

VCX and VCX-Equivalent Devices

TC74VCX/TC7MA/TC7SA Series

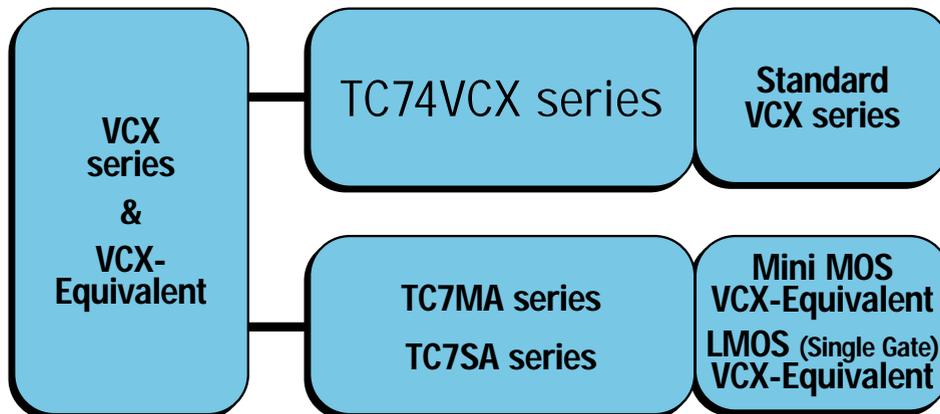
2.5V/3.3V CMOS Logic IC Series

Electronic devices used in information, communication and portable systems are rapidly advancing into the realm of lower voltage. Higher performance is therefore required of the standard logic which is used for interfacing with these devices. In response to these demands, Toshiba offers a wide line-up of VCX and VCX-equivalent devices which support a wide range of low-voltage applications. The TC74VCX, TC7MA and TC7SA feature high speed and high drive capability as well as excellent interfacing capability, cost performance and a wide package line up which enables support for all types of low-voltage systems. In order to meet market requirements, Toshiba will continue to offer standard logic ICs with smaller packages and increasing levels of performance.

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VCX Series & VCX-Equivalent Line Up



Overview

High Speed: 3.0ns max.t_{pd} @ 2.5V +/- 0.2V
2.5ns max.t_{pd} @ 3.3V +/- 0.3V (TC74VCX16245)

High Drive: 24mA @ V_{cc}=3.0V

Supply Voltage Range: 1.8V to 3.6V

3.6V tolerant inputs and outputs

Bus Hold* / Serial Resistor (TC74VCX series, TC7MA series)
*Optional product, based on demand

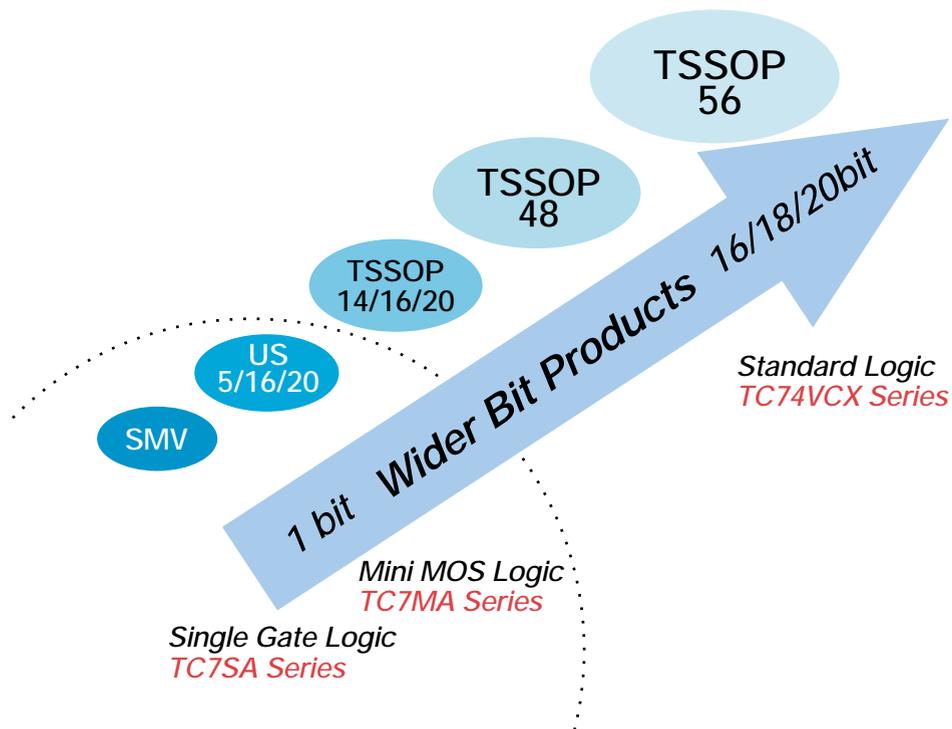
Wide Line up : 8, 16, 18, 20 bit Bus, Gate, MSI, Single Gate (TC7SA)

Wide package Line up: TSSOP14, 16, 20, 48, 56-pin (TC74VCX)

US 16, 20-pin (TC7MA) , US 5-pin (USV), SMV 5-pin (TC7SA)

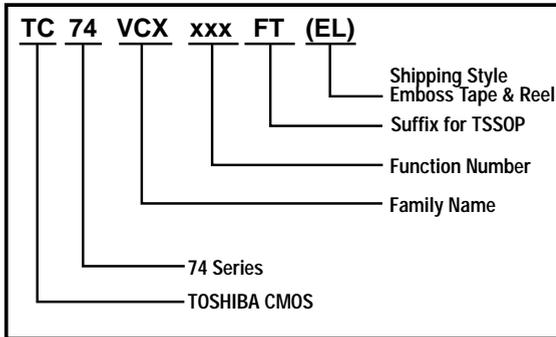
Available from three sources (TC74VCX)

