QUICKSWITCH® PRODUCTS 2.5V / 3.3V 16-BIT HIGH BANDWIDTH BUS SWITCH

IDTQS32XVH2245

FEATURES:

- **N channel FET switches with no parasitic diode to V_{CC}**
  - *Isolation under power-off conditions*
  - *No DC path to V_{CC} or GND*
  - *5V tolerant in OFF and ON state*
- **5V tolerant I/Os**
- **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**
- **V_{CC} operation: 2.3V to 3.6V**
- **High bandwidth**
- **LVTTL-compatible control Inputs**
- **Undershoot Clamp Diodes on all switch and control Inputs**
- **Low I/O capacitance, 4pF typical**
- **25Ω resistors for low noise and line matching**
- **Available in 40-pin QVSOP package**

APPLICATIONS:

- **Hot-swapping**
- **Low distortion analog switch**
- **Replaces mechanical relay**
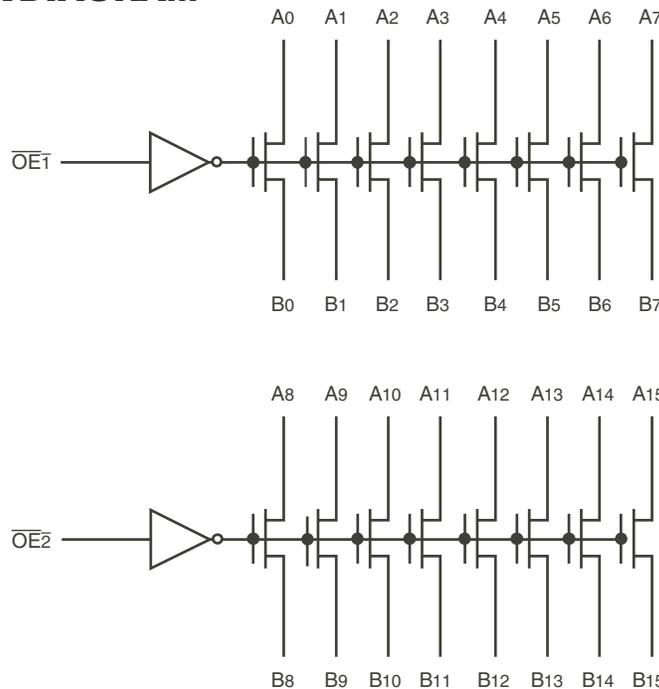- **ATM 25/155 switching**

DESCRIPTION:

The QS32XVH2245 HotSwitch is a high bandwidth, 16-bit bus switch. The QS32XVH2245, with 25Ω ON resistance and 1.35ns propagation delay, is ideal for line matching and low noise environments. The switches can be turned ON under the control of the LVTTL-compatible Output Enable ($\overline{OEx}$) signal for bidirectional data flow with no added delay or ground bounce. In the ON state, the switches can pass signals up to 5V. In the OFF state, the switches offer very high impedance at the terminals.
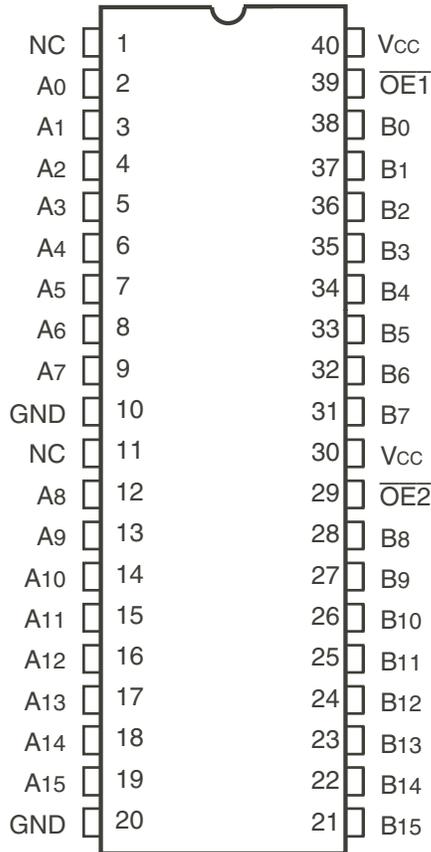
The combination of small propagation delay, high OFF impedance, and over-voltage tolerance makes the QS32XVH2245 ideal for hot-swapping applications.

