LT3592: Step-Down 500mA LED Driver with 10:1 Dimming

DESCRIPTION

Demonstration circuit 1205A features the LT3592 36V step-down 500mA LED driver with 10:1 dimming. The demonstration circuit is designed to drive two red 500mA LEDs mounted on the PCB from a wide input voltage range. The high 2.2MHz switching frequency permits the use of a small inductor and ceramic capacitors to save space and cost. Current mode control provides fast transient response and cycle-by-cycle current limit for short-circuit protection. The LEDs have two brightness settings. With BRIGHT pulled high or left floating, the two red LEDs are driven with 500mA. With BRIGHT pulled to GND, the LED current drops to 50mA for 10:1 analog dimming.

The typical efficiency of the LT3592 DC1205A is 85% with $12V_{IN}$ and the two LEDs at 4.6V total with 500mA as shown in Figure 1. Although the board is stuffed with two red LEDs, different LED strings can be powered from the LT3592. The minimum input voltage to run the step-down converter at 2.2MHz with a given string of LEDs is shown in Figure 2.

The LT3592 data sheet gives a complete description of the part, operation and applications information. The data sheet must be read in conjunction with this Demo Manual for DC1205A. The LT3592 is assembled in a 10-lead plastic DFN (3mm × 2mm) DDB package with a thermally enhanced ground pad. Proper board layout is essential for maximum thermal performance. See the data sheet section Layout Hints.

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

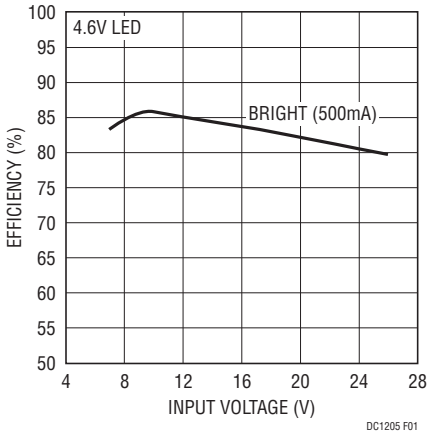


Figure 1. Input Voltage vs Efficiency

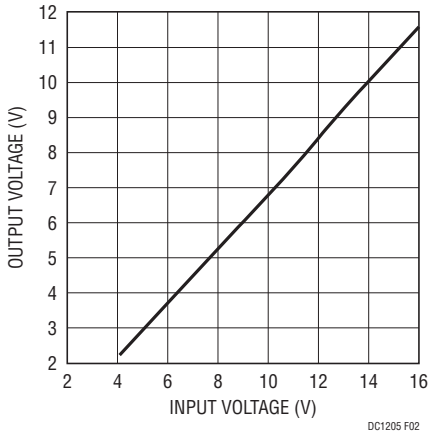


Figure 2. Minimum Input Voltage vs LED Voltage

QUICK START PROCEDURE

Demonstration circuit 1205A is easy to set up for evaluating the LT3592 36V step-down 500mA LED driver with 10:1 dimming. Follow the test procedure outlined below and see Figure 3.

1. Set up DC1205A as shown in Figure 3 with hand-held multimeters, and a bench supply (power turned off) with voltage greater than the LED string (approximately 3.5V to 5V) and less than 36V.
2. Turn on the bench power supply and observe a constant 500mA through the string of LEDs with BRIGHT terminal floating.
3. Tie BRIGHT terminal to GND terminal and observe the LED current dropping to 50mA as brightness also decreases.
4. Use the $\overline{\text{SHDN}}$ terminal to turn the LEDs on and off by respectively floating or grounding the terminal.

