

# SMT10E-12 V SERIES

*0.8 V to 3.63 Vin Single output*



10 A Current rating

Input voltage range: 10 Vdc to 14 Vdc

Output voltage range: 0.8 Vdc to 3.63 Vdc

Ultra high efficiency: 94% @ 12 Vin and 3.3 Vout

Extremely low internal power dissipation

Minimal thermal design concerns

Designed in reliability: MTBF of 6,920,000 hours per Telcordia SR-332

Ideal solution where board space is at a premium or tighter card pitch is required

Industry standard surface-mount footprint

Available RoHS compliant

THE SMT10E-12 series are non-isolated dc-dc converters packaged in a single-in-line footprint giving designers a cost effective solution for conversion from a 10 Vdc to 14 Vdc input to output voltages of 0.8 Vdc to 3.63 Vdc. The SMT10E-12 offers a wide output trim range, which allows maximum design flexibility and a pathway for future upgrades.

The SMT10E-12 is designed for applications that include distributed power, workstations, optical network and wireless applications. Implemented using state of the art surface mount technology and automated manufacturing techniques, the SMT10E-12 offers compact size and efficiencies of up to 94%

[ 2 YEAR WARRANTY ]



Stresses in excess of the maximum ratings can cause permanent damage to the device. Operation of the device is not implied at these or any other conditions in excess of those given in the specification. Exposure to absolute maximum ratings can adversely affect device reliability.

**Absolute Maximum Ratings**

| Characteristic             | Symbol          | Min  | Typ | Max  | Units | Notes and Conditions                             |
|----------------------------|-----------------|------|-----|------|-------|--|
| Input voltage - continuous | $V_{in} (cont)$ | -0.3 |     | 14   | V DC  | $V_{in(+)} - V_{in(-)}$                          |
| Input voltage - peak/surge | $V_{surge}$     | -0.3 |     | 14.5 | V DC  | 2s max, non-repetitive                           |
| Operating temperature      | $T_{op}$        | -40  |     | 85   | °C    | Measured at thermal reference points, see Note 1 |
| Storage temperature        | $T_{storage}$   | -40  |     | 125  | °C    |  |
| Output power (3.3V)        | $P_{out} (max)$ |      |     | 33.0 | W     |  |

All specifications are typical at nominal input  $V_{in} = 12V$ , full load under any resistive load combination at 25°C unless otherwise stated.

**Input Characteristics**

| Characteristic            | Symbol          | Min | Typ | Max | Units             | Notes and Conditions                                     |
|---------------------------|-----------------|-----|-----|-----|-------------------|--|
| Input voltage - operating | $V_{in} (oper)$ | 10  | 12  | 14  | V DC              |  |
| Input current - no load   | $I_{in}$        |     | 70  | 100 | mA DC             | $V_{in} (min) - V_{in} (max)$ , enabled                  |
| Input current - quiescent | $I_{in} (off)$  |     | 7   |     | mA DC             | Converter disabled                                       |
| Inrush current ( $i^2t$ ) | $I_{inrush}$    |     | 0.1 |     | A <sup>2</sup> μs | Complies with ETS300 132 Part 4.7, with recommended LISN |
| Input ripple current      |                 |     | 120 |     | mA rms            |  |
| Input fuse*               |                 |     |     | 6   | A                 | Slowblow/antisurge HRC recommended*                      |

\*See Application Note 143 for manufacturer and part number

**Turn On/Off**

| Characteristic                              | Symbol               | Min | Typ | Max | Units | Notes and Conditions   |
|---|----------------------|-----|-----|-----|-------|--|
| Input voltage - turn on                     | $V_{in} (on)$        |     |     | 10  | V DC  |  |
| Turn on delay - enabled, then power applied | $T_{delay} (power)$  |     | 20  |     | msec  | With the enable signal asserted, this is the time from when the input voltage reaches the minimum specified operating voltage until the output voltage is within the total regulation band |
| Turn on delay - power applied, then enabled | $T_{delay} (enable)$ |     | 20  |     | msec  | $V_{in} = V_{in} (nom)$ , then enabled. This is the time taken until the output voltage is within the total error band   |
| Rise time                                   | $T_{rise}$           |     | 15  |     | msec  | From 10% to 90%; full resistive load, no external capacitance  |

