超小型、低输入电压、低 $R_{导通}$ 负载开关

查询样品: TPS22908

特性

- 低输入电压：**1.0V** 至 **3.6V**
- 超低导通状态电阻（$R_{导通}$）
- 典型 $R_{导通}$ 值
  - 在输入电压 **(VIN) = 3.6V** 时，$R_{导通}$**=28mΩ**
  - **VIN=2.5V** 时，$R_{导通}$**=33mΩ**
  - **VIN=1.8V** 时，$R_{导通}$**=42mΩ**
  - **VIN=1.2V** 时，$R_{导通}$**=70mΩ**
- **1A** 最大持续开关电流
- 最大静态电流 **= 1μA**
- 最大关断电流 **= 1μA**
- 低控制输入阀值可实现低压逻辑的使用
- 受控制的转换率以避免浪涌电流
- 超小型四端子晶圆级芯片封装 **(WCSP)**
  - 标称尺寸 **-** 细节请见附录
  - **0.9mm × 0.9mm**
  - 焊球间距 **0.5mm**，高度 **0.6mm**
- 快速输出放电 **(QOD)**

应用范围

- 电池供电类设备
- 便携式工业设备
- 便携式医疗设备
- 便携式媒体播放器
- 销售点终端
- 全球卫星定位 **(GPS)** 设备
- 数码摄像机
- 便携式仪表
- 智能电话**/**平板电脑

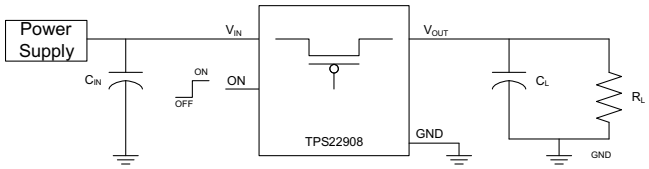


图 **1.** 典型应用

说明

TPS22908 是一款具有受控接通功能的超小型、低 $R_{导通}$ 负载开关。 此器件包括一个 P 通道金属氧化物半导体场效应晶体管 (MOSFET)，此晶体管可在 1.0V 至 3.6V 的输入电压范围内运行。此开关由一个开/关输入 (ON) 控制，此输入能够与低电压控制信号直接对接。

TPS22908 采用一个节省空间的 4 端子晶圆级芯片封装 (WCSP)，此封装的焊球间距为 0.5mm (YZT)。 器件在自然通风环境下的额定运行温度范围为 -40°C 至 85°C。

订购信息

封装和订购信息，请参见本文档末尾的封装选项附录。

特性列表

器件	**VIN = 3.6V** 时的 $R_{导通}$（典型值）	**VIN = 3.6V** 时的上升时间（典型值）	快速输出放电 (1)	最大电流	使能
TPS22908	28mΩ	105μs	支持	1A	高电平有效

(1) 通过一个 80Ω 的电阻器，此特性可将开关的输出放电至接地水平，从而防止此输出悬空。

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

ABSOLUTE MAXIMUM RATINGS

Over operating free-air temperature range (unless otherwise noted)(1)

			VALUE	UNIT(2)
V_{IN}	Supply voltage range		–0.3 to 4	V
V_{OUT}	Output voltage range		–0.3 to (V_{IN} + 0.3)	V
V_{ON}	Input voltage range		–0.3 to 4	V
I_{MAX}	Maximum Continuous Switch Current for V_{IN} >= 1.2V		1	A
	Maximum Continuous Switch Current at V_{IN} = 1.0V		0.6	
T_A	Operating free-air temperature range(3)		–40 to 85	°C
T_J	Maximum junction temperature		125	°C
T_{STG}	Storage temperature range		–65 to 150	°C
T_{LEAD}	Maximum lead temperature (10-s soldering time)		300	°C
ESD	Electrostatic discharge protection	Human-Body Model (HBM)	2000	V
		Charged-Device Model (CDM)	1000	

(1) Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) All voltage values are with respect to network ground terminal.
(3) In applications where high power dissipation and/or poor package thermal resistance is present, the maximum ambient temperature may have to be derated. Maximum ambient temperature [TA(max)] is dependent on the maximum operating junction temperature [$T_{J(max)}$], the maximum power dissipation of the device in the application [$P_{D(max)}$], and the junction-to-ambient thermal resistance of the part/package in the application (θ_{JA}), as given by the following equation: $T_{A(max)} = T_{J(max)} – (\theta_{JA} \times P_{D(max)})$

THERMAL INFORMATION

THERMAL METRIC(1)(2)		TPS22908 YZT (4 PINS)	UNITS
Θ_{JA}	Junction-to-ambient thermal resistance	188	°C/W
$\Theta_{JC(top)}$	Junction-to-case(top) thermal resistance	2	
Θ_{JB}	Junction-to-board thermal resistance	33	
Ψ_{JT}	Junction-to-top characterization parameter	9.1	
Ψ_{JB}	Junction-to-board characterization parameter	33	
$\Theta_{JC(bottom)}$	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
(2) For thermal estimates of this device based on PCB copper area, see the TI PCB Thermal Calculator.

RECOMMENDED OPERATING CONDITIONS

		MIN	MAX	UNIT
V_{IN}	Input voltage range	1.0	3.6	V
V_{ON}	ON voltage range	0	3.6	V
V_{OUT}	Output voltage range	0	V_{IN}	V
V_{IH}	High-level input voltage, ON	0.85	3.6	V
V_{IL}	Low-level input voltage, ON	0	0.4	V
C_{IN}	Input capacitor	1(1)		µF

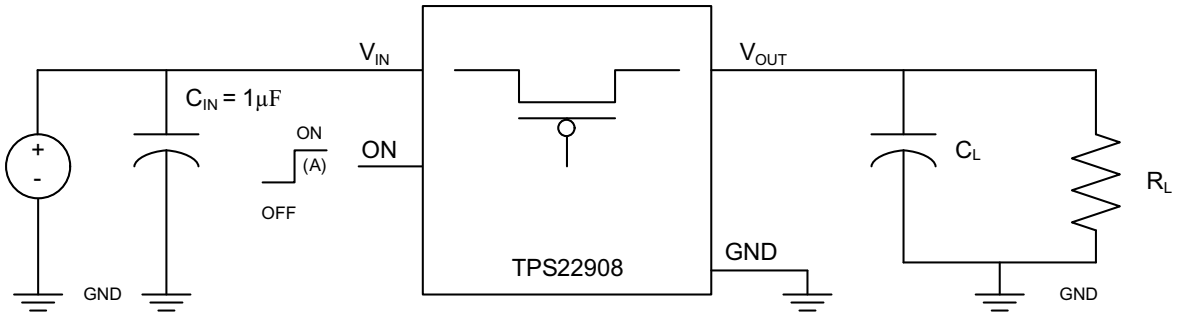
(1) Refer to application section.

ELECTRICAL CHARACTERISTICS

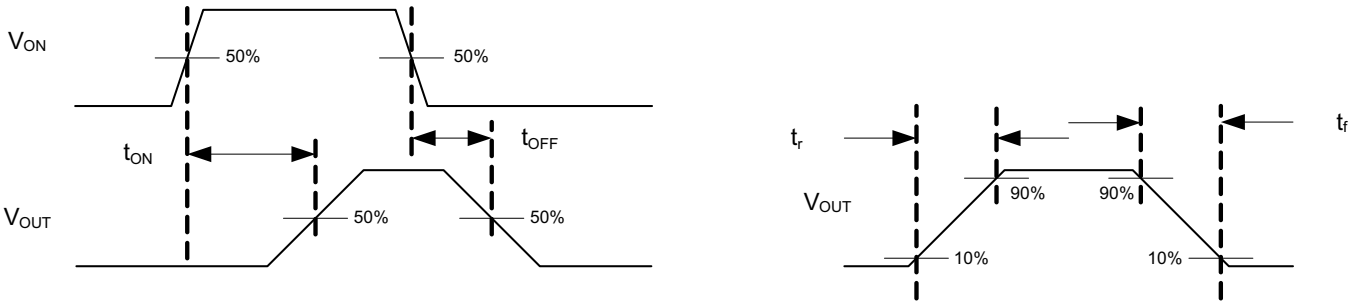
Unless otherwise noted the specification applies over the operating ambient temp –40°C ≤ T_A ≤ 85°C. Typical values are for V_{IN} = 3.6 V, and T_A = 25°C unless otherwise noted.

