

48 V MOTIX™ gate driver TLE9140EQW

Evaluation board

Z8F80474925

About this document

Scope and purpose

This board is to be used during the design-in process for evaluating and measuring characteristic curves, and for checking datasheet specifications.

This document describes how to use the TLE9140EQW evaluation board v2.0.

Intended audience

This document is intended for electronic engineers who want to evaluate a 48 V 3-phase gate driver.

Table 1 Supplementary links and document references

Reference	Description
TLE9140EQW datasheet	Datasheet contains reference information for the 48 V MOTIX™ 3-phase gate driver TLE9140EQW
TLE987x Product Page	All information of MOTIX™ MUC

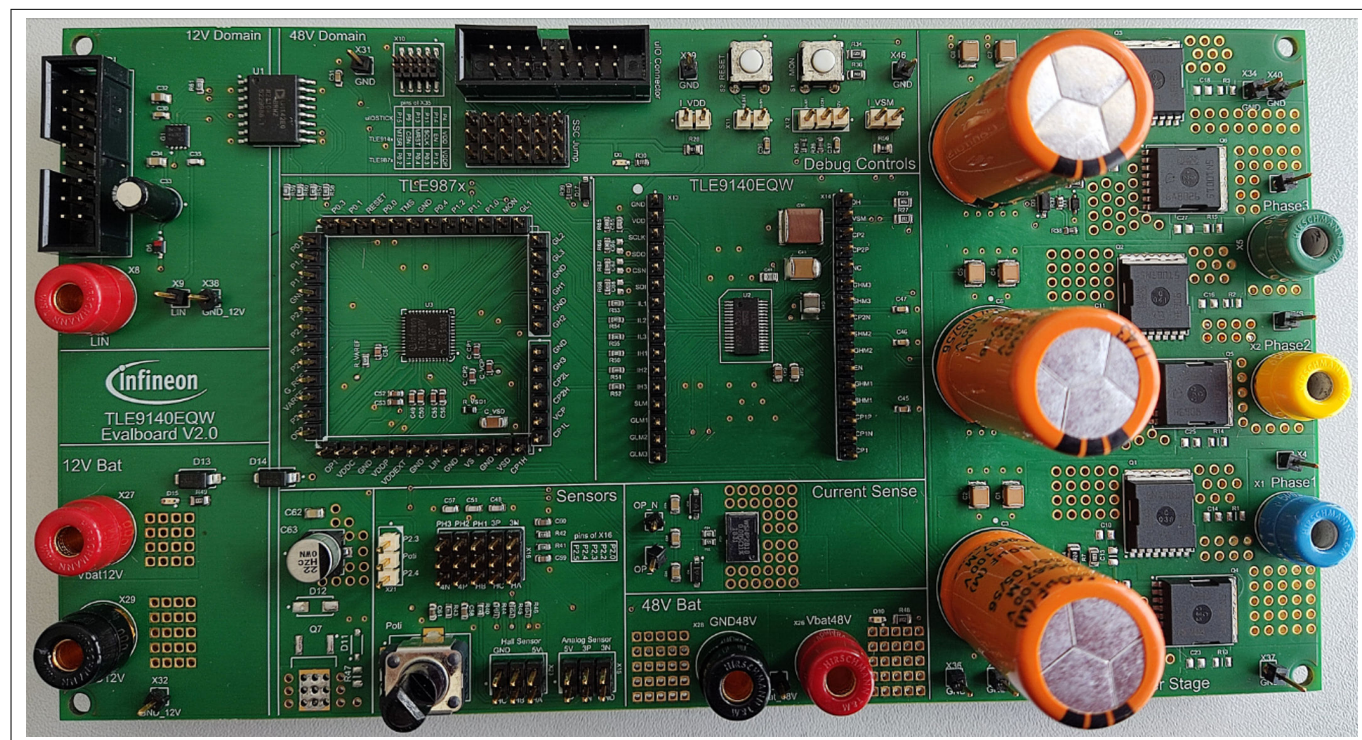


Figure 1 48 V MOTIX™ gate driver TLE9140EQW evaluation board

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Safety precautions

Safety precautions

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Table 2 Safety precautions

	Caution: The heat sink and device surfaces of the evaluation or reference board may become hot during testing. Hence, necessary precautions are required while handling the board. Failure to comply may cause injury.
	Caution: Only personnel familiar with the drive, power electronics and associated machinery should plan, install, commission and subsequently service the system. Failure to comply may result in personal injury and/or equipment damage.
	Caution: The evaluation or reference board contains parts and assemblies sensitive to electrostatic discharge (ESD). Electrostatic control precautions are required when installing, testing, servicing or repairing the assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with electrostatic control procedures, refer to the applicable ESD protection handbooks and guidelines.
	Caution: A drive that is incorrectly applied or installed can lead to component damage or reduction in product lifetime. Wiring or application errors such as undersizing the motor, supplying an incorrect or inadequate AC supply, or excessive ambient temperatures may result in system malfunction.

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1 Evaluation board introduction

1 Evaluation board introduction

1.1 Concept of the evaluation board

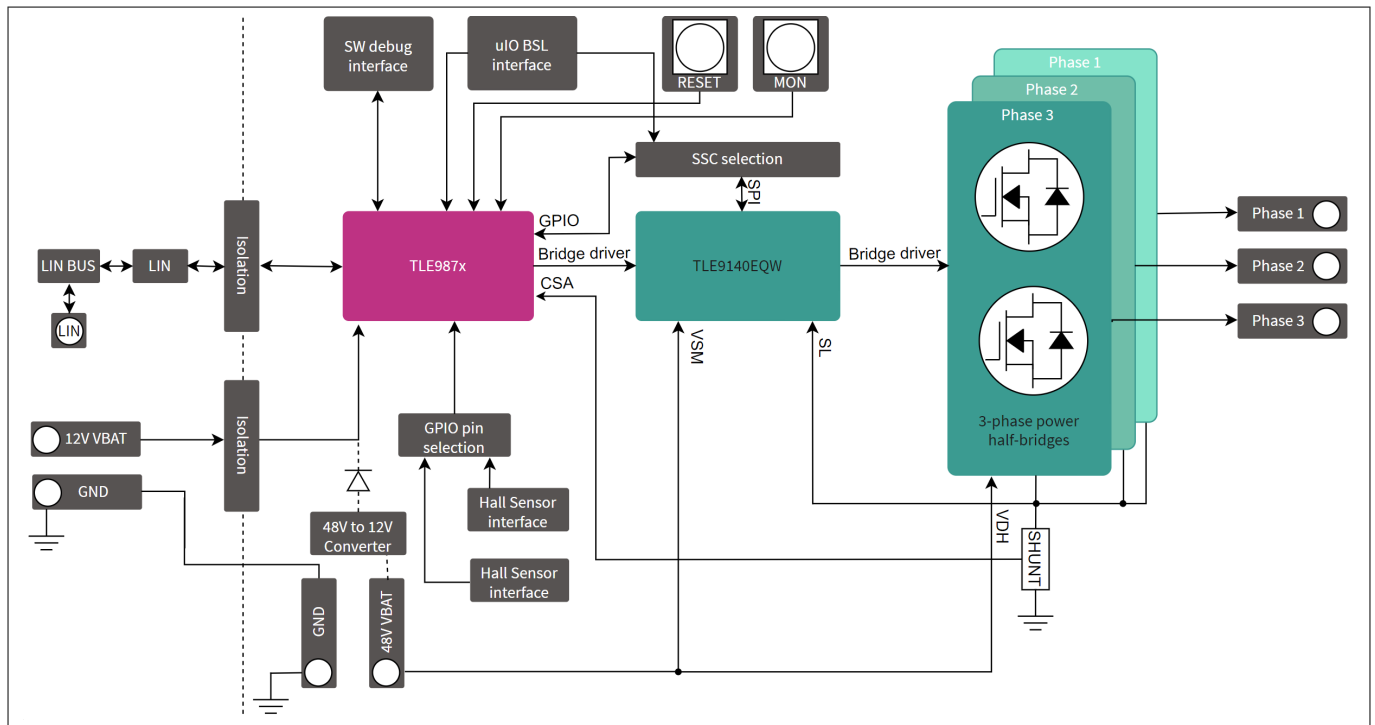


Figure 2 Concept of the evaluation board

This evaluation board can be used to evaluate MOTIX™ 48 V gate driver TLE9140EQW in two scenarios:

1. MOTIX™ 48 V gate driver TLE9140EQW controlled by MOTIX™ MCU device TLE987x
2. Evaluate MOTIX™ 48 V gate driver TLE9140EQW with config wizard in Infineon toolbox

It contains the TLE9140EQW, TLE987x and their typical application circuits including three half-bridges to drive a BLDC motor. The jumper X35 provide the possibilities to either connect the TLE9140EQW to uIO-Stick or to TLE987x. All pins of the TLE9140EQW device and the TLE987x device are connected to pin headers for easy measurement.

The evaluation board is supplied by 12 V and 48 V/24 V power supply via banana jacks, and the LIN communication works via banana jacks.

An SWD interface is available for J-Linker. There are two battery LEDs (12 V and 48 V) to indicate that the board is supplied correctly.

Note: 12 V GND is not connected to 48 V GND on the board due to the required isolation for 12 V system and 48 V system. Therefore, they must be connected externally in order to make the board operate properly.

1.2 Key features

The evaluation board has the following features:

- The TLE9140EQW can be controlled by the on board MOTIX™ MUC device or uIO-Stick (config wizard) with additional inputs signals
- Drive 24 V/48 V DC or BLDC motors (48 V supply can be replaced by 24 V supply to drive the applications in 24 V domain)
- High voltage capability: robustness up to 110 V

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- Capable of high frequency PWM, for example: 20 kHz
- Adjustable charge and discharge currents for optimized EMC performance
- High voltage compatible inputs
- Active LS freewheeling during VSM overvoltage
- SPI communication
- Protections and diagnostics, for example against overtemperature, overcurrent, undervoltage, timeout watchdog and off-state diagnostic

1.3 Application diagram of BLDC motor control

As a starting point for the evaluation board, the application block diagram shown in Figure 3 was used. All input pins of TLE9140EQW are connected to the outputs of the power stage in the TLE987x device. The SPI ports are connected to the GPIO pins of the TLE987x device.

