

TC74AC139P, TC74AC139F, TC74AC139FT

Dual 2-to-4 Line Decoder

The TC74AC139 is an advanced high speed CMOS 2-to-4 LINE DECODER fabricated with silicon gate and double-layer metal wiring C²MOS technology.

It achieves the high speed operation similar to equivalent Bipolar Schottky TTL 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.

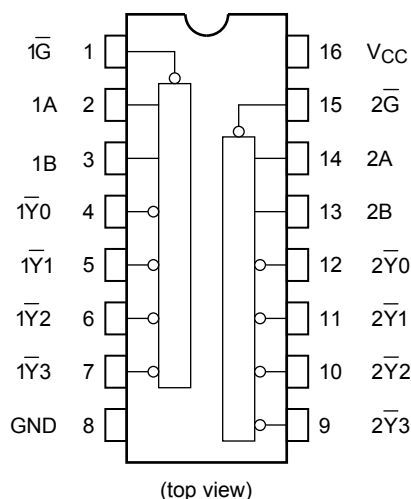
When the enable input is held "H", all four outputs are fixed at a high logic level independent of the other inputs.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

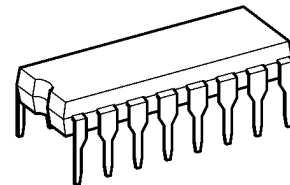
Features

- High speed: $t_{pd} = 5.9 \text{ ns (typ.)}$ at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 8 \mu\text{A (max)}$ at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- Symmetrical output impedance:
 $|I_{OH}| = I_{OL} = 24 \text{ mA (min)}$ Capability of driving 50Ω transmission lines.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC} \text{ (opr)} = 2 \text{ V to } 5.5 \text{ V}$
- Pin and function compatible with 74F139

Pin Assignment

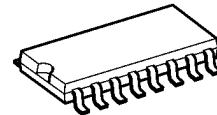


TC74AC139P



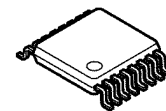
DIP16-P-300-2.54A

TC74AC139F



SOP16-P-300-1.27A

TC74AC139FT



TSSOP16-P-0044-0.65A

Weight

DIP16-P-300-2.54A	: 1.00 g (typ.)
SOP16-P-300-1.27A	: 0.18 g (typ.)
TSSOP16-P-0044-0.65A	: 0.06 g (typ.)

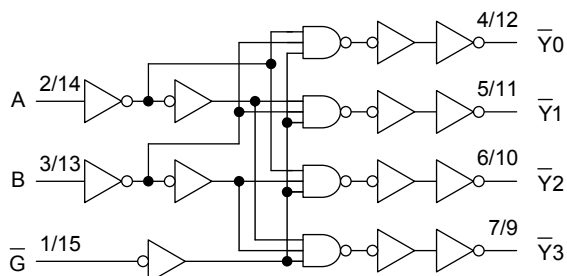
The diagram shows two logic blocks: a 4-to-1 MUX on the left and a 4-to-1 DMUX on the right.

4-to-1 MUX: The MUX has four data inputs labeled 1A, 1B, 1G, and 2A, 2B, 2G. The inputs 1A, 1B, and 1G are grouped by a bracket labeled (2), (3), and (1) respectively. The inputs 2A, 2B, and 2G are grouped by a bracket labeled (14), (13), and (15) respectively. The MUX has two select inputs labeled X/Y and EN. The output is labeled Y, with values 0, 1, 2, 3 corresponding to the select inputs. The output is also labeled with binary values 1Y0, 1Y1, 1Y2, 1Y3, 2Y0, 2Y1, 2Y2, 2Y3.

4-to-1 DMUX: The DMUX has four data inputs labeled 1A, 1B, 1G, and 2A, 2B, 2G. The inputs 1A, 1B, and 1G are grouped by a bracket labeled (2), (3), and (1) respectively. The inputs 2A, 2B, and 2G are grouped by a bracket labeled (14), (13), and (15) respectively. The DMUX has two select inputs labeled 0 and 1, with a bracket labeled G/3. The output is labeled Y, with values 0, 1, 2, 3 corresponding to the select inputs. The output is also labeled with binary values 1Y0, 1Y1, 1Y2, 1Y3, 2Y0, 2Y1, 2Y2, 2Y3.

