# 75 WATT HE TRIPLE SERIES DC/DC CONVERTERS

## Features

- Small size 2.4" x 2.28" x 0.53" half-brick package
- Excellent Thermal Performance with metal baseplate
- High Efficiency
- Volt-seconds clamp and fast over voltage clamp
- Pulse-by-pulse current limiting, short circuit frequency foldback
- Over-temperature protection
- Auto-softstart
- Low Noise
- Constant frequency for normal operation
- 2:1 Input Voltage Range
- Positive logic primary remote ON/OFF
- Negative logic primary shutdown as an option
- Very low temperature coefficient
- Water Washable
- Trimmable output voltage
- Low Cost
- Available in both RoHS and Non-RoHS construction. See ordering info below model selection chart.

## Description

The Standard Triple HE DC/DC converter provides three regulated low voltage DC outputs at high efficiency and low cost. The unit has feedback from the +5 Vdc output. The auxiliary outputs are cross regulated to the main feedback loop (reference the block diagram). The Standard Triple HE meets rigorous requirements in an industry standard case size and is well suited for most telecommunication applications.

The Standard Triple HE includes primary remote on/off control plus threaded-through holes to allow easy mounting or the addition of a heat sink for high temperature use.

| Selection Chart | | | | | |
|---|---|---|---|---|---|
| Model | Input Range VDC | | Iin ADC | Vout VDC | Iout ADC |
| | Min | Max | TYP | | |
| 24T5.12HE | 18 | 36 | 3.63 | 5, ±12 | 15, ±2.0 |
| 24T5.15HE | 18 | 36 | 3.60 | 5, ±15 | 15, ±2.0 |
| 48T5.12HE | 36 | 75 | 1.80 | 5, ±12 | 15, ±2.0 |
| 48T5.15HE | 36 | 75 | 1.79 | 5, ±15 | 15, ±2.0 |
| 48T5.17HE | 36 | 75 | 1.78 | 5, ±17 | 15, ±2.0 |

The output currents are the maximum ratings of each of the outputs. It is up to the user to ensure that the total power output is below 75 Watts.

Default ON/OFF logic is positive.

Add -N to the model number to order negative ON/OFF logic.

To order RoHS, add (RoHS) to part number.

### 75 Watt HE Triple Series Block Diagram
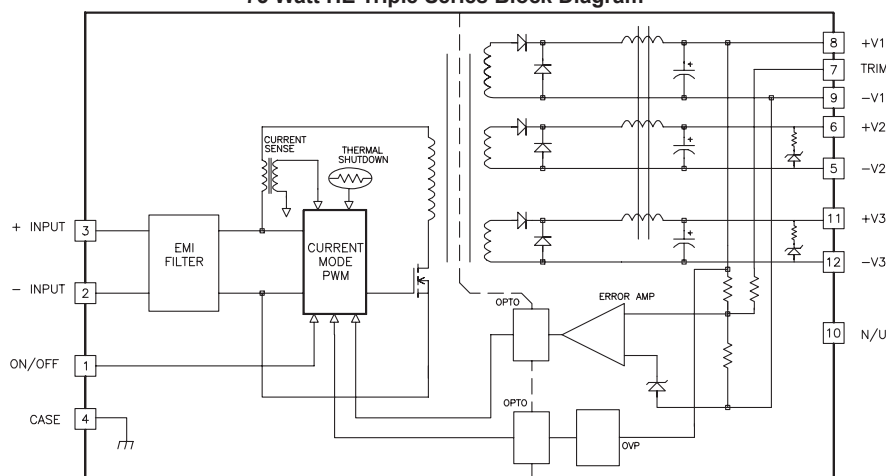
# 75 WATT HE TRIPLE SERIES DC/DC CONVERTERS

Unless otherwise stated, these specifications apply for baseplate temperature TB=23±2ºC, nominal input voltage, and rated typ load. (1)