The QS32XVH2245 is characterized for operation from -40°C to +85°C.

FUNCTIONAL BLOCK DIAGRAM

INDUSTRIAL TEMPERATURE RANGE

JUNE 2011

DSC-5777/14

PIN CONFIGURATION

```
        NC  | 1         40 |  Vcc
        A0  | 2         39 |  OE1
        A1  | 3         38 |  B0
        A2  | 4         37 |  B1
        A3  | 5         36 |  B2
        A4  | 6         35 |  B3
        A5  | 7         34 |  B4
        A6  | 8         33 |  B5
        A7  | 9         32 |  B6
       GND  | 10        31 |  B7
        NC  | 11        30 |  Vcc
        A8  | 12        29 |  OE2
        A9  | 13        28 |  B8
       A10  | 14        27 |  B9
       A11  | 15        26 |  B10
       A12  | 16        25 |  B11
       A13  | 17        24 |  B12
       A14  | 18        23 |  B13
       A15  | 19        22 |  B14
       GND  | 20        21 |  B15
```

QVSOP
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. sink 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)	4	6	pF
$C_{I/O}$	Quickswitch Channels (Switch ON)	8	12	pF

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

PIN DESCRIPTION

Pin Names	Description
OEx	Output Enable
A x	Data I/Os
B x	Data I/Os

FUNCTION TABLE[1]

OEx	Function
H	Disconnected
L	Connect (Ax = Bx)

NOTE:
1. H = HIGH Voltage Level
   L = LOW Voltage Level

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

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 LOW 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 ≤ V_{IN} ≤ V_{CC}			—	—	±1	µA
I_{OZ}	Off-State Current (Hi-Z)	0V ≤ V_{OUT} ≤ 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	18	27	39	Ω
		Typical at V_{CC} = 2.5V	V_{IN} = 1.7V	I_{ON} = 15mA	18	28	41	
		V_{CC} = 3V	V_{IN} = 0V	I_{ON} = 30mA	18	25	38	
			V_{IN} = 2.4V	I_{ON} = 15mA	18	26	40	

NOTE:
1. Typical values are at V_{CC} = 3.3V and T_A = 25°C.

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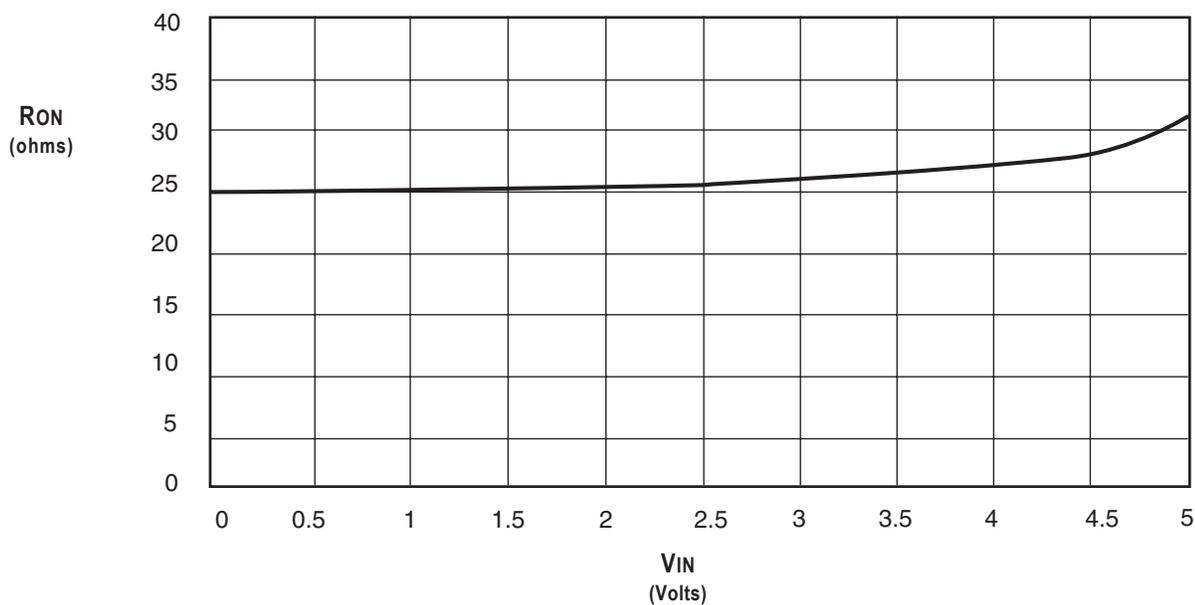
POWER SUPPLY CHARACTERISTICS

