# Ultra-Small, Low on Resistance Load Switch with Controlled Turn-on

**Check for Samples: TPS22929**

## 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 (25C)**
- **Low Threshold Control Input**
- **Controlled Slew-rate Options**
- **Under-Voltage Lock Out**
- **Quick Output Discharge Transistor**
- **Reverse Current Protection**

## APPLICATIONS

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

## DESCRIPTION

The TPS22929 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 TPS22929 is active high enable.

The TPS22929 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 TPS22929 family has various slew rate options (see ).

The TPS22929 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 (10µs 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 TPS22929 is available in an small, space-saving 6-pin SOT23-6 package and is characterized for operation over the free-air temperature range of –40°C to 85°C.

## TYPICAL APPLICATION

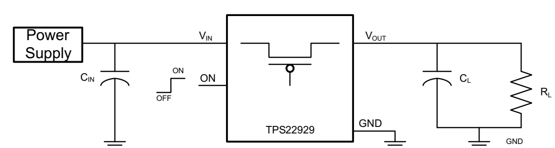



**Table 1. Feature List**

| DEVICE | rON (typ) at 3.3 V | Rise Time at 3.3 V (typ) | QUICK OUTPUT DISCHARGE(1) | MAXIMUM OUTPUT CURRENT (3.3 V and 25°C)(2) | ENABLE |
|---|---|---|---|---|---|
| TPS22929A(3) | 115-mΩ | 0.5 µs | Yes | 1.8-A | Active High |
| TPS22929B(3) | 115-mΩ | 100 µs | Yes | 1.8-A | Active High |
| TPS22929C(3) | 115-mΩ | 1000 µs | Yes | 1.8-A | Active High |
| TPS22929D | 115-mΩ | 4500 µs | Yes | 1.8-A | Active High |

(1) This feature discharges the output of the switch to ground through an 150-Ω resistor, preventing the output from floating.
(2) See “Thermal Considerations” section in Application Information to calculate maximum continuous current for a specific application.
(3) Contact local sales/distributor or factory for availability.

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.

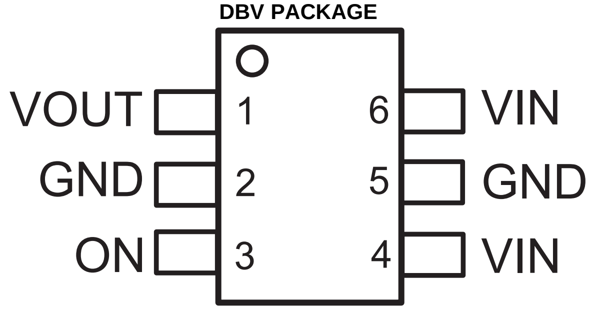
## ORDERING INFORMATION

| $T_A$ | PACKAGE[1] | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---|---|---|---|---|
| –40°C to 85°C | DBV | Contact factory for availability[2] | TPS22929ADBVT | Contact factory for availability[2] |
| | | | TPS22929ADBVR | |
| | | | TPS22929BDBVT | |
| | | | TPS22929BDBVR | |
| | | | TPS22929CDBVT | |
| | | | TPS22929CDBVR | |
| | | Tape of 3000 | TPS22929DDBVT | _F4_ |
| | | Reel of 250 | TPS22929DDBVR | |

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.
(2) Contact factory for details and availability for PREVIEW devices, minimum order quantities may apply.

## DEVICE INFORMATION

DBV PACKAGE




## PIN FUNCTIONS

| TPS22929 DBV | PIN NAME | DESCRIPTION |
|---|---|---|
| 2, 5 | GND | Ground |
| 3 | ON | Switch control input, active high. Do not leave floating |
| 1 | VOUT | Switch output |
| 4, 6 | VIN | Switch input, bypass this input with a ceramic capacitor to ground |

## BLOCK DIAGRAM

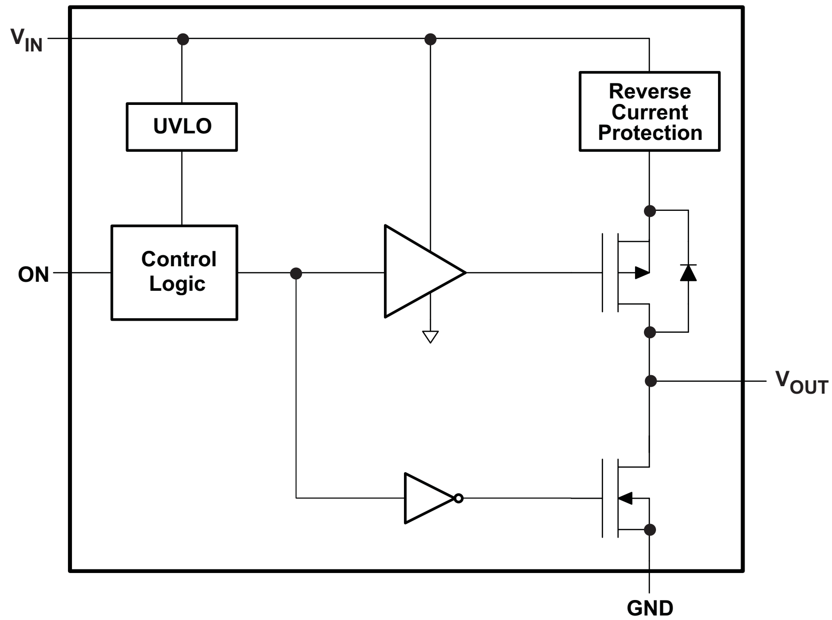



**Table 2. FUNCTION TABLE**

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

(1) See Application section 'Output Pull-Down'

## ABSOLUTE MAXIMUM RATINGS

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

| | | | VALUE | UNIT |
|---|---|---|---|---|
| $V_{IN}$ | Input voltage range | | –0.3 to 6 | V |
| $V_{OUT}$ | Output voltage range | | VIN + 0.3 | V |
| $V_{ON}$ | Input voltage range | | –0.3 to 6 | V |
| $P_{MAX}$ | Maximum continuous power dissipation @ 25°C | | 463 | mW |
| | Maximum continuous power dissipation @ 70°C | | 254 | |
| | Maximum continuous power dissipation @ 85°C | | 185 | |
| $I_{MAX}$ | Maximum continuous operating current | | 2 | A |
| $T_A$ | Operating free-air temperature range | | –40 to 85 | °C |
| $T_J$ | Maximum junction temperature | | 125 | °C |
| $T_{STG}$ | Storage temperature range | | –65 to 150 | °C |
| ESD | Electrostatic discharge protection | Human-Body Model (HBM) (VIN, VOUT, GND pins) | 2000 | V |
| | | Charged-Device Model (CDM) (VIN, VOUT, ON, GND pins) | 1000 | |

## THERMAL INFORMATION

| THERMAL METRIC[1] | | TPS22929 SOT23-6 (6) PINS | UNITS |
|---|---|---|---|
| $\theta_{JA}$ | Junction-to-ambient thermal resistance | 216 | °C/W |
| $\theta_{JCtop}$ | Junction-to-case (top) thermal resistance | 209 | |
| $\theta_{JB}$ | Junction-to-board thermal resistance | 131 | |
| $\psi_{JT}$ | Junction-to-top characterization parameter | 52 | |
| $\psi_{JB}$ | Junction-to-board characterization parameter | 110 | |
| $\theta_{JCbot}$ | Junction-to-case (bottom) thermal resistance | N/A | |

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

## 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 = 3.61 V to 5.5 V | 1.1 | 5.5 | V |
| | | VIN = 1.4 V to 3.6 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. 6V | | 0.4 | V |
| $C_{IN}$ | Input Capacitor | | 1 [1] | | μF |

(1) Refer to the application section.

