MTR (50) Single and Dual DC-DC Converters

16 TO 50 VOLT INPUT – 20 TO 30 WATT

FEATURES

- Input voltage range 16 to 50 volts
- Transient protection up to 80 volts per MIL-STD-704A
- Operating temperature -55 °C to +125 °C
- Fully isolated, magnetic feedback
- Fixed high frequency switching
- Inhibit and synchronization function
- Indefinite short circuit and overload protection
- Soft-start function limits inrush current during start-up

MODELS OUTPUT VOLTAGE (V)	
SINGLE	DUAL
3.3	±5
5	±12
8.5	±15
12	
15	

LEGACY MTR (40):
16 - 40 Vin, 50 V transient / 50 ms.
Datasheet at www.interpoint.com/mtr40

DESCRIPTION

The Interpoint® MTR (50) Series™ of DC-DC converters offers up to 30 watts of power from single or dual output configurations in a low profile package. The MTR (50) converters are manufactured in our fully certified and qualified MIL-PRF-38534 Class H production facility and packaged in hermetically sealed steel cases. They are ideal for use in programs requiring high reliability, small size, and high efficiency.

The MTR (50) have a wide input voltage range of 16 to 50 volts. Transient protection of up to 80 volts input meets the transient requirements of MIL-STD-704A. The converters operate over the full military temperature range with up to 81% efficiency typical. The converters are offered with standard screening, "ES" screening, or fully compliant to "883" MIL-PRF-38534 Class H screening. See Table 12 on page 28. Standard Microcircuit Drawings (SMD) are available, refer to the cross-reference in Table 3 on page 6.

COVER MARKING

The cover marking for the MTR (50) has "MTR (50) DC-DC CONVERTER" below the model number. Figure 8 on page 6 illustrates the cover marking.

CONVERTER DESIGN

The MTR (50) converters are constant frequency, pulse-width modulated switching regulators which use a quasi-square wave, single ended, forward converter design. Tight load regulation is maintained via wide bandwidth magnetic feedback and, on single output models, through use of remote sense. On dual output models, the positive output is independently regulated and the negative output is cross regulated through the use of tightly coupled magnetics.

All models include a soft-start function to prevent large current draw and minimize overshoot. Indefinite short circuit protection and overload protection are provided by a constant current-limit feature. This protective system senses current in the converter's secondary stage and limits it to approximately 140% of the maximum rated output current.

MTR (50) converters are provided with internal filtering capacitors that help reduce the need for external components in normal operation. Use our FMCE-0328™, FMCE-0528™ or FMCE-0828™ EMI filter to meet the requirements of MIL-STD-461C CE03 and CS01 and/or MIL-STD-461D, E and F CE102 and CS101 levels of conducted emissions.

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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 500 kHz and 675 kHz. The sync control operates with a duty cycle between 40% and 60%. The sync pin must be connected to input common pin when not in use.

Dynamic Response

The MTR (50) Series feed-forward compensation system provides excellent dynamic response and audio rejection. Audio rejection is typically 40 dB. The minimum to maximum step line transition response is typically less than 4%.

Inhibit Function

MTR (50) Series converters provide an inhibit terminal that can be used to disable internal switching, resulting in no output voltage and very low quiescent input current. The converter is inhibited when the inhibit pin is pulled below 0.8 volts and enabled when its inhibit pin is left floating. An external inhibit interface should be capable of pulling the converter's inhibit pin below 0.8 volts while sinking the maximum inhibit current and also allowing the inhibit pin to float high to enable the converter. A voltage should not be applied to the inhibit pin. The open circuit voltage present on the inhibit pin is 9 to 11 volts.

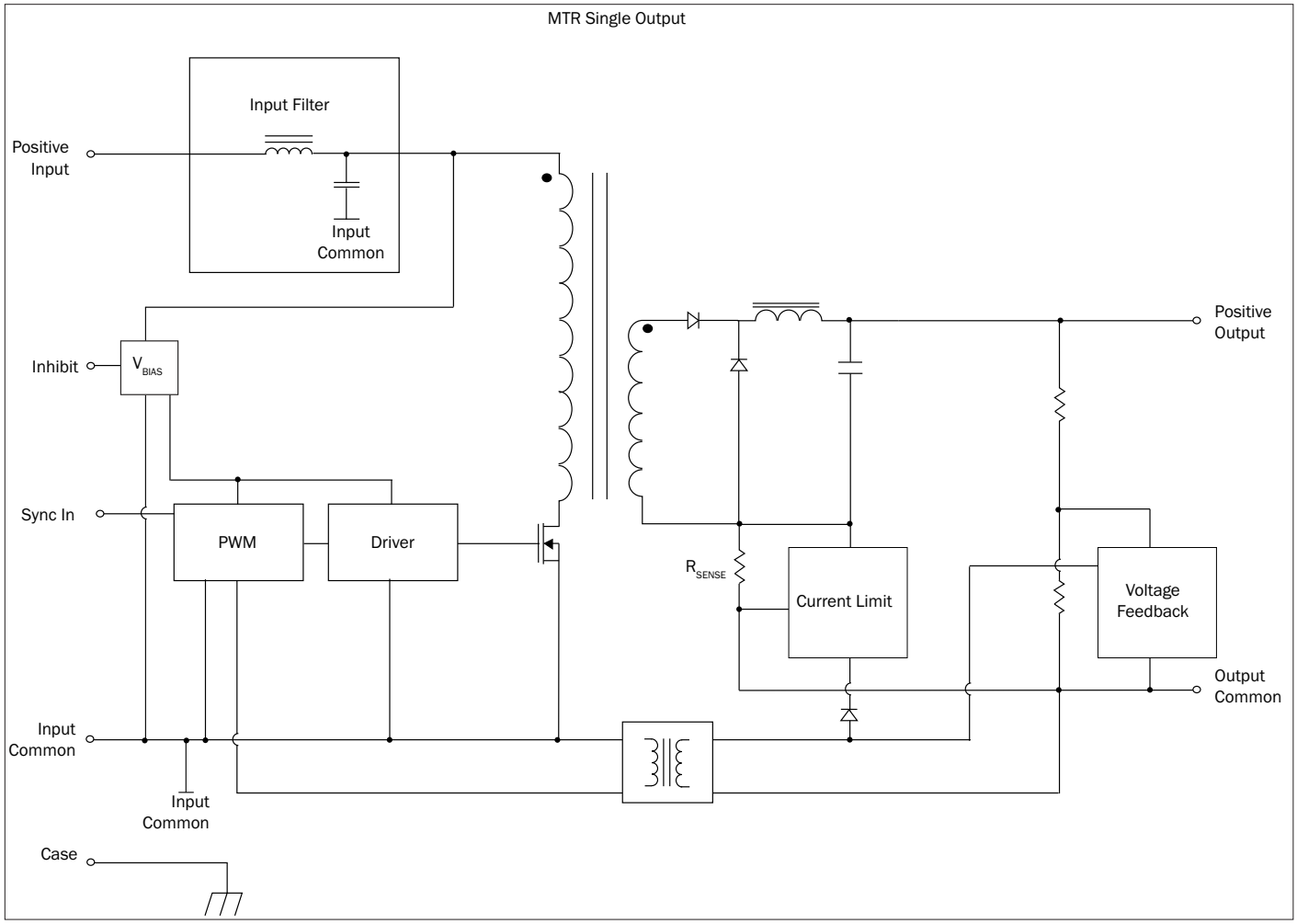

Figure 1: MTR (50) Single Block Diagram

MTR (50) Single and Dual DC-DC Converters

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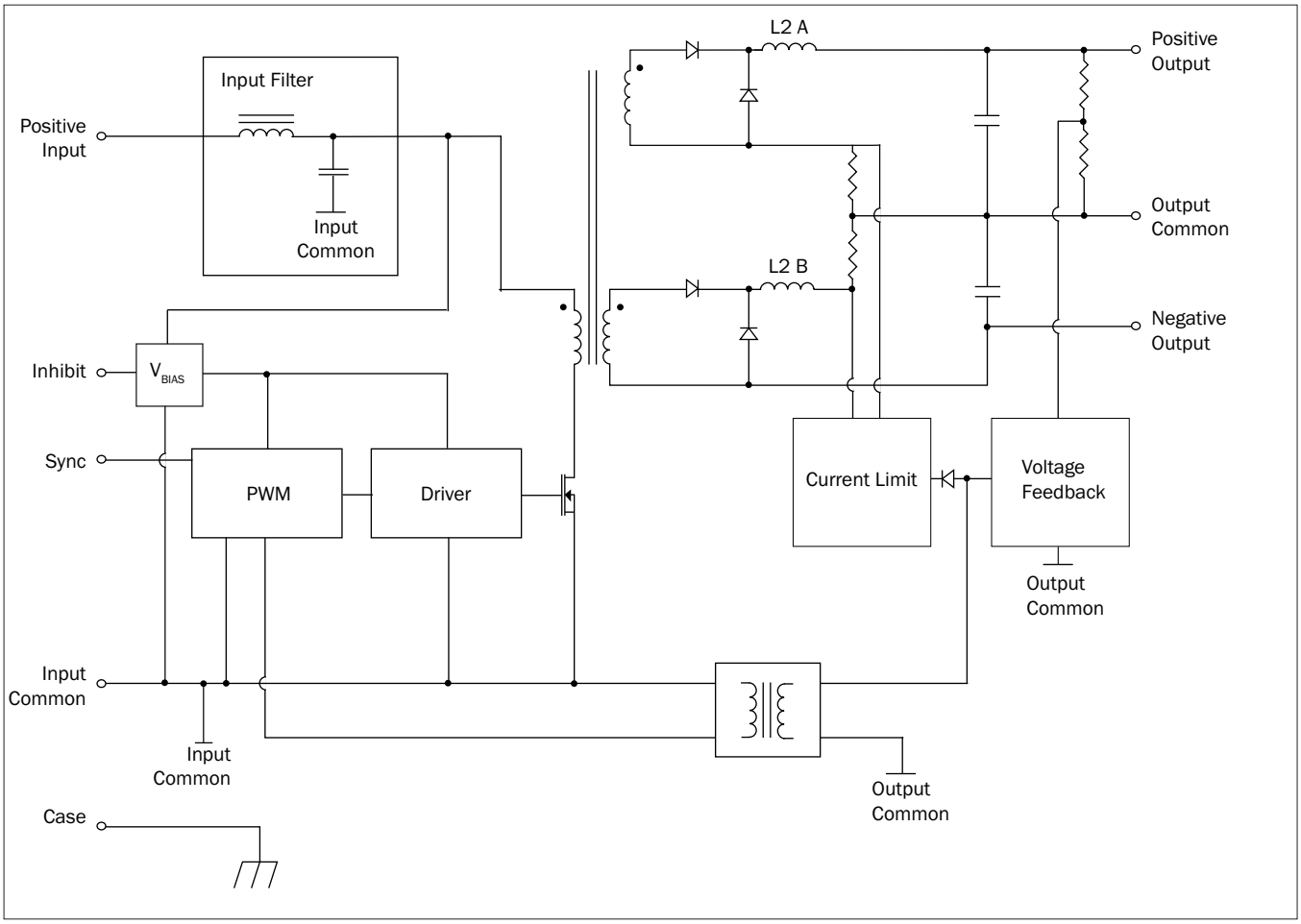
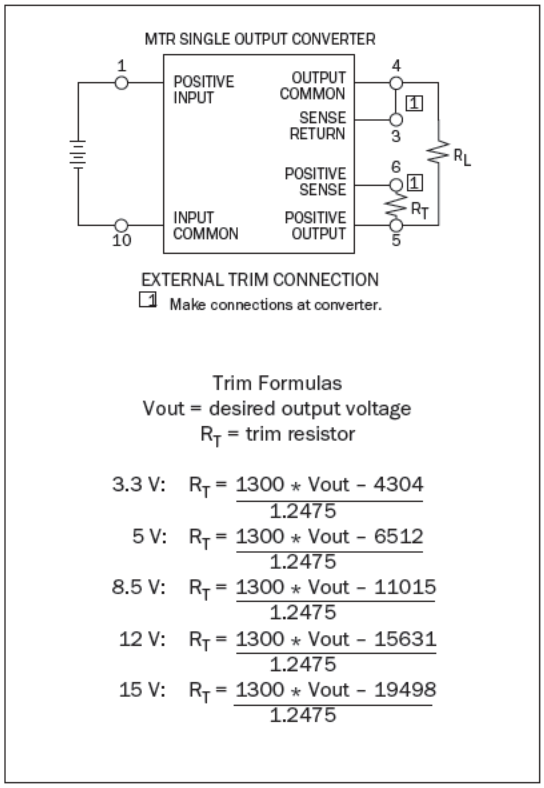


FIGURE 2: MTR (50) DUAL BLOCK DIAGRAM

MTR (50) Single and Dual DC-DC Converters

16 TO 50 VOLT INPUT – 20 TO 30 WATT

TRIM AND REMOTE SENSE (AVAILABLE ON SINGLE OUTPUT MODELS ONLY)



