MPE Single and Dual DC/DC Converters

28 VOLT INPUT – 25 WATT

FEATURES

- –55°C to +125°C operation
- 16 to 50 VDC input
- Fully isolated
- Magnetic feedback
- Fixed frequency, 500 kHz typical
- Topology – Single ended forward
- 65 V for up to 1 sec. transient protection
- Inhibit and sync functions
- Undervoltage lockout
- Up to 87% efficiency, 43 W/in^3
- Output short circuit protection



MODELS	
VDC OUTPUT	
SINGLE	DUAL
1.8	±5
2.5	±7
3.3	±12
5	±15
12	
15	
28	

DESCRIPTION

The MPE Series™ of high frequency DC/DC converters offers a wide input voltage range of 16 to 50 volts and up to 25 watts of output power. The units are capable of withstanding short term transients up to 65 volts. The package is a hermetically sealed, welded metal case. Flanged and non-flanged models are available.

CONVERTER DESIGN

The MPE converters are switching regulators that use a quasi-square wave, single-ended forward converter design with a constant switching frequency of 500 kHz. Isolation between input and output circuits is provided with transformers in the forward path and in the feedback control loop.

HIGHER POWER DENSITY

The MPE Series offers a new standard of performance for small size and high power density. At just 0.360 inch high and a total footprint of 1.7 in^2, this low profile package offers a total power density of up to 43 watts per cubic inch.

LOW NOISE, HIGH AUDIO REJECTION

The MPE converters current mode control system provides excellent dynamic response and noise rejection. Audio rejection is typically 50 dB. Output voltage response for a 50% to 100% step load transient is as low as 4% with a 400 μs recovery time. Input ripple current is typically 35 mA p-p with output ripple voltage 30 mV p-p at 20 MHz BW.

INHIBIT FUNCTION

MPE converters provide an inhibit terminal that can be used to disable internal switching, resulting in no output and very low quiescent input current. The converter is inhibited when a TTL compatible low (≤0.8 V – output disabled) is applied to the inhibit pin. The unit is enabled when the pin, which is internally connected to a pull-up current source, is left unconnected or is connected to an open-collector gate. The open circuit voltage associated with the inhibit pin is 8.5 to 12 V. In the inhibit mode, a maximum of 4 mA must be sunk from the inhibit pin.

SYNCHRONIZATION

A synchronization feature is included with the MPE Series that allows the user to match the switching frequency of the converter to the frequency of a system clock. Synchronization allows the user to adjust the nominally 500 kHz operating frequency to any frequency within the range of 450 kHz to 550 kHz. This is initiated by applying a TTL compatible input of the desired frequency to sync pin.

SHORT CIRCUIT PROTECTION

MPE Series converters provide short circuit protection by restricting the output current to approximately 115% of the full load output current.

UNDERVOLTAGE LOCKOUT

Undervoltage lockout with hysteresis prevents the units from operating below approximately 15 VDC input voltage to keep system current levels smooth, especially during initialization or re-start operations.

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28 VOLT INPUT – 25 WATT

OPERATING CONDITIONS AND CHARACTERISTICS

Input Voltage Range
- 16 to 50 VDC continuous
- 65 V for up to 1 sec transient

Output Power
- 10 to 25 watts depending on model

Power Dissipation (Pd)
- 8.5 W

Lead Soldering Temperature (10 sec per lead)
- 300°C

Storage Temperature Range (Case)
- –65°C to +150°C

Case Operating Temperature (Tc)
- –55°C to +125°C full power
- –55°C to +135°C absolute

Derating Output Power/Current
- Linearly from 100% at 125°C to 0% at 135°C

Output Voltage Temperature Coefficient
- 100 ppm/°C typical
- 150 ppm/°C maximum

Input to Output Capacitance
- 60 pF typical

Current Limit
- 115% of full load typical

Isolation
- 100 megohm minimum at 500 V

Audio Rejection
- 50 dB typical

Conversion Frequency (-55°C to +125°C Tc)
- Free run 500 kHz typical (430 kHz min, 570 kHz max)

