



# High Speed CMOS 10-bit Bus Switches

QS3384  
QS32384

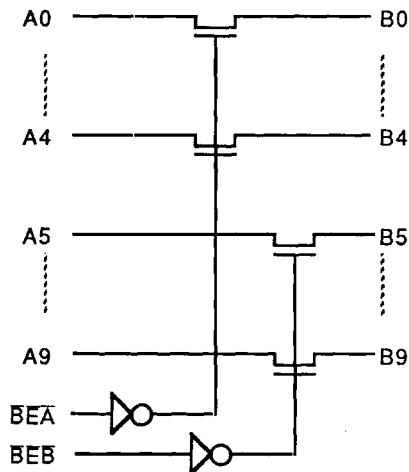
## FEATURES/BENEFITS

- 5Ω switches connect inputs to outputs
- Direct bus connection when switches on
- Zero propagation delay (3384)
- Undershoot Clamp diodes on all inputs
- Low power CMOS proprietary technology
- 32384 is 25Ω version for low noise
- Two enables control 5 bits each
- Zero ground bounce in flow-through mode
- TTL-compatible input and output levels
- Available in 24-pin PDIP, ZIP, SOIC and QSOP

## DESCRIPTION

The QS3384 and QS32384 each provide a set of ten high-speed CMOS TTL-compatible bus switches. The low on resistance (5Ω) of the QS3384 allows inputs to be connected to outputs without adding propagation delay and without generating additional ground bounce noise. The QS32384 adds an internal 25Ω resistor to reduce reflection noise in high speed applications. The bus enable (BE) signals turn the switches on. Two bus enable signals are provided, one for each of the upper and lower five bits of the two 10-bit buses.

## FUNCTIONAL BLOCK DIAGRAM



### PIN DESCRIPTION

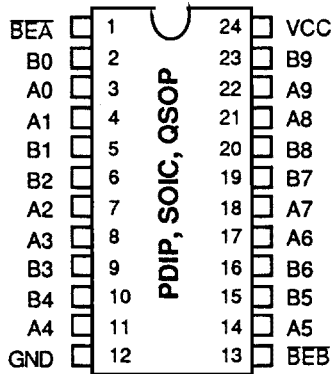
Name	I/O	Function
A0-9	I/O	Bus A
B0-9	I/O	Bus B
BEA, BEB	I	Bus Switch Enable

### FUNCTION TABLE

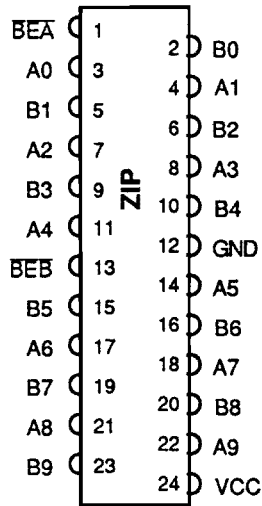
BEA	BEB	B0-4	B5-9	Function
H	H	Hi-Z	Hi-Z	Disconnect
L	H	A0-4	Hi-Z	Connect
H	L	Hi-Z	A5-9	Connect
L	L	A0-4	A5-9	Connect

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## PIN CONFIGURATIONS



ALL PINS TOP VIEW



## ABSOLUTE MAXIMUM RATINGS

Supply Voltage to Ground.....	-0.5V to +7.0V
DC Switch Voltage $V_s$ .....	-0.5V to +7.0V
DC Input Voltage $V_i$ .....	-0.5V to +7.0V
AC Input Voltage (for a pulse width $\leq 20$ ns).....	-3.0V
DC Input Diode Current with $V_i < 0$ .....	-20 mA
DC Output Current Max. sink current/pin.....	120 mA
Maximum Power Dissipation.....	0.5 watts
$T_{STG}$ Storage Temperature.....	-65° to +165°C

## CAPACITANCE

$T_A = 25^\circ\text{C}$ ,  $f = 1$  MHz,  $V_{in} = 0\text{V}$ ,  $V_{out} = 0\text{V}$

Pins	SOIC		QSOP		PDIP, PLCC		ZIP		Unit
	Typ	Max	Typ	Max	Typ	Max	Typ	Max	
Controls	3	4	3	4	4	5	6	7	pF
QuickSwitch Channels	7	8	7	8	8	9	10	11	pF

Note: Capacitance is characterized but not tested

**DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE**

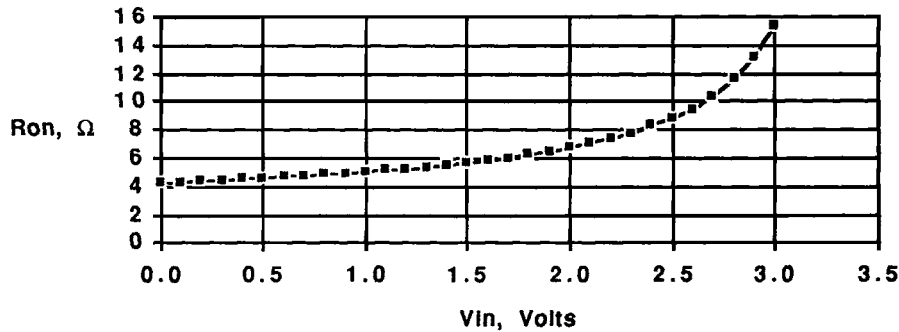
Commercial TA = 0° C to 70° C, Vcc = 5.0V±5%      Military TA = -55° C to 125° C, Vcc = 5.0V±10%

