

### GENERAL DESCRIPTION

The SGM7SZ245 is an octal bus transceiver with 3-state outputs, which accepts a wide supply voltage range of 1.8V to 5.0V. The An and Bn are 8-bit data input-output ports, DIR is the direction control input and  $\overline{OE}$  is an output enable input.

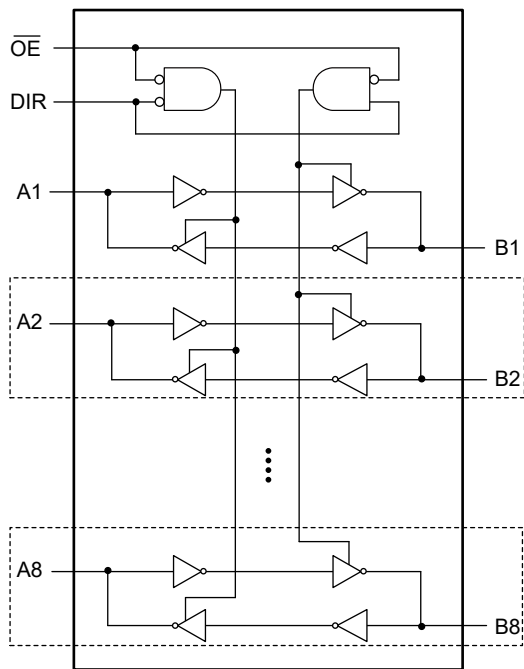
When DIR is set high, it allows transmission from An to Bn. When DIR is set low, it allows transmission from Bn to An.  $\overline{OE}$  can be used to make the outputs disabled so that the buses are effectively isolated.

The SGM7SZ245 is available in Green TSSOP-20, TQFN-5.5x3.5-24L and TQFN-3x3-20L packages. It operates over an ambient temperature range of -40°C to +125°C.

### FEATURES

- **Wide Operating Voltage Range: 1.8V to 5.0V**
- **+20mA/-20mA Output Current at  $V_{CC} = 5.0V$**
- **Low Power Consumption,  $I_{CC}$ : 10nA (TYP)**
- **High Current Output Drive Capability: 15 LSTTL Loads**
- **$t_{PD} = 8.9ns$  (TYP) at  $V_{CC} = 5.0V$**
- **Low Input Current:  $\pm 10nA$  (TYP)**
- **-40°C to +125°C Operating Temperature Range**
- **Available in Green TSSOP-20, TQFN-5.5x3.5-24L and TQFN-3x3-20L Packages**

### LOGIC DIAGRAM



### FUNCTION TABLE

CONTROL INPUT		INPUT/OUTPUT	
$\overline{OE}$	DIR	An	Bn
L	L	An = Bn	Inputs
L	H	Inputs	Bn = An
H	X	Z	Z

H = High Voltage Level  
 L = Low Voltage Level  
 Z = High-Impedance State  
 X = Don't Care

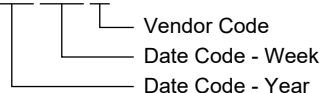
**PACKAGE/ORDERING INFORMATION**

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

**MARKING INFORMATION**

NOTE: XXXXX = Date Code and Vendor Code.

**XXXXX**



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 <sup>(1)</sup>**

- Supply Voltage Range,  $V_{CC}$  ..... -0.3V to 6.0V
- Input Voltage Range,  $V_I$  <sup>(2)</sup> ..... -0.3V to 6.0V
- Output Voltage Range,  $V_O$  <sup>(2)</sup>
  - Suspend or 3-State Mode ..... -0.3V to 6.0V
  - Active Mode ..... -0.3V to MIN(6.0V,  $V_{CC} + 0.5V$ )
- Input Clamp Current,  $I_{IK}$  <sup>(2)</sup> ( $V_I < 0V$  or  $V_I > V_{CC}$ ) .....  $\pm 20mA$
- Output Clamp Current,  $I_{OK}$  <sup>(2)</sup> ( $V_O < 0V$  or  $V_O > V_{CC}$ ) ...  $\pm 20mA$
- Continuous Output Current,  $I_O$  .....  $\pm 40mA$
- Continuous Output Current through  $V_{CC}$  or GND .....  $\pm 70mA$
- Junction Temperature <sup>(3)</sup> ..... +150°C
- Storage Temperature Range ..... -65°C to +150°C
- Lead Temperature (Soldering, 10s) ..... +260°C
- ESD Susceptibility
  - HBM ..... 6000V
  - MM ..... 400V
  - CDM ..... 1000V

