

RED60 Series

60 Watts

- EN50155 and EN45545-2 for Rail Applications
- Wide input 4:1 (9-36V, 16-75V and 36-160V)
- Single and dual outputs
- -40 to 105°C Operation
- Remote on/off and +10% Output Trim
- 3 Year warranty



Dimensions:

2 x 1 x 0.4" (50.8 x 25.4 x 10.2mm)

The 4:1 wide input RED60 series of single and dual output DC/DC converters come in a 2x1" with a nominal input of 24, 48 and 110V and outputs from 3.3 to 53V. The RED60 series has both IEC62368-1, EN50155 safety and EN45545-2 approvals for rail applications. The units operate from -40 to +105°C and come complete with remote on/off function and output trim. All models have a Fidus 3 year warranty.

Models & Ratings

Model Number	Input Voltage	Output Voltage	Output Current	No Load Current	Maximum Capacitive Load	Efficiency
RED60-24S3P3W	9-36V	3.3V	18.2A	15mA	26000uF	88%
RED60-24S05W		5V	12A	15mA	17000uF	91%
RED60-24S12W		12V	5A	15mA	3000uF	93%
RED60-24S15W		15V	4A	15mA	1900uF	93%
RED60-24S24W		24V	2.5A	15mA	730uF	90.5%
RED60-24S48W		48V	1.25A	20mA	190uF	91.5%
RED60-24S53W		53V	1.14A	20mA	150uF	91.5%
RED60-24D12W		±12	±2.5A	20mA	±1500uF	90.5%
RED60-24D15W		±15	±2A	20mA	±940uF	90.5%
RED60-24D24W		±24	±1.25A	20mA	±370uF	91.5%
RED60-48S3P3W	18-75V	3.3V	18.2A	10mA	26000uF	89%
RED60-48S05W		5V	12A	10mA	17000uF	91.5%
RED60-48S12W		12V	5A	10mA	3000uF	92.5%
RED60-48S15W		15V	4A	10mA	1900uF	94%
RED60-48S24W		24V	2.5A	10mA	730uF	91.5%
RED60-48S48W		48V	1.25A	20mA	190uF	92%
RED60-48S53W		53V	1.14A	20mA	150uF	92%
RED60-48D12W		±12	±2.5A	20mA	±1500uF	91.5%
RED60-48D15W		±15	±2A	20mA	±940uF	91.5%
RED60-48D24W		±24	±1.25A	20mA	±370uF	92%
RED60-110S3P3W	36-160V	3.3V	18.2A	10mA	26000uF	88%
RED60-110S05W		5V	12A	10mA	17000uF	91%
RED60-110S12W		12V	5A	10mA	3000uF	92%
RED60-110S15W		15V	4A	10mA	1900uF	92%
RED60-110S24W		24V	2.5A	10mA	730uF	90.5%
RED60-110S48W		48V	1.25A	20mA	190uF	91%
RED60-110S53W		53V	1.14A	20mA	150uF	91%
RED60-110D12W		±12	±2.5A	20mA	±1500uF	90.5%
RED60-110D15W		±15	±2A	20mA	±940uF	90.5%
RED60-110D24W		±24	±1.25A	20mA	±370uF	91%

Notes

1. For negative enable logic add **N** or leave blank for default positive switching logic. For heatsink options then add **HS, HC1, HC2, HC3**.

2. Series diode or mosfet required for reverse polarity protection

3. Input fuse required: 24V: 10A fast acting, 48V: 6.3A slow blow and 72V: 3.15A slow blow

Input

Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Input voltage range	9	24	36	VDC	
	18	48	75		
	36	110	160		
Start up voltage			9	VDC	24V Nominal
			18		48V Nominal
			36		110V Nominal
Shut down voltage	7	8	8.8	VDC	24V Nominal
	15	16	17.5		48V Nominal
	32	34	35.8		110V Nominal
Startup time		30	60	ms	
Input filter					Pi type
Input surge voltage			50	VDC	24V Nominal 1sec max
			100		48V Nominal 1sec max
			200		110V Nominal 1sec max
Remote ON/OFF Positive logic (standard)	0		1.2	VDC	Or short for OFF (ref –Vin pin)
	3		12		Or open for On (ref –Vin pin)
Remote ON/OFF Negative logic (add –N)	3		12	VDC	Or open for OFF (ref –Vin pin)
	0		1.2		Or short for ON (ref –Vin pin)
Control pin current	-0.5		0.5	mA	
Remote off input current		3		mA	

