

FEATURES/BENEFITS

- Enhanced N channel FET with no inherent diode to V_{CC}
- 5Ω bidirectional switches connect inputs to outputs
- Pin compatible with the 74F253, 74FCT253, and 74FCT253T
- Zero propagation delay, zero ground bounce
- Undershoot clamp diodes on all switch and control pins
- TTL-compatible control inputs
- QS32253 is 25Ω version for low noise
- Available in SOIC (S1), QSOP

APPLICATIONS

- Logic replacement
- Video, audio, graphics switching, muxing
- Hot-swapping, hot-docking (Application Note AN-13)
- Voltage translation (5V to 3.3V; Application Note AN-11)
- Bus funneling

DESCRIPTION

The QS3253 is a high-speed CMOS TTL-compatible dual 4:1 multiplexer/demultiplexer with 3-state outputs. The QS3253 is function and pinout compatible version of the 74F253, 74FCT253, and the 74ALS/AS/LS253 dual 4:1 multiplexers. The low ON resistance of the QS3253 allows inputs to be connected to outputs without adding propagation delay and without generating additional ground bounce noise.

The QS32253 has 25Ω series resistors to reduce ground bounce noise.

Mux/Demux devices provide an order of magnitude faster speed than equivalent logic devices.

Figure 1. Functional Block Diagram

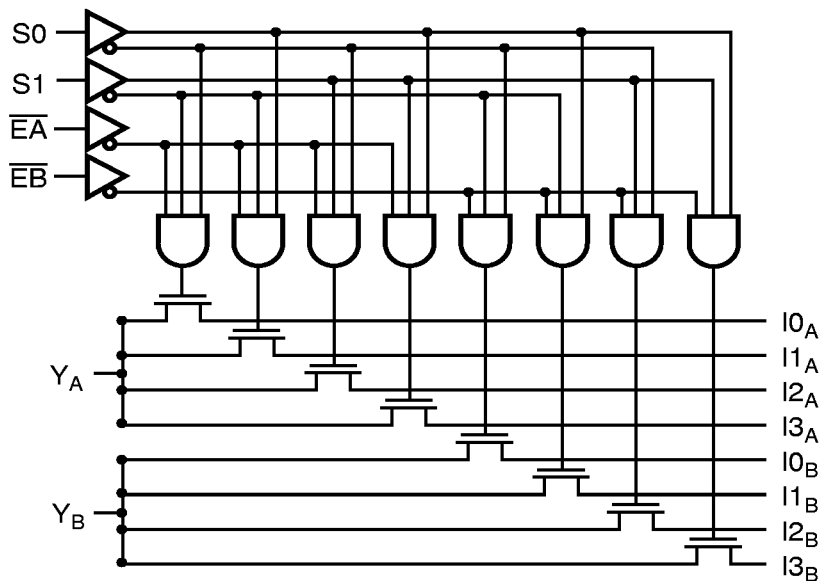


Table 1. Pin Description

Name	I/O	Description
I _{XX}	I	Data Inputs
S0, S1	I	Select Inputs
\overline{EA} , \overline{EB}	I	Enable Inputs
Y _A , Y _B	O	Data Outputs

Figure 2. Pin Configuration
(All Pins Top View)

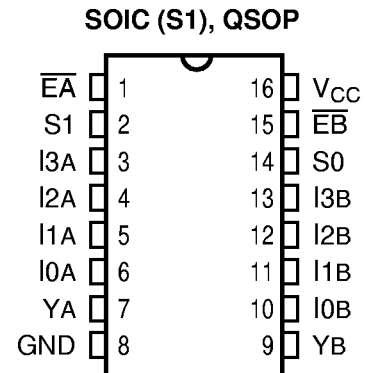


Table 2. Function Table

Enable		Select		Outputs		Function
\overline{EA}	\overline{EB}	S1	S0	Y _A	Y _B	
H	X	X	X	Hi-Z	X	Disable A
X	H	X	X	X	Hi-Z	Disable B
L	L	L	L	I0A	I0B	S1-0 = 0
L	L	L	H	I1A	I1B	S1-0 = 1
L	L	H	L	I2A	I2B	S1-0 = 2
L	L	H	H	I3A	I3B	S1-0 = 3

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		Unit
		Typ	Max	
Control Inputs		4	5	pF
QuickSwitch Channels (Switch OFF)	Demux	5	7	pF
	Mux	14	16	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."

