



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.

The SGM2258 is available in Green TQFN-2.1×1.6-10L package. It operates over an ambient temperature range of -40°C to $+85^{\circ}\text{C}$.

FEATURES

- **Supply Voltage Range: 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°C to $+85^{\circ}\text{C}$**
- **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	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2258	TQFN-2.1×1.6-10L	-40°C to +85°C	SGM2258YTQD10/TR	2258 XXXX	Tape and Reel, 3000

NOTE: XXXX = Date Code.

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..... -0.3V to 6V
 Analog, Digital Voltage Range ⁽¹⁾..... -0.3V to (V₊) + 0.3V
 Continuous Current D1, D2, or D..... ±100mA
 Junction Temperature..... +150°C
 Storage Temperature Range..... -65°C to +150°C
 Lead Temperature (Soldering, 10s)..... +260°C
 ESD Susceptibility
 MM..... 400V

NOTE:

1. Signals on D1, D2, D or S exceeding V₊ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

RECOMMENDED OPERATING CONDITIONS

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

OVERSTRESS CAUTION

Stresses beyond those listed may cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational section of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

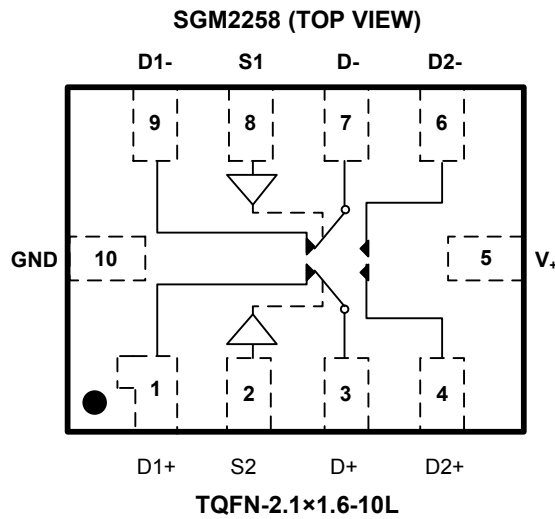
ESD SENSITIVITY CAUTION

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, specification or other related things if necessary without notice at any time.

PIN CONFIGURATION



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).

FUNCTION TABLE

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

NOTE: Switches shown for logic "0" input.

