RENESAS

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 RON - 4Ω typical
- Flat RON characteristics over operating range
- Rail-to-rail switching 0 - 5V
- Bidirectional dataflow with near-zero delay: no added ground bounce
- Excellent RON 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 TSSOP package

APPLICATIONS:

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

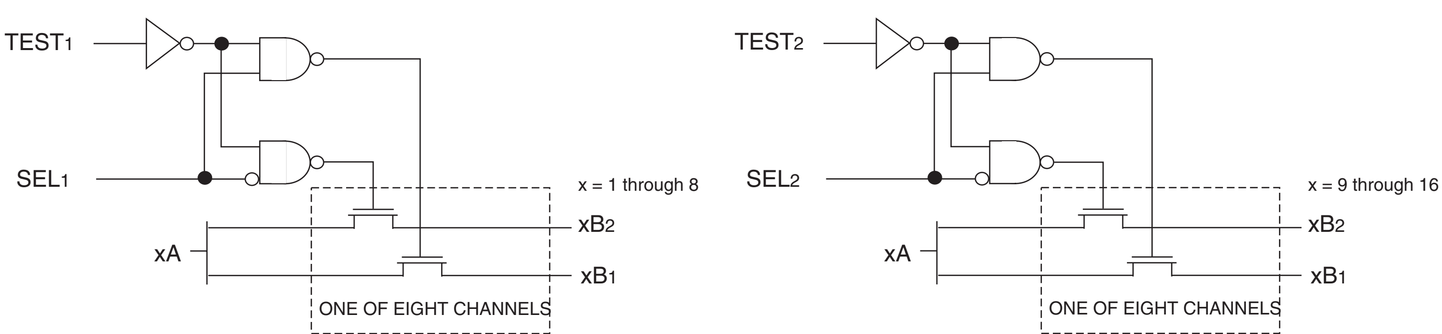
DESCRIPTION:

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.

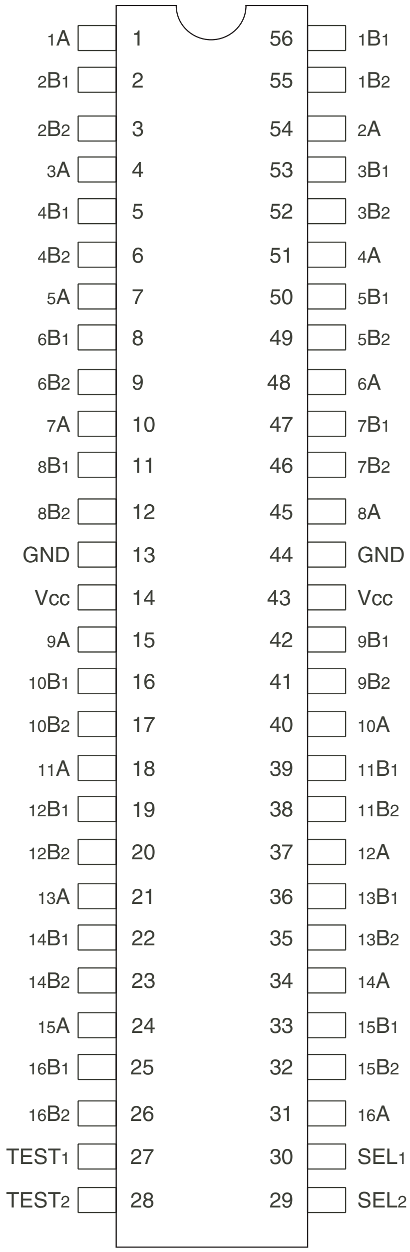
The combination of near-zero propagation delay, high OFF impedance, and over-voltage tolerance also makes the QS3VH16233 ideal for high performance communications applications.

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

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



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 V_S	– 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 (TA = +25°C, f = 1MHz, VIN = 0V, VOUT = 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
xA	I/O	Bus A
xBx	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

