74LVC245A
Octal Bus Transceiver with 3-State Outputs

GENERAL DESCRIPTION

The 74LVC245A is an octal bus transceiver with 3-state outputs, which can accept supply voltage range from 1.65V to 3.6V. The device is mainly used for asynchronous communication between data buses. Both 3.3V and 5V devices can drive inputs, enabling this device to operate as translator in a mixed 3.3V and 5V system environment.

The An and Bn are 8-bit data input-output ports, DIR is the direction control input and $\overline{OE}$ is the 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.

This device is highly suitable for partial power-down applications by using power-off leakage current (I_{OFF}) circuit. When the device is powered down, the outputs are disabled, and the current backflow can be prevented from passing through the device.

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

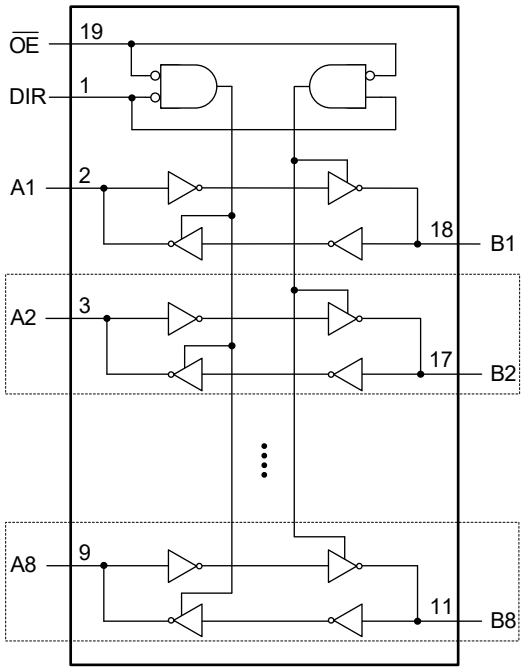
FEATURES

- **Wide Supply Voltage Range: 1.65V to 3.6V**
- **Inputs Accept Voltages up to 5.5V**
- **+24mA/-24mA Output Current**
- **All Ports Support Mixed Mode Signal Operation**
- **Support Partial Power-Down Mode**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green SOIC-20, SSOP-20 and TSSOP-20 Packages**

APPLICATIONS

Medical System
Computing: Server, PC and Notebook
Telecom System
Industrial System

LOGIC DIAGRAM

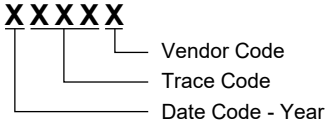


PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
74LVC245A	SOIC-20	-40℃ to +125℃	74LVC245AXS20G/TR	74LVC245AXS20 XXXXX	Tape and Reel, 1500
	SSOP-20	-40℃ to +125℃	74LVC245AXSS20G/TR	74LVC245A XSS20 XXXXX	Tape and Reel, 2000
	TSSOP-20	-40℃ to +125℃	74LVC245AXTS20G/TR	0BNXTS20 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 (1)

Supply Voltage Range, V_{CC} ..... -0.5V to 6.5V
Input Voltage Range, V_I (2) ..... -0.5V to 6.5V
Output Voltage Range, V_O (2)
High-State or Low-State..... -0.5V to MIN(6.5V, V_{CC} + 0.5V)
3-State Mode ..... -0.5V to 6.5V
Input Clamp Current, I_{IK} (V_I < 0V) .....-50mA
Output Clamp Current, I_{OK} (V_O < 0V).....-50mA
Continuous Output Current, I_O .....±50mA
Continuous Current through V_{CC} or GND.....±100mA
Junction Temperature (3) .....+150℃
Storage Temperature Range .....-65℃ to +150℃
Lead Temperature (Soldering, 10s) .....+260℃
ESD Susceptibility
HBM.....7000V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range, V_{CC} .....1.65V to 3.6V
Input Voltage Range, V_I .....0V to 5.5V
Output Voltage Range, V_O
High-State or Low-State..... 0V to V_{CC}
3-State Mode .....0V to 5.5V
High-State or Low-State Output Current, I_O .....±24mA
Input Transition Rise or Fall Rate, Δt/ΔV ..... 10ns/V (MAX)
Operating Temperature Range .....-40℃ to +125℃

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 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