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP	MAX	UNIT
POWER SUPPLIES AND CURRENTS								
I_{IN}	Quiescent current	I_{OUT} = 0 mA, V_{IN} = V_{ON}		Full		0.19	1	µA
$I_{IN(OFF)}$	OFF-state supply current	V_{ON} = 0 V, V_{OUT} = Open		Full		0.12	1	µA
$I_{IN(LEAK)}$	OFF-state supply current	V_{ON} = 0 V, V_{OUT} = 0 V		Full		0.12	1	µA
I_{ON}	ON pin input leakage current	V_{ON} = 1.1 V to 3.6 V		Full		0.01	0.1	µA
RESISTANCE AND SWITCH CHARACTERISTICS								
R_{ON}	ON-state resistance	I_{OUT} = –200 mA	V_{IN} = 3.6 V	25°C		28.2	32.1	mΩ
				Full			34.9	
			V_{IN} = 2.5 V	25°C		33.1	37.5	mΩ
				Full			40.6	
			V_{IN} = 1.8 V	25°C		41.5	50.3	mΩ
				Full			54.0	
			V_{IN} = 1.2 V	25°C		69.7	87.3	mΩ
				Full			91.2	
			V_{IN} = 1.0 V	25°C		112	155	mΩ
				Full			156	
R_{PD}	Output pulldown resistance	V_{IN} = 3.3 V, V_{ON} = 0 V, I_{OUT} = 30 mA		25°C		80	100	Ω

SWITCHING CHARACTERISTIC MEASUREMENT INFORMATION



TEST CIRCUIT



t_{ON}/t_{OFF} WAVEFORMS

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

Figure 2. Test Circuit and t_{ON}/t_{OFF} Waveforms

SWITCHING CHARACTERISTICS

PARAMETER		TEST CONDITION	TPS22908			UNIT
			MIN	TYP	MAX	
V_{IN} = 3.6 V, T_A = 25°C (unless otherwise noted)						
t_{ON}	Turn-ON time	R_L = 10 Ω, C_L = 0.1 μF		110		μs
t_{OFF}	Turn-OFF time	R_L = 10 Ω, C_L = 0.1 μF		5		
t_R	V_{OUT} Rise time	R_L = 10 Ω, C_L = 0.1 μF		105		
t_F	V_{OUT} Fall time	R_L = 10 Ω, C_L = 0.1 μF		2		
V_{IN} = 1.0 V, T_A = 25°C (unless otherwise noted)						
t_{ON}	Turn-ON time	R_L = 10 Ω, C_L = 0.1 μF		493		μs
t_{OFF}	Turn-OFF time	R_L = 10 Ω, C_L = 0.1 μF		7		
t_R	V_{OUT} Rise time	R_L = 10 Ω, C_L = 0.1 μF		442		
t_F	V_{OUT} Fall time	R_L = 10 Ω, C_L = 0.1 μF		2		

FUNCTIONAL BLOCK DIAGRAM and PIN DESCRIPTIONS

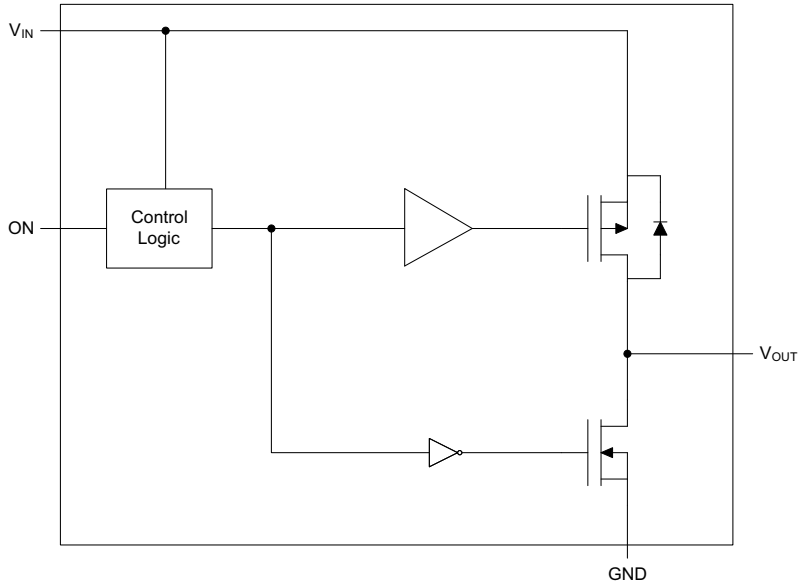


Figure 3. Functional Block Diagram

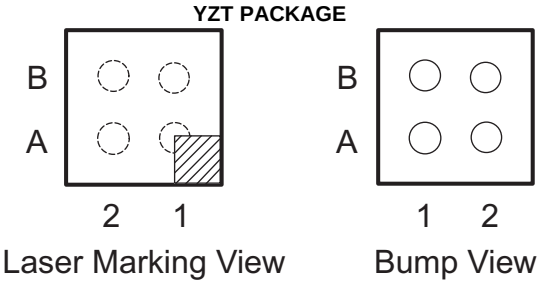


Table 1. FUNCTIONAL TABLE

ON	V_{IN} to V_{OUT}	V_{OUT} to GND
L	Off	On
H	On	Off

PIN DESCRIPTIONS

TPS22908 YZT	PIN NAME	DESCRIPTION
B2	ON	Switch control input, active high. Do not leave floating.
B1	GND	Ground
A2	V_{IN}	Switch input, bypass capacitor recommended for minimizing V_{IN} dip. See Application Information.
A1	V_{OUT}	Switch output

TYPICAL DC CHARACTERISTICS

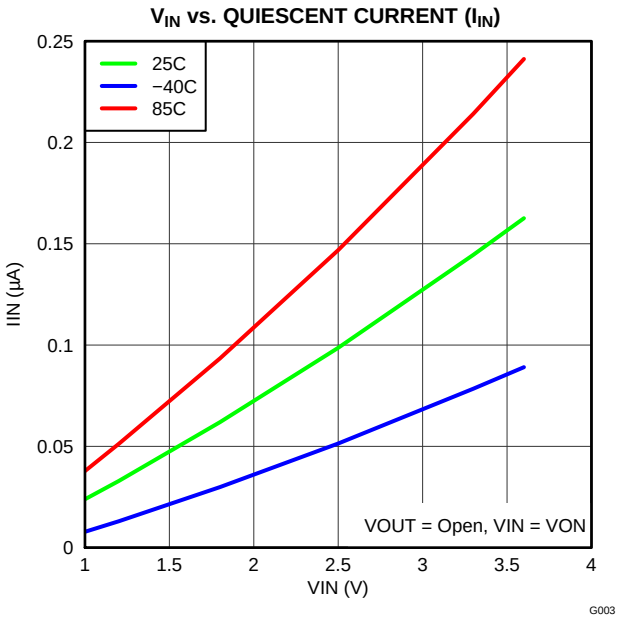


Figure 4.

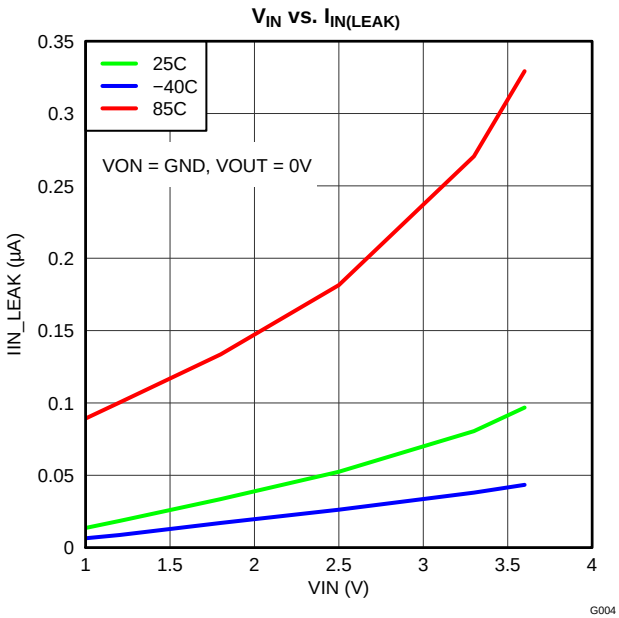


Figure 5.