Inhibit Pin Voltage (unit enabled)
- 8.5 to 12 V

Undervoltage Lockout
- 15 V input typical

SYNC AND INHIBIT

Sync In (450 to 550 kHz)
- Duty cycle 40% to 60%
- Logic low 0.8 V max
- Logic high 4.5 V min, 5 V max
- Referenced to input common

Inhibit TTL Open Collector
- Logic low (output disabled)
  Logic low voltage ≤0.8 V
  Inhibit pin current 4.0 mA max
- Referenced to input common
- Logic high (output enabled)
  Open collector or unconnected

MECHANICAL AND ENVIRONMENTAL

Size (maximum)

Non flanged 1.460 x 1.130 x 0.360 (37.08 x 28.70 x 9.15 mm)

Flanged 2.005 x 1.130 x 0.360 (50.93 x 28.70 x 9.15)

See cases E5, E6, G5 and G6 for dimensions.

Weight (maximum)

38 grams

Screening

Standard or ES. See “125°C Non-QML Products—Environmental Screening (Standard and ES)” for more information.

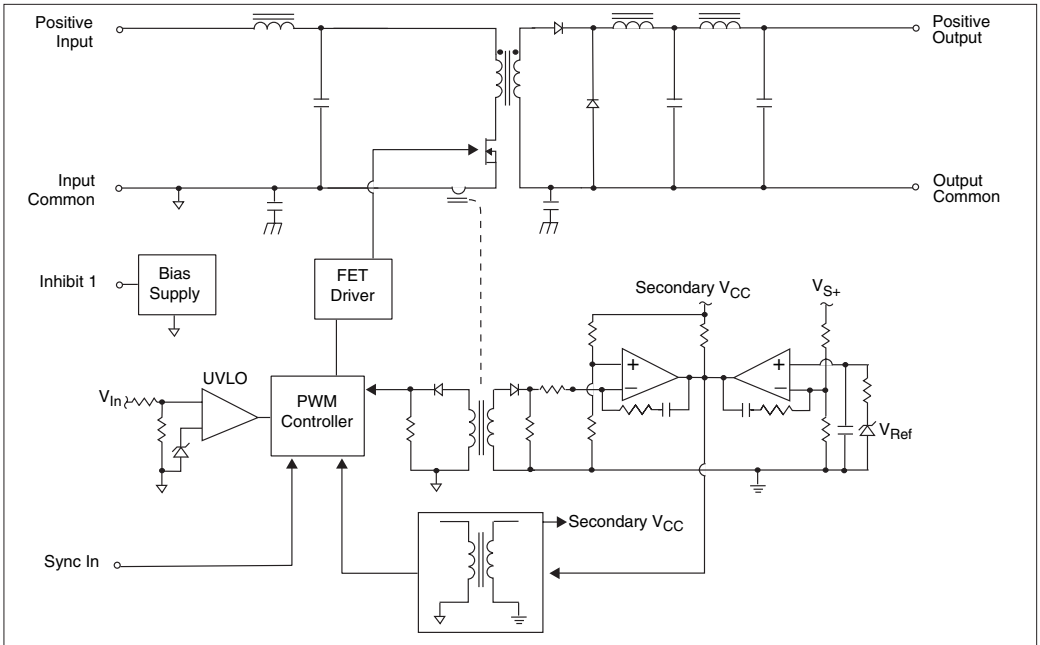


FIGURE 1: SIMPLIFIED SCHEMATIC - MPE 28 SINGLE

MPE Single and Dual DC/DC Converters

28 VOLT INPUT – 25 WATT

PIN OUT

Pin	Single Output (Except MPE2828S)	MPE2828S	Dual Output
1	Inhibit	Inhibit	Inhibit
2	Output Common	Positive Output	Positive Output
3	Positive Output	No Connection	Output Common
4	Sync	Output Common	Negative Output
5	Case Ground	Sync	Sync
6	Input Common	Case Ground	Case Ground
7	Positive Input	Input Common	Input Common
8	———	Positive Input	Positive Input

