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

GENERAL DESCRIPTION

The SGM65230 is a 4-Bit 1-of-2 Multiplexer/Demultiplexer and high bandwidth bus switch. It supports rail-to-rail switching on data I/O ports and the power supply range is designed from 2.3V to 3.6V.

The SGM65230 has low on-resistance (R_{ON}) and low data I/O capacitance. These features make the device allow for minimal propagation delay and minimize signal distortion on the data bus.

It is recommended to connect a pull-up resistor between the $\overline{OE}$ pin and V_{CC} pin to ensure high impedance during power-on or power-off. The ability of the driver to absorb current can determine the minimum value of the resistor.

The SGM65230 is designed with an I_{OFF} circuitry. When the device is powered down, the I_{OFF} circuitry can effectively prevent the destructive current backflow, and the SGM65230 has an isolation function in the state of power-off. This feature is widely used in partial-power-down applications.

The SGM65230 is suitable in a variety of applications such as high bandwidth equipment, broadband communications and data-intensive computing systems.

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

FEATURES

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

APPLICATIONS

Infrastructure Equipment

Wired and Wireless IP Phones

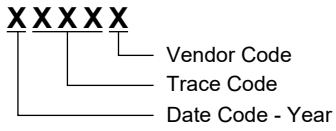
Optical Networking: Video over Fiber and EPON

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 respected to GND, unless otherwise noted.
2. V_I and V_O are respectively used to represent $V_{I/O}$ under specific conditions.
3. In order to ensure the normal operation of the device, all unused control inputs must be kept on V_{CC} or GND.

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

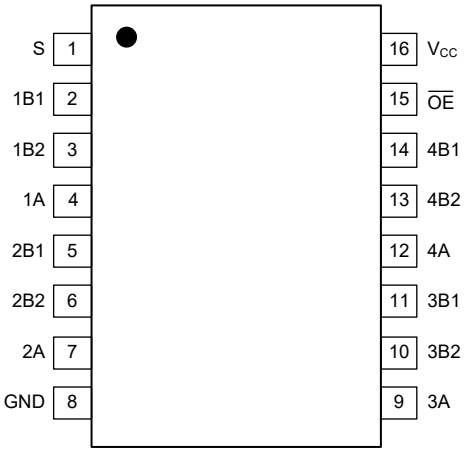
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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)

