

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



Typical unit

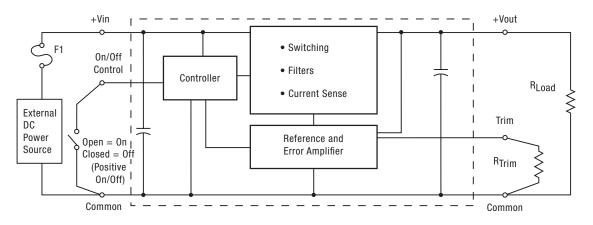
#### **FEATURES**

- 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







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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)

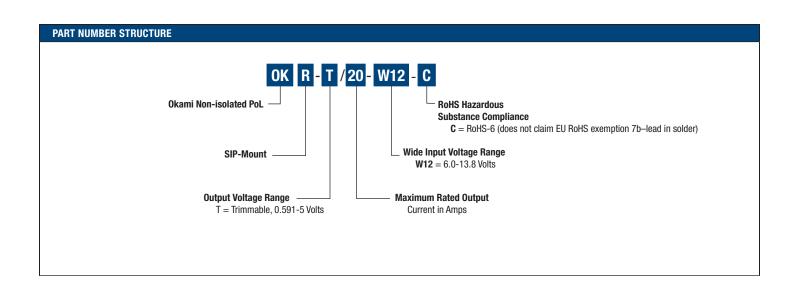
① Dimensions are in inches (mm).

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 $\mu$ F and 2 47 $\mu$ F ceramic. Input cap is 22  $\mu$ 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.



