



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**

SGM7223

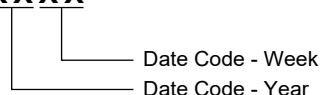
PACKAGE/ORDERING INFORMATION

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 GND0V 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.

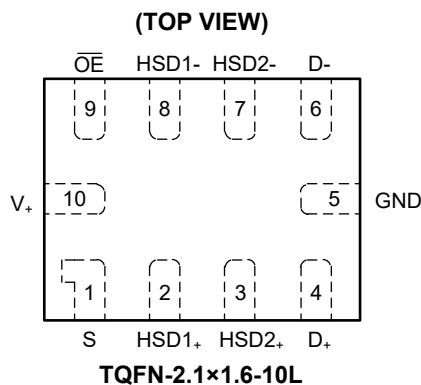
ESD SENSITIVITY CAUTION

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

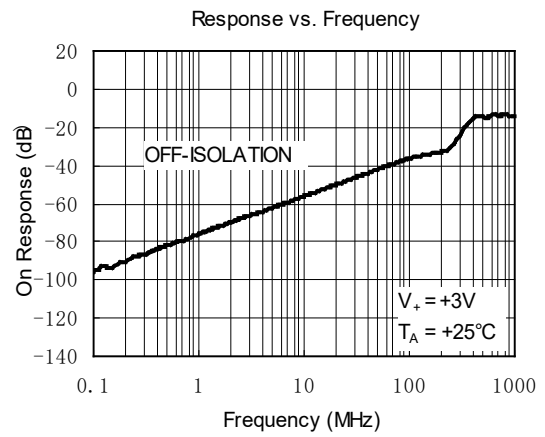
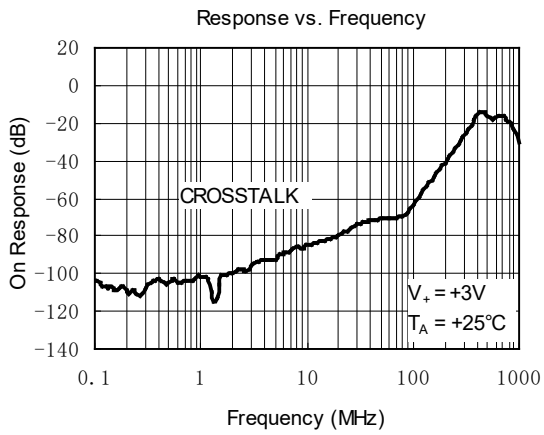
NOTE: Switches Shown For Logic "0" Input.

ELECTRICAL CHARACTERISTICS

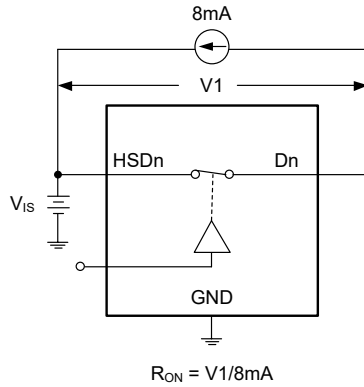
($V_+ = 1.8V$ to $4.3V$, $GND = 0V$, $V_{IH} = 1.6V$, $V_{IL} = 0.5V$, Full = $-40^\circ C$ to $+85^\circ C$. Typical values are at $V_+ = 3.3V$, $T_A = +25^\circ C$, unless otherwise noted.)

