DOT247 3-Phase Inverter Evaluation Board

User’s Guide

User’s Guide

＜High Voltage Safety Precautions＞

◇ Read all safety precautions before use

Please note that this document covers only Half Bridge SiC Module Evaluation Driver Board (SCZ4006KTAC23-EVK-A13) and its functions. For additional information, please refer to the datasheet.

To ensure safe operation, please carefully read all precautions before handling the evaluation board

Depending on the configuration of the board and voltages used,

Potentially lethal voltages may be generated.

Therefore, please make sure to read and observe all safety precautions described in the red box below.

Before Use

[1] Verify that the parts/components are not damaged or missing (i.e. due to the drops).
[2] Check that there are no conductive foreign objects on board.
[3] Be careful when performing soldering on the module and/or evaluation board to ensure that solder splash does not occur.
[4] Check that there are no condensation or water droplets on the circuit board.

During Use

[5] Be careful do not allow conductive objects to come into contact with the board.
[6] **Brief accidental contact or even bringing your hand close to the board may result in discharge and lead to severe injury or death.**

Therefore, DO NOT touch the board with your bare hands or bring them too close to the board. In addition, as mentioned above please exercise extreme caution when using conductive tools such as tweezers and screwdrivers.

[7] If used under conditions beyond its rated voltage, it may cause defects such as short-circuit, depending on the circumstances, explosion or other permanent damages.
[8] It is imperative to wear insulated gloves when handling equipment during operational procedures.

After Use

[9] The ROHM Evaluation Board contains the circuit which stores high voltage. Since it stores the charges even after the connected power circuits are cut, please discharge the electricity after using it, and please deal with it after confirming such electric discharge.
[10] Protect against electric shocks by wearing insulated gloves when handling.

This evaluation board is intended for use only in research and development facilities and should be handled **only by qualified personnel familiar with all safety and operating procedures.**

We recommend carrying out operations in a safe environment that includes the use of high voltage signage at all entrances, safety interlocks, and protective glasses.

DOT247 3-Phase Inverter Evaluation Board

SCZ4006KTAC23-EVK-A13

This document outlines the design, implementation, and performance analysis of a three-phase inverter system utilizing 1200V Silicon Carbide (SiC) MOSFETs, tailored for demanding applications such as photovoltaic (PV) inverters, uninterruptible power supplies (UPS), motor drives, switch-mode power supplies (SMPS), servers, and other industrial-grade applications.

Traditionally, inverter systems operating at 750Vdc have utilized 1200V Insulated Gate Bipolar Transistors (IGBTs) as switching devices. However, recent advancements in SiC MOSFETs offer significant advantages over IGBTs, including lower on-resistance, higher power density, faster switching speeds, and improved overall efficiency. This design capitalizes following benefits by replacing conventional IGBTs with SiC MOSFETs, resulting in enhanced thermal performance, reduced switching losses, and greater system reliability.

Key Components

- **SCZ4006KTAC23**: A robust SiC MOSFET with 6mΩ Rds_on in a compact 2-in-1, is selected for its excellent thermal and electrical characteristics, making it ideal for this current application.
- **BM61S41RFV-CE2**: A high-speed, isolated gate driver with 4A source and sink current capability ensures precise and reliable switching of SiC MOSFETs, contributing to the overall efficiency and stability of the inverter system.
- **PSR100KTQFH1L00:** This resistor is ideal for current sensing in high power applications, especially in automotive and industrial grade applications due to its high-power dissipation and low resistance.
- **LMR1802G-LBTR:** low-noise, low input offset voltage CMOS operational amplifier, designed for high-precision analog signal processing in Industrial applications.

Typical Application Circuit

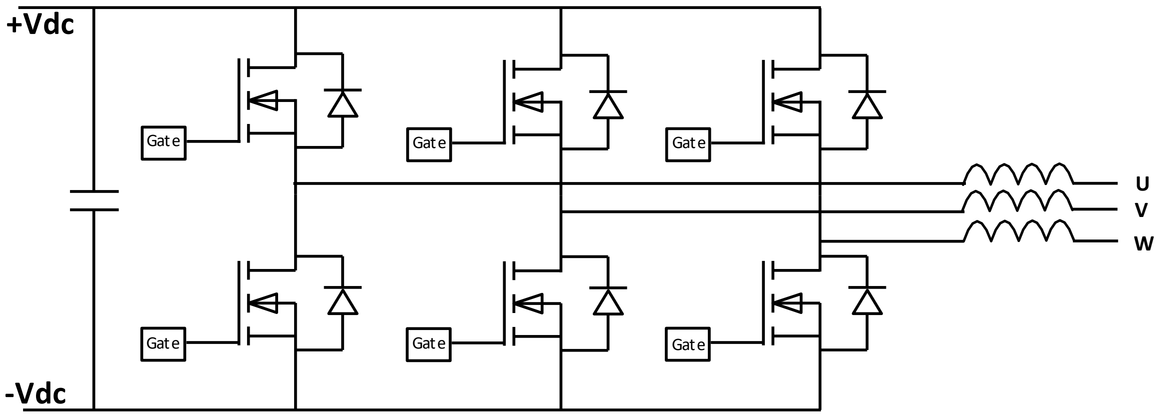


Figure 1. Application diagram

Table of Contents

1 Overview of the EVK

This manual provides instructions for using the EVK board to evaluate DOT247 devices in a three-phase inverter configuration. Users are advised to read the manual thoroughly before starting any test. The board includes gate driver and sensing board for driving gate signals and monitoring voltage and current.

Key features:

- **Compact Design:** Reduced cooling requirements and smaller footprint.
- **High Switching Frequency:** Optimizes the magnetics and filters.
- **Higher Efficiency**: low $R_{DS(on)}$ of 6 mΩ and a thermal resistance (R_{thJC}) of 0.17°C/W, the device offers reduced conduction and switching losses, along with improved thermal performance.
- **Scalable Architecture**: Easily adaptable for different power levels and applications.

2 Functional Block Diagram

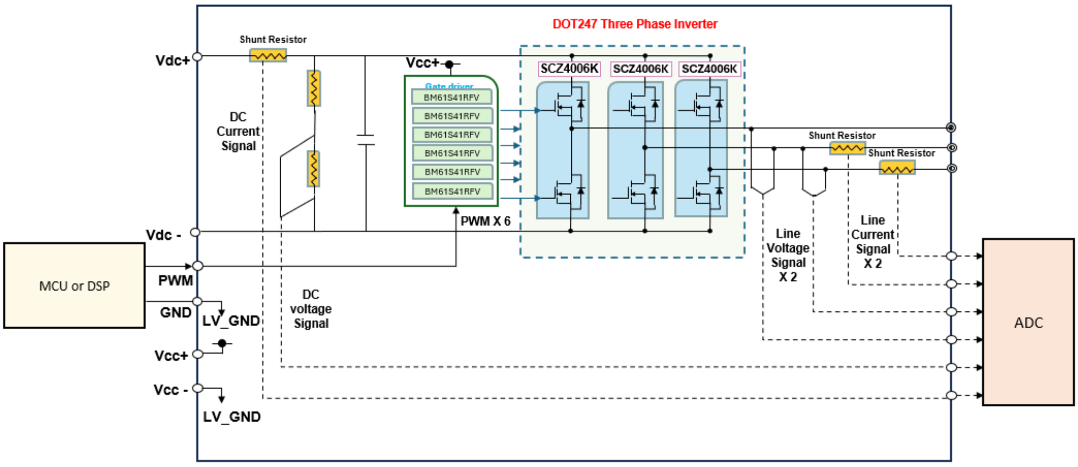


Figure 2. Three Phase Inverter Functional Block Diagram

2.1 Functional Description

The inverter operates through a series of well-defined stages:

DC Input Stage

This stage receives power from sources such as photovoltaic (PV) panels, battery banks, or rectified AC supplies. The input voltage should be regulated and conditioned to 750V_{dc} for ensuring stable operation of the power stage. External Input filtering and surge protection are implemented to safeguard against the voltage spikes and transient immunities.

Power Stage

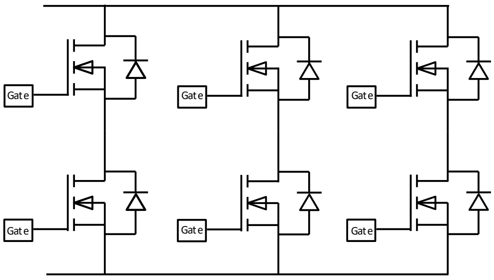


Figure 3. Power Stage circuit

The core of the inverter consists of three half-bridge modules using SiC MOSFETs (SCZ4006KTAC23). The MOSFETs are driven from the control circuitry to synthesize a sinusoidal AC waveform from the DC input.

Gate Driver Circuitry

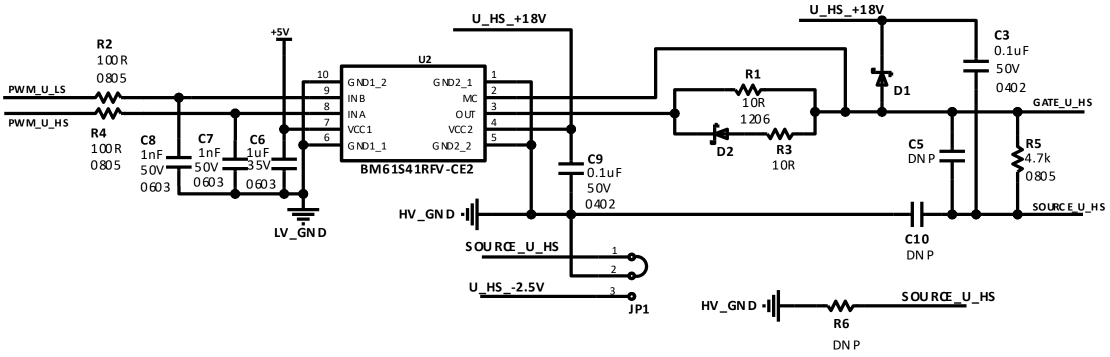


Figure 4. Gate driver circuit

Each SiC MOSFET is driven by a high-speed, isolated gate driver (BM61S41RFV-CE2) with isolation level of 3750Vrms. Isolation between control and power stages ensures safety and noise immunity, which is critical in high-voltage environments.

Gate resistors play a critical role in the performance and reliability of SiC MOSFET-based power circuits. When using a gate driver like the BM61S41RFV-CE2, selecting the appropriate gate resistor is essential to balance switching speed, EMI, and thermal performance.

Key Factors in Gate Resistor Selection

1. Switching Speed vs. EMI
   Lower Rg results in faster switching but higher EMI and overshoot
   Higher Rg slows switching, reducing EMI but increasing switching losses

2. Gate Charge and Drive Current
For detailed guidelines on gate driver circuit design, refer to the ROHM documentation provided at the link below.
https://fscdn.rohm.com/en/products/databook/applinote/discrete/sic/mosfet/gate_drive_circuit-design_guidelines_an-e.pdf

3. Damping Oscillations
   Use a series resistor close to the gate pin
   Split gate resistors can be used for turn-on and turn-off control

Control Logic and PWM Generation

The inverter's control system typically implemented using an external MCU to generate precise PWM signals and regulate output voltage, frequency. It also monitors system parameters such as current, voltage, and temperature to implement protection features like overcurrent shutdown.

Inductive Load

CVE3527H-220M (22 μH) from Sagami, with a DC saturation current of 28 A; 40 units are connected in series to achieve a total inductance of 880 μH.

The output of the inverter is used to drive 20A of current on to a balanced 3 phase star inductive load (880uH/28A).

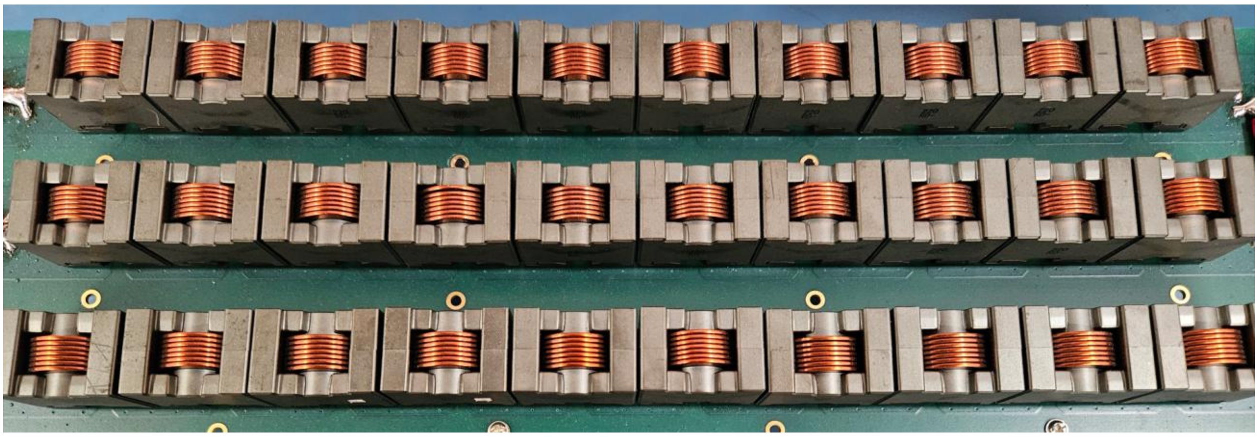


Figure 5. Inductive Load for three Phase Inverter Testing

Thermal Management

In this Reference design we have considered **LAM 5 170 ME** customised heat sink from fisher electronics to meet the thermal requirement for 10kVA and 20A of continuous current using a forced cooling (Fan) method.

