SGM5223
0.5Ω Ultra Low ON-Resistance Dual SPDT Analog Switch

GENERAL DESCRIPTION

The SGM5223 is a dual single-pole/double-throw (SPDT) analog switch that is designed to operate from a single +1.8V to +4.2V power supply. Targeted applications include battery powered equipment that benefit from SGM5223's low on-resistance (0.5Ω) and fast switching speeds (t_{ON} = 17ns, t_{OFF} = 27.5ns).

SGM5223 has excellent on-resistance matching (0.18 Ω MAX) between switches and guarantees excellent on-resistance flatness over all signal range (0.1Ω TYP). This ensures excellent linearity and low distortion when switching audio signals.

The SGM5223 is a committed dual single-pole/double -throw (SPDT) that consist of two normally open (NO) and two normally close (NC) switches. This configuration can be used as a dual 2-to-1 multiplexer.

SGM5223 is available in Green TQFN-1.8×1.4-10L package.

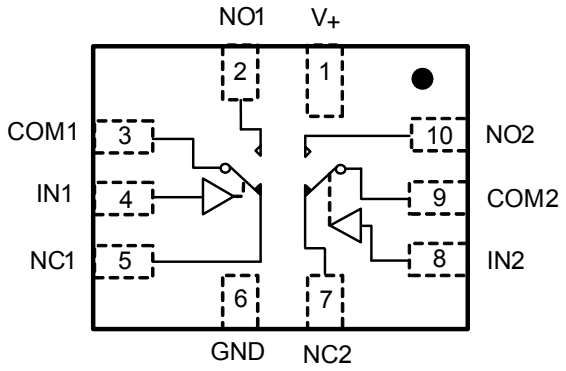
APPLICATIONS

Portable Instrumentation
Battery-Operated Equipment
Computer Peripherals
Speaker and Earphone Switching
Medical Equipment
Audio and Video Switching

FEATURES

- **Voltage Operation: 1.8V to 4.2V**
- **Ultra Low On-Resistance: 0.5Ω (TYP) at 4.2V**
- **Fast Switching Times**
  - **t_{ON} 17ns**
  - **t_{OFF} 27.5ns**
- **High Off-Isolation: -58dB at 1MHz**
- **Low Crosstalk: -104dB at 1MHz**
- **Rail-to-Rail Input and Output Operation**
- **1.8V Logic Compatible Control Pin**
- **Break-Before-Make Switching**
- **Extended Industrial Temperature Range: -40°C to +85°C**
- **Available in Green TQFN-1.8×1.4-10L Package**

PIN CONFIGURATION (TOP VIEW)



TQFN-1.8×1.4-10L

FUNCTION TABLE

LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

Switches Shown For Logic "0" Input.

PACKAGE/ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM5223	TQFN-1.8×1.4-10L	-40°C to +85°C	SGM5223YWQ10/TR	5223	Tape and Reel, 3000

ABSOLUTE MAXIMUM RATINGS

V_+ , IN to GND..... 0V to 4.6V
Analog, Digital voltage range (1)..... -0.3V to (V_+) + 0.3V
Continuous Current NO, NC, or COM.....±250mA
Peak Current NO, NC, or COM.....±350mA
Operating Temperature Range.....-40°C to +85°C
Junction Temperature.....150°C
Storage Temperature Range.....-65°C to +150°C
Lead Temperature (soldering, 10s)..... 260°C
ESD (HBM).....4000V

NOTES:
1. Signals on NC, NO, or COM or IN 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 DESCRIPTION

PIN	NAME	FUNCTION
1	V_+	Power Supply.
6	GND	Ground.
4, 8	IN1, IN2	Digital Control Pin to Connect the COM Terminal to the NO or NC Terminals.
3, 9	COM1, COM2	Common Terminal.
2, 10	NO1, NO2	Normally-Open Terminal.
5, 7	NC1, NC2	Normally-Closed Terminal.

NOTE: NO, NC and COM terminals may be an input or output.

