# AOS SEMICONDUCTOR

## 产品规格说明书

Product Data Sheet

## AOS273xx

WEB | www.aossemi.cn

电源管理IC  通信接口芯片  二三极管  LDO稳压器  逻辑器件

MOSFETs  运算放大器  显示驱动  MCU单片机  光电器件

## 8-Bit Octal D-Type Flip-Flops With Clear

## DESCRIPTIONS

The AOS273 devices are positive-edge-triggered D-type flip-flops with a direct active low clear ¬(CLR) input.

Information at the data (D) inputs meeting the setup time requirements is transferred to the Q outputs on the positive-going edge of the clock (CLK) pulse. Clock triggering occurs at a particular voltage level and is not related directly to the transition time of the positive-going pulse. When CLK is at either the high or low level, the D input has no effect at the output.

## FEATURES

Wide Operating Voltage Range of 1.65V to 5.5V
Outputs Can Drive Up to 10 LSTTL Loads
Low Power Consumption: 8μA(Max)
±4mA Output Drive at 4.5V
Low Input Current of 1μA Maximum
Contain Eight Flip-Flops with Single-Rail Outputs
Direct Clear Input
Individual Data Input to Each Flip-Flop
Micro Size Packages: TSSOP20, SOP20

## APPLICATIONS

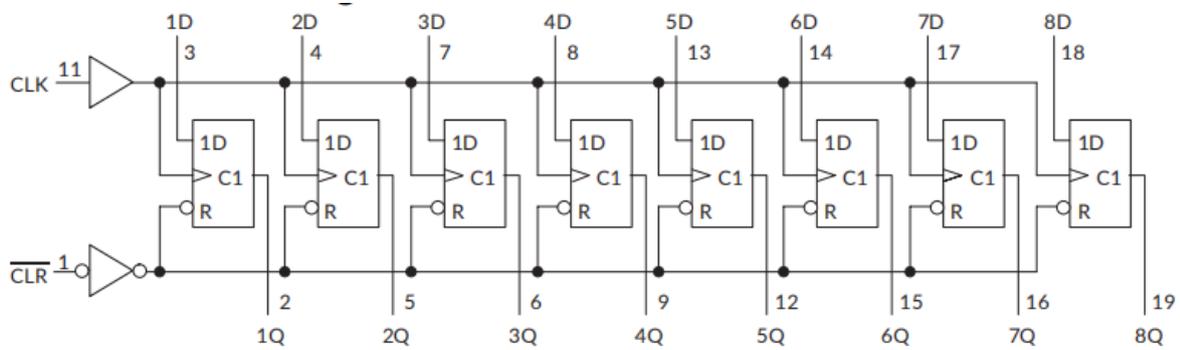Buffer or Storage Registers
Shift Registers
Pattern Generators

### Device Information [1]

| PARTNUMBER | PACKAGE | BODY SIZE (NOM) |
|---|---|---|
| AOS273 | TSSOP20 | 6.50mm×4.40mm |
| | SOP20 | 12.80mm×7.50mm |

(1)For all available packages, see the orderable addendum at the end of the data sheet.

## Functional Block Diagram



## Functional Table

| INPUTS | | | OUTPUT |
|---|---|---|---|
| ¬ CLR | CLK | D | Q |
| L | X | X | L |
| H |  | H | H |
| H |  | L | L |
| H | L | X | Qo |

NOTE:
H=High voltage level
L=Low voltage level
X=don't care

## PACKAGE/ORDERING INFORMATION

| PRODUCT | ORDERING NUMBER | TEMPERATURE RANGE | PACKAGE LEAD | PACKAGE MARKING[2] | MSL[3] | PACKAGE OPTION |
|---------|-----------------|-------------------|--------------|----------------------|--------|----------------|
| AOS273 | AOS273XTSS20 | -40℃~+125℃ | TSSOP20 | AOS273 | MSL3 | Tape and Reel,4000 |
|  | AOS273XS20 | -40℃~+125℃ | SOP20 | AOS273 | MSL3 | Tape and Reel,1500 |

NOTE:
(1) This information is the most current data available for the designated devices. This data is subject to change without noticeand revision of this document. For browser-based versions of this data sheet, refer to the right-hand navigation.
(2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.
(3) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

