

EVAL-1ED44176N01F evaluation board

1ED44176N01F Function test board

About this document

Scope and purpose

The gate driver evaluation board EVAL-1ED44176N01F was developed to show the functionalities and key features of Infineon's low-side gate driver with integrated over-current protection, 1ED44176N01F. This application note is a user's guide for the EVAL-1ED44176N01F. It explains the board's hardware, and provides detailed instructions on how to check the functions of the driver IC. The design was tested as described in this document, but not qualified regarding manufacturing, lifetime or over the full range of ambient operating conditions. EVAL-1ED44176N01F is available from Infineon in sampling quantities.

The boards provided by Infineon are subjected to functional testing only.

Owing to their purpose, evaluation boards are not subjected to the same procedures regarding Returned Material Analysis (RMA), Process Change Notification (PCN) and Product Discontinuation (PD) as regular products. The evaluation boards are intended for development support only and should not be used directly as reference designs for volume production.

See Legal Disclaimer and Warnings for further restrictions on Infineon's warranty and liability.

Intended audience

- The board is intended to support skilled technicians in a professional laboratory environment during their first steps with the driver.

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Electrical description

1 Electrical description

1.1 Main features

This evaluation board “EVAL-1ED44176” has been developed to evaluate the key functions of Infineon’s low-side gate driver with built-in over-current protection and enable/ fault output indication. Figure 1 is the block diagram of the board. The board mainly consists of an onboard pulse generator, one 1ED44176N01F to drive a MOSFET (Q1) connected with an adjustable resistance load (potentiometer-R3) and R7, which works as a current-sense resistor to sense the Q1 turn-on current and feed it back to the OCP pin of the driver. If the Q1 turn-on current exceeds 3.5 mA, then the voltage on R7 is higher than 0.5 V. It will trigger the over-current protection of the driver. Rotating the potentiometer (R3) will change the Q1 turn-on current. The two LEDs on the board show the different working statuses of the driver. If the green LED (D2) lights up, it is working in normal operation mode. If the red LED (D1) lights up, it is in fault-condition mode.

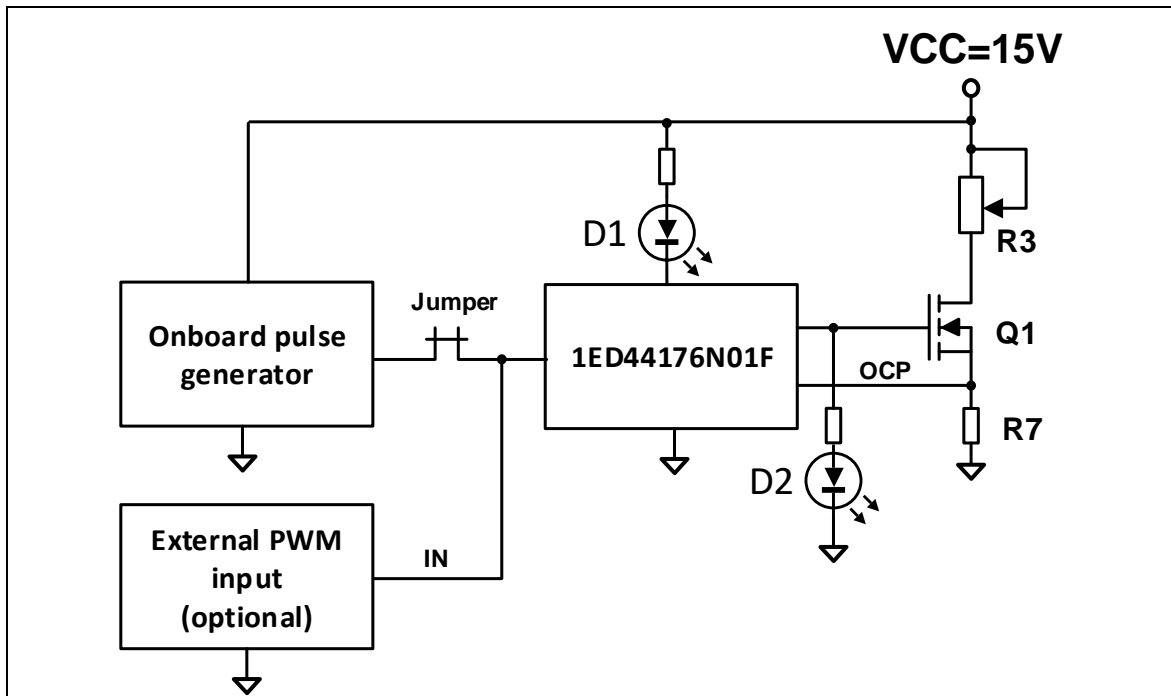


Figure 1 EVAL-1ED44176 block diagram

Figure 2 and Figure 3 show the top view and the overview functionalities on the top side of the EVAL-1ED44176. The size of the board is width x length x height = 33 x 38 x 18 mm³.

The evaluation board has an onboard pulse generator circuit, which is made of comparator (IC2), resistors (R8~R12) and capacitors (C5 and C6) to create an input signal with a fixed frequency and duty cycle. We also can use an external pulse generator to create the input signal with different frequencies and duty cycles.

