# UIS48T14050
# DC-DC Converter
## 18-75 VDC Input, 5 VDC, 14 A, 70 W Output

The high performance 14A UIS48T14050 DC-DC converter provides a high efficiency single output, in a 1/16th brick package. Specifically designed for operation in systems that have limited airflow and increased ambient temperatures, the UIS48T14050 converter utilizes the same pinout and Input/Output functionality of the industry-standard sixteenth bricks. In addition, a baseplate / heat spreader feature is available (-xDxBx suffix) that provides an effective thermal interface for coldplate and heat sinking options.

The UIS48T14050 converter thermal performance is accomplished through the use advanced circuits, packaging, and processing techniques to achieve ultra-high efficiency, excellent thermal management, and a low-body profile.

Operating from a wide-range 18-75V input, the UIS48T14050 converter utilizes digital control and provides a fully regulated 5.0V output voltage. The designer can expect reliability improvement over other available converters because of the UIS48T14050's optimized thermal efficiency.

RoHS Compliant

### Key Features & Benefits

- Industry-standard sixteenth-brick pin-out
- Ultra wide input voltage range
- Delivers 70W at 90% efficiency
- Paste In Hole (PIH) compatible
- Withstands 100V input transient for 100ms
- Fixed-frequency operation
- On-board input differential LC-filter
- Start-up into pre-biased load
- No minimum load required
- Minimum of 2,250$V_{DC}$ I/O isolation
- Fully protected (OTP, OCP, OVP, UVLO)
- Positive or negative logic ON/OFF option
- Low height of 0.453" (11.5mm)
- Weight: 18 g without baseplate / heat spreader,
  24 g with baseplate / heat spreader
- High reliability: MTBF = 14.3 million hours, calculated per Telcordia SR-332, Method I Case 1
- Approved to the latest edition of the following standards: UL/CSA60950-1, IEC60950-1 and EN60950-1.
- Designed to meet Class B conducted emissions per FCC and EN55022 when used with external filter
- All materials meet UL94, V-0 flammability rating

### Applications

- Intermediate Bus Architectures
- Data communications/processing
- LAN/WAN
- Servers, storage, instrumentation, embedded equipment

## 1. ELECTRICAL SPECIFICATIONS

Conditions: $T_A$ = 25 ºC, Airflow = 300 LFM (1.5 m/s), Vin = 48 VDC, Cin = 100 µF, unless otherwise specified.

| PARAMETER | NOTES | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| ***ABSOLUTE MAXIMUM RATINGS*** | | | | | |
| Input Voltage | Continuous | -0.3 | | 80 | VDC |
| | Transient (100ms) | | | 100 | VDC |
| Operating Temperature (See Derating Curves) | Ambient ($T_A$) | -40 | | 85 | °C |
| | Component ($T_C$) [1] | -40 | | 125 | °C |
| Storage Temperature | | -55 | | 125 | °C |
| ***ISOLATION CHARACTERISTICS*** | | | | | |
| Isolation Voltage | Input to Output | 2250 | | | VDC |
| | Input to Baseplate | 1500 | | | VDC |
| | Output to Baseplate | 1500 | | | VDC |
| Isolation Resistance | | 10 | | | MΩ |
| Isolation Capacitance | | | - | | pF |
| ***FEATURE CHARACTERISTICS*** | | | | | |
| Switching Frequency | | | 330 | | kHz |
| Output Overvoltage Protection | Non-latching | 115 | 125 | 130 | % |
| Over Temperature Shutdown | Non-latching Component ($T_C$) [1] | | 130 | | °C |
| Auto-Restart Period | Applies to all protection features | | 500 | | ms |
| Turn-On Time from Vin | Time from UVLO to Vo = 90% $V_{OUT(NOM)}$, Resistive load | | 100 | 130 | ms |
| Turn-On Time from ON/OFF Control | Time from ON to Vo = 90% $V_{OUT(NOM)}$, Resistive load | | 100 | 130 | ms |
| Turn-On Time from Vin (w/ Co max.) | Time from UVLO to Vo = 90% $V_{OUT(NOM)}$ Resistive load, $C_{EXT}$ = 10000 µF load | | 100 | 130 | ms |
| Turn-On Time from ON/OFF Control (w/ Co max.) | Time from ON to Vo = 90% $V_{OUT(NOM)}$ Resistive load, $C_{EXT}$ = 10000 µF load | | 100 | 130 | ms |
| ON/OFF Control (Positive Logic) | Converter Off (logic low) | -15 | | 0.8 | VDC |
| | Converter On (logic high) | 2.4 | | 15 | VDC |
| ON/OFF Control (Negative Logic) | Converter Off (logic low) | 2.4 | | 15 | VDC |
| | Converter On (logic high) | -15 | | 0.8 | VDC |
| ***INPUT CHARACTERISTICS*** | | | | | |
| Operating Input Voltage Range | | 18 | 48 | 75 | VDC |
| Input Undervoltage Lockout | | | | | |
| Turn-on Threshold | | 16.8 | 17.2 | 17.8 | VDC |
| Turn-off Threshold | | 14.9 | 15.5 | 16.1 | VDC |
| Lockout Hysteresis Voltage | | 0.5 | 1.7 | 2.3 | VDC |
| Maximum Input Current | Po = 70 W @ 18 VDC In | | | 5 | ADC |
| Input Standby Current | Vin = 48 V, converter disabled | | 3 | 5 | mA |
| Input No Load Current | Vin = 48V, converter enabled (No load on the output) | | 50 | 100 | mA |
| Input Reflected-Ripple Current, ic | Vin = 48 V, 20 MHz bandwidth, Po = 70 W (Figs. 14,15, 16) | | 600 | | $mA_{PK-PK}$ |
| | | | 200 | | $mA_{RMS}$ |
| Input Reflected-Ripple Current, $i_S$ | | | 30 | | $mA_{PK-PK}$ |
| | | | 6 | | $mA_{RMS}$ |
| Input Voltage Ripple Rejection | 120 Hz | | 45 | | dB |

[1] Reference Figure G for component $T_C$ locations.

