

Features

- Industry-standard Pin Configuration
- Automotive AEC-Q100 Grade 1 Qualified (Refer to TPM27524Q)
- 4.5-V to 23-V Single-Supply Range
- Dual Independent Channels
- 5-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 (14-ns Typical)
- Fast Rise-and-fall Times (7-ns and 6-ns Typical)
- <1-ns Typical Delay Matching between Two Channels
- Two Outputs Used in Parallel for Higher Drive Current
- ESD Protection Exceeds JESD 22 – 6-kV HBM, 1.5-kV CDM
- Available in SOP8, EMSOP8, DFN3X3-8, DFN2X2-8, and DFN1.5X1.5-8 Packages

Description

The TPM2752x family is a series of dual-channel low-side gate drivers for MOSFET, IGBT, and GaN power switches.

High sourcing and sinking current capability of 5 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 DC input voltage capability, which improves system robustness, especially in noisy industrial applications. Ultra-low propagation delay and excellent matching between two channels are designed for applications with tight timing requirements.

The TPM2752x family consists of a set of gate drivers with different polarities, allowing customers to select based on application needs. The wide range of the package supports SOP8, EMSOP8, and DFN3X3-8, aligning with industrial standard packages. Extra ultra-small DFN2X2-8 and DFN1.5X1.5-8 packages assist the design of ultra-compact synchronous rectifiers in power bricks.

Applications

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

Typical Application Circuit

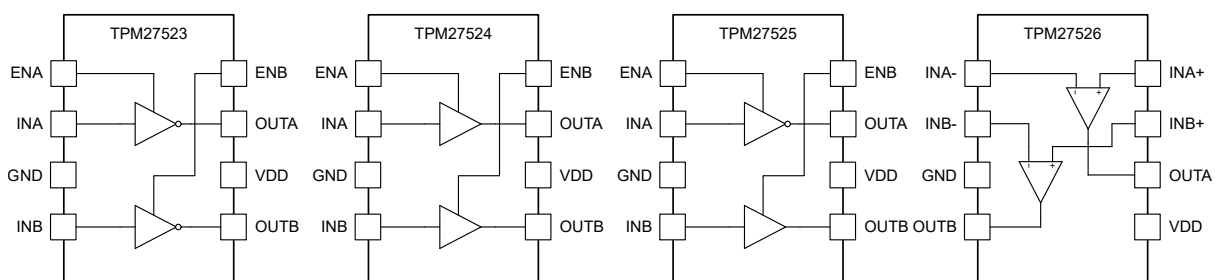


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Revision History

Date	Revision	Notes
2020-02-24	Rev A.0	Initial release
2020-02-24	Rev A.1	Minor updates on Input hysteresis
2022-04-21	Rev A.2	Updated order information, automotive grade devices, electrical table rising/ falling timing, and block diagrams
2022-12-20	Rev A.3	Moved automotive TPM27524Q to a separate datasheet
2024-03-17	Rev A.4	Changed TPM27524-DF6R Pin1 location to Q2, misc updates on tape & reel info
2024-04-22	Rev A.5	Added input threshold electrical parameters
2024-12-02	Rev A.6	Added TPM27524-DF6R-S part number. Misc correction
2025-03-16	Rev A.7	Added TPM27524A part numbers and TPM27524A improved noise filtering Updated the Electrical Characteristics table
2026-02-12	Rev A.8	Added DFN1.5X1.5-8 package option Updated EMSOP package exposed pad dimensions Updated Thermal Resistance on DFN1.5X1.5-8 package Updated pinout and pinmap description Updated timing description

Pin Configuration and Functions

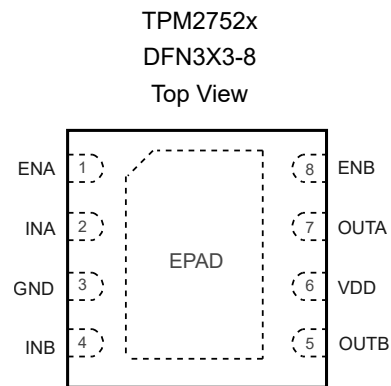
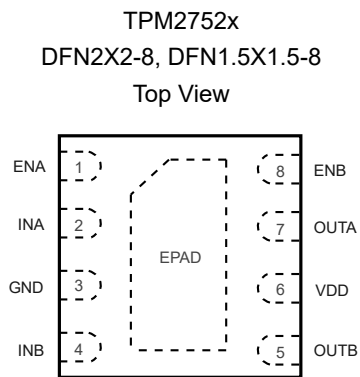
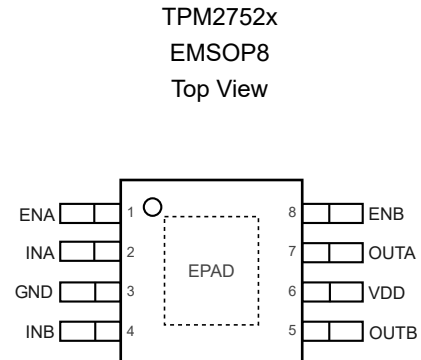
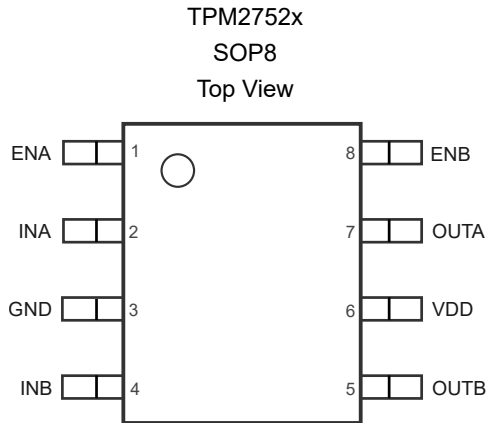


Table 1. Pin Functions: TPM2752x

Pin	Name	I/O	Description
1	ENA	Input	Channel A enable input, output enabled if unbiased or floating.
8	ENB	Input	Channel B enable input, output enabled if unbiased or floating.
3	GND	Ground	Device ground
2	INA	Input	Logic input. TPM27523: Inverting input; TPM27524: Non-inverting input; TPM27525: Inverting input. Output low if unbiased or floating.
4	INB	Input	Logic input. TPM27523: Inverting input; TPM27524: Non-inverting input; TPM27525: Non-inverting input. Logic input. TPM27523: Inverting input; TPM27524: Non-inverting input; TPM27525: Inverting input. Output low if unbiased or floating.
7	OUTA	Output	Channel A output
5	OUTB	Output	Channel B output
6	VDD	Power	Power supply input
EPAD	EPAD	GND	Exposed Pad. Connect to GND.

