



- ▶ **Wide Model Line-Up**
- ▶ **Tight $\pm 0.03\%$ Line/Load Regulation**
- ▶ **Low Output Ripple & Noise**
- ▶ **Continuous Six-Sided Shielding**
- ▶ **UL 1950 Approved, File No. E140645**
- ▶ **CSA 22.2 Approved, File No. LR89494**
- ▶ **MTBF Of Over 1,300,000 Hours**

E Series

General Description

The **E** series is a family of compact, single and dual output 2W, 3W and 5W DC/DC converters specifically designed to economically deliver the reliability and performance required for board level power distribution in applications such as telecommunications equipment, data acquisition subsystems, portable instrumentation and microprocessor based systems. High performance features include 500 VDC input/output isolation, short circuit protection with automatic restart and line/load regulation as tight as $\pm 0.03\%$. All models in the series are fully approved to the latest revisions of UL 1950 and CSA 22.2.

Fifty models operate from power busses of 5, 12, 24, 28 or 48 VDC and provide output voltage levels of 5, 12, 15, ± 12 or ± 15 VDC. Standard features include an internal π filter to reduce reflected ripple current, output voltage balance of $\pm 1\%$ (for dual output units) and output ripple noise of only 20mV Pk-Pk.

All units are packaged in compact metal cases. The 2W and 3W models are packaged in miniature 2.0 x 1.0 x 0.35 inch cases and the 5W models are in 2.0 x 2.0 x 0.375 inch cases. Two industry standard pin-outs are offered for each model. Six-sided continuous shielding virtually eliminates radiated RFI/EMI.

Operation is specified over the full operating temperature range of -30°C to $+75^{\circ}\text{C}$ with no derating required. Cooling is by free-air convection.

Electrical Specifications

Input Specifications:

Input Voltage Range ⁽¹⁾	See Table 1
Input Filter	π (Pi) Network
Fault Mode Current	150% of Full Load Current
Reflected Ripple Current	See Model Selection Guide
Reverse Polarity Input Current	5A, Max.

Output Specifications:

Output Voltage and Current ⁽²⁾	See Model Selection Guide
Output Voltage Accuracy;	
2W, 3W Models	$\pm 5\%$, Max.
5W, Single Output Models	$\pm 3\%$
5W, Dual Output Models	$\pm 2\%$

Voltage Balance (Dual Outputs) ⁽³⁾;

2W, 3W Models	$\pm 3\%$
5W Models	$\pm 1\%$

Ripple & Noise (20 MHz BW) ⁽⁴⁾;

2W, 3W Models	15 mV Pk-Pk
5W Models	20 mV Pk-Pk

Line Regulation ⁽⁵⁾;

2W, 3W Models	$\pm 0.3\%$
5W, Single Output Models	$\pm 0.3\%$, Max.
5W Dual Output Models	$\pm 0.03\%$, Max.

Load Regulation ⁽⁶⁾;

2W, 3W Models	$\pm 0.3\%$
5W, Single Output Models	$\pm 0.3\%$, Max.
5W, Dual Output Models	$\pm 0.03\%$, Max.

Transient Recovery Time

	200 μSec , Max.
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Overshoot ⁽⁷⁾;

5W Models (10% to 90% of load)	$\pm 0.1\%$
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Temperature Coefficient @ FL

	$\pm 0.01\%/^{\circ}\text{C}$
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Warm-up Drift @ FL (30 min.)

	$\pm 0.2\%$
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Short Circuit Protection;

2W & 3W Models	Continuous
5W, Single Output Models	Continuous
5W, Dual Output Models	Short Term
Short Circuit Restart	Automatic

General Specifications:

Efficiency ⁽⁸⁾	See Model Selection Guide
Isolation Voltage (1 min.)	500 VDC, Min.
Isolation Resistance	$10^9 \Omega$
Isolation Capacitance	70 pF
CM Current Noise (20 MHz BW)	<1.5 mA Pk-Pk
Switching Frequency	100 kHz

Environmental Specifications:

