

The TQ8017 is a non-blocking 16 x 16 digital crosspoint switch capable of data rates greater than 1.25 Gigabits per second per port. Utilizing a fully differential internal data path and PECL I/O, the TQ8017 offers a high data rate with exceptional signal fidelity. The symmetrical switching and noise rejection characteristics inherent in differential logic result in low jitter and signal skew. The TQ8017 is ideally suited for digital video, data communications and telecommunication switching applications.

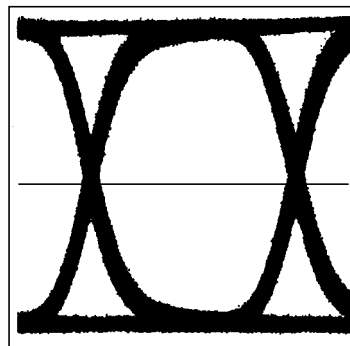
The non-blocking architecture uses 16 fully independent 16:1 multiplexers (see diagram on page 2), allowing each output port to be independently programmed to any input port. The switch is configured by sequentially loading each multiplexer's 4-bit program latch (OAO:3) with the desired input port address (IAO:3) and enabling the LOAD pin. When complete, the CONFIGURE pin is strobed and all new configurations are simultaneously transferred into the switch multiplexers. Data integrity is maintained on all unchanged data paths.

Electrical Characteristics

	<i>Min</i>	<i>Max</i>	<i>Units</i>
Data Rate/port	1.25		Gb/s
Jitter		150	ps pk-pk
Channel Propagation Delay		2000	ps
Ch-to-Ch Propagation Delay Skew		500	ps

TQ8017

**1.25 Gigabit/sec
16x16 Digital PECL
Crosspoint Switch**



Typical output waveform with all channels driven

Features

- >20 Gb/s aggregate BW
- 1.25 Gb/s/port NRZ data rate
- Non-blocking architecture
- 500 ps delay match
- Differential PECL-level data I/O; Selectable CMOS/TTL-level control inputs
- Low jitter and signal skew
- Fully differential data path
- Double-buffered configuration latches
- 132-pin MQFP package
- Single +5V supply

Applications

- Telecom/Datacom Switching
- Hubs and Routers
- Video Switching

SWITCHING PRODUCTS

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Figure 1. TQ8017 Architecture

