

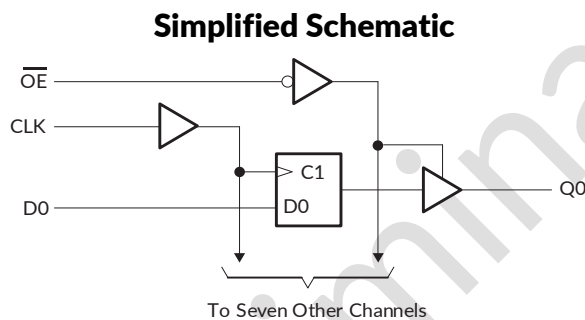
# Octal Edge-Triggered D-Type Flip-Flops With 3-State Outputs

## 1 FEATURES

- **Operating Voltage Range: 4.5V to 5.5V**
- **Low Power Consumption: 40 $\mu$ A (Max)**
- **Inputs are TTL-Voltage Compatible**
- **Operating Temperature Range: -40 $^{\circ}$ C to 125 $^{\circ}$ C**
- **3-State Outputs Drive Bus Lines Directly**
- **Micro Size Packages: TSSOP20, SOP20**

## 2 APPLICATIONS

- **Power Sub-station controls**
- **Industrial**
- **Personal electronics**
- **Test and Measurement Solutions**
- **Patient Monitoring**



## 3 DESCRIPTIONS

The RS574T is high-speed octal D-type flip-flops featuring separate D-type inputs for each flip-flop and 3-state outputs for bus oriented applications. A clock (CLK) and an output enable ( $\overline{OE}$ ) input are common to all flip-flops.

The 8 flip-flops will store the state of their individual D-inputs that meet the set-up and hold times requirements on the low-to-high CLK transition. When  $\overline{OE}$  is low the contents of the 8 flip-flops are available at the outputs. When  $\overline{OE}$  is high, the outputs go to the high-impedance OFF-state. Operation of the  $\overline{OE}$  input does not affect the state of the flip-flops.

This device available in Green TSSOP20, SOP20 packages. It operates over an ambient temperature range of -40 $^{\circ}$ C to 125 $^{\circ}$ C.

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

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS574T	TSSOP20	6.50mm $\times$ 4.40mm
	SOP20	12.80mm $\times$ 7.50mm

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

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## 4 REVISION HISTORY

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

Version	Change Date	Change Item
A.0	2026/01/21	Preliminary version completed

Preliminary version

**5 PACKAGE/ORDERING INFORMATION <sup>(1)</sup>**

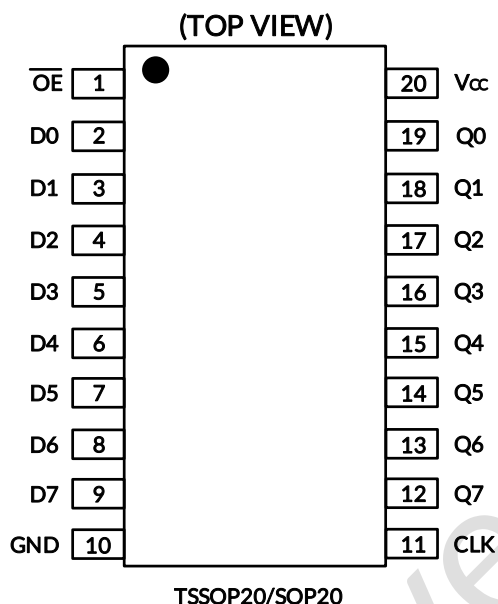
PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING <sup>(2)</sup>	MSL <sup>(3)</sup>	PACKAGE OPTION
RS574T	RS574TXS20	-40°C ~125°C	SOP20	RS574T	MSL3	Tape and Reel, 1500
	RS574TXTSS20	-40°C ~125°C	TSSOP20	RS574T	MSL3	Tape and Reel, 4000

**NOTE:**

- (1) This information is the most current data available for the designated devices. This data is subject to change without notice and 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) Runic classify the MSL level with using the common preconditioning setting in our assembly factory conforming to the JEDEC industrial standard J-STD-20F, Please align with Runic if your end application is quite critical to the preconditioning setting or if you have special requirement.

