

# MWR Triple DC-DC Converters

## 14 TO 50 VOLT INPUT - 35 WATT

### FEATURES

- Input voltage range 14 to 50 volts
- Transient protection up to 80 volts for one second
- Indefinite short circuit protection
- -55°C to +125°C operation
- Magnetic feedback
- Synchronization
- Inhibit function
- Up to 33 W/in<sup>3</sup>, 85% efficiency
- Undervoltage lockout



MODELS
OUTPUT VOLTAGE (V)
TRIPLE
3.3 ±12
3.3 ±15
5 ±12
5 ±15

### DESCRIPTION

The Interpoint® MWR Series™ of DC-DC converters offers up to 35 watts of power in a low profile package. They have a wide input voltage range of 40 to 50 volts and are capable of withstanding up to 80 volts for up to one second. The MWR converters are manufactured in our fully certified and qualified MIL-PRF-38534 Class H production facility and packaged in hermetically sealed, welded steel cases. Flanged and non-flanged cases are available. They are ideal for use in programs requiring high reliability, small size, and high efficiency.

### CONVERTER DESIGN

MWR Series DC-DC converters are switching regulators that use flyback conversion topology with a clock frequency of approximately 300 kHz. MWR Series converters incorporate two internal converters with one converter phase shifted approximately 120° from the other to create a dual phase/phase-shifted operation. Each of the internal converters operates at the clock frequency. This design provides completely independent regulation with no cross regulation effect between the main and auxiliary outputs and no minimum loading required on the main output. The design minimizes input ripple, greatly reduces output ripple and improves efficiency. See Figure 1 on page 2.

### AUDIO REJECTION

The MWR converters' feed-forward compensation system provides excellent dynamic response and audio rejection. Audio rejection is typically 40 dB.

The MWR Series converters have internal filtering capacitors that help reduce the need for external components in normal operation. Use our FMCE-0528 EMI filter to meet the requirements of MIL-STD-461C CE03 and CS01 and MIL-STD-461D, E and F CE102 and CS101. Any of our Interpoint FMCE filters can be used to the rated current of the filter.

### INHIBIT FUNCTION

MWR 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 the inhibit pin is pulled below 0.8 volts. The unit is enabled when the pin, which is internally connected to a pull-up resistor, is left unconnected or is connected to an open-collector gate. The open circuit output 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

Synchronizing the converter with the system clock allows the designer to confine switching noise to clock transitions, minimizing interference and reducing the need for filtering. In sync mode, the converter will run at any frequency between 270 kHz and 330 kHz. The sync control operates with a duty cycle between 40% and 60%.

### SHORT CIRCUIT PROTECTION

MWR Series converters provide indefinite short circuit protection by restricting the output current to approximately 150% of the full load output current. The output current is sensed in the secondary stage to provide highly predictable and accurate current limiting, and to eliminate foldback characteristics. For better protection, the current limit function of the main and the auxiliary sides are linked together. If one output goes to current limit, the other outputs will be turned off at the same time.

### UNDERVOLTAGE LOCKOUT

Undervoltage lockout with hysteresis prevents the units from operating below approximately 12 volts input voltage to keep system current levels smooth, especially during initialization or re-start operations.

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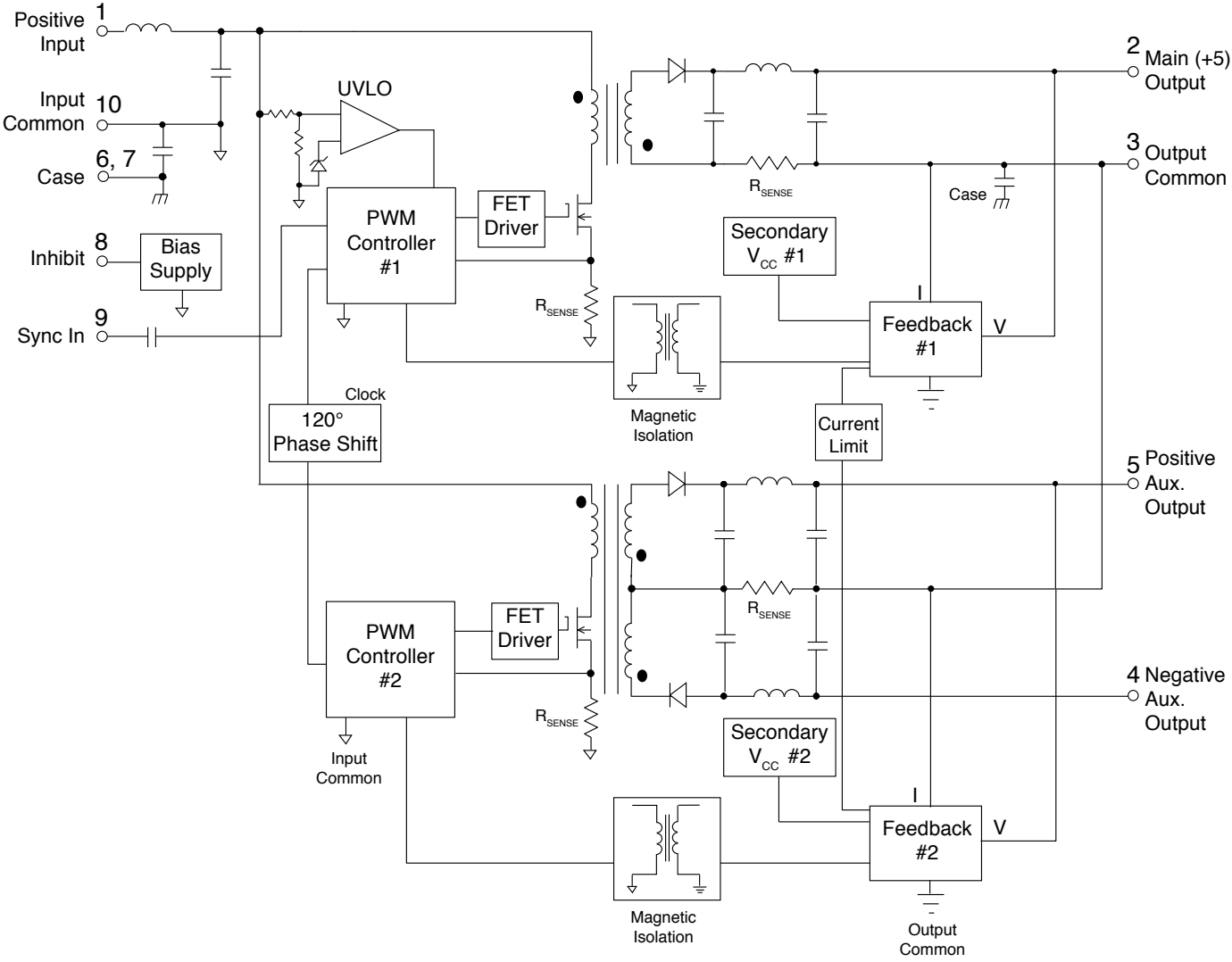


