

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

# TC7W139F, TC7W139FU

## 2-TO-4 LINE DECODER

The TC7W139 is a high speed C<sup>2</sup>MOS 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 C<sup>2</sup>MOS low power dissipation.

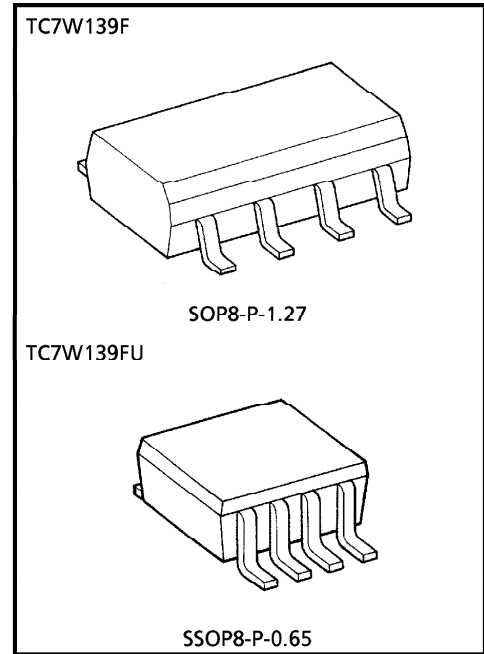
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

### FEATURES

- High Speed .....  $t_{pd} = 6ns$  (Typ.) at  $V_{CC} = 5V$
- Low Power Dissipation .....  $I_{CC} = 2\mu A$  (Max.) at  $T_a = 25^\circ C$
- High Noise Immunity .....  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (Min.)
- Output Drive Capability ..... 10 LSTTL Loads
- Symmetrical Output Impedance ...  $|I_{OH}| = I_{OL} = 4mA$
- Balanced Propagation Delays .....  $t_{pLH} \cong t_{pHL}$
- Wide Operating Voltage Range ...  $V_{CC} (opr) = 2V \sim 6V$

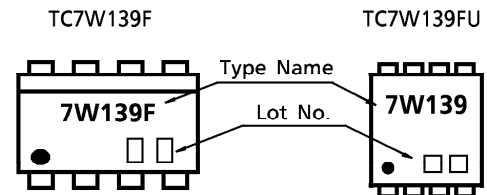
### TRUTH TABLE

INPUTS		OUTPUTS				SELECTED OUTPUT
SELECT		$\overline{Y0}$	$\overline{Y1}$	$\overline{Y2}$	$\overline{Y3}$	
B	A					
L	L	L	H	H	H	$\overline{Y0}$
L	H	H	L	H	H	$\overline{Y1}$
H	L	H	H	L	H	$\overline{Y2}$
H	H	H	H	H	L	$\overline{Y3}$

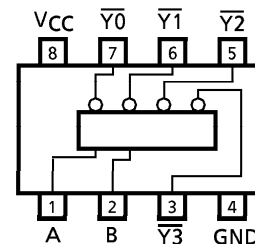


Weight SOP8-P-1.27 : 0.05g (Typ.)  
SSOP8-P-0.65 : 0.02g (Typ.)

### MARKING



### PIN ASSIGNMENT (TOP VIEW)



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● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

**MAXIMUM RATINGS (Ta = 25°C)**

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage Range	V <sub>CC</sub>	-0.5~7	V
DC Input Voltage	V <sub>IN</sub>	-0.5~V <sub>CC</sub> +0.5	V
DC Output Voltage	V <sub>OUT</sub>	-0.5~V <sub>CC</sub> +0.5	V
Input Diode Current	I <sub>IK</sub>	±20	mA
Output Diode Current	I <sub>OK</sub>	±20	mA
DC Output Current	I <sub>OUT</sub>	±25	mA
DC V <sub>CC</sub> /Ground Current	I <sub>CC</sub>	±25	mA
Power Dissipation	P <sub>D</sub>	300	mW
Storage Temperature	T <sub>stg</sub>	-65~150	°C
Lead Temperature 10s	T <sub>L</sub>	260	°C

**RECOMMENDED OPERATING CONDITIONS**

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V <sub>CC</sub>	2~6	V
Input Voltage	V <sub>IN</sub>	0~V <sub>CC</sub>	V
Output Voltage	V <sub>OUT</sub>	0~V <sub>CC</sub>	V
Operating Temperature	T <sub>opr</sub>	-40~85	°C
Input Rise and Fall Time	t <sub>r</sub> , t <sub>f</sub>	0~1000 (V <sub>CC</sub> = 2.0V) 0~ 500 (V <sub>CC</sub> = 4.5V) 0~ 400 (V <sub>CC</sub> = 6.0V)	ns

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- The information contained herein is subject to change without notice.

