TEXAS INSTRUMENTS
TPS22998
JAJSKQ2A – OCTOBER 2021 – REVISED DECEMBER 2021

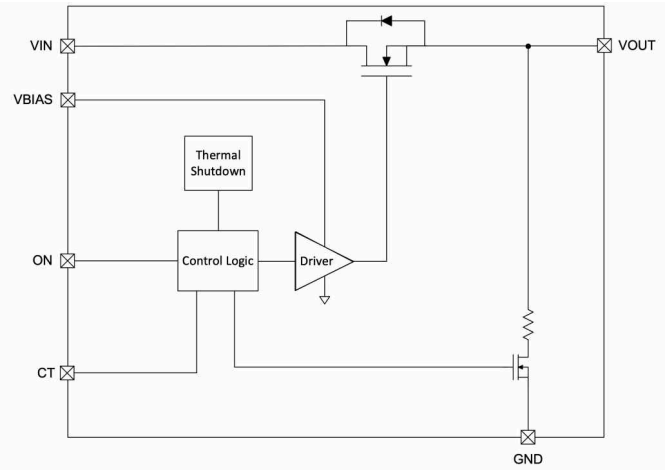
TPS22998 5.5V、10A、オン抵抗 4mΩ、ロード・スイッチ

1 特長

- 動作入力電圧範囲 (V_{IN}):0.2V～5.5V
- バイアス電圧範囲:2.2V～5.5V
- 最大連続電流:10A
- オン抵抗 (R_{ON}):4mΩ (標準値)
- トライステート・ピンによりスルー・レートを調整可能
- クイック出力放電 (QOD):50Ω
- サーマル・シャットダウン
- 低い消費電力:
  - オン状態 (I_Q):15µA (標準値)
  - オフ状態 (I_{SD}):3µA (標準値)

2 アプリケーション

- ソリッド・ステート・ドライブ (SSD)
- PC とノート PC
- 産業用 PC
- 光学モジュール



TPS22998 のブロック図

3 概要

TPS22998 は、シングル・チャネルのロード・スイッチで、立ち上がり時間を設定して突入電流を最小化できます。このデバイスは、0.2V～5.5V の入力電圧範囲で動作できる N チャネル MOSFET を内蔵し、最大 10A の連続電流をサポートします。

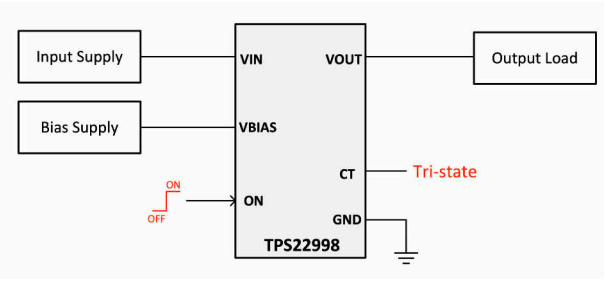
スイッチは、オン・オフ入力 (ON) で制御されます。この入力ピンは、低電圧の制御信号 (V_{IH} = 0.9V) と直接接続できます。TPS22998 は、スイッチがオフになるときに働く固定のクイック出力放電を備えており、出力をグランドにプルダウンします。

TPS22998 は、1.5 × 2.0mm、0.5mm ピッチの 10 ピン WQFN パッケージ (RYZ) で供給され、-40℃～+105℃の周囲温度範囲で動作するよう設計されています。

製品情報

部品番号	パッケージ(1)	本体サイズ (公称)
TPS22998	WQFN (10)	1.5 × 2.0mm

(1) 利用可能なすべてのパッケージについては、このデータシートの末尾にある注文情報を参照してください。



TPS22998 の代表的なアプリケーション

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Table of Contents

1 特長 ... 1
2 アプリケーション ... 1
3 概要 ... 1
4 Revision History ... 2
5 Pin Configuration and Functions ... 3
6 Specifications ... 4
6.1 Absolute Maximum Ratings ... 4
6.2 ESD Ratings ... 4
6.3 Recommended Operating Conditions ... 4
6.4 Thermal Information ... 4
6.5 Electrical Characteristics (VBIAS = 5 V) ... 5
6.6 Electrical Characteristics (VBIAS = 3.3 V) ... 5
6.7 Electrical Characteristics (VBIAS = 2.2 V) ... 6
6.8 Switching Characteristics (VBIAS = 2.2 V to 5 V) ... 7
6.9 Timing Diagram ... 8
6.10 Typical Characteristics ... 9
7 Detailed Description ... 11
7.1 Overview ... 11
7.2 Functional Block Diagram ... 11
7.3 Feature Description ... 11
7.4 Device Functional Modes ... 12
8 Application and Implementation ... 13
8.1 Application Information ... 13
8.2 Typical Application ... 13
9 Power Supply Recommendations ... 15
10 Layout ... 15
10.1 Layout Guidelines ... 15
10.2 Layout Example ... 15
11 Device and Documentation Support ... 16
11.1 Receiving Notification of Documentation Updates ... 16
11.2 サポート・リソース ... 16
11.3 Trademarks ... 16
11.4 Electrostatic Discharge Caution ... 16
11.5 Glossary ... 16
12 Mechanical, Packaging, and Orderable Information ... 17

4 Revision History

資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

Changes from Revision * (October 2021) to Revision A (December 2021)	Page
• データシートのステータスを「事前情報」から「量産データ」に変更	1

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5 Pin Configuration and Functions

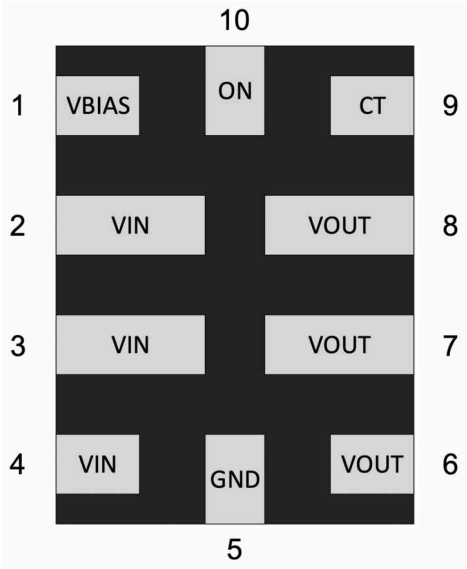


図 5-1. TPS22998 RYZ Package, 10-Pin WQFN (Top View)

表 5-1. Pin Functions

PIN		I/O(1)	DESCRIPTION
NAME	NO.		
VBIAS	1	I	Device bias supply
VIN	2, 3, 4	I	Switch input
GND	5	G	Device ground
VOUT	6, 7, 8	O	Switch output
CT	9	I	Slew rate control – can be pulled up, left floating, or tie to ground
ON	10	I	Enable pin

(1) I = Input, O = Output, I/O = Input or Output, G = Ground, P = Power.