Output

Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Output voltage	3.3		53	VDC	See Model & Ratings table
Set point accuracy			±1	%	
Line regulation			±0.2	%	Low line to High line
Load regulation	±0.5		±1.0	%	0 to 100% load change. ±0.5 for single and ±1.0 for dual
Cross regulation	-5.0		5.0	%	Asymmetrical load 25% / 100%
Output voltage adjustability	-10	+10	+20	%	Trim and remote sense see application note. +20% for 15 and 24V outputs only
Ripple & Noise (20MHz bandwidth)		75	100	mV pk-pk	3.3V and 5V (20MHz BW and 1uF/100V X7R MLCC)
		100	125		12V and 15V (20MHz BW and 1uF/100V X7R MLCC)
		150	200		24V (20MHz BW and 1uF/100V X7R MLCC)
		300	350		48V and 53V (20MHz BW and 1uF/100V X7R MLCC)
Overvoltage protection		3.9		VDC	3.3V
		6.2			5V
		15			12V
		20			15V
		30			24V
		60			48V
		63			53V
Overload protection		150		%	Automatic recovery
Short circuit protection					Continuous with automatic recovery
Transient response		250		us	For a 25% load change

General					
Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Efficiency	88		94	%	See Model & Ratings table
Isolation 36V Nominal	3000			VDC	Input to output
	2250				Input to case
Isolation resistance	1			GOhm	At 500VDC
Isolation capacitance			1500	pF	
Switching frequency	200	250	275	kHz	
Power density			50	W/in ³	
MTBF		>0.7245		MHrs	As per MIL-HDBK-217F, 25°C GB
Weight			34	g	
Case material	Copper				
Base material	FR4 PCB				
Potting material	Silicone (UL94 V-0)				
Safety approvals	IEC/ EN/ UL 62368-1 (UL: E193009)				
Standards	EN50155, EN45545-2				

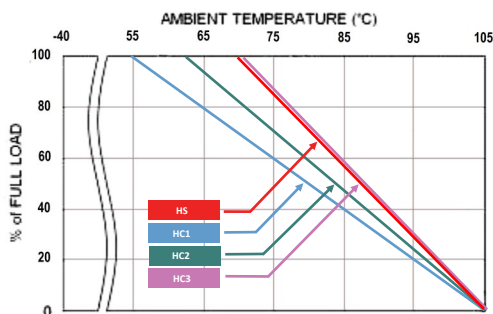
EMC: Emissions		
	Standard	Notes & Conditions
Conducted	EN50121-3-2, EN55032 A/B	See application note
Radiated	EN50121-3-2, EN55032 A/B	See application note

EMC: Immunity			
	Standard	Criteria	Notes & Conditions
ESD	EN61000-4-2	A	Air ±8kV, Contact ±6kV
Radiated	EN61000-4-3	A	20V/m
EFT/Burst	EN61000-4-4	A	2kV: 24V Nominal external input capacitor required: 2x in parallel 220uF/100V and TVS (SMDJ58A 58V, 3000W peak pulse power in parallel) 48V Nominal external input capacitor required: 2x in parallel 220uF/100V and TVS (SMDJ120A 120V, 3000W peak pulse power in parallel) 110V Nominal external input capacitor required: 2x in parallel 150uF/200V and TVS (SMDJ170A, 170V, 3000W peak pulse power in parallel)
Surges	EN61000-4-5	A	2kV: 24V Nominal external input capacitor required: 2x in parallel 220uF/100V and TVS (SMDJ58A 58V, 3000W peak pulse power in parallel) 48V Nominal external input capacitor required: 2x in parallel 220uF/100V and TVS (SMDJ120A 120V, 3000W peak pulse power in parallel) 110V Nominal external input capacitor required: 2x in parallel 150uF/200V and TVS (SMDJ170A, 170V, 3000W peak pulse power in parallel)
Conducted	EN61000-4-6	A	10Vrms
Magnetic fields	EN61000-4-8	A	100A/m continuous. 1000A/m 1 sec

