

PRELIMINARY



BHE30006 DC/DC CONVERTER

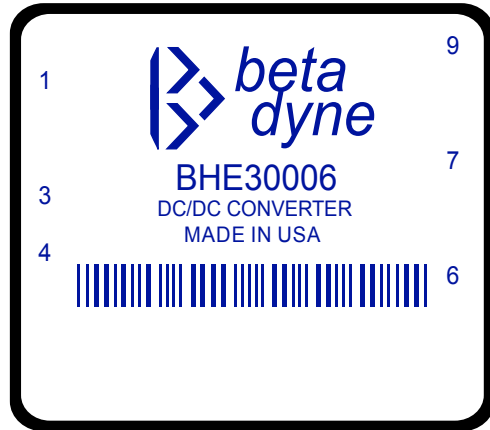
High Efficiency 40W, Input Range >5:1

20 to 110 V_{DC} Input; 13V_{OUT}@3A

US Patent 5,777,519

Key Features

- Wide input voltage range >5:1
- Less than 20mV output noise
- Efficiency up to 85%
- Six-sided shielding
- Soft start
- Hiccup short circuit protection
- Adjustable output
- 1mA off state current
- 100µS transient response
- Industry standard pinouts



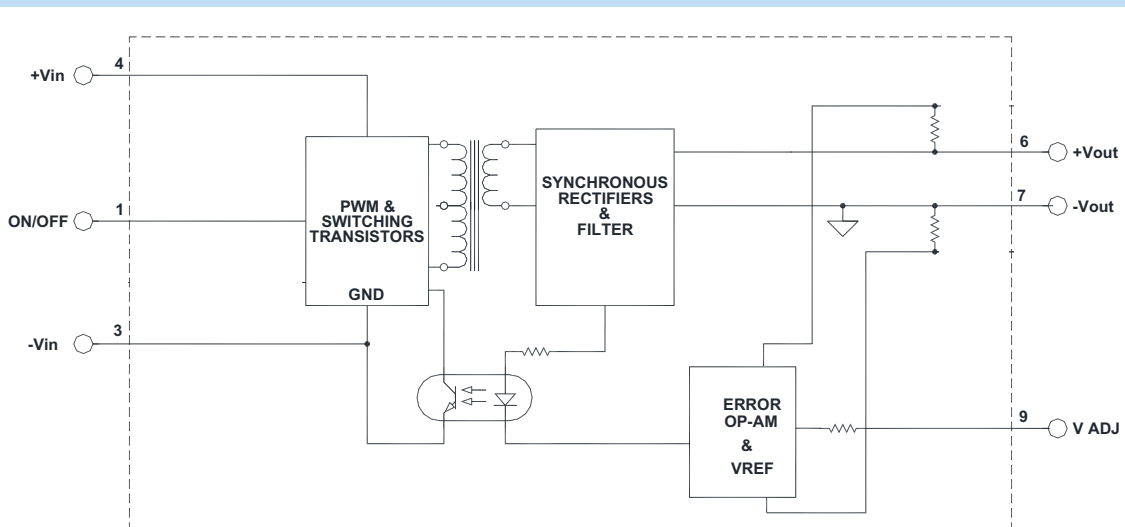
Beta Dyne is protected under various patents, including but not limited to U.S. Patent numbers: 5,777,519; 6,188,276; 6,262,901; 6,452,818; 6,473,3171.

Applications

- Railway Converters
- Instrumentation
- Test & Measurement
- Telecom

Functional Description

The BHE30006 is a high-performance, low-noise, isolated DC/DC converters consisting of a single output. The converter incorporates low switching noise techniques at its input and synchronous rectification on the output to provide 40W of output power at 85% efficiency in a 1.98"x1.58"x.55" case. Its high efficiency and SMT Technology allow the converter to operate from -40°C to +70°C without derating. The BHE30006 is designed to meet the BASIC requirements of UL/EN60950-1 and CE mark.



Typical Block Diagram of a BHE30006 Converter

Unless otherwise specified, all parameters are given under typical +25°C with nominal input voltage and under full output load conditions.