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6 Specifications

6.1 Absolute Maximum Ratings

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

		MIN	MAX	UNIT
V_{IN}	Input Voltage	–0.3	6	V
V_{BIAS}	Bias Voltage	–0.3	6	V
V_{ON}, VCT	Control Pin Voltage	–0.3	6	V
I_{MAX}	Maximum Current		10	A
T_J	Junction temperature		Internally Limited	°C
T_{stg}	Storage temperature	–65	150	°C

(1) Operation outside the Absolute Maximum Ratings may cause permanent device damage. Absolute Maximum Ratings do not imply functional operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions. If used outside the Recommended Operating Conditions but within the Absolute Maximum Ratings, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.

6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)	±2000	V
		Charged device model (CDM), per ANSI/ESDA/JEDEC JS-002(2)	±1000	

(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.

6.3 Recommended Operating Conditions

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

		MIN	NOM	MAX	UNIT
V_{IN}	Input Voltage	0.2		5.5	V
V_{BIAS}	Bias Voltage	2.2		5.5	V
V_{CT}	Control Pin Voltage	0		5.5	V
T_A	Ambient Temperature	–40		105	°C

6.4 Thermal Information

THERMAL METRIC (1)		TPS22998 RYZ (WQFN) 10 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance	84.1	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	77.5	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	16.6	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	4.0	°C/W
Y_{JB}	Junction-to-board characterization parameter	16.0	°C/W

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

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6.5 Electrical Characteristics (VBIAS = 5 V)

Over operating free-air temperature range (unless otherwise noted). Typical values are at T_A = 25°C.

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
Power Consumption							
$I_{SD,VBIAS}$	VBIAS Shutdown Current	ON = 0 V	25°C		3		uA
			–40°C to 85°C			5	uA
			–40°C to 105°C			6	uA
$I_{Q,VBIAS}$	VBIAS Quiescent Current	ON > V_{IH}	25°C		15		uA
			–40°C to 85°C			20	uA
			–40°C to 105°C			20	uA
$I_{SD,VIN}$	VIN Shutdown Current	ON = 0 V	25°C		0.1		uA
			–40°C to 85°C			1	uA
			–40°C to 105°C			2	uA
I_{ON}	ON pin leakage	ON = VBIAS	–40°C to 105°C		0.1		uA
Performance							
R_{ON}	On-Resistance	VIN = 0.2 V to 5 V	25°C		4		mΩ
			–40°C to 85°C			6	mΩ
			–40°C to 105°C			7	mΩ
V_{IH}	Turn on threshold, rising		–40°C to 105°C	0.765	0.9	1.035	V
V_{IL}	Turn off threshold, falling		–40°C to 105°C	0.595	0.7	0.805	V
$V_{ON,HYST}$	ON pin hysteresis		–40°C to 105°C		0.2		V
$t_{ON,DEGLITCH}$	On pin deglitch time		–40°C to 105°C	2	5	7	us
R_{QOD}	QOD Resistance	VOUT = VIN	25°C		50		Ω
			–40°C to 105°C	40		60	Ω
Protection							
TSD	Thermal Shutdown		-	130	150	180	°C
TSD_{HYS}	Thermal Shutdown Hysteresis		-		20		°C

6.6 Electrical Characteristics (VBIAS = 3.3 V)

Over operating free-air temperature range (unless otherwise noted). Typical values are at T_A = 25°C.

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
Power Consumption							
$I_{SD,VBIAS}$	VBIAS Shutdown Current	ON = 0 V	25°C		3		uA
			–40°C to 85°C			5	uA
			–40°C to 105°C			5	uA
$I_{Q,VBIAS}$	VBIAS Quiescent Current	ON > V_{IH}	25°C		15		uA
			–40°C to 85°C			20	uA
			–40°C to 105°C			20	uA
$I_{SD,VIN}$	VIN Shutdown Current	ON = 0 V	25°C		0.1		uA
			–40°C to 85°C			1	uA
			–40°C to 105°C			3	uA
I_{ON}	ON pin leakage	ON = VBIAS	–40°C to 105°C		0.1	1	uA
Performance							

6.6 Electrical Characteristics (VBIAS = 3.3 V) (continued)

Over operating free-air temperature range (unless otherwise noted). Typical values are at T_A = 25°C.

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
R_{ON}	On-Resistance	VIN = 0.2 V to 3.3 V	25°C		4		mΩ
			–40°C to 85°C			7	mΩ
			–40°C to 105°C			7	mΩ
V_{IH}	ON pin turn on threshold, rising		–40°C to 105°C	0.765	0.9	1.035	V
V_{IL}	ON pin turn off threshold, falling		–40°C to 105°C	0.595	0.7	0.805	V
$V_{ON,HYST}$	ON pin hysteresis		–40°C to 105°C		0.2		V
$t_{ON,DEGLITCH}$	On pin deglitch time		–40°C to 105°C	2	5	6.5	us
R_{QOD}	QOD Resistance	VOUT = VIN	25°C		50		Ω
			–40°C to 105°C	40		60	Ω
Protection							
TSD	Thermal Shutdown		-	130	150	180	°C
TSD_{HYS}	Thermal Shutdown Hysteresis		-		20		°C

6.7 Electrical Characteristics (VBIAS = 2.2 V)

Over operating free-air temperature range (unless otherwise noted). Typical values are at T_A = 25°C.

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
Power Consumption							
$I_{SD,VBIAS}$	VBIAS Shutdown Current	ON = 0 V	25°C		3		uA
			–40°C to 85°C			5	uA
			–40°C to 105°C			5	uA
$I_{Q,VBIAS}$	VBIAS Quiescent Current	ON > V_{IH}	25°C		15		uA
			–40°C to 85°C			20	uA
			–40°C to 105°C			20	uA
$I_{SD,VIN}$	VIN Shutdown Current	ON = 0 V	25°C		0.1		uA
			–40°C to 85°C			1	uA
			–40°C to 105°C			3	uA
I_{ON}	ON pin leakage	ON = VBIAS	–40°C to 105°C		0.1	1	uA
Performance							
R_{ON}	On-Resistance	VIN = 0.2 V to 2.2 V	25°C		4.3		mΩ
			–40°C to 85°C			7	mΩ
			–40°C to 105°C			7	mΩ
V_{IH}	ON pin turn on threshold, rising		–40°C to 105°C	0.765	0.9	1.035	V
V_{IL}	ON pin turn off threshold, falling		–40°C to 105°C	0.595	0.7	0.805	V
$V_{ON,HYST}$	ON pin hysteresis		–40°C to 105°C		0.2		V
$t_{ON,DEGLITCH}$	On pin deglitch time		–40°C to 105°C	2	4.5	6.5	us
R_{QOD}	QOD Resistance	VOUT = VIN	25°C		50		Ω
			–40°C to 105°C	40		60	Ω
Protection							
TSD	Thermal Shutdown		-	130	150	180	°C
TSD_{HYS}	Thermal Shutdown Hysteresis		-		20		°C

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6.8 Switching Characteristics (VBIAS = 2.2 V to 5 V)

Over operating free-air temperature range (unless otherwise noted), CIN=47uF. Typical values are at T_A = 25°C, C_L = 0.1µF, and a current load of 1mA.

