

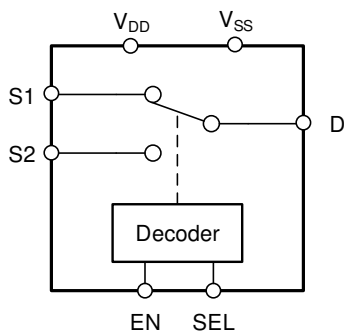
TMUX7219M 1.8V ロジック対応、44V、ラッチアップ・フリー、拡張温度、2:1 (SPDT) 高精度スイッチ

1 特長

- デュアル電源電圧範囲: $\pm 4.5V \sim \pm 22V$
- 単一電源電圧範囲: $4.5V \sim 44V$
- $-55^{\circ}C \sim +125^{\circ}C$ の動作温度範囲
- 低オン抵抗: 2.1Ω
- 少ない電荷注入: $-10pC$
- 大電流対応: $330mA$ (最大値)
- ラッチアップ・フリー
- 1.8V ロジック互換
- ロジック・ピンにプルアップ抵抗とプルダウン抵抗を内蔵
- フェイルセーフ・ロジック
- レール・ツー・レール動作
- 双方向の信号パス
- ブレイク・ビフォー・メイクのスイッチング動作

2 アプリケーション

- 航空用フライト・コントロール・ユニット
- 航空機のcockpit・ディスプレイ
- スタンドアロンの航空用高精度フライト・コントロール
- インターコネクト / ディストリビューション・ボックス
- 航空宇宙 / 防衛



機能ブロック図

3 概要

TMUX7219M は、シングル・チャンネル、2:1 (SPDT) 構成、ラッチアップ・フリーの相補型金属酸化膜半導体 (CMOS) スイッチです。このデバイスは単一電源 ($4.5V \sim 44V$)、デュアル電源 ($\pm 4.5V \sim \pm 22V$)、または非対称電源 ($V_{DD} = 12V$, $V_{SS} = -5V$ など) で適切に動作します。TMUX7219M は、ソース (Sx) およびドレイン (Dx) ピンで、 V_{SS} から V_{DD} までの範囲の双方向アナログおよびデジタル信号をサポートします。

TMUX7219M は、EN ピンの制御によりイネーブルまたはディスエーブルにできます。ディスエーブルのときは、両方の信号経路のスイッチがオフになります。イネーブルのとき、SEL ピンを使用して信号経路 1 (S1 から D へ) または信号経路 2 (S2 から D へ) をオンにできます。すべてのロジック制御入力、 $1.8V \sim V_{DD}$ のロジック・レベルをサポートしており、有効な電源電圧範囲で動作している場合、TTL ロジックと CMOS ロジックの両方の互換性を確保できます。フェイルセーフ・ロジック回路により、電源ピンよりも先に制御ピンに電圧が印加されるため、デバイスへの損傷の可能性が避けられます。

TMUX72xx ファミリーはラッチアップ・フリーであるため、一般的に過電圧イベントによって発生するデバイス内の寄生構造間の好ましくない大電流イベントを防止できます。ラッチアップ状態は通常、電源レールがオフにされるまで継続するため、デバイスの故障の原因となる場合があります。このラッチアップ・フリーという特長により、TMUX72xx スイッチおよびマルチプレクサ・ファミリーは過酷な環境でも使用できます。さらに、TMUX7219M は、最低 $-55^{\circ}C$ までの拡張温度範囲での使用が定格内であるため、過酷な産業用および航空宇宙のアプリケーションに理想的です。

製品情報 (1)

| 部品番号 | パッケージ | 本体サイズ (公称) |
|-----------|-----------|-----------------|
| TMUX7219M | VSSOP (8) | 3.00mm × 3.00mm |

- (1) 利用可能なパッケージについては、データシートの末尾にあるパッケージ・オプションについての付録を参照してください。



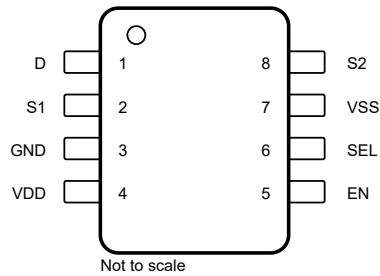
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4 Revision History

| DATE | REVISION | NOTES |
|----------|----------|-----------------|
| May 2022 | * | Initial Release |

5 Pin Configuration and Functions



**図 5-1. DGK Package
8-Pin VSSOP
(Top View)**

表 5-1. Pin Functions

| PIN | | TYPE ⁽¹⁾ | DESCRIPTION ⁽²⁾ |
|-----------------|-----|---------------------|---|
| NAME | NO. | | |
| D | 1 | I/O | Drain pin. Can be an input or output. |
| S1 | 2 | I/O | Source pin 1. Can be an input or output. |
| GND | 3 | P | Ground (0 V) reference |
| V _{DD} | 4 | P | Positive power supply. This pin is the most positive power-supply potential. For reliable operation, connect a decoupling capacitor ranging from 0.1 μF to 10 μF between V _{DD} and GND. |
| EN | 5 | I | Active high logic enable, has internal pull-up resistor. When this pin is low, all switches are turned off. When this pin is high, the SEL logic input determine which switch is turned on. |
| SEL | 6 | I | Logic control input, has internal pull-down resistor. Controls the switch connection as shown in セクション 8.5 . |
| V _{SS} | 7 | P | Negative power supply. This pin is the most negative power-supply potential. In single-supply applications, this pin can be connected to ground. For reliable operation, connect a decoupling capacitor ranging from 0.1 μF to 10 μF between V _{SS} and GND. |
| S2 | 8 | I/O | Source pin 2. Can be an input or output. |

- (1) I = input, O = output, I/O = input and output, P = power.
 (2) Refer to [セクション 8.4](#) for what to do with unused pins.

6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)^{(1) (2)}

| | | MIN | MAX | UNIT |
|------------------------|--|--------------|--------------------------------|------|
| $V_{DD} - V_{SS}$ | Supply voltage | | 48 | V |
| V_{DD} | | -0.5 | 48 | V |
| V_{SS} | | -48 | 0.5 | V |
| V_{SEL} or V_{EN} | Logic control input pin voltage (SEL, EN) ⁽³⁾ | -0.5 | 48 | V |
| I_{SEL} or I_{EN} | Logic control input pin current (SEL, EN) ⁽³⁾ | -30 | 30 | mA |
| V_S or V_D | Source or drain voltage (Sx, D) ⁽³⁾ | $V_{SS}-0.5$ | $V_{DD}+0.5$ | V |
| I_{IK} | Diode clamp current ⁽³⁾ | -30 | 30 | mA |
| I_S or $I_{D(CONT)}$ | Source or drain continuous current (Sx, D) | | $I_{DC} + 10\%$ ⁽⁴⁾ | mA |
| T_A | Ambient temperature | -55 | 150 | °C |
| T_{stg} | Storage temperature | -65 | 150 | °C |
| T_J | Junction temperature | | 150 | °C |
| P_{tot} | Total power dissipation ⁽⁵⁾ | | 460 | mW |

- (1) Operation outside the Absolute Maximum Ratings may cause permanent device damage. Absolute maximum ratings do not imply functional operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions. If briefly operating outside the Recommended Operating Conditions but within the Absolute Maximum Ratings, the device may not sustain damage, but it may not be fully functional. Operating the device in this manner may affect device reliability, functionality, performance, and shorten the device lifetime.
- (2) All voltages are with respect to ground, unless otherwise specified.
- (3) Pins are diode-clamped to the power-supply rails. Over voltage signals must be voltage and current limited to maximum ratings.
- (4) Refer to *Source or Drain Continuous Current* table for I_{DC} specifications.
- (5) For DGK package: P_{tot} derates linearly above $T_A = 70^\circ\text{C}$ by $6.7\text{mW}/^\circ\text{C}$.

6.2 ESD Ratings

| | | | VALUE | UNIT |
|-------------|-------------------------|--|-------|------|
| $V_{(ESD)}$ | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/ JEDEC JS-001, all pins ⁽¹⁾ | ±2000 | V |
| | | Charged device model (CDM), per JEDEC JS-002, all pins ⁽²⁾ | ±500 | |

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

6.3 Thermal Information

| THERMAL METRIC ⁽¹⁾ | | TMUX7219M | UNIT |
|-------------------------------|--|-------------|------|
| | | DGK (VSSOP) | |
| | | 8 PINS | |
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance | 152.1 | °C/W |
| $R_{\theta JC(top)}$ | Junction-to-case (top) thermal resistance | 48.4 | °C/W |
| $R_{\theta JB}$ | Junction-to-board thermal resistance | 73.2 | °C/W |
| Ψ_{JT} | Junction-to-top characterization parameter | 4.1 | °C/W |
| Ψ_{JB} | Junction-to-board characterization parameter | 71.8 | °C/W |
| $R_{\theta JC(bot)}$ | Junction-to-case (bottom) thermal resistance | N/A | °C/W |

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

6.4 Recommended Operating Conditions

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

| | | MIN | NOM | MAX | UNIT |
|----------------------------------|--|----------|-----|-------------------------|------|
| $V_{DD} - V_{SS}$ ⁽¹⁾ | Power supply voltage differential | 4.5 | | 44 | V |
| V_{DD} | Positive power supply voltage | 4.5 | | 44 | V |
| V_S or V_D | Signal path input/output voltage (source or drain pin) (Sx, D) | V_{SS} | | V_{DD} | V |
| V_{SEL} or V_{EN} | Address or enable pin voltage | 0 | | 44 | V |
| I_S or I_D (CONT) | Source or drain continuous current (Sx, D) | | | I_{DC} ⁽²⁾ | mA |
| T_A | Ambient temperature | -55 | | 125 | °C |

(1) V_{DD} and V_{SS} can be any value as long as $4.5\text{ V} \leq (V_{DD} - V_{SS}) \leq 44\text{ V}$, and the minimum V_{DD} is met.

(2) Refer to *Source or Drain Continuous Current* table for I_{DC} specifications.

6.5 Source or Drain Continuous Current

at supply voltage of $V_{DD} \pm 10\%$, $V_{SS} \pm 10\%$ (unless otherwise noted)

| CONTINUOUS CURRENT PER CHANNEL (I_{DC}) | | $T_A = 25^\circ\text{C}$ | $T_A = 85^\circ\text{C}$ | $T_A = 125^\circ\text{C}$ | UNIT |
|---|------------------------------------|--------------------------|--------------------------|---------------------------|------|
| PACKAGE | TEST CONDITIONS | | | | |
| DGK (VSSOP) | +44 V Single Supply ⁽¹⁾ | 330 | 210 | 120 | mA |
| | $\pm 15\text{ V}$ Dual Supply | 330 | 210 | 120 | mA |
| | +12 V Single Supply | 240 | 160 | 100 | mA |
| | $\pm 5\text{ V}$ Dual Supply | 240 | 160 | 100 | mA |
| | +5 V Single Supply | 180 | 120 | 80 | mA |

(1) Specified for nominal supply voltage only.

6.6 ±15 V Dual Supply: Electrical Characteristics

$V_{DD} = +15\text{ V} \pm 10\%$, $V_{SS} = -15\text{ V} \pm 10\%$, $GND = 0\text{ V}$ (unless otherwise noted)

Typical at $V_{DD} = +15\text{ V}$, $V_{SS} = -15\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | T_A | MIN | TYP | MAX | UNIT | |
|-------------------------------------|---|---|-----------------|-------|--------|------|-------------------------|----|
| ANALOG SWITCH | | | | | | | | |
| R_{ON} | On-resistance | $V_S = -10\text{ V to } +10\text{ V}$ $I_D = -10\text{ mA}$ Refer to On-Resistance | 25°C | 2.1 | 2.9 | | Ω | |
| | | | -40°C to +85°C | | | 3.8 | Ω | |
| | | | -55°C to +125°C | | | 4.5 | Ω | |
| ΔR_{ON} | On-resistance mismatch between channels | $V_S = -10\text{ V to } +10\text{ V}$ $I_D = -10\text{ mA}$ Refer to On-Resistance | 25°C | 0.05 | 0.25 | | Ω | |
| | | | -40°C to +85°C | | | 0.3 | Ω | |
| | | | -55°C to +125°C | | | 0.35 | Ω | |
| $R_{ON\ FLAT}$ | On-resistance flatness | $V_S = -10\text{ V to } +10\text{ V}$ $I_S = -10\text{ mA}$ Refer to On-Resistance | 25°C | 0.5 | 0.6 | | Ω | |
| | | | -40°C to +85°C | | | 0.7 | Ω | |
| | | | -55°C to +125°C | | | 0.85 | Ω | |
| $R_{ON\ DRIFT}$ | On-resistance drift | $V_S = 0\text{ V}$, $I_S = -10\text{ mA}$ Refer to On-Resistance | -55°C to +125°C | 0.01 | | | $\Omega/^\circ\text{C}$ | |
| $I_{S(OFF)}$ | Source off leakage current ⁽¹⁾ | $V_{DD} = 16.5\text{ V}$, $V_{SS} = -16.5\text{ V}$ Switch state is off $V_S = +10\text{ V} / -10\text{ V}$ $V_D = -10\text{ V} / +10\text{ V}$ Refer to Off-Leakage Current | 25°C | -0.15 | 0.05 | 0.15 | nA | |
| | | | -40°C to +85°C | | | -1.6 | 1.6 | nA |
| | | | -55°C to +125°C | | | -15 | 15 | nA |
| $I_{D(OFF)}$ | Drain off leakage current ⁽¹⁾ | $V_{DD} = 16.5\text{ V}$, $V_{SS} = -16.5\text{ V}$ Switch state is off $V_S = +10\text{ V} / -10\text{ V}$ $V_D = -10\text{ V} / +10\text{ V}$ Refer to Off-Leakage Current | 25°C | -1 | 0.05 | 1 | nA | |
| | | | -40°C to +85°C | | | -3 | 3 | nA |
| | | | -55°C to +125°C | | | -26 | 26 | nA |
| $I_{S(ON)}$ $I_{D(ON)}$ | Channel on leakage current ⁽²⁾ | $V_{DD} = 16.5\text{ V}$, $V_{SS} = -16.5\text{ V}$ Switch state is on $V_S = V_D = \pm 10\text{ V}$ Refer to On-Leakage Current | 25°C | -1 | 0.04 | 1 | nA | |
| | | | -40°C to +85°C | | | -1.8 | 1.8 | nA |
| | | | -55°C to +125°C | | | -18 | 18 | nA |
| LOGIC INPUTS (SEL / EN pins) | | | | | | | | |
| V_{IH} | Logic voltage high | | -55°C to +125°C | 1.3 | | 44 | V | |
| V_{IL} | Logic voltage low | | -55°C to +125°C | 0 | | 0.8 | V | |
| I_{IH} | Input leakage current | | -55°C to +125°C | | 0.005 | 2 | μA | |
| I_{IL} | Input leakage current | | -55°C to +125°C | -1 | -0.005 | | μA | |
| C_{IN} | Logic input capacitance | | -55°C to +125°C | | 3 | | pF | |
| POWER SUPPLY | | | | | | | | |
| I_{DD} | V_{DD} supply current | $V_{DD} = 16.5\text{ V}$, $V_{SS} = -16.5\text{ V}$ Logic inputs = 0 V, 5 V, or V_{DD} | 25°C | 30 | 40 | | μA | |
| | | | -40°C to +85°C | | | 48 | μA | |
| | | | -55°C to +125°C | | | 62 | μA | |
| I_{SS} | V_{SS} supply current | $V_{DD} = 16.5\text{ V}$, $V_{SS} = -16.5\text{ V}$ Logic inputs = 0 V, 5 V, or V_{DD} | 25°C | 3 | 10 | | μA | |
| | | | -40°C to +85°C | | | 15 | μA | |
| | | | -55°C to +125°C | | | 25 | μA | |

(1) When V_S is positive, V_D is negative, or when V_S is negative, V_D is positive.