ELECTRICAL CHARACTERISTICS

(V_+ = +4.2V, GND = 0V, V_{IH} = +1.6V, V_{IL} = +0.6V, T_A = -40°C to +85°C. Typical values are at V_+ = +4.2V, T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}			-40°C to +85°C	0		V_+	V
On-Resistance	R_{ON}	V_+ = 4.2V, V_{NO} or V_{NC} = 1V, I_{COM} = -100mA, Test Circuit 1		+25°C		0.5	0.75	Ω
				-40°C to +85°C			0.85	Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 4.2V, V_{NO} or V_{NC} = 1V, I_{COM} = -100mA, Test Circuit 1		+25°C		0.11	0.18	Ω
				-40°C to +85°C		0.1	0.23	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 4.2V, V_{NO}, V_{NC} or V_{COM} = 1V, 2.5V, I_{COM} = -100mA, Test Circuit 1		+25°C		0.1	0.22	Ω
				-40°C to +85°C			0.26	Ω
Source OFF Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_+ = 4.2V, V_{NO} or V_{NC} = 3.3V/0.3V, V_{COM} = 0.3V/3.3V		-40°C to +85°C			1	μA
Channel ON Leakage Current	$I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$	V_+ = 4.2V, V_{COM} = 0.3V/3.3V, V_{NO} or V_{NC} = 0.3V/3.3V, or floating		-40°C to +85°C			1	μA
DIGITAL INPUTS								
Input High Voltage	V_{INH}			-40°C to +85°C	1.6			V
Input Low Voltage	V_{INL}			-40°C to +85°C			0.5	V
Input Leakage Current	I_{IN}	V_+ = 4.2V, V_{IN} = 0V or 4.2V		-40°C to +85°C			1	μA
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	V_{IH} = 3V, V_{IL}= 0V, Test Circuit2		+25°C		17.0		ns
Turn-Off Time	t_{OFF}	V_{IH} = 3V, V_{IL}= 0V, Test Circuit2		+25°C		27.5		ns
Break-Before-Make Time Delay	t_D	V_{IH} = 3V, V_{IL}= 0V, Test Circuit3		+25°C		5.0		ns
Off Isolation	O_{ISO}	V_{BIAS} = 2.1V, Signal = 0dBm, V_{IH} = 3V, V_{IL}= 0V, Test Circuit4	100kHz	+25°C		-78		dB
			1MHz	+25°C		-58		dB
Channel-to-Channel Crosstalk	X_{TALK}	V_{BIAS} = 2.1V, Signal = 0dBm, V_{IH} = 3V, V_{IL}= 0V, Test Circuit5	100kHz	+25°C		-100		dB
			1MHz	+25°C		-104		dB
-3dB Bandwidth	BW	V_{BIAS} = 2.1V, Signal = 0dBm, V_{IH} = 3V, V_{IL}= 0V, Test Circuit6		+25°C		55		MHz
Channel ON Capacitance	C_{ON}			+25°C		95		pF
Charge Injection Select Input to Common I/O	Q	V_G = GND, R_S = 0Ω, C_L = 1.0nF, V_{IH} = 3V, V_{IL}= 0V, Q = C_L x V_{OUT}, Test Circuit7		+25°C		13		pC
POWER REQUIREMENTS								
Power Supply Range	V_+			-40°C to +85°C	1.8		4.2	V
Power Supply Current	I_+	V_+ = 4.2V, V_{IN} = 0V or V_+		-40°C to +85°C			1	μA

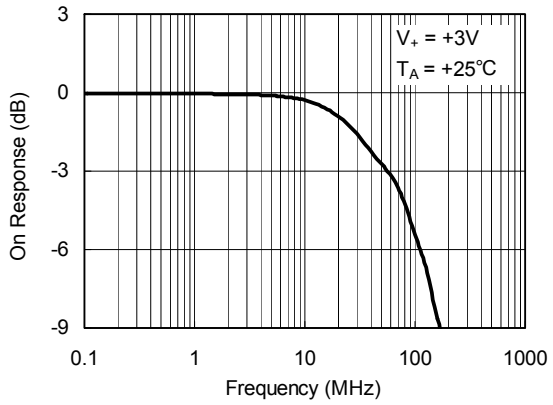
ELECTRICAL CHARACTERISTICS

(V_+ = +2.7V to +3.6V, V_{IH} = +1.6V, V_{IL} = +0.4V, T_A = -40°C to +85°C. Typical values are at V_+ = +3.0V, T_A = +25°C, unless otherwise noted.)

