QUALITY SEMICONDUCTOR, INC.

QuickSwitch® Products

High-Speed CMOS 20-Bit Bus Switch

QS32X384
QS32X2384

FEATURES/BENEFITS

- Enhanced N channel FET with no inherent diode to V_{CC}
- 5Ω bidirectional switches connect inputs to outputs
- Zero propagation delay and zero ground bounce
- Undershoot clamp diodes on all switch and control pins
- QS32X2384 has 25Ω resistors for low noise
- Four enables control five bits each
- TTL-compatible input and output levels
- Available in 48 pin QVSOP (Q1)

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 QS32X384, and QS32X2384 provide a set of twenty high-speed CMOS TTL-compatible bus switches. The low ON resistance of the QS32X384 allows inputs to be connected to outputs without adding propagation delay and without generating additional ground bounce noise. The QS32X2384 includes internal 25Ω series termination resistors to reduce reflection noise in high speed applications. The Bus Enable (BE) signals turn the switches on. Four Bus Enable signals are provided, one for each of five bits of the 20-bit bus. The '384 family of QuickSwitch products is ideal for switching wide digital buses, as well as hotplug buffering, and 5V to 3V conversion.

Figure 1. Functional Block Diagram

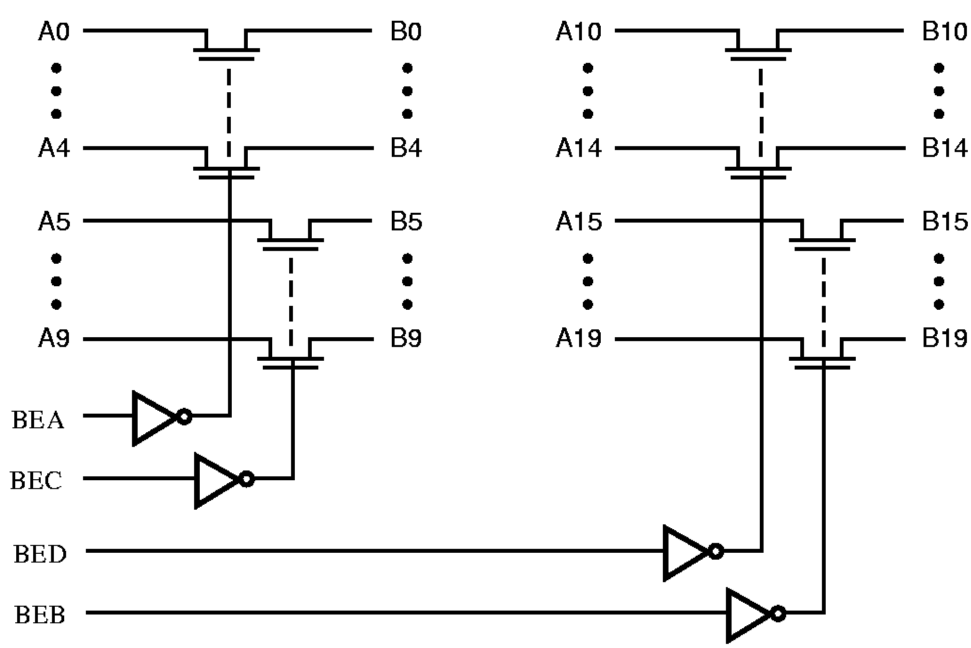


Table 1. Pin Description

Name	I/O	Function
A0-A19	I/O	Bus A
B0-B19	I/O	Bus B
BEA	I	Enable,0-4
BEB	I	Enable, 15-19
BEC	I	Enable, 5-9
BED	I	Enable, 10-14

Figure 2. Pin Configuration (All Pins Top View)

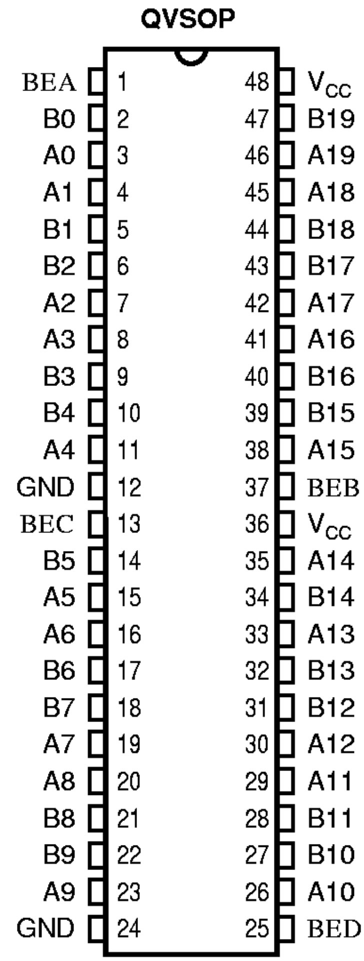


Table 2. Function Table

BEA	BEB	B0-B4	B15-B19	Function
H	H	Hi-Z	Hi-Z	Disconnect
L	H	A0-A4	Hi-Z	Connect
H	L	Hi-Z	A15-A19	Connect
L	L	A0-A4	A15-A19	Connect
BEC	**BED**	**B5-B9**	**B10-B14**	**Function**
H	H	Hi-Z	Hi-Z	Disconnect
L	H	A5-A9	Hi-Z	Connect
H	L	Hi-Z	A10-A14	Connect
L	L	A5-A9	A10-A14	Connect