ELECTRICAL CHARACTERISTICS

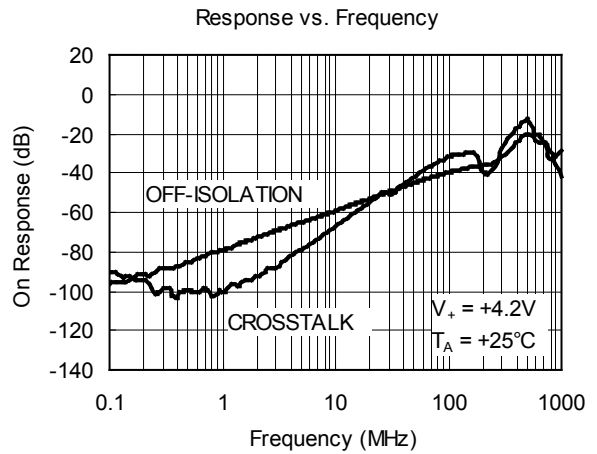
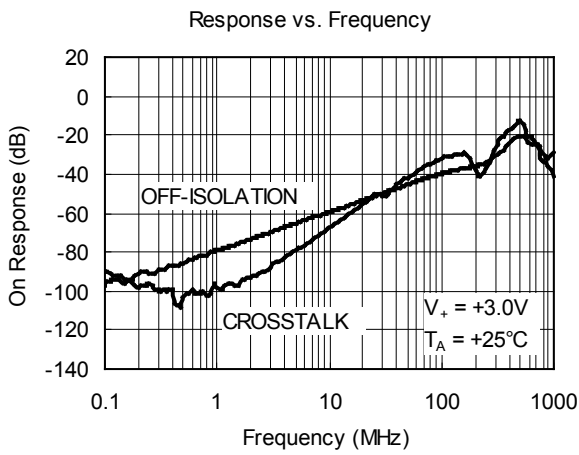
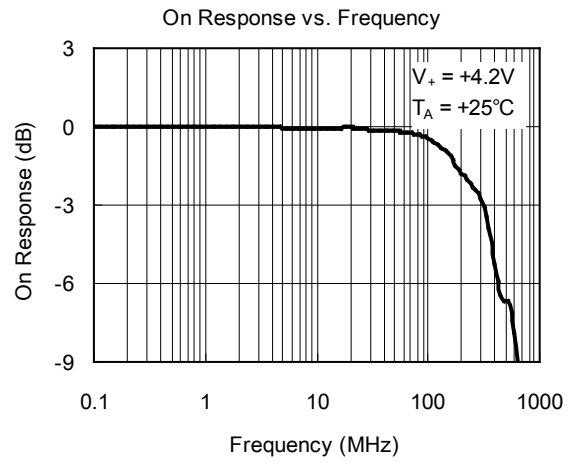
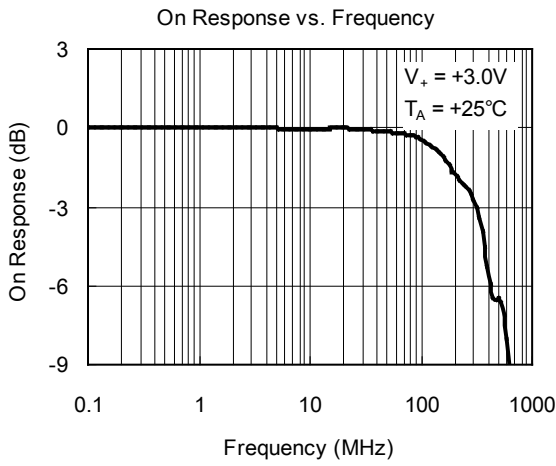
(V₊ = 4.5V to 5.5V, V_{IH} = 1.6V, V_{IL} = 0.5V, Full = -40°C to +85°C. Typical values are at V₊ = 5V, T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range (D1+, D1-, D2+, D2-)	V _{IS}		Full	0		V ₊	V
On-Resistance	R _{ON}	V ₊ = 4.5V, 0V ≤ V _{IS} ≤ V ₊ , I _D = -100mA, Test Circuit 1	+25°C		4.5	8.5	Ω
			Full			9.5	Ω
On-Resistance Match Between Channels	ΔR _{ON}	V ₊ = 4.5V, 0V ≤ V _{IS} ≤ V ₊ , I _D = -100mA, Test Circuit 1	+25°C		0.3	0.6	Ω
			Full			0.8	Ω
On-Resistance Flatness	R _{FLAT(ON)}	V ₊ = 4.5V, 0V ≤ V _{IS} ≤ V ₊ , I _D = -100mA, Test Circuit 1	+25°C		2	3.4	Ω
			Full			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	Full			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	Full			1	μA
DIGITAL INPUTS							
Input High Voltage	V _{INH}		Full	1.6			V
Input Low Voltage	V _{INL}		Full			0.5	V
Input Leakage Current	I _{IN}	V ₊ = 5.5V, V _S = 0V or 5.5V	Full			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°C		70		ns
Turn-Off Time	t _{OFF}		+25°C		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°C		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°C		6		pC
Channel On Capacitance	C _{ON}		+25°C		41		pF
Off Isolation	O _{ISO}	V ₊ = 4.2V, Signal = 0dBm, R _L = 50Ω, Test Circuit 5	f = 1MHz	+25°C		-71	dB
			f = 10MHz	+25°C		-51	dB
Channel-to-Channel Crosstalk	X _{TALK}	V ₊ = 4.2V, Signal = 0dBm, R _L = 50Ω, Test Circuit 6	f = 1MHz	+25°C		-99	dB
			f = 10MHz	+25°C		-67	dB
-3dB Bandwidth	BW	V ₊ = 4.2V, Signal = 0dBm, R _L = 50Ω, Test Circuit 7	+25°C		300		MHz
POWER REQUIREMENTS							
Power Supply Range	V ₊		Full	1.8		5.5	V
Power Supply Current	I ₊	V ₊ = 5.5V, V _{IN} = 0V or V ₊	Full			1	μA

