LT4276, LT4321
PoE PD with Synchronous Flyback and Ideal Diode Bridge

DESCRIPTION

Demonstration circuit 2046A-F is an Ethernet Alliance™ certified PoE Powered Device (PD) with an isolated power supply using synchronous flyback topology, featuring the LT®4276 and ideal diode bridge controller (LT4321).

The LT4276 provides IEEE802.3af (PoE, Type 1), IEEE802.3at (PoE+, Type 2), and LTPoE++™ PD interfacing and power supply control. When the PD is fully powered, the PD interface switches power over from the Power Sourcing Equipment (PSE) to the switcher through an external, low resistance, high power N-channel FET. The highly integrated LT4276 controls a high power, small-sized power supply that utilizes a highly efficient flyback topology with synchronous rectification. The LT4321 provides further efficiency improvement by minimizing the bridge losses.

The DC2046A-F supplies a 5V output at up to 2.3A. It also demonstrates the use of an optional auxiliary power supply input of 48V. When present, the auxiliary supply becomes the dominant supply over PoE to provide power.

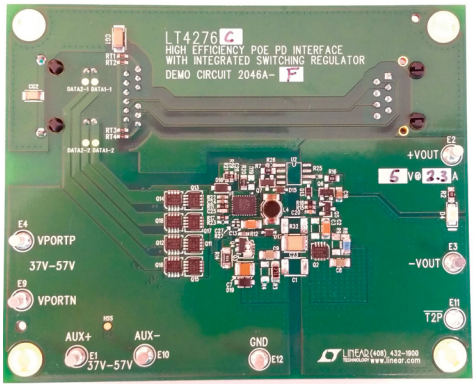
Design files for this circuit board are available.

PERFORMANCE SUMMARY

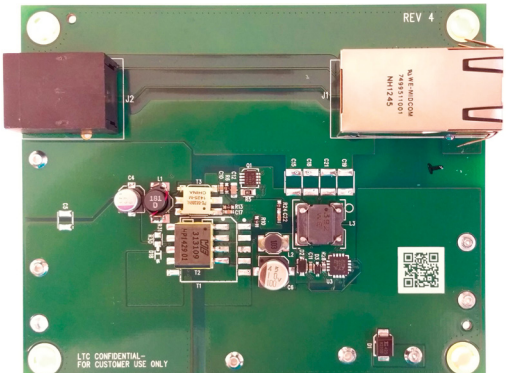
Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	VALUE
Port Voltage (V_{PORT})	At Ethernet Port	37V to 57V
Auxiliary Voltage	From AUX+ to AUX– Terminals	37V to 57V
Output Voltage		5V (Typ)
Output Current		2.3A (Max)
Output Voltage Ripple	V_{PORT} = 37V, I_{OUT} = 2.3A	30mV_{P-P} (Typ)
Output Regulation		±0.2% (Typ)
Efficiency	V_{PORT} = 48V, I_{OUT} = 2.3A, End to End	90% (Typ)
Switching Frequency		250kHz (Typ)

