SGM65230
4-Bit 1-of-2 Multiplexer/Demultiplexer, Low-Voltage High-Bandwidth Bus Switch

GENERAL DESCRIPTION

The SGM65230 is a high-bandwidth bus switch with a low and flat on-resistance (R_{ON}). The low and flat on-resistance allows for minimal propagation delay and supports rail-to-rail switching on the data input/output (I/O) ports. The device also features low data I/O capacitance to minimize capacitive loading and signal distortion on the data bus. Specifically designed to support high-bandwidth applications, the SGM65230 provides an optimized bus switch solution ideally suited for broadband communications, networking and data-intensive computing systems.

The SGM65230 is organized as two 1-of-4 multiplexers/demultiplexers with separate control inputs (S, $\overline{OE}$). The inputs (S, $\overline{OE}$) control the data path of each multiplexer/demultiplexer. When $\overline{OE}$ is low, the associated multiplexer/demultiplexer is enabled, and the A port is connected to the B port, allowing bidirectional data flow between ports. When $\overline{OE}$ is high, the associated multiplexer/demultiplexer is disabled, and a high-impedance state exists between the A and B ports.

This device is fully specified for partial-power-down applications using I_{OFF}. The I_{OFF} circuitry prevents damaging current backflow through the device when it is powered down. The device has isolation during power-off.

To ensure the high-impedance state during power-up or power-down, $\overline{OE}$ should be tied to V_{CC} through a pull-up resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

The SGM65230 is available in a Green TSSOP-16 package. It operates over an operating temperature range of -40℃ to +125℃.

FEATURES

- **High-Bandwidth Data Path (Up to 400MHz)**
- **5V Tolerant I/Os with Device Powered Up or Powered Down**
- **Low and Flat On-Resistance (R_{ON}) Characteristics with 3.3V V_{CC}: 4Ω (TYP)**
- **Rail-to-Rail Switching on Data I/O Ports**
  - **0V to 5V Signal Passing with 3.3V V_{CC}**
  - **0V to 3.3V Signal Passing with 2.5V V_{CC}**
- **Bidirectional Data Flow**
- **Low Input/Output Capacitance Minimizes Loading and Signal Distortion: $C_{IO(OFF)}$ = 7pF (TYP)**
- **Fast Switching Frequency: $f_{\overline{OE}}$ = 20MHz (TYP)**
- **Data and Control Inputs Provide Undershoot Clamp Diodes**
- **Low Power Consumption: I_{CC} = 0.6mA (TYP)**
- **V_{CC} Operating Range from 2.3V to 3.6V**
- **Data I/Os Support 0V to 5V Signaling Levels: (0.8V, 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5V)**
- **Control Inputs Can Be Driven by TTL or 5V/3.3V CMOS Outputs**
- **I_{OFF} Supports Partial-Power-Down Mode Operation**
- **Available in a Green TSSOP-16 Package**

APPLICATIONS

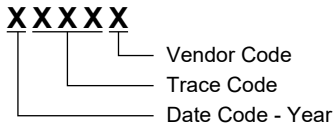
IP Phones: Wired and Wireless
Optical Networking: Video over Fiber and EPON
Infrastructure Equipment

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM65230	TSSOP-16	-40℃ to +125℃	SGM65230XTS16G/TR	SGM65230 XTS16 XXXXX	Tape and Reel, 4000

MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace 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

Supply Voltage Range, V_{CC} ..... -0.3V to 4.6V
Control Input Voltage (1), V_{IN} ..... -0.3V to 7V
Switch I/O Voltage (1) (2), $V_{I/O}$ ..... -0.3V to 7V
Switch I/O Current, $I_{I/O}$ ..... ±64mA (MAX)
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 3000V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS (3)

Supply Voltage Range, V_{CC} ..... 2.3V to 3.6V
Control Input Voltage, V_{IN} ..... 0V to 5.5V
Switch I/O Voltage, $V_{I/O}$ ..... 0V to 5.5V
Operating Temperature Range ..... -40℃ to +125℃

NOTES:

1. All voltages are with respect to ground, unless otherwise specified.
2. V_I and V_O are used to denote specific conditions for $V_{I/O}$.
3. All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