PINS NOT IN USE

Sync and Inhibit Leave unconnected

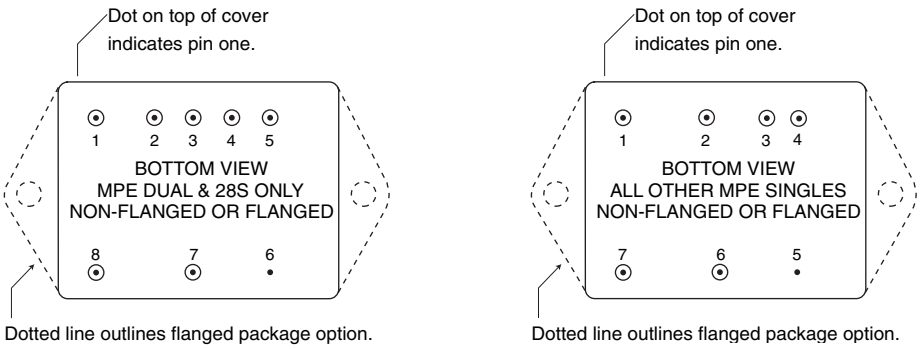


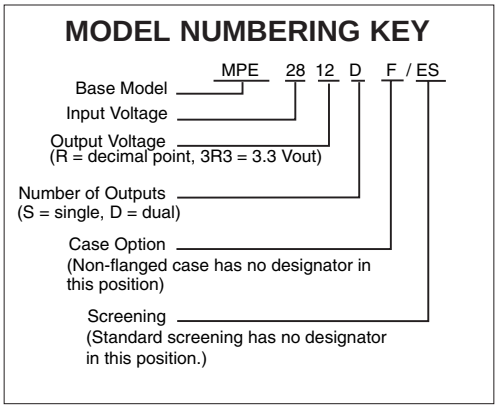
FIGURE 2 & 3: PIN OUT

See cases E5, E6, G5 and G6 for dimensions.

MPE Single and Dual DC/DC Converters

28 VOLT INPUT – 25 WATT

MODEL NUMBERING KEY



MODEL SELECTION

MPE28 _____	_____	_____	_____
base model	V_{out} *value*	*number of outputs*	*case option*	*screening*

Choose one from each of the following rows:

V_{out} *value*	for singles: 1R8, 2R5, 3R3, 5, 12, 15, 28 for duals: 5, 7, 12, 15 "R" = decimal point, 3R3 = 3.3VDC
Number of outputs	S (single) or D (dual)
Case option	non-flanged case, leave blank or F (flanged case)
Screening	standard screening, leave blank /ES (ES screening)

MPE Single and Dual DC/DC Converters

28 VOLT INPUT – 25 WATT

Electrical Characteristics: 25°C Tc, 28 VDC Vin, 100% load, free run, unless otherwise specified.

SINGLE OUTPUT MODELS		MPE281R8S			MPE282R5S			MPE283R3S			MPE2805S			
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
OUTPUT VOLTAGE		1.78	1.8	1.82	2.47	2.5	2.53	3.26	3.3	3.34	4.95	5	5.05	VDC
OUTPUT CURRENT	V_{IN} = 16 to 50 VDC	—	—	5.56	—	—	5	—	—	4.55	—	—	4	A
OUTPUT POWER	V_{IN} = 16 to 50 VDC	—	—	10	—	—	12.5	—	—	15	—	—	20	W
OUTPUT RIPPLE	10 kHz - 20 MHz	—	30	60	—	30	60	—	25	60	—	40	80	mV p-p
VOLTAGE	Tc = –55°C to +125°C	—	35	80	—	35	80	—	30	80	—	50	100	
LINE REGULATION	V_{IN} = 16 TO 50 VDC	—	5	20	—	5	20	—	5	20	—	5	20	mV
LOAD REGULATION	NO LOAD TO FULL	—	10	20	—	5	20	—	5	20	—	5	20	mV
INPUT VOLTAGE	CONTINUOUS	16	28	50	16	28	50	16	28	50	16	28	50	
	TRANSIENT – 1 SEC[1]	—	—	65	—	—	65	—	—	65	—	—	65	VDC
INPUT CURRENT	NO LOAD	—	25	40	—	25	40	—	25	40	—	25	40	mA
	INHIBITED	—	2.5	4	—	2.5	4	—	2.5	4	—	2.5	4	
INPUT RIPPLE	10 kHz - 20 MHz	—	20	55	—	20	60	—	20	65	—	30	70	mA pp
CURRENT	Tc = –55°C to +125°C	—	30	75	—	30	80	—	30	80	—	40	85	
EFFICIENCY		69	72	—	73	76	—	76	79	—	79	82	—	%
LOAD FAULT[2]	POWER DISSIPATION	—	—	—	—	—	—	—	—	—	—	—	—	
	SHORT CIRCUIT	—	6	8	—	6	8	—	6	8	—	6	8	W
	RECOVERY[1, 3]	—	—	20	—	—	20	—	—	20	—	—	20	ms
STEP LOAD RESP	50% – 100% – 50%													
	TRANSIENT[4]	–	60	200	–	60	200	–	60	200	—	100	400	mV pk
	RECOVERY[3]	—	200	400	—	100	300	—	200	300	—	200	300	µs
STEP LINE RESP[1]	16 – 50 – 16 VDC													
	TRANSIENT[4]	–	200	350	—	200	350	—	200	350	—	250	450	mV pk
	RECOVERY[3]	—	0.5	1	—	0.5	1	—	0.5	1	—	0.5	1	ms
START-UP	DELAY	—	15	20	—	15	20	—	15	20	—	15	20	ms
	OVERSHOOT[1]	—	—	50	—	—	50	—	—	50	—	0	50	mV pk
CAPACITANCE[1]	MAXIMUM OUTPUT	—	—	2000	—	—	2000	—	—	2000	—	—	2000	µF