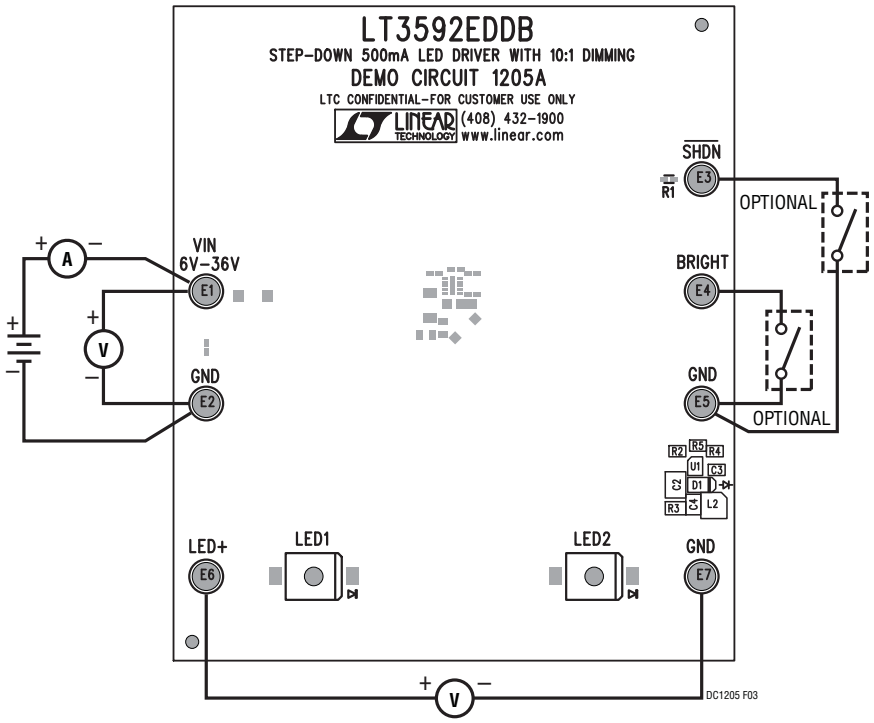
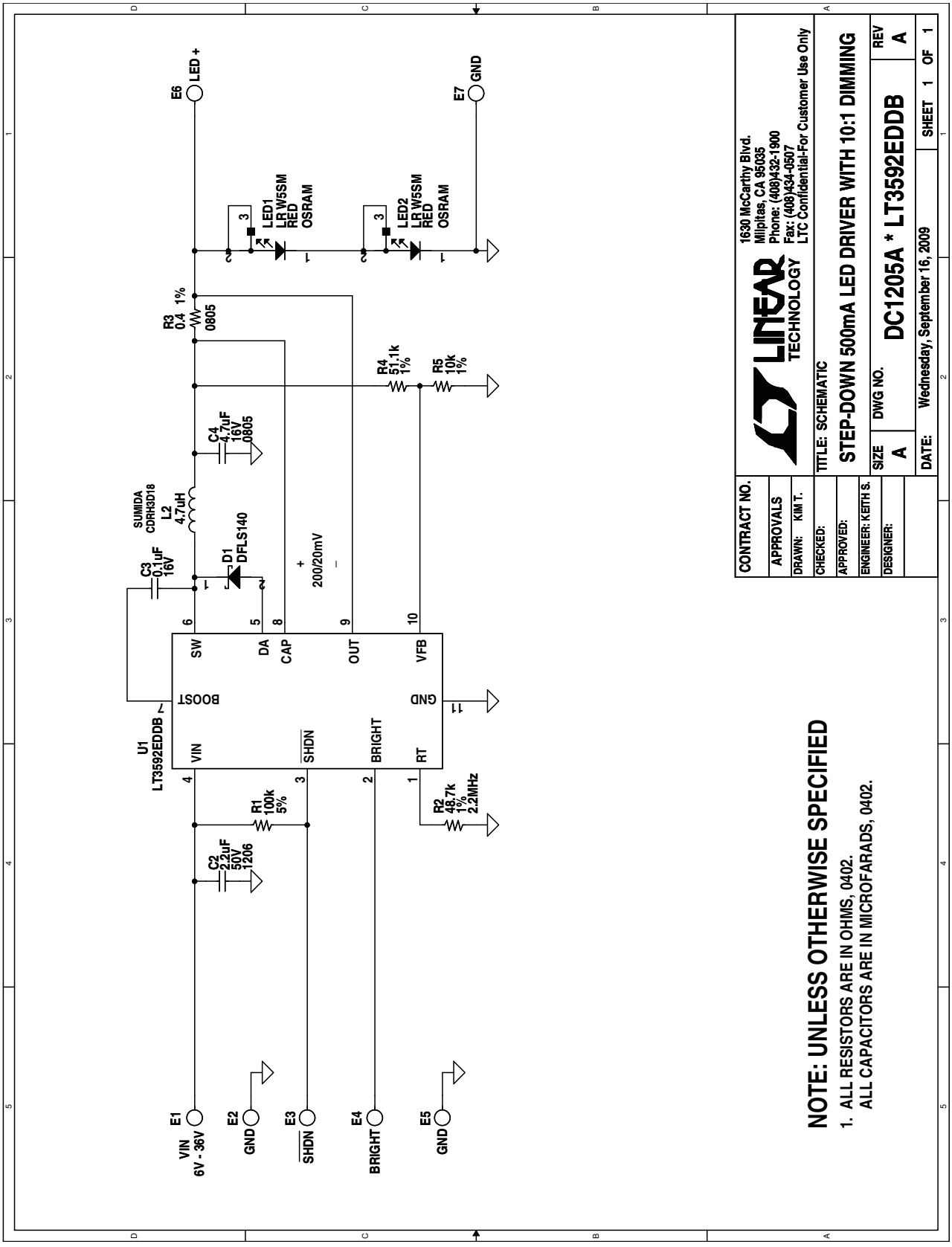


