

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

DESCRIPTION:

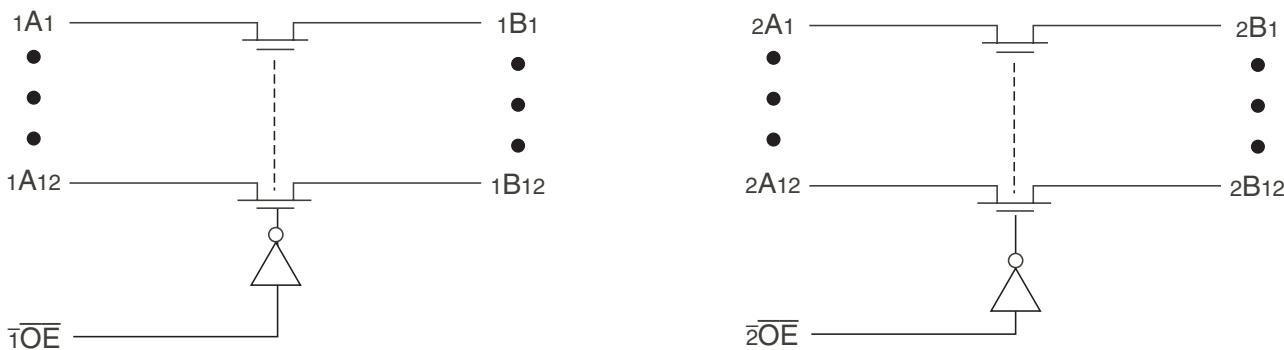
The QS3VH16211 HotSwitch is a 24-bit high bandwidth bus switch. The QS3VH16211 has very low ON resistance, resulting in under 250ps propagation delay through the switch. This device operates as a 24-bit bus switch. When $\bar{1OE}$ is low, 1An is connected to 1Bn. When $\bar{2OE}$ is low, 2An is connected to 2Bn. 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 makes the QS3VH16211 ideal for high performance communications applications. It is also suitable for switching wide digital buses.

The QS3VH16211 is characterized for operation from -40°C to +85°C.

APPLICATIONS:

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

FUNCTIONAL BLOCK DIAGRAM

PIN CONFIGURATION

NC	1	56	$\bar{1OE}$
1A1	2	55	$\bar{2OE}$
1A2	3	54	1B1
1A3	4	53	1B2
1A4	5	52	1B3
1A5	6	51	1B4
1A6	7	50	1B5
GND	8	49	GND
1A7	9	48	1B6
1A8	10	47	1B7
1A9	11	46	1B8
1A10	12	45	1B9
1A11	13	44	1B10
1A12	14	43	1B11
2A1	15	42	1B12
2A2	16	41	2B1
VCC	17	40	2B2
2A3	18	39	2B3
GND	19	38	GND
2A4	20	37	2B4
2A5	21	36	2B5
2A6	22	35	2B6
2A7	23	34	2B7
2A8	24	33	2B8
2A9	25	32	2B9
2A10	26	31	2B10
2A11	27	30	2B11
2A12	28	29	2B12

TSSOP
TOP VIEW

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

Symbol	Description	Max.	Unit
VTERM ⁽²⁾	Supply Voltage to Ground	-0.5 to 4.6	V
VTERM ⁽³⁾	DC Switch Voltage Vs	-0.5 to 5.5	V
VTERM ⁽³⁾	DC Input Voltage Vin	-0.5 to 5.5	V
VAC	AC Input Voltage (pulse width $\leq 20\text{ns}$)	-3	V
Iout	DC Output Current (max. current/pin)	120	mA
TSTG	Storage Temperature	-65 to +150	$^{\circ}\text{C}$

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. Vcc terminals.
3. All terminals except Vcc.

CAPACITANCE ($T_A = +25^{\circ}\text{C}$, $f = 1\text{MHz}$, $VIN = 0\text{V}$, $VOUT = 0\text{V}$)

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	I/O	Description
xA1 - xA12	I/O	Bus A
xB1 - xB12	I/O	Bus B
$\bar{1OE}$ - $\bar{2OE}$	I	Data Select

FUNCTION TABLE⁽¹⁾

$\bar{1OE}$	$\bar{2OE}$	1Ax	2Ax	Function
L	L	1Bx	2Bx	1Ax to 1Bx, 2Ax to 2Bx
L	H	1Bx	Z	1Ax to 1Bx
H	L	Z	2Bx	2Ax to 2Bx
H	H	Z	Z	Disconnect

