P-DUKE POWER

RCD20W Series

DC-DC Converter
Up to 20 Watts

3 YEARS WARRANTY

RoHS COMPLIANT

REACH COMPLIANT

Railway | Automation | Datacom

IPC | Industry | Measurement

Telecom | Automobile | Boat

Charger | Medical | PV

3000 VDC Isolation Voltage | 2250 VDC Isolation Voltage | 4 : 1 Wide Input Range | 6 sided Shielding | LOW Standby Power | NO Min. Load Required | REMOTE ON OFF | OCP | OVP | SCP | UVP | OTP | Internal EN50121-3-2 Filter

PART NUMBER STRUCTURE

RCD20 - 48 S 05 W - M3 A HC1

Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Input Range	Operating Temp. Options	Remote ON/OFF & Trim Options	Assembly Options
	24:9~36 **48:**18~75 **110:**36~160	**S:**Single	**3P3:**3.3 **05:**5 **5P1:**5.1 **12:**12 **15:**15 **24:**24	4:1	**□:**Standard -40°C~105°C With derating **M3:**M3 Version -55°C~105°C With derating	**□:**Negative logic **A:**Positive logic **B:**Without Ctrl pin **C:**Negative logic without Trim pin **D:**Without Ctrl & Trim pin **E:**Positive logic without Trim pin	**□:** None **HC1:** 7GA0117P01-F; H=0.3” **HC2:** 7GA0118P01-F; H=0.5” **HC3:** 7GA0119P01-F; H=0.8”
		D: Dual	**12:**±12 **15:**±15 **24:**±24				

TECHNICAL SPECIFICATION All specifications are typical at nominal input, full load and 25℃ unless otherwise noted

Model Number	Input Range	Output Voltage	Output Current @Full Load	Input Current @ No Load	Efficiency	Maximum Capacitor Load
	VDC	VDC	mA	mA	%	μF
RCD20-24S3P3W	9 ~ 36	3.3	5500	10	88	8000
RCD20-24S05W	9 ~ 36	5	4000	10	89	5000
RCD20-24S5P1W	9 ~ 36	5.1	4000	10	89	5000
RCD20-24S12W	9 ~ 36	12	1670	7	89	850
RCD20-24S15W	9 ~ 36	15	1330	7	89	700
RCD20-24S24W	9 ~ 36	24	833	10	91	220
RCD20-24D12W	9 ~ 36	±12	±833	7	89	±500
RCD20-24D15W	9 ~ 36	±15	±667	7	90	±350
RCD20-24D24W	9 ~ 36	±24	±417	12	91	±100
RCD20-48S3P3W	18 ~ 75	3.3	5500	10	89	8000
RCD20-48S05W	18 ~ 75	5	4000	10	90	5000
RCD20-48S5P1W	18 ~ 75	5.1	4000	10	90	5000
RCD20-48S12W	18 ~ 75	12	1670	5	89	850
RCD20-48S15W	18 ~ 75	15	1330	5	90	700
RCD20-48S24W	18 ~ 75	24	833	8	91	220
RCD20-48D12W	18 ~ 75	±12	±833	5	89	±500
RCD20-48D15W	18 ~ 75	±15	±667	5	90	±350
RCD20-48D24W	18 ~ 75	±24	±417	10	91	±100
RCD20-110S3P3W	36 ~ 160	3.3	5500	6	88	8000
RCD20-110S05W	36 ~ 160	5	4000	6	90	5000
RCD20-110S5P1W	36 ~ 160	5.1	4000	6	90	5000
RCD20-110S12W	36 ~ 160	12	1670	6	90	850
RCD20-110S15W	36 ~ 160	15	1330	6	90	700
RCD20-110S24W	36 ~ 160	24	833	6	91	220
RCD20-110D12W	36 ~ 160	±12	±833	6	90	±500
RCD20-110D15W	36 ~ 160	±15	±667	6	90	±350
RCD20-110D24W	36 ~ 160	±24	±417	6	91	±100

