

## FEATURES

- -55°C to +125°C operation
- 16 to 40 VDC input
- Fully isolated
- Magnetic feedback
- Fixed frequency 550 kHz typ.
- Topology – Single Ended Forward
- Will withstand transients of up to 50 V for up to 120 msec.
- Output trim 60% to 110%
- Input and output side inhibit
- Remote sense
- Synchronization
- Parallel up to 5 units
- Output short circuit protection
- Up to 80 W/in<sup>3</sup>, 87% efficiency

# DC/DC CONVERTERS

## 28 VOLT INPUT

## MOR SERIES

### 120 WATT



### MODELS

#### VDC OUTPUT

| SINGLES | DUALS |
|---------|-------|
| 3.3     | ±3.3  |
| 5       | ±5    |
| 6.3     | ±6.3  |
| 9.5     | ±9.5  |
| 12      | ±12   |
| 15      | ±15   |

Size (max): 3.005 x 1.505 x 0.400 inches (76.33 x 38.23 x 10.16 mm) case U2  
Case U2 (flanged, short leads) and case Z (tabbed, leads bent down) are shown in the picture. Also available: flanged – leads bent down (case V); tabbed – short leads (case Y) and leads bent up (case W). See Section B8, cases U2, V, W, Y, and Z for dimensions and options.

Weight: 110 grams typical

Screening: Standard, ES, or 883 (Class H). See Section C2 for screening options, see Section A5 for ordering information.

## DESCRIPTION

With up to 120 watts of output power, the MOR Series™ of DC/DC converters operates from a standard 28 volt bus and offers a wide input range of 16 to 40 VDC. Full operation over the military temperature range, -55°C to +125°C, makes the MOR Series an ideal choice for military, aerospace, space, and other high reliability applications. In compliance with MIL-STD-704D, the converters will withstand transients of up to 50 volts for up to 120 milliseconds. Use Interpoint's FME28-461 EMI filter to pass MIL-STD-461C, CE03 requirements.

The MOR Series converters incorporate a single-ended forward topology which uses a constant frequency Pulse Width Modulator

(PWM) current mode control design and switches at 550 kHz, nominal. The converters also provide short circuit protection by restricting the current to 125% of the full load output current. All models offer two inhibits, one referenced to input common and one referenced to output common. A remote sense function is available on single output models.

Using the trim function, the MOR Series can provide any output from 2 to 33 VDC. For example, trimming the two 15 volt outputs of the 15 dual (MOR2815D) to 14 volts, and then stacking the outputs will provide a 28 volt output. See Figure 11.

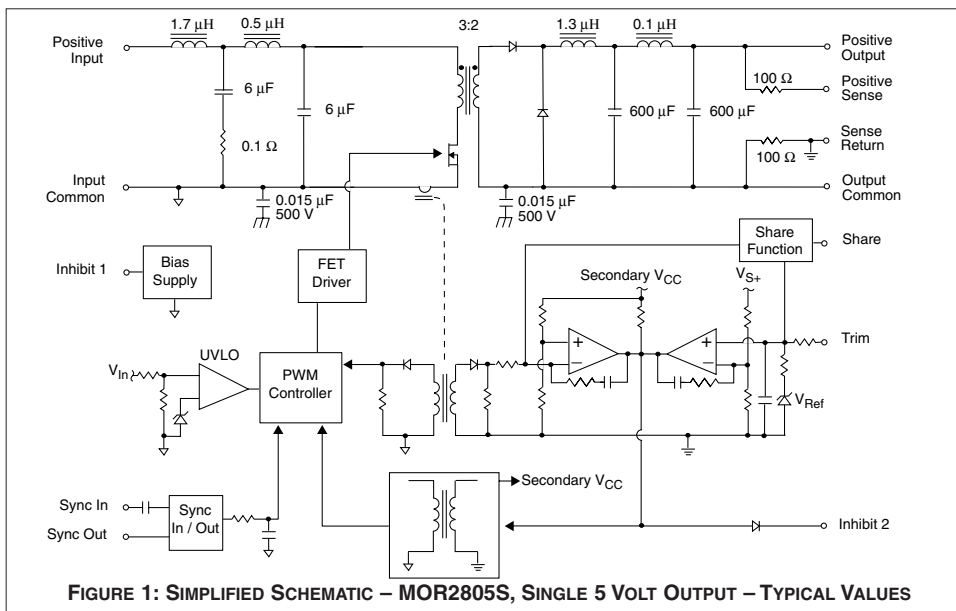


FIGURE 1: SIMPLIFIED SCHEMATIC – MOR2805S, SINGLE 5 VOLT OUTPUT – TYPICAL VALUES

# MOR SERIES

## 120 WATT

# DC/DC CONVERTERS

### ABSOLUTE MAXIMUM RATINGS

- Input Voltage**
- 16 to 40 VDC
- Power Dissipation (Pd)**
- 30 W
- Output Power**
- 66 to 120 watts depending on model
- Lead Soldering Temperature (10 sec per lead)**
- 300°C
- Storage Temperature Range (Case)**
- -65°C to +150°C

### SYNC AND INHIBIT (INH1, INH2)

- Sync In (525 to 625 kHz)**
- Logic low 0.8 V max, duty cycle 15% to 50%
  - Logic high 4.5 V min, 9 V max
  - Referenced to input common
- Sync Out - Referenced to input common**
- Inhibit (INH1, INH2) : TTL Open Collector**
- Logic low (output disabled), V = 0.2 V max.
  - INH1 referenced to input common
  - INH2 referenced to output common
  - Logic high (output enabled) open collector

### TYPICAL CHARACTERISTICS

- Output Voltage Temperature Coefficient**
- 100 ppm/°C typical
- Input to Output Capacitance**
- 150 pF typical
- Undervoltage Lockout**
- 15.5 V input typical
- Current Limit**
- 125% of full load typical
- Isolation**
- 100 megohm minimum at 500 V
- Audio Rejection**
- 40 dB typical
- Conversion Frequency**
- Free run mode 550 kHz typical
  - 460 kHz. min, 570 kHz max
  - External sync range 525 to 625 kHz
- Inhibit Pin Voltage (unit enabled)**
- INH1 = 13 V typ, INH2 = 8 V typ

### RECOMMENDED OPERATING CONDITIONS

- Input Voltage Range**
- 16 to 40 VDC continuous
  - 50 V for 120 msec transient
- 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

### PINS NOT IN USE

- Trim** No connection
- Case** Users discrimination
- Inhibit (INH1, INH2)** No connection
- Sync Out** No connection
- Sync In** Connect to input common
- Share** No connection
- Sense Lines** Must be connected to appropriate outputs

