

# 74HC139D

## 1. Functional Description

- Dual 2-to-4 Line Decoder

## 2. General

The 74HC139D is a high speed CMOS 2-to-4 LINE DECODER/DEMULTIPLEXER fabricated with silicon gate C<sup>2</sup>MOS technology.

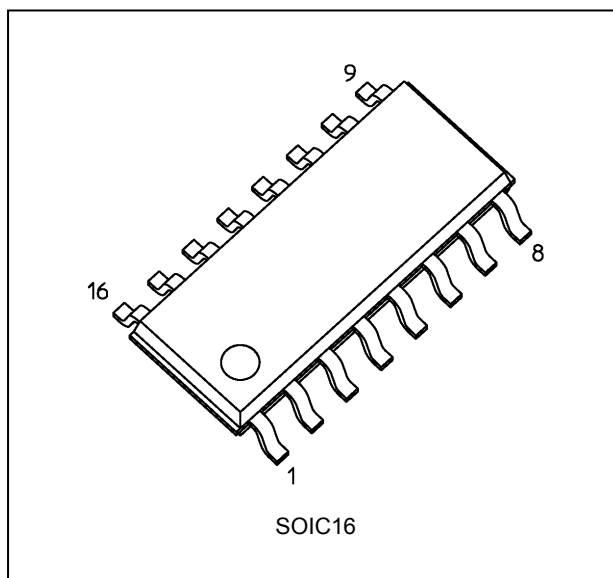
It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

The active low enable input can be used for gating or it can be used as a data input for demultiplexing applications. When the enable input is held "H", all four outputs are fixed at a high logic level independent of the other inputs. All inputs are equipped with protection circuits against static discharge or transient excess voltage.

## 3. Features

- (1) High speed:  $t_{pd} = 10 \text{ ns}$  (typ.) at  $V_{CC} = 5 \text{ V}$
- (2) Low power dissipation:  $I_{CC} = 4.0 \mu\text{A}$  (max) at  $T_a = 25^\circ\text{C}$
- (3) Balanced propagation delays:  $t_{PLH} \approx t_{PHL}$
- (4) Wide operating voltage range:  $V_{CC(\text{opr})} = 2.0 \text{ to } 6.0 \text{ V}$

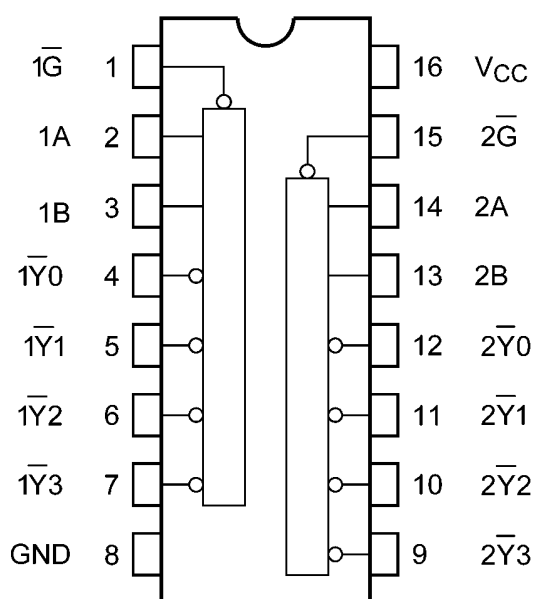
## 4. Packaging



Start of commercial production

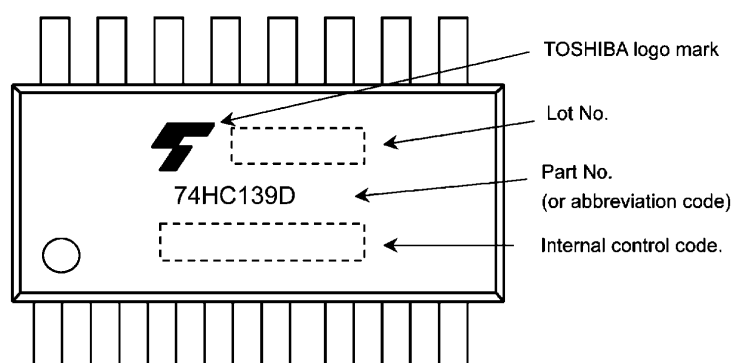
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## 5. Pin Assignment