LAM 5 170 ME Heat sink Specifications

Table 1. Heat Sink Specifications

Attribute	Specification
Series	LAM 5
Dimensions (W x H x L)	50 mm x 50 mm x 170 mm
Thermal Resistance	Vary with the Air flow

DC0502024M2B-2T0 – 24VDC Axial Fan Specifications

Wakefield Thermal 50mm by 50mm by 20mm, 2BALL DC Fan - DC0502024M2B-2T0

Table 2. Fan Specifications

Parameter	Specification
Dimensions	50mm x 50mm x 20mm
Rated Voltage	24VDC
Current Rating	0.210 A
Power Consumption	5.04 W
Speed	6400 RPM
Air Flow	17.6 CFM (0.493 m³/min)
Noise Level	36 dB(A)

Operating Temperature	-10°C to +70°C (14°F to 158°F)
Lifetime	70,000 hours @ 40°C

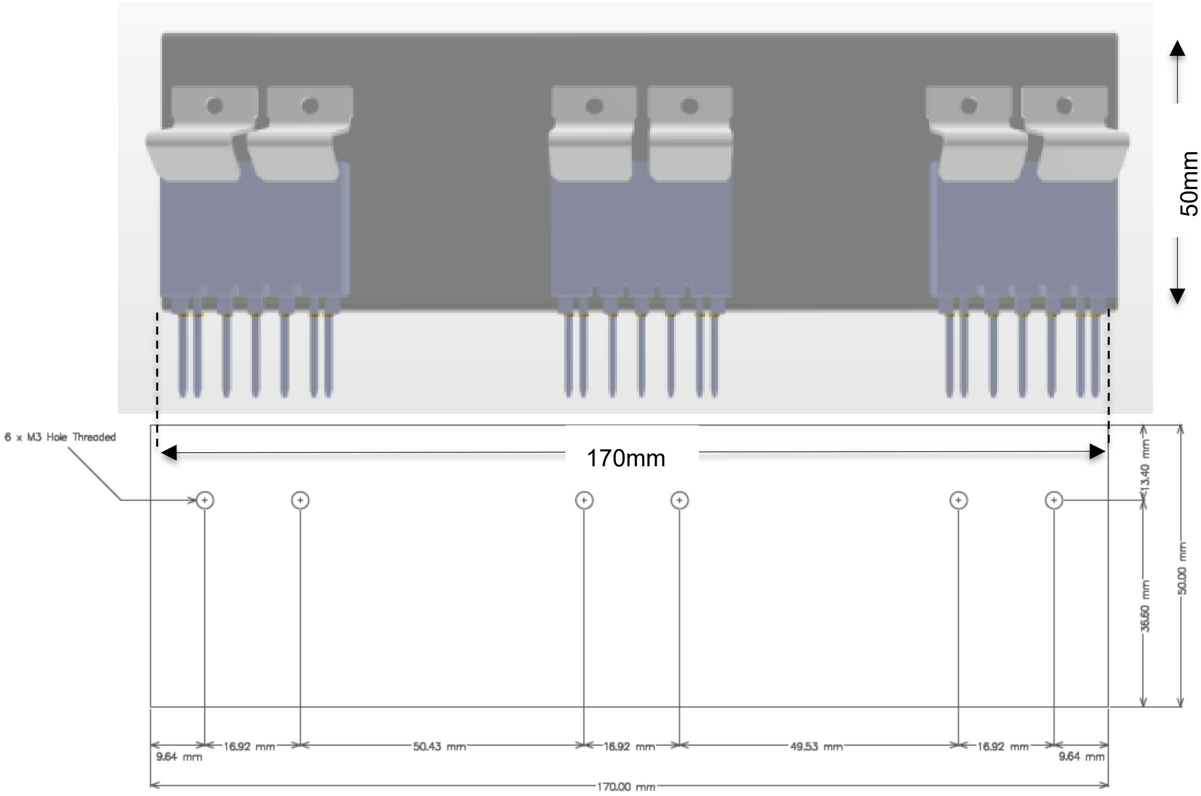


Figure 6. Screw and Clip placement for the MOSFET on heat sink

THFM 1 Spring Specifications

Table 3. Spring clip Specifications

Parameter	Specification
Part Number	THFM 1
Mounting Type	Screw mounting
Spring Force	55 N
Material Thickness	0.8 mm
Dimensions (L x W x H)	15 mm x 10.4 mm x 30 mm
Fixing Hole Diameter	3.2 mm

Heat sink mounting

Ensure the screw is positioned exactly as shown in the diagram and verify that the clip is securely fastened in its designated location.

3 Electrical Specifications

3.1 Inverter Board Specifications

Table 4. Power Board Specifications

Parameter	Specs				Remark
	Min	Typ	max	unit	
DC-Input Voltage	-	750	-	Vdc	Max. 800VDC
Output Current (cont.) @25°C	-	20	-	Arms	Rated output 10kVA @ 20kHz
Switching Frequency	20			kHz	
Dimension	-	217.00 x 143.00	-	mm	

3.2 Current and Voltage Sensing Board Specifications

Table 5. Voltage Sensing Board Specifications

Parameter	Spec				Remark
	Min	Typ	Max	Unit	
Measurement range	0	750	800	Vdc	
Conversion Ratio	-	0.0053	-	V/V	First Stage: 0.0021 V/V Second Stage: 2.52 V/V
Accuracy	-	Within 1%	-		With a 200kHz LPF
Dimension	-	30.00x 28.00	-	mm	

Table 6. Current Sensing Board Specifications

Parameter	Spec				Remark
	Min	Typ	Max	Unit	
Measurement range		45		A	
Conversion Ratio	-	0.033	-	V/A	First Stage: 0.0082 V/V Second Stage: 4.01 V/V
Accuracy	-	Within 1%	-		With a 200kHz LPF
Dimension	-	30.00 x 28.00	-	mm	

3.3 Gate Driver Board

Table 7. Gate Driver Board Specifications

Parameter	Spec				Remark
	Min	Typ	Max	Unit	
Output Voltage	-	18	-	V	Gate Driver is tested with 18V output at 27◦C
Minimum Pulse Width	60	-	-	nS	

Time delay	-	-	65	nS	
Isolation Voltage	-	3750	-	Vrms	
Dimension	-	32.6 X 27.6	-	mm	

4 Sensing

4.1 Vdc sensing

The DC voltage is obtained by measuring the potential difference between the DC positive and negative rails, as depicted in Figure 7.

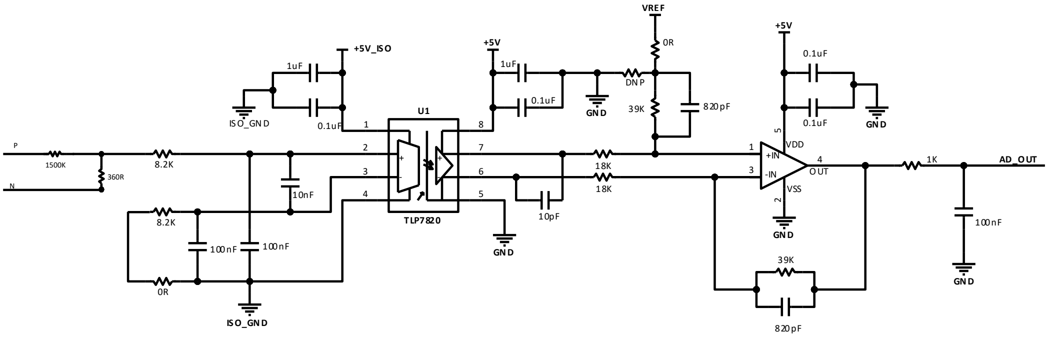


Figure 7. DC Voltage Sensing

Below waveform is obtained from the M5 stack GUI, which measures the ADC reading of the DC bus voltage.

M5Stack and GUI Overview

M5Stack is a modular, stackable, and portable development platform based on the ESP32 microcontroller. It is designed for rapid prototyping and development of IoT (Internet of Things), robotics and embedded systems.

GUI Development with M5Stack

M5Stack offers UIFlow, a graphical programming environment that simplifies GUI and logic development, especially for beginners and educators.

Built-in Widgets: Buttons, sliders, labels, charts, and more.
Real-time Preview: Instantly see GUI layout and behaviour.
Cloud Integration: Save and manage projects online.

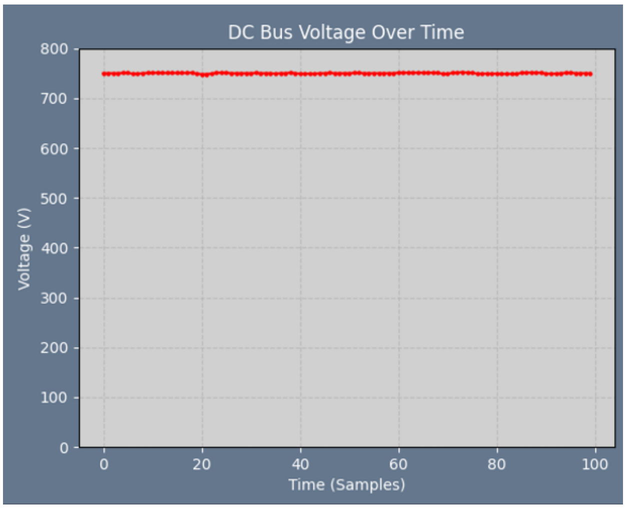


Figure 8. GUI output of DC bus voltage sensing

4.2 Idc sensing

The DC input current is sensed using a shunt resistor positioned on the DC line. The resulting small voltage drop across the shunt is then amplified by a differential amplifier stage, as illustrated in Figure 9 and ADC output is fed back to the controller.

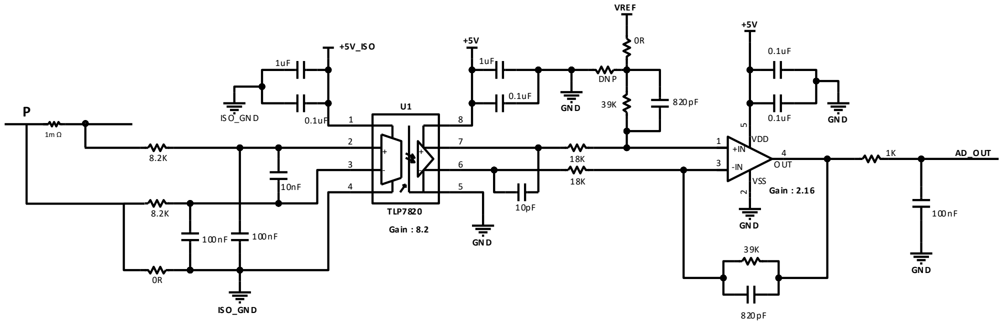


Figure 9. Line Current Sensing Circuit

4.3 Output Phase Current Sensing

Phase current is sensed via a shunt resistor placed on the phase line. The resulting voltage drop is amplified using a differential amplifier stage (refer Figure 10), and the conditioned signal is digitized through an ADC and fed back to the controller for monitoring and control.

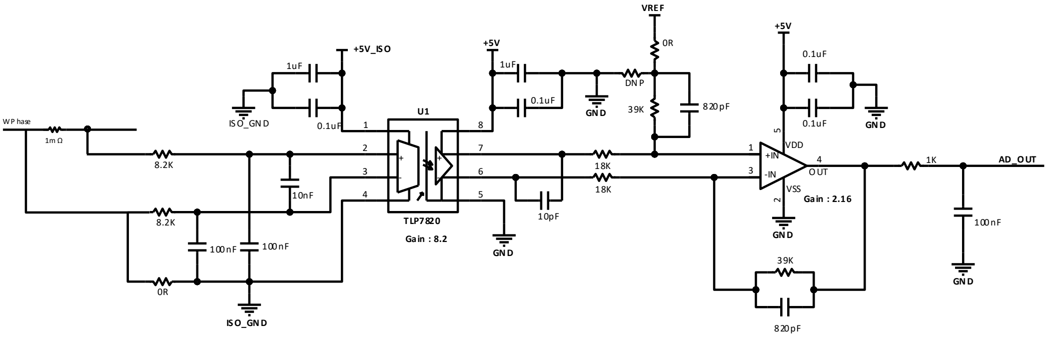


Figure 10. Phase Current Sensing Circuit

4.4 Phase to Phase Voltage Sensing

Phase-to-phase voltage is sensed using a resistor divider network connected between two phase lines.

The resulting differential voltage is amplified and digitized via an ADC and fed back to the controller for real-time monitoring and control.

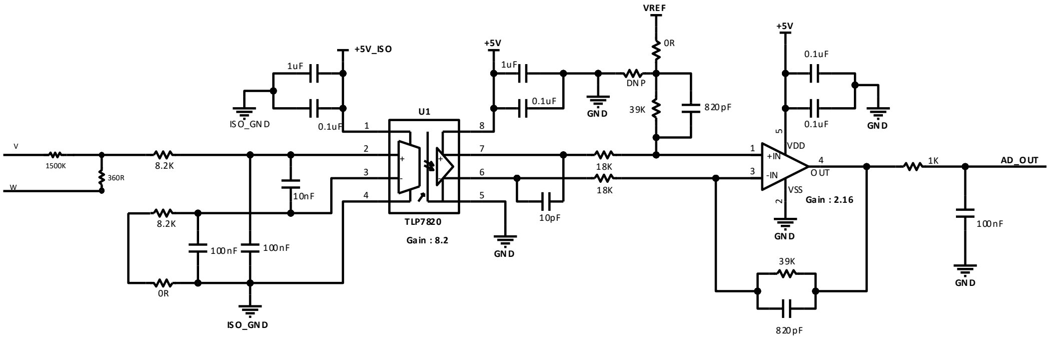


Figure 11. Phase to Phase Voltage sensing

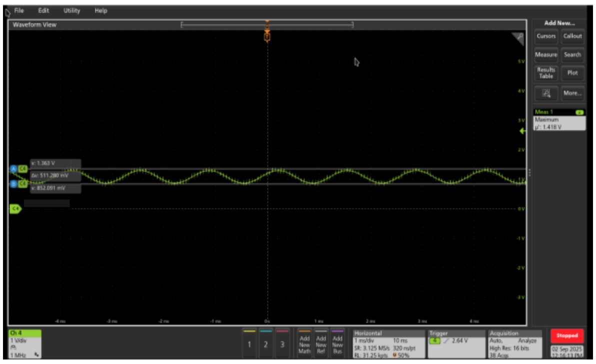


Figure 12. Phase-to-Phase Voltage Sensing Waveform

Gate driver design

ROHM's BM61S41RFV-CE2 is a single-channel isolated gate driver. This device offers a high isolation rating of 3750 Vrms and features a typical Under-Voltage Lockout (UVLO) threshold of 15 V, making it well-suited for SiC MOSFET applications. It also includes active Miller clamp protection to prevent unintended turn-on of the MOSFET. The gate driver is powered with 5 V on the primary side and 18 V on the secondary side.