Preliminary version

## 6 PIN CONFIGURATIONS



### PIN DESCRIPTION

PIN	NAME	TYPE <sup>(1)</sup>	FUNCTION
TSSOP20/SOP20			
1	$\overline{OE}$	I	3-State output enable input
2	D0	I	Data input
3	D1	I	Data input
4	D2	I	Data input
5	D3	I	Data input
6	D4	I	Data input
7	D5	I	Data input
8	D6	I	Data input
9	D7	I	Data input
10	GND	G	Ground.
11	CLK	I	Clock input
12	Q7	O	Data output
13	Q6	O	Data output
14	Q5	O	Data output
15	Q4	O	Data output
16	Q3	O	Data output
17	Q2	O	Data output
18	Q1	O	Data output
19	Q0	O	Data output
20	V <sub>CC</sub>	P	Supply voltage

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

## 7 SPECIFICATIONS

### 7.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) <sup>(1) (2)</sup>

		MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage range	-0.5	6.5	V
V <sub>I</sub>	Input voltage range <sup>(2)</sup>	-0.5	6.5	V
V <sub>O</sub>	Output Voltage range <sup>(2)</sup>	-0.5	V <sub>CC</sub> +0.5	V
I <sub>IK</sub>	Input clamp current	V <sub>I</sub> <0	-20	mA
I <sub>OK</sub>	Output clamp current	V <sub>O</sub> < 0 or V <sub>O</sub> > V <sub>CC</sub>	±20	mA
I <sub>O</sub>	Continuous output current	V <sub>O</sub> = 0 to V <sub>CC</sub>	±25	mA
	Continuous current through V <sub>CC</sub> or GND		±75	mA
θ <sub>JA</sub>	Package thermal impedance <sup>(3)</sup>	SOP20	40	°C/W
		TSSOP20	40	
T <sub>J</sub>	Junction temperature <sup>(4)</sup>	-65	150	°C
T <sub>stg</sub>	Storage temperature	-65	150	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions is not implied. 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<sub>J(MAX)</sub>, R<sub>θJA</sub>, and T<sub>A</sub>. The maximum allowable power dissipation at any ambient temperature is P<sub>D</sub> = (T<sub>J(MAX)</sub> - T<sub>A</sub>) / R<sub>θJA</sub>. All numbers apply for packages soldered directly onto a PCB.

### 7.2 ESD Ratings

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

		VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge	Human-Body Model (HBM), MIL-STD-883K METHOD 3015.9	±2000
		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.

## 8 ELECTRICAL CHARACTERISTICS

over recommended operating free-air temperature range (TYP values are at  $T_A = +25^\circ\text{C}$ , Full= $-40^\circ\text{C}$  to  $125^\circ\text{C}$ , unless otherwise noted.)<sup>(1)</sup>

### 8.1 Recommended Operating Conditions

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
Supply voltage	$V_{CC}$		4.5	5.5	V
High-level input voltage	$V_{IH}$	$V_{CC}=4.5\text{V to }5.5\text{V}$	2		V
Low-level input voltage	$V_{IL}$	$V_{CC}=4.5\text{V to }5.5\text{V}$		0.8	V
Input voltage	$V_I$		0	5.5	V
Output voltage	$V_O$		0	$V_{CC}$	V
High-level output current	$I_{OH}$	$V_{CC}=4.5\text{V to }5.5\text{V}$		-16	mA
Low-level output current	$I_{OL}$	$V_{CC}=4.5\text{V to }5.5\text{V}$		16	mA
Input transition rise or fall rate	$\Delta t / \Delta v$	$V_{CC}=4.5\text{V to }5.5\text{V}$		20	ns/V
Operating temperature	$T_A$		-40	125	$^\circ\text{C}$

(1) All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation.

