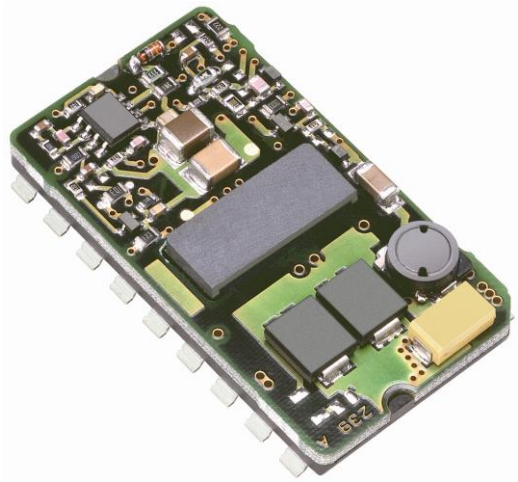
RNS / RND Series

DC-DC Converters

The RNS / RND Series of converters are industry standard, 2 × 1” size, low profile, single- and double-output DC-DC converters intended for SMT placement and reflow soldering.

The product provides onboard conversion of a wide range 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.



RoHS Compliant

Key Features & Benefits

- RoHS lead-free and lead-solder-exempt products are available
- Single- and double-output models
- Basic isolation
- 1500 VDC I/O electric strength test voltage
- Synchronization function
- Low profile – 8.5 mm height
- Excellent co-planarity
- Convection cooling
- Low conducted and radiated EMI
- Wide input range
- Output overcurrent protection
- Remote on/off (primary referenced)
- Output voltage trim adjust, positive or negative
- Operating temperature up to 110°C
- Approved to the latest edition of the following standards: UL/CSA60950-1, IEC60950-1 and EN60950-1

Applications

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

1. MODEL SELECTION

1.1 SINGLE-OUTPUT MODELS

MODEL[1]	INPUT VOLTAGE VDC	MAX INPUT CURRENT A	OUTPUT VOLTAGE V	OUTPUT RATED CURRENT A	OUTPUT RIPPLE/NOISE mV_{PP}	TYPICAL EFFICIENCY %
RNS01EE-M6	18 – 72	0.5	3.30	1.5	25	78
RNS03ZE-M6	38 – 75	0.4	2.50 [2] / 3.30	3.0	50	79
RNS01EG-M6	18 – 72	0.5	5.05	1.2	25	79
RNS02ZG-M6	38 – 75	0.4	5.05	2.0	50	83
RNS0.9ET-M6	18 – 72	0.5	7.00	0.9	25	80
RNS0.6ZH-M6	38 – 75	0.3	12.0 / 15.0 [2]	0.6	40	83

1.2 DOUBLE-OUTPUT MODELS

MODEL[1]	INPUT VOLTAGE VDC	MAX. INPUT CURRENT A	OUTPUT VOLTAGE V	OUTPUT RATED CURRENT A	OUTPUT RIPPLE/NOISE mV_{PP}	TYPICAL EFFICIENCY %
RND02ZGE-M6	38 – 75	0.4	+3.27 +5.20	1.0 1.0	50	81
RND02ZGG-M6	38 – 75	0.4	±5.10	± 1.0	50	81
RND0.8ZHH-M6	36 – 75	0.4	±12.0 / ±15.0 [2]	± 0.42	50	85

2. ABSOLUT 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 specified input voltage, output load and temperature range, unless otherwise noted.

PARAMETER	CONDITIONS / DESCRIPTION	MIN	MAX	UNIT
Input voltage (Vin)	Continuous RNS01EE/RNS01EG/RNS0.9ET All other models	(18) 38	(72) 75	VDC VDC
Transient input voltage (Vint)	Transient, 100 ms		100	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	V

3. ENVIRONMENTAL AND MECHANICAL SPECIFICATIONS

PARAMETER	CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
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 at 25 °C,GB)		4590		1000 h

1 Add G to the end of the part number for products, which comply to RoHS for all 6 substances.
2 Output voltage adjusted using the trim function.

4. ISOLATION SPECIFICATIONS

PARAMETER	CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
Insulation Safety Rating			Basic insulation		
Electriic strength test voltage			1500		VDC
Insulation Resistance (Rps)		10			MΩ
Insulation Capacitance (Cps)			2200		pF

5. INPUT SPECIFICATIONS

5.1 SINGLE-OUTPUT MODELS

PARAMETER	CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
Input Voltage (Vin)	Continuous (4:1 input range) Continuous standard input range	(18) 38	(48) 48	(72) 75	VDC
Input current when shut down	Vin.Nom, Remote Control activated			3	mA
Input Current No Load	Vin.Nom, Io = 0 (4:1 range) Vin.Nom, Io = 0 std input range			(30) 10	mA
Turn-On Input Voltage **18-72** Vin	Ramping Up, Io.Max	16.5	17.5	18	V
Turn-Off Input Voltage **18-72** Vin	Ramping Down, Io.Max	15.5	16	16.5	
Turn-On Input Voltage **38-75** Vin	Ramping Up, Io.Max	34	36	38	V
Turn-Off Input Voltage **38-75** Vin	Ramping Down, Io.Max	30	33	36	
Turn-On Time	To Output Regulation Band After Remote Control Rise Time		250 25 5	400	ms
Input Reflected Ripple Current	Vin.Max, Io.Max			30	mAp-p
Input Capacitance				1.4	µF

5.2 DOUBLE-OUTPUT MODELS

PARAMETER	CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
Input Voltage (Vin)	Continuous	36 (38)	48	75	VDC
Input Current when Shutdown	Vin.Nom, Rem. Cont. activated			3	mA
Input Current No Load	Vin.Nom, Io = 0			10	mA
Turn-On Input Voltage (-ZGG)	Ramping Up, Io.Max	27.5	29	31.5	V
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	V
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	V
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
Input Reflected Ripple Current	Vin.Max, Io.Max			30	mAp-p
Input Capacitance				1.4	µF

6. OUTPUT SPECIFICATIONS

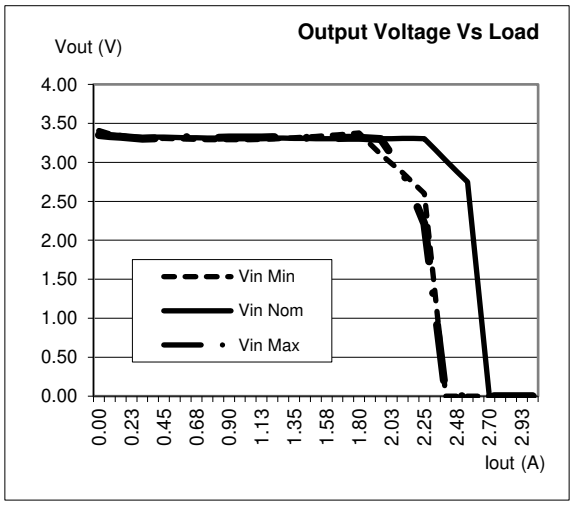
6.1 RNS01EE: 3.3 V / 1.5 A

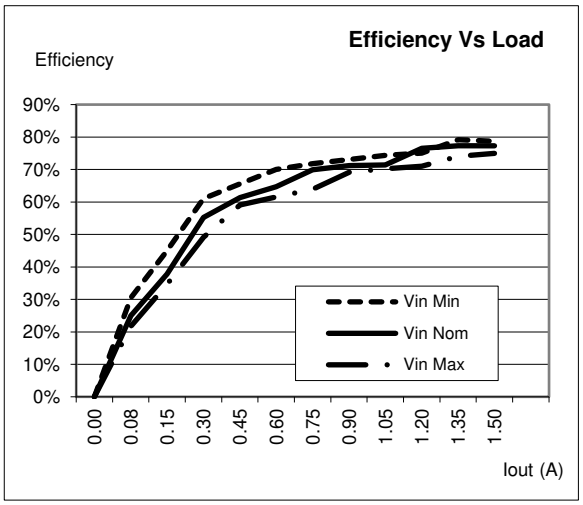
All specifications apply over input voltage, output load and temperature of 25 °C, unless otherwise noted.

