

# SGM7SZ245

## Octal Bus Transceivers with 3-State Outputs

### GENERAL DESCRIPTION

These octal bus transceivers are designed for asynchronous two-way communication between data buses. The control-function implementation minimizes external timing requirements.

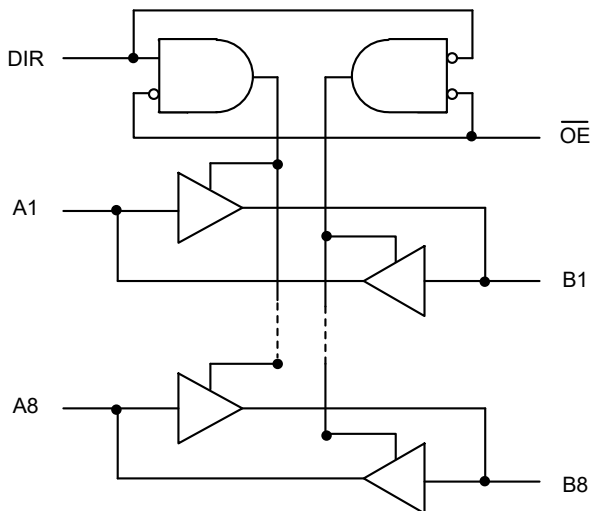
The device allows data transmission from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction-control (DIR) input. The output-enable ( $\overline{OE}$ ) input can be used to disable the device so that the buses are effectively isolated.

The SGM7SZ245 is available in Green TSSOP-20, TQFN-5.5×3.5-24L and TQFN-3×3-20L packages. It operates over an ambient temperature range of -40°C to +125°C.

### FEATURES

- **Wide Operating Voltage Range: 1.8V to 5.0V**
- **High-Current 3-State Outputs Drive Bus Lines Directly or Up to 15 LSTTL Loads**
- **Low Power Consumption,  $I_{CC}$ : 13μA (MAX)**
- **Typical  $t_{PD}$  = 8.9ns at 5.0V**
- **±20mA Output Drive at 5.0V**
- **Low Input Current: ±8μA (MAX)**
- **Available in Green TSSOP-20, TQFN-5.5×3.5-24L and TQFN-3×3-20L Packages**

### LOGIC DIAGRAM



NOTE: Positive logic.

### FUNCTION TABLE

INPUTS		OPERATION
$\overline{OE}$	DIR	
L	L	B data to A bus.
L	H	A data to B bus.
H	X	Isolation.

### PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM7SZ245	TSSOP-20	-40°C to +125°C	SGM7SZ245XTS20G/TR	SGM7SZ245XTS20 XXXXX	Tape and Reel, 4000
	TQFN-3x3-20L	-40°C to +125°C	SGM7SZ245XTQG20G/TR	SGM A5QG XXXXX	Tape and Reel, 4000
	TQFN-5.5x3.5-24L	-40°C to +125°C	SGM7SZ245XTQQ24G/TR	SGM7SZ245 XTQQ 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

Supply Voltage Range, $V_{CC}$	-0.3V to 6.0V
Input Clamp Current, $I_{IK}^{(1)}$	
( $V_I < 0$ or $V_I > V_{CC}$ )	$\pm 20$ mA
Output Clamp Current, $I_{OK}^{(1)}$	
( $V_O < 0$ or $V_O > V_{CC}$ )	$\pm 20$ mA
Continuous Output Current, $I_O$ ( $V_O = 0V$ to $V_{CC}$ )	$\pm 40$ mA
Continuous Current through $V_{CC}$ or GND	$\pm 70$ mA
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10s)	+260°C
ESD Susceptibility	
HBM	6000V
MM	400V
CDM	1000V

