RS154 4-to-16 Line Decoder/Demultiplexer

1 FEATURES

- **Decodes 4 Binary-Coded Inputs Into 16 Mutually-Exclusive Outputs**
- **Operating Voltage Range: 1.65V to 5.5V**
- **Low Power**
- **Inputs Accept Voltage to 5.5V**
- **Operating Temperature Range: -40°C to +125°C**
- **PACKAGES: TSSOP24**

2 APPLICATIONS

- **Power Infrastructure**
- **Factory Automation**

3 DESCRIPTIONS

The RS154 is a 4-to-16 line decoder/demultiplexer. It decodes four binary weighted address inputs (A0 to A3) to sixteen mutually exclusive outputs ($\overline{Y0}$ to $\overline{Y15}$).

The RS154 features two input enable ($\overline{E0}$ and $\overline{E1}$) inputs. A HIGH on either of the input enables forces the outputs HIGH. The device can be used as a 1-to-16 demultiplexer by using one of the enable inputs as the multiplexed data input. When the other enable input is LOW the addressed output will follow the state of the applied data.

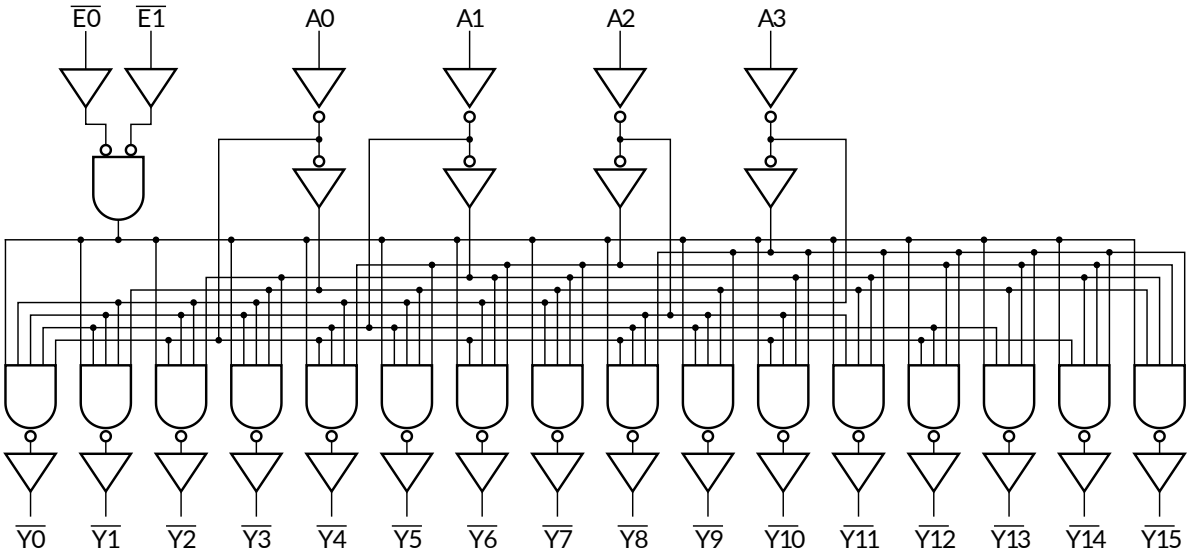
The RS154 is available in Green TSSOP24 packages. It operates over an ambient temperature range of -40°C to +125°C.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS154	TSSOP24	7.80mm×4.40mm

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

4 Functional Block Diagram



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5 Revision History

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

VERSION	Change Date	Change Item
A.0	2024/04/18	Preliminary version completed
A.1	2024/04/29	Initial version completed

6 PACKAGE/ORDERING INFORMATION (1)

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING (2)	MSL(3)	PACKAGE OPTION
RS154	RS154XTSS24	-40°C ~+125°C	TSSOP24	RS154	MSL3	Tape and Reel, 4000

