

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>

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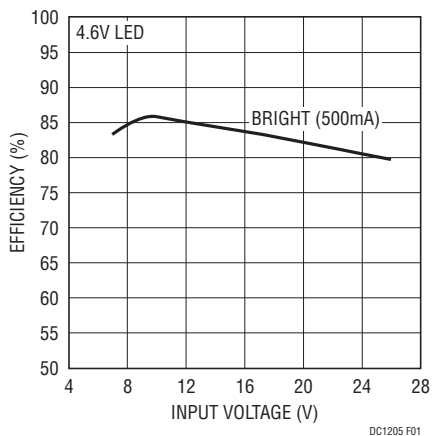


Figure 1. Input Voltage vs Efficiency

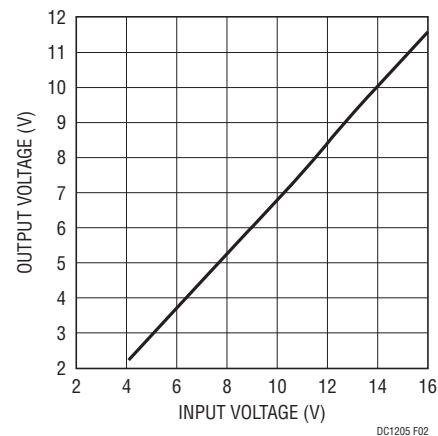


Figure 2. Minimum Input Voltage vs LED Voltage

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.

