Features

- Industry-Standard Pin-Out
- 4.5-V to 23-V Single-Supply Range
- Single Channel 5-A Peak Source and Sink-Drive Current
- TTL and CMOS Compatible Threshold
- Outputs Held Low During VDD-UVLO or Input Floating
- Low Propagation Delay (13-ns Typical)
- Fast Rise and Fall Times (7-ns and 6-ns Typical)
- ESD Protection Exceeds JESD 22 − 6-kV HBM, 1.5-kV CDM
- Available in SOT23-5 Package

Applications

- Switched-Mode Power Supplies
- DC-DC Converters
- Motor Control, Solar Inverters, UPS
- Gate & IGBT Drive

Description

The TPM27517 is a single-channel low-side gate-driver for MOSFET, IGBT and GaN power switches.

High sourcing and sinking current capability of 5-A allows improving switching efficiencies by minimizing slew time and switching loss. The device supports maximum 25-V supply voltage and −5 V input voltage. It improves system robustness especially in noisy industrial applications. Ultra-low propagation delay allows applications with tight timing requirements.

A small SOT23-5 package assists design for high density power supply.

Application Diagram

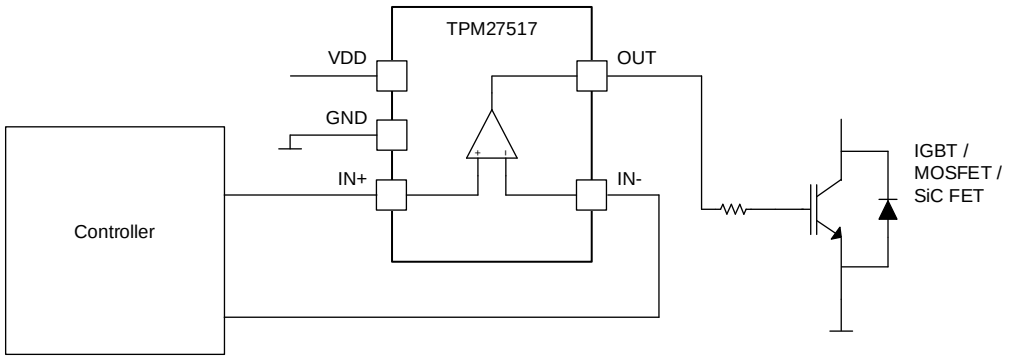


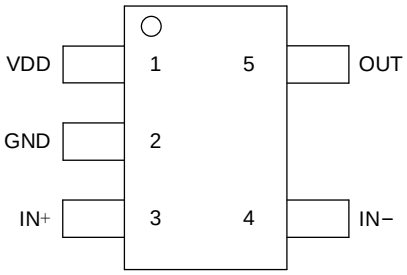
Table of Contents

Revision History

Date	Revision	Notes
2021-09-08	Rev.A.0	First release version

Pin Configuration and Functions

SOT23-5
Top View



Pin Functions

Pin		I/O	Description
No.	Name		
2	GND	Ground	Device Ground
3	IN+	Input	Logic Non-inverting Input.
4	IN−	Input	Logic Inverting Input.
5	OUT	Output	Channel Output
1	VDD	Power	Power Supply Input

Specifications

Absolute Maximum Ratings

Parameter		Min	Max	Unit
V_{DD}	Power Supply Voltage	−0.3	25	V
OUT	Output Voltage Range	−0.3	V_{DD} + 0.3	V
	Output Voltage Range (200-ns pulse)	−2	V_{DD} + 0.3	V
IN+, IN−	Input Voltage Range	−5	20	V
	Continuous Output Channel Current OUT	−300	300	mA
	Pulsed Output Channel Current OUT (500 ns)	−5	5	A
T_J	Operating Junction Temperature Range	−40	150	°C
T_{STG}	Storage Temperature Range	−65	150	°C
T_L	Lead Temperature (Soldering 10 sec)		260	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.
(2) The inputs are protected by ESD protection diodes to each power supply. If the input extends more than 300 mV beyond the power supply, the input current should be limited to less than 10 mA.
(3) Power dissipation and thermal limits must be observed.