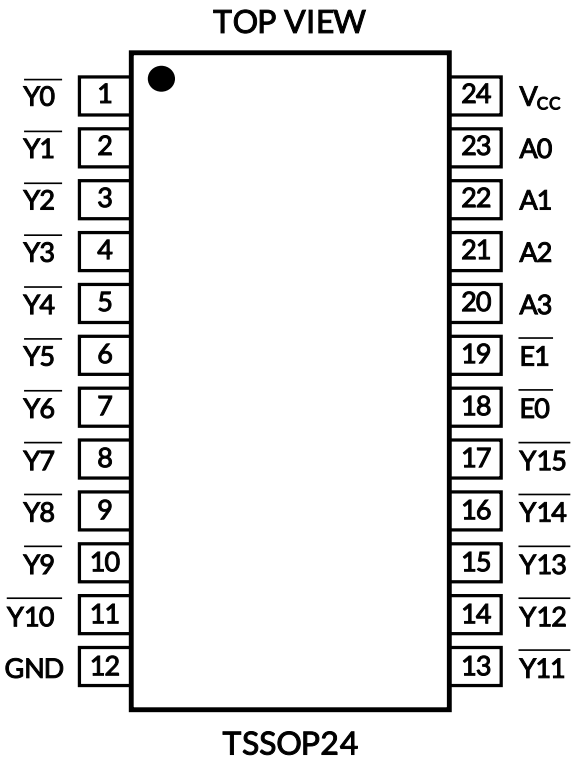
NOTE:

(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) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

7 PIN CONFIGURATIONS



7.1 PIN DESCRIPTION

SYMBOL	PIN	DESCRIPTION
	TSSOP14	
$\overline{Y0}, \overline{Y1}, \overline{Y2}, \overline{Y3}, \overline{Y4}, \overline{Y5}, \overline{Y6}, \overline{Y7}, \overline{Y8}, \overline{Y9}, \overline{Y10}, \overline{Y11}, \overline{Y12}, \overline{Y13}, \overline{Y14}, \overline{Y15}$	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17	Data output (active LOW)
GND	12	Ground (0 V)
$\overline{E0}, \overline{E1}$	18, 19	Enable output (active LOW)
A0, A1, A2, A3	23, 22, 21, 20	Address input
V_{CC}	24	Supply voltage

7.2 Device Function Table

Input						Output															
$\overline{E0}$	$\overline{E1}$	A0	A1	A2	A3	$\overline{Y0}$	$\overline{Y1}$	$\overline{Y2}$	$\overline{Y3}$	$\overline{Y4}$	$\overline{Y5}$	$\overline{Y6}$	$\overline{Y7}$	$\overline{Y8}$	$\overline{Y9}$	$\overline{Y10}$	$\overline{Y11}$	$\overline{Y12}$	$\overline{Y13}$	$\overline{Y14}$	$\overline{Y15}$
H	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	L	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
		H	L	L	L	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H
		L	H	L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H
		H	H	L	L	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H
		L	L	H	L	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H
		H	L	H	L	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H
		L	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H
		H	H	H	L	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H
		L	L	L	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H
		H	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H
		L	H	L	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H
		H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H
		L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H
		H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H
		L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H
		H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L

(1) H = HIGH voltage level; L = LOW voltage level; X=don't care

8 SPECIFICATIONS

8.1 Absolute Maximum Ratings

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

SYMBOL	PARAMETER	CONDITIONS	MIN	MAX	UNIT
V_{CC}	Supply Voltage Range		-0.5	6.5	V
I_{IK}	Input Clamp Current	V_I < -0.5 V or V_I > V_{CC} + 0.5 V (2)		±20	mA
I_{OK}	Output Clamp Current	V_O < -0.5 V or V_O > V_{CC} + 0.5 V (2)		±20	mA
I_O	Output Current	-0.5 V < V_O < V_{CC} + 0.5 V (2)		±25	mA
I_{CC}	Supply Current			50	mA
I_{GND}	Ground Current			-50	mA
θ_{JA}	Package thermal impedance (3)	TSSOP24		35	°C/W
T_{stg}	Storage Temperature		-65	150	°C
P_{tot}	Total Power Dissipation	T_{amb} = -40°C to +125°C		500	mW

(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 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.

8.2 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)	±2000	V
	Charged-Device Model (CDM)	±1000	
	Machine Model (MM)	±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.

