

**FEATURES/BENEFITS**

- Enhanced N channel FET with no inherent diode to  $V_{CC}$
- $5\Omega$  bidirectional switches connect inputs to outputs
- Zero propagation delay (QS3384), zero ground bounce
- Undershoot clamp diodes on all switch and control pins
- QS32384 is  $25\Omega$  version for low noise
- Two enables control five bits each
- Available in TSSOP, SOIC, QSOP AND HQSOP

**APPLICATIONS**

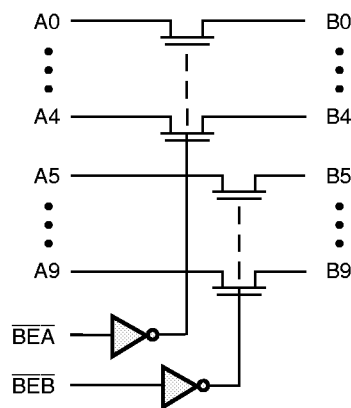
- Hot-swapping, hot-docking (Application Note AN-13)
- Voltage translation (5V to 3.3V; Application Note AN-11)
- Power conservation
- Capacitance reduction and isolation
- Bus isolation
- Clock gating

**DESCRIPTION**

The QS3384 and QS32384 provide a set of ten high-speed CMOS, TTL-compatible bus switches. The low ON resistance of QS3384 allows inputs to be connected to outputs without adding propagation delay and without generating additional ground bounce. Two banks of 5 switches are controlled by independent Bus Enable ( $\overline{BE}$ ) signals.

The QS32384 adds an internal series resistor with each switch to reduce reflection noise in high speed applications. When closed, the switch acts as the source (series) termination for the driver connected to it.

**Figure 1. Functional Block Diagram**



**Table 1. Pin Description**

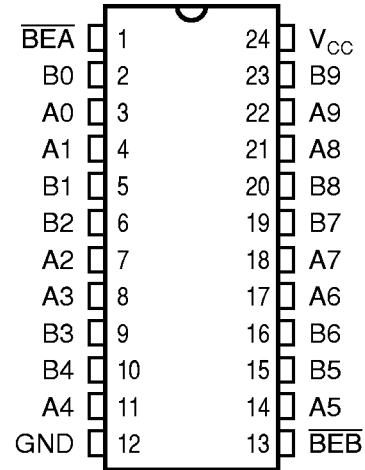
Name	I/O	Function
A0-A9	I/O	Bus A
B0-B9	I/O	Bus B
$\overline{\text{BEA}}, \overline{\text{BEB}}$	I	Bus Switch Enable

**Table 2. Function Table**

$\overline{\text{BEA}}$	$\overline{\text{BEB}}$	B0-B4	B5-B9	Function
H	H	Hi-Z	Hi-Z	Disconnect
L	H	A0-A4	Hi-Z	Connect
H	L	Hi-Z	A5-A9	Connect
L	L	A0-A4	A5-A9	Connect

**Figure 2. Pin Configuration**  
(All Pins Top View)

TSSOP, SOIC, QSOP, HQSOP



**Table 3. 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 $V_{IN}$ .....	-0.5V to 7.0V
AC Input Voltage (for a pulse width $\leq 20\text{ns}$ ) .....	-3.0V
DC Output Current Max. Sink Current/Pin .....	120mA
Maximum Power Dissipation .....	0.5 watts
$T_{STG}$ Storage Temperature .....	-65° to 150°C

**Note:** ABSOLUTE MAXIMUM CONTINUOUS RATINGS are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute-maximum conditions is not implied.

**Table 4. Capacitance**

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

Pins	SOIC, QSOP		Unit
	Typ	Max	
Control Inputs	3	5	pF
QuickSwitch Channels (Switch OFF)	5	7	pF

**Note:** Capacitance is guaranteed but not production tested. For total capacitance while the switch is ON, please see Section 1 under "Input and Switch Capacitance."

**Table 5. DC Electrical Characteristics Over Operating Range**

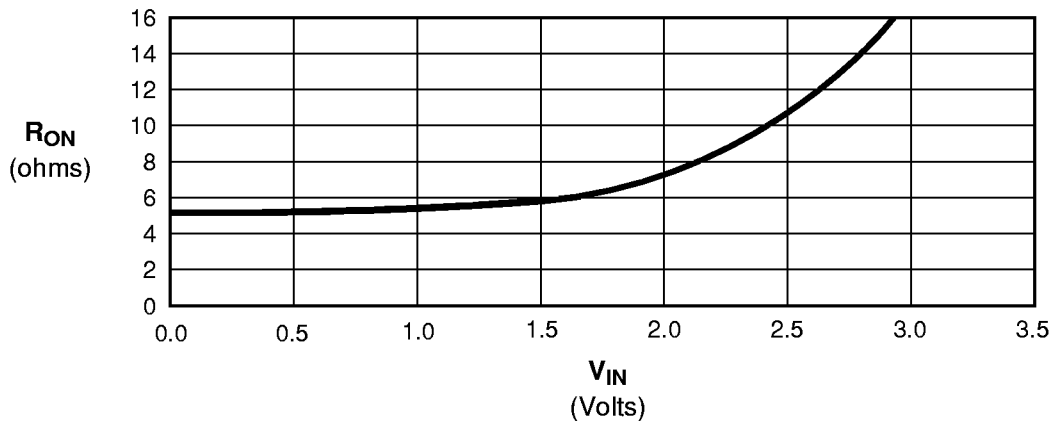
Commercial:  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 5\%$     Military:  $T_A = -55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 10\%$

