FAIRCHILD
SEMICONDUCTOR®

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QSE156, QSE157, QSE158, QSE159
QSE156C, QSE157C, QSE158C, QSE159C
# Plastic Silicon OPTOLOGIC® Photosensor

Features

■ Bipolar silicon IC

■ Package type: Sidelooker

■ Medium wide reception angle, 50°

■ Package material and color: black epoxy

■ Also available in clear package: "C" suffix

■ Matched emitter: QEE113/QEE123

■ Daylight filter

■ High sensitivity

■ Direct TTL/LSTTL interface

Description

The QSE15X family are OPTOLOGIC® ICs which feature a Schmitt trigger at output which provides hysteresis for noise immunity and pulse shaping. The basic building block of this IC consists of a photodiode, a linear amplifier, voltage regulator, Schmitt trigger and four output options. The TTL/LSTTL compatible output can drive up to ten TTL loads over supply currents from 4.5 to 16.0 Volts. The devices are marked with a color stripe for easy identification.

Package Dimensions
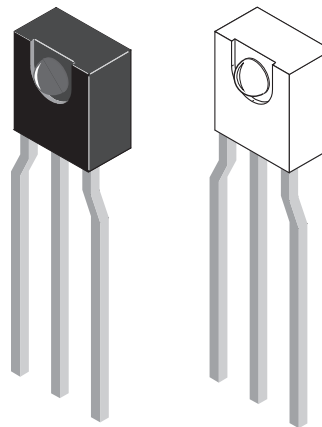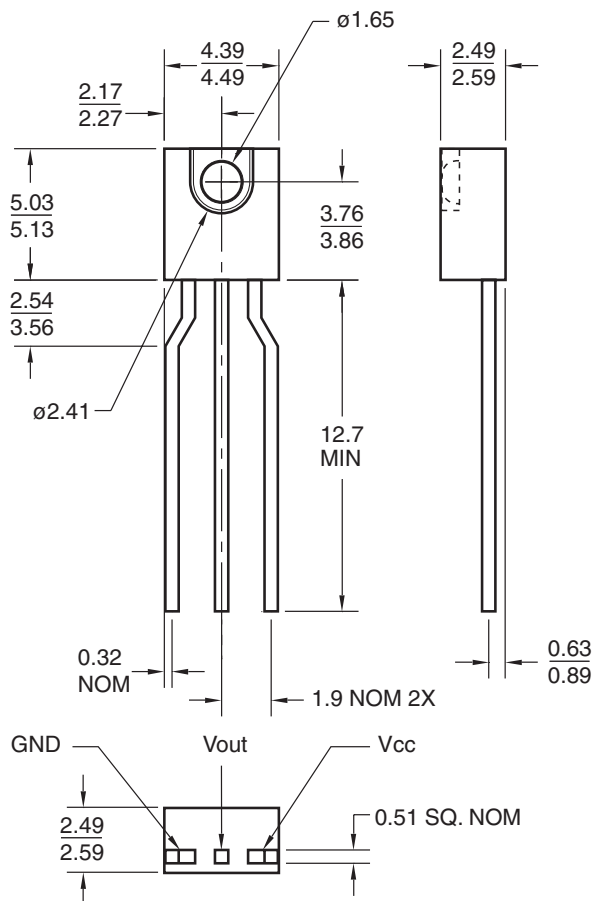
| Part Number Definitions		Color Code
QSE156/C	Totem-Pole, buffer output	Red
QSE157/C	Totem-Pole, inverter output	Yellow
QSE158/C	Open-collector, buffer output	Green
QSE159/C	Open-collector, inverter output	Blue

Input/Output Table		
Part Number	Light	Output
QSE156/C	On	HIGH
	Off	LOW
QSE157/C	On	LOW
	Off	HIGH
QSE158/C	On	HIGH
	Off	LOW
QSE159/C	On	LOW
	Off	HIGH

Note:

