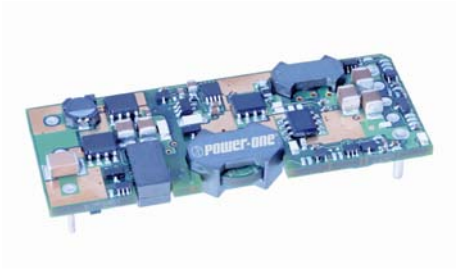
E2S Series – Eighth-Brick DC/DC Converter
48V Input **Data Sheet**
5.0V, 3.3V, 2.5V, 2.0V, 1.8V, 1.5V, 1.2V Output



Applications

Distributed power architectures
Telecommunications equipment
LAN/WAN applications
Data processing applications

Features

Low profile (<8.5mm)
2000 VDC input to output isolation meets basic insulation
High efficiency
Start-up into high capacitive load
Low conducted and radiated EMI
Output overcurrent protection
Output overvoltage protection
Overtemperature protection
Back drive protection
Remote sense
Set point accuracy 1%
Remote on/off (primary referenced), positive or negative logic
Output voltage trim adjust
UL 1950 Recognized, CSA 22.2 No. 950-95 certified, TUV IEC950

Description

The new E2S15 series of single-output DC/DC converters, offer unprecedented density and performance in an eighth brick, which is 40% smaller than the traditional quarter-brick footprint. Patent pending technology combined with thermally optimized construction allows the E2S15 to provide 15A of output current in an 8.5mm package without a heatsink. And the E2S15 series requires minimal derating to operating in high ambient temperatures. The 100% surface mount design provides consistent high quality and reliability and the SMT mounting option eliminates the need for separate (additional manual) operations to mount the converters to the motherboards during mass production.

Selection Chart						
Model	**Input Voltage Range, VDC**	**Input Current, Max, ADC**	**Output Voltage, VDC**	**Output Rated Current, I rated ADC**	**Output Ripple / Noise, Typ, mV p-p**	**Efficiency @ I rated, Typical, %**
E2S15ZY	36-75	0.62	1.2	15	30	81.5
E2S15ZA	36-75	0.77	1.5	15	30	83.5
E2S15ZB	36-75	0.9	1.8	15	30	84.5
E2S15ZC	36-75	1.0	2.0	15	30	85.5
E2S15ZD	36-75	1.2	2.5	15	30	87
E2S15ZE	36-75	1.60	3.3	15	30	88
E2S10ZG	36-75	1.65	5.0	10	30	86

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings may cause performance degradation, adversely effect long-term reliability, and cause permanent damage to the converter.

Parameter	Conditions/Description	Min	Max	Units
Input Voltage	Continuous 100 ms		75 100	VDC VDC
Operating Temperature	Ambient	-40	85	C
Storage Temperature		-55	125	C
ON/OFF Control Voltage	Referenced to -Vin		20	VDC

Environmental and Mechanical Specifications

All specifications apply over specified input voltage, output load, and temperature range, unless otherwise noted.

Parameter	Conditions/Description	Min	Nom	Max	Units
Shock	Halfsine wave, 3 axes	50			g
Sinusoidal Vibration	GR-63-Core, Section 5.A.2	1			
Weight			0.53 (15)		Oz/g
Water Washing	Standard process		Yes		
MTBF	Telcordia TR-332, Method I Case 1		2.6		MHrs

Isolation Specifications

All specifications apply over specified input voltage, output load, and temperature range, unless otherwise noted.

Parameter	Conditions/Description	Min	Nom	Max	Units
Insulation Safety Rating			Basic		
Isolation Voltage		2000			VDC
Isolation Resistance		10			MOhm
Isolation Capacitance			160		pF

Input Specifications

All specifications apply over specified input voltage, output load, and temperature range, unless otherwise noted.

