

Single-Channel 2-A High-Speed, Low-Side Gate Driver**Features**

- Industry-Standard Pin-out
- 4.5-V to 23-V Single-Supply Range
- Single Channel
- 2-A Peak Source and Sink-Drive Current
- Independent Enable Function for Each Output
- TTL and CMOS Compatible Threshold
- Outputs Held Low during VDD-UVLO or Input Floating
- Low Propagation Delay
- Fast Rise-and-Fall Times
- ESD Protection Exceeds JESD 22 – 4-kV HBM, 1.5-kV CDM
- Available in QFN2X2-8, SOP8 Packages

Description

The TPM27217 is a single-channel low-side gate driver for MOSFET, IGBT, and GaN power switches.

High sourcing and sinking current capability of 2-A allows for improving switching efficiencies by minimizing slew time and switching loss. The device supports a maximum 25-V supply voltage and -5 V improves system robustness, especially in noisy industrial applications.

Applications

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

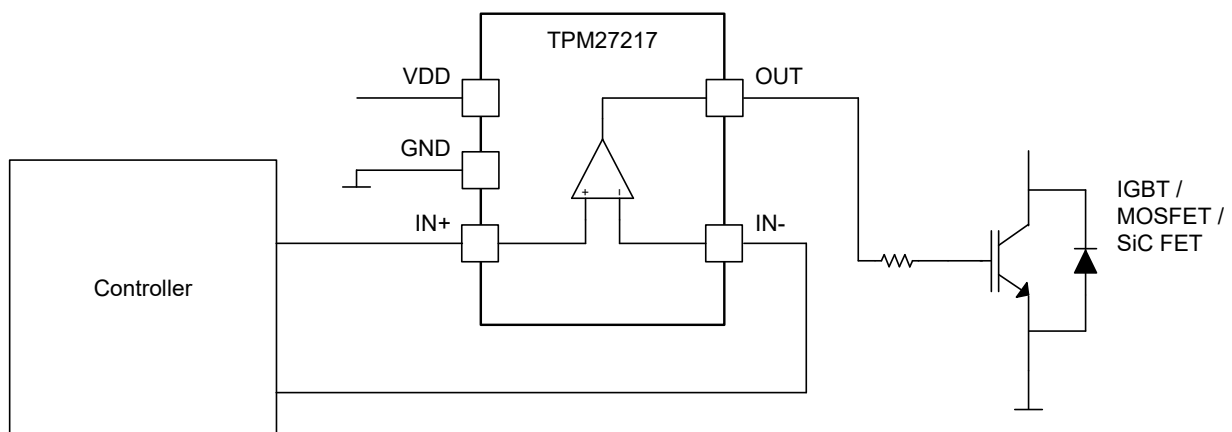
Typical Application Circuit

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Revision History

Date	Revision	Notes
2022-09-09	Rev.P.0	Initial release
2023-08-07	Rev.A.0	Correction on electrical table

Pin Configuration and Functions

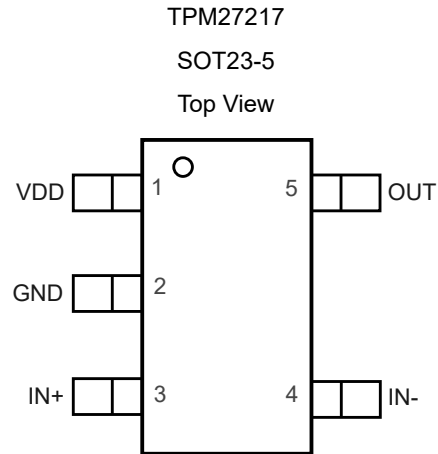


Table 1. Pin Functions: TPM27217

Pin	Name	I/O	Description
1	VDD	Supply	Device Supply
2	GND	Ground	Device Ground
3	IN+	Input	Non-inverting Input
4	IN-	Input	Inverting Input
5	OUT	Output	Channel Output

