QUALITY SEMICONDUCTOR, INC.

High-Speed CMOS
Quadruple Bus Switches With
Individual Active Low Enables

FEATURES/BENEFITS

- Enhanced N channel FET with no inherent diode to V_{CC}
- Pin compatible with the 74'125 function
- Available in SOIC (S1), QSOP
- Undershoot clamp diodes on all switch and control inputs
- Zero propagation delay, zero added ground bounce

APPLICATIONS

- Hot-docking, hot-swapping (Application Note AN-13)
- Voltage translation (5V to 3.3V; Application Note AN-11)
- Power conservation
- Capacitance reduction and isolation (Mass storage, work stations)
- Logic replacement (data processing)
- Clock gating
- Bus isolation

DESCRIPTION

The QS3125 provides a set of four high-speed low resistance CMOS switches connecting inputs to outputs without propagation delay and without generating additional ground bounce noise. Individual enables ($\overline{OE}$) are used to turn on the switches. The QS3125 is ideal for signal and control switching since the device adds no noise, ground bounce, propagation delay, or significant power consumption to the system. The QS3125 can also be used for analog switching applications such as video.

QuickSwitch devices provide an order of magnitude faster speed than conventional logic devices.

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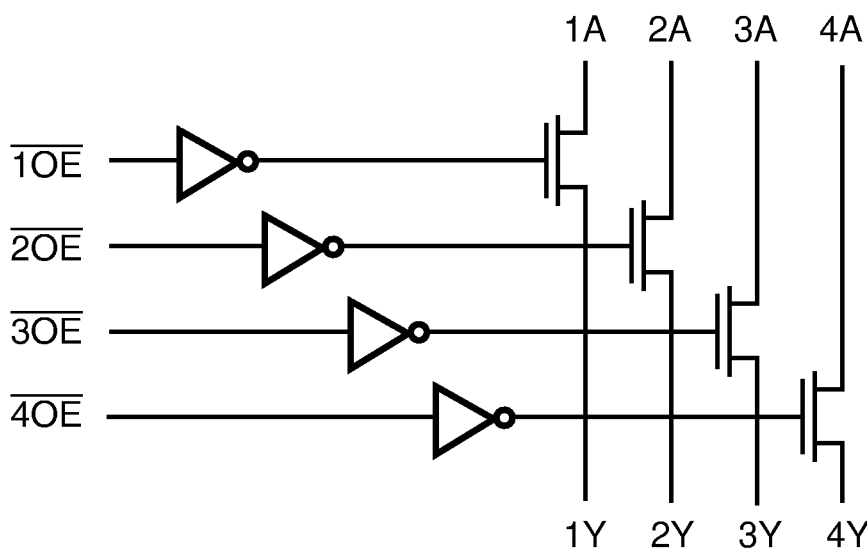## Figure 1. Functional Block Diagram

Table 1. Pin Description

Name	I/O	Description
1A-4A	I/O	Bus A
1Y-4Y	I/O	Bus B
$\overline{1OE}$-$\overline{4OE}$	I	Bus Switch Enable

Table 2. Function Table

$\overline{nOE}$	nA	nY	Function
L	H	H	Connect
L	L	L	Connect
H	X	X	Disconnect

Figure 2. Pin Configuration (All Pins Top View)