Electrical description



Figure 2 EVAL-1ED44176 top view

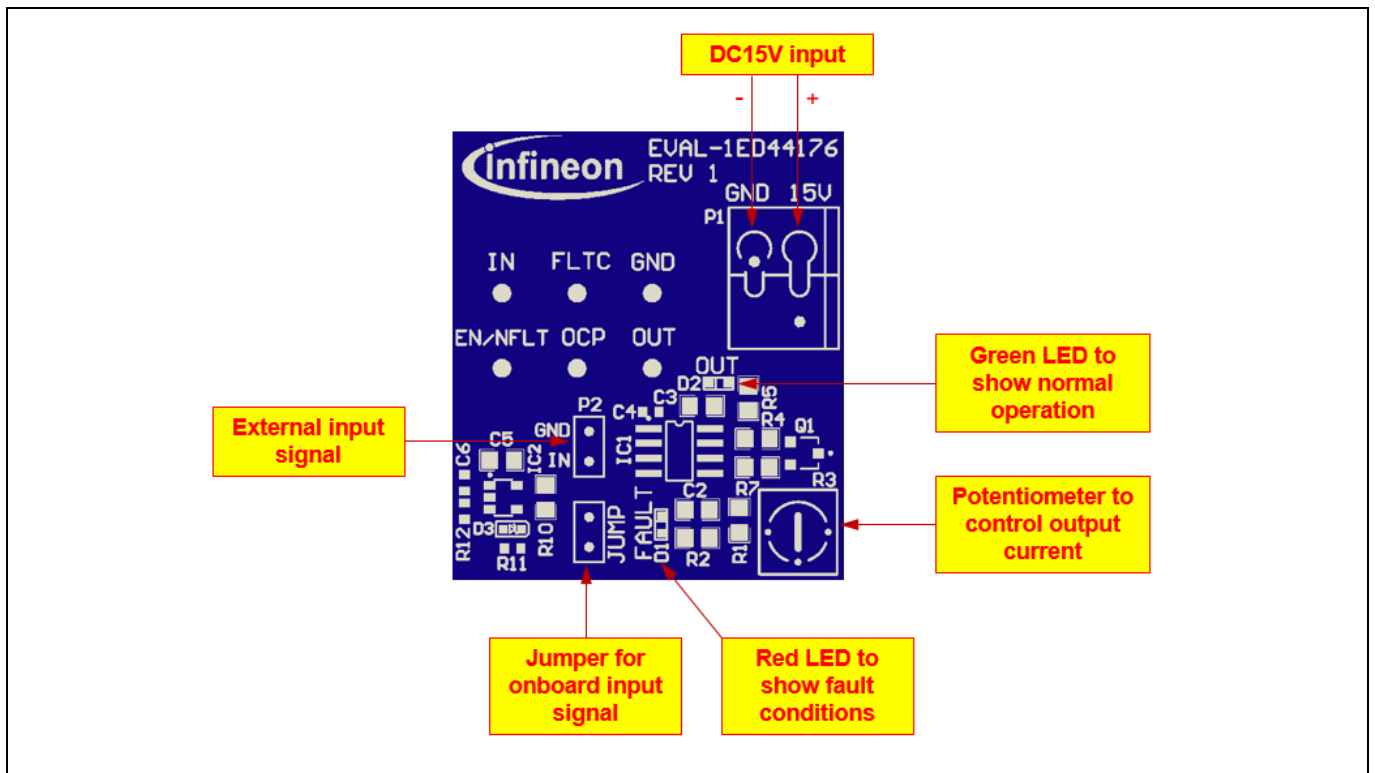


Figure 3 Overview functionalities on top side

Electrical description

1.2 Electrical features

1.2.1 Supply voltage +15 V

The evaluation board is intended to evaluate the basic functions of 1ED44176N01F quickly. It can work with one stable DC supply voltage (+15 V).

Table 1 Absolute maximum ratings

| Pin name | Min. | Max. | Units | Definition |
|----------|-------|------|-------|---------------------|
| 15 V | - 0.2 | 20 | V | Supply voltage |
| IN | - 0.2 | VCC | V | Logic input voltage |

Table 2 Recommended operating ratings

| Pin name | Min. | Typ. | Max. | Units | Definition |
|----------|------|------|------|-------|---------------------|
| 15 V | 14 | 15 | 16 | V | Supply voltage |
| IN | 0 | 5 | VCC | V | Logic input voltage |

The peak voltage of IN pin cannot exceed VCC (15 V pin).

1.2.2 Start-up

To start operation, the following steps have to be taken:

- 1) Connect +15 V DC power supply to the “P1” connector, +15 V to the “15 V” pin and ground to the “GND” pin.
- 2) Connect the shorting jumper to the “JUMP” connector to short the two pins.
- 3) Set-up the power supply, voltage $V = +15\text{ V}$ and current limit $I = 0.25\text{ A}$.
- 4) Either the LED (D1) or LED (D2) lights up. If the red LED (D1) lights up, the 1ED44176N01F is working in fault mode. If the green LED (D2) lights up, the 1ED44176N01F is working in normal operation mode.
- 5) The board is now ready for testing.

1.2.3 Onboard pulse-signal generator or external-input-pulse signal

The onboard pulse-signal generator generates the input signal for 1ED44176N01F. It is implemented by a comparator (IC2) with a self-oscillation configuration. The output of the comparator is clamped by a 3.3 V Zener diode (D3). The onboard pulse-signal generator circuit and its output waveform are shown in Figure 4 and Figure 5.

If the board uses an external-input-pulse signal, the shorting jumper needs to be disconnected from the “JUMP” connector. The input of the driver is non-inverting input logic, and output is in phase with input.

