

# 800mA Rugged Linear Regulator with Monitors

## DESCRIPTION

Demonstration circuit 2276A is an 800mA low dropout rugged linear regulator featuring **LT<sup>®</sup>3089**. Key features of the IC are the extended safe operating area (SOA), output current monitor, temperature monitor and programmable current limit.

The LT3089 can be paralleled for higher output current or heat spreading. The device withstands reverse input and reverse output-to-input voltages without reverse current flow.

The LT3089's precision 50 $\mu$ A reference current source allows a single resistor to program output voltage to any level between zero and 34.5V. The current reference architecture enables load regulation to be independent of output voltage. The LT3089 is stable with or without input and output capacitors.

The output current monitor ( $I_{OUT}/5000$ ) and die junction temperature output (1 $\mu$ A/ $^{\circ}$ C) provide system monitoring and debug capability. In addition, a single resistor programs current limit.

Internal protection circuitry includes reverse-battery and reverse-current protection, current limiting and thermal limiting. DC2318A uses the LT3089EDF which is a 12-lead (4mm  $\times$  4mm) plastic DF package with an exposed pad on the bottom-side of the IC for better thermal performance.

These features make DC2318A an ideal circuit for surface-mount power supply, rugged industrial power supply, low output voltage supply and post regulator for switching supplies.

**Design files for this circuit board are available at**  
<http://www.linear.com/demo/DC2318A>

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## PERFORMANCE SUMMARY

Specifications are at  $T_A = 25^{\circ}$ C

CONDITIONS	$I_{OUT}$	$V_{IN}(V)$			$V_{OUT}(V)$		
		MIN	TYP	MAX*	MIN	TYP	MAX
Shunt at 1.2V for JP1	10mA	2.5		36.0	1.15	1.2	1.25
	800mA	2.9		3.7	1.15	1.2	1.25
Shunt at 1.5V for JP1	10mA	2.8		36.0	1.44	1.5	1.56
	800mA	3.2		4.0	1.44	1.5	1.56
Shunt at 1.8V for JP1	10mA	3.1		36.0	1.74	1.8	1.87
	800mA	3.5		4.3	1.74	1.8	1.87
Shunt at 2.5V for JP1	10mA	3.8		36.0	2.42	2.5	2.59
	800mA	4.2		5.0	2.42	2.5	2.59
Shunt at 3.3V for JP1	10mA	4.6		36.0	3.19	3.3	3.42
	800mA	5.0		5.8	3.19	3.3	3.42
Shunt at 5.0V for JP1	10mA	6.3		36.0	4.83	5.0	5.18
	800mA	6.7		7.5	4.83	5.0	5.18

\*The maximum input voltage for 800mA load current is set by the 50 $^{\circ}$ C temperature rise of LT3089 on the demo circuit. Higher input voltage can be reached if larger copper area or force-air cooling is applied. The output current is also limited by the differential voltage of input and output voltage, please refer the data sheet for details.

# DEMO MANUAL DC2318A

## QUICK START PROCEDURE

Demonstration circuit 2318A is easy to set up to evaluate the performance of the LT3089. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

NOTE: When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the terminals of the input or output capacitors. See Figure 2 for proper scope probe technique

1. Use JP1 to set the desired output voltage
2. With power off, connect the input power supply to  $V_{IN}$  and GND.

3. Turn on the power at the  $V_{IN}$ .

NOTE: Make sure that the  $V_{IN}$  voltage does not exceed 36V.

4. Check for the proper output voltages:

NOTE: If there is no output, temporarily disconnect the load to make sure that the load is not set too high or is shorted.

5. Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, efficiency and other parameters.

NOTE: Make sure that the power dissipation is limited below the thermal limit.

