P-DUKE® **P-DUKE POWER**

RED20W 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

cULus CB CE

2250 VDC Isolation Voltage | 4 : 1 Wide Input Range | 6 sided Shielding | LOW Standby Power | REMOTE ON OFF | OCP | OVP | SCP | UVP

PART NUMBER STRUCTURE

RED20 - 48 S 05 W - M3 A HC

Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Input Range	Operating Temp. Option	Remote ON/OFF & Trim Option	Assembly Option
	24:9~36 **48:**18~75 **110:**43~160	**S:**Single	**3P3:**3.3 **05:**5 **12:**12 **15:**15	4:1	**□:** Standard -40~+101℃ With derating **M3:** M3 Version -55~+101℃ 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 **HC:** Heat-sink with Clamp
		D:Dual	**12:**±12 **15:**±15				

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

Model Number	Input Range VDC	Output Voltage VDC	Output Current @Full Load mA	Input Current @ No Load mA	Efficiency %	Maximum Capacitor Load µF
RED20-24S3P3W	9 ~ 36	3.3	4500	6	85	7000
RED20-24S05W	9 ~ 36	5	4000	6	88	5000
RED20-24S12W	9 ~ 36	12	1670	6	89	850
RED20-24S15W	9 ~ 36	15	1330	6	88	700
RED20-24D12W	9 ~ 36	±12	±833	6	88	±500
RED20-24D15W	9 ~ 36	±15	±667	6	89	±350
RED20-48S3P3W	18 ~ 75	3.3	4500	4	85	7000
RED20-48S05W	18 ~ 75	5	4000	4	88	5000
RED20-48S12W	18 ~ 75	12	1670	4	89	850
RED20-48S15W	18 ~ 75	15	1330	4	89	700
RED20-48D12W	18 ~ 75	±12	±833	4	88	±500
RED20-48D15W	18 ~ 75	±15	±667	4	89	±350
RED20-110S3P3W	43 ~ 160	3.3	4500	3	85	7000
RED20-110S05W	43 ~ 160	5	4000	3	87	5000
RED20-110S12W	43 ~ 160	12	1670	3	88	850
RED20-110S15W	43 ~ 160	15	1330	3	88	700
RED20-110D12W	43 ~ 160	±12	±833	3	88	±500
RED20-110D15W	43 ~ 160	±15	±667	3	89	±350

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)	43	110	160	
Start up voltage		24Vin(nom)			9	
		48Vin(nom)			18	VDC
		110Vin(nom)			43	
Shutdown voltage		24Vin(nom)	7.5	8	8.8	
		48Vin(nom)	15.5	16	17.5	VDC
		110Vin(nom)	38.5	40	42	
Start up time	Constant resistive load	Power up			30	ms
		Remote ON/OFF			30	
Input surge voltage	100 ms, max.	24Vin(nom)			50	
		48Vin(nom)			100	VDC
		110Vin(nom)			170	
Input filter		24Vin(nom), 48 Vin(nom)		Common Chock		
		110Vin(nom)		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

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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		-10		+10	%
Ripple and noise	20MHz bandwidth	3.3Vout, 5Vout		75		mVp-p
	With a 1μF/50V X7R MLCC	12Vout, 15Vout		100		
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	5.6		7.0	
		12Vout	13.5		19.6	
		15Vout	16.8		20.5	
Over load protection	% of Iout rated			150		%
Short circuit protection			Continuous, automatics recovery			

GENERAL SPECIFICATIONS

Parameter	Conditions		Min.	Typ.	Max.	Unit
Isolation voltage	1 minute	Input to Output	2250			VDC
		Input (Output) to Case	1600			
Isolation resistance	500VDC		1			GΩ
Isolation capacitance					3000	pF
Switching frequency			297	330	363	kHz
Safety approvals	IEC /UL/ EN60950-1				UL:E193009	
					CB:UL(Demko)	
Standard approvals	EN50155					
	EN45545-2					
Case material					Nickel-coated copper	
Base material					FR4 PCB	
Potting material					Silicone (UL94 V-0)	
Weight					30g (1.06oz)	
MTBF	MIL-HDBK-217F, Full load				1.523×10^6 hrs	

