QUICKSWITCH® PRODUCTS HIGH-SPEED CMOS QUICKSWITCH DUAL 4:1 MUX/DEMUX

QS3253
QS32253

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**

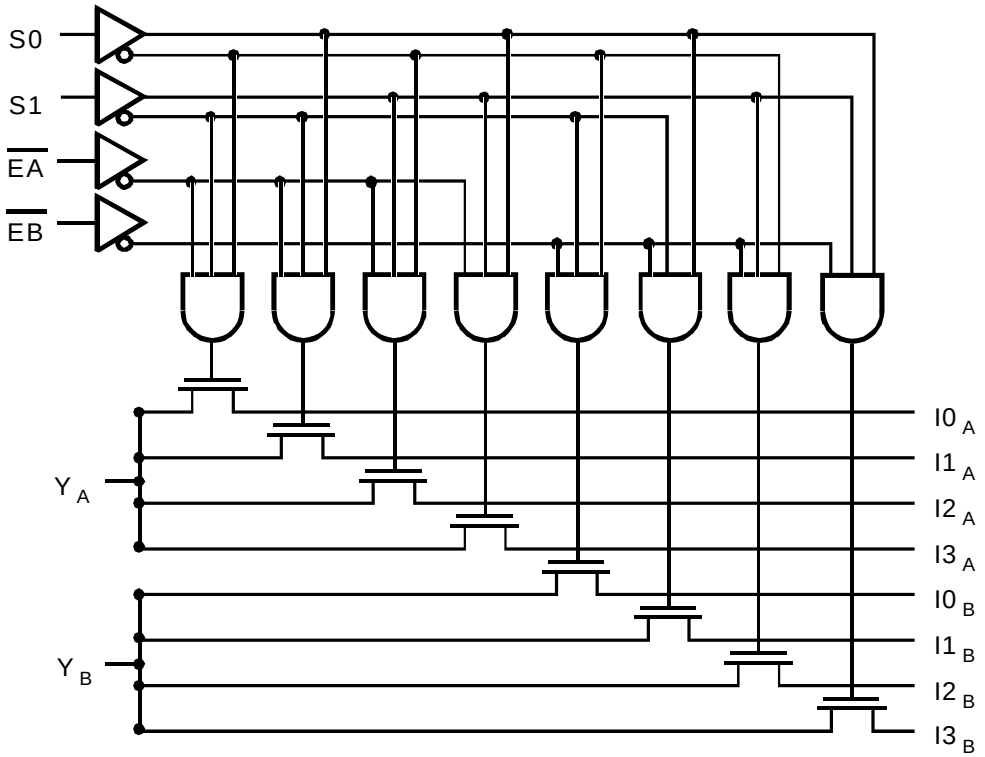
DESCRIPTION

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 resitors to reduce ground bounce noise.

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

FUNCTIONAL BLOCK DIAGRAM



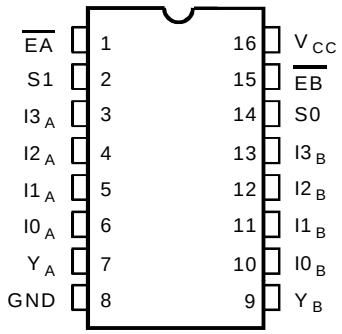
OCTOBER 1999

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

PIN CONFIGURATION

(ALL PINS TOP VIEW)

SOIC (S1), QSOP



FUNCTION TABLE

Enable		Select		Outputs		
$\overline{EA}$	$\overline{EB}$	S1	S0	Y_A	Y_B	Function
H	X	X	X	Hi-Z	X	Disable A
X	H	X	X	X	Hi-Z	Disable B
L	L	L	L	$I0_A$	$I0_B$	S1-0 = 0
L	L	L	H	$I1_A$	$I1_B$	S1-0 = 1
L	L	H	L	$I2_A$	$I2_B$	S1-0 = 2
L	L	H	H	$I3_A$	$I3_B$	S1-0 = 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.

CAPACITANCE

T_A = 25°C, f = 1MHz, V_{IN} = 0V, V_{OUT} = 0V

Pins		SOIC, QSOP Typ	Max	Unit
Control Inputs		4	5	pF
QuickSwitch Channels	Demux	5	7	pF
(Switch OFF)	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."

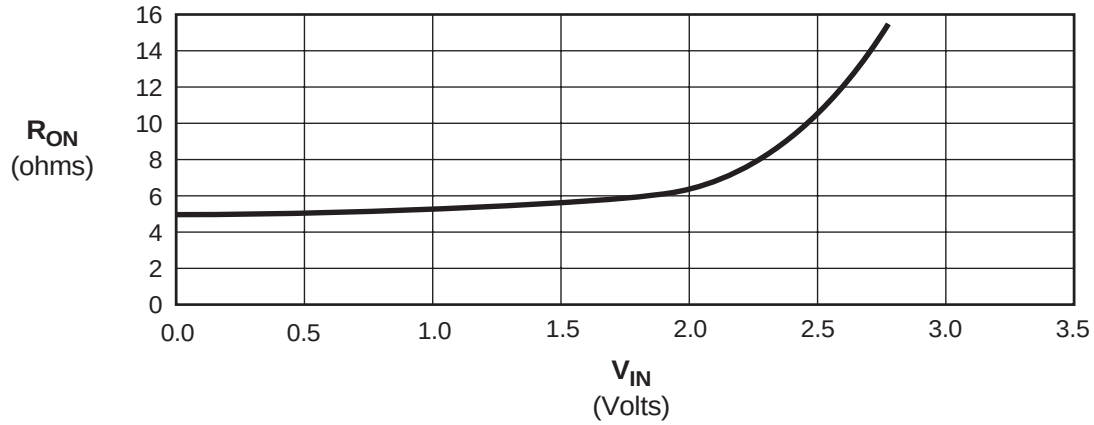
DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

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 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)	$0V \le V_{IN} \le V_{CC}$		—	—	1	µA
$\| I_{OZ} \|$	Off-State Current (Hi-Z)	$0V \le V_{OUT} \le V_{CC}$		—	—	1	µA
R_{ON}	Switch On Resistance(2)	V_{CC} = Min., V_{IN} = 0.0V	QS3253	—	5	7	Ω
		I_{ON} = 30mA	QS32253	20	28	40	
R_{ON}	Switch On Resistance(2)	V_{CC} = Min., V_{IN} = 2.4V	QS3253	—	10	15	Ω
		I_{ON} = 15mA	QS32253	20	35	48	
V_P	Pass Voltage(3)	$V_{IN} = V_{CC}$ = 5V, I_{OUT} = –5µA		3.7	4.0	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." R_{ON} guaranteed, but not production tested.
3. Pass voltage is guaranteed, but not production tested.

TYPICAL ON RESISTANCE VS. V_{IN} AT V_{CC} = 5.0V (QS3253)



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

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	µA
ΔI_{CC}	Power Supply Current[2] per Input HIGH	V_{CC} = Max., V_{IN} = 3.4V, f = 0 per control input	1.5	mA
Q_{CCD}	Dynamic Power Supply Current per MHz[3]	V_{CC} = 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} = 3.4V, 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.

Switching Characteristics Over Operating Range

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

		QS3253			QS32253			
Symbol	Description[1]	Min	Typ	Max	Min	Typ	Max	Unit
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 $\overline{En}$ to Y	0.5	—	6.0	0.5	—	7.0	ns
t_{PLZ} t_{PHZ}	Switch Turn-off Delay[2] $\overline{En}$ 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 = 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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