Symbol	Paramete	Test	Min	Typ	Max	Unit
Vih	Input HIGH Voltage	Guaranteed Logic HIGH for Control Inputs	2.0			Volts
Vil	Input LOW Voltage	Guaranteed Logic LOW for Control Inputs			0.8	Volts
<i>i</i> <sub>in</sub>	Input Leakage Current	0 ≤ Vin ≤ Vcc			1	μA
<i>i</i> <sub>oz</sub>	Off State Current (Hi-Z)	0 ≤ A, B ≤ Vcc		.001	1	μA
<i>i</i> <sub>os</sub>	Short Circuit Current (2)	A (B) = 0V, B (A) = Vcc		300		mA
Vic	Clamp Diode Voltage	Vcc = Min, <i>i</i> <sub>in</sub> = -18 mA		-0.7	-1.2	Volts
Ron	Switch On Resistance Note(3)	Vcc = Min, Vin = 0.0 Volts <i>i</i> <sub>on</sub> = 30 mA	3384	5	7	Ω
			32384	20	28	40
		Vcc = Min, Vin = 2.4 Volts <i>i</i> <sub>on</sub> = 15 mA	3384	10	15	Ω
			32384	20	35	48

**Notes:**

1. Typical values indicate V<sub>CC</sub>=5.0V and T<sub>A</sub>=25°C.
2. Not more than one output should be used to test this high power condition, and the duration is ≤1 second.
3. Measured by voltage drop between A and B pin at indicated current through the switch. On resistance is determined by the lower of the voltages on the two (A, B) pins.

**On Resistance vs Vin @ 4.75 Vcc (338X Only)**



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**POWER SUPPLY CHARACTERISTICS**

Symbol	Parameter	Test Conditions (1)	Min	Typ	Max	Unit
I <sub>cc</sub>	Quiescent Power Supply Current	V <sub>cc</sub> = MAX, V <sub>i</sub> = GND or V <sub>cc</sub> , f = 0	-	-	1.5	mA
ΔI <sub>cc</sub>	Pwr Supply Current, per Input High (2)	V <sub>cc</sub> = MAX, Input = 3.4 V, f = 0 Per control input	-	-	2.5	mA
Q <sub>ccd</sub>	Dynamic Pwr Supply Current per mHz (3)	V <sub>cc</sub> = MAX, A & B pins open, Control input toggling @ 50% duty cycle	-	-	0.25	mA/ mHz

1. For conditions shown as MIN or MAX use the appropriate values specified under DC specifications.
2. Per TTL driven input (V<sub>i</sub>=3.4V, control inputs only). A and B pins do not contribute to I<sub>cc</sub>.
3. This current applies to the control inputs only and represents the current required to switch internal capacitance at the specified frequency. The A and B inputs generate no significant AC or DC currents as they transition. This parameter is not tested but is guaranteed by design.

**SWITCHING CHARACTERISTICS OVER OPERATING RANGE**

Commercial TA = 0° C to 70°C, Vcc = 5.0V±5%      Military TA = -55°C to 125° C, Vcc = 5.0V±10%  
 Load = 50 pF, Rload = 500Ω unless otherwise noted

Symbol	Description	Note	Com		Mil		Unit	
			Min	Max	Min	Max		
t PLH t PHL	Data Propagation Delay Ai to Bi, Bi to Ai	338X	2,3		0.25		0.25	ns
		3238X	2,3		1.25		1.25	ns
t PZH t PZL	Switch Turn On Delay BEA, BEB to Ai, Bi	338X	1	1.5	6.5	1.5	7.5	ns
		3238X	1	1.5	7.5	1.5	8.5	ns
t PLZ t PHZ	Switch Turn Off Delay BEa, BEB to Ai, Bi	338X	1,2	1.5	5.5	1.5	6.5	ns
		3238X	1,2					
Qcd	Charge Injection, Typical	338X	4,5		1.5		1.5	pC
		3238X	4,5					

**Notes:**

- 1) See Test Circuit and Waveforms. Minimums guaranteed but not tested.
- 2) This parameter is guaranteed by design but not tested.
- 3) The bus switch contributes no propagation delay other than the RC delay of the on resistance of the switch and the load capacitance. The time constant for the switch and alone is of the order of 0.25 ns for 50 pf load. Since this time constant is much smaller than the rise/fall times of typical driving signals, it adds very little propagation delay to the system. Propagation delay of the bus switch when used in a system is determined by the driving circuit on the driving side of the switch and its interaction with the load on the driven side.
- 4) Measured at switch turn off, A to C, load = 50 pF in parallel with 10 meg scope probe, Vin at A = 0.0 volts.
- 5) Characterized parameter but not 100% tested.

