NV Series

SMT DC-DC Converters

The NV Series converters are low profile, single-and dual-output DC-DC converters intended for SMT placement and reflow soldering. The product provides onboard conversion for a wide range of standard telecom and datacom input voltages to isolated low-output voltages. Proprietary patented manufacturing process with full process automation ensures optimal product quality in an extremely small footprint.

MELCHER
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RoHS Compliant

C SP US

Key Features & Benefits

- RoHS-compliant for all six substances
- Single-and double-output models available
- Basic insulation
- 1500 VDC i/o electric strength test voltage
- Low conducted and radiated EMI
- Extremely-wide input ranges (up to 4:1)
- Wide output range (3.3 V to 48 V)
- Output overcurrent protection
- Parallel and series connection providing flexible output voltages and power
- Operating temperature up to 110 °C
- Full rated output power at 71 ºC with convection cooling
- Low profile SMT design, 8.5 mm height
- Excellent co-planarity (within 0.1 mm)
- Safety-approved to IEC/EN 60950-1 2ndEd and UL/CSA 60950-1 2nd Ed

Applications

- Distributed power architectures
- Telecommunications equipment
- LAN/WAN applications
- Data processing
- Industrial applications

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1. MODEL SELECTION

1.1 SINGLE-OUTPUT MODELS

MODEL	INPUT VOLTAGE VDC	INPUT CURRENT, MAX A	OUTPUT VOLTAGE V	OUTPUT CURRENT A	OUTPUT RIPPLE/NOISE, mV P-P	TYPICAL EFFICIENCY %
NVS01YG-M6G	18 – 36	0.27	5.0	1.0	50	82
NVS0.5YH-M6G	18 – 36	0.33	12	0.5	95	83
NVS01ZG-M6G	36 – 75	0.17	5.0	1.0	50	82
NVS0.5ZH-M6G	36 – 75	0.17	12	0.5	95	82
NVS0.9CE-M6G	9 – 36	0.45	3.3	0.9	50	79
NVS0.7CG-M6G	9 – 36	0.55	5.0	0.7	50	81
NVS0.3CH-M6G	9 – 36	0.65	12	0.34	95	82
NVS0.3CJ-M6G	9 – 36	0.65	15	0.28	120	82
NVS0.9EE-M6G	18 – 75	0.33	3.3	0.9	50	80
NVS0.7EG-M6G	18 – 75	0.33	5.0	0.7	50	81
NVS0.3EH-M6G	18 – 75	0.33	12	0.34	95	82
NVS0.3EJ-M6G	18 – 75	0.33	15	0.28	120	82

To order models which use lead solder exemption remove suffix ‘G’ from model number.

1.2 DUAL-OUTPUT MODELS

MODEL	INPUT VOLTAGE VDC	INPUT CURRENT, MAX A	OUTPUT VOLTAGE V	OUTPUT CURRENT A	OUTPUT RIPPLE/NOISE, mV P-P	TYPICAL EFFICIENCY %
NVD0.1YGG-M6G	18 - 36	0.27	±5.0	±0.5	60	82
NVD0.5YHH-M6G	18 - 36	0.33	±12	±0.25	100	83
NVD0.4YJJ-M6G	18 - 36	0.33	±15	±0.20	120	84
NVD0.7CGG-M6G	9 – 36	0.65	±5.0	±0.35	50	81
NVD0.3CHH-M6G	9 – 36	0.65	±12	±0.17	95	82
NVD0.3CJJ-M6G	9 – 36	0.65	±15	±0.14	120	82
NVD0.2CKK-M6G	9 – 36	0.65	±24	±0.08	190	83
NVD0.7EGG-M6G	18 – 75	0.33	±5.0	±0.35	50	81
NVD0.3EHH-M6G	18 – 75	0.33	±12	±0.17	95	82
NVD0.3EJJ-M6G	18 – 75	0.33	±15	±0.14	120	82
NVD0.2EKK-M6G	18 – 75	0.33	±24	±0.08	190	83

To order models which use lead solder exemption remove suffix ‘G’ from model number.

