



SGM7223

High Speed USB 2.0 (480Mbps) DPDT Analog Switch

GENERAL DESCRIPTION

The SGM7223 is a DPDT (double-pole/double-throw) analog switch. It operates from a 1.8V to 4.3V single power supply. Each switch of the SGM7223 is bidirectional, which can ensure that the high speed signals have little or no attenuation at the outputs.

The SGM7223 features high speed, low bit-to-bit skew and wide bandwidth. The high performances make it very suitable for multiple applications, such as cellular phones and computer peripherals, etc.

The SGM7223 has a power-off protection. It can prevent accidental signal leakage and ensure system reliability under power-down and over-voltage conditions. In addition, the device is capable of withstanding a V_{BUS} short to D+ or D- when the device is either powered on or powered off because of the special circuitry on the D+/D- pins.

The SGM7223 is available in a Green TQFN-2.1×1.6-10L package. It operates over an ambient temperature range of -40°C to +85°C.

APPLICATIONS

Cellular Phones
Digital Cameras
Portable Equipment
Computer Peripherals
Battery-Powered Systems
Routes Signals for USB 2.0 Full-Speed

FEATURES

- **Supply Voltage Range:** 1.8V to 4.3V
- **On-Resistance:** 4.5Ω (TYP) at 3V
- **-3dB Bandwidth:** 500MHz
- **Low Bit-to-Bit Skew:** 50ps (TYP)
- **Fast Switching Times:**
 - t_{ON} : 11ns
 - t_{OFF} : 20ns
- **High Off-Isolation:** -30dB ($R_L = 50\Omega$, $f = 250\text{MHz}$)
- **Low Crosstalk:** -33dB ($R_L = 50\Omega$, $f = 250\text{MHz}$)
- **Power-Off and Power-On Protections**
- **Rail-to-Rail Input and Output Operation**
- **Break-Before-Make Switching**
- **-40°C to +85°C Operating Temperature Range**
- **Available in a Green TQFN-2.1×1.6-10L Package**

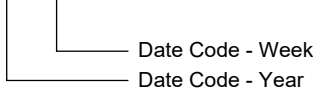
PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|---------|---------------------|-----------------------------|------------------|-----------------|---------------------|
| SGM7223 | TQFN-2.1x1.6-10L | -40°C to +85°C | SGM7223YTQD10/TR | 7223 XXXX | Tape and Reel, 3000 |

MARKING INFORMATION

NOTE: XXXX = Date Code.

XXXX



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

- V+, IN to GND.....0V to 4.6V
- Analog, Digital Voltage Range.....-0.3V to (V+) + 0.3V
- Continuous Current HSDn or Dn±100mA
- Peak Current HSDn or Dn±150mA
- Junction Temperature.....+150°C
- Storage Temperature Range.....-65°C to +150°C
- Lead Temperature (Soldering, 10s).....+260°C
- ESD Susceptibility
- HBM.....4000V
- MM.....400V

RECOMMENDED OPERATING CONDITIONS

- Operating Temperature Range.....-40°C to +85°C

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

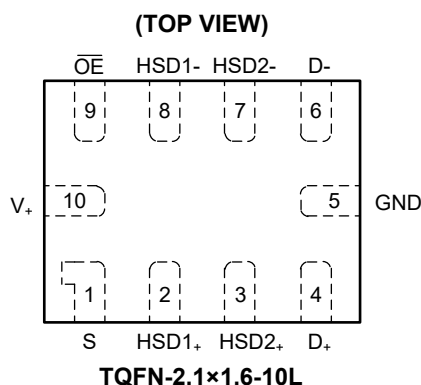
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO 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.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATION



PIN DESCRIPTION

| PIN | NAME | FUNCTION |
|---------------------|---------------------------------------|-----------------------------|
| 1 | S | Select Input Pin. |
| 2, 3, 8, 7, 4, 6 | HSD1+, HSD2+, HSD1., HSD2., D+, D. | Data Ports. |
| 5 | GND | Ground. |
| 9 | \overline{OE} | Output Enable Control Pins. |
| 10 | V ₊ | Positive Power Supply. |

FUNCTION TABLE

| \overline{OE} | S | HSD1+ HSD1- | HSD2+ HSD2- |
|-----------------|---|----------------|----------------|
| 0 | 0 | ON | OFF |
| 0 | 1 | OFF | ON |
| 1 | x | OFF | OFF |

