

# TPS22918-Q1 5.5V、2A、导通电阻为 52mΩ 的负载开关

## 1 特性

- 符合 AEC-Q100 标准
- 集成式单通道负载开关
- 符合汽车类应用的 16 通道 AFE:
  - 器件温度等级 2:  $-40^{\circ}\text{C}$  至  $+105^{\circ}\text{C}$  的环境工作温度范围
- 提供功能安全
  - 提供文档以帮助创建功能安全系统设计
- 输入电压范围: 1V 至 5.5V
- 低导通电阻 ( $R_{\text{ON}}$ )
  - $R_{\text{ON}} = 52\text{m}\Omega$  ( $V_{\text{IN}} = 5\text{V}$  时的典型值)
  - $R_{\text{ON}} = 53\text{m}\Omega$  ( $V_{\text{IN}} = 3.3\text{V}$  时的典型值)
- 2A 最大持续开关电流
- 低静态电流
  - $8.3\mu\text{A}$  ( $V_{\text{IN}} = 3.3\text{V}$  时的典型值)
- 低控制输入阈值支持使用 1V 或更高的 GPIO
- 可配置快速输出放电 (QOD)
- 通过 CT 引脚可配置上升时间
- 小型 SOT23-6 封装 (DBV)
  - $2.9\text{mm} \times 2.8\text{mm}$ , 间距 0.95mm, 高 1.45mm (带引线)
- ESD 性能测试符合 AEC Q100 标准
  - $\pm 2\text{kV}$  人体模型 (HBM) 和  $\pm 750\text{V}$  带电器件模型 (CDM)

## 2 应用

- 汽车电子产品
- 信息娱乐系统
- 仪表组
- ADAS (高级驾驶辅助系统)

## 3 说明

TPS22918-Q1 是一款单通道负载开关, 可对上升时间和快速输出放电进行配置。此器件包括一个 N 沟道金属氧化物半导体场效应晶体管 (MOSFET), 可在 1V 至 5.5V 的输入电压范围内运行并可支持 2A 的最大持续电流。此开关由一个开关输入控制, 能够直接连接低电压控制信号。

该器件的可配置上升时间可降低大容量负载电容所产生的浪涌电流, 从而降低或消除电源压降。TPS22918-Q1 具有一个可配置的快速输出放电 (QOD) 引脚, 用于控制器件的下降时间, 以便针对掉电或排序进行灵活设计。

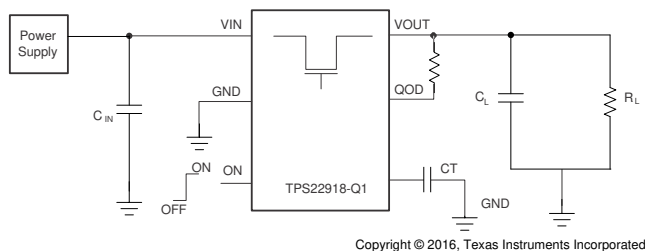
TPS22918-Q1 采用小型、带引线的 SOT-23 封装 (DBV), 方便对焊接点进行外观检查。该器件在自然通风环境下的额定运行温度范围为  $-40^{\circ}\text{C}$  至  $+105^{\circ}\text{C}$ 。

器件信息<sup>(1)</sup>

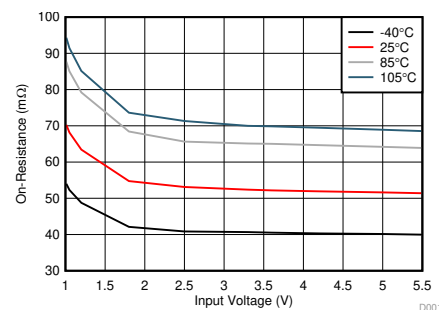
| 器件型号        | 封装         | 封装尺寸 (标称值)                           |
|-------------|------------|--------------------------------------|
| TPS22918-Q1 | SOT-23 (6) | $2.90\text{mm} \times 1.60\text{mm}$ |

(1) 如需了解所有可用封装, 请参阅数据表末尾的可订购产品附录。

简化原理图



导通电阻与输入电压间的关系  
典型值



$I_{\text{OUT}} = -200\text{mA}$



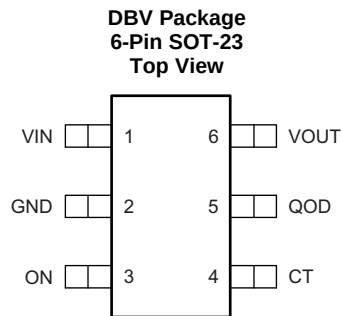
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## 4 修订历史记录

| Changes from Revision A (July 2016) to Revision B | Page     |
|---------------------------------------------------|----------|
| • 向 <a href="#">特性</a> 部分添加了提供功能安全的链接.....        | <b>1</b> |
| Changes from Original (July 2016) to Revision A   | Page     |
| • 已将器件状态由“产品预览”更改为“量产数据” .....                    | <b>1</b> |

## 5 Pin Configuration and Functions



### Pin Functions

| PIN |      | TYPE | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----|------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NO. | NAME |      |                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 1   | VIN  | I    | Switch input. Place ceramic bypass capacitor(s) between this pin and GND. See the <a href="#">Detailed Description</a> section for more information                                                                                                                                                                                                                                                                         |
| 2   | GND  | —    | Device ground                                                                                                                                                                                                                                                                                                                                                                                                               |
| 3   | ON   | I    | Active high switch control input. Do not leave floating                                                                                                                                                                                                                                                                                                                                                                     |
| 4   | CT   | O    | Switch slew rate control. Can be left floating. See the <a href="#">Feature Description</a> section for more information                                                                                                                                                                                                                                                                                                    |
| 5   | QOD  | O    | Quick Output Discharge pin. This functionality can be enabled in one of three ways <ul style="list-style-type: none"> <li>Placing an external resistor between VOUT and QOD</li> <li>Tying QOD directly to VOUT and using the internal resistor value (<math>R_{PD}</math>)</li> <li>Disabling QOD by leaving pin disconnected</li> </ul> See the <a href="#">Quick Output Discharge (QOD)</a> section for more information |
| 6   | VOUT | O    | Switch output                                                                                                                                                                                                                                                                                                                                                                                                               |

## 6 Specifications

### 6.1 Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) <sup>(1)</sup> <sup>(2)</sup>

|                  |                                                                         | MIN  | MAX | UNIT |
|------------------|-------------------------------------------------------------------------|------|-----|------|
| V <sub>IN</sub>  | Input voltage                                                           | −0.3 | 6   | V    |
| V <sub>OUT</sub> | Output voltage                                                          | −0.3 | 6   | V    |
| V <sub>ON</sub>  | ON voltage                                                              | −0.3 | 6   | V    |
| I <sub>MAX</sub> | Maximum continuous switch current, T <sub>A</sub> = 70°C <sup>(3)</sup> |      | 2   | A    |
| I <sub>MAX</sub> | Maximum continuous switch current, T <sub>A</sub> = 85°C <sup>(3)</sup> |      | 1.5 | A    |
| I <sub>PLS</sub> | Maximum pulsed switch current, pulse < 300 μs, 2% duty cycle            |      | 2.5 | A    |
| T <sub>J</sub>   | Maximum junction temperature                                            |      | 150 | °C   |
| T <sub>stg</sub> | Storage temperature                                                     | −65  | 150 | °C   |

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. 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) Assumes 12-K power-on hours at 100% duty cycle. This information is provided solely for your convenience and does not extend or modify the warranty provided under TI's standard terms and conditions for TI's semiconductor products.

### 6.2 ESD Ratings

|                    |                         | VALUE                                                   | UNIT  |
|--------------------|-------------------------|---------------------------------------------------------|-------|
| V <sub>(ESD)</sub> | Electrostatic discharge | Human-body model (HBM), per AEC Q100-002 <sup>(1)</sup> | ±2000 |
|                    |                         | Charged-device model (CDM), per AEC Q100-011            | ±750  |

- (1) AEC Q100-002 indicates that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

### 6.3 Recommended Operating Conditions

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

|                     |                                               |                                | MIN              | MAX             | UNIT |
|---------------------|-----------------------------------------------|--------------------------------|------------------|-----------------|------|
| V <sub>IN</sub>     | Input voltage                                 |                                | 1                | 5.5             | V    |
| V <sub>ON</sub>     | ON voltage                                    |                                | 0                | 5.5             | V    |
| V <sub>OUT</sub>    | Output voltage                                |                                |                  | V <sub>IN</sub> | V    |
| V <sub>IH, ON</sub> | High-level input voltage, ON                  | V <sub>IN</sub> = 1 V to 5.5 V | 1                | 5.5             | V    |
| V <sub>IL, ON</sub> | Low-level input voltage, ON                   | V <sub>IN</sub> = 1 V to 5.5 V | 0                | 0.5             | V    |
| T <sub>A</sub>      | Operating free-air temperature <sup>(1)</sup> |                                | −40              | 105             | °C   |
| C <sub>IN</sub>     | Input Capacitor                               |                                | 1 <sup>(2)</sup> |                 | μF   |

- (1) 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 [T<sub>A(MAX)</sub>] is dependent on the maximum operating junction temperature [T<sub>J(MAX)</sub>], the maximum power dissipation of the device in the application [P<sub>D(MAX)</sub>], and the junction-to-ambient thermal resistance of the part-package in the application (θ<sub>JA</sub>), as given by the following equation: T<sub>A(MAX)</sub> = T<sub>J(MAX)</sub> − (θ<sub>JA</sub> × P<sub>D(MAX)</sub>).
- (2) See the [Application and Implementation](#) section.

### 6.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |                                              | TPS22918-Q1  | UNIT |
|-------------------------------|----------------------------------------------|--------------|------|
|                               |                                              | DBV (SOT-23) |      |
|                               |                                              | 6 PINS       |      |
| R <sub>θJA</sub>              | Junction-to-ambient thermal resistance       | 183.2        | °C/W |
| R <sub>θJC(top)</sub>         | Junction-to-case (top) thermal resistance    | 151.6        | °C/W |
| R <sub>θJB</sub>              | Junction-to-board thermal resistance         | 34.1         | °C/W |
| ψ <sub>JT</sub>               | Junction-to-top characterization parameter   | 37.2         | °C/W |
| ψ <sub>JB</sub>               | Junction-to-board characterization parameter | 33.6         | °C/W |

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

## 6.5 Electrical Characteristics

Unless otherwise noted, the specification in the following table applies over the following operating ambient temperature  $-40^{\circ}\text{C} \leq T_A \leq +105^{\circ}\text{C}$  (full). Typical values are for  $T_A = 25^{\circ}\text{C}$ .