Features:

- Galvanic isolation between input and output (3750 Vrms)
- Active Miller clamp for enhanced switching performance
- Under-voltage lockout (UVLO) on both input and output sides
- Fast propagation delay: 65ns max
- Minimum input pulse width: 60ns
- Automotive-grade reliability (AEC-Q100 Grade 1)

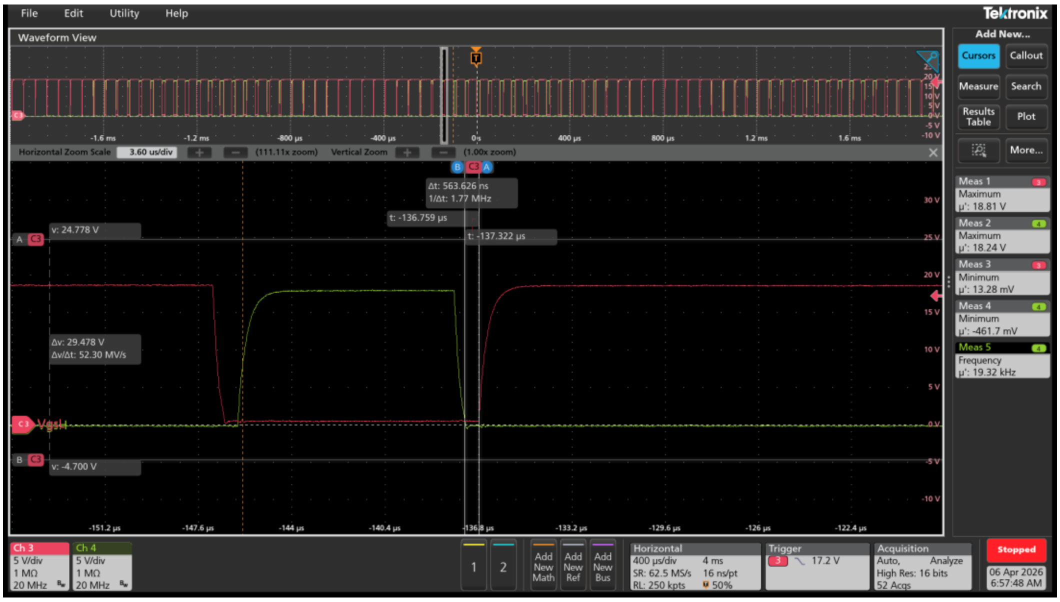


Figure 13. High Side (Red) and Low Side (Green) gate Pulse

5 Board Dimensions

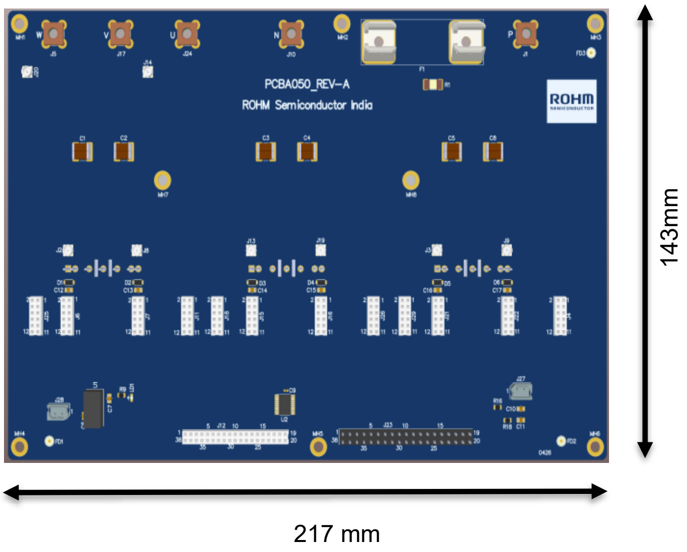


Figure 14. Power Board Top View

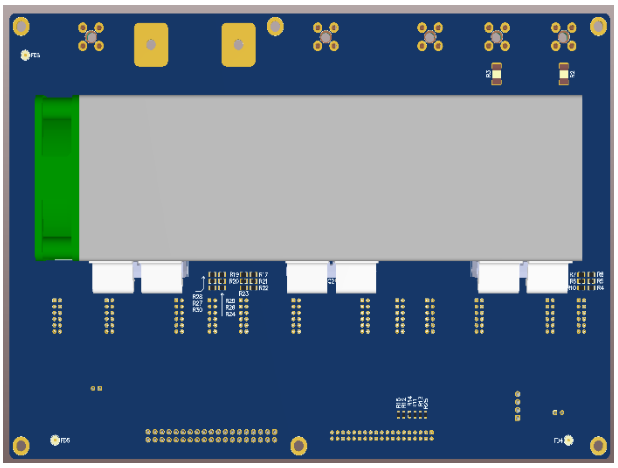


Figure 15. Power Board Bottom View

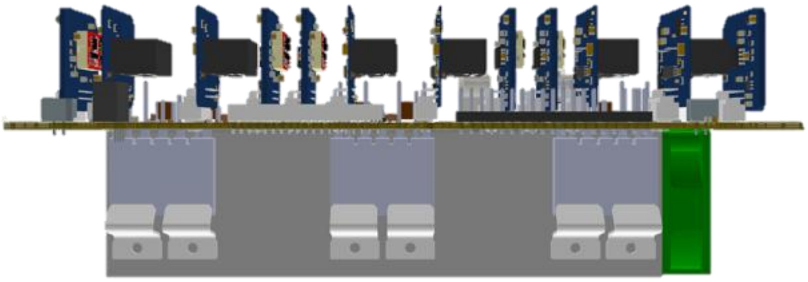


Figure 16. Power Board Side View

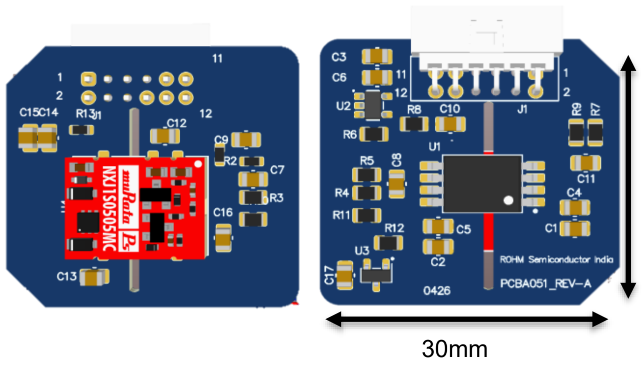


Figure 17. Sensing Board Top and Bottom View

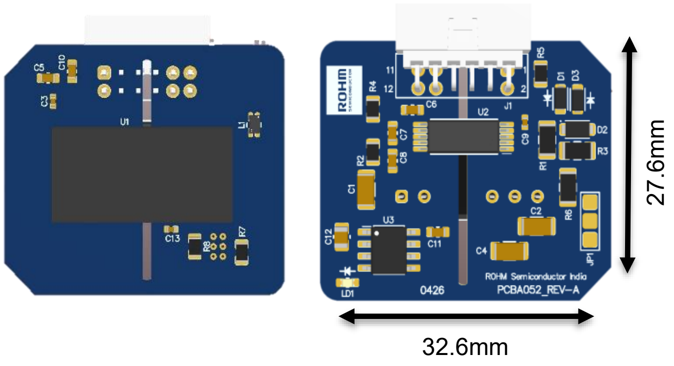


Figure 18. Gate driver Board Top and Bottom View

6 Wiring Connection Diagram

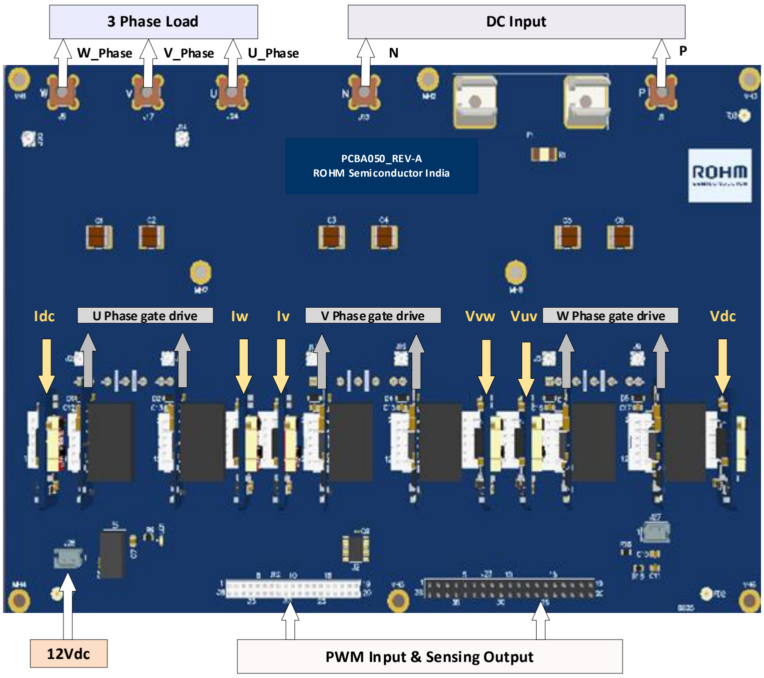


Figure 19. Wiring Diagram for the Board Connection

6.1 Board Terminal Connection

Table 8. Board terminal & connector Connection

Pin No	Connection Point	Comment
1	P	Input DC
2	N	Neutral
3	U, V, W	Phase Terminal
4	J25, J26, J29	Voltage Sensing Connector
5	J4, J11, J18	Current Sensing Connector
6	J6, J7, J15, J16, J21, J22	Gate Driver Board connector*
7	J12, J23	PWM Signals
8	J28	12V Connector
9	J27	5V Connector
10	J2, J3, J8, J9, J13, J14, J19, J20	MMCX connector

- Connect all gate driver boards to their respective positions on the main board using designated connectors.
- Attach voltage and current sensing boards to the appropriate input/output terminals as per the wiring diagram (Fig 13).
- Verify that the cooling fan is properly mounted and connected to the 24V supply on the main board.

7 Pre-Power Checks

Before powering the system, perform the following checks:

- **Visual Inspection:** Ensure all components are securely mounted, connectors are properly seated, and no foreign objects are present.
- **Continuity Test:** Verify that there are no short circuits between power rails and ground.
- **Polarity Check:** Confirm correct polarity of DC input, fan supply, and signal connections.
- **Gate Driver Status:** Verify proper isolation and ensure gate driver connectivity with external PWM signals before powering the DC input.
- **Dead Time Validation:** Ensure appropriate dead time is configured between high-side and low-side gate pulses. Confirm timing aligns with the 120° phase shift requirement for three-phase operation.
- **Cooling System:** Ensure the fan is operational and airflow is unobstructed.
- **Signal Verification:** Confirm PWM signals are present and correctly mapped to gate driver inputs.

8 Operation

8.1 Power-Up Sequence

The power-up process ensures safe initialization of all subsystems before the inverter begins operation. It involves sequential activation and verification of components to prevent damage and ensure system stability.

i. **Auxiliary Power Activation**

- Power up the 24V supply to the fan, confirm the air flow direction.
- Power up the 12V supply to the J28 connector for powering up gate drive and sensing Board.

ii. **Control System Initialization**

- Power on the external MCU.

Table 9. PWM Specifications

Parameter	**Spec**			
	Min	Typ	Max	Unit
Carrier Frequency	0.2	1	1.5	kHz
Switching Frequency	15	-	20	kHz
Dead Time	-	850	-	nsec
Modulation Index (m)	0.2	-	0.8	
Duty Cycle Resolution	Depends on controller; higher resolution gives smoother control			
Synchronization	Carrier and reference signals must be synchronized			

- MCU begins executing firmware and initializes communication with sensing boards and gate drivers.

iii. **Sensing System**

- Voltage and current sensing boards begin monitoring input/output conditions.
- Ensure sensing accuracy and signal integrity before proceeding.

iv. **Gate Driver Readiness**

- Gate drivers receive PWM signals from the MCU via the 38-pin connector (J12 & J23).

v. **DC-Input**

- Gradually apply DC input voltage 0 to (600–750Vdc) to the inverter.

- Monitor voltage rises and ensures it remains within safe limits.

vi. **MOSFET Switching Activation**

- MCU enables PWM output to gate driver. (PWM control signals will be generated using a TI DSPIC, following the specified parameters), The PWM outputs are active-low due to the inverting buffer in the signal path. As a result, a logic HIGH at the controller appears as a logic LOW at the downstream device.
  - SiC MOSFETs begin switching, generating modulated AC waveform.

vii. **Output Verification**

- Measure output voltage and frequency.
- Confirm balanced three-phase output and correct waveform shape.
- Check for abnormal noise, heating, or waveform distortion.

