UM2103
User manual

Getting started with STEVAL-OET003V1 evaluation board for automotive-grade ESD protection

Introduction

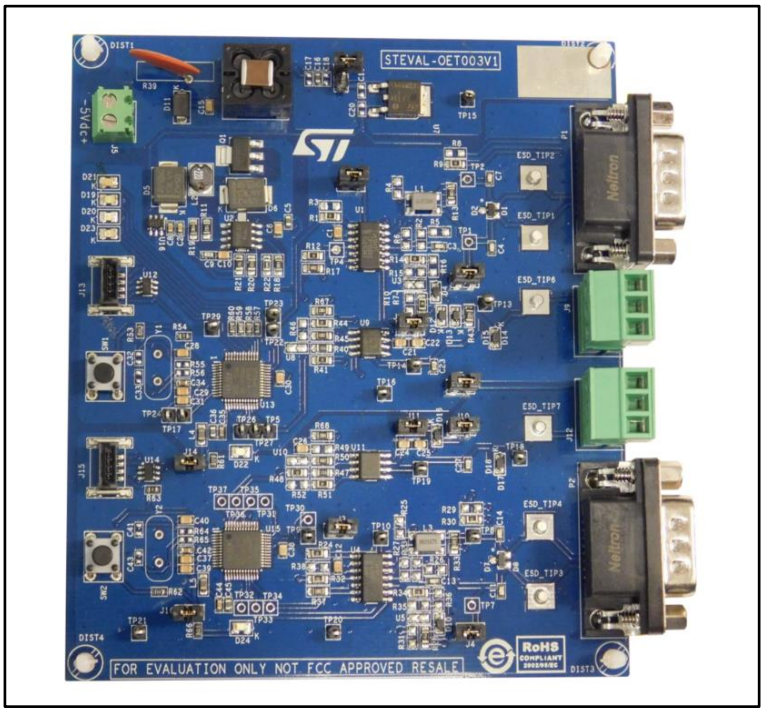
The STEVAL-OET003V1 evaluation board is designed to provide a demonstration tool to evaluate ESD protection robustness for automotive applications.

The demonstration tool includes:

1. two STM8AF528 MCUs (one configured as the master node and the other as the slave node)
2. two NXP LIN bus transceivers
3. two NXP CAN bus transceivers
4. a step-up converter to boost 5 to 12 V for transceiver supply voltage
5. a linear regulator to obtain a 3.3 V supply voltage
6. an automotive-grade ESD protection device for each transceiver
7. possibility to test several ESD protection part numbers

The protection robustness is evaluated by monitoring the communication flow between the master and the slave nodes.

Figure 1: STEVAL-OET003V1 evaluation board



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1 Getting started

To start the application board, connect the 5 V supply voltage to the screw connector and push the reset button to align the nodes.

The three-color LED (orange, yellow and blue) starts blinking sequentially to indicate normal communication; if a communication fault occurs, the blinking LED switches off and the red LED turns on.

2 Board description

The evaluation board implements a master/slave structure, by using two on-board STM8AF528 MCU nodes which communicate via a LIN/CAN protocol implementation.

The board features:

- 5 V input voltage
- 12 V output, boost topology converter for transceiver supply voltage
- 3.3 V regulated voltage
- LIN bus transceiver
- CAN bus transceiver
- automotive grade ESD protections
- IEC61000-4-2 & ISO10605 compatibility

The board is specifically designed to reduce noise impact due to electrostatic discharge. Refer to *Section 7: "Layout"* to view the ground track and plane design.

Regarding the ground net, a star connection links all the tracks to the A7985A ground reference pin; whereas, the ground plane is split in two parts: one for the master and one for the slave node, both referring to the respective ground connection.

2.1 Board supply

The board supplies three different voltage references: the microcontroller section, the LIN/CAN transceiver modules and the CAN connector.

The main voltage reference (Vin = 5 V) is provided through the J5 screw connector and the A7985A DC - DC converter (in boost topology) raises it to 12 V to obtain the supply voltage for the LIN and CAN transceivers.

Moreover, a 3.3 V reference (not available by default) is generated by using the ST LF33CDT-TRY very low drop voltage regulator, starting from 5 V input voltage (this reference is shown on the CAN connector); to enable this reference voltage, the J6 jumper must be closed and the C19 and C20 capacitors must be assembled.

2.2 LIN and CAN connectors

The CAN connection uses two standard RS232 connectors; while LIN communication uses two screw connectors (where it is possible to connect an external supply voltage for the transceiver module and the LIN bus).

