

# TC74VCX157FT

## LOW-VOLTAGE QUAD 2-CHANNEL MULTIPLEXER WITH 3.6 V TOLERANT INPUTS AND OUTPUTS

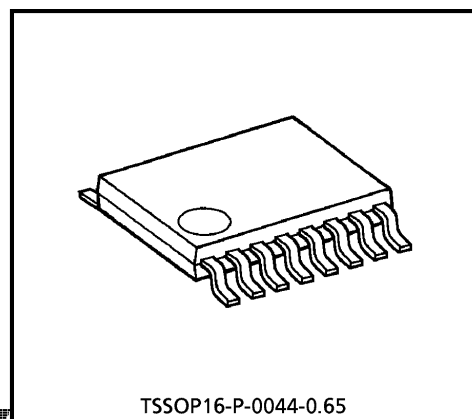
The TC74VCX157FT is a high performance CMOS MULTIPLEXER. Designed for use in 1.8, 2.5 or 3.3 Volt systems, it achieves high speed operation while maintaining the CMOS low power dissipation. It is also designed with over voltage tolerant inputs and outputs up to 3.6V.

It consists of four 2-input digital multiplexers with common select and strobe inputs.

When the  $\overline{\text{STROBE}}$  input is held "H" level, selection of data is inhibited and all the outputs become "L" level.

The SELECT decoding determines whether the A or B inputs get routed to their corresponding Y outputs.

All inputs are equipped with protection circuits against static discharge.



TSSOP16-P-0044-0.65

Weight : 0.06 g (Typ.)

# PRELIMINARY

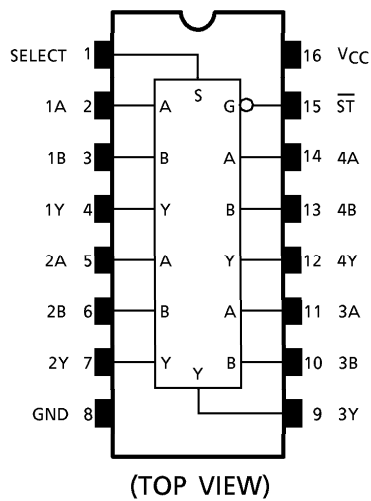
### FEATURES

- Low Voltage Operation :  $V_{CC} = 1.8\sim 3.6\text{ V}$
- High Speed Operation :  $t_{pd} = 2.5\text{ ns (max) at } V_{CC} = 3.0\sim 3.6\text{ V}$   
 $t_{pd} = 3.0\text{ ns (max) at } V_{CC} = 2.3\sim 2.7\text{ V}$   
 $t_{pd} = 5.0\text{ ns (max) at } V_{CC} = 1.8\text{ V}$
- Output Current :  $I_{OH}/I_{OL} = \pm 24\text{ mA (min) at } V_{CC} = 3.0\text{ V}$   
 $I_{OH}/I_{OL} = \pm 18\text{ mA (min) at } V_{CC} = 2.3\text{ V}$   
 $I_{OH}/I_{OL} = \pm 6\text{ mA (min) at } V_{CC} = 1.8\text{ V}$
- Latch-up Performance :  $\pm 300\text{ mA}$
- ESD Performance : Human Body Model  $> \pm 2000\text{ V}$   
Machine Model  $> \pm 200\text{ V}$
- Package : TSSOP  
(Thin Shrink Small Outline Package)
- Power Down Protection is provided on all inputs and outputs.