Notes
1. Guaranteed by design, not tested.
2. Short circuit measured with 1% 10 milli-ohm resistive load.
3. Recovery: time to settle to within 1% of resulting V_{out}DC.
4. Transient transistion time >10 µs.

MPE Single and Dual DC/DC Converters

28 VOLT INPUT – 25 WATT

Electrical Characteristics: 25°C Tc, 28 VDC Vin, 100% load, free run, unless otherwise specified.

SINGLE OUTPUT MODELS		MPE2812S			MPE2815S			MPE2828S			
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
OUTPUT VOLTAGE		11.88	12.00	12.12	14.85	15	15.15	27.72	28.00	28.28	VDC
OUTPUT CURRENT	V_{IN} = 16 to 50 VDC	—	—	2.08	—	—	1.67	—	—	0.89	A
OUTPUT POWER	V_{IN} = 16 to 50 VDC	—	—	25	—	—	25	—	—	25	W
OUTPUT RIPPLE VOLTAGE	10 kHz - 20 MHz	—	35	80	—	40	80	—	80	120	mV p-p
	Tc = –55°C to +125°C	—	40	100	—	50	100	—	100	180	
LINE REGULATION	V_{IN} = 16 to 50 VDC	—	5	20	—	5	20	—	150	280	mV
LOAD REGULATION	NO LOAD TO FULL	—	5	20	—	5	20	—	150	280	mV
INPUT VOLTAGE	CONTINUOUS	16	28	50	16	28	50	16	28	50	VDC
	TRANSIENT – 1 SEC[1]	—	—	65	—	—	65	—	—	65	V
INPUT CURRENT	NO LOAD	—	20	40	—	20	40	—	30	50	mA
	INHIBITED	—	2.5	4	—	2.5	4	—	2.5	4	
INPUT RIPPLE CURRENT	10 kHz - 20 MHz	—	35	80	—	35	80	—	40	70	mA p-p
	Tc = –55°C to +125°C	—	45	90	—	50	110	—	50	100	
EFFICIENCY		83	86	—	84	88	—	81	85	—	%
LOAD FAULT[2]	SHORT CIRCUIT	—	6	8	—	5	7.5	—	6	8	W
	RECOVERY[1, 3]	—	—	20	—	—	20	—	—	20	mS
STEP LOAD RESP.	50% – 100% – 50%	—	—	—	—	—	—	—	—	—	
	TRANSIENT[4]	—	350	500	—	400	600	—	900	1200	mV pk
	RECOVERY[3]	—	300	500	—	300	500	—	400	600	µs
STEP LINE RESP.[1]	16 – 50 – 16 VDC	—	—	—	—	—	—	—	—	—	
	TRANSIENT[4]	—	—	1500	—	—	1500	—	1400	1800	mV pk
	RECOVERY[3]	—	0.5	1	—	0.5	1	—	0.5	1	ms
START-UP	DELAY	—	15	20	—	15	20	—	15	20	ms
	OVERSHOOT[1]	—	0	120	—	0	150	—	0	280	mV pk
CAPACITANCE[1]	MAXIMUM OUTPUT	—	—	2000	—	—	2000	—	—	2000	µF