(2) When V_S is at a voltage potential, V_D is floating, or when V_D is at a voltage potential, V_S is floating.

6.7 ±15 V Dual Supply: Switching Characteristics

$V_{DD} = +15\text{ V} \pm 10\%$, $V_{SS} = -15\text{ V} \pm 10\%$, $GND = 0\text{ V}$ (unless otherwise noted)

Typical at $V_{DD} = +15\text{ V}$, $V_{SS} = -15\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | T_A | MIN | TYP | MAX | UNIT |
|--|--|---|-----------------|-----|--------|------|------|
| t_{TRAN} | Transition time from control input | $V_S = 10\text{ V}$ $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Transition Time | 25°C | | 120 | 175 | ns |
| | | | -40°C to +85°C | | | 190 | ns |
| | | | -55°C to +125°C | | | 210 | ns |
| $t_{\text{ON (EN)}}$ | Turn-on time from enable | $V_S = 10\text{ V}$ $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Turn-on and Turn-off Time | 25°C | | 100 | 170 | ns |
| | | | -40°C to +85°C | | | 185 | ns |
| | | | -55°C to +125°C | | | 200 | ns |
| $t_{\text{OFF (EN)}}$ | Turn-off time from enable | $V_S = 10\text{ V}$ $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Turn-on and Turn-off Time | 25°C | | 100 | 180 | ns |
| | | | -40°C to +85°C | | | 195 | ns |
| | | | -55°C to +125°C | | | 210 | ns |
| t_{BBM} | Break-before-make time delay | $V_S = 10\text{ V}$, $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Break-Before-Make | 25°C | | 50 | | ns |
| | | | -40°C to +85°C | 1 | | | ns |
| | | | -55°C to +125°C | 1 | | | ns |
| $T_{\text{ON (VDD)}}$ | Device turn on time (V_{DD} to output) | V_{DD} rise time = 100ns $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Turn-on (VDD) Time | 25°C | | 0.19 | | ms |
| | | | -40°C to +85°C | | | 0.2 | ms |
| | | | -55°C to +125°C | | | 0.22 | ms |
| t_{PD} | Propagation delay | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ Refer to Propagation Delay | 25°C | | 700 | | ps |
| Q_{INJ} | Charge injection | $V_D = 0\text{ V}$, $C_L = 1\text{ nF}$ Refer to Charge Injection | 25°C | | -10 | | pC |
| O_{ISO} | Off-isolation | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 0\text{ V}$, $f = 100\text{ kHz}$ Refer to Off Isolation | 25°C | | -75 | | dB |
| O_{ISO} | Off-isolation | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 0\text{ V}$, $f = 1\text{ MHz}$ Refer to Off Isolation | 25°C | | -55 | | dB |
| X_{TALK} | Crosstalk | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 0\text{ V}$, $f = 100\text{ kHz}$ Refer to Crosstalk | 25°C | | -117 | | dB |
| X_{TALK} | Crosstalk | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 0\text{ V}$, $f = 1\text{ MHz}$ Refer to Crosstalk | 25°C | | -106 | | dB |
| BW | -3dB Bandwidth | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 0\text{ V}$ Refer to Bandwidth | 25°C | | 40 | | MHz |
| I_L | Insertion loss | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 0\text{ V}$, $f = 1\text{ MHz}$ | 25°C | | -0.18 | | dB |
| ACPSRR | AC Power Supply Rejection Ratio | $V_{PP} = 0.62\text{ V}$ on V_{DD} and V_{SS} $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$, $f = 1\text{ MHz}$ Refer to ACPSRR | 25°C | | -64 | | dB |
| THD+N | Total Harmonic Distortion + Noise | $V_{PP} = 15\text{ V}$, $V_{\text{BIAS}} = 0\text{ V}$ $R_L = 10\text{ k}\Omega$, $C_L = 5\text{ pF}$, $f = 20\text{ Hz}$ to 20 kHz Refer to THD + Noise | 25°C | | 0.0005 | | % |
| $C_{\text{S(OFF)}}$ | Source off capacitance | $V_S = 0\text{ V}$, $f = 1\text{ MHz}$ | 25°C | | 33 | | pF |
| $C_{\text{D(OFF)}}$ | Drain off capacitance | $V_S = 0\text{ V}$, $f = 1\text{ MHz}$ | 25°C | | 48 | | pF |
| $C_{\text{S(ON)}}$, $C_{\text{D(ON)}}$ | On capacitance | $V_S = 0\text{ V}$, $f = 1\text{ MHz}$ | 25°C | | 148 | | pF |

6.8 ±20 V Dual Supply: Electrical Characteristics

$V_{DD} = +20\text{ V} \pm 10\%$, $V_{SS} = -20\text{ V} \pm 10\%$, GND = 0 V (unless otherwise noted)

Typical at $V_{DD} = +20\text{ V}$, $V_{SS} = -20\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | T_A | MIN | TYP | MAX | UNIT | |
|-------------------------------------|---|---|-----------------|-------|--------|------|-------------------------|----|
| ANALOG SWITCH | | | | | | | | |
| R_{ON} | On-resistance | $V_S = -15\text{ V to }+15\text{ V}$ $I_D = -10\text{ mA}$ Refer to On-Resistance | 25°C | 1.9 | 2.7 | | Ω | |
| | | | -40°C to +85°C | | | 3.5 | Ω | |
| | | | -55°C to +125°C | | | 4.2 | Ω | |
| ΔR_{ON} | On-resistance mismatch between channels | $V_S = -15\text{ V to }+15\text{ V}$ $I_D = -10\text{ mA}$ Refer to On-Resistance | 25°C | 0.04 | 0.22 | | Ω | |
| | | | -40°C to +85°C | | | 0.28 | Ω | |
| | | | -55°C to +125°C | | | 0.3 | Ω | |
| $R_{ON\ FLAT}$ | On-resistance flatness | $V_S = -15\text{ V to }+15\text{ V}$ $I_S = -10\text{ mA}$ Refer to On-Resistance | 25°C | 0.3 | 0.75 | | Ω | |
| | | | -40°C to +85°C | | | 0.9 | Ω | |
| | | | -55°C to +125°C | | | 1.2 | Ω | |
| $R_{ON\ DRIFT}$ | On-resistance drift | $V_S = 0\text{ V}$, $I_S = -10\text{ mA}$ Refer to On-Resistance | -55°C to +125°C | 0.009 | | | $\Omega/^\circ\text{C}$ | |
| $I_{S(OFF)}$ | Source off leakage current ⁽¹⁾ | $V_{DD} = 22\text{ V}$, $V_{SS} = -22\text{ V}$ Switch state is off $V_S = +15\text{ V} / -15\text{ V}$ $V_D = -15\text{ V} / +15\text{ V}$ Refer to Off-Leakage Current | 25°C | -1.5 | 0.05 | 1.5 | nA | |
| | | | -40°C to +85°C | | -4 | | 4 | nA |
| | | | -55°C to +125°C | | -24 | | 24 | nA |
| $I_{D(OFF)}$ | Drain off leakage current ⁽¹⁾ | $V_{DD} = 22\text{ V}$, $V_{SS} = -22\text{ V}$ Switch state is off $V_S = +15\text{ V} / -15\text{ V}$ $V_D = -15\text{ V} / +15\text{ V}$ Refer to Off-Leakage Current | 25°C | -2 | 0.1 | 2 | nA | |
| | | | -40°C to +85°C | | -8 | | 8 | nA |
| | | | -55°C to +125°C | | -44 | | 44 | nA |
| $I_{S(ON)}$ $I_{D(ON)}$ | Channel on leakage current ⁽²⁾ | $V_{DD} = 22\text{ V}$, $V_{SS} = -22\text{ V}$ Switch state is on $V_S = V_D = \pm 15\text{ V}$ Refer to On-Leakage Current | 25°C | -2 | 0.1 | 2 | nA | |
| | | | -40°C to +85°C | | -5 | | 5 | nA |
| | | | -55°C to +125°C | | -29 | | 29 | nA |
| LOGIC INPUTS (SEL / EN pins) | | | | | | | | |
| V_{IH} | Logic voltage high | | -55°C to +125°C | 1.3 | | 44 | V | |
| V_{IL} | Logic voltage low | | -55°C to +125°C | 0 | | 0.8 | V | |
| I_{IH} | Input leakage current | | -55°C to +125°C | | 0.005 | 2 | μA | |
| I_{IL} | Input leakage current | | -55°C to +125°C | -1 | -0.005 | | μA | |
| C_{IN} | Logic input capacitance | | -55°C to +125°C | | 3 | | pF | |
| POWER SUPPLY | | | | | | | | |
| I_{DD} | V_{DD} supply current | $V_{DD} = 22\text{ V}$, $V_{SS} = -22\text{ V}$ Logic inputs = 0 V, 5 V, or V_{DD} | 25°C | 34 | 44 | | μA | |
| | | | -40°C to +85°C | | | 50 | μA | |
| | | | -55°C to +125°C | | | 65 | μA | |
| I_{SS} | V_{SS} supply current | $V_{DD} = 22\text{ V}$, $V_{SS} = -22\text{ V}$ Logic inputs = 0 V, 5 V, or V_{DD} | 25°C | 4 | 9 | | μA | |
| | | | -40°C to +85°C | | | 12 | μA | |
| | | | -55°C to +125°C | | | 25 | μA | |

(1) When V_S is positive, V_D is negative, or when V_S is negative, V_D is positive.

(2) When V_S is at a voltage potential, V_D is floating, or when V_D is at a voltage potential, V_S is floating.

6.9 ±20 V Dual Supply: Switching Characteristics

$V_{DD} = +20\text{ V} \pm 10\%$, $V_{SS} = -20\text{ V} \pm 10\%$, $GND = 0\text{ V}$ (unless otherwise noted)

Typical at $V_{DD} = +20\text{ V}$, $V_{SS} = -20\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | T_A | MIN | TYP | MAX | UNIT |
|--|--|---|-----------------|-----|--------|------|------|
| t_{TRAN} | Transition time from control input | $V_S = 10\text{ V}$ $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Transition Time | 25°C | | 110 | 175 | ns |
| | | | -40°C to +85°C | | | 190 | ns |
| | | | -55°C to +125°C | | | 205 | ns |
| $t_{\text{ON (EN)}}$ | Turn-on time from enable | $V_S = 10\text{ V}$ $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Turn-on and Turn-off Time | 25°C | | 110 | 170 | ns |
| | | | -40°C to +85°C | | | 185 | ns |
| | | | -55°C to +125°C | | | 200 | ns |
| $t_{\text{OFF (EN)}}$ | Turn-off time from enable | $V_S = 10\text{ V}$ $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Turn-on and Turn-off Time | 25°C | | 90 | 180 | ns |
| | | | -40°C to +85°C | | | 190 | ns |
| | | | -55°C to +125°C | | | 200 | ns |
| t_{BBM} | Break-before-make time delay | $V_S = 10\text{ V}$, $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Break-Before-Make | 25°C | | 55 | | ns |
| | | | -40°C to +85°C | 1 | | | ns |
| | | | -55°C to +125°C | 1 | | | ns |
| $T_{\text{ON (VDD)}}$ | Device turn on time (V_{DD} to output) | V_{DD} rise time = 100ns $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Turn-on (VDD) Time | 25°C | | 0.18 | | ms |
| | | | -40°C to +85°C | | | 0.2 | ms |
| | | | -55°C to +125°C | | | 0.22 | ms |
| t_{PD} | Propagation delay | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ Refer to Propagation Delay | 25°C | | 715 | | ps |
| Q_{INJ} | Charge injection | $V_D = 0\text{ V}$, $C_L = 1\text{ nF}$ Refer to Charge Injection | 25°C | | -15 | | pC |
| O_{ISO} | Off-isolation | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 0\text{ V}$, $f = 100\text{ kHz}$ Refer to Off Isolation | 25°C | | -75 | | dB |
| O_{ISO} | Off-isolation | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 0\text{ V}$, $f = 1\text{ MHz}$ Refer to Off Isolation | 25°C | | -55 | | dB |
| X_{TALK} | Crosstalk | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 0\text{ V}$, $f = 100\text{ kHz}$ Refer to Crosstalk | 25°C | | -117 | | dB |
| X_{TALK} | Crosstalk | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 0\text{ V}$, $f = 1\text{ MHz}$ Refer to Crosstalk | 25°C | | -106 | | dB |
| BW | -3dB Bandwidth | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 0\text{ V}$, Refer to Bandwidth | 25°C | | 38 | | MHz |
| I_L | Insertion loss | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 0\text{ V}$, $f = 1\text{ MHz}$ | 25°C | | -0.16 | | dB |
| ACPSRR | AC Power Supply Rejection Ratio | $V_{PP} = 0.62\text{ V}$ on V_{DD} and V_{SS} $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$, $f = 1\text{ MHz}$ Refer to ACPSRR | 25°C | | -63 | | dB |
| THD+N | Total Harmonic Distortion + Noise | $V_{PP} = 20\text{ V}$, $V_{\text{BIAS}} = 0\text{ V}$ $R_L = 10\text{ k}\Omega$, $C_L = 5\text{ pF}$, $f = 20\text{ Hz}$ to 20 kHz Refer to THD + Noise | 25°C | | 0.0005 | | % |
| $C_{\text{S(OFF)}}$ | Source off capacitance | $V_S = 0\text{ V}$, $f = 1\text{ MHz}$ | 25°C | | 32 | | pF |
| $C_{\text{D(OFF)}}$ | Drain off capacitance | $V_S = 0\text{ V}$, $f = 1\text{ MHz}$ | 25°C | | 45 | | pF |
| $C_{\text{S(ON)}}$, $C_{\text{D(ON)}}$ | On capacitance | $V_S = 0\text{ V}$, $f = 1\text{ MHz}$ | 25°C | | 146 | | pF |