BOARD PHOTOS



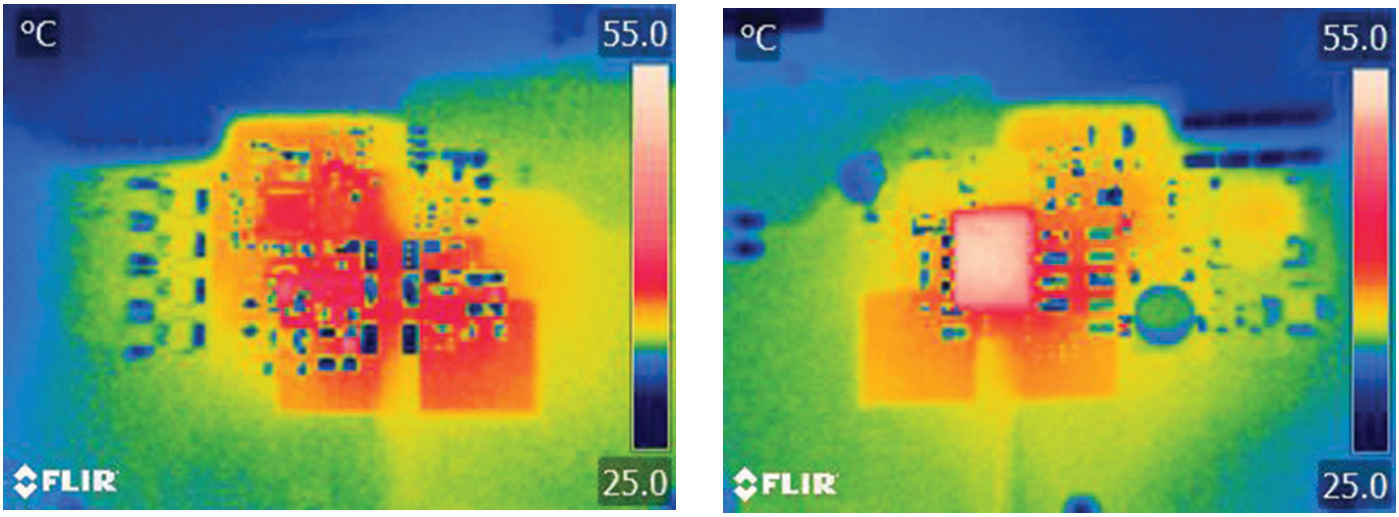
Top Side



Bottom Side

EA Certified™

TYPICAL PERFORMANCE CHARACTERISTICS



Top Side **Bottom Side**

Figure 1. Thermal Pictures – V_{PORT} = 57V, 5V/2.3A

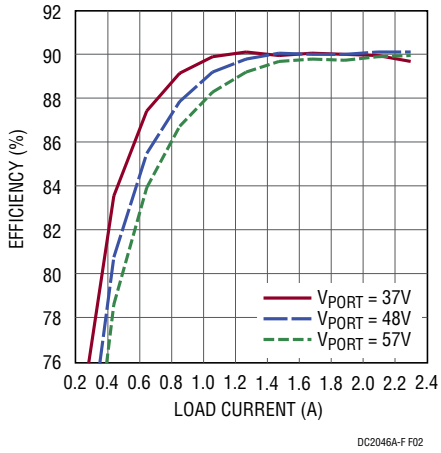


Figure 2. Efficiency (End to End)

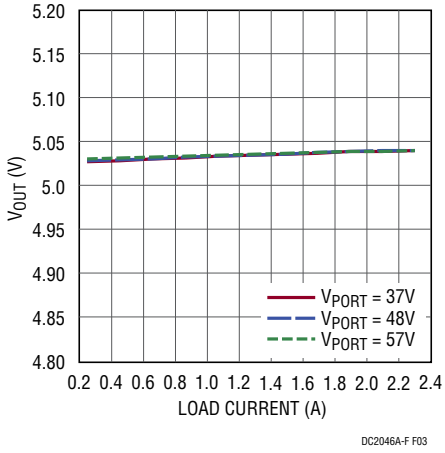


Figure 3. Output Voltage Regulation

TYPICAL PERFORMANCE CHARACTERISTICS

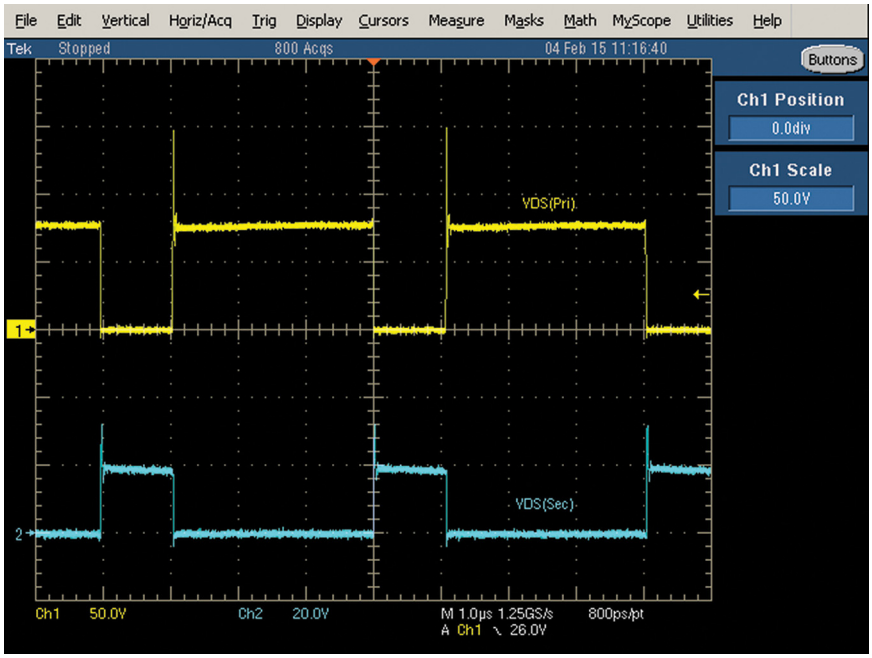


Figure 4. Stresses (V_{PORT} = 57V, 5V/2.3A)