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**PIN ASSIGNMENT**



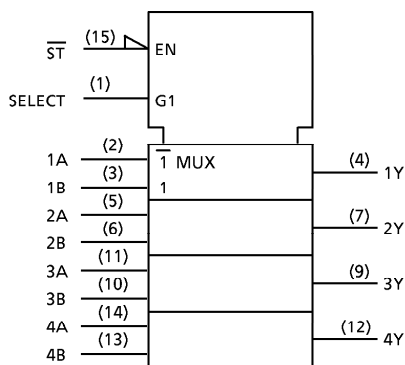
**TRUTH TABLE**

INPUTS				OUTPUTS
$\overline{ST}$	SELECT	A	B	Y
H	X	X	X	L
L	L	L	X	L
L	L	H	X	H
L	H	X	L	L
L	H	X	H	H

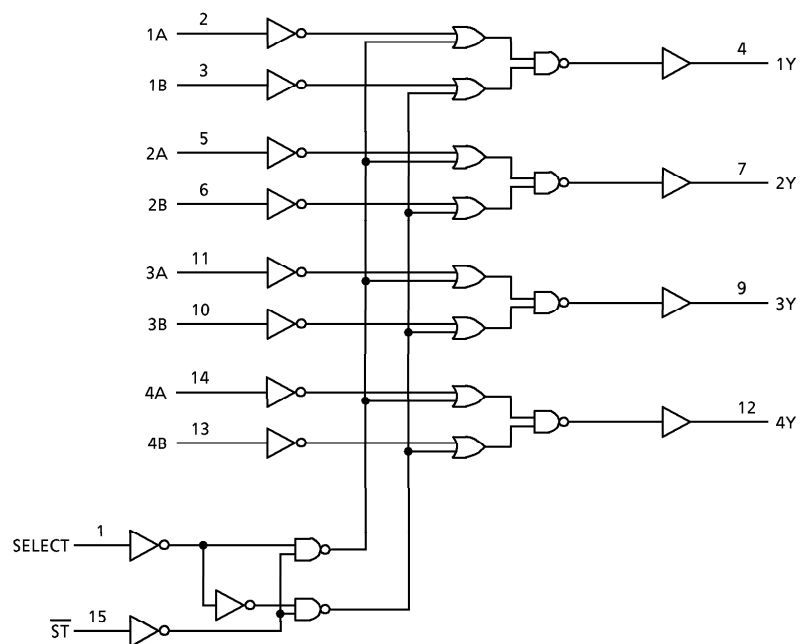
X : Don't Care

**PRELIMINARY**

**IEC LOGIC SYMBOL**



**SYSTEM DIAGRAM**



## MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Power Supply Voltage	$V_{CC}$	-0.5~4.6	V
DC Input Voltage	$V_{IN}$	-0.5~4.6	V
DC Output Voltage	$V_{OUT}$	-0.5~4.6 (Note 1)	V
		-0.5~ $V_{CC} + 0.5$ (Note 2)	
Input Diode Current	$I_{IK}$	-50	mA
Output Diode Current	$I_{OK}$	±50 (Note 3)	mA
DC Output Current	$I_{OUT}$	±50	mA
Power Dissipation	$P_D$	180	mW
DC $V_{CC}$ /Ground Current	$I_{CC}/I_{GND}$	±100	mA
Storage Temperature	$T_{stg}$	-65~150	°C

(Note 1):  $V_{CC} = 0\text{ V}$

(Note 2): High or Low State.  $I_{OUT}$  absolute maximum rating must be observed.

(Note 3):  $V_{OUT} < \text{GND}$ ,  $V_{OUT} > V_{CC}$

# PRELIMINARY

## RECOMMENDED OPERATING RANGE

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	$V_{CC}$	1.8~3.6	V
		1.2~3.6 (Note 4)	
Input Voltage	$V_{IN}$	-0.3~3.6	V
Output Voltage	$V_{OUT}$	0~3.6 (Note 5)	V
		0~ $V_{CC}$ (Note 6)	
Output Current	$I_{OH}/I_{OL}$	±24 (Note 7)	mA
		±18 (Note 8)	
		±6 (Note 9)	
Operating Temperature	$T_{opr}$	-40~85	°C
Input Rise And Fall Time	$dt/dv$	0~10 (Note 10)	ns/V

(Note 4): Data Retention Only

(Note 5):  $V_{CC} = 0\text{ V}$

(Note 6): High or Low State

(Note 7):  $V_{CC} = 3.0\sim 3.6\text{ V}$

(Note 8):  $V_{CC} = 2.3\sim 2.7\text{ V}$

(Note 9):  $V_{CC} = 1.8\text{ V}$

(Note 10):  $V_{IN} = 0.8\sim 2.0\text{ V}$ ,  $V_{CC} = 3.0\text{ V}$

**ELECTRICAL CHARACTERISTICS**

DC Characteristics (Ta = -40~85°C, 2.7 V < VCC ≤ 3.6 V)