6.10 44 V Single Supply: Electrical Characteristics

$V_{DD} = +44\text{ V}$, $V_{SS} = 0\text{ V}$, $GND = 0\text{ V}$ (unless otherwise noted)
 Typical at $V_{DD} = +44\text{ V}$, $V_{SS} = 0\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | T_A | MIN | TYP | MAX | UNIT | |
|-------------------------------------|---|---|-----------------|-----|-------|--------|-------------------------|----|
| ANALOG SWITCH | | | | | | | | |
| R_{ON} | On-resistance | $V_S = 0\text{ V to }40\text{ V}$ $I_D = -10\text{ mA}$ Refer to On-Resistance | 25°C | | 2.2 | 2.8 | Ω | |
| | | | -40°C to +85°C | | | 3.6 | Ω | |
| | | | -55°C to +125°C | | | 4.2 | Ω | |
| ΔR_{ON} | On-resistance mismatch between channels | $V_S = 0\text{ V to }40\text{ V}$ $I_D = -10\text{ mA}$ Refer to On-Resistance | 25°C | | 0.1 | 0.2 | Ω | |
| | | | -40°C to +85°C | | | 0.3 | Ω | |
| | | | -55°C to +125°C | | | 0.35 | Ω | |
| $R_{ON\ FLAT}$ | On-resistance flatness | $V_S = 0\text{ V to }40\text{ V}$ $I_D = -10\text{ mA}$ Refer to On-Resistance | 25°C | | 0.2 | 1 | Ω | |
| | | | -40°C to +85°C | | | 1.3 | Ω | |
| | | | -55°C to +125°C | | | 1.5 | Ω | |
| $R_{ON\ DRIFT}$ | On-resistance drift | $V_S = 22\text{ V}$, $I_S = -10\text{ mA}$ Refer to On-Resistance | -55°C to +125°C | | 0.008 | | $\Omega/^\circ\text{C}$ | |
| $I_{S(OFF)}$ | Source off leakage current ⁽¹⁾ | $V_{DD} = 44\text{ V}$, $V_{SS} = 0\text{ V}$ Switch state is off $V_S = 40\text{ V} / 1\text{ V}$ $V_D = 1\text{ V} / 40\text{ V}$ Refer to Off-Leakage Current | 25°C | -5 | 0.05 | 5 | nA | |
| | | | -40°C to +85°C | | -10 | | 10 | nA |
| | | | -55°C to +125°C | | -35 | | 35 | nA |
| $I_{D(OFF)}$ | Drain off leakage current ⁽¹⁾ | $V_{DD} = 44\text{ V}$, $V_{SS} = 0\text{ V}$ Switch state is off $V_S = 40\text{ V} / 1\text{ V}$ $V_D = 1\text{ V} / 40\text{ V}$ Refer to Off-Leakage Current | 25°C | -8 | 0.05 | 8 | nA | |
| | | | -40°C to +85°C | | -12 | | 12 | nA |
| | | | -55°C to +125°C | | -70 | | 70 | nA |
| $I_{S(ON)}$ $I_{D(ON)}$ | Channel on leakage current ⁽²⁾ | $V_{DD} = 44\text{ V}$, $V_{SS} = 0\text{ V}$ Switch state is on $V_S = V_D = 40\text{ V or }1\text{ V}$ Refer to On-Leakage Current | 25°C | -8 | 0.05 | 8 | nA | |
| | | | -40°C to +85°C | | -10 | | 10 | nA |
| | | | -55°C to +125°C | | -45 | | 45 | nA |
| LOGIC INPUTS (SEL / EN pins) | | | | | | | | |
| V_{IH} | Logic voltage high | | -55°C to +125°C | | 1.3 | 44 | V | |
| V_{IL} | Logic voltage low | | -55°C to +125°C | | 0 | 0.8 | V | |
| I_{IH} | Input leakage current | | -55°C to +125°C | | 0.005 | 2 | μA | |
| I_{IL} | Input leakage current | | -55°C to +125°C | | -1 | -0.005 | μA | |
| C_{IN} | Logic input capacitance | | -55°C to +125°C | | 3 | | pF | |
| POWER SUPPLY | | | | | | | | |
| I_{DD} | V_{DD} supply current | $V_{DD} = 44\text{ V}$, $V_{SS} = 0\text{ V}$ Logic inputs = 0 V, 5 V, or V_{DD} | 25°C | | 17 | 50 | μA | |
| | | | -40°C to +85°C | | | 60 | μA | |
| | | | -55°C to +125°C | | | 75 | μA | |

- (1) When V_S is 40 V, V_D is 1 V, or when V_S is 1 V, V_D is 40 V.
 (2) When V_S is at a voltage potential, V_D is floating, or when V_D is at a voltage potential, V_S is floating.

6.11 44 V Single Supply: Switching Characteristics

$V_{DD} = +44\text{ V}$, $V_{SS} = 0\text{ V}$, $GND = 0\text{ V}$ (unless otherwise noted)

Typical at $V_{DD} = +44\text{ V}$, $V_{SS} = 0\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | T_A | MIN | TYP | MAX | UNIT |
|--|--|---|-----------------|-----|--------|------|------|
| t_{TRAN} | Transition time from control input | $V_S = 18\text{ V}$ $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Transition Time | 25°C | | 120 | 175 | ns |
| | | | -40°C to +85°C | | | 190 | ns |
| | | | -55°C to +125°C | | | 205 | ns |
| $t_{\text{ON (EN)}}$ | Turn-on time from enable | $V_S = 18\text{ V}$ $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Turn-on and Turn-off Time | 25°C | | 120 | 168 | ns |
| | | | -40°C to +85°C | | | 185 | ns |
| | | | -55°C to +125°C | | | 195 | ns |
| $t_{\text{OFF (EN)}}$ | Turn-off time from enable | $V_S = 18\text{ V}$ $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Turn-on and Turn-off Time | 25°C | | 120 | 180 | ns |
| | | | -40°C to +85°C | | | 200 | ns |
| | | | -55°C to +125°C | | | 205 | ns |
| t_{BBM} | Break-before-make time delay | $V_S = 18\text{ V}$, $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Break-Before-Make | 25°C | | 45 | | ns |
| | | | -40°C to +85°C | 1 | | | ns |
| | | | -55°C to +125°C | 1 | | | ns |
| $T_{\text{ON (VDD)}}$ | Device turn on time (V_{DD} to output) | V_{DD} rise time = 1 μs $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Turn-on (VDD) Time | 25°C | | 0.15 | | ms |
| | | | -40°C to +85°C | | | 0.17 | ms |
| | | | -55°C to +125°C | | | 0.19 | ms |
| t_{PD} | Propagation delay | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ Refer to Propagation Delay | 25°C | | 930 | | ps |
| Q_{INJ} | Charge injection | $V_D = 22\text{ V}$, $C_L = 1\text{ nF}$ Refer to Charge Injection | 25°C | | -16 | | pC |
| O_{ISO} | Off-isolation | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 6\text{ V}$, $f = 100\text{ kHz}$ Refer to Off Isolation | 25°C | | -75 | | dB |
| O_{ISO} | Off-isolation | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 6\text{ V}$, $f = 1\text{ MHz}$ Refer to Off Isolation | 25°C | | -55 | | dB |
| X_{TALK} | Crosstalk | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 6\text{ V}$, $f = 100\text{ kHz}$ Refer to Crosstalk | 25°C | | -117 | | dB |
| X_{TALK} | Crosstalk | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 6\text{ V}$, $f = 1\text{ MHz}$ Refer to Crosstalk | 25°C | | -106 | | dB |
| BW | -3dB Bandwidth | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 6\text{ V}$ Refer to Bandwidth | 25°C | | 37 | | MHz |
| I_L | Insertion loss | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 6\text{ V}$, $f = 1\text{ MHz}$ | 25°C | | -0.18 | | dB |
| ACPSRR | AC Power Supply Rejection Ratio | $V_{PP} = 0.62\text{ V}$ on V_{DD} and V_{SS} $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$, $f = 1\text{ MHz}$ Refer to ACPSRR | 25°C | | -60 | | dB |
| THD+N | Total Harmonic Distortion + Noise | $V_{PP} = 22\text{ V}$, $V_{BIAS} = 22\text{ V}$ $R_L = 10\text{ k}\Omega$, $C_L = 5\text{ pF}$, $f = 20\text{ Hz}$ to 20 kHz Refer to THD + Noise | 25°C | | 0.0004 | | % |
| $C_{S(\text{OFF})}$ | Source off capacitance | $V_S = 6\text{ V}$, $f = 1\text{ MHz}$ | 25°C | | 34 | | pF |
| $C_{D(\text{OFF})}$ | Drain off capacitance | $V_S = 6\text{ V}$, $f = 1\text{ MHz}$ | 25°C | | 48 | | pF |
| $C_{S(\text{ON})}$, $C_{D(\text{ON})}$ | On capacitance | $V_S = 6\text{ V}$, $f = 1\text{ MHz}$ | 25°C | | 146 | | pF |

6.12 12 V Single Supply: Electrical Characteristics

$V_{DD} = +12\text{ V} \pm 10\%$, $V_{SS} = 0\text{ V}$, $GND = 0\text{ V}$ (unless otherwise noted)

Typical at $V_{DD} = +12\text{ V}$, $V_{SS} = 0\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | T_A | MIN | TYP | MAX | UNIT | |
|-------------------------------------|---|---|-----------------|-------|--------|------|-------------------------|---------------|
| ANALOG SWITCH | | | | | | | | |
| R_{ON} | On-resistance | $V_S = 0\text{ V to }10\text{ V}$ $I_D = -10\text{ mA}$ Refer to On-Resistance | 25°C | 4.6 | | 6 | Ω | |
| | | | -40°C to +85°C | | | 7.5 | Ω | |
| | | | -55°C to +125°C | | | 8.4 | Ω | |
| ΔR_{ON} | On-resistance mismatch between channels | $V_S = 0\text{ V to }10\text{ V}$ $I_D = -10\text{ mA}$ Refer to On-Resistance | 25°C | 0.08 | | 0.2 | Ω | |
| | | | -40°C to +85°C | | | 0.32 | Ω | |
| | | | -55°C to +125°C | | | 0.35 | Ω | |
| $R_{ON\ FLAT}$ | On-resistance flatness | $V_S = 0\text{ V to }10\text{ V}$ $I_S = -10\text{ mA}$ Refer to On-Resistance | 25°C | 1.2 | | 2 | Ω | |
| | | | -40°C to +85°C | | | 2.2 | Ω | |
| | | | -55°C to +125°C | | | 2.4 | Ω | |
| $R_{ON\ DRIFT}$ | On-resistance drift | $V_S = 6\text{ V}$, $I_S = -10\text{ mA}$ Refer to On-Resistance | -55°C to +125°C | 0.017 | | | $\Omega/^\circ\text{C}$ | |
| $I_{S(OFF)}$ | Source off leakage current ⁽¹⁾ | $V_{DD} = 13.2\text{ V}$, $V_{SS} = 0\text{ V}$ Switch state is off $V_S = 10\text{ V} / 1\text{ V}$ $V_D = 1\text{ V} / 10\text{ V}$ Refer to Off-Leakage Current | 25°C | -0.5 | 0.05 | 0.5 | nA | |
| | | | -40°C to +85°C | | | | 2 | nA |
| | | | -55°C to +125°C | | | | 12 | nA |
| $I_{D(OFF)}$ | Drain off leakage current ⁽¹⁾ | $V_{DD} = 13.2\text{ V}$, $V_{SS} = 0\text{ V}$ Switch state is off $V_S = 10\text{ V} / 1\text{ V}$ $V_D = 1\text{ V} / 10\text{ V}$ Refer to Off-Leakage Current | 25°C | -0.5 | 0.05 | 0.5 | nA | |
| | | | -40°C to +85°C | | | | 3 | nA |
| | | | -55°C to +125°C | | | | 23 | nA |
| $I_{S(ON)}$ $I_{D(ON)}$ | Channel on leakage current ⁽²⁾ | $V_{DD} = 13.2\text{ V}$, $V_{SS} = 0\text{ V}$ Switch state is on $V_S = V_D = 10\text{ V}$ or 1 V Refer to On-Leakage Current | 25°C | -1.5 | 0.05 | 1.5 | nA | |
| | | | -40°C to +85°C | | | | 3 | nA |
| | | | -55°C to +125°C | | | | 15 | nA |
| LOGIC INPUTS (SEL / EN pins) | | | | | | | | |
| V_{IH} | Logic voltage high | | -55°C to +125°C | 1.3 | | 44 | V | |
| V_{IL} | Logic voltage low | | -55°C to +125°C | 0 | | 0.8 | V | |
| I_{IH} | Input leakage current | | -55°C to +125°C | | 0.005 | 2 | μA | |
| I_{IL} | Input leakage current | | -55°C to +125°C | -1 | -0.005 | | μA | |
| C_{IN} | Logic input capacitance | | -55°C to +125°C | | 3 | | pF | |
| POWER SUPPLY | | | | | | | | |
| I_{DD} | V_{DD} supply current | $V_{DD} = 13.2\text{ V}$, $V_{SS} = 0\text{ V}$ Logic inputs = 0 V , 5 V , or V_{DD} | 25°C | 10 | | 35 | μA | |
| | | | -40°C to +85°C | | | | 45 | μA |
| | | | -55°C to +125°C | | | | 55 | μA |

(1) When V_S is 10 V, V_D is 1 V, or when V_S is 1 V, V_D is 10 V.

(2) When V_S is at a voltage potential, V_D is floating, or when V_D is at a voltage potential, V_S is floating.

6.13 12 V Single Supply: Switching Characteristics

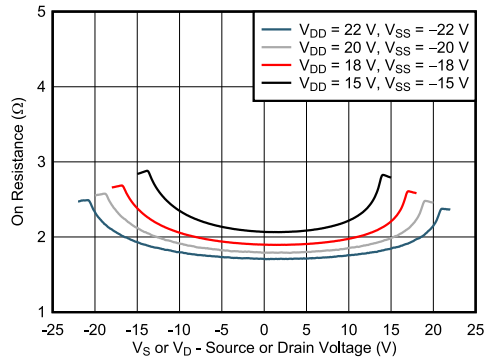
 $V_{DD} = +12\text{ V} \pm 10\%$, $V_{SS} = 0\text{ V}$, $GND = 0\text{ V}$ (unless otherwise noted)

 Typical at $V_{DD} = +12\text{ V}$, $V_{SS} = 0\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