Electrical description

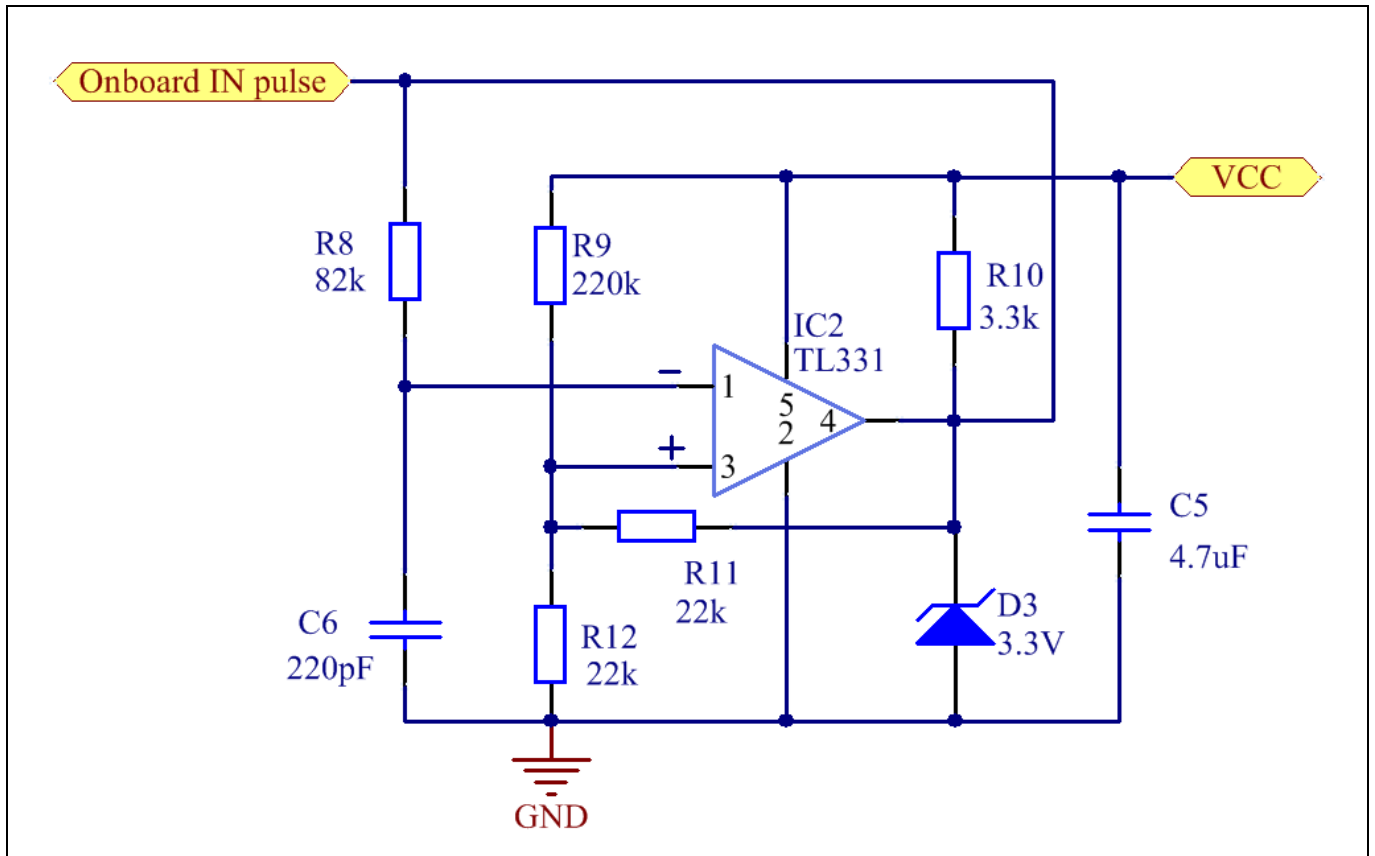


Figure 4 Onboard pulse-signal generator schematic



Figure 5 Onboard pulse-signal generator output (C1: IN)

Electrical description

1.2.4 Normal operation

Rotating the potentiometer (R3) clockwise ensures the green LED (D2) is lit; the 1ED44176N01F is working in normal operation mode (FLTC is low, EN/FLT pin is pulled up.) Figure 6 shows the 1ED44176N01F working in normal operation mode.



Figure 6 Normal operation (C1: IN, C2:FLTC, C3:EN/NFLT, C4:OCP)

1.2.5 Undervoltage lockout and fault output

The +15V supply is monitored by the 1ED44176N01F. In case of an undervoltage of $V_{CC} < V_{CCUV}$ (typically 11.4 V) for a DC power supply, the driver output is switched off. At the same time, EN/FLT is internally pulled down. This status is visible from the red FAULT LED. Figure 7 shows the function of undervoltage lockout and fault output.