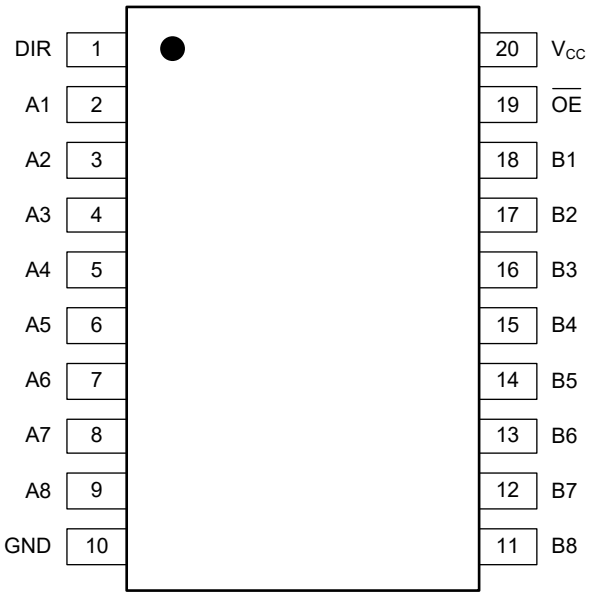
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

(TOP VIEW)



SOIC-20/SSOP-20/TSSOP-20

PIN DESCRIPTION

PIN	NAME	FUNCTION
1	DIR	Direction Control Input.
2, 3, 4, 5, 6, 7, 8, 9	A1, A2, A3, A4, A5, A6, A7, A8	Data Inputs/Outputs.
10	GND	Ground.
11, 12, 13, 14, 15, 16, 17, 18	B8, B7, B6, B5, B4, B3, B2, B1	Data Inputs/Outputs.
19	$\overline{OE}$	Output Enable Input (Active-Low).
20	V_{CC}	Supply Voltage.

ELECTRICAL CHARACTERISTICS

(Full = -40℃ to +125℃, all typical values are measured at T_A= +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
High-Level Input Voltage	V_{IH}	V_{CC} = 1.65V to 1.95V	Full	0.65 × V_{CC}			V
		V_{CC} = 2.3V to 2.7V	Full	1.7			
		V_{CC} = 2.7V to 3.6V	Full	2.0			
Low-Level Input Voltage	V_{IL}	V_{CC} = 1.65V to 1.95V	Full			0.35 × V_{CC}	V
		V_{CC} = 2.3V to 2.7V	Full			0.7	
		V_{CC} = 2.7V to 3.6V	Full			0.8	
High-Level Output Voltage	V_{OH}	V_{CC} = 1.65V to 3.6V, I_{OH} = -100μA	Full	V_{CC} - 0.2	V_{CC} - 0.01		V
		V_{CC} = 1.65V, I_{OH} = -4mA	Full	1.10	1.53		
		V_{CC} = 2.3V, I_{OH} = -8mA	Full	1.60	2.17		
		V_{CC} = 2.7V, I_{OH} = -12mA	Full	2.10	2.54		
		V_{CC} = 3.0V, I_{OH} = -12mA	Full	2.30	2.85		
		V_{CC} = 3.0V, I_{OH} = -24mA	Full	2.10	2.69		
Low-Level Output Voltage	V_{OL}	V_{CC} = 1.65V to 3.6V, I_{OL} = 100μA	Full		0.01	0.20	V
		V_{CC} = 1.65V, I_{OL} = 4mA	Full		0.08	0.60	
		V_{CC} = 2.3V, I_{OL} = 8mA	Full		0.12	0.75	
		V_{CC} = 2.7V, I_{OL} = 12mA	Full		0.17	0.60	
		V_{CC} = 3.0V, I_{OL} = 24mA	Full		0.32	0.75	
Input Leakage Current	I_I	Control inputs, V_{CC} = 3.6V, V_I = 0V to 5.5V	Full		±0.01	±10	μA
Power-Off Leakage Current	I_{OFF}	V_{CC} = 0V, V_I or V_O = 5.5V	Full		±0.01	±10	μA
Off-State Output Current (1)	I_{OZ}	V_{CC} = 3.6V, V_I = 0V to 5.5V	Full		±0.01	±10	μA
Supply Current	I_{CC}	V_{CC} = 3.6V, V_I = V_{CC} or GND, I_O = 0A	Full		0.1	20	μA
		V_{CC} = 3.6V, 3.6V ≤ V_I ≤ 5.5V, I_O = 0A	Full		0.1	20	
Additional Supply Current	ΔI_{CC}	V_{CC} = 2.7V to 3.6V, one input at V_{CC} - 0.6V, other inputs at V_{CC} or GND	Full		0.1	30	μA
Input Capacitance	C_I	Control inputs, V_{CC} = 3.3V, V_I = V_{CC} or GND	+25℃		3.5		pF
Input/Output Capacitance	$C_{I/O}$	A or B ports, V_{CC} = 3.3V, V_I = V_{CC} or GND	+25℃		6		pF