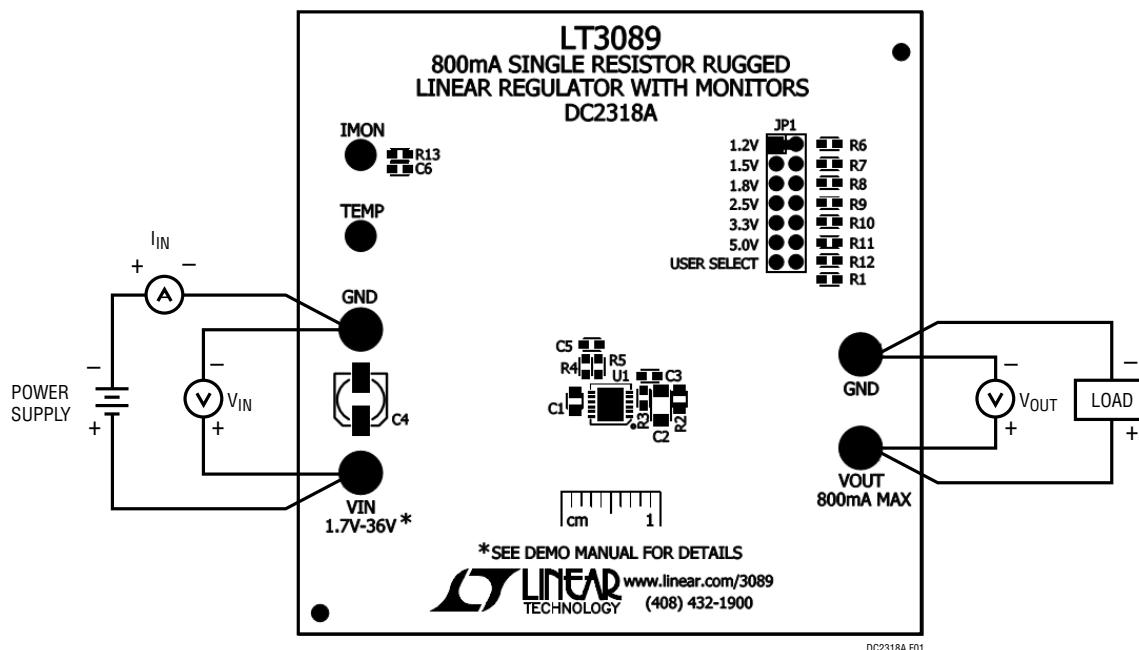


Figure 1. Test Procedure Setup Drawing for DC2276A

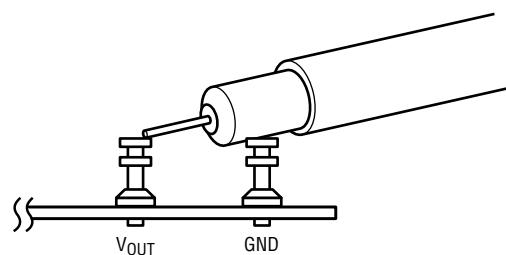


Figure 2. Measuring Input or Output Ripple

## THERMAL IMAGE

An example thermal image shows the temperature distribution on the PC board. The test is done in still air at room temperature with 2W power dissipation in the LT3089 IC. This gives an IC case-to-ambient thermal resistance of

$\theta_{CA} = 23.5^{\circ}\text{C}/\text{W}$  on the demo circuit. This IC, at its highest point reaches  $75^{\circ}\text{C}$ , at  $V_{IN} = 5.0\text{V}$ ,  $V_{OUT} = 2.5\text{V}$ , and  $800\text{mA}$  load current.