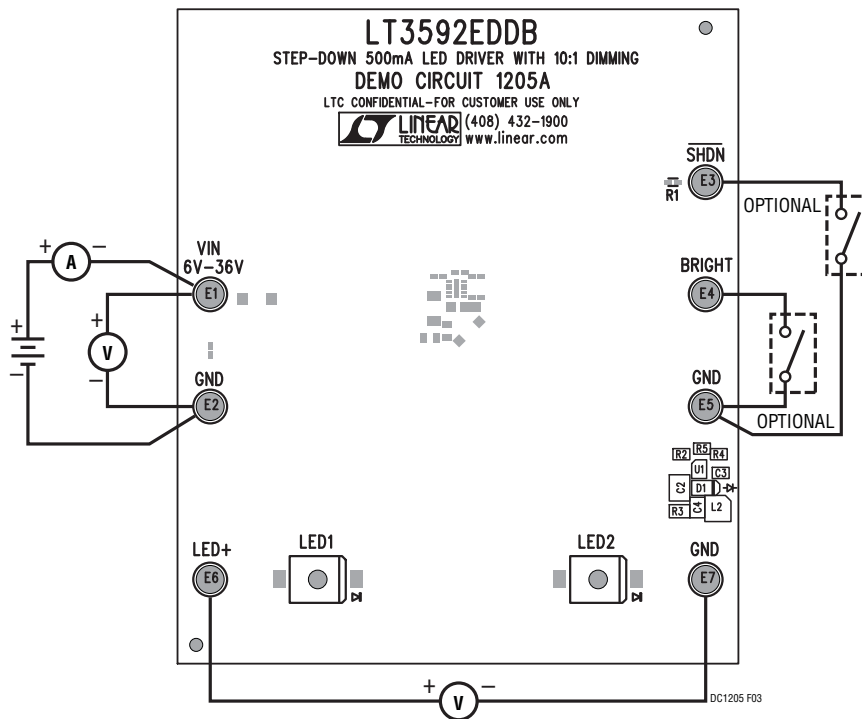
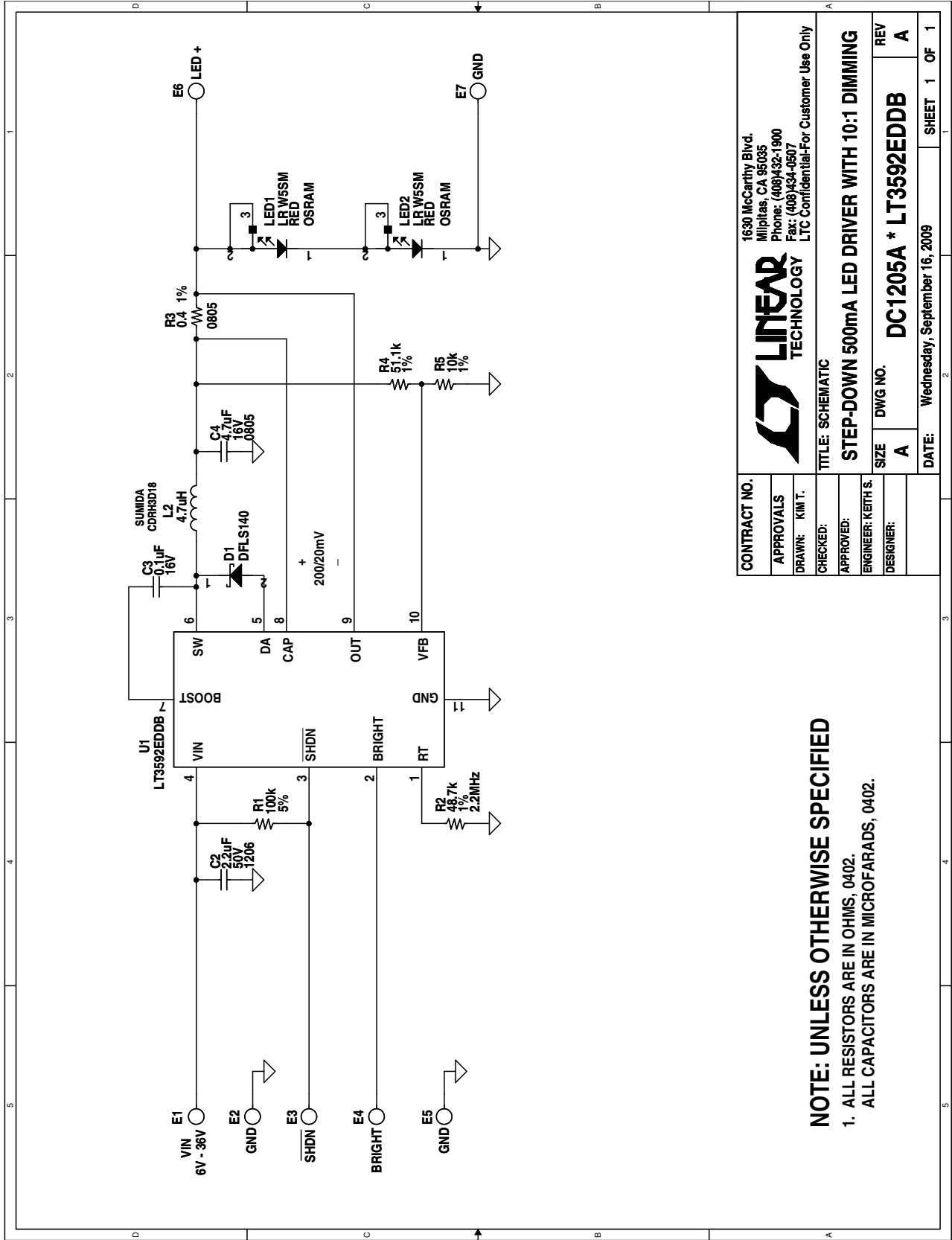


Figure 3. Proper Measurement Equipment Setup

PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|-----|------------|--|--|
| REQUIRED CIRCUIT COMPONENTS | | | | |
| 1 | 1 | C2 | Capacitor, X7R, 2.2 μ F, 50V, 10%, 1206 | Murata, GCM31CR71H225KA55 |
| 2 | 1 | C3 | Capacitor, X7R, 0.1 μ F, 16V, 10%, 0402 | TDK, C1005X7R1C104K |
| 3 | 1 | C4 | Capacitor, X5R, 4.7 μ F, 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, 4.7 μ H, L-CDRH3D18 | Sumida, CDRH3D18NP-4R7NC |
| 9 | 1 | R2 | Resistor, Chip, 48.7k, 1/16W, 2.2MHz, 1%, 0402 | Vishay, CRCW040248K7FKED |
| 10 | 1 | R3 | Resistor, 0.4 Ω , 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 |

