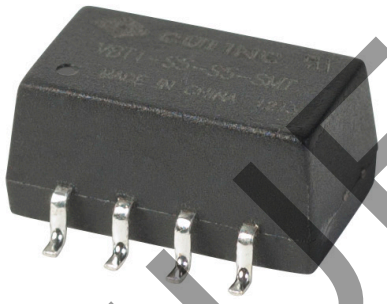
CUI INC®

SERIES: VBT1-SMT | **DESCRIPTION:** DC-DC CONVERTER

DISCONTINUED

FEATURES

- 1 W isolated output
- industry standard 8 pin SMT package
- single unregulated outputs
- 1,000 V isolation
- short circuit protection
- UL safety approvals (some models)
- wide temperature (-40~85°C)
- efficiency up to 79%



RoHS c UL® US

MODEL

MODEL	input voltage typ (Vdc)	input voltage range (Vdc)	output voltage (Vdc)	output current min (mA)	output current max (mA)	output power max (W)	ripple and noise[1] max (mVp-p)	efficiency typ (%)
VBT1-S3.3-S3.3-SMT	3.3	3.0~3.63	3.3	30	303	1	75	73
VBT1-S3.3-S5-SMT	3.3	3.0~3.63	5	20	200	1	75	74
VBT1-S5-S3.3-SMT	5	4.5~5.5	3.3	30	303	1	75	72
VBT1-S5-S5-SMT	5	4.5~5.5	5	20	200	1	75	77
VBT1-S5-S9-SMT	5	4.5~5.5	9	12	111	1	75	76
VBT1-S5-S12-SMT	5	4.5~5.5	12	9	84	1	75	79
VBT1-S5-S15-SMT	5	4.5~5.5	15	7	67	1	75	78
VBT1-S5-S24-SMT	5	4.5~5.5	24	4	42	1	75	78
VBT1-S12-S3.3-SMT	12	10.8~13.2	3.3	30	303	1	75	75
VBT1-S12-S5-SMT	12	10.8~13.2	5	20	200	1	75	69
VBT1-S12-S9-SMT	12	10.8~13.2	9	12	111	1	75	73
VBT1-S12-S12-SMT	12	10.8~13.2	12	9	84	1	75	73
VBT1-S12-S15-SMT	12	10.8~13.2	15	7	67	1	75	74
VBT1-S12-S24-SMT	12	10.8~13.2	24	4	42	1	75	79
VBT1-S15-S5-SMT	15	13.5~16.5	5	20	200	1	75	74
VBT1-S15-S15-SMT	15	13.5~16.5	15	7	67	1	75	79
VBT1-S24-S3.3-SMT	24	21.6~26.4	3.3	30	300	1	75	69
VBT1-S24-S5-SMT	24	21.6~26.4	5	20	200	1	75	70
VBT1-S24-S9-SMT	24	21.6~26.4	9	11	110	1	75	72
VBT1-S24-S12-SMT	24	21.6~26.4	12	8	83	1	75	75
VBT1-S24-S15-SMT	24	21.6~26.4	15	7	67	1	75	76
VBT1-S24-S24-SMT	24	21.6~26.4	24	4	42	1	75	77

Notes: 1. ripple and noise are measured at 20 MHz BW

PART NUMBER KEY

VBT1 - SXX - SXX - SMT - X

- VBT1: Base Number
- SXX (first): Input Voltage
- SXX (second): Output Voltage
- SMT: Packaging Style
- X: Package Options "blank" = standard TR = Tape & Reel

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INPUT

parameter	conditions/description	min	typ	max	units
operating input voltage	3.3 V model	3.0	3.3	3.63	Vdc
	5 V model	4.5	5	5.5	Vdc
	12 V model	10.8	12	13.2	Vdc
	15 V model	13.5	15	16.5	Vdc
	24 V model	21.6	24	26.4	Vdc

