P-DUKE POWER

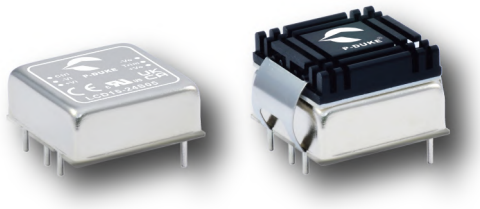
LCD15 Series

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

1600 VDC Isolation Voltage | 2 : 1 Input Range | 6 sided Shielding | NO Min. Load Required | REMOTE ON OFF | OCP | OVP | SCP | UVP

PART NUMBER STRUCTURE

LCD15 - 48 S 05 - A HC

Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Remote ON/OFF & Trim Options	Assembly Options
	12:9~18 **24:**18~36 **48:**36~75	**S:**Single	**3P3:**3.3 **05:**5 **12:**12 **15:**15 **24:**24	□: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	**05:**±5 **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
LCD15-12S3P3	9 ~ 18	3.3	4000	120	84	12000
LCD15-12S05	9 ~ 18	5	3000	90	88	6000
LCD15-12S12	9 ~ 18	12	1300	30	86	1000
LCD15-12S15	9 ~ 18	15	1000	30	88	660
LCD15-12S24	9 ~ 18	24	625	12	90	200
LCD15-12D05	9 ~ 18	±5	±1500	30	85	±3000
LCD15-12D12	9 ~ 18	±12	±625	30	87	±520
LCD15-12D15	9 ~ 18	±15	±500	30	88	±330
LCD15-12D24	9 ~ 18	±24	±315	17	90	±100
LCD15-24S3P3	18 ~ 36	3.3	4000	50	86	12000
LCD15-24S05	18 ~ 36	5	3000	65	88	6000
LCD15-24S12	18 ~ 36	12	1300	20	87	1000
LCD15-24S15	18 ~ 36	15	1000	20	88	660
LCD15-24S24	18 ~ 36	24	625	10	90	200
LCD15-24D05	18 ~ 36	±5	±1500	15	85	±3000
LCD15-24D12	18 ~ 36	±12	±625	15	88	±520
LCD15-24D15	18 ~ 36	±15	±500	25	88	±330
LCD15-24D24	18 ~ 36	±24	±315	12	90	±100
LCD15-48S3P3	36 ~ 75	3.3	4000	25	86	12000
LCD15-48S05	36 ~ 75	5	3000	35	88	6000
LCD15-48S12	36 ~ 75	12	1300	12	88	1000
LCD15-48S15	36 ~ 75	15	1000	12	88	660
LCD15-48S24	36 ~ 75	24	625	10	91	200
LCD15-48D05	36 ~ 75	±5	±1500	12	85	±3000
LCD15-48D12	36 ~ 75	±12	±625	15	89	±520
LCD15-48D15	36 ~ 75	±15	±500	20	88	±330
LCD15-48D24	36 ~ 75	±24	±315	10	91	±100

INPUT SPECIFICATIONS

Parameter	Conditions		Min.	Typ.	Max.	Unit
Operating input voltage range		12Vin(nom)	9	12	18	VDC
		24Vin(nom)	18	24	36	
		48Vin(nom)	36	48	75	
Start up voltage		12Vin(nom)			9	VDC
		24Vin(nom)			18	
		48Vin(nom)			36	
Shutdown voltage		12Vin(nom)	7	8	8.8	VDC
		24Vin(nom)	14.5	15.5	17.5	
		48Vin(nom)	32	33.5	35	
Start up time	Constant resistive load	Power up			30	ms
		Remote ON/OFF			30	
Input surge voltage	100ms, max.	12Vin(nom)			36	VDC
		24Vin(nom)			50	
		48Vin(nom)			100	
Input filter				Pi type		
Remote ON/OFF	Referred to –Vin pin	Positive logic (Option) DC-DC ON		Open or 3 ~ 15VDC		
		Positive logic (Option) DC-DC OFF		Short or 0 ~ 1.2VDC		
		Negative logic (Standard) DC-DC ON		Short or 0 ~ 1.2VDC		
		Negative logic (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	
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					
		Single				
	With a 1μF M/C X7R and a 10μF T/C	3.3Vout, 5Vout		75		mVp-p
	With a 1μF M/C X7R and a 10μF T/C	12Vout,15Vout		100		
	With a 6.8μF/50V X7R MLCC	24Vout		100		
		Dual				
	With a 4.7μF/50V X7R MLCC for each output	24Vout		100		
	With a 1μF M/C X7R and a 10μF T/C for each output	others		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	
		24Vout	29.1		32.5	
Over load protection	% of Iout rated; Hiccup mode			150		%
Short circuit protection			Continuous, automatics recovery			