## ELECTRICAL CHARACTERISTICS

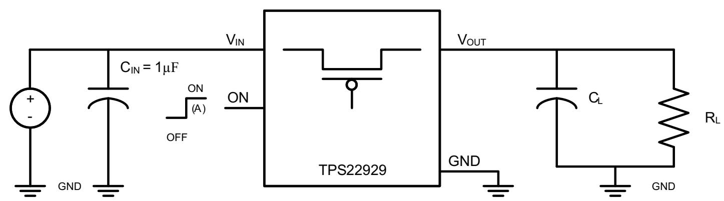
VIN = 1.4 V to 5.5 V, $T_A$ = –40ºC to 85ºC (unless otherwise noted)

| 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 |

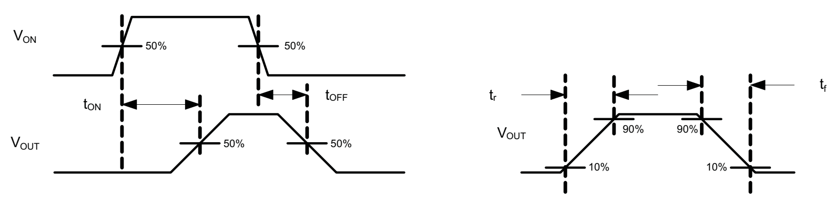
## SWITCHING CHARACTERISTICS

| PARAMETER | | TEST CONDITION | TPS22929D TYP | UNIT |
|---|---|---|---|---|
| **VIN = 5 V, $T_A$ = 25°C (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, $T_A$ = 25°C (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, $T_A$ = 25°C (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 | |

