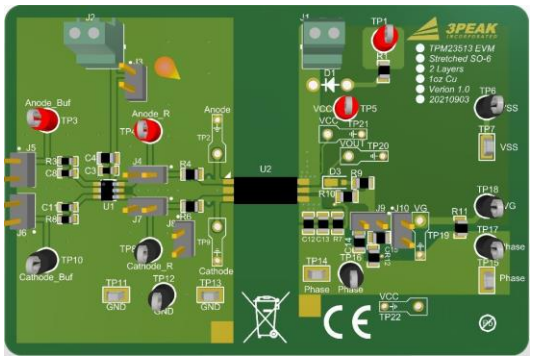
TPM23513B Driver EVM User's Guide



Key Features

- Single-Channel Isolated Gate Driver with Optocoupler-Compatible Input
- 4.5-A Source/5-A Sink Peak Output Current with Rail to-Rail Output
- 10-V to 40-V Output Driver Supply Voltage
- 5.7-V Reverse Polarity Voltage Handling Capability on Input Stage
- 5-kVRMS Reinforced Isolation Rating
- ±150-kV/μs Common-Mode Transient Immunity (CMTI)
- Industrial Standard Wide-Body WSOP6 Package
- Operating Ambient Temperature −40°C to +125°C

DESCRIPTIONS

The TPM23513B driver is a single-channel isolated gate driver for IGBTs, MOSFETs, and SiC MOSFETs. Its input is optocoupler compatible with the industrial standard widebody WSOP6 package. The driver is capable of sourcing 4.5 A and sinking 5 A of current. The output stage can withstand high voltages up to 40 V, making it suitable for the latest generation of IGBT and SiC-based applications.

APPLICATIONS

- Industrial Motor-Control Drives
- Industrial Power Supplies, UPS
- Solar Inverters
- Induction Heating

Revision History

Revise Date	Version	Reason/Issue
2024-11-22	A0	First Issue

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1. Electrical Specifications

A summary of the TPM23513B EVM performance specifications is provided in Table.1. Specifications are given for VCC2=15V, unless otherwise specified. The ambient temperature is 25℃ for all measurements, unless otherwise noted.

Table.1 TPM23513B EVM Performance Specification

PARAMETER	DESCRIPTION	MIN	Type	Max	UNITS
VDD	Primary-side power supply	4.5		5.5	V
VCC	Secondary-side power supply	10	15	40	V