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	—	4	8	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 per Output Enable Control Input[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)
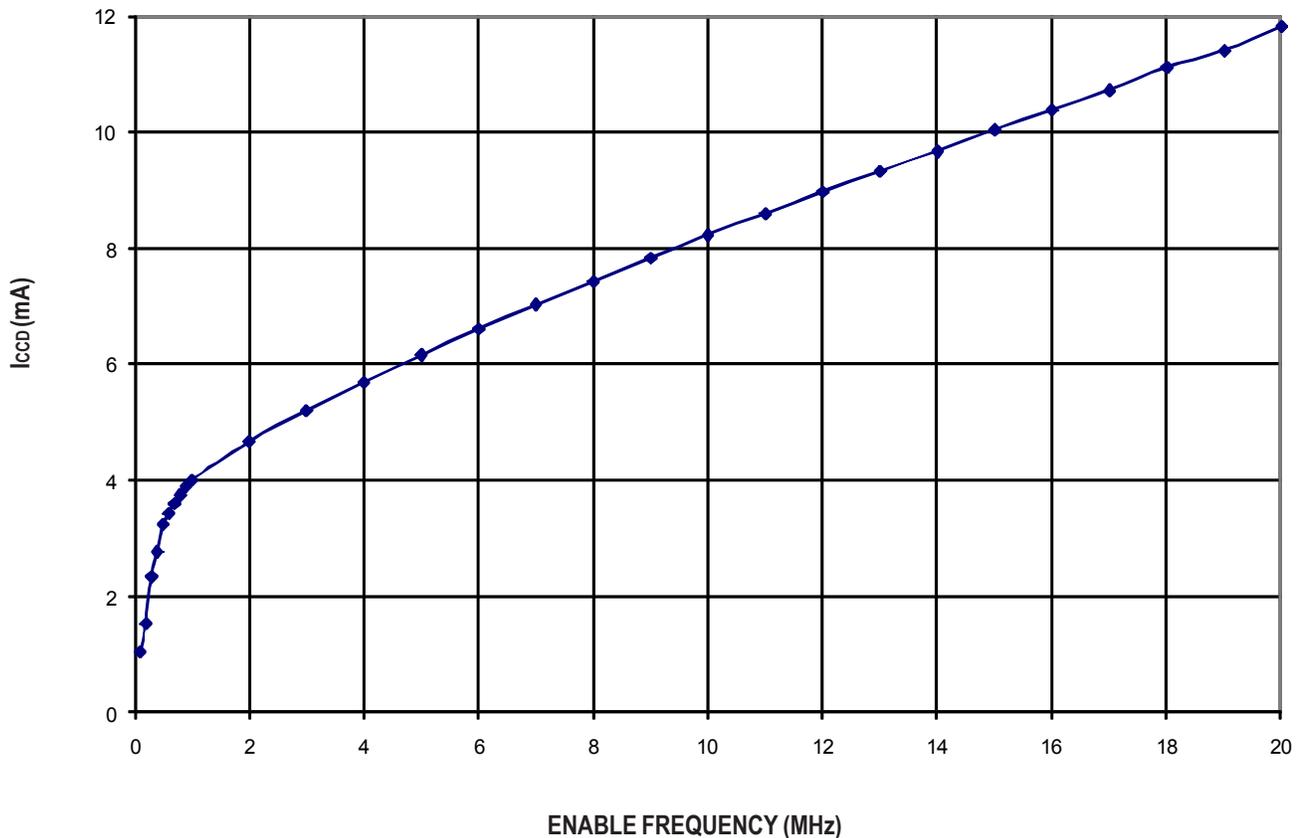
SWITCHING CHARACTERISTICS OVER OPERATING RANGE

