



3-to-8 Line Decoder/Demultiplexer: Inverting

CJ74LVC138 Logic

1 Introduction

The CJ74LVC138 is a 3-to-8 line decoder/demultiplexer. It accepts three binary weighted address inputs (A0, A1 and A2) and, when enabled, provides eight mutually exclusive outputs ($\bar{Y}0$ to $\bar{Y}7$) that are LOW when selected.

There are three enable inputs: two active LOW ($\bar{E}1$ and $\bar{E}2$) and one active HIGH (E3). Every output will be HIGH unless $\bar{E}1$ and $\bar{E}2$ are LOW and E3 is HIGH.

This multiple enable function allows easy parallel expansion of the device to a 1-of-32 (5 lines to 32 lines) decoder with just four CJ74LVC138 devices and one inverter. The CJ74LVC138 can be used as an eight output demultiplexer by using one of the active LOW enable inputs as the data input and the remaining enable inputs as strobes. Unused enable inputs must be permanently tied to their appropriate active HIGH or LOW state.

2 Available Packages

PART NUMBER	PACKAGE
CJ74LVC138	SOP16
	TSSOP16
	QFN3.5x2.5-16L

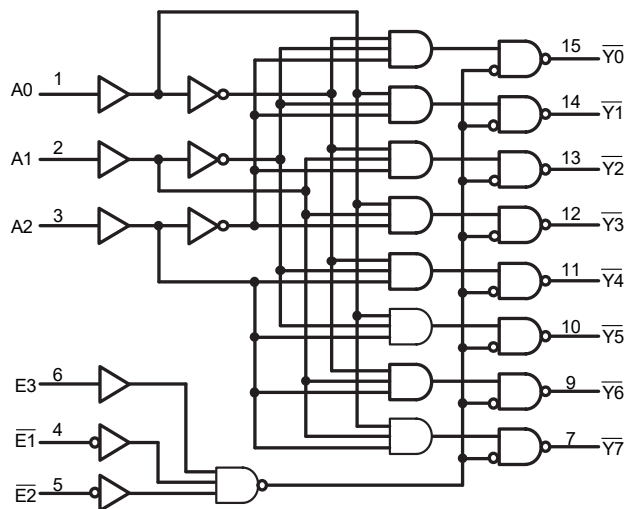
Note: For all available packages, please refer to the part Orderable Information.

3 Features

- 5V tolerant inputs/outputs for interfacing with 5V logic
- Wide supply voltage range from 1.2V to 3.6V
- CMOS low power consumption
- Direct interface with TTL levels
- Demultiplexing capability
- Multiple input enable for easy expansion
- Ideal for memory chip select decoding
- Mutually exclusive outputs
- Specified from -40°C to +125°C

4 Applications

- LED Displays
- Servers
- White Goods
- Power Infrastructure
- Building Automation
- Factory Automation



Logic diagram

5 Orderable Information

DEVICE	PACKAGE	OP TEMP	ECO PLAN	MSL	PACKING OPTION	SORT
CJ74LVC138AEN	SOP16	-40~125°C	RoHS & Green	Level 3 168HR	Tape and Reel 4000 Units / Reel	Active
CJ74LVC138BEN	TSSOP16	-40~125°C	RoHS & Green	Level 3 168HR	Tape and Reel 5000 Units / Reel	Active
CJ74LVC138QEN	QFN3.5x2.5-16L	-40~125°C	RoHS & Green	Level 3 168HR	Tape and Reel 3000 Units / Reel	Active

Note:

ECO PLAN: For the RoHS and Green certification standards of this product, please refer to the official report provided by JSCJ.

MSL: Moisture Sensitivity Level. Determined according to JEDEC industry standard classification.

SORT: Specifically defined as follows:

Active: Recommended for new products;

Customized: Products manufactured to meet the specific needs of customers;

Preview: The device has been released and has not been fully mass produced. The sample may or may not be available;

NoRD: It is not recommended to use the device for new design. The device is only produced for the needs of existing customers;

Obsolete: The device has been discontinued.