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

| SINGLE OUTPUT MODELS    |                                | MOR283R3S |      |      | MOR2805S |      |      | MOR286R3S |      |      | MOR289R5S |      |      | UNITS  |
|-------------------------|--------------------------------|-----------|------|------|----------|------|------|-----------|------|------|-----------|------|------|--------|
| PARAMETER               | CONDITION                      | MIN       | TYP  | MAX  | MIN      | TYP  | MAX  | MIN       | TYP  | MAX  | MIN       | TYP  | MAX  |        |
| OUTPUT VOLTAGE          |                                | 3.25      | 3.30 | 3.35 | 4.95     | 5.00 | 5.05 | 6.24      | 6.30 | 6.36 | 9.40      | 9.50 | 9.60 | VDC    |
| OUTPUT CURRENT          | V <sub>IN</sub> = 16 to 40 VDC | 0         | —    | 20   | 0        | —    | 20   | 0         | —    | 16   | 0         | —    | 11   | A      |
| OUTPUT POWER            | V <sub>IN</sub> = 16 to 40 VDC | 0         | —    | 66   | 0        | —    | 100  | 0         | —    | 100  | 0         | —    | 105  | W      |
| OUTPUT RIPPLE VOLTAGE   | 10 kHz - 20 MHz                | —         | —    | —    | —        | —    | —    | —         | —    | —    | —         | —    | —    | mV p-p |
|                         | Tc = -55°C to +125°C           | —         | 30   | 80   | —        | 30   | 80   | —         | 75   | 100  | —         | 75   | 120  |        |
|                         | 10 kHz - 2 MHz                 | —         | 20   | 50   | —        | 20   | 50   | —         | 50   | 60   | —         | 50   | 80   |        |
| LINE REGULATION         | V <sub>IN</sub> = 16 to 40 VDC | —         | 0    | 20   | —        | 0    | 20   | —         | 0    | 20   | —         | 0    | 20   | mV     |
| LOAD REGULATION         | NO LOAD TO FULL                | —         | 0    | 20   | —        | 0    | 20   | —         | 0    | 20   | —         | 0    | 20   | mV     |
| INPUT VOLTAGE           | CONTINUOUS                     | 16        | 28   | 40   | 16       | 28   | 40   | 16        | 28   | 40   | 16        | 28   | 40   | VDC    |
|                         | TRANSIENT 120 ms               | —         | —    | 50   | —        | —    | 50   | —         | —    | 50   | —         | —    | 50   | V      |
| INPUT CURRENT           | NO LOAD                        | —         | 70   | 130  | —        | 70   | 130  | —         | 70   | 130  | —         | 70   | 130  | mA     |
|                         | FULL LOAD                      | —         | —    | 3.2  | —        | —    | 4.67 | —         | —    | 4.45 | —         | —    | 4.63 | A      |
|                         | INHIBITED - INH1               | —         | —    | 10   | —        | —    | 10   | —         | —    | 10   | —         | —    | 10   | mA     |
|                         | INHIBITED - INH2               | —         | —    | 70   | —        | —    | 70   | —         | —    | 70   | —         | —    | 70   |        |
| INPUT RIPPLE CURRENT    | 10 kHz - 20 MHz                | —         | —    | —    | —        | —    | —    | —         | —    | —    | —         | —    | —    | mA pp  |
|                         | Tc = -55°C to +125°C           | —         | 40   | 90   | —        | 50   | 130  | —         | 50   | 100  | —         | 50   | 130  |        |
| EFFICIENCY              |                                | 74        | 78   | —    | 78       | 81   | —    | 81        | 83   | —    | 81        | 84   | —    | %      |
| LOAD FAULT <sup>1</sup> | POWER DISSIPATION              | —         | —    | —    | —        | —    | —    | —         | —    | —    | —         | —    | —    | W      |
|                         | OVERLOAD                       | —         | —    | 27   | —        | —    | 30   | —         | —    | 30   | —         | —    | 30   |        |
|                         | SHORT CIRCUIT <sup>2</sup>     | —         | —    | 22   | —        | —    | 27   | —         | —    | 24   | —         | —    | 24   |        |
|                         | RECOVERY                       | —         | —    | 10   | —        | —    | 10   | —         | —    | 10   | —         | —    | 10   | ms     |
|                         | OUTPUT CURRENT                 | —         | —    | —    | —        | —    | —    | —         | —    | —    | —         | —    | —    | A      |
|                         | TRIP POINT                     | —         | —    | 25   | —        | —    | 25   | —         | —    | 20   | —         | —    | 14   |        |
| STEP LOAD RESP.         | SHORT CIRCUIT <sup>2</sup>     | —         | —    | 24   | —        | —    | 24   | —         | —    | 19   | —         | —    | 13   | mV pk  |
|                         | 50% - 100% - 50%               | —         | —    | —    | —        | —    | —    | —         | —    | —    | —         | —    | —    |        |
|                         | TRANSIENT                      | —         | —    | 250  | —        | —    | 250  | —         | —    | 500  | —         | —    | 500  |        |
| STEP LINE RESP.         | RECOVERY <sup>3</sup>          | —         | —    | 200  | —        | —    | 200  | —         | —    | 300  | —         | —    | 300  | μs     |
|                         | 16 - 40 - 16 VDC               | —         | —    | —    | —        | —    | —    | —         | —    | —    | —         | —    | —    | mV pk  |
|                         | TRANSIENT <sup>4</sup>         | —         | —    | 400  | —        | —    | 400  | —         | —    | 500  | —         | —    | 500  |        |
| START-UP                | RECOVERY <sup>3</sup>          | —         | —    | 300  | —        | —    | 300  | —         | —    | 300  | —         | —    | 300  | μs     |
|                         | DELAY                          | —         | —    | 10   | —        | —    | 10   | —         | —    | 10   | —         | —    | 10   | ms     |
|                         | OVERSHOOT                      | —         | 0    | 25   | —        | 0    | 50   | —         | 0    | 50   | —         | 0    | 50   | mV pk  |
| INHIBIT PIN CURRENT     | UNIT INHIBITED                 | —         | 0.1  | 1.0  | —        | 0.1  | 1.0  | —         | 0.1  | 1.0  | —         | 0.1  | 1.0  | mA     |

Notes: See notes 1, 2, 3, and 4 on the following page.

# DC/DC CONVERTERS

## MOR SERIES 120 WATT

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

| SINGLE AND DUAL OUTPUT MODELS                                  |                                         | MOR2812S |       |       | MOR2815S |       |       | MOR283R3D |      |                 | MOR2805D |      |                  | UNITS  |
|----------------------------------------------------------------|-----------------------------------------|----------|-------|-------|----------|-------|-------|-----------|------|-----------------|----------|------|------------------|--------|
| PARAMETER                                                      | CONDITIONS                              | MIN      | TYP   | MAX   | MIN      | TYP   | MAX   | MIN       | TYP  | MAX             | MIN      | TYP  | MAX              |        |
| OUTPUT VOLTAGE <sup>5</sup>                                    | +V <sub>OUT</sub>                       | 11.88    | 12.00 | 12.12 | 14.85    | 15.00 | 15.15 | 3.25      | 3.30 | 3.35            | 4.95     | 5.00 | 5.05             | VDC    |
|                                                                | -V <sub>OUT</sub>                       | —        | —     | —     | —        | —     | —     | 3.22      | 3.30 | 3.38            | 4.92     | 5.00 | 5.08             |        |
| OUTPUT CURRENT                                                 | V <sub>IN</sub> = 16 to 40 VDC          | 0        | —     | 9.2   | 0        | —     | 8     | —         | ±10  | 20 <sup>6</sup> | —        | ±10  | 20 <sup>6</sup>  | A      |
| OUTPUT POWER                                                   | V <sub>IN</sub> = 16 to 40 VDC          | —        | —     | 110   | —        | —     | 120   | —         | —    | 66 <sup>6</sup> | —        | —    | 100 <sup>6</sup> | W      |
| OUTPUT RIPPLE VOLTAGE<br>+V <sub>OUT</sub> , ±V <sub>OUT</sub> | 10 kHz - 20 MHz<br>Tc = -55°C to +125°C | —        | 75    | 120   | —        | 75    | 150   | —         | 50   | 80              | —        | 50   | 80               | mV p-p |
|                                                                | 10 kHz - 2 MHz<br>Tc = -55°C to +125°C  | —        | 50    | 100   | —        | 50    | 120   | —         | 35   | 50              | —        | 35   | 50               |        |
|                                                                |                                         | —        | 50    | 100   | —        | 50    | 120   | —         | 35   | 50              | —        | 35   | 50               |        |
| LINE REGULATION<br>V <sub>IN</sub> = 16 to 40 VDC              | +V <sub>OUT</sub>                       | —        | 0     | 20    | —        | 0     | 20    | —         | 25   | 50              | —        | 25   | 50               | mV     |
|                                                                | -V <sub>OUT</sub>                       | —        | —     | —     | —        | —     | —     | —         | 50   | 100             | —        | 50   | 100              |        |
| LOAD REGULATION                                                | +V <sub>OUT</sub>                       | —        | 0     | 20    | —        | 0     | 20    | —         | 25   | 50              | —        | 25   | 50               | mV     |
|                                                                | -V <sub>OUT</sub>                       | —        | —     | —     | —        | —     | —     | —         | 50   | 150             | —        | 50   | 150              |        |
| CROSS REGULATION <sup>7</sup>                                  | NEGATIVE V <sub>OUT</sub>               | —        | —     | —     | —        | —     | —     | —         | 6    | 10              | —        | 5    | 8                | %      |
| INPUT VOLTAGE                                                  | CONTINUOUS                              | 16       | 28    | 40    | 16       | 28    | 40    | 16        | 28   | 40              | 16       | 28   | 40               | VDC    |
|                                                                | TRANSIENT 120 msec                      | —        | —     | 50    | —        | —     | 50    | —         | —    | 50              | —        | —    | 50               | V      |
| INPUT CURRENT                                                  | NO LOAD                                 | —        | 70    | 130   | —        | 70    | 130   | —         | 70   | 140             | —        | 70   | 140              | mA     |
|                                                                | FULL LOAD                               | —        | —     | 4.72  | —        | —     | 5.10  | —         | —    | 3.2             | —        | —    | 4.67             | A      |
|                                                                | INHIBITED - INH1                        | —        | —     | 10    | —        | —     | 10    | —         | —    | 10              | —        | —    | 10               | mA     |
|                                                                | INHIBITED - INH2                        | —        | —     | 70    | —        | —     | 70    | —         | —    | 70              | —        | —    | 70               |        |
| INPUT RIPPLE CURRENT                                           | 10 kHz - 20 MHz<br>Tc = -55°C to +125°C | —        | 50    | 130   | —        | 50    | 130   | —         | 60   | 130             | —        | 60   | 130              | mA p-p |
| EFFICIENCY                                                     |                                         | 84       | 86    | —     | 84       | 87    | —     | 76        | 77   | —               | 78       | 81   | —                | %      |
| LOAD FAULT <sup>1</sup>                                        | POWER DISSIPATION OVERLOAD              | —        | —     | 30    | —        | —     | 30    | —         | —    | 27              | —        | —    | 30               | W      |
|                                                                | SHORT CIRCUIT <sup>2</sup>              | —        | —     | 22    | —        | —     | 22    | —         | —    | 22              | —        | —    | 27               |        |
|                                                                | RECOVERY                                | —        | —     | 10    | —        | —     | 10    | —         | —    | 10              | —        | —    | 10               | ms     |
|                                                                | OUTPUT CURRENT TRIP POINT               | —        | —     | 12    | —        | —     | 10    | —         | —    | 25              | —        | —    | 25               | A      |
|                                                                | SHORT CIRCUIT <sup>2</sup>              | —        | —     | 11    | —        | —     | 9     | —         | —    | 24              | —        | —    | 24               |        |
|                                                                |                                         | —        | —     | —     | —        | —     | —     | —         | —    | —               | —        | —    | —                |        |
| STEP LOAD RESP.<br>+V <sub>OUT</sub> , ±V <sub>OUT</sub>       | 50% - 100% - 50%                        | —        | —     | —     | —        | —     | —     | —         | —    | —               | —        | —    | —                | mV pk  |
|                                                                | TRANSIENT                               | —        | —     | 600   | —        | —     | 600   | —         | —    | 250             | —        | —    | 250              |        |
|                                                                | RECOVERY <sup>3</sup>                   | —        | —     | 300   | —        | —     | 300   | —         | —    | 200             | —        | —    | 200              | μs     |
| STEP LINE RESP.<br>+V <sub>OUT</sub> , ±V <sub>OUT</sub>       | 16 - 40 - 16 VDC                        | —        | —     | —     | —        | —     | —     | —         | —    | —               | —        | —    | —                | mV pk  |
|                                                                | TRANSIENT <sup>4</sup>                  | —        | —     | 600   | —        | —     | 600   | —         | —    | 400             | —        | —    | 400              |        |
|                                                                | RECOVERY <sup>3</sup>                   | —        | —     | 300   | —        | —     | 300   | —         | —    | 300             | —        | —    | 300              | μs     |
| START-UP                                                       | DELAY                                   | —        | —     | 10    | —        | —     | 10    | —         | —    | 10              | —        | —    | 10               | ms     |
|                                                                | OVERSHOOT                               | —        | —     | 50    | —        | —     | 50    | —         | —    | 25              | —        | —    | 50               | mV pk  |
| INHIBIT PIN CURRENT                                            | UNIT INHIBITED                          | —        | 0.1   | 1.0   | —        | 0.1   | 1.0   | —         | 0.1  | 1.0             | —        | 0.1  | 1.0              | mA     |

