Power Mate Technology, Inc

P-DUKE®

FDC15 Series

DC-DC Converter
Up to 15 Watts

3 YEARS WARRANTY

RoHS COMPLIANT

REACH COMPLIANT

Automation | Datacom | IPC

Industry | Measurement | Telecom

Automobile | Boat | Charger

Medical | PV | Railway

c UL us | CB | CE | UKCA

1600 VDC Isolation Voltage | 4 : 1 Wide Input Range | 6 sided Shielding | REMOTE ON OFF | OCP | OVP | SCP

PART NUMBER STRUCTURE

FDC15 - 48 S 05 - HC

Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Assembly Options
	24:9~36 **48:**18~75	**S:**Single	**05:**5 **12:**12 **15:**15	□: None **HC:** Heat-sink with Clamp
		D:Dual	**05:**±5 **12:**±12 **15:**±15	

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 Min. Load mA	Output Current @Full Load Full Load mA	Input Current @ No Load mA	Efficiency %	Maximum Capacitor Load µF
FDC15-24S05	9 ~ 36	5	210	3000	20	80	6800
FDC15-24S12	9 ~ 36	12	100	1250	10	82	890
FDC15-24S15	9 ~ 36	15	80	1000	20	82	570
FDC15-24D05	9 ~ 36	±5	±105	±1500	20	80	±1700
FDC15-24D12	9 ~ 36	±12	±50	±625	20	82	±300
FDC15-24D15	9 ~ 36	±15	±40	±500	20	82	±200
FDC15-48S05	18 ~ 75	5	210	3000	15	80	6800
FDC15-48S12	18 ~ 75	12	100	1250	15	82	890
FDC15-48S15	18 ~ 75	15	80	1000	10	82	570
FDC15-48D05	18 ~ 75	±5	±105	±1500	10	80	±1700
FDC15-48D12	18 ~ 75	±12	±50	±625	20	82	±300
FDC15-48D15	18 ~ 75	±15	±40	±500	15	82	±200

* The output requires a minimum loading on the output to maintain specified regulation. Operation under no-load condition will not damage these devices, however they may not meet all listed specification.

INPUT SPECIFICATIONS

Parameter	Conditions			Min.	Typ.	Max.	Unit
Operating input voltage range		24Vin(nom)		9	24	36	VDC
		48Vin(nom)		18	48	75	
Start up time	Constant resistive load	Power up			20		ms
Input surge voltage	100 ms, max.	24Vin(nom)				50	VDC
		48Vin(nom)				100	
Input filter					Pi type		
Remote ON/OFF	Referred to –Vin pin	Positive logic	DC-DC ON		Open or 3.5 ~ 12VDC		
			DC-DC OFF		Short or 0 ~ 1.2VDC		
		Input current of Ctrl pin		-0.5		+0.5	mA
		Remote off input current			20		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		-0.2		+0.2	%
Load regulation	Min. Load to Full Load	Single	-0.5		+0.5	%
		Dual	-1.0		+1.0	
Cross regulation	Asymmetrical load 25%/100% FL	Dual	-5.0		+5.0	%
Voltage adjustability			-10		+10	%
Ripple and noise	Measured by 20MHz bandwidth			75		mVp-p
Temperature coefficient			-0.02		+0.02	%/℃
Transient response recovery time	25% load step change			250		µs
Over voltage protection	Zener diode clamp	5Vout		6.2		VDC
		12Vout		15		
		15Vout		18		
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 Input(Output) to Case	1600 1600			VDC
Isolation resistance	500VDC		1			GΩ
Isolation capacitance					300	pF
Switching frequency			243	270	297	kHz
Safety approvals	IEC/ EN/ UL 62368-1				UL:E193009 CB: UL(Demko)	
Case material					Nickel-coated copper	
Base material					Non-conductive black plastic	
Potting material					Epoxy (UL94 V-0)	
Weight					48g (1.69oz)	
MTBF	MIL-HDBK-217F, Full load				2.250 x 10^6 hrs	

ENVIRONMENTAL SPECIFICATIONS

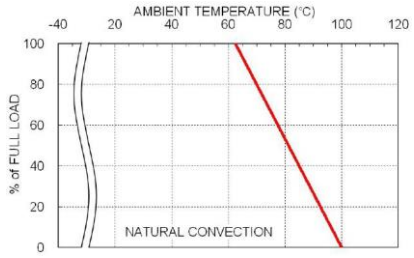
Parameter	Conditions		Min.	Typ.	Max.	Unit
Operating ambient temperature		With derating	-40		+85	℃
Maximum case temperature					100	℃
Storage temperature range			-55		+125	℃
Thermal impedance		Without heat-sink With heat-sink		10 8.24		℃/W
Thermal shock					MIL-STD-810F	
Vibration					MIL-STD-810F	
Relative humidity					5% to 95% RH	

