

双通道、限流、配电开关

 查询样品: [TPS2052C](#), [TPS2062C](#), [TPS2062C-2](#), [TPS2066C](#), [TPS2066C-2](#), [TPS2060C](#), [TPS2064C](#), [TPS2064C-2](#), [TPS2002C](#), [TPS2003C](#)

特性

- 双电源开关系列
- **0.5A, 1A, 1.5A, 2A** 的额定电流
- 准确度为 $\pm 20\%$ 的电流限值容限
- 快速过流响应 - **2 μ s** (典型值)
- **70m Ω** (典型值) 高侧 N 通道金属氧化物半导体场效应晶体管 (MOSFET)
- 工作电压范围: **4.5V 至 5.5V**
- 去尖峰脉冲故障报告 (**FLT \bar{x}**)
- 所选的具有 (TPS20xxC) 和不具有 (TPS20xxC-2) 输出放电的部件

- 反向电流阻断
- 内置软启动
- 与现有的 **TI 开关系列产品** 引脚到引脚相对应
- 环境温度范围: **-40°C 至 85°C**

应用范围

- **USB** 端口/集线器、笔记本、台式机
- 高清数字电视
- 机顶盒
- 短路保护功能

说明

TPS20xxC 和 TPS20xxC-2 双配电开关系列产品用于诸如 USB 等有可能遇到高电容负载和短路的应用。这一系列产品为电流介于 0.5A 和 2A 之间的应用提供具有固定电流限值阈值的多种器件。

当输出负载超过电流限值阈值时, TPS20xxC 和 TPS20xxC-2 通过运行在恒定电流模式下来将输出电流限制在安全的水平上。这就在所有条件下提供了一个可预计的故障电流。当输出被短接时, 快速过载响应时间减轻了主 5V 电源提供稳压电源的负担。为了大大减少打开和关闭期间的电流冲击, 电源开关的上升和下降次数受到控制。

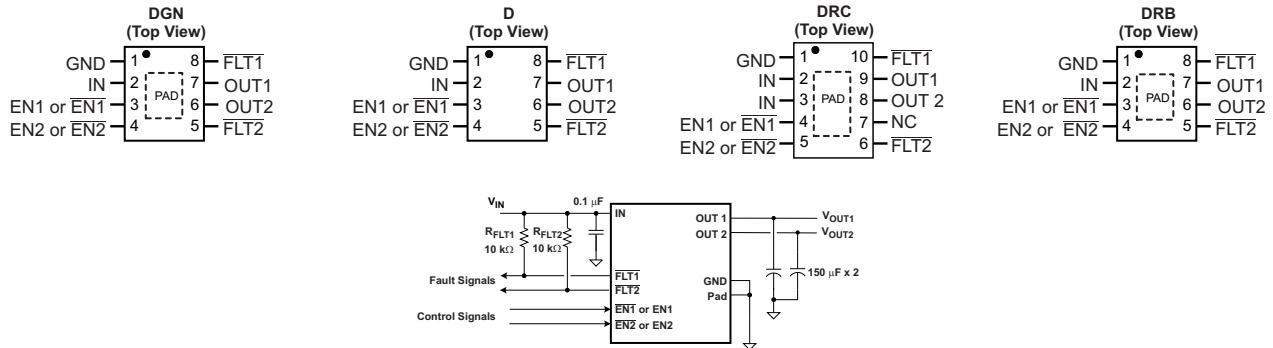


Figure 1. TYPICAL APPLICATION

Table 1. Devices

| RATED CURRENT | DEVICES | STATUS | | | |
|---------------|----------------------|--------------------|-------------------|-------------------|--------------|
| | | MSOP-8 (PowerPad™) | SON -10 | SOIC-8 | SON-8 |
| 0.5 A | TPS2052C | Active | — | — | — |
| 1 A | TPS2062C and 66C | Active and Active | — | Active and Active | — |
| 1 A | TPS2062C-2 and 66C-2 | — and Active | — | — | Active and — |
| 1.5 A | TPS2060C and 64C | Active and Active | — | — | — |
| 1.5 A | TPS2064C-2 | Active | — | — | — |
| 2 A | TPS2002C and 03C | — | Active and Active | — | — |



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PowerPAD is a trademark of Texas Instruments.



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.

DEVICE INFORMATION⁽¹⁾⁽²⁾

| MAXIMUM OPERATING CURRENT | ENABLE | OUTPUT DISCHARGE | BASE PART NUMBER | PACKAGE DEVICES and MARKING ⁽³⁾ | | | |
|---------------------------|--------|------------------|------------------|--------------------------------------------|------------------------|--------------|-------------|
| | | | | SOIC-8 (D) | MSOP-8 (DGN) PowerPAD™ | SON-10 (DRC) | SON-8 (DRB) |
| 0.5 | High | Y | TPS2052C | – | PYNI | – | – |
| 1 | Low | Y | TPS2062C | 2062C | VRBQ | – | – |
| 1 | Low | N | TPS2062C-2 | – | – | – | PYVI |
| 1 | High | Y | TPS2066C | 2066C | VRDQ | – | – |
| 1 | High | N | TPS2066C-2 | – | PYUI | – | – |
| 1.5 | Low | Y | TPS2060C | – | VRAQ | – | – |
| 1.5 | High | Y | TPS2064C | – | VRCQ | – | – |
| 1.5 | High | N | TPS2064C-2 | – | PYTI | – | – |
| 2 | Low | Y | TPS2002C | – | – | VREQ | – |
| 2 | High | Y | TPS2003C | – | – | VRFQ | – |

- (1) For the most current packaging and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.
- (2) Package code for MSOP-8 is “DGN” and for SON is “DRC”.
- (3) “–” indicates the device is not available in this package.

ABSOLUTE MAXIMUM RATINGS⁽¹⁾⁽²⁾

| | | VALUE | | UNIT |
|---------------------------------------------------------------------------------------|---------------------------------------------|--------------------|--------|------|
| | | MIN | MAX | |
| Voltage range on IN, OUTx, ENx or \overline{ENx} , \overline{FLTx} ⁽³⁾ | | –0.3 | 6 | V |
| Voltage range from IN to OUT | | –6 | 6 | V |
| Maximum junction temperature, T _J | | Internally Limited | | °C |
| ESD | Human Body Model | | 2 | kV |
| | Charged Device Model | | 500 | V |
| | IEC 61000-4-2, Contact / Air ⁽⁴⁾ | | 8 / 15 | kV |

- (1) Absolute maximum ratings apply over recommended junction temperature range.
- (2) All voltages are with respect to GND unless otherwise noted.
- (3) See [INPUT AND OUTPUT CAPACITANCE](#) section.
- (4) V_{OUT} was surged on a PCB with input and output bypassing per [Figure 1](#) (except input capacitor was 22 μF) with no device failure.

THERMAL INFORMATION

| THERMAL METRIC ⁽¹⁾⁽²⁾ | | D | DGN | DRC | DRB | UNITS |
|----------------------------------|----------------------------------------------|--------|--------|---------|--------|-------|
| | | 8 PINS | 8 PINS | 10 PINS | 8-PINS | |
| θ _{JA} | Junction-to-ambient thermal resistance | 129.9 | 57.2 | 45.4 | 50.8 | °C/W |
| θ _{JCtop} | Junction-to-case (top) thermal resistance | 83.5 | 110.5 | 58 | 60.3 | |
| θ _{JB} | Junction-to-board thermal resistance | 70.4 | 60.7 | 21.1 | 26.3 | |
| ψ _{JT} | Junction-to-top characterization parameter | 36.6 | 7.8 | 1.9 | 2.1 | |
| ψ _{JB} | Junction-to-board characterization parameter | 66.9 | 24 | 21.3 | 26.5 | |
| θ _{JCbot} | Junction-to-case (bottom) thermal resistance | n/a | 14.3 | 9.1 | 9.8 | |

- (1) 有关传统和新的热 度量的更多信息，请参阅 [IC 封装热量应用报告](#)，[SPRA953](#)。
- (2) 有关该器件的基于印刷电路板 (PCB) 覆铜区的热评估信息，请参阅 [TI PCB 热应力 计算](#)。

RECOMMENDED OPERATING CONDITIONS

| | | MIN | NOM | MAX | UNIT |
|--------------|----------------------------------------|---------------------------------|-----|-----|------|
| V_{IN} | Input voltage, IN | 4.5 | | 5.5 | V |
| V_{Enable} | Input voltage, ENx or \overline{ENx} | 0 | | 5.5 | |
| I_{OUTx} | Continuous output current, OUTx | TPS2052C | | 0.5 | A |
| | | TPS2062C, 62C-2, 66C, and 66C-2 | | 1 | |
| | | TPS2060C, 64C and 64C-2 | | 1.5 | |
| | | TPS2002C and 03C | | 2 | |
| T_J | Operating junction temperature | -40 | | 125 | °C |
| I_{FLTx} | Sink current into \overline{FLTx} | 0 | | 5 | mA |

ELECTRICAL CHARACTERISTICS⁽¹⁾
 $T_J = T_A = 25^\circ\text{C}$, $V_{IN} = 5\text{ V}$, $V_{ENx} = V_{IN}$ or $V_{\overline{ENx}} = 0\text{ V}$ (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | | MIN | TYP | MAX | UNIT | |
|---------------------------------------------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------------|------|------|------|---|
| POWER SWITCH | | | | | | | | |
| $r_{DS(on)}$ | On-resistance | TPS2052C (0.5 A) | | DGN | 70 | 84 | mΩ | |
| | | TPS2052C (0.5 A) | | DGN | 70 | 95 | | |
| | | -40°C ≤ (T _J , T _A) ≤ 85°C | | | | | | |
| | | TPS2062C, 66C, and 66C-2 (1 A) | | DGN | 70 | 84 | | |
| | | TPS2062C, 66C, and 66C-2 (1 A), | | DGN | 70 | 95 | | |
| | | -40°C ≤ (T _J , T _A) ≤ 85°C | | | | | | |
| | | TPS2062C and 66C (1 A) | | D | 90 | 108 | | |
| | | TPS2062C and 66C (1 A), | | D | 90 | 122 | | |
| | | -40°C ≤ (T _J , T _A) ≤ 85°C | | | | | | |
| | | TPS2062C-2 (1 A) | | DRB | 73 | 87 | | |
| | | TPS2062C-2 (1 A) | | DRB | 73 | 101 | | |
| -40°C ≤ (T _J , T _A) ≤ 85°C | | | | | | | | |
| TPS2060C, 64C, and 64C-2 (1.5 A) | | | 70 | 84 | | | | |
| TPS2060C, 64C, and 64C-2 (1.5 A), | | | 70 | 95 | | | | |
| -40°C ≤ (T _J , T _A) ≤ 85°C | | | | | | | | |
| TPS2002C and 03C (2 A) | | | 70 | 84 | | | | |
| TPS2002C and 03C (2 A), | | | 70 | 95 | | | | |
| -40°C ≤ (T _J , T _A) ≤ 85°C | | | | | | | | |
| CURRENT LIMIT | | | | | | | | |
| I_{OS} | Current limit, See Figure 7 | TPS2052C (0.5 A) | | 0.75 | 1 | 1.25 | A | |
| | | TPS2062C, 62C-2, 66C, and 66C-2 (1 A) | | 1.28 | 1.61 | 1.94 | | |
| | | TPS2060C, 64C, and 64C-2 (1.5 A) | | 1.83 | 2.29 | 2.75 | | |
| | | TPS2002C and 03C (2 A) | | 2.55 | 3.15 | 3.77 | | |
| t_{IOS} | Short-circuit response time | $V_{IN} = 5\text{ V}$ (see Figure 6), One-half full load → $R_{(SHORT)} = 50\text{ m}\Omega$, Measure from application to when current falls below 120% of final value | | | 2 | | μs | |
| SUPPLY CURRENT | | | | | | | | |
| I_{SD} | Supply current, device disabled | $I_{(OUTx)} = 0\text{ mA}$ | | | 0.01 | 1 | μA | |
| I_{S1E} | Supply current, single switch enabled | $I_{(OUTx)} = 0\text{ mA}$ | | | 60 | 75 | | |
| I_{S2E} | Supply current, both switches enabled | $I_{(OUTx)} = 0\text{ mA}$ | | | 100 | 120 | | |
| I_{LKG} | Leakage current | $V_{OUT} = 0\text{ V}$, $V_{IN} = 5.5\text{ V}$, disabled, measured I_{VIN} | | TPS20xxC-2 | 0.05 | 1 | | |
| | Reverse leakage current | $V_{OUT} = 5.5\text{ V}$, $V_{IN} = 0\text{ V}$, measured I_{OUTx} | | | 0.15 | 1 | | |
| OUTPUT DISCHARGE | | | | | | | | |
| R_{PD} | Output pull-down resistance ⁽²⁾ | $V_{IN} = V_{(OUTx)} = 5\text{ V}$, disabled | | TPS20xxC | 400 | 470 | 600 | Ω |

(1) Pulsed testing techniques maintain junction temperature approximately equal to ambient temperature

(2) These parameters are provided for reference only, and do not constitute part of TI's published device specifications for purposes of TI's product warranty.

