LT3033
3A, 0.95V to 10V Very Low Dropout Linear Regulator with Programmable Current Limit

DESCRIPTION

Demonstration circuit 2362A is an adjustable 3A linear regulator featuring the LT®3033. The LT3033 is a very low dropout voltage (VLDO™) linear regulator that operates from a single input supply down to 0.95V. The device supplies 3A output current with 95mV typical dropout voltage. The LT3033 is ideal for low input voltage to low output voltage applications, providing comparable electrical efficiency to a switching regulator.

The LT3033 optimizes stability and transient response with low ESR ceramic output capacitors as small as 10µF. A 10nF bypass capacitor at REF/BYP pin typically reduces output voltage noise to 60µV_{RMS} in a 10Hz to 100kHz bandwidth. Soft-start time is directly proportional to the REF/BYP capacitor value.

The LT3033's current limit, accurate to ±12% over a wide input voltage and temperature range, can be programmed by a single resistor. When the input-to-output differential voltage exceeds 5V, foldback current limit lowers the internal current limit level, which may override the external programmable current limit.

LT3033 has a PWRGD pin which indicates when the ADJ pin is within 8% of its nominal value. By connecting an external pull-up resistor from PWRGD to either the IN or OUT pin, PWRGD is pulled low when the output falls below 90.1% of the regulated voltage. As the output voltage rises above 92% of its regulated voltage, the PWRGD pin voltage is pulled up.

The LT3033 features output current monitoring by connecting a resistor from the IMON pin to GND. The IMON pin is the collector of a PNP current mirror that outputs 1/2650th of the power PNP current. This circuitry is active for $V_{IMON} \leq (V_{OUT} - 400mV)$.

The LT3033 also features shutdown, reverse-battery protection, thermal limiting with hysteresis and reverse-current protection.

The LT3033 is available as an adjustable device with an output voltage down to the 200mV reference. The device is available in a thermally enhanced, low profile 3mm × 4mm × 0.75mm QFN package.

The LT3033 data sheet gives a complete description of the part, operation and application information. The data sheet must be read in conjunction with this quick start guide for demo circuit 2362A.

Design files for this circuit board are available.

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range	V_{OUT} = 0.9V	1.05		10	V
Output Voltage V_{OUT}	Shunt at 0.9V for JP2	0.863	0.899	0.935	V
	Shunt at 1V for JP2	0.966	1.006	1.046	V
	Shunt at 1.2V for JP2	1.152	1.2	1.248	V
	Shunt at 1.5V for JP2	1.44	1.5	1.56	V
	Shunt at 1.8V for JP2	1.74	1.81	1.88	V
	Shunt at 5V for JP2	4.86	5.06	5.26	V
Maximum Output Current	Shunt at 2A for JP3	1.8	2	2.2	A

QUICK START PROCEDURE

Demonstration circuit 2362A is easy to set up to evaluate the performance of the LT3033. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below.

NOTE: The shutdown jumper JP1 shunt is required to be in the OFF or ON position for proper operation.

NOTE: The PWRGD jumper JP4 shunt is required to be in the IN or OUT position for proper operation.

1. Use JP2 to set the desired output voltage. Use JP3 to set the output current limit at 2A or NA (NA = not applicable; internal current limit). Place JP1 shunt in the ON position.
2. With power off, connect the power supply, load and meters as shown in Figure 1.
3. Turn on the power at the input.

   NOTE: Make sure that the input voltage does not exceed 10V.
4. Check for the proper output voltage.

   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 voltage is established, adjust the input voltage and load current within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters.

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 output voltage ripple by touching the probe tip directly across the +VOUT and GND terminals. See Figure 2 for proper scope probe technique.