Electrical Specifications

INPUT SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Input Voltage Range		20	70	110	V _{DC}
Input Filter	LC				
Reverse Polarity Input Current	External series-blocking diode			12	A
Input Surge Current (20µS Spike)				10	A
Short Circuit Current Limit			150		% I _{IN}
Undervoltage Shutdown		18			Vdc
Turn-on Delay	See Figures 5 & 6	40	50	60	mS
Soft Start					mS
Off State Current,			2		mA
Remote ON/OFF Control, Positive Logic	Standard on All Model				
Converter ON	Pin 1 Open				
Converter OFF	Pin 1 Voltage	-0.6	0	0.2	Vdc
Logic Input Reference	-Input				
Logic Compatibility	TTL Open Collector or CMOS Open Drain				

OUTPUT SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Output Voltage			13		V _{DC}
Output Current			3		A
Output Voltage Accuracy			±1	±1.5	%
Output Voltage Adjustment	See Figure 10		5	±10	%
Minimum Load		None			% of FL
Ripple & Noise (20 MHz Bandwidth)	See Figures 1-4 & 9, with external components		.5	1	% of V _{PP}
Line Regulation, Single	Minimum V _{IN} to maximum V _{IN}		±.5	±1.0	%
Load Regulation, Single	NL to FL		±.2	±.5	%
Temperature Coefficient @ FL			0.02		%/°C of V _{OUT}
Transient Response Time (to within 0.5% of V _{OUT})	See Figure 7, 50% FL to FL to 50% FL		100		µS
Short Circuit Protection	All outputs, by Hiccup technique				

ENVIROMENTAL & GENERAL SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Efficiency	V _{IN} = 70V, I _{OUT} = 3A		85		
Isolation Voltage (1 min.)			1500		Vdc
Isolation Resistance			100		MΩ
Isolation Capacitance			1090		pF
Switching Frequency			200		kHz
MTBF	per MIL-HNBK-217F(Ground Benign, +25C)		1 x 10 ⁶		Hours
Thermal Resistance			1.0		°C/W
Operating Temperature, Industrial	See Figure 8, Derating	-40		+70	°C/W
Maximum Operating Case Temperature				110	°C
EMI/RFI	Six-sided continuous shielded metal case				
Humidity	Up to 95% non-condensing				

PHYSICAL CHARACTERISTICS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Dimensions (L×W×H)	1.98×1.58×0.55 in. (50.29×40.13×13.97mm)				
Weight	2.3 oz. (66.4g)				
Case Material	Coated metal				
Shielding Connection	-Input (Pin 3)				

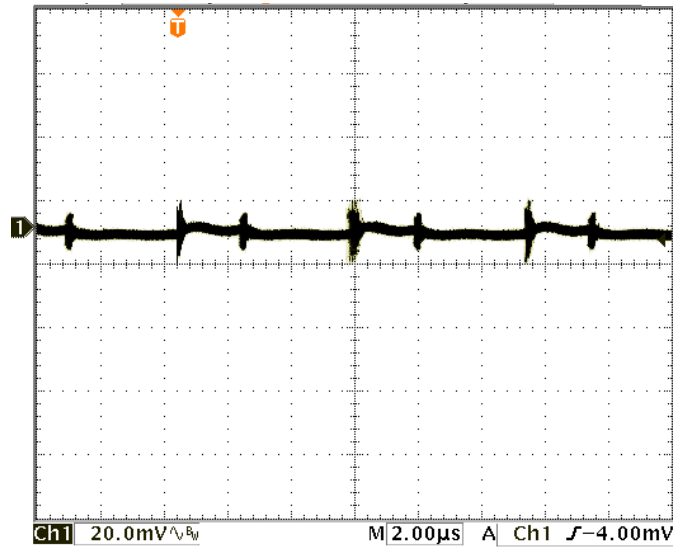


FIGURE 1. Typical output ripple at $V_{IN} = 20V$, $I_O = 3A$ with a 47uF external output capacitor