FIGURE 1: MWR BLOCK DIAGRAM

# MWR Triple DC-DC Converters

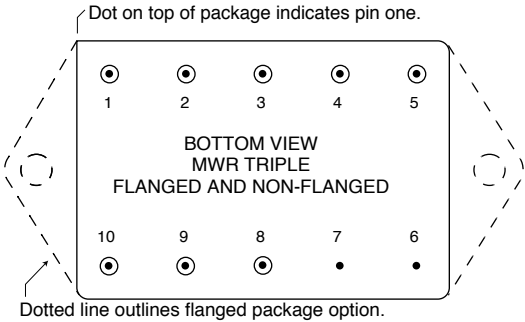
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PIN OUT	
Pin	Triple Output
1	Positive Input
2	Main Output
3	Output Common
4	Neg. Aux. Output
5	Pos. Aux. Output
6	Case Ground
7	Case Ground
8	Inhibit
9	Sync. In
10	Input Common

TABLE 1: PIN OUT

PINS NOT IN USE	
Inhibit	Leave unconnected
Sync	Leave unconnected or tie to input common

TABLE 2: PINS NOT IN USE

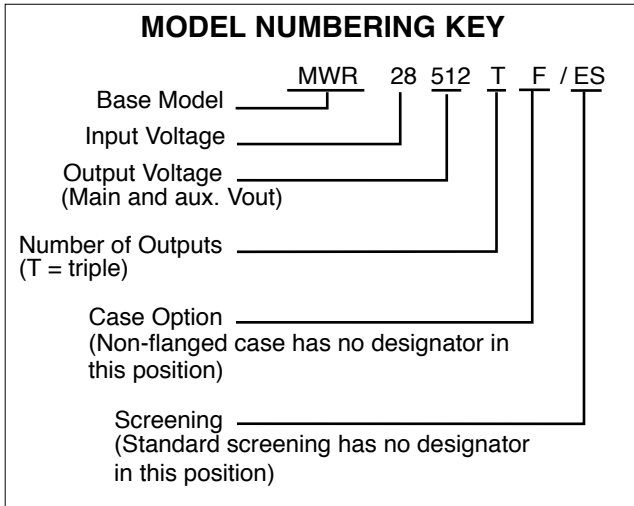


See Figure 15 on page 13 and Figure 16 on page 14 for dimensions.

FIGURE 2: MWR TRIPLE

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<b>SMD NUMBERS</b>	
STANDARD MICROCIRCUIT DRAWING (SMD)	MWR SIMILAR PART
5962-1722601HXC	MWR283R312T/883
5962-1722602HXC	MWR283R315T/883
5962-1722603HXC	MWR28512T/883
5962-1722604HXC	MWR28515T/883
The SMD number shown is for Class H screening, non-flanged. To indicate the flanged case option change the "X" to "Z" in the SMD number. For exact specifications for an SMD product, refer to the SMD drawing. SMDs can be downloaded from <a href="https://landandmaritimeapps.dla.mil/programs/smcr">https://landandmaritimeapps.dla.mil/programs/smcr</a>	

TABLE 3: SMD CROSS REFERENCE

FIGURE 3: MODEL NUMBERING KEY

<b>MODEL NUMBER OPTIONS</b>					
TO DETERMINE THE MODEL NUMBER ENTER ONE OPTION FROM EACH CATEGORY IN THE FORM BELOW.					
CATEGORY	Base Model and Input Voltage	Output Voltage <sup>1</sup>	Number of Outputs <sup>2</sup>	Case Options <sup>3</sup>	Screening <sup>4</sup>
OPTIONS	MWR28	3R312, 3R315T, 512T, 515T	T	(non-flanged, leave blank) F (flanged)	(standard, leave blank) ES 883
FILL IN FOR MODEL #	MWR28	_____	_____	_____	/ _____

Notes

1. Output Voltage: An R indicates a decimal point. 3R312T has a 3.3 volt main and ±12 volt auxiliaries.
2. Number of Outputs: T is a triple output.
3. Case Options: For the standard case, Figure 15 on page 13, leave the case option blank. For the flanged case option, Figure 16 on page 14, insert the letter F in the Case Option position.
4. Screening: For standard screening leave the screening option blank. For other screening options, insert the desired screening level. For more information see Table 10 on page 15 and Table 11 on page 16.

TABLE 4: MODEL NUMBER OPTIONS

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TABLE 5: OPERATING CONDITIONS, ALL MODELS, 25°C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

MWR SERIES		ALL MODELS			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	
LEAD SOLDERING TEMPERATURE <sup>1</sup>	10 SECONDS MAX.	—	—	300	°C
STORAGE TEMPERATURE <sup>1</sup>		-65	—	+150	°C
CASE OPERATING TEMPERATURE	FULL POWER	-55	—	+125	°C
	ABSOLUTE <sup>1</sup>	-55	—	+135	
DERATING OUTPUT POWER/CURRENT <sup>1</sup>	LINEARLY	From 100% at 125°C to 0% at 135°C			
ESD RATING <sup>1, 2</sup> MIL-PRF-38534, 3.9.5.8.2	MIL-STD-883, METHOD 3015 CLASS 2	2000 - 3999			V
ISOLATION: INPUT TO OUTPUT OR ANY PIN TO CASE EXCEPT CASE PINS	500 V AT 25°C	100	—	—	Megohms
UNDERVOLTAGE LOCKOUT <sup>1</sup> -55°C TO +125°C	RISING V <sub>IN</sub> (TURN ON) FALLING V <sub>IN</sub> (TURN OFF)	—	12.93 11.85	—	V
CURRENT LIMIT <sup>3, 4</sup> % OF FULL LOAD	MAIN ±AUX.	—	150 130	—	
AUDIO REJECTION <sup>1</sup>		—	40	—	dB
CONVERSION FREQUENCY	FREE RUN -55°C TO +125°C	260	—	340	kHz
SYNCHRONIZATION	INPUT FREQUENCY	270	—	330	kHz
	DUTY CYCLE <sup>1</sup>	40	—	60	%
	ACTIVE LOW	—	—	0.8	V
	ACTIVE HIGH <sup>1</sup>	4.5	—	5.0	
	REFERENCED TO IF NOT USED		INPUT COMMON LEAVE UNCONNECTED OR TIE TO INPUT COMMON		
INHIBIT ACTIVE LOW (OUTPUT DISABLED) Do not apply a voltage to the inhibit pin <sup>6</sup>	INHIBIT PIN PULLED LOW <sup>5</sup>	—	—	0.8	V
	INHIBIT PIN SOURCE CURRENT <sup>1</sup>	—	—	4	mA
	REFERENCED TO	INPUT COMMON			
INHIBIT ACTIVE HIGH (OUTPUT ENABLED) Do not apply a voltage to the inhibit pin <sup>6</sup>	INHIBIT PIN CONDITION	OPEN COLLECTOR OR UNCONNECTED			
	OPEN PIN VOLTAGE <sup>1</sup>	8.5	—	12	V