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#### **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		
NPUT         Image range         Fast blow         6.0         12         13.8         Vdc.           Becommended External Fuse         Fast blow         6.0         12         13.8         Vdc.           Bringin jingut voltage         5.2         5.4         5.6         Vdc.           Indervoltage Shutdown         4.2         4.4         4.6         Vdc.           Indervoltage Shutdown         6.7 Type         4.2         4.4         4.6         Vdc.           Indervoltage Shutdown         6.7 Type         8.8         A         A           Indervoltage Shutdown         1         A*Sec         A         A           Short Growth Input Current         Vot = 5V         100         mA         A           Short Growth Input Current         Vot = 5V         100         mA         A           Shut-Down Mode Input Current         Measured at input with specified filter Cin = 100µF, Clus = 100µF, Clus = 10µH         10         mA, Apk-t           EticEAL and SAFETY         10         mA, Apk-t         No.6 add Shut20wn Mode Shut20wn Gold Shut20wn G				noot long torm ronability.		
Operating voltage range         6.0         12         13.8         Vdc.           Seconomed of Extornal Fuse         Fast blow         40         A           Num On/Star-up Inveshold         Rising input voltage         5.2         5.4         5.6         Vdc.           Invenal Fitter Type         C-Type            Vdc.         Vdc.           methal Fitter Type         C-Type           A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td></td<>						
Becommended External Fuse         Fast blow			6.0	12	13.8	Vdc
Num On/Start-up threshold         Rising input voltage         5.2         5.4         5.6         Vdc.           Intervalage Shutddown         C-Type         0.         4.2         4.4         4.6         Vdc           Intervalage Shutddown         C-Type         0.         4.2         4.4         4.6         Vdc           Pull Load Conditions         Vin @ min, SVeet         1.5         A         A           Invalue         1.1         A-Sec         A         A           Short Circuit Input Current         Voit = 5V         100         mA           Shut-Down Mode Input Current         Voit = 5V         100         mA, PA           Shut-Down Mode Input Current         Measured at input with specified filter Cin = 100µF, Cbus = 10µH         10         mA, PA           Efficiency         12Vin, SVoit, 20A         92         94.2         %           Safety         Certified to UL-60961-15, CSA-C22         So         8,724,722         Hours           Safety         Certified to UL-60961-15, CSA-C22         8,724,722         Hours           Safety         Certified to UL-60961-15, CSA-C22         8,724,722         Hours           Safety         Certified To UL-60961-15, CSA-C22         8,724,722         Hours		Fast blow	0.0			
Indervoltage Shutdown			52	5.4		
Internal Filter Type C-Type C-				-		
Ippl Load Conditions         Vin = nominal (SVset)         8.8         A           Low Line         Vin = nominal (SVset)         15         A           Inrush Transient         1         A*Sec           Sont Gircuit Input Current         NA         mA           No Load Input Current         NA         mA           Sont Gircuit Input Current         Vout = 5V         100         mA           Sont-Gircuit Rupt Current         Measured at input with specified filter         NA         mA           Sont-Gircuit Rupt Current         Measured at input with specified filter         10         mA, pk-1           SthEFAL and SAFFY         10         mA, pk-1         SthEFAL and SAFFY         Total act and the provide filter         NA           Sthefat and SAFFY         100-fic Clus = 10/4         10         mA, pk-1           Sthefat and SAFFY         Total act act and the provide filter         Yes         Sthefat act act act act act act act act act a		C-Type	7.2	T.T		Vuc
Full Lad Conditions         Wn = nominal (Stept)         8.8         A           Low Line         Vin @ min, SVset         15         A           Inrush Transient         1         A^2-Sec           Short Circuit Input Current         NA         mA           No Load Input Current         NA         mA           No Load Input Current         Measured at input with specified filter Cin = 100µF, Cbus = 1000µF, Lbus = 1µH         10         mA, pk-1           Editected (back) ripple current         Measured at input with specified filter Cin = 100µF, Cbus = 1000µF, Lbus = 1µH         10         mA, pk-1           Editected (back) ripple current         Measured at input with specified filter Cin = 100µF, Cbus = 1000µF, Lbus = 1µH         10         mA, pk-1           Editected (back) ripple current         Measured at input with specified filter Cin = 100µF, Cbus = 1000µF, Cbus = 10µH         10         mA, pk-1           Edited MTBF         Per filter/difae bull-rospost-1, CA-C2.2         94.2         %           Saleulated MTBF         Per Teleordfa SR332, gue class 3, ground filter, Tambient = -25 C         8,724,722         Hours           Saleulated MTBF         Per Mil-IDBK-217N2 Method         10,772.399         Hours           YMAMLC EditAbar TERSTIDS         Filter = 1AµLSS         01,772.399         Hours           YMAMLC EditAbar TE		С-туре				