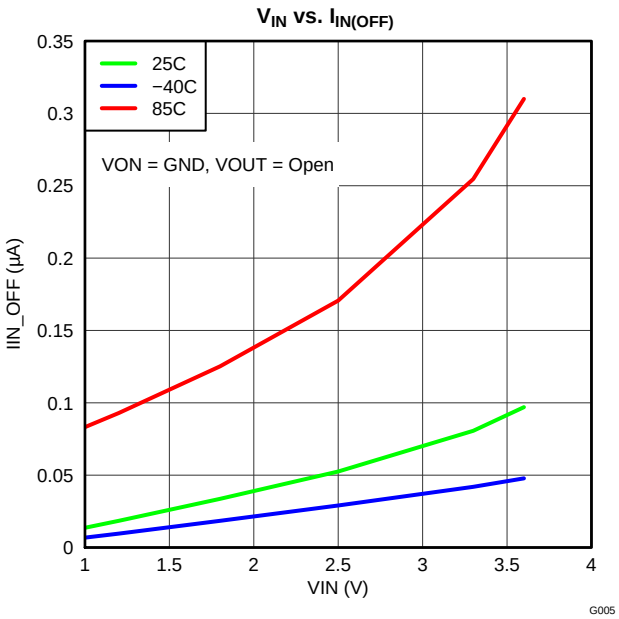


Figure 6.

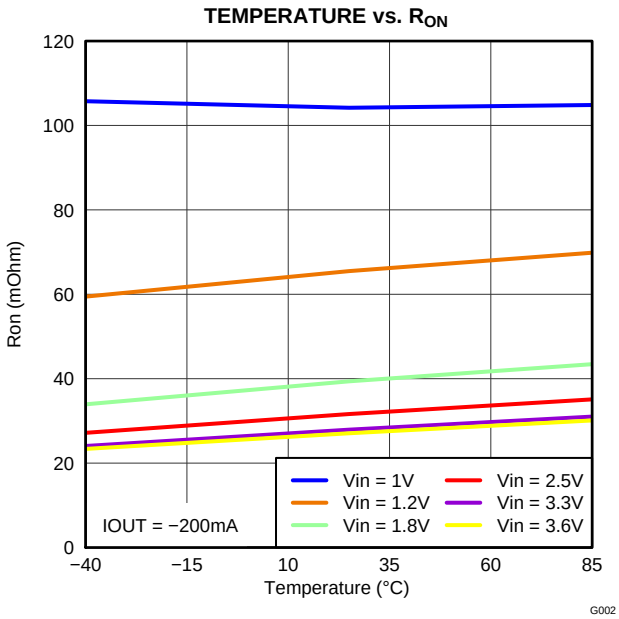


Figure 7.

TYPICAL DC CHARACTERISTICS (continued)

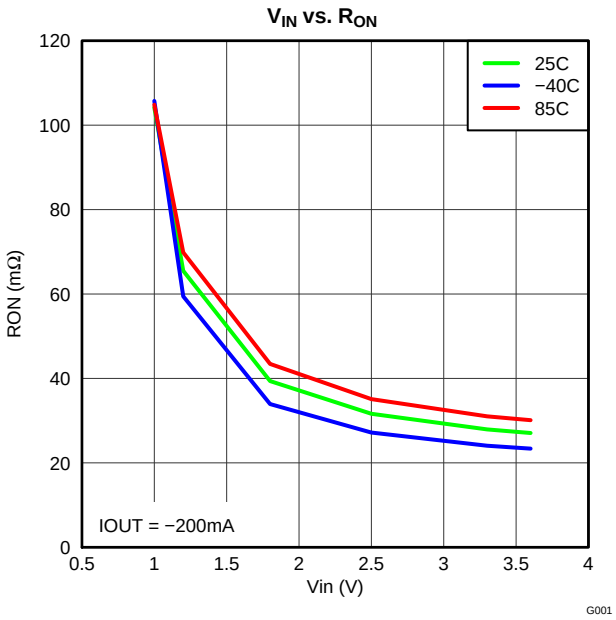


Figure 8.

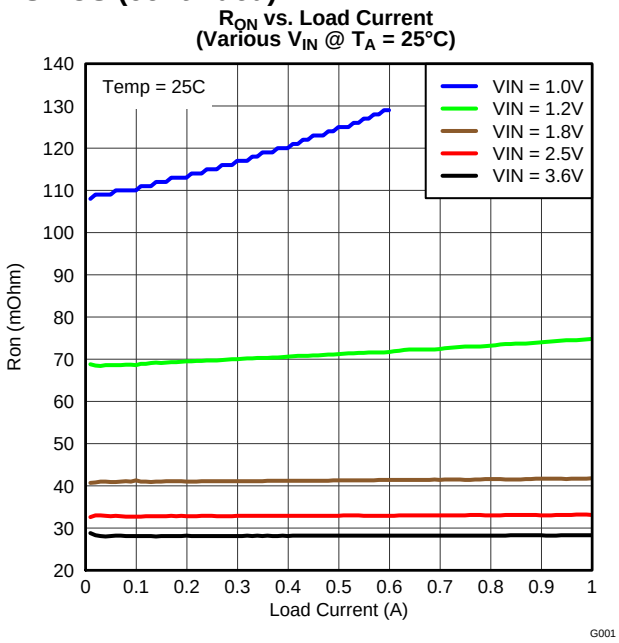


Figure 9.

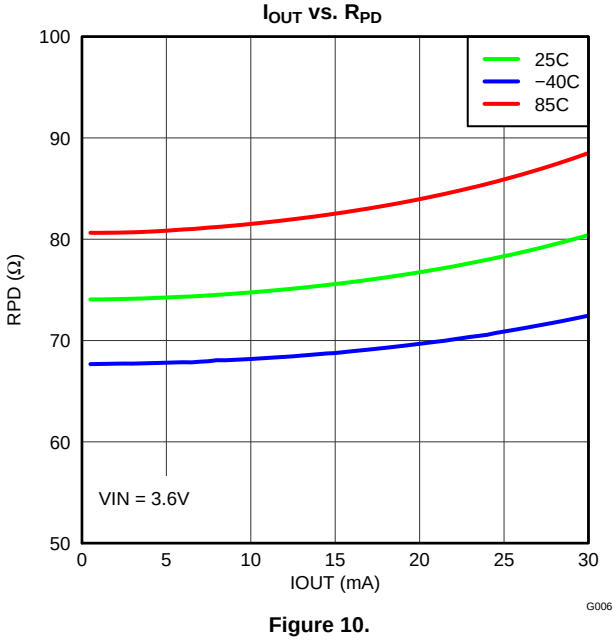


Figure 10.

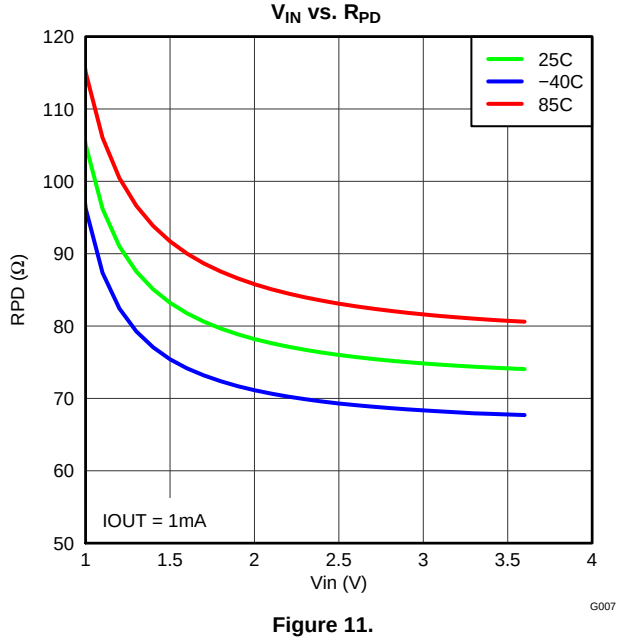


Figure 11.