GENERAL SPECIFICATIONS

Parameter	Conditions		Min.	Typ.	Max.	Unit
Isolation voltage	1 minute	Input to Output	1600			VDC
		Input(Output) to Case	1000			
Isolation resistance	500VDC		1			GΩ
Isolation capacitance					1000	pF
Switching frequency			360	400	440	kHz
Safety approvals	IEC /EN/ UL 62368-1				UL:E193009 CB:UL(Demko)	
Case material					Nickel-coated copper	
Base material					FR4 PCB	
Potting material					Epoxy (UL94 V-0)	
Weight					15g (0.53oz)	
MTBF	MIL-HDBK-217F, Full load				1.600×10^6 hrs	

ENVIRONMENTAL SPECIFICATIONS

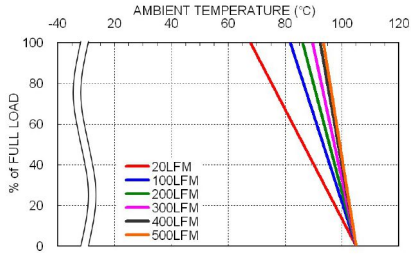
Parameter	Conditions		Min.	Typ.	Max.	Unit
Operating ambient temperature		With derating	-40		+105	℃
Maximum case temperature					105	℃
Storage temperature range			-55		+125	℃
Thermal impedance		Without heat-sink		18.2		℃/W
		With heat-sink		15.8		
Thermal shock					MIL-STD-810F	
Vibration					MIL-STD-810F	
Relative humidity					5% to 95% RH	

EMC SPECIFICATIONS

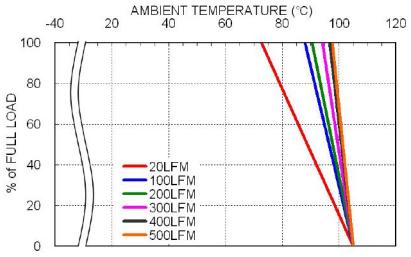
Parameter	Conditions		Level
EMI	EN55032	With external components	Class A, Class B
EMS	EN55024		
ESD	EN61000-4-2	Air ± 8kV and Contact ± 6kV	Perf. Criteria A
Radiated immunity	EN61000-4-3	10 V/m	Perf. Criteria A
Fast transient	EN61000-4-4	± 2kV With an external input filter capacitor (Nippon chemi-con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

