

# SMT15E SERIES

## 3.0 Vin to 5.5 Vin Single output

**15 A current rating**

**Input voltage range: 3.0 Vdc to 5.5 Vdc**

**Output voltage range: 0.8 Vdc to 3.63 Vdc**

**Ultra high efficiency: 96% @ 5 Vin and 3.3 Vout**

**Extremely low internal power dissipation**

**Minimal thermal design concerns**

**Designed in reliability: MTBF of >7 million 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 SMT15E series are non-isolated dc-dc converters packaged in a surface mount footprint giving designers a cost effective solution for conversion from either a 5 Vdc or 3.3 Vdc input to output voltages of 0.8 Vdc to 3.63 Vdc. Local voltage conversion by the SMT15E series from existing 5 Vdc or 3.3 Vdc system voltages eliminates the need for redesign of existing power architectures when voltage requirements change. The SMT15E 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 SMT15E offers compact size and efficiencies of up to 96%.

[ 2 YEAR WARRANTY ]



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TECHNOLOGIES

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		5.5	V DC	$V_{in(+)} - V_{in(-)}$
Input voltage - peak/surge	$V_{surge}$	-0.3		6	V DC	2s max, non-repetitive
Operating temperature	$T_{op}$	-40		100	°C	Measured at thermal reference points, see Note 1 for thermal Derating
Storage temperature	$T_{storage}$	-40		125	°C	
Output power (S2V5)	$P_{out}$ (max)	0		41.25	W	
Output power (S3V3)	$P_{out}$ (max)	0		54.45	W	
Output power (W3V3)	$P_{out}$ (max)	0		54.45	W	

All specifications are typical at nominal input  $V_{in} = 5V$ , 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)	3	5	5.5	V DC	See Note 2
Input current - no load	$I_{in}$		70	150	mA DC	$V_{in}$ (min) - $V_{in}$ (max), enabled
Input current - quiescent	$I_{in}$ (off)		2		mA DC	Converter disabled
Inrush current ( $i^2t$ )	$I_{inrush}$		12		A <sup>2</sup> μs	Complies with ETS300 132 Part 4.7, with recommended LISN
Input ripple current			110		mA rms	
Input fuse*				16	A	Slowblow/antisurge HRC recommended

\*Fuse A - S(T) 1.25 x 0.25 inches  
SIBA P/N 70-065-65/16ARS

**Turn On/Off**

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input voltage - turn on	$V_{in}$ (on)	2.25	2.70	3	V DC	Will regulate @ $V_{in} > 3V$ if $V_{out} \leq 2V5$
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> Open collector or equivalent compatible						<b>See Notes 2 and 3</b> See Application Note 136 for Remote ON/OFF details
Control pin open circuit voltage	$V_{ih}$		0		V	$I_{ih} = 0 \mu\text{A}$ ; open circuit voltage
High level input current	$I_{ih}$			300	$\mu\text{A}$	Current flowing into control pin when pin is pulled high
High level input voltage	$V_{ih}$	1.2			Vin	Converter guaranteed OFF when control pin is greater than $V_{ih}$ (min)
Acceptable high level leakage current	$I_{ih}$ (leakage)			-10	$\mu\text{A}$	Acceptable leakage current from signal pin into the open collector driver (neg = from converter)
Low level input voltage	$V_{il}$	0		0.5	V	Converter guaranteed ON when control pin is less than $V_{il}$ (max)
Low level input current	$I_{il}$			20	$\mu\text{A}$	$V_{il} = < 0.4 \text{ V}$

## Reliability and Service Life

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Mean time between failure	MTBF	680,000			Hours	MIL-HDBK-217F, $V_{in} = V_{in} \text{ (nom)}$ ; $I_{out} = I_{out} \text{ (max)}$ ; ambient 25°C; ground benign environment
Mean time between failure	MTBF	7,042,000			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	$F_{sw}$		300		kHz	Fixed frequency
Weight			6.3		g	
Coplanarity			100		$\mu\text{m}$	Measured from seating plane

## 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 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

Characteristic	Notes and Conditions
UL/cUL60950	File No. E174104
TÜV Product Services EN60950	B03 10 38572 037
CB certificate and report to IEC60950	DE3-51686M1

## Material Ratings

Characteristic - Signal Name	Notes and Conditions
Flammability rating	UL94V-0

## Model Numbers

Model Number	Input Voltage	Output Voltage	Output Current (Max.)	Typical Efficiency	Max. Load Regulation
SMT15E-05S2V5J	3.0 - 5.5VDC	2.5V	15A	93.5%	±1.0%
SMT15E-05S3V3J	4.5 - 5.5VDC	3.3V	15A	95%	±1.0%
SMT15E-05W3V3J	3.0 - 5.5VDC	0.8V - 3.63V	15A	95%	±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.