Figure 3. Proper Measurement Equipment Setup

PARTS LIST

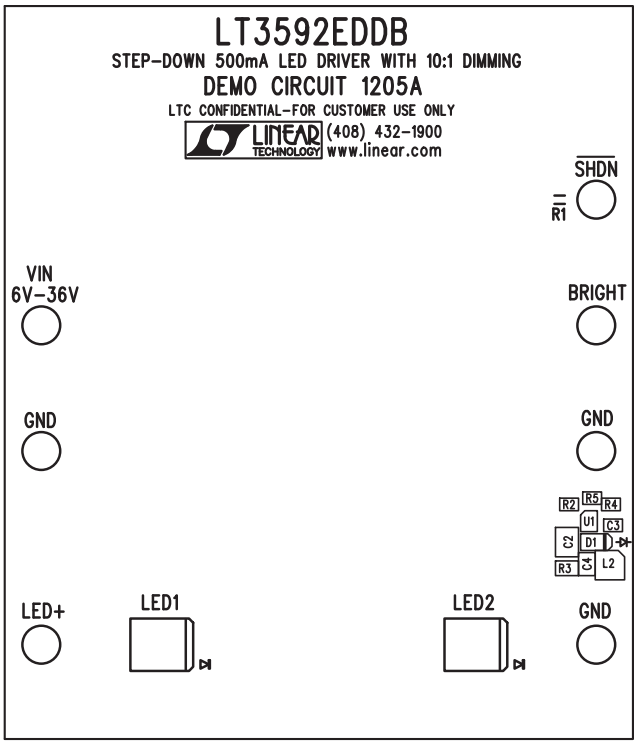
ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
REQUIRED CIRCUIT COMPONENTS				
1	1	C2	Capacitor, X7R, 2.2µF, 50V, 10%, 1206	Murata, GCM31CR71H225KA55
2	1	C3	Capacitor, X7R, 0.1µF, 16V, 10%, 0402	TDK, C1005X7R1C104K
3	1	C4	Capacitor, X5R, 4.7µF, 16V, 10%, 0805	TDK, C2012X5R1C475K
4	1	D1	Diode, Schottky, 1A, POWERDI123	Diode Inc., DFLS140-7-F
6	2	LED2, LED1	LED, Golden Dragon, Red, LED-SFH4230	Osram, LR W5SM-HYJY-1
7	1	L2	Inductor, PWR, 4.7µH, L-CDRH3D18	Sumida, CDRH3D18NP-4R7NC
9	1	R2	Resistor, Chip, 48.7k, 1/16W, 2.2MHz, 1%, 0402	Vishay, CRCW040248K7FKED
10	1	R3	Resistor, 0.4Ω, 1%, 1/4W, 0805	Susumu International USA Inc., RL1220S-R40-F
11	1	R4	Resistor, Chip, 51.1k, 1/16W, 1%, 0402	Vishay, CRCW040251K1FKED
12	1	R5	Resistor, Chip, 10k, 1/16W, 1%, 0402	Vishay, CRCW040210K0FKED
13	1	U1	IC, LT3592EDDB#PBF, DFN10DDB	Linear Tech, LT3592EDDB#PBF
ADDITIONAL DEMO BOARD CIRCUIT COMPONENTS				
8	1	R1	Resistor, Chip, 100k, 1/16W, 1%, 0402	Vishay, CRCW0402100KFKED
HARDWARE FOR DEMO BOARD ONLY				
5	7	E1-E7	TP, Turret, 0.094"	Mill-Max, 2501-2-00-80-00-00-07-0