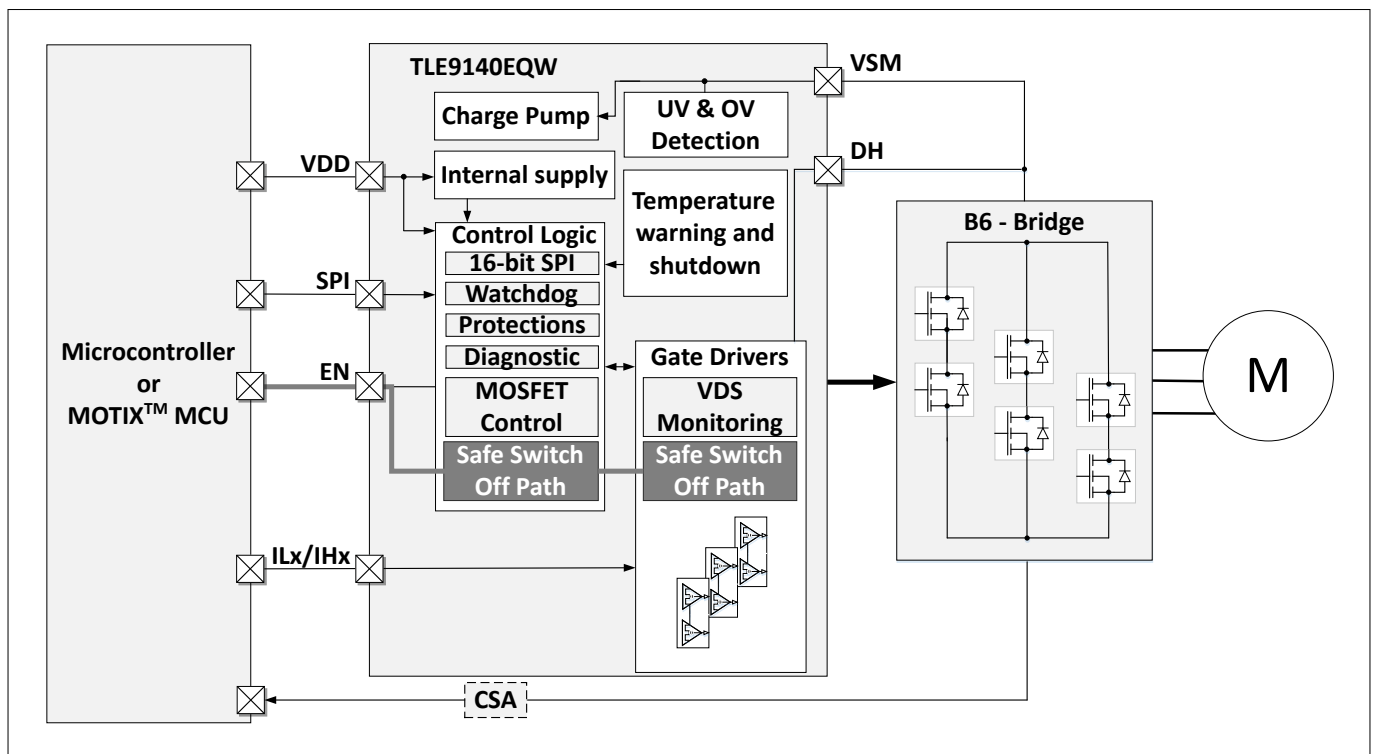


Figure 3 Application diagram of BLDC motor control with the evaluation board

2 Evaluation board description

2 Evaluation board description

For the purpose of evaluation for motor control design, discrete components are populated on board. They can be adapted to the dedicated motor control applications.

Figure 4 and Figure 5 show the interconnects, jumper settings, test points and the non-populated components.

2.1 Interconnects

In Figure 4 the interconnects of the 48 V MOTIX™ gate driver TLE9140EQW evaluation board are shown.

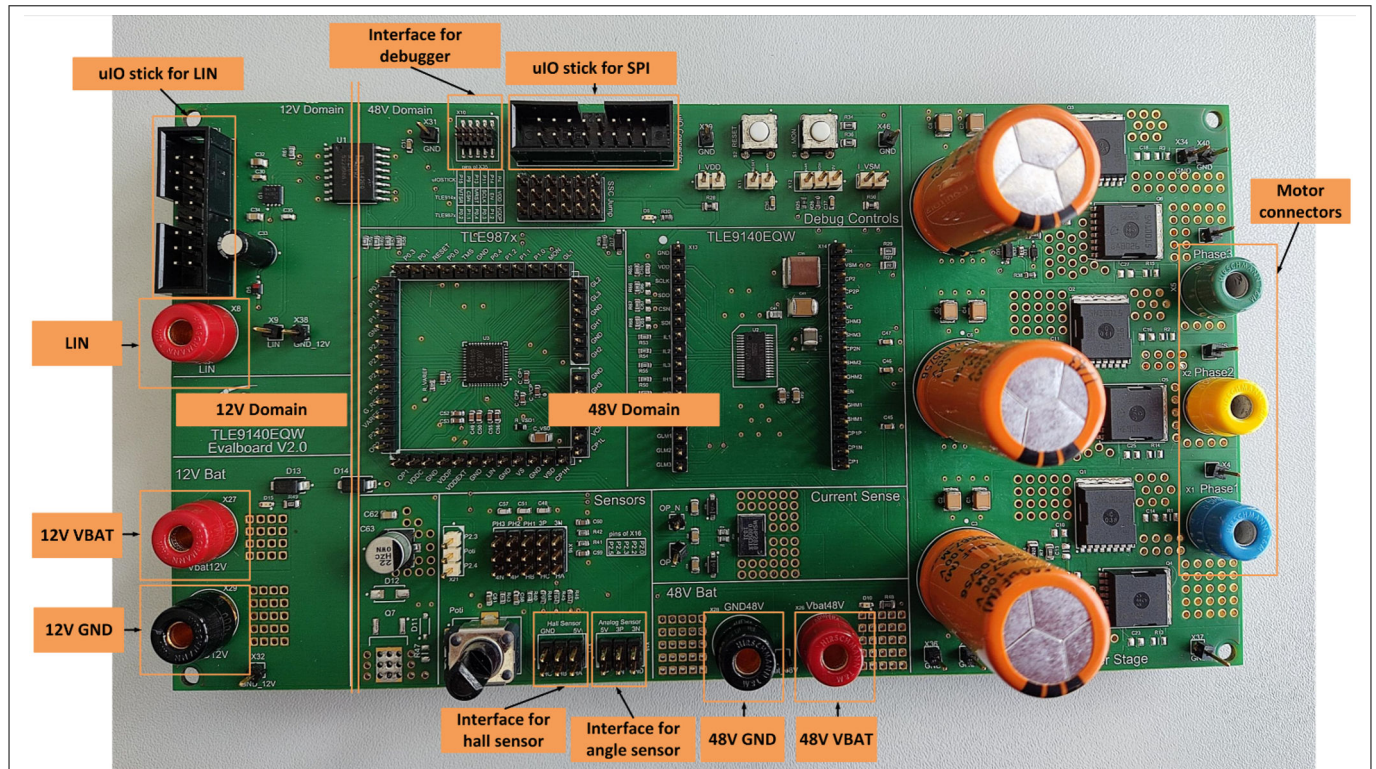


Figure 4 Interconnects of the evaluation board

Power supply

The X26 and X28 are connectors for 48 V/24 V GND and battery.

The X27 and X29 are connectors for 12 V GND and battery.

Motor connectors

The X26 and X28 are connectors for 48 V/24 V GND and battery.

Hall sensor interface

The X23 is the interface of hall sensor as shown in the following table.

Table 3 Hall sensor interface

GND	n.c.	5V
HC	HB	HA

Angle sensor interface

The X15 is the interface of analog angle sensor as shown in the following table.

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Table 4 Angle sensor interface

5V	3P	3N
4P	4N	GND

LIN connector and the uIO-Stick interface for LIN

The X8 is the LIN connector.

The X25 is intended to connect additional hardware for LIN communication.

Table 5 LIN connector and the uIO-Stick interface for LIN

2 (12V GND)	4	6 (12V VBAT)	8	10	12	14	16
1	3	5 (BUS)	7	9	11	13	15

Jumpers to select different use cases

The X35 can be used to select different use cases. For the use case “MOTIX™ MUC + TLE9140EQW” the last two rows (TLE9140EQW and TLE987x) should be connected via jumpers. For the use case “Evaluate TLE9140EQW with config wizard” the first two rows (uIO-Stick and TLE9140EQW) should be connected via jumpers.

Table 6 Jumpers to select different use cases

uIO-Stick	P15	P9	P13	P11	P14	P4
TLE9140EQW	MTSR	CSN	MRST	SCLK	EN	VDD
TLE987x	P0.2	P1.1	P0.4	P0.3	P1.2	VDDP

Interface for debugger

The debugger (J-Link) can be connected to X10 to debug the code.

Table 7 Interface for debugger

2(SWDIO)	4(SWCLK)	6	8	10(RESET)
1(5V)	3(GND)	5(GND)	7	9(GND)

2.2 Jumper settings

The following table summarize the flexible configurations provided by jumpers:

Table 8 Jumper settings

X11	Enable or disable RESET button
X12	Enable or disable MON button
X16	Select the applications configurations with hall sensor or angle sensor
X21	Enable or disable potentiometer
X35	Select TLE987X or uIO-Stick as the master of SSC

For this board, P2.0, P2.2, P2.3, P2.4 and P2.5 in X16 can be used for different application configurations. PHx means phase voltage from corresponding BEMF. Hx means connector for hall sensor. 4N and 4P pins are the connectors for angle sensor. The definition of pins is described in the following table.