6 Pin Configuration and Marking Information

6.1 Pin Configuration

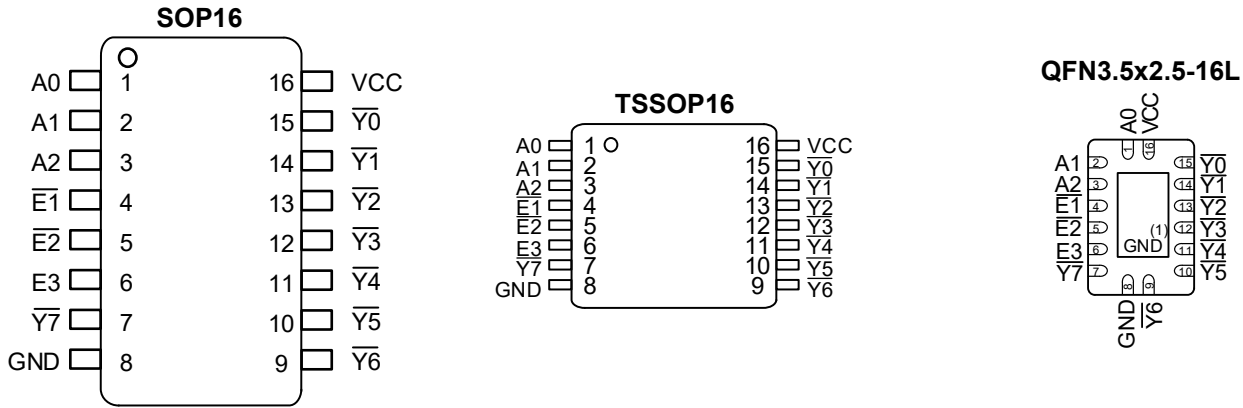


Figure 6-1 Pin configuration

Note:

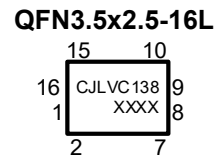
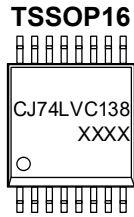
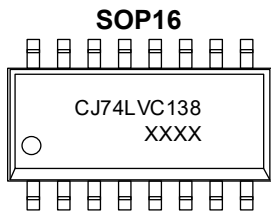
- (1) This is not a supply pin. The substrate is attached to this pad using conductive die attach material. There is no electrical or mechanical requirement to solder this pad. However, if it is soldered, the solder land should remain floating or be connected to GND.

6.2 Pin Function

PIN		I/O ⁽¹⁾	DESCRIPTION
No.	NAME		
1	A0	I	Address input
2	A1	I	Address input
3	A2	I	Address input
4	E1	I	Enable input (active LOW)
5	E2	I	Enable input (active LOW)
6	E3	I	Enable input (active HIGH)
7	Y7	O	Output
8	GND	G	Ground (0V)
9	Y6	O	Output
10	Y5	O	Output
11	Y4	O	Output
12	Y3	O	Output
13	Y2	O	Output
14	Y1	O	Output
15	Y0	O	Output
16	VCC	P	Supply voltage

(1) I-Input, O-Output, P-Power, G-Ground

6.3 Marking Information



XXXX: Code, indicates weekly record information.

7 Specifications

7.1 Absolute Maximum Ratings

Voltages are referenced to GND(ground=0V), unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V _{CC}	Supply voltage	-	-0.5	+6.5	V
I _{IK}	Input clamping current	V _I < 0V	-50	-	mA
V _I	Input voltage	-	-0.5	+6.5	V
I _{OK}	Output clamping current	V _O > V _{CC} or V _O < 0V	-	±50	mA
V _O	Output voltage	Output HIGH or LOW state	-0.5	V _{CC} +0.5	V
I _O	Output current	V _O =0V to V _{CC}	-	±50	mA
I _{CC}	Supply current	-	-	100	mA
I _{GND}	Ground current	-	-100	-	mA
P _{tot}	Total power dissipation	-	-	500	mW
T _{stg}	Storage temperature	-	-65	+150	°C
T _L	Soldering temperature	10s	-	260	°C

Note: Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to GND. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.

7.2 Recommended Operating Conditions

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V _{CC}	Supply voltage	-	1.65	-	3.6	V
		Functional	1.2	-	-	V
V _I	Input voltage	-	0	-	5.5	V
V _O	Output voltage	Output HIGH or LOW-state	0	-	V _{CC}	V
T _{amb}	Ambient temperature	-	-40	-	+125	°C
Δt/ΔV	Input transition rise and fall rate	V _{CC} =1.65V to 2.7V	0	-	20	ns/V
		V _{CC} =2.7V to 3.6V	0	-	10	ns/V