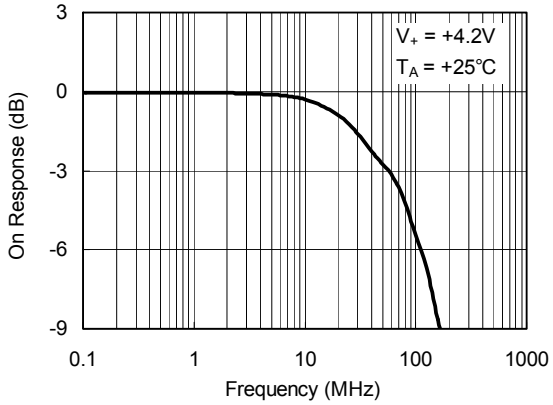
PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}			-40°C to +85°C	0		V_+	V
On-Resistance	R_{ON}	V_+ = 2.7V, V_{NO} or V_{NC} = 1V, I_{COM} = -100mA, Test Circuit 1		+25°C		0.6	0.9	Ω
				-40°C to +85°C			1	Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 2.7V, V_{NO} or V_{NC} = 1V, I_{COM} = -100mA, Test Circuit 1		+25°C		0.15	0.22	Ω
				-40°C to +85°C		0.15	0.25	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 2.7V, V_{NO}, V_{NC} or V_{COM} = 1V, 2.5V, I_{COM} = -100mA, Test Circuit 1		+25°C		0.1	0.22	Ω
				-40°C to +85°C		0.1	0.26	Ω
Source OFF Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_+ = 3.6V, V_{NO} or V_{NC} = 3.3V/0.3V, V_{COM} = 0.3V/3.3V		-40°C to +85°C			1	μA
Channel ON Leakage Current	$I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$	V_+ = 3.6V, V_{COM} = 0.3V/3.3V, V_{NO} or V_{NC} = 0.3V/3.3V, or floating		-40°C to +85°C			1	μA
DIGITAL INPUTS								
Input High Voltage	V_{INH}			-40°C to +85°C	1.5			V
Input Low Voltage	V_{INL}			-40°C to +85°C			0.4	V
Input Leakage Current	I_{IN}	V_+ = 2.7V, V_{IN} = 0V or 2.7V		-40°C to +85°C			1	μA
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	V_{IH} = 1.5V, V_{IL}= 0V, Test Circuit2		+25°C		22		ns
Turn-Off Time	t_{OFF}	V_{IH} = 1.5V, V_{IL}= 0V, Test Circuit2		+25°C		34		ns
Break-Before-Make Time Delay	t_D	V_{IH} = 1.5V, V_{IL}= 0V, Test Circuit3		+25°C		15.5		ns
Off Isolation	O_{ISO}	V_{BIAS} = 1.5V, Signal = 0dBm, V_{IH} = 1.5V, V_{IL}= 0V, Test Circuit4	100kHz	+25°C		-78		dB
			1MHz	+25°C		-58		dB
Channel-to-Channel Crosstalk	X_{TALK}	V_{BIAS} = 1.5V, Signal = 0dBm, V_{IH} = 1.5V, V_{IL}= 0V, Test Circuit5	100kHz	+25°C		-100		dB
			1MHz	+25°C		-104		dB
-3dB Bandwidth	BW	V_{BIAS} = 1.5V, Signal = 0dBm, V_{IH} = 1.5V, V_{IL}= 0V, Test Circuit6		+25°C		55		MHz
Charge Injection Select Input to Common I/O	Q	V_G = GND, R_S = 0Ω, C_L = 1.0nF, Q = C_L x V_{OUT}, V_{IH} = 1.5V, V_{IL}= 0V, Test Circuit7		+25°C		8.5		pC
Channel ON Capacitance	C_{ON}			+25°C		95		pF