## Input Parameters

| Model | | 24T5.12HE | 24T5.15HE | Units |
|---|---|---|---|---|
| Voltage Range | MIN<br>TYP<br>MAX | 18<br>24<br>36 | | V |
| Input Overvoltage  (100 ms) | MAX | 50 | | V |
| Input Ripple Rejection  (120Hz) | TYP | 50 | | dB |
| Undervoltage Lockout | | Yes | | |
| Input Reverse Voltage Protection | | Yes | | |
| Input Current    No Load<br>Typ Load | TYP<br>TYP | 15<br>3.67 | | mA<br>A |
| Inrush Current | MAX | 0.5 | | A²s |
| Reflected Ripple, 12µH<br>Source Impedance (3) | TYP | 20 | | mA P-P |
| Efficiency | TYP | 85 | 85 | % |
| Switching Frequency | TYP | 325 | | kHz |
| Recommended Fuse | | (2) | | A |

## Input Parameters

| Model | | 48T5.12HE | 48T5.15HE | 48T5.17HE | Units |
|---|---|---|---|---|---|
| Voltage Range | MIN<br>TYP<br>MAX | 36<br>48<br>75 | | | V |
| Input Overvoltage  (100 mSec) | MAX | 85 | | | V |
| Input Ripple Rejection  (120Hz) | TYP | 50 | | | dB |
| Undervoltage Lockout | | Yes | | | |
| Input Reverse Voltage Protection | | Yes | | | |
| Input Current    No Load<br>Typ Load | TYP<br>TYP | 12<br>1.8 | | | mA<br>A |
| Inrush Current | MAX | 0.5 | | | A²s |
| Reflected Ripple, 12µH<br>Source Impedance (3) | TYP | 20 | | | mA P-P |
| Efficiency | TYP | | 88 | 89 | % |
| Switching Frequency | TYP | 325 | | | kHz |
| Recommended Fuse | | (2) | | | A |

**Notes:**

(1) Refer to the CALEX Application Notes for the definition of terms, measurement circuits, and other information.

(2) These units are not fused and need to be fused by the user. Refer to the CALEX Application Notes for information of fusing. For inrush current, refer to the specifications above.

(3) 33µF capacitor connected between the two "Input" pins. Then insert current sensor in series with 12µH inductor between 33µF and the source. The reflected ripple current is measured over a 5 Hz to 20 MHz bandwidth. Noise should be minimized in the measurement.

(4) Noise is measured per the CALEX Application Notes.  Output noise is measured with a 10µH tantalum capacitor in parallel with a 0.1 µF ceramic capacitor connected across the output to CMN. Measurement bandwidth is 0-20MHz.

(5) Optimum performance is obtained when this power supply is operated within the minimum to maximum load specifications. No damage to module will occur, when the output is operated at less than minimum load, but the output voltage may contain a low frequency component that may exceed output noise specifications. Total output power must not exceed 75W.

(6) Load Transient Recovery Time is defined as the time for the output to settle from a 50% to 75%  or 25% step load change to a 1% error band (rise time of step = 2µs).

(7) Load Transient Overshoot is defined as the peak overshoot during a transient as defined in the Note 6 above.

(8) Load regulation is defined as the output voltage change when simultaneously changing all outputs from typ. to min load and noting the change.  The voltage is measured at the output pin.

(9) Cross regulation is defined as the change in one output (set at 70% of maximum load) when only one of the other outputs is changed for 70% of maximum to 20% of maximum load.

(10) Most switches would be suitable for the logic ON/OFF control. In case there is a problem you can make the following estimations and then leave some margin.
When open collector is used for logic high, "Open Circuit Voltage at ON/OFF Pin", "Output Resistance" and "External Leakage Current Allowed for Logic High" are used to estimate the high impedance requirement of open collector.
When switch is used for logic low, "Open Circuit Voltage at ON/OFF Pin", "Output Resistance" and "LOW Logic Level" are used to estimate the low impedance requirement of the switch.