8.2 Performance

8.2.1 Test bench Configuration

Table 10. Test Equipment List

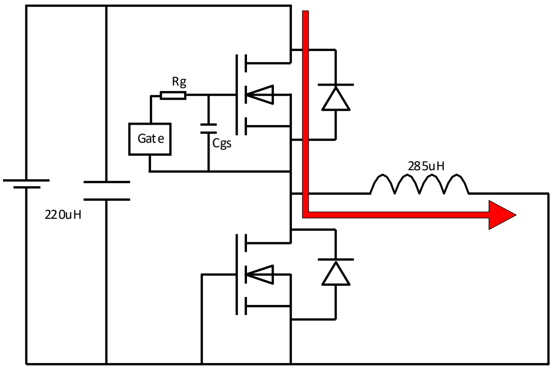
S.No	Name	Model	Description
1	Kikusui DC Power Supply	PXB20K − 1500	Input DC Voltage
2	Tenma DC Power Supply	72 − 10505	Auxiliary supply for FAN & Digital circuits
3	Inductive Load	880uH / Phase	Star Connection
4	Hioki Power Analyzer	PW6001	Parameter monitoring (I/P and O/P voltage and current)
5	Tektronix Oscilloscope	MSO44	Capture Gate Signals, Phase Current & Voltage
6	Tektronix Differential Probe	THDP0200	Measure Vgs, Vuv, Vvw & Vwu
7	Tektronix Current Probe	TRCP0600	Measure Iu, Iv & Iw
8	Hioki Data Logger	LR8431 − 20	Measure Temperature of Devices

8.2.2 Double Pulse Test (DPT)

Purpose of DPT:

The double pulse test is used to validate the switching characteristics of **SCZ4006KTAC23**. It helps to measure the followings:

1. Turn-on & Turn-off Losses
2. Drain to Source (Vds) Surge Voltage & Current Overshoot
3. Switching speed

Test Circuit	Test Conditions
 Figure 20. Double Pulse Circuit	Table 11: Double Pulse Test condition

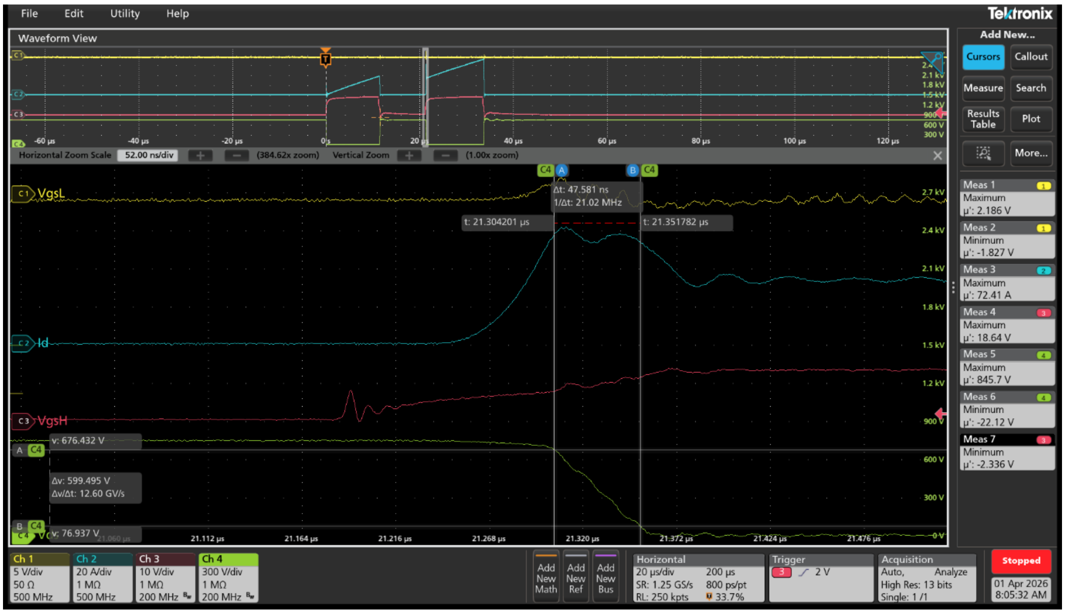
V_{dc}	750V
V_{gs_off}	0V
V_{gs_on}	18V
I_d	30A
R_{g_on}	10Ω
R_{g_off}	5Ω
C_{gs_ext}	DNP

Measurement of Phase W:

CH1	Low Side Gate to source Voltage(5V/div)
CH2	Drain Current(20A/div)
CH3	High Side Gate to Source Voltage (10V/div)
CH4	Drain to Source Voltage (300V/div)

Turn ON:

- Vds_max = 846V
- dv/dt =12.6 GV/sec and di/dt=1.21GA/sec
- Turn On loss= 1.81mJ



Δt: 47.581 ns
1/Δt: 21.02 MHz
t: 21.304201 µs
t: 21.351782 µs

v: 676.432 V
Δv: 599.495 V
Δv/Δt: 12.60 GV/s
v: 76.937 V

Meas 1 Maximum µ': 2.186 V
Meas 2 Minimum µ': -1.827 V
Meas 3 Maximum µ': 72.41 A
Meas 4 Maximum µ': 18.64 V
Meas 5 Maximum µ': 845.7 V
Meas 6 Minimum µ': -22.12 V
Meas 7 Minimum µ': -2.336 V

Ch 1: 5 V/div, 50 Ω, 500 MHz
Ch 2: 20 A/div, 1 MΩ, 500 MHz
Ch 3: 10 V/div, 1 MΩ, 200 MHz
Ch 4: 300 V/div, 1 MΩ, 200 MHz

Horizontal: 20 µs/div, 200 µs, SR: 1.25 GS/s, 800 ps/pt, RL: 250 kpts, 33.7%
Trigger: 3, 2 V
Acquisition: Auto, Analyze, High Res: 13 bits, Single: 1 /1
01 Apr 2026 8:05:32 AM

Figure 21. dv/dt_turn On

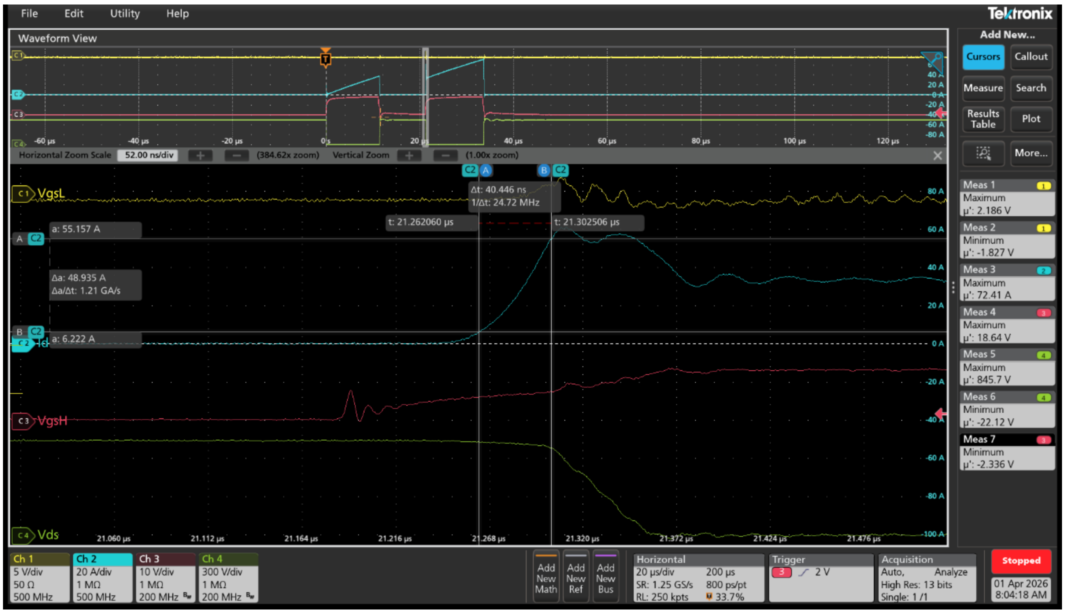


Figure 22. di/dt_turn on

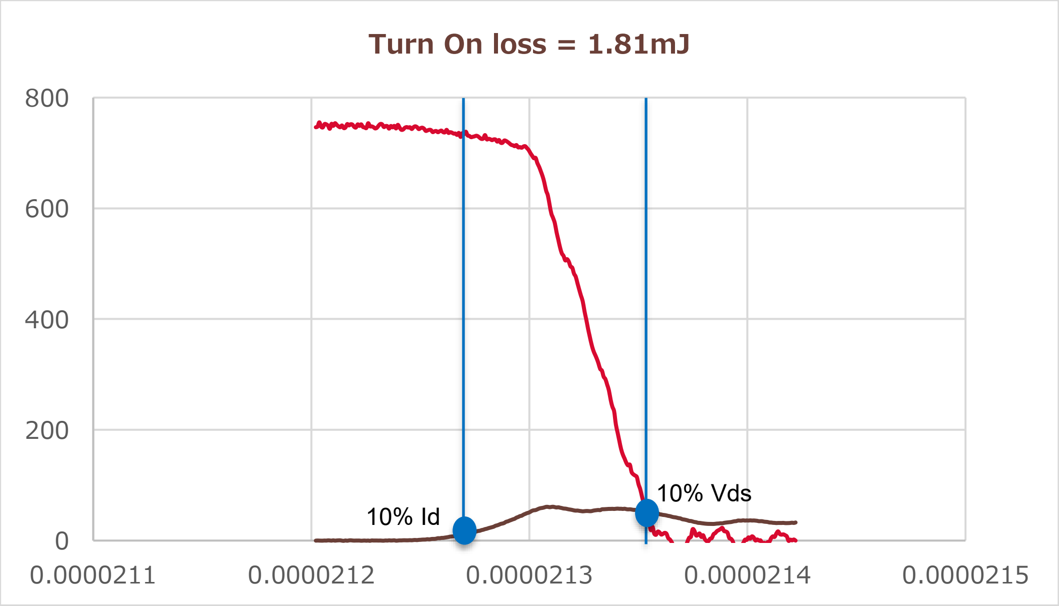
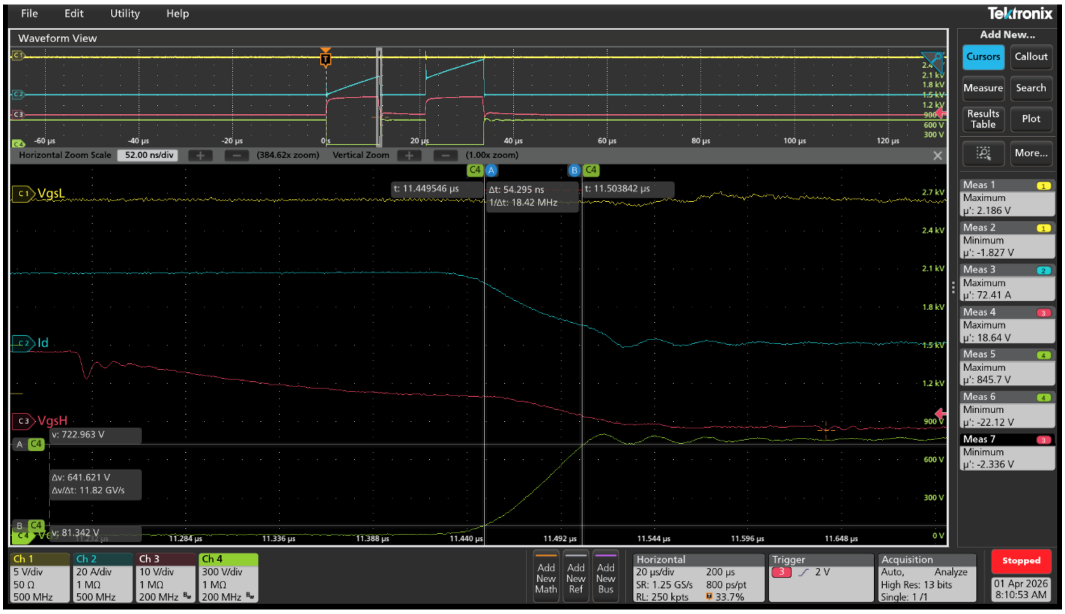


Figure 23. Turn on Loss

Turn OFF

- Vds_max = 846V
- dv/dt =11.82GV/sec and di/dt=0.413GA/sec
- Turn-off= 0.38mJ



Horizontal Zoom Scale 52.00 ns/div (384.62x zoom) Vertical Zoom (1.00x zoom)