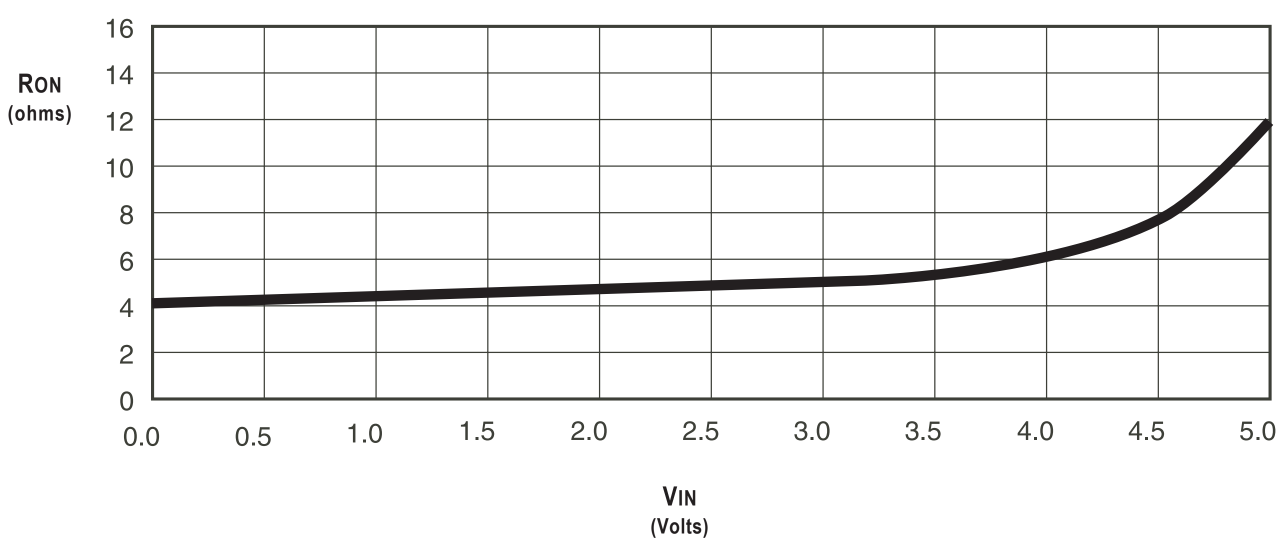
DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE[1]

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 for Control Inputs	V_{CC} = 2.3V to 2.7V		1.7	—	—	V
			V_{CC} = 2.7V to 3.6V		2	—	—	
V_{IL}	Input LOW Voltage	Guaranteed Logic HIGH for Control Inputs	V_{CC} = 2.3V to 2.7V		—	—	0.7	V
			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 (Typ. at V_{CC} = 2.5V)	V_{IN} = 0V	I_{ON} = 30mA	—	6	8	Ω
			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