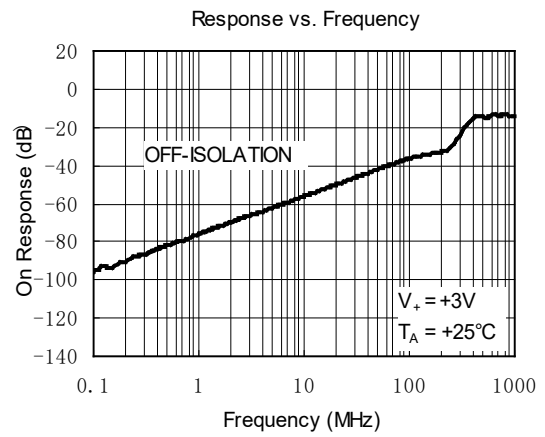
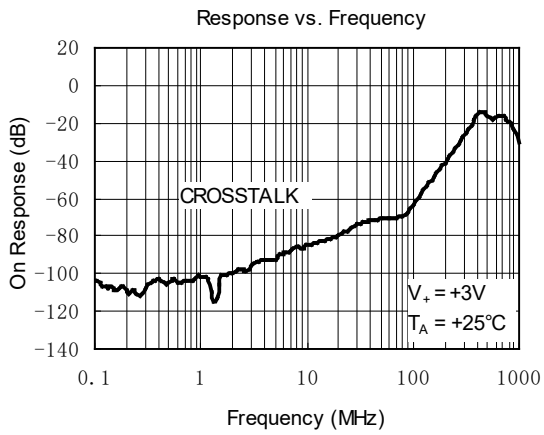
NOTE: Switches Shown For Logic "0" Input.

ELECTRICAL CHARACTERISTICS

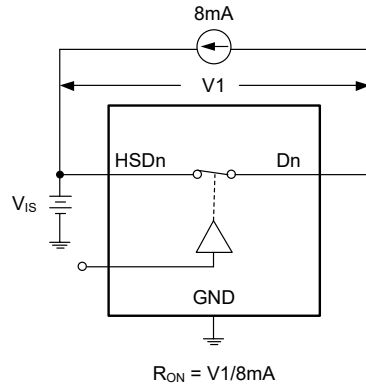
($V_+ = 1.8V$ to $4.3V$, $GND = 0V$, $V_{IH} = 1.6V$, $V_{IL} = 0.5V$, Full = $-40^\circ C$ to $+85^\circ C$. Typical values are at $V_+ = 3.3V$, $T_A = +25^\circ C$, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|--|--------------------------------------|--|-------|-----|------|-------|----------|
| Analog Switch | | | | | | | |
| Analog I/O Voltage (HSD1+, HSD1-, HSD2+, HSD2-) | V_{IS} | | Full | 0 | | V_+ | V |
| On-Resistance | R_{ON} | $V_+ = 3V$, $V_{IS} = 0V$ to $0.4V$, $I_D = 8mA$, Test Circuit 1 | +25°C | | 4.5 | 8.5 | Ω |
| | | | Full | | | 9 | |
| On-Resistance Match between Channels | ΔR_{ON} | $V_+ = 3V$, $V_{IS} = 0V$ to $0.4V$, $I_D = 8mA$, Test Circuit 1 | +25°C | | 0.2 | 0.6 | Ω |
| | | | Full | | | 1.5 | |
| On-Resistance Flatness | $R_{FLAT(ON)}$ | $V_+ = 3V$, $V_{IS} = 0V$ to $1.0V$, $I_D = 8mA$, Test Circuit 1 | +25°C | | 1.8 | 2.2 | Ω |
| | | | Full | | | 2.8 | |
| Power Off Leakage Current (D+, D-) | I_{OFF} | $V_+ = 0V$, $V_D = 0V$ to $3.6V$, V_S , $V_{OE} = 0V$ or $3.6V$ | Full | | | 1 | μA |
| Increase in I_+ per Control Voltage | I_{CCT} | $V_+ = 3.6V$, V_S or $V_{OE} = 2.6V$ | Full | | | 5 | μA |
| Source Off Leakage Current | $I_{HSD2(OFF)}$, $I_{HSD1(OFF)}$ | $V_+ = 3.6V$, $V_{IS} = 3.3V/0.3V$, $V_D = 0.3V/3.3V$ | Full | | | 1 | μA |
| Channel On Leakage Current | $I_{HSD2(ON)}$, $I_{HSD1(ON)}$ | $V_+ = 3.6V$, $V_{IS} = 3.3V/0.3V$, $V_D = 3.3V/0.3V$ or floating | Full | | | 1 | μA |