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
VIN = 5 V						
t_{ON}	Turn ON time	CT = Open		250		us
t_{ON}	Turn ON time	CT = V_{BIAS}		1870		us
t_{ON}	Turn ON time	CT = GND		3728		us
t_{RISE}	Rise time	CT = Open		225		us
t_{RISE}	Rise time	CT = V_{BIAS}		1838		us
t_{RISE}	Rise time	CT = GND		3697		us
t_D	Delay time	CT = Open		26		us
t_D	Delay time	CT = V_{BIAS}		31		us
t_D	Delay time	CT = GND		31		us
t_{FALL}	Fall time	CT = Open		11		us
t_{OFF}	Turn OFF time	CT = Open		3		us
VIN = 3.3 V						
t_{ON}	Turn ON time	CT = Open		175		us
t_{ON}	Turn ON time	CT = V_{BIAS}		1261		us
t_{ON}	Turn ON time	CT = GND		3586		us
t_{RISE}	Rise time	CT = Open		150		us
t_{RISE}	Rise time	CT = V_{BIAS}		1232		us
t_{RISE}	Rise time	CT = GND		2478		us
t_D	Delay time	CT = Open		26		us
t_D	Delay time	CT = V_{BIAS}		29		us
t_D	Delay time	CT = GND		29		us
t_{FALL}	Fall time	CT = Open		11		us
t_{OFF}	Turn OFF time	CT = Open		3		us
VIN = 1.8 V						
t_{ON}	Turn ON time	CT = Open		102		us
t_{ON}	Turn ON time	CT = V_{BIAS}		664		us
t_{ON}	Turn ON time	CT = GND		1302		us
t_{RISE}	Rise time	CT = Open		75		us
t_{RISE}	Rise time	CT = V_{BIAS}		634		us
t_{RISE}	Rise time	CT = GND		1272		us
t_D	Delay time	CT = Open		27		us
t_D	Delay time	CT = V_{BIAS}		29		us
t_D	Delay time	CT = GND		30		us
t_{FALL}	Fall time	CT = Open		11		us
t_{OFF}	Turn OFF time	CT = Open		3		us
VIN = 0.6 V						
t_{ON}	Turn ON time	CT = Open		51		us
t_{ON}	Turn ON time	CT = V_{BIAS}		213		us
t_{ON}	Turn ON time	CT = GND		393		us
t_{RISE}	Rise time	CT = Open		23		us
t_{RISE}	Rise time	CT = V_{BIAS}		183		us
t_{RISE}	Rise time	CT = GND		365		us

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6.8 Switching Characteristics (VBIAS = 2.2 V to 5 V) (continued)

Over operating free-air temperature range (unless otherwise noted), CIN=47uF. Typical values are at T_A = 25°C, C_L = 0.1µF, and a current load of 1mA.

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_D	Delay time	CT = Open		27		us
t_D	Delay time	CT = V_{BIAS}		29		us
t_D	Delay time	CT = GND		29		us
t_{FALL}	Fall time	CT = Open		10		us
t_{OFF}	Turn OFF time	CT = Open		4		us
VIN = 0.285 V						
t_{ON}	Turn ON time	CT = Open		37		us
t_{ON}	Turn ON time	CT = V_{BIAS}		96		us
t_{ON}	Turn ON time	CT = GND		158		us
t_{RISE}	Rise time	CT = Open		11		us
t_{RISE}	Rise time	CT = V_{BIAS}		66		us
t_{RISE}	Rise time	CT = GND		128		us
t_D	Delay time	CT = Open		27		us
t_D	Delay time	CT = V_{BIAS}		29		us
t_D	Delay time	CT = GND		30		us
t_{FALL}	Fall time	CT = Open		9		us
t_{OFF}	Turn OFF time	CT = Open		4		us

6.9 Timing Diagram

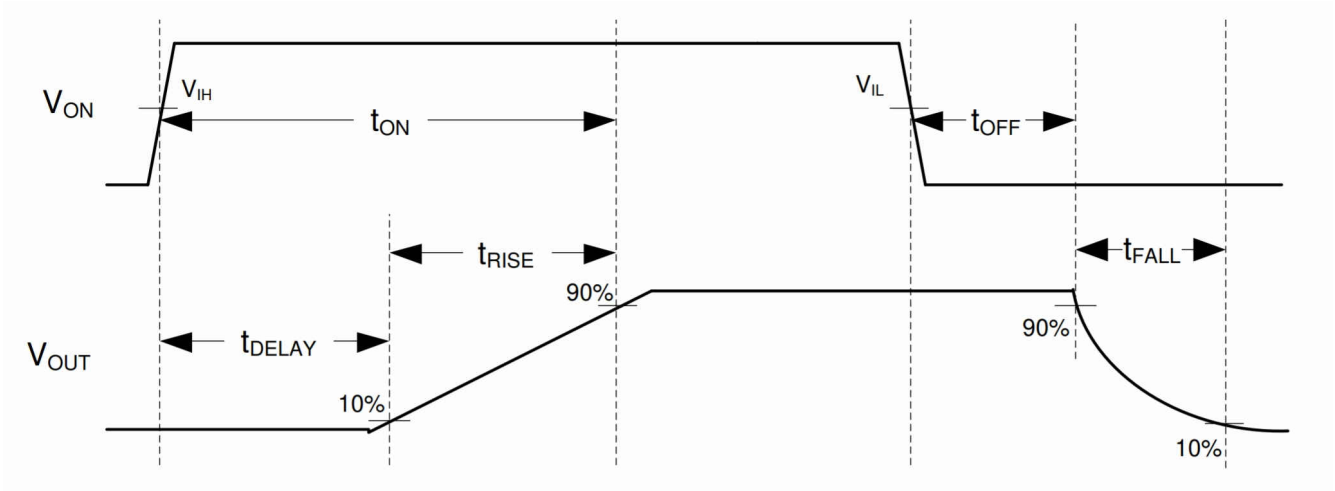
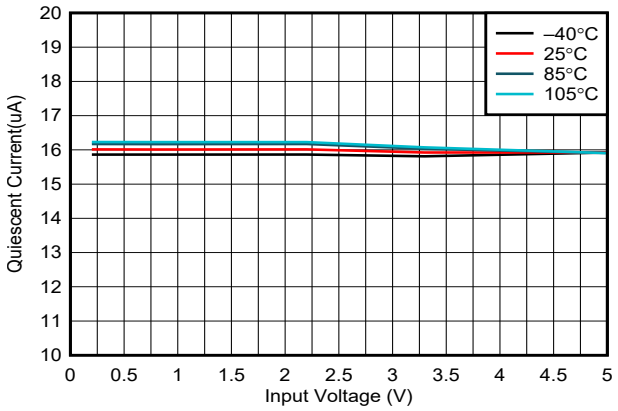