2. EVM Documentation

2.1 Schematic

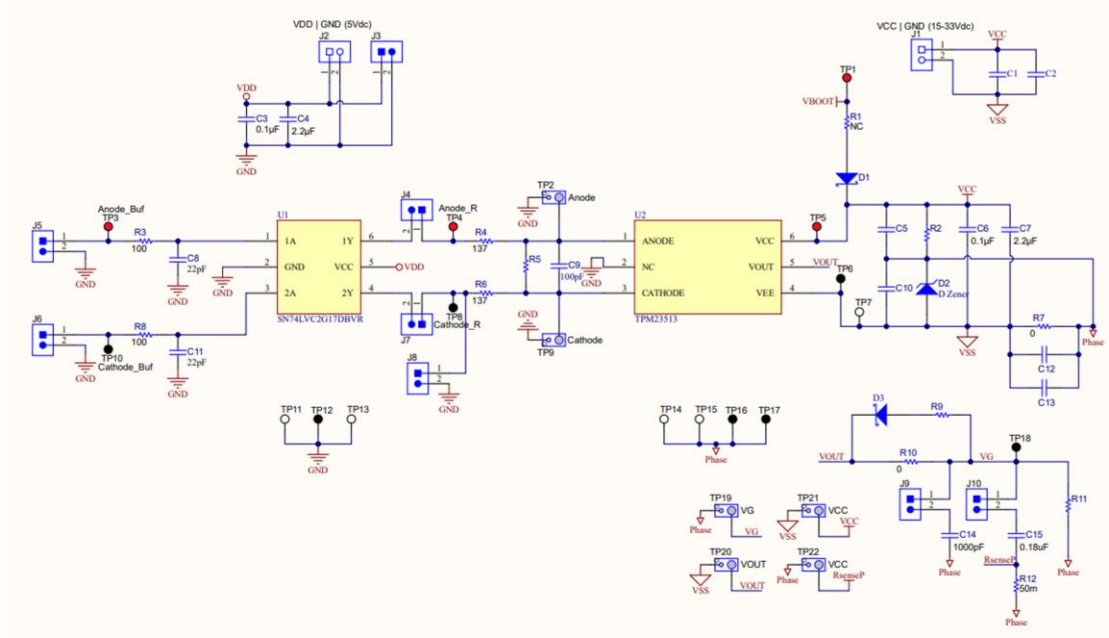


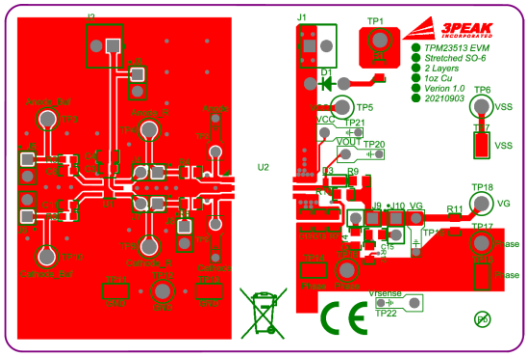
Fig. 1 TPM23513B EVM Schematic

2.2 Bill of Material

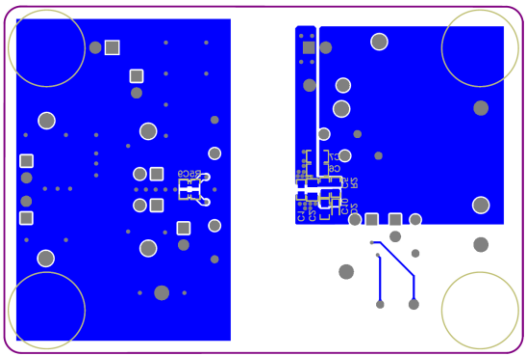
Table.2 TPM23513B EVM Bill of Materials

Designator	Qty	Value	Description	Package	Part No.	MFR
C1	1	100nF ±10% 50V	CAP CREM, 2.2F, 50V X5R	0603	CC0603KRX 7R9BB104	YAGEO
C4, C7	1	2.2uF ±10% 50V	CAP CREM, 2.2F, 50V X5R	0805	CL21A225KB QNNNE	SAMSUNG
C8, C11	2	22pF ±5% 50V	CAP CREM, 22pF, 50V C0G	0603	CL10C220JB 8NNNC	SAMSUNG
C6	2	100nF ±10% 50V	CAP CREM, 100nF, 50V X7R	0805	CC0805KRX 7R9BB104	YAGEO
C9	1	100pF ±5% 50V	CAP CREM, 100pF, 50V C0G	0603	CL10C101JB 8NNNC	SAMSUNG
C14	1	1nF ±10% 50V	CAP CREM, 10nF, 50V X7R	0805	CL21B102KB CNNNC	SAMSUNG
C15	1	180nF ±10% 50V	CAP CREM, 180nF, 50V X7R	0805	TCC0805X7 R184K500DT	CCTC
R4, R6	2	137Ω ±1% 125mW	Res,0.125W,0805	0805	CR0805F813 70G	LIZ
R7, R10	1	0Ω 125mW	Res,0.125W,0805	0805	CRCW08050 000Z0ECC	VISHAY
R12	1	50mΩ ±1% 125mW	Res,1%,0.125W,0805	0805	WSL0805R0 500FEA	VISHAY
U1	1	SN74LVC2G 17DBVR	Dual Schmitt-Trigger Buffer	SOT-23-6	SN74LVC2G 17DBVR	TI
U2	1	TPM23513B	Opto-Compatible 1CH Isolated Gate Driver	WSOP-6	TPM23513B-SOER	3PEAK

2.3 PCB Layout



Top Layer



Layer 2

Fig. 2 TPM23513B EVM PCB Layout

3. Test Setup and Procedure

3.1 Test Setup

The TPM23513 EVM is provided with input/output connectors and test points as shown in Table.3.

Table.3 TPM23513B EVM Connections

Designator	Description
J1	+10 V–40 V Output-Side Supply
J2	+5 V Buffer Supply
J3	+5 V Buffer Supply
J4	Anode Buffer Jumper
J5	Anode Buffer Input
J6	Cathode Buffer Input
J7	Cathode Buffer Jumper
J8	Cathode Resistor to GND Jumper
J9	VOUT Pin to 1nF Load Jumper
J10	VOUT Pin to 180nF+50Ω Load Jumper

The recommended connections to evaluate TPM23513B-EVM are shown in Fig.3.