7.3 Electrical Characteristics
7.3.1 DC Characteristics 1
 $T_{amb} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, voltages are referenced to GND (ground=0V), unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT	
V_{IH}	HIGH-level input voltage	$V_{CC}=1.2\text{V}$	1.08	-	-	V	
		$V_{CC}=1.65\text{V}$ to 1.95V	$0.65 \times V_{CC}$	-	-	V	
		$V_{CC}=2.3\text{V}$ to 2.7V	1.7	-	-	V	
		$V_{CC}=2.7\text{V}$ to 3.6V	2.0	-	-	V	
V_{IL}	LOW-level input voltage	$V_{CC}=1.2\text{V}$	-	-	0.12	V	
		$V_{CC}=1.65\text{V}$ to 1.95V	-	-	$0.35 \times V_{CC}$	V	
		$V_{CC}=2.3\text{V}$ to 2.7V	-	-	0.7	V	
		$V_{CC}=2.7\text{V}$ to 3.6V	-	-	0.8	V	
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}	$I_o = -100\mu\text{A}$; $V_{CC}=1.65\text{V}$ to 3.6V	$V_{CC}-0.2$	-	-	V
			$I_o = -4\text{mA}$; $V_{CC}=1.65\text{V}$	1.2	-	-	V
			$I_o = -8\text{mA}$; $V_{CC}=2.3\text{V}$	1.8	-	-	V
			$I_o = -12\text{mA}$; $V_{CC}=2.7\text{V}$	2.2	-	-	V
			$I_o = -18\text{mA}$; $V_{CC}=3.0\text{V}$	2.4	-	-	V
			$I_o = -24\text{mA}$; $V_{CC}=3.0\text{V}$	2.2	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}	$I_o = 100\mu\text{A}$; $V_{CC}=1.65\text{V}$ to 3.6V	-	-	0.2	V
			$I_o = 4\text{mA}$; $V_{CC}=1.65\text{V}$	-	-	0.45	V
			$I_o = 8\text{mA}$; $V_{CC}=2.3\text{V}$	-	-	0.6	V
			$I_o = 12\text{mA}$; $V_{CC}=2.7\text{V}$	-	-	0.4	V
			$I_o = 24\text{mA}$; $V_{CC}=3.0\text{V}$	-	-	0.55	V
I_I	Input leakage current	$V_I=5.5\text{V}$ or GND; $V_{CC}=3.6\text{V}$	-	-	± 5	μA	
I_{CC}	Supply current	$V_I=V_{CC}$ or GND; $I_o=0\text{A}$; $V_{CC}=3.6\text{V}$	-	-	15	μA	
ΔI_{CC}	Additional supply current	Per input pin; $V_I=V_{CC}-0.6\text{V}$; $I_o=0\text{A}$; $V_{CC}=2.7\text{V}$ to 3.6V	-	-	500	μA	
C_i	Input capacitance	$V_{CC}=0\text{V}$ to 3.6V ; $V_I = \text{GND}$ to V_{CC}	-	4.0	-	pF	

Note: All typical values are measured at $V_{CC}=3.3\text{V}$ (unless stated otherwise) and $T_{amb}=25^{\circ}\text{C}$.

7.3.2 DC Characteristics 2
 $T_{amb} = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, voltages are referenced to GND (ground=0V), unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS		MIN.	TYP.	MAX.	UNIT
V_{IH}	HIGH-level input voltage	$V_{CC}=1.2\text{V}$		1.08	-	-	V
		$V_{CC}=1.65\text{V}$ to 1.95V		$0.65 \times V_{CC}$	-	-	V
		$V_{CC}=2.3\text{V}$ to 2.7V		1.7	-	-	V
		$V_{CC}=2.7\text{V}$ to 3.6V		2.0	-	-	V
V_{IL}	LOW-level input voltage	$V_{CC}=1.2\text{V}$		-	-	0.12	V
		$V_{CC}=1.65\text{V}$ to 1.95V		-	-	$0.35 \times V_{CC}$	V
		$V_{CC}=2.3\text{V}$ to 2.7V		-	-	0.7	V
		$V_{CC}=2.7\text{V}$ to 3.6V		-	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}	$I_o = -100\mu\text{A}; V_{CC}=1.65\text{V}$ to 3.6V	$V_{CC}-0.3$	-	-	V
			$I_o = -4\text{mA}; V_{CC}=1.65\text{V}$	1.05	-	-	V
			$I_o = -8\text{mA}; V_{CC}=2.3\text{V}$	1.65	-	-	V
			$I_o = -12\text{mA}; V_{CC}=2.7\text{V}$	2.05	-	-	V
			$I_o = -18\text{mA}; V_{CC}=3.0\text{V}$	2.25	-	-	V
			$I_o = -24\text{mA}; V_{CC}=3.0\text{V}$	2.0	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}	$I_o = 100\mu\text{A}; V_{CC}=1.65\text{V}$ to 3.6V	-	-	0.3	V
			$I_o = 4\text{mA}; V_{CC}=1.65\text{V}$	-	-	0.65	V
			$I_o = 8\text{mA}; V_{CC}=2.3\text{V}$	-	-	0.8	V
			$I_o = 12\text{mA}; V_{CC}=2.7\text{V}$	-	-	0.6	V
			$I_o = 24\text{mA}; V_{CC}=3.0\text{V}$	-	-	0.8	V
I_I	Input leakage current	$V_I = 5.5\text{V}$ or GND; $V_{CC} = 3.6\text{V}$		-	-	± 20	μA
I_{CC}	Supply current	$V_I = V_{CC}$ or GND; $I_o = 0\text{A}; V_{CC} = 3.6\text{V}$		-	-	200	μA
ΔI_{CC}	Additional supply current	Per input pin; $V_I = V_{CC} - 0.6\text{V}; I_o = 0\text{A}; V_{CC} = 2.7\text{V}$ to 3.6V		-	-	5000	μA

Note: All typical values are measured at $V_{CC} = 3.3\text{V}$ (unless stated otherwise) and $T_{amb} = 25^{\circ}\text{C}$.

