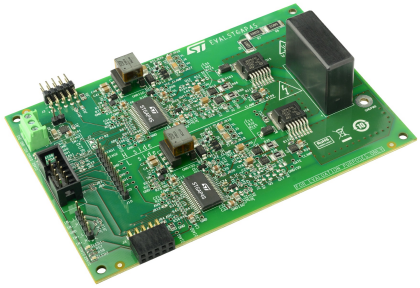
EVALSTGAP4S

Data brief

Demonstration board for STGAP4S advanced galvanically isolated gate driver



Product status link
EVALSTGAP4S

Features

- **Board:**
  - Half-bridge configuration
  - SCTH100N65G2-7AG 650 V, 20 mΩ SiC MOSFETs
  - High voltage rail up to: 520 V (limited by MOSFETs and capacitors rating)
  - On-board 3.3 V linear regulator for LV side supply
  - Flybacks for HV +18 / -5 V driving supply
  - Fault LED indicators
  - Maximum working voltage across isolation: 1200 V
  - Suitable to be used in combination with STEVAL-PCC009V2 and STSW-STGAP4 GUI
  - RoHS compliant
- **STGAP4S device:**
  - Integrated isolated flyback for HV side supply
  - Negative gate driving
  - Desaturation detection
  - Soft turn-off
  - 3.3 V logic interface, 5 V tolerant
  - Isolated ADC
  - Internal temperature sensor
  - Overtemperature warning and shutdown feature
  - SPI with daisy chain for parameters programming and diagnostic

Description

The EVALSTGAP4S is a galvanically isolated single gate driver for IGBTs and SiC MOSFETs with advanced protection, configuration, and diagnostic features. The architecture of the STGAP4S isolates the channel gate driving from the control and the low voltage interface circuitry through a true galvanic isolation.

The EVALSTGAP4S board allows evaluating all the STGAP4S features while driving a power switch with a voltage rating up to 650 V. The board is provided with two SiC MOSFETs in a H^2PAK-7 package connected in half-bridge configuration. The two STGAP4S drivers are connected in an SPI daisy chain and the high voltage side of each is fed by its own flyback power supply, whose controller is integrated in the driver.

Multiple boards can be connected and share the same logic supply voltage in order to evaluate complex topologies, such as full-bridge inverter. The connection of multiple boards allows the implementation of the SPI daisy chain with more than two devices.

In combination with the STEVAL-PCC009V2 and STSW-STGAP4 GUI, the board allows to easily enable, configure, or disable all of the driver's protection and control features through the SPI interface. Advanced diagnostic is also available thanks to the driver's status registers that can be accessed through the SPI.