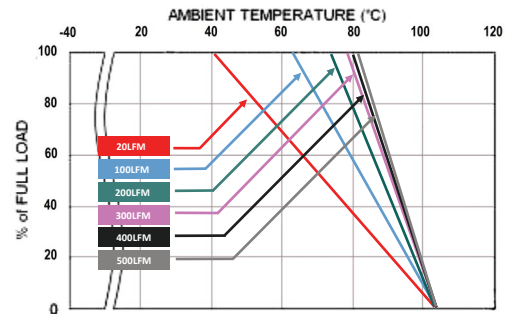
Thermal Considerations	
<p>Sufficient cooling should be provided to ensure reliable operation. Sufficient cooling is monitored by measuring the temperature of the centre point on the bottom of the unit as shown. This temperature should not exceed max case temperature.</p> <p>Thermal conditions (from which graphs are derived) utilise 20LFM from above.</p>	

Environmental

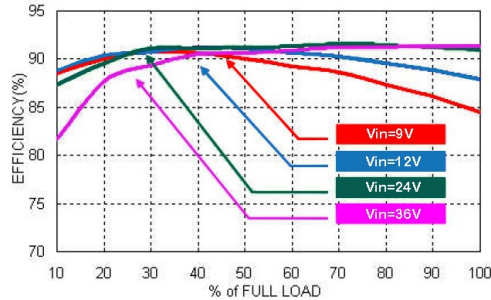
Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Operating temperature	-40		105	°C	Base-plate temp. See de-rating curve
Max case temp			105	°C	
Over temp protection			115	°C	
Storage temperature	-55		125	°C	
Thermal impedance		10.8		°C/W	DC-DC module
		8.3			HC1
		7			HC2
		5.7			HC3
		5.9			HS
Humidity	5		95	% RH	Non-condensing
Thermal shock and vibration	EN61373, MIL-STD-810F				



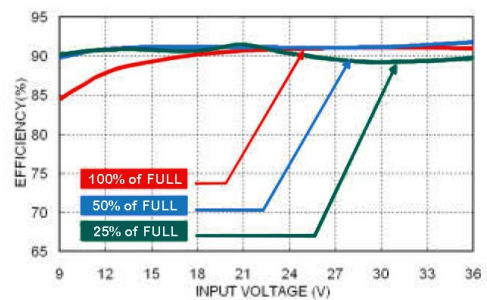
RED60-24S05 Derating curve with heatsink



RED60-24S05 Derating curve



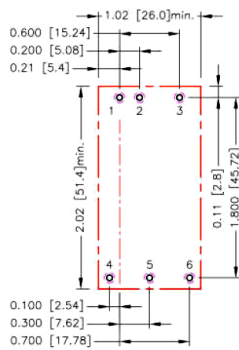
RED60-24S05W Efficiency vs. Output Load



RED60-24S05W Efficiency vs. Input Voltage

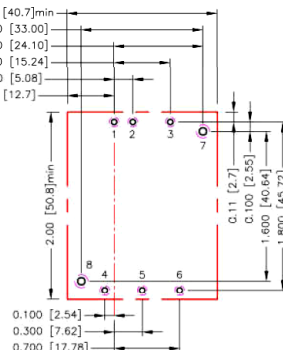
Pad layout

Standard



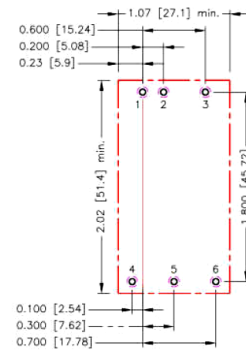
All dimensions in inch[mm]
 Pad size(lead free recommended)
 Through hole 1.2.3.4.5.6: $\Phi 0.051[1.30]$
 Top view pad 1.2.3.4.5.6: $\Phi 0.064[1.63]$
 Bottom view pad 1.2.3.4.5.6: $\Phi 0.102[2.60]$

