

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

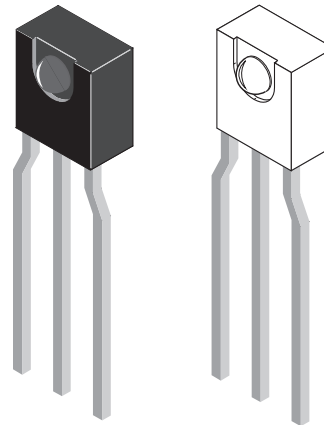
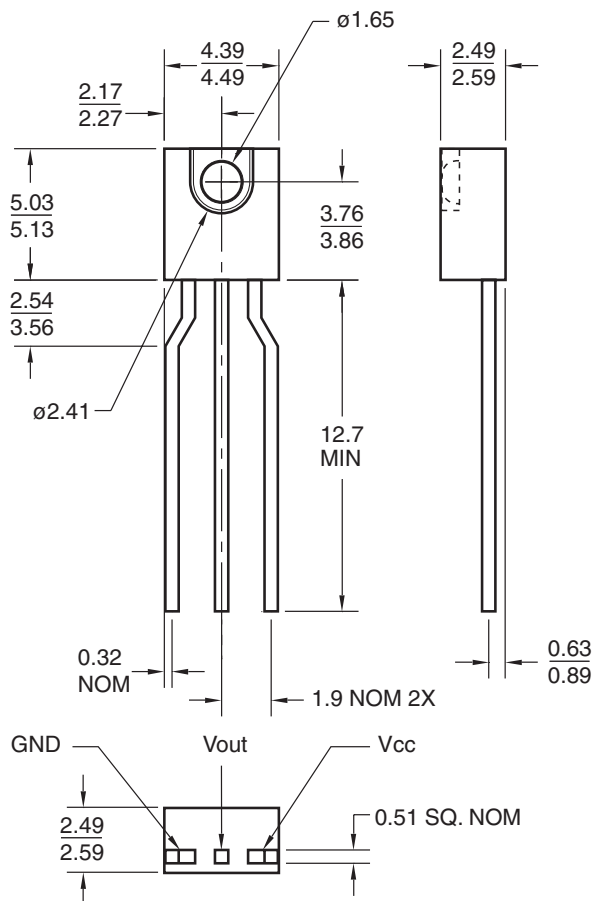
## Features

- 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



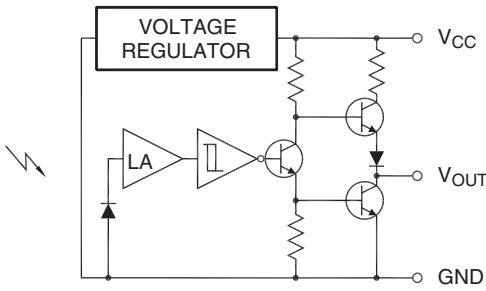
Part Number Definitions		Color Code
QSE156/C	Totem-Pole, buffer output	Red
QSE157/C	Totem-Pole, inverter output	Yellow
QSE158/C	Open-collector, buffer output	Green
QSE159/C	Open-collector, inverter output	Blue

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

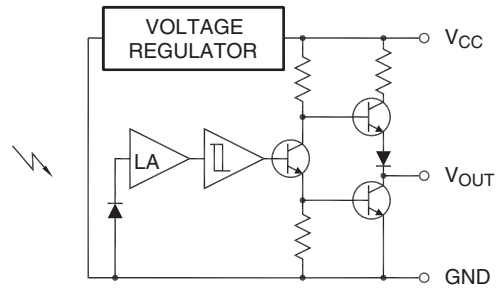
**Note:**

1. Dimensions for all drawings are in millimeters.

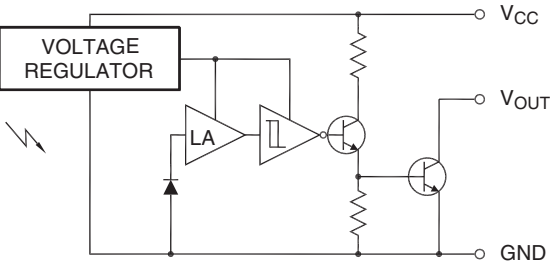
## Block Diagrams



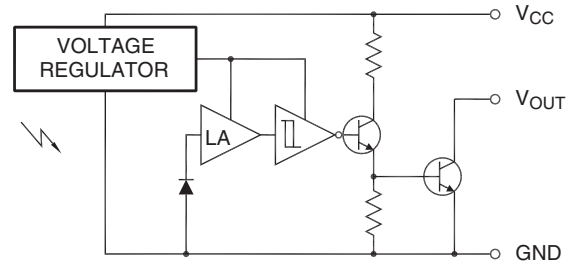
**QSE156**  
Totem-Pole Output Buffer



**QSE157**  
Totem-Pole Output Inverter



**QSE158**  
Open-Collector Output Buffer



**QSE159**  
Open-Collector Output Inverter

## Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ 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	$^\circ\text{C}$
$T_{STG}$	Storage Temperature	-40 to +100	$^\circ\text{C}$
$T_{SOL-I}$	Soldering Temperature (Iron) <sup>(2,3,4)</sup>	240 for 5 sec	$^\circ\text{C}$
$T_{SOL-F}$	Soldering Temperature (Flow) <sup>(2,3)</sup>	260 for 10 sec	$^\circ\text{C}$
$I_O$	Output Current	50	mA
$V_{CC}$	Supply Voltage	4.0 to 16	V
$V_O$	Output Voltage	35	V
$P_D$	Power Dissipation <sup>(1)</sup>	100	mW

### Notes:

1. Derate power dissipation linearly 2.50mW/ $^\circ\text{C}$  above 25 $^\circ\text{C}$ .
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.

