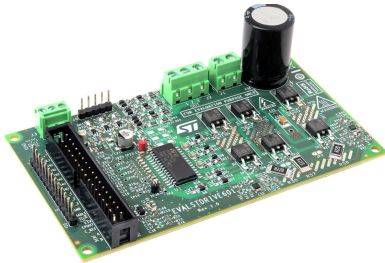


Demonstration board for STDRIVE601 triple gate driver



Product status link

[EVALSTDRIVE601](#)

Features

- High voltage rail up to 600 V
- Driver supply input voltage range 9 V - 20 V
- STGD6M65DF2 IGBTs power stage featuring:
 - $V_{(BR)CES} = 650 \text{ V}$
 - $V_{CE(sat)} = 1.55 \text{ V @ } I_C = 6 \text{ A}$
- Dual footprint for IGBT/MOSFET package:
 - DPAK
 - PowerFlat 8x8 HV
- Selectable single or 3-shunt current sensing topology:
 - Sensored or sensorless BEMF detection
 - FOC or 6-Step algorithm
- SmartShutdown overcurrent protection
- Hall effect sensors connector
- Bus voltage sensing
- 450 V bulk capacitor
- Connector for interfacing with MCU
- RoHS compliant

Applications

- Three-phase motor drives
- Fans
- Pumps
- Refrigerator compressors
- Industrial inverters
- Appliances

Description

The **EVALSTDRIVE601** demonstration board is a complete 3-phase inverter which allows evaluating all of the STDRIVE601 features. The power stage features STGD6M65DF2 IGBTs, but can be populated with any IGBT or power MOSFET in DPAK or powerFLAT 8x8 HV package. The board is designed to support a three shunt or a single shunt current sensing topology.

A strip connector allows an easy interfacing with MCU control.

The STDRIVE601 is a 600V gate driver device manufactured with BCD6s offline technology. It is a single-chip with three half-bridge gate drivers for N-channel power MOSFETs or IGBTs suitable for 3-phase applications. The device integrates three bootstrap diodes and a smart shutdown feature able to detect very fast overcurrent condition, minimizing the propagation delay between the overcurrent event and the output switch-off.

1 Safety and operating instructions



1.1 General terms

Warning: During assembly, testing, and operation, the evaluation board poses several inherent hazards, including bare wires, moving or rotating parts, and hot surfaces.

Danger: There is a danger of serious personal injury, property damage, or death due to electrical shock and burn hazards if the kit or components are improperly used or installed incorrectly.

Attention: The kit is not electrically isolated from the high-voltage supply DC input. The evaluation board is directly linked to the power supply voltage. No insulation is ensured between the accessible parts and the high voltage. All measuring equipment must be isolated from the mains before powering the board. This prevents shock from occurring as a result of touching any single point in the circuit, but does NOT prevent shock when touching two or more points in the circuit.

Important: All operations involving transportation, installation and use, and maintenance must be performed by skilled technical personnel able to understand and implement national accident prevention regulations. For the purposes of these basic safety instructions, "skilled technical personnel" are suitably qualified people who are familiar with the installation, use, and maintenance of power electronic systems.

1.2 Intended use of evaluation board

The evaluation board is designed for demonstration purposes only, and must not be used for electrical installations or machinery. Technical data and information concerning the power supply conditions are detailed in the documentation and should be strictly observed.

1.3 Installing the evaluation board

- The installation and cooling of the evaluation board must be in accordance with the specifications and target application.
- The motor drive converters must be protected against excessive strain. In particular, components should not be bent nor should isolating distances be altered during transportation or handling.
- No contact must be made with other electronic components and contacts.
- The board contains electrostatically sensitive components that are prone to damage if used incorrectly. Do not mechanically damage or destroy the electrical components (potential health risks).