Trim Formulas
Vout = desired output voltage
R_T = trim resistor

3.3 V: $R_T = \frac{1300 * Vout - 4304}{1.2475}$

5 V: $R_T = \frac{1300 * Vout - 6512}{1.2475}$

8.5 V: $R_T = \frac{1300 * Vout - 11015}{1.2475}$

12 V: $R_T = \frac{1300 * Vout - 15631}{1.2475}$

15 V: $R_T = \frac{1300 * Vout - 19498}{1.2475}$

FIGURE 3: TRIM CONNECTION [1, 2, 3]

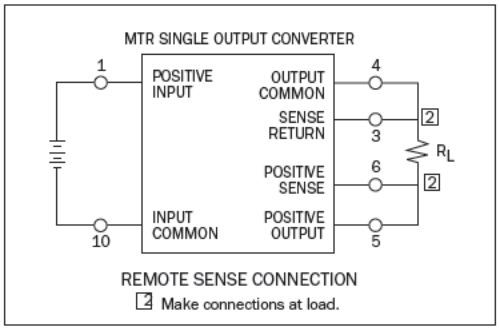


FIGURE 4: REMOTE SENSE CONNECTION [4]

Notes for Remote Sense and Trim

1. When trimming output voltage and/or remote sensing, the total output voltage increase must be less than 0.6 volts at the converters pins. Do not exceed the maximum power.
2. If neither voltage trim nor remote sense will be used, connect pin 3 to pin 4 and pin 5 to pin 6.
3. CAUTION: The converter will be permanently damaged if the remote sense (pin 6) is shorted to ground. Damage may also result if the output common or positive output is disconnected from the load when the remote sense leads are connected to the load.
4. When using remote sense for voltage compensation or when using remote sense for trim, the output will drift over temperature. Contact Applications Engineering for more information at powerapps@craneae.com

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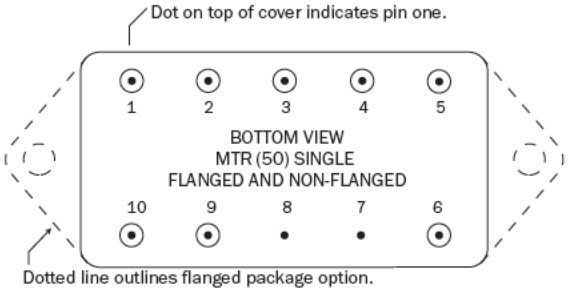
PIN OUT		
Pin	**Single Output**	**Dual Output**
1	Positive Input	Positive Input
2	Inhibit	Inhibit
3	Sense Return	Positive Output
4	Output Common	Output Common
5	Positive Output	Negative Output
6	Positive Sense	Case Ground
7	Case Ground	Case Ground
8	Case Ground	Case Ground
9	Sync	Sync
10	Input Common	Input Common

TABLE 1: MTR (50) PIN OUT

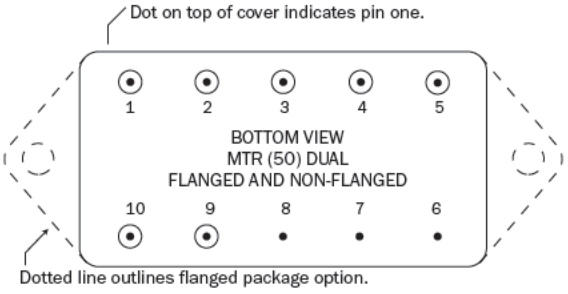
PINS NOT IN USE	
Inhibit	Leave unconnected
Sync In	Connect to input common
Sense Lines	Must be connected to appropriate outputs

TABLE 2: MTR (50) PINS NOT IN USE



For dimensions see Figure 48 on page 26 and Figure 49 on page 27

FIGURE 5: MTR (50) PIN OUT SINGLE OUTPUT MODELS



For dimensions see cases Figure 48 on page 26 and Figure 49 on page 27

FIGURE 6: MTR (50)PIN OUT DUAL OUTPUT MODELS

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MODEL NUMBERING KEY

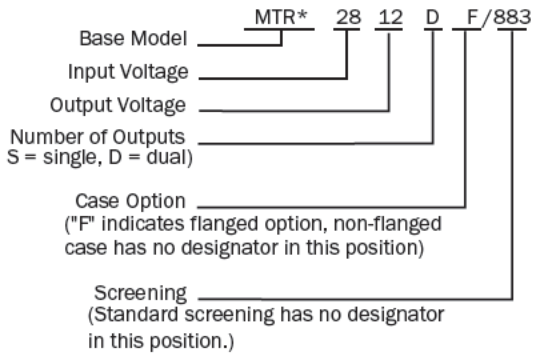

FIGURE 7: MTR (50) MODEL NUMBERING KEY

* "INTERPOINT MTR (50) DC-DC CONVERTER" is printed under the model number on the cover

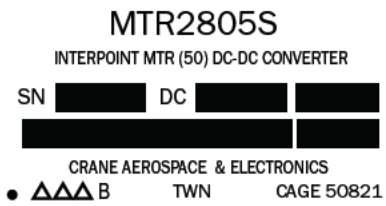

FIGURE 8: COVER MARKING FOR MTR (50) - 50 VIN

SMD NUMBERS	
STANDARD MICROCIRCUIT DRAWING (SMD)	**MTR (50) SIMILAR PART**
5962-0150103HXC	MTR283R3S/883
5962-9306803HXC	MTR2805S/883
5962-9306903HXC	MTR2812S/883
5962-9307003HXC	MTR2815S/883
5962-9320503HXC	MTR2805D/883
5962-9307103HXC	MTR2812D/883
5962-9307203HXC	MTR2815D/883

SMD numbers shown are for screening level Class H, standard case (X), standard pin seal and non-solder dipped pins (C). For other options please refer to the SMD for the SMD number and the vendor similar number. All SMD numbers are listed on the SMD in the "Bulletin" which is the last page of the SMD. For exact specifications for an SMD product, refer to the SMD. SMDs can be downloaded from https://landandmaritimeapps.dla.mil/programs/smcr

TABLE 3: MTR (50) SMD NUMBER CROSS REFERENCE

MTR (50) MODEL NUMBER OPTIONS

TO DETERMINE THE MODEL NUMBER ENTER ONE OPTION FROM EACH CATEGORY IN THE FORM BELOW.

CATEGORY	Base Model and Input Voltage	Output Voltage [1]	Number of Outputs [2]	Case Options [3]	Screening [4]
OPTIONS	MTR28	3R3, 05, 8R5, 12, 15	S	(non-flanged, leave blank)	(standard, leave blank)
		05, 12, 15	D	F (flanged)	ES
					883
FILL IN FOR MODEL # [5]	MTR28	_____	_____	_____	/ _____

Notes for MTR (50) Models
1. Output Voltage: An R indicates a decimal point. 3R3 is 3.3 volts out. The values of 3.3 and 8.5 volts are only available in single output models.
2. Number of Outputs: S is a single output and D is a dual output.
3. Case Options: For the standard case, Figure 48 on page 26, leave the case option blank. For the flanged case option, Figure 49 on page 27, 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 12 on page 28.
5. If ordering by model number add suffix "-Q" to request solder dipped leads (MTR2805S/883-Q).

TABLE 4: MTR (50) MODEL NUMBER OPTIONS

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TABLE 5: MTR (50) OPERATING CONDITIONS, ALL MODELS: 25°C T_C, 28 V_{IN}, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

		ALL MODELS			
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
LEAD SOLDERING TEMPERATURE [1]	10 SECONDS MAX.	—	—	300	°C
STORAGE TEMPERATURE [1]		-65	—	+150	°C
CASE OPERATING TEMPERATURE	FULL POWER	-55	—	+125	°C
	ABSOLUTE [1]	-55	—	+135	
DERATING OUTPUT POWER/CURRENT [1]	LINEARLY	From 100% at 125°C to 0% at 135°C			
ESD RATING [1, 2] MIL-PRF-38534, 3.9.5.8.2	MIL STD 883 METHOD 3015 CLASS 3B	—	—	≥8000	V
ISOLATION: INPUT TO OUTPUT, INPUT TO CASE, OUTPUT TO CASE [3]	@ 500 VDC AT 25°C	100	—	—	Megohms
INPUT TO OUTPUT CAPACITANCE [1]		—	50	—	pF
CURRENT LIMIT [4]	% OF FULL LOAD	—	140	—	%
AUDIO REJECTION [1]		—	40	—	dB
SWITCHING FREQUENCY	-55°C TO +125°C	530	—	670	kHz
SYNCHRONIZATION -55°C TO +125°C	INPUT FREQUENCY	500	—	675	kHz
	DUTY CYCLE [1]	40	—	60	%
	ACTIVE LOW	—	—	0.8	V
	ACTIVE HIGH [1]	4.5	—	5.0	
	REFERENCED TO	INPUT COMMON			
	IF NOT USED	CONNECT TO INPUT COMMON			
INHIBIT ACTIVE LOW (OUTPUT DISABLED) Do not apply a voltage to the inhibit pin. [5]	INHIBIT PIN PULLED LOW	—	—	0.8	V
	INHIBIT PIN SOURCE CURRENT [1]	—	—	8	mA
	REFERENCED TO	INPUT COMMON			
INHIBIT ACTIVE HIGH (OUTPUT ENABLED) Do not apply a voltage to the inhibit pin. [5]	INHIBIT PIN CONDITION	OPEN COLLECTOR OR UNCONNECTED			
	OPEN INHIBIT PIN VOLTAGE [1]	9	—	11	V

For mean time between failures (MTBF) contact Applications Engineering at powerapps@craneae.com

Notes
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Passed 8000 volts.
3. When testing isolation, input pins are tied together and output pins are tied together. They are tested against each other and against case. Discharge the pins before and after testing.
4. Dual outputs: The over-current limit will trigger when the sum of the currents from both outputs reaches 140% (typical value) of the maximum rated "total" current of both outputs.
5. 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: MTR (50) ELECTRICAL CHARACTERISTICS -55°C TO +125°C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

SINGLE OUTPUT MODELS		MTR283R3S			MTR2805S			MTR288R5S			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE		3.201	3.30	3.399	4.85	5.00	5.15	8.23	8.5	8.77	V
OUTPUT CURRENT	V_{IN} = 16 TO 50	0	—	6.06	0	—	5.0	0	—	2.94	A
OUTPUT POWER	V_{IN} = 16 TO 50	0	—	20	0	—	25	0	—	25	W
OUTPUT RIPPLE	T_C = 25°C	—	10	40	—	15	70	—	15	60	mV p-p
10 kHZ - 2 MHZ	T_C = -55°C TO +125°C	—	15	50	—	15	90	—	20	60	
LINE REGULATION	V_{IN} = 16 TO 50	—	0	10	—	2	50	—	2	50	mV
LOAD REGULATION	NO LOAD TO FULL	—	1	10	—	2	50	—	2	50	mV
INPUT VOLTAGE	CONTINUOUS	16	28	50	16	28	50	16	28	50	V
NO LOAD TO FULL	TRANSIENT 50 ms [1]	—	—	80	—	—	80	—	—	80	
INPUT CURRENT	NO LOAD	—	40	80	—	50	80	—	50	80	mA
	INHIBITED	—	3	8	—	3	8	—	3	8	
INPUT RIPPLE CURRENT [2]	10 kHZ - 10 MHZ	—	30	100	—	30	100	—	30	100	mA p-p
EFFICIENCY	T_C = 25°C	73	74	—	75	77	—	77	81	—	%
	T_C = -55°C TO +125°C	71	74	—	73	76	—	76	79	—	
LOAD FAULT [3, 4]	POWER DISSIPATION	—	8	12	—	8	12	—	6	12	W
SHORT CIRCUIT	RECOVERY [1]	—	1.4	6	—	1.4	5	—	1.4	5	ms
STEP LOAD RESPONSE [4, 5]	TRANSIENT	—	±80	±250	—	±100	±300	—	±150	±400	mV pk
50% - 100% - 50%	RECOVERY	—	50	200	—	50	200	—	30	200	µs
STEP LINE RESPONSE [1, 4, 6]	TRANSIENT	—	—	±300	—	±200	±300	—	±400	±500	mV pk
V_{IN} = 16 - 40 - 16	RECOVERY	—	—	400	—	—	400	—	—	400	µs
START-UP [4, 7]	DELAY	—	2.5	5	—	2.5	5	—	2.5	5	ms
FULL LOAD	OVERSHOOT	—	0	50	—	0	80	—	0	150	mV pk
CAPACITIVE LOAD [1]	NO EFFECT ON DC PERFORMANCE	—	—	3000	—	—	3000	—	—	3000	µF

Notes
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Tested with 6800 pF ceramic bypass capacitor connected externally from input common to case.
3. Indefinite short circuit protection not guaranteed above 125°C case.
4. Recovery time is measured from application of the transient to point at which V_{OUT} is within 1% of final value.
5. Step load transition test is performed at 50 µs ±10 µs.
6. Step line characterization test is performed at 100 µs ± 20 µs.
7. Tested on release from inhibit.