| | | | | | |
|---|---|---|---|---|---|
| ***OUTPUT CHARACTERISTICS*** | | | | | |
| Output Voltage Setpoint | $V_{IN}$ = 48 V, $I_{OUT}$ = 0 A, $T_A$ = 25°C | 4.95 | 5.00 | 5.05 | VDC |
| Output Voltage Trim Range [2] | Industry-std. equations | -20 | | +10 | % |
| Remote Sense Compensation [3] | Percent of $V_{OUT}$ (NOM) | | | +10 | % |
| Output Regulation | | | | | |
| Over Line | $I_{OUT}$ = 14 A, $T_A$ = 25°C | | ±24 | ±48 | mV |
| Over Load | $V_{IN}$ = 48 V, $T_A$ = 25°C | | ±24 | ±48 | mV |
| Output Voltage Range | Over line, load and temperature | 4.85 | 5.0 | 5.15 | VDC |
| Output Ripple and Noise | 20 MHz bandwidth $C_{EXT}$ =10 µF tantalum + 1 µF ceramic<br>$C_{EXT}$ =100 µF tantalum + 1 µF ceramic | | 50<br>25 | 100<br>50 | $mV_{PK-PK}$ |
| Admissible External Load Capacitance | $I_{OUT}$ = 14 A (resistive) $C_{EXT}$<br>ESR | | | 4700 | µF<br>mΩ |
| Output Current Range | Vin:18 V – 75 V | 0 | | 14 | ADC |
| Current Limit Inception | Non-latching | 16 | 18 | 20 | ADC |
| RMS Short-Circuit Current | Non-latching Short = 10 mΩ | | 2.9 | 5 | $A_{RMS}$ |
| ***DYNAMIC RESPONSE*** | | | | | |
| Output Voltage Current Transient | 48V, 10µF Tan & 1µF Ceramic load cap, 0.1A/µs | | | | |
| Positive Step Change in Output Current | 25% Io.max to 50% Io.max | | 250 | | mV |
| Negative Step Change in Output Current | 50% Io.max to 25% Io.max | | 250 | | mV |
| Settling Time | to 2% of $V_{OUT}$ | | 300 | | µs |
| ***EFFICIENCY*** | | | | | |
| @ 60% Load<br>@ 100% Load | $48V_{IN}$, $T_A$ = 25°C, 300LFM | 88<br>89 | 89<br>90 | | % |

## 2. ENVIRONMENT AND MECHANICAL SPECIFICATIONS

| PARAMETER | NOTES | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| ***ENVIRONMENTAL*** | | | | | |
| Operating Humidity | Non-condensing | | | 95 | % |
| Storage Humidity | Non-condensing | | | 95 | % |
| ***MECHANICAL*** | | | | | |
| Weight | Without baseplate / heat spreader | | 18 | | g |
| | With baseplate / heat spreader | | 24 | | g |
| Vibration | GR-63-CORE, Sect. 5.4.2 | 1 | | | g |
| Shocks | Half Sinewave, 3-axis | 50 | | | g |
| ***RELIABILITY*** | | | | | |
| MTBF | Telcordia SR-332, Method I Case 1<br>50% electrical stress, 40°C components | | 14.3 | | MHrs |
| ***EMI AND REGULATORY COMPLIANCE*** | | | | | |
| Conducted Emissions | CISPR 22 B with external EMI filter network | | | | |

[2] For input voltage >22 V
[3] See *"Input Output Impedance"*, Page 4



# 3. OPERATIONS

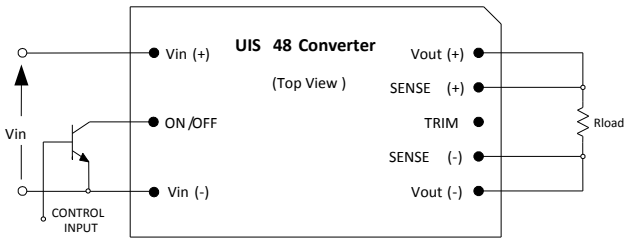
## 3.1. INPUT AND OUTPUT IMPEDANCE

These power converters have been designed to be stable with no external capacitors when used in low inductance input and output circuits.
However, in some applications, the inductance associated with the distribution from the power source to the input of the converter can affect the stability of the converter. A 100 µF electrolytic capacitor with adequate ESR based on input impedance is recommended to ensure stability of the converter.
In many end applications, a high capacitance value is applied to the converter's output via distributed capacitors. The power converter will exhibit stable operation with external load capacitance up to 4700 µF.

## 3.2. ON/OFF (PIN 2)

The ON/OFF pin is used to turn the power converter on or off remotely via a system signal. There are two remote control options available, positive and negative logic, with both referenced to Vin (-). A typical connection is shown in Figure A.
The positive logic version turns on when the ON/OFF pin is at a logic high or left open and turns off when it is at a logic low. See the Electrical Specifications for logic high/low definitions.

*Fig. A: Typ. Circuit configuration for ON/OFF function.*

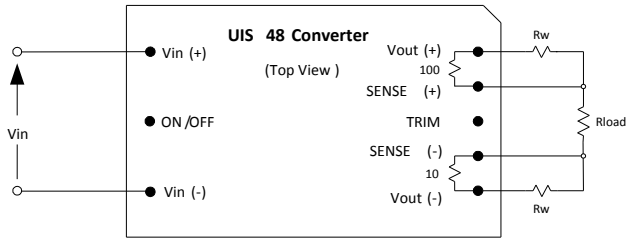



The negative logic version turns on when the ON/OFF pin is at a logic low and turns off when the pin is at logic high. To enable automatic power up of the converter without the need of an external control signal the ON/OFF pin can be hard wired directly to Vin (-) for N and left open for P version.
A properly de-bounced mechanical switch, open-collector transistor, or FET can be used to drive the input of the ON/OFF pin. The device must be capable of sinking up to 0.2 mA at a low level voltage of ≤ 0.8 V. An external voltage source (±15 V maximum) may be connected directly to the ON/OFF input, in which case it must be capable of sourcing or sinking up to 1 mA depending on the signal polarity. If optocoupler is used to control the on/off, then the ON/OFF pin should be tied to a 3V3 rail via 3.3kohm resistor to prevent optocoupler leakage from affecting the on/off function. See the Startup Information section for system timing waveforms associated with use of the ON/OFF pin.

## 3.3. SENSE (PINS 5 AND 7)

The remote sense feature of the converter compensates for voltage drops occurring between the output pins of the converter and the load. The SENSE (-) (Pin 5) and SENSE (+) (Pin 7) pins should be connected at the load or at the point where regulation is required (see Fig. B).

*Fig. B: Remote sense circuit configuration.*




**CAUTION**
If remote sensing is not utilized, the SENSE (-) pin must be connected to the Vout (-) pin (Pin 4), and the SENSE (+) pin must be connected to the Vout (+) pin (Pin 8) to ensure the converter will regulate at the specified output voltage. If these connections are not made, the converter will deliver an output voltage that is higher than the specified data sheet value.

Because the sense leads carry minimal current, large traces on the end-user board are not required. However, sense traces should be run side by side and located close to a ground plane to minimize system noise and ensure optimum performance.
The converter's output overvoltage protection (OVP) senses the voltage across Vout (+) and Vout (-), and not across the sense lines, so the resistance (and resulting voltage drop) between the output pins of the converter and the load should be minimized to prevent unwanted triggering of the OVP.
When utilizing the remote sense feature, care must be taken not to exceed the maximum allowable output power capability of the converter, which is equal to the product of the nominal output voltage and the allowable output current for the given conditions.
When using remote sense, the output voltage at the converter can be increased by as much as 10% above the nominal rating in order to maintain the required voltage across the load. Therefore, the designer must, if necessary, decrease the maximum current (originally obtained from the derating curves) by the same percentage to ensure the converter's actual output power remains at or below the maximum allowable output power.