### Notes:

1. Load fault conditions are measured with a resistive load.
2. Short circuit is measured with a 10 m W (±10%) load.
3. Time to settle to within 1% of Vout.
4. Transition time > 10 μs
5. Output voltage for dual output models is measured at half load.

6. The maximum specification is the total output current/power. Up to 70% of that total is available from either output provided the other output maintains a minimum of 15% the total power used.

7. Cross regulation percentages are for the following conditions:

|                         |                         |
|-------------------------|-------------------------|
| +Po = 30% and -Po = 70% | +Po = 10% and -Po = 50% |
| +Po = 70% and -Po = 30% | +Po = 50% and -Po = 10% |

# MOR SERIES

## 120 WATT

# DC/DC CONVERTERS

**Electrical Characteristics: Tc = 25°C, full load, Vin = 28 VDC, free run, unless otherwise specified.**

| DUAL OUTPUT MODELS                                             |                                         | MOR286R3D |      |      | MOR289R5D |       |       | MOR2812D |       |       | MOR2815D |       |       | UNITS          |
|----------------------------------------------------------------|-----------------------------------------|-----------|------|------|-----------|-------|-------|----------|-------|-------|----------|-------|-------|----------------|
| PARAMETER                                                      | CONDITIONS                              | MIN       | TYP  | MAX  | MIN       | TYP   | MAX   | MIN      | TYP   | MAX   | MIN      | TYP   | MAX   |                |
| OUTPUT VOLTAGE <sup>5</sup>                                    | +V <sub>OUT</sub>                       | 6.24      | 6.30 | 6.36 | 9.40      | 9.50  | 9.60  | 11.88    | 12.00 | 12.12 | 14.85    | 15.00 | 15.15 | VDC            |
|                                                                | -V <sub>OUT</sub>                       | 6.20      | 6.30 | 6.40 | 9.35      | 9.50  | 9.65  | 11.80    | 12.00 | 12.20 | 14.76    | 15.00 | 15.24 |                |
| OUTPUT CURRENT <sup>6</sup>                                    | V <sub>IN</sub> = 16 to 40 VDC          | —         | ±8   | 16   | —         | ±5.53 | 11.05 | —        | ±4.58 | 9.16  | —        | ±4.00 | 8.00  | A <sup>6</sup> |
| OUTPUT POWER                                                   | V <sub>IN</sub> = 16 to 40 VDC          | —         | —    | 100  | —         | —     | 105   | —        | —     | 110   | —        | —     | 120   | W              |
| OUTPUT RIPPLE VOLTAGE<br>+V <sub>OUT</sub> / -V <sub>OUT</sub> | 10 kHz - 20 MHz<br>Tc = -55°C to +125°C | —         | 50   | 100  | —         | 75    | 120   | —        | 75    | 120   | —        | 75    | 150   | mV p-p         |
|                                                                | 10 kHz - 2 MHz<br>Tc = -55°C to +125°C  | —         | 30   | 60   | —         | 50    | 80    | —        | 50    | 100   | —        | 50    | 120   |                |
| LINE REGULATION<br>V <sub>IN</sub> = 16 to 40 VDC              | +V <sub>OUT</sub>                       | —         | 25   | 50   | —         | 25    | 50    | —        | 25    | 50    | —        | 25    | 50    | mV             |
|                                                                | -V <sub>OUT</sub>                       | —         | 50   | 160  | —         | 50    | 100   | —        | 50    | 100   | —        | 50    | 100   |                |
| LOAD REGULATION                                                | +V <sub>OUT</sub>                       | —         | 25   | 50   | —         | 25    | 50    | —        | 25    | 50    | —        | 25    | 50    | mV             |
|                                                                | -V <sub>OUT</sub>                       | —         | 50   | 200  | —         | 50    | 200   | —        | 50    | 200   | —        | 50    | 200   |                |
| CROSS REGULATION <sup>7</sup>                                  | NEGATIVE V <sub>OUT</sub>               | —         | 5    | 8    | —         | 4     | 7     | —        | 3     | 5     | —        | 2     | 4     | %              |
| INPUT VOLTAGE                                                  | CONTINUOUS                              | 16        | 28   | 40   | 16        | 28    | 40    | 16       | 28    | 40    | 16       | 28    | 40    | VDC            |
|                                                                | TRANSIENT 120 msec                      | —         | —    | 50   | —         | —     | 50    | —        | —     | 50    | —        | —     | 50    | V              |
| INPUT CURRENT                                                  | NO LOAD                                 | —         | 70   | 140  | —         | 70    | 140   | —        | 70    | 140   | —        | 70    | 140   | mA             |
|                                                                | FULL LOAD                               | —         | —    | 4.45 | —         | —     | 4.63  | —        | —     | 4.72  | —        | —     | 5.10  | A              |
|                                                                | INHIBITED - INH1                        | —         | —    | 10   | —         | —     | 10    | —        | —     | 10    | —        | —     | 10    | mA             |
|                                                                | INHIBITED - INH2                        | —         | —    | 70   | —         | —     | 70    | —        | —     | 70    | —        | —     | 70    |                |
| INPUT RIPPLE CURRENT                                           | 10 kHz - 20 MHz<br>Tc = -55°C to +125°C | —         | —    | 130  | —         | —     | 130   | —        | —     | 130   | —        | —     | 130   | mA p-p         |
| EFFICIENCY                                                     |                                         | 81        | 83   | —    | 82        | 84    | —     | 84       | 86    | —     | 85       | 87    | —     | %              |
| LOAD FAULT <sup>1</sup>                                        | POWER DISSIPATION OVERLOAD              | —         | —    | 30   | —         | —     | 30    | —        | —     | 30    | —        | —     | 30    | W              |
|                                                                | SHORT CIRCUIT <sup>2</sup>              | —         | —    | 24   | —         | —     | 24    | —        | —     | 22    | —        | —     | 20    |                |
|                                                                | RECOVERY                                | —         | —    | 10   | —         | —     | 10    | —        | —     | 10    | —        | —     | 10    |                |
|                                                                | OUTPUT CURRENT TRIP POINT               | —         | —    | 20   | —         | —     | 14    | —        | —     | 11    | —        | —     | 10    | A              |
|                                                                | SHORT CIRCUIT <sup>2</sup>              | —         | —    | 19   | —         | —     | 13    | —        | —     | 10    | —        | —     | 9     |                |
|                                                                |                                         |           |      |      |           |       |       |          |       |       |          |       |       |                |
| STEP LOAD RESP.<br>± V <sub>OUT</sub>                          | 50% - 100% — 50%                        | —         | —    | 500  | —         | —     | 500   | —        | —     | 600   | —        | —     | 600   | mV pk          |
|                                                                | TRANSIENT                               | —         | —    | 500  | —         | —     | 500   | —        | —     | 600   | —        | —     | 600   |                |
|                                                                | RECOVERY <sup>3</sup>                   | —         | —    | 300  | —         | —     | 300   | —        | —     | 300   | —        | —     | 300   | µs             |
| STEP LINE RESP.<br>± V <sub>OUT</sub>                          | 16 - 40 - 16 VDC                        | —         | —    | 500  | —         | —     | 600   | —        | —     | 600   | —        | —     | 750   | mV pk          |
|                                                                | TRANSIENT <sup>4</sup>                  | —         | —    | 500  | —         | —     | 600   | —        | —     | 600   | —        | —     | 750   |                |
|                                                                | RECOVERY <sup>3</sup>                   | —         | —    | 300  | —         | —     | 300   | —        | —     | 300   | —        | —     | 300   | µs             |
| START-UP                                                       | TIME                                    | —         | —    | 10   | —         | —     | 10    | —        | —     | 10    | —        | —     | 10    | ms             |
|                                                                | OVERSHOOT                               | —         | —    | 50   | —         | —     | 50    | —        | —     | 50    | —        | —     | 50    | mV pk          |
| INHIBIT PIN CURRENT                                            | UNIT INHIBITED                          | —         | 0.1  | 1.0  | —         | 0.1   | 1.0   | —        | 0.1   | 1.0   | —        | 0.1   | 1.0   | mA             |