3 Firmware description

The communication described is mainly based on a simple LIN/CAN communication, where the loop status (normal or fault) is shown respectively by:

- a three-color LED (orange, blue or purple in case of normal operation)
- a red LED if the communication fails

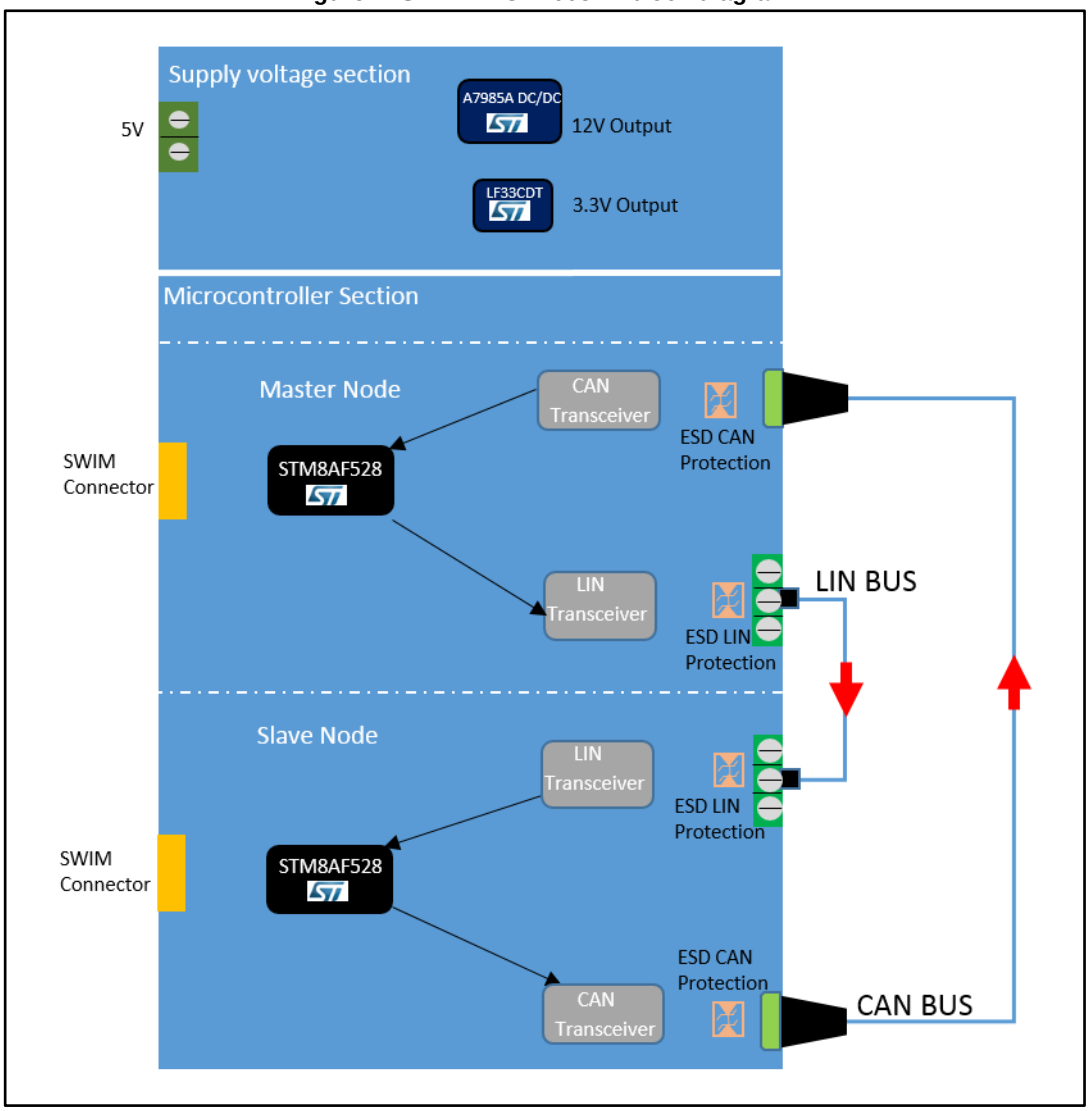
The communication flow starts when the master sends the LIN frame to the slave.

If the received frame is correctly recognized, the slave sends a new frame to the master through the CAN protocol; after frame reception, the status loop is incremented by switching a new LED on.

If the communication is corrupted, the status LED turns off and the red LED switches on.

4 Block diagram

Figure 2: STEVAL-OET003V1 block diagram



5 ESD test

5.1 Connections (supply and data lines)

Supply: 5 V must be connected to the J5 screw connector.

CAN connection: through DB9 female connectors, connect one wire between pins 2 (CANL) to standard RS232 connector (DB9 male P1 and P2) and one other wire between pins 7 (CANH) standard RS232 connector (DB9 male P1 and P2).