### 3.4. OUTPUT VOLTAGE ADJUST /TRIM (PIN 6)

The output voltage can be adjusted up 10% or down 20%, relative to the rated output voltage by the addition of an externally connected resistor.
The TRIM pin should be left open if trimming is not being used. To minimize noise pickup, a 0.1 µF capacitor is connected internally between the TRIM and SENSE (-) pins.
To increase the output voltage, refer to Fig. C. A trim resistor, $R_{T\text{-}INCR}$, should be connected between the TRIM (Pin 6) and SENSE (+) (Pin 7), with a value of:

$$R_{T\text{-}INCR} = \frac{5.11(100+\Delta)V_{O\text{-}NOM} - 626}{1.225\Delta} - 10.22 \quad [k\Omega]$$

where,

$R_{T\text{-}INCR}$ = Required value of trim-up resistor kΩ]

$V_{O\text{-}NOM}$ = Nominal value of output voltage [V]

$$\Delta = \left| \frac{(V_{O\text{-}REQ} - V_{O\text{-}NOM})}{V_{O\text{-}NOM}} \right| X\ 100 \quad [\%]$$

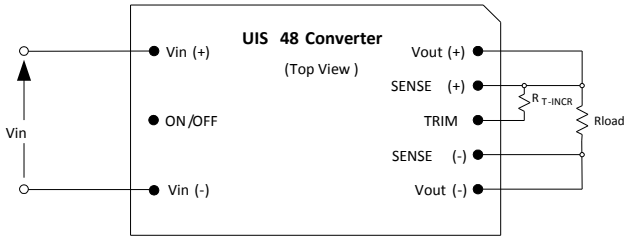
$V_{O\text{-}REQ}$ = Desired (trimmed) output voltage [V].

When trimming up, care must be taken not to exceed the converter's maximum allowable output power. See the previous section for a complete discussion of this requirement.



*Fig. C: Configuration for increasing output voltage.*



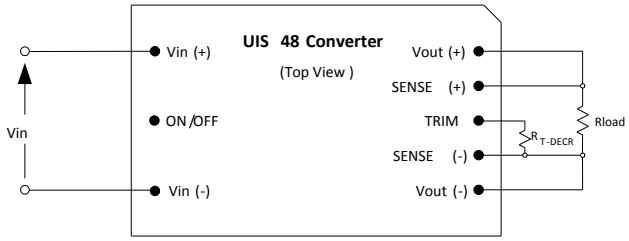

To decrease the output voltage (Fig. D), a trim resistor, $R_{T\text{-}DECR}$, should be connected between the TRIM (Pin 6) and SENSE(-) (Pin 5), with a value of:

$$R_{T\text{-}DECR} = \frac{511}{|\Delta|} - 10.22 \quad [k\Omega]$$

where, $\mathbf{R_{T\text{-}DECR}}$ = Required value of trim-down resistor [kΩ] and $\mathbf{\Delta}$ is defined above.

**Note:** The above equations for calculation of trim resistor values match those typically used in conventional industry-standard quarter-bricks, one-eighth bricks and sixteenth bricks.

*Fig. D: Configuration for decreasing output voltage.*




Trimming/sensing beyond 110% of the rated output voltage is not an acceptable design practice, as this condition could cause unwanted triggering of the output overvoltage protection (OVP) circuit. The designer should ensure that the difference between the voltages across the converter's output pins and its sense pins does not exceed 10% of $V_{OUT}$(nom), or:

$$[V_{OUT}(+) - V_{OUT}(-)] - [V_{SENSE}(+) - V_{SENSE}(-)] \leq V_{O\text{-}NOM} \times 10\% \ [V]$$

This equation is applicable for any condition of output sensing and/or output trim.

# 4. PROTECTION FEATURES

## 4.1. INPUT UNDERVOLTAGE LOCKOUT (UVLO)

Input undervoltage lockout is standard with this converter. The converter will shut down when the input voltage drops below a pre-determined voltage.
The input voltage must be typically 17.2V for the converter to turn on. Once the converter has been turned on, it will shut off when the input voltage drops typically below 15.5V. This feature is beneficial in preventing deep discharging of batteries used in telecom applications.

## 4.2. OUTPUT OVERCURRENT PROTECTION (OCP)

The converter is protected against overcurrent or short circuit conditions. Upon sensing an overcurrent condition, the converter will shut down after entering the constant current mode of operation, regardless of the value of the output voltage.
Once the converter has shut down, it will enter hiccup mode with attempt to restart every 500 ms until the overload or short circuit conditions are removed.

## 4.3. OUTPUT OVERVOLTAGE PROTECTION (OVP)

The converter will shut down if the output voltage across Vout(+) and Vout(-) exceeds the threshold of the OVP circuitry. Once the converter has shut down, it will attempt to restart every 500 ms until the OVP condition is removed.

## 4.4. OVERTEMPERATURE PROTECTION (OTP)

The converter will shut down under an overtemperature condition to protect itself from overheating caused by operation outside the thermal derating curves, or operation in abnormal conditions. The converter will automatically restart after it has cooled to a safe operating temperature.

## 4.5. SAFETY REQUIREMENTS

The converters are safety approved to UL/CSA60950-1 2nd Ed, EN60950-1 2nd Ed, and IEC60950-1 2nd Ed. Basic Insulation is provided between input and output.
The converters have no internal fuse. To comply with safety agencies requirements, an input line fuse must be used external to the converter. The fuse must not be placed in the grounded input line.
The UIS48 converter is UL approved for a fuse rating of 6 Amps.

## 4.6. ELECTROMAGNETIC COMPATIBILITY (EMC)

EMC requirements must be met at the end-product system level, as no specific standards dedicated to EMC characteristics of board mounted component dc-dc converters exist. However, Bel Power Solutions tests its converters to several system level standards, primary of which is the more stringent EN55022, Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.
An effective internal LC differential filter significantly reduces input reflected ripple current, and improves EMC.
With the addition of an external filter, the UIS48T14050 converter will pass the requirements of Class B conducted emissions per EN55022 and FCC requirements. Refer to Figures 18 – 20 for typical performance with external filter.



### 4.7. STARTUP INFORMATION (USING NEGATIVE ON/OFF)

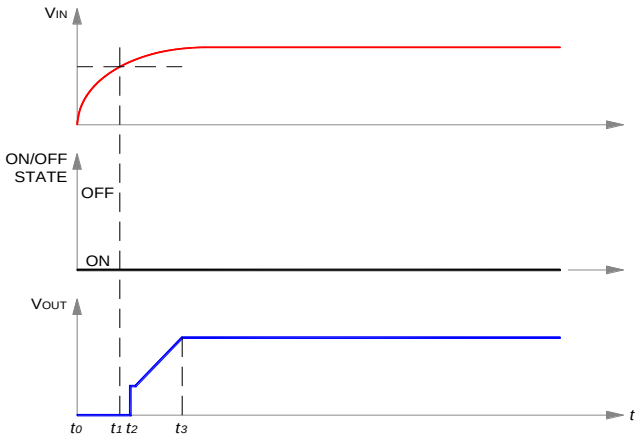
**Scenario #1: Initial Startup From Bulk Supply**

ON/OFF function enabled, converter started via application of $V_{IN}$. See Figure E.

| Time | Comments |
|---|---|
| $t_0$ | ON/OFF pin is ON; system front-end power is toggled on, $V_{IN}$ to converter begins to rise. |
| $t_1$ | $V_{IN}$ crosses undervoltage Lockout protection circuit threshold; converter enabled. |
| $t_2$ | Converter begins to respond to turn-on command (converter turn-on delay). |
| $t_3$ | Converter $V_{OUT}$ reaches 100% of nominal value. |

For this example, the total converter startup time ($t_3$- $t_1$) is typically 100 ms.