**For mean time between failures (MTBF) contact Applications Engineering  
powerapps@craneae.com +1 425.882.3100 option 7**

## Notes

- Guaranteed by qualification test and/or analysis. Not an in-line test.
- Passes 2000 volts.
- Current limit is defined as the point at which the output voltage decreases by 1%. For better protection, the current limit function of the main and the auxiliary sides are linked together. If one output goes to current limit, the other outputs will be turned off at the same time.
- The over-current limit will trigger when the sum of the auxiliary outputs reach 130% (typical value) of the maximum rated "total" current of both outputs.
- Tested with inhibit pin connected to input common.
- An external inhibit interface should be used to pull the inhibit low or leave it floating. The inhibit pin can be left unconnected if not used.

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TABLE 6: ELECTRICAL CHARACTERISTICS -55°C TO +125°C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

TRIPLE OUTPUT MODEL – MWR283R312T		3.3 (MAIN)			±12 (AUXILIARIES)			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE	MAIN AND POS. AUX	3.23	3.30	3.37	11.76	12.00	12.24	V
	NEG. AUX.	—	—	—	11.70	12.00	12.30	
OUTPUT CURRENT VIN = 14 TO 50 V	MAIN AND EITHER OUTPUT	—	—	3.0	—	±0.833	1.16 <sup>1</sup>	A
	MAX TOTAL AUX	—	—	—	—	—	1.67	
OUTPUT POWER VIN = 14 TO 50 V	MAIN AND EITHER OUTPUT	—	—	10	—	±10	14 <sup>1</sup>	W
	MAX TOTAL AUX	—	—	—	—	—	20	
OUTPUT RIPPLE 10 kHz - 20 MHz	TC = 25°C	—	15	45	—	50	80	mV p-p
	TC = -55°C TO +125°C	—	15	60	—	50	120	
LINE REGULATION VIN = 14 TO 50 V	MAIN AND POS. AUX	—	5	25	—	5	50	mV
	NEG. AUX.	—	—	—	—	28	120	
LOAD REGULATION BALANCED AUX.	MAIN AND +AUX., NL - FL	—	5	25	—	5	50	mV
	-AUX., NL - FL	—	—	—	—	20	100	
CROSS REGULATION <sup>2</sup> TC = 25°C	EFFECT ON NEGATIVE AUXILIARY	—	—	—	—	250	600	mV
INPUT VOLTAGE	CONTINUOUS	14	28	50	—	—	—	V
	TRANSIENT 1 sec <sup>1</sup>	—	—	80	—	—	—	V
INPUT CURRENT	NO LOAD	—	50	65	—	—	—	mA
	INHIBITED	—	2.5	4	—	—	—	
INPUT RIPPLE CURRENT <sup>3</sup> 10 kHz - 20 MHz		—	36	100	—	—	—	mA p-p
EFFICIENCY <sup>4</sup>	TC = 25°C	78	81	—	—	—	—	%
	TC = -55°C TO +125°C	77	—	—	—	—	—	
LOAD FAULT <sup>5, 6</sup>	POWER DISSIPATION	—	6	9.5	—	5	9.5	W
	RECOVERY <sup>1</sup>	—	15	20	—	—	20	ms
STEP LOAD RESPONSE <sup>6, 7</sup> 50% - 100% - 50%	TRANSIENT	—	±75	±350	—	±150	±600	mV pk
	RECOVERY	—	120	400	—	175	600	μs
STEP LINE RESPONSE <sup>1, 6, 8</sup> 14 - 50 - 14 VIN	TRANSIENT	—	±100	±400	—	±200	±400	mV pk
	RECOVERY	—	400	600	—	200	600	μs
START-UP <sup>6, 9</sup>	DELAY	—	15	20	—	—	20	ms
	OVERSHOOT <sup>1</sup>	—	5	33	—	5	60	mV pk
CAPACITIVE LOAD <sup>1, 10</sup> 25°C		—	—	1000	—	—	500	μF

## Notes

- Guaranteed by design and/or analysis. Not an in-line test.
- Effect on -Vout for the following conditions. Percentages are of total aux. power (20 W). Conditions are referenced to balanced aux. loads of 50%/50%.  
+Po = 70%, -Po = 30%  
+Po = 30%, -Po = 70%
- At loads <20% of full load, higher input ripple current is possible.
- The efficiency of the converter with all outputs at full load.
- Each output tested separately.

- Recovery and startup times are measured from application of the transient or change in condition to the point at which VOUT is within 1% of final value.
- Step load test is performed at 10 microseconds typical.
- Step line test is performed at 100 microseconds ± 20 microseconds.
- Tested on release from inhibit.
- No effect on dc performance. Applies to each auxiliary.

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TABLE 7: ELECTRICAL CHARACTERISTICS -55°C TO +125°C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

TRIPLE OUTPUT MODEL – MWR283R315T		3.3 (MAIN)			±15 (AUXILIARIES)			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE	MAIN AND POS. AUX	3.23	3.30	3.37	14.70	15.00	15.30	V
	NEG. AUX.	—	—	—	14.62	15.00	15.38	
OUTPUT CURRENT VIN = 14 TO 50 V	MAIN AND EITHER OUTPUT	—	—	3.0	—	±0.667	0.93 <sup>1</sup>	A
	MAX TOTAL AUX	—	—	—	—	—	1.34	
OUTPUT POWER VIN = 14 TO 50 V	MAIN AND EITHER OUTPUT	—	—	10	—	±10	14 <sup>1</sup>	W
	MAX TOTAL AUX	—	—	—	—	—	20	
OUTPUT RIPPLE 10 kHz - 20 MHz	TC = 25°C	—	15	45	—	35	80	mV p-p
	TC = -55°C TO +125°C	—	15	60	—	35	100	
LINE REGULATION VIN = 14 TO 50 V	MAIN AND POS. AUX	—	5	25	—	5	50	mV
	NEG. AUX.	—	—	—	—	25	120	
LOAD REGULATION BALANCED AUX.	MAIN AND +AUX., NL - FL	—	5	25	—	5	50	mV
	-AUX., NL - FL	—	—	—	—	28	100	
CROSS REGULATION <sup>2</sup> TC = 25°C	EFFECT ON NEGATIVE AUXILIARY	—	—	—	—	250	600	mV
INPUT VOLTAGE	CONTINUOUS	14	28	50	—	—	—	V
	TRANSIENT 1 sec <sup>1</sup>	—	—	80	—	—	—	V
INPUT CURRENT	NO LOAD	—	50	70	—	—	—	mA
	INHIBITED	—	2.5	4	—	—	—	
INPUT RIPPLE CURRENT <sup>3</sup>	10 kHz - 20 MHz	—	36	100	—	—	—	mA p-p
EFFICIENCY <sup>4</sup>	TC = 25°C	79	82	—	—	—	—	%
	TC = -55°C TO +125°C	78	—	—	—	—	—	
LOAD FAULT <sup>5, 6</sup>	POWER DISSIPATION	—	6	9.5	—	5	9.5	W
	RECOVERY <sup>1</sup>	—	15	20	—	—	20	ms
STEP LOAD RESPONSE <sup>6, 7</sup> 50% - 100% - 50%	TRANSIENT	—	±75	±350	—	±175	±600	mV pk
	RECOVERY	—	120	400	—	145	600	μs
STEP LINE RESPONSE <sup>1, 6, 8</sup> 14 - 50 - 14 VIN	TRANSIENT	—	±100	±400	—	±200	±400	mV pk
	RECOVERY	—	400	600	—	200	700	μs
START-UP <sup>6, 9</sup>	DELAY	—	15	20	—	—	20	ms
	OVERSHOOT <sup>1</sup>	—	5	33	—	5	70	mV pk
CAPACITIVE LOAD <sup>1, 10</sup>	25°C	—	—	1000	—	—	500	μF