-HS



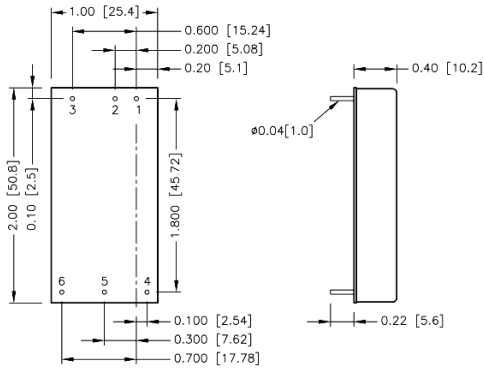
All dimensions in inch[mm]
 Pad size(lead free recommended)
 Through hole 1.2.3.4.5.6: $\Phi 0.051[1.30]$
 Through hole 7.8: $\Phi 0.071[1.80]$
 Top view pad 1.2.3.4.5.6: $\Phi 0.064[1.63]$
 Top view pad 7.8: $\Phi 0.089[2.25]$
 Bottom view pad 1.2.3.4.5.6: $\Phi 0.102[2.60]$
 Bottom view pad 7.8: $\Phi 0.142[3.60]$

-HC1 - HC2 - HC3



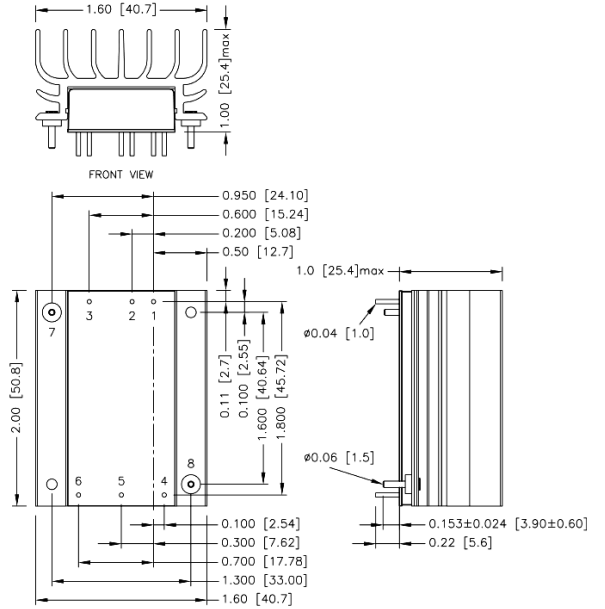
All dimensions in inch[mm]
 Pad size(lead free recommended)
 Through hole 1.2.3.4.5.6: $\Phi 0.051[1.30]$
 Top view pad 1.2.3.4.5.6: $\Phi 0.064[1.63]$
 Bottom view pad 1.2.3.4.5.6: $\Phi 0.102[2.60]$

Mechanical Details



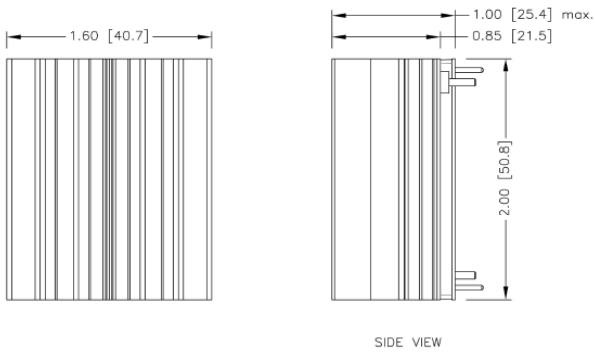
BOTTOM VIEW

Pin	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	Ctrl	Ctrl
4	+Vout	+Vout
5	-Vout	Com
6	Trim	-Vout
7	Heat Sink	Heat Sink
8	Heat Sink	Heat Sink