Dual 5-A High-speed, Low-side Gate Driver

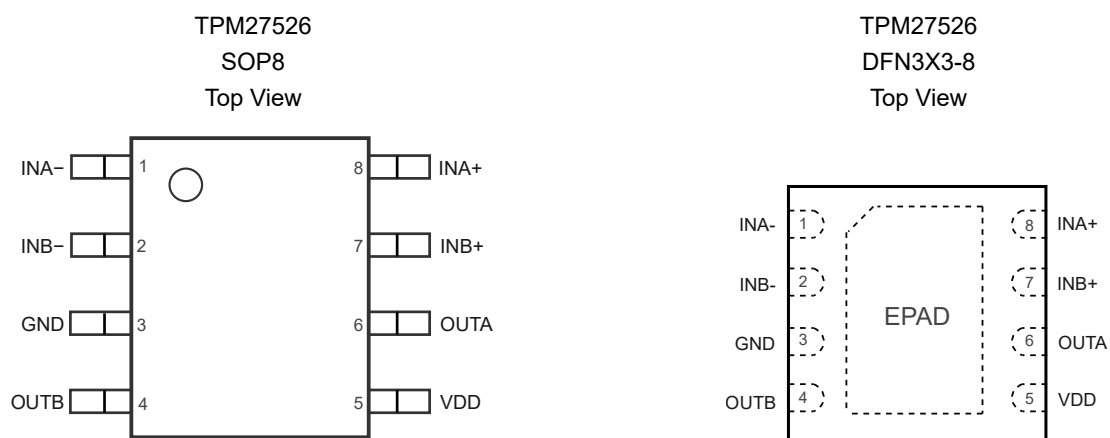


Table 2. Pin Functions: TPM27526

Pin	Name	I/O	Description
1	INA-	Input	Logic input. Inverting input. Output low if unbiased or floating.
2	INB-	Input	Logic input. Inverting input. Output low if unbiased or floating.
3	GND	Ground	Device ground
4	OUTB	Output	Channel B output
5	VDD	Power	Power supply input
6	OUTA	Output	Channel A output
7	INB+	Input	Logic input. Non-inverting input. Output low if unbiased or floating.
8	INA+	Input	Logic input. Non-inverting input. Output low if unbiased or floating.
EPAD	EPAD	GND	Exposed Pad. Connect to GND.

Specifications

Absolute Maximum Ratings ⁽¹⁾

Parameter		Min	Max	Unit
	Power Supply Voltage, VDD	-0.3	25	V
	Output Voltage Range OUTA, OUTB	-0.3	VDD + 0.3	V
	Output Voltage Range OUTA, OUTB (200-ns pulse)	-2	VDD + 0.3	
	Input Voltage Range INA, INB, INA+, INA-, INB+, INB-, ENA, ENB	-5	20	V
	Continuous Output Channel Current OUTA, OUTB	-300	300	mA
	Pulsed Output Channel Current OUTA, OUTB (500 ns)	-5	5	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

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	Max	Unit
Power Supply Voltage, VDD	4.5	23	V
Input Voltage Range INA, INB, INA+, INA-, INB+, INB-, ENA, ENB	0	20	V
Operating Ambient Temperature Range	-40	125	°C

Thermal Information

Package Type	θ _{JA}	θ _{JC-top}	Unit
SOP8	122.3	60.4	°C/W
EMSOP8	63.0	42.6	°C/W

Dual 5-A High-speed, Low-side Gate Driver

Package Type	θ_{JA}	θ_{JC-top}	Unit
DFN3X3-8	75	33	°C/W
DFN2X2-8	55	50	°C/W
DFN1.5X1.5-8	74.8	72.4	°C/W

Electrical Characteristics

All test conditions: $V_{DD} = 12\text{ V}$, $T_J = -40\text{ }^{\circ}\text{C}$ to $150\text{ }^{\circ}\text{C}$, and $1\text{-}\mu\text{F}$ capacitor between V_{DD} and GND, unless otherwise noted.

Parameter		Conditions	Min	Typ	Max	Unit
DD(off)	Start-up Current, based on TPM27524 Circuitry	$V_{DD} = 3.4\text{ V}$, INA = H, INB = H		40	100	μA
		$V_{DD} = 3.4\text{ V}$, INA = L, INB = L		40	100	
V_{ON}	Supply under Voltage Lock Out Rising Threshold	$T_J = 25\text{ }^{\circ}\text{C}$	3.91	4.2	4.5	V
		$T_J = -40\text{ }^{\circ}\text{C} - 150\text{ }^{\circ}\text{C}$	3.7	4.2	4.65	
V_{OFF}	Supply under Voltage Lock Out Falling Threshold	$T_J = -40\text{ }^{\circ}\text{C} - 150\text{ }^{\circ}\text{C}$	3.4	3.9	4.4	V
V_{DD_H}	Supply under Voltage Lock Out Hysteresis		0.2	0.3	0.5	V
V_{EN_H}	Enable High Threshold	Enable high threshold	1.7	1.9	2.3	V
V_{EN_L}	Enable Low Threshold	Enable low threshold	1	1.2	1.4	V
V_{EN_HYS}	Enable Hysteresis		0.52	0.7	0.88	V
V_{IN_H}	Input Signal High Threshold	Input high threshold	1.65	1.95	2.3	V
V_{IN_L}	Input Signal Low Threshold	Input low threshold	1	1.25	1.4	V
V_{IN_HYS}	Input Hysteresis		0.52	0.7	0.88	V
I_{OUT}	Output Peak Current	$C_{LOAD} = 0.22\text{ }\mu\text{F}$, $F_{SW} = 1\text{ kHz}$		± 5		A
$V_{DD} - V_{OH}$	Output High Voltage	$I_{OUT} = -10\text{ mA}$			40	mV
V_{OL}	Output Low Voltage	$I_{OUT} = 10\text{ mA}$			10	mV
R_{OH}	Output Pull-up Resistance, PMOS Pull-up only	$I_{OUT} = -10\text{ mA}$	1	1.6	3	Ω
R_{OL}	Output Pull-down Resistance	$I_{OUT} = 10\text{ mA}$	0.15	0.5	1	Ω
t_R	Output Rise Time ⁽¹⁾	$C_{LOAD} = 1.8\text{ nF}$		7	18	ns
t_F	Output Fall Time ⁽¹⁾	$C_{LOAD} = 1.8\text{ nF}$		6	10	ns
t_M	Delay Matching between OUTA and OUTB ⁽¹⁾	INA = INB, OUTA and OUTB measured at 50%		1	4	ns
t_{PW}	Minimal Pulse Width ⁽¹⁾	All except TPM27524A		15	25	ns
		TPM27524A		16		ns
t_{D1}	Input to Output Propagation Delay ⁽¹⁾ , Input Rising	$C_{LOAD} = 1.8\text{ nF}$, 5-V INx pulse, all except TPM27524A	6	14	23	ns
		$C_{LOAD} = 1.8\text{ nF}$, 5-V INx pulse, TPM27524A		25		ns
t_{D2}	Input to Output Propagation Delay ⁽¹⁾ , Input Falling	$C_{LOAD} = 1.8\text{ nF}$, 5-V INx pulse, all except TPM27524A	6	14	23	ns
		$C_{LOAD} = 1.8\text{ nF}$, 5-V INx pulse, TPM27524A		24		ns
t_{D3}	Enable to Output Propagation Delay, EN Rising Edge ⁽¹⁾	$C_{LOAD} = 1.8\text{ nF}$, 5-V ENx pulse	6	14	23	ns

Dual 5-A High-speed, Low-side Gate Driver

Parameter		Conditions	Min	Typ	Max	Unit
t_{D4}	Enable to Output Propagation Delay, EN Falling ⁽¹⁾	$C_{LOAD} = 1.8 \text{ nF}$, 5-V ENx pulse	6	14	23	ns