図 6-1. TPS22998 Timing Diagram

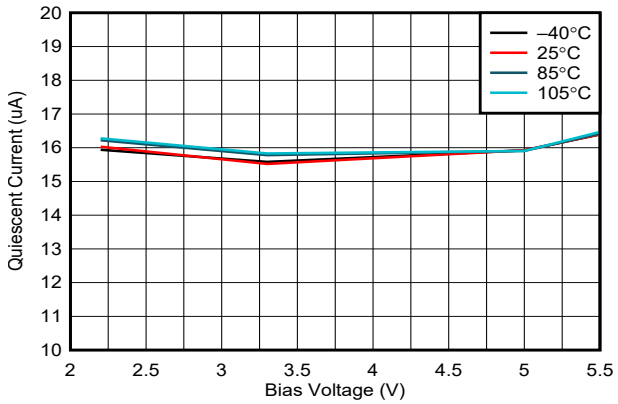
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6.10 Typical Characteristics



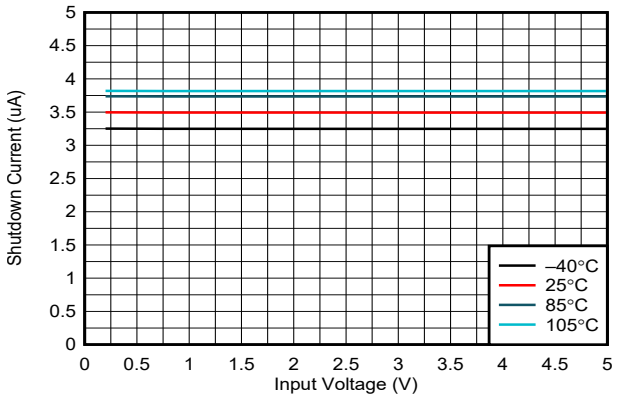
VBIAS = 5 V VOUT = Open

図 6-2. Quiescent Current vs Input Voltage



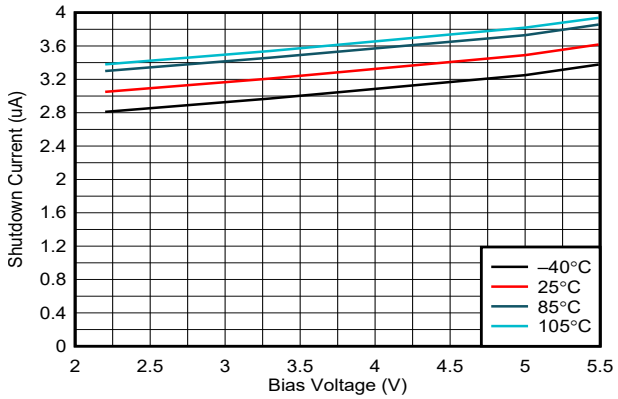
VIN = VBIAS VOUT = Open

図 6-3. Quiescent Current vs Bias Voltage



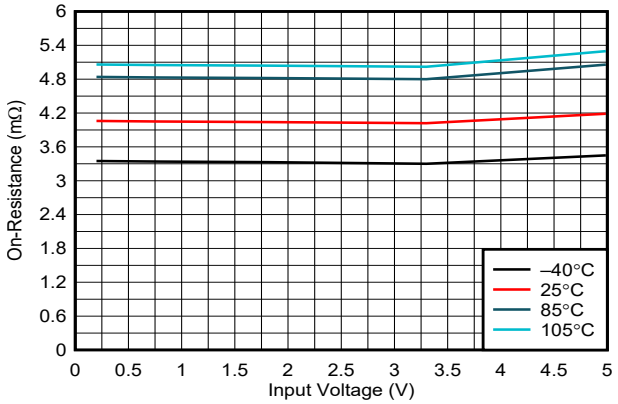
VBIAS = 5 V VOUT = 0 V

図 6-4. VBIAS Shutdown Current vs Input Voltage



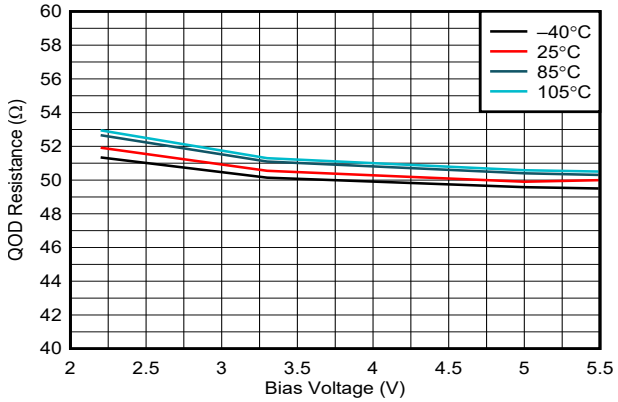
VIN = VBIAS VOUT = 0 V

図 6-5. VBIAS Shutdown Current vs Bias Voltage



VBIAS = 5 V I_{LOAD} = 200 mA

図 6-6. On-Resistance vs Input Voltage

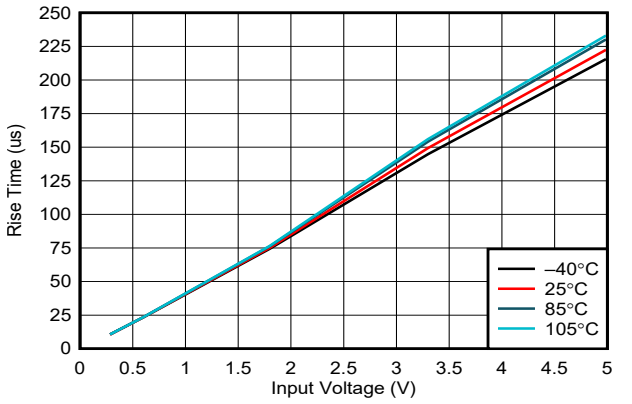


VIN = VBIAS

図 6-7. QOD Resistance vs Bias Voltage

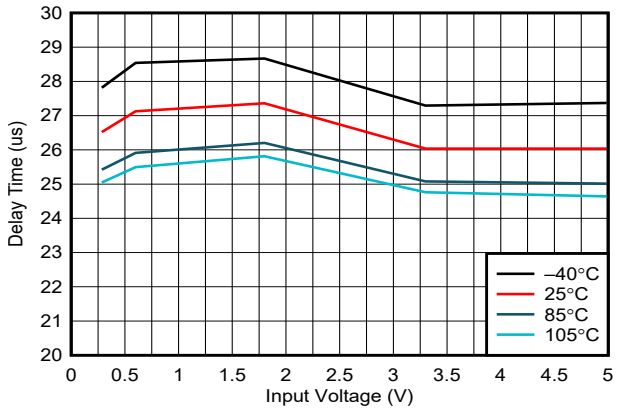
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6.10 Typical Characteristics (continued)