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Unless otherwise stated, these specifications apply for baseplate temperature TB=23±2ºC, nominal input voltage, and rated typ load. (1)

| Output Parameters (VO1) | | | |
|---|---|---|---|
| Model | | 24T5.12HE    48T5.12HE<br>24T5.15HE    48T5.15HE<br>48T5.17HE | Units |
| Output Voltage | | 5 | V |
| Output Voltage Setpoint Accuracy @ Typ Load | MAX | ±1 | % |
| Turn On Overshoot Min-Max Load | TYP | 0 | % |
| Temperature Coefficient | TYP<br>MAX | 0.003<br>0.01 | %/ºC |
| Noise and Ripple RMS (4) | TYP<br>TYP | 100<br>50 | mV P-P<br>mV RMS |
| Load Current (5) (12) | MIN<br>TYP<br>MAX | 1.5<br>10<br>15 | A |
| Load Transient Overshoot (7) | TYP | 4 | % |
| Load Transient Recovery Time (6) | TYP | 200 | µs |
| Load Regulation (5) Min-Typ Load | TYP<br>MAX | 1<br>1.2 | % |
| Line Regulation Vin = Min-Max | TYP<br>MAX | 0.01<br>0.1 | % |
| Overvoltage Protection (OVP) Threshhold OVP Type - Non-latching Open Loop Overvoltage Clamp | TYP | 130 | % |
| Output Current Limit Vout = 90% of Vout-nom | TYP | 120 | % |
| Output Short Circuit Current Vout = 0.25V | MAX | 175 | % |

| Output Parameters (VO2, VO3) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Model | | 24T5.12HE | 48T5.12HE | 24T5.15HE | 48T5.15HE | 48T5.17HE | Units |
| Output Voltage | | ±12 | | ±15 | | ±17 | V |
| Output Voltage Setpoint Accuracy @ Typ Load | MAX | ±5.5 | | | | | % |
| Turn On Overshoot Min-Max Load | TYP | 0 | | | | | % |
| Temperature Coefficient | TYP<br>MAX | 0.02<br>0.05 | | | | | %/ºC |
| Noise and Ripple RMS (4) | TYP<br>TYP | 150<br>100 | 150<br>100 | 200<br>150 | 200<br>150 | 200<br>150 | mV P-P<br>mV RMS |
| Load Current (5) (12) | MIN<br>TYP<br>MAX | 0.2<br>1.041<br>2.0 | | 0.2<br>0.833<br>2.0 | | 0.2<br>0.735<br>2.0 | A |
| Load Transient Overshoot (7) | TYP | 4 | | | | | % |
| Load Regulation (5) Min-Typ Load | TYP<br>MAX | 3.5<br>5 | | | | | % |
| Line Regulation Vin = Min-Max | TYP<br>MAX | 0.5<br>1 | | | | | % |
| Cross Regulation (9) | TYP | 4 | | | | | % |
| Absolute Regulation | TYP | 8 | | | | | % |
| Output Voltage Protection Open Loop Overvoltage Clamp | | Yes (Volt-Seconds Clamp) | | | | | % |

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## General Specifications

| All Models | | | Units |
|---|---|---|---|
| **Primary Remote ON/OFF Function** | | | |
| HIGH Logic Level for ON | MIN | 3.0 | VDC |
| External Leakage Current Allowed for Logic High (14) | MAX | 10 | µA |
| Input Diode Protection Voltage | MAX | 50 | VDC |
| LOW Logic Level or Tie ON/OFF Pin to -INPUT | MAX | 1.0 | VDC |
| Sinking Current for Primary Logic Level | MAX | 500 | µA |
| Open Circuit Voltage at ON/OFF Pin (10) Positive Logic Negative Logic | TYP TYP | 2.3 1.5 | VDC VDC |
| Output Resistance (10) | TYP | 3 | k Ω |
| Idle Current (Module is OFF) | TYP | 2 | mADC |
| Turn-on Time to 1% error | TYP | 20 | ms |
| Remote ON/OFF Logic (13) | HIGH - Module ON LOW - Module OFF | | |
| **Output Voltage Trim** | | | |
| Trim Range | MIN MAX | ±10 | % of Vout |
| Input Resistance | TYP | 10 | kΩ |
| Open Circuit Voltage | TYP | 2.5 | V |
| **Trim Limit** | | | |
| Maximum Output Voltage | MAX | 110 | % of Vout |
| **Isolation** | | | |
| Input to Output Isolation 10µA Leakage Vnom = 24V Vnom = 48V | MIN MIN | 700 1544 | VDC VDC |
| Input to Output Resistance | MIN | 10 | MΩ |
| Input to Output Capacitance | TYP | 1800 | pF |
| **Environmental** | | | |
| Calculated MTBF, Bellcore Method 1, Case 1 | >1,000,000 | | h |
| Baseplate Operating Temperature Range | MIN MAX | -40 100 | °C |
| Storage Temperature | MIN MAX | -40 120 | °C |
| Thermal Impedance (11) | TYP | 7 | °C/W |
| Thermal Shutdown Baseplate Temperature (Auto Restart) | TYP | 110 | °C |
| **General** | | | |
| Unit Weight | TYP | 4.6/114 | oz/g |
| Case Dimension | 2.4" x 2.28" x 0.53" | | |
| Torque on Mounting Inserts | MAX | 12 in. oz. | |
| Agency Approvals | Designed to Meet UL60950 | | |
| Chassis Mounting Kit | MS25 | | |

