TPS22929D Ultra-Small, Low on Resistance Load Switch With Controlled Turn-on

1 Features

- Integrated Single Load Switch
- Small SOT23-6 Package
- Input Voltage Range: 1.4 V to 5.5 V
- Low ON-Resistance
  - r_{ON} = 115 mΩ at VIN = 5 V
  - r_{ON} = 115 mΩ at VIN = 3.3 V
  - r_{ON} = 118 mΩ at VIN = 2.5 V
  - r_{ON} = 129 mΩ at VIN = 1.5 V
- 1.8-A Continuous Switch Current (25°C)
- Low Threshold Control Input
- Controlled Slew-rate
- Under-Voltage Lock Out
- Quick Output Discharge
- Reverse Current Protection

2 Applications

- Portable Industrial Equipment
- Portable Medical Equipment
- Portable Media Players
- Point Of Sales Terminal
- GPS Devices
- Digital Cameras
- Portable Instrumentation
- Smartphones

3 Description

The TPS22929D is a small, low r_{ON} load switch with controlled turn on. The device contains a P-channel MOSFET that can operate over an input voltage range of 1.4 V to 5.5 V. The switch is controlled by an on/off input (ON), which is capable of interfacing directly with low-voltage control signals. The TPS22929D is active high enable.

The TPS22929D contains a 150-Ω on-chip load resistor for quick output discharge when the switch is turned off. The rise time of the device is internally controlled in order to avoid inrush current.

The TPS22929D device provides circuit breaker functionality by latching off the power-switch during reverse voltage situations. An internal reverse voltage comparator disables the power-switch when the output voltage (V_{OUT}) is driven higher than the input (V_{IN}) to quickly (10 µs typ) stop the flow of current towards the input side of the switch. Reverse current is always active, even when the power-switch is disabled. Additionally, under-voltage lockout (UVLO) protection turns the switch off if the input voltage is too low.

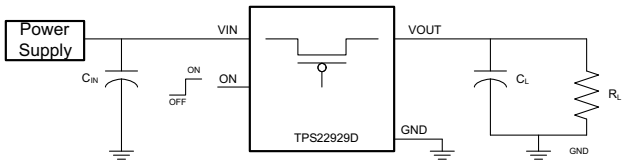
The TPS22929D is available in a small, space-saving 6-pin SOT23 package and is characterized for operation over the free-air temperature range of –40°C to 85°C.

Device Information(1)

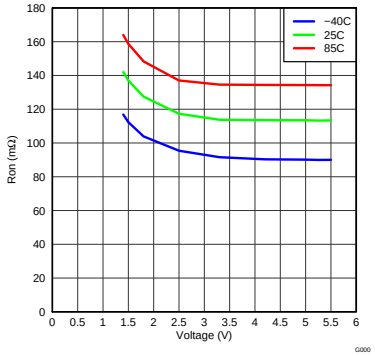
PART NUMBER	PACKAGE	BODY SIZE (NOM)
TPS22929D	SOT23 (6)	2.90 mm × 1.60 mm

(1) For all available packages, see the orderable addendum at the end of the datasheet.

4 Simplified Schematic



On-State Resistance vs Input Voltage



An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

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5 Revision History

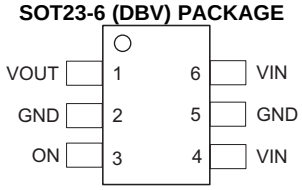
Changes from Original (December 2011) to Revision A **Page**

- Updated to enhanced datasheet standards ... 1
- Added Handling Ratings table. ... 4
- Added Thermal Information table. ... 4
- Added Detailed Description section. ... 12
- Added Application and Implementation section. ... 14
- Added Power Supply Recommendations section. ... 18
- Added Layout section. ... 18

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6 Pin Configuration and Functions

SOT23-6 (DBV) PACKAGE



Pin Functions

PIN		DESCRIPTION
NAME	DBV	
GND	2, 5	Ground
ON	3	Switch control input, active high. Do not leave floating
VOUT	1	Switch output
VIN	4, 6	Switch input, bypass this input with a ceramic capacitor to ground

7 Specifications

7.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
V_{IN}	Input voltage range	–0.3	6	V
V_{OUT}	Output voltage range	–0.3	6	V
V_{ON}	Input voltage range	–0.3	6	V
P_{MAX}	Maximum continuous power dissipation at 25°C		463	mW
	Maximum continuous power dissipation at 70°C		254	
	Maximum continuous power dissipation at 85°C		185	
I_{MAX}	Maximum continuous operating current		2	A
T_A	Operating free-air temperature range	–40	85	°C
T_J	Maximum junction temperature		125	°C

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7.2 Handling Ratings

			MIN	MAX	UNIT
T_{stg}	Storage temperature range		–65	150	°C
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins(1)	–2	2	kV
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins(2)	–1	1	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process. Pins listed as 2 kV may actually have higher performance.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process. Pins listed as 1 kV may actually have higher performance.

7.3 Recommended Operating Conditions

			MIN	MAX	UNIT
V_{IN}	Input voltage range		1.4	5.5	V
V_{ON}	ON voltage range		0	5.5	V
V_{OUT}	Output voltage range			V_{IN}	
V_{IH}	High-level input voltage, ON	VIN = 1.4 V to 5.5 V	1.1	5.5	V
V_{IL}	Low-level input voltage, ON	VIN = 3.61 V to 5.5 V		0.6	V
		VIN = 1.4 V to 3.6 V		0.4	V
C_{IN}	Input Capacitor		1 (1)		µF

(1) Refer to the application section.

7.4 Thermal Information

THERMAL METRIC(1)		TPS22929D DBV 6 PINS	UNITS
$R_{\theta JA}$	Junction-to-ambient thermal resistance	216	°C/W
$R_{\theta JCtop}$	Junction-to-case (top) thermal resistance	209	
$R_{\theta JB}$	Junction-to-board thermal resistance	131	
ψ_{JT}	Junction-to-top characterization parameter	52	
ψ_{JB}	Junction-to-board characterization parameter	110	

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, SPRA953.

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7.5 Electrical Characteristics

