SGM2258
4.5Ω, 300MHz, Low-Power Full-Speed USB (12Mbps) Switch

GENERAL DESCRIPTION

The SGM2258 is a high-performance, dual, single-pole/ double-throw (SPDT) CMOS analog switch designed for switching USB 1.1 signals. High bandwidth and low on-resistance make this switch able to pass both USB low and full-speed signal with minimum signal distortion.

The SGM2258 features guaranteed on-resistance matching (0.3Ω TYP) between switches and guaranteed on-resistance flatness over the signal range (2Ω TYP). This ensures excellent linearity and low distortion when switching signals.

The device is fabricated with sub-micron CMOS technology to achieve fast switching speeds and designed for break-before-make operation. The select input is TTL-level compatible.

SGM2258 is available in Green TQFN-2.1×1.6-10L package. It operates over an ambient temperature range of -40℃ to +85℃.

FEATURES

- **Operation Voltage: +1.8V to +5.5V**
- **On-Resistance: 4.5Ω (TYP) at +4.5V**
- **High Bandwidth: 300MHz**
- **Switching Times:**
  - **t_{ON} 70ns**
  - **t_{OFF} 20ns**
- **High Off-Isolation: -51dB at 10MHz**
- **Low Crosstalk: -67dB at 10MHz**
- **Rail-to-Rail Operation**
- **TTL/CMOS Compatible**
- **Break-Before-Make Switching**
- **Extended Industrial Temperature Range:**
  - **-40℃ to +85℃**
- **Available in Green TQFN-2.1×1.6-10L Package**

APPLICATIONS

Routes Signals for USB 1.1
Portable Instrumentation
Battery-Operated Equipment
Computer Peripherals
Cell Phones
PDAs
MP3s

PACKAGE/ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM2258	TQFN-2.1×1.6-10L	-40℃ to +85℃	SGM2258YTQD10/TR	2258	Tape and Reel, 3000

ABSOLUTE MAXIMUM RATINGS

V_+, IN to GND ..... -0.3V to 6V
Analog, Digital voltage range (1) ..... -0.3V to (V_+) + 0.3V
Continuous Current D1, D2, or D……..... ±100mA
Operating Temperature Range..... -40℃ to +85℃
Junction Temperature..... 150℃
Storage Temperature Range.....-65℃ to +150℃
Lead Temperature (soldering, 10s)..... 260℃
ESD Susceptibility
MM.....400V

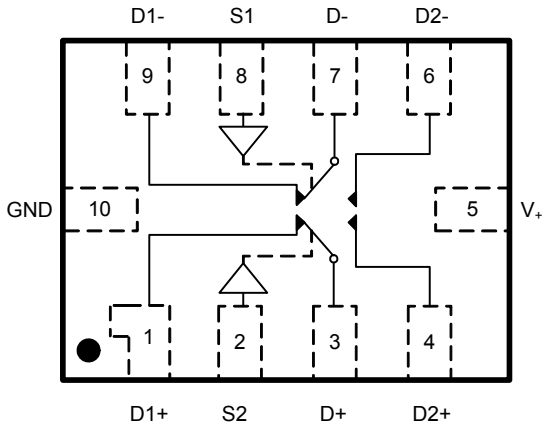
NOTES:
1. Signals on D1, D2, D or S exceeding V_+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
2. Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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.

SGMICRO reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SGMICRO sales office to get the latest datasheet.

PIN CONFIGURATION (TOP VIEW)



TQFN-2.1×1.6-10L

FUNCTION TABLE

S	D2-, D2+	D1-, D1+
0	OFF	ON
1	ON	OFF

Switches Shown For Logic "0" Input

PIN DESCRIPTION

PIN	NAME	FUNCTION
5	V_+	Power Supply.
10	GND	Ground.
8, 2	S1, S2	Select Input.
7, 3	D-, D+	Common Output/Data Port.
6, 4	D2-, D2+	Data Port (Normally Open).
9, 1	D1-, D1+	Data Port (Normally Closed).