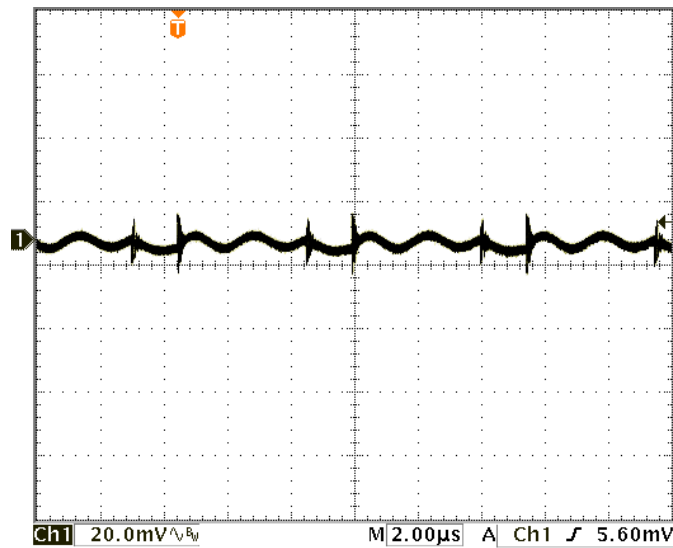


FIGURE 2. Typical output ripple at $V_{IN} = 48V$, $I_O = 3A$ with a 47uF external output capacitor

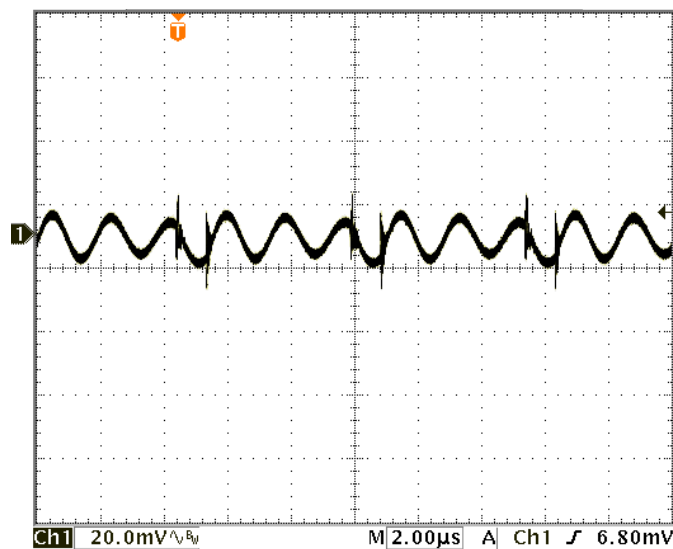


FIGURE 3. Typical output ripple at $V_{IN} = 72V$, $I_O = 3A$ with a 47uF external output capacitor

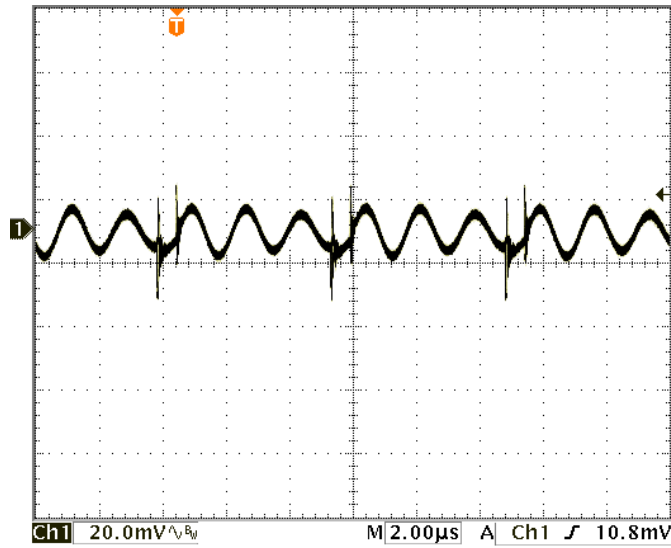


FIGURE 4. Typical output ripple at $V_{IN} = 110V$, $I_O = 3A$ with a $47\mu F$ external output capacitor

