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Semiconductor Catalog 2012-11

# General-Purpose Logic ICs



SEMICONDUCTOR & STORAGE PRODUCTS

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## ▶ Preface

As the semiconductor industry enters the deep-sub-nanometer age, we are seeing further increases in the performance of large-scale integrated (LSI) circuits. Combined with surface-mount technology (SMT), highly integrated LSI chips are accelerating trends toward miniaturization and high performance in computers and various other electronic equipment, resulting in a multitude of new products.

Advances in LSI technology inevitably affect the standard logic ICs that serve as peripheral interfaces to CPUs, large-capacity memories and ASICs. To take full advantage of the latest LSI products, it is essential that the performance of logic ICs be improved.

To meet these needs, Toshiba is committed to developing the highest-performance CMOS logic products using microfabrication technology. Toshiba is also expanding the offerings of ultra-compact packages to help improve board utilization.

This catalog presents the Toshiba line of CMOS logic ICs centered on these new products. We hope that this catalog will come in handy as a selection guide. For the up-to-date information, please visit our website (<http://www.semicon.toshiba.co.jp/eng/product/logic/index.html>).

Some of the products discussed in this document are still under development. For details concerning shipping dates and availability, please contact your nearest Toshiba office or distributor.

# 1 Toshiba General-Purpose Logic Family

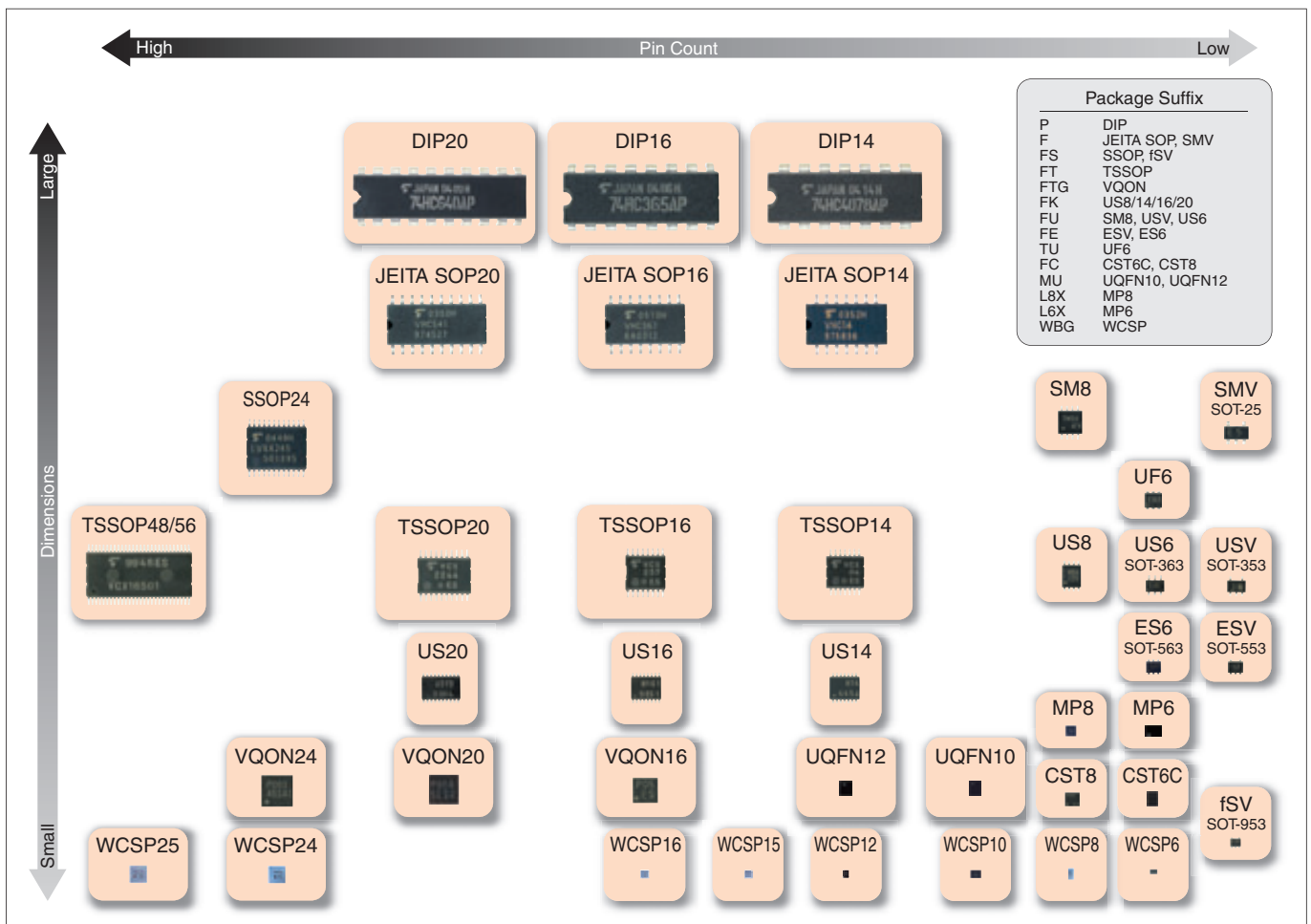
GENERAL-PURPOSE LOGIC ICs

## Functions and Family/Series Names

	General-Purpose Logic	One-Gate CMOS (L-MOS)
Standard family	TC4000/4500 Series	TC4S/4W Series
5-V family	TC74HC/HCT Series	TC7WT Series
	TC74VHC/VHCT Series	TC7SH/7WH Series TC7SET Series
	TC74AC/ACT Series	-
Low-voltage family	TC74LVX Series	-
	TC74LCX Series	TC7SZ/WZ/PZ Series
	TC74VCX Series	TC7PA Series
	-	TC7SG/WG/PG Series

	Bus Switch	Level Shifter		ASSP
8 bits	TC7MB Series	TC7MP/LX Series	Glue logic	TC7MP01
Multiplexer	TC7MB Series	-	Multi-function gates	TC7MP97/98 TC7SP97/98 TC7SP57/58
4 bits	TC7MB Series	TC7MP/LX Series	8-bit bidirectional buffers	TC7MP245
2 bits	TC7WB Series	TC7WP/LX Series	Bus buffers with output series resistor	TC7MP85400/85410
1 bit	TC7SB Series	TC7SP/LX Series		

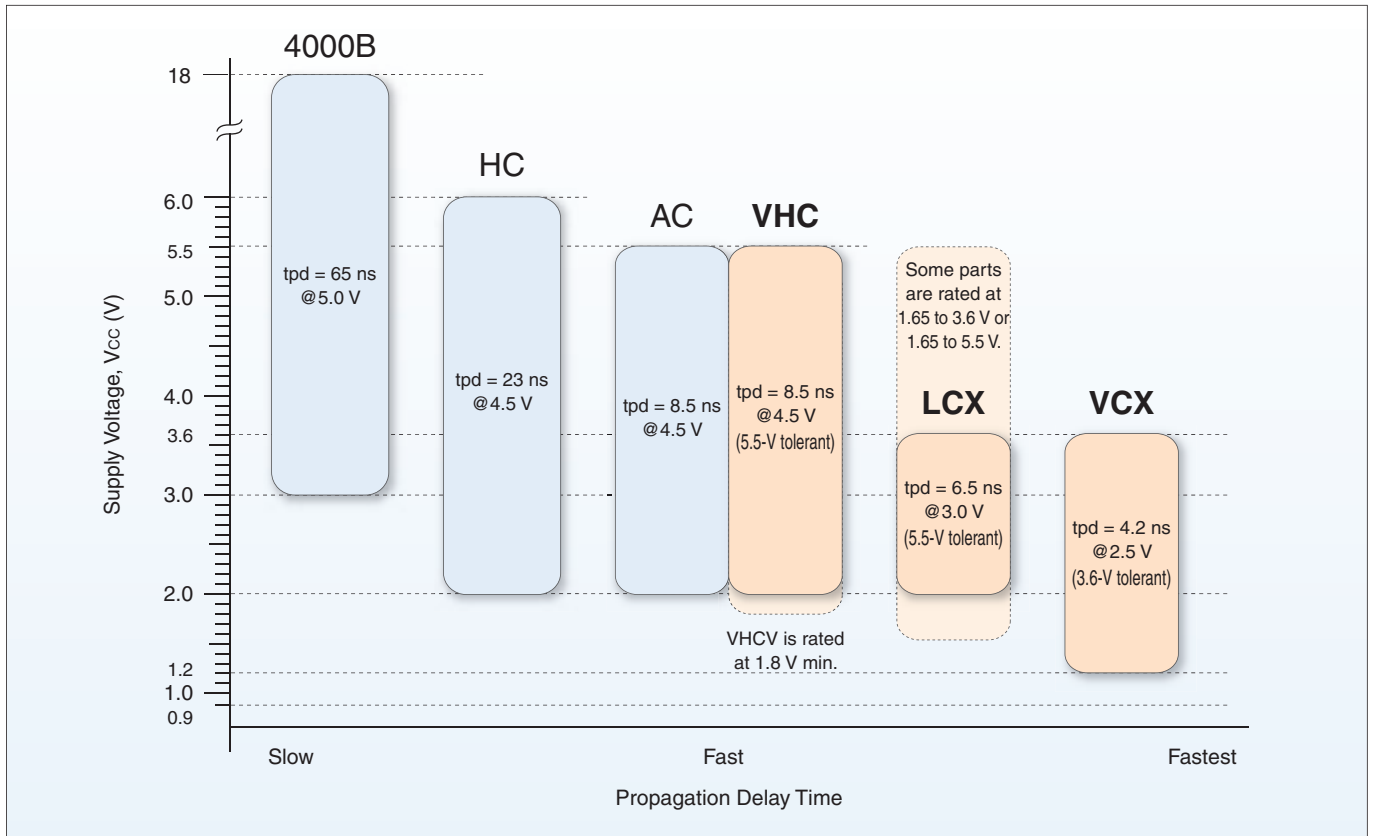
## Package Types



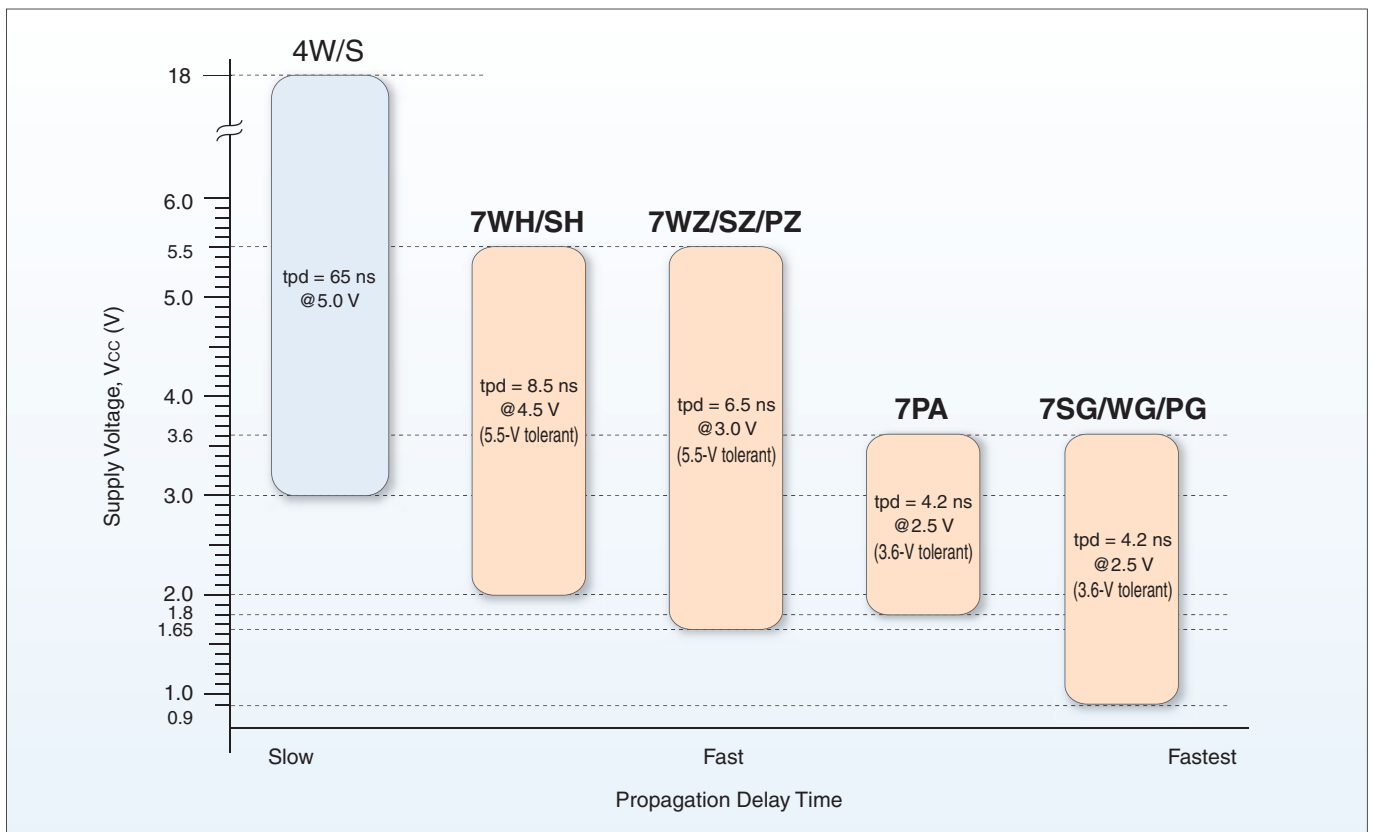
# 2 Family Positioning: Supply Voltages vs Speeds

## GENERAL-PURPOSE LOGIC ICs

### General-Purpose Logic



### One-Gate Logic (L-MOS)





# 3 Part Naming Conventions

## GENERAL-PURPOSE LOGIC ICs

General-Purpose Logic

**TC 4011 B P**

- Package type\*
- B Series gates
- U: Unbuffered, blank: Buffered
- Function
- Toshiba CMOS logic

**TC 74 VHC T 244 A FT**

- Package type\*
- Revision code
- Function
- U: Unbuffered, blank: Buffered, T: TTL-level input, H: Bushold input, R: Built-in output serial resistor, V: Schmitt-trigger inputs, 9: Schmitt-trigger inputs and two-sided pin assignment, Z: Hot plugging
- Series (VCX, LCX, LVX, AC, VHC, HC)
- Toshiba CMOS logic

One-Gate CMOS (L-MOS)

**TC 7 S H U 04 FU**

- Package type (F: SMV FU: SM8, USV or US6 FK: US8 FE: ESV or ES6 FC: CST8 FS: fSV L8X: MP8)
- Letter beginning with A for upgraded versions
- Function: Same as for standard CMOS logic
- U: Unbuffered, blank: Buffered, T: TTL-level input
- Number of pins (S: 5 pins, P: 6 pins, W: 8 pins)
- Series
- Toshiba CMOS logic

\*: Refer to the package types given in the following table.

## Package Types

### 14-, 16-, 20-, 24-, 48- and 56-Pin

Series	Suffix Package # of Pins	P DIP			F SOP			FS SSOP	FT TSSOP					FK US			FTG VQON			MU UQFN		WBG WCSP						
		14	16	20	14	16	20	24	14	16	20	48	56	14	16	20	16	20	24	10	12	10	12	15	16	24		
CMOS Logic	TC4xxxB	○	○	○	○	○	○	-	△	△	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	TC74HCxxx	○	○	○	○	○	○	-	△	△	△	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	TC74ACxxx	○	○	○	○	○	○	-	△	△	△	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	TC74VHCxxx	○	-	○	○	○	○	-	○	○	○	-	-	-	△	△	△	-	-	-	-	-	-	-	-	-	-	
CMOS Logic (Low-Voltage)	TC74LVXxxx	-	-	-	-	○	-	○	-	○	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	TC74LCXxxx	-	-	-	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	TC74VCXxxx	-	-	-	-	-	-	-	○	○	○	○	○	○	△	○	○	△	△	-	-	-	-	-	-	-	-	
Bus Switch	TC7USBxxx	-	-	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-	△	△	○	-	-	-	-	-	
	TCUAxxx	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	○	-	-		
	TC7MBxxx	-	-	-	-	-	-	-	○	○	○	-	-	-	○	○	△	-	-	-	-	-	-	-	-	-		
	TC7MBLxxx	-	-	-	-	-	-	-	○	○	○	-	-	-	○	○	△	△	-	-	-	-	-	-	-	-		
Level Shifter	TC7QPBxxx	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	○	-	-	-	-	-	-	-	-	-		
	TC7MPBxxx	-	-	-	-	-	-	-	○	-	○	-	-	-	○	○	-	-	-	-	-	-	-	-	-	-		
	TC7MPxxx	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	○	-	○	-	-	-	-	-	-	-		
	TC7LXxxx	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	△	-	○	-	○	○		
ASSP	TC7MPxxx	-	-	-	-	-	-	-	○	-	-	-	-	-	○	○	○	-	○	-	-	-	-	-	-	-		

### 8-Pin

Series	# of Pins Package	8					
		SM8	US8	CST8	MP8	WCSP8	WBG
Bus Switch	TC7USBxxx	-	○	-	-	-	○
	TC7WBxxx	-	○	-	△	-	-
	TC7WBLxxx	-	○	-	-	-	-
	TC7PBxxx	-	○	○	-	-	-
Level Shifter	TC7WPxxx	-	○	○	-	-	-
	TC7WPBxxx	-	○	○	△	-	-
	TC7LXxxx	-	○	-	-	○	-
L-MOS	TC4Wxxx	○	-	-	-	-	-
	TC7WTxxx	○	-	-	-	-	-
	TC7WHxxx	○	○	○	-	-	-
	TC7WZxxx	○	○	-	-	-	-
	TC7WGxxx	○	○	-	-	-	-

### 5- and 6-Pin

Series	# of Pins Package	5				6							
		SMV	USV	ESV	fSV	US6	ES6	UF6	CST6C	MP6	WCSP6		
Bus Switch	TC7SBxxx	-	○	-	-	-	○	-	-	-	-	-	-
	TC7SBLxxx	-	○	-	-	-	-	-	-	-	-	△	
	TC7PBxxx	-	-	-	-	-	-	△	-	-	-	-	
	TC7SPxxx	-	-	-	-	-	-	○	-	-	-	-	
Level Shifter	TC7SPxxx	-	-	-	-	-	-	○	○	△	○	-	
	TC7LXxxx	-	-	-	-	-	-	-	-	-	-	○	
L-MOS	TC4Sxxx	○	△	-	-	-	-	-	-	-	-	-	
	TC7SLxxx	○	○	-	-	-	-	-	-	-	-	-	
	TC7SHxxx	○	○	○	○	-	-	-	-	-	-	-	
	TC7SETxxx	○	○	-	-	-	-	-	-	-	-	-	
	TC7SZxxx	○	○	○	-	-	-	-	-	-	-	-	
	TC7SAxxx	○	○	-	-	-	-	-	-	-	-	-	
	TC7PAxxx	-	-	-	-	○	○	-	-	-	-	-	
	TC7SGxxx	-	○	○	○	-	-	-	-	-	△	-	
TC7PGxxx	-	-	-	-	○	○	-	-	-	-	-		

(○) : Available for all functions, (△) : Available only for some functions, (-) : Not available

# ▶ 4 General-Purpose Logic Families

## GENERAL-PURPOSE LOGIC ICs

### General-Purpose Logic

Toshiba has expanded its low-voltage product line by introducing the new TC74VCX Series.

TC74VCX/LCX/LVX Series devices provide different features such as high-speed operation, high drive capability, interface capability and low cost, so they can readily fulfill the requirements of low-voltage systems. To meet customers' needs, we continue to offer higher-performance general-purpose logic ICs.

#### ▶ High-Speed CMOS Logic

Characteristics and Features		3.3-V Logic			5-V Logic		
		74VCX	74LCX	74LVX	74AC (ACT)	74VHC (VHCT)	74HC (HCT)
Power supply voltage range		1.2 to 3.6 V	1.65 to 3.6 V 2.0 to 3.6 V (74LCX16xxx)	2.0 to 3.6 V	2.0 to 5.5 V (5.0 ± 0.5 V)	2.0 to 5.5 V (5.0 ± 0.5 V) 1.8 to 5.5 V (74VHCV)	2.0 to 6.0 V (5.0 ± 0.5 V)
Propagation delay  VCX: 16244 Other series: 244 (guaranteed value)	@4.5 V $C_L = 50$ pF $C_L = 15$ pF	– –	– –	– –	8.5 ns –	8.5 ns 6.5 ns	23 ns –
	@3.0 V $C_L = 50$ pF $C_L = 30$ pF $C_L = 15$ pF	– 2.5 ns –	– 6.5 ns –	– 12.0 ns 8.5 ns	– 13.0 ns –	– 13.5 ns 10.0 ns	– – –
	@2.7 V $C_L = 50$ pF $C_L = 15$ pF	– –	– 7.5 ns –	– 17.0 ns 13.5 ns	– –	– –	– –
	@2.3 V $C_L = 30$ pF	3.2 ns	–	–	–	–	–
	@1.8 V $C_L = 30$ pF	5.7 ns	–	–	–	–	–
Simultaneous switching noise (typ.) $V_{OLP}$ VCX: 16244, other series: 244		0.8 V	0.8 V	0.3 V	1.2 V	0.7 V (74VHC) 1.0 V (74VHCV)	0.5 V
Power-down protection on inputs		Yes	Yes	Yes	No	Yes	No
Power-down protection on outputs		Yes	Yes	No	No	No (74VHC) Yes (74VHCT/VHCV)	No
Output current (guaranteed value)		± 24 mA	± 24 mA	± 4 mA	± 24 mA	± 8 mA ± 16 mA (74VHCV)	± 4/6 mA
Quiescent supply current (240 type)		20 μA	10 μA	40 μA	80 μA	40 μA	40 μA
Input voltage $V_{IH}/V_{IL}$		2.0 V/0.8 V			3.5 V/1.5 V (2.0 V/0.8 V)		
Operating temperature		– 40 to 85 °C					
Package		TSSOP,US, VQON	SOP, TSSOP, SSOP, US	SOP, TSSOP SSOP, US	DIP, SOP, TSSOP	SOP, TSSOP, US, DIP	DIP, SOP TSSOP
Number of devices		91	42	5	83	100	137

## ► Improved Interface Flexibility

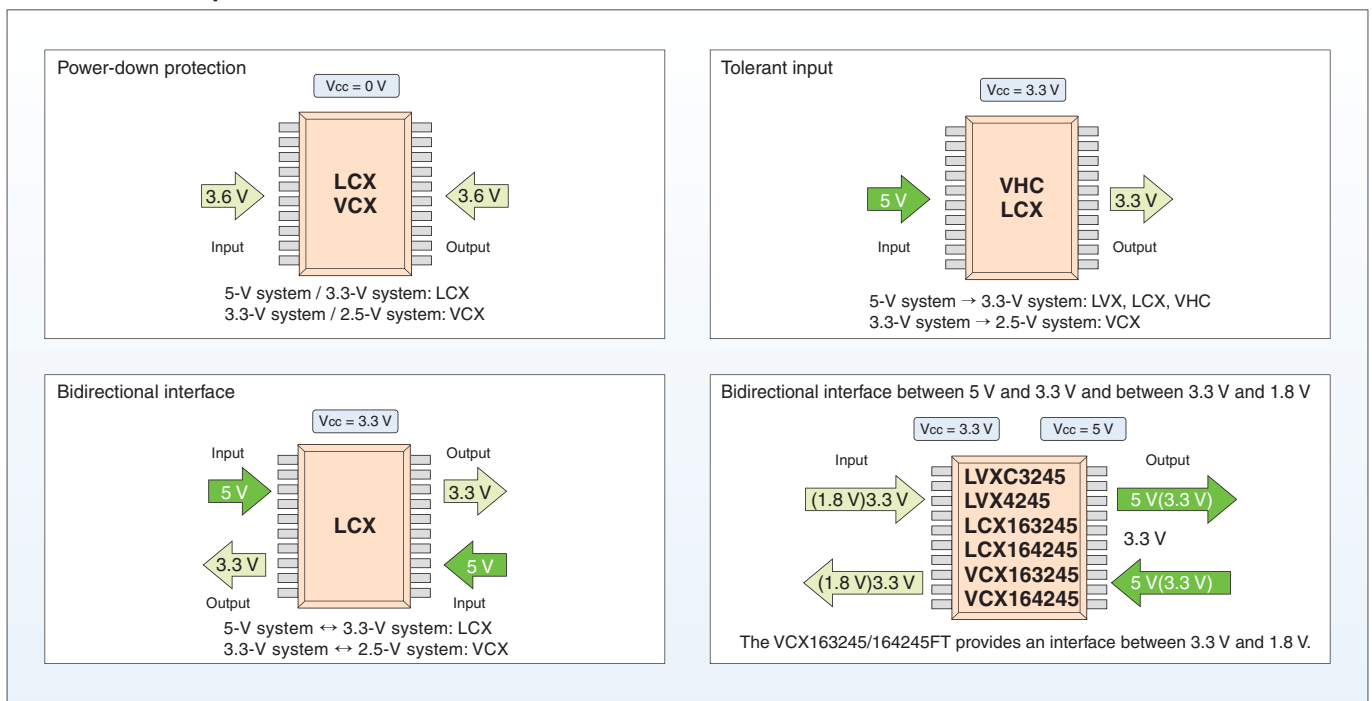
- Voltage tolerance: Suitable for level shifting between different voltage levels and for battery backup circuits
- Power-down protection: Suitable for preventing device destruction caused by input/output voltage mismatch

## ■ Permissible I/O Voltage Ranges

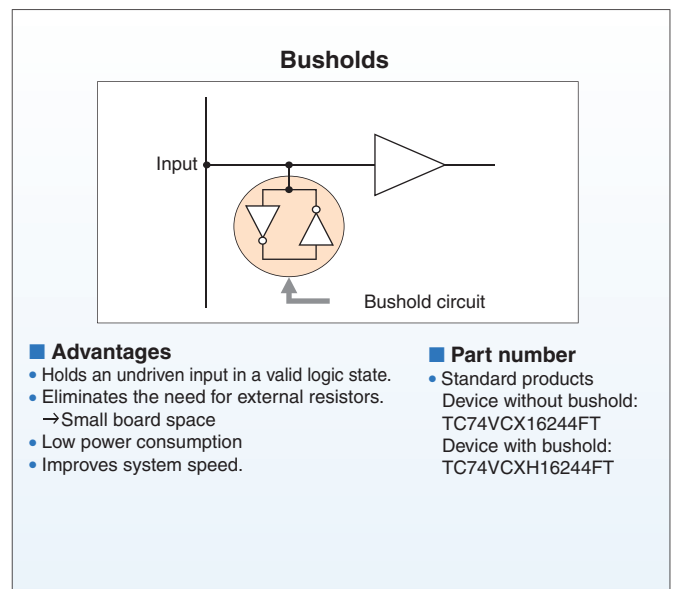
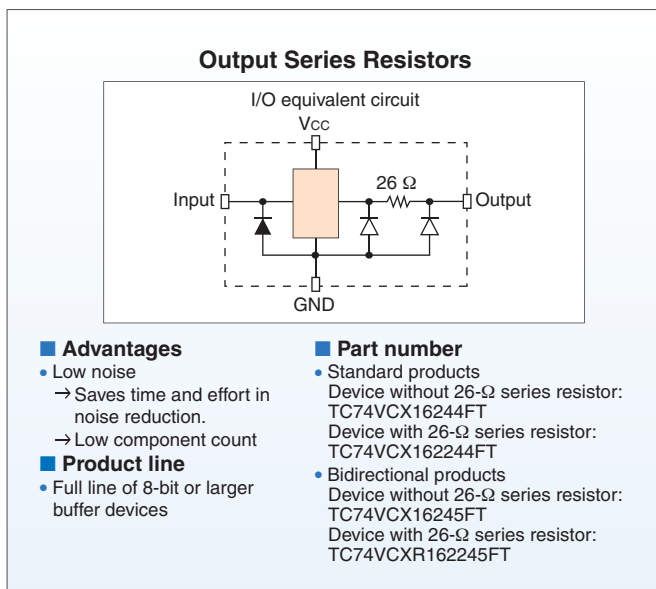
	VCX	LCX	LVX	VHC	VHCT	VHCV
Input voltage range (active)	0 to 3.6 V	0 to 5.5 V	0 to 5.5 V	0 to 5.5 V	0 to 5.5 V	0 to 5.5 V
(power-down)	0 to 3.6 V	0 to 5.5 V	0 to 5.5 V	0 to 5.5 V	0 to 5.5 V	0 to 5.5 V
Output voltage range (output enabled)	0 to V <sub>CC</sub>	0 to V <sub>CC</sub>	0 to V <sub>CC</sub>	0 to V <sub>CC</sub>	0 to V <sub>CC</sub>	0 to V <sub>CC</sub>
(output disabled)	0 to 3.6 V	0 to 5.5 V	0 to V <sub>CC</sub>	0 to V <sub>CC</sub>	0 to 5.5 V	0 to 5.5 V
(power-down)	0 to 3.6 V	0 to 5.5 V	0*	0*	0 to 5.5 V	0 to 5.5 V

\*: Do not apply a voltage.

## ■ Interface Examples



## ► Output Series Resistor and Bushold for the 74VCX Series



# ▶ 4 General-Purpose Logic Families

## GENERAL-PURPOSE LOGIC ICs

### General-Purpose Logic

#### ▶ TC74VHCV Series

##### ■ Overview

The TC74VHCV Series is a variant of its predecessor, TC74VHC Series, and features Schmitt-trigger buffers on all input pins, power-down protection on all output pins, and an output drive strength of 16 mA. The TC74VHCV Series is ideal for interfacing between different voltage levels and slowly changing inputs.

##### ■ Key Specifications

Characteristic	Symbol	Rating	Test Condition
Power Supply Voltage	V <sub>cc</sub>	1.8 to 5.5 V	
Output Current	I <sub>out</sub>	±16 mA (Min.)	V <sub>cc</sub> = 4.5 V
Delay time (VHCV244)	tpLH/HL	8.5 ns	V <sub>cc</sub> = 4.5 V, CL = 50 pF
Input hysteresis voltage	VH	0.4 to 1.4 V	V <sub>cc</sub> = 4.5 V

##### ■ Features

- Power-down protection on all output pins
- Schmitt-trigger buffers on all input pins
- Output drive strength of 16 mA min (@ 4.5 V), compared to 8 mA of the TC74VHC
- Minimum operating voltage as low as 1.8 V
- Product offerings include a new function, a Schmitt buffer, designated TC74VHCV17FT/FK.
- Available in the industry-standard TSSOP and small US packages.
- Pin-compatible with other 74 sub-families for easy replacement

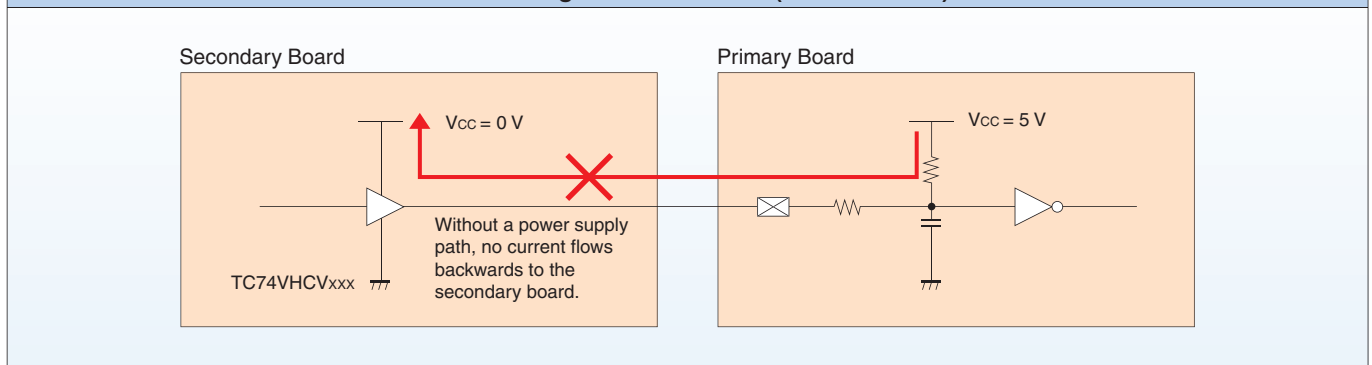
##### ■ Product Lineup

Function	Part Number		Function	Part Number	
	TSSOP	US		TSSOP	US
Hex Schmitt inverter (Open Drain)	TC74VHCV05FT	TC74VHCV05FK	Octal Bus Buffer (3-state)	TC74VHCV541FT	TC74VHCV541FK
Hex Schmitt buffer (Open Drain)	TC74VHCV07FT	TC74VHCV07FK	Octal Bus Transceiver (3-state)	TC74VHCV245FT	TC74VHCV245FK
Hex Schmitt Inverter	TC74VHCV14FT	TC74VHCV14FK	Octal D-Type Flip-Flop (3-state)	TC74VHCV374FT	TC74VHCV374FK
Hex Schmitt Buffer	TC74VHCV17FT	TC74VHCV17FK	Octal D-Type Flip-Flop (3-state)	TC74VHCV574FT	TC74VHCV574FK
Octal Bus Buffer (3-state, inverted)	TC74VHCV240FT	TC74VHCV240FK	Octal D-Type Latch (3-state)	TC74VHCV373FT	TC74VHCV373FK
Octal Bus Buffer (3-state)	TC74VHCV244FT	TC74VHCV244FK	Octal D-Type Latch (3-state)	TC74VHCV573FT	TC74VHCV573FK
Octal Bus Buffer (3-state, inverted)	TC74VHCV540FT	TC74VHCV540FK			

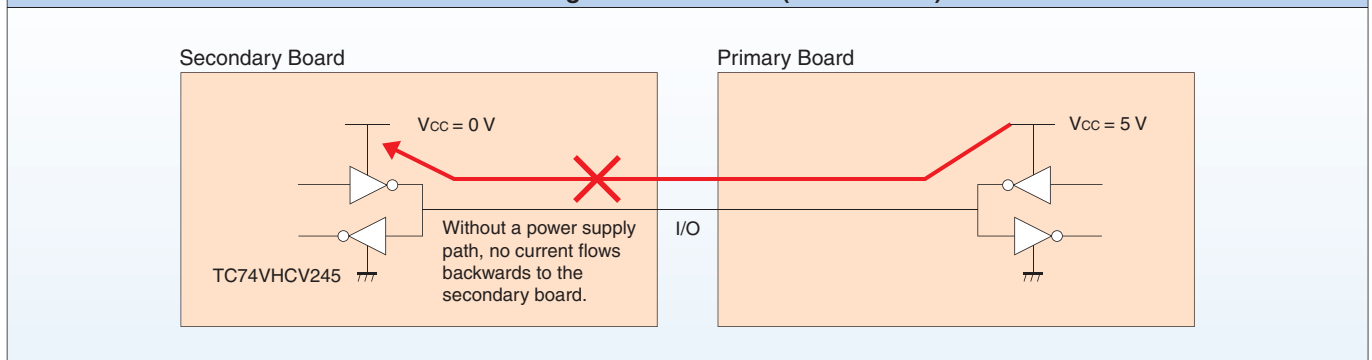
##### ■ Using Power Management for Energy-Saving Purposes

The secondary board provides power-down protection for the output; thus it does not draw current from the primary board even when its power supply is removed.