2. ABSOLUTE MAXIMUM RATINGS

Stresses in excess of the absolute maximum ratings may cause performance degradation, adversely affect long term reliability, and cause permanent damage to the converter.
All specifications apply over input voltage, output load, and temperature range, unless otherwise noted.

PARAMETER	CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNITS
Operating Case Temperature (T_C)		-40		110	°C
Storage Temperature (T_S)		-55		100	°C

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3. ENVIRONMENTAL AND MECHANICAL

PARAMETER	CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNITS
Shock	IEC68-2-27			100	g_n
Sinusoidal Vibration	IEC68-2-6			10	g_n
Weight				0.4/12	oz/g
Water Washing	Standard process		Yes		N/A
MTBF	Per Bellcore TR-NWT-000332 (100% load @25 °C, GB)		4.902		1000 h

4. INSULATION

PARAMETER	CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNITS
Insulation Safety Rating	Vin = Vin.Min – Vin.Max		Basic		N/A
Electric Strength Test Voltage			1500		VDC
Insulation Capacitance (Cps)			1100		pF
Insulation Resistance (Rps)		10			MΩ

5. INPUT DATA

5.1 MODELS WITH V_{in} = 9 – 36 V

PARAMETER	CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNITS
Input Voltage Range (Vi)	Continuous	9		36	V
Transient Input Voltage (Vint)	Transient, 100 ms			40	V
Input Current when Shutdown	Vin.Nom, Iout = 0 A		10	20	mA
Turn-On Time	To Output Regulation Band		250	500	ms
	Rise Time		10		ms
Input Reflected Ripple Current	Vin.Max, Io.Max			30	mApp
Input Capacitance				0.6	µF

5.2 MODELS WITH V_{in} = 18 – 36 V

PARAMETER	CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNITS
Input Voltage Range (Vi)	Continuous	18		36	V
Transient Input Voltage (Vint)	Transient, 100 ms			40	V
Input Current when Shutdown	Vin.Nom, Iout = 0 A		10	20	mA
Turn-On Time	To Output Regulation Band		250	500	ms
	Rise Time		10		ms
Input Reflected Ripple Current	Vin.Max, Io.Max			30	mApp
Input Capacitance				0.6	µF

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5.3 MODELS WITH V_{in} = 18 – 75 V

PARAMETER	CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNITS
Input Voltage Range (Vi)	Continuous	18		75	V
Transient Input Voltage (Vint)	Transient, 100 ms			100	V
Input Current when Shutdown	Vin.Nom, Iout = 0 A		8	10	mA
Turn-On Time	To Output Regulation Band		250	500	ms
	Rise Time		10		ms
Input Reflected Ripple Current	Vin.Max, Io.Max			30	mApp
Input Capacitance				0.3	µF

5.4 MODELS WITH V_{in} = 36 – 75 V

PARAMETER	CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNITS
Input Voltage Range (Vi)	Continuous	36		75	V
Transient Input Voltage (Vint)	Transient, 100 ms			100	V
Input Current when Shutdown	Vin.Nom, Iout = 0 A		8	10	mA
Turn-On Time	To Output Regulation Band		250	500	ms
	Rise Time		10		ms
Input Reflected Ripple Current	Vin.Max, Io.Max			30	mApp
Input Capacitance				0.3	µF

6. OUTPUT DATA

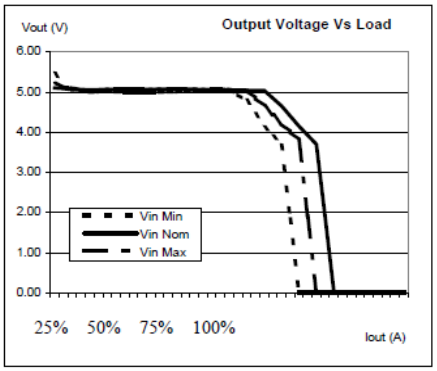
All specifications apply over input voltage, output load, and temperature range, unless otherwise noted.