1. Dimensions for all drawings are in millimeters.
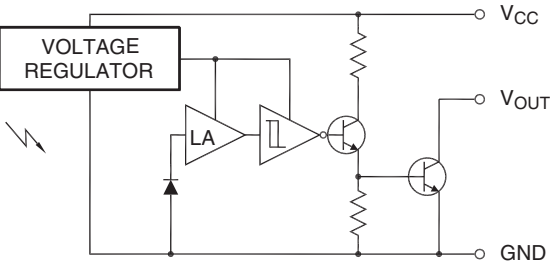
www.fairchildsemi.com
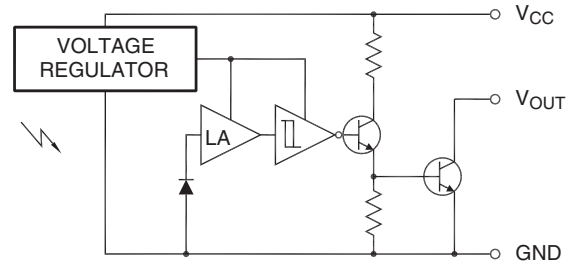
Block Diagrams
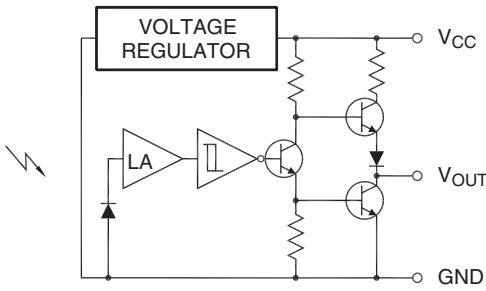
QSE156
Totem-Pole Output Buffer
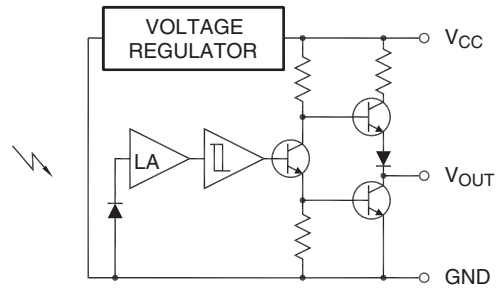
QSE157
Totem-Pole Output Inverter

QSE158
Open-Collector Output Buffer

QSE159
Open-Collector Output Inverter

Absolute Maximum Ratings (T_A = 25°C unless otherwise specified)

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Rating	Unit
T_{OPR}	Operating Temperature	-40 to +85	°C
T_{STG}	Storage Temperature	-40 to +100	°C
T_{SOL-I}	Soldering Temperature (Iron)[2,3,4]	240 for 5 sec	°C
T_{SOL-F}	Soldering Temperature (Flow)[2,3]	260 for 10 sec	°C
I_O	Output Current	50	mA
V_{CC}	Supply Voltage	4.0 to 16	V
V_O	Output Voltage	35	V
P_D	Power Dissipation[1]	100	mW

Notes:

1. Derate power dissipation linearly 2.50mW/°C above 25°C.

2. RMA flux is recommended.

3. Methanol or isopropyl alcohols are recommended as cleaning agents.

4. Soldering iron tip 1/16" (1.6mm) minimum from housing.

Electrical Characteristics $(T_A = -40°C$ to $+85°C$, $V_{CC} = 4.5V$ to $16V$)

| Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Ee(+)	Positive Going Threshold Irradiance[5]	$T_A = 25°C$	0.025		0.250	mW/cm^2
Ee(+)/Ee(-)	Hysteresis Ratio			1.10	2.00	
I_{CC}	Supply Current[6]	Ee = 0 or 0.3mW/cm^2			5.0	mA
	Peak to Peak Ripple which will Cause False Triggering	f = DC to 50MHz			2.00	V
QSE156/C (Buffer Totem Pole)						
V_{OH}	High Level Output Voltage[5]	Ee = 0.3mW/cm^2, I_{OH} = -10mA	$V_{CC} - 2.1$			V
V_{OL}	Low Level Output Voltage	Ee = 0, I_{OL} = 16mA			0.40	V
QSE157/C (Inverter Totem Pole)						
V_{OH}	High Level Output Voltage[5]	Ee = 0, I_{OH} = -10mA	$V_{CC} - 2.1$			V
V_{OL}	Low Level Output Voltage	Ee = 0.3mW/cm^2, I_{OL} = 16mA			0.40	V
QSE158/C (Buffer Open Collector)						
I_{OH}	High Level Output Current[5]	Ee = 0.3mW/cm^2, V_{OH} = 30V			100	µA
V_{OL}	Low Level Output Voltage	Ee = 0, I_{OL} = 16mA			0.40	V
QSE159/C (Inverter Open Collector)						
I_{OH}	High Level Output Current[5]	Ee = 0, V_{OH} = 30V			100	µA
V_{OL}	Low Level Output Voltage	Ee = 0.3mW/cm^2, I_{OL} = 16mA			0.40	V
QSE156/C, QSE157/C						
t_R, t_F	Output Rise, Fall Times	Ee = 0 or 0.3mW/cm^2, f = 10kHz, DC = 50%, $R_L = 360\Omega$[5]			70	nS
t_{PHL}, t_{PLH}	Propagation Delay			6.0		µS
QSE158/C, QSE159/C						
t_R, t_F	Output Rise, Fall Times	Ee = 0 or 0.3mW/cm^2, f = 10kHz, DC = 50%, $R_L = 360\Omega$[5]			100	nS
t_{PHL}, t_{PLH}	Propagation Delay			6.0		µS

Note:

5. λ = 880nm (AlGaAs).

Typical Performance Curves (Sensor Coupled to QEE113 Emitter)
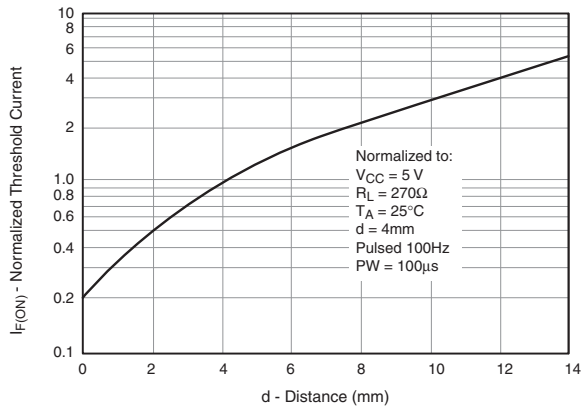
Fig. 1 Output Voltage vs. Input Current (Inverters)
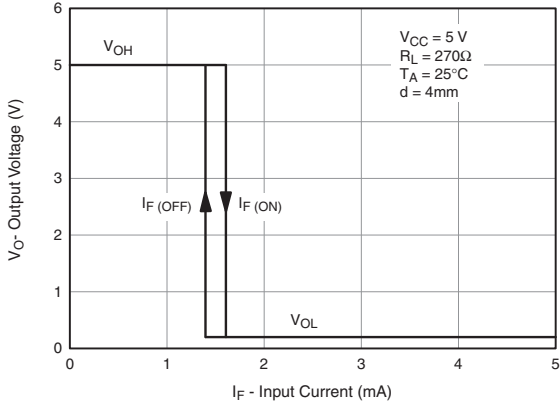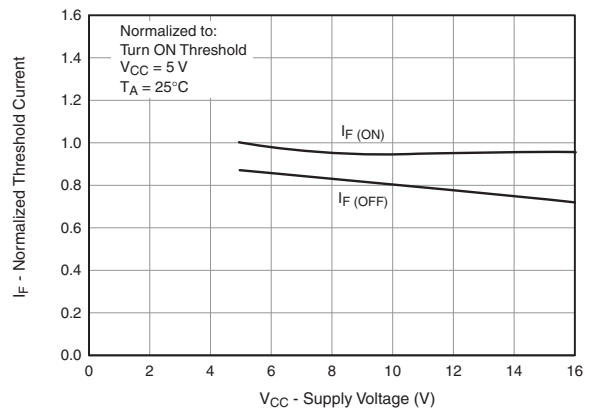