A C4: t: 11.449546 µs
Δt: 54.295 ns
1/Δt: 18.42 MHz
B C4: t: 11.503842 µs

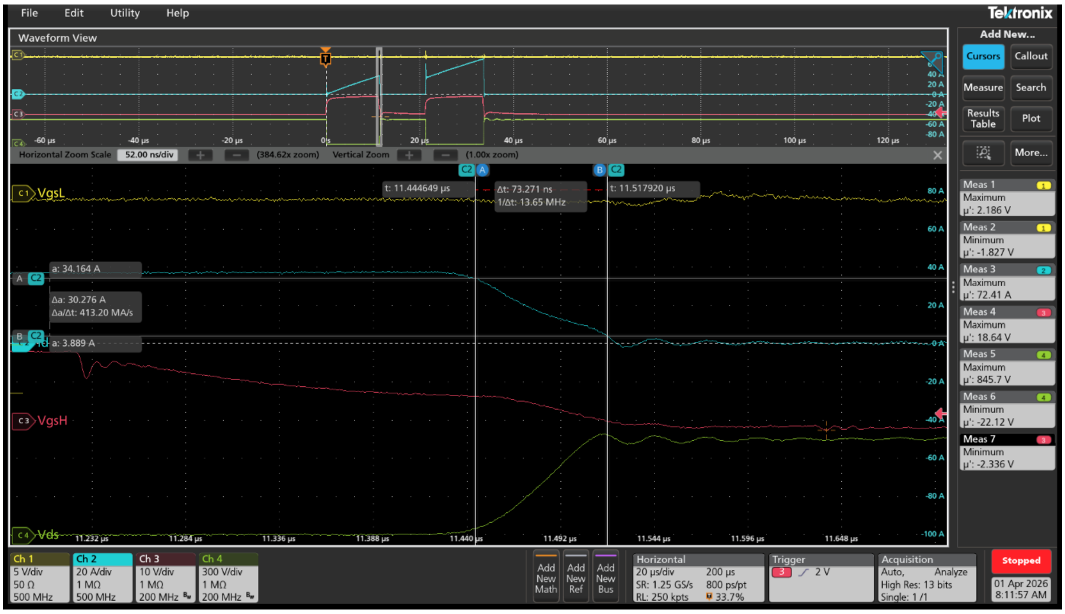
A C4 v: 722.963 V
Δv: 641.621 V
Δv/Δt: 11.82 GV/s
B C4 v: 81.342 V

Meas 1 Maximum µ': 2.186 V
Meas 2 Minimum µ': -1.827 V
Meas 3 Maximum µ': 72.41 A
Meas 4 Maximum µ': 18.64 V
Meas 5 Maximum µ': 845.7 V
Meas 6 Minimum µ': -22.12 V
Meas 7 Minimum µ': -2.336 V

Ch 1: 5 V/div, 50 Ω, 500 MHz
Ch 2: 20 A/div, 1 MΩ, 500 MHz
Ch 3: 10 V/div, 1 MΩ, 200 MHz
Ch 4: 300 V/div, 1 MΩ, 200 MHz

Horizontal: 20 µs/div, 200 µs, SR: 1.25 GS/s, 800 ps/pt, RL: 250 kpts, 33.7%
Trigger: 3, 2 V
Acquisition: Auto, Analyze, High Res: 13 bits, Single: 1 /1
01 Apr 2026 8:10:53 AM

Figure 24. dv/dt_turn off



Horizontal Zoom Scale 52.00 ns/div (384.62x zoom) Vertical Zoom (1.00x zoom)

A C2: t: 11.444649 µs
Δt: 73.271 ns
1/Δt: 13.65 MHz
B C2: t: 11.517920 µs

A C2 a: 34.164 A
Δa: 30.276 A
Δa/Δt: 413.20 MA/s
B C2 a: 3.889 A

Meas 1 Maximum µ': 2.186 V
Meas 2 Minimum µ': -1.827 V
Meas 3 Maximum µ': 72.41 A
Meas 4 Maximum µ': 18.64 V
Meas 5 Maximum µ': 845.7 V
Meas 6 Minimum µ': -22.12 V
Meas 7 Minimum µ': -2.336 V

Ch 1: 5 V/div, 50 Ω, 500 MHz
Ch 2: 20 A/div, 1 MΩ, 500 MHz
Ch 3: 10 V/div, 1 MΩ, 200 MHz
Ch 4: 300 V/div, 1 MΩ, 200 MHz

Horizontal: 20 µs/div, 200 µs, SR: 1.25 GS/s, 800 ps/pt, RL: 250 kpts, 33.7%
Trigger: 3, 2 V
Acquisition: Auto, Analyze, High Res: 13 bits, Single: 1 /1
01 Apr 2026 8:11:57 AM