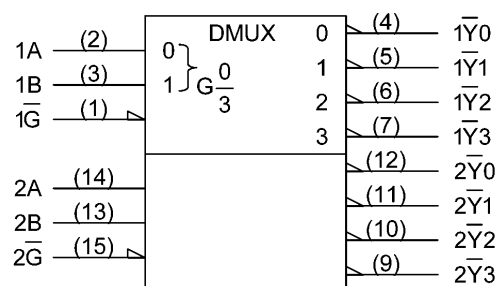
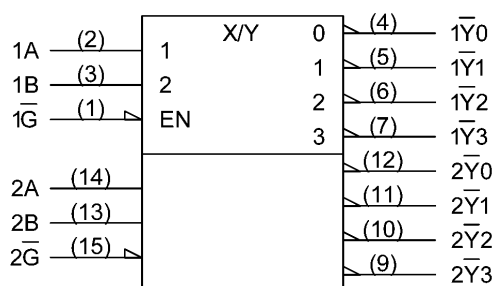


(top view)

## 6. Marking



## 7. IEC Logic Symbol



## 8. Truth Table

Inputs			Outputs				Selected Output
Enable	Select		$\overline{Y}0$	$\overline{Y}1$	$\overline{Y}2$	$\overline{Y}3$	
$\overline{G}$	B	A					
H	X	X	H	H	H	H	None
L	L	L	L	H	H	H	$\overline{Y}0$
L	L	H	H	L	H	H	$\overline{Y}1$
L	H	L	H	H	L	H	$\overline{Y}2$
L	H	H	H	H	H	L	$\overline{Y}3$

X: Don't care

## 9. Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	-0.5 to 7.0	V
Input voltage	$V_{IN}$	-0.5 to $V_{CC} + 0.5$	V
Output voltage	$V_{OUT}$	-0.5 to $V_{CC} + 0.5$	V
Input diode current	$I_{IK}$	$\pm 20$	mA
Output diode current	$I_{OK}$	$\pm 20$	mA
Output current	$I_{OUT}$	$\pm 25$	mA
$V_{CC}$ /ground current	$I_{CC}$	$\pm 50$	mA
Power dissipation	$P_D$	500	mW
Storage temperature	$T_{stg}$	-65 to 150	°C

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

## 10. Operating Ranges (Note)

Characteristics	Symbol	Test Condition	Rating	Unit
Supply voltage	$V_{CC}$		2.0 to 6.0	V
Input voltage	$V_{IN}$		0 to $V_{CC}$	V
Output voltage	$V_{OUT}$		0 to $V_{CC}$	V
Operating temperature	$T_{opr}$		-40 to 85	°C
Input rise and fall times	$t_r, t_f$	$V_{CC} = 2.0 \text{ V}$	0 to 1000	ns
		$V_{CC} = 4.5 \text{ V}$	0 to 500	
		$V_{CC} = 6.0 \text{ V}$	0 to 400	

Note: The operating ranges are required to ensure the normal operation of the device. Unused inputs must be tied to either  $V_{CC}$  or GND.

## 11. Electrical Characteristics

11.1. DC Characteristics (Unless otherwise specified,  $T_a = 25\text{ }^{\circ}\text{C}$ )

Characteristics	Symbol	Test Condition		$V_{CC}$ (V)	Min	Typ.	Max	Unit
High-level input voltage	$V_{IH}$	—		2.0	1.50	—	—	V
				4.5	3.15	—	—	
				6.0	4.20	—	—	
Low-level input voltage	$V_{IL}$	—		2.0	—	—	0.50	V
				4.5	—	—	1.35	
				6.0	—	—	1.80	
High-level output voltage	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -20\text{ }\mu\text{A}$	2.0	1.9	2.0	—	V
				4.5	4.4	4.5	—	
				6.0	5.9	6.0	—	
			$I_{OH} = -4\text{ mA}$	4.5	4.18	4.31	—	
			$I_{OH} = -5.2\text{ mA}$	6.0	5.68	5.80	—	
Low-level output voltage	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 20\text{ }\mu\text{A}$	2.0	—	0.0	0.1	V
				4.5	—	0.0	0.1	
				6.0	—	0.0	0.1	
			$I_{OL} = 4\text{ mA}$	4.5	—	0.17	0.26	
			$I_{OL} = 5.2\text{ mA}$	6.0	—	0.18	0.26	
Input leakage current	$I_{IN}$	$V_{IN} = V_{CC}$ or GND		6.0	—	—	$\pm 0.1$	$\mu\text{A}$
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND		6.0	—	—	4.0	$\mu\text{A}$