TYPICAL DC CHARACTERISTICS (continued)

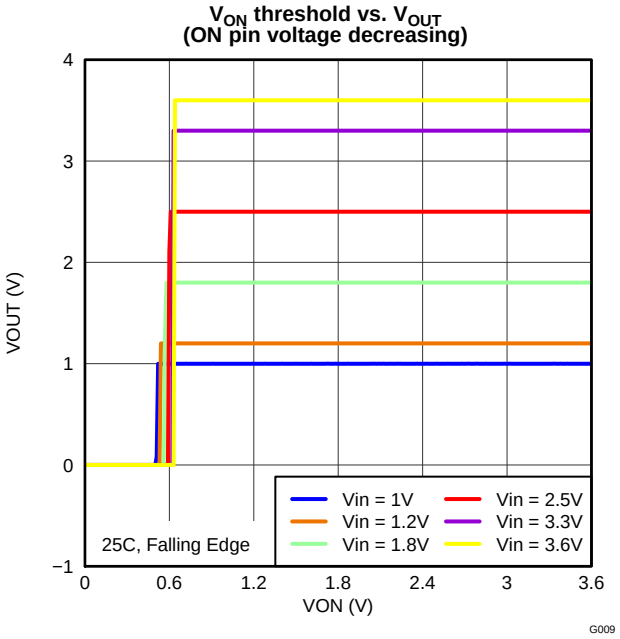


Figure 12.

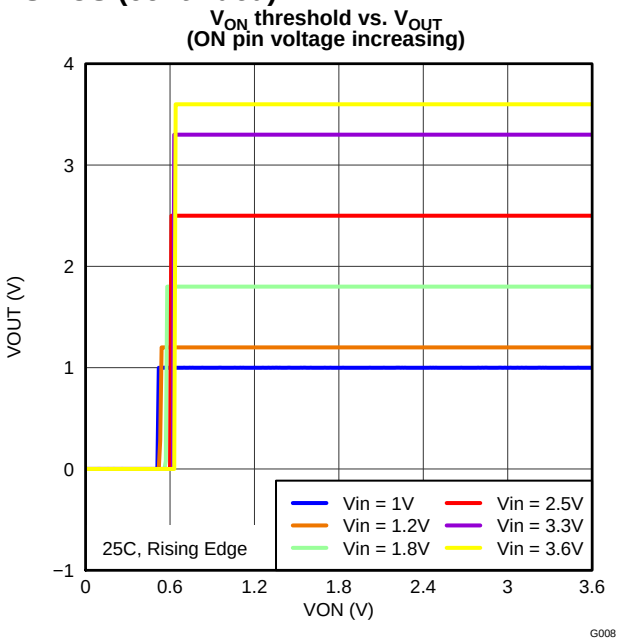


Figure 13.

TYPICAL SWITCHING CHARACTERISTICS

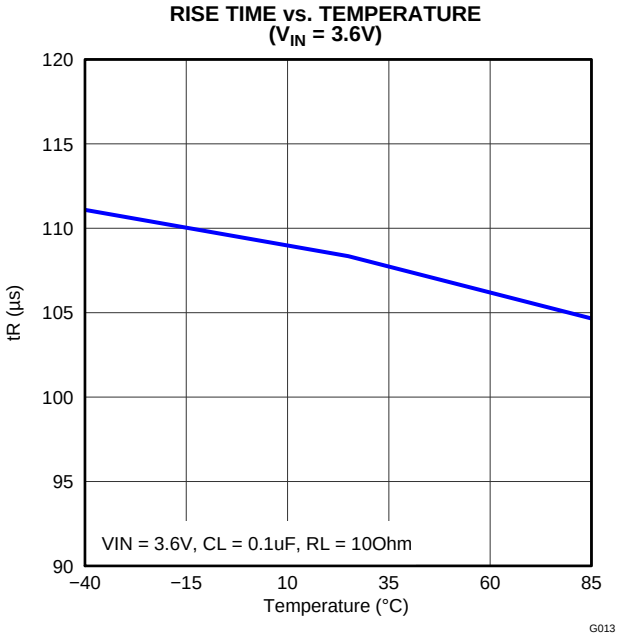


Figure 14.

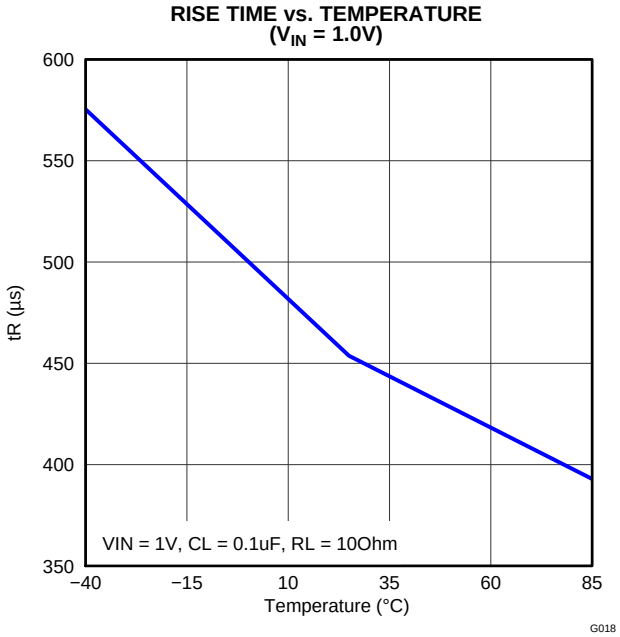


Figure 15.

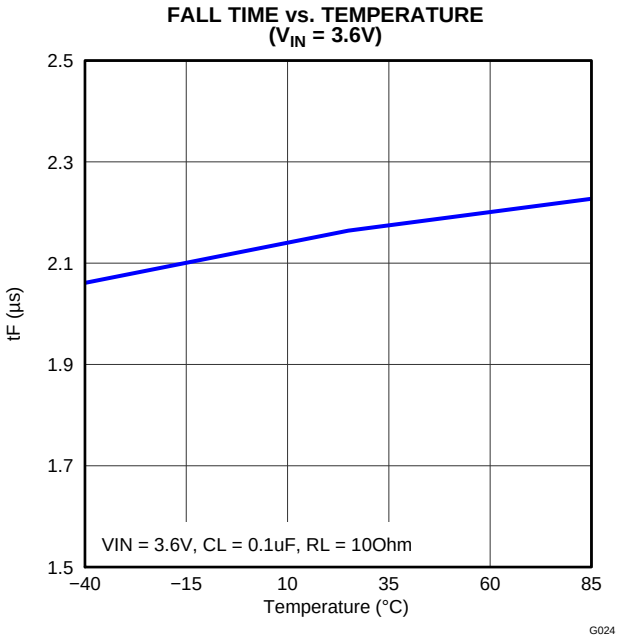


Figure 16.

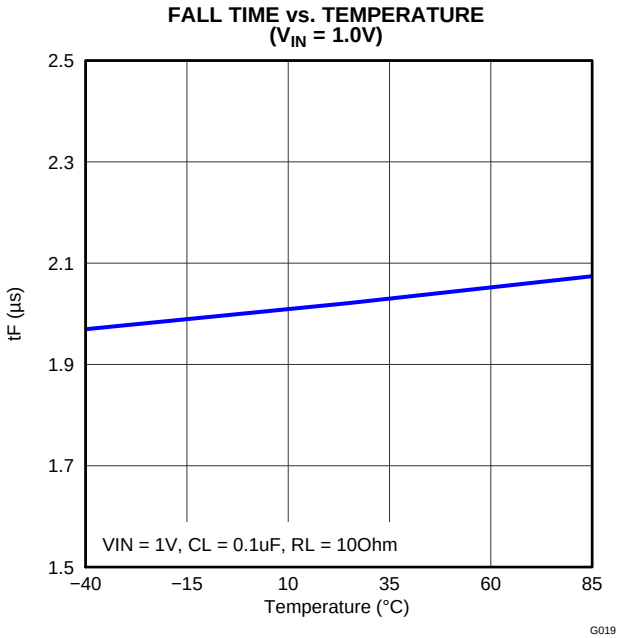


Figure 17.