## PARAMETRIC MEASUREMENT INFORMATION




TEST CIRCUIT




$t_{ON}$/$t_{OFF}$ WAVEFORMS

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

**Figure 1. Test Circuit and $t_{ON}$/$t_{OFF}$ Waveforms**

## TYPICAL CHARACTERISTICS

**ON-STATE RESISTANCE vs INPUT VOLTAGE**

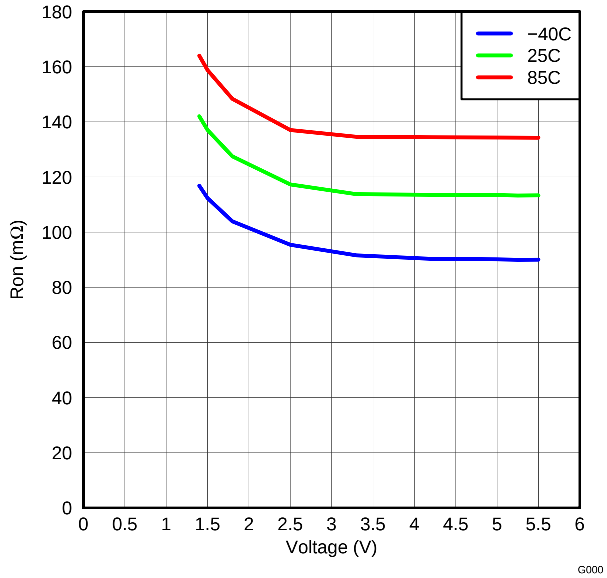



**Figure 2.**

**ON INPUT THRESHOLD**

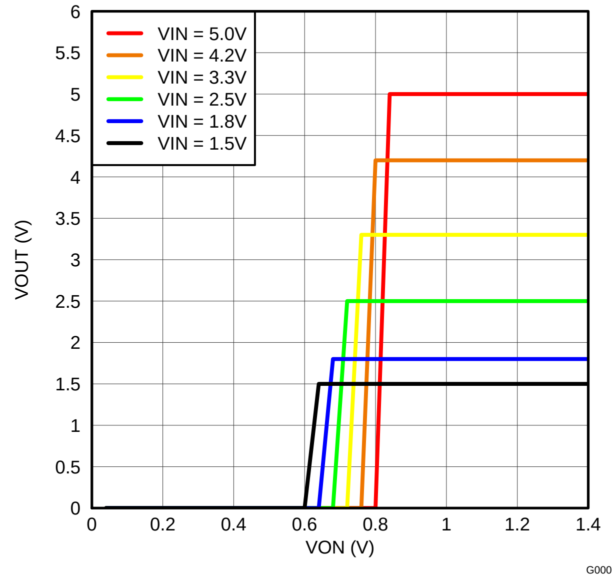



**Figure 3.**

**INPUT CURRENT, QUIESCENT vs INPUT VOLTAGE**

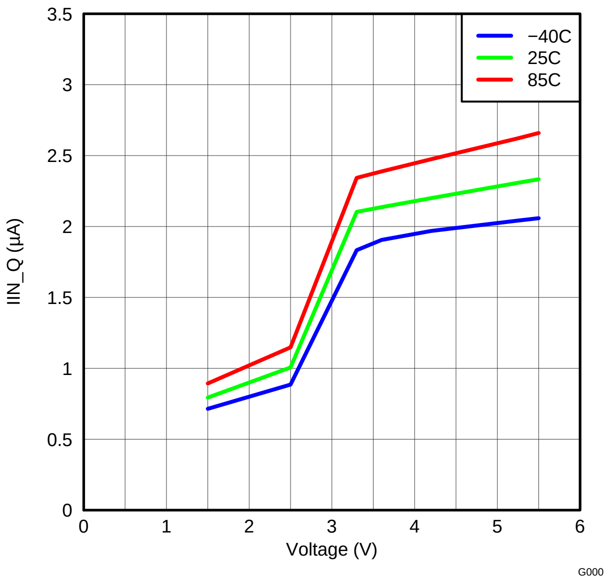



**Figure 4.**

**INPUT CURRENT, LEAK vs INPUT VOLTAGE**

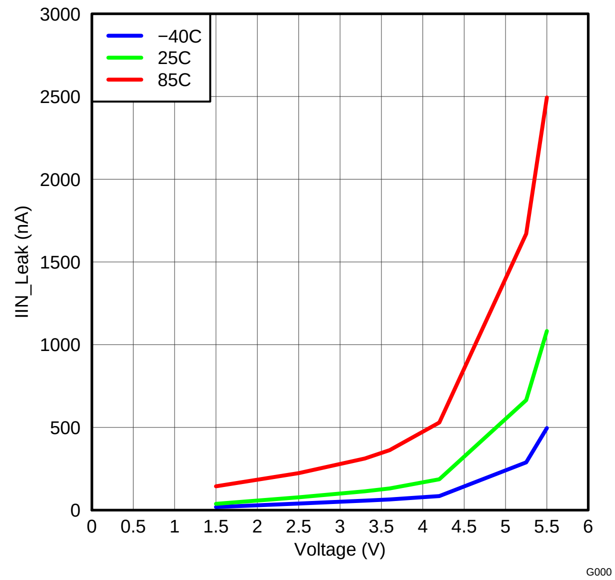



**Figure 5.**

## TYPICAL CHARACTERISTICS (continued)

**ON-STATE RESISTANCE vs TEMPERATURE**

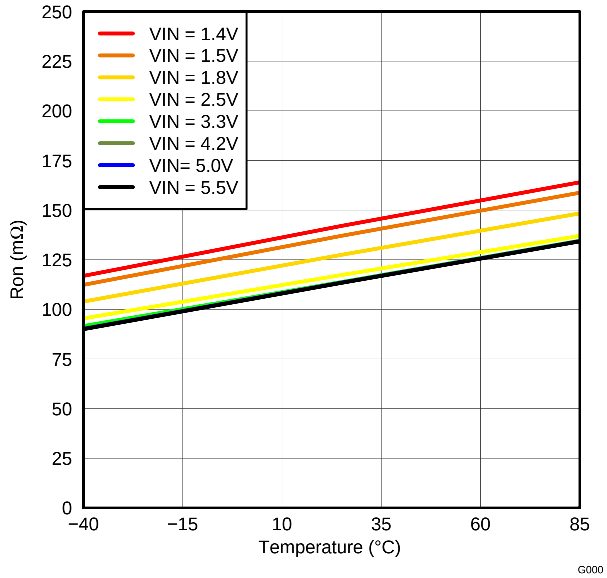



**Figure 6.**

**INPUT CURRENT, OFF vs INPUT VOLTAGE**

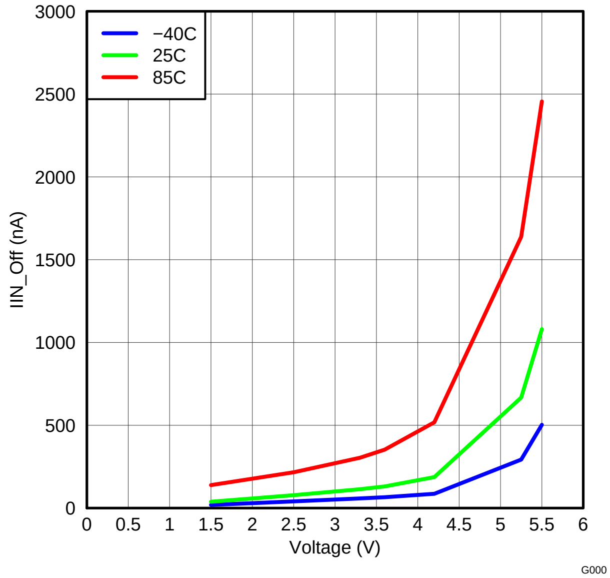



**Figure 7.**

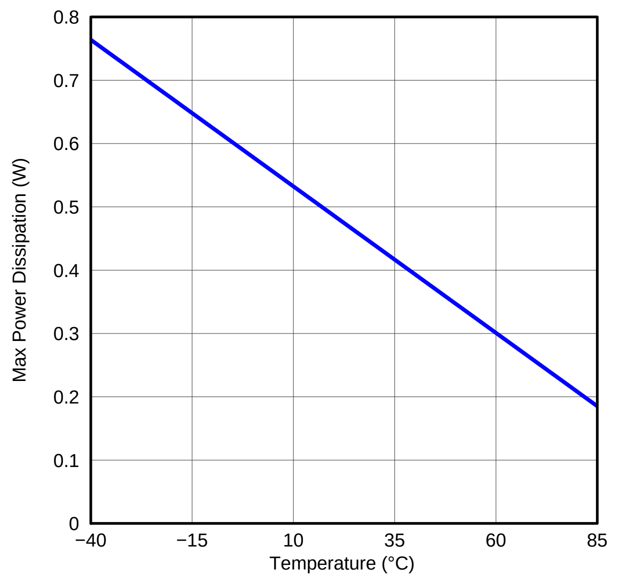



**Figure 8. Allowable Power Dissipation**

## TYPICAL CHARACTERISTICS (continued)

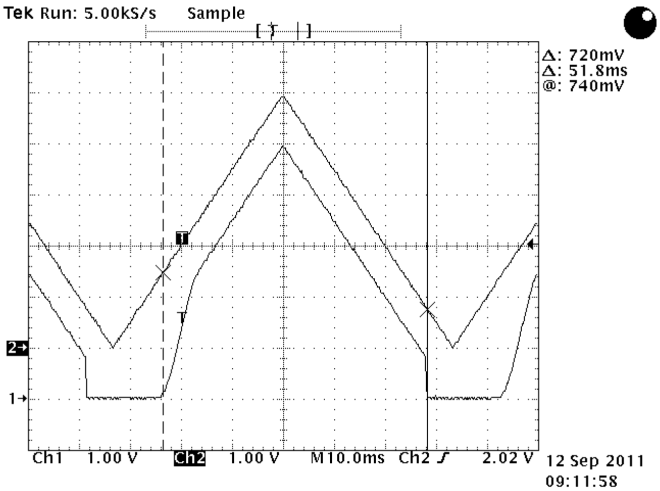