ELECTRICAL CHARACTERISTICS

–40°C ≤ (T_J = T_A) ≤ 125°C, 4.5 V ≤ V_{IN} ≤ 5.5 V, V_{ENx} = V_{IN} or V_{ENx} = 0 V, I_{OUTx} = 0 A, typical values are at 5 V and 25°C (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS ⁽¹⁾ | | MIN | TYP | MAX | UNIT |
|-----------------------------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------|------|------|------|
| POWER SWITCH | | | | | | | |
| r _{DS(on)} | On-resistance | TPS2052C (0.5 A) | DGN | | 70 | 112 | mΩ |
| | | TPS2062C, 66C, and 66C-2 (1 A) | DGN | | 70 | 112 | |
| | | TPS2062C and 66C (1 A) | D | | 90 | 135 | |
| | | TPS2062C-2 (1 A) | DRB | | 73 | 115 | |
| | | TPS2060C, 64C, and 64C-2 (1.5 A) | DGN | | 70 | 112 | |
| | | TPS2002C and 03C (2 A) | DRC | | 70 | 112 | |
| ENABLE INPUT (ENx or ENx̄) | | | | | | | |
| V _{IH} | ENx (ENx̄), High-level input voltage | 4.5 V ≤ V _{IN} ≤ 5.5 V | | 2 | | | V |
| V _{IL} | ENx (ENx̄), Low-level input Voltage | | | | | 0.8 | |
| | Hysteresis | V _{IN} = 5 V | | | 0.14 | | |
| | Leakage current | V _{ENx} = 5.5 V or 0 V, V _{ENx} = 0 V or 5.5 V | | -1 | 0 | 1 | μA |
| t _{on} | Turn-on time ⁽²⁾ | V _{IN} = 5 V, C _L = 1 μF, R _L = 100 Ω, ENx ↑ or ENx ↓, See Figure 4 , Figure 5 , and Figure 2 | | | | | ms |
| | | 1 A, 1.5 A, 2 A Rated | | 1.4 | 1.9 | 2.4 | |
| t _{off} | Turn-off time ⁽²⁾ | V _{IN} = 5 V, C _L = 1 μF, R _L = 100 Ω, ENx ↑ or ENx ↓, See Figure 4 , Figure 5 , and Figure 2 | | | | | ms |
| | | 1 A, 1.5 A, 2 A Rated | | 1.95 | 2.60 | 3.25 | |
| t _r | Rise time, output ⁽²⁾ | C _L = 1 μF, R _L = 100 Ω, see Figure 3 | | | | | ms |
| | | 1 A, 1.5 A, 2 A Rated | | 0.58 | 0.82 | 1.15 | |
| t _f | Fall time, output ⁽²⁾ | C _L = 1 μF, R _L = 100 Ω, see Figure 3 | | | | | ms |
| | | 1 A, 1.5 A, 2 A Rated | | 0.33 | 0.47 | 0.66 | |
| CURRENT LIMIT | | | | | | | |
| I _{OS} | Current-limit, See Figure 7 | TPS2052C (0.5A) | | 0.7 | 1 | 1.3 | A |
| | | TPS2062C, 62C-2, 66C, and 66C-2 (1 A) | | 1.12 | 1.61 | 2.10 | |
| | | TPS2060C, 64C, and 64C-2 (1.5 A) | | 1.72 | 2.29 | 2.86 | |
| | | TPS2002C and 03C (2 A) | | 2.35 | 3.15 | 3.95 | |
| t _{IOS} | Short-circuit response time | V _{IN} = 5 V (see Figure 6), One-half full load → R _(SHORT) = 50 mΩ, measure from application to when current falls below 120% of final value | | | 2 | | μs |
| SUPPLY CURRENT | | | | | | | |
| I _{SD} | Supply current, switch disabled | Standard conditions, I _(OUTx) = 0 mA | | | 0.01 | 10 | μA |
| I _{S1E} | Supply current, single switch enabled | Standard conditions, I _(OUTx) = 0 mA | | | | 90 | |
| I _{S2E} | Supply current, both switches enabled | Standard conditions, I _(OUTx) = 0 mA | | | | 150 | |
| I _{LKG} | Leakage current | V _{OUT} = 0 V, V _{IN} = 5.5 V, disabled, measured I _{VIN} | TPS20xxC-2 | | 0.05 | | |
| | Reverse leakage current | V _{OUT} = 5.5 V, V _{IN} = 0 V, measured I _(OUTx) | | | 0.20 | | |
| UNDERVOLTAGE LOCKOUT | | | | | | | |
| UVLO | Low-level input voltage, IN | VIN rising | | 3.4 | | 4.0 | V |
| | Hysteresis, IN | | | | 0.14 | | V |
| FLTx | | | | | | | |
| | Output low voltage, FLTx | I _(FLTx) = 1 mA | | | | 0.2 | V |
| | Off-state leakage | V _(FLTx) = 5.5 V | | | | 1 | μA |
| | FLTx deglitch ⁽²⁾ | FLTx overcurrent assertion and deassertion | | 7 | 10 | 13 | ms |

(1) Pulsed testing techniques maintain junction temperature approximately equal to ambient temperature

(2) These parameters are provided for reference only, and do not constitute part of TI's published device specifications for purposes of TI's product warranty.

ELECTRICAL CHARACTERISTICS (continued)

$-40^{\circ}\text{C} \leq (T_J = T_A) \leq 125^{\circ}\text{C}$, $4.5\text{ V} \leq V_{IN} \leq 5.5\text{ V}$, $V_{ENx} = V_{IN}$ or $V_{ENx} = 0\text{ V}$, $I_{OUTx} = 0\text{ A}$, typical values are at 5 V and 25°C (unless otherwise noted)

| PARAMETER | TEST CONDITIONS ⁽¹⁾ | | MIN | TYP | MAX | UNIT |
|--------------------------------------------|-----------------------------------------------------------|----------|-----|-----|------|--------------------|
| OUTPUT DISCHARGE | | | | | | |
| Output pull-down resistance ⁽³⁾ | $V_{IN} = 5\text{ V}$, $V_{OUT} = 5\text{ V}$, disabled | TPS20xxC | 300 | 470 | 800 | Ω |
| | $V_{IN} = 4\text{ V}$, $V_{OUT} = 5\text{ V}$, disabled | TPS20xxC | 350 | 560 | 1200 | |
| THERMAL SHUTDOWN | | | | | | |
| Junction thermal shutdown threshold | In current limit | | 135 | | | $^{\circ}\text{C}$ |
| | Not in current limit | | 155 | | | |
| Hysteresis | | | | 20 | | $^{\circ}\text{C}$ |

(3) These parameters are provided for reference only, and do not constitute part of TI's published device specifications for purposes of TI's product warranty.