NOTE: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

### 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.

### RECOMMENDED OPERATING CONDITIONS <sup>(2)</sup>

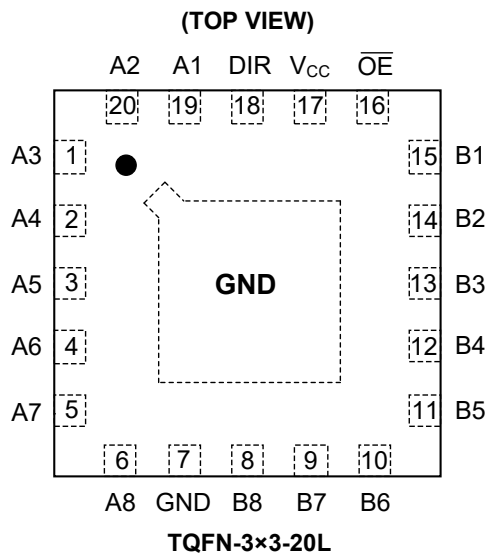
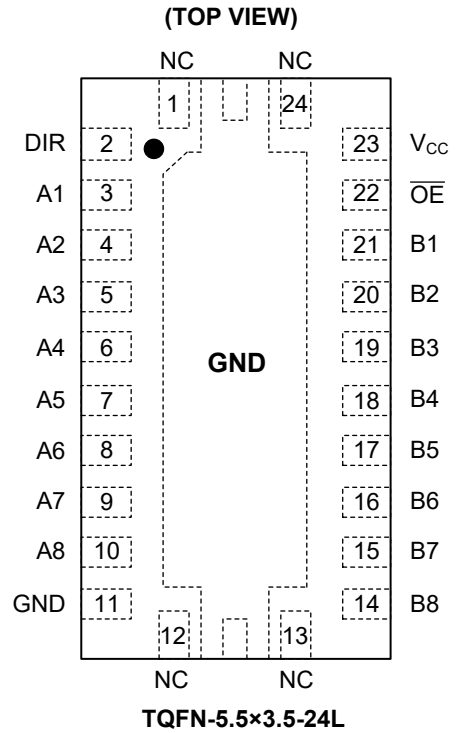
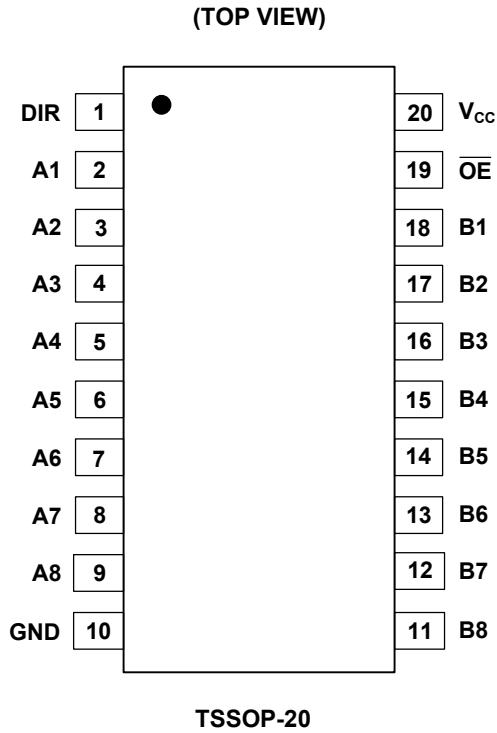
Supply Voltage Range, $V_{CC}$	1.8V to 5.0V
High-Level Input Voltage, $V_{IH}$	
( $V_{CC} = 1.8V$ )	1.2V (MIN)
( $V_{CC} = 3.3V$ )	1.75V (MIN)
( $V_{CC} = 5.0V$ )	2.2V (MIN)
Low-Level Input Voltage, $V_{IL}$	
( $V_{CC} = 1.8V$ )	0.4V (MAX)
( $V_{CC} = 3.3V$ )	0.65V (MAX)
( $V_{CC} = 5.0V$ )	0.65V (MAX)
Input Voltage Range, $V_I$	0V to $V_{CC}$
Output Voltage Range, $V_O$	0V to $V_{CC}$
Input Transition Rise or Fall Rate, $\Delta t/\Delta V$	
( $V_{CC} = 1.8V$ )	500ns (MAX)
( $V_{CC} = 3.3V$ )	250ns (MAX)
( $V_{CC} = 5.0V$ )	200ns (MAX)
Operating Temperature Range	-40°C to +125°C

NOTE: 2. All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation.

