NON-ISOLATED DC/DC CONVERTERS
3.3V Input / 0.9V – 2.5V Output / 7A

bel POWER PRODUCTS

BP06xRAH-07C

SRAH-07C / VRAH-07C Series **RoHS Compliant**

- Nonisolated
- Compact, low profile surface mount package
- Fixed frequency
- High efficiency means less power dissipation
- Excellent thermal performance
- Optimized for cost
- Remote on/off
- Undervoltage lockout (UVLO)
- Over current and short circuit protection
- Industrial temperature range -40° to +85° C

Description

The Bel SRAH-07C and VRAH-07C modules are a series of non-isolated, step down DC/DC power converters that operate from a nominal 3.3V source. These converters are available in a range of output voltages from 0.9V to 2.5V. They are packaged in a compact, overmolded package rated at 7A. Optional lead forming provides a vertical mount product for minimal footprint or a surface mount option for a very low profile. Standard features include remote on/off, over current and short circuit protection, and output voltage adjust. These products may be used almost anywhere low voltage silicon is employed and a 3.3V source is available. Typical applications include file servers, routers, line cards and other computing and communications equipment.

Applications

- Distributed power architectures
- Data networking equipment
- Telecommunications
- Computers and peripherals

Options

- Wide range adjustable output

Part Number Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Part Number Surface Mount	Part Number Vertical Mount
2.5V	3.3V	7A	17.5W	92%	SRAH-07C250	VRAH-07C250
1.8V	3.3V	7A	12.6W	88%	SRAH-07C180	VRAH-07C180
1.5V	3.3V	7A	10.5W	86%	SRAH-07C150	VRAH-07C150
1.2V	3.3V	7A	8.4W	83%	SRAH-07C120	VRAH-07C120
0.9V	3.3V	7A	6.3W	80%	SRAH-07C090	VRAH-07C090
0.9V - 2.5V	3.3V	7A	17.5W	92%	SRAH-07C1A0	VRAH-07C1A0

Absolute Maximum Ratings

Parameter	Symbol	Min	Typical	Max	Unit
Continuous Input Voltage	Vin	-0.3		6	V
Output Enable Terminal Voltage	Vouten	-0.3		6	V
Ambient Temperature	Tamb	-40		85	°C
Storage Temperature	Tstor	-40		125	°C

Note: Use beyond the maximum ratings may cause a reliability degradation of the DC/DC converter or may permanently damage the device.

Input Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Operating Input Voltage	All	Vin	3		3.6	V
Input Current	2.5V 1.8V 1.5V 1.2V 0.9V	Iin			6.6 5.3 4.6 3.8 3.0	A
No Load Input Current	All				110	mA
Remote Off Input Current				7	15	mA
Input Reflected Ripple Current[1]	All			50	80	mA_{rms}
Input Reflected Ripple Current (P-P)[1]	All			150	250	mApk
I^2t Inrush Current Transient	All			0.08	0.16	A^2s
Turn On Voltage Threshold	All		2.5		2.8	V
Turn Off Voltage Threshold	All			2.4		V

Note: Input capacitance 270µF/16V, ESR = 0.03 Ω max at 100kHz @ 25° C.
1. With simulated source impedance of 500nH, 5Hz to 20MHz.

Output Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Output Voltage Set Point [1]	2.5V 1.8V 1.5V 1.2V 0.9V	Vout	2.450 1.764 1.470 1.176 0.882	2.500 1.800 1.500 1.200 0.900	2.550 1.836 1.530 1.224 0.918	V
Load Regulation	2.5V 1.8V 1.5V 1.2V 0.9V			3 3 3 1 1	10 10 10 5 5	mV
Line Regulation	2.5V 1.8V 1.5V 1.2V 0.9V			3 3 3 1 1	10 10 10 5 5	mV
Regulation Over Temperature (-40° to +85° C)	2.5V 1.8V 1.5V 1.2V 0.9V			20 15 15 10 8	40 30 30 20 15	mV
Total Output Voltage Regulation	2.5V 1.8V 1.5V 1.2V 0.9V			26 21 21 12 10	60 50 50 30 25	mV
Output Ripple and Noise [2]	2.5V 1.8V 1.5V 1.2V 0.9V			40 40 40 40 40	80 80 80 80 70	mVp-p
Output Ripple and Noise [2]	All			10	20	mVrms
Output Current Range	All	Iout	0		7	A
Output DC Current Limit	All	Ioutlim	8.4		16	A
Short Circuit Surge	All	Ioutsurge		0.08	0.12	A^2s
Turn on Time	All	Ton		7	15	ms
Overshoot at Turn On	All			0	1	%
Output Capacitance	All	Cout	0		2200	µF

Note: All specifications are typical at nominal input, full load at 25° C unless otherwise stated.
1. Vin = 3.3V, Iout = full load, Ta = 25° C.
2. 0 - 20MHz, 1µF ceramic cap and 10µF aluminum cap on output.