ELECTRICAL CHARACTERISTICS

(V_+ = +4.5V to +5.5V, V_{IH} = +1.6V, V_{IL} = +0.5V, T_A = -40℃ to +85℃. Typical values are at V_+ = +5.0V, T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range (D1+, D1-, D2+, D2-)	V_{IS}			-40℃ to +85℃	0		V_+	V
On-Resistance	R_{ON}	V_+ = 4.5V, 0V ≤ V_{IS} ≤ V_+, I_D = -100mA , Test Circuit 1		+25℃		4.5	8.5	Ω
				-40℃ to +85℃			9.5	Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 4.5V, 0V ≤ V_{IS} ≤ V_+, I_D = -100mA , Test Circuit 1		+25℃		0.3	0.6	Ω
				-40℃ to +85℃			0.8	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 4.5V, 0V ≤ V_{IS} ≤ V_+, I_D = -100mA , Test Circuit 1		+25℃		2	3.4	Ω
				-40℃ to +85℃			3.8	Ω
Source Off Leakage Current	$I_{D2(OFF)}$, $I_{D1(OFF)}$	V_+ = 5.5V, V_{IS} = 3.3V/0.3V, V_D = 0.3V/ 3.3V		-40℃ to +85℃			1	μA
Channel On Leakage Current	$I_{D2(ON)}$, $I_{D1(ON)}$	V_+ = 5.5V, V_{IS} = 0.3V/3.3V, V_D = 0.3V/3.3V or floating		-40℃ to +85℃			1	μA
DIGITAL INPUTS								
Input High Voltage	V_{INH}			-40℃ to +85℃	1.6			V
Input Low Voltage	V_{INL}			-40℃ to +85℃			0.5	V
Input Leakage Current	I_{IN}	V_+ = 5.5V, V_S = 0V or 5.5V		-40℃ to +85℃			1	μA
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	V_+ = 4.2V, V_{IS} = 3.0V, R_L = 50Ω, C_L = 35pF, Test Circuit 2		+25℃		70		ns
Turn-Off Time	t_{OFF}			+25℃		20		ns
Break-Before-Make Time Delay	t_D	V_+ = 4.2V, V_{IS} = 3.0V, R_L = 50Ω, C_L = 35pF, Test Circuit 3		+25℃		10		ns
Charge Injection	Q	V_+ = 4.2V, V_G = GND, R_G = 0Ω, C_L = 1.0nF, Q = C_L × V_{OUT}, Test Circuit 4		+25℃		6		pC
Channel On Capacitance	C_{ON}			+25℃		41		pF
Off Isolation	O_{ISO}	V_+ = 4.2V, Signal = 0dBm, R_L = 50Ω, Test Circuit 5	f = 1MHz	+25℃		-71		dB
			f = 10MHz	+25℃		-51		dB
Channel-to-Channel Crosstalk	X_{TALK}	V_+ = 4.2V, Signal = 0dBm, R_L = 50Ω, Test Circuit 6	f = 1MHz	+25℃		-99		dB
			f = 10MHz	+25℃		-67		dB
-3dB Bandwidth	BW	V_+ = 4.2V, Signal = 0dBm, R_L = 50Ω, Test Circuit 7		+25℃		300		MHz
POWER REQUIREMENTS								
Power Supply Range	V_+			-40℃ to +85℃	1.8		5.5	V
Power Supply Current	I_+	V_+ = 5.5V, V_{IN} = 0V or V_+		-40℃ to +85℃			1	μA

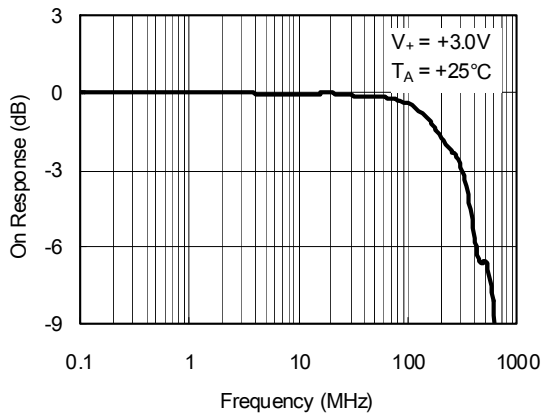
ELECTRICAL CHARACTERISTICS

(V_+ = +2.7V to +3.6V, V_{IH} = +1.5V, V_{IL} = +0.4V, T_A = -40℃ to +85℃. Typical values are at V_+ = +3.0V, T_A = +25℃, unless otherwise noted.)