7.3.3 AC Characteristics 1

T_{amb}=-40°C to +85°C, voltages are referenced to GND (ground=0V), unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT	
t _{pd}	Propagation delay	A _n to \bar{Y}_n See Figure 8-5	V _{CC} =1.2V	-	14	-	ns
			V _{CC} =1.65V to 1.95V	0.5	5.2	11.5	ns
			V _{CC} =2.3V to 2.7V	1.5	3.0	6.5	ns
			V _{CC} =2.7V	1.5	3.2	6.8	ns
			V _{CC} =3.0V to 3.6V	1.0	2.7	5.8	ns
		E3 to \bar{Y}_n See Figure 8-5	V _{CC} =1.2V	-	14	-	ns
			V _{CC} =1.65V to 1.95V	1.0	5.5	11.4	ns
			V _{CC} =2.3V to 2.7V	1.5	3.2	6.5	ns
			V _{CC} =2.7V	1.5	3.3	6.8	ns
			V _{CC} =3.0V to 3.6V	1.0	2.9	5.8	ns
		\bar{E}_n to \bar{Y}_n See Figure 8-6	V _{CC} =1.2V	-	15	-	ns
			V _{CC} =1.65V to 1.95V	1.0	5.6	11.5	ns
			V _{CC} =2.3V to 2.7V	1.8	3.3	6.5	ns
			V _{CC} =2.7V	1.5	3.4	6.4	ns
			V _{CC} =3.0V to 3.6V	1.0	2.9	5.8	ns
t _{sk(o)}	Output skew time	-	-	-	1.0	ns	
C _{PD}	Power dissipation capacitance	V _I =GND to V _{CC}	V _{CC} =1.65V to 1.95V	-	9.9	-	pF
			V _{CC} =2.3V to 2.7V	-	15.8	-	pF
			V _{CC} =3.0V to 3.6V	-	21.1	-	pF

Note:

- (1) Typical values are measured at T_{amb}=25°C and V_{CC}=1.2V, 1.8V, 2.5V, 2.7V and 3.3V respectively.
- (2) t_{pd} is the same as t_{PLH} and t_{PHL}.
- (3) Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.
- (4) C_{PD} is used to determine the dynamic power dissipation (P_D in uW).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o)$ 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 inputs switching;
- $\sum (C_L \times V_{CC}^2 \times f_o)$ =sum of outputs.

7.3.4 AC Characteristics 2

$T_{amb} = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, voltages are referenced to GND (ground=0V), unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS		MIN.	TYP.	MAX.	UNIT
t_{pd}	Propagation delay	An to \bar{Y}_n See Figure 8-5	$V_{CC}=1.65\text{V to }1.95\text{V}$	0.5	-	12.7	ns
			$V_{CC}=2.3\text{V to }2.7\text{V}$	1.5	-	7.3	ns
			$V_{CC}=2.7\text{V}$	1.5	-	8.5	ns
			$V_{CC}=3.0\text{V to }3.6\text{V}$	1.0	-	7.5	ns
		E3 to \bar{Y}_n See Figure 8-5	$V_{CC}=1.65\text{V to }1.95\text{V}$	1.0	-	12.5	ns
			$V_{CC}=2.3\text{V to }2.7\text{V}$	1.5	-	7.1	ns
			$V_{CC}=2.7\text{V}$	1.5	-	8.5	ns
			$V_{CC}=3.0\text{V to }3.6\text{V}$	1.0	-	7.5	ns
		\bar{E}_n to \bar{Y}_n See Figure 8-6	$V_{CC}=1.65\text{V to }1.95\text{V}$	1.0	-	12.8	ns
			$V_{CC}=2.3\text{V to }2.7\text{V}$	1.8	-	7.3	ns
			$V_{CC}=2.7\text{V}$	1.5	-	8.0	ns
			$V_{CC}=3.0\text{V to }3.6\text{V}$	1.0	-	7.5	ns
$t_{sk(o)}$	Output skew time	-		-	-	1.5	ns

Note:

- (1) Typical values are measured at $T_{amb}=25^{\circ}\text{C}$ and $V_{CC}=1.2\text{V}, 1.8\text{V}, 2.5\text{V}, 2.7\text{V}$ and 3.3V respectively.
- (2) t_{pd} is the same as t_{PLH} and t_{PHL} .
- (3) Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

8 Detailed Description

8.1 Overview

The CJ74LVC138 is a 3-to-8 line decoder/demultiplexer. It accepts three binary weighted address inputs (A0, A1 and A2) and, when enabled, provides eight mutually exclusive outputs ($\bar{Y}0$ to $\bar{Y}7$) that are LOW when selected.