## PIN CONFIGURATIONS

**(TOP VIEW)**

```
        CLR  1  ●           20  Vcc
        1Q   2               19  8Q
        1D   3               18  8D
        2D   4               17  7D
        2Q   5               16  7Q
        3Q   6               15  6Q
        3D   7               14  6D
        4D   8               13  5D
        4Q   9               12  5Q
        GND  10              11  CLK
```
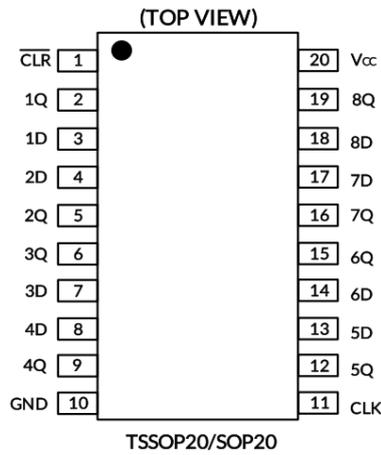
TSSOP20/SOP20

## PIN DESCRIPTION

| PIN TSSOP20/SOP20 | NAME | I/O TYPE[1] | FUNCTION |
|---|---|---|---|
| 1 | ¬ CLR | I | Active low clear input |
| 2 | 1Q | O | Output 1 |
| 3 | 1D | I | Input1 |
| 4 | 2D | I | Input 2 |
| 5 | 2Q | O | Output 2 |
| 6 | 3Q | O | Output 3 |
| 7 | 3D | I | Input 3 |
| 8 | 4D | I | Input 4 |
| 9 | 4Q | O | Output 4 |
| 10 | GND | - | Ground |
| 11 | CLK | I | Clock input |
| 12 | 5Q | O | Output 5 |
| 13 | 5D | I | Input 5 |
| 14 | 6D | I | Input 6 |
| 15 | 6Q | O | Output 6 |
| 16 | 7Q | O | Output 7 |
| 17 | 7D | I | Input 7 |
| 18 | 8D | I | Input 8 |
| 19 | 8Q | O | Output 8 |
| 20 | Vcc | P | Power |

(1) I=input, O=output, P=power.

## SPECIFICATIONS
## Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted)[1]

| SYMBOL | PARAMETER | CONDITION | MIN | MAX | UNIT |
|--------|-----------|-----------|-----|-----|------|
| $V_{CC}$ | Supply Voltage | | -0.5 | 6.5 | V |
| $I_{IK}$ | Input Clamp Current[2] | $V_I < 0$ or $V_I > V_{CC}$ | | ± 20 | mA |
| $I_{OK}$ | Output Clamp Current[2] | $V_O < 0$ or $V_O > V_{CC}$ | | ± 20 | mA |
| $I_O$ | Continuous Output Current | $V_O = 0V$ to $V_{CC}$ | | ± 25 | mA |
| | Continuous current through $V_{CC}$ or GND | | | 50 | mA |
| JA | Package thermal impedance [3] | TSSOP20 | | 40 | ℃/W |
| | | SOP20 | | 40 | |
| $T_J$ | Junction Temperature [4] | | -40 | 150 | ℃ |
| $T_{stg}$ | Storage Temperature | | -65 | 150 | |

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.

(3) The package thermal impedance is calculated in accordance with JESD-51.

(4) The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{JA}$, and $T_A$. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(MAX)} - T_A) / R_{JA}$. All numbers apply for packages soldered directly onto a PCB.

## ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

| | | | VALUE | UNIT |
|---|---|---|---|---|
| $V_{(ESD)}$ | Electrostatic discharge | Human-body model (HBM), MIL-STD-883K METHOD 3015.9 | ± 2000 | V |
| | | Charged-device model (CDM), ANSI/ESDA/JEDEC JS-002-2018 | ± 1000 | |
| | | Machine Model (MM), JESD22-A115C (2010) | ± 200 | |

ESD SENSITIVITY CAUTION

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.

