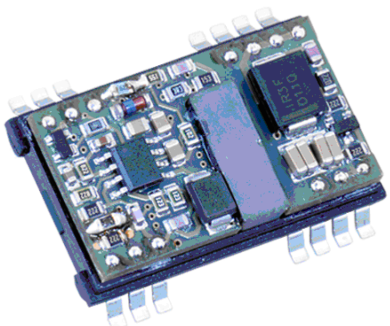


Features

- RoHS lead-free-solder and lead-solder-exempted products are 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 and UL/CSA 60950-1.

Applications

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

Description

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.

Model Selection

Single-output models

Model	Input Voltage VDC	Input Current A	Output Voltage V	Output Rated Current A	Output Ripple/Noise mV_{pp}	Typical Efficiency %
NVS01YG-M6[1]	18 – 36	0.27	5.0	1.0	50	82
NVS0.5YH-M6[1]	18 – 36	0.33	12	0.5	95	83
NVS0.4YJ-M6[1]	18 – 36	0.33	15	0.4	120	84
NVS01ZG-M6[1]	36 – 75	0.17	5.0	1.0	50	82
NVS0.5ZH-M6[1]	36 – 75	0.17	12	0.5	95	82
NVS0.4ZJ-M6[1]	36 – 75	0.17	15	0.4	120	84
NVS0.9CE-M6[1]	9 – 36	0.45	3.3	0.9	50	79
NVS0.7CG-M6[1]	9 – 36	0.55	5.0	0.7	50	81
NVS0.3CH-M6[1]	9 – 36	0.65	12	0.34	95	82
NVS0.3CJ-M6[1]	9 – 36	0.65	15	0.28	120	82
NVS0.9EE-M6[1]	18 – 75	0.33	3.3	0.9	50	80
NVS0.7EG-M6[1]	18 – 75	0.33	5.0	0.7	50	81
NVS0.3EH-M6[1]	18 – 75	0.33	12	0.34	95	82
NVS0.3EJ-M6[1]	18 – 75	0.33	15	0.28	120	82

[1] For products RoHS-compliant for all 6 substances, change the suffix -M6 to -M6G.

Dual-output models

Model	Input Voltage VDC	Input Current A	Output Voltage V	Output Rated Current A	Output Ripple/Noise mV_{pp}	Typical Efficiency, %
NVD01YGG-M6[1][1]	18 – 36	0.27	±5.0	±0.50	60	82
NVD0.5YHH-M6[1]	18 – 36	0.33	±12	±0.25	100	83
NVD0.4YJJ-M6[1]	18 – 36	0.33	±15	±0.20	120	84
NVD01ZGG-M6[1]	36 – 75	0.17	±5.0	±0.50	60	82
NVD0.5ZHH-M6[1]	36 – 75	0.17	±12	±0.25	100	83
NVD0.4ZJJ-M6[1]	36 – 75	0.17	±15	±0.20	120	84
NVD0.7CGG-M6[1]	9 – 36	0.65	±5.0	±0.35	50	81
NVD0.3CHH-M6[1]	9 – 36	0.65	±12	±0.17	95	82
NVD0.3CJJ-M6[1]	9 – 36	0.65	±15	±0.14	120	82
NVD0.2CKK-M6[1]	9 – 36	0.65	±24	±0.08	190	83
NVD0.7EGG-M6[1]	18 – 75	0.33	±5.0	±0.35	50	81
NVD0.3EHH-M6[1]	18 – 75	0.33	±12	±0.17	95	82
NVD0.3EJJ-M6[1]	18 – 75	0.33	±15	±0.14	120	82
NVD0.2EKK-M6[1]	18 – 75	0.33	±24	±0.08	190	83

[1] For products RoHS-compliant for all 6 substances, change the suffix -M6 to -M6G.

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	Max	Unit
Operating CaseTemp. (Tc)		–40	110	°C
Storage Temperature (Ts)		–55	120	°C

Environmental and Mechanical

Parameter	Conditions/Description	Min	Nom	Max	Unit
Shock	IEC68-2-27			100	g
Sinusoidal Vibration	IEC68-2-6			10	g
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		kHrs

Insulation

Parameter	Conditions/Description	Min	Nom	Max	Unit
Insulation Safety Rating	Vin = Vin.Min – Vin.Max	Basic			N/A
Electric Strength Test			1500		VDC
Insulation Resistance (Rps)		10			MΩ
Insulation Capacitance (Cps)			1100		pF