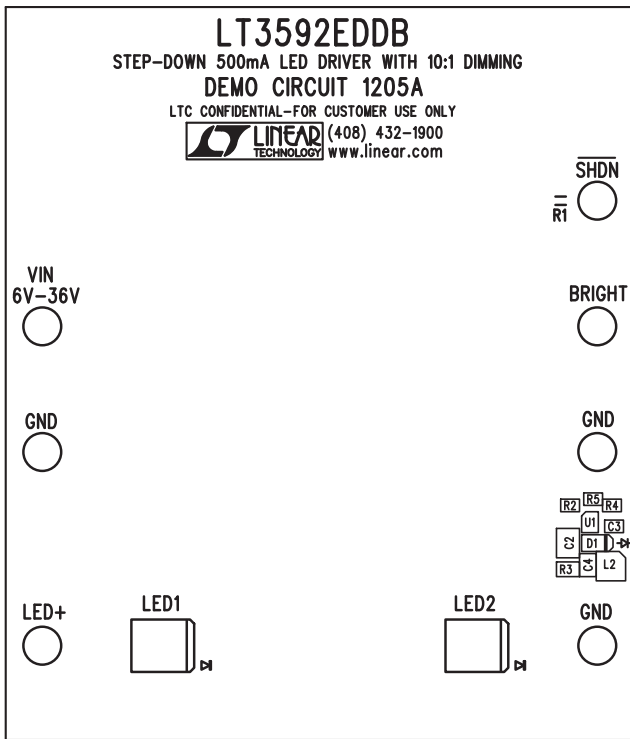
SCHEMATIC DIAGRAM



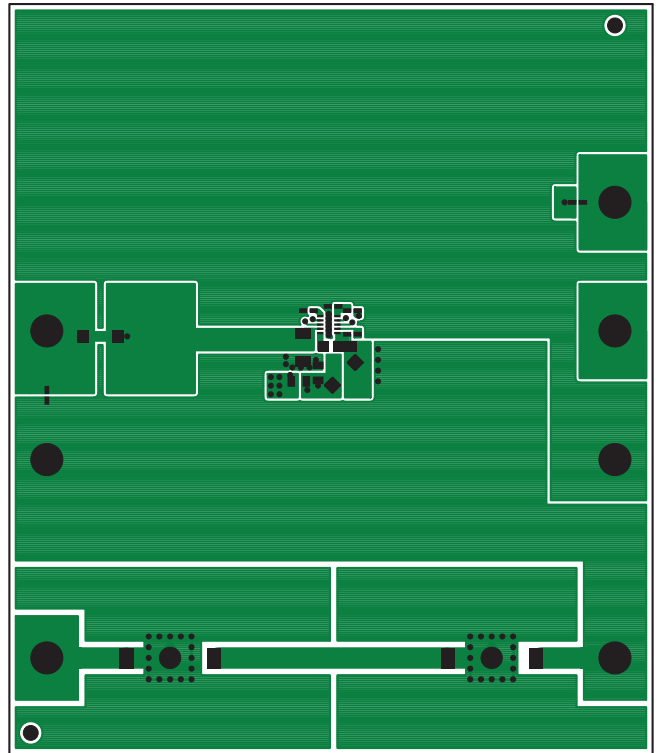
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|--|--|---|--|
| CONTRACT NO. | | 1630 McCarthy Blvd. Milpitas, CA 95035 Phone: (408)432-1900 Fax: (408)434-0907 LTC Confidential-For Customer Use Only | |
| APPROVALS | | LINEAR TECHNOLOGY | |
| DRAWN: KIM T. | | TITLE: SCHEMATIC | |
| CHECKED: | | STEP-DOWN 500mA LED DRIVER WITH 10:1 DIMMING | |
| APPROVED: | | SIZE A | |
| ENGINEER: KETH S. | | DWG NO. DC1205A * LT3592EDDB | |
| DESIGNER: | | REV A | |
| DATE: Wednesday, September 16, 2009 | | SHEET 1 OF 1 | |