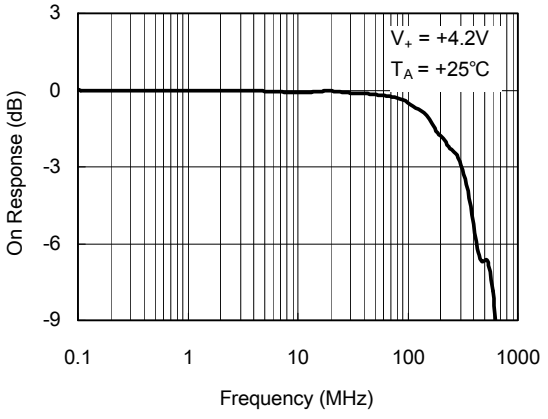
PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range (D1+, D1-, D2+, D2-)	V_{IS}			-40℃ to +85℃	0		V_+	V
On-Resistance	R_{ON}	V_+ = 2.7V, 0V ≤ V_{IS} ≤ V_+, I_D = -100mA , Test Circuit 1		+25℃		7	13	Ω
				-40℃ to +85℃			14	Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 2.7V, 0V ≤ V_{IS} ≤ V_+, I_D = -100mA , Test Circuit 1		+25℃		0.3	0.85	Ω
				-40℃ to +85℃			1.0	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ =2.7V, 0V ≤ V_{IS} ≤ V_+, I_D = -100mA , Test Circuit 1		+25℃		7	9.5	Ω
				-40℃ to +85℃			10.3	Ω
Source Off Leakage Current	$I_{D2(OFF)}$, $I_{D1(OFF)}$	V_+ = 3.6V, V_{IS} = 3.3V/0.3V, V_D = 0.3V/3.3V		-40℃ to +85℃			1	μA
Channel On Leakage Current	$I_{D2(ON)}$, $I_{D1(ON)}$	V_+ = 3.6V, V_D = 0.3V/3.3V, V_{IS} = 0.3V/3.3V or floating		-40℃ to +85℃			1	μA
DIGITAL INPUTS								
Input High Voltage	V_{INH}			-40℃ to +85℃	1.5			V
Input Low Voltage	V_{INL}			-40℃ to +85℃			0.4	V
Input Leakage Current	I_{IN}	V_+ = 2.7V, V_S = 0V or 2.7V		-40℃ to +85℃			1	μA
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	V_{IS} = 1.5V, R_L = 50Ω, C_L = 35pF, Test Circuit 2		+25℃		95		ns
Turn-Off Time	t_{OFF}			+25℃		40		ns
Break-Before-Make Time Delay	t_D	V_{IS} = 1.5V, R_L = 50Ω, C_L = 35pF, Test Circuit 3		+25℃		12		ns
Charge Injection	Q	V_G = GND, R_G = 0Ω, C_L = 1.0nF, Q = C_L × V_{OUT}, Test Circuit 4		+25℃		5		pC
Channel On Capacitance	C_{ON}			+25℃		41		pF
Off Isolation	O_{ISO}	Signal = 0dBm, R_L = 50Ω, Test Circuit 5	f = 1MHz	+25℃		-72		dB
			f = 10MHz	+25℃		-52		dB
Channel-to-Channel Crosstalk	X_{TALK}	Signal = 0dBm, R_L = 50Ω, Test Circuit 6	f = 1MHz	+25℃		-99		dB
			f = 10MHz	+25℃		-67		dB
-3dB Bandwidth	BW	Signal = 0dBm, R_L = 50Ω, Test Circuit 7		+25℃		300		MHz