1 Schematic diagram

Figure 1. **EVALSTGAP4S schematic diagram – connectors**

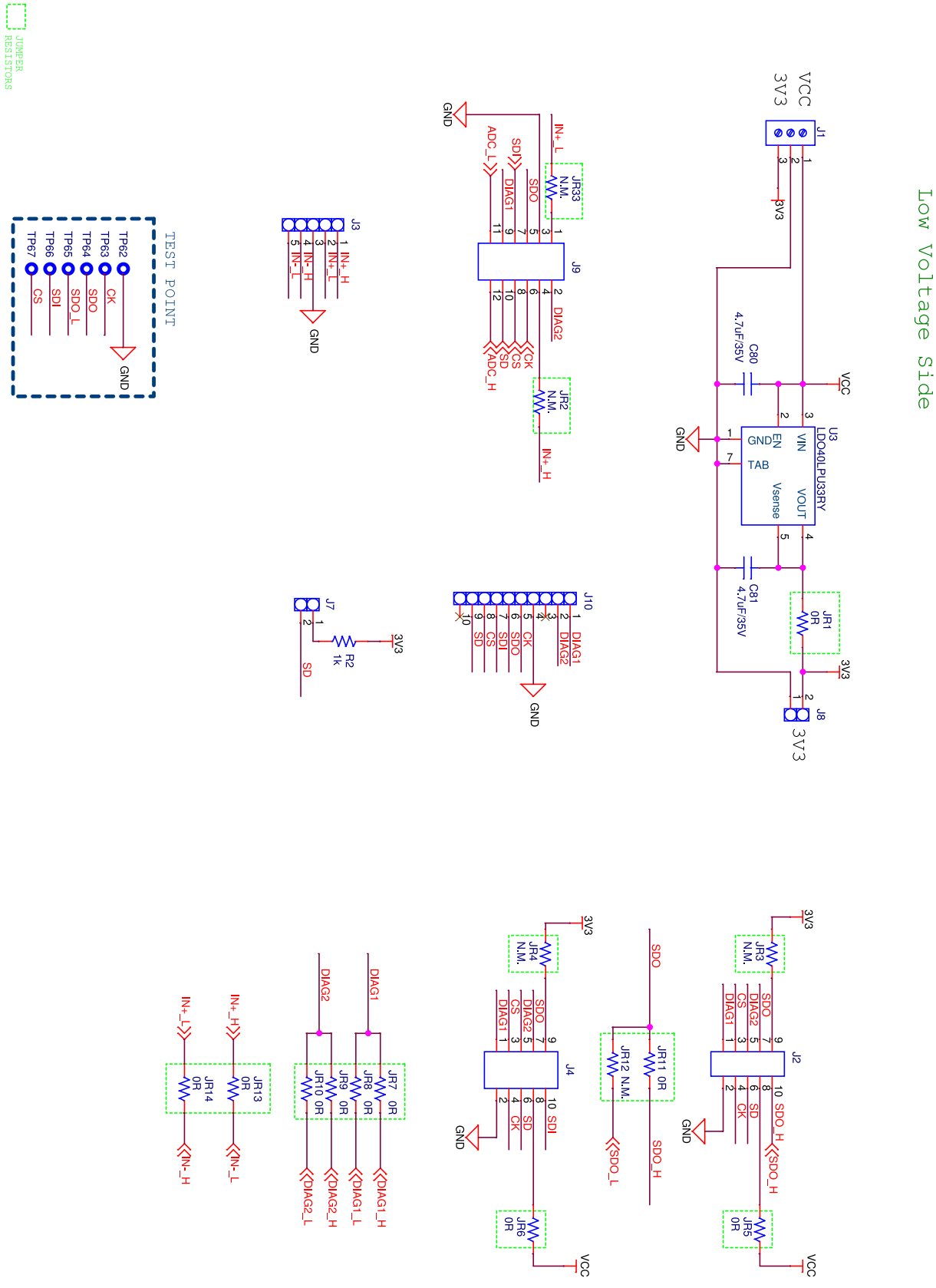