PCB LAYOUT AND FILM

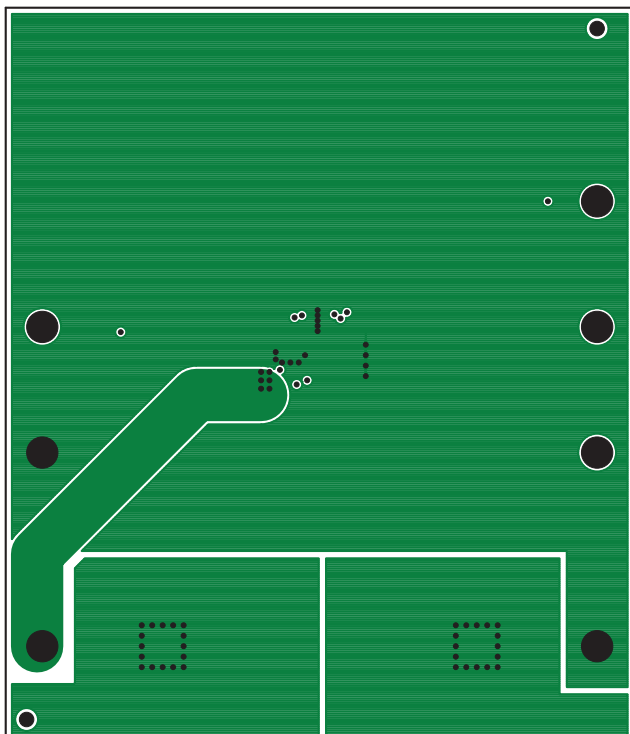
Top Silkscreen



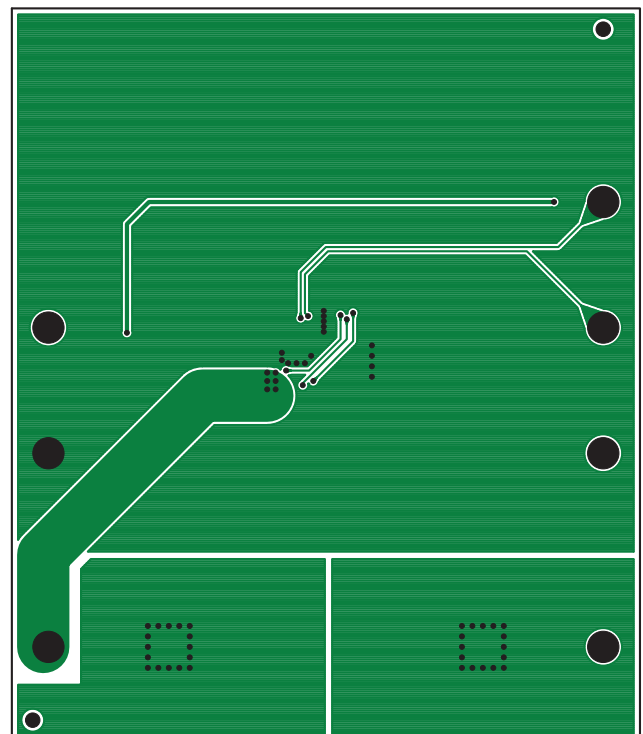
Layer 1—Top Layer



Layer 2—GND Plane 1

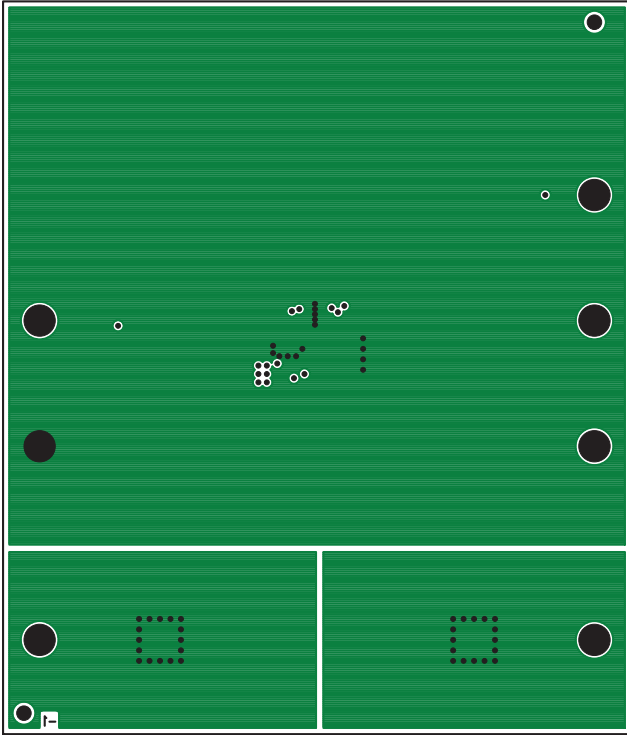


Layer 3—GND Plane 2

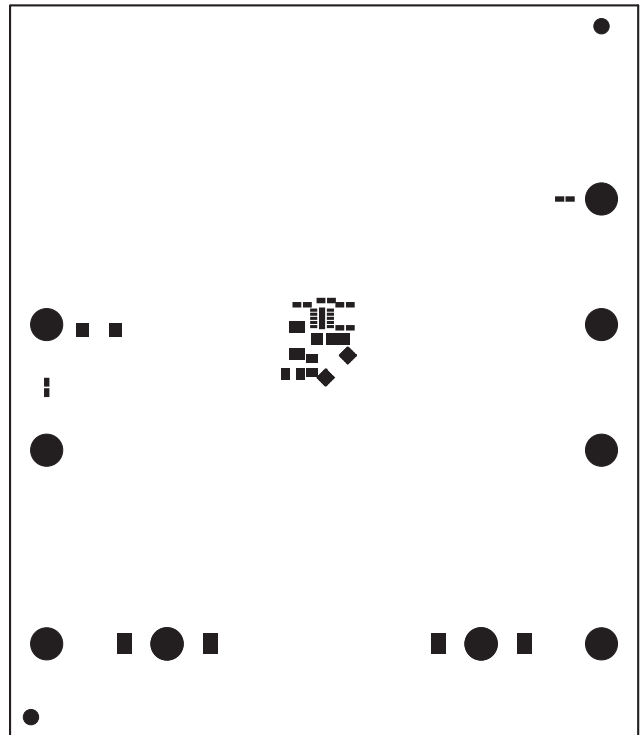


PCB LAYOUT AND FILM

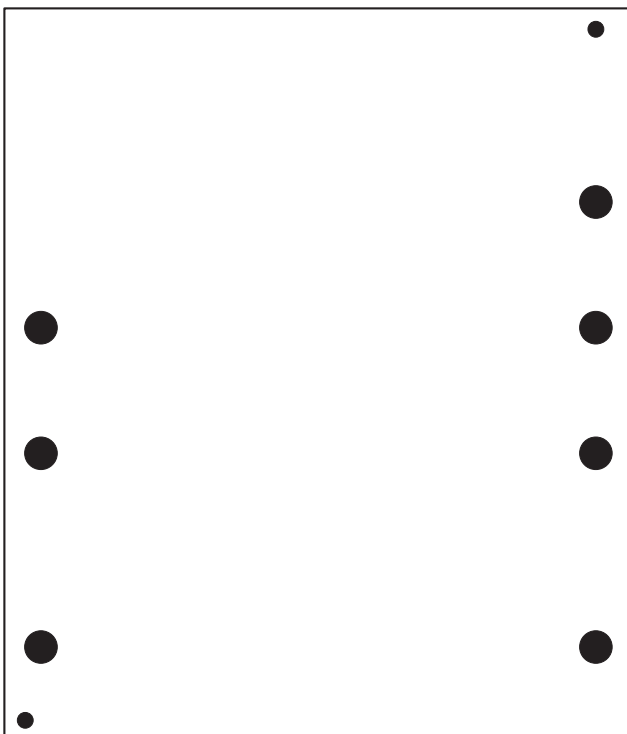
Layer 4—Bottom Layer



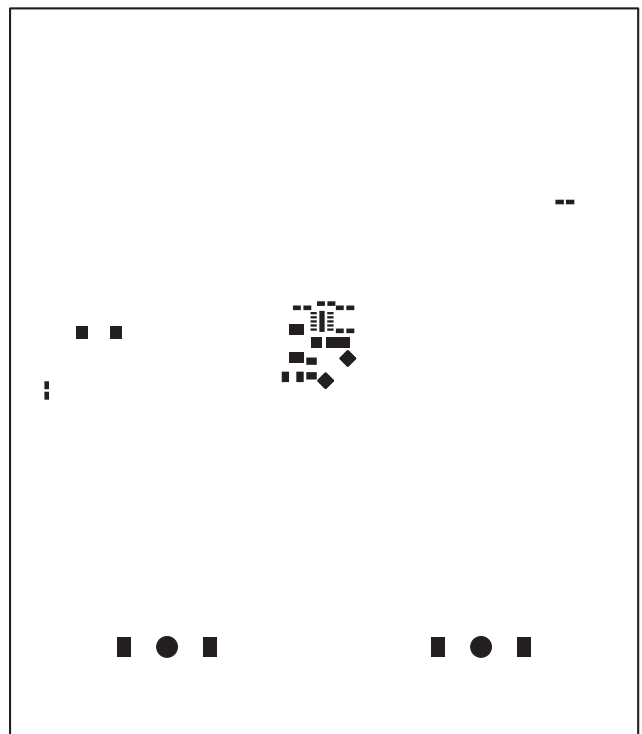
Top Solder Mask



Bottom Solder Mask



Top Solder Paste Mask



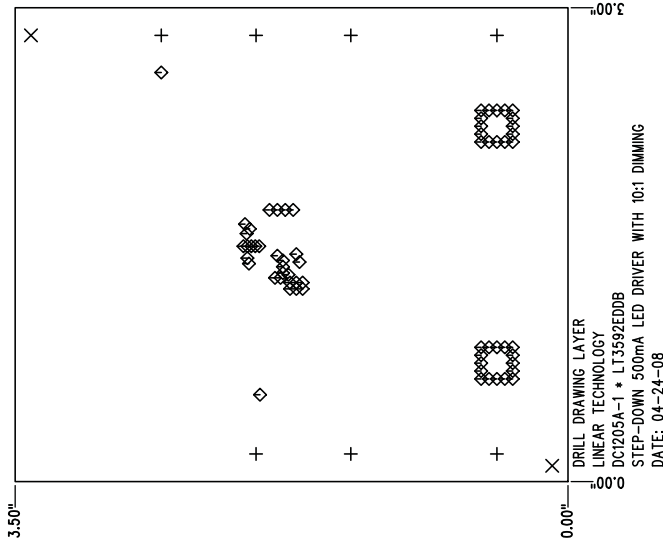
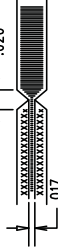
FABRICATION DRAWING

| REVISIONS | | | |
|-----------|-------------------|------|----------|
| REV | DESCRIPTION | APPR | DATE |
| A | FINAL FABRICATION | KS | 04-24-08 |

| SIZE | QTY | SYM | PLATED | TOL |