## ELECTRICAL CHARACTERISTICS

over recommended operating free-air temperature range (TYP values are at TA= +25℃, Full=-40℃ to 125℃, unless otherwise noted.)[1]

## Recommended Operating Conditions

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | Operating | 1.65 | 5.5 | |
| High-level input voltage | $V_{IH}$ | $V_{CC}$=1.65V | 1.15 | | |
| | | $V_{CC}$=4.5V | 3.2 | | |
| | | $V_{CC}$=5.5V | 3.85 | | |
| Low-level input voltage | $V_{IL}$ | $V_{CC}$=1.65V | | 0.5 | V |
| | | $V_{CC}$=4.5V | | 1.3 | |
| | | $V_{CC}$=5.5V | | 1.65 | |
| Input voltage | $V_I$ | | 0 | $V_{CC}$ | |
| Output voltage | $V_O$ | | 0 | $V_{CC}$ | |
| Input transition rise or fall rate | t/ V | $V_{CC}$=1.65V | | 30 | ns/V |
| | | $V_{CC}$=4.5V | | 10 | |
| | | $V_{CC}$=5.5V | | 5 | |
| Operating temperature | $T_A$ | | -40 | 125 | ℃ |

## DC Characteristics

| PARAMETER | | TEST CONDITIONS | $V_{CC}$ | TEMP | MIN[2] | TYP[3] | MAX[2] | UNIT |
|---|---|---|---|---|---|---|---|---|
| $V_{OH}$ | | $I_{OH}$ = − 20μA | 1.65 V | Full | $V_{CC}$-0.1 | | | V |
| | | | 4.5 V | | $V_{CC}$-0.1 | | | |
| | | | 5.5 V | | $V_{CC}$-0.1 | | | |
| | | $I_{OH}$ = − 4mA | 4.5 V | | 4 | | | |
| | | $I_{OH}$ = − 5.2mA | 5.5 V | | 5 | | | |
| $V_{OL}$ | | $I_{OL}$= 20μA | 1.65 V | Full | | | 0.1 | V |
| | | | 4.5 V | | | | 0.1 | |
| | | | 5.5 V | | | | 0.1 | |
| | | $I_{OL}$= 4mA | 4.5 V | | | | 0.5 | |
| | | $I_{OL}$= 5.2mA | 5.5 V | | | | 0.5 | |
| $I_I$ | All inputs | $V_I$=5.5V or GND | 5.5V | 25℃ | | ± 0.1 | ± 1 | μA |
| | | | | Full | | | ± 10 | |
| | $I_{CC}$ | $V_I$=5.5V or GND, $I_O$=0 | 5.5V | 25℃ | | 0.1 | 8 | μA |
| | | | | Full | | | 80 | |
| | $C_i$ | f=1MHz | 1.65V to 5.5V | 25℃ | | 3.2 | | pF |

(1)All unused inputs of the device must be held at VCC or GND to ensure proper device operation.

(2)Limits are 100% production tested at 25° C. Limits over the operating temperature range are ensured through correlations usingstatistical quality control (SQC) method.

(3)Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical valuesmay vary over time and will also depend on the application and configuration.

## Electrical Characteristics

over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | | FROM (INPUT) | TO (OUTPUT) | Vcc | TA=25℃ | | | TA=-40℃ to 125℃ | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | MIN | MAX | |
| $t_w$ | pulse width | CLK | | 1.65 | | 17.5 | | 140 | | ns |
| | | | | 4.5 | | 14 | | 120 | | |
| | | | | 5 | | 5 | | 24 | | |
| | | | | 5.5 | | 4 | | 20 | | |
| $t_{su}$ | set-up time | nD | CLK | 1.65 | | -7 | | 10.5 | | ns |
| | | | | 4.5 | | -2 | | 7.5 | | |
| | | | | 5 | | -2 | | 7.5 | | |
| | | | | 5.5 | | -1 | | 7.5 | | |
| $t_h$ | hold time | nD | CLK | 1.65 | | -8 | | 52.5 | | ns |
| | | | | 4.5 | | -3 | | 22.5 | | |
| | | | | 5 | | -2 | | 12 | | |
| | | | | 5.5 | | -1 | | 10.5 | | |

(1)This parameter is ensured by design and/or characterization and is not tested in production.