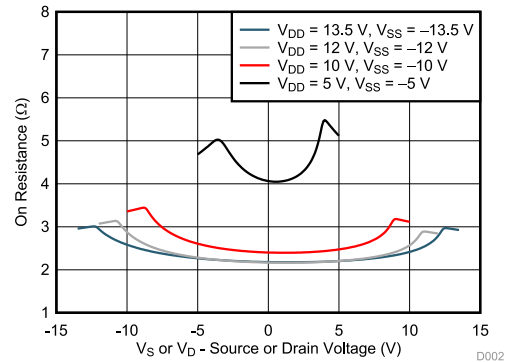
| PARAMETER | | TEST CONDITIONS | T_A | MIN | TYP | MAX | UNIT |
|--|--|---|-----------------|-----|--------|------|------|
| t_{TRAN} | Transition time from control input | $V_S = 8\text{ V}$ $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Transition Time | 25°C | | 180 | 185 | ns |
| | | | -40°C to +85°C | | | 215 | ns |
| | | | -55°C to +125°C | | | 235 | ns |
| $t_{\text{ON (EN)}}$ | Turn-on time from enable | $V_S = 8\text{ V}$ $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Turn-on and Turn-off Time | 25°C | | 120 | 180 | ns |
| | | | -40°C to +85°C | | | 210 | ns |
| | | | -55°C to +125°C | | | 230 | ns |
| $t_{\text{OFF (EN)}}$ | Turn-off time from enable | $V_S = 8\text{ V}$ $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Turn-on and Turn-off Time | 25°C | | 130 | 210 | ns |
| | | | -40°C to +85°C | | | 235 | ns |
| | | | -55°C to +125°C | | | 250 | ns |
| t_{BBM} | Break-before-make time delay | $V_S = 8\text{ V}$, $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Break-Before-Make | 25°C | | 40 | | ns |
| | | | -40°C to +85°C | 1 | | | ns |
| | | | -55°C to +125°C | 1 | | | ns |
| $T_{\text{ON (VDD)}}$ | Device turn on time (V_{DD} to output) | V_{DD} rise time = 100ns $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ Refer to Turn-on (VDD) Time | 25°C | | 0.19 | | ms |
| | | | -40°C to +85°C | | | 0.2 | ms |
| | | | -55°C to +125°C | | | 0.22 | ms |
| t_{PD} | Propagation delay | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ Refer to Propagation Delay | 25°C | | 740 | | ps |
| Q_{INJ} | Charge injection | $V_D = 6\text{ V}$, $C_L = 1\text{ nF}$ Refer to Charge Injection | 25°C | | -6 | | pC |
| O_{ISO} | Off-isolation | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 6\text{ V}$, $f = 100\text{ kHz}$ Refer to Off Isolation | 25°C | | -75 | | dB |
| O_{ISO} | Off-isolation | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 6\text{ V}$, $f = 1\text{ MHz}$ Refer to Off Isolation | 25°C | | -55 | | dB |
| X_{TALK} | Crosstalk | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 6\text{ V}$, $f = 100\text{ kHz}$ Refer to Crosstalk | 25°C | | -117 | | dB |
| X_{TALK} | Crosstalk | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 6\text{ V}$, $f = 1\text{ MHz}$ Refer to Crosstalk | 25°C | | -106 | | dB |
| BW | -3dB Bandwidth | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 6\text{ V}$ Refer to Bandwidth | 25°C | | 42 | | MHz |
| I_L | Insertion loss | $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $V_S = 6\text{ V}$, $f = 1\text{ MHz}$ | 25°C | | -0.3 | | dB |
| ACPSRR | AC Power Supply Rejection Ratio | $V_{PP} = 0.62\text{ V}$ on V_{DD} and V_{SS} $R_L = 50\ \Omega$, $C_L = 5\text{ pF}$, $f = 1\text{ MHz}$ Refer to ACPSRR | 25°C | | -65 | | dB |
| THD+N | Total Harmonic Distortion + Noise | $V_{PP} = 6\text{ V}$, $V_{BIAS} = 6\text{ V}$ $R_L = 10\text{ k}\Omega$, $C_L = 5\text{ pF}$, $f = 20\text{ Hz}$ to 20 kHz Refer to THD + Noise | 25°C | | 0.0009 | | % |
| $C_{S(\text{OFF})}$ | Source off capacitance | $V_S = 6\text{ V}$, $f = 1\text{ MHz}$ | 25°C | | 38 | | pF |
| $C_{D(\text{OFF})}$ | Drain off capacitance | $V_S = 6\text{ V}$, $f = 1\text{ MHz}$ | 25°C | | 56 | | pF |
| $C_{S(\text{ON})}$, $C_{D(\text{ON})}$ | On capacitance | $V_S = 6\text{ V}$, $f = 1\text{ MHz}$ | 25°C | | 150 | | pF |

6.14 Typical Characteristics

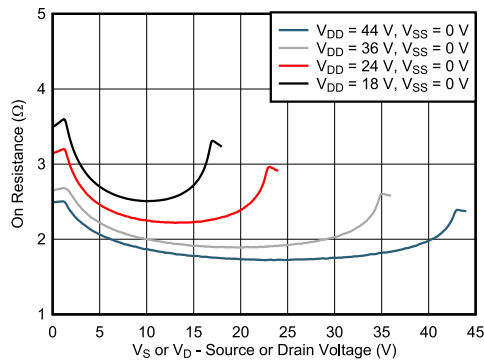
at $T_A = 25^\circ\text{C}$



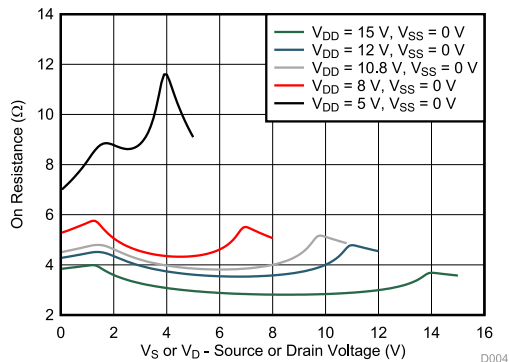
6-1. On-Resistance vs Source or Drain Voltage – Dual Supply



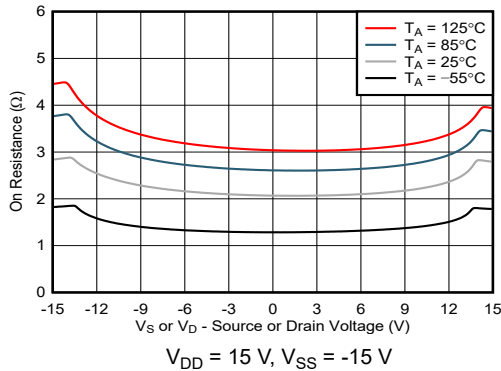
6-2. On-Resistance vs Source or Drain Voltage – Dual Supply



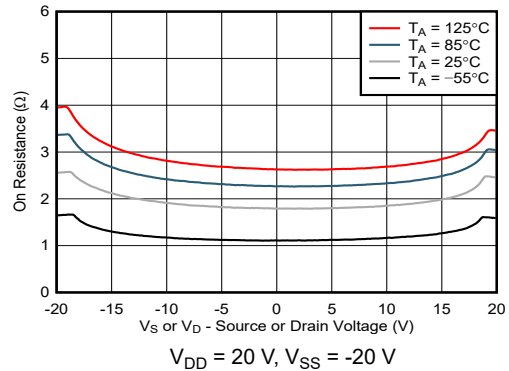
6-3. On-Resistance vs Source or Drain Voltage – Single Supply



6-4. On-Resistance vs Source or Drain Voltage – Single Supply



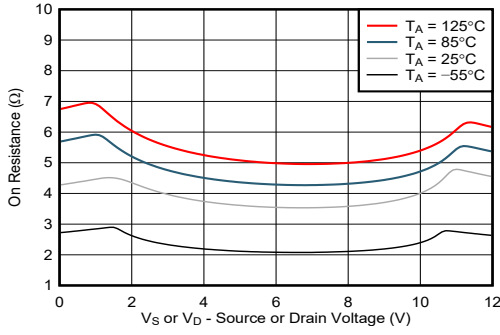
6-5. On-Resistance vs Temperature



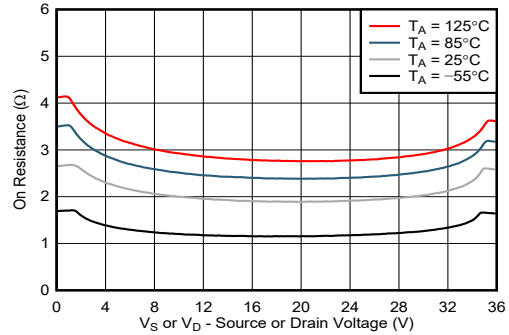
6-6. On-Resistance vs Temperature

6.14 Typical Characteristics (continued)

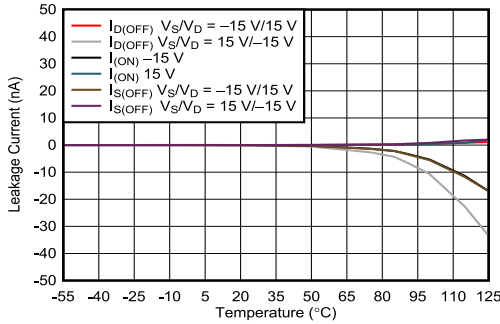
at $T_A = 25^\circ\text{C}$



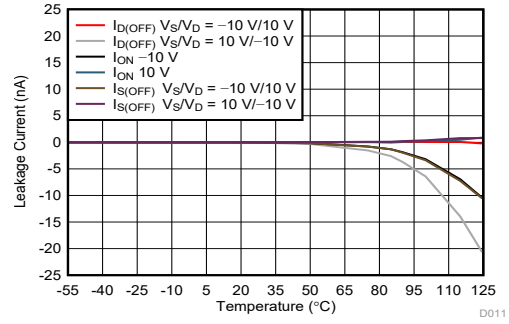
6-7. On-Resistance vs Temperature



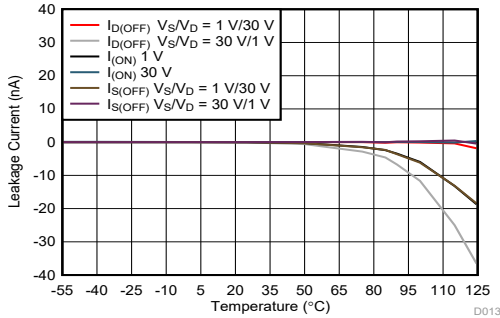
6-8. On-Resistance vs Temperature



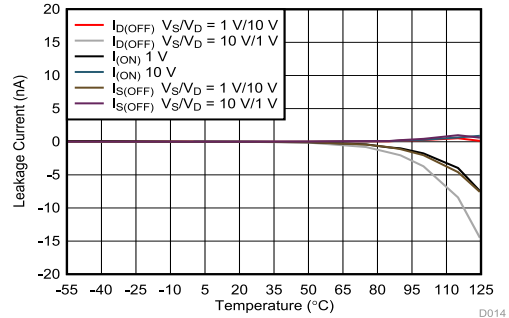
6-9. Leakage Current vs Temperature



6-10. Leakage Current vs Temperature



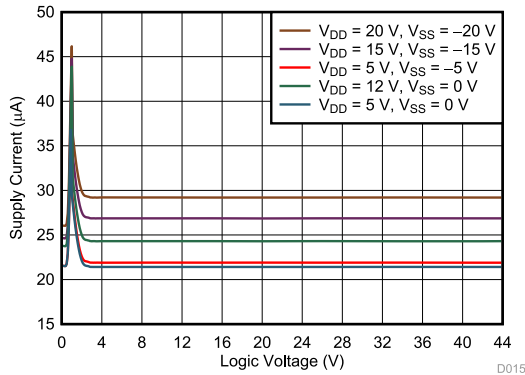
6-11. Leakage Current vs Temperature



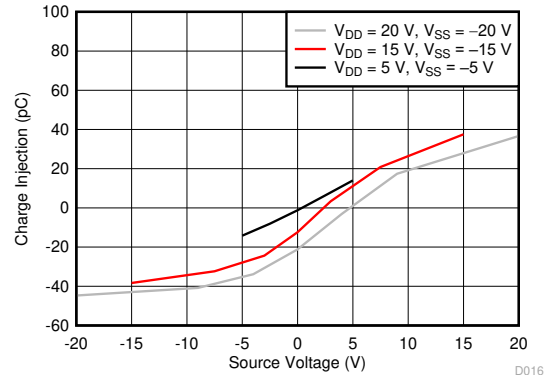
6-12. Leakage Current vs Temperature

6.14 Typical Characteristics (continued)

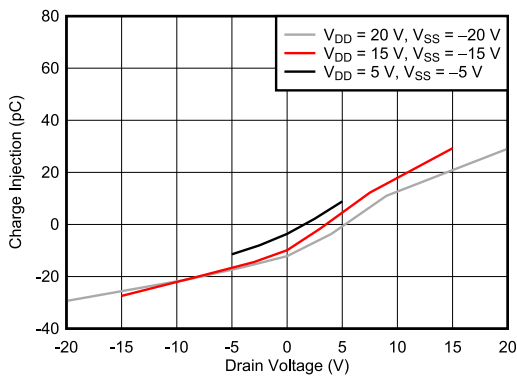
at $T_A = 25^\circ\text{C}$



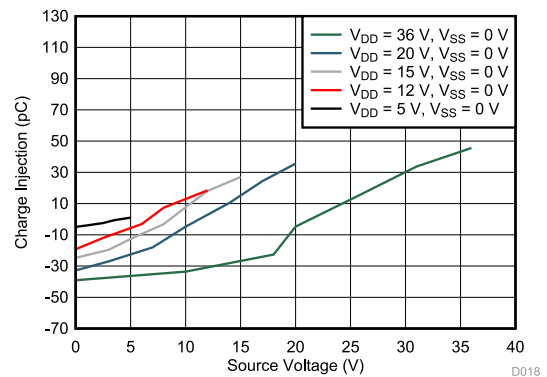
6-13. Supply Current vs Logic Voltage



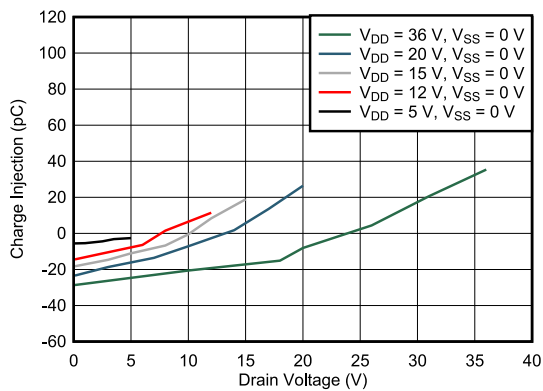
6-14. Charge Injection vs Source Voltage – Dual Supply



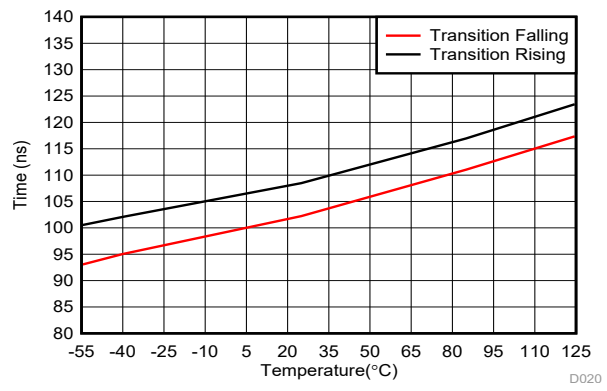
6-15. Charge Injection vs Drain Voltage – Dual Supply



6-16. Charge Injection vs Source Voltage – Single Supply



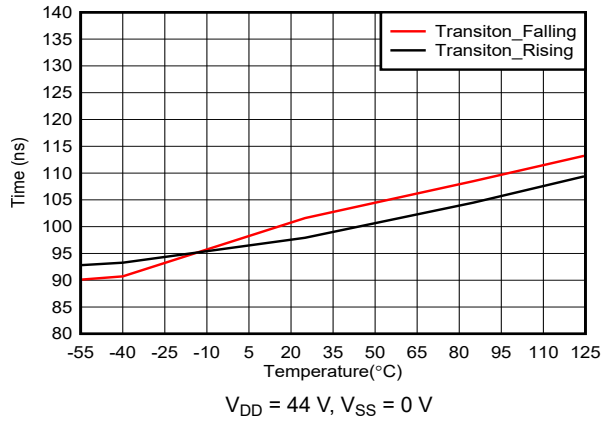
6-17. Charge Injection vs Drain Voltage – Single Supply



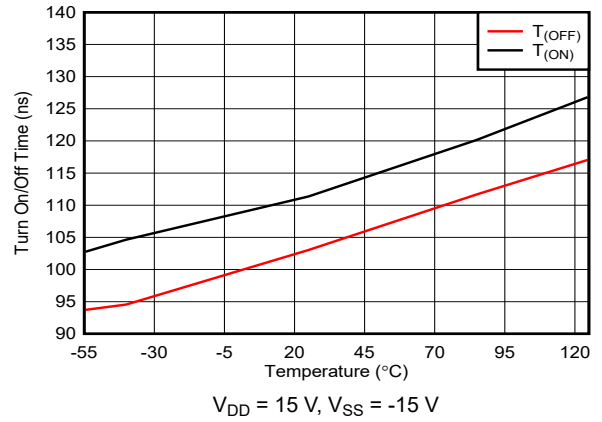
6-18. $T_{\text{TRANSITION}}$ vs Temperature