PARAMETER		CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io = 1.5 A, 25 °C	3.27	3.30	3.3	VDC
Output Current *	Io	Vin.Min to Vin.Max	0.15		1.5	ADC
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max		25	70	mV
Load Regulation		Vin.Nom, Io.Min to Io.Max		35	90	mV
Dynamic Regulation Peak Deviation Settling Time		50-100% Io.Max load step change. to 1% error band			 300 300	 ± mV µs
Output Voltage Ripple	Vr	Vin.Min to Vin.Max, Io.Min to Io Max, 20 MHz Bandwidth		25	50	mVp-p
Admissible Load Capacitance	Comax	Io.Max, Vin.Nom			2,200	µF
Output Current Limit Threshold	Icl	Vout ≤0.90 Vo.Nom	110		150	%Io.Max
Switching Frequency	Fs	Vin.Nom, Io.Max		410		kHz
Temperature Coefficient	Tco				0.02	%Vo/°C
Trim Range	Vt	Io.Min to Io.Max, Vin.Min to Vin.Max	2.75		3.85	Vo

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

TYPICAL CHARACTERISTIC CURVES





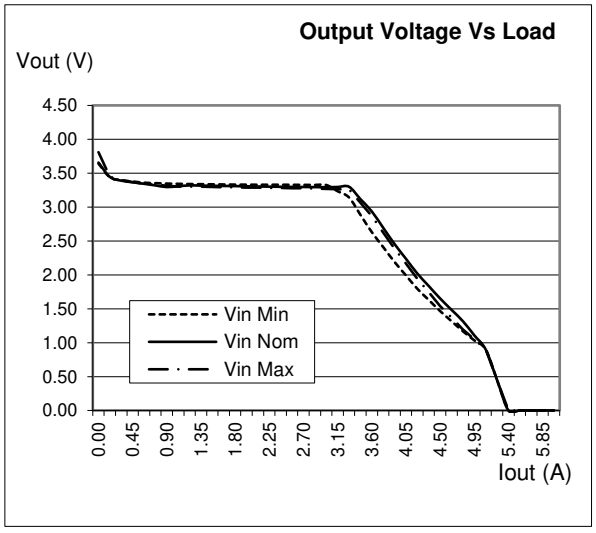
6.2 RNS03ZE: 3.3 V / 3.0 A

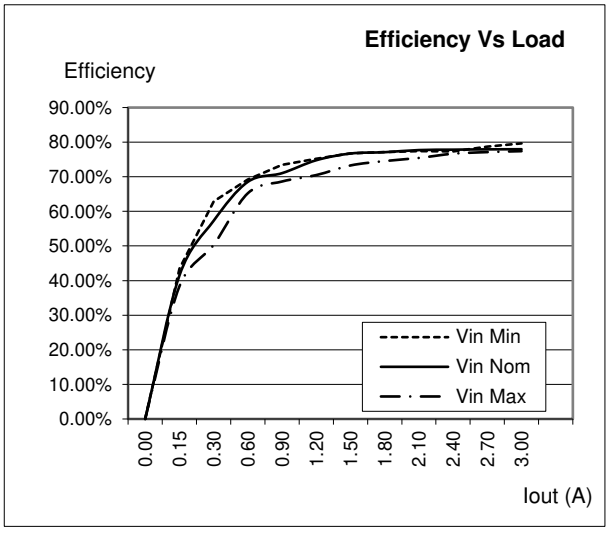
All specifications apply over input voltage, output load and temperature range, unless otherwise noted.

PARAMETER		CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io = 2.0 A, 25 °C	3.27	3.30	3.33	VDC
Output Current *	Io	Vin.Min to Vin.Max	0.3		3.0	ADC
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max			50	mV
Load Regulation		Vin.Nom, Io.Min to Io.Max			120	mV
Dynamic Regulation Peak Deviation Settling Time		25-75% Io.Max load step change. to 1% error band			 300 300	 ± mV µs
Output Voltage Ripple	Vr	Vin.Min to Vin.Max, Io.Min to Io Max, 20 MHz Bandwidth		50	70	mVp-p
Admissible Load Capacitance	Comax	Io.Max, Vin.Nom			15,000	µF
Output Current Limit Threshold	Icl	Vout ≤0.90 Vo.Nom	110		140	%Io.Max
Switching Frequency	Fs	Vin.Nom, Io.Max		400		kHz
Temperature Coefficient	Tco				0.02	%Vo/°C
Trim Range	Vt	Io.Min to Io.Max, Vin.Min to Vin.Max	2.3		4.0	Vo

* At Iout < Iout.Min, the output may contain low frequency component that exceeds ripple specifications. The output voltage may rise to a maximum of 4.0V.

TYPICAL CHARACTERISTIC CURVES





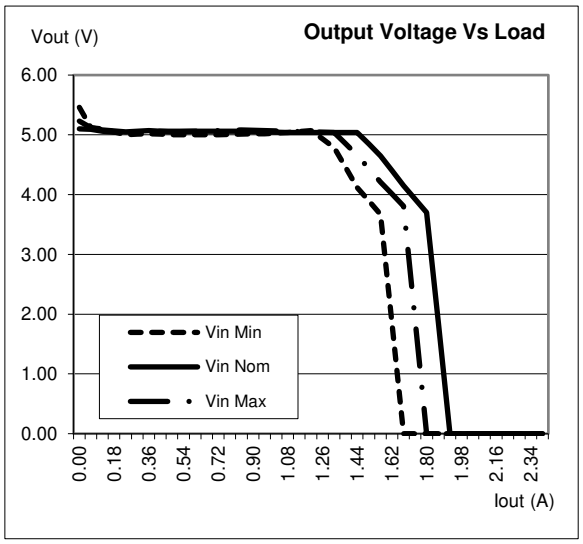
6.3 RNS01EG: 5.05 V / 1.2 A

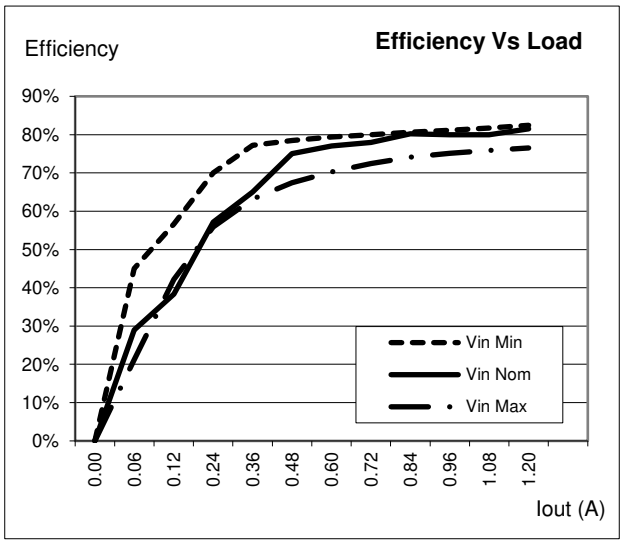
All specifications apply over input voltage, output load and temperature of 25 °C, unless otherwise noted.