Figure 25. di/dt_turn off

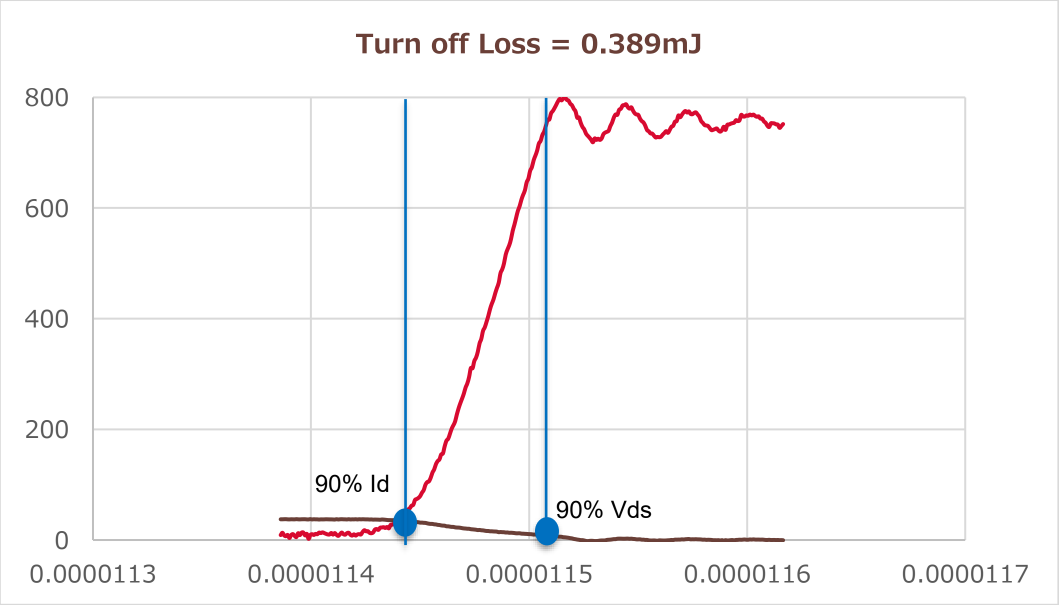


Figure 26. Turn Off Loss

8.2.3 Inverter Validation

8.2.4 Test Setup

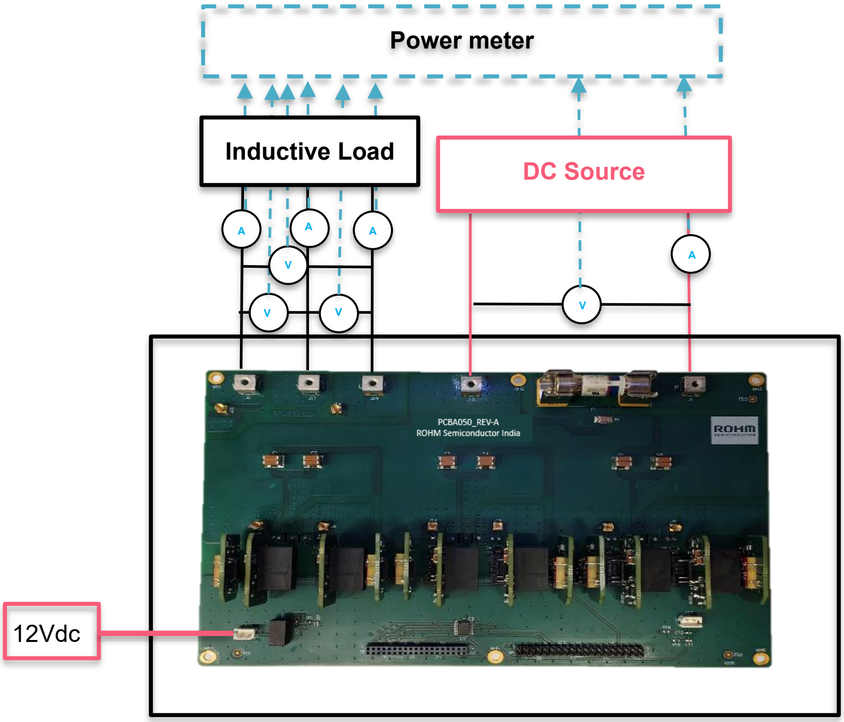


Figure 27. Test Measurement Diagram

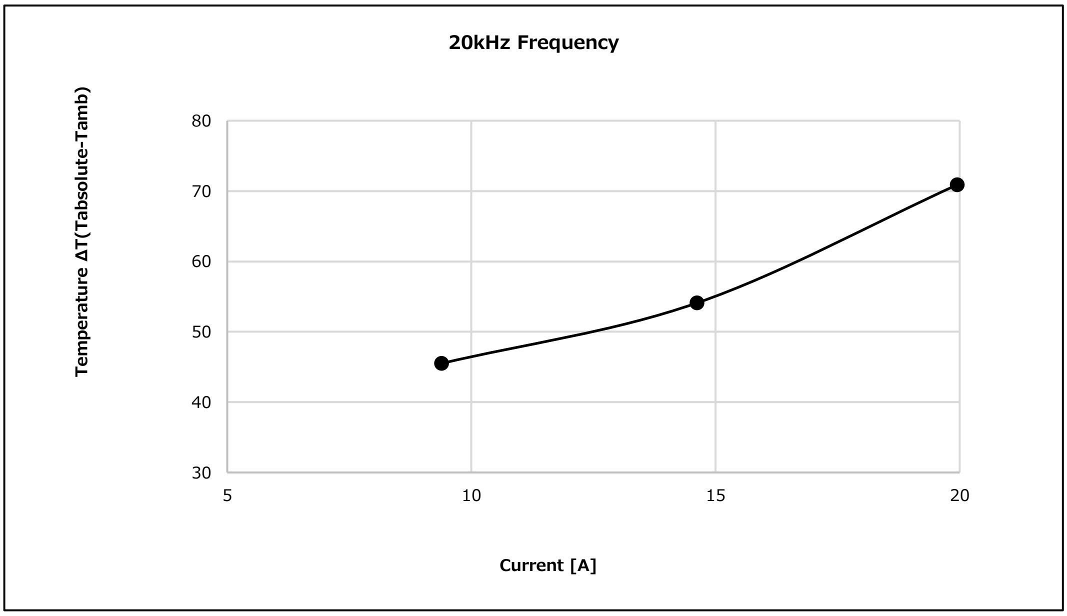


Figure 28. Phase Current Vs Temperature

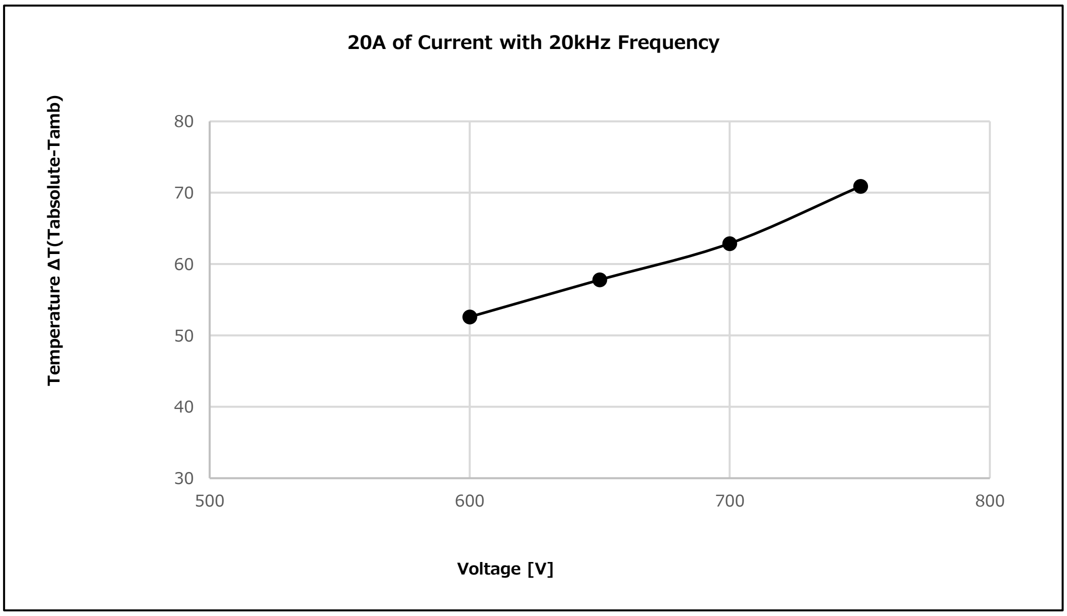


Figure 29. Voltage Vs Temperature

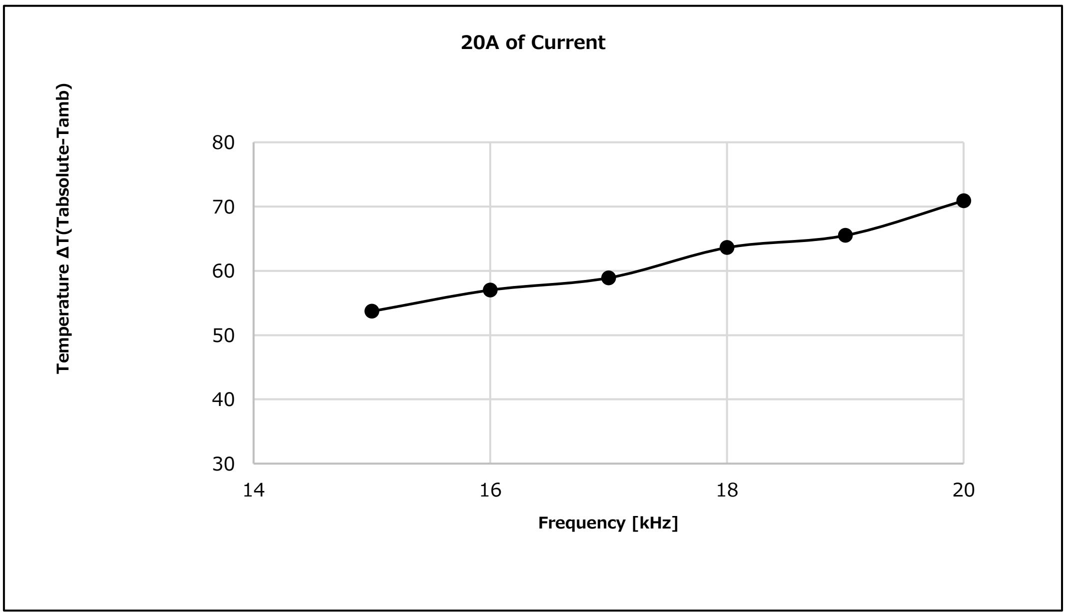
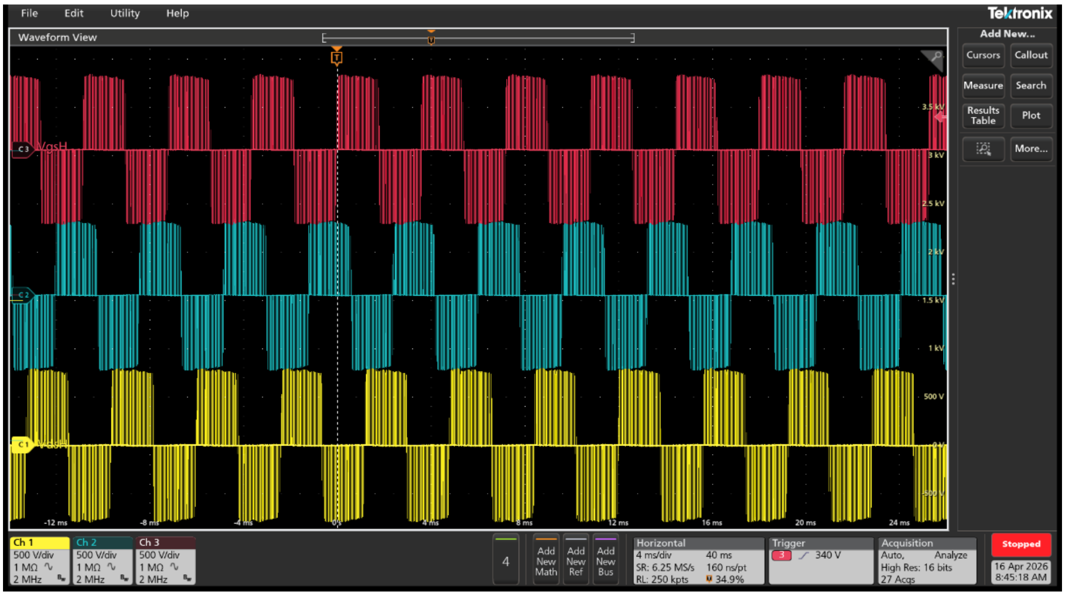


