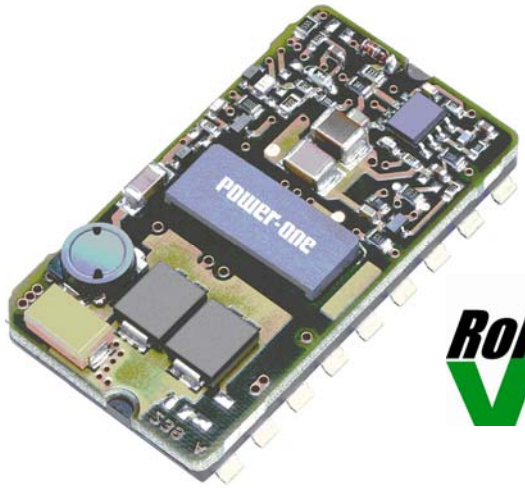
power-one®
Changing the Shape of Power



RoHS Compliant

Applications

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

Features

- RoHS lead free and lead-solder-exempt products are available
- Single board design
- Basic isolation
- Synchronization function
- Low profile – 8.5 mm height
- Excellent co-planarity
- Input-to-output isolation: 1500 VDC
- Convection cooling
- Low conducted and radiated EMI
- Output overcurrent protection
- Remote on/off (primary referenced)
- Wide output voltage trim adjust, positive or negative
- Operating temperature to 110 °C
- UL, CSA, and EN/IEC60950 (3rd ed.) approved

Description

The RND Series of converters are industry standard, 2” x 1” size, low profile, dual output, DC-DC converters intended for SMT placement and reflow soldering. The product provides onboard conversion of standard telecom, datacom and industrial input voltages to isolated low output voltages without the need for any additional cooling. Proprietary patented manufacturing process ensures optimal quality through full process automation. The converters are cost effective high performance alternatives to competing products on the market.

Model Selection

Model	Input Voltage, VDC	Input Current, max ADC	Output Voltage, VDC	Output Rated Current, ADC	Output Ripple/Noise, mV p-p	Typical Efficiency, %
RND02ZGE-M6	38-75	0.4	+ 3.27	1.0	50	81
			+ 5.20	1.0		
RND02ZGG-M6	38-75	0.4	± 5.10	± 1.0	50	81
RND0.8ZHH-M6	36-75	0.4	± 12.0 / ±15.0*	± 0.42	50	85

*Output voltage with trim adjustment

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. Specifications apply over specified input voltage, output load and temperature range, unless otherwise noted.

Parameter	Conditions/Description	Min	Max	Units
Input voltage (Vin) Transient Input Voltage (Vint)	Continuous Transient, 100 ms	(36) 38	75 100	VDC VDC
Operating CaseTemp. (Tc)	All operating conditions	-45	110	°C
Storage Temperature (Ts)		-55	125	°C
ON/OFF Control Voltage (Vrc)	Referenced to -Vin	-5	16	VDC

Environmental and Mechanical Specifications

Parameter	Conditions/Description	Min	Nom	Max	Units
Shock	IEC68-2-27			100	g
Sinusoidal Vibration	IEC68-2-6			10	g
Weight				0.6/17	oz/g
Water Washing	Standard process		Yes		
MTBF	Per Bellcore TR-NWT-000332 (100% load @25 °C, GB)		4,132		kHr

Isolation Specifications

Parameter	Conditions/Description	Min	Nom	Max	Units
Insulation Safety Rating			Basic		
Isolation Voltage (Vps)				1,500	VDC
Isolation Resistance (Rps)		10			MΩ
Isolation Capacitance (Cps)			2,200		pF

Input Specifications

Parameter	Conditions/Description	Min	Nom	Max	Units
Input Voltage (Vin)	Continuous	36 (38)	48	75	VDC
Input Current when Shutdown	Vin.Nom, Rem. Cont. activated			3	mADC
Input Current No Load	Vin.Nom, Io = 0			10	mADC
Turn-On Input Voltage (-ZGG)	Ramping Up, Io.Max	27.5	29	31.5	VDC
Turn-Off Input Voltage (-ZGG)	Ramping Down, Io.Max	26.5	28	30.5	
Turn-On Input Voltage (-ZHH)	Ramping Up, Io.Max	32	34.5	36	VDC
Turn-Off Input Voltage (-ZHH)	Ramping Down, Io.Max	30	33.5	35	
Turn-On Input Voltage (-ZGE)	Ramping Up, Io.Max	34	36.5	38	VDC
Turn-Off Input Voltage (-ZGE)	Ramping Down, Io.Max	30	34.5	36	
Turn-On Time	To Output Regulation Band After Remote Control Rise Time		250 25 5	400	ms ms ms
Input Reflected Ripple Current	Vin.Max, Io.Max			30	mAp-p
Input Capacitance				1.4	µF

Output Specifications

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

RND02ZGE: (Vo1) 5.2V/1.0A

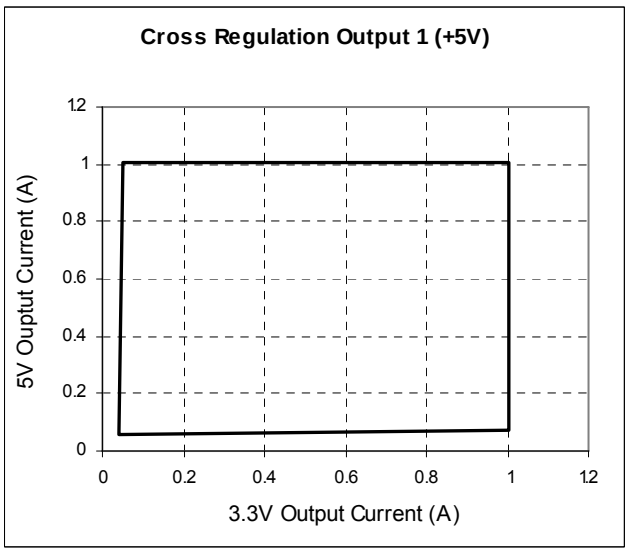
Parameter		Conditions/Description	Min	Nom	Max	Units
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io1 = 0.6 A, Io2 = 0.9 A, 25 °C	5.08	5.2	5.24	VDC
Output Current *	Io	Vin.Min to Vin.Max	0.1		1.0	ADC
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max			50	mV
Load Regulation		Vin.Nom, Io.Min to Io.Max		120	220	mV
Cross Regulation		Io1 =1.0A, Io2 Min to Max, measure ΔVo1			130	mV
Dynamic Regulation Peak Deviation Settling Time		25-75% Io.Max load step change. to 1% error band			 200 300	 ± mV µs
Output Voltage Ripple		Vin.Min to Vin.Max, Io.Min to Io Max, 20 MHz Bandwidth		50	100	mVp-p
Admissible Load Cap.		Io.Max, Vin.Nom			2,200	µF
Output Current Limit Threshold		Vout ≤0.90 Vo.Nom, both outputs set to Icl	110		150	%Io.Max
Switching Frequency		Vin.Nom, Io.Max		380		kHz
Temperature Coeff.					0.02	%Vo/°C
Trim Range		Io.Min to Io.Max, Vin.Min to Vin.Max	4.43		5.95	Vo