VCX Wide Products & Package Line Up

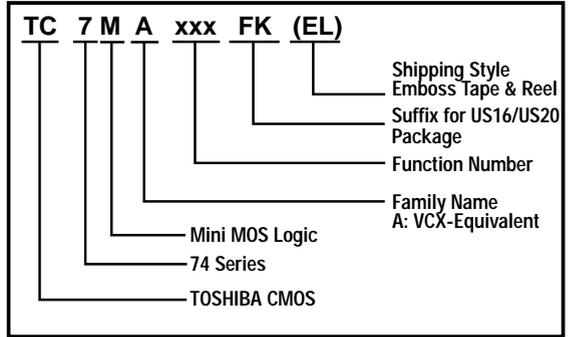


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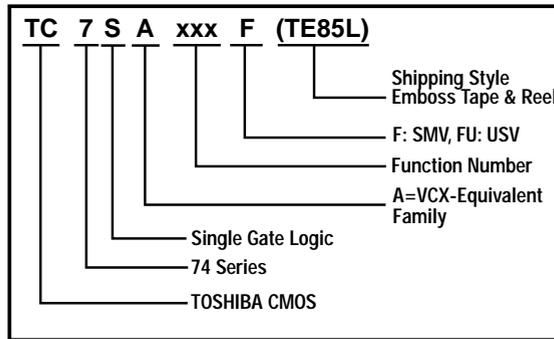
Standard VCX Series



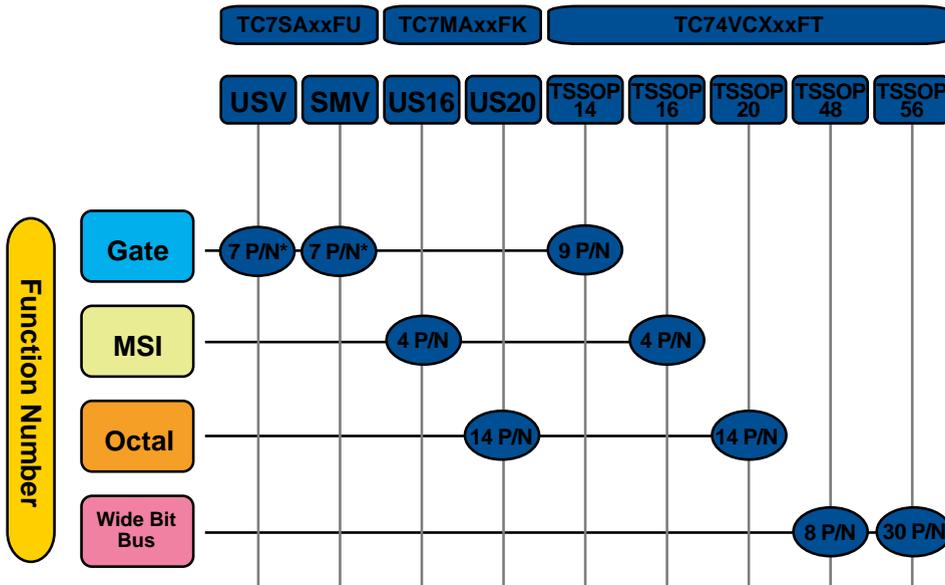
Mini VCX-Equivalent



Single Gate VCX-Equivalent



Wide Function Line Up



* include "Planned"

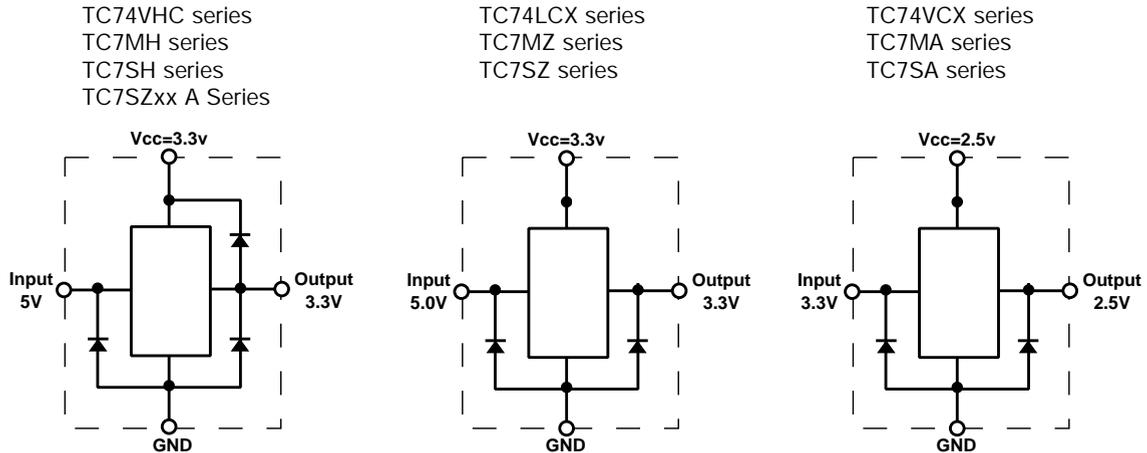
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Electrical Characteristics

Characteristics		TC74VCX Series	TC7MA Series	7C7SA Series
Power Supply Voltage		1.8 - 3.6V	1.8 - 3.6V	1.8 - 3.6V
Propagation Delay Time CL=30pF, RL=500ohm Ta=-40 to 85° C	Part No.	TC74VCX16244FT	TC7MA244FK	TC7SA00FU
	VCC=3.3±0.3V	2.5ns max.	3.5ns max.	2.8ns max.
	VCC=2.5±0.2V	3.0ns max.	4.2ns max.	3.7ns max.
	VCC=1.8V	5.0ns max.	8.4ns max.	7.4ns max.
Output Current Drive	VCC=3.3±0.3V	±24mA	±24mA	±24mA
	VCC=2.5±0.2V	±18mA	±18mA	±18mA
	VCC=1.8V	±6mA	±6mA	±6mA
Input voltage (VIH/VIL)	VCC=3.3±0.3V	2.0/0.8V	2.0/0.8V	2.0/0.8V
	VCC=2.5±0.2V	1.6/0.7V	1.6/0.7V	1.6/0.7V
	VCC=1.8V	0.7Vcc/0.2Vcc	0.7Vcc/0.2Vcc	0.7Vcc/0.2Vcc
3.6V Input Tolerance		YES	YES	YES
3.6V Output Tolerance		YES	YES	YES
Quiescent Supply Current		20µA	20µA	20µA
Operating Temperature Range		-40 to 85° C		