TYPICAL PERFORMANCE CHARACTERISTICS

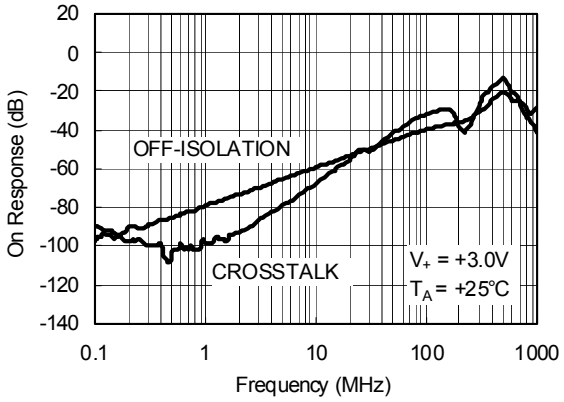
On Response vs. Frequency



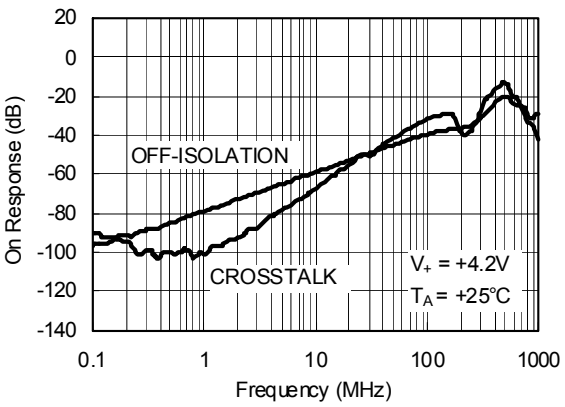
On Response vs. Frequency



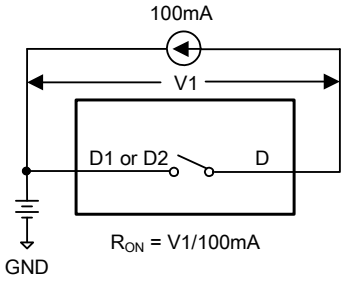
Response vs. Frequency



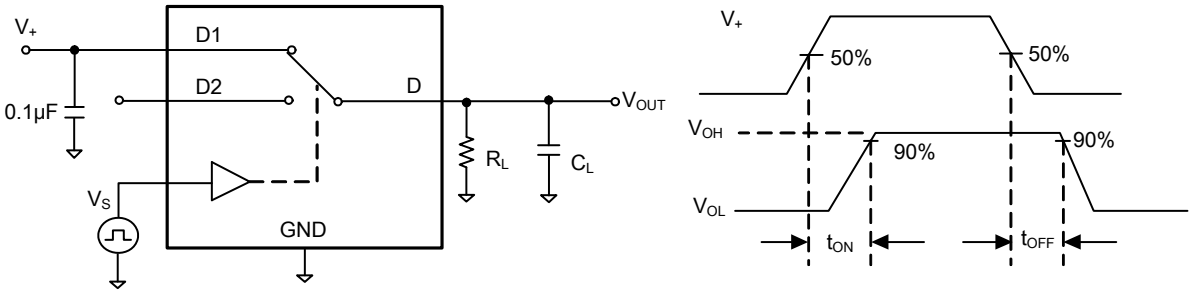
Response vs. Frequency