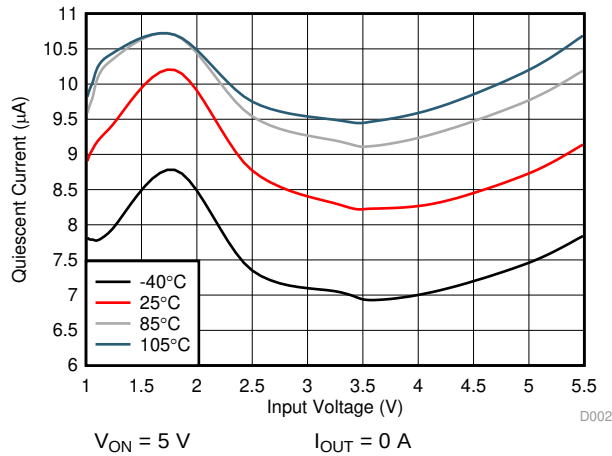
| PARAMETER                             | TEST CONDITIONS                                   | $T_A$                                          | MIN                                            | TYP  | MAX | UNIT             |
|---------------------------------------|---------------------------------------------------|------------------------------------------------|------------------------------------------------|------|-----|------------------|
| $I_{Q, VIN}$ Quiescent current        | $V_{ON} = 5\text{ V}, I_{OUT} = 0\text{ A}$       | $V_{IN} = 5.5\text{ V}$                        | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ | 9.2  | 16  | $\mu\text{A}$    |
|                                       |                                                   | $V_{IN} = 5\text{ V}$                          |                                                | 8.7  | 16  |                  |
|                                       |                                                   | $V_{IN} = 3.3\text{ V}$                        |                                                | 8.3  | 15  |                  |
|                                       |                                                   | $V_{IN} = 1.8\text{ V}$                        |                                                | 10.2 | 17  |                  |
|                                       |                                                   | $V_{IN} = 1.2\text{ V}$                        |                                                | 9.3  | 16  |                  |
|                                       |                                                   | $V_{IN} = 1\text{ V}$                          |                                                | 8.9  | 15  |                  |
| $I_{SD, VIN}$ Shutdown current        | $V_{ON} = 0\text{ V}, V_{OUT} = 0\text{ V}$       | $V_{IN} = 5.5\text{ V}$                        | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ | 0.5  | 5   | $\mu\text{A}$    |
|                                       |                                                   | $V_{IN} = 5\text{ V}$                          | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ | 0.5  | 4.5 |                  |
|                                       |                                                   | $V_{IN} = 3.3\text{ V}$                        | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ | 0.5  | 3.5 |                  |
|                                       |                                                   | $V_{IN} = 1.8\text{ V}$                        | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ | 0.5  | 2.5 |                  |
|                                       |                                                   | $V_{IN} = 1.2\text{ V}$                        | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ | 0.4  | 2   |                  |
|                                       |                                                   | $V_{IN} = 1\text{ V}$                          | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ | 0.4  | 2   |                  |
| $I_{ON}$ ON pin input leakage current | $V_{IN} = 5.5\text{ V}, I_{OUT} = 0\text{ A}$     | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ |                                                |      | 0.1 | $\mu\text{A}$    |
| $R_{ON}$ On-Resistance                | $V_{IN} = 5.5\text{ V}, I_{OUT} = -200\text{ mA}$ | $25^{\circ}\text{C}$                           |                                                | 51   | 59  | $\text{m}\Omega$ |
|                                       |                                                   | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ |                                                |      | 78  |                  |
|                                       | $V_{IN} = 5\text{ V}, I_{OUT} = -200\text{ mA}$   | $25^{\circ}\text{C}$                           |                                                | 52   | 59  |                  |
|                                       |                                                   | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ |                                                |      | 79  |                  |
|                                       | $V_{IN} = 4.2\text{ V}, I_{OUT} = -200\text{ mA}$ | $25^{\circ}\text{C}$                           |                                                | 52   | 59  |                  |
|                                       |                                                   | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ |                                                |      | 79  |                  |
|                                       | $V_{IN} = 3.3\text{ V}, I_{OUT} = -200\text{ mA}$ | $25^{\circ}\text{C}$                           |                                                | 53   | 59  |                  |
|                                       |                                                   | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ |                                                |      | 80  |                  |
|                                       | $V_{IN} = 2.5\text{ V}, I_{OUT} = -200\text{ mA}$ | $25^{\circ}\text{C}$                           |                                                | 53   | 61  |                  |
|                                       |                                                   | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ |                                                |      | 80  |                  |
|                                       | $V_{IN} = 1.8\text{ V}, I_{OUT} = -200\text{ mA}$ | $25^{\circ}\text{C}$                           |                                                | 55   | 65  |                  |
|                                       |                                                   | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ |                                                |      | 88  |                  |
| $V_{HYS}$ ON pin hysteresis           | $V_{IN} = 1\text{ V to } 5.5\text{ V}$            | $25^{\circ}\text{C}$                           |                                                | 107  |     | $\text{mV}$      |
|                                       |                                                   | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ |                                                |      |     |                  |
| $R_{PD}$ Output pull down resistance  | $V_{IN} = 5\text{ V}, V_{ON} = 0\text{ V}$        | $25^{\circ}\text{C}$                           |                                                | 24   |     | $\Omega$         |
|                                       |                                                   | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ |                                                |      | 30  |                  |
|                                       | $V_{IN} = 3.3\text{ V}, V_{ON} = 0\text{ V}$      | $25^{\circ}\text{C}$                           |                                                | 25   |     |                  |
|                                       |                                                   | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ |                                                |      | 35  |                  |
|                                       | $V_{IN} = 1.8\text{ V}, V_{ON} = 0\text{ V}$      | $25^{\circ}\text{C}$                           |                                                | 45   |     |                  |
|                                       |                                                   | $-40^{\circ}\text{C to } +105^{\circ}\text{C}$ |                                                |      | 60  |                  |

## 6.6 Switching Characteristics

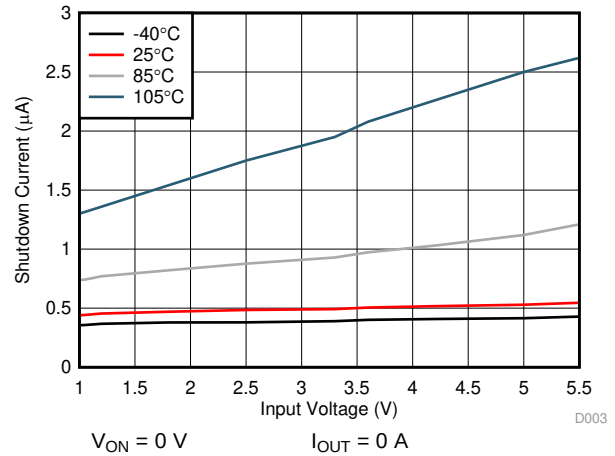
See timing test circuit in [Figure 21](#) (unless otherwise noted) for references to external components used for the test condition in the switching characteristics table. Switching characteristics shown below are only valid for the power-up sequence where VIN is already in steady state condition before the ON pin is asserted high. Test Conditions:  $V_{ON} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

| PARAMETER                     |                            | TEST CONDITION                                                                         | MIN | TYP  | MAX | UNIT |
|-------------------------------|----------------------------|----------------------------------------------------------------------------------------|-----|------|-----|------|
| <b>V<sub>IN</sub> = 5 V</b>   |                            |                                                                                        |     |      |     |      |
| t <sub>ON</sub>               | Turnon time                | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 1950 |     | μs   |
| t <sub>OFF</sub>              | Turnoff time               | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 2    |     | μs   |
| t <sub>R</sub>                | V <sub>OUT</sub> rise time | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 2540 |     | μs   |
| t <sub>F</sub>                | V <sub>OUT</sub> fall time | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 2    |     | μs   |
| t <sub>D</sub>                | Delay time                 | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 690  |     | μs   |
| <b>V<sub>IN</sub> = 3.3 V</b> |                            |                                                                                        |     |      |     |      |
| t <sub>ON</sub>               | Turnon time                | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 1430 |     | μs   |
| t <sub>OFF</sub>              | Turnoff time               | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 2    |     | μs   |
| t <sub>R</sub>                | V <sub>OUT</sub> rise time | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 1680 |     | μs   |
| t <sub>F</sub>                | V <sub>OUT</sub> fall time | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 2    |     | μs   |
| t <sub>D</sub>                | Delay time                 | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 590  |     | μs   |
| <b>V<sub>IN</sub> = 1.8 V</b> |                            |                                                                                        |     |      |     |      |
| t <sub>ON</sub>               | Turnon time                | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 965  |     | μs   |
| t <sub>OFF</sub>              | Turnoff time               | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 2    |     | μs   |
| t <sub>R</sub>                | V <sub>OUT</sub> rise time | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 960  |     | μs   |
| t <sub>F</sub>                | V <sub>OUT</sub> fall time | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 2    |     | μs   |
| t <sub>D</sub>                | Delay time                 | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 480  |     | μs   |
| <b>V<sub>IN</sub> = 1 V</b>   |                            |                                                                                        |     |      |     |      |
| t <sub>ON</sub>               | Turnon time                | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 725  |     | μs   |
| t <sub>OFF</sub>              | Turnoff time               | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 3    |     | μs   |
| t <sub>R</sub>                | V <sub>OUT</sub> rise time | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 560  |     | μs   |
| t <sub>F</sub>                | V <sub>OUT</sub> fall time | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 2    |     | μs   |
| t <sub>D</sub>                | Delay time                 | R <sub>L</sub> = 10 Ω, C <sub>IN</sub> = 1 μF, C <sub>OUT</sub> = 0.1 μF, CT = 1000 pF |     | 430  |     | μs   |

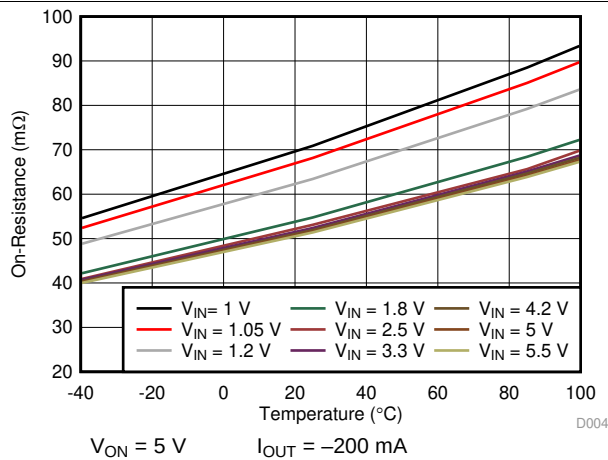
## 6.7 Typical DC Characteristics



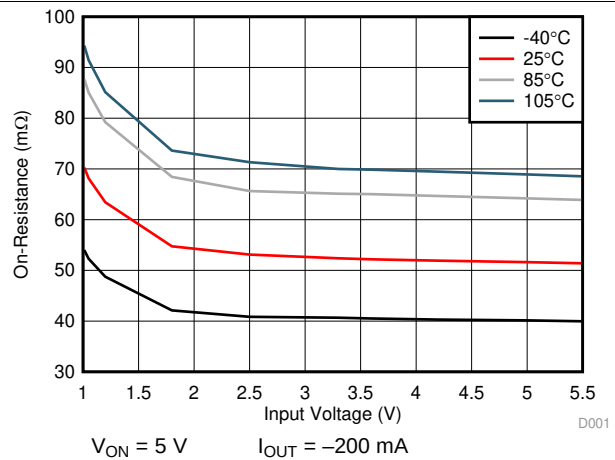
**Figure 1. Quiescent Current vs Input Voltage**