*Fig. E: Startup scenario #1.*



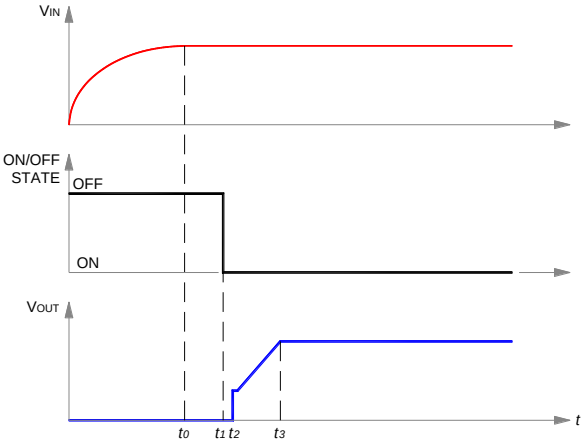

**Scenario #2: Initial Startup Using ON/OFF Pin**

With $V_{IN}$ previously powered, converter started via ON/OFF pin. See Figure F.

| Time | Comments |
|---|---|
| $t_0$ | $V_{IN}$ at nominal value. |
| $t_1$ | Arbitrary time when ON/OFF pin is enabled (converter enabled). |
| $t_2$ | End of converter turn-on delay. |
| $t_3$ | Converter $V_{OUT}$ reaches 100% of nominal value. |

For this example, the total converter startup time ($t_3$- $t_1$) is typically 100 ms.

*Fig. F: Startup scenario #2.*



# 5. CHARACTERIZATION

## 5.1. GENERAL INFORMATION

The converter has been characterized for many operational aspects, to include thermal derating (maximum load current as a function of ambient temperature and airflow), efficiency, startup and shutdown parameters, output ripple and noise, transient response to load step-change, overcurrent, and short circuit.
The following pages contain specific plots or waveforms associated with the converter. Additional comments for specific data are provided below.

## 5.2. TEST CONDITIONS

All data presented were taken with the converter soldered to a test board, specifically a 0.060" thick printed wiring board (PWB) with four layers. The top and bottom layers were not metalized. The two inner layers, comprised of two-ounce copper, were used to provide traces for connectivity to the converter.
The lack of metallization on the outer layers as well as the limited thermal connection ensured that heat transfer from the converter to the PWB was minimized. This provides a worst-case but consistent scenario for thermal derating purposes.
All measurements requiring airflow were made in the vertical and horizontal wind tunnel using Infrared (IR) thermography and thermocouples for thermometry.
Ensuring components on the converter do not exceed their ratings is important to maintaining high reliability. If one anticipates operating the converter at or close to the maximum loads specified in the derating curves, it is prudent to check actual operating temperatures in the application. Thermographic imaging is preferable; if this capability is not available, then thermocouples may be used. The use of AWG #40 gauge thermocouples is recommended to ensure measurement accuracy. Careful routing of the thermocouple leads will further minimize measurement error. Refer to Figure H for the optimum measuring thermocouple location.

## 5.3. THERMAL DERATING – AIR COOLED

Load current vs. ambient temperature and airflow rates are given in Figures 1 for converter w/o baseplate / heat spreader, and in Figures 5 for converter with baseplate / heat spreader equipped with a .45" finned heat sink. Ambient temperature was varied between 25°C and 85°C, with airflow rates from 30 to 500LFM (0.15 to 2.5m/s) and with $V_{IN}$=48V.
Load current vs. ambient temperature and airflow rates are given in Figure 3 for a converter w/o baseplate / heat spreader. Ambient temperature was varied between 25°C and 85°C, with airflow rates from 30 to 500LFM (0.15 to 2.5m/s) and with $V_{IN}$=24V.

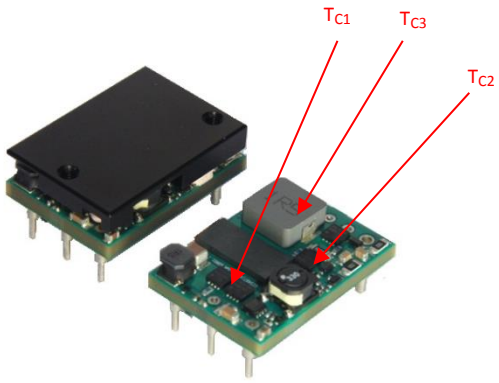
Note that the use of baseplate / heat spreader alone without heatsink or attachment to cold plate provides lower power rating than open frame due to the restriction of airflow across the module
For each set of conditions, the maximum load current was defined as the lowest of:

(i) The output current at which any FET junction temperature does not exceed a maximum temperature of 125°C as indicated by the thermal measurement, the user should design for TB ≤ 105°C.
(ii) The output current at which the temperature at the thermocouple locations $T_{C1}$, $T_{C2}$ and $T_{C3}$ do not exceed 125°C (Figure G).
(iii) The nominal rating of the converter (14 A/70 W).



*Fig. G Locations of the thermocouples for thermal testing.*




### 5.4. EFFICIENCY

Figure 7 shows the efficiency vs. load current plot for ambient temperature ($T_A$) of 25ºC and for converter without baseplate / heat spreader, air flowing from pin 3 to pin 1 at a rate of 300LFM (1.5m/s) with vertically mounting and input voltages of 18V, 24V, 36V, 48V, 60V and 75V.

### 5.5. POWER DISSIPATION

Figure 8 shows the power dissipation vs. load current plot for ambient temperature ($T_A$) of 25ºC and for converter w/o baseplate / heat spreader, air flowing from pin 3 to pin 1 at a rate of 300 LFM (1.5 m/s) with vertically mounting and input voltages of 18V, 24V, 36V, 48V, 60V and 75V.

### 5.6. STARTUP

Output voltage waveforms, during the turn-on transient using the ON/OFF pin for full rated load currents (resistive load) are shown with and without external load capacitance in Figure 9 and 10, respectively.

### 5.7. RIPPLE AND NOISE

Figure 13 shows the output voltage ripple waveform, measured at full rated load current with a 10µF tantalum and a 1µF ceramic capacitor across the output. Note that all output voltage waveforms are measured across the 1µF ceramic capacitor.
The input reflected-ripple current waveforms are obtained using the test setup shown in Figure 14.
The corresponding waveforms are shown in Figure 15 and Figure 16.