| Digital Inputs | | | | | | | |
| Input High Voltage | V_{IH} | | Full | 1.6 | | | V |
| Input Low Voltage | V_{IL} | | Full | | | 0.5 | V |
| Input Leakage Current | I_{IN} | $V_+ = 3V$, V_S , $V_{OE} = 0V$ or V_+ | Full | | | 1 | μA |
| Dynamic Characteristics | | | | | | | |
| Turn-On Time | t_{ON} | $V_{IS} = 0.8V$, $R_L = 50\Omega$, $C_L = 10pF$, Test Circuit 2 | +25°C | | 11 | | ns |
| Turn-Off Time | t_{OFF} | | +25°C | | 20 | | ns |
| Break-Before-Make Time Delay | t_D | $V_{IS} = 0.8V$, $R_L = 50\Omega$, $C_L = 10pF$, Test Circuit 3 | +25°C | | 5 | | ns |
| Propagation Delay | t_{PD} | $R_L = 50\Omega$, $C_L = 10pF$ | +25°C | | 0.3 | | ns |
| Off Isolation | O_{ISO} | Signal = 0dBm, $R_L = 50\Omega$, $f = 250MHz$, Test Circuit 4 | +25°C | | -30 | | dB |
| Channel-to-Channel Crosstalk | X_{TALK} | Signal = 0dBm, $R_L = 50\Omega$, $f = 250MHz$, Test Circuit 5 | +25°C | | -33 | | dB |
| -3dB Bandwidth | BW | Signal = 0dBm, $R_L = 50\Omega$, $C_L = 5pF$ Test Circuit 6 | +25°C | | 500 | | MHz |
| Channel-to-Channel Skew | t_{SKEW} | $R_L = 50\Omega$, $C_L = 10pF$ | +25°C | | 0.05 | | ns |
| Charge Injection Select Input to Common I/O | Q | $V_S = GND$, $C_L = 1nF$, $R_S = 0\Omega$, $Q = C_L \times V_{OUT}$, Test Circuit 7 | +25°C | | 9.8 | | pC |
| HSD+, HSD-, D+, D- On Capacitance | C_{ON} | | +25°C | | 6.5 | | pF |
| Power Requirements | | | | | | | |
| Power Supply Range | V_+ | | Full | 1.8 | | 4.3 | V |
| Power Supply Current | I_+ | $V_+ = 3V$, V_S , $V_{OE} = 0V$ or V_+ | Full | | | 1 | μA |