ENVIRONMENTAL SPECIFICATIONS

Parameter	Conditions		Min.	Typ.	Max.	Unit
Operating ambient temperature	Standard	With derating	-40		+101	℃
	M3 Version	With derating	-55		+101	
Maximum case temperature					+105	℃
Storage temperature range			-55		+125	℃
Thermal impedance		Without heat-sink		12		℃/W
		With heat-sink		10		
Thermal shock					MIL-STD-810F	
Shock					EN61373, MIL-STD-810F	
Vibration					EN61373, MIL-STD-810F	
Relative humidity					5% to 95% RH	

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EMC SPECIFICATIONS

Parameter	Conditions			Level
EMI	EN55032, EN55011	24VDC, 48VDC	Without external components	Class B
	EN55032	110VDC	Without external components	Class A
			With external components	Class B
ESD	EN61000-4-2	Air ± 8kV and Contact ± 6kV		Perf. Criteria A
Radiated immunity	EN61000-4-3	10 V/m		Perf. Criteria A
Fast transient	EN61000-4-4	±2kV		Perf. Criteria A
	24VDC, 48VDC	With an external input filter capacitor (Nippon chemi-con KY series, 220μF/100V)		
	110VDC	With an external input filter capacitor (Rubycon BXF series, 100μF/250V)		
Surge	EN61000-4-5	EN55024 ±2kV and EN50155 ±2kV		Perf. Criteria A
	24VDC, 48VDC	With an external input filter capacitor (Nippon chemi-con KY series, 220μF/100V)		
	110VDC	With an external input filter capacitor (Rubycon BXF series, 100μF/250V)		
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.

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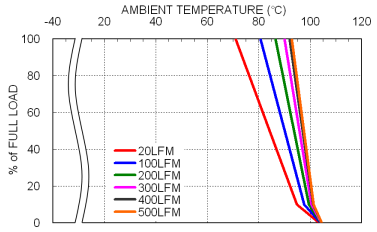
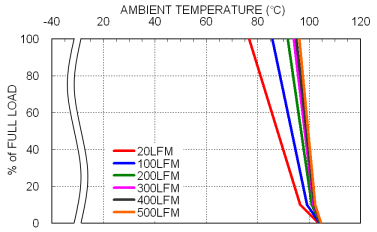
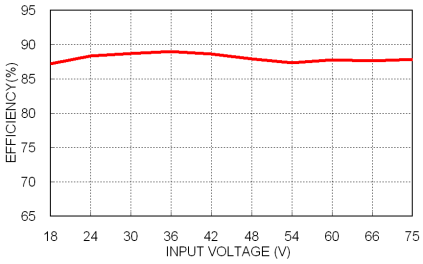
CHARACTERISTIC CURVE