PARAMETER		SYMBOL	TEST CONDITION	VCC (V)	Min	Max	UNIT
Input Voltage	"H" Level	V <sub>IH</sub>		2.7~3.6	2.0	—	V
	"L" Level	V <sub>IL</sub>		2.7~3.6	—	0.8	
Output Voltage	"H" Level	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -100 μA	2.7~3.6	V <sub>CC</sub> - 0.2	V
				I <sub>OH</sub> = -12 mA	2.7	2.2	
				I <sub>OH</sub> = -18 mA	3.0	2.4	
				I <sub>OH</sub> = -24 mA	3.0	2.2	
	"L" Level	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 100 μA	2.7~3.6	—	0.2
				I <sub>OL</sub> = 12 mA	2.7	—	0.4
				I <sub>OL</sub> = 18 mA	3.0	—	0.4
				I <sub>OL</sub> = 24 mA	3.0	—	0.55
Input Leakage Current		I <sub>IN</sub>	V <sub>IN</sub> = 0~3.6 V	2.7~3.6	—	± 5.0	μA
Power Off Leakage Current		I <sub>OFF</sub>	V <sub>IN</sub> , V <sub>OUT</sub> = 0~3.6 V	0	—	10.0	μA
Quiescent Supply Current		I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	2.7~3.6	—	20.0	μA
			V <sub>CC</sub> ≤ V <sub>IN</sub> ≤ 3.6 V	2.7~3.6	—	± 20.0	
Increase In I <sub>CC</sub> Per Input		ΔI <sub>CC</sub>	V <sub>IH</sub> = V <sub>CC</sub> - 0.6 V	2.7~3.6	—	750	μA

**PRELIMINARY**

**ELECTRICAL CHARACTERISTICS**

DC Characteristics (Ta = -40~85°C, 2.3 V ≤ VCC ≤ 2.7 V)

PARAMETER		SYMBOL	TEST CONDITION	VCC (V)	Min	Max	UNIT
Input Voltage	"H" Level	V <sub>IH</sub>		2.3~2.7	1.6	—	V
	"L" Level	V <sub>IL</sub>		2.3~2.7	—	0.7	
Output Voltage	"H" Level	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -100 μA	2.3~2.7	V <sub>CC</sub> - 0.2	V
				I <sub>OH</sub> = -6 mA	2.3	2.0	
				I <sub>OH</sub> = -12 mA	2.3	1.8	
				I <sub>OH</sub> = -18 mA	2.3	1.7	
	"L" Level	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 100 μA	2.3~2.7	—	0.2
				I <sub>OL</sub> = 12 mA	2.3	—	0.4
				I <sub>OL</sub> = 18 mA	2.3	—	0.6
Input Leakage Current		I <sub>IN</sub>	V <sub>IN</sub> = 0~3.6 V	2.3~2.7	—	± 5.0	μA
Power Off Leakage Current		I <sub>OFF</sub>	V <sub>IN</sub> , V <sub>OUT</sub> = 0~3.6 V	0	—	10.0	μA
Quiescent Supply Current		I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	2.3~2.7	—	20.0	μA
			V <sub>CC</sub> ≤ V <sub>IN</sub> ≤ 3.6 V	2.3~2.7	—	± 20.0	

**ELECTRICAL CHARACTERISTICS**

DC Characteristics (Ta = -40~85°C, 1.8 V ≤ VCC < 2.3 V)