Inputs			Outputs				Selected Output
Enable	Select		$\bar{Y}_0$	$\bar{Y}_1$	$\bar{Y}_2$	$\bar{Y}_3$	
$\bar{G}$	B	A					
H	X	X	H	H	H	H	None
L	L	L	L	H	H	H	$\bar{Y}_0$
L	L	H	H	L	H	H	$\bar{Y}_1$
L	H	L	H	H	L	H	$\bar{Y}_2$
L	H	H	H	H	H	L	$\bar{Y}_3$

System Diagram



Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	-0.5 to 7.0	V
DC input voltage	V_{IN}	-0.5 to $V_{CC} + 0.5$	V
DC output voltage	V_{OUT}	-0.5 to $V_{CC} + 0.5$	V
Input diode current	I_{IK}	± 20	mA
Output diode current	I_{OK}	± 50	mA
DC output current	I_{OUT}	± 50	mA
DC V_{CC} /ground current	I_{CC}	± 200	mA
Power dissipation	P_D	500 (DIP) (Note 2)/180 (SOP/TSSOP)	mW
Storage temperature	T_{stg}	-65 to 150	°C

Note 1: 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.).

Note 2: 500 mW in the range of $T_a = -40^\circ\text{C}$ to 65°C . From $T_a = 65^\circ\text{C}$ to 85°C a derating factor of $-10\text{ mW}/^\circ\text{C}$ should be applied up to 300 mW.

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2.0 to 5.5	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 time	dt/dV	0 to 100 ($V_{CC} = 3.3 \pm 0.3\text{ V}$) 0 to 20 ($V_{CC} = 5 \pm 0.5\text{ V}$)	ns/V

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs must be tied to either VCC or GND.

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit
				V _{CC} (V)	Min	Typ.	Max	Min	Max
High-level input voltage	V _{IH}	—		2.0 3.0 5.5	1.50 2.10 3.85	— — —	— — —	1.50 2.10 3.85	V
Low-level input voltage	V _{IL}	—		2.0 3.0 5.5	— — —	— — —	0.50 0.90 1.65	— 0.90 1.65	V
High-level output voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -50 µA	2.0 3.0 4.5	1.9 2.9 4.4	2.0 3.0 4.5	— — —	1.9 2.9 4.4	V
			I _{OH} = -4 mA	3.0	2.58	—	—	2.48	
			I _{OH} = -24 mA	4.5	3.94	—	—	3.80	
			I _{OH} = -75 mA (Note)	5.5	—	—	—	3.85	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50 µA	2.0 3.0 4.5	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	V
			I _{OL} = 12 mA	3.0	—	—	0.36	—	
			I _{OL} = 24 mA	4.5	—	—	0.36	—	
			I _{OL} = 75 mA (Note)	5.5	—	—	—	—	
Input leakage current	I _{IN}	V _{IN} = V _{CC} or GND		5.5	—	—	±0.1	—	µA
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND		5.5	—	—	8.0	—	µA

Note: This spec indicates the capability of driving 50 Ω transmission lines.

One output should be tested at a time for a 10 ms maximum duration.

AC Characteristics (C_L = 50 pF, R_L = 500 Ω, input: t_r = t_f = 3 ns)

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit
				V _{CC} (V)	Min	Typ.	Max	Min	Max
Propagation delay time (A, B- $\bar{Y}$)	t _{pLH}	—		3.3 ± 0.3	—	8.2	13.9	1.0	16.0
	t _{pHL}	—		5.0 ± 0.5	—	6.2	9.0	1.0	10.3
Propagation delay time ($\bar{G}$ - $\bar{Y}$)	t _{pLH}	—		3.3 ± 0.3	—	7.6	12.9	1.0	14.8
	t _{pHL}	—		5.0 ± 0.5	—	5.8	8.5	1.0	9.6
Input capacitance	C _{IN}	—		—	—	5	10	—	pF
Power dissipation capacitance	C _{PD}	(Note)		—	—	110	—	—	pF