Output Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Transient Response [3]						
ΔV 50% to 100% of Max Load	2.5V			120	180	mV
Settling Time		Ts		40	80	µs
ΔV 100% to 50% of Max Load				120	180	mV
Settling Time		Ts		40	80	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	1.8V			120	180	mV
Settling Time		Ts		40	80	µs
ΔV 100% to 50% of Max Load				120	180	mV
Settling Time		Ts		40	80	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	1.5V			100	150	mV
Settling Time		Ts		40	80	µs
ΔV 100% to 50% of Max Load				100	150	mV
Settling Time		Ts		40	80	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	1.2V			50	100	mV
Settling Time		Ts		40	80	µs
ΔV 100% to 50% of Max Load				50	100	mV
Settling Time		Ts		40	80	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	0.9V			50	100	mV
Settling Time		Ts		40	80	µs
ΔV 100% to 50% of Max Load				50	100	mV
Settling Time		Ts		40	80	µs

Note: All specifications are typical at nominal input, full load at 25° C unless otherwise stated.
3. di/dt = 0.5A/1µS, Ta = 25° C without external load capacitance.

General Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Efficiency[1]	2.5V 1.8V 1.5V 1.2V 0.9V	η	 90 86 84 81 78	 92 88 86 83 80		%
Switching Frequency	All	Fsw	250	300	340	kHz
Output Voltage Trim Range[2]	1.8V		50		146	%
Weight	All			5		g

1. Vin=3.3V, full load and Ta=25° C.
2. See graphs on page 9.

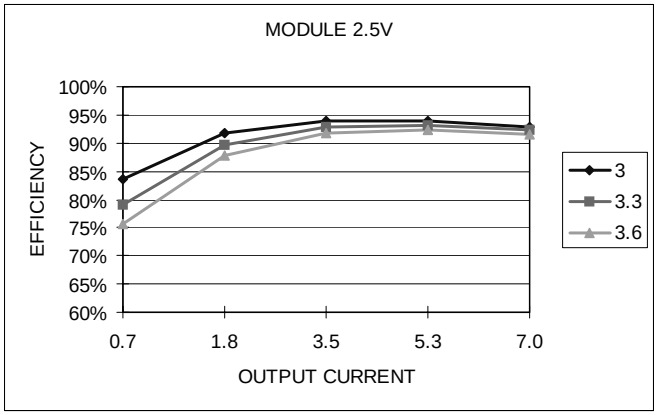
Control Specifications

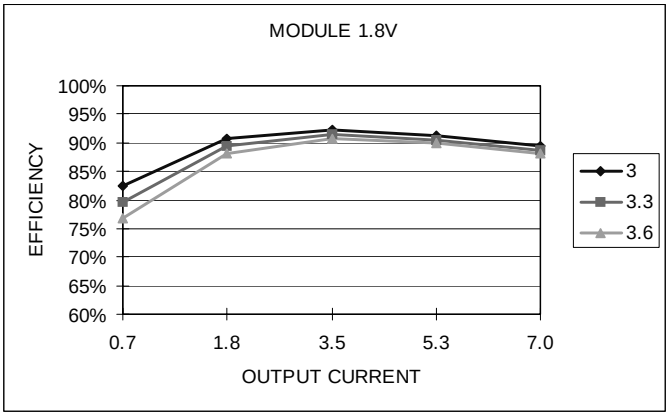
Parameter	Module	Symbol	Min	Typical	Max	Units
Remote On/Off [3]	All	Vouten				V
Signal Low (Unit Off)	All		-0.3		1	V
Signal High (Unit On)	All		1.8		3.6	V

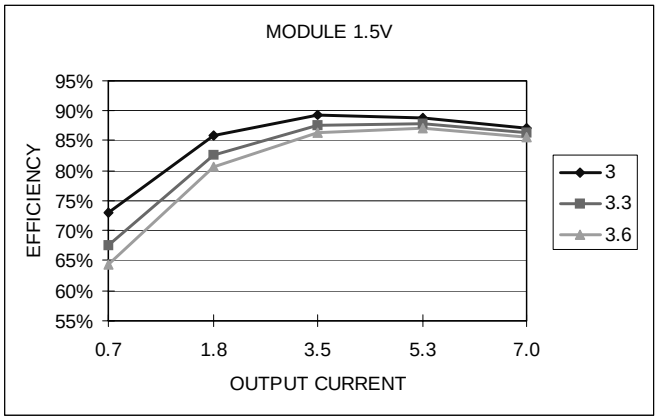
3. With remote on/off pin 1 open, the module is on.