Low Line         Vin @ min, Syset         15         A           Inrush Transient         1         A*Sec           Sort Circuit input Current         NA         mA           No Load Input Gurrent         NA         mA           Shut-Down Mode Input Current         NA         mA           Shut-Down Mode Input Current         NA         mA           Atterbox Mode Input Current         Measured input Systef         NA         mA           Shut-Down Mode Input Current         Measured input Systef         NA         mA           Shut-Down Mode Input Current         Measured input Systef         NA         mA           Shut-Down Mode Input Current         Measured input Systef         NA         mA           Status         Certified to UL-60650-1, CSA-C22.2         No.60950-1, HCF06950-1, CSA-C22.2         Yes         %           Sateulated MTBF         Per Telcordia SS32, Issue 1 class 3, ground fixed, Tambinent = +25°C         8,724,722         Hours           Sateulated MTBF         Per Mil-HDBK-217N2 Method         10,772,399         Hours           Sateulated MTBF         Inculated SS32, Issue 1 class 3, ground fixed, Tambinent = +25°C         8,724,722         Hours           Sateulated MTBF         Per Mil-HDBK-217N2 Method         10,772,399         Hours     <		Vin - nominal (5Vcot)		0.0		٨
Inrush Transient         1         A*-Sec Not Carcuit Input Current           Short Circuit Input Current         NA         mA           No Load Input Current         Wassured at input with specified filter Cin = 100µF, Cbus = 100µF, Lbus = 1µH         NA         mA           Statt-Down Mode Input Current         Measured at input with specified filter Cin = 100µF, Cbus = 100µF, Lbus = 1µH         NA         mA, pk-i           Statt-Down Mode Input Current         Measured at input with specified filter Cin = 100µF, Cbus = 100µF, Lbus = 1µH         10         mA, pk-i           Statter         Statt-Dosgoon 1, CSA-C22.2         Na         Na         mA, pk-i           Statter         Certified to UL-60950-1, CSA-C22.2         Na         Na         mA           Statter         Per Telocordia SR323, Sisue 1 class 3, ground fixed, Tambient = +25°C         8,724,722         Hours           Startup Time         Per FileCordia SR32, Sisue 1 class 3, ground fixed, Tambient = +25°C         8,724,722         Hours           Startup Time         (lout 50% - 75% nom, within 2% of Vout set, di/dt = 1A/µSec)         75         µSec           Dynamic Load Response         (lout 50% - 75% nom, within 2% of Vout set, di/dt = 1A/µSec)         75         V           Dynamic Load Response         (lout 50% - 75% nom, within 2% of Vout set, di/dt = 1A/µSec)         150         mV		( )				
Short Circuit Input Current     NA     MA       No Load Input Current     Vout = 5V     100     mA       Shut-Down Mode Input Current     Measured at input with specified filter Cin = 100µF, Cluss = 100µF, Lbus = 10µH     10     mA, pk-1       Reflected (back) ripple current     Measured at input with specified filter Cin = 100µF, Cluss = 100µF, Cluss = 100µF, Cluss = 10µH     10     mA, pk-1       Reflected (back) ripple current     Certified to UL-60950-1, CSA-C22.2 No.60950-1, ICC /60950-1, CSA-C22.2 No.60950-1, ICC /60950-1, CSA -C22.2     92     94.2     %       Safety     Certified to UL-60950-1, CSA-C22.2 No.60950-1, EC /60950-1, CSA -C22.2     Rours     Yes     Hours       Saleulated MTBF     Per Telecordia SR332, issue 1 class 3, ground fixed, Tambient = 4-25°C     8,724,722     Hours       Saleulated MTBF     Per Mil-HDBK-217N2 Method     10,772,399     Hours       VAMMIC CHARAFETISTICS     Filter     Filter     Filter       Trade Switching Frequency     670     KHz     KHz       Sharub Time     4     10     mS       Opnamic Load Response     (Jout 50% - 75% norm, within 2% of Vout set, di/dt = 1A/µSec)     150     mV       Positive Logic, ON state     Pin pulled high     1.2     5     V       Positive Logic, ON state     Pin open or pulled low     0     6670     µA       Perotive Logi		VIII @ IIIII, JVSEL				