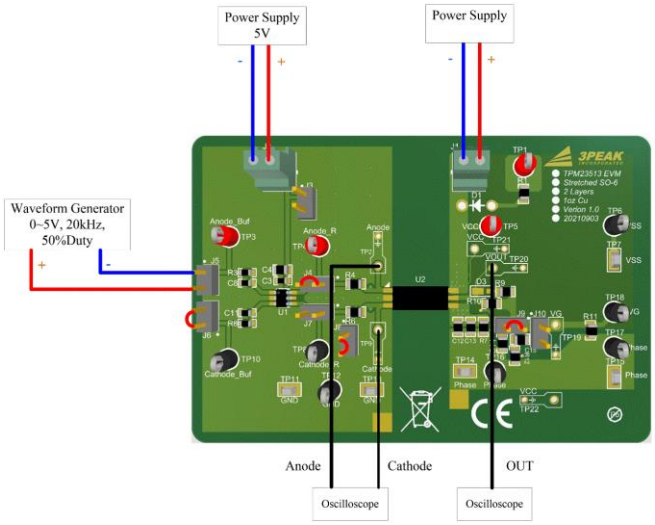


Fig. 3 EVM Test Setup

3.2 Test Equipment

Table. 4 lists the equipment used by 3PEAK. Other instruments capable of supporting the required voltage, current, and power levels for this EVM test may also be used.

Table.4 Test Equipments Used by 3PEAK

Instruments	Model	Vender
DC Source	E36313A	Keysight
Waveform Generator	33600A	Keysight
Oscilloscope	MXR108A	Keysight

3.3 Test Procedure

• Set up the EVM as described in Fig.3.
• Set the waveform generator to 5V, 20kHz, 50%.
• Set the primary power supply to 5V and the secondary power supply to 10V~40V.
• Oscilloscope is used to capture waveforms.

4. Test Results and Performance Evaluation

4.1 Example Input and Output Waveforms

Below shows the input and output waveforms of the EVM. The orange, red, and blue waveforms in the diagram represent the input voltage, input current, and output voltage of the TPM23513B, respectively.

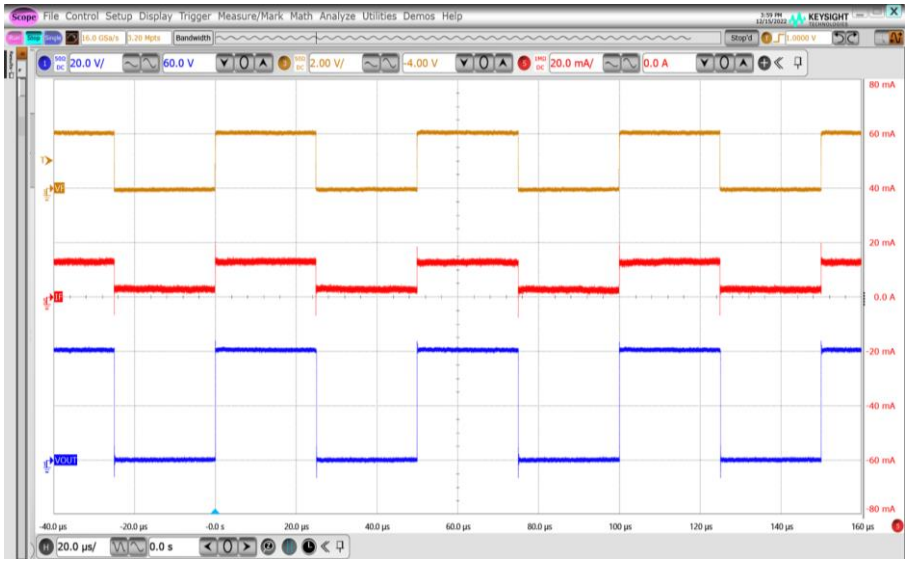


Fig. 4 Output Rise Time @ VCC2=40V, 1nF load

4.2 Output Rising Waveforms

Below shows the output rising waveforms of the EVM. As shown in Fig.5, the output rise time is nearly 12ns. As shown in Fig.6, the propagation delay from input to output is nearly 63ns.