Note: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

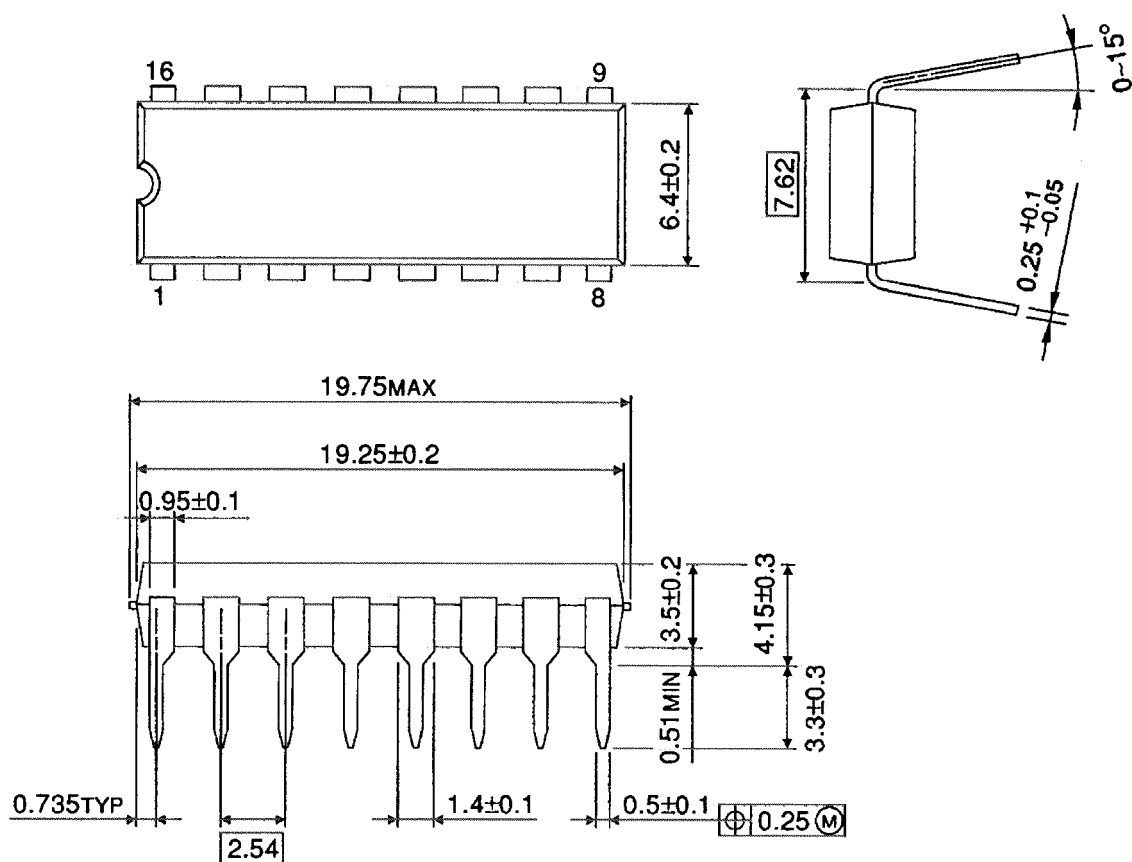
Average operating current can be obtained by the equation:

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

Package Dimensions

DIP16-P-300-2.54A

Unit : mm

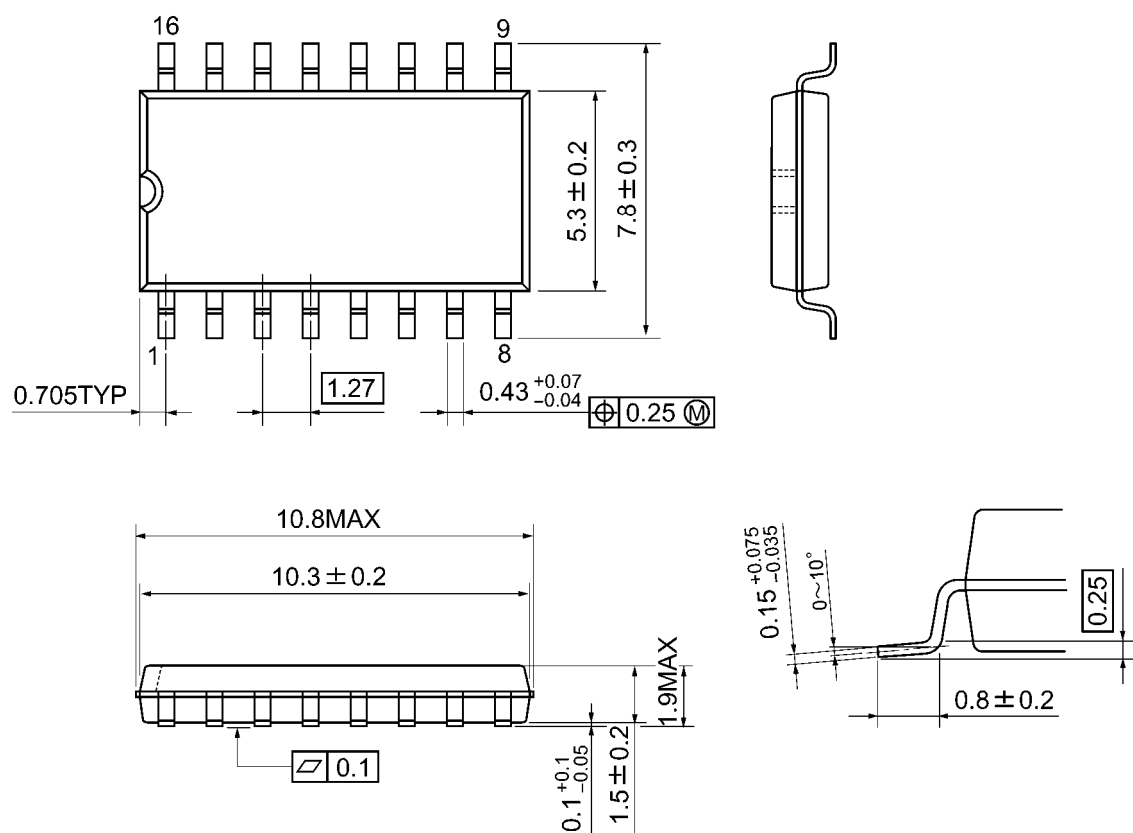


Weight: 1.00 g (typ.)