## Switching Characteristics

over recommended operating free-air temperature range,$C_L$=50pF (unless otherwise noted)[1]

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC}$ | $T_A$=25℃ | | | $T_A$=-40℃ to 125℃ | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | MAX | |
| $f_{max}$ maximum frequency | CLK | | 1.65 | | 12 | | 2 | | MHz |
| | | | 4.5 | | 32 | | 16 | | |
| | | | 5 | | 50 | | 25 | | |
| | | | 5.5 | | 55 | | 27 | | |
| $t_{pd}$ | CLK | nQ | 1.65 | | 31 | | | 52.7 | ns |
| | | | 4.5 | | 8.4 | | | 14.28 | |
| | | | 5 | | 8 | | | 13.6 | |
| | | | 5.5 | | 7.5 | | | 12.75 | |
| $t_{PHL}$ | ¬ CLR | nQ | 1.65 | | 8 | | | 13.6 | ns |
| | | | 4.5 | | 2 | | | 3.4 | |
| | | | 5 | | 1.9 | | | 3.23 | |
| | | | 5.5 | | 1.8 | | | 3.06 | |
| $t_{rec}$ | ¬ CLR | nQ | 1.65 | | -7.5 | | | 37 | ns |
| | | | 4.5 | | -1.5 | | | 19 | |
| | | | 5 | | -1.4 | | | 14.5 | |
| | | | 5.5 | | -1.3 | | | 14 | |
| $t_t$ | | nQ | 1.65 | | 14.5 | | | 45 | ns |
| | | | 4.5 | | 5.5 | | | 22 | |
| | | | 5 | | 5.2 | | | 15 | |
| | | | 5.5 | | 5 | | | 15 | |

(1)This parameter is ensured by design and/or characterization and is not tested in production.

## Operating Characteristics

TA= 25℃

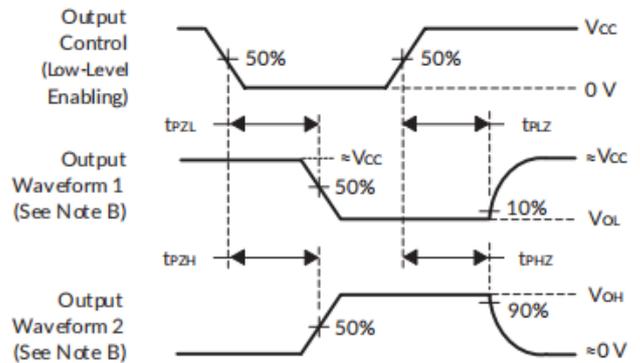| PARAMETER | | TEST CONDITIONS | TYP | UNIT |
|---|---|---|---|---|
| $C_{pd}$ | Power dissipation capacitance per package | $V_I$= GND to $V_{CC}$ | 28 | pF |

## Parameter Measurement Information



**LOAD CIRCUIT**
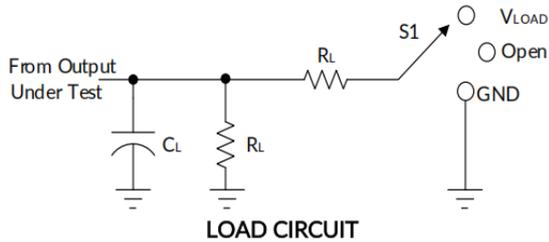
| TEST | S1 |
|---|---|
| $t_{pd}$ | Open |
| $t_{PLZ}/t_{PZL}$ | $V_{LOAD}$ |
| $t_{PHZ}/t_{PZH}$ | GND |

| $V_{CC}$ | $V_I$ | $V_M$ | $C_L$ | $R_L$ | $V_{TP}$ |
|---|---|---|---|---|---|
| $1.8V \pm 0.15V$ | $V_{CC}$ | $V_{CC}/2$ | 50pF | 1k | 0.15V |
| $2.5V \pm 0.2V$ | $V_{CC}$ | $V_{CC}/2$ | 50pF | 1k | 0.15V |
| $3.3V \pm 0.3V$ | $V_{CC}$ | $V_{CC}/2$ | 50pF | 1k | 0.3V |
| $5V \pm 0.5V$ | $V_{CC}$ | $V_{CC}/2$ | 50pF | 1k | 0.3V |