## Notes

- Guaranteed by design and/or analysis. Not an in-line test.
- Effect on -Vout for the following conditions. Percentages are of total aux. power (20 W). Conditions are referenced to balanced aux. loads of 50%/50%.  
+Po = 70%, -Po = 30%  
+Po = 30%, -Po = 70%
- At loads <20% of full load, higher input ripple current is possible.
- The efficiency of the converter with all outputs at full load.
- Each output tested separately.

- Recovery and startup times are measured from application of the transient or change in condition to the point at which VOUT is within 1% of final value.
- Step load test is performed at 10 microseconds typical.
- Step line test is performed at 100 microseconds ± 20 microseconds.
- Tested on release from inhibit.
- No effect on dc performance. Applies to each auxiliary.

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TABLE 8: ELECTRICAL CHARACTERISTICS -55°C TO +125°C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

TRIPLE OUTPUT MODEL – MWR28512T		5 (MAIN)			±12 (AUXILIARIES)			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE	MAIN AND POS. AUX	4.90	5.00	5.10	11.76	12.00	12.24	V
	NEG. AUX.	—	—	—	11.70	12.00	12.30	
OUTPUT CURRENT VIN = 14 TO 50 V	MAIN AND EITHER OUTPUT	—	—	3.0	—	±0.833	1.16 <sup>1</sup>	A
	MAX TOTAL AUX	—	—	—	—	—	1.67	
OUTPUT POWER VIN = 14 TO 50 V	MAIN AND EITHER OUTPUT	—	—	15	—	±10	14 <sup>1</sup>	W
	MAX TOTAL AUX	—	—	—	—	—	20	
OUTPUT RIPPLE 10 kHz - 20 MHz	TC = 25°C	—	20	45	—	50	80	mV p-p
	TC = -55°C TO +125°C	—	20	60	—	50	120	
LINE REGULATION VIN = 14 TO 50 V	MAIN AND POS. AUX	—	5	25	—	5	50	mV
	NEG. AUX.	—	—	—	—	28	120	
LOAD REGULATION BALANCED AUX.	MAIN AND +AUX., NL - FL	—	5	25	—	5	50	mV
	-AUX., NL - FL	—	—	—	—	20	100	
CROSS REGULATION <sup>2</sup> TC = 25°C	EFFECT ON NEGATIVE AUXILIARY	—	—	—	—	250	600	mV
INPUT VOLTAGE	CONTINUOUS	14	28	50	—	—	—	V
	TRANSIENT 1 sec <sup>1</sup>	—	—	80	—	—	—	V
INPUT CURRENT	NO LOAD	—	50	70	—	—	—	mA
	INHIBITED	—	2.5	4	—	—	—	
INPUT RIPPLE CURRENT <sup>3</sup> 10 kHz - 20 MHz		—	40	100	—	—	—	mA p-p
EFFICIENCY <sup>4</sup>	TC = 25°C	81	84	—	—	—	—	%
	TC = -55°C TO +125°C	80	—	—	—	—	—	
LOAD FAULT <sup>5, 6</sup>	POWER DISSIPATION	—	7	9.5	—	5	9.5	W
	RECOVERY <sup>1</sup>	—	15	20	—	—	20	ms
STEP LOAD RESPONSE <sup>6, 7</sup> 50% - 100% - 50%	TRANSIENT	—	±75	±350	—	±150	±600	mV pk
	RECOVERY	—	230	400	—	175	600	μs
STEP LINE RESPONSE <sup>1, 6, 8</sup> 14 - 50 - 14 VIN	TRANSIENT	—	±100	±400	—	±200	±400	mV pk
	RECOVERY	—	400	900	—	200	600	μs
START-UP <sup>6, 9</sup>	DELAY	—	15	20	—	—	20	ms
	OVERSHOOT <sup>1</sup>	—	5	50	—	5	60	mV pk
CAPACITIVE LOAD <sup>1, 10</sup> 25°C		—	—	1000	—	—	500	μF

### Notes

- Guaranteed by design and/or analysis. Not an in-line test.
- Effect on -Vout for the following conditions. Percentages are of total aux. power (20 W). Conditions are referenced to balanced aux. loads of 50%/50%.  
+Po = 70%, -Po = 30%  
+Po = 30%, -Po = 70%
- At loads <20% of full load, higher input ripple current is possible.
- The efficiency of the converter with all outputs at full load.
- Each output tested separately.

- Recovery and startup times are measured from application of the transient or change in condition to the point at which VOUT is within 1% of final value.
- Step load test is performed at 10 microseconds typical.
- Step line test is performed at 100 microseconds ± 20 microseconds.
- Tested on release from inhibit.
- No effect on dc performance. Applies to each auxiliary.