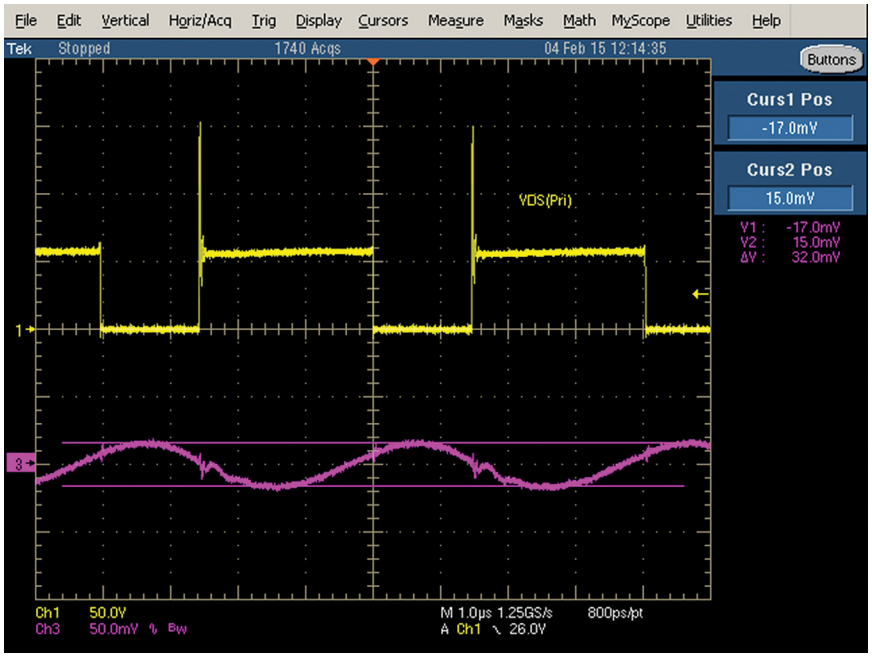


Figure 5. Output Voltage Ripple (V_{PORT} = 37V, 5V/2.3A)

TYPICAL PERFORMANCE CHARACTERISTICS

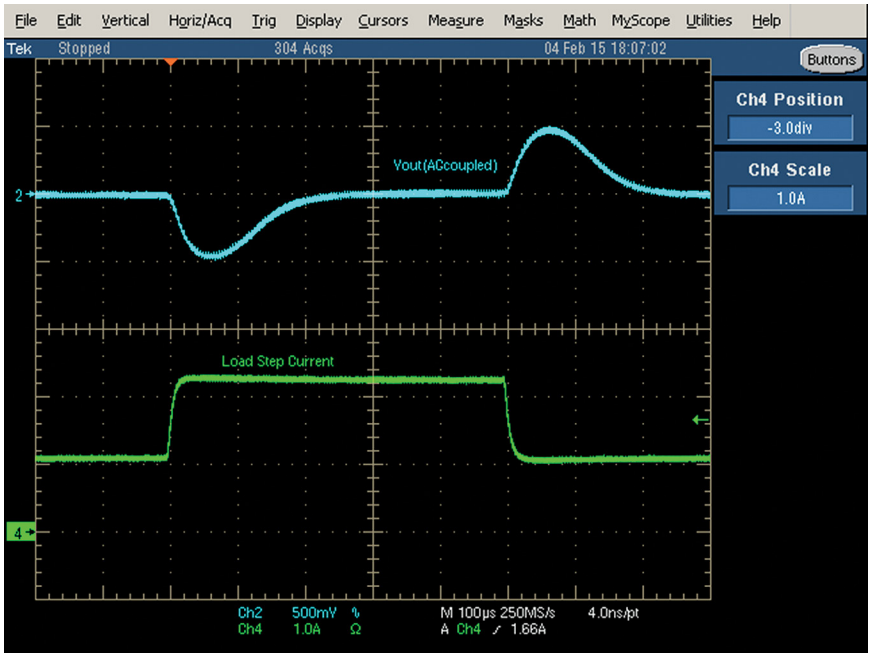


Figure 6. Load Transient Response (V_{PORT} = 37V, 1.15A to 2.3A to 1.15A)

