



# XWR15 DC/DC CONVERTER

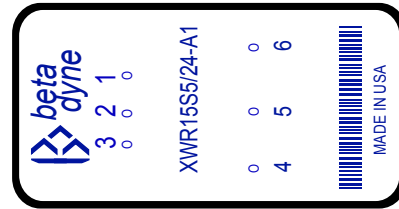
15W High Efficiency, 2:1 Wide Input Range  
US Patent 5,777,519

## Key Features

- Wide input voltage range (2:1)
- Less than 50mV output noise
- Efficiency up to 90%
- Six-sided shielding
- Soft start
- Single/Dual output
- Short circuit protection
- Adjustable output
- 1mA off state current
- Industry pinouts

### Available upon request:

- Unbalanced output voltages for dual outputs
- 1.8, 2.5, 3.3V<sub>OUT</sub>



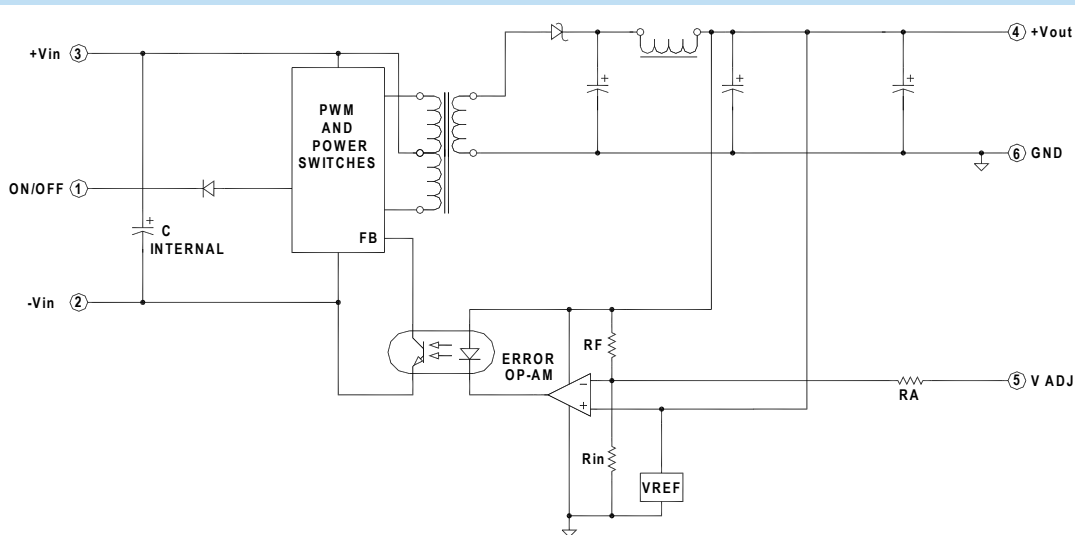
Beta Dyne is protected under various patents, including but not limited to U.S. Patent numbers: 5,777,519; 6,188,276; 6,262,901; 6,452,818; 6,473,3171.

## Applications

- High-Resolution Data Converters
- Instrumentation
- Test & Measurement
- Telecom

## Functional Description

The XWR15 series is a family of high-performance, low-noise, low-cost isolated DC/DC converters consisting of single and dual output models. The converter incorporates low switching noise techniques at its input and output sections to achieve low output ripple.



Typical Block Diagram of XWR15 Single Output Converter

## Electrical Specifications

### INPUT SPECIFICATIONS

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

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Input Voltage Range	See Model Selection Guide				
Input Filter	LC				
Reverse Polarity Input Current	External series-blocking diode			12	A
Input Surge Current (20µS Spike)				10	A
Short Circuit Current Limit	by Hiccup Technique		150		% I <sub>IN</sub>
Undervoltage Shutdown, 12V <sub>in</sub> Models		7			Vdc
Undervoltage Shutdown, 24V <sub>in</sub> Models		13			Vdc
Undervoltage Shutdown, 48V <sub>in</sub> Models		28			Vdc
Off State Current, 12, 24, 48V			750		µA
Remote ON/OFF Control, A2 Single Models Only					
Converter ON	Open (Open circuit voltage at Pin 1: 10V Max.)				
Converter OFF		-0.6	0	0.2	Vdc
Logic Input Reference	-Input				
Logic Compatibility	TTL Open Collector or CMOS Open Drain				
Reflected Input Ripple(Typical)	12V <sub>IN</sub> =600mA, 24V <sub>IN</sub> =200mA, 48V <sub>IN</sub> =150mA				mA <sub>pk-pk</sub>