TYPICAL SWITCHING CHARACTERISTICS (continued)

TURN-ON TIME vs. TEMPERATURE (V_{IN} = 3.6V)

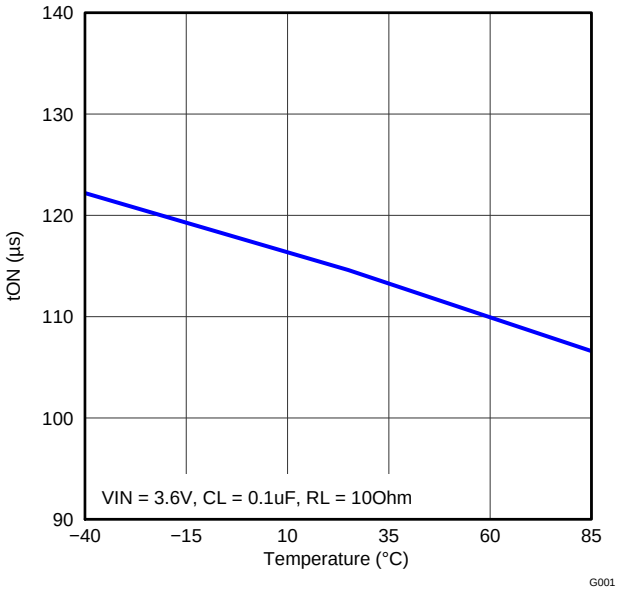


Figure 18.

TURN-ON TIME vs. TEMPERATURE (V_{IN} = 1.0V)

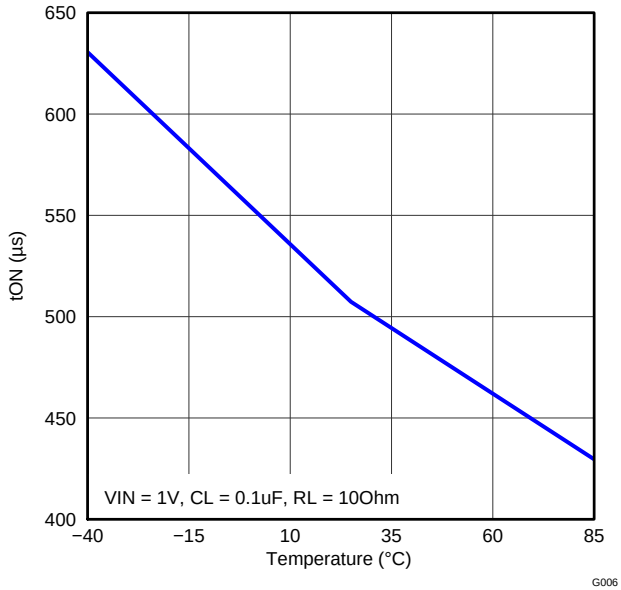


Figure 19.

TURN-OFF TIME vs. TEMPERATURE (V_{IN} = 3.6V)

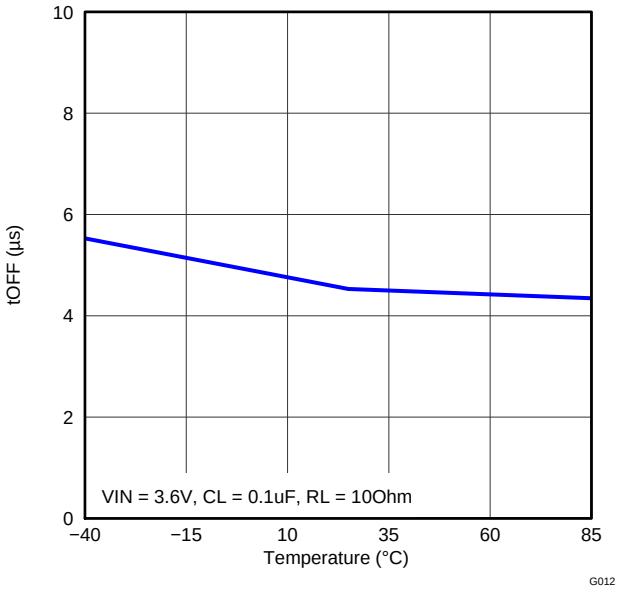


Figure 20.

TURN-OFF TIME vs. TEMPERATURE (V_{IN} = 1.0V)

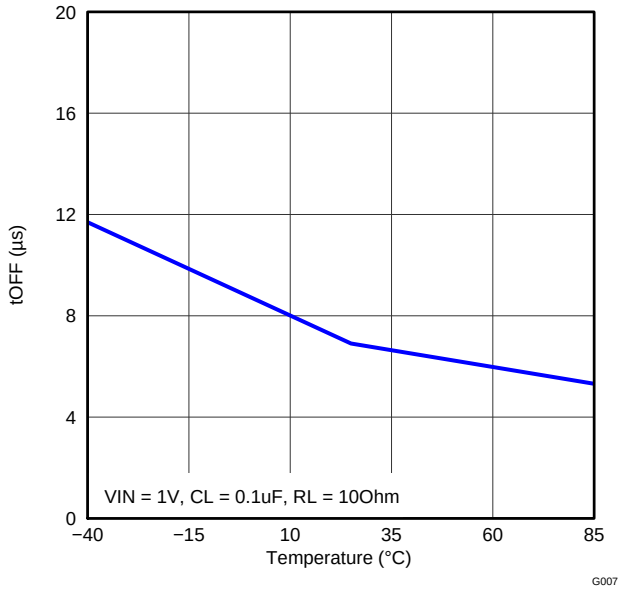


Figure 21.

TYPICAL SWITCHING CHARACTERISTICS (continued)

RISE TIME vs. V_{IN} (C_L = 0.1µF)

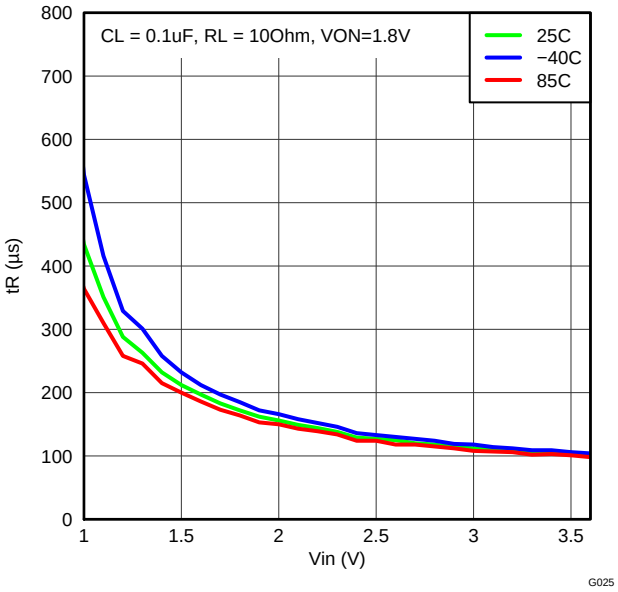


Figure 22.

RISE TIME vs. V_{IN} (C_L = 1µF)

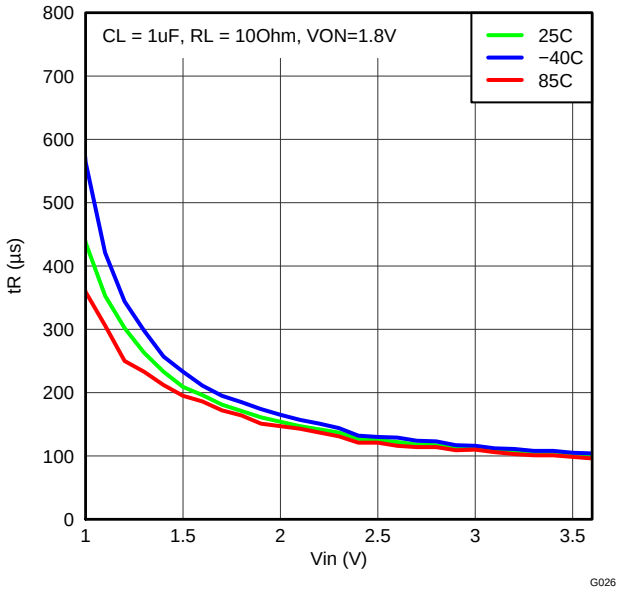


Figure 23.

