/W block	YYLLWW123456

Layout Considerations

The JRCW1300U power module series are constructed using a single PWB with integral base plate; as such, component clearance between the bottom of the power module and the mounting (Host) board is limited. Avoid placing copper areas on the outer layer directly underneath the power module.

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 OmniOn Power™ Board Mounted Power Modules: Soldering and Cleaning Application Note.

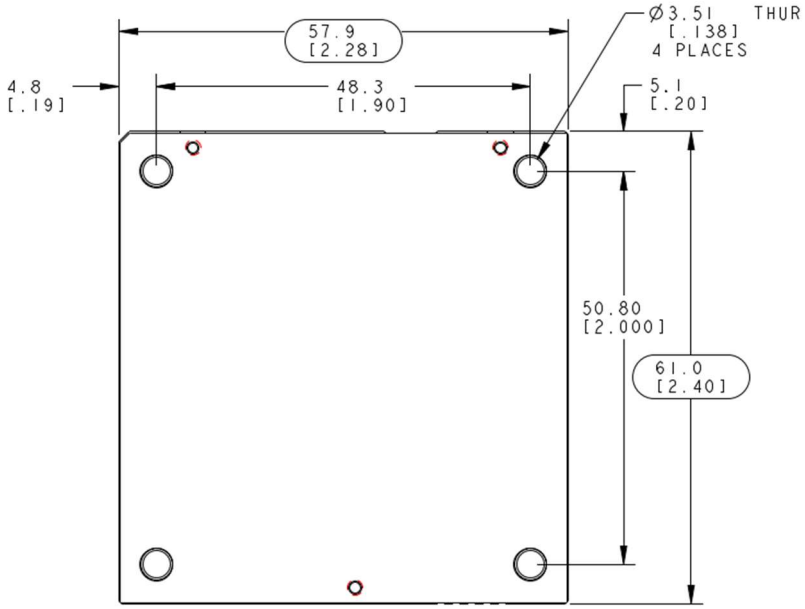
Through-Hole Lead-Free Soldering Information

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. The JRCW016A0R cannot be processed with paste-through-hole Pb or Pb-free reflow process. If additional information is needed, please consult with your OmniOn Power™ representative for more details.

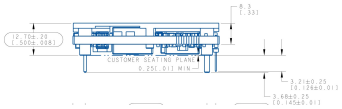
Mechanical Outline for Through-Hole Module

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 side label includes OmniOn name, product designation and date code.

Top View*

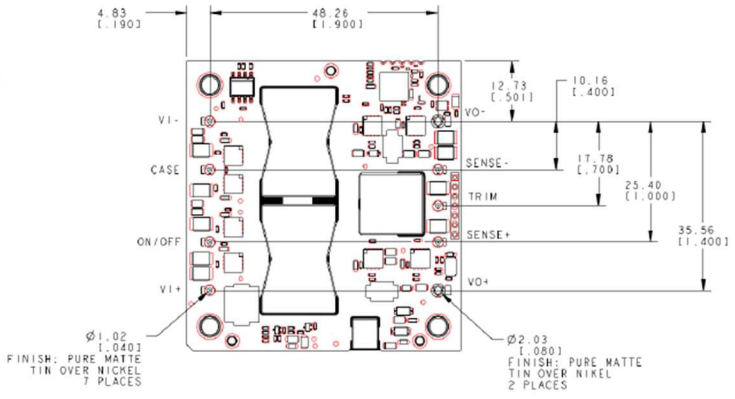


Side View**



Pin	Description
1	VIN(+)
2	ON/OFF
3	Baseplate
4	VIN(-)
5	Vout(-)
6	SENSE(-)
7	TRIM
8	SENSE(+)
9	Vout(+)