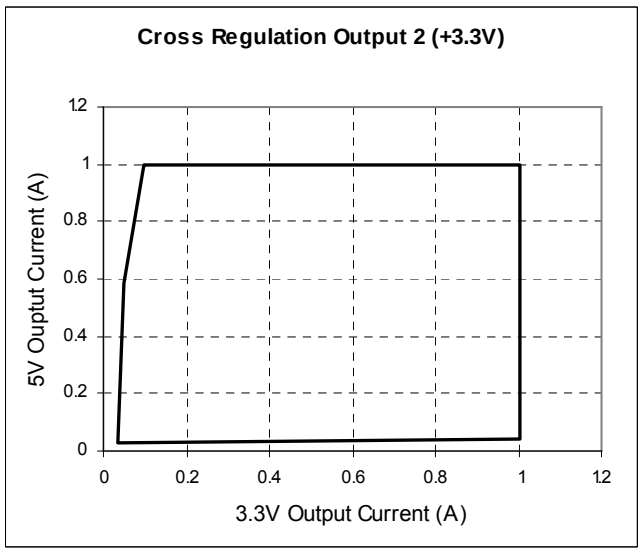
RND02ZGE: (Vo2) 3.27V/1.0A

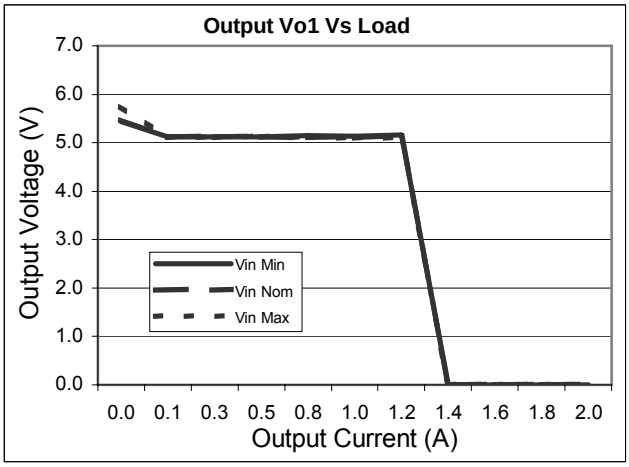
Parameter		Conditions/Description	Min	Nom	Max	Units
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io1 = 0.6 A, Io2 = 0.9 A, 25 °C	3.24	3.27	3.3	VDC
Output Current *	Io	Vin.Min to Vin.Max	0.1		1.0	ADC
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max			40	mV
Load Regulation		Vin.Nom, Io.Min to Io.Max		100	210	mV
Cross Regulation		Io2 =1.0A, Io1 Min to Max, measure ΔVo2			90	mV
Dynamic Regulation Peak Deviation Settling Time		25-75% Io.Max load step change. to 1% error band			 200 300	 ± mV µs
Output Voltage Ripple		Vin.Min to Vin.Max, Io.Min to Io Max, 20 MHz Bandwidth		50	100	mVp-p
Admissible Load Cap.		Io.Max, Vin.Nom			3,300	µF
Output Current Limit Threshold		Vout ≤0.90 Vo.Nom, both outputs set to Icl	110		150	%Io.Max
Switching Frequency		Vin.Nom, Io.Max		380		kHz
Temperature Coeff.					0.02	%Vo/°C
Trim Range		Io.Min to Io.Max, Vin.Min to Vin.Max	2.8		3.8	Vo

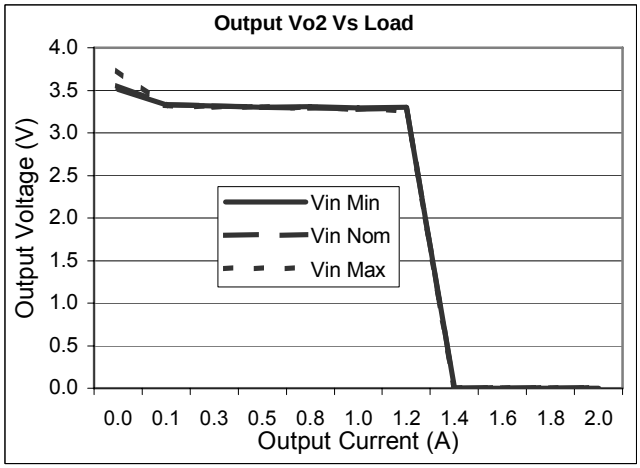
* At Iout<Iout.Min, the output may contain low frequency component that exceeds ripple specifications.