4.2.1 Output Rise Time

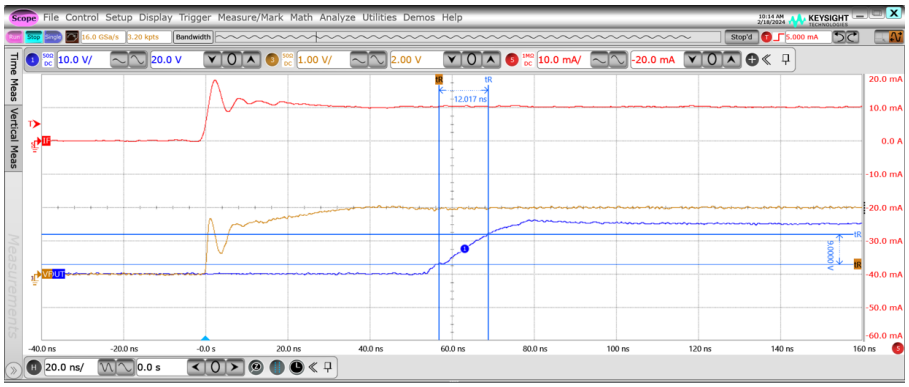


Fig. 5 Output Rise Time @ VCC2=15V, 1nF load

4.2.2 Propagation Delay

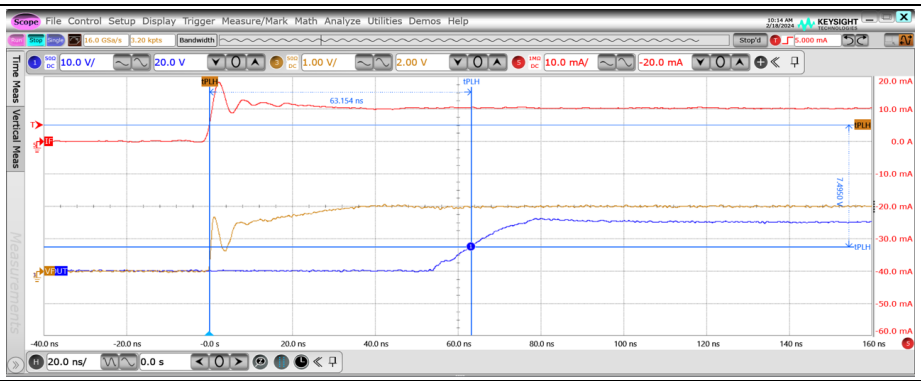


Fig. 6 Propagation Delay Time @ VCC2=15V, 1nF load

4.3 Output Falling Waveforms

Below shows the output falling waveforms of the EVM. As shown in Fig.7, the output fall time is nearly 7.6ns. As shown in Fig.8, the propagation delay from input to output is nearly 60ns.

4.3.1 Output Fall Time

Fig. 7 Output Fall Time @ VCC2=15V, 1nF load

4.3.2 Propagation Delay

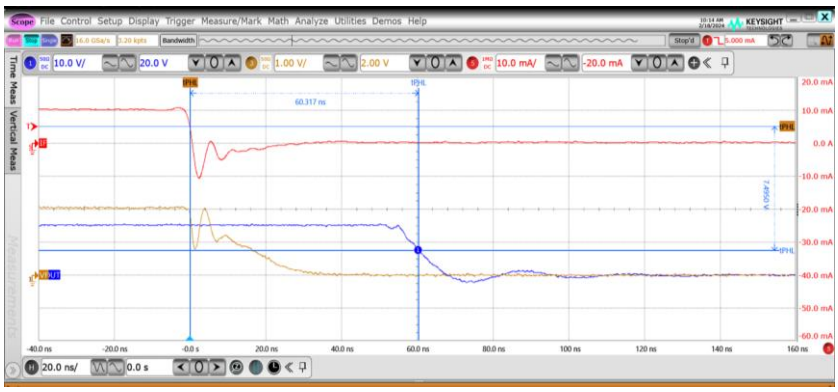


Fig. 8 Propagation Delay Time @ VCC2=15V, 1nF load

4.4 Peak Output Current Measurement Using 180nF&50mΩ Load

The output can be configured to measure the peak output current by shifting the jumper from J9 to J10. This jumper connects a 180 nF load capacitor and a 50 mΩ resistor in series (C15 and R12), allowing the output current to be indirectly measured by monitoring the voltage across R12. The output current is then determined by dividing the voltage across R12 by its resistance value.