*Fig. 1: Available load current vs. ambient air temperature and airflow rates for UIS48T14050 converter w/o baseplate mounted vertically with air flowing from pin 3 to pin 1, MOSFET temperature ≤ 125°C, Vin=48V*

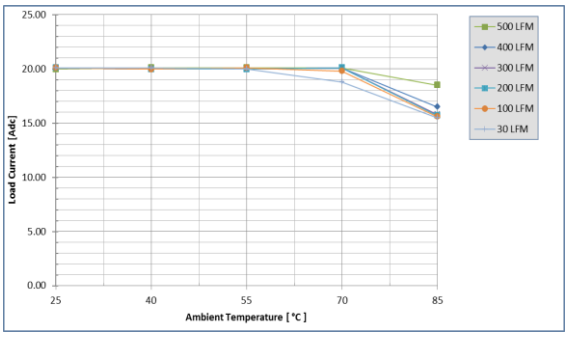



*Fig. 2: Power derating vs. ambient air temperature and airflow rates for UIS48T14050 converter w/o baseplate mounted vertically with air flowing from pin 3 to pin 1, MOSFET temperature ≤ 125°C, Vin=48V*

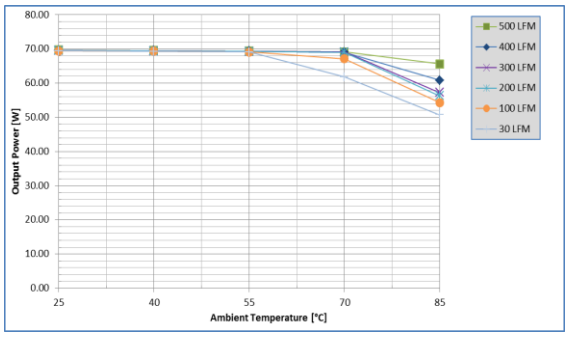



*Fig. 3: Available load current vs. ambient air temperature and airflow rates for UIS48T14050 converter w/o baseplate mounted vertically with air flowing from pin 3 to pin 1, MOSFET temperature ≤ 125°C, Vin=24V*

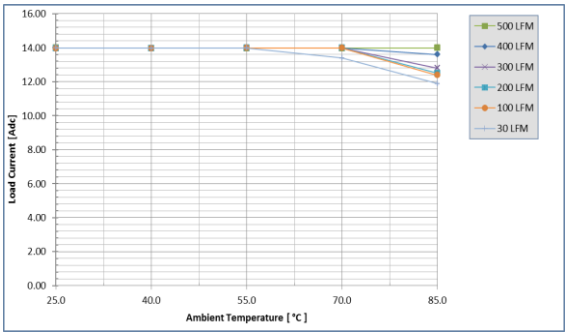



*Fig. 4: Power derating vs. ambient air temperature and airflow rates for UIS48T14050 converter w/o baseplate mounted vertically with air flowing from pin 3 to pin 1, MOSFET temperature ≤ 125°C, Vin=24V*

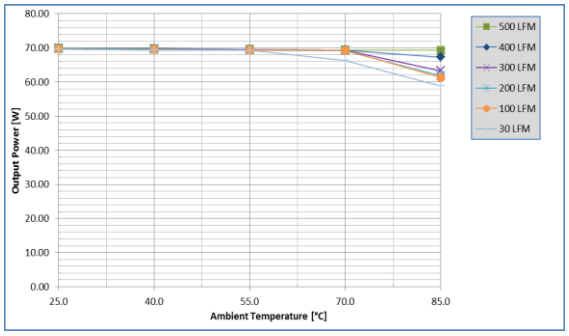



*Fig. 5: Available load current vs. ambient air temperature and airflow rates for UIS48T14050 converter with baseplate equipped with .45" finned heatsink mounted vertically with air flowing from pin 3 to pin 1, MOSFET temperature ≤ 125°C, Vin=48V*

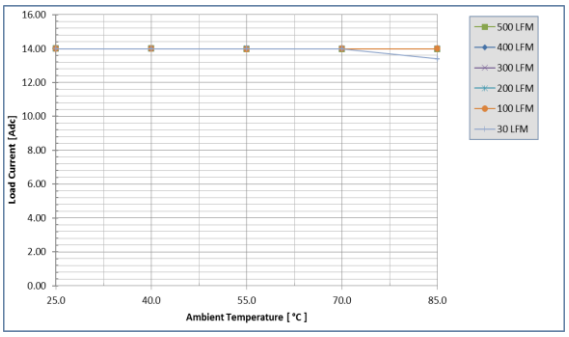



*Fig. 6: Power derating vs. ambient air temperature and airflow rates for UIS48T14050 converter with baseplate equipped with .45" finned heatsink mounted vertically with air flowing from pin 3 to pin 1, MOSFET temperature ≤ 125°C, Vin=48V*

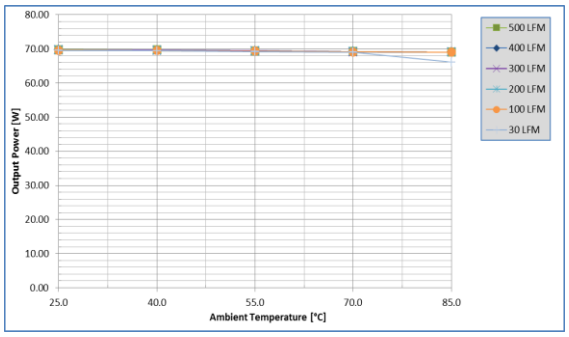


*Fig. 7: Efficiency vs. load current and input voltage for UIS48T14050 converter w/o baseplate mounted vertically with air flowing from pin 3 to pin 1 at a rate of 300 LFM (1.5 m/s) and Ta = 25°C.*

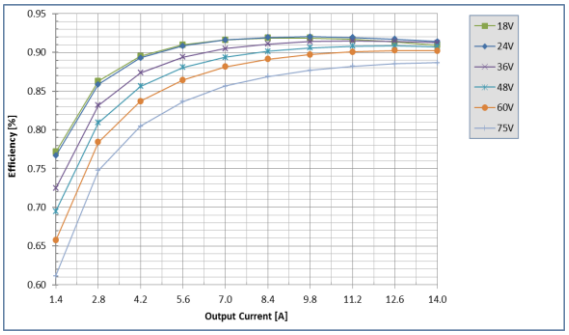



*Fig. 8: Power dissipation vs. load current and input voltage for UIS48T14050 converter w/o baseplate mounted vertically with air flowing from pin 3 to pin 1 at a rate of 300 LFM (1.5 m/s) and Ta = 25°C*