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TABLE 9: ELECTRICAL CHARACTERISTICS -55°C TO +125°C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

TRIPLE OUTPUT MODEL – MWR28515T		5 (MAIN)			±15 (AUXILIARIES)			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE	MAIN AND POS. AUX	4.90	5.00	5.10	14.70	15.00	15.30	V
	NEG. AUX.	—	—	—	14.62	15.00	15.38	
OUTPUT CURRENT VIN = 14 TO 50 V	MAIN AND EITHER OUTPUT	—	—	3.0	—	±0.667	0.93 <sup>1</sup>	A
	MAX TOTAL AUX	—	—	—	—	—	1.34	
OUTPUT POWER VIN = 14 TO 50 V	MAIN AND EITHER OUTPUT	—	—	15	—	±10	14 <sup>1</sup>	W
	MAX TOTAL AUX	—	—	—	—	—	20	
OUTPUT RIPPLE 10 kHz - 20 MHz	TC = 25°C	—	20	45	—	35	80	mV p-p
	TC = -55°C TO +125°C	—	20	60	—	35	100	
LINE REGULATION VIN = 14 TO 50 V	MAIN AND POS. AUX	—	5	25	—	5	50	mV
	NEG. AUX.	—	—	—	—	28	120	
LOAD REGULATION BALANCED AUX.	MAIN AND +AUX., NL - FL	—	5	25	—	50	50	mV
	-AUX., NL - FL	—	—	—	—	25	100	
CROSS REGULATION <sup>2</sup> TC = 25°C	EFFECT ON NEGATIVE AUXILIARY	—	—	—	—	250	600	mV
INPUT VOLTAGE	CONTINUOUS	14	28	50	—	—	—	V
	TRANSIENT 1 sec <sup>1</sup>	—	—	80	—	—	—	V
INPUT CURRENT	NO LOAD	—	50	70	—	—	—	mA
	INHIBITED	—	2.5	4	—	—	—	
INPUT RIPPLE CURRENT <sup>3</sup>	10 kHz - 20 MHz	—	40	100	—	—	—	mA p-p
EFFICIENCY <sup>4</sup>	TC = 25°C	82	85	—	—	—	—	%
	TC = -55°C TO +125°C	81	—	—	—	—	—	
LOAD FAULT <sup>5, 6</sup>	POWER DISSIPATION	—	7	9.5	—	5	9.5	W
	RECOVERY <sup>1</sup>	—	15	20	—	—	20	ms
STEP LOAD RESPONSE <sup>6, 7</sup> 50% - 100% - 50%	TRANSIENT	—	±75	±350	—	±175	±600	mV pk
	RECOVERY	—	230	400	—	145	600	μs
STEP LINE RESPONSE <sup>1, 6, 8</sup> 14 - 50 - 14 VIN	TRANSIENT	—	±100	±400	—	±200	±400	mV pk
	RECOVERY	—	400	900	—	200	700	μs
START-UP <sup>6, 9</sup>	DELAY	—	15	20	—	—	20	ms
	OVERSHOOT <sup>1</sup>	—	5	50	—	5	70	mV pk
CAPACITIVE LOAD <sup>1, 10</sup>	25°C	—	—	1000	—	—	500	μF

## Notes

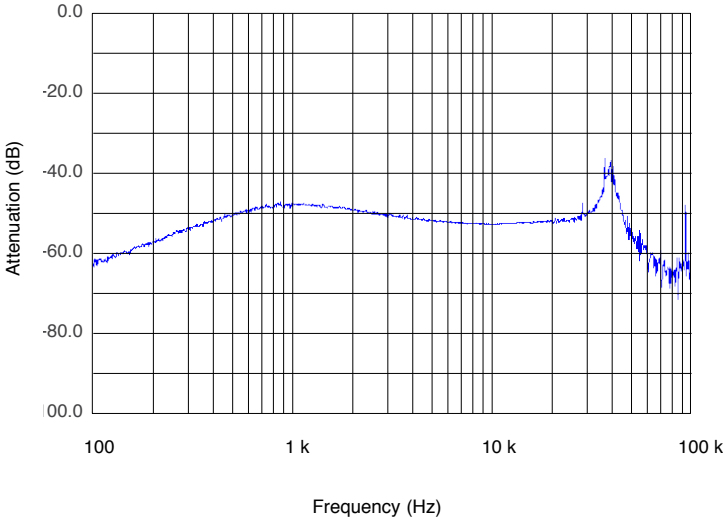
- Guaranteed by design and/or analysis. Not an in-line test.
- Effect on -Vout for the following conditions. Percentages are of total aux. power (20 W). Conditions are referenced to balanced aux. loads of 50%/50%.  
+Po = 70%, -Po = 30%  
+Po = 30%, -Po = 70%
- At loads <20% of full load, higher input ripple current is possible.
- The efficiency of the converter with all outputs at full load.
- Each output tested separately.

- Recovery and startup times are measured from application of the transient or change in condition to the point at which VOUT is within 1% of final value.
- Step load test is performed at 10 microseconds typical.
- Step line test is performed at 100 microseconds ± 20 microseconds.
- Tested on release from inhibit.
- No effect on dc performance. Applies to each auxiliary.

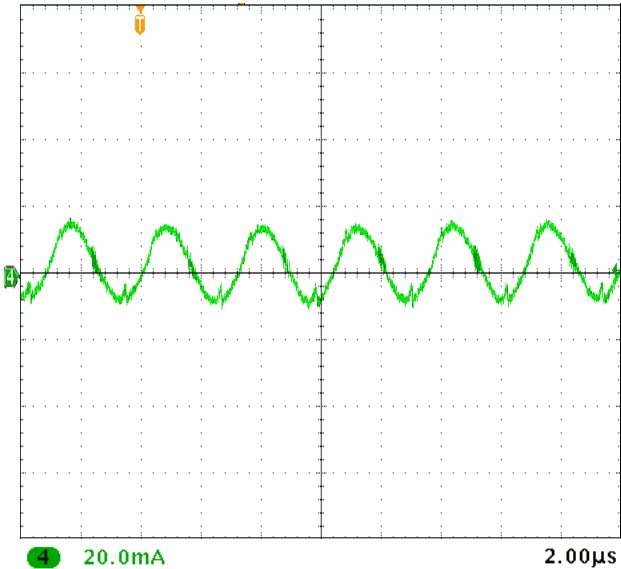
# MWR Triple DC-DC Converters

## 14 TO 50 VOLT INPUT - 35 WATT

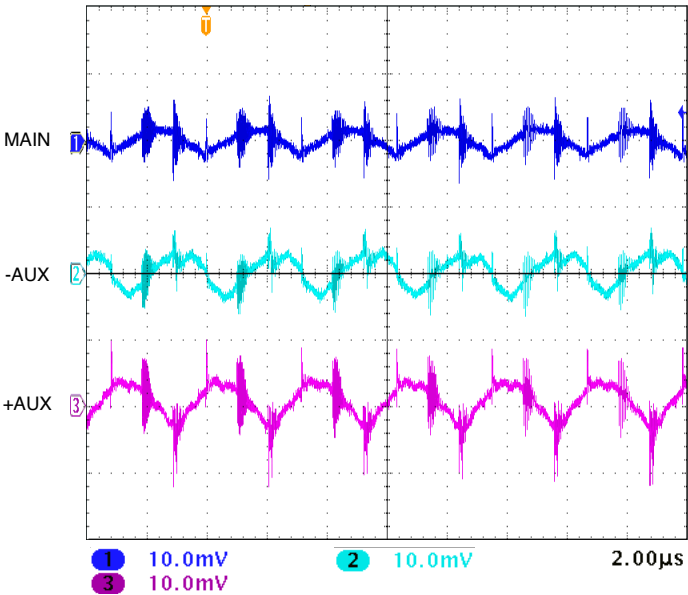
TYPICAL PERFORMANCE PLOTS: 25°C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.  
FOR REFERENCE ONLY, NOT GUARANTEED SPECIFICATIONS.