(11) Thermal impedance is tested with the converter mounted vertically and facing another printed circuit board 1/2 inch away. If converter is mounted horizontally with no obstruction, thermal impedance is approximately 7°C/W.

(12) Minimum load is defined as 10% of maximum load. Calex Mfg. Co. Inc. does not guarantee performance for loads less than the minimum. Loads less than the minimum shall not damage the unit.

(13) The unit can be configured with negative logic for Remote ON/OFF.

(14) When an external On/Off switch is used, such as open collector switch, logic high requires the switch to be high-impedance. Switch leakage currents greater than 10µA may be sufficient to trigger the ON/OFF to the logic-low state.

(15) When using the trim function, the user should remember that all three voltages will go up or down at the same time.

(16) Water Washability - Calex DC/DC converters are designed to withstand most solder/wash processes. Careful attention should be used when assessing the applicability in your specific manufacturing process. Converters are not hermetically sealed.

(17) Torque fasteners into threaded mounting inserts at 12 in. oz. or less. Greater torque may result in damage to unit and void the warranty.

(18) RoHS Compliance:
See Calex Website www.calex.com/RoHS.html for the complete RoHS Compliance statement.
The RoHS marking is as follows.
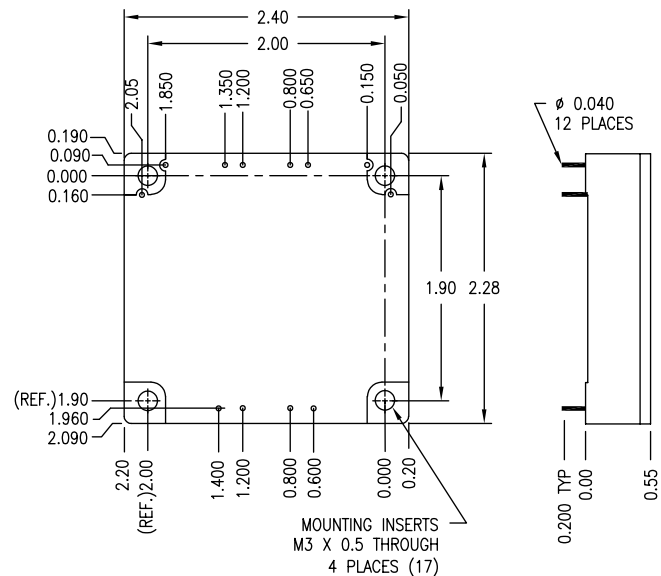


TOLERANCE: ALL DIMENSIONS ARE TYPICAL IN INCHES UNLESS OTHERWISE NOTED:

| X.XX | ±0.020 |
|---|---|
| X.XXX | ±0.005 |

| Pin | Function | Pin | Function |
|---|---|---|---|
| 1 | Primary ON/OFF | 7 | TRIM |
| 2 | -V IN | 8 | + V1 |
| 3 | + VIN | 9 | - V1 |
| 4 | CASE | 10 | N/U |
| 5 | - V2 | 11 | + V3 |
| 6 | + V2 | 12 | - V3 |