Parameter	Conditions/Description	Min	Nom	Max	Units
Input Voltage	Continuous	36	48	75	VDC
Turn-On Input Voltage	Ramping Up Vin= 36-75	33		35	VDC
Turn-Off Input Voltage	Ramping Down Vin = 36-75	31		33	VDC
Turn-On Time	To Output Regulation Band 100% Resistive Load		3		ms
Input Reflected Ripple Current	25MHz Bandwidth		6		$mA_{pk.pk}$
Inrush Transient	Vin=Vin.max			0.1	A^2s

Output Specifications

All specifications apply over specified input voltage, output load and temperature range, unless otherwise noted.

Parameter	Conditions/Description	Min	Nom	Max	Units
Output Voltage Setpoint Accuracy	Vin=Vin.nom, Full Load	-1		1	%Vout
Output Current		0		15	ADC
Line Regulation	Vin.min to Vin.max, Iout.max		+/- 2	+/- 5	mV
Load Regulation	Vin=Vnom, Iout.min to Iout.max		+/- 2	+/- 5	mV
Total output voltage regulation	Over all input voltage, load, and temperature conditions	-3		3	%Vout
Remote Sense Headroom***				10%	%Vout
Dynamic Regulation Peak Deviation Settling Time	50-75% load step change di/dt = 5 A/µs to 1% error band		 140 100		 mV s
Admissible Load Capacitance	Iout.max, Nom Vin			15,000	F
Output Current Limit Threshold**	Vout≤0.97Vout.nom	16.5		20	Adc
Switching Frequency			435		kHz
Over voltage Protection, Non Latching	Over all input voltage and load conditions	115	122	127	%Vout
Trim Range	Iout.max, Vin=Vnom	-20		+10	%Vout

** Overcurrent protection is non-latching with auto recovery.
*** Vout can be increased up to 10% via the sense leads or up to 10% via the trim function, however total output voltage trim from all sources should not exceed 10% of Vout (NOM) in order to insure specified operation of over-voltage protection circuitry.

Feature Specifications

All specifications apply over specified input voltage, output load, and temperature range, unless otherwise noted.

Parameter	Conditions/Description	Min	Nom	Max	Units
Shutdown (ON/OFF)					
Negative Logic	On/Off signal is low – converter is ON				
- Converter ON	Low logic range	-20		0.8	VDC
- Converter OFF	High logic range	2.4		20	VDC
Positive Logic	On/Off signal is low –converter is OFF				
- Converter ON	High logic range	2.4		20	VDC
- Converter OFF	Low logic range	-20		0.8	VDC
Overtemperature Protection (PCB)	Shut down		118		C

Output Voltage Trim

The trim feature allows the user to adjust the output voltage from the nominal value. This can be used to compensate distribution drops, perform margining in production, or accommodate other requirements when output voltage needs to be adjusted from the nominal.

The converter's output voltage (at the terminals) can be adjusted up 10% or down 20% relative to the nominal output voltage by connecting the TRIM pin to sense (+) or sense (-) via a trim resistor. The Trim pin should be left open if the trimming function is not to be used.
To trim up the output voltage, a trim resistor, RT-INCR, should be connected between TRIM (Pin 6) and SENSE(+) (Pin 7), as illustrated in Fig. 1. The trim-up resistor can be calculated from:

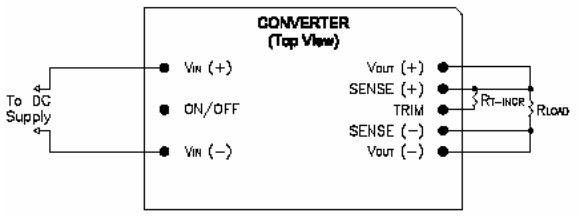


Figure 1. Output Voltage Trim-up

$$R_{T\text{-}INCR} = \frac{5.1(100+\Delta)V_{O\text{-}NOM} - 624.75}{1.225\,\Delta} - 10.2 \quad [K\Omega]$$

where,
$R_{T\text{-}INCR}$ Required value of trim-up resistor
$V_{O\text{-}NOM}$ = Nominal value of output voltage insert absolute value bars

$$\Delta = \left| \frac{V_{O\text{-}REQ} - V_{O\text{-}NOM}}{V_{O\text{-}NOM}} \right| \times 100 \quad [\%]$$

$V_{O\text{-}REQ}$ = Desired (trimmed) output voltage

When trimming up, care must be taken not to exceed the converter's maximum allowable output power.