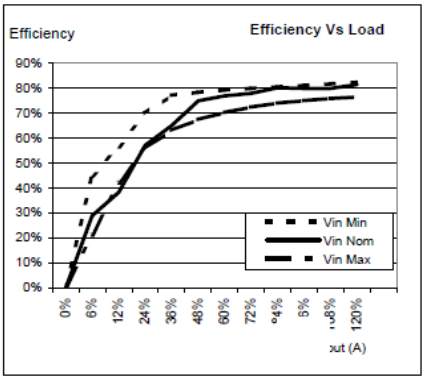
PARAMETER	CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNITS
Output Voltage Accuracy	Vi nom, 50% Io. Max			± 1	%Vo
Line Regulation	Vi min to Vi max, 50% Io max			± 1	%Vo
Load Regulation	Vin.Nom, Io.Min to Io.Max				
	3.3 Vo			±4	%Vo
	Other Output Voltages			±3	%Vo
Maximum Output Capacitance	Total, for single and dual outputs				
	3.3 Vo			680	µF
	5 Vo, ±5 Vo			680	µF
	12 Vo, ±12 Vo			150	µF
	15 Vo, ±15 Vo			100	µF
	±24 Vo			47	µF
Dynamic Regulation	50-100% Io.Max load step				
Peak Deviation	change			5	%Vo
Settling Time	to 1% error band			1	ms

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PARAMETER	CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNITS
	Vin.Min to Vin.Max, Io.Min to Io Max, 20 MHz Bandwidth				
Output Voltage Ripple	3.3 Vo		50	80	mVpp
	5 Vo, ±5 Vo		50	80	mVpp
	12 Vo, ±15 Vo, ±24 Vo		0.8	1	%Vopp
Output Current Limit Threshold	Output Current Limit Threshold	120		200	%Iomax
Switching Frequency	Vin.Nom, Io.Max		400		kHz
Temperature Coefficient				0.02	%Vo/°C

TYPICAL CHARACTERISTIC CURVES





7. APPLICATION AND AUXILIARY FUNCTIONS

7.1 TYPICAL APPLICATION

This series of converters does not require any external components for proper operation. However, if the distribution of the input voltage to the converter contains significant inductance, a capacitor across the input terminals may be required to stabilize the input voltage. A minimum of 0.47µF, quality electrolytic or ceramic capacitor, is recommended for this purpose. For output decoupling it is recommended to connect, directly across the output pins, a 0.47 µF ceramic capacitor (for 3.3 V and 5 V outputs) or a 0.27 µF ceramic capacitor (for other outputs). Care must be taken to ensure the maximum rated output capacitance for the device is not exceeded, when dimensioning decoupling capacitors in the system, as this could cause the unit to detect an overload and enter a 'hiccup' mode of operation.

7.2 OUTPUT CURRENT LIMITATION

When the output is overloaded above the maximum output current rating, the voltage will start to reduce to maintain the output power to a safe level. In a condition of high overload or short-circuit where the output voltage is pulled below approximately 30% of Vo.nom, the unit will enter a 'Hiccup' mode of operation. Under this condition the unit will attempt to restart, approximately every 100 ms until the overload has cleared.

7.3 PARALLEL OPERATION

Paralleling of two converters is possible by direct connection of the output voltage terminal pins. The load regulation characteristic is designed to facilitate current sharing (typically ± 20%). However, this may cause start-up problems at initial start-up, and is only recommended in applications where one converter is able to deliver the full load current (true redundant systems).

7.4 SERIES OPERATION

The outputs of two units may be connected in series to achieve a higher system voltage.

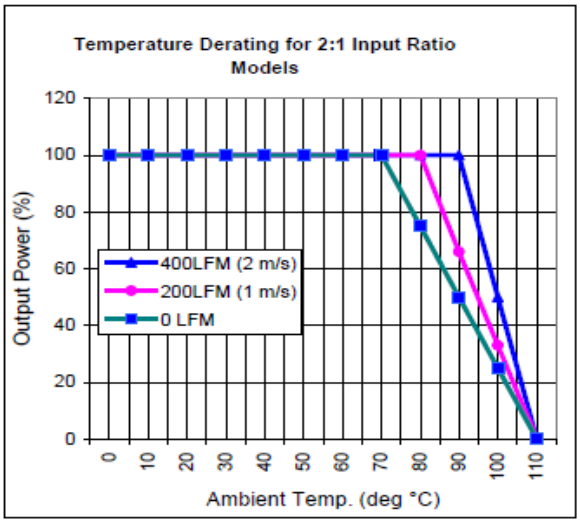
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8. TEMPERATURE DERATING CURVES

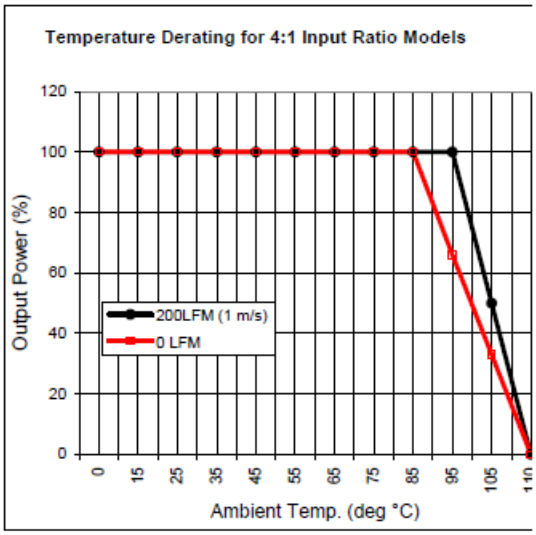
The derating curves below give an indication of the output power achievable with and without forced-air cooling. However in the final application the temperature rise of the converter is also influenced by factors such as heat conduction through the leads to the PCB, orientation, the temperature of surrounding components and the input voltage. To ensure the reliability of the converter, care must be taken to guarantee that the maximum case temperature is not exceeded under any conditions. The measurement point for case temperature is specified on the mechanical drawing (Tc).

Temperature derating for 18 – 36 V and 36 – 75 V input voltage ranges:



The 9 – 36 V and 18 – 75 V input voltage versions of this series feature a 4:1 input voltage range and can operate at full power at 85 °C ambient temperature with only convection cooling.

Temperature derating for 9 – 36 V and 18 – 75 V input voltage ranges:



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9. SAFETY

These converters are tested with 1500 VDC from input to output. The input-to-output resistance is greater than 10 MΩ. These converters are provided with Basic Insulation between input and output. Nevertheless, if the system using the converter needs to receive safety agency approval, certain rules must be followed in the design of the system. In particular, all of the creepage and clearance requirements of the end-use application must be observed.

In order to consider the output of the converter as SELV (Safety Extra Low Voltage) or TNV-1, according to IEC/EN 60950-1 and UL/CSA 60950-1, one of the following requirements must be met in the system design:

(i) Fuse: The converter has no internal fuse. An external fuse must be provided to protect the system from catastrophic failure. Recommended fuses are listed in the table below:

INPUT VOLTAGE RANGE	RECOMMENDED FUSE
36 – 75V	F0.315A
18 – 36V	F0.5A
9 – -6V	F1.0A
18 – -5V	F0.5A

(ii) The user can select a lower rating fuse based upo the inrush transient and the maximum input curren of the converter, which occurs at the minimu input voltage. Both input traces and the chassis ground trace (if applicable) must be capable of conducting a current of 1.5 times the value of the fuse without opening. The fuse must not be placed in the grounded input line, if any.

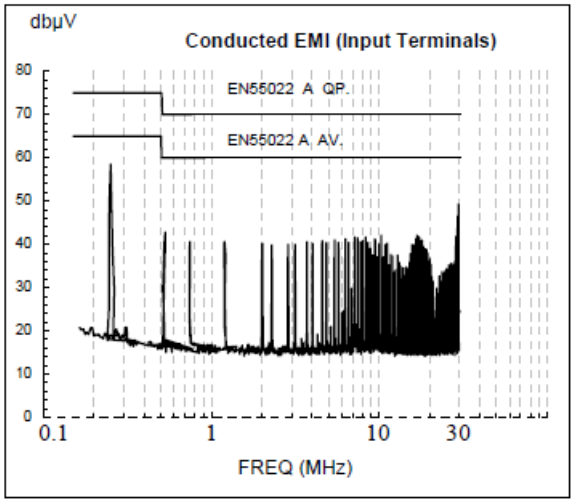
(iii) If the voltage source feeding the module is SELV, TNV-1, or TNV-2, the output of the converter is considered SELV and may be grounded or ungrounded.

(iv) The circuitry of the converter may generate transients, which exceed the input voltage. Even if the input voltage is SELV (<60V) the components on the primary side of the converter may have to be considered as hazardous. A safety interlock may be needed to prevent the user from accessing the converter while operational.

10. EMC SPECIFICATIONS

10.1 CONDUCTED NOISE

The converters meet the requirements of EN 55011/55022, (conducted noise on the input terminals) without any external components. The results for this solution are displayed below.



To meet class B for the above standards, it is necessary to fit a 3.3 µF ceramic capacitor across the input terminals.

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10.2 ELECTROMAGNETIC SUSCEPTIBILITY

STANDARD	APPLIED STRESS	CLASS LEVEL	PERFORMANCE CRITERION[1]
Electrostatic Discharge EN 61000-4-2	2 kV to pins	1	B
Electromagnetic Field EN 61000-4-3	3 V/m	2	A
Electrical Fast Transient EN 61000-4-4	2000 Vp to input	3	B
Conducted Disturbances EN 61000-4-6	3 VAC to input	2	B

[1] **A** denotes normal operation, no deviation from specification. **B** denotes temporary deviation from specification is possible.

11. SURFACE MOUNT ASSEMBLY

11.1 SOLDERING

The following soldering instructions must be observed to prevent failure or significant degradation of the module performance. Power Bel Solutions will not honor any warranty claims arising from failure to observe these instructions. The lead-frame is constructed for a high temperature glass filled, UL94 V-0 flame retardant, dually orthophthalate molding compound commonly used for packaging of electronics components. It has passed NASA outgassing tests, and is certified to MIL-M-14. The coefficient of thermal expansion is equivalent to FR4. The gull wing leads are formed to ensure optimal solder joint strength and structure. Furthermore they facilitate visual inspection (manual or automatic). The leads are formed from a 97 Cu alloy plated with Ni and matte Sn. This material is commonly used in the manufacture of integrated circuits. It has good corrosion resistance and exhibits the nobility inherent to all high copper alloys. Unlike brasses, this material is essentially immune to stress corrosion cracking. It also exhibits excellent solderability. It is readily wetted by solders and performs well in standard solderability tests. (Dip of Class II or better). The product is manufactured with a patented process, which is fully automated, and 'in-line'. This ensures that there is no contamination or mechanical stress on the lead-frame so that the co planarity and solderability are maintained. The product is shipped in JEDEC trays to ensure preservation of the co-planarity and enable fully automated assembly in the final application. Mind the marking for pin 1! These products are approved for forced convection reflow soldering only. Products RoHS-compliant for all 6 substance (model designation ending with -M6G) allow for a solder profile with higher temperatures; see tables below.

RECOMMENDED REFLOW PROFILE (measured at the leads of the converter)

PRODUCT	PRE-HEAT RAMP			PRE-HEAT SOAKING			RAMP TO REFLOW	REFLOW				COOLING
	From	To	Rate	From	To	Time	Rate	Time above liquids	Peak temp.	Time within ±5 °C of peak temp	Time to peak	Rate
	°C	°C	°C/s	°C	°C	s	°C	s	°C	s	s	°C/s
M6 (Sn-Pb eutectic)	25	150	2	150	183	90-120	2	45	220±5	10	180	3
M6G (lead free)	25	180	2	180	217	90-120	2	45	240±5	10	210	3

WORST CASE REFLOW PARAMETERS FOLLOWING J-STD-020D (measured in the center, on top side of the converter)

PRODUCT	PRE-HEAT RAMP			PRE-HEAT SOAKING			RAMP TO REFLOW	REFLOW				COOLING
	From	To	Rate	From	To	Max. Time	Rate	Max. time above liquids	Max. peak temp.	Max. time within ±5 °C of peak temp	Max. time to peak	Rate
	°C	°C	°C/s	°C	°C	s	°C	s	°C	s	s	°C/s
M6 (Sn-Pb eutectic)	25	150	3	100	150	120	3	45	230	10	360	6
M6G (lead free)	25	180	3	150	200	120	3	45	260	10	480	6

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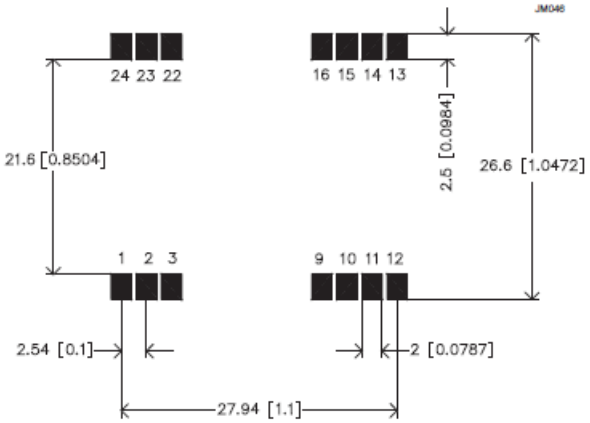
11.2 PICK & PLACE ASSEMBLY

The product is designed with a large flat area in the center of the top surface to serve as a pick up point for automated vacuum pick and place equipment. The 'open board' construction of the unit ensures that weight is kept to a minimum. However due to the relatively large size of the component, a large nozzle (>6.0mm, depending on vacuum pressure) is recommended for picking and placing.

The unit may also be automatically handled using 'odd-form' placement equipment, with mechanical grippers. For this type of equipment the end edges of the device, which have no leads and also feature the greatest dimensional accuracy, should be used as pick-up points.

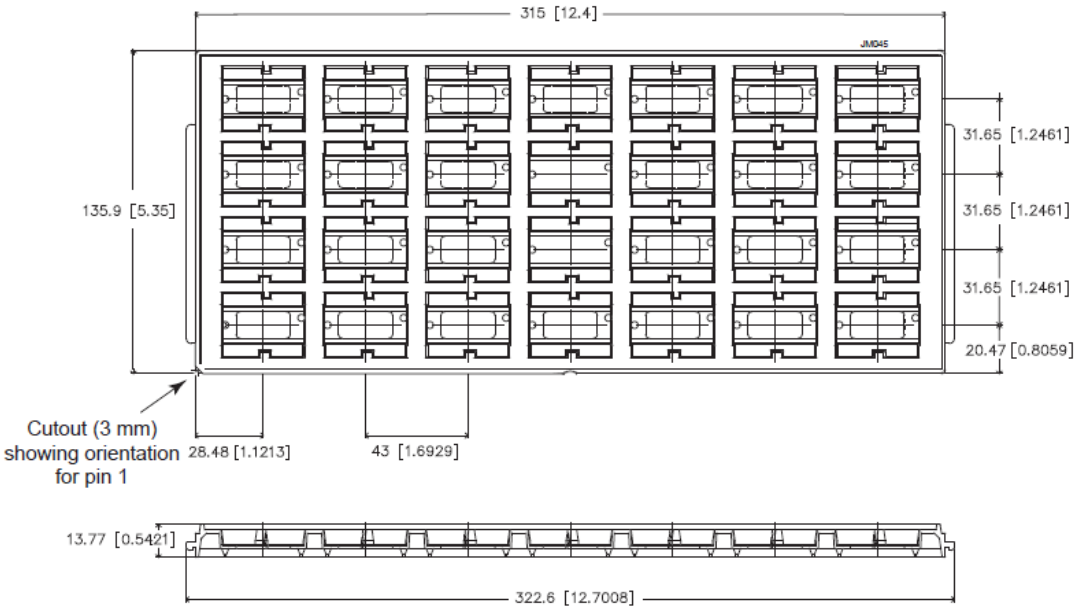
11.3 RECOMMENDED SOLDER LANDS

Dimensions in mm [inches]



11.4 PACKAGING: JEDEC TRAY

Dimensions in mm [inches]



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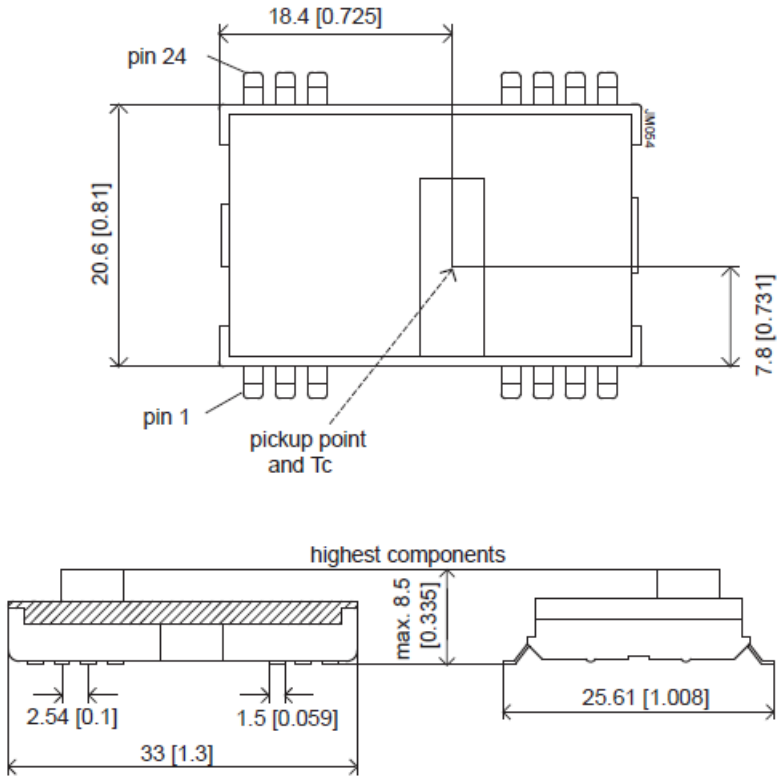
11.5 PIN ALLOCATION

PIN	FUNCTION		REFERENCE
	Single Output Models	*Dual Output Models*	
1	+Vin	+Vin	Primary
2	-Vin	-Vin	Primary
3	-Vin	-Vin	Primary
4	No pin	No pin	-
5	No pin	No pin	-
6	No pin	No pin	-
7	No pin	No pin	-
8	No pin	No pin	-
9	No Connection	No connection	Secondary
10	No Connection	Vo Return / Common	Secondary
11	-Vo	-Vo	Secondary
12	-Vo	-Vo	Secondary
13	+Vo	-Vo	Secondary
14	+Vo	+Vo	Secondary
15	+Vo	+Vo	Secondary
16	-Vo	Vo Return / Common	Secondary
17	No pin	No pin	-
18	No pin	No pin	-
19	No pin	No pin	-
20	No pin	No pin	-
21	No pin	No pin	-
22	+Vin	+Vin	Primary
23	+Vin	+Vin	Primary
24	-Vin	-Vin	Primary

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12. MECHANICAL PARAMETERS

Dimensions in mm [inches]



For more information on these products consult: tech.support@psbel.com

NUCLEAR AND MEDICAL APPLICATIONS - Products are not designed or intended for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems.
TECHNICAL REVISIONS - The appearance of products, including safety agency certifications pictured on labels, may change depending on the date manufactured. Specifications are subject to change without notice.

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