

## 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<sub>ON</sub> , 4Ω typical
- Flat R<sub>ON</sub> characteristics over operating range
- Rail-to-rail switching 0 - 5V
- Bidirectional dataflow with near-zero delay: no added ground bounce
- Excellent R<sub>ON</sub> matching between channels
- Vcc operation: 2.3V to 3.6V
- High bandwidth - up to 500MHz
- LVTTTL-compatible control Inputs
- Undershoot Clamp Diodes on all switch and control Inputs
- Low I/O capacitance, 4pF typical
- Available in 80-pin QVSOP package

## APPLICATIONS:

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

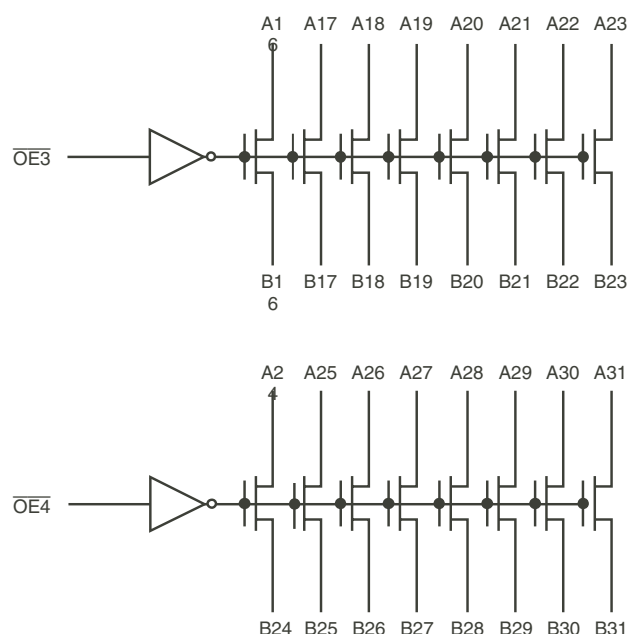
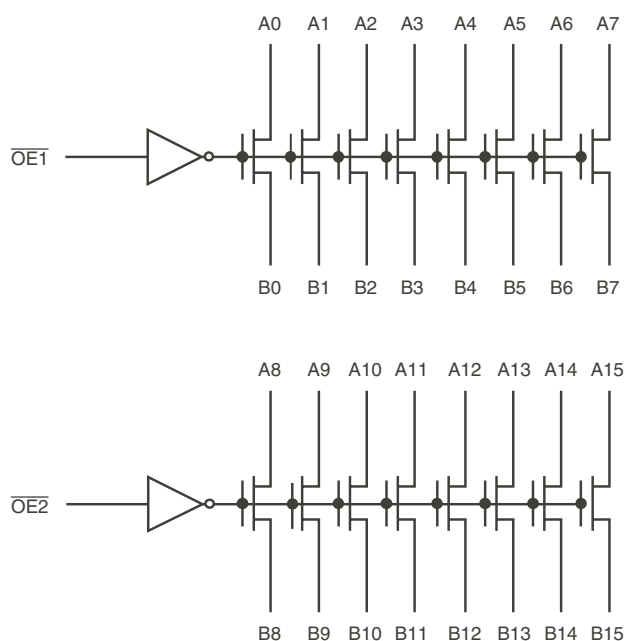
## DESCRIPTION:

The QS34XVH245 HotSwitch is a high bandwidth 32-bit bus switch. The QS34XVH245 has very low ON resistance, resulting in under 250ps propagation delay through the switch. The switches can be turned ON under the control of individual LVTTTL-compatible Output Enable ( $\overline{OE}x$ ) signals for bidirectional data flow with no added delay or ground bounce. In the ON state, the switches can pass up to 5V. 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 makes the QS34XVH245 ideal for high performance communications applications.

The QS34XVH245 is characterized for operation from -40°C to +85°C.