#### Notes:

1. Load fault conditions are measured with a resistive load.
2. Short circuit is measured with a 10 m W (±10%) load.
3. Time to settle to within 1% of Vout.
4. Transition time > 10 µs
5. Output voltage for dual output models is measured at half load.

6. The maximum specification is the total output current/power. Up to 70% of that total is available from either output provided the other output maintains a minimum of 15% the total power used.
7. Cross regulation percentages are for the following conditions:  
 +Po = 30% and -Po = 70%      +Po = 10% and -Po = 50%  
 +Po = 70% and -Po = 30%      +Po = 50% and -Po = 10%

# DC/DC CONVERTERS

MOR SERIES  
120 WATT

## PIN DESCRIPTIONS AND FUNCTIONS

### PIN OUT

| Pin | Single Output    | Dual Output      |
|-----|------------------|------------------|
| 1   | Positive Input   | Positive Input   |
| 2   | Input Common     | Input Common     |
| 3   | Trim             | Case             |
| 4   | Inhibit 1 (INH1) | Inhibit 1 (INH1) |
| 5   | Sync Out         | Sync Out         |
| 6   | Sync In          | Sync In          |
| 7   | Positive Output  | Positive Output  |
| 8   | Output Common    | Output Common    |
| 9   | Sense Return     | Negative Output  |
| 10  | Positive Sense   | Trim             |
| 11  | Share            | Share            |
| 12  | Inhibit 2 (INH2) | Inhibit 2 (INH2) |

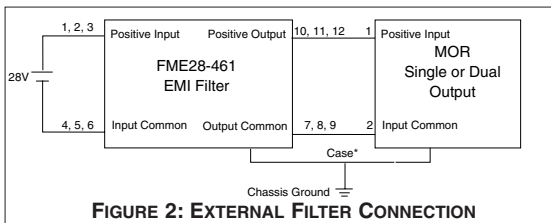
### POSITIVE INPUT AND INPUT COMMON

Steady state voltage range is 16 to 40 VDC. Transient range is 40 to 50 V for a maximum of 120 msec. Low voltage lockout prevents the units from operating below approximately 15.5 VDC input voltage to keep system current levels smooth, especially during initialization or re-start operations. All models include a soft-start function to prevent large current draw and minimize overshoot.

### CASE AND EXTERNAL INPUT FILTERS

Internal 500 V capacitors are connected between the case and input common and between the case and output common. See Figure 1.

Interpoint's FME filters are recommended to meet CE03 requirements for reflected input line current. When using an external input filter it is important that the case of the filter and the case of the converter be connected through as low as an impedance as possible. Direct connection of the baseplates to chassis ground is the best connection. If connected by a single trace, the trace should be as wide as it is long.



### TRIM

Both single and dual output models include a trim function. Output voltage can be trimmed from 60% up to 110% of nominal V out. When trimming up, do not exceed the maximum output power. When trimming down, do not exceed the maximum output current.

#### Trim Formulas

$$\text{Trim Up: } \alpha = \frac{V_o}{V_o \text{ nominal}}, 1.0 \leq \alpha \leq 1.1$$

$$R_T (\text{k}\Omega) = \left( \frac{V_o}{2.5} - 1 \right) \cdot 20 - 50$$

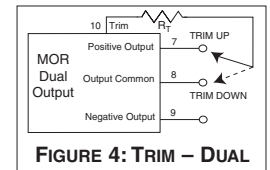
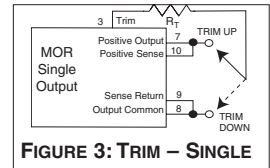
$$(\alpha - 1)$$

$$\text{Example: } V_o \text{ nominal} = 5.0, V_o = 5.25, \alpha = 1.05, R_T = 390 \text{ k}\Omega$$

$$\text{Trim Down: } \alpha = \frac{V_o}{V_o \text{ nominal}}, 0.6 \leq \alpha \leq 1.0$$

$$R_T (\text{k}\Omega) = \frac{50 \cdot \alpha - 30}{1 - \alpha}$$

$$\text{Example: } V_o \text{ nominal} = 5.0, V_o = 4.5, \alpha = 0.9, R_T = 150 \text{ k}\Omega$$

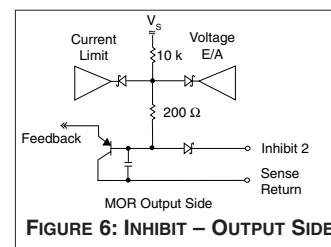
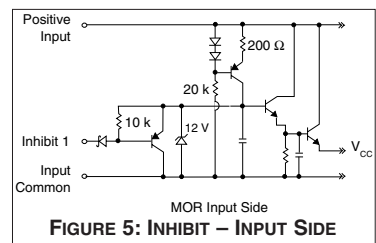


On dual models the positive output is regulated and the negative output is transformer coupled (cross-regulated) to the positive output. When trimming the duals, both output voltages will be adjusted equally.

### INHIBIT 1 AND 2

Two inhibit terminals disable switching, resulting in no output and very low quiescent input current. The two inhibit pins allow access to an inhibit function on either side of the isolation barrier to help maintain isolation.

An open collector is required for interfacing with both of the inhibit pins. Applying an open-collector TTL logic low to either inhibit pin will inhibit the converter. Applying an open collector TTL logic high or leaving the pins open will enable the converter. Inhibit 1 is referenced to Input Common, while Inhibit 2 is referenced to Sense Return on the output side.



The open circuit voltage for Inhibit 1 is 13 V and for Inhibit 2 it is 8 V. Float the inhibit pin(s) if not used. The required logic low voltage level is 0.2 V maximum.

# MOR SERIES 120 WATT

# DC/DC CONVERTERS

## SYNC IN AND SYNC OUT

The MOR converters can be synchronized to the system clock by applying a TTL compatible sync signal to the Sync In pin. Sync Out can be used to synchronize other components to the MOR converter's switching frequency.

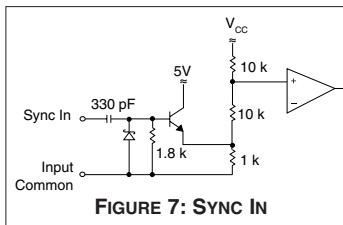


FIGURE 7: SYNC IN

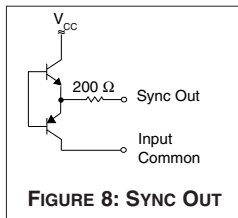


FIGURE 8: SYNC OUT

The frequency range for external synchronization is 525 to 625 kHz. The requirements for an external signal are 15% to 50% duty cycle,  $0 \leq L \leq 0.8$  V and  $4.5 \leq H \leq 9$  V. Both Sync In and Sync Out are referenced to input common. Sync In should be grounded to input common if not used.

## POSITIVE SENSE, SENSE RETURN

A special remote sensing feature maintains the desired output voltage at the load. When this feature is not used, connect the sense lines to their respective output terminals. Remote sensing is available on single output models only. See Figure 12. Do not exceed 110% of  $V_{out}$  and maximum output power.