6.14 Typical Characteristics (continued)

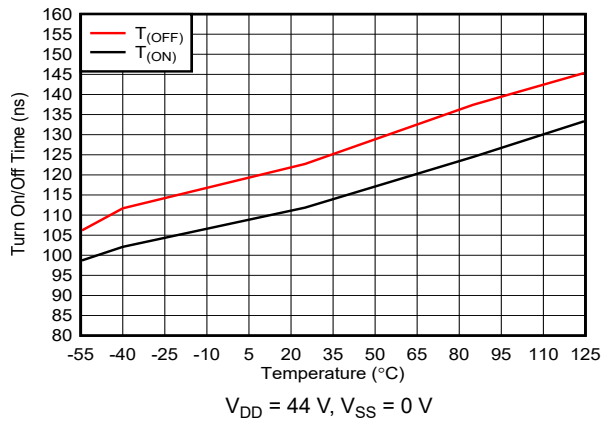
at $T_A = 25^\circ\text{C}$



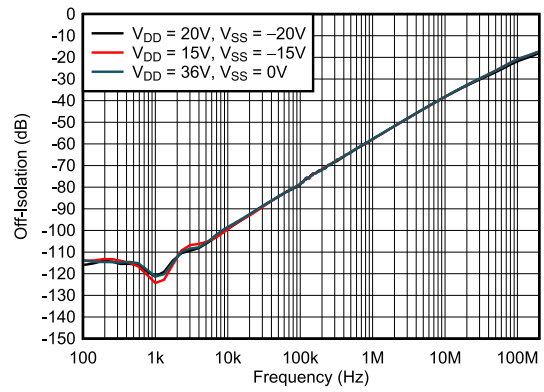
6-19. $T_{\text{TRANSITION}}$ vs Temperature



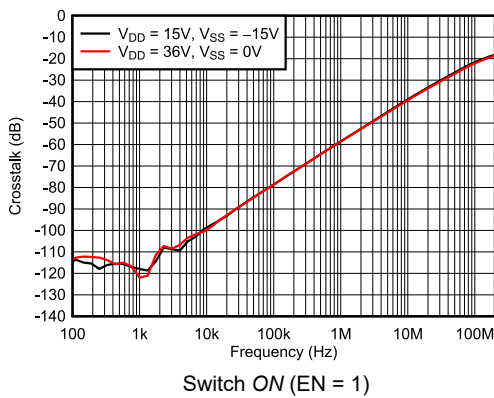
6-20. T_{ON} and T_{OFF} vs Temperature



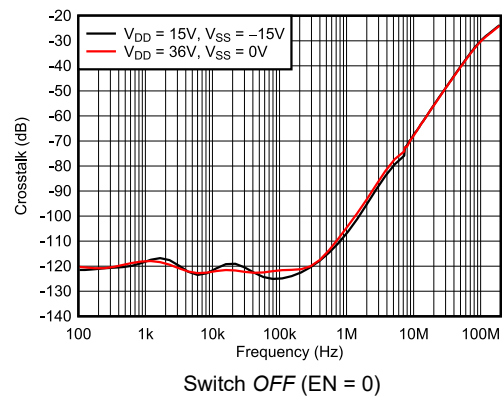
6-21. T_{ON} and T_{OFF} vs Temperature



6-22. Off-Isolation vs Frequency



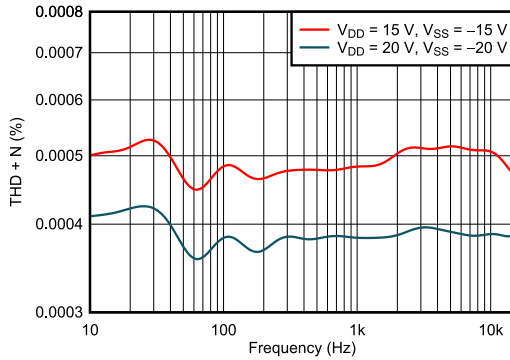
6-23. Crosstalk vs Frequency



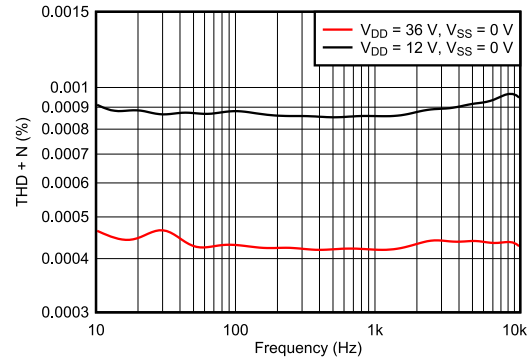
6-24. Crosstalk vs Frequency

6.14 Typical Characteristics (continued)

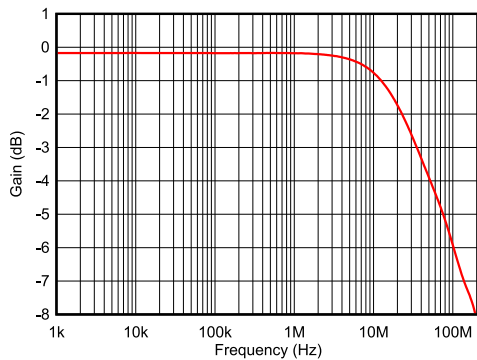
at $T_A = 25^\circ\text{C}$



6-25. THD+N vs Frequency (Dual Supply)

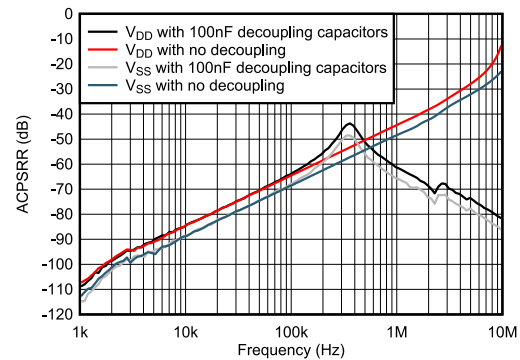


6-26. THD+N vs Frequency (Single Supply)



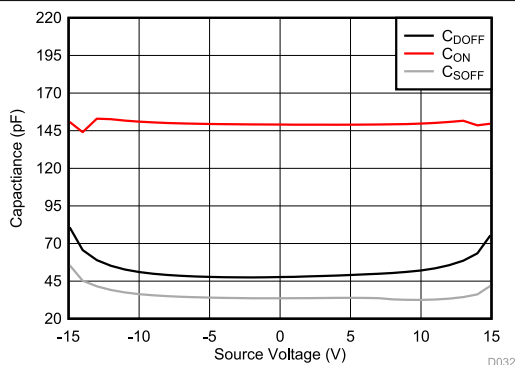
$V_{DD} = 15\text{ V}, V_{SS} = -15\text{ V}$

6-27. On Response vs Frequency



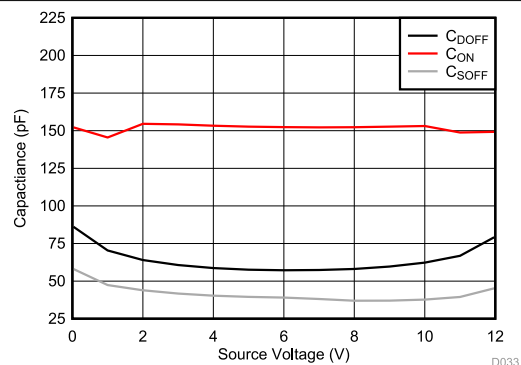
$V_{DD} = +15\text{ V}, V_{SS} = -15\text{ V}$

6-28. ACPSRR vs Frequency



$V_{DD} = +15\text{ V}, V_{SS} = -15\text{ V}$

6-29. Capacitance vs Source Voltage or Drain Voltage



$V_{DD} = 12\text{ V}, V_{SS} = 0\text{ V}$

6-30. Capacitance vs Source Voltage or Drain Voltage

7 Parameter Measurement Information

7.1 On-Resistance

The on-resistance of a device is the ohmic resistance between the source (Sx) and drain (D) pins of the device. The on-resistance varies with input voltage and supply voltage. The symbol R_{ON} is used to denote on-resistance. Figure 7-1 shows the measurement setup used to measure R_{ON} . Voltage (V) and current (I_{SD}) are measured using the following setup, where R_{ON} is computed as $R_{ON} = V / I_{SD}$:

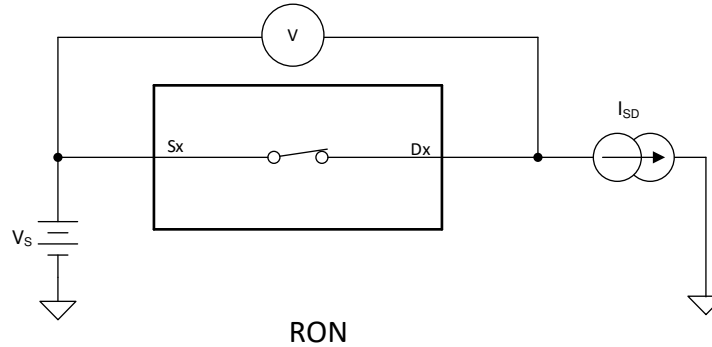


Figure 7-1. On-Resistance

7.2 Off-Leakage Current

There are two types of leakage currents associated with a switch during the off state:

1. Source off-leakage current.
2. Drain off-leakage current.

Source leakage current is defined as the leakage current flowing into or out of the source pin when the switch is off. This current is denoted by the symbol $I_{S(OFF)}$.

Drain leakage current is defined as the leakage current flowing into or out of the drain pin when the switch is off. This current is denoted by the symbol $I_{D(OFF)}$.

Figure 7-2 shows the setup used to measure both off-leakage currents.

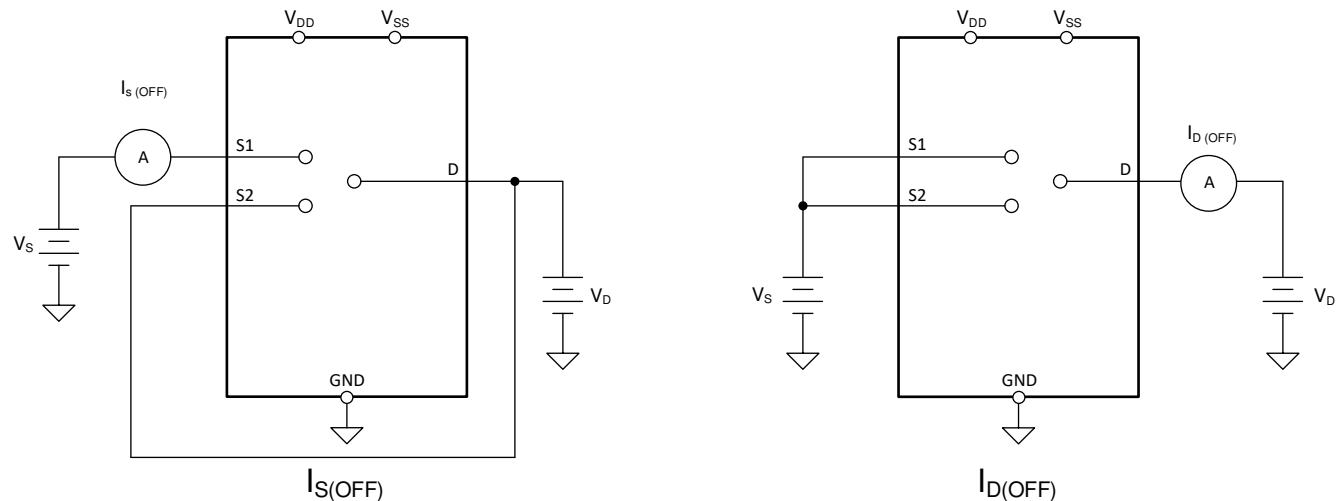
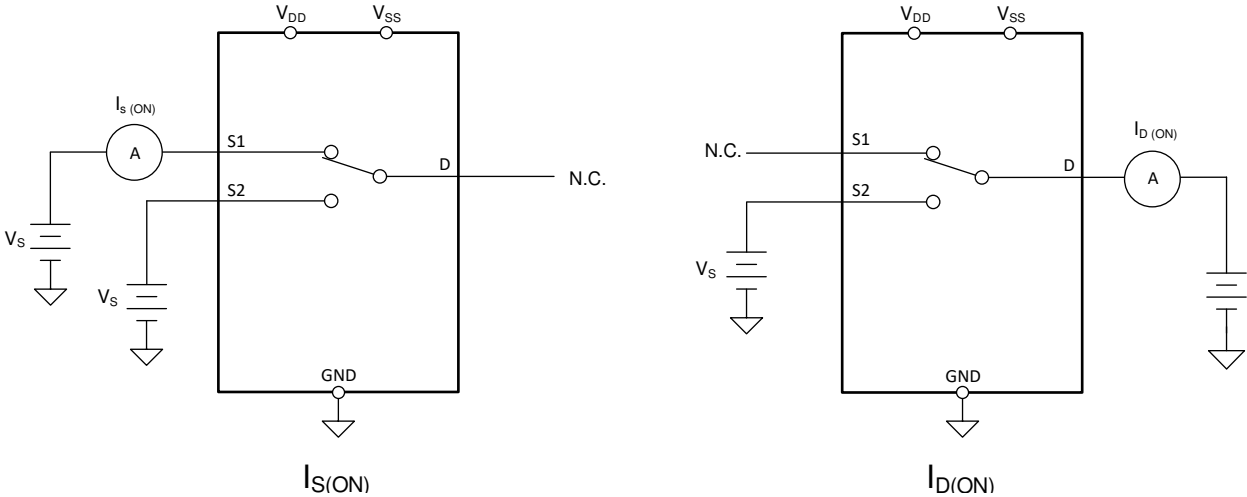


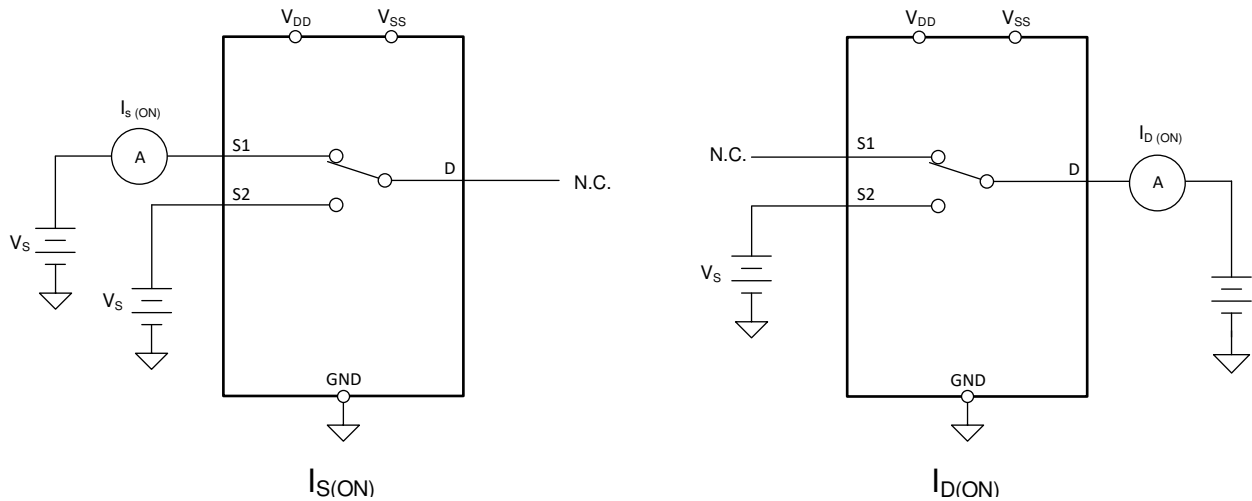
Figure 7-2. Off-Leakage Measurement Setup

7.3 On-Leakage Current

Source on-leakage current is defined as the leakage current flowing into or out of the source pin when the switch is on. This current is denoted by the symbol $I_{S(ON)}$.

