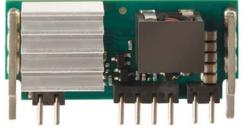


Adjustable Output 20-Amp SIP-mount DC-DC Converters



Typical unit

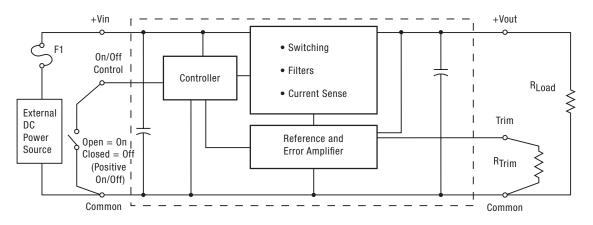
FEATURES

- 670 KHz operation
- 6.0-13.8 Vdc input voltage range
- Programmable output voltage from 0.591-5.0 VDC
- High power conversion efficiency at 94%
- Outstanding thermal derating performance
- Over temperature and over current protection
- On/Off control
- SIP, 1.45 x 0.44 x 0.61 inches (36.8 x 11.2 x 15.5 mm)
- Certified to UL/EN/IEC 60950-1 safety standards, 2nd edition (pending)
- RoHS-6 hazardous substance compliance
- Power Good



The OKR-T/20-W12-C is a miniature SIP non-isolated Point-of-Load (PoL) DC/DC power converter measuring only 1.45 x 0.44 x 0.61 inches (36.8 x 11.2 x 15.5 mm). The wide input range is 6.0 to 13.8 Volts DC. Based on 670 KHz synchronous buck topology, the high power conversion efficient Point of Load (PoL) module features programmable output voltage and On/Off control, under voltage lock out (UVLO), overcurrent and over temperature protections. These units meet all standard UL/EN/ IEC 60950-1 safety certifications (pending) and RoHS-6 hazardous substance compliance.

Figure 1. Connection Diagram







www.murata-ps.com/support

Adjustable Output 20-Amp SIP-mount DC-DC Converters

PERFORMANCE SPECIFICATIONS SUMMARY AND ORDERING GUIDE													
	Output						Input					Package	
		Іоит		R/N (mVp-p)	Regulation	on (Max.)			lin,	lın,	Efficie	ency	
Root Model	Vout (Volts)	(Amps max)	Power (Watts)	Max.	Line	Load	VIN Nom. (Volts)	Range (Volts)	no load (mA)	full load (Amps)	Min.	Тур.	Dimensions: inches (mm) L x W x H
OKR-T/20-W12-C	0.591-5	20	100	25	±0.3%	±0.5%	12	6.0-13.8	100	8.9	92%	94%	1.45 x 0.44 x 0.61 (36.8 x 11.2 x 15.5)

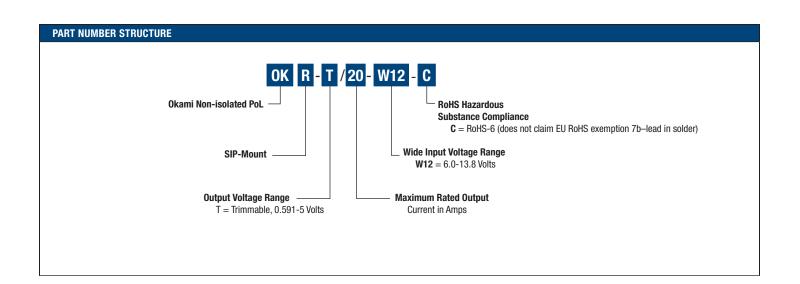
① Dimensions are in inches (mm).

② Ripple and Noise is shown at Vout=1.8V. See specs for details.

③ All specifications are at nominal line voltage, Vout= 5V and full load, +25 deg.C.

unless otherwise noted. Output capacitors are 3 22 μ F and 2 47 μ F ceramic. Input cap is 22 μ F. See detailed specifications. I/O caps are necessary for our test equipment and may not be needed for your application.

④ Vin must be 2V or higher than Vout for 3.3 to 5V outputs.