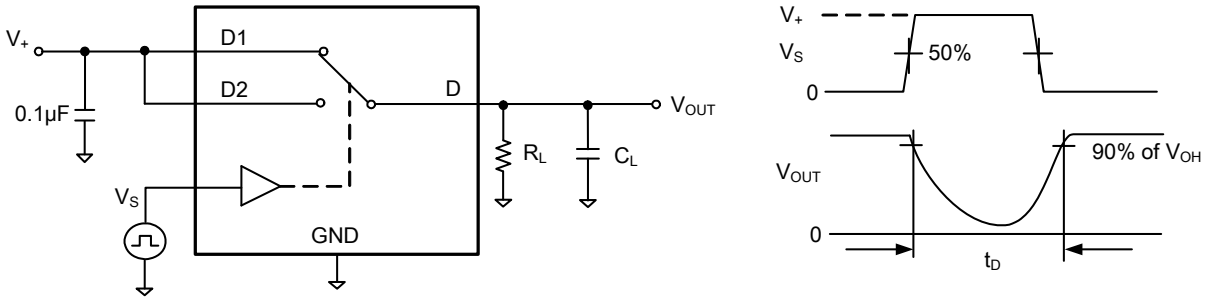
TEST CIRCUITS



Test Circuit 1. On Resistance

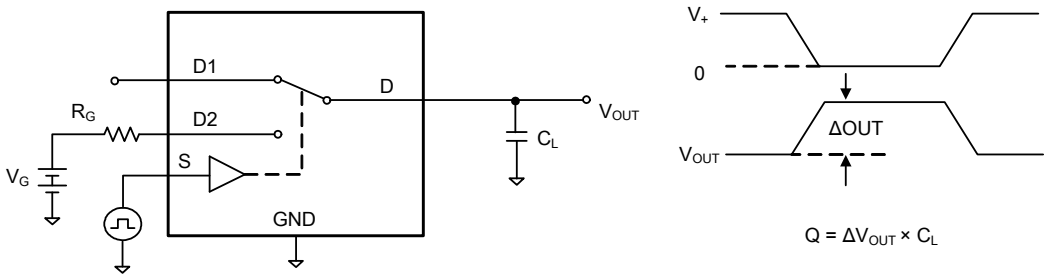


Test Circuit 2. Switching Times (t_{ON}, t_{OFF})

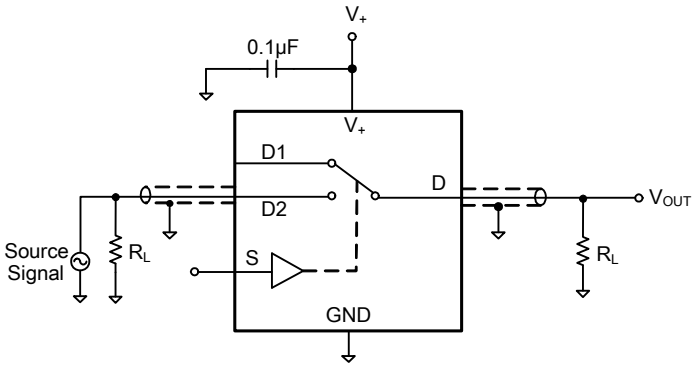


Test Circuit 3. Break-Before-Make Time Delay (t_D)

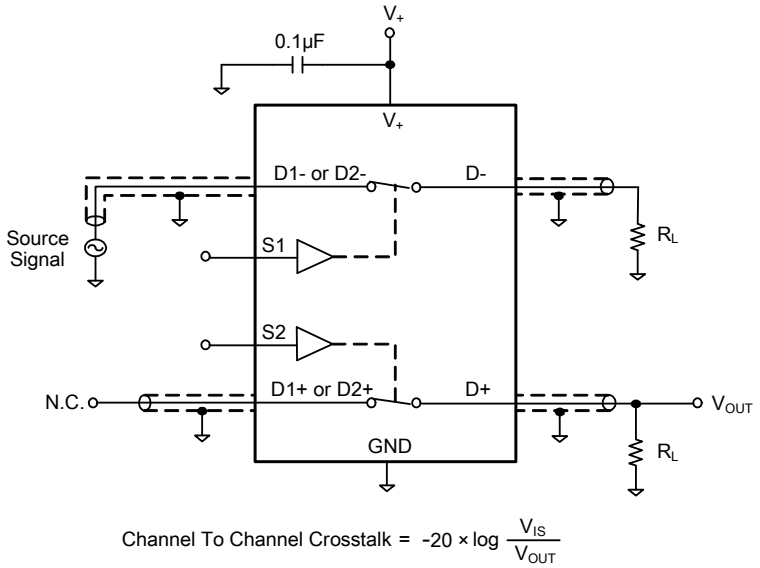
TEST CIRCUITS (Cont.)



