



P-DUKE POWER

LED15 Series

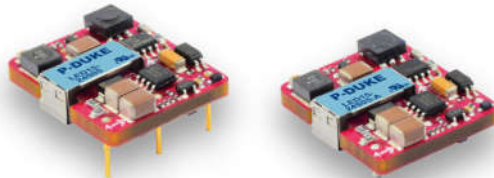
DC-DC Converter
Up to 15 Watts

3

YEARS
WARRANTY

ROHS
COMPLIANT

REACH
COMPLIANT



Automation



Datacom



IPC



Industry



Measurement



Telecom



Automobile



Boat



Charger



Medical



PV



Railway



2250
VDC
Isolation
Voltage

2 : 1
Input
Range

NO
Min. Load
Required

REMOTE
ON
OFF

OCP

OVP

SCP

UVP

PART NUMBER STRUCTURE

LED15 -

48

S

05

-

A

R

Series Name

Input
Voltage
(VDC)

Output
Quantity

Output
Voltage
(VDC)

Option

Conformal Coating
Option

24: 18~36
48: 36~75

S: Single

3P3: 3.3
05: 5
12: 12
15: 15

□: Negative logic remote ON/OFF with DIP(Standard)
A: Negative logic remote ON/OFF with SMD
B: Positive logic remote ON/OFF with DIP
C: Positive logic remote ON/OFF with SMD
D: DIP type without Ctrl pin
E: SMD type without Ctrl pin
F: DIP type, negative logic remote ON/OFF without Trim pin
G: SMD type, negative logic remote ON/OFF without Trim pin
H: DIP type without Ctrl & Trim pin
I: SMD type without Ctrl & Trim pin
J: DIP type, positive logic remote ON/OFF without Trim pin
K: SMD type, positive logic remote ON/OFF without Trim pin

□: None
R: Conformal Coating

TECHNICAL SPECIFICATION All specifications are typical at nominal input, full load and 25°C 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
LED15-24S3P3	18 ~ 36	3.3	3500	20	86	10000
LED15-24S05	18 ~ 36	5	3000	20	87	6000
LED15-24S12	18 ~ 36	12	1250	15	87	1000
LED15-24S15	18 ~ 36	15	1000	15	88	660
LED15-48S3P3	36 ~ 75	3.3	3500	15	85	10000
LED15-48S05	36 ~ 75	5	3000	15	87	6000
LED15-48S12	36 ~ 75	12	1250	10	87	1000
LED15-48S15	36 ~ 75	15	1000	10	88	660

INPUT SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Operating input voltage range	24Vin(nom) 48Vin(nom)		18 36	24 48	36 75	VDC
Start up voltage	24Vin(nom) 48Vin(nom)				18 36	VDC
Shutdown voltage	24Vin(nom) 48Vin(nom)		13 28.5	14.5 30.5	16 33	VDC
Start up time	Constant resistive load	Power up Remote ON/OFF			30 30	ms
Input surge voltage	100ms, max.	24Vin(nom) 48Vin(nom)			50 100	VDC
Remote ON/OFF	Referred to -Vin pin	Positive logic DC-DC ON (Option) DC-DC OFF Negative logic DC-DC ON (Standard) DC-DC OFF Input current of Ctrl pin Remote off input current	-0.5		Open or 3 ~ 15VDC Short or 0 ~ 1.2VDC Short or 0 ~ 1.2VDC Open or 3 ~ 15VDC 1.0 20	mA 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	No Load to Full Load		-0.2		+0.2	%
Voltage adjustability			-10		+10	%
Ripple and noise	Measured by 20MHz bandwidth With a 1μF M/C X7R and a 10μF T/C	3.3Vout, 5Vout 12Vout, 15Vout		75 100		mVp-p
Temperature coefficient			-0.02		+0.02	%/°C
Transient response recovery time	25% load step change, ΔIo/Δt=0.1A/us			300		μs
Over voltage protection		3.3Vout 5Vout 12Vout 15Vout	3.7 5.6 13.5 16.8		5.4 7.0 19.6 20.5	VDC
Over load protection	% of Iout rated; Hiccup mode				150	%
Output voltage overshoot				3		%
Short circuit protection			Continuous, automatics recovery			

GENERAL SPECIFICATIONS

Parameter	Conditions	Min.	Typ.	Max.	Unit
Isolation voltage	1 minute Input to Output	2250			VDC
Isolation resistance	500VDC	10			MΩ
Isolation capacitance			1000		pF
Switching frequency	3.3Vout, 5Vout 12Vout, 15Vout	243 423	270 470	297 517	kHz
Safety approvals	IEC/ UL/ EN60950-1			UL:E193009 CB:UL(Demko)	
Weight				10.5g (0.36oz)	
MTBF	MIL-HDBK-217F, Full load			3.438 x 10 ⁶ hrs	