INPUT SPECIFICATIONS

Parameter	Conditions			Min.	Typ.	Max.	Unit
Operating input voltage range		24Vin(nom)		9	24	36	
		48Vin(nom)		18	48	75	VDC
		110Vin(nom)		36	110	160	
Start up voltage		24Vin(nom)				9	
		48Vin(nom)				18	VDC
		110Vin(nom)				36	
Shutdown voltage		24Vin(nom)		7.5	8	8.8	
		48Vin(nom)		15.5	16	17.5	VDC
		110Vin(nom)		32	34	35.5	
Start up time	Constant resistive load	Power up			30	40	ms
		Remote ON/OFF			30	40	
Input surge voltage	1 second, max.	24Vin(nom)				50	
		48Vin(nom)				100	VDC
		110Vin(nom)				185	
Input filter					Pi type		
Remote ON/OFF	Referred to –Vin pin	Positive logic	DC-DC ON		Open or 3 ~ 15VDC		
		(Option)	DC-DC OFF		Short or 0 ~ 1.2VDC		
		Negative logic	DC-DC ON		Short or 0 ~ 1.2VDC		
		(Standard)	DC-DC OFF		Open or 3 ~ 15VDC		
		Input current of Ctrl pin		-0.5		+1.0	mA
		Remote off input current			2.5		mA

OUTPUT SPECIFICATIONS

Parameter	Conditions		Min.	Typ.	Max.	Unit
Voltage accuracy			-1.0		+1.0	%
Line regulation	Low Line to High Line at Full Load	Single	-0.2		+0.2	%
		Dual	-0.5		+0.5	
Load regulation	No Load to Full Load	Single	-0.2		+0.2	%
		Dual	-1.0		+1.0	
	10% Load to 90% Load	Single	-0.1		+0.1	
		Dual	-0.8		+0.8	
Cross regulation	Asymmetrical load 25%/100% FL	Dual	-5.0		+5.0	%
Voltage adjustability	Single output	24Vout	-10		+20	%
		Others	-10		+10	
Ripple and noise	Measured by 20MHz bandwidth					mVp-p
		Single				
	With a 22μF/25V X7R MLCC	3.3Vout, 5Vout, 5.1Vout		75		
	With a 22μF/25V X7R MLCC	12Vout, 15Vout		100		
	With a 4.7μF/50V X7R MLCC	24Vout		125		
		Dual				
	With a 10μF/25V X7R MLCC for each output	12Vout, 15Vout		100		
	With a 4.7μF/50V X7R MLCC for each output	24Vout		125		
Temperature coefficient			-0.02		+0.02	%/℃
Transient response recovery time	25% load step change			250		μs
Over voltage protection		3.3Vout	3.7		5.4	VDC
		5Vout, 5.1Vout	5.6		7.0	
		12Vout	13.5		19.6	
		15Vout	16.8		20.5	
		24Vout	29.1		32.5	
Over load protection	% of Iout rated			170		%
Short circuit protection			Continuous, automatics recovery			

GENERAL SPECIFICATIONS

Parameter	Conditions			Min.	Typ.	Max.	Unit
Isolation voltage	1 minute	110Vin(nom)	Input to Output	3000			VDC
			Input (Output) to Case	2250			
	1 minute	24Vin, 48Vin	Input to Output	2250			
			Input (Output) to Case	1600			
Isolation resistance	500VDC			1			GΩ
Isolation capacitance						2000	pF
Switching frequency		110Vin	3.3Vout, 5Vout, 5.1Vout	210	240	270	kHz
			Others	260	300	340	
		24Vin, 48Vin	3.3Vout, 5Vout, 5.1Vout	230	270	310	
			Others	290	330	370	
Safety approvals	IEC/ EN/ UL 62368-1					UL:E193009 CB:UL(Demko)	
Standard approvals	EN50155 EN45545-2						
Case material							Copper
Base material							FR4 PCB
Potting material							Silicone (UL94 V-0)
Weight							16g (0.56oz)
MTBF	MIL-HDBK-217F, Full load						1.201×10^6 hrs