Notes

1. Guaranteed by design, not tested.

2. Short circuit measured with 1% 10 milli-ohm resistive load.

3. Recovery: time to settle within 1% of resulting V_{out}DC.

4. Transient transisiton time> 10 µs.

MPE Single and Dual DC/DC Converters

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Electrical Characteristics: 25°C Tc, 28 VDC Vin, 100% load, free run, unless otherwise specified.

DUAL OUTPUT MODELS		MPE2805D			MPE2807D			MPE2812D			MPE2815D			
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
OUTPUT VOLTAGE	$+V_{OUT}$	4.95	5.00	5.05	6.93	7.00	7.07	11.88	12.00	12.12	14.85	15.00	15.15	VDC
	$-V_{OUT}$	4.92	5.00	5.08	6.90	7.00	7.10	11.82	12.00	12.18	14.78	15.00	15.23	
OUTPUT CURRENT[2]	V_{IN} = 16 to 50 VDC	—	±2.0	2.8	—	±1.5	2.1	—	±1.04	1.46	—	±0.83	1.17	A
OUTPUT POWER[2]	V_{IN} = 16 to 50 VDC	—	—	20	—	—	21	—	—	25	—	—	25	W
OUTPUT RIPPLE	10 kHz - 20 MHz	—	45	80	—	25	70	—	35	80	—	50	80	mV p-p
VOLTAGE $\pm V_{OUT}$	Tc = –55°C to +125°C	—	50	90	—	30	80	—	40	90	—	50	90	
LINE REGULATION	BALANCED $+V_{OUT}$	—	5	20	—	5	20	—	5	20	—	5	20	mV
V_{IN} = 16 TO 50 VDC	LOAD $-V_{OUT}$	—	20	100	—	20	100	—	20	150	—	25	150	
LOAD REGULATION	BALANCED $+V_{OUT}$	—	5	20	—	5	20	—	5	20	—	5	20	mV
	LOAD $-V_{OUT}$	—	35	200	—	50	200	—	60	250	—	100	250	
CROSS REGULATION[3]	NEGATIVE V_{OUT}	—	2.5	7	—	2	6	—	2	6	—	1.5	5	%
INPUT VOLTAGE	CONTINUOUS	16	28	50	16	28	50	16	28	50	16	28	50	VDC
NO LOAD TO FULL	TRANSIENT – 1 SEC[1]	—	—	65	—	—	65	—	—	65	—	—	65	
INPUT CURRENT	NO LOAD	—	30	45	—	30	45	—	30	45	—	30	45	mA
	INHIBITED	—	2.5	4	—	2.5	4	—	2.5	4	—	2.5	4	
INPUT RIPPLE	10 kHz - 20 MHz	—	25	50	—	30	50	—	35	60	—	30	60	mA pp
CURRENT	Tc = –55°C to +125°C	—	35	70	—	35	70	—	50	100	—	40	100	
EFFICIENCY		78	81	—	81	83	—	82	85	—	83	86	—	%
LOAD FAULT	SHORT CIRCUIT[4] POWER DISSIPATION	—	6	8	—	6	7.5	—	5	7.5	—	5	7.5	W
	RECOVERY[1,5]	—	15	20	—	15	20	—	15	20	—	15	20	ms
STEP LOAD RESP.[6]	50% – 100% – 50%													
BALANCED LOADS	TRANSIENT $+V_{OUT}$	-400	100	400	-400	125	400	-550	350	550	-600	400	600	mV pk
	$-V_{OUT}$	-400	100	400	-400	125	400	-550	350	550	-600	400	600	
	RECOVERY[5]	—	200	450	—	200	450	—	250	500	—	250	500	µs
STEP LINE RESP.[1]	16 – 50 – 16 VDC													
$\pm V_{OUT}$	TRANSIENT[7]	-400	200	400	-450	300	450	-1500	750	1500	-1500	750	1500	mV pk
	RECOVERY[5]	—	0.2	0.5	—	0.5	1	—	0.5	1	—	0.5	1	ms
START-UP	DELAY	—	15	20	—	15	20	—	15	20	—	15	20	ms
	OVERSHOOT[1]	—	0	50	—	0	70	—	0	120	—	0	150	mV pk
CAPACITANCE[1]	MAX OUTPUT	—	—	1000	—	—	1000	—	—	1000	—	—	1000	µF