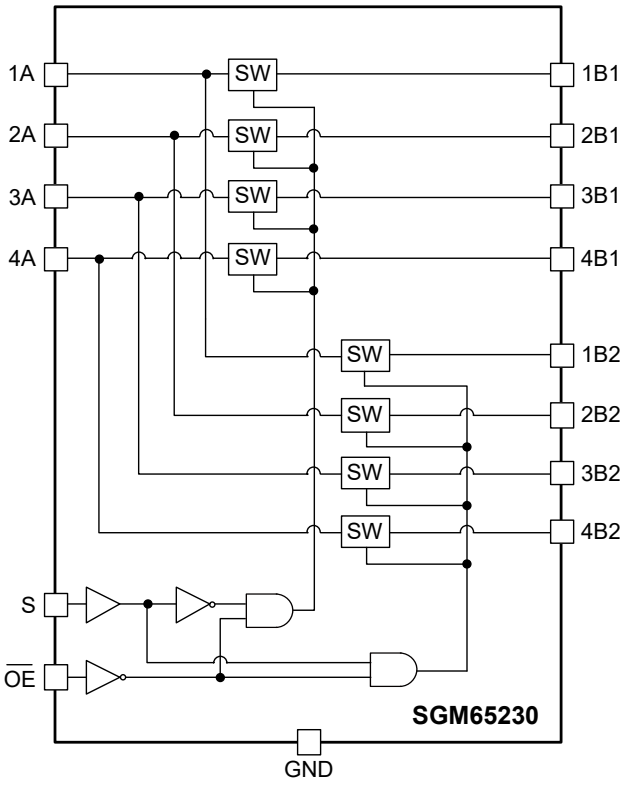


TSSOP-16

PIN DESCRIPTION

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

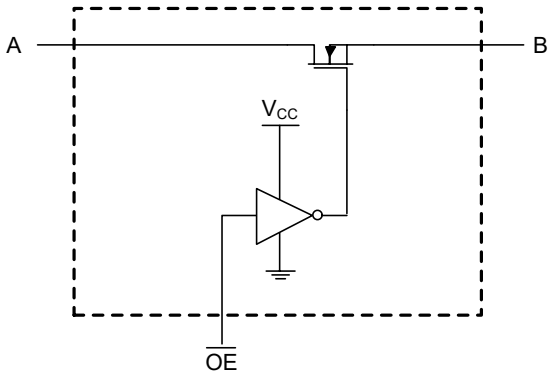
FUNCTIONAL BLOCK DIAGRAM



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

SIMPLIFIED SCHEMATIC OF EACH SWITCH (SW)



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		
-3dB Bandwidth		BW	V_{CC} = 2.5V or 3.3V, R_L = 50Ω		Full		400		MHz
Channel-to-Channel Crosstalk		X_{TALK}	V_{CC} = 2.5V or 3.3V, R_L = 50Ω, f = 1MHz		Full		-80		dB
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} are for control inputs. V_I, V_O, I_I and I_O are for data pins.
2. The I_{OZ} of I/O ports include the input leakage current.
3. ΔI_{CC} refers to the increase in the supply current of each input at a specific TTL voltage level, not at V_{CC} or GND.
4. I_{CCD} is the dynamic power supply current, which is related to the operating frequency of a single control input.
5. It is measured by the voltage drop under the current indicated through the switch between terminal A and terminal B. The lower of the two terminal voltages determines the value of the on resistance.

SWITCHING CHARACTERISTICS

(T_A = +25℃, unless otherwise noted.) (see Table 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		

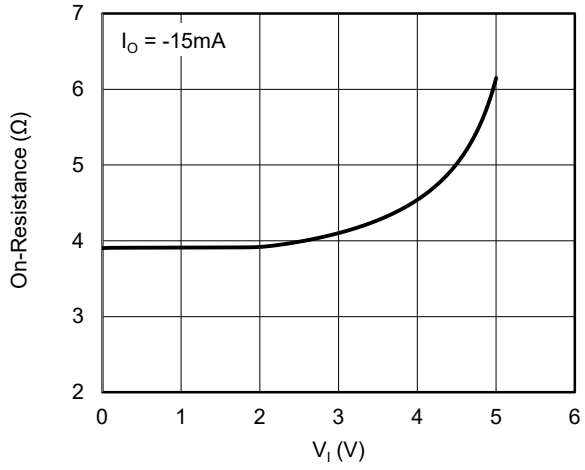
NOTE:

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

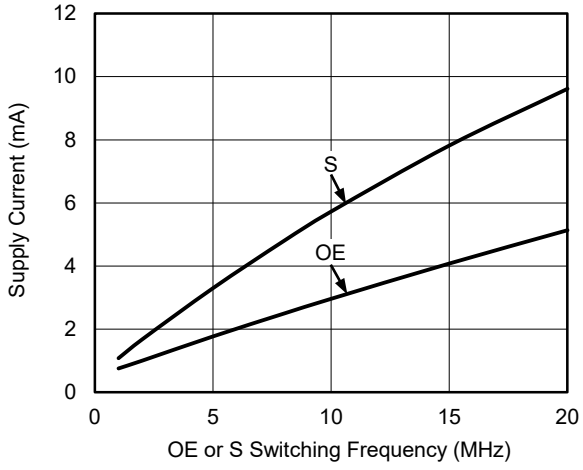
TYPICAL PERFORMANCE CHARACTERISTICS

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

On-Resistance



Supply Current vs. OE or S Switching Frequency



TEST CIRCUIT

Table 1. Parameter Test Information

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

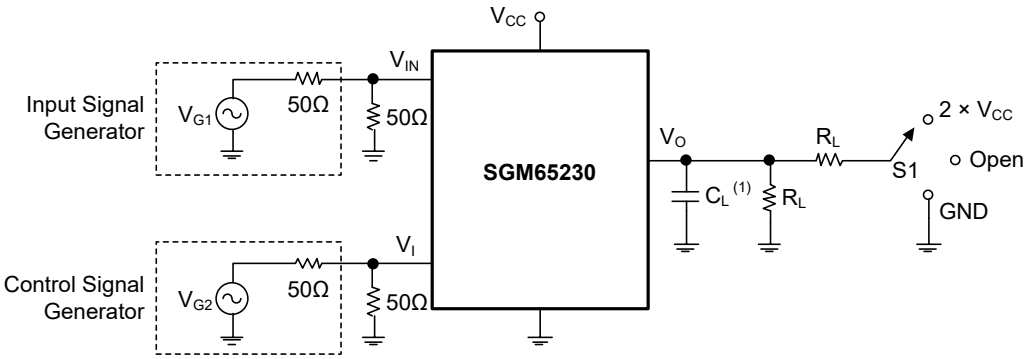
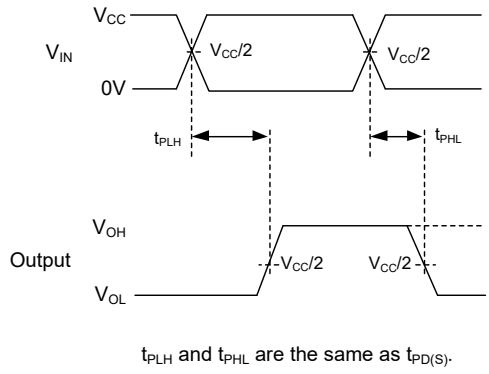
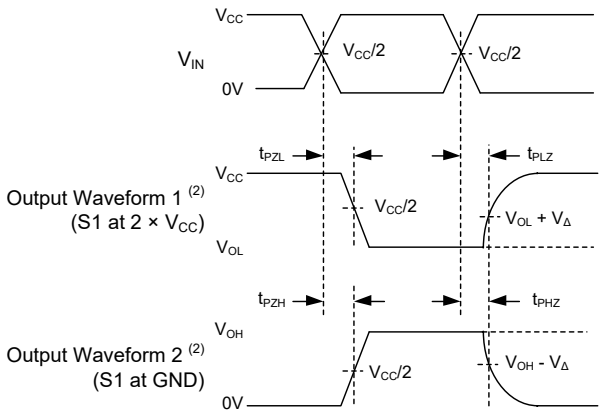


Figure 1. Test Circuit



t_{PLH} and t_{PHL} are the same as $t_{PD(S)}$.

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



t_{PZL} and t_{PZH} are the same as t_{EN}.
t_{PLZ} and t_{PHZ} are the same as t_{DIS}.

(2) Voltage Waveforms & Enable and Disable Times

NOTES:

1. The C_L includes probe capacitance and clamp capacitance.
2. Waveform 1 indicates the output when internal conditions force the output to low, except the output port is disabled through the output control. Waveform 2 indicates the output when internal conditions force the output to high, except the output port is disabled through the output control.
3. For all input signals from signal generator equipment, the following conditions are required: PRR ≤ 10MHz, Z_O = 50Ω, t_R ≤ 2.5ns, t_F ≤ 2.5ns.
4. Only one output port is measured at a time.