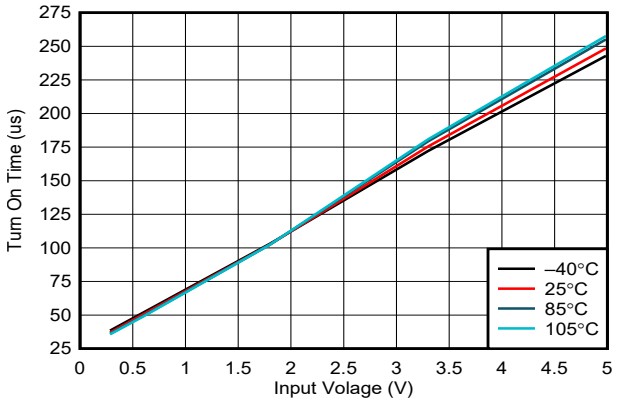
VBIAS = 5 V C_L = 0.1 µF CT = Floating

図 6-8. Rise Time vs Input Voltage



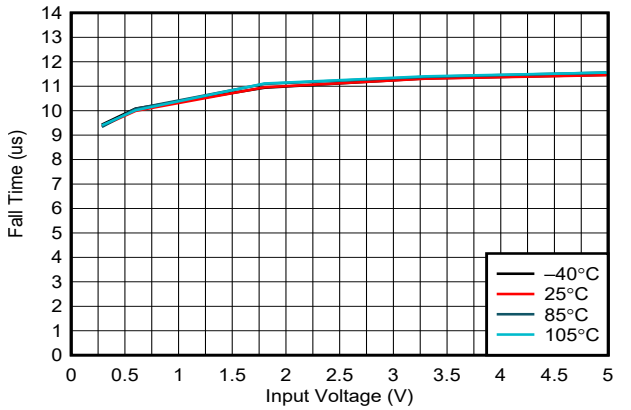
VBIAS = 5 V C_L = 0.1 µF CT = Floating

図 6-9. Delay Time vs Input Voltage



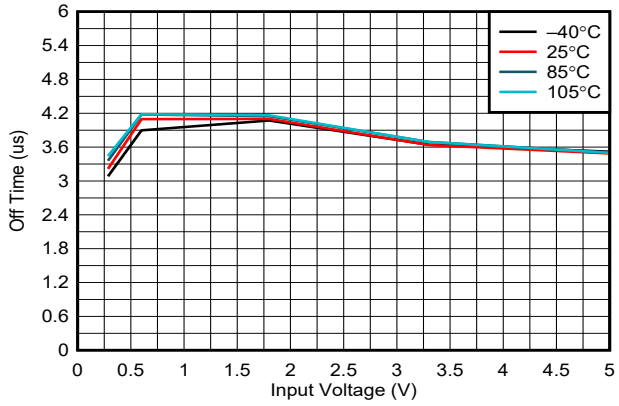
VBIAS = 5 V C_L = 0.1 µF CT = Floating

図 6-10. Turn-On Time vs Input Voltage



VBIAS = 5 V C_L = 0.1 µF CT = Floating

図 6-11. Fall Time vs Input Voltage



VBIAS = 5 V C_L = 0.1 µF CT = Floating

図 6-12. Off Time vs Input Voltage

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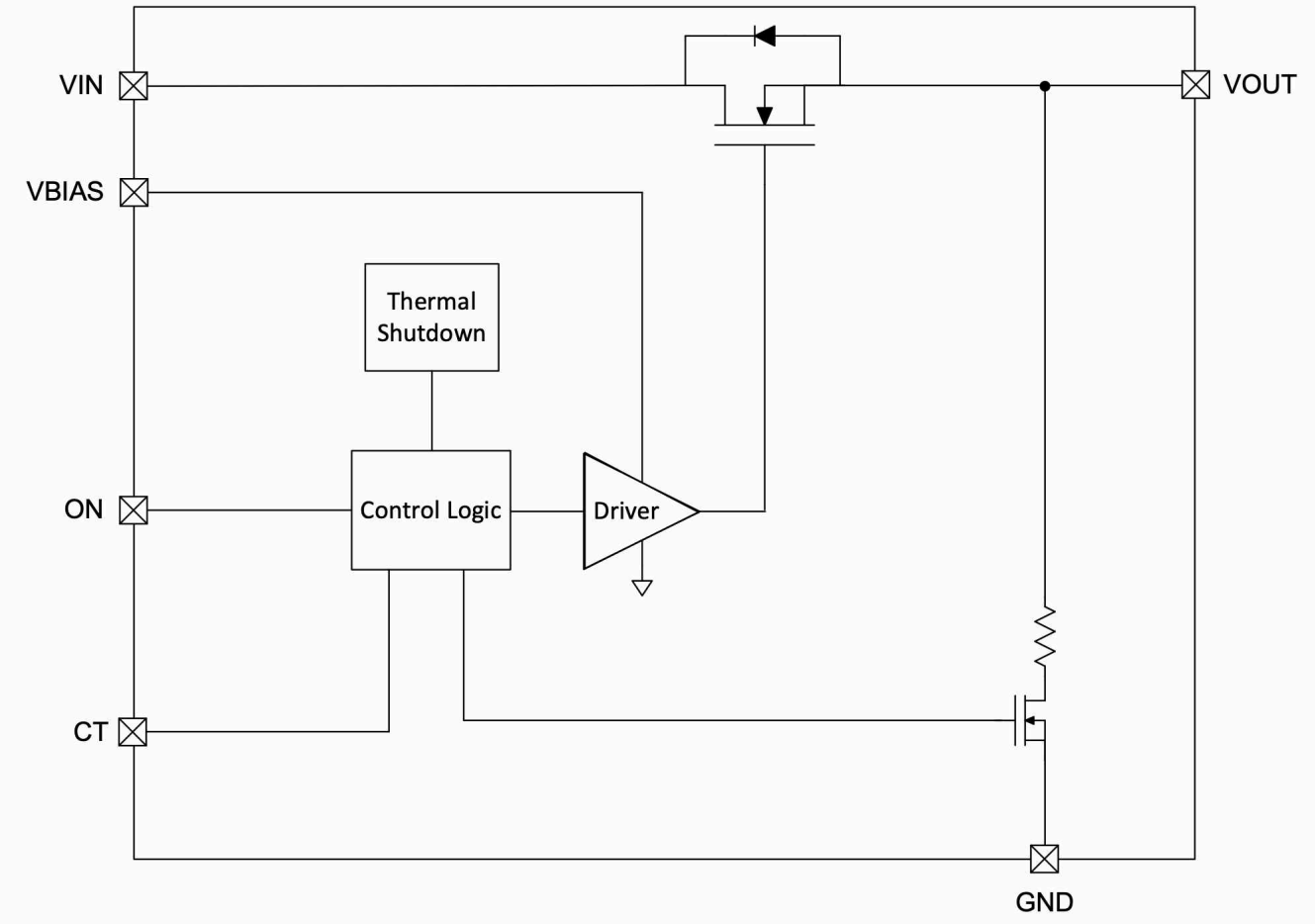
7 Detailed Description

7.1 Overview

The TPS22998 device is a single-channel load switch with a 4-mΩ power MOSFET designed to operate up to 10 A. The voltage range is 0.2 V to 5.5 V. A configurable rise time provides flexibility for power sequencing and minimizes inrush current for high capacitance loads.