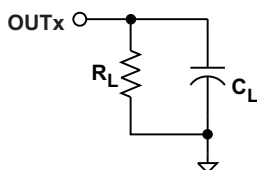


Figure 2. Output Rise / Fall Test Load

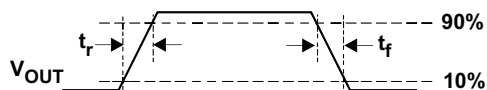


Figure 3. Power-On and Off Timing

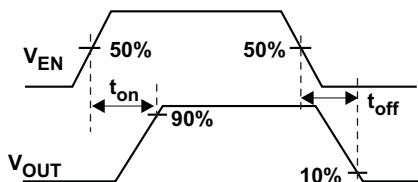


Figure 4. Enable Timing, Active High Enable

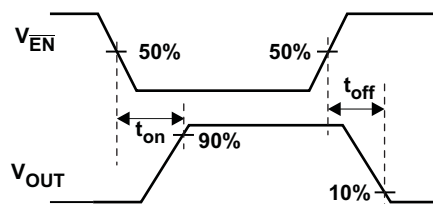


Figure 5. Enable Timing, Active Low Enable

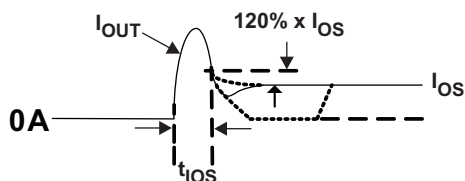


Figure 6. Output Short Circuit Parameters

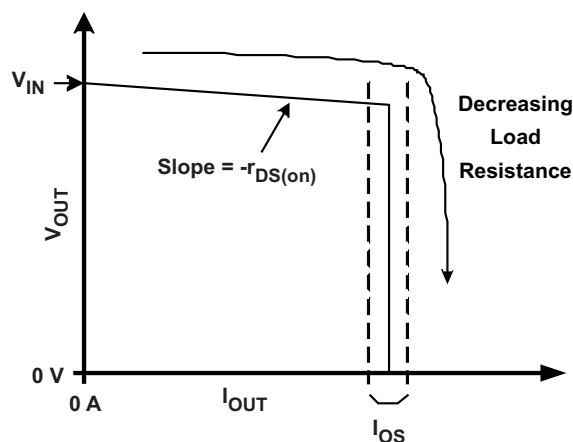


Figure 7. Output Characteristic Showing Current Limit

FUNCTIONAL BLOCK DIAGRAM

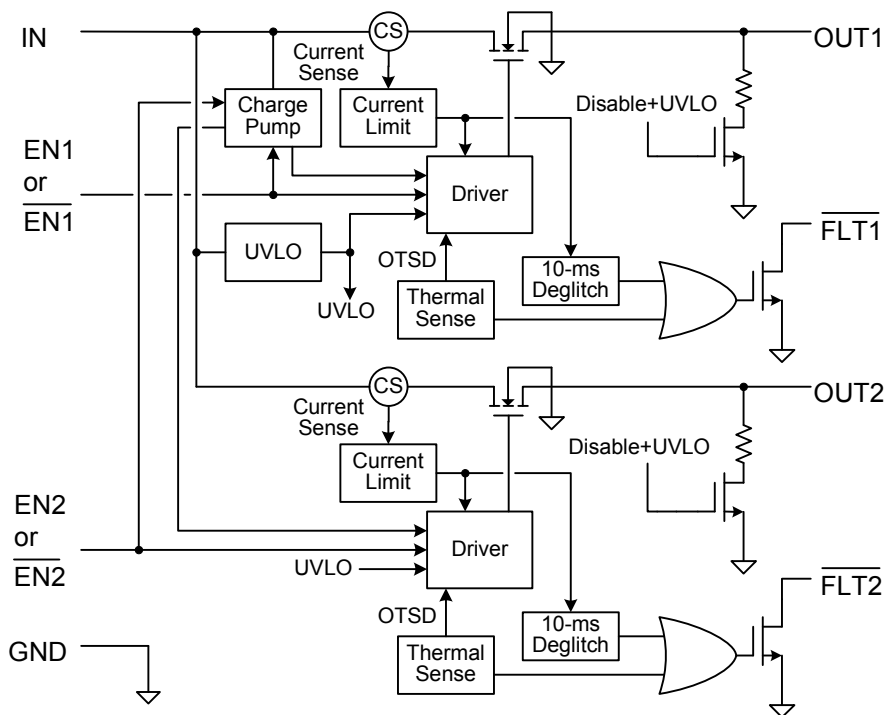


Figure 8. TPS20xxC FUNCTIONAL BLOCK DIAGRAM

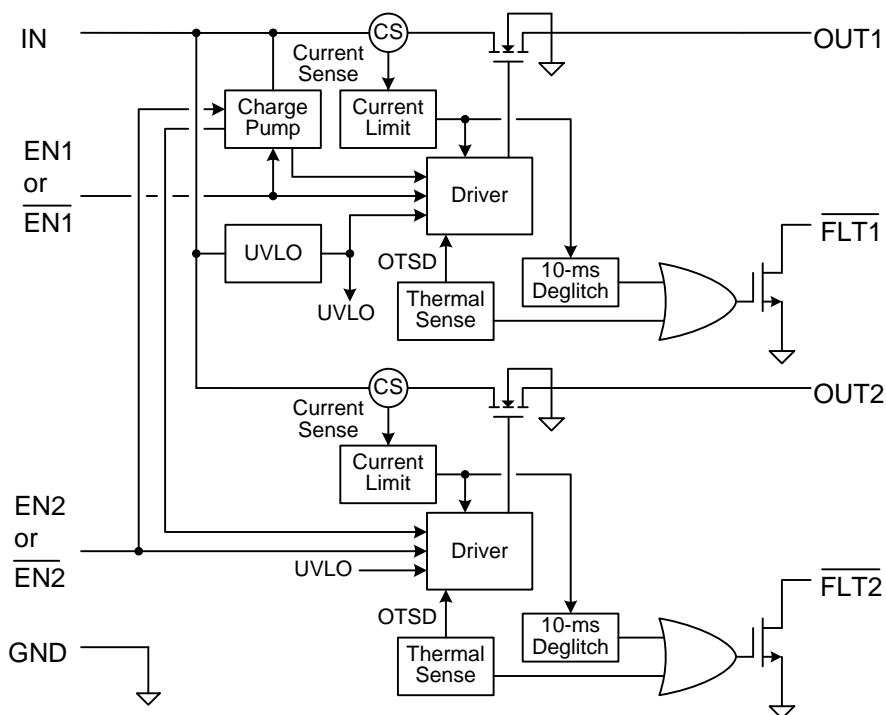


Figure 9. TPS20xxC-2 FUNCTIONAL BLOCK DIAGRAM

DEVICE INFORMATION
PIN FUNCTIONS – MSOP-8 PACKAGES

| NAME | TPS2052C TPS2066C TPS2066C-2 TPS2064C TPS2064C-2 | TPS2062C TPS2060C | I/O | DESCRIPTION |
|--------------------------|--------------------------------------------------------------|----------------------|-----|------------------------------------------------------------------------------------------------------------------------------|
| GND | 1 | 1 | Pwr | Ground connection |
| IN | 2 | 2 | I | Input voltage and power-switch drain; connect a 0.1 μ F or greater ceramic capacitor from IN to GND close to the IC |
| EN1 | 3 | - | I | Enable input channel 1, logic high turns on power switch |
| $\overline{\text{EN1}}$ | - | 3 | I | Enable input channel 1, logic low turns on power switch |
| EN2 | 4 | - | I | Enable input channel 2, logic high turns on power switch |
| $\overline{\text{EN2}}$ | - | 4 | I | Enable input channel 2, logic low turns on power switch |
| $\overline{\text{FLT2}}$ | 5 | 5 | O | Active-low open-drain output, asserted during overcurrent, or overtemperature conditions on channel 2 |
| OUT2 | 6 | 6 | O | Power-switch output channel 2, connected to load |
| OUT1 | 7 | 7 | O | Power-switch output channel 1, connected to load |
| $\overline{\text{FLT1}}$ | 8 | 8 | O | Active-low open-drain output, asserted during over-current, or overtemperature conditions on channel 1 |
| PowerPAD™ | PAD | PAD | Pwr | Internally connected to GND; used to heat-sink the part to the circuit board traces. Connect PAD to GND plane as a heatsink. |

PIN FUNCTIONS – SOIC-8 PACKAGES

| NAME | TPS2066C | TPS2062C | I/O | DESCRIPTION |
|--------------------------|----------|----------|-----|-------------------------------------------------------------------------------------------------------------------------|
| GND | 1 | 1 | Pwr | Ground connection |
| IN | 2 | 2 | I | Input voltage and power-switch drain; connect a 0.1 μ F or greater ceramic capacitor from IN to GND close to the IC |
| EN1 | 3 | - | I | Enable input channel 1, logic high turns on power switch |
| $\overline{\text{EN1}}$ | - | 3 | I | Enable input channel 1, logic low turns on power switch |
| EN2 | 4 | - | I | Enable input channel 2, logic high turns on power switch |
| $\overline{\text{EN2}}$ | - | 4 | I | Enable input channel 2, logic low turns on power switch |
| $\overline{\text{FLT2}}$ | 5 | 5 | O | Active-low open-drain output, asserted during overcurrent, or overtemperature conditions on channel 2 |
| OUT2 | 6 | 6 | O | Power-switch output channel 2, connected to load |
| OUT1 | 7 | 7 | O | Power-switch output channel 1, connected to load |
| $\overline{\text{FLT1}}$ | 8 | 8 | O | Active-low open-drain output, asserted during overcurrent, or overtemperature conditions on channel 1 |

PIN FUNCTIONS – SON-10 PACKAGES

| NAME | TPS2003C | TPS2002C | I/O | DESCRIPTION |
|--------------------------|----------|----------|-----|------------------------------------------------------------------------------------------------------------------------------|
| GND | 1 | 1 | Pwr | Ground connection |
| IN | 2, 3 | 2, 3 | I | Input voltage and power-switch drain; connect a 0.1 μ F or greater ceramic capacitor from IN to GND close to the IC |
| EN1 | 4 | - | I | Enable input channel 1, logic high turns on power switch |
| $\overline{\text{EN1}}$ | - | 4 | I | Enable input channel 1, logic low turns on power switch |
| EN2 | 5 | - | I | Enable input channel 2, logic high turns on power switch |
| $\overline{\text{EN2}}$ | - | 5 | I | Enable input channel 2, logic low turns on power switch |
| $\overline{\text{FLT2}}$ | 6 | 6 | O | Active-low open-drain output, asserted during overcurrent, or overtemperature conditions on channel 2 |
| NC | 7 | 7 | | No connect – leave floating. |
| OUT2 | 8 | 8 | O | Power-switch output channel 2, connect to load |
| OUT1 | 9 | 9 | O | Power-switch output channel 1, connect to load |
| $\overline{\text{FLT1}}$ | 10 | 10 | O | Active-low open-drain output, asserted during overcurrent, or overtemperature conditions on channel 1 |
| PowerPAD™ | PAD | PAD | Pwr | Internally connected to GND; used to heat-sink the part to the circuit board traces. Connect PAD to GND plane as a heatsink. |

PIN FUNCTIONS – SON-8 PACKAGES

| NAME | TPS2062C-2 | I/O | DESCRIPTION |
|--------------------------|------------|-----|------------------------------------------------------------------------------------------------------------------------------|
| GND | 1 | Pwr | Ground connection |
| IN | 2 | I | Input voltage and power-switch drain; connect a 0.1 μ F or greater ceramic capacitor from IN to GND close to the IC |
| $\overline{\text{EN}}1$ | 3 | I | Enable input channel 1, logic low turns on power switch |
| $\overline{\text{EN}}2$ | 4 | I | Enable input channel 2, logic low turns on power switch |
| $\overline{\text{FLT}}2$ | 5 | O | Active-low open-drain output, asserted during over-current, or over-temperature conditions on channel 2 |
| OUT2 | 6 | O | Power-switch output channel 2, connect to load |
| OUT1 | 7 | O | Power-switch output channel 1, connect to load |
| $\overline{\text{FLT}}1$ | 8 | O | Active-low open-drain output, asserted during over-current, or over-temperature conditions on channel 1 |
| PowerPAD™ | PAD | Pwr | Internally connected to GND; used to heat-sink the part to the circuit board traces. Connect PAD to GND plane as a heatsink. |

TYPICAL CHARACTERISTICS

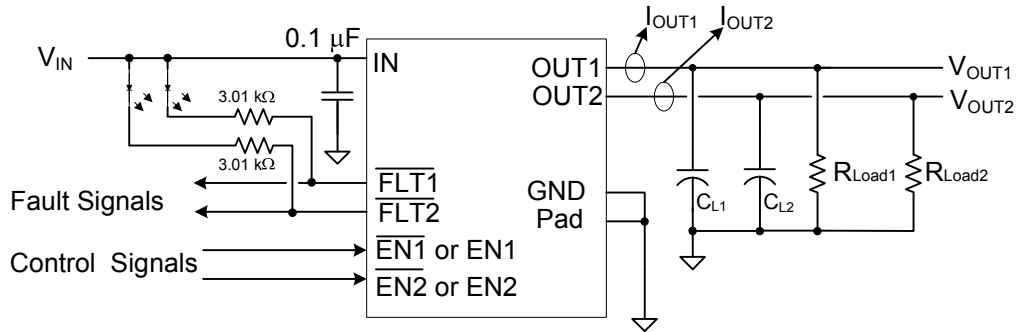


Figure 10. Test Circuit for System Operation in Typical Characteristics Section

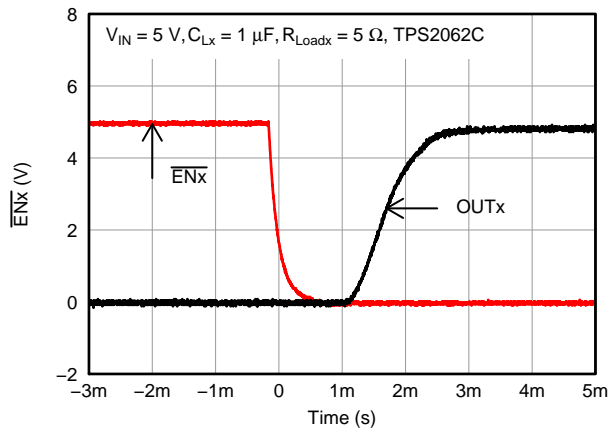


Figure 11. TPS2062C Turn on Delay and Rise Time With 1- μ F Load

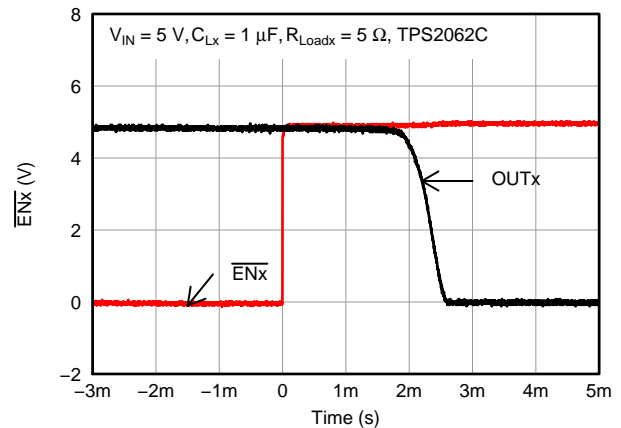


Figure 12. TPS2062C Turn off Delay and Fall Time With 1- μ F Load

TYPICAL CHARACTERISTICS (continued)