Adjustable Output 20-Amp SIP-mount DC-DC Converters

FUNCTIONAL SPECIFICATIONS

Dutput Power 102 W Dutput Current Current-limited, no damage, short-circuit protected 0 20 A Dn/Off Control short-circuit protected 0 20 A Dn/Off Control win - Zero (no power) -40 7 Vide Storage Temperature Range Win = Zero (no power) -40 125 °C Storage Temperature Range Guines and stress stratings. Exposure of devices to grate than any of these conditions may adversely affect long-term reliability. Proper operation under conditions of these listed in the Performance/Functional Specifications Table is not implied or recommended. NPU Diprating voltage range Fast blow 6.0 12 13.8 Vdc Recommended External Fuse Fast blow 4.2 4.4 4.6 Vde Indervoltage Shutdown C-Type 2.5 5.4 5.6 Vdc Indervoltage Shutdown Vin = nominal (SVset) 8.8 A A Low Line Vin = nominal (SVset) 8.8 A A Low Line Vin = nominal (SVset) 10 mA mA </th <th>ABSOLUTE MAXIMUM RATINGS</th> <th>Conditions</th> <th>Minimum</th> <th>Typical/Nominal</th> <th>Maximum</th> <th>Units</th>	ABSOLUTE MAXIMUM RATINGS	Conditions	Minimum	Typical/Nominal	Maximum	Units
Duput Current Curron-Limited, no damage, short-circuit protected 0 20 A DAVOIT Control Sware Good Pin short-circuit protected Vin Win Win Sware Good Pin Vin 2mo (in control symple control Vin 2mo (in control symple control Vin Vin Sware Food Pin Vin 2mo (in control symple control Vin 2mo (in control symple control Vin	Input Voltage, Continuous	Full power operation	6.0	12	13.8	Vdc
Jumper eshort-circuit protected 0 20 Au Number Power Good Pin 7 Vice Storage Temperature Range Vin = Zero (mp power) -40 125 °C Vissolute maximums are stress ratings. Exposure of devices to greater than any of these conditions may adversely affect long-term reliability. Proper operation under conditions in the list of timplet or recommended. 7 Vice Vissolute maximums are stress ratings. Exposure of devices to greater than any of these conditions may adversely affect long-term reliability. Proper operation under conditions in the reformance/stress ratings. Exposure of devices to greater than any of these conditions may adversely affect long-term reliability. Proper operation under conditions in the reformance/stress ratings. Exposure of the reformance/stress ratings. Exposure of devices to greater than any of these conditions are adversely affect long-term reliability. Proper operation under conditions in the reformance/stress ratings. Exposure of the reformance/stress ratings. Exposure o	Output Power				102	W
Driver Good Prime Vin Win Win Win Win Win Win Win Win Stress Stres <ths< td=""><td>Output Current</td><td>· - ·</td><td>0</td><td></td><td>20</td><td>A</td></ths<>	Output Current	· - ·	0		20	A
Drover Good Pin	On/Off Control				Vin	Vdc
Storage Emperature Bange Vin = Zero (in power) -40 125 °C. Storage Emperature Bange Vin = Zero (in power) -40 12 13.8 Vic Storage Emperature Bange 6.0 12 13.8 Vic Deparating voltage range 6.0 12 13.8 Vic Storage Environmed Vice Control Fuse Fast blow 40 A A Deparating voltage range 6.0 12 13.8 Vic Storage Environmed Vice Contral Fuse Fast blow 40 A A Deparating voltage range C-Type 42 4.4 4.6 Vic Internal Filter Type C-Type 41 A A A Device Vin @ mining (Vicet) 8.8 A A Invalue Translent Vin @ mining (Vicet) 8.8 A A Stort Circuit Input Current Vicet = 5V 100 mA A Stort Circuit Input Current Woot = 5V 100 mA A A <tr< td=""><td>Power Good Pin</td><td></td><td></td><td></td><td></td><td></td></tr<>	Power Good Pin					
Display maximums are series ratings. Exposure of devices to grater than any of these conditions may adversely affect long-torm reliability. Proper operation under conditions a transmented factmane like of the Performance/Functional Specifications Table is not implied or recommended. NPUT Performance/Functional Specifications Table is not implied or recommended. NPUT 6.0 12 13.8 Vdc. Operating voltage range East blow 6.0 12 40.0 A NPUT Hour on Start-rup With restold Rising input voltage 5.2 5.4 5.6 Vdc. Internal Filter Type C. Type 4.2 4.4 4.6 Vdc Internal Filter Type C. Type 8.8 A A Internal Filter Type 0.2 8.8 A A Not Continue Current Vin @ min, 5Vset 1 A A Not Continue Current Vout = SV NA mA mA Shot Grout renue Measured at input with specified filter Continue Contenet NA mA Performane Contenet Effectency 12Vin, 5Vout, 20A 92 94.2 94 <		Vin = Zero (no power)	-40			
Number Specifications Table is not implied or recommended. Number Apparating voltage range 6.0 12 13.8 Vdc. Specificational Fuse Fast blow 40 A furm 0x/Start-up threshold Rising input voltage 5.2 5.4 5.6 Vdc. furm 0x/Start-up threshold Rising input voltage 5.2 5.4 5.6 Vdc. part current Fast blow 4.2 4.4 4.6 Vdc. Full Lad Conditions Vin = moninal (5Vset) 8.8 A A Invush Transient Vin @ min, 5Vset 15 A A Short Girout Input Current NoA mA MA MA No Load Input Current Vout = 5V 100 mA, Pk- B Short-Down Mode Input Current Koot (500, 700, 200 92 94.2 % Stort-Down Mode Input Current Messured at Input with specified filter 10 mA, Pk- Stort-Down Mode Input Current Koot (500, 71, C5A, C22, 2 94.2 % Sately <td></td> <td></td> <td></td> <td>ffect long-term reliability</td> <td></td> <td></td>				ffect long-term reliability		
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Indervoltage Shutdown			52	5.4		
Internal Filter Type C-Type C-				-		
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Efficiency 12Vin, 5Vout, 2OA 92 94.2 % Safety Certified to UL-60950-1, CSA-C22.2, No.60950-1, EC/60950-1, 2nd edition (pending) Yes ////////////////////////////////////	Reflected (back) ripple current			10		mA, pk-p
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Calculated MTBFPer Mil-HDBK-217N2 Method10,772,399HoursVMAMIC CHARACTERISTICS670KHzStartup Time670KHzStartup Time(Jout 50% - 75% nom, within 2% of Vout set, di/dt = 1A/μSec)410mSDynamic Load Response(Jout 50% - 75% nom, within 2% of Vout set, di/dt = 1A/μSec)410mSDynamic Load Response(Jout 50% - 75% nom, within 2% of Vout set, di/dt = 1A/μSec)75μSecDynamic Load Peak Deviation150mVEarture Startup Time150mVEarture Logic, ON statePin pulled high1.25VControl Current, ON statePin open or pulled low00.7VControl Current, OF StateOpen collector/drain00mVPower Good OptionPG000, Open Drain Configuration, Sinking:-15-12.5-9.2%Vout window for PG00D: Lower limit-15-12.5-9.2%%Volt window for PG00D: Lower limit0100102WVoltage Vershoot-Startup0100102WVoltage Overshoot-StartupAt 50% load±1.5% of VnoOutput Voltage Overshoot-StartupOutput Voltage Overshoot-Startup5% of VnoOutput Voltage Overshoot-StartupOutput Voltage Overshoot-Startup5% of VnoOutput Voltage Overshoot-StartupOutput Voltage Overshoot-Startup5% of VnoOutput Voltage Overshoot-StartupOutput Voltage Overshoot-Startup5 <td>Calculated MTBF</td> <td>Per Telcordia SR332, issue 1 class 3, ground</td> <td></td> <td>8,724,722</td> <td></td> <td>Hours</td>	Calculated MTBF	Per Telcordia SR332, issue 1 class 3, ground		8,724,722		Hours
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	Current Limit Inception	98% of Vnom., after warmup	22	26	31	A