**DC ELECTRICAL CHARACTERISTICS**

CHARACTERISTIC	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C		UNIT		
			V <sub>CC</sub>	MIN.	TYP.	MAX.	MIN.		MAX.	
High-Level Input Voltage	V <sub>IH</sub>	—	2.0	1.5	—	—	1.5	—	V	
			4.5	3.15	—	—	3.15	—		
			6.0	4.2	—	—	4.2	—		
Low-Level Input Voltage	V <sub>IL</sub>	—	2.0	—	—	0.5	—	0.5	V	
			4.5	—	—	1.35	—	1.35		
			6.0	—	—	1.8	—	1.8		
High-Level Output Voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -20μA	2.0	1.9	2.0	—	1.9	—	V
				4.5	4.4	4.5	—	4.4	—	
			I <sub>OH</sub> = -4mA I <sub>OH</sub> = -5.2mA	4.5	4.18	4.31	—	4.13	—	
				6.0	5.68	5.80	—	5.63	—	
Low-Level Output Voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20μA	2.0	—	0.0	0.1	—	0.1	V
				4.5	—	0.0	0.1	—	0.1	
			I <sub>OL</sub> = 4mA I <sub>OL</sub> = 5.2mA	4.5	—	0.17	0.26	—	0.33	
				6.0	—	0.18	0.26	—	0.33	
Input Leakage Current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	6.0	—	—	±0.1	—	±1.0	μA	
Quiescent Supply Current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	6.0	—	—	2.0	—	20.0		

**AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = 15pF, V<sub>CC</sub> = 5V, Ta = 25°C)**

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Transition Time	t <sub>TLH</sub>	—	—	4	8	ns
	t <sub>THL</sub>					
Propagation Delay Time (A, B- $\bar{Y}$ )	t <sub>pLH</sub>	—	—	12	22	
	t <sub>pHL</sub>					

**AC ELECTRICAL CHARACTERISTICS** ( $C_L = 50\text{pF}$ , Input  $t_r = t_f = 6\text{ns}$ )

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C		UNIT	
			VCC	MIN.	TYP.	MAX.	MIN.		MAX.
Output Transition Time	$t_{TLH}$ $t_{THL}$	—	2.0	—	30	75	—	95	ns
			4.5	—	8	15	—	19	
			6.0	—	7	13	—	16	
Propagation Delay Time (A, B- $\bar{Y}$ )	$t_{pLH}$ $t_{pHL}$	—	2.0	—	45	130	—	165	
			4.5	—	15	26	—	33	
			6.0	—	13	22	—	28	
Input Capacitance	$C_{IN}$	—		—	5	10	—	10	pF
Power Dissipation Capacitance	$C_{PD}$	(Note 1)		—	46	—	—	—	

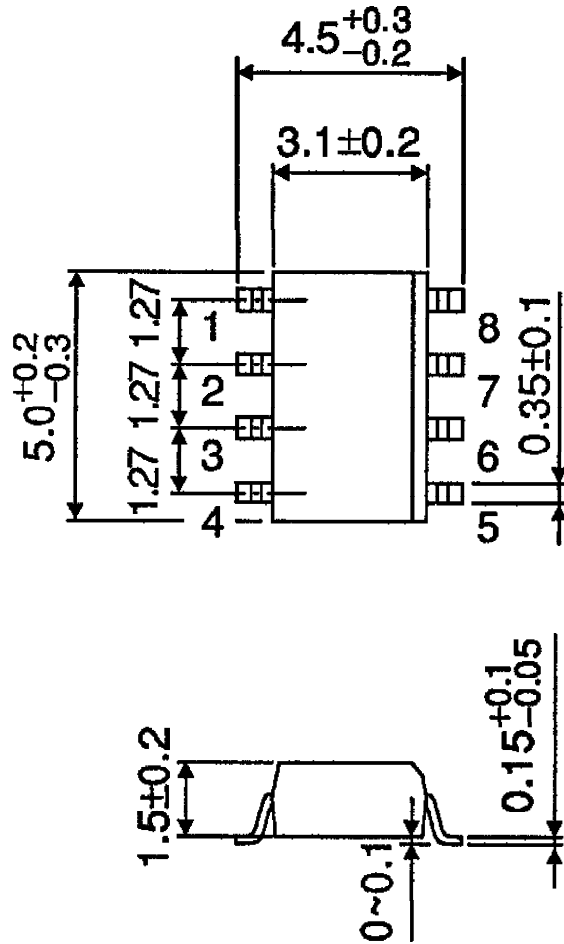
Note 1 :  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation.

$$I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

OUTLINE DRAWING  
SOP8-P-1.27

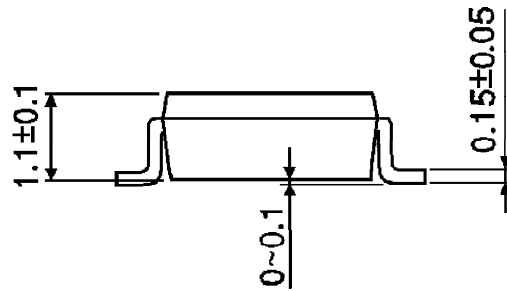
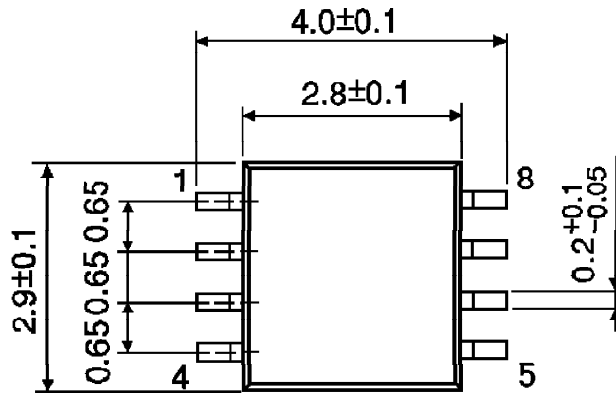
Unit : mm



Weight : 0.05g (Typ.)

OUTLINE DRAWING  
SSOP8-P-0.65

Unit : mm



Weight : 0.02g (Typ.)