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

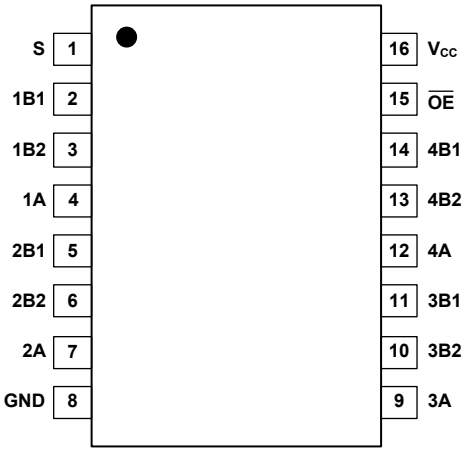
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATION

(TOP VIEW)

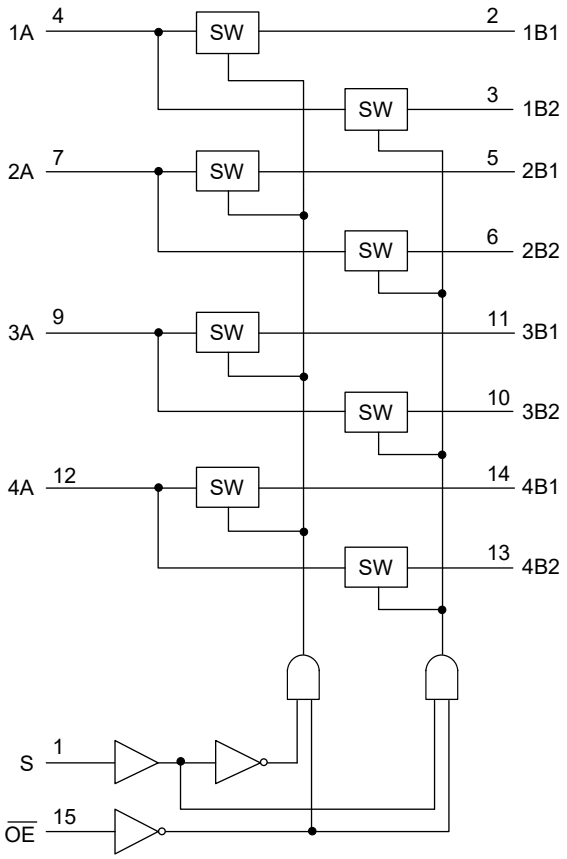


TSSOP-16

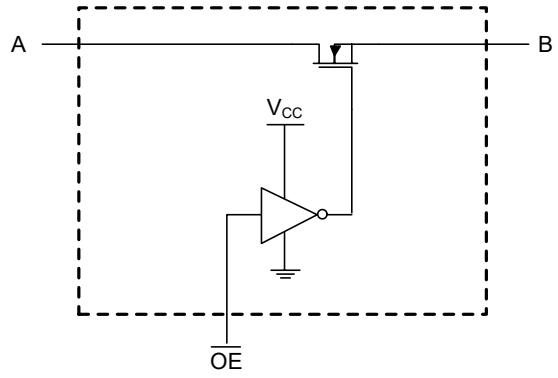
PIN DESCRIPTION

PIN	NAME	I/O	FUNCTION
1	S	I	Select Pin.
2	1B1	I/O	Channel 1 I/O 1.
3	1B2	I/O	Channel 1 I/O 2.
4	1A	I/O	Channel 1 Common.
5	2B1	I/O	Channel 2 I/O 1.
6	2B2	I/O	Channel 2 I/O 2.
7	2A	I/O	Channel 2 Common.
8	GND	—	Ground.
9	3A	I/O	Channel 3 Common.
10	3B2	I/O	Channel 3 I/O 2.
11	3B1	I/O	Channel 3 I/O 1.
12	4A	I/O	Channel 4 Common.
13	4B2	I/O	Channel 4 I/O 2.
14	4B1	I/O	Channel 4 I/O 1.
15	$\overline{OE}$	I	Output Enable (Active Low).
16	V_{CC}	—	Power Supply.