PARAMETER		SYMBOL	TEST CONDITION	VCC (V)	Min	Max	UNIT	
Input Voltage	"H" Level	V <sub>IH</sub>		1.8~2.3	0.7 × V <sub>CC</sub>	—	V	
	"L" Level	V <sub>IL</sub>		1.8~2.3	—	0.2 × V <sub>CC</sub>		
Output Voltage	"H" Level	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -100 μA	1.8	V <sub>CC</sub> - 0.2	V	
				I <sub>OH</sub> = -6 mA	1.8	1.4		
	"L" Level	V <sub>OL</sub>	V <sub>N</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 100 μA	1.8	—		0.2
				I <sub>OL</sub> = 6 mA	1.8	—		0.3
Input Leakage Current		I <sub>IN</sub>	V <sub>IN</sub> = 0~3.6 V	1.8	—	±5.0	μA	
Power Off Leakage Current		I <sub>OFF</sub>	V <sub>IN</sub> , V <sub>OUT</sub> = 0~3.6 V	0	—	10.0	μA	
Quiescent Supply Current		I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	1.8	—	20.0	μA	
			V <sub>CC</sub> ≤ V <sub>IN</sub> ≤ 3.6 V	1.8	—	±20.0		

**PRELIMINARY**

AC Characteristics (Ta = -40~85°C, Input t<sub>r</sub> = t<sub>f</sub> = 2.0 ns, C<sub>L</sub> = 30 pF, R<sub>L</sub> = 500 Ω)

PARAMETER		SYMBOL	TEST CONDITION	VCC (V)	Min	Max	UNIT
Propagation Delay Time (A, B-Y)	t <sub>pLH</sub> t <sub>pHL</sub>	(Fig.1, 2)	1.8	1.0	5.0	ns	
			2.5 ± 0.2	0.8	3.0		
			3.3 ± 0.3	0.6	2.5		
Propagation Delay Time (SELECT-Y)	t <sub>pLH</sub> t <sub>pHL</sub>	(Fig.1, 2)	1.8	1.0	6.5	ns	
			2.5 ± 0.2	0.8	4.1		
			3.3 ± 0.3	0.6	3.5		
Propagation Delay Time (ST-Y)	t <sub>pLH</sub> t <sub>pHL</sub>	(Fig.1, 2)	1.8	1.0	5.0	ns	
			2.5 ± 0.2	0.8	3.8		
			3.3 ± 0.3	0.6	3.5		
Output To Output Skew	t <sub>osLH</sub> t <sub>osHL</sub>	(Note 11)	1.8	—	0.5	ns	
			2.5 ± 0.2	—	0.5		
			3.3 ± 0.3	—	0.5		

For C<sub>L</sub> = 50 pF, add approximately 300 ps to the AC maximum specification.

(Note 11): Parameter guaranteed by design.

$$(t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|)$$

Dynamic Switching Characteristics (Ta = 25°C, Input tr = tf = 2.0 ns, CL = 30 pF)

PARAMETER	SYMBOL	TEST CONDITION	VCC (V)	Typ.	UNIT
Quiet Output Maximum Dynamic VOL	VOLP	VIH = 1.8 V, VIL = 0 V (Note 12)	1.8	0.25	V
		VIH = 2.5 V, VIL = 0 V (Note 12)	2.5	0.6	
		VIH = 3.3 V, VIL = 0 V (Note 12)	3.3	0.8	
Quiet Output Minimum Dynamic VOL	VOLV	VIH = 1.8 V, VIL = 0 V (Note 12)	1.8	-0.25	V
		VIH = 2.5 V, VIL = 0 V (Note 12)	2.5	-0.6	
		VIH = 3.3 V, VIL = 0 V (Note 12)	3.3	-0.8	
Quiet Output Minimum Dynamic VOH	VOHV	VIH = 1.8 V, VIL = 0 V (Note 12)	1.8	1.5	V
		VIH = 2.5 V, VIL = 0 V (Note 12)	2.5	1.9	
		VIH = 3.3 V, VIL = 0 V (Note 12)	3.3	2.2	

(Note 12): Parameter guaranteed by design.