### 8.2 DC Characteristics

PARAMETER	TEST CONDITIONS	$V_{CC}$	TEMP	MIN <sup>(2)</sup>	TYP <sup>(3)</sup>	MAX <sup>(2)</sup>	UNIT
$V_{OH}$	$I_{OH} = -50\mu\text{A}$	4.5V to 5.5V	Full	$V_{CC}-0.1$			V
	$I_{OH} = -8\text{mA}$	4.5V		4.15			
	$I_{OH} = -16\text{mA}$	5.5V		5.1			
$V_{OL}$	$I_{OL} = 50\mu\text{A}$	4.5V to 5.5V	Full			0.1	V
	$I_{OL} = 8\text{mA}$	4.5V				0.2	
	$I_{OL} = 16\text{mA}$	5.5V				0.5	
$I_I$	$V_I=5.5\text{V or GND}$	0V to 5.5V	$+25^\circ\text{C}$			$\pm 1$	$\mu\text{A}$
			Full			$\pm 2$	
$I_{OZ}^{(4)}$	$V_O=V_{CC} \text{ or GND}$	5.5	$+25^\circ\text{C}$			$\pm 1$	$\mu\text{A}$
			Full			$\pm 2.5$	
$I_{CC}$	$V_I=V_{CC} \text{ or GND, } I_O=0$	5.5V	$+25^\circ\text{C}$			4	$\mu\text{A}$
			Full			40	
$C_i$ (Input Capacitance)	$V_I = V_{CC} \text{ or GND}$	5V	$+25^\circ\text{C}$		6		pF
$C_o$ (Output Capacitance)	$V_O = V_{CC} \text{ or GND}$	5V	$+25^\circ\text{C}$		6		pF

(1) All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation.

(2) Limits are 100% production tested at  $25^\circ\text{C}$ . Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.

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

(4) For input and output pins,  $I_{OZ}$  includes the input leakage current.

### 8.3 Timing Requirements

over recommended operating free-air temperature range (unless otherwise noted) <sup>(1)</sup>

SYMBOL	PARAMETER	TEMP	V <sub>CC</sub> =5V ± 0.5V		UNIT
			MIN	MAX	
t <sub>w</sub>	Pulse duration, CLK high or low	25°C	7		ns
		Full	7.5		
t <sub>su</sub>	Setup time, data before CLK↑	25°C	-4		ns
		Full	-4.5		
t <sub>h</sub>	Hold time, data after CLK↑	25°C	5		ns
		Full	5.5		

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

### 8.4 Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) <sup>(1)</sup>

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	TEMP	V <sub>CC</sub> =5V ± 0.5V			UNIT
					MIN	TYP	MAX	
t <sub>PLH</sub>	CLK	Q	C <sub>L</sub> = 15 pF	25°C		10		ns
				Full	5		18	
t <sub>PHL</sub>	CLK	Q	C <sub>L</sub> = 15 pF	25°C		10		ns
				Full	5		18	
t <sub>PZH</sub>	$\overline{OE}$	Q	C <sub>L</sub> = 15 pF	25°C		7		ns
				Full	3.5		14	
t <sub>PZL</sub>	$\overline{OE}$	Q	C <sub>L</sub> = 15 pF	25°C		6		ns
				Full	3		12	
t <sub>PHZ</sub>	$\overline{OE}$	Q	C <sub>L</sub> = 15 pF	25°C		8		ns
				Full	4		16	
t <sub>PLZ</sub>	$\overline{OE}$	Q	C <sub>L</sub> = 15 pF	25°C		7		ns
				Full	3.5		14	

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

### 8.5 Operating Characteristics

T<sub>A</sub> = +25°C

PARAMETER	TEST CONDITIONS	V <sub>CC</sub> = 5V	UNIT
		TYP	
C <sub>pd</sub> Power dissipation capacitance	No load, f = 1 MHz	20	pF

### 8.6 Typical Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

At  $T_A = +25^\circ\text{C}$ , unless otherwise noted.