QSOP

```
        NC [ 1      16 ] V_CC
       1OE [ 2      15 ] 4OE
        1A [ 3      14 ] 4A
        1Y [ 4      13 ] 4Y
       2OE [ 5      12 ] 3OE
        2A [ 6      11 ] 3A
        2Y [ 7      10 ] 3Y
       GND [ 8       9 ] NC
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SOIC (S1)

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       1OE [ 1      14 ] V_CC
        1A [ 2      13 ] 4OE
        1Y [ 3      12 ] 4A
       2OE [ 4      11 ] 4Y
        2A [ 5      10 ] 3OE
        2Y [ 6       9 ] 3A
       GND [ 7       8 ] 3Y
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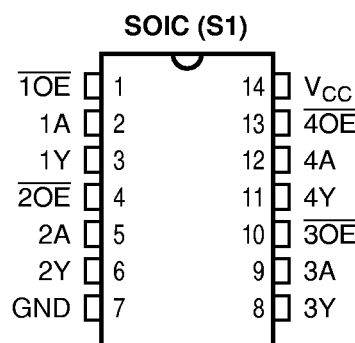
Table 3. Absolute Maximum Ratings

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, V_{OUT} = 0V

Pins	SOIC, QSOP Typ	Max	Unit
$\overline{OE}$ (Inputs)	3	5	pF
QuickSwitch Channels (Switch OFF)	5	7	pF

Note: Capacitance is guaranteed, but not production tested and are typical values. 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

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

Symbol	Parameter	Test Conditions	Min	Typ[1]	Max	Unit
V_{IH}	Input HIGH Voltage	Guaranteed Logic HIGH for Control Pins	2.0	—	—	V
V_{IL}	Input LOW Voltage	Guaranteed Logic LOW for Control Pins	—	—	0.8	V
$\lvert I_{IN} \rvert$	Input Leakage Current (Control Inputs)	$0V \leq V_{IN} \leq V_{CC}$	—	—	1	μA
$\lvert I_{OZ} \rvert$	Off-State Current (Hi-Z)	$0V \leq V_{OUT} \leq V_{CC}$, Switches OFF	—	—	1	μA
R_{ON}	Switch On Resistance[2,3]	V_{CC} = Min., V_{IN} = 0.0V, I_{ON} = 30mA	—	5	7	Ω
		V_{CC} = Min., V_{IN} = 2.4V, I_{ON} = 15mA	—	10	15	
V_P	Pass Voltage[4]	$V_{IN} = V_{CC} = 5V$, $I_{OUT} = -5μA$	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 Characteristics."
3. R_{ON} guaranteed, but not production tested.
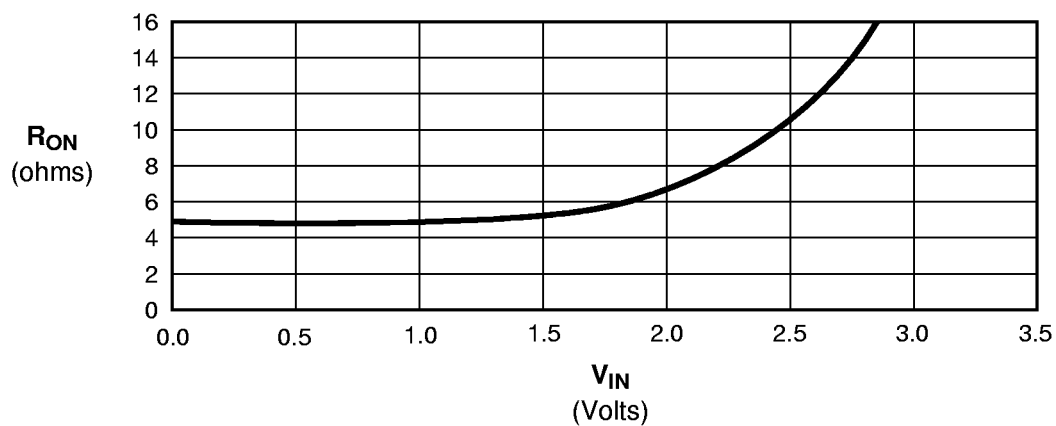4. Pass Voltage is guaranteed, but not production tested.

Figure 3. Typical ON Resistance vs V_{IN} at V_{CC} = 5.0V

Table 6. Power Supply Characteristics Over Operating Range

T_A = –40°C to 85°C, V_{CC} = 5.0V ± 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	µA
ΔI_{CC}	Power Supply Current[2] per Input HIGH	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 Y Pins Open, Controls 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} = 3.4V, control inputs only). A and Y pins do not contribute to 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 Y inputs generate no significant AC or DC currents as they change states. This parameter is guaranteed, but not production tested.

Table 7. Switching Characteristics Over Operating Range

Commercial T_A = –40°C to 85°C, V_{CC} = 5.0V ± 5%
C_{LOAD} = 50pF, R_{LOAD} = 500Ω unless otherwise noted.

Symbol	Description[1]	QS3125			Unit
		Min	Typ	Max	
t_{PLH} t_{PHL}	Data Propagation Delay[2,3] A to Y	—	—	0.25[3]	ns
