QUICKSWITCH® PRODUCTS
2.5V / 3.3V 32:16 MUX/DEMUX HIGH BANDWIDTH BUS SWITCH

IDTQS3VH16233

FEATURES:

- **N channel FET switches with no parasitic diode to Vcc**
  - **Isolation under power-off conditions**
  - **No DC path to Vcc or GND**
  - **5V tolerant in OFF and ON state**
- **5V tolerant I/Os**
- **Low R_{ON} - 4Ω typical**
- **Flat R_{ON} characteristics over operating range**
- **Rail-to-rail switching 0 - 5V**
- **Bidirectional dataflow with near-zero delay: no added ground bounce**
- **Excellent R_{ON} matching between channels**
- **Vcc operation: 2.3V to 3.6V**
- **High bandwidth - up to 500 MHz**
- **LVTTL-compatible control Inputs**
- **Undershoot Clamp Diodes on all switch and control Inputs**
- **Low I/O capacitance, 4pF typical**
- **Available in SSOP and TSSOP packages**

APPLICATIONS:

- **Hot-swapping**
- **10/100 Base-T, Ethernet LAN switch**
- **Low distortion analog switch**
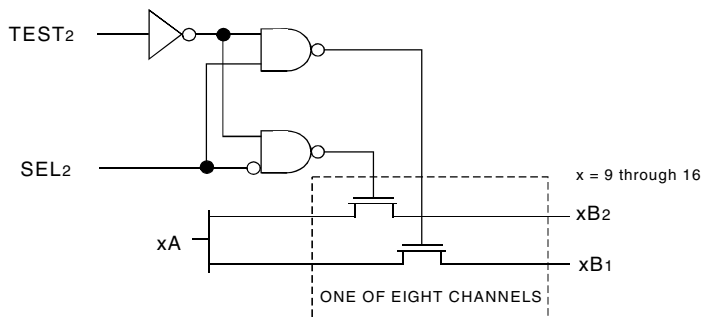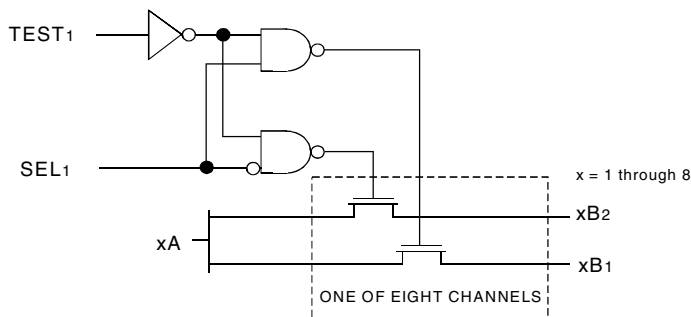- **Replaces mechanical relay**
- **ATM 25/155 switching**

DESCRIPTION:

The QS3VH16233 HotSwitch is a 32-bit to 16-bit high bandwidth bus switch, which can multiplex or demultiplex data. The QS3VH16233 has very low ON resistance, resulting in under 250ps propagation delay through the switch. This device can be used as two 16-bit to 8-bit multiplexers or as one 32-bit to 16-bit multiplexer. SELx inputs control the data flow. TESTx inputs control either one or two ports connection. In the OFF and ON states, the switches are 5V-tolerant. In the OFF state, the switches offer very high impedance at the terminals.

The combination of near-zero propagation delay, high OFF impedance, and over-voltage tolerance also makes the QS3VH16233 ideal for high performance communications applications.