**Figure 9. ULVO Response $I_{OUT}$ = -100mA**

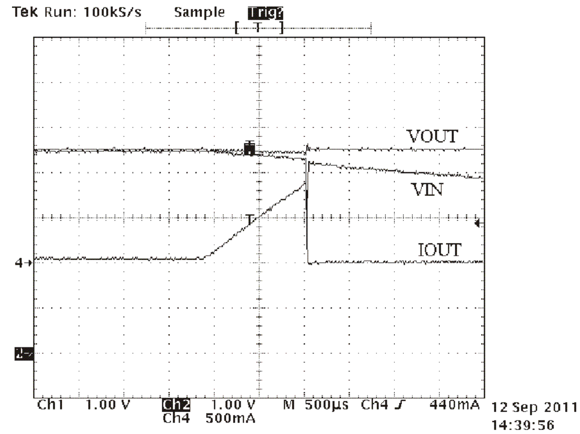



**Figure 10. Reverse Current Protection $V_{OUT}$ = 3.3V, $V_{IN}$ = 3.3V Decreasing to 0V**

## TYPICAL AC CHARACTERISTICS FOR tps22929B

**RISE TIME vs TEMPERATURE**

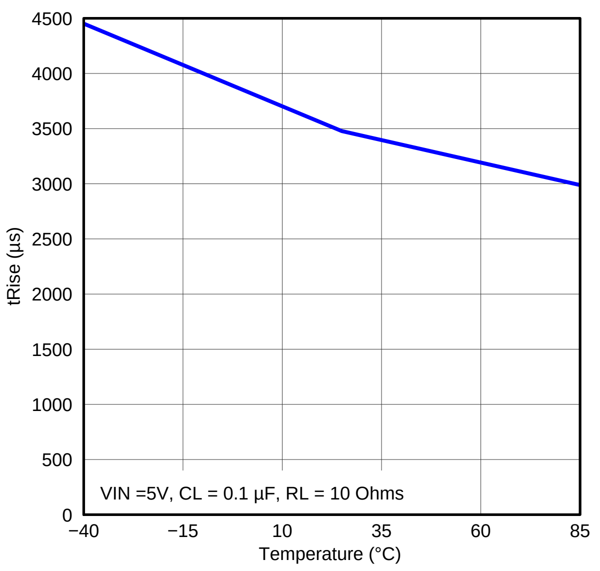



**Figure 11.**

**FALL TIME vs TEMPERATURE**

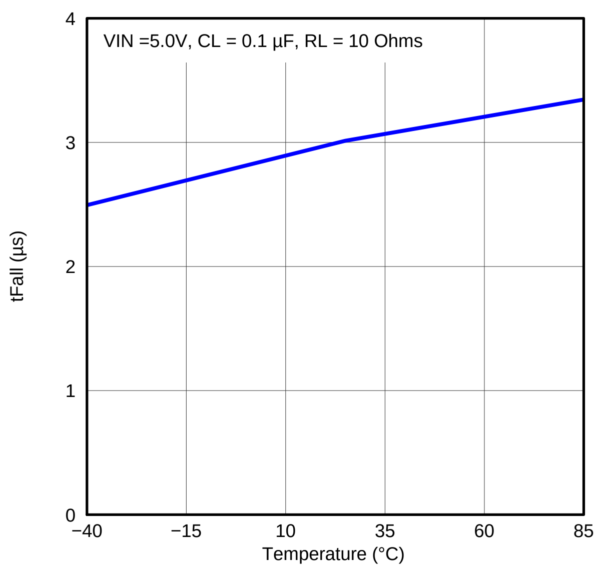



**Figure 12.**

## TYPICAL CHARACTERISTICS (continued)

**RISE TIME vs TEMPERATURE**

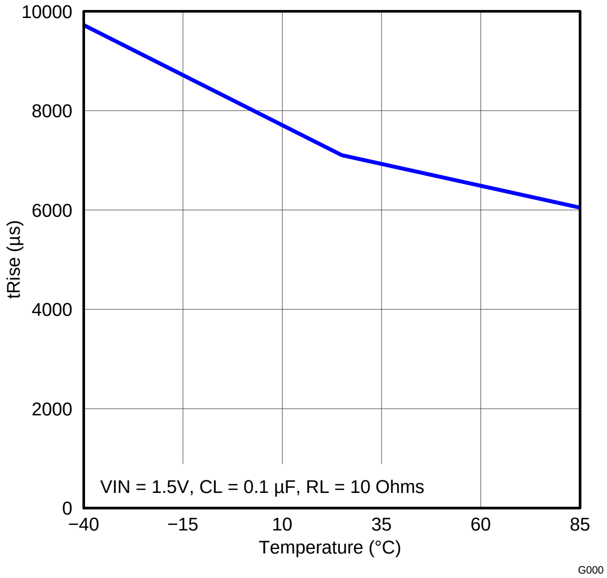



**Figure 13.**

**FALL TIME vs TEMPERATURE**

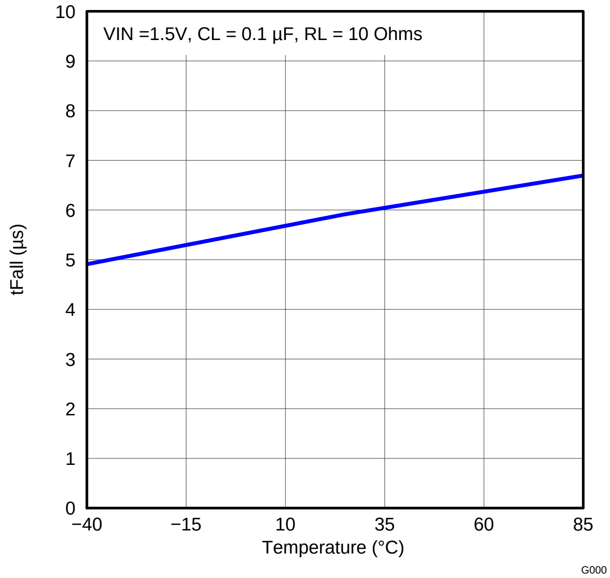



**Figure 14.**

**TURN-ON TIME vs TEMPERATURE**

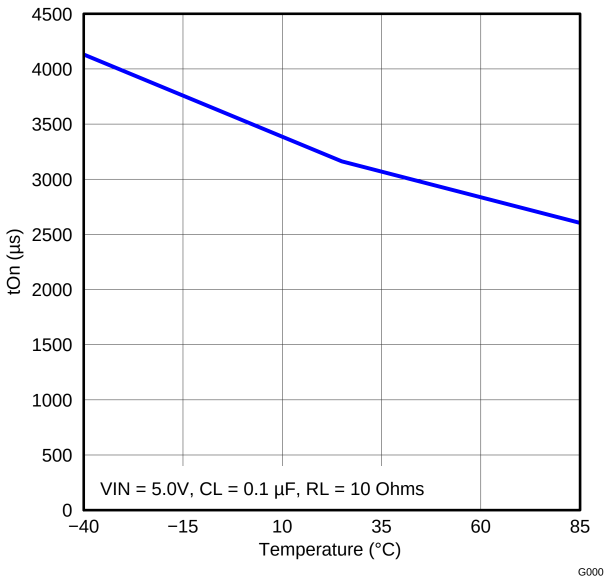



**Figure 15.**

**TURN-OFF TIME vs TEMPERATURE**

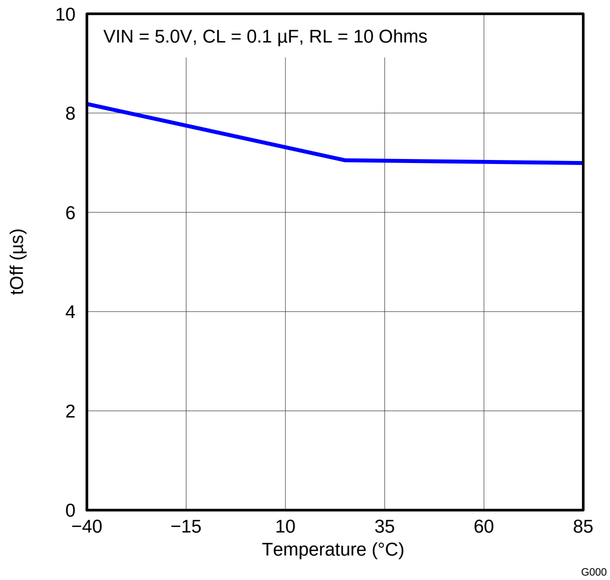



**Figure 16.**

## TYPICAL CHARACTERISTICS (continued)

**TURN-ON TIME vs TEMPERATURE**

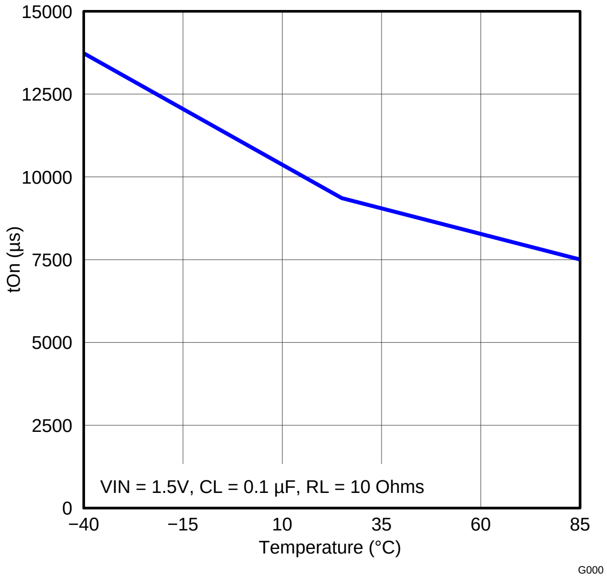



**Figure 17.**

**TURN-OFF TIME vs TEMPERATURE**

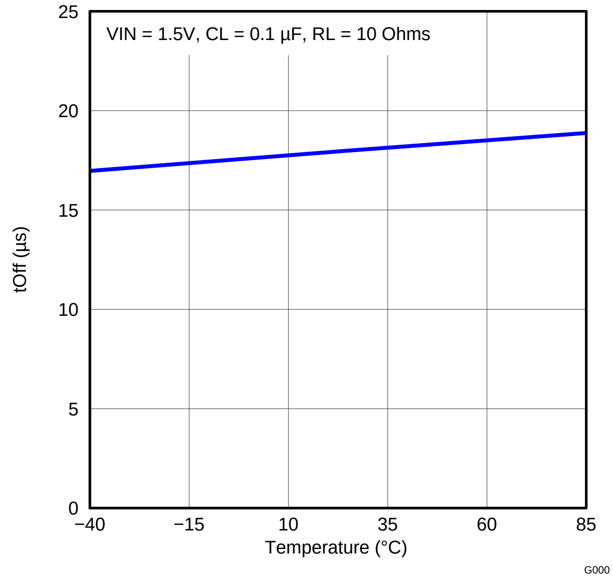



**Figure 18.**

**RISE TIME vs INPUT VOLTAGE**

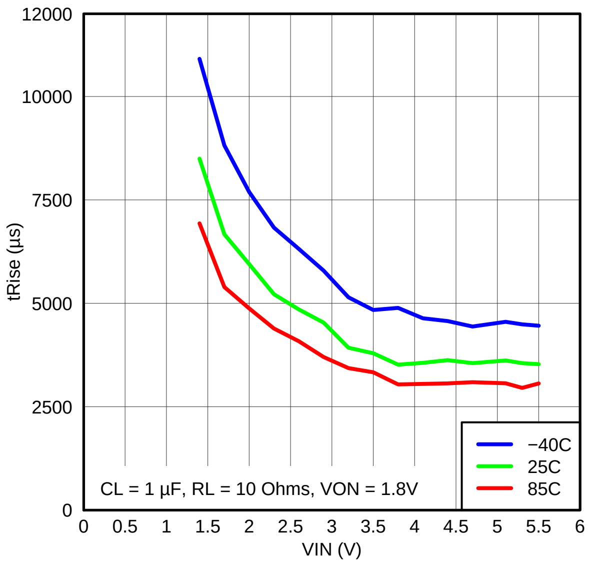