PARAMETER		CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io = 0.2 A, 25 °C	5.02	5.05	5.08	VDC
Output Current *	Io	Vin.Min to Vin.Max	0.15		1.2	ADC
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max		60	100	mV
Load Regulation		Vin.Nom, Io.Min to Io.Max		40	100	mV
Dynamic Regulation Peak Deviation Settling Time		50-100% Io.Max load step change. to 1% error band			 250 300	 ± mV µs
Output Voltage Ripple	Vr	Vin.Min to Vin.Max, Io.Min to Io Max, 20 MHz Bandwidth		25	50	mVp-p
Admissible Load Capacitance	Comax	Io.Max, Vin.Nom			2,200	µF
Output Current Limit Threshold	Icl	Vout ≤0.90 Vo.Nom	110		150	%Io.Max
Switching Frequency	Fs	Vin.Nom, Io.Max		410		kHz
Temperature Coefficient	Tco				0.02	%Vo/°C
Trim Range	Vt	Io.Min to Io.Max, Vin.Min to Vin.Max	4.3		5.9	Vo

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

TYPICAL CHARACTERISTIC CURVES





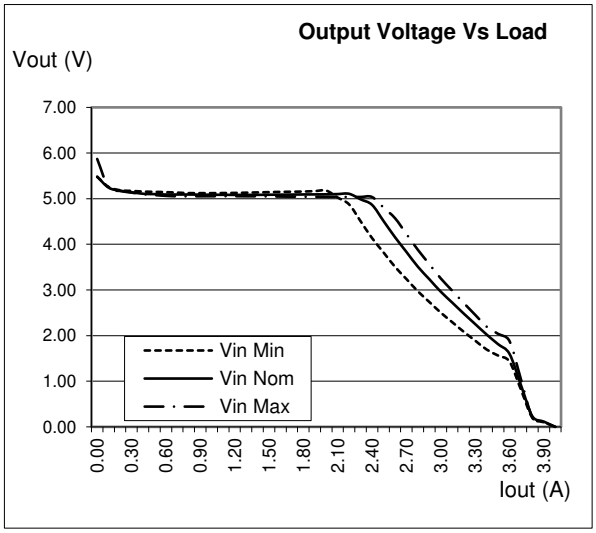
6.4 RNS02ZG: 5.05 V / 2.0 A

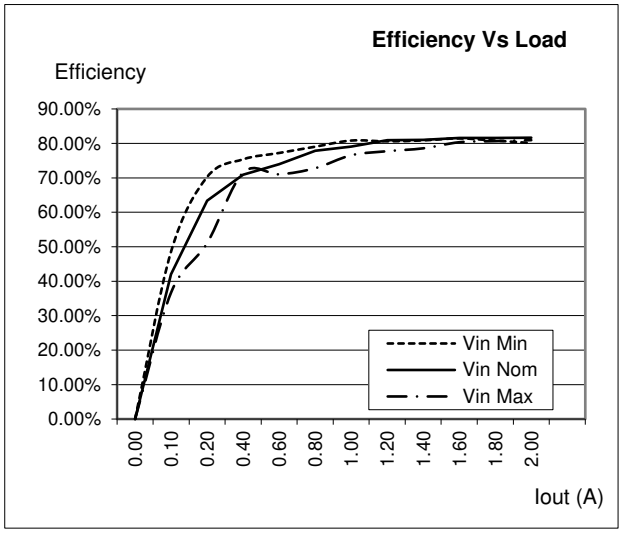
All specifications apply over input voltage, output load and temperature range, unless otherwise noted.

PARAMETER		CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
Output Voltage Setpoint Accuracy	Vo	Vin.nom, Io = 1.5 A, 25 °C	5.02	5.05	5.08	VDC
Output Current *	Io	Vin.min to Vin.max	0.2		2.0	ADC
Line Regulation		Vin.min to Vin.max, 50% Io.Max			100	mV
Load Regulation		Vin.nom, Io.min to Io.max			180	mV
Dynamic Regulation Peak Deviation Settling Time		25-75% Io.Max load step change. to 1% error band			 250 300	 ± mV µs
Output Voltage Ripple	Vr	Vin.min to Vin.max, Io.min to Io max, 20 MHz Bandwidth		50	70	mVp-p
Admissible Load Capacitance	Comax	Io.max, Vin.nom			10,000	µF
Output Current Limit Threshold	Icl	Vout ≤0.90 Vo.nom	110		140	%Io.Max
Switching Frequency	Fs	Vin.nom, Io.max		400		kHz
Temperature Coefficient	Tco				0.02	%Vo/°C
Trim Range	Vt	Io.mmin to Io.Max, Vin.min to Vin.max	4.0		6.0	Vo

* At Iout < Iout.min, the output may contain low frequency component that exceeds ripple specifications. The output voltage may rise to a maximum of 6.0 V

TYPICAL CHARACTERISTIC CURVES





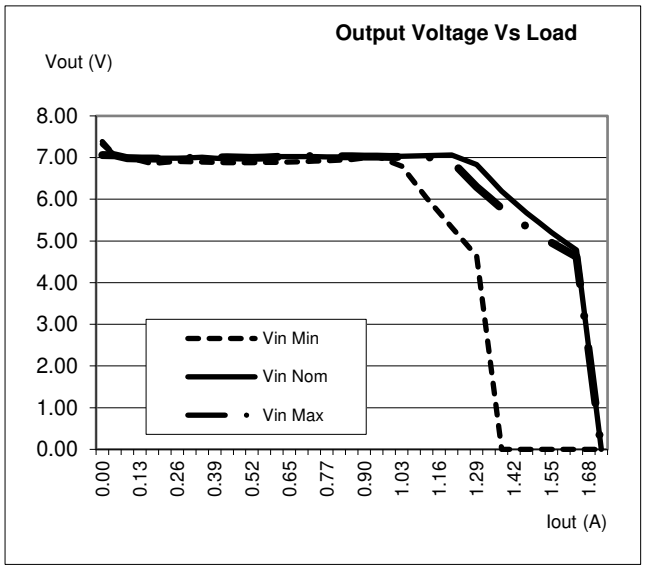
6.5 RNS0.9ET : 7.0 V / 0.86 A

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

PARAMETER		CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io = 0.72 A, 25 °C	6.95	7.00	7.05	VDC
Output Current *	Io	Vin.Min to Vin.Max	0.08		0.86	ADC
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max		80	100	mV
Load Regulation		Vin.Nom, Io.Min to Io.Max		50	100	mV
Dynamic Regulation Peak Deviation Settling Time		50-100% Io.Max load step change. to 1% error band			 250 250	 ± mV µs
Output Voltage Ripple	Vr	Vin.Min to Vin.Max, Io.Min to Io Max, 20 MHz Bandwidth		25	50	mVp-p
Admissible Load Capacitance	Comax	Io.Max, Vin.Nom			2,200	µF
Output Current Limit Threshold	Icl	Vout ≤0.90 Vo.Nom	110		150	%Io.Max
Switching Frequency	Fs	Vin.Nom, Io.Max		410		kHz
Temperature Coefficient	Tco				0.02	%Vo/°C
Trim Range	Vt	Io.Min to Io.Max, Vin.Min to Vin.Max	5.95		8.05	Vo