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Specifications

Absolute Maximum Ratings ⁽¹⁾

Parameter		Min	Max	Unit
	Power Supply Voltage, VDD	-0.3	25	V
	Output Voltage Range OUT	-0.3	VDD + 0.3	V
		-2	VDD + 0.3 (200-ns pulse)	
	Input Voltage Range IN+, IN-	-5	20	V
	Pulsed Output Channel Current OUT (500 ns)	-2	2	A
	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⁾	±4	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	Max	Unit
Power Supply Voltage, VDD	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	52	°C/W

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Electrical Characteristics

All test conditions: $V_{DD} = 18\text{ V}$, $T_A = -40\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$, and $1\text{-}\mu\text{F}$ capacitor between V_{DD} and GND, unless otherwise noted.

Parameter	Conditions	Min	Typ	Max	Unit
$I_{DD(off)}$	Start-up Current $V_{DD} = I_{NA} = I_{NB} = 3.4\text{ V}$		54	80	μA
V_{ON}	Supply Under Voltage Lock Out Rising Threshold $T_J = -40\text{ }^{\circ}\text{C} - 150\text{ }^{\circ}\text{C}$	3.5	3.85	4.2	V
V_{OFF}	Supply Under Voltage Lock Out Falling Threshold $T_J = -40\text{ }^{\circ}\text{C} - 150\text{ }^{\circ}\text{C}$	3.3	3.6	4	V
V_{DD_H}	Supply Under Voltage Lock Out Hysteresis		0.25		V
V_{IN_H}	IN+ High Threshold		1.7	2.1	V
V_{IN_L}	IN+ Low Threshold	1	1.15		V
V_{IN+_HYS}	IN+ Hysteresis		0.55		V
V_{IN_H}	IN- Signal High Threshold		1.7	2.1	V
V_{IN_L}	IN- Signal Low Threshold	1	1.15		V
V_{IN_HYS}	IN- Hysteresis		0.55		V
I_{OUT}	Output Peak Current $C_{LOAD} = 0.22\text{ }\mu\text{F}$, $F_{SW} = 1\text{ kHz}$		± 2		A
R_{OH}	Output Pull-up Resistance, PMOS Pull-up Only $I_{OUT} = -10\text{ mA}$	3	6	10	Ω
R_{OL}	Output Pull-down Resistance $I_{OUT} = 10\text{ mA}$	0.5	0.93	1.6	Ω
V_{OH}	Output Pull-up Voltage, $V_{DD} - V_{OUT}$ $I_{OUT} = -10\text{ mA}$			100	mV
V_{OL}	Output Pull-down Voltage $I_{OUT} = 10\text{ mA}$	3		16	mV
t_R	Output Rise-time ⁽¹⁾ $C_{LOAD} = 1.8\text{ nF}$		9		ns
t_F	Output Fall-time ⁽¹⁾ $C_{LOAD} = 1.8\text{ nF}$		8		ns
t_M	Delay matching between OUTA and OUTB ⁽¹⁾ $I_{NA} = I_{NB}$, OUTA and OUTB measured at 50%		1	4	ns
t_{D1}	Input to Output Propagation Delay ⁽¹⁾ $C_{LOAD} = 1\text{ nF}$, 5-V INx pulse		18		ns
t_{D2}	Input to Output Propagation Delay ⁽¹⁾ $C_{LOAD} = 1.8\text{ nF}$, 5-V INx pulse		14		ns