2.5V/3.3V interface solution

I/O Equivalent Circuit



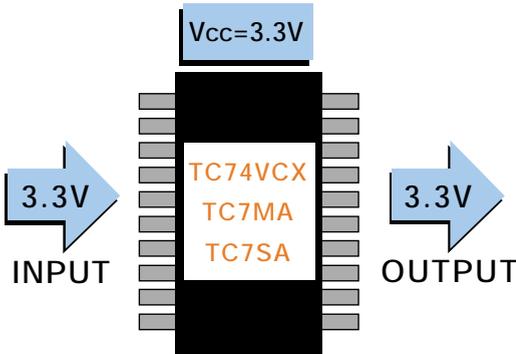
Recommended Operating Condition

/ Family Name	TC74VHC series TC7MH series TC7SH series	TC74LCS series TC7MZ series TC7SZ series	TC74VCX series TC7MA series TC7SA series
DC Input Voltage	0V to +5.5V	0V to 5.5V	0V to 3.6V
DC Output Voltage	0V to Vcc	0V to 5.5V	0V to 3.6V
Tolerance	5V Input Tolerance	5V I/O Tolerance	3.6V I/O Tolerance

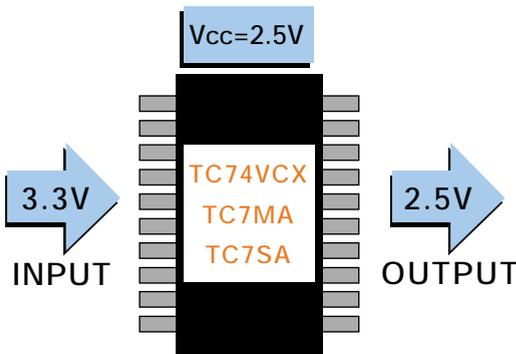
* : Off State

Interface example

3.3V High Speed Interface

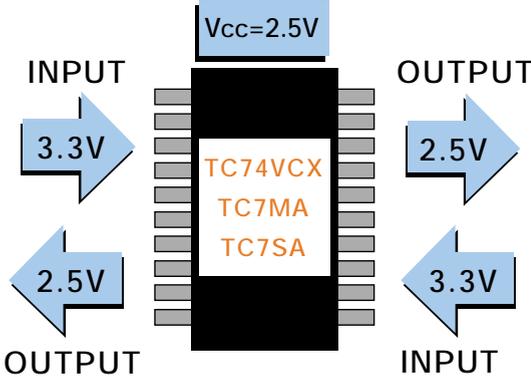


3.3V to 2.5V Transition

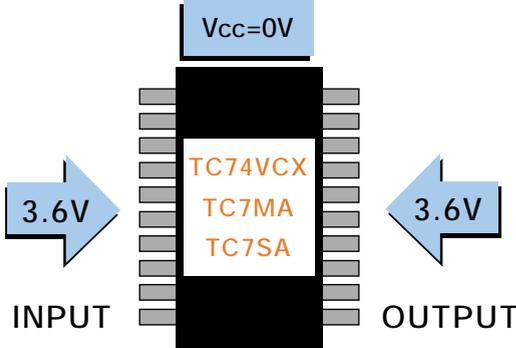


Maximum Overvoltage:
Inputs/Outputs: 3.6V

3.3V to 2.5V
Bi-directional Transition



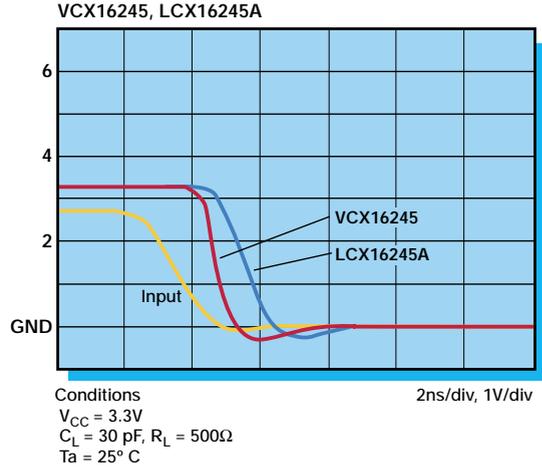
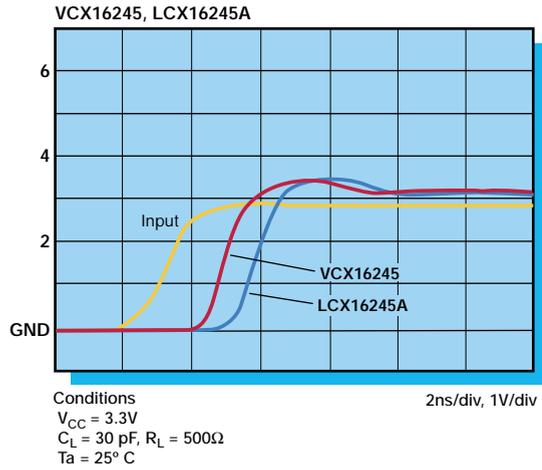
Power Down Protection