VOLTAGE WAVEFORMS
PULSE DURATIONS



VOLTAGE WAVEFORMS
SETUP AND HOLD AND INPUT RISE AND FALL TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY AND OUTPUT TRANSITION TIMES



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES FOR 3-STATE OUTPUTS
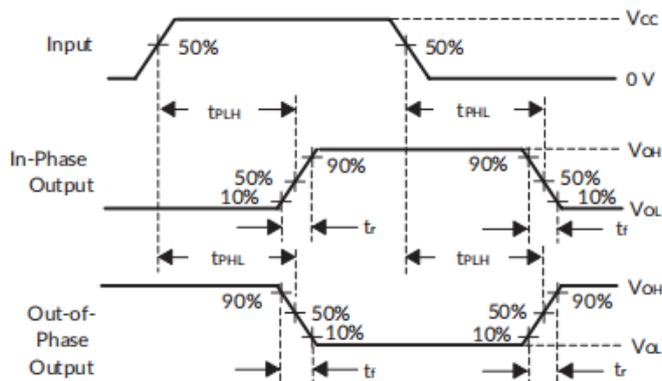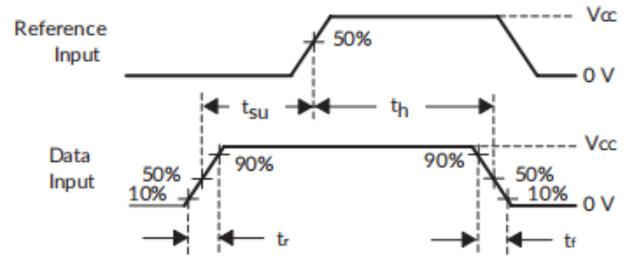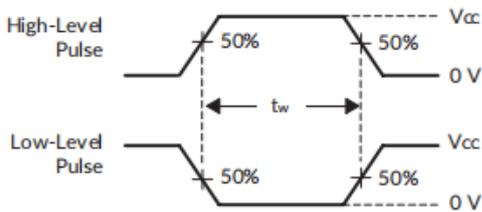
NOTES:
A. $C_L$ includes probe and test-fixture capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
C. Phaserelationshipsbetweenwaveformswerechosenarbitrarily.All input pulses are supplied by generators having the following characteristics: PRR $\leqslant$ 1 MHz, $Z_0$= 50 , $t_r$= 6 ns, $t_f$= 6 ns.
D. The outputs are measured one at a time with one input transition per measurement.
E. $t_{PLZ}$ and $t_{PHZ}$ are the same as $t_{dis}$.
F. $t_{PZL}$ and $t_{PZH}$ are the same as $t_{en}$.
G. $t_{PLH}$ and $t_{PHL}$ are the same as $t_{pd}$.