TYPICAL PERFORMANCE CHARACTERISTICS

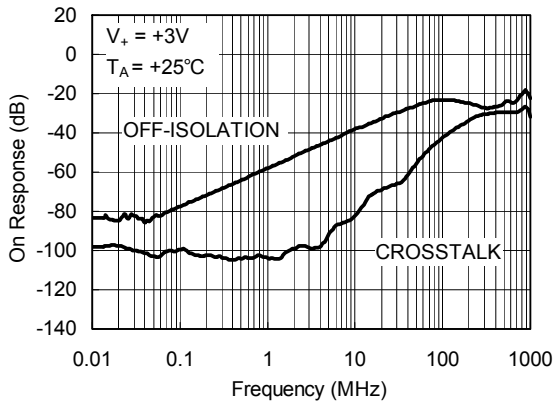
On Response vs. Frequency



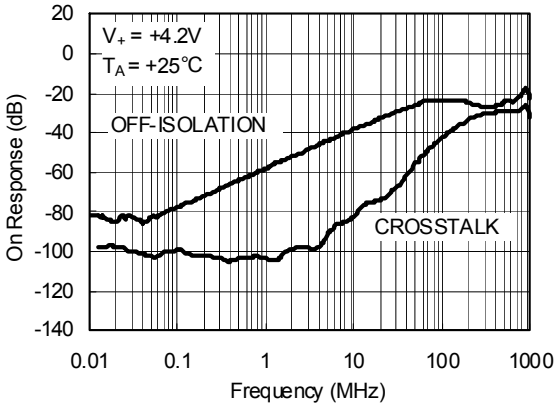
On Response vs. Frequency



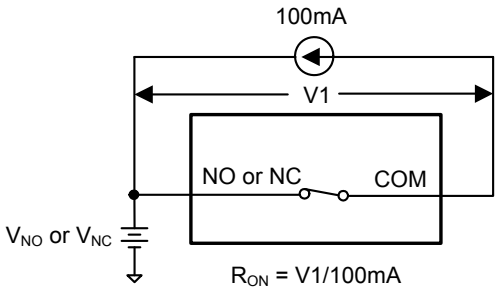
Response vs. Frequency



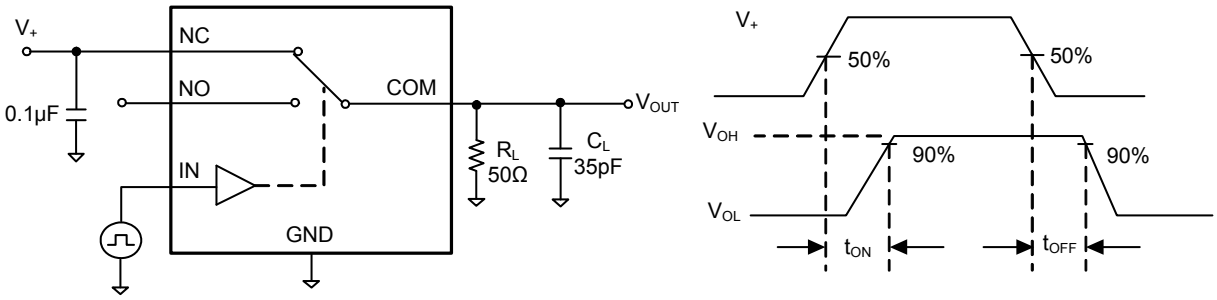
Response vs. Frequency