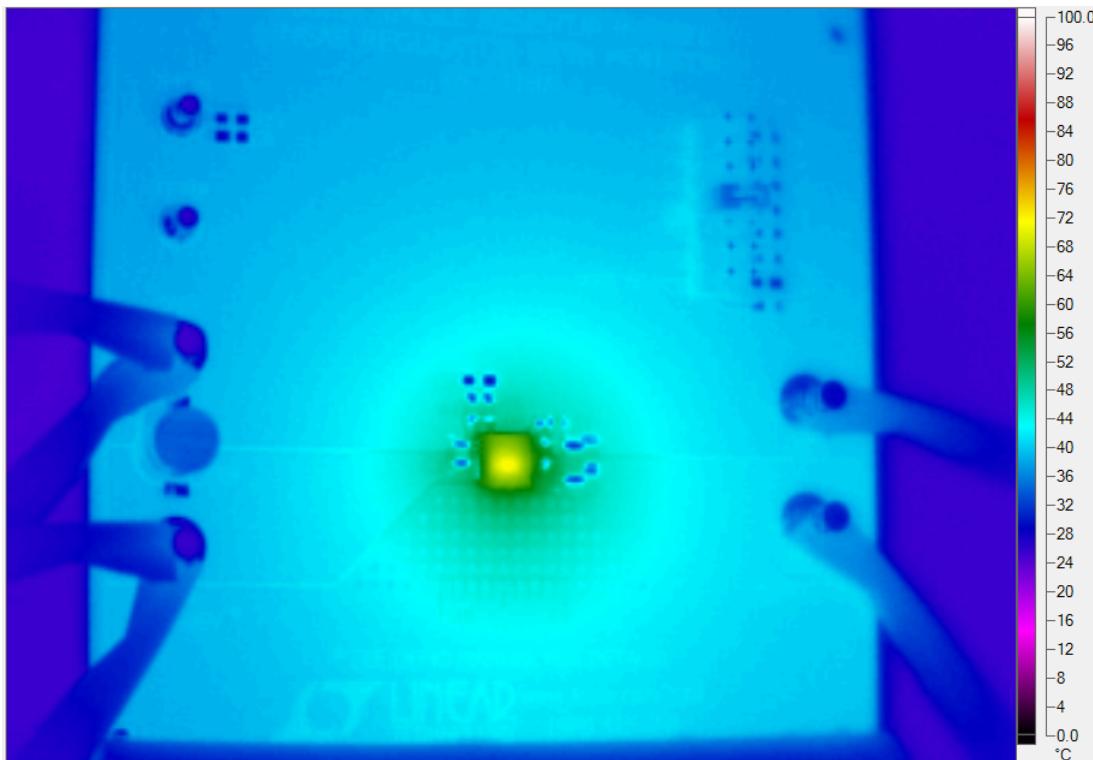


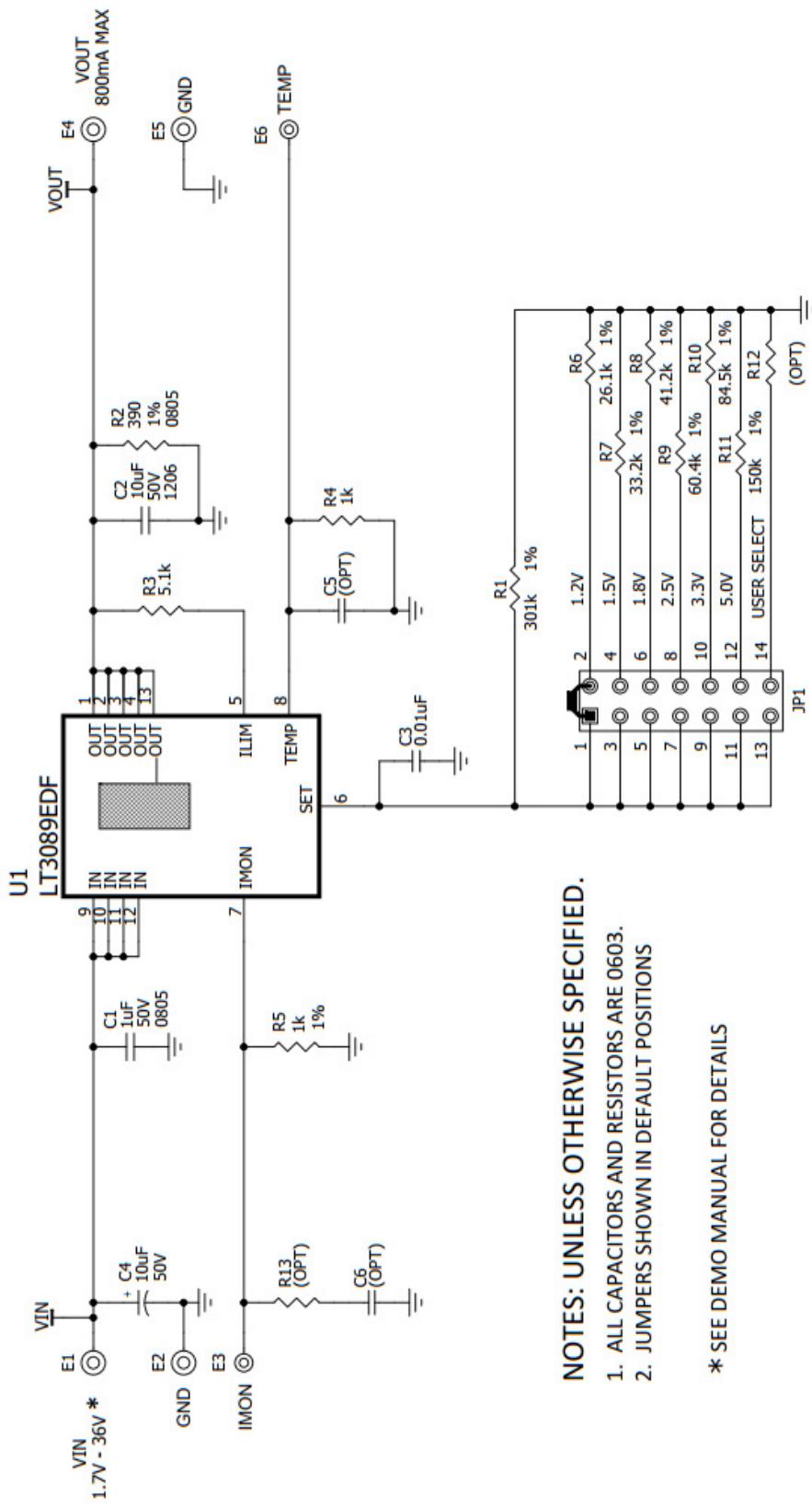
Figure 3. Temperature Rise at 2W Dissipation ( $V_{IN} = 5.0\text{V}$ ,  $V_{OUT} = 2.5\text{V}$ ,  $I_{O} = 800\text{mA}$ )