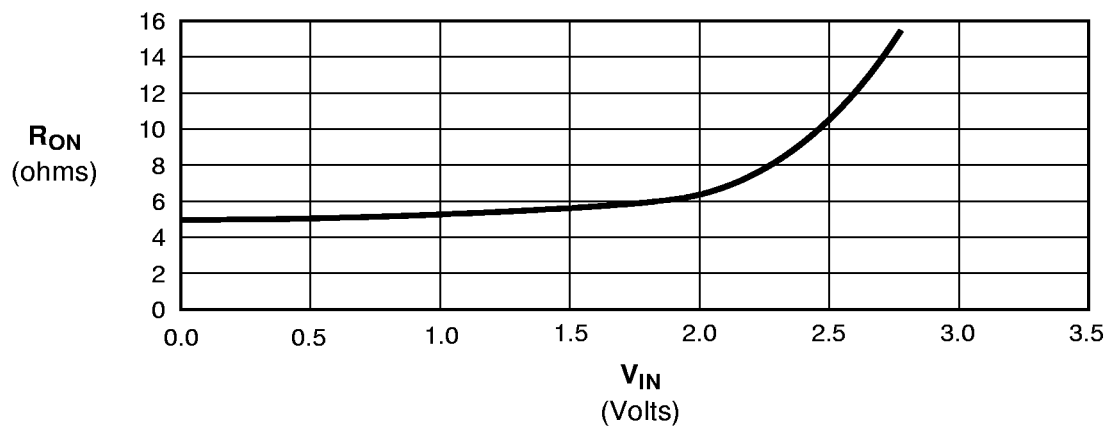
Table 5. DC Electrical Characteristics Over Operating Range $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$, $V_{CC} = 5.0\text{V} \pm 5\%$

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
$ I_{IN} $	Input Leakage Current (Control Inputs)	$0\text{V} \leq V_{IN} \leq V_{CC}$	—	—	1	μA
$ I_{OZ} $	Off-State Current (Hi-Z)	$0\text{V} \leq V_{OUT} \leq V_{CC}$	—	—	1	μA
R_{ON}	Switch On Resistance ⁽²⁾	$V_{CC} = \text{Min.}, V_{IN} = 0.0\text{V}$ QS3253	—	5	7	Ω
		$I_{ON} = 30\text{mA}$ QS32253	20	28	40	
R_{ON}	Switch On Resistance ⁽²⁾	$V_{CC} = \text{Min.}, V_{IN} = 2.4\text{V}$ QS3253	—	10	15	Ω
		$I_{ON} = 15\text{mA}$ QS32253	20	35	48	
V_P	Pass Voltage ⁽³⁾	$V_{IN} = V_{CC} = 5\text{V}, I_{OUT} = -5\mu\text{A}$	3.7	4.0	4.2	V

Notes:

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

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Figure 3. Typical ON Resistance vs. V_{IN} at $V_{CC} = 5.0\text{V}$ (QS3253)

Note: For QS32253, add 23Ω to R_{ON} shown.

Table 6. Power Supply Characteristics Over Operating Range

$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = 5.0\text{V} \pm 5\%$

Symbol	Parameter	Test Conditions ⁽¹⁾	Max	Unit
I_{CCQ}	Quiescent Power Supply Current	$V_{CC} = \text{Max.}$, $V_{IN} = \text{GND}$ or V_{CC} , $f = 0$	3	μA
ΔI_{CC}	Power Supply Current ⁽²⁾ per Input HIGH	$V_{CC} = \text{Max.}$, $V_{IN} = 3.4\text{V}$, $f = 0$ per control input	1.5	mA
Q_{CCD}	Dynamic Power Supply Current per MHz ⁽³⁾	$V_{CC} = \text{Max.}$, I and Y 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). I and Y 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 I and Y 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

$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = 5.0\text{V} \pm 5\%$

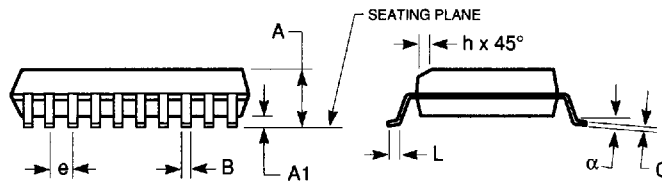
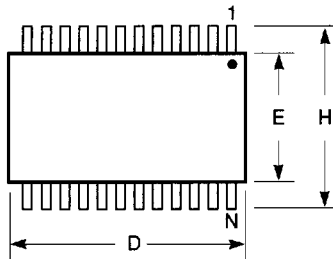
$C_{LOAD} = 50\text{pF}$, $R_{LOAD} = 500\Omega$ unless otherwise noted.