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

TYPICAL CHARACTERISTIC CURVES



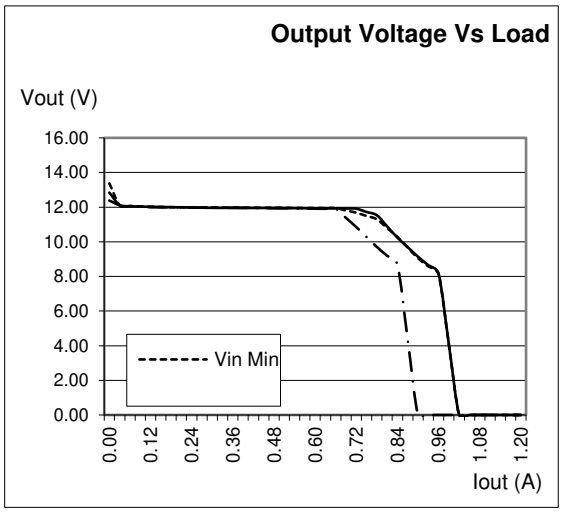
6.6 RNS0.6ZH : 12.0 V / 0.6 A

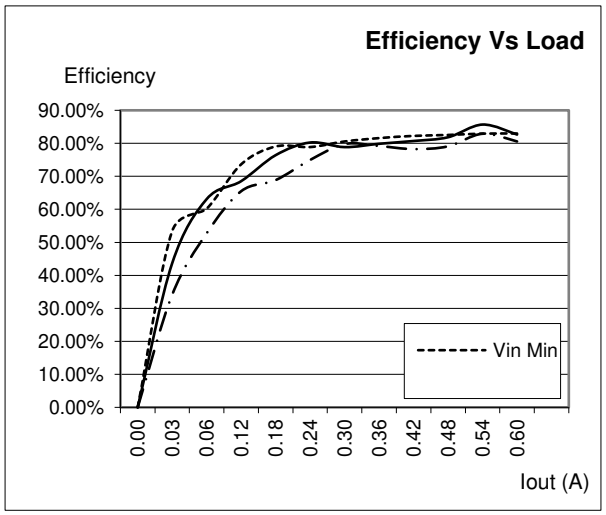
All specifications apply over input voltage, output load and temperature range, unless otherwise noted.

PARAMETER		CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io = 0.3 A, 25 °C	11.83	12.00	12.18	VDC
Output Current *	Io	Vin.Min to Vin.Max	0.06		0.6	ADC
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max			50	mV
Load Regulation		Vin.Nom, Io.Min to Io.Max			250	mV
Dynamic Regulation Peak Deviation Settling Time		25-75% Io.Max load step change. to 1% error band			 400 250	 ± mV µs
Output Voltage Ripple	Vr	Vin.Min to Vin.Max, Io.Min to Io Max, 20 MHz Bandwidth		40	100	mVp-p
Admissible Load Capacitance	Comax	Io.Max, Vin.Nom			220	µF
Output Current Limit Threshold	Icl	Vout ≤0.90 Vo.Nom	110		140	%Io.Max
Switching Frequency	Fs	Vin.Nom, Io.Max		400		kHz
Temperature Coefficient	Tco				0.02	%Vo/°C
Trim Range	Vt	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. The output voltage may rise to a maximum of 14.0V

TYPICAL CHARACTERISTIC CURVES





6.7 RND02ZGE

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

Vo1: 5.2 V / 1.0 A

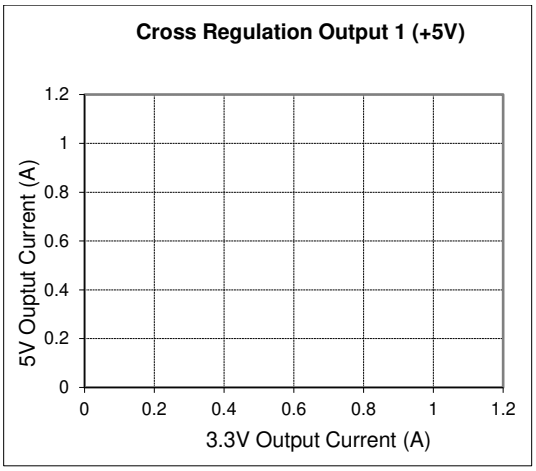
PARAMETER		CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io1 = 0.6 A, Io2 = 0.9 A, 25°C	5.08	5.2	5.24	VDC
Output Current *	Io	Vin.Min to Vin.Max	0.1		1.0	ADC
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max			50	mV
Load Regulation		Vin.Nom, Io.Min to Io.Max		120	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

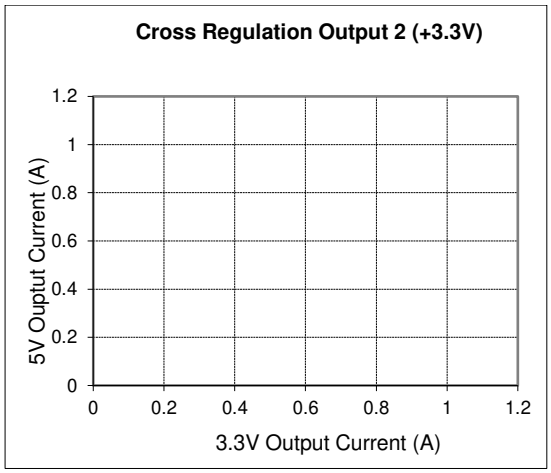
Vo2: 3.27 V / 1.0 A

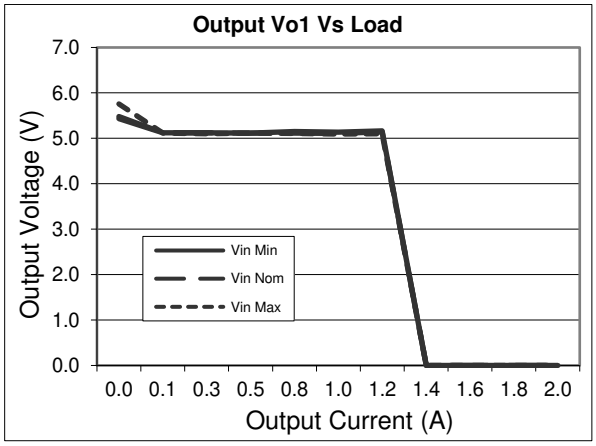
PARAMETER		CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io1 = 0.6 A, Io2 = 0.9 A, 25°C	3.24	3.27	3.3	V
Output Current *	Io	Vin.Min to Vin.Max	0.1		1.0	A
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max			40	mV
Load Regulation		Vin.Nom, Io.Min to Io.Max		100	210	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

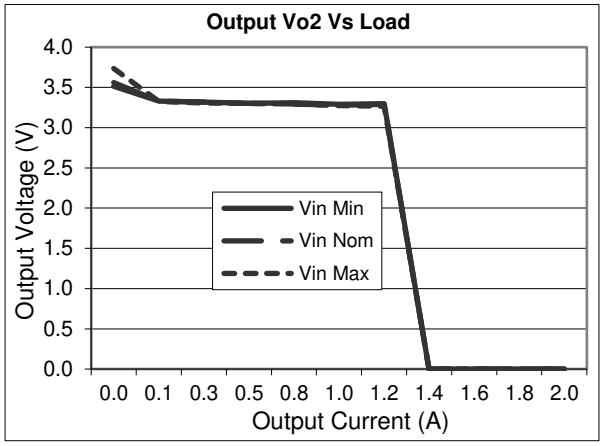
* At Iout < Iout.Min, the output may contain low frequency component that exceeds ripple specifications.