## SHARE (PARALLELING)

By using the Share pin, up to five single or dual converters may be paralleled for a total output power of over 500 watts (90%  $P_{out}$  / converter, max.). The converters will share within 10% of each other at 25 to 90% rated power. MOR converters feature true n+1 redundancy for reliability in critical applications. See Figure 9 for the proper connections.

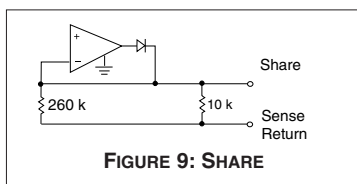


FIGURE 9: SHARE

All Positive Outputs and Positive Senses should be connected to a common point. All Negative Outputs and Sense Returns should be connected to a common point. The Share pin is referenced to Sense Return. Leave the share pin floating (unconnected) if not used.

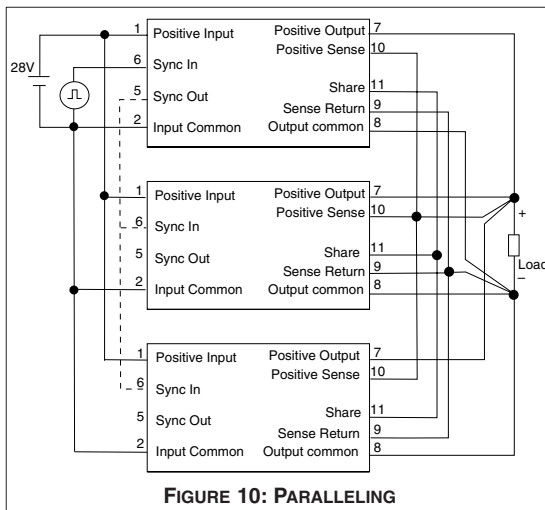


FIGURE 10: PARALLELING

## POSITIVE OUTPUT, NEGATIVE OUTPUT AND OUTPUT COMMON

Output current is limited to 125% of maximum specified current under short circuit or load fault conditions.

Single output models operate from no load to full load. Dual output models with balanced loads operate from no load to full load. For dual models with unbalanced loads, at least 10% of the total output power must be drawn from the positive output at all times, however, the negative output does not require a minimum load. See note 7, cross regulation, under the Electrical Characteristics Tables. Dual outputs may be "stacked" to double the output voltage.

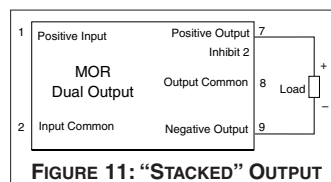


FIGURE 11: "STACKED" OUTPUT

## TYPICAL CONNECTIONS

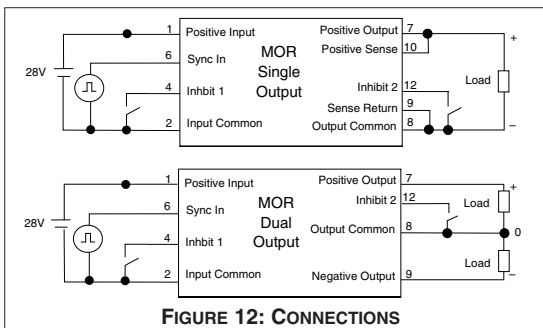


FIGURE 12: CONNECTIONS

# DC/DC CONVERTERS

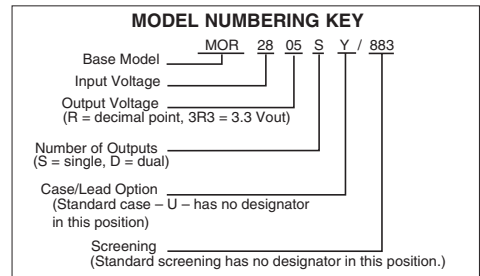
## MOR SERIES 120 WATT

| PIN OUT | Pin | Single Output    | Dual Output      |
|---------|-----|------------------|------------------|
|         | 1   | Positive Input   | Positive Input   |
|         | 2   | Input Common     | Input Common     |
|         | 3   | Trim             | Case             |
|         | 4   | Inhibit 1 (INH1) | Inhibit 1 (INH1) |
|         | 5   | Sync Out         | Sync Out         |
|         | 6   | Sync In          | Sync In          |
|         | 7   | Positive Output  | Positive Output  |
|         | 8   | Output Common    | Output Common    |
|         | 9   | Sense Return     | Negative Output  |
|         | 10  | Positive Sense   | Trim             |
|         | 11  | Share            | Share            |
|         | 12  | Inhibit 2 (INH2) | Inhibit 2 (INH2) |

Angled corner and cover marking indicate pin one for cases U and V. Cover marking indicates pin one for cases W, Y, and Z.

Outline shown is case U, pin out is the same for all cases. Also available: flanged – leads bent down (case V); tabbed – leads bent up (case W), short leads (case Y), and leads bent down (case Z). See Figures 55 through 60 for dimensions.

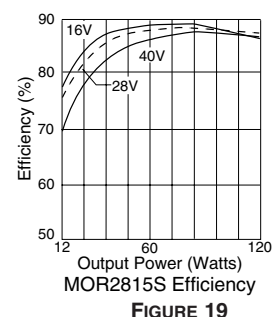
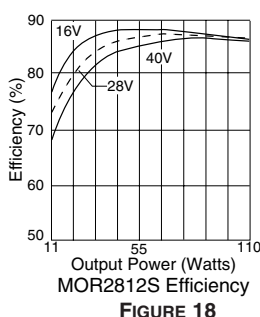
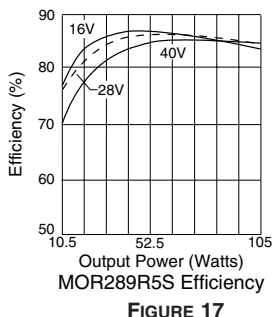
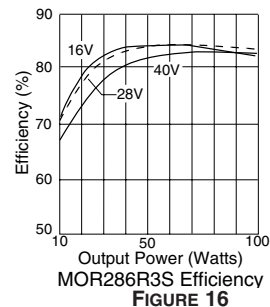
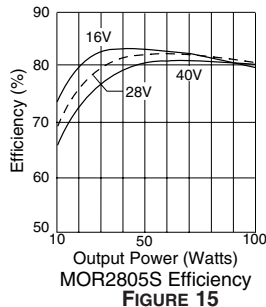
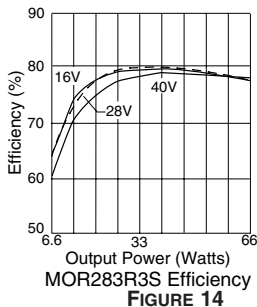
**FIGURE 13: PIN OUT TOP VIEW**



| STANDARD MICROCIRCUIT DRAWING (SMD) | MOR SERIES SIMILAR PART |
|-------------------------------------|-------------------------|
| 5962-9954401HXC                     | MOR283R3S/883           |
| 5962-9954801HXC                     | MOR2805S/883            |
| 5962-9954501HXC                     | MOR286R3S/883           |
| 5962-9954601HXC                     | MOR289R5S/883           |
| 5962-9954901HXC                     | MOR2812S/883            |
| 5962-9955001HXC                     | MOR2815S/883            |
| 5962-9956401HXC                     | MOR283R3D/883           |
| 5962-9956101HXC                     | MOR2805D/883            |
| 5962-9956501HXC                     | MOR286R3D/883           |
| 5962-9956601HXC                     | MOR289R5D/883           |
| 5962-9956201HXC                     | MOR2812D/883            |
| 5962-9956301HXC                     | MOR2815D/883            |

For exact specifications for an SMD product, refer to the SMD drawing. In the SMD number the "X" in the "HXC" suffix corresponds to case U, case V=U, case W=T, case Y=Y, and case Z=Z. SMDs can be downloaded from: <http://www.dscc.dia.mil/programs/smcr>

Typical Performance Curves: 25°C Tc, 28 VDC Vin, 100% load, 20 MHz BW, free run, unless otherwise specified.

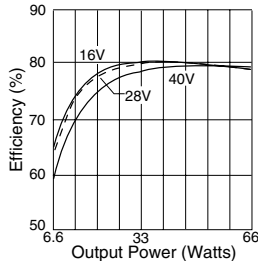


# MOR SERIES

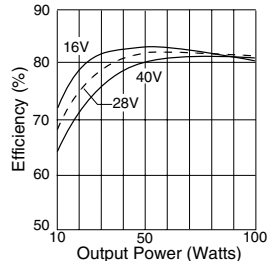
## 120 WATT

# DC/DC CONVERTERS

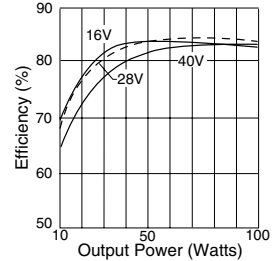
Typical Performance Curves: 25°C Tc , 28 VDC Vin, 100% load, 20 MHz BW, free run, unless otherwise specified.