### 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 CONFIGURATIONS



## PIN DESCRIPTION

PIN			NAME	I/O	FUNCTION
TSSOP-20	TQFN-3×3-20L	TQFN-5.5×3.5-24L			
1	18	2	DIR	I	Direction-Control Signal.
2	19	3	A1	I/O	Input/Output A1.
3	20	4	A2	I/O	Input/Output A2.
4	1	5	A3	I/O	Input/Output A3.
5	2	6	A4	I/O	Input/Output A4.
6	3	7	A5	I/O	Input/Output A5.
7	4	8	A6	I/O	Input/Output A6.
8	5	9	A7	I/O	Input/Output A7.
9	6	10	A8	I/O	Input/Output A8.
10	7	11	GND	–	Ground.
11	8	14	B8	I/O	Input/Output B8.
12	9	15	B7	I/O	Input/Output B7.
13	10	16	B6	I/O	Input/Output B6.
14	11	17	B5	I/O	Input/Output B5.
15	12	18	B4	I/O	Input/Output B4.
16	13	19	B3	I/O	Input/Output B3.
17	14	20	B2	I/O	Input/Output B2.
18	15	21	B1	I/O	Input/Output B1.
19	16	22	$\overline{\text{OE}}$	I	3-State Output-Mode Enable. Pull $\overline{\text{OE}}$ high to place all outputs in 3-state mode.
20	17	23	V <sub>CC</sub>	–	Supply Voltage. 1.8V ≤ V <sub>CC</sub> ≤ 5.0V.
–	–	1, 12, 13, 24	NC	–	No Connection.
–	Exposed Pad	Exposed Pad	GND	–	Exposed Pad is Internally Connected to GND. Connect it to a large ground plane to maximize thermal performance; not intended as an electrical connection point.

**ELECTRICAL CHARACTERISTICS**(Full = -40°C to +125°C, typical values are at T<sub>A</sub> = +25°C, unless otherwise noted.)

PARAMETER		CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
High-Level Output Voltage (V <sub>OH</sub> )	V <sub>I</sub> = V <sub>IH</sub>	I <sub>OH</sub> = -20μA	V <sub>CC</sub> = 1.8V	Full	1.79	1.799		V
			V <sub>CC</sub> = 3.3V	Full	3.29	3.299		
			V <sub>CC</sub> = 5.0V	Full	4.99	4.999		
		I <sub>OH</sub> = -6mA, V <sub>CC</sub> = 3.3V	Full	3.20	3.25			
		I <sub>OH</sub> = -7.8mA, V <sub>CC</sub> = 5.0V	Full	4.88	4.95			
Low-Level Output Voltage (V <sub>OL</sub> )	V <sub>I</sub> = V <sub>IL</sub>	I <sub>OL</sub> = 20μA	V <sub>CC</sub> = 1.8V	Full		0.002	0.01	V
			V <sub>CC</sub> = 3.3V	Full		0.001	0.01	
			V <sub>CC</sub> = 5.0V	Full		0.001	0.01	
		I <sub>OL</sub> = 6mA, V <sub>CC</sub> = 3.3V	Full		0.06	0.115		
		I <sub>OL</sub> = 7.8mA, V <sub>CC</sub> = 5.0V	Full		0.07	0.14		
Input Leakage Current (I <sub>I</sub> )	DIR or $\overline{\text{OE}}$	V <sub>CC</sub> = 5.0V, V <sub>I</sub> = V <sub>CC</sub> or 0V		Full		±0.01	8	μA
3-State Output Leakage (I <sub>OZ</sub> )	A or B	V <sub>CC</sub> = 5.0V, V <sub>O</sub> = V <sub>CC</sub> or 0V		Full		±0.01	7.3	μA
Quiescent Supply Current (I <sub>CC</sub> )		V <sub>CC</sub> = 5.0V, V <sub>I</sub> = V <sub>CC</sub> or 0V, I <sub>O</sub> = 0		Full		0.01	13	μA
Power Off Leakage Current (I <sub>OFF</sub> )		V <sub>CC</sub> = 0V, V <sub>I</sub> or V <sub>O</sub> = 0V to 5.0V		Full		±0.01	10	μA
Input Capacitance (C <sub>I</sub> )	DIR or $\overline{\text{OE}}$	V <sub>CC</sub> = 1.8V to 5.0V		+25°C		15.6		pF