<div align="center">Figure 1. Load Circuit and Voltage Waveforms</div>

## PACKAGE OUTLINE DIMENSIONS
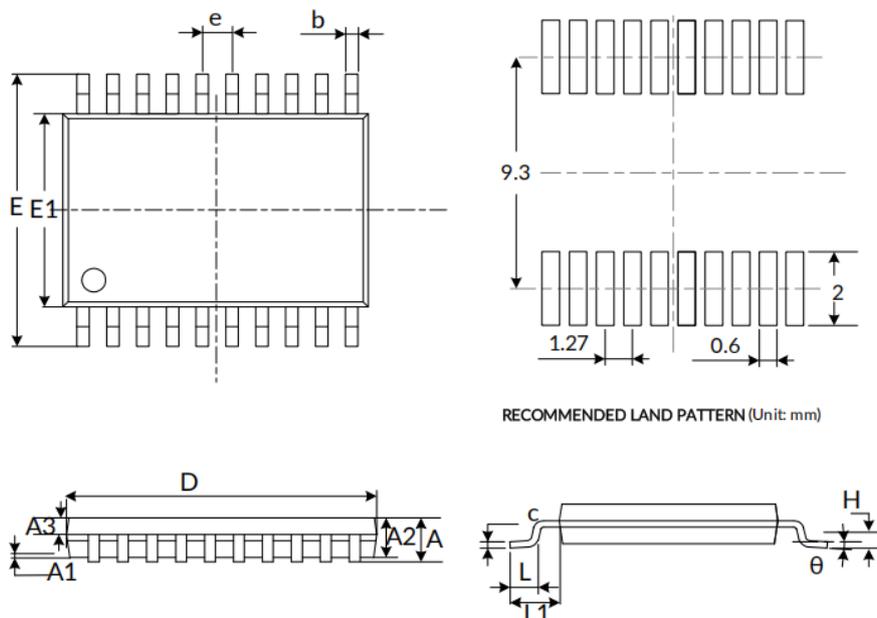## TSSOP20[4]
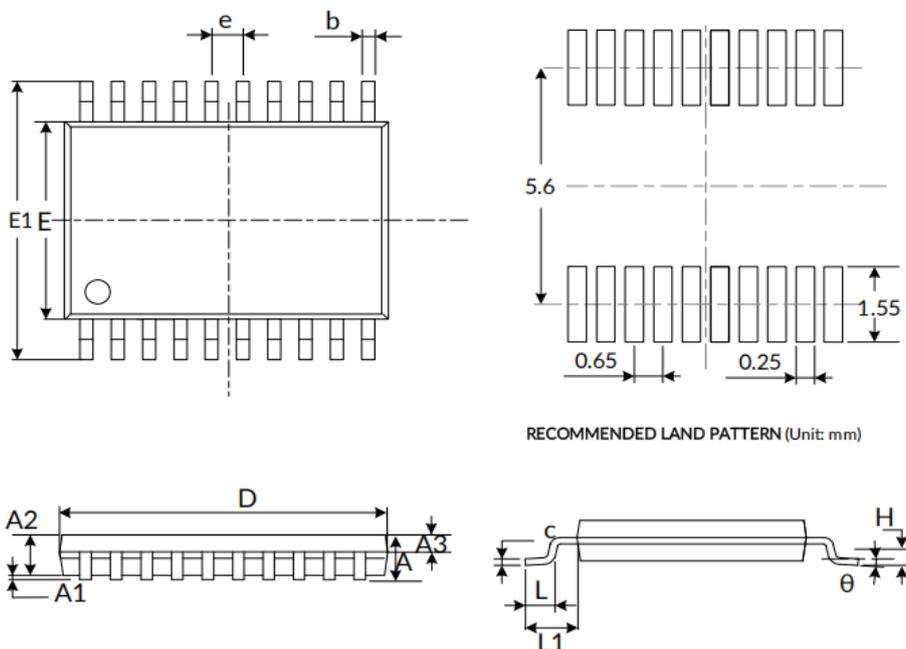


RECOMMENDED LAND PATTERN (Unit: mm)

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A[1] | | 1.200 | | 0.047 |
| A1 | 0.050 | 0.150 | 0.002 | 0.006 |
| A2 | 0.800 | 1.050 | 0.031 | 0.041 |
| A3 | 0.390 | 0.490 | 0.015 | 0.020 |
| b | 0.200 | 0.290 | 0.008 | 0.011 |
| c | 0.130 | 0.170 | 0.005 | 0.007 |
| D[1] | 6.400 | 6.600 | 0.252 | 0.260 |
| E[1] | 4.300 | 4.500 | 0.169 | 0.177 |
| E1 | 6.200 | 6.600 | 0.244 | 0.260 |
| e | 0.650(BSC)[2] | | 0.026(BSC)[2] | |
| L | 0.450 | 0.750 | 0.018 | 0.030 |
| H | 0.250(TYP) | | 0.010(TYP) | |
| | 0° | 8° | 0° | 8° |
| L1 | 1.000(REF)[3] | | 0.039(REF)[3] | |

NOTE:
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers),"Basic" spacing is nominal.
3. REF is the abbreviation for Reference.
4. This drawing is subject to change without notice.