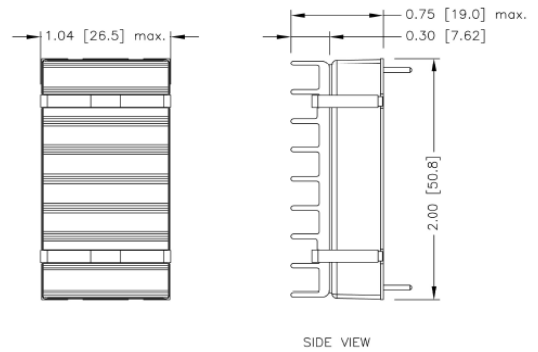


BOTTOM VIEW

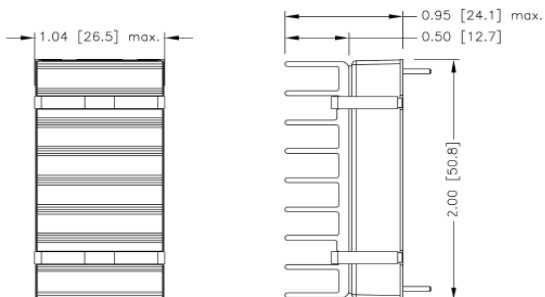
HS Heatsink 7G-0110A-F



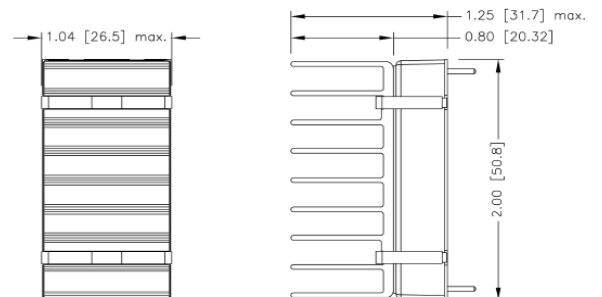
HC1 Heatsink 7GA012P01-F



HC2 Heatsink 7GA0121P01-F



HC3 Heatsink 7GA0122P01-F



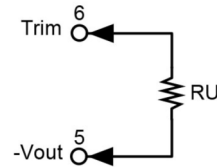
Notes

- All dimensions shown in inches [mm]
- Tolerance 2DP ± 0.02 [1DP ± 0.05], 3DP ± 0.010 [2DP ± 0.025]

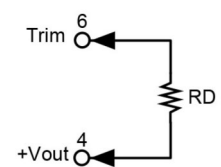
Trim Tables

Output voltage trim function allows the user to increase or decrease the output voltage set point. The module may be connected with an external resistor (R_{trim}) between TRIM pin and either +Vout or -Vout. By adjusting R_{trim} , the output voltage can be changed by +10% or -20% of nominal the output voltage.

Trim up (RU)