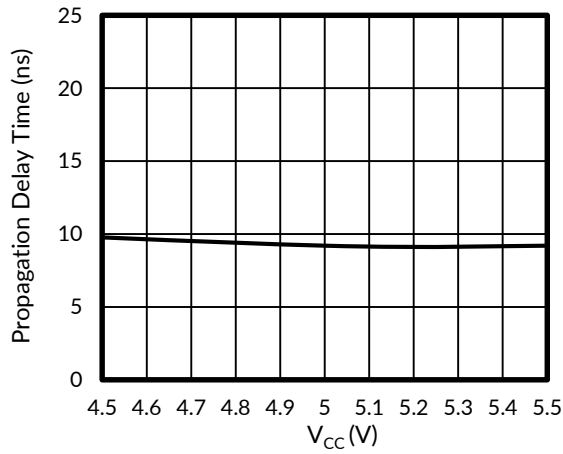


Figure 1.  $T_{PD}$  vs  $V_{CC}$

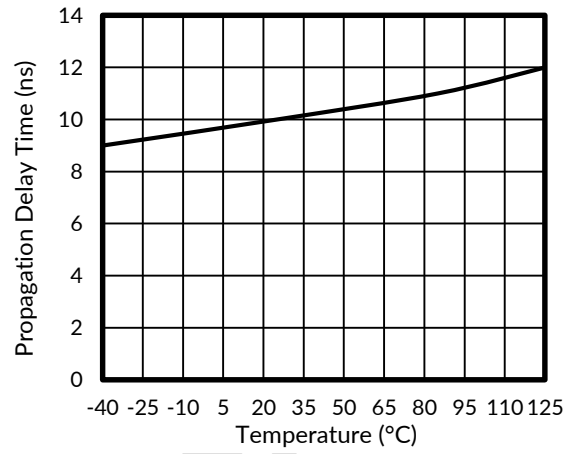
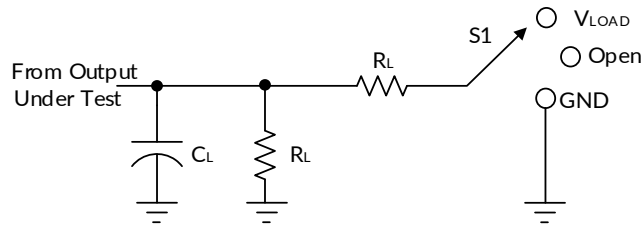