NOTE:

1. For I/O ports, the parameter I_{OZ} includes the input leakage current.

DYNAMIC CHARACTERISTICS

(See Figure 1 for test circuit. Full = -40℃ to +125℃, all typical values are measured at T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN (1)	TYP	MAX (1)	UNITS
Propagation Delay (2)	t_{PD}	An or Bn to Bn or An	V_{CC} = 1.8V ± 0.15V	Full	0.5	3.5	13.7	ns
			V_{CC} = 2.5V ± 0.2V	Full	0.5	2.5	9.7	
			V_{CC} = 2.7V	Full	0.5	2.5	8.3	
			V_{CC} = 3.3V ± 0.3V	Full	0.5	2.5	7.3	
Enable Time (2)	t_{EN}	$\overline{OE}$ to An or Bn	V_{CC} = 1.8V ± 0.15V	Full	0.5	5.5	18.0	ns
			V_{CC} = 2.5V ± 0.2V	Full	0.5	3.5	12.0	
			V_{CC} = 2.7V	Full	0.5	3.5	11.0	
			V_{CC} = 3.3V ± 0.3V	Full	0.5	3.5	10.0	
Disable Time (2)	t_{DIS}	$\overline{OE}$ to An or Bn	V_{CC} = 1.8V ± 0.15V	Full	0.5	4.5	18.0	ns
			V_{CC} = 2.5V ± 0.2V	Full	0.5	2.5	10.5	
			V_{CC} = 2.7V	Full	0.5	3.0	9.5	
			V_{CC} = 3.3V ± 0.3V	Full	0.5	3.0	8.5	
Output Skew Time	$t_{SK(O)}$	V_{CC} = 3.3V ± 0.3V		Full		0.3	1.5	ns
Power Dissipation Capacitance (3)	C_{PD}	Outputs enabled, f = 10MHz	V_{CC} = 1.8V	+25℃		12		pF
			V_{CC} = 2.5V	+25℃		13		
			V_{CC} = 3.3V	+25℃		13		
		Outputs disabled, f = 10MHz	V_{CC} = 1.8V	+25℃		1		
			V_{CC} = 2.5V	+25℃		1		
			V_{CC} = 3.3V	+25℃		1		

NOTES:

1. Specified by design and characterization, not production tested.

2. t_{PD} is the same as t_{PLH} and t_{PHL}. t_{DIS} is the same as t_{PLZ} and t_{PHZ}. t_{EN} is the same as t_{PZL} and t_{PZH}.

3. C_{PD} is used to determine the dynamic power dissipation (P_D 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_i = Input frequency in MHz.

   f_o = Output frequency in MHz.

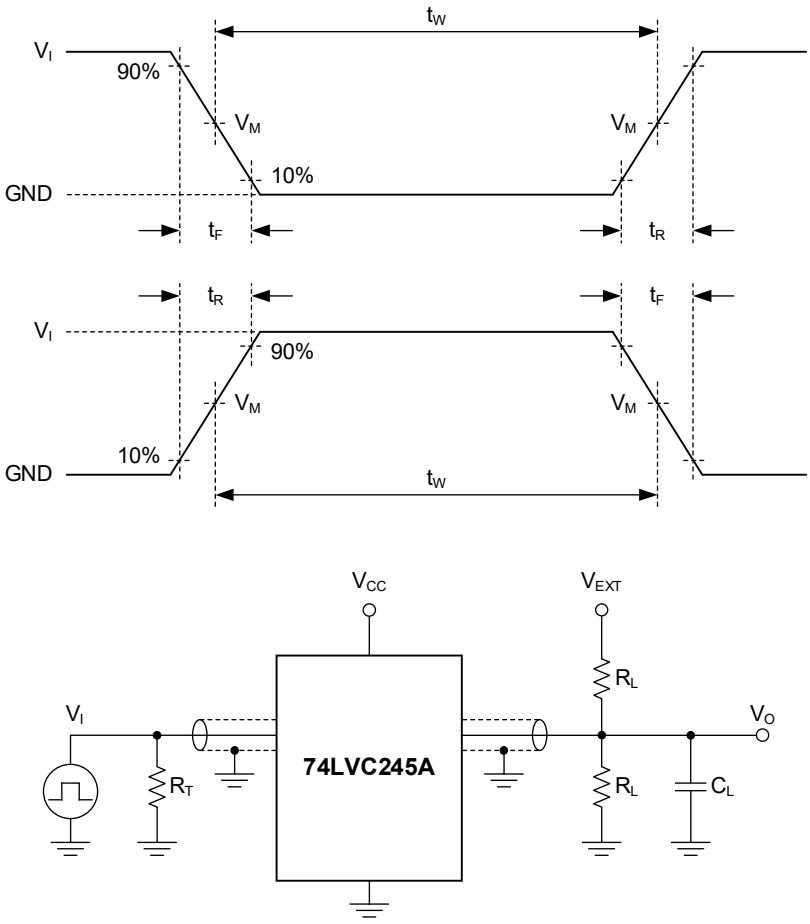
   C_L = Output load capacitance in pF.

