

LTC4274: Single Port IEEE802.3at PSE

DESCRIPTION

Demonstration circuit 1567A features the LTC4274, a single power sourcing equipment (PSE) controller designed for use in IEEE 802.3 Type 1 and Type 2 (high power) compliant Power over Ethernet (PoE) systems. The LTC4274 is configured in the DC1567A as a midspan power injector where data comes in from an existing network system and out, along with power, to a powered device (PD). The LTC4274 autonomously detects a PD, turns power on to the port, and disconnects port power without the need for a microcontroller. A 2-event classification and a two second backoff timer support the midspan configuration.

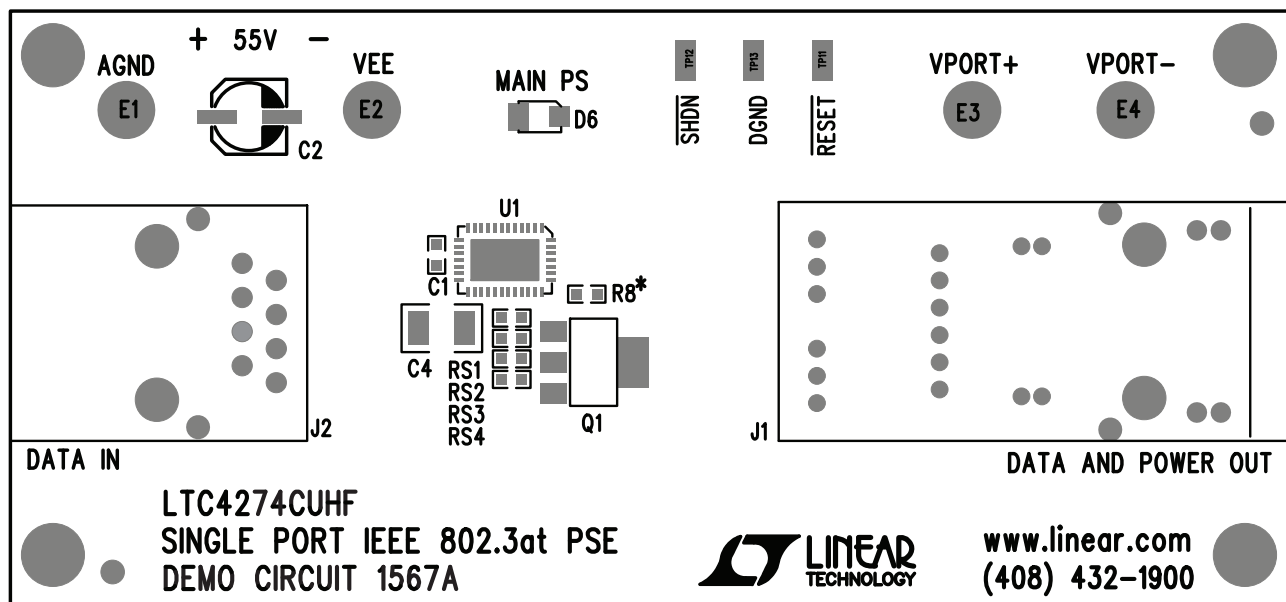
Only a single 55V supply is required to power the DC1567A. A simple 3-component regulator circuit on the board powers the digital supply of the LTC4274.

The LTC4274 delivers lowest-in-industry heat dissipation by utilizing a low R_{ON} external MOSFET and a 0.25Ω sense resistor, eliminating the need for expensive heat sinks. An external MOSFET also provide a more robust solution compared to an integrated MOSFET.

Power controlled by the LTC4274 is connected to the center taps on the cable side of the Ethernet transformers for data pairs 4/5 and 7/8. An integrated RJ45 connector includes the Ethernet transformer, common mode termination, and LEDs. One LED is also controlled by the LTC4274 to indicate the port is powered. Test turrets provide test points for port power measurements.