(1) Guaranteed by design

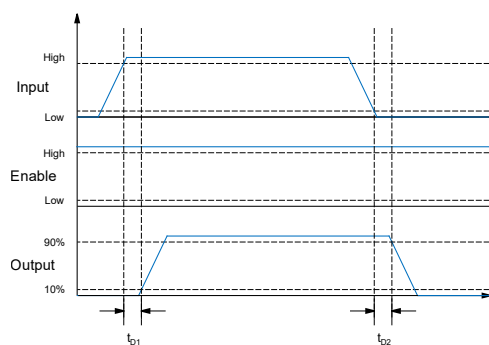


Figure 1. Input Timing Diagram

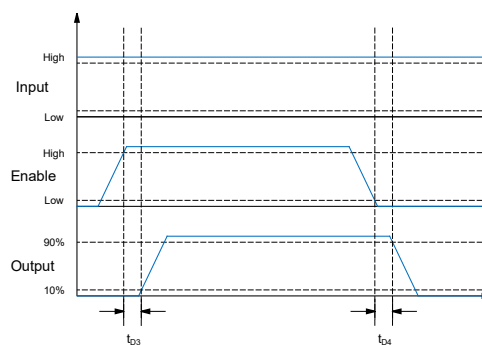


Figure 2. Enable Timing Diagram

Typical Performance Characteristics

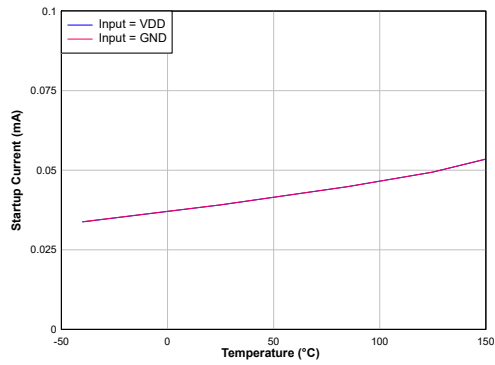


Figure 3. Start-up Current vs. Temperature

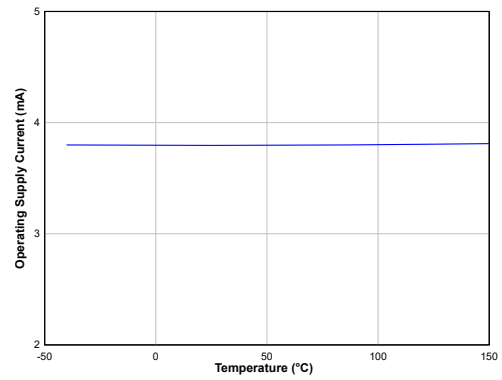


Figure 4. Operating Current vs. Ambient Temperature

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

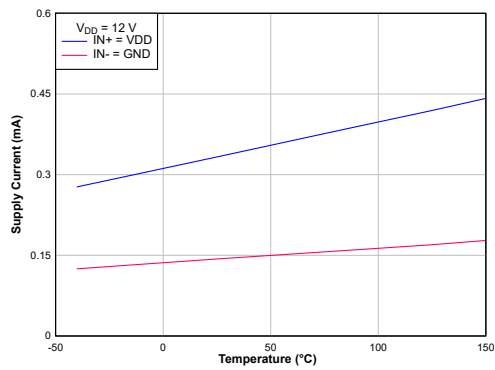


Figure 5. Supply Current vs. Temperature (On/Off)

