SGM7226
V_{BUS} Directly Powered, High Speed USB 2.0 (480Mbps) DPDT Analog Switch

GENERAL DESCRIPTION

The SGM7226 is a high-speed, low-power double-pole/ double-throw (DPDT) analog switch that operates from a single 1.8V to 5.5V power supply and it can be powered directly from V_{BUS} of USB interface.

SGM7226 is designed for the switching of high-speed USB 2.0 signals in handset and consumer applications, such as cell phones, digital cameras, and notebooks with hubs or controllers with limited USB I/Os.

The SGM7226 has low bit-to-bit skew and high channel-to-channel noise isolation, and is compatible with various standards, such as high-speed USB 2.0 (480Mb/s). Each switch is bidirectional and offers little or no attenuation of the high-speed signals at the outputs. Its bandwidth is wide enough to pass high-speed USB 2.0 differential signals (480Mb/s) with good signal integrity.

The SGM7226 contains special circuitry on the D+/D- pins which allows the device to withstand a V_{BUS} short to D+ or D- when the USB devices are either powered off or powered on.

SGM7226 is available in Green TQFN-2.6×1.8-16L package. It operates over an ambient temperature range of -40℃ to +85℃.

FEATURES

- **Supply Range: 1.8V to 5.5V**
- **On-Resistance: 5Ω (TYP)**
- **Directly Powered by V_{BUS}**
- **D+/D- Short to V_{BUS} Protection**
- **Fast Switching Times:**
  t_{ON} = 15ns (TYP)
  t_{OFF} = 20ns (TYP)
- **Crosstalk: -30dB at 250MHz**
- **Off-Isolation: -35dB at 250MHz**
- **Break-Before-Make Switching**
- **Operating Temperature Range:**
  -40℃ to +85℃
- **Available in Green TQFN-2.6×1.8-16L Package**

APPLICATIONS

Route Signals for USB 2.0
Digital Cameras and Camcorders
Portable Instrumentation

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM7226	TQFN-2.6×1.8-16L	-40℃ to +85℃	SGM7226YTQA16G/TR	7226 XXXXX	Tape and Reel, 3000

NOTE: XXXXX = Date Code and Vendor 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_{CC} to GND ..... 0V to 6.0V
V_{SET} ..... -0.3V to 5.5V
$\overline{OE}$, S, HSDn+, HSDn-, D+, D- ..... -0.3V to 3.3+0.3V
Continuous Current HSDn or Dn ..... ±50mA
Peak Current HSDn or Dn ..... ±100mA
Junction Temperature ..... 150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... 260℃
ESD Susceptibility
HBM 8000V
MM 400V

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range ..... 1.8V to 5.5V
Operating Temperature Range ..... -40℃ to +85℃

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.

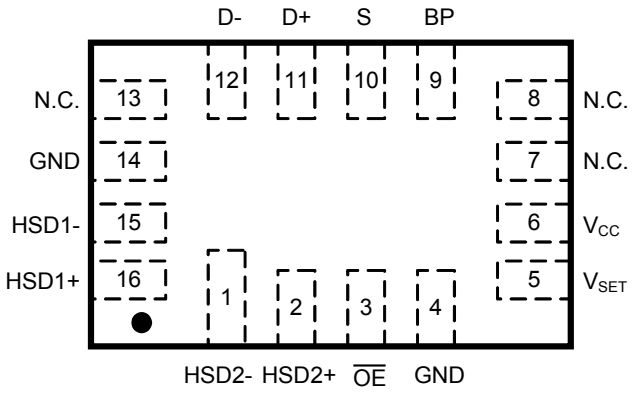
ESD SENSITIVITY CAUTION

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 (TOP VIEW)