   V_{CC} = Supply voltage in Volts.

   N = Number of inputs switching.

   $\Sigma(C_L \times V_{CC}^2 \times f_o)$ = Sum of 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).

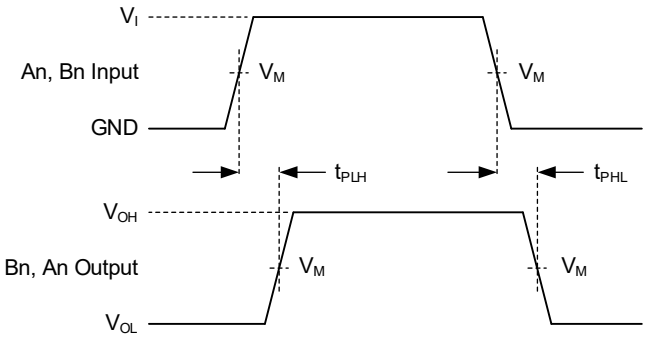
V_{EXT}: External voltage is used to measure switching time.

Figure 1. Test Circuit for Measuring Switching Times

Table 1. Test Conditions

SUPPLY VOLTAGE	INPUT		LOAD		V_{EXT}		
V_{CC}	V_I	t_R, t_F	C_L	R_L	t_{PLH}, t_{PHL}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
1.8V ± 0.15V	V_{CC}	≤ 2.0ns	30pF	1kΩ	Open	GND	2 × V_{CC}
2.5V ± 0.2V	V_{CC}	≤ 2.0ns	30pF	500Ω	Open	GND	2 × V_{CC}
2.7V	2.7V	≤ 2.5ns	50pF	500Ω	Open	GND	2 × V_{CC}
3.3V ± 0.3V	2.7V	≤ 2.5ns	50pF	500Ω	Open	GND	2 × V_{CC}

WAVEFORMS

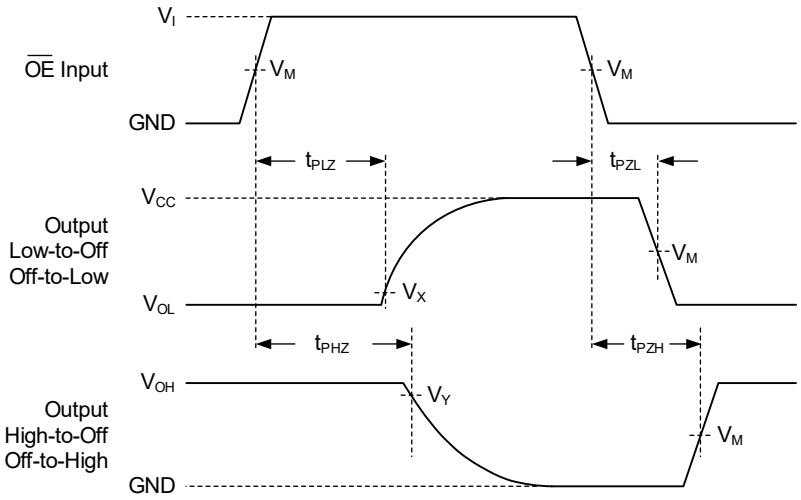


Test conditions are given in Table 1.