**RECOMMENDED OPERATING CONDITIONS**

- Supply Voltage Range,  $V_{CC}$  ..... 1.8V to 5.0V
- Input Voltage Range,  $V_I$  ..... 0V to 5.0V
- Output Voltage Range,  $V_O$ 
  - Suspend or 3-State Mode ..... 0V to 5.0V
  - Active Mode ..... 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

**OVERSTRESS CAUTION**

1. 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.
2. The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.
3. The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

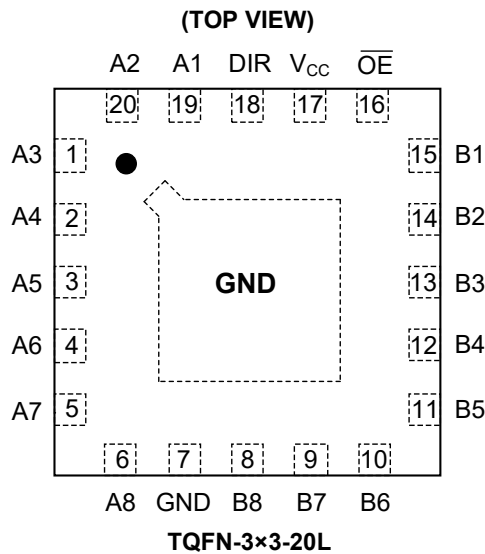
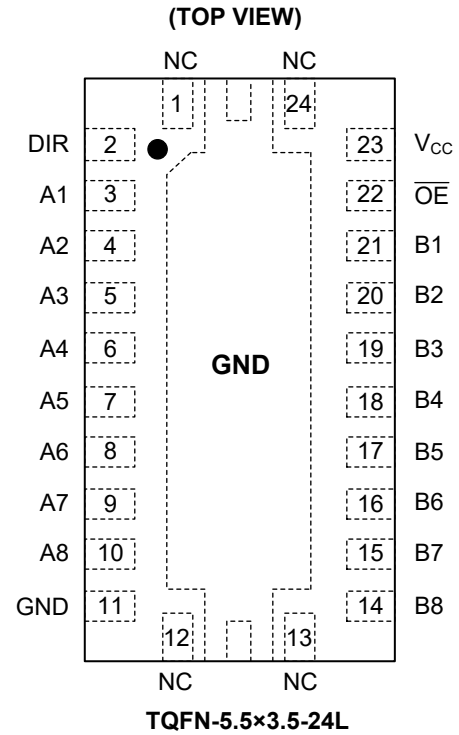
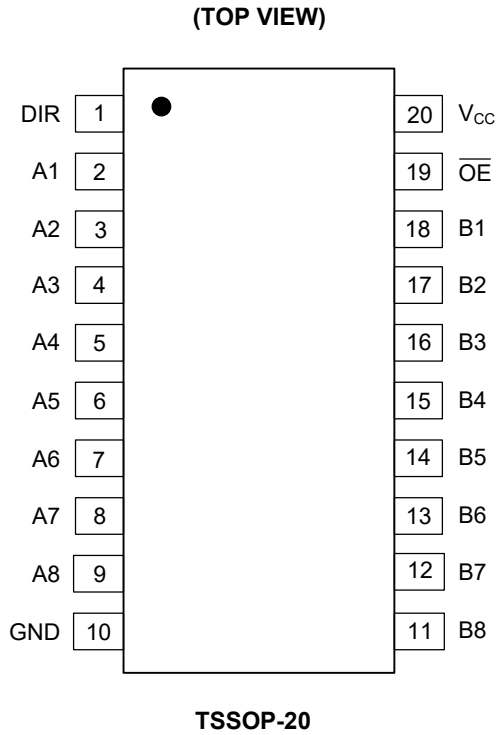
**ESD SENSITIVITY CAUTION**

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, or specifications without prior notice.