## FUNCTIONAL BLOCK DIAGRAM

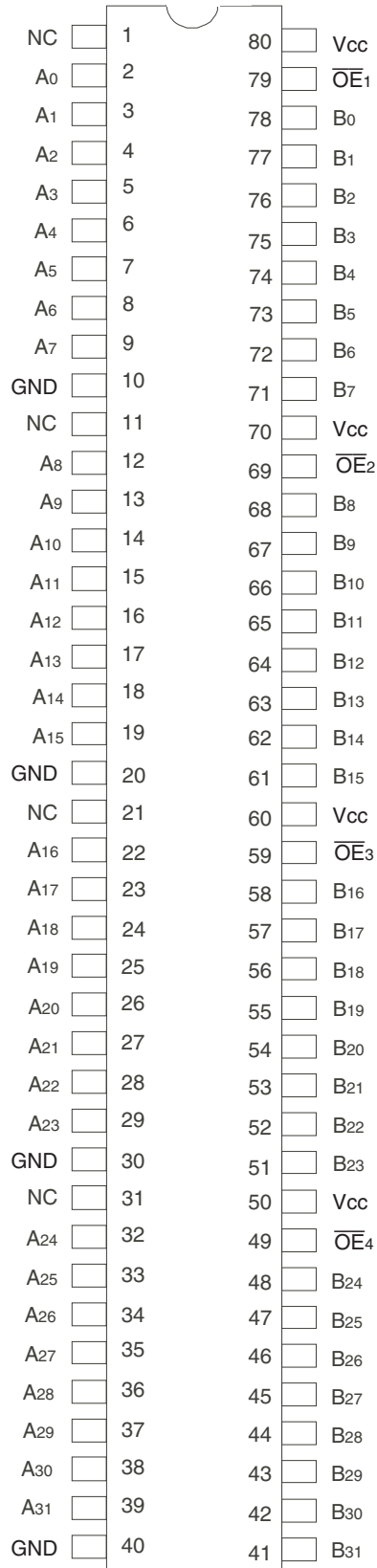


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**INDUSTRIAL TEMPERATURE RANGE**

**JANUARY 2013**

## PIN CONFIGURATION



## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

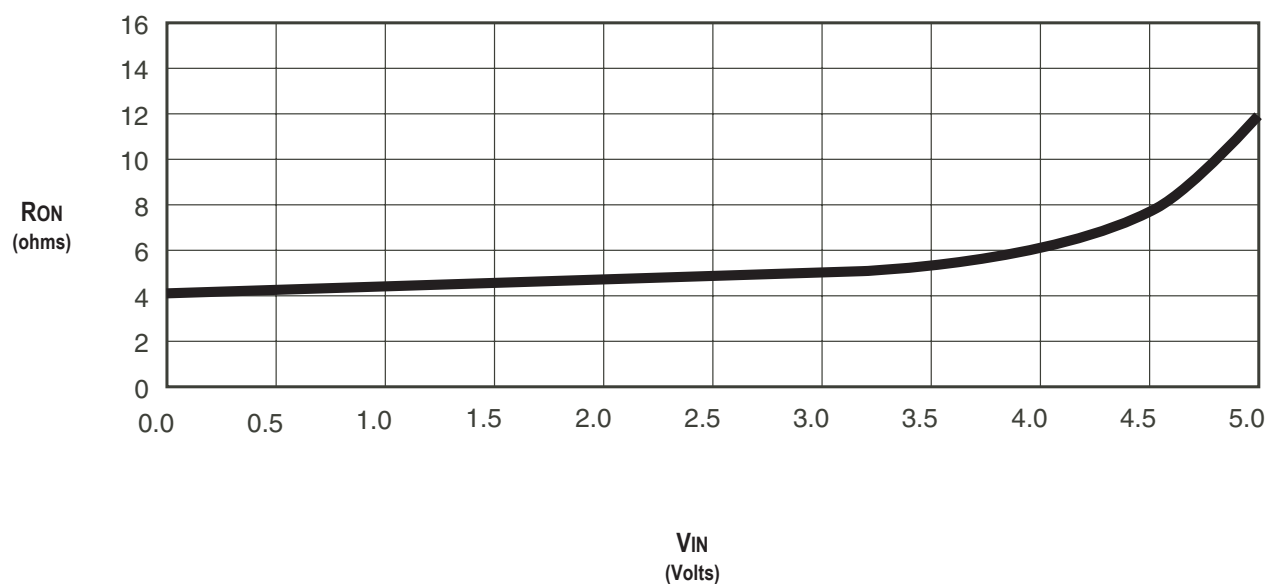
Industrial:  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 0.3\text{V}$