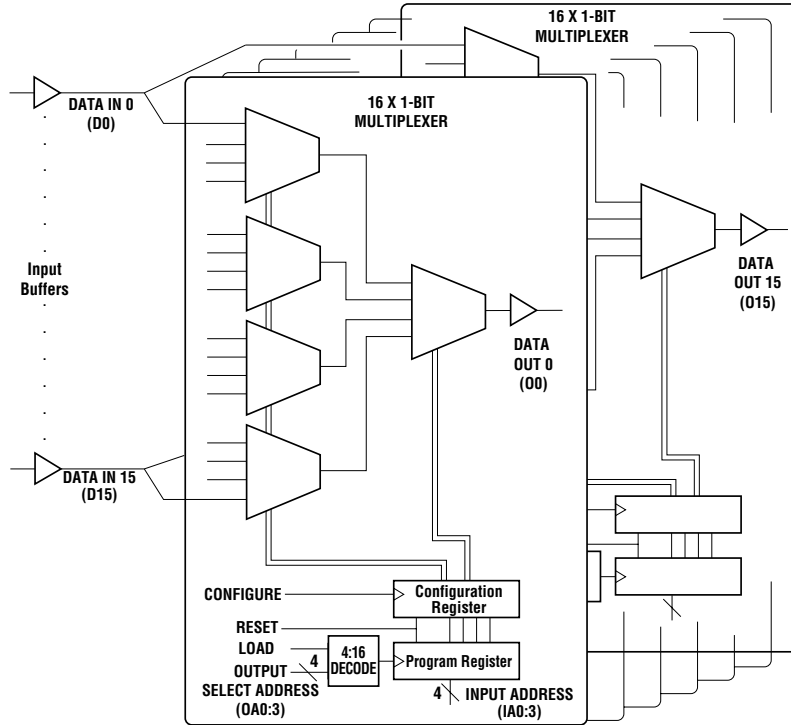


Table 1. Absolute Maximum Ratings⁵

Symbol	Parameter	Absolute Max. Rating	Notes
T _{STOR}	Storage Temperature	-65° C to +150° C	
T _{CH}	Junction (Channel) Temperature	-65° C to +150° C	1
T _C	Case Temperature Under Bias	-65° C to +125° C	2
V _{CC}	Supply Voltage	0 V to +7 V	3
V _{TT}	Load Termination Supply Voltage	V _{CC} to 0 V	4
V _{IN}	Voltage Applied to Any PECL Input; Continuous	GND -0.5 V to V _{CC} +0.5 V	
I _{IN}	Current Into Any PECL Input; Continuous	-1.0 mA to +1.0 mA	
V _{IN}	Voltage Applied to Any TTL/CMOS Input; Continuous	-0.5 V to V _{CC} +0.5 V	
I _{IN}	Current Into Any TTL/CMOS Input; Continuous	-1.0 mA to +1.0 mA	
V _{OUT}	Voltage Applied to Any PECL Output	GND -0.5 V to V _{CC} +0.5 V	4
I _{OUT}	Current From Any PECL Output; Continuous	-40 mA	
P _D	Power Dissipation per Output P _{OUT} = (GND - V _{OUT}) x I _{OUT}	50 mW	

- Notes: 1. For die applications.
 2. T_C is measured at case top.
 3. All voltages specified with respect to GND, defined as 0V.
 4. Subject to I_{OUT} and power dissipation limitations.
 5. Absolute maximum ratings, as detailed in this table, are the ratings beyond which the device's performance may be impaired and/or permanent damage to the device may occur.

Table 2. Recommended Operating Conditions⁴

Symbol	Parameter	Min	Typ	Max	Units	Notes
T _C	Case Operating Temperature	0		85	°C	1,3
V _{CC}	Supply Voltage	4.5		5.5	V	
V _{TT}	Load Termination Supply Voltage		V _{CC} - 2.0		V	2
R _{LOAD}	Output Termination Load Resistance		50		Ω	2
Θ _{JC}	Thermal Resistance Junction to Case			7	°C/W	

- Notes: 1. T_C measured at case top. Use of adequate heatsink is required.
 2. The V_{TT} and R_{LOAD} combination is subject to maximum output current and power restrictions.
 3. Contact the Factory for extended temperature range applications.
 4. Functionality and/or adherence to electrical specifications is not implied when the device is subjected to conditions that exceed, singularly or in combination, the operating range specified.

Table 3. Pin Descriptions

Signal	Name/Level	Description																														
D0 to D15, ND0 to ND15	Data input true and complement. Differential PECL	Differential data input ports.																														
O0 to O15, NO0 to NO15	Data output true and complement. Differential PECL	Differential data output ports.																														
IA0:3	Input address. CMOS/TTL	Input port selection address that is written into the selected output port program latches (OA0:3). <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>IA3</th> <th>IA2</th> <th>IA1</th> <th>IA0</th> <th>Input port</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>0</td><td>2</td></tr> <tr><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>15</td></tr> </tbody> </table>	IA3	IA2	IA1	IA0	Input port	0	0	0	0	0	0	0	0	1	1	0	0	1	0	2	⋮	⋮	⋮	⋮	⋮	1	1	1	1	15
IA3	IA2	IA1	IA0	Input port																												
0	0	0	0	0																												
0	0	0	1	1																												
0	0	1	0	2																												
⋮	⋮	⋮	⋮	⋮																												
1	1	1	1	15																												
OA0:3	Output select address. CMOS/TTL	Output port selection address. Selects the output port program latches to which the input port selection address (IA0:3) is written. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>OA3</th> <th>OA2</th> <th>OA1</th> <th>OA0</th> <th>Output port</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>0</td><td>2</td></tr> <tr><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>15</td></tr> </tbody> </table>	OA3	OA2	OA1	OA0	Output port	0	0	0	0	0	0	0	0	1	1	0	0	1	0	2	⋮	⋮	⋮	⋮	⋮	1	1	1	1	15
OA3	OA2	OA1	OA0	Output port																												
0	0	0	0	0																												
0	0	0	1	1																												
0	0	1	0	2																												
⋮	⋮	⋮	⋮	⋮																												
1	1	1	1	15																												
LOAD	CMOS/TTL	Enables the selected output port program latches while set 'high'. Latches the data when set to a 'low' level.																														
CONFIGURE	CMOS/TTL	Transfers the program latches data to the configuration latches and implements the switch changes while set 'high'. Latches the data when set to a 'low' level.																														
RESET	CMOS/TTL	Configures the switch into Broadcast or Pass-Through mode, overwriting existing configurations. Broadcast mode: All output ports are connected to data input port 0. This mode is selected by applying a RESET "high" pulse with CONFIGURE held "low." Pass-through mode: IO is connected to O0, I1 to O1, etc. This mode is selected by applying a RESET "high" pulse with CONFIGURE held "high."																														
CNTRL LVL	Input level control. GND/Open	Selects the input levels for the input address (IA0:3), output address (OA0:3), CONFIGURE, LOAD and RESET inputs. Inputs are configured for TTL when tied to GND and CMOS when left unconnected.																														