## S2V5 Model

## Input Characteristics

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input current - operating	$I_{in}$		8	9	A DC	$V_{in} = V_{in} (nom)$ ; $I_{out} = I_{out} (max.)$ ; $V_O = V_O (nom)$
Reflected ripple current	$I_{in} (ripple)$		110 370		mA rms mA pk-pk	$I_{out} = I_{out} (max.)$ , 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

## S2V5 Model

## Electrical Characteristics - O/P

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Nominal set-point voltage	$V_O (nom)$	2.43	2.5	2.57	V DC	$V_{in} = V_{in} (nom)$ ; $I_{out} = I_{out} (nom)$
Total regulation band	$V_O$	2.38		2.612	V DC	For all line, static load and temperature until end of life
Line regulation			0.2	0.5	%	$I_{out} = I_{out} (nom)$ ; $V_{in} (min)$ to $V_{in} (max)$
Load regulation				1.0	%	$V_{in} = V_{in} (nom)$ ; $I_{out} (min)$ to $I_{out} (max)$
Output current continuous	$I_{out}$	0		15	A DC	
Output current - short circuit	$I_{sc}$		10	20	A rms	Continuous, unit auto recovers from short, $V_O < 100mV$
Output voltage - noise	$V_{p-p}$ $V_{rms}$			60 25	mV pk-pk mV rms	Measurement bandwidth: 20MHz. See Application Note 136 for measurement set-up details

## S2V5 Model

## Electrical Characteristics - O/P

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Load transient response - peak deviation	$V_{dynamic}$		50		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	$T_{recovery}$		50		$\mu\text{sec}$	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	$C_{ext}$	0		10,000	$\mu\text{F}$	

## S2V5 Model

## Protection and Control Features

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Allowable output voltage*		10		10	% %	Trim up (% of $V_O \text{ nom}$ ). Trim down (% of $V_O \text{ nom}$ ) See Application Note 136 for details of trim equations and trim curves
Remote sense voltage				10	%	If Trim up is invoked de-rate power accordingly (remote sense + trim $\leq 10\%$ )

\* $V_{in} \text{ (min)} = 3.3\text{V}$  at max. trim-up

## S2V5 Model

## Efficiency

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Efficiency	$\eta$	92.5	93.5		%	$I_{out} = 100\% I_{out} \text{ (max)}$ , $V_{in} = V_{in} \text{ (nom)}$
Efficiency	$\eta$	94	95		%	$I_{out} = 50\% I_{out} \text{ (max)}$ , $V_{in} = V_{in} \text{ (nom)}$

## S3V3 Model

## Input Characteristics

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input current - operating	$I_{in}$		10.4	11.8	ADC	$V_{in} = V_{in} (nom)$ ; $I_{out} = I_{out} (max.)$ ; $V_O = V_O (nom)$
Reflected ripple current	$I_{in} (ripple)$		110 370		mA rms mA pk-pk	$I_{out} = I_{out} (max.)$ , 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

## S3V3 Model

## Electrical Characteristics - O/P

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Nominal set-point voltage	$V_O (nom.)$	3.21	3.3	3.39	VDC	$V_{in} = V_{in} (nom)$ ; $I_{out} = I_{out} (nom)$
Total regulation band	$V_O$	3.15		3.45	VDC	For all line, static load and temperature until end of life
Line regulation			0.2	0.5	%	$I_{out} = I_{out} (nom)$ ; $V_{in} (min)$ 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		15	ADC	
Output current - short circuit	$I_{sc}$		10	20	A rms	Continuous, unit auto recovers from short, $V_O < 100mV$
Output voltage - noise	$V_{p-p}$ $V_{rms}$			60 25	mV pk-pk mV rms	Measurement bandwidth 20MHz See Application Note 136 for set-up details



## S3V3 Model

## Electrical Characteristics - O/P

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Load transient response - peak deviation	$V_{dynamic}$		60		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	$T_{recovery}$		50		$\mu\text{sec}$	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	$C_{ext}$	0		10,000	$\mu\text{F}$	

## S3V3 Model

## Protection and Control Features

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Allowable output voltage		10		10	% %	Trim up (% of $V_O$ nom). Trim down (% of $V_O$ nom) See Application Note 136 for details of trim equations and trim curves
Remote sense voltage				10	%	If Trim up is invoked de-rate power accordingly (remote sense + trim $\leq 10\%$ )

## S3V3 Model

## Efficiency

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Efficiency	$\eta$	94	95		%	$I_{out} = 100\% I_{out} (max)$ , $V_{in} = V_{in} (nom)$
Efficiency	$\eta$	94	96		%	$I_{out} = 50\% I_{out} (max)$ , $V_{in} = V_{in} (nom)$

## W3V3 Model

## Input Characteristics

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input current - operating	$I_{in}$		10.4	11.8	ADC	$V_{in} = V_{in} (nom)$ ; $I_{out} = I_{out} (max.)$ ; $V_O = V_O (nom)$
Reflected ripple current	$I_{in} (ripple)$		110 370		mA rms mA pk-pk	$I_{out} = I_{out} (max.)$ , 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

## W3V3 Model

## Electrical Characteristics - O/P

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Nominal set-point voltage	$V_O (nom.)$	3.21	3.3	3.39	VDC	$V_{in} = V_{in} (nom)$ ; $I_{out} = I_{out} (nom)$
Total regulation band	$V_O$	3.15		3.45	VDC	For all line, static load and temperature until end of life
Line regulation			0.2	0.5	%	$I_{out} = I_{out} (nom)$ ; $V_{in} (min)$ to $V_{in} (max)$
Load regulation				1.0	%	$V_{in} = V_{in} (nom)$ ; $I_{out} (min)$ to $I_{out} (max)$
Output current continuous	$I_{out}$	0		15	ADC	
Output current - short circuit	$I_{sc}$		10	20	A rms	Continuous, unit auto recovers from short, $V_O < 100mV$
Output voltage - noise	$V_{p-p}$ $V_{rms}$			60 25	mV pk-pk mV rms	Measurement bandwidth 20MHz See Application Note 136 for set-up details

## W3V3 Model

## Electrical Characteristics - O/P

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Load transient response - peak deviation	$V_{dynamic}$		80		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	$T_{recovery}$		50		$\mu\text{sec}$	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	$C_{ext}$	0		10,000	$\mu\text{F}$	