LOGIC DIAGRAM (POSITIVE LOGIC)



SIMPLIFIED SCHEMATIC, EACH SWITCH (SW)



FUNCTION TABLE

CONTROL INPUTS		INPUT/OUTPUT A	FUNCTION
$\overline{OE}$	S		
L	L	B1	A port = B1 port
L	H	B2	A port = B2 port
H	X	Z	Disconnect

ELECTRICAL CHARACTERISTICS

(Full = -40℃ to +125℃, typical values are at V_{CC} = 3.3V, T_A = +25℃, unless otherwise noted.) (1)

PARAMETER		SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
Clamp Diode Voltage		V_{IK}	V_{CC} = 3.6V, I_I = -18mA		Full			-1.5	V
Control Inputs High Voltage		V_{INH}	V_{CC} = 2.3V to 2.7V		Full	1.7		5.5	V
			V_{CC} = 2.7V to 3.6V		Full	2		5.5	
Control Inputs Low Voltage		V_{INL}	V_{CC} = 2.3V to 2.7V		Full	0		0.7	V
			V_{CC} = 2.7V to 3.6V		Full	0		0.8	
Control Inputs Leakage Current		I_{IN}	V_{CC} = 3.6V, V_{IN} = 0V to 5.5V		+25℃		±0.01	±0.5	μA
					Full			±1	
3-State Output Leakage (2)		I_{OZ}	V_{CC} = 3.6V, V_O = 0V to 5.5V, V_I = 0V, switch off, V_{IN} = V_{CC} or GND		+25℃		±0.01	±0.5	μA
					Full			±1	
Off Leakage Current		I_{OFF}	V_{CC} = 0V, V_O = 0V to 5.5V, V_I = 0V		+25℃		±0.01	±0.5	μA
					Full			±1	
Quiescent Supply Current		I_{CC}	V_{CC} = 3.6V, $I_{I/O}$ = 0, switch on or off, V_{IN} = V_{CC} or GND		+25℃		0.6	0.7	mA
					Full			1	
Increase in I_{CC} per Control Input (3)		ΔI_{CC}	V_{CC} = 3.6V, one input at 3V, other inputs at V_{CC} or GND		+25℃		3	40	μA
					Full			50	
Per Control Input (4)		I_{CCD}	V_{CC} = 3.6V, A and B ports open, control input switching at 50% duty cycle		+25℃		0.5	1	mA/MHz
					Full			1.5	
Control Inputs Capacitance		C_{IN}	V_{CC} = 3.3V, V_{IN} = 5.5V, 3.3V or 0V		+25℃		5		pF
Input/Output Off Capacitance	A ports	$C_{IO(OFF)}$	V_{CC} = 3.3V, switch off, V_{IN} = V_{CC} or GND, $V_{I/O}$ = 5.5V, 3.3V or 0V		+25℃		7		pF
	B ports		V_{CC} = 3.3V, switch off, V_{IN} = V_{CC} or GND, $V_{I/O}$ = 5.5V, 3.3V or 0V		+25℃		7		pF
Input/Output On Capacitance	A ports	$C_{IO(ON)}$	V_{CC} = 3.3V, switch on, V_{IN} = V_{CC} or GND, $V_{I/O}$ = 5.5V, 3.3V or 0V		+25℃		11		pF
	B ports				+25℃		11		
On-Resistance (5)		R_{ON}	V_{CC} = 2.3V	V_I = 0V, I_O = 30mA	+25℃		4	6	Ω
					Full			7	
				V_I = 1.7V, I_O = -15mA	+25℃		4.5	6	
					Full			8	
			V_{CC} = 3.3V	V_I = 0V, I_O = 30mA	+25℃		4	6	
					Full			7	
				V_I = 2.4V, I_O = -15mA	+25℃		4	6	
					Full			7	

NOTES:

1. V_{IN} and I_{IN} refer to control inputs. V_I, V_O, I_I and I_O refer to data pins.
2. For I/O ports, the parameter I_{OZ} includes the input leakage current.
3. This is the increase in supply current for each input that is at the specified TTL voltage level, rather than V_{CC} or GND.
4. This parameter specifies the dynamic power-supply current associated with the operating frequency of a single control input.
5. Measured by the voltage drop between the A and B terminals at the indicated current through the switch. On-resistance is determined by the lower of the two (A or B) terminal voltages.