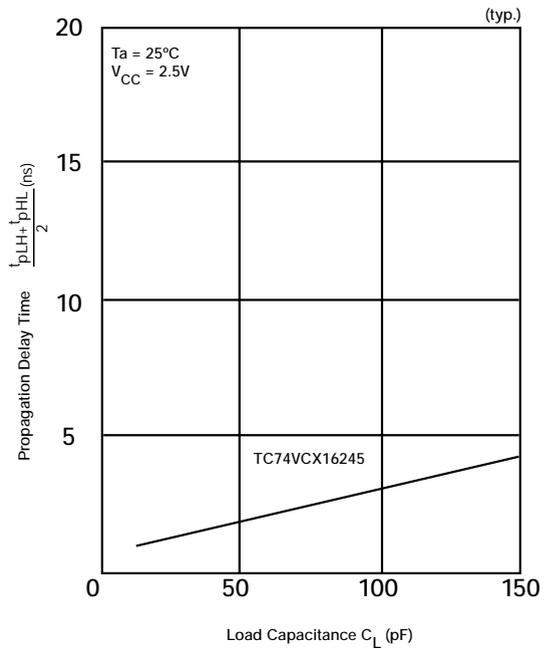
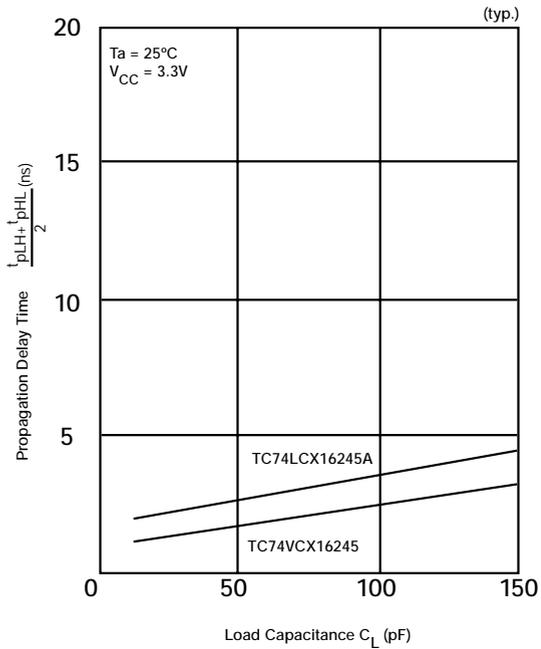
$I_{OFF} = 10 \mu A \text{ max. @ } -40 \sim +85^\circ C$
Zero Power Off Leakage Current

TC74VCX Series

Switching Waveforms

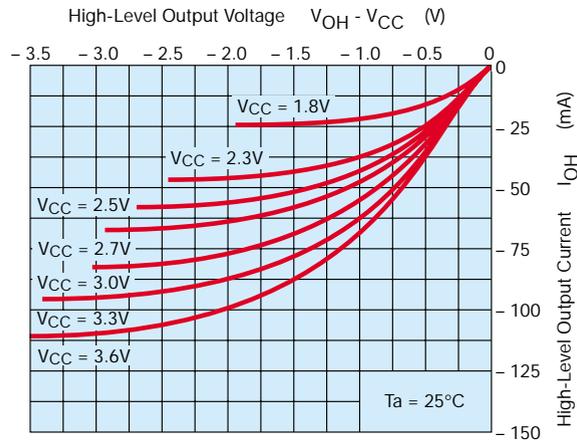
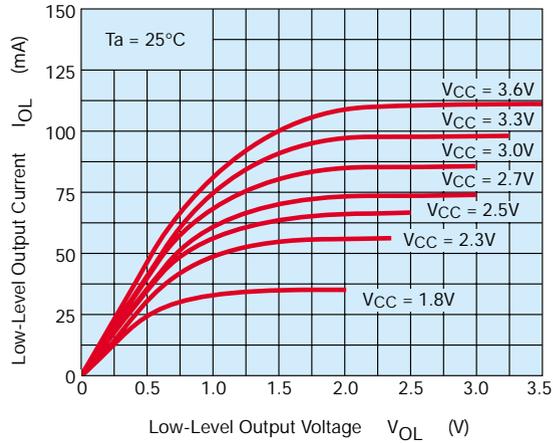


Switching Waveforms

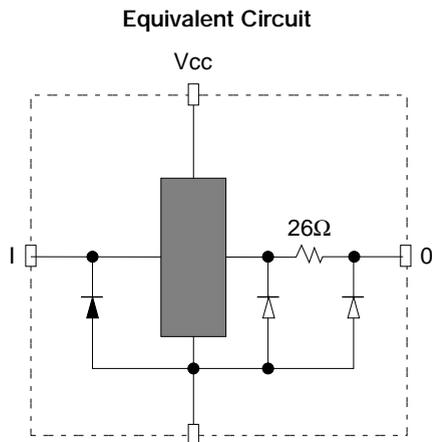


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Output Current Characteristics



Output Series Resistor



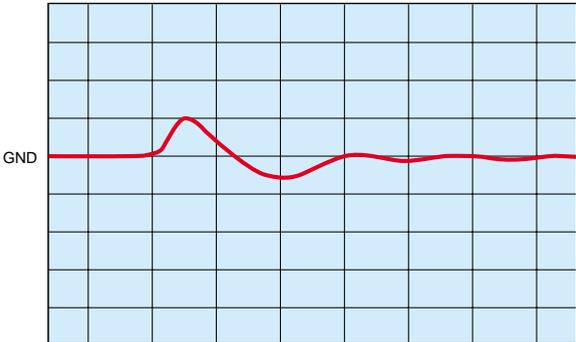
Part No.
TC74VCX162244FT
↓
Output Series Resistor

Output series resistor can reduce the following noise

- Reflection Noise
- Switching Noise

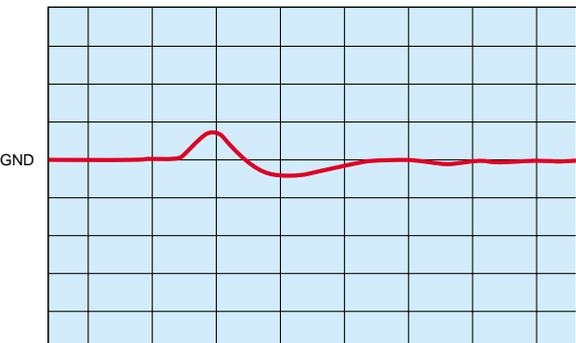
Simultaneous Switching Noise

VCX162244FT (Vcc=3.3V Typical Data)