### OUTPUT SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Voltage and Current Ratings	See Model Selection Guide				
Output Voltage Accuracy, Single and Dual			±1	±1.5	%
Output Voltage Adjustment, Single Only	See Figure 7		±10		%
Voltage Balance, Dual <sup>1</sup>			±0.2	±0.5	%
Minimum Load <sup>1</sup>		10			% of FL
Ripple & Noise	See Figure 5, (20MHz bandwidth)		50		mV <sub>pp</sub>
Line Regulation, Single and Dual	Minimum V <sub>IN</sub> to maximum V <sub>IN</sub>		±.1		%
Load Regulation, Single	NL to FL		±.1		%
Load Regulation, Dual <sup>2</sup>			±.1		%
Temperature Coefficient @ FL			0.02		%/°C of V <sub>OUT</sub>
Transient Response Time (to within 0.5% of V <sub>OUT</sub> )	50% FL to FL to 50% FL, See Figure 1				
Short Circuit Protection	All outputs, by Hiccup Technique				

### GENERAL SPECIFICATIONS

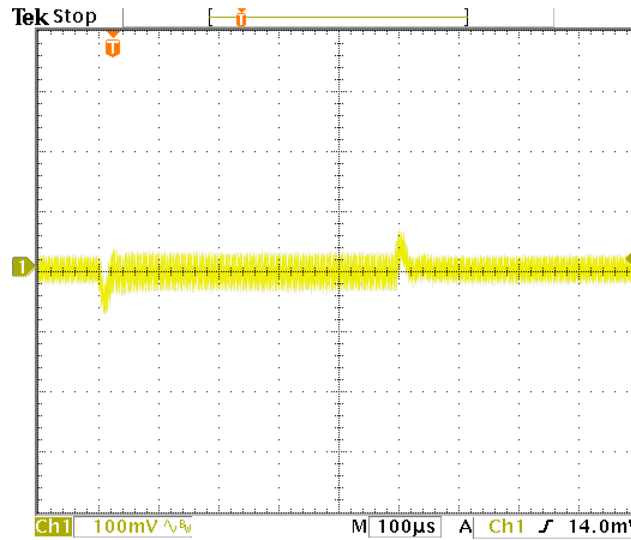
PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Efficiency	See Model Selection Guide				
Isolation Voltage (1 min.)			1500		Vdc
Isolation Resistance			10 <sup>9</sup>		Ω
Isolation Capacitance			80		pF
Switching Frequency			160		kHz

### ENVIRONMENTAL SPECIFICATIONS

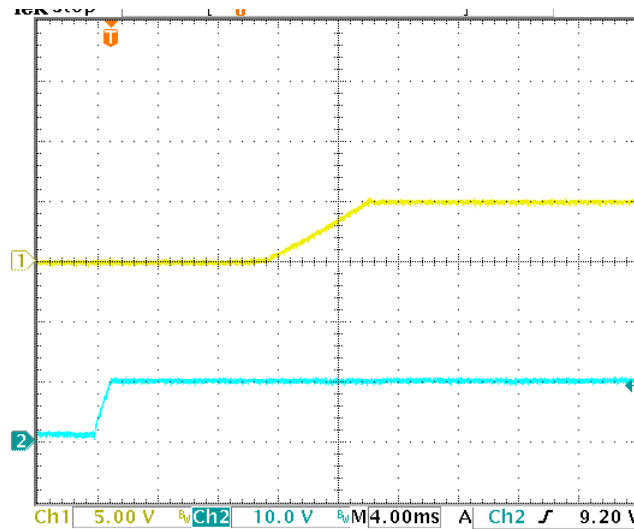
PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Operating Temperature, Industrial (Ambient) <sup>*</sup>		-40		+75	°C
Operating Temperature, Extended (X) <sup>3</sup>	See Ordering Guide (Please contact factory)	-55		+85	°C
Storage Temperature Range		-55		+125	°C
Maximum Operating Case Temperature				105	°C
Thermal Resistance			9.3		°C/W
Humidity	Up to 95% non-condensing				
Cooling	Free-air convection				
EMI/RFI	Six-sided continuous shielded metal case				
MTBF	per MIL-HNBK-217F (Ground benign, +25°C)		1×10 <sup>6</sup>		hours