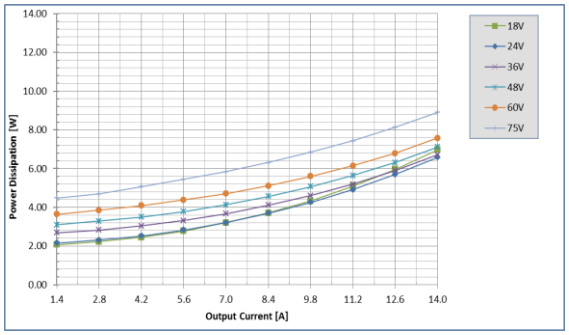



*Fig. 9: Turn-on transient at full rated load current (resistive) with Cout 10 µF tantalum + 1 µF ceramic at Vin = 48 V, triggered via ON/OFF pin. Top trace: ON/OFF signal (5 V/div.). Bottom trace: output voltage (2 V/div.). Time scale: 50 ms/div.*

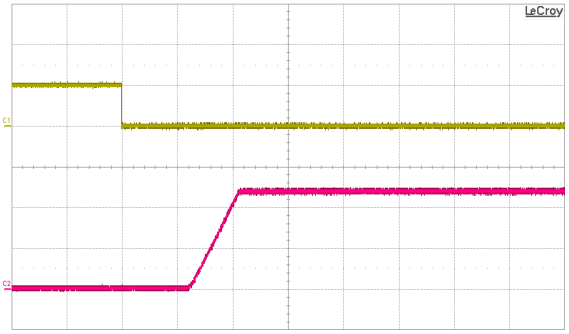



*Fig. 10: Turn-on transient at full rated load current (resistive) plus 4,700 µF at Vin = 48 V, triggered via ON/OFF pin. Top trace: ON/OFF signal (5 V/div.). Bottom trace: output voltage (2 V/div.). Time scale: 50 ms/div.*

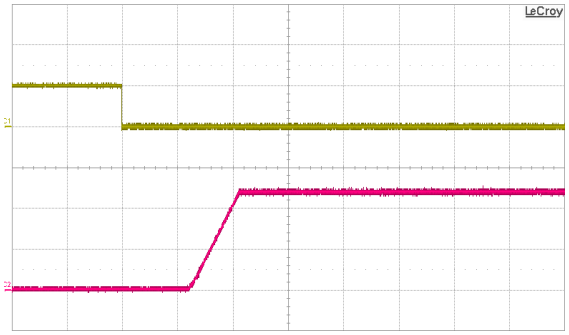



*Fig. 11: Output voltage response to load current step-change(7A – 10.5 A –7 A) at Vin = 48 V. Current slew rate: 0.1 A/µs. Co = 470uF E-cap +1 µF ceramic + 10 µF tantalum. Time scale: 100 µs/div.*

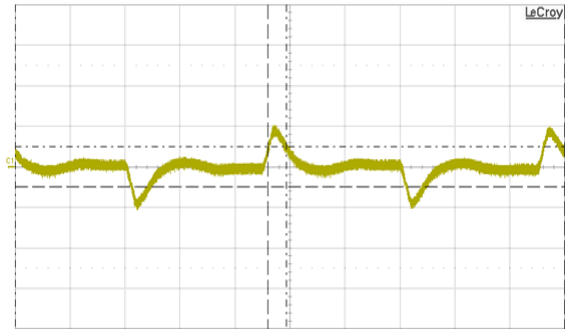



*Fig. 12: Output voltage response to load current step-change(7A – 10.5A – 7A) at Vin = 48 V. Current slew rate: 0.1 A/µs. Co = 4700uF E-cap +1 µF ceramic + 10 µF tantalum. Time scale: 500 µs/div.*

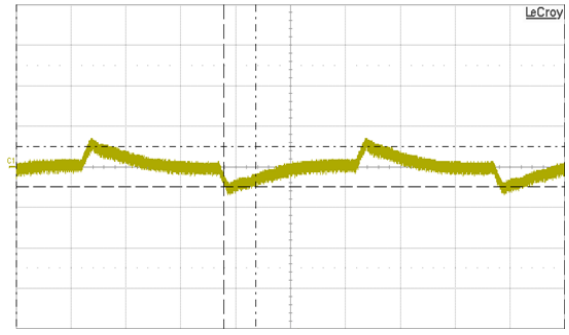


*Fig. 13: Output voltage ripple (50 mV/div.) at full rated load current into a resistive load with Co = 10 µF tantalum + 1 µF ceramic and Vin = 48 V. Time scale: 1µs/div.*

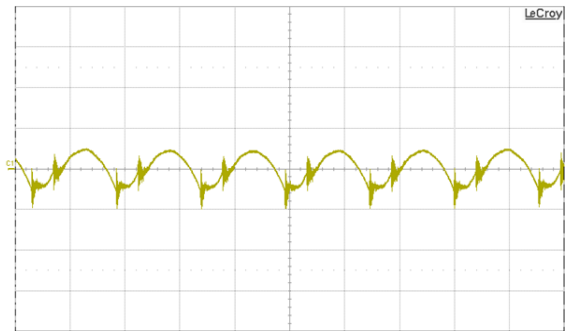



*Fig. 14: Test setup for measuring input reflected ripple currents, $i_c$ and $i_s$.*

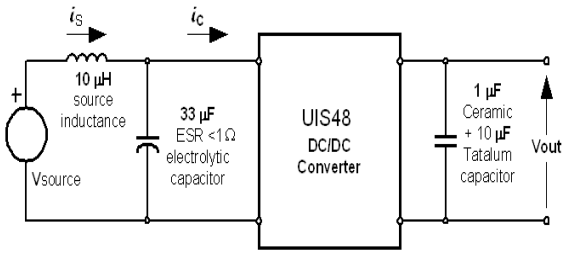



*Fig. 15: Input reflected ripple current, $i_c$ (200mA/div.), measured at input terminals at full rated load current and Vin = 48 V. Refer to Fig. 14 for test setup. Time scale: 2 µs/div.*

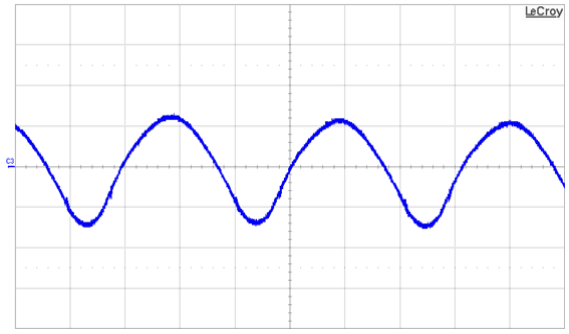



*Fig. 16: Input reflected ripple current, $i_s$ (20 mA/div.), measured through 10 µH at the source at full rated load current and Vin =48 V. Refer to Fig. 14 for test setup. Time scale: 2 µs/div.*

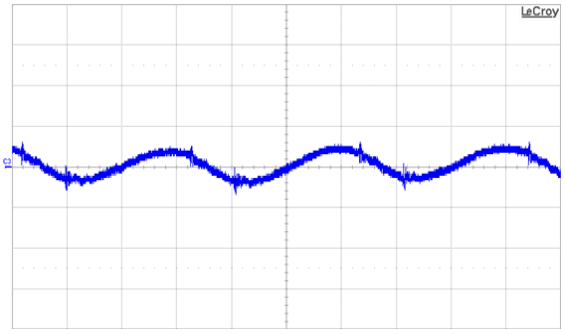



*Fig. 17: Load current (top trace, 5 A/div., 100 ms/div.) into a 10 mΩ short circuit during restart, at Vin = 48 V. Bottom trace (5 A/div., 10 ms/div.) is an expansion of the on-time portion of the top trace.*