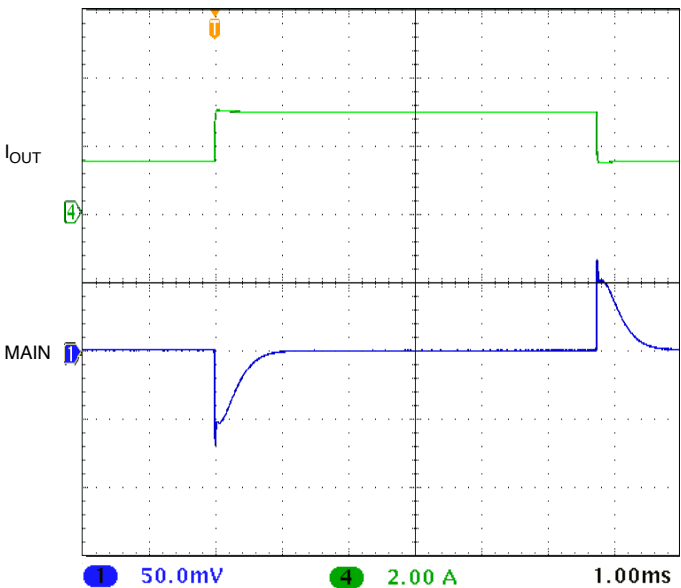
MWR28515T AUDIO REJECTION WITH FMCE-0528  
FIGURE 4



UNITS ARE PER DIVISION  
MWR28515T INPUT RIPPLE  
FIGURE 5



UNITS ARE PER DIVISION  
MWR28515T OUTPUT RIPPLE  
FIGURE 6

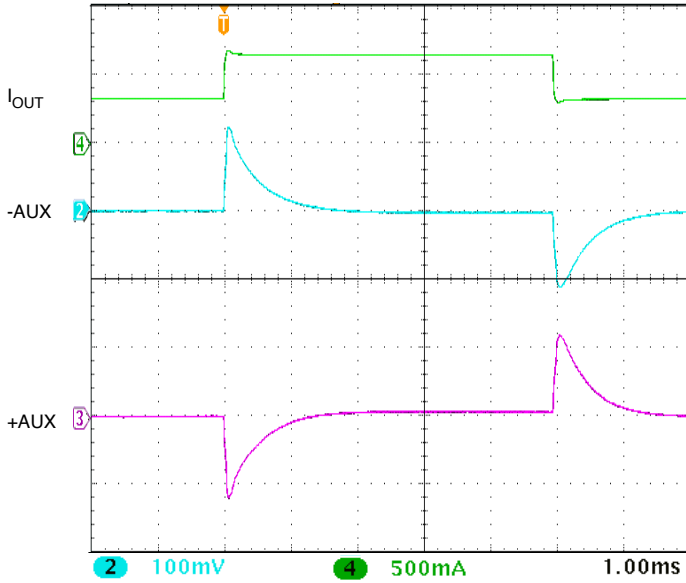


UNITS ARE PER DIVISION, 10 µS SLEW RATE  
MWR28515T STEP LOAD MAIN, 50% - 100% - 50%  
FIGURE 7

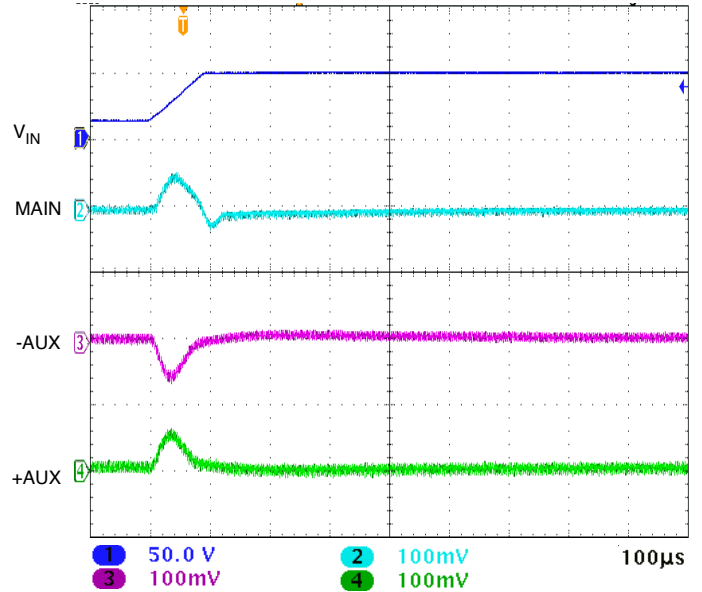
# MWR Triple DC-DC Converters

## 14 TO 50 VOLT INPUT - 35 WATT

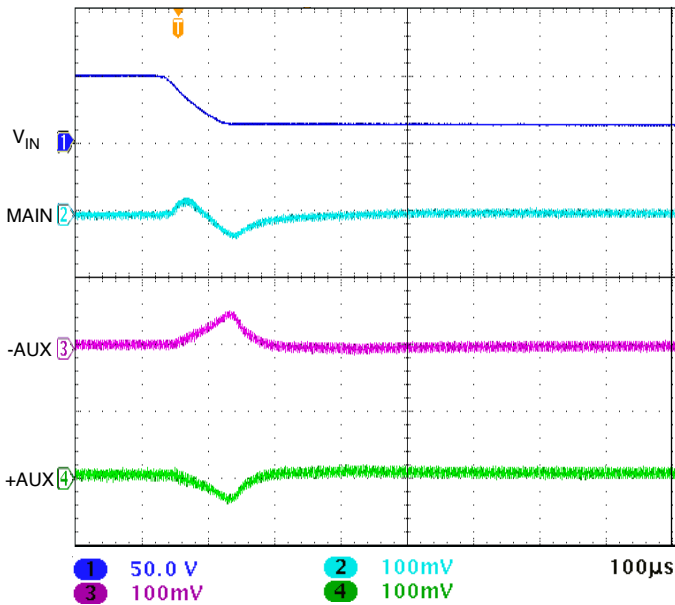
TYPICAL PERFORMANCE PLOTS: 25°C CASE, 28 V<sub>IN</sub>, 100% LOAD, UNLESS OTHERWISE SPECIFIED.  
 FOR REFERENCE ONLY, NOT GUARANTEED SPECIFICATIONS.