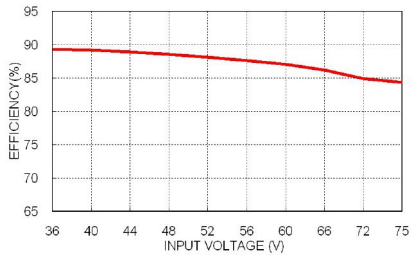
CHARACTERISTIC CURVE



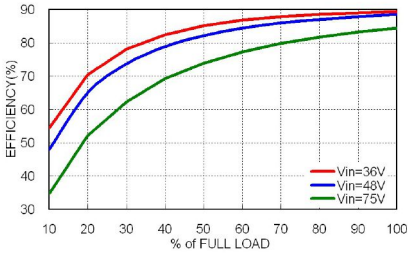
LCD15-48S05 Derating Curve



LCD15-48S05 Derating Curve With Heat-sink



LCD15-48S05 Efficiency vs. Input Voltage



LCD15-48S05 Efficiency vs. Output Load

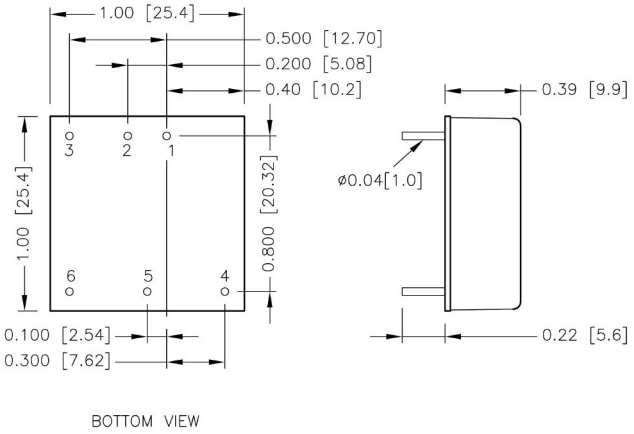
FUSE CONSIDERATION

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
LCD15-12S□□、LCD15-12D□□	3.15	Slow-Blow
LCD15-24S□□、LCD15-24D□□	1.6	Slow-Blow
LCD15-48S□□、LCD15-48D□□	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

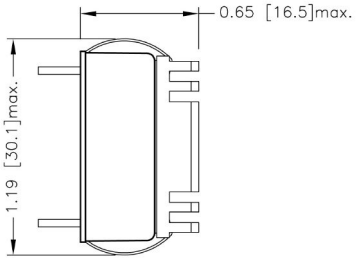
PIN CONNECTION

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]
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

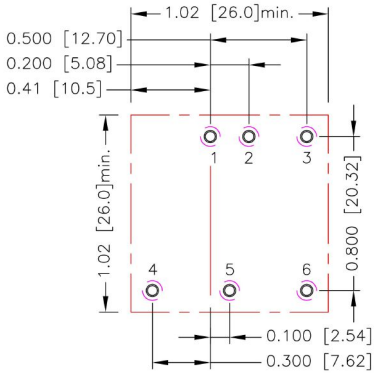
-HC (Heat-sink with clamps)



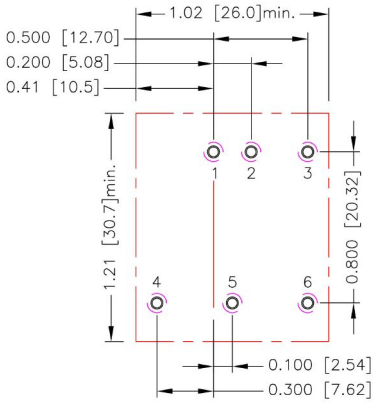
* All dimensions in inch [mm]

RECOMMENDED PAD LAYOUT

Standard



-HC

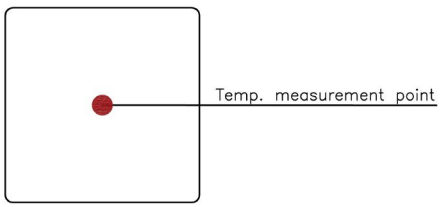


All dimensions in inch[mm]
Pad size(lead free recommended)
Through hole 1.2.3.4.5.6: Φ0.051[1.30]
Top view pad 1.2.3.4.5.6: Φ0.064[1.63]
Bottom view pad 1.2.3.4.5.6: Φ0.102[2.60]

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 “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

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

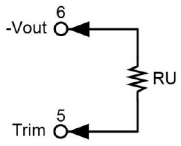
■ Trim constants

Module	G	H	K	L
LCD15-□□S3P3	5110	2050	0.8	2.5
LCD15-□□S05	5110	2050	2.5	2.5
LCD15-□□S12	10000	5110	9.5	2.5
LCD15-□□S15	10000	5110	12.5	2.5
LCD15-□□S24	56000	13000	21.5	2.5

EXTERNAL OUTPUT TRIMMING

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

Trim-up



□□S3P3

△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

□□S05

△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

□□S12

△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

□□S15

△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

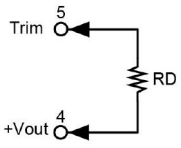
□□S24

△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



□□S3P3

△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

□□S05

△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

□□S12

△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

□□S15

△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

□□S24

△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

P-DUKE

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