1.4 Operating the evaluation board

To properly operate the board, follow these safety rules:

1. Work area safety:
 - The work area must be clean and tidy.
 - Do not work alone when boards are energized.
 - Protect against inadvertent access to the area where the board is energized using suitable barriers and signs.
 - A system architecture that supplies power to the evaluation board must be equipped with additional control and protective devices in accordance with the applicable safety requirements (i.e., compliance with technical equipment and accident prevention rules).
 - Use a non-conductive and stable work surface.
 - Use adequately insulated clamps and wires to attach measurement probes and instruments.
2. Electrical safety:
 - Remove the power supply from the board and electrical loads before taking any electrical measurements.
 - Proceed with the arrangement of measurement setup, wiring, or configuration paying attention to high voltage sections.
 - Once the setup is complete, energize the board.

Danger: *Do not touch the evaluation board when it is energized or immediately after it has been disconnected from the voltage supply as several parts and power terminals containing potentially energized capacitors need time to discharge.*
Do not touch the boards after disconnection from the voltage supply as several parts, like heat sinks and transformers, may still be very hot.
The kit is not electrically isolated from the DC input.

3. Personal safety:
 - Always wear suitable personal protective equipment such as, for example, insulating gloves and safety glasses.
 - Take adequate precautions and install the board in such a way to prevent accidental touch. Use protective shields such as, for example, an insulating box with interlocks, if necessary.