No Load Input Current         Vout = 5V         100         mA           Shut-Down Mode Input Current         Measured at input with specified filter Cin = 100µF, Cous = 1000µF, Lous = 1µH         10         mA, A           Selfected (back) ripple current         Measured at input with specified filter Cin = 100µF, Cous = 1000µF, Lous = 1µH         10         mA, A, A           Stite         12Vin, 5Vout, 20A         92         94.2         %           Safety         Oartified to UL-60950-1, CSA-C22.2, No.60950-1, IEC/60950-1, 2nd edition (pending)         Yes            Salculated MTBF         Per Teloridis RT32, issue 1 class 3, ground fixed, Jambient = +25°C         8,724,722         Hours           Salculated MTBF         Per Mil-HDBK-217N2 Method         10,772,399         Hours           Salculated MTBF         Oat Salculate 10         mA         mA           Opnamic Load Response         (Jout 50% -75% nom, within 2% of Vout set, di/dt = 1AµSec)         75         µSec           Opnamic Load Response         Oat Salculated MTB         150						
Shut-Down Mode Input Current         Massured at input with specified filter Cin = 100µF, Cous = 1000µF, Lous = 1µH         10         mA, pk-1           Selfected (back) ripple current         Measured at input with specified filter Cin = 100µF, Cous = 1000µF, Lous = 1µH         10         mA, pk-1           Selfet         Certified to UL-60950-1, CSA-C22.2 No.60950-1, IEC/60950-1, 2A dedition (gending)         92         94.2         %           Safety         Certified to UL-60950-1, CSA-C22.2 No.60950-1, IEC/60950-1, 2A dedition (gending)         Yes         Hours           Calculated MTBF         Per Telecordia SR332, issue 1 class 3, ground fixed, Tambient = +,25° C         8,724,722         Hours           Calculated MTBF         Per Mil-HDBK-217N2 Method         10,772,399         Hours           Startup Time         670         KHz           Oynamic Load Response         (lout 50% - 75% nom, within 2% of Vout set, di/dt = 1A/µSec)         75         µSec           Oynamic Load Response         (lout 50% - 75% nom, within 2% of Vout set, di/dt = 1A/µSec)         0.04         1.3         mA           Paramic Load Response         (lout 50% - 75% nom, within 2% of Vout set, di/dt = 1A/µSec)         0.04         1.3         MA           Paramic Load Response         (lout 50% - 75% nom, within 2% of Vout set, di/dt = 1A/µSec)         0.04         1.3         MA           Postite Logic,		Varia 51				_
Metered (back) ripple current         Measured at input with specified filter Cin = 100µF, Cbus = 1000µF, Lbus = 1µH         10         mA, pk-1           SENERAL and SAFETY         12Vin, 5Vout, 20A         92         94.2         %           Certified to UL-06950-1, CSA-C22.2         No.60950-1, ECA-C22.2         Yes         %           Safety         Octrified to UL-06950-1, CSA-C22.2         No.60950-1, ECA-C22.2         No.60950-1, ECA-C22.2         No.60950-1, ECA-C22.2         No.60950-1, ECA-C22.2         Hours           Calculated MTBF         Per Telcordia SR332, issue 1 class 3, ground fixed, Tambient = +25 °C         8,724,722         Hours           Calculated MTBF         Per Mil-HDBK-217N2 Method         10,772,399         Hours           YMAMIC CHARACTERISTICS         ************************************		vout = 5V				_
Vehiceted (dack) htppic current         Cin = 100µF, Cbus = 1000µF, Lbus = 1µH         10         IIIA, pk-1           SENERAL and SAFETY         12Vin, 5Vout, 20A         92         94.2         %           Safety         Certified to UL-60950-1, CSA-C22.2         Ves         %           Safety         No.60950-1, ICSA-C22.2         Ves         %           Safety         No.60950-1, ICSA-C22.2         Wes         %           Safety         No.60950-1, ICSA-C22.2         Hours         %           Safety         Per Telcordia SR332, Issue 1 class 3, ground fixed, Tambient = +25 C         8,724,722         Hours           Salculated MTBF         Per Mil-HDBK-217N2 Method         10,772,399         Hours           VAMID CARACTERISTICS         670         KHz           Starup Time         (fout 50% - 75% nom, within 2% of Vout set, di/dt = 1A/µSec)         75         µSec           Opnamic Load Response         (fout 50% - 75% nom, within 2% of Vout set, di/dt = 1A/µSec)         75         V           Starup Time         0         150         mV           ParkINES and OPTIONS         TS         V         V           Starup Time         0.04         1.3         mA           Option Coursel, ON state         Pin open or pulled low         0	Snut-Down Mode Input Current			NA		mA
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