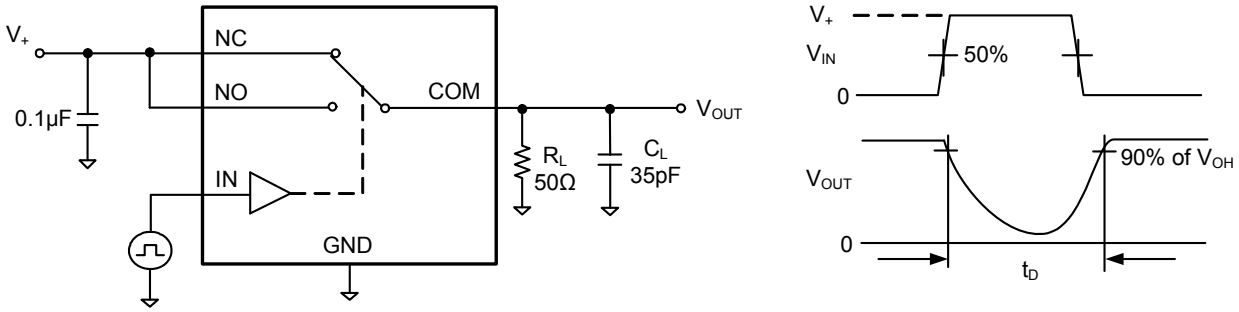
TEST CIRCUITS



Test Circuit 1. On Resistance

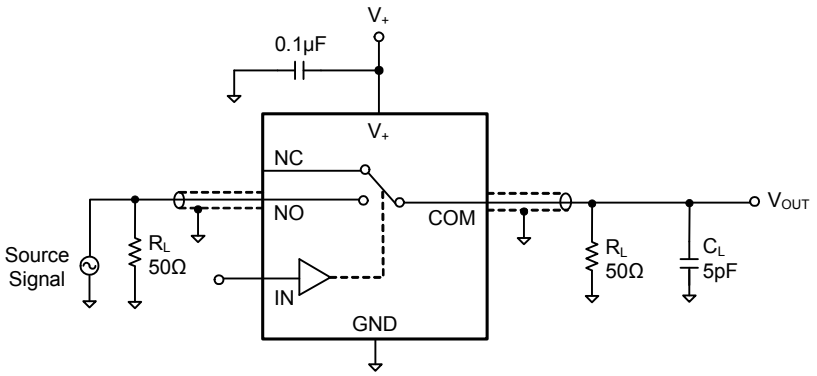


Test Circuit 2. Switching Times (t_{ON}, t_{OFF})

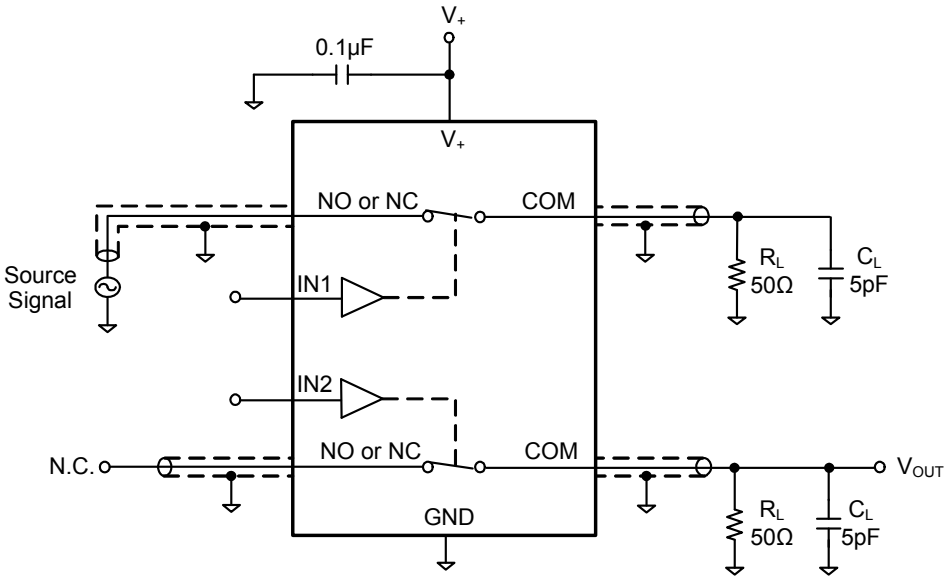


Test Circuit 3. Break-Before-Make Time (t_D)

TEST CIRCUITS (Cont.)