## W3V3 Model

## Protection and Control Features

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Allowable output voltage		75		10	% %	Trim up (% of $V_O$ nom). Trim down (% of $V_O$ nom) See Application Note 136 for details of trim equations and trim curves
Remote sense voltage				10	%	If Trim up is invoked de-rate power accordingly (remote sense + trim $\leq 10\%$ )

## W3V3 Model

## Efficiency

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Efficiency	$\eta$	94	95		%	$I_{out} = 100\% I_{out} (max)$ , $V_{in} = V_{in} (nom)$
Efficiency	$\eta$	94	96		%	$I_{out} = 50\% I_{out} (max)$ , $V_{in} = V_{in} (nom)$

S2V5 Model

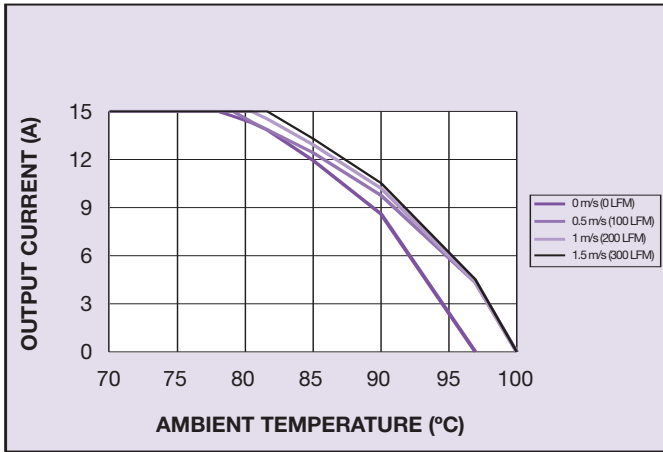


Figure 1: Derating Curve with  $V_{in} = 5V$  and No Trim

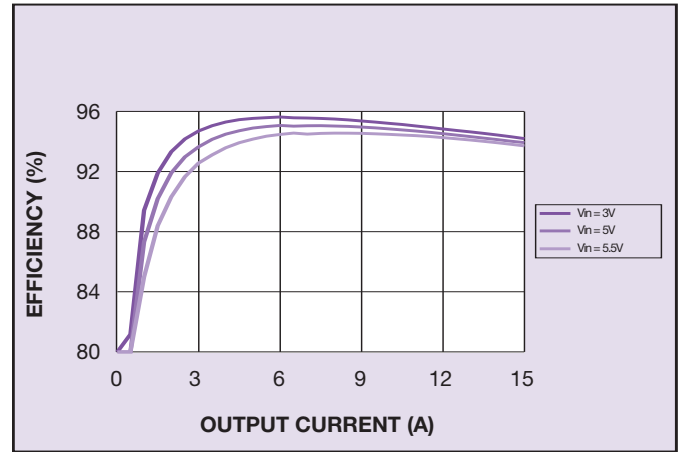


Figure 2: Efficiency vs Load

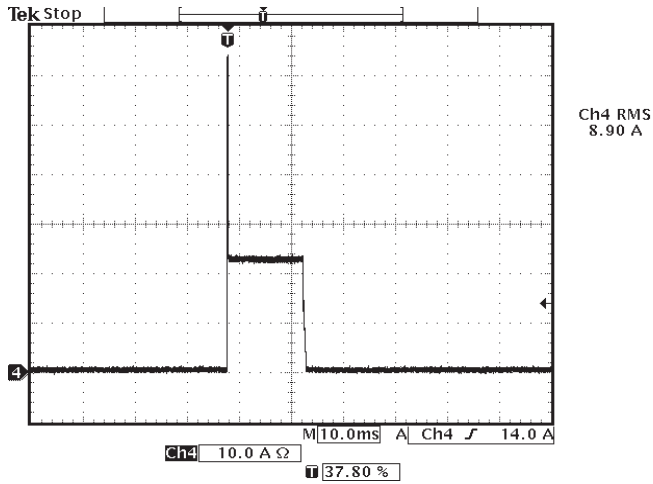


Figure 3: Short Circuit Characteristic (Channel 1:  $I_{sc}$ )

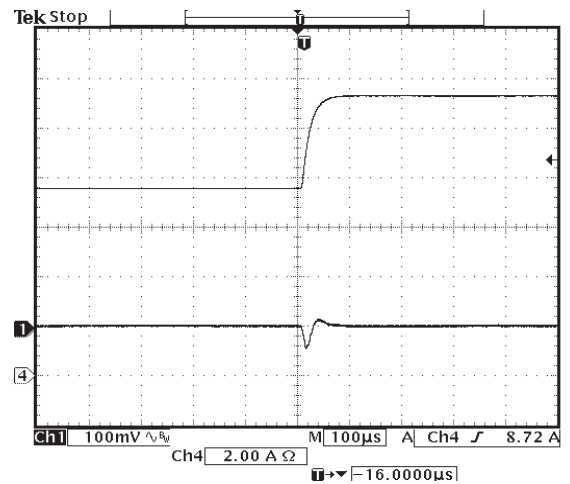


Figure 4: Typical Transient Response 50% - 75% Step Load Change (Channel 1:  $V_o$ , Channel 4:  $I_o$ )