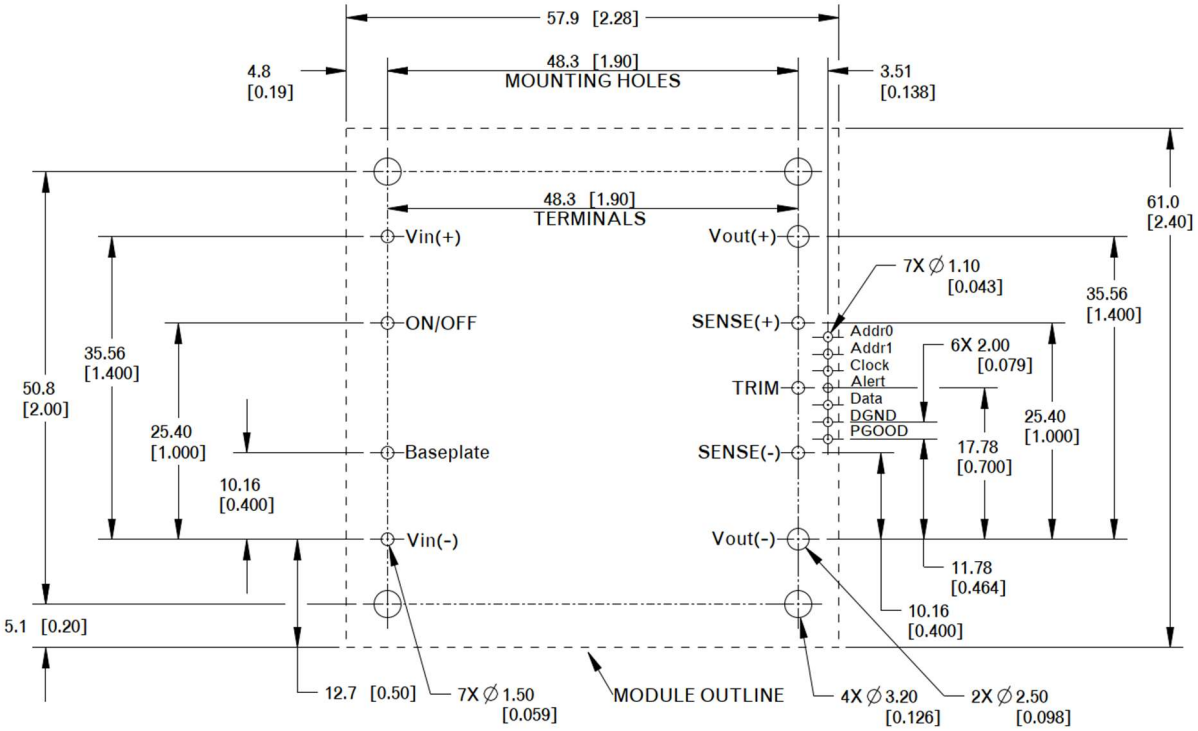
Bottom View



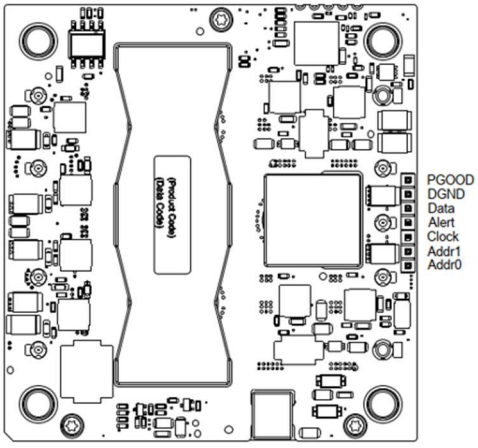
**For optional PIN lengths and unthreaded inserts, see table 3, device options.

Recommended Pad Layout for Through Hole Module

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.]



SIGNAL PIN DEFINATION



PIN	Description
1	VIN +
2	On/Off
3	NC
4	VIN -
5	Vout -
6	SENSE -
7	TRIM
8	SENSE +
9	Vout +
10	PGOOD
11	DGND
12	Data
13	Alert
14	Clock
15	Addr1
16	Addr0

Ordering Information

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

Input Voltage	Output Voltage	Output Current	Efficiency	Connector Type	Product codes	Ordering Codes
48V (36-75V_{dc})	50V	26A	- %	Through hole	JRCW1300U641Z	1600484815A
48V (36-75V_{dc})	50V	26A	- %	Through hole, I^2C	JRCW1300U641-PHZ	1600490315A

Table 2. Device Codes

	Characteristic	Character and position	Definition
Ratings	Form Factor	J	J = Half Brick
	Family Designator	RC	RC = Orca Family
	Input Voltage	W	W = Wide Range, 36V-75V
	Output Power	1300	1300 Watts Maximum Output Power
	Output Voltage	U	U = 50.0V 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
	Load Share	P	P= Forced Droop Output for use in parallel applications
			–
	Customer Specific	XY	XY = Customer Specific Modified Code, Omit for Standard Code
	Mechanical Features	18	Omit = M3 x 0.5 threaded heat sink insert standoffs, 4 places 18 = Unthreaded insert standoffs, 4 places
	Tunable Loop™	T	Internal Compensation network optimized for Tunable Loop™ applications
	RoHS	Z	Omit = RoHS 5/6 Lead Based Solder Used Z = RoHS Complaint

Table 3. Device Options

Contact Us

For more information, call us at
+1-877-546-3243 (US)
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Change History (excludes grammar and clarifications)

Revision	Date	Description of the change
1.0	3rd May 2025	Draft spec from JRCW450U
1.1	29th May 2025	Modified I/O isolation and output parameter levels
1.2	11th Aug 2025	Added eff and characteristic curves
1.3	12th Dec2025	Modified multiple parameter values
1.4	6th Feb 2026	Modified I/O cap details , relaxed output regulation
1.5	28th Feb 2026	Added load sharing through DLS
1.6	19th March 2026	Modified output regulation, I^2C details
1.7	7th April 2026	Updated as per OmniOn Power template
1.8	8th April 2026	Update I2C details
1.9	10th June 2026	Add “Measurement System Characteristics”, update “Tdelay” “Side View” Pin length

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