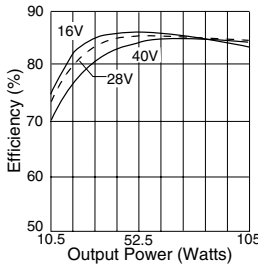
MOR283R3D Efficiency  
**FIGURE 20**



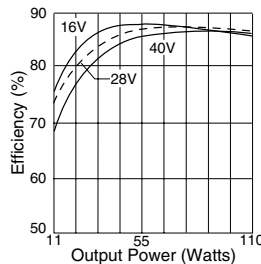
MOR2805D Efficiency  
**FIGURE 21**



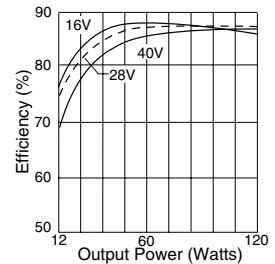
MOR286R3D Efficiency  
**FIGURE 22**



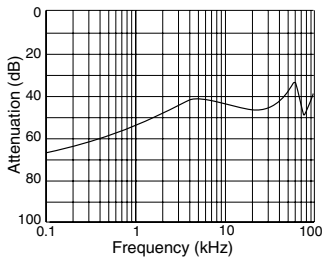
MOR289R5D Efficiency  
**FIGURE 23**



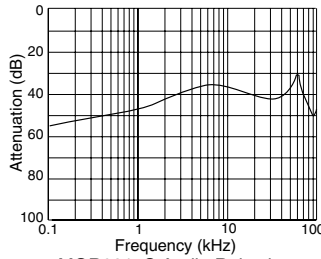
**FIGURE 24**



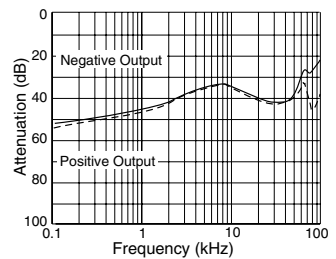
**FIGURE 25**



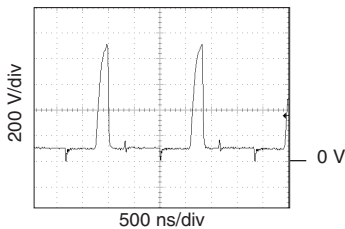
MOR2805S Audio Rejection  
**FIGURE 26**



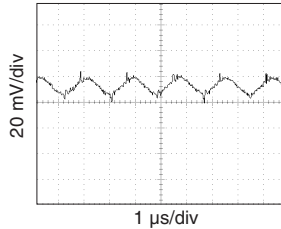
**FIGURE 27**



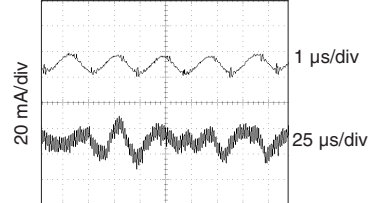
**FIGURE 28**



Representative of all models  
MOR2812D Sync Out  
**FIGURE 29**



80% Load  
MOR2805S Output Ripple (Vout)  
**FIGURE 30**



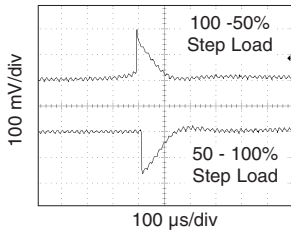
MOR2805S Input Ripple Current (Iin)  
**FIGURE 31**



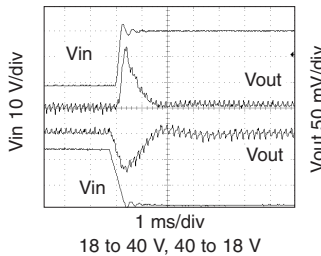
# DC/DC CONVERTERS

## MOR SERIES 120 WATT

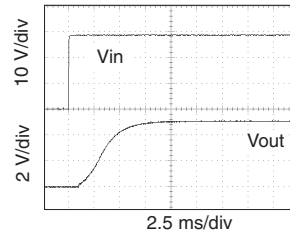
Typical Performance Curves: 25°C Tc , 28 VDC Vin, 100% load, 20 MHz BW, free run, unless otherwise specified.



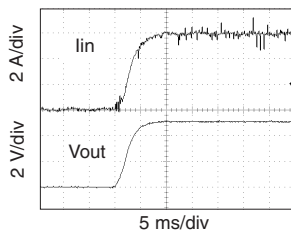
MOR2805S Step Load Response  
**FIGURE 32**



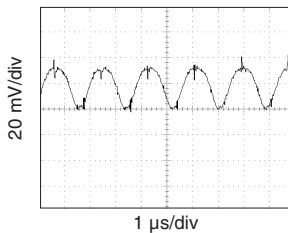
MOR2805S Step Line Response  
**FIGURE 33**



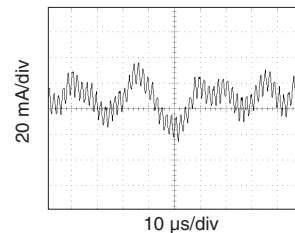
All combinations of line and load  
MOR2805S Turn On Response  
**FIGURE 34**



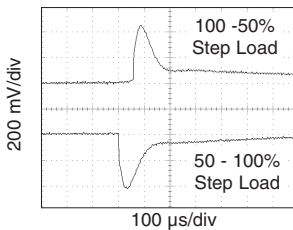
With and without 470  $\mu$ F cap. load  
MOR2805S Inhibit Release Inrush Current  
**FIGURE 35**



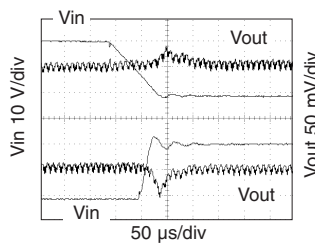
MOR2815S Output Ripple (Vout)  
**FIGURE 36**



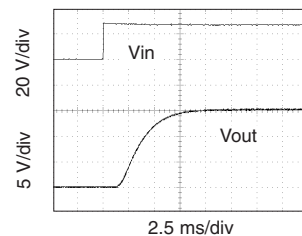
MOR2815S Input Ripple (Iin)  
**FIGURE 37**



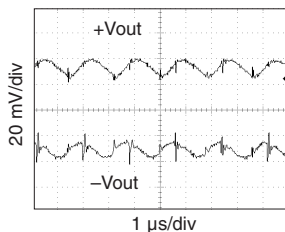
MOR2815S Step Load Response  
**FIGURE 38**



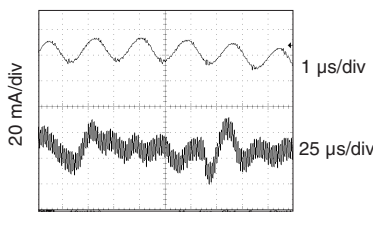
MOR2815S Step Line Response  
**FIGURE 39**



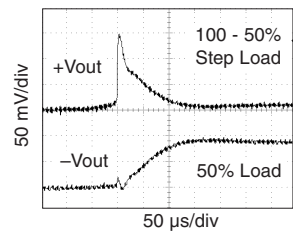
All combinations of line and load  
MOR2815S Turn On Response  
**FIGURE 40**



MOR2805D Output Ripple ( $\pm$ Vout)  
**FIGURE 41**



MOR2805D Input Ripple (Iin)  
**FIGURE 42**

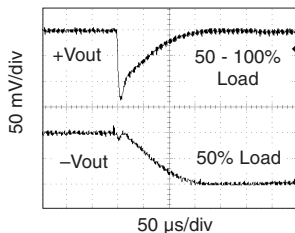


MOR2805D Step Load Response  
**FIGURE 43**

# MOR SERIES 120 WATT

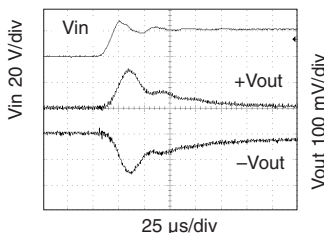
# DC/DC CONVERTERS

Typical Performance Curves: 25°C Tc , 28 VDC Vin, 100% load, 20 MHz BW, free run, unless otherwise specified.