Package Dimensions

SOP16-P-300-1.27A

Unit: mm

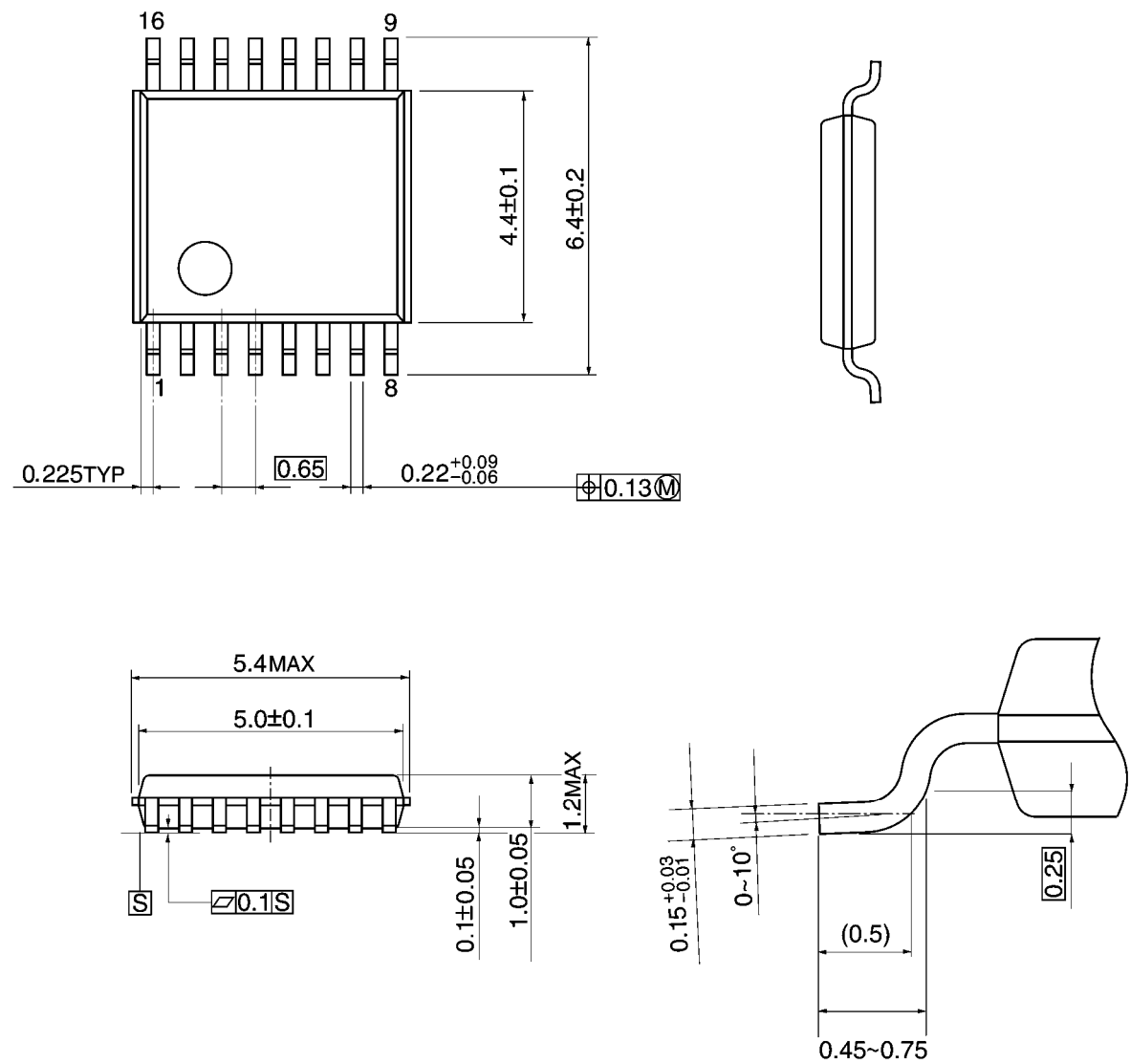


Weight: 0.18 g (typ.)

Package Dimensions

TSSOP16-P-0044-0.65A

Unit: mm



Weight: 0.06 g (typ.)

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