#### 1. Interfacing Between Boards (Unidirectional)



#### 2. Interfacing Between Boards (Bidirectional)





## ▶ TC74VHC9 Series

### ■ Overview

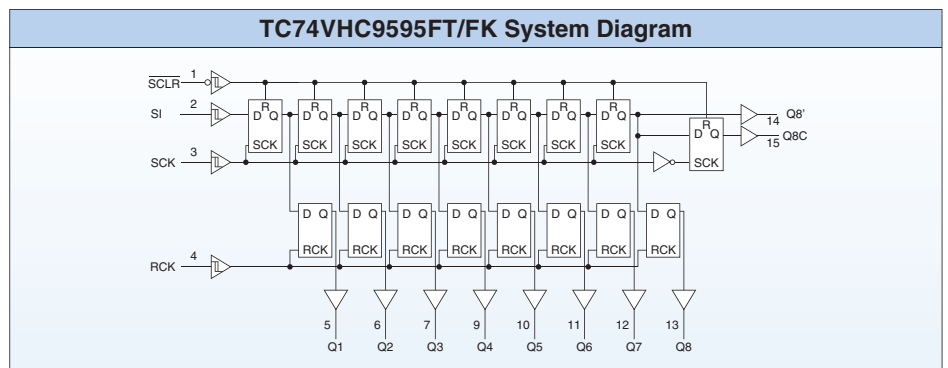
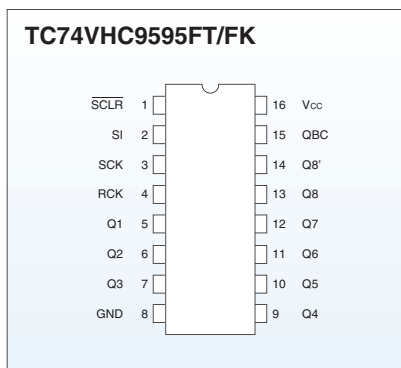
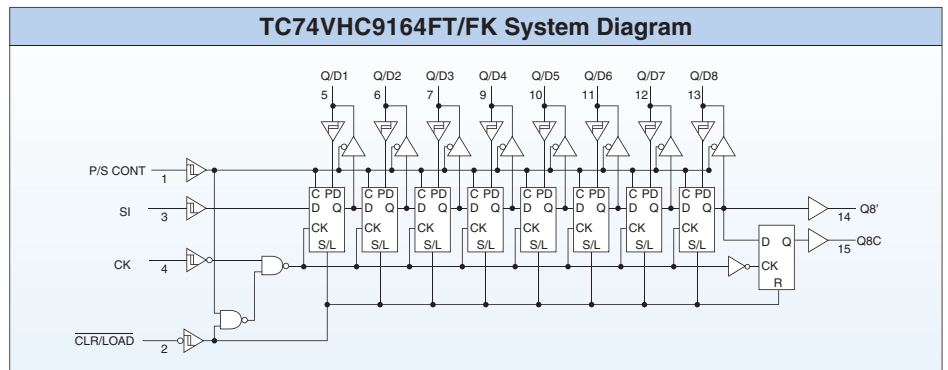
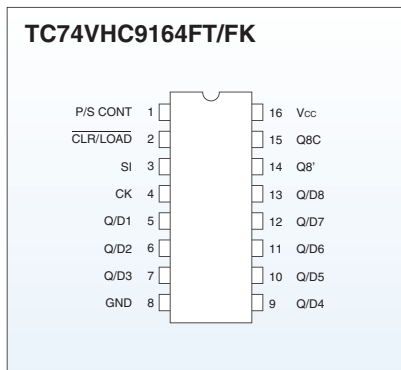
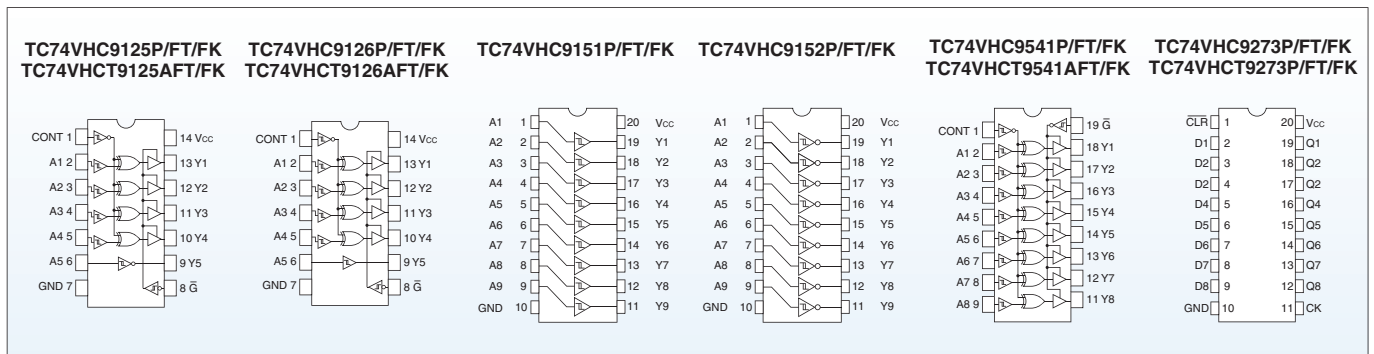
The TC74VHC9 Series is a variant of the TC74VHC Series. The TC74VHC9 Series features Schmitt-trigger inputs and has input and output pins on opposite sides of the package to ease board layout.

### ■ Features

- Schmitt-trigger buffers on all input pins
- Configurable as inverting and noninverting via the CONT input (9125/9126/9541)
- Available in through-hole DIP, industry-standard TSSOP and small US packages.
- Key electrical parameters equivalent to the TC74VHC Series

### ■ Product Lineup

Function	CMOS Input			TTL Input		
	DIP	TSSOP	US	DIP	TSSOP	US
5-Bit Universal Schmitt Buffer (Y5: Inverting type)	TC74VHC9125P	TC74VHC9125FT	TC74VHC9125FK	-	TC74VHCT9125AFT	TC74VHCT9125AFK
5-Bit Universal Schmitt Buffer (Y5: Non-Inverting type)	TC74VHC9126P	TC74VHC9126FT	TC74VHC9126FK	-	TC74VHCT9126AFT	TC74VHCT9126AFK
Octal Universal Schmitt Buffer	TC74VHC9541P	TC74VHC9541FT	TC74VHC9541FK	-	TC74VHCT9541AFT	TC74VHCT9541AFK
Octal D-Type Flip Flop with Clear	TC74VHC9273P	TC74VHC9273FT	TC74VHC9273FK	TC74VHCT9273P	TC74VHCT9273FT	TC74VHCT9273FK
9-Bit Universal Schmitt Buffer	TC74VHC9151P	TC74VHC9151FT	TC74VHC9151FK	-	-	-
9-Bit Universal Schmitt Inverter	TC74VHC9152P	TC74VHC9152FT	TC74VHC9152FK	-	-	-
8-Bit Shift Register (P-IN/S-OUT, S-IN/P-OUT)	-	TC74VHC9164FT	TC74VHC9164FK	-	-	-
8-Bit Shift Register/Latch	-	TC74VHC9595FT	TC74VHC9595FK	-	-	-



# 4 General-Purpose Logic Families

## GENERAL-PURPOSE LOGIC ICs

### General-Purpose Logic

#### TC74LCXZ, TC74LCXZA Series

##### Overview

The TC74LCXZ and TC74LCXZA Series are designed to support hot swap insertion and removal.

The TC74LCXZ assumes a high-impedance state when the  $V_{CC}$  power supply is turned on and off and when  $V_{CC}$  is between 0 V and 1.5 V; thus it permits hot swap insertion and removal during 3.3-V operation.

The TC74LCXZA Series assumes a high-impedance state when the  $V_{CC}$  power supply is turned on and off and when  $V_{CC}$  is between 0 V and 1.2 V; thus it permits hot swap insertion and removal during 2.5-V operation.

##### Key Specifications

Characteristic	Symbol	TC74LCXZ240/244	TC74LCXZA240/244
Power supply voltage	$V_{CC}$	2.7 V to 3.6 V	2.3 V to 2.7 V
Output current	$I_{OH}$	- 24 mA (min) @ $V_{CC} = 3.0$ V	- 12 mA (min) @ $V_{CC} = 2.3$ V
	$I_{OL}$	+ 36 mA (min) @ $V_{CC} = 3.0$ V	+ 18 mA (min) @ $V_{CC} = 2.3$ V
3-state output off-state current	$I_{OZPU}, I_{OZPD}$	$\pm 5.0$ $\mu$ A (max) @ $V_{CC} = 0$ V to 1.5 V	$\pm 5.0$ $\mu$ A (max) @ $V_{CC} = 0$ V to 1.2 V
Quiescent supply current	$I_{CC}$	$\pm 40$ $\mu$ A (max)	$\pm 40$ $\mu$ A (max)

##### Product Lineup

###### TC74LCXZ Series

Function	Part Number	
	TSSOP	US
Octal Bus Buffer (3-State, Inverted)	TC74LCXZ240FT	TC74LCXZ240FK
Octal Bus Buffer (3-State)	TC74LCXZ244FT	TC74LCXZ244FK

###### TC74LCXZA Series

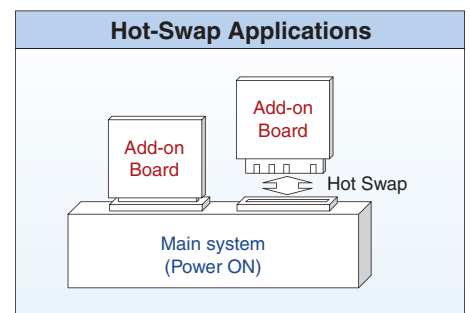
Function	Part Number	
	TSSOP	US
Octal Bus Buffer (3-State, Inverted)	TC74LCXZA240FT	TC74LCXZA240FK
Octal Bus Buffer (3-State)	TC74LCXZA244FT	TC74LCXZA244FK

##### Features

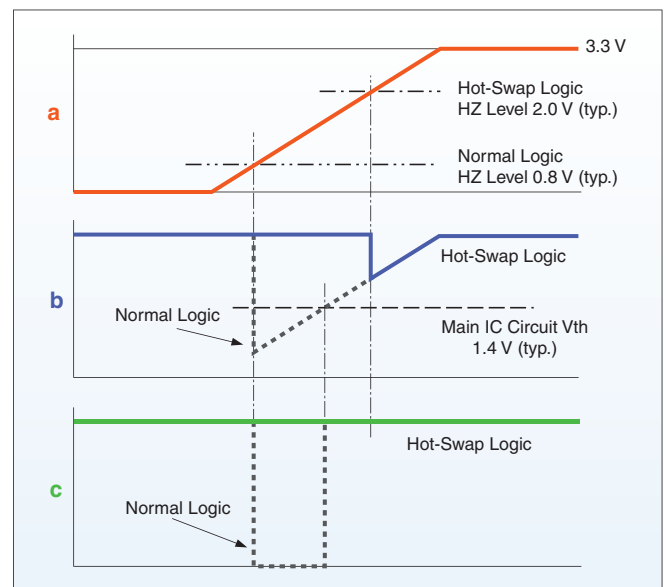
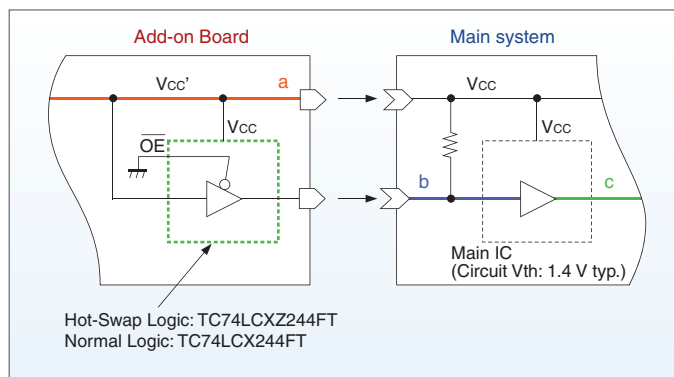
- Power-down protection provided on all inputs and outputs
- Available in industry-standard TSSOP packages and small US packages.

##### Application

- Networking
- Servers
- Routers
- Computer Terminals
- Personal Computers



##### Operation



## ASSPs (Application-Specific Standard Products)

### ► Multi-Function Gate Logic

#### ■ Overview

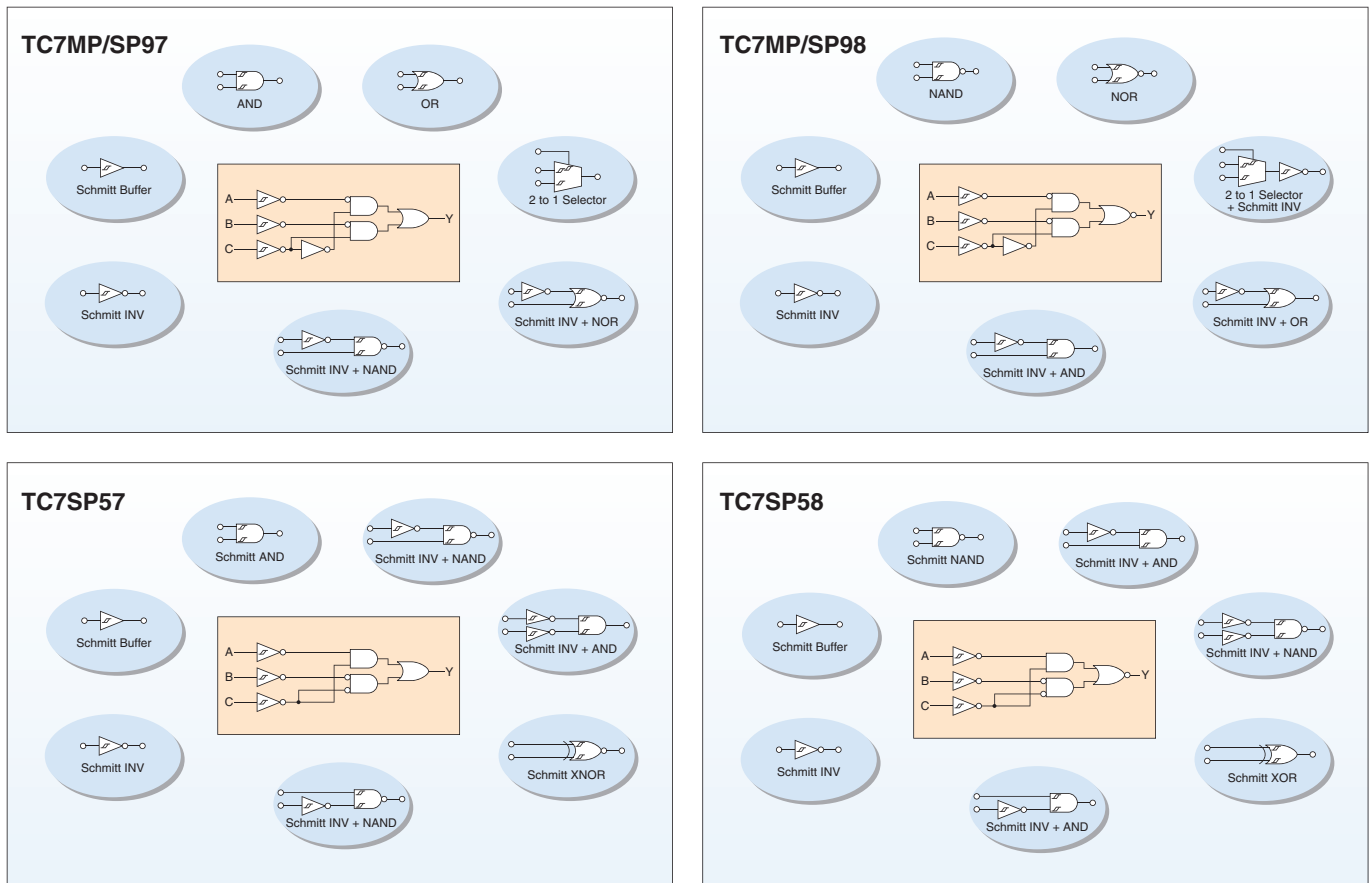
The multi-function gate logic is an IC capable of performing seven types of gate function with a single device.

#### ■ Features

- Seven types of gate function can be supported with a single device
- Power supply voltage:  $V_{CC} = 1.2$  to  $3.6$  V
- Output current:  $I_{OH}/I_{OL} = \pm 8$  mA @  $V_{CC} = 3.0$  V
- Propagation delay:  $t_{pLH}/t_{pHL} = 10$  ns (max) @  $V_{CC} = 3.0$  V
- Voltage tolerance: 3.6-V tolerant inputs
- Quiescent supply current: 2  $\mu$ A (max) @  $V_{CC} = 3.6$  V or 0 V,  $V_{IN} = 3.6$  V
- Package: TSSOP14, US14, UF6, US6, WCP6

#### ■ Seven Types of Function Available with Multi-Function Gate Logic

Three inputs select a particular logical function to be performed.



#### ■ Product Lineup

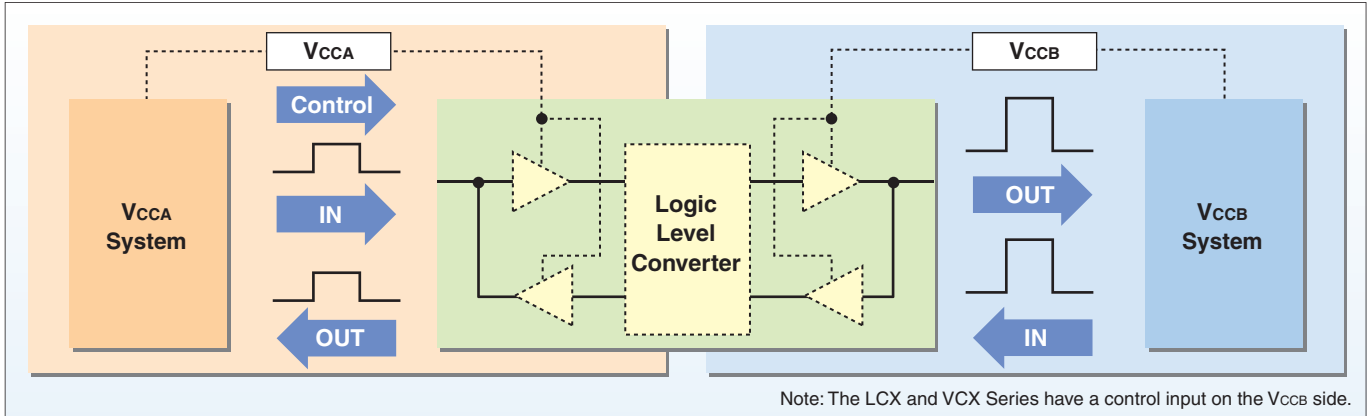
Part Number	# of Pins	Function	Package	Mass Production
<b>TC7MP97</b>	14	Low-Voltage Triple Configurable Multiple-Function Gate	US14/TSSOP14	Y
<b>TC7MP98</b>	14	Low-Voltage Triple Configurable Multiple-Function Gate	US14/TSSOP14	Y
<b>TC7SP97</b>	6	Low-Voltage Single Configurable Multiple-Function Gate	UF6/WCSP6	Y
<b>TC7SP98</b>	6	Low-Voltage Single Configurable Multiple-Function Gate	UF6/WCSP6	Y
<b>TC7SP57</b>	6	Low-Voltage Single Configurable Multiple-Function Gate	US6/WCSP6	Y
<b>TC7SP58</b>	6	Low-Voltage Single Configurable Multiple-Function Gate	US6/WCSP6	Y

# 4 General-Purpose Logic Families

## GENERAL-PURPOSE LOGIC ICs

### Level Shifters

#### Dual-Supply Bidirectional Bus Transceivers



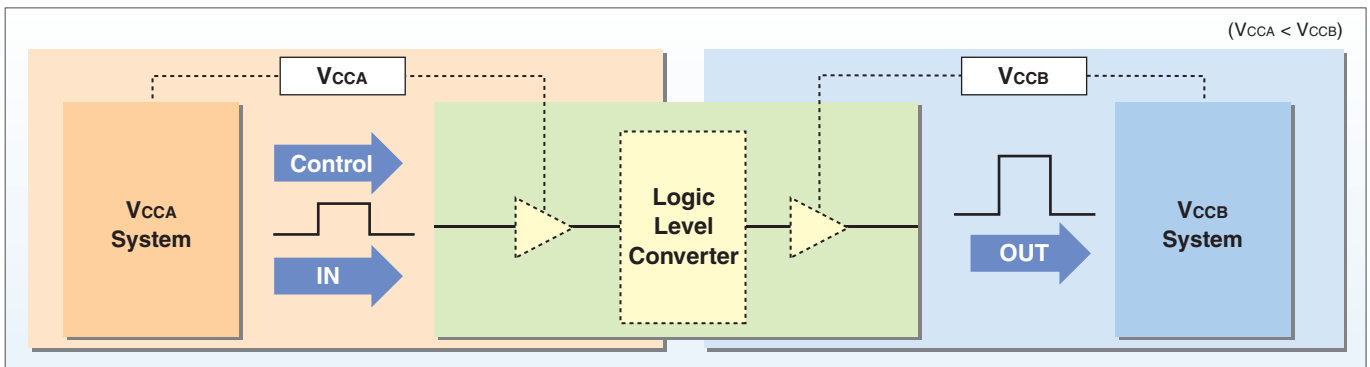
Dual-supply bidirectional level shifters are an ideal solution for mixed-voltage systems. These devices provide bidirectional voltage translation between a wide range of voltage levels.

\*: These devices allow bidirectional voltage translation between  $V_{CCA}$  and  $V_{CCB}$ .

#### Product Lineup

Bit Width	Part Number				Package
4	TC7MP3125FTG	TC7MPH3125FTG	TC7MPN3125FTG	TC7MPS3125FTG	VQON16 US16
	TC7MP3125FK	TC7MPH3125FK	TC7MPN3125FK	TC7MPS3125FK	
8	TC7MP3245FTG	TC7MPH3245FTG	TC7MPN3245FTG		VQON24
	TC74LVXC3245FS				SSOP24
16	TC74LVX4245FS				SSOP24
	TC74VCX163245FT				TSSOP48
	TC74VCX164245FT				TSSOP48
	TC74LCX163245FT	TC74LCXR163245FT			TSSOP48
	TC74LCX164245FT	TC74LCXR164245FT			TSSOP48
					TSSOP48

#### Dual-Supply Unidirectional Bus Buffers



Dual-supply unidirectional bus buffers are an ideal solution for mixed-voltage systems. They provide unidirectional voltage translation between a wide range of voltage levels.

\*: These devices allow voltage translation from  $V_{CCA}$  to  $V_{CCB}$ .

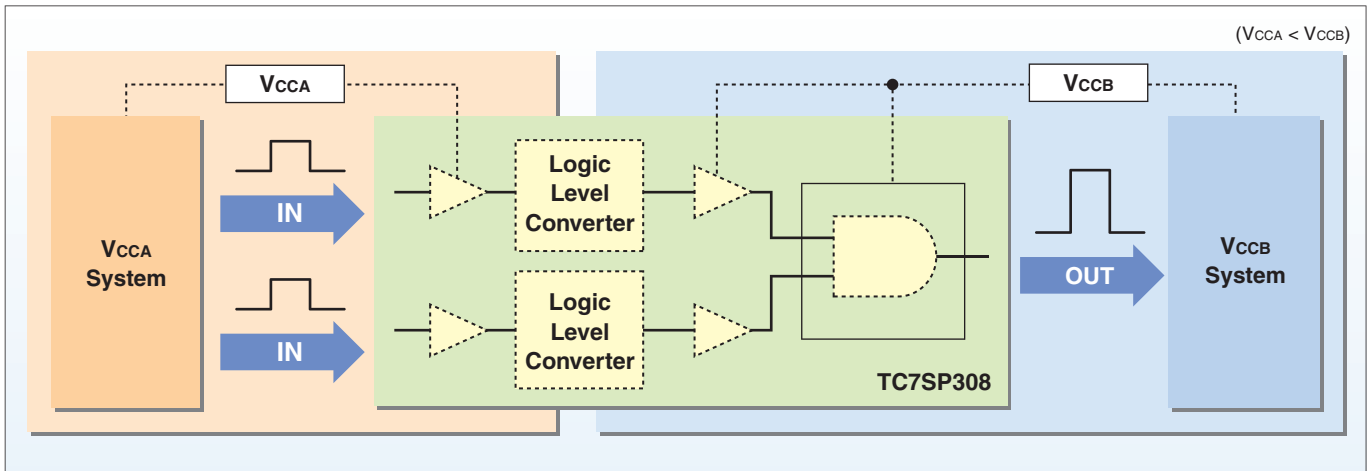
#### Features

- Supply voltage:  $V_{CCA} = 1.1$  to  $2.7$  V  
 $V_{CCB} = 1.65$  to  $3.6$  V
- Latch-up immunity:  $\pm 300$  mA or higher
- ESD performance:  $\pm 200$  V or higher (machine model)  
 $\pm 2000$  V or higher (human body model)
- Low current consumption:  $2.0 \mu\text{A}$  (max)
- 3.6-V tolerant function and power-down protection provided on all inputs and outputs.

#### Product Lineup

Bit Width	Part Number		Package	Mass Production
1	TC7SP3125TU	TC7SPN3125TU	UF6	Y
	TC7SP3125CFC	TC7SPN3125CFC	CST6C	Y
	TC7SP3125WBG	TC7SPN3125WBG	WCSP6	Y
	TC7SP334L6X	TC7SPN334L6X	MP6	Under development
2	TC7WP3125FC	TC7WPN3125FC	CST8	Y
	TC7WP3125FK	TC7WPN3125FK	US8	Y

## ▶ Logic Gates with Level-Shifting Function



The TC7SP Series integrates a level shifter and a logic gate into a single chip to help save board space. It is housed in the ultra-small WCSP6 package.

### ■ Features

- Supply voltage:  $V_{CCA} = 1.1$  to  $2.7$  V  
 $V_{CCB} = 1.65$  to  $3.6$  V
- Latch-up immunity:  $\pm 300$  mA or higher
- ESD performance:  $\pm 200$  V or higher (machine model)  
 $\pm 2000$  V or higher (human body model)
- Low current consumption:  $2.0$   $\mu$ A (max)
- 3.6-V tolerant function and power-down protection provided on all inputs and outputs.

### ■ Pin Assignment Diagrams (Top View)

TC7SP300WBG	TC7SP302WBG	TC7SP308WBG
TC7SP332WBG	TC7SP381WBG	TC7SP386WBG

### ■ Product Lineup

Part Number	Features	Package
TC7SP300WBG	2-Input NAND Gate with Level Shift Function	WCSP6
TC7SP302WBG	2-Input NOR Gate with Level Shift Function	WCSP6
TC7SP308WBG	2-Input AND Gate with Level Shift Function	WCSP6
TC7SP332WBG	2-Input OR Gate with Level Shift Function	WCSP6
TC7SP381WBG	2-Input Exclusive-NOR Gate with Level Shift Function	WCSP6
TC7SP386WBG	2-Input Exclusive-OR Gate with Level Shift Function	WCSP6

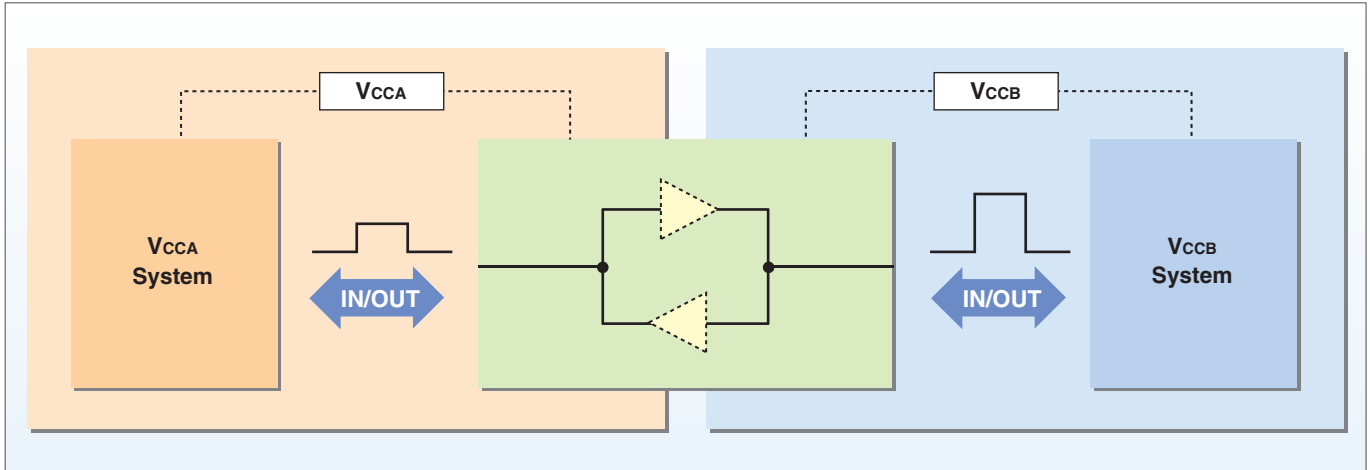


# ▶ 4 General-Purpose Logic Families

## GENERAL-PURPOSE LOGIC ICs

### Level Shifters

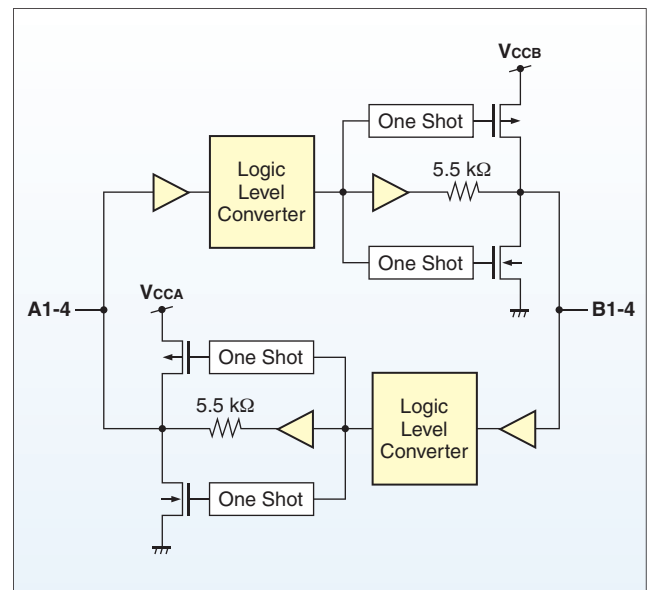
#### ▶ Dual-Supply Bus Transceivers with Auto Direction Sensing (Bus Buffers)



The TC7LX Series allows for bidirectional translation between different voltage nodes ranging from 1.2 V to 3.6 V without a need for a direction control (DIR) signal. It is easy to use because no limitation exists for the combinations of  $V_{CCA}$  and  $V_{CCB}$  voltages and their power-up sequence. The small chip-scale WCSP packages and the reduced pin count (no DIR pin) help to save the board space needed for soldering.