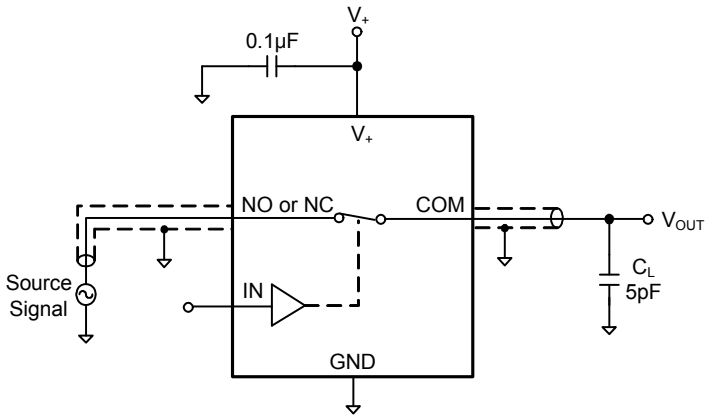
Test Circuit 4. Off Isolation



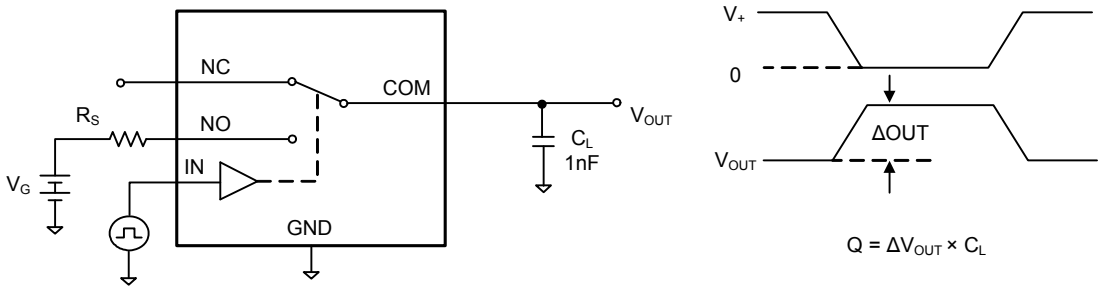
$$\text{Channel To Channel Crosstalk} = -20 \times \log \frac{V_{NO} \text{ or } V_{NC}}{V_{OUT}}$$

Test Circuit 5. Channel-to-Channel Crosstalk

TEST CIRCUITS (Cont.)



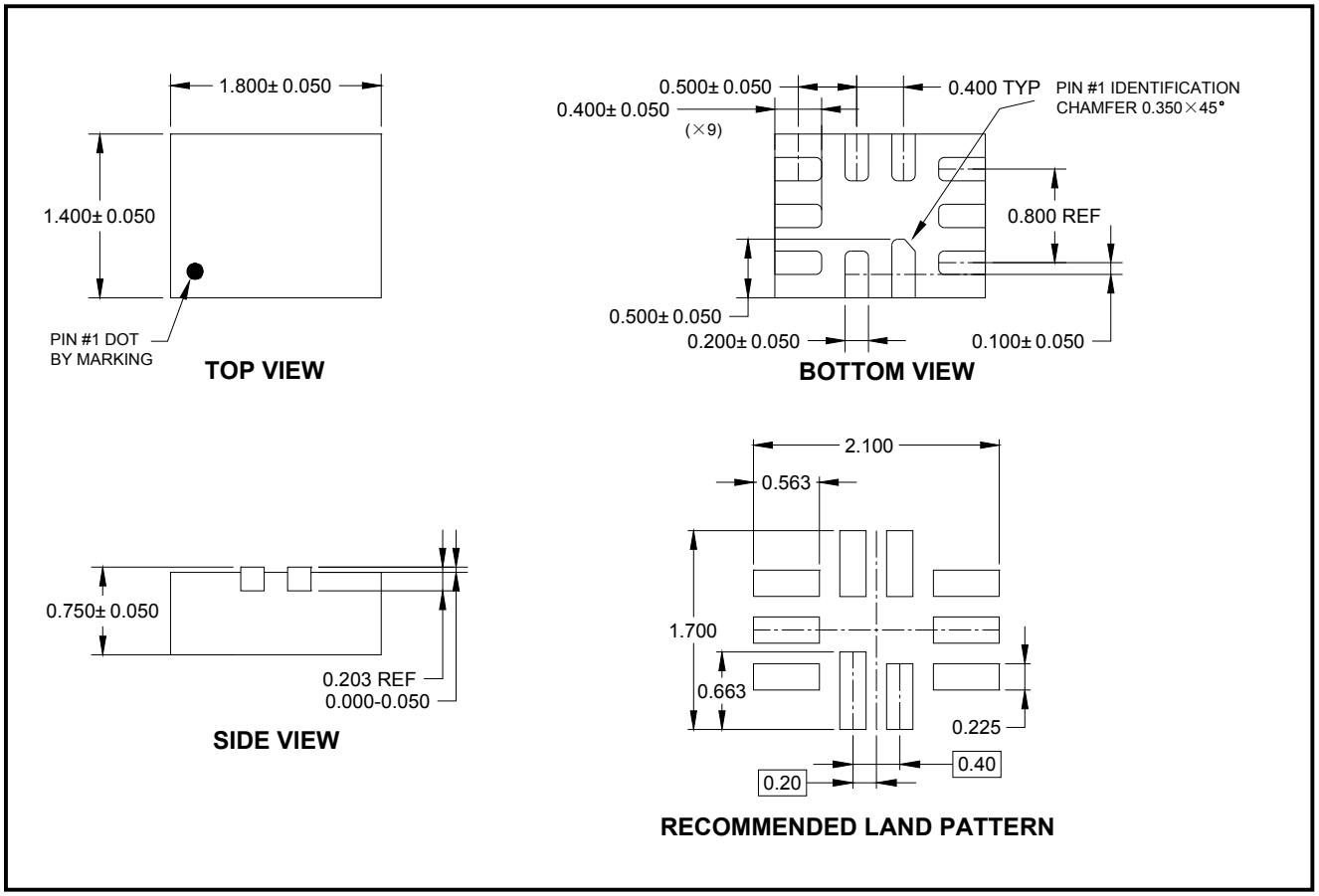
Test Circuit 6. -3dB Bandwidth



Test Circuit 7. Charge Injection (Q)