Symbol	Description ⁽¹⁾	QS3253			QS32253			Unit
		Min	Typ	Max	Min	Typ	Max	
t_{PLH} t_{PHL}	Data Propagation Delay ^(2,3) In to Y	—	—	0.25 ⁽³⁾	—	—	1.25 ⁽³⁾	ns
t_{PZL} t_{PZH}	Switch Turn-on Delay Sn to Y	0.5	—	6.6	0.5	—	7.0	ns
t_{PZL} t_{PZH}	Switch Turn-on Delay $\overline{\text{En}}$ to Y	0.5	—	6.0	0.5	—	7.0	ns
t_{PLZ} t_{PHZ}	Switch Turn-off Delay ⁽²⁾ $\overline{\text{En}}$ to Y, Sn to Y	0.5	—	6.0	0.5	—	6.0	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 QS3253 and 1.25ns for QS32253 for $C_L = 50\text{pF}$. 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.

300-MIL SOIC - Package Code SO
Plastic Small Outline Gull-Wing



Notes:

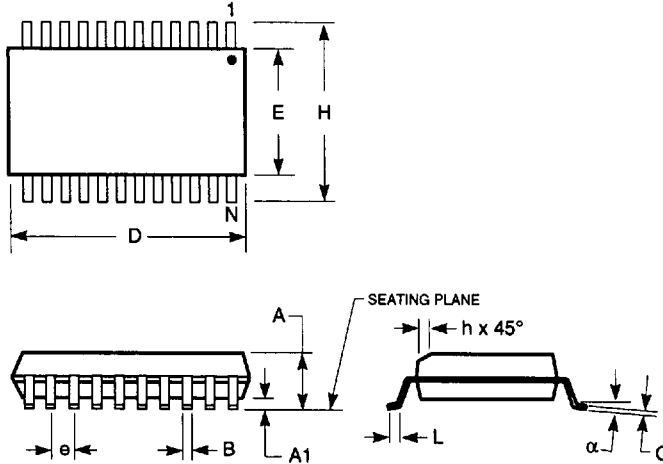
1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.006in. per side.
5. Lead coplanarity is 0.004in. maximum.

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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150-MIL SOIC - Package Code S1
Plastic Small Outline Gull-Wing



JEDEC#	MS-012AB			MS-012AC		
DWG#	PS-14B			PS-16B		
Symbol	Min	Nom	Max	Min	Nom	Max
A	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
B	0.014	0.016	0.019	0.014	0.016	0.019
C	0.0075	0.008	0.0098	0.0075	0.008	0.0098
D	0.337	0.341	0.346	0.386	0.390	0.394
E	0.150	0.154	0.157	0.150	0.154	0.157
e	0.050 BSC			0.050 BSC		
H	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
L	0.016	0.025	0.035	0.016	0.025	0.035
N	14			16		
α	0°	5°	8°	0°	5°	8°

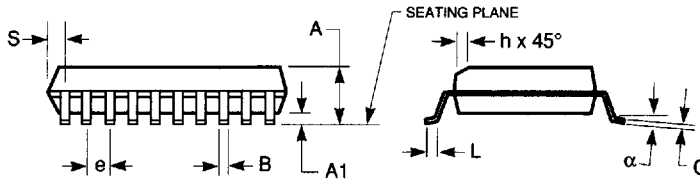
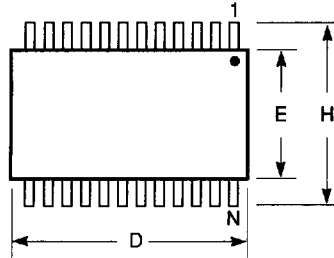
Notes:

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 0.006 in. per side.
5. Lead coplanarity is 0.004 in. maximum.

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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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