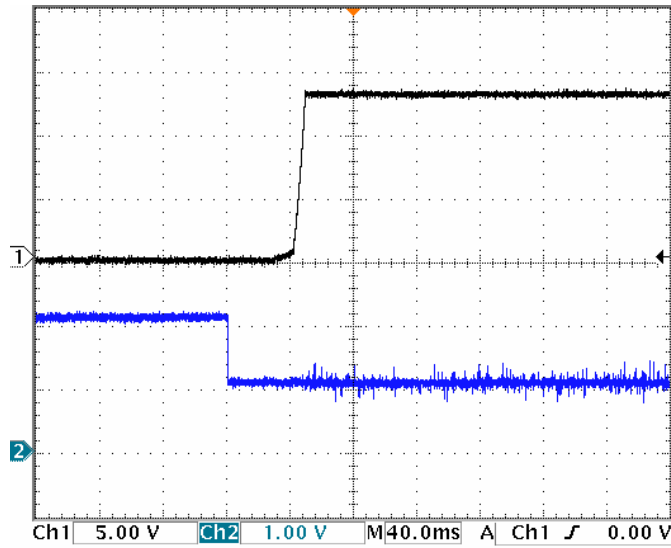


FIGURE 5. Start up and delay time of the BHE30006 at $V_{IN} = 20V$ and $I_{OUT} = 3A$

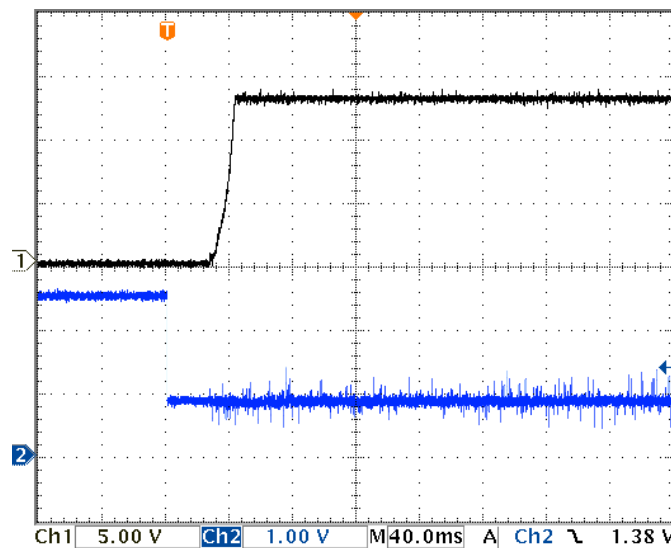


FIGURE 6. Start up and delay time of the BHE30006 at $V_{IN} = 70V$ and $I_{OUT} = 3A$

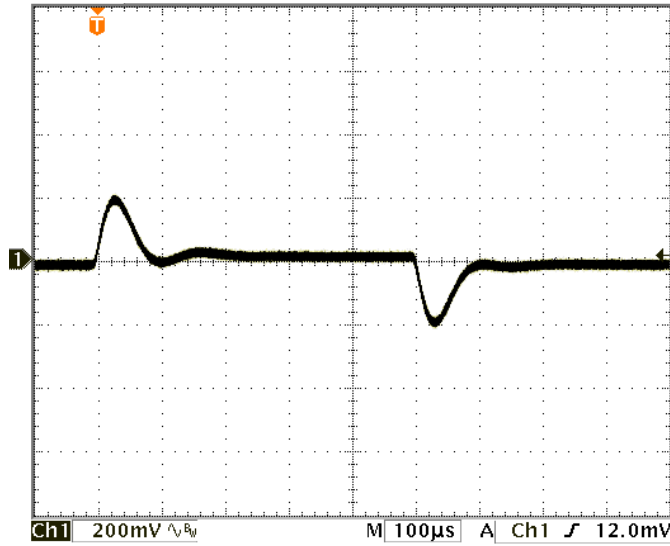


FIGURE 7. Transient response at $V_{IN} = 72$, with IO switching from Full Load (3A) to Half Load (1.5A)