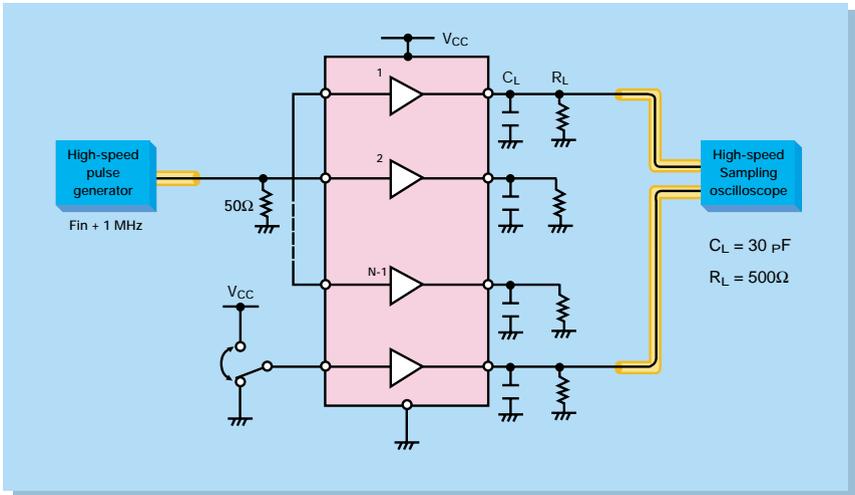
0.5V/div 2ns/div

VCX162244FT (Vcc=2.5V Typical Data)



0.5V/div 2ns/div

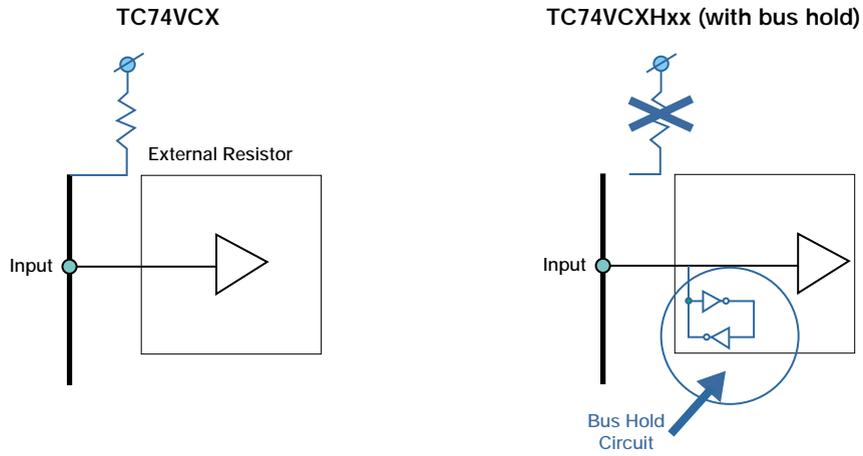
Test Circuit for Simultaneous Switching Noise



Bus Hold

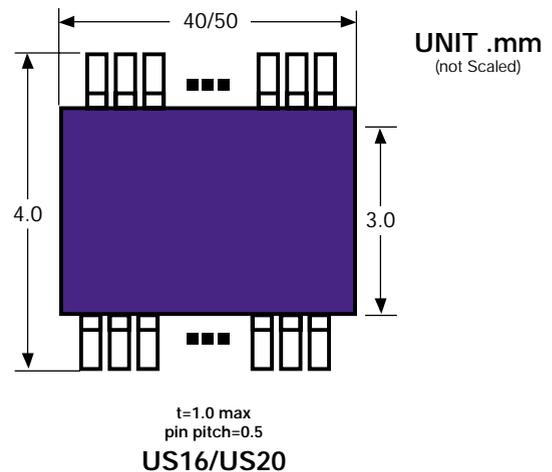
Bus Hold

- Holds the last known state of the inputs
- Eliminates the need for external resistor (i.e., saves board space)
- Reduces power consumption
- Improves system speed when switching the bus from tri-state
- Can provide TC74VCXHxx based on demand



TC7MA series (Mini VCX-Equivalent)

Information systems, communication and portable systems are rapidly moving to smaller packaging. In order to meet these new market demands, Toshiba offers VCX-Equivalent devices packaged in our very new package (US16/US20). It is the TC7MA series.



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Function Availability

P/N	TC74VCX	TC7MA	TC7SA	PINS
00	Available	—	Available	14 / 5
02	2Q/00	—	Planned	14 / 5
04	Mar/00	—	Planned	14 / 5
08	Available	—	Available	14 / 5
14	Mar/00	—	—	14
32	Available	—	Planned	14 / 5
74	2Q/00	—	—	14
86	2Q/00	—	—	14
125	Mar/00	—	Planned	14 / 5
126	—	—	Planned	14 / 5
138	2Q/00	2Q/00	—	16
157	1Q/00	1Q/00	—	16
244	Available	Available	—	20
2244	Available	Available	—	20
245	Available	Available	—	20
2245	Available	Available	—	20
257	Mar/00	Mar/00	—	16
367	2Q/00	2Q/00	—	16
373	Available	Available	—	20
2373	Available	Available	—	20
374	Available	Available	—	20
2374	Available	Available	—	20
541	Available	Available	—	20
2541	Available	Available	—	20
573	Available	Available	—	20
2573	Available	Available	—	20
574	Available	Available	—	20
2574	Available	Available	—	20
16244	Available	—	—	48
162244	Available	—	—	48
16245	Available	—	—	48
R162245	Available	—	—	48
16373	Available	—	—	48
162373	Available	—	—	48
16374	Available	—	—	48