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		OUTPUT		
V_{CC}	V_I	V_M (1)	V_M	V_X	V_Y
1.8V ± 0.15V	V_{CC}	0.5 × V_{CC}	0.5 × V_{CC}	V_{OL} + 0.15V	V_{OH} - 0.15V
2.5V ± 0.2V	V_{CC}	0.5 × V_{CC}	0.5 × V_{CC}	V_{OL} + 0.15V	V_{OH} - 0.15V
2.7V	2.7V	1.5V	1.5V	V_{OL} + 0.3V	V_{OH} - 0.3V
3.3V ± 0.3V	2.7V	1.5V	1.5V	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 2.5ns.

REVISION HISTORY

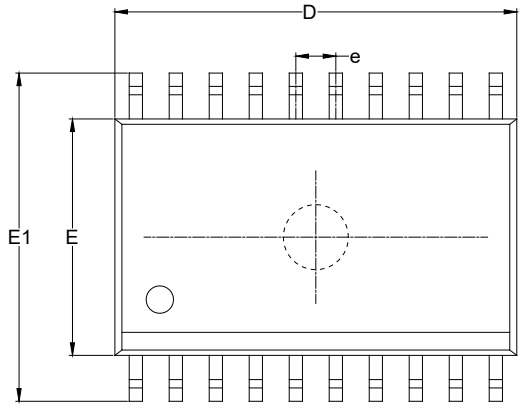
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

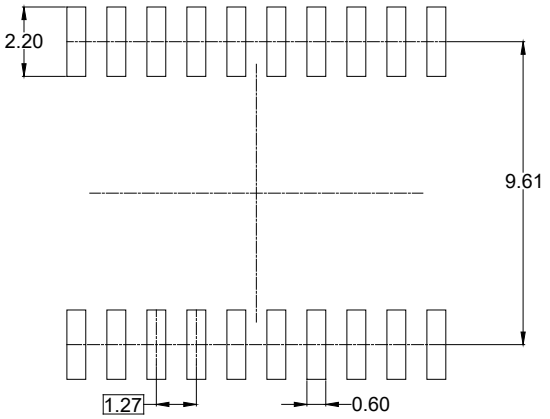
SEPTEMBER 2024 – REV.A to REV.A.1	Page
Updated GENERAL DESCRIPTION section	1
Updated RECOMMENDED OPERATING CONDITIONS section	2
Added SOIC-20 package	All

Changes from Original (JUNE 2023) to REV.A	Page
Changed from product preview to production data	All

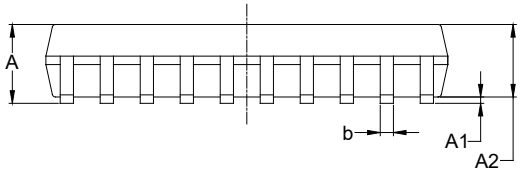
PACKAGE OUTLINE DIMENSIONS

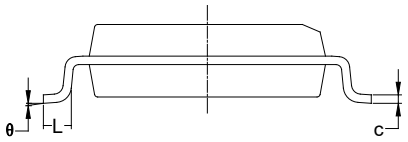
SOIC-20





RECOMMENDED LAND PATTERN (Unit: mm)