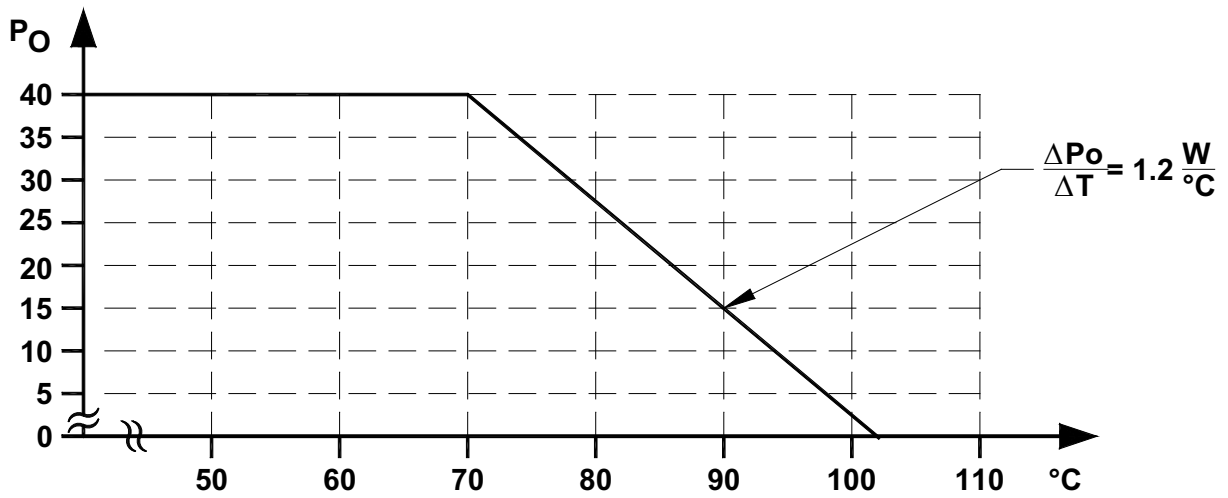
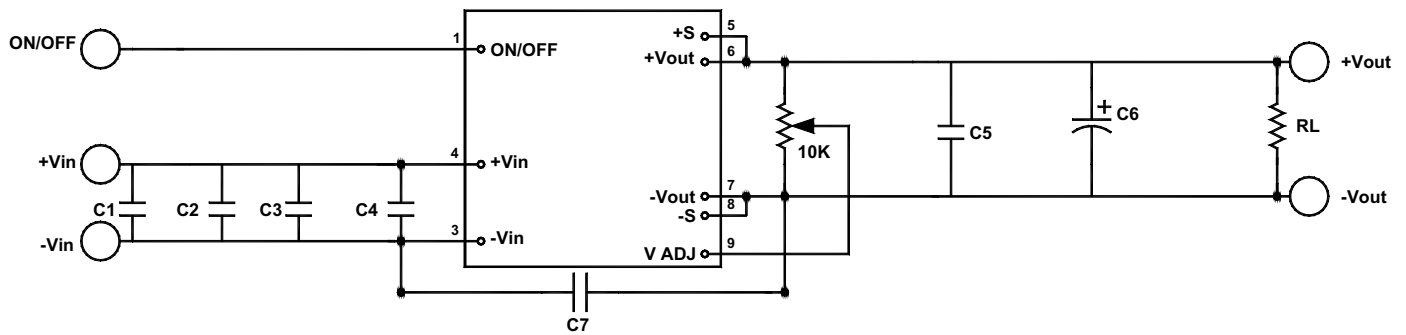


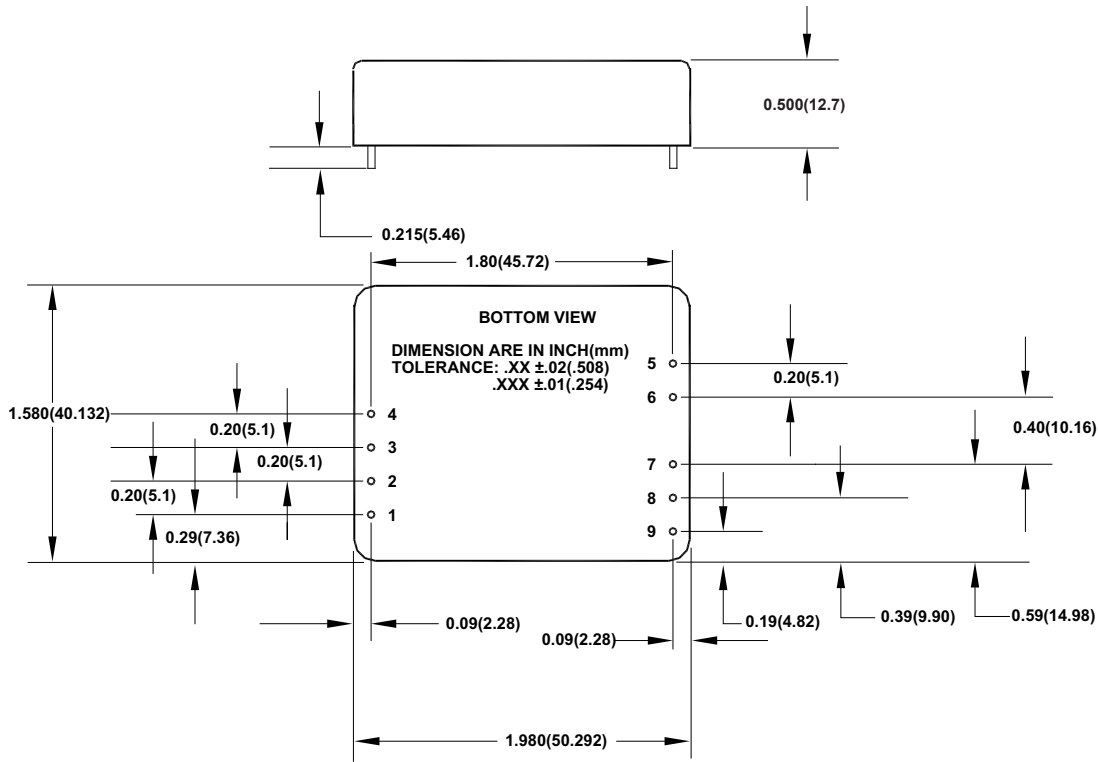
FIGURE 8. Derating diagram of the BHE30006