ESD, Electrostatic Discharge Protection

Symbol	Parameter	Condition	Minimum Level	Unit
HBM	Human Body Model ESD	ANSI/ESDA/JEDEC JS-001(1)	±6	kV
CDM	Charged Device Model ESD	ANSI/ESDA/JEDEC JS-002(2)	±1.5	kV

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Unit
Power Supply Voltage, V_{DD}	4.5		23	V
Input Voltage Range IN+, IN−	0		20	V
Operating Ambient Temperature Range	−40		125	°C

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
SOT23-5	89.1	52.0	°C/W

Electrical Characteristics

All test condition is V_{DD} = 12 V, T_J = −40°C − 150°C, 1-μF capacitor between V_{DD} and GND, unless otherwise noted.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{DD(off)}$	Start-up current,	V_{DD} = 3.4 V, IN+ = H, IN− = L		40	100	μA
		V_{DD} = 3.4 V, IN+ = L, IN− = H		40	100	
V_{ON}	Supply Under Voltage Lock Out rising threshold	T_J = 25 °C	3.91	4.2	4.5	V
		T_J = −40 °C − 150 °C	3.7	4.2	4.65	
V_{OFF}	Supply Under Voltage Lock Out falling threshold	T_J = −40 °C − 150 °C	3.4	3.9	4.4	V
V_{DD_H}	Supply Under Voltage Lock Out hysteresis		0.2	0.3	0.5	V
V_{IN-_H}	IN− high threshold	IN− high threshold		1.9	2.3	V
V_{IN-_L}	IN− low threshold	IN− low threshold	1	1.2		V
V_{IN-_HYS}	IN− hysteresis		0.7	0.9	1.1	V
V_{IN+_H}	IN+ signal high threshold	IN+ high threshold		2.1	2.3	V
V_{IN+_L}	IN+ signal low threshold	IN+ low threshold	1	1.2		V
V_{IN+_HYS}	IN+ hysteresis		0.7	0.9	1.1	V
I_{OUT}	Output peak current	C_{LOAD} = 0.22 μF, F_{SW} = 1 kHz		±5		A
V_{DD} − V_{OH}	Output high voltage	I_{OUT} = −10 mA			40	mV
V_{OL}	Output low voltage	I_{OUT} = 10 mA			10	mV
R_{OH}	Output pull-up Resistance, PMOS pull-up only	I_{OUT} = −10 mA	1	1.6	3	Ω
R_{OL}	Output pull-down Resistance	I_{OUT} = 10 mA	0.15	0.5	1	Ω
t_R	Output rise-time	C_{LOAD} = 1.8 nF		7	18	ns
t_F	Output fall-time	C_{LOAD} = 1.8 nF		6	10	ns
t_{PW}	Minimal pulse width			15	25	ns
t_{D1}	IN+ to output propagation delay	C_{LOAD} = 1.8 nF, 5-V IN+ pulse	6	13	23	ns
t_{D2}	IN+ to output propagation delay	C_{LOAD} = 1.8 nF, 5-V IN+ pulse	6	13	23	ns
t_{D3}	IN− to output propagation delay	C_{LOAD} = 1.8 nF, 5-V IN− pulse	6	13	23	ns
t_{D4}	IN− to output propagation delay	C_{LOAD} = 1.8 nF, 5-V IN− pulse	6	13	23	ns