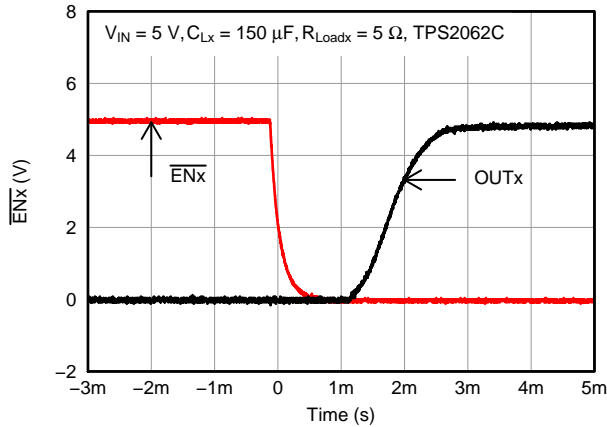


Figure 13. TPS2062C Turn on Delay and Rise Time With 150-µF Load

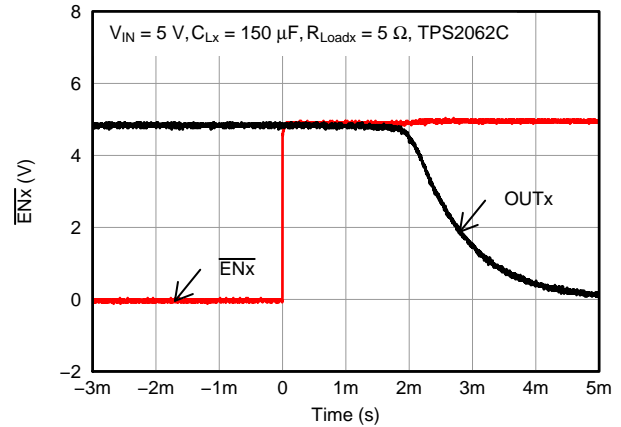


Figure 14. TPS2062C Turn off Delay and Fall Time With 150-µF Load

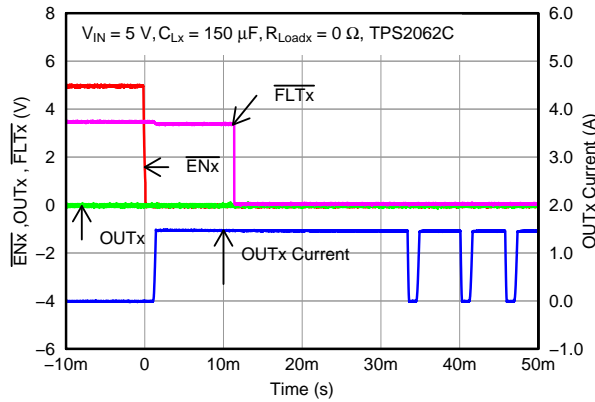


Figure 15. TPS2062C Enable Into Short

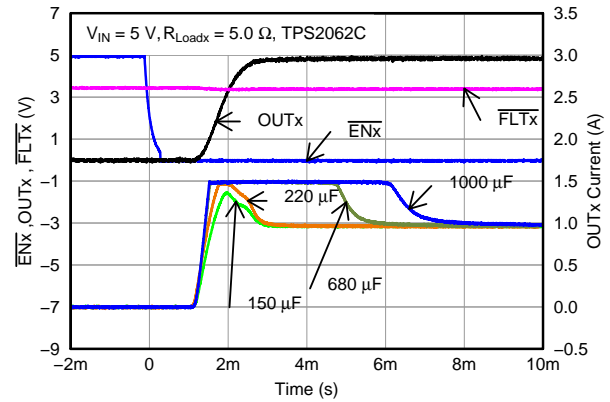


Figure 16. TPS2062C Inrush Current With Different Load Capacitance

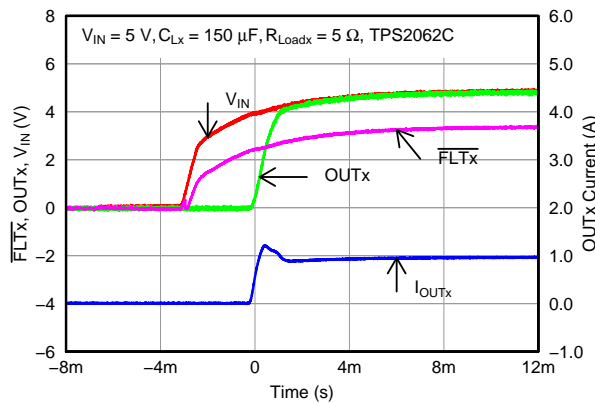


Figure 17. TPS2062C Power Up – Enabled

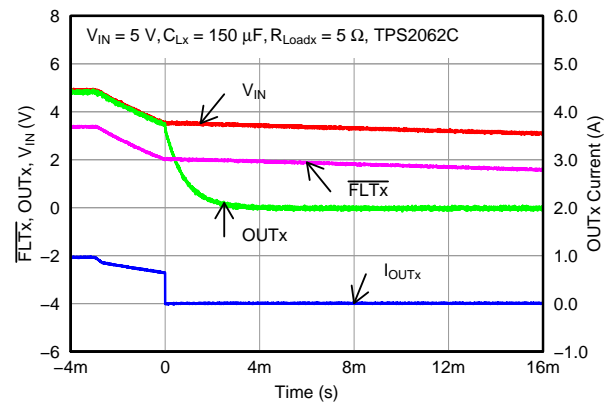


Figure 18. TPS2062C Power Down – Enabled

TYPICAL CHARACTERISTICS (continued)

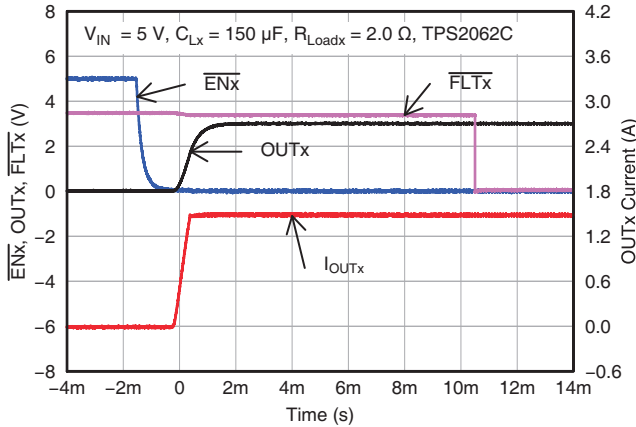


Figure 19. TPS2062C Enable With 2-Ω Load

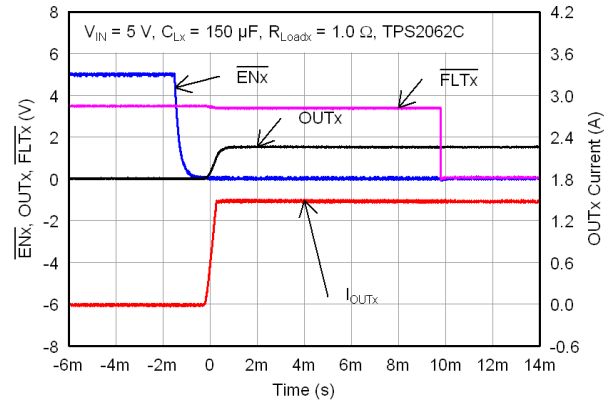


Figure 20. TPS2062C Enable With 1-Ω Load

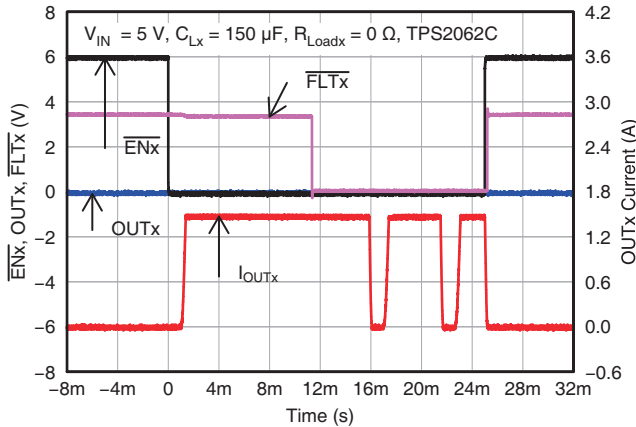


Figure 21. TPS2062C Enable/Disable into Output Short

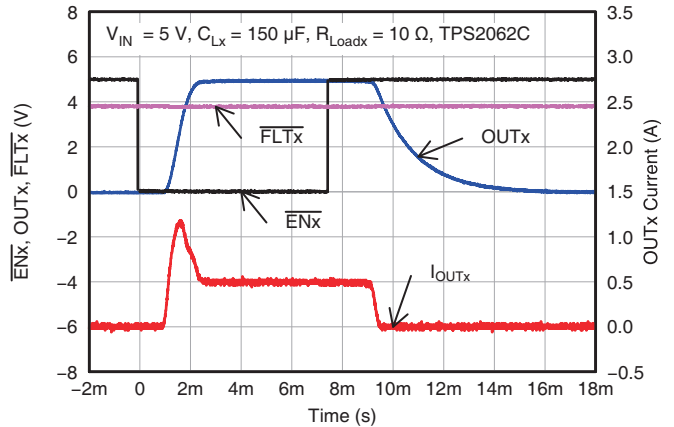


Figure 22. TPS2062C Enable/Disable into 10-Ω Load

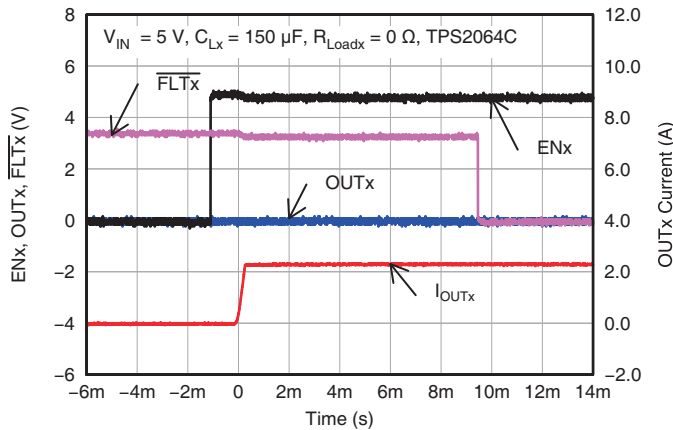


Figure 23. TPS2064C Enable into Short

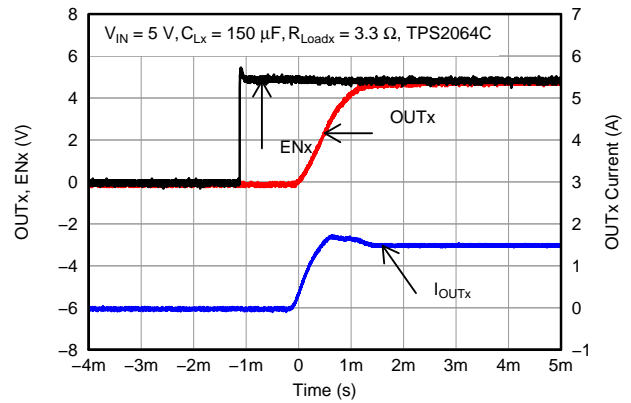


Figure 24. TPS2064C Enable into 3.3 Ω and 150-μF Load

TYPICAL CHARACTERISTICS (continued)