There are three enable inputs: two active LOW ($\bar{E}1$ and $\bar{E}2$) and one active HIGH (E3). Every output will be HIGH unless $\bar{E}1$ and $\bar{E}2$ are LOW and E3 is HIGH.

This multiple enable function allows easy parallel expansion of the device to a 1-of-32 (5 lines to 32 lines) decoder with just four CJ74LVC138 devices and one inverter. The CJ74LVC138 can be used as an eight output demultiplexer by using one of the active LOW enable inputs as the data input and the remaining enable inputs as strobes. Unused enable inputs must be permanently tied to their appropriate active HIGH or LOW state.

8.2 Functional Block Diagram

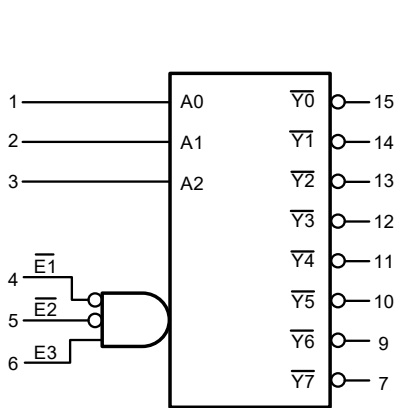


Figure 8-1 Logic symbol

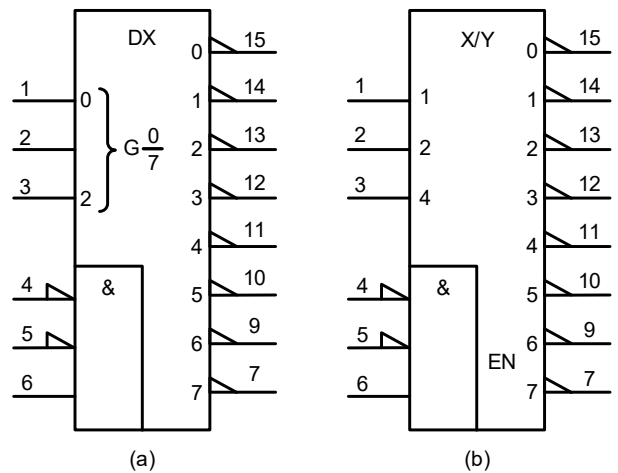


Figure 8-2 IEC logic symbol

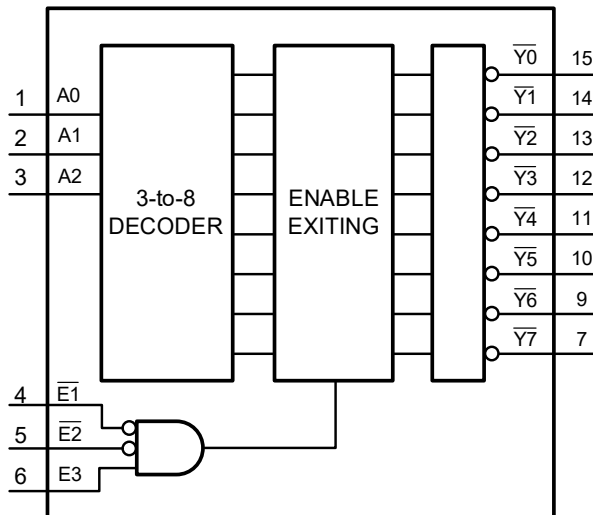


Figure 8-3 Functional diagram

8.3 Function Table⁽¹⁾

INPUT						OUTPUT							
$\bar{E}1$	$\bar{E}2$	$\bar{E}3$	A0	A1	A2	$\bar{Y}0$	$\bar{Y}1$	$\bar{Y}2$	$\bar{Y}3$	$\bar{Y}4$	$\bar{Y}5$	$\bar{Y}6$	$\bar{Y}7$
H	X	X	X	X	X	H	H	H	H	H	H	H	H
X	H	X	X	X	X	H	H	H	H	H	H	H	H
X	X	L	X	X	X	H	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	H	H	H	H	H
L	L	H	H	L	L	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	L	H	H	H	H	H
L	L	H	H	H	L	H	H	H	L	H	H	H	H
L	L	H	L	L	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	L	H	H
L	L	H	L	H	H	H	H	H	H	H	H	L	H
L	L	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.