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Table 4. DC Characteristics^{1,2} – Within recommended operating conditions, unless otherwise indicated.

Symbol	Parameter	Min	Max	Units	Test Cond.	Notes
V _{IH}	PECL Input Voltage High	V _{CC} - 1.1	V _{CC} - 0.5	V		
V _{IL}	PECL Input Voltage Low	V _{TT}	V _{CC} - 1.5	V		
I _{IH}	PECL Input Current High		+30	μA	V _{IH} = V _{CC} - 0.7 V	
I _{IL}	PECL Input Current Low	-30		μA	V _{IL} = V _{CC} - 2.0 V	
V _{ICM}	PECL Input Common Mode Voltage	V _{CC} - 1.5	V _{CC} - 1.1	V		
V _{IDIF}	PECL Input Differential Voltage (pk-pk)	400	1200	mV		
V _{IH}	CMOS/TTL Input Voltage High	3.5/2.0	V _{CC} /V _{CC}	V		2
V _{IL}	CMOS/TTL Input Voltage Low	0/0	1.5/0.8	V		2
I _{IH}	CMOS/TTL Input Current High		+200	μA	V _{IH} = V _{CC}	2
I _{IL}	CMOS/TTL Input Current Low		-100	μA	V _{IL} = 0 V	2
V _{OCM}	PECL Output Common Mode	V _{CC} - 1.5	V _{CC} - 1.1	V		
V _{ODIF}	PECL Output Differential Voltage	600		mV		
V _{OH}	PECL Output Voltage High	V _{CC} - 1.0	V _{CC} - 0.6	V		
V _{OL}	PECL Output Voltage Low	V _{TT}	V _{CC} - 1.6	V		
I _{OH}	PECL Output Current High	20	27	mA		
I _{OL}	PECL Output Current Low	0	8	mA		
I _{CC}	Power Supply Current (+)		970	mA		

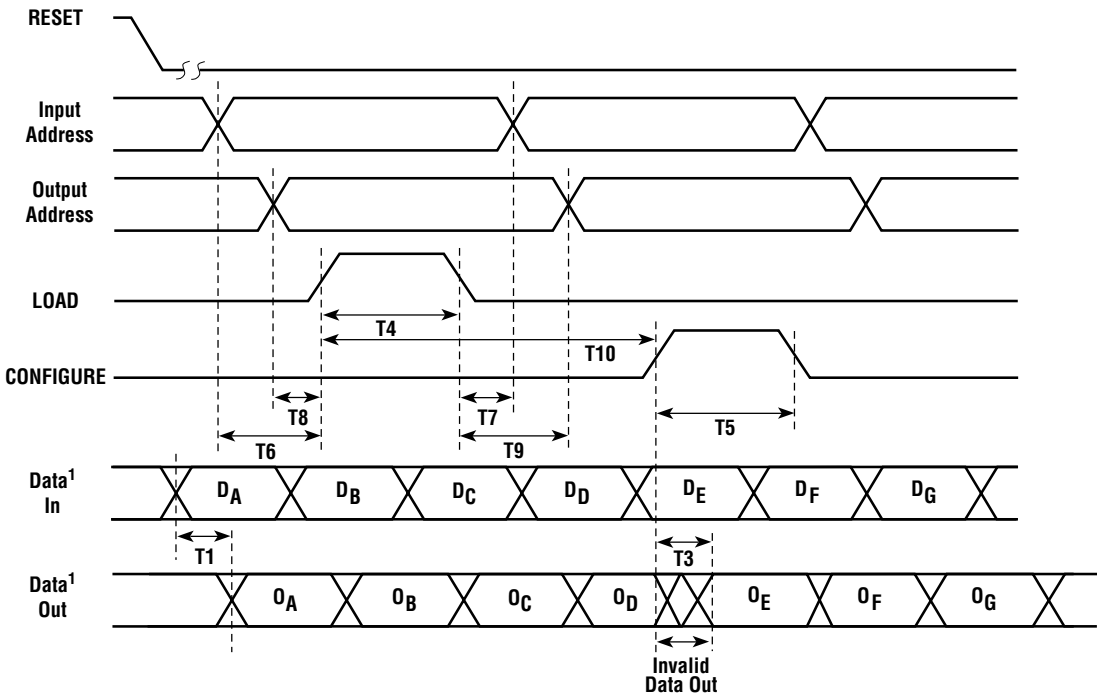
Notes: 1. Test conditions unless otherwise indicated: V_{TT} = V_{CC} - 2.0 V, R_{LOAD} = 50 Ω to V_{TT}.
 2. Input level is selected by the CNTRL LVL input. Tying CNTRL LVL to GND selects TTL levels, leaving CNTRL LVL OPEN selects CMOS levels.