Electrical description

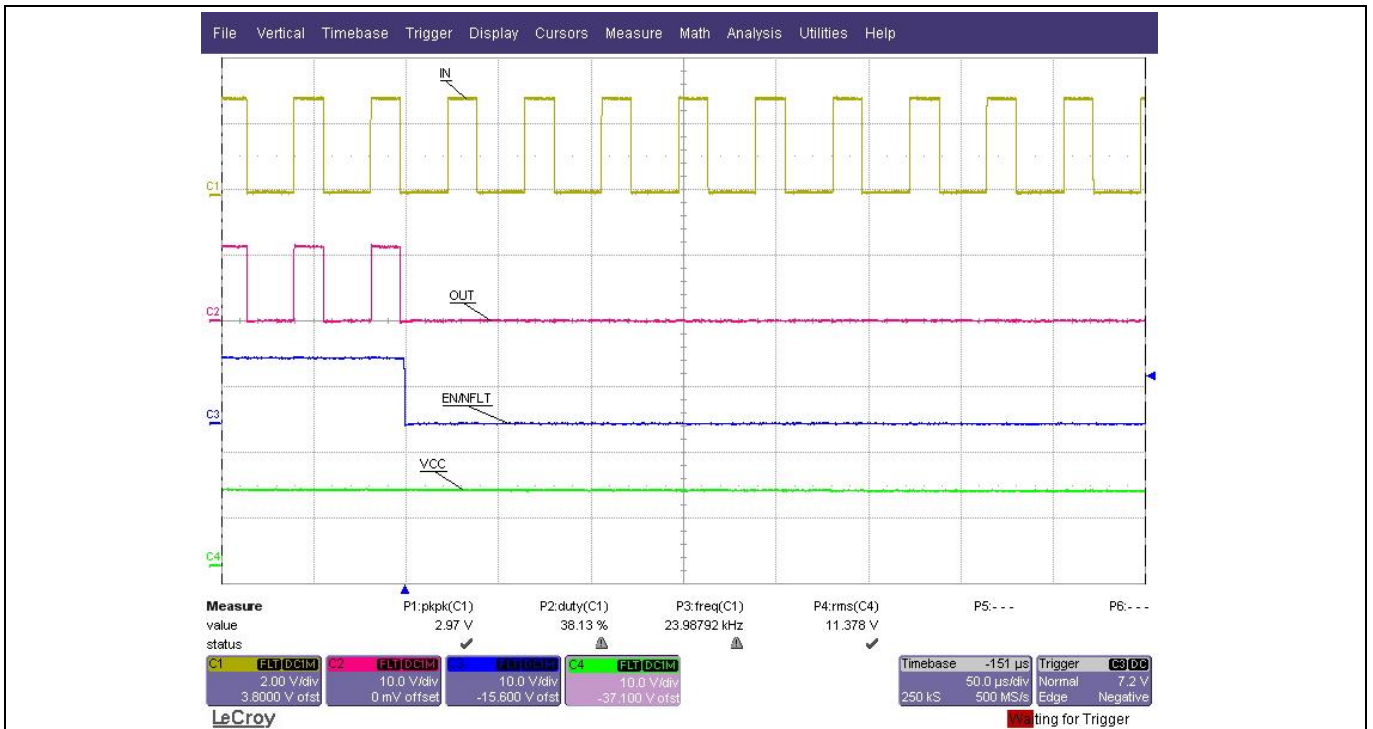


Figure 7 UVLO and fault output (C1: IN, C2:OUT,C3:EN/NFLT, C4:VCC)

1.2.6 Over-current protection and fault output

The 1ED44176N01F has an over-current protection function with a threshold V_{CSTH} (typically 0.5 V) at the OCP pin. The evaluation board offers the opportunity to test this function. The voltage at this pin is the voltage across the current-sense resistor (R7). Rotating the potentiometer (R3) anticlockwise makes sure the red LED (D1) is lit; the 1ED44176N01F is working in over-current protection mode. The driver output is switched off. At the same time, the EN/ \overline{FLT} pin is internally pulled down, and an internal current source charges the capacitor (C3) between \overline{FLT} and VSS to program the fault clear time. Figure 8 shows the over-current protection function and fault output.

Electrical description

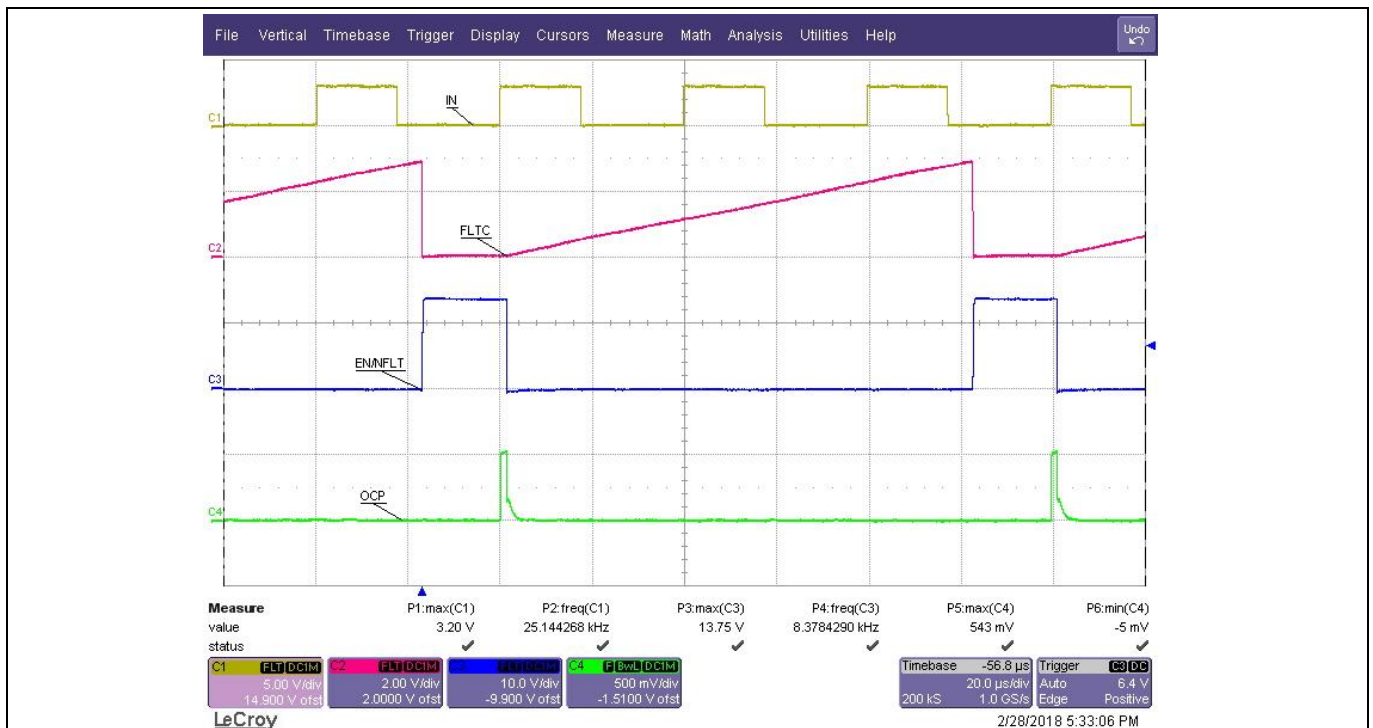


Figure 8 OCP and fault output (C1: IN, C2:FLTC,C3:EN/NFLT, C4:OCP)