T_A = -40°C to +85°C

Symbol	Parameter	V_{CC} = 2.5 ± 0.2V [1]		V_{CC} = 3.3 ± 0.3V [1]		Unit
		Min. [4]	Max.	Min. [4]	Max.	
t_{PLH} t_{PHL}	Data Propagation Delay[2,3] Ax to/from Bx	——	0.9	——	1.35	ns
t_{PZL} t_{PZH}	Switch Turn-On Delay $\overline{OEx}$ to Ax/Bx	1.5	9	1.5	8	ns
t_{PLZ} t_{PHZ}	Switch Turn-Off Delay $\overline{OEx}$ to Ax/Bx	1.5	7.5	1.5	7.5	ns
$f\overline{OEx}$	Operating Frequency - Enable[2,5]	——	10	——	20	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 1.35ns 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 $\overline{OEx}$ control input (pass voltage > V_{CC}, V_{IN} = 5V, R_{LOAD} ≥ 1MΩ, no C_{LOAD}).
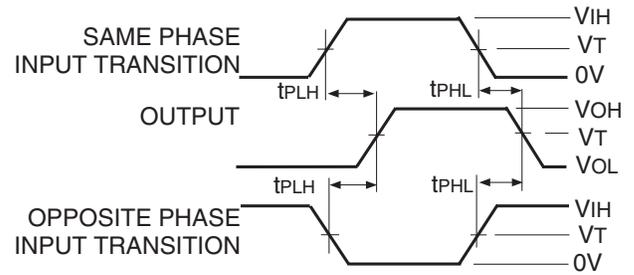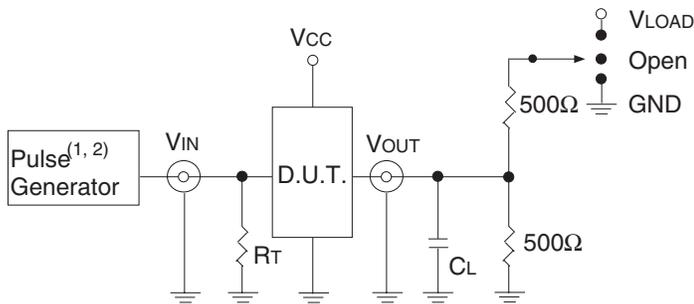
SOME APPLICATIONS FOR HOTSWITCH PRODUCTS