**PHYSICAL CHARACTERISTICS**

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Dimensions (L×W×H)	2.00×1.00×0.445 in. (50.80×25.40×11.43mm)				
Weight	1.04 oz. (30g)				
Case Material	Coated metal				
Shielding Connection, 12, 24V <sub>IN</sub>	-Input (Pin 3)				
Shielding Connection, 48V <sub>IN</sub>	+Input (Pin 4)				



**FIGURE 1. Transient response of XWR15S5/24-A1 from Full load to Half Load**



**FIGURE 2. Output voltage delay & rise time of XWR15S5/24-A1 at V<sub>in</sub>=24V & I<sub>o</sub>=3A.**

**OUTPUT VOLTAGE ADJUSTMENT**

For single models, the output reference voltage is referenced to the output ground: Pin 6 for singles. To trim the output voltage high, connect a 1% resistor (0kΩ–200kΩ range) between GND (Pin 6) and V<sub>OUT</sub> Adjust (Pin 5) for the singles. To trim the output voltage low, connect a 1% resistor (50kΩ–500kΩ range) between +V<sub>OUT</sub> (Pin 4) and V<sub>OUT</sub> Adjust (Pin 5) for the singles.

Avoid using a low resistance potentiometer or a high temperature coefficient such as wound wire.

## Model Selection Guide

MODEL NUMBER	INPUT				OUTPUT		
	Voltage (Vdc)		Current (mA)		Voltage (Vdc)	Current (mA)	Efficiency Full Load (%)
	Nominal	Range	No Load	Full Load			
XWR15S3.3/12-A_	12	9-18	6	1424	+3.3	4250	82
XWR15S5/12-A_	12	9-18	9	1474	+5	3000	85
XWR15S12/12-A_	12	9-18	19	1456	+12	1250	86
XWR15S15/12-A_	12	9-18	21	1427	+15	1000	87
XWR15S3.3/24-A_	24	18-36	6	701	+3.3	4250	83
XWR15S5/24-A_	24	18-36	6	732	+5	3000	85
XWR15S12/24-A_	24	18-36	8	715	+12	1250	88
XWR15S15/24-A_	24	18-36	9	699	+15	1000	89
XWR15S3.3/48-A_	48	36-75	5	349	+3.3	4250	83
XWR15S5/48-A_	48	36-75	4	361	+5	3000	87
XWR15S12/48-A_	48	36-75	5	354	+12	1250	89
XWR15S15/48-A_	48	36-75	8	354	+15	1000	88
XWR15D5/12-A_	12	9-18	7	1477	±5	±1500	84
XWR15D12/12-A_	12	9-18	20	1661	±12	±725	87
XWR15D15/12-A_	12	9-18	29	1619	±15	±575	88
XWR15D5/24-A_	24	18-36	6	728	±5	±1500	86
XWR15D12/24-A_	24	18-36	14	814	±12	±725	89
XWR15D15/24-A_	24	18-36	18	795	±5	±575	90
XWR15D5/48-A_	48	36-75	5	369	±5	±1500	84
XWR15D12/48-A_	48	36-75	9	412	±12	±725	88
XWR15D15/48-A_	48	36-75	14	403	±15	±575	88

*Contact factory for custom input and output voltage combinations*

- <sup>1</sup> In applications where the  $-V_{OUT}$  is loaded more than  $+V_{OUT}$ , a minimum load is required between  $+V_{OUT}$  and GND. If the load is connected between  $+V_{OUT}$  and  $-V_{OUT}$ , no minimum load is required.
- <sup>2</sup> For dual converters if only the  $-V_{OUT}$  is loaded. A 10% FL must be connected from  $+V_{OUT}$  to Ground.
- <sup>3</sup> Contact factory for  $-55^{\circ}$  to  $+85^{\circ}\text{C}$  operating temperature range.
- <sup>4</sup> The maximum input current at any given input range measured at minimum input voltage is given as  $1.6 \cdot I_{NOMINAL}$ . Nominal input current is the typical value measured at the input of the converter under full-load room temperature and nominal input voltage (12, 24 and  $48V_{IN}$ ).
- <sup>5</sup> Adequate insulation is to be provided to the converters at the end usage as per applicable requirements.
- <sup>6</sup> Temperature rise on the case of the converters is to be considered during the end usage as per applicable requirements.