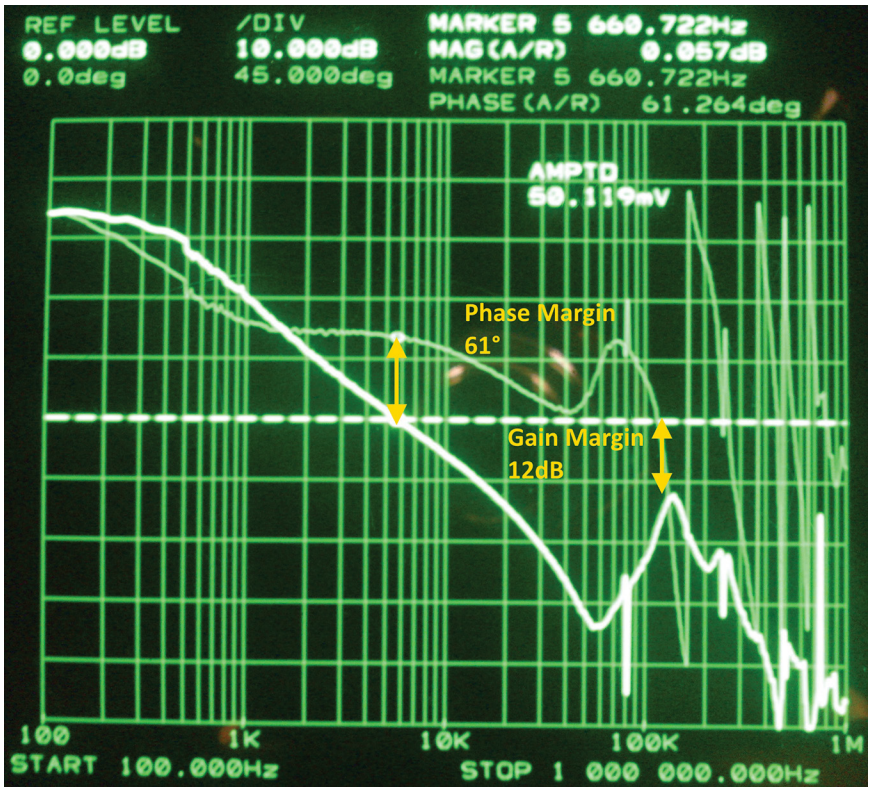


Figure 7. Gain and Phase Margin of the Flyback Loop (V_{PORT} = 37V, 5V/0.23A)

QUICK START PROCEDURE

Demonstration circuit 2046A-F is easy to set up to evaluate the performance of the LT4276 in a PoE+ application. Refer to Figure 8 for proper 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 output voltage ripple by touching the probe tip and probe ground directly across the +VOUT and –VOUT terminals. See Figure 9 for proper scope probe technique.

1. Place test equipment (voltmeter, ammeter, power supplies, and electronic load) as shown in Figure 8.
2. Input supplies:
   A) Connect a PoE+ capable PSE with a CAT-5 cable to the RJ45 connector, J1. See Figure 8.
   B) Or, connect a 37V to 57V capable power supply (Power Supply in Figure 8) across V_{PORTP} and V_{PORTN}.
   C) If evaluating the auxiliary power supply (Auxiliary Supply in Figure 8), connect a 37V to 57V capable power supply across AUX+ to AUX–.
3. Check for the proper output voltage of 5V.
4. Once the proper output voltage is confirmed, adjust the load within the operating range and observe the output voltage regulation, ripple voltage, efficiency, and other parameters.

