



# Low-Noise LNB15 DC/DC CONVERTER

5mV Low Noise, High Efficiency 15W, 2:1 Input Range  
US Patent 5,777,519

## Key Features

- Wide input voltage range (2:1)
- Less than 5mV output noise
- Efficiency up to 88%
- Six-sided shielding
- Soft start
- Single/Dual output
- Short circuit protection
- Adjustable output
- 1mA off state current
- 250mV dropout linear regulators
- Dual output tracking linear regulator
- 5 $\mu$ S transient response
- Industry pinouts

### Available upon request:

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



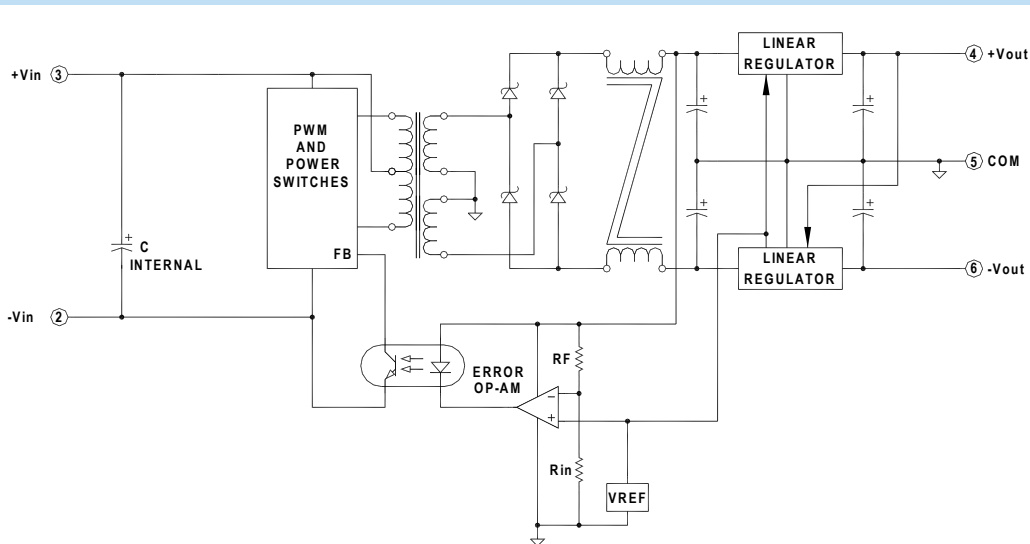
Beta Dyne is protected under various patents, including but not limited to U.S. Patent numbers: 5,777,519; 6,188,276; 6,262,901; 6,452,818; 6,473,3171.

## Applications

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

## Functional Description

The Low-Noise LNB15 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. Low dropout linear regulators reduce the output noise to 5mV<sub>pp</sub>, while a patented control circuit maintains minimum constant dropout voltage over line, load, temperature and output adjust ranges.



Typical Block Diagram of LNB15 Dual 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			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				

### 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			3	±5	%
Voltage Balance, Dual <sup>1</sup>			±0.2	±0.5	%
Minimum Load <sup>1</sup>		10			% of FL
Ripple & Noise (20 MHz Bandwidth)	See Figure 4, with external capacitor		10		mV <sub>PP</sub>
Ripple & Noise, 3.3V <sub>OUT</sub> only (20 MHz Bandwidth)	See Figure 4, with external capacitor		20		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				µS
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>		T
Isolation Capacitance			80		pF
Switching Frequency			160		kHz

### ENVIRONMENTAL SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Operating Temperature, Industrial (Ambient) <sup>3</sup>		-40		+75	°C
Operating Temperature, Extended (X)	See Ordering Guide (Please contact factory)	-55		+85	°C
Storage Temperature Range		-55		+125	°C
Maximum Operating Case Temperature				105	°C
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)				