**ORDERING GUIDE**

**XWR15** / **X-**

Power \_\_\_\_\_

Number of Outputs (S = Single, D = Dual) \_\_\_\_\_

Output Voltage \_\_\_\_\_

Case Type: \_\_\_\_\_

Insert **A1** for 2:3 pin case without ON/OFF pin

Insert **A2** for 3:3 pin case with ON/OFF pin

Insert **X** for  $-55^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  (Optional)

Input Voltage \_\_\_\_\_

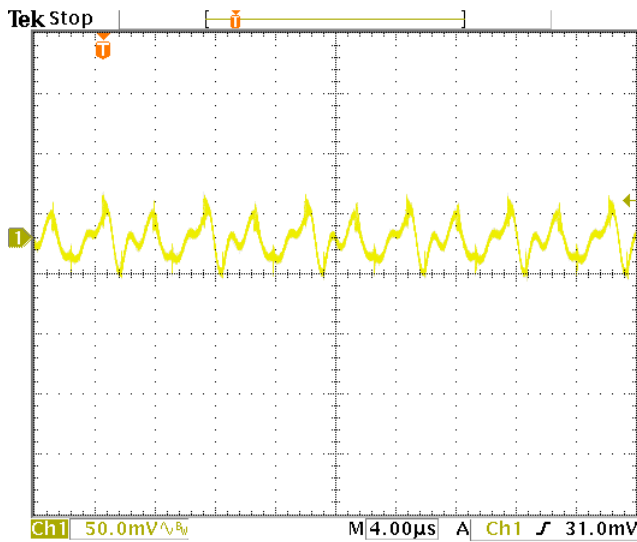


FIGURE 3. Output ripple of XWR15SS5/24-A1 as shown in figure 5.