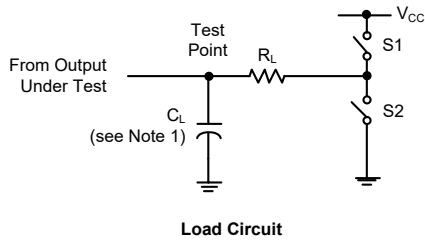
**SWITCHING CHARACTERISTICS**(Full = -40°C to +125°C, typical values are at T<sub>A</sub> = +25°C, unless otherwise noted.)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub>	MIN	TYP	MAX	UNITS
<b>(C<sub>L</sub> = 50pF)</b>							
t <sub>PD</sub>	A or B	B or A	1.8V		26.7		ns
			3.3V		11.0		
			5.0V		8.9		
t <sub>EN</sub>	$\overline{\text{OE}}$	A or B	1.8V		36.6		ns
			3.3V		13.6		
			5.0V		10.1		
t <sub>DIS</sub>	$\overline{\text{OE}}$	A or B	1.8V		39.5		ns
			3.3V		43.4		
			5.0V		44.9		
<b>(C<sub>L</sub> = 150pF)</b>							
t <sub>PD</sub>	A or B	B or A	1.8V		31.8		ns
			3.3V		11.8		
			5.0V		8.3		
t <sub>EN</sub>	$\overline{\text{OE}}$	A or B	1.8V		41.9		ns
			3.3V		16.8		
			5.0V		14.0		
t <sub>DIS</sub>	$\overline{\text{OE}}$	A or B	1.8V		60		ns
			3.3V		62		
			5.0V		64.3		

**SWITCHING CHARACTERISTICS (continued)**(Full = -40°C to +125°C, typical values are at T<sub>A</sub> = +25°C, unless otherwise noted.)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Input/Output Capacitance (C <sub>IO</sub> )				10.8		pF
Output Rise and Fall Times (t <sub>r</sub> , t <sub>f</sub> )	C <sub>L</sub> = 15pF	V <sub>CC</sub> = 1.8V		17.0		ns
		V <sub>CC</sub> = 3.3V		11.9		
		V <sub>CC</sub> = 5.0V		9.9		
	C <sub>L</sub> = 30pF	V <sub>CC</sub> = 1.8V		17.6		
		V <sub>CC</sub> = 3.3V		11.4		
		V <sub>CC</sub> = 5.0V		9.6		
	C <sub>L</sub> = 50pF	V <sub>CC</sub> = 1.8V		18.2		
		V <sub>CC</sub> = 3.3V		10.8		
		V <sub>CC</sub> = 5.0V		9.4		
Power Dissipation Capacitance per Transceiver (C <sub>PD</sub> )	No load			63.3		pF

PARAMETER MEASUREMENT INFORMATION



PARAMETER	$R_L$	$C_L$	S1	S2
$t_{EN}$	1k $\Omega$	50pF or 150pF	Open	Closed
			Closed	Open
$t_{DIS}$	1k $\Omega$	50pF	Open	Closed
			Closed	Open
$t_{PD}$ or $t_t$	-	50pF or 150pF	Open	Open

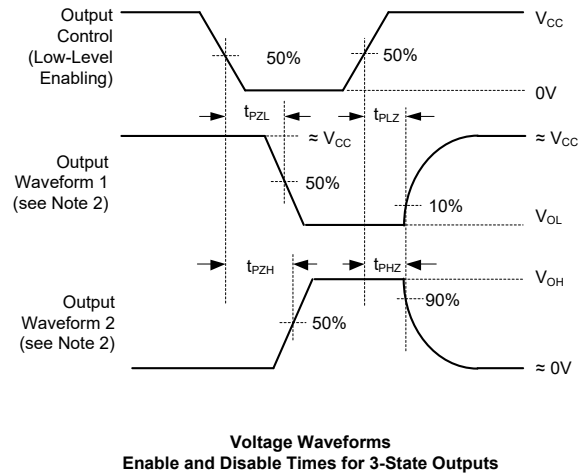
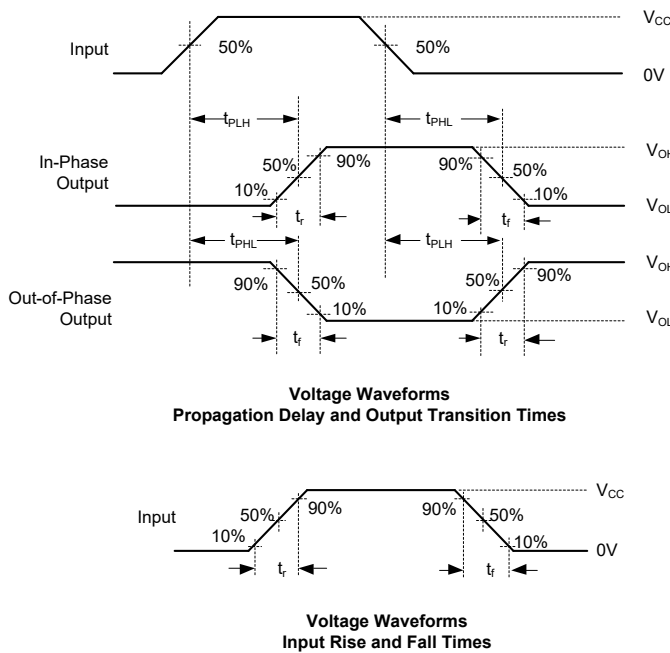