Certified to UL-60950-1, CSA-622.2     Yes       Safety     No.60950-1, IEC/60950-1, 2nd edition (gending)     Yes       Calculated MTBF     Per Telordia SR322, Issue 1 class 3, ground fixed, Tambient = +25C     8,724,722       Calculated MTBF     Per Mil-HDBK-217N2 Method     10,772,399       Calculated MTBF     Image: Calculated MTBF     Per Mil-HDBK-217N2 Method       Startup Time     670     KHz       Startup Time     (lout 50% - 75% nom, within 2% of Vout set, di/dt = 1A/µSec)     75     µSec       Dynamic Load Response     (lout 50% - 75% nom, within 2% of Vout set, di/dt = 1A/µSec)     150     mV       Dynamic Load Peak Deviation     150     mV     To     To       Partite Logic, ON state     Pin pulled high     1.2     5     V       Control Current, OF state     Pin open or pulled low     0     0.7     V       Positive Logic, OF state     Open collector/drain     0     0     mV       Power God Option     Prover God Option     Prover God Option     Prover God Option     Prover God Op						
SafetyNo.60950-1, IEC/60950-1, 2nd edition (pending)YesCalculated MTBFPer Telocrofic RS32, issue 1 class 3, ground fixed, Tambient = +25°C8,724,722HoursCalculated MTBFPer Mil-HDBK-217N2 Method10,772,399HoursVNAMIC CHARACTERISTICS670KHzStartup Time670KHzStartup Time410mSOynamic Load Response(lout 50% - 75% nom, within 2% of Vout set, dl/dt = 1A/µSec)75µSecOynamic Load Peak Deviation150mVE-AURES and OPTIONS75NControl Current, ON statePin pulled high1.25VPositive Logic, OFF statePin open or pulled low00.77VControl Current, OF stateOpen collector/drain066µAPer Good OptionmAPositive Logic, OFF statePin open or pulled low00.77VControl Current, OF state010.010.2MPositive Logic, OFF statePin open or pulled low00.77VPotor Our Or PG00D: Upper limit+8.3+12.5+16.2%Vout window for PG00D: Upper limit-15-12.5-9.2%Vout window for PG00D: Upper limit-15-12.5%%Vout window for PG00D: Upper limit-15-12.5%%Vout window for PG00D: Upper limit-15-12.5%%Vout window for PG00D: Upper limit-15	Efficiency		92	94.2		%
Calculated MTBF         Per Telcordia SR332, issue 1 class 3, ground fixed, Tambient = +25°C         8,724,722         Hours           Calculated MTBF         Per Mil-HDBK-217N2 Method         10,772,399         Hours           DYNAMIC CHARACTERISTICS         670         KHz           Startup Time         670         KHz           Dynamic Load Response         (lout 50% - 75% nom, within 2% of Vout set, di/dt = 1A/µSec)         75         µSec           Dynamic Load Peak Deviation         150         mV           FEATURES and OPTIONS         75         V           Second OPTIONS         5         V           Control Current, ON state         Pin pulled high         1.2         5         V           Control Current, OFF state         Open collector/drain         0         0.7         V           PGODD, Open Drain Configuration, Sinking:         Vout window for PGODD: Lower limit         +8.3         +12.5         +16.2         %           Vout window for PGODD: Lower limit         -15         -12.5         -9.2         %         %           Vout Window for PGODD: Lower limit         0.591         5         Vdc         %         %         %           Vout Window for PGODD: Lower limit         0.591         5         %         % <t< td=""><td>Safety</td><td>No.60950-1, IEC/60950-1, 2nd edition</td><td></td><td>Yes</td><td></td><td></td></t<>	Safety	No.60950-1, IEC/60950-1, 2nd edition		Yes		
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DYNAMIC CHARACTERISTICS       KHz         Fixed Switching Frequency       670       KHz         Startup Time       4       10       mS         Dynamic Load Response       (lout 50% - 75% nom, within 2% of Vout set, di/dt = 1A/μSec)       75       μSec         Dynamic Load Peak Deviation       150       mV         Extruites and OPTIONS       75       V         Remote On/Off Control       5       V         Control Current, ON state       0.04       1.3       mA         Positive Logic, OFF state       Pin open or pulled low       0       0.7       V         Control Current, OFF state       open collector//drain       0       66       µA         Positive Logic, OFF state       open collector//drain       0       0       0.7       V         Control Current, OFF state       open collector//drain       0       mV       ower Good Option         PG00D, Open Drain Configuration, Sinking:       Vout window for PG00D: Lower limit       +8.3       +12.5       +16.2       %         Vout window for PG00D: Lower limit       -15       -12.5       -9.2       %         Vout window for PG00D: Lower limit       0       100       102       W         Moltage       See trim formula	Calculated MTBF			10.772.399		Hours
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Output Current Range         Continuous         0         20         A					5	% Vo se
		1			1	- r
Current Limit Inception         98% of Vnom., after warmup         22         26         31         A						
	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**