(1) Guaranteed by design, not tested in production

Single-Channel 2-A High-Speed, Low-Side Gate Driver

Typical Performance Characteristics

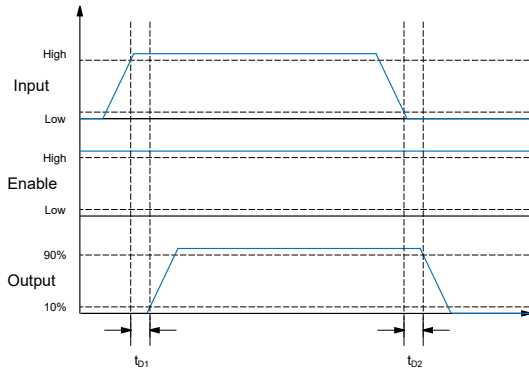


Figure 1. Input Timing Diagram

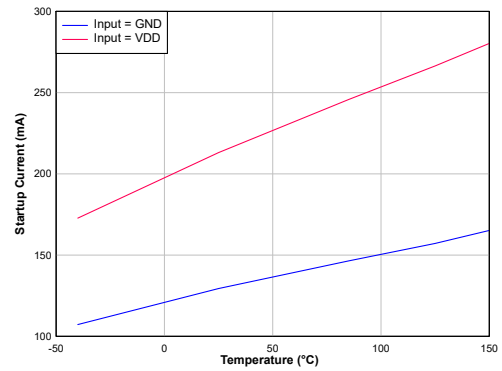


Figure 2. Start-up Current vs. Temperature

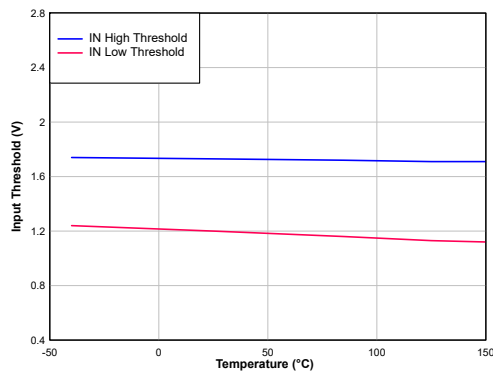


Figure 3. Input Threshold vs Temperature

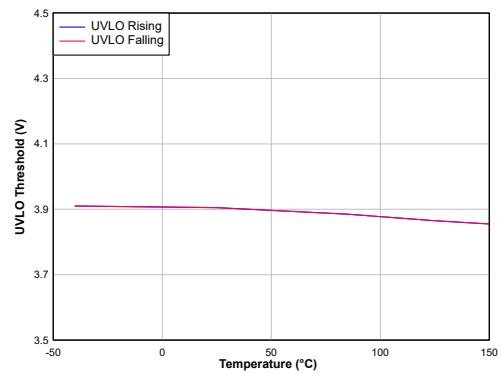


Figure 4. UVLO Threshold vs Temperature

$f = 500 \text{ kHz}$, $C_L = 500 \text{ pF}$, $V_{DD} = 12 \text{ V}$

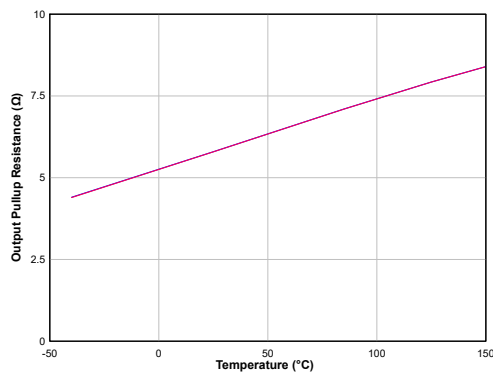


Figure 5. Output Pull-up Resistance vs Temperature

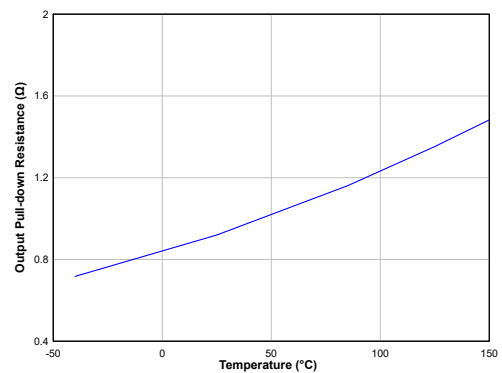


Figure 6. Output Pull-down Resistance vs Temperature

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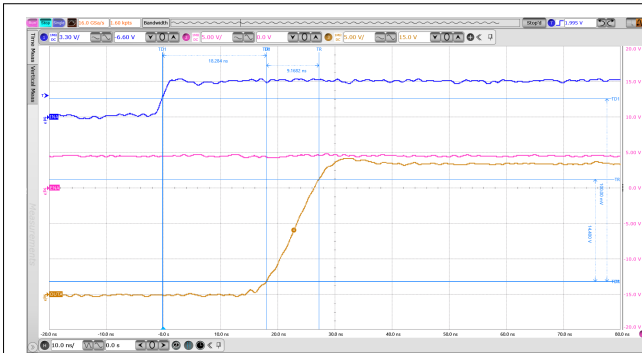