Figure 2. **EVALSTGAP4S schematic diagram – low-side**

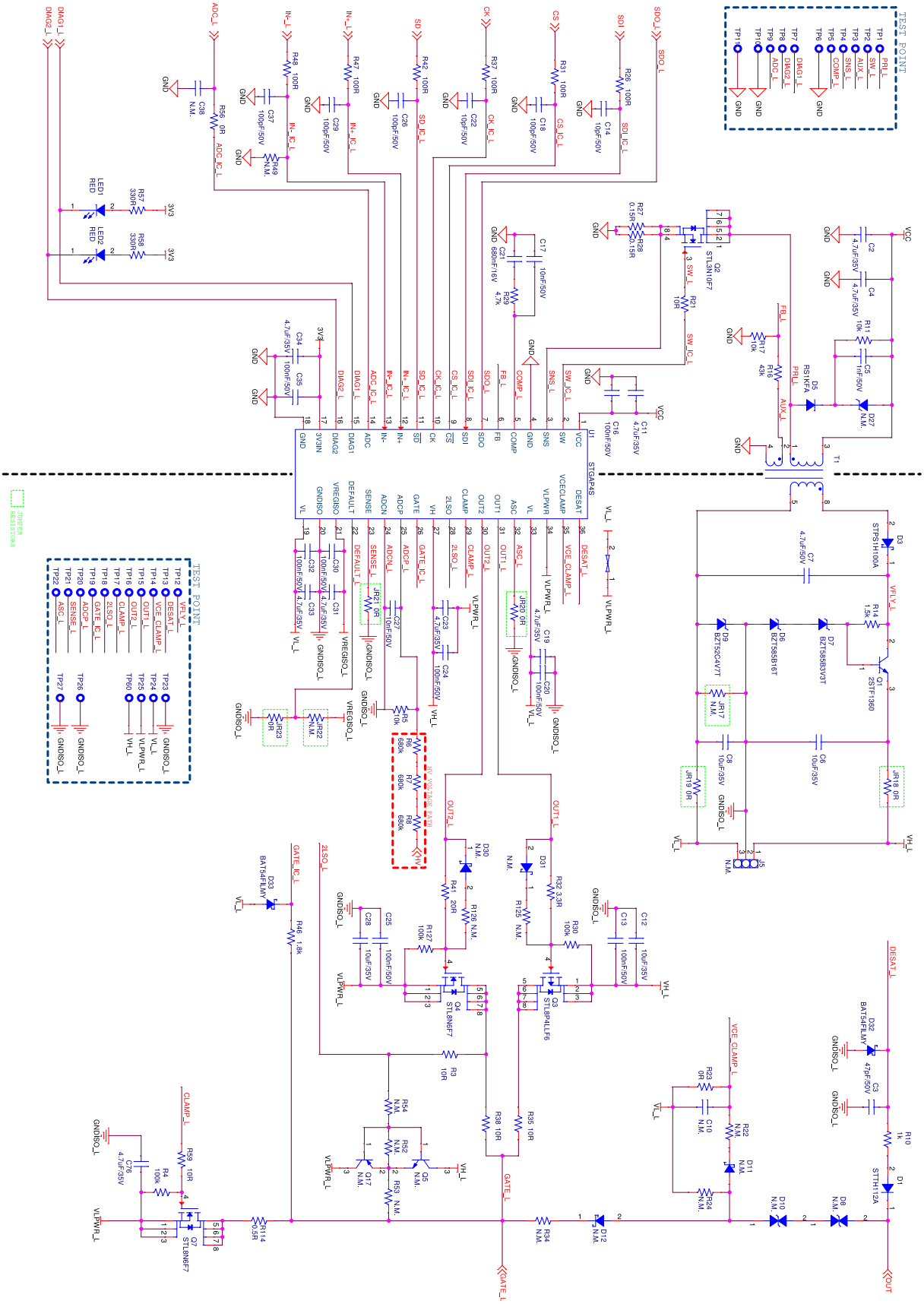


Figure 3. **EVALSTGAP4S