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

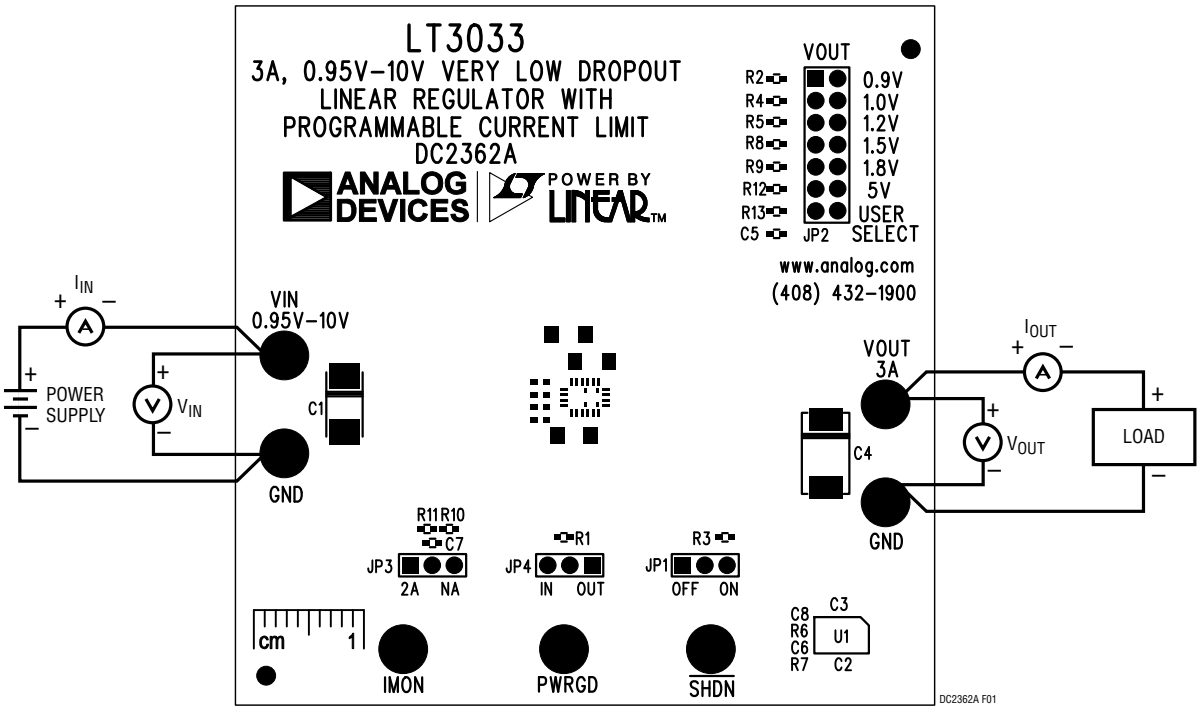


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

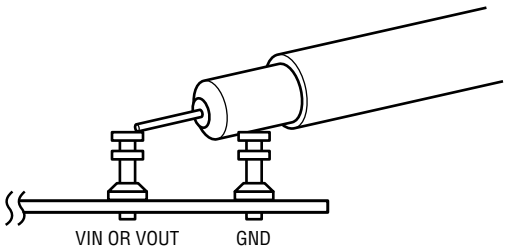


Figure 2. Proper Scope Probe Placement for Measuring Input or Output Ripple

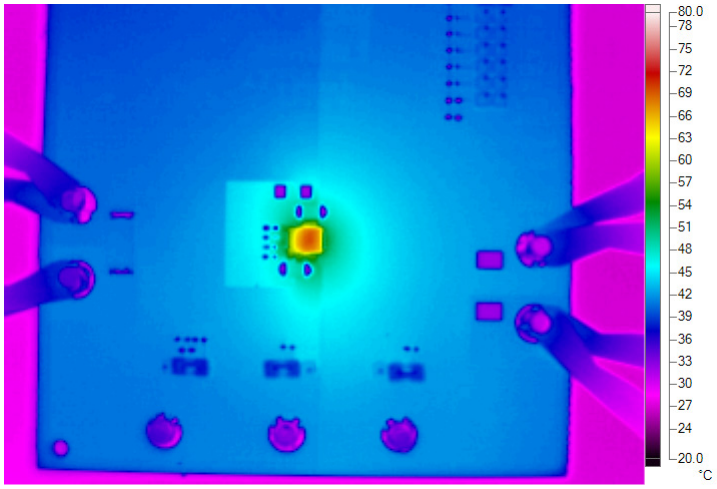
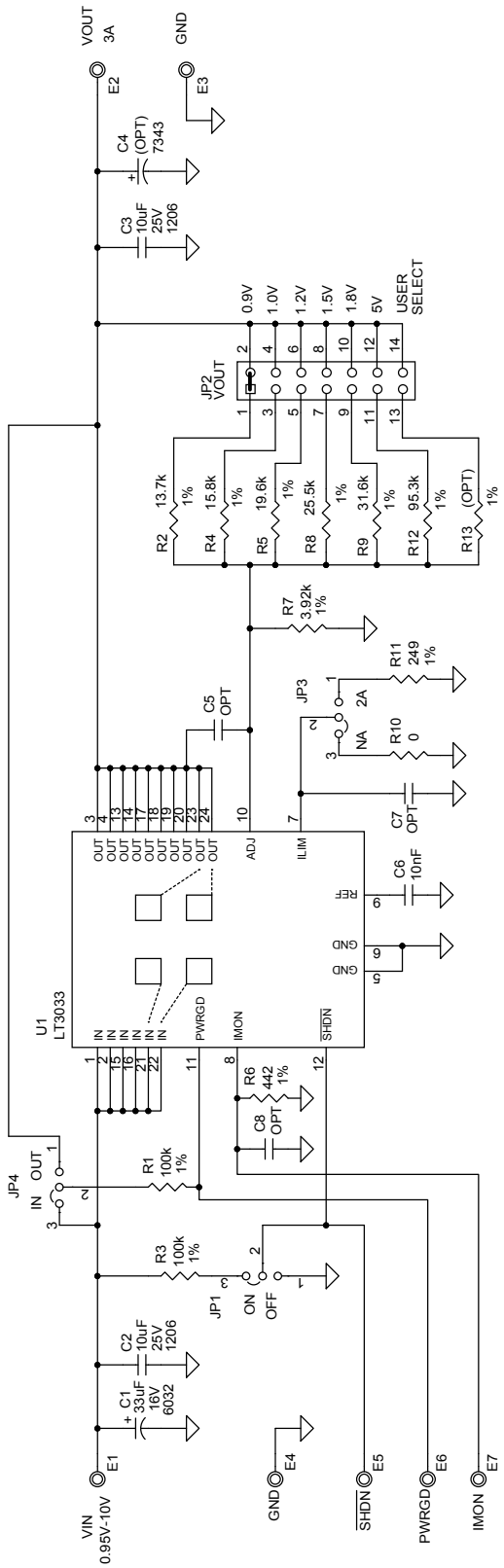