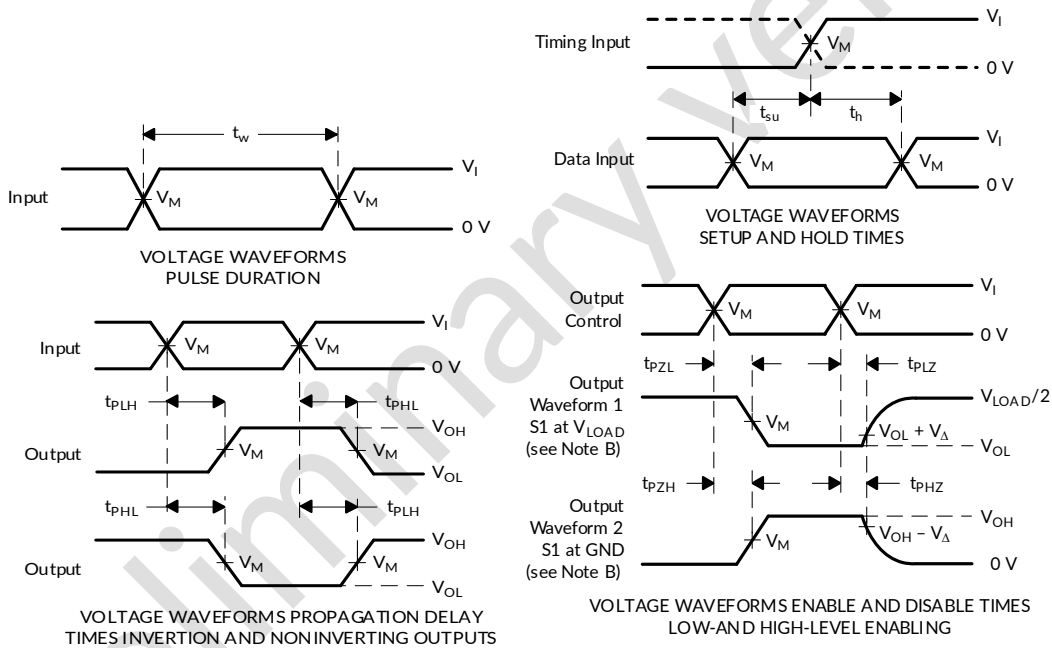
Figure 2.  $T_{PD}$  vs Temperature

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## 9 PARAMETER MEASUREMENT INFORMATION



TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$V_{LOAD}$
$t_{PHZ}/t_{PZH}$	GND



- NOTES: A.  $C_L$  includes probe and jig 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. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_o = 50\Omega$ .  
 D. The outputs are measured one at a time, with one 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  $t_{pd}$ .  
 H. All parameters and waveforms are not applicable to all devices.

**Figure 3. Load Circuit and Voltage Waveforms**

## 10 DETAILED DESCRIPTION

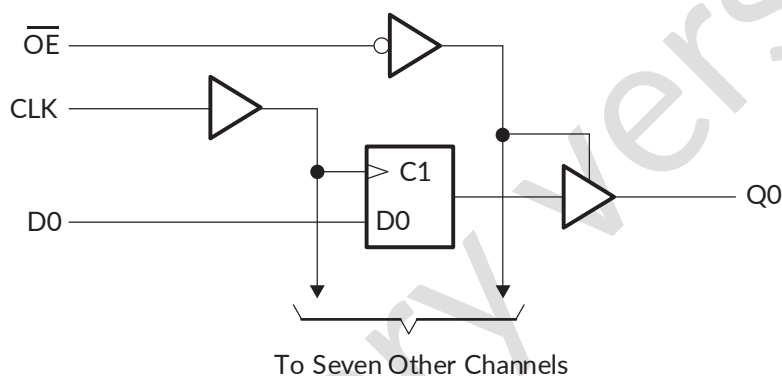
### 10.1 Overview

The RS574T devices are octal edge-triggered D-type flip-flops that feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. These devices are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

On the positive transition of the clock (CLK) input, the Q outputs are set to the logic levels of the data (D) inputs. The states of the Q outputs are not predictable until the first valid clock.

A buffered output-enable ( $\overline{OE}$ ) input can be used to place the eight outputs in either a normal logic state (high or low) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and the increased drive provide the capability to drive bus lines without interface or pull-up components.

### 10.2 Functional Block Diagram



### 10.3 Feature Description

- 5.5V tolerant input allows for 5 V to 3.3 V voltage translation
- Slow edges reduce output ringing