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

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DC1567 F01

Figure 1. DC1567A

DEMO MANUAL DC1567A

DESCRIPTION

Table 1. Typical DC1567A Performance Summary ($T_A = 25^\circ\text{C}$)

PARAMETER	CONDITION	VALUE
Input Voltage	GND – V_{EE} , Typical Voltage, IEEE Type 1 and Type 2 Complaint Output	51V to 57V
V_{DD} Supply Voltage	V_{DD} – DGND, Generated on Demo Board from V_{EE}	3.4V to 3.8V
Powered Pairs	PoE Power at RJ45 Connector	Alternative-B (Positive on Pins 4/5, Negative on 7/8)
PSE Operation Mode	AUTO Hardwired HI	IEEE802.3at Mode
Midspan Backoff	MID Pin Hardwired HI, Backoff Time After Detection	2.5s
Detection Type	25k Signature Detection	4-Point PD Detection
	Class 4	2-Event Classification
RJ45 Amber LED Indicator	PD Detected and Port Power is On	LED On
	Port Power is Off	LED Off
Port Output Voltage	$V_{EE} = -55.0\text{V}$, $R_{SENSE} = 0.25\Omega$, MOSFET = IRFM120A, Port Load = 600mA	-54.7V
Disconnect Current	DC Disconnect, Maintain Power Signature, Typical Disconnect Current at the Port for 350ms, $R_{SENSE} = 0.25\Omega$	<7.8mA
Auto Mode Overcurrent Sense	$R_{SENSE} = 0.25\Omega$, Class 0 or Class 3	376mA
	$R_{SENSE} = 0.25\Omega$, Class 1	112mA
	$R_{SENSE} = 0.25\Omega$, Class 2	208mA
	$R_{SENSE} = 0.25\Omega$, Class 4	636mA

QUICK START PROCEDURE

1. Connect a 55V power supply across GND and V_{EE} as shown in Figure 2.
2. Connect probes across V_{PORT+} and V_{PORT-} for measurements
3. Connect with a CAT5 cable to a PD at J1.
4. Connect a PHY with a CAT5 cable to J2 for data testing (optional).

OPERATION

DC1567A provides a simple single port IEEE 802.3at Type 1 and Type 2 PSE solution with the LTC4274. It runs fully autonomously and only requires a supply at V_{EE} . Detection, classification, port power on and disconnect is all performed without the need of a microcontroller. The voltage drop to the port is minimized with the LTC4274 solution because of the low R_{ON} external MOSFET and a 0.25Ω sense resistor, thus reducing power consumption.

Input Supply

IEEE 802.3at requires that a Type 2 PSE output at the port between 50V to 57V. To meet this requirement, it is recommended to supply a nominal 55V across AGND and V_{EE} on the DC1567A as shown in Figure 2. Main PS LED indicates the input power supply is powering the LTC4274.

V_{DD} Supply

DC1567A generates a V_{DD} supply from V_{EE} using just three components allowing for V_{EE} to be the only required supply. V_{DD} is tied to AGND and DGND is a negative voltage below AGND.

Auto Mode

The auto pin on the LTC4274 is tied logic high on the DC1567A to set the device to auto mode. In auto mode, the LTC4274 autonomously detects, classifies, powers on a valid detected PD, and disconnects power to the port when the PD is removed. An LED in the integrated RJ45 connector displays if the port is powered.

Midspan

The LTC4274 on the DC1567A, the MID pin is tied logic high to set the device to midspan mode. In midspan mode, port detection occurs every midspan backoff time of 2.5s.

Detection and Classification

The LTC4274 performs 4-point PD detection with 2-point forced voltage and 2-point forced current for higher reliability of valid PD detection. Once a valid PD is detected, classification is carried out. The LTC4274 in auto mode

