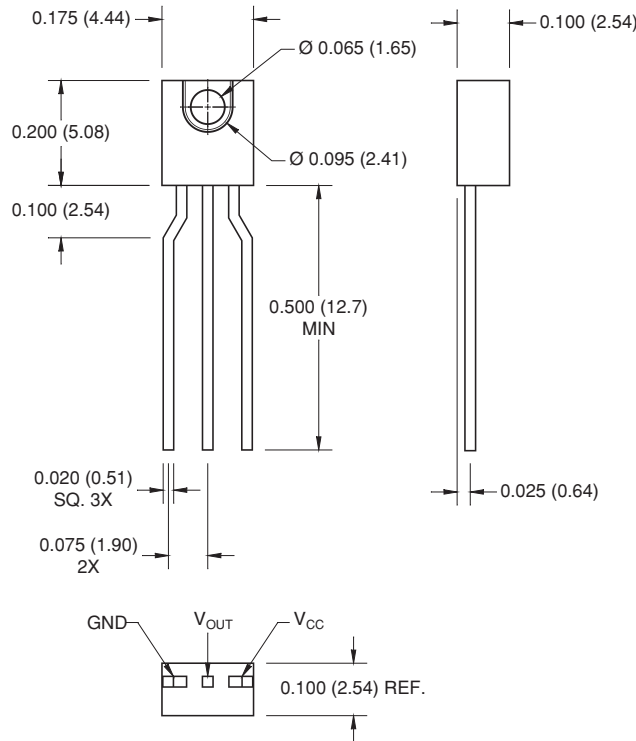


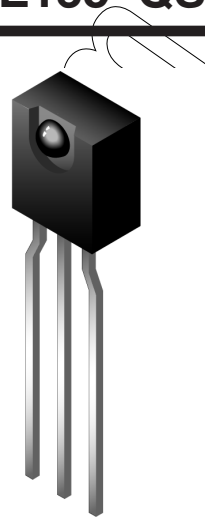
**QSE156 QSE157 QSE158 QSE159**

**PACKAGE DIMENSIONS**



**NOTES:**

1. Dimensions for all drawings are in inches (mm).
2. Tolerance of  $\pm .010 (.25)$  on all non-nominal dimensions unless otherwise specified.



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

Input/Output Table		
Part Number	Light	Output
QSE156	On	High
	Off	Low
QSE157	On	Low
	Off	High
QSE158	On	High
	Off	Low
QSE159	On	Low
	Off	High

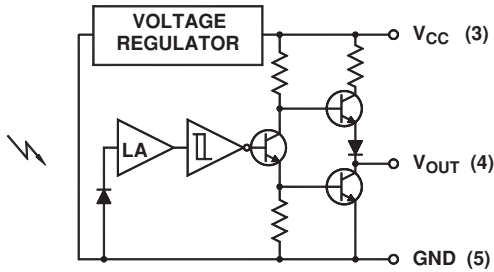
**DESCRIPTION**

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.

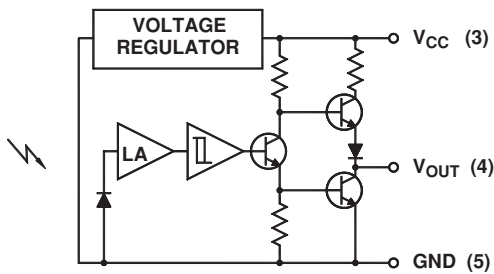
**FEATURES**

- Bipolar silicon IC
- Package type: Sidelooker
- Medium wide reception angle, 50°
- Package material and color: black epoxy
- Matched emitter: QEE113/QEE123
- Daylight filter
- High sensitivity
- Direct TTL/LSTTL interface

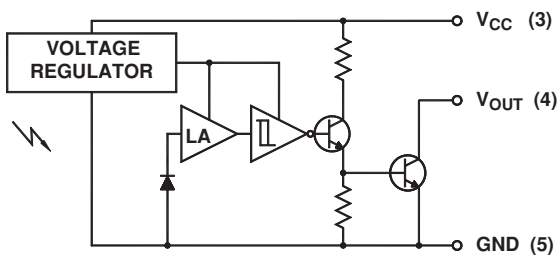
**QSE156 QSE157 QSE158 QSE159**



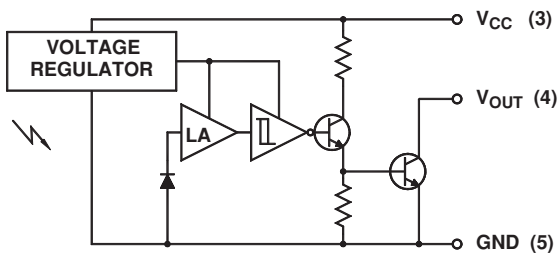
**QSE156**  
Totem-Pole Output Buffer



**QSE157**  
Totem-Pole Output inverter



**QSE158**  
Open-Collector Output Buffer



**QSE159**  
Open-Collector Output Inverter

**QSE156 QSE157 QSE158 QSE159**

**ABSOLUTE MAXIMUM RATINGS** ( $T_A = 25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Rating	Unit
Operating Temperature	$T_{OPR}$	-40 to +85	$^\circ\text{C}$
Storage Temperature	$T_{STG}$	-40 to +100	$^\circ\text{C}$
Soldering Temperature (Iron) <sup>(2,3,4)</sup>	$T_{SOL-I}$	240 for 5 sec	$^\circ\text{C}$
Soldering Temperature (Flow) <sup>(2,3)</sup>	$T_{SOL-F}$	260 for 10 sec	$^\circ\text{C}$
Output Current	$I_O$	50	mA
Supply Voltage	$V_{CC}$	4.0 to 16	V
Output Voltage	$V_O$	30	V
Power Dissipation <sup>(1)</sup>	$P_D$	100	mW

**NOTES:**

1. Derate power dissipation linearly 2.50 mW/ $^\circ\text{C}$  above 25 $^\circ\text{C}$ .
2. RMA flux is recommended.
3. Methanol or isopropyl alcohols are recommended as cleaning agents.
4. Soldering iron 1/16" (1.6 mm) minimum from housing.
5.  $\lambda = 880 \text{ nm}$  (AlGaAs).