#### ■ Features (TC7LX1104WBG)

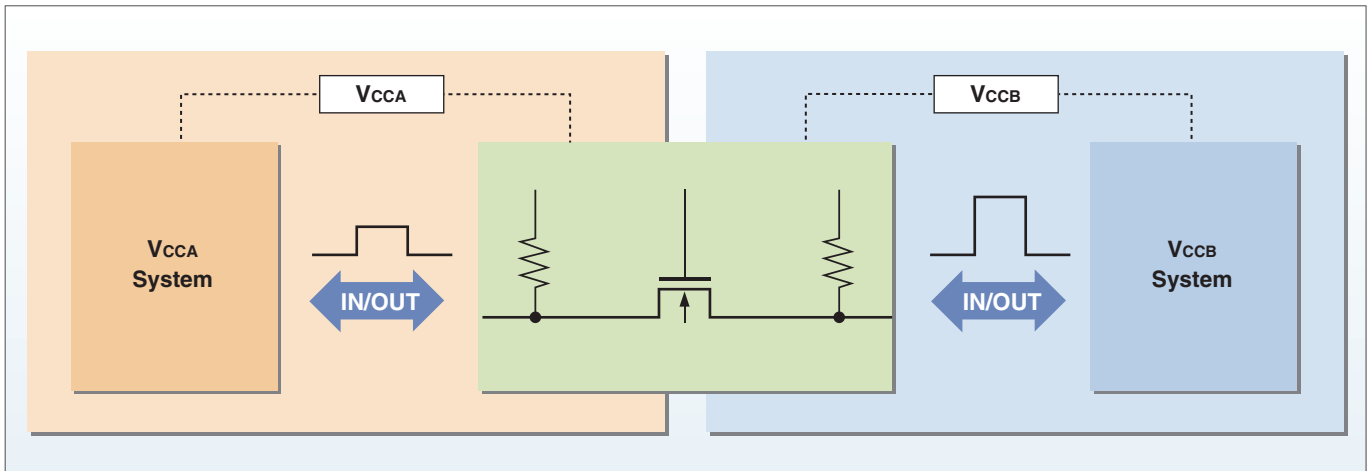
- Power supply voltage (V):  $V_{CCA} = 1.2$  to  $3.6$  V  
 $V_{CCB} = 1.2$  to  $3.6$  V
- High-speed operation:  $t_{pd} = 5.7$  ns  
( $V_{CCA} = 1.8 \pm 0.15$  V,  $V_{CCB} = 3.3 \pm 0.3$  V)
- Maximum data rate: 120 Mbps  
( $V_{CCA} = 1.8 \pm 0.15$  V,  $V_{CCB} = 3.3 \pm 0.3$  V)
- Latch-up performance:  $\pm 300$  mA or higher
- ESD performance:  $\pm 200$  V or higher (machine model)  
 $\pm 2000$  V or higher (human body model)
- Low current consumption:  $2 \mu\text{A}$  (max)
- Ultra-small package: WCSP12
- 3.6-V tolerant function and power-down protection provided on all inputs and outputs.
- If at least one of the  $V_{cc}$  power supplies is turned off ( $V_{CCA/B} = 0$  V), all ports are disabled.



#### ■ Product Lineup

Part Number	Configuration	Bit Width	Package	Mass Production
TC7LX1101WBG	SPST	1	WCSP6	Y
TC7LX1102WBG	SPST	2	WCSP8	Y
TC7LX1102FK	SPST	2	US8	Y
TC7LX1104WBG	SPST	4	WCSP12	Y
TC7LX0104MU	SPST	4	UQFN12	Y
TC7LX1106WBG	SPST	6	WCSP16	Y
TC7LX1108WBG	SPST	8	WCSP24	Y
TC7LX1204WBG	SPDT	4	WCSP24	Y

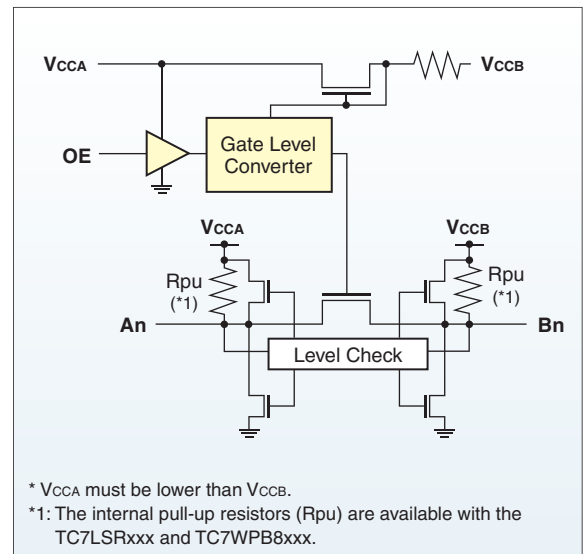
## ► Dual-Supply Bus Transceivers with Auto Direction Sensing (High-Speed Bus Switches)



The TC7LS and TC7WPB8 Series are dual-supply, bidirectional bus switch level shifter that allows voltage translation between 1.8 to 5 V and 2.5 to 5 V. The integrated level-shift assist circuit enables bidirectional voltage translation at high speed. The TC7LS and TC7WPB8 Series are ideal for voltage translation for open-drain applications such as I<sup>2</sup>C.

### ■ Features

- Power supply voltage:  $V_{CCA} = 1.65$  to  $5.5$  V,  $V_{CCB} = 2.3$  to  $5.5$  V
- Maximum data rate: 40 Mbps (TC7LS Series)  
24 Mbps (TC7WPB8 Series)  
( $V_{CCA} = 3.3$  V,  $V_{CCB} = 5.0$  V,  $C_L = 15$  pF)
- Low current consumption:  $1\mu\text{A}$  (max)
- 5.5-V tolerant function and power-down protection provided on all inputs and outputs.
- If at least one of the Vcc power supplies is turned off ( $V_{CCA/B} = 0$  V), all ports are disabled.
- The TC7LSRxxx and TC7WPB8xxx have internal pull-up resistors.



### ■ Product Lineup

Configuration	Bit Width	Series	Function Number		Package		Mass Production
			w/o Pull-Up	w/ Pull-Up	Suffix	Name	
SPST	1	TC7LS	A01	RA01	FU	US6	Under development
			B01	RB01	L6X	MP6	Under development
					MX	sMP6	Under development
	2		A02	RA02	FK	US8	Under development
			B02	RB02	L8X	MP8	Under development
					MU	UQFN8	Under development
	4		A04	RA04	FT	TSSOP14	Under development
			B04	RB04	MU	UQFN12	Under development
	8		A08	RA08	FT	TSSOP20	Under development
		B08	RB08				
2	TC7WPB		8306 8307	L8X	MP8	Y	

# 4 General-Purpose Logic Families

## GENERAL-PURPOSE LOGIC ICs

### Level Shifters

#### Dual-Supply Bus Transceiver with Auto Direction Sensing (Switch Types)

##### TC7MPB/QPB/WPB/SPBxxx Series

##### Overview

The TC7MPB/QPB/WPB/SPBxxx Series consist of high-speed dual-supply CMOS bus switches with low-on resistance, which provide for interfacing between different voltage levels.

##### Feature

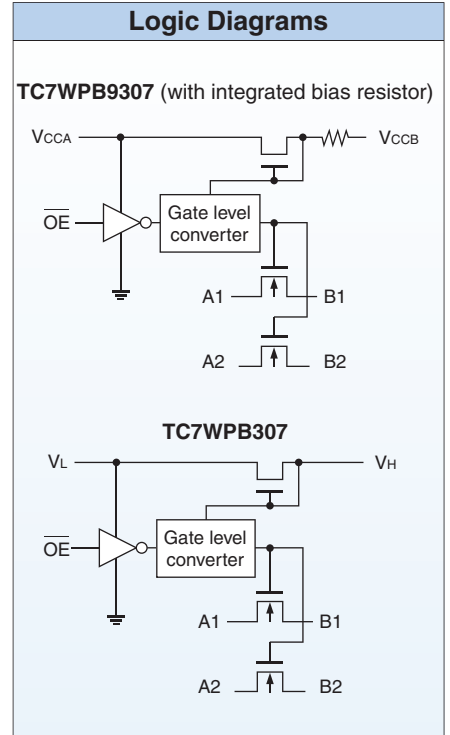
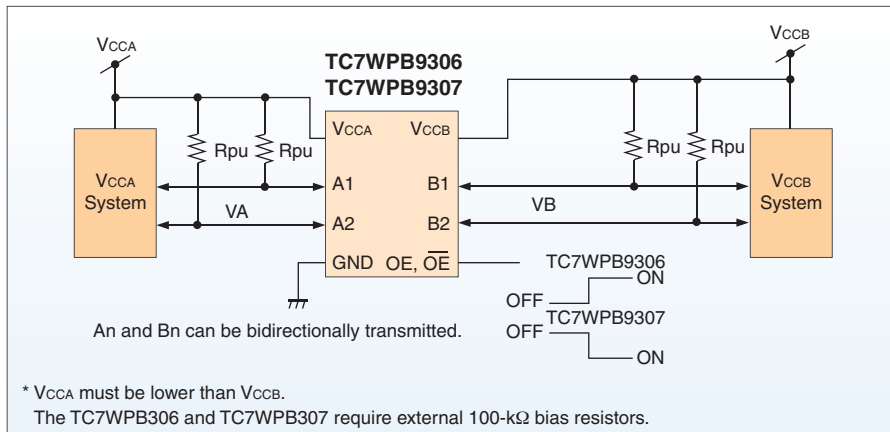
- Provides bidirectional interfacing between the lower-voltage side (1.8 V, 2.5 V or 3.3 V) and the higher-voltage side (2.5 V, 3.3 V or 5.0 V) without a DIR pin, if the application circuit shown below is used.
- Output enable pin (TC7WPB306/9306: active-high; TC7WPB307/9307: active-low)
- On-resistance: 5  $\Omega$  (typ.) when the switch is turned on. @  $V_{CCA} = 3\text{ V}$ ,  $V_{CCB} = 4.5\text{ V}$ ,  $V_{IS} = 0\text{ V}$
- Partial power-down protection: Consumes power-off leakage current ( $I_{OFF}$ ) of only 1  $\mu\text{A}$  (max), making the device suitable for power management.
- Available in leaded UF6, US and TSSOP packages and leadless CST8 and VQON packages.
- The 9306 and 9307 incorporate a bias resistor of approx. 200 k $\Omega$  required for voltage translation.

##### Key Specifications

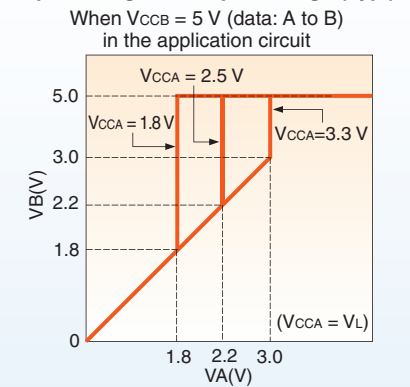
Characteristic	Symbol	Rating
Power supply voltage	$V_{CCA}$ (VL)	1.65 V to 5.5 V (1.8 to 5 V)
	$V_{CCB}$ (VH)	2.3 V to 5.5 V ( $V_L + 0.5$ to 5.5 V)
On-resistance (typ.)	$R_{ON}$	5 $\Omega$ @ $V_{CCA}$ (VL) = 3.0 V, $V_{CCB}$ (VH) = 4.5 V, $V_{IS} = 0\text{ V}$ , $T_a = 25^\circ\text{C}$
Power-off leakage current (max)	$I_{OFF}$	1 $\mu\text{A}$ @ $V_{CCA}$ (VL) = $V_{CCB}$ (VH) = 0 V

\*  $V_{CCA} = V_L$  and  $V_{CCB} = V_H$  for the TC7WPB306 and TC7WPB307

##### Application Circuit



#### Input Voltage vs Output Voltage (Typ.)



##### Product Lineup

Configuration	# Circuits	Bias Resistor	Series	Function Number	Package		Mass Production
					Suffix	Name	
SPST	2	N	TC7WPB	306 307	FK	US8	Y
					FC	CST8	Y
	1	Y	TC7SPB	9306 9307	TU	UF6	Y
					FK	US8	Y
					FC	CST8	Y
					FT	TSSOP14	Y
					FK	US14	Y
					FTG	VQON16	Y
	2	Y	TC7QPB	9306 9307	FT	TSSOP20	Y
					FK	US20	Y
8	Y	TC7MPB	9307	FT	TSSOP14	Y	
				FK	US14	Y	
SPDT	2	Y	TC7MPB	9326 9327	FTG	VQON16	Y

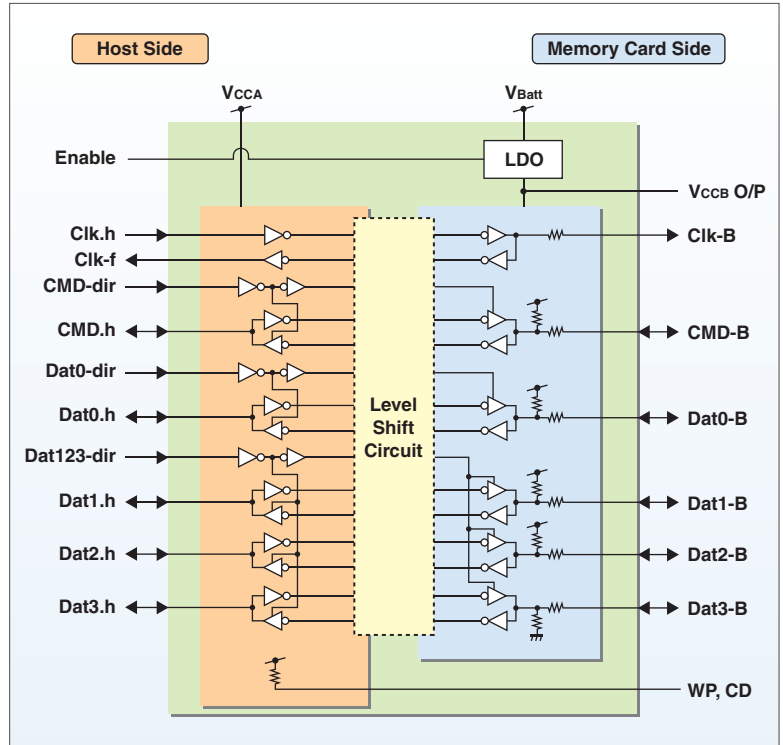
## ► Dual-Supply Level Shifters for SD Memory Cards

### T3GE9WBG

#### ■ Features

- Voltage translation between 1.8-V and 2.9-V buses  
( $V_{CCA} = 1.8 \pm 0.15 \text{ V}$ ,  
 $V_{CCB} = 2.9 \pm 0.1 \text{ V}$ )
- High speed:  $t_{pd} = 8.5 \text{ ns (max)}$
- Output current:  $I_{OHB}/I_{OLB} = \pm 6 \text{ mA (min)}$   
( $V_{CCB} = 2.8 \text{ V}$ )  
 $I_{OHA}/I_{OLA} = \pm 6 \text{ mA (min)}$   
( $V_{CCB} = 1.65 \text{ V}$ )
- On-chip lowpass filter on the memory card side
- Internal pull-up and pull-down resistors on the memory card side
- Latch-up immunity:  $\pm 200 \text{ mA}$  or higher
- ESD performance  
Host side: Machine model:  $\pm 200 \text{ V}$  or higher  
Human body model:  $\pm 2000 \text{ V}$  or higher  
Card side: IEC61000-4-2 Level 4:  $\pm 8000 \text{ V}$  or higher
- Ultra-small package: WCSP24

#### ■ Circuit Configuration

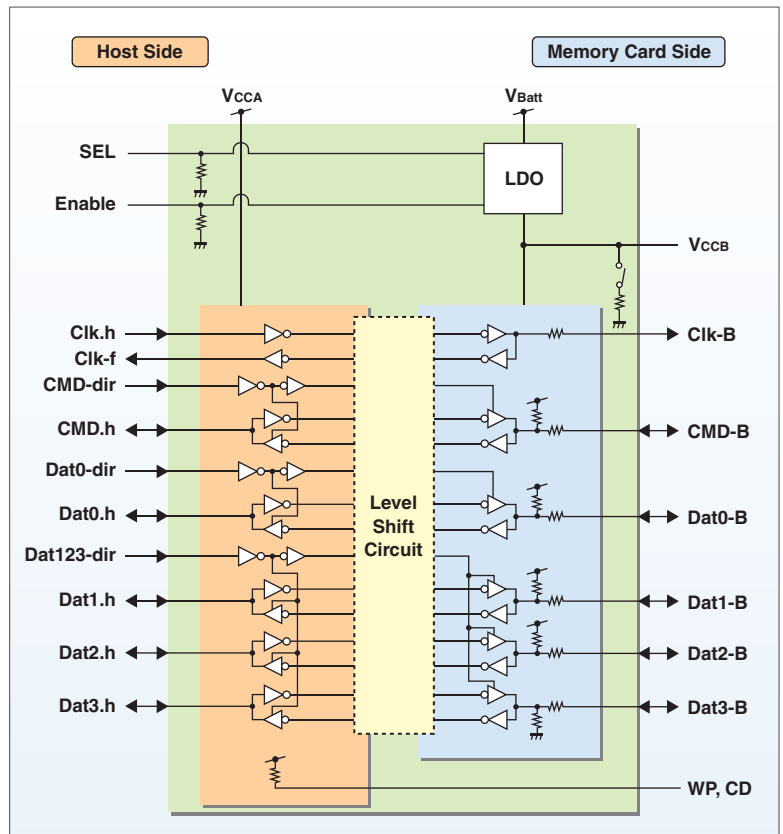


### T3GF3WBG

#### ■ Features

- Voltage translation between 1.8-V and 1.8/2.9-V buses (SD 3.0-compliant)
- High speed:  $t_{pd} = 5.0 \text{ ns (max)}$   
( $V_{CCA} = 1.8 \pm 0.15 \text{ V}$ ,  
 $V_{CCB} = 2.9 \pm 0.1 \text{ V}$ )  
 $t_{pd} = 7.0 \text{ ns (max)}$   
( $V_{CCA} = 1.8 \pm 0.15 \text{ V}$ ,  
 $V_{CCB} = 1.8 \pm 0.1 \text{ V}$ )
- Output current:  $I_{OHB}/I_{OLB} = \pm 6 \text{ mA (min)}$   
( $V_{CCB} = 2.8 \text{ V}$ )  
 $I_{OHA}/I_{OLA} = \pm 6 \text{ mA (min)}$   
( $V_{CCA} = 1.65 \text{ V}$ )
- On-chip lowpass filter on the memory card side
- Internal pull-up and pull-down resistors on the memory card side
- Latch-up immunity:  $\pm 200 \text{ mA}$
- ESD performance  
Host side: Machine model:  $\pm 200 \text{ V}$  or higher  
Human body model:  $\pm 2000 \text{ V}$  or higher  
Card side: IEC61000-4-2 Level 4:  $\pm 8000 \text{ V}$  or higher
- Ultra-small package: WCSP25

#### ■ Circuit Configuration



# ▶ 4 General-Purpose Logic Families

## GENERAL-PURPOSE LOGIC ICs

### Bus Switches

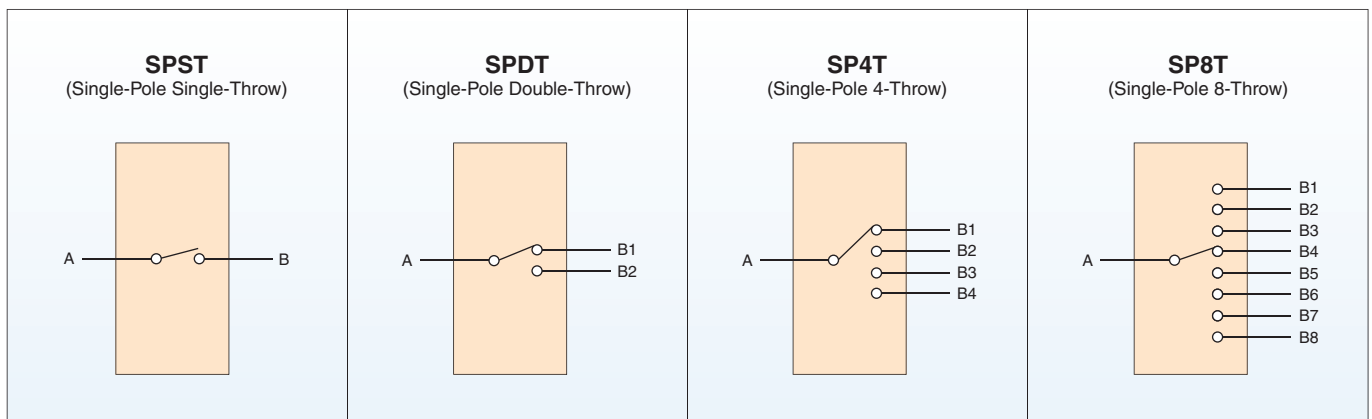
#### ▶ Overview

Series	Part Number	Power Supply Voltage	Features
High-Speed Transmission Switches	<b>PCI3412/3415</b> <b>PCI3212/3215</b>	3.0 to 3.6 V	Bus switches compliant with PCI Express 3.0 (8 Gbps) Usable for high-speed Gbps interfacing, such as USB 3.0, DisplayPort 1.2 and SATA 3.0
	<b>USB3212</b>	1.65 to 1.95 V	Bus switches compliant with USB 3.0 SuperSpeed (5 Gbps) transfer mode
USB 2.0 Switches	<b>USB40/42</b>	2.3 to 4.3 V	Bus switches compliant with USB 2.0 High-Speed (480 Mbps) transfer mode
	<b>USB221/31</b>	2.3 to 3.6 V	
	<b>UA221/231</b>	2.3 to 3.6 V	These USB Audio switches support USB 2.0 high-speed signals (480 MHz) and analog audio signals.
Low-Voltage Bus Switches	<b>MBL/WBL/SBLxxxxA</b>	2.0 to 3.6 V	3.3-V bus switches Consists of P-channel and N-channel MOSFET transistors.
	<b>MBLxxxxS</b> <b>MBL/WBL/SBLxxxxC</b>	1.65 to 3.6 V	3.3-V bus switches Bus switches with lower switch capacitances than that of the previous MBLxxxxA
5-V Bus Switches	<b>MB/WB/SBxxxx</b> <b>MB/WB/SBxxxxC</b>	4.5 to 5.5 V	5-V bus switches Consists of N-channel MOSFET transistors. The SB66/67/3157 and WB66/67 consist of P-channel and N-channel MOSFET transistors.

#### ■ Examples of Switch Configuration

The above switches are available in SPST (single pole, single throw) and/or multi-throw (SPDT, SP4T, SP8T) configurations. SPST switches are simple on-off switches that connect and disconnect between two terminals.

The multi-throw switches are multiplexers that allow a signal to be transmitted to one of the selected output terminals.





## ► High-Speed Transmission Switches

### PCI Express switches

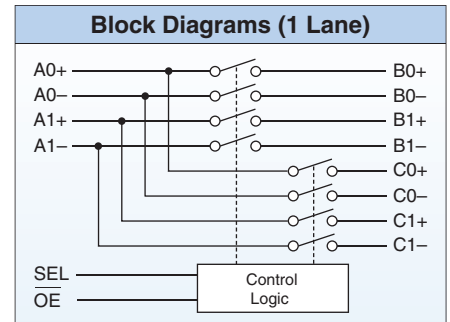
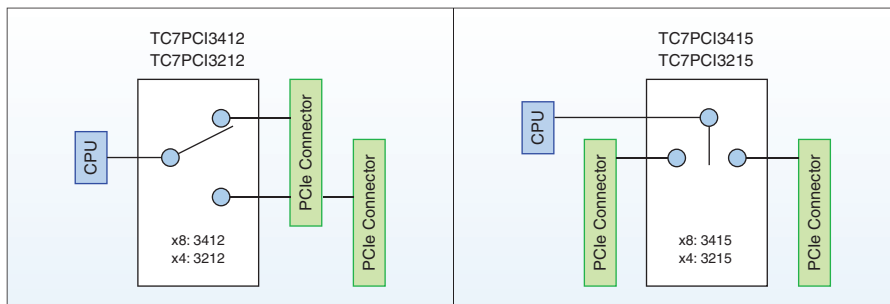
Supports PCI Express 3.0 (8 Gbps) transfer rates

Usable for Gbps high-speed interfacing such as USB 3.0, DisplayPort and SATA

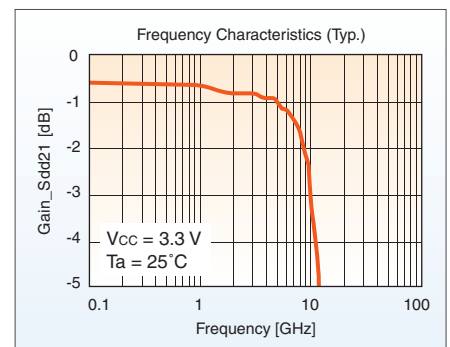
#### ■ Features

- Operating power supply voltage: 3.0 V to 3.6 V
- High bandwidth: 10 GHz@-3 dB,  $V_{CC} = 3.3$  V
- Low insertion loss: -1 dB@4 GHz,  $V_{CC} = 3.3$  V
- Low crosstalk: -40 dB@4 GHz,  $V_{CC} = 3.3$  V
- Housed in the TQFN42 and TQFN20 packages with electrodes on the bottom

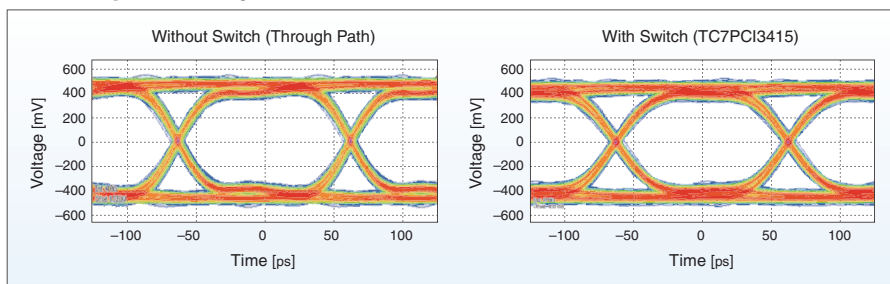
#### ■ Application Example



#### ■ Frequency Characteristics



#### ■ PCI Express3.0 Eye-Pattern



### USB 3.0 switches

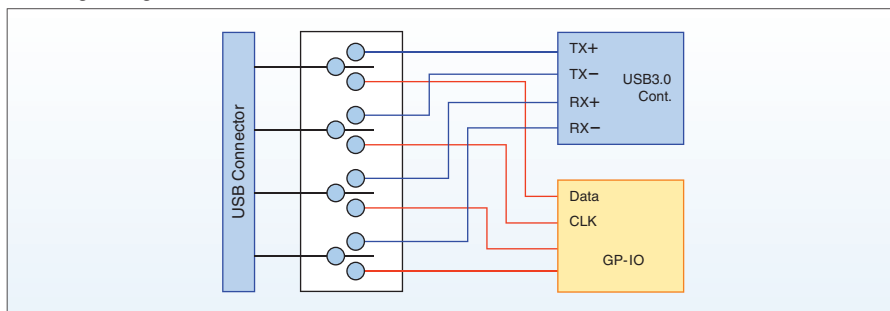
Compliant with USB 3.0 SuperSpeed (5 Gbps) transfer mode

#### ■ Features

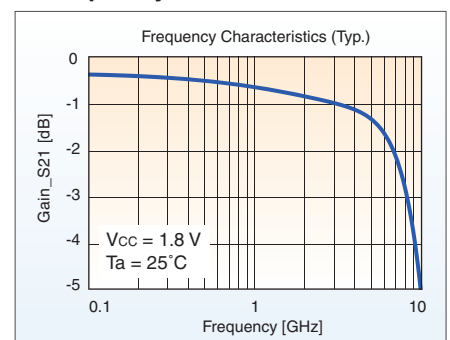
- Operating power supply voltage: 1.65 V to 1.95 V
- High bandwidth: 8 GHz@-3 dB,  $V_{CC} = 1.8$  V
- Low insertion loss: -1 dB@2.5 GHz,  $V_{CC} = 1.8$  V
- Housed in the tiny WCSP20 package

#### ■ Application Example

USB/Digital Signal Switch



#### ■ Frequency Characteristics



#### ■ Product Lineup

Configuration	# Circuits	Part Number	Package		Mass Production	
			Suffix	Number of Pins		
SPDT	2Lane (4 differential channel)	TC7PCI3412	MT	TQFN42	42	Under development
		TC7PCI3415	MT	TQFN42	42	Under development
	1Lane (2 differential channel)	TC7PCI3212	MT	TQFN20	20	Under development
		TC7PCI3215	MT	TQFN20	20	Under development
	1Lane (2 differential channel)	TC7USB3212	WBG	WCSP20	20	Under development

# 4 General-Purpose Logic Families

## GENERAL-PURPOSE LOGIC ICs

### Bus Switches

#### ► USB 2.0 High-Speed Switches

##### TC7USB Series

Compliant with USB 2.0 High-Speed (480 Mbps) transfer mode

The newest releases, the TC7USB40 and TC7USB42, have lower switch pin capacitances than their predecessor, TC7USB221.

##### ■ Features (TC7USB40/42)

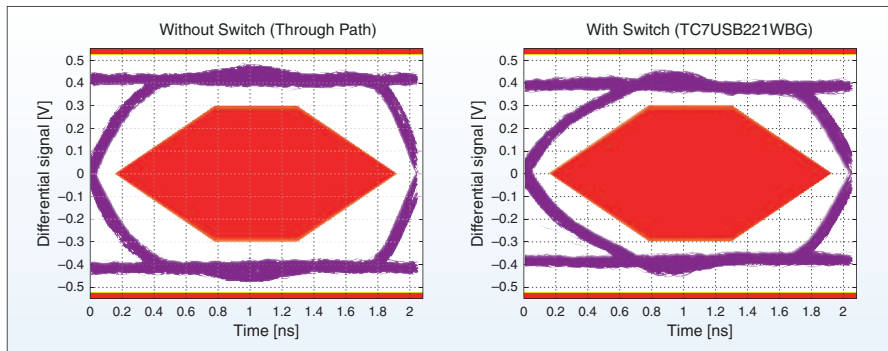
- Operating supply voltage up to 4.3 V
- Reduced switch on-capacitance and on-resistance to realize wide bandwidth
- Control and switch pins are equipped with power-down protection.
- Housed in the small UQFN10 package with electrodes on the bottom

##### ■ Key Specifications

Characteristic	Symbol	Test Condition	TC7USB221WBG	TC7USB40MU
Power supply voltage	V <sub>CC</sub>	–	2.3 V to 3.6 V	2.3 V to 4.3 V
Switch on-capacitance (typ.)	C <sub>IO</sub>	V <sub>CC</sub> = 3.3 V	7 pF	5 pF
Switch on-resistance (typ.)	R <sub>ON</sub>	V <sub>CC</sub> = 3 V, V <sub>IS</sub> = 0 V	6.5 Ω	4.5 pF
–3 dB Bandwidth (typ.)	BW	V <sub>CC</sub> = 3.3 V	720 MHz	1500 MHz
Package	–	–	WCSP10 (1.2 x 1.6 mm)	UQFN10 (1.4 x 1.8 mm)

##### ■ USB 2.0 Eye-Pattern (TC7USB221WBG)

Near End High Speed Signal Quality Test. Results for HSSQ Device.



##### TCUA Series

This switch is able to multiplex between USB 2.0 and analog audio signals.