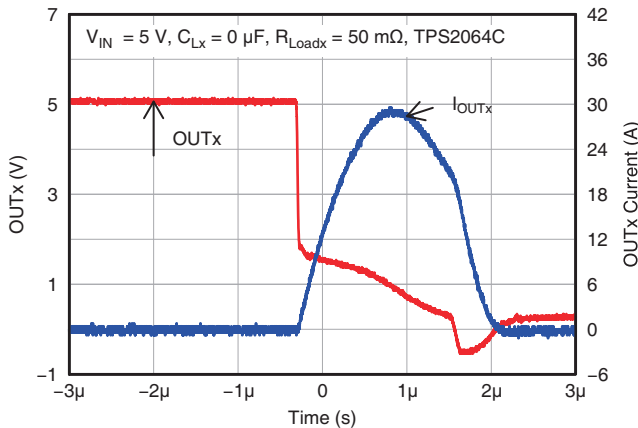


Figure 25. TPS2064C Short Applied

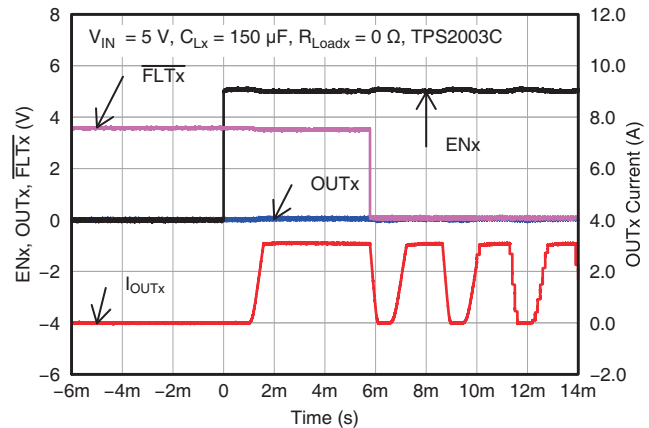


Figure 26. TPS2003C Enable into Short

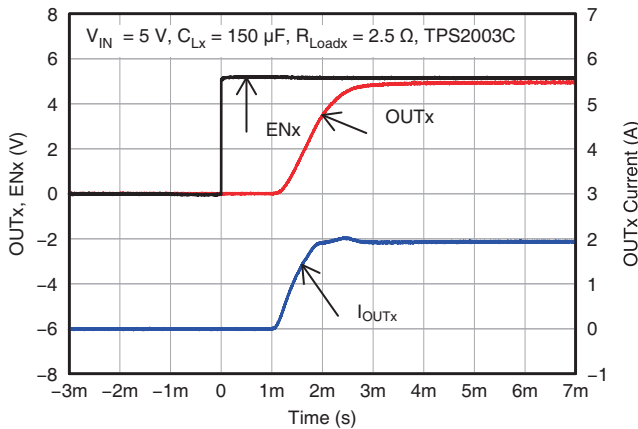


Figure 27. TPS2003C Enable into 2.5 Ω and 150-μF Load

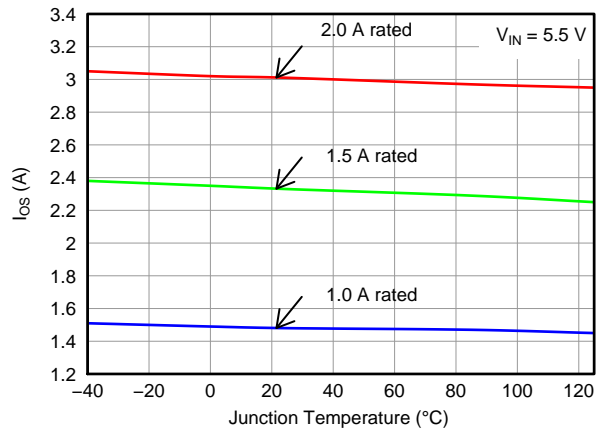


Figure 28. Current Limit (I_{OS}) vs Temperature

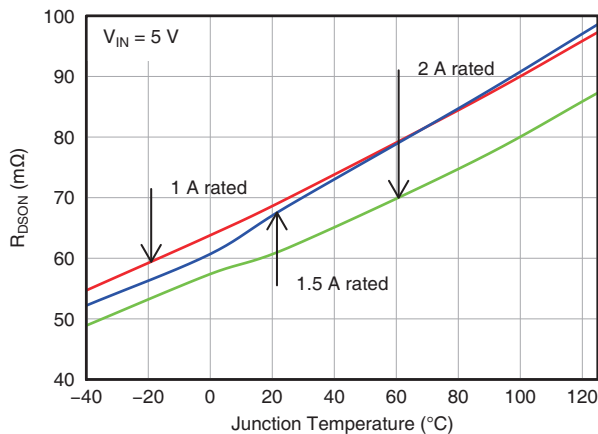


Figure 29. Input - output Resistance ($R_{DS(ON)}$) vs Temperature

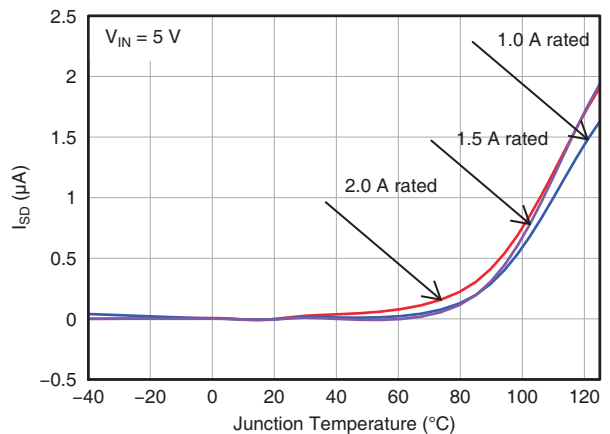


Figure 30. Supply Current (Device Disable) - I_{SD} vs Temperature

TYPICAL CHARACTERISTICS (continued)

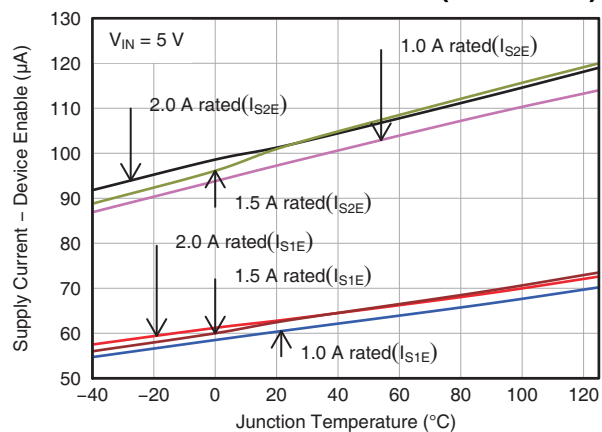


Figure 31. Supply Current (Enable) - I_{SE} vs Temperature

DETAILED DESCRIPTION

OVERVIEW

The TPS20xxC and TPS20xxC-2 dual are current-limited, power-distribution switches providing between 0.5 A and 2 A of continuous load current in 5-V circuits. These parts use N-channel MOSFETs for low resistance, maintaining output voltage load regulation. They are designed for applications where short circuits or heavy capacitive loads are encountered. Device features include UVLO, ON/OFF control (Enable), reverse blocking when disabled, output discharge when TPS20xxC disabled, overcurrent protection, overtemperature protection, and deglitched fault reporting. They are pin for pin with existing [TI Switch Portfolio](#).

UNDERVOLTAGE LOCKOUT (UVLO)

The undervoltage lockout (UVLO) circuit disables the power switch when the input voltage is below the UVLO threshold. Built-in hysteresis prevents unwanted on/off cycling due to input voltage drop from large current surges. $\overline{\text{FLT}}_{\text{x}}$ is high impedance when the TPS20xxC and TPS20xxC-2 dual are in UVLO.

ENABLE (EN_{x} or $\overline{\text{EN}}_{\text{x}}$)

The logic input of EN_{x} or $\overline{\text{EN}}_{\text{x}}$ disables all of the internal circuitry while maintaining the power switch OFF. The supply current of the device can be reduced to less than 1 μA when both switches are disabled. A logic low input on $\overline{\text{EN}}_{\text{x}}$ or a logic high input on EN_{x} enables the driver, control circuits, and power switch of corresponding channel.

The EN_{x} or $\overline{\text{EN}}_{\text{x}}$ input voltage is compatible with both TTL and CMOS logic levels. The $\overline{\text{FLT}}_{\text{x}}$ is immediately cleared and the output discharge circuit is enabled when the device is disabled.

DEGLITCHED FAULT REPORTING

$\overline{\text{FLT}}_{\text{x}}$ is an open-drain output that asserts (active low) during an overcurrent or overtemperature condition on each corresponding channel. The $\overline{\text{FLT}}_{\text{x}}$ output remains asserted until the fault condition is removed or the channel is disabled. The TPS20xxC and TPS20xxC-2 dual eliminates false $\overline{\text{FLT}}_{\text{x}}$ reporting by using internal delay circuitry after entering or leaving an overcurrent condition. The “deglitch” time is typically 10 ms. This ensures that $\overline{\text{FLT}}_{\text{x}}$ is not accidentally asserted under overcurrent conditions with a short time, such as starting into a heavy capacitive load. Over temperature conditions are not deglitched. The $\overline{\text{FLT}}_{\text{x}}$ pin is high impedance when the device is disabled and in undervoltage lockout (UVLO). The fault circuits are independent so that another channel continues to operate when one channel is in a fault condition.

OVERCURRENT PROTECTION

The TPS20xxC and TPS20xxC-2 dual responds to overloads by limiting each channel output current to the static I_{OS} levels shown in the *Electrical Characteristics* table. When an overload condition is present, the device maintains a constant current (I_{OS}) and reduces the output voltage accordingly, with the output voltage falling to ($I_{\text{OS}} \times R_{\text{SHORT}}$). Three possible overload conditions can occur. In the first condition, the output has been shorted before the device is enabled or before voltage is applied to IN. The device senses over-current and immediately switches into a constant-current output. In the second condition, a short or an overload occurs while the device is enabled. At the instant a short-circuit occurs, high currents may flow for several microseconds (t_{IOS}) before the current-limit circuit reacts. The device operates in constant-current mode after the current-limit circuit has responded. In the third condition, the load is increased gradually beyond the recommended operating current. The current is permitted to rise until the current-limit threshold is reached. The devices are capable of delivering current up to the current-limit threshold without damage. Once the threshold is reached, the device switches into constant-current mode. For all of the above three conditions, the device may begin thermal cycling if the overcurrent condition persists.

OVERTEMPERATURE PROTECTION

The TPS20xxC and TPS20xxC-2 dual includes per channel overtemperature protection circuitry, which activates at 135°C (min) junction temperature while in current limit. There is an overall thermal shutdown of 155°C (min) junction temperature when the TPS20xxC and TPS20xxC-2 dual are not in current limit. The device remains off until the junction temperature cools 20°C and then restarts. Thermal shutdown may occur during an overload due to the relatively large power dissipation $[(V_{IN} - V_{OUT}) \times I_{OS}]$ driving the junction temperature up. The power switch cycles on and off until the fault is removed. This topology allows one channel to continue normal operation even if the other channel is in an over-temperature condition.

SOFTSTART, REVERSE BLOCKING AND DISCHARGE OUTPUT

The power MOSFET driver incorporates circuitry that controls the rise and fall times of the output voltage to limit large current and voltage surges on the input supply, and provides built-in soft-start functionality.