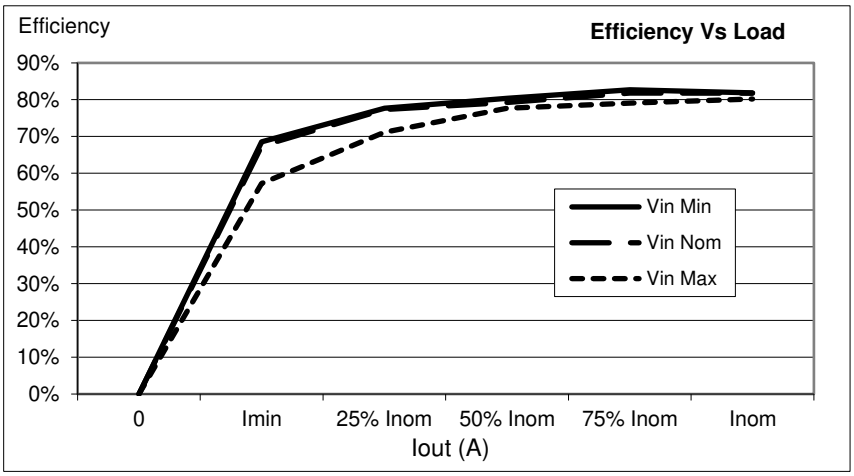
TYPICAL CHARACTERISTIC CURVES











6.8 RND02ZGG

All specifications apply over input voltage, output load and temperature range, unless otherwise noted.
Note: Maximum output power is 9W:

Vo1: +5.1 V / 0.75 A

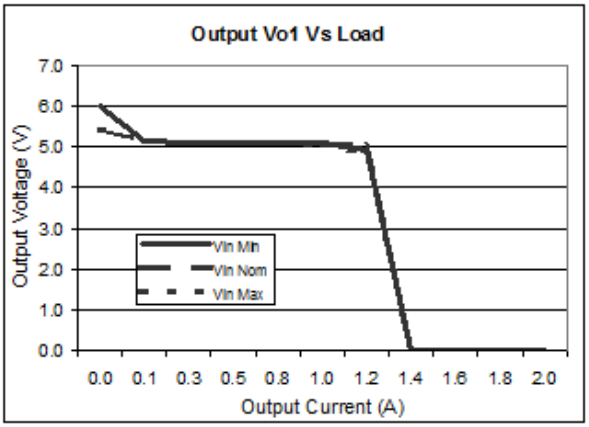
PARAMETER		CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io1=Io2 = 0.3 A, 25 °C	5.06	5.1	5.14	V
Output Current *	Io	Vin.Min to Vin.Max	0.1	0.75	1.00	A
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max			40	mV
Load Regulation		Vin.Nom, Io.Min to Io.Nom		100	250	mV
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

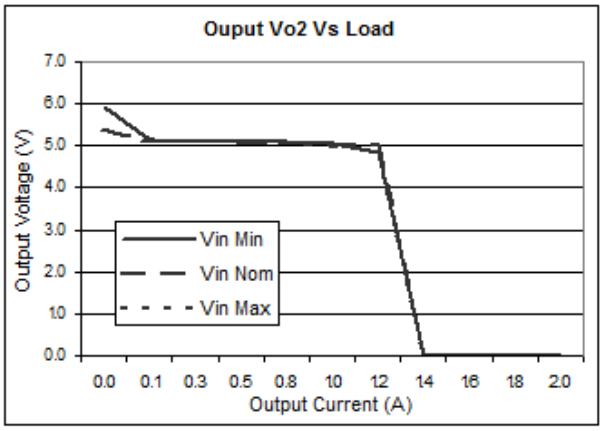
Vo2: -5.1 V / 0.75 A

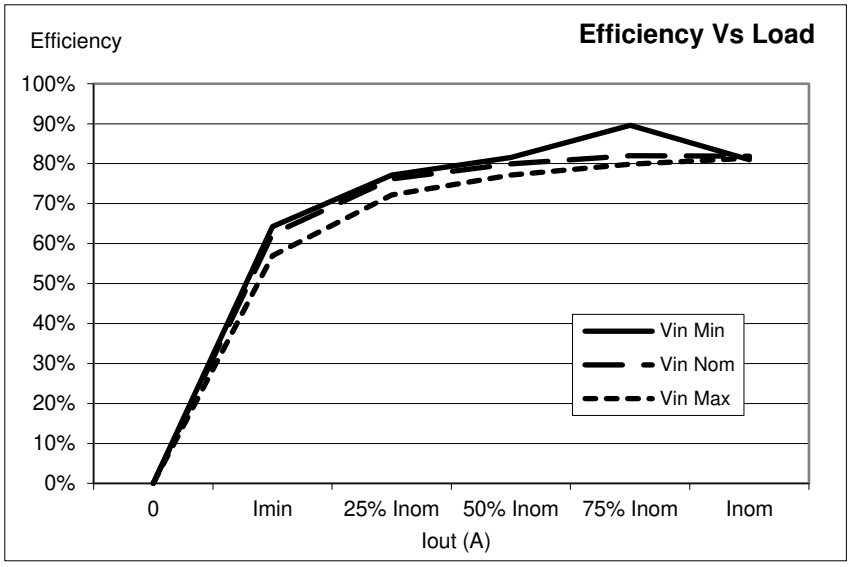
PARAMETER		CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io1 =Io2 = 0.3 A, 25 °C	-5.06	-5.10	-5.14	V
Output Current *	Io	Vin.Min to Vin.Max	0.1	0.75	1.0	A
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max			40	mV
Load Regulation		Vin.Nom, Io.Min to Io.Nom		100	250	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.
# 2200 µF on each output

TYPICAL CHARACTERISTIC CURVES







6.9 RND0.8ZHH

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

Vo1: +12.0 V / 0.42 A

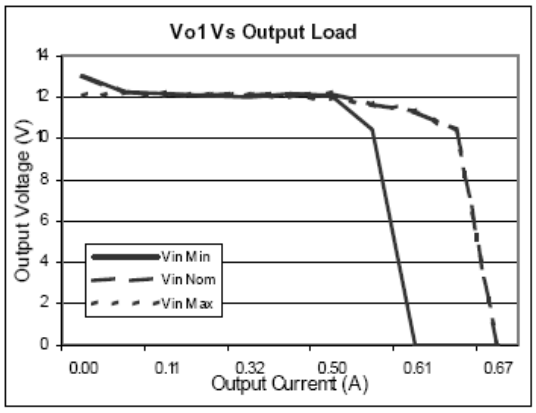
PARAMETER		CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io = 0.3 A, 25 °C	11.82	12.00	12.18	V
Output Current *	Io	Vin.Min to Vin.Max	0.042		0.42	A
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max			90	mV
Load Regulation		Vin.Nom, Io.Min to Io.Max		100	170	mV
Cross 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