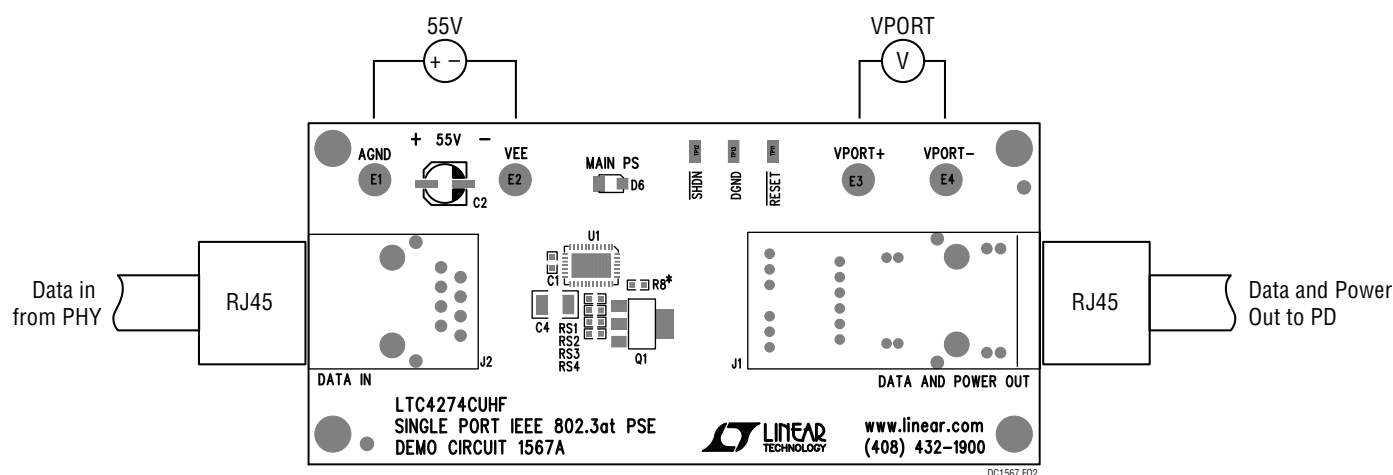


Figure 2. DC1567A Setup

QUICK START PROCEDURE

detects and classifies class 0 through class 4 PDs and sets the port current limits according to the PD class. In the event a class 4 is detected, the LTC4274 outputs a 2-Event classification to signal to the PD that it is a valid IEEE 802.3at PSE and can supply the high power.

Disconnect

The LTC4274 performs DC disconnect. In order for a PD to remain on, it must display a maintain power signature by drawing more than 10mA. If the port load is less than 5mA for 350ms, then the LTC4274 will remove power from the port.

Overcurrent

The LTC4274 in auto mode detects, classifies and sets the current limits according to the classification results. Refer to Table 1 for the overcurrent limits with a 0.25Ω sense resistor.

$\overline{\text{SHDN}}$ and $\overline{\text{RESET}}$

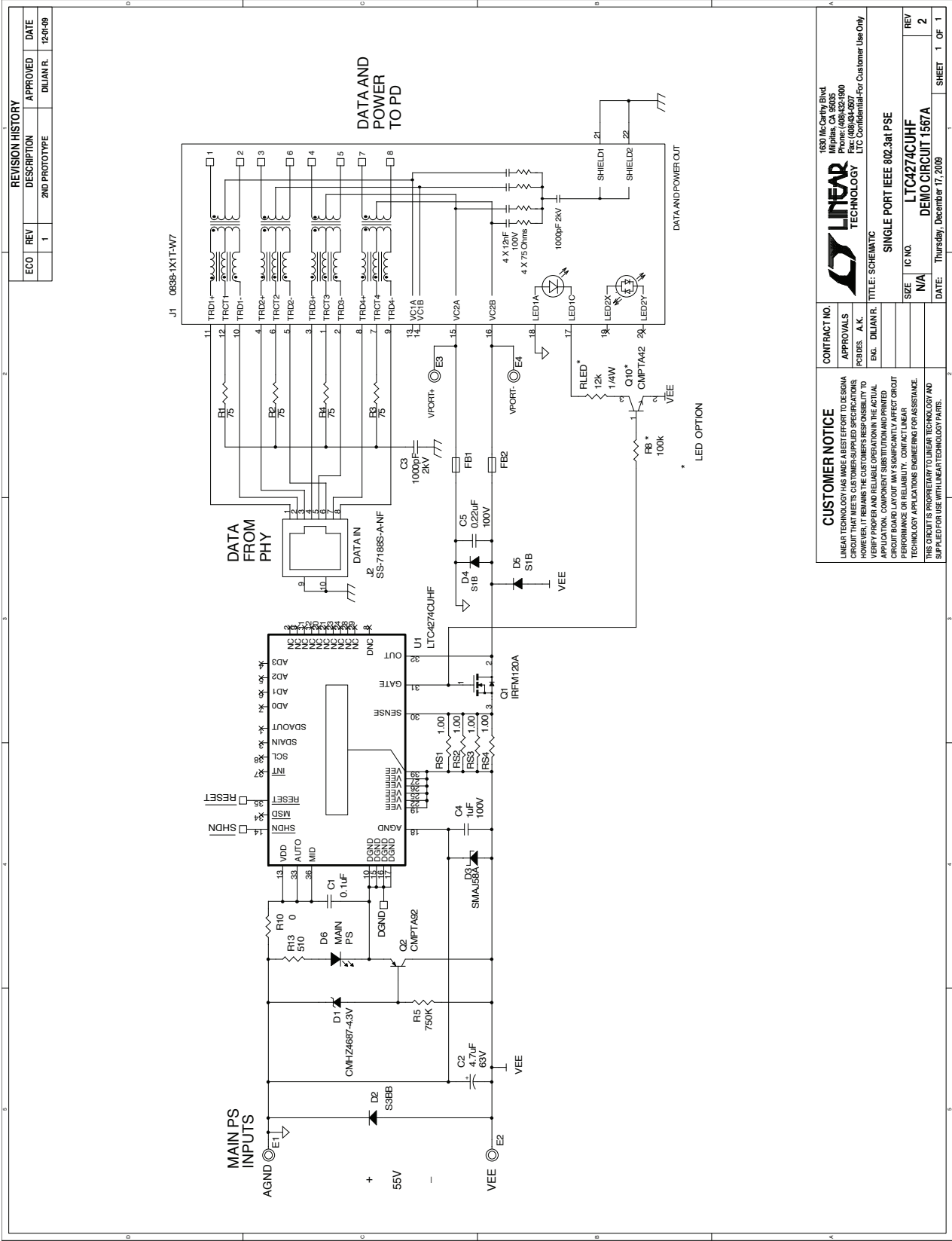
The DC1567A has test points to the LTC4274 $\overline{\text{SHDN}}$, $\overline{\text{RESET}}$ and DGND pins. Momentarily tying $\overline{\text{SHDN}}$ to DGND will shut down the port if it is on and disable detection preventing the port from turning on again. Momentarily tying $\overline{\text{RESET}}$ to DGND will reset the LTC4274 to its auto mode state without having to cycle power.