Notes

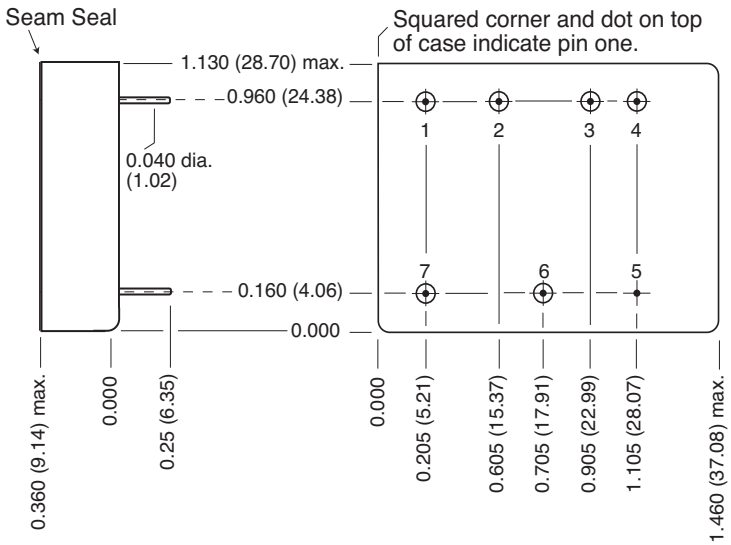
1. Guaranteed by Design, not tested.

2. Up to 70% of the total output power is available from either output providing the opposite output is simultaneously carrying 30% of the total output power.
3. Effect on $-V_{out}$ for the following conditions:
   +Po = 30% to 70%
   - Po = 70% to 30%
   Positive output must carry a minimum of 30% of the total output power in order to maintain regulation on the negative output.
4. Indefinite short circuit protection not guaranteed above 125°C (case)
5. Recovery time is measured from application of the transient to point at which V_{out} is within regulation.
6. Response of either output with the opposite output held at half of the total output power.
7. Input step transition time >10 µs.

MPE Single and Dual DC/DC Converter Cases

28 VOLT INPUT – 25 WATT

BOTTOM VIEW CASE E5



Seal hole: 0.123 ±0.002 (3.12 ±0.05)

Case dimensions in inches (mm)
Tolerance ±0.005 (0.13) for three decimal places
±0.01 (0.3) for two decimal places
unless otherwise specified

CAUTION
Heat from reflow or wave soldering may damage the device.
Solder pins individually with heat application not exceeding 300°C for 10 seconds per pin.

Materials

Header	Cold Rolled Steel/Nickel/Gold
Cover	Cold Rolled Steel/Nickel/Gold
Pins	#52 alloy/Gold; ceramic seal

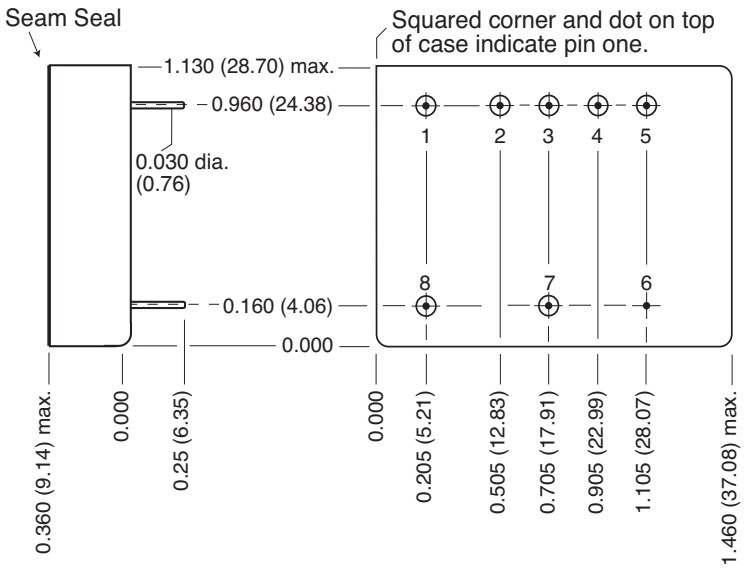
Case E5, Rev C, 20060413
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FIGURE 4: CASE E5