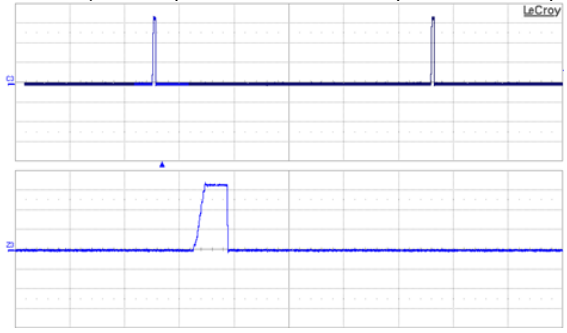
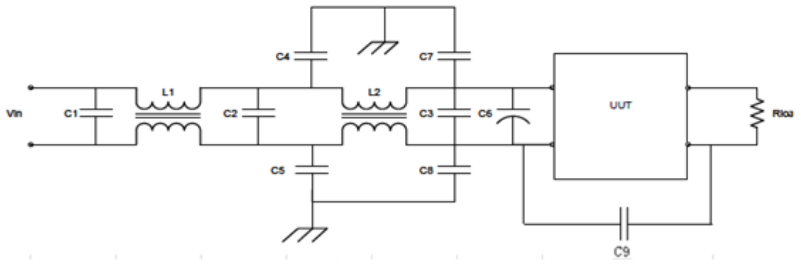


*Fig. 18: Typical input EMI filter circuit to attenuate conducted emissions.*




| COMP. | DESCRIPTION |
|---|---|
| C1, C2, C3 | 2x1uF, 100V ceramic cap |
| C6 | 100uF, 100V electrolytic cap |
| L1, L2 | 0.59mH, Pulse P0353NL |
| C4, C5 | 4.7nF, ceramic cap |
| C7, C8 | 4.7nF, ceramic cap |
| C9 | 1nF, ceramic cap |

*Fig. 19: Vin+ Peak Detector EMI waveform*

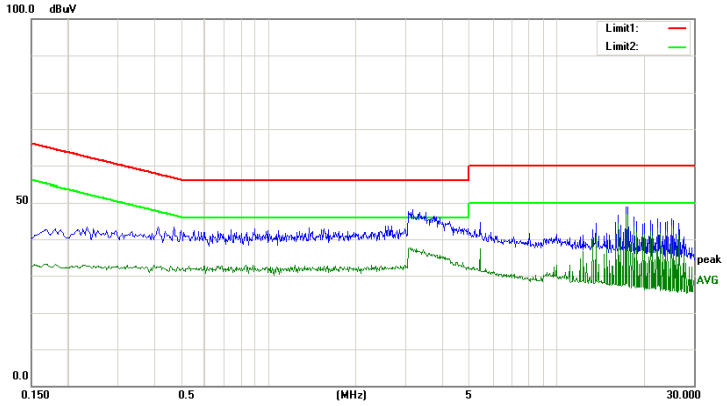
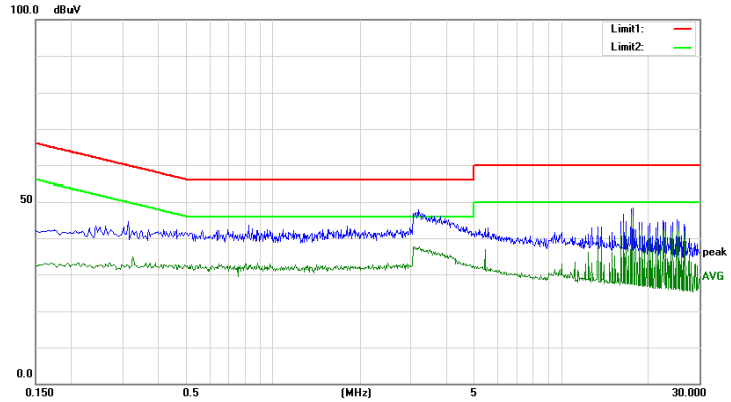
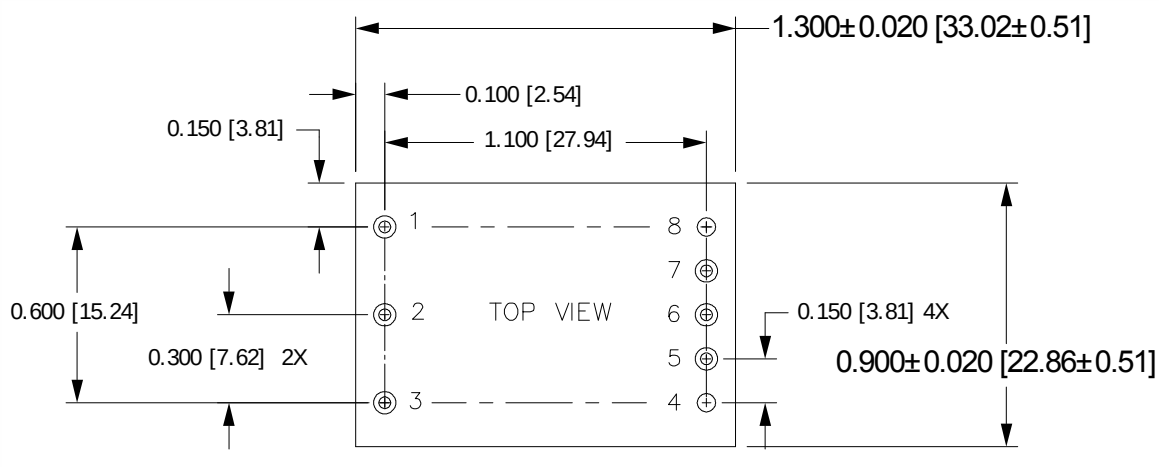



*Fig. 20: Vin- Peak Detector EMI waveform*



## 6. PHYSICAL INFORMATION

### 6.1. UIS48T PINOUT (THROUGH-HOLE)

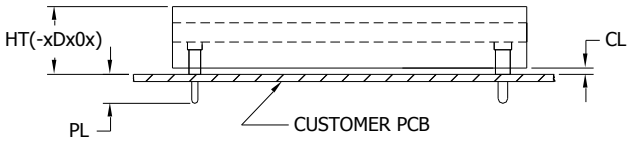



| PAD/PIN CONNECTIONS | |
|---|---|
| PAD/PIN # | FUNCTION |
| 1 | $V_{IN}$ (+) |
| 2 | ON/OFF |
| 3 | $V_{IN}$ (-) |
| 4 | $V_{OUT}$ (-) |
| 5 | $V_{OUT}$ (-) Sense |
| 6 | Trim |
| 7 | $V_{OUT}$ (+) Sense |
| 8 | $V_{OUT}$ (+) |