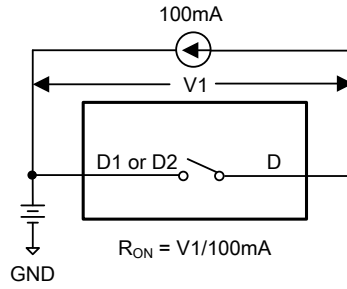
ELECTRICAL CHARACTERISTICS (continued)(V₊ = 2.7V to 3.6V, V_{IH} = 1.5V, V_{IL} = 0.4V, Full = -40°C to +85°C. Typical values are at V₊ = 3V, T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range (D1+, D1-, D2+, D2-)	V _{IS}		Full	0		V ₊	V
On-Resistance	R _{ON}	V ₊ = 2.7V, 0V ≤ V _{IS} ≤ V ₊ , I _D = -100mA, Test Circuit 1	+25°C		7	13	Ω
			Full			14	Ω
On-Resistance Match Between Channels	ΔR _{ON}	V ₊ = 2.7V, 0V ≤ V _{IS} ≤ V ₊ , I _D = -100mA, Test Circuit 1	+25°C		0.3	0.85	Ω
			Full			1.0	Ω
On-Resistance Flatness	R _{FLAT(ON)}	V ₊ = 2.7V, 0V ≤ V _{IS} ≤ V ₊ , I _D = -100mA, Test Circuit 1	+25°C		7	9.5	Ω
			Full			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	Full			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	Full			1	μA
DIGITAL INPUTS							
Input High Voltage	V _{INH}		Full	1.5			V
Input Low Voltage	V _{INL}		Full			0.4	V
Input Leakage Current	I _{IN}	V ₊ = 2.7V, V _S = 0V or 2.7V	Full			1	μA
DYNAMIC CHARACTERISTICS							
Turn-On Time	t _{ON}	V _{IS} = 1.5V, R _L = 50Ω, C _L = 35pF, Test Circuit 2	+25°C		95		ns
Turn-Off Time	t _{OFF}		+25°C		40		ns
Break-Before-Make Time Delay	t _D	V _{IS} = 1.5V, R _L = 50Ω, C _L = 35pF, Test Circuit 3	+25°C		12		ns
Charge Injection	Q	V _G = GND, R _G = 0Ω, C _L = 1.0nF, Q = C _L × V _{OUT} , Test Circuit 4	+25°C		5		pC
Channel On Capacitance	C _{ON}		+25°C		41		pF
Off Isolation	O _{ISO}	Signal = 0dBm, R _L = 50Ω, Test Circuit 5	f = 1MHz	+25°C		-72	dB
			f = 10MHz	+25°C		-52	dB
Channel-to-Channel Crosstalk	X _{TALK}	Signal = 0dBm, R _L = 50Ω, Test Circuit 6	f = 1MHz	+25°C		-99	dB
			f = 10MHz	+25°C		-67	dB
-3dB Bandwidth	BW	Signal = 0dBm, R _L = 50Ω, Test Circuit 7	+25°C		300		MHz