##### ■ Features

- The USB switches support USB 2.0 high-speed applications due to reduced pin capacitances.
- The audio switches allow for negative signals. (Up to ±1.5 V)
- Available in tiny WCSP packages

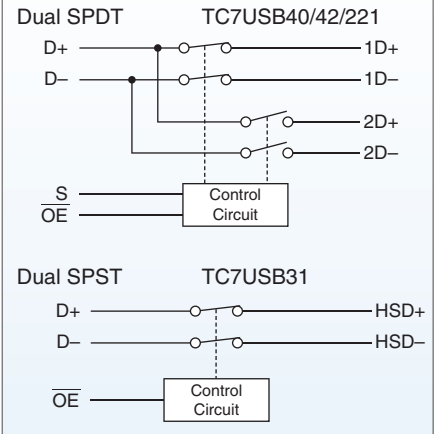
##### ■ Key Specifications

Configuration	Symbol	Test Condition	TCUA221 (Dual SPDT)	TCUA231 (Dual SP3T)
Power supply voltage	V <sub>CC</sub>	–	2.3 V to 3.6 V	2.3 V to 3.6 V
Switch on-capacitance (typ.)	C <sub>IO</sub>	V <sub>CC</sub> = 3.3 V	7 pF	8 pF
USB switch on-resistance (typ.)	R <sub>ON</sub>	V <sub>CC</sub> = 3.3 V, V <sub>IS</sub> = 0 V	5.5 Ω	6.5 Ω
Audio switch on-resistance (typ.)	R <sub>ON</sub>	V <sub>CC</sub> = 3 V, V <sub>IS</sub> = 0 V	4.5 Ω	5.5 Ω
Quiescent supply current (max)	I <sub>CC</sub>	V <sub>CC</sub> = 3.6 V	2 μA	2 μA
Package	–	–	WCSP10 (1.2 x 1.6 mm)	WCSP15 (1.6 x 1.6 mm)

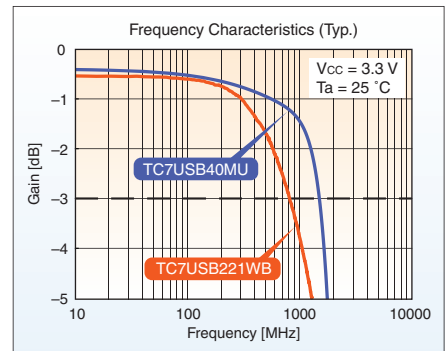
##### ■ Product Lineup

Configuration	#Circuits	Part Number	Package			Mass Production
			Suffix	Name	Number of Pins	
SPDT	Dual	TC7USB221	WBG	WCSP10	10	Y
			FT	TSSOP14	14	Y
	Dual	TC7USB40	MU	UQFN10	10	Y
			FT	TSSOP14	14	Under development
	Dual	TC7USB42	MU	UQFN10	10	Under development
			FT	TSSOP14	14	Under development
SPST	Dual	TC7USB31	WBG	WCSP8	8	Y
			FK	US8	8	Y
SP3T (USB + Audio + Digital Single-end Signal)	Dual	TCUA231	WBG	WCSP15	15	Y
SPDT (USB + Audio)	Dual	TCUA221	WBG	WCSP10	10	Y
SPDT (USB + Audio) With Pop Sound Eliminator at Audio Switch	Dual	TCUA2221	WBG	WCSP10	10	Y

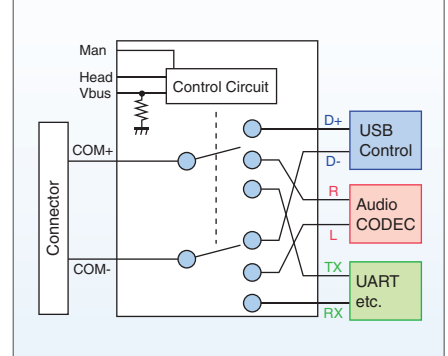
#### Block Diagrams



##### ■ Frequency Characteristics (–3 dB Point)



#### Dual SP3T TCUA231



## ► Low-Voltage Bus Switches

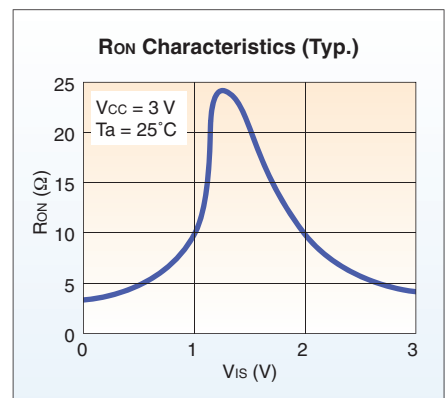
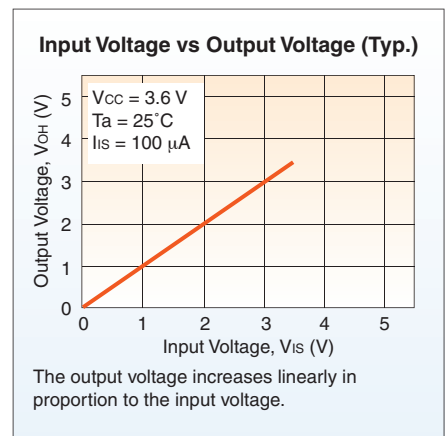
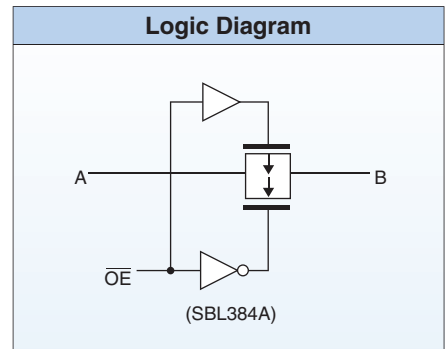
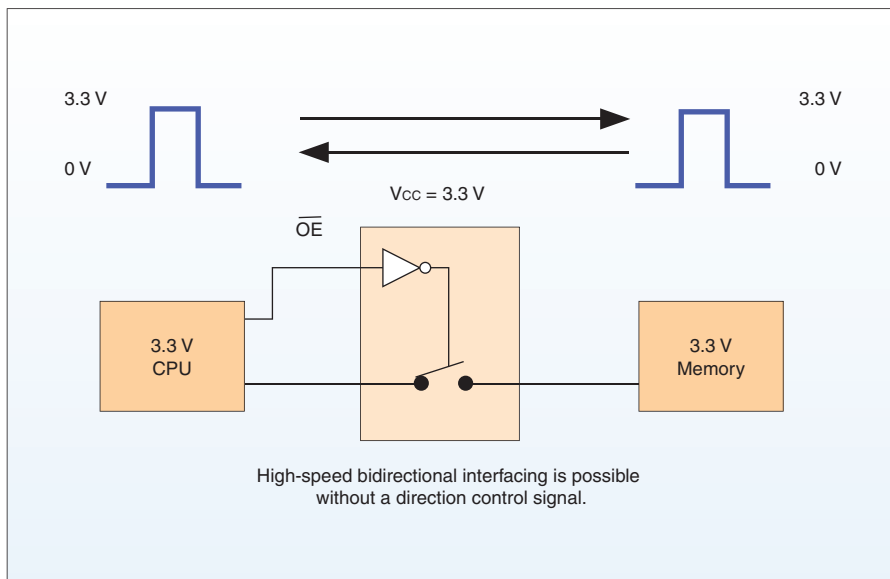
The TC7MBL/WBL/SBLxxxA Series of 8-bit, 2-bit and 1-bit low-voltage bus switches are suitable for high-speed interfacing in low-voltage systems

### ■ Features

- Parallel P- and N-channel FETs help to reduce power consumption.
- 3.3- or 2.5-V supply voltage
- On-resistance: 4  $\Omega$  (typ.) at turn-on @  $V_{CC} = 3.0\text{ V}$ ,  $V_{IS} = 0\text{ V}$
- Low-voltage bus switches provide high-speed bidirectional interfacing. They are suitable for a wide range of applications, such as the I<sup>2</sup>C bus interface for PDAs.
- Packages: USV, US8, US16, US20, TSSOP16, TSSOP20

### ■ Key Specifications

Characteristic	Symbol	Rating
Power supply voltage	$V_{CC}$	2.0 to 3.6 V
On-resistance (typ.)	$R_{ON}$	4 $\Omega$ @ $V_{CC} = 3.0\text{ V}$ , $V_{IS} = 0\text{ V}$
Output voltage (typ.)	$V_{OH}$	Full swing
Quiescent supply current (max)	$I_{CC}$	10 $\mu\text{A}$ @ $V_{CC} = 3.6\text{ V}$



### ■ Product Lineup

Configuration	# Circuits	Series	Function Number	Package			Mass Production
				Suffix	Name	Number of Pins	
SPST	Single	<b>TC7SBL</b>	384A	FU	USV	5	Y
	Dual	<b>TC7WBL</b>	125A 126A	FK	US8	8	Y
	Octal	<b>TC7MBL</b>	3244A	FT	TSSOP20	20	Y
				FK	US20		
SPDT	Quad	<b>TC7MBL</b>	3245A	FT	TSSOP20	20	Y
				FK	US20		
SPDT	Quad	<b>TC7MBL</b>	3257A	FT	TSSOP16	16	Y
				FK	US16		

# 4 General-Purpose Logic Families

## GENERAL-PURPOSE LOGIC ICs

### Bus Switches

#### Low-Voltage, Low-Capacitance Bus Switches

##### TC7MBLxxxxS and TC7SBL/WBL/MBLxxxxC Series Bus switches with reduced switch pin capacitances

###### Overview

The TC7MBLxxxxS and TC7SBL/WBL/MBLxxxxC Series have lower switch pin capacitances compared to the previous series (MBLxxxxA).

Bus switches are generally used to isolate different bus lines. If switch pin capacitances are large compared to the output load capacitances, it might be difficult to reduce the rise and fall times (tr/tf) of the output signals.

With reduced switch pin capacitances, the TC7MBxxxxS and TC7SBL/MBLxxxxC Series help to reduce the output delay.

###### Features

- The TC7SBLxxxxC and TC7MBLxxxxC Series provide power-down protection at both the control and switch pins. This is beneficial for power management.
- Available in US and TSSOP leaded packages and VQON leadless packages.

###### Key Specifications

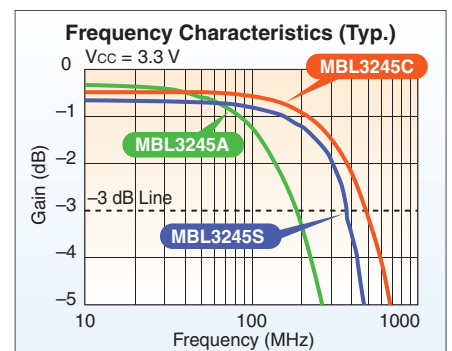
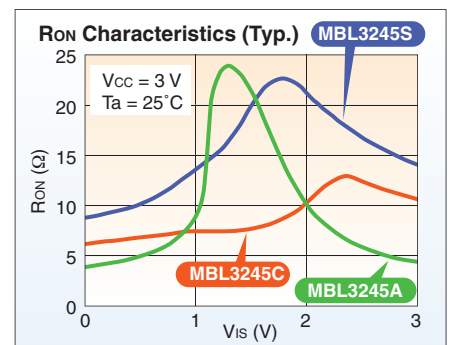
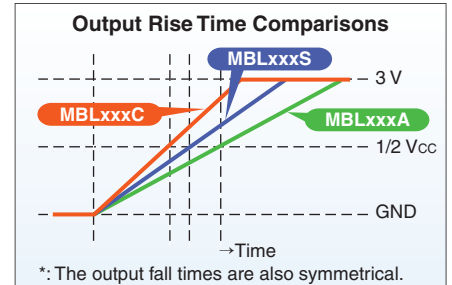
Characteristic	Symbol	MBL3245A	MBL3245S	MBL3245C
Power supply voltage	V <sub>CC</sub>	2.0 to 3.6 V	1.65 to 3.6 V	
Output voltage (typ.)	V <sub>OH</sub>	Full swing		
Quiescent supply current (max)	I <sub>CC</sub>	10 μA @ V <sub>CC</sub> = 3.6 V		

###### Characteristics Comparison

Characteristic	Symbol	Test Condition	MBL3245A	MBL3245S	MBL3245C
Switch ON-resistance (typ.)	C <sub>IO</sub>	V <sub>CC</sub> = 3 V	34 pF	12 pF	7.5 pF
ON-resistance (typ.)	R <sub>ON</sub>	V <sub>CC</sub> = 3 V V <sub>IS</sub> = 0 V	4 Ω	9 Ω	6.5 Ω
Approx. output rise and fall times	tr/tf	V <sub>CC</sub> = 3 V C <sub>L</sub> = 15 pF	4.4 ns	2.4 ns	2.0 ns
Power-down protection			Control pin	Control pin	Control and switch pins

###### Product Lineup

Configuration	# Circuits	Series	Function Number	Package			Mass Production
				Suffix	Name	Number of Pins	
SPST	Single	TC7SBL	66C	FU	USV	5	Y
							384C
	Dual	TC7WBL	3305C	FK	US8	8	Y
							3306C
	Quad	TC7MBL	6125S 6126S	FK	US14	14	Y
				FT	TSSOP14	14	Y
				FTG	VQON16	16	Y
			3125C 3126C	FK	US14	14	Y
				FT	TSSOP14	14	Y
				FTG	VQON16	16	Y
	Octal	3245S	3245C	FK	US20	20	Y
				FT	TSSOP20	20	Y
Dual	6353S	3257C	FK	US16	16	Y	
			FT	TSSOP16	16	Y	
Quad	3253C	3253C	FTG	VQON16	16	Y	
			FK	US16	16	Y	
Dual	3253C	3253C	FT	TSSOP16	16	Y	
			FTG	VQON16	16	Y	



## ► 5 V Bus Switches That Consist of N- and P-Channel FETs

**TC7WB/SBxxxx and TC7WB/SBxxxxC Series**  
**Improves the speed and reduces the current consumption of 5-V systems.**  
**Available in 2-bit and 1-bit configurations.**  
**New C Series with reduced switch capacitances**

### ■ Features

- Parallel N/P-channel FET configuration ideal for reducing system current consumption
- Supply voltage range of 1.65 to 5.5 V
- On-resistance: 4 Ω (typ.) @  $V_{CC} = 4.5\text{ V}$ ,  $V_{IS} = 0\text{ V}$
- New bus switches are available in the small MP8 and MP6 packages with electrodes on the bottom.

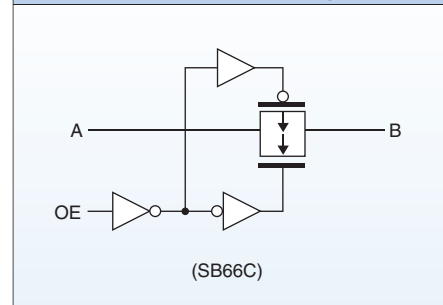
### ■ Key Specifications

Characteristic	Symbol	Standard	Low-Capacitance
		<b>SB66</b>	<b>SB66C</b>
Power supply voltage	$V_{CC}$	2.0 to 5.5 V	1.65 to 5.5 V
Output voltage (typ.)	$V_{OH}$	Full swing	Full swing
Quiescent supply current (max)	$I_{CC}$	10 μA @ $V_{CC} = 5.5\text{ V}$	

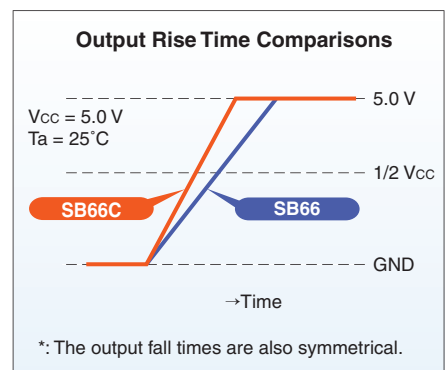
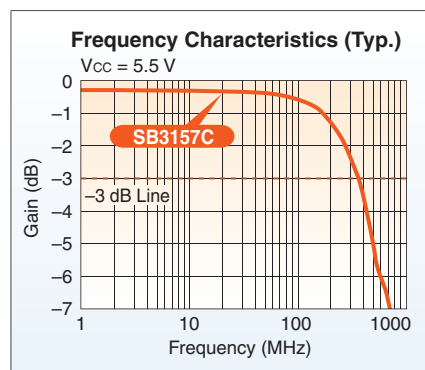
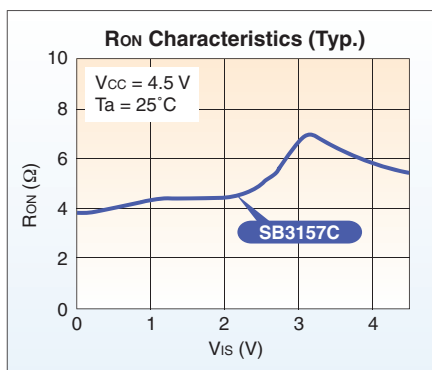
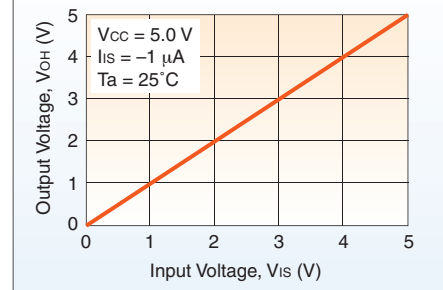
### ■ Characteristics Comparison

Characteristic	Symbol	Test Condition	Standard	Low-Capacitance
			<b>SB66</b>	<b>SB66C</b>
Switch on-resistance (typ.)	$C_{IO}$	$V_{CC} = 5.0\text{ V}$	16 pF	10 pF
On-resistance (typ.)	$R_{ON}$	$V_{CC} = 4.5\text{ V}$	3 Ω	4.0 Ω
		$V_{IS} = 0\text{ V}$		
Approx. output rise and fall times	$t_r/t_f$	$V_{CC} = 4.5\text{ V}$ $C_L = 15\text{ pF}$	2.7 ns	2.1 ns

### P/N-Channel Switch Configuration



### Input Voltage vs Output Voltage (Typ.)



### ■ Product Lineup with a Parallel P/N-Channel Switch Configuration

Configuration	# Circuits	Series	Function Number		Package			Mass Production
			Standard	Low-Capacitance	Suffix	Name	Number of Pins	
SPST	Single	<b>TC7SB</b>	66		FU	USV	5	Y
					FU	USV	5	Y
			66C	L6X	MP6	6	Under development	
				FU	USV	5	Y	
	67C	L6X	MP6	6	Under development			
		FU	USV	5	Y			
SPDT	Single	<b>TC7WB</b>	66		FK	US8	8	Y
					FK	US8	8	Y
			66C	L8X	MP8	8	Y	
				L8X	MP8	8	Y	
			67C	FK	US8	8	Y	
				L8X	MP8	8	Y	
3157C	FU	US6	6	Y				
	L6X	MP6	6	Under development				



# 4 General-Purpose Logic Families

## GENERAL-PURPOSE LOGIC ICs

### Bus Switches

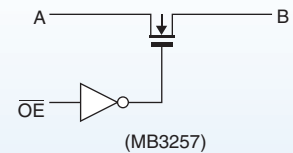
#### 5 V Bus Switches That Consist of N-Channel FETs

**TC7SB/WB/MBxxxx and TC7WB/MBxxxxC Series**  
 Improves the speed and reduces the current consumption of 5-V systems.  
 Available in 8-bit, 4-bit, 2-bit, 1-bit configurations.  
 New C Series with reduced switch capacitances

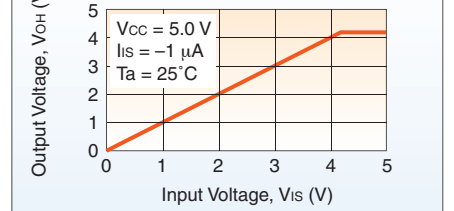
#### Features

- Parallel N-channel FET configuration ideal for reducing system current consumption
- Supply voltage range of 4.0 to 5.5 V
- TC7SB/WB/MBxxxC Series: Low-capacitance 5-V bus switches
- Both control and switch pins have power-down protection function, which eases system power management.
- Packages: Leadless US and TSSOP, and leadless VQON

#### N-Channel FET Switch Configuration



#### Input Voltage vs Output Voltage (Typ.)

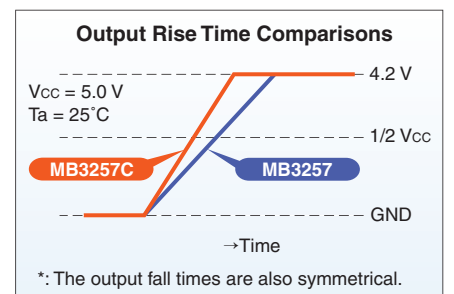
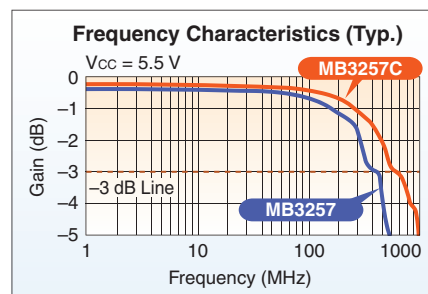
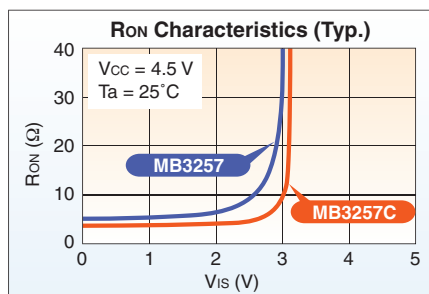


#### Key Specifications

Characteristic	Symbol	Standard	Low-Capacitance
		<b>MB3257</b>	<b>MB3257C</b>
Power supply voltage	V <sub>CC</sub>	4.5 to 5.5 V	4.0 to 5.5 V
Output voltage (typ.)	V <sub>OH</sub>	4.2 V @ I <sub>IS</sub> = -1 μA, V <sub>CC</sub> = 5.0 V	
Power-off leakage current (max)	I <sub>OFF</sub>	1 μA @ A <sub>n</sub> , B <sub>n</sub> , OE = 0 to 5.5 V, V <sub>CC</sub> = 0 V	
Quiescent supply current (max)	I <sub>CC</sub>	10 μA @ V <sub>CC</sub> = 5.5 V	

#### Characteristics Comparison

Characteristic	Symbol	Test Condition	Standard	Low-Capacitance
			<b>MB3257</b>	<b>MB3257C</b>
Switch on-resistance (typ.)	C <sub>I/O</sub>	V <sub>CC</sub> = 5.0 V	19 pF	8.5 pF
On-resistance (typ.)	R <sub>ON</sub>	V <sub>CC</sub> = 4.5 V	5 Ω	3 Ω
		V <sub>IS</sub> = 0 V		
Approx. output rise and fall times	tr/tf	V <sub>CC</sub> = 4.5 V C <sub>L</sub> = 15 pF	2.9 ns	2.0 ns



#### Product Lineup

Configuration	# Circuits	Series	Function Number		Suffix	Package		Mass Production			
			Standard	Low-Capacitance		Name	Number of Pins				
SPST	Single	<b>TC7SB</b>	384		FU	USV	5	Y			
			385								
	Dual	<b>TC7WB</b>	125		FK	US8	8	Y			
			126								
	Quad	<b>TC7MB</b>	3125C 3126C		FT	TSSOP14	14	Y			
						FK	US14		14		
			Octal	3244	3244C		FT	TSSOP20	20	Y	
							FK	US20	20		
					3245	3245C		FT	TSSOP20	20	Y
								FK	US20	20	
SPDT	Quad	3257	3257C	FT	TSSOP16	16	Y				
				FK	US16	16					
				FTG	VQON16	16					
SP4T	Dual	3253		FT	TSSOP16	16	Y				
	FK		US16	16							
SP8T	Single	3251		FT	TSSOP16	16	Y				
				FK	US16	16					

# 5 L-MOS (1- to 3-Gate Logic ICs)

## GENERAL-PURPOSE LOGIC ICs

### Overview of L-MOS

#### ■ Packaging Features

##### 1. Ultra-small, thin packages

Many L-MOS ICs are available in ultra-small, thin packages such as 5-pin fSV (SOT-953) (measuring 1.0 mm x 1.0 mm x 0.48 mm) and CST8 (measuring 1.45 mm x 1.35 mm x 0.38 mm).

##### 2. Product series and function lineups

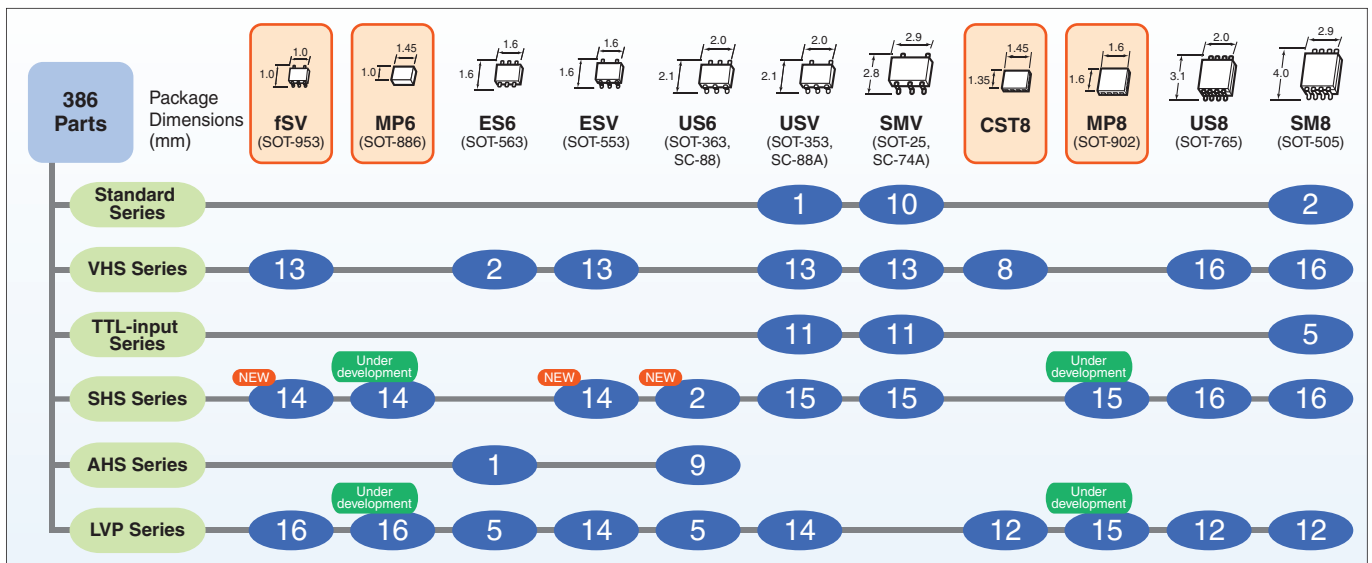
Toshiba offers a wide range of functions as well as product series that meet various supply voltage requirements.

##### 3. General packages

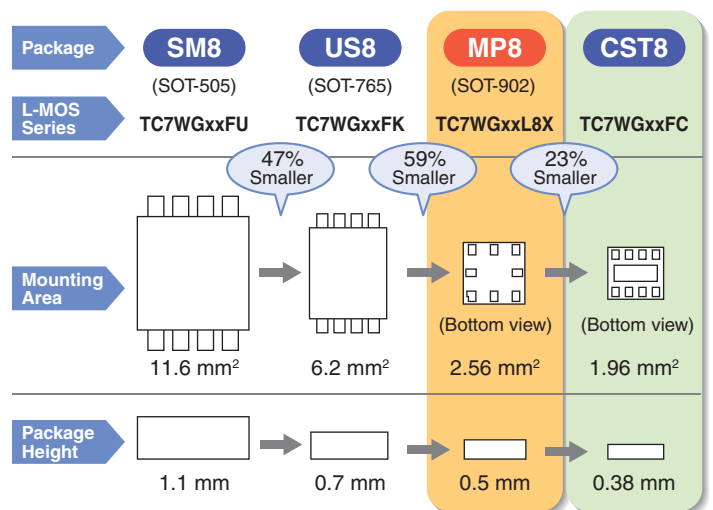
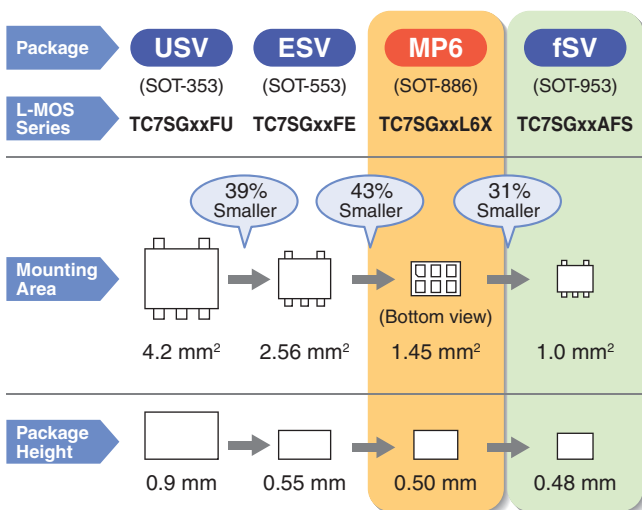
L-MOS ICs are also available in various industry-standard packages for ease of use:

fSV (SOT-953), ESV (SOT-553), USV (SOT-353), SMV (SOT-25), ES6 (SOT-563), US6 (SOT-363), MP8 (SOT-902), US8 (SOT-765), SM8 (SOT-505), MP6 (SOT-886)

#### ■ Product Lineup



#### ► Ultra-Small, Thin Packages



#### ■ fSV

- Package dimensions: 1.0 mm x 1.0 mm x 0.48 mm (typ.)
- Lead pitch: 0.35 mm

#### ■ CST8

- Package dimensions: 1.45 mm x 1.35 mm x 0.38 mm (typ.)
- Lead pitch: 0.40 mm

#### ■ MP8

- Package dimensions: 1.6 mm x 1.6 mm x 0.5 mm (typ.)
- Lead pitch: 0.50 mm

#### ■ MP6

- Package dimensions: 1.45 mm x 1.00 mm x 0.50 mm (typ.)
- Lead pitch: 0.50 mm

# 5 L-MOS (1- to 3-Gate Logic ICs)

## GENERAL-PURPOSE LOGIC ICs

### L-MOS Performance Comparisons

The SHS Series is now available in the fSV package.

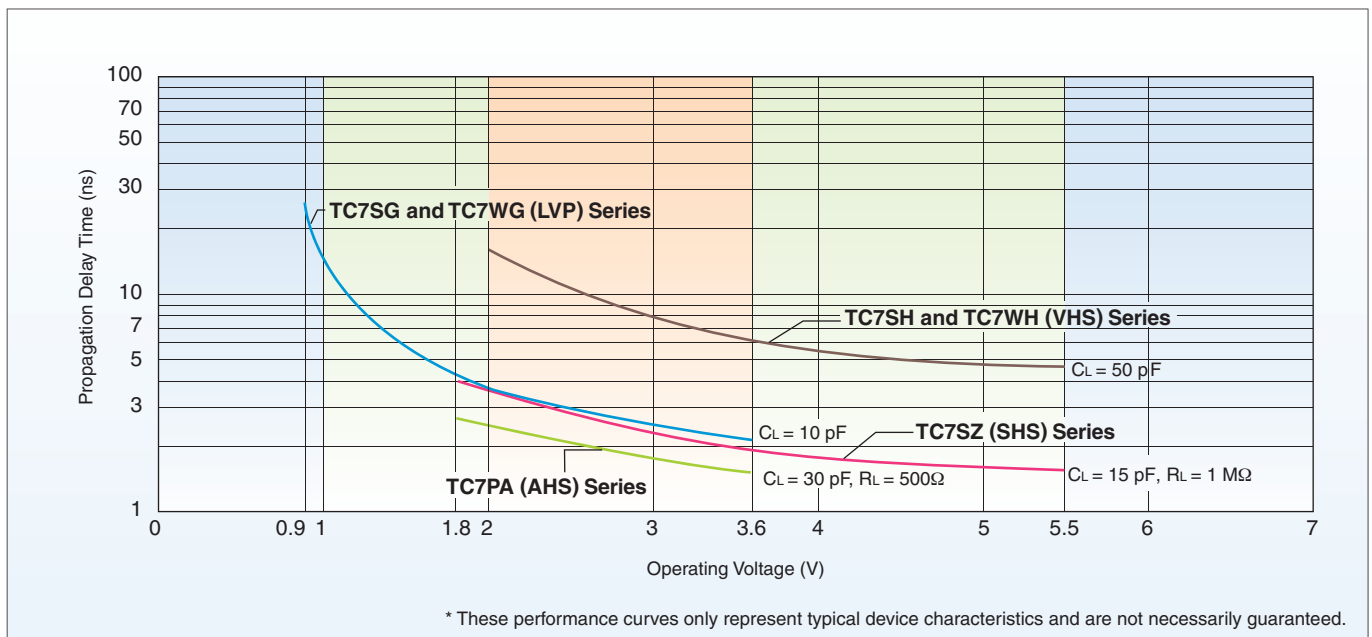
Parameter	LVP Series*2	AHS Series	SHS Series*1	VHS Series	TTL-Level Input Series	
Propagation delay time (NAND gate)	2.5 ns typ. @ V <sub>CC</sub> = 3.3 V C <sub>L</sub> = 15 pF T <sub>a</sub> = 25°C	2.8 ns max @ V <sub>CC</sub> = 3.3 V C <sub>L</sub> = 30 pF R <sub>L</sub> = 500 Ω T <sub>a</sub> = -40 to 85°C	2.4 ns typ. @ V <sub>CC</sub> = 3.3 V C <sub>L</sub> = 15 pF R <sub>L</sub> = 1 MΩ T <sub>a</sub> = 25°C	3.7 ns typ. @ V <sub>CC</sub> = 5 V C <sub>L</sub> = 15 pF T <sub>a</sub> = 25°C	4.2 ns typ. @ V <sub>CC</sub> = 5 V C <sub>L</sub> = 15 pF T <sub>a</sub> = 25°C	10 ns typ. (3-State Buffer) @ V <sub>CC</sub> = 5.5 V C <sub>L</sub> = 15 pF T <sub>a</sub> = 25°C
Operating voltage	0.9 to 3.6 V	1.8 to 3.6 V	1.8 to 5.5 V 1.65 to 5.5 V*3	2 to 5.5 V	4.5 to 5.5 V	4.5 to 5.5 V
Input voltage tolerance	5.5 V	3.6 V	5.5 V	5.5 V	-	-
Output power-down protection	3.6 V*2 _ *2	3.6 V	5.5 V*1 _ *1	-	-	-
Output current	I <sub>OH</sub> , I <sub>OL</sub> 8 mA min (@ V <sub>CC</sub> = 3 V)	24 mA min (@ V <sub>CC</sub> = 3 V)	24 mA min (@ V <sub>CC</sub> = 3 V)	8 mA min (@ V <sub>CC</sub> = 4.5 V)	8 mA min (@ V <sub>CC</sub> = 4.5 V)	4 mA min (@ V <sub>CC</sub> = 4.5 V)
Electrical characteristics (except for permissible power dissipation rating)	-	Same as TC74VCXxx series	Same as TC74LCXxx series when V <sub>CC</sub> = 3.3 V	Same as TC74VHCxxx series	Accepts TTL-level inputs: V <sub>IL</sub> = 0.8 V (max) V <sub>IH</sub> = 2.0 V (min) Delivers full-swing outputs.	