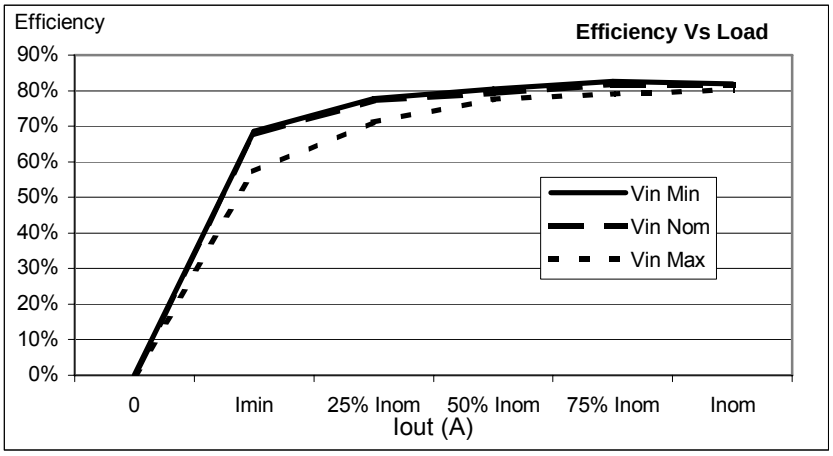
RND02ZGE Typical Characteristic Curves











Output Specifications

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

Note:- Maximum output power is 9W

RND02ZGG: (Vo1) +5.1V/0.75A

Parameter		Conditions/Description	Min	Nom	Max	Units
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io1=Io2 = 0.3 A, 25 °C	5.06	5.1	5.14	VDC
Output Current *	Io	Vin.Min to Vin.Max	0.1	0.75	1.00	ADC
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max			40	mV
Load Regulation		Vin.Nom, Io.Min to Io.Nom		100	250	mV
Cross Regulation		Io1 = 0.5A, Io2 Min to Nom, measure ΔVo2			100	mV
Dynamic Regulation Peak Deviation Settling Time		25-75% Io.Max load step change. to 1% error band			 250 200	 ± mV µs
Output Voltage Ripple		Vin.Min to Vin.Max, Io.Min to Io Max, 20 MHz Bandwidth		50	100	mVp-p
Admissible Load Cap.		Io.Max, Vin.Nom			2,200#	µF
Output Current Limit Threshold		Vout ≤0.90 Vo.Nom, both outputs set to Icl	110		150	%Io.Max
Switching Frequency		Vin.Nom, Io.Max		400		kHz
Temperature Coeff.					0.02	%Vo/°C
Trim Range		Io.Min to Io.Max, Vin.Min to Vin.Max	4.0		7.0	Vo

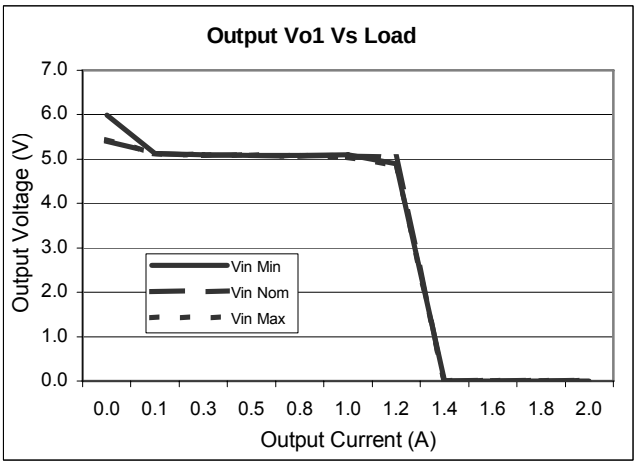
RND02ZGG: (Vo2) -5.1V/0.75A

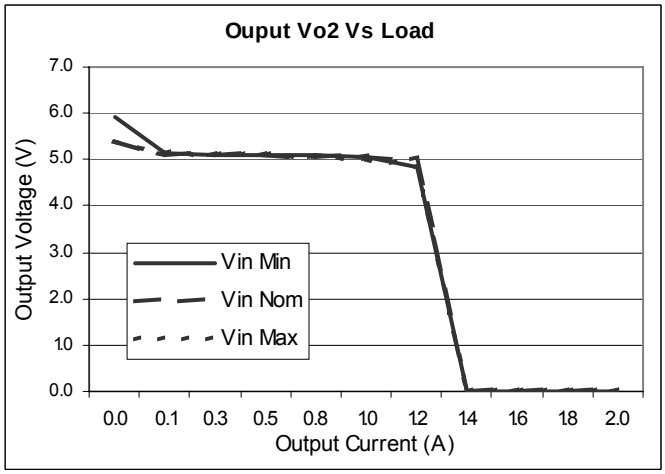
Parameter		Conditions/Description	Min	Nom	Max	Units
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io1 =Io2 = 0.3 A, 25 °C	-5.06	-5.10	-5.14	VDC
Output Current *	Io	Vin.Min to Vin.Max	0.1	0.75	1.0	ADC
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max			40	mV
Load Regulation		Vin.Nom, Io.Min to Io.Nom		100	250	mV
Cross Regulation		Io2 = 0.5 A, Io1 Min to Max, measure ΔVo1			100	mV
Dynamic Regulation Peak Deviation Settling Time		25-75% Io.Max load step change. to 1% error band			 250 200	 ± mV µs
Output Voltage Ripple		Vin.Min to Vin.Max, Io.Min to Io Max, 20 MHz Bandwidth		50	100	mVp-p
Admissible Load Cap.		Io.Max, Vin.Nom			2,200#	µF
Output Current Limit Threshold		Vout ≤0.90 Vo.Nom, both outputs set to Icl	110		150	%Io.Max
Switching Frequency		Vin.Nom, Io.Max		400		kHz
Temperature Coeff.					0.02	%Vo/°C
Trim Range		Io.Min to Io.Max, Vin.Min to Vin.Max	-4.0		-7.0	Vo

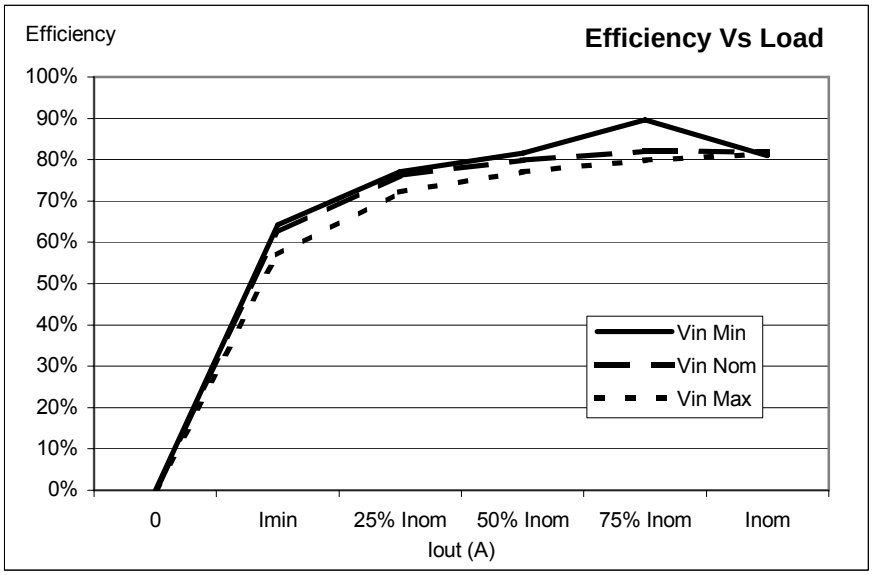
* At Iout<Iout.Min, the output may contain low frequency component that exceeds ripple specifications.