ENVIRONMENTAL SPECIFICATIONS

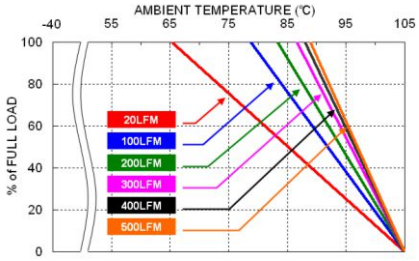
Parameter	Conditions			Min.	Typ.	Max.	Unit
Operating ambient temperature	Standard type	With derating		-40		+105	℃
	M3 version	With derating		-55		+105	
Maximum case temperature						105	℃
Over temperature protection					115		℃
Storage temperature range				-55		+125	℃
Thermal impedance	Natural convection	Without Heat-sink			15.5		℃/W
		With Heat-sink	HC1		12.3		
			HC2		10.7		
			HC3		9.1		
Thermal shock						MIL-STD-810F	
Shock						EN61373, MIL-STD-810F	
Vibration						EN61373, MIL-STD-810F	
Relative humidity						5% to 95% RH	

EMC SPECIFICATIONS

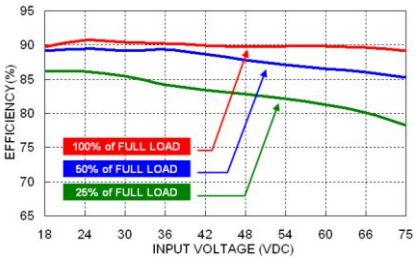
Parameter	Conditions			Level
EMI	EN50121-3-2		Without external components	
	EN55032	110Vin	With an aluminum electrolytic capacitor (Nippon chemi-con KXJ series, 47μF/200V)	Class A
		24Vin, 48Vin	Without external components	Class A
		All	With external components	Class B
EMS	EN55035 and EN50121-3-2			
ESD	EN61000-4-2	Air ± 8kV and Contact ± 6kV		Perf. Criteria A
Radiated immunity	EN61000-4-3	20 V/m		Perf. Criteria A
Fast transient	EN61000-4-4	±2kV		Perf. Criteria A
	RCD20-24□□□W	With an aluminum electrolytic capacitor (Nippon chemi-con KY series, 220μF/100V) and a TVS (SMDJ58A, 58V, 3000Watt peak pulse power) in parallel		
	RCD20-48□□□W	With an aluminum electrolytic capacitor (Nippon chemi-con KY series, 220μF/100V)		
	RCD20-110□□□W	With an aluminum electrolytic capacitor (Nippon chemi-con KXJ series, 150μF/200V) and a TVS (SMBJ300A, 300V, 600Watt peak pulse power) in parallel		
Surge	EN61000-4-5	±2kV		Perf. Criteria A
	RCD20-24□□□W	With an aluminum electrolytic capacitor (Nippon chemi-con KY series, 220μF/100V) and a TVS (SMDJ58A, 58V, 3000Watt peak pulse power) in parallel		
	RCD20-48□□□W	With an aluminum electrolytic capacitor (Nippon chemi-con KY series, 220μF/100V)		
	RCD20-110□□□W	With an aluminum electrolytic capacitor (Nippon chemi-con KXJ series, 150μF/200V) and a TVS (SMBJ300A, 300V, 600Watt peak pulse power) in parallel		
Conducted immunity	EN61000-4-6	10 Vr.m.s		Perf. Criteria A
Power frequency magnetic field	EN61000-4-8	100A/m continuous; 1000A/m 1 second		Perf. Criteria A

CAUTION: This power module is not internally fused. An input line fuse must always be used.