\*1: The TC7SZxxF/FU/FE, TC7PZxxFU and TC7WZxxFU/FK/L8X Series have input voltage tolerance and output power-down protection features. The TC7SZxxAFS Series has only the input voltage tolerance feature.

\*2: The TC7SGxxFU/FE, TC7PGxxxFU and TC7WGxxFU/FK/FC/L8X Series have input voltage tolerance and output power-down protection features. TC7SGxxAFS and TC7PGxxAFE have only the input voltage tolerance feature.

\*3: TC7WZxxFU/FK/L8X and TC7SZxxAFS/FE Series

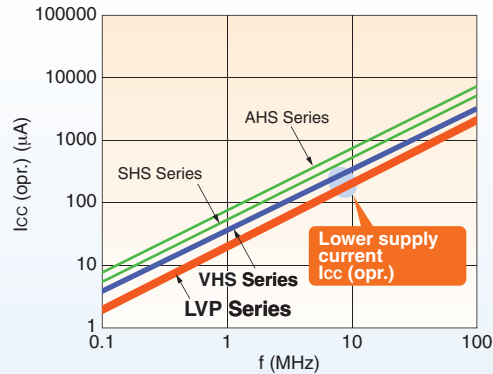
### Comparisons of Propagation Delay Times Among L-MOS Series



## Typical Performance Characteristics of the L-MOS ICs

### ► Low Power Consumption

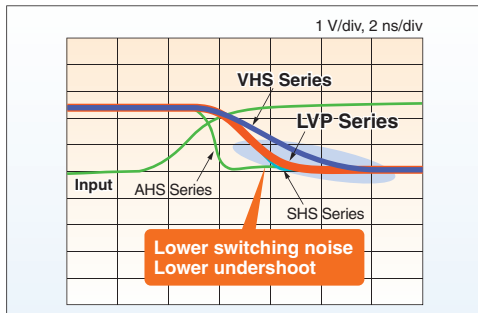
The lowered power consumption helps to extend battery life for portable electronic devices.



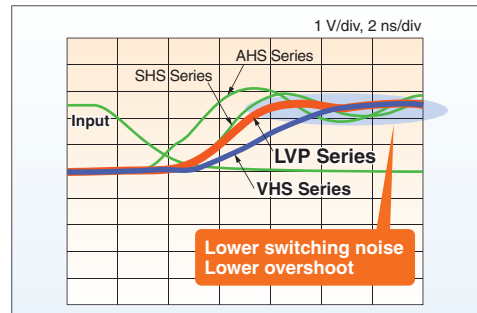
\* These performance curves only represent typical device characteristics and are not necessarily guaranteed.

### ► Optimal Switching Characteristics

$tp_{HL}$  @  $V_{CC} = 2.5 \text{ V}$ ,  $C_L = 30 \text{ pF}$



$tp_{LH}$  @  $V_{CC} = 2.5 \text{ V}$ ,  $C_L = 30 \text{ pF}$

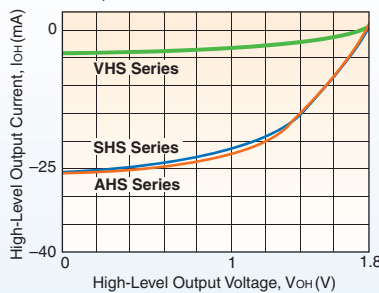


\* These performance curves only represent typical device characteristics and are not necessarily guaranteed.

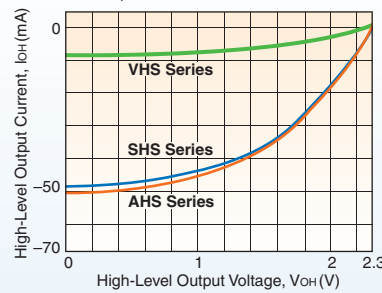
### ► Drive Current (Typ.)

#### ■ High-level output current

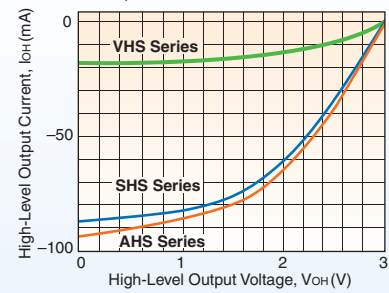
$V_{CC} = 1.8 \text{ V}$ ,  $T_a = 25^\circ\text{C}$



$V_{CC} = 2.3 \text{ V}$ ,  $T_a = 25^\circ\text{C}$

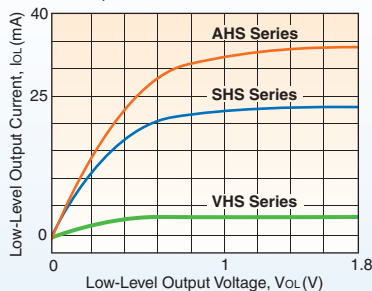


$V_{CC} = 3.0 \text{ V}$ ,  $T_a = 25^\circ\text{C}$

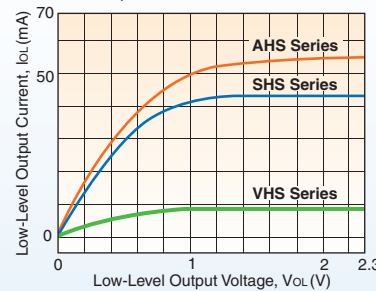


#### ■ Low-level output current

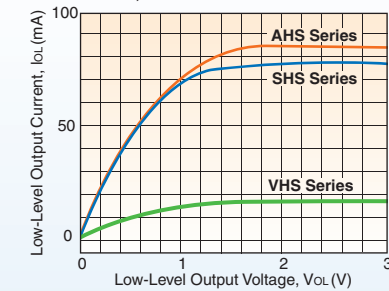
$V_{CC} = 1.8 \text{ V}$ ,  $T_a = 25^\circ\text{C}$



$V_{CC} = 2.3 \text{ V}$ ,  $T_a = 25^\circ\text{C}$



$V_{CC} = 3.0 \text{ V}$ ,  $T_a = 25^\circ\text{C}$



\* These performance curves only represent typical device characteristics and are not necessarily guaranteed.

# 5 L-MOS (1- to 3-Gate Logic ICs)

## GENERAL-PURPOSE LOGIC ICs

### Interface Characteristics

#### Interface Performance

The AHS, SHS, VHS and LVP Series incorporate input voltage tolerant and output power-down protection features.

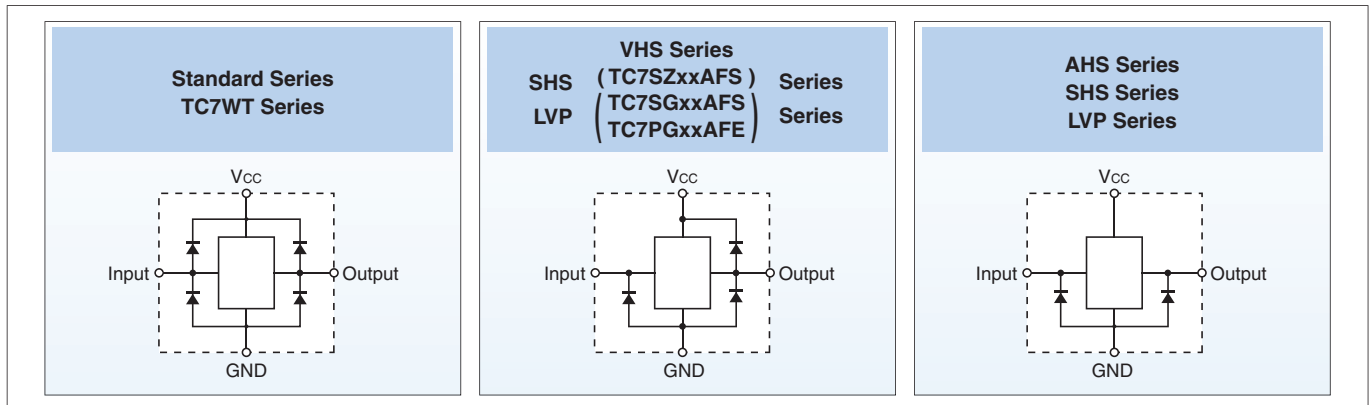
- Input voltage tolerant: Allows interfacing between components using different supply voltages (e.g., backup circuit)
- Output power-down protection: Allows a voltage to be applied to an output when power is removed (for IC protection)

#### Input and Output Voltage Ranges

Series		LVP	SHS	AHS	VHS
Input voltage range	Active	0 to 5.5 V	0 to 5.5 V	0 to 3.6 V	0 to 5.5 V
	Power-down	0 to 5.5 V	0 to 5.5 V	0 to 3.6 V	0 to 5.5 V
Output voltage range	Output enabled	0 to V <sub>CC</sub>	0 to V <sub>CC</sub>	0 to V <sub>CC</sub>	0 to V <sub>CC</sub>
	Output disabled	0 to 3.6 V☆	0 to 5.5 V☆	0 to 3.6 V	0 to V <sub>CC</sub>
	Power-down	0 to 3.6 V☆	0 to 5.5 V☆	0 to 3.6 V	0 to V <sub>CC</sub>

☆: The permissible output voltage range of the TC7SGxxAFS, TC7PGxxAFE and TC7SZxxAFS Series is 0 to V<sub>CC</sub> when outputs are disabled.

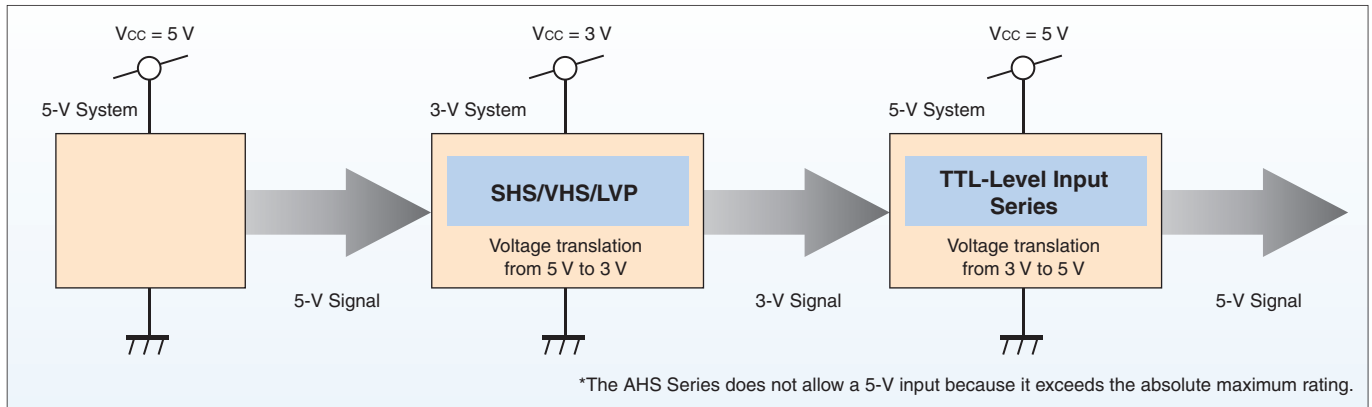
#### I/O Equivalent Circuit Diagrams



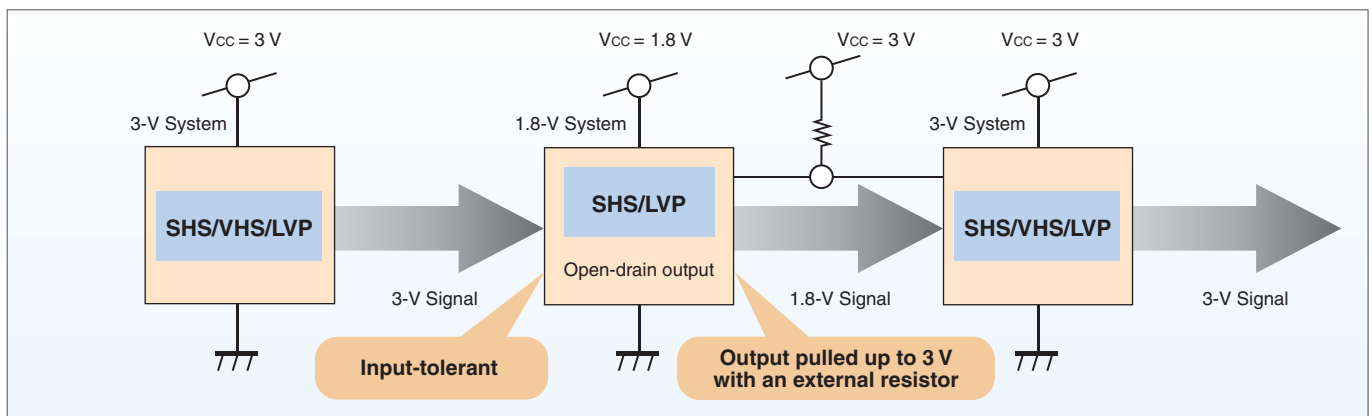
#### Application Example (Interfacing Between 1.8 V, 3 V and 5 V)

As many CPUs and memories are now available in low-voltage versions, many applications are being designed to operate in a mixed 1.8-V/3-V/5-V supply environment. Toshiba's L-MOS ICs act as an interface between different voltage domains.

#### Application Example (Interfacing from a 5-V Domain to a 3-V Domain to a 5-V Domain)



#### Application Example (Interfacing from a 3-V Domain to a 1.8-V Domain to a 3-V Domain)



## New Product

### ► Digital Clock Buffer IC: TC7SX04BFE

Toshiba has released a new L-MOS device designated the TC7SX04BFE, which is specifically designed for clock buffer applications.

The TC7SX04BFE incorporates amplification and wave-shaping circuits in a single package, reducing the number of external components required.

#### ■ Applications

Cell phones, smartphones, tablet PCs, digital cameras, etc.

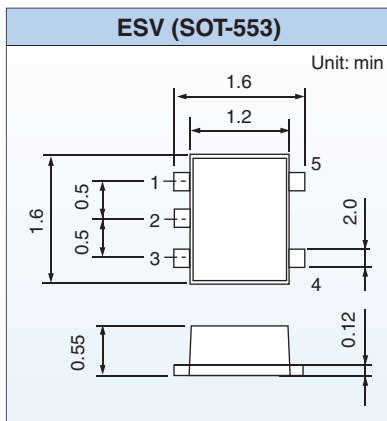
#### ■ Features

- Operating supply voltage:  $V_{CC} = 1.65\text{ V to }3.6\text{ V}$
- Reduces external component count and thus board space.
- Allows both sine-wave and square-wave clock inputs.
- Provides an output enable control input pin.

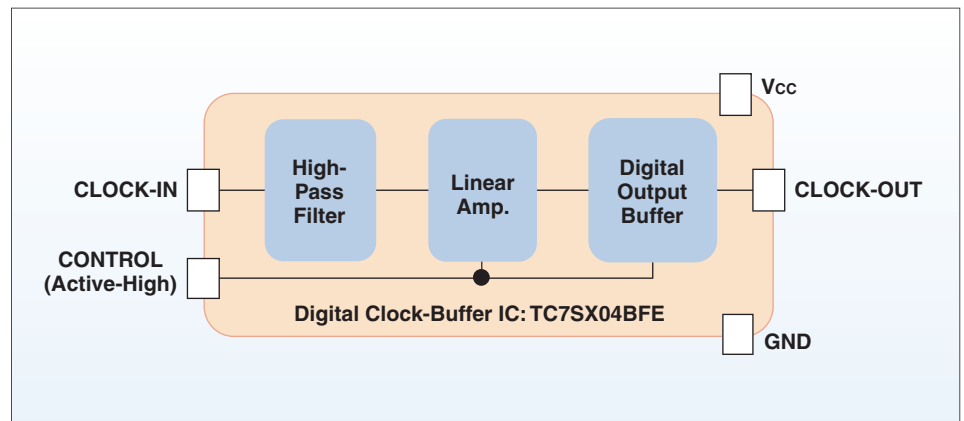
#### ■ Electrical Characteristics

Characteristic	Symbol	Condition	Min	Typ.	Max	Unit
Power supply voltage	$V_{CC}$	–	1.65	–	3.6	V
Clock frequency	$f_{IN}$	Square wave	0.032	–	80	MHz
Clock frequency	$f_{IN}$	Sine wave	12	–	80	MHz
CLOCK-IN voltage (peak-to-peak)	$V_{ICPP}$	CONTROL = High (Output enabled)	0.7	–	3.6	V
Slew rate	SR	$V_{CC} = 1.65\text{ to }1.95\text{ V}$ , $C_L = 25\text{ pF}$ , $R_L = 1\text{ M}\Omega$	0.53	–	–	V/ns
Input capacitance (CLOCK-IN pin)	$C_{IN-CKI}$	$V_{CC} = 3.3\text{ V}$ , $T_a = 25^\circ\text{C}$	–	3.3	–	pF

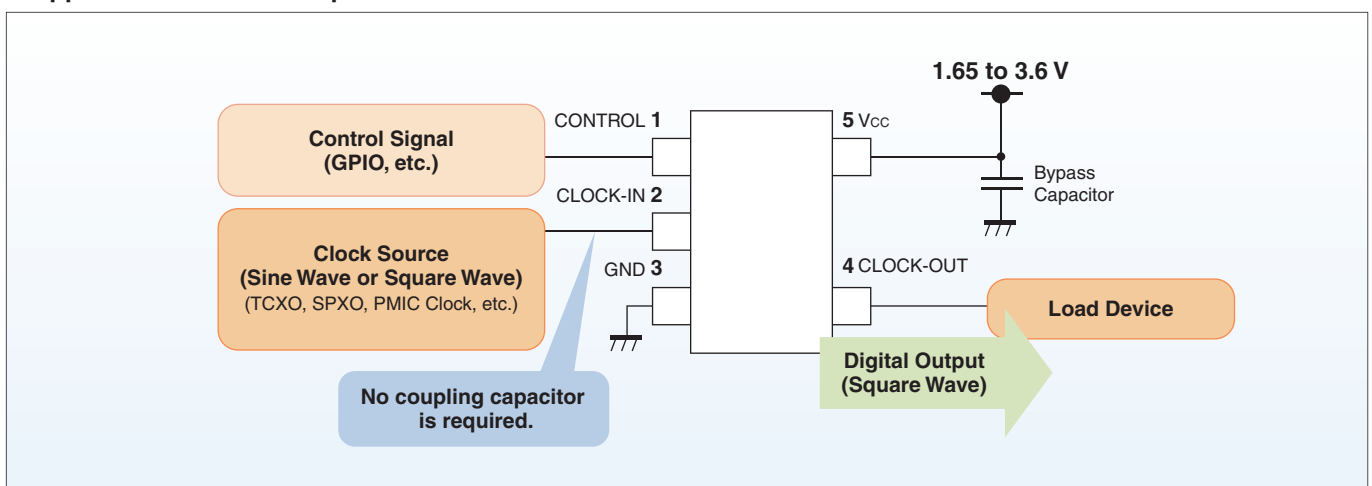
#### ■ Package Dimensions



#### ■ TC7SX04BFE Block Diagram



#### ■ Application Circuit Example





# 6 Functional Selection Table (General-Purpose Logic ICs)

GENERAL-PURPOSE LOGIC ICs

## CMOS Logic ICs (74AC, 74VHC, 74HC and Standard Series)

No. (xxx)	# of Pins	Functions	ACL									VHS						HS-C <sup>2</sup> MOS						Standard C <sup>2</sup> MOS		
			Part Number	TC74AC			TC74ACT			TC74VHC			TC74VHCT			TC74VHCV		TC74HC			TC74HCT			TC		
				xxxP	xxxF	xxxFT	xxxP	xxxF	xxxFT	xxxF	xxxFT	xxxFK	xxxAF	xxxAFT	xxxAFK	xxxFT	xxxFK	xxxAP	xxxAF	xxxAFT	xxxAP	xxxAF	xxxAFT	xxxBP	xxxBF	xxxBFT
Package	DIP	SOP	TSSOP	DIP	SOP	TSSOP	SOP	TSSOP	US	SOP	TSSOP	US	TSSOP	US	DIP	SOP	TSSOP	DIP	SOP	TSSOP	DIP	SOP	TSSOP			
00	14	Quad 2-Input NAND Gate																								
02	14	Quad 2-Input NOR Gate																								
03	14	Quad 2-Input NAND Gate (Open-Drain)																								
04	14	Hex Inverter																								
U04	14	Hex Inverter																								
05	14	Hex Inverter (Open-Drain)																								
07	14	Hex Buffer (Open-Drain)																								
08	14	Quad 2-Input AND Gate																								
10	14	Triple 3-Input NAND Gate																								
11	14	Triple 3-Input AND Gate																								
14	14	Hex Schmitt Inverter																								
17	14	Hex Schmitt Buffer																								
20	14	Dual 4-Input NAND Gate																								
21	14	Dual 4-Input AND Gate																								
27	14	Triple 3-Input NOR Gate																								
30	14	8-Input NAND Gate																								
32	14	Quad 2-Input OR Gate																								
42	16	BCD-to-Decimal Decoder																								
74	14	Dual D-Type Flip-Flop with Preset and Clear																								
85	16	4-Bit Magnitude Comparator																								
86	14	Quad Exclusive -OR Gate																								
107	14	Dual J-K Flip-Flop with Clear																								
109	16	Dual J-K Flip-Flop with Preset and Clear																								
112	16	Dual J-K Flip-Flop with Preset and Clear																								
123A	16	Dual Monostable Multivibrator (tw out = 1.0 Cx · Rx)																								
125	14	Quad Bus Buffer (3-State)																								
126	14	Quad Bus Buffer (3-State)																								
132	14	Quad 2-Input Schmitt NAND Gate																								
133	16	13-Input NAND Gate																								
138	16	3-to-8 Line Decoder																								
139	16	Dual 2-to-4 Line Decoder																								
148	16	8-to-3 Line Priority Encoder																								
151	16	8-Channel Multiplexer																								
153	16	Dual 4-Channel Multiplexer																								
155	16	Dual 2-to-4 Line Decoder																								
157	16	Quad 2-Channel Multiplexer																								
158	16	Quad 2-Channel Multiplexer (Inv.)																								
161	16	Sync. Binary Counter with Async. Clear																								
163	16	Sync. Binary Counter with Sync. Clear																								
164	14	8-Bit Serial-In / Parallel-Out Shift Register																								
165	16	8-Bit Parallel-In / Serial-Out Shift Register																								
166	16	8-Bit Parallel-In / Serial-Out Shift Register																								
173	16	Quad D-Type Register (3-State)																								
174	16	Hex D-Type Flip-Flop with Clear																								
175	16	Quad D-Type Flip-Flop with Clear																								
191	16	4-Bit Binary Up/Down Counter																								
193	16	Sync. Up/Down Binary Counter																								
221A	16	Dual Monostable Multivibrator (tw out = 1.0 Cx · Rx)																								

○ : Being or planned to be manufactured also at Toshiba's fabs outside of Japan

□ : Manufactured only in Japan

(\*) : The part number suffix is AP and AF, not AAP or AAF.

# 6 Functional Selection Table (General-Purpose Logic ICs)

## GENERAL-PURPOSE LOGIC ICs

### CMOS Logic ICs (74AC, 74VHC, 74HC and Standard Series)

No. (xxx)	# of Pins	Functions	ACL									VHS						HS-C <sup>2</sup> MOS						Standard C <sup>2</sup> MOS		
			Part Number	TC74AC			TC74ACT			TC74VHC			TC74VHCT			TC74VHCV		TC74HC			TC74HCT			TC		
				xxxP	xxxF	xxxFT	xxxP	xxxF	xxxFT	xxxF	xxxFT	xxxFK	xxxAF	xxxAFT	xxxAFK	xxxFT	xxxFK	xxxAP	xxxAF	xxxAFT	xxxAP	xxxAF	xxxAFT	xxxBP	xxxBF	xxxBFT
Package	DIP	SOP	TSSOP	DIP	SOP	TSSOP	SOP	TSSOP	US	SOP	TSSOP	US	TSSOP	US	DIP	SOP	TSSOP	DIP	SOP	TSSOP	DIP	SOP	TSSOP			
237	16	3-to-8 Line Decoder/Latch																								
238	16	3-to-8 Line Decoder																								
240	20	Octal Bus Buffer (3-State, Inverted)																								
241	20	Octal Bus Buffer (3-State)																								
244	20	Octal Bus Buffer (3-State)																								
245	20	Octal Bus Transceiver (3-State)																								
251	16	8-Channel Multiplexer (3-State)																								
253	16	Dual 4-Channel Multiplexer (3-State)																								
257	16	Quad 2-Channel Multiplexer (3-State)																								
258	16	Quad 2-Channel Multiplexer (3-State, Inverted)																								
259	16	8-Bit Addressable Latch																								
273	20	Octal D-Type Flip-Flop with Clear																								
279	16	Quad S-R Latch																								
280	14	9-Bit Parity Generator/Checker																								
283	16	4-Bit Binary Full Adder																								
299	20	8-Bit PIPO Shift Register																								
365	16	Hex Bus Buffer (3-State)																								
366	16	Hex Bus Buffer (3-State, Inverted)																								
367	16	Hex Bus Buffer (3-State)																								
368	16	Hex Bus Buffer (3-State, Inverted)																								
373	20	Octal D-Type Latch (3-State)																								
374	20	Octal D-Type Flip-Flop (3-State)																								
375	16	Quad D-Type Latch																								
377	20	Octal D-Type Flip-Flop																								
390	16	Dual Decade Counter																								
393	14	Dual Binary Counter																								
423A	16	Dual Monostable Multivibrator (tw out = 1.0 Cx · Rx)																								
521	20	8-Bit Equality Comparator																								
534	20	Octal D-Type Flip-Flop (3-State, Inverted)																								
540	20	Octal Bus Buffer (3-State, Inverted)																								
541	20	Octal Bus Buffer (3-State)																								
564	20	Octal D-Type Flip-Flop (3-State, Inverted)																								
573	20	Octal D-Type Latch (3-State)																								
574	20	Octal D-Type Flip-Flop (3-State)																								
590	16	8-Bit Binary Counter/register (3-State)																								
592	16	8-Bit Register/Binary Counter																								
595	16	8-Bit Shift Register/Latch (3-State)																								
597	16	8-Bit Latch/Shift Register																								
640	20	Octal Bus Transceiver (3-State, Inverted)																								
670	16	4-Word x 4-Bit Register File (3-State)																								
688	20	8-Bit Equality Comparator																								
697	20	U/D 4-Bit Binary Counter/Register (3-State)																								
4001	14	Quad 2-Input Positive NOR Gate																								
4002	14	Dual 4-Input Positive NOR Gate																								

○ : Being or planned to be manufactured also at Toshiba's fabs outside of Japan

□ : Manufactured only in Japan

(\*): The part number suffix is AP and AF, not AAP or AAF.



# 6 Functional Selection Table (General-Purpose Logic ICs)

## GENERAL-PURPOSE LOGIC ICs

### Low-Voltage CMOS Logic ICs (74VCX, 74LCX and 74LVX Series)

No. (xxx)	# of Pins	Functions	Part Number	Low-Voltage C <sup>2</sup> MOS								
				TC74VCX			TC74LCX			TC74LVX		
				xxxFT	xxxFK	xxxFTG	xxxF	xxxFT	xxxFK	xxxF	xxxFT	xxxFK
			Package	TSSOP	US	VQON	SOP	TSSOP	US	SOP	TSSOP	US
00	14	Quad 2-Input NAND Gate		○	□		□	○	□			
02	14	Quad 2-Input NOR Gate		○	○		□	○	□			
04	14	Hex Inverter		○	○		□	○	□			
05	14	Hex Inverter (Open-Drain)					□	○	□			
07	14	Hex Buffer (Open-Drain)					□	○	○			
08	14	Quad 2-Input AND Gate		○	○		□	○	○			
14	14	Hex Schmitt Inverter		○	○		□	○	○			
32	14	Quad 2-Input OR Gate		○	○		□	○	○			
74	14	Dual D-Type Flip-Flop with Preset and Clear		○	□		□	○	○			
86	14	Quad Exclusive-OR Gate		○	□		□	○	□			
125	14	Quad Bus Buffer (3-State)		○	□		□	○	○			
126	14	Quad Bus Buffer (3-State)					□	○	□			
2125	14	Quad Bus Buffer with Series Resistor (3-State)		○	○							
138	16	3-to-8 Line Decoder		○	○		□	○	○			
157	16	Quad 2-Channel Multiplexer		○	○		□	○	○			
174	16	Hex D-Type Flip-Flop with Clear										
240	20	Octal Bus Buffer (3-State/Inverting)					□	○	○			
244	20	Octal Bus Buffer (3-State)		○	□		□	○	○			
2244	20	Octal Bus Buffer with Series Resistor (3-State)		○	□							
245	20	Octal Bus Transceiver (3-State)		○	□	□	□	○	○			
R2245	20	Octal Bus Transceiver with Series Resistor (3-State)		○	□	□						
257	16	Quad 2-Channel Multiplexer (3-State)		○	○		□	○	□			
273	20	Octal D-Type Flip-Flop with Clear					□	○	○			
367	16	Hex Bus Buffer (3-State)										
373	20	Octal D-Type Latch (3-State)		○	□		□	○	○			
2373	20	Octal D-Type Latch with Series Resistor (3-State)		○	□							
374	20	Octal D-Type Flip-Flop (3-State)		○	□		□	○	○			
2374	20	Octal D-Type Flip-Flop with Series Resistor (3-State)		○	□							
540	20	Octal Bus Buffer (3-State/Inverting)					□	○	○			
541	20	Octal Bus Buffer (3-State)		○	○	□	□	○	○			
2541	20	Octal Bus Buffer with Series Resistor (3-State)		○	○	□						
573	20	Octal D-Type Latch (3-State)		○	○		□	○	○			
2573	20	Octal D-Type Latch with Series Resistor (3-State)		○	○							
574	20	Octal D-Type Flip-Flop (3-State)		○	○		□	○	○			
2574	20	Octal D-Type Flip-Flop with Series Resistor (3-State)		○	○							
646	24	Octal Bus Transceiver/Register (3-State)						□★				
652	24	Octal Bus Transceiver/Register (3-State)						□★				
C3245	24	Dual Supply Octal Bus Transceiver (3-State)									□★	
4245	24	Dual Supply Octal Bus Transceiver (3-State)									□★	
4051	16	8-Channel Analog Multiplexer/Demultiplexer								□	□	□
4052	16	Dual 4-Channel Analog Multiplexer/Demultiplexer								□	□	□
4053	16	Triple 2-Channel Analog Multiplexer/Demultiplexer								□	□	□
16240	48	16-Bit Bus Buffer (3-State/Inverting)						□				
16244	48	16-Bit Bus Buffer (3-State)		□				□				
H16244	48	16-Bit Bus Buffer with Bushold		□								
162244	48	16-Bit Bus Buffer with Series Resistor (3-State)		□								
H162244	48	16-Bit Bus Buffer with Bushold/Series Resistor		□								
16245	48	16-Bit Bus Transceiver (3-State)		□				□				
H16245	48	16-Bit Bus Transceiver with Bushold		□								
R162245	48	16-Bit Bus Transceiver with Series Resistor (3-State)		□								
HR162245	48	16-Bit Bus Transceiver with Bushold/Series Resistor		□								
16373	48	16-Bit D-Type Latch (3-State)		□				□				
H16373	48	16-Bit D-Type Latch with Bushold		□								
162373	48	16-Bit D-Type Latch with Series Resistor (3-State)		□								
H162373	48	16-Bit D-Type Latch with Bushold/Series Resistor		□								
16374	48	16-Bit Bus Flip-Flop (3-State)		□				□				
H16374	48	16-Bit Bus Flip-Flop with Bushold		□								
162374	48	16-Bit Bus Flip-Flop with Series Resistor (3-State)		□								
H162374	48	16-Bit Bus Flip-Flop with Bushold/Series Resistor		□								

○: Being or planned to be manufactured also at Toshiba's fabs outside of Japan

□: Manufactured only in Japan

★: Housed in an SSOP package.