PIN CONFIGURATIONS



## PIN DESCRIPTION

PIN			NAME	FUNCTION
TSSOP-20	TQFN-3×3-20L	TQFN-5.5×3.5-24L		
1	18	2	DIR	Direction Control Input.
2	19	3	A1	Input/Output A1.
3	20	4	A2	Input/Output A2.
4	1	5	A3	Input/Output A3.
5	2	6	A4	Input/Output A4.
6	3	7	A5	Input/Output A5.
7	4	8	A6	Input/Output A6.
8	5	9	A7	Input/Output A7.
9	6	10	A8	Input/Output A8.
10	7	11	GND	Ground.
11	8	14	B8	Input/Output B8.
12	9	15	B7	Input/Output B7.
13	10	16	B6	Input/Output B6.
14	11	17	B5	Input/Output B5.
15	12	18	B4	Input/Output B4.
16	13	19	B3	Input/Output B3.
17	14	20	B2	Input/Output B2.
18	15	21	B1	Input/Output B1.
19	16	22	$\overline{OE}$	Output Enable Input (Active Low).
20	17	23	V <sub>CC</sub>	Supply Voltage.
–	–	1, 12, 13, 24	NC	No Connection.
–	Exposed Pad	Exposed Pad	GND	Connect it to GND internally. This pad is not an electrical connection point.

**ELECTRICAL CHARACTERISTICS**(Full = -40°C to +125°C, typical values are at  $T_A = +25^\circ\text{C}$ , unless otherwise noted.)

PARAMETER		CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
High-Level Input Voltage ( $V_{IH}$ )	$V_{CC} = 1.8\text{V}$			Full	1.2			V
	$V_{CC} = 3.3\text{V}$			Full	1.75			
	$V_{CC} = 5.0\text{V}$			Full	2.2			
Low-Level Input Voltage ( $V_{IL}$ )	$V_{CC} = 1.8\text{V}$			Full			0.4	V
	$V_{CC} = 3.3\text{V}$			Full			0.65	
	$V_{CC} = 5.0\text{V}$			Full			0.65	
High-Level Output Voltage ( $V_{OH}$ )	$V_I = V_{IH}$	$I_{OH} = -20\mu\text{A}$	$V_{CC} = 1.8\text{V}$	Full	1.79	1.799		V
			$V_{CC} = 3.3\text{V}$	Full	3.29	3.299		
			$V_{CC} = 5.0\text{V}$	Full	4.99	4.999		
		$I_{OH} = -6\text{mA}, V_{CC} = 3.3\text{V}$		Full	3.20	3.25		
		$I_{OH} = -7.8\text{mA}, V_{CC} = 5.0\text{V}$		Full	4.88	4.95		
Low-Level Output Voltage ( $V_{OL}$ )	$V_I = V_{IL}$	$I_{OL} = 20\mu\text{A}$	$V_{CC} = 1.8\text{V}$	Full		0.002	0.01	V
			$V_{CC} = 3.3\text{V}$	Full		0.001	0.01	
			$V_{CC} = 5.0\text{V}$	Full		0.001	0.01	
		$I_{OL} = 6\text{mA}, V_{CC} = 3.3\text{V}$		Full		0.06	0.115	
		$I_{OL} = 7.8\text{mA}, V_{CC} = 5.0\text{V}$		Full		0.07	0.14	
Input Leakage Current ( $I_I$ )	DIR or $\overline{OE}$	$V_{CC} = 5.0\text{V}, V_I = V_{CC}$ or $0\text{V}$		Full		$\pm 0.01$	8	$\mu\text{A}$
3-State Output Leakage ( $I_{OZ}$ )	A or B	$V_{CC} = 5.0\text{V}, V_O = V_{CC}$ or $0\text{V}$		Full		$\pm 0.01$	7.3	$\mu\text{A}$
Quiescent Supply Current ( $I_{CC}$ )		$V_{CC} = 5.0\text{V}, V_I = V_{CC}$ or $0\text{V}, I_O = 0\text{A}$		Full		0.01	13	$\mu\text{A}$
Power Off Leakage Current ( $I_{OFF}$ )		$V_{CC} = 0\text{V}, V_I$ or $V_O = 0\text{V}$ to $5.0\text{V}$		Full		$\pm 0.01$	10	$\mu\text{A}$
Input Capacitance ( $C_i$ )	DIR or $\overline{OE}$	$V_{CC} = 1.8\text{V}$ to $5.0\text{V}$		+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>	OE	A or B	1.8V		36.6		ns
			3.3V		13.6		
			5.0V		10.1		
t <sub>DIS</sub>	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>	OE	A or B	1.8V		41.9		ns
			3.3V		16.8		
			5.0V		14.0		
t <sub>DIS</sub>	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.)