Rail-to-Rail Switching

Hot-Swapping
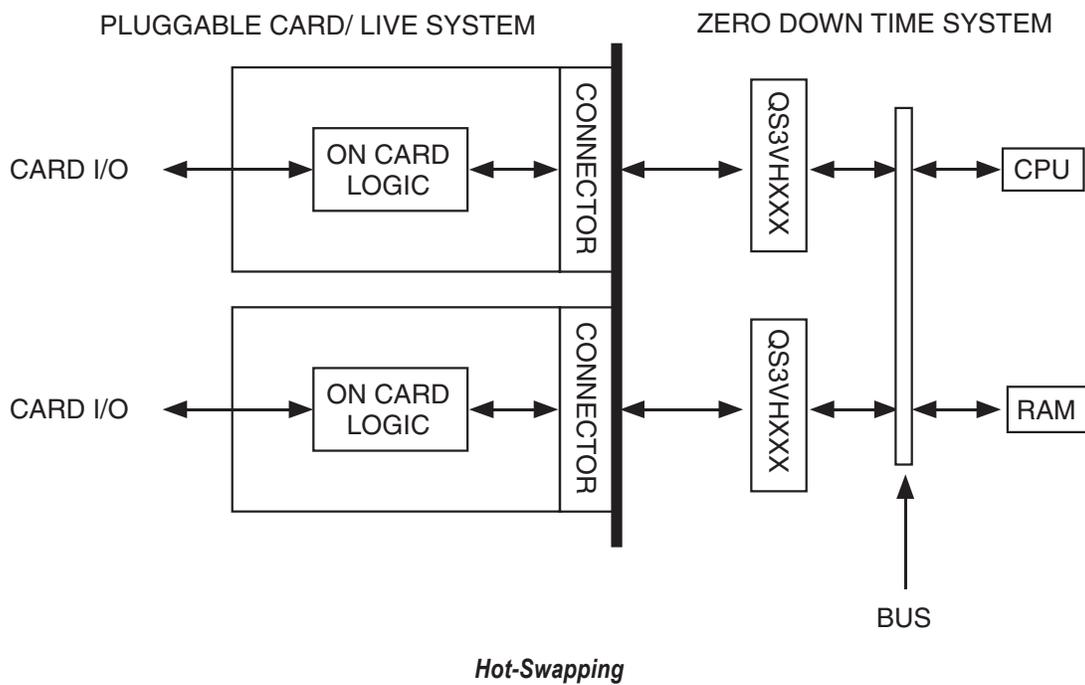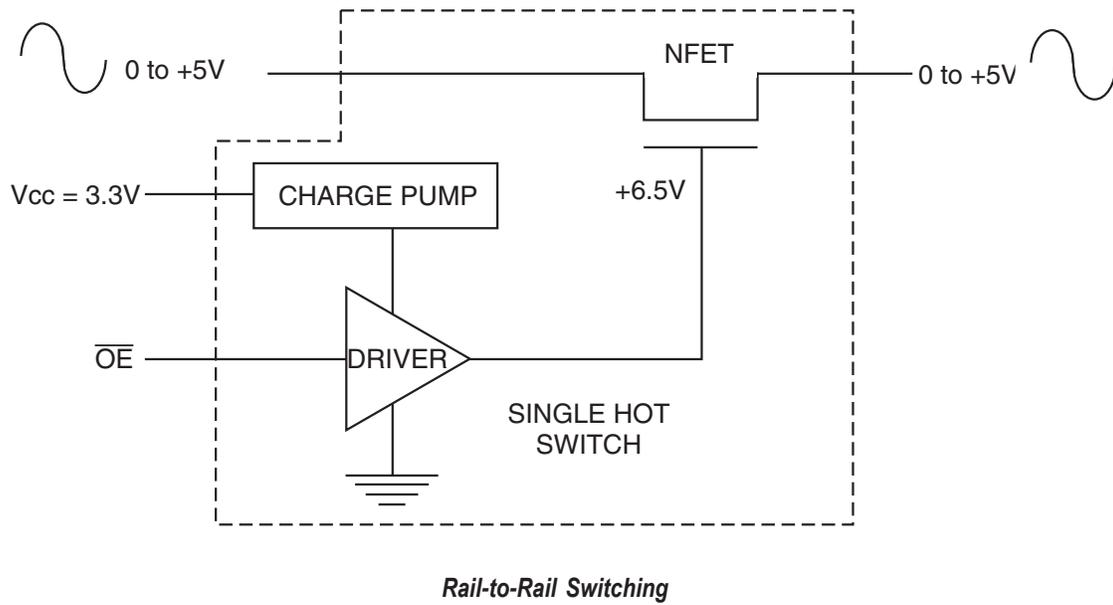
TEST CIRCUITS AND WAVEFORMS