The TPS20xxC and TPS20xxC-2 dual power switch will block current from OUT to IN when turned off by the UVLO or disabled.

The TPS20xxC dual includes an output discharge function on each channel. A 470Ω (typ.) discharge resistor will dissipate stored charge and leakage current on OUTx when the device is in UVLO or disabled. However as this circuit is biased from IN, the output discharge will not be active when IN voltage is close to 0 V.

The TPS20xxC-2 does not have this function. The output is be controlled by an external loadings when the device is in ULVO or disabled.

APPLICATION INFORMATION

INPUT AND OUTPUT CAPACITANCE

Input and output capacitance improves the performance of the device. For all applications, a 0.1 μF or greater ceramic bypass capacitor between IN and GND is recommended as close to the device as possible for local noise de-coupling. The actual capacitance should be optimized for the particular application. This precaution reduces ringing on the input due to power-supply transients. Additional input capacitance may be needed on the input to reduce the overshoot voltage from exceeding the absolute maximum voltage of the device during heavy transients.

A 120 μF minimum output capacitance is required when implementing USB standard applications. Typically this uses a 150 μF electrolytic capacitor. If the application does not require 120 μF of output capacitance, a minimum of 10 μF ceramic capacitor on the output is recommended in order to reduce the transient negative voltage on OUTx pin caused by load inductance during a short circuit. The transient negative voltage should be less than 1.5 V for 10 μs .

POWER DISSIPATION AND JUNCTION TEMPERATURE

It is good design practice to estimate power dissipation and maximum expected junction temperature of the TPS20xxC and TPS20xxC-2 dual. The system designer can control choices of package, proximity to other power dissipating devices, and printed circuit board (PCB) design based on these calculations. These have a direct influence on maximum junction temperature. Other factors such as airflow and maximum ambient temperature are often determined by system considerations.

Addition of extra PCB copper area around these devices is recommended to reduce the thermal impedance and maintain the junction temperature as low as practical.

The following procedure requires iteration because power loss is due to the two internal MOSFETs $2 \times I^2 \times r_{\text{DS(on)}}$, and $r_{\text{DS(on)}}$ is a function of the junction temperature. As an initial estimate, use the $r_{\text{DS(on)}}$ at 125°C from the typical characteristics, and the preferred package thermal resistance for the preferred board construction from the thermal parameters section.

$$T_J = T_A + [(2 \times I_{\text{OUT}}^2 \times r_{\text{DS(on)}}) \times \theta_{\text{JA}}]$$

Where:

I_{OUT} = rated OUT pin current (A)

$r_{\text{DS(on)}}$ = Power switch on-resistance at an assumed T_J (Ω)

T_A = Maximum ambient temperature ($^{\circ}\text{C}$)

T_J = Maximum junction temperature ($^{\circ}\text{C}$)

θ_{JA} = Thermal resistance ($^{\circ}\text{C}/\text{W}$)

If the calculated T_J is substantially different from the original assumption, look up a new value of $r_{\text{DS(on)}}$ and recalculate.

If the resulting T_J is not less than 125°C, try a PCB construction and/or package with lower θ_{JA} .

REVISION HISTORY

| Changes from Original (October 2011) to Revision A | Page |
|------------------------------------------------------------------------------------------------------------------------|-------------|
| • Changed devices TPS2062C and TPS2066C MSOP-8 package From: Preview to Active | 1 |
| • Changed the I _{OS} current limit values for TPS2062C and 66C (1 A). | 3 |
| • Changed the I _{OS} current limit values for TPS2062C/66C (1 A). | 4 |
| <hr/> | |
| Changes from Revision A (March 2012) to Revision B | Page |
| • Changed device TPS2060C MSOP-8 package From: Preview To: Active | 1 |
| <hr/> | |
| Changes from Revision B (March 2012) to Revision C | Page |
| • Changed devices TPS2062C and TPS2066C SOIC-8 package From: Preview To: Active | 1 |
| • Changed the TPS2062C and 66C r _{DS(on)} D package TYP value From: 84 to 90 mΩ and added the MAX value | 3 |
| • Changed the TPS2062C and 66C r _{DS(on)} D package TYP value From: 84 to 90 mΩ | 4 |
| <hr/> | |
| Changes from Revision C (June 2012) to Revision D | Page |
| • Changed the Device Information table, Package Devices and Marking columns | 2 |
| <hr/> | |
| Changes from Revision D (July 2012) to Revision E | Page |
| • Changed devices TPS2002C and TPS2003C SON-10 package From: Preview To: Active | 1 |
| • Changed the I _{OS} current limit values for TPS2002C and 03C (2 A). | 3 |
| • Corrected Note 2 references in the ELECTRICAL CHARACTERISTICS table | 4 |
| • Changed the I _{OS} current limit values for TPS2002C and 03C (2 A). | 4 |
| <hr/> | |
| Changes from Revision E (August 2012) to Revision F | Page |
| • 将特性从 1A , 1.5A , 2A 的额定电流改为 : 0.5A , 1A , 1.5A , 2A 的额定电流 | 1 |
| • 将特性从 : 禁用时输出放电改为 : 所选的具有 (TPS20xxC) 和不具有 (TPS20xxC-2)输出放电的部件 | 1 |
| • Added DRB pin option | 1 |
| • Added TPS2052C, TPS2062C-2, TPS2064C-2, and TPS2066C-2 devices to Table 1 | 1 |
| • Added TPS2052C, TPS2062C-2, TPS2064C-2, and TPS2066C-2 devices to | 2 |
| • Added TPS2052C, TPS2062C-2, TPS2064C-2, and TPS2066C-2 devices to RECOMMENDED OPERATING CONDITIONS table | 3 |
| • Added TPS2052C and TPS2066C-2 devices to r _{DS(on)} | 3 |
| • Added the TPS2052C and TPS2064C-2 devices to I _{OS} | 3 |
| • Added Leakage Current | 3 |
| • Added TPS2052C and TPS2066C-2 devices to r _{DS(on)} | 4 |
| • Added the TPS2052C and TPS2064C-2 devices to I _{OS} | 4 |
| • Added Leakage Current | 4 |
| • Added text to the SOFTSTART, REVERSE BLOCKING AND DISCHARGE OUTPUT section | 14 |
| • Added last paragraph in the DISCHARGE OUTPUT section | 14 |

Changes from Revision F (November 2012) to Revision G**Page**

- Changed device TPS2062C-2 SON-8 packages From: Preview To: Active 1
 - Changed devices TPS2066C-2, and TPS2064C-2 MSOP-8 package From: Preview To: Active 1
-

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| TPS2002CDRCR | ACTIVE | VSON | DRC | 10 | 3000 | RoHS & Green | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | VFEQ | Samples |
| TPS2002CDRCT | ACTIVE | VSON | DRC | 10 | 250 | RoHS & Green | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | VFEQ | Samples |
| TPS2003CDRCR | ACTIVE | VSON | DRC | 10 | 3000 | RoHS & Green | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | VRFQ | Samples |
| TPS2003CDRCT | ACTIVE | VSON | DRC | 10 | 250 | RoHS & Green | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | VRFQ | Samples |
| TPS2052CDGN | ACTIVE | HVSSOP | DGN | 8 | 80 | RoHS & Green | NIPDAUAG | Level-2-260C-1 YEAR | -40 to 125 | PYNI | Samples |
| TPS2052CDGNR | ACTIVE | HVSSOP | DGN | 8 | 2500 | RoHS & Green | NIPDAUAG | Level-2-260C-1 YEAR | -40 to 125 | PYNI | Samples |
| TPS2060CDGN | ACTIVE | HVSSOP | DGN | 8 | 80 | RoHS & Green | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | VRAQ | Samples |
| TPS2060CDGNR | ACTIVE | HVSSOP | DGN | 8 | 2500 | RoHS & Green | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | VRAQ | Samples |
| TPS2062CD | ACTIVE | SOIC | D | 8 | 75 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 2062C | Samples |
| TPS2062CDGN | ACTIVE | HVSSOP | DGN | 8 | 80 | RoHS & Green | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | VRBQ | Samples |
| TPS2062CDGNR | ACTIVE | HVSSOP | DGN | 8 | 2500 | RoHS & Green | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | VRBQ | Samples |
| TPS2062CDR | ACTIVE | SOIC | D | 8 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 2062C | Samples |
| TPS2062CDRBR-2 | ACTIVE | SON | DRB | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | PYVI | Samples |
| TPS2062CDRBT-2 | ACTIVE | SON | DRB | 8 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | PYVI | Samples |
| TPS2064CDGN | ACTIVE | HVSSOP | DGN | 8 | 80 | RoHS & Green | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | VRCQ | Samples |
| TPS2064CDGN-2 | ACTIVE | HVSSOP | DGN | 8 | 80 | RoHS & Green | NIPDAUAG | Level-2-260C-1 YEAR | -40 to 125 | PYTI | Samples |
| TPS2064CDGNR | ACTIVE | HVSSOP | DGN | 8 | 2500 | RoHS & Green | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | VRCQ | Samples |
| TPS2064CDGNR-2 | ACTIVE | HVSSOP | DGN | 8 | 2500 | RoHS & Green | NIPDAUAG | Level-2-260C-1 YEAR | -40 to 125 | PYTI | Samples |
| TPS2065CDBVR-2 | ACTIVE | SOT-23 | DBV | 5 | 3000 | RoHS & Green | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | PYQI | Samples |
| TPS2065CDBVT-2 | ACTIVE | SOT-23 | DBV | 5 | 250 | RoHS & Green | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | PYQI | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| TPS2065CDGN-2 | ACTIVE | HVSSOP | DGN | 8 | 80 | RoHS & Green | NIPDAUAG | Level-2-260C-1 YEAR | -40 to 125 | PYRI | Samples |
| TPS2065CDGNR-2 | ACTIVE | HVSSOP | DGN | 8 | 2500 | RoHS & Green | NIPDAUAG | Level-2-260C-1 YEAR | -40 to 125 | PYRI | Samples |
| TPS2066CD | ACTIVE | SOIC | D | 8 | 75 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 2066C | Samples |
| TPS2066CDGN | ACTIVE | HVSSOP | DGN | 8 | 80 | RoHS & Green | NIPDAUAG | Level-1-260C-UNLIM | -40 to 85 | VRDQ | Samples |
| TPS2066CDGN-2 | ACTIVE | HVSSOP | DGN | 8 | 80 | RoHS & Green | NIPDAUAG | Level-2-260C-1 YEAR | -40 to 125 | PYUI | Samples |
| TPS2066CDGNR | ACTIVE | HVSSOP | DGN | 8 | 2500 | RoHS & Green | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | VRDQ | Samples |
| TPS2066CDGNR-2 | ACTIVE | HVSSOP | DGN | 8 | 2500 | RoHS & Green | NIPDAUAG | Level-2-260C-1 YEAR | -40 to 125 | PYUI | Samples |
| TPS2066CDR | ACTIVE | SOIC | D | 8 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 2066C | Samples |

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSELETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