No. (xxx)	# of Pins	Functions	Part Number	Low-Voltage C <sup>2</sup> MOS								
				TC74VCX			TC74LCX			TC74LVX		
				xxxFT	xxxFK	xxxFTG	xxxF	xxxFT	xxxFK	xxxF	xxxFT	xxxFK
Package	TSSOP	US	VQON	SOP	TSSOP	US	SOP	TSSOP	US			
Z240	20	Octal Bus Buffer (3-State)						<input type="checkbox"/>	<input type="checkbox"/>			
ZA240	20	Octal Bus Buffer (3-State)						<input type="checkbox"/>	<input type="checkbox"/>			
Z244	20	Octal Bus Buffer (3-State)						<input type="checkbox"/>	<input type="checkbox"/>			
ZA244	20	Octal Bus Buffer (3-State)						<input type="checkbox"/>	<input type="checkbox"/>			
16500	56	18-Bit Universal Bus Transceiver (3-State)		<input type="checkbox"/>								
H16500	56	18-Bit Universal Bus Transceiver with Bushold (3-State)		<input type="checkbox"/>								
R162500	56	18-Bit Universal Bus Transceiver with Series Resistor (3-State)		<input type="checkbox"/>								
HR162500	56	18-Bit Universal Bus Transceiver with Bushold/Series Resistor (3-State)		<input type="checkbox"/>								
16501	56	18-Bit Universal Bus Transceiver (3-State)		<input type="checkbox"/>								
H16501	56	18-Bit Universal Bus Transceiver with Bushold (3-State)		<input type="checkbox"/>								
R162501	56	18-Bit Universal Bus Transceiver with Series Resistor (3-State)		<input type="checkbox"/>								
HR162501	56	18-Bit Universal Bus Transceiver with Bushold/Series Resistor (3-State)		<input type="checkbox"/>								
16543	56	16-Bit Registered Transceiver (3-State)		<input type="checkbox"/>								
H16543	56	16-Bit Registered Transceiver with Bushold		<input type="checkbox"/>								
R162543	56	16-Bit Registered Transceiver with Series Resistor (3-State)		<input type="checkbox"/>								
HR162543	56	16-Bit Registered Transceiver with Bushold/Series Resistor		<input type="checkbox"/>								
16600	56	18-Bit Universal Bus Transceiver (3-State)		<input type="checkbox"/>								
H16600	56	18-Bit Universal Bus Transceiver with Bushold (3-State)		<input type="checkbox"/>								
R162600	56	18-Bit Universal Bus Transceiver with Series Resistor (3-State)		<input type="checkbox"/>								
HR162600	56	18-Bit Universal Bus Transceiver with Bushold/Series Resistor (3-State)		<input type="checkbox"/>								
16601	56	18-Bit Universal Bus Transceiver (3-State)		<input type="checkbox"/>								
H16601	56	18-Bit Universal Bus Transceiver with Bushold (3-State)		<input type="checkbox"/>								
R162601	56	18-Bit Universal Bus Transceiver with Series Resistor (3-State)		<input type="checkbox"/>								
HR162601	56	18-Bit Universal Bus Transceiver with Bushold/Series Resistor (3-State)		<input type="checkbox"/>								
16646	56	16-Bit Bus Transceiver/Register (3-State)		<input type="checkbox"/>								
16646A	56	16-Bit Bus Transceiver/Register (3-State)						<input type="checkbox"/>				
H16646	56	16-Bit Bus Transceiver/Register with Bushold		<input type="checkbox"/>								
R162646	56	16-Bit Bus Transceiver/Register with Series Resistor (3-State)		<input type="checkbox"/>								
HR162646	56	16-Bit Bus Transceiver with Bushold/Series Resistor		<input type="checkbox"/>								
16652	56	16-Bit Bus Transceiver/Register (3-State)		<input type="checkbox"/>								
16652A	56	16-Bit Bus Transceiver/Register (3-State)						<input type="checkbox"/>				
H16652	56	16-Bit Bus Transceiver/Register with Bushold		<input type="checkbox"/>								
R162652	56	16-Bit Bus Transceiver/Register with Series Resistor (3-State)		<input type="checkbox"/>								
HR162652	56	16-Bit Bus Transceiver/Register with Bushold/Series Resistor		<input type="checkbox"/>								
16721	56	20-Bit D-Type Flip-Flop (3-State)		<input type="checkbox"/>								
162721	56	20-Bit D-Type Flip-Flop with Series Resistor (3-State)		<input type="checkbox"/>								
16821	56	20-Bit D-Type Flip-Flop (3-State)		<input type="checkbox"/>								
162821	56	20-Bit D-Type Flip-Flop with Series Resistor (3-State)		<input type="checkbox"/>								
16823	56	18-Bit D-Type Flip-Flop (3-State)		<input type="checkbox"/>								
162823	56	18-Bit D-Type Flip-Flop with Series Resistor (3-State)		<input type="checkbox"/>								
16827	56	20-Bit Bus Buffer (3-State)		<input type="checkbox"/>								
H16827	56	20-Bit Bus Buffer with Bushold		<input type="checkbox"/>								
162827	56	20-Bit Bus Buffer with Series Resistor (3-State)		<input type="checkbox"/>								
H162827	56	20-Bit Bus Buffer with Bushold/Series Resistor		<input type="checkbox"/>								
16834	56	18-Bit Universal Bus Driver (3-State)		<input type="checkbox"/>								
162834	56	18-Bit Universal Bus Driver with Series Resistor (3-State)		<input type="checkbox"/>								
16835	56	18-Bit Universal Bus Driver (3-State)		<input type="checkbox"/>								
162835	56	18-Bit Universal Bus Driver with Series Resistor (3-State)		<input type="checkbox"/>								
16841	56	20-Bit D-Type Latch (3-State)		<input type="checkbox"/>								
162841	56	20-Bit D-Type Latch with Series Resistor (3-State)		<input type="checkbox"/>								
16843	56	18-Bit D-Type Latch (3-State)		<input type="checkbox"/>								
162843	56	18-Bit D-Type Latch with Series Resistor (3-State)		<input type="checkbox"/>								
163245	48	Dual Supply 16-Bit Bus Transceiver (3-State)		<input type="checkbox"/>				<input type="checkbox"/>				
R163245	48	Dual Supply 16-Bit Bus Transceiver with Series Resistor (3-State)		<input type="checkbox"/>				<input type="checkbox"/>				
164245	48	Dual Supply 16-Bit Bus Transceiver (3-State)		<input type="checkbox"/>				<input type="checkbox"/>				
R164245	48	Dual Supply 16-Bit Bus Transceiver with Series Resistor (3-State)		<input type="checkbox"/>				<input type="checkbox"/>				

: Manufactured only in Japan



# 7 Functional Cross-Reference (General-Purpose Logic ICs)

GENERAL-PURPOSE LOGIC ICs

## CMOS Logic ICs (74AC, 74VHC, 74HC and Standard Series)

Functions		ACL		VHS		HS-C <sup>2</sup> MOS		Standard C <sup>2</sup> MOS		
		TC74AC/ACTxxx Series		TC74VHC/VHCT/VHCVxxx Series		TC74HC/HCTxxx Series		TC4000/4500 Series		
Gates	NAND		AC00, ACT00, AC10, AC20	VHC00, VHCT00A, VHC10, VHC20	HC00A, HCT00A, HC10A, HC20A, HC30A, HC133A	4011B				
		Open-Drain		VHC03	HC03A					
	NOR		AC02, ACT02	VHC02, VHC27	HC02A, HCT02A, HC27A, HC4002A, HC4078A	4001B				
	AND		AC08, ACT08, AC11	VHC08, VHCT08A, VHC11, VHC21	HC08A, HCT08A, HC11A, HC21A	4081B				
	OR		AC32, ACT32	VHC32, VHCT32A	HC32A, HCT32A, HC4072A, HC4075A, HC4078A	4071B				
	Buffer					HC4050A, HCT7007A	4050B			
		Open-Drain				HC07A				
	Inverter		AC04, ACT04	VHC04, VHCT04A, VHCU04	HC04A, HCT04A, HCU04A, HC4049A	4069UB, 4049B				
		Open-Drain	AC05	VHC05	HC05A					
	Exclusive-OR		AC86, ACT86	VHC86, VHCT86A	HC86A, HCT86A	4030B				
	Exclusive-NOR				HC7266A					
	Schmitt	NAND			VHC132	HC132A	4093B			
			Buffer		VHCV17					
		Inverter			VHCV07					
Open-Drain			AC14, ACT14	VHC14, VHCT14A, VHCV14	HC14A	4584B				
Buffers	3-State Buffer	QUAD	AC125, AC126	VHC125, VHCT125A, VHC126, VHCT126A	HC125A, HC126A					
		HEX	AC367	VHC367, VHCT367A, VHC368	HC365A, HC366A, HC367A, HC368A,					
		OCTAL	AC240, ACT240, AC244, ACT244, AC245, ACT245 AC540, ACT540, AC541, ACT541 AC640, ACT640	VHC240, VHCT240A, VHC244, VHCT244A VHC540, VHCT540A, VHC541, VHCT541A VHC245, VHCT245A	HC240A, HCT240A, HC241A, HC244A, HCT244A HC245A, HCT245A, HC540A, HCT540A, HC541A HCT541A, HC640A					
	Schmitt	Buffer		VHC9151, VHC9152						
		3-State Buffer		VHC9541, VHCT9541A, VHC9125, VHCT9125A VHC9126, VHCT9126A, VHCV240, VHCV244 VHCV540, VHCV541, VHCV245	HC7240A, HC7244A					
	Flip-Flops	DUAL	QUAD	AC74, ACT74, AC109, AC112, ACT112	VHC74, VHCT74A	HC74A, HCT74A, HC107A, HC109A, HC112A	4013B, 4027B			
			HEX	AC174, ACT174	VHC174	HC175A, HC174A, HCT174A				
			OCTAL	AC273, ACT273, AC374, ACT374, AC377 AC534, AC574, ACT574	VHC273, VHC374, VHCT374A, VHC574, VHCT574A	HC273A, HCT273A, HC374A, HCT374A, HC377A, HC564A, HC574A, HCT574A				
			Schmitt		VHC9273, VHCT9273, VHCV374, VHCV574					
		Latches		AC373, ACT373, AC573, ACT573	VHC373, VHCT373A, VHC573, VHCT573A	HC259A, HC279A, HC373A, HCT373A, HC375A HC573A, HCT573A	4044B			
Multivibrators			VHC123A, VHC221A	HC123A, HC221A, HC423A, HC4538A	4538B					
Decoders		AC138, ACT138, AC139, ACT139	VHC138, VHCT138A, VHC139, VHCT139A, VHC238	HC42A, HC138A, HCT138A, HC139A, HCT139A HC155A, HC237A, HC238A, HC4028A, HC4511A	4028B, 4511B					
Encoders				HC148A						
Drivers	LED			HC4511A	4511B					
Registers	Shift		AC164, ACT164, AC166, AC299, ACT299	VHC164, VHC165, VHC299, VHC595	HC164A, HC165A, HC166A, HC173A, HC299A, HC595A, HC597A, HC670A, HC4094A, HC40105A	4015B, 4021B, 4094B				
	Schmitt Shift			VHC9164, VHC9595						
Counters	Binary		AC161, ACT161, AC163, ACT163, AC393	VHC161, VHC163, VHC393, VHC4040, VHC4020	HC161A, HC163A, HC191A, HC193A, HC393A, HC590A, HC592A, HC697A, HC4020A, HC4040A, HC4520A	4520B, 4020B, 4024B, 4040B				
		Decade	AC390		HC390A					
	Divider				HC4024A, HC4060A, HC40102A, HC40103A, HC7292A	4020B, 4024B, 4040B, 4521B				
	Others				HC4017A	4017B				
Multiplexers	Analog			VHC4051A, VHC4052A, VHC4053A	HC4051A, HC4052A, HC4053A, HCT4053A	4051B, 4052B, 4053B				
	Digital		AC151, ACT151, AC153, ACT153, AC157, ACT157, AC257, ACT257, AC258	VHC153, VHC157, VHC257	HC151A, HC153A, HC157A, HCT157A, HC158A, HC251A, HC253A, HC257A	4512B				
Arithmetic Circuits	Adder		AC283		HC283A					
	Comparator		AC521, ACT521		HC85A, HC688A, HCT688A					
	Parity Tree		AC280, ACT280		HC280A					
FIFO Memories					HC40105A					
Others	Analog Switch			VHC4066A	HC4066A	4066B				



# 7 Functional Cross-Reference (General-Purpose Logic ICs)

## GENERAL-PURPOSE LOGIC ICs

### Low-Voltage CMOS Logic ICs (74VCX, 74LCX and 74LVX Series)

Functions		VCX	LCX	LVX
		TC74VCXxxx Series	TC74LCXxxx Series	TC74LVXxxx Series
Gates Buffers	NAND	VCX00	LCX00	
	NOR	VCX02	LCX02	
	AND	VCX08	LCX08	
	OR	VCX32	LCX32	
	Inverter	VCX04	LCX04	
	Bus Buffer	VCX125, VCX2125, VCX244, VCX2244, VCX541, VCX2541, VCX16244, VCX162244, VCX16827, VCX162827, VCXH16244, VCXH162244, VCXH16827, VCXH162827	LCX125, LCX126, LCX240, LCX244, LCX540, LCX541, LCX16240, LCX16244, LCXZ240, LCXZ244, LCXZA240, LCXZA244	
	Bus Transceiver	VCX245, VCXR2245, VCX16245, VCXR162245, VCX16500, VCXR162500, VCX16501, VCXR162501, VCX16543, VCXR162543, VCX16600, VCXR162600, VCX16601, VCXR162601, VCX16646, VCXR162646, VCX16652, VCXR162652, VCXH16245, VCXHR162245, VCXH16543, VCXHR162543, VCXH16646, VCXHR162646, VCXH16652, VCXHR162652, VCXH16500, VCXH16501, VCXH16600, VCXH16601, VCXHR162500, VCXHR162501, VCXHR162600, VCXHR162601	LCX245, LCX646, LCX652, LCX16646A, LCX16245, LCX16652A	
	Dual Supply	VCX163245, VCX164245	LCX163245, LCXR163245, LCX164245, LCXR164245	LVX4245, LVXC3245
	Exclusive-OR	VCX86	LCX86	
	Schmitt Trigger	VCX14	LCX14	
Open-Drain		LCX05, LCX07		
Flip-Flops		VCX74, VCX374, VCX2374, VCX574, VCX2574, VCX16374, VCX162374, VCX16721, VCX162721, VCX16821, VCX162821, VCX16823, VCX162823, VCX16834, VCX162834, VCX16835, VCX162835, VCXH16374, VCXH162374	LCX74, LCX273, LCX374, LCX574, LCX16374	
Latches		VCX373, VCX2373, VCX573, VCX2573, VCX16373, VCX162373, VCX16841, VCX162841, VCX16843, VCX162843, VCXH16373, VCXH162373	LCX373, LCX573, LCX16373	
Decoders		VCX138	LCX138	
Multiplexers	Digital	VCX157, VCX257	LCX157, LCX257	
	Analog			LVX4051, LVX4052, LVX4053

# 8 Product Selection Tables

GENERAL-PURPOSE LOGIC ICs

## Level Shifters

### Dual-Supply Level Shifters

Direction	Part Number	Number of Pins	Bit Width	Functions						TSSOP 48	SSOP 24	VQON 24	US16	VQON 16	US8	CST8	UF6	MP6	CST6C	WCSP6	
				Sleep Mode	Bushold	Low Noise	Series Resistor	A-Bus (V)	B-Bus (V)	xxxFT	xxxFS	xxxFTG	xxxFK	xxxFTG	xxxFK	xxxFC	xxxTU	xxxL6X	xxxFC	xxxWBG	
Bidirectional	TC74VCX163245	48	16					2.5	1.8												
	TC74VCX164245									1.8	2.5										
	TC74LCX163245									2.5	3.3										
	TC74LCXR163245						○	5	3.3												
	TC74LCX164245							2.5	5												
	TC74LCXR164245						○	3.3	3.3												
	TC74LVXC3245	24	8					3.3	5												
									5	3.3											
	TC74LVX4245																				
TC7MP3245					○				1.2	1.8											
						○			1.5	2.5											
TC7MPH3245			○				1.8	2.5													
				○			2.5	3.3													
TC7MPN3245			○				1.2	1.8													
				○			1.5	2.5													
TC7MP3125	16	4	○				1.8	2.5													
					○			1.5	3.3												
TC7MPH3125					○			1.8	3.3												
					○				2.5	3.3											
TC7MPN3125			○				1.2	1.8													
				○			1.5	2.5													
TC7MPS3125			○				1.8	3.3													
				○			2.5	3.3													
Unidirectional	TC7WP3125	8	2	○																	
					○																
	TC7WPN3125			○																	
				○																	
	TC7SP3125	6	1	○				1.2	1.8												
						○			1.5	2.5											
	TC7SPN3125					○			1.8	3.3											
						○															
TC7SP334					○																
					○																
TC7SPN334			○																		
			○																		
TC7SP3125C			○																		
			○																		

□: Manufactured only in Japan \*\* : Under development

### Logic Gates with Level-Shifting Function

Direction	Part Number	Number of Pins	Bit Width	Functions			WCSP6
				Function	A-Bus (V)	B-Bus (V)	xxxWBG
Unidirectional	TC7SP300	6	1	NAND	1.2	1.8	□
	TC7SP302			NOR			□
	TC7SP308			AND			□
	TC7SP332			OR			□
	TC7SP381			Exclusive-NOR			□
				Exclusive-OR			□
	TC7SP386						□

□: Mass production

### Dual-Supply Bus Transceivers with Auto Direction Sensing (Bus Buffers)

Direction	Part Number	Number of Pins	Bit Width	Functions					WCSP24	WCSP16	WCSP12	UQFN12	US8	WCSP8	WCSP6
				Auto Direction Sensing	Sleep Mode	Multiplexer	V <sub>CCA</sub> (V)	V <sub>CCB</sub> (V)	xxxWBG	xxxWBG	xxxWBG	xxxMU	xxxFK	xxxWBG	xxxWBG
Bidirectional	TC7LX1101	6	1	○	○										□
	TC7LX1102	8	2	○	○		1.2	1.2						□	□
	TC7LX1104	12	4	○	○		1.5	1.5			□				
	TC7LX0104	12	4	○	○		1.8	1.8				□			
	TC7LX1106	16	6	○	○		2.5	2.5							
	TC7LX1108	24	8	○	○		3.3	3.3			□				
	TC7LX1204	24	4	○	○	○									

□: Mass production

# 8 Product Selection Tables

## GENERAL-PURPOSE LOGIC ICs

### ■ Dual-Supply Bus Transceivers with Auto Direction Sensing (Switch Types)

Functions	Bit Width	Series	Function Number			Number of Pins	TSSOP	US8/	VQON	UF6	USV/	CST8	MP6/8	UQFN
			14/16/20	14/16/20	16/20			US6			8/12			
			5 V ↔ 1.8 V Level Shift	5 V ↔ 1.8 V Level-Shift Assist Circuit	5 V ↔ 1.8 V Level-Shift Assist Circuit Pull-Up Resistors		xxxFT	xxxFK	xxxFTG	xxxTU	xxxFU	xxxFC	xxxL6X/L8X	MU
SPST	1	TC7SPBxxx	9306			6				○				
			9307							○				
		TC7LSxxx		A01	RA01	6					**		**	
				B01	RB01						**		**	
	2	TC7WPBxxx	9307			8		○				○		
			9306					○				○		
					8307	8							○	
					8306								○	
		TC7LSxxx		A02	RA02	8		○					○	**
				B02	RB02			○					○	**
	4	TC7QPBxxx	9307			14	○	○	○★					
			9306				○	○	○★					
		TC7LSxxx		A04	RA04	12/14	**							**
				B04	RB04		**							**
8	TC7MPBxxx	9307			20	○	○							
			A08	RA08		**								
	TC7LSxxx		B08	RB08	20	**								
						**								
SPDT	2	TC7MPBxxx	9327			14	○	○	○★					
			9326				○	○	○★					

○: Mass production ★: Housed in an VQON16 package \*\*: Under development

## Bus Switches

### Functional Selection Table

Type	Configuration	# Circuits	Control Input	Series	Function Number				Packaging						
					Standard 5 V	Low Cap. 5 V	Low Voltage 3 V	Low Voltage/ Low Cap. 3 V	Suffix	Name	Number of Pins				
High Speed Switches	SPDT	Octal	Active-low	TC7PClxxx				3412	MT	TQFN42	42				
								3415	MT	TQFN42	42				
		Quad	Active-low		3212	MT	TQFN20	20							
					3215	MT	TQFN20	20							
USB Switches	SPST	Dual	Active-low	TC7USBxxx				31	WBG	WCSP8	8				
								FK	US8						
	SPDT	Dual	Active-low		Active-low	40				MU	UQFN10	10			
										FT	TSSOP14	14			
		Dual	Active-low		Active-low	42					MU	UQFN10	10		
											FT	TSSOP14	14		
	SPDT	Dual	Active-low		Active-low	221				WBG	WCSP10	10			
										FT	TSSOP14	14			
	SPDT	Dual	-		-	TCUAxxx				221	WBG	WCSP10	10		
										2221	WBG	WCSP10	10		
										231	WBG	WCSP15	15		
	Bus Switches	SPST	Single		Active-high Active-low	TC7SBxxx		66	66C 67C	66C, L66C 67C	FU	USV	5		
L6X				MP6							6				
Active-low Active-high				384 385							L384A	L384C	FU	USV	5
Dual			Active-high Active-low	66	66C 67C	66C 67C	FK	US8	8	L8X	MP8	8			
													Active-low Active-high	125 126	L125A L126A
			Active-high Active-low			L3305C L3306C	FK	US8	8						
										Quad	Active-low Active-high			L6125S L6126S	FT
FK			US14												
Active-low Active-high					L3125C L3126C	FT	TSSOP14	14							
						FK	US14								
Octal			Active-low (one per 4 switches)	3244	3244C	L3244A				FT	TSSOP20	20			
										FK	US20				
			Active-low (for all 8 switches)	3245	3245C	L3245A	L3245S L3245C	FTG	VQON20	20					
								FT	TSSOP20						
Bus Exchanges			Single	Active-low	TC7WBxxx	383				FK	US8	8			
Multiplexers/ Demultiplexers	SPDT	Single	-	TC7SBxxx			3157C	3157C	FU	US6	6				
									L6X	MP6	6				
		Dual	Active-low	TC7MBxxx					L6353S	FT	TSSOP14	14			
										FK	US14				
										FTG	VQON16				
	Quad	Active-low	3257	3257C	L3257A	L3257C	FT	TSSOP16	16						
							FK	US16							
	SP4T	Dual	Active-low	3253			L3253C	FT	TSSOP16	16					
								FK	US16						
FTG								VQON16							
SP8T	Single	Active-low	3251				FT	TSSOP16	16						
							FK	US16							
Demultiplexers	SPDT	Single	-	TC7PBxxx			53	TU	UF6	6					
								SP3T	Single	-	TC7PBxxx			54	FK
FC	CST8														

# 8 Product Selection Tables

GENERAL-PURPOSE LOGIC ICs

## L-MOS Product Lineup by Series and Package

Function	LVP Series								AHS Series		SHS Series								VHS Series								VHS TTL-Level Input Series		High-Speed TTL-Level-Input Series		Standard Series				
	0.9 to 3.6 V								1.8 to 3.6 V		1.65 to 5.5 V				1.8 to 5.5 V				1.65 to 5.5 V								2 to 5.5 V		4.5 to 5.5 V		4.5 to 5.5 V		3 to 18 V		
I <sub>OH</sub> /I <sub>OL</sub>	8 mA min @ V <sub>CC</sub> = 3 V								24 mA min @ V <sub>CC</sub> = 3 V		24 mA min @ V <sub>CC</sub> = 3 V								8 mA min @ V <sub>CC</sub> = 4.5 V								4 mA min @ V <sub>CC</sub> = 4.5 V		0.42 mA min @ V <sub>CC</sub> = 5 V						
tpLH/tpHL (NAND gate)	2.5 ns typ. @ V <sub>CC</sub> = 3.3 V C <sub>L</sub> = 15 pF, T <sub>a</sub> = 25°C								2.8 ns max @ V <sub>CC</sub> = 3.3 V C <sub>L</sub> = 15 pF, T <sub>a</sub> = 25°C		2.4 ns typ. @ V <sub>CC</sub> = 3.3 V C <sub>L</sub> = 15 pF, T <sub>a</sub> = 25°C								3.7 ns typ. @ V <sub>CC</sub> = 5 V, C <sub>L</sub> = 15 pF, T <sub>a</sub> = 25°C								4.2 ns typ. @ V <sub>CC</sub> = 5 V, C <sub>L</sub> = 15 pF, T <sub>a</sub> = 25°C		10 ns typ. @ V <sub>CC</sub> = 5 V, C <sub>L</sub> = 15 pF, T <sub>a</sub> = 25°C		65 ns typ. @ V <sub>CC</sub> = 5 V, C <sub>L</sub> = 15 pF, T <sub>a</sub> = 25°C				
Input voltage tolerance	Yes								Yes		Yes								Yes								No		No						
Output power-down protection	No		Yes				No		Yes				No		Yes				No								No		No						
Package	fSV (SOT-953)	MP6 (SOT-886)	ESV (SOT-553)	USV (SOT-353) (SC-88A)	ES6 (SOT-563)	US6 (SOT-363) (SC-88)	CST8	MP8 (SOT-902)	US8 (SOT-765)	SM8 (SOT-505)	ES6 (SOT-563)	US6 (SOT-363) (SC-88)	fSV (SOT-953)	MP6 (SOT-886)	ESV (SOT-553)	USV (SOT-353) (SC-88A)	SMV (SOT-25) (SC-74A)	US6 (SOT-363) (SC-88)	MP8 (SOT-902)	US8 (SOT-765)	SM8 (SOT-505)	fSV (SOT-953)	ESV (SOT-553)	USV (SOT-353) (SC-88A)	SMV (SOT-25) (SC-74A)	ES6 (SOT-563)	CST8	US8 (SOT-765)	SM8 (SOT-505)	USV (SOT-353) (SC-88A)	SMV (SOT-25) (SC-74A)	SM8 (SOT-505)	SMV (SOT-25) (SC-74A)	SM8 (SOT-505)	
NAND	TC7S00AFS	TC7SG00L6X	TC7SG00FE	TC7SG00FU			TC7WG00FC	TC7WG00L8X	TC7WG00FK	TC7WG00FU			TC7S200AFS	TC7S200L6X	TC7S200FE	TC7S200FU	TC7S200F		TC7W200L8X	TC7W200FK	TC7W200FU	TC7SH00FS	TC7SH00FE	TC7SH00FU	TC7SH00F		TC7WH00FC	TC7WH00FK	TC7WH00FU	TC7SET00FU	TC7SET00F			TC4S11F	
NAND (Unbuffered)																																			TC4S11F
NAND (Open-Drain)																																			TC4S11F
AND	TC7S08AFS	TC7SG08L6X	TC7SG08FE	TC7SG08FU			TC7WG08FC	TC7WG08L8X	TC7WG08FK	TC7WG08FU			TC7S208AFS	TC7S208L6X	TC7S208FE	TC7S208FU	TC7S208F		TC7W208L8X	TC7W208FK	TC7W208FU	TC7SH08FS	TC7SH08FE	TC7SH08FU	TC7SH08F		TC7WH08FC	TC7WH08FK	TC7WH08FU	TC7SET08FU	TC7SET08F			TC4S81F	
AND (Open-Drain)																																			TC4S81F
NOR	TC7S02AFS	TC7SG02L6X	TC7SG02FE	TC7SG02FU			TC7WG02FC	TC7WG02L8X	TC7WG02FK	TC7WG02FU			TC7S202AFS	TC7S202L6X	TC7S202FE	TC7S202FU	TC7S202F		TC7W202L8X	TC7W202FK	TC7W202FU	TC7SH02FS	TC7SH02FE	TC7SH02FU	TC7SH02F		TC7WH02FC	TC7WH02FK	TC7WH02FU	TC7SET02FU	TC7SET02F			TC4S01F	
OR	TC7S03AFS	TC7SG03L6X	TC7SG03FE	TC7SG03FU			TC7WG03FC	TC7WG03L8X	TC7WG03FK	TC7WG03FU			TC7S232AFS	TC7S232L6X	TC7S232FE	TC7S232FU	TC7S232F		TC7W232L8X	TC7W232FK	TC7W232FU	TC7SH32FS	TC7SH32FE	TC7SH32FU	TC7SH32F		TC7WH32FC	TC7WH32FK	TC7WH32FU	TC7SET32FU	TC7SET32F			TC4S71F	
Exclusive-OR	TC7S086AFS	TC7SG086L6X	TC7SG086FE	TC7SG086FU				TC7WG086L8X					TC7S286AFS	TC7S286L6X	TC7S286FE	TC7S286FU	TC7S286F		TC7W286L8X			TC7SH86FS	TC7SH86FE	TC7SH86FU	TC7SH86F									TC4S30F	
Inverter	TC7S04AFS	TC7SG04L6X	TC7SG04FE	TC7SG04FU	TC7PG04FE	TC7PG04FU	TC7WG04FC	TC7WG04L8X	TC7WG04FK	TC7WG04FU		TC7PA04FU	TC7S204AFS	TC7S204L6X	TC7S204FE	TC7S204FU	TC7S204F		TC7W204L8X	TC7W204FK	TC7W204FU	TC7SH04FS	TC7SH04FE	TC7SH04FU	TC7SH04F		TC7PH04FE	TC7WH04FC	TC7WH04FK	TC7WH04FU	TC7SET04FU	TC7SET04F			TC4S69F
Inverter*1 (Unbuffered)	TC7SGU04AFS	TC7SGU04L6X	TC7SGU04FE	TC7SGU04FU	TC7PGU04FE	TC7PGU04FU	TC7WGU04FC	TC7WGU04L8X	TC7WGU04FK	TC7WGU04FU		TC7PAU04FU	TC7SZU04AFS	TC7SZU04L6X	TC7SZU04FE	TC7SZU04FU	TC7SZU04F		TC7WZU04L8X	TC7WZU04FK	TC7WZU04FU	TC7SHU04FS	TC7SHU04FE	TC7SHU04FU	TC7SHU04F									TC4S69F	
Inverter*2 (Open-Drain)	TC7S05AFS	TC7SG05L6X	TC7SG05FE					TC7WG05L8X				TC7PA05FU	TC7S205AFS	TC7S205L6X	TC7S205FE	TC7S205FU	TC7S205F		TC7W205L8X	TC7W205FK	TC7W205FU	TC7SH05FS	TC7SH05FE												
Non-Inverter*2 (Open-Drain)	TC7S07AFS	TC7SG07L6X	TC7SG07FE					TC7WG07L8X				TC7S207AFS	TC7S207L6X	TC7S207FE	TC7S207FU	TC7S207F		TC7W207L8X	TC7W207FK	TC7W207FU	TC7SH07FS	TC7SH07FE													
Schmitt Inverter	TC7SG14AFS	TC7SG14L6X	TC7SG14FE	TC7SG14FU	TC7PG14FE	TC7PG14FU	TC7WG14FC	TC7WG14L8X	TC7WG14FK	TC7WG14FU		TC7PA14FU	TC7S214AFS	TC7S214L6X	TC7S214FE	TC7S214FU	TC7S214F	TC7P214FU	TC7W214L8X	TC7W214FK	TC7W214FU	TC7SH14FS	TC7SH14FE	TC7SH14FU	TC7SH14F									TC4S584F	
Schmitt Buffer	TC7SG17AFS	TC7SG17L6X	TC7SG17FE	TC7SG17FU	TC7PG17FE	TC7PG17FU	TC7WG17FC	TC7WG17L8X	TC7WG17FK	TC7WG17FU		TC7PA17FU	TC7S217AFS	TC7S217L6X	TC7S217FE	TC7S217FU	TC7S217F	TC7P217FU	TC7W217L8X			TC7SH17FS	TC7SH17FE	TC7SH17FU	TC7SH17F										
Non-Inverter	TC7SG34AFS	TC7SG34L6X	TC7SG34FE	TC7SG34FU	TC7PG34FE	TC7PG34FU	TC7WG34FC	TC7WG34L8X	TC7WG34FK	TC7WG34FU		TC7PA34FU	TC7S234AFS	TC7S234L6X	TC7S234FE	TC7S234FU	TC7S234F		TC7W234L8X	TC7W234FK	TC7W234FU	TC7SH34FS	TC7SH34FE	TC7SH34FU	TC7SH34F		TC7PH34FE	TC7WH34FC	TC7WH34FK	TC7WH34FU	TC7SET34FU	TC7SET34F			
Analog Switch																																		TC4S66F	
Analog Multiplexer												TC7PA53FU																						TC4S66F (USV)	
D-Type Flip-Flop with Preset and Clear							TC7WG74FC	TC7WG74L8X	TC7WG74FK	TC7WG74FU									TC7WZ74L8X	TC7WZ74FK	TC7WZ74FU							TC7WH74FC	TC7WH74FK	TC7WH74FU				TC4W66FU	
D-Type Flip-Flop	TC7SG79AFS	TC7SG79L6X		TC7SG79FU																															
D-Type Flip-Flop	TC7SG80AFS			TC7SG80FU																															
D-Type Flip-Flop with Clear												TC7PA175FU																							
3-State Buffer	TC7SG125AFS	TC7SG125L6X	TC7SG125FE	TC7SG125FU			TC7WG125FC	TC7WG125L8X	TC7WG125FK	TC7WG125FU			TC7S2125AFS	TC7S2125L6X	TC7S2125FE	TC7S2125FU	TC7S2125F		TC7W2125L8X	TC7W2125FK	TC7W2125FU	TC7SH125FS	TC7SH125FE	TC7SH125FU	TC7SH125F									TC7WT125FU	
3-State Buffer	TC7SG126AFS	TC7SG126L6X	TC7SG126FE	TC7SG126FU			TC7WG126FC	TC7WG126L8X	TC7WG126FK	TC7WG126FU			TC7S2126AFS	TC7S2126L6X	TC7S2126FE	TC7S2126FU	TC7S2126F		TC7W2126L8X	TC7W2126FK	TC7W2126FU	TC7SH126FS	TC7SH126FE	TC7SH126FU	TC7SH126F									TC7WT126FU	
3-State Inverting Buffer																																			TC7WT240FU
3-State Buffer																																			TC7WT241FU
Bus Transceiver																					TC7WZ245FK	TC7WZ245FU													
Bus Transceiver (Open-Drain)																					TC7WZ246FK	TC7WZ246FU													
Monostable Multivibrator																																			
Digital Multiplexer																												TC7WH157FC	TC7WH157FK	TC7WH157FU					
1-to-2 Decoder												TC7PA19AFS	TC7PA19FU																						
Multiple-Function Gate																																			
Multiple-Function Gate																																			
Multiple-Function Gate																																			
Multiple-Function Gate																																			
Multiple-Function Gate (TTL-input)																																			
Multiple-Function Gate (TTL-input)																																			
Multiple-Function Gate (TTL-input)																																			
Multiple-Function Gate (TTL-input)																																			

\*1: The U04 function in all product series has no output power-down protection feature.