Adjustable Output 20-Amp SIP-mount DC-DC Converters

FUNCTIONAL SPECIFICATIONS (CONT.)

OUTPUT (CONT.)	Conditions	Minimum	Typical/Nominal	Maximum	Units
Short Circuit					
Short Circuit Current	Hiccup technique, autorecovery within ±1% of Vout		1		А
Short Circuit Duration (remove short for recovery)	Output shorted to ground, no damage				
Regulation					
Total Regulation Band		-3		3	% Vo set
Line Regulation	Vin = min to max, output @ nominal load			±0.3	%
Load Regulation	Min load to max load			±0.5	%
Ripple and Noise	1.8Vo, 12Vin		15	25	mV pk-pk
Temperature Coefficient			0.02		% of Vnom./°C
Maximum Capacitive Loading	Low ESR; > 1 mohm		1000		μF
	ESR > 15 mohm		5000		μF
MECHANICAL					
Outline Dimensions	L x W x H		1.45 x 0.44 x 0.61		Inches
			36.8 x 11.2 x 15.5		mm
Weight			0.29		Ounces
			8.2		Grams
ENVIRONMENTAL					
Operating Ambient Temperature Range	full power, all output voltages, see derating curves	0		70	°C
Storage Temperature	Vin = Zero (no power)	-40		125	°C
RoHS rating			RoHS-6		

Trim Connections

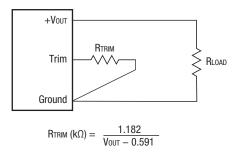
Output Voltage Adustment

The output voltage may be adjusted over a limited range by connecting an external trim resistor (Rtrim) between the Trim pin and Ground. The Rtrim resistor must be a 1/10 Watt precision metal film type, $\pm 0.5\%$ accuracy or better with low temperature coefficient, ± 100 ppm/oC. or better. Mount the resistor close to the converter with very short leads or use a surface mount trim resistor.