To trim down the output voltage, a trim resistor, $R_{T\text{-}DECR}$, should be connected between TRIM (Pin 6) and SENSE(-) (Pin 5), as illustrated in Figure 2.

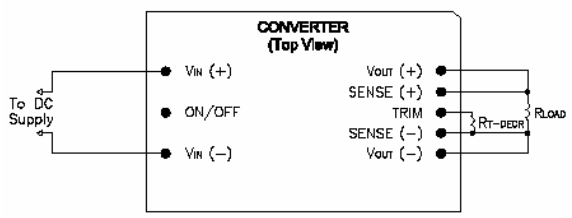


Figure 2. Output Voltage Trim-down

The trip-down resistor can be calculated from:

$$R_{T\text{-}DECR} = \frac{510}{\Delta} - 10.2 \quad [K\Omega]$$

where,
$R_{T\text{-}DECR}$ Required value of trim-down resistor and **Δ** is as defined above.

Characteristic Curves

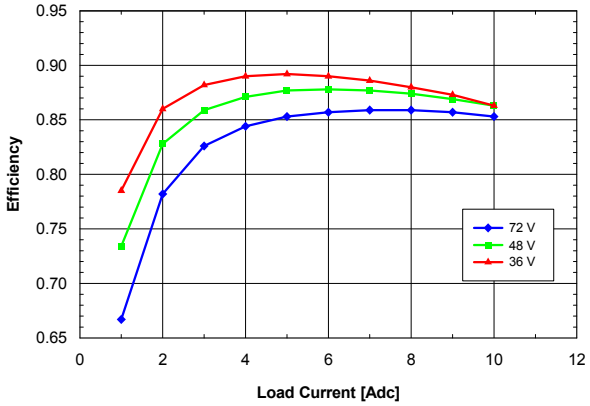


Figure 3. E2S10ZG (5.0V) Efficiency vs. Load

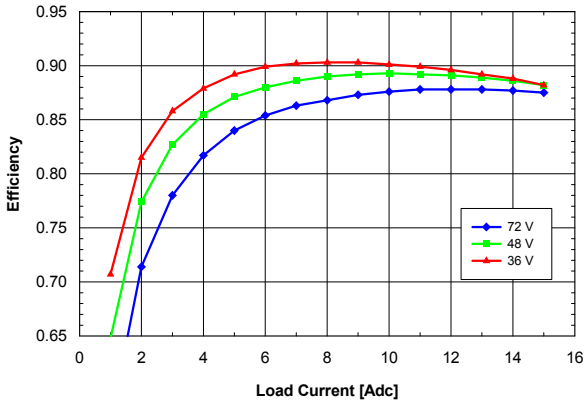


Figure 4. E2S15ZE (3.3V) Efficiency vs. Load

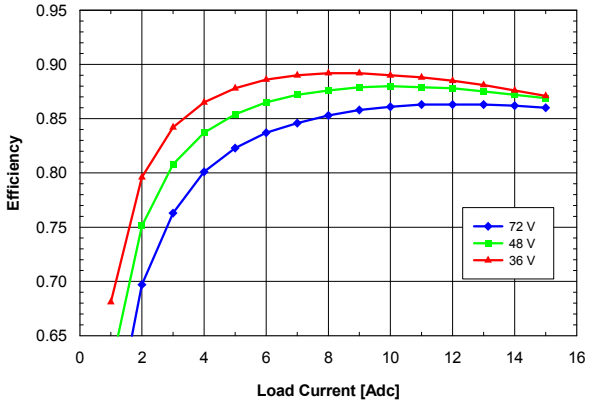


Figure 5. E2S15ZD (2.5V) Efficiency vs. Load

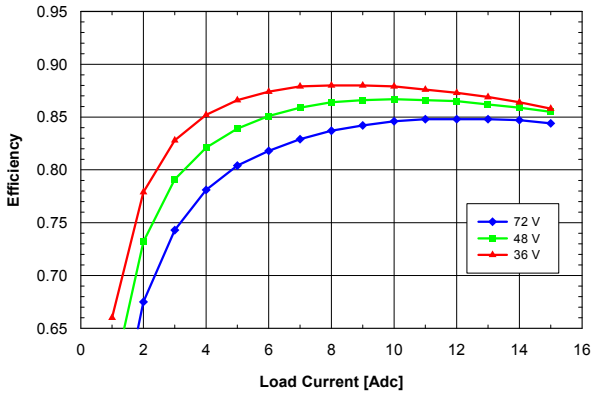