An enable pin (ON) controls the switch, which is capable of interfacing directly with low voltage GPIO signals. The TPS22998 device uses quick output discharge when switch turns off, pulling the output down to 0 V through an internal 50-Ω resistor.

7.2 Functional Block Diagram



7.3 Feature Description

7.3.1 ON and OFF Control

The ON pin controls the state of the switch. The ON pin is compatible with standard GPIO logic threshold so it can be used in a wide variety of applications. When the pin pull high, the device enables, and when it is low, the device disables.

7.3.2 Adjustable Slew Rate

The CT pin is a tri-state pin, meaning that it has three different slew rates depending on the connection to the pin. The CT pin can be grounded, pulled high, or left floating. Floating defines as an effective resistance to GND or other pins greater than 10 MΩ.

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7.3.3 Thermal Shutdown

When the device temperature reaches 150°C (typical), the device shuts itself off to prevent thermal damage. After it cools off by about 20°C, the device turns back on. If the device is kept in a thermally stressful environment, then the device oscillates between these two states until it can keep its temperature below the thermal shutdown point.

7.4 Device Functional Modes

The below table summarizes the device functional modes:

ON	Fault Condition	VOUT State
L	None	QOD to GND
H	None	Connected to VIN
H	Thermal shutdown	QOD to GND

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8 Application and Implementation

Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

8.1 Application Information

This section highlights some of the design considerations when implementing this device in various applications.

8.2 Typical Application

This typical application demonstrates how to use the TPS22998 device to limit startup inrush current.

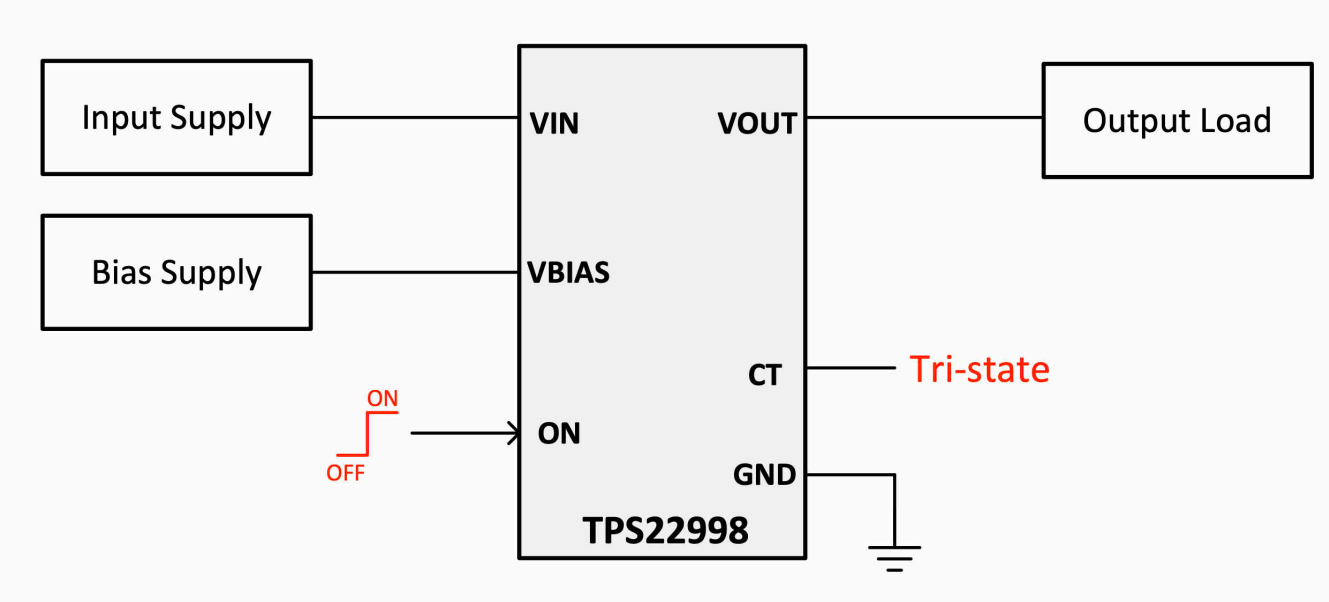


図 8-1. TPS22998 Basic Application

8.2.1 Design Requirements

For this example, the values below are used as the design parameters.

表 8-1. Design Parameters

PARAMETER	VALUE
V_{BIAS}	3.3 V
V_{IN}	1.8 V
Load capacitance	470 µF
Maximum inrush current	1 A

8.2.2 Detailed Design Procedure

When the switch enables, the charge up the output capacitance from 0 V to the set value (1.8 V in this example). This charge arrives in the form of inrush current. Calculate inrush current using 式 1.

$$\text{Inrush Current} = C_L \times dVOUT/dt \quad (1)$$

Where:

- C_L is the output capacitance.
- dVOUT is the change in VOUT during the ramp up of the output voltage when device is enabled. Because rise time is 10% of VOUT to 90% of VOUT, this is 80% of the VIN value.
- dt is the rise time in VOUT during the ramp up of the output voltage when the device is enabled.

The TPS22998 offers an adjustable rise time for VOUT, allowing the user to control the inrush current during turn on. Calculate the appropriate rise time using the design requirements and the inrush current equation as shown below.

$$1A = 470\ \mu F \times (1.8\ V \times 80\%) / dt \quad (2)$$

$$dt = 677 \mu s \quad (3)$$

To ensure an inrush current of less than 1 A, a C_T setting that yields a rise time of more than 677 µs must be chosen. By pulling the CT pin high, a rise time of 900 µs is selected, limiting the inrush current to below 1 A.

8.2.3 Application Performance Plots

The below scope shot shows the TPS22998 turning on into a 470-µF load with the CT pin tied to VBIAS.

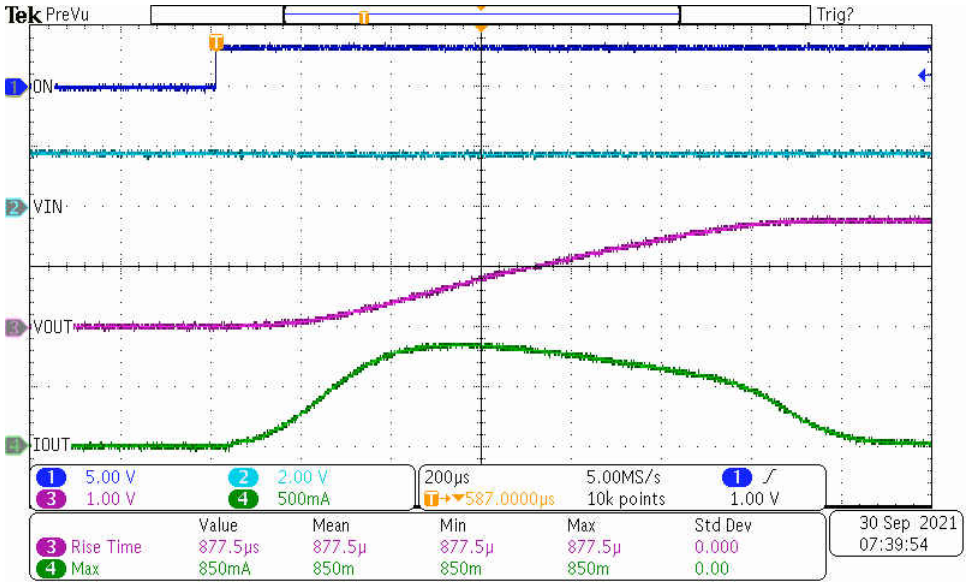


図 8-2. TPS22998 Turn-On into 470 µF (CT = V_{BIAS})