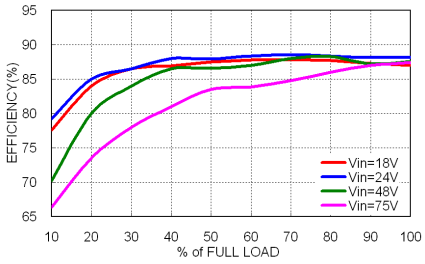
RED20-48S05W Derating Curve



RED20-48S05W Derating Curve With Heat-sink



RED20-48S05W Efficiency vs. Input Voltage



RED20-48S05W Efficiency vs. Output Load

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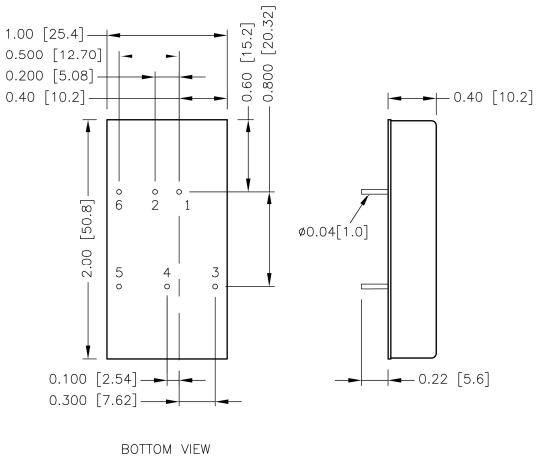
FUSE CONSIDERATION

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：

Model	Fuse Rating (A)	Fuse Type
RED20-24S□□W、RED20-24D□□W	4	Slow-Blow
RED20-48S□□W、RED20-48D□□W	2	Slow-Blow
RED20-110S□□W、RED20-110D□□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



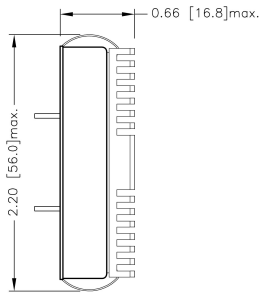
PIN CONNECTION

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

1. All dimensions in inch [mm]
2. Tolerance :x.xx±0.02 [x.x±0.5]
   x.xxx±0.01 [x.xx±0.25]
3. Pin pitch tolerance ±0.01 [0.25]
4. Pin dimension tolerance ±0.004[0.10]

HEAT-SINK OPTIONS

-HC (Heat-sink with clamps)



* All dimensions in inch [mm]

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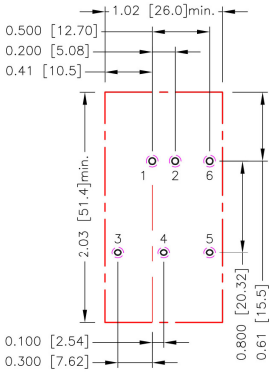
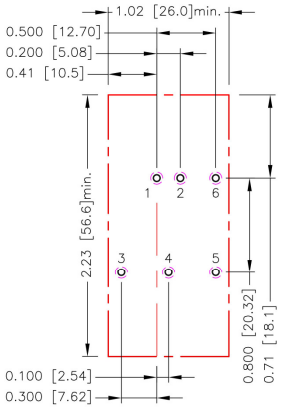
RECOMMENDED PAD LAYOUT

Standard



-HC

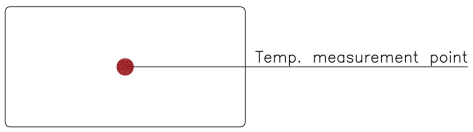


All dimensions in inch[mm]
Pad size(lead free recommended)
Through hole 1.2.3.4.5.6: Φ0.051[1.30]
Top view pad 1.2.3.4.5.6: Φ0.064[1.63]
Bottom view pad 1.2.3.4.5.6: Φ0.102[2.60]

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 105℃.
When Operating, adequate cooling must be provided to maintain the test point temperature at or below 105℃.
Although the maximum point Temperature of the power modules is 105℃, 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

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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 +Vout or -Vout pins.
With an external resistor between the Trim and -Vout, the output voltage set point increases.
With an external resistor between the Trim and +Vout, 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**

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

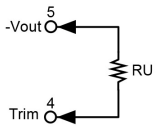
■ **Trim constants**

Module	G	H	K	L
RED20-□□S3P3W	5110	2050	0.8	2.5
RED20-□□S05W	5110	2050	2.5	2.5
RED20-□□S12W	10000	5110	9.5	2.5
RED20-□□S15W	10000	5110	12.5	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

□□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

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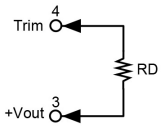
OUTPUT VOLTAGE ADJUSTMENT(CONTINUED)

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

□□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

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