NOTE:

1. H = HIGH Voltage Level
- L = LOW Voltage Level
- Z = High-Impedance

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE⁽¹⁾

Following Conditions Apply Unless Otherwise Specified:

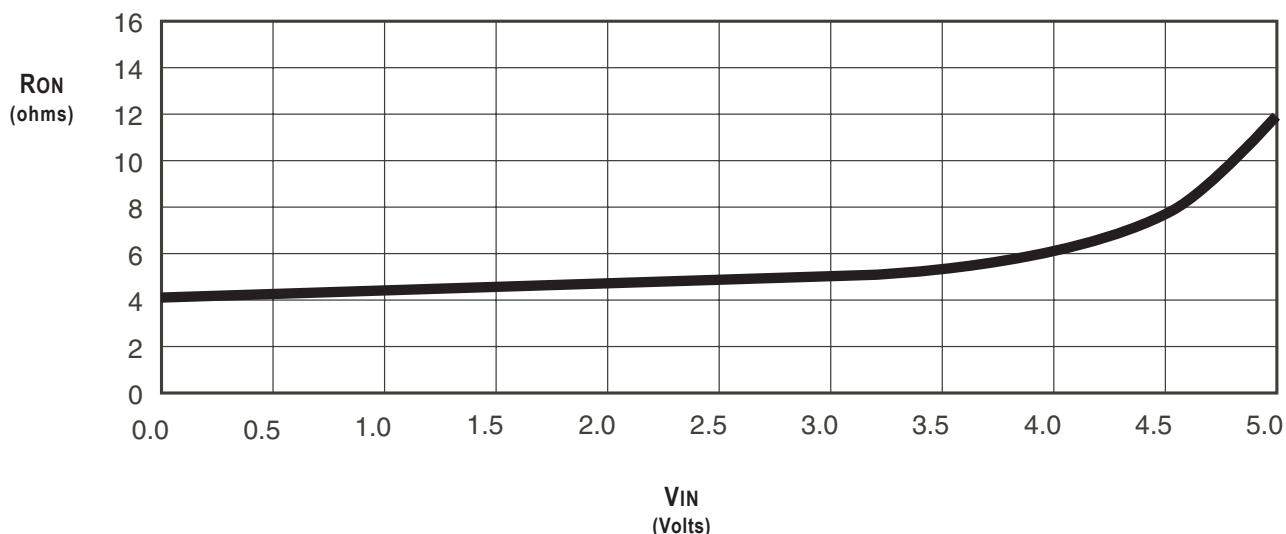
Industrial: TA = -40°C to +85°C, VCC = 3.3V ± 0.3V

Symbol	Parameter	Test Conditions			Min.	Typ. ⁽¹⁾	Max.	Unit
VIH	Input HIGH Voltage	Guaranteed Logic HIGH for Control Inputs	VCC = 2.3V to 2.7V	1.7	—	—	—	V
			VCC = 2.7V to 3.6V	2	—	—	—	
VIL	Input LOW Voltage	Guaranteed Logic HIGH for Control Inputs	VCC = 2.3V to 2.7V	—	—	0.7	—	V
			VCC = 2.7V to 3.6V	—	—	0.8	—	
IIN	Input Leakage Current (Control Inputs)	0V ≤ VIN ≤ VCC	—	—	—	±1	μA	
IOZ	Off-State Current (Hi-Z)	0V ≤ VOUT ≤ 5V, Switches OFF	—	—	—	±1	μA	
IOFF	Data Input/Output Power Off Leakage	VIN or VOUT 0V to 5V, VCC = 0V	—	—	—	±1	μA	
RON	Switch ON Resistance	VCC = 2.3V (Typ. at VCC = 2.5V)	VIN = 0V	ION = 30mA	—	6	8	Ω
		VIN = 1.7V	ION = 15mA	—	7	9		
		VIN = 0V	ION = 30mA	—	4	6		
		VIN = 2.4V	ION = 15mA	—	5	8		

NOTE:

1. Typical values are at VCC = 3.3V and TA = 25°C, unless otherwise noted.

TYPICAL ON RESISTANCE vs VIN AT VCC = 3.3V



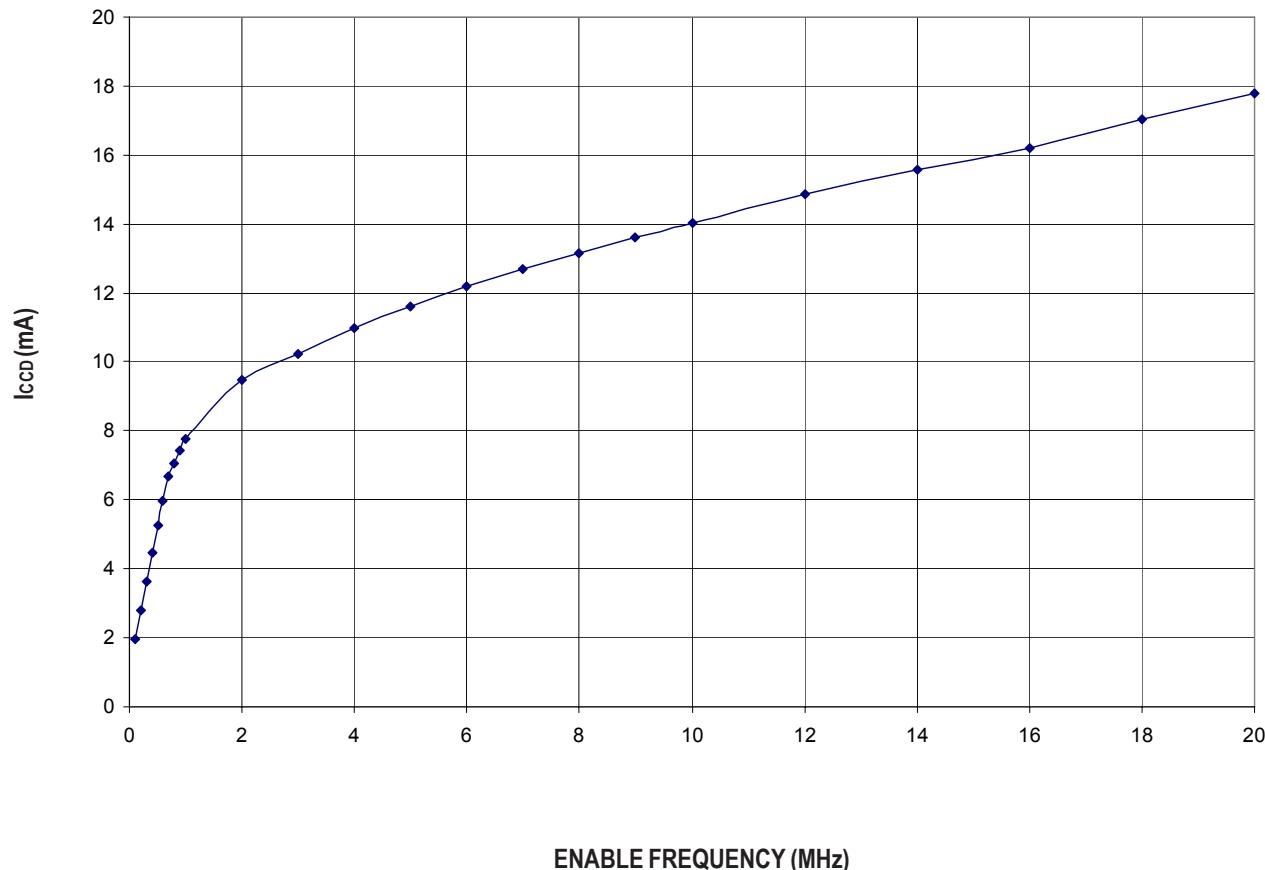
POWER SUPPLY CHARACTERISTICS

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



SWITCHING CHARACTERISTICS OVER OPERATING RANGE

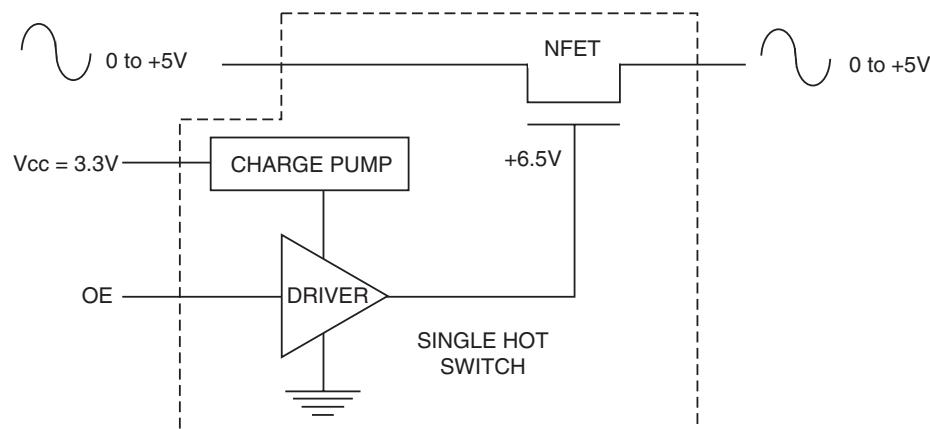
TA = -40°C to +85°C

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}	Data Propagation Delay ^(2,3) xAx to xBx or xBx to xAx	—	0.2	—	0.2	ns
t _{PHL}	Switch Turn-On Delay x _{OE} to xAx or xBx	1.5	9	1.5	9	ns