VIN = 1.4 V to 5.5 V, T_A = –40ºC to 85ºC (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
I_{IN}	Quiescent current	I_{OUT} = 0, V_{IN} = V_{ON} = 5.25 V	Full		2.2	10	µA
		I_{OUT} = 0, V_{IN} = V_{ON} = 4.2 V			2.1	7.0	
		I_{OUT} = 0, V_{IN} = V_{ON} = 3.6 V			2.0	7.0	
		I_{OUT} = 0, V_{IN} = V_{ON} = 2.5 V			1.0	5.0	
		I_{OUT} = 0, V_{IN} = V_{ON} = 1.5 V			0.8	5.0	
$I_{IN(off)}$	Off supply current	V_{ON} = GND, V_{OUT} = Open, V_{IN} = 5.25 V	Full		0.8	10	µA
		V_{ON} = GND, V_{OUT} = Open, V_{IN} = 4.2 V			0.3	7.0	
		V_{ON} = GND, V_{OUT} = Open, V_{IN} = 3.6 V			0.2	7.0	
		V_{ON} = GND, V_{OUT} = Open, V_{IN} = 2.5 V			0.2	5.0	
		V_{ON} = GND, V_{OUT} = Open, V_{IN} = 1.5 V			0.1	5.0	
$I_{IN(Leakage)}$	Leakage current	V_{ON} = GND, V_{OUT} = 0, V_{IN} = 5.25 V	Full		0.8	10	µA
		V_{ON} = GND, V_{OUT} = 0, V_{IN} = 4.2 V			0.3	7.0	
		V_{ON} = GND, V_{OUT} = 0, V_{IN} = 3.6 V			0.2	7.0	
		V_{ON} = GND, V_{OUT} = 0, V_{IN} = 2.5 V			0.2	5.0	
		V_{ON} = GND, V_{OUT} = 0, V_{IN} = 1.5 V			0.1	5.0	
r_{ON}	On-resistance	V_{IN} = 5.25 V, I_{OUT} = –200 mA	25°C		115	150	mΩ
			Full			175	
		V_{IN} = 5.0 V, I_{OUT} = –200 mA	25°C		115	150	
			Full			175	
		V_{IN} = 4.2 V, I_{OUT} = –200 mA	25°C		115	150	
			Full			175	
		V_{IN} = 3.3 V, I_{OUT} = –200 mA	25°C		115	150	
			Full			175	
		V_{IN} = 2.5 V, I_{OUT} = –200 mA	25°C		118	155	
			Full			180	
		V_{IN} = 1.5 V, I_{OUT} = –200 mA	25°C		129	170	
			Full			200	
RPD	Output pull down resistance	V_{IN} = 3.3 V, V_{ON} = 0, I_{OUT} = 30 mA	25°C		150	200	Ω
UVLO	Under voltage lockout	V_{IN} increasing, V_{ON} = 3.6 V, I_{OUT} = –100 mA	Full			1.4	V
		V_{IN} decreasing, V_{ON} 3.6 V, R_L = 10 Ω		0.50			
I_{ON}	ON input leakage current	V_{ON} = 1.4 V to 5.25 V or GND	Full			1	µA
V_{RVP}	Reverse Current Voltage Threshold				77		mV
t_{DELAY}	Reverse Current Response Delay	V_{IN} = 5V			10		µs

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7.6 Switching Characteristics

PARAMETER		TEST CONDITION	TPS22929D	UNIT
			TYP	
VIN = 5 V, T_A = 25ºC (unless otherwise noted)				
t_{ON}	Turn-ON time	R_L = 10 Ω, C_L = 0.1 µF	3315	µs
t_{OFF}	Turn-OFF time	R_L = 10 Ω, C_L = 0.1 µF	7.4	
t_R	VOUT rise time	R_L = 10 Ω, C_L = 0.1 µF	3660	
t_F	VOUT fall time	R_L = 10 Ω, C_L = 0.1 µF	6.1	
VIN = 3.3 V, T_A = 25ºC (unless otherwise noted)				
t_{ON}	Turn-ON time	R_L = 10 Ω, C_L = 0.1 µF	4655	µs
t_{OFF}	Turn-OFF time	R_L = 10 Ω, C_L = 0.1 µF	9.5	
t_R	VOUT rise time	R_L = 10 Ω, C_L = 0.1 µF	4150	
t_F	VOUT fall time	R_L = 10 Ω, C_L = 0.1 µF	3.0	
VIN = 1.5 V, T_A = 25ºC (unless otherwise noted)				
t_{ON}	Turn-ON time	R_L = 10 Ω, C_L = 0.1 µF	10175	µs
t_{OFF}	Turn-OFF time	R_L = 10 Ω, C_L = 0.1 µF	18.3	
t_R	VOUT rise time	R_L = 10 Ω, C_L = 0.1 µF	7812	
t_F	VOUT fall time	R_L = 10 Ω, C_L = 0.1 µF	3.0	

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7.7 Typical Characteristics

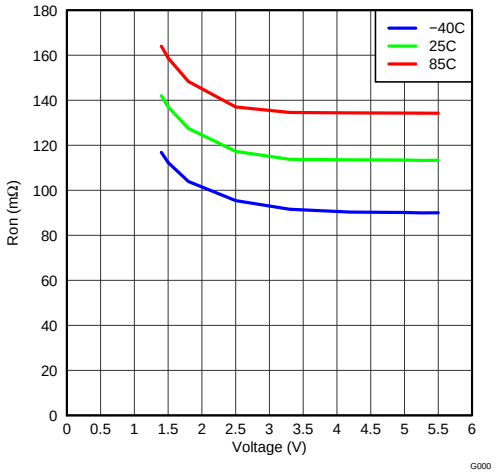


Figure 1. On-State Resistance vs Input Voltage

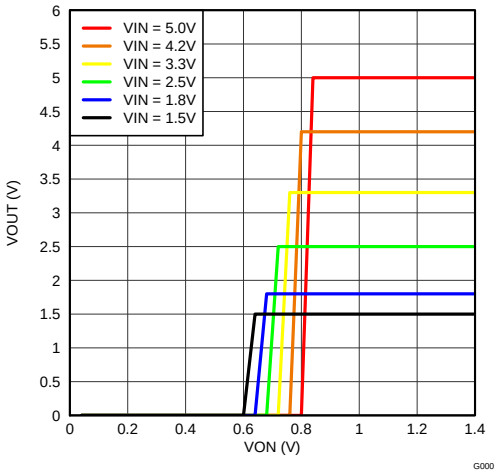


Figure 2. On Input Threshold

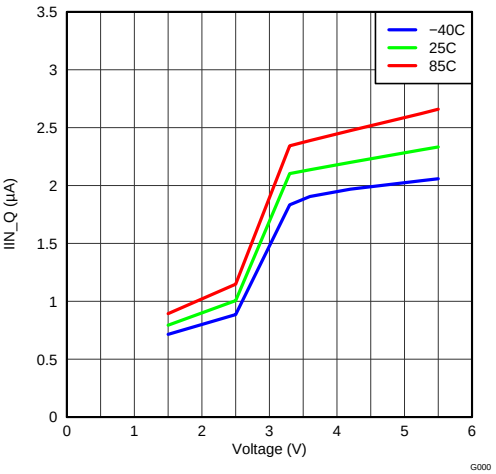


Figure 3. Input Current, Quiescent vs Input Voltage

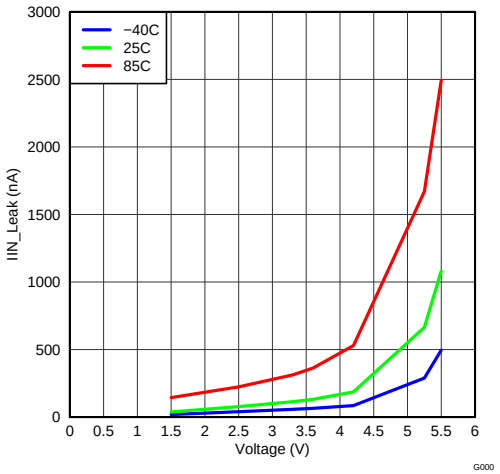


Figure 4. Input Current, Leak vs Input Voltage

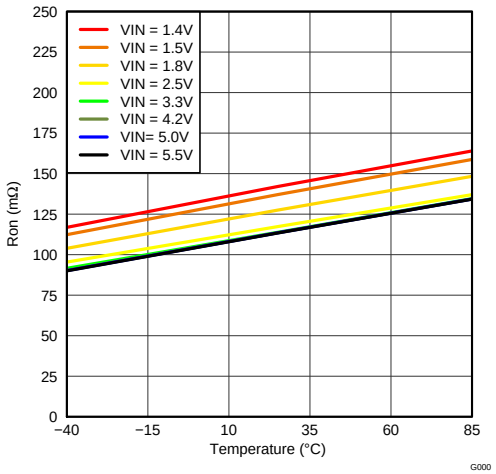


Figure 5. On-State Resistance vs Temperature

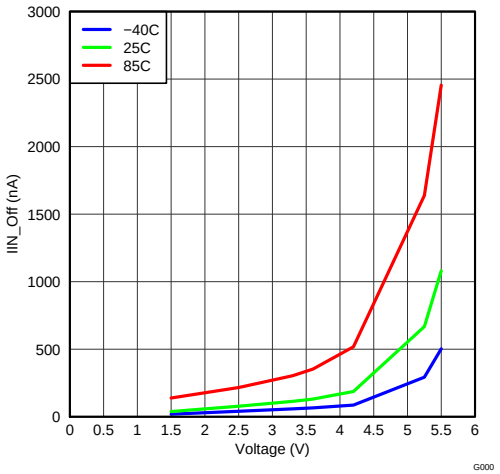


Figure 6. Input Current, Off vs Input Voltage

Typical Characteristics (continued)