**UIS48T Platform Notes**

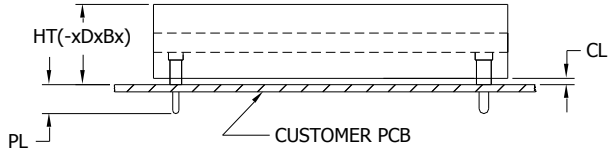
- All dimensions are in inches [mm]
- Pins 1,2,3,5,6,7 are Ø 0.040" [1.02] with Ø 0.076" [1.93] shoulder
- Pins 4 and 8 are Ø 0.062" [1.57] straight shank
- Pin Material: Brass Alloy 360
- Pin Finish: Tin over Nickel

SIDE VIEW
NO BASEPLATE/HEAT SPREADER




| | HEIGHT [HT] | MIN CLEARANCE [CL] | SPECIAL FEATURES |
|---|---|---|---|
| D | 0.445"+/-0.020 [11.30+/-0.51] | 0.0314" [0.80] | 0 |
| | 0.520" +0.0315/-0.020 [13.20 +0.8/-0.51] | 0.0314" [0.80] | B |

SIDE VIEW
WITH BASEPLATE/HEAT SPREADER

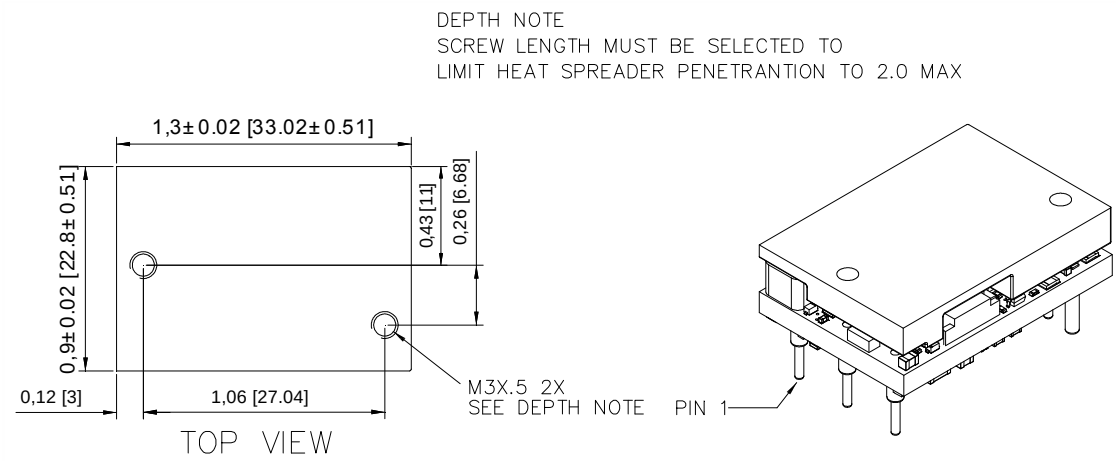



| PIN OPTION | PIN LENGTH [PL] |
|---|---|
| | ±0.005" [±0.13] |
| A | 0.188" [4.78] |
| B | 0.145" [3.68] |



## 6.2. BASEPLATE / HEAT SPREADER INTERFACE INFORMATION




## 6.3. CONVERTER PART NUMBERING/ORDERING INFORMATION

| PRODUCT SERIES | INPUT VOLTAGE | MOUNTING SCHEME | RATED CURRENT | OUTPUT VOLTAGE | | ON/OFF LOGIC | MAXIMUM HEIGHT [HT] | PIN LENGTH [PL] | SPECIAL FEATURES | RoHS |
|---|---|---|---|---|---|---|---|---|---|---|
| **UIS** | **48** | **T** | **14** | **050** | **-** | **N** | **D** | **A** | **B** | **G** |
| Quarter Brick Format | 18-75 V | T ⇒ Through-hole | 14 ⇒ 14 ADC | 050 ⇒ 5 V | | N ⇒ Negative<br>P ⇒ Positive | D ⇒ 0.440" for –xDx0x<br>0.520" for –xDxBx | Through hole<br>A ⇒ 0.188"<br>B ⇒ 0.145" | 0 ⇒ Standard<br>B ⇒ Baseplate option | G ⇒ RoHS compliant for all six substances |

The example above describes P/N UIS48T14050-NDABG: 18-75V input, through-hole, 14A@5V output, negative ON/OFF logic, maximum height of 0.52", 0.188" pin length, with Baseplate (Heat Spreader) option, RoHS compliant for all 6 substances. Consult factory for availability of other options.

# 7. SOLDERING INFORMATION

## 7.1. THROUGH HOLE SOLDERING

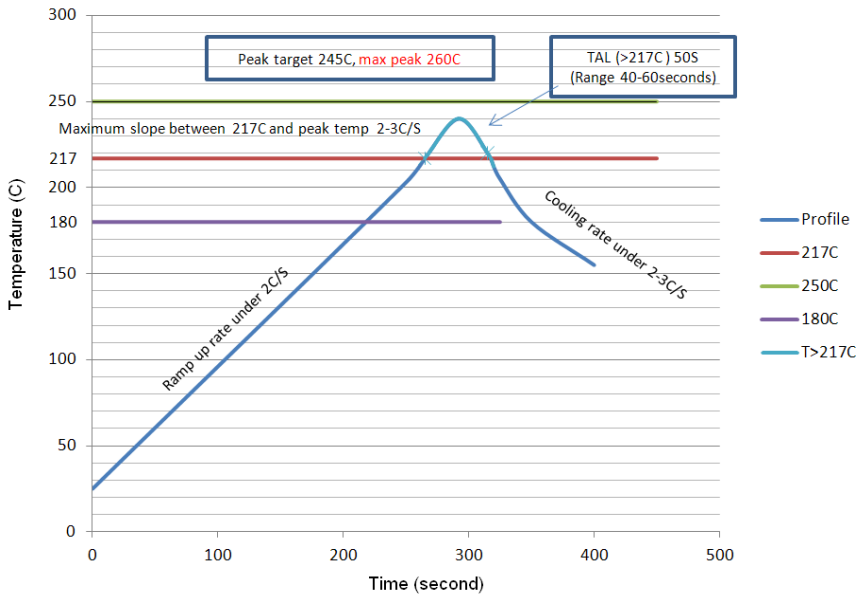
Below table lists the temperature and duration for wave soldering

| WAVE SOLDER PROCESS SPECIFICATION | PB-FREE | SN/PB EUTECTIC |
|---|---|---|
| Maximum Preheat Temperature | 130°C | 110°C |
| Maximum Pot Temperature | 265°C | 255°C |
| Maximum Solder Dwell Time | 7 Sec | 6 Sec |

## 7.2. LEAD FREE REFLOW SOLDERING

The unit is Paste In Hole (PIH) compatible. The profile below is provided as a guideline for Pb-free reflow only. There are many other factors which will affect the result of reflow soldering. Please check with your process engineer thoroughly.

*Fig. 21: Lead Free solder reflow profile*




For PIH reflow process, the unit has a MSL rating of 1.