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TABLE 7: MTR (50) ELECTRICAL CHARACTERISTICS -55°C TO +125°C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

SINGLE OUTPUT MODELS		MTR2812S			MTR2815S			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE		11.64	12.00	12.36	14.55	15.00	15.45	V
OUTPUT CURRENT	V_{IN} = 16 TO 50	0	—	2.5	0	—	2.0	A
OUTPUT POWER	V_{IN} = 16 TO 50	0	—	30	0	—	30	W
OUTPUT RIPPLE	T_C = 25°C	—	10	40	—	10	40	mV p-p
10 kHz - 2 MHz	T_C = -55°C TO +125°C	—	15	90	—	15	90	
LINE REGULATION	V_{IN} = 16 TO 50	—	2	50	—	2	50	mV
LOAD REGULATION	NO LOAD TO FULL	—	2	50	—	2	50	mV
INPUT VOLTAGE	CONTINUOUS	16	28	50	16	28	50	V
NO LOAD TO FULL	TRANSIENT 50 ms [1]	—	—	80	—	—	80	
INPUT CURRENT	NO LOAD	—	50	80	—	50	80	mA
	INHIBITED	—	3	8	—	3	8	
INPUT RIPPLE CURRENT [2]	10 kHz - 10 MHz	—	35	100	—	35	100	mA p-p
EFFICIENCY	T_C = 25°C	77	80	—	79	80	—	%
	T_C = -55°C TO +125°C	75	77	—	75	77	—	
LOAD FAULT [3, 4]	POWER DISSIPATION	—	6	12	—	5	12	W
SHORT CIRCUIT	RECOVERY [1]	—	1.4	5	—	1.4	5	ms
STEP LOAD RESPONSE [4, 5]	TRANSIENT	—	±150	±400	—	±150	±500	mV pk
50% - 100% - 50%	RECOVERY	—	30	200	—	30	200	µs
STEP LINE RESPONSE [1, 4, 6]	TRANSIENT	—	±400	±500	—	±500	±600	mV pk
V_{IN} = 16 - 40 - 16	RECOVERY	—	—	400	—	—	400	µs
START-UP [4, 7]	DELAY	—	2.5	5	—	2.5	5	ms
FULL LOAD	OVERSHOOT	—	0	180	—	0	180	mV pk
CAPACITIVE LOAD [1]	NO EFFECT ON DC PERFORMANCE	—	—	3000	—	—	3000	µF

Notes
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Tested with 6800 pF ceramic bypass capacitor connected externally from input common to case.
3. Indefinite short circuit protection not guaranteed above 125°C case.
4. Recovery time is measured from application of the transient to point at which V_{OUT} is within 1% of final value.
5. Step load transition test is performed at 50 µs ±10 µs.
6. Step line characterization test is performed at 100 µs ± 20 µs.
7. Tested on release from inhibit.

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TABLE 8: MTR (50) ELECTRICAL CHARACTERISTICS -55°C TO +125°C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

DUAL OUTPUT MODELS		MTR2805D			MTR2812D			MTR2815D			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE	+ V_{OUT}	4.850	5.00	5.150	11.64	12.00	12.36	14.55	15.00	15.45	V
	- V_{OUT}	4.825	5.00	5.172	11.58	12.00	12.42	14.47	15.00	15.53	
OUTPUT CURRENT [2]	EITHER OUTPUT	0	2.5	4.5 [1]	0	1.25	2.25 [1]	0	1.00	1.80 [1]	A
V_{IN} = 16 TO 50	TOTAL OUTPUT	—	—	5	—	—	2.5	—	—	2.00	
OUTPUT POWER [2]	EITHER OUTPUT	0	12.5	22.5 [1]	0	15	27 [1]	0	15	27 [1]	W
V_{IN} = 16 TO 50	TOTAL OUTPUT	—	—	25	—	—	30	—	—	30	
OUTPUT RIPPLE	T_C = 25°C	—	5	40	—	20	80	—	20	80	mV p-p
10 kHz - 2 MHz ± V_{OUT}	T_C = -55°C TO +125°C	—	10	90	—	30	120	—	20	120	
LINE REGULATION	+ V_{OUT}	—	2	50	—	2	50	—	2	50	mV
V_{IN} = 16 TO 50	- V_{OUT}	—	5	100	—	20	150	—	40	180	
LOAD REGULATION	+ V_{OUT}	—	2	50	—	2	50	—	2	50	mV
NO LOAD TO FULL	- V_{OUT}	—	10	100	—	20	150	—	20	180	
CROSS REGULATION [1]	SEE NOTE 3	—	6	10	—	3	6	—	3	6	%
EFFECT ON -V_{OUT}, 25°C	SEE NOTE 4	—	9	14	—	5	9	—	6	9	
INPUT VOLTAGE	CONTINUOUS	16	28	50	16	28	50	16	28	50	V
NO LOAD TO FULL	TRANSIENT 50 ms [1]	—	—	80	—	—	80	—	—	80	
INPUT CURRENT	NO LOAD	—	50	90	-	60	90	—	60	90	mA
	INHIBITED	—	3	8	—	3	8	—	3	8	
INPUT RIPPLE CURRENT [5]	10 kHz - 10 MHz	—	25	100	—	30	100	—	30	100	mA p-p
EFFICIENCY	T_C = 25°C	76	79	—	76	80	—	78	80	—	%
BALANCED LOAD	T_C = -55°C TO +125°C	73	78	—	74	77	—	75	77	—	
LOAD FAULT [6, 7]	POWER DISSIPATION	—	7	12	—	5	12	—	5	12	W
SHORT CIRCUIT	RECOVERY [1]	—	1.4	5.0	—	1.4	5.0	—	1.4	5.0	ms
STEP LOAD RESPONSE [7, 8]	TRANSIENT	—	±80	±300	—	±130	±300	—	±120	±400	mV pk
50% - 100% - 50%	RECOVERY	—	70	200	—	10	200	—	10	200	µs
STEP LINE RESPONSE [1, 7, 9]	TRANSIENT	—	±200	±400	—	±200	±400	—	±400	±500	mV pk
V_{IN} = 16 - 40 - 16, ± V_{OUT}	RECOVERY	—	—	400	—	—	400	—	—	400	µs
START-UP [7, 10]	DELAY	—	2.5	5	—	2.5	5	—	2.5	5	ms
FULL LOAD	OVERSHOOT	—	0	180	—	0	180	—	0	180	mV pk
CAPACITIVE LOAD [1, 11]	NO EFFECT ON DC PERFORMANCE	—	—	1500	—	—	1500	—	—	1500	µF

Notes
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Up to 90% of the total output current/power is available from either output providing the opposite output is carrying at least 10% of the total output power.
3. Effect on negative V_{OUT} from 50%/50% loads to 80%/20% or 20%/80% loads.
4. Effect on negative V_{OUT} from 50%/50% loads to 90%/10% or 10%/90% loads. See Figure 24 on page 18.
5. Tested with 6800 pF ceramic bypass capacitor connected externally from input common to case.
6. Indefinite short circuit protection not guaranteed above 125°C case.
7. Recovery time is measured from application of the transient to point at which V_{OUT} is within 1% of final value.
8. Step load transition test is performed at 50 µs ±10 µs.
9. Step line characterization test is performed at 100 µs ± 20 µs.
10. Tested on release from inhibit.
11. Applies to each output.

MTR (50) Single and Dual DC-DC Converters

16 TO 50 VOLT INPUT – 20 TO 30 WATT

TABLE 9: MTR (50) ELECTRICAL CHARACTERISTICS -55°C TO +125°C CASE, 42 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

		ALL MODELS			
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
LEAD SOLDERING TEMPERATURE [1]	10 SECONDS MAX.	—	—	300	°C
STORAGE TEMPERATURE [1]		-65	—	+150	°C
CASE OPERATING TEMPERATURE	FULL POWER	-55	—	+125	°C
	ABSOLUTE [1]	-55	—	+135	
DERATING OUTPUT POWER/CURRENT [1]	LINEARLY	From 100% at 125°C to 0% at 135°C			
ESD RATING [1, 2] MIL-PRF-38534, 3.9.5.8.2	MIL STD 883 METHOD 3015 CLASS 3B	—	—	≥8000	V
ISOLATION: INPUT TO OUTPUT, INPUT TO CASE, OUTPUT TO CASE [3]	@ 500 VDC AT 25°C	100	—	—	Megohms
INPUT TO OUTPUT CAPACITANCE [1]		—	50	—	pF
CURRENT LIMIT [4]	% OF FULL LOAD	—	140	—	%
AUDIO REJECTION [1]		—	40	—	dB
SWITCHING FREQUENCY	-55°C TO +125°C	530	—	670	kHz
SYNCHRONIZATION -55°C TO +125°C	INPUT FREQUENCY	500	—	675	kHz
	DUTY CYCLE [1]	40	—	60	%
	ACTIVE LOW	—	—	0.8	V
	ACTIVE HIGH [1]	4.5	—	5.0	
	REFERENCED TO	INPUT COMMON			
	IF NOT USED	CONNECT TO INPUT COMMON			
INHIBIT ACTIVE LOW (OUTPUT DISABLED) Do not apply a voltage to the inhibit pin. [5]	INHIBIT PIN PULLED LOW	—	—	0.8	V
	INHIBIT PIN SOURCE CURRENT [1]	—	—	8	mA
	REFERENCED TO	INPUT COMMON			
INHIBIT ACTIVE HIGH (OUTPUT ENABLED) Do not apply a voltage to the inhibit pin. [5]	INHIBIT PIN CONDITION	OPEN COLLECTOR OR UNCONNECTED			
	OPEN INHIBIT PIN VOLTAGE [1]	9	—	11	V

For mean time between failures (MTBF) contact Applications Engineering at powerapps@craneae.com

Notes
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Passed 8000 volts.
3. When testing isolation, input pins are tied together and output pins are tied together. They are tested against each other and against case. Discharge the pins before and after testing.
4. Dual outputs: The over-current limit will trigger when the sum of the currents from both outputs reaches 140% (typical value) of the maximum rated "total" current of both outputs.
5. 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.

42 volt specifications are for reference only and are not guaranteed.

MTR (50) Single and Dual DC-DC Converters

16 TO 50 VOLT INPUT – 20 TO 30 WATT

TABLE 10: MTR (50) ELECTRICAL CHARACTERISTICS -55°C TO +125°C CASE, 42 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

SINGLE OUTPUT MODELS		MTR2805S			MTR2812S			MTR2815S			UNITS
PARAMETER [1]	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE		4.85	5.00	5.15	11.64	12.00	12.36	14.55	15.00	15.45	V
OUTPUT CURRENT	V_{IN} = 16 TO 50	0	—	5.0	0	—	2.5	0	—	2.0	A
OUTPUT POWER	V_{IN} = 16 TO 50	0	—	25	0	—	30	0	—	30	W
OUTPUT RIPPLE	T_C = 25°C	—	15	70	—	10	40	—	10	40	mV p-p
10 kHz - 2 MHz	T_C = -55°C TO +125°C	—	15	90	—	15	90	—	15	90	
LINE REGULATION	V_{IN} = 16 TO 50	—	2	50	—	2	50	—	2	50	mV
LOAD REGULATION	NO LOAD TO FULL	—	2	50	—	2	50	—	2	50	mV
INPUT VOLTAGE	CONTINUOUS	16	42	50	16	42	50	16	42	50	V
NO LOAD TO FULL	TRANSIENT 50 ms [1]	—	—	80	—	—	80	—	—	80	
INPUT CURRENT	NO LOAD	—	50	80	—	50	80	—	50	80	mA
	INHIBITED	—	3	8	—	3	8	—	3	8	
INPUT RIPPLE CURRENT [2]	10 kHz - 10 MHz	—	45	120	—	55	120	—	55	120	mA p-p
EFFICIENCY	T_C = 25°C	74	76	—	74	76	—	74	76	—	%
	T_C = -55°C TO +125°C	72	75	—	70	72	—	70	72	—	
LOAD FAULT [3]	POWER DISSIPATION	—	11	13	—	10	12	—	9	12	W
SHORT CIRCUIT	RECOVERY [1]	—	1.4	5	—	1.4	5	—	1.4	5	ms
STEP LOAD RESPONSE [4, 5]	TRANSIENT	—	±100	±300	—	±150	±400	—	±150	±500	mV pk
50% - 100% - 50%	RECOVERY	—	50	200	—	30	200	—	30	200	µs
STEP LINE RESPONSE [1, 4, 6]	TRANSIENT	—	±200	±300	—	±400	±500	—	±500	±600	mV pk
V_{IN} = 16 - 40 - 16	RECOVERY	—	—	400	—	—	400	—	—	400	µs
START-UP [7]	DELAY	—	2.5	5	—	2.5	5	—	2.5	5	ms
FULL LOAD	OVERSHOOT [1]	—	0	80	—	0	180	—	0	180	mV pk
CAPACITIVE LOAD [1]	NO EFFECT ON DC PERFORMANCE	—	—	3000	—	—	3000	—	—	3000	µF

Notes
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Tested with 6800 pF ceramic bypass capacitor connected externally from input common to case.
3. Indefinite short circuit protection not guaranteed above 125°C case.
4. Recovery time is measured from application of the transient to point at which V_{OUT} is within 1% of final value.
5. Step load transition test is performed at 50 µs ±10 µs.
6. Step line characterization test is performed at 100 µs ± 20 µs.
7. Tested on release from inhibit.