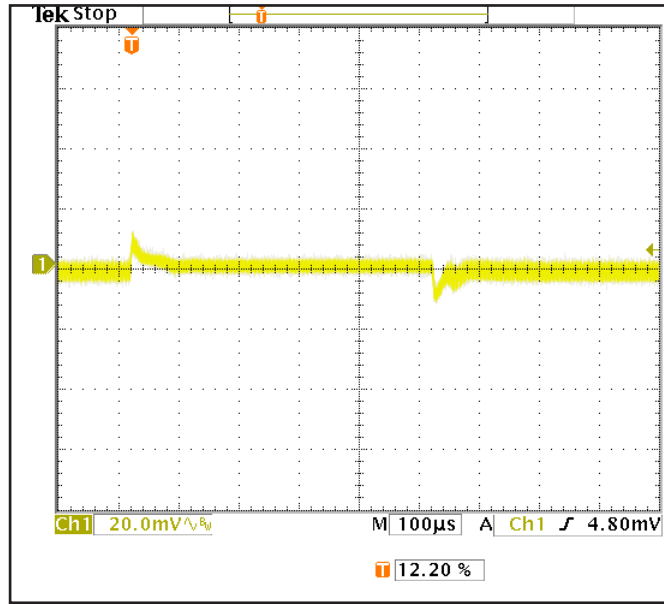


FIGURE 1. Transient response of LNB15S5/24-A1 from Full load to Half Load

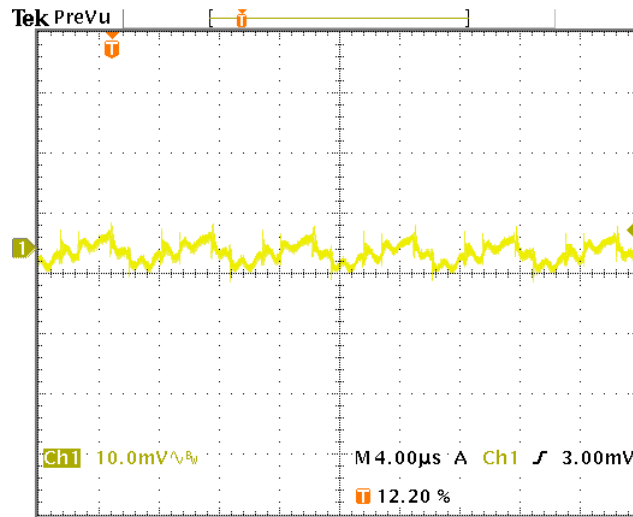


FIGURE 2. Typical output ripple of LNB15S5/24-A1 as shown in Figure 4.

**OUTPUT VOLTAGE ADJUSTMENT**

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

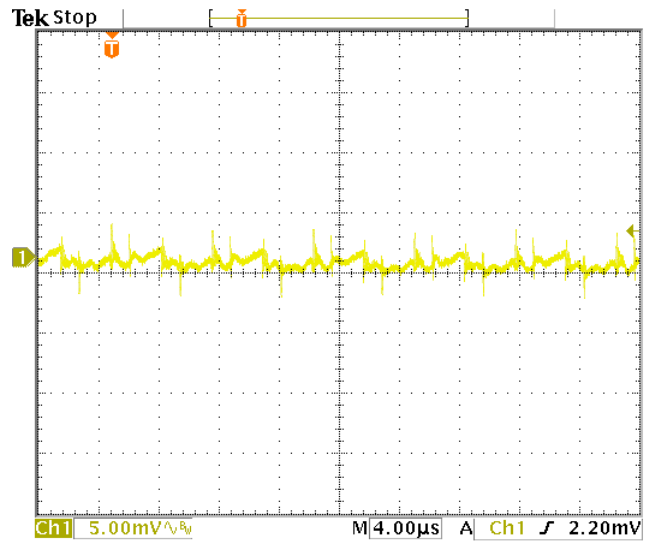
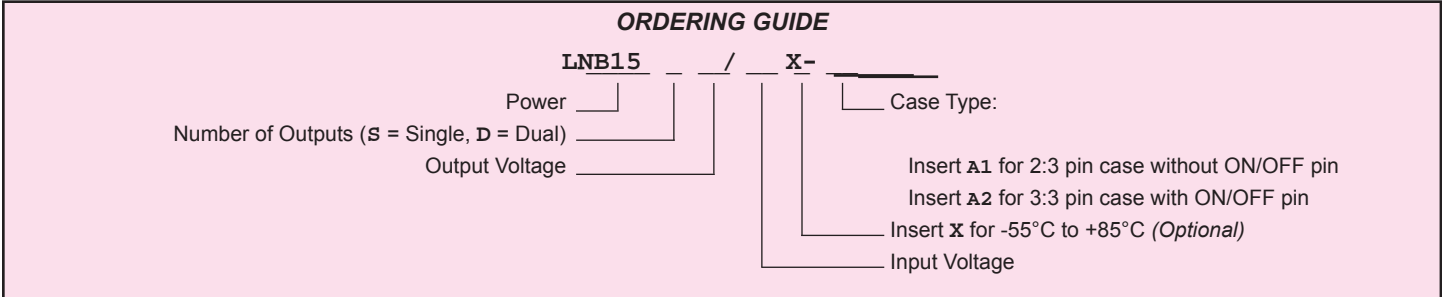
Avoid using a low resistance potentiometer or a high temperature coefficient such as wound wire.