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 ≤ 20ns)	–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°C, f = 1MHz, V_{IN} = 0V

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

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

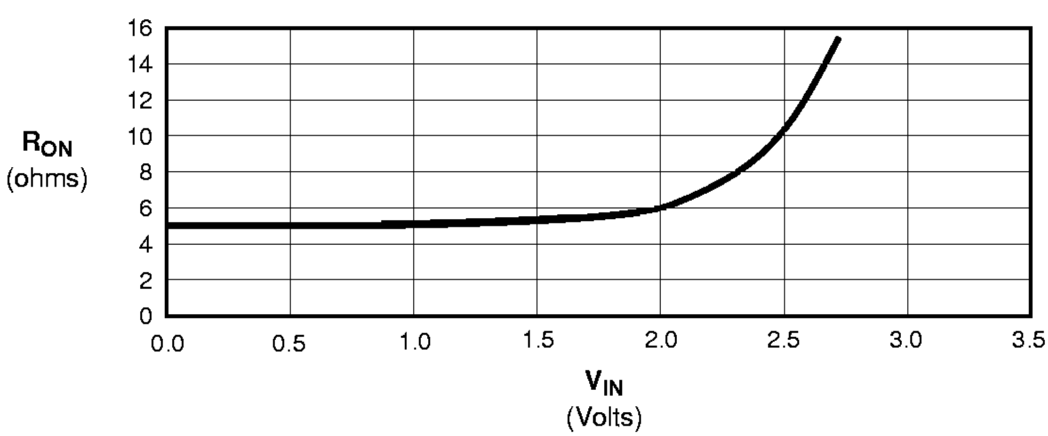
Table 5. DC Electrical Characteristics Over Operating Range

T_A = –40°C to 85°C, V_{CC} = 5.0V ± 5%

Symbol	Parameter	Test Conditions		Min	Typ(1)	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	µA
$\|I_{OZ}\|$	Off-State Current (Hi-Z)	$0 \leq V_{OUT} \leq V_{CC}$, Switches OFF		—	0.01	1	µA
R_{ON}	Switch ON Resistance(2)	V_{CC} = Min., V_{IN} = 0.0V	32X384	—	5	7	Ω
		I_{ON} = 30mA	32X2384	20	28	40	
R_{ON}	Switch ON Resistance(2)	V_{CC} = Min., V_{IN} = 2.4V	32X384	—	10	15	Ω
		I_{ON} = 15mA	32X2384	20	35	48	
V_P	Pass Voltage(3)	$V_{IN} = V_{CC}$ = 5V, I_{OUT} = –5µA		3.7	4	4.2	V

Notes:
1. Typical values indicate V_{CC} = 5.0V and T_A = 25°C.
2. For a diagram explaining the procedure for R_{ON} measurement, please see section 1 under "DC Electrical Characterisitcs." 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} = 5.0V (32X384)



Note: For QS32X2384, add 23Ω to R_{ON} shown.

Table 6. Power Supply Characteristics Over Operating Range

$T_A = -40°C$ to $85°C$, $V_{CC} = 5.0V \pm 5\%$

Symbol	Parameter	Test Conditions(1)	Max	Unit
I_{CCQ}	Quiescent Power Supply Current	V_{CC} = Max., V_{IN} = GND or V_{CC}, f = 0	3.0	mA
ΔI_{CC}	Power Supply Current per Input HIGH(2)	V_{CC} = Max., V_{IN} = 3.4V, f = 0 per Control Input	2.5	mA
Q_{CCD}	Dynamic Power Supply Current per MHz(3)	V_{CC} = Max., A and B Pins Open, Control Inputs Toggling @ 50% Duty Cycle	0.25	mA/MHz

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Notes:
1. For conditions shown as Min. or Max., use the appropriate values specified under DC specifications.
2. Per TTL driven input (V_{IN} = 3.4V, control inputs only). A and B pins do not contribute to ΔI_{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 design, but not production tested.

Table 7. Switching Characteristics Over Operating Range

$T_A = -40°C$ to $85°C$, $V_{CC} = 5.0V \pm 5\%$
C_{LOAD} = 50pF, R_{LOAD} = 500Ω unless otherwise noted.

Symbol	Description(1)	QS32X384			QS32X2384			Unit
		Min	Typ	Max	Min	Typ	Max	
t_{PLH} t_{PHL}	Data Propagation Delay(2,4) Ai to Bi, Bi to Ai	—	—	0.25(3)	—	—	1.25(3)	ns
t_{PZL} t_{PZH}	Switch Turn-on Delay BEn to Ai, Bi	1.5	—	6.5	1.5	—	7.5	ns
t_{PLZ} t_{PHZ}	Switch Turn-off Delay(2) BEn to Ai, Bi	1.5	—	5.5	1.5	—	5.5	ns

Notes:
1. See Test Circuit and Waveforms. Minimums guaranteed but not production tested.
2. This parameter is guaranteed, but not production tested.
3. The time constant for the switch alone is of the order of 0.25ns for QS532X384 and 1.25ns for QS32X2384 at C_L = 50pF.
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.