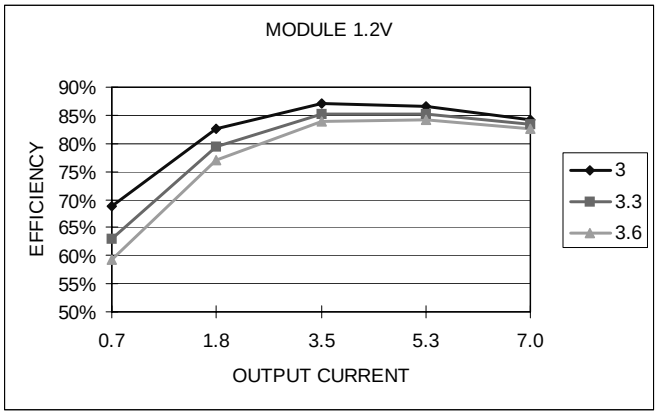
Note: On/off pin designed to work with an open collector/drain switch.

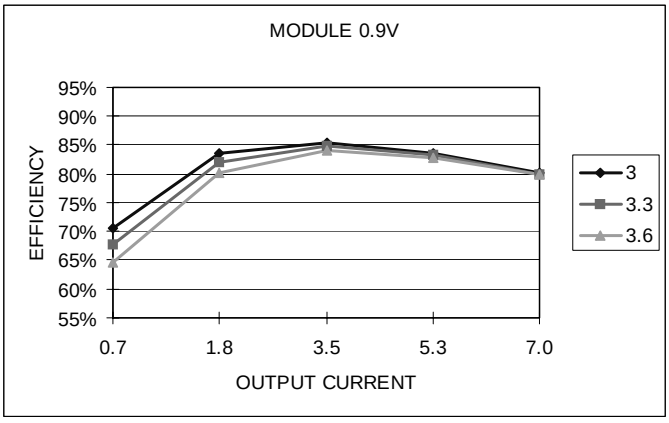
Efficiency Data





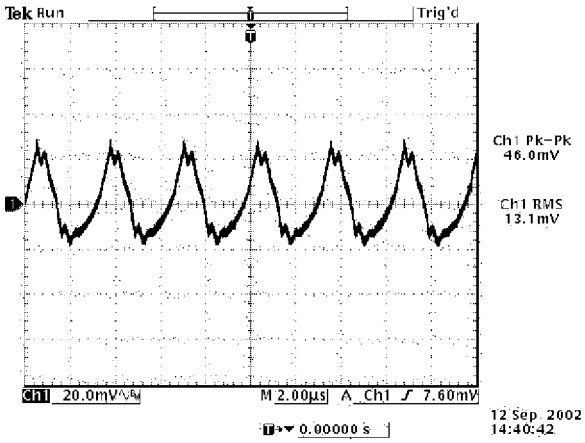






Ripple and Noise

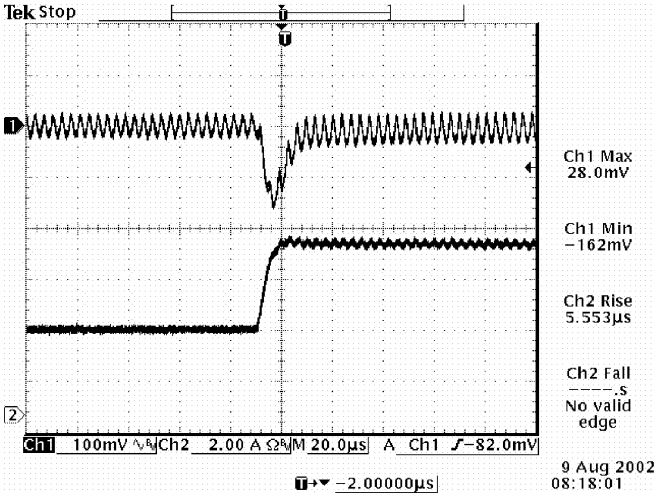
1µF ceramic cap and 10µF aluminum cap added at the output.



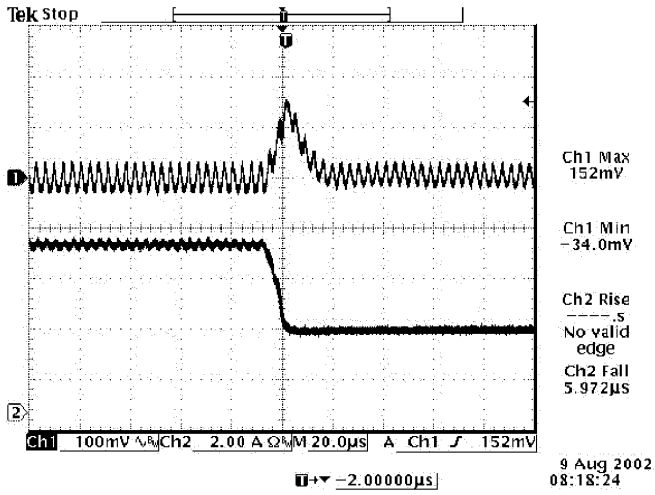
Ripple and noise at full load and 3.3Vdc input,
1.8Vdc output and Ta=25° C