schematic diagram – high-side**

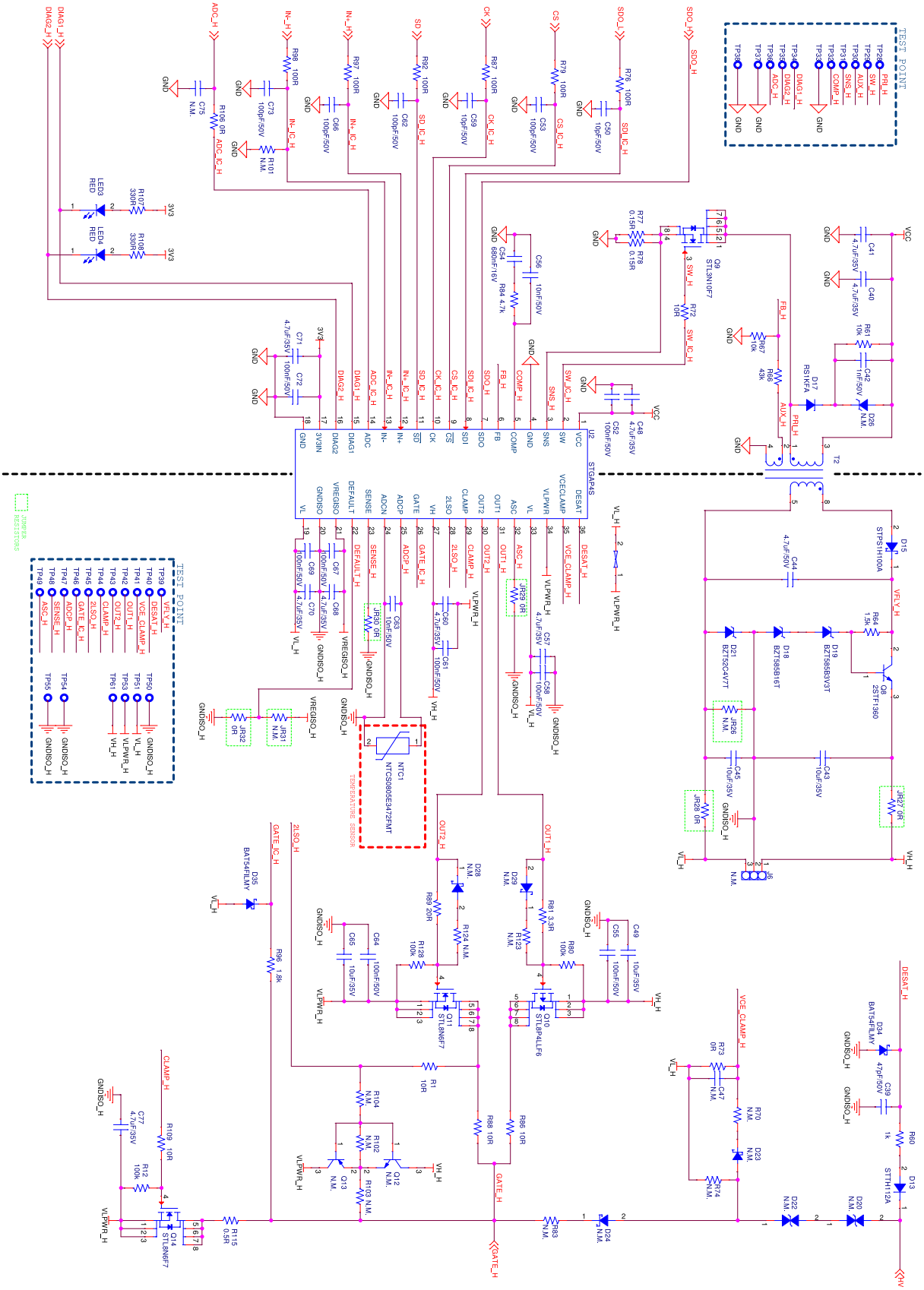
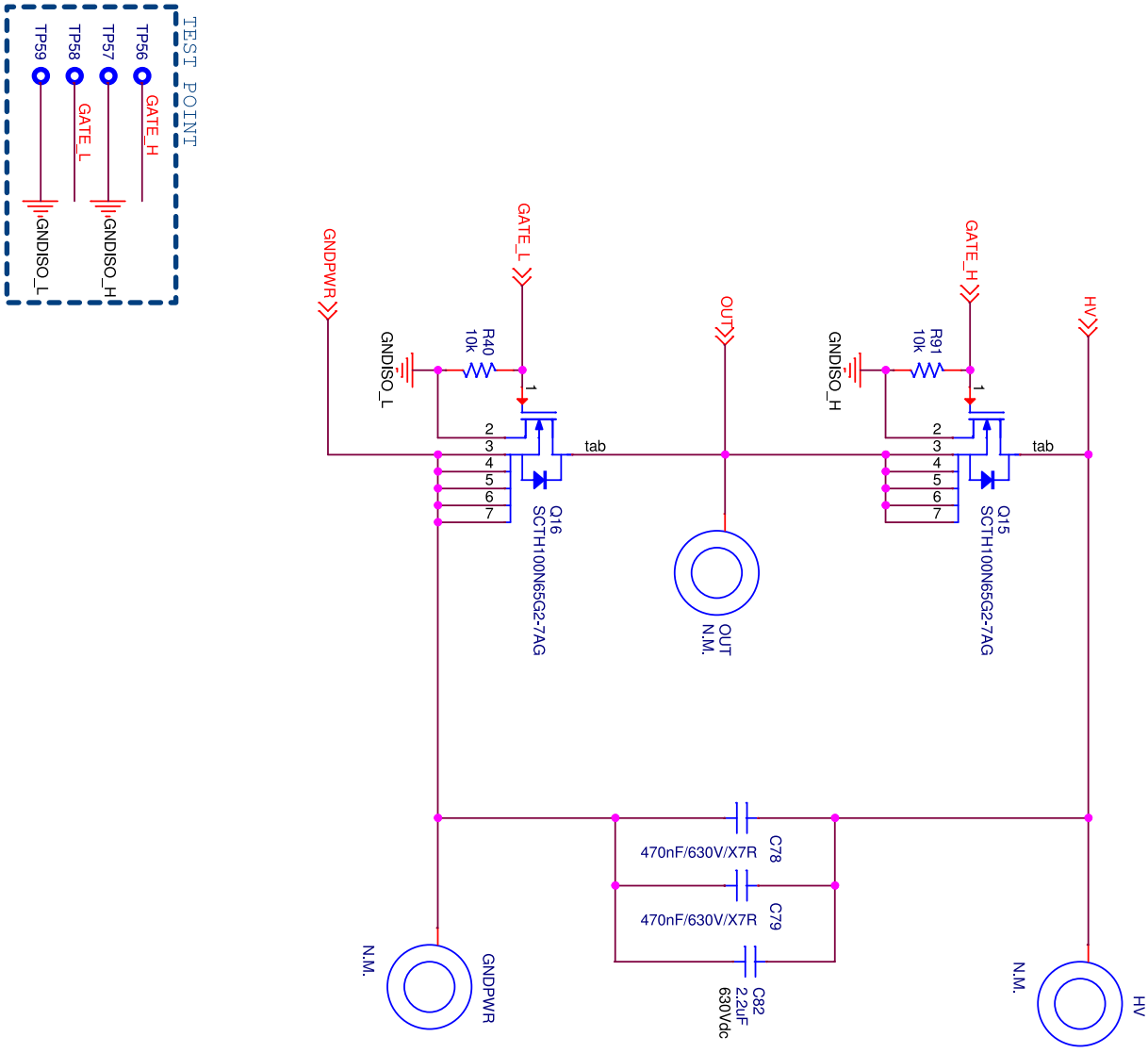