TQFN-2.6×1.8-16L

PIN DESCRIPTION

PIN	NAME	FUNCTION
1	HSD2-	Multiplexed Source Inputs.
2	HSD2+	Multiplexed Source Inputs.
3	$\overline{OE}$	Output Enable. When $\overline{OE}$ = "Low", selected input channel will be connected with D-/D+; When $\overline{OE}$ = "High", all input channel will be disconnected with D-/D+.
4, 14	GND	Ground. Both GND pins must not be floated.
5	V_{SET}	Internal Used Pin. A 10kΩ resistor must be connected between V_{SET} pin and V_{CC} pin.
6	V_{CC}	Power Supply.
7, 8, 13	N.C.	No Connect.
9	BP	Internal Voltage Reference Decoupling Pin. A 2.2μF ceramic capacitor must be used to provide enough decoupling. Connect the capacitor between BP pin and GND.
10	S	Channel Select Input.
11	D+	USB Data Bus.
12	D-	USB Data Bus.
15	HSD1-	Multiplexed Source Inputs.
16	HSD1+	Multiplexed Source Inputs.

FUNCTION TABLE

$\overline{OE}$	S	HSD1+, HSD1-	HSD2+, HSD2-
0	0	ON	OFF
0	1	OFF	ON
1	X	OFF	OFF

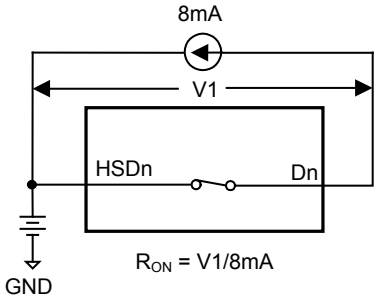
X = Don't care.

ELECTRICAL CHARACTERISTICS

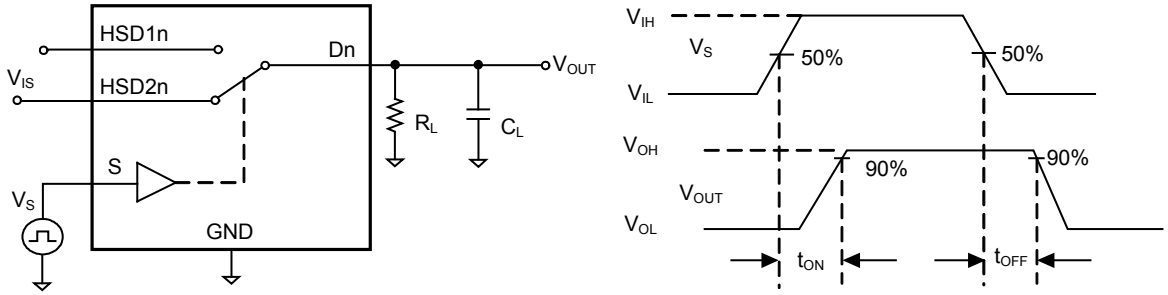
(V_{CC} = +5.0V, T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
ANALOG SWITCH						
Analog I/O Voltage (D+, D-, HSD1+, HSD1-, HSD2+, HSD2-)	V_{IS}		0		3.3	V
On-Resistance	R_{ON}	V_{IS} = 0V to 0.4V, I_D = 8mA, Test Circuit 1		5	6.5	Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_{IS} = 0V to 0.4V, I_D = 8mA, Test Circuit 1		0.35	0.6	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_{IS} = 0V to 1.0V, I_D = 8mA, Test Circuit 1		0.6	1	Ω
Power Off Leakage Current (D+, D-)	I_{OFF}	V_{CC} = 0V, V_D = 0V to 3.6V, V_S , $V_{\overline{OE}}$ = 0V or 3.6 V			1	μA
Source Off Leakage Current	$I_{HSD2(OFF)}$, $I_{HSD1(OFF)}$	V_{IS} = 3.3V/0.3V, V_D = 0.3V/3.3V			1	μA
Channel On Leakage Current	$I_{HSD2(ON)}$, $I_{HSD1(ON)}$	V_{IS} = 3.3V/0.3V, V_D = 3.3V/0.3V or floating			1	μA
DIGITAL INPUTS						
Input High Voltage	$V_{IH\ (S,\ \overline{OE})}$		1.5		3.3	V
	$V_{IH\ (V_{SET})}$		1.5		5.5	
Input Low Voltage	V_{IL}				0.35	V
Input Leakage Current	$I_{IN\ (S,\ \overline{OE})}$				1	μA
	$I_{IN\ ((V_{SET})}$				1.5	
DYNAMIC CHARACTERISTICS						
Turn-On Time	t_{ON}	V_{IS} = 0.8V, R_L = 50Ω, C_L = 10pF, Test Circuit 2		15		ns
Turn-Off Time	t_{OFF}			20		ns
Break-Before-Make Time Delay	t_D	V_{IS} = 0.8V, R_L = 50Ω, C_L = 10pF, Test Circuit 3		3.5		ns
Propagation Delay	t_{PD}	R_L = 50Ω, C_L = 10pF		0.5		ns
Off Isolation	O_{ISO}	Signal = 0dBm, R_L = 50Ω, f = 250MHz, Test Circuit 4		-35		dB
Channel-to-Channel Crosstalk	X_{TALK}	Signal = 0dBm, R_L = 50Ω, f = 250MHz, Test Circuit 5		-30		dB
-3dB Bandwidth	BW	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 6		550		MHz
Channel-to-Channel Skew	t_{SKEW}	R_L = 50Ω, C_L = 10pF		1.5		ns
Charge Injection Select Input to Common I/O	Q	V_G = GND, C_L = 1.0nF, R_G = 0Ω, Q = C_L × V_{OUT}, Test Circuit 7		10		pC
HSD+, HSD-, D+, D- ON Capacitance	C_{ON}	f = 1MHz		10		pF
		f = 250MHz		15		
POWER REQUIREMENTS						
Power Supply Range	V_{CC}		1.8		5.5	V
Power Supply Current	I_{CC}			20	30	μA