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

### NOTE:

1. Typical values are at  $V_{CC} = 3.3\text{V}$  and  $T_A = 25^{\circ}\text{C}$ .

## TYPICAL ON RESISTANCE vs $V_{IN}$ AT $V_{CC} = 3.3\text{V}$



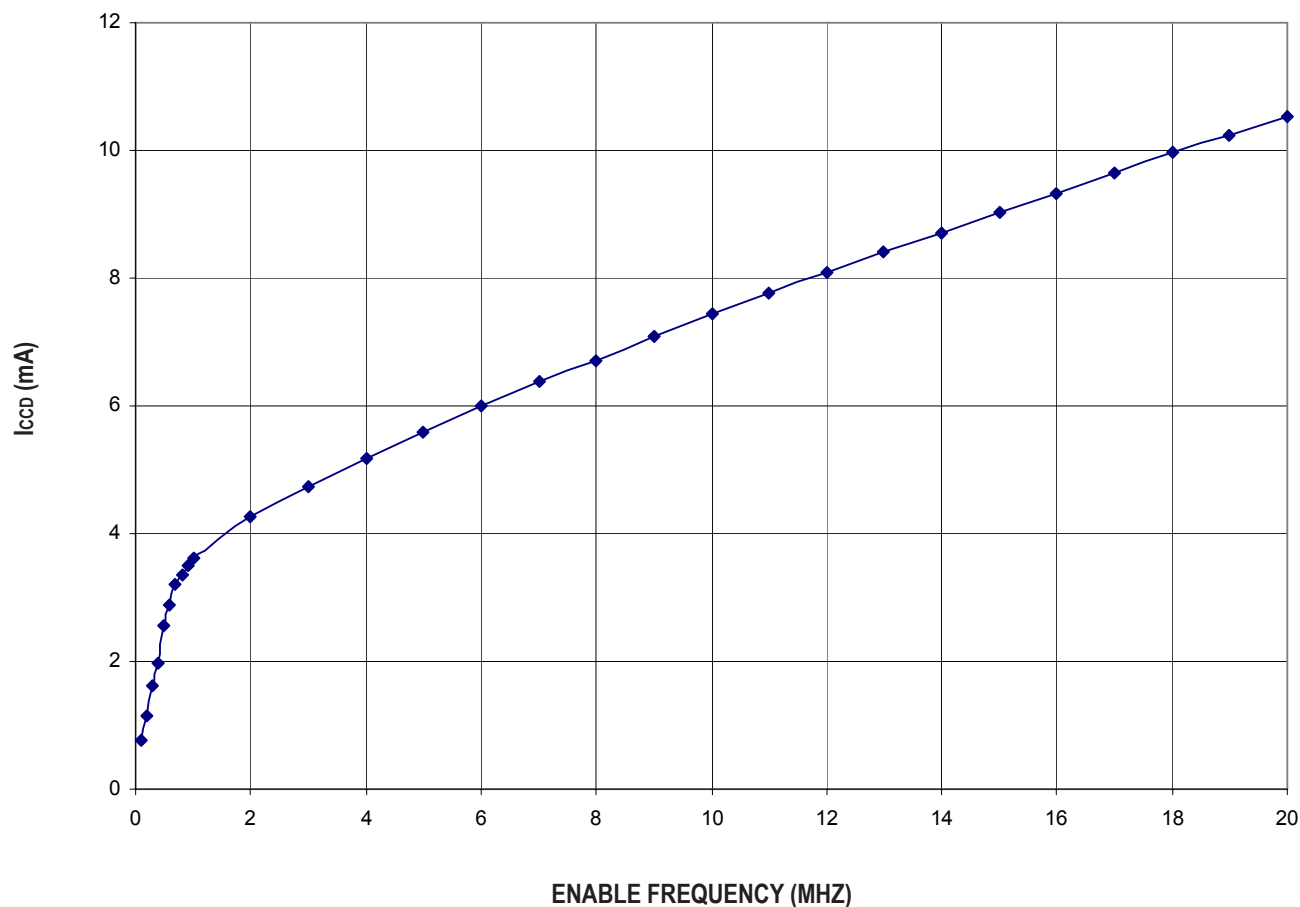
## POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions <sup>(1)</sup>	Min.	Typ.	Max.	Unit
I <sub>CCQ</sub>	Quiescent Power Supply Current	V <sub>CC</sub> = Max., V <sub>IN</sub> = GND or V <sub>CC</sub> , f = 0	—	8	16	mA
ΔI <sub>CC</sub>	Power Supply Current <sup>(2,3)</sup> per Input HIGH	V <sub>CC</sub> = Max., V <sub>IN</sub> = 3V, f = 0 per Control Input	—	—	30	μA
I <sub>CCD</sub>	Dynamic Power Supply Current per Output Enable Control Input <sup>(4)</sup>	V <sub>CC</sub> = 3.3V, A and B Pins Open, Control Inputs Toggling @ 50% Duty Cycle	See Typical I <sub>CCD</sub> 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<sub>CC</sub>.
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<sub>CCD</sub> vs ENABLE FREQUENCY CURVE AT V<sub>CC</sub> = 3.3V