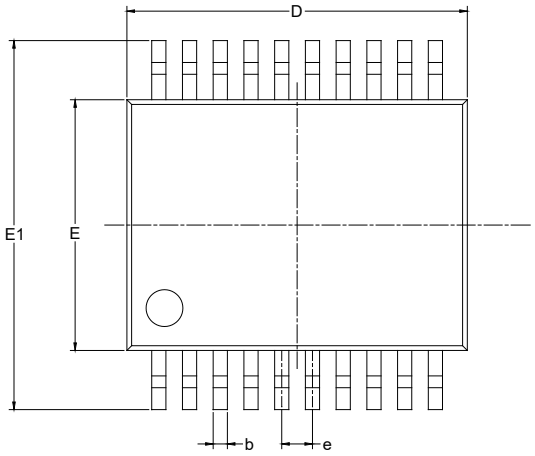


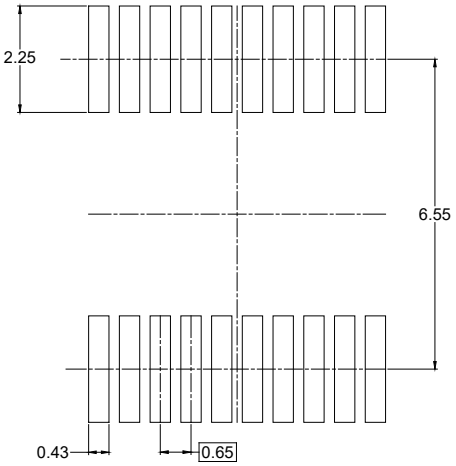
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	2.350	2.650	0.093	0.104
A1	0.100	0.300	0.004	0.012
A2	2.100	2.500	0.083	0.098
b	0.330	0.510	0.013	0.020
c	0.204	0.330	0.008	0.013
D	12.520	13.000	0.493	0.512
E	7.400	7.600	0.291	0.299
E1	10.210	10.610	0.402	0.418
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

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

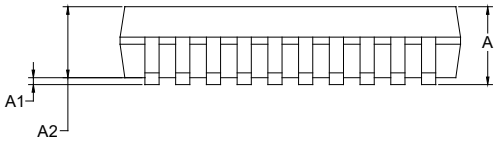
PACKAGE OUTLINE DIMENSIONS

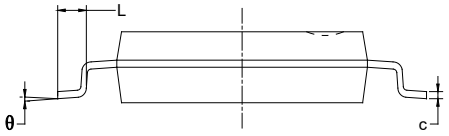
SSOP-20





RECOMMENDED LAND PATTERN (Unit: mm)



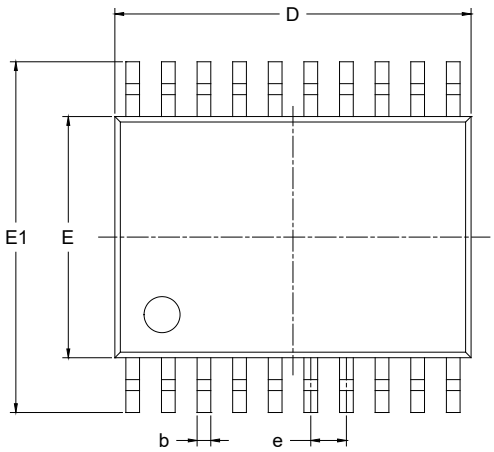


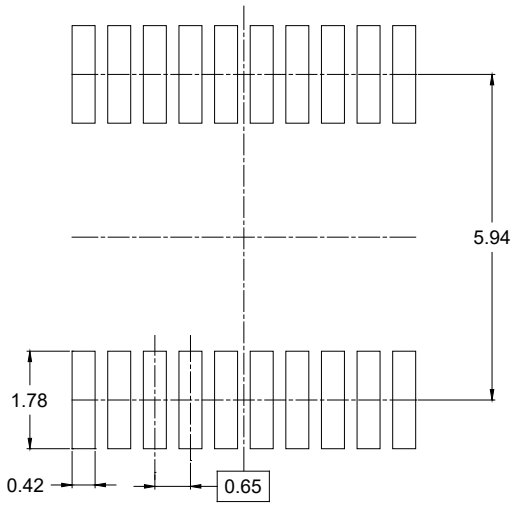
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.730		0.068
A1	0.050	0.230	0.002	0.009
A2	1.400	1.600	0.055	0.063
b	0.220	0.380	0.009	0.015
c	0.090	0.250	0.004	0.010
D	7.000	7.400	0.276	0.291
E	5.100	5.500	0.201	0.217
E1	7.600	8.000	0.299	0.315
e	0.65 BSC		0.026 BSC	
L	0.550	0.950	0.022	0.037
θ	0°	8°	0°	8°

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

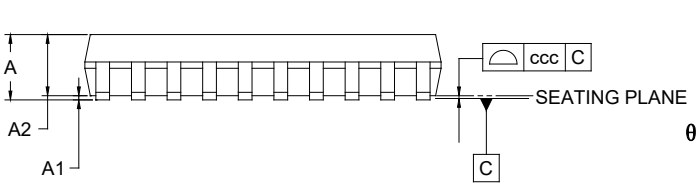
PACKAGE OUTLINE DIMENSIONS

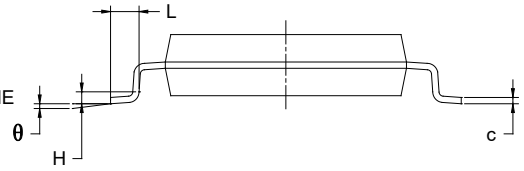
TSSOP-20





RECOMMENDED LAND PATTERN (Unit: mm)