Transient Response

Transient response: di/dt = 0.5A/µS, no external load capacitance



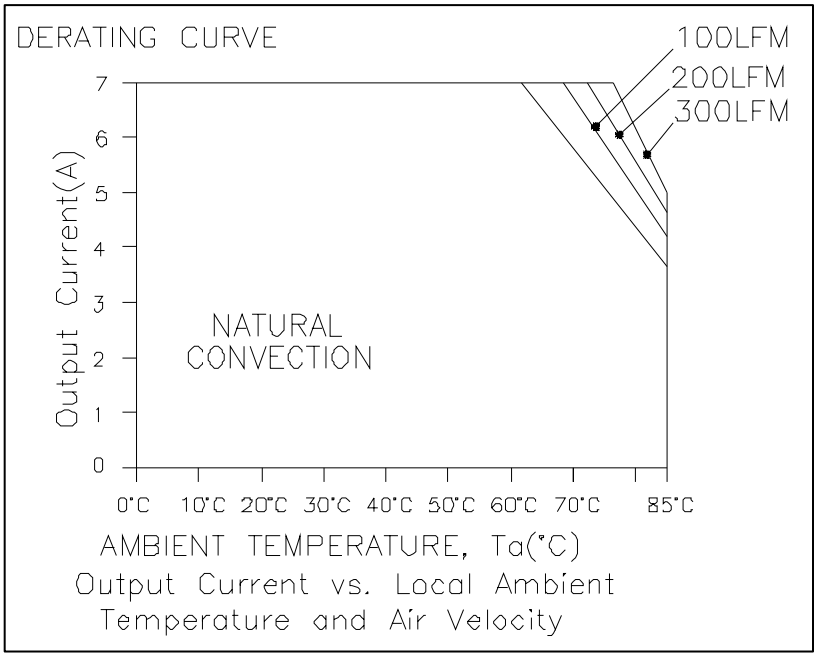
Vout=1.8V
50% to 100% load transients at 3.3V input and Ta=25° C



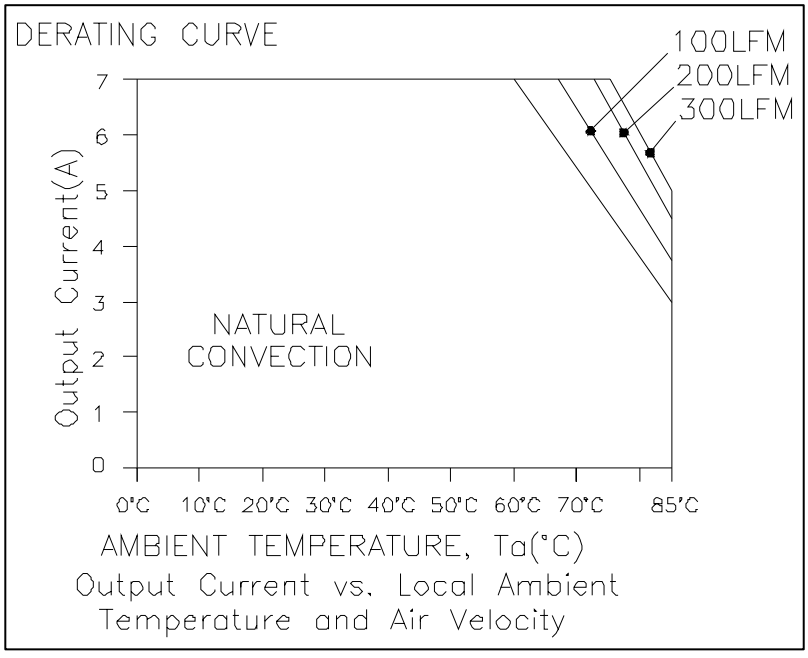
Vout=1.8V
100% to 50% load transients at 3.3V input and Ta=25° C