**Figure 19.**

**RISE TIME vs INPUT VOLTAGE**

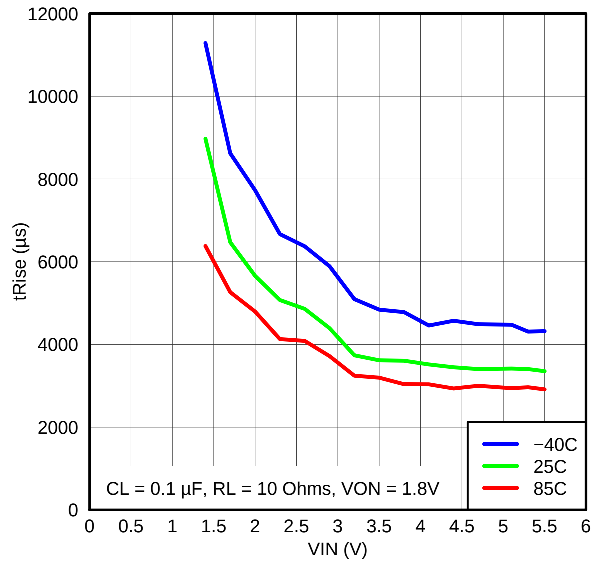



**Figure 20.**

## TYPICAL CHARACTERISTICS (continued)

### TURN-ON RESPONSE
$V_{IN}$ = 5V, $T_A$ = 25°C, $C_{IN}$ = 10μF, $C_L$ = 1μF, $R_L$ = 10Ω

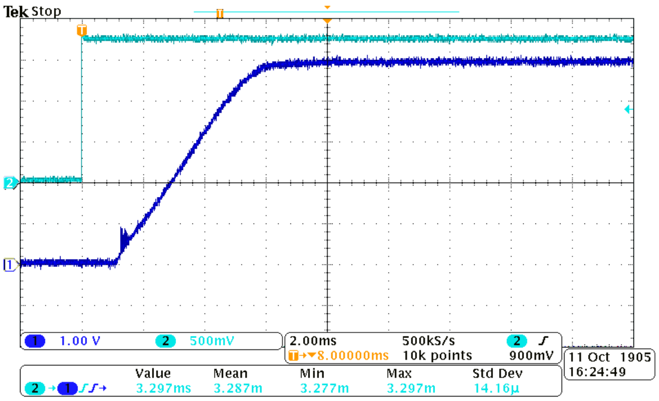



**Figure 21.**

### TURN-OFF RESPONSE
$V_{IN}$ = 5V, $T_A$ = 25°C, $C_{IN}$ = 10μF, $C_L$ = 1μF, $R_L$ = 10Ω

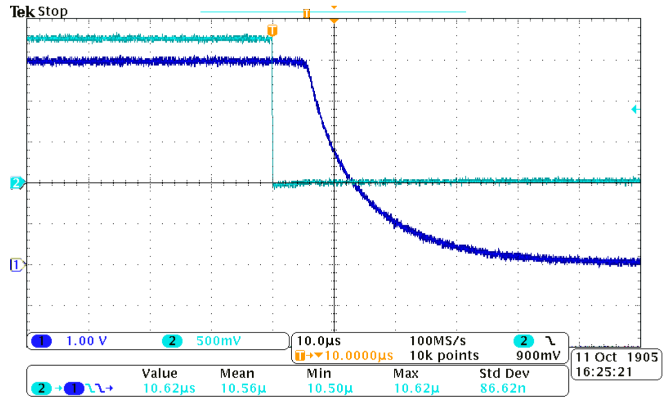



**Figure 22.**

### TURN-ON RESPONSE TIME
$V_{IN}$ = 5V, $T_A$ = 25°C, $C_{IN}$ =1μF, $C_L$ = 0.1μF, $R_L$ = 10Ω

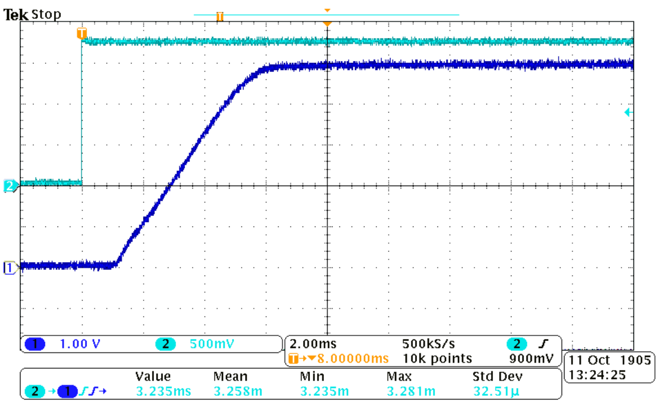



**Figure 23.**

### TURN-OFF RESPONSE TIME
$V_{IN}$ = 5V, $T_A$ = 25°C, $C_{IN}$ = 1μF, $C_L$ = 0.1μF, $R_L$ = 10Ω

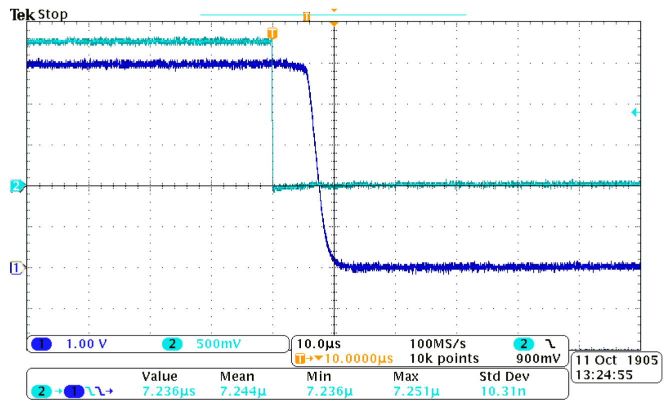



**Figure 24.**

### TURN-ON RESPONSE TIME
$V_{IN}$ = 1.5V, $T_A$ = 25°C, $C_{IN}$ = 10μF, $C_L$ = 1μF, $R_L$ = 10Ω

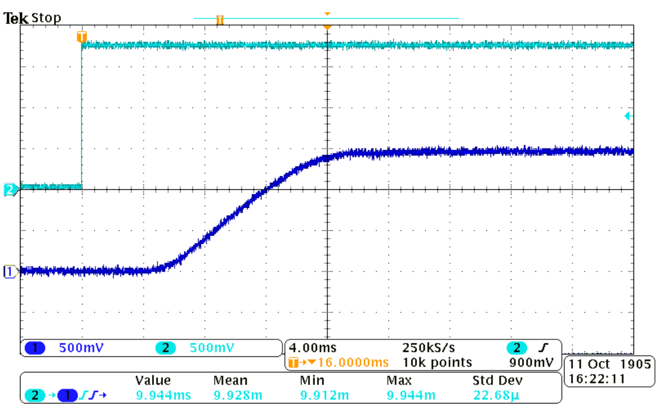



**Figure 25.**

### TURN-OFF RESPONSE TIME
$V_{IN}$ = 1.5V, $T_A$ = 25°C, $C_{IN}$ = 10μF, $C_L$ = 1μF, $R_L$ = 10Ω