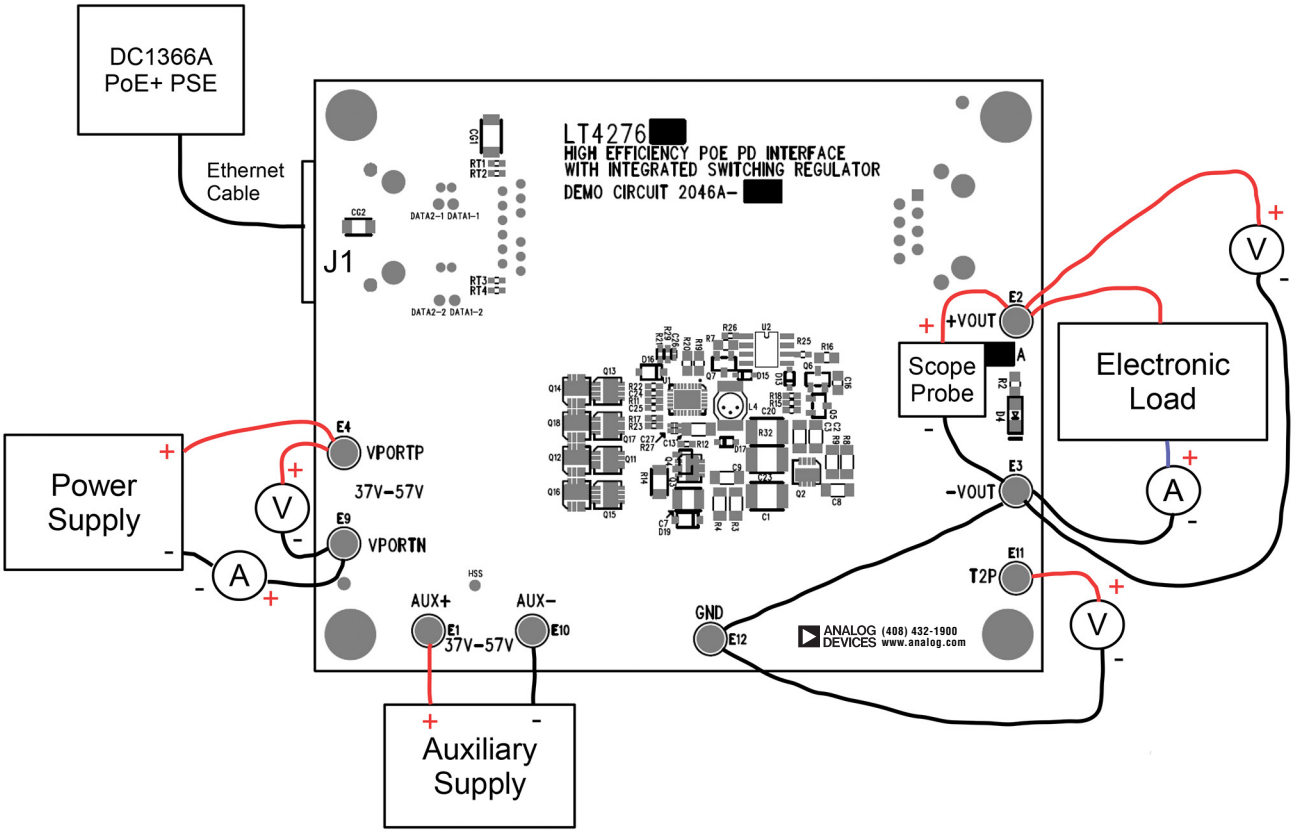


Figure 8. Proper Measurement Equipment Setup

QUICK START PROCEDURE

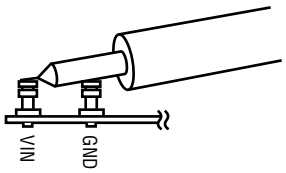


Figure 9. Measuring Output Ripple

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURE/PART #
DC2046A General BOM				
1	1	CG1	Cap, Cer, X7R 1000pF 2KV 10% 1808	Murata GR442QR73D102KW01L
2	1	CG2	Cap, Cer, X7R 0.01µF 100V 20% 1206	AVX 12061C103AT2A
3	0	C1	Cap, Cer, Opt 2kV 1812	Opt
4	0	C5	Cap, Cer, X7U Opt 6.3V 10% 1210	Opt
5	1	C6	Cap, Elec, 10µF 100V 10% 6.3x7.7	SunCon 100CE10BS
6	1	C7	Cap, Cer, X7R 2.2µF 100V 10% 1210	Murata GRM32ER72A225KA35
7	1	C10	Cap, Cer, X7R 10nF 100V 20% 0603	Murata GRM188R72A103KA01D
8	1	C11	Cap, Cer, X7R 0.047µF 100V 20% 0603	Kemet C0603C473M1RACTU
9	1	C12	Cap, Cer, X7R 0.047µF 100V 10% 0805	Murata GRM21BR72A473KA01L
10	1	C13	Cap, Cer, X7R 10µF 10V 10% 1206	Murata GRM31CR71A106KA01L
11	0	C15, C18, C19, C21	Cap, Cer, X5R Opt 2kV 20% 1812	Opt
12	1	C17	Cap, Cer, X7R 1µF 25V 10% 0603	Murata GRM188R71E105KA12
13	1	C20	Cap, Cer, X7R 2.2nF 25V 10% 0603	Murata GRM188R71E222KA01
14	1	C23	Cap, Cer, X7R 4.7nF 2kV 10% 1812	Murata GR443DR73D472KW01L
15	1	C26	Cap, Cer, X5R 100pF 16V 10% 0402	AVX 0402YC101KAT2A
16	0	C27	Cap, Cer, X7R Opt 6.3V 10% 0402	Opt