|-------|-----|-----|--------|-----------|
| 0.094 | 7 | + | YES | +/-0.003" |
| 0.07 | 2 | X | NO | +/-0.003" |
| 0.012 | 63 | ◇ | YES | +/-0.003" |

NOTES: UNLESS OTHERWISE SPECIFIED

- FAB PER IPC-A-600
- MATERIAL: EPOXY FIBERGLASS, NEMA GRADE FR-4
FINISHED THICKNESS TO BE 0.062" +/- .005"
TOTAL OF 4 LAYERS WITH 2 OZ. CU ON THE
OUTER LAYERS AND 1 OZ. CU ON THE INNER LAYERS.
FLAMMABILITY RATING: 94 V-0 MINIMUM .
- SIZE: CUT TO DIMENSIONS AND TOLERANCES SHOWN.
0.00" ARE PRIMARY DATUMS.
- DRILLING: DRILL HOLES PER SCHEDULE. PLATE THROUGH
HOLES WITH COPPER, 0.001" THICK MIN.
ALL HOLE SIZES ARE SPECIFIED AFTER PLATING.
HOLE LOCATION TOLERANCES ARE +/-0.003"
IN RELATION TO CENTER
- FINISH: SMOBC USING LPI BOTH SIDES, COLOR GREEN.
GOLD IMMERSION. USE LEAD FREE SOLDER FOR PROTOTYPE.
FOR SILKSCREEN: USE WHITE NON-CONDUCTIVE INK.
- DO NOT ALTER ARTWORK e.g. TO ADD LOGO OR DATE CODE.
PAD SIZE CAN BE MODIFIED TO MEET END FINISH.
- PCBS ARE TO BE ROHS COMPLIANT.
- SCORING FOR PANELIZED PCB:



SHOWN FROM COMPONENT SIDE

| APPROVALS | | DATE | |
|--------------|----------|----------|--|
| DRAWN | | | |
| CHECK | | | |
| DESIGN | KIM T. | 04-24-08 | |
| ENGR | KEITH S. | 04-24-08 | |
| SCALE = NONE | | | |

| | | | |
|--|-----------------------|--|---|
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| TITLE: FABRICATION DRAWING | | | |
| STEP-DOWN 500mA LED DRIVER WITH 10:1 DIMMING | | | |
| SIZE | DEMO | REV. | A |
| A | DC1205A * LT13592EDDB | | |
| SHT 1 of 1 | | | |

DEMO MANUAL DC1205A

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