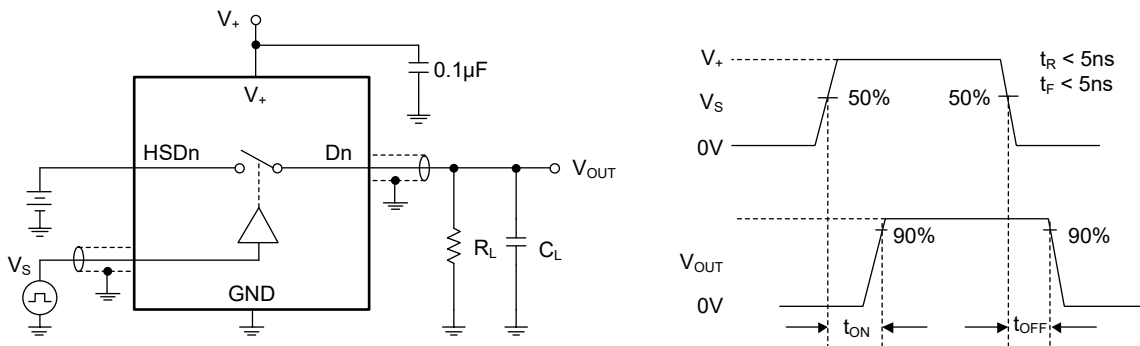
TYPICAL PERFORMANCE CHARACTERISTICS



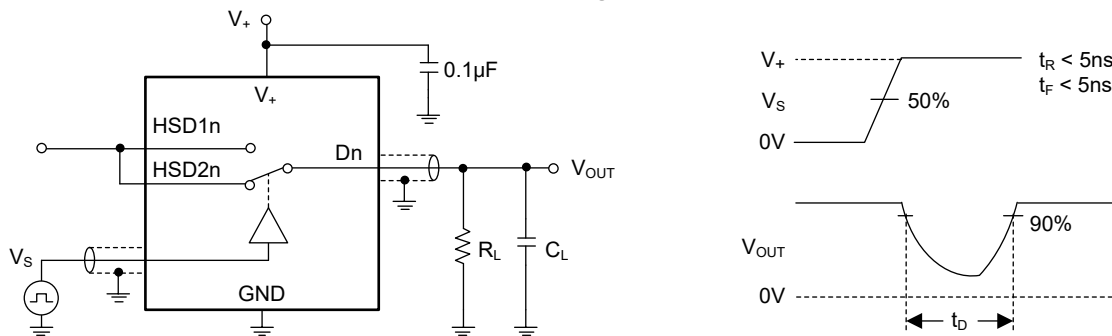
TEST CIRCUITS



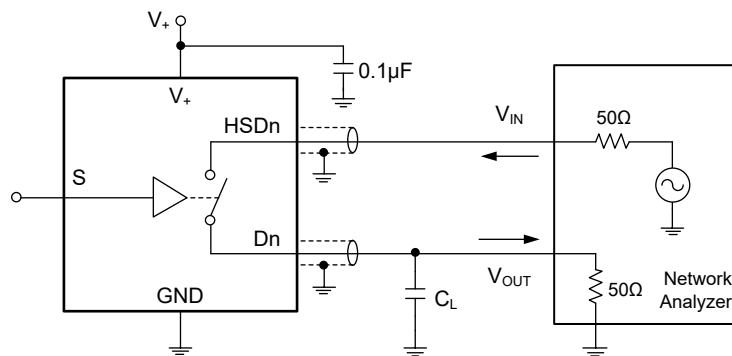
Test Circuit 1. On-Resistance



Test Circuit 2. Switching Times (t_{ON} , t_{OFF})

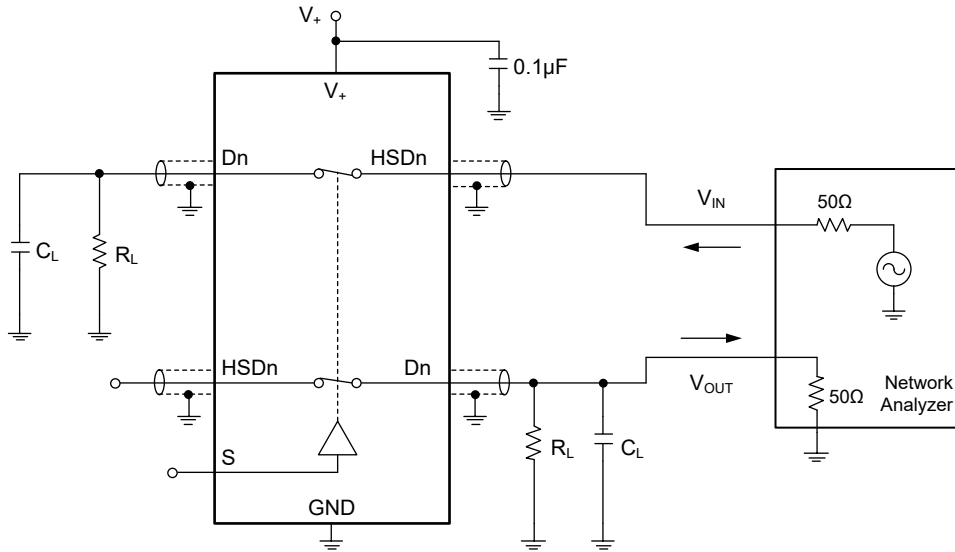


Test Circuit 3. Break-Before-Make Time (t_D)



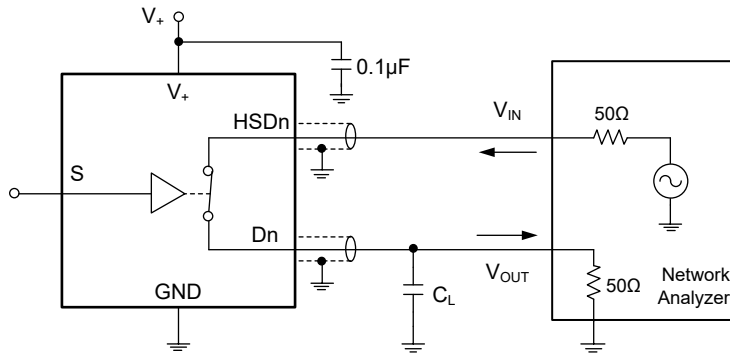
Test Circuit 4. Off Isolation

TEST CIRCUITS (continued)