The QS3VH16233 is characterized for operation from -40°C to +85°C.
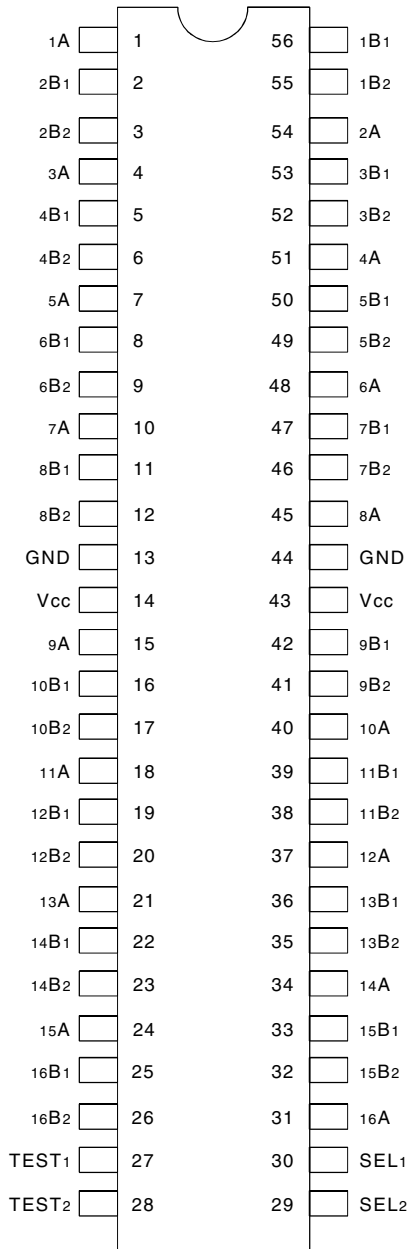
FUNCTIONAL BLOCK DIAGRAM

TEST1 · SEL1 · xA · xB2 · xB1 · x = 1 through 8 · ONE OF EIGHT CHANNELS

TEST2 · SEL2 · xA · xB2 · xB1 · x = 9 through 16 · ONE OF EIGHT CHANNELS

INDUSTRIAL TEMPERATURE RANGE

AUGUST 2003

DSC-5882/6

PIN CONFIGURATION

1A	1		56	1B1	
2B1	2		55	1B2	
2B2	3		54	2A	
3A	4		53	3B1	
4B1	5		52	3B2	
4B2	6		51	4A	
5A	7		50	5B1	
6B1	8		49	5B2	
6B2	9		48	6A	
7A	10		47	7B1	
8B1	11		46	7B2	
8B2	12		45	8A	
GND	13		44	GND	
Vcc	14		43	Vcc	
9A	15		42	9B1	
10B1	16		41	9B2	
10B2	17		40	10A	
11A	18		39	11B1	
12B1	19		38	11B2	
12B2	20		37	12A	
13A	21		36	13B1	
14B1	22		35	13B2	
14B2	23		34	14A	
15A	24		33	15B1	
16B1	25		32	15B2	
16B2	26		31	16A	
TEST1	27		30	SEL1	
TEST2	28		29	SEL2	

SSOP/ TSSOP
TOP VIEW

ABSOLUTE MAXIMUM RATINGS[1]

Symbol	Description	Max.	Unit
V_{TERM}[2]	Supply Voltage to Ground	– 0.5 to 4.6	V
V_{TERM}[3]	DC Switch Voltage Vs	– 0.5 to 5.5	V
V_{TERM}[3]	DC Input Voltage V_{IN}	– 0.5 to 5.5	V
V_{AC}	AC Input Voltage (pulse width ≤20ns)	– 3	V
I_{OUT}	DC Output Current (max. current/pin)	120	mA
T_{STG}	Storage Temperature	-65 to +150	°C

NOTES:
1. Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
2. V_{CC} terminals.
3. All terminals except V_{CC}.

CAPACITANCE $(T_A = +25°C, f = 1MHz, V_{IN} = 0V, V_{OUT} = 0V)$

Symbol	Parameter[1]		Typ.	Max.	Unit
C_{IN}	Control Inputs		3	5	pF
$C_{I/O}$	Quickswitch Channels (Switch OFF)	Mux	8	12	pF
		Demux	4	6	
$C_{I/O}$	Quickswitch Channels (Switch ON)	Mux	16	24	pF
		Demux	8	12	

NOTE:
1. This parameter is guaranteed but not production tested.