\*2: The 05 and 07 functions in all product series has the output power-down protection feature.

### Part Naming Conventions

TC 7 S H U 04 FU

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

- ①..... Toshiba CMOS device
- ②-④..... Product series
- 4\_\_ : Standard Series
- 7\_\_ : High-Speed Series
- 7\_\_H: VHS Series
- 7\_\_E: VHS TTL-Level Input Series
- 7\_\_Z: SHS Series
- 7\_\_A: AHS Series
- 7\_\_G: LVP Series

- ⑤..... Number of Pins
- S: 5 pins
- P: 6 pins

# 8 Product Selection Tables

GENERAL-PURPOSE LOGIC ICs

## L-MOS (Pin Assignments)

### 5-Pin Single-Gate Logic Packages: SMV (SOT-25)(SC-74A), USV (SOT-353)(SC-88A), ESV (SOT-553)

<b>04: Inverter</b> 	<b>U04: Inverter (Unbuffered)</b> 	<b>05: Inverter (Open-Drain)</b> 	<b>07: Non-Inverter (Open-Drain)</b> 	<b>14: Schmitt Inverter</b> 	<b>17: Schmitt Buffer</b> 	<b>34: Non-Inverter</b> 	<b>00: NAND</b> 	<b>02: NOR</b> 
<b>08: AND</b> 	<b>32: OR</b> 	<b>86: Exclusive-OR</b> 	<b>125: 3-State Buffer</b> 	<b>126: 3-State Buffer</b> 	<b>79: D-Type Flip-Flop</b> 	<b>80: D-Type Flip-Flop</b> 		

### 5-Pin Single-Gate Logic Package: fSV (SOT-953)

<b>04: Inverter</b> 	<b>U04: Inverter (Unbuffered)</b> 	<b>05: Inverter (Open-Drain)</b> 	<b>07: Non-Inverter (Open-Drain)</b> 	<b>14: Schmitt Inverter</b> 	<b>17: Schmitt Buffer</b> 	<b>34: Non-Inverter</b> 	<b>00: NAND</b> 	<b>02: NOR</b> 
<b>08: AND</b> 	<b>32: OR</b> 	<b>86: Exclusive-OR</b> 	<b>125: 3-State Buffer</b> 	<b>126: 3-State Buffer</b> 	<b>79: D-Type Flip-Flop</b> 	<b>80: D-Type Flip-Flop</b> 		

### 6-Pin Dual-Gate Logic Packages: US6 (SOT-363)(SC-88), ES6 (SOT-563)

<b>04: Inverter</b> 	<b>U04: Inverter (Unbuffered)</b> 	<b>05: Inverter (Open-Drain)</b> 	<b>14: Schmitt Inverter</b> 	<b>17: Schmitt Buffer</b> 	<b>34: Non-Inverter</b> 
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### 6-Pin Single-Gate Logic Packages: US6 (SOT-363)(SC-88), ES6 (SOT-563)

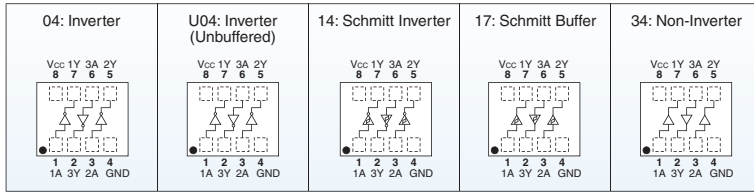
<b>19: 1-to-2 Decoder</b> 	<b>53: Analog Multiplexer</b> 	<b>175: D-Type Flip-Flop with Clear</b> 
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### 8-Pin Triple-Gate Logic Packages: SM8 (SOT-505), US8 (SOT-765)

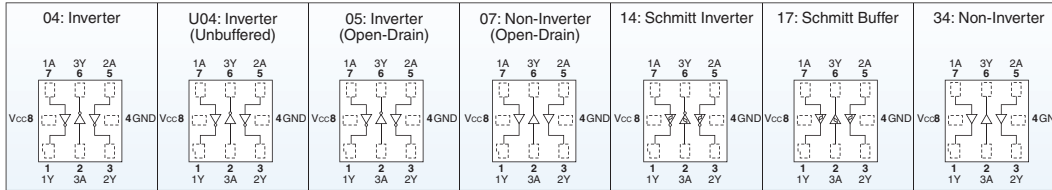
<b>04: Inverter</b> 	<b>U04: Inverter (Unbuffered)</b> 	<b>05: Inverter (Open-Drain)</b> 	<b>07: Non-Inverter (Open-Drain)</b> 	<b>14: Schmitt Inverter</b> 	<b>17: Schmitt Buffer</b> 	<b>34: Non-Inverter</b> 
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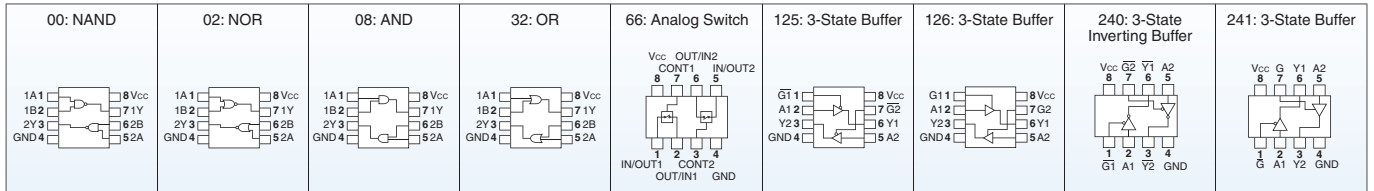
**8-Pin Triple-Gate Logic** Package: CST8



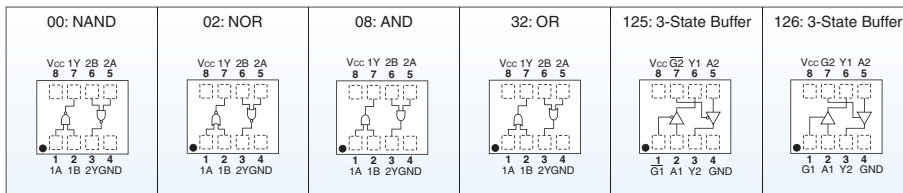
**8-Pin Triple-Gate Logic** Package: MP8 (SOT-902)



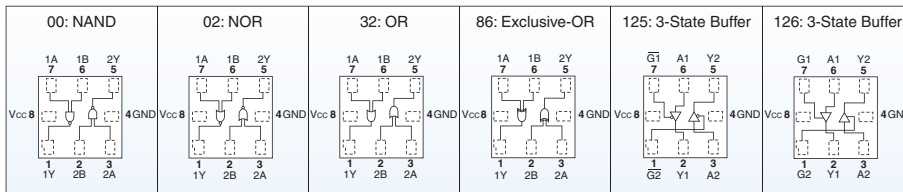
**8-Pin Dual-Gate Logic** Packages: SM8 (SOT-505), US8 (SOT-765)



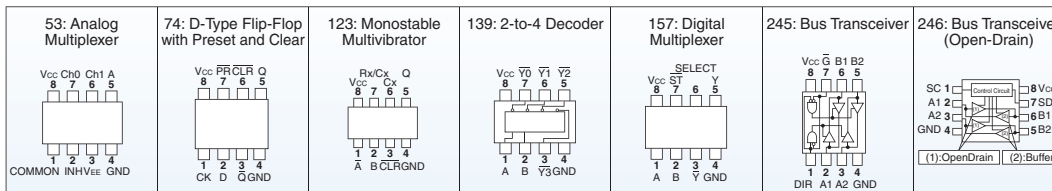
**8-Pin Dual-Gate Logic** Package: CST8



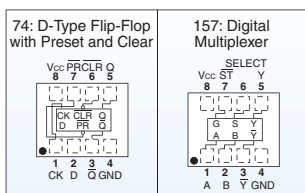
**8-Pin Dual-Gate Logic** Package: MP8 (SOT-902)



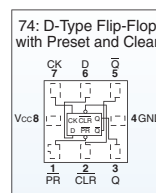
**8-Pin Single-Gate Logic** Packages: SM8 (SOT-505), US8 (SOT-765)



**8-Pin Single-Gate Logic** Package: CST8



**8-Pin Single-Gate Logic** Package: MP8 (SOT-902)



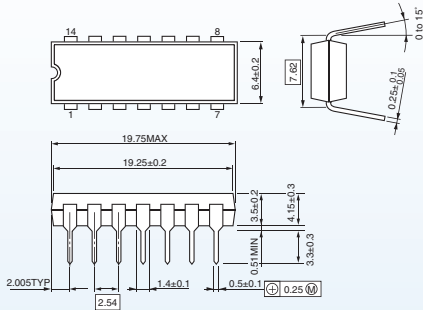
# 9 Package Dimensions

GENERAL-PURPOSE LOGIC ICs

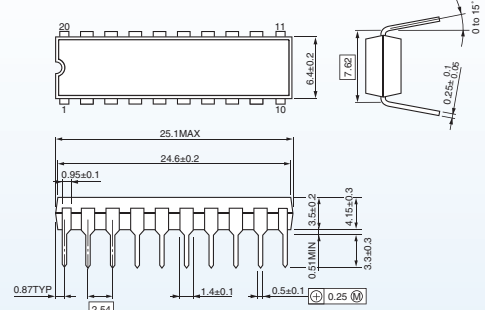
## DIP Packages

Unit: mm

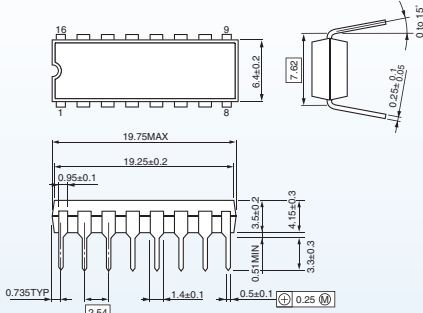
### DIP14-P-300-2.54



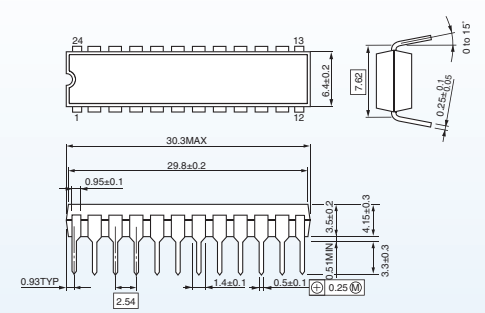
### DIP20-P-300-2.54A



### DIP16-P-300-2.54A



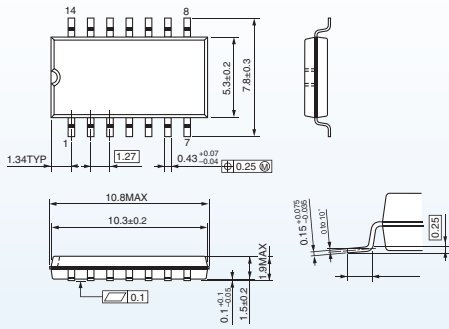
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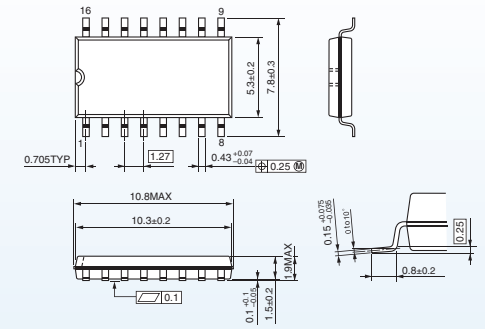
## SOP Packages

Unit: mm

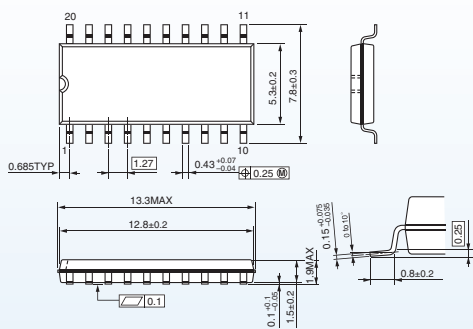
### SOP14-P-300-1.27A



### SOP16-P-300-1.27A



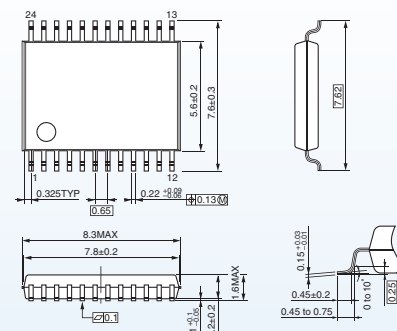
### SOP20-P-300-1.27A



## SSOP Packages

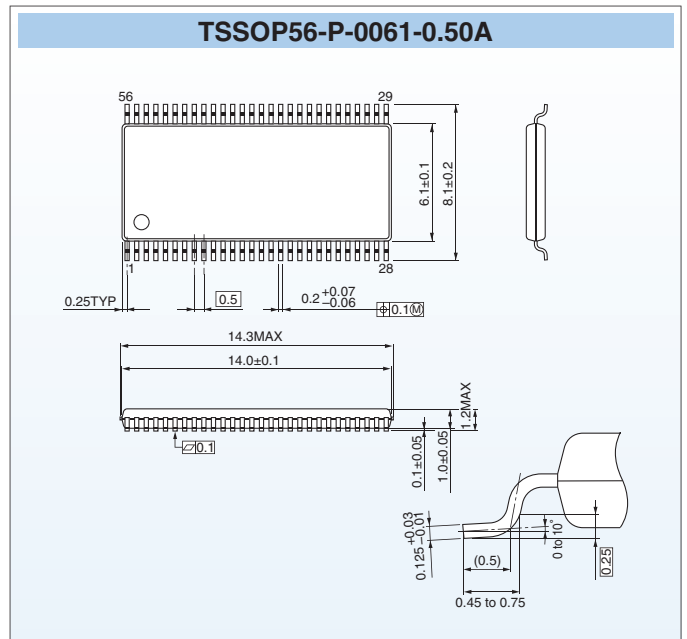
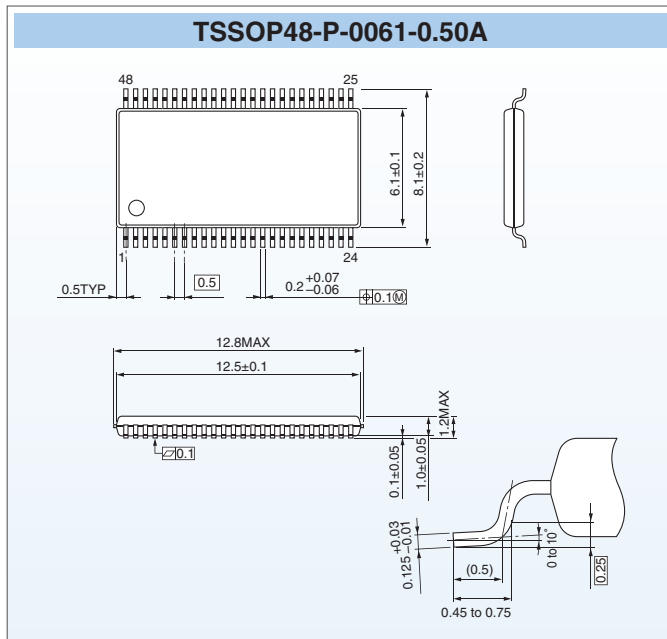
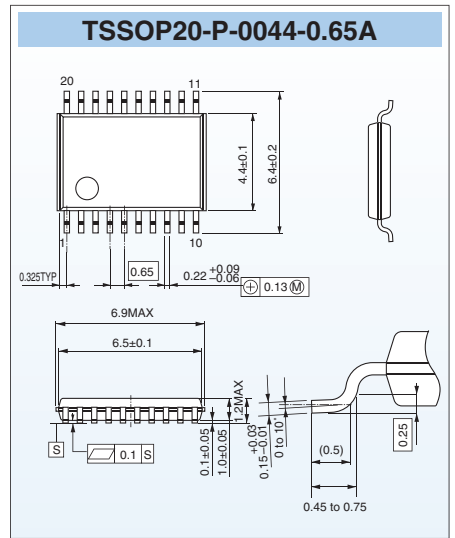
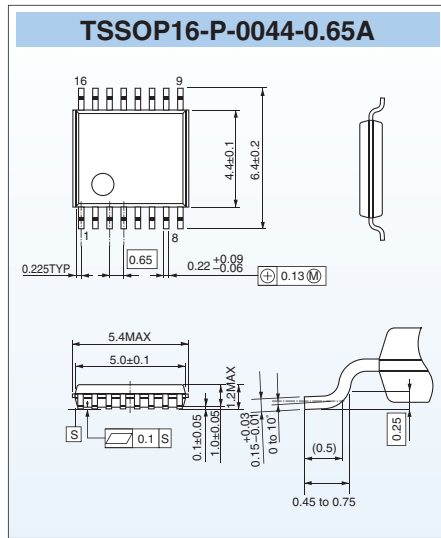
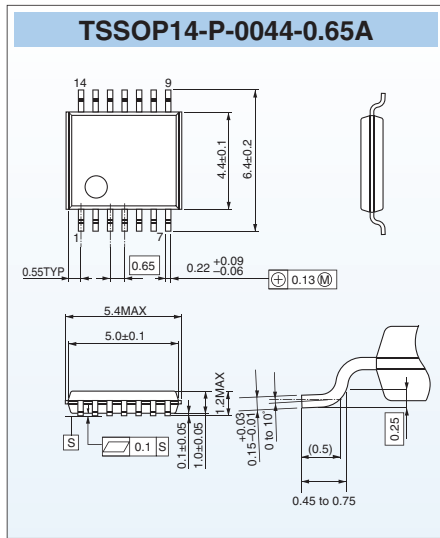
Unit: mm

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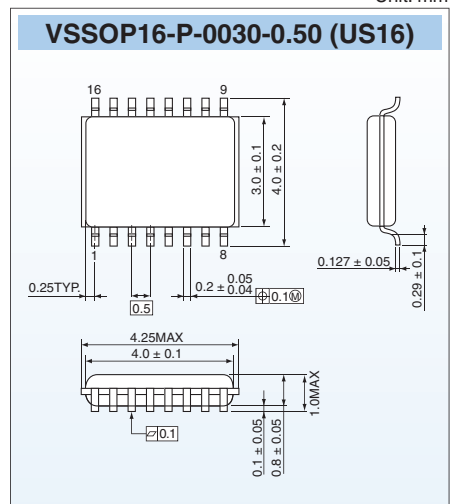
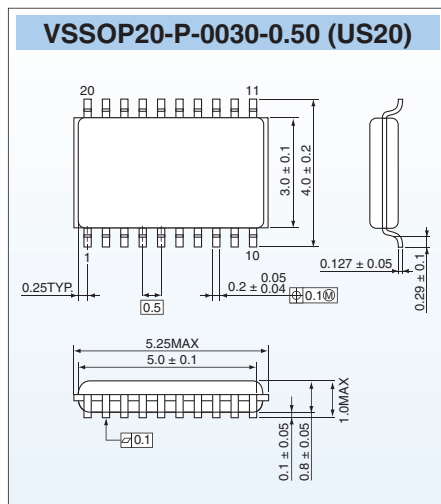
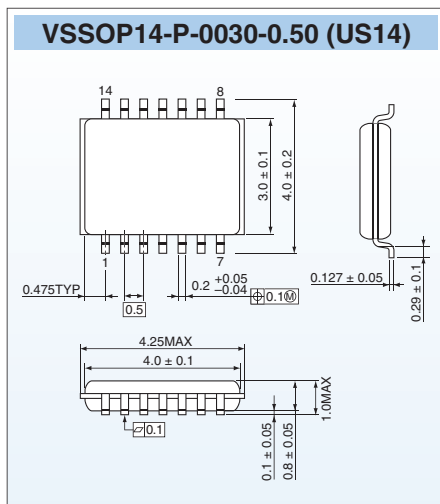
■ TSSOP Packages (14-, 16-, 20-, 48- and 56-Pin)

Unit: mm



■ US Packages (14-, 16- and 20-Pin)

Unit: mm

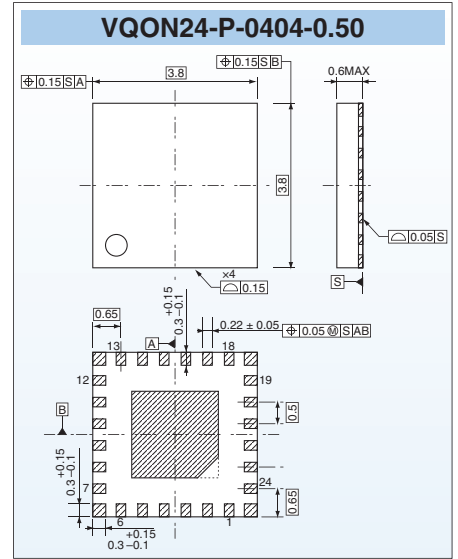
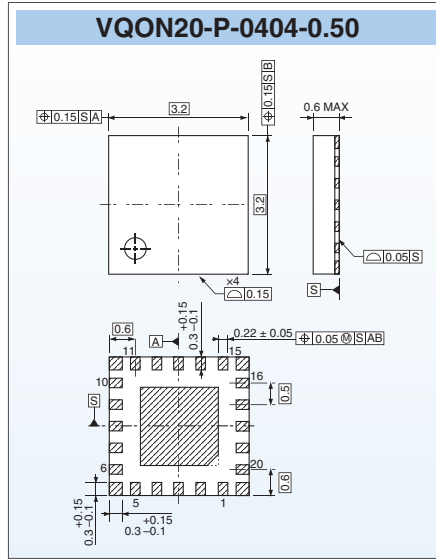
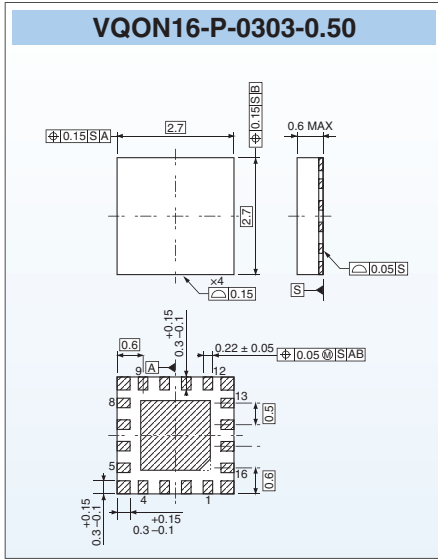


# 9 Package Dimensions

## GENERAL-PURPOSE LOGIC ICs

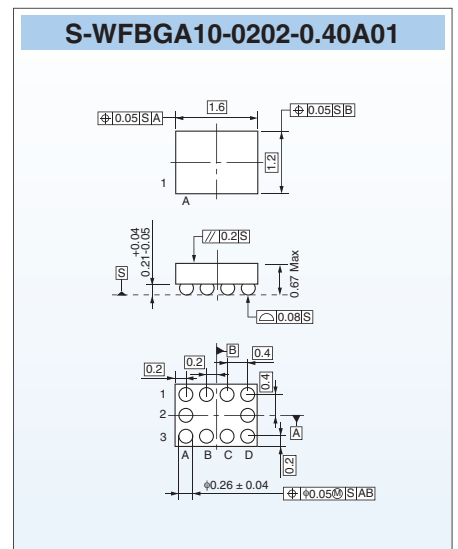
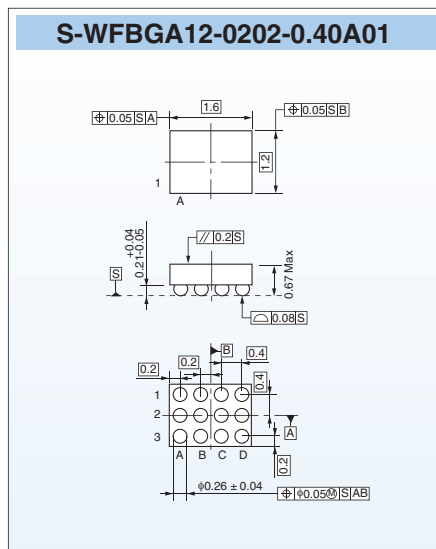
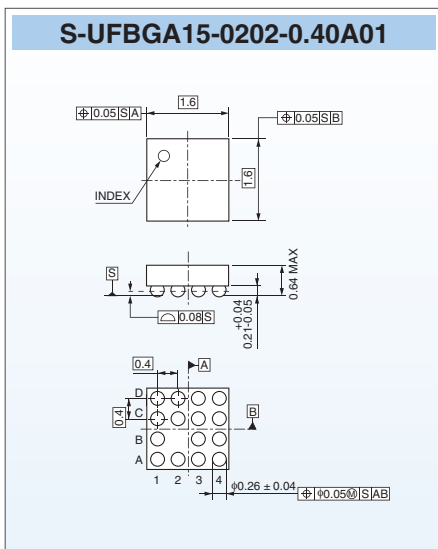
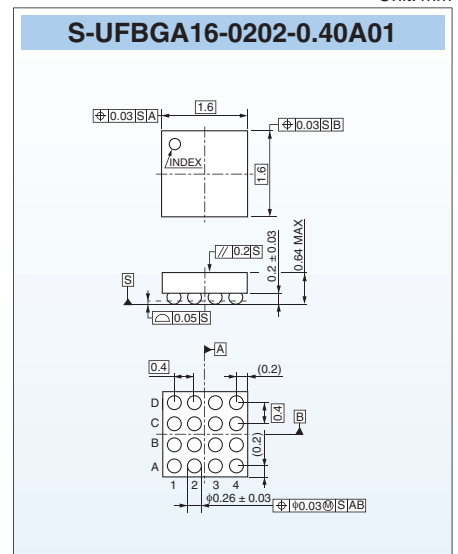
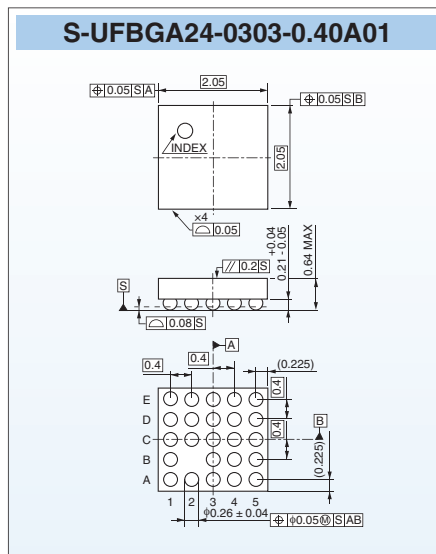
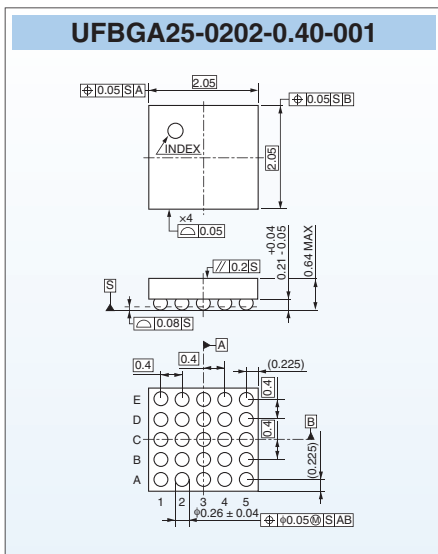
### ■ VQON Packages (16-, 20- and 24-Pin)

Unit: mm

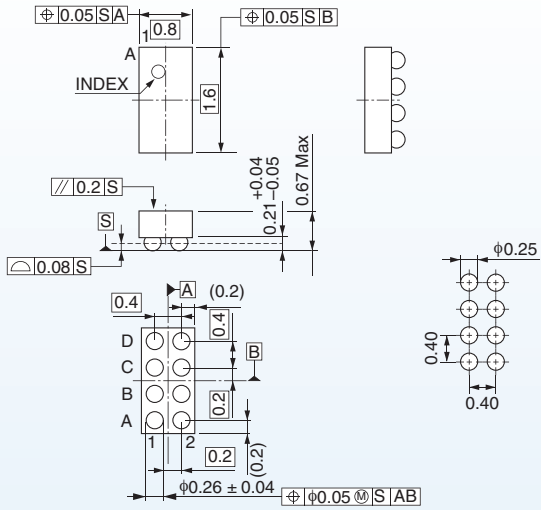


### ■ WCSP Packages (6-, 8-, 10-, 12-, 15-, 16-, 24- and 25-Pin)

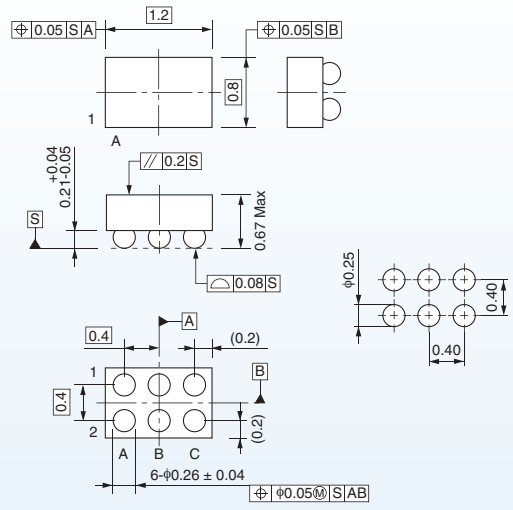
Unit: mm



### S-WFBGA8-0102-0.40A01 (WCSP8)



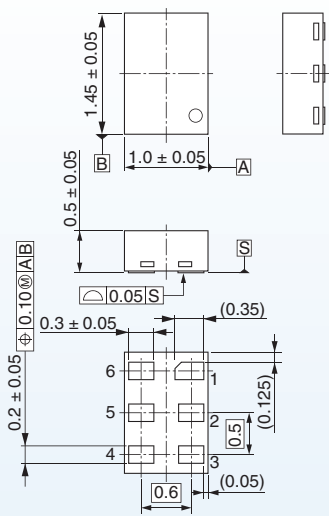
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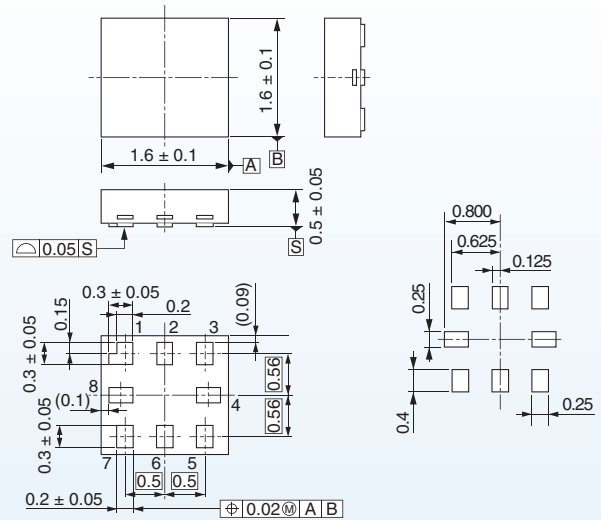
## QFN Packages (6-, 8-, 10- and 12-Pin)