2,200µF on each output

RND02ZGG Typical Characteristic Curves







Output Specifications

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

RND0.8ZHH: (Vo1) +12.0V/0.42A

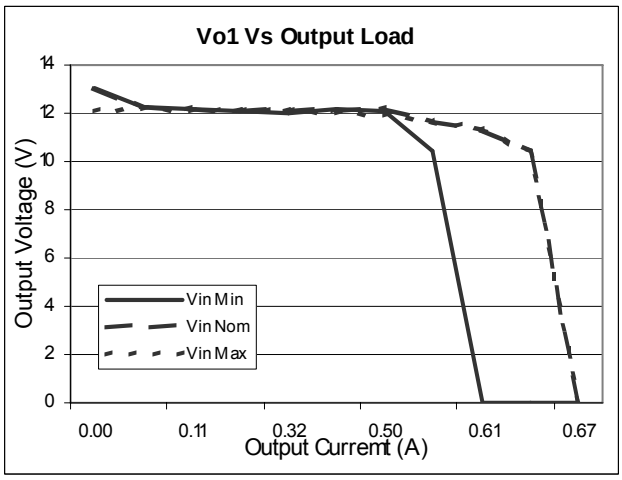
Parameter		Conditions/Description	Min	Nom	Max	Units
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io = 0.3 A, 25 °C	11.82	12.00	12.18	VDC
Output Current *	Io	Vin.Min to Vin.Max	0.042		0.42	ADC
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max			90	mV
Load Regulation		Vin.Nom, Io.Min to Io.Max		100	170	mV
Cross Regulation		Io1 = 0.42 A, Io2 Min to Max, measure ΔVo2			60	mV
Dynamic Regulation Peak Deviation Settling Time		25-75% Io.Max load step change. to 1% error band			 400 300	 ± mV µs
Output Voltage Ripple		Vin.Min to Vin.Max, Io.Min to Io Max, 20 MHz Bandwidth		40	100	mVp-p
Admissible Load Cap.		Io.Max, Vin.Nom			100**	µF
Output Current Limit Threshold		Vout ≤0.90 Vo.Nom, both outputs set to Icl	110		150	%Io.Max
Switching Frequency		Vin.Nom, Io.Max		400		kHz
Temperature Coeff.					0.02	%Vo/°C
Trim Range		Io.Min to Io.Max, Vin.Min to Vin.Max	9.0		15.0	Vo

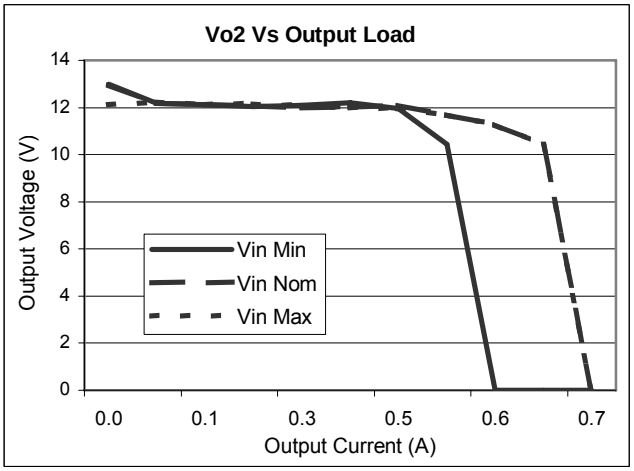
RND0.8ZHH: (Vo2) -12.0V/0.42A

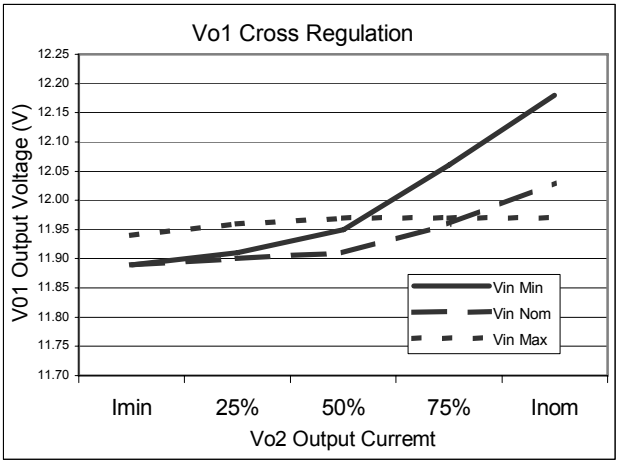
Parameter		Conditions/Description	Min	Nom	Max	Units
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io = 0.3 A, 25 °C	-11.82	-12.00	-12.18	VDC
Output Current *	Io	Vin.Min to Vin.Max	0.042		0.42	ADC
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max			90	mV
Load Regulation		Vin.Nom, Io.Min to Io.Max		100	170	mV
Cross Regulation		Io1 = 0.42A, Io2 Min to Max, measure ΔVo2			60	mV
Dynamic Regulation Peak Deviation Settling Time		25-75% Io.Max load step change. to 1% error band			 400 300	 ± mV µs
Output Voltage Ripple		Vin.Min to Vin.Max, Io.Min to Io Max, 20 MHz Bandwidth		40	100	mVp-p
Admissible Load Cap.		Io.Max, Vin.Nom			100**	µF
Output Current Limit Threshold		Vout ≤0.90 Vo.Nom, both outputs set to Icl	110		150	%Io.Max
Switching Frequency		Vin.Nom, Io.Max		400		kHz
Temperature Coeff.					0.02	%Vo/°C
Trim Range		Io.Min to Io.Max, Vin.Min to Vin.Max	-9.0		-15.0	Vo

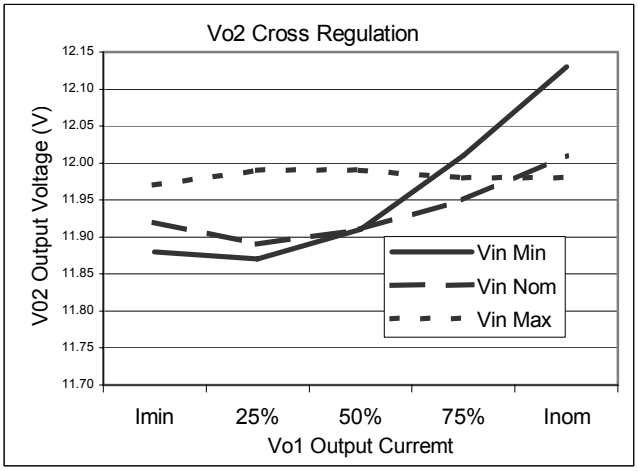
* At Iout<Iout.Min, the output may contain low frequency component that exceeds ripple specifications.
** 100µF on each output