TYPICAL SWITCHING SCOPE CAPTURES AT T_A = 25°C

TURN-ON RESPONSE TIME
(V_{IN} = 3.6V, C_{IN} = 10µF, C_L = 1µF, R_L = 10Ω)

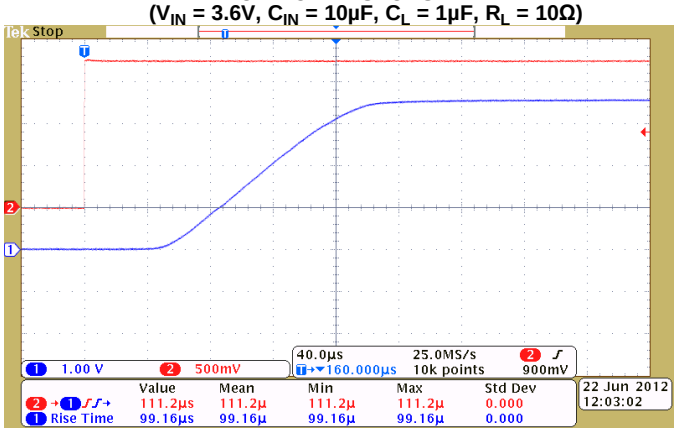


Figure 24.

TURN-ON RESPONSE TIME
(V_{IN} = 1.0V, C_{IN} = 10µF, C_L = 1µF, R_L = 10Ω)

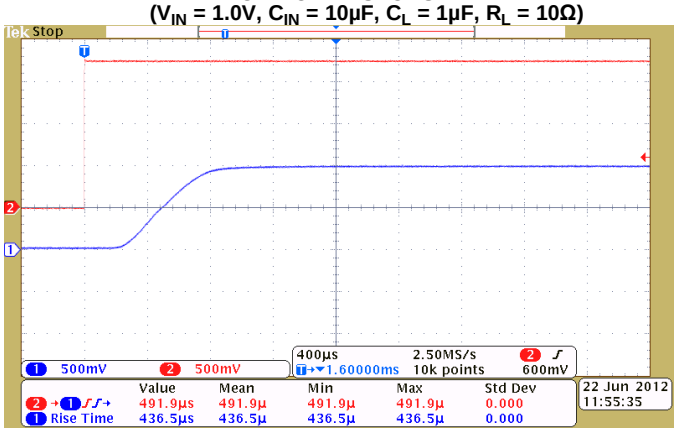


Figure 25.

TURN-ON RESPONSE TIME
(V_{IN} = 3.6V, C_{IN} = 1µF, C_L = 0.1µF, R_L = 10Ω)

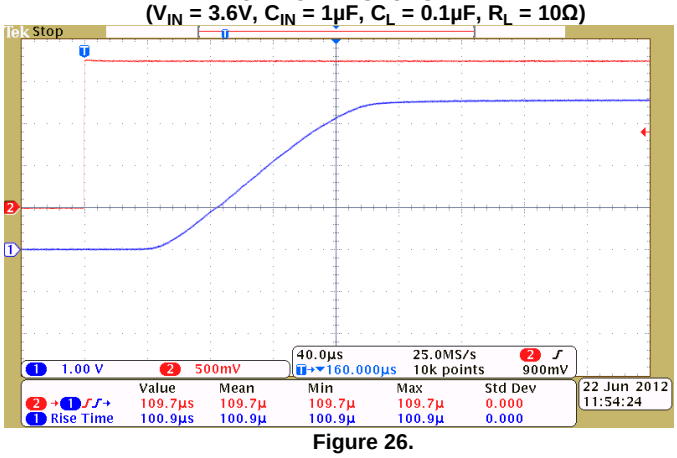


Figure 26.

TURN-ON RESPONSE TIME
(V_{IN} = 1.0V, C_{IN} = 1µF, C_L = 0.1µF, R_L = 10Ω)

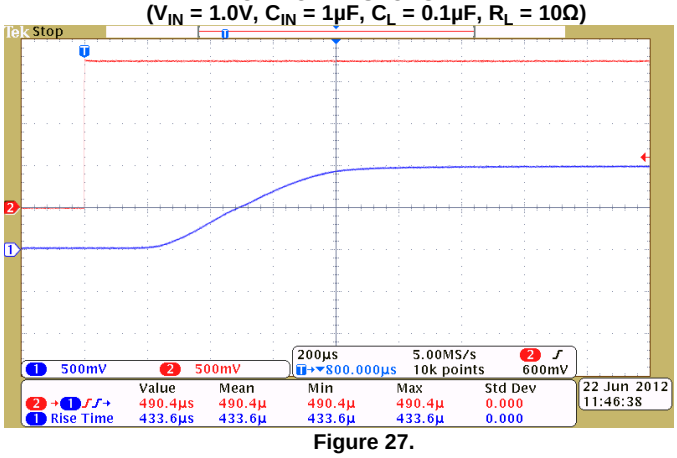


Figure 27.

TURN-OFF RESPONSE TIME
(V_{IN} = 3.6V, C_{IN} = 10µF, C_L = 1µF, R_L = 10Ω)

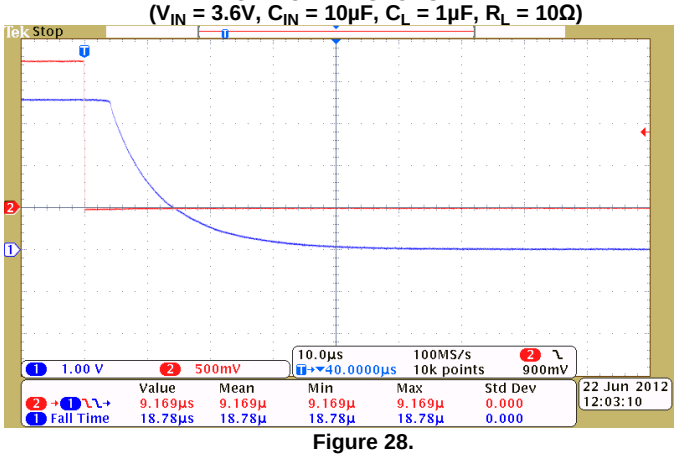


Figure 28.

TURN-OFF RESPONSE TIME
(V_{IN} = 1.0V, C_{IN} = 10µF, C_L = 1µF, R_L = 10Ω)

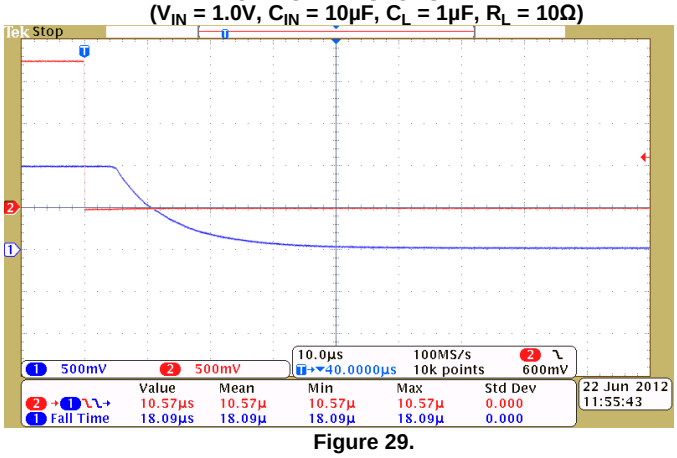


Figure 29.

TYPICAL SWITCHING SCOPE CAPTURES AT T_A = 25°C (continued)

TURN-OFF RESPONSE TIME
(V_{IN} = 3.6V, C_{IN} = 1µF, C_L = 0.1µF, R_L = 10Ω)

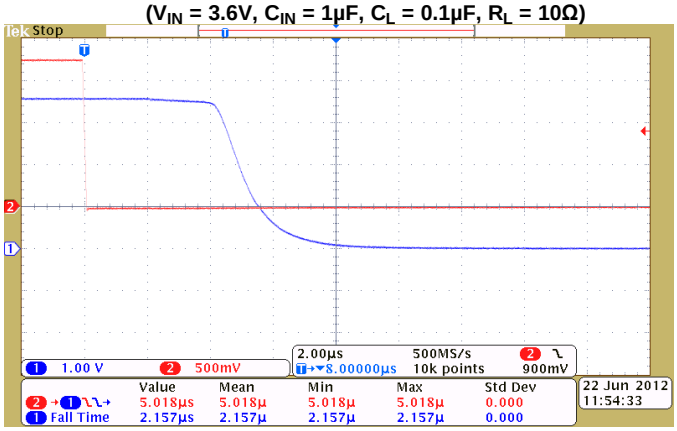


Figure 30.