OUTPUT

parameter	conditions/description	min	typ	max	units
line regulation	for Vin change of 1%, 3.3 V model			1.5	%
	for Vin change of 1%, all other models			1.2	%
load regulation	measured from 10% load to full load				
	3.3 V model		15	20	%
	5 V model		12.8	15	%
	9 V model		8.3	10	%
	12 V model		6.8	10	%
	15 V model		6.3	10	%
	24 V model		6.0	10	%
voltage accuracy	see derating curves				
switching frequency	100% load, 5 and 12 V input		100		kHz
	100% load, 24 V input		500		kHz
	100% load, all other models		100	500	kHz
temperature coefficient			±0.03		%/°C

PROTECTIONS

parameter	conditions/description	min	typ	max	units
short circuit protection				1	s

SAFETY AND COMPLIANCE

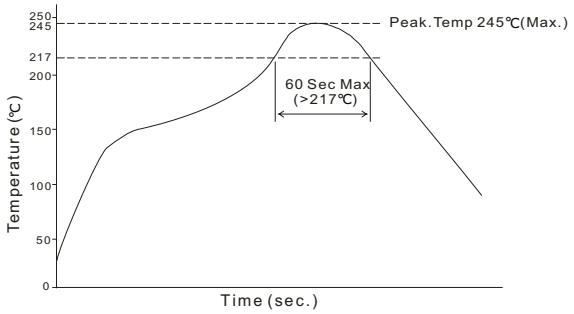
parameter	conditions/description	min	typ	max	units
isolation voltage	for 1 minute at 1 mA max.	1,000			Vdc
isolation resistance	at 500 Vdc	1,000			MΩ
safety approvals[1]	UL 60950-1 (E222736)				
MTBF		3,500,000			hours
RoHS compliant	yes				

Notes: 1. VBT1-S3.3-S9/12/15/24, VBT1-S5-S3.3 and 24, VBT1-S12-S3.3 and S24, VBT1-S15 (all), and VBT1-S24 (all) models UL 60950-1 pending

ENVIRONMENTAL

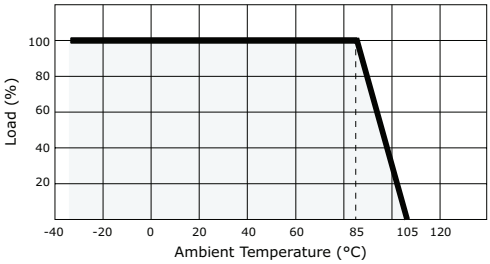
parameter	conditions/description	min	typ	max	units
operating temperature		-40		85	°C
storage temperature		-55		125	°C
storage humidity	non-condensing			95	%
temperature rise	at full load		25		°C
reflow soldering	see reflow soldering profile			245	°C