Figure 6. E2S15ZC (2.0V) Efficiency vs. Load

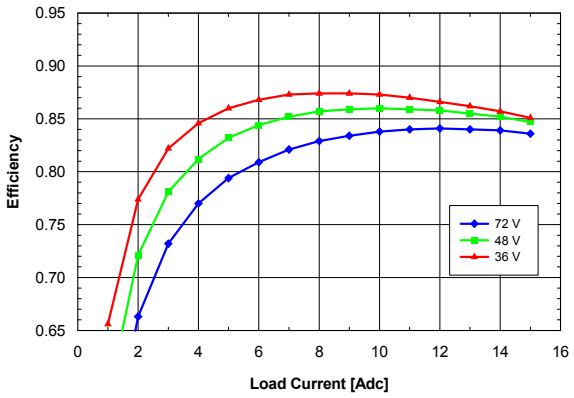


Figure 7. E2S15ZB (1.8V) Efficiency vs. Load

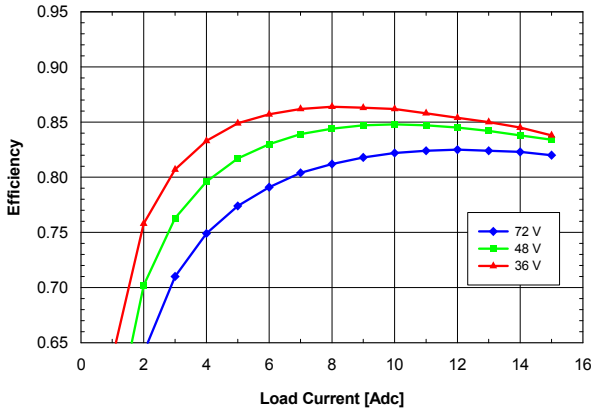


Figure 8. E2S15ZA (1.5V) Efficiency vs. Load

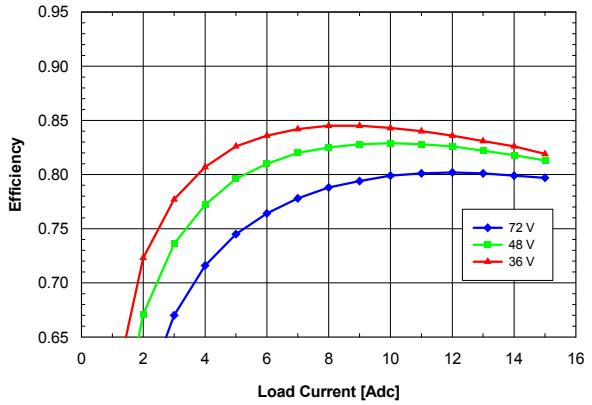


Figure 9. E2S15ZY (1.2V) Efficiency vs. Load

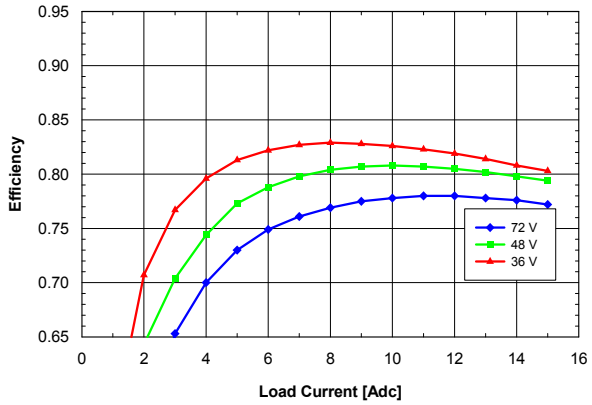


Figure 10. E2S15ZW (1.0V) Efficiency vs. Load

Thermal Considerations

The E2S15 series converters are designed for natural or forced convection cooling. The maximum allowable output power of the converters is determined by meeting the derating criteria of all electronic components used in the power supplies. An example of the derating criteria for the semiconductor junction temperature is not to exceed 120ºC to provide reliable long-term operation of the converters.