TURN-OFF RESPONSE TIME
(V_{IN} = 1.0V, C_{IN} = 1µF, C_L = 0.1µF, R_L = 10Ω)

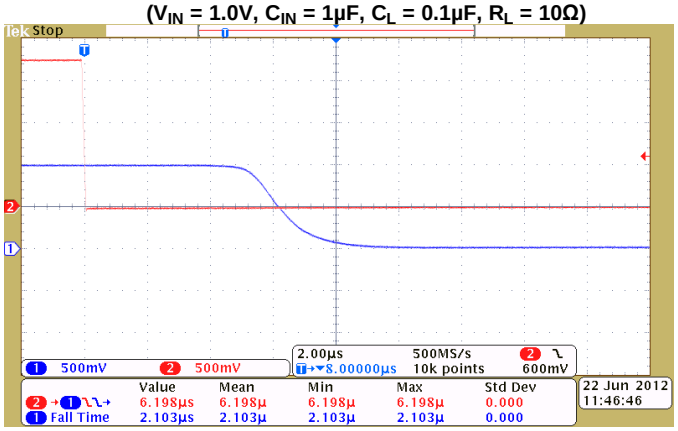


Figure 31.

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 or higher GPIOs.

INPUT CAPACITOR (OPTIONAL)

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 can be placed between V_{IN} and GND. A 1-µF ceramic capacitor, C_{IN}, placed close to the pins, is usually sufficient. Higher values of C_{IN} can be used to further reduce the voltage drop during high-current application. When switching heavy loads, it is recommended to have an input capacitor about 10 times higher than the output capacitor to avoid excessive voltage drop.

OUTPUT CAPACITOR (OPTIONAL)

Due to the integrated body diode of the PMOS switch, a C_{IN} greater than C_L is highly recommended. A C_L greater than C_{IN} can cause V_{OUT} to exceed V_{IN} when the system supply is removed. This could result in current flow through the body diode from V_{OUT} to V_{IN}. A C_{IN} to C_L ratio of at least 10 to 1 is recommended for minimizing V_{IN} dip caused by inrush currents during startup; however, a 10 to 1 ratio for capacitance is not required for proper functionality of the device. A ratio smaller than 10 to 1 (such as 1 to 1) could cause slightly more V_{IN} dip at turn on due to inrush currents.

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.

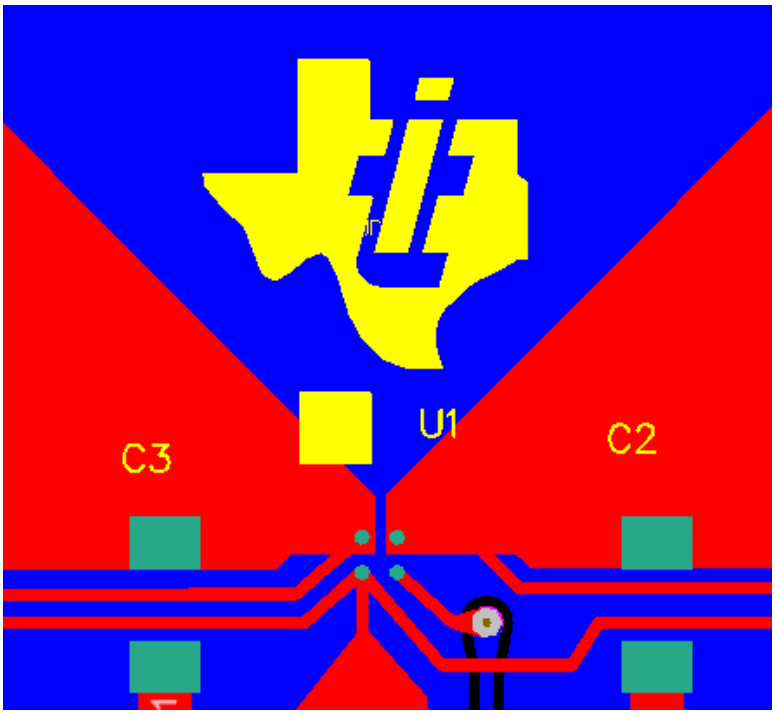


Figure 32. Layout

REVISION HISTORY

Changes from Revision A (August 2012) to Revision B **Page**

- 更新了特性。 1
- Added Layout graphic. 14

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TPS22908YZTR	ACTIVE	DSBGA	YZT	4	3000	RoHS & Green	SNAGCU	Level-1-260C-UNLIM	-40 to 85	AT	Samples
TPS22908YZTT	ACTIVE	DSBGA	YZT	4	250	RoHS & Green	SNAGCU	Level-1-260C-UNLIM	-40 to 85	(AT, ATF)	Samples

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

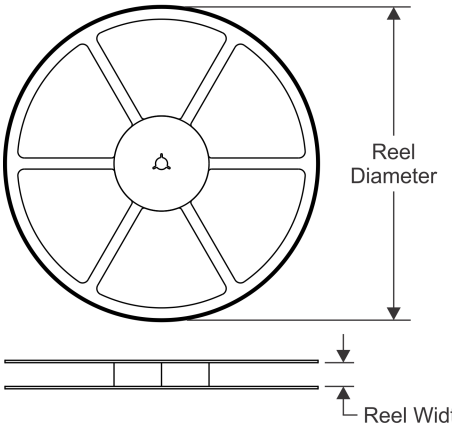
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

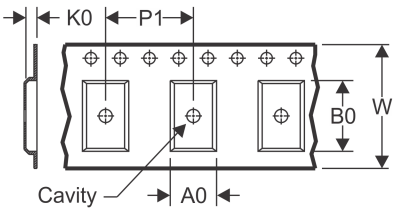
(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

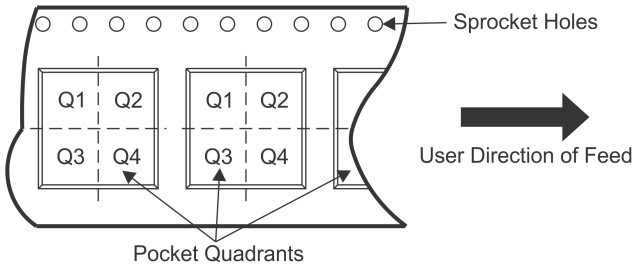


TAPE DIMENSIONS



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

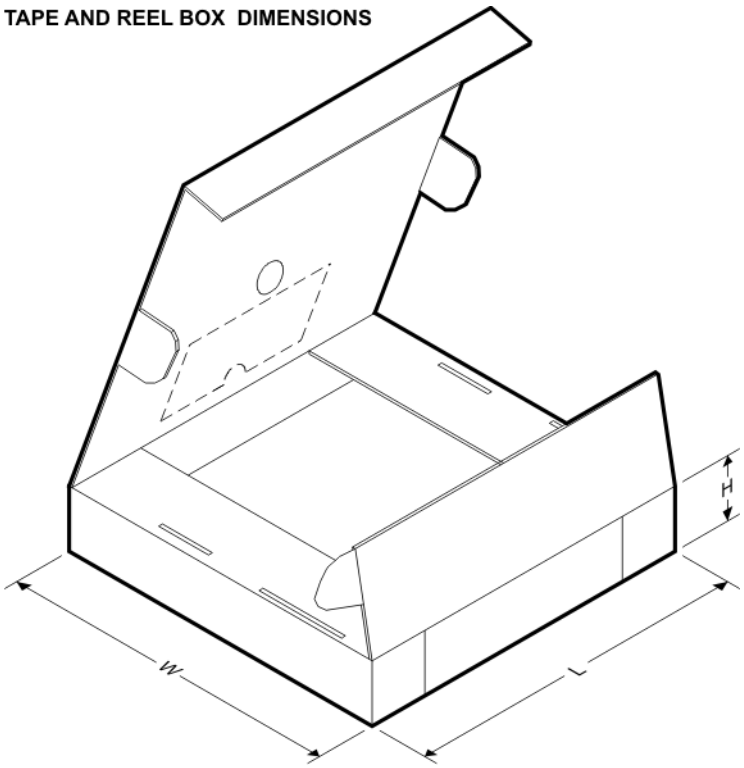
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TPS22908YZTR	DSBGA	YZT	4	3000	178.0	9.2	1.0	1.0	0.73	4.0	8.0	Q1
TPS22908YZTR	DSBGA	YZT	4	3000	180.0	8.4	0.99	0.99	0.69	4.0	8.0	Q1
TPS22908YZTT	DSBGA	YZT	4	250	180.0	8.4	0.99	0.99	0.69	4.0	8.0	Q1
TPS22908YZTT	DSBGA	YZT	4	250	178.0	9.2	1.0	1.0	0.73	4.0	8.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