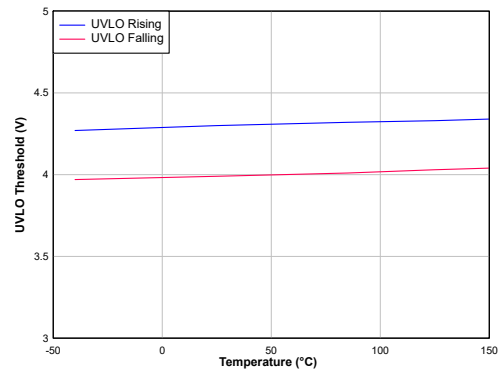


Figure 6. UVLO Threshold vs. Temperature

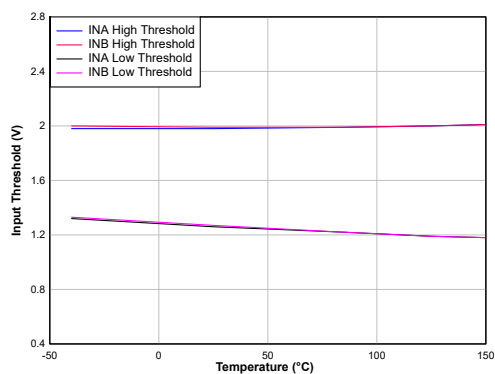


Figure 7. Input Threshold vs. Temperature

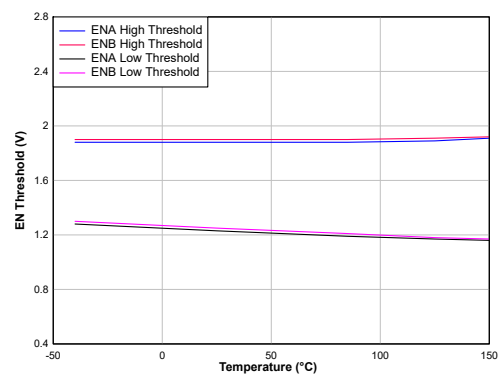


Figure 8. Enable Threshold vs. Temperature

Dual 5-A High-speed, Low-side Gate Driver

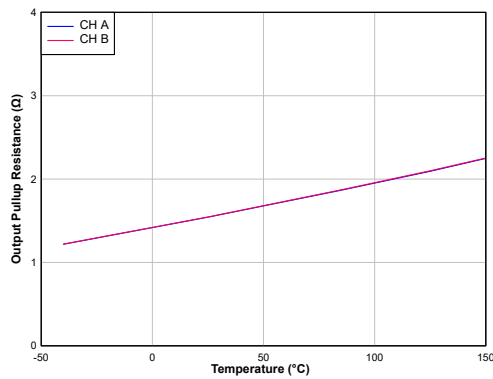


Figure 9. Output Pull-up Resistance vs. Temperature

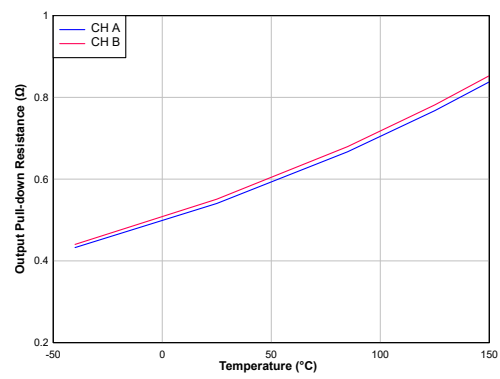


Figure 10. Output Pull-down Resistance vs. Temperature

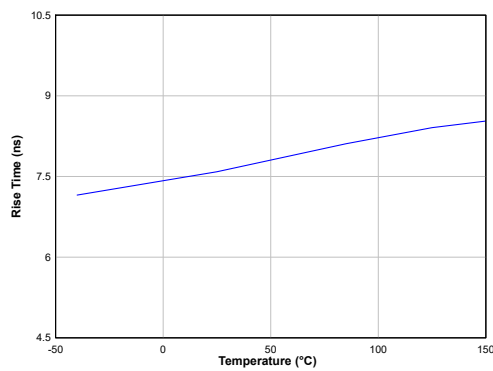


Figure 11. Rise-time vs. Temperature

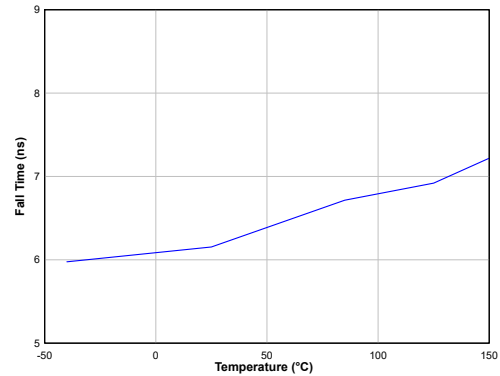


Figure 12. Fall-time vs. Temperature

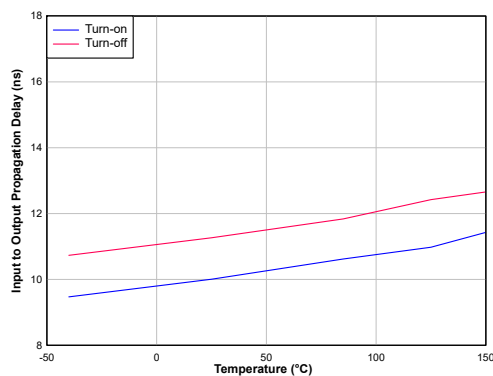


Figure 13. Input to Output Propagation Delay vs. Temperature

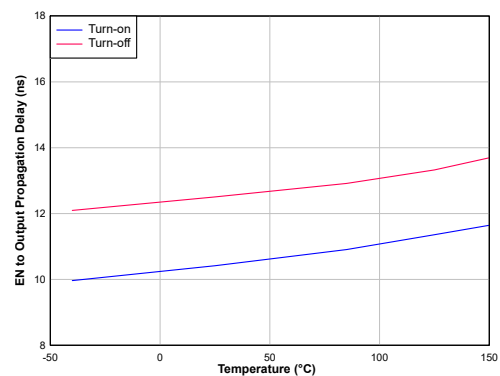
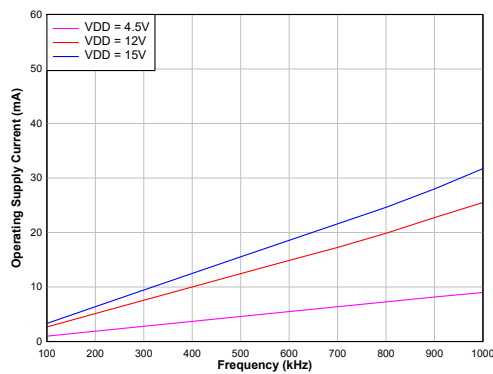
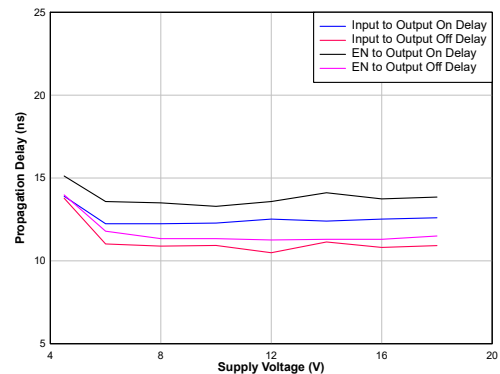
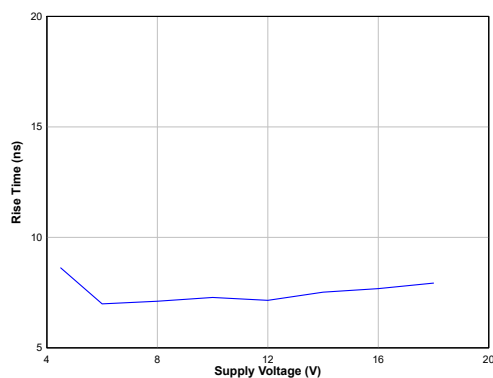
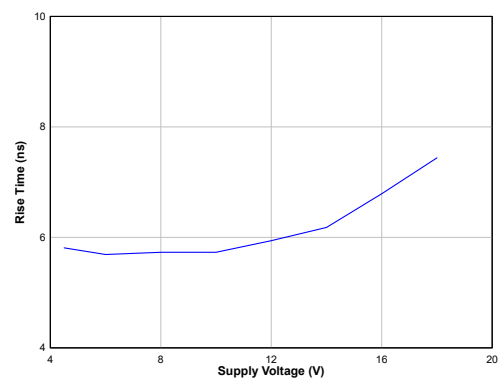
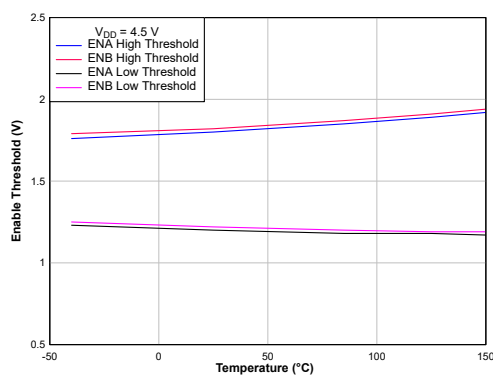
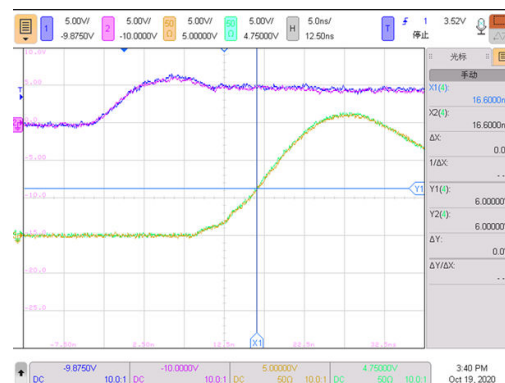


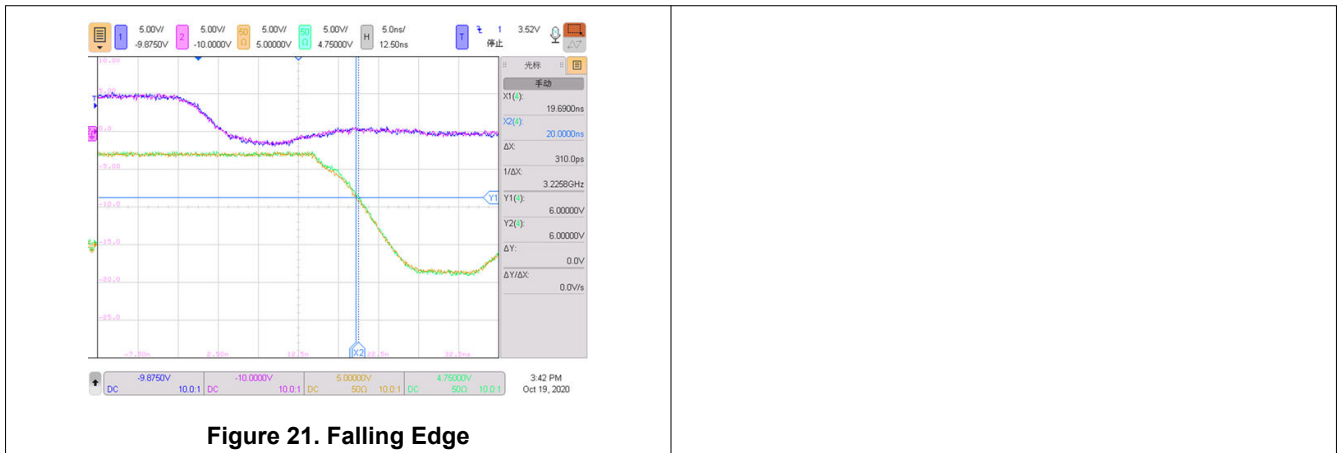
Figure 14. Enable to Output Propagation Delay vs. Temperature


Figure 15. Operating Supply Current vs. Frequency

Figure 16. Propagation Delay vs. Supply Voltage

Figure 17. Rise-time vs. Supply Voltage

Figure 18. Fall-time vs. Supply Voltage

Figure 19. Enable Threshold vs. Temperature

VDD = 4.5 V


Figure 20. Rising Edge

Dual 5-A High-speed, Low-side Gate Driver



Detailed Description

Overview

The TPM2752x is a series of dual-channel low-side gate drivers designed for high-performance power supplies, motor controls, and inverters. Designed with industrial standard pin-out and package, the TPM2752x accelerates the design process. With extended voltage ranges of supply voltage and negative input voltage on inputs, the TPM2752x improves system-level reliability. 5-A strong driving capability improves gate driver efficiency and lowers heat generation, especially in high-frequency switching applications.