t_{PZH} t_{PZL}	Switch Turn-on Delay $\overline{OE}$ to nA/ny	1.5	—	6.5	ns
t_{PHZ} t_{PLZ}	Switch Turn-off Delay[2] $\overline{OE}$ to nA/ny	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 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 alone is of the order of 0.25ns for C_L = 50pF. 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.

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300-MIL SOIC - Package Code SO
Plastic Small Outline Gull-Wing
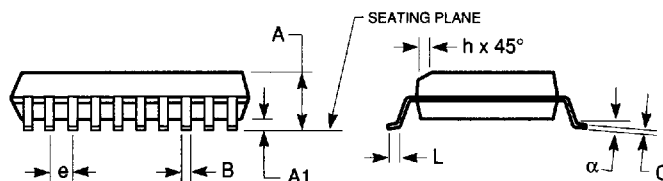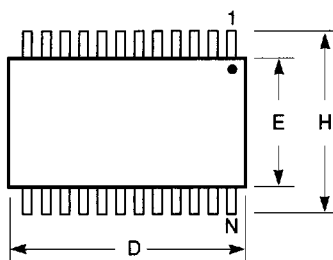
Notes:
1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.006in. per side.
5. Lead coplanarity is 0.004in. maximum.

JEDEC#	MS-013AA		MS-013AC		MS-013AD		MS-013AE	
DWG#	PS16A		PS20A		PS24A		PS28A	
Symbol	Min	Max	Min	Max	Min	Max	Min	Max
A	0.096	0.104	0.096	0.104	0.096	0.104	0.096	0.104
A1	0.005	0.011	0.005	0.011	0.005	0.011	0.005	0.011
B	0.014	0.019	0.014	0.019	0.014	0.019	0.014	0.019
C	0.009	0.012	0.009	0.012	0.009	0.012	0.009	0.012
D	0.402	0.412	0.500	0.510	0.602	0.612	0.701	0.711
E	0.292	0.299	0.292	0.299	0.292	0.299	0.292	0.299
e	0.044	0.056	0.044	0.056	0.044	0.056	0.044	0.056
H	0.396	0.416	0.396	0.416	0.396	0.416	0.396	0.416
h	0.010	0.016	0.010	0.016	0.010	0.016	0.010	0.016
L	0.020	0.040	0.020	0.040	0.020	0.040	0.020	0.040
N	16		20		24		28	
α	0°	8°	0°	8°	0°	8°	0°	8°

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Q QUALITY
SEMICONDUCTOR, INC.

150-MIL QSOP - Package Code Q
Quarter-Size Outline Package
Plastic Small Outline Gull-Wing

Notes:
1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.006in. per side.
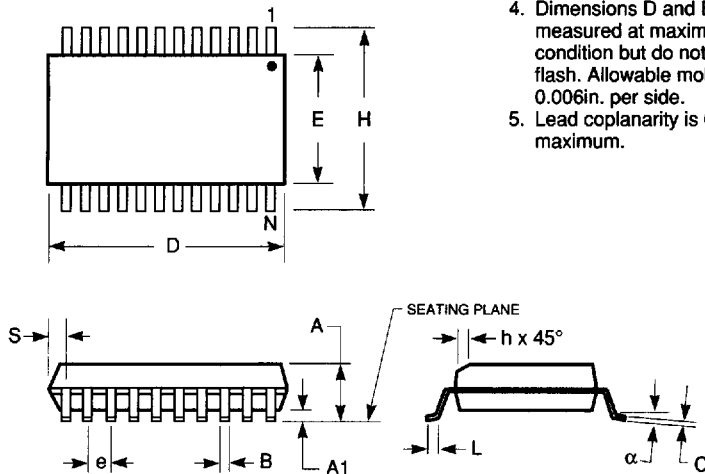5. Lead coplanarity is 0.004in. maximum.

JEDEC#	MO-137AB			MO-137AD			MO-137AE			MO-137AF		
DWG#	PSS-16A			PSS-20A			PSS-24A			PSS-28A		
Symbol	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
A	0.060	0.064	0.068	0.060	0.064	0.068	0.060	0.064	0.068	0.060	0.064	0.068
A1	0.004	0.006	0.008	0.004	0.006	0.008	0.004	0.006	0.008	0.004	0.006	0.008
B	0.009	0.010	0.012	0.009	0.010	0.012	0.009	0.010	0.012	0.009	0.010	0.012
C	0.007	0.008	0.010	0.007	0.008	0.010	0.007	0.008	0.010	0.007	0.008	0.010
D	0.189	0.193	0.197	0.337	0.341	0.344	0.337	0.341	0.344	0.386	0.390	0.394
E	0.150	0.154	0.157	0.150	0.154	0.157	0.150	0.154	0.157	0.150	0.154	0.157
e	0.025 BSC			0.025 BSC			0.025 BSC			0.025 BSC		
H	0.230	0.236	0.244	0.230	0.236	0.244	0.230	0.236	0.244	0.230	0.236	0.244
h	0.010	0.013	0.016	0.010	0.013	0.016	0.010	0.013	0.016	0.010	0.013	0.016
L	0.016	0.025	0.035	0.016	0.025	0.035	0.016	0.025	0.035	0.016	0.025	0.035
N	16			20			24			28		
α	0°	5°	8°	0°	5°	8°	0°	5°	8°	0°	5°	8°
S	0.006	0.009	0.010	0.056	0.058	0.060	0.031	0.033	0.035	0.031	0.033	0.035

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