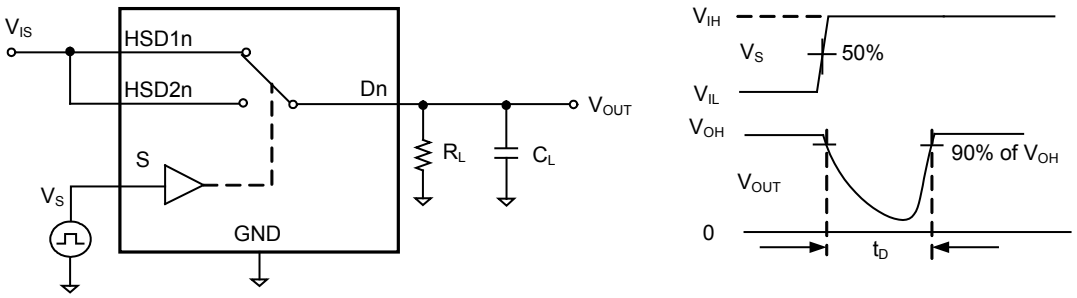
TEST CIRCUITS



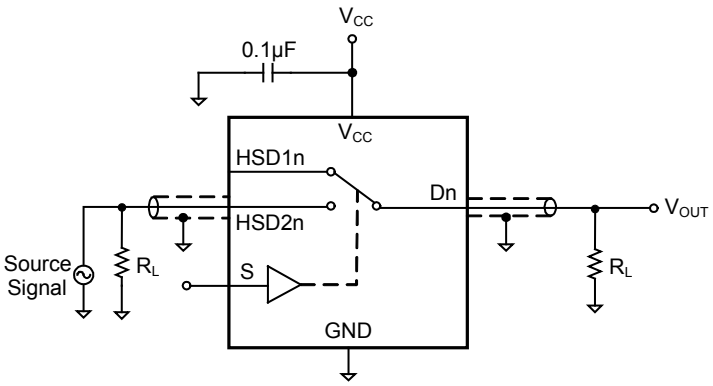
Test Circuit 1. On Resistance



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

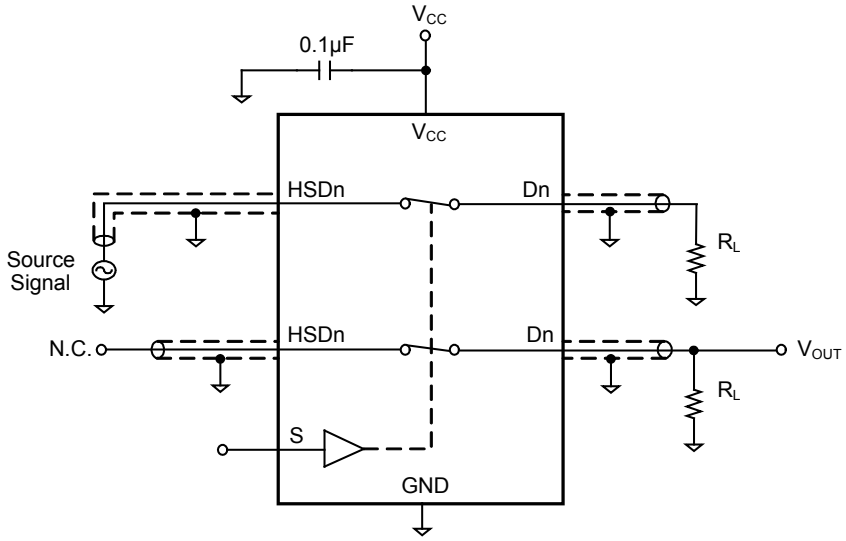