11.2. DC Characteristics (Unless otherwise specified,  $T_a = -40\text{ to }85\text{ }^{\circ}\text{C}$ )

Characteristics	Symbol	Test Condition		$V_{CC}$ (V)	Min	Max	Unit
High-level input voltage	$V_{IH}$	—		2.0	1.50	—	V
				4.5	3.15	—	
				6.0	4.20	—	
Low-level input voltage	$V_{IL}$	—		2.0	—	0.50	V
				4.5	—	1.35	
				6.0	—	1.80	
High-level output voltage	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -20\text{ }\mu\text{A}$	2.0	1.9	—	V
				4.5	4.4	—	
				6.0	5.9	—	
			$I_{OH} = -4\text{ mA}$	4.5	4.13	—	
			$I_{OH} = -5.2\text{ mA}$	6.0	5.63	—	
Low-level output voltage	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 20\text{ }\mu\text{A}$	2.0	—	0.1	V
				4.5	—	0.1	
				6.0	—	0.1	
			$I_{OL} = 4\text{ mA}$	4.5	—	0.33	
			$I_{OL} = 5.2\text{ mA}$	6.0	—	0.33	
Input leakage current	$I_{IN}$	$V_{IN} = V_{CC}$ or GND		6.0	—	$\pm 1.0$	$\mu\text{A}$
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND		6.0	—	40.0	$\mu\text{A}$

**11.3. AC Characteristics**(Unless otherwise specified,  $C_L = 15 \text{ pF}$ ,  $V_{CC} = 5 \text{ V}$ ,  $T_a = 25 \text{ }^\circ\text{C}$ , Input:  $t_r = t_f = 6 \text{ ns}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Output transition time	$t_{TLH}, t_{THL}$	—	—	4	8	ns
Propagation delay time (A, B - $\bar{Y}$ )	$t_{PLH}, t_{PHL}$	—	—	12	22	ns
Propagation delay time ( $\bar{G} - \bar{Y}$ )	$t_{PLH}, t_{PHL}$	—	—	10	18	ns

**11.4. AC Characteristics**(Unless otherwise specified,  $C_L = 50 \text{ pF}$ ,  $T_a = 25 \text{ }^\circ\text{C}$ , Input:  $t_r = t_f = 6 \text{ ns}$ )

Characteristics	Symbol	Note	$V_{CC}$ (V)	Min	Typ.	Max	Unit
Output transition time	$t_{TLH}, t_{THL}$		2.0	—	30	75	ns
			4.5	—	8	15	
			6.0	—	7	13	
Propagation delay time (A, B - $\bar{Y}$ )	$t_{PLH}, t_{PHL}$		2.0	—	45	130	ns
			4.5	—	15	26	
			6.0	—	13	22	
Propagation delay time ( $\bar{G} - \bar{Y}$ )	$t_{PLH}, t_{PHL}$		2.0	—	39	110	ns
			4.5	—	13	22	
			6.0	—	11	19	
Input capacitance	$C_{IN}$		—	—	5	—	pF
Power dissipation capacitance	$C_{PD}$	(Note 1)	—	—	46	—	pF

Note 1:  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation.