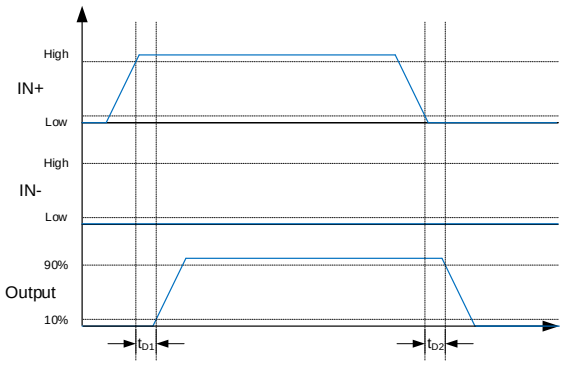


Figure 1 IN+ Timing Diagram

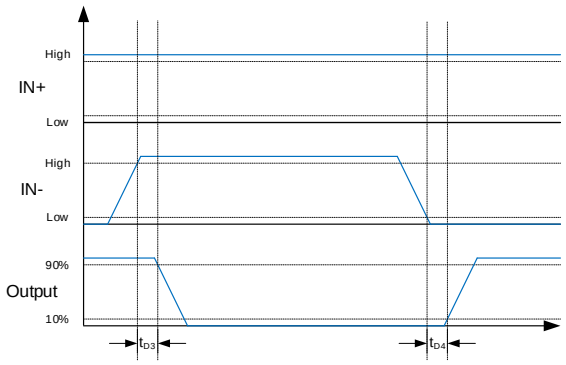


Figure 2 IN− Timing Diagram

Typical Performance Characteristics

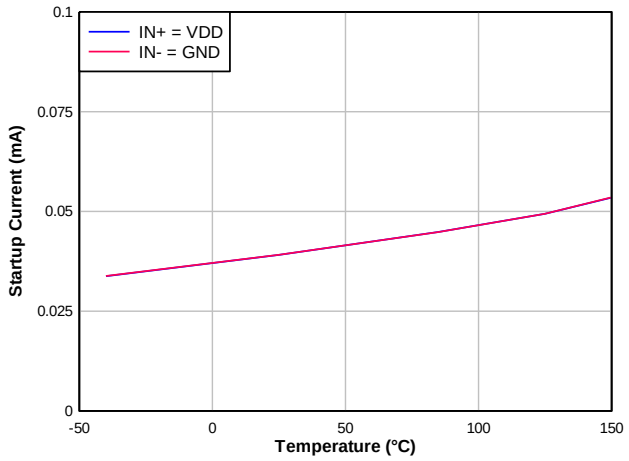


Figure 3 Start-up Current vs. Temperature

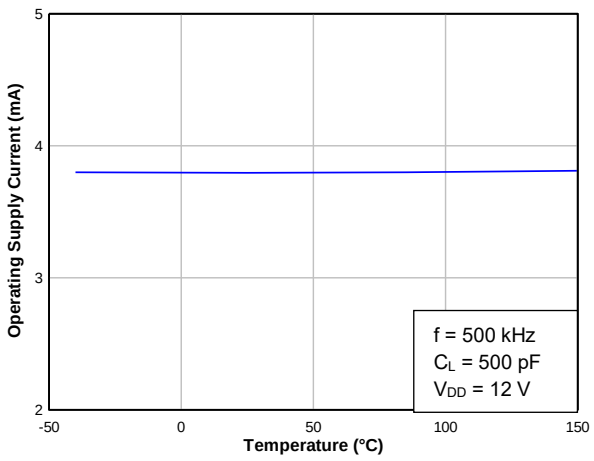


Figure 4 Operating Current vs Ambient Temperature

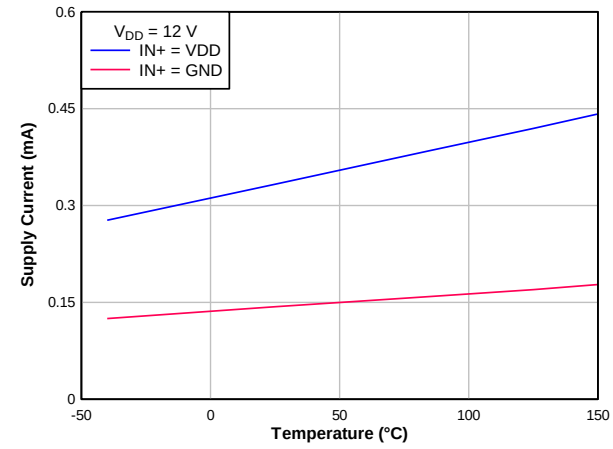


Figure 5. Supply Current vs Temperature (On/Off)