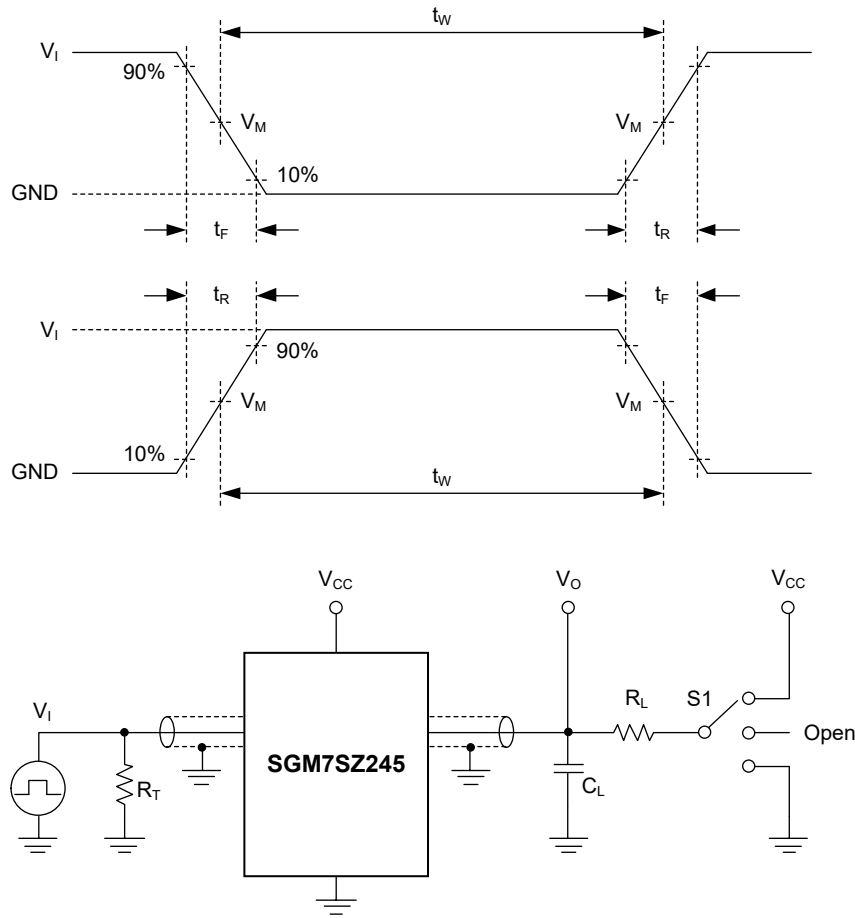
PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Input/Output Capacitance (C <sub>IO</sub> )				10.8		pF
Output Rise and Fall Times (t <sub>R</sub> , t <sub>F</sub> )	C <sub>L</sub> = 15pF	V <sub>CC</sub> = 1.8V		17.0		ns
		V <sub>CC</sub> = 3.3V		11.9		
		V <sub>CC</sub> = 5.0V		9.9		
	C <sub>L</sub> = 30pF	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> ) <sup>(1)(2)</sup>	No load			63.3		pF