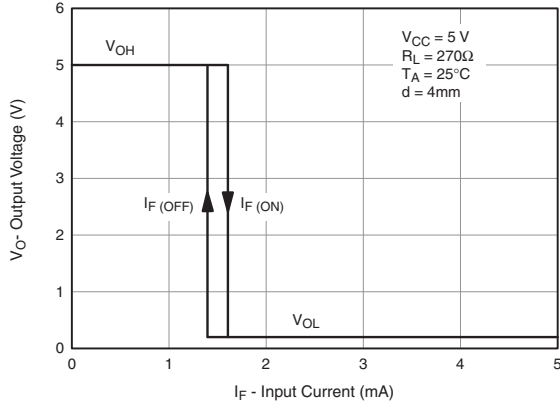
**Electrical Characteristics** ( $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ ,  $V_{CC} = 4.5\text{V}$  to  $16\text{V}$ )

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

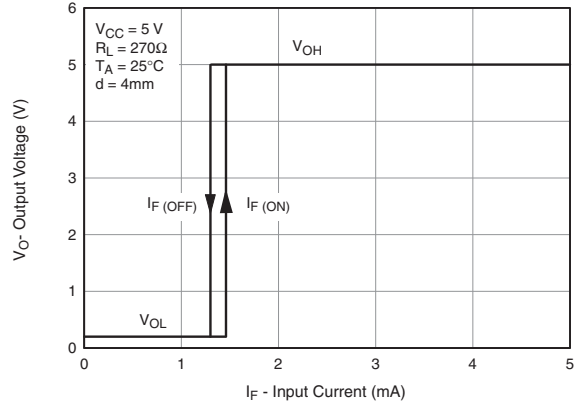
**Note:**5.  $\lambda = 880\text{nm}$  (AlGaAs).

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

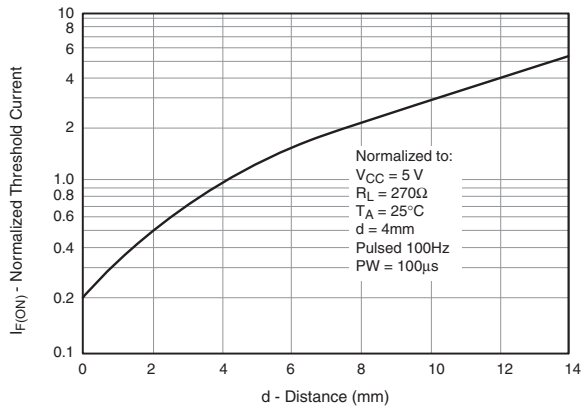
**Fig. 1 Output Voltage vs. Input Current (Inverters)**



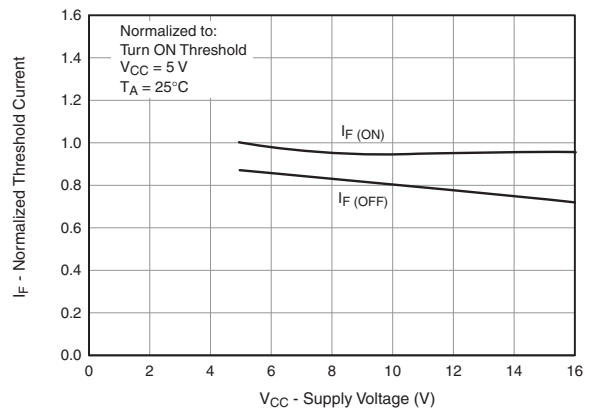
**Fig. 2 Output Voltage vs. Input Current (Buffers)**