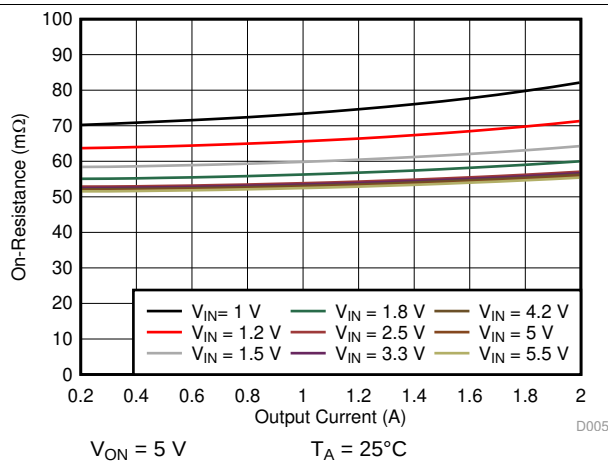
**Figure 2. Shutdown Current vs Input Voltage**



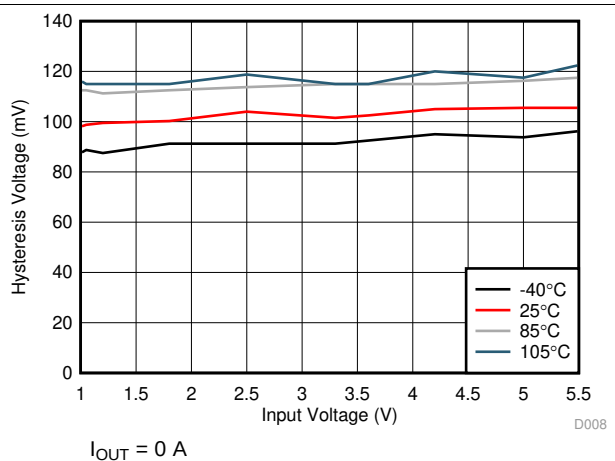
**Figure 3. On-Resistance vs Temperature**



**Figure 4. On-Resistance vs Input Voltage**

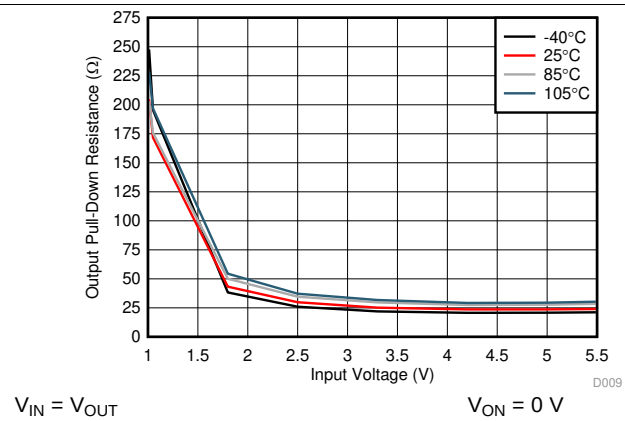


**Figure 5. On-Resistance vs Output Current**



**Figure 6. Hysteresis Voltage vs Input Voltage**

## Typical DC Characteristics (continued)



**Figure 7. Output Pull-Down Resistance vs Input Voltage**

## 6.8 Typical AC Characteristics

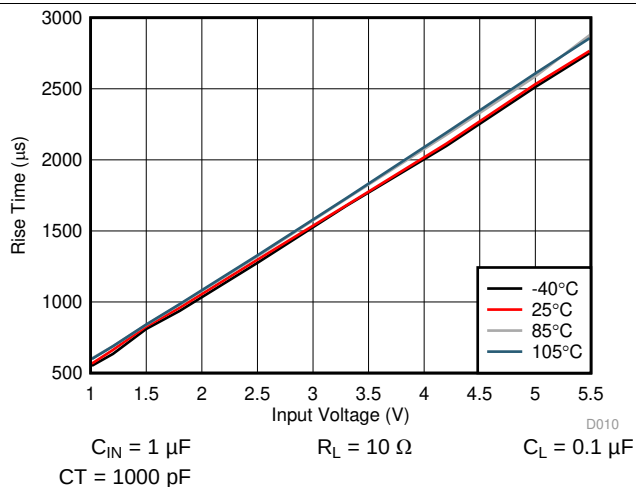


Figure 8. Rise Time vs Input Voltage

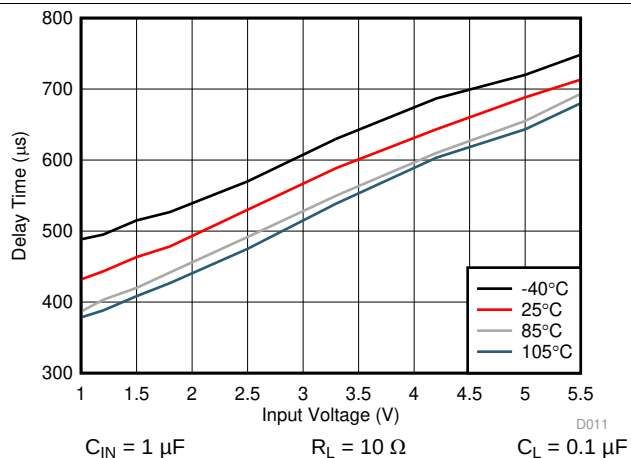


Figure 9. Delay Time vs Input Voltage

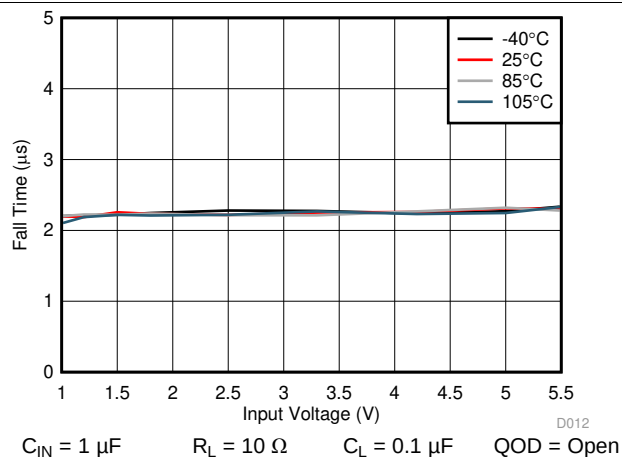


Figure 10. Fall Time vs Input Voltage

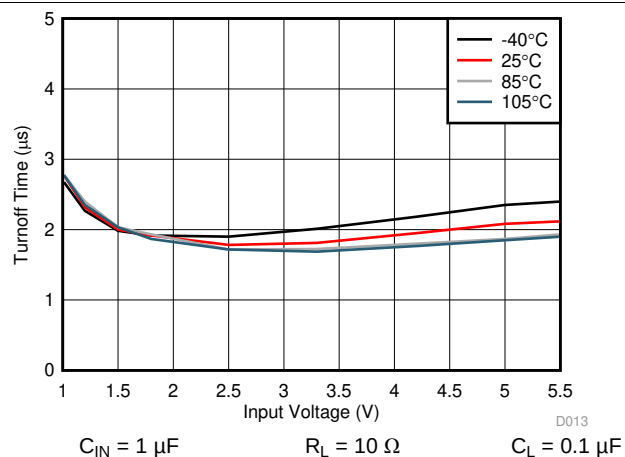


Figure 11. Turnoff Time vs Input Voltage

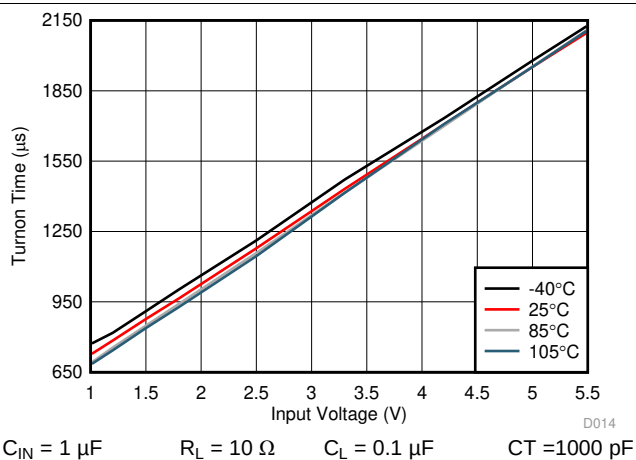


Figure 12. Turnon Time vs Input Voltage

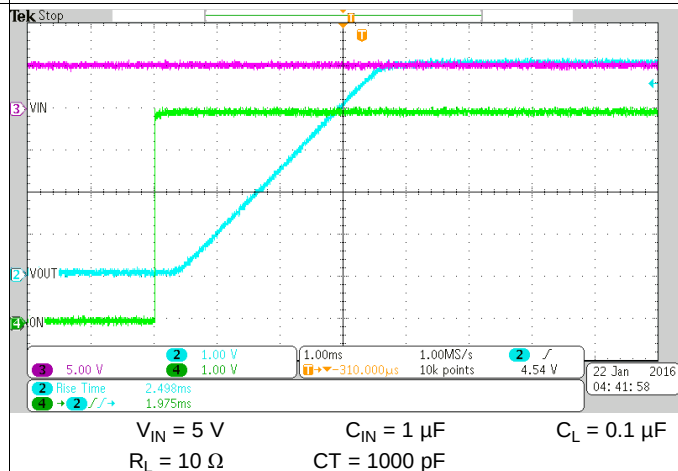
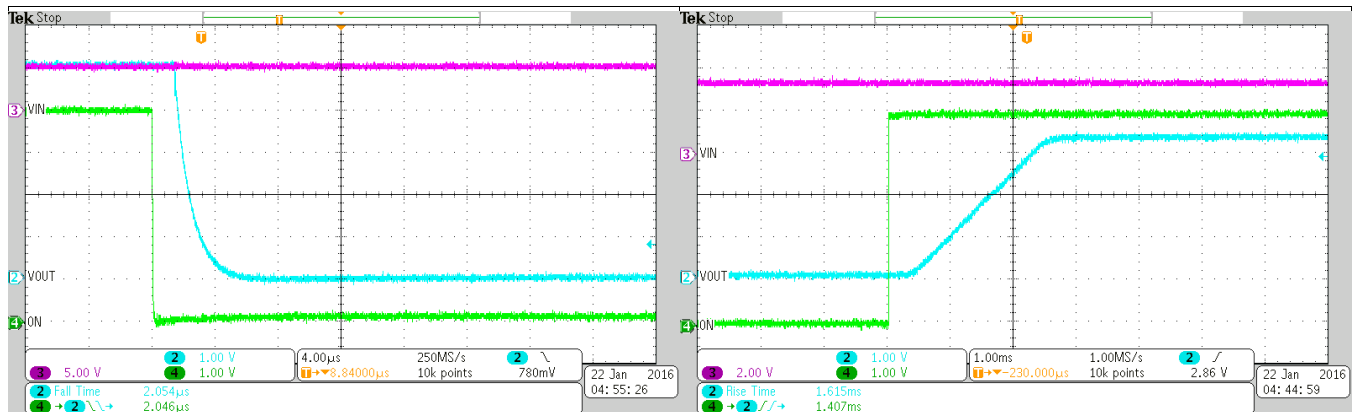