PIN DESCRIPTION

Pin Names	I/O	Description
x A	I/O	Bus A
x B x	I/O	Bus B
SELx	I	Data Select
TESTx	I	Port Select

FUNCTION TABLE[1]

SELx	TESTx	xA	Function
L	L	xB1	xA to xB1
H	L	xB2	xA to xB2
X	H	xB1, xB2	xA to xB1 and xB2

NOTE:
1. H = HIGH Voltage Level
   L = LOW Voltage Level
   X = Don't Care

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE[1]

Following Conditions Apply Unless Otherwise Specified:
Industrial: T_A = –40°C to +85°C, V_{CC} = 3.3V ± 0.3V

Symbol	Parameter	Test Conditions			Min.	Typ.[1]	Max.	Unit
V_{IH}	Input HIGH Voltage	Guaranteed Logic HIGH	V_{CC} = 2.3V to 2.7V		1.7	—	—	V
		for Control Inputs	V_{CC} = 2.7V to 3.6V		2	—	—	
V_{IL}	Input LOW Voltage	Guaranteed Logic HIGH	V_{CC} = 2.3V to 2.7V		—	—	0.7	V
		for Control Inputs	V_{CC} = 2.7V to 3.6V		—	—	0.8	
I_{IN}	Input Leakage Current (Control Inputs)	$0V \leq V_{IN} \leq V_{CC}$			—	—	±1	µA
I_{OZ}	Off-State Current (Hi-Z)	$0V \leq V_{OUT} \leq 5V$, Switches OFF			—	—	±1	µA
I_{OFF}	Data Input/Output Power Off Leakage	V_{IN} or V_{OUT} 0V to 5V, V_{CC} = 0V			—	—	±1	µA
R_{ON}	Switch ON Resistance	V_{CC} = 2.3V	V_{IN} = 0V	I_{ON} = 30mA	—	6	8	Ω
		(Typ. at V_{CC} = 2.5V)	V_{IN} = 1.7V	I_{ON} = 15mA	—	7	9	
		V_{CC} = 3V	V_{IN} = 0V	I_{ON} = 30mA	—	4	6	
			V_{IN} = 2.4V	I_{ON} = 15mA	—	5	8	

NOTE:

1. Typical values are at V_{CC} = 3.3V and T_A = 25°C, unless otherwise noted.

TYPICAL ON RESISTANCE vs V_{IN} AT V_{CC} = 3.3V
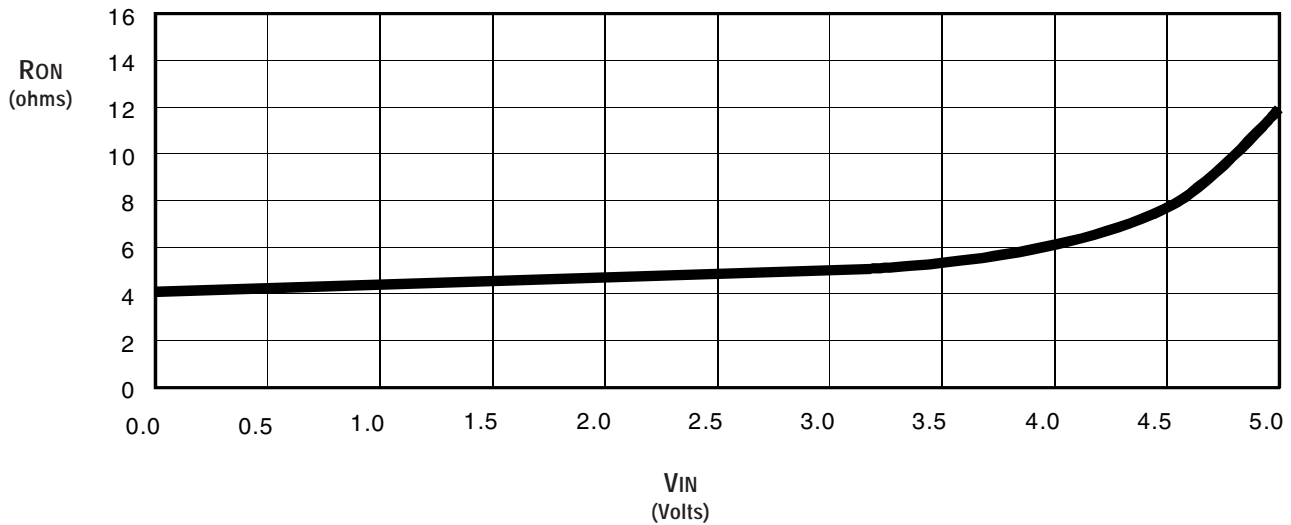
POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions[1]	Min.	Typ.	Max.	Unit
I_{CCQ}	Quiescent Power Supply Current	V_{CC} = Max., V_{IN} = GND or V_{CC}, f = 0	—	1.5	3	mA
ΔI_{CC}	Power Supply Current[2,3] per Input HIGH	V_{CC} = Max., V_{IN} = 3V, f = 0 per Control Input	—	—	30	µA
I_{CCD}	Dynamic Power Supply Current[4]	V_{CC} = 3.3V, A and B Pins Open, Control Inputs Toggling @ 50% Duty Cycle	See Typical I_{CCD} vs Enable Frequency graph below			