Thermal Considerations

SRAH-07C

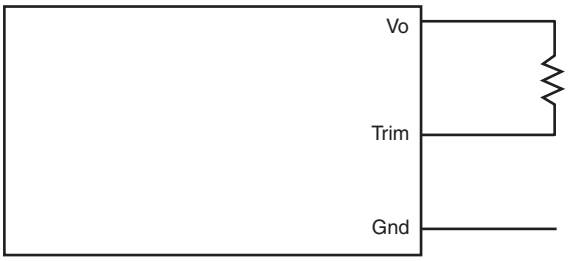


VRAH-07C

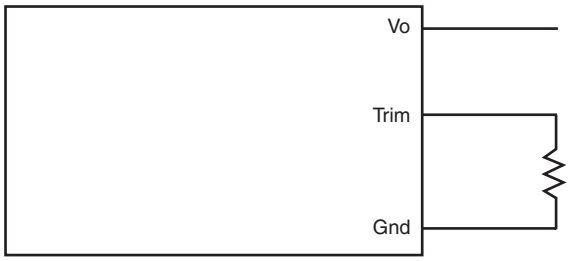


Output Voltage Set-Point Adjustment

Trim Down Test Circuit



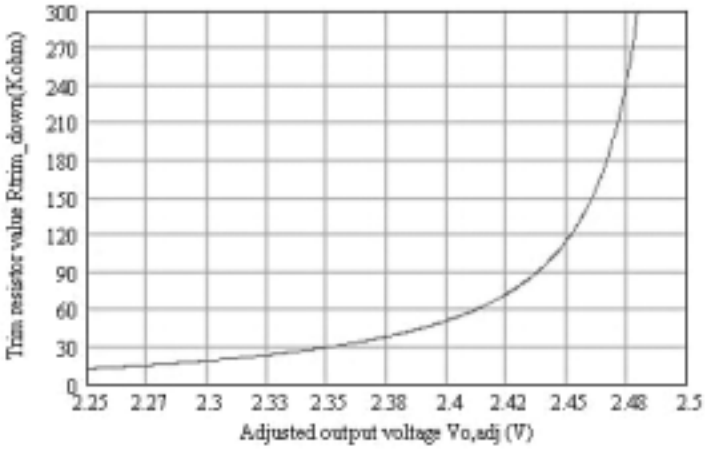
Trim Up Test Circuit



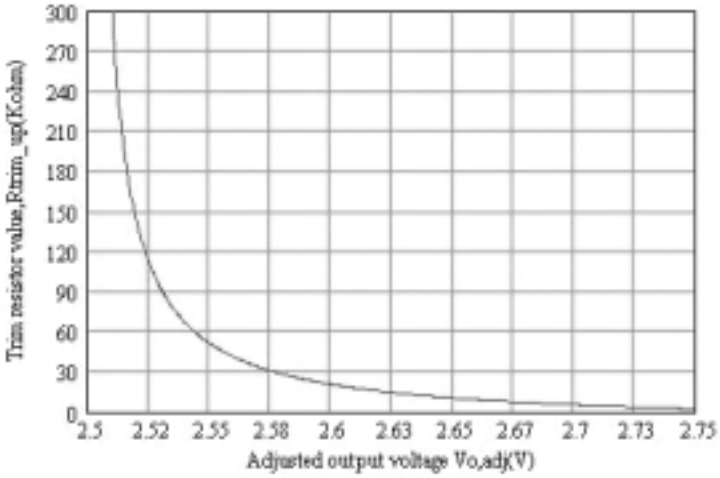
Output Voltage Set-Point Adjustment

xRAH-07C250 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{6.4943}{\text{Vo} - \text{Vo, adj}} - 13.83\right) \text{ Kohm}$$



$$\text{Rtrim up} = \left(\frac{3.064}{\text{Vo, adj} - \text{Vo}} - 10\right) \text{ Kohm}$$

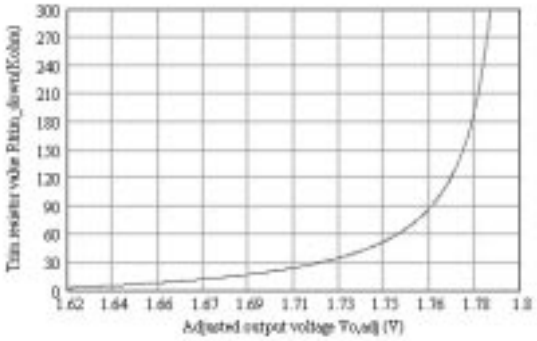


BP06xRAH-07C

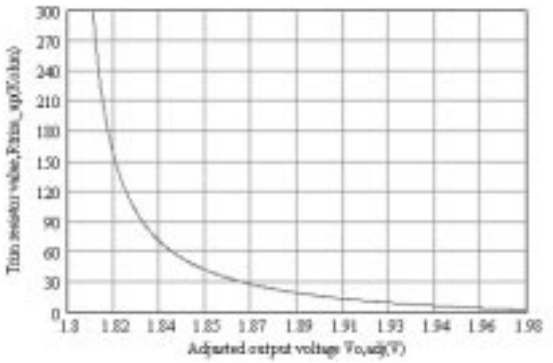
Output Voltage Set-Point Adjustment

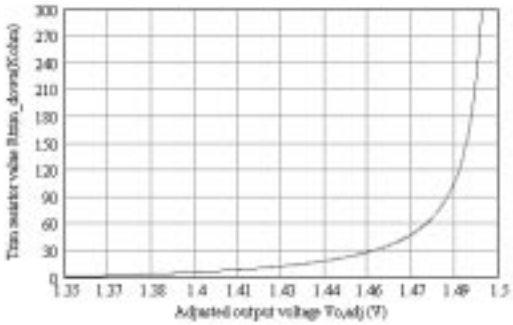
xRAH-07C180 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{3.8488}{Vo - Vo,\ adj} - 18.83\right) \text{Kohm}$$