Figure 13. Rise Time ( $t_R$ ) at  $V_{IN} = 5 V$

## Typical AC Characteristics (continued)

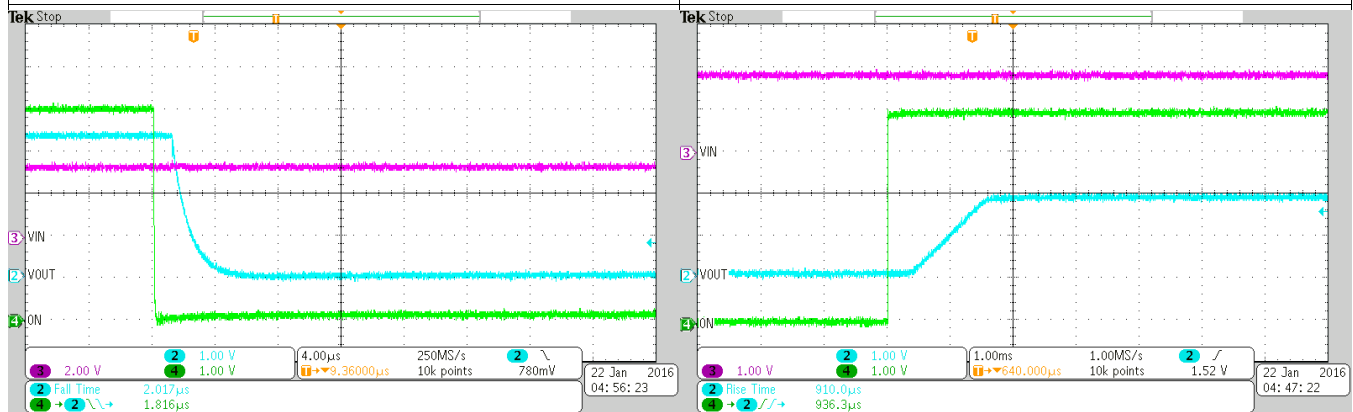


$V_{IN} = 5\text{ V}$   $C_{IN} = 1\text{ }\mu\text{F}$   $C_L = 0.1\text{ }\mu\text{F}$   
 $R_L = 10\text{ }\Omega$  QOD = Open

$V_{IN} = 3.3\text{ V}$   $C_{IN} = 1\text{ }\mu\text{F}$   $C_L = 0.1\text{ }\mu\text{F}$   
 $R_L = 10\text{ }\Omega$  CT = 1000 pF

**Figure 14. Fall Time ( $t_F$ ) at  $V_{IN} = 5\text{ V}$**

**Figure 15. Rise Time ( $t_R$ ) at  $V_{IN} = 3.3\text{ V}$**

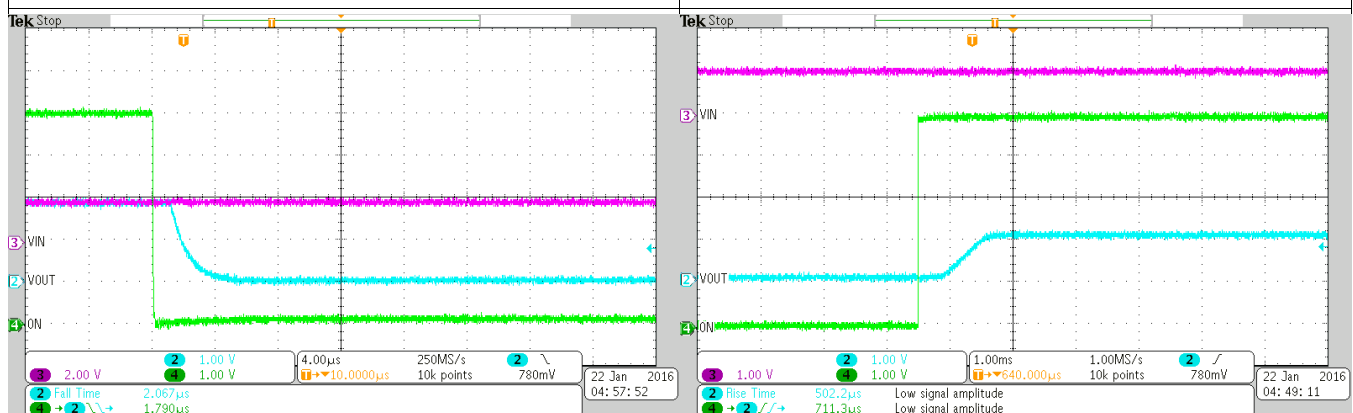


$V_{IN} = 3.3\text{ V}$   $C_{IN} = 1\text{ }\mu\text{F}$   $C_L = 0.1\text{ }\mu\text{F}$   
 $R_L = 10\text{ }\Omega$  QOD = Open

$V_{IN} = 1.8\text{ V}$   $C_{IN} = 1\text{ }\mu\text{F}$   $C_L = 0.1\text{ }\mu\text{F}$   
 $R_L = 10\text{ }\Omega$  CT = 1000 pF

**Figure 16. Fall Time ( $t_F$ ) at  $V_{IN} = 3.3\text{ V}$**

**Figure 17. Rise Time ( $t_R$ ) at  $V_{IN} = 1.8\text{ V}$**



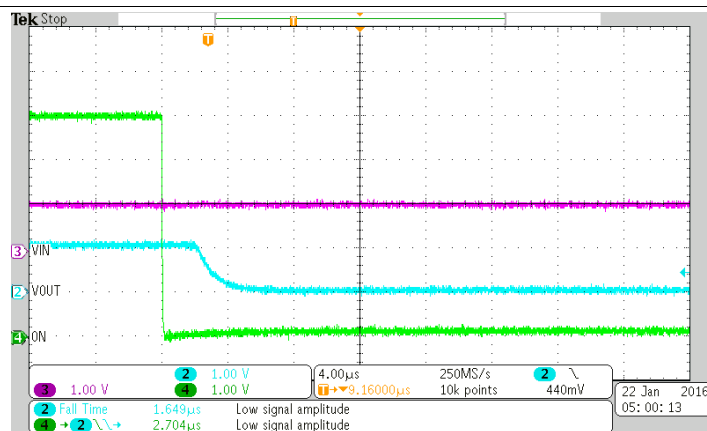
$V_{IN} = 1.8\text{ V}$   $C_{IN} = 1\text{ }\mu\text{F}$   $C_L = 0.1\text{ }\mu\text{F}$   
 $R_L = 10\text{ }\Omega$  QOD = Open

$V_{IN} = 1.0\text{ V}$   $C_{IN} = 1\text{ }\mu\text{F}$   $C_L = 0.1\text{ }\mu\text{F}$   
 $R_L = 10\text{ }\Omega$  CT = 1000 pF

**Figure 18. Fall Time ( $t_F$ ) at  $V_{IN} = 1.8\text{ V}$**

**Figure 19. Rise Time ( $t_R$ ) at  $V_{IN} = 1\text{ V}$**

## Typical AC Characteristics (continued)



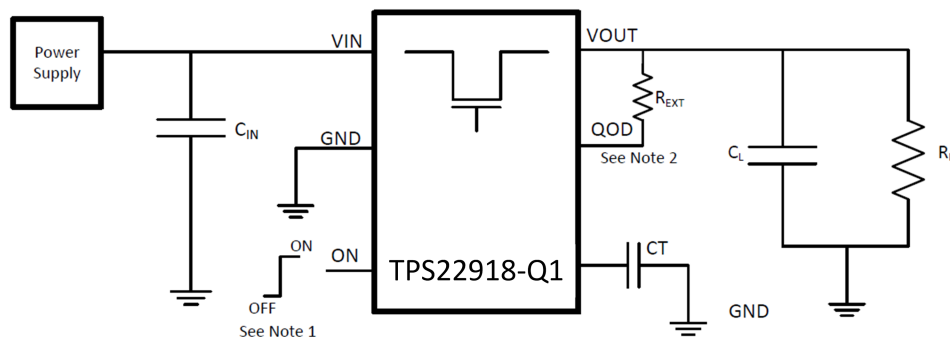
$V_{IN} = 1.0 \text{ V}$   
 $R_L = 10 \text{ } \Omega$

$C_{IN} = 1 \text{ } \mu\text{F}$   
QOD = Open

$C_L = 0.1 \text{ } \mu\text{F}$

**Figure 20. Fall Time ( $t_F$ ) at  $V_{IN} = 1 \text{ V}$**

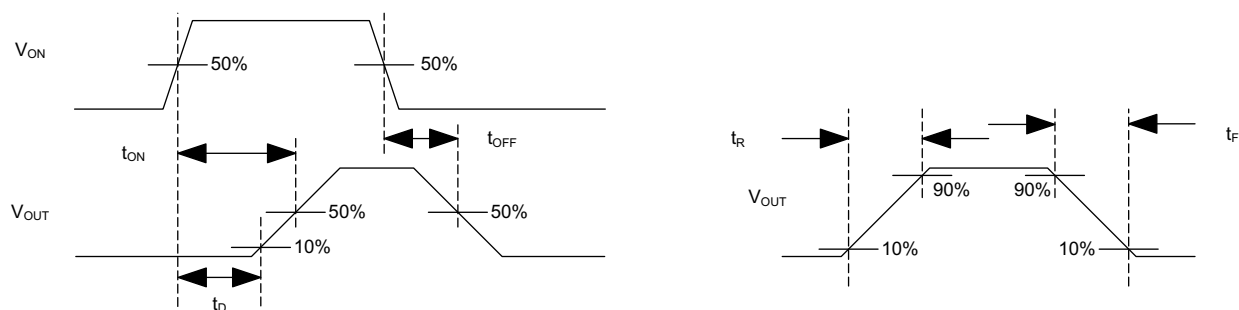
## 7 Parameter Measurement Information



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- (1) Rise and fall times of the control signal is 100 ns.
- (2) Turnoff times and fall times are dependent on the time constant at the load. For TPS22918-Q1, the internal pull-down resistance  $R_{PD}$  is enabled when the switch is disabled. The time constant is  $(R_{QOD} \parallel R_L) \times C_L$  where  $R_{QOD}$  equals  $R_{PD} + R_{EXT}$ .

**Figure 21. Test Circuit**



**Figure 22. Timing Waveforms**

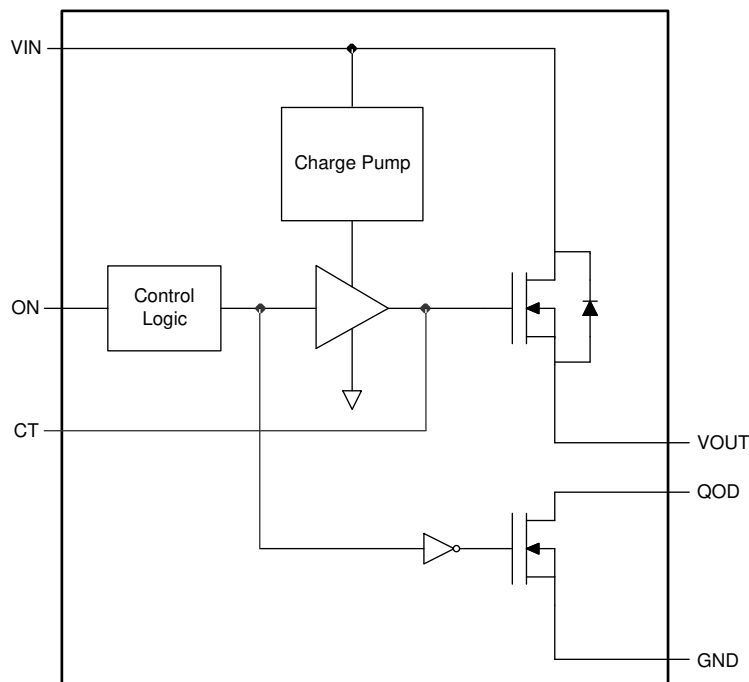
## 8 Detailed Description

### 8.1 Overview

The TPS22918-Q1 is a 5.5-V, 2-A load switch in a 6-pin SOT-23 package. To reduce voltage drop for low voltage and high current rails, the device implements a low resistance N-channel MOSFET which reduces the drop out voltage through the device.