## Signal Electrical Interface

| Characteristic - Signal Name            | Symbol                   | Min | Typ | Max | Units   | Notes and Conditions   |
|---|--------------------------|-----|-----|-----|---------|--|
| <b>At remote/control ON/OFF pin</b>     |                          |     |     |     |         | <b>See Notes 2 and 3</b>   |
| Open collector or equivalent compatible |                          |     |     |     |         | See Application Note 143 for Remote ON/OFF details   |
| Control pin open circuit voltage        | $V_{ih}$                 |     | 0   |     | V       | $I_{ih} = 0 \mu A$ ; open circuit voltage  |
| High level input current                | $I_{ih}$                 |     |     | 1   | mA      | Current flowing into control pin when pin is pulled high (max at $V_{ih} = 5.5V$ )               |
| High level input voltage                | $V_{ih}$                 | 1.6 |     |     | Vin     | Converter guaranteed ON when control pin is greater than $V_{ih}(\text{min})$ or open cct.       |
| Acceptable high level leakage current   | $I_{ih}(\text{leakage})$ |     |     | -10 | $\mu A$ | Acceptable leakage current from signal pin into the open collector driver (neg = from converter) |
| Low level input voltage                 | $V_{il}$                 |     |     | 0.8 | V       | Converter guaranteed OFF when control pin is less than $V_{il}(\text{max})$ volts or open cct.   |
| Low level input current                 | $I_{il}$                 |     |     | 20  | $\mu A$ | $V_{il} = < 0.4 V$   |

## Reliability and Service Life

| Characteristic            | Symbol | Min | Typ       | Max | Units | Notes and Conditions   |
|---------------------------|--------|-----|-----------|-----|-------|--|
| Mean time between failure | MTBF   |     | 482,000   |     | Hours | MIL-HDBK-217F,<br>$V_{in} = V_{in}(\text{nom})$ ; $I_{out} = I_{out}(\text{max})$ ; ambient 25°C;<br>ground benign environment |
| Mean time between failure | MTBF   |     | 6,920,000 |     | Hours | Telcordia SR-332   |
| Mean time between failure | MTBF   | TBA |           |     | Hours | Demonstrated. This entry will be periodically updated as the number of test hours increase                                     |

## Other Specifications

| Characteristic      | Symbol   | Min | Typ | Max | Units   | Notes and Conditions        |
|---------------------|----------|-----|-----|-----|---------|-----------------------------|
| Switching frequency | $F_{sw}$ |     | 200 |     | kHz     | Fixed frequency             |
| Weight              |          |     | 7   |     | g       |                             |
| Coplanarity         |          |     | 100 |     | $\mu m$ | Measured from seating plane |

## Environmental Specifications

| Characteristic      | Symbol | Min | Typ | Max | Units | Notes and Conditions                      |
|---------------------|--------|-----|-----|-----|-------|---|
| Thermal performance |        | -40 |     | 85  | °C    | See Note 5 and individual derating curves |

## EMC

## Electromagnetic Compatibility

| Phenomenon         | Port      | Standard    | Test level             | Criteria | Notes and conditions         |
|--------------------|-----------|-------------|------------------------|----------|------------------------------|
| <b>Immunity:</b>   |           |             |                        |          |                              |
| Conducted immunity |           | EN61000-4-6 |                        |          |                              |
| Radiated immunity  |           | EN61000-4-3 |                        |          |                              |
| ESD                | Enclosure | EN61000-4-2 | 6kV contact<br>8kV air | NP       | As per ETS 300 386-1 table 5 |

## Performance criteria:

NP: Normal Performance: EUT shall withstand applied test and operate within relevant limits as specified without damage.

RP: Reduced Performance: EUT shall withstand applied test. Reduced performance is permitted within specified limits, resumption to normal performance shall occur at the cessation of the test.

LFS: Loss of Function (self recovery): EUT shall withstand applied test without damage, temporary loss of function permitted during test. Unit will self recover to normal performance after test.