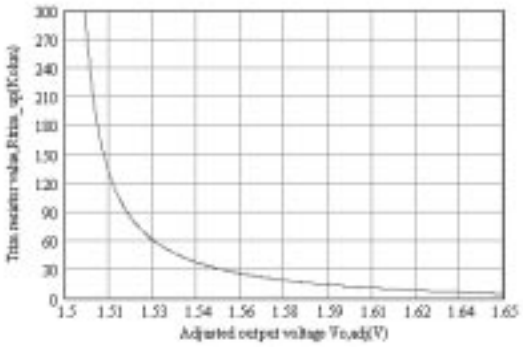
$$\text{Rtrim up} = \left(\frac{3.064}{Vo,\ adj - Vo} - 15\right) \text{Kohm}$$





xRAH-07C150 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{1.7874}{Vo - Vo,\ adj} - 11.7\right) \text{Kohm}$$

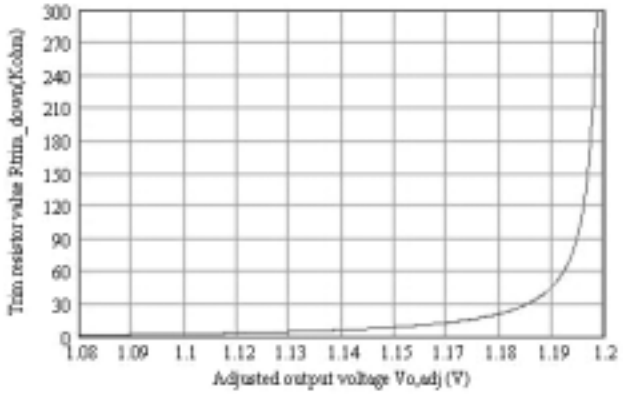


$$\text{Rtrim up} = \left(\frac{2.088}{Vo,\ adj - Vo} - 9.09\right) \text{Kohm}$$

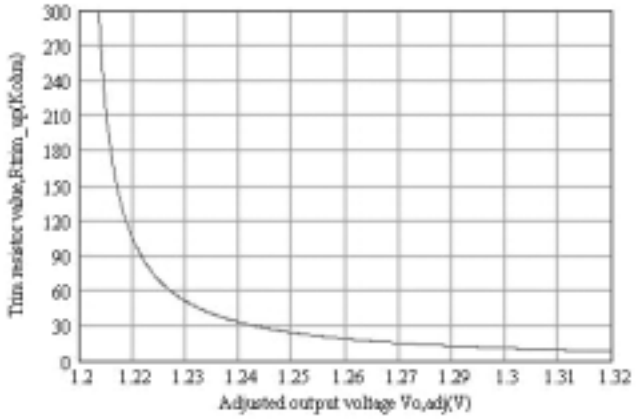
Output Voltage Set-Point Adjustment

xRAH-07C120 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{0.622}{Vo - Vo,\ adj} - 4.15\right) \text{ Kohm}$$

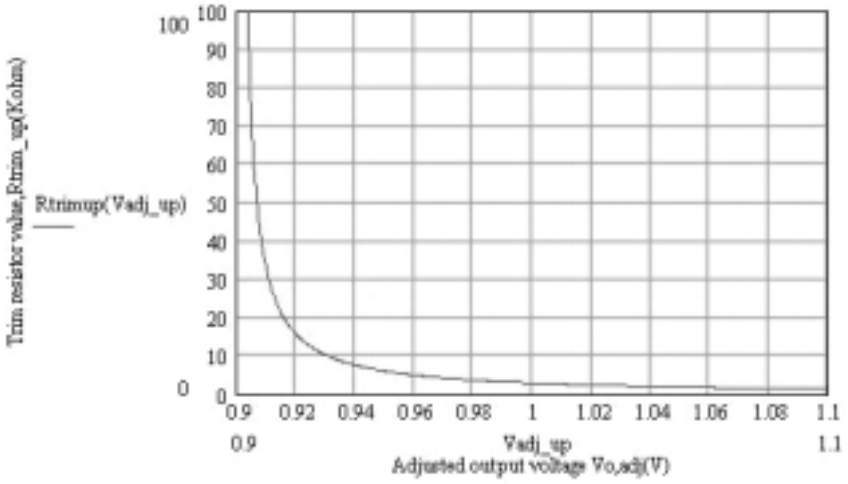


$$\text{Rtrim up} = \left(\frac{1.232}{Vo,\ adj - Vo} - 2.61\right) \text{ Kohm}$$