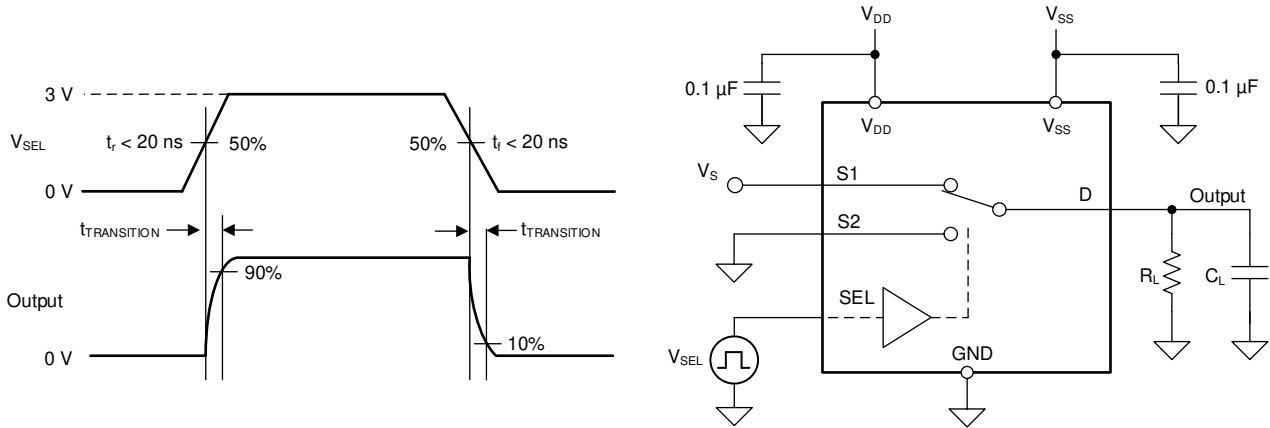
Drain on-leakage current is defined as the leakage current flowing into or out of the drain pin when the switch is on. This current is denoted by the symbol $I_{D(ON)}$.

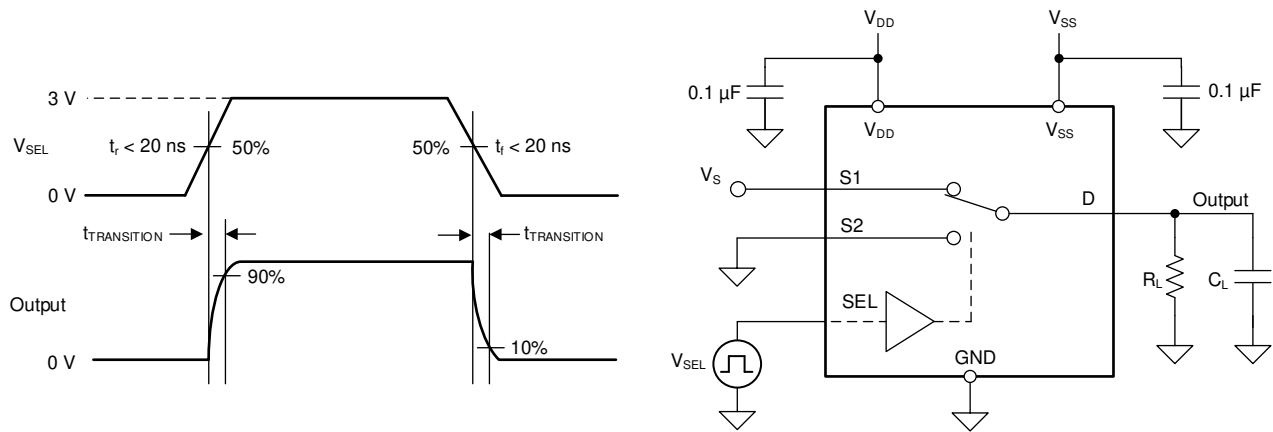
Either the source pin or drain pin is left floating during the measurement.  shows the circuit used for measuring the on-leakage current, denoted by $I_{S(ON)}$ or $I_{D(ON)}$.



 **7-3. On-Leakage Measurement Setup**

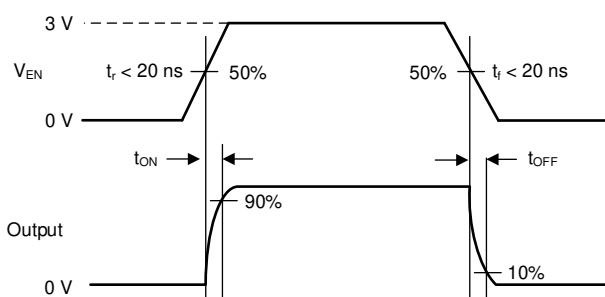
7.4 Transition Time

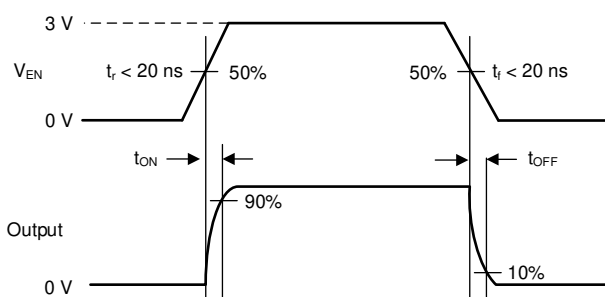
Transition time is defined as the time taken by the output of the device to rise or fall 90% after the address signal has risen or fallen past the logic threshold. The 90% transition measurement is utilized to provide the timing of the device. System level timing can then account for the time constant added from the load resistance and load capacitance.  shows the setup used to measure transition time, denoted by the symbol $t_{TRANSITION}$.

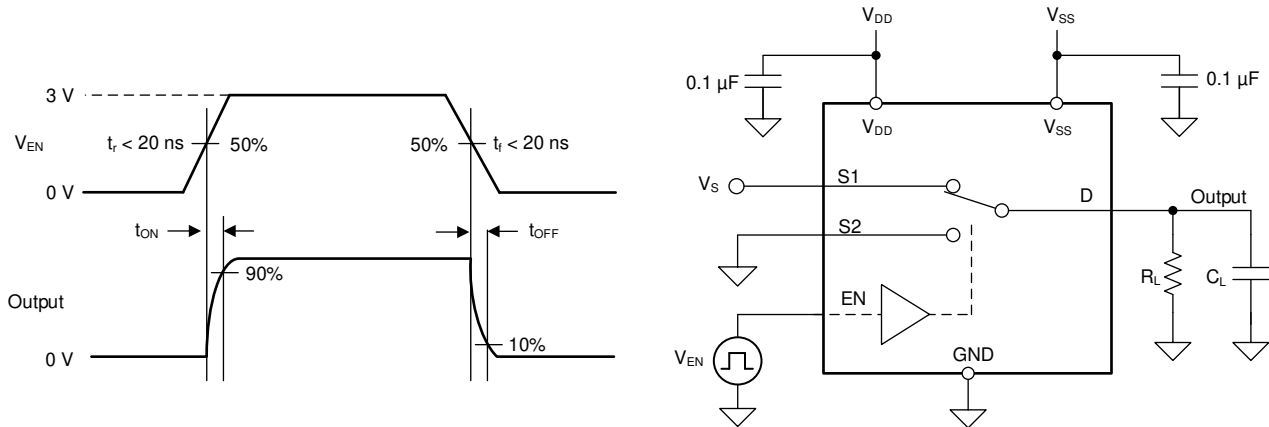


 **7-4. Transition-Time Measurement Setup**

7.5 $t_{ON(EN)}$ and $t_{OFF(EN)}$

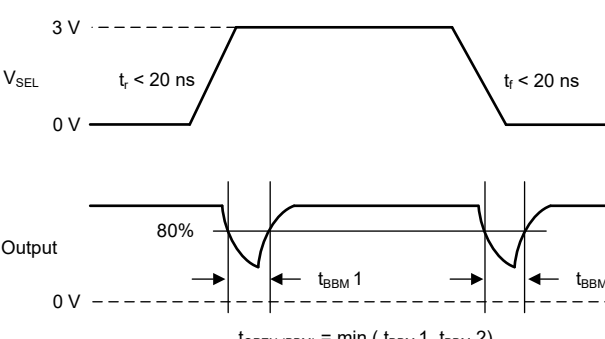
Turn-on time is defined as the time taken by the output of the device to rise to 90% after the enable has risen past the logic threshold. The 90% measurement is utilized to provide the timing of the device. System level timing can then account for the time constant added from the load resistance and load capacitance.  7-5 shows the setup used to measure turn-on time, denoted by the symbol $t_{ON(EN)}$.

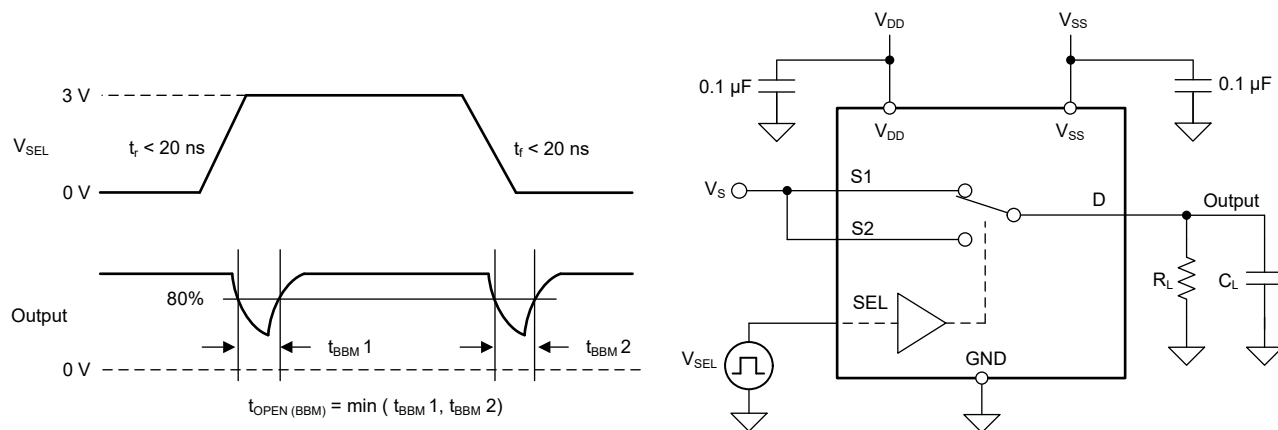
Turn-off time is defined as the time taken by the output of the device to fall to 10% after the enable has fallen past the logic threshold. The 10% measurement is utilized to provide the timing of the device. System level timing can then account for the time constant added from the load resistance and load capacitance.  7-5 shows the setup used to measure turn-off time, denoted by the symbol $t_{OFF(EN)}$.



 7-5. Turn-On and Turn-Off Time Measurement Setup


7.6 Break-Before-Make

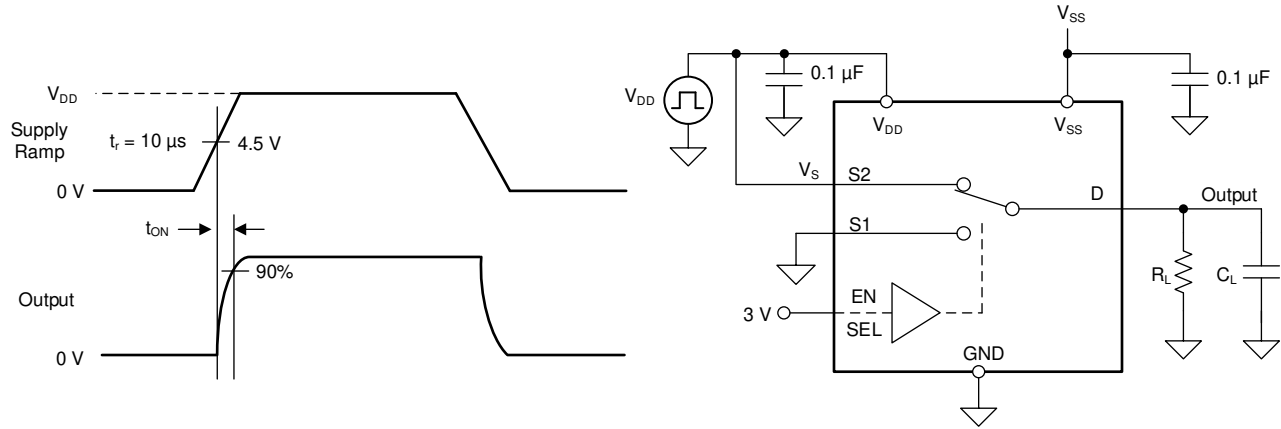
Break-before-make delay is a safety feature that prevents two inputs from connecting when the device is switching. The output first breaks from the on-state switch before making the connection with the next on-state switch. The time delay between the *break* and the *make* is known as break-before-make delay.  7-6 shows the setup used to measure break-before-make delay, denoted by the symbol $t_{OPEN(BBM)}$.



 7-6. Break-Before-Make Delay Measurement Setup


7.7 $t_{ON(VDD)}$ Time

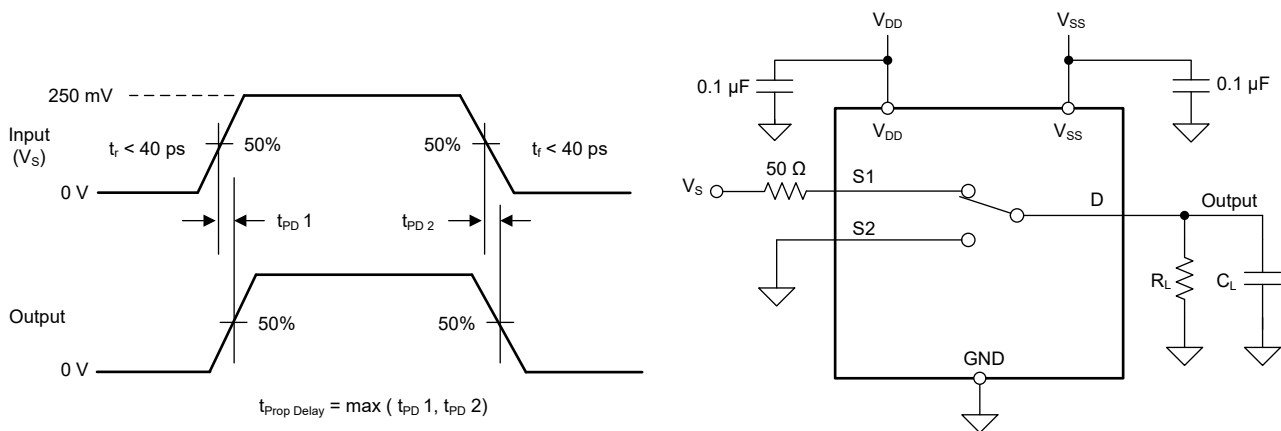
The $t_{ON(VDD)}$ time is defined as the time taken by the output of the device to rise to 90% after the supply has risen past the supply threshold. The 90% measurement is used to provide the timing of the device turning on in the system.  7-7 shows the setup used to measure turn on time, denoted by the symbol $t_{ON(VDD)}$.