1.3 Pin assignment and test point

Table 3

| Connector name | Pin name | Description |
|----------------|----------|--|
| P1 | 15V | positive 15 V DC power supply |
| | GND | ground of 15 V DC power supply |
| P2 | IN | external logic input signal “+” |
| | GND | external logic input signal “ground” |
| JUMP | | connecting shorting jumper to the connector to short the two terminals for on-board pulse-signal generation. |

Table 4

| Test point name | Description |
|-----------------|--|
| IN | logic input pin of 1ED44176N01F |
| FLTC | fault-clear time program pin of 1ED44176N01F |
| GND | ground of the evaluation board |
| OUT | gate-drive output pin of 1ED44176N01F |
| OCP | current-sense input pin of 1ED44176N01F |
| EN/NFLT | enable and fault reporting pin of 1ED44176N01F |

Electrical description

1.4 Schematic

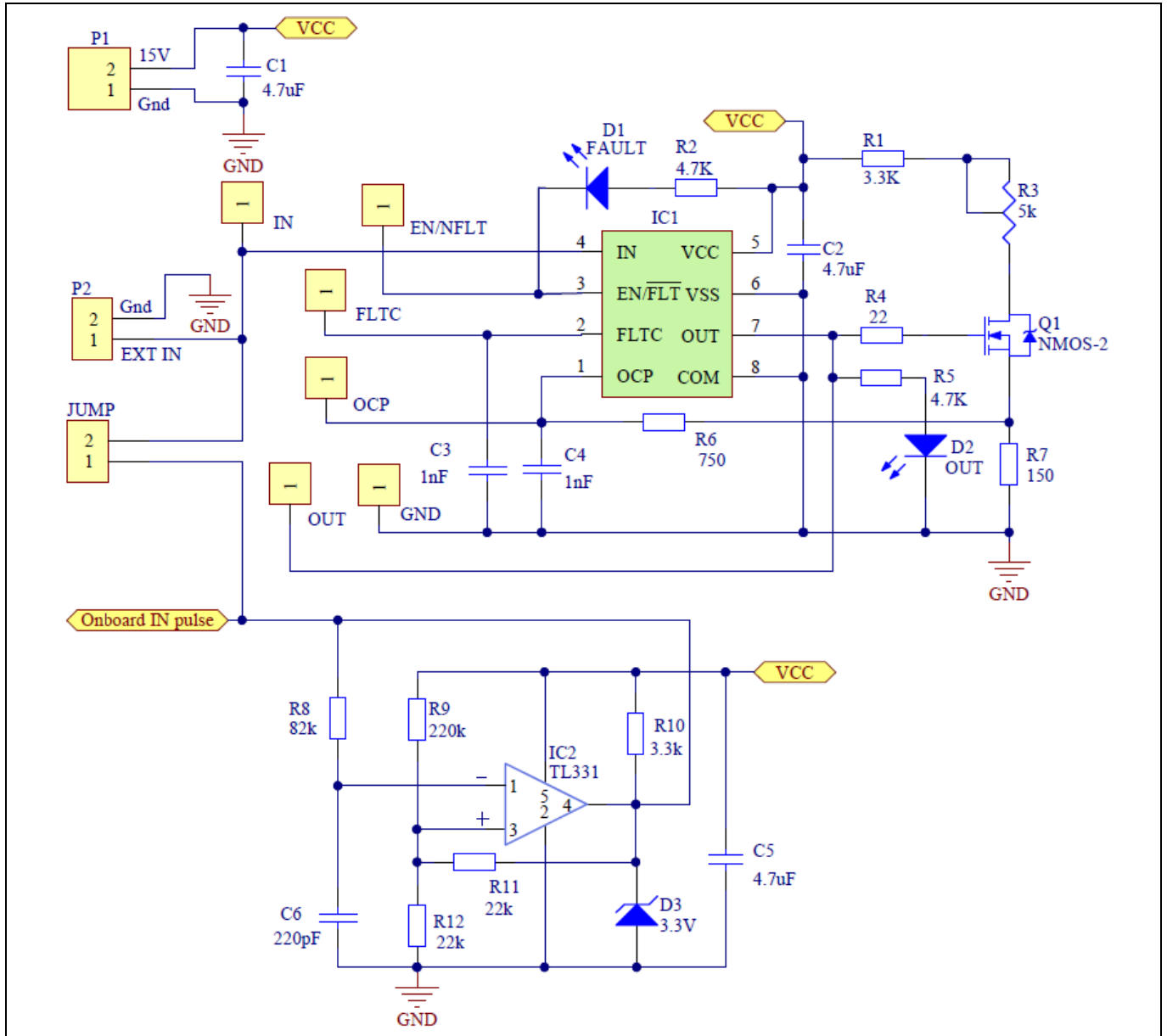


Figure 9 EVAL-1ED44176 top view

Electrical description

1.5 Layout

1.5.1 Assembly drawing