Figure 1. Load Circuit and Voltage Waveforms

NOTES:

- $C_L$  includes probe and test-fixture capacitance.
- 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.
- Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1\text{MHz}$ ,  $Z_O = 50\Omega$ ,  $t_r = 6\text{ns}$ ,  $t_f = 6\text{ns}$ .
- The outputs are measured one at a time with one input transition per measurement.
- $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{DIS}$ .
- $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{EN}$ .
- $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{PD}$ .

**REVISION HISTORY**

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

**Changes from Original (DECEMBER 2017) to REV.A**

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Changed from product preview to production data.....All

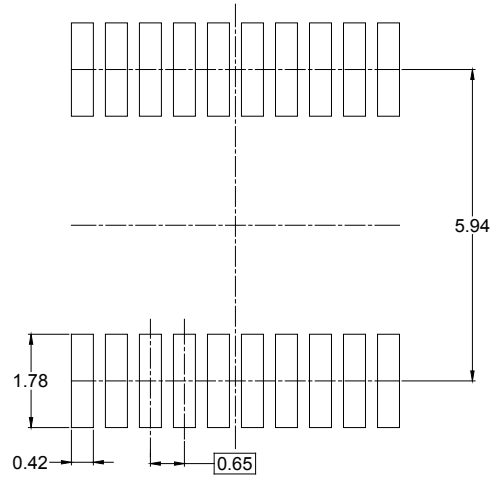
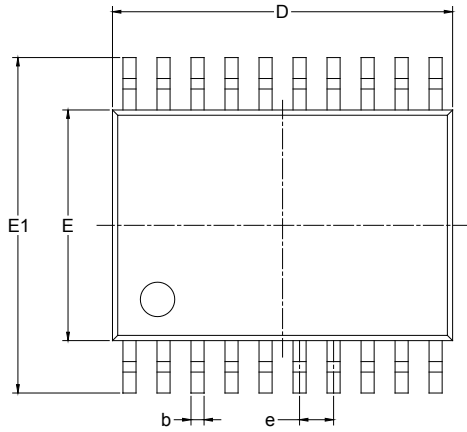
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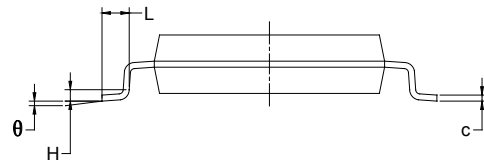
# PACKAGE INFORMATION

## PACKAGE OUTLINE DIMENSIONS

### TSSOP-20



RECOMMENDED LAND PATTERN (Unit: mm)

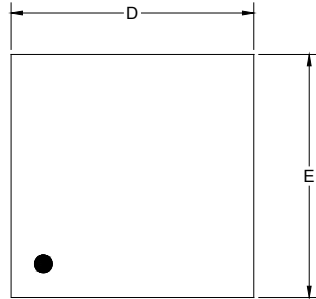


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.100		0.043
A1	0.050	0.150	0.002	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	6.400	6.600	0.252	0.259
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°