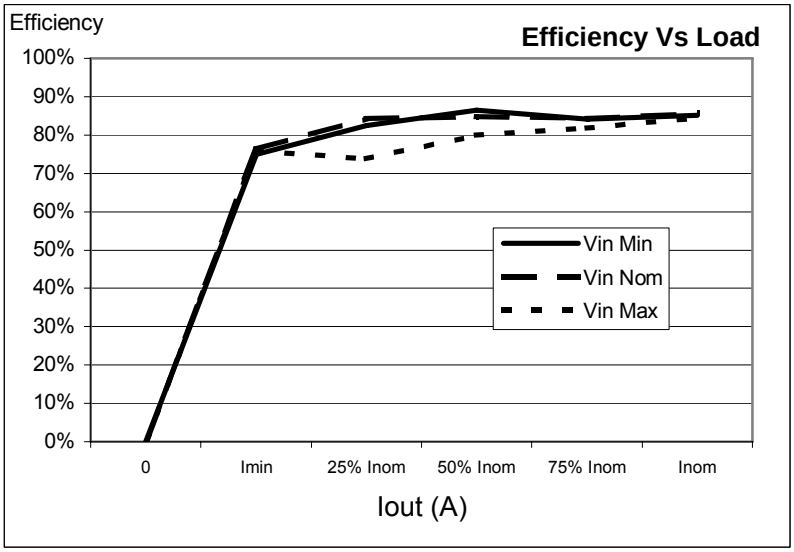
RND0.8ZHH Typical Characteristic Curves











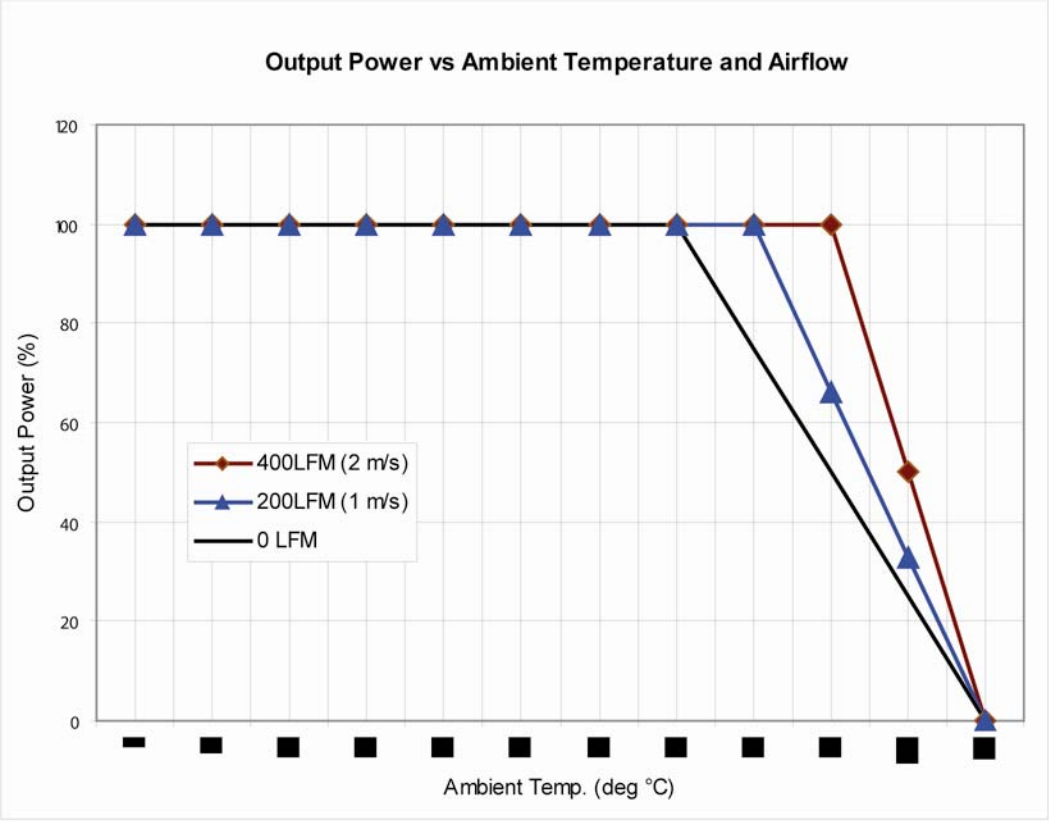
Feature Specifications

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

Parameter	Conditions/Description	Min	Nom	Max	Units
Remote Control:					
Converter OFF	RC pin is pulled low	-1.0		1.0	VDC
Converter ON	Voltage source or open circuit	4.0		6	VDC
Sink Current	Vin=Vin.Nom		0.3		mADC
[RND0.8ZHH model only]					
Synchronization:					
Frequency Range	TTL compatible square wave on sync pin. Referenced to -Vin	450		600	kHz

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, in order to ensure the reliability of the unit, care must be taken to ensure the maximum case temperature is not exceeded under any conditions.



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 stabilise the input voltage. A minimum of 1 µF, quality electrolytic / ceramic capacitor is recommended for this purpose. For output decoupling it is recommended to connect, directly across the output pins, a 1 µF ceramic capacitor (for 3.3 V and 5 V outputs) or a 0.27 µF ceramic capacitor (for 12 V outputs).

Synchronization Feature

It is possible to synchronize the switching frequency of one or more converters to an external symmetrical clock signal. It is recommended that the signal be driven by a TTL compatible output. The rise time of the clock signal should be less than 10 ns. If the synchronization feature is not used, it should be left open circuit.

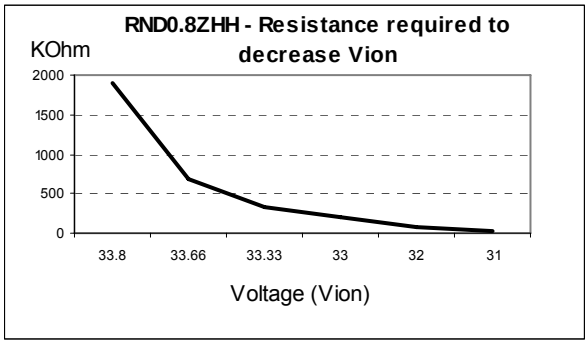
Turn-On Input Voltage

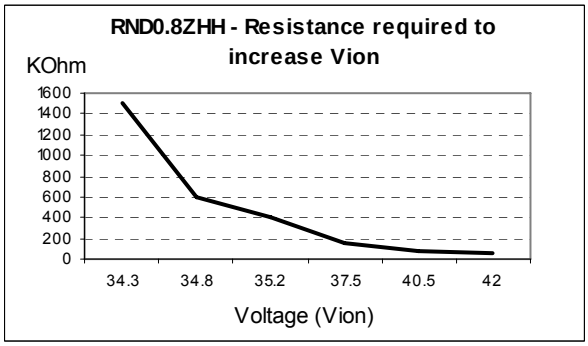
An external resistor can program the input voltage at which the converter switches on. The voltage at which the unit switches off is typically 1 V below the turn-on input voltage (Vion).