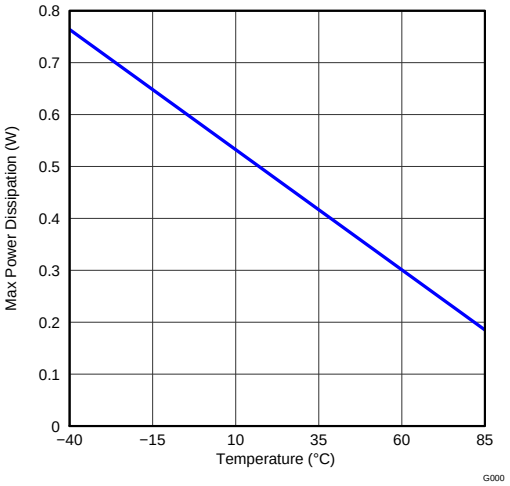


Figure 7. Allowable Power Dissipation

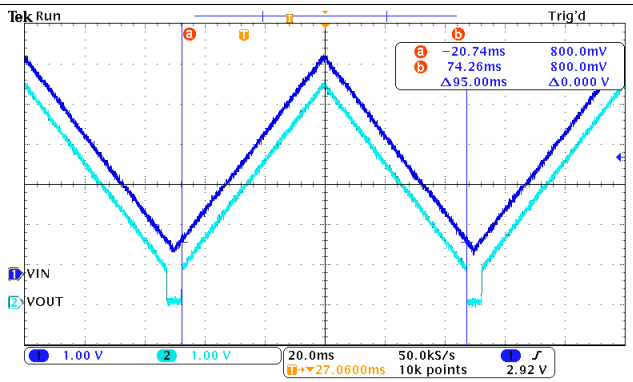


Figure 8. Under-Voltage Lockout Response (IOUT = –100mA)

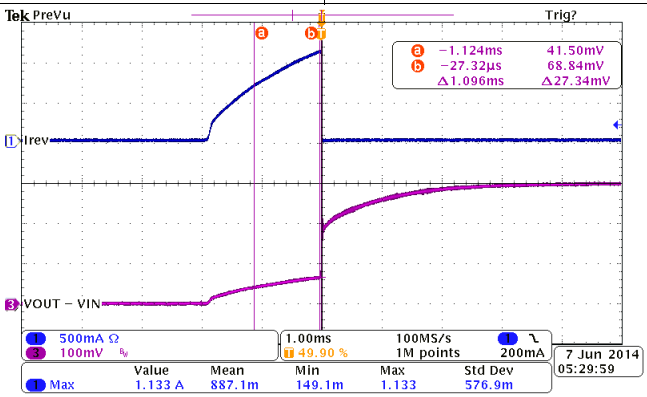


Figure 9. Reverse Current Protection (VIN = 3.0 V, VOUT Ramp up From 3.0 V to 3.3 V)

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7.7.1 Typical AC Characteristics

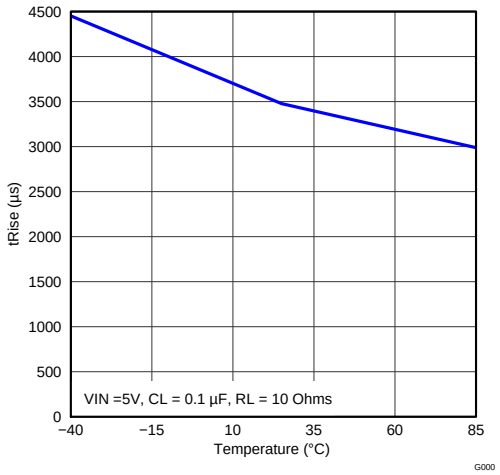


Figure 10. Rise Time vs Temperature

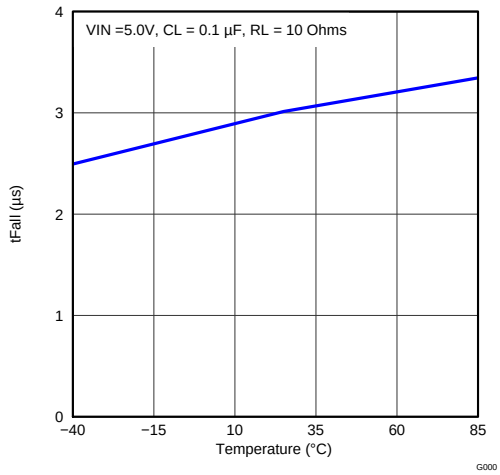


Figure 11. Fall Time vs Temperature

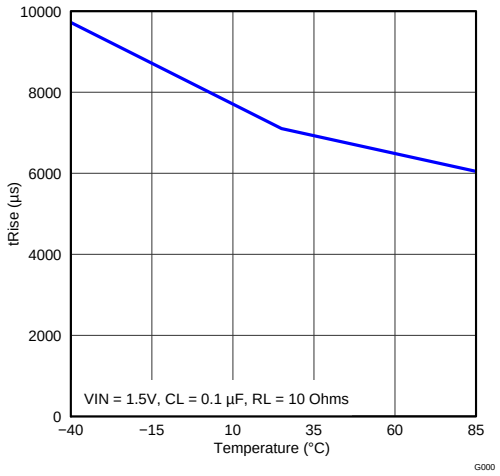


Figure 12. Rise Time vs Temperature

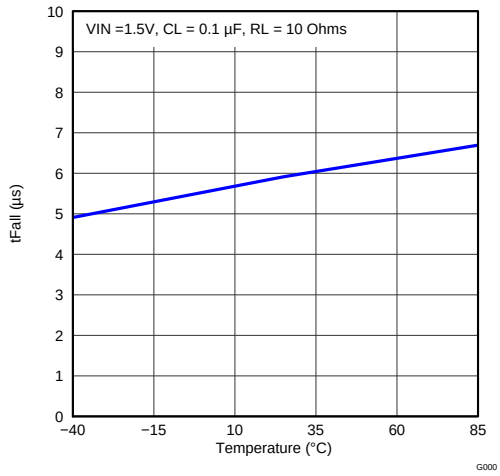


Figure 13. Fall Time vs Temperature

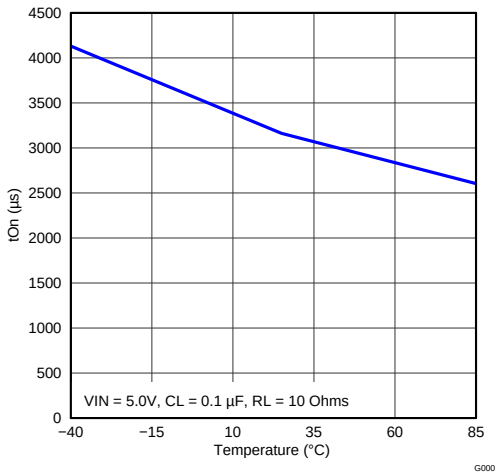


Figure 14. Turn-On Time vs Temperature

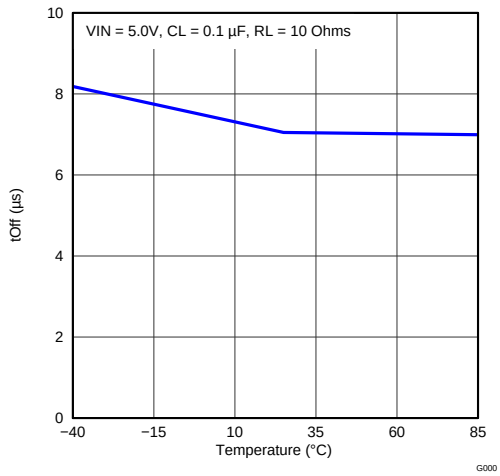


Figure 15. Turn-Off Time vs Temperature

Typical AC Characteristics (continued)