Operating Temperature Range (Ambient)	-30°C to $+75^{\circ}\text{C}$
Storage Temperature Range	-40°C to $+125^{\circ}\text{C}$
Derating	None Required
Cooling ⁽⁹⁾	Free-air Convection

Physical Characteristics:

Size; 2W, 3W Models	2 x 1 x 0.35 inches, (51 x 25.5 x 8.96mm)
5W Models	2 x 2 x 0.375 inches (51 x 51 x 9.52mm)
Weight; 2W, 3W Models	1.5 Oz (39.25g)
5W Models	2.6 Oz (68g)
Case Material	Metal, Black Coated
Shielding Connection;	
Single Output Models	To Negative (-) Output
Dual Output Models	To Output Common

Reliability Specifications:

MTBF; Ground Benign, @ $+25^{\circ}\text{C}$ Ambient ⁽¹⁰⁾ ;	
2W, 3W Models	1,655,000 Hours
5W Models	1,311,000 Hours

Typical Applications:

- ▶ Telecommunications Equipment
- ▶ Mobile/Battery Driven Equipment
- ▶ Distributed Power Networks
- ▶ Data Acquisition Subsystems
- ▶ General Purpose Board Level DC/DC Converter

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E Series

UL 1950 and CSA 22.2 APPROVED
2W, 3W and 5W, Single and Dual Output
Tightly Regulated DC/DC CONVERTERS

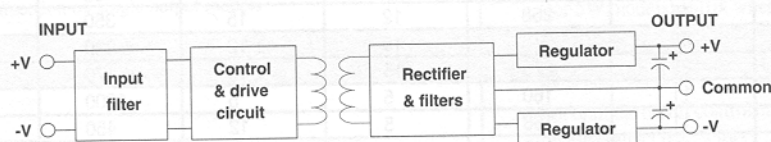
Specification Notes

1. Any voltage greater than the specified maximum input range may cause damage to the electrolytic capacitors of the Pi filter network (located in parallel with the input protection circuits).
 2. Total output power should not exceed the specified output ratings for any particular model.
 3. Voltage balance is specified with balanced loads applied. The outputs of dual output units may be operated with unbalanced loads. Care must be taken not to exceed the maximum limits of the individual outputs or the overall power ratings of the module. Operating outputs in an unbalanced state may affect some specifications such as output accuracy.
 For more information on applying a specific model, please contact the factory.
 4. These units operate as complete converters with no need for external components. However, in some noise sensitive analog applications it is recommended that a 15 μ F - 25V tantalum electrolytic capacitor be placed in parallel with a 0.1 μ F ceramic capacitor as close to the load as possible. This will reduce the converter output ripple to approximately 5 mV Pk-Pk.
 5. Line regulation is measured by monitoring the output voltage while the module input voltage is varied from low line to high line.
 6. Load regulation is measured at nominal input voltage while the output load is varied from no load to full load. Dual output models are loaded equally.
 7. Overshoot is measured for a step load change of 10% to 90%.
 8. Efficiency is specified for nominal input voltage line and full output load.
 9. Free-air convection cooling requires that the application be properly ventilated. Using a converter in a sealed application, or one in which air movement is severely restricted, could cause thermal runaway. The use of a ground plane under the converter is recommended for heat sinking and to reduce EMI.
 10. MTBF is calculated per MIL-HDBK-217F.
- * For information on the standard conditions and methods used or approved by CDI to test DC/DC converter parameters, see the application note "Testing DC/DC converters" on page 92.

Table 1 - Input Voltage Ranges vs Rated Output Load

Nominal Input (VDC)	Input Voltage Range (VDC) at:			
	20% Load	40% Load	60% Load	100% Load
5	4.30 - 6.00	4.40 - 5.70	4.55 - 5.60	4.65 - 5.25
12	10.3 - 15.0	10.4 - 14.6	10.60 - 13.60	10.90 - 13.20
24	20.4 - 30.0	20.6 - 29.0	21.00 - 27.00	21.60 - 26.40
28	24.2 - 36.0	24.5 - 34.0	24.90 - 31.80	25.20 - 30.80
48	41.3 - 60.0	42.0 - 58.0	42.30 - 54.40	43.20 - 52.80

