

# LT6658

## Precision Dual Output, High Current, Low Noise, Voltage Reference

### DESCRIPTION

Demonstration circuit 2432B features the **LT®6658**, a precision dual output reference that combines the performance of a low drift low noise reference and a linear regulator. Demonstration circuits are available with 1.25V, 1.8V, 2.5V, 3.0V, 3.3V and 5V output option parts. Both outputs are ideal for driving the precision reference inputs of high resolution ADCs and DACs, even with heavy loading while simultaneously acting as output supplies for powering microcontrollers and other supporting devices. Both outputs have the same precision specifications and

track each other over temperature. Each output can be configured with external resistors to give an output voltage up to 6V.

Using Kelvin connections, the LT6658 typically has 0.1ppm/mA load regulation with up to 150mA load current. A noise reduction pin is available to band-limit and lower the total integrated noise.

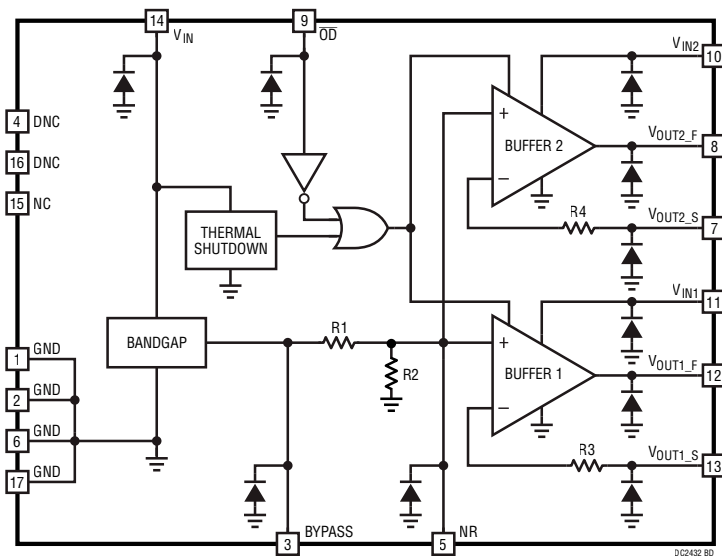
**Design files for this circuit board are available.**

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### PERFORMANCE SUMMARY Specifications are at T<sub>A</sub> = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V <sub>IN</sub>	Input Supply Range		5V		36	V
V <sub>OUT</sub>	Output Voltage Accuracy		-0.05		+0.05	%
Temperature Drift					10	ppm
I <sub>Q</sub>	Supply Current			2		mA
Load Regulation	OUT1	0mA to 150mA			2	μV/mA
Load Regulation	OUT2	0mA to 50mA			3.75	μV/mA

### LT6658 BLOCK DIAGRAM



Voltage Option (V)	R1 (Ω)	R2 (Ω)	R3, R4 (Ω)
1.2	400	9600	768
1.8	400	2903	705
2.5	400	OPEN	800
3	400	OPEN	800
3.3	400	OPEN	800
5	400	OPEN	800

## QUICK START PROCEDURE

With the demonstration circuit, it is easy to set up and evaluate the performance of the LT6658. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below.

1. With the power off, connect the power supply positive to  $V_{IN}$  and the common to GND. With default settings, the supply can range from  $V_{OUT} + 2.5V$  to 36V.
2. Connect a DVM to the  $V_{OUT}$  turret OUT1 with the common connection attached to ground.
3. Turn on power supply and confirm reference operation on OUT1, and also OUT2.

## JUMPER SUMMARY

**JP1:**  $V_{IN}$  Input Selection. This jumper has 3 positions:

1. SEP: Separates the  $V_{IN}$  from the  $V_{IN1}$  and  $V_{IN2}$  output buffer supplies
2. COM/V2: Shorts the  $V_{IN2}$  output buffer supply pin to  $V_{IN}$
3. COM/V1: Shorts the  $V_{IN1}$  output buffer supply pin to  $V_{IN}$

**JP2:**  $V_{IN1}/V_{IN2}$  Output Buffer Supply Connection:

1. SEP: Separates the  $V_{IN1}$  and  $V_{IN2}$  output buffer supply
2. COM: Shorts the  $V_{IN1}$  and  $V_{IN2}$  output buffer supplies