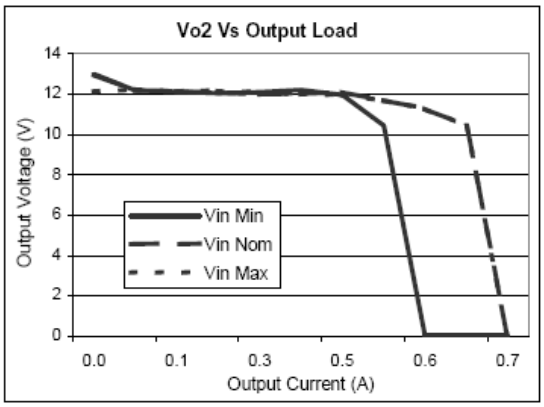
Vo2: -12.0 V / 0.42 A

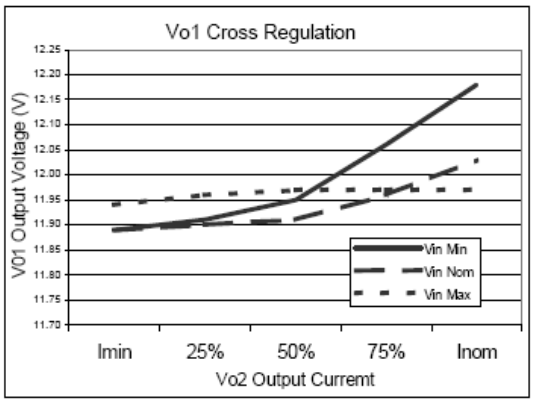
PARAMETER		CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
Output Voltage Setpoint Accuracy	Vo	Vin.Nom, Io = 0.3 A, 25 °C	–11.82	–12.00	–12.18	V
Output Current *	Io	Vin.Min to Vin.Max	0.042		0.42	A
Line Regulation		Vin.Min to Vin.Max, 50% Io.Max			90	mV
Load Regulation		Vin.Nom, Io.Min to Io.Max		100	170	mV
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

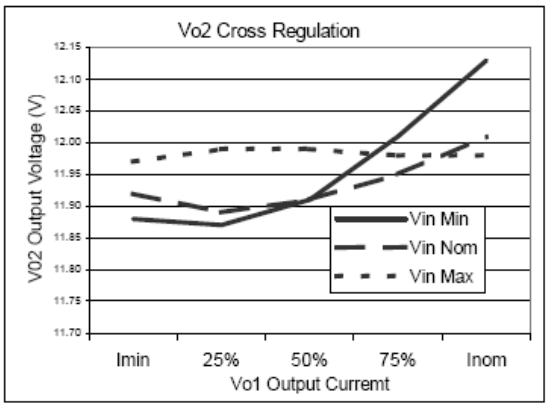
* At Iout<Iout.Min, the output may contain low frequency component that exceeds ripple specifications.
** 100 µF on each output

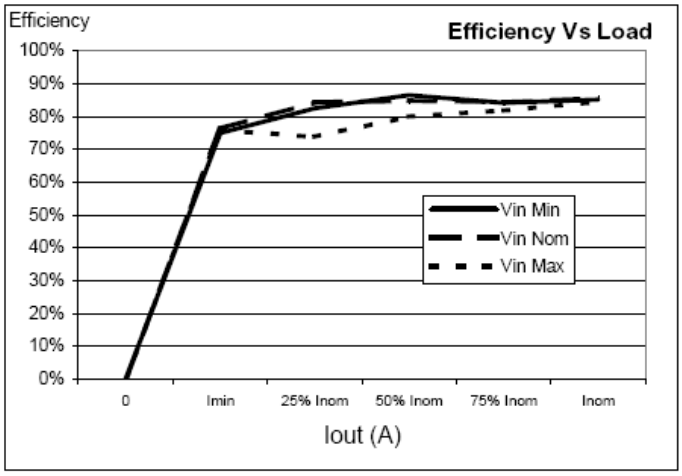
TYPICAL CHARACTERISTIC CURVES





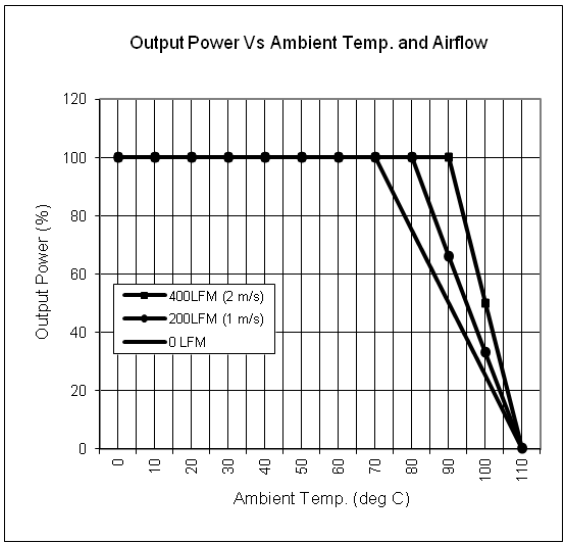






7. TEMPERATURE CONSIDERATIONS

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, Bel Power Solutions limits maximum allowable case temperature (Tc) to 110 °C (see Mechanical Drawings).
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.



8. APPLICATION AND AUXILIARY FUNCTIONS

1.1 SHUTDOWN (REMOTE CONTROL)

PARAMETER	CONDITIONS/DESCRIPTION		MIN	NOM	MAX	UNITS
Remote Control:	Converter OFF	RC pin is pulled low	–1.0		1.0	V
	Converter ON	Voltage source or open circuit	4.0		6	V
	Sink Current	Vin=Vin.Nom		0.3		mA
Synchronization:* Frequency Range	TTL compatible square wave on sync pin. Referenced to –Vin (RNS 4:1 input range)		450 (520)		600 (688)	kHz

* All RNS except RNS0.6ZH, and RND0.8ZHH (as only RND model)

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 the -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 the -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.

1.2 EXTERNAL COMPONENTS

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 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 7 V and 12 V outputs).

1.3 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, SYNC (pin 7) should be left open-circuit.

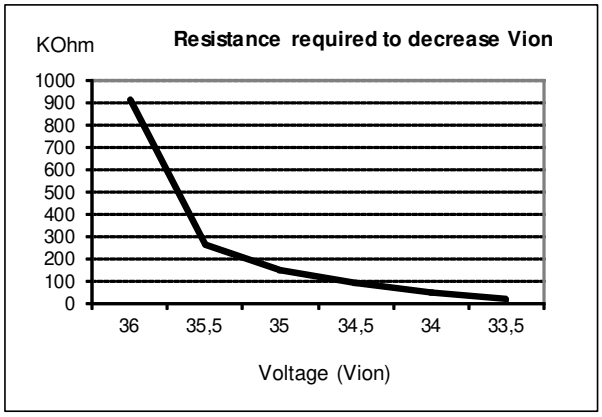
1.4 PUL (PROGRAMMABLE UNDERVOLTAGE LOCKOUT)

Note: This feature is not available on 4:1 input range devices, RNS01EE/RNS01EG/RNS0.9ET.