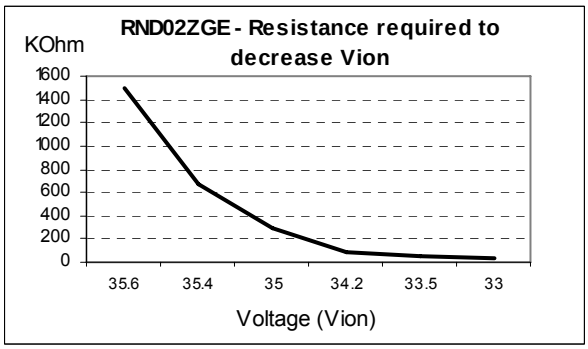
The characteristic curves below shows the typical resistor values required to achieve adjustment of turn-on input voltage (Vion).

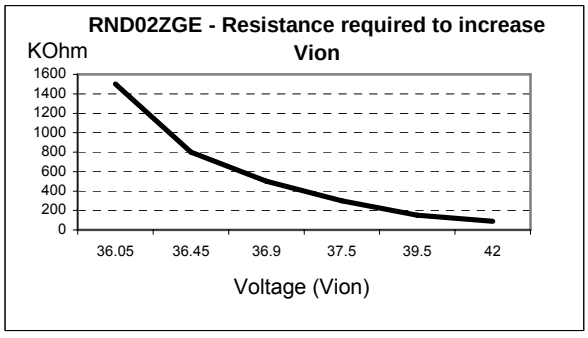
To **decrease** Vion the resistor should be connected between pins 10 and 11.

To **increase** Vion the resistor should be connected between pins 11 and 17.









Output Voltage Trim

Note: For setting nominal output voltage pin 8 must be connected to pin 9.

The trim feature allows the user to adjust the output voltage from the nominal. This can be used to accommodate a different requirement or to do production margin testing.
Output voltage can be adjusted by an external resistor. If pin 8 and pin 9 are not connected together the output will decrease to a low value. To increase Vo a resistor should be connected between pin 8 / 9 and pin 17 (-Vin). To decrease Vo, a resistor should be connected between pin 8 and 9 (NOR).

To **increase** Vo:

Radj = A x (B - Vd) / (Vd - Vo), kΩ
Where: Vd = Desired output voltage
Vo = Nominal output voltage.

To **reduce** Vo:

Radj = C x (Vo - Vd) / (Vd - D), kΩ
Where: Vd = Desired output voltage
Vo = Nominal output voltage.

Model	A	B	C	D
RND02ZGE	0.5	3.92	2.0	2.56
RND02ZGG	0.5	7.1	2.243	3.7
RND0.8ZHH	0.572	16.126	2.243	8.295

Notes:
1. When the output voltage is trimmed up, the output power from the converter must not exceed its maximum rating. This is determined by measuring the output voltage on the output pins, and multiplying it by the output current.

2. The trim feature allows the generation of additional standard voltages such as ±15 V from the ±12 V model.

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%).

Output Current Limiting

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.

Thermal Considerations

The converter is designed for natural or forced convection cooling. The output power of the converter is limited by the maximum case temperature (Tc). To ensure reliable long term operation of the converters, and to comply with safety agency requirements, Power-One limits maximum allowable case temperature (Tc) to 110 °C (see Mechanical Drawings).

Remote Control Feature

The remote control pin functions as a normal soft shutdown. It is referenced to the –Vin pin. With positive logic, when the remote control pin is pulled low, the output is turned off and the unit goes into a very low input power mode.

An open collector switch is recommended to control the voltage between the remote control pin and -Vin pin of the converter. The remote control pin is pulled up internally, so no external voltage source is required. The user should avoid connecting a resistor between the remote control pin and the +Vin pin.

The user must take care to ensure that the pin reference for the control is connected close to -Vin pin. The control signal must not be referenced ahead of EMI filtering, or remotely from the unit. If the remote control pin is not used, it can be left floating.

Safety Considerations

These converters feature 1500 VDC isolation from input to output. The input-to-output resistance is greater than 10MΩ. These converters are provided with Basic Insulation between input and output circuits according to EN60950 / UL1950 / CSA60950-00. 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. These documents include UL60950, CSA60950-00 and EN60950, although specific applications may have additional requirements.

In order for the output of the converter to be considered as SELV (Safety Extra Low Voltage) or TNV-1, according to EN60950 / UL1950 / CSA60950-00, one of the following requirements must be met in the system design:

- The converter has no internal fuse. An external fuse must be provided to protect the system from catastrophic failure. A fuse with a rating not greater than 2.0 A is recommended. 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, the output of the converter is considered SELV and may be grounded or ungrounded.

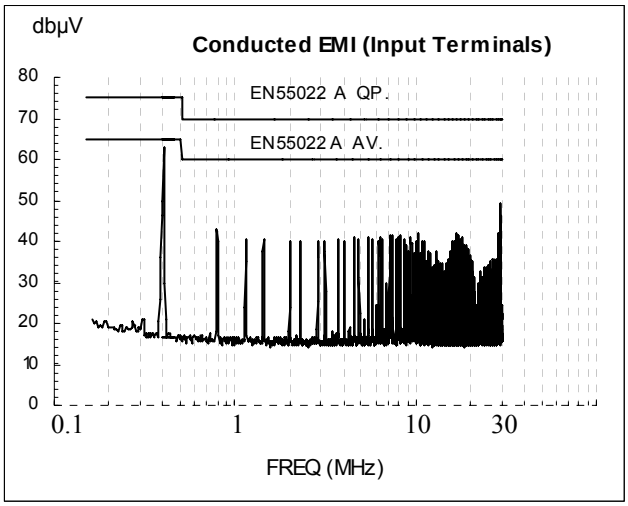
- The circuitry on the converter carry transients, which exceed the input voltage. Even if the input voltage is SELV (<60V) the components on the primary side of the converter may have to be considered as hazardous. A safety interlock may be needed to prevent the user from accessing the converter while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

EMC Specifications

Conducted Noise:

The converters meet the requirements of EN55022, CISPR22 and FCC CFR title 47 part 15 Sub-part J - Conducted (conducted noise on the input terminals) without any external components. The results for this solution are displayed below.