## Referenced ETSI standards:

ETS 300 386-1 table 5 (1997): Public telecommunication network equipment, EMC requirements

ETS 300 132-2 (1996): Power supply interface at the input to telecommunication equipment: Part 2 operated by direct current (DC)

ETR 283 (1997): Transient voltages at interface A on telecommunication direct current (DC) power distributions

## Safety Agency Approvals

| Standard                    | Category                          |
|-----------------------------|-----------------------------------|
| UL/cUL CSA 22.2<br>UL60950  | File No. E174104                  |
| TÜV Product Service EN60950 | Certificate No. B 03 10 38572 037 |

## Material Ratings

| Characteristic      | Notes and Conditions |
|---------------------|----------------------|
| Flammability rating | UL94V-0              |

## Model Numbers

| Model Number   | Input Voltage  | Output Voltage | Output Current (Max.) | Typical Efficiency | Max. Load Regulation |
|----------------|----------------|----------------|-----------------------|--------------------|----------------------|
| SMT10E-12W3V3J | 10.0 - 14.0VDC | 0.8V - 3.63V   | 10A                   | 94% @ full load    | ±1.0%                |

## RoHS Compliance Ordering Information



The 'J' at the end of the part number indicates that the part is Pb-free (RoHS 6/6 compliant). TSE RoHS 5/6 (non Pb-free) compliant versions may be available on special request, please contact your local sales representative for details.

## W3V3 Model

## Input Characteristics

| Characteristic                      | Symbol            | Min | Typ  | Max | Units   | Notes and Conditions   |
|-------------------------------------|-------------------|-----|------|-----|---------|--|
| Input current - operating           | $I_{in}$          |     | 3.85 | 3.9 | A DC    | $V_{in} = V_{in} (nom)$ ; $I_{out} = I_{out} (max.)$ ; $V_O = V_O (nom)$                             |
| Reflected ripple current            | $I_{in} (ripple)$ |     | 120  |     | mA rms  | $I_{out} = I_{out} (max.)$ , measured without external filter  |
| Input capacitance - internal filter | $C_{input}$       |     | 18.8 |     | $\mu F$ | Internal to converter  |
| Input capacitance - external bypass | $C_{bypass}$      | 100 |      |     | $\mu F$ | Recommended customer added capacitance may be required on source impedance on customers applications |

## W3V3 Model

## Electrical Characteristics - O/P

| Characteristic                 | Symbol                 | Min   | Typ | Max      | Units              | Notes and Conditions  |
|--------------------------------|------------------------|-------|-----|----------|--------------------|---|
| Nominal set-point voltage      | $V_O (nom)$            | 0.785 | 0.8 | 0.815    | V DC               | $V_{in} = V_{in} (nom)$ ; $I_{out} = I_{out} (nom)$                                   |
| Total regulation band          | $V_O$                  |       | 3   |          | %                  | For all line, static load and temperature until end of life                           |
| Line regulation                |                        |       |     | 1        | %                  | $I_{out} = I_{out} (nom)$ ; $V_{in} (min)$ to $V_{in} (max)$                          |
| Load regulation                |                        |       |     | 1        | %                  | $V_{in} = V_{in} (nom)$ ; $I_{out} (min)$ to $I_{out} (max)$                          |
| Output current continuous      | $I_{out}$              | 0     |     | 10       | A DC               |   |
| Output current - short circuit | $I_{sc}$               |       | 10  | 20       | A rms              | Continuous, unit auto recovers from short, $V_O < 100mV$                              |
| Output voltage - noise         | $V_{p-p}$<br>$V_{rms}$ |       |     | 80<br>25 | mV pk-pk<br>mV rms | Measurement bandwidth: 20MHz. See Application Note 143 for measurement set-up details |

## W3V3 Model

## Electrical Characteristics - O/P

| Characteristic                           | Symbol                | Min | Typ | Max    | Units           | Notes and Conditions  |
|--|-----------------------|-----|-----|--------|-----------------|---|
| Load transient response - peak deviation | $V_{\text{dynamic}}$  |     | 100 |        | mV              | Peak deviation for 50% to 75% step load, $di/dt = 100 \text{ mA}/\mu\text{sec}$ . Measurement taken with no external capacitors |
| Load transient response - recovery       | $T_{\text{recovery}}$ |     | 100 |        | $\mu\text{sec}$ | Settling time to within 1% of output set point voltage for 50% to 75% step load. Measurement taken with no external capacitors  |
| External load capacitance                | $C_{\text{ext}}$      | 0   |     | 10,000 | $\mu\text{F}$   |   |