Figure 30. Frequency V/s Temperature



Ch 1
500 V/div
1 MΩ
2 MHz

Ch 2
500 V/div
1 MΩ
2 MHz

Ch 3
500 V/div
1 MΩ
2 MHz

Horizontal
4 ms/div 40 ms
SR: 6.25 MS/s 160 ns/pt
RL: 250 kpts 34.9%

Trigger
3 340 V

Acquisition
Auto, Analyze
High Res: 16 bits
27 Acqs

16 Apr 2026
8:45:18 AM

Figure 31. Phase to Phase Voltage

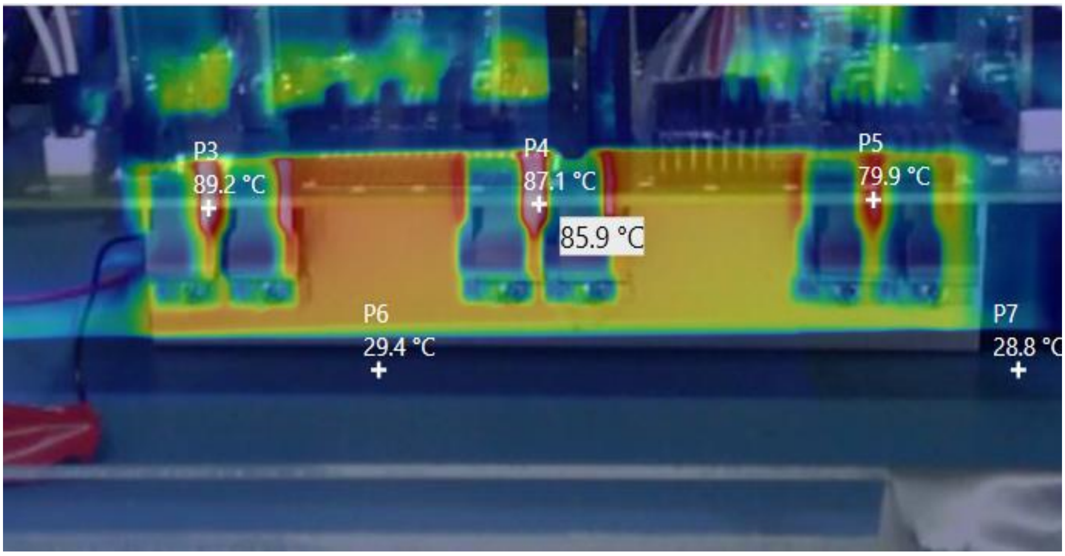


Figure 3215. Temperature measurement using Thermal Camera

9 Schematics

9.1 Power Board Schematic

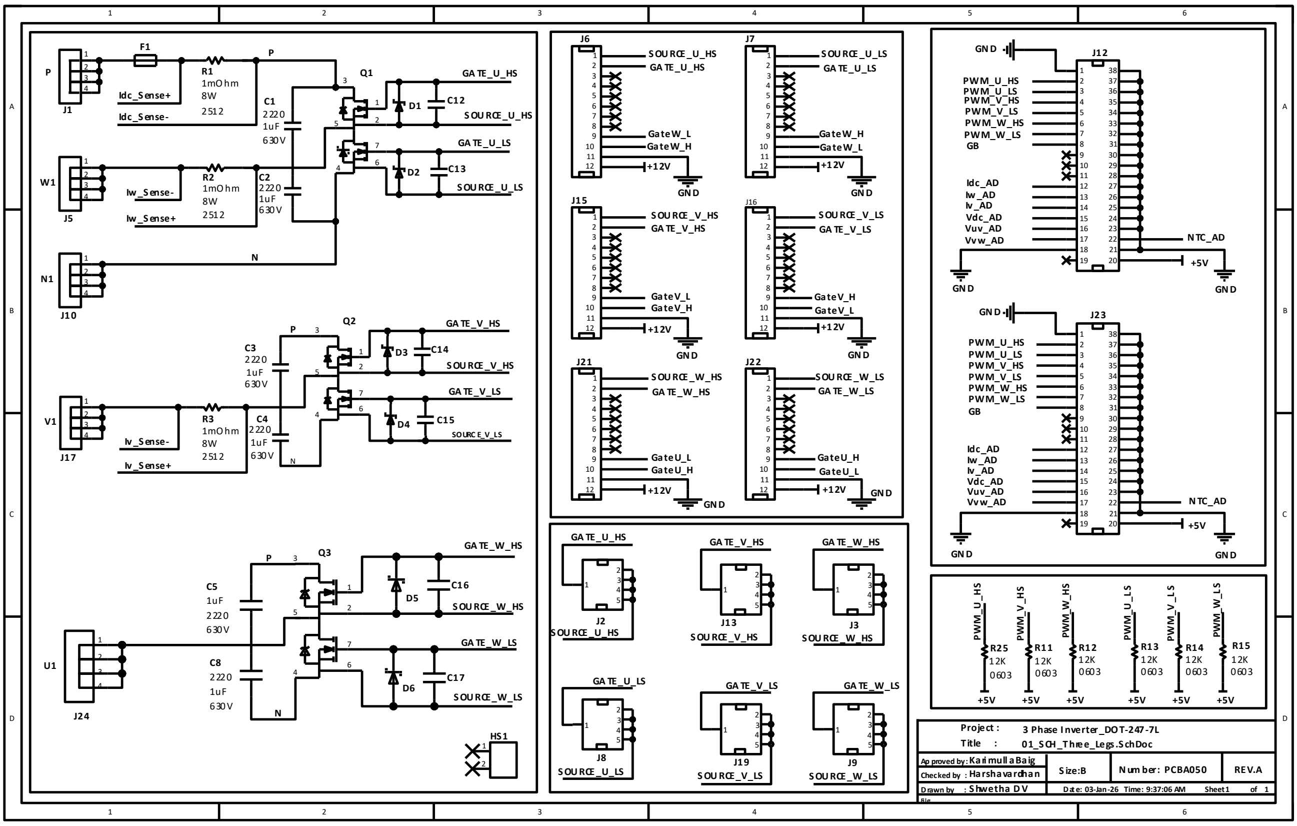


Figure 33. Main Board Schematic 1

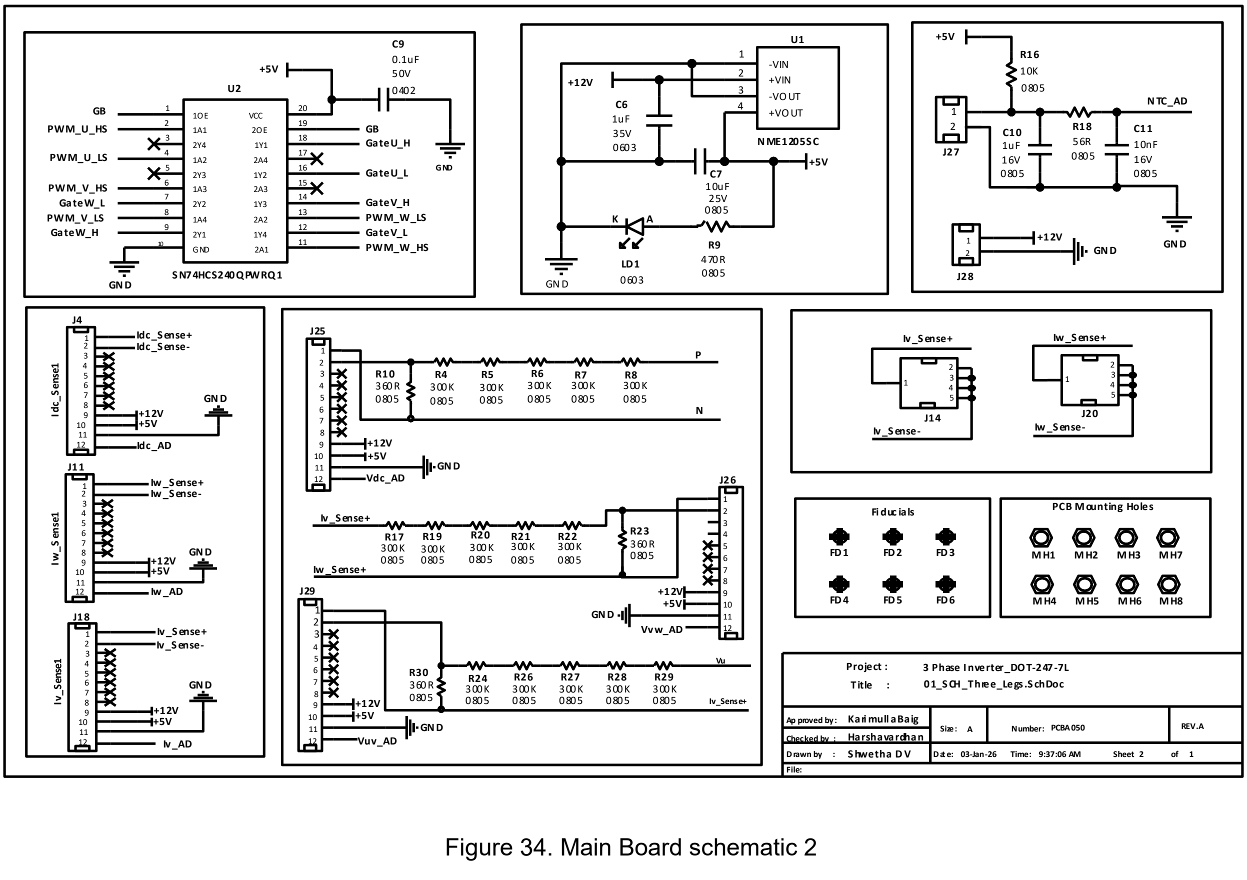


Figure 34. Main Board schematic 2

9.2 Gate Driver Schematic

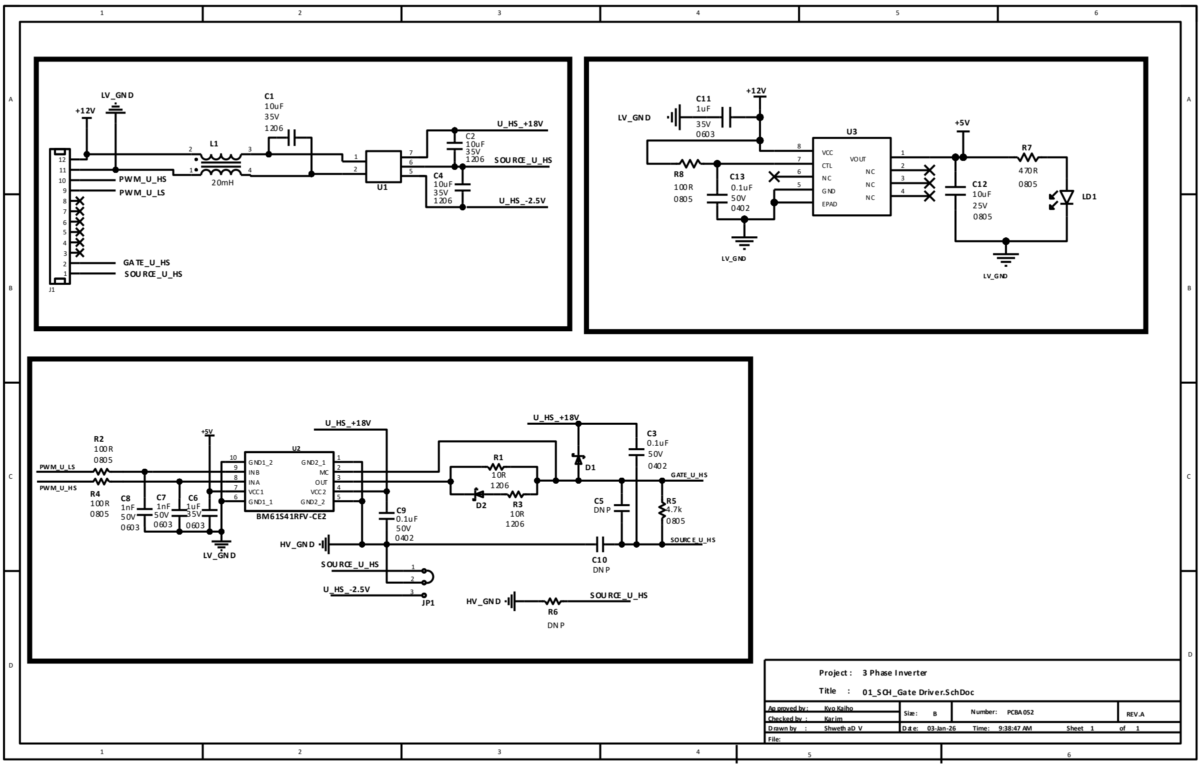


Figure 35. Gate Driver Board Schematic

9.3 Sensing Board Schematic

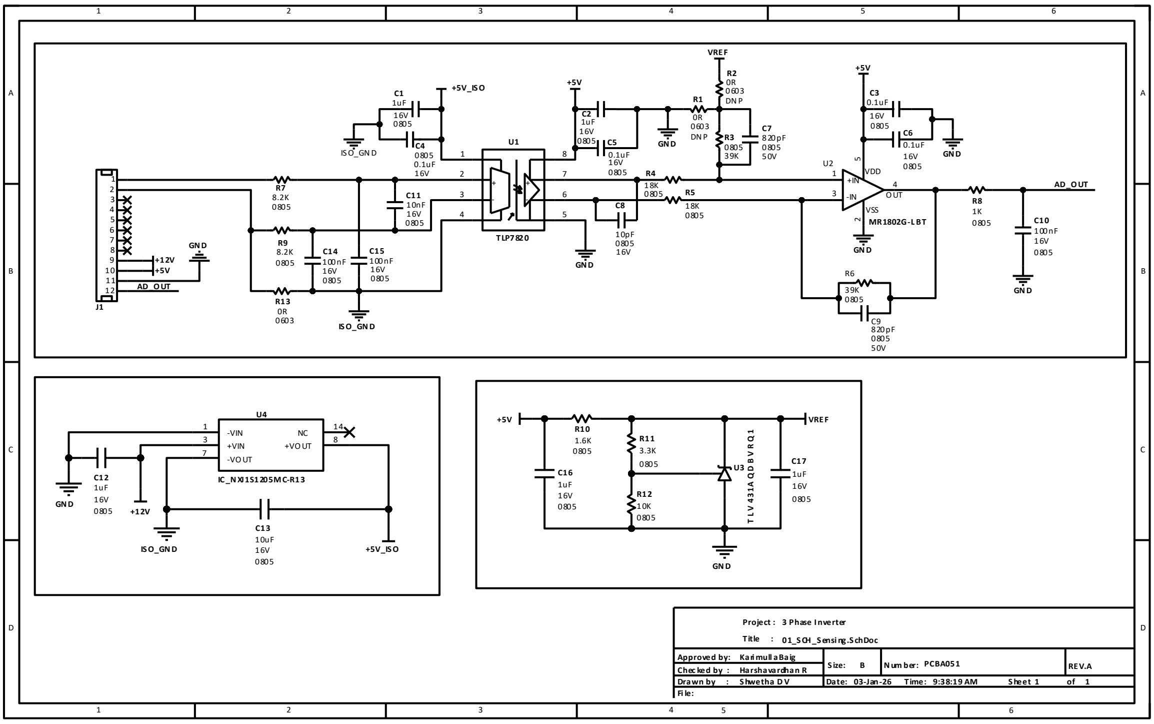


Figure 36. Sensing Board Schematic

10 Bill of Material

Power Board BOM

Table 12. Main Board BOM

Sl.No	Designator	Value	Description	Package	Quantity	Manufacturer	Part Number
1	C1, C2, C3, C4, C5, C8	1uF	SMD,1uF,630V,10%, X7R	2220	6	TDK	CAA572X7T2J105M640LH
2	C6	1uF	SMD, 1uF,35V,10%, X7R	0603	1	TDK	CGA3E1X7R1V105K080AC
3	C7	10uF	SMD, 10uF, 25V,10%,0805, X7S	8005	1	TDK	C2012X7S1E106K125AE
4	C9	0.1uF	SMD, 0.1uF, 50V,10%,0402, X7R	0402	1	TDK	CGA2B3X7R1H104K050BB
5	C10	1uF	SMD, 1uF, 16V,10%,0805, X7R	0805	1	KEMET	C0805C105K4RACAUTO
6	C11	10nF	SMD, 10nF, 16V,5%,0805, U2J	0805	1	KEMET	C0805C103J4JACTU
7	C12, C13, C14, C15, C16, C17	DNP	-	-	6	-	-
8	D1, D2, D3, D4, D5, D6	40V,1A	40V 1A 2-Pin, SMD, Schottky	SOD-123F	6	ROHM	RB160MM-40TR
9	F1	Fuse Holder	63A, TH, Fuse Holder	-	1	Littelfuse	01240040H
10	HS1	LAM 5 170 24V ME	24V, ME,170mm x 50mm x 50mm,	-	1	Fischer Elektronik	LAM 5 170 24V ME
11	J1, J5, J10, J17, J24	74650074R	50A, Screw Terminal, TH	M4	5	Würth Elektronik	74650074R
12	J2, J3, J8, J9, J13, J14, J19, J20	73415-2061	RF Connector,170V	-	8	MOLEX	0734152061
13	J4, J6, J7, J11, J15, J16, J18, J21, J22, J25, J26, J29	79107-7005	TH Connector,12 position's,1A,125V	-	12	MOLEX	79107-7005
14	J12	79107-7068	Connector, TH,38 positions	-	1	MOLEX	79107-7068
15	J23	67997-438HLF	Connector, TH,38 positions,5A	-	1	MOLEX	67997-438HLF
16	J27, J28	DIP 5.08x2N	Connector, TH,2 positions,3A,250V	-	2	MOLEX	22-03-5025
17	LD1	Diode_LED	GREEN LED	0603	1	ROHM	SML-D12P8WT86
18	Q1, Q2, Q3	SCZ4006KTBC23	DOT247-7L, -55°C ~ 150°C,1200V,130A	DOT247-7L	3	ROHM	SCZ4006KTBC23
19	R1, R2, R3	1mOhm	Shunt Resistor, SMD, 1% ,8W	2512	3	ROHM	PSR100KTQFH1L00
20	R4, R5, R6, R7, R8, R17, R19, R20, R21, R22, R24, R26, R27, R28, R29	300K	SMD,1% ,400mW	0805	15	ROHM	ESR10EZPJ304
21	R9	470R	SMD ,0.5%,500mW	0805	1	ROHM	ESR10EZPD4700
22	R10, R23, R30	360R	SMD, 5%,500mW	0805	3	ROHM	ESR10EZPJ361
23	R11, R12, R13, R14, R15, R25	12K	SMD,0.5%,250mW	0603	6	ROHM	ESR03EZPD1202

24	R16	10K	SMD,0.5%,150V,400 mW	0805	1	ROHM	ESR10EZPD1002
25	R18	56R	SMD, 0.5%,150V,500mW	0805	1	ROHM	ESR10EZPD56R0
26	U1	NME1205SC	Isolated DC/DC Converters - 1W, 12-5V,200mA	(SIP-4)	1	Murata	NME1205SC
27	U2	SN74HCS240QPWRQ1	buffers and line drivers with 3-state outputs -40 to 125C,	TSSOP - 20	1	Texas Instruments	SN74HCS240QPWRQ1
28	F	Cooling Fan	24VDC	50X20mm	1	Wakefield-Vette	DC0502024M2B-2T0
29	Clip	Spring Clip	Retaining Spring for MOSFETs	-	6	Fischer Elektronik	THFM 1

Gate Driver Board BOM

Table 13. Gate driver BOM

Sl.No	Designator	Value	Description	Package	Quantity	Manufacturer	Part Number
1	C1, C2, C4	10uF	35V,20%, X7R, AEC-Q200, SMD	1206	18	TDK	CGA5L1X7R1V106M160AC
2	C3, C9, C13	0.1uF	50V,10%, X7R, AEC-Q200, SMD	0402	18	TDK	CGA2B3X7R1H104K050BB
3	C6, C10, C11	1uF	35V,10%,X7R, AEC-Q200, SMD	0603	18	TDK	CGA3E1X7R1V105K080AC
4	C5	DNP	-	-	6	-	-
5	C7, C8	1000pF	50V,10%,X7R, AEC-Q200, SMD,	0603	12	Murata	GCM188R71H102KA37J
6	C12	10uF	SMD, 25V,10%, X7S	0805	6	KEMET	C2012X7S1E106K125AE
7	D1, D3	60V,1A	SMD, Schottky,60V,1A	SOD-323HE-2	12	ROHM	RB160VAM-60TR
8	D2	40V,1A	Diode, SMD, Schottky,40V,1A	SOD-123FL	6	ROHM	RB160MM-40TR
9	J1	1511193112	Connector, TH,12 positions,2A	-	6	MOLEX	1511193112
10	L1	200 Ohms Impedance	Common Mode Choke 500mA	-	6	Murata	DLW21PH201XQ2L
11	LD1	LED	SMD Green 2.5-16 mcd	0603	6	ROHM	SML_D12P8WT86
12	R1, R3	10R	SMD,1%,1206,200V,750 mW	1206	12	ROHM	ESR18EZPF10R0
13	R2, R4, R8	100R	SMD, 1%,150V,500mW	0805	18	ROHM	ESR10EZPF1000
14	R5	4.7k	SMD, 0.5%,150V,400mW	0805	6	ROHM	ESR10EZPD4701
15	R6	0R	SMD,0R,5%,1W	1206	6	ROHM	PMR18EZPJ000
16	R7	470R	SMD,0.5%,150V,500 mW	0805	6	ROHM	ESR10EZPD4700
17	U1	DC/DC TH 12-18/2.5V	Isolated DC/DC Converters - Through TH 12-18/2.5V 5.2KVSMD	7-SIP Module, 5 Leads	6	Murata	MGJ2D121802SC
18	U2	1ch isolated Gate Driver	Gate Drivers Isolation Voltage 3750Vrms providing Galvanic Isolation	SSOP-B10W	6	ROHM	BM61S41RFV-CE2
19	U3	200mA ,5.0V	LDO Voltage Regulators 200mA, 5.0V out	SOT223-4	6	ROHM	BD450M2WEFJ-CE2

Sensing Board BOM

Table 14. Sensing Board BOM

Sl no	Designator	Value	Description	Package	Quantity	Manufacturer	Manufacturer Part Number
1	C1, C2, C12, C16, C17	1uF	SMD,16V, ±5%, X7R	0805	30	KEMET	C0805C105J4RAC7210
2	C3, C4, C5, C6	0.1uF	SMD,16V,5%, U2J	0805	24	KEMET	C0805C104J4JACAUTO
3	C7, C9	820pF	SMD, 50V,5%,C0G	0805	12	KEMET	C0805C821J5GACAUTO
4	C8	10pF	SMD, 16V,10%,X8R	0805	6	KEMET	C0805C100K4HACAUTO
5	C10, C14, C15	100nF	SMD,16V, ±5%, X7R	0805	18	KEMET	C0805C104J4RACTU
6	C11	10nF	SMD,16V,2%, X8R	0805	6	KEMET	C0805C103G4HACAUTO
7	C13	10uF	SMD,16V, 10%, X5R	0805	6	Murata	GRT21BR61C106KE01L
8	J1	1511193112	Connector, TH,12 positions,2A	-	6	Molex	1511193112
9	R1, R2, R13	0R	SMD,0R,100mW,50V	0603	18	ROHM	SFR03EZPJ000
10	R3, R6	39K	SMD, ±5%,0.4W	0805	12	ROHM	ESR10EZPJ393
11	R4, R5	18K	SMD, 5%,0.4W,150V	0805	12	ROHM	ESR10EZPJ183
12	R7, R9	8.2K	SMD, ±1%,0.4W,150V	0805	12	ROHM	ESR10EZPF8201
13	R8	1K	SMD, ±1%,0.4W,150V	0805	6	ROHM	ESR10EZPF1001
14	R10	1.6K	SMD, ±5%,0.4W,150V	0805	6	ROHM	ESR10EZPJ162
15	R11	3.3K	SMD, ±1%,0.4W,150V	0805	6	ROHM	ESR10EZPF3301
16	R12	10K	SMD, ±5%,0.4W	0805	6	ROHM	ESR10EZPF1002
17	U1	Amplifiers	Optically Isolated Amplifiers	SOIC-8	6	Toshiba	TLP7820
18	U2	Operational Amplifiers	Op Amps 5uV Offset Voltage	SSOP5	6	ROHM	LMR1802G-LBTR
19	U3	SHUNT REGULATOR	TLV431BQDBZRQ1, ±0.5%,SOT-23-3,15 mA-40°C ~ 125°C (TA)	SOT-23-3	6	Texas Instruments	TLV431BQDBZRQ1
20	U4	DC/DC	Isolated DC/DC Converters, SM 1W 12V-5V Single 4.2kV	(SOP-8)	6	Murata	NXJ1S1205MC-R13