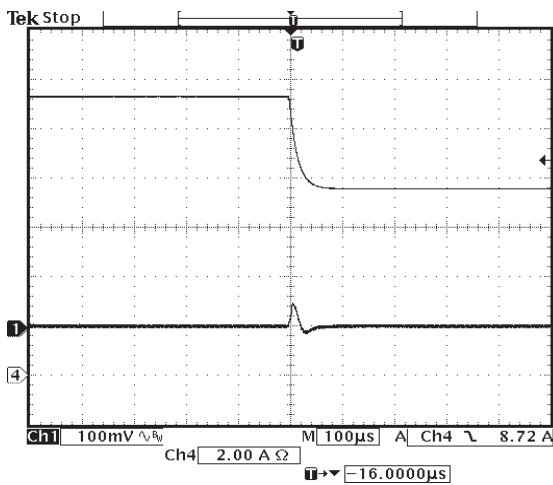


Figure 5: Typical Transient Response 75% - 50% Step Load Change (Channel 1:  $V_o$ , Channel 4:  $I_o$ )

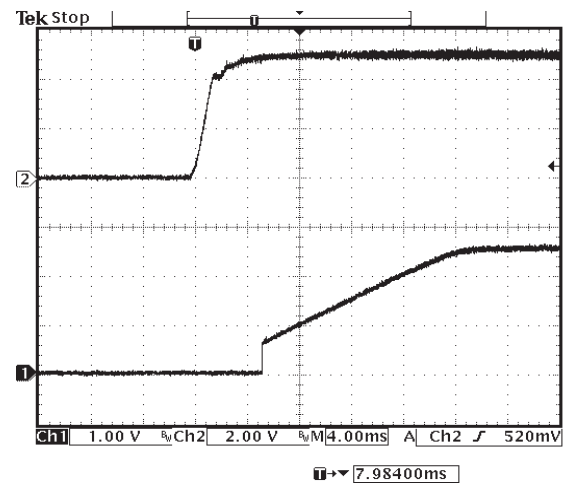


Figure 6: Typical Power-up Characteristic (Channel 1:  $V_o$ , Channel 2:  $V_{in}$ )

S2V5 Model

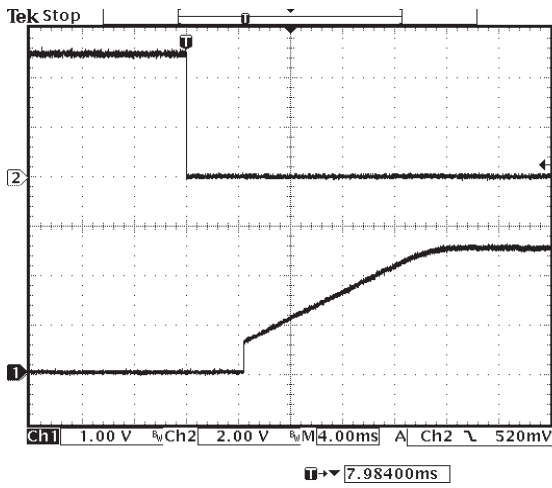


Figure 7: Control On/Off Characteristic  
(Channel 1: Vo, Channel 2: Remote ON/OFF)

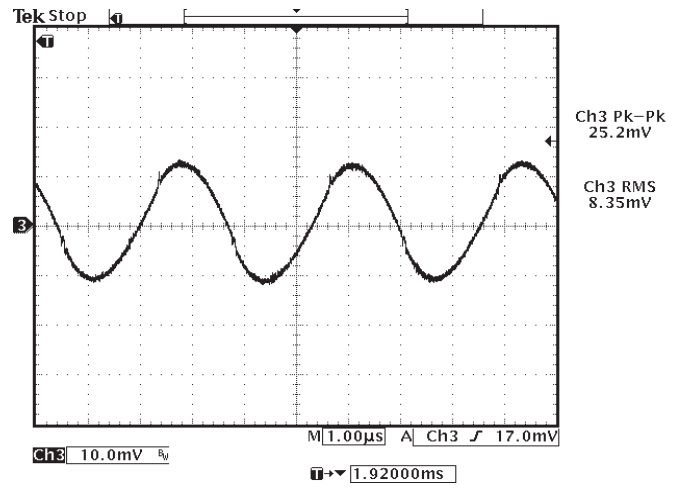


Figure 8: Typical Ripple and Noise\*  
(Channel 3: Vo)