Figure 3. Temperature Rise at 1.5W Dissipation (V_{IN} = 1.4V, V_{OUT} = 0.9V, I_{OUT} = 3A, T_A = 25°C)

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP., TANT., 33µF, 16V, 20% 6032	AVX, TAJW336M016
2	2	C2, C3	CAP., X7R, 10µF, 25V, 10% 1206	MURATA, GRM31CR71E106KA12L
3	1	C6	CAP., X7R, 10nF, 25V, 10% 0402	MURATA, GRM155R71E103KA01D
4	2	R1, R3	RES., CHIP, 100k, 1/16W, 1% 0402	VISHAY, CRCW0402100KFKED
5	1	R2	RES., CHIP, 13.7k, 1/16W, 1% 0402	VISHAY, CRCW040213K7FKED
6	1	R4	RES., CHIP, 15.8k, 1/16W, 1% 0402	VISHAY, CRCW040215K8FKED
7	1	R5	RES., CHIP, 19.6k, 1/16W, 1% 0402	VISHAY, CRCW040219K6FKED
8	1	R6	RES., CHIP, 442Ω, 1/16W, 1% 0402	VISHAY, CRCW0402442RFKED
9	1	R7	RES., CHIP, 3.92k, 1/16W, 1% 0402	VISHAY, CRCW04023K92FKED
10	1	R8	RES., CHIP, 25.5k1/16W, 1% 0402	VISHAY, CRCW040225K5FKED
11	1	R9	RES., CHIP, 31.6k1/16W, 1% 0402	VISHAY, CRCW040231K6FKED
12	1	R10	RES., CHIP, 0Ω, 1/16W, 1% 0402	VISHAY, CRCW04020000Z0ED
13	1	R11	RES., CHIP, 249Ω, 1/16W, 1% 0402	VISHAY, CRCW0402249RFKED
14	1	R12	RES., CHIP, 95.3k, 1/16W, 1% 0402	VISHAY, CRCW040295K3FKED
15	1	U1	I.C. LINEAR REGULATOR	ANALOG DEVICES, LT3033EUDC#PBF
Additional Demo Board Circuit Components				
1	1	C4	CAP., 7343	
2	3	C5, C7, C8	CAP., 0402	
3	1	R13	RES., 0402	
Hardware: For Demo Board Only				
1	7	E1, E2, E3, E4, E5, E6, E7	TESTPOINT, TURRET, .094" pbf	MILL-MAX, 2501-2-00-80-00-00-07-0
2	3	JP1, JP3, JP4	HEADER 3 PIN 0.079 SINGLE ROW	WURTH ELEKTRONIK, 620 003 111 21
3	1	JP2	2X7, 0.079 DOUBLE ROW HEADER	SAMTEC, TMM107-02-L-D
4	4	XJP1-XJP4	SHUNT, 0.079" CENTER	WURTH ELEKTRONIK, 608 002 134 21

SCHEMATIC DIAGRAM



NOTE: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS AND CAPACITORS ARE IN 0402.

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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