Trim Down RD



3.3V OUTPUT TRIM UP											
$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	3.333	3.366	3.399	3.432	3.465	3.498	3.531	3.564	3.597	3.630	Volts
RU	43.179	21.758	13.410	8.966	6.206	4.325	2.961	1.927	1.115	0.462	kOhms
5V OUTPUT TRIM UP											
$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	5.05	5.10	5.15	5.20	5.25	5.30	5.35	5.40	5.45	5.50	Volts
RU	35.360	16.244	9.752	6.483	4.514	3.198	2.257	1.550	1.00	0.559	kOhms
12V OUTPUT TRIM UP											
$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	12.12	12.24	12.36	12.48	12.60	12.72	12.84	12.96	13.08	13.20	Volts
RU	392.864	172.175	101.446	66.591	45.837	32.068	22.264	14.929	9.234	4.685	kOhms
15V OUTPUT TRIM UP											
$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	15.15	15.30	15.45	15.60	15.75	15.90	16.05	16.20	16.35	16.50	Volts
RU	413.163	198.115	125.754	89.445	67.618	53.050	42.636	34.820	28.739	23.872	kOhms
15V OUTPUT TRIM UP											
$\Delta V\%$	11	12	13	14	15	16	17	18	19	20	%
Vout	16.65	16.80	16.95	17.10	17.25	17.40	17.55	17.70	17.85	18.00	Volts
RU	19.888	16.568	13.759	11.350	9.262	7.434	5.822	4.389	3.106	1.951	kOhms
24V OUTPUT TRIM UP											
$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	24.24	24.48	24.72	24.96	25.20	25.44	25.68	25.92	26.16	26.40	Volts
RU	947.146	472.772	303.499	216.605	163.724	128.153	102.589	83.329	68.298	56.240	kOhms
24V OUTPUT TRIM UP											
$\Delta V\%$	11	12	13	14	15	16	17	18	19	20	%
Vout	26.4	26.88	27.12	27.36	27.60	27.84	28.08	28.32	28.56	28.80	Volts
RU	46.353	38.099	31.104	25.101	19.892	15.330	11.302	7.718	4.509	1.619	kOhms
48V OUTPUT TRIM UP											
$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	48.48	48.96	49.44	49.92	50.40	50.88	51.36	51.84	52.32	52.80	Volts
RU	531.639	226.403	131.987	86.042	58.867	40.910	28.162	18.642	11.263	5.376	kOhms
53V OUTPUT TRIM UP											
$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	53.53	54.06	54.59	55.12	55.65	56.18	56.71	57.24	57.77	58.30	Volts
RU	626.943	246.375	140.489	90.768	61.891	43.022	29.726	19.853	12.231	6.169	kOhms

3.3V OUTPUT TRIM DOWN											
$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	3.267	3.234	3.201	3.168	3.135	3.102	3.069	3.036	3.003	2.970	Volts
RU	68.728	31.256	18.592	12.227	8.398	5.841	4.012	2.639	1.570	0.715	kOhms
5V OUTPUT TRIM DOWN											
$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	4.95	4.90	4.85	4.80	4.75	4.70	4.65	4.60	4.55	4.50	Volts
RU	46.686	20.817	12.360	8.162	5.653	3.984	2.794	1.903	1.210	0.656	kOhms
12V OUTPUT TRIM DOWN											
$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	11.88	11.76	11.64	11.52	11.40	11.28	11.16	11.04	10.92	10.80	Volts
RU	435.294	201.116	120.429	79.573	54.894	38.371	26.535	17.639	10.709	5.137	kOhms
15V OUTPUT TRIM DOWN											
$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	14.85	14.70	14.55	14.40	14.25	14.10	13.95	13.80	13.65	13.50	Volts
RU	302.154	132.798	78.547	51.685	35.680	25.055	17.489	11.826	7.429	3.916	kOhms
24V OUTPUT TRIM DOWN											
$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	23.76	23.52	23.28	23.04	22.80	22.56	22.32	22.08	21.84	21.60	Volts
RU	736.083	326.672	192.473	125.790	85.913	59.383	40.459	26.282	15.263	6.454	kOhms
48V OUTPUT TRIM DOWN											
$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	47.52	47.04	46.56	45.08	45.60	45.12	44.64	44.16	43.68	43.20	Volts
RU	558.604	257.390	153.744	101.292	69.616	48.413	33.225	21.811	12.920	5.798	kOhms
53V OUTPUT TRIM DOWN											
$\Delta V\%$	1	2	3	4	5	6	7	8	9	10	%
Vout	52.47	51.94	51.41	50.88	50.35	49.82	49.29	48.76	48.23	47.70	Volts
RU	551.986	256.323	153.564	101.358	69.765	48.589	33.408	21.991	13.093	5.962	kOhms