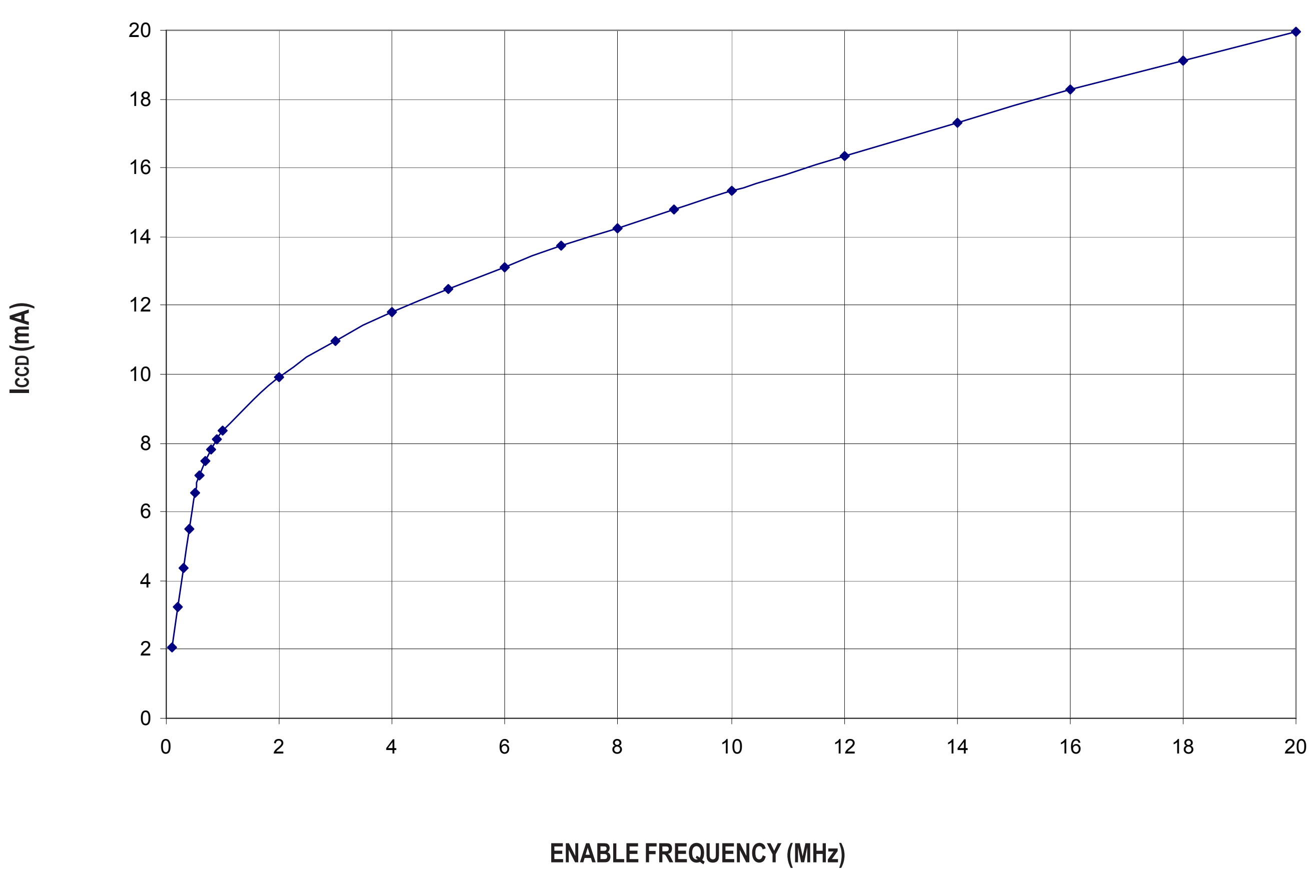


POWER SUPPLY CHARACTERISTICS

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 ΔIcc.
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



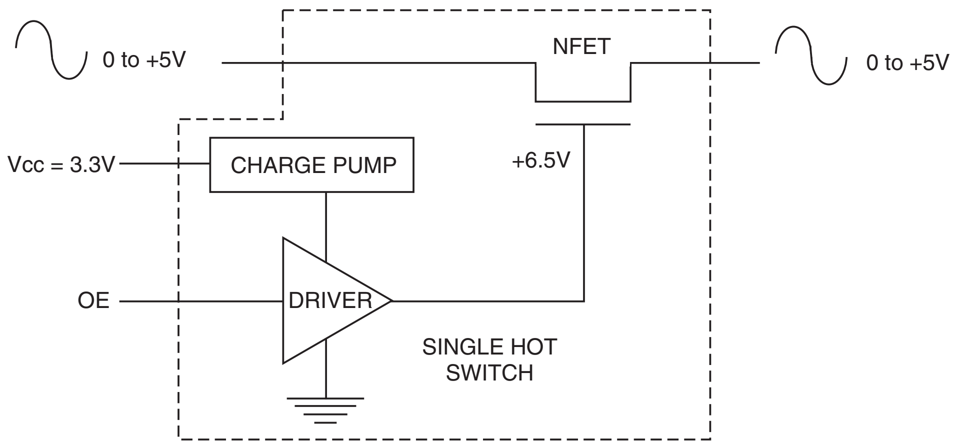
SWITCHING CHARACTERISTICS OVER OPERATING RANGE

T_A = -40°C to +85°C

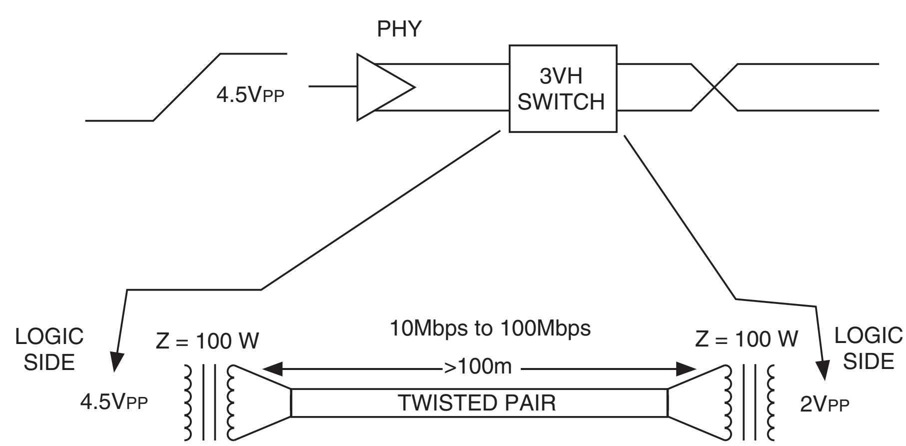
Symbol	Parameter	Vcc = 2.5 ± 0.2V (1) Min. (4)	Vcc = 2.5 ± 0.2V (1) Max.	Vcc = 3.3 ± 0.3V (1) Min. (4)	Vcc = 3.3 ± 0.3V (1) Max.	Unit
t_{PLH} t_{PHL}	Data Propagation Delay(2,3) A to B or B to A	—	0.2	—	0.2	ns
t_{BX}	Switch Multiplex Delay SEL to xA	1.5	9	1.5	7.5	ns
t_{PZH} t_{PZL}	Switch Turn-On Delay 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, $R_{LOAD} \geq 1M\Omega$, no C_{LOAD}).