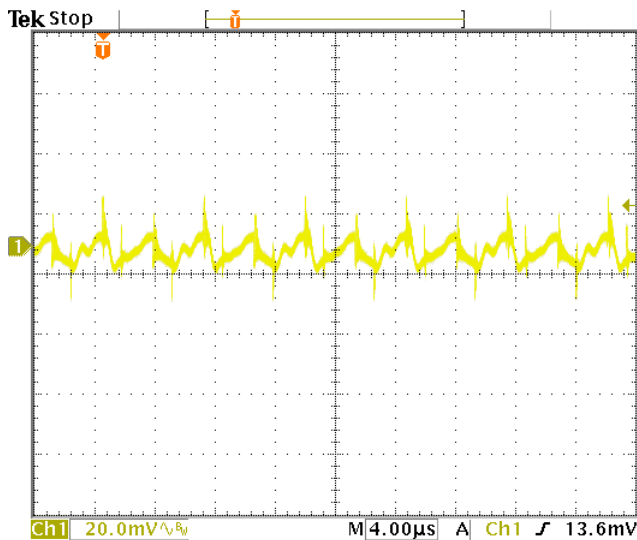
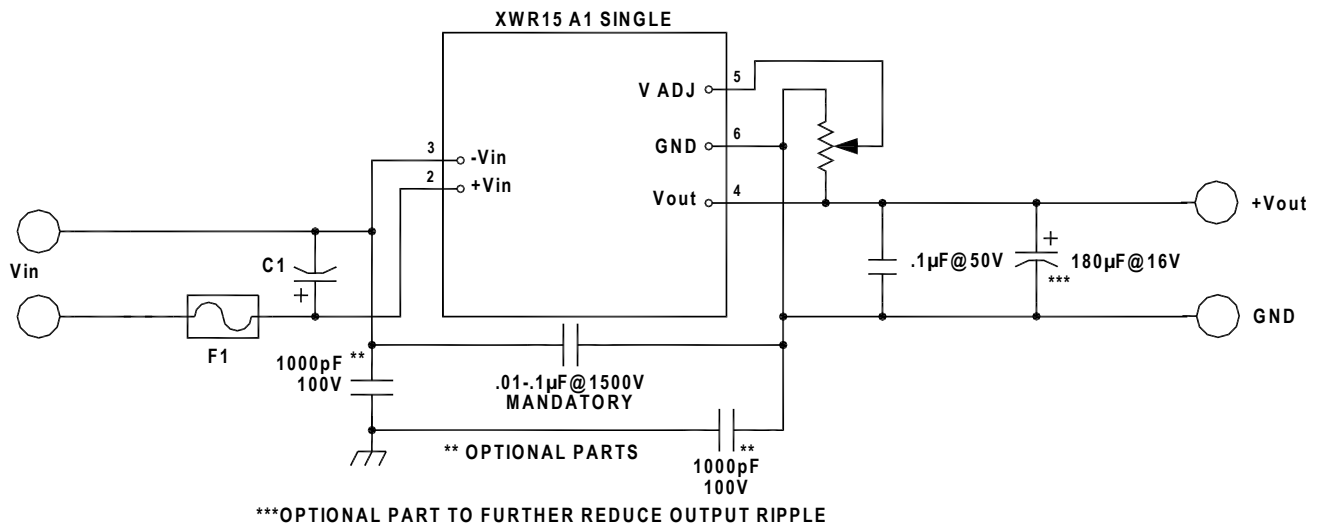
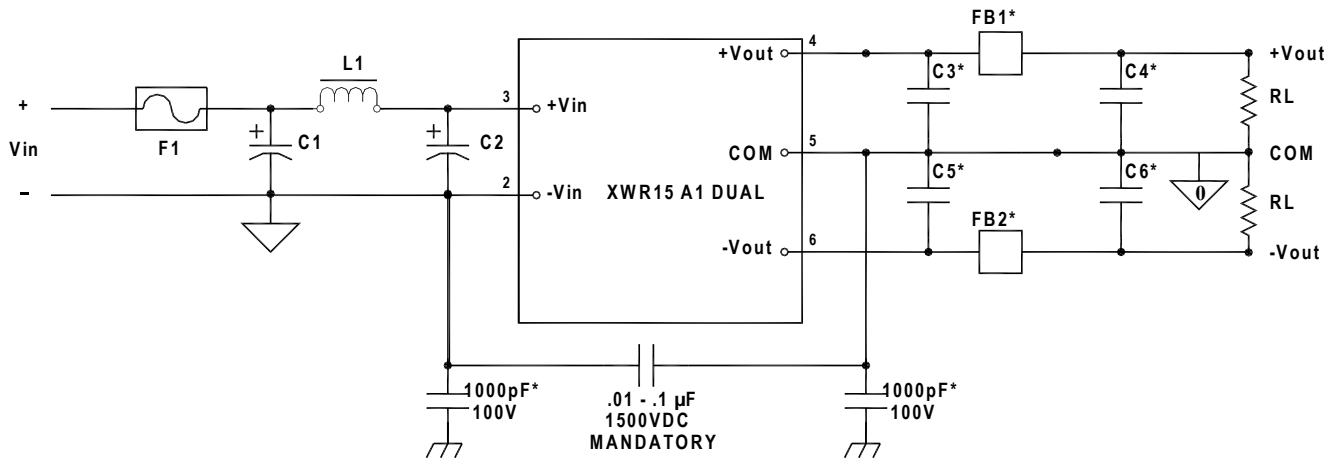


FIGURE 4. Output ripple of XWR15SS5/24-A1 as shown in figure 5 with an additional 180µF@16V low esr capacitor.