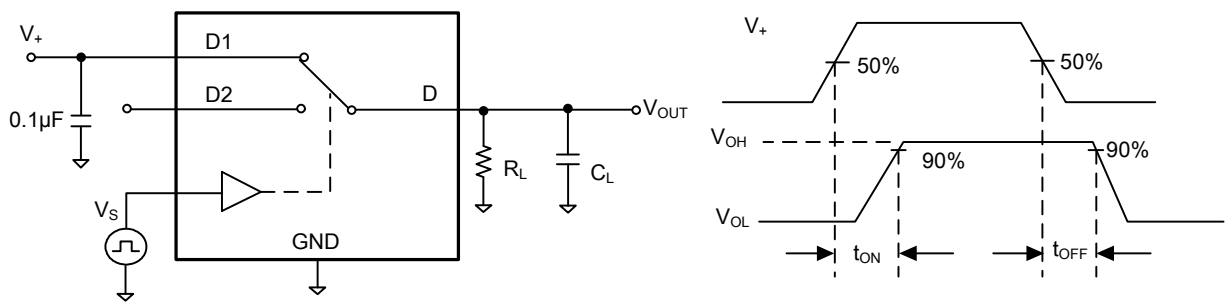
TYPICAL PERFORMANCE CHARACTERISTICS



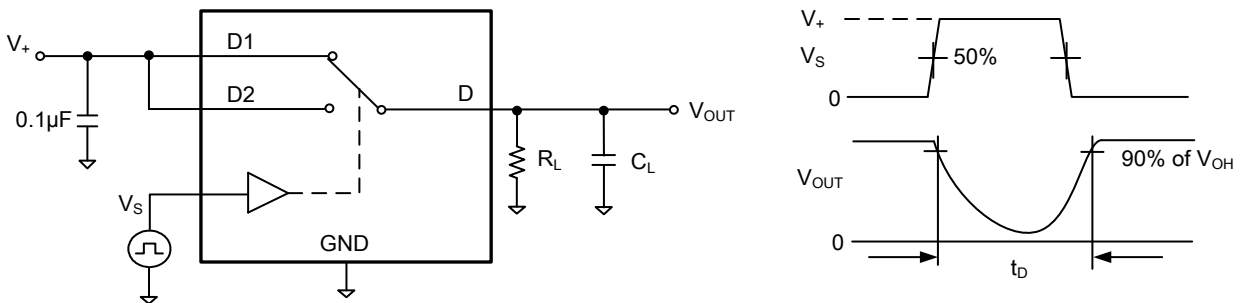
TEST CIRCUITS



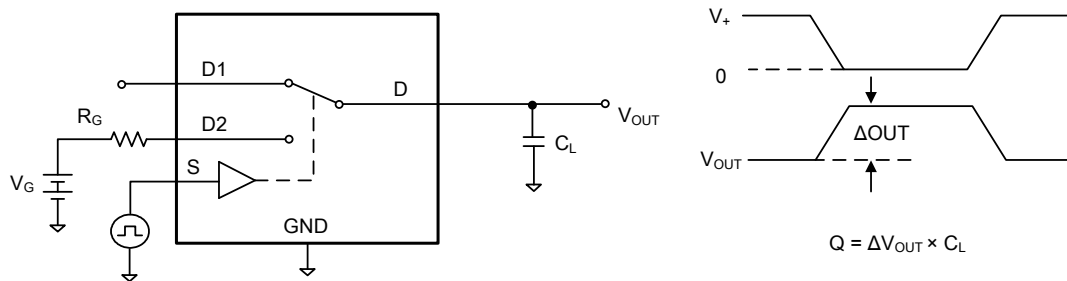
Test Circuit 1. On-Resistance



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

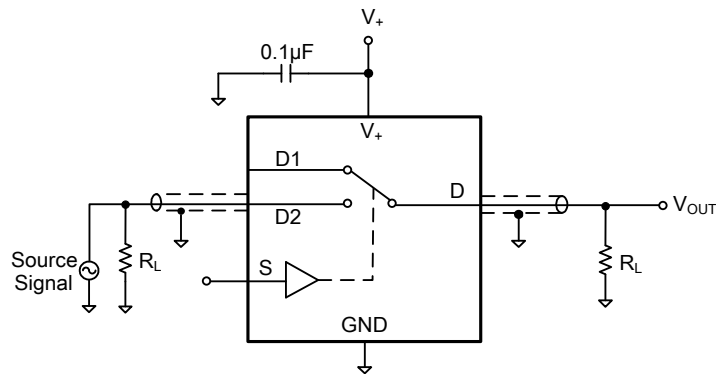


Test Circuit 3. Break-Before-Make Time Delay (t_D)