## W3V3 Model

## Protection and Control Features

| Characteristic           | Symbol | Min | Typ | Max  | Units | Notes and Conditions   |
|--------------------------|--------|-----|-----|------|-------|--|
| Allowable output voltage |        | 0.8 |     | 3.63 | V     | Trim up. Note that the maximum output power is still 33W. De-rate the maximum output current accordingly |
| Open sense voltage       |        |     |     | 10   | %     |  |

## W3V3 Model

## Efficiency

| Characteristic | Symbol | Min | Typ | Max | Units | Notes and Conditions   |
|----------------|--------|-----|-----|-----|-------|--|
| Efficiency     | $\eta$ | 92  | 94  |     | %     | $I_{\text{out}} = 100\% I_{\text{out}} (\text{max})$ ,<br>$V_{\text{in}} = V_{\text{in}} (\text{nom})$ |
| Efficiency     | $\eta$ | 93  | 94  |     | %     | $I_{\text{out}} = 50\% I_{\text{out}} (\text{max})$ ,<br>$V_{\text{in}} = V_{\text{in}} (\text{nom})$  |

## W3V3 Model

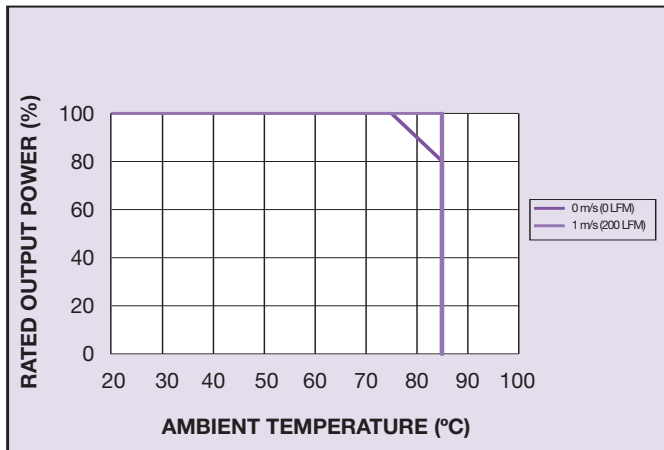


Figure 1: De-rating Curve  
with  $V_{in} = 12V$  and No Trim ( $V_{out} = 0.8V$ )

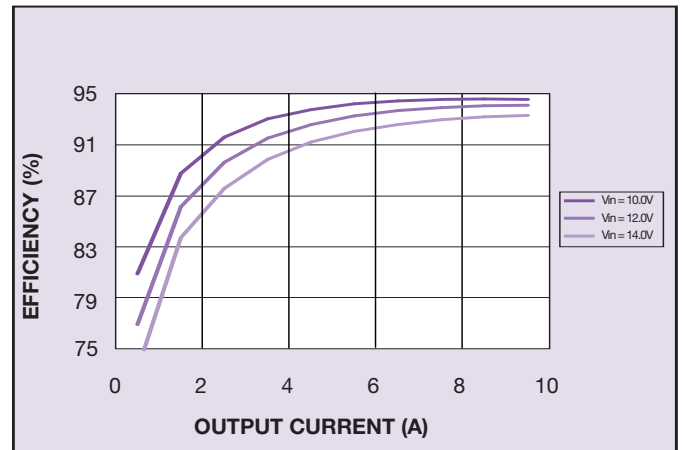


Figure 2: Efficiency vs Load

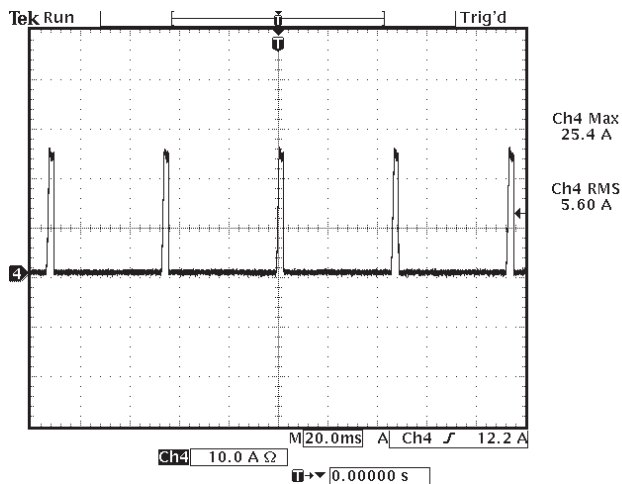


Figure 3: Short Circuit Characteristic  
(Channel 4:  $I_{s/c}$ )