In the tables below, the calculated resistance is given. Do not exceed the specified limits of the output voltage or the converter's maximum power rating when applying these resistors. Also, avoid high noise at the Trim input. However, to prevent instability, you should never connect any capacitors to Trim.

OKR-T/20-W12-C

Output Voltage	Calculated Rtrim (Ω)
5 V.	268
3.3 V.	436
2.5 V.	619
1.8 V.	978
1.5 V.	1300
1.2 V.	1940
1.0 V.	2890
0.591 V.	∞ (open)

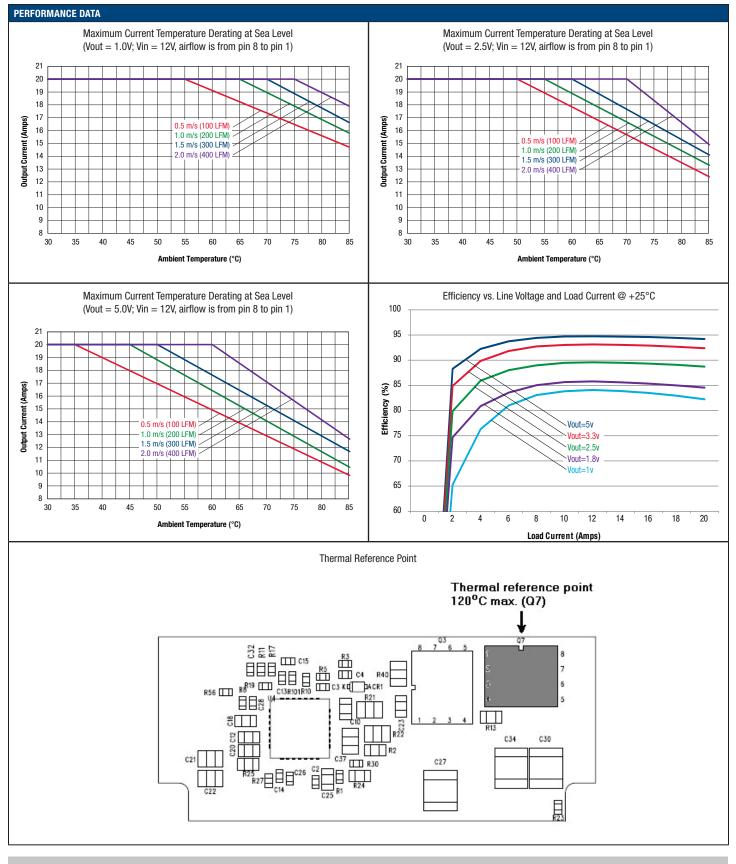


Resistor Trim Equation, OKR-T/20-W12-C models:

RTRIM (k Ω) = $\frac{1.182}{(V_{OUT} - 0.591)}$



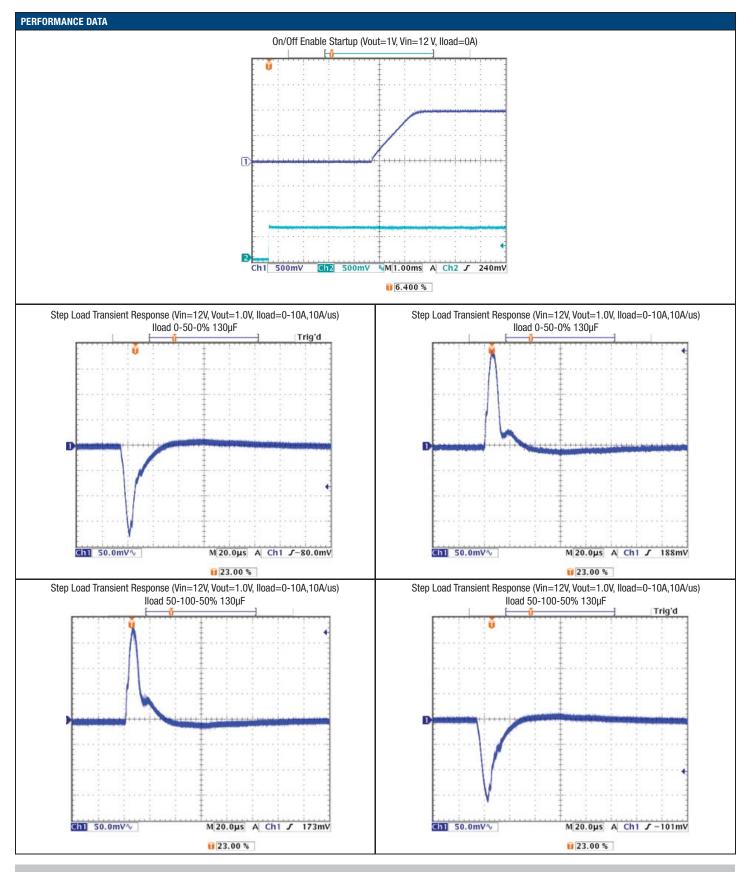
Adjustable Output 20-Amp SIP-mount DC-DC Converters