Functional Block Diagram

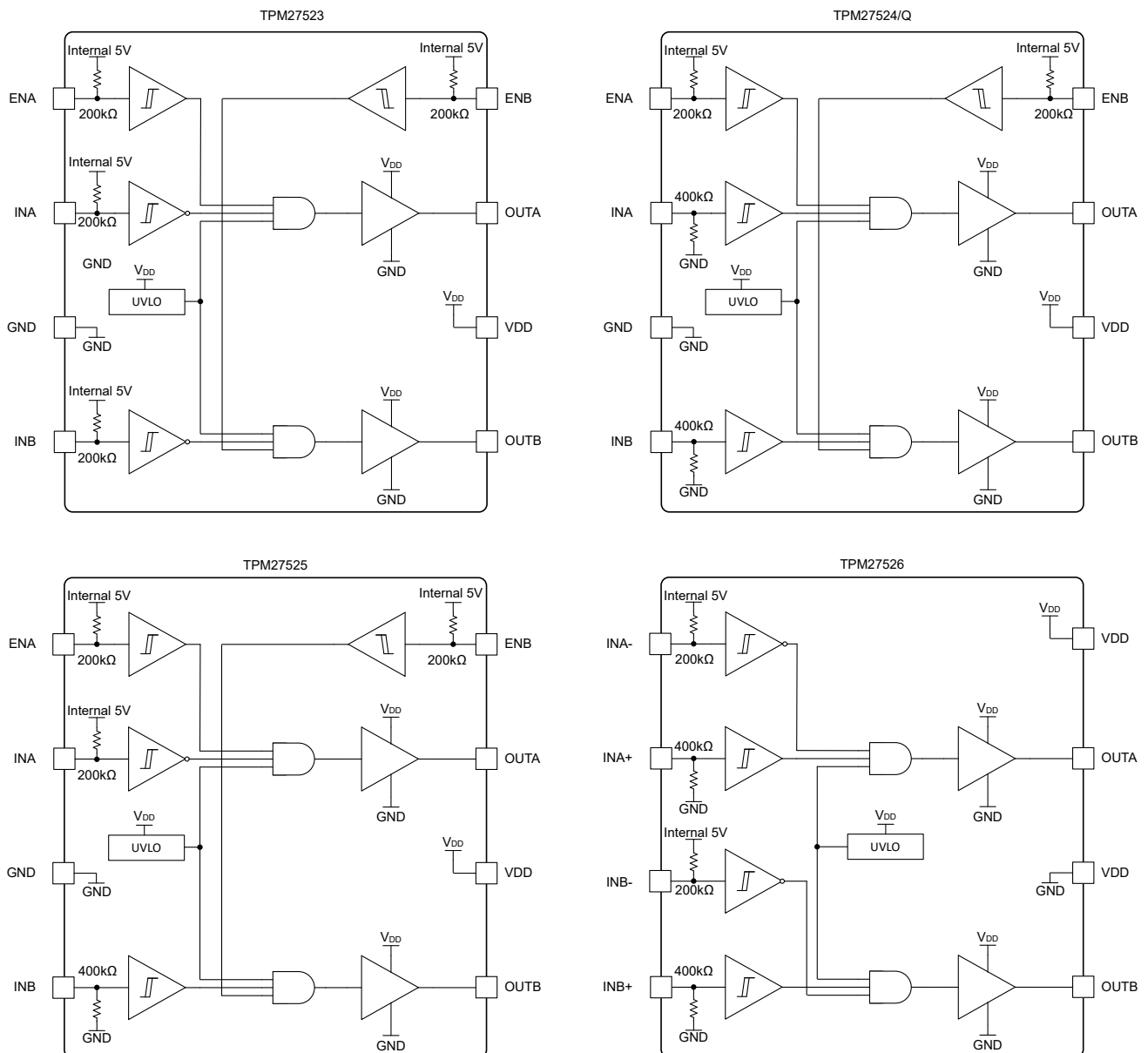


Figure 22. Functional Block Diagram

Feature Description

Low Propagation Delay Driver Outputs

The low-propagation-delay design allows the device to achieve industrial-leading low propagation delay between inputs and outputs. The low delay enhances driver performance in high-frequency switching regulators. Matching between two channels is optimized to support parallel driving. 3PEAK recommends tying IN1 and IN2 locally together with a high-input slew rate, to avoid shoot-through between the two well-matched channels. Capacitors are not recommended on IN1 and IN2 nodes when used in parallel.

Supply and UVLO

The device monitors the supply voltage with under-voltage lock-out (UVLO). When the supply voltage is below the UVLO threshold, the outputs are 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 the output current. The output current can be calculated using external transistor gate charge times switching frequency f_{sw} .

Channel Input

The input of the TPM2752x gate drivers supports TTL and CMOS input with the threshold voltage independent of the supply voltage. The threshold is also designed to support a wide range of ambient temperatures. Wide hysteresis enhances system-level noise immunity. The integrated pull-up and pull-down resistors set the device state when inputs are floating. EN supports NC connection with the help of internal pull-up resistors.