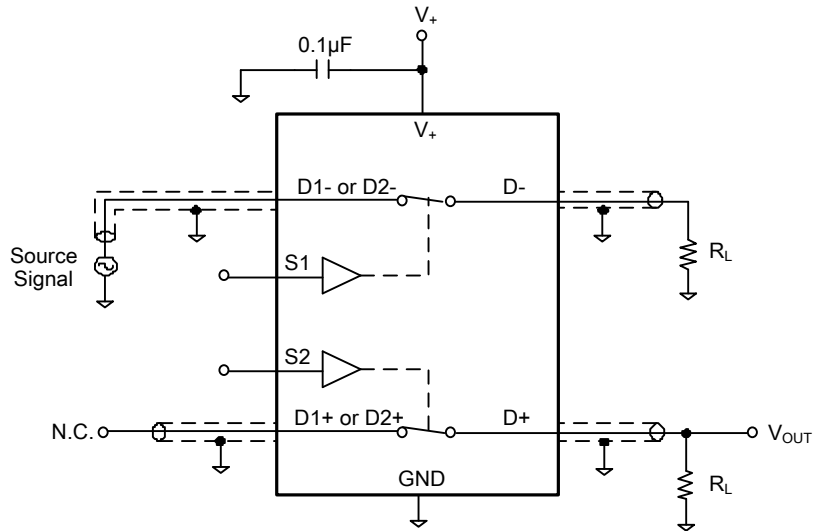


Test Circuit 4. Charge Injection

TEST CIRCUITS (continued)

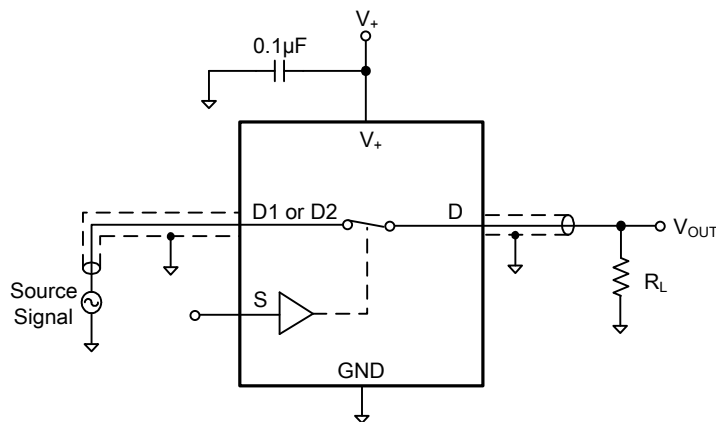


Test Circuit 5. Off Isolation



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

Test Circuit 6. Channel-to-Channel Crosstalk



Test Circuit 7. -3dB Bandwidth

REVISION HISTORY

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

JANUARY 2013 – REV.A.1 to REV.A.2

Added Recommended Land Pattern Information	9
Added Tape and Reel Information.....	10, 11

MAY 2011 – REV.A to REV.A.1

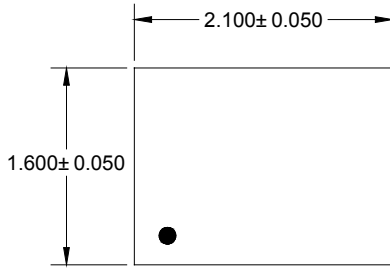
Updated Package Description	All
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Changes from Original (OCTOBER 2009) to REV.A