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Mkami OKR-T/20-W12-C

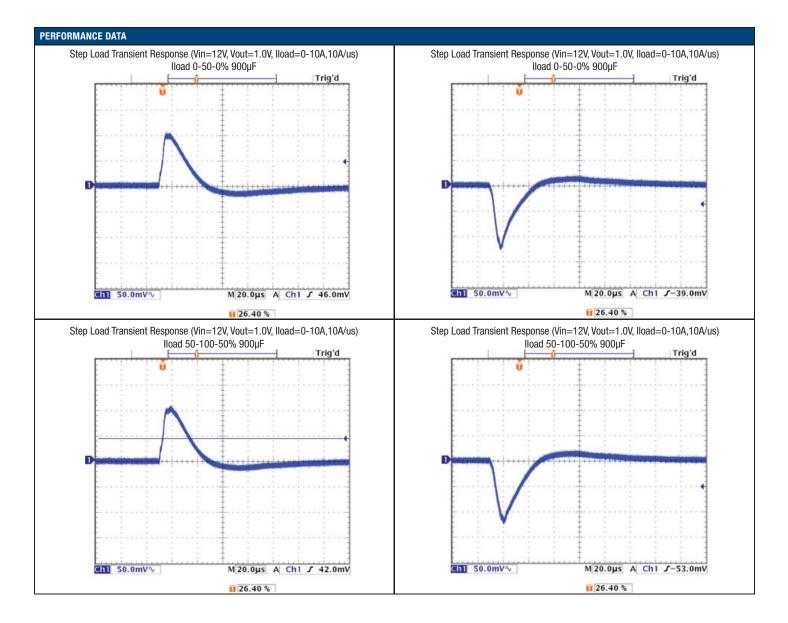
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Adjustable Output 20-Amp SIP-mount DC-DC Converters



Mkami OKR-T/20-W12-C

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TECHNICAL NOTES

Input Fusing

Certain applications and/or safety agencies may require fuses at the inputs of power conversion components. Fuses should also be used when there is the possibility of sustained input voltage reversal which is not current-limited. For greatest safely, we recommend a fast blow fuse installed in the ungrounded input supply line.

The installer must observe all relevant safety standards and regulations. For safety agency approvals, install the converter in compliance with the end-user safety standard, i.e. IEC/EN/UL 60950-1.

Input Under-Voltage Shutdown and Start-Up Threshold

Under normal start-up conditions, converters will not begin to regulate properly until the ramping-up input voltage exceeds and remains at the Start-Up Threshold Voltage (see Specifications). Once operating, converters will not turn off until the input voltage drops below the Under-Voltage Shutdown Limit. Subsequent restart will not occur until the input voltage rises again above the Start-Up Threshold. This built-in hysteresis prevents any unstable on/off operation at a single input voltage.

Users should be aware however of input sources near the Under-Voltage Shutdown whose voltage decays as input current is consumed (such as capacitor inputs), the converter shuts off and then restarts as the external capacitor recharges. Such situations could oscillate. To prevent this, make sure the operating input voltage is well above the UV Shutdown voltage AT ALL TIMES.

Start-Up Time

Assuming that the output current is set at the rated maximum, the Vin to Vout Start-Up Time (see Specifications) is the time interval between the point when the ramping input voltage crosses the Start-Up Threshold and the fully loaded regulated output voltage enters and remains within its specified accuracy band. Actual measured times will vary with input source impedance, external input capacitance, input voltage slew rate and final value of the input voltage as it appears at the converter.