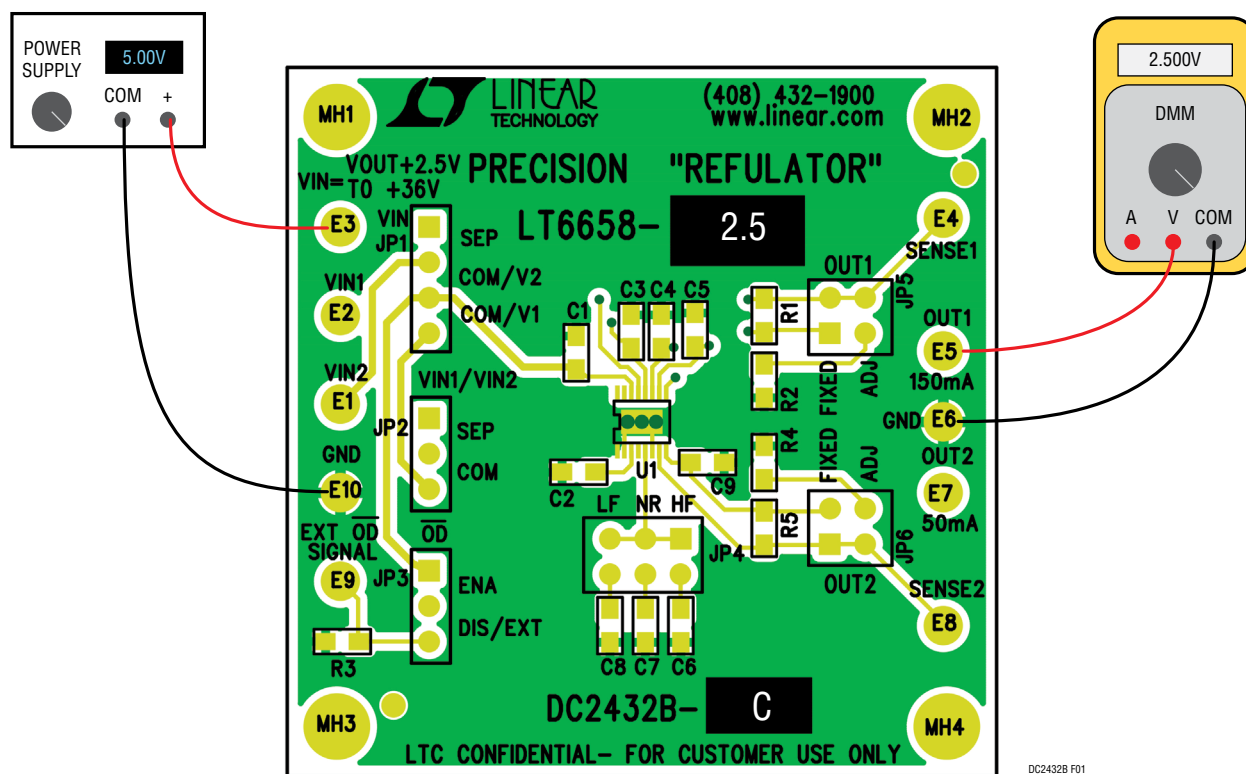


Figure 1. Test Setup

## QUICK START PROCEDURE

### JP3: $\overline{OD}$ Output Disable:

1. ENA: Enables the outputs
2. DIS/EXT: Disables the outputs or allows the  $\overline{OD}$  pin to be driven externally.

### JP4: Noise Reduction Select:

1. LF: 10 $\mu$ F
2. NF: Optional cap
3. HF: 0.1 $\mu$ F

### JP5: OUT1 Select:

1. Fixed: OUT1 sense line is shorted to OUT1 Force and the output is fixed.
2. ADJ: OUT1 sense line is separated from OUT1 Force allowing for resistors R1 and R2 to be installed and programming the OUT1 voltage to a different value.

### JP6: OUT2 Select:

1. Fixed: OUT2 sense line is shorted to OUT2 Force and the output is fixed.
2. ADJ: OUT2 sense line is separated from OUT2 Force allowing for resistors R4 and R5 to be installed and programming the OUT2 voltage to a different value.

## OPTIONAL SETTINGS

### 1. Programming the Output Voltage

By separating the  $V_{OUT\_S}$  line from the  $V_{OUT\_F}$  and using 2 resistors to create a divider in the feedback of the output amplifier, the reference output can be programmed from the nominal output voltage, up to 2.5V below the supply voltage. The output voltage range is limited on the high side due to internal ESD clamps that protect the pins when the voltage goes above 6V. The output voltage can be set using the equation:

$V_{OUT} = V_{REF} \cdot (R1 + R2)/R2$  with  $V_{REF}$  set by nominal output voltage

The resistors will affect the temperature drift and accuracy of the LT6658 output, so care should be given when choosing resistors. It is crucial that the resistor ratio stay consistent over temperature to guarantee the best reference performance.

### 2. Setting the Noise Reduction

The noise reduction pin can be used to filter the reference output. The demo board comes with two pre-installed capacitors that can be selected with the NR jumper. The effects of the different capacitors are shown in Figure 2, and the 3dB frequencies produced by various NR capacitors for each output voltage variant are provided in Table 1.

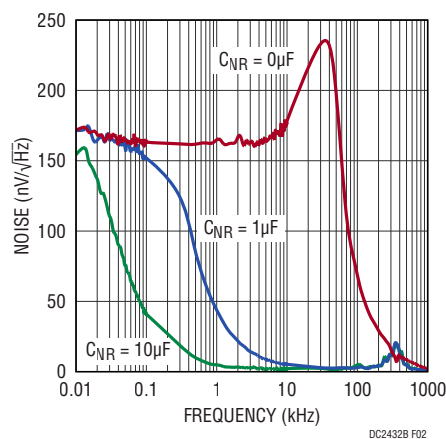


Figure 2. LT6658 Bandgap Output Voltage Noise with Various NR Capacitor Values

Table 1. NR Capacitor Values and the Corresponding 3dB Frequency

NR Capacitor ( $\mu$ F)	1.2V NR 3dB Frequency (Hz)	1.8V NR 3dB Frequency (Hz)	2.5V, 3V, 3.3V, 5V NR 3dB Frequency (Hz)
0.1	4145	4522	3979
0.22	1884	2055	1809
0.47	882	962	847
1	414	452	398
2.2	188	206	181
4.7	88	96	85
10	41	45	40
22	19	21	18



## ESD Caution

**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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