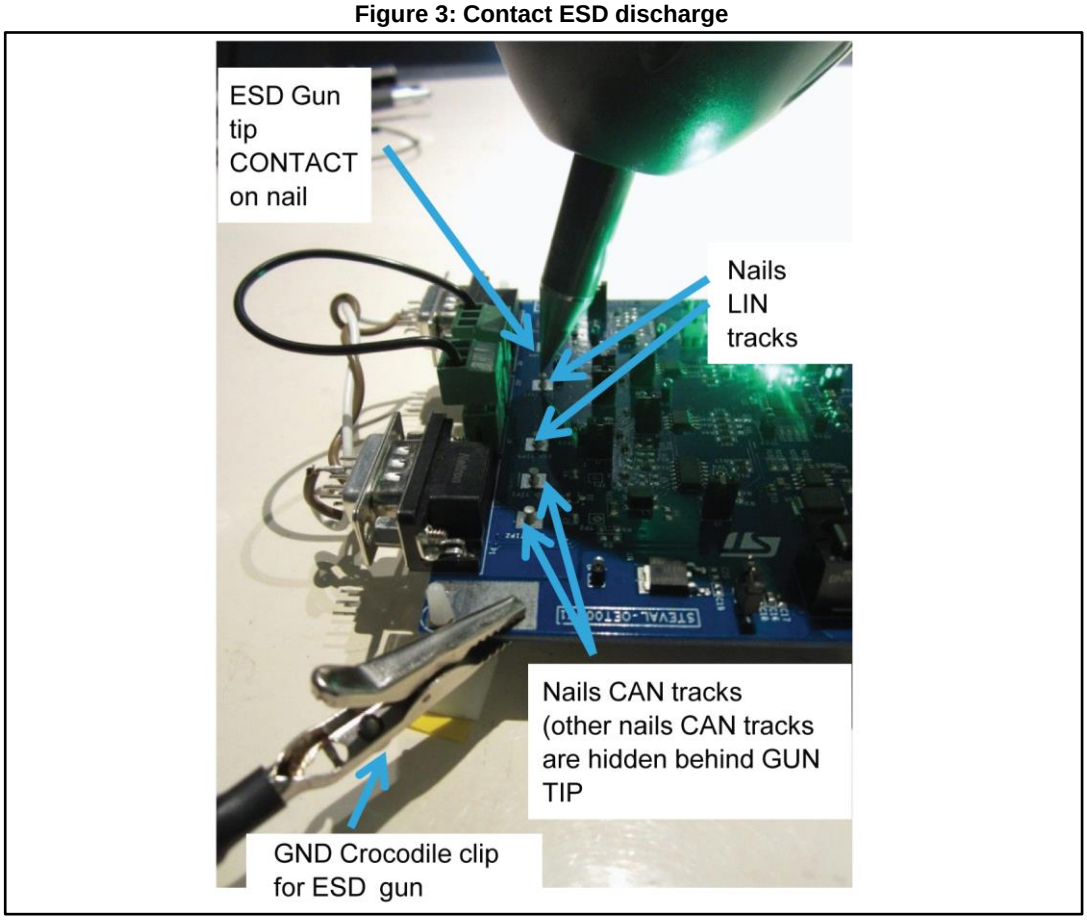
LIN: 1 wire between pin 1 of J12 and pin 3 of J9 screw connectors.

When the board is supplied and data lines connected, the green and red LEDs will turn on. Push the “SW1” button and then, 3 LEDs will blink (the red LED turns off).

The evaluation board is now ready for the ESD test.

5.2 ESD application

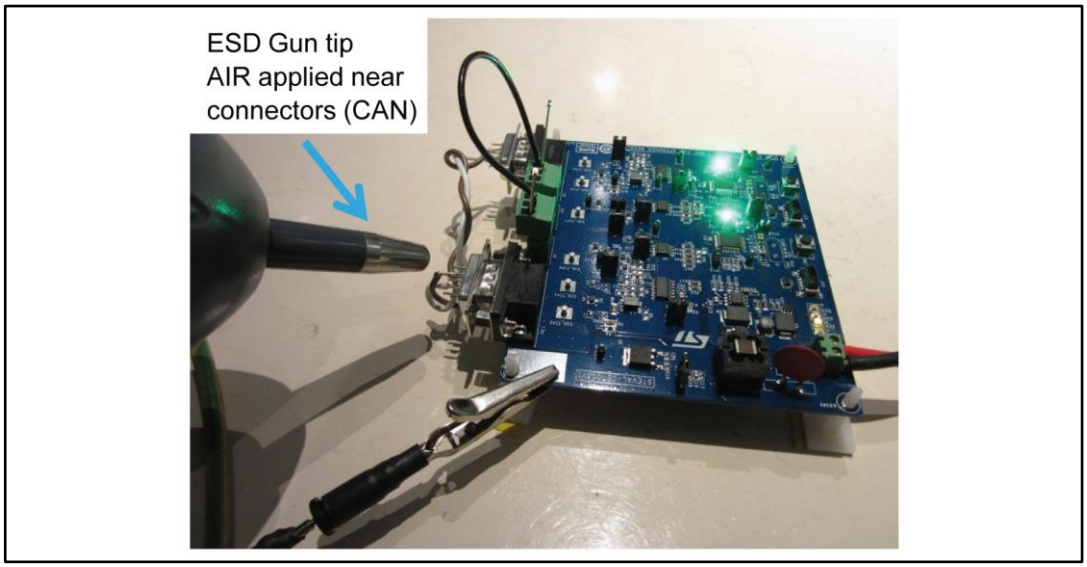
Figure 3: Contact ESD discharge



ESD contact: the ground ESD gun can be applied directly to the PCB ground with the GND plane close to the P1 connector. The ESD gun tip is applied on nail LIN (ESD_TIP6 & 7 markings) or nail CAN (ESD_TIP1 to 4 markings) and then ESD shoots can be performed.

If the LEDs stop blinking, push the “SW2” button and then the “SW1” button. The demo board is still operational and the LEDs blink again.

Figure 4: Air ESD discharge



ESD air: the same connections must be done, but the ESD gun tip placed close to DB9 and the screw connectors where the data line wires are connected.

By default, ESDCAN02-2BWY and ESDLIN1524BJ are soldered on the PCB to protect the transceivers against ESD discharge.

For each ESD protection device (see the next section to test other ESD protection devices), the evaluation board is always operational even for ESD levels equal to ± 30 kV in contact or air ESD discharge, and this is for R = 330 Ω and C = 330 pF or other RC values and for more than 3 pulses (ISO10605 conditions).