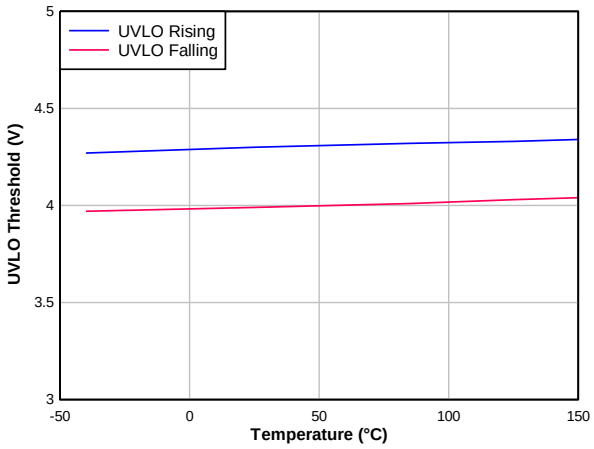


Figure 6 UVLO Threshold vs Temperature

Typical Performance Characteristics (Continued)

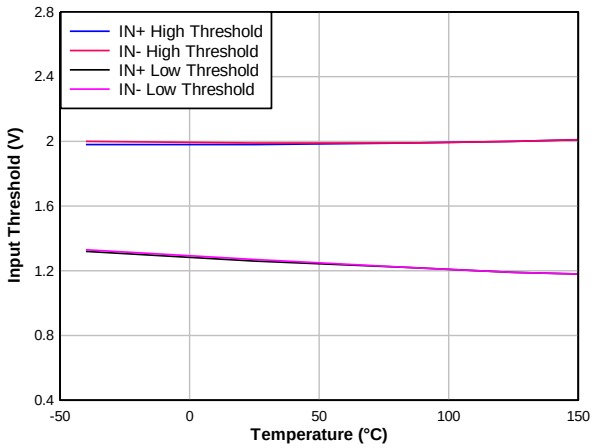


Figure 7 Input Threshold vs Temperature

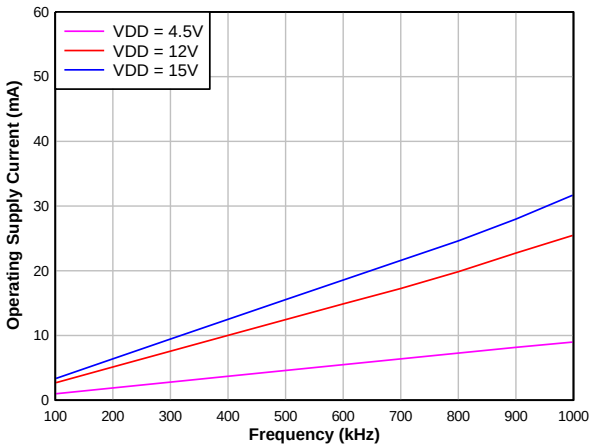


Figure 8 Operating Supply Current vs Frequency

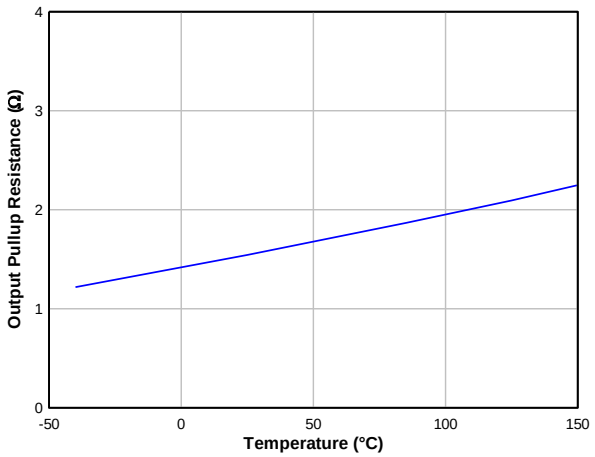