Test Circuit 3. Break-Before-Make Time Delay (t_D)



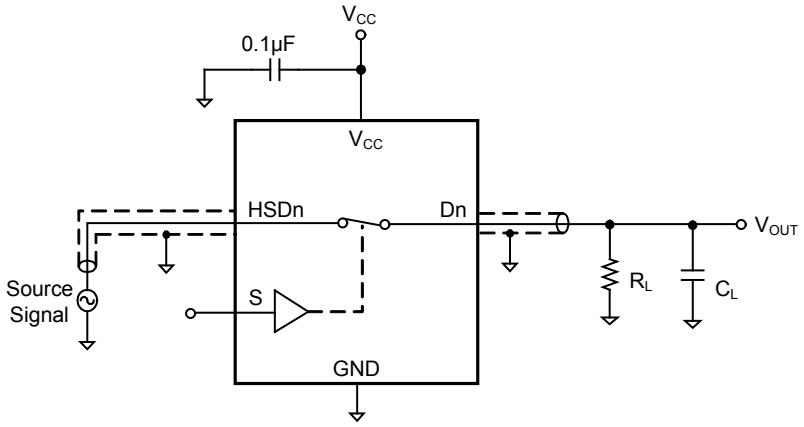
Test Circuit 4. Off Isolation

TEST CIRCUITS

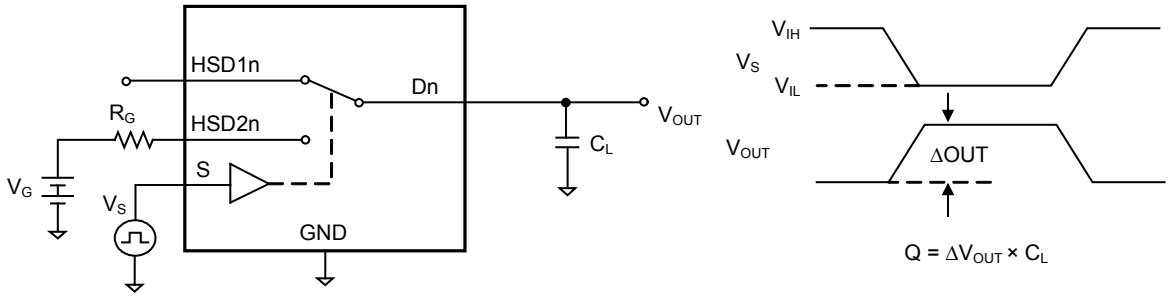


$$\text{Channe-to-Channel Crosstalk} = -20 \times \log \frac{V_{HSDn}}{V_{OUT}}$$