2 Schematic diagram

Figure 1. EVALSTDRIVE601 schematic – Driver output stages

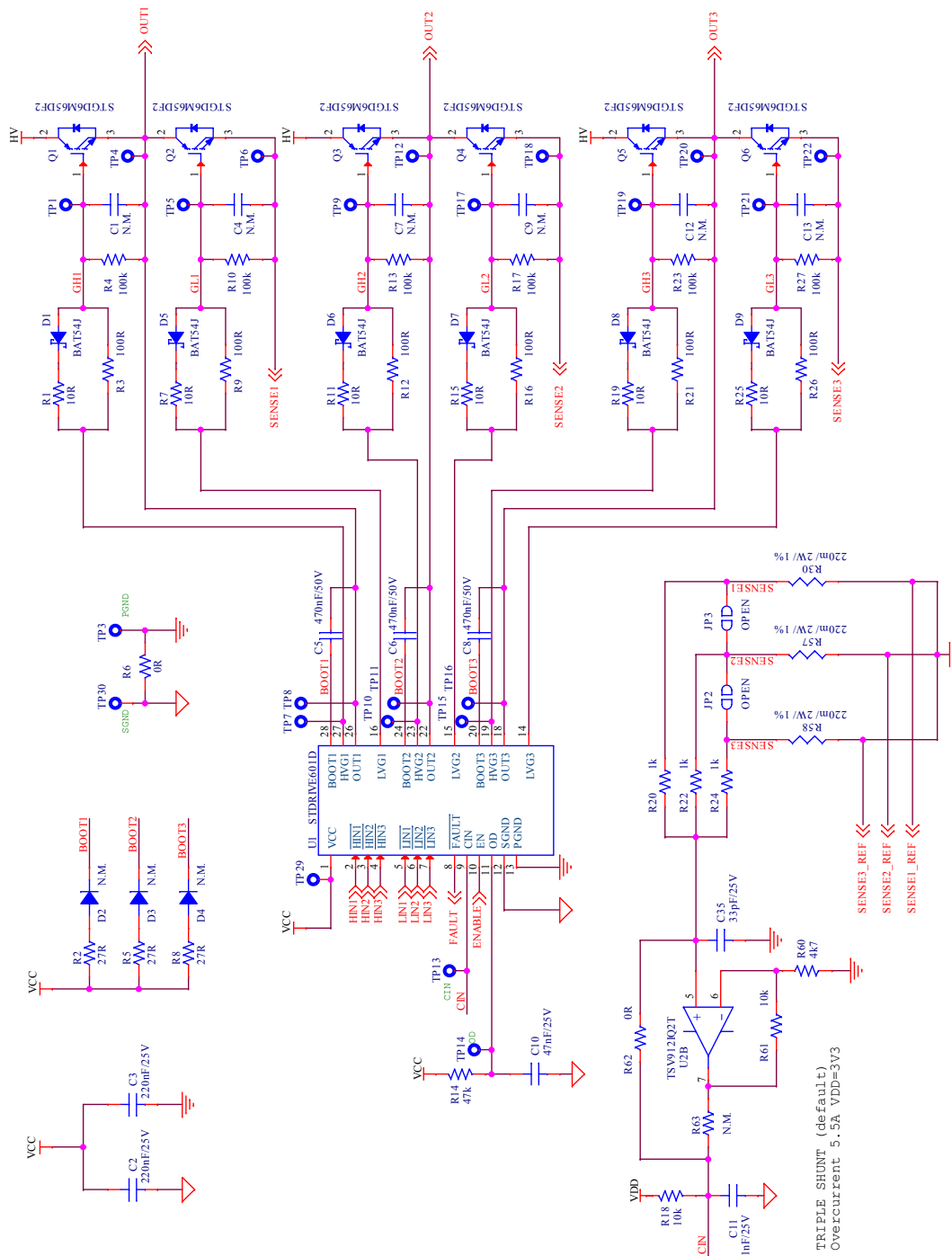
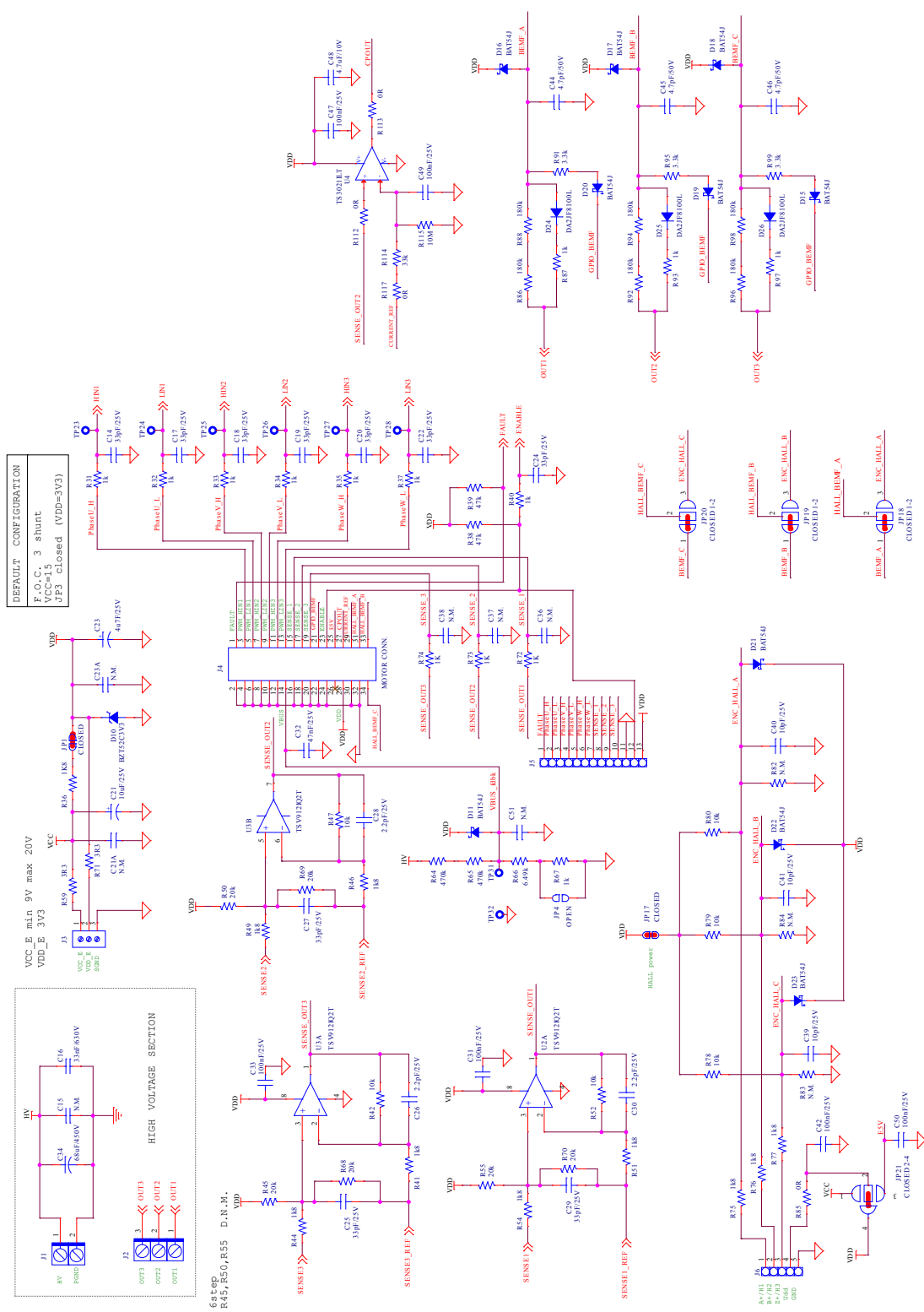