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Table 9 Pin definition

PH3	PH2	PH1	3P	3N
P2.5	P2.4	P2.3	P2.2	P2.0
4N	4P	HB	HC	HA

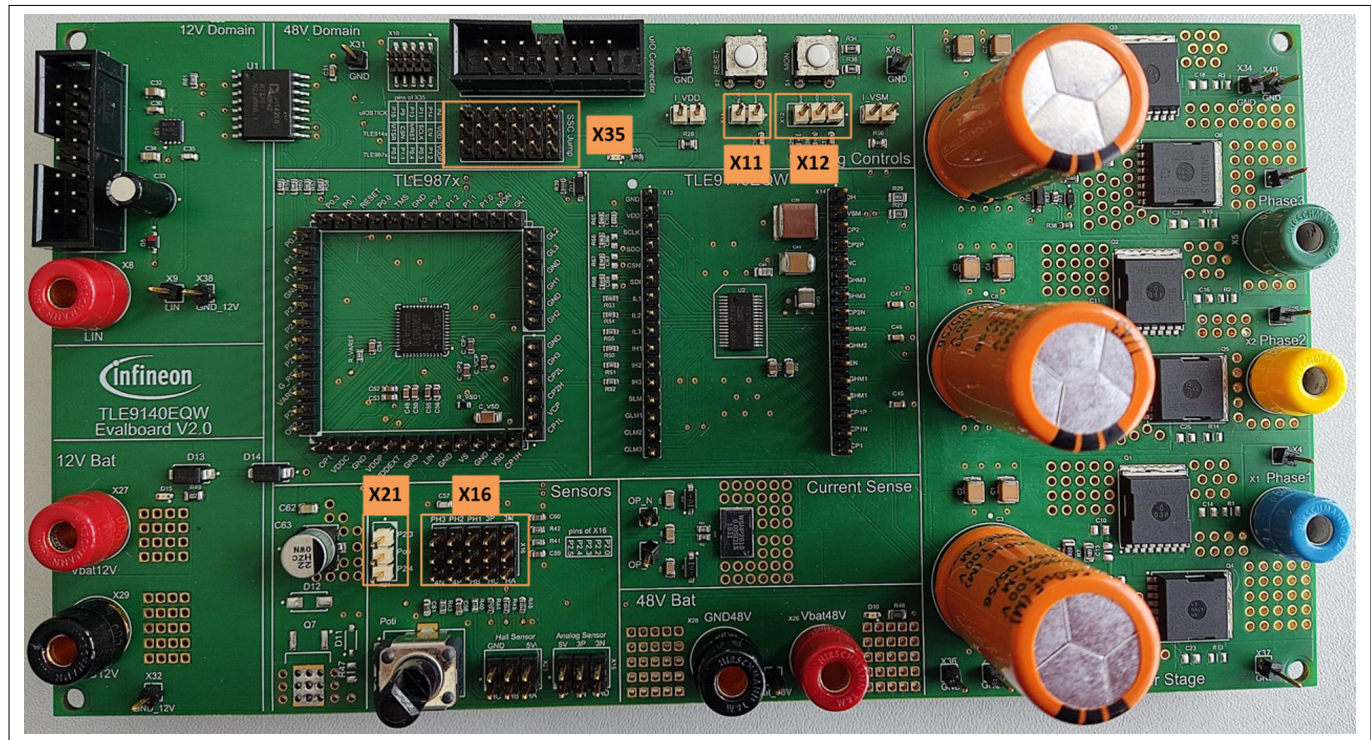


Figure 5 Jumpers on the evaluation board

2.3 Test points

The TLE9140EQW is used to drive the 3-phase half-bridges. All pins of the TLE9140EQW and TLE987X can be tested via the headers. The test points for 3- phases are available on board for easy measurement. Test points OP_P and OP_N is used to measurement the voltage drops across the shunt resistance. Test points I_VDD and I_VSM are used to measure the voltage drop across the 5 mΩ resistance in the VDD and 48 V supply line. The current consumption and the power consumption can be calculated based on the measurement result. In addition, many test points of 48 V supply, 48 V GND and 12 V supply are available on board for measurement.

[illegible]

Figure 6 **Test points on board**

2.4 Component list

1. Use two diodes (D13 and D14) to implement the voltage isolation between 12 V domain and 48 V domain
2. Use a source follower (Q7, C62, C63, R47, D11) to generate 12 V supply from 48 V battery

TLE9140EQW has a current source gate driver. With the sequencer different currents can be selected for charging and discharging phases. The EMC performance can be improved without snubbers, gate-drain capacitance and gate-source capacitance. In case those components are preferred, the soldering places are available on the evaluation board.

Table 10 **Values for optional components**

Q7	N-channel MOSFET
D12	Anti-reverse diode
D11	Zener diode to control Q7 with R47
R47	Resistor to control Q7 with D11
R1	Resistance snubber high-side MOSFET phase 1
C14	Capacitor snubber high-side MOSFET phase 1
C10	Gate-drain capacitor high-side MOSFET phase 1
C13	Gate-source capacitor high-side MOSFET phase 1
R13	Resistance snubber low-side MOSFET phase 1

(table continues...)

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Table 10 (continued) Values for optional components

C23	Capacitor snubber low-side MOSFET phase 1
C19	Gate-drain capacitor low-side MOSFET phase 1
C22	Gate-source capacitor low-side MOSFET phase 1
R2	Resistance snubber high-side MOSFET phase 2
C16	Capacitor snubber high-side MOSFET phase 2
C11	Gate-drain capacitor high-side MOSFET phase 2
C15	Gate-source capacitor high-side MOSFET phase 2
R14	Resistance snubber low-side MOSFET phase 2
C25	Capacitor snubber low-side MOSFET phase 2
C20	Gate-drain capacitor low-side MOSFET phase 2
C24	Gate-source capacitor low-side MOSFET phase 2
R3	Resistance snubber high-side MOSFET phase 3
C18	Capacitor snubber high-side MOSFET phase 3
C12	Gate-drain capacitor high-side MOSFET phase 3
C17	Gate-source capacitor high-side MOSFET phase 3
R15	Resistance snubber low-side MOSFET phase 3
C27	Capacitor snubber low-side MOSFET phase 3
C21	Gate-drain capacitor low-side MOSFET phase 3
C26	Gate-source capacitor low-side MOSFET phase 3

Table 11 Bill of material

Designator	Value	Description	Footprint	Manufacturer Order Number
C1, C4, C7	100nF	Surface Mount Ceramic Capacitor Automotive Grade	CAPC3225X127N	12101C104K4Z2A
C2, C5, C8	2.2uF	Surface Mount Ceramic Capacitor Automotive Grade	CAPC3225X127N	12101C104K4Z2A
C3, C6, C9	560uF	Long-life grade capacitors, Low impedance at high frequency	CAPPRD750W80D1 825H3700B	B41858C9567M000
C10, C11, C12, C19, C20, C21	33pF	Chip Monolithic Ceramic Capacitor	CAPC2013X100N	GRM21A5C2D330J W01
C13, C15, C17, C22, C24, C26	330pF	Chip Monolithic Ceramic Capacitor	CAPC2013X70N	GRM2165C2A331J A01
C14, C16, C18, C23, C25, C27	4.7nF	Farnell: 08051C473KAT2A 100V (optional)	CAPC2013X94N	08055F472KAT2A
C28, C29, C64	1nF	Chip Monolithic Ceramic Capacitor	CAPC2013X70N-0	GCM216R71H102K A37
C30, C31	100nF	Surface Mount Multilayer Ceramic Chip Capacitor	CAPC1608X87N	C0603C104J3RAC

(table continues...)

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Table 11 (continued) Bill of material

Designator	Value	Description	Footprint	Manufacturer Order Number
C32	1uF	Surface Mount Ceramic Capacitor Automotive Grade	CAPC2013X140N-2	08053C105K4Z2A
C33	22uF	High Endurance Radial Leaded Aluminium Electrolytic Capacitor	CAPPRD200W50D500H1200B	ECA1HHG220
C34, C62	100nF	Surface Mount Multilayer Ceramic Chip Capacitor	CAPC2013X88N	C0805C104J5RAC
C35	220pF	Surface Mount Multilayer Ceramic Chip Capacitor	CAPC1608X87N	C0603C221G5GAC
C36, C37, C45, C46, C47	1nF	Chip Monolithic Ceramic Capacitor	CAPC1608X90N	GRM188R71H102J A01, GRM188R72A102K A01
C39	22uF	CAP/CERA/22uF/100V/20% / X7S (EIA) / -55°C to 125°C/ 5750/SMD / -	CAPC5750X310N	C5750X7S2A226M2 80KB
C40	220nF	Chip Monolithic Ceramic Capacitor	CAPC3225X220N	GRM32DR72D224K W01
C41	470nF	CAP/CERA/470nF/200V/10% / X7R (EIA) / -55°C to 125°C/ 1812(4532) / SMD / -	CAPC4532X200N	GRM43DR72D474K W01
C42	470nF	Chip Monolithic Ceramic Capacitor	CAPC2013X135N	GRM21BR71H474K A88
C43	1uF	Chip Monolithic Ceramic Capacitor	CAPC2013X95N	GRM219R7YA105K A12
C44	3.3nF	Chip Monolithic Ceramic Capacitor	CAPC2013X70N-0	GCM216R72A332J A37
C48, C51, C57	470pF	Surface Mount Ceramic Chip Capacitor	CAPC1608X87N	C0603C471G5GAC
C49, C52, C54, C55	100nF	CAP/CERA/100nF/50V/10% / X8R (EIA) / -55°C to 150°C/603/SMD / -	CAPC1608X90N-4	CGA3E3X8R1H104 K080AB
C50	1uF	CAP/CERA/1uF/50V/10% / X5R (EIA) / -55°C to 85°C/603/SMD / -	CAPC1608X90N-4	CGA3E3X5R1H105 K080AB
C53, C56	330nF	Chip Monolithic Ceramic Capacitor	CAPC1608X90N	GRM188R71C334J A01
C58, C59, C60, C61	4.7nF	Surface Mount Multilayer Ceramic Chip Capacitor	CAPC1608X87N	C0603C472F3GAC
C63	22uF	Conductive Polymer Hybrid Aluminum Electrolytic Capacitor, ZC Series, Type V, High temperature Lead-Free reflow	CAPAE660X610N	EEH2C1H220P

(table continues...)