NOTES:
1. For conditions shown as Min. or Max., use the appropriate values specified under DC Electrical Characteristics.
2. Per input driven at the specified level. A and B pins do not contribute to ΔI_{CC}.
3. This parameter is guaranteed but not tested.
4. This parameter represents the current required to switch internal capacitance at the specified frequency. The A and B inputs do not contribute to the Dynamic Power Supply Current. This parameter is guaranteed but not production tested.

TYPICAL I_{CCD} VS ENABLE FREQUENCY CURVE AT V_{CC} = 3.3V

ENABLE FREQUENCY (MHz)
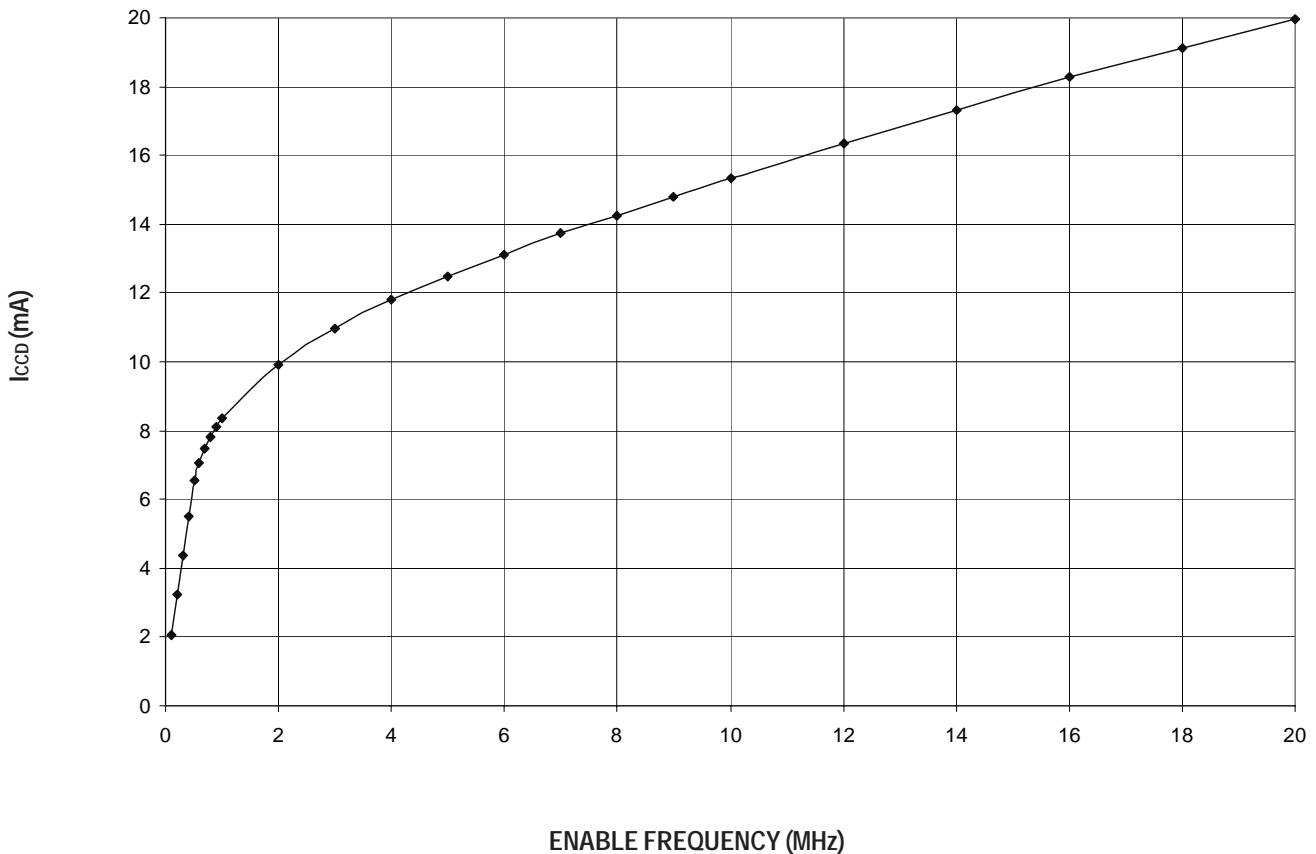
SWITCHING CHARACTERISTICS OVER OPERATING RANGE

$T_A = -40°C$ to $+85°C$

Symbol	Parameter	$V_{CC} = 2.5 \pm 0.2V$ [1]		$V_{CC} = 3.3 \pm 0.3V$ [1]		Unit
		Min. [4]	Max.	Min. [4]	Max.	
t_{PLH} t_{PHL}	Data Propagation Delay [2,3] A to B or B to A	—	0.2	—	0.2	ns
t_{BX}	Switch Multiplex Delay SEL to xA	1.5	9	1.5	7.5	ns