SOP20[4]



RECOMMENDED LAND PATTERN (Unit: mm)

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A[1] | | 2.650 | | 0.104 |
| A1 | 0.100 | 0.300 | 0.004 | 0.012 |
| A2 | 2.250 | 2.350 | 0.089 | 0.093 |
| A3 | 0.970 | 1.070 | 0.038 | 0.042 |
| b | 0.390 | 0.470 | 0.015 | 0.019 |
| c | 0.250 | 0.290 | 0.010 | 0.011 |
| D[1] | 12.700 | 12.900 | 0.500 | 0.508 |
| E | 10.100 | 10.500 | 0.398 | 0.413 |
| E1[1] | 7.400 | 7.600 | 0.291 | 0.299 |
| e | 1.270(BSC)[2] | | 0.050(BSC)[2] | |
| L | 0.700 | 1.000 | 0.028 | 0.039 |
| H | 0.250(TYP) | | 0.010(TYP) | |
| θ | 0° | 8° | 0° | 8° |
| L1 | 1.400(REF)[3] | | 0.055(REF)[3] | |

NOTE:
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers),"Basic" spacing is nominal.
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4. This drawing is subject to change without notice.

## TAPE AND REEL INFORMATION

REEL DIMENSIONS                                              TAPE DIMENSION
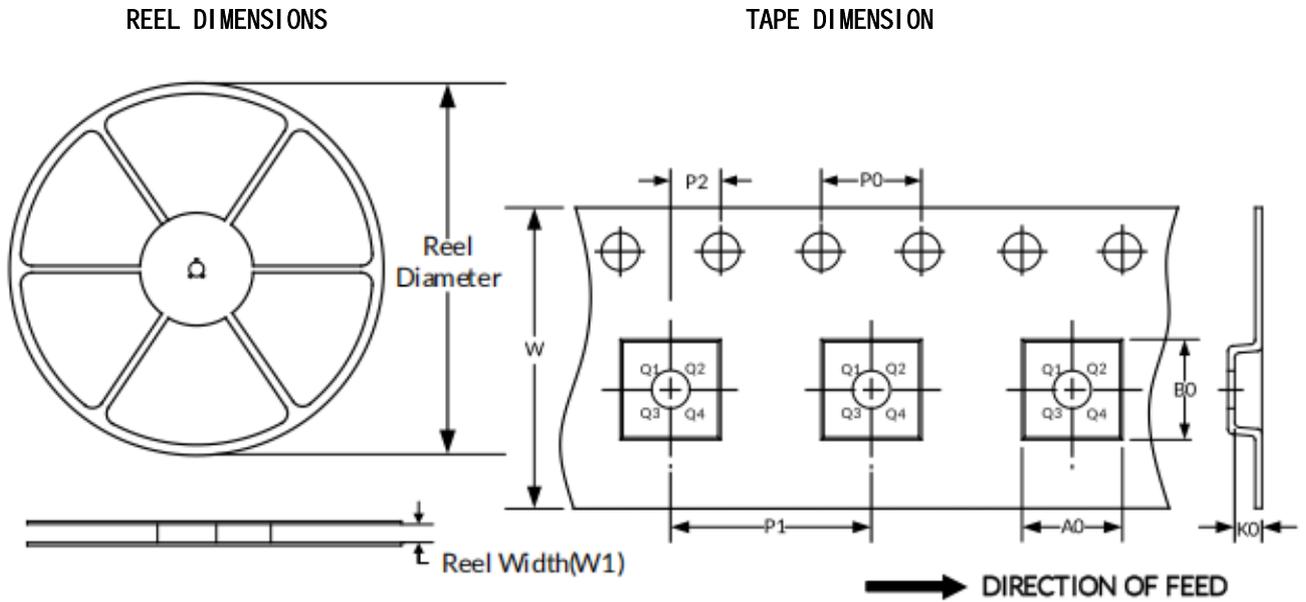


NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF TAPE AND REEL

| Package Type | Reel Diameter | Reel Width (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|
| TSSOP20 | 13'' | 12.4 | 6.75 | 6.95 | 1.20 | 4.0 | 8.0 | 2.0 | 16.0 | Q1 |
| SOP20 | 13'' | 24.4 | 10.75 | 13.55 | 2.65 | 4.0 | 12.0 | 2.0 | 24.0 | Q1 |

NOTE:

1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.