Fig. 2 Output Voltage vs. Input Current (Buffers)
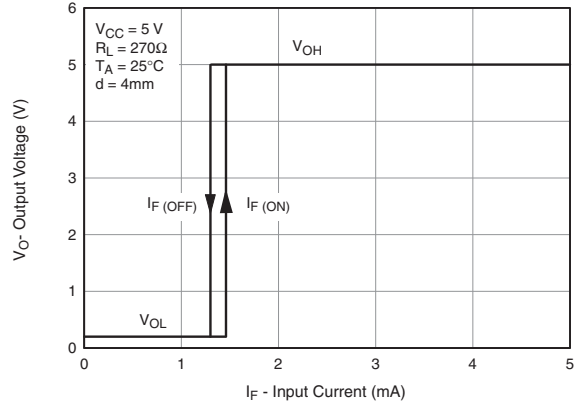
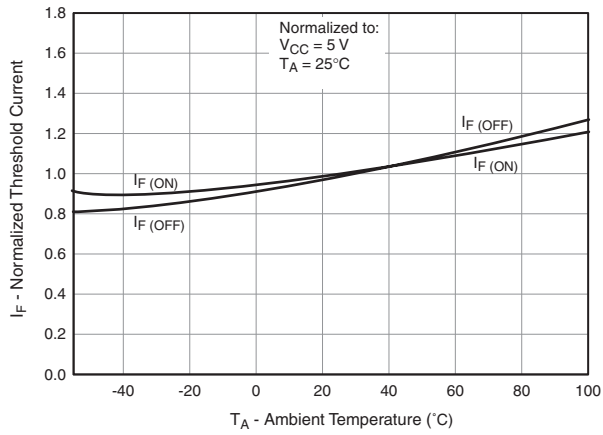**Fig. 3 Threshold Current vs. Distance**

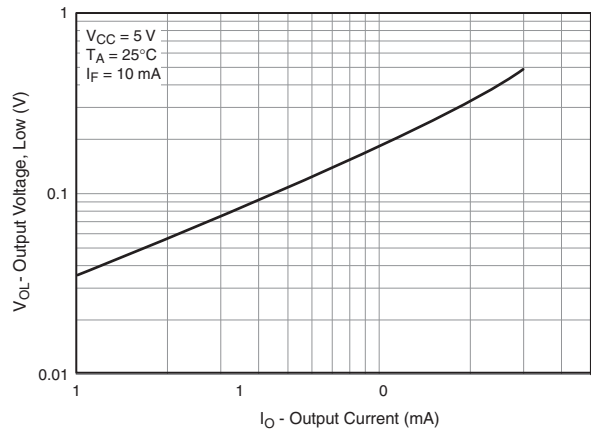**Fig. 4 Normalized Threshold Current vs. Supply Voltage**

Typical Performance Curves (Sensor Coupled to QEE113 Emitter) (Continued)

Fig. 5 Normalized Threshold Current vs. Ambient Temperature

Normalized to:
V_{CC} = 5 V
T_A = 25°C

I_F - Normalized Threshold Current

$I_{F\ (OFF)}$
$I_{F\ (ON)}$
$I_{F\ (ON)}$
$I_{F\ (OFF)}$

T_A - Ambient Temperature (°C)

Fig. 6 Low Output Voltage vs. Output Current

V_{CC} = 5 V
T_A = 25°C
I_F = 10 mA

V_{OL} - Output Voltage, Low (V)

I_O - Output Current (mA)

Fig. 7 Response Time vs. Forward Current

V_{CC} = 5 V
R_L = 270Ω
T_A = 25°C
I_F Pulsed
T = 10 ms
Duty Cycle = 50%

Response Delay Time (µs)

T_{PLH}
T_{PHL}

I_F - Forward Current (mA)
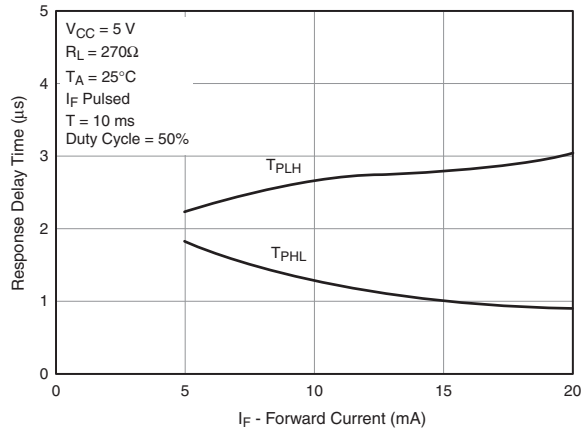
Fig. 8 Switching Speed Test Circuit