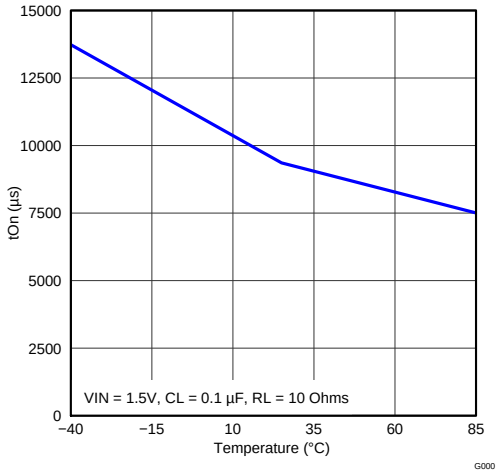


Figure 16. Turn-On Time vs Temperature

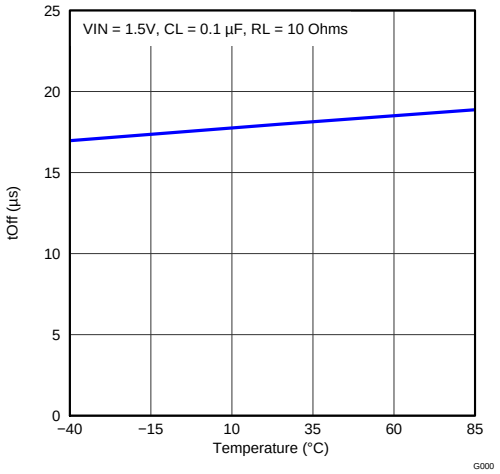


Figure 17. Turn-Off Time vs Temperature

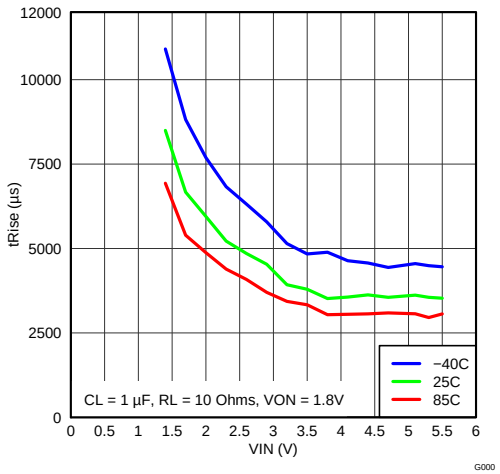


Figure 18. Rise Time vs Input Voltage

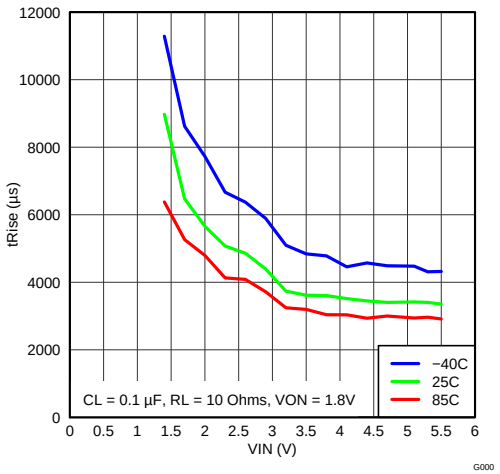
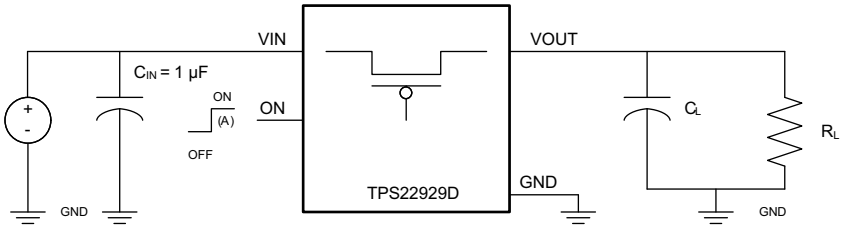


Figure 19. Rise Time vs Input Voltage

8 Parametric Measurement Information



A. Rise and fall times of the control signal is 100 ns.

Figure 20. Test Circuit

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Parametric Measurement Information (continued)

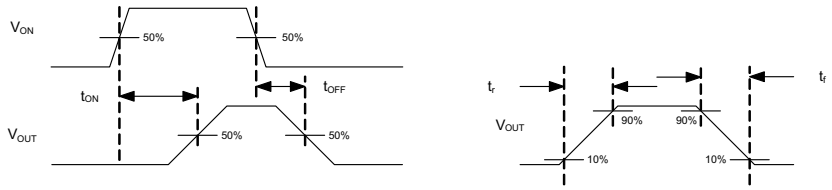


Figure 21. T_{ON}/T_{OFF} Waveforms

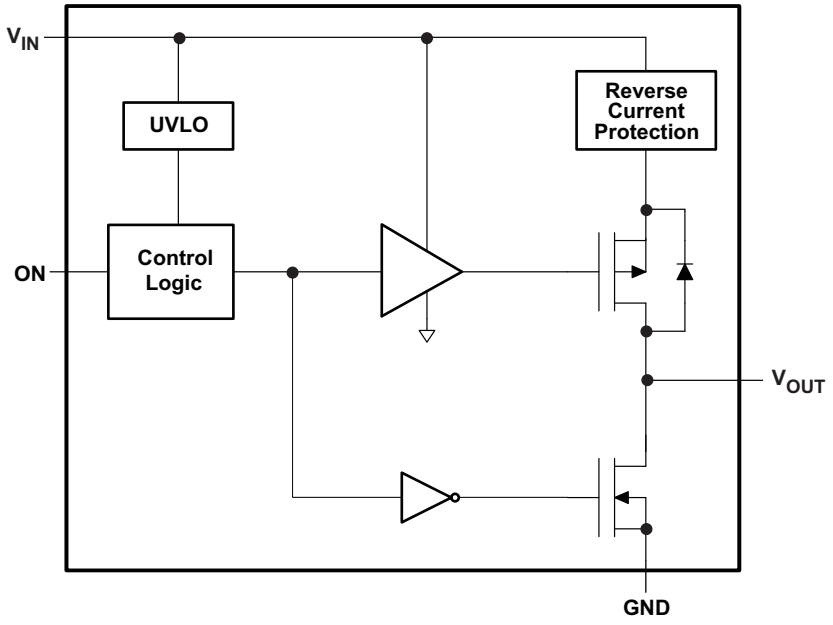
9 Detailed Description

9.1 Overview

The TPS22929D is a single channel, 1.8-A load switch in a small, space-saving 6-pin SOT23-6 package. This devices implement a low resistance P-channel MOSFET with a controlled rise time for applications that need to limit the inrush current.