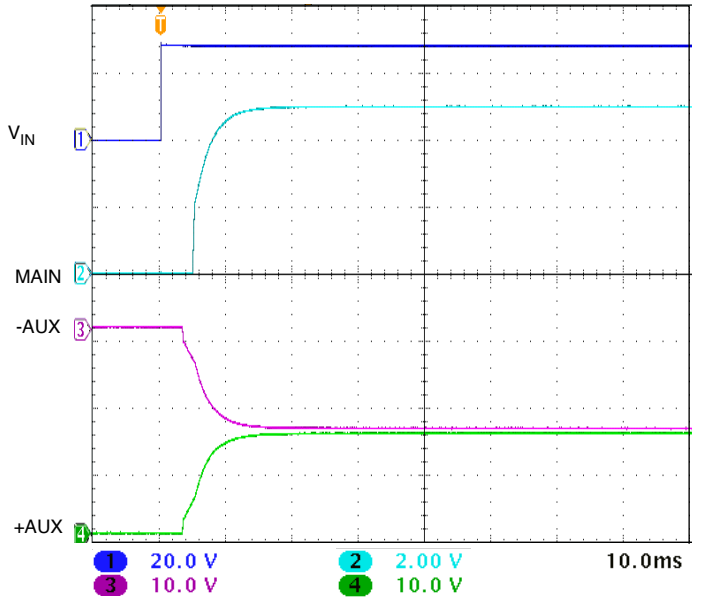
UNITS ARE PER DIVISION, 10  $\mu$ S SLEW RATE  
 MWR28515T STEP LOAD  $\pm$ AUX., 50% - 100% - 50%  
 FIGURE 8



UNITS ARE PER DIVISION  
 MWR28515T STEP LINE 14 V<sub>IN</sub> TO 50 V<sub>IN</sub>  
 FIGURE 9



UNITS ARE PER DIVISION  
 MWR28515T STEP LINE 50 V<sub>IN</sub> TO 14 V<sub>IN</sub>  
 FIGURE 10

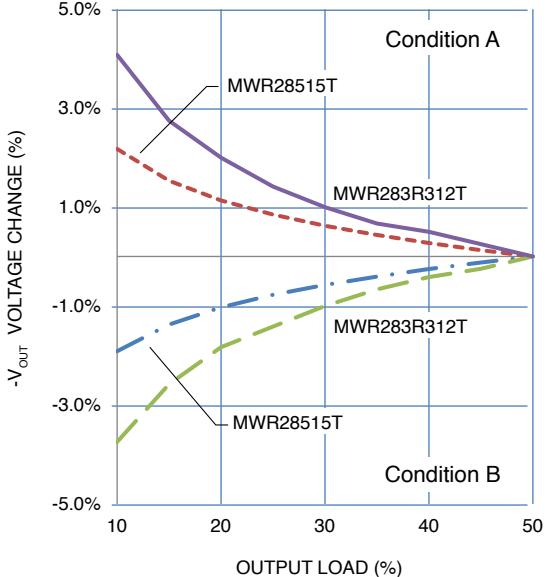


UNITS ARE PER DIVISION  
 MWR28515T START-UP INTO FULL LOAD  
 FIGURE 11

# MWR Triple DC-DC Converters

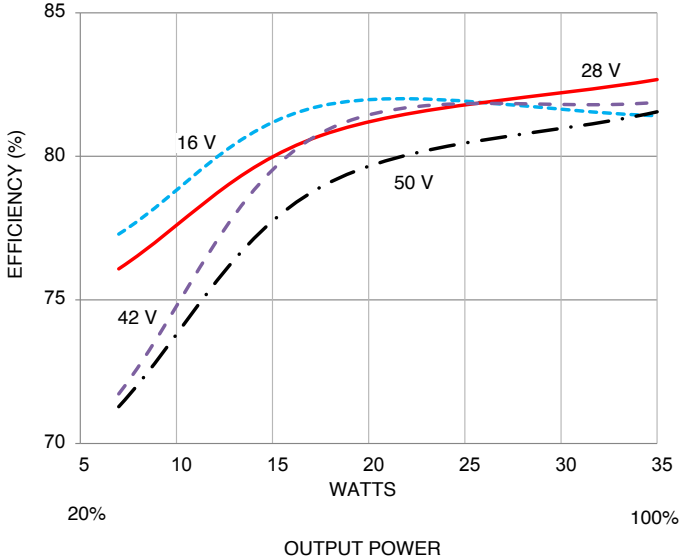
## 14 TO 50 VOLT INPUT - 35 WATT

TYPICAL PERFORMANCE PLOTS: 25°C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.  
 FOR REFERENCE ONLY, NOT GUARANTEED SPECIFICATIONS.



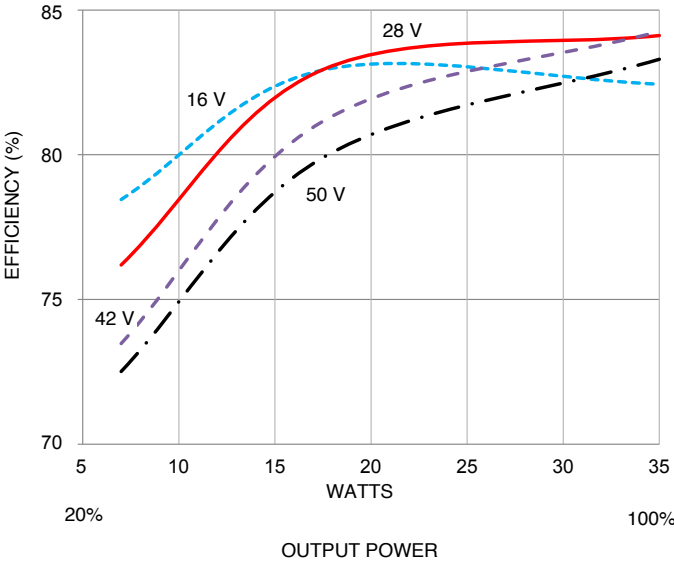
CONDITION A LOAD: -V 50%, +V 50% TO 10%  
 CONDITION B LOAD: +V 50%, -V 50% TO 10%  
 CROSS REGULATION