TEST CONDITIONS

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

Propagation Delay

Test Circuits for All Outputs

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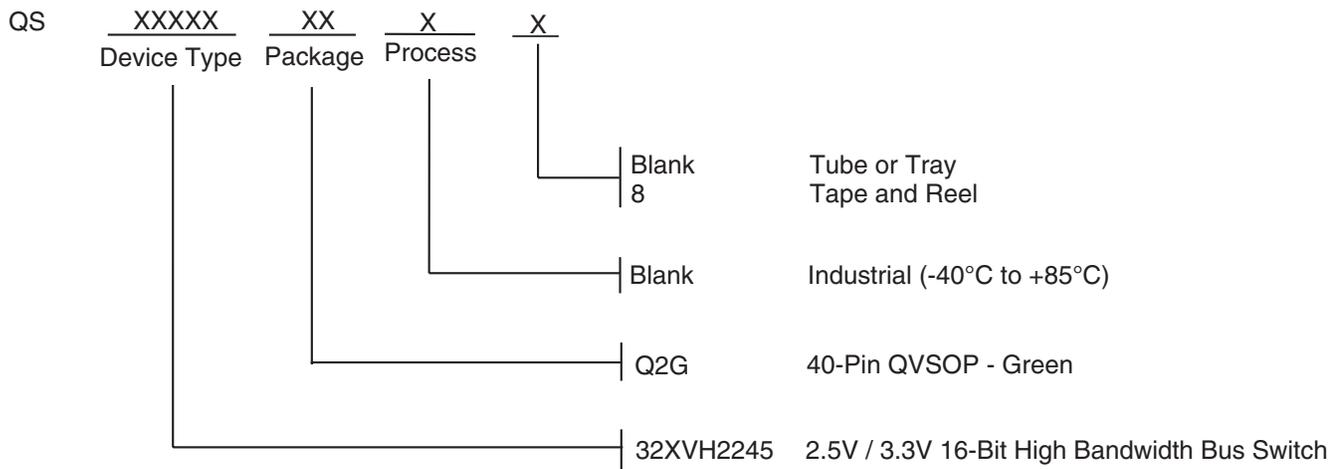R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

NOTES:
1. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_F ≤ 2.5ns; t_R ≤ 2.5ns.
2. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_F ≤ 2ns; t_R ≤ 2ns.
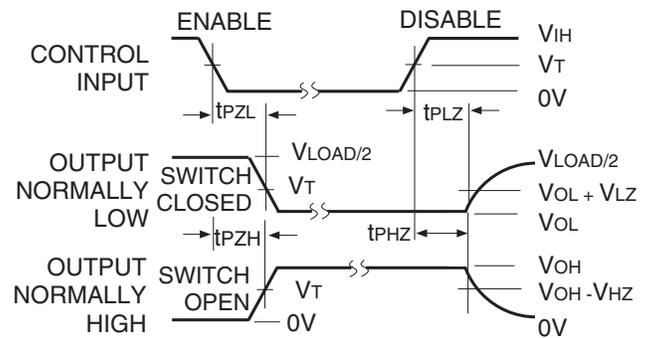
NOTE:
1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

Enable and Disable Times

SWITCH POSITION

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

ORDERING INFORMATION

```
QS      XXXXX      XX      X      X
      Device Type  Package  Process
```

Blank	Tube or Tray
8	Tape and Reel
Blank	Industrial (-40°C to +85°C)
Q2G	40-Pin QVSOP - Green
32XVH2245	2.5V / 3.3V 16-Bit High Bandwidth Bus Switch

Datasheet Document History

09/01/08	Pg. 4, 8	Revise I_{CCQ} Typ. and Max. Remove non green package version and updated the ordering information by removing the "IDT" notation.
06/14/11	Pg. 8	Updated ordering information to include tube or tray and tape & reel.

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