SWITCHING CHARACTERISTICS

(T_A = +25℃, unless otherwise noted.) (See Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 2.5V ± 0.2V			V_{CC} = 3.3V ± 0.3V			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
$f_{\overline{OE}}$ or f_S (1)	$\overline{OE}$ or S	A or B		10			20		MHz
t_{PD}	A or B	B or A		0.6			0.6		ns
$t_{PD(S)}$	S	A		12			10		ns
t_{EN}	S	B		15			12		ns
	$\overline{OE}$	A or B		15			12		
t_{DIS}	S	B		15			11		ns
	$\overline{OE}$	A or B		15			11		

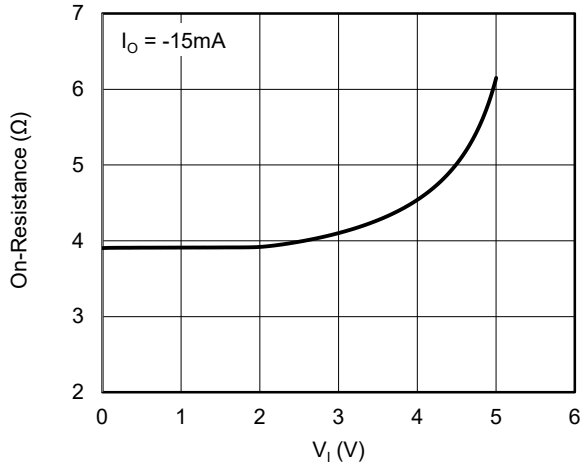
NOTE:

1. Maximum switching frequency for control inputs (V_O > V_{CC}, V_I = 5V, R_L ≥ 1MΩ, C_L = 0).

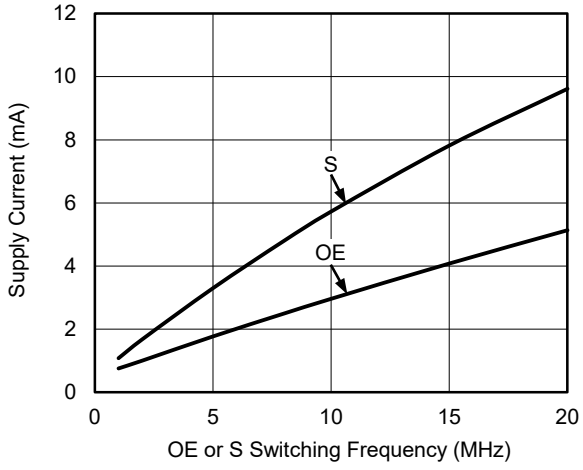
TYPICAL PERFORMANCE CHARACTERISTICS

T_A = +25℃, V_{CC} = 3.3V, GND = 0V, unless otherwise noted.

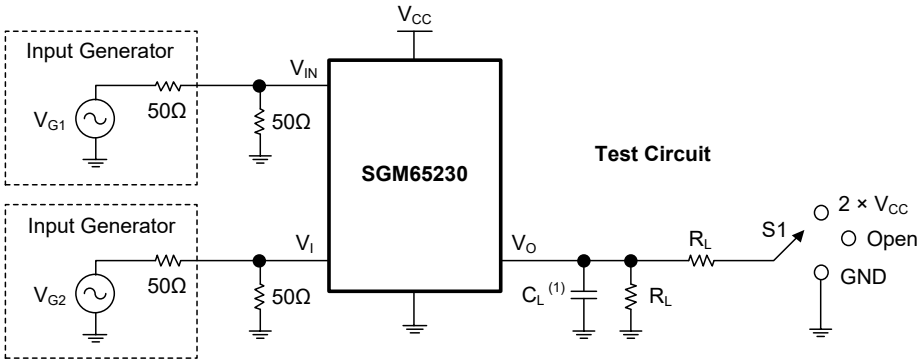
On-Resistance



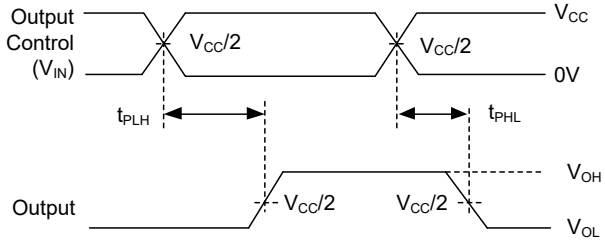
Supply Current vs. OE or S Switching Frequency