Test Circuit 5. Channel-to-Channel Crosstalk

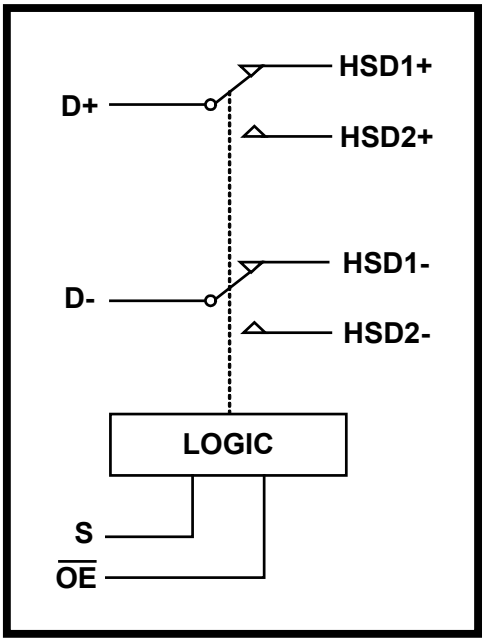


Test Circuit 6. -3dB Bandwidth



Test Circuit 7. Charge Injection (Q)

FUNCTIONAL BLOCK DIAGRAM



APPLICATION INFORMATION

Meeting USB 2.0 V_{BUS} Short Requirements

Power-Off Protection

For a V_{BUS} short circuit, the switch is expected to withstand such a condition for at least 24 hours. The SGM7226 has specially designed circuitry which prevents unintended signal bleed through as well as guaranteed system reliability during a power-down, over-voltage condition. The protection has been added to the common pins (D+, D-).

Power-On Protection

The USB 2.0 specification also notes that the USB device should be capable of withstanding a V_{BUS} short during transmission of data. This protection works by limiting current flow back into the V_{CC} rail during the over-voltage event so current remains within the safe operating range.

Application Circuit

The application circuit is shown in Figure 1. If SGM7226 is powered from V_{BUS}, a 5.1V Zener diode is recommended to be used to suppress the voltage spike in V_{BUS} power line generated by USB interface hot-insertion.