t_{PZH} t_{PZL}	Switch Turn-On Delay SEL to xBx	1.5	9	1.5	8	ns
t_{PHZ} t_{PLZ}	Switch Turn-Off Delay SEL to xBx	1.5	7.5	1.5	7.5	ns
t_{PZH} t_{PZL}	Switch Turn-On Delay TEST to xBx	1.5	8.5	1.5	9	ns
t_{PHZ} t_{PLZ}	Switch Turn-Off Delay TEST to xBx	1.5	8.5	1.5	8.5	ns
f_{Sx}	Operating Frequency - Enable [2,5]	—	7.5	—	15	MHz

NOTES:

1. See Test Conditions under TEST CIRCUITS AND WAVEFORMS.
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 0.2ns at $C_L = 50pF$. Since this time constant is much smaller than the rise and 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.
4. Minimums are guaranteed but not production tested.
5. Maximum toggle frequency for Sx control input (pass voltage > V_{CC}, V_{IN} = 5V, R_{LOAD} > $1M\Omega$, no C_{LOAD}).

SOME APPLICATIONS FOR HOTSWITCH PRODUCTS
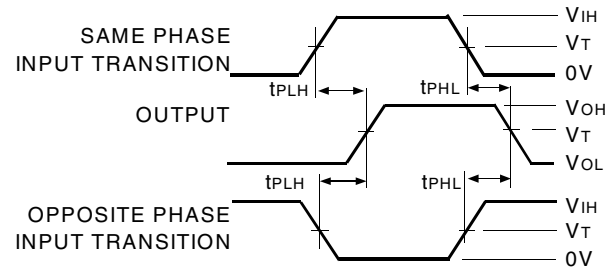
Rail-to-Rail Switching

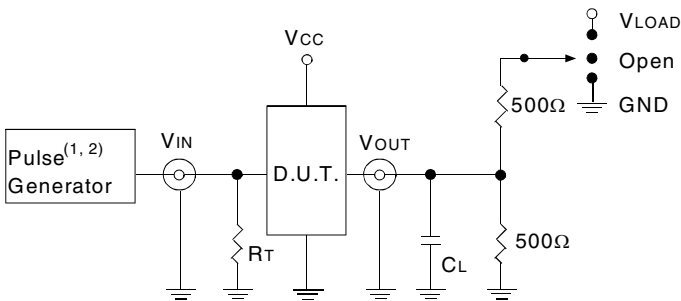*Fast Ethernet Data Switching (LAN Switch)*