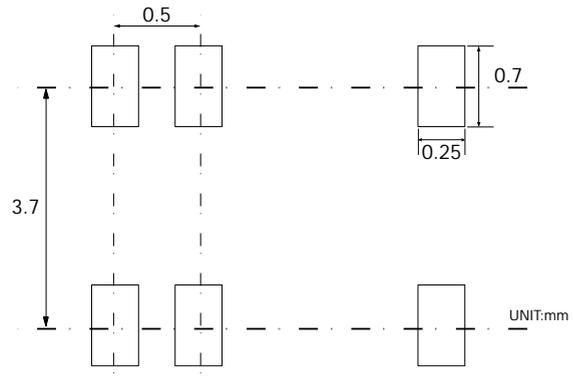
P/N	TC74VCX	TC7MA	TC7SA	PINS
162374	Available	—	—	48
16500	Available	—	—	56
162500	Available	—	—	56
16501	Available	—	—	56
162501	Available	—	—	56
16543	Available	—	—	56
162543	Available	—	—	56
16600	Available	—	—	56
162600	Available	—	—	56
16601	Available	—	—	56
162601	Available	—	—	56
16646	Available	—	—	56
162646	Available	—	—	56
16652	Available	—	—	56
162652	Available	—	—	56
16721	Mar/00	—	—	56
162721	Mar/00	—	—	56
16821	Mar/00	—	—	56
162821	Mar/00	—	—	56
16823	Mar/00	—	—	56
162823	Mar/00	—	—	56
16827	Available	—	—	56
162827	Available	—	—	56
16834	Available	—	—	56
162834	Available	—	—	56
16835	Available	—	—	56
162835	Available	—	—	56
16841	Available	—	—	56
162841	Available	—	—	56
16843	Available	—	—	56
162843	Available	—	—	56
4x244	Planned	—	—	TBD
4x245	Planned	—	—	TBD
4x373	Planned	—	—	TBD
4x374	Planned	—	—	TBD

All information included in this table is subject to change without notice.

US16/US20 Features

- **The smallest package in the world for 20 and 16 pin count**
Mounting Area : 20 mm² (20 pin),
16 mm² (16 pin)
- **The thinnest package in the world**
Thickness : 1.0mm max
- **Easy to assemble**
0.5 mm pin pitch
- **High Reliability / Quality**
Accept IR reflow / No dry pack required
- **Tape & Reel**
One reel is contained 2500pcs. For both 16 pin and 20 pin devices.

Recommended Mount Pad Dimension (Example)



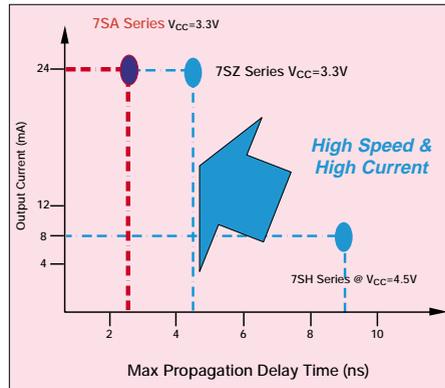
TC7SA series

Single Gate VCX-Equivalent

Application High performance PC
PC server
High speed Network

Package: USV, SMV

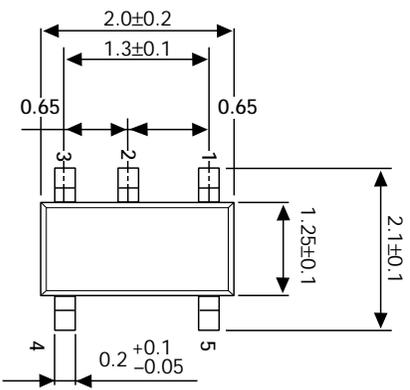
TC7SA (VCX Equivalent) vs. TC7SZ (LCX Equivalent)



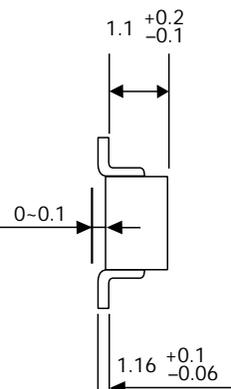
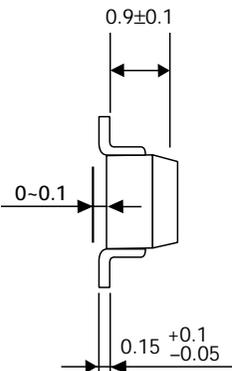
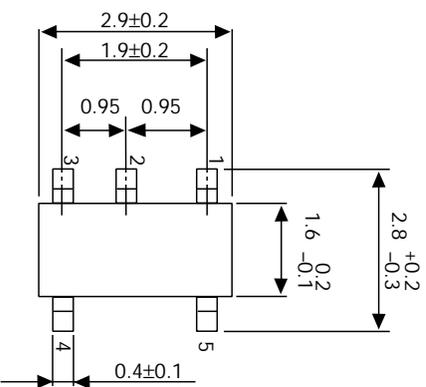
TC7SZ (LCX Equiv.) vs. TC7SA (VCX Equiv.)

Parameter	Condition	TC7SZ	TC7SA
Equivalent		LCX	VCX
Operating Voltage		1.8V to 5.5V	1.8V to 3.6V
t_{PLH} , t_{PHL}	$V_{CC} = 2.3V$, $C_L = 30pF$		3.7 ns max.
	$V_{CC} = 3.0V$, $C_L = 30pF$		2.8 ns max.
	$V_{CC} = 2.3V$, $C_L = 50pF$	5.5 ns max.	
	$V_{CC} = 3.0$, $C_L = 50pF$	4.8 ns max.	
I_{OH} , I_{OL}	$V_{CC} = 2.5 \pm 0.2V$	$\pm 8mA$ min.	$\pm 6mA$ min.
	$V_{CC} = 3.3 \pm 0.3V$	$\pm 24mA$ min.	$\pm 24mA$ min.
	$V_{CC} = 5.0 \pm 0.5V$	$\pm 32mA$ min.	