PARTS LIST

ITEM	QUANTITY	REFERENCE- DESCRIPTION	DESCRIPTION	MANUFACTURER'S PART NUMBER
REQUIRED CIRCUIT COMPONENTS:				
1	1	C1	Cap., X7R, 0.1 μ F, 10V, 10%, 0603	AVX, 0603ZC104KAT
2	1	C2	CAP, Elect., 4.7 μ F, 63V, c-PANA-EEVFK-C	Panasonic, EEEFK1J4R7R
3	1	C3	Cap., X7R, 1000pF, 2kV, 10%, 1808	TDK, C4520X7R3D102K
4	1	C4	Cap., X7R, 1 μ F, 100V, 10%, 1210	AVX, 12101C105KAT
5	1	C5	CAP, 0.22 μ F 20% 100V X7R 1206	AVX, 12061C224MAT2A
6	1	D1	Diode, Zener, 4.3V, DOD-123, CCP-mark.	Central Semi., CMHZ4687
7	1	D2	3.0A Diode Rectifier, 100V, S3BC, SMB	Diodes, S3BB
8	1	D3	Diode, TVS, 58V, SMA	Diodes Inc., SMAJ58A-13-F
9	2	D4, D5	DIODE, Rectifier, 100V, 1A, SMA	Vishay, S1B-E3
10	1	D6	LED, Amber	Panasonic, LN1451C-TR
11	4	E2 to E4	TP, Turret, 0.094"	MILL-MAX, 2501-2-00-80-00-00-07-0
12	2	FB1, FB2	FerriteBead, 2A, 0.1 Ω DC, 600 Ω at 100MHz	TDK, MPZ2012S601A
13	1	J1	PoE+ Single Port MagJack w/LEDS	Bel Fuse, 0838-1X1T-W7
14	1	J2	8 Contact, 8 Position, Shielded Jack	Bel Steward Connector, SS-7188S-A-NF
15	1	Q1	Power MOSFET, 100V/2.3A, SOT-223	Fairchild Semi., IRFM120ATF
16	1	Q2	PNP Transistor, SOT23, Code C2D	Central Semi., CMPTA92E
17	1	Q10	NPN Transistor, SOT23, Code C1D	Central Semi., CMPTA42
18	1	RLED	Res., Chip, 12K, 1/4W, 5%, 0805	Panasonic, ERJ-P06J123V
19	4	RS-1 to RS-4	Res., Chip, 1, 1/16W, 1%, 0603	Vishay, CRCW06031R00FNEA
20	4	R1 to R4	Res., Chip, 75, 1/16W, 5%, 0603	Vishay, CRCW060375R0JNEA
21	1	R5	Res., Chip, 750K, 1/16W, 5%, 0603	Vishay, CRCW0603750KJNEA
22	1	R8	Res., Chip, 100K, 1/16W, 5%, 0603	Vishay, CRCW0603100KJNEA
23	1	R10	Res, Chip, 0 Ω 1/16W, 0603	Vishay, CRCW06030000Z0EA
24	1	R13	Res., Chip, 510, 1/16W, 5%, 0603	Vishay, CRCW0603510RJKEA
25	1	U1	I.C., LTC4274CUHF 38Pin UHF	Linear Tech., LTC4274CUHF
26	4	MTGS at 4 Corners	Standoff, Nylon, 0.25, 1/4"	Keystone, 8831(Snap On)
27	1		Fab, Printed Circuit Board	Demo Circuit 1567A
28	1		Stencil	Stencil 1567A