SOLDERING

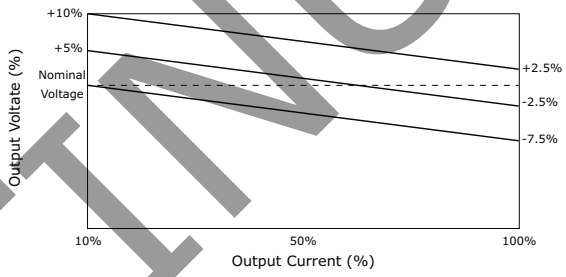


DERATING CURVES

1. output power vs. ambient temperature



2. output voltage vs. output current

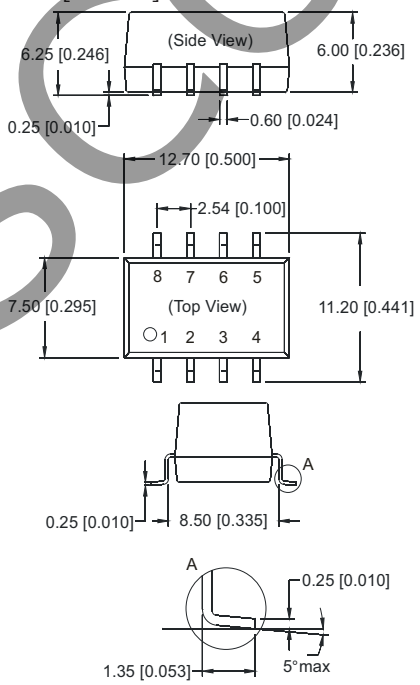


MECHANICAL

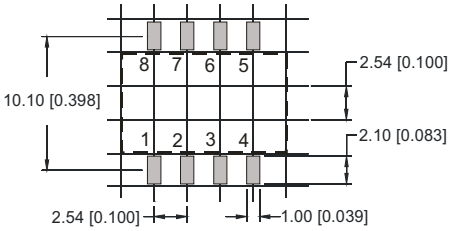
parameter	conditions/description	min	typ	max	units
dimensions	12.70 x 11.20 x 6.25 (0.500 x 0.441 x 0.246 inch)				mm
case material	plastic (UL94-V0)				
weight			1.41		g

MECHANICAL DRAWING

units: mm [inches]
tolerance: ±0.15 [±0.006]
pin section tolerance: ±0.10 mm [±0.004]



RECOMMENDED FOOTPRINT
Top view,grid:2.54mm(0.1inch)



PIN CONNECTIONS	
PIN	FUNCTION
1	GND
2	+Vin
4	0 V
5	+Vo
3,6,7	NC
8	NC

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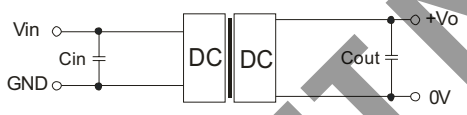
APPLICATION NOTES

1. **Requirement on Output Load**
   In order to ensure the product operates efficiently and reliably, make sure the specified range of input voltage is not exceeded and the minimum output load is not less than 10% load. If the actual load is less than the specified minimum load, the output ripple may increase sharply while its efficiency and reliability will reduce greatly. If the actual output power is very small, please add an appropriate resistor as extra loading.

2. **Overload Protection**
   Under normal operating conditions, the output circuit of these products has no protection against over-current and short-circuits. The simplest method is to connect a self-recovery fuse in series at the input end or add a circuit breaker to the circuit.

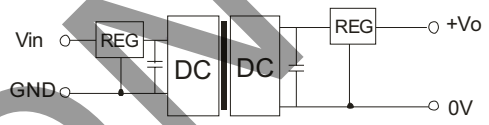
3. **Filtering**
   In some circuits which are sensitive to noise and ripple, a filtering capacitor may be added to the DC/DC output end and input end to reduce the noise and ripple. However, the capacitance of the output filter capacitor must be proper. If the capacitance is too big, a startup problem might arise. For every channel of output, provided the safe and reliable operation is ensured, the greatest capacitance of its filter capacitor sees the external capacitor table. To get an extremely low ripple, an "LC" filtering network may be connected to the input and output ends of the DC/DC converter, which may produce a more significant filtering effect. It should also be noted that the inductance and the frequency of the "LC" filtering network should be staggered with the DC/DC frequency to avoid mutual interference (Figure 1).

Figure 1



4. **Output Voltage Regulation and Over-voltage Protection Circuit**
   The simplest device for output voltage regulation, over-voltage and over-current protection is a linear voltage regulator with overheat protection that is connected to the input or output end in series (Figure 2).

Figure 2



5. **External Capacitor Table**
   It is not recommended to connect any external capacitor in the application field with less than 0.5 W output.

Table 1

Vin (Vdc)	Cin (μF)	Vout (Vdc)	Cout (μF)
3.3/5	4.7	3.3/5	10
12	2.2	9	4.7
15	2.2	12	2.2
24	0.47	15	1
--	--	24	0.47

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Note: 1. All specifications are measured at Ta=25°C, humidity<75%, nominal input voltage and rated output load unless otherwise specified.

REVISION HISTORY

rev.	description	date
1.0	initial release	01/14/2011
1.01	new template applied	04/11/2012
1.02	V-Infinity branding removed	09/05/2012
1.03	added TR package option	11/01/2012
1.04	discontinued alternate pin configuration, "X", option	07/09/2013
1.05	reflow solder profile changed	05/25/2014

The revision history provided is for informational purposes only and is believed to be accurate.

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CUI offers a two (2) year limited warranty. Complete warranty information is listed on our website.

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