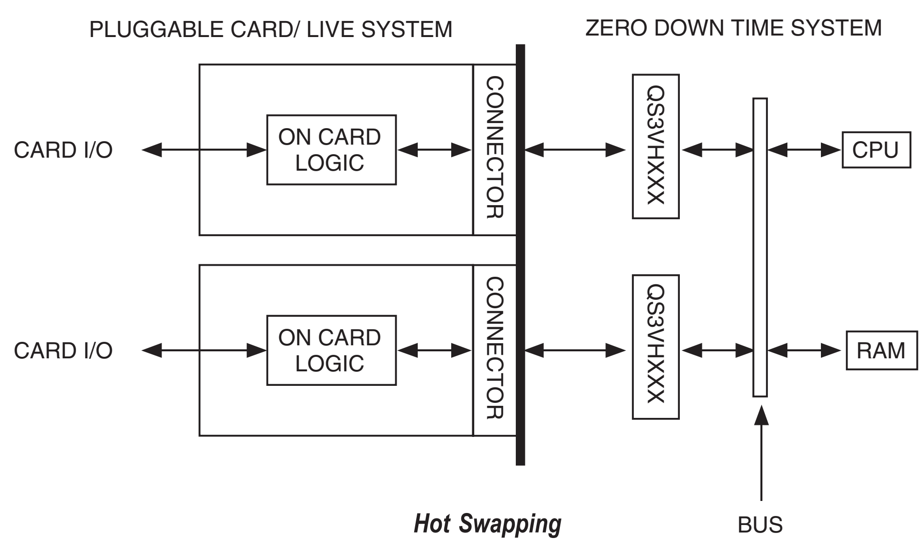
SOME APPLICATIONS FOR HOTSWITCH PRODUCTS



Rail-to-Rail Switching



Fast Ethernet Data Switching (LAN Switch)

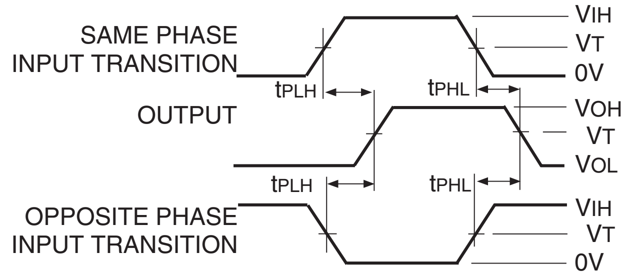


Hot Swapping

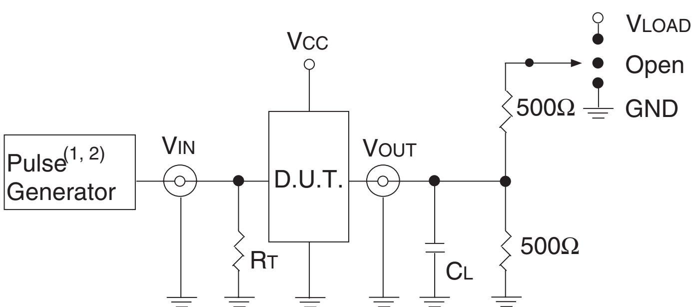
TEST CIRCUITS AND WAVEFORMS

TEST CONDITIONS

Symbol	Vcc(1)= 3.3V ± 0.3V	Vcc(2)= 2.5V ± 0.2V	Unit
VLOAD	6	2 x Vcc	V
VIH	3	Vcc	V
VT	1.5	Vcc/2	V
VLZ	300	150	mV
VHZ	300	150	mV
CL	50	30	pF



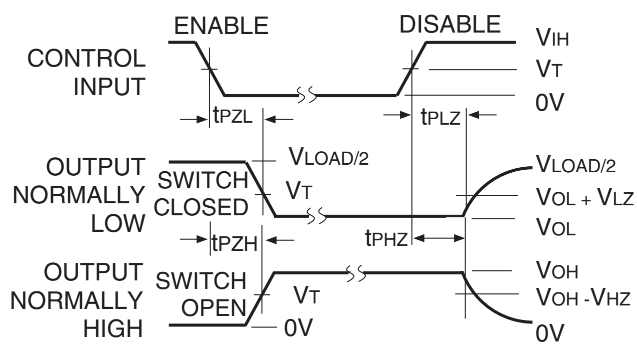
Propagation Delay



Test Circuits for All Outputs

DEFINITIONS:
CL = Load capacitance: includes jig and probe capacitance.
RT = Termination resistance: should be equal to ZOUT of the Pulse Generator.

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



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

Enable and Disable Times

SWITCH POSITION

Test	Switch
tPLZ/tPZL	VLOAD
tPHZ/tPZH	GND
tPD	Open

ORDERING INFORMATION

QS XXXXX XX X

XXXXX = Device Type, XX = Package

Blank	Tube or Tray
8	Tape and Reel
PAG	Thin Shrink Small Outline Package - TSSOP Green
3VH16233	2.5V / 3.3V 32:16 Mux / Demux High Bandwidth Switch

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