Figure 9 Output Pull-up Resistance vs Temperature

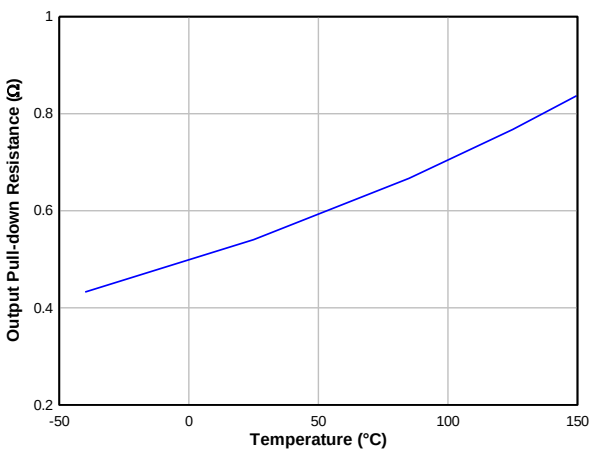


Figure 10. Output Pull-down Resistance vs Temperature

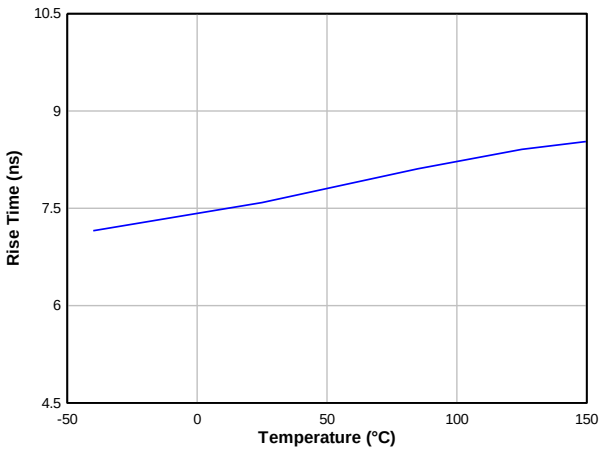


Figure 11 Rise-time vs Temperature

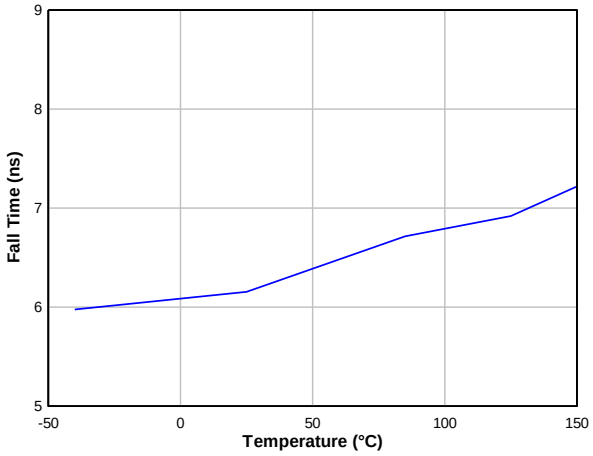


Figure 12. Fall-time vs Temperature

Typical Performance Characteristics (Continued)