Capacitive Characteristics (Ta = 25°C)

PARAMETER	SYMBOL	TEST CONDITION	VCC (V)	Typ.	UNIT
Input Capacitance	CIN		1.8, 2.5, 3.3	6	pF
Power Dissipation Capacitance	CPD	fIN = 10 MHz (Note 13)	1.8, 2.5, 3.3	20	pF

(Note 13): CPD is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

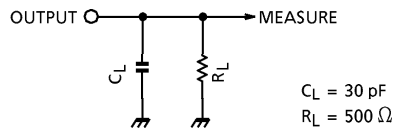
Average operating current can be obtained by the equation :

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

**PRELIMINARY**

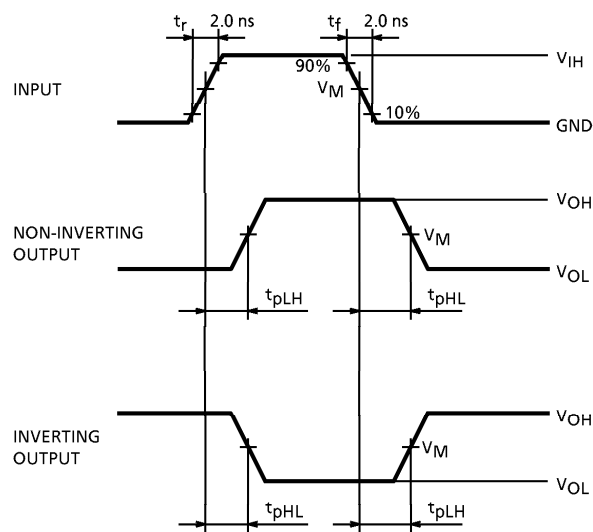
**TEST CIRCUIT**

Fig.1



**AC WAVEFORM**

Fig.2  $t_{pLH}$ ,  $t_{pHL}$

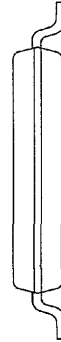
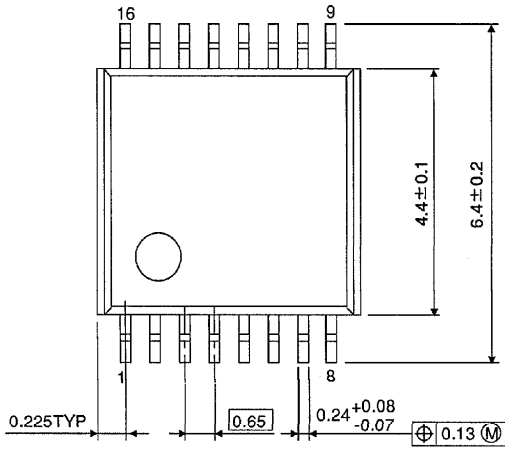


SYMBOL	$V_{CC}$		
	$3.3 \pm 0.3 \text{ V}$	$2.5 \pm 0.2 \text{ V}$	1.8 V
$V_{IH}$	2.7 V	$V_{CC}$	$V_{CC}$
$V_M$	1.5 V	$V_{CC}/2$	$V_{CC}/2$

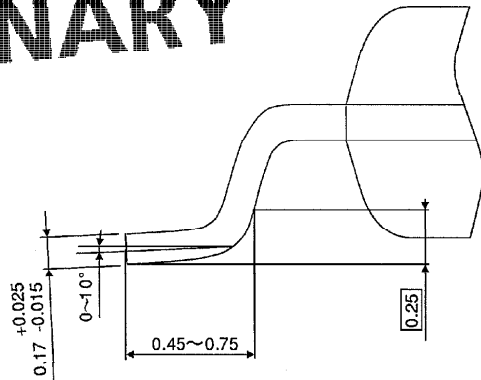
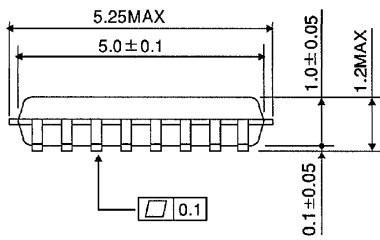
**PRELIMINARY**

OUTLINE DRAWING  
TSSOP16-P-0044-0.65

Unit : mm



**PRELIMINARY**



Weight : 0.06 g (typ.)