8.3 Recommended Operating Conditions

Voltages are reference to GND (ground=0 V).

SYMBOL	PARAMETER	CONDITIONS	RS154			UNIT
			MIN	TYP	MAX	
V_{CC}	Supply Voltage		1.65	5.0	5.5	V
V_I	Input Voltage		0		V_{CC}	V
V_O	Output Voltage		0		V_{CC}	V
T_{amb}	Ambient Temperature		-40	25	125	°C
Δt/ΔV	Input Transition Rise and Fall Rate	V_{CC} = 2.0 V			625	ns/V
		V_{CC} = 4.5 V		1.67	139	ns/V
		V_{CC} = 5.5 V			83	ns/V

8.4 ELECTRICAL CHARACTERISTICS

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	CONDITIONS	25°C			-40°C to +85°C		-40°C to +125°C		UNIT
			MIN(1)	TYP(2)	MAX(1)	MIN(1)	MAX(1)	MIN(1)	MAX(1)	
V_{IH}	HIGH-Level Input Voltage	V_{CC} = 1.65 V	1.3			1.3		1.3		V
		V_{CC} = 2.0 V	1.5			1.5		1.5		V
		V_{CC} = 4.5 V	3.15			3.15		3.15		V
		V_{CC} = 5.5 V	3.85			3.85		3.85		V
V_{IL}	LOW-Level Input Voltage	V_{CC} = 1.65 V			0.4		0.4		0.4	V
		V_{CC} = 2.0 V			0.5		0.5		0.5	V
		V_{CC} = 4.5 V			1.35		1.35		1.35	V
		V_{CC} = 5.5 V			1.65		1.65		1.65	V
V_{OH}	HIGH-Level Output Voltage	V_I = V_{IH} or V_{IL}								
		V_{CC} = 1.65 V; I_O = -20 μA	1.55			1.55		1.55		V
		V_{CC} = 2.0 V; I_O = -20 μA	1.9			1.9		1.9		V
		V_{CC} = 4.5 V; I_O = -20 μA	4.4			4.4		4.4		V
		V_{CC} = 5.5 V; I_O = -20 μA	5.4			5.4		5.4		V
		V_{CC} = 4.5 V; I_O = -4 mA	3.98			3.84		3.7		V
		V_{CC} = 5.5 V; I_O = -5.2 mA	4.98			4.84		4.7		V
V_{OL}	LOW-Level Output Voltage	V_I= V_{IH} or V_{IL}								
		V_{CC} = 1.65 V; I_O = 20 μA			0.1		0.1		0.1	V
		V_{CC} = 2.0 V; I_O = 20 μA			0.1		0.1		0.1	V
		V_{CC} = 4.5 V; I_O = 20 μA			0.1		0.1		0.1	V
		V_{CC} = 5.5 V; I_O = 20 μA			0.1		0.1		0.1	V
		V_{CC} = 4.5 V; I_O = 4 mA			0.26		0.33		0.4	V
		V_{CC} = 5.5 V; I_O = 5.2 mA			0.26		0.33		0.4	V
I_I	Input Leakage Current	V_{CC} = 5.5 V; V_I = V_{CC} or GND			±1		±1		±1	μA
I_{CC}	Supply Current	V_{CC} = 5.5 V; V_I = V_{CC} or GND I_O = 0 A			5		10		20	μA
C_I	Input Capacitance			5						pF

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

(2) 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.