The device has a configurable slew rate which helps reduce or eliminate power supply droop because of large inrush currents. Furthermore, the device features a QOD pin, which allows to configure the discharge rate of VOUT once the switch is disabled. During shutdown, the device has very low leakage currents, thereby reducing unnecessary leakages for downstream modules during standby. Integrated control logic, driver, charge pump, and output discharge FET eliminates the need for any external components, which reduces solution size and bill of materials (BOM) count.

### 8.2 Functional Block Diagram



### 8.3 Feature Description

#### 8.3.1 On and Off Control

The ON pin controls the state of 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 V or higher GPIO voltage. This pin cannot be left floating and must be driven either high or low for proper functionality.

#### 8.3.2 Quick Output Discharge (QOD)

The TPS22918-Q1 includes a QOD feature. The QOD pin can be configured in one of three valid ways:

- QOD pin shorted to VOUT pin. Using this method, the discharge rate after the switch becomes disabled is controlled with the value of the internal resistance  $R_{PD}$ . The value of this resistance is listed in the [Electrical Characteristics](#) table.
- QOD pin connected to VOUT pin using an external resistor  $R_{EXT}$ . After the switch becomes disabled, the discharge rate is controlled by the value of the total resistance of the QOD. To adjust the total QOD resistance, [Equation 1](#) can be used.

## Feature Description (continued)

$$R_{QOD} = R_{PD} + R_{EXT}$$

Where:

- $R_{QOD}$  is the total output discharge resistance
  - $R_{PD}$  is the internal pulldown resistance
  - $R_{EXT}$  is the external resistance placed between the VOUT and QOD pin. (1)
- QOD pin is unused and left floating. Using this method, there is no quick output discharge functionality, and the output remains floating after the switch is disabled.

The fall times of the device depend on many factors including the total resistance of the QOD,  $V_{IN}$ , and the output capacitance. When QOD is shorted to VOUT, the fall time changes over  $V_{IN}$  as the internal  $R_{PD}$  varies over  $V_{IN}$ . To calculate the approximate fall time of  $V_{OUT}$  for a given  $R_{QOD}$ , use [Equation 2](#) and [Table 1](#).

$$V_{CAP} = V_{IN} \times e^{-t/\tau}$$

Where:

- $V_{CAP}$  is the voltage across the capacitor (V)
- $t$  is the time since power supply removal (s)
- $\tau$  is the time constant equal to  $R_{QOD} \times C_L$  (2)

The fall times' dependency on  $V_{IN}$  becomes minimal as the QOD value increases with additional external resistance. See [Table 1](#) for QOD fall times.

**Table 1. QOD Fall Times**

| $V_{IN}$ (V) | FALL TIME ( $\mu$ s) 90% - 10%, $C_{IN} = 1 \mu$ F, $I_{OUT} = 0$ A, $V_{ON} = 0$ V <sup>(1)</sup> |                  |                   |                          |                  |                   |
|--------------|----------------------------------------------------------------------------------------------------|------------------|-------------------|--------------------------|------------------|-------------------|
|              | $T_A = 25^\circ\text{C}$                                                                           |                  |                   | $T_A = 85^\circ\text{C}$ |                  |                   |
|              | $C_L = 1 \mu$ F                                                                                    | $C_L = 10 \mu$ F | $C_L = 100 \mu$ F | $C_L = 1 \mu$ F          | $C_L = 10 \mu$ F | $C_L = 100 \mu$ F |
| 5.5          | 42                                                                                                 | 190              | 1880              | 40                       | 210              | 2150              |
| 5            | 43                                                                                                 | 200              | 1905              | 45                       | 220              | 2200              |
| 3.3          | 47                                                                                                 | 230              | 2150              | 50                       | 260              | 2515              |
| 2.5          | 58                                                                                                 | 300              | 2790              | 60                       | 345              | 3290              |
| 1.8          | 75                                                                                                 | 430              | 4165              | 80                       | 490              | 4950              |
| 1.2          | 135                                                                                                | 955              | 9910              | 135                      | 1035             | 10980             |
| 1            | 230                                                                                                | 1830             | 19625             | 210                      | 1800             | 19270             |

(1) Typical values with QOD shorted to VOUT

### 8.3.2.1 QOD when System Power is Removed

The adjustable QOD can be used to control the power down sequencing of a system even when the system power supply is removed. When the power is removed, the input capacitor discharges at  $V_{IN}$ . Past a certain  $V_{IN}$  level, the strength of the  $R_{PD}$  is reduced. If there is still remaining charge on the output capacitor, this results in longer fall times. For further information regarding this condition, see the [Shutdown Sequencing During Unexpected System Power Loss](#) section.

### 8.3.2.2 Internal QOD Considerations

Special considerations must be taken when using the internal  $R_{PD}$  by shorting the QOD pin to the VOUT pin. The internal  $R_{PD}$  is a pulldown resistance designed to quickly discharge a load after the switch has been disabled. Care must be used to ensure that excessive current does not flow through  $R_{PD}$  during discharge so that the maximum  $T_J$  of  $150^\circ\text{C}$  is not exceeded. When using only the internal  $R_{PD}$  to discharge a load, the total capacitive load must not exceed  $200 \mu$ F. Otherwise, an external resistor,  $R_{EXT}$ , must be used to ensure the amount of current flowing through  $R_{PD}$  is properly limited and the maximum  $T_J$  is not exceeded. To ensure the device is not damaged, the remaining charge from  $C_L$  must decay naturally through the internal QOD resistance and must not be driven.

### 8.3.3 Adjustable Rise Time (CT)

A capacitor to GND on the CT pin sets the slew rate for each channel. The capacitor to GND on the CT pin must be rated for 25 V and above. An approximate formula for the relationship between CT and slew rate is shown in Equation 3.

$$SR = 0.55 \times CT + 30$$

where

- SR is the slew rate (in  $\mu\text{s}/\text{V}$ )
- CT is the capacitance value on the CT pin (in pF)
- The units for the constant 30 are  $\mu\text{s}/\text{V}$ . The units for the constant 0.55 are  $\mu\text{s}/(\text{V} \times \text{pF})$

(3)

Equation 3 accounts for 10% to 90% measurement on  $V_{\text{OUT}}$  and does not apply for CT less than 100 pF. Use Table 2 to determine rise times for when CT is greater or equal to 100 pF.

Rise time can be calculated by multiplying the input voltage by the slew rate. Table 2 contains rise time values measured on a typical device.

**Table 2. Rise Time Table**

| CTx (pF) | RISE TIME ( $\mu\text{s}$ ) 10% - 90%, $C_L = 0.1 \mu\text{F}$ , $C_{\text{IN}} = 1 \mu\text{F}$ , $R_L = 10 \Omega$<br>Typical values at 25°C with a 25-V X7R 10% ceramic capacitor on CT |             |             |             |             |             |             |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|          | VIN = 5 V                                                                                                                                                                                  | VIN = 3.3 V | VIN = 2.5 V | VIN = 1.8 V | VIN = 1.5 V | VIN = 1.2 V | VIN = 1.0 V |
| 0        | 135                                                                                                                                                                                        | 95          | 75          | 60          | 50          | 45          | 40          |
| 220      | 650                                                                                                                                                                                        | 455         | 350         | 260         | 220         | 185         | 160         |
| 470      | 1260                                                                                                                                                                                       | 850         | 655         | 480         | 415         | 340         | 300         |
| 1000     | 2540                                                                                                                                                                                       | 1680        | 1300        | 960         | 810         | 660         | 560         |
| 2200     | 5435                                                                                                                                                                                       | 3580        | 2760        | 2020        | 1715        | 1390        | 1220        |
| 4700     | 12050                                                                                                                                                                                      | 7980        | 6135        | 4485        | 3790        | 3120        | 2735        |
| 10000    | 26550                                                                                                                                                                                      | 17505       | 13460       | 9790        | 8320        | 6815        | 5950        |

As the voltage across the capacitor approaches the capacitor rated voltage, the effective capacitance reduces. Depending on the dielectric material used, the voltage coefficient changes. See Table 3 for the recommended minimum voltage rating for the CT capacitor.

**Table 3. Recommended CT Capacitor Voltage Rating**

| VIN (V)      | RECOMMENDED CT CAPACITOR VOLTAGE RATING (V) <sup>(1)</sup> |
|--------------|------------------------------------------------------------|
| 1 V to 1.2 V | 10                                                         |
| 1.2 V to 4 V | 16                                                         |
| 4 V to 5.5 V | 20                                                         |

(1) If using  $V_{\text{IN}} = 1.2 \text{ V}$  or  $4 \text{ V}$ , it is recommended to use the higher voltage rating.

## 8.4 Device Functional Modes

Table 4 describes the connection of the VOUT pin depending on the state of the ON pin.

**Table 4. VOUT Connection**

| ON | QOD Configuration                               | TPS22918-Q1                                 |
|----|-------------------------------------------------|---------------------------------------------|
| L  | QOD pin connected to VOUT with $R_{\text{EXT}}$ | GND (via $R_{\text{EXT}} + R_{\text{PD}}$ ) |
| L  | QOD pin tied to VOUT directly                   | GND (via $R_{\text{PD}}$ )                  |
| L  | QOD pin left open                               | Open                                        |
| H  | Any valid QOD configuration                     | VIN                                         |

## 9 Application and Implementation

### NOTE

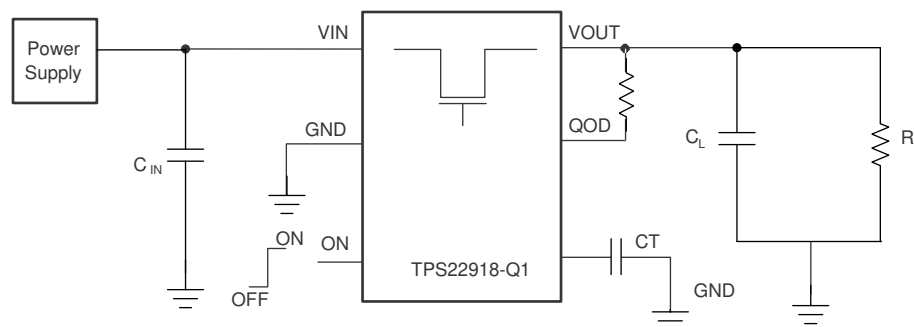
Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation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

### 9.1 Application Information

This section highlights some of the design considerations when implementing this device in various applications. A PSPICE model for this device is also available in the product page of this device on [www.ti.com](http://www.ti.com) (See the [器件支持](#) section for more information).

### 9.2 Typical Application

This typical application demonstrates how the TPS22918-Q1 can be used to power downstream modules.



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**Figure 23. Typical Application Schematic**

#### 9.2.1 Design Requirements

For this design example, use the input parameters listed in [Table 5](#).