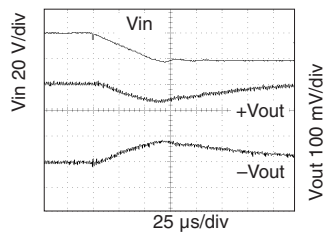
MOR2805D Step Load Response

**FIGURE 44**



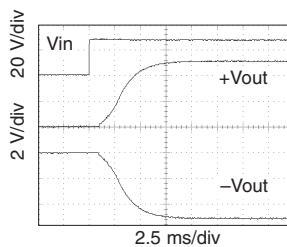
18 to 40 V, 80% load each output  
MOR2805D Step Line Response

**FIGURE 45**



40 to 18 V, 80% load each output  
MOR2805D Step Line Response

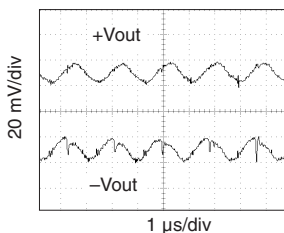
**FIGURE 46**



80% load each output

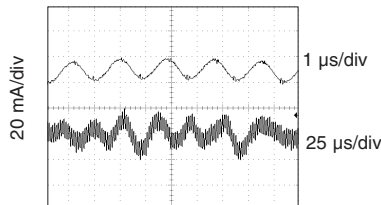
MOR2805D Turn On Response

**FIGURE 47**



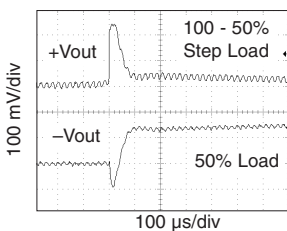
MOR2812D Output Ripple (±Vout)

**FIGURE 48**



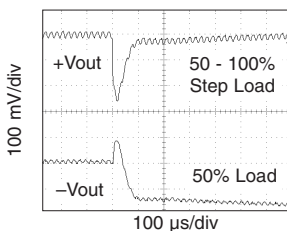
MOR2812D Input Ripple (lin)

**FIGURE 49**



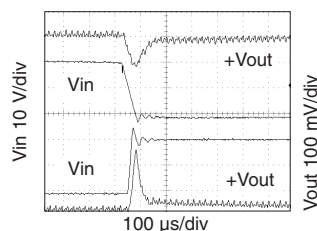
MOR2812D Step Load Response

**FIGURE 50**



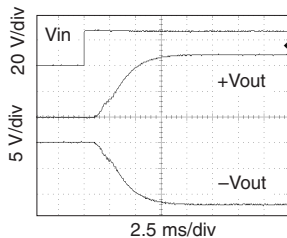
MOR2812D Step Load Response

**FIGURE 51**



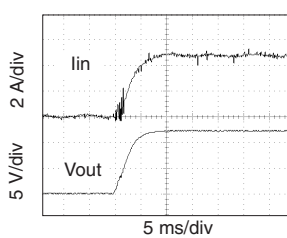
18 to 40 V, 40 to 18 V  
MOR2812D Step Line Response

**FIGURE 52**



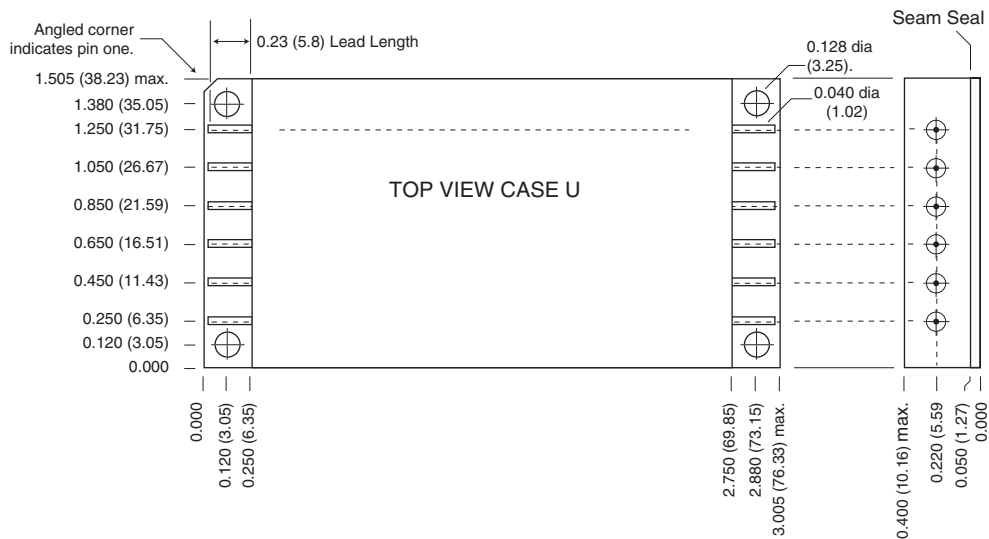
MOR2812D Turn On Response

**FIGURE 53**



MOR2812D Inhibit Release Inrush Current

**FIGURE 54**



## Materials

Header Cold Rolled Steel/Nickel/Gold  
 Cover Kovar/Nickel  
 Pins #52 alloy/Gold  
 compression glass seal

## Case dimensions in inches (mm)

Tolerance  $\pm 0.005$  (0.13) for three decimal places  
 $\pm 0.01$  (0.2) for two decimal places  
 unless otherwise specified

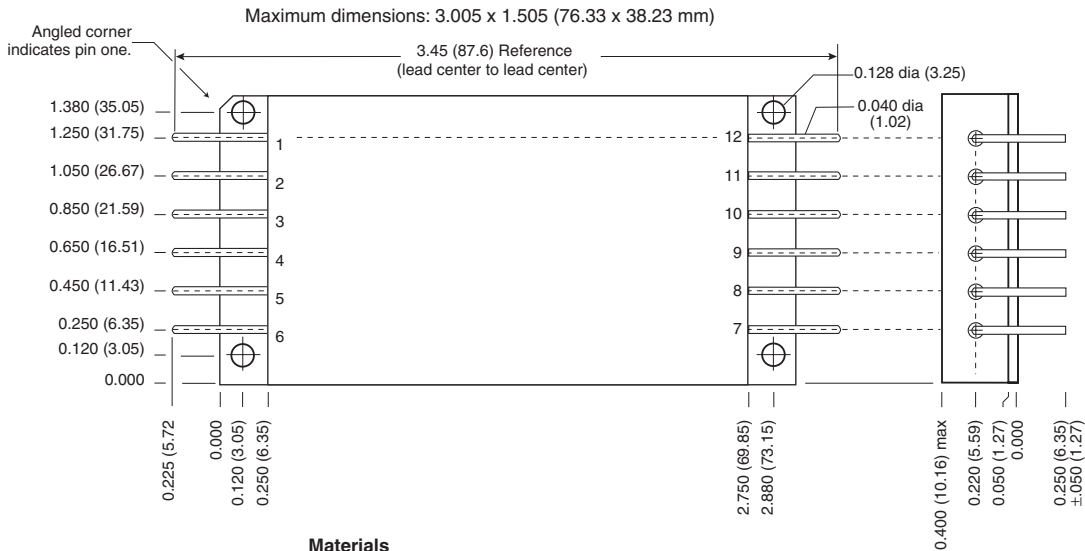
## CAUTION

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.

FIGURE 55

**PIN-SIDE VIEW CASE V\***  
Flanged case, down leaded

\*Requires case option designator added to model number: MOR2805SV



**Materials**

Header Cold Rolled Steel/Nickel/Gold  
Cover Kovar/Nickel  
Pins #52 alloy/Gold  
compression glass seal

**Case dimensions in inches (mm)**

Tolerance ±0.005 (0.13) for three decimal places  
±0.01 (0.2) for two decimal places  
unless otherwise specified

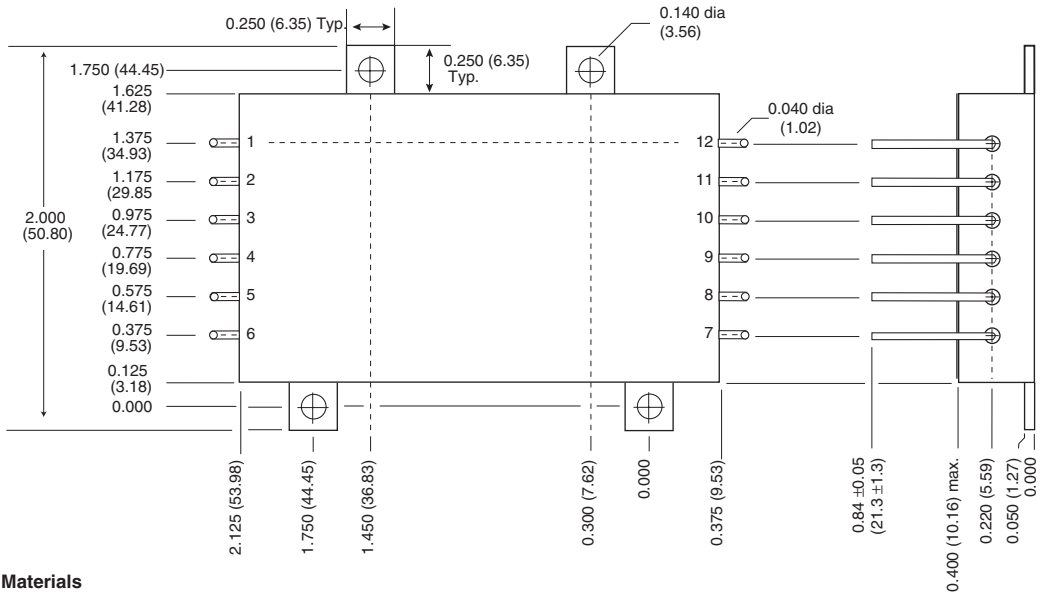
**CAUTION**

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.