This device is also designed to have very low leakage current during off state. This prevents downstream circuits from pulling high standby current from the supply. Integrated control logic, driver, power supply, and output discharge FET eliminates the need for additional external components, which reduces solution size and bill of materials (BOM) count.

9.2 Functional Block Diagram



9.3 Feature Description

9.3.1 On/Off Control

The ON pin controls the state of the switch. Asserting ON high enables the switch. ON is active high and has a low threshold, making it capable of interfacing with low-voltage signals. The ON pin is compatible with standard GPIO logic threshold. It can be used with any microcontroller with 1.2-V, 1.8-V, 2.5-V or 3.3-V GPIOs.

9.3.2 Output Pull-Down

The output pull-down is active when the user is turning off the main pass FET. The pull-down discharges the output rail to approximately 10% of the rail, and then the output pull-down is automatically disconnected to optimize the shutdown current.

9.3.3 Under-Voltage Lockout

The under-voltage lockout turns-off the switch if the input voltage drops below the under-voltage lockout threshold. During under-voltage lockout (UVLO), if the voltage level at V_{OUT} exceeds the voltage level at V_{IN} by the Reverse Current Voltage Threshold (V_{RVP}), the body diode will be disengaged to prevent any current flow to V_{IN}. With the ON pin active the input voltage rising above the under-voltage lockout threshold will cause a controlled turn-on of the switch which limits current over-shoots.

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Feature Description (continued)

9.3.4 Reverse Current Protection

In a scenario where V_{OUT} is greater than V_{IN}, there is potential for reverse current through the pass FET or the body diode. The TPS22929D monitors V_{IN} and V_{OUT} voltage levels. When the reverse current voltage threshold (V_{RVP}) is exceeded, the switch is disabled (within 10 µs typ). Additionally, the body diode is disengaged so as to prevent any reverse current flow to V_{IN}. The FET, and the output (V_{OUT}), will resume normal operation when the reverse voltage scenario is no longer present.

Use the following formula to calculate the amount of reverse current required to activate the protection circuit for a particular application:

$$I_{RC} = \frac{0.077V}{R_{ON(VIN)}}$$

Where,

I_{RC} is the amount of reverse current,

$R_{ON(VIN)}$ is the on-resistance as determined by the input voltage.

9.4 Device Functional Modes

Table 1. Function Table

ON	VIN to VOUT	VOUT to GND(1)
L	OFF	ON
H	ON	OFF

(1) See *Output Pull-Down* section.

10 Application and Implementation

10.1 Application Information

10.1.1 VIN to VOUT Voltage Drop

The VIN to VOUT voltage drop in the device is determined by the R_{ON} of the device and the load current. The R_{ON} of the device depends upon the VIN condition of the device. Refer to the R_{ON} specification of the device in the Electrical Characteristics table of this datasheet. Once the R_{ON} of the device is determined based upon the VIN conditions, use Equation 1 to calculate the VIN to VOUT voltage drop:

$$\Delta V = I_{LOAD} \times R_{ON} \quad (1)$$

Where,

ΔV = Voltage drop from VIN to VOUT

I_{LOAD} = Load current

R_{ON} = On-resistance of the device for a specific V_{IN}

An appropriate I_{LOAD} must be chosen such that the I_{MAX} specification of the device is not violated.

10.1.2 Input Capacitor

To limit the voltage drop on the input supply caused by transient inrush currents, when the switch turns on into a discharged load capacitor or short-circuit, a capacitor needs to be placed between VIN and GND. A 1-µF ceramic capacitor, CIN, placed close to the pins is usually sufficient. Higher values of CIN can be used to further reduce the voltage drop.

10.1.3 Output Capacitor

A C_{IN} to C_L ratio of 10 to 1 is recommended for minimizing V_{IN} dip caused by inrush currents during startup.

10.2 Typical Application

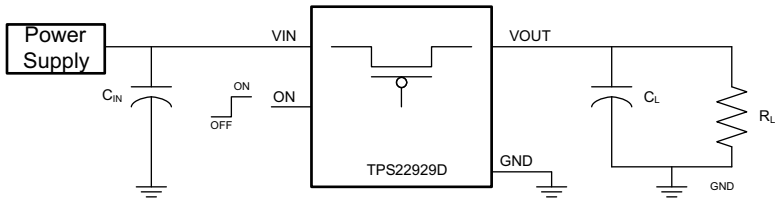


Figure 22. Typical Application Schematic

10.2.1 Design Requirements

Design Parameter	Example Value
VIN	1.5 V to 5 V
CL	0.1 µF to 1 µF
Maximum Acceptable Inrush Current	10 mA

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10.2.2 Detailed Design Procedure

10.2.2.1 Managing Inrush Current

When the switch is enabled, the output capacitors must be charged up from 0-V to VIN voltage. This charge arrives in the form of inrush current. Inrush current can be calculated using the following equation:

$$\text{Inrush Current} = C \times \frac{dv}{dt} \tag{2}$$

Where,

C = Output capacitance

$\frac{dv}{dt}$ = Output slew rate

The TPS22929D offers a very slow controlled rise time for minimizing inrush current. This device can be selected based upon the maximum acceptable slew rate which can be calculated using the design requirements and the inrush current equation. An output capacitance of 1.0 µF will be used since the amount of inrush increases with output capacitance:

$$10\ \text{mA} = 1.0\ \mu\text{F} \times \frac{dv}{dt} \tag{3}$$

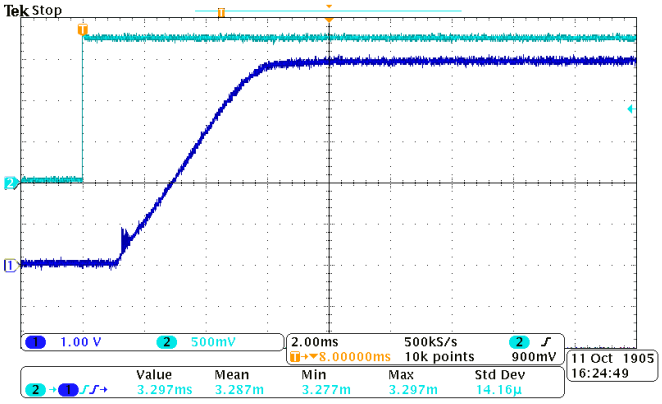
$$\frac{dv}{dt} = 10\ \text{V/ms} \tag{4}$$

To ensure an inrush current of less than 10 mA, a device with a slew rate less than 10 V/ms must be used.

The TPS22929D has a typical rise time of 4500 µs at 3.3 V . This results in a slew rate of 733 mV/ms which meets the above design requirements.