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

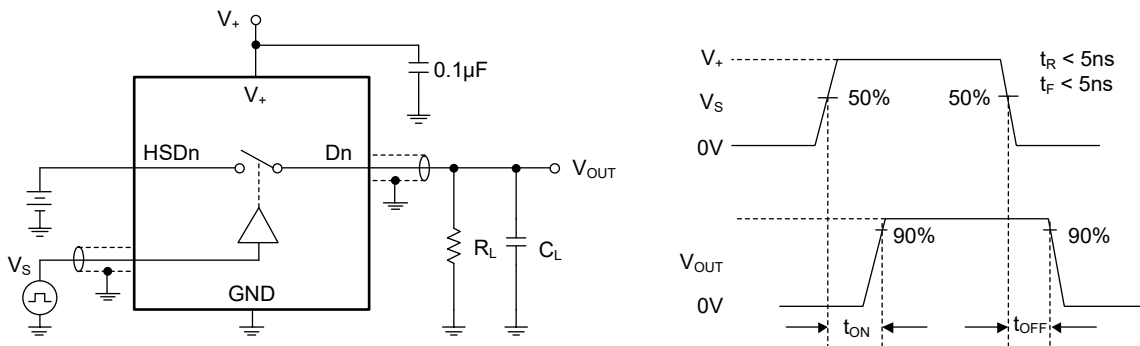
TYPICAL PERFORMANCE CHARACTERISTICS



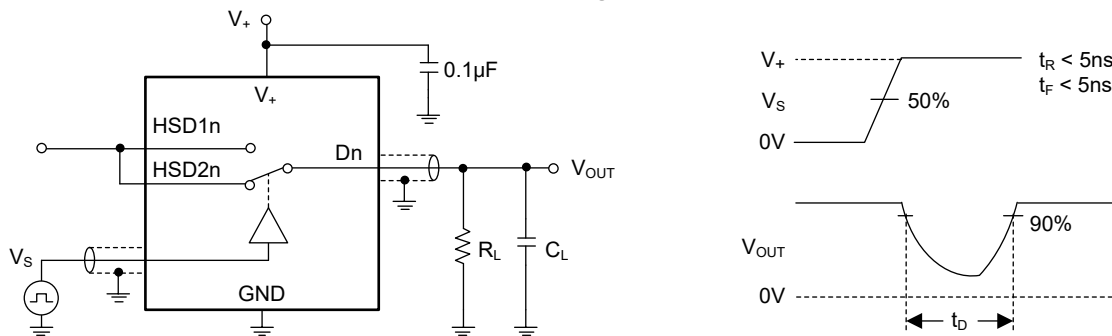
TEST CIRCUITS



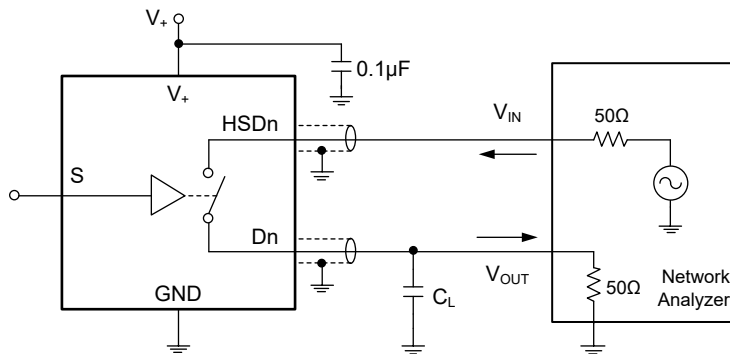
Test Circuit 1. On-Resistance



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

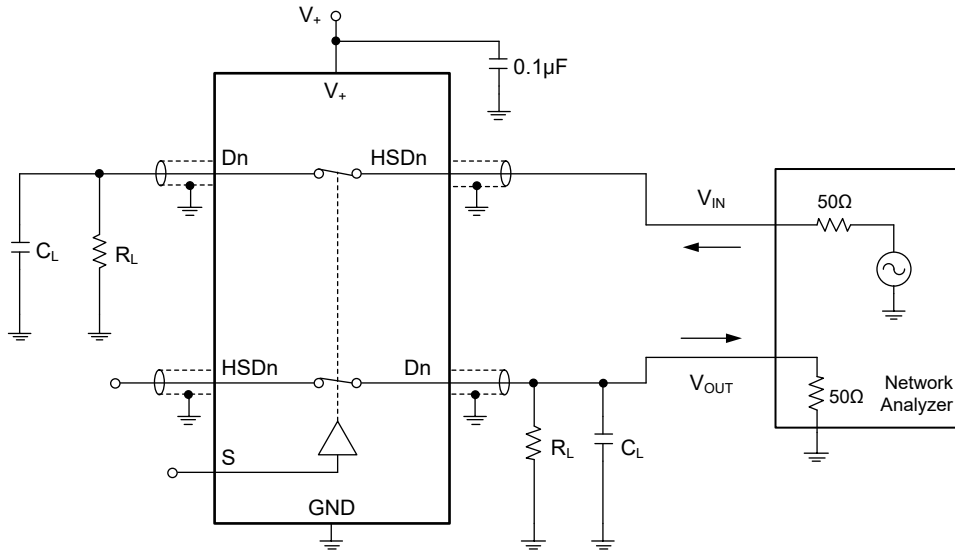


Test Circuit 3. Break-Before-Make Time (t_D)