Figure 4. **EVALSTGAP4S schematic diagram – power stage**



2 Bill of material

Table 1. Bill of material

Part reference	Part value	Part description
C2, C4, C40, C41, C80	4.7 µF / 35 V	SMT ceramic capacitor - size 1206
C3, C39	47 pF / 50 V	SMT ceramic capacitor - size 0603
C5, C42	1 nF / 50 V	SMT ceramic capacitor - size 0603
C6, C8, C12, C28, C43, C45, C49, C65	10 µF / 35 V	SMT ceramic capacitor - size 1206
C7, C44	4.7 µF / 50 V	SMT ceramic capacitor - size 1210
C10, C47	N.M.	SMT ceramic capacitor - size 0603
C11, C19, C23, C31, C33, C34, C48, C57, C60, C68, C70, C71, C76, C77, C81	4.7 µF / 35 V	SMT ceramic capacitor - size 0805
C13, C16, C20, C24, C25, C52, C55, C58, C61, C64	100 nF / 50 V	SMT ceramic capacitor - size 0603
C14, C22, C50, C59	10 pF / 50 V	SMT ceramic capacitor - size 0402
C38, C75	N.M.	SMT ceramic capacitor - size 0402
C17, C27, C56, C63	10 nF / 50 V	SMT ceramic capacitor - size 0402
C21, C54	680 nF / 16 V	SMT ceramic capacitor - size 0603
C18, C26, C29, C37, C53, C62, C66, C73	100 pF / 50 V	SMT ceramic capacitor - size 0402
C30, C32, C35, C67, C69, C72	100 nF / 50 V	SMT ceramic capacitor - size 0402
C78, C79	470 nF / 630 V / X7R	SMT ceramic capacitor - size 2225
C82	2.2 µF ECWFG2J225J or equivalent	Film capacitor (Automotive) - pitch 27.5 mm
D1, D13	STTH112A	High voltage rectifier - SMA
D3, D15	STPS1H100A	High voltage power Schottky rectifier - SMA
D5, D17	RS1KFA	Fast recovery rectifiers - SOD-123FA
D6, D18	BZT585B16T	Precision Zener diode - SOD523
D7, D19	BZT585B3V3T	Precision Zener diode - SOD523
D8, D10, D20, D22	N.M.	TVS diodes - SMB P6SMB510CA or equivalent
D9, D21	BZT52C4V7T	Zener diode - SOD523
D11, D23	N.M.	Signal Schottky diode - SOD-323 BAT20JFILM or equivalent
D12, D24	N.M.	High voltage power Schottky rectifier - SMA STPS1H100A or equivalent
D26, D27	N.M.	TVS diodes - SOD-123FL SZSMF24AT1G or equivalent
D28, D29, D30, D31	N.M.	Automotive low drop power Schottky rectifier - SOD123Flat STPS2L40ZFY or equivalent
D32, D33, D34, D35	BAT54FILMY	Automotive small signal Schottky diodes - SOT23
OUT, HV, GNDPWR	N.M.	M3 screw
JR1, JR7, JR8, JR9, JR10, JR13, JR14, JR18, JR19, JR20, JR21, JR23, JR27, JR28, JR29, JR30, JR32	0 Ω	SMT resistor - size 0603