42 volt specifications are for reference only and are not guaranteed.

MTR (50) Single and Dual DC-DC Converters

16 TO 50 VOLT INPUT – 20 TO 30 WATT

TABLE 11: MTR (50) ELECTRICAL CHARACTERISTICS -55°C TO +125°C CASE, 42 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

DUAL OUTPUT MODELS		MTR2812D			MTR2815D			UNITS
PARAMETER [1]	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE	+ V_{OUT}	11.64	12.00	12.36	14.55	15.00	15.45	V
	- V_{OUT}	11.58	12.00	12.42	14.47	15.00	15.53	
OUTPUT CURRENT [2]	EITHER OUTPUT	0	1.25	2.25 [1]	0	1.00	1.80 [1]	A
V_{IN} = 16 TO 50	TOTAL OUTPUT	–	–	2.5	–	–	2.00	
OUTPUT POWER [2]	EITHER OUTPUT	0	15	27 [1]	0	15	27 [1]	W
V_{IN} = 16 TO 50	TOTAL OUTPUT	–	–	30	–	–	30	
OUTPUT RIPPLE	T_C = 25°C	–	20	80	–	20	80	mV p-p
10 kHz - 2 MHz, ± V_{OUT}	T_C = -55°C TO +125°C	–	30	120	–	20	120	
LINE REGULATION	+ V_{OUT}	–	2	50	–	2	50	mV
V_{IN} = 16 TO 50	- V_{OUT}	–	20	150	–	40	180	
LOAD REGULATION	+ V_{OUT}	–	2	50	–	2	50	mV
NO LOAD TO FULL	- V_{OUT}	–	20	150	–	20	180	
CROSS REGULATION	SEE NOTE 3	–	4	7	–	4	7	%
EFFECT ON -V_{OUT}, 25°C	SEE NOTE 4	–	7	9	–	8	10	
INPUT VOLTAGE	CONTINUOUS	16	42	50	16	42	50	V
NO LOAD TO FULL	TRANSIENT 50 ms [1]	–	–	80	–	–	80	
INPUT CURRENT	NO LOAD	–	60	90	–	60	90	mA
	INHIBITED	–	3	8	–	3	8	
INPUT RIPPLE CURRENT [5]	10 kHz - 10 MHz	–	45	120	–	45	120	mA p-p
EFFICIENCY	T_C = 25°C	73	76	–	74	76	–	%
BALANCED LOAD	T_C = -55°C TO +125°C	70	72	–	70	72	–	
LOAD FAULT [6]	POWER DISSIPATION	–	8	12	–	7	12	W
SHORT CIRCUIT	RECOVERY [1]	–	1.4	5.0	–	1.4	5.0	ms
STEP LOAD RESPONSE [7, 8]	TRANSIENT	–	±130	±300	–	±120	±400	mV pk
50% - 100% - 50% ± V_{OUT}	RECOVERY	–	10	200	–	10	200	µs
STEP LINE RESPONSE [1, 9]	TRANSIENT	–	±200	±400	–	±400	±500	mV pk
V_{IN} = 16 - 40 - 16, ± V_{OUT}	RECOVERY	–	–	400	–	–	400	µs
START-UP [10]	DELAY	–	2.5	5	–	2.5	5	ms
FULL LOAD	OVERSHOOT [1]	–	0	180	–	0	180	mV pk
CAPACITIVE LOAD 1, [11]	NO EFFECT ON DC PERFORMANCE	–	–	1500	–	–	1500	µF

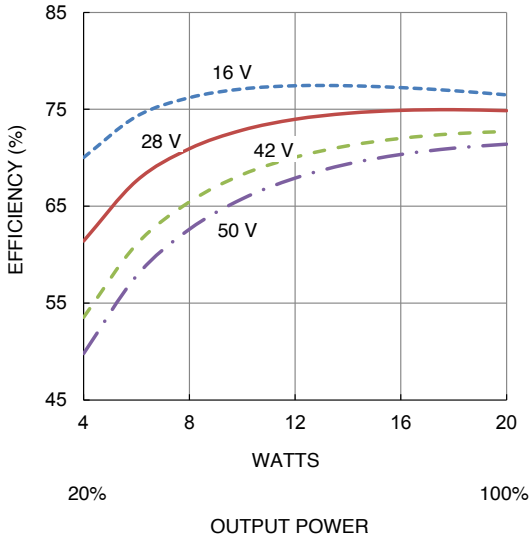
Notes
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Up to 90% of the total output current/power is available from either output providing the opposite output is carrying at least 10% of the total output power.
3. Effect on negative V_{OUT} from 50%/50% loads to 80%/20% or 20%/80% loads.
4. Effect on negative V_{OUT} from 50%/50% loads to 90%/10% or 10%/90% loads. See Figure 24 on page 18.
5. Tested with 6800 pF ceramic bypass capacitor connected externally from input common to case.
6. Indefinite short circuit protection not guaranteed above 125°C case.
7. Recovery time is measured from application of the transient to point at which V_{OUT} is within 1% of final value.
8. Step load transition test is performed at 50 µs ±10 µs.
9. Step line characterization test is performed at 100 µs ± 20 µs.
10. Tested on release from inhibit.
11. Applies to each output.

42 volt specifications are for reference only and are not guaranteed.

MTR (50) Single and Dual DC-DC Converters

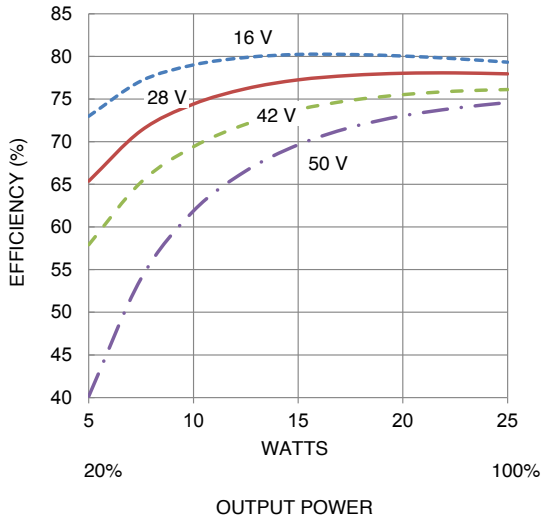
16 TO 50 VOLT INPUT – 20 TO 30 WATT

MTR (50) Typical Performance Plots: 25°C case, 28 Vin, 100% load, unless otherwise specified.
For reference only, not guaranteed specifications.



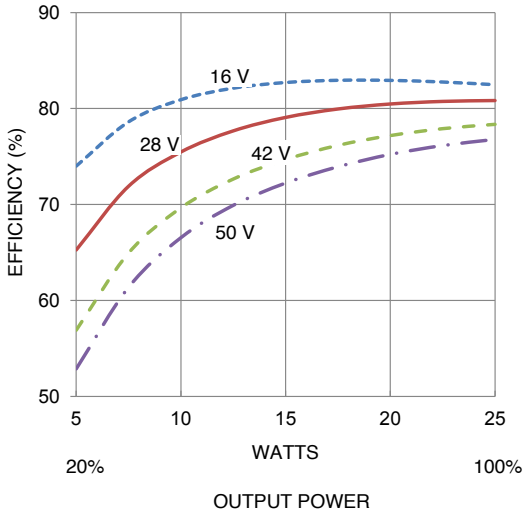
MTR283R3S Efficiency

Figure 9



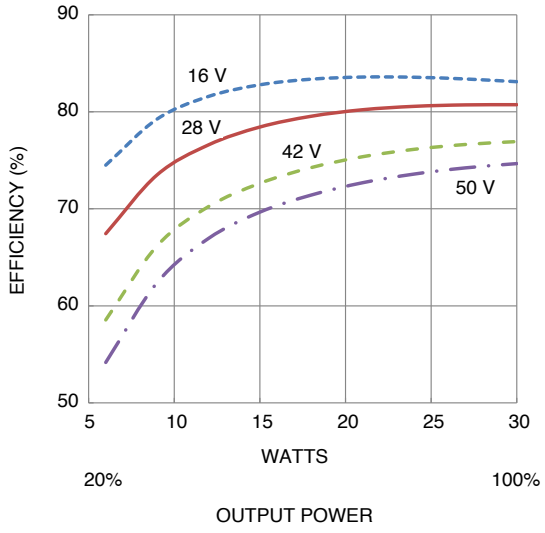
MTR2805S Efficiency

Figure 10



MTR288R5S Efficiency

Figure 11



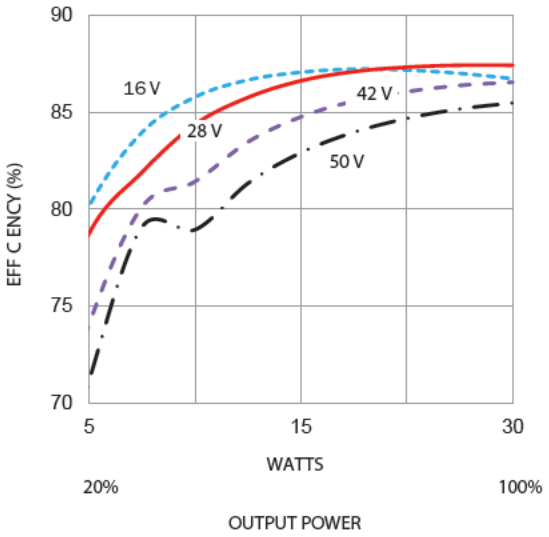
MTR2812S Efficiency

Figure 12

MTR (50) Single and Dual DC-DC Converters

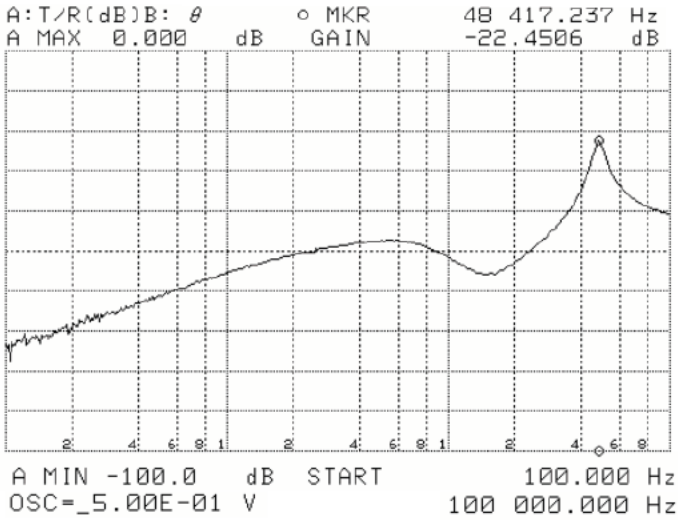
16 TO 50 VOLT INPUT – 20 TO 30 WATT

MTR (50) TYPICAL PERFORMANCE PLOTS: 25°C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.
FOR REFERENCE ONLY, NOT GUARANTEED SPECIFICATIONS.