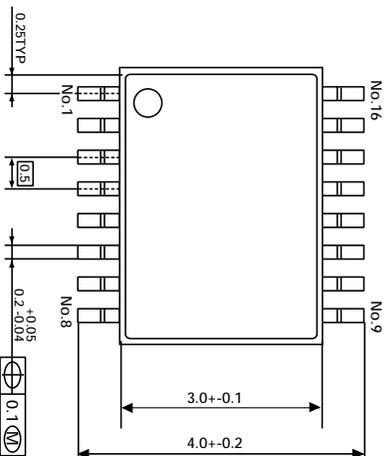
USV 5 pin



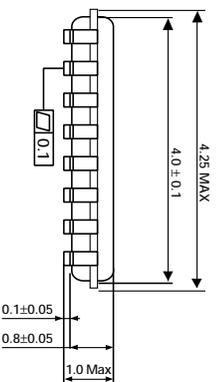
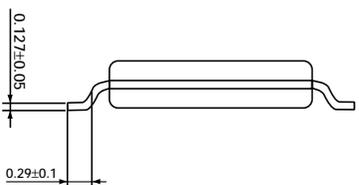
SMV 5 pin



US16 16 pin

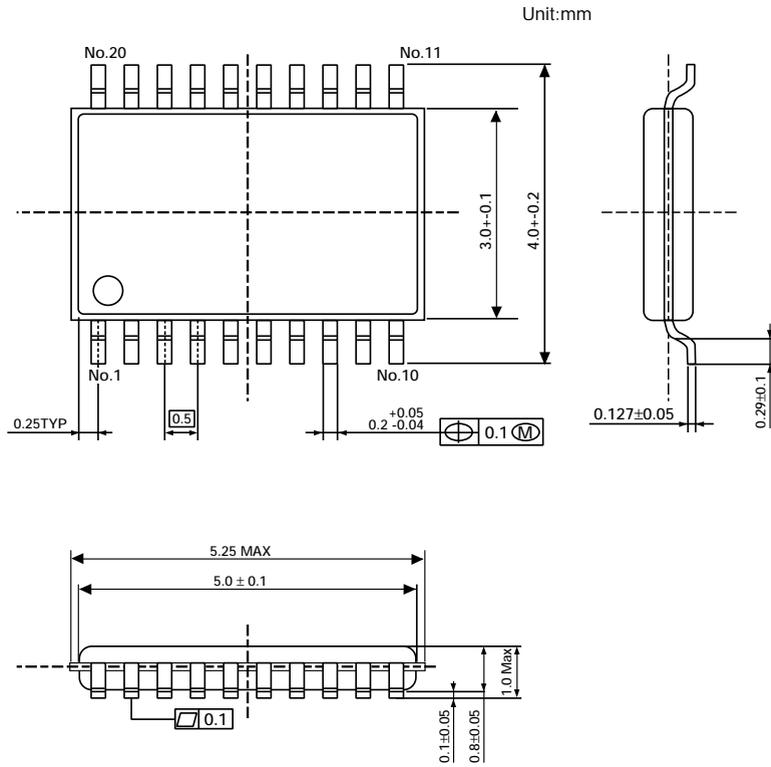


Unit:mm

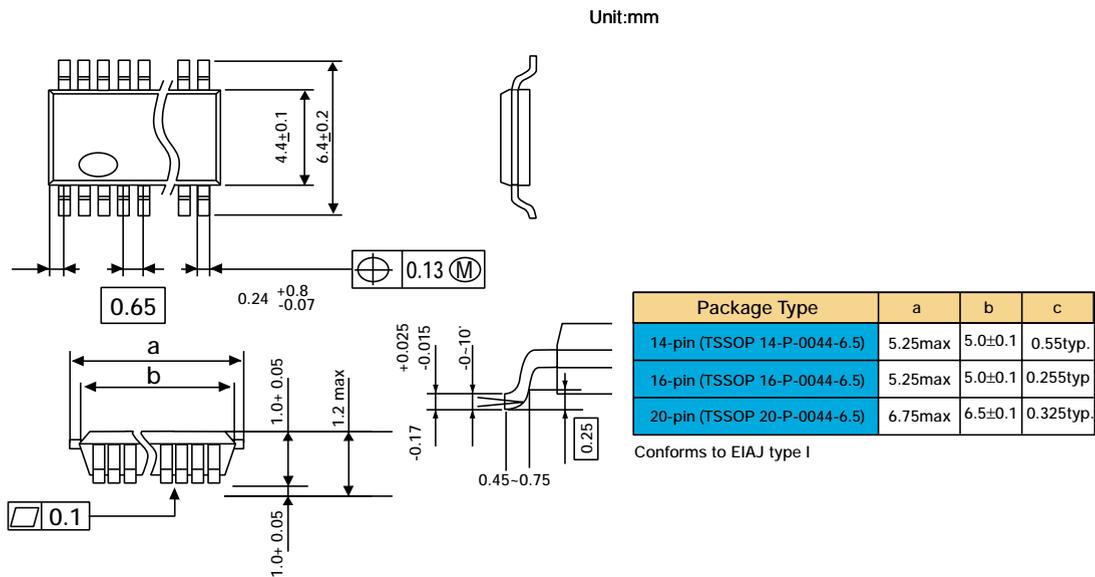


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US20 20 pin

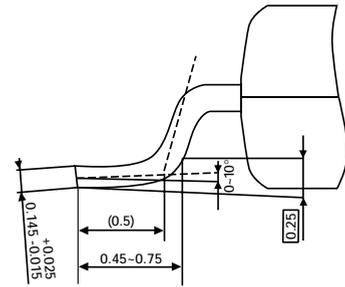
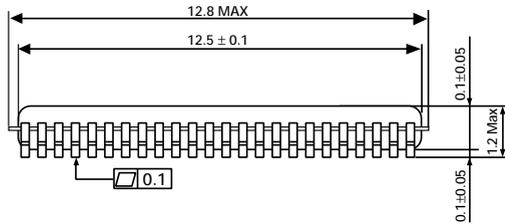
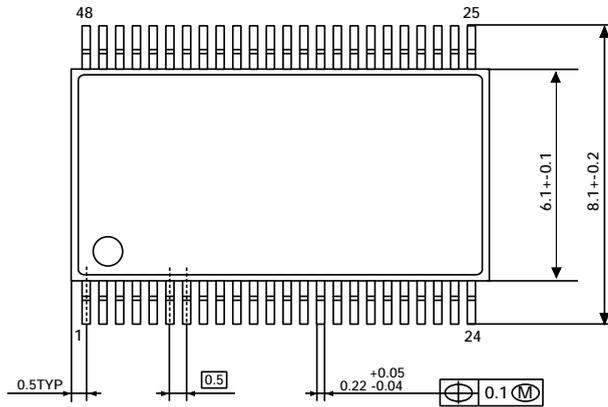