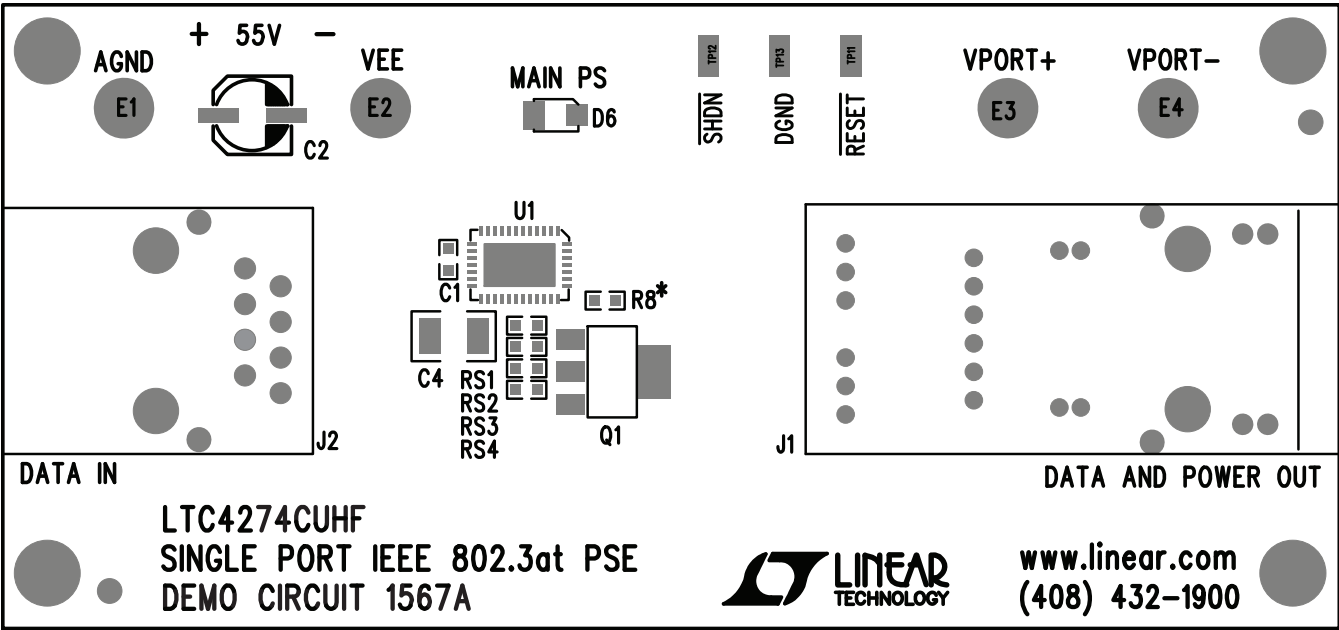
DEMO MANUAL DC1567A

SCHEMATIC DIAGRAM

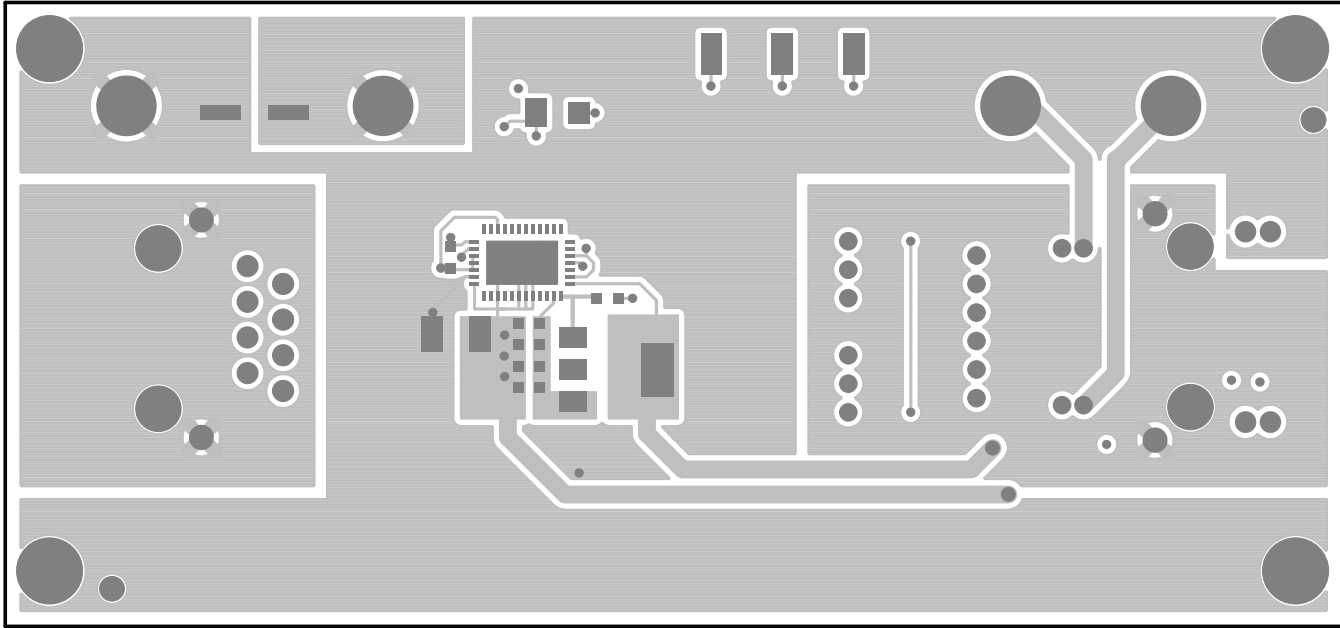


PCB LAYOUT AND FILM