\*Multiply values by 2, see Application Note 136 for set-up details

S3V3 Model

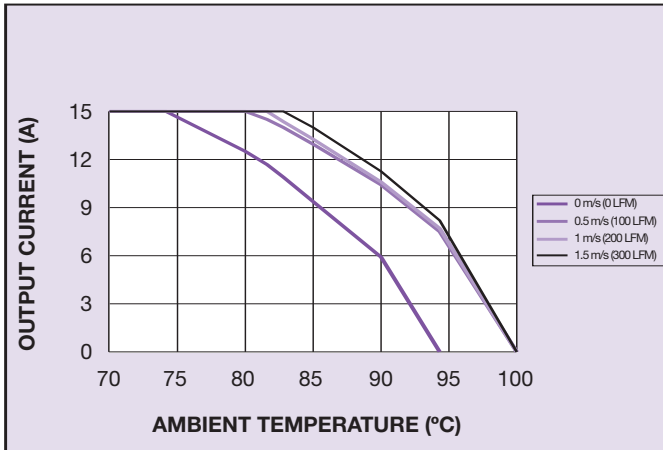


Figure 9: Derating Curve with  $V_{in} = 5V$  and No Trim

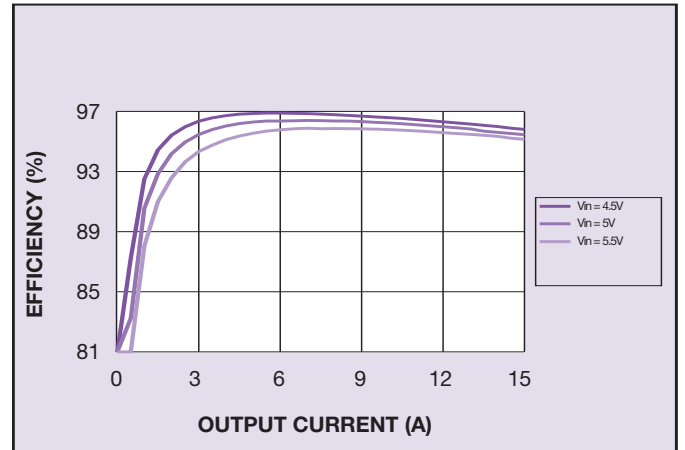


Figure 10: Efficiency vs Load

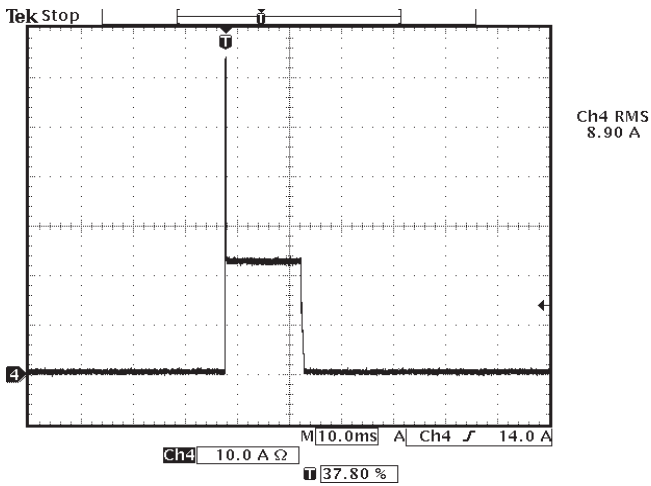


Figure 11: Short Circuit Characteristic (Channel 4:  $I_o$ )

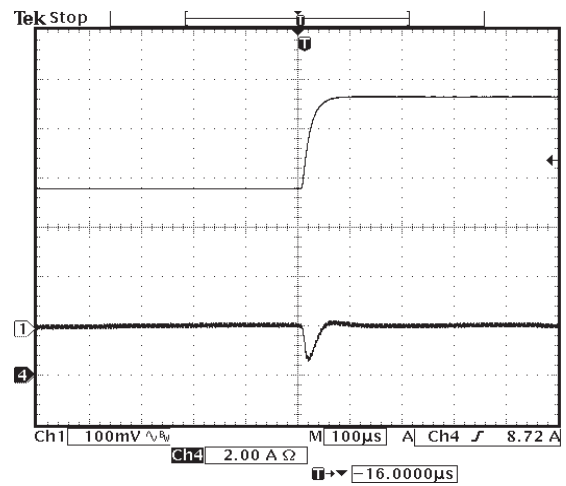


Figure 12: Typical Transient Response 50% - 75% Step Load Change (Channel 1:  $V_o$ , Channel 4:  $I_o$ )

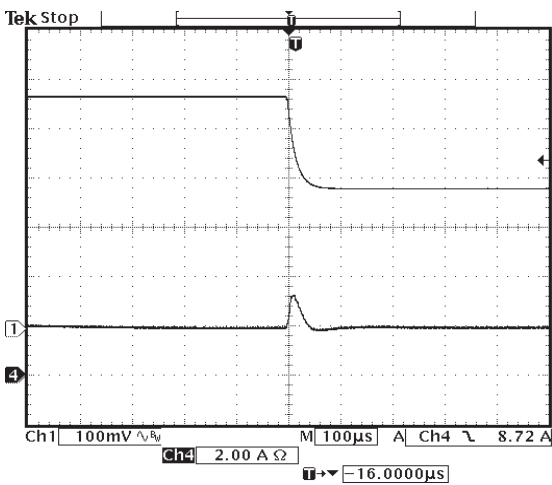


Figure 13: Typical Transient Response 75% - 50% Step Load Change (Channel 1:  $V_o$ , Channel 4:  $I_o$ )

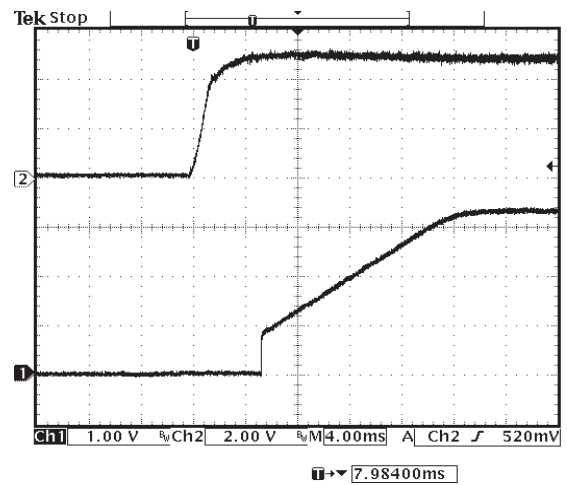


Figure 14: Typical Power-up Characteristic (Channel 1:  $V_o$ , Channel 2:  $V_{in}$ )