### 10.4 Device Functional Modes

**Table 1. Function Table (Each Flip-Flop)**

INPUT			OUTPUT
$\overline{OE}$	CLK	D	Q
L	↑	H	H
L	↑	L	L
L	H or L	X	$Q_0$
H	X	X	Z

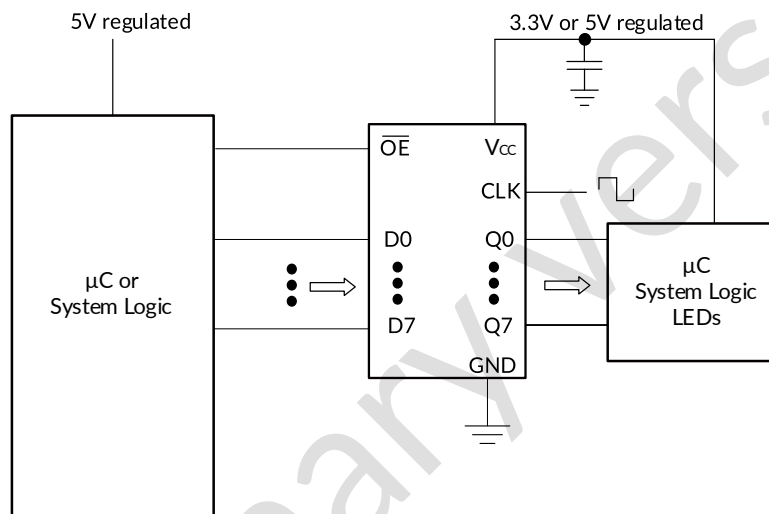
## 11 APPLICATION AND IMPLEMENTATION

Information in the following applications sections is not part of the Runic component specification, and Runic does not warrant its accuracy or completeness. Runic's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

### 11.1 Application Information

RS574T is a low-drive CMOS device that can be used for a multitude of bus interface type applications where output ringing is a concern. The low drive and slow edge rates will minimize overshoot and undershoot on the outputs. The inputs can accept voltages to 5.5 V at any valid  $V_{CC}$  making it Ideal for down translation.

### 11.2 Typical Application



**Figure 4. Typical Application Schematic**

### 11.3 Design Requirements

This device uses CMOS technology and has balanced output drive. Care should be taken to avoid bus contention because it can drive currents that would exceed maximum limits. Outputs can be combined to produce higher drive but the high drive will also create faster edges into light loads so routing and load conditions should be considered to prevent ringing.

## 12 POWER SUPPLY RECOMMENDATIONS

The power supply pin should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, a 0.1 $\mu$ F capacitor is recommended and if there are multiple  $V_{CC}$  terminals then 0.01 $\mu$ F or 0.022 $\mu$ F capacitors are recommended for each power terminal. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. The 0.1 $\mu$ F and 1 $\mu$ F capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible.

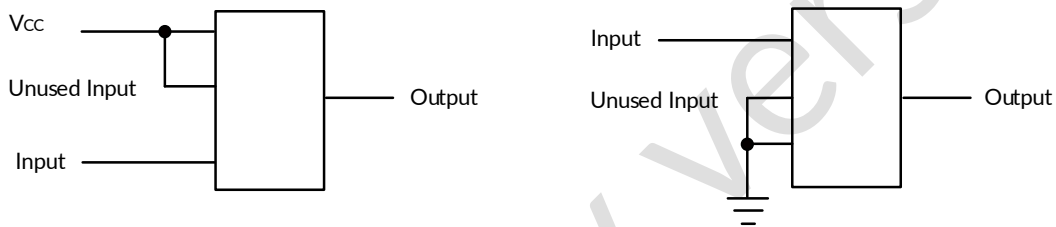
## 13 LAYOUT

### 13.1 Layout Guidelines

When using multiple bit logic devices, inputs should not float. In many cases, functions or parts of functions of digital logic devices are unused. Some examples are when only two inputs of a triple-input AND gate are used, or when only 3 of the 4-buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states.

Specified in Figure 5 are rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or  $V_{CC}$ , whichever makes more sense or is more convenient. It is acceptable to float outputs unless the part is a transceiver. If the transceiver has an output enable pin, it will disable the outputs section of the part when asserted. This will not disable the input section of the I/Os so they also cannot float when disabled.