Simplified Block Diagram (2 & 3 Watt E Series)



Model Selection Guide for 2/3W

Model Number	Input				Output		Efficiency @FL (%)	Case Style
	Nominal Voltage (VDC)	Current (mA)		Reflected Ripple (mA P-P)	Voltage (VDC)	Current (mA)		
		No-Load	Full-Load					
205S5E	5	100	720	30	5	400	55	D or D1
312S5E	5	100	1130	30	12	250	53	D or D1
315S5E	5	60	1030	30	15	200	58	D or D1
212D5E	5	100	660	30	± 12	± 100	72	D
315D5E	5	140	910	30	± 15	± 100	66	D
205S12E	12	30	290	10	5	400	58	D or D1
312S12E	12	20	450	10	12	250	56	D or D1
315S12E	12	20	410	10	15	200	61	D or D1
212D12E	12	30	327	10	± 12	± 100	61	D
315D12E	12	30	403	10	± 15	± 100	62	D
205S24E	24	15	130	7	5	400	64	D or D1
312S24E	24	20	205	7	12	250	61	D or D1
315S24E	24	20	200	7	15	200	62	D or D1
212D24E	24	25	163	7	± 12	± 100	61	D
315D24E	24	25	201	7	± 15	± 100	62	D
205S28E	28	15	110	6	5	400	65	D or D1
312S28E	28	20	178	6	12	250	60	D or D1
315S28E	28	20	175	5	15	200	61	D or D1
212D28E	28	25	140	6	± 12	± 100	61	D
315D28E	28	25	173	6	± 15	± 100	62	D
205S48E	48	15	80	5	5	400	52	D or D1
312S48E	48	15	104	5	12	250	60	D or D1
315S48E	48	15	102	5	15	200	61	D or D1
212D48E	48	13	79	5	± 12	± 100	63	D
315D48E	48	13	99	5	± 15	± 100	63	D

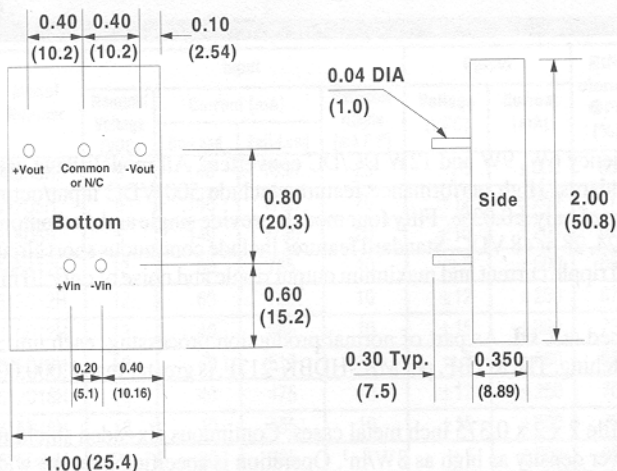
Model Selection Guide for 5W

Model Number	Input				Output		Efficiency @FL (%)	Case Style
	Nominal Voltage (VDC)	Current (mA)		Reflected Ripple (mA P-P)	Voltage (VDC)	Current (mA)		
		No-Load	Full-Load					
505S5E	5	90	1500	30	5	1000	67	A or A1
512S5E	5	80	1650	30	12	450	65	A or A1
515S5E	5	70	1580	30	15	350	66	A or A1
512D5E	5	132	1650	40	± 12	± 220	63	A or A1
515D5E	5	132	1500	40	± 15	± 170	68	A or A1
505S12E	12	40	600	15	5	1000	69	A or A1
512S12E	12	40	750	15	12	450	60	A or A1
515S12E	12	40	625	15	15	350	70	A or A1
512D12E	12	70	653	30	± 12	± 220	65	A or A1
515D12E	12	60	600	30	± 15	± 170	71	A or A1
505S24E	24	20	360	12	5	1000	70	A or A1
512S24E	24	20	360	12	12	450	67	A or A1
515S24E	24	20	312	12	15	350	70	A or A1
512D24E	24	30	320	15	± 12	± 220	66	A or A1
515D24E	24	30	300	15	± 15	± 170	71	A or A1
505S28E	28	20	255	12	5	1000	70	A or A1
512S28E	28	15	287	12	12	450	67	A or A1
515S28E	28	15	268	12	15	350	70	A or A1
512D28E	28	28	275	15	± 12	± 220	68	A or A1
515D28E	28	28	275	15	± 15	± 170	66	A or A1
505S48E	48	11	160	5	5	1000	70	A or A1
512S48E	48	11	168	5	12	450	67	A or A1
515S48E	48	11	156	5	15	350	70	A or A1
512D48E	48	15	160	10	± 12	± 220	69	A or A1
515D48E	48	15	160	10	± 15	± 170	67	A or A1