The graphs in figures. 11-18 show the maximum output current of the E2S15 series converters at different ambient temperatures under both natural and forced (airflow direction from pin1 to pin3) convection.

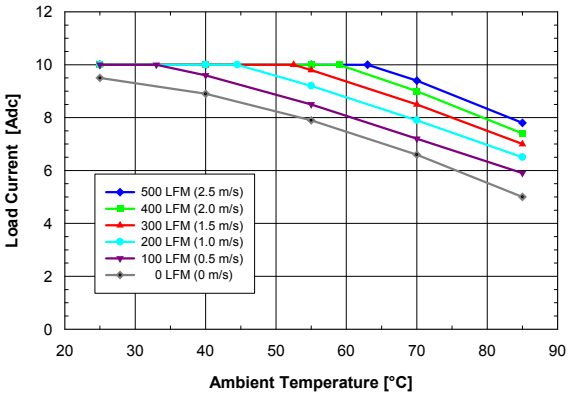


Figure 11. E2S10ZG (5.0V) Derating Curves

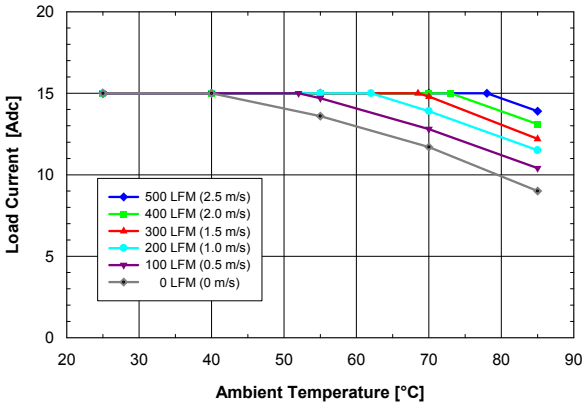


Figure 12. E2S15ZE (3.3V) Derating Curves

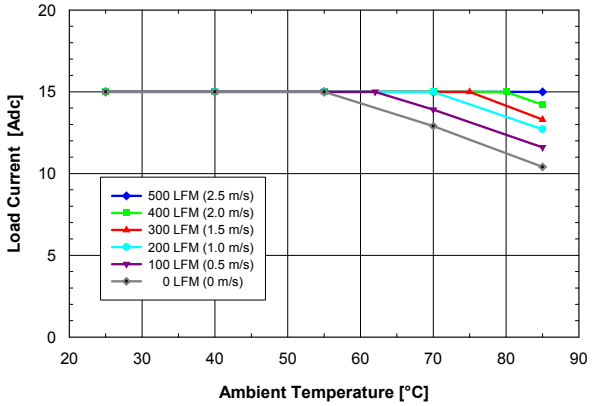


Figure 13. E2S15ZD (2.5V) Derating Curves