## NOTES:

- Power dissipation capacitance per transceiver.
- C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$$
 where:  
 f<sub>i</sub> = Input frequency in MHz. f<sub>o</sub> = Output frequency in MHz.  
 C<sub>L</sub> = Output load capacitance in pF. V<sub>CC</sub> = Supply voltage in Volts.  
 N = Number of inputs switching.  $\Sigma(C_L \times V_{CC}^2 \times f_o)$  = Sum of the outputs.

TEST CIRCUIT



Test conditions are given in Table 1.

Definitions for test circuit:

$R_L$ : Load resistance.

$C_L$ : Load capacitance (includes jig and probe).

$R_T$ : Termination resistance (equals to output impedance  $Z_O$  of the pulse generator).

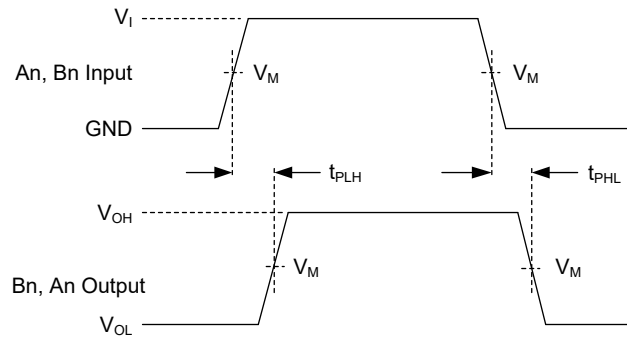
S1: Test selection switch.

Figure 1. Test Circuit for Measuring Switching Times

Table 1. Test Conditions

SUPPLY VOLTAGE	INPUT		LOAD		S1 POSITION		
$V_{CC}$	$V_I$	$t_R, t_F$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
1.8V to 5.0V	$V_{CC}$	6.0ns	50pF, 150pF	1k $\Omega$	Open	GND	$V_{CC}$

WAVEFORMS

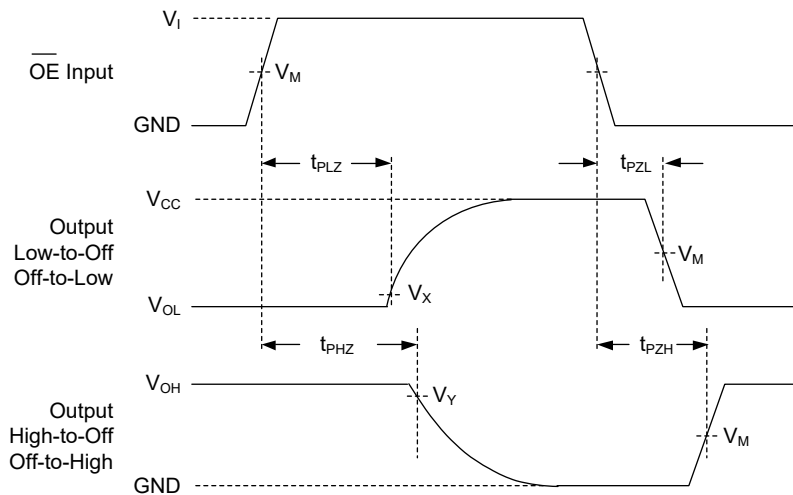


Test conditions are given in Table 1.

Measurement points are given in Table 2.

Logic levels:  $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

Figure 2. Input (An, Bn) to Output (Bn,An) Propagation Delay Times



Test conditions are given in Table 1.

Measurement points are given in Table 2.