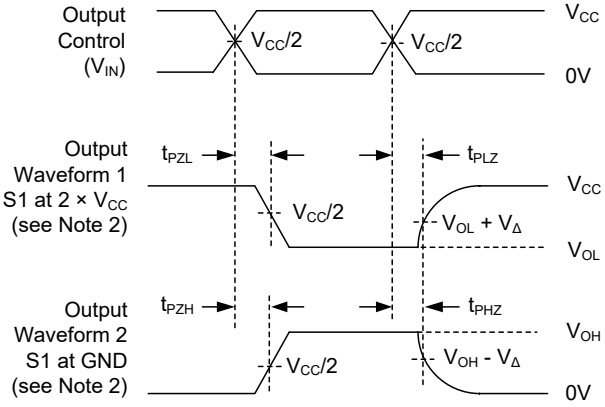
PARAMETER MEASUREMENT INFORMATION



PARAMETER	V_{CC}	S1	R_L	V_I	C_L	V_Δ
$t_{PD(S)}$	2.5V ± 0.2V 3.3V ± 0.3V	Open Open	500Ω 500Ω	V_{CC} or GND V_{CC} or GND	30pF 50pF	
t_{PLZ}/t_{PZL}	2.5V ± 0.2V 3.3V ± 0.3V	2 × V_{CC} 2 × V_{CC}	500Ω 500Ω	GND GND	30pF 50pF	0.15V 0.3V
t_{PHZ}/t_{PZH}	2.5V ± 0.2V 3.3V ± 0.3V	GND GND	500Ω 500Ω	V_{CC} V_{CC}	30pF 50pF	0.15V 0.3V



(1) Voltage Waveforms
Propagation Delay Times ($t_{PD(S)}$)



(2) Voltage Waveforms
Enable and Disable Times

NOTES:
1. C_L includes probe and jig capacitance.
2. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
3. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10MHz, Z_O = 50Ω, t_r ≤ 2.5ns, t_f ≤ 2.5ns.
4. The outputs are measured one at a time, with one transition per measurement.
5. t_{PLZ} and t_{PHZ} are the same as t_{DIS}.
6. t_{PZL} and t_{PZH} are the same as t_{EN}.
7. t_{PLH} and t_{PHL} are the same as $t_{PD(S)}$.