S3V3 Model

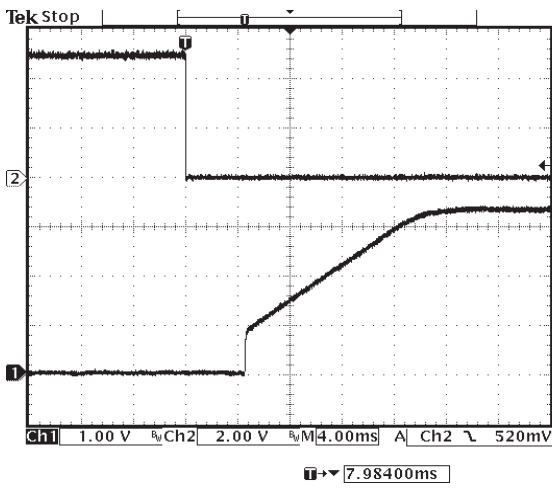


Figure 15: Control On/Off Characteristic  
(Channel 1: Vo, Channel 2: Remote ON/OFF)

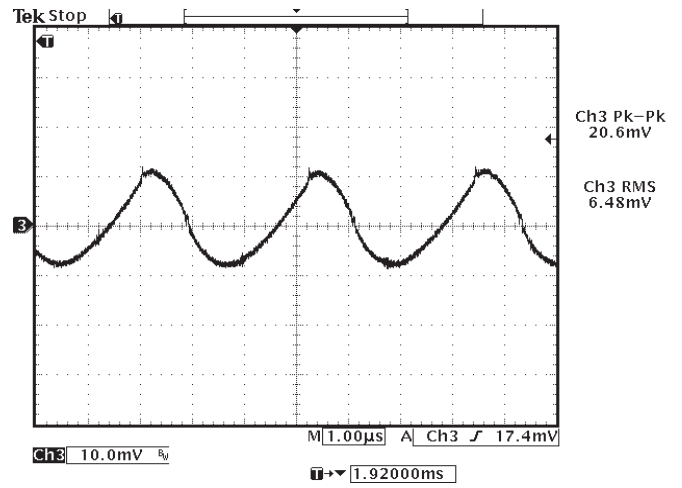


Figure 16: Typical Ripple and Noise\*  
(Channel 3: Vo)

\*Multiply values by 2, see Application Note 136 for set-up details

W3V3 Model

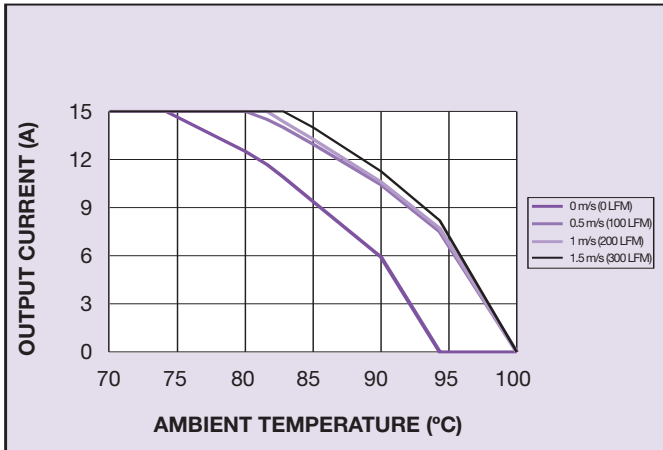


Figure 17: Derating Curve with  $V_{in} = 5V$  and No Trim

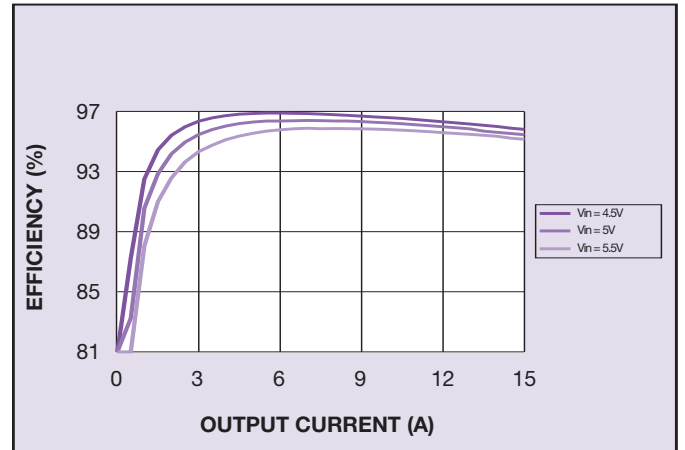


Figure 18: Efficiency vs Load

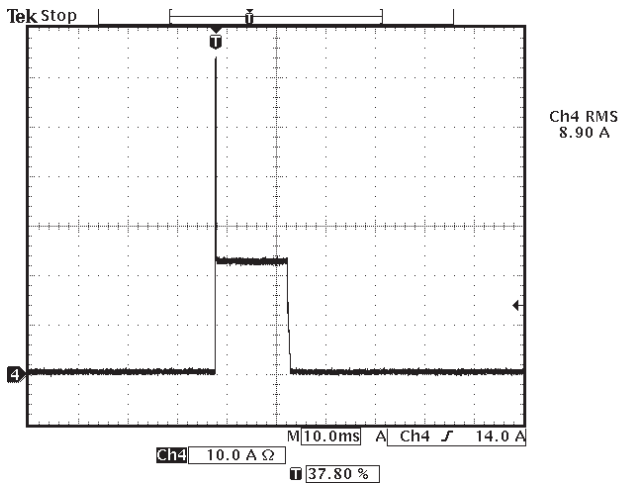


Figure 19: Short Circuit Characteristic (Channel 4:  $I_o$ )