**Table 5. Design Parameter**

| DESIGN PARAMETER                  | EXAMPLE VALUE |
|-----------------------------------|---------------|
| $V_{IN}$                          | 5 V           |
| Load current                      | 2 A           |
| $C_L$                             | 22 $\mu$ F    |
| $t_F$                             | 4 ms          |
| Maximum acceptable inrush current | 400 mA        |

## 9.2.2 Detailed Design Procedure

### 9.2.2.1 Input Capacitor ( $C_{IN}$ )

To limit the voltage drop on the input supply caused by transient in-rush currents when the switch turns on into a discharged load capacitor or short-circuit, a capacitor must be placed between VIN and GND. A 1  $\mu$ F 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.

### 9.2.2.2 Output Capacitor ( $C_L$ ) (Optional)

Because of the integrated body diode in the MOSFET, 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 VOUT to VIN. A  $C_{IN}$  to  $C_L$  ratio of 10 to 1 is recommended for minimizing  $V_{IN}$  dip caused by inrush currents during startup.

### 9.2.2.3 Shutdown Sequencing During Unexpected System Power Loss

Microcontrollers and processors often have a specific shutdown sequence in which power must be removed. Using the adjustable Quick Output Discharge function of the TPS22918-Q1, adding a load switch to each power rail can be used to manage the power down sequencing in the event of an unexpected system power loss (battery removal). To determine the QOD values for each load switch, first confirm the power down order of the device this is wished to power sequence. Be sure to check if there are voltage or timing margins that must be maintained during power down. Next, refer to [Table 1](#) in the [Quick Output Discharge \(QOD\)](#) section to determine appropriate  $C_{OUT}$  and  $R_{QOD}$  values for each power rail's load switch so that the load switches' fall times correspond to the order in which they need to be powered down. In the above example, make sure this power rail's fall time to be 4 ms. Using [Equation 2](#), to determine the appropriate  $R_{QOD}$  to achieve our desired fall time. Because fall times are measured from 90% of  $V_{OUT}$  to 10% of  $V_{OUT}$ , [Equation 2](#) becomes [Equation 4](#).

$$.5 V = 4.5 V \times e^{-(4 \text{ ms}) / (R \times (22 \mu\text{F}))} \quad (4)$$

$$R_{QOD} = 83.333 \Omega \quad (5)$$

Refer to [Figure 7](#),  $R_{PD}$  at  $V_{IN} = 5 V$  is approximately 25  $\Omega$ . Using [Equation 1](#), the required external QOD resistance can be calculated as shown in [Equation 6](#).

$$83.333 \Omega = 25 \Omega + R_{EXT} \quad (6)$$

$$R_{EXT} = 58.333 \Omega \quad (7)$$

[Figure 24](#) through [Figure 29](#) are scope shots demonstrating an example of the QOD functionality when power is removed from the device (both ON and VIN are disconnected simultaneously). The input voltage is decaying in all scope shots below.

- Initial  $V_{IN} = 3.3 V$
- QOD = Open, 500  $\Omega$ , or shorted to VOUT
- $C_L = 1 \mu\text{F}$ , 10  $\mu\text{F}$
- $V_{OUT}$  is left floating

NOTE:  $V_{IN}$  may appear constant in some figures. This is because the time scale of the scope shot is too small to show the decay of  $C_{IN}$ .

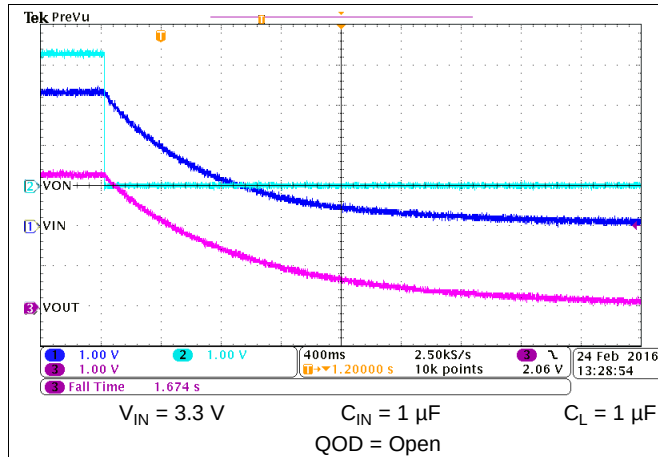


Figure 24. Fall Time ( $t_F$ ) at  $V_{IN} = 3.3\text{ V}$

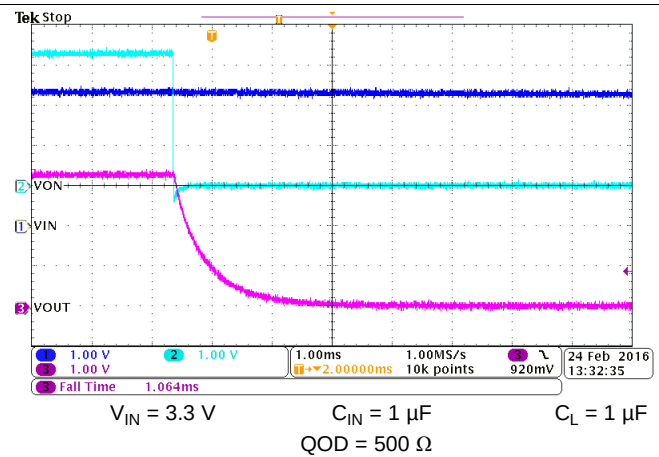


Figure 25. Fall Time ( $t_F$ ) at  $V_{IN} = 3.3\text{ V}$

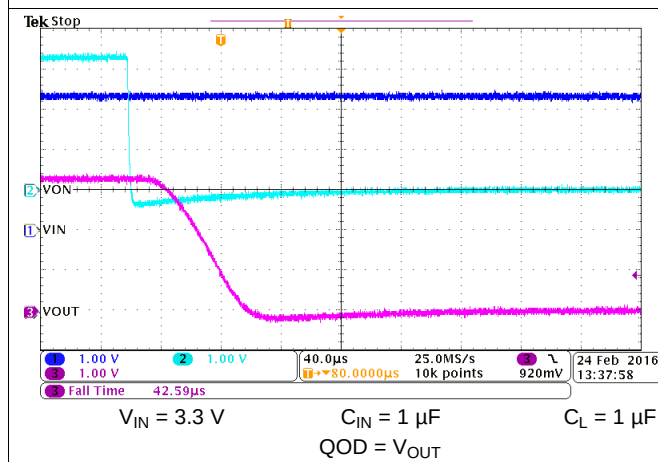


Figure 26. Fall Time ( $t_F$ ) at  $V_{IN} = 3.3\text{ V}$

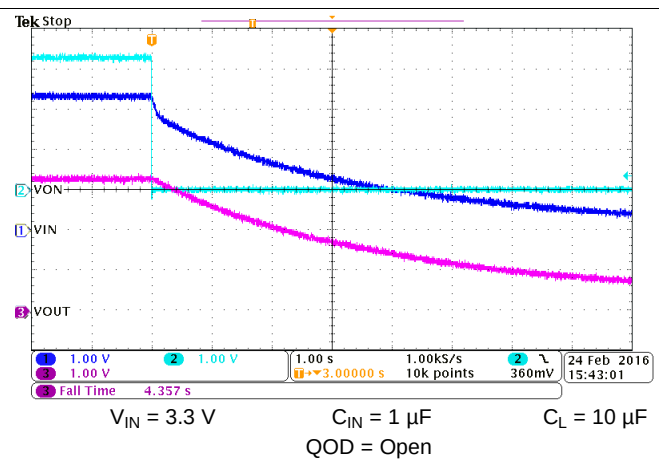


Figure 27. Fall Time ( $t_F$ ) at  $V_{IN} = 3.3\text{ V}$

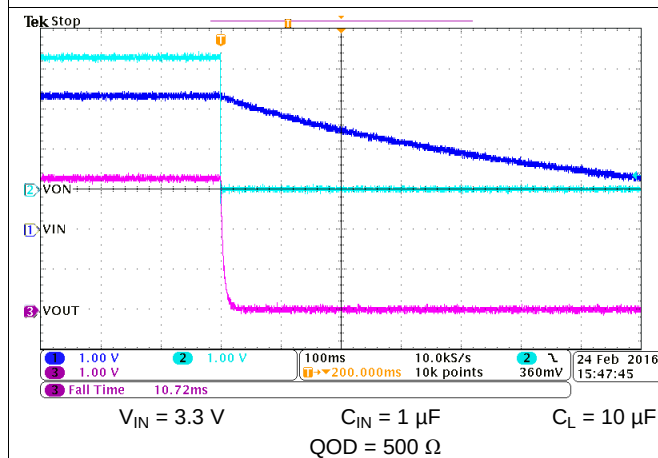


Figure 28. Fall Time ( $t_F$ ) at  $V_{IN} = 3.3\text{ V}$

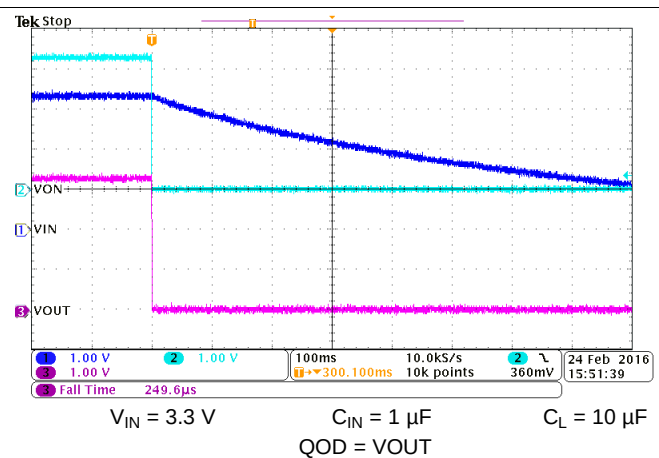


Figure 29. Fall Time ( $t_F$ ) at  $V_{IN} = 3.3\text{ V}$

#### 9.2.2.4 $V_{IN}$ to $V_{OUT}$ Voltage Drop

The  $V_{IN}$  to  $V_{OUT}$  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  $V_{IN}$  conditions of the device. Refer to the  $R_{ON}$  specification of the device in the [Electrical Characteristics](#) table. When the  $R_{ON}$  of the device is determined based upon the  $V_{IN}$  conditions, use [Equation 8](#) to calculate the  $V_{IN}$  to  $V_{OUT}$  voltage drop.