V <sub>IN</sub>	F1 (A)	C1 (Low ESR) (µF)	C Internal (µF)
12	2	47@25V	33@25V
24	1	22@50V	3.3@50V
48	0.5	10@100V	2.2@100V

FIGURE 5. Typical connection diagram of XWR15 A1 Single DC/DC Converter



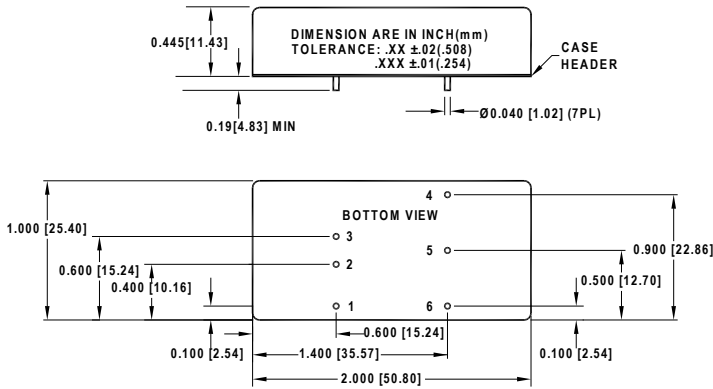
FB1, FB2 = CMS2-5.6/3/4.8-4S2 (Ferroxcube)  
 \* Output filter component shown may be needed if output ripple/noise less than 10mV is required.

Typical Values

V <sub>IN</sub>	F1 (A)	C1(Low ESR) (µF)	L1 (µH)	C2 (µF)	C3 - C6 (µF)
12	2	47@25V	0.6	47@25V	10
24	1	22@50V	1	22@50V	10
48	0.5	10@100V	2	10@100V	10

FIGURE 6. Typical connection diagram of XWR15 A1 Dual DC/DC Converter

### MECHANICAL SPECIFICATIONS A1/A2 CASE



### A1/A2 CASE

Pin	Function	
	SINGLE	DUAL
1	ON/OFF	ON/OFF
2	-V <sub>IN</sub>	-V <sub>IN</sub>
3	+V <sub>IN</sub>	+V <sub>IN</sub>
4	+V <sub>OUT</sub>	+V <sub>OUT</sub>
5	V <sub>OUT</sub> ADJ	GND (COM)
6	GND	-V <sub>OUT</sub>

Note: On/Off pin only on A2 configuration

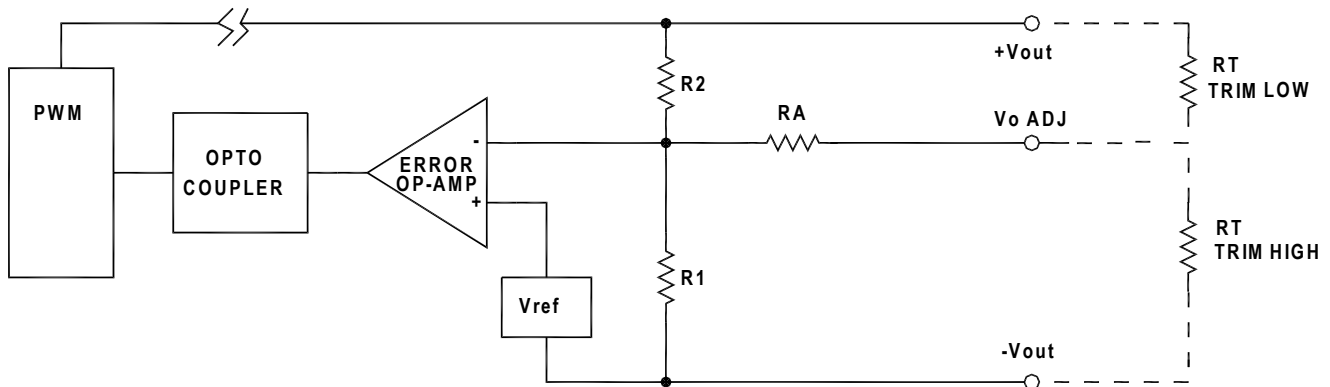


FIGURE 7. Typical connection diagram of XWR15 A1 output adjustment circuit

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:

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

### Output Adjustment Component Values

V <sub>OUT</sub> (V)	R <sub>2</sub> (KOhm)	R <sub>1</sub> (KOhm)	R <sub>A</sub> (KOhm)	V <sub>REF</sub> (V)
3.3	4.22	2.49	5.62	1.224
5	2.49	2.49	9.53	2.5
12	9.53	2.49	20.0	2.5
15	15k	3.01	24.0	2.5