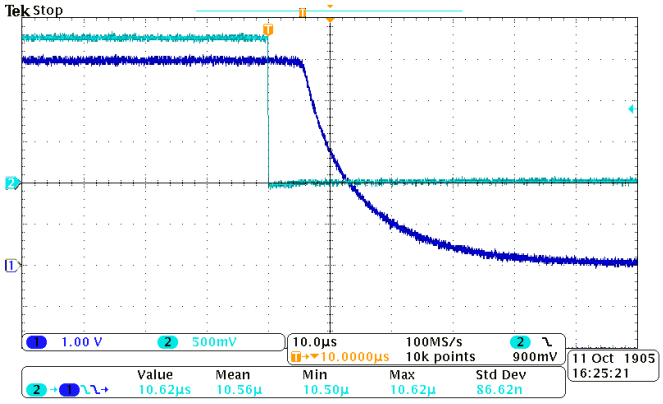
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10.2.3 Application Curves



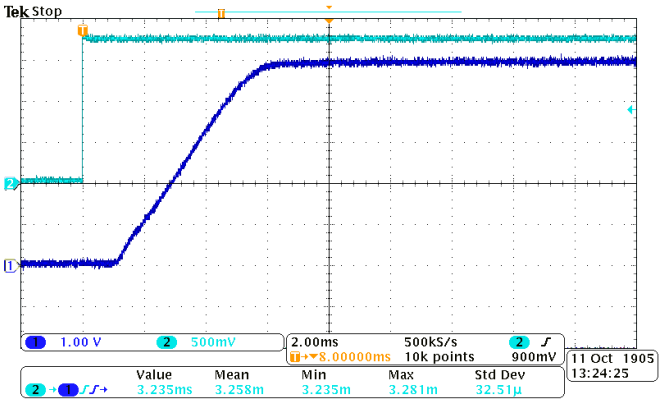
V_{IN} = 5 V T_A = 25°C C_{IN} = 10 µF
C_L = 1 µF R_L = 10 Ω

Figure 23. Turn-On Response



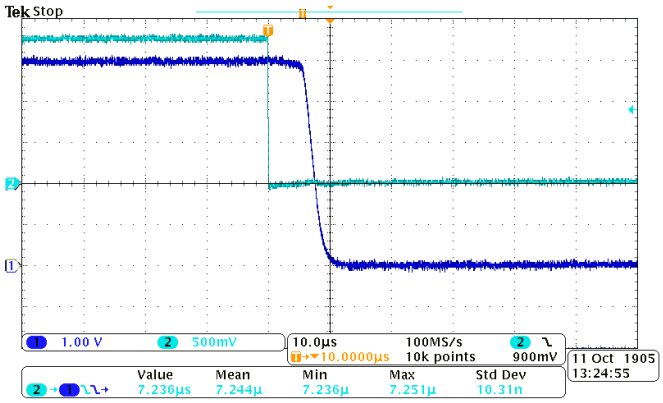
V_{IN} = 5 V T_A = 25°C C_{IN} = 10 µF
C_L = 1 µF R_L = 10 Ω

Figure 24. Turn-Off Response



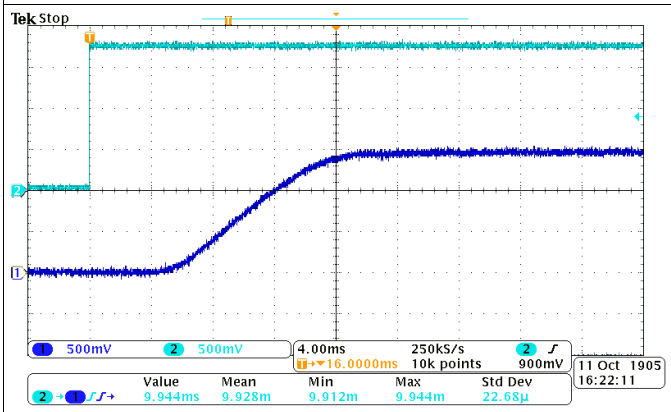
V_{IN} = 5 V T_A = 25°C C_{IN} = 1 µF
C_L = 0.1 µF R_L = 10 Ω

Figure 25. Turn-On Response Time



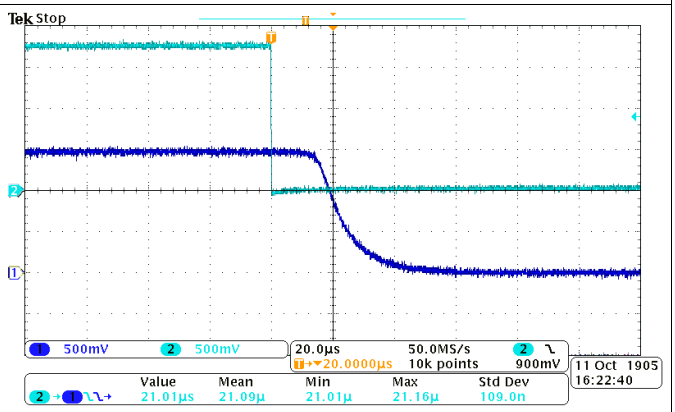
V_{IN} = 5 V T_A = 25°C C_{IN} = 1 µF
C_L = 0.1 µF R_L = 10 Ω

Figure 26. Turn-Off Response Time



V_{IN} = 1.5 V T_A = 25°C C_{IN} = 10 µF
C_L = 1 µF R_L = 10 Ω

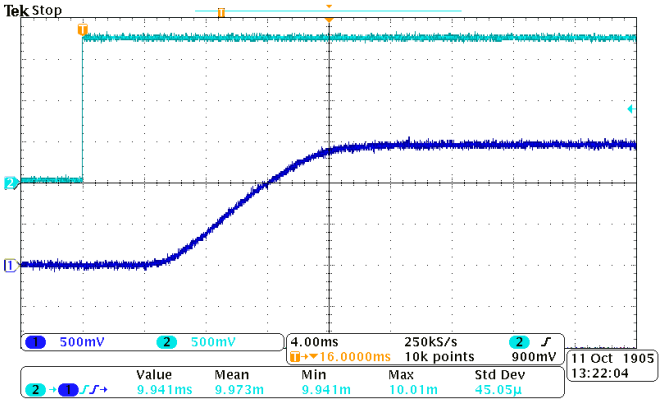
Figure 27. Turn-On Response Time



V_{IN} = 1.5 V T_A = 25°C C_{IN} = 10 µF
C_L = 1 µF R_L = 10 Ω

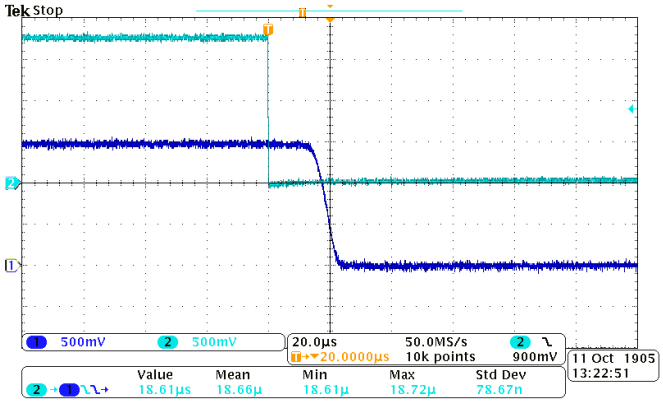
Figure 28. Turn-Off Response Time

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V_{IN} = 1.5 V T_A = 25°C C_{IN} = 1 µF
C_L = 0.1 µF R_L = 10 Ω

Figure 29. Turn-On Response Time



V_{IN} = 1.5 V T_A = 25°C C_{IN} = 1 µF
C_L = 0.1 µF R_L = 10 Ω

Figure 30. Turn-Off Response Time

11 Power Supply Recommendations

The device is designed to operate with a VIN range of 1.4 V to 5.5 V.

12 Layout

12.1 Layout Guidelines

For best performance, all traces should be as short as possible. To be most effective, the input and output capacitors should be placed close to the device to minimize the effects that parasitic trace inductances may have on normal operation. Using wide traces for V_{IN}, V_{OUT}, and GND helps minimize the parasitic electrical effects along with minimizing the case to ambient thermal impedance.