Figure 7. INx Rising Edge

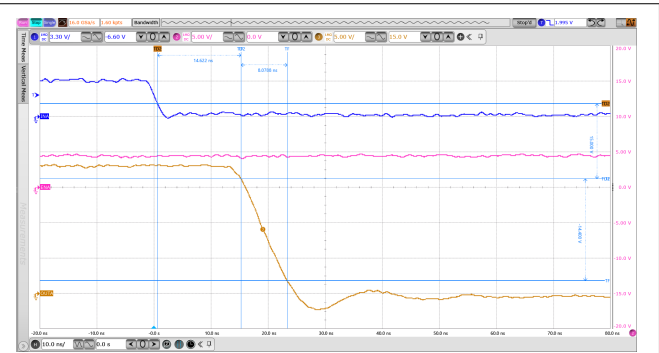


Figure 8. INx Falling Edge

Detailed Description

Overview

The TPM27217 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 TPM27217 accelerates the design process. With extended voltage ranges on supply voltage and negative input voltage, the TPM27217 improves system-level reliability. Its 2-A strong driving capability improves gate driver efficiency and lowers heat generation, especially in high-frequency switching applications.

Functional Block Diagram

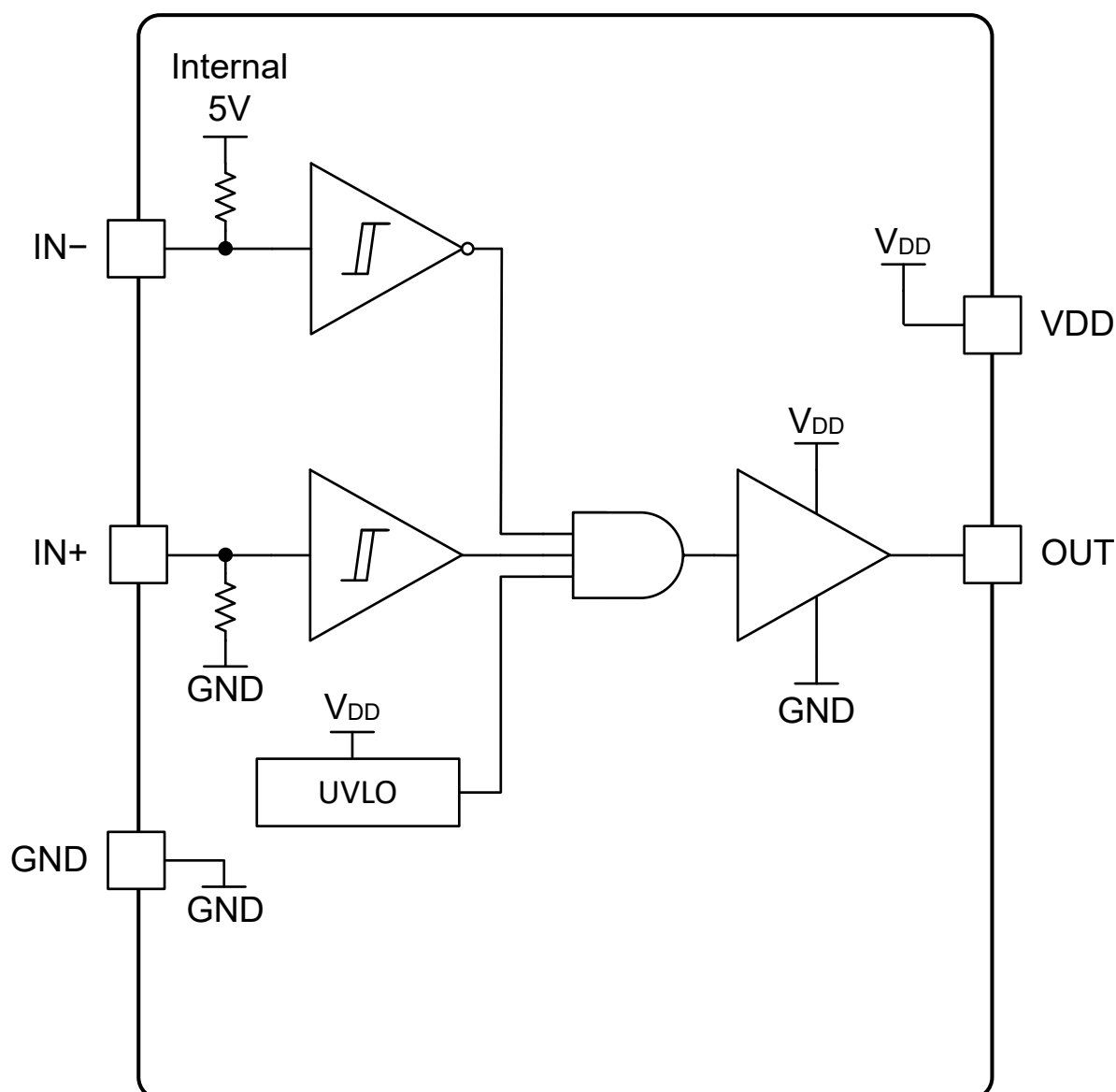


Figure 9. Functional Block Diagram

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} .