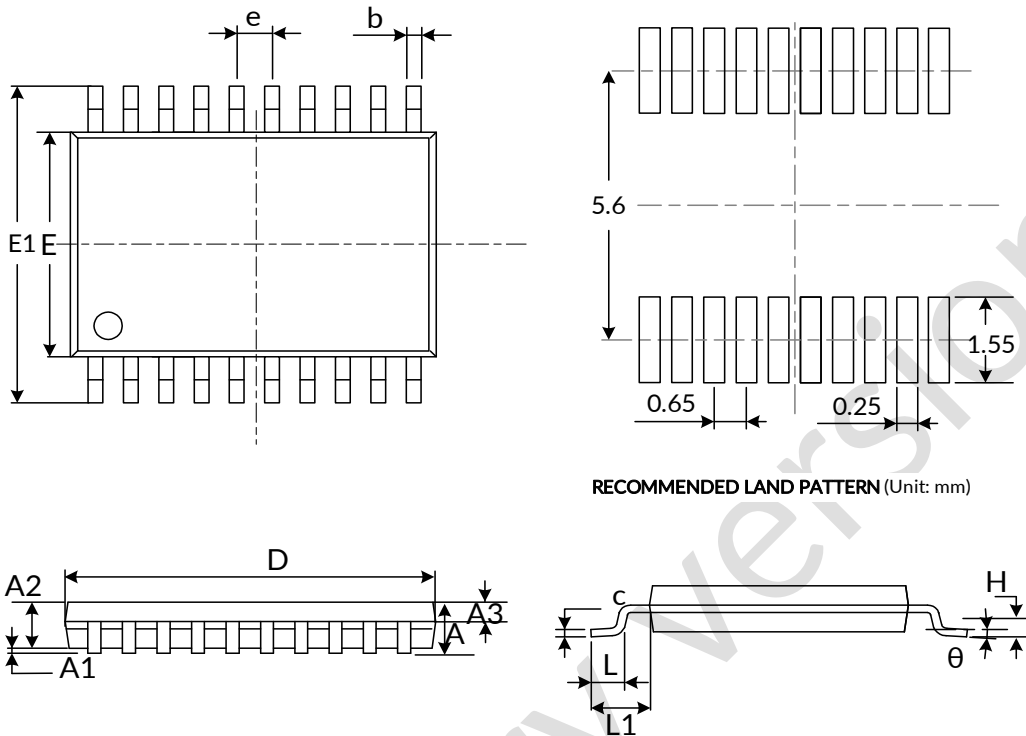
### 13.2 Layout Example



**Figure 5. Layout Diagram**

# 14 PACKAGE OUTLINE DIMENSIONS

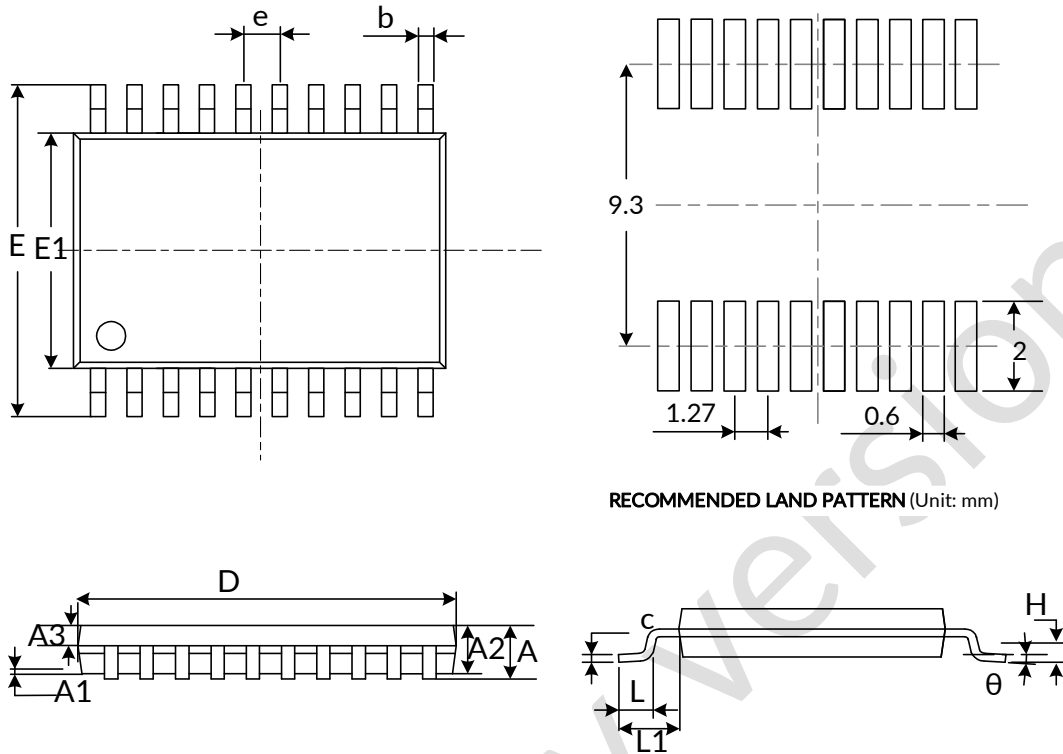
## TSSOP20<sup>(4)</sup>


**RECOMMENDED LAND PATTERN (Unit: mm)**

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A <sup>(1)</sup>		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 <sup>(1)</sup>	6.400	6.600	0.252	0.260
E <sup>(1)</sup>	4.300	4.500	0.169	0.177
E1	6.200	6.600	0.244	0.260
e	0.650(BSC) <sup>(2)</sup>		0.026(BSC) <sup>(2)</sup>	
L	0.450	0.750	0.018	0.030
H	0.250(TYP)		0.010(TYP)	
$\theta$	0°	8°	0°	8°
L1	1.00(REF) <sup>(3)</sup>		0.039(REF) <sup>(3)</sup>	