ENVIRONMENTAL SPECIFICATIONS

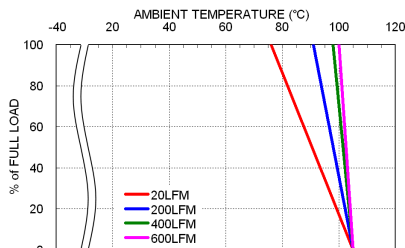
Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating ambient temperature	With derating *The power module operates in a variety of thermal environments; however, sufficient cooling should be provided to help ensure reliable operation.	-40		+105	°C
Maximum case temperature				120	°C
Storage temperature range		-55		+125	°C
Thermal shock				MIL-STD-810F	
Vibration				MIL-STD-810F	
Relative humidity				5% to 95% RH	
Lead-free reflow solder process	Only for SMD type			IPC J-STD-020E	
Moisture sensitivity level(MSL)	Only for SMD type			IPC J-STD-033C Level 2a	

EMC SPECIFICATIONS

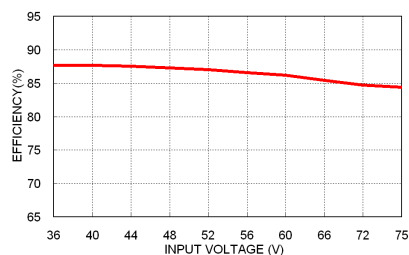
Parameter	Conditions	Level
EMI	EN55032 With external components	Class A, Class B
Radiated immunity	EN61000-4-3 10 V/m	Perf. Criteria A
Fast transient	EN61000-4-4 ± 2kV	Perf. Criteria B
Surge	EN61000-4-5 With an external input filter capacitor (Nippon chemi-con KY series, 220μF/100V) ± 1kV With an external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

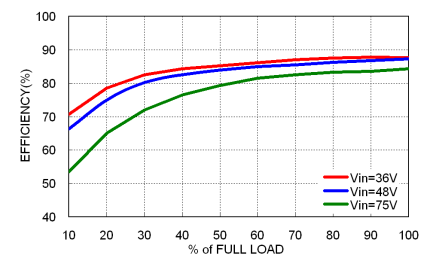
CHARACTERISTIC CURVE



LED15-48S05 Derating Curve



LED15-48S05 Efficiency vs. Input Voltage



LED15-48S05 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.

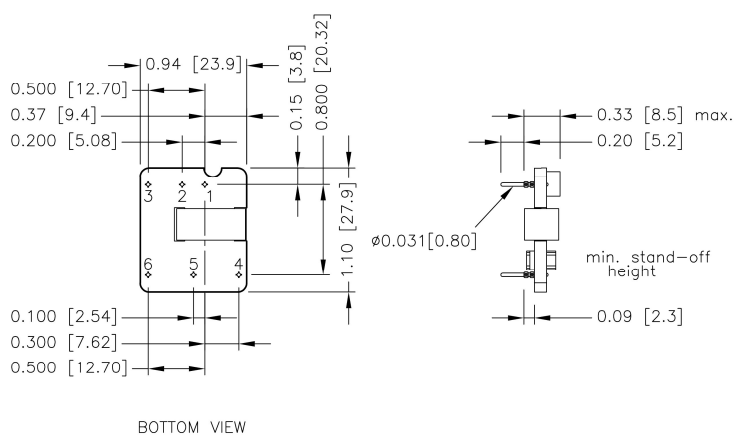
The input line fuse suggest as below :

Model	Fuse Rating (A)	Fuse Type
LED15-24□□□	1.6	Slow-Blow
LED15-48□□□	1.0	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

DIP TYPE

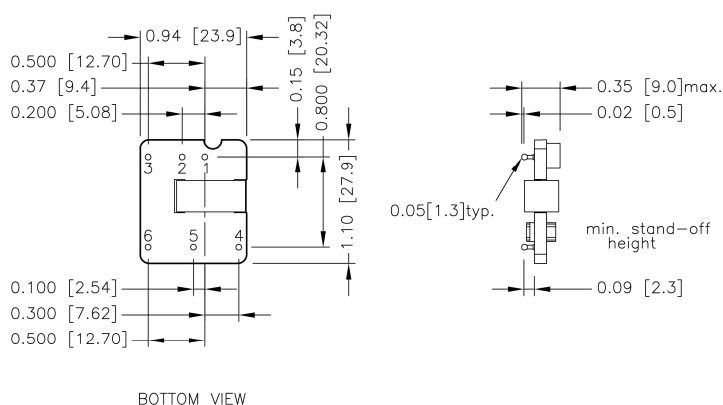


PIN CONNECTION

PIN	DEFINE
1	+Vin
2	-Vin
3	Ctrl
4	+Vout
5	Trim
6	-Vout

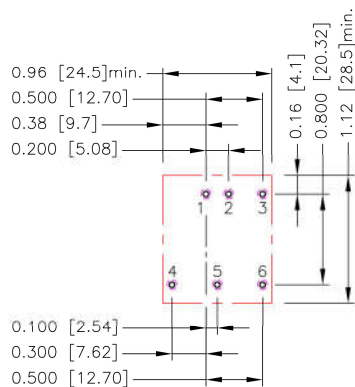
1. All dimensions in inch [mm]
2. Tolerance : $x.xx \pm 0.02$ [$x.x \pm 0.5$]
 $x.xxx \pm 0.01$ [$x.xx \pm 0.25$]
3. Pin dimension tolerance ± 0.004 [0.10]