Table 5. AC Characteristics¹ – Within recommended operating conditions, unless otherwise indicated.

Symbol	Parameter	Min	Typ	Max	Units	Notes
	Maximum Data Rate/Port			1.25	Gb/s	1,2
	Jitter			150	ps pk-pk	1
T ₁	Channel Propagation Delay			2000	ps	3
T ₂	Ch-to-Ch Propagation Delay Skew			500	ps	
T ₃	CONFIG to Data Out (Oi) Delay			5	ns	
T ₄	LOAD Pulse Width	7			ns	
T ₅	CONFIG Pulse Width	7			ns	
T ₆	IAi to LOAD High Setup Time	0			ns	
T ₇	LOAD to IAi Low Hold Time	3			ns	
T ₈	OAi to LOAD High Setup Time	0			ns	
T ₉	LOAD to OAi Low Hold Time	3			ns	
T ₁₀	Load ↑ to CONFIG ↑	0			ns	
T ₁₁	RESET Pulse Width	10			ns	
T _{R,F}	Output Rise or Fall Time		250	400	ps	3

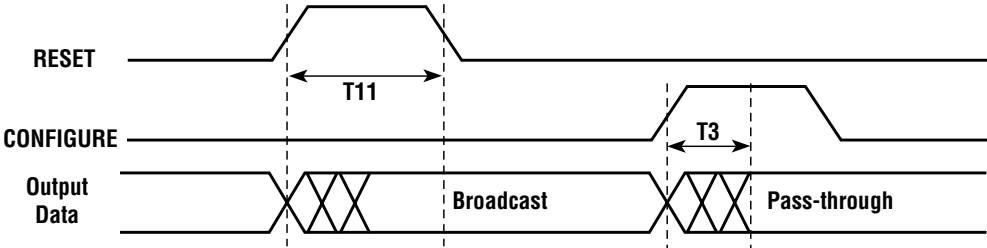
Notes: 1. Test conditions: V_{CC} = 5.0 V; V_{TT} = 3.0 V, R_{LOAD} = 50 Ω to V_{TT}; PECL inputs: V_{IH} = 3.9 V; V_{IL} = 3.5 V; CMOS inputs: V_{IH} = 3.5 V, V_{IL} = 1.5 V; PECL outputs: V_{OH} ≥ 4.0 V, V_{OL} ≤ 3.4 V; PECL inputs rise and fall times ≤ 1 ns; CMOS inputs rise and fall times ≤ 20 ns. A bit error rate of 1E-13 BER or better for 2²³-1PRBS pattern, jitter and rise/fall times are guaranteed through characterization.
 2. 1.2 Gb/s Non-Return-Zero (NRZ) data equivalent to 600 MHz clock signal.
 3. Rise and fall times are measured at the 20% and 80% points of the transition from V_{OL} max to V_{OL} min.

Figure 2. Timing Diagram – Switch Configuration



Notes: 1. No data loss on unchanged paths

Figure 3. Timing Diagram – Reset



- Notes: 1. LOAD input must remain LOW to insure correct programming of the switch.
- 2. "Broadcast" is defined as data input 0 to all data outputs (0...15).
- 3. "Pass-through" is defined as data input 0 to data output 0, data input 1 to data output 1, etc.