## SWITCHING CHARACTERISTICS OVER OPERATING RANGE

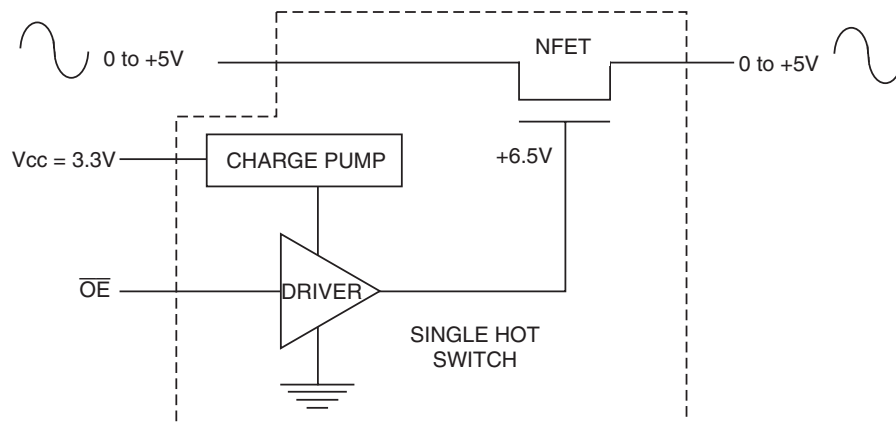
T<sub>A</sub> = -40°C to +85°C

Symbol	Parameter	V <sub>CC</sub> = 2.5 ± 0.2V <sup>(1)</sup>		V <sub>CC</sub> = 3.3 ± 0.3V <sup>(1)</sup>		Unit
		Min. <sup>(4)</sup>	Max.	Min. <sup>(4)</sup>	Max.	
t <sub>PLH</sub> t <sub>PHL</sub>	Data Propagation Delay <sup>(2,3)</sup> A <sub>x</sub> to/from B <sub>x</sub>	—	0.2	—	0.2	ns
t <sub>PZH</sub> t <sub>PZL</sub>	Switch Turn-On Delay O <sub>Ex</sub> to A <sub>x</sub> /B <sub>x</sub>	1.5	8	1.5	7	ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Switch Turn-Off Delay O <sub>Ex</sub> to A <sub>x</sub> /B <sub>x</sub>	1.5	7	1.5	6.5	ns
f <sub>O<sub>Ex</sub></sub>	Operating Frequency - Enable <sup>(2,5)</sup>	—	10	—	20	MHz