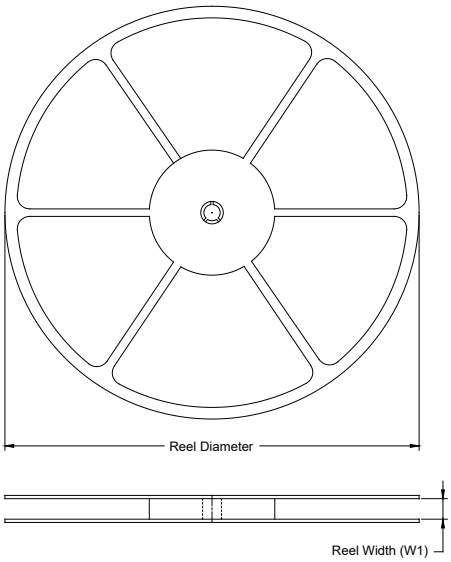


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.200
A1	0.050	-	0.150
A2	0.800	-	1.050
b	0.190	-	0.300
c	0.090	-	0.200
D	6.400	-	6.600
E	4.300	-	4.500
E1	6.200	-	6.600
e	0.650 BSC		
L	0.450	-	0.750
H	0.250 TYP		
θ	0°	-	8°
ccc	0.100		

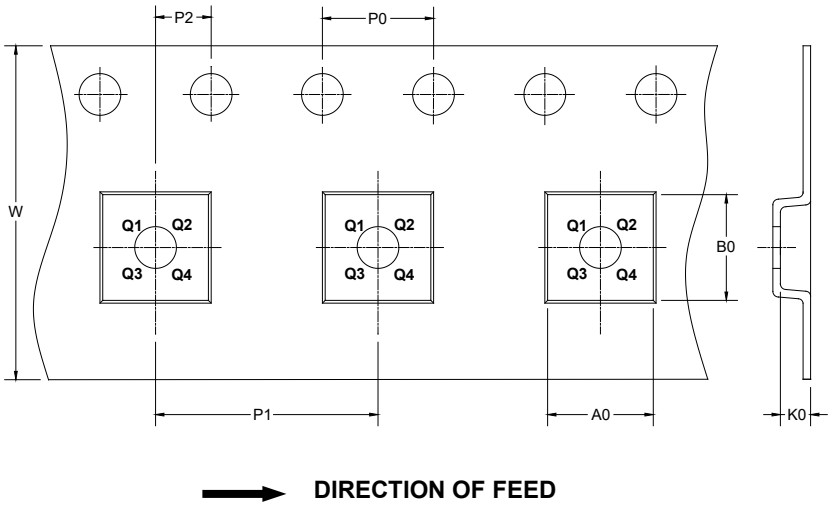
NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.
3. Reference JEDEC MO-153.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



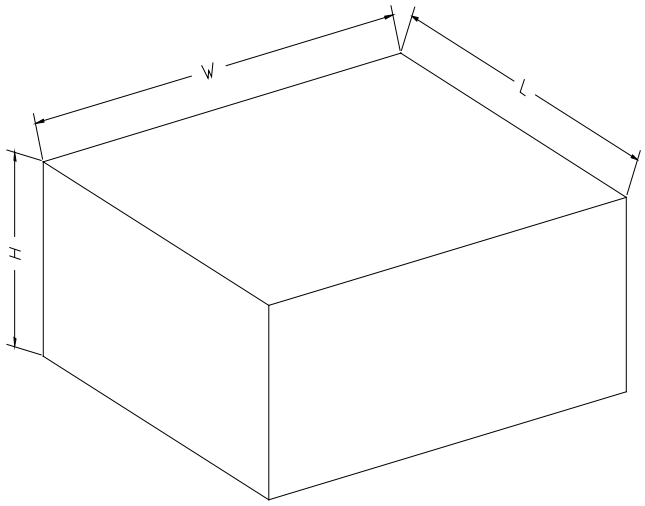
NOTE: The picture is only for reference. Please make the object as the standard.

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
SOIC-20	13″	24.4	10.90	13.30	3.00	4.0	12.0	2.0	24.0	Q1
SSOP-20	13″	16.4	8.40	7.75	2.50	4.0	12.0	2.0	16.0	Q1
TSSOP-20	13″	16.4	6.80	6.90	1.50	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