Top Silkscreen

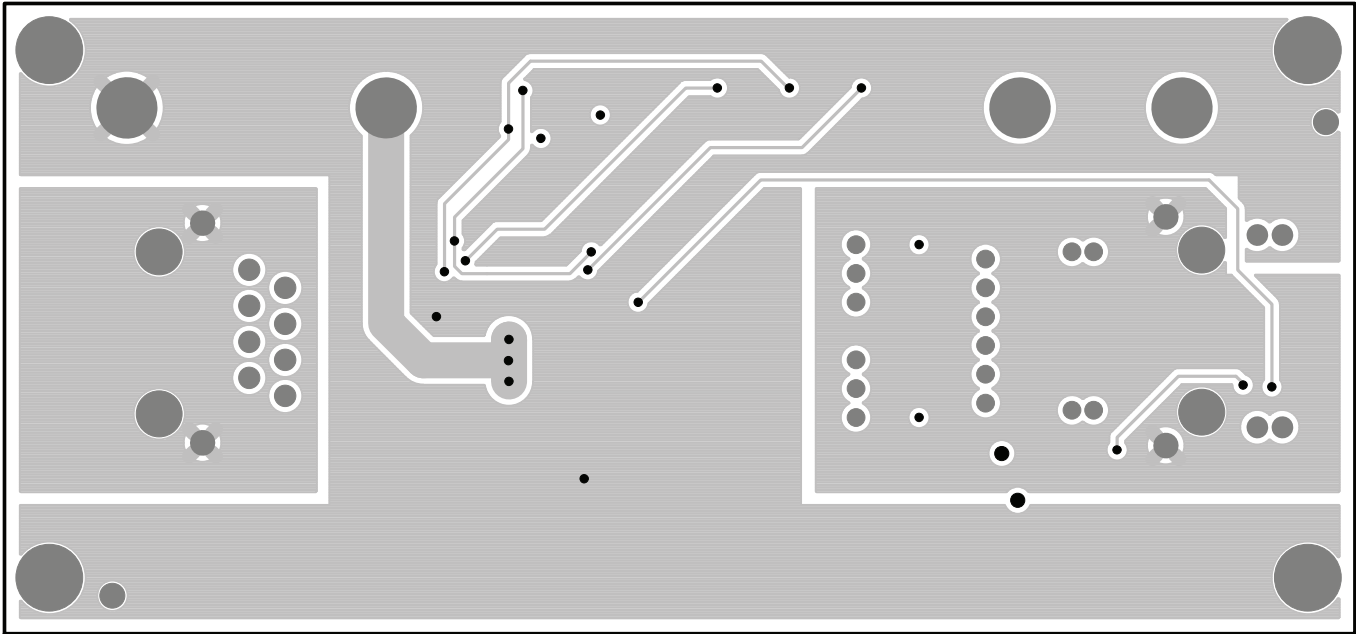


Top Side



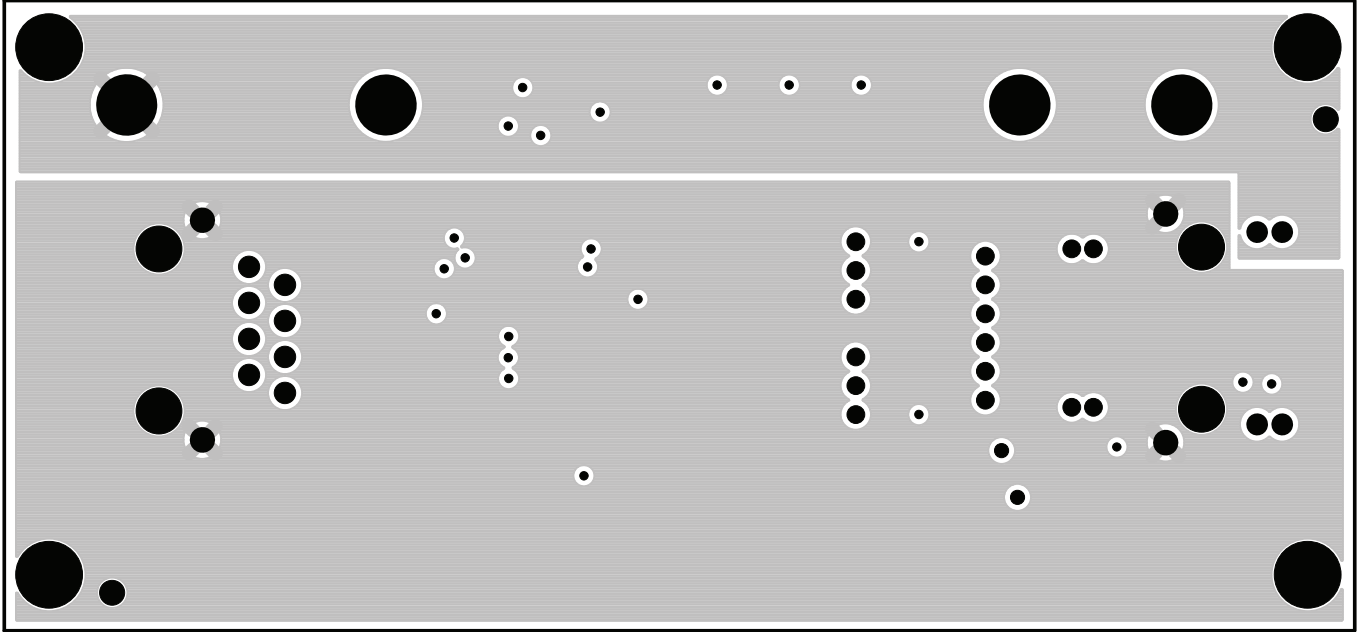
PCB LAYOUT AND FILM