To meet level 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 Outcome *
Electrostatic Discharge EN61000-4-2	2 kV to pins	1	B
Electromagnetic Field EN61000-4-3	3V/m	2	A
Electrical Fast Transient EN61000-4-4	2000 Vp to input	3	B
Conducted Disturbances EN61000-4-6	3Vrms to input	2	B

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

Surface Mount Assembly

Soldering:

The following instructions must be observed when soldering the unit. Failure to observe these instructions may result in failure or significant degradation of the module performance. Power-One will not honor any warranty claims arising from failure to observe these instructions.

This product is approved for forced convection reflow soldering only.

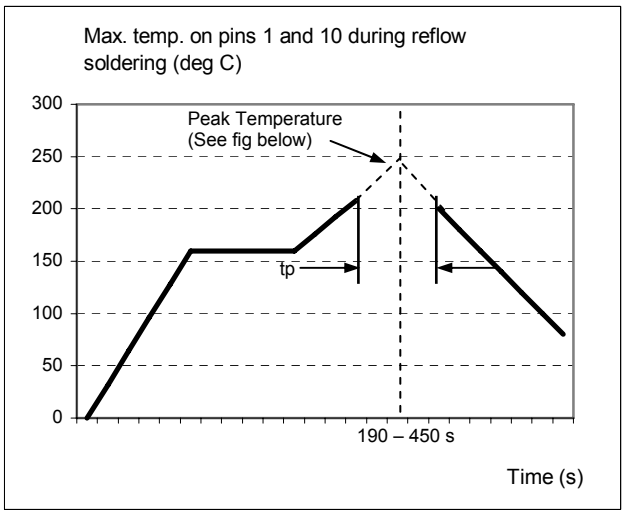
The curves below define the maximum peak reflow temperature permissible measured on Pins 1 and 10 of the converter.

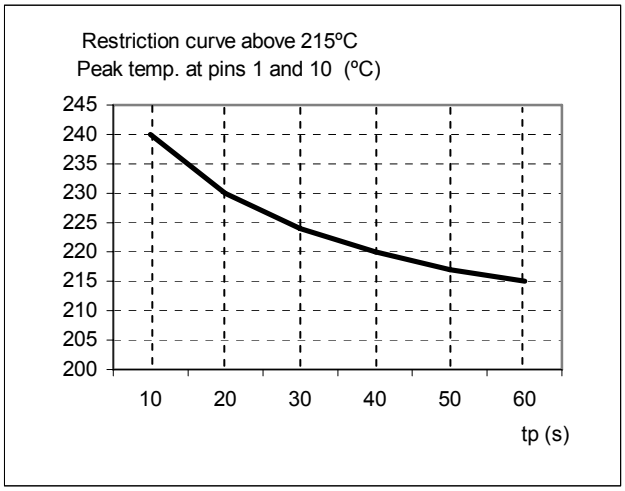
The lead-frame is constructed for a high temperature glass filled, UL94V0 flame retardant, diallyl ortho-phthalate moulding compound commonly used for packaging of electronics components. It has passed NASA outgassing tests and is certified to MIL-M-14. The coefficient of thermal expansion is equivalent 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 Cu and Sn 90. 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.



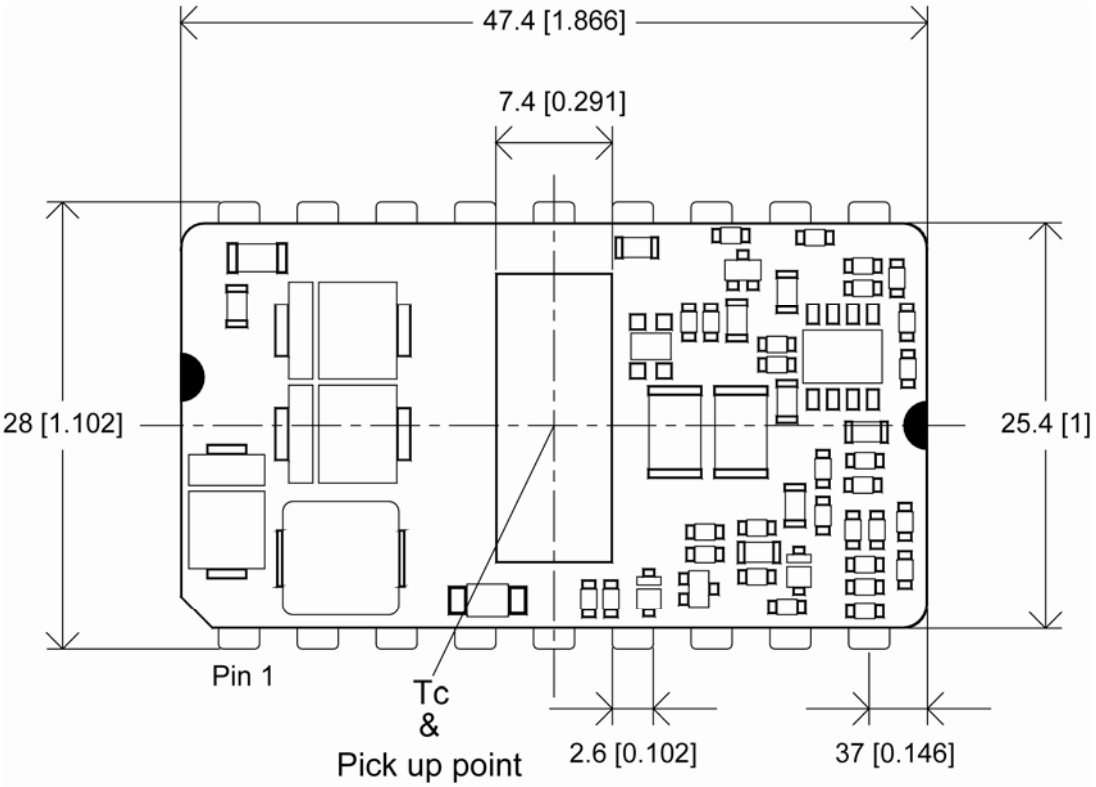


Pick & Place Assembly:

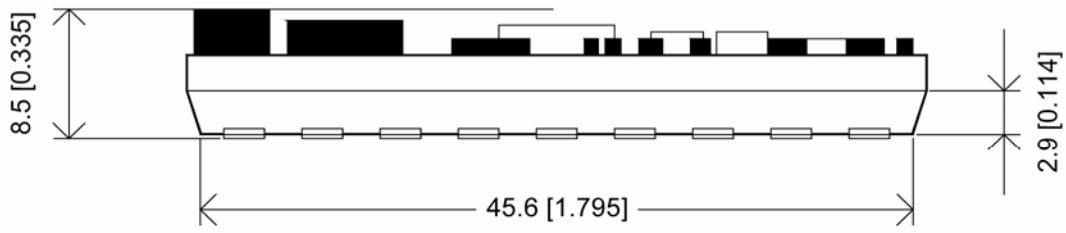
The product is designed with a large flat area in the center of the top surface to serve as a pick up point for automated vacuum pick and place equipment. The 'open board' construction of the unit ensures that weight is kept to a minimum. However due to the relatively large size of the component, a large nozzle (> 8.0 mm, 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.