PACKAGE OUTLINE DIMENSIONS

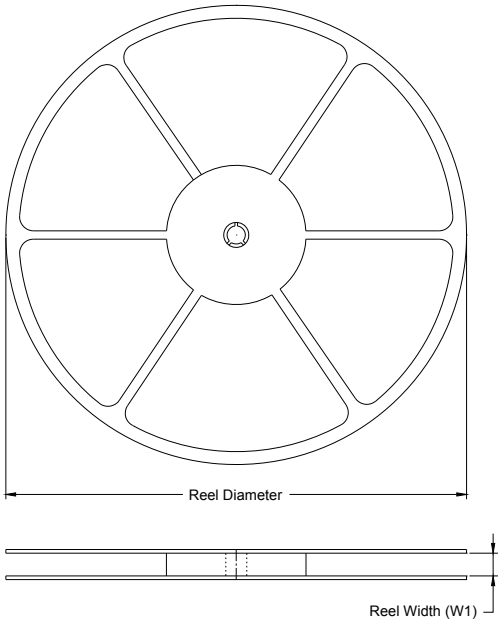
TQFN-1.8×1.4-10L



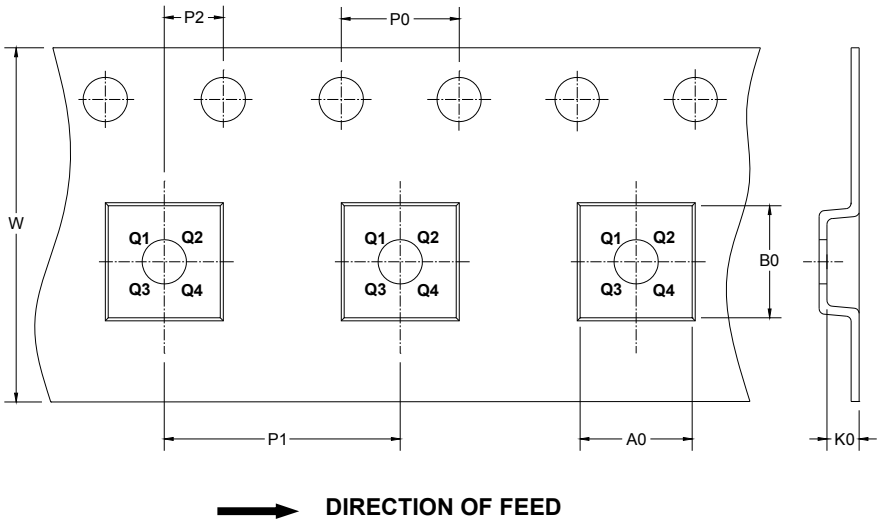
NOTE: All linear dimensions are in millimeters.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS

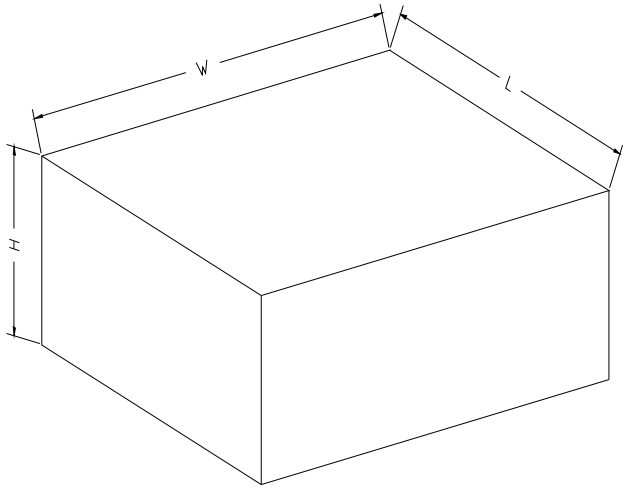


NOTE: The picture is only for reference. Please make the object as the standard.

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-1.8×1.4-10L	7″	9.0	1.75	2.10	1.00	4.00	4.00	2.00	8.00	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