FIGURE 12



MWR283R312T EFFICIENCY

FIGURE 13



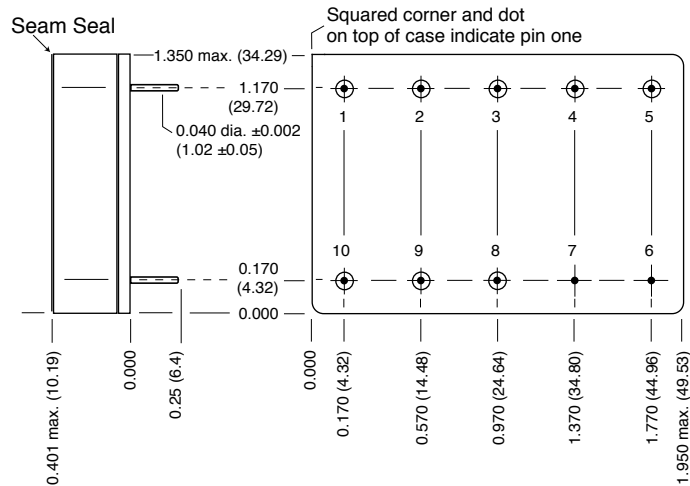
MWR28515T EFFICIENCY

FIGURE 14

# MWR Triple DC-DC Converters

## 14 TO 50 VOLT INPUT - 35 WATT

BOTTOM VIEW MWR



**Weight:** 58 grams max.

**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 Kovar/Nickel  
 Pins #52 alloy/Gold ceramic seal  
 Gold plating of 50 - 150 microinches is included in pin diameter  
 Seal hole 0.120 ±0.002 (3.05 ± 0.05)

Please refer to the numerical dimensions for accuracy.

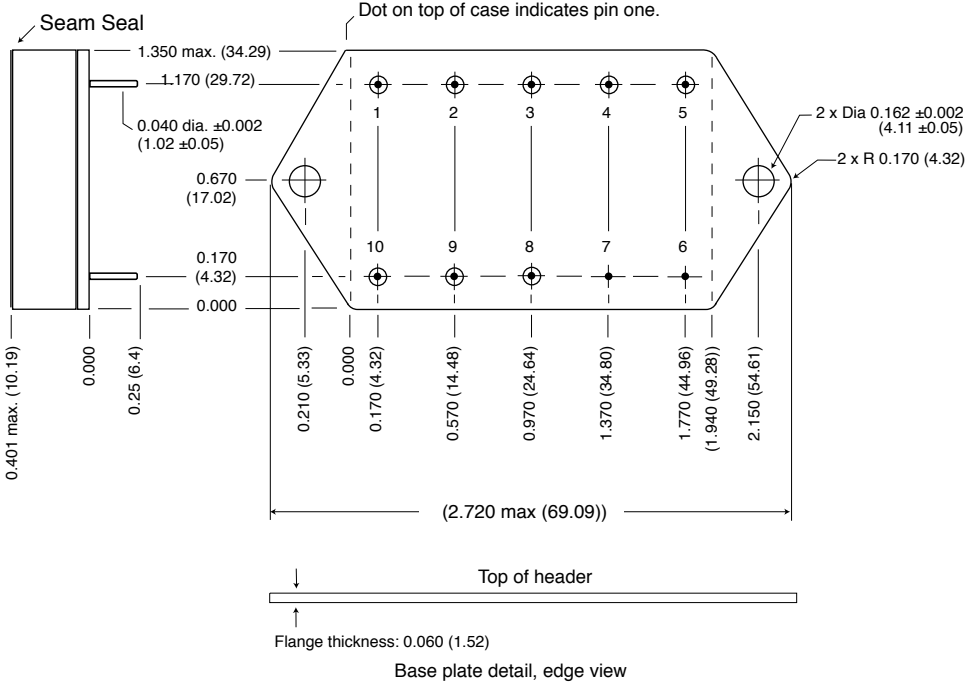
FIGURE 15: MWR

# MWR Triple DC-DC Converters

## 14 TO 50 VOLT INPUT - 35 WATT

### BOTTOM VIEW MWR FLANGED

Flanged cases: Designator "F" required in Case Option position of model number.



**Weight:** 60 grams maximum

**Case dimensions in inches (mm)**

Tolerance  $\pm 0.005$  (0.13) for three decimal places  
 $\pm 0.01$  (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 Kovar/Nickel
- Pins #52 alloy/Gold ceramic seal
- Gold plating of 50 - 150 microinches included in pin diameter
- Seal Hole: 0.120  $\pm 0.002$  (3.04  $\pm 0.05$ )

Please refer to the numerical dimensions for accuracy.

FIGURE 16: MWR FLANGED

# MWR Triple DC-DC Converters

14 TO 50 VOLT INPUT - 35 WATT

## ELEMENT EVALUATION <sup>1</sup> HIGH RELIABILITY /883 (CLASS H)

COMPONENT-LEVEL TEST PERFORMED	QML	
	CLASS H /883	
	M/S <sup>2</sup>	P <sup>3</sup>
Element Electrical	■	■
Visual	■	■
Internal Visual	■	
Final Electrical	■	■
Wire Bond Evaluation	■	■

Notes

1. Element evaluation does not apply to standard and /ES product.
2. M/S = Active components (microcircuit and semiconductor die).
3. P = Passive components, Class H element evaluation. Not applicable to standard and /ES element evaluation.

TABLE 10: ELEMENT EVALUATION

# MWR Triple DC-DC Converters

## 14 TO 50 VOLT INPUT - 35 WATT

### ENVIRONMENTAL SCREENING HIGH RELIABILITY STANDARD, /ES AND /883 (CLASS H)

TEST PERFORMED	NON-QML <sup>1</sup>		QML <sup>2</sup>
	STANDARD	/ES	CLASS H /883
<b>Pre-cap Inspection, Method 2017, 2032</b>	■	■	■
<b>Temperature Cycle (10 times)</b>			
Method 1010, Cond. C, -65°C to +150°C, ambient			■
Method 1010, Cond. B, -55°C to +125°C, ambient		■	
<b>Constant Acceleration</b>			
Method 2001, 3000 g			■
Method 2001, 500 g		■	
<b>PIND, Test Method 2020, Cond. A</b>			■ <sup>3</sup>
<b>Burn-in Method 1015, +125°C case, typical <sup>4</sup></b>			
96 hours		■	
160 hours			■
<b>Final Electrical Test, MIL-PRF-38534, Group A,</b>			
Subgroups 1 through 6, -55°C, +25°C, +125°C case			■
Subgroups 1 and 4, +25°C case	■	■	
<b>Hermeticity Test</b>			
Gross Leak, Cond. C <sub>1</sub> , fluorocarbon		■	■
Fine Leak, Cond. A <sub>2</sub> , helium		■	■
Gross Leak, Dip	■		
<b>Final visual inspection, Method 2009</b>	■	■	■

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

#### Notes

- Standard and ES are non-QML products and may not meet all of the requirements of MIL-PRF-38534.
- All processes are QML qualified and performed by certified operators.
- Not required by DLA but performed to assure product quality.
- Burn-in temperature designed to bring the case temperature to +125°C minimum. Burn-in is a powered test.

TABLE 11: ENVIRONMENTAL SCREENING