TSSOP 14/16/20 pin

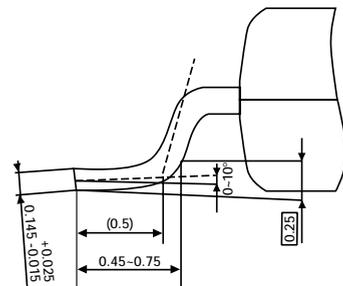
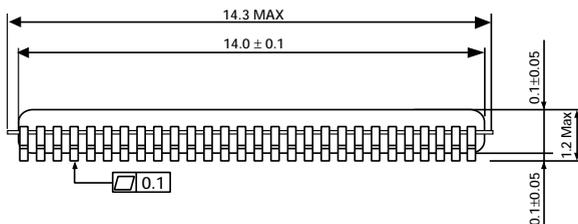
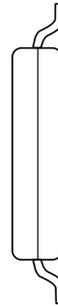
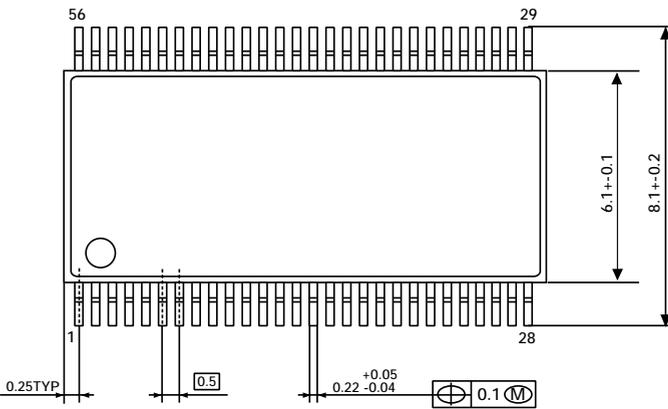


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TSSOP 48 pin



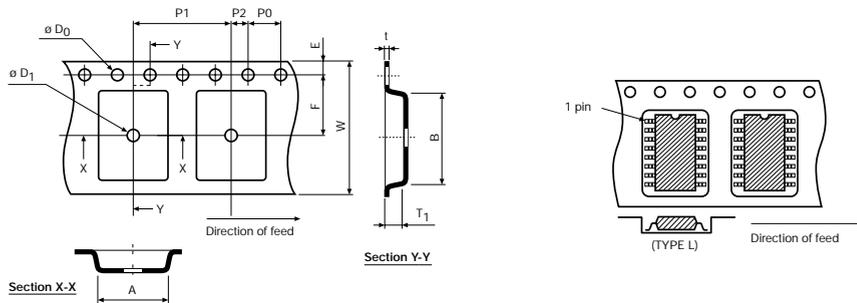
TSSOP 56 pin



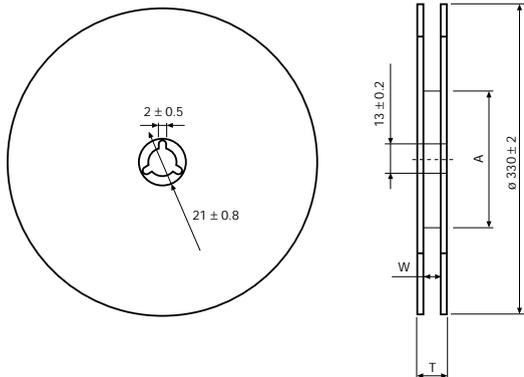
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TSSOP / US16 / US20 Package

	A	B	W	F	E	P1	P2	P0	øD0	t	T1	øD1
TSSOP 14, 16 Pin type	6.8 ±0.1	5.4 ±0.1	16.0 ±0.3	7.5 ±0.1	1.75 ±0.1	8.0 ±0.1	2.0 ±0.1	4.0 ±0.1	1.5 +0.1 -0	0.3 ±0.05	1.5 ±0.1	1.6 ±0.1
TSSOP 20 Pin type	6.8 ±0.1	6.9 ±0.1	16.0 ±0.3	7.5 ±0.1	1.75 ±0.1	8.0 ±0.1	2.0 ±0.1	4.0 ±0.1	1.5 +0.1 -0	0.3 ±0.05	1.5 ±0.1	1.6 ±0.1
US16 Pin type	4.25 ±0.1	4.26 ±0.1	12.0 ±0.3	5.5 ±0.1	1.75 ±0.1	8.0 ±0.1	2.0 ±0.1	4.0 ±0.1	1.5 +0.1 -0	0.3 ±0.05	1.3 ±0.1	1.6 ±0.1
US20 Pin type	4.25 ±0.1	5.26 ±0.1	12.0 ±0.3	5.5 ±0.1	1.75 ±0.1	8.0 ±0.1	2.0 ±0.1	4.0 ±0.1	1.5 +0.1 -0	0.3 ±0.05	1.3 ±0.1	1.6 ±0.1



Mechanical Specifications of Reel



TSSOP14	ø 100 ± 1	17.5 ± 0.5	21.5 ± 1.0
TSSOP16			
TSSOP20			
TSSOP48-P	ø 100 ± 1	25.5 ± 0.5	29.5 ± 1.0
TSSOP56-P			
US16	ø 100 ± 1	13.0 ± 0.5	17.0 ± 1.0
US20			