TYPICAL APPLICATION CIRCUIT

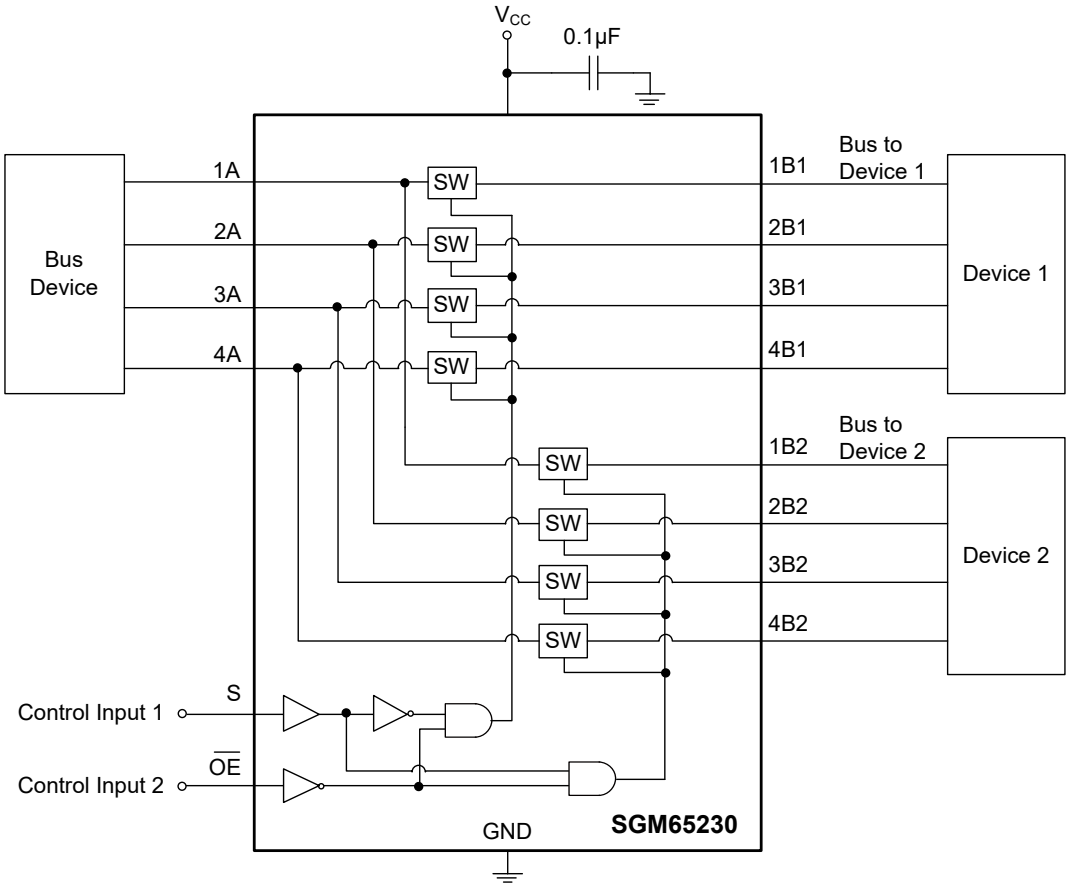


Figure 2. Typical Application Circuit

APPLICATION INFORMATION

The SGM65230 can multiplex and demultiplex up to 4 channels simultaneously in many applications through 2:1 configuration. The typical application circuit of a 4-bit bus switch is shown in Figure 2. When the application requires less than 4 bits, tie the A side of the unused channels to high or low.

Power Supply Recommendations

In order to reduce power interference, the V_{CC} terminal needs to be connected with a good capacitor and as close as possible to the V_{CC} pin. It is recommended to connect 0.1μF capacitor for single power supply equipment. Generally, multiple capacitors can also be connected in parallel to reduce noise. The commonly used capacitor values are 0.1μF and 1μF.

REVISION HISTORY

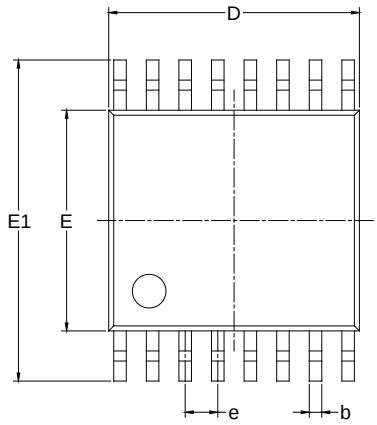
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

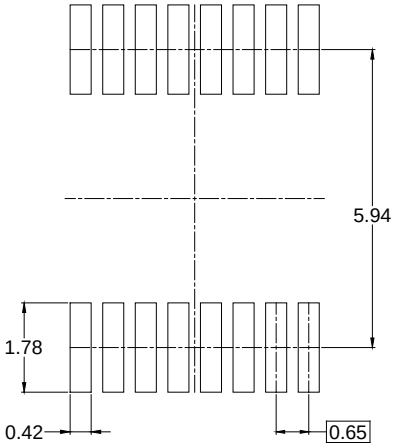
APRIL 2022 – REV.A to REV.A.1	Page
Updated Tape and Reel Information	11

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

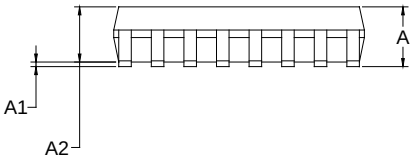
PACKAGE OUTLINE DIMENSIONS

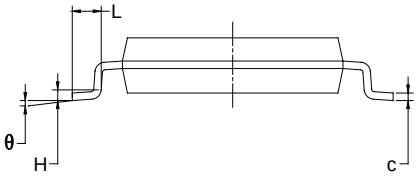
TSSOP-16





RECOMMENDED LAND PATTERN (Unit: mm)