 7-7. $t_{ON(VDD)}$ Time Measurement Setup

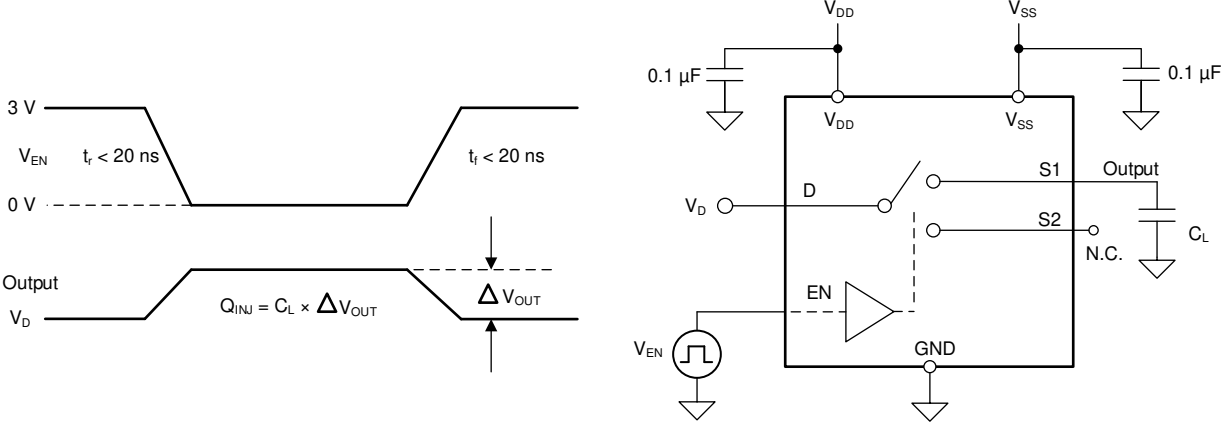
7.8 Propagation Delay

Propagation delay is defined as the time taken by the output of the device to rise or fall 50% after the input signal has risen or fallen past the 50% threshold.  7-8 shows the setup used to measure propagation delay, denoted by the symbol t_{PD} .



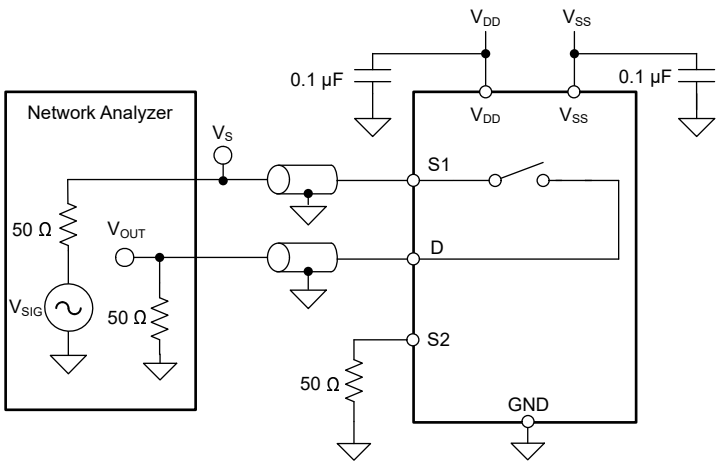
 7-8. Propagation Delay Measurement Setup

7.9 Charge Injection

The TMUX7219M has a transmission-gate topology. Any mismatch in capacitance between the NMOS and PMOS transistors results in a charge injected into the drain or source during the falling or rising edge of the gate signal. The amount of charge injected into the source or drain of the device is known as charge injection, and is denoted by the symbol Q_C . 



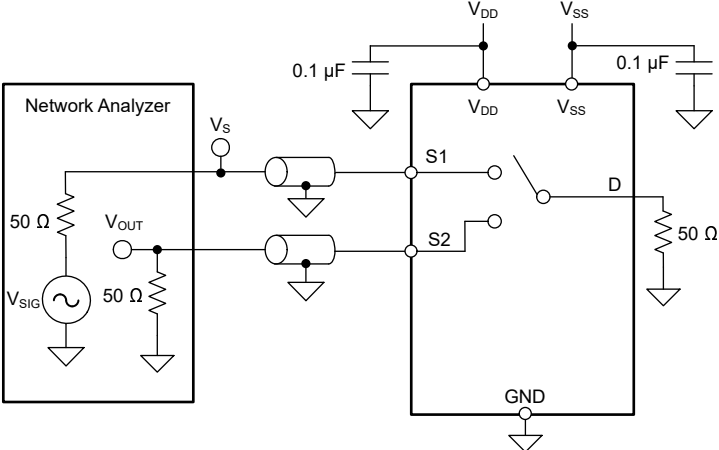
7.10 Off Isolation

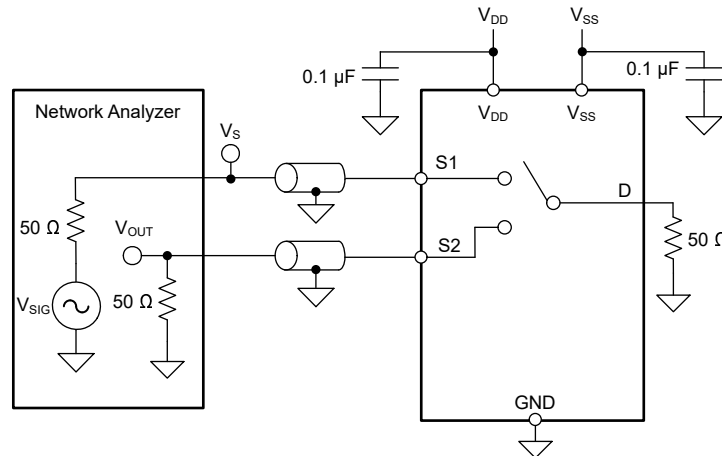
Off isolation is defined as the ratio of the signal at the drain pin (D) of the device when a signal is applied to the source pin (Sx) of an off-channel. 

$$\text{Off Isolation} = 20 \times \text{Log} \frac{V_{\text{OUT}}}{V_S}$$



7.11 Crosstalk

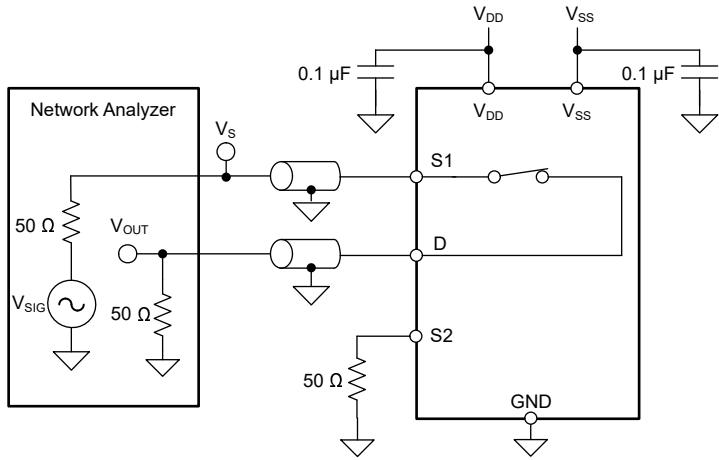
Crosstalk is defined as the ratio of the signal at the drain pin (D) of a different channel, when a signal is applied at the source pin (Sx) of an on-channel.  shows the setup used to measure, and the equation used to calculate crosstalk.

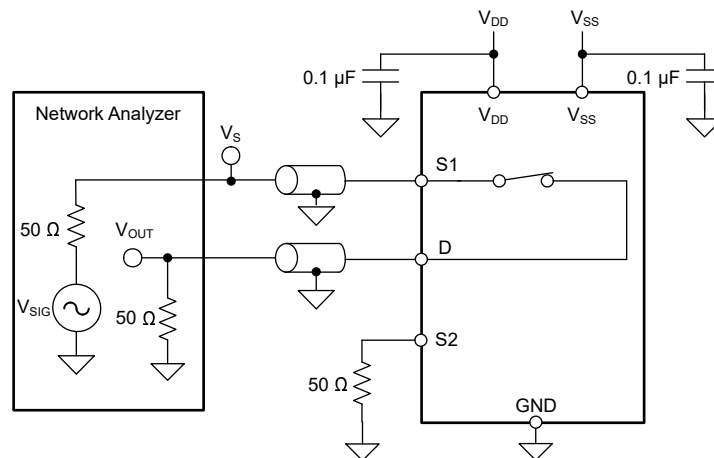


$$\text{Crosstalk} = 20 \times \text{Log} \frac{V_{\text{OUT}}}{V_S}$$

 7-11. Crosstalk Measurement Setup

7.12 Bandwidth

Bandwidth is defined as the range of frequencies that are attenuated by less than 3 dB when the input is applied to the source pin (Sx) of an on-channel, and the output is measured at the drain pin (D) of the device.  shows the setup used to measure bandwidth.



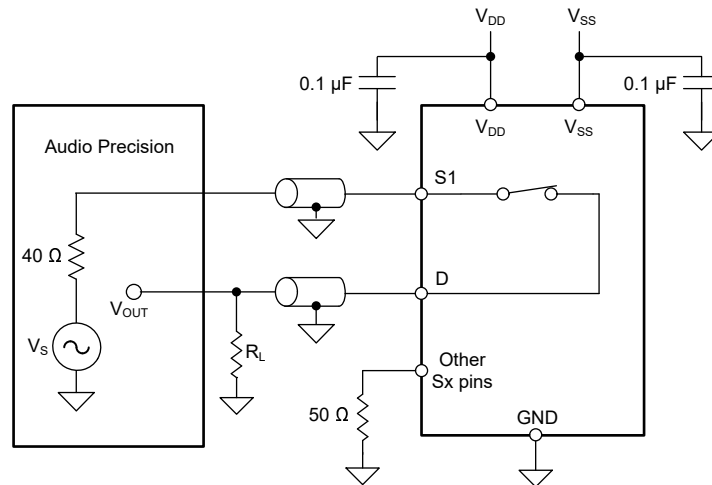
$$\text{Bandwidth} = 20 \times \text{Log} \frac{V_{\text{OUT}}}{V_S}$$

 7-12. Bandwidth Measurement Setup

7.13 THD + Noise

The total harmonic distortion (THD) of a signal is a measurement of the harmonic distortion, and is defined as the ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency at the mux output.

The on-resistance of the device varies with the amplitude of the input signal and results in distortion when the drain pin is connected to a low-impedance load. Total harmonic distortion plus noise is denoted as THD + N.

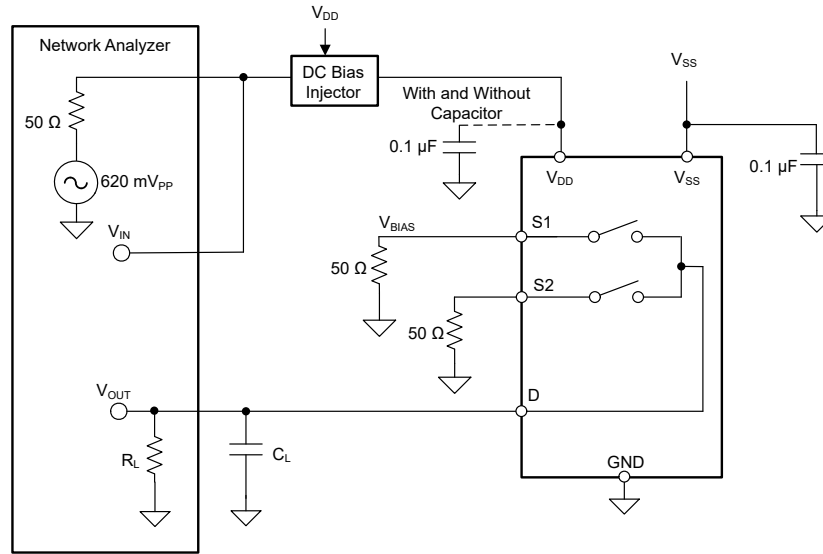


7-13. THD + N Measurement Setup

7.14 Power Supply Rejection Ratio (PSRR)

PSRR measures the ability of a device to prevent noise and spurious signals that appear on the supply voltage pin from coupling to the output of the switch. The DC voltage on the device supply is modulated by a sine wave of 620 mV_{PP}. The ratio of the amplitude of signal on the output to the amplitude of the modulated signal is the ACPSRR. A high ratio represents a high degree of tolerance to supply rail variation.

This helps stabilize the supply and immediately filter as much of the supply noise as possible.



$$\text{PSRR} = 20 \times \text{Log} \frac{V_{\text{OUT}}}{V_{\text{IN}}}$$

7-14. ACPSRR Measurement Setup

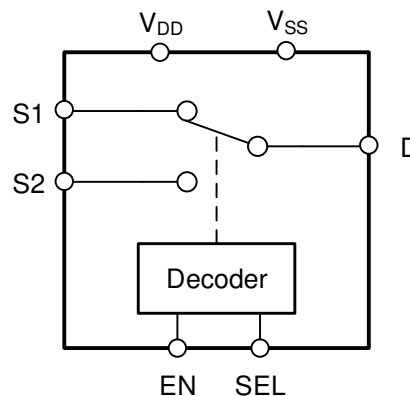
8 Detailed Description

8.1 Overview

The TMUX7219M is a 2:1, 1-channel switch. Each input is turned on or turned off based on the state of the select line and enable pin.

8.2 Functional Block Diagram

The following figure shows the functional block diagram of the TMUX7219M.



8.3 Feature Description

8.3.1 Bidirectional Operation

The TMUX7219M conducts equally well from source (S_x) to drain (D) or from drain (D) to source (S_x). Each channel has very similar characteristics in both directions and supports both analog and digital signals.

8.3.2 Rail-to-Rail Operation

The valid signal path input and output voltage for TMUX7219M ranges from V_{SS} to V_{DD}.

8.3.3 1.8 V Logic Compatible Inputs

The TMUX7219M has 1.8 V logic compatible control for all logic control inputs. 1.8 V logic level inputs allows the device to interface with processors that have lower logic I/O rails and eliminates the need for an external translator, which saves both space and BOM cost. For more information on 1.8 V logic implementations refer to [Simplifying Design with 1.8 V logic Muxes and Switches](#).

8.3.4 Integrated Pull-Up and Pull-Down Resistor on Logic Pins

The TMUX7219M has internal weak pull-up and pull-down resistors to GND to ensure the logic pins are not left floating. The value of this pull-down resistor is approximately 4 M Ω , but is clamped to about 1 μ A at higher voltages. The EN pin integrates a pull-up resistor to V_{DD} and the SEL pin integrates a pull-down resistor. This feature integrates up to two external components and reduces system size and cost.