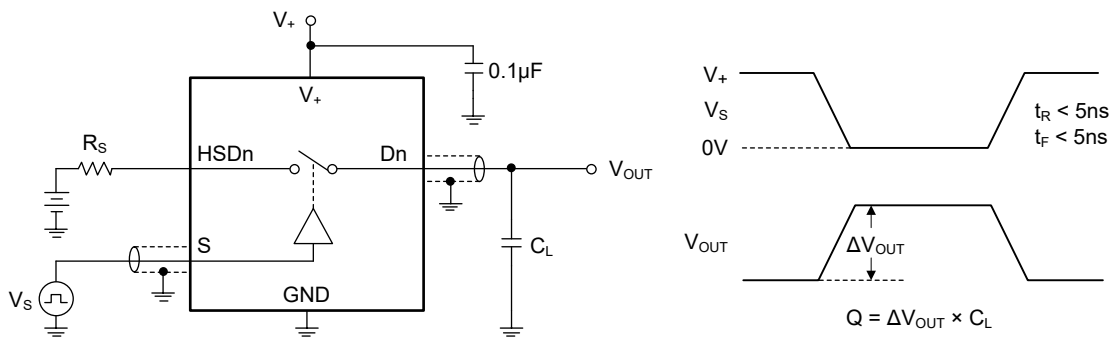


$$\text{Channel-to-Channel Crosstalk} = -20 \log (V_{\text{HSDn}}/V_{\text{OUT}})$$

Test Circuit 5. Channel-to-Channel Crosstalk



Test Circuit 6. -3dB Bandwidth



Test Circuit 7. Charge Injection (Q)

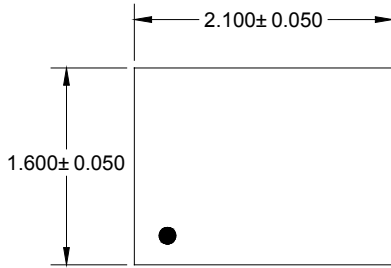
REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

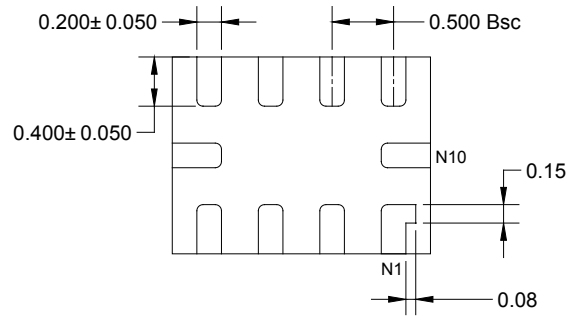
| MAY 2016 – REV.A.1 to REV.A.2 | Page |
|--|-------------|
| Added Recommended Land Pattern section..... | 11 |
| Added Tape and Reel Information section | 12, 13 |
| <hr/> | |
| MAY 2011 – REV.A to REV.A.1 | Page |
| Updated package name..... | All |
| <hr/> | |
| Changes from Original (AUGUST 2008) to REV.A | Page |
| Changed from product preview to production data..... | All |

PACKAGE OUTLINE DIMENSIONS

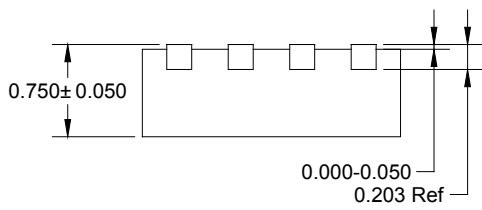
TQFN-2.1×1.6-10L



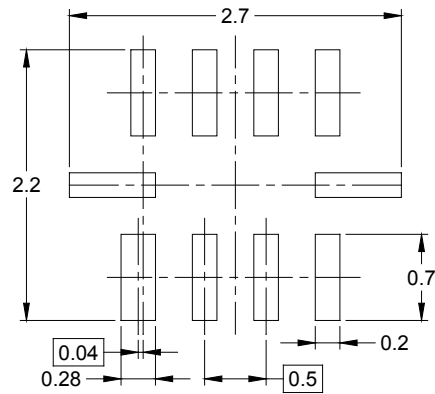
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN

NOTE: All linear dimensions are in millimeters.

PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

| Package Type | Reel Diameter | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|------------------|---------------|--------------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| TQFN-2.1×1.6-10L | 7" | 9.0 | 1.90 | 2.30 | 0.90 | 4.0 | 4.0 | 2.0 | 8.0 | Q1 |

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PACKAGE INFORMATION

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

| Reel Type | Length (mm) | Width (mm) | Height (mm) | Pizza/Carton |
|-------------|-------------|------------|-------------|--------------|
| 7" (Option) | 368 | 227 | 224 | 8 |
| 7" | 442 | 410 | 224 | 18 |

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单击下面可查看定价，库存，交付和生命周期等信息

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