8.5 Dynamic Characteristics

GND (ground = 0 V); C_L = 50 pF unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	25°C			-40°C to +85°C		-40°C to +125°C		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{pd}	Propagation Delay	An to $\overline{Yn}$; see Figure 1 (1)								
		V_{CC} = 1.65 V		65	98		100		100	ns
		V_{CC} = 2.0 V		36	54		56		57	ns
		V_{CC} = 4.5 V		13	20		20		21	ns
		V_{CC} =5 V; C_L=15 pF		11						ns
		V_{CC} = 5.5 V		11	17		18		18	ns
		$\overline{En}$ to $\overline{Yn}$; see Figure 2								
		V_{CC} = 1.65 V		60	90		90		90	ns
		V_{CC} = 2.0 V		33	50		51		53	ns
		V_{CC} = 4.5 V		12	18		20		21	ns
		V_{CC} = 5 V; C_L=15 pF		11						ns
		V_{CC} = 5.5 V		11	17		17		18	ns
t_t	Transition Time	see Figure 1 and Figure 2 (2)								
		V_{CC} = 1.65 V		31	47		48		48	ns
		V_{CC} = 2.0 V		16	24		26		27	ns
		V_{CC} = 4.5 V		7	11		19		22	ns
		V_{CC} = 5.5 V		6	13		16		19	ns
C_{PD}	Power Dissipation Capacitance	per gate; V_I = GND to V_{CC} (3)		62						pF

(1) t_{pd} is the same as t_{PLH} and t_{PHL}

(2) t_t is the same as t_{TLH} and t_{THL}

(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 V;
N = number of load switching outputs;
$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

9 Parameter Measurement Information

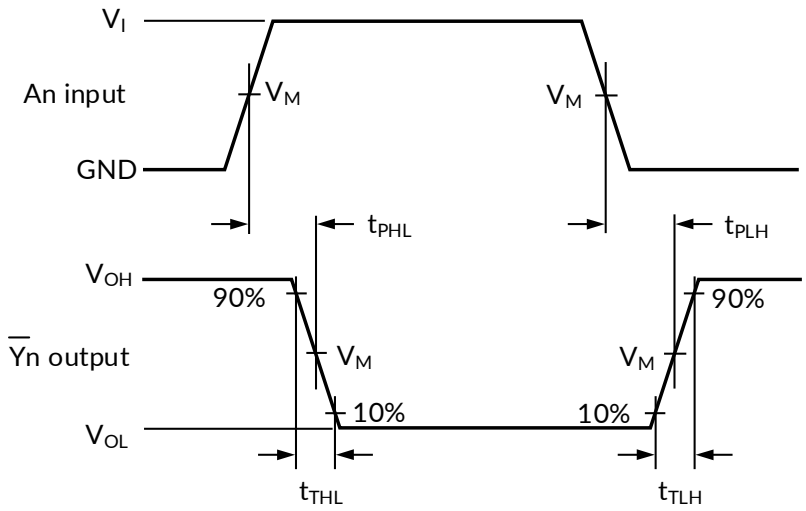


Figure 1. Propagation delay address input (An) to output ($\overline{Y}n$) and transition time output ($\overline{Y}n$)