Part reference	Part value	Part description
JR2, JR12, JR17, JR22, JR26, JR31, JR33	N.M.	SMT resistor - size 0603
JR3, JR4	N.M.	SMT resistor - size 0402
JR5, JR6	0 Ω	SMT resistor - size 0805
JR11	100 Ω	SMT resistor - size 0603
J1	MORSV-350-3P_screw	Screw terminal block 3 poles, pitch 3,5 mm
J2	Angled pin header	2x5 pins - 90 degree, 2,54 mm
J3	Pin header	1x5 pins, 2,54 mm
J4	Angled female pin header	2x5 female pins - 90 degree, 2,54 mm
J5, J6	N.M.	1x3 pins, 2,54 mm
J7	N.M.	1x2 pins, 2,54 mm
J8	Pin header	1x2 pins, 2,54 mm
J9	2-1761603-3 or equivalent	Flat cable connector - 2x5 pins, 2,54 mm
J10	Pin header	1x10 pins, 2,54 mm
LED1, LED2, LED3, LED4	Red LED	Size 0603
NTC1	NTCS0805E3472FMT	NTC thermistor - size 0805
Q1, Q8	2STF1360	Low voltage fast-switching NPN power transistors - SOT-89
Q2, Q9	STL3N10F7	N-channel 100V, 4A STripFET VII DeepGATE power MOSFET - PowerFLAT 2x2 mm
Q3, Q10	STL8P4LLF6	P-channel 40V, 8A STripFET F6 power MOSFET - PowerFLAT 3.3x3.3 mm
Q4, Q7, Q11, Q14	STL8N6F7	N-channel 60V, 8A STripFET F7 Power MOSFET in a PowerFLAT - PowerFLAT 3.3x3.3 mm
Q5, Q12	N.M.	60V, 1A fast-switching NPN power transistor - SOT-23
Q13, Q17	N.M.	Low voltage fast-switching PNP power transistor - SOT-23
Q15, Q16	SCTH100N65G2-7AG	Automotive-grade SiC Power MOSFET, 650V, 95A - H^2PAK-7L
R1, R3	10 Ω	SMT resistor - size 0805
R2	1 kΩ	SMT resistor - size 0402
R4, R12, R30, R80, R127, R128	100 kΩ	SMT resistor - size 0402
R5, R11, R40, R61, R91	10 kΩ	SMT resistor - size 0603
R6, R7, R8	680 kΩ	SMT resistor - size 2512
R10, R60	1 kΩ	SMT resistor - size 0603
R14, R64	1.5 kΩ	SMT resistor - size 0603
R16, R66	43 kΩ	SMT resistor - size 0402
R17, R67	10 kΩ	SMT resistor - size 0402
R21, R59, R72, R109	10 Ω	SMT resistor - size 0603
R22, R54, R70, R104, R123, R124, R125, R126	N.M.	SMT resistor - size 0603
R23, R73	0 Ω	SMT resistor - size 0603
R24, R34, R53, R74, R83, R103	N.M.	SMT resistor - size 0805
R56, R106	0 Ω	SMT resistor - size 0402
R27, R28, R77, R78	0.15 Ω	SMT resistor - size 0603

Part reference	Part value	Part description
R29, R84	4.7 kΩ	SMT resistor - size 0402
R32, R81	3.3 Ω	SMT resistor - size 0603
R35, R38, R86, R88	10 Ω	SMT resistor - size 1210
R41, R89	20 Ω	SMT resistor - size 0603
R26, R31, R37, R42, R47, R76, R79, R87, R48, R92, R97, R98	100 Ω	SMT resistor - size 0402
R46, R96	1.8 kΩ	SMT resistor - size 0603
R49, R52, R101, R102	N.M.	SMT resistor - size 0402
R57, R58, R107, R108	330 Ω	SMT resistor - size 0603
R114, R115	0.5 Ω	SMT resistor - size 0603
TP1 to TP67	N.M.	Test point - Diam. 1.27, hole 0.8 mm
T1, T2	750318616	Auxiliary gate drive transformer
U1, U2	STGAP4S	Advanced isolated gate driver for IGBTs and SiC MOSFETs - SO-36W
U3	LDO40LPU33RY	Low-dropout regulator - DFN6 (3x3)
	Flat cable	Flat cable, 10 poles 10 cm