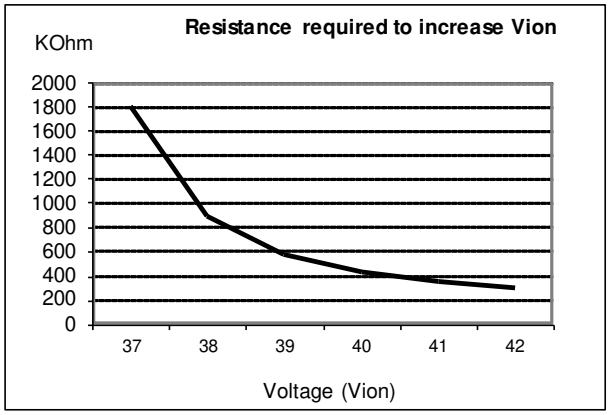
An external resistor can program the input voltage at which the converter switches on. The voltage at which the unit switches off, is typically 1V below the turn-on input voltage (Vion).
The characteristic curves below shows the typical resistor values required to achieve adjustment of turn-on input voltage (Vion).

1.5 RNS MODELS

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

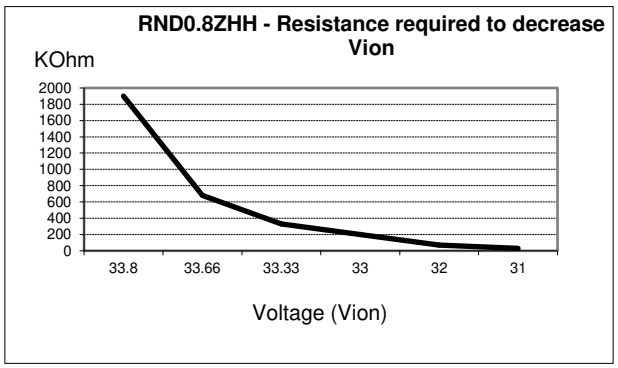


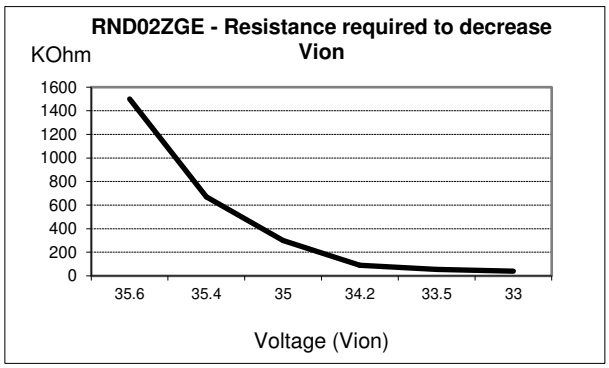
To increase Vion the resistor should be connected between pins 11 and 17.



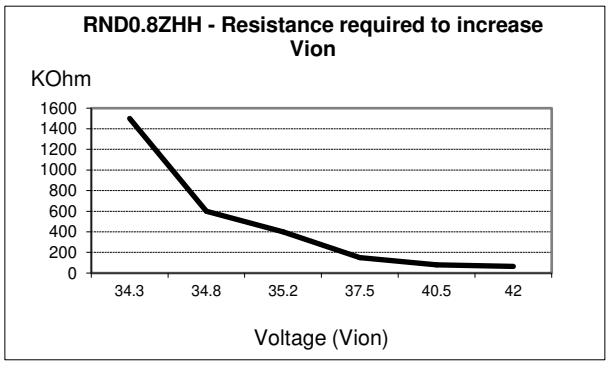
1.6 RND MODELS

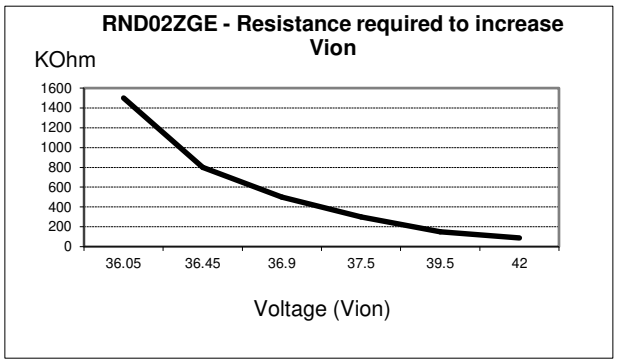
To decrease Vion the resistor should be connected between pins 10 and 11.





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





1.7 OUTPUT VOLTAGE ADJUSTMENT

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 × (B - Vd) / (Vd – Vo), kΩ
Where: Vd = Desired output voltage
Vo = Nominal output voltage.

To **reduce** Vo:

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

MODEL	A	B	C	D
RNS01EE	3.18	3.86	13	2.75
RNS03ZE	4.21	4.12	17.58	1.75
RNS01EG	3.18	5.93	12.6	4.28
RNS02ZG	4.21	6.39	17.97	2.62
RNS0.9ET	3.18	8.05	12.6	5.95
RNS0.6ZH	0.489	16.27	2.832	8.715
RND02ZGE	0.5	3.92	2.0	2.56
RND02ZGG	0.5	7.1	2.243	3.7
RND02ZHH	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 2.5 V from 3.3 V model, 15 V from 12 V model and 6 V or 8 V from the 7 V model, and ±15 V from the ±12 V model.

1.8 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.

1.9 PARALLEL OPERATION

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.

9. SAFETY CONSIDERATIONS

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. 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 converter is SELV, TNV-1, or TNV-2, the output of the converter is considered SELV and may be grounded or ungrounded.

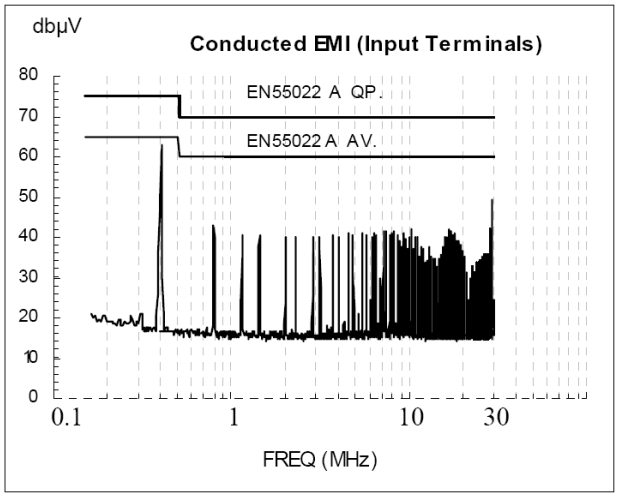
- The circuitry of the converter may generate transients, which exceed the input voltage. Even if the input voltage is SELV (<60 V), the components on the primary side of the converter may have to be considered as hazardous. A safety interlock may be needed to prevent the user from accessing the converter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