C_2

R_2

**Pulse
Generator**
V_O = 5V
f = 10 KHz
d.c. = 50%

R_1

5V

.1 uf
bypass

C_1

GND

R_1 = 360Ω C_1 = 15 pf C_1 and C_2 include probe and
R_2 = 180Ω C_2 = 20 pf   stray wire capacitance
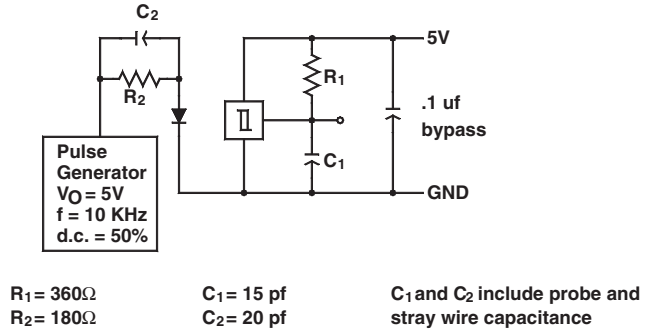
Fig. 9 Switching Times Definition for Buffers

50%

0 mA

t_{PLH} t_{PHL}

V_{OH}

**Output
V_O**   90%   10%

50%

V_{OL} 10%   90%

t_r t_f
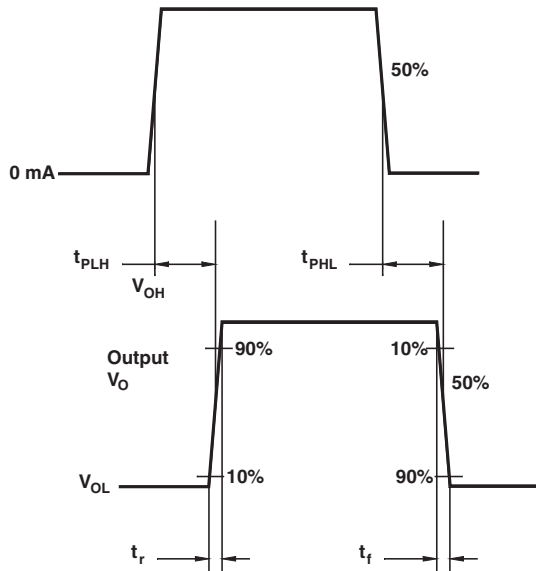
Fig. 10 Switching Times Definition for Inverters

50%

0 mA

t_{PHL} t_{PLH}

V_{OH} 10%   90%

**Output
V_O**   90%   10%

V_{OL}

t_f t_r
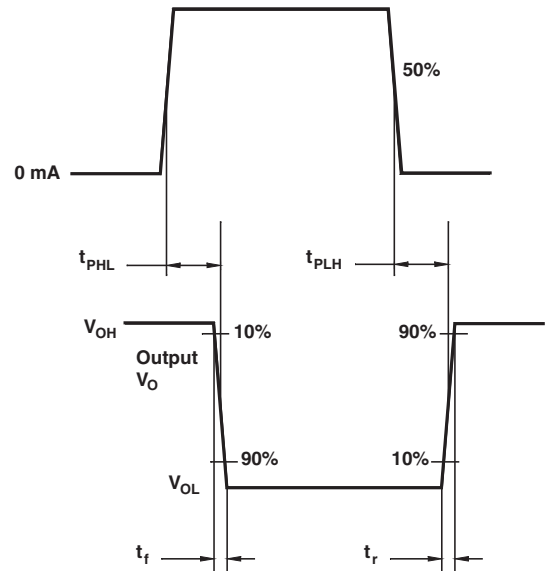
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