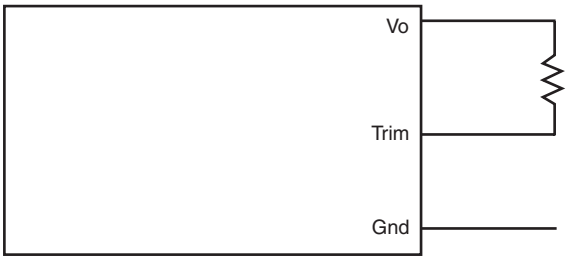
xRAH-07C090 Trim Resistor Calculation

$$\text{Rtrim up} = \left(\frac{0.3064}{Vo,\ adj - Vo} - 0.178\right) \text{ Kohm}$$

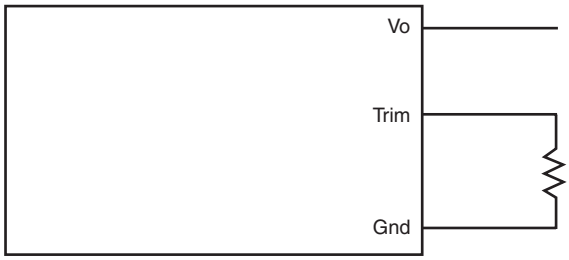


Output Voltage Set-Point Adjustment

Trim Down Test Circuit



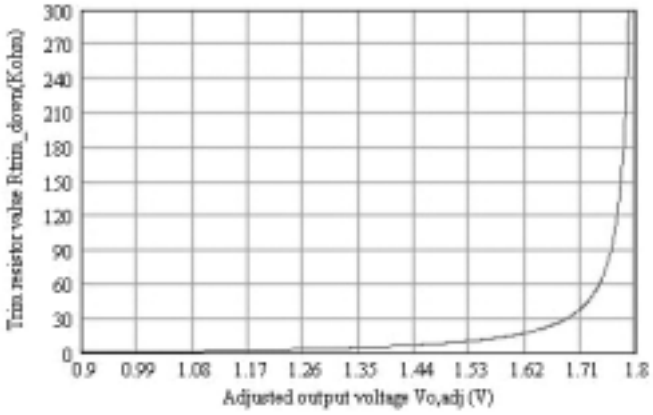
Trim Up Test Circuit



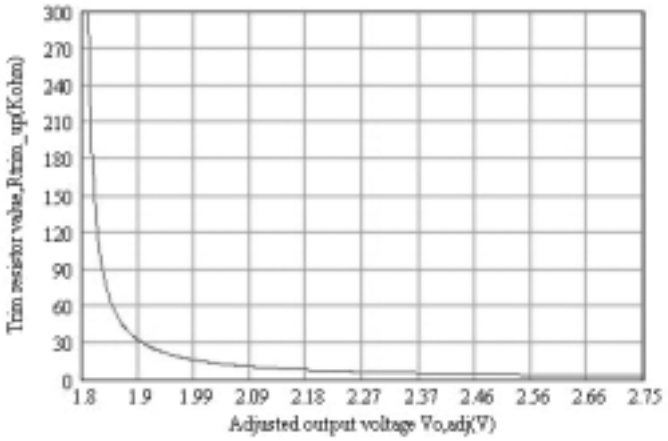
Output Voltage Set-Point Adjustment

xRAH-07C1A0 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{3.8488}{Vo - Vo,\ adj} - 4.091\right) \text{ Kohm}$$



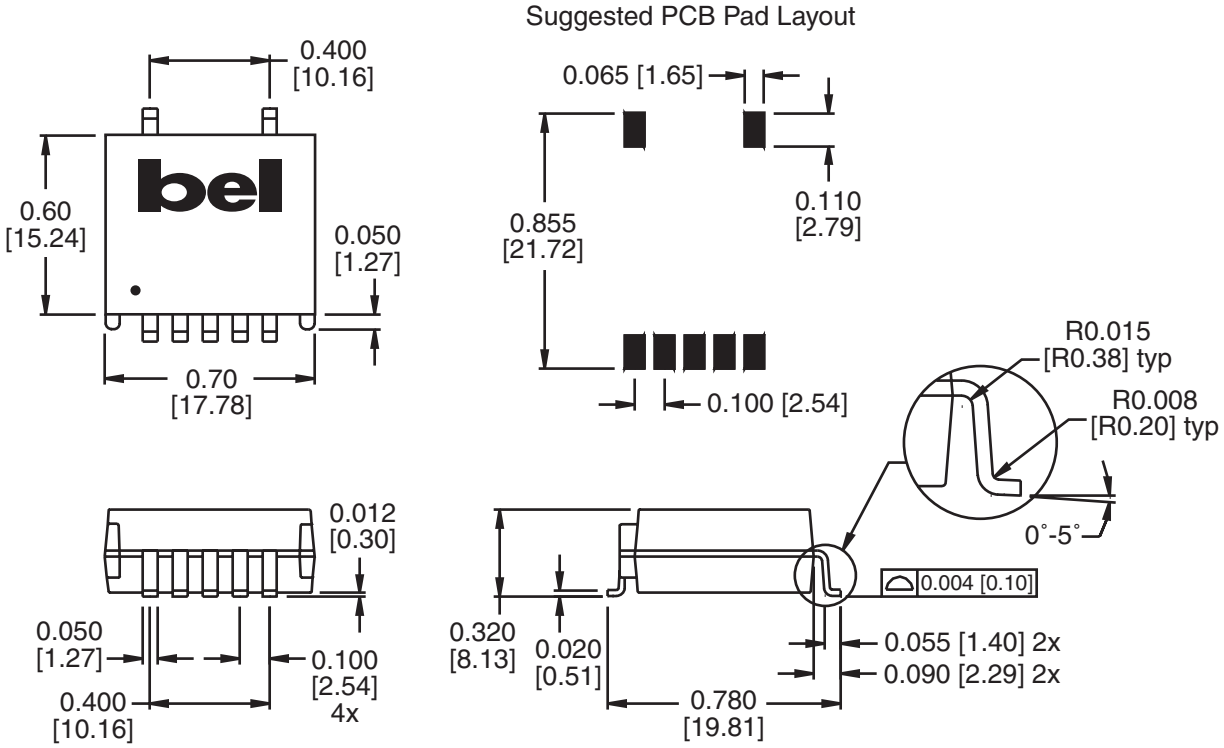
$$\text{Rtrim up} = \left(\frac{3.064}{Vo,\ adj - Vo} - 0.261\right) \text{ Kohm}$$