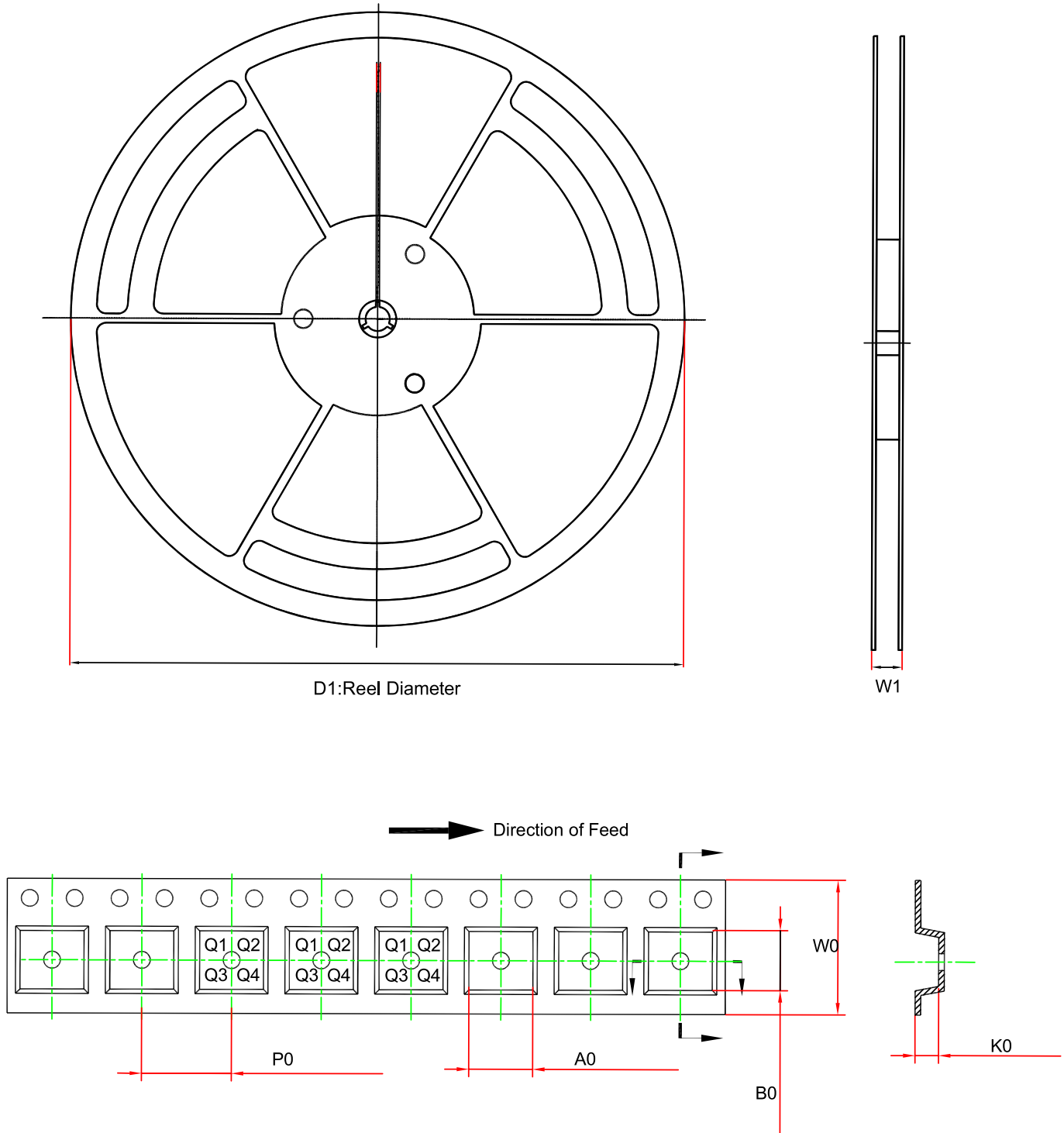
Inputs can withstand DC -5 V, to improve robustness on ground bouncing.

Output Stage

The TPM2752x output stage is able to deliver high current sourcing and sinking up to 5 A with low propagation delay. The delay matching between dual channels is also optimized within 1 ns.

In case of higher output driving capabilities needed, the TPM2752x allows paralleling the dual channel to achieve a higher driving current. In this case, it is recommended to use a high slew rate on IN1 and IN2 and connect IN1 and IN2 to avoid shoot through between channels.