3 Board layout

Figure 5. **EVALSTGAP4S – layout – top layer**

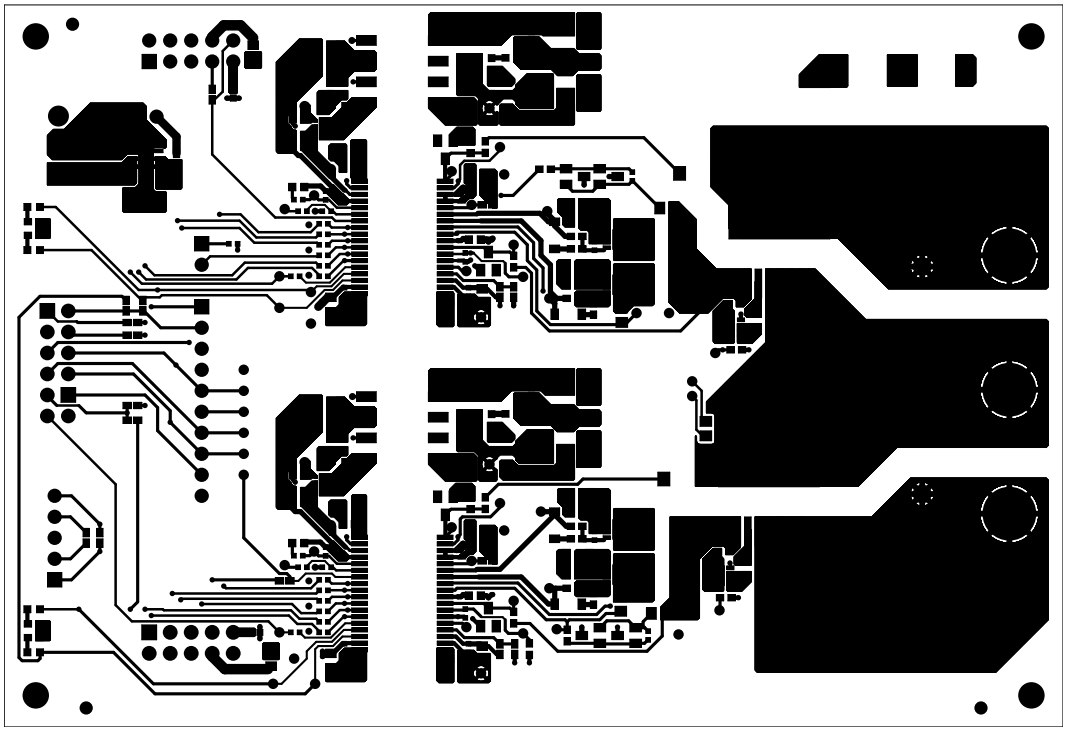


Figure 6. **EVALSTGAP4S – layout – inner 1 layer**

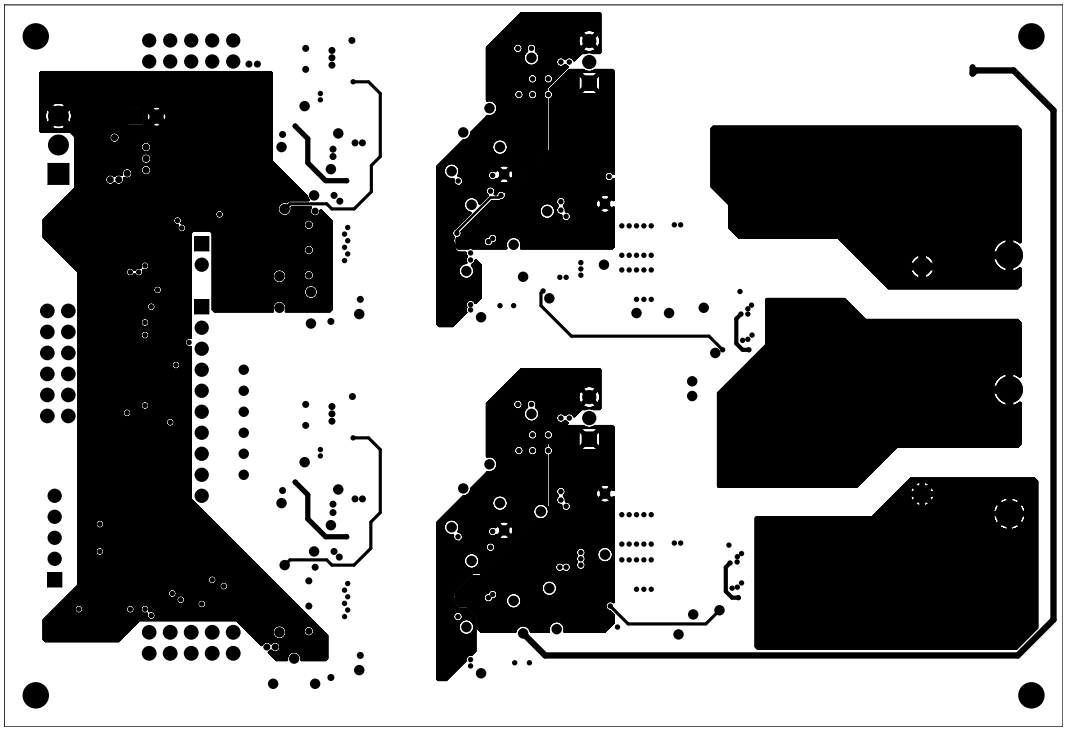


Figure 7. **EVALSTGAP4S – layout – inner 2 layer**

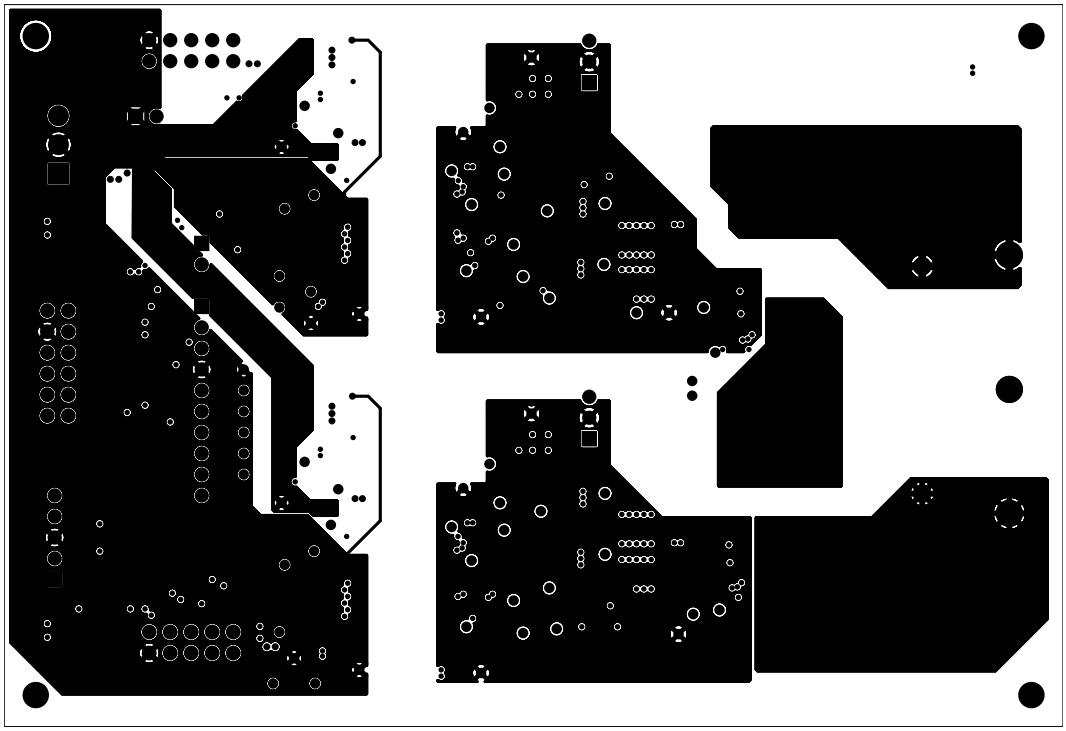


Figure 8. **EVALSTGAP4S – layout – bottom layer**

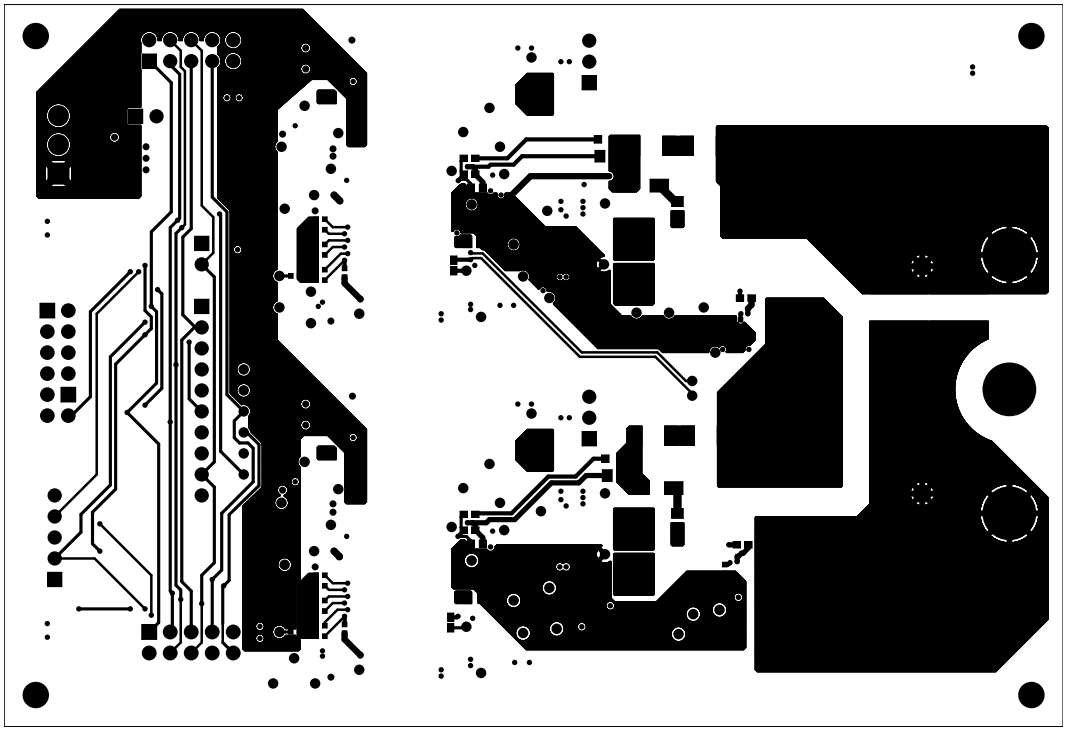