11 PCB Layout

Power Board PCB Layout

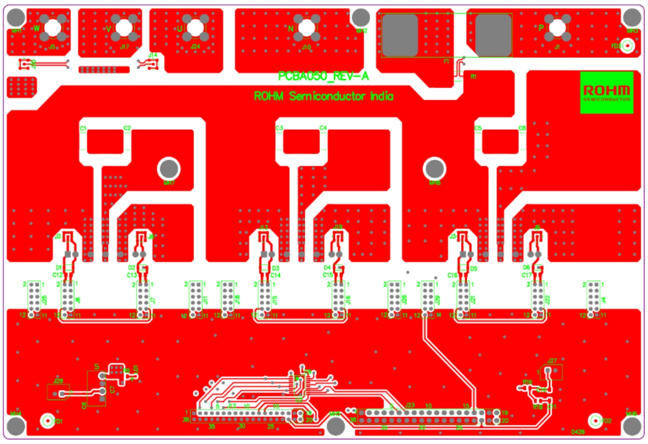


Figure 37. Top Layer

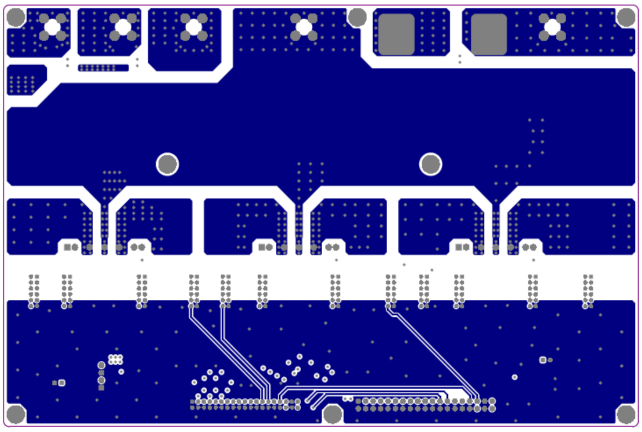


Figure 38. Mid Layer 1

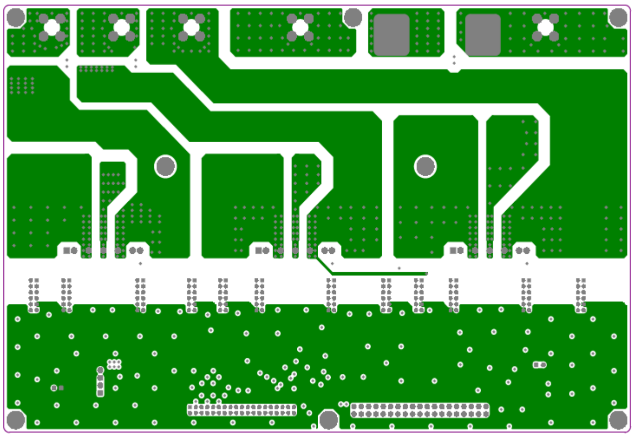


Figure 39. Mid Layer 2

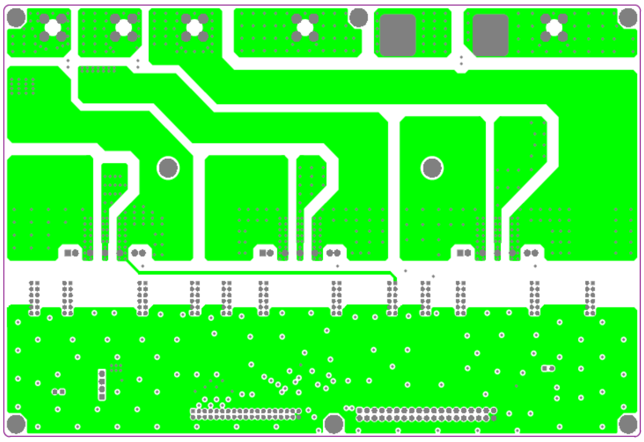


Figure 40. Mid Layer 3

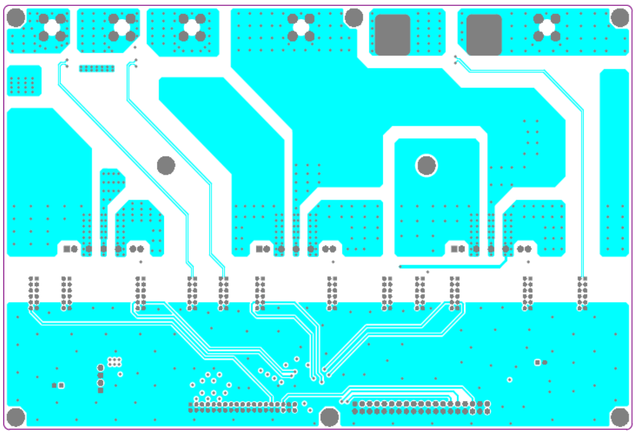


Figure 41. Mid Layer 4

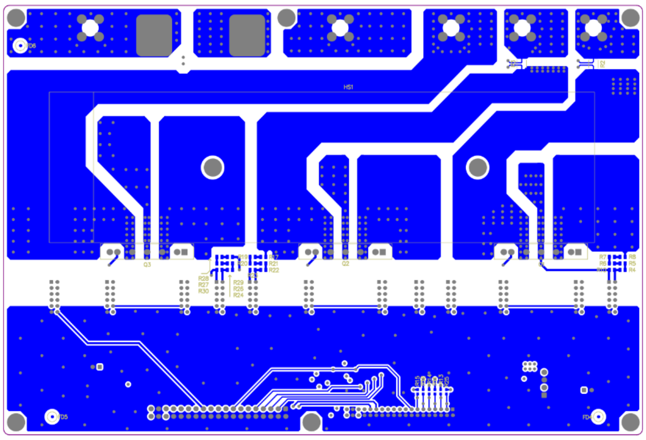


Figure 42. Bottom layer

Sensing Board PCB Layout

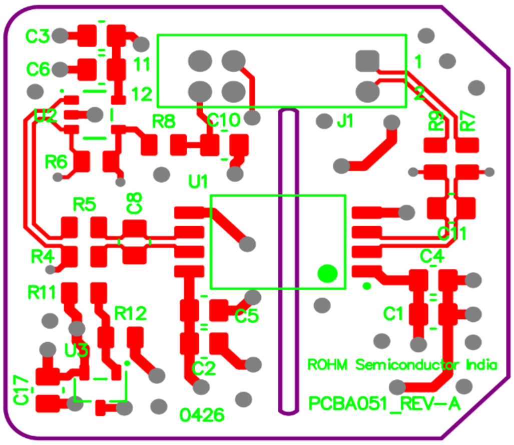


Figure 43. Top Layer

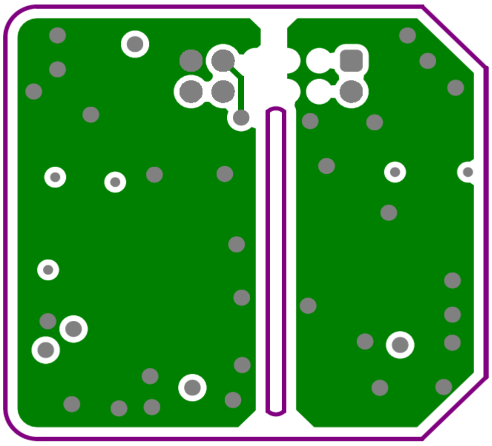


Figure 44. Mid-1 Layer

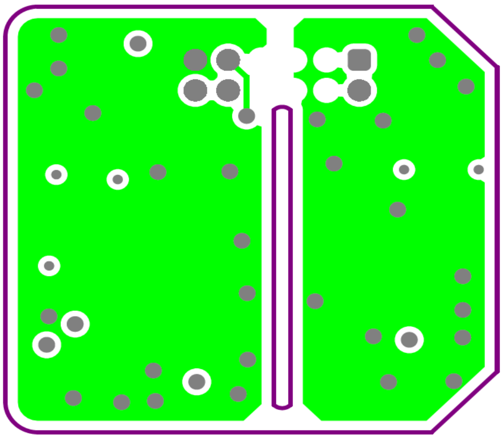


Figure 45. Mid-2 Layer

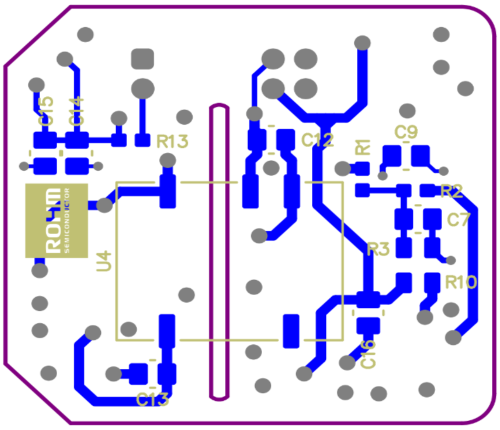


Figure 46. Bottom Layer

Gate Driver Board PCB Layout

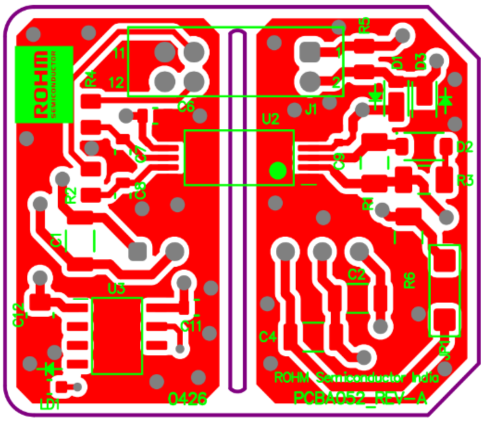


Figure 47. Top Layer

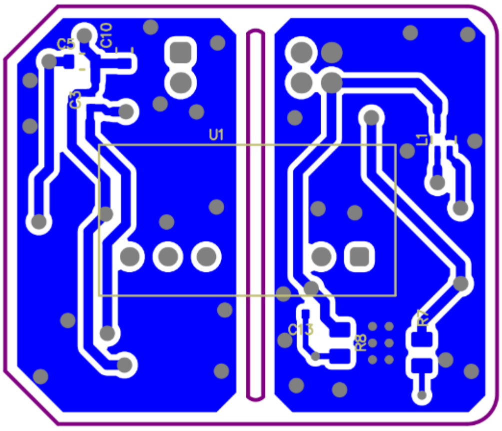


Figure 48. Bottom Layer

12 Troubleshooting

This section lists frequently encountered problems during operation and their recommended solutions.

Table 15. Trouble Shooting

Issue	Possible Cause	Recommended Fix
No output voltage	Input power not connected	Check input terminals and power source
Overtemperature	Poor ventilation or fan failure	Inspect cooling system
Inverter not starting	Faulty control signal or configuration	Verify control wiring and settings

13 Revision History

Revision	Date	Description of change
1	May 2026	Initial version

Notice

1) The information contained in this document is intended to introduce ROHM Group (hereafter referred to asROHM) products. When using ROHM products, please verify the latest specifications or datasheets before use.

2) ROHM products are designed and manufactured for use in general electronic equipment and applications (such as Audio Visual equipment, Office Automation equipment, telecommunication equipment, home appliances, amusement devices, etc.) or specified in the datasheets. Therefore, please contact the ROHM sales representative before using ROHM products in equipment or devices requiring extremely high reliability and whose failure or malfunction may cause danger or injury to human life or body or other serious damage (such as medical equipment, transportation, traffic, aircraft, spacecraft, nuclear power controllers, fuel control, automotive equipment including car accessories, etc. hereafter referred to as Specific Applications). Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses, or losses incurred by you or third parties arising from the use of ROHM Products for Specific Applications.

3) Electronic components, including semiconductors, can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against physical injury, and damage to any property, which a failure or malfunction of products may cause.

4) The information contained in this document, including application circuit examples and their constants, is intended to explain the standard operation and usage of ROHM products, and is not intended to guarantee, either explicitly or implicitly, the operation of the product in the actual equipment it will be used. As a result, you are solely responsible for it, and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses, or losses incurred by you or third parties arising from the use of such information.

5) When exporting ROHM products or technologies described in this document to other countries, you must abide by the procedures and provisions stipulated in all applicable export laws and regulations, such as the Foreign Exchange and Foreign Trade Act and the US Export Administration Regulations, and follow the necessary procedures in accordance with these provisions.

6) The technical information and data described in this document, including typical application circuits, are examples only and are not intended to guarantee to be free from infringement of third parties intellectual property or other rights. ROHM does not grant any license, express or implied, to implement, use, or exploit any intellectual property or other rights owned or controlled by ROHM or any third parties with respect to the information contained herein.

7) No part of this document may be reprinted or reproduced in any form by any means without the prior written consent of ROHM.

8) All information contained in this document is current as of the date of publication and subject to change without notice. Before purchasing or using ROHM products, please confirm the latest information with the ROHM sales representative.

9) ROHM does not warrant that the information contained herein is error-free. ROHM shall not be in any way responsible or liable for any damages, expenses, or losses incurred by you or third parties resulting from errors contained in this document.

ROHM
SEMICONDUCTOR

Thank you for your accessing to ROHM product informations.
More detail product informations and catalogs are available, please contact us.

ROHM Customer Support System

https://www.rohm.com/contactus