Test Circuit 4. Charge Injection



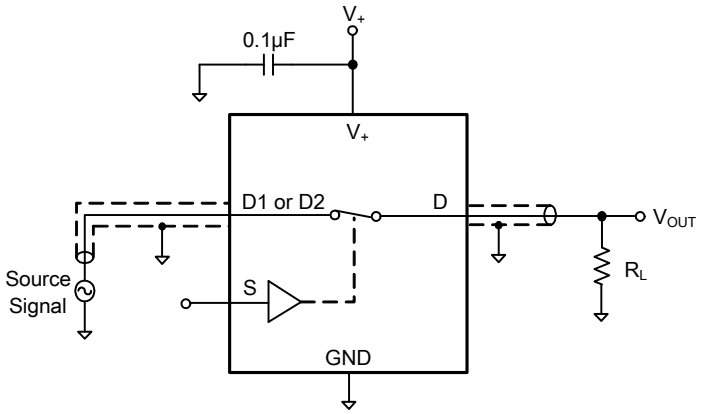
Test Circuit 5. Off Isolation



$$\text{Channel To Channel Crosstalk} = -20 \times \log \frac{V_{IS}}{V_{OUT}}$$

Test Circuit 6. Channel-to-Channel Crosstalk

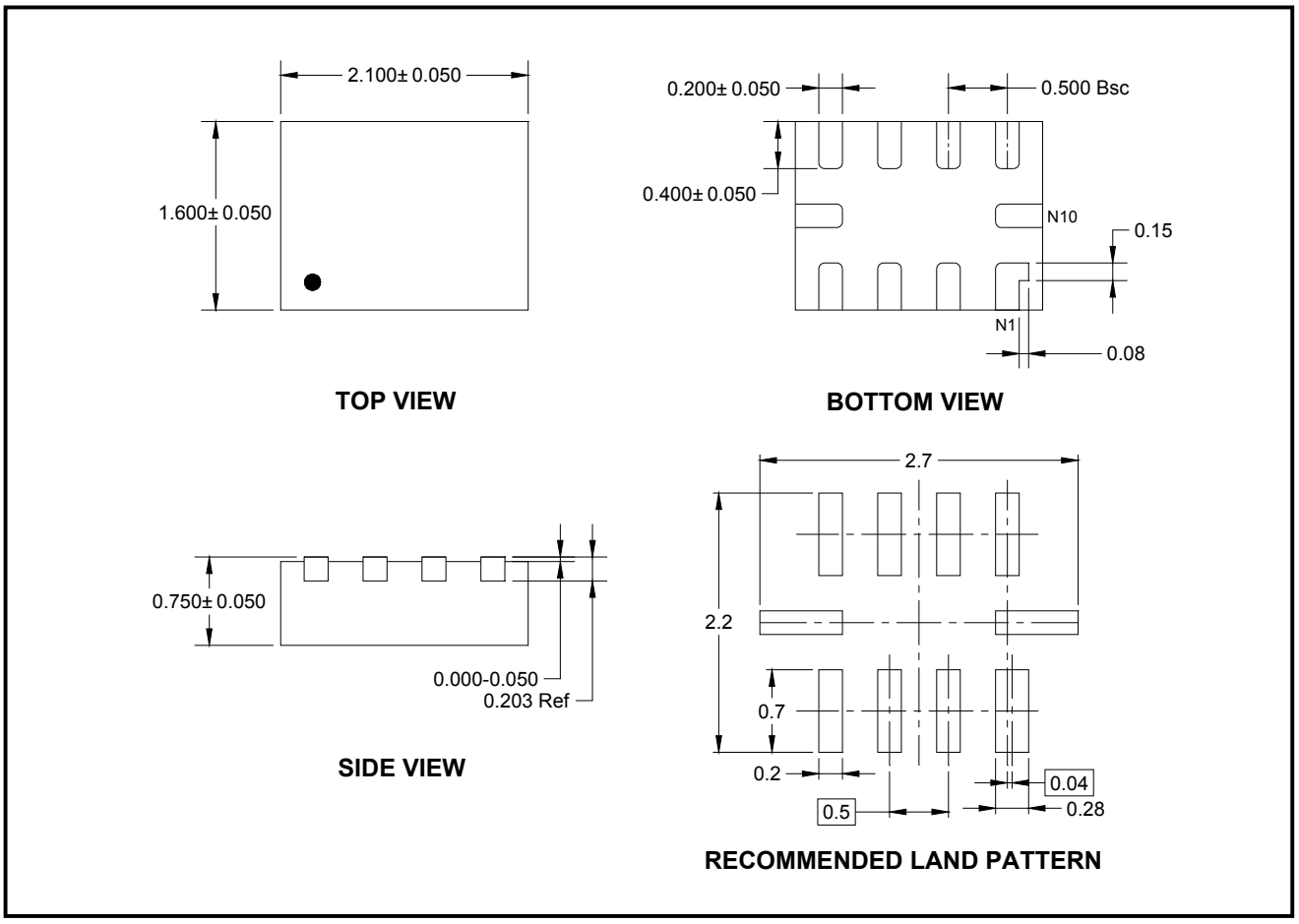
TEST CIRCUITS (Cont.)