Figure 1. Test Circuit and Voltage Waveforms

TYPICAL APPLICATION CIRCUIT

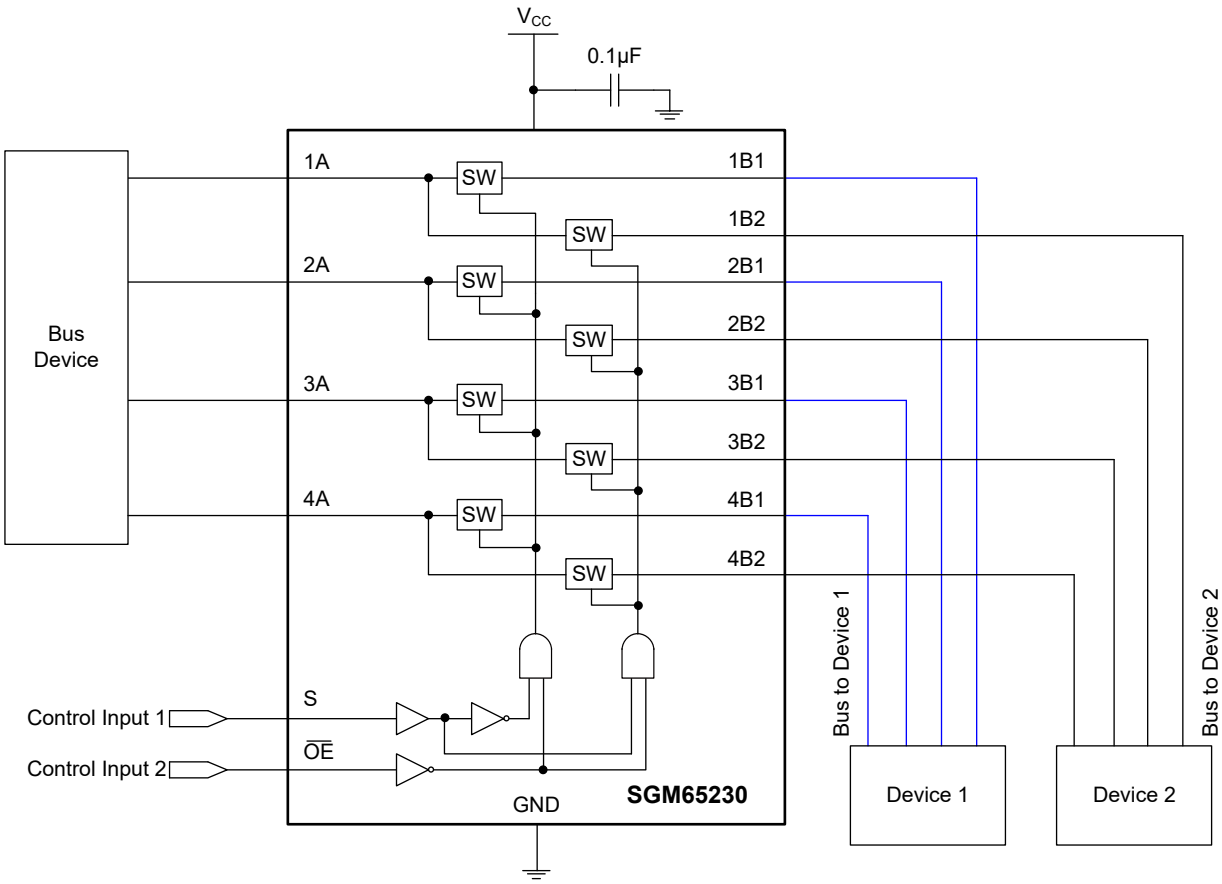


Figure 2. Typical Application Circuit

APPLICATION INFORMATION

The SGM65230 can be used to multiplex and demultiplex up to 4 channels simultaneously in a 2:1 configuration. The application shown in Figure 2 is a 4-bit bus switch. This circuit could be applied to many situations. If an application requires less than 4 bits, be sure to tie the A side to either high or low for unused channels.

Power Supply Recommendations

Each V_{CC} terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, a 0.1μF bypass capacitor is recommended. To reject different frequencies of noise, use multiple bypass capacitors in parallel. Capacitors with values of 0.1μF and 1μF are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results.

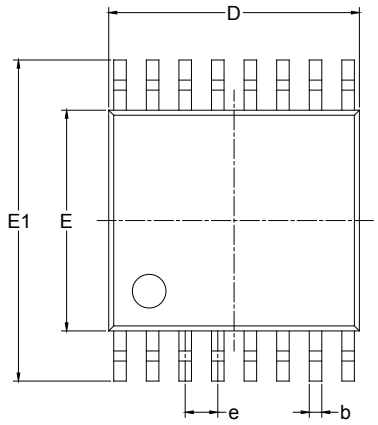
REVISION HISTORY

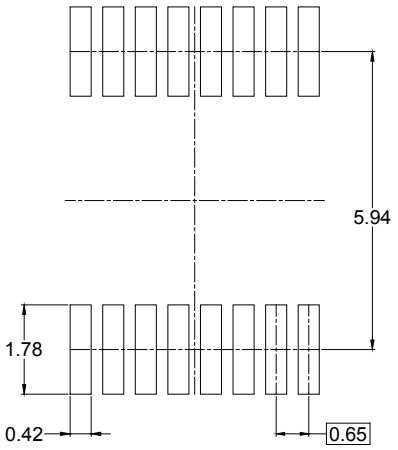
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (DECEMBER 2020) to REV.A	Page
Changed from product preview to production data	All