Figure 2. EVALSTDRIIVE601 schematic – feedback network



3 Bill of material

Table 1. Bill of material – components common to all device variants

Reference	Part Value	Part Description	Package
C1, C4, C7, C9, C12, C13, C36, C37, C38, C51	N.M.	SMT ceramic capacitor	Size 0603
C2, C3	220 nF / 25 V	SMT ceramic capacitor	Size 0603
C5, C6, C8	470 nF / 50 V	SMT ceramic capacitor	Size 0805
C10, C32	47 nF / 25 V	SMT ceramic capacitor	Size 0603
C11	1 nF / 25 V	SMT ceramic capacitor	Size 0603
C14, C17, C18, C19, C20, C22, C24, C25, C27, C29, C35	33 pF / 25 V	SMT ceramic capacitor	Size 0603
C15	N.M.	Film capacitor	4x13 mm, Pitch 10 mm
C16	33 nF / 630 V	SMT multilayer capacitor	Size 1210
C21A	N.M.	SMT ceramic capacitor	Size 1206
C21	10 μ F / 25 V	SMD aluminum elect. capacitor	Size C
C23A	N.M.	SMT ceramic capacitor	Size 0805
C23	4.7 μ F / 25 V	SMD auminum elect. capacitor	Dim. 3.3x3.3 mm
C26, C28, C30	2.2 pF / 25 V	SMT ceramic capacitor	Size 0603
C31, C33, C42, C47, C49, C50	100 nF / 25 V	SMT ceramic capacitor	Size 0603
C34	68 μ F / 450 V	THT electrolytic capacitor, radial p7.5 d18h25	Diam. 18 mm, pitch 7.5 mm
C39, C40, C41	10 pF / 25 V	SMT ceramic capacitor	Size 0603
C44, C45, C46	4.7 pF / 50 V	SMT ceramic capacitor	Size 0603
C48	4.7 μ F / 10 V	SMT ceramic capacitor	Size 0805
D1, D5, D6, D7, D8, D9, D11, D15, D16, D17, D18, D19, D20, D21, D22, D23	BAT54J	40V, 300mA small signal Schottky SMT Diode	SOD-323
D2, D3, D4	N.M.	Turbo 2 ultrafast high-voltage rectifier	SMA
D10	BZT52C3V3	Zener diode 3.3 V	SOD-123
D24, D25, D26	DA2JF8100L	800V fast recovery diode	SC-90A (SMini2-F5-B)
JP1, JP17	CLOSED	SMT jumper	Soldering pad
JP2, JP3	OPEN	SMT jumper	Size 0805
JP4	OPEN	SMT jumper	Soldering pad
JP18, JP19, JP20	CLOSED 1-2	SMT jumper	Soldering pad
JP21	CLOSED 2-4	SMT jumper	Soldering pads
J1	MORSV-508-2P_screw	Connector terminal block T.H. 2 positions 5.08 mm	Pitch 5.08 mm
J2	MORSV-508-3P_screw	Terminal block T.H. 3 positions, 5.08 mm	Pitch 5.08 mm
J3	MORSV-350-3P_screw	Terminal block T.H. 3 positions, 3.5 mm	Pitch 3.5 mm
J4	MOTOR CONN.	Header Vertical Connector 2x17 poles, pitch 2.54 mm	2x17 pins
J5	STRIP 1x13	Strip connector 13 pos, 2.54 mm	1x13 pins
J6	STRIP 1x5	Strip connector 5 pos, 2.54 mm	1x5 pins