Inner Layer 2



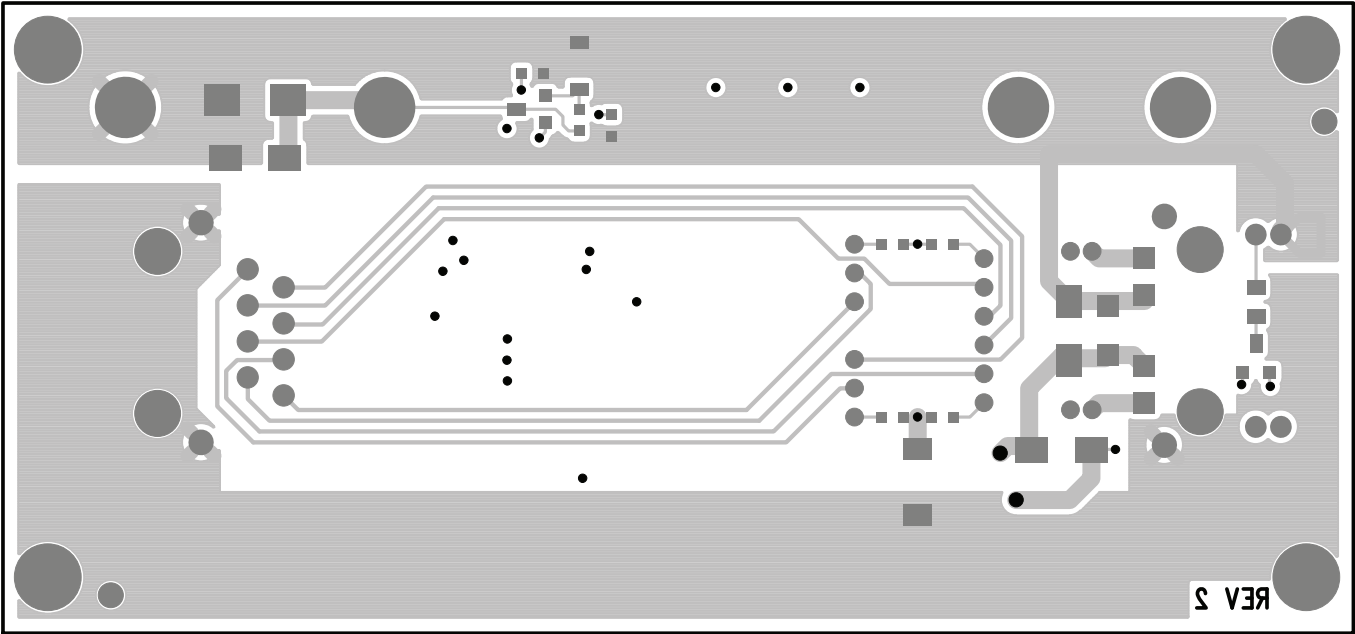
PCB LAYOUT AND FILM

Inner Layer 3



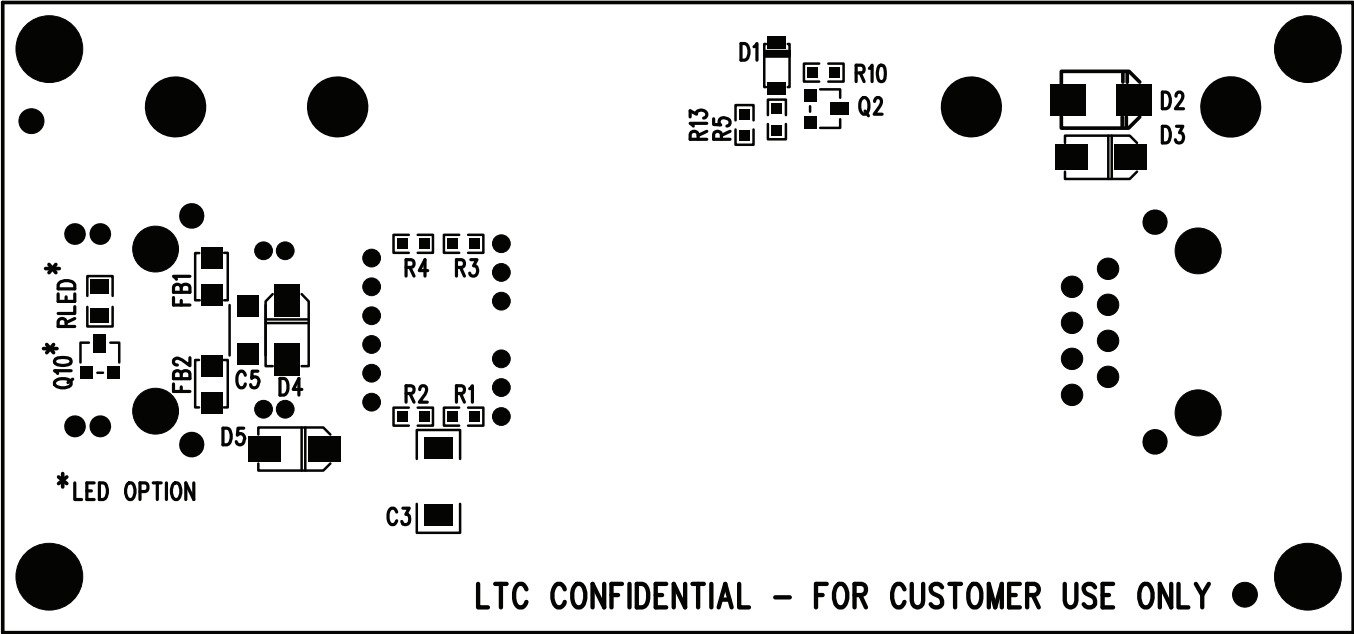
PCB LAYOUT AND FILM

Bottom Side



PCB LAYOUT AND FILM

Silkscreen Bottom



DEMO MANUAL DC1567A

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