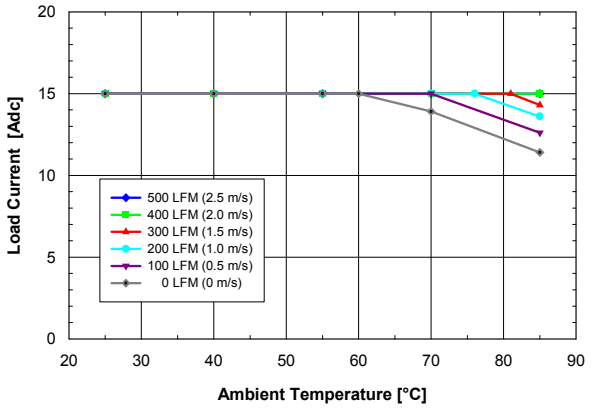


Figure 14. E2S15ZC (2.0V) Derating Curves

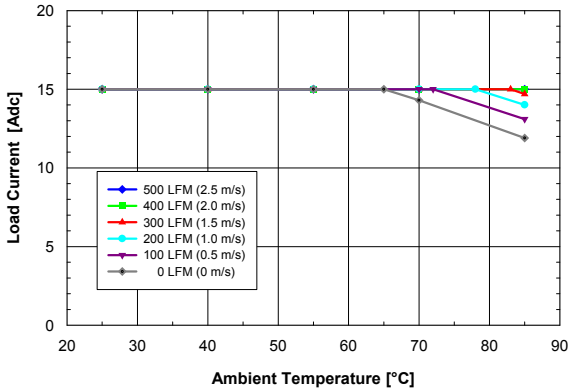


Figure 15. E2S15ZB (1.8V) Derating Curves

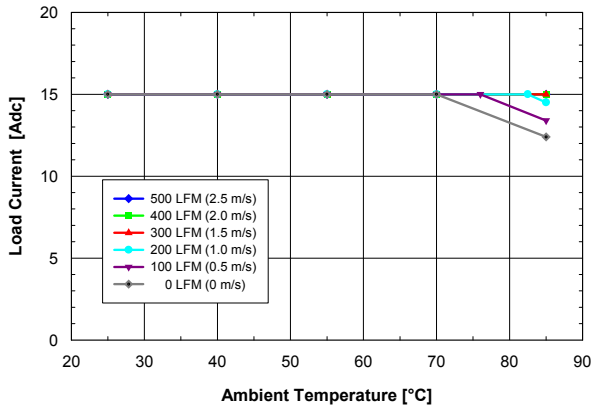


Figure 16. E2S15ZA (1.5V) Derating Curves

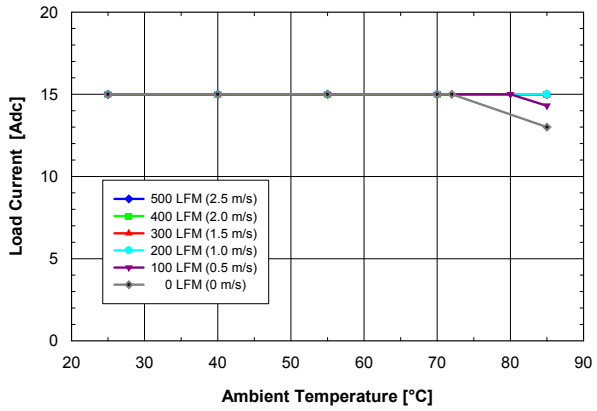


Figure 17. E2S15ZY (1.2V) Derating Curves

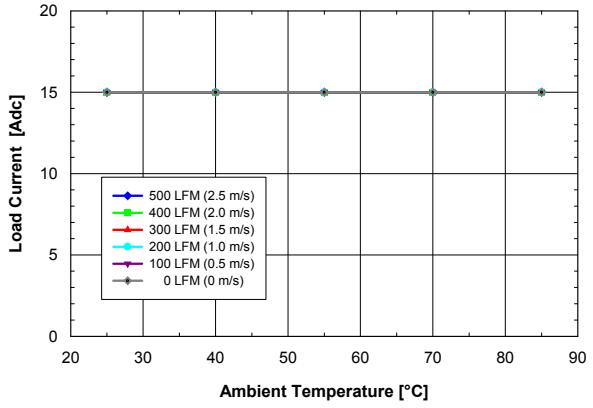
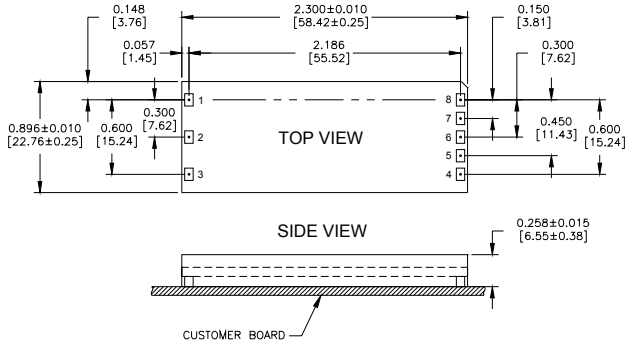