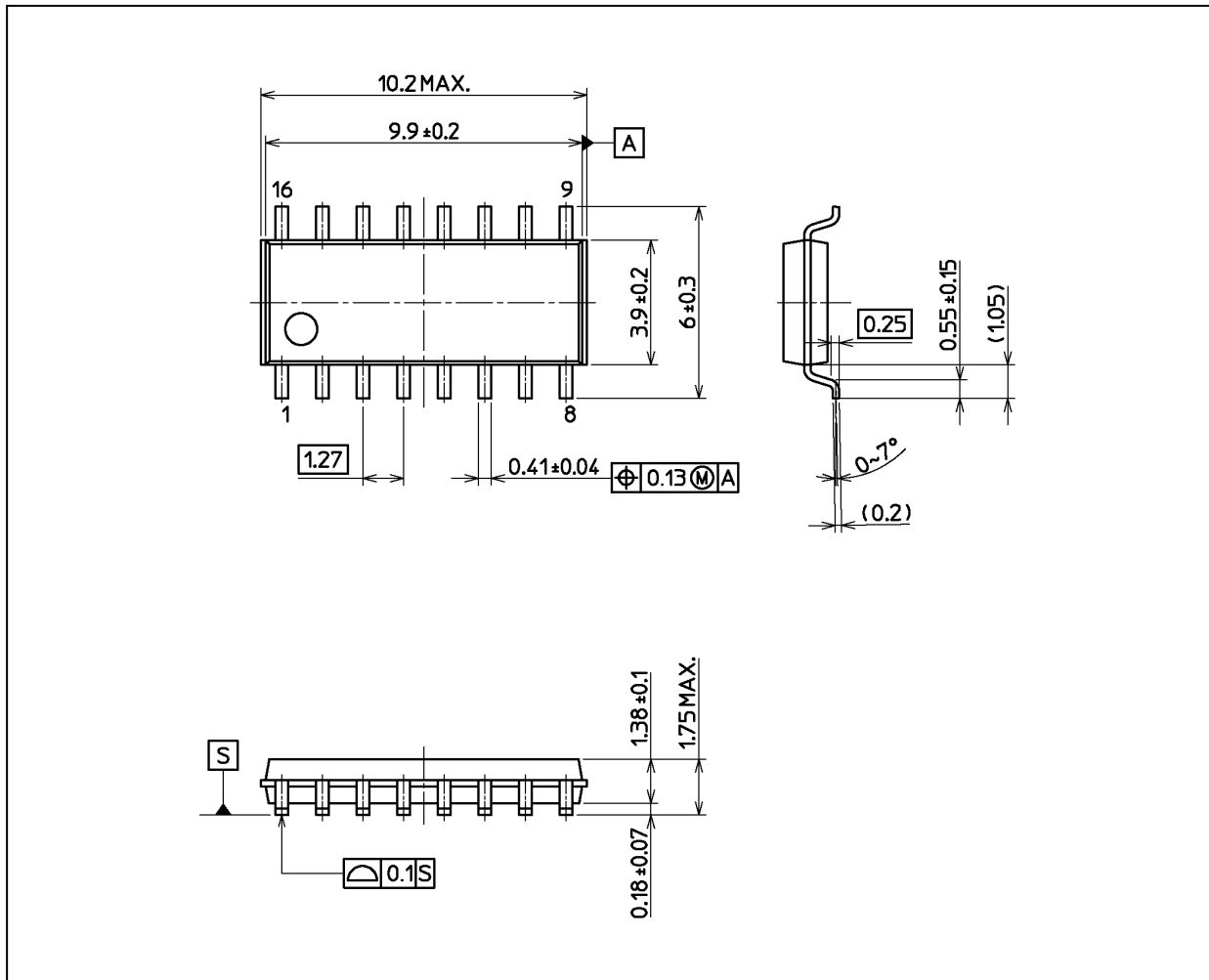
$$I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/2 \text{ (per decoder)}$$

**11.5. AC Characteristics**(Unless otherwise specified,  $C_L = 50 \text{ pF}$ ,  $T_a = -40 \text{ to } 85 \text{ }^\circ\text{C}$ , Input:  $t_r = t_f = 6 \text{ ns}$ )

Characteristics	Symbol	$V_{CC}$ (V)	Min	Max	Unit
Output transition time	$t_{TLH}, t_{THL}$	2.0	—	95	ns
		4.5	—	19	
		6.0	—	16	
Propagation delay time (A, B - $\bar{Y}$ )	$t_{PLH}, t_{PHL}$	2.0	—	165	ns
		4.5	—	33	
		6.0	—	28	
Propagation delay time ( $\bar{G} - \bar{Y}$ )	$t_{PLH}, t_{PHL}$	2.0	—	140	ns
		4.5	—	28	
		6.0	—	24	

## Package Dimensions

Unit: mm



Weight: 0.15 g (typ.)

Package Name(s)
Nickname: SOIC16

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