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9 Power Supply Recommendations

The TPS22998 device is designed to operate with a VIN range of 0.2 V to 5.5 V. Regulate the VIN power supply well and place as close to the device terminal as possible. The power supply must be able to withstand all transient load current steps. In most situations, using an input capacitance (C_{IN}) of 1 µF is sufficient to prevent the supply voltage from dipping when the switch is turned on. In cases where the power supply is slow to respond to a large transient current or large load current step, additional bulk capacitance can be required on the input.

10 Layout

10.1 Layout Guidelines

For best performance, all traces must be as short as possible. To be most effective, place the input and output capacitors close to the device to minimize the effects that parasitic trace inductances can have on normal operation. Using wide traces for VIN, VOUT, and GND helps minimize the parasitic electrical effects.

10.2 Layout Example

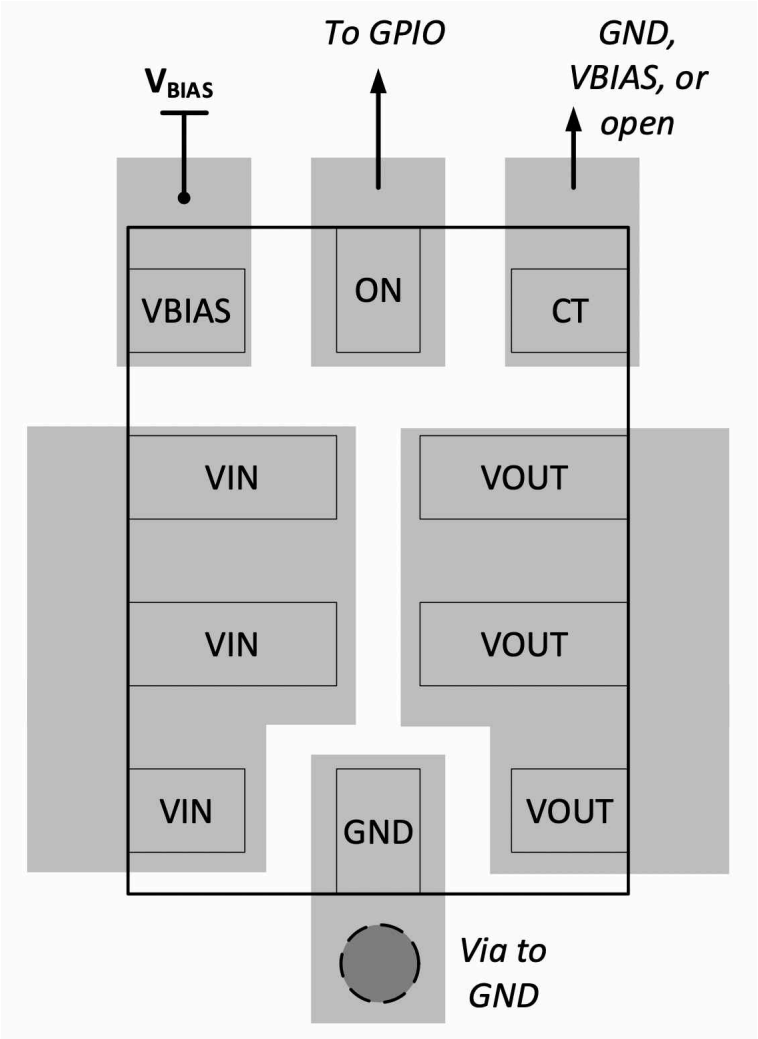


図 10-1. TPS22998 Layout Example

11 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

11.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Subscribe to updates* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

11.2 サポート・リソース

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11.4 Electrostatic Discharge Caution



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.

11.5 Glossary

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

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12 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)
TPS22998RYZR	Active	Production	WQFN-HR (RYZ) | 10	3000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 105	1LF
TPS22998RYZR.A	Active	Production	WQFN-HR (RYZ) | 10	3000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 105	1LF

(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.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

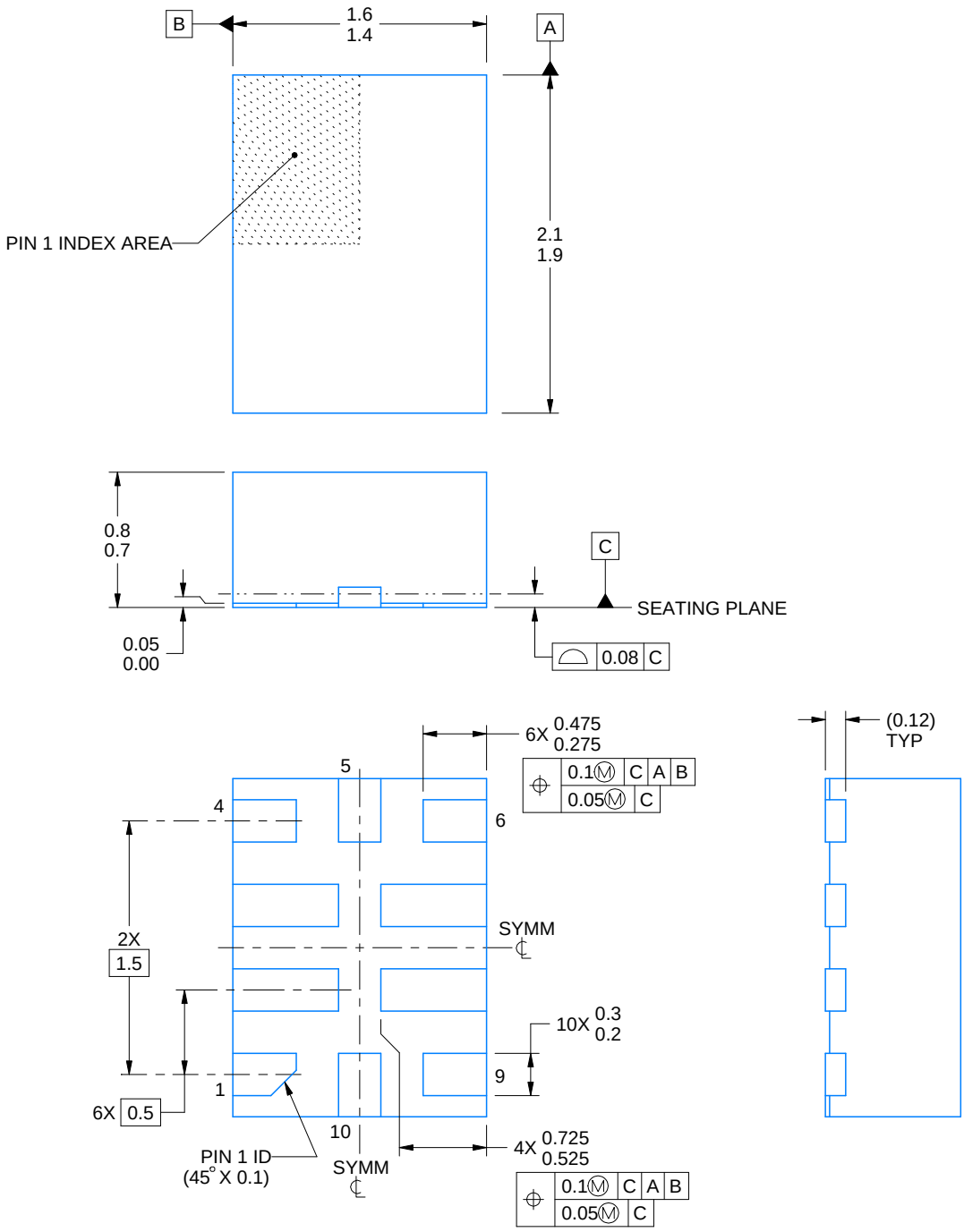
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