Input Data

Models with V_{in} = 9 – 36 V

Parameter	Conditions/Description	Min	Nom	Max	Unit
Input voltage (Vin) Transient Input Voltage (Vint)	Continuous Transient, 100 ms	9		36 40	V V
Input Current when Shutdown	Vin.Nom, Iout = 0 A		10	20	mA
Turn-On Time	To Output Regulation Band Rise Time		250 10	500	ms ms
Input Reflected Ripple Current	Vin.Max, Io.Max			30	mA_{pp}
Input Capacitance				0.6	μF

Models with V_{in} = 18 – 36 V

Parameter	Conditions/Description	Min	Nom	Max	Unit
Input voltage (Vin) Transient Input Voltage (Vint)	Continuous Transient, 100 ms	18		36 40	V V
Input Current when Shutdown	Vin.Nom, Iout = 0 A		10	20	mA
Turn-On Time	To Output Regulation Band Rise Time		250 10	500	ms ms
Input Reflected Ripple Current	Vin.Max, Io.Max			30	mA_{pp}
Input Capacitance				0.6	μF

Models with V_{in} = 18 – 75 V

Parameter	Conditions/Description	Min	Nom	Max	Unit
Input voltage (Vin) Transient Input Voltage (Vint)	Continuous Transient, 100 ms	18		75 100	V V
Input Current when Shutdown	Vin.Nom, Iout = 0 A		8	10	mA
Turn-On Time	To Output Regulation Band Rise Time		250 10	500	ms ms
Input Reflected Ripple Current	Vin.Max, Io.Max			30	mA_{pp}
Input Capacitance				0.3	μF

Models with V_{in} = 36 – 75 V

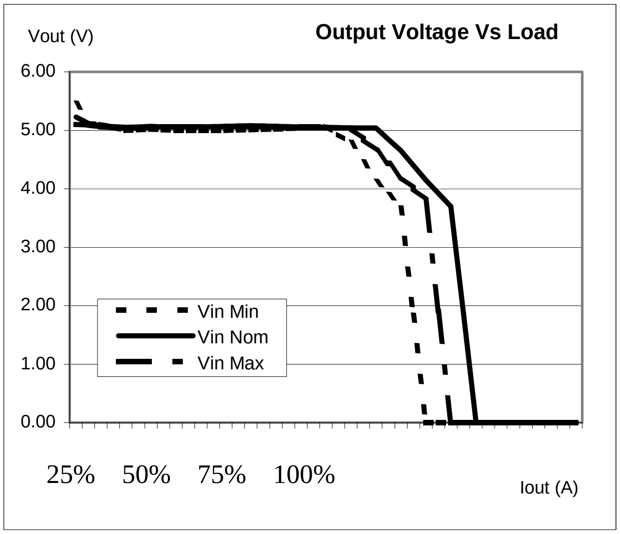
Parameter	Conditions/Description	Min	Nom	Max	Unit
Input voltage (Vin) Transient Input Voltage (Vint)	Continuous Transient, 100 ms	36		75 100	V V
Input Current when Shutdown	Vin.Nom, Iout = 0 A		8	10	mA
Turn-On Time	To Output Regulation Band Rise Time		250 10	500	ms ms
Input Reflected Ripple Current	Vin.Max, Io.Max			30	mA_{pp}
Input Capacitance				0.3	μF