$\Delta V$  is the  $I_{LOAD} \times R_{ON}$

where

- $\Delta V$  is the voltage drop from  $V_{IN}$  to  $V_{OUT}$
- $I_{LOAD}$  is the load current
- $R_{ON}$  is the 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. (8)

### 9.2.2.5 Inrush Current

Use Equation 9 to determine how much inrush current is caused by the  $C_L$  capacitor.

$$I_{INRUSH} = C_L \times \frac{dV_{OUT}}{dt}$$

where

- $I_{INRUSH}$  is the amount of inrush caused by  $C_L$
- $C_L$  is the capacitance on  $V_{OUT}$
- $dt$  is the output voltage rise time during the ramp up of  $V_{OUT}$  when the device is enabled
- $dV_{OUT}$  is the change in  $V_{OUT}$  during the ramp up of  $V_{OUT}$  when the device is enabled

The appropriate rise time can be calculated using the design requirements and the inrush current equation. As the rise time (measured from 10% to 90% of  $V_{OUT}$ ) is calculated, this is accounted in the  $dV_{OUT}$  parameter (80% of  $V_{OUT} = 4$  V) as shown in Equation 10.

$$400 \text{ mA} = 22 \mu\text{F} \times 4 \text{ V} / dt \quad (10)$$

$$dt = 220 \mu\text{s} \quad (11)$$

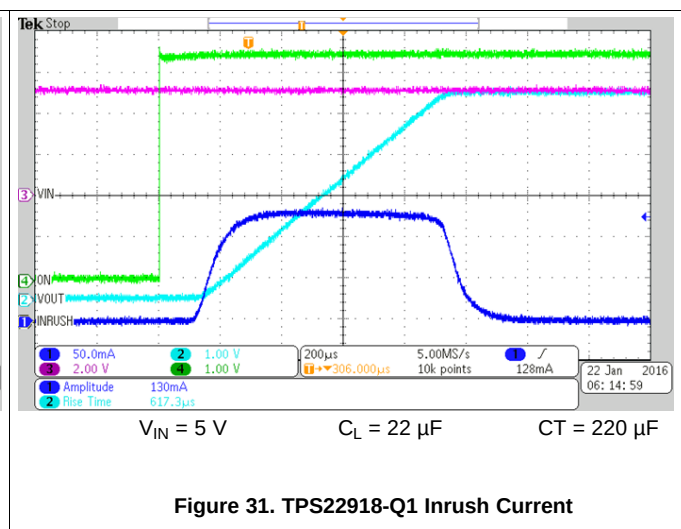
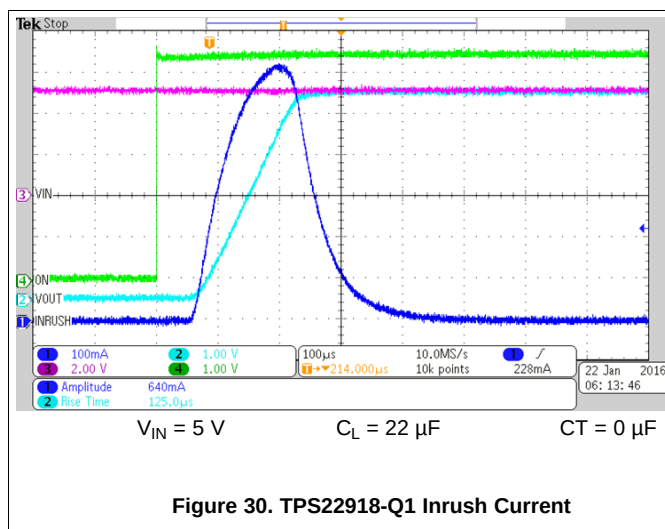
To ensure an inrush current of less than 400 mA, choose a CT value that yields a rise time of more than 220  $\mu\text{s}$ . Referring to the Table 2 at  $V_{IN} = 5$  V,  $CT = 220 \mu\text{F}$  provides a typical rise time of 650  $\mu\text{s}$ . Adding this rise time and voltage into Equation 9, yields Equation 12.

$$I_{Inrush} = 22 \mu\text{F} \times 4 \text{ V} / 650 \mu\text{s} \quad (12)$$

$$I_{Inrush} = 135 \text{ mA} \quad (13)$$

This inrush current can be seen in the Application Curves section. An appropriate  $C_L$  value must be placed on  $V_{OUT}$  such that the  $I_{MAX}$  and  $I_{PLS}$  specifications of the device are not violated.

### 9.2.3 Application Curves



## 10 Power Supply Recommendations

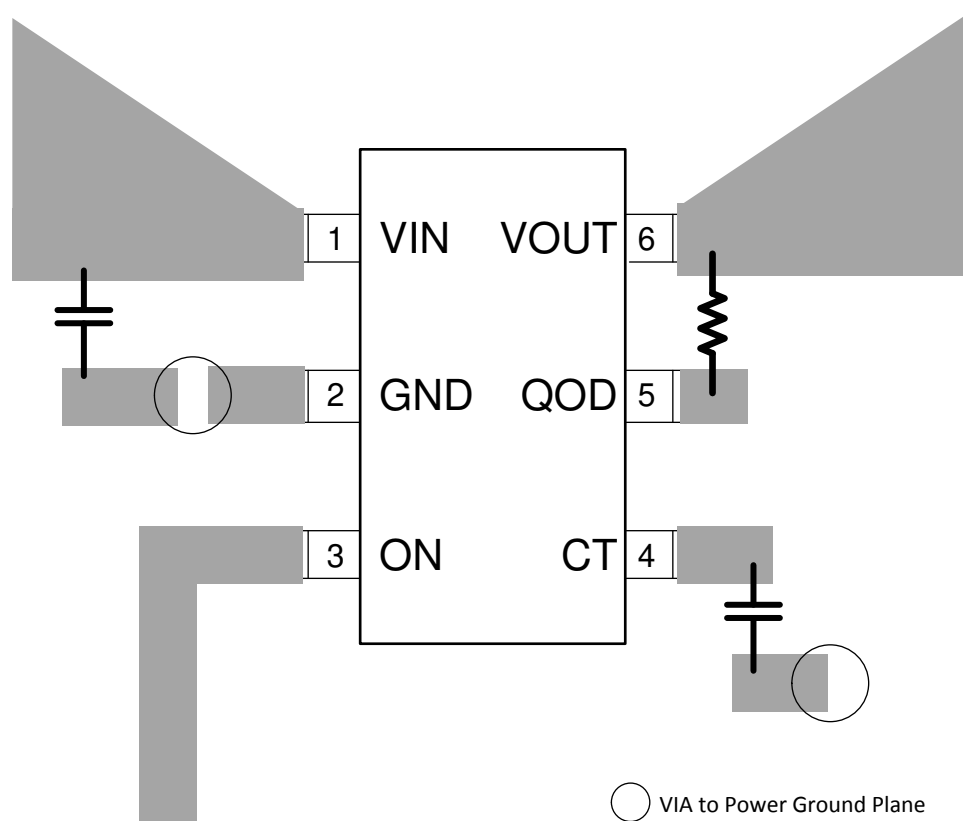
The TPS22918-Q1 is designed to operate from a VIN range of 1 V to 5.5 V. This supply must be well regulated and placed as close to the device terminal as possible with the recommended 1- $\mu$ F bypass capacitor. If the supply is located more than a few inches from the device terminals, additional bulk capacitance may be required in addition to the ceramic bypass capacitors. If additional bulk capacitance is required, an electrolytic, tantalum, or ceramic capacitor of 1  $\mu$ F may be sufficient.

## 11 Layout

### 11.1 Layout Guidelines

- VIN and VOUT traces must be as short and wide as possible to accommodate for high current.
- The VIN pin must be bypassed to ground with low ESR ceramic bypass capacitors. The typical recommended bypass capacitance is 1  $\mu$ F ceramic with X5R or X7R dielectric. This capacitor must be placed as close to the device pins as possible.
- The VOUT pin must be bypassed to ground with low ESR ceramic bypass capacitors. The typical recommended bypass capacitance is one-tenth of the VIN bypass capacitor of X5R or X7R dielectric rating. This capacitor must be placed as close to the device pins as possible.

### 11.2 Layout Example



**Figure 32. Recommended Board Layout**

### 11.3 Thermal Considerations

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

## Thermal Considerations (接下页)

The maximum IC junction temperature must be restricted to 150°C under normal operating conditions. To calculate the maximum allowable dissipation,  $P_{D(max)}$  for a given output current and ambient temperature, use [Equation 14](#).

$$P_{D(MAX)} = \frac{T_{J(MAX)} - T_A}{\theta_{JA}} \quad (14)$$

Where:

$P_{D(MAX)}$  is the maximum allowable power dissipation

$T_{J(MAX)}$  is the maximum allowable junction temperature (150°C for the TPS22918-Q1)

$T_A$  is the ambient temperature of the device

$\theta_{JA}$  is the junction to air thermal impedance. See the [Thermal Information](#) table. This parameter is highly dependent upon board layout.

## 12 器件和文档支持

### 12.1 器件支持

#### 12.1.1 开发支持

关于 TPS22918 PSpice 瞬态模型，请参见 [SLVMBI6](#)。

### 12.2 文档支持

#### 12.2.1 相关文档

请参阅如下相关文档：

- 《TPS22918 5.5V、2A、导通电阻为 50mΩ 的负载开关评估模块》，[SLVUAP0](#)
- 《负载开关功耗之静态电流与关断电流》，[SLVA757](#)
- 《负载开关导通电阻基础知识》，[SLVA771](#)

### 12.3 接收文档更新通知

要接收文档更新通知，请导航至 [TI.com.cn](#) 上的器件产品文件夹。单击右上角的通知我进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

### 12.4 社区资源

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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### 12.5 商标

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### 12.6 静电放电警告



ESD 可能会损坏该集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理措施和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

### 12.7 Glossary

[SLYZ022](#) — *TI Glossary*.

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

## 13 机械、封装和可订购信息

以下页面包含机械、封装和可订购信息。这些信息是指定器件的最新可用数据。数据如有变更，恕不另行通知，且不会对此文档进行修订。如需获取此数据表的浏览器版本，请查阅左侧的导航栏。

## PACKAGING INFORMATION

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| TPS22918TDBVRQ1  | ACTIVE        | SOT-23       | DBV                | 6    | 3000           | RoHS & Green    | SN                                   | Level-3-260C-168 HR  | -40 to 105   | 13NW                    | <a href="#">Samples</a> |
| TPS22918TDBVTQ1  | ACTIVE        | SOT-23       | DBV                | 6    | 250            | RoHS & Green    | SN                                   | Level-3-260C-168 HR  | -40 to 105   | 13NW                    | <a href="#">Samples</a> |

<sup>(1)</sup> 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.

<sup>(2)</sup> **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.

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

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

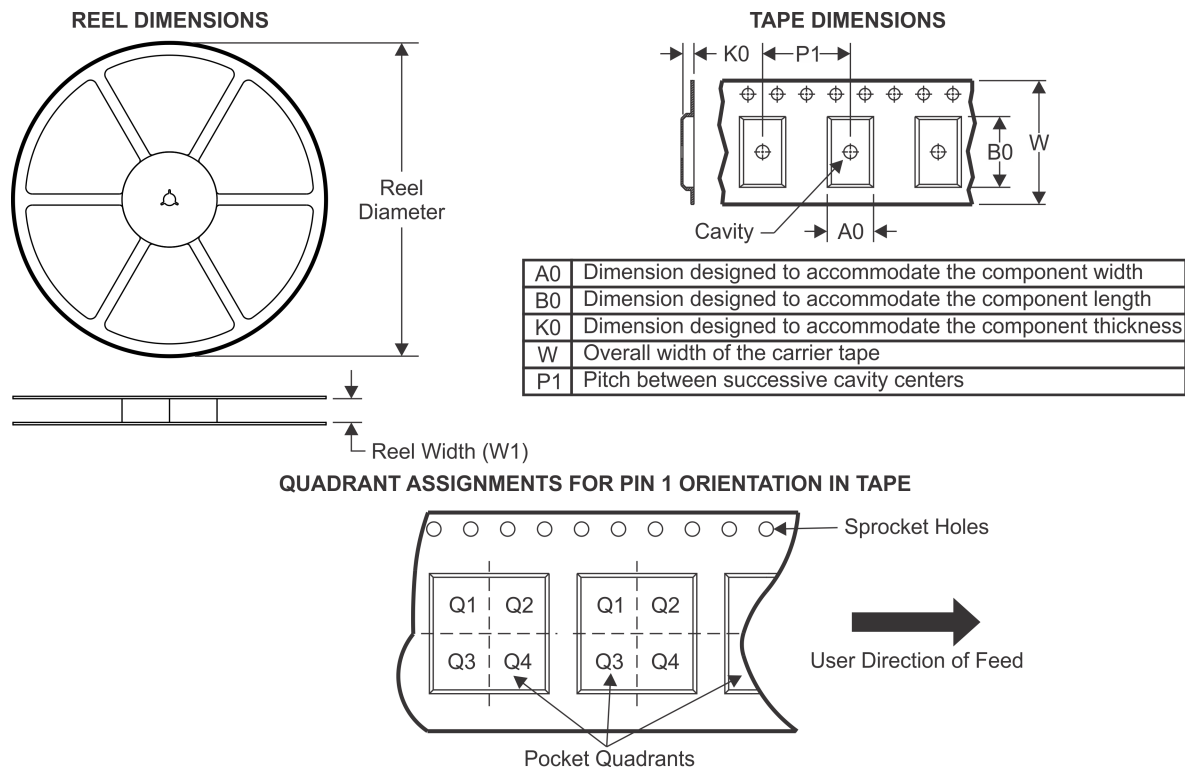
<sup>(5)</sup> Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

<sup>(6)</sup> 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.