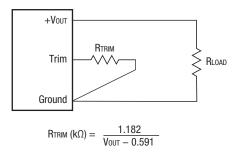
#### **Output Voltage Adustment**

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,  $\pm 100$  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 ( $\Omega$ )
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)

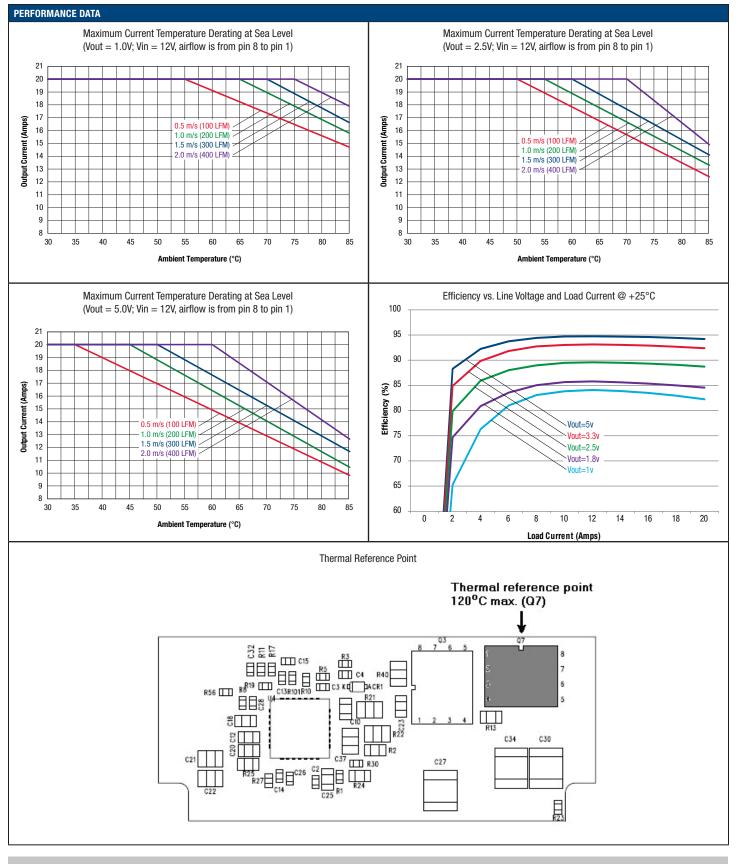


#### Resistor Trim Equation, OKR-T/20-W12-C models:

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



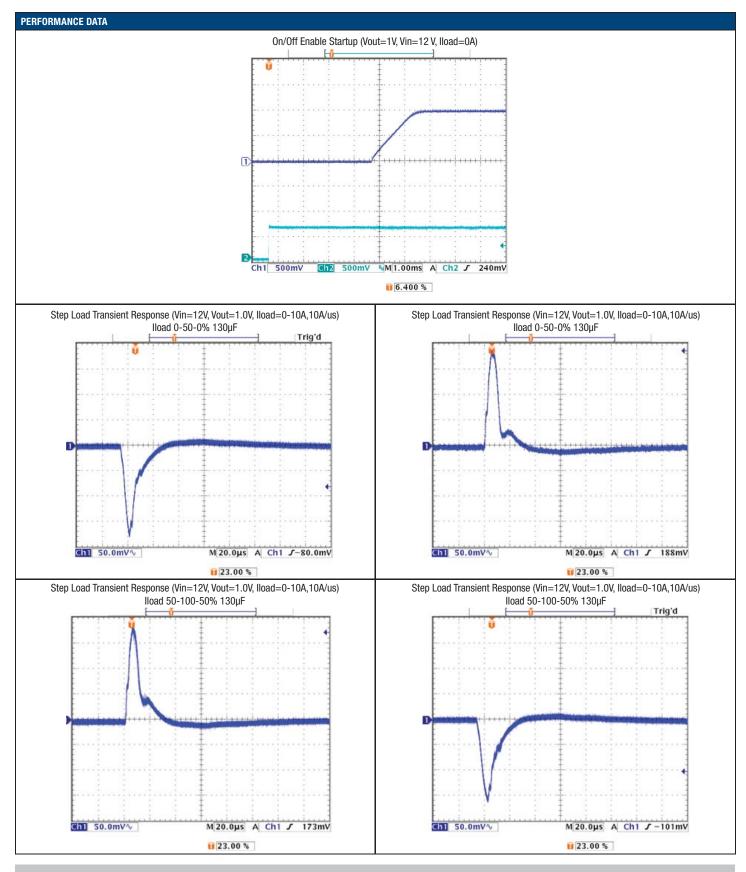
### Adjustable Output 20-Amp SIP-mount DC-DC Converters