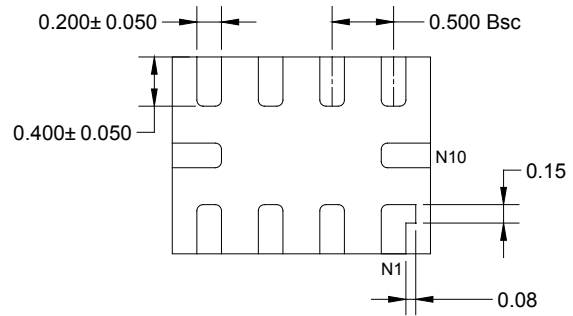
Changed from product preview to production data.....	All
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PACKAGE OUTLINE DIMENSIONS

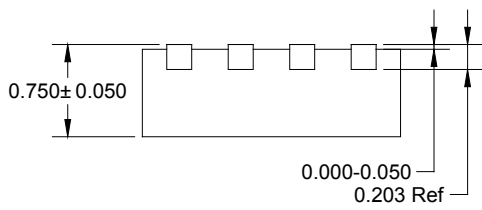
TQFN-2.1×1.6-10L



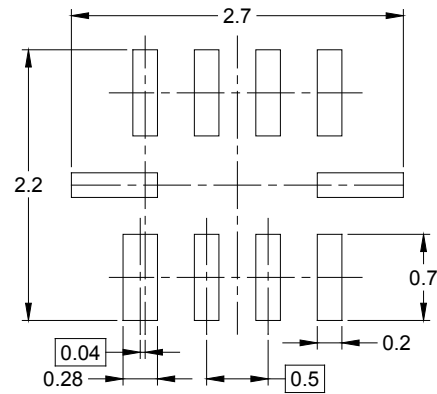
TOP VIEW



BOTTOM VIEW



SIDE VIEW



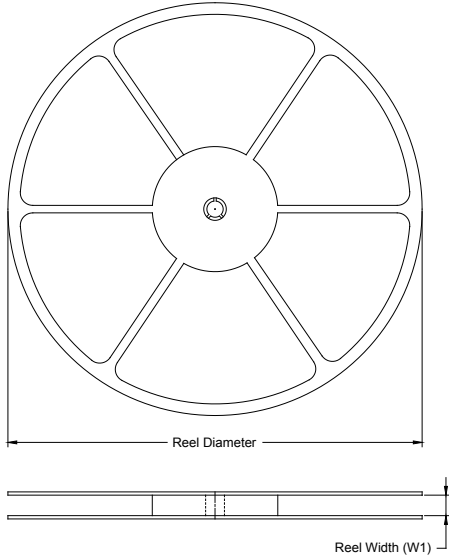
RECOMMENDED LAND PATTERN

NOTE: All linear dimensions are in millimeters.

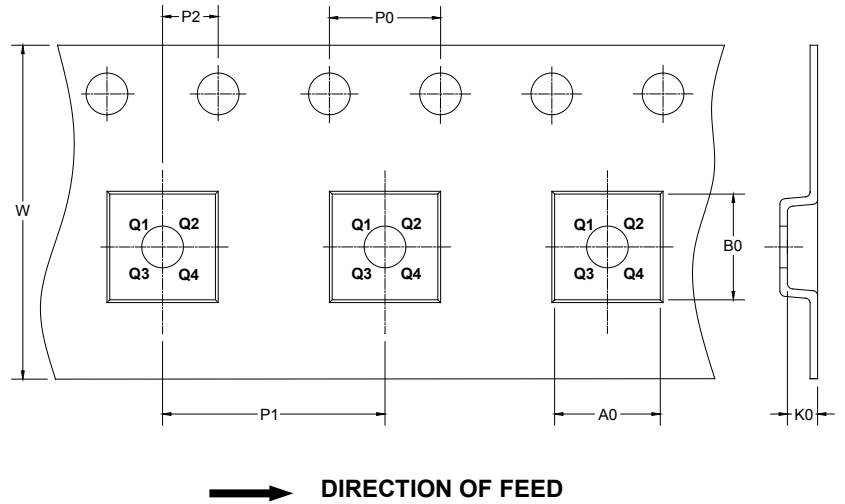
PACKAGE INFORMATION

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