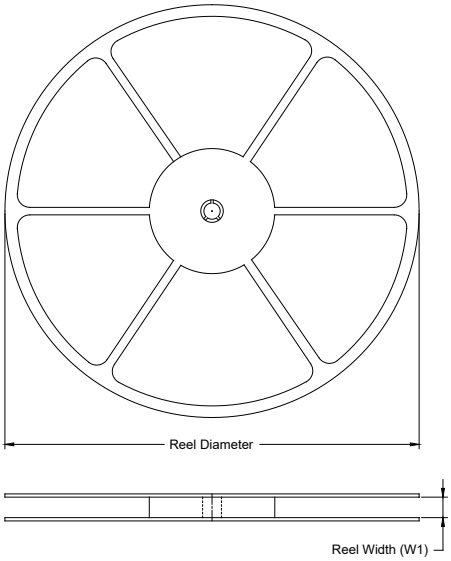


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.860	5.100	0.191	0.201
E	4.300	4.500	0.169	0.177
E1	6.200	6.600	0.244	0.260
e	0.650 BSC		0.026 BSC	
L	0.500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

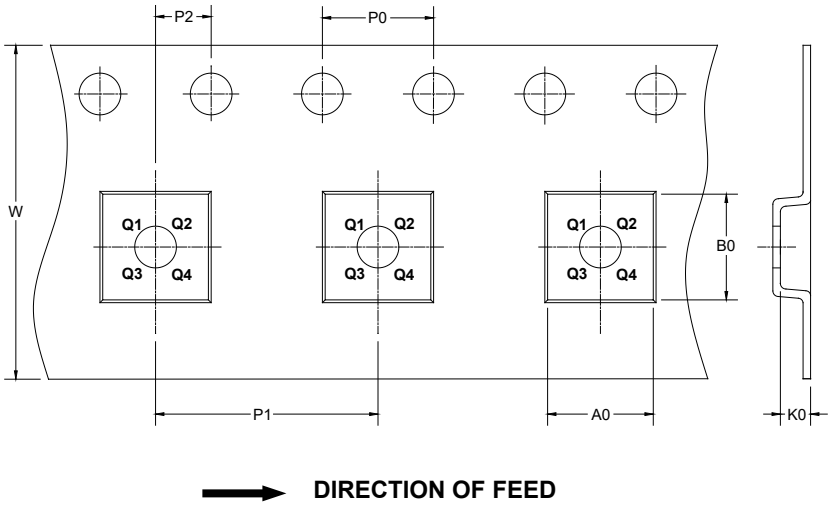
NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



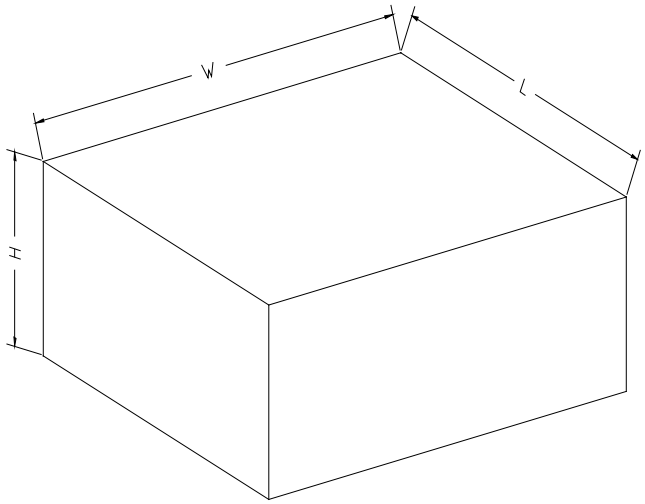
NOTE: The picture is only for reference. Please make the object as the standard.

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	Assembly House
TSSOP-16	13″	16.4	6.80	5.40	1.60	4.0	8.0	2.0	16.0	Q1	ANST
TSSOP-16	13″	12.4	6.80	5.40	1.30	4.0	8.0	2.0	12.0	Q1	HTTS

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