Symbol	Parameter	Test Conditions	Min	Typ <sup>(1)</sup>	Max	Unit
$V_{IH}$	Input HIGH Voltage	Guaranteed Logic HIGH for Control Inputs	2.0	—	—	V
$V_{IL}$	Input LOW Voltage	Guaranteed Logic LOW for Control Inputs	—	—	0.8	V
$ I_{IN} $	Input Leakage Current (Control Inputs)	$0 \leq V_{IN} \leq V_{CC}$	—	0.01	1	$\mu\text{A}$
$ I_{OZ} $	Off-State Current (Hi-Z)	$0 \leq V_{OUT} \leq V_{CC}$ , Switches OFF	—	0.01	1	$\mu\text{A}$
$R_{ON}$	Switch ON Resistance <sup>(2)</sup>	$V_{CC} = \text{Min.}$ , 3384 (Com)	—	5	7	$\Omega$
		$V_{IN} = 0.0\text{V}$ , 3384 (Mil)	—	10	15	
		$I_{ON} = 30\text{mA}$ , 32384 (Com)	20	28	40	
		32384 (Mil)	—	35	45	
$R_{ON}$	Switch ON Resistance <sup>(2)</sup>	$V_{CC} = \text{Min.}$ , 3384 (Com)	—	10	15	$\Omega$
		$V_{IN} = 2.4\text{V}$ , 3384 (Mil)	—	15	20	
		$I_{ON} = 15\text{mA}$ , 32384 (Com)	20	35	48	
		32384 (Mil)	—	40	55	
$V_P$	Pass Voltage <sup>(3)</sup>	$V_{IN} = V_{CC} = 5\text{V}$ , $I_{OUT} = -5\mu\text{A}$	3.7	4	4.2	V

**Notes:**

1. Typical values indicate  $V_{CC} = 5.0\text{V}$  and  $T_A = 25^{\circ}\text{C}$ .
2. For a diagram explaining the procedure for  $R_{ON}$  measurement, please see Section 1 under "DC Electrical Characteristics." Max. value of  $R_{ON}$  guaranteed, but not production tested.
3. Pass Voltage is guaranteed but not production tested.

**Figure 3. Typical ON Resistance vs  $V_{IN}$  at  $V_{CC} = 5.0\text{V}$  (QS3384)**



**Note:** For QS32384, add  $23\Omega$  to  $R_{ON}$  shown.

**Table 6. Power Supply Characteristics Over Operating Range**

Commercial:  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 5\%$       Military:  $T_A = -55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 10\%$

Symbol	Parameter	Test Conditions <sup>(1)</sup>	Max	Unit
$I_{CCQ}$	Quiescent Power Supply Current	$V_{CC} = \text{Max.}, V_{IN} = \text{GND or } V_{CC}, f = 0$	1.5	mA
$\Delta I_{CC}$	Power Supply Current per Input HIGH <sup>(2)</sup>	$V_{CC} = \text{Max.}, V_{IN} = 3.4\text{V}, f = 0$ per Control Input	2.5	mA
$Q_{CCD}$	Dynamic Power Supply Current per MHz <sup>(3)</sup>	$V_{CC} = \text{Max.}, A$ and $B$ Pins Open, Control Inputs Toggling @ 50% Duty Cycle	0.25	mA/MHz

**Notes:**

1. For conditions shown as Min. or Max., use the appropriate values specified under DC specifications.
2. Per TTL driven input ( $V_{IN} = 3.4\text{V}$ , control inputs only). A and B pins do not contribute to  $\Delta I_{CC}$ .
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 guaranteed by characterization, but not production tested.

**Table 7. Switching Characteristics Over Operating Range**

Commercial:  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 5\%$       Military:  $T_A = -55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 10\%$   
 $C_{LOAD} = 50\text{pF}$ ,  $R_{LOAD} = 500\Omega$  unless otherwise noted.

Symbol	Description <sup>(1)</sup>		QS3384			QS32384			Unit
			Min	Typ	Max	Min	Typ	Max	
$t_{PLH}$	Data Propagation Delay <sup>(2,4)</sup>	COM	—	—	0.25 <sup>(3)</sup>	—	—	1.25 <sup>(3)</sup>	ns
$t_{PHL}$	Ai to Bi, Bi to Ai	MIL	—	—	0.75 <sup>(3)</sup>	—	—	1.75 <sup>(3)</sup>	ns
$t_{PZL}$	Switch Turn-on Delay	COM	1.5	—	6.5	1.5	—	7.5	ns
$t_{PZH}$	$\overline{BEA}$ , $\overline{BEB}$ to Ai, Bi	MIL	1.5	—	7.5	1.5	—	8.5	ns
$t_{PLZ}$	Switch Turn-off Delay <sup>(2)</sup>	COM	1.5	—	5.5	1.5	—	5.5	ns
$t_{PHZ}$	$\overline{BEA}$ , $\overline{BEB}$ to Ai, Bi	MIL	1.5	—	6.5	1.5	—	6.5	ns

**Notes:**

1. See Test Circuit and Waveforms. Minimums guaranteed but not production tested.
2. This parameter is guaranteed by but not production tested.
3. The time constant for the switch alone is of the order of 0.25ns for QS3384 and 1.25ns for QS32384 for  $C_L = 50\text{pF}$ .
4. The bus switch contributes no propagation delay other than the RC delay of the ON resistance of the switch and the load capacitance. 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.