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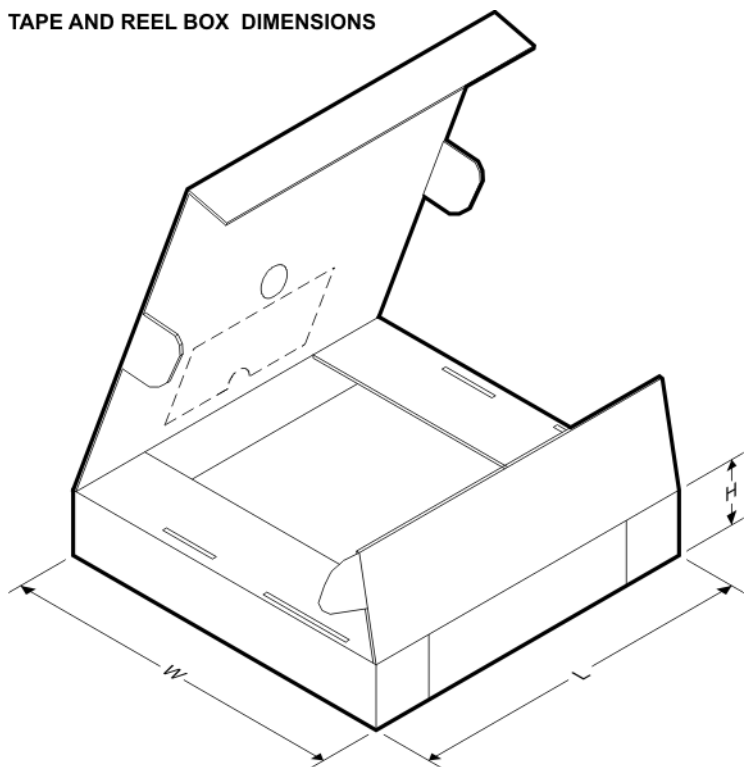


**TAPE AND REEL INFORMATION**


\*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 |
|-----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TPS22918TDBVRQ1 | SOT-23       | DBV             | 6    | 3000 | 178.0              | 9.0                | 3.23    | 3.17    | 1.37    | 4.0     | 8.0    | Q3            |
| TPS22918TDBVTQ1 | 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) |
|-----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TPS22918TDBVRQ1 | SOT-23       | DBV             | 6    | 3000 | 190.0       | 190.0      | 30.0        |
| TPS22918TDBVTQ1 | SOT-23       | DBV             | 6    | 250  | 190.0       | 190.0      | 30.0        |

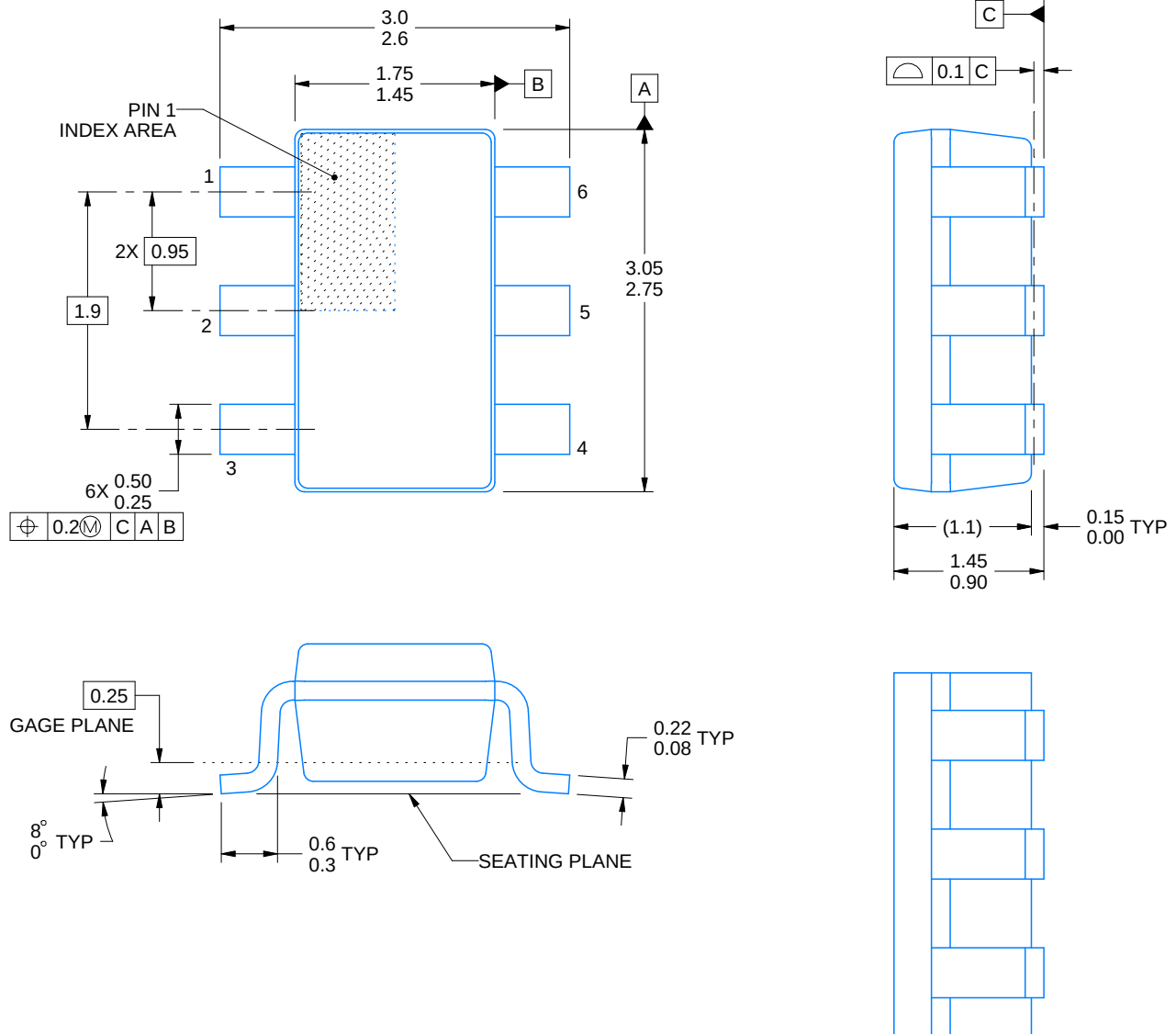
DBV0006A



## PACKAGE OUTLINE

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



ALTERNATIVE PACKAGE SINGULATION VIEW

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### NOTES:

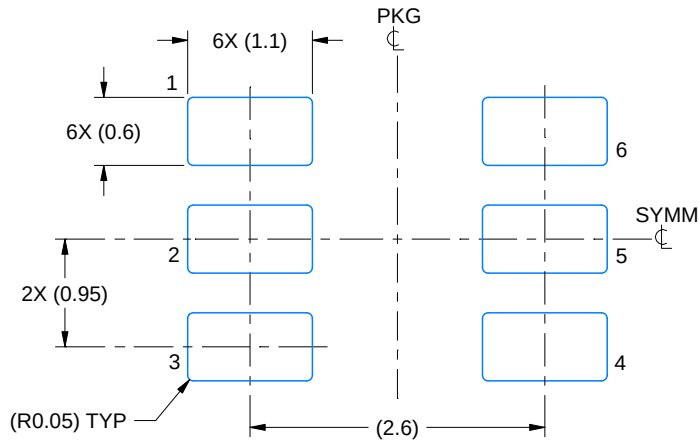
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed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

# EXAMPLE BOARD LAYOUT

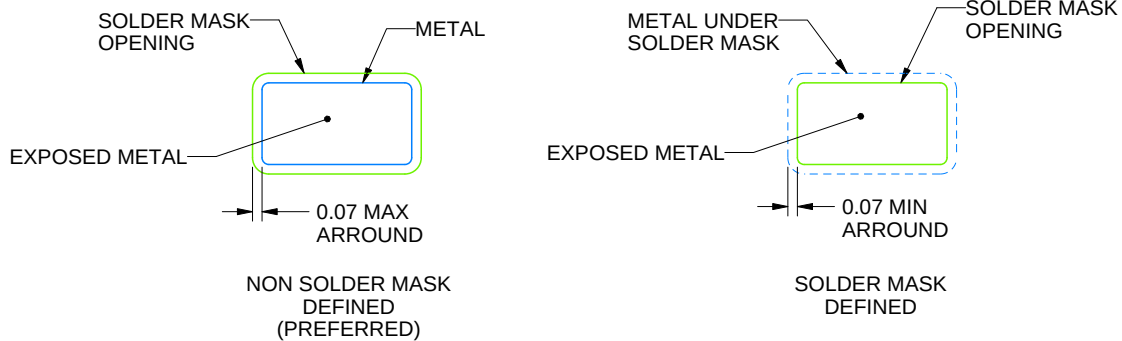
DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:15X



SOLDER MASK DETAILS

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NOTES: (continued)

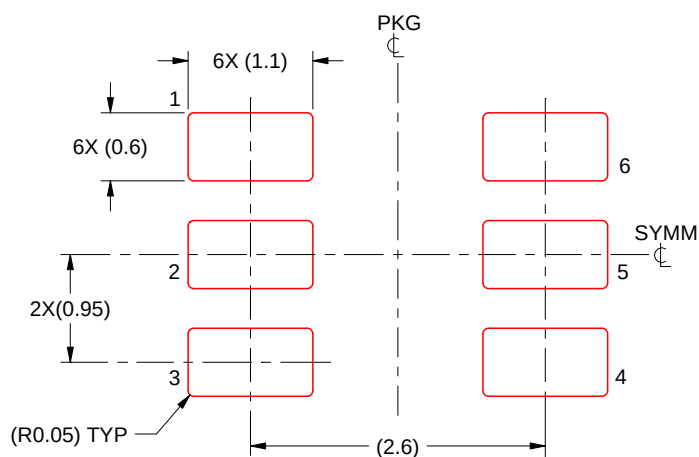
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



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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