## Model Selection Guide

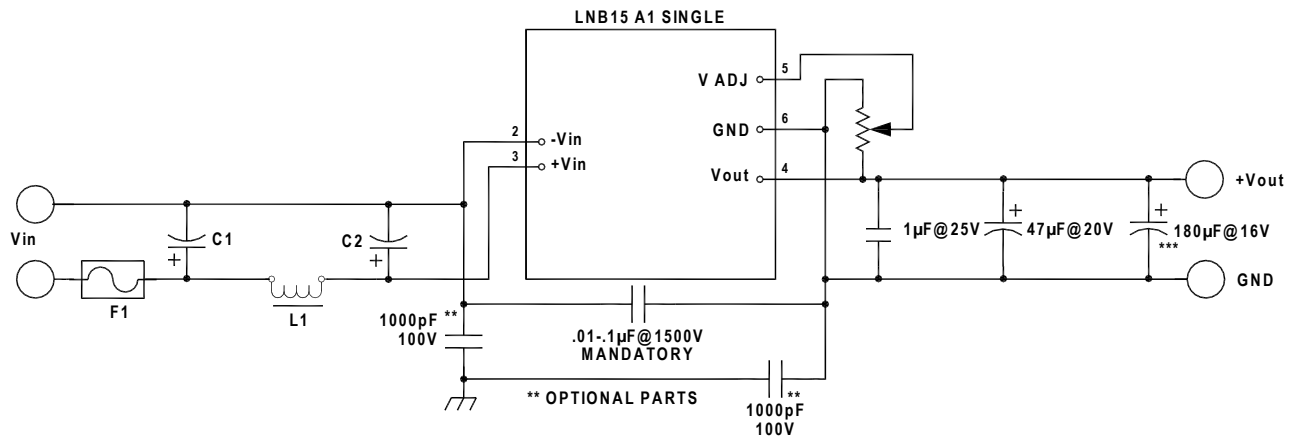
MODEL NUMBER	INPUT				OUTPUT		
	Voltage (Vdc)		Current (mA)		Voltage (Vdc)	Current (mA)	Efficiency Full Load (%)
	Nominal	Range	No Load	Full Load			
LNB15S2.5/12-A_	12	9-18	TBD	TBD	TBD	TBD	TBD
LNB15S3.3/12-A_	12	9-18	7	1451	+3.3	4250	80
LNB15S5/12-A_	12	9-18	14	1533	+5	3000	81
LNB15S12/12-A_	12	9-18	16	1474	+12	1250	85
LNB15S15/12-A_	12	9-18	31	1454	+15	1000	86
LNB15S2.5/24-A_	24	18-36	TBD	TBD	TBD	TBD	TBD
LNB15S3.3/24-A_	24	18-36	60	701	+3.3	4250	81
LNB15S5/24-A_	24	18-36	16	732	+5	3000	83
LNB15S12/24-A_	24	18-36	20	715	+12	1250	88
LNB15S15/24-A_	24	18-36	22	699	+15	1000	87
LNB15S2.5/48-A_	48	36-72	TBD	TBD	TBD	TBD	TBD
LNB15S3.3/48-A_	48	36-72	5	357	+3.3	4250	82
LNB15S5/48-A_	48	36-72	4	374	+5	3000	84
LNB15S12/48-A_	48	36-72	12	360	+12	1250	88
LNB15S15/48-A_	48	36-72	13	357	+15	1000	88
LNB15D5/12-A_	12	9-18	29	1569	±5	±1500	80
LNB15D12/12-A_	12	9-18	76	1513	±12	±625	82
LNB15D15/12-A_	12	9-18	109	1524	±15	±500	82
LNB15D5/24-A_	24	18-36	24	763	±5	±1500	82
LNB15D12/24-A_	24	18-36	50	747	±12	±625	84
LNB15D15/24-A_	24	18-36	56	743	±5	±500	84
LNB15D5/48-A_	48	36-72	10	376	±5	±1500	83
LNB15D12/48-A_	48	36-72	22	371	±12	±625	84
LNB15D15/48-A_	48	36-72	28	370	±15	±500	85

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  $+85^{\circ}$ 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.