8.4 Testing Circuit

8.4.1 AC Testing Circuit 1

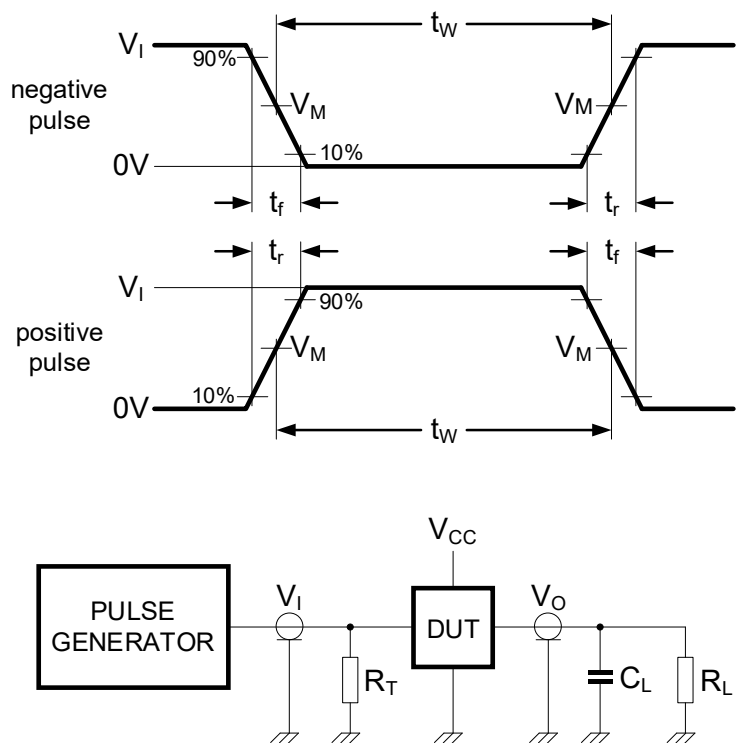


Figure 8-4 Test circuit for measuring switching times

Definitions for test circuit:

R_L =Load resistance.

C_L =Load capacitance including jig and probe capacitance.

R_T =Termination resistance should be equal to the output impedance Z_o of the pulse generator.

8.4.2 AC Testing Waveforms

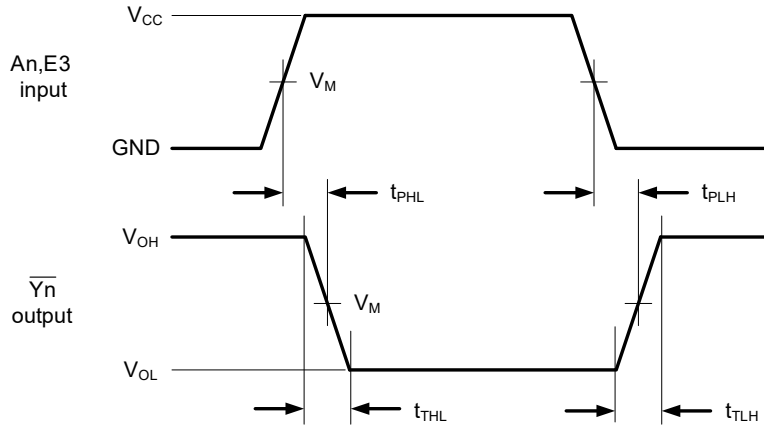


Figure 8-5 The inputs An, E3 to outputs Yn propagation delays

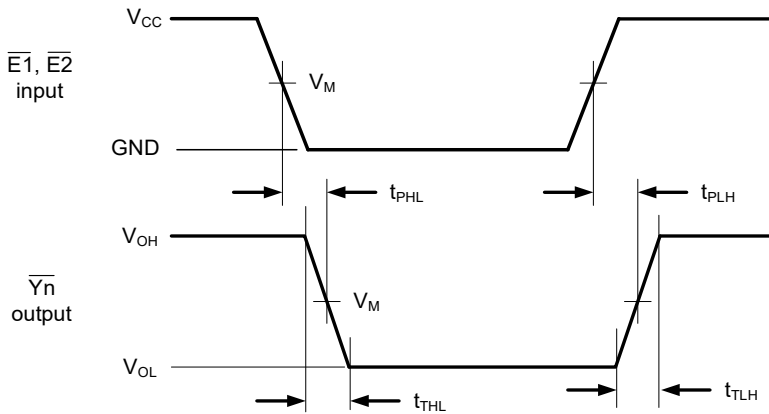


Figure 8-6 The inputs En to outputs Yn propagation delays

8.4.3 Measurement Points

SUPPLY VOLTAGE	INPUT	OUTPUT
V_{CC}	V_M	V_M
$< 2.7V$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
$\geq 2.7V$	1.5V	1.5V