Typical Performance Data

Figure 4. Data Eye Closure

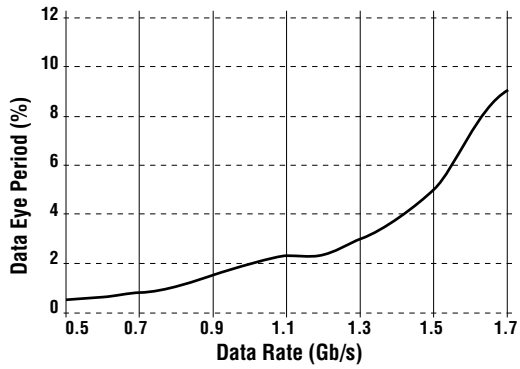


Figure 5. Data Eye Closure Time & Amplitude vs Data Rate (typical)

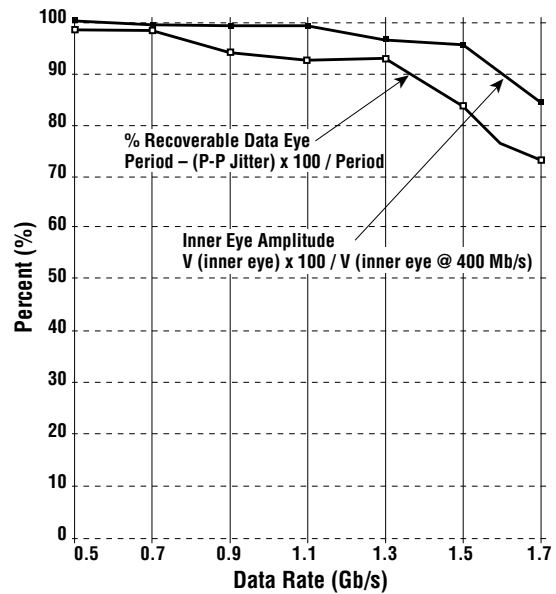


Figure 6. RMS Jitter vs. Data Rate (typical)

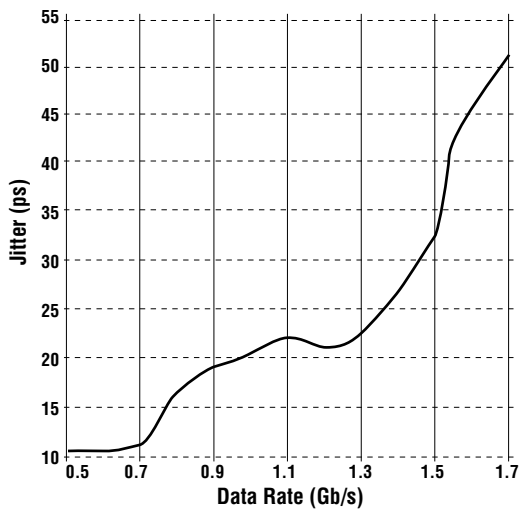
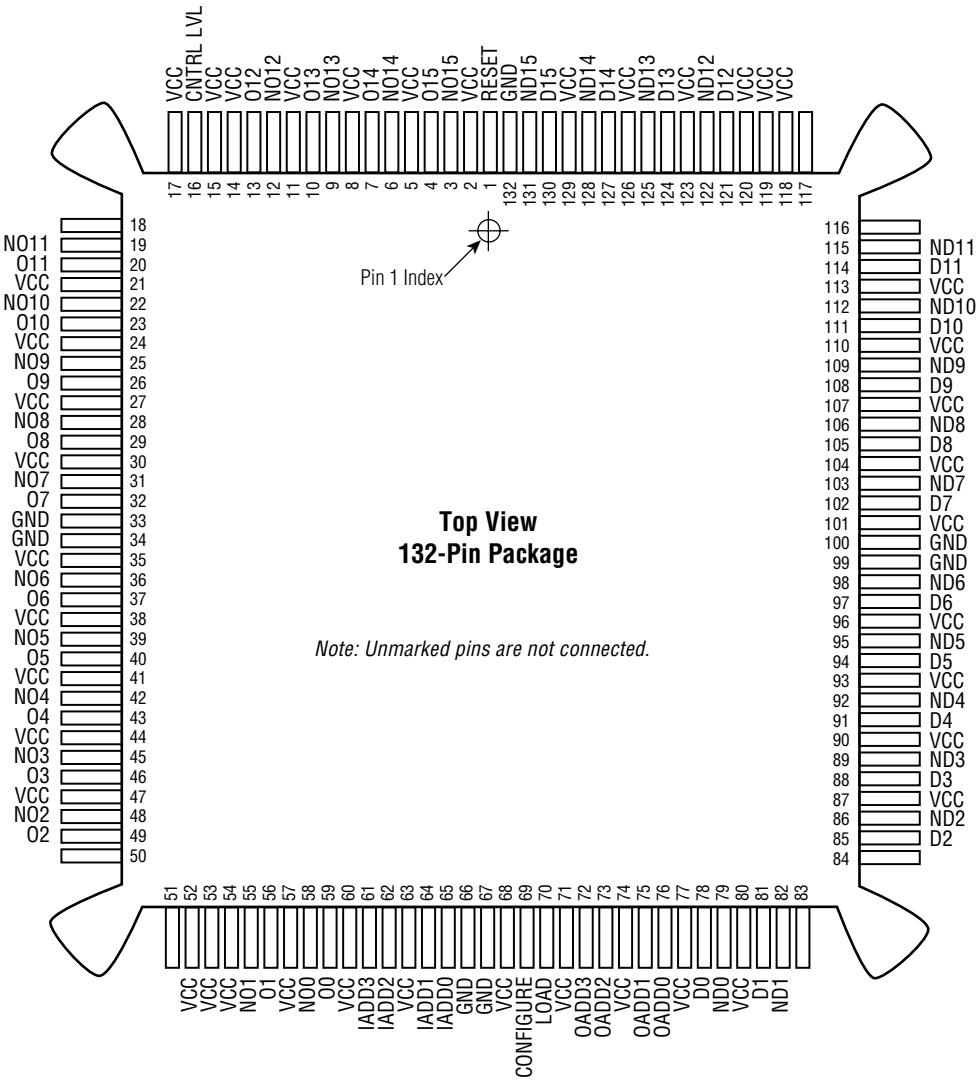