SCHEMATIC DIAGRAM

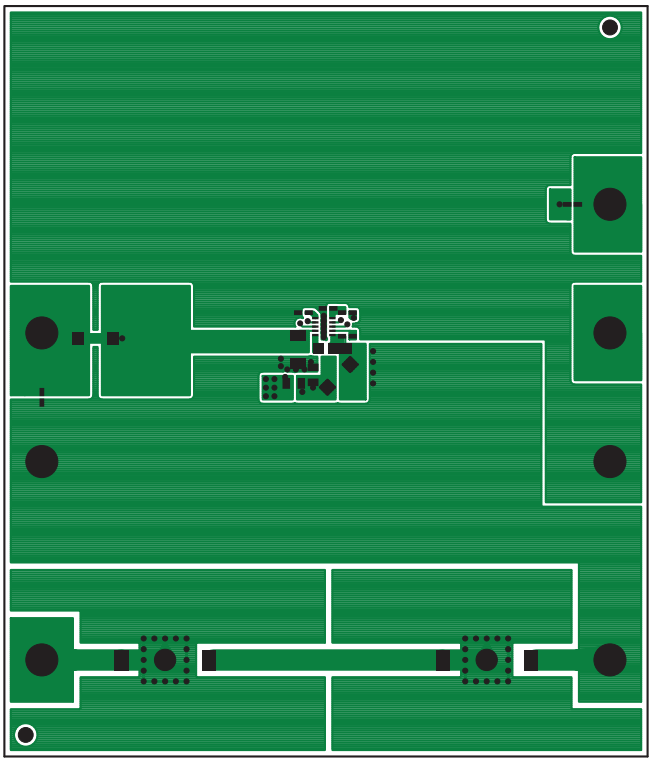


PCB LAYOUT AND FILM

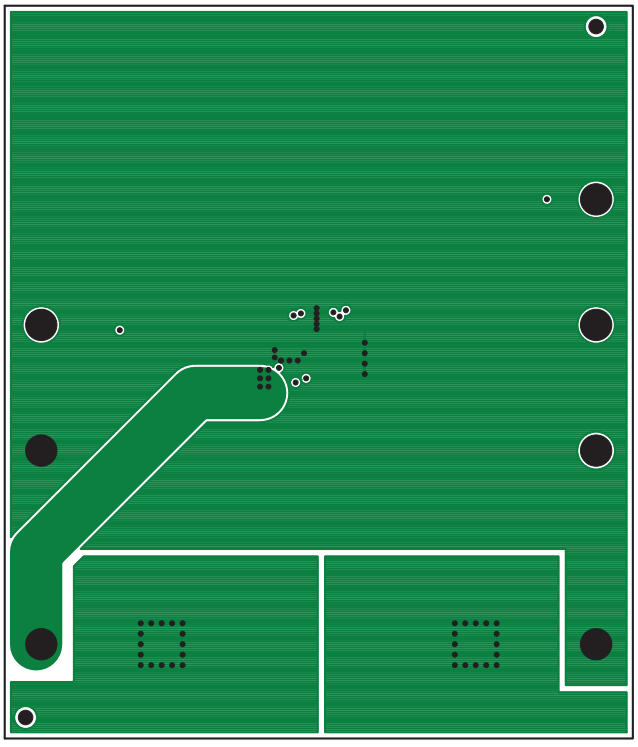
Top Silkscreen



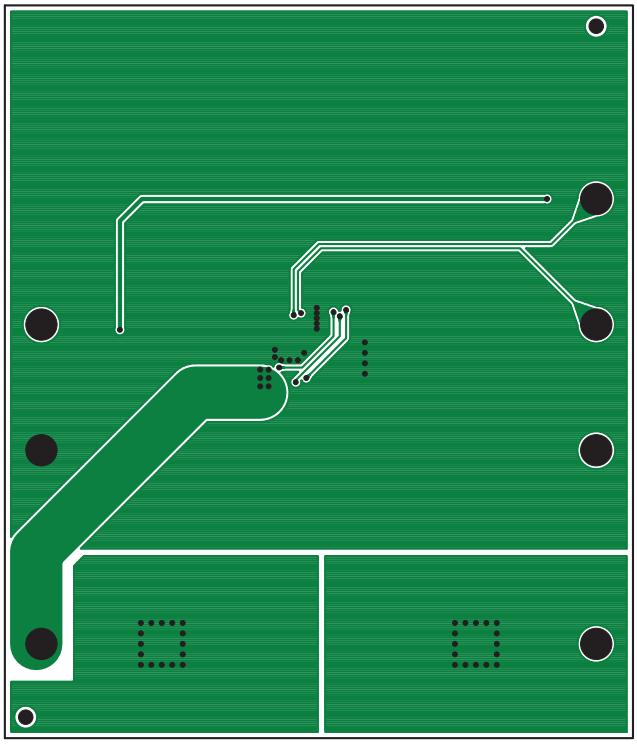