These converters include a soft start circuit to moderate the duty cycle of its PWM controller at power up, thereby limiting the input inrush current.

The On/Off Remote Control interval from On command to Vout regulated assumes that the converter already has its input voltage stabilized above the Start-Up Threshold before the On command. The interval is measured from the On command until the output enters and remains within its specified accuracy band. The specification assumes that the output is fully loaded at maximum rated current. Similar conditions apply to the On to Vout regulated specification such as external load capacitance and soft start circuitry.

Recommended Input Filtering

The user must assure that the input source has low AC impedance to provide dynamic stability and that the input supply has little or no inductive content, including long distributed wiring to a remote power supply. The converter will operate with no additional external capacitance if these conditions are met.

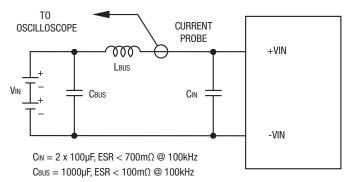
For best performance, we recommend installing a low-ESR capacitor immediately adjacent to the converter's input terminals. The capacitor should be a ceramic type such as the Murata GRM32 series or a polymer type. Initial suggested capacitor values are 10 to 22 μ F, rated at twice the expected maximum input voltage. Make sure that the input terminals do not go below the undervoltage shutdown voltage at all times. More input bulk capacitance may be added in parallel (either electrolytic or tantalum) if needed.

Recommended Output Filtering

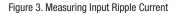
The minimum external output capacitance required for proper operation is 3 22μ F and 2 47μ F ceramic type. The maximum external output capacitance is 1500μ F. Operating outside of these minimum and maximum limits may affect the performance of the unit.

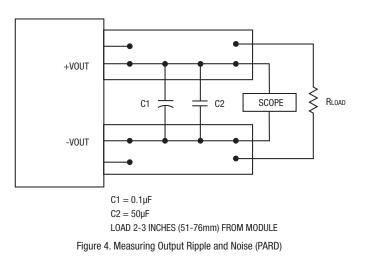
Input Ripple Current and Output Noise

All models in this converter series are tested and specified for input reflected ripple current and output noise using designated external input/output components, circuits and layout as shown in the figures below. In the figure below, the Cbus and Lbus components simulate a typical DC voltage bus. Please note that the values of Cin, Lbus and Cbus will vary according to the specific converter model.



 $LBUS = 1\mu H$





Minimum Output Loading Requirements

All models regulate within specification and are stable under no load to full load conditions. Operation under no load might however slightly increase output ripple and noise.

Mkami OKR-T/20-W12-C

Adjustable Output 20-Amp SIP-mount DC-DC Converters

Thermal Shutdown

To prevent many over temperature problems and damage, these converters include thermal shutdown circuitry. If environmental conditions cause the temperature of the DC/DC's to rise above the Operating Temperature Range up to the shutdown temperature, an on-board electronic temperature sensor will power down the unit. When the temperature decreases below the turn-on threshold, the converter will automatically restart. There is a small amount of hysteresis to prevent rapid on/off cycling. The temperature sensor is typically located adjacent to the switching controller, approximately in the center of the unit. See the Performance and Functional Specifications.

CAUTION: If you operate too close to the thermal limits, the converter may shut down suddenly without warning. Be sure to thoroughly test your application to avoid unplanned thermal shutdown.

Temperature Derating Curves

The graphs in this data sheet illustrate typical operation under a variety of conditions. The Derating curves show the maximum continuous ambient air temperature and decreasing maximum output current which is acceptable under increasing forced airflow measured in Linear Feet per Minute ("LFM"). Note that these are AVERAGE measurements. The converter will accept brief increases in current or reduced airflow as long as the average is not exceeded.

Note that the temperatures are of the ambient airflow, not the converter itself which is obviously running at higher temperature than the outside air. Also note that very low flow rates (below about 25 LFM) are similar to "natural convection," that is, not using fan-forced airflow.

Murata Power Solutions makes Characterization measurements in a closed cycle wind tunnel with calibrated airflow. We use both thermocouples and an infrared camera system to observe thermal performance.

<u>CAUTION</u>: If you routinely or accidentally exceed these Derating guidelines, the converter may have an unplanned Over Temperature shut down. Also, these graphs are all collected at slightly above Sea Level altitude. Be sure to reduce the derating for higher density altitude.

Output Current Limiting

Current limiting inception is defined as the point at which full power falls below the rated tolerance. See the Performance/Functional Specifications. Note particularly that the output current may briefly rise above its rated value in normal operation as long as the average output power is not exceeded. This enhances reliability and continued operation of your application. If the output current is too high, the converter will enter the short circuit condition.