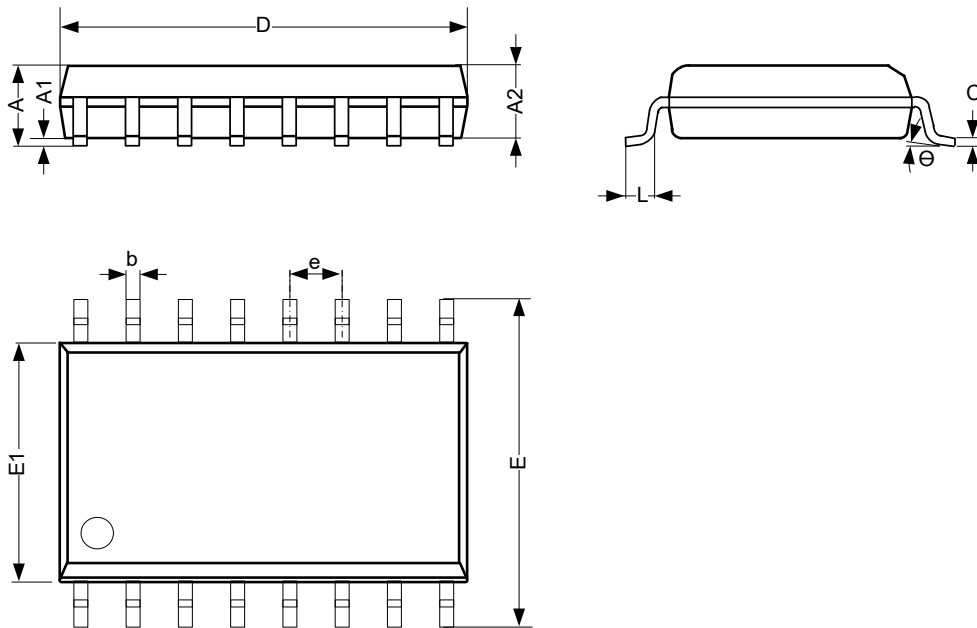
8.4.4 Test Data

SUPPLY VOLTAGE	INPUT		LOAD	
	V_I	t_r, t_f	C_L	R_L
1.2V	V_{CC}	$\leq 2.0ns$	30pF	1k Ω
1.65V to 1.95V	V_{CC}	$\leq 2.0ns$	30pF	1k Ω
2.3V to 2.7V	V_{CC}	$\leq 2.0ns$	30pF	500 Ω
2.7V	2.7V	$\leq 2.5ns$	50pF	500 Ω
3.0V to 3.6V	2.7V	$\leq 2.5ns$	50pF	500 Ω

9 Mechanical Information

9.1 SOP16 Mechanical Information

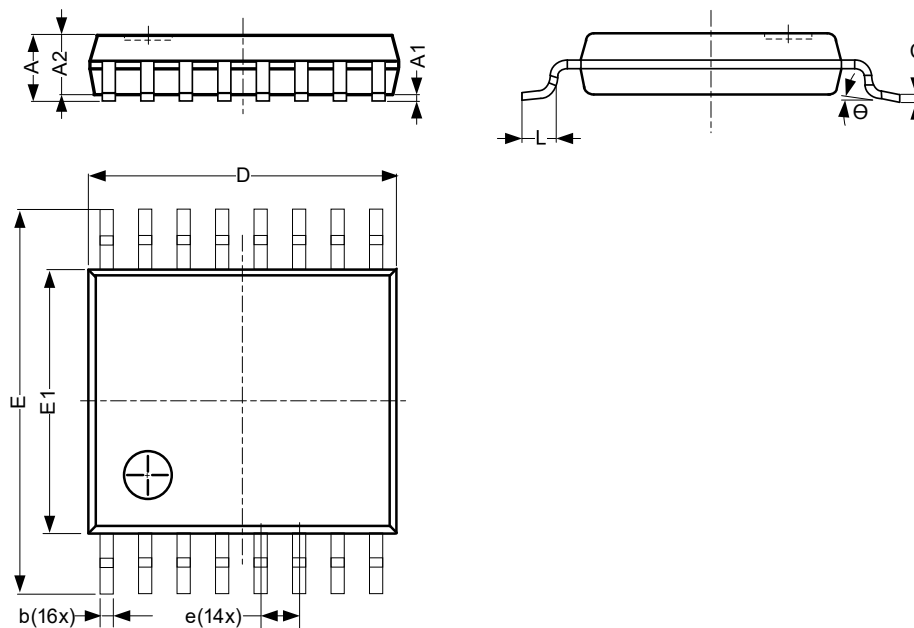
9.1.1 SOP16 Outline Dimensions



SYMBOL	Dimensions In Millimeters		
	Min.	Typ.	Max.
A	1.35	-	1.80
A1	0.10	-	0.25
A2	1.25	-	1.55
b	0.33	-	0.51
c	0.19	-	0.25
D	9.50	-	10.10
E	5.80	-	6.30
E1	3.70	-	4.10
e	1.27 BSC		
L	0.35	-	0.89
θ	0°	-	8°
Unit: mm			