Mechanical Drawing

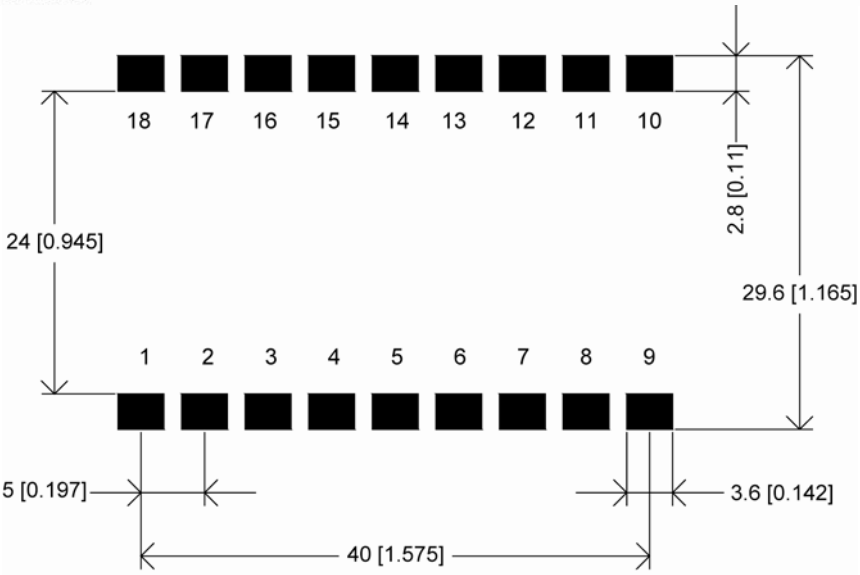
Note:- mm[inches]
Tolerances: -
0.5-10 ±0.1
10-100 ±0.2



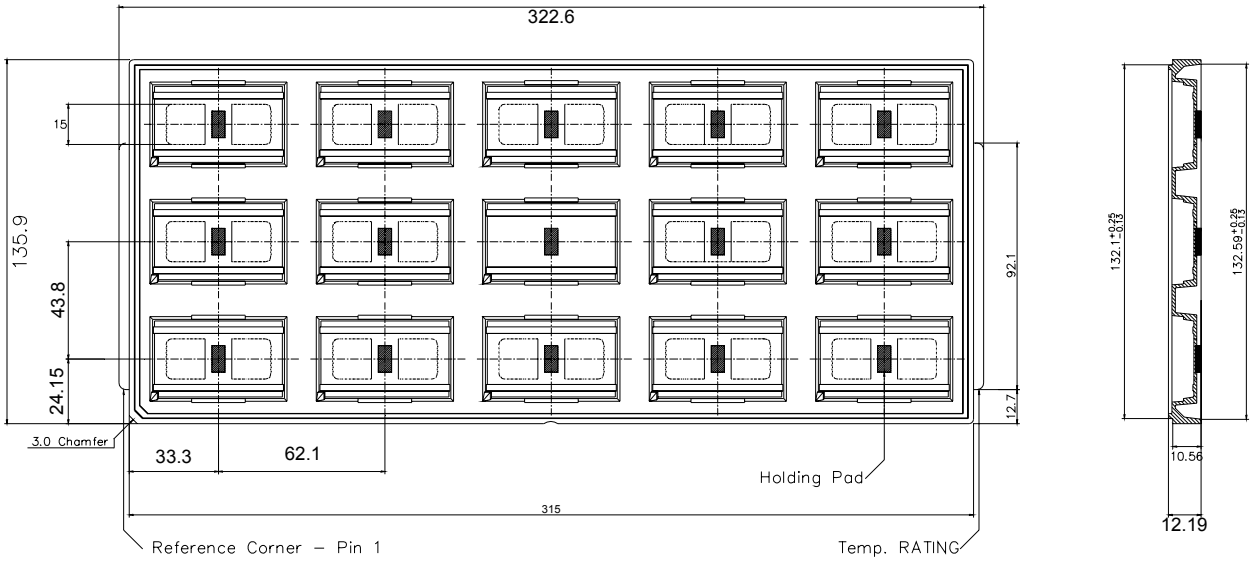
Top View



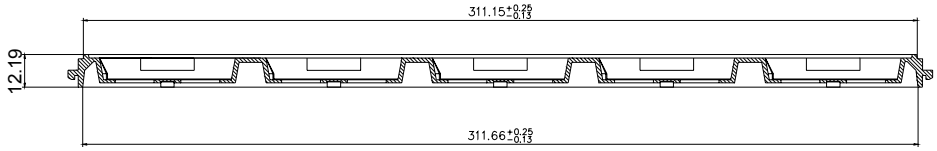
Height Profile



Recommended land pattern



JEDEC TRAY



Pinout

Pin	Designation	Function	Reference
1	Vout1	Output voltage 1 (positive)	Secondary
2	Rtn	Output voltage return	Secondary
3	Vout2	Output voltage 2	Secondary
4	NC	Not connected	Secondary
5	NC	Not connected	Secondary
6	NC	Not connected	Primary
7	Sync	Synchronization input	Primary
8	Trim	Output voltage adjust **Note: - To set nominal output voltage connect pins 8 and 9 together**	Primary
9	NOR	Connection for nominal output voltage	Primary
10	TOA	Turn-on/off input voltage adjust	Primary
11	RC	Remote control. Pull low to turn unit off	Primary
12	NC	Not connected	Primary
13	NC	Not connected	Primary
14	NC	Not connected	Primary
15	NC	Not connected	Primary
16	NC	Not connected	Primary
17	-Vin	Negative input voltage	Primary
18	+Vin	Positive input voltage	Primary

Ordering Information

Options	Suffixes to add to part number
RoHS lead-solder exempt compliant [1]	No RoHS suffix character required
RoHS compliant for all six substances	Add "G" as the last character of the part number.

[1] The solder exemption refers to all the restricted materials except lead in solder.