Figure 5. Package Pinout

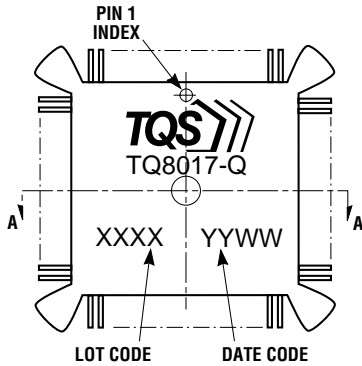


SWITCHING PRODUCTS

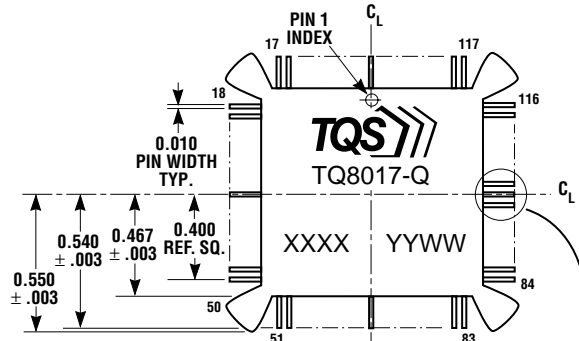
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Figure 6. Mechanical Dimensions

Bottom View

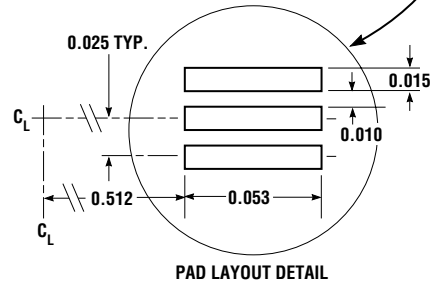
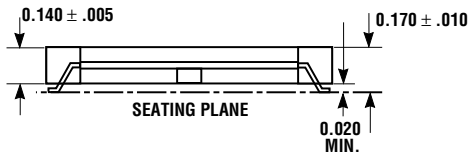


Top View



- Notes: 1. Part is symmetrical about the center axes.
- 2. Centerline bisects center pin in both directions.
- 3. See pad detail below.

Section A-A



Ordering Information

TQ8017-Q 1.25 Gb/s 16x16 PECL Crosspoint Switch

Additional Information

For latest specifications, additional product information, worldwide sales and distribution locations, and information about TriQuint:

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