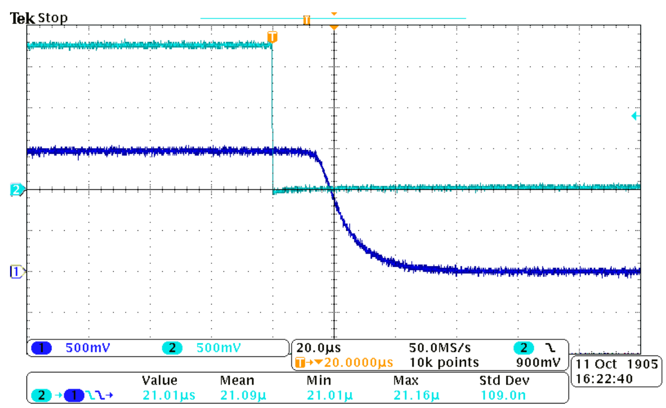



**Figure 26.**

# TYPICAL CHARACTERISTICS (continued)

**TURN-ON RESPONSE TIME**
**$V_{IN}$ = 1.5V, $T_A$ = 25°C, $C_{IN}$ = 1μF, $C_L$ = 0.1μF, $R_L$ = 10Ω**

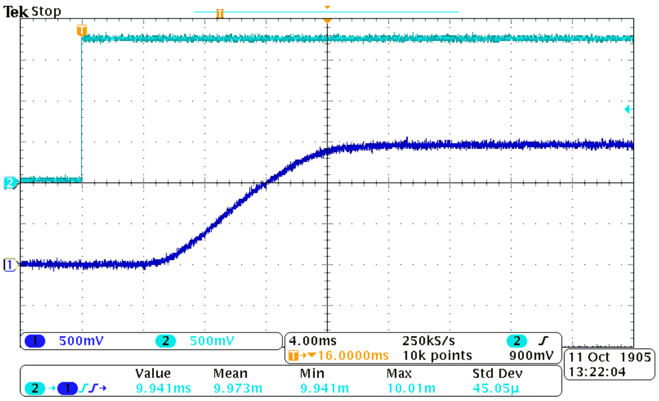



**Figure 27.**

**TURN-OFF RESPONSE TIME**
**$V_{IN}$ = 1.5V, $T_A$ = 25°C, $C_{IN}$ = 1μF, $C_L$ = 0.1μF, $R_L$ = 10Ω**

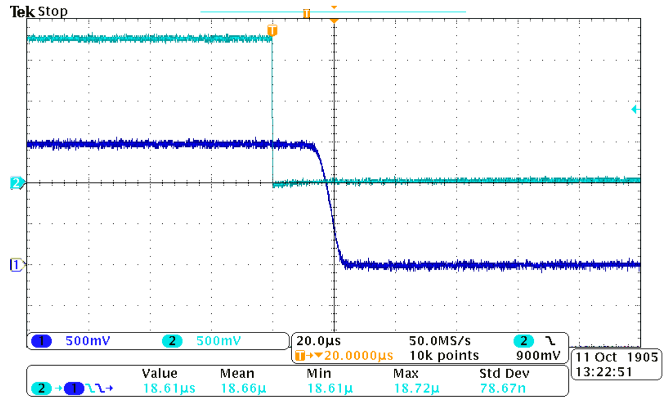



**Figure 28.**

# APPLICATION INFORMATION

## 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.

## 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.

## 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.

## Output Pull-Down

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

## 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.

## 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 TPS22929 monitors $V_{IN}$ and $V_{OUT}$ voltage levels. When the reverse current voltage threshold ($V_{RVP}$) is exceeded, the switch is disabled (within 10μs 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 current scenario is no longer present.