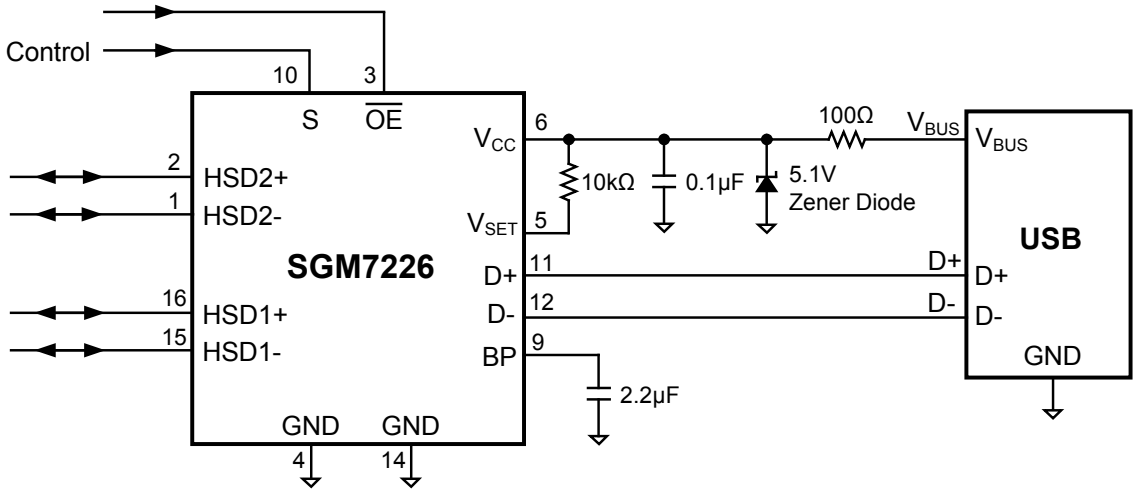
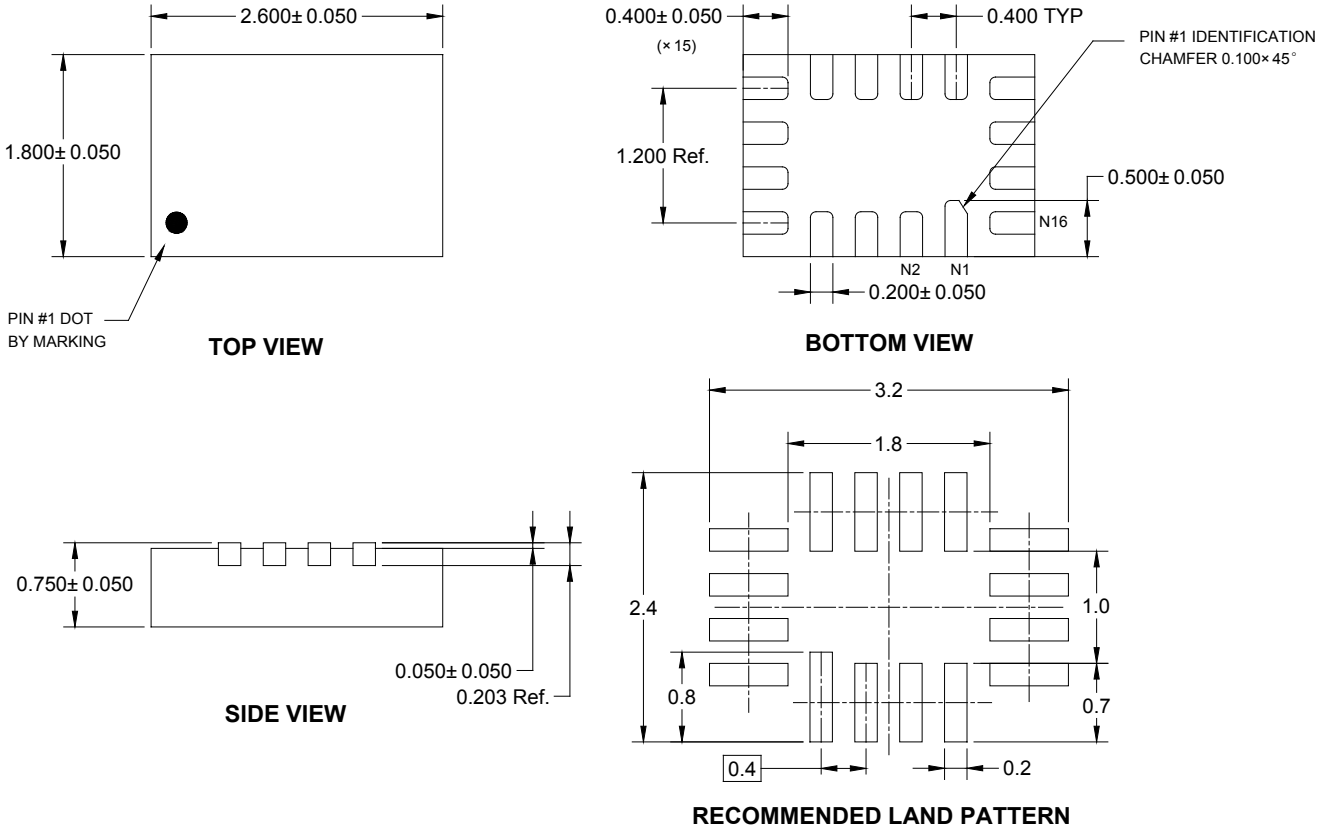