Note: Default output voltage of SRAH-07C1A0 is 1.8V

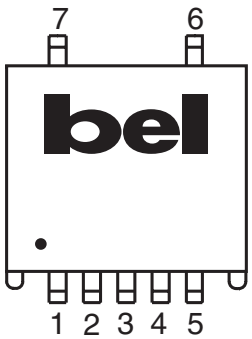
Mechanical

SRAH-07C



Dimensions are in inches [millimeters].
Standard dimension tolerance is ±0.005 [0.13] unless otherwise noted.

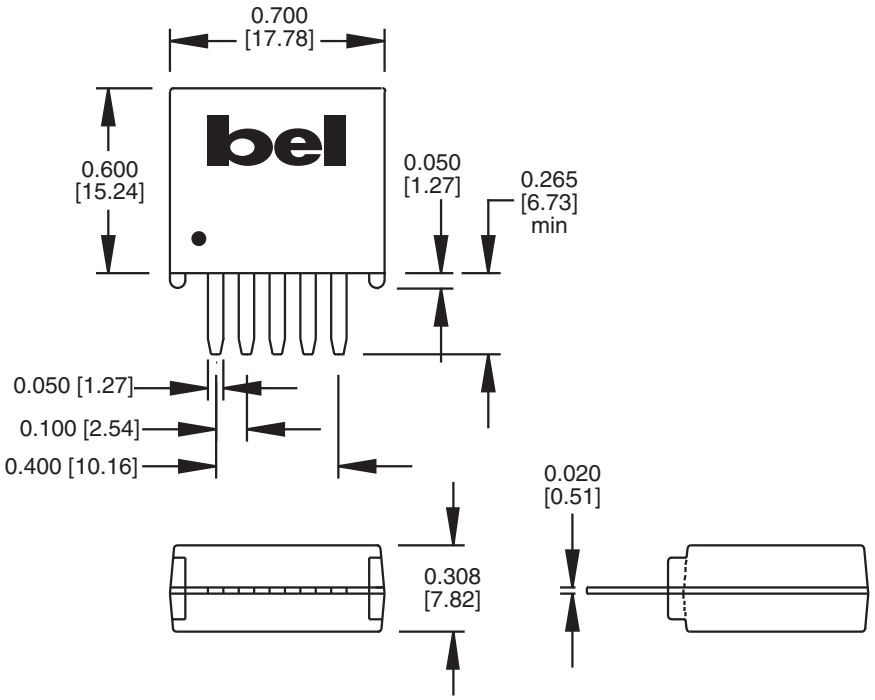
Pin	Function
1	Remote On/Off
2	+Vin
3	Ground
4	+Vo
5	Trim
6	No Connection
7	No Connection



BP06xRAH-07C

Mechanical

VRAH-07C



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Standard dimension tolerance is ±0.005 [0.13] unless otherwise noted.

Pin	Function
1	Remote On/Off
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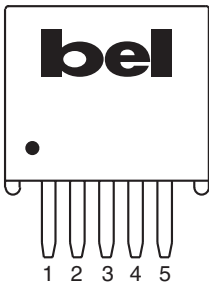
3	Ground
4	+Vo
5	Trim



RoHS Compliance
Complies with the European Directive 2002/95/EC, calling for the elimination of lead and other hazardous substances from electronic products. These parts are not however compatible with the higher temperatures associated with lead free solder processes and must be soldered using a reflow profile with a peak temperature of no more than 240ºC.

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