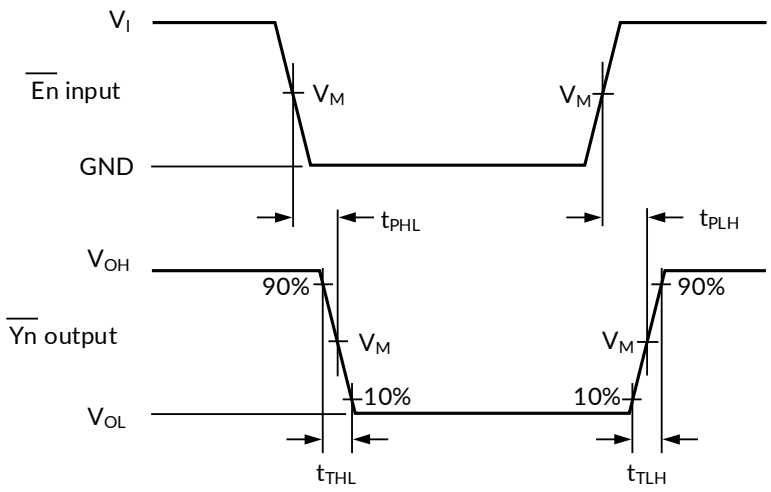
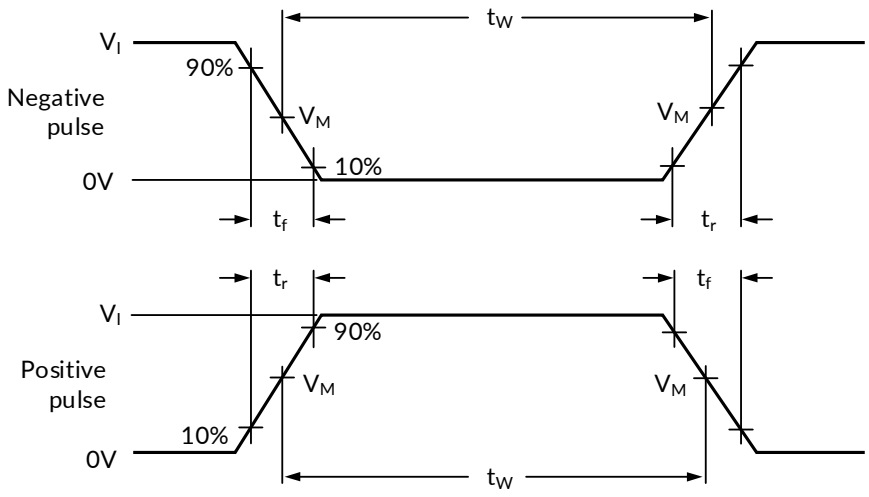
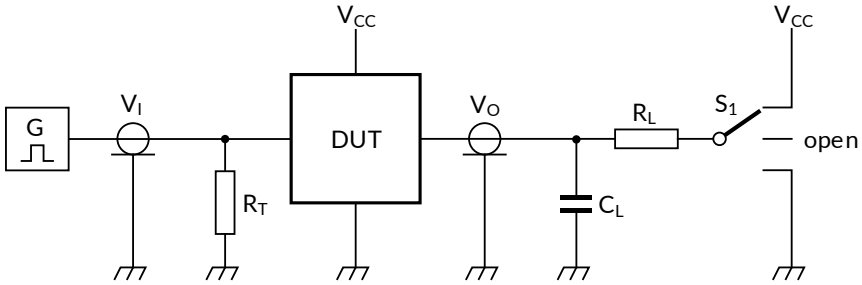


Figure 2. Propagation delay enable input ($\overline{E}n$) to output ($\overline{Y}n$) and transition time output ($\overline{Y}n$)





Test data is given in Table 1.
Definitions for test circuit:
R_T = Termination resistance; should be equal to output impedance Zo of the pulse generator.
C_L = Load capacitance including jig and probe capacitance.
R_L = Load resistor.
S_1 = Test selection switch.

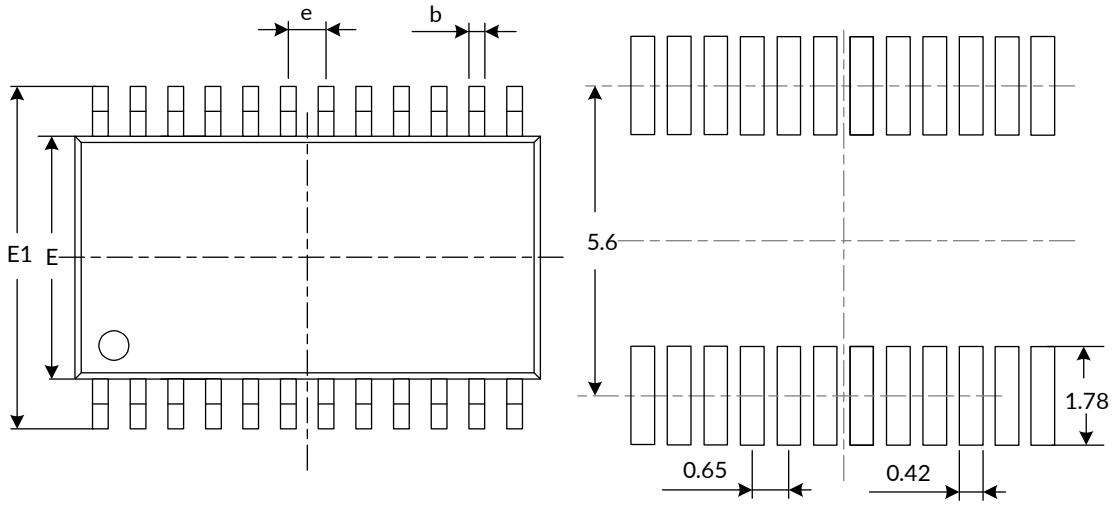
Figure 3. Test circuit for measuring switching times