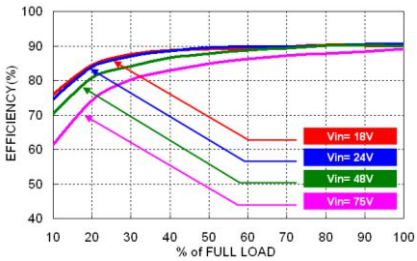
CHARACTERISTIC CURVE



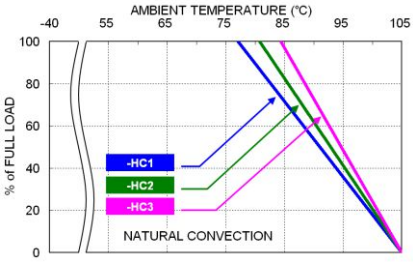
RCD20-48S05W Derating Curve



RCD20-48S05W Efficiency vs. Input Voltage



RCD20-48S05W Efficiency vs. Output Load



RCD20-48S05W Derating Curve
With Heat-sink

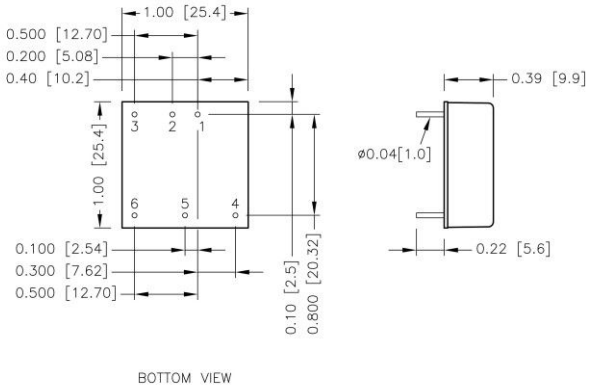
FUSE CONSIDERATION

This power module is not internally fused. An input line fuse must always be used.
This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture.
To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.
The input line fuse suggest as below：

Modules	Fuse Rating (A)	Fuse Type
RCD20-24□□□W	4	Slow-Blow
RCD20-48□□□W	2	Slow-Blow
RCD20-110□□□W	1	Slow-Blow

The table based on the information provided in this data sheet on inrush energy and maximum DC input current at low Vin..

MECHANICAL DRAWING



BOTTOM VIEW

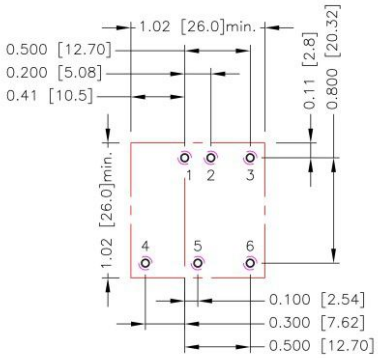
PIN CONNECTION

PIN	SINGLE	DUAL
1	+Vin	+Vin
2	-Vin	-Vin
3	Ctrl	Ctrl
4	+Vout	+Vout
5	Trim	Common
6	-Vout	-Vout

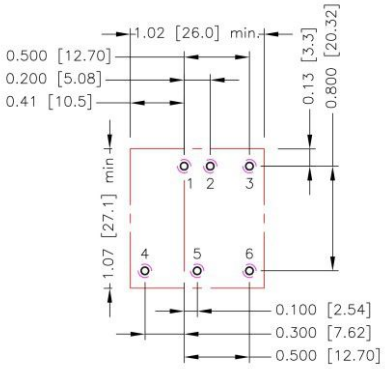
1. All dimensions in inch [mm]
   Tolerance :x.xx±0.02 [x.x±0.5]
   x.xxx±0.010 [x.xx±0.25]
2. Pin dimension tolerance ±0.004[0.10]

RECOMMENDED PAD LAYOUT

Standard



-HC1、-HC2、-HC3

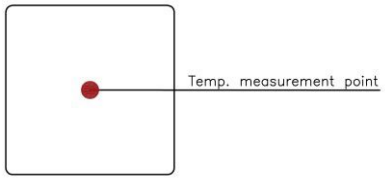


All dimensions in inch[mm]
Pad size(lead free recommended)
Through hole 1.2.3.4.5.6: Φ0.051[1.30]
Top view pad 1.2.3.4.5.6: Φ0.064[1.63]
Bottom view pad 1.2.3.4.5.6: Φ0.102[2.60]