MPE Single and Dual DC/DC Converter Cases

28 VOLT INPUT – 25 WATT

BOTTOM VIEW CASE E6



Seal hole: 0.091 ±0.002 (2.311 ±0.05)

Case dimensions in inches (mm)
Tolerance ±0.005 (0.13) for three decimal places
±0.01 (0.3) for two decimal places
unless otherwise specified

CAUTION
Heat from reflow or wave soldering may damage the device.
Solder pins individually with heat application not exceeding 300°C for 10 seconds per pin.

Materials

Header	Cold Rolled Steel/Nickel/Gold
Cover	Cold Rolled Steel/Nickel/Gold
Pins	#52 alloy/Gold; ceramic seal

Case E6, Rev C, 20060413
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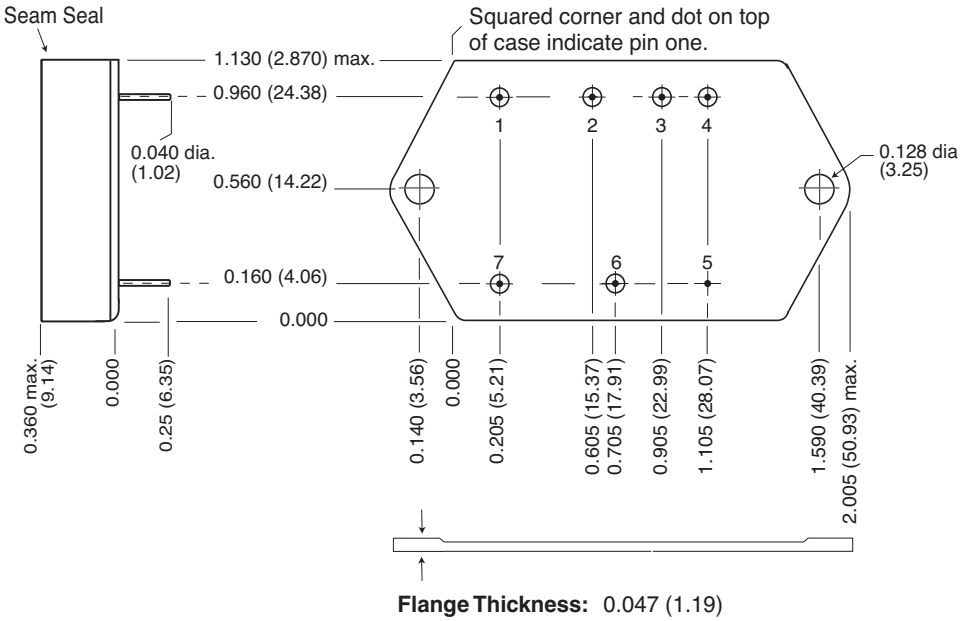
FIGURE 5: CASE E6

MPE Single and Dual DC/DC Converter Cases

28 VOLT INPUT – 25 WATT

BOTTOM VIEW CASE G5

*Designator "F" required in Case Option position of model number.



Flange Thickness: 0.047 (1.19)

Seal hole: 0.123 ±0.002 (3.12 ±0.05)

Case dimensions in inches (mm)
Tolerance ±0.005 (0.13) for three decimal places
±0.01 (0.3) for two decimal places
unless otherwise specified

CAUTION
Heat from reflow or wave soldering may damage the device.
Solder pins individually with heat application not exceeding 300°C for 10 seconds per pin.