PACKAGE OUTLINE

RYZ0010A

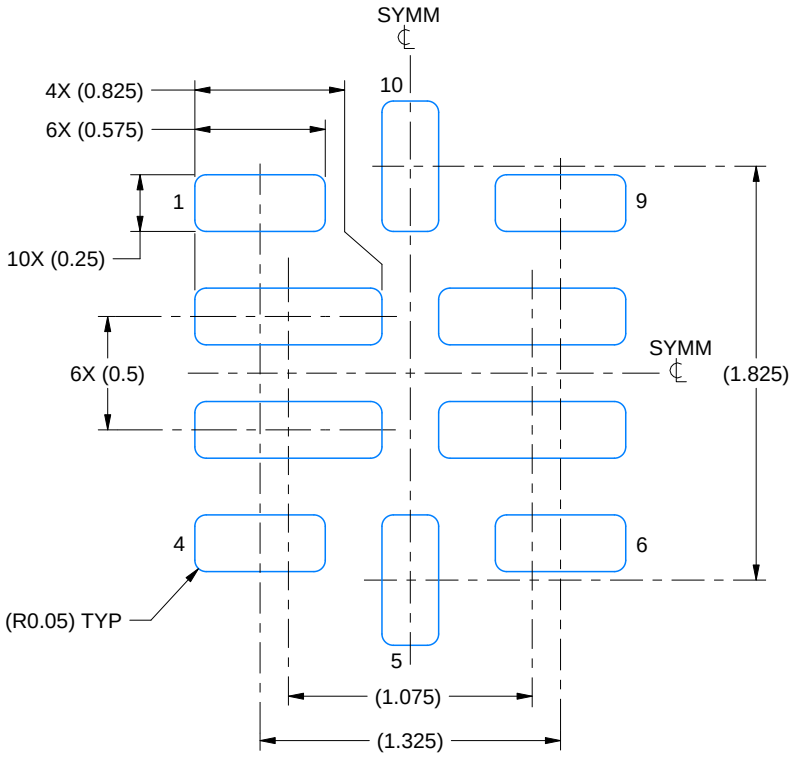
WQFN-HR - 0.8 mm max height

PLASTIC QUAD FLATPACK - NO LEAD

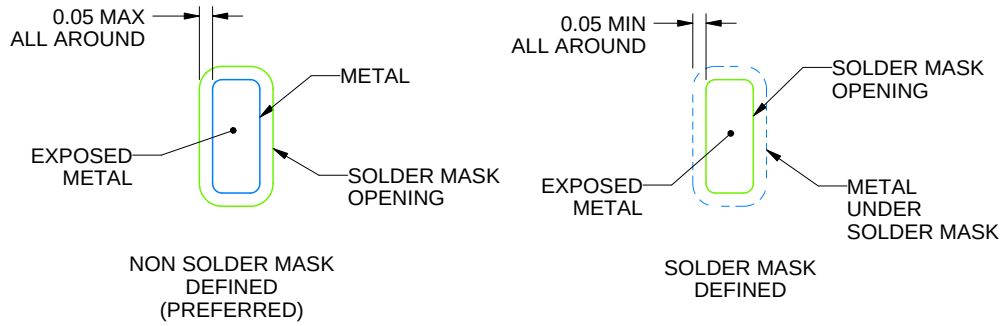


NOTES:

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:30X

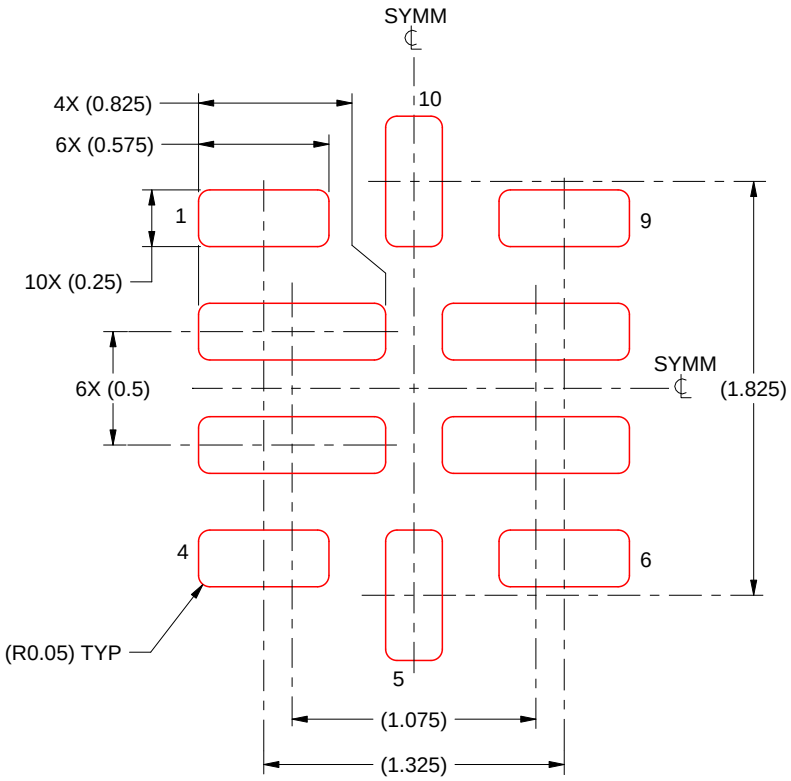


SOLDER MASK DETAILS
NOT TO SCALE

4226834/B 06/2021

NOTES: (continued)

3. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).



SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICKNESS
SCALE: 30X

4226834/B 06/2021

NOTES: (continued)

5. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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