17	1	D1	Diode, Schottky, B2100 100V SMB	Diodes Inc. B2100-13-F
18	1	D2	Diode, TVS, PTVS58VS1UR 58V SOD123	NXP PTVS58VS1UR
19	1	D3	Diode, Zener, MMSZ5252BS 24V SOD323	Diodes Inc. MMSZ5252BS
20	1	D4	Diode, Led Green	ROHM SML-010FTT86L
21	1	D13	Diode, Schottky, NXP, BAT46W 100V SOD323	NXP BAT46WJ,115
22	1	D15	Diode, Diodes Inc., BAV19WS 120V SOD323	Diodes Inc. BAV19WS
23	1	D16	Diode, TVS, PTVS58VS1UR 58V SOD123	NXP PTVS58VS1UR
24	1	D17	Diode, Schottky, BAT54WS 30V SOD323	Diodes Inc. BAT54WS
25	1	D19	Diode, TVS, PTVS58VS1UR 58V SOD123	NXP PTVS58VS1UR
26	7	E1, E2, E3, E4, E9, E10, E12	TP, Turret, PAD150-094 0.094	Mill-Max 2501-2-00-80-00-00-07-0
27	1	J1	Conn, Integrated Jack, 7499511001	Würth 7499511001
28	1	J2	Conn, RJ45 Jack, SS-6488-NF-K1	Stewart Connector SS-6488-NF-K1 Alternate: SS-6488S-A-NF
29	1	L2	Ind, 10µH	Coilcraft DO1608C-103
30	1	L4	Ind, 100µH	Coilcraft DO1608C-104
31	9	Q1, Q11, Q12, Q13, Q14, Q15, Q16, Q17, Q18	MOSFET, N-CH, PSMN075-100MSE 100V LFPAK33	NXP PSMN075-100MSE
32	1	Q5	Tran, PNP, MMBT3906 40V SOT23	Fairchild MMBT3906
33	1	Q6	Tran, NPN, MMBT3904 40V SOT23	Fairchild MMBT3904
34	1	Q7	Tran, PNP, FMMT723 100V SOT23	Diodes Inc. FMMT723TA
34	0	Q7 (Alternate)	Tran, PNP, PBSS9110T 100V SOT23	NXP PBSS9110T