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Table 11 (continued) Bill of material

Designator	Value	Description	Footprint	Manufacturer Order Number
C65	47pF	CAP/CERA/47pF/50V/5% / C0G (EIA) / NP0 / -55°C to 150°C/603/SMD / -	CAPC1608X90N-4	CGA3E2NP01H470 J080AA
C66, C67, C68	47pF	CAP/CERA/47pF/50V/5% / C0G (EIA) / NP0 / -55°C to 150°C/603/SMD / -	CAPC1608X90N-4	CGA3E2NP01H470 J080AA
C_CP1, C_CP2, C_VCP	220nF	CAP/CERA/220nF/50V/10% / X7R (EIA) / -55°C to 125°C/603/SMD / -	CAPC1608X90N-4	CGA3E3X7R1H224 K080AB
C_VSD	10uF	CAP/CERA/10uF/50V/10% / X7R (EIA) / -55°C to 125°C/ 1206/SMD / -	CAPC3216X190N	CGA5L1X7R1H106 K160AC
D1, D2, D3		General-Purpose Zener diode	SODFL2513X80N	BZX100A,115
D4, D16	6.8V	Zener Diode Voltage Regulator 500 mW, 6.8 V ±5%	SOD3716X135N	MMSZ6V8T1G
D5	BAS3010B-03W	Medium Power AF Schottky Diode	SOD2513X110N-V	BAS3010B-03W
D6, D10, D15	Green	Surface Mount LED, Green, 570nm	LEDSC160X80X80-2N	LG Q971-KN-1
D7, D8, D9	4.70V	Zener Voltage Regulator, 4.7V	SOD3716X135N	MMSZ4V7T1G
D11	17V	Zener Voltage Regulator, 17V	SOD3716X135N	MMSZ5247BT1G
D12	ES1D	Surface Mount Fast Rectifier	DIOM5227X250N	ES1D
D13, D14	ES1D	Surface Mount Fast Rectifier	DIOM5227X250N	ES1D
D17	5.60V	Zener Diode 5.6 Volt 500 mW SOD-123	SOD3716X135N	MMSZ5V6T1G
G1	TLE8457ALE	LIN Transceiver with integrated Voltage Regulator, VCC 5V	SON65P300X300X 110-9N	TLE8457ALE
I_VDD, I_VSM, X11	HTSW-102-07-L-S	Through hole .025 SQ Post Header, 2.54mm pitch, 2 pin, vertical, single row	HDRV2W64P254_1 X2_496X248X838B	HTSW-102-07-L-S

(table continues...)

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Table 11 (continued) Bill of material

Designator	Value	Description	Footprint	Manufacturer Order Number
Jumper1, Jumper2, Jumper3, Jumper4, Jumper5, Jumper6, Jumper7, Jumper8, Jumper9, Jumper10, Jumper11, Jumper12, Jumper13, Jumper14	SNT-100-BK-G-H	Jumper, 1x2-Positions, Pitch 2,54mm, Body 5,08x2,54mm, black, Au, with handle	CON-F-SOC-JMP-254-1X2-BK-G-H	SNT-100-BK-G-H
OP_N, OP_P, Vbat_48V, X4, X6, X7, X9, X31, X32, X33, X34, X36, X37, X38, X39, X40, X45, X46	TSW-101-22-L-S	Through hole .025" SQ Post Header, 1 pin, vertical	CON-M-THT-TSW-101-22-L-S	TSW-101-22-L-S
Poti	10k	Compact type potentiometer	POT-THT-RK09K113	RK09K1130AAU
Q1, Q2, Q3, Q4, Q5, Q6	IAUT300N10S5N015	OptiMOS™ 5 Power-Transistor, 100V	INF-PG-HSOF-8-1-0-V	IAUT300N10S5N015
Q7	AUIRLR014N	HEXFET® Power MOSFET, VDSS 55V, ID 10A	TO229P991X239-3_4N	AUIRLR014N
R1, R2, R3, R13, R14, R15, R47	100k	Standard Thick Film Chip Resistor	RESC2113X50N	CRCW0805100KFK
R4, R5, R6, R16, R17, R18	2.2R	High Power Thick Film Chip Resistor 2.2 Ohm, 200 V	RESC3116X65N-2	CRCW12062R20FK EAHP
R7, R8, R9, R19, R20, R21	100k	Standard Thick Film Chip Resistor	RESC2113X50N	CRCW0805100KFK
R10, R11, R12	0R	Standard Thick Film Chip Resistor	RESC2113X50N	CRCW08050000Z0
R22, R24	12R	Standard Thick Film Chip Resistor	RESC1609X50N	CRCW060312R0FK
R23	5mR	Power Metal Strip Resistor	RES-SMD-WSHM2818	WSHP28185L000F EA
R25	1k	RES/STD/1k/100mW/1% / 100ppm/K / -55°C to 155°C/ 0603/SMD / -	RESC1609X50N	CRCW06031K00FK
R26, R39	10k	General Purpose Chip Resistor	RESC1608X55N-1	RC0603FR-0710KL
R27	2.2R	Standard Thick Film Chip Resistor	RESC2113X50N	CRCW08052R20FK

(table continues...)

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Table 11 (continued) Bill of material

Designator	Value	Description	Footprint	Manufacturer Order Number
R28, R56	10mR	Current Sensing resistor	RESC2113X50N	ERJ-6CWDR010V
R29	150R	Standard Thick Film Chip Resistor	RESC2113X50N	CRCW0805150RFK
R30	5.6k	Standard Thick Film Chip Resistor	RESC1609X50N	CRCW06035K60FK
R31, R33, R37	30k	Standard Thick Film Chip Resistor	RESC1609X50N	CRCW060330K0FK
R32, R35, R38	3k	Standard Thick Film Chip Resistor	RESC1609X50N	CRCW06033K00FK
R34	102k	Standard Thick Film Chip Resistor	RESC2113X50N	CRCW0805102KFK
R36	34k	Standard Thick Film Chip Resistor	RESC2113X50N	CRCW080534K0FK
R40, R41, R42, R43	2.15k	Standard Thick Film Chip Resistor	RESC1609X50N	CRCW06032K15FK
R44, R45, R46	4.7k	General Purpose Chip Resistor	RESC1608X55N-1	RC0603FR-074K7L
R48	39k	Standard Thick Film Chip Resistor	RESC2113X50N	CRCW080539K0FK
R49	10k	General Purpose Chip Resistor	RESC2013X60N	RC0805FR-0710KL
R50, R51, R52, R53, R54, R55, R57, R58, R59, R60, R61, R65, R66, R67, R68	0R	0R/75V/1%, RES/STD/0R/100mW/1% / 200ppm/K / -55°C to 155°C/0603/SMD / -	RESC1608X55N-1	RC0603FR-070RL
R_VAREF	200R	Standard Thick Film Chip Resistor	RESC1609X50N	CRCW0603200RFK
R_VSD1	2R	Standard Thick Film Chip Resistor	RESC1609X50N	CRCW06032R00FK
S1, S2	B3W-1000	THT Sealed Tactile Switch, Without ground terminal, SPST-NO, 4 Pins	SW-THT-B3W-1000	B3W-1000
U1	ADUM142E0BRWZ	Quad Digital Isolator	SOIC127P1032X26 5-16N-3	ADUM142E0BRWZ
U2	TLE9140EQW	MOTIX™ 48 V/24 V bridge driver	PG-TSDSO-32-1	TLE9140EQW
U3	IFX_TLE9879QXA40	Microcontroller with LIN and BLDC MOSFET Driver for Automotive Applications	QFN50P700X700X 90-49N-3	TLE9879QXA40
X1	930 176-102	Socket with Insulated Head and Ring, M6 Thread, Blue, 60 Vdc, 32A	CON-F-THT-930 176-102	930 176-102

(table continues...)

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Table 11 (continued) Bill of material

Designator	Value	Description	Footprint	Manufacturer Order Number
X2	930 176-103	Socket with Insulated Head and Ring, M6 Thread, Yellow, 60 Vdc, 32A	CON-F-THT-930 176-103	930 176-103
X5	930 176-104	Socket with Insulated Head and Ring, M6 Thread, Green, 60 Vdc, 32A	CON-F-THT-930 176-104	930 176-104
X8, X26, X27	9.3E+08	Socket with Insulated Head and Ring, M6 Thread, Red, 60 Vdc, 32A	CON-F-THT-930176701	930176701
X10	FTSH-105-01-L-DV	SMT Micro Header, 1.27mm Pitch, 10 Pin, Vertical, Double Row, DAP	CON-M-SMD-FTSH-105-01-L-DV	FTSH-105-01-L-DV
X12, X21	HTSW-103-07-G-S	Through hole .025" SQ Post Header, 2.54mm pitch, 3 pin, vertical, single row	CON-THT-2.54-3-1-8.38	HTSW-103-07-G-S
X13, X14	TSW-116-07-L-S	Through hole .025" SQ Post Header, 2.54mm pitch, 16 pin, vertical, single row	HDRV16W64P254_1X16_4070X254X838B	TSW-116-07-L-S
X15, X23	TSW-103-08-G-D	2.54mm Pitch Header Strip, 6 pins, vertical, double row	HDRV6W64P254_3X2_508X762X838B	TSW-103-08-G-D
X16	TSW-105-07-G-T	THROUGH-HOLE .025" SQ POST HEADER	CON-M-THT-TSW-105-07-G-T	TSW-105-07-G-T
X17, X22	TSW-106-07-L-S	Through hole .025" SQ Post Header, 2.54mm pitch, 6 pin, vertical, single row	CON-M-THT-TSW-106-07-L-S	TSW-106-07-L-S
X18, X19, X20	TSW-112-07-L-S	Through hole .025" SQ Post Header, 2.54mm pitch, 12 pin, vertical, single row	HDRV12W64P254_1X12_3048X254X898B	TSW-112-07-L-S
X24, X25	SBH11-PBPC-D08-ST-BK	Through hole .100" Male Shrouded Box Header, 16 pin, vertical, double row	CON-M-THT-SBH11-PBPC-D08-ST-BK	SBH11-PBPC-D08-ST-BK
X28, X29	9.3E+08	Socket with Insulated Head and Ring, M6 Thread, Black, 60 Vdc, 32A	CON-F-THT-930176700	930176700
X35	TSW-106-07-G-T	Conn Unshrouded Header HDR 18 POS 2.54mm Solder ST Thru-Hole	CON-M-THT-TSW-106-07-G-T	TSW-106-07-G-T