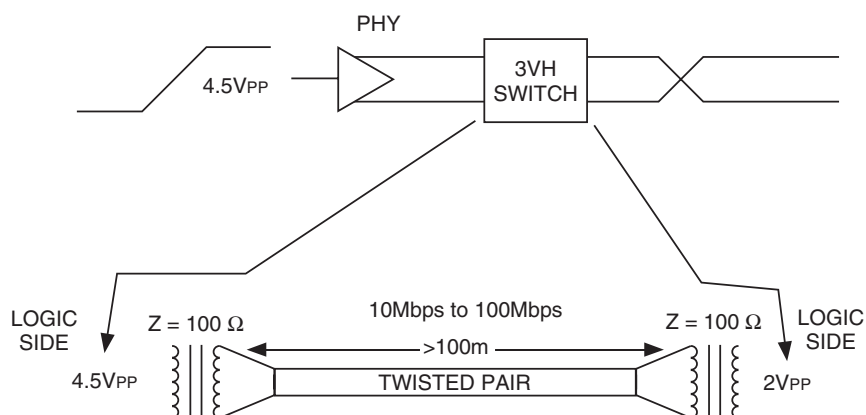
### NOTES:

- See Test Conditions under TEST CIRCUITS AND WAVEFORMS.
- This parameter is guaranteed but not production tested.
- 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<sub>L</sub> = 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.
- Minimums are guaranteed but not production tested.
- Maximum toggle frequency for O<sub>Ex</sub> control input (pass voltage > V<sub>CC</sub>, V<sub>IN</sub> = 5V, R<sub>LOAD</sub> ≥ 1MΩ, no C<sub>LOAD</sub>).

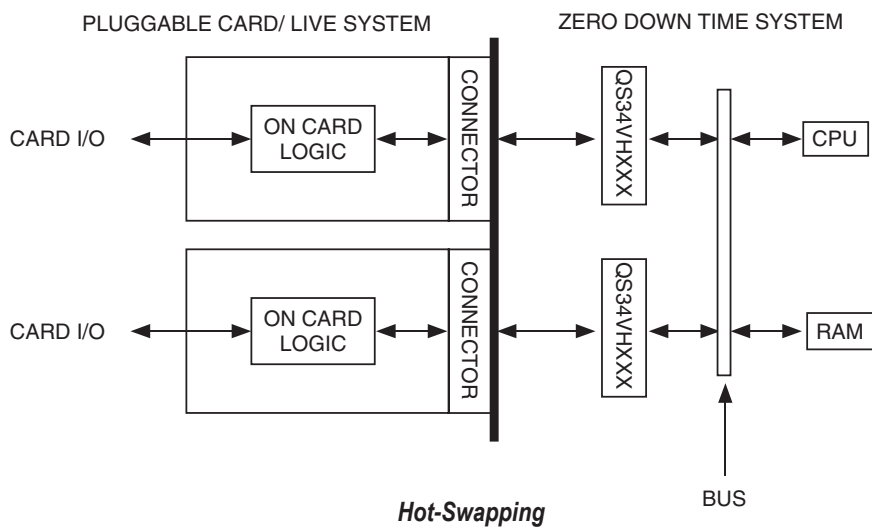
## SOME APPLICATIONS FOR HOTSWITCH PRODUCTS



*Rail-to-Rail Switching*



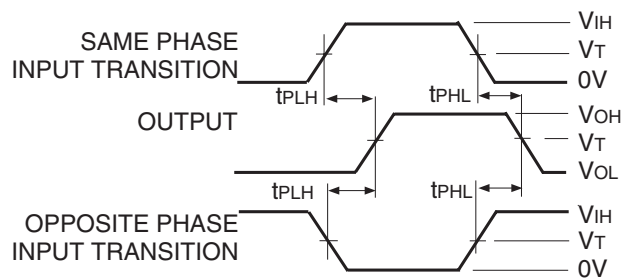
*Fast Ethernet Data Switching (LAN Switch)*