**Fig. 3 Threshold Current vs. Distance**

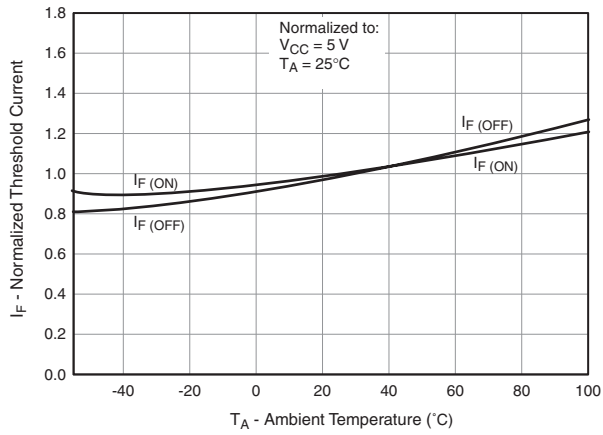


**Fig. 4 Normalized Threshold Current vs. Supply Voltage**

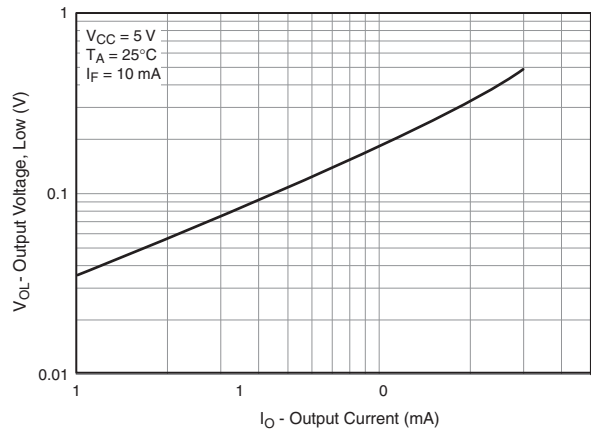


**Typical Performance Curves** (Sensor Coupled to QEE113 Emitter) (Continued)

**Fig. 5 Normalized Threshold Current vs. Ambient Temperature**



**Fig. 6 Low Output Voltage vs. Output Current**



**Fig. 7 Response Time vs. Forward Current**

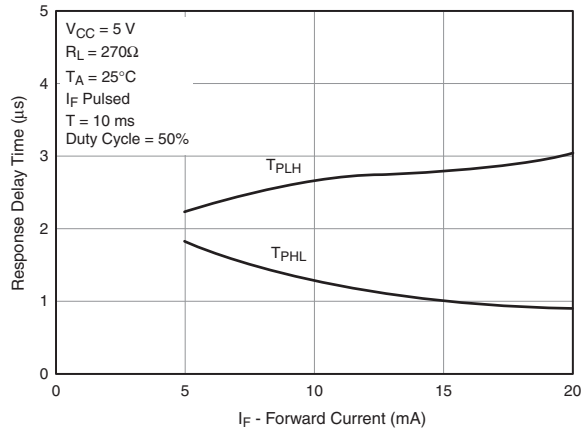
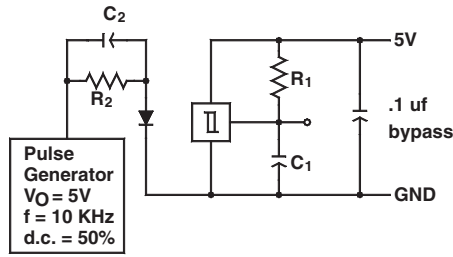


Fig. 8 Switching Speed Test Circuit



$R_1 = 360\Omega$   
 $R_2 = 180\Omega$

$C_1 = 15\text{ pf}$   
 $C_2 = 20\text{ pf}$

$C_1$  and  $C_2$  include probe and  
 stray wire capacitance

Fig. 9 Switching Times Definition for Buffers

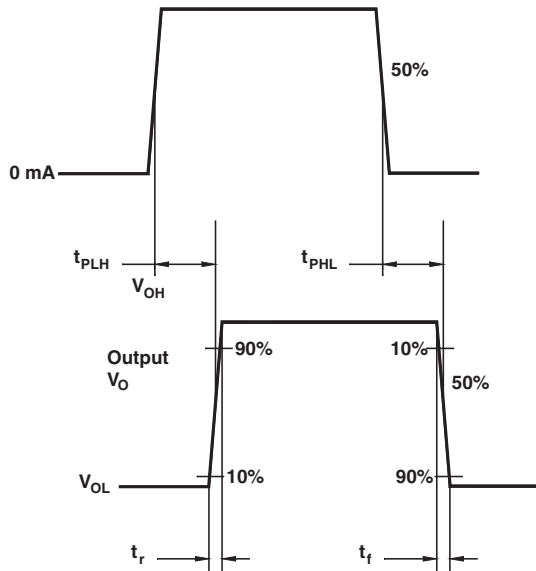
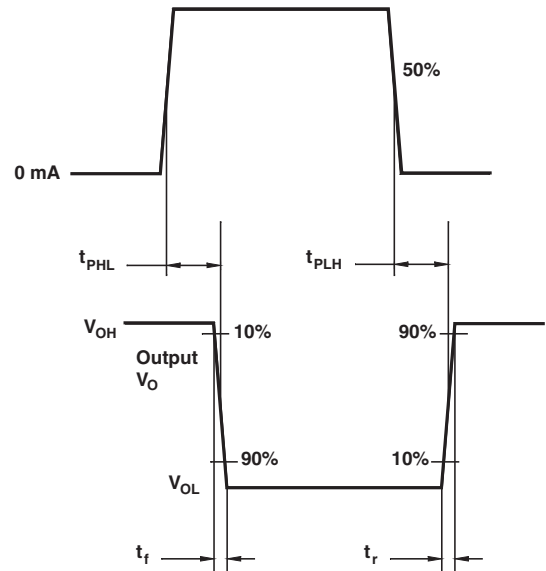



Fig. 10 Switching Times Definition for Inverters





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