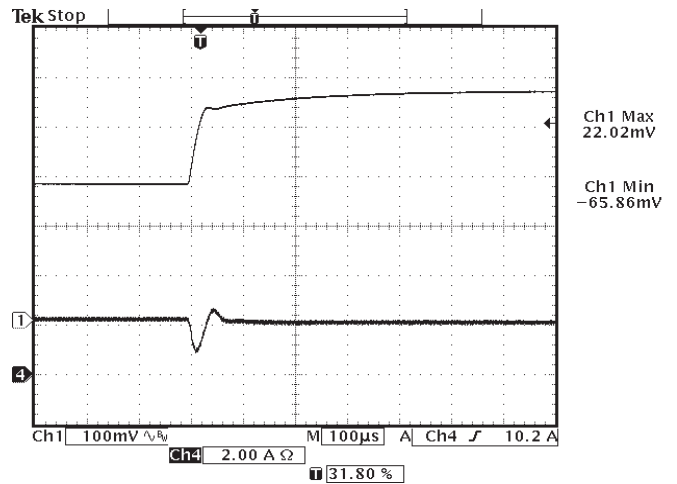


Figure 20: Typical Transient Response 50% - 75% Step Load Change (Channel 1:  $V_o$ , Channel 4:  $I_o$ )

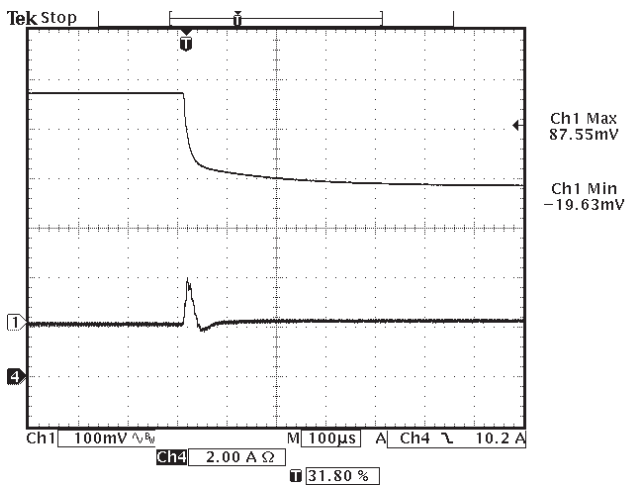


Figure 21: Typical Transient Response 75% - 50% Step Load Change (Channel 1:  $V_o$ , Channel 4:  $I_o$ )

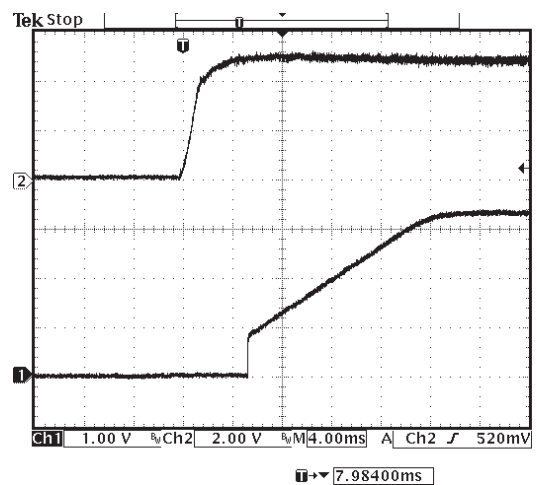


Figure 22: Typical Power-up Characteristic (Channel 1:  $V_o$ , Channel 2:  $V_{in}$ )



W3V3 Model

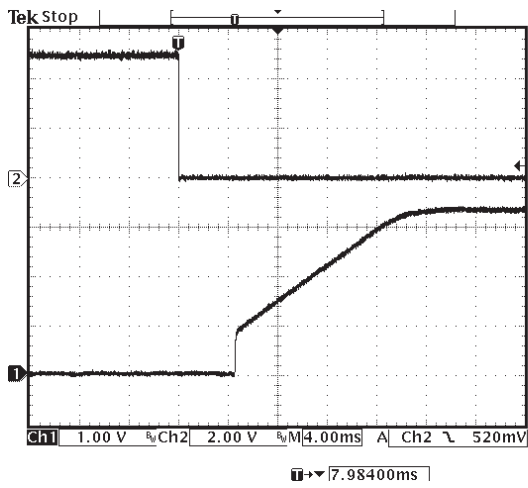


Figure 23: Control On/Off Characteristic  
(Channel 1: Vo, Channel 2: Remote ON/OFF)