Output Short Circuit Condition

When a converter is in current-limit mode, the output voltage will drop as the output current demand increases. If the output voltage drops too low (approximately 98% of nominal output voltage for most models), the magnetically coupled voltage used to develop primary side voltages will also drop, thereby shutting down the PWM controller. Following a time-out period, the PWM will restart, causing the output voltage to begin ramping up to its appropriate value. If the short-circuit condition persists, another shutdown cycle will initiate. This rapid on/off cycling is called "hiccup mode". The hiccup cycling reduces the average output current, thereby preventing excessive internal temperatures and/or component damage. A short circuit can be tolerated indefinitely.

The "hiccup" system differs from older latching short circuit systems because you do not have to power down the converter to make it restart. The system will automatically restore operation as soon as the short circuit condition is removed.

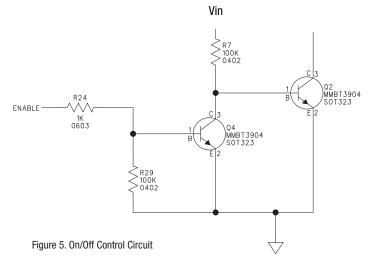
External Enable On/Off Control (see figure 5)

The forced On/Off enable option uses positive logic for the external control. The converter may be powered ON by applying a positive voltage (logic HI) between the On/Off pin and the negative power input (-Vin). This positive voltage is referred to –Vin and must be in the range of at least +2.0V and not to exceed the power supply input voltage (+Vin). The current drain is 12 mA max. when turned on.

If the On/Off pin is left open, an internal 100 Kilohm pulldown resistor will turn the converter OFF. The OFF condition may also be commanded by grounding the pin or from an external logic LO voltage not to exceed +0.4 Volts. All voltages are referred to the –Vin negative power input.

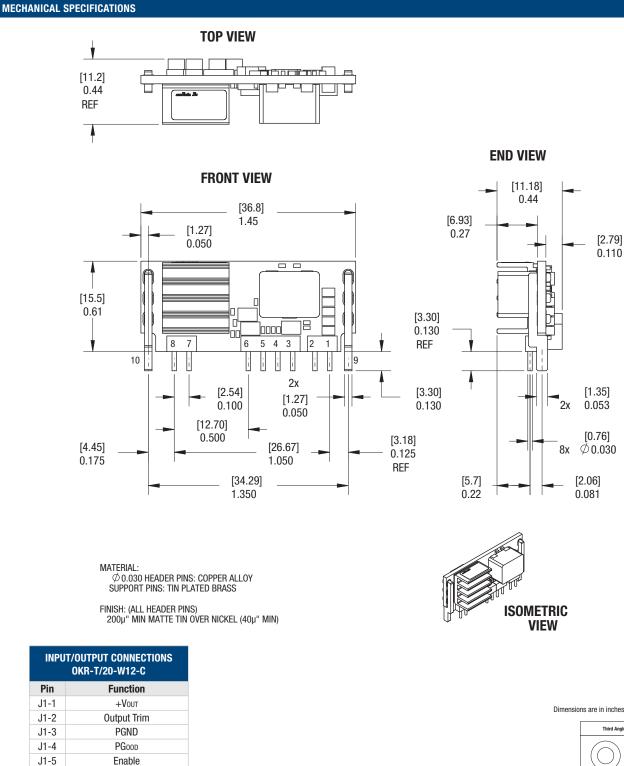
If you wish to control the On/Off circuit by external logic rather than a switch, carefully compare your logic threshold voltages with that of the On/Off input.

The circuit below indicates the equivalent input. Please avoid false signals from ground bounce errors on the On/Off control.





Adjustable Output 20-Amp SIP-mount DC-DC Converters



Dimensions are in inches (mm shown for ref. only).

Third Angle Projection

Tolerances (unless otherwise specified): .XX \pm 0.02 (0.5) .XXX \pm 0.010 (0.25) Angles \pm 2°

Components are shown for reference only.