Logic levels:  $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

Figure 3. Enable and Disable Times

Table 2. Measurement Points

SUPPLY VOLTAGE	INPUT <sup>(1)</sup>		OUTPUT		
$V_{CC}$	$V_I$	$V_M$	$V_M$	$V_X$	$V_Y$
1.8V to 5.0V	$V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.3V$	$V_{OH} - 0.3V$

NOTE:

1. The measurement points should be  $V_{IH}$  or  $V_{IL}$  when the input rising or falling time exceeds 6.0ns.



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**REVISION HISTORY**

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

<b>NOVEMBER 2023 – REV.A to REV.A.1</b>	<b>Page</b>
Updated Absolute Maximum Ratings and Recommended Operating Conditions sections .....	2
Updated Tape and Reel Information section .....	13

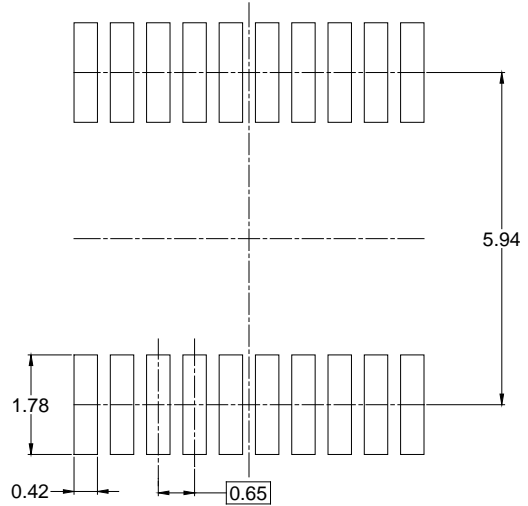
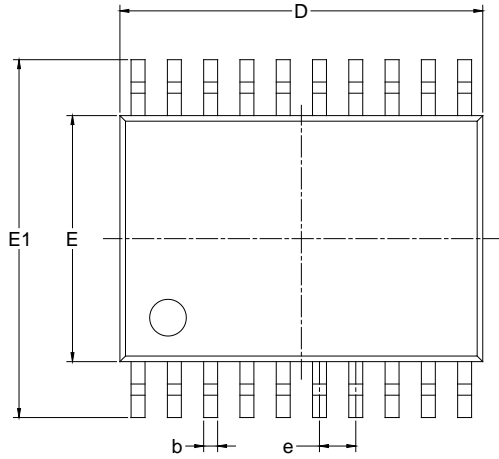
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<b>Changes from Original (DECEMBER 2017) to REV.A</b>	
Changed from product preview to production data.....	All

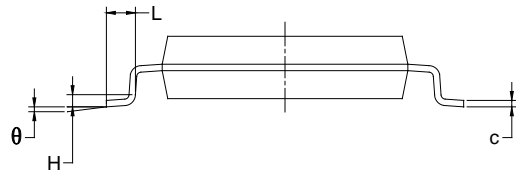
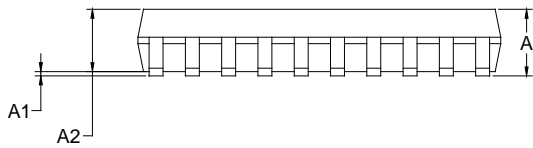
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PACKAGE OUTLINE DIMENSIONS

TSSOP-20



RECOMMENDED LAND PATTERN (Unit: mm)



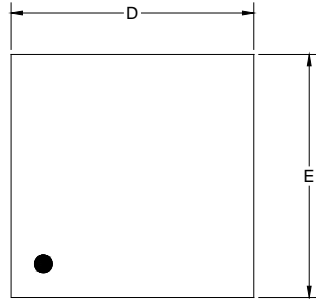
Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A		-	1.200
A1	0.050	-	0.150
A2	0.800	-	1.050
b	0.190	-	0.300
c	0.090	-	0.200
D	6.400	-	6.600
E	4.300	-	4.500
E1	6.250	-	6.550
e	0.650 BSC		
L	0.450	-	0.750
H	0.250 TYP		
θ	0°	-	8°