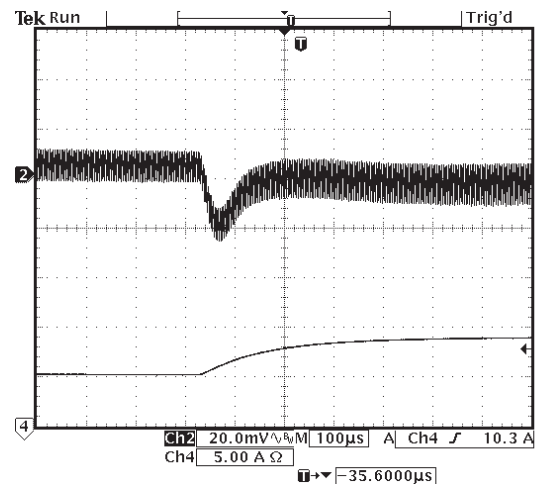


Figure 4: Typical Transient Response 50% - 75%  
Step Load Change (Channel 2:  $V_o$ , Channel 4:  $I_o$ )

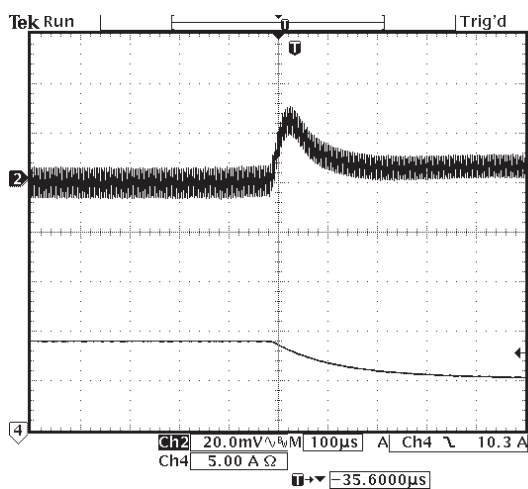


Figure 5: Typical Transient Response 75% - 50%  
Step Load Change (Channel 2:  $V_o$ , Channel 4:  $I_o$ )

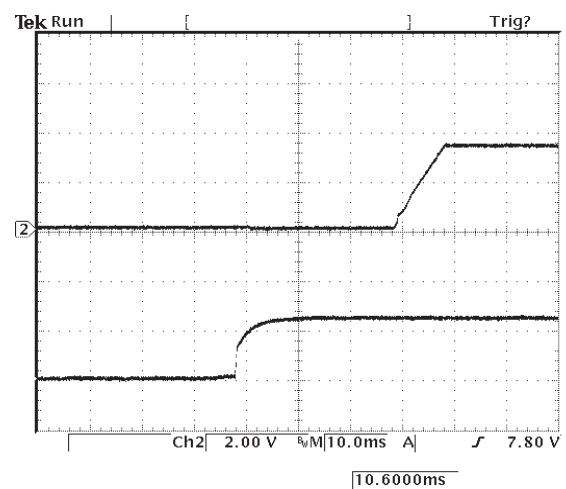


Figure 6: Typical Power-up Characteristic  
(Channel 1:  $V_{in}$ , Channel 2:  $V_o$ )