- C1,C2,C3,C4 = 2.2µF@450V ceramic
- C5=1µF@25V ceramic
- C6=47µF@20V Low ESR Tantalum
- C7= 0.01-0.1µF@1.5KV

FIGURE 9. Connection diagram of the BHE30006 with external components

MECHANICAL SPECIFICATIONS



Pin	Function
	SINGLE
1	ON/OFF
2	NO PIN
3	-V _{IN}
4	+V _{IN}
5	NO PIN
6	+V _{OUT}
7	-V _{OUT}
8	NO PIN
9	V _{OUT} ADJ

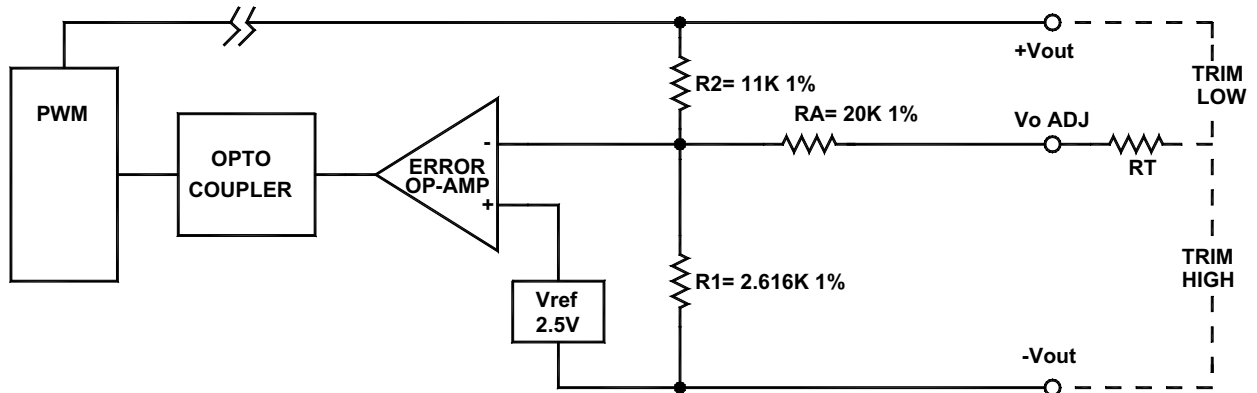


FIGURE 10. Typical connection diagram of BHE30S output adjustment circuit

Where Vo is the required higher value:

$$R_{\text{TRIM HIGH}} = [(R_1 R_2 V_{\text{REF}}) / \{V_O R_1 - V_{\text{REF}}(R_1 + R_2)\}] - R_A \text{ in KOhm}$$

Where Vo is the required lower value:

$$R_{\text{TRIM LOW}} = [(V_O - V_{\text{REF}}) R_1 R_2] / [(R_1 + R_2) V_{\text{REF}} - V_O R_1] - R_A \text{ in KOhm}$$