5.3 ESD part number changes

It is possible to change ESD protection devices. The first step is to unsolder (with air heater, for example) ESDLINxx (D14(15)) or D17(18)), or ESDCANxx (D1(2) or D7(8)) close to the connectors. ESDLINxx and ESDCANxx samples are available in a bag (see list below). ESDCAN footprints are compatible with all ESDCANxx part numbers and for LIN part. ESD tests can be performed again after ESD device replacement.

ESD protection available in STEVAL-OET003:

- ESDCAN02-2BWY in SOT323-3L (Marking: C02) (2 samples soldered on PCB)
- ESDLIN1524BJ in SOD323 (Marking: 24) (2 samples soldered on PCB)

Part numbers available in bag:

- ESDCAN03-2BWY in SOT323-3L (Marking: C03) (1 sample)
- ESDCAN01-2BLY in SOT23-3L (Marking: EN24) (1 sample)
- ESDCAN24-2BLY in SOT23-3L (Marking: EL24) (1 sample)
- ESDLIN03-1BWY in SOT323-3L (Marking: C12) (1 sample)

6 Schematic diagrams

Figure 5: Power section

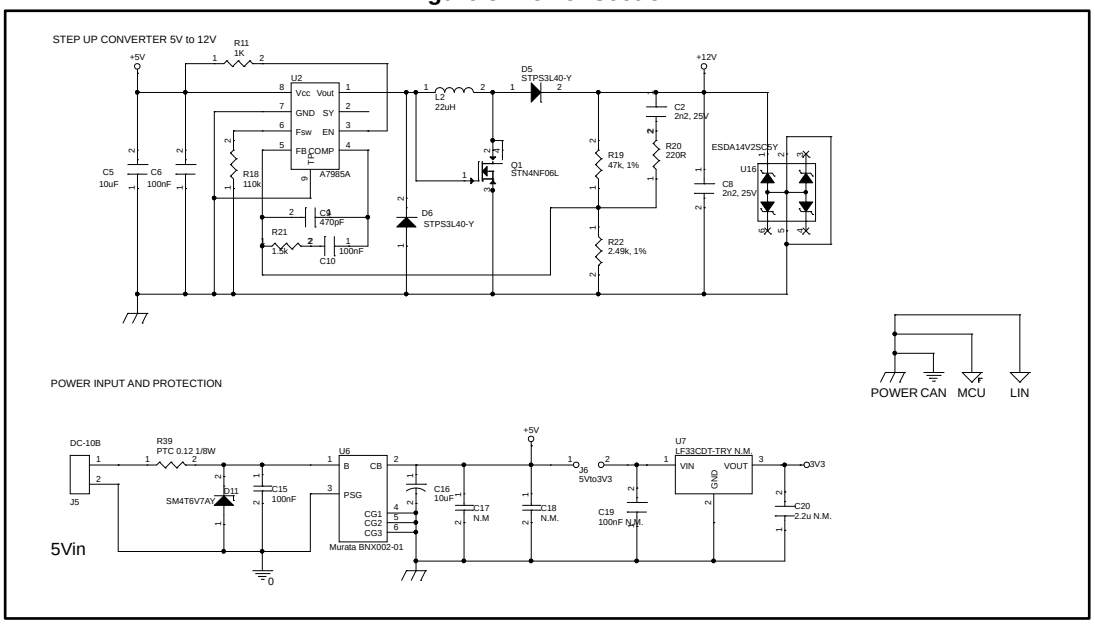


Figure 6: LIN section

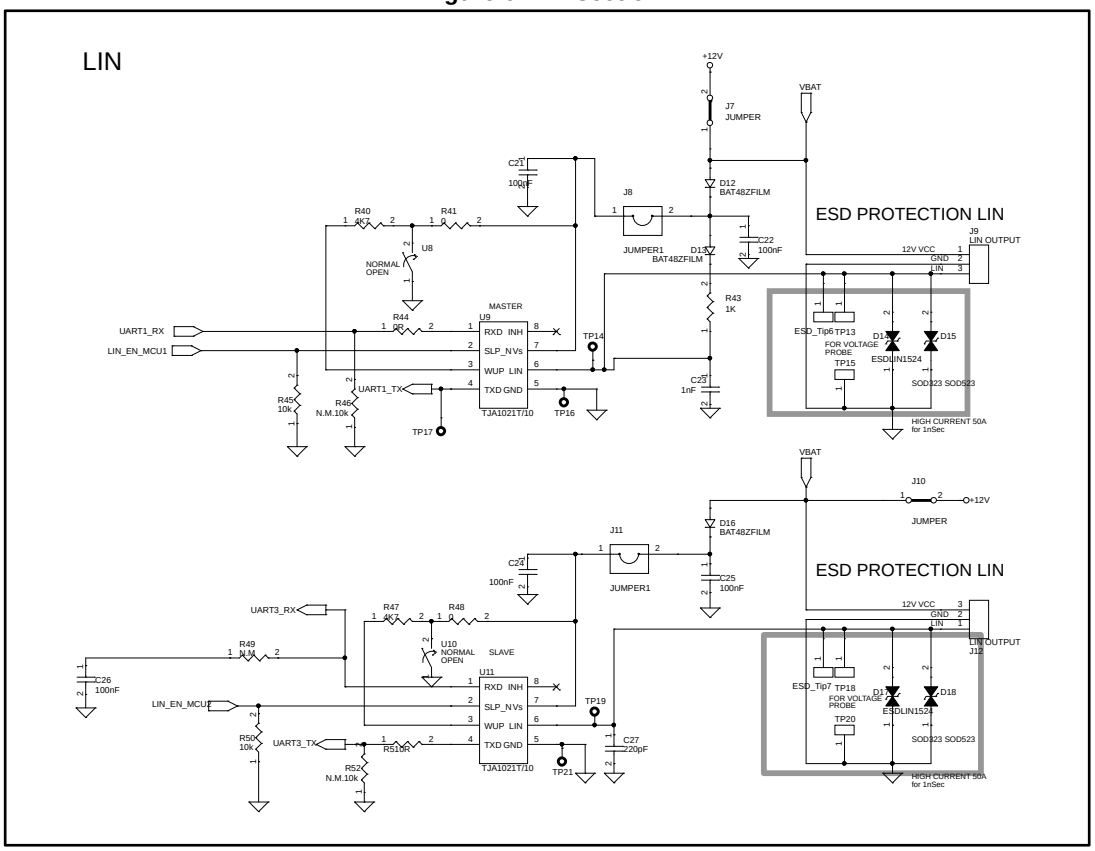


Figure 7: CAN section

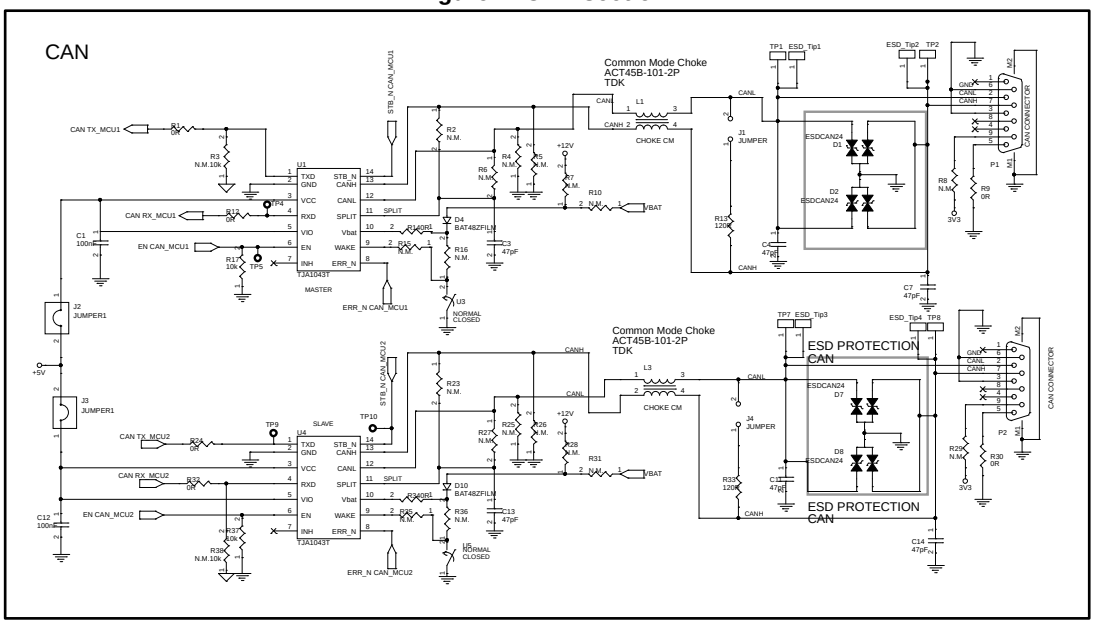


Figure 8: Master node

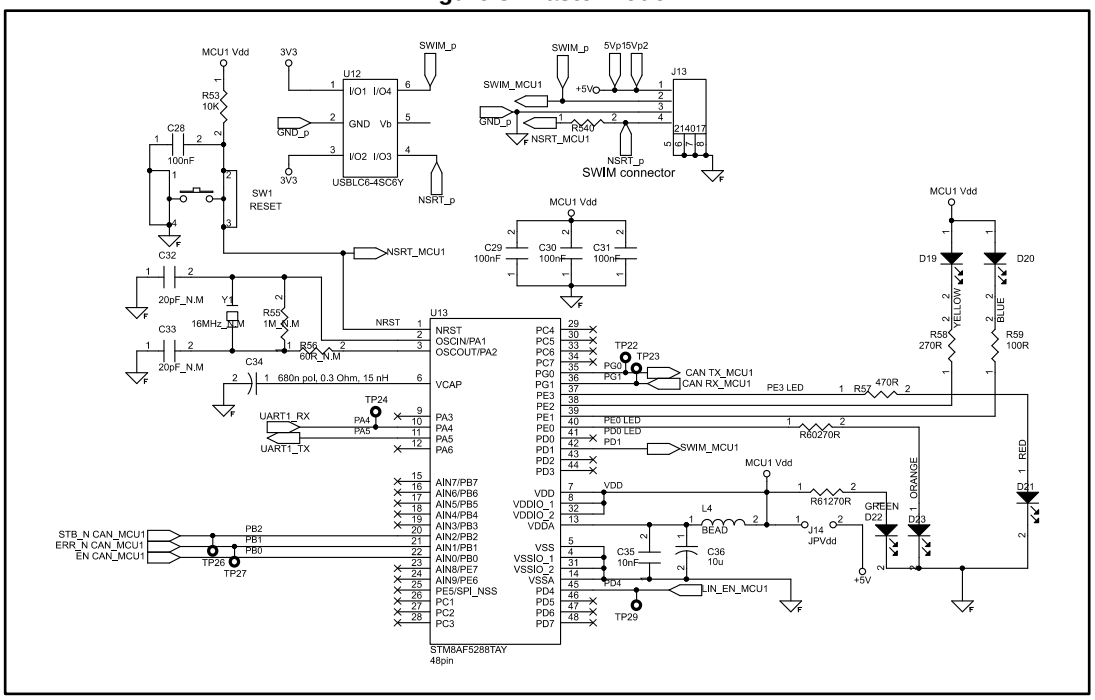
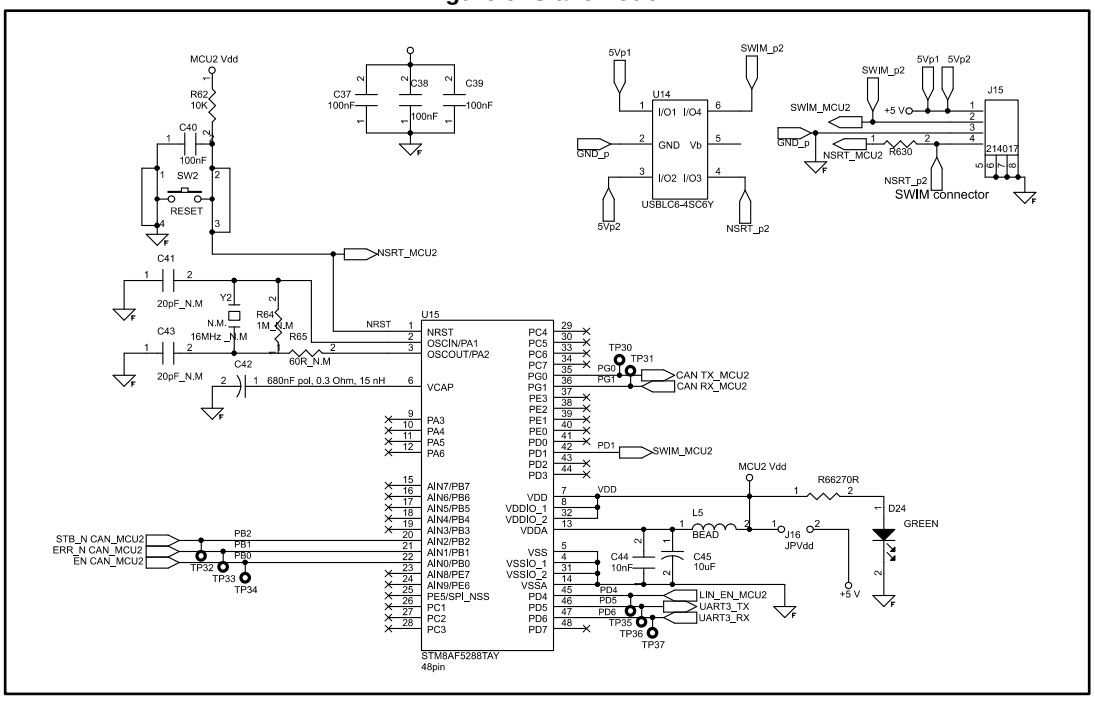