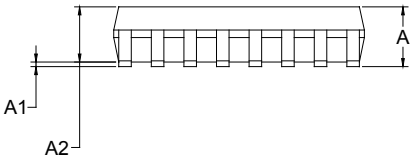
PACKAGE OUTLINE DIMENSIONS

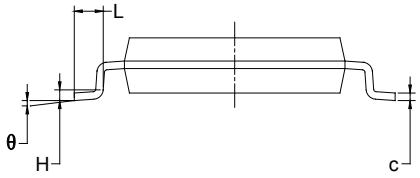
TSSOP-16





RECOMMENDED LAND PATTERN (Unit: mm)

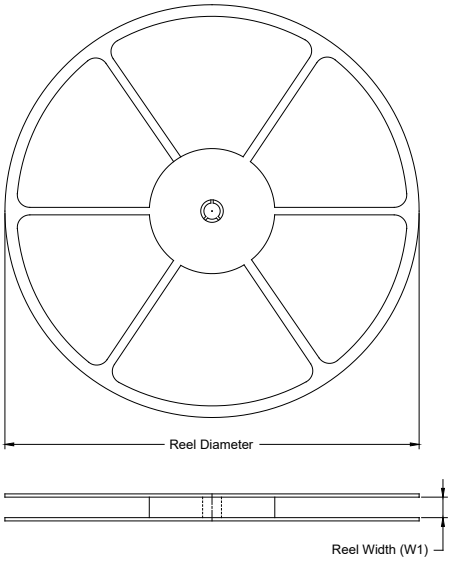




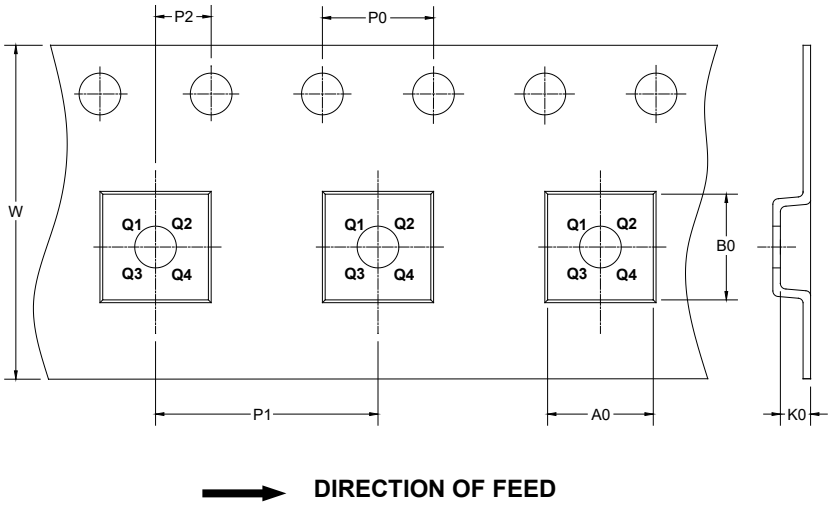
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.860	5.100	0.191	0.201
E	4.300	4.500	0.169	0.177
E1	6.200	6.600	0.244	0.260
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



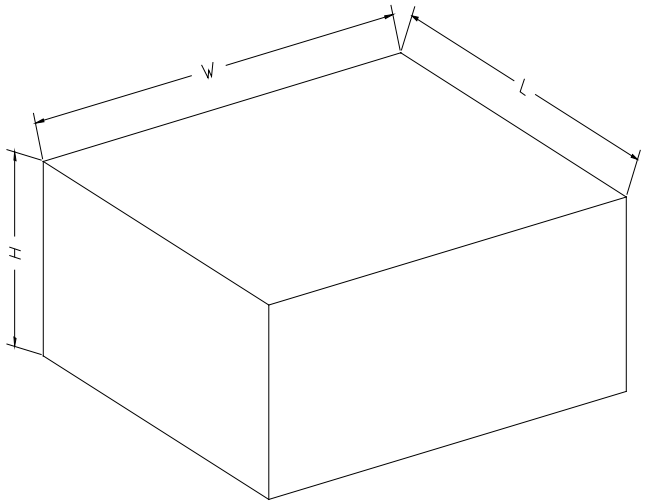
NOTE: The picture is only for reference. Please make the object as the standard.

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
TSSOP-16	13″	16.4	6.80	5.40	1.60	4.0	8.0	2.0	16.0	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
13″	386	280	370	5

DD0002