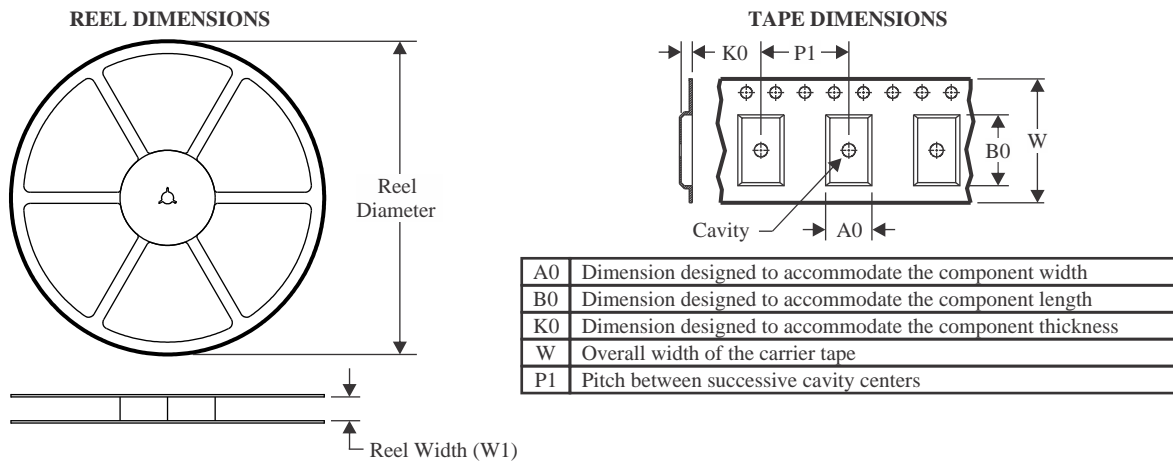
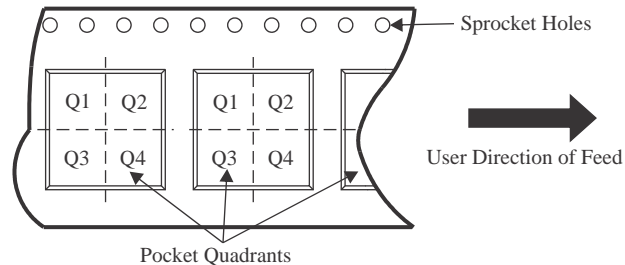
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

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

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

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TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TPS2002CDRCR | VSON | DRC | 10 | 3000 | 330.0 | 12.4 | 3.3 | 3.3 | 1.1 | 8.0 | 12.0 | Q2 |
| TPS2002CDRCT | VSON | DRC | 10 | 250 | 180.0 | 12.4 | 3.3 | 3.3 | 1.1 | 8.0 | 12.0 | Q2 |
| TPS2003CDRCR | VSON | DRC | 10 | 3000 | 330.0 | 12.4 | 3.3 | 3.3 | 1.1 | 8.0 | 12.0 | Q2 |
| TPS2003CDRCT | VSON | DRC | 10 | 250 | 180.0 | 12.4 | 3.3 | 3.3 | 1.1 | 8.0 | 12.0 | Q2 |
| TPS2052CDGNR | HVSSOP | DGN | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| TPS2060CDGNR | HVSSOP | DGN | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| TPS2062CDGNR | HVSSOP | DGN | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| TPS2062CDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TPS2062CDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TPS2062CDRBR-2 | SON | DRB | 8 | 3000 | 330.0 | 12.4 | 3.3 | 3.3 | 1.1 | 8.0 | 12.0 | Q2 |
| TPS2062CDRBT-2 | SON | DRB | 8 | 250 | 180.0 | 12.4 | 3.3 | 3.3 | 1.1 | 8.0 | 12.0 | Q2 |
| TPS2064CDGNR | HVSSOP | DGN | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| TPS2064CDGNR-2 | HVSSOP | DGN | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| TPS2065CDBVR-2 | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TPS2065CDBVR-2 | SOT-23 | DBV | 5 | 3000 | 178.0 | 9.0 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TPS2065CDBVT-2 | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |

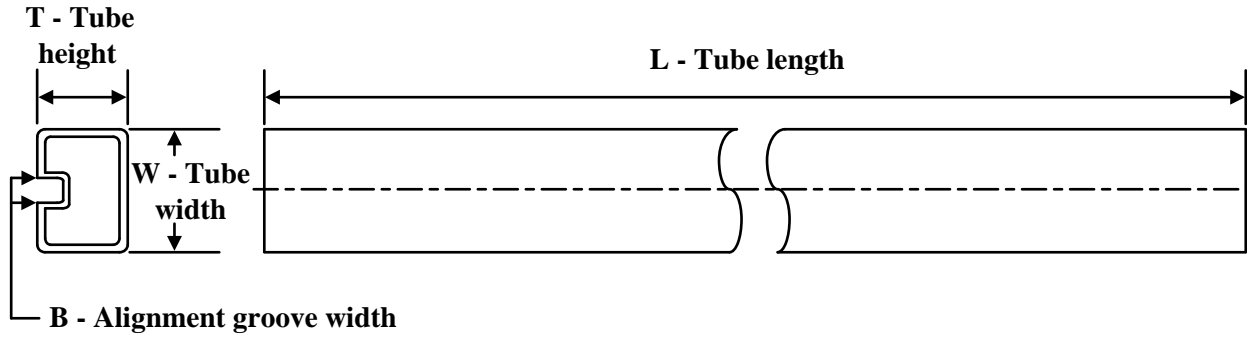
| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TPS2065CDBVT-2 | SOT-23 | DBV | 5 | 250 | 178.0 | 8.4 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TPS2065CDGNR-2 | HVSSOP | DGN | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| TPS2066CDGNR | HVSSOP | DGN | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| TPS2066CDGNR-2 | HVSSOP | DGN | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| TPS2066CDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TPS2002CDRCR | VSON | DRC | 10 | 3000 | 367.0 | 367.0 | 35.0 |
| TPS2002CDRCT | VSON | DRC | 10 | 250 | 210.0 | 185.0 | 35.0 |
| TPS2003CDRCR | VSON | DRC | 10 | 3000 | 367.0 | 367.0 | 35.0 |
| TPS2003CDRCT | VSON | DRC | 10 | 250 | 210.0 | 185.0 | 35.0 |
| TPS2052CDGNR | HVSSOP | DGN | 8 | 2500 | 366.0 | 364.0 | 50.0 |
| TPS2060CDGNR | HVSSOP | DGN | 8 | 2500 | 364.0 | 364.0 | 27.0 |
| TPS2062CDGNR | HVSSOP | DGN | 8 | 2500 | 364.0 | 364.0 | 27.0 |
| TPS2062CDR | SOIC | D | 8 | 2500 | 340.5 | 336.1 | 25.0 |
| TPS2062CDR | SOIC | D | 8 | 2500 | 356.0 | 356.0 | 35.0 |
| TPS2062CDRBR-2 | SON | DRB | 8 | 3000 | 335.0 | 335.0 | 25.0 |
| TPS2062CDRBT-2 | SON | DRB | 8 | 250 | 182.0 | 182.0 | 20.0 |
| TPS2064CDGNR | HVSSOP | DGN | 8 | 2500 | 364.0 | 364.0 | 27.0 |
| TPS2064CDGNR-2 | HVSSOP | DGN | 8 | 2500 | 366.0 | 364.0 | 50.0 |
| TPS2065CDBVR-2 | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TPS2065CDBVR-2 | SOT-23 | DBV | 5 | 3000 | 180.0 | 180.0 | 18.0 |
| TPS2065CDBVT-2 | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TPS2065CDBVT-2 | SOT-23 | DBV | 5 | 250 | 180.0 | 180.0 | 18.0 |
| TPS2065CDGNR-2 | HVSSOP | DGN | 8 | 2500 | 366.0 | 364.0 | 50.0 |

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TPS2066CDGNR | HVSSOP | DGN | 8 | 2500 | 364.0 | 364.0 | 27.0 |
| TPS2066CDGNR-2 | HVSSOP | DGN | 8 | 2500 | 366.0 | 364.0 | 50.0 |
| TPS2066CDR | SOIC | D | 8 | 2500 | 340.5 | 336.1 | 25.0 |

TUBE


*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|---------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| TPS2052CDGN | DGN | HVSSOP | 8 | 80 | 330 | 6.55 | 500 | 2.88 |
| TPS2060CDGN | DGN | HVSSOP | 8 | 80 | 330 | 6.55 | 500 | 2.88 |
| TPS2062CD | D | SOIC | 8 | 75 | 507 | 8 | 3940 | 4.32 |
| TPS2062CDGN | DGN | HVSSOP | 8 | 80 | 330 | 6.55 | 500 | 2.88 |
| TPS2064CDGN | DGN | HVSSOP | 8 | 80 | 330 | 6.55 | 500 | 2.88 |
| TPS2064CDGN-2 | DGN | HVSSOP | 8 | 80 | 330 | 6.55 | 500 | 2.88 |
| TPS2065CDGN-2 | DGN | HVSSOP | 8 | 80 | 330 | 6.55 | 500 | 2.88 |
| TPS2066CD | D | SOIC | 8 | 75 | 507 | 8 | 3940 | 4.32 |
| TPS2066CDGN | DGN | HVSSOP | 8 | 80 | 330 | 6.55 | 500 | 2.88 |
| TPS2066CDGN-2 | DGN | HVSSOP | 8 | 80 | 330 | 6.55 | 500 | 2.88 |

GENERIC PACKAGE VIEW

DGN 8

PowerPAD VSSOP - 1.1 mm max height

3 x 3, 0.65 mm pitch

SMALL OUTLINE PACKAGE

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



4225482/A

DGN0008G



PACKAGE OUTLINE

PowerPAD™ VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



4225480/B 12/2022

PowerPAD is a trademark of Texas Instruments.

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. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-187.

EXAMPLE BOARD LAYOUT

DGN0008G

PowerPAD™ VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 15X



SOLDER MASK DETAILS

4225480/B 12/2022

NOTES: (continued)

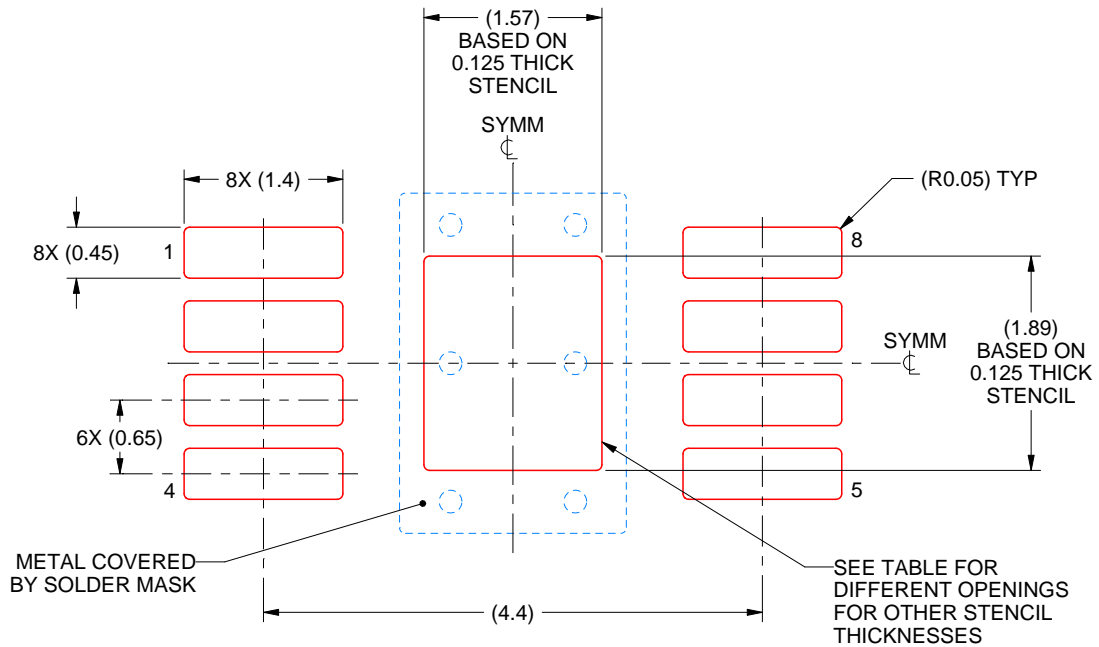
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.
9. Size of metal pad may vary due to creepage requirement.