NOTES:

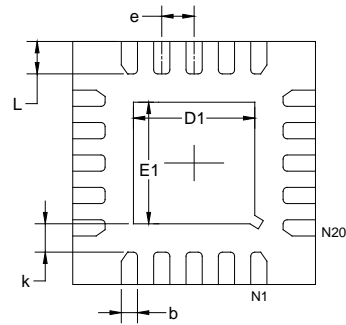
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

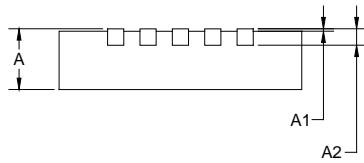
TQFN-3x3-20L



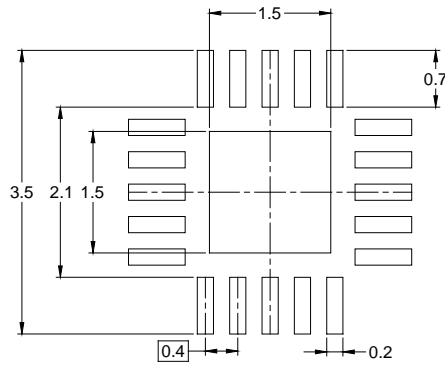
TOP VIEW



BOTTOM VIEW



SIDE VIEW



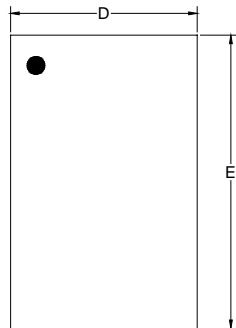
RECOMMENDED LAND PATTERN (Unit: mm)

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

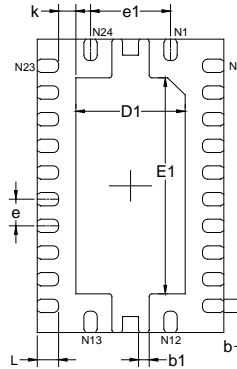
NOTE: This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

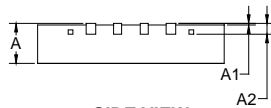
TQFN-5.5x3.5-24L



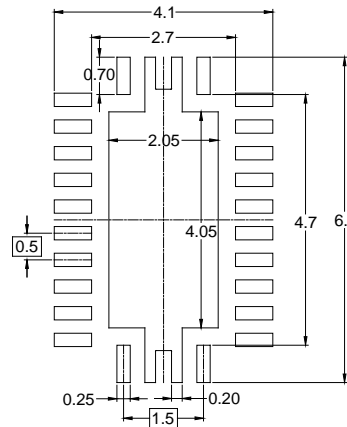
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN (Unit: mm)

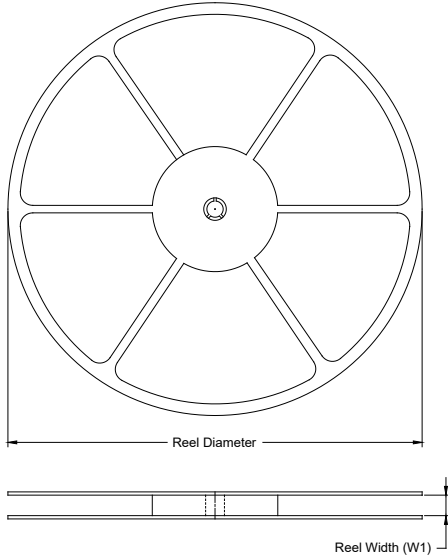
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	3.400	3.600	0.134	0.142
D1	1.950	2.150	0.077	0.085
E	5.400	5.600	0.213	0.220
E1	3.950	4.150	0.156	0.163
k	0.325 REF		0.013 REF	
b	0.200	0.300	0.008	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	

NOTE: This drawing is subject to change without notice.

# 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	Q2
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