t _{PZH}	Switch Turn-Off Delay x _{OE} to xAx or xBx	1.5	8.5	1.5	8.5	ns
t _{PLZ}	Operating Frequency - Enable ^(2,5)	—	7.5	—	20	MHz

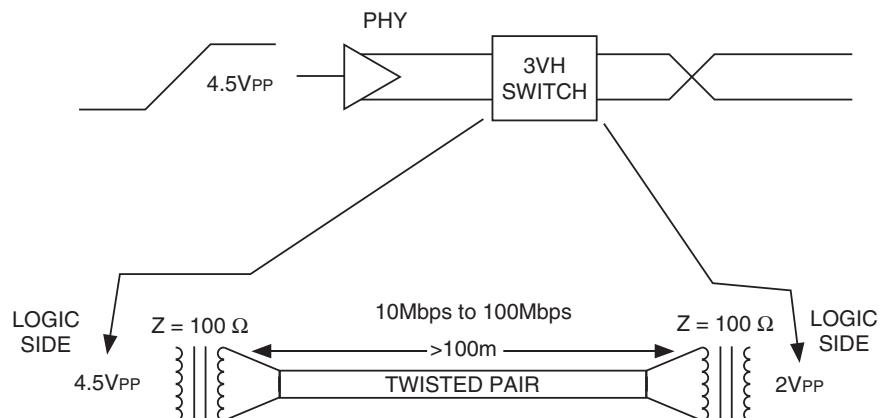
NOTES:

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 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 x_{OE} control input (pass voltage > V_{CC}, V_{IN} = 5V, R_{LOAD} ≥ 1MΩ, no C_{LOAD}).

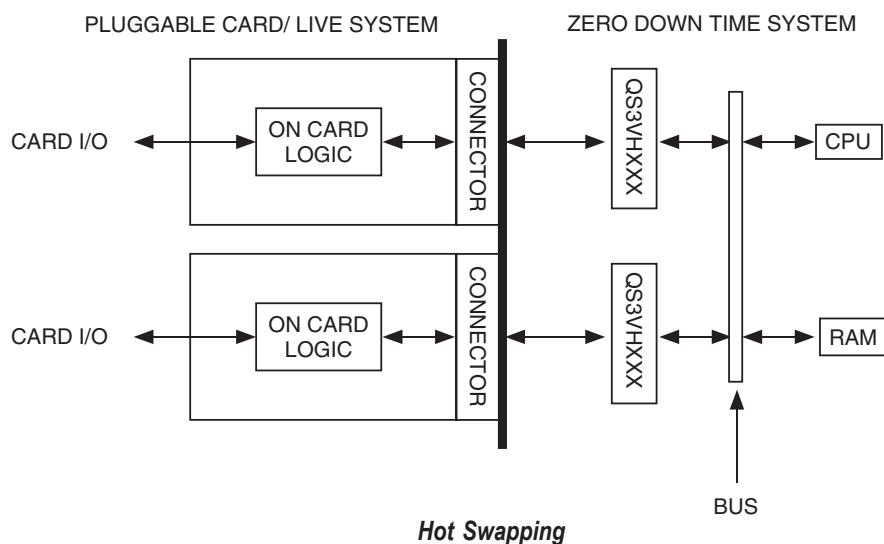
SOME APPLICATIONS FOR HOTSWITCH PRODUCTS



Rail-to-Rail Switching



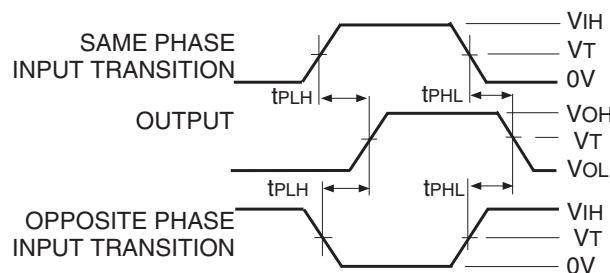
Fast Ethernet Data Switching (LAN Switch)