Layer 1—Top Layer



Layer 2—GND Plane 1

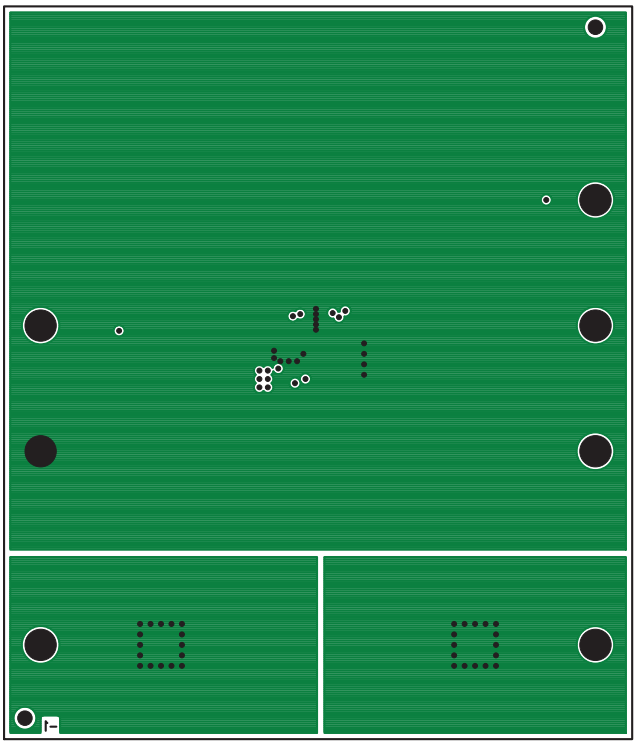


Layer 3—GND Plane 2

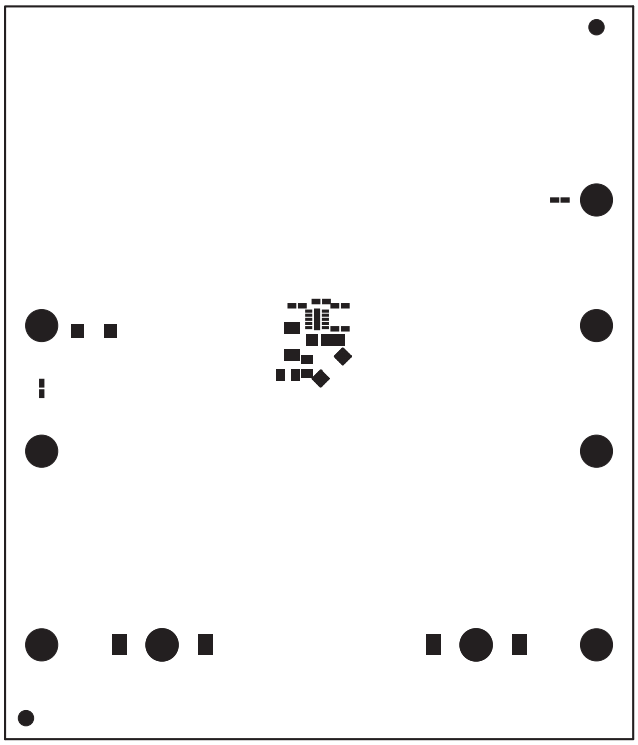


PCB LAYOUT AND FILM