12.1.1 Thermal Considerations

For best device performance, be sure to follow the thermal guidelines in the *Thermal Information* table. To calculate max allowable continuous current for your application for a specific V_{IN} and ambient temperature, use the following formula:

$$I_{MAX} = \sqrt{\frac{\frac{T_J - T_A}{\theta_{JA}}}{R_{ON}}}$$

Where:

- I_{MAX}= Max allowable continuous current
- T_J= Max thermal junction temperature (125°C)
- T_A= Ambient temperature of the application
- θ_{JA}= Junction-to-air thermal impedance (216°C/W)
- R_{ON}= R_{ON} at a specified input voltage VIN (see *Electrical Characteristics*)

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12.2 Layout Example

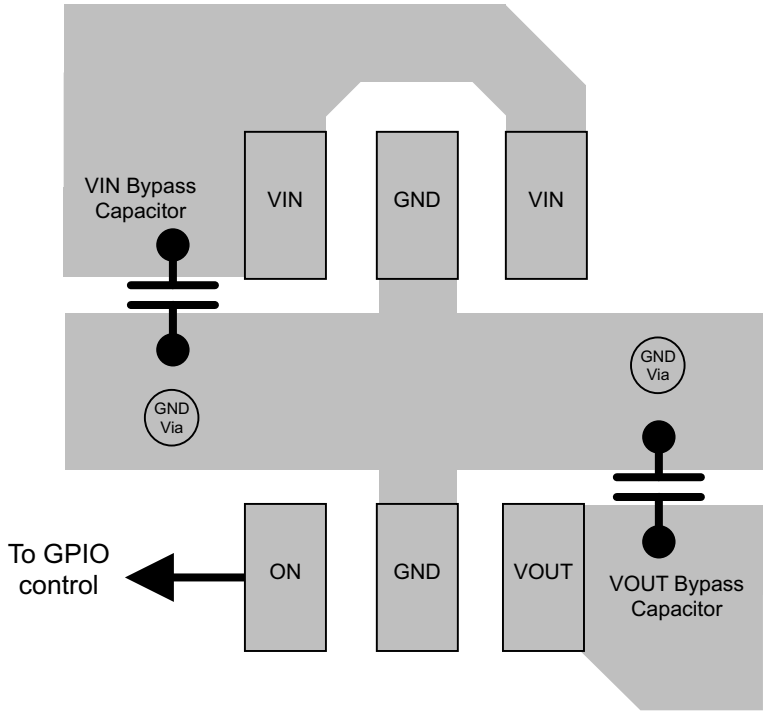


Figure 31. Layout Drawing

13 Device and Documentation Support

13.1 Trademarks

All trademarks are the property of their respective owners.

13.2 Electrostatic Discharge Caution

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

13.3 Glossary

SLYZ022 — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

14 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TPS22929DDBVR	Active	Production	SOT-23 (DBV) | 6	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(NF4F, NF4W)
TPS22929DDBVR.A	Active	Production	SOT-23 (DBV) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(NF4F, NF4W)
TPS22929DDBVR.B	Active	Production	SOT-23 (DBV) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(NF4F, NF4W)
TPS22929DDBVRG4	Active	Production	SOT-23 (DBV) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	NF4W NF4F
TPS22929DDBVRG4.A	Active	Production	SOT-23 (DBV) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	NF4W NF4F
TPS22929DDBVRG4.B	Active	Production	SOT-23 (DBV) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	NF4W NF4F
TPS22929DDBVT	Active	Production	SOT-23 (DBV) | 6	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(NF4F, NF4W)
TPS22929DDBVT.A	Active	Production	SOT-23 (DBV) | 6	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(NF4F, NF4W)
TPS22929DDBVT.B	Active	Production	SOT-23 (DBV) | 6	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(NF4F, NF4W)

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

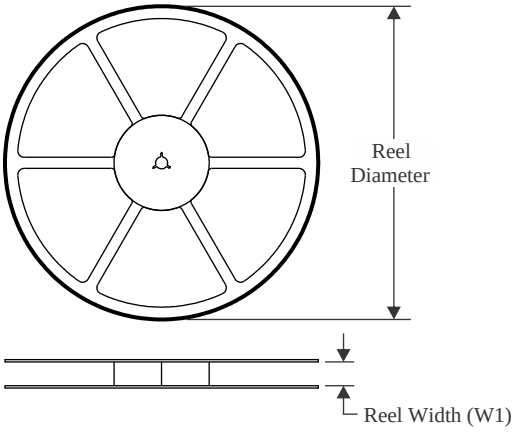
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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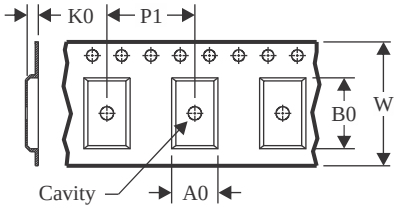
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TAPE AND REEL INFORMATION

REEL DIMENSIONS

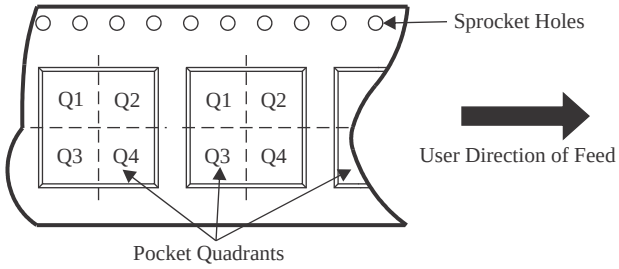


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

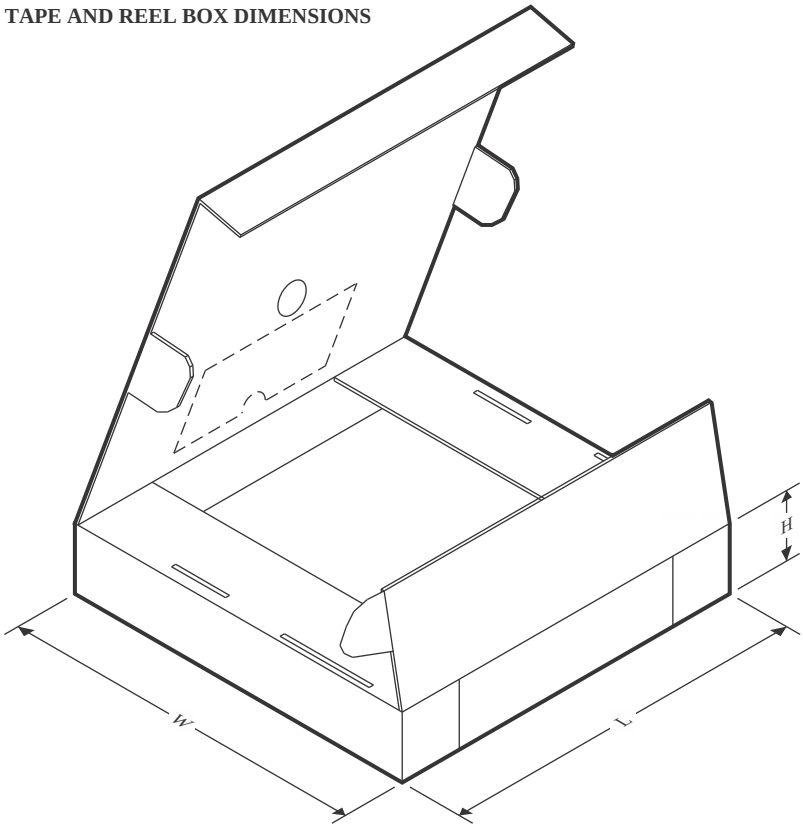
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TPS22929DDBVR	SOT-23	DBV	6	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS22929DDBVRG4	SOT-23	DBV	6	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TPS22929DDBVT	SOT-23	DBV	6	250	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