Unit: mm

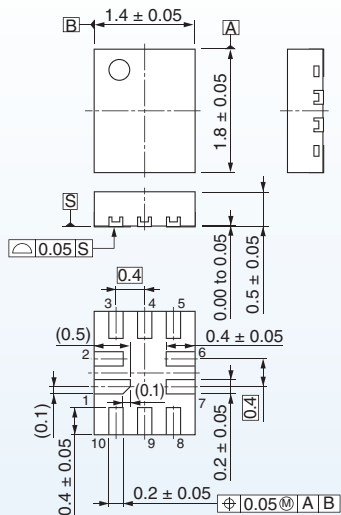
### MP6



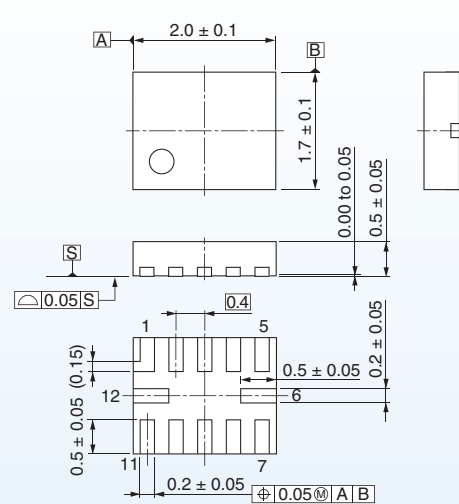
### MP8



### UQFN10



### UQFN12



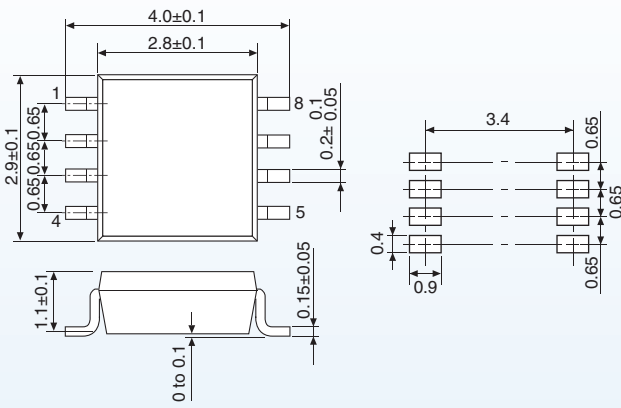
# 9 Package Dimensions

## GENERAL-PURPOSE LOGIC ICs

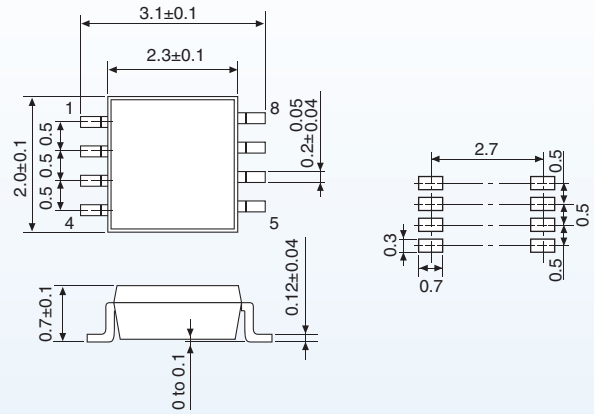
### 8-Pin Packages

Unit: mm

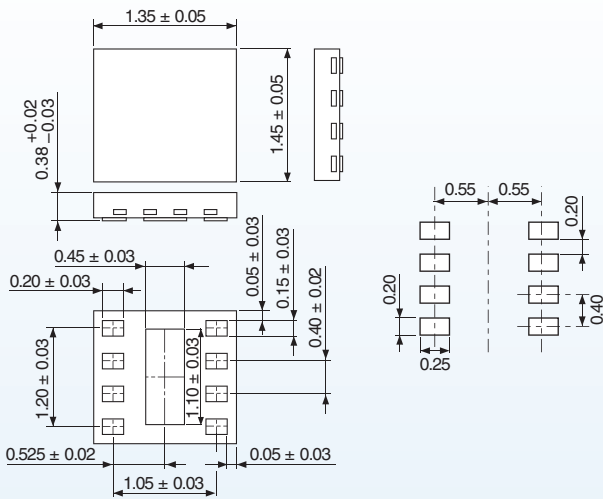
**SSOP8-P-0.65 (SM8)**



**SSOP8-P-0.50A (US8)**



**CSON8-P-0.4 (CST8)**

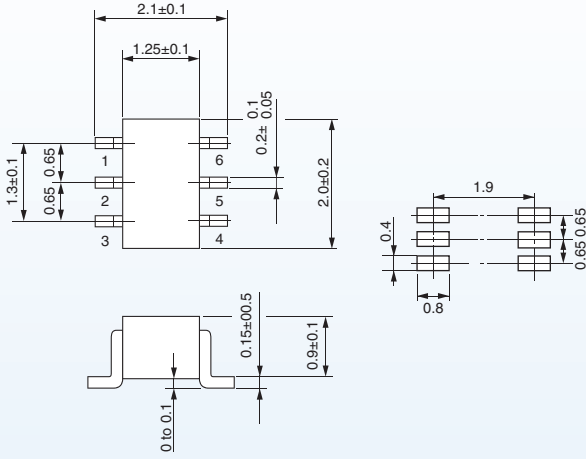




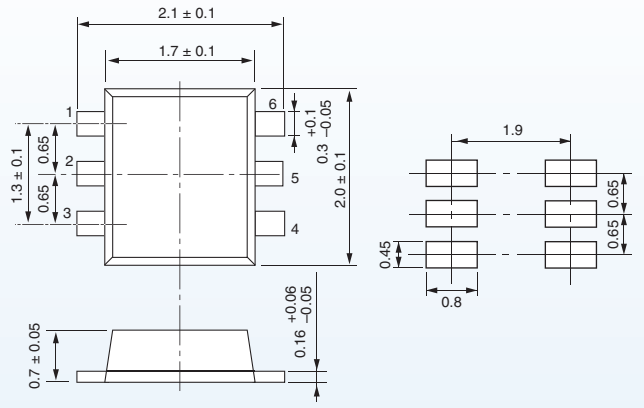
■ 6-Pin Packages

Unit: mm

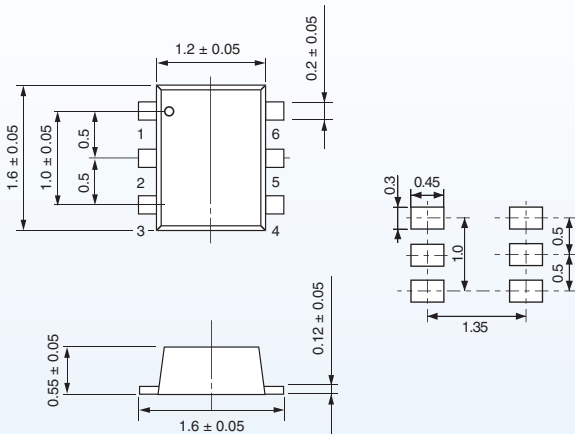
SSOP6-P-0.65A (US6)



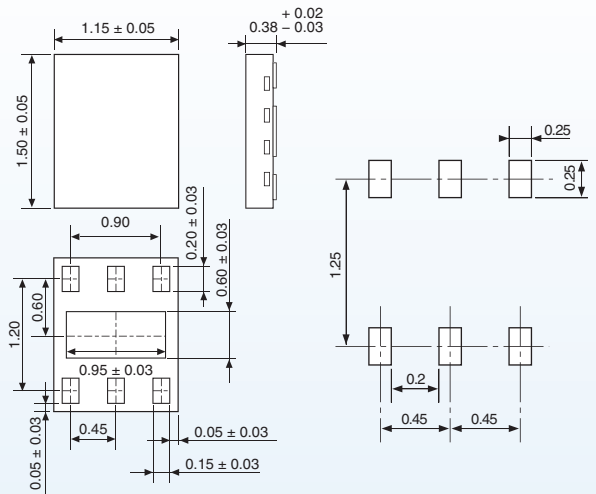
UF6



SON6-P-0.50 (ES6)



CST6C

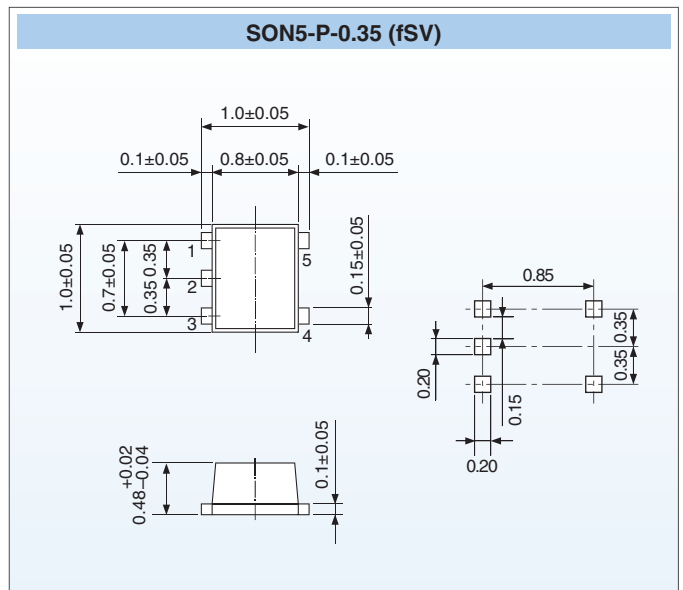
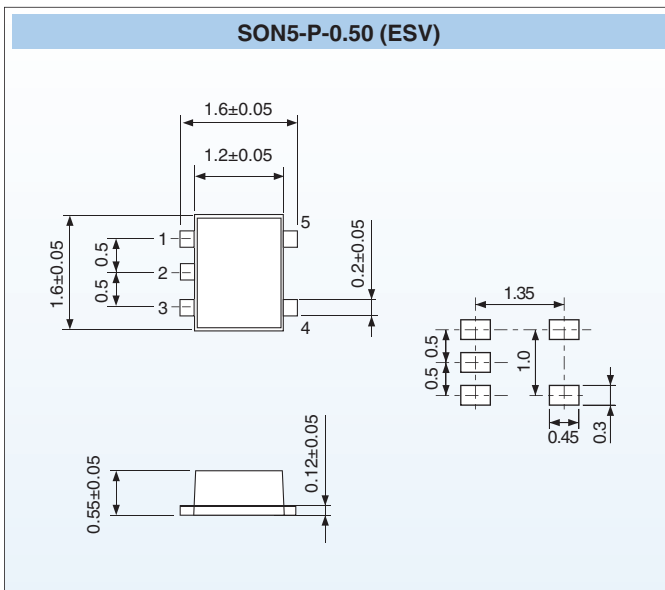
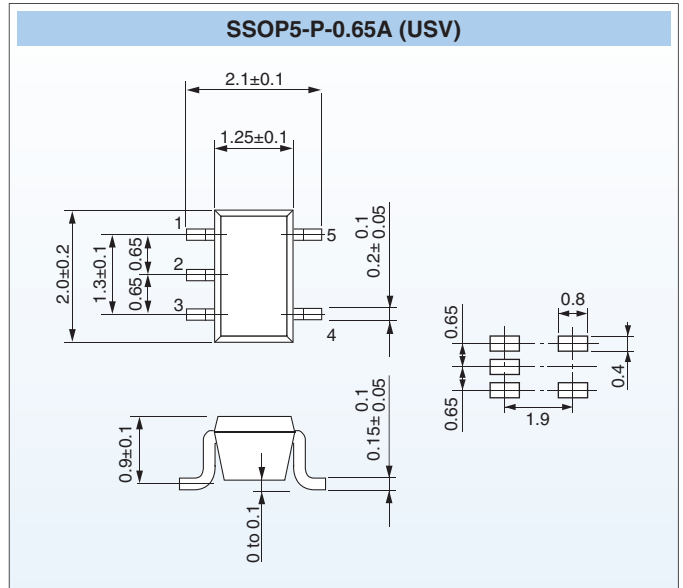
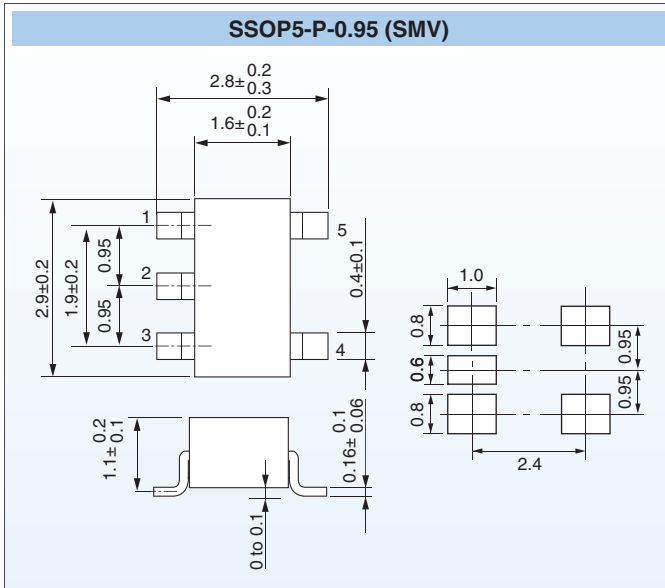


# 9 Package Dimensions

## GENERAL-PURPOSE LOGIC ICs

### 5-Pin Packages

Unit: mm



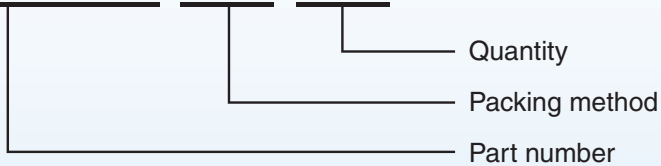
# ▶ 10 Packing Methods

GENERAL-PURPOSE LOGIC ICs

## Ordering Information

For tape-and-reel packing, use the information shown below to specify the packing method and quantity when placing an order. The quantity must meet the minimum order and must be a multiple of the "minimum order quantity" shown in the table.

**TC74HCT244AF (EL) 6000**



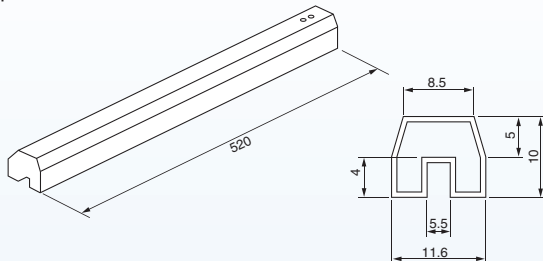
Packing			No suffix	(EL)/(ELQ)	(SPL)	(EB)	(TE12L)	(TE85L)	(TPL3)	Minimum Order Quantity
Package	# of Pins	Suffix	Tube	Embossed Tape	Taping 50 Units/Reel	Embossed Tape	Embossed Tape	Embossed Tape	Embossed Tape	
DIP	14,16,20,24	P	○	-	-	-	-	-	-	-
SOP	14,16,20	F	○	○	-	-	-	-	-	2,000
SSOP	24	FS	-	○	○	-	-	-	-	2,000
TSSOP	14,16,20	FT	-	○	○	-	-	-	-	2,000
	48,56	FT	-	○	○	-	-	-	-	1,000
US	14,16,20	FK	-	○	○	-	-	-	-	2,500
VQON	16,20,24	FTG	-	-	○	○	-	-	-	2,000
SM8	8	FU	-	-	-	-	○	-	-	3,000
US8	8	FK	-	-	-	-	-	○	-	3,000
CST8	8	FC	-	-	-	-	-	○	-	5,000
US6	6	FU	-	-	-	-	-	○	-	3,000
ES6	6	FE	-	-	-	-	-	○	-	4,000
UF6	6	TU	-	-	-	-	-	○	-	3,000
SMV	5	F	-	-	-	-	-	○	-	3,000
USV	5	FU	-	-	-	-	-	○	-	3,000
ESV	5	FE	-	-	-	-	-	○	-	4,000
fSV	5	FS	-	-	-	-	-	-	○	10,000
WCSP	24,16,15,12,10,8,6	WBG	-	○	-	-	-	-	-	3,000

## Tube Packing

### DIP Package

CMOS (Standard/NHS/ACL Series)  
Type No. 8VC1C5A

Unit: mm



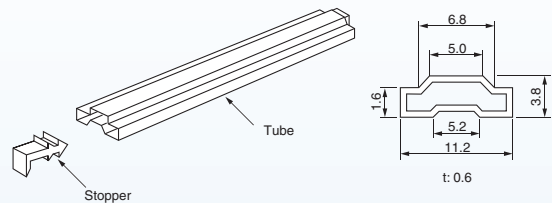
Tube thickness: 0.5  
Length: 520  
Material: PVC (transparent)

Package Code	Maximum Storage Quantity
DIP14-P-300-2.54	25 pcs/tube
DIP16-P-300-2.54A	25 pcs/tube
DIP20-P-300-2.54A	20 pcs/tube
DIP24-P-300-2.54	16 pcs/tube

### SOP Package

CMOS  
Type No. 7VC747P2

Unit: mm



Package Code	Maximum Storage Quantity
SOP14-P-300-1.27A	50 pcs/tube
SOP16-P-300-1.27A	50 pcs/tube
SOP20-P-300-1.27A	40 pcs/tube

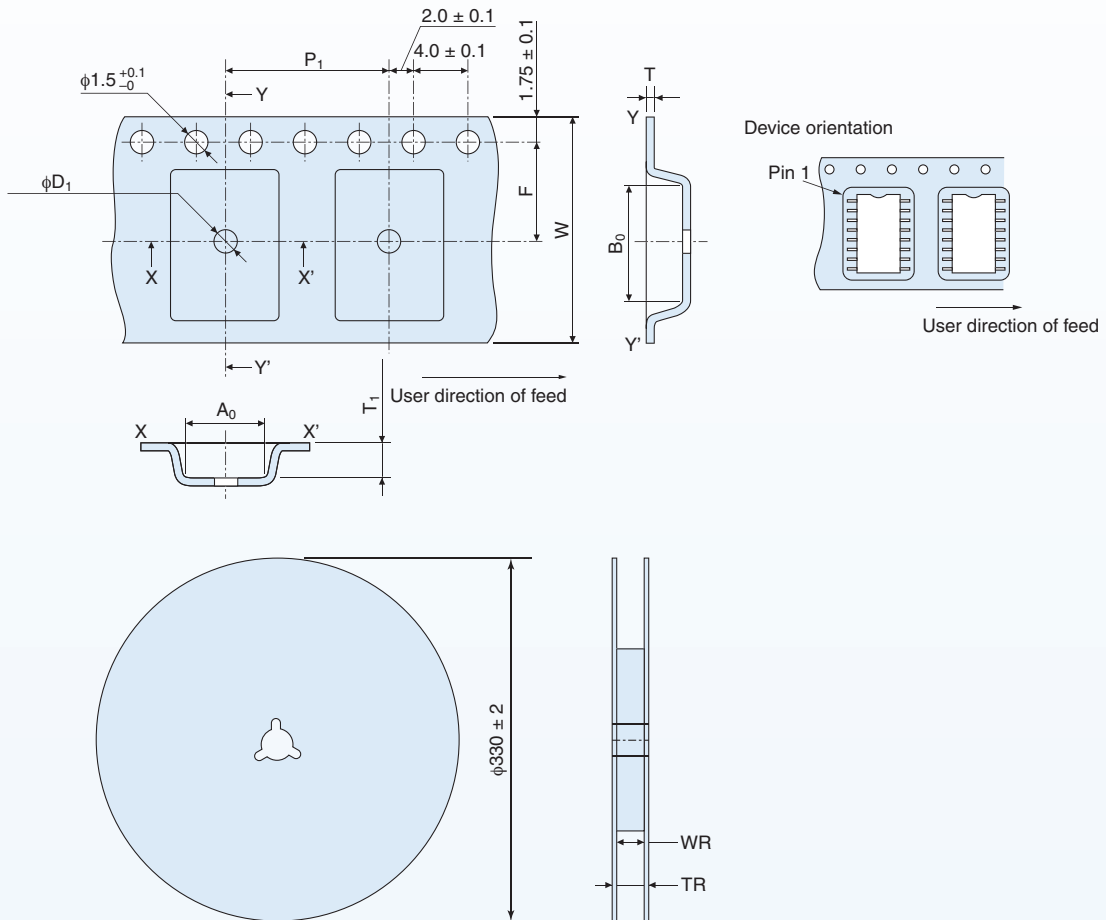
# ▶ 10 Packing Methods

GENERAL-PURPOSE LOGIC ICs

## Tape and Reel

### Embossed Tape Width: 16 to 24 mm

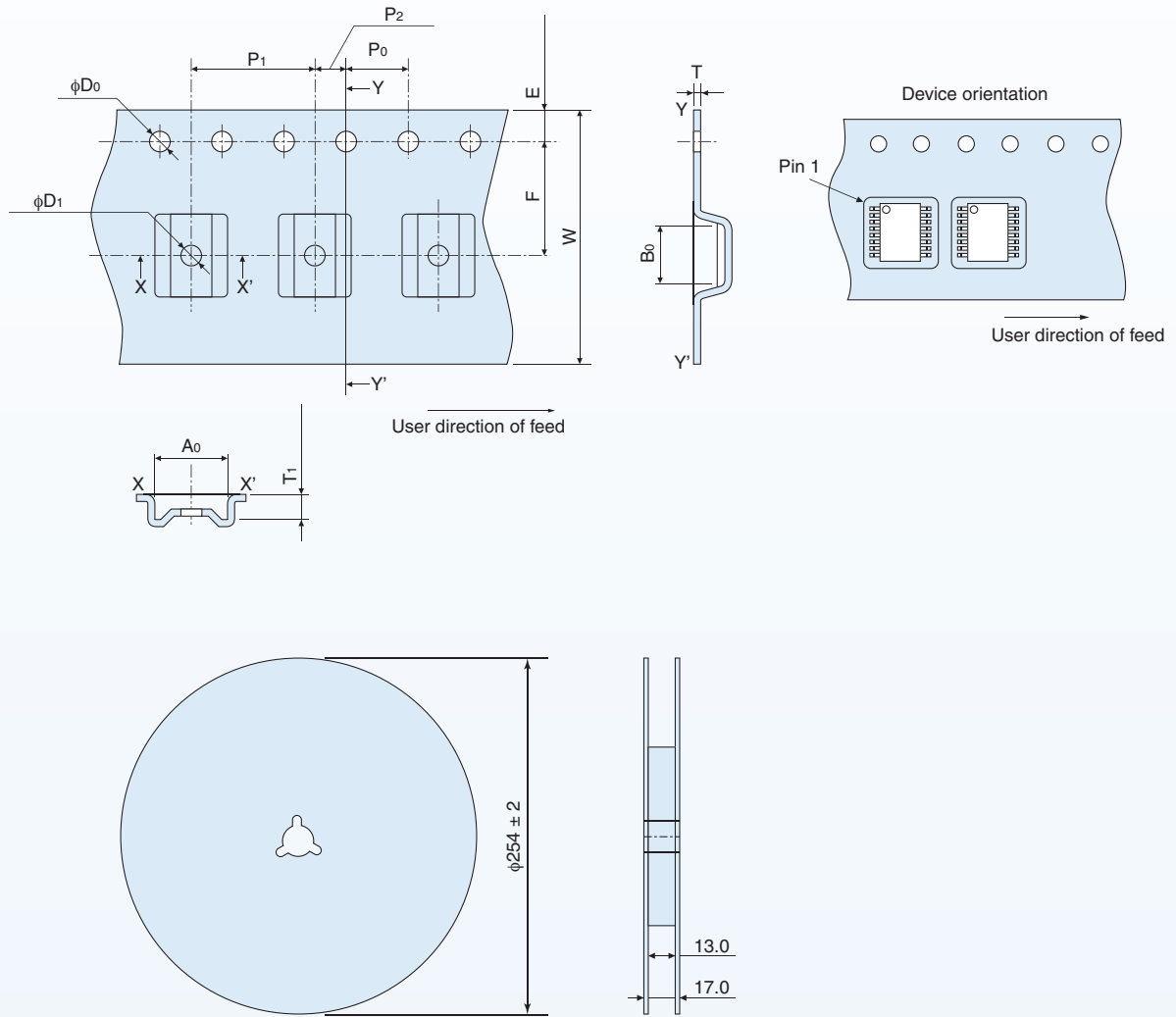
Unit: mm



Package Code	A <sub>0</sub>	B <sub>0</sub>	W	F	P <sub>1</sub>	T	T <sub>1</sub>	φD <sub>1</sub>	WR	TR
SOP14-P-300-1.27A	8.5	10.8	16.0	7.5	12.0	0.3	2.1	1.65	17.5	21.5
SOP16-P-300-1.27A	8.5	10.8	16.0	7.5	12.0	0.3	2.1	1.65	17.5	21.5
SOP20-P-300-1.27A	8.3	13.2	24.0	11.5	12.0	0.3	2.2	2.0	25.5	29.5
SSOP24-P-300-0.65D	8.0	8.3	16.0	7.5	12.0	0.3	1.85	1.6	17.5	21.5
TSSOP14-0044-0.65A	6.8	5.5	16.0	7.5	8.0	0.3	1.5	1.6	17.5	21.5
TSSOP16-0044-0.65A	6.8	5.5	16.0	7.5	8.0	0.3	1.5	1.6	17.5	21.5
TSSOP20-0044-0.65A	6.8	7.0	16.0	7.5	8.0	0.3	1.5	1.6	17.5	21.5
TSSOP48-P-0061-0.50A	8.6	13.1	24.0	11.5	12.0	0.3	1.65	1.5	25.5	29.5
TSSOP56-P-0061-0.50A	8.6	14.0	24.0	11.5	12.0	0.3	1.65	1.5	25.5	29.5

Embossed Tape (US14, US16 and US20)

Unit: mm



Package Code	A <sub>0</sub>	B <sub>0</sub>	W	F	E	P <sub>1</sub>	P <sub>2</sub>	P <sub>0</sub>	$\phi D_0$	T	T <sub>1</sub>	$\phi D_1$
VSSOP14-P-0030-0.50	4.25	4.26	12.0	5.5	1.75	8.0	2.0	4.0	1.5	0.3	1.3	1.6
VSSOP16-P-0030-0.50	4.25	4.26	12.0	5.5	1.75	8.0	2.0	4.0	1.5	0.3	1.3	1.6
VSSOP20-P-0030-0.50	4.25	5.26	12.0	5.5	1.75	8.0	2.0	4.0	1.5	0.3	1.3	1.6

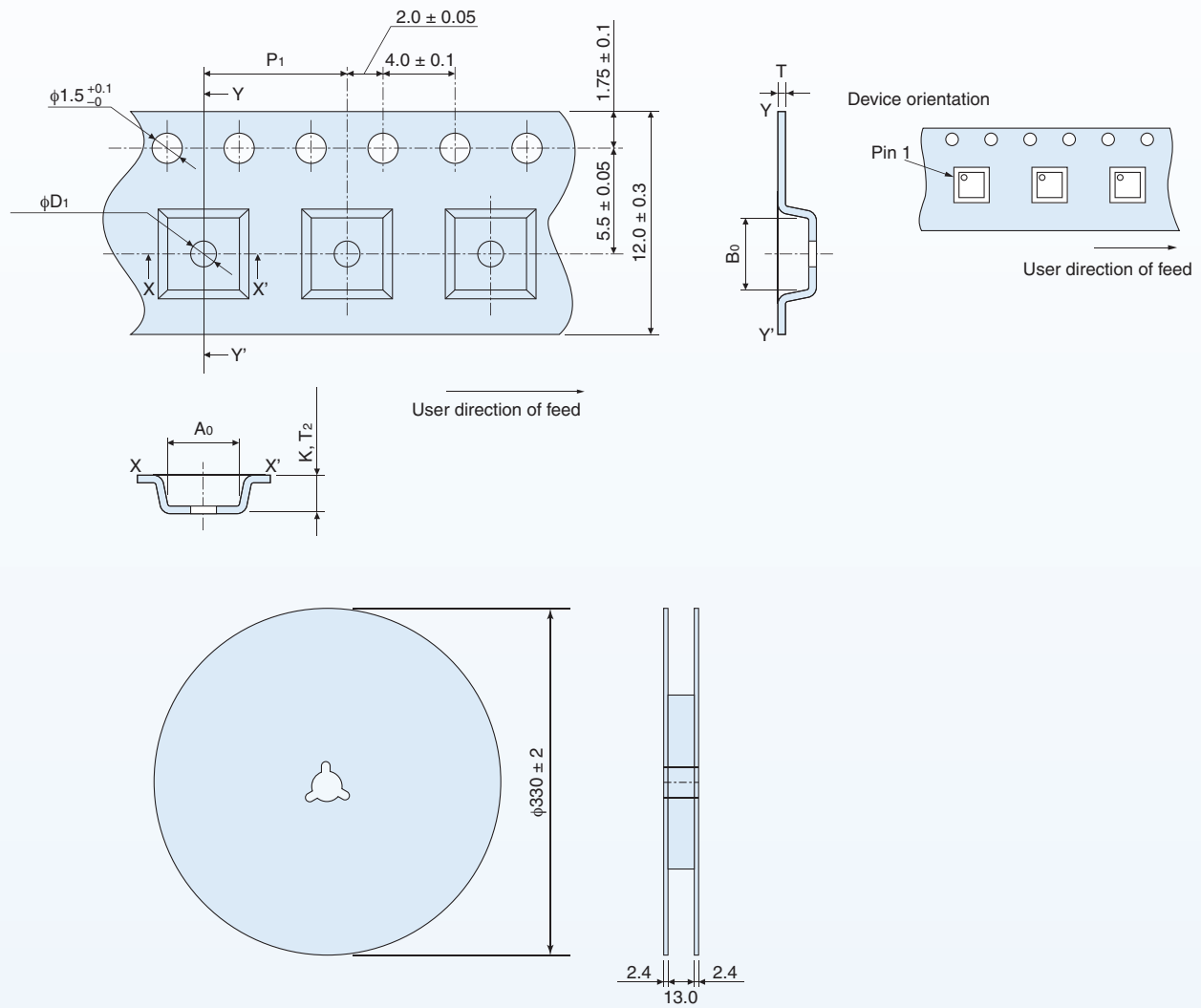
# ▶ 10 Packing Methods

GENERAL-PURPOSE LOGIC ICs

## Tape and Reel

### Embossed Tape (VQON16, VQON20 and VQON24)

Unit: mm



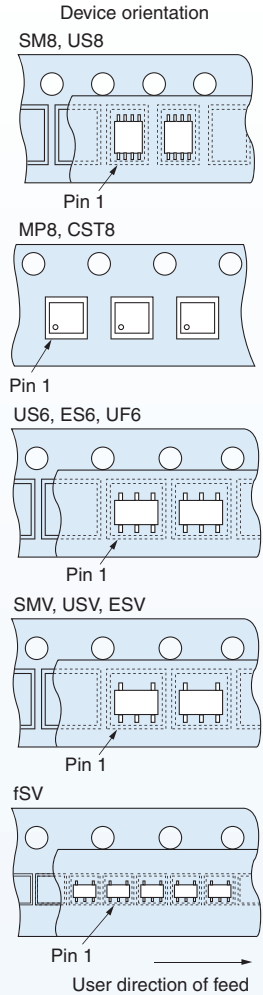
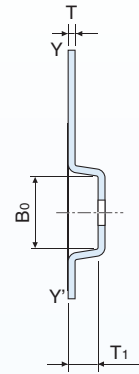
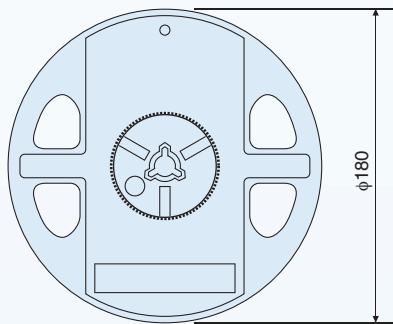
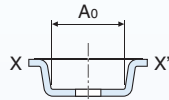
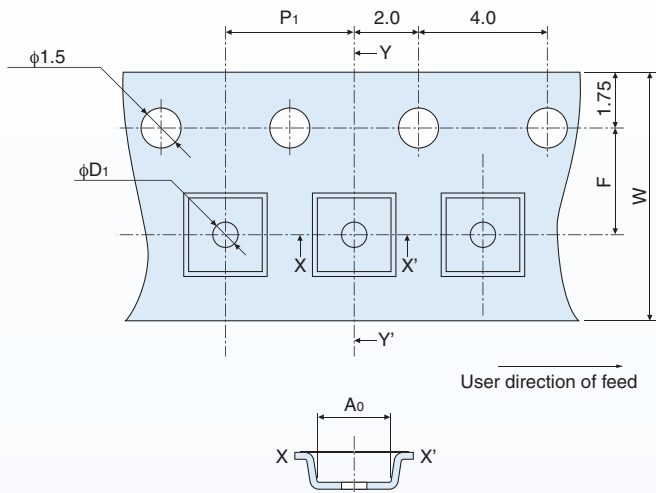
Package Code	A <sub>0</sub>	B <sub>0</sub>	P <sub>1</sub>	T	K	T <sub>2</sub>	φD <sub>1</sub>
VQON16-P-0303-0.50	2.95	2.95	8.0	0.3	1.5	1.8max	1.0
VQON20-P-0404-0.50	3.50	3.50	8.0	0.3	1.3	1.6max	1.0
VQON24-P-0404-0.50	4.05	4.05	8.0	0.3	1.5	1.8max	1.0

Note: T<sub>2</sub> is the sum of K and the cover tape thickness.



Embossed Tape (8-, 6-, 5-Pin and WCSP Packages)

Unit: mm



Package Code	$A_0$	$B_0$	W	F	$P_1$	T	$T_1$	$\phi D_1$	WR
SM8	3.05	4.4	12.0	5.5	4.0	0.30	1.4	1.05	13.0
US8	2.25	3.3	8.0	3.5	4.0	0.30	1.0	1.05	9.0
MP8	1.75	1.75	8.0	3.5	4.0	0.18	0.65	0.5	9.0
CST8	1.6	1.5	8.0	3.5	4.0	0.20	0.50	0.5	9.0
US6	2.2	2.3	8.0	3.5	4.0	0.25	1.2	1.1	9.0
ES6	1.75	1.8	8.0	3.5	4.0	0.20	0.65	0.5	9.0
UF6	2.2	2.3	8.0	3.5	4.0	0.18	0.85	1.1	9.0
SMV	3.05	3.3	8.0	3.5	4.0	0.30	1.45	1.1	9.0
USV	2.2	2.3	8.0	3.5	4.0	0.25	1.2	1.1	9.0
ESV	1.75	1.8	8.0	3.5	4.0	0.20	0.65	0.5	9.0
fSV	1.1	1.11	8.0	3.5	2.0	0.18	0.57	-	9.0
WCSP24	2.20	2.20	8.0	3.5	4.0	0.25	0.80	-	9.0
WCSP16	1.81	1.81	8.0	5.5	4.0	0.25	0.76	0.5	9.0
WCSP15	1.81	1.81	8.0	5.5	4.0	0.25	0.76	0.5	9.0
WCSP12	1.4	1.8	8.0	3.5	4.0	0.25	0.75	0.5	9.0
WCSP10	1.4	1.8	8.0	3.5	4.0	0.25	0.75	0.5	9.0
WCSP8	0.93	1.73	8.0	3.5	4.0	0.20	0.72	-	9.0
WCSP6	0.94	1.34	8.0	3.5	4.0	0.25	0.76	-	9.0

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