Table 1. Test data

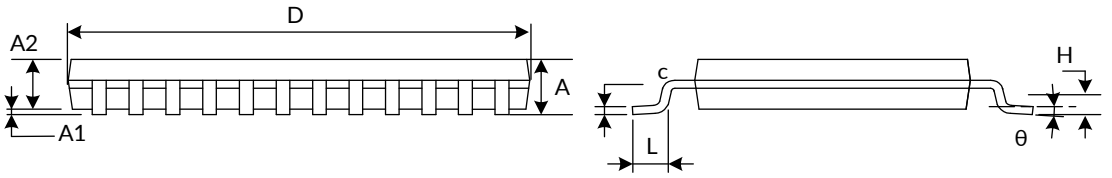
S1 position	Input		Load	
t_{PHL}/t_{PLH}	V_I	t_r, t_f	C_L	R_L
open	V_{CC}	6ns	15pF, 50pF	1kΩ

10 PACKAGE OUTLINE DIMENSIONS

TSSOP24 (3)



RECOMMENDED LAND PATTERN (Unit: mm)



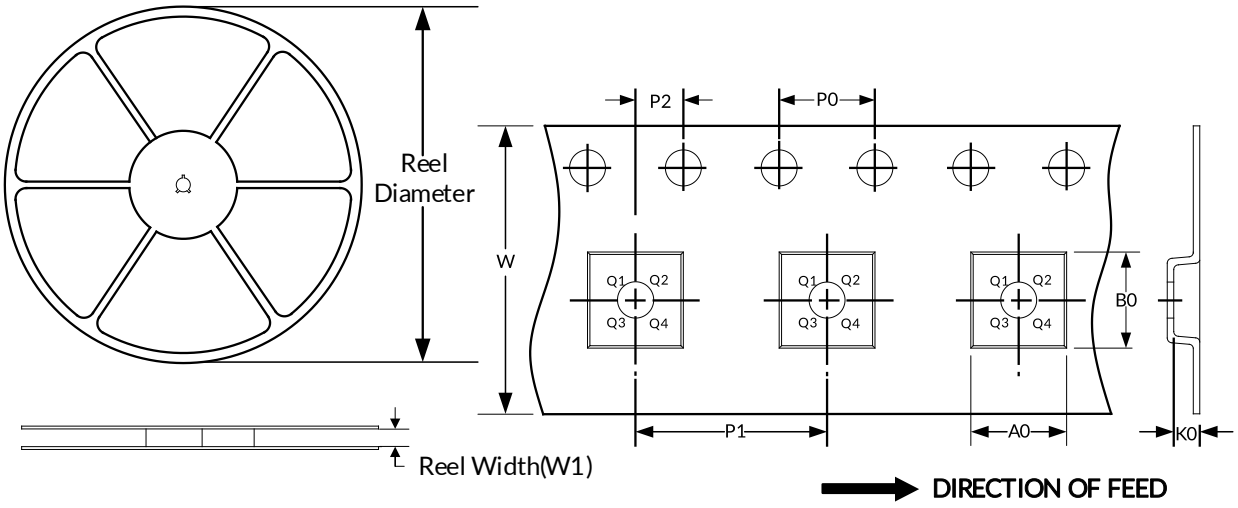
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.200	0.290	0.008	0.011
c	0.130	0.170	0.005	0.007
D (1)	7.700	7.900	0.303	0.311
E (1)	4.300	4.500	0.169	0.177
E1	6.200	6.600	0.244	0.260
e	0.650 (BSC) (2)		0.026 (BSC) (2)	
L	0.450	0.750	0.018	0.030
H	0.250 (TYP)		0.010 (TYP)	
θ	0°	8°	0°	8°

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. This drawing is subject to change without notice.

11 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
TSSOP24	13"	16.4	6.95	8.30	1.60	4.0	8.0	2.0	16.0	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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