Figure 1. Application Circuit

PACKAGE OUTLINE DIMENSIONS

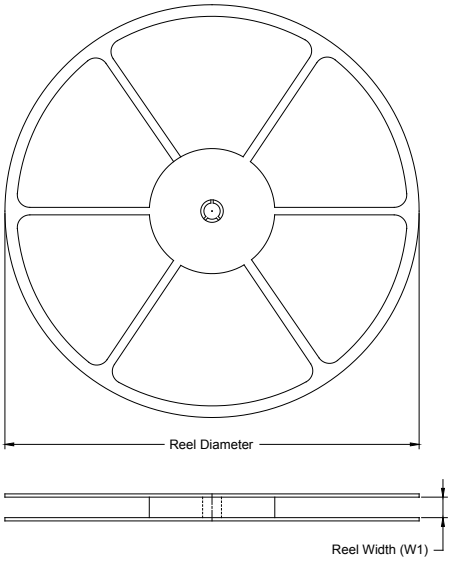
TQFN-2.6×1.8-16L



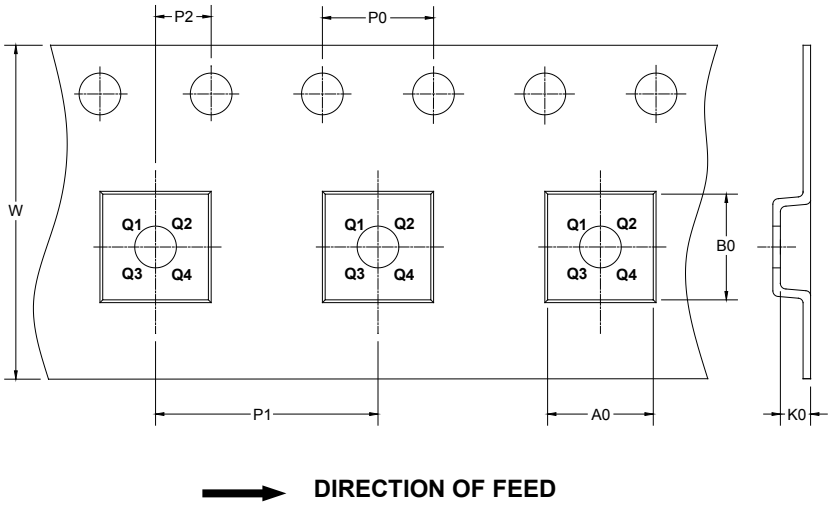
NOTE: All linear dimensions are in millimeters.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



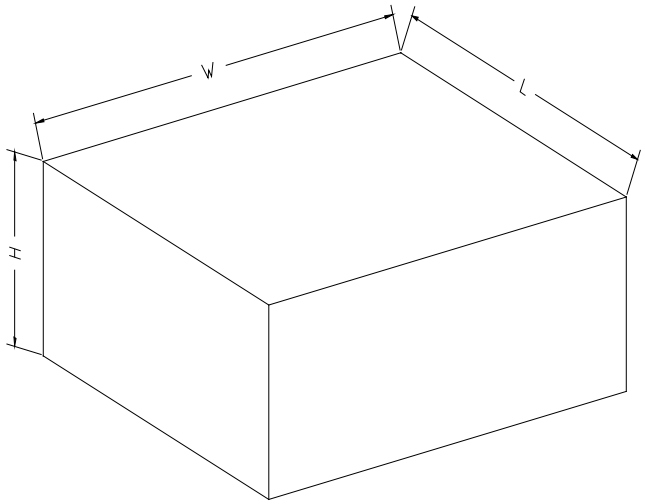
NOTE: The picture is only for reference. Please make the object as the standard.

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-2.6×1.8-16L	7″	9.0	2.01	2.81	0.93	4.0	4.0	2.0	8.0	Q1

DD0001

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