2.5 Schematic

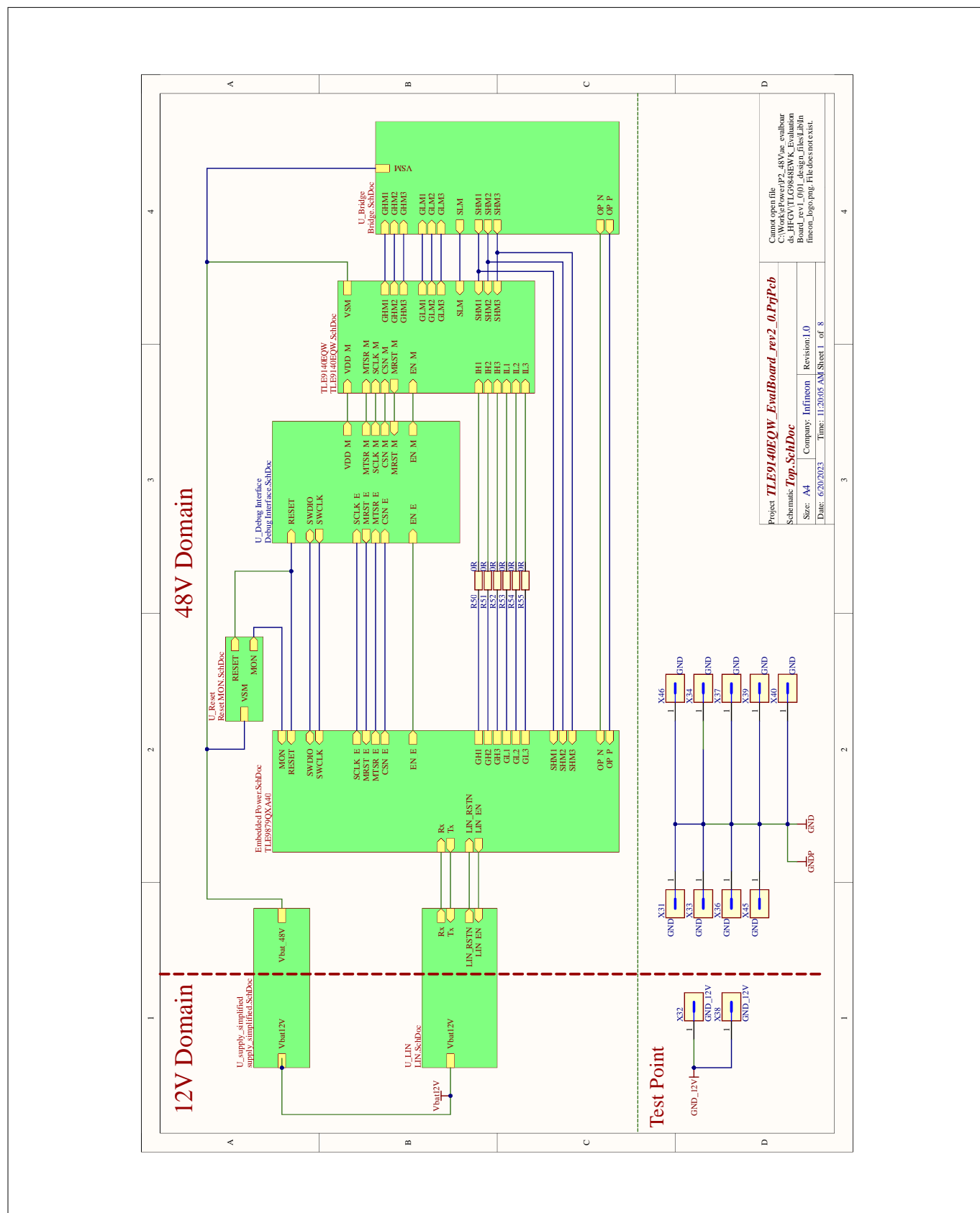


Figure 7 **Schematic 1/8**

2 Evaluation board description

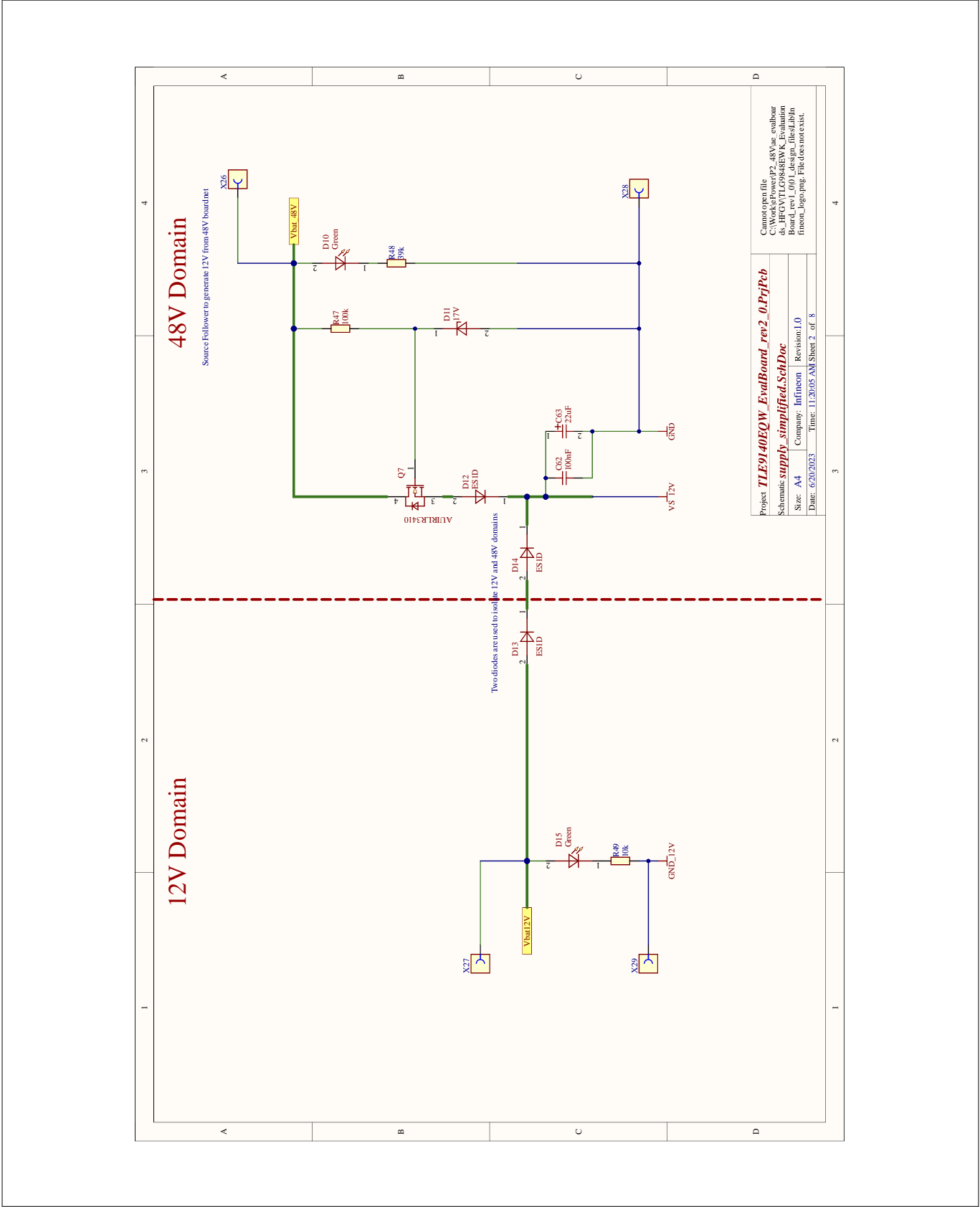


Figure 8 Schematic 2/8

2 Evaluation board description

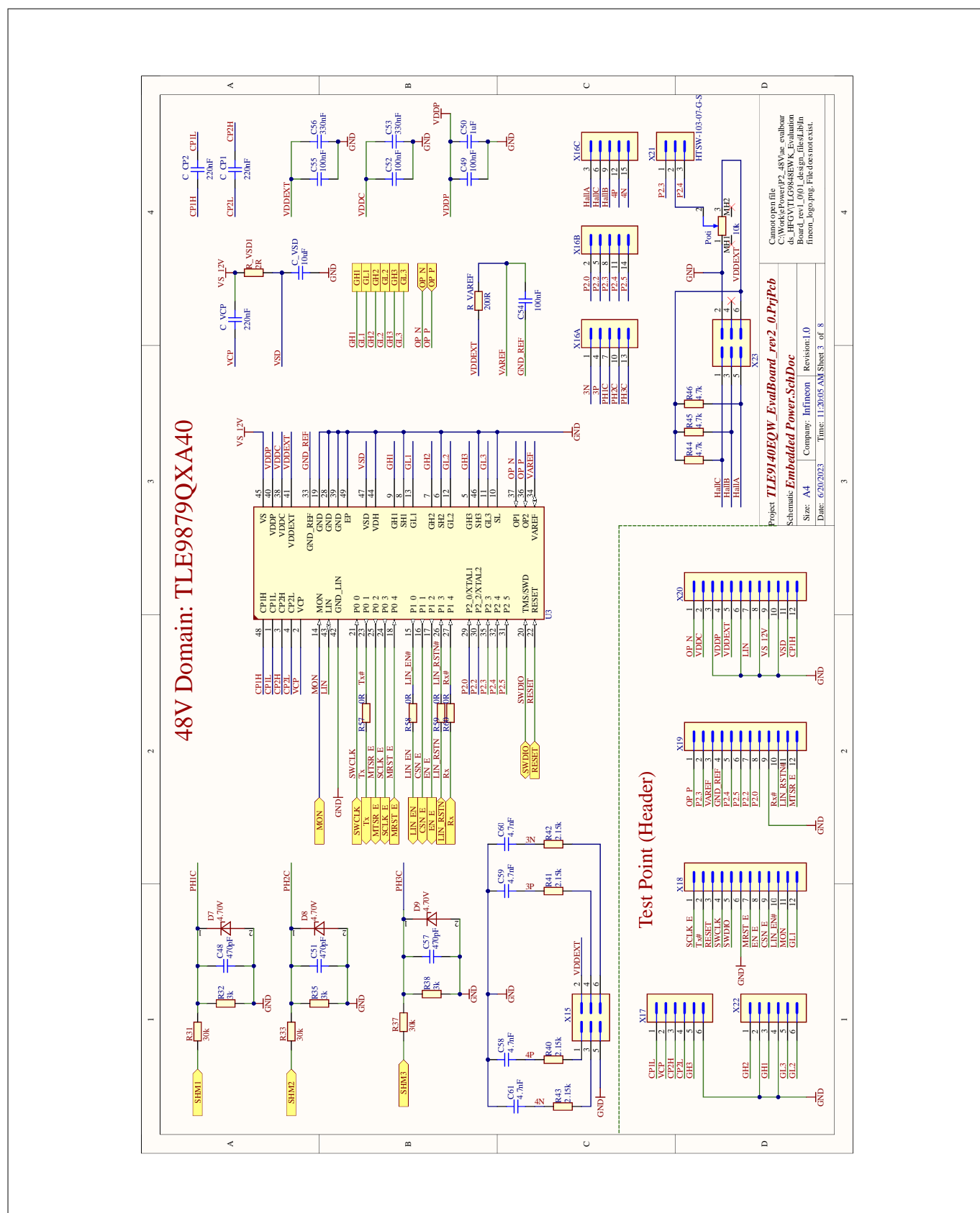


Figure 9 **Schematic 3/8**

2 Evaluation board description

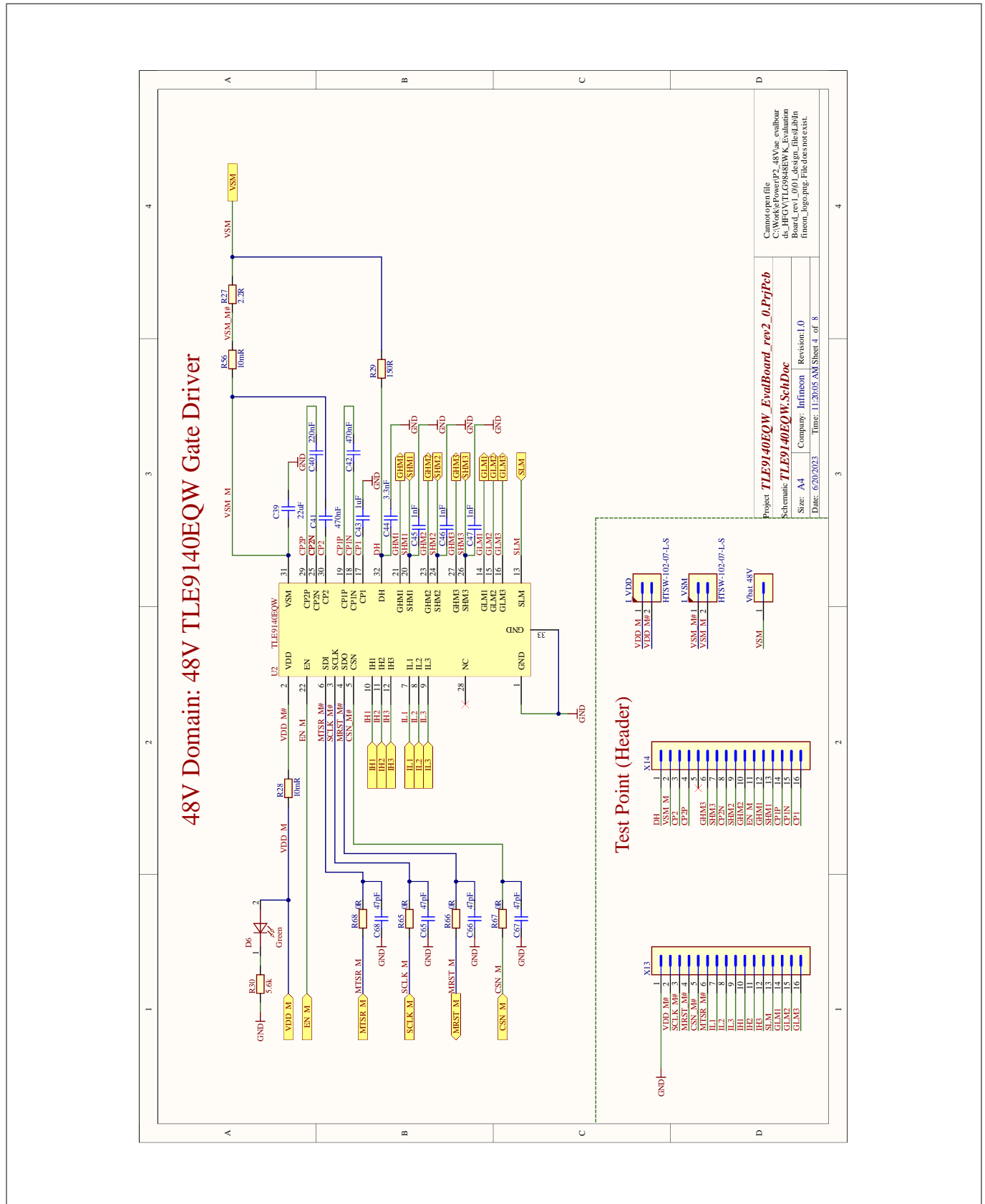


Figure 10 Schematic 4/8

2 Evaluation board description

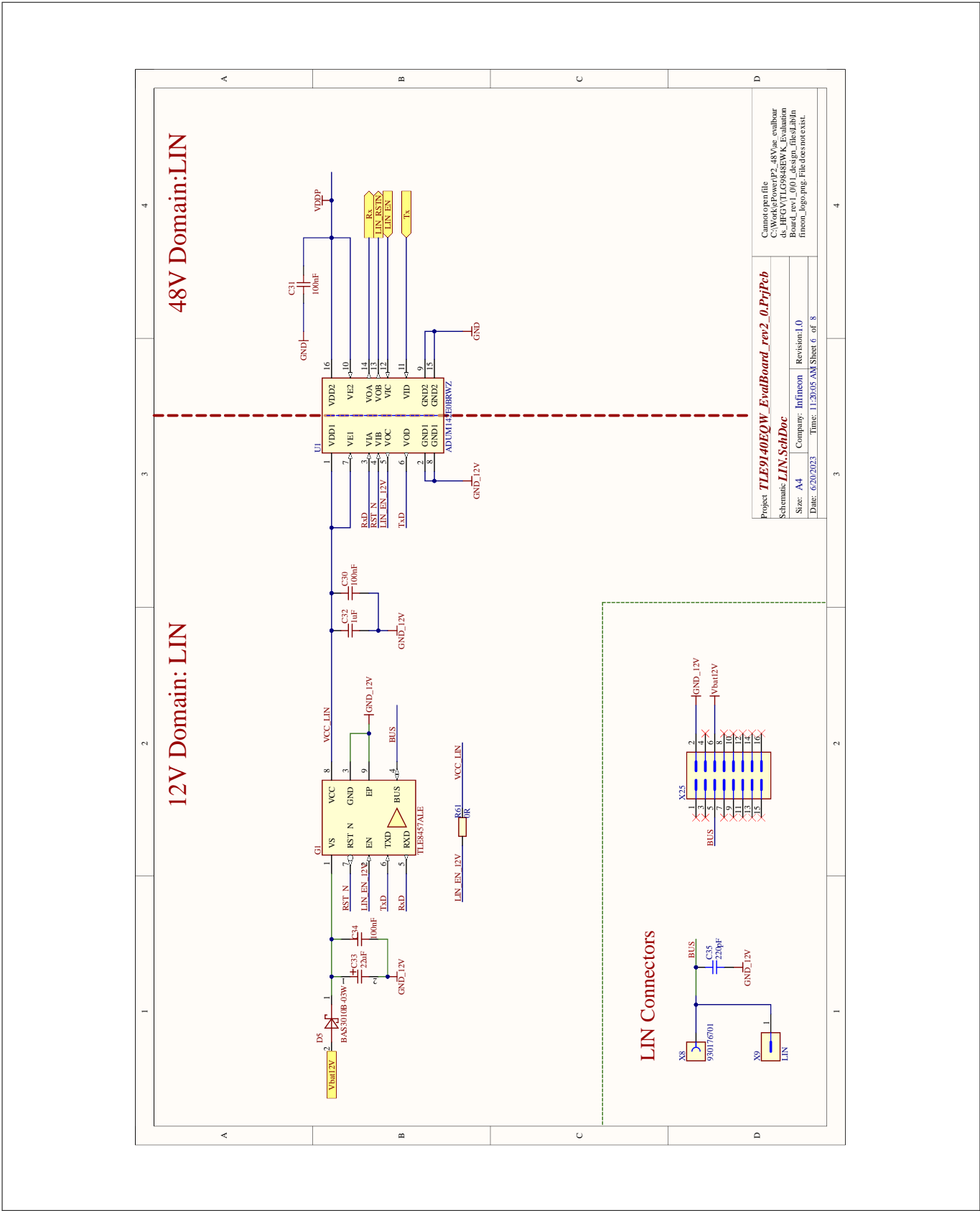


Figure 12 Schematic 6/8

2 Evaluation board description

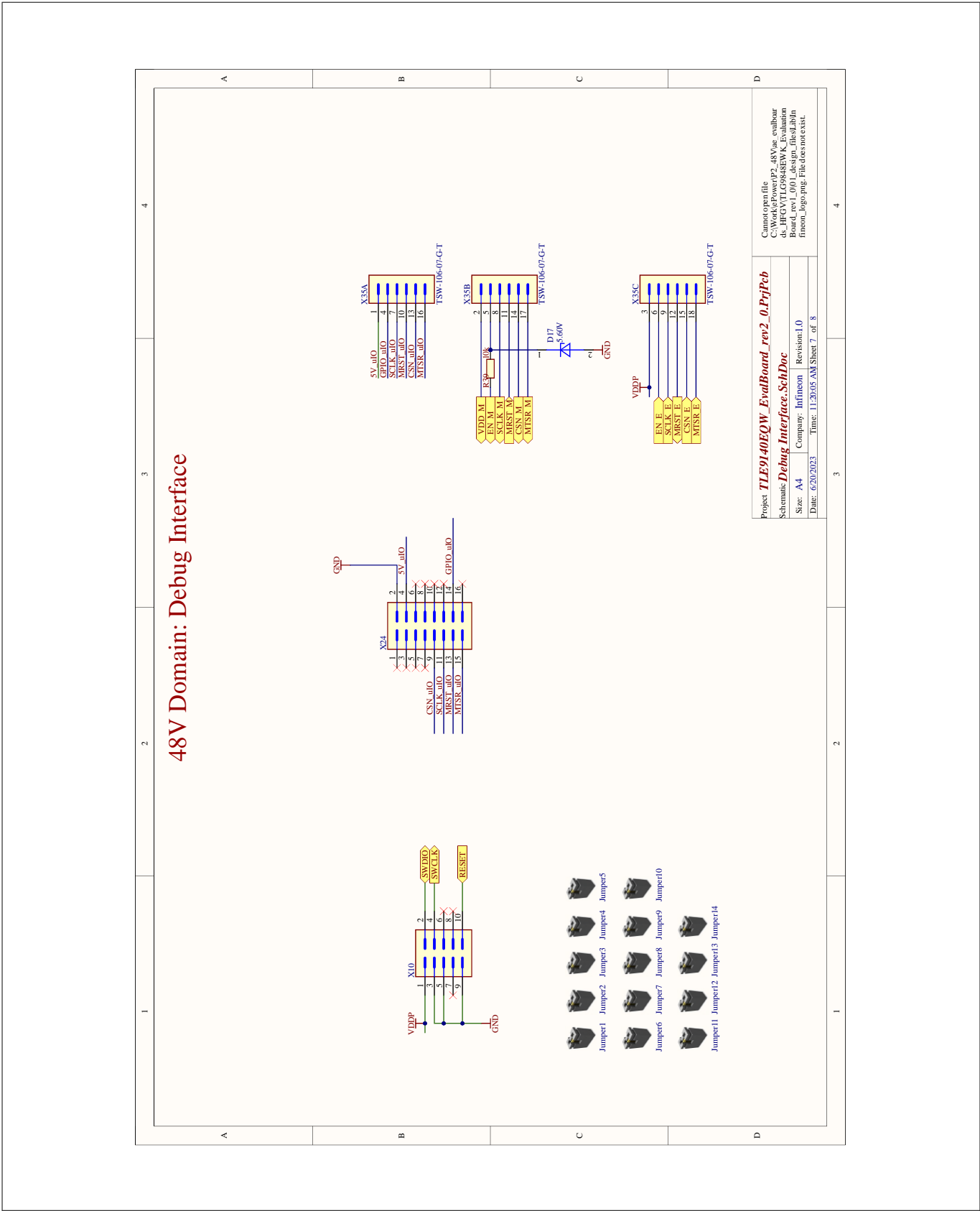


Figure 13 Schematic 7/8

48V Domain: RESET and MON

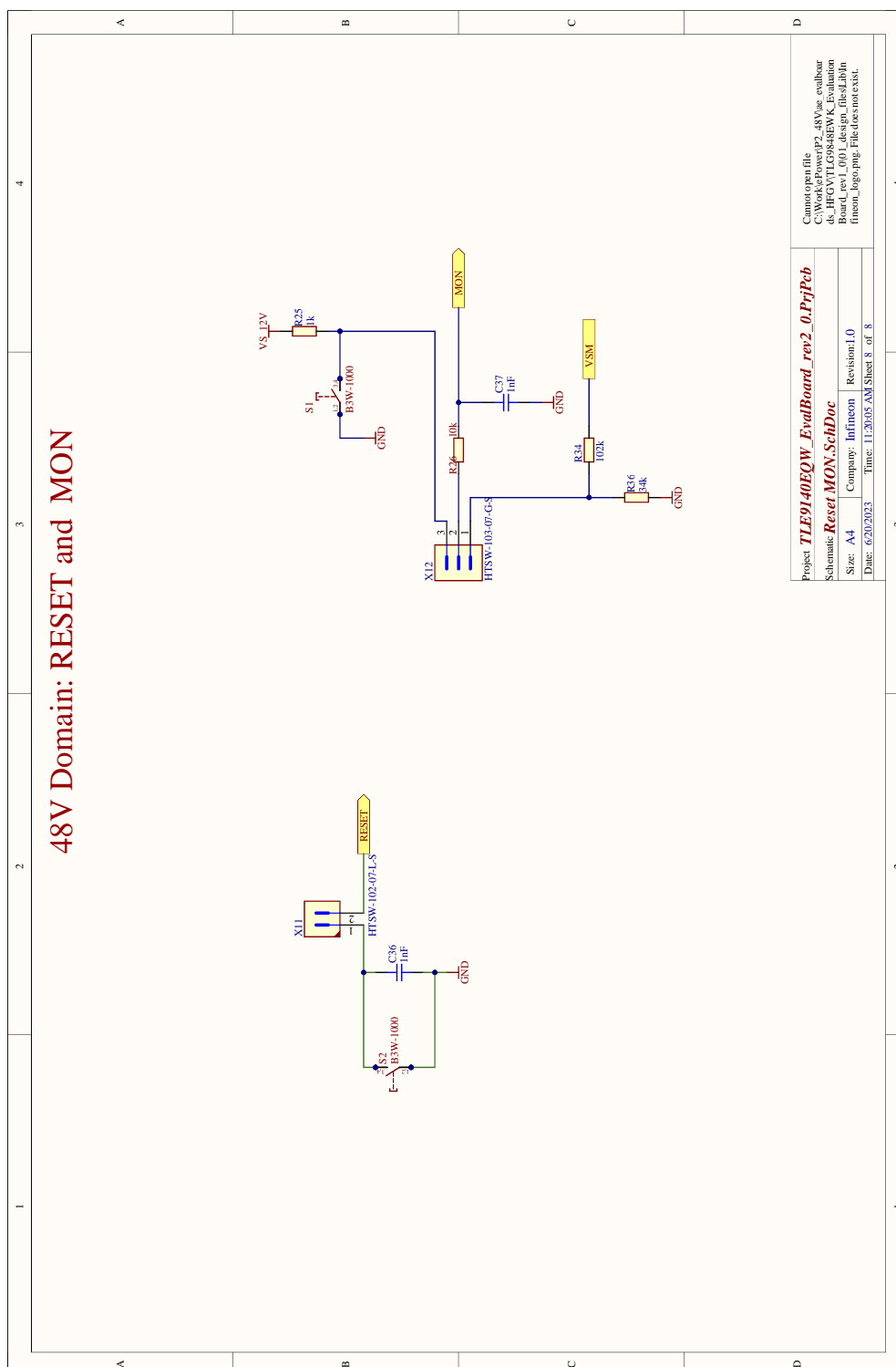


Figure 14 **Schematic 8/8**

2 Evaluation board description

2.6 Layout

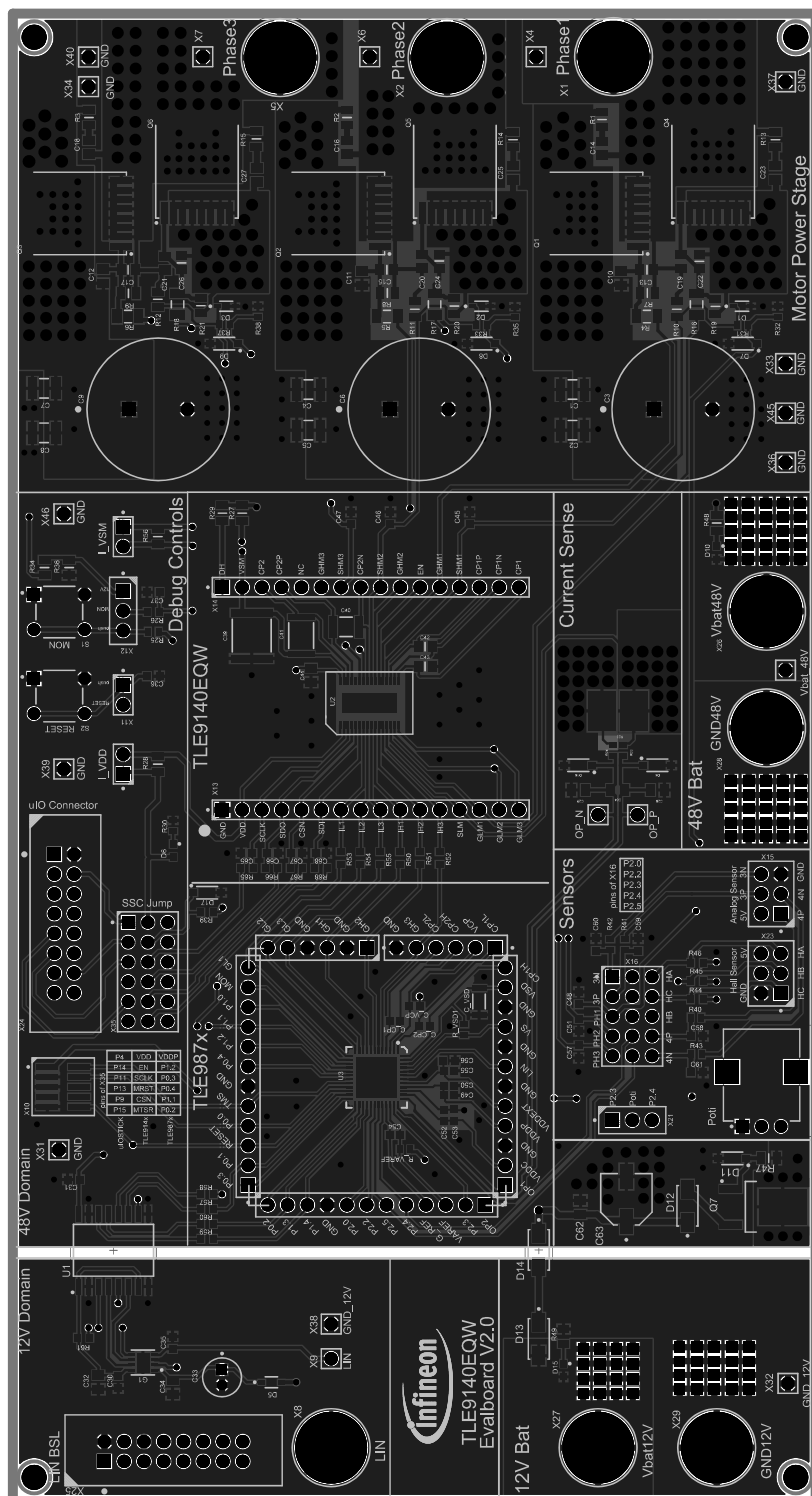


Figure 15 Top layer

3 Getting started

3 Getting started

3.1 Target applications

The target application of TLE9140EQW device is 48 V/24 V DC and BLDC motor control. In the evaluation board the TLE9140EQW with required external components are available to support the evaluation of the device itself and the applications.

3.2 Evaluation setups

Two setups can be used to evaluation the TLE9140EQW device with the evaluation board. Example code is available for the setup “TLE9140EQW + TLE987x” (refer to the [TLE987x_TLE9140_FOC_App](#)) to support the evaluation. The config wizard can be used to have an easy evaluation for the setup “TLE9140EQW + uIO-Stick + input generator” (refer to the [Config Wizard for MOTIX™ BLDC Motor Gate Driver ICs](#)).

3.2.1 Getting started: TLE9140EQW driven by TLE987x

The getting started steps are based on an application software example provided in the delivery package, named TLE987x FOC sensorless example with TLE9140. This application example integrates the relevant software components of the Motor Control Demo for TLE9140EQW and the low level driver to run on the evaluation board with TLE9140EQW and TLE987x in a Keil® µVision® 5 software project. This software example is designed to drive a motor in two configurable control modes:

- Sensorless FOC mode
- V to F (voltage to frequency) mode

Hardware setup

- A 48 V bipolar (4Q) power supply with adjustable output voltage that is capable to backsupply (in generator mode) and to deliver a current sufficient for turning the designed motor
- The evaluation board with TLE9140EQW and TLE987x connected to the power supply and connected to the PC via XMC™ link - isolated debug probe based on the Segger J-Link interface
- Evalboard V2.0 with TLE987x
- Specific hardware settings:
 - Jumpers X35 must be set for SPI communication between TLE987x and TLE9140EQW and to provide VDD (digital supply) of TLE9140EQW
 - Jumper X12 (MON of TLE987x) must be connected to the 12 V on Evalboard V2.0
 - The ground lines of 12 V and 48 V need to be connected externally

Software preparation

For the evaluation of the TLE987x-eSL-Demo-TLE9140 Motor Control Library using the demo software example, the following software tool chain in MS Windows is required:

- Arm® Keil® µVision® 5, an integrated development environment (IDE)
- Infineon Embedded Power SDK (LLD) integrated in Keil® µVision® 5
- Segger J-Link Driver
- Infineon Config Wizard installed in Infineon Toolbox
- Micro Inspector Pro installed in Infineon Toolbox

Getting started steps

- Load the provided application software example project FOC.uvprojx in Keil® µVision® 5
- Choose the corresponding hardware target device in Keil® µVision® 5
- Configure the motor parameters in Config Wizard

3 Getting started

- Build the Keil® µVision® 5 project
Expected result: compiled successfully without any error or warning