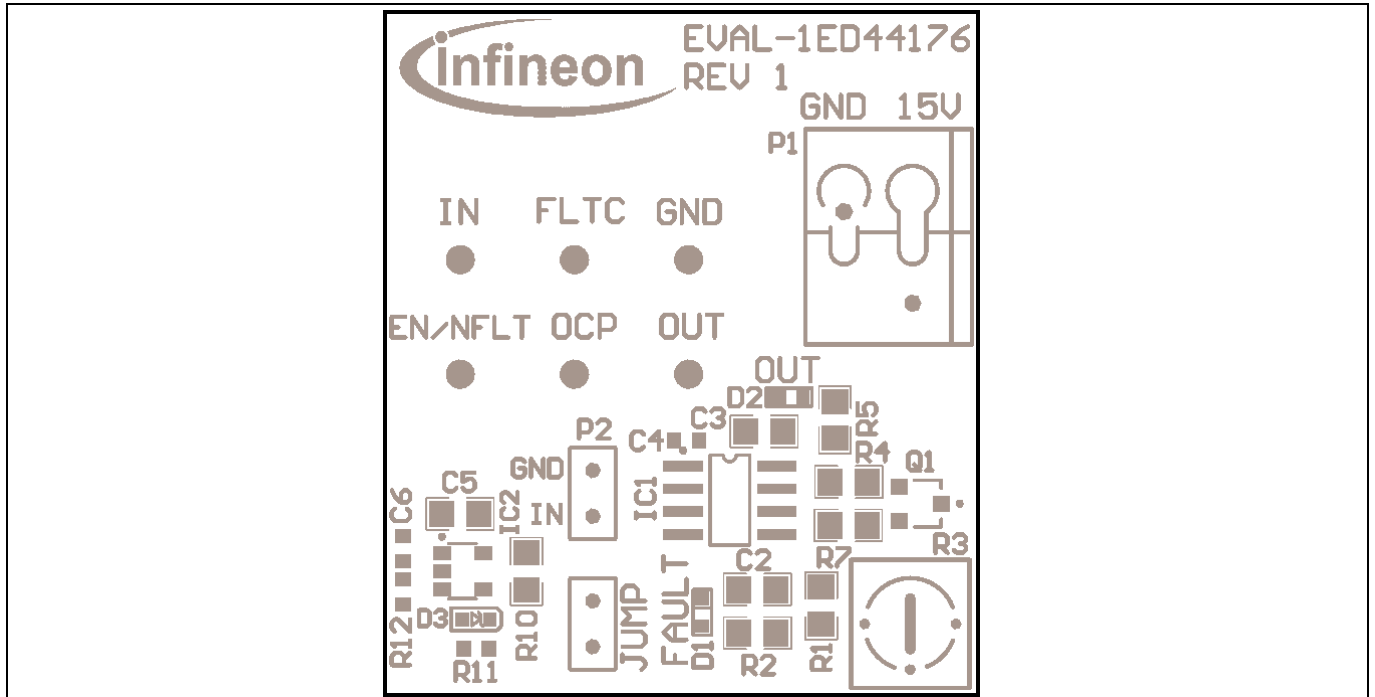


Figure 10 Assembly drawing top view

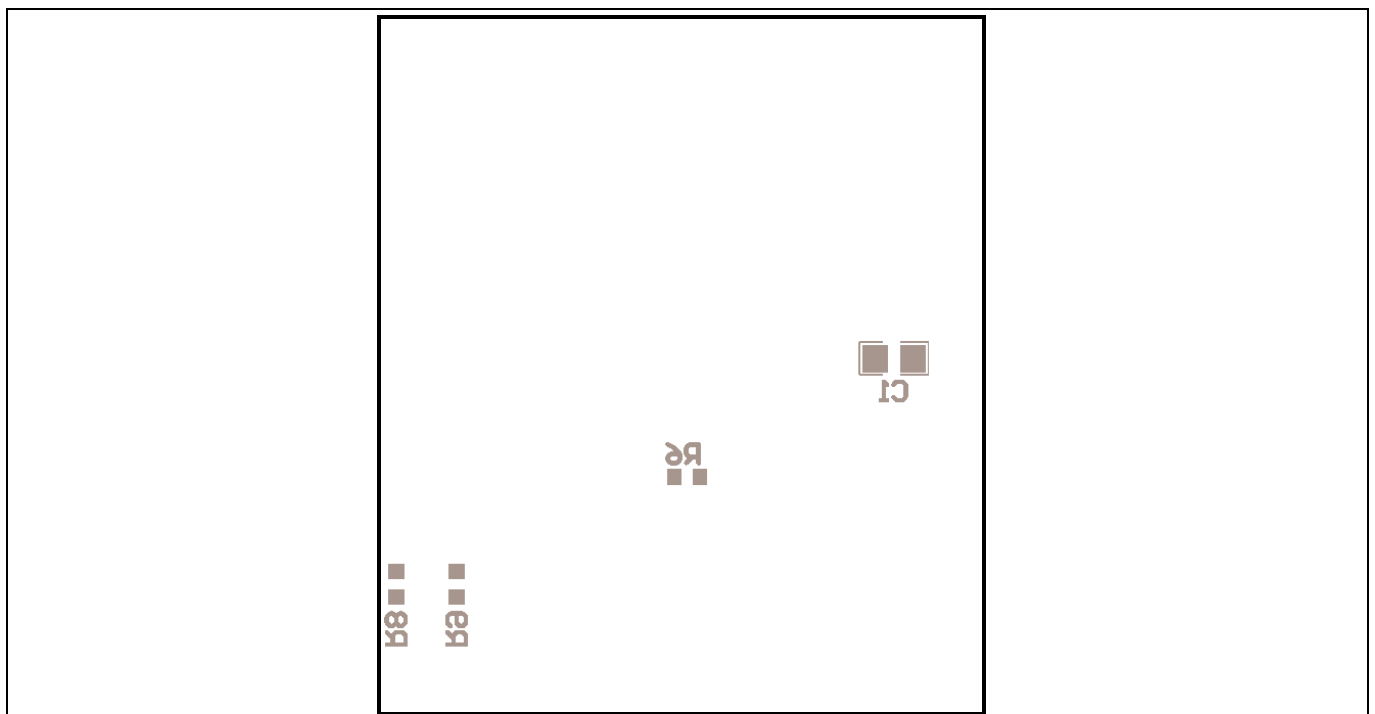


Figure 11 Assembly drawing bottom view

Electrical description

1.5.2 Top layout

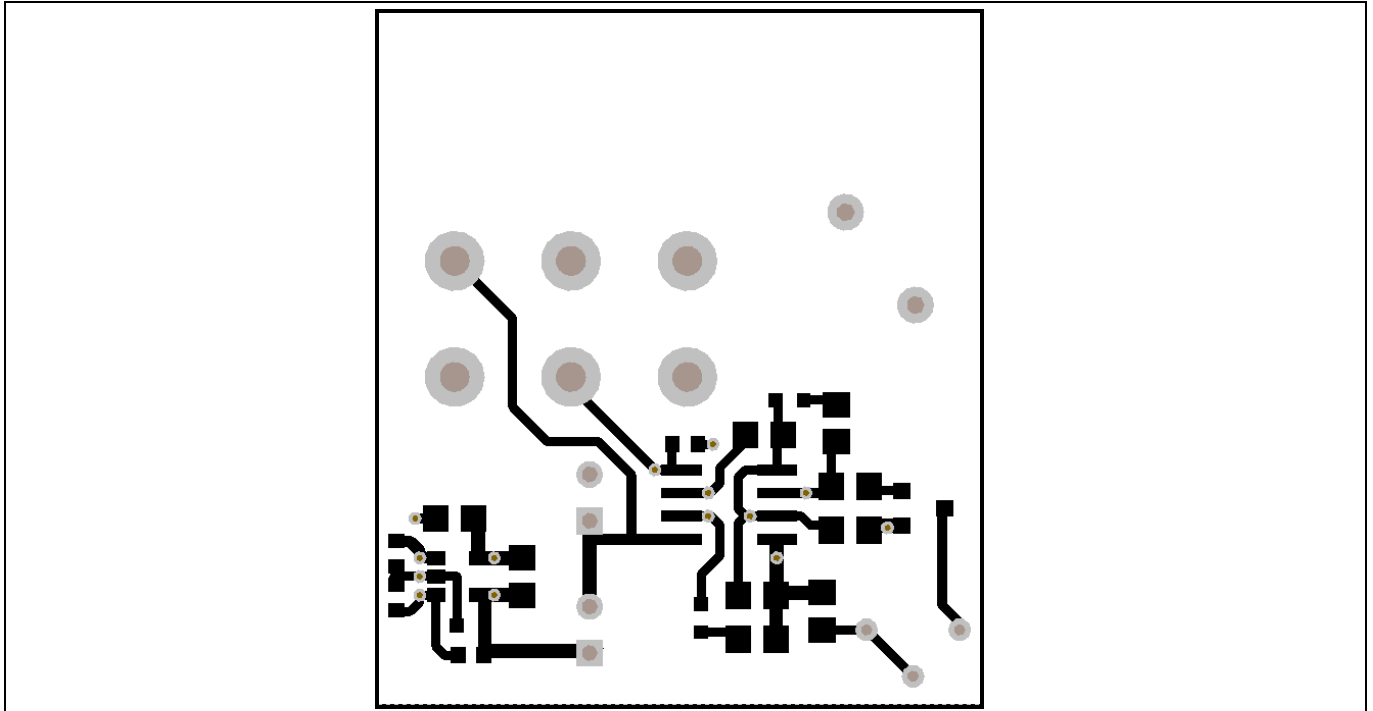


Figure 12 Layout top view

1.5.3 Bottom layout

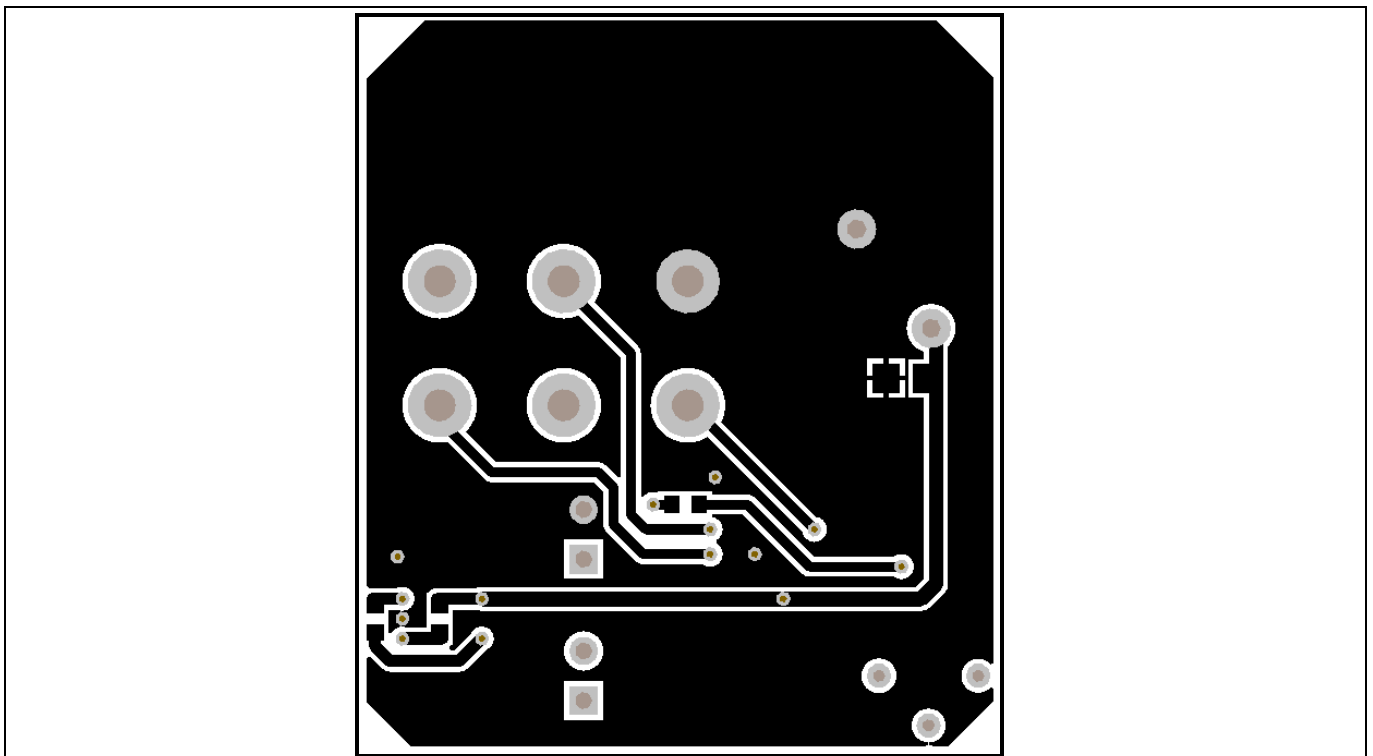


Figure 13 Layout bottom view

Bill of material

2 Bill of material

Table 5

| Designator | Description | Footprint | Vendor | Part# | Quantity |
|------------|----------------------------------|--------------|----------------------|-------------------|----------|
| C1, C2, C5 | CAP CER 4.7UF 25V X7R 0805 | 0805 | Yageo | CC0805KKX7R8BB475 | 3 |
| C3 | CAP CER 1000PF 50V NPO 0805 | 0805 | Yageo | CC0805FRNPO9BN102 | 1 |
| C4 | CAP CER 1000PF 25V C0G/NPO 0603 | 0603 | Yageo | CC0603JRNPO8BN102 | 1 |
| C6 | CAP CER 220PF 50V C0G/NPO 0603 | 0603 | Yageo | CC0603JRNPO9BN221 | 1 |
| D1 | LED RED CLEAR 0603 R/A SMD | 0603 | Lite-On Inc. | LTST-S270EKT | 1 |