THERMAL CONSIDERATIONS

The power module operates in a variety of thermal environments.
However, sufficient cooling should be provided to help ensure reliable operation of the unit.
Heat is removed by conduction, convection, and radiation to the surrounding environment.
Proper cooling can be verified by measuring the point as the figure below.
The temperature at this location should not exceed “Maximum case temperature”.
When operating, adequate cooling must be provided to maintain the test point temperature at or below “Maximum case temperature”.
You can limit this temperature to a lower value for extremely high reliability.

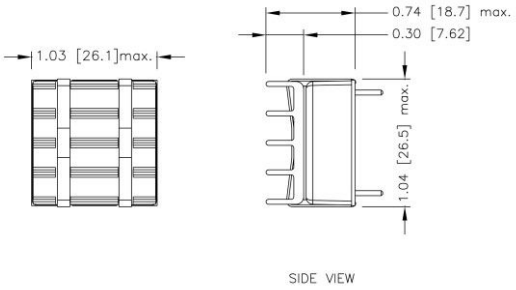
■ Thermal test condition with vertical direction by natural convection (20LFM).



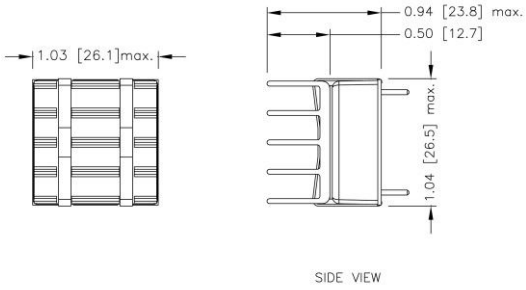
TOP VIEW

HEAT-SINK TYPE OPTIONS

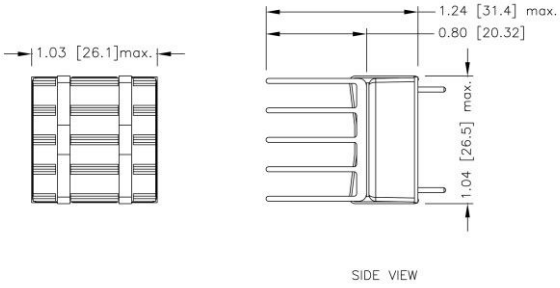
RCD20-□□□□□W-**HC1**
7GA0117P01-F



RCD20-□□□□□W-**HC2**
7GA0118P01-F



RCD20-□□□□□W-**HC3**
7GA0119P01-F



1. All dimensions in inch [mm]
2. Tolerance :x.xx±0.02 [x.x±0.5]
   x.xxx±0.010 [x.xx±0.25]

OUTPUT VOLTAGE ADJUSTMENT

Output voltage set point adjustment allows the user to increase or decrease the output voltage set point of the module.
This is accomplished by connecting an external resistor between the Trim pin and either the +Output or -Output pins.
With an external resistor between the Trim and -Output pin, the output voltage set point increases.
With an external resistor between the Trim and +Output pin, the output voltage set point decreases.
The external Trim resistor needs to be at least 1/16W of rated power.

■ Trim Up Equation

$$R_U = \left[\frac{G \times L}{(V_{o,up} - L - K)} - H \right] \Omega$$

■ Trim Down Equation

$$R_D = \left[\frac{(V_{o,down} - L) \times G}{(V_o - V_{o,down})} - H \right] \Omega$$

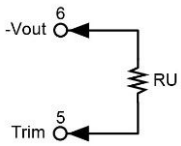
■ Trim Constants

Module	G	H	K	L
RCD20-□□S3P3W	5110	2050	0.8	2.5
RCD20-□□S05W	5110	2050	2.5	2.5
RCD20-□□S5P1W	5110	2050	2.6	2.5
RCD20-□□S12W	10000	5110	9.5	2.5
RCD20-□□S15W	10000	5110	12.5	2.5
RCD20-□□S24W	56000	13000	21.5	2.5

EXTERNAL OUTPUT TRIMMING

Output can be externally trimmed by using the method shown below.