Tape and Reel Information

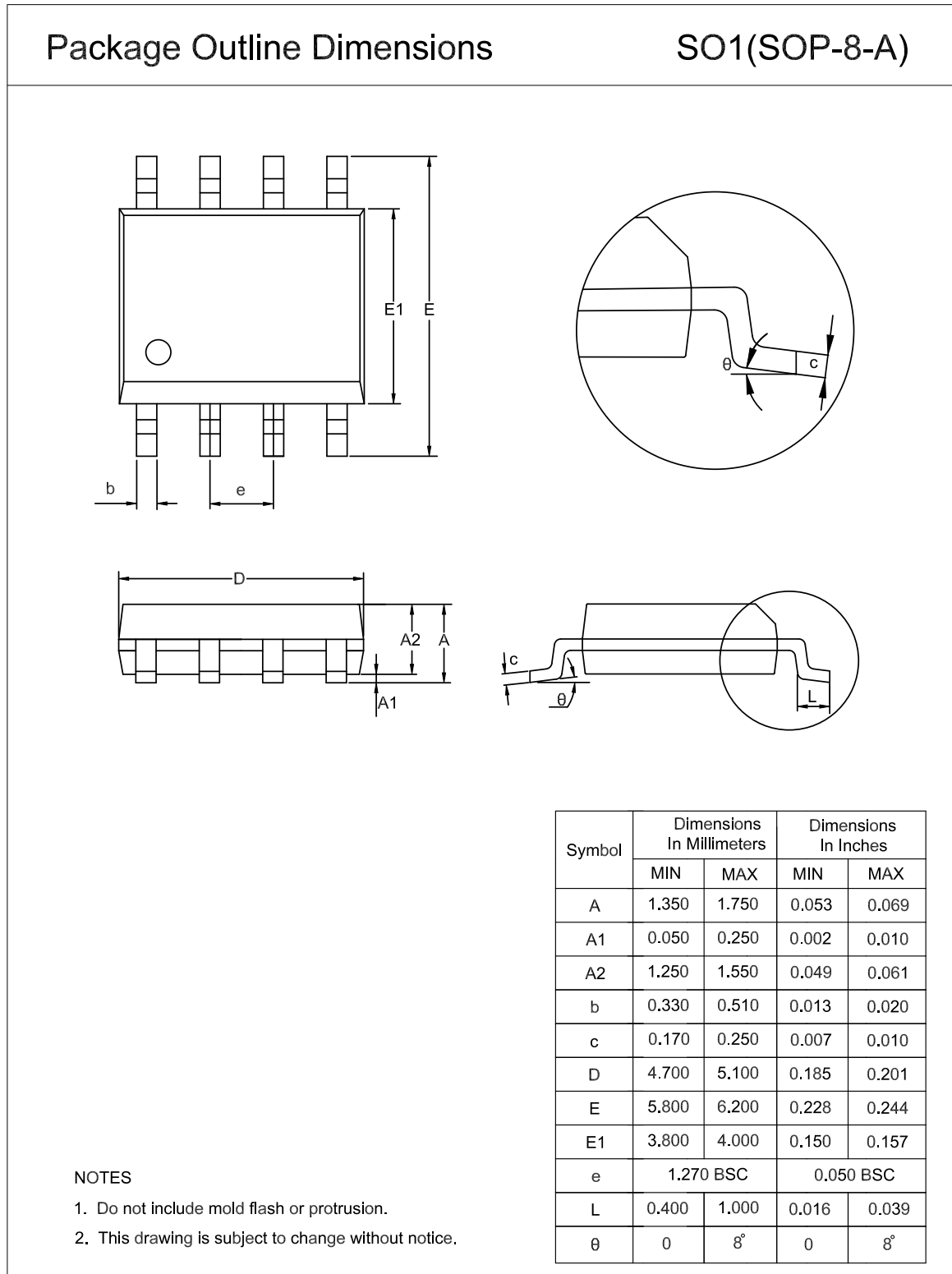


Dual 5-A High-speed, Low-side Gate Driver

Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPM27523-EV1R	EMSOP8	330	17.6	5.3	3.4	1.4	8	12	Q1
TPM27523-SO1R	SOP8	330.0	17.6	6.5	5.4	2	8.0	12.0	Q1
TPM27524-DF4R	DFN2X2-8	180	12.5	2.3	2.3	1.1	4	8	Q1
TPM27524A-DFSR	DFN1.5X1.5-8	180	13.1	1.7	1.7	0.75	4	8	Q1
TPM27524-DF6R	DFN3X3-8	330	17.6	3.3	3.3	1.1	8	12	Q2
TPM27524-DF6R-S	DFN3X3-8	330	17.6	3.3	3.3	1.1	8	12	Q2
TPM27524-EV1R	EMSOP8	330	17.6	5.3	3.4	1.4	8	12	Q1
TPM27524A-EV1R	EMSOP8	330	17.6	5.3	3.4	1.4	8	12	Q1
TPM27524-SO1R	SOP8	330.0	17.6	6.5	5.4	2	8.0	12.0	Q1
TPM27524A-SO1R	SOP8	330.0	17.6	6.5	5.4	2	8.0	12.0	Q1
TPM27524-SO1R-S	SOP8	330.0	17.6	6.5	5.4	2	8.0	12.0	Q1
TPM27525-SO1R	SOP8	330.0	17.6	6.5	5.4	2	8.0	12.0	Q1
TPM27526-DF6R-S	DFN3X3-8	330	17.6	3.3	3.3	1.1	8	12	Q2
TPM27526-SO1R	SOP8	330.0	17.6	6.5	5.4	2	8.0	12.0	Q1

Package Outline Dimensions

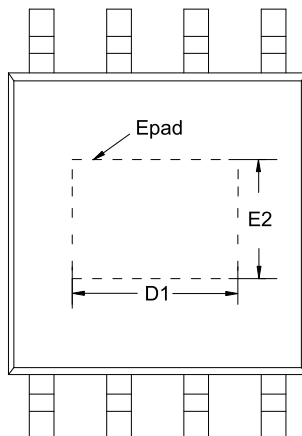
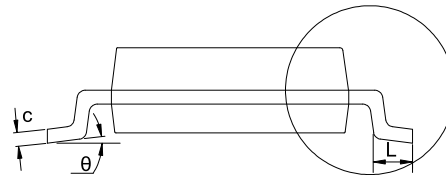
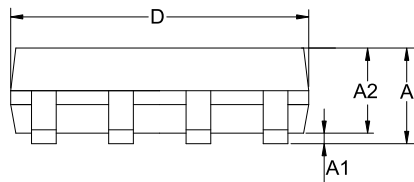
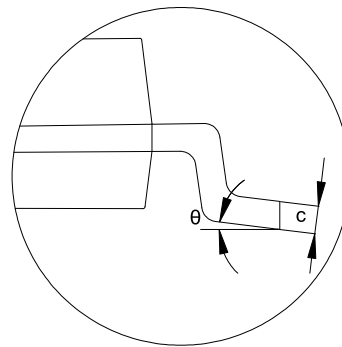
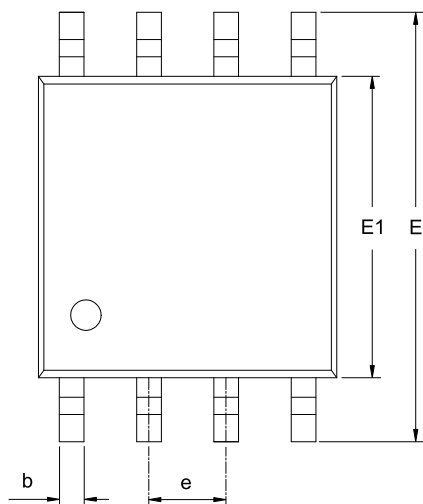
SOP8



EMSOP8

Package Outline Dimensions

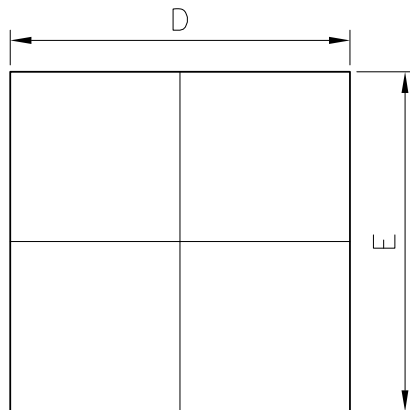
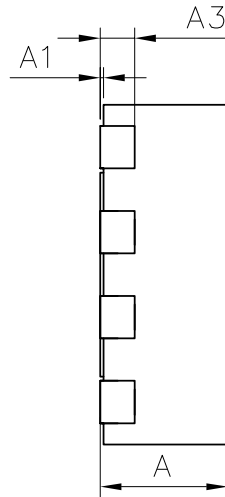
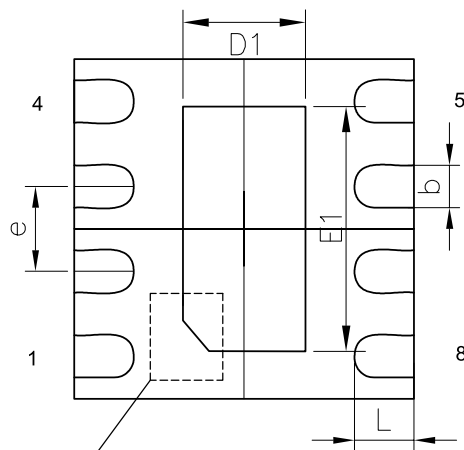
EV1(EMSOP-8-C)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.800	1.100	0.031	0.043
A1	0.050	0.150	0.002	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
D1	1.700	2.100	0.067	0.083
E	4.700	5.100	0.185	0.201
E1	2.900	3.100	0.114	0.122
E2	1.450	1.650	0.057	0.065
e	0.650 BSC		0.026 BSC	
L	0.400	0.800	0.016	0.031
θ	0	8°	0	8°

NOTES

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

DFN2X2-8
Package Outline Dimensions
DFJ(DFN2X2-8-G)

Top View

Side View

Bottom View
NOTES

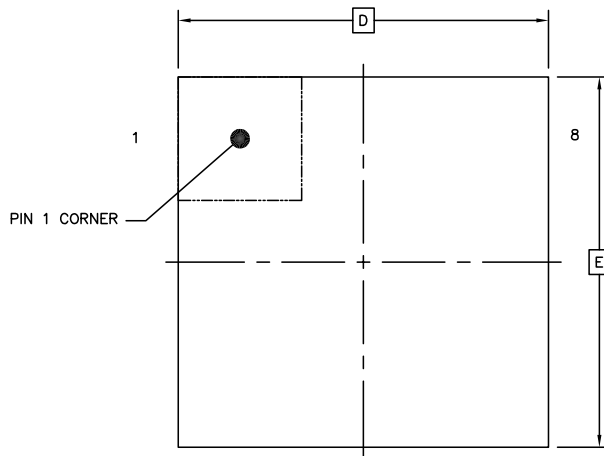
1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.
3. The many types of E-pad Pin1 signs may appear in the product.