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# Mkami OKR-T/20-W12-C

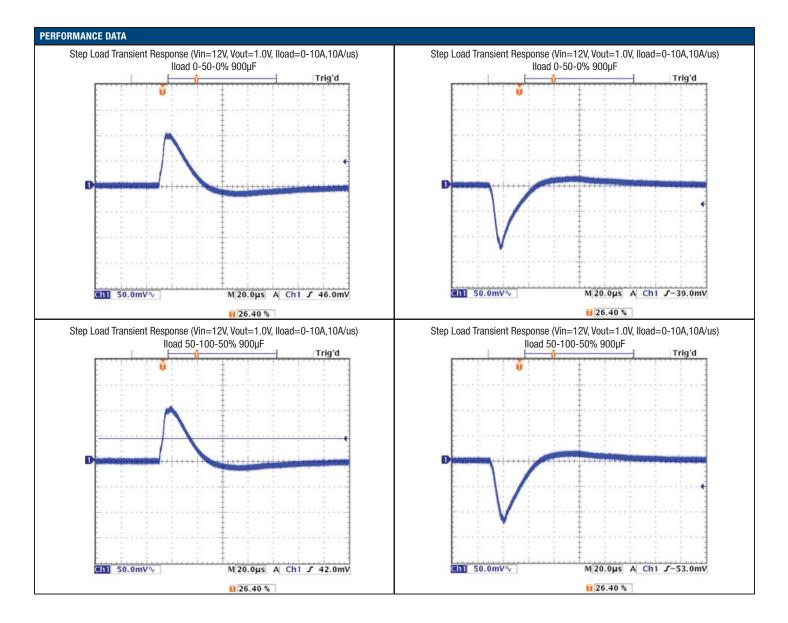
Adjustable Output 20-Amp SIP-mount DC-DC Converters



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



# Mkami OKR-T/20-W12-C

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

#### 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.

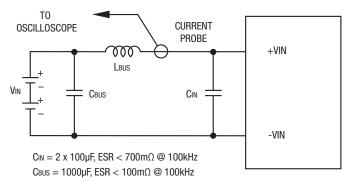
For best performance, we recommend installing a low-ESR capacitor immediately adjacent to the converter's input terminals. The capacitor should be a ceramic type such as the Murata GRM32 series or a polymer type. Initial suggested capacitor values are 10 to 22  $\mu$ F, rated at twice the expected maximum 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**

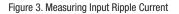
The minimum external output capacitance required for proper operation is 3  $22\mu$ F and 2  $47\mu$ F ceramic type. The maximum external output capacitance is  $1500\mu$ F. Operating outside of these minimum and maximum limits may affect the performance of the unit.

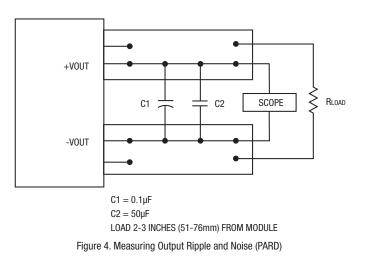
#### **Input Ripple Current and Output Noise**

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.

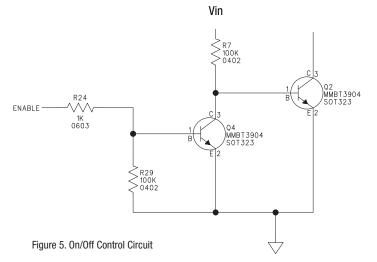
#### External Enable On/Off Control (see figure 5)

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.

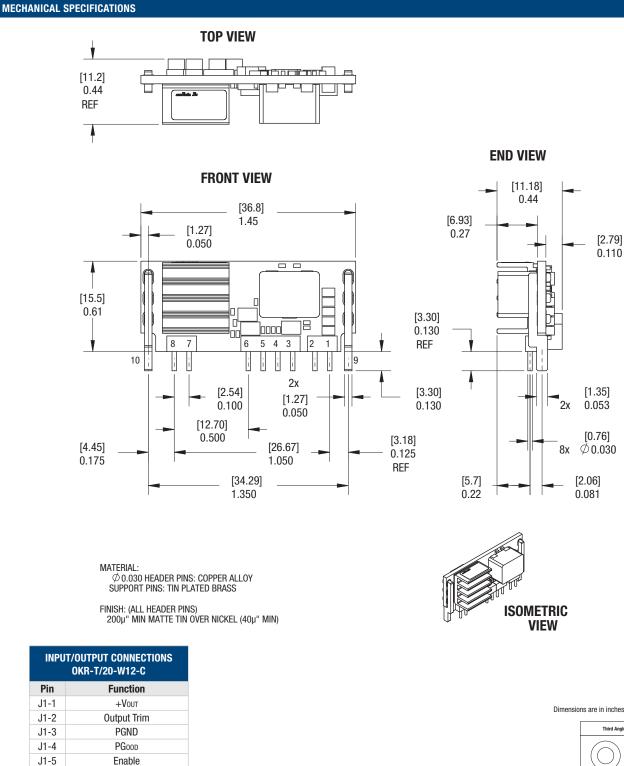
If you wish to control the On/Off circuit by external logic rather than a switch, carefully compare your logic threshold voltages with that of the On/Off input.