**FIGURE 56**

## PIN-SIDE VIEW CASE W\* (Tabbed case, up-ledged)

\*Requires case option designator added to model number: MOR2805SW



### Materials

Header Cold Rolled Steel/Nickel/Gold  
Cover Kovar/Nickel  
Pins #52 alloy/Gold  
compression glass seal

### Case dimensions in inches (mm)

Tolerance ±0.005 (0.13) for three decimal places  
±0.01 (0.2) 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.

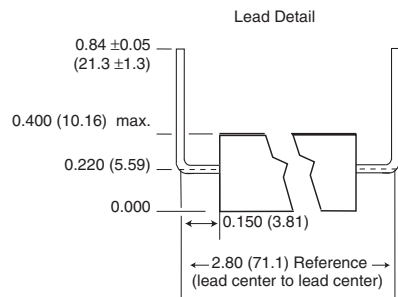
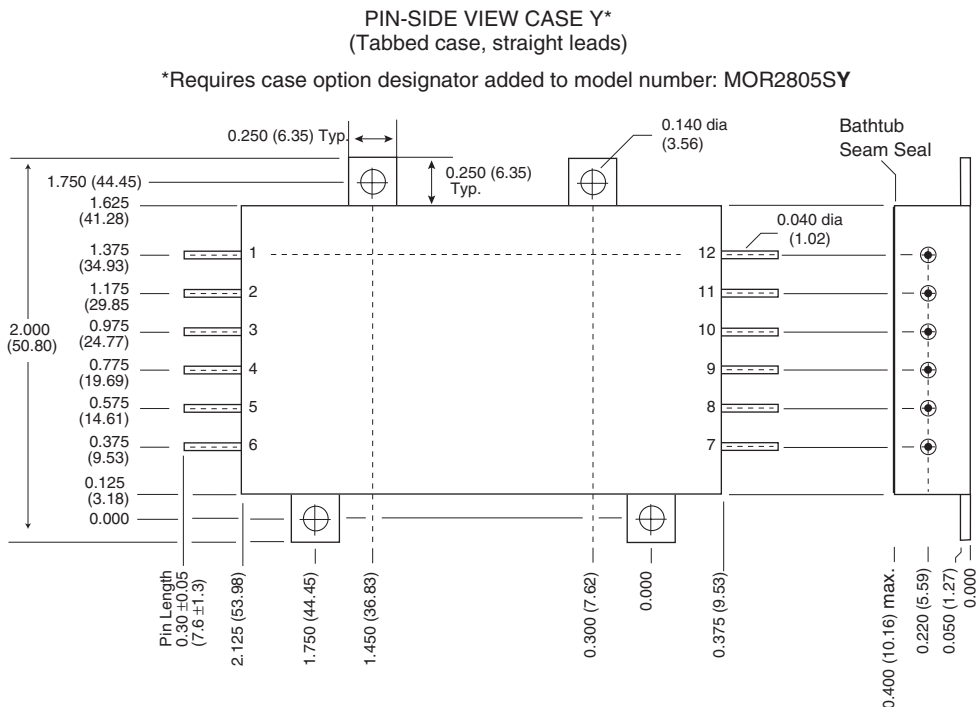


FIGURE 57



## Materials

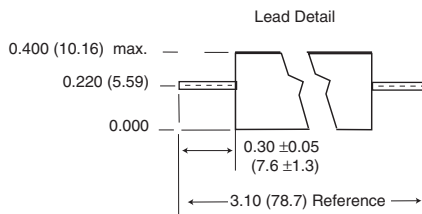
Header Cold Rolled Steel/Nickel/Gold  
Cover Kovar/Nickel  
Pins #52 alloy/Gold  
compression glass seal

## Case dimensions in inches (mm)

Tolerance ±0.005 (0.13) for three decimal places  
±0.01 (0.2) for two decimal places  
unless otherwise specified

## CAUTION

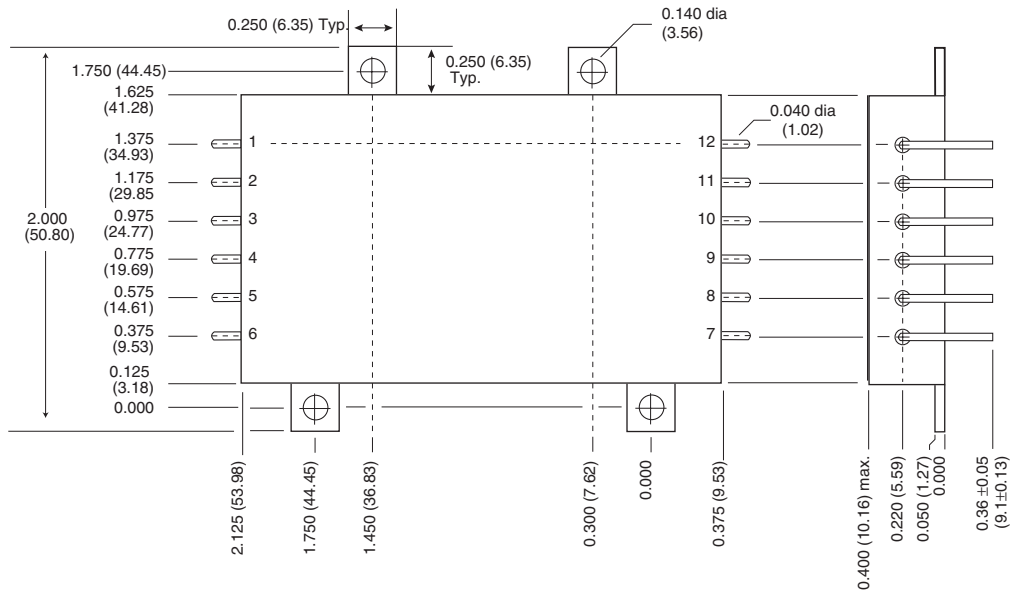
Heat from reflow or wave soldering may damage the device. Solder pins individually with heat application not exceeding 300°C for 10 seconds per pin.



**FIGURE 58**

## PIN-SIDE VIEW CASE Z\* (Tabbed case, down-leaded)

\*Requires case option designator added to model number: MOR2805SZ



### Materials

Header Cold Rolled Steel/Nickel/Gold  
Cover Kovar/Nickel  
Pins #52 alloy/Gold  
compression glass seal

### Case dimensions in inches (mm)

Tolerance ±0.005 (0.13) for three decimal places  
±0.01 (0.2) 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.

### Lead Detail

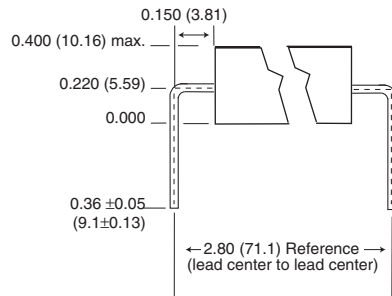


FIGURE 59

# ENVIRONMENTAL SCREENING

| TEST                                                                                                                                       | 125°C<br>STANDARD | 125°C<br>/ES     | /883 (Class H)*  |
|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------|------------------|
| PRE-CAP INSPECTION 25°C<br>Method 2017, 2032                                                                                               | yes               | yes              | yes              |
| TEMPERATURE CYCLE (10 times)<br>Method 1010, Cond. C, -65°C to 150°C<br>Method 1010, Cond. B, -55°C to 125°C                               | no<br>no          | no<br>yes        | yes<br>no        |
| CONSTANT ACCELERATION 25°C<br>Method 2001, 3000 g<br>Method 2001, 500 g                                                                    | no<br>no          | no<br>yes        | yes<br>no        |
| BURN-IN<br>Method 1015, 160 hours at 125°C<br>96 hours at 125°C case (typical)                                                             | no<br>no          | no<br>yes        | yes<br>no        |
| FINAL ELECTRICAL TEST MIL-PRF-38534, Group A<br>Subgroups 1 through 6: -55°C, +25°C, +125°C<br>Subgroups 1 and 4: +25°C case               | no<br>yes         | no<br>yes        | yes<br>no        |
| HERMETICITY TESTING 25°C<br>Fine Leak, Method 1014, Cond. A<br>Gross Leak, Method 1014, Cond. C<br>Gross Leak, Dip (1 x 10 <sup>-3</sup> ) | no<br>no<br>yes   | yes<br>yes<br>no | yes<br>yes<br>no |
| FINAL VISUAL INSPECTION 25°C<br>Method 2009                                                                                                | yes               | yes              | yes              |

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

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