Figure 9. **EVALSTGAP4S – layout – top components placement**

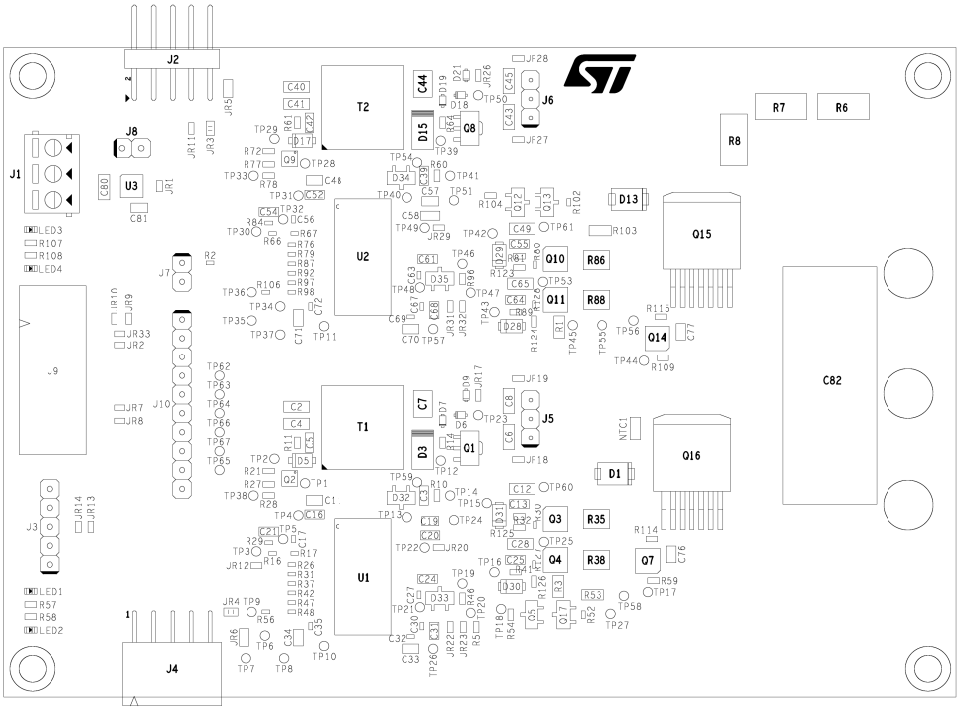
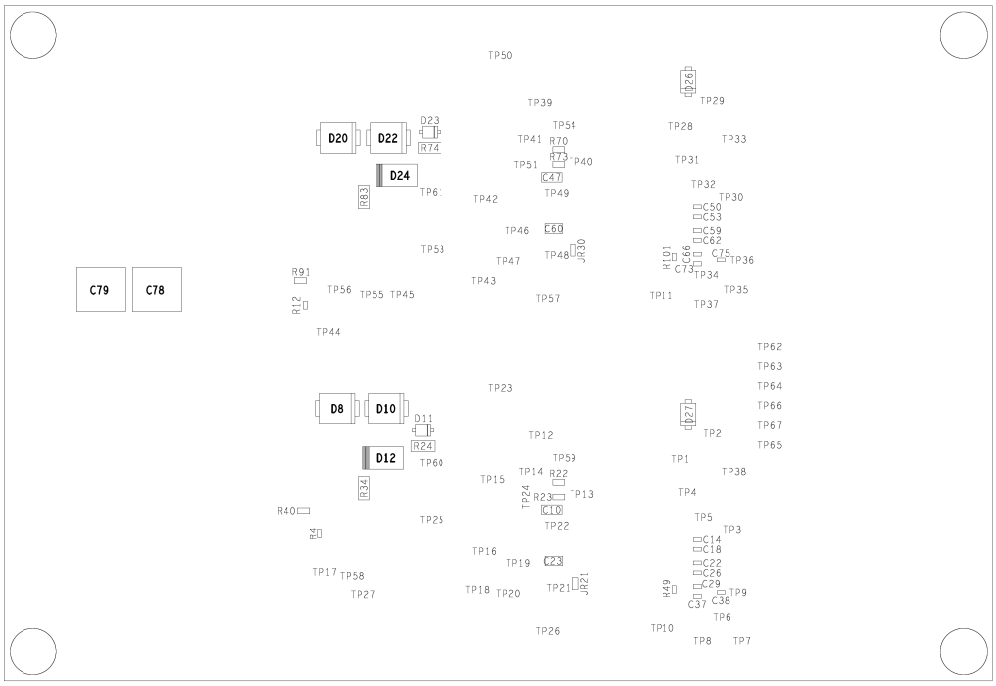


Figure 10. **EVALSTGAP4S – layout – bottom components placement**



Revision history

Table 2. **Document revision history**

Date	Version	Changes
17-Mar-2023	1	Initial release.
20-Nov-2023	2	Updated Figure 1, Figure 2, Figure 3, Figure 4, Table 1.

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