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.800	0.900	0.031	0.035
A1	0.000	0.050	0.000	0.002
b	0.180	0.300	0.007	0.012
A3	0.150	0.250	0.006	0.010
D	1.900	2.100	0.075	0.083
D1	0.750	0.850	0.030	0.033
E	1.900	2.100	0.075	0.083
E1	1.550	1.650	0.061	0.065
e	0.500 BSC		0.020BSC	
L	0.250	0.350	0.010	0.014

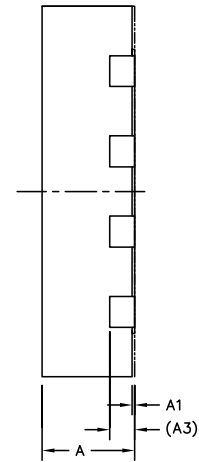
DFN3X3-8

Package Outline Dimensions

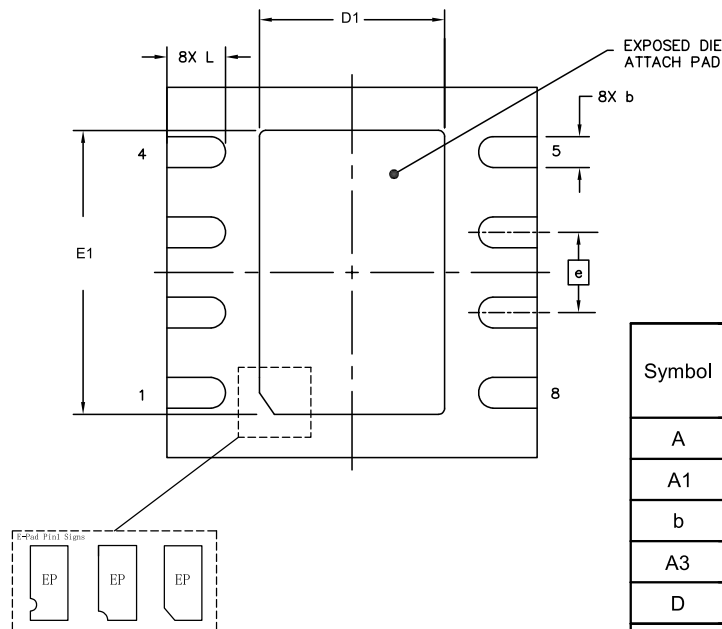
DF6(DFN3X3-8-B)



TOP VIEW



SIDE VIEW



BOTTOM VIEW

NOTES

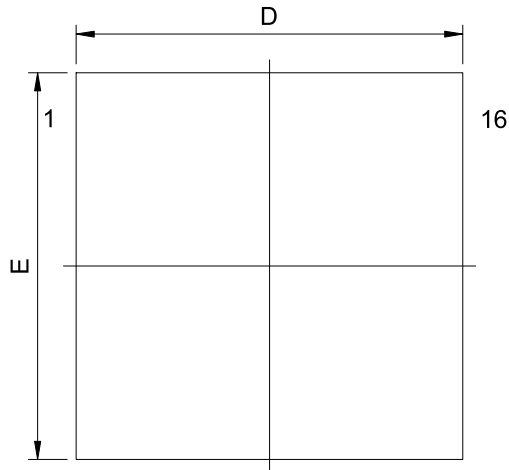
1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.
3. The many types of E-pad Pin1 signs may appear in the product.

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
b	0.250	0.350	0.010	0.014
A3	0.150	0.250	0.006	0.010
D	2.900	3.100	0.114	0.122
D1	1.100	1.300	0.043	0.051
E	2.900	3.100	0.114	0.122
E1	2.050	2.250	0.081	0.089
e	0.650 BSC		0.026 BSC	
L	0.350	0.450	0.014	0.018

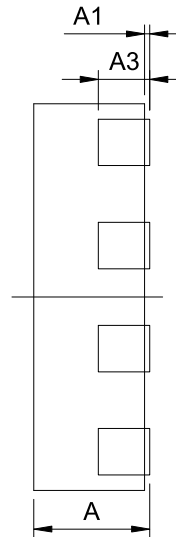
DFN1.5X1.5-8

Package Outline Dimensions

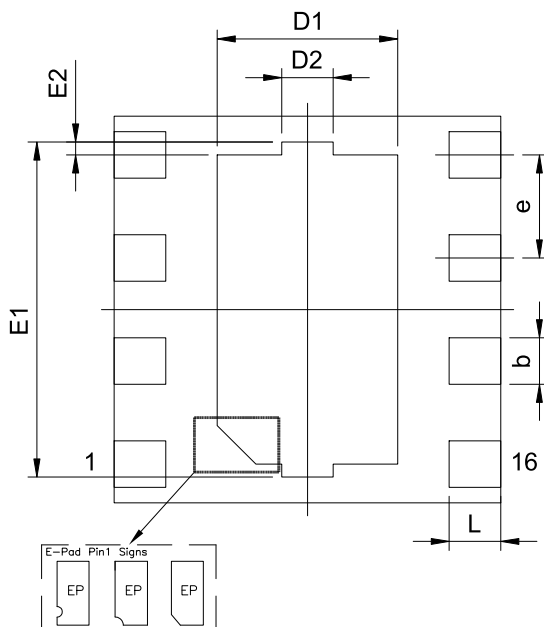
DFS(DFN1.5X1.5-8-B)



TOP VIEW



SIDE VIEW



BOTTOM VIEW

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.400	0.500	0.016	0.020
A1	0.000	0.050	0.000	0.002
b	0.130	0.230	0.005	0.009
A3	0.152REF		0.006REF	
D	1.450	1.550	0.057	0.061
D1	0.600	0.800	0.024	0.031
D2	0.200REF		0.008REF	
E	1.450	1.550	0.057	0.061
E1	1.200	1.400	0.047	0.055
E2	0.050REF		0.002REF	
e	0.400BSC		0.016BSC	
L	0.150	0.250	0.006	0.010

NOTES:

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.
3. The many types of E-pad PIN1 signs may appear in the product

Order Information

Order Number	Operating Ambient Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPM27523-EV1R	-40 °C to 125 °C ⁽¹⁾	EMSOP8	M523	MSL3	Tape and Reel,3000	Green
TPM27523-SO1R	-40 °C to 125 °C ⁽¹⁾	SOP8	M523	MSL3	Tape and Reel,4000	Green
TPM27524-DF4R	-40 °C to 125 °C ⁽¹⁾	DFN2X2-8	M524	MSL3	Tape and Reel,3000	Green
TPM27524A-DFSR	-40 °C to 125 °C ⁽¹⁾	DFN1.5X1.5-8	54	MSL3	Tape and Reel,3000	Green
TPM27524-DF6R	-40 °C to 125 °C ⁽¹⁾	DFN3X3-8	M524	MSL3	Tape and Reel,4000	Green
TPM27524-DF6R-S	-40 °C to 125 °C ⁽¹⁾	DFN3X3-8	M524	MSL3	Tape and Reel,4000	Green
TPM27524-EV1R	-40 °C to 125 °C ⁽¹⁾	EMSOP8	M524	MSL3	Tape and Reel,3000	Green
TPM27524A-EV1R	-40 °C to 125 °C ⁽¹⁾	EMSOP8	M524A	MSL3	Tape and Reel,3000	Green
TPM27524-SO1R	-40 °C to 125 °C ⁽¹⁾	SOP8	M524	MSL3	Tape and Reel,4000	Green
TPM27524A-SO1R	-40 °C to 125 °C ⁽¹⁾	SOP8	M524A	MSL3	Tape and Reel,4000	Green
TPM27524-SO1R-S	-40 °C to 125 °C ⁽¹⁾	SOP8	M524	MSL3	Tape and Reel,4000	Green
TPM27525-SO1R	-40 °C to 125 °C ⁽¹⁾	SOP8	M525	MSL3	Tape and Reel,4000	Green
TPM27526-DF6R-S	-40 °C to 125 °C ⁽¹⁾	DFN3X3-8	M526	MSL2	Tape and Reel,4000	Green
TPM27526-SO1R	-40 °C to 125 °C ⁽¹⁾	SOP8	M526	MSL3	Tape and Reel,4000	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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