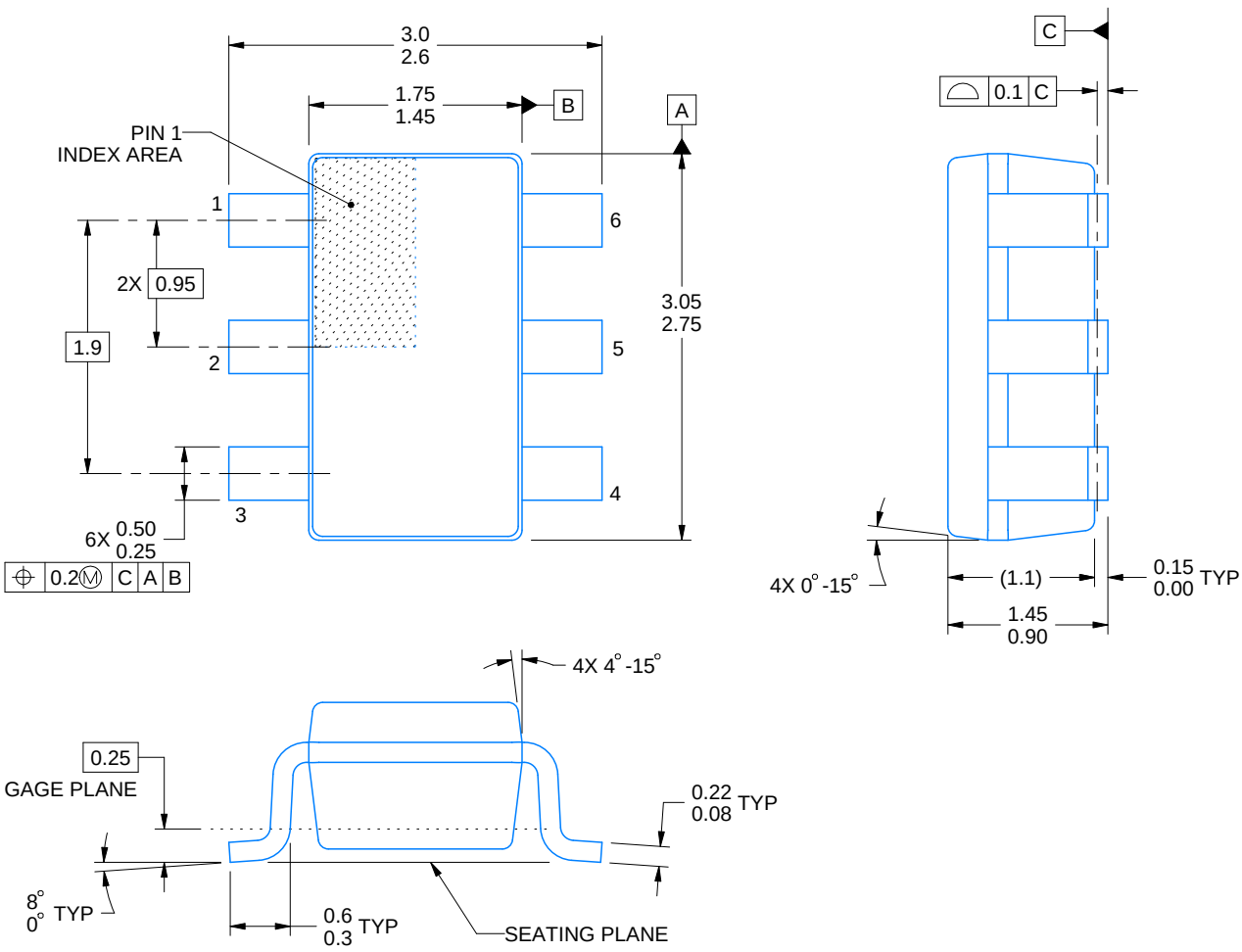
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS22929DDBVR	SOT-23	DBV	6	3000	208.0	191.0	35.0
TPS22929DDBVRG4	SOT-23	DBV	6	3000	180.0	180.0	18.0
TPS22929DDBVT	SOT-23	DBV	6	250	180.0	180.0	18.0

PACKAGE OUTLINE

DBV0006A

SOT-23 - 1.45 mm max height

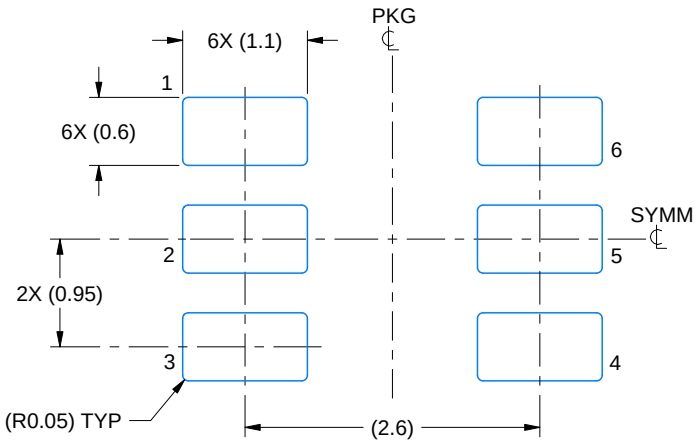
SMALL OUTLINE TRANSISTOR



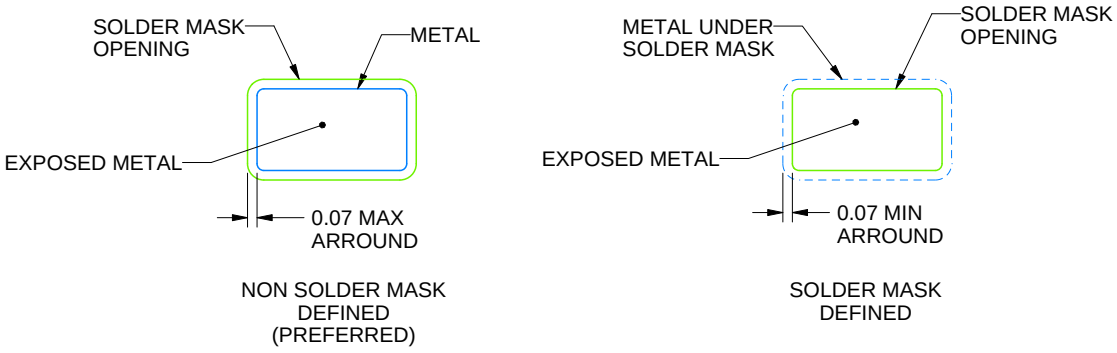
4214840/G 08/2024

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.25 per side.
4. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
5. Refernce JEDEC MO-178.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X

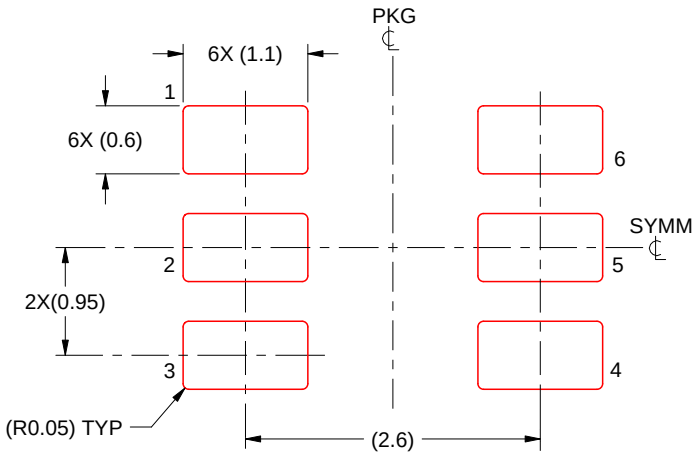


SOLDER MASK DETAILS

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NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

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NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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