EMC SPECIFICATIONS

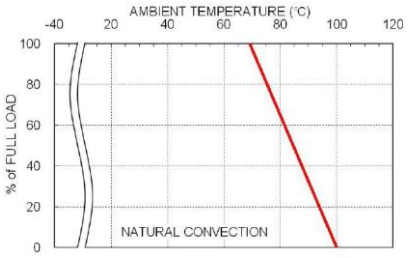
Parameter	Conditions		Level
EMI	EN55032		Class A, Class B
EMS	EN55024		
ESD	EN61000-4-2	Air ± 8kV and Contact ± 6kV	Perf. Criteria B
Radiated immunity	EN61000-4-3	10 V/m	Perf. Criteria A
Fast transient	EN61000-4-4	± 2kV With an external input filter capacitor (Nippon chemi-con KY series, 220μF/100V)	Perf. Criteria B
Surge	EN61000-4-5	± 1kV With an external input filter capacitor (Nippon chemi-con KY series, 220μF/100V)	Perf. Criteria B
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.

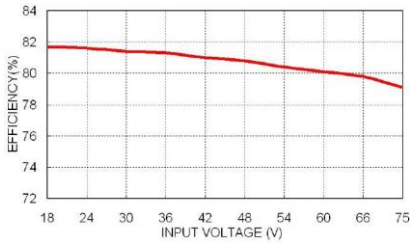
CHARACTERISTIC CURVE



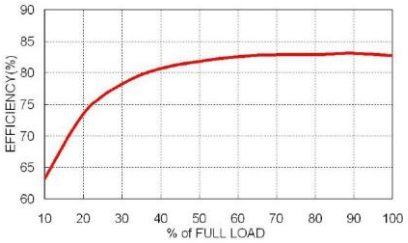
FDC15-48S05 Derating Curve



FDC15-48S05 Derating Curve With Heat-sink



FDC15-48S05 Efficiency vs. Input Voltage



FDC15-48S05 Efficiency vs. Output Load

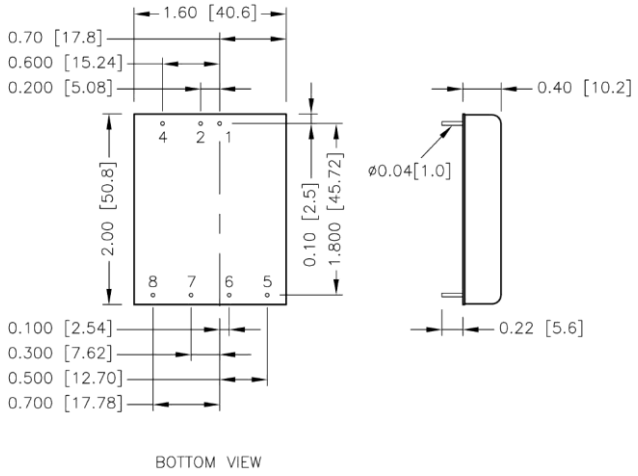
FUSE CONSIDERATION

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
FDC15-24□□□	3.15	Slow-Blow
FDC15-48□□□	1.6	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



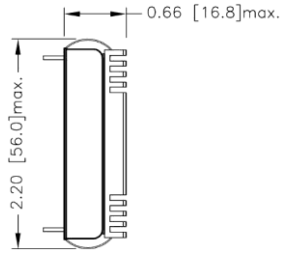
PIN CONNECTION

PIN	SINGLE	DUAL
1	+Vin	+Vin
2	-Vin	-Vin
4	Ctrl	Ctrl
5	No pin	+Vout
6	+Vout	Common
7	-Vout	-Vout
8	Trim	Trim

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 dimension tolerance ±0.004[0.10]

HEAT-SINK OPTIONS

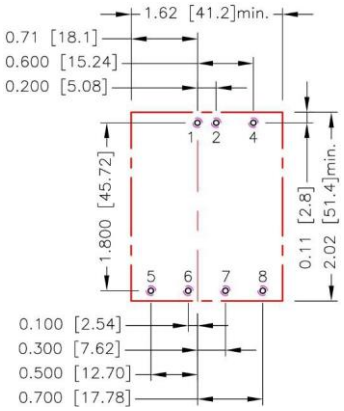
-HC (Heat-sink with clamps)



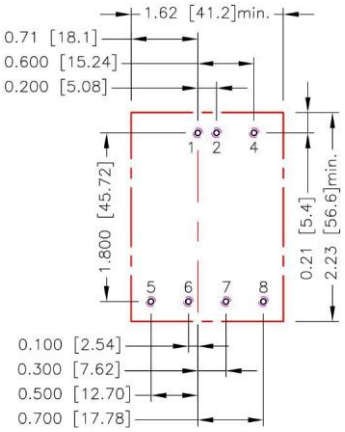
* All dimensions in inch [mm]