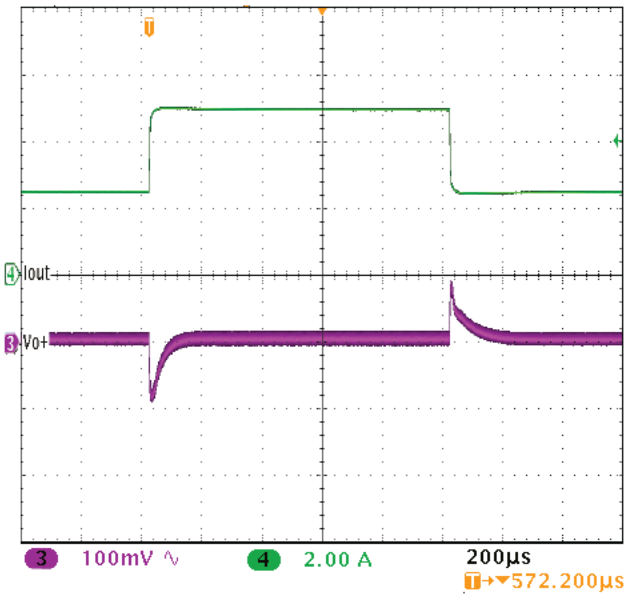
MTR2815S EFFICIENCY

FIGURE 13



MTR2805S AUDIO REJECTION

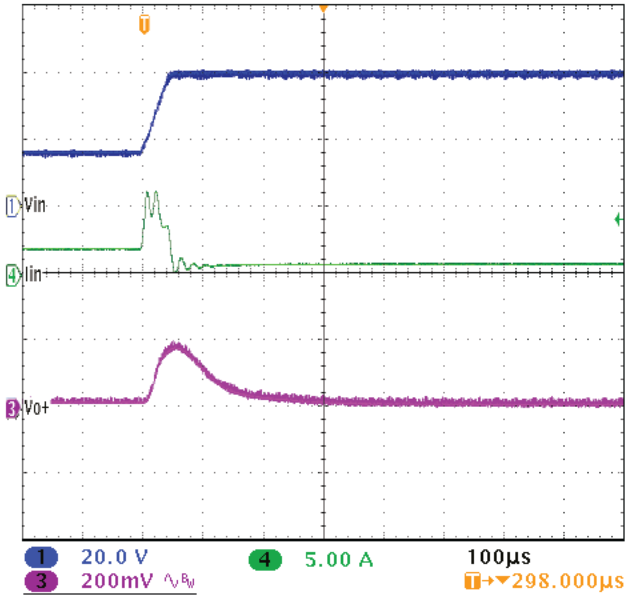
FIGURE 14



UNITS ARE PER DIVISION

MTR2805S STEP LOAD 50% - 100% - 50%

FIGURE 15



UNITS ARE PER DIVISION

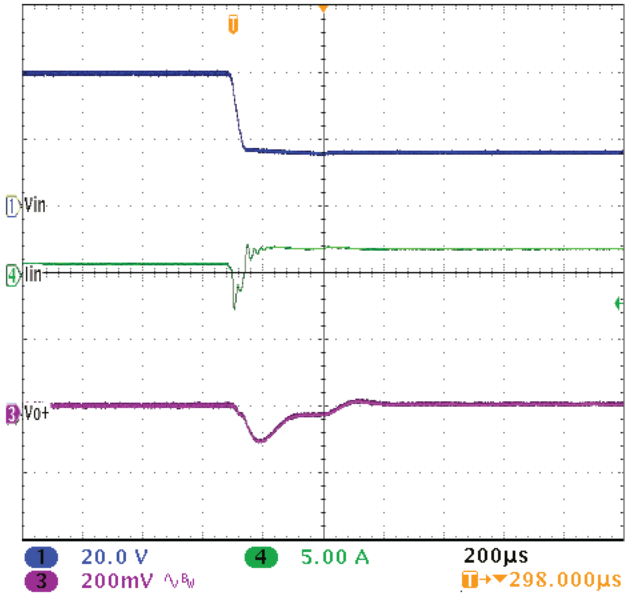
MTR2805S STEP LINE 16 - 40 VOLTS

FIGURE 16

MTR (50) Single and Dual DC-DC Converters

16 TO 50 VOLT INPUT – 20 TO 30 WATT

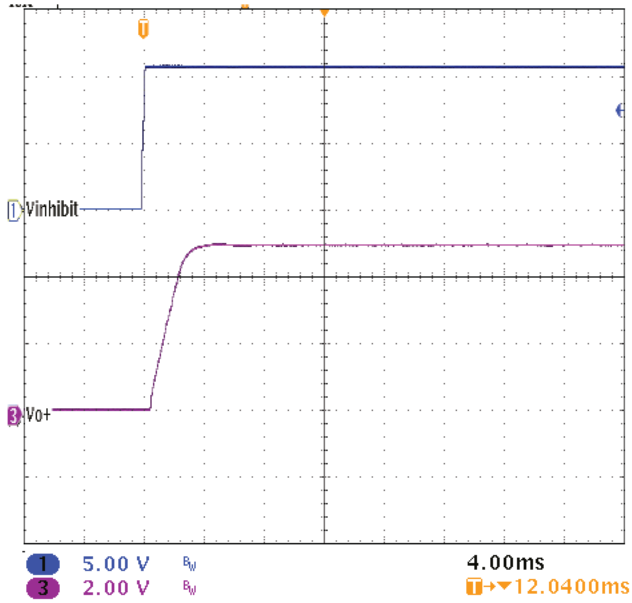
MTR (50) TYPICAL PERFORMANCE PLOTS: 25°C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.
FOR REFERENCE ONLY, NOT GUARANTEED SPECIFICATIONS.



UNITS ARE PER DIVISION

MTR2805S STEP LINE 40 - 16 VOLTS

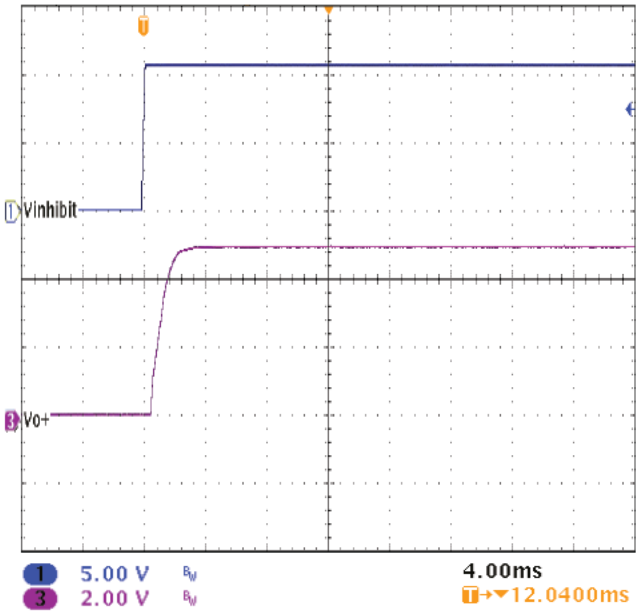
FIGURE 17



UNITS ARE PER DIVISION

MTR2805S START-UP INTO NO LOAD, 3000 µF CAP LOAD

FIGURE 18



UNITS ARE PER DIVISION

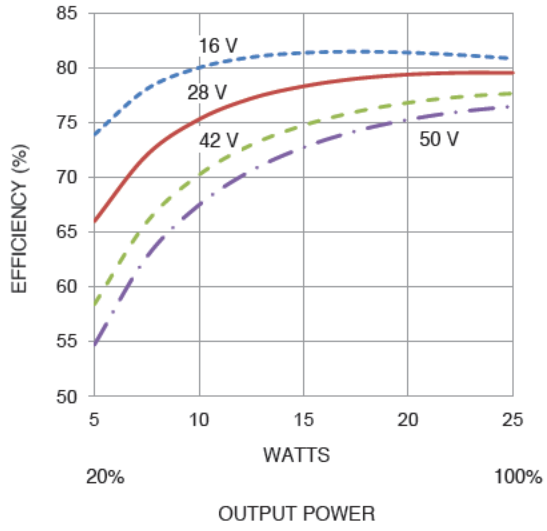
MTR2805S START-UP INTO NO LOAD

FIGURE 19

MTR (50) Single and Dual DC-DC Converters

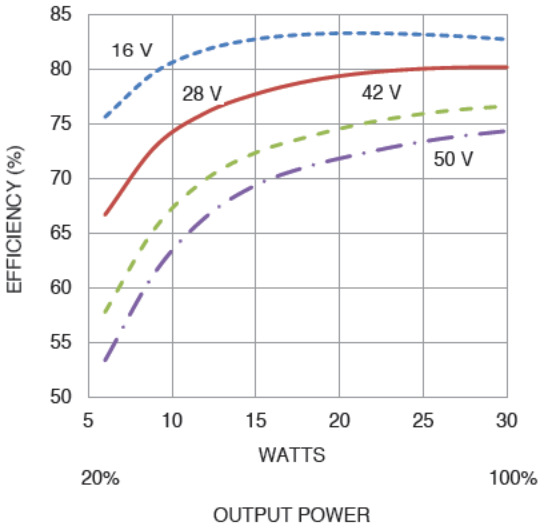
16 TO 50 VOLT INPUT – 20 TO 30 WATT

MTR (50) Typical Performance Plots: 25°C case, 28 Vin, 100% load, unless otherwise specified.
For reference only, not guaranteed specifications.



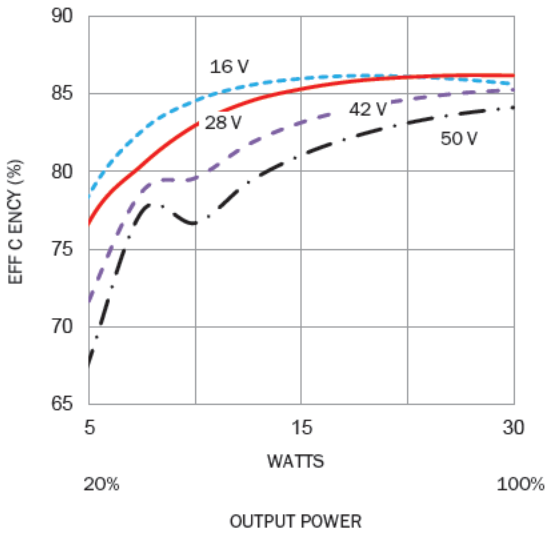
MTR2805D Efficiency

Figure 20



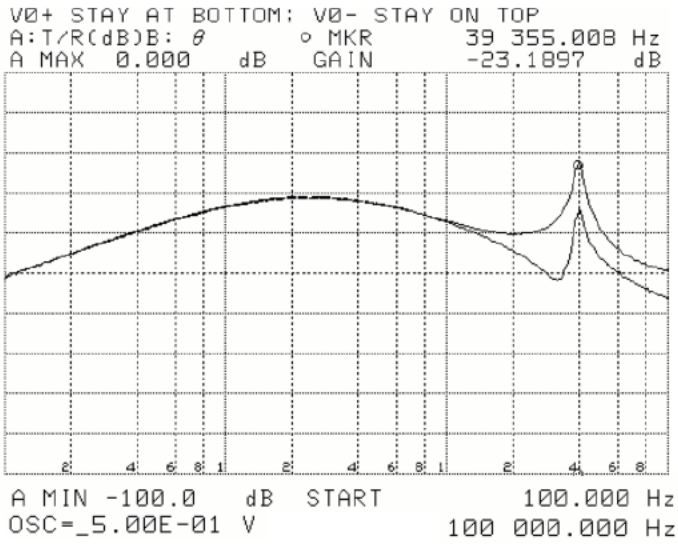
MTR2812D Efficiency

Figure 21



MTR2815D Efficiency

Figure 22



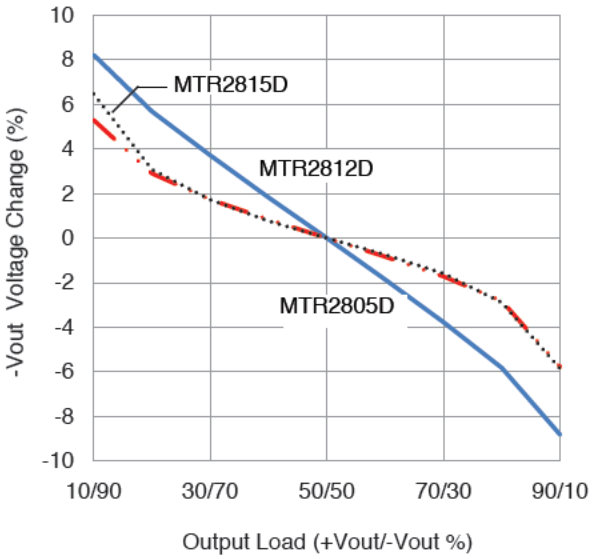
MTR2815D Audio Rejection

Figure 23

MTR (50) Single and Dual DC-DC Converters

16 TO 50 VOLT INPUT – 20 TO 30 WATT

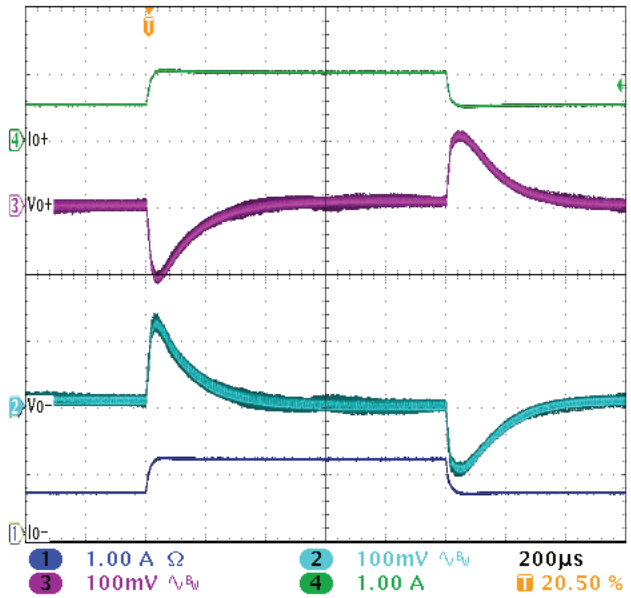
MTR (50) Typical Performance Plots: 25°C case, 28 Vin, 100% load, unless otherwise specified.
For reference only, not guaranteed specifications.