**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<sup>(4)</sup>**


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A <sup>(1)</sup>		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 <sup>(1)</sup>	12.700	12.900	0.500	0.508
E	10.100	10.500	0.398	0.413
E1 <sup>(1)</sup>	7.400	7.600	0.291	0.299
e	1.270(BSC) <sup>(2)</sup>		0.050(BSC) <sup>(2)</sup>	
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) <sup>(3)</sup>		0.055(REF) <sup>(3)</sup>	

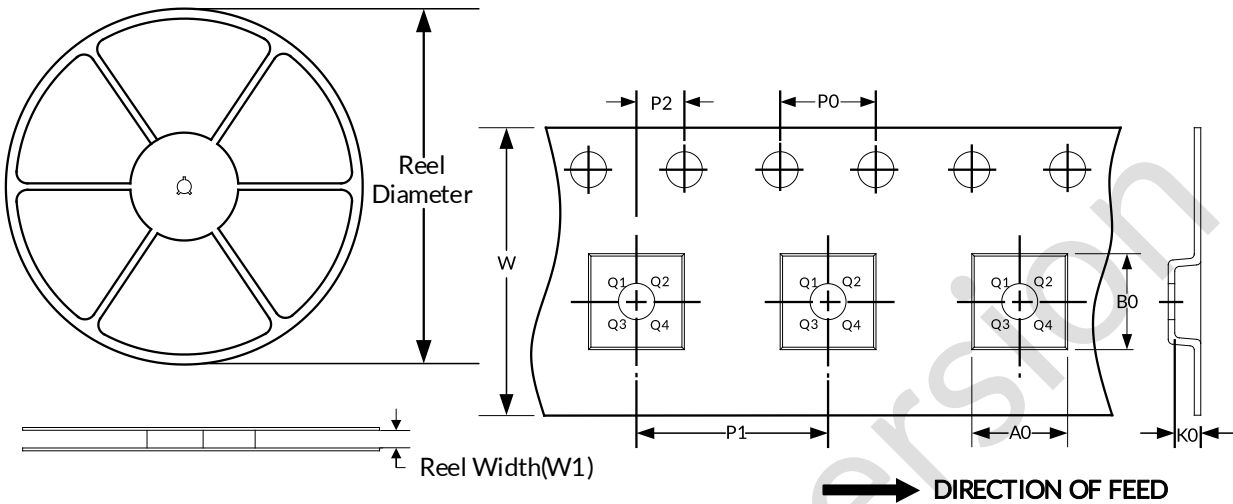
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4. This drawing is subject to change without notice.

# 15 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.

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