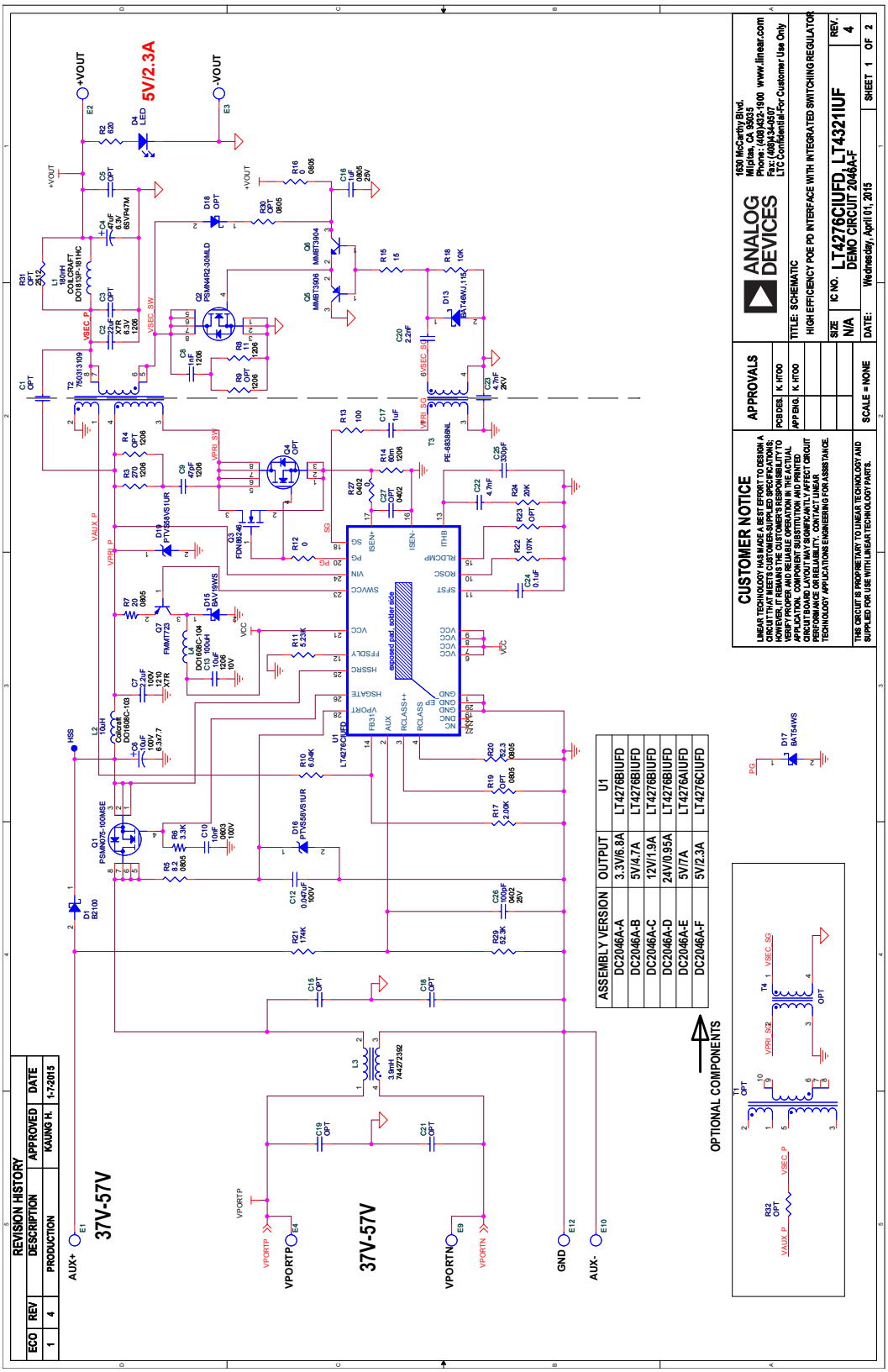
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURE/PART #
35	4	RT1, RT2, RT3, RT4	Res, Chip, 75Ω 5% 0603	NIC NRC06J750TRF
36	1	R5	Res, Chip, 8.2Ω 5% 0805	NIC NRC10J8R2TRF
37	1	R6	Res, Chip, 3.3k 5% 0603	NIC NRC06J332TRF
38	1	R7	Res, Chip, 20Ω 5% 0805	Vishay CRCW080520R0JNEA
39	1	R12	Res, Chip, 0Ω 5% 0603	NIC NRC06ZOTRF
40	1	R13	Res, Chip, 100Ω 5% 0603	Vishay CRCW0603100RFKEA
41	1	R15	Res, Chip, 15Ω 5% 0603	NIC NRC06J150TRF
42	1	R17	Res, Chip, 2.00k 1% 0603	NIC NRC06F2001TRF
43	1	R18	Res, Chip, 10k 5% 0603	Yageo RC0603JR-0710KL
44	1	R21	Res, Chip, 174k 1% 0603	Vishay CRCW0603174KFKEA
45	1	R22	Res, Chip, 107k 1% 0603	NIC NRC06F1073TRF
46	1	R27	Res, Chip, 0Ω 5% 0402	NIC NRC04ZOTRF
47	1	R28	Res, Chip, 0Ω 5% 0603	NIC NRC06ZOTRF
48	1	R29	Res, Chip, 52.3k 1% 0603	Vishay CRCW060352K3FKEA
49	0	R32	Res, Chip, Opt 5% 1812	Opt
50	1	T3	XFMR, SMD Gate Drive, PE-68386NL	Pulse PE-68386NL
50	0	T3 (Alternate)	XFMR, SMD Gate Drive, EPA4271GE	PCA EPA4271GE
51	0	T4	XFMR, SMD Gate Drive, Opt	Opt
52	1	U3	IC, PoE Ideal Bridge Controller, LT4321IUF QFN16	Analog Devices LT4321IUF
DC2046A-F BOM				
1	1	C2	Cap, Cer, X7R 22µF 6.3V 10% 1206	Murata GRM31CR70J226KE19
2	0	C3	Cap, Cer, Opt	Opt
3	1	C4	Cap, Elec, 47µF 6.3V 20% 5.0X5.3	Panasonic 6SVP47M
4	1	C8	Cap, Cer, U2J 1nF 630V 5% 1206	Murata GRM31A7U2J102JW31
5	1	C9	Cap, Cer, U2J 47pF 630V 5% 1206	Murata GRM31A7U2J470JW31
6	1	C16	Cap, Cer, X7R 1µF 25V 10% 0805	Murata GRM21BR71E105KA99L
7	1	C22	Cap, Cer, X7R 4.7nF 25V 10% 0603	Murata GRM18871E472KA01D
8	1	C24	Cap, Cer, X7R 0.1uF 25V 20% 0603	Murata GRM188R71E104KA01D
9	1	C25	Cap, Cer, X7R 330pF 25V 10% 0603	AVX 06031C331KAZ2A
10	0	D18	Diode, Diodes Inc., Opt 40V SOD323	Diodes Inc. Opt
11	0	E11	TP, Turret, Opt 0.094"	Opt
12	1	L1	Ind, 180nH	Coilcraft DO1813P-181HC
13	1	L3	Ind, CMC, 3.9mH	Würth 744272392
14	1	Q2	MOSFET, N-CH, PSMN4R2-30MLD 30V LFPAK33	NXP PSMN4R2-30MLD
15	1	Q3	MOSFET, N-CH, FDN86246 100V SOT23	Fairchild FDN86246
16	0	Q4	MOSFET, N-CH, Opt	Opt
17	1	R2	Res, Chip, 620Ω 5% 0805	NIC NRC10J621TRF
18	1	R3	Res, Chip, 270Ω 5% 1206	NIC NRC12J271TRF
19	0	R4	Res, Chip, Opt	Opt
20	1	R8	Res, Chip, 11Ω 5% 1206	Vishay CRCW120611R0JNEA