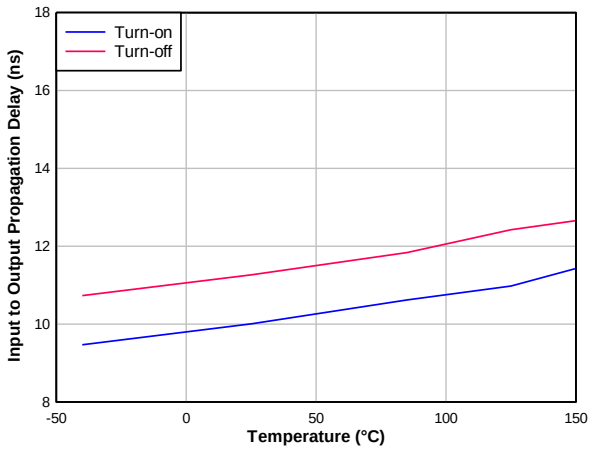


Figure 13 Input to Output Propagation Delay vs Temperature

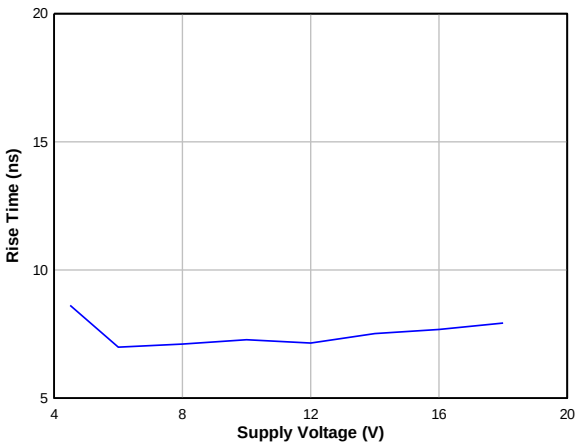


Figure 14 Rise-time vs Supply Voltage

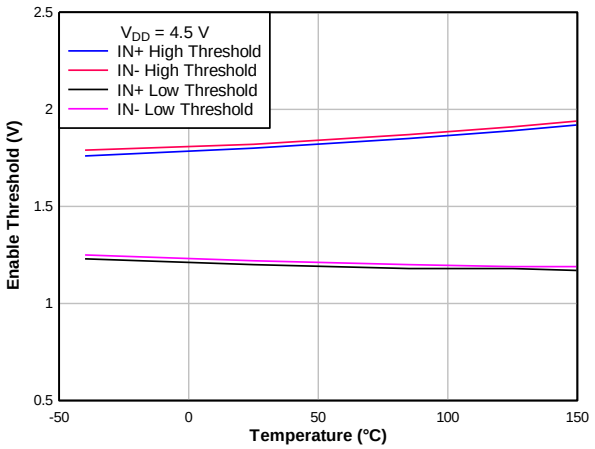


Figure 15 Enable Threshold vs Temperature

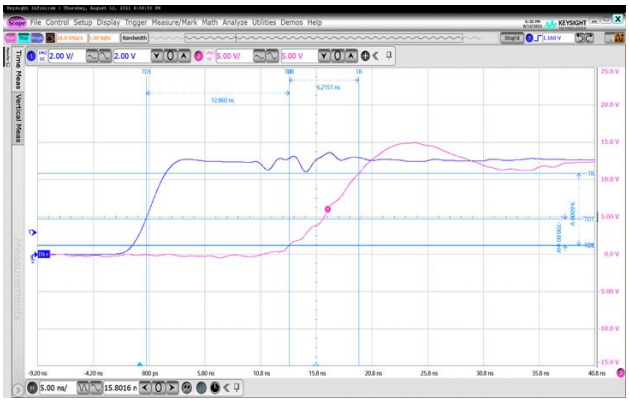


Figure 16 IN+ Rising Edge

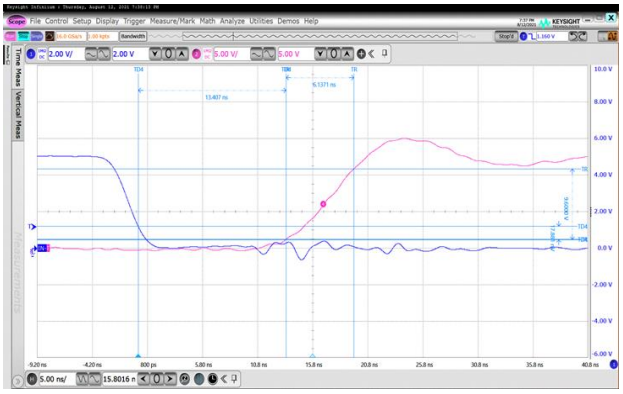


Figure 17 IN+ Falling Edge

Detailed Description

Overview

The TPM27517 single-channel low-side gate driver is designed for high performance power supplies, motor controls and inverters. Designed with the industrial standard of pin-out and package, the TPM27517 accelerates design process. With extended voltage ranges on supply voltage and negative input voltage, the TPM27517 improves system level reliability. Its 5-A strong driving capability improves gate driver efficiency and lowers heat generation, especially in high-frequency switching applications.