+Vin

(+) Remote Sense

(-) Remote Sense

Mechanical Support

Mechanical Support

J1-6

J1-7

J1-8

J1-9

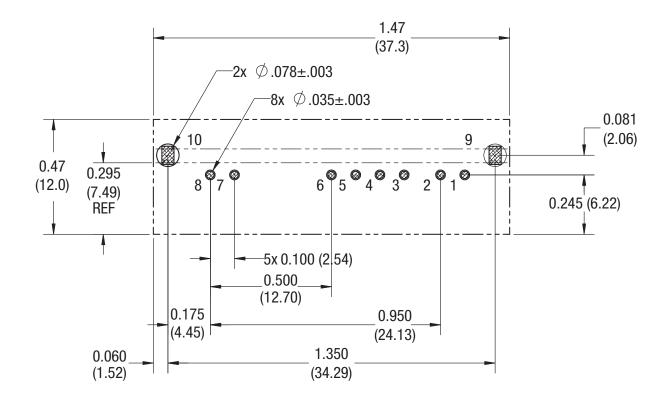
J1-10



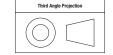
Adjustable Output 20-Amp SIP-mount DC-DC Converters

MECHANICAL SPECIFICATIONS

RECOMMENDED FOOTPRINT (VIEW FROM TOP)



Dimensions are in inches (mm shown for ref. only).

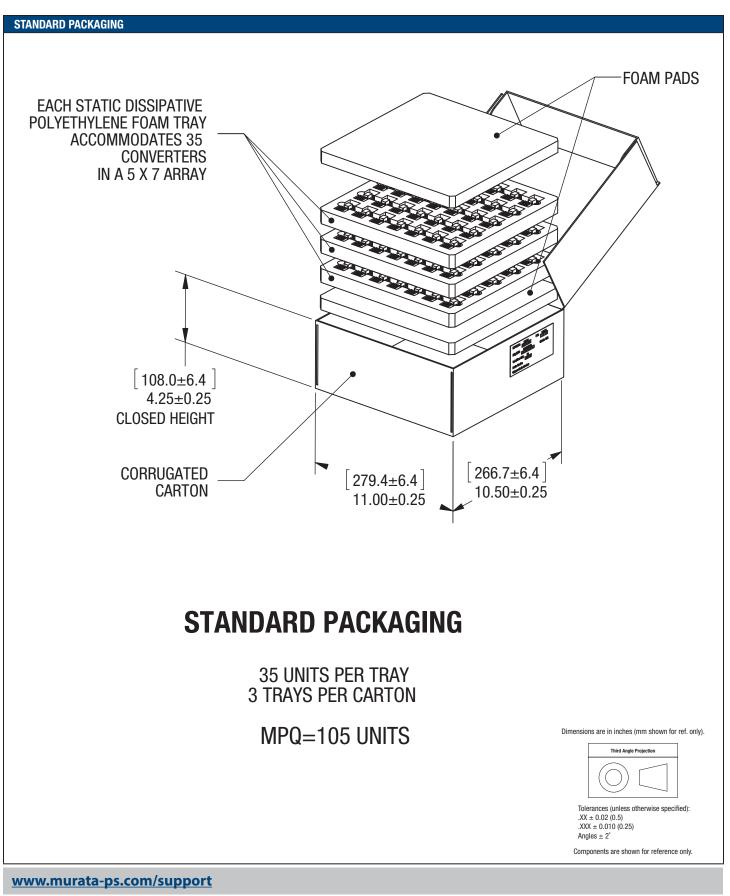


Tolerances (unless otherwise specified): .XX \pm 0.02 (0.5) .XXX \pm 0.010 (0.25) Angles \pm 2°

Components are shown for reference only.

Mkami OKR-T/20-W12-C

Adjustable Output 20-Amp SIP-mount DC-DC Converters



Mkami OKR-T/20-W12-C

Adjustable Output 20-Amp SIP-mount DC-DC Converters

Soldering Guidelines

Murata Power Solutions recommends the specifications below when installing these converters. These specifications vary depending on the solder type. Exceeding these specifications may cause damage to the product. Your production environment may differ; therefore please thoroughly review these guidelines with your process engineers.

Wave Solder Operations for through-hole mounted products (THMT)								
For Sn/Ag/Cu based solders: For Sn/Pb based solders:								
Maximum Preheat Temperature	115° C.	Maximum Preheat Temperature	105° C.					
Maximum Pot Temperature	270° C.	Maximum Pot Temperature	250° C.					
Maximum Solder Dwell Time	7 seconds	Maximum Solder Dwell Time	6 seconds					

Murata Power Solutions, Inc. 11 Cabot Boulevard, Mansfield, MA 02048-1151 U.S.A. ISO 9001 and 14001 REGISTERED



This product is subject to the following operating requirements and the Life and Safety Critical Application Sales Policy: Refer to: <u>http://www.murata-ps.com/requirements/</u>

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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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