Units are per Division

MTR (50) Cross Regulation

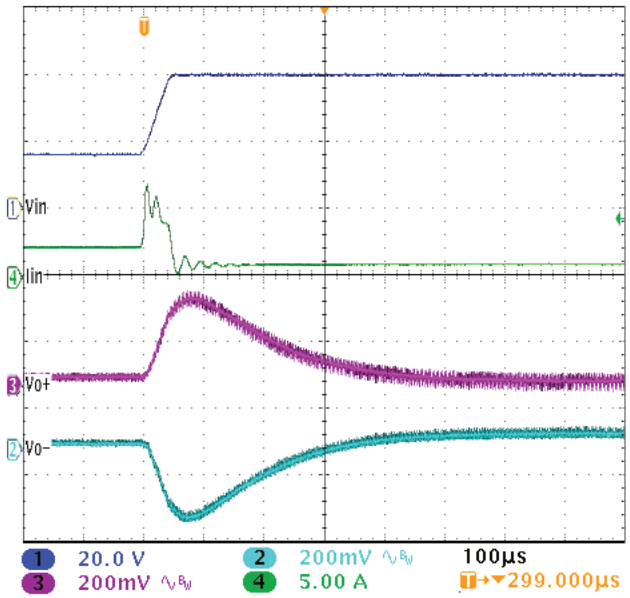
Figure 24



Units are per Division

MTR2815D Step Load 50% - 100% - 50%

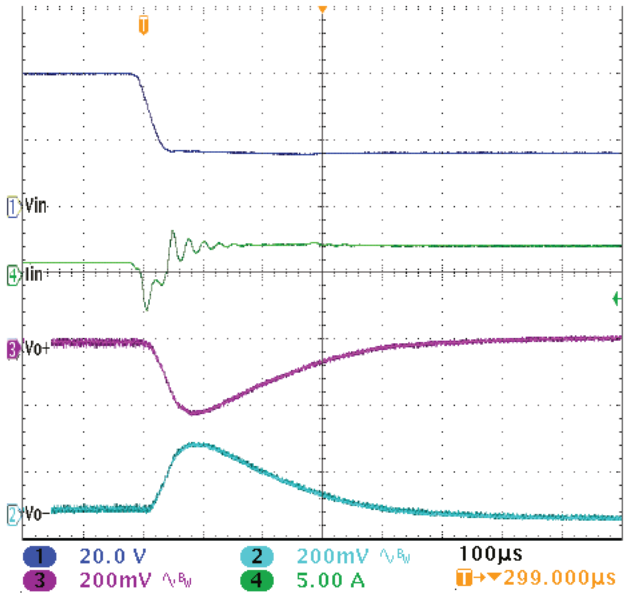
Figure 25



Units are per Division

MTR2815D Step Line 16 - 40 Volts

Figure 26



Units are per Division

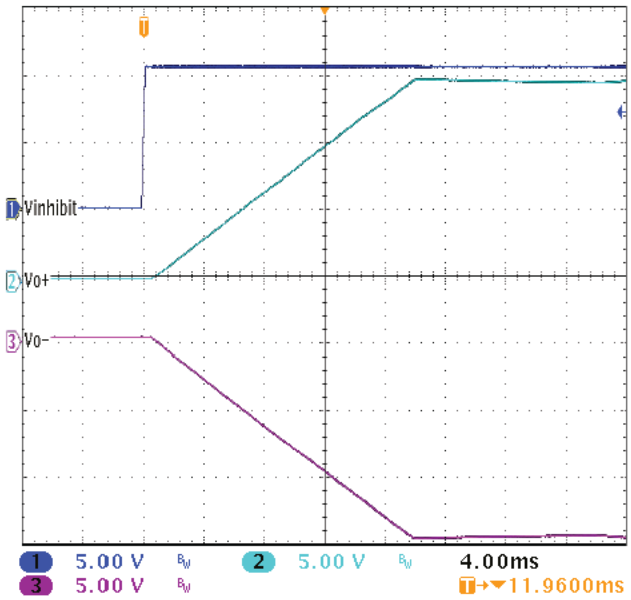
MTR2815D Step Line 40 - 16 Volts

Figure 27

MTR (50) Single and Dual DC-DC Converters

16 TO 50 VOLT INPUT – 20 TO 30 WATT

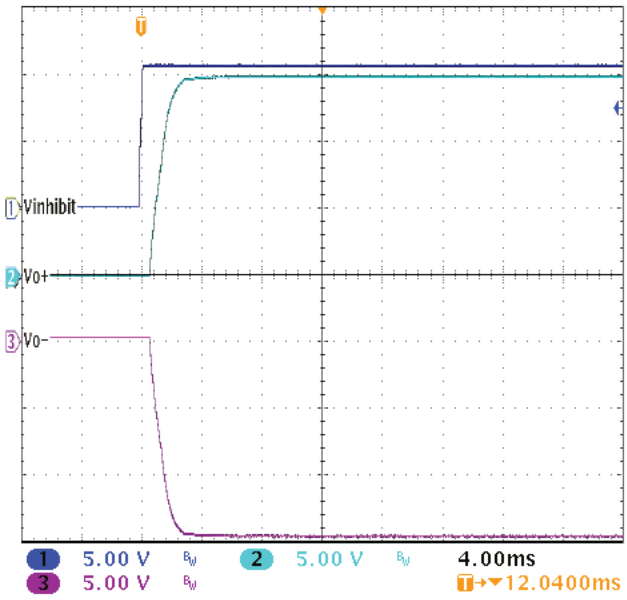
MTR (50) Typical Performance Plots: 25°C case, 28 Vin, 100% load, unless otherwise specified.
For reference only, not guaranteed specifications.



Units are per Division

MTR2815D Start-up into No Load, 1500 µF Cap Load Each

Figure 28



Units are per Division

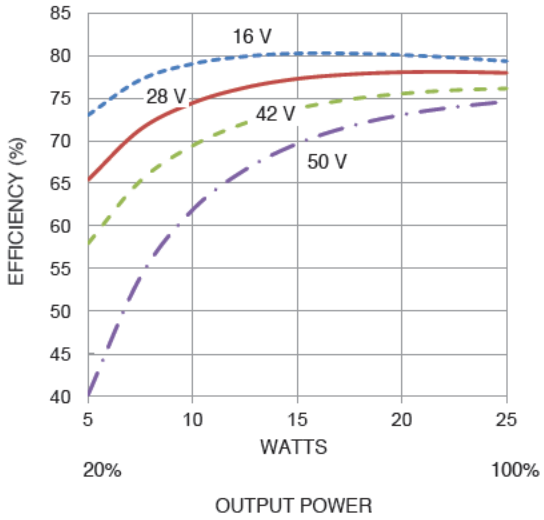
MTR2815D Start-up into No Load

Figure 29

MTR (50) Single and Dual DC-DC Converters

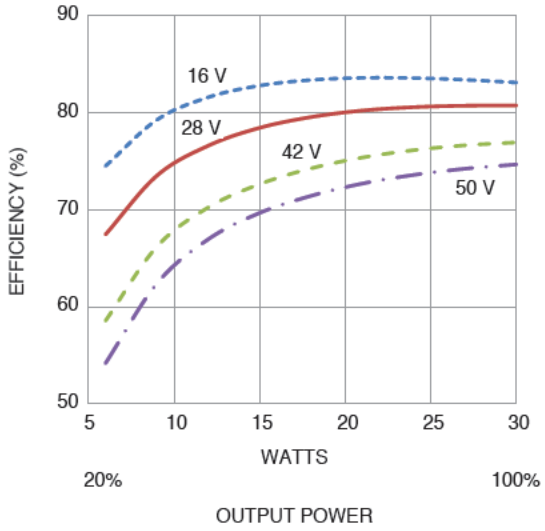
16 TO 50 VOLT INPUT – 20 TO 30 WATT

MTR (50) Typical Performance Plots: 25°C case, 42 Vin, 100% load, unless otherwise specified.
For reference only, not guaranteed specifications.



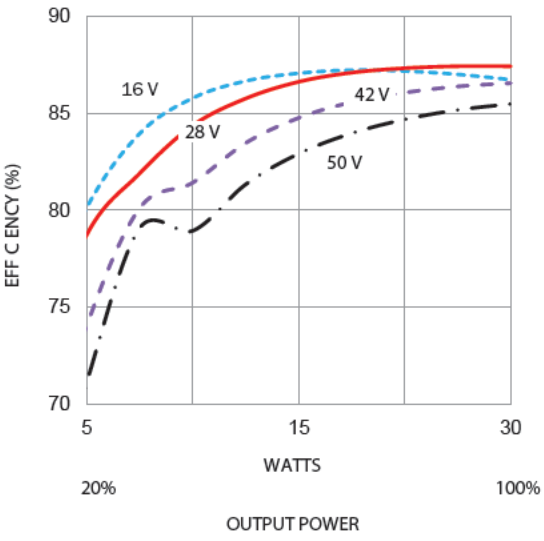
5 Volt Single - Efficiency

Figure 30



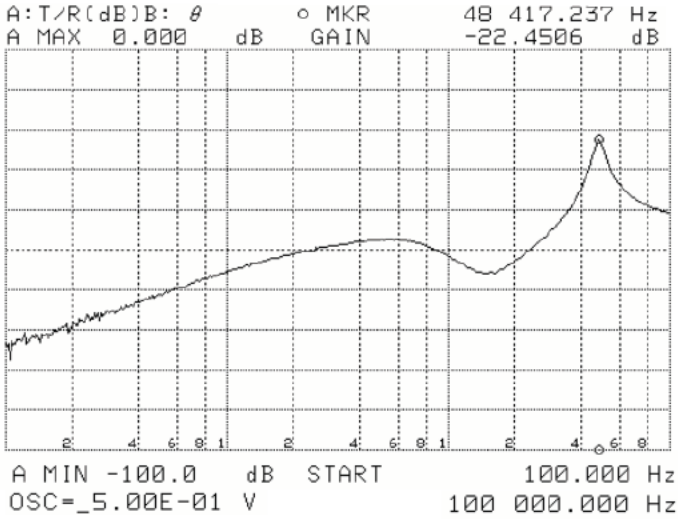
12 Volt Single - Efficiency

Figure 31



15 Volt Single - Efficiency

Figure 32



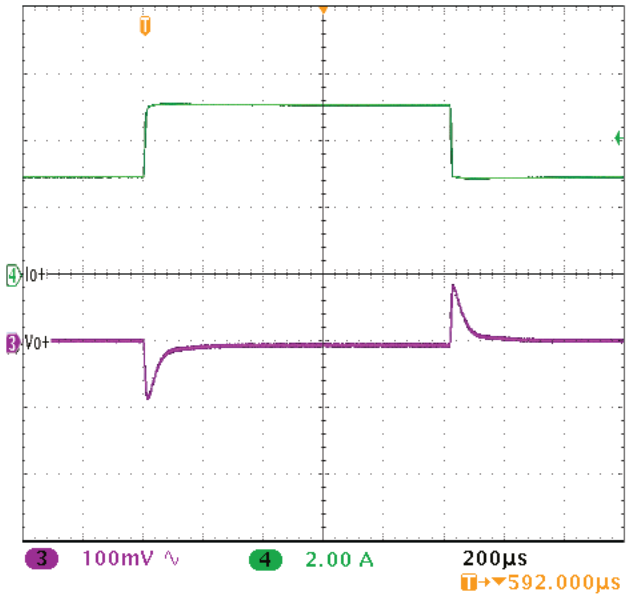
Audio Rejection - 28 Vin
Representative of Single Outputs

Figure 33

MTR (50) Single and Dual DC-DC Converters

16 TO 50 VOLT INPUT – 20 TO 30 WATT

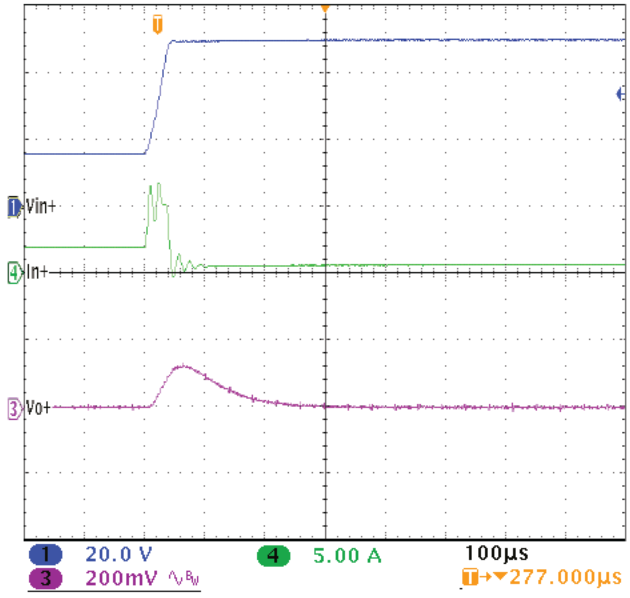
MTR (50) Typical Performance Plots: 25°C case, 42 Vin, 100% load, unless otherwise specified.
For reference only, not guaranteed specifications.