Functional Block Diagram

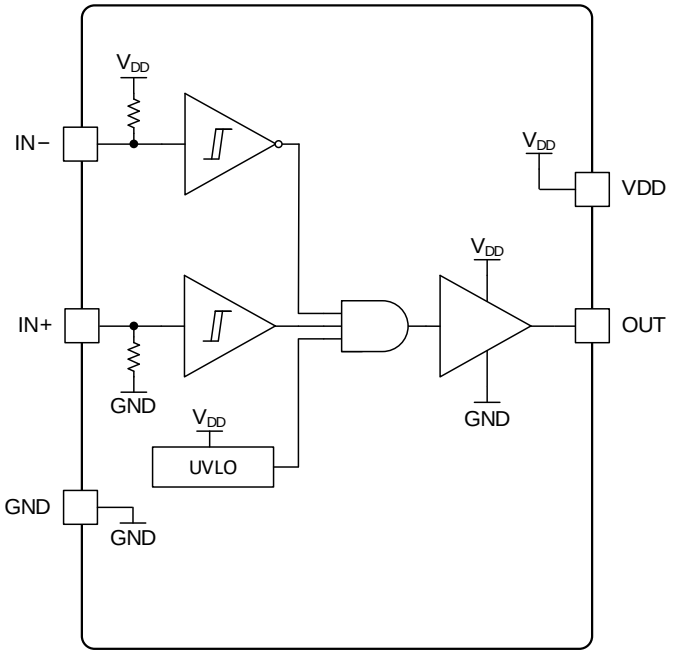


Figure 18 Functional Block Diagram

Feature Description

Low Propagation Delay Driver Output

The low-propagation-delay design between the device input and output allows the device to achieve the industrial leading performance. The low delay enhances the driver performance in high frequency switching regulators.

Supply and UVLO

The device monitors supply voltage with under-voltage lock-out (UVLO). When the supply voltage is below the UVLO threshold, the output is held low in UVLO to avoid glitches during power rising and falling. The device quiescent current and operating current are measured as shown in Figure 5. The current is related to internal quiescent current consumption as well as output current. The output current can be calculated using external transistor gate charge times switching frequency f_{sw}.

Channel Input

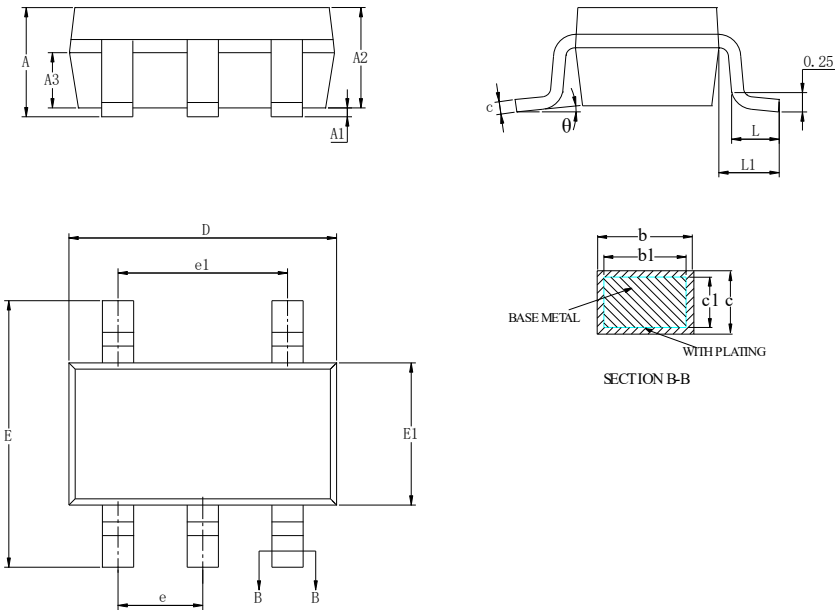
The input of the TPM27517 gate driver supports TTL and CMOS input with threshold voltage independent of supply voltage. The threshold is also designed as temperature independent to support a wide range of ambient temperature. Wide hysteresis enhances system level noise immunity. The integrated pull-down resistor sets the device in low state when the inputs are floating. The inputs can withstand DC −5 V to improve robustness on ground bouncing.

Output Stage

The TPM27517 output stage can deliver high current sourcing and sinking up to 5-A with low propagation delay.

Package Outline Dimensions

SOT23-5



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.25
A1	0.04	—	0.10
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.33	—	0.41
b1	0.32	0.35	0.38
c	0.15	—	0.19
c1	0.14	0.15	0.16
D	2.82	2.92	3.02
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95BSC		
e1	1.90BSC		
L	0.30	—	0.60
L1	0.60REF		
θ	0	—	8°

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPM27517-S5TR	−40°C – 125°C (1)	SOT23-5	M57	MSL3	3000	Green

(1) Ambient temperature indicates device operation condition range. Application thermal behavior needs to be taken care of when operating in high temperature scenarios.

Green: 3PEAK defines "Green" to mean RoHS compatible and free of halogen substances.