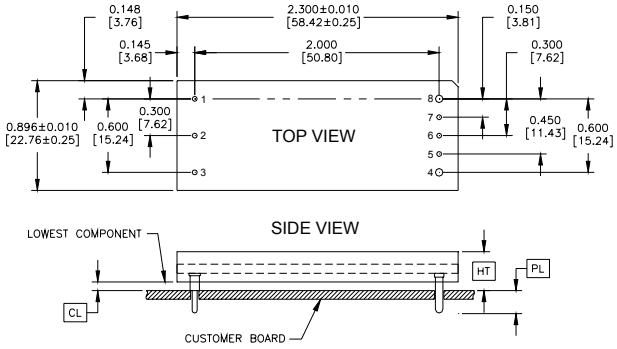
Figure 18. E2S15ZW (1.0V) Derating Curves

Min. 0.080" X 0.112" [2.03 x 2.84]
Max. 0.092" X 0.124" [2.34 x 3.15]

MECHANICAL DRAWING Inches (mm)



E2S15 Pinout (Surface Mount)



E2S15 Pinout (Through-hole)

Pad/Pin Connections	
Pad/Pin #	**Function**
1	Vin (+)
2	ON/OFF
3	Vin (-)
4	Vout (-)
5	SENSE(-)
6	TRIM
7	SENSE(+)
8	Vout (+)

Height Option	HT (Max. Height) +0.000 [0.00] - 0.038 [-0.97]	CL (Min. Clearance) +0.030 [+0.77] -0.000 [-0.00]
	0.303 [7.69]	0.030 [0.77]
C2	0.336 [8.53]	0.063 [1.60]

E2S Platform Notes

All dimensions are in inches [mm]
Connector Material: Copper
Connector Finish: Gold over Nickel
Converter Weight: 0.53 oz [15 g]
Recommended Surface-Mount Pads:

ORDERING INFORMATION

Product Series	Output Current	Input Voltage	Output Voltage 1		ON/OFF Logic	Surface Mount	Pin Length	Height Option
E2S	**15**	**Z**	**G**	**-**	**N**	**M6**		**C2**
Single Output Eighth-Brick Format	Vout1=5 Iout = 10A Vout1 < 5 Iout=15A	Z = 48Vin Nom.	G = 5.0V E = 3.3V D = 2.5V C = 2.0V B = 1.8V A = 1.5V Y = 1.2V W = 1.0V		N Negative (Blank) Positive	M6 Surface Mount (Blank) Through Hole	Blank 0.188” 7 0.145” 8 0.110” *Not valid w/M6 Option*	*See Chart Below* *Not Valid w/M6 Option*

Height, Clearance and Pin Options for Through Hole Versions

Height Option	HT (Maximum Height)	CL (Minimum Clearance)
	+0.000 [+0.00] -0.038 [- 0.97]	+0.030 [+0.77] -0.000 [- 0.00]
blank	0.303 [7.69]	0.030 [0.77]
C2	0.336 [8.53]	0.063 [1.600]
C3	0.400 [10.16]	0.127 [3.23]
C4	0.500 [12.70]	0.227 [5.77]

Pin Option	PL Pin Length
	±0.005 [±0.13]
	0.188 [4.77]
7	0.145 [3.68]
8	0.110 [2.79]

Pins 1-3 and 5-7 are ϕ 0.040" (1.02) with ϕ 0.078" (1.98) shoulder
Pins 4 and 8 are ϕ 0.062" (1.57) without shoulder

Example: E2S10ZG-NM6 indicates a 5.0V output model with Negative On/Off logic in a SMT mounting package.

Notes

1. Consult factory for the complete list of available options.
2. Power-One products are not authorized for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems without the express written consent of the respective divisional president of Power-One, Inc.
3. The appearance of products, including safety agency certifications pictured on labels, may change depending on the date manufactured. Specifications are subject to change without notice.