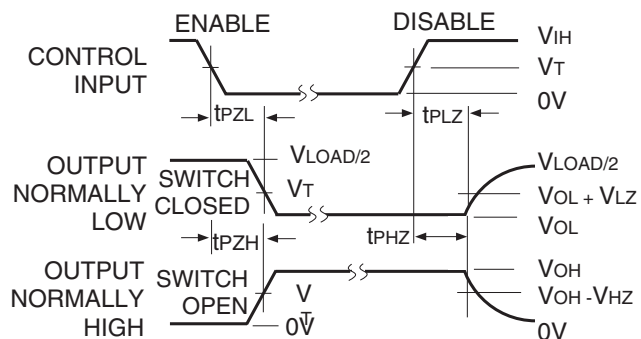
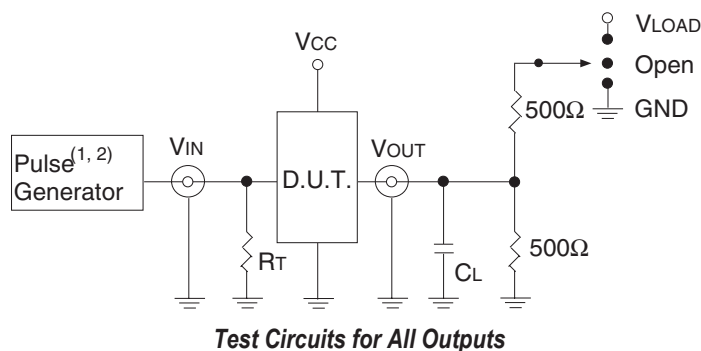
## TEST CIRCUITS AND WAVEFORMS

### TEST CONDITIONS

Symbol	$V_{CC}^{(1)} = 3.3V \pm 0.3V$	$V_{CC}^{(2)} = 2.5V \pm 0.2V$	Unit
$V_{LOAD}$	6	$2 \times V_{CC}$	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*



**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:**

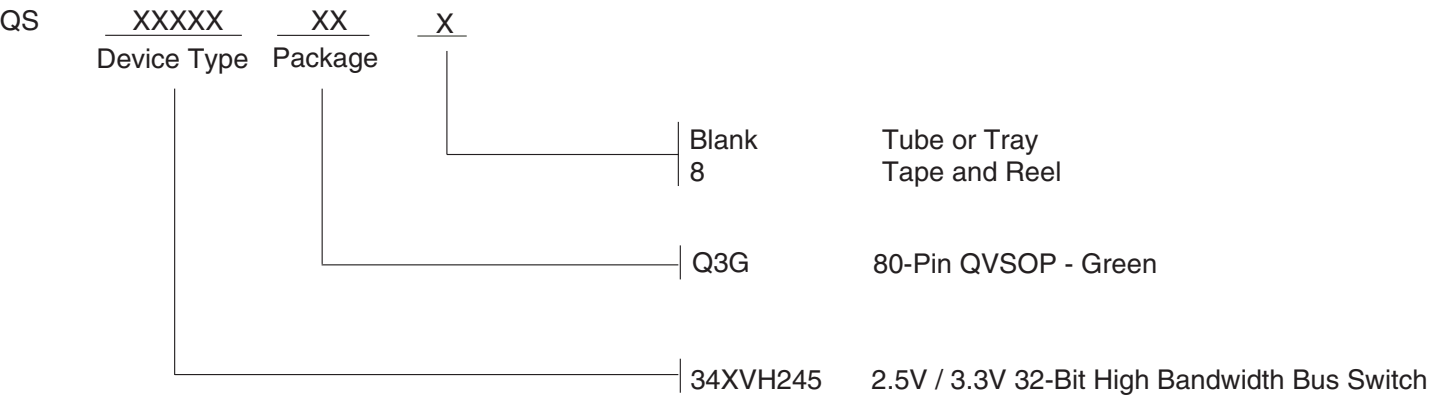
1. Pulse Generator for All Pulses: Rate  $\leq 10\text{MHz}$ ;  $t_f \leq 2.5\text{ns}$ ;  $t_r \leq 2.5\text{ns}$ .

2. Pulse Generator for All Pulses: Rate  $\leq 10\text{MHz}$ ;  $t_f \leq 2\text{ns}$ ;  $t_r \leq 2\text{ns}$ .

### SWITCH POSITION

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

ORDERING INFORMATION





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