Reference	Part Value	Part Description	Package
Q1, Q2, Q3, Q4, Q5, Q6	STGD6M65DF2	Trench gate field-stop IGBT, M series 650V, 6A low loss	DPAK
	Alternative P.N.	N.M.	equivalent PowerFLAT 8x8
R1, R7, R11, R15, R19, R25	10 Ω	SMT resistor	Size 0805
R2, R5, R8	27 Ω	SMT resistor	Size 0805
R3, R9, R12, R16, R21, R26	100 Ω	SMT resistor	Size 0805
R4, R10, R13, R17, R23, R27	100 k Ω	SMT resistor	Size 0603
R6, R62, R85, R112, R113, R117	0 Ω	SMT resistor	Size 0603
R14, R38, R39	47 k Ω	SMT resistor	Size 0603
R18, R42, R47, R52, R61, R78, R79, R80	10 k Ω	SMT resistor	Size 0603
R20, R22, R24, R31, R32, R33, R34, R35, R37, R40, R72, R73, R74	1 k Ω	SMT resistor	Size 0603
R30, R57, R58	220 m Ω / 2 W/ 1%	SMT resistor	Size 1210/2512
R36	1.8 k Ω	SMT resistor	Size 1206
R41, R44, R46, R49, R51, R54, R75, R76, R77	1.8 k Ω	SMT resistor	Size 0603
R45, R50, R55, R68, R69, R70	20 k Ω	SMT resistor	Size 0603
R59, R71	3.3 Ω	SMT resistor	Size 0603
R60	4.7 k Ω	SMT resistor	Size 0603
R63, R82, R83, R84	N.M.	SMT resistor	Size 0603
R64, R65	470 k Ω	SMT resistor	Size 1206
R66	6.49 k Ω	SMT resistor	Size 0805
R67, R87, R93, R97	1 k Ω	SMT resistor	Size 0805
R86, R88, R92, R94, R96, R98	180 k Ω	SMT resistor	Size 1206
R91, R95, R99	3.3 k Ω	SMT resistor	Size 0603
R114	33 k Ω	SMT resistor	Size 0603
R115	10 M Ω	SMT resistor	Size 0603
TP1, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21, TP22, TP23, TP24, TP25, TP26, TP27, TP28, TP31, TP32	-	TP for probe	Diam. 1.27, Hole 0.8mm
TP29	-	Red bead terminal, diam. 1.02mm	Diam. 2,54 , Hole 1mm
TP30	-	Black bead terminal, diam. 1.02mm	Diam. 2,54 , Hole 1mm
U1	STDRIVE601	600 V Triple half-bridge high-voltage gate driver	SO-28
U2,U3	TSV912IQ2T	Dual rail-to rail input/output 8 MHz operational amplifiers	DFN8 2x2
U4	TS3021ILT	Rail-to-rail 1.8 V high-speed comparator	SOT23-5