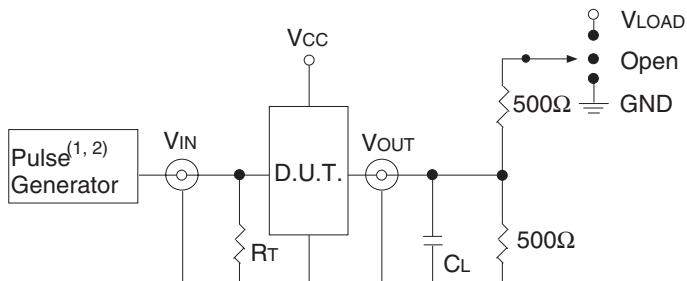
TEST CIRCUITS AND WAVEFORMS

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



Test Circuits for All Outputs

DEFINITIONS:

CL = Load capacitance: includes jig and probe capacitance.

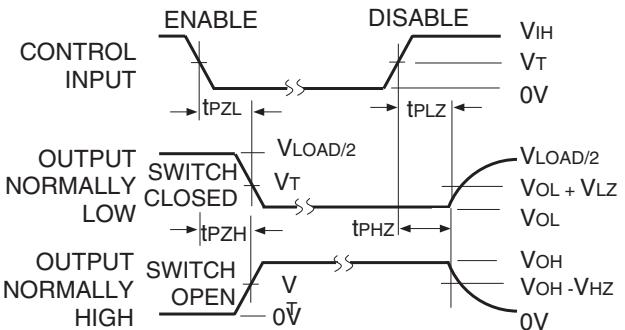
RT = Termination resistance: should be equal to ZOUT of the Pulse Generator.

NOTES:

1. Pulse Generator for All Pulses: Rate $\leq 1.0\text{MHz}$; $t_f \leq 2.5\text{ns}$; $t_r \leq 2.5\text{ns}$.
2. Pulse Generator for All Pulses: Rate $\leq 1.0\text{MHz}$; $t_f \leq 2\text{ns}$; $t_r \leq 2\text{ns}$.

SWITCH POSITION

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

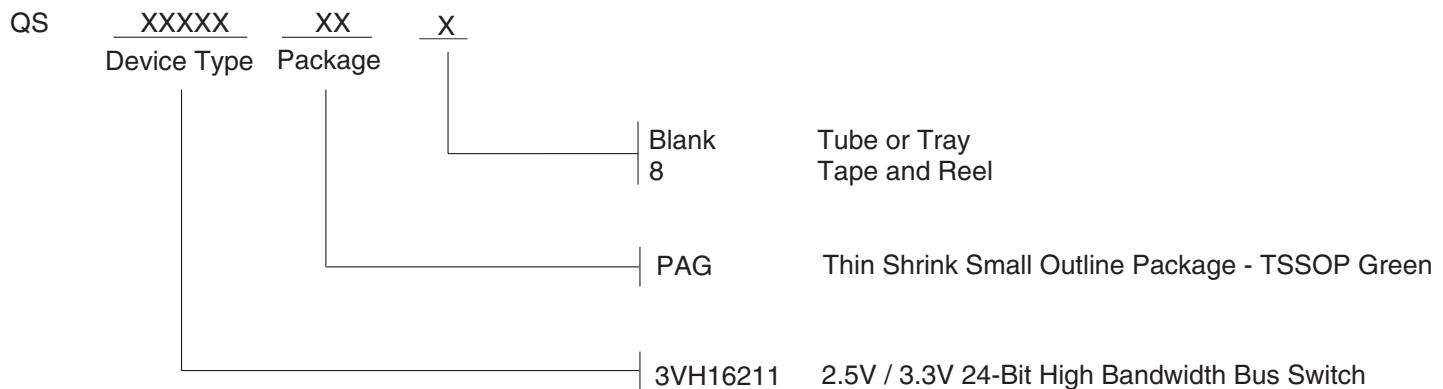


NOTE:

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

Enable and Disable Times

ORDERING INFORMATION



Datasheet Document History

01/31/13

Pg. 1, 8

Updated the Ordering Information by removing non green package version, the "IDT" notation and Adding Tape and Reel information.

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