**FIGURE 3. Typical output ripple of LNB15S5/24-A1 as shown in Figure 4 with an additional 180uF@16V low esr capacitor.**

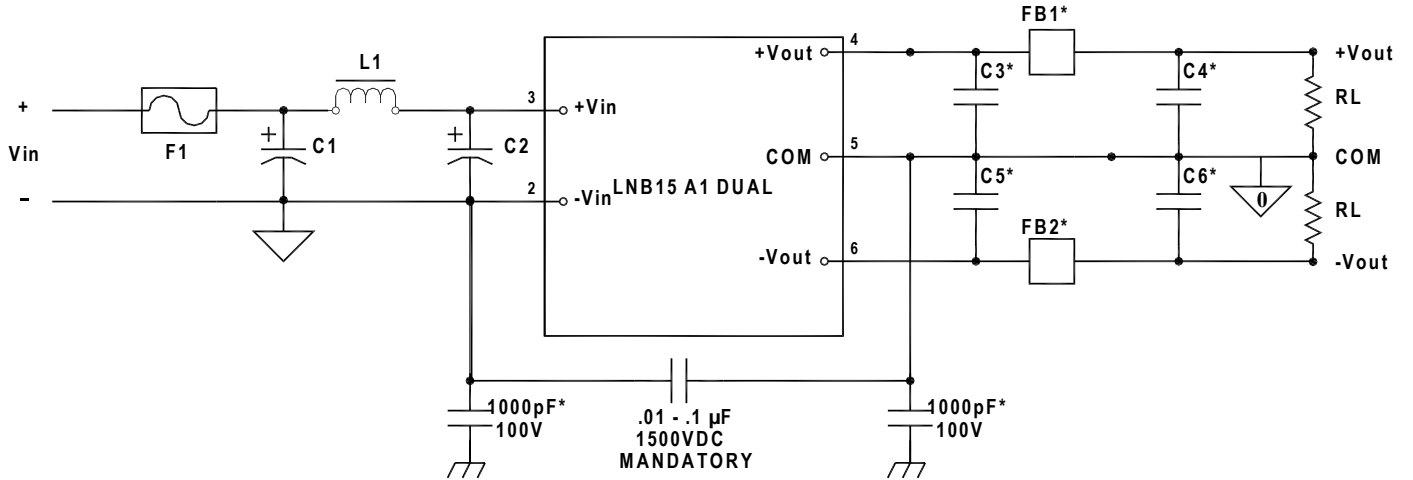


\*\*\* OPTIONAL PARTS TO FURTHER REDUCE OUTPUT RIPPLE

**Typical Values**

V <sub>IN</sub>	F1 (A)	C1 (Low ESR) (µF)	L1 (µH)	C2 (µF)	C Internal (µF)
12	2	47@25V	0.6	47@25V	33@25V
24	1	22@50V	1.0	22@50V	3.3@50V
48	0.5	10@100V	2.2	10@100V	2.2@100V

**FIGURE 4. Typical connection diagram of LNB15 A1 Single DC/DC Converter**



FB1, FB2 = CMS2-5.6/3/4.8-4S2 (Ferroxcube)

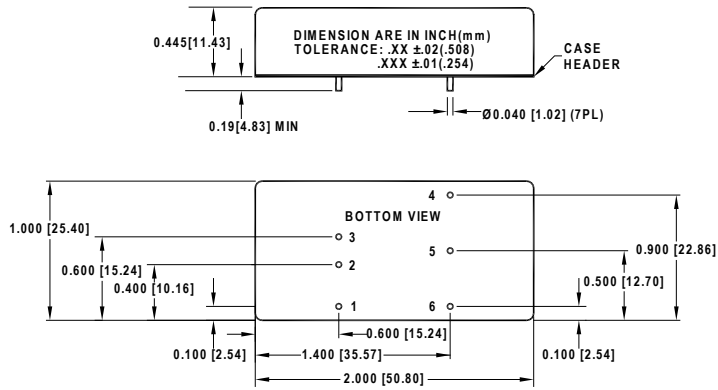
\* Output filter component shown may be needed if output ripple/noise less than 10mV is required.

**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	1.0	22@50V	10
48	0.5	10@100V	2.2	10@100V	10

**FIGURE 5. Typical connection diagram of LNB15 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**