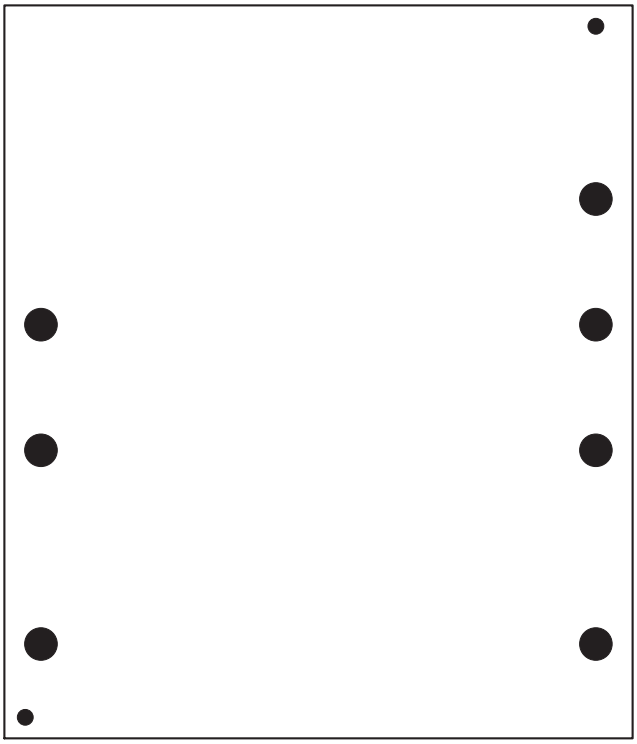
Layer 4—Bottom Layer



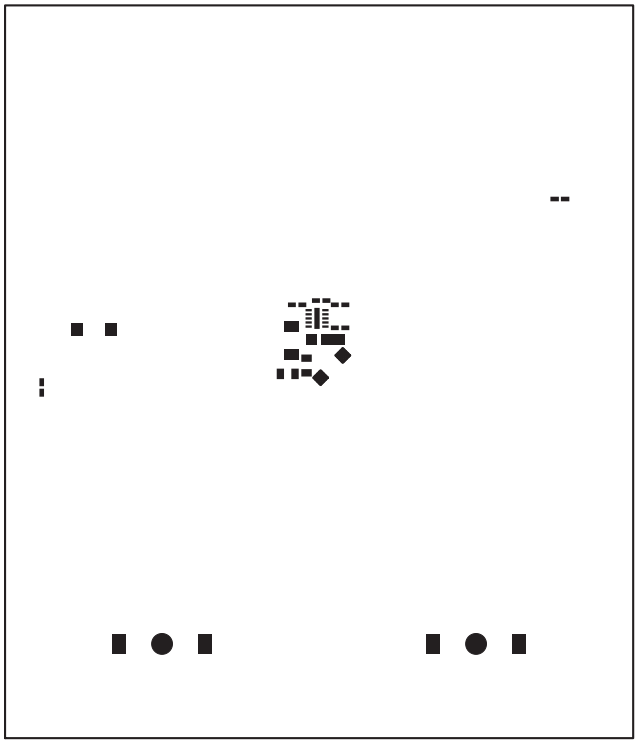
Top Solder Mask



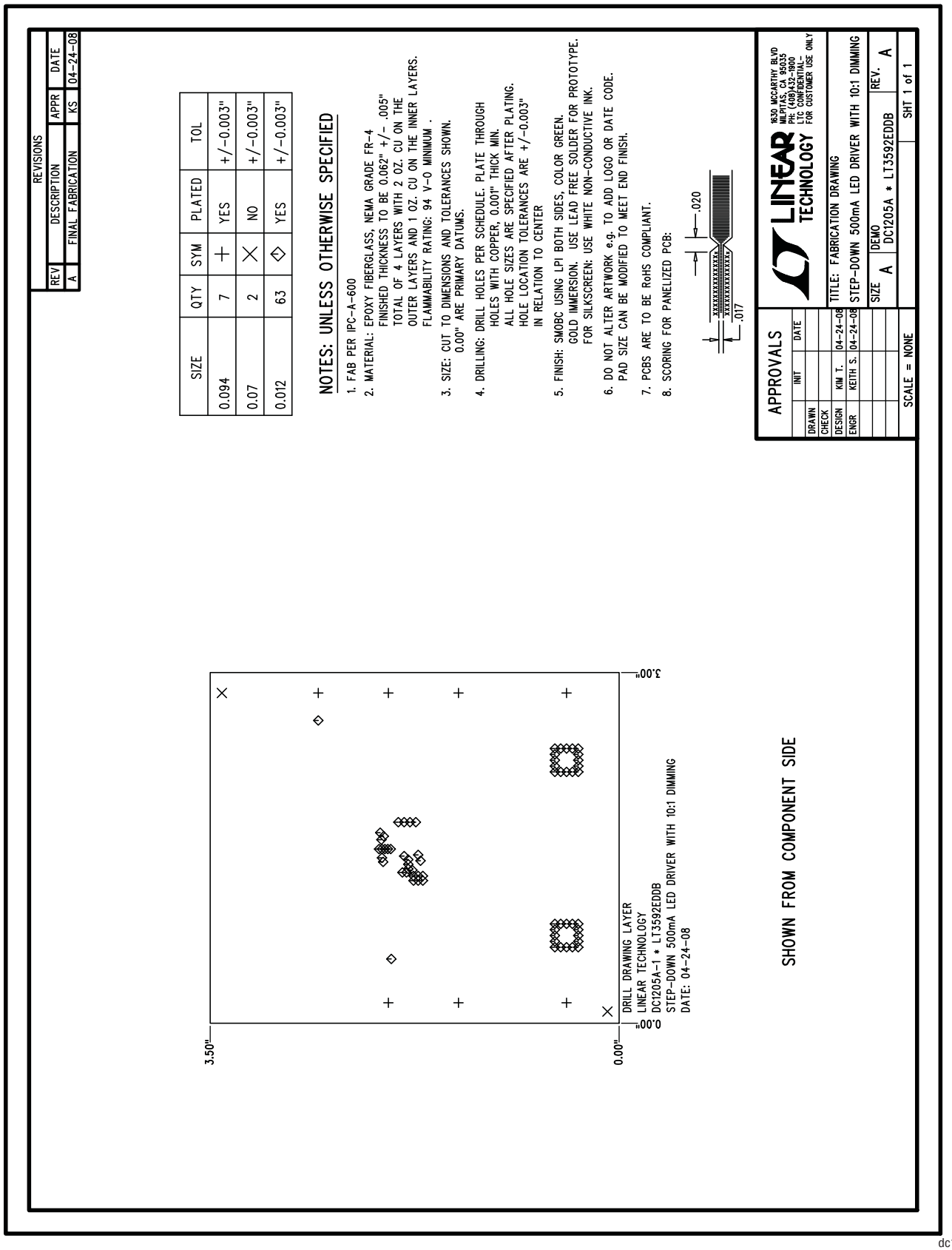
Bottom Solder Mask



Top Solder Paste Mask



FABRICATION DRAWING



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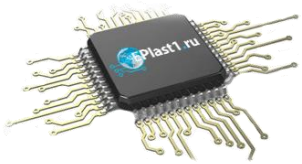

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