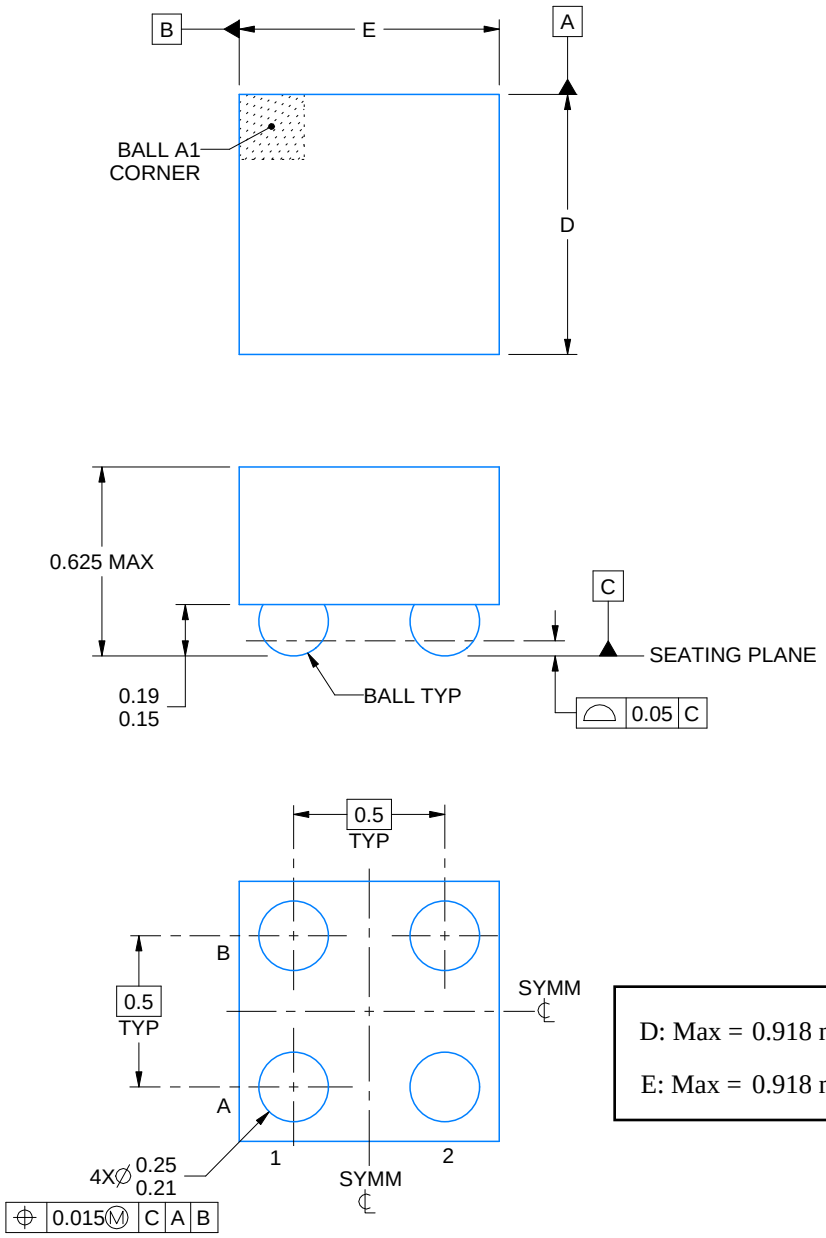
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS22908YZTR	DSBGA	YZT	4	3000	220.0	220.0	35.0
TPS22908YZTR	DSBGA	YZT	4	3000	182.0	182.0	20.0
TPS22908YZTT	DSBGA	YZT	4	250	182.0	182.0	20.0
TPS22908YZTT	DSBGA	YZT	4	250	220.0	220.0	35.0

PACKAGE OUTLINE

YZT0004

DSBGA - 0.625 mm max height

DIE SIZE BALL GRID ARRAY



D: Max = 0.918 mm, Min =0.858 mm

E: Max = 0.918 mm, Min =0.858 mm

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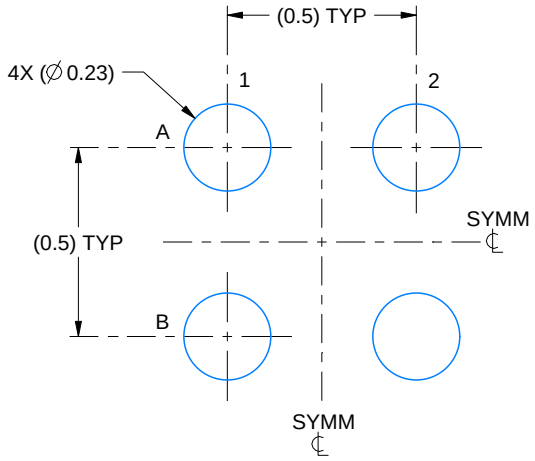
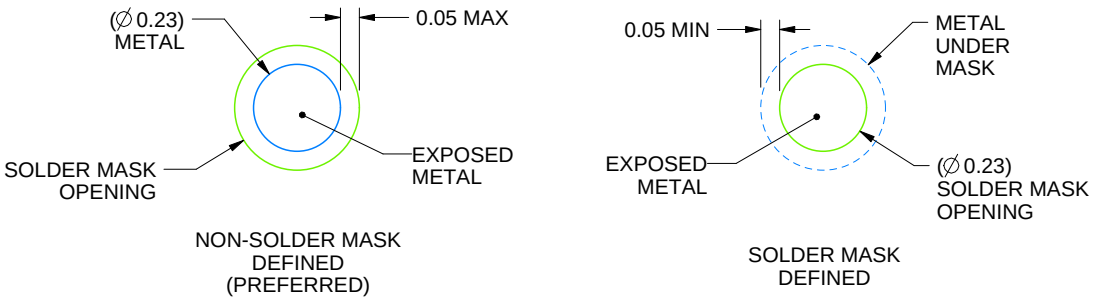
NOTES:

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.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:50X



SOLDER MASK DETAILS
NOT TO SCALE

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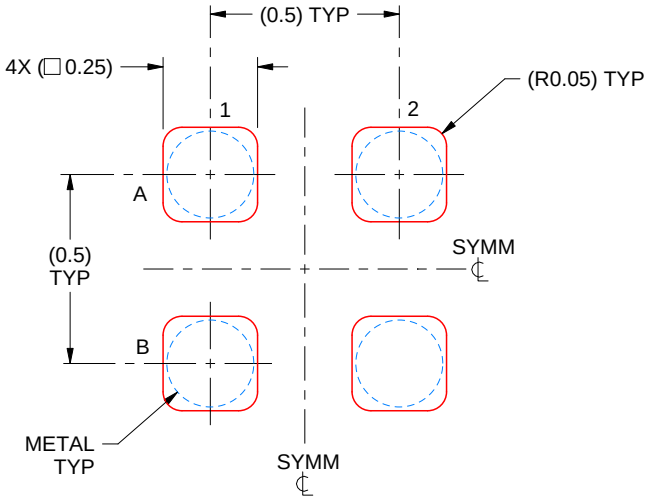
NOTES: (continued)

3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints.
   Refer to Texas Instruments Literature No. SNVA009 (www.ti.com/lit/snva009).



SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE:50X

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NOTES: (continued)

4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release.

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