 - In Keil® µVision® 5, configure the connection to the target device to use the XMC™ Link - Isolated Debug Probe based on the Segger J-Link
 - In Keil® µVision® 5, download the compiled code to the target flash memory
 - Launch Micro Inspector Pro from Infineon Toolbox
 - Load the workspace file "microInspector.wsp" provided in the corresponding "microinspector" folder in the example project
 - Run the Micro Inspector project and take the control on the software execution:
 - Switch "Enable power stage" on
 - Switch "Enable control" on
 - Set a reference motor speed from the cursor
 - Expected result: The motor starts turning
- More details are described in the document "Motor Control Demo for TLE9140EQW with TLE987x".

3.2.2 Getting started: TLE9140EQW driven by config wizard with a pulse generator

In this setup the uIO-Stick is the interface between the PC and the TLE9140EQW evaluation board. It is controlled by the PC software and emulates the SPI communication as shown in Figure 7.

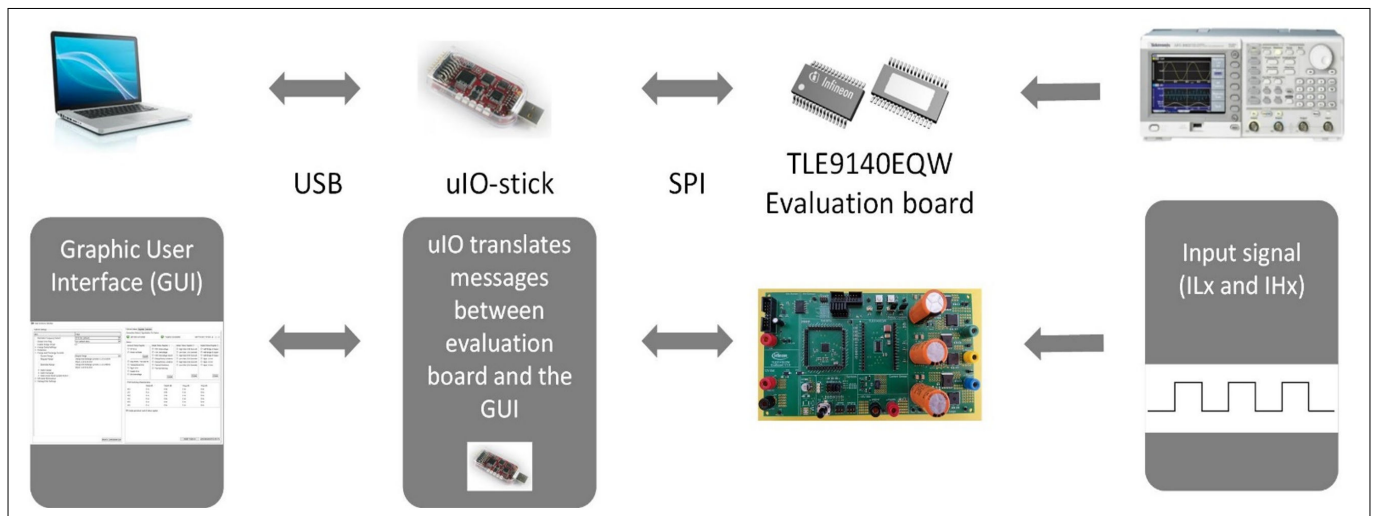


Figure 16 TLE9140EQW driven by config wizard with a pulse generator

Hardware setup

- A 48 V bipolar (4Q) power supply with adjustable output voltage that is capable to backsupply (in generator mode) and to deliver a current sufficient for turning the designed motor
- The evaluation board with TLE9140EQW connected to the power supply and connected to the PC via uIO-Stick
- Evalboard V2.0 with TLE9140EQW
- Specific hardware settings:
 - Jumpers X35 must be set for SPI communication between uIO-Stick and TLE9140EQW and to provide VDD (digital supply) of TLE9140EQW
 - Inputs pins IHx and ILx are connected the output of the pulse generator

3 Getting started

Software preparation

Install Config Wizard for MOTIX™ BLDC Motor Gate Driver ICs

Getting started steps

- Set the jumper for the test mode: SPI connection between TLE9140EQW and the uIO-Stick