Use the following formula to calculate the amount of reverse current 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 at the VIN of the reverse current condition.

## Board Layout

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.

## Thermal Considerations

For best device performance, be sure to follow the thermal guidelines in the Thermal Information table on page 4. 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
$\theta_{JA}$= Junction-to-air thermal impedance (216°C/W)
$R_{ON}$= $R_{ON}$ at a specified input voltage VIN (see Electrical Characteristics table on page 5)

## PACKAGING INFORMATION

| Orderable Device | Status [1] | Package Type | Package Drawing | Pins | Package Qty | Eco Plan [2] | Lead/ Ball Finish | MSL Peak Temp [3] | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TPS22929DDBVR | ACTIVE | SOT-23 | DBV | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TPS22929DDBVT | ACTIVE | SOT-23 | DBV | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

[1] The marketing status values are defined as follows:
**ACTIVE:** Product device recommended for new designs.
**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.
**OBSOLETE:** TI has discontinued the production of the device.

[2] Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
**TBD:** The Pb-Free/Green conversion plan has not been defined.
**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

[3] MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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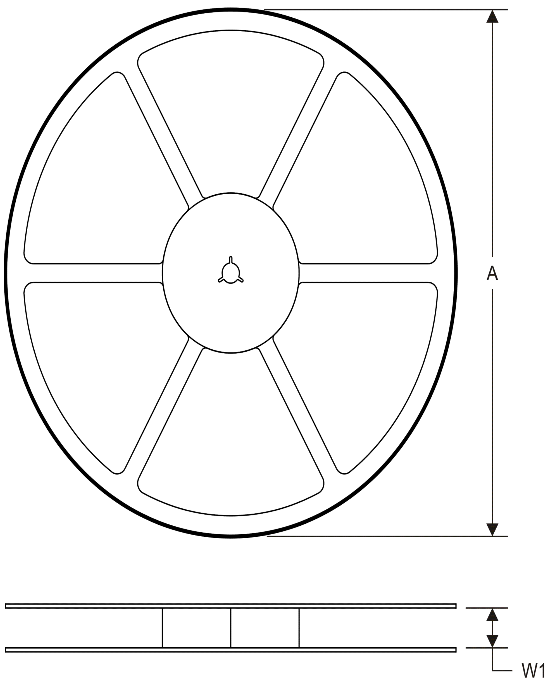
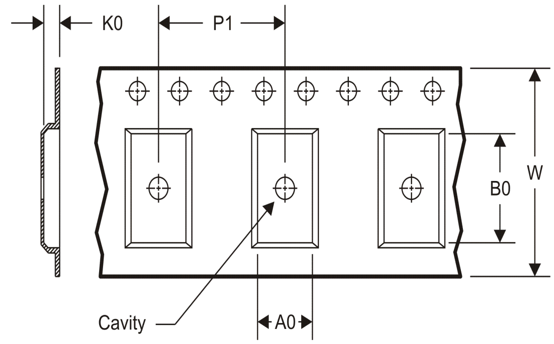
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

## TAPE AND REEL INFORMATION

### REEL DIMENSIONS




### TAPE DIMENSIONS



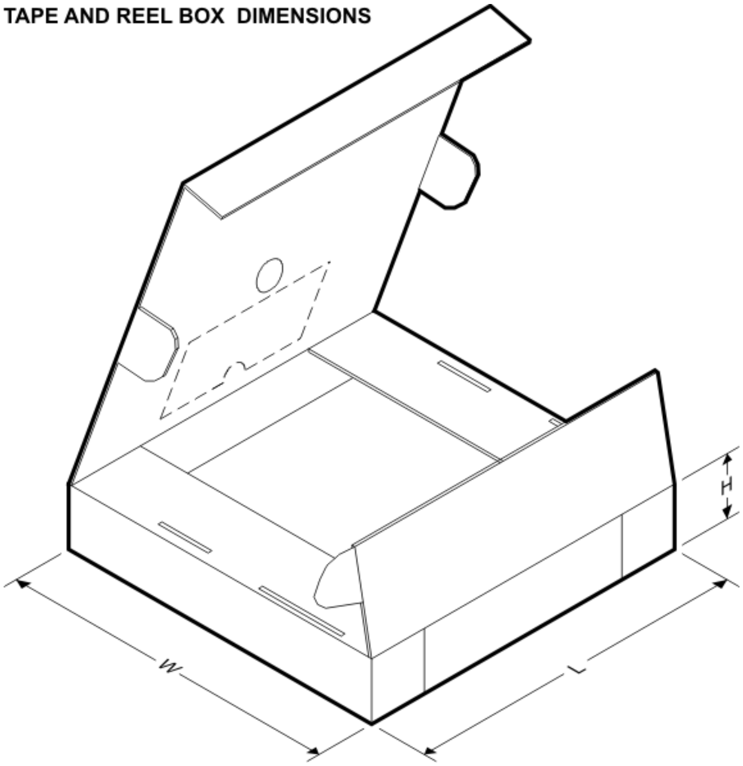

| | |
|---|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

### TAPE AND REEL INFORMATION

*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 | 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 |