4 Layout and component placements

Figure 3. EVALSTDRIVE601 layout - component placement top view

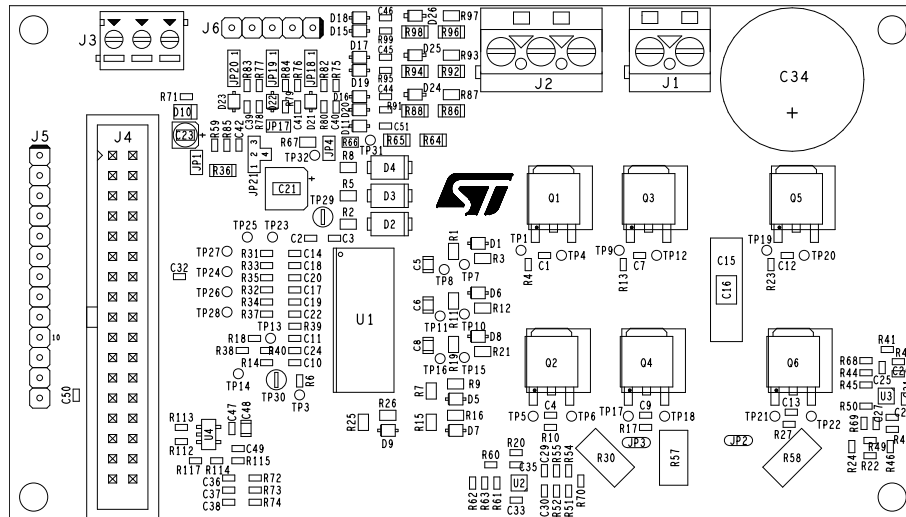


Figure 4. EVALSTDRIVE601 layout - top layer

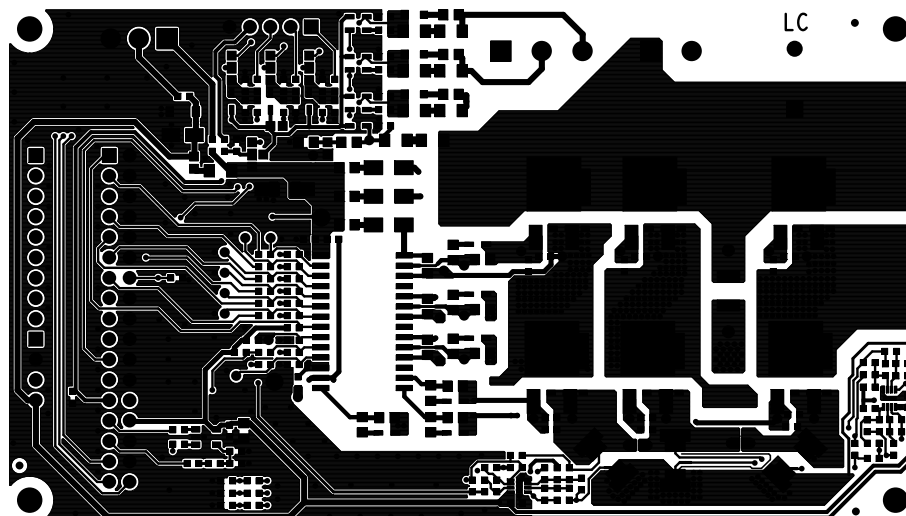
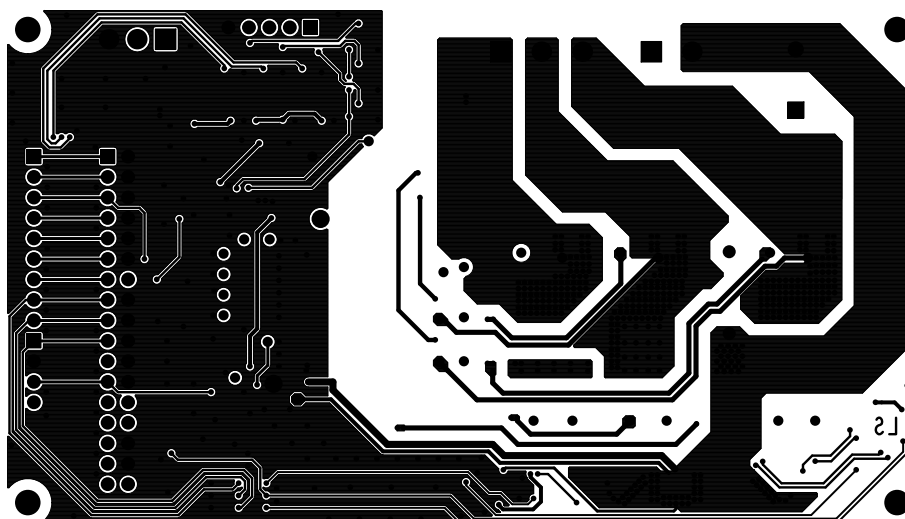


Figure 5. EVALSTDRIVE601 layout - bottom layer



Revision history

Table 2. Document revision history

Date	Version	Changes
29-May-2019	1	Initial release.
08-Aug-2024	2	Added Section 1 ; updated Table 1 .

IMPORTANT NOTICE – READ CAREFULLY

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgment.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2024 STMicroelectronics – All rights reserved