8.3.5 Fail-Safe Logic

The TMUX7219M supports Fail-Safe Logic on the control input pins (EN and SEL) allowing for operation up to 44 V above ground, regardless of the state of the supply pins. This feature allows voltages on the control pins to be applied before the supply pin, protecting the device from potential damage. Fail-Safe Logic minimizes system complexity by removing the need for power supply sequencing on the logic control pins. For example, the Fail-Safe Logic feature allows the logic input pins of the TMUX7219M to be ramped to +44 V while V_{DD} and V_{SS} = 0 V. The logic control inputs are protected against positive faults of up to +44 V in powered-off condition, but do not offer protection against negative overvoltage conditions.

8.3.6 Latch-Up Immune

Latch-up is a condition where a low impedance path is created between a supply pin and ground. This condition is caused by a trigger (current injection or overvoltage), but once activated, the low impedance path remains even after the trigger is no longer present. This low impedance path may cause system upset or catastrophic damage due to excessive current levels. The latch-up condition typically requires a power cycle to eliminate the low impedance path.

The TMUX72xx family of devices are constructed on Silicon on Insulator (SOI) based process where an oxide layer is added between the PMOS and NMOS transistor of each CMOS switch to prevent parasitic structures from forming. The oxide layer is also known as an insulating trench and prevents triggering of latch up events due to overvoltage or current injections. The latch-up immunity feature allows the TMUX72xx family of switches and multiplexers to be used in harsh environments. For more information on latch-up immunity refer to [Using Latch Up Immune Multiplexers to Help Improve System Reliability](#).

8.3.7 Ultra-Low Charge Injection

Figure 8-1 shows how the TMUX7219M has a transmission gate topology. Any mismatch in the stray capacitance associated with the NMOS and PMOS causes an output level change whenever the switch is opened or closed.

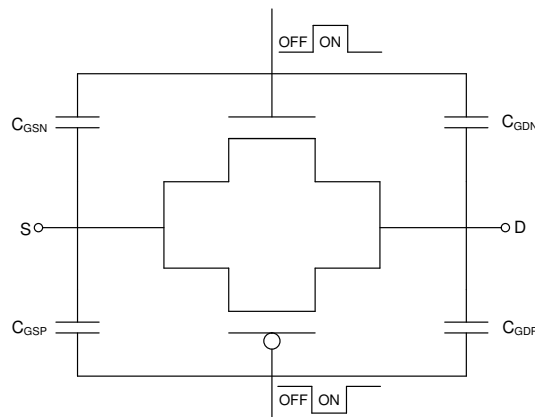


Figure 8-1. Transmission Gate Topology

The TMUX7219M contains specialized architecture to reduce charge injection on the source (S_x). To further reduce charge injection in a sensitive application, a compensation capacitor (C_p) can be added on the drain (D). This will ensure that excess charge from the switch transition will be pushed into the compensation capacitor on the drain (D) instead of the source (S_x). As a general rule, C_p should be 20× larger than the equivalent load capacitance on the source (S_x). Figure 8-2 shows charge injection variation with source voltage with different compensation capacitors on the drain side.

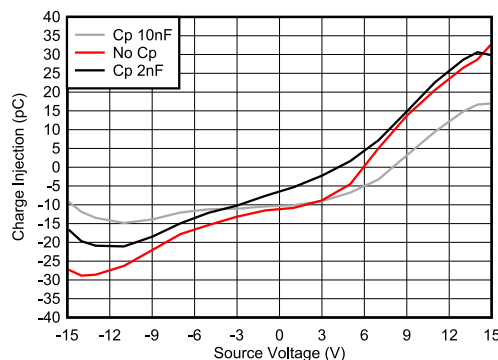


Figure 8-2. Charge Injection Compensation

8.4 Device Functional Modes

When the EN pin of the TMUX7219M is pulled high, one of the switches is closed based on the state of the SEL pin. When the EN pin is pulled low, both of the switches are in an open state regardless of the state of the SEL pin. The control pins can be as high as 44 V.

The TMUX7219M can operate without any external components except for the supply decoupling capacitors. The EN pin has an internal pull-up resistor of 4 MΩ, and SEL pin has internal pull-down resistor of 4 MΩ. If unused, EN pin must be tied to V_{DD} and SEL pin must be tied to GND to ensure the device does not consume additional current as highlighted in [Implications of Slow or Floating CMOS Inputs](#). Unused signal path inputs (S1, S2, or D) should be connected to GND.

8.5 Truth Tables

表 8-1 show the truth tables for the TMUX7219M.

表 8-1. TMUX7219M Truth Table

| EN | SEL | Selected Source Connected To Drain (D) Pin |
|----|------------------|--|
| 0 | X ⁽¹⁾ | All sources are off (HI-Z) |
| 1 | 0 | S1 |
| 1 | 1 | S2 |

(1) X denotes *do not care*.

9 Application and Implementation

注

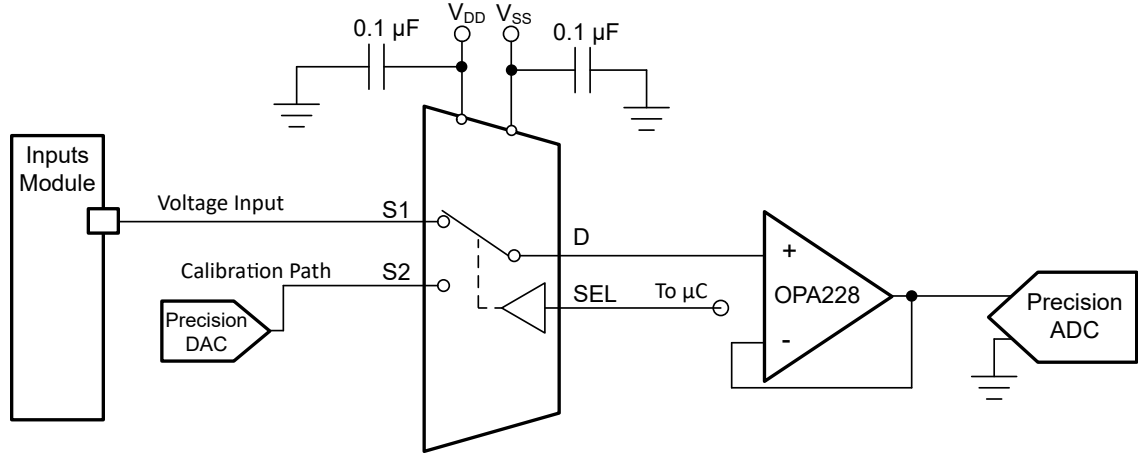
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9.1 Application Information

TMUX7219M is part of the precision switches and multiplexers family of devices. TMUX7219M offers low RON, low on and off leakage currents, and ultra-low charge injection performance. These properties make TMUX7219M ideal for implementing high precision industrial systems requiring selection of one of two inputs or outputs.

9.2 Typical Applications

9.2.1 Data Acquisition Calibration

One application of the TMUX7219M is in Data Acquisition systems (DAQ). To account for system loss and ensure the lowest possible noise floor, a calibration path is needed. To minimize board space and automate this procedure, many applications utilize a 2:1 (SPDT) switch.  9-1 shows the TMUX7219M configured for switching a calibration path on a precision measurement module.

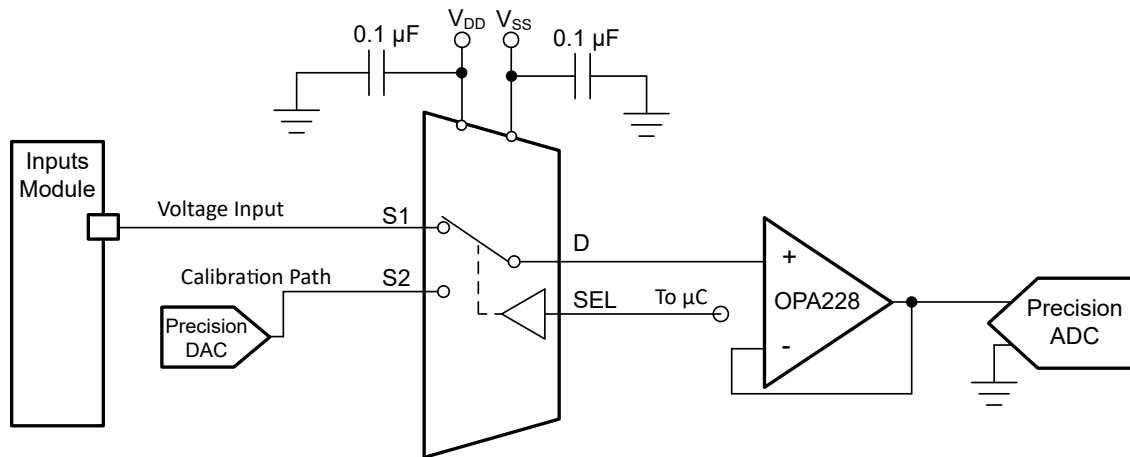


図 9-1. Calibration Path Switching for Data Acquisition

9.2.1.1 Design Requirements

For the design example, use the parameters listed in [表 9-1](#).

表 9-1. Design Parameters

| PARAMETERS | VALUES |
|--------------------------|-------------------------------------|
| Supply (V_{DD}) | 15 V |
| Supply (V_{SS}) | -15 V |
| MUX I/O signal range | -15 V to 15 V (Rail-to-Rail) |
| Control logic thresholds | 1.8 V compatible (up to 44V) |
| EN | EN pulled high to enable the switch |

9.2.1.2 Detailed Design Procedure

The TMUX7219M can be operated without any external components except for the supply decoupling capacitors. All inputs passing through the switch must fall within the recommended operating conditions, including signal range and continuous current. For this design, with a dual supply of ± 15 V, the signal range can range from -15 V to +15 V. Industrial applications such as factory automation and control and test and measurement benefit from using a 2:1 switch, because it allows additional flexibility in the design. A single 2:1 switch has numerous applications such as switching between an analog signal path and a calibration path, and allowing a single channel to be configured as either an analog input or analog output.


10 Power Supply Recommendations

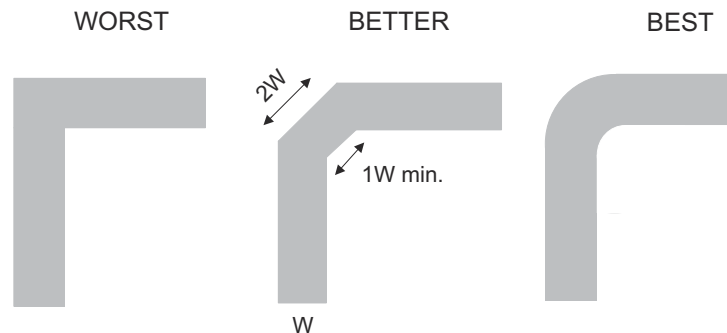
The TMUX7219M operates across a wide supply range of ± 4.5 V to ± 22 V (4.5 V to 44 V in single-supply mode). The device also performs well with asymmetrical supplies such as $V_{DD} = 12$ V and $V_{SS} = -5$ V.

Power-supply bypassing improves noise margin and prevents switching noise propagation from the supply rails to other components. Good power-supply decoupling is important to achieve optimum performance. For improved supply noise immunity, use a supply decoupling capacitor ranging from 0.1 μ F to 10 μ F at both the V_{DD} and V_{SS} pins to ground. Place the bypass capacitors as close to the power supply pins of the device as possible using low-impedance connections. TI recommends using multi-layer ceramic chip capacitors (MLCCs) that offer low equivalent series resistance (ESR) and inductance (ESL) characteristics for power-supply decoupling purposes. For very sensitive systems, or for systems in harsh noise environments, avoiding the use of vias for connecting the capacitors to the device pins may offer superior noise immunity. The use of multiple vias in parallel lowers the overall inductance and is beneficial for connections to ground and power planes. Always ensure the ground (GND) connection is established before supplies are ramped.

11 Layout

11.1 Layout Guidelines

When a PCB trace turns a corner at a 90° angle, a reflection can occur. A reflection occurs primarily because of the change of width of the trace. At the apex of the turn, the trace width increases to 1.414 times the width. This increase upsets the transmission-line characteristics, especially the distributed capacitance and self-inductance of the trace which results in the reflection. Not all PCB traces can be straight and therefore some traces must turn corners.  11-1 shows progressively better techniques of rounding corners. Only the last example (BEST) maintains constant trace width and minimizes reflections.



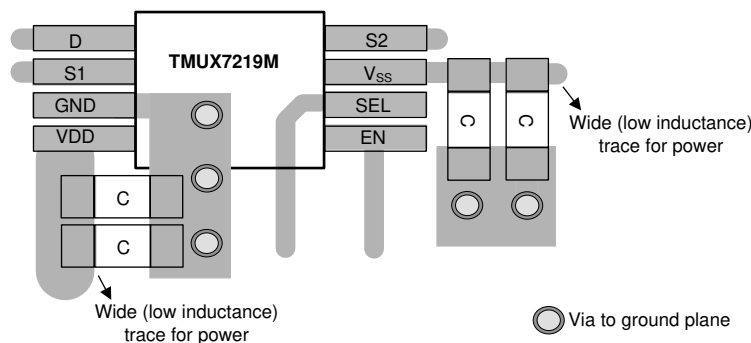
 11-1. Trace Example

Route high-speed signals using a minimum of vias and corners which reduces signal reflections and impedance changes. When a via must be used, increase the clearance size around it to minimize its capacitance. Each via introduces discontinuities in the signal's transmission line and increases the chance of picking up interference from the other layers of the board. Be careful when designing test points, through-hole pins are not recommended at high frequencies.

セクション 11.2 illustrates an example of a PCB layout with the TMUX7219M. Some key considerations are:

- For reliable operation, connect a decoupling capacitor ranging from 0.1 μF to 10 μF between VDD/VSS and GND. TI recommends placing the lowest value capacitor as close to the pin as possible. Make sure that the capacitor voltage rating is sufficient for the supply voltage.
- Keep the input lines as short as possible.
- Use a solid ground plane to help reduce electromagnetic interference (EMI) noise pickup.
- Do not run sensitive analog traces in parallel with digital traces. Avoid crossing digital and analog traces if possible, and only make perpendicular crossings when necessary.
- Using multiple vias in parallel will lower the overall inductance and is beneficial for connection to ground planes.

11.2 Layout Example



 11-2. TMUX7219MDGK Layout Example

12 Device and Documentation Support

12.1 Documentation Support

12.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, [Improve Stability Issues with Low CON Multiplexers](#) application brief
- Texas Instruments, [Improving Signal Measurement Accuracy in Automated Test Equipment](#) application brief
- Texas Instruments, [Multiplexers and Signal Switches Glossary](#) application report
- Texas Instruments, [QFN/SON PCB Attachment](#) application report
- Texas Instruments, [Quad Flatpack No-Lead Logic Packages](#) application report
- Texas Instruments, [Simplifying Design with 1.8 V logic Muxes and Switches](#) application brief
- Texas Instruments, [System-Level Protection for High-Voltage Analog Multiplexers](#) application report

12.2 Receiving Notification of Documentation Updates

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

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[テキサス・インスツルメンツ用語集](#) この用語集には、用語や略語の一覧および定義が記載されています。

13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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 |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|---------|
| TMUX7219MDGKR | ACTIVE | VSSOP | DGK | 8 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | X219 | 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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DGK0008A



PACKAGE OUTLINE

VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



4214862/A 04/2023

NOTES:

PowerPAD is a trademark of Texas Instruments.

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

DGK0008A

™ VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 15X



SOLDER MASK DETAILS

4214862/A 04/2023

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

DGK0008A

TM VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
SCALE: 15X

4214862/A 04/2023

NOTES: (continued)

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

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