SMD TYPE



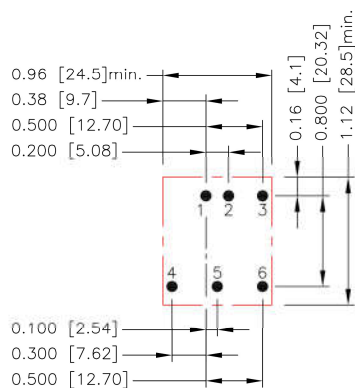
RECOMMENDED PAD LAYOUT

DIP TYPE



All dimensions in inch[mm]
 Pad size(lead free recommended)
 Through hole 1.2.3.4.5.6: $\Phi 0.043$ [1.10]
 Top view pad 1.2.3.4.5.6: $\Phi 0.054$ [1.38]
 Bottom view pad 1.2.3.4.5.6: $\Phi 0.087$ [2.20]

SMD TYPE



All dimensions in inch[mm]
 Pad size(lead free recommended)
 Top view pad: $\Phi 0.091$ [2.30]

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.

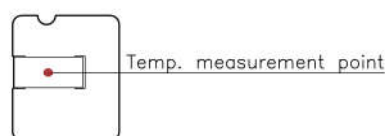
Proper cooling can be verified by measuring the point as the figure below.

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 +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

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

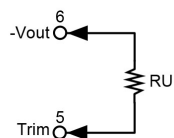
Trim Down Equation

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

EXTERNAL OUTPUT TRIMMING

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

Trim-up



Trim constants

Module	G	H	K	L
LED15-□□S3P3	5110	2050	0.8	2.5
LED15-□□S05	5110	2050	2.5	2.5
LED15-□□S12	10000	5110	9.5	2.5
LED15-□□S15	10000	5110	12.5	2.5

□□S3P3

ΔV (%)	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

□□S05

ΔV (%)	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

□□S12

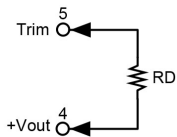
ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	12.120	12.240	12.360	12.480	12.600	12.720	12.840	12.960	13.080	13.200
RU (kΩ)	203.223	99.057	64.334	46.973	36.557	29.612	24.652	20.932	18.038	15.723

□□S15

ΔV (%)	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

OUTPUT VOLTAGE ADJUSTMENT(CONTINUED)

Trim-down



□□S3P3

ΔV (%)	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 (k Ω)	116.719	54.779	34.133	23.810	17.616	13.486	10.537	8.325	6.604	5.228

□□S05

ΔV (%)	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 (k Ω)	248.340	120.590	78.007	56.715	43.940	35.423	29.340	24.778	21.229	18.390

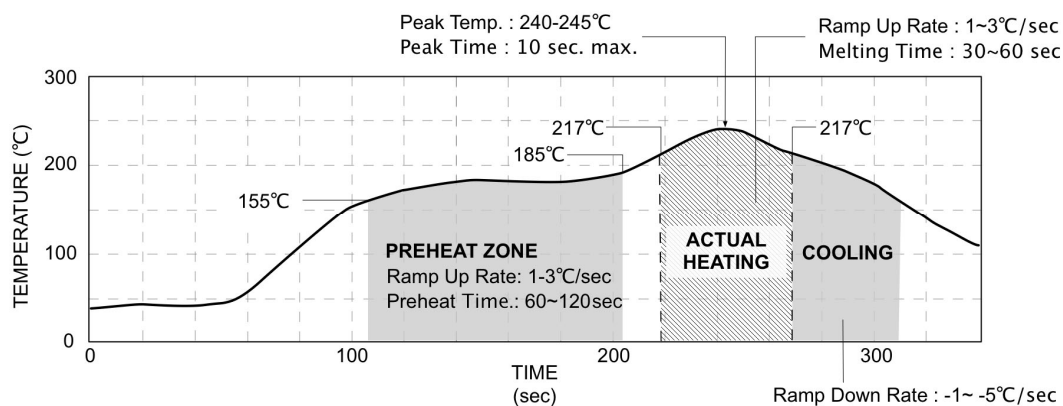
□□S12

ΔV (%)	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 (k Ω)	776.557	380.723	248.779	182.807	143.223	116.834	97.985	83.848	72.853	64.057

□□S15

ΔV (%)	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 (k Ω)	818.223	401.557	262.668	193.223	151.557	123.779	103.938	89.057	77.483	68.223

LEAD FREE REFLOW PROFILE For SMD Type



*The curves define the maximum peak reflow temperature permissible measured on pin1 or Vin pin.