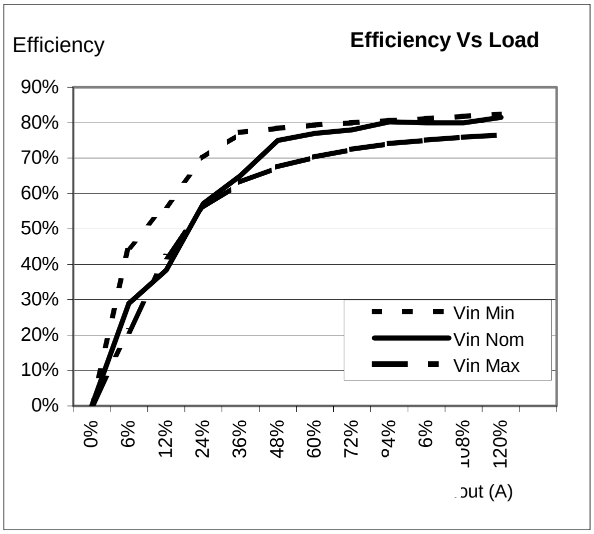
Output Data

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

Parameter	Conditions/Description	Min	Nom	Max	Unit
Output Voltage Accuracy	Vin.Nom, 50% Io.Max			±1	%Vo
Line Regulation	Vin.Min to Vin.Max, 50% Io.Max			±1	%Vo
Load Regulation	Vin.Nom, Io.Min to Io.Max 3.3 Vo Other Output Voltages			 ±4 ±3	 %Vo %Vo
Maximum Output Capacitance	Total, for single and dual outputs 3.3 Vo 5 Vo, ±5 Vo 12 Vo, ±12 Vo 15 Vo, ±15 Vo ±24 Vo			 680 680 150 100 47	 µF µF µF µF µF
Dynamic Regulation Peak Deviation Settling Time	50-100% Io.Max load step change to 1% error band			 5 1	 %Vo ms
Output Voltage Ripple	Vin.Min to Vin.Max, Io.Min to Io Max, 20 MHz Bandwidth 3.3 Vo 5 Vo, ±5 Vo 12 Vo, ±15 Vo, ±24 Vo		 50 50 0.8	 80 80 1	 mV_{pp} mV_{pp} $\%V_{o\ pp}$
Output Current Limit Threshold	Output Current Limit Threshold	120		200	%Io.Max
Switching Frequency	Vin.Nom, Io.Max		400		kHz
Temperature Coefficient				0.02	%Vo/°C

Typical Characteristic Curves for Single 5 V Output Models



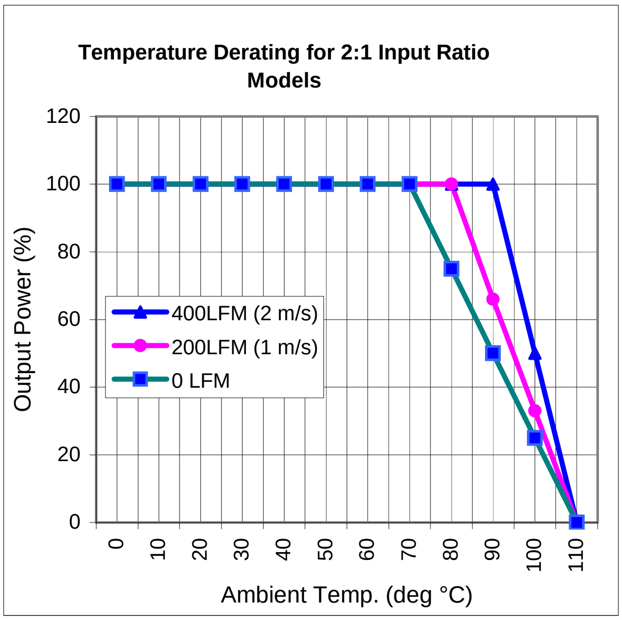


Application and Auxiliary Functions

Temperature Derating Curves

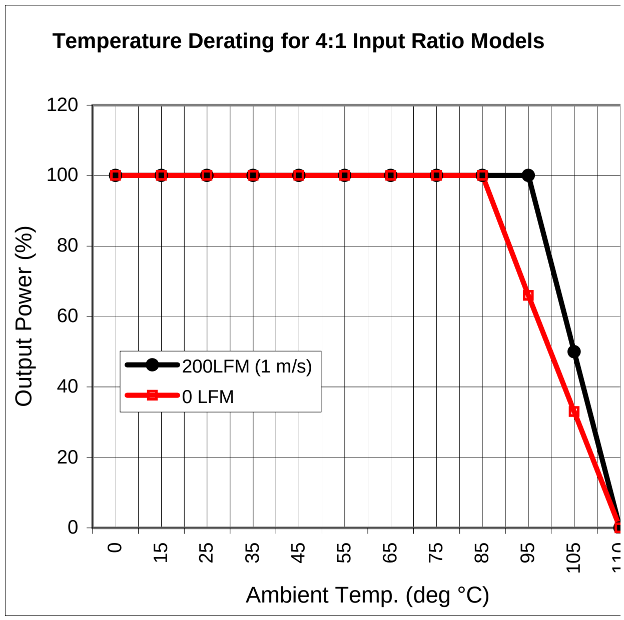
The derating curves below give an indication of the output power achievable with and without forced-air cooling. However in the final application the temperature rise of the converter is also influenced by factors such as heat conduction through the leads to the PCB, orientation, the temperature of surrounding 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 ºC ambient temperature with only convection cooling.

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



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.

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.

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).

Series Operation

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

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 safety requirements 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:

- 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:

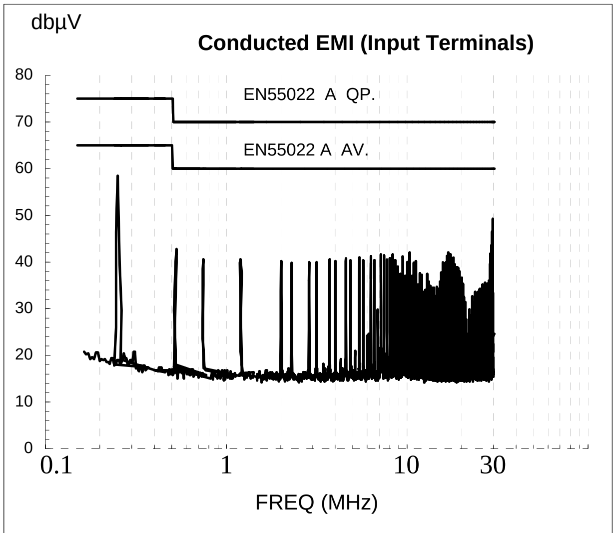
Input Voltage Range	Recommended Fuse
36 – 75V	F0.315A
18 – 36V	F0.5A
9 – -6V	F1.0A
18 – -5V	F0.5A