9.2 TSSOP16 Mechanical Information

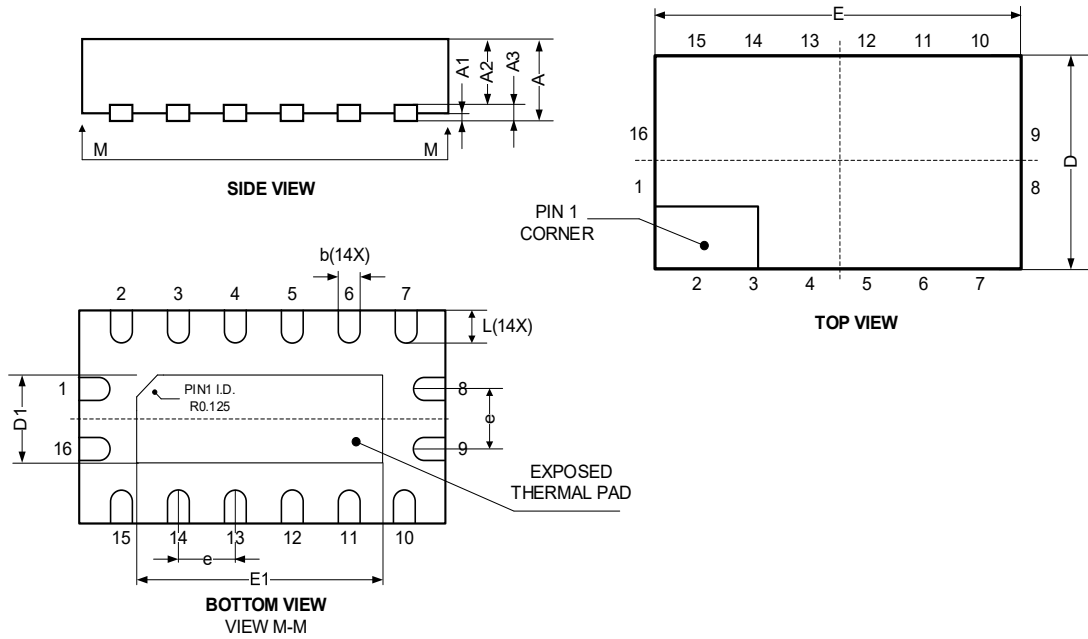
9.2.1 TSSOP16 Outline Dimensions



SYMBOL	Dimensions In Millimeters		
	Min.	Typ.	Max.
A	-	-	1.20
A1	0.05	-	0.15
A2	0.80	-	1.05
b	0.19	-	0.30
c	0.09	-	0.20
D	4.90	-	5.10
E	6.20	-	6.60
E1	4.30	-	4.50
e	0.65 BSC		
L	0.45	-	0.75
Θ	0°	-	8°
Unit: mm			

9.3 QFN3.5x2.5-16L Mechanical Information

9.3.1 QFN3.5x2.5-16L Outline Dimensions



SYMBOL	Dimensions In Millimeters		
	Min.	Typ.	Max.
A	0.80	-	1.00
A1	0.00	-	0.05
A2	0.60	-	0.70
A3	-	0.20	-
D	2.40	-	2.60
E	3.40	-	3.60
e	0.50 BSC		
b	0.18	-	0.30
L	0.30	-	0.50
D1	0.85	-	1.15
E1	1.85	-	2.15
Unit: mm			

10 Notes and Revision History

10.1 Associated Product Family and Others

To view other products of the same type or IC products of other types, click the official website of JSCJ -- <https://www.jscj-elec.com> for more details.

10.2 Notes

Electrostatic Discharge Caution



This IC may be damaged by ESD. Relevant personnel shall comply with correct installation and use specifications to avoid ESD damage to the IC. If appropriate measures are not taken to prevent ESD damage, the hazards caused by ESD include but are not limited to degradation of integrated circuit performance or complete damage of integrated circuit. For some precision integrated circuits, a very small parameter change may cause the whole device to be inconsistent with its published specifications.

DISCLAIMER

IMPORTANT NOTICE, PLEASE READ CAREFULLY

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