- Connect the pulse generator to the inputs of the TLE9140EQW device
- Connect the motor or the load
- Connect the uIO-Stick to the TLE9140EQW evaluation board and to the PC
- Connect the 48 V or 24 V power supply
- Turn on the 48 V or 24 V power supply
- Start the TLE9140EQW Config Wizard
- To operate the half-bridges:
 - Enable the charge pump
 - Provide the proper input signals with the pulse generator
 - Configure the MOSFET driver timings and currents
 - Enable the gate driver
 - Update the configuration

For more details please click the question mark in Config Wizard for MOTIX™ BLDC Motor Gate Driver ICs to download the document “Config Wizard Tool for MOTIX™ BLDC Motor Gate Driver IC for TLE9140EQW”.

4 Start your evaluation

4 Start your evaluation

Now you have the basic setup to investigate the device. You can make the evaluation with the evaluation board in different application conditions such as different supply voltages, PWM frequency, duty cycle, temperatures or with different motor loads.

In case you have further questions for the setup please contact your IFX sales representative or the [IFX technical support](#).

Revision history

Document version	Date of release	Description of changes
Rev. 5.0	2024-08-23	<ul style="list-style-type: none">• Add of bill of material• Add of schematic and layout
Rev. 4.0	2023-12-13	<ul style="list-style-type: none">• Correct typos (refer to evaluation board v2.0)
Rev. 3.0	2023-08-01	<ul style="list-style-type: none">• Add config wizard chapter (refer to evaluation board v2.0)
Rev. 2.0	2020-08-01	<ul style="list-style-type: none">• Refer to evaluation board v2.0
Rev. 1.0	2019-11-01	<ul style="list-style-type: none">• Initial release (refer to evaluation board v1.0)

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