Units are per Division

5 Volt Single - Step Load 50% - 100% - 50%

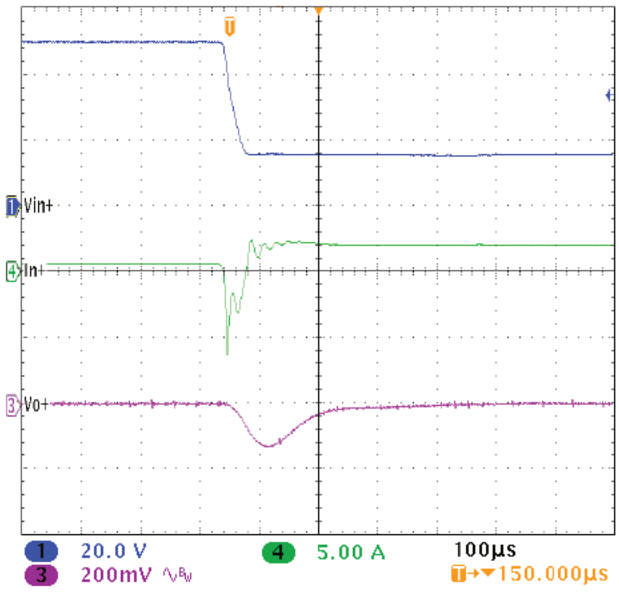
Figure 34



Units are per Division

5 Volt Single - Step Line 16 - 50 Volts

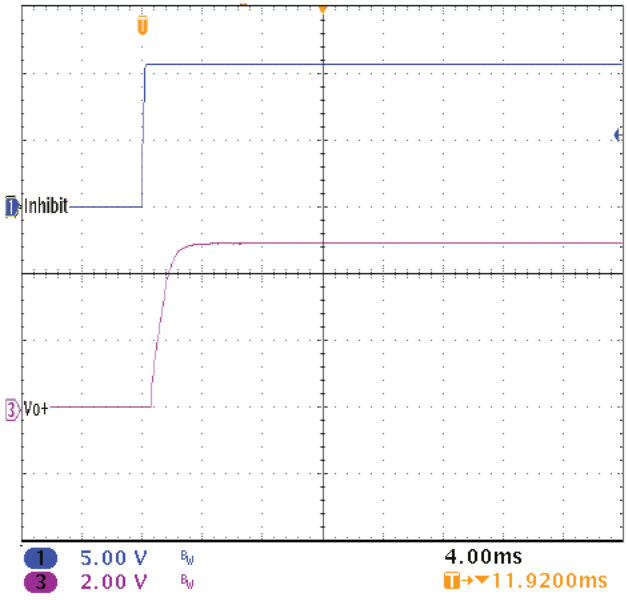
Figure 35



Units are per Division

5 Volt Single - Step Line 50 - 16 Volts

Figure 36



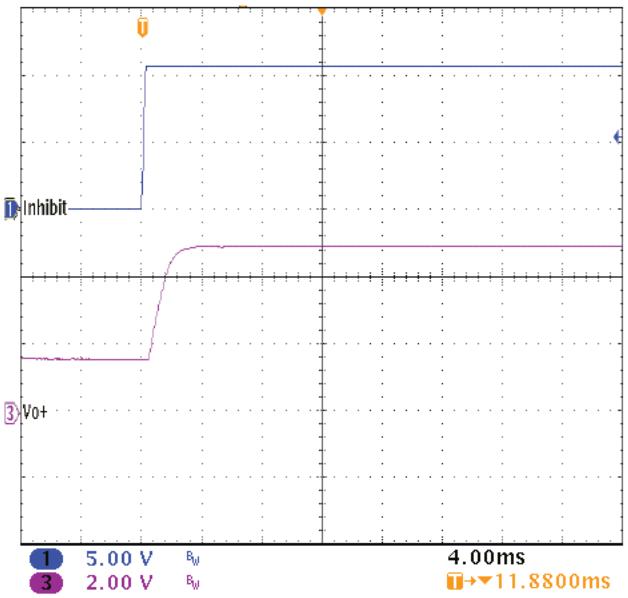
5 Volt Single - Start-up into No Load
3000 µF Cap Load

Figure 37

MTR (50) Single and Dual DC-DC Converters

16 TO 50 VOLT INPUT – 20 TO 30 WATT

MTR (50) TYPICAL PERFORMANCE PLOTS: 25°C CASE, 42 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.
FOR REFERENCE ONLY, NOT GUARANTEED SPECIFICATIONS.



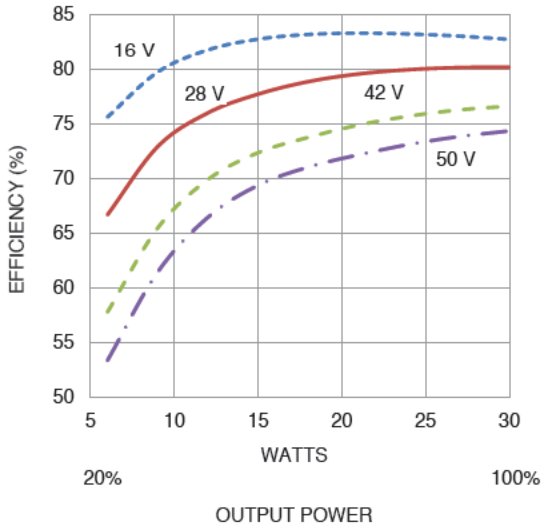
5 VOLT SINGLE - START-UP INTO NO LOAD

FIGURE 38

MTR (50) Single and Dual DC-DC Converters

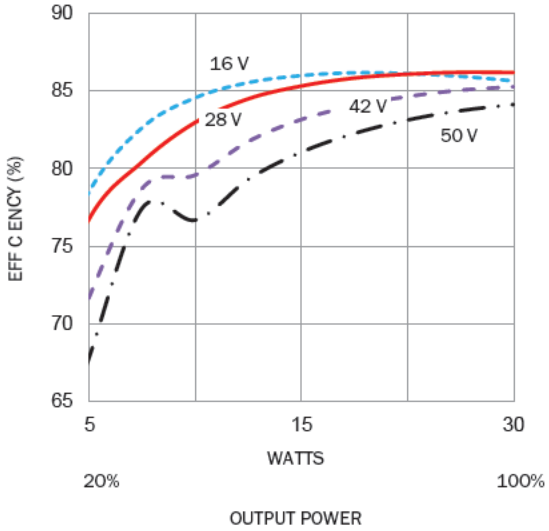
16 TO 50 VOLT INPUT – 20 TO 30 WATT

MTR (50) Typical Performance Plots: 25°C case, 42 Vin, 100% load, unless otherwise specified.
For reference only, not guaranteed specifications.



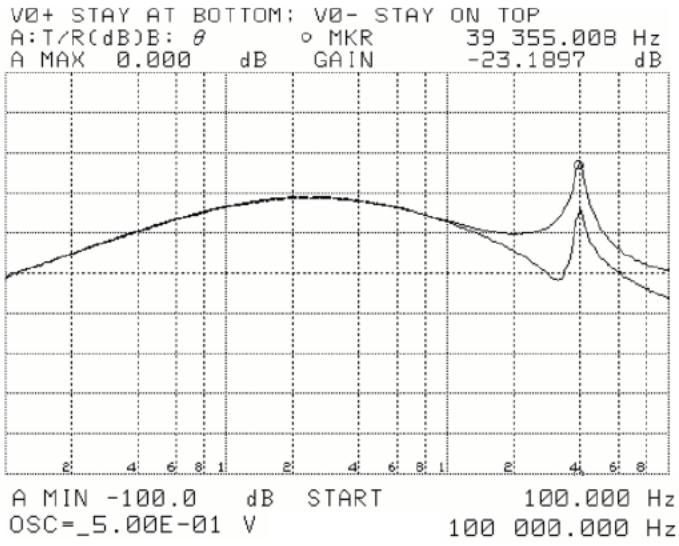
12 Volt Dual - Efficiency

Figure 39



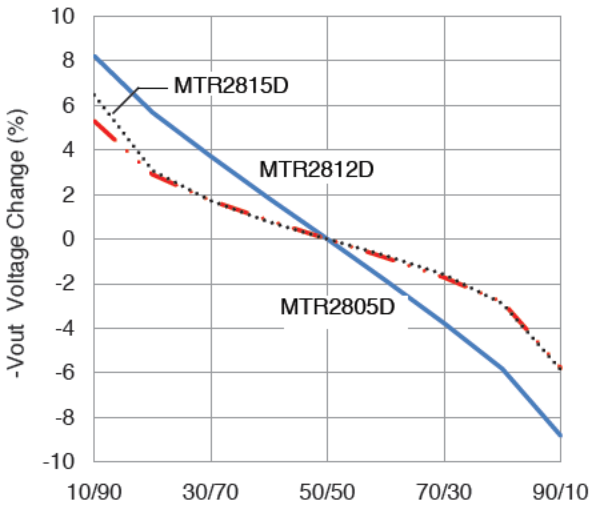
15 Volt Dual - Efficiency

Figure 40



Audio Rejection - 28 Vin
Representative of Dual Outputs

Figure 41



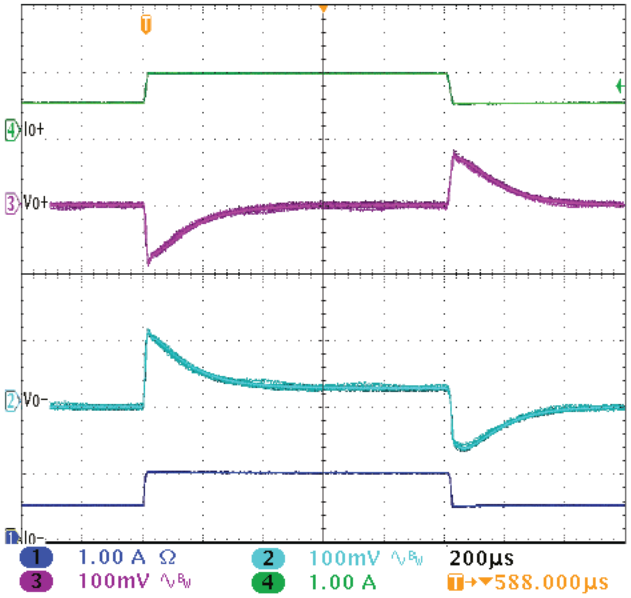
Units are per Division
MTR Cross Regulation (28 Vin)

Figure 42

MTR (50) Single and Dual DC-DC Converters

16 TO 50 VOLT INPUT – 20 TO 30 WATT

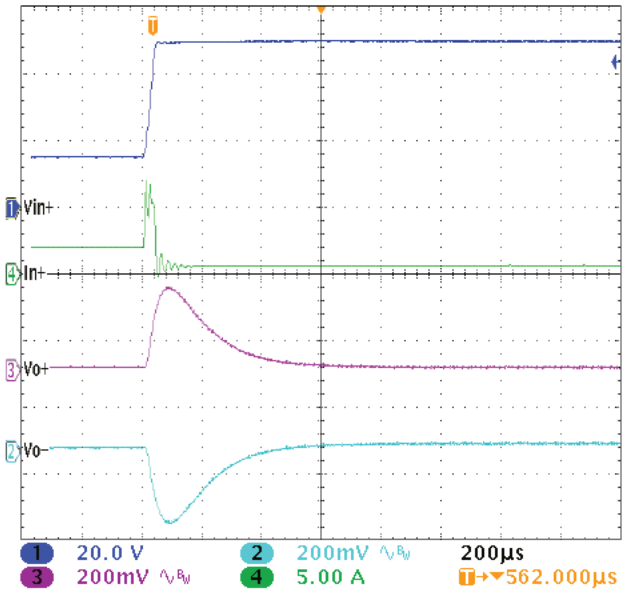
MTR (50) TYPICAL PERFORMANCE PLOTS: 25°C CASE, 42 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.
FOR REFERENCE ONLY, NOT GUARANTEED SPECIFICATIONS.