| D2 | LED GREEN CLEAR 0603 R/A SMD | 0603 | Lite-On Inc. | LTST-S270GKT | 1 |
| D3 | DIODE ZENER 3.3V 150MW SSMINI2 | SC-79 | Panasonic | DZ2S033M0L | 1 |
| IC1 | Low side driver with OCP | SOIC8 | Infineon | 1ED44176N01F | 1 |
| IC2 | IC DIFF COMP SINGLE SOT23-5 | SOT23-5 | TI | TL331IDBVR | 1 |
| JUMP, P2 | CONN HEADER 20POS .100" SGL GOLD | Through Hole | Samtec Inc | TSW-120-05-G-S | 2 |
| P1 | TERM BLOCK 2POS 45DEG 3.81MM | Through Hole | Würth Electronics | 691412320002 | 1 |
| Q1 | MOSFET N-CH 30V 1.2A SOT-23 | SOT-23 | Infineon | IRLML2803TRPBF | 1 |
| R2, R5 | RES SMD 4.7K OHM 1% 1/8W 0805 | 0805 | Yageo | RC0805FR-074K7L | 2 |
| R3 | TRIMMER 5K OHM 0.5W PC PIN | Through Hole | Bourns Inc. | 3362P-1-502TLF | 1 |
| R4 | RES SMD 22 OHM 1% 1/8W 0805 | 0805 | Yageo | RC0805FR-0722RL | 1 |
| R6 | RES SMD 750 OHM 1% 1/10W 0603 | 0603 | Yageo | RC0603FR-07750RL | 1 |
| R7 | RES SMD 150 OHM 1% 1/8W 0805 | 0805 | Yageo | RC0805FR-07150RL | 1 |
| R8 | RES SMD 82K OHM 1% 1/10W 0603 | 0603 | Yageo | RC0603FR-0782KL | 1 |
| R9 | RES SMD 220K OHM 1% 1/10W 0603 | 0603 | Yageo | RC0603FR-07220KL | 1 |
| R11, R12 | RES SMD 22K OHM 1% 1/10W 0603 | 0603 | Yageo | RC0603FR-0722KL | 2 |
| R1, R10 | RES SMD 3.3K OHM 1% 1/8W 0805 | 0805 | Yageo | RC0805FR-073K3L | 2 |
| Test point | TEST POINT PC MINI .040"D BLACK | Through Hole | Keystone Electronics | 5001 | 6 |
| Jumper | SHORTING JUMPER GLD/NICKEL BLUE | Through Hole | 3M | 929955-06 | 1 |

References

3 References

1. [1] Datasheet of 1ED44176N01F, Rev 1.0
2. [2] Application Note AN2018-03 Low - Side Driver with Over Current Protection and Fault/Enable, Rev 1.0

References

Revision history

Major changes since the last revision

| Version number | Revision Date | Revision description |
|----------------|---------------|--------------------------|
| 1.0 | 2018-05-25 | Create the document V1.0 |
| | | |

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