10. EMC SPECIFICATIONS

10.1 CONDUCTED NOISE

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

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

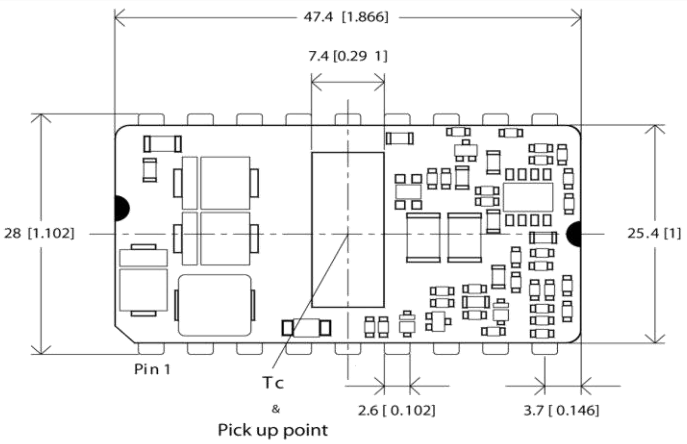


10.2 ELECTROMAGNETIC SUSCEPTIBILITY

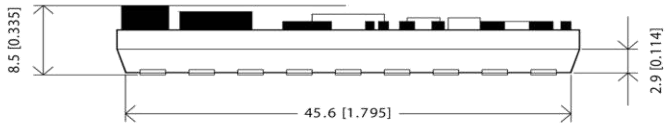
STANDARD	APPLIED STRESS	CLASS LEVEL	PERFORMANCE CRITERION *
Electrostatic Discharge EN61000-4-2	2 kV to pins	1	B
Electromagnetic Field EN61000-4-3	3 V/m	2	A
Electrical Fast Transient EN61000-4-4	2000 Vp to input	3	B
Conducted Disturbances EN61000-4-6	3 VAC to input	2	B

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

11. MECHANICAL SPECIFICATIONS



Top View



Height Profile

Note: Dimensions in mm [inches]

12. SURFACE MOUNT ASSEMBLY

Soldering

The following soldering instructions must be observed to prevent failure or significant degradation of the module performance. Bel Power 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 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 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 following tables.

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)

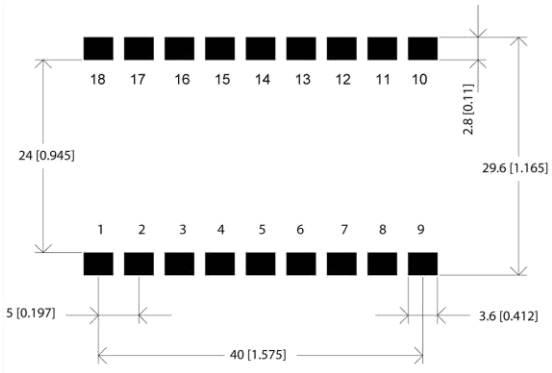
PRODUCT	PRE-HEAT RAMP			PRE-HEAT SOAKING			RAMP TO REFLOW	REFLOW				COOLING
	From	To	Rate	From	To	Max. time	Rate	Max. time above liquidus	Max. peak temp.	Max. time within ±5 °C of peak temp.	Max. time to peak	Rate
	°C	°C	°C/s	°C	°C	s	°C	s	°C	s	s	°C/s
-M6 (Sn-Pb eutectic)	25	150	3	100	150	120	3	45	230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

PICK & PLACE ASSEMBLY

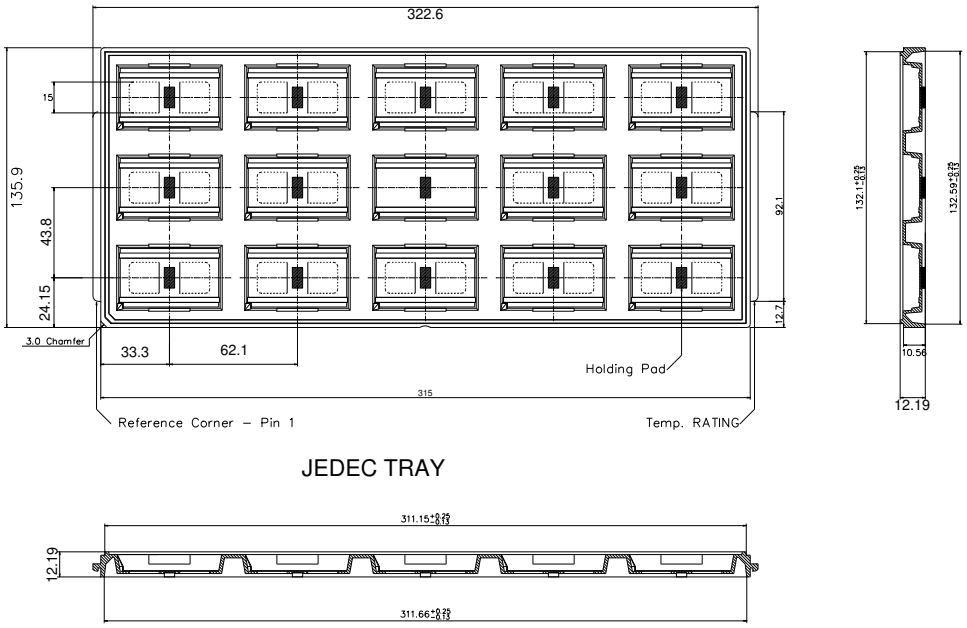
The product is designed with a large flat area in the center of the top surface to serve as a pick up point for automated vacuum pick and place equipment. The 'open board' construction of the unit ensures that weight is kept to a minimum. However due to the relatively large size of the component, a large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



JEDEC TRAY

Note: Dimensions in mm [inches]

PIN ALLOCATION

PIN	DESIGNATION	SINGLE-OUTPUT MODELS	DESIGNATION	DOUBLE-OUTPUT MODELS	REFERENCED TO
1	+Vo	Positive output	+Vo1	Output voltage 1	Secondary
2	–Vo	Negative output	RTN	Output voltage return	Secondary
3	n.c.	n.c.	–Vo2	Output voltage 2.	Secondary
4	n.c.	n.c.	n.c.	n.c.	Secondary
5	n.c.	n.c.	n.c.	n.c.	Secondary
6	n.c.	n.c.	n.c.	n.c.	Primary
7	Sync	Synchronization input	Sync	Synchronization input	Primary
8[1]	Trim[1]	Output voltage adjust.	Trim[1]	Output voltage adjust.	Primary
9[1]	NOR[1]	Nominal output voltage	NOR[1]	Nominal output voltage	Primary
10[2]	PUL[2]	Turn-on/off adjust	PUL[2]	Turn-on/off adjust	Primary
11	SD	Shutdown	SD	Shutdown	Primary
12	n.c.	n.c.	n.c.	n.c.	Primary
13	n.c.	n.c.	n.c.	n.c.	Primary
14	n.c.	n.c.	n.c.	n.c.	Primary
15	n.c.	n.c.	n.c.	n.c.	Primary
16	n.c.	n.c.	n.c.	n.c.	Primary
17	–Vin	Negative input	–Vin	Negative input	Primary
18	+Vin	Positive input	+Vin	Positive input	Primary

[1] Connect pin 8 to pin 9, in order to get the nominal output voltage
[2] This feature is not available on 4:1 input range devices, RNS01EE, RNS01EG, RNS0.9ET.

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.