Trim-up



□□S3P3W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	3.333	3.366	3.399	3.432	3.465	3.498	3.531	3.564	3.597	3.630
RU	(kΩ)	385.071	191.511	126.990	94.730	75.374	62.470	53.253	46.340	40.963	36.662

□□S05W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	5.050	5.100	5.150	5.200	5.250	5.300	5.350	5.400	5.450	5.500
RU	(kΩ)	253.450	125.700	83.117	61.825	49.050	40.533	34.450	29.888	26.339	23.500

□□S5P1W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	5.151	5.202	5.253	5.304	5.355	5.406	5.457	5.508	5.559	5.610
RU	(kΩ)	248.440	123.195	81.447	60.573	48.048	39.698	33.734	29.261	25.782	22.999

□□S12W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	12.120	12.240	12.360	12.480	12.600	12.720	12.840	12.960	13.080	13.200
RU	(kΩ)	203.223	99.057	64.334	46.973	36.557	29.612	24.652	20.932	18.038	15.723

□□S15W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	15.150	15.300	15.450	15.600	15.750	15.900	16.050	16.200	16.350	16.500
RU	(kΩ)	161.557	78.223	50.446	36.557	28.223	22.668	18.700	15.723	13.409	11.557

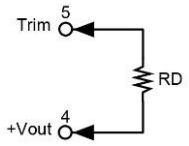
□□S24W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	24.240	24.480	24.720	24.960	25.200	25.440	25.680	25.920	26.160	26.400
RU	(kΩ)	570.333	278.667	181.444	132.833	103.667	84.222	70.333	59.917	51.815	45.333

△V	(%)	11	12	13	14	15	16	17	18	19	20
Vout	(V)	26.640	26.880	27.120	27.360	27.600	27.840	28.080	28.320	28.560	28.800
RU	(kΩ)	40.030	35.611	31.872	28.667	25.889	23.458	21.314	19.407	17.702	16.167

OUTPUT VOLTAGE ADJUSTMENT(CONTINUED)

Trim-down



□□S3P3W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	3.267	3.234	3.201	3.168	3.135	3.102	3.069	3.036	3.003	2.970
RD	(kΩ)	116.719	54.779	34.133	23.810	17.616	13.486	10.537	8.325	6.604	5.228

□□S05W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	4.950	4.900	4.850	4.800	4.750	4.700	4.650	4.600	4.550	4.500
RD	(kΩ)	248.340	120.590	78.007	56.715	43.940	35.423	29.340	24.778	21.229	18.390

□□S5P1W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	5.049	4.998	4.947	4.869	4.845	4.794	4.743	4.692	4.641	4.590
RD	(kΩ)	253.350	123.095	79.677	57.968	44.942	36.258	30.056	25.404	21.786	18.891

□□S12W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	11.880	11.760	11.640	11.520	11.400	11.280	11.160	11.040	10.920	10.800
RD	(kΩ)	776.557	380.723	248.779	182.807	143.223	116.834	97.985	83.848	72.853	64.057

□□S15W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	14.850	14.700	14.550	14.400	14.250	14.100	13.950	13.800	13.650	13.500
RD	(kΩ)	818.223	401.557	262.668	193.223	151.557	123.779	103.938	89.057	77.483	68.223

□□S24W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	23.760	23.520	23.280	23.040	22.800	22.560	22.320	22.080	21.840	21.600
RD	(kΩ)	4947.667	2439.333	1603.222	1185.167	934.333	767.111	647.667	558.083	488.407	432.667

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