Test Circuit 7. -3dB Bandwidth

PACKAGE OUTLINE DIMENSIONS

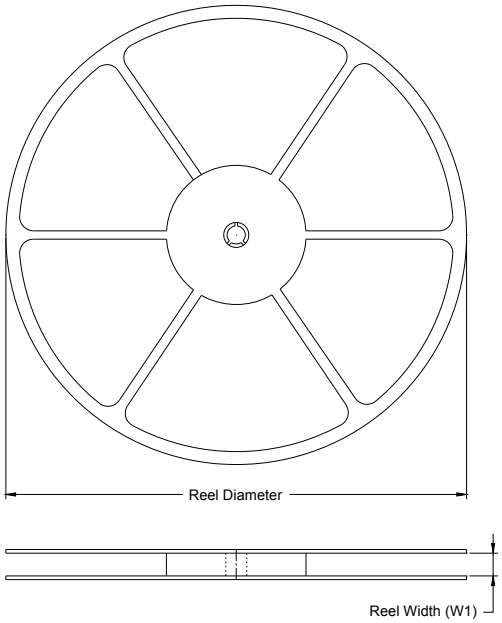
TQFN-2.1×1.6-10L



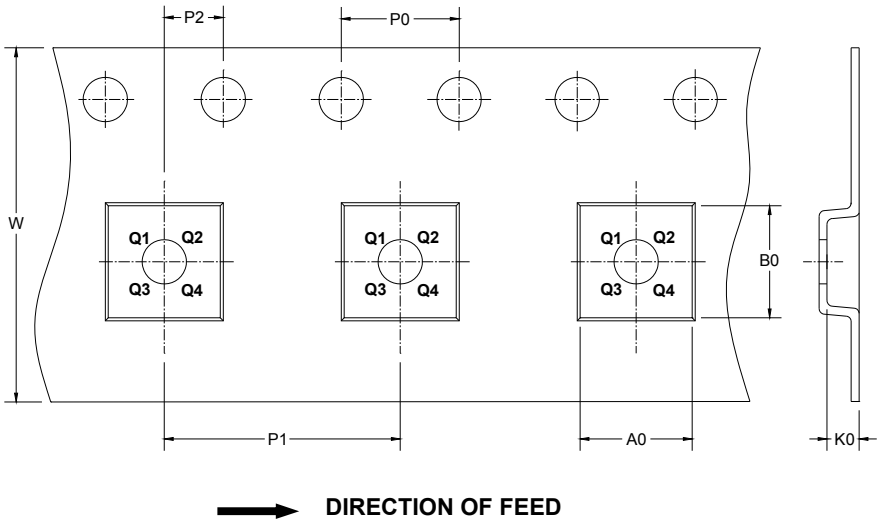
NOTE: All linear dimensions are in millimeters.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS

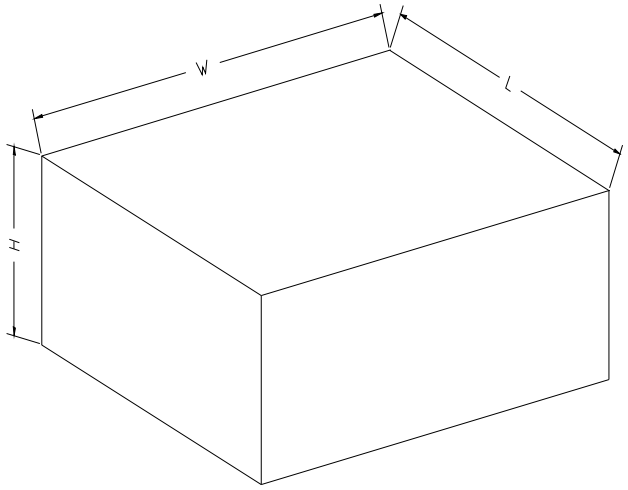


NOTE: The picture is only for reference. Please make the object as the standard.

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	1.9	2.3	0.9	4.0	4.00	2.0	8.0	Q1

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