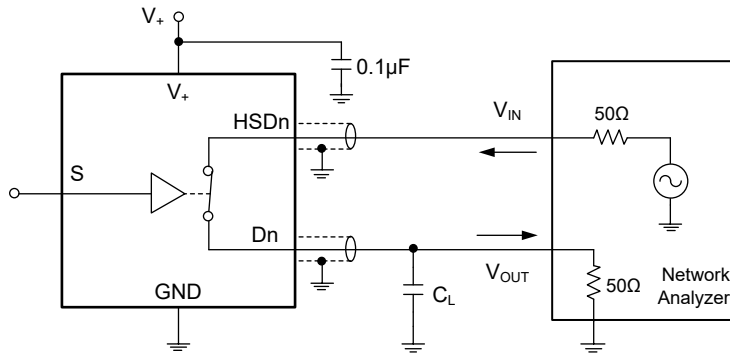
Test Circuit 4. Off Isolation

TEST CIRCUITS (continued)

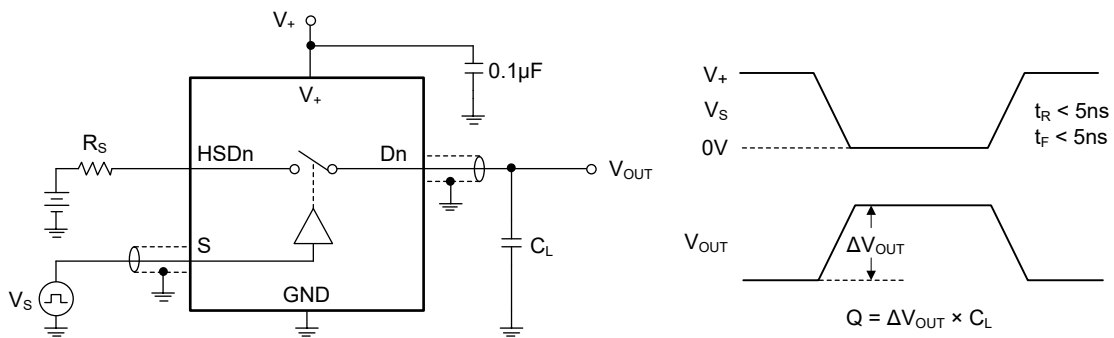


$$\text{Channel-to-Channel Crosstalk} = -20 \log (V_{\text{HSDn}}/V_{\text{OUT}})$$

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.

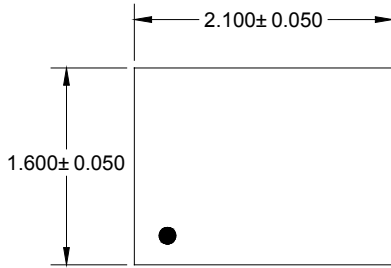
MAY 2016 – REV.A.1 to REV.A.2	Page
Added Recommended Land Pattern section.....	11
Added Tape and Reel Information section	12, 13

MAY 2011 – REV.A to REV.A.1	Page
Updated package name.....	All

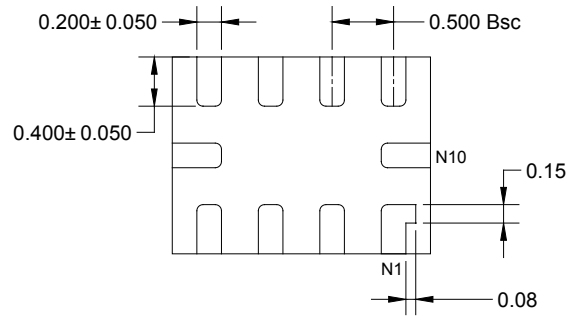
Changes from Original (AUGUST 2008) to REV.A	Page
Changed from product preview to production data.....	All

PACKAGE OUTLINE DIMENSIONS

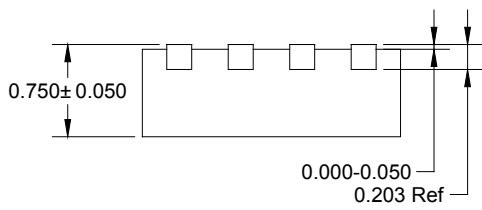
TQFN-2.1×1.6-10L



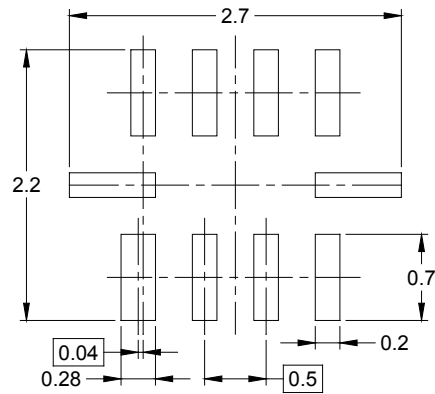
TOP VIEW



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

DD0001

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

DD0002