Figure 9: Slave node



7 Layout

Figure 10: STEVAL-OET003V1 top layer

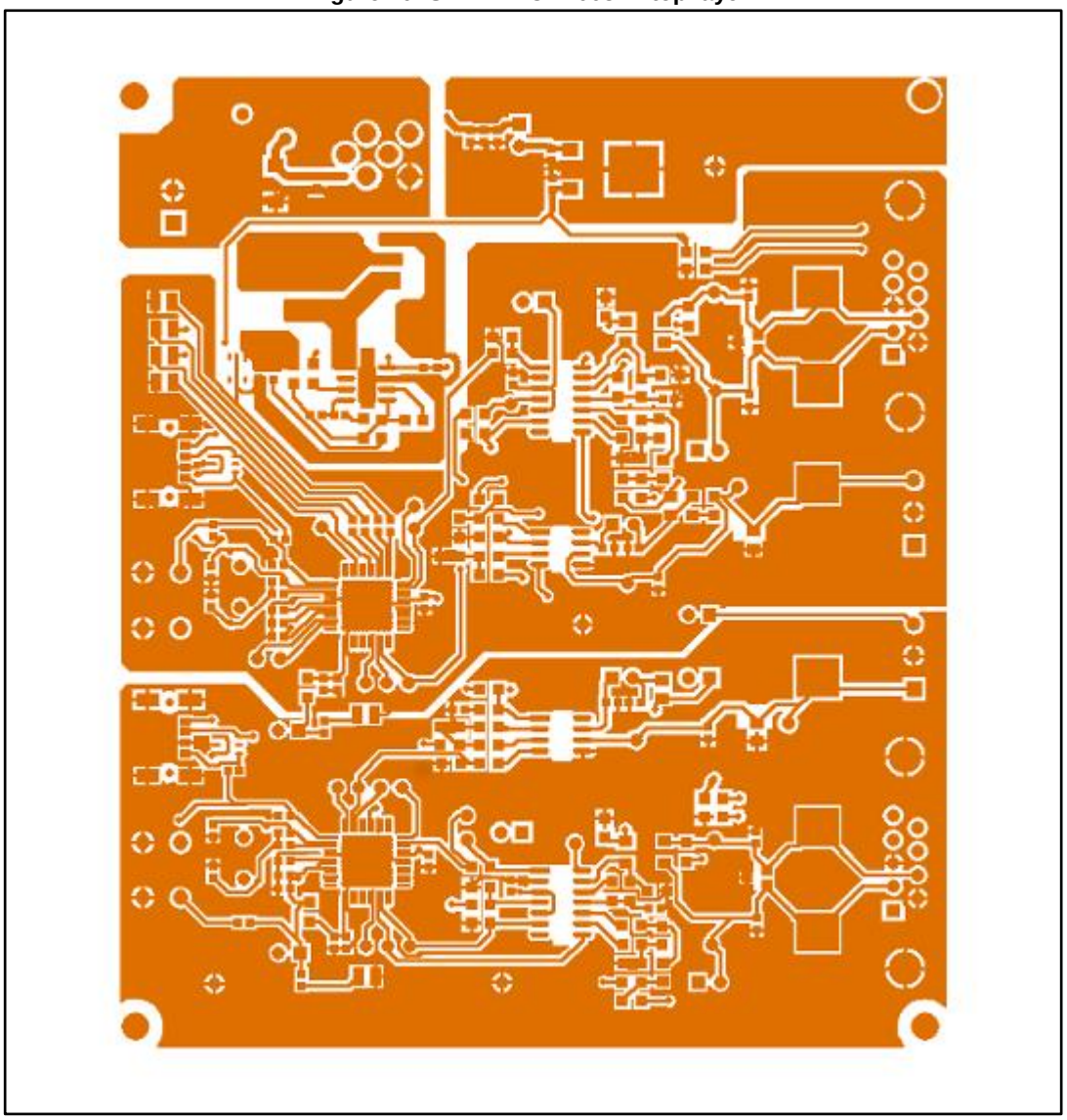


Figure 11: STEVAL-OET003V1 bottom layer

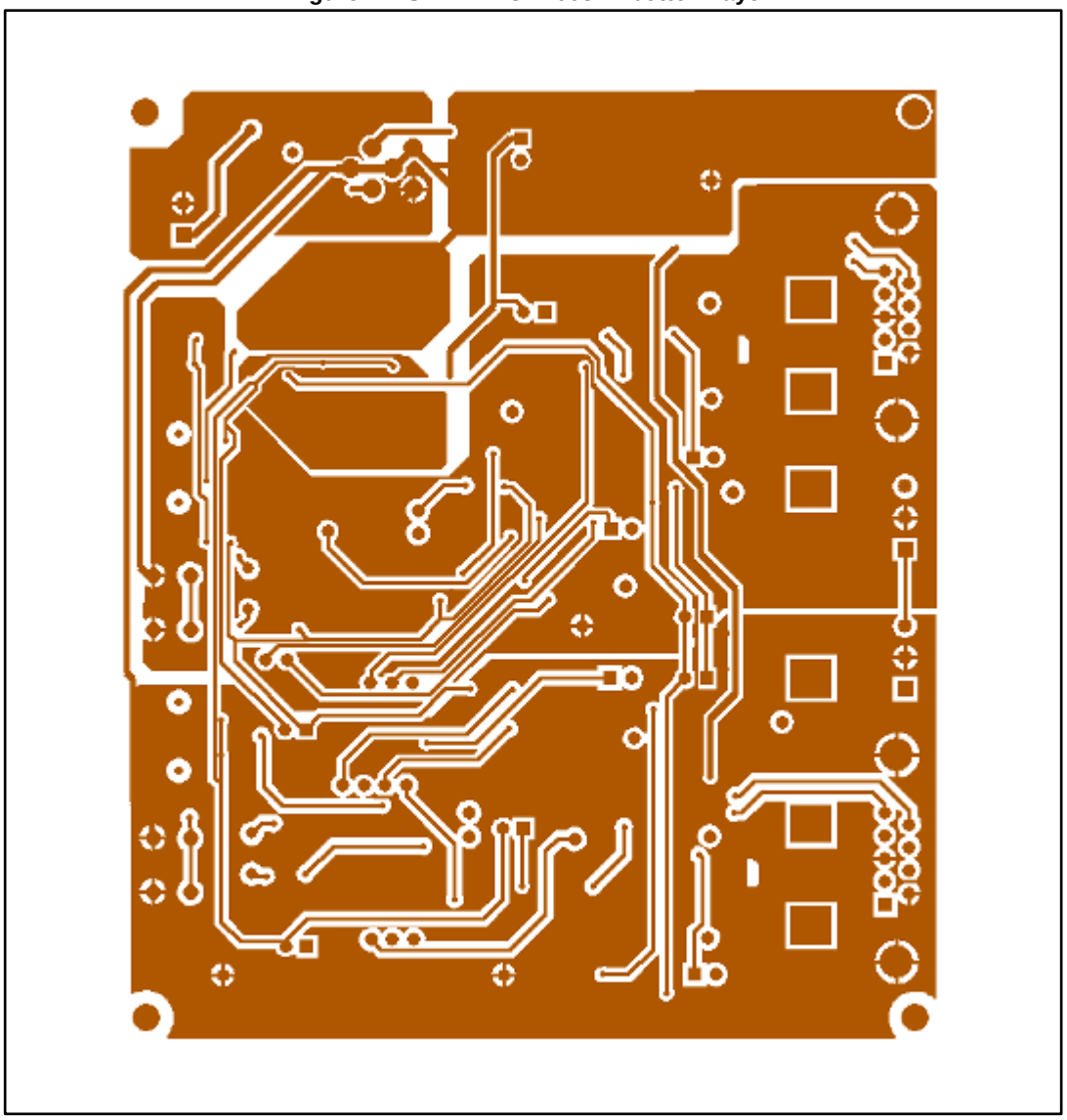
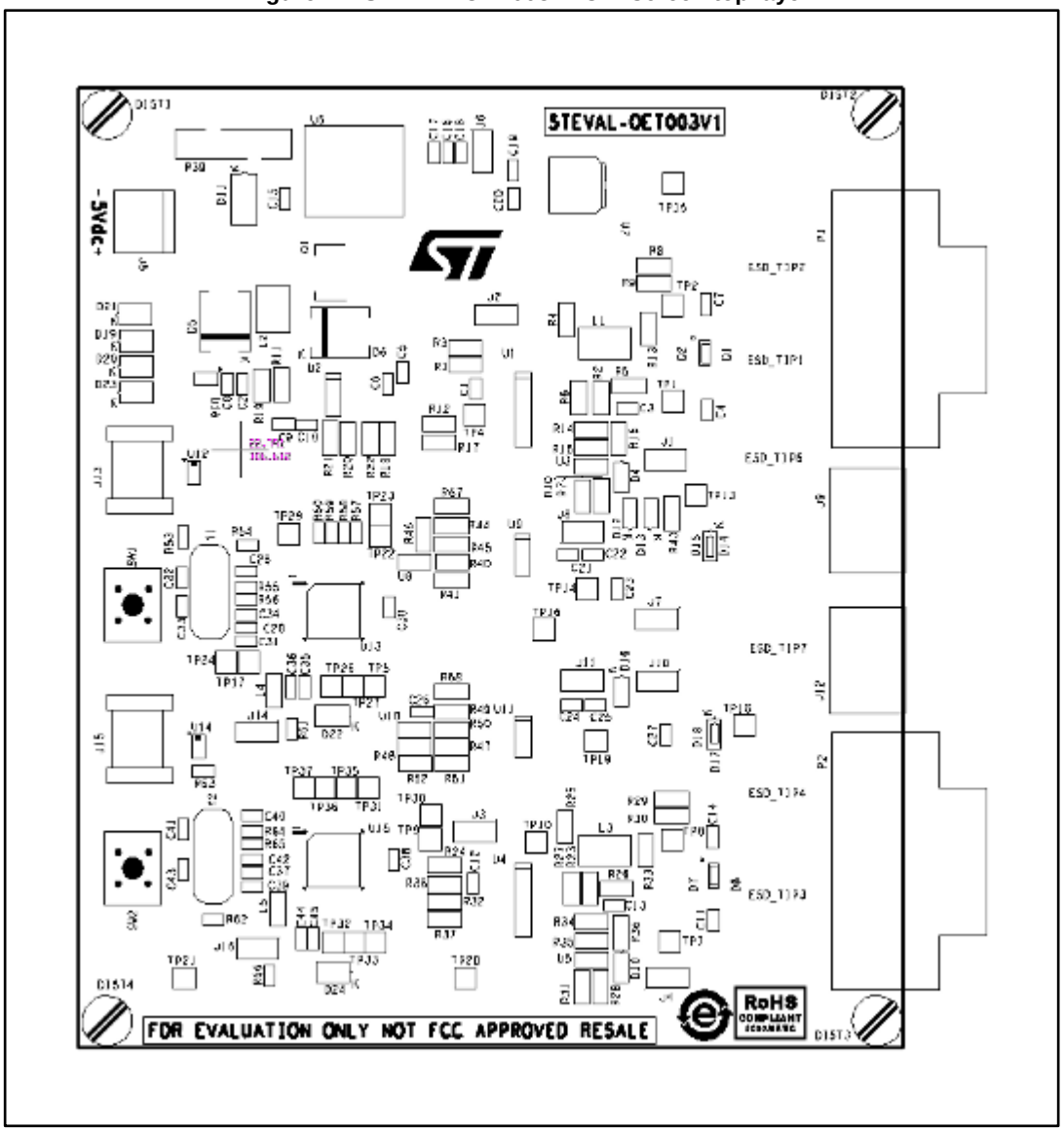


Figure 12: STEVAL-OET003V1 silk screen top layer



8 Revision history

Table 1: Document revision history

Date	Revision	Changes
26-Aug-2016	1	Initial release.
24-Oct-2016	2	Added *Section 5: "ESD test"* Minor text corrections throughout document

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