## W3V3 Model

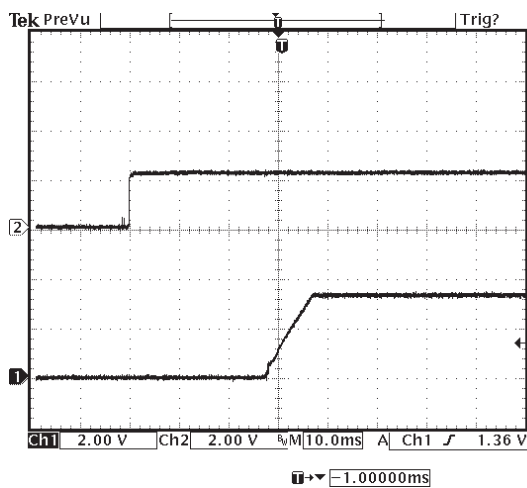


Figure 7: Control On/Off Characteristic  
(Channel 1: Vo, Channel 2: Remote ON/OFF)

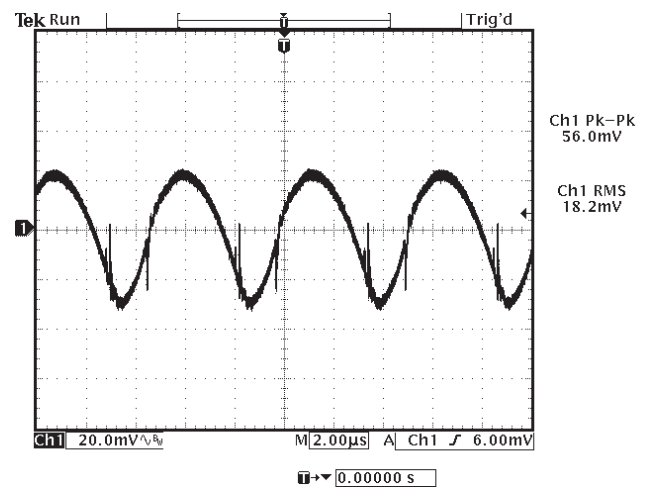
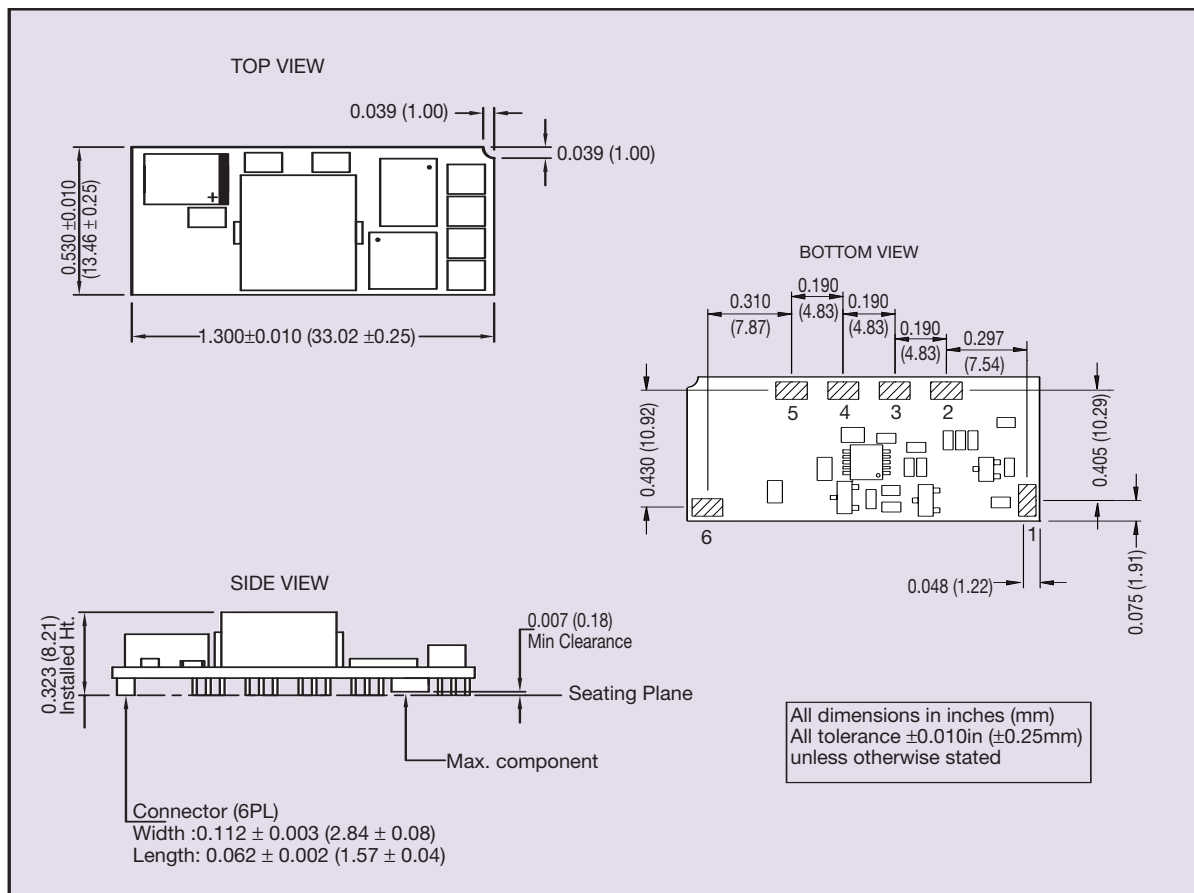