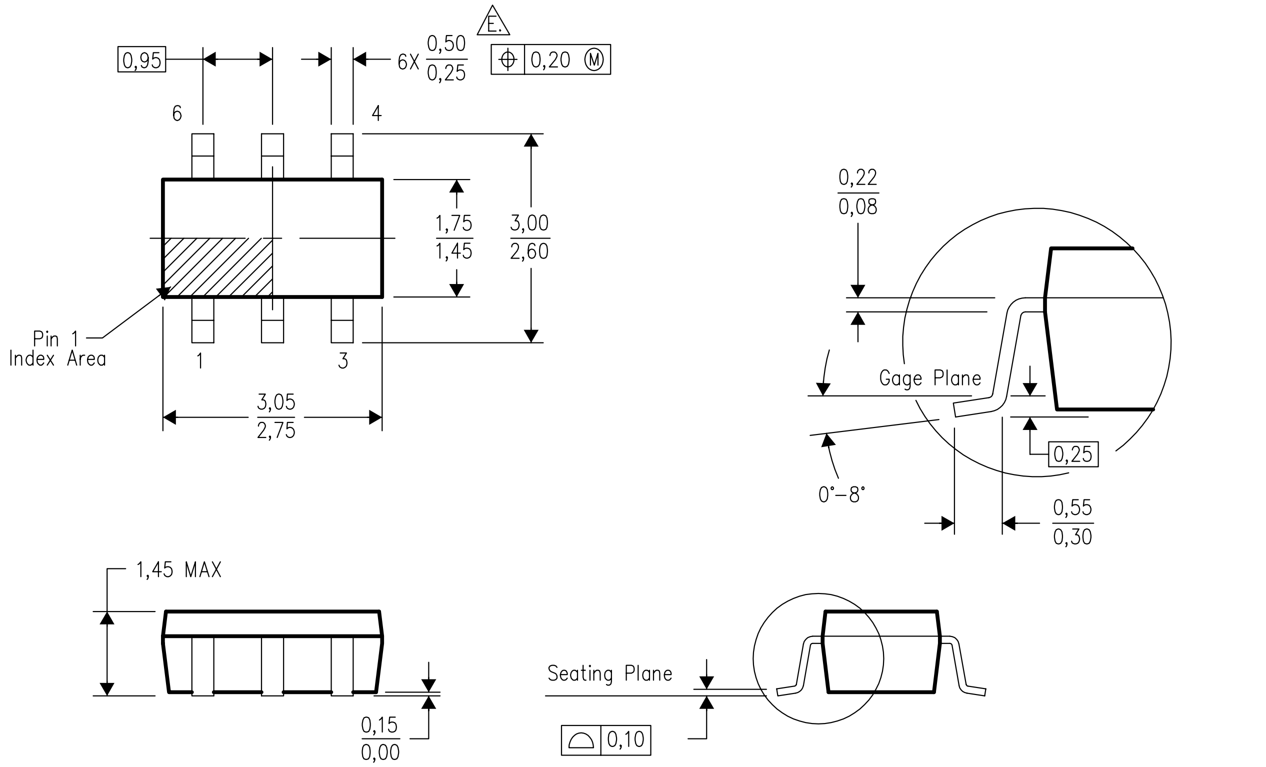
TAPE AND REEL BOX DIMENSIONS




*All dimensions are nominal

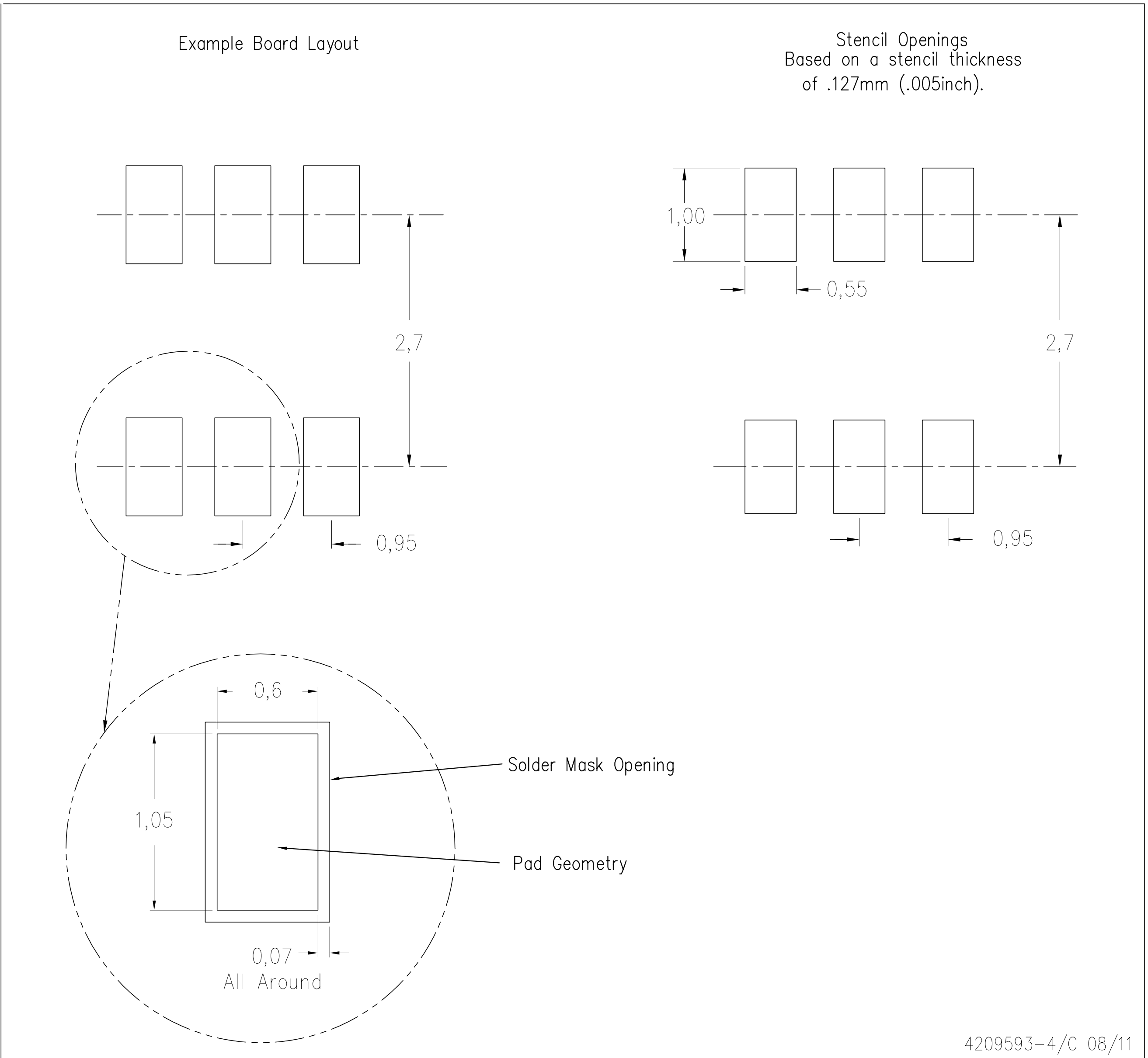
| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| TPS22929DDBVR | SOT-23 | DBV | 6 | 3000 | 180.0 | 180.0 | 18.0 |
| TPS22929DDBVT | SOT-23 | DBV | 6 | 250 | 180.0 | 180.0 | 18.0 |

DBV (R-PDSO-G6) PLASTIC SMALL-OUTLINE PACKAGE




NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
- D. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
- E. Falls within JEDEC MO-178 Variation AB, except minimum lead width.

DBV (R-PDSO-G6) PLASTIC SMALL OUTLINE




NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
- D. Publication IPC-7351 is recommended for alternate designs.
- E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

## IMPORTANT NOTICE



Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

| **Products** | | **Applications** | |
|---|---|---|---|
| Audio | www.ti.com/audio | Communications and Telecom | www.ti.com/communications |
| Amplifiers | amplifier.ti.com | Computers and Peripherals | www.ti.com/computers |
| Data Converters | dataconverter.ti.com | Consumer Electronics | www.ti.com/consumer-apps |
| DLP® Products | www.dlp.com | Energy and Lighting | www.ti.com/energy |
| DSP | dsp.ti.com | Industrial | www.ti.com/industrial |
| Clocks and Timers | www.ti.com/clocks | Medical | www.ti.com/medical |
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| RFID | www.ti-rfid.com | | |
| OMAP Mobile Processors | www.ti.com/omap | | |
| Wireless Connectivity | www.ti.com/wirelessconnectivity | | |
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