Materials

Header	Cold Rolled Steel/Nickel/Gold
Cover	Cold Rolled Steel/Nickel/Gold
Pins	#52 alloy/Gold; ceramic seal

Case G5, Rev C, 20060413
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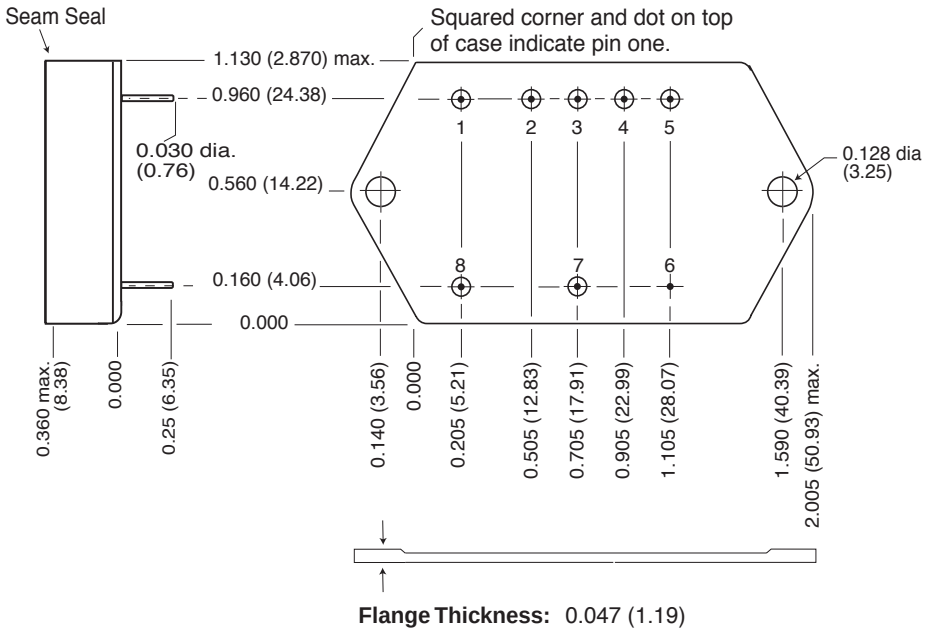
FIGURE 6: CASE G5

MPE Single and Dual DC/DC Converter Cases

28 VOLT INPUT – 25 WATT

BOTTOM VIEW CASE G6

*Designator "F" required in Case Option position of model number.



Seal hole: 0.091 ±0.002 (2.311 ±0.05)

Case dimensions in inches (mm)
Tolerance ±0.005 (0.13) for three decimal places
±0.01 (0.3) for two decimal places
unless otherwise specified

CAUTION
Heat from reflow or wave soldering may damage the device.
Solder pins individually with heat application not exceeding 300°C for 10 seconds per pin.

Materials

Header	Cold Rolled Steel/Nickel/Gold
Cover	Cold Rolled Steel/Nickel/Gold
Pins	#52 alloy/Gold; ceramic seal

Case G6, Rev C, 20060413
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FIGURE 7: CASE G6

MPE Single and Dual DC/DC Converters

28 VOLT INPUT – 25 WATT

125°C NON-QML PRODUCTS—ENVIRONMENTAL SCREENING (STANDARD AND ES)

TEST	125°C STANDARD non-QML[1]	125°C /ES non-QML[1]
Pre-cap Inspection Method 2017, 2032	yes	yes
Temperature Cycle (10 times) Method 1010, Cond. B, -55°C to 125°C, ambient	no	yes
Constant Acceleration Method 2001, 500 g	no	yes
Burn-In 96 hours, typical case temperature 125°C case[2]	no	yes
Final Electrical Test MIL-PRF-38534, Group A Subgroups 1 and 4: +25°C case	yes	yes
Hermeticity Test Fine Leak, Method 1014, Cond. A Gross Leak, Method 1014, Cond. C Gross Leak, Dip (1 x 10^{-3})	 no no yes	 yes yes no
Final Visual Inspection Method 2009	yes	yes

Test methods are referenced to MIL-STD-883 as determined by MIL-PRF-38534.

Notes:
1. Non-QML products do not meet all of the requirements of MIL-PRF-38534
2. Burn-in is still air with an ambient temperature designed to bring the case temperature to 125°C

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