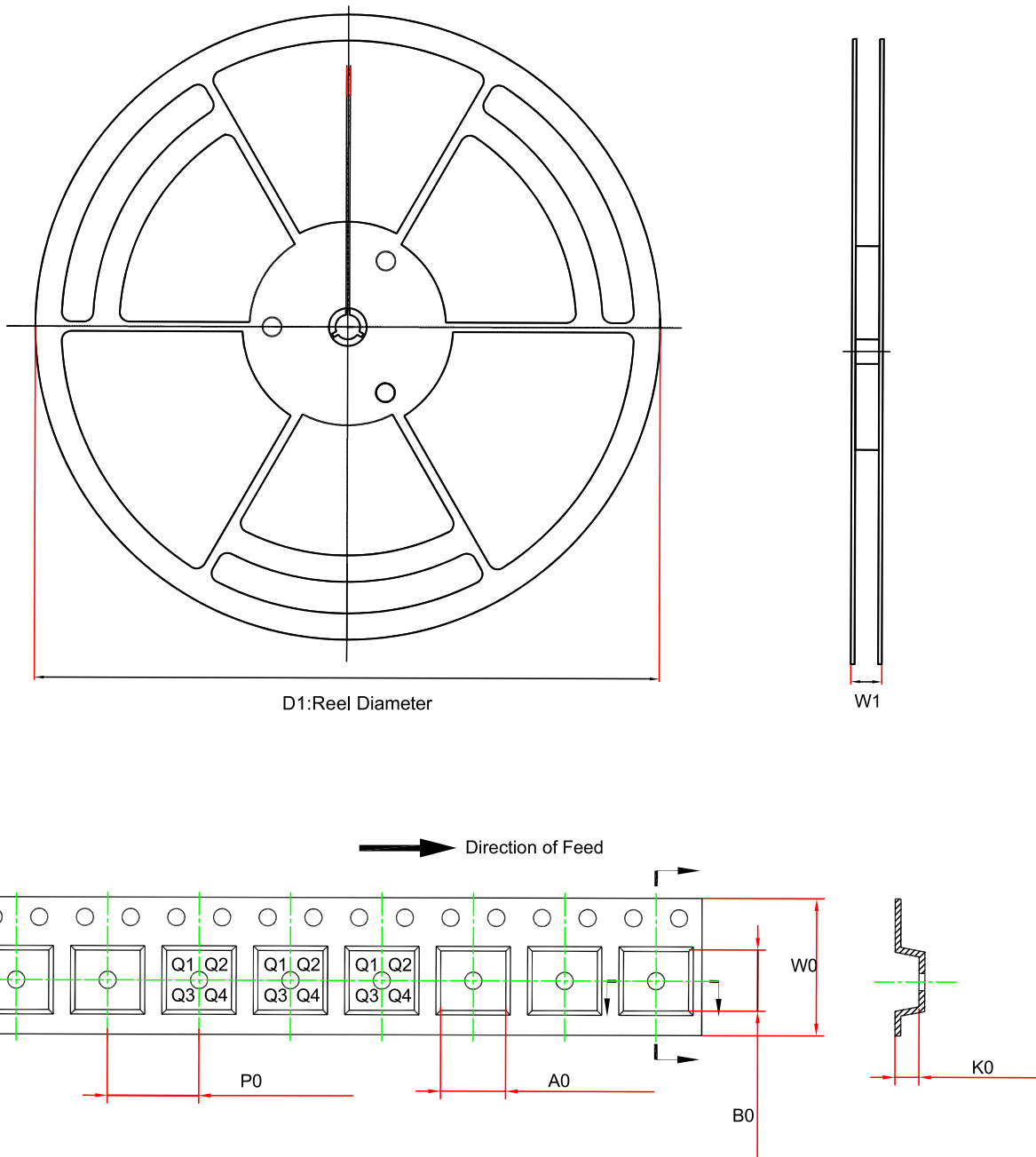
Channel Input

The input of the TPM27217 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 temperatures. Wide hysteresis enhances system-level noise immunity. The integrated pull-down resistor sets the device in a low state when the inputs are floating. The inputs can withstand DC -5 V to improve robustness on ground bouncing.

Output Stage

The TPM27217 output stage can deliver high current sourcing and sinking up to 2-A with low propagation delay.

Tape and Reel Information



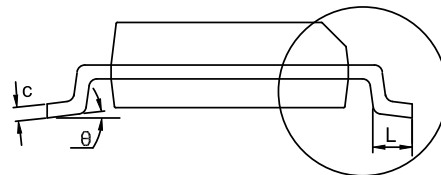
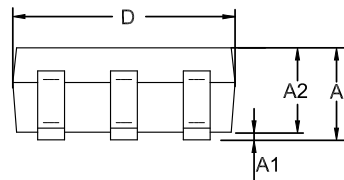
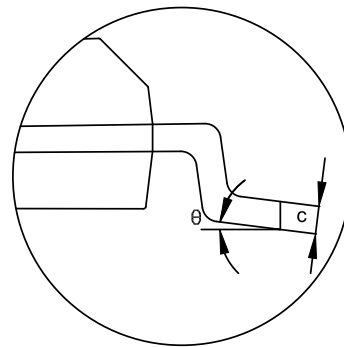
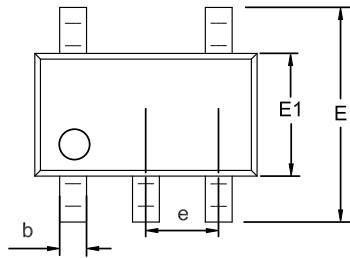
Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPM27217-S5TR	SOT23-5	180	12	3.3	3.25	1.4	4	8	Q3

Package Outline Dimensions

SOT23-5

Package Outline Dimensions

S5T(SOT23-5-A)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.150	0.000	0.006
A2	1.000	1.200	0.039	0.047
b	0.280	0.500	0.011	0.020
c	0.100	0.230	0.004	0.009
D	2.820	3.020	0.111	0.119
E	2.600	3.000	0.102	0.118
E1	1.500	1.720	0.059	0.068
e	0.950 BSC		0.037 BSC	
L	0.300	0.600	0.012	0.024
θ	0	8°	0	8°

NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

Order Information

Order Number	Operating Ambient Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPM27217-S5TR	-40 °C to 125 °C ⁽¹⁾	SOT23-5	217	3	Tape and Reel, 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.

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