Figure 8: Typical Ripple and Noise,  
Vin = 12V, Vout = 3V3 and Iout = 10A



| Pin Connections |                 |
|-----------------|-----------------|
| Pin No.         | Function        |
| 1               | Remote ON/OFF   |
| 2               | Remote Sense +* |
| 3               | Trim*           |
| 4               | +Vout           |
| 5               | Ground          |
| 6               | +Vin            |

Figure 9: Mechanical Drawing and Pinout Table

\*The sense function and the trim function are customer specified options. Please consult factory for details.

**Note 1**

Thermal reference is defined as the highest temperature measured at any one of the specified thermal reference points. See Figure 10: Thermal reference points.

**Note 2**

The Remote ON/OFF pin is referenced to ground.

**Note 3**

The SMT10E-12 features an 'active high' Remote ON/OFF operation. If not using the Remote ON/OFF pin, leave the pin open (the converter will be on). The Remote ON/OFF pin is referenced to ground.

The following conditions apply for the SMT10E:

| Configuration                          | Converter Operation |
|--|---------------------|
| Remote pin open circuit                | Unit is ON          |
| Remote pin pulled low [Von/off <.8V]   | Unit is OFF         |
| Remote pin pulled high [Von/off >1.6V] | Unit is ON          |

An 'Active Low' Remote ON/OFF version is also possible with this converter. Please consult the factory for details.

**Note 4**

Thermal reference set up: Unit mounted on an edge card test board 203mm x 190mm. Test board mounted vertically. For test details and recommended set-up see Application Note 143.

**Note 5**

Max 75°C for full load in still air. See Application Note 143 for a detailed thermal de-rating.

**CAUTION:** Hazardous internal voltages and high temperatures. Ensure that unit is accessible only to trained personnel. The user must provide the recommended fusing in order to comply with safety approvals.

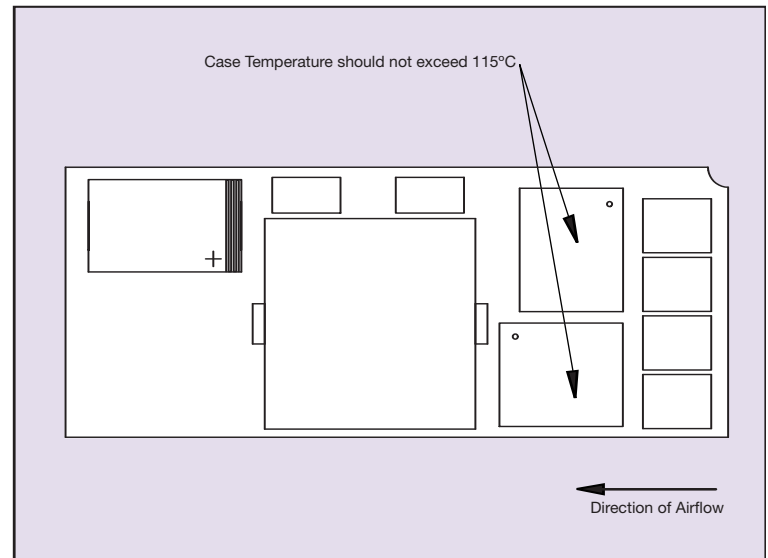


Figure 10: Thermal Reference Points

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