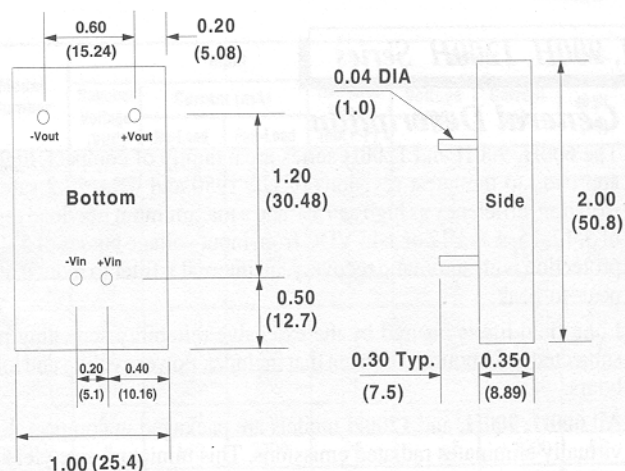
Mechanical Configurations:

2W and 3W Models

CASE D

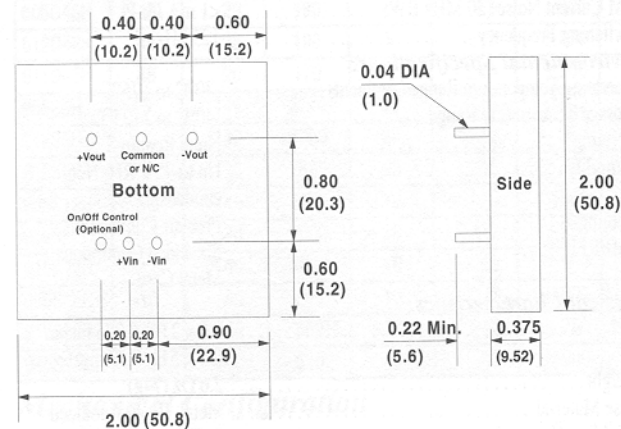


CASE D1 (OPTIONAL)

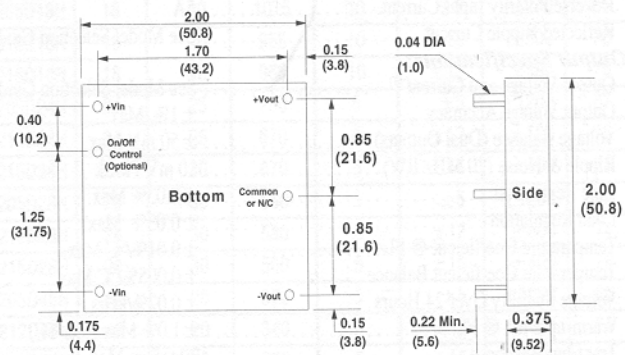


5W Models

CASE A



CASE A1 (OPTIONAL)



Note: All dimensions are typical in inches (mm).
 Tolerance X.XX = ± 0.02 , (± 0.5)
 X.XXX = ± 0.010 , (± 0.25)
 N/C = No connection on single output models

Ordering information

- Case D (for 2W and 3W models) and case A (for 5W models) pinning is standard, and these models do not require a suffix.
- Case D1 or A1 pinning is alternate. These models require a "D1" (for 2W and 3W models) or "A1" (for 5W models) suffix when ordering.
 i.e. 205SE-D1
 i.e. 512D28E-A1
- For optional on/off control input (5W models only), please contact the factory.