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

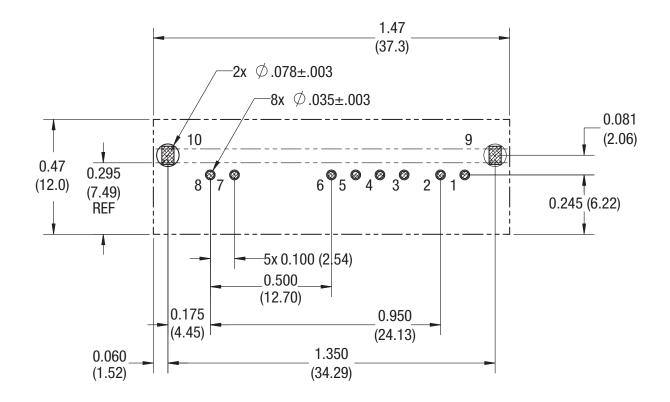
J1-10



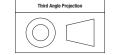
Adjustable Output 20-Amp SIP-mount DC-DC Converters

**MECHANICAL SPECIFICATIONS** 

## RECOMMENDED FOOTPRINT (VIEW FROM TOP)



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

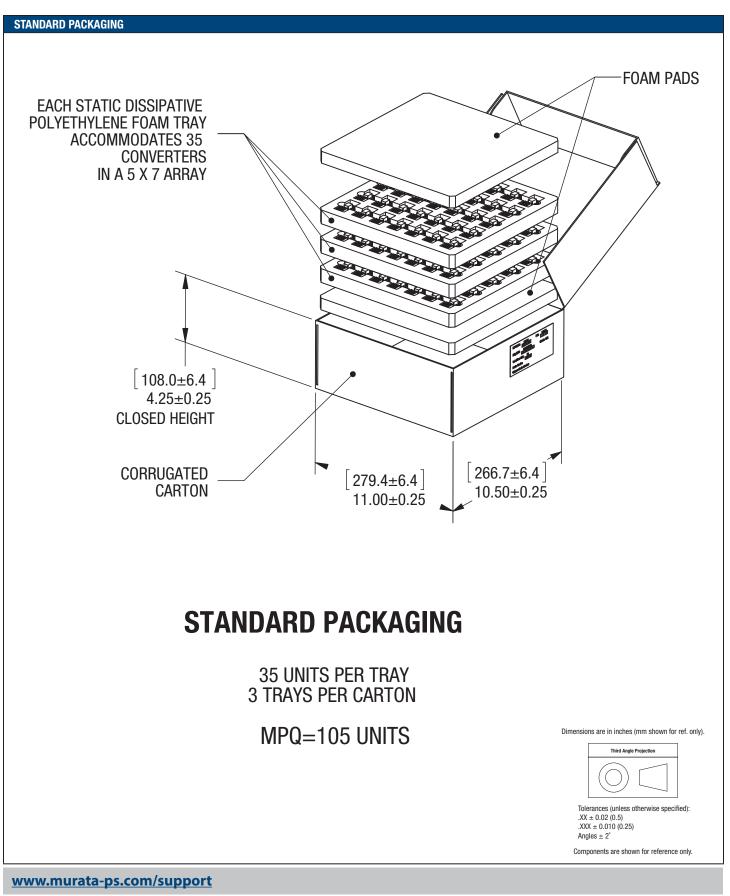


Tolerances (unless otherwise specified): .XX  $\pm$  0.02 (0.5) .XXX  $\pm$  0.010 (0.25) Angles  $\pm$  2°

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>

Murata Power Solutions, Inc. makes no representation that the use of its products in the circuits described herein, or the use of other technical information contained herein, will not infringe upon existing or future patent rights. The descriptions contained herein do not imply the granting of licenses to make, use, or sell equipment constructed in accordance therewith. Specifications are subject to change without notice. *Control of the control of t* 



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- 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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