UNITS ARE PER DIVISION

15 VOLT DUAL - STEP LOAD 50% - 100% - 50%

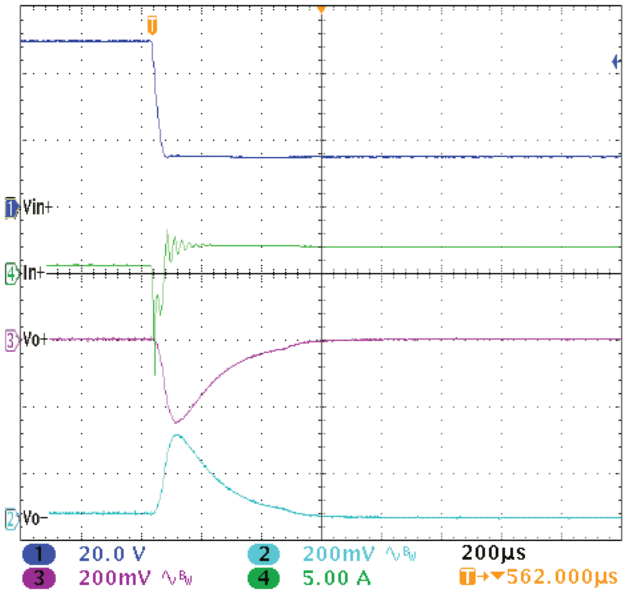
FIGURE 43



UNITS ARE PER DIVISION

15 VOLT DUAL - STEP LINE 16 - 50 VOLTS

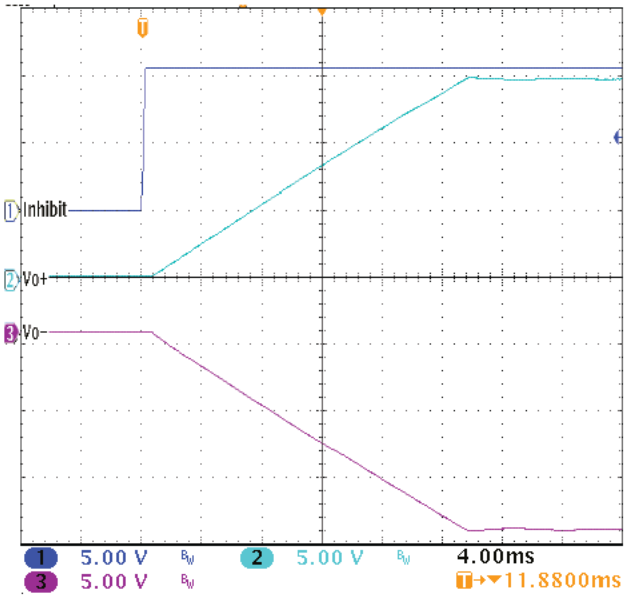
FIGURE 44



UNITS ARE PER DIVISION

15 VOLT DUAL - STEP LINE 50 - 16 VOLTS

FIGURE 45



UNITS ARE PER DIVISION

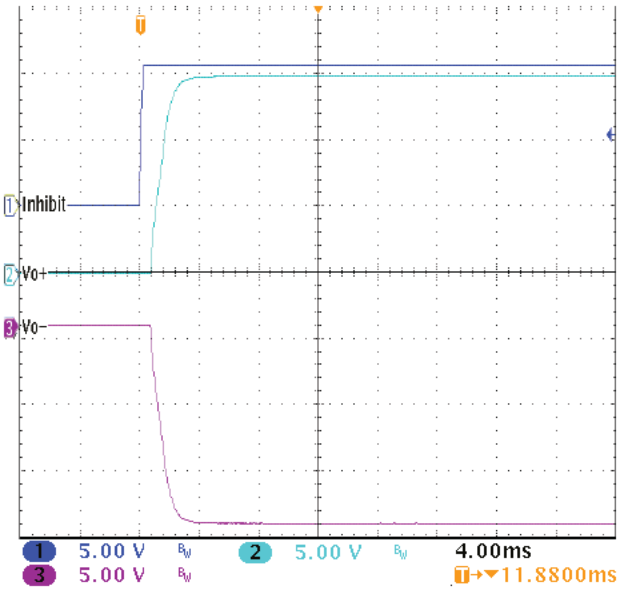
15 VOLT DUAL - START-UP INTO NO LOAD 1500 µF CAP LOAD EACH

FIGURE 46

MTR (50) Single and Dual DC-DC Converters

16 TO 50 VOLT INPUT – 20 TO 30 WATT

MTR (50) Typical Performance Plots: 25°C case, 42 Vin, 100% load, unless otherwise specified.
For reference only, not guaranteed specifications.



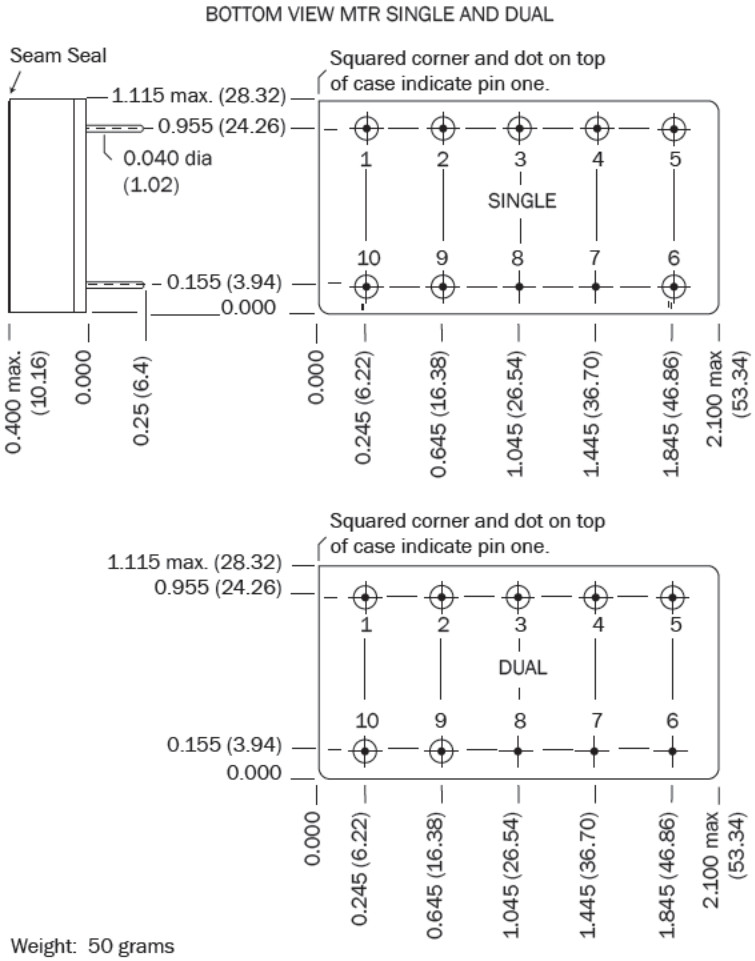
Units are per Division

15 Volt Dual - Start-up into No Load

Figure 47

MTR (50) Single and Dual DC-DC Converters

16 TO 50 VOLT INPUT – 20 TO 30 WATT



Weight: 50 grams

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 included in pin diameter Seal hole 0.120 ±0.002 (3.05 ± 0.05)

Please refer to the numerical dimensions for accuracy.

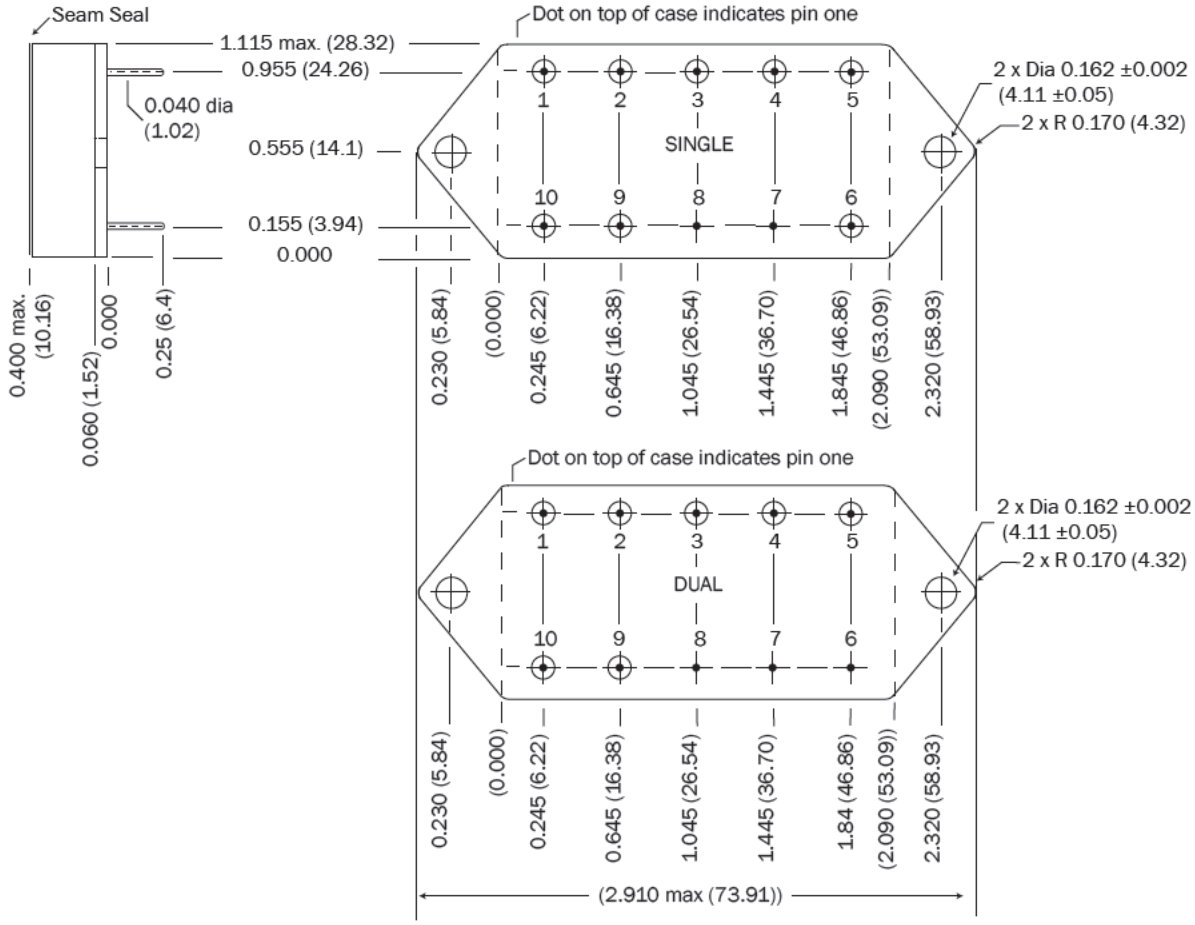
FIGURE 48: MTR (50) CASE H2

MTR (50) Single and Dual DC-DC Converters

16 TO 50 VOLT INPUT – 20 TO 30 WATT

BOTTOM VIEW MTR (50) SINGLE AND DUAL FLANGED

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



Weight: 54 grams

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 included in pin diameter
Seal hole 0.120 ±0.002 (3.04 ±0.05)

Please refer to the numerical dimensions for accuracy.

FIGURE 49: MTR (50) CASE K3

MTR (50) Single and Dual DC-DC Converters

16 TO 50 VOLT INPUT – 20 TO 30 WATT

ELEMENT EVALUATION TABLES FOR QML PRODUCTS ARE IN "APP-009 QUALITY AND CERTIFICATION", APPENDIX A, IN COMPLIANCE WITH MIL-PRF-38534 REVISION L. (LINK HTTPS://WWW.CRANEAE.COM/QUALITY-ASSURANCE-MODULAR-POWER)

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

TEST PERFORMED	NON-QML [1]		CLASS H QML [2]	
	STANDARD	/ES	/883 CH [3]	/883 QML [4]
Pre-cap Inspection, Method 2017, 2032	■	■	■	■
Temperature Cycle (10 times)				
Method 1010, Cond. C, -65°C to +150°C, ambient			■	■
Method 1010, Cond. B, -55°C to +125°C, ambient		■		
Constant Acceleration				
Method 2001, 3000 g			■	■
Method 2001, 500 g		■		
PIND, Test Method 2020, Cond. A			■ [5]	■ [5]
Burn-in Method 1015, +125°C case, typical [6]				
96 hours		■		
160 hours			■	■
Final Electrical Test, MIL-PRF-38534, Group A,				
Subgroups 1 through 6, -55°C, +25°C, +125°C case			■	■
Subgroups 1 and 4, +25°C case	■	■		
Hermeticity Test, Method 1014				
Gross Leak, Cond. C_1, fluorocarbon		■	■	■
Fine Leak, Cond. A_2, helium		■	■	■
Gross Leak, Dip	■			
Final visual inspection, Method 2009	■	■	■	■

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

Notes
1. Non-QML products may not meet all of the requirements of MIL-PRF-38534.
2. All processes are QML qualified and performed by certified operators.
3. Class H QML products with no SMD number are marked "CH" per MIL-PRF-38534, 3.9.5.8.3, Table III.
4. Class H QML products have an SMD number
5. Not required by DLA but performed to assure product quality.
6. Burn-in temperature designed to bring the case temperature to +125°C minimum. Burn-in is a powered test.

TABLE 12: ENVIRONMENTAL SCREENING HIGH RELIABILITY STANDARD, /ES AND /883 (CLASS H)