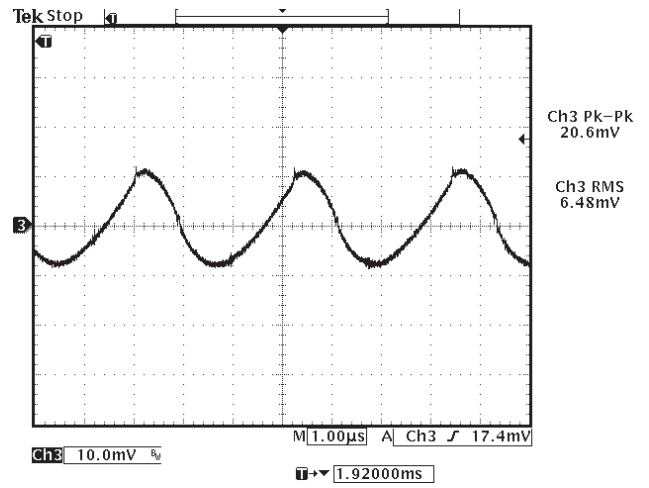
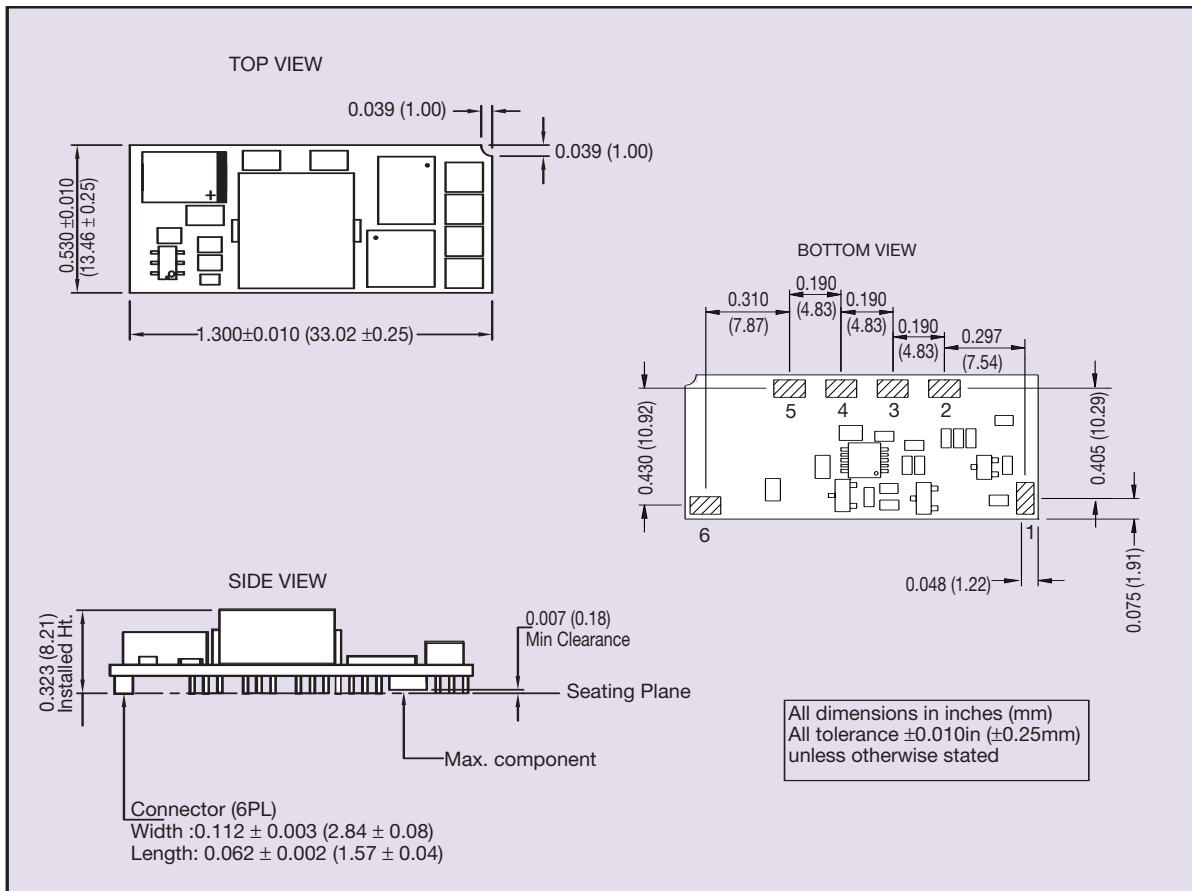


Figure 24: Typical Ripple and Noise\*  
(Channel 3: Vo)

\*Multiply values by 2, see Application Note 136 for set-up details



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

Figure 25: Mechanical Drawing and Pinout Table

**Note 1**

Thermal reference is defined as the highest temperature measured at any one of the specified thermal reference points. See Figure 26: Thermal reference points.

**Note 2**

The Remote ON/OFF pin is referenced to ground.

**Note 3**

The SMT15E features a 'Negative Logic' 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 SMT15E:

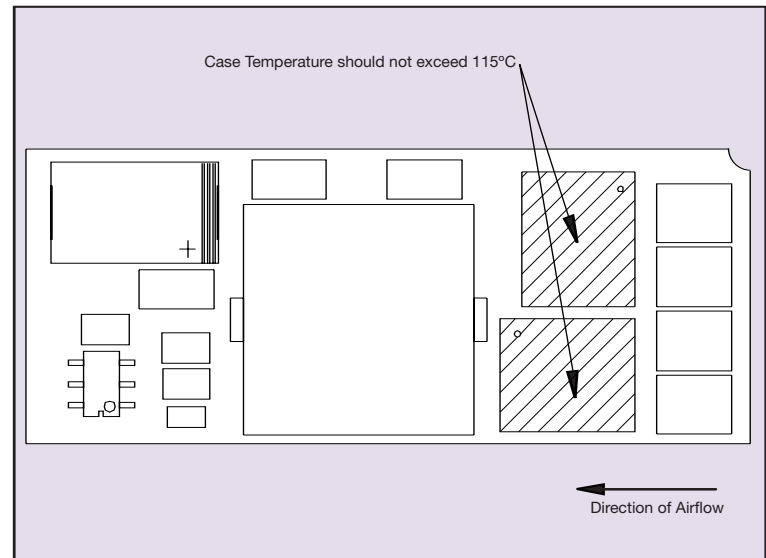
<b>Configuration</b>	<b>Converter Operation</b>
Remote pin open circuit	Unit is ON
Remote pin pulled low	Unit is ON
Remote pin pulled high [Von/off >1.2V]	Unit is OFF

A 'Positive Logic' 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 136.

**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 26: Thermal Reference Points**

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