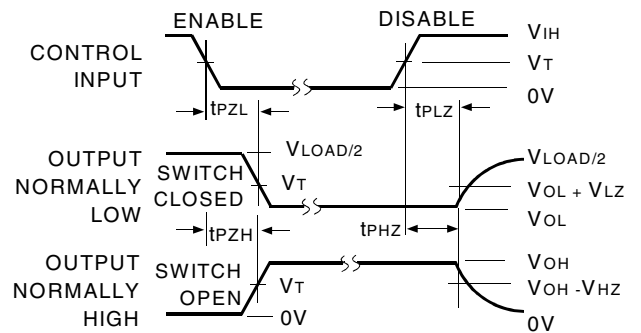*Hot Swapping*

TEST CIRCUITS AND WAVEFORMS

TEST CONDITIONS

Symbol	$V_{CC}^{(1)}$ = 3.3V ± 0.3V	$V_{CC}^{(2)}$ = 2.5V ± 0.2V	Unit
V_{LOAD}	6	2 x V_{CC}	V
V_{IH}	3	V_{CC}	V
V_T	1.5	V_{CC}/2	V
V_{LZ}	300	150	mV
V_{HZ}	300	150	mV
C_L	50	30	pF

Propagation Delay

Test Circuits for All Outputs

NOTE:
1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

Enable and Disable Times

DEFINITIONS:
C_L = Load capacitance: includes jig and probe capacitance.
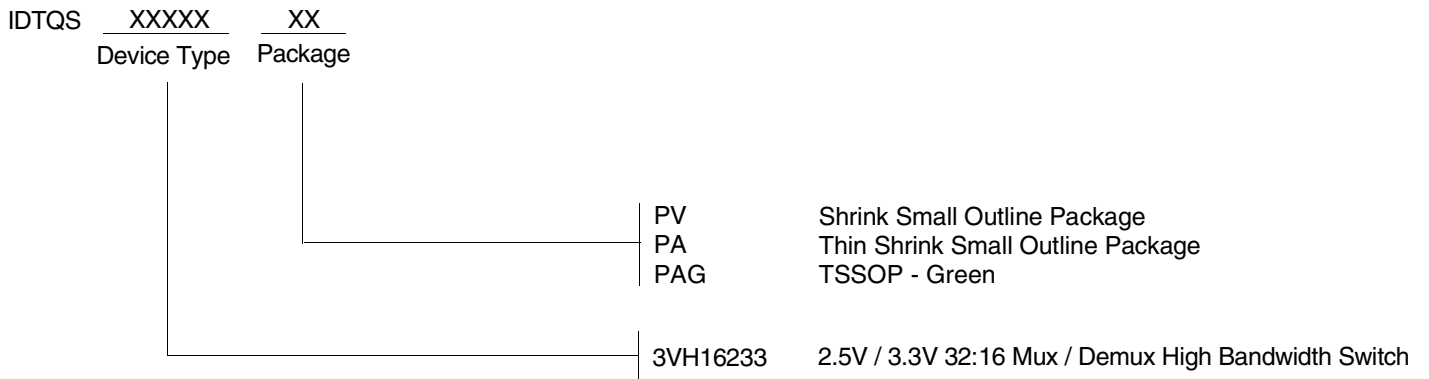R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

NOTES:
1. Pulse Generator for All Pulses: Rate ≤ 1.0MHz; t_F ≤ 2.5ns; t_R ≤ 2.5ns.
2. Pulse Generator for All Pulses: Rate ≤ 1.0MHz; t_F ≤ 2ns; t_R ≤ 2ns.

SWITCH POSITION

Test	Switch
t_{PLZ}/t_{PZL}	V_{LOAD}
t_{PHZ}/t_{PZH}	GND
t_{PD}	Open

ORDERING INFORMATION

IDTQS <u>XXXXX</u> <u>XX</u>
Device Type   Package

PV	Shrink Small Outline Package
PA	Thin Shrink Small Outline Package
PAG	TSSOP - Green

3VH16233	2.5V / 3.3V 32:16 Mux / Demux High Bandwidth Switch