EXAMPLE STENCIL DESIGN

DGN0008G

PowerPAD™ VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
EXPOSED PAD 9:
100% PRINTED SOLDER COVERAGE BY AREA
SCALE: 15X

| STENCIL THICKNESS | SOLDER STENCIL OPENING |
|-------------------|------------------------|
| 0.1 | 1.76 X 2.11 |
| 0.125 | 1.57 X 1.89 (SHOWN) |
| 0.15 | 1.43 X 1.73 |
| 0.175 | 1.33 X 1.60 |

4225480/B 12/2022

NOTES: (continued)

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



D0008A

PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4214825/C 02/2019

NOTES:

1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed $.006$ [0.15] per side.
4. This dimension does not include interlead flash.
5. Reference JEDEC registration MS-012, variation AA.

EXAMPLE BOARD LAYOUT

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE
 EXPOSED METAL SHOWN
 SCALE:8X



SOLDER MASK DETAILS

4214825/C 02/2019

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

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE
BASED ON .005 INCH [0.125 MM] THICK STENCIL
SCALE:8X

4214825/C 02/2019

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.

GENERIC PACKAGE VIEW

DRC 10

VSON - 1 mm max height

3 x 3, 0.5 mm pitch

PLASTIC SMALL OUTLINE - NO LEAD

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



4226193/A



4218878/B 07/2018

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. The package thermal pad must be soldered to the printed circuit board for optimal thermal and mechanical performance.

EXAMPLE BOARD LAYOUT

DRC0010J

VSON - 1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:20X



SOLDER MASK DETAILS

4218878/B 07/2018

NOTES: (continued)

4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/sluea271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

EXAMPLE STENCIL DESIGN

DRC0010J

VSON - 1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 11:
80% PRINTED SOLDER COVERAGE BY AREA
SCALE:25X

4218878/B 07/2018

NOTES: (continued)

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

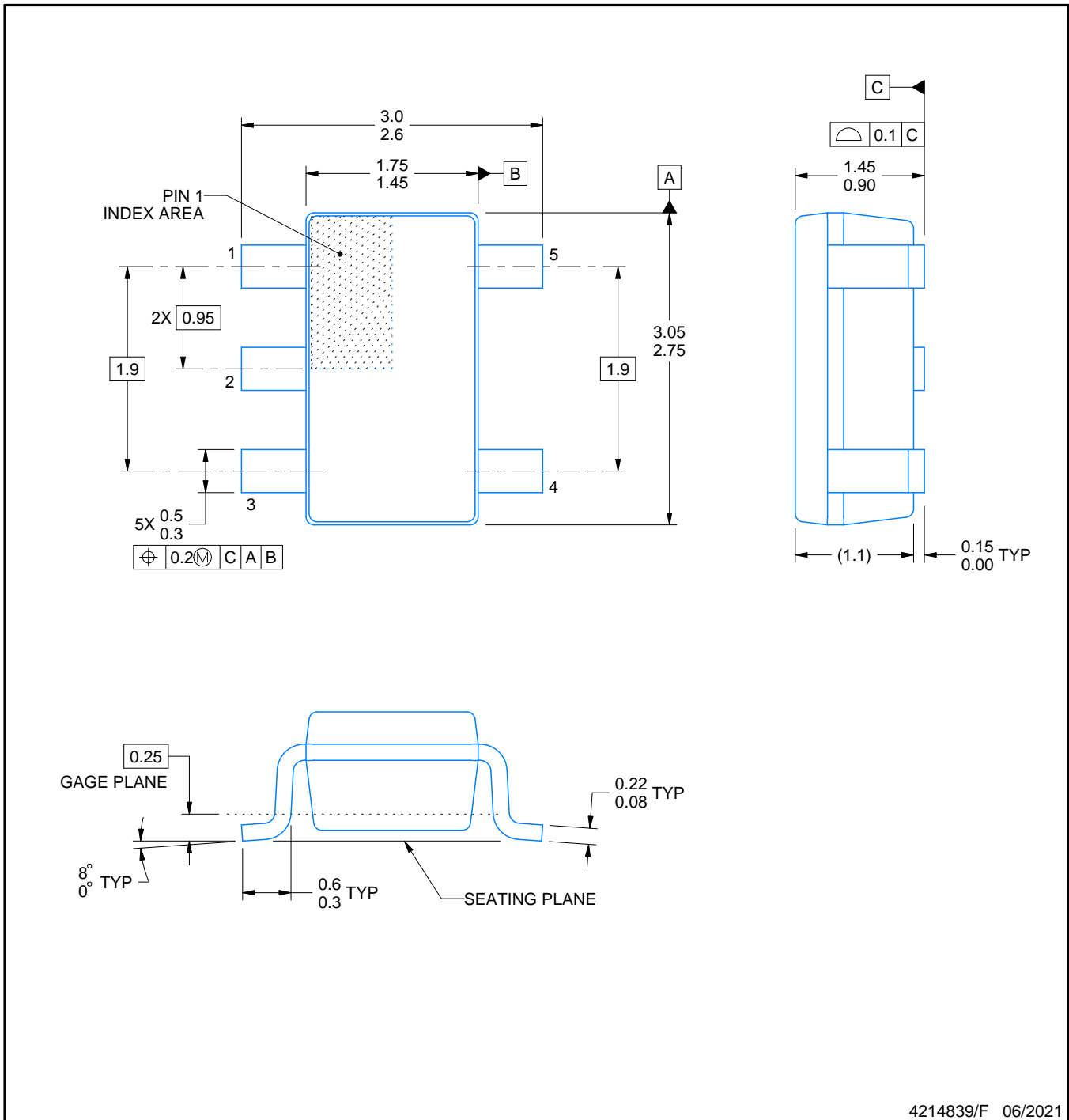
DBV0005A



PACKAGE OUTLINE

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



4214839/F 06/2021

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. Reference JEDEC MO-178.
4. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25 mm per side.

EXAMPLE BOARD LAYOUT

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

4214839/F 06/2021

NOTES: (continued)

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

EXAMPLE STENCIL DESIGN

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



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

4214839/F 06/2021

NOTES: (continued)

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

DRB 8

GENERIC PACKAGE VIEW

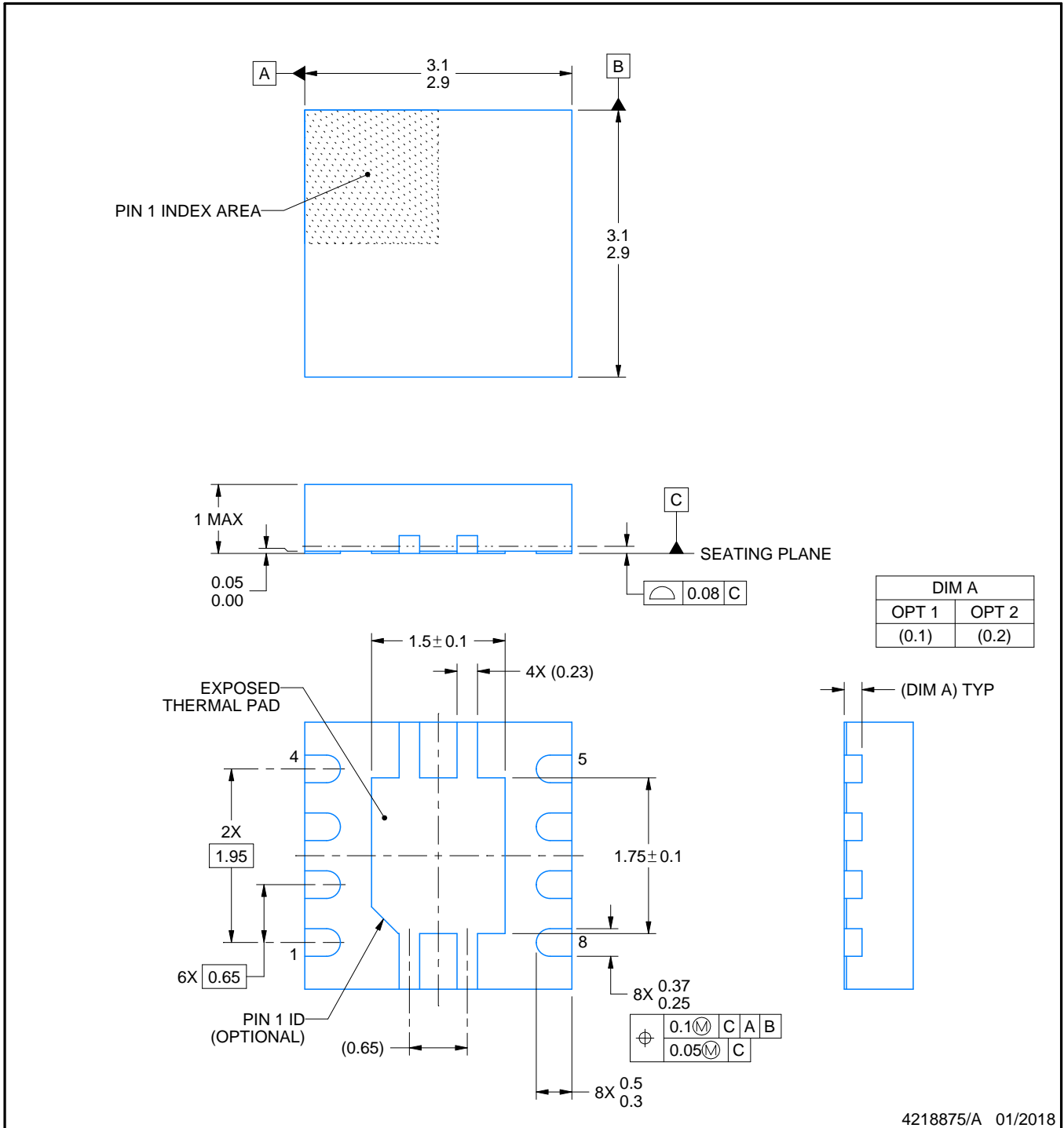
VSON - 1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4203482/L



4218875/A 01/2018

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. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

EXAMPLE BOARD LAYOUT

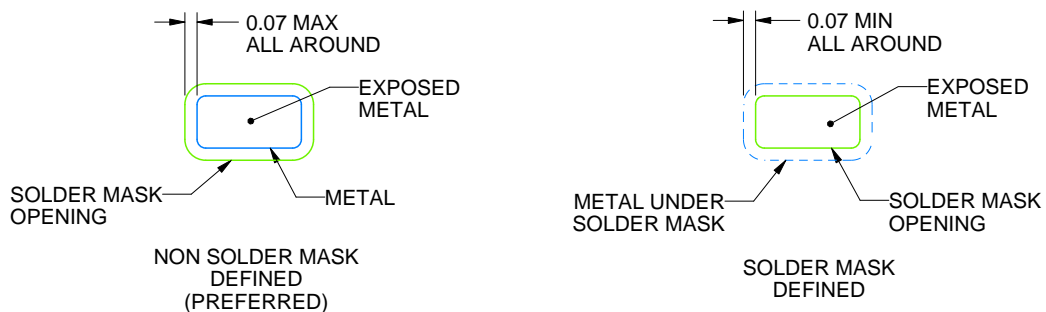
DRB0008A

VSON - 1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:20X



SOLDER MASK DETAILS

4218875/A 01/2018

NOTES: (continued)

4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/sluea271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

EXAMPLE STENCIL DESIGN

DRB0008A

VSON - 1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD
84% PRINTED SOLDER COVERAGE BY AREA
SCALE:25X

4218875/A 01/2018

NOTES: (continued)

6. 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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