# DEMO MANUAL DC2318A

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	1	C1	CAP, X7R, 1µF, 50V, 10%, 0805	MURATA, GRM21BR71H105KA12L
2	1	C2	CAP, CER., 10µF, X5R, 50V, 20%, 1206	MURATA, GRM31CR61H106MA12L
3	1	C3	CAP, CER., 0.01µF, X7R, 25V, 10%, 0603	MURATA, GRM188R71E103KA01D
4	1	C4	CAP, ALUM., 10µF, 50V, 20%, SMD	SUN ELECT., 50CE10BSS
5	1	R1	RES., 301k, 1/10W, 1%, 0603	VISHAY, CRCW0603301KFKEA
6	1	R2	RES., 390Ω, 1/8W, 1%, 0805	VISHAY, CRCW0805390RFKEA
7	1	R3	RES., 5.1k, 1/10W, 1%, 0603	VISHAY, CRCW06035K10FKEA
8	2	R4, R5	RES., 1k, 1/10W, 1%, 0603	VISHAY, CRCW06031K00FKEA
9	1	R6	RES., 26.1k, 1/10W, 1%, 0603	VISHAY, CRCW060326K1FKEA
10	1	R7	RES., 33.2k, 1/10W, 1%, 0603	VISHAY, CRCW060333K2FKEA
11	1	R8	RES., 41.2k, 1/10W, 1%, 0603	VISHAY, CRCW060341K2FKEA
12	1	R9	RES., 60.4k, 1/10W, 1%, 0603	VISHAY, CRCW060360K4FKEA
13	1	R10	RES., 84.5k, 1/10W, 1%, 0603	VISHAY, CRCW060384K5FKEA
14	1	R11	RES., 150k, 1/10W, 1%, 0603	VISHAY, CRCW0603150KFKEA
15	1	U1	I.C., LINEAR REGULATOR, 12DFN (4 × 4)	LINEAR TECH., LT3089EDF#PBF
<b>Additional Demo Board Circuit Components</b>				
16	0	C5, C6 (OPT)	CAP, 0603	
17	0	R12, R13 (OPT)	RES., 0603	
<b>Hardware: For Demo Board Only</b>				
18	4	E1, E2, E4, E5	TEST POINT, TURRET, .094" MTG. HOLE	MILL-MAX, 2501-2-00-80-00-00-07-0
19	2	E3, E6	TEST POINT, TURRET, .061" MTG. HOLE	MILL-MAX, 2308-2-00-80-00-00-07-0
20	1	JP1	CONN., HEADER, 2 × 7, 2mm	SAMTEC, TMM-107-02-L-D
21	1	XJP1	SHUNT, 2mm	SAMTEC, 2SN-BK-G

## SCHEMATIC DIAGRAM



# DEMO MANUAL DC2318A

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Mailing Address:

Linear Technology  
1630 McCarthy Blvd.  
Milpitas, CA 95035

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**Офис по работе с юридическими лицами:**

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

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