4.4.1 Peak Source Output Current Measurement

The orange and green waveforms in the diagram represent the input voltage and the voltage across R12, respectively. The overshoot observed in the voltage across R12 is attributed to the parasitic inductance of R12. The peak source output current is calculated by dividing the voltage across R12 by its resistance value: 258.8mV/50mΩ=5.18A.

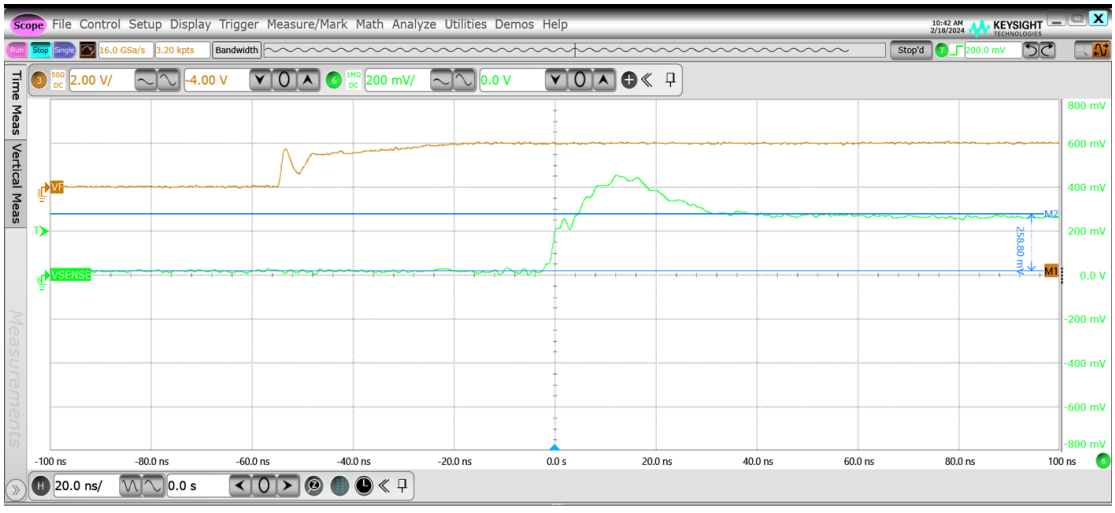


Fig. 9 Peak Source Output Current Measurement@ VCC2=15V

4.4.2 Peak Sink Output Current Measurement

The peak sink output current is calculated by dividing the voltage across R12 by its resistance value: 462.7mV/50mΩ=9.254A.

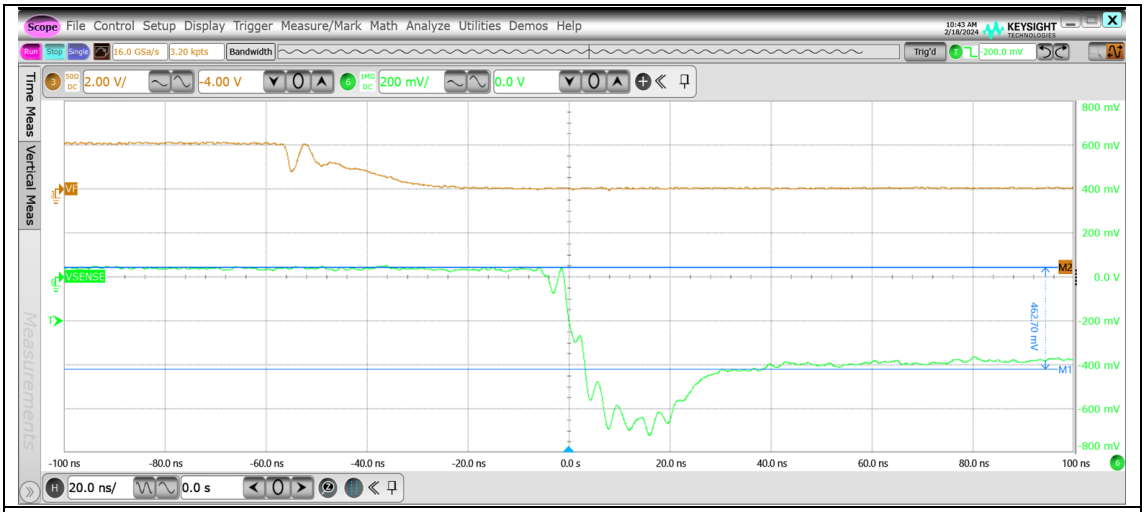


Fig. 10 Peak Sink Output Current Measurement@ VCC2=15V

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