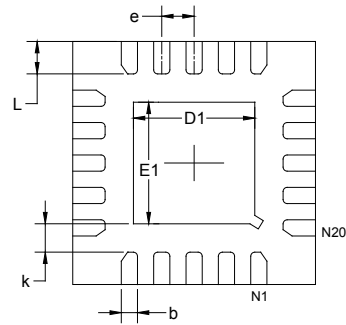
# PACKAGE INFORMATION

## PACKAGE OUTLINE DIMENSIONS

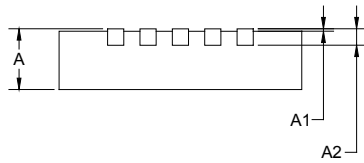
### TQFN-3×3-20L



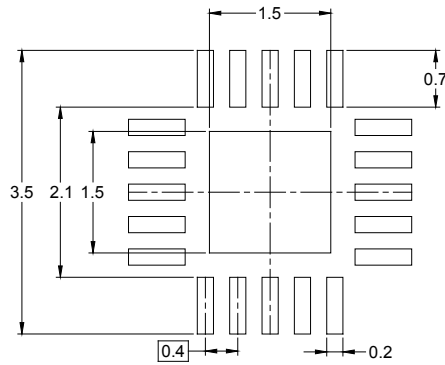
TOP VIEW



BOTTOM VIEW



SIDE VIEW



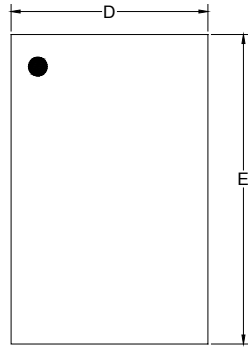
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	2.924	3.076	0.115	0.121
D1	1.400	1.600	0.055	0.063
E	2.924	3.076	0.115	0.121
E1	1.400	1.600	0.055	0.063
k	0.200 MIN		0.008 MIN	
b	0.150	0.250	0.006	0.010
e	0.400 TYP		0.016 TYP	
L	0.324	0.476	0.013	0.019

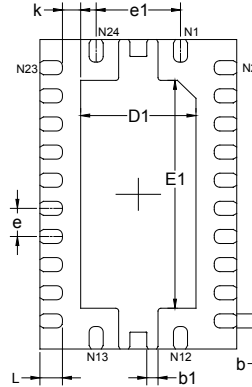
# PACKAGE INFORMATION

## PACKAGE OUTLINE DIMENSIONS

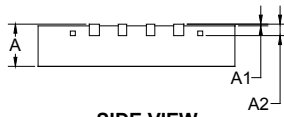
### TQFN-5.5×3.5-24L



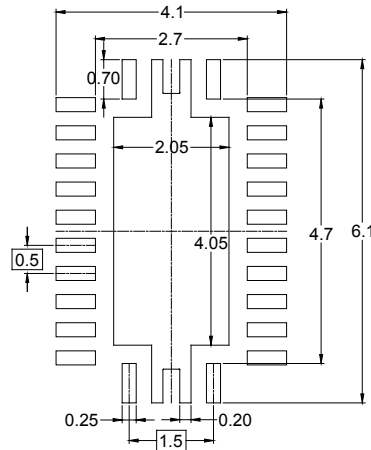
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	3.400	3.600	0.134	0.142
D1	1.950	2.150	0.077	0.085
E	5.400	5.600	0.213	0.220
E1	3.950	4.150	0.156	0.163
k	0.325 REF		0.013 REF	
b	0.200	0.300	0.008	0.012
b1	0.150	0.250	0.006	0.010
L	0.300	0.500	0.012	0.020
e	0.500 BSC		0.020 BSC	
e1	1.500 BSC		0.059 BSC	

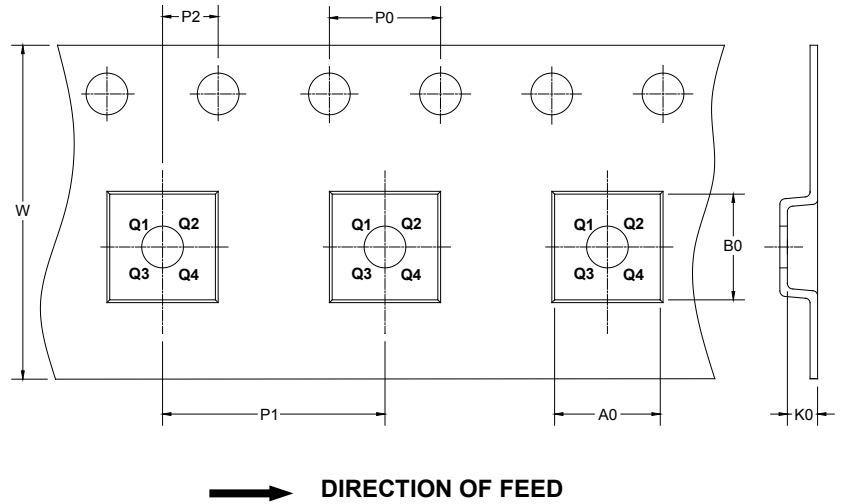
# PACKAGE INFORMATION

## 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
TSSOP-20	13"	12.4	6.80	6.85	1.70	4.0	8.0	2.0	12.0	Q1
TQFN-3×3-20L	13"	12.4	3.30	3.30	1.10	4.0	8.0	2.0	12.0	Q1
TQFN-5.5×3.5-24L	13"	12.4	3.80	5.80	1.00	4.0	8.0	2.0	12.0	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
13"	386	280	370	5

DD0002