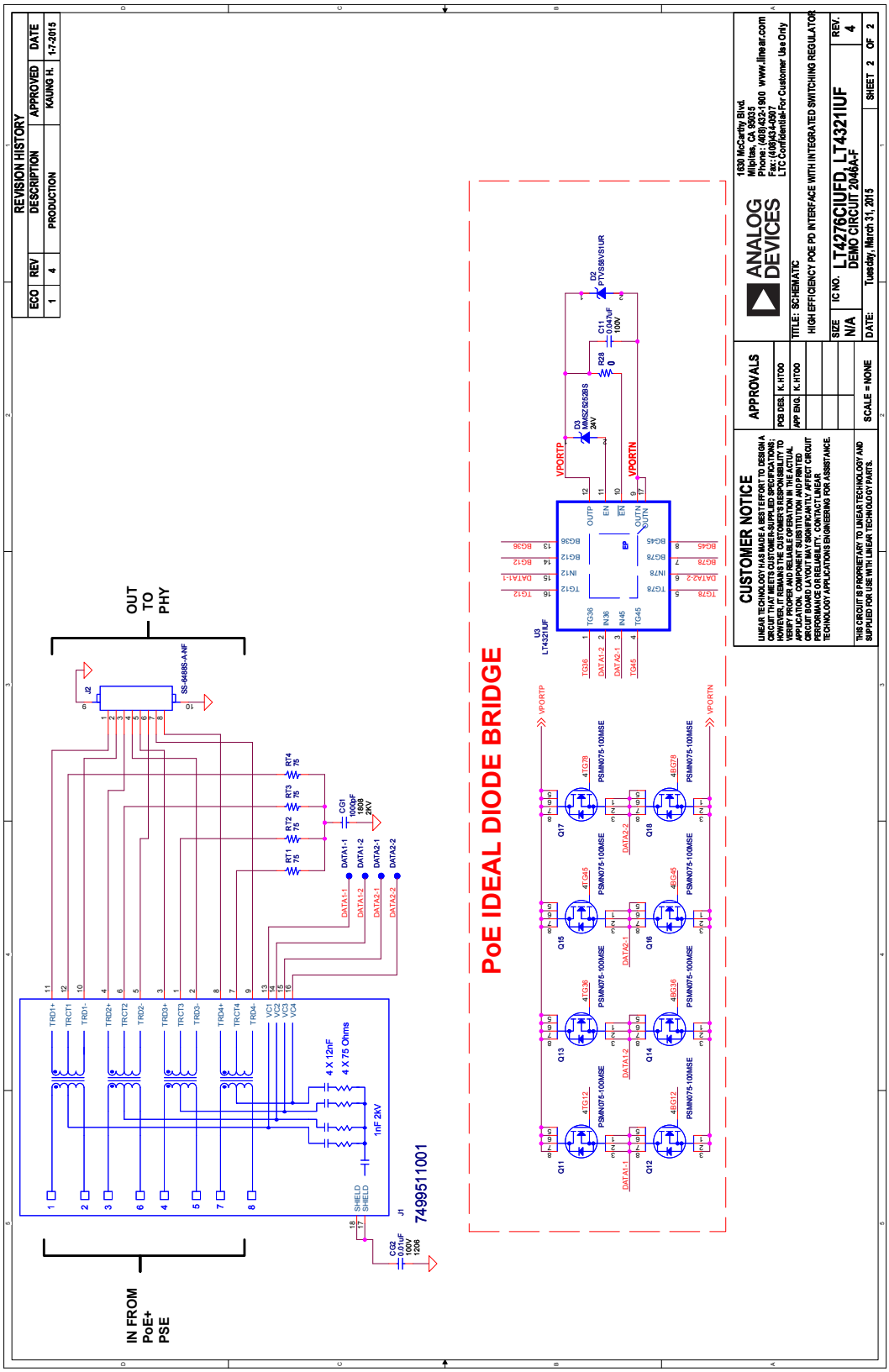
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURE/PART #
21	0	R9	Res, Chip, Opt 5% 1206	Opt
22	1	R10	Res, Chip, 6.04k 1% 0603	Vishay CRCW06036K04FKEA
23	1	R11	Res, Chip, 5.23k 1% 0603	Vishay CRCW06035K23FKEA
24	1	R14	Res, Chip, 60mΩ 1% 1206	Vishay WSL1206R0600FEA
25	1	R16	Res, Chip, 0Ω, Shunt, 0805	Vishay CRCW08050000Z0EA
26	0	R19	Res, Chip, Opt 1% 0805	Opt
27	1	R20	Res, Chip, 52.3Ω 1% 0805	Vishay CRCW080552R3FKEA
28	0	R23	Res, Chip, Opt 5% 0603	Opt
29	1	R24	Res, Chip, 20k 5% 0603	TBD CRCW060320K0FKEA
30	0	R25	Res, Chip, Opt 5% 0603	Opt
31	0	R26	Res, Chip, Opt 5% 0603	Opt
32	0	R30	Res, Chip, Opt 5% 0805	Opt
33	0	R31	Res, Chip, Opt, Shunt, 2512	Opt
34	0	T1	XFMR, Flyback Tran, Opt	Opt
35	1	T2	XFMR, Flyback Tran, 750313109	Würth 750313109
36	1	U1	IC, PD & Switcher Controller, LT4276CIUFD QFN28	Analog Devices LT4276CIUFD
37	0	U2	Opto, Opt SO8	Fairchild MOC207M
38	1		Fab, Printed Circuit Board	Demo Circuit 2046A

SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM



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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- *Подбор аналогов.*
- *Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.*

- *Приемлемые сроки поставки, возможна ускоренная поставка.*
- *Доставку товара в любую точку России и стран СНГ.*
- *Комплексную поставку.*
- *Работу по проектам и поставку образцов.*
- *Формирование склада под заказчика.*

- *Сертификаты соответствия на поставляемую продукцию (по желанию клиента).*
- *Тестирование поставляемой продукции.*
- *Поставку компонентов, требующих военную и космическую приемку.*
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- *Техническую поддержку проекта.*
- *Защиту от снятия компонента с производства.*
- *Оценку стоимости проекта по компонентам.*
- *Изготовление тестовой платы монтаж и пусконаладочные работы.*

Тел: +7 (812) 336 43 04 (многоканальный)
Email: org@lifeelectronics.ru

www.lifeelectronics.ru