RECOMMENDED PAD LAYOUT

Standard



-HC

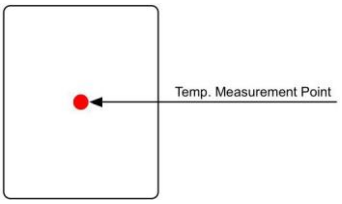


All dimensions in inch[mm]
Pad size(lead free recommended)
Through hole 1.2.4.5.6.7.8:Φ0.051[1.30]
Top view pad 1.2.4.5.6.7.8:Φ0.064[1.63]
Bottom view pad 1.2.4.5.6.7.8:Φ0.102[2.60]

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

OUTPUT VOLTAGE ADJUSTMENT

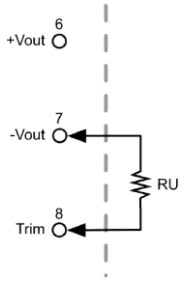
Output voltage set point adjustment allows the user to increase or decrease the output voltage set point of the module.
This is accomplished by connecting an external resistor between the Trim pin and either the +Vout or - Vout pins.
With an external resistor between the Trim and - Vout pin, the output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

EXTERNAL OUTPUT TRIMMING

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

Trim-up

Single Output



□□S3P3/ □□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)	57.930	26.165	15.577	10.283	7.106	4.988	3.476	2.341	1.459	0.753

□□S05/ □□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)	36.570	16.580	9.917	6.585	4.586	3.253	2.302	1.588	1.032	0.588

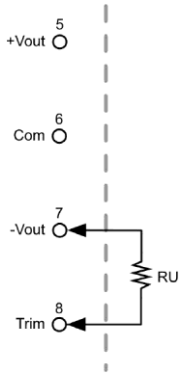
□□S12/ □□S12W

△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)	367.91	165.95	98.636	64.977	44.782	31.318	21.701	14.488	8.879	4.391

□□S15/ □□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)	404.184	180.592	106.061	68.796	46.437	31.531	20.883	12.898	6.687	1.718

Dual Output



□□D05/ □□D05W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	10.100	10.200	10.300	10.400	10.500	10.600	10.700	10.800	10.900	11.000
RU	(kΩ)	90.303	40.602	24.034	15.751	10.781	7.467	5.100	3.325	1.945	0.840

□□D12/ □□D12W

△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)	218.210	98.105	58.070	38.052	26.042	18.035	12.316	8.026	4.690	2.021

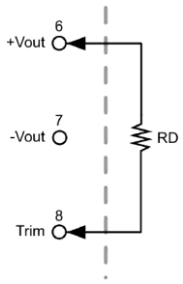
□□D15/ □□D15W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	30.300	30.600	30.900	31.200	31.500	31.800	32.100	32.400	32.700	33.000
RU	(kΩ)	268.288	120.644	71.429	46.822	32.058	22.215	15.184	9.911	5.810	2.529

OUTPUT VOLTAGE ADJUSTMENT (CONTINUED)

Trim-down

Single Output



□□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)	69.470	31.235	18.490	12.117	8.294	5.745	3.924	2.559	1.497	0.647

□□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)	45.533	20.612	12.306	8.152	5.660	3.999	2.812	1.922	1.230	0.676

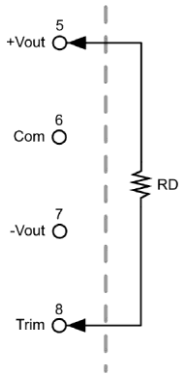
□□S12W

△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)	460.990	207.95	123.6	81.423	56.118	39.249	27.199	18.162	11.132	5.509

□□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)	499.82	223.41	131.27	85.204	57.563	39.136	25.974	16.102	8.424	2.282

Dual Output



□□D05/ □□D05W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	9.900	9.800	9.700	9.600	9.500	9.400	9.300	9.200	9.100	9.000
RD	(kΩ)	109.297	48.998	28.899	18.849	12.819	8.799	5.928	3.775	2.100	0.760

□□D12/ □□D12W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	23.760	23.520	23.280	23.040	22.80	22.560	22.320	22.080	21.840	21.600
RD	(kΩ)	273.442	123.016	72.874	47.803	32.760	22.732	15.568	10.196	6.017	2.675

□□D15/ □□D15W

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	29.700	29.400	29.100	28.800	28.500	28.200	27.900	27.600	27.300	27.000
RD	(kΩ)	337.712	152.022	90.126	59.178	40.609	28.230	19.387	12.756	7.598	3.471