- The user can select a lower rating fuse based upon the inrush transient and the maximum input current of the converter, which occurs at the minimum 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.
- 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.
- 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.

EMC Specifications

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.

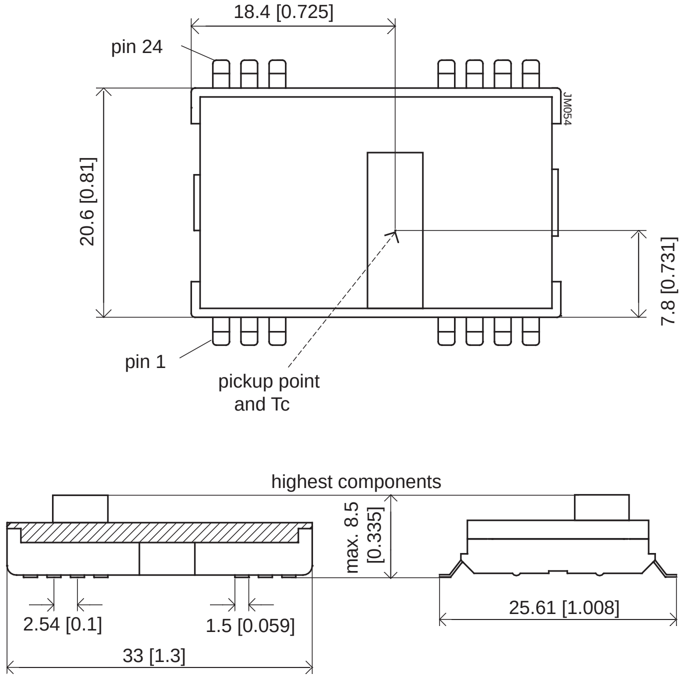
Electromagnetic Susceptibility:

Standard	Applied Stress	Class Level	Performance Criterion*
Electrostatic Discharge EN61000-4-2	2 kV to pins	1	B
Electromagnetic Field EN61000-4-3	3 V/m	2	A
Electrical Fast Transient EN61000-4-4	2000 Vp to input	3	B
Conducted Disturbances EN61000-4-6	3 VAC to input	2	B

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

Mechanical Data

Dimensions in mm [inches]



Surface Mount Assembly

Soldering

The following soldering instructions must be observed to prevent failure or significant degradation of the module performance. Power-One 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 ortho-phthalate 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 substances (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 liquidus	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)

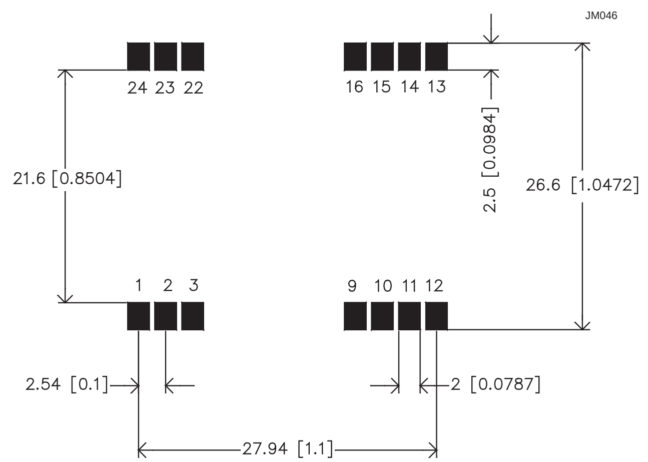
Product	Pre-heat ramp			Pre-heat soaking			Ramp to reflow	Reflow				Cooling
	From	To	Rate	From	To	Max. time	Rate	Max. time above liquidus	Max. peak temp.	Max. time within ±5 °C of peak temp.	Max. time to peak	Rate
	°C	°C	°C/s	°C	°C	s	°C	s	°C	s	s	°C/s
-M6 (Sn-Pb eutectic)	25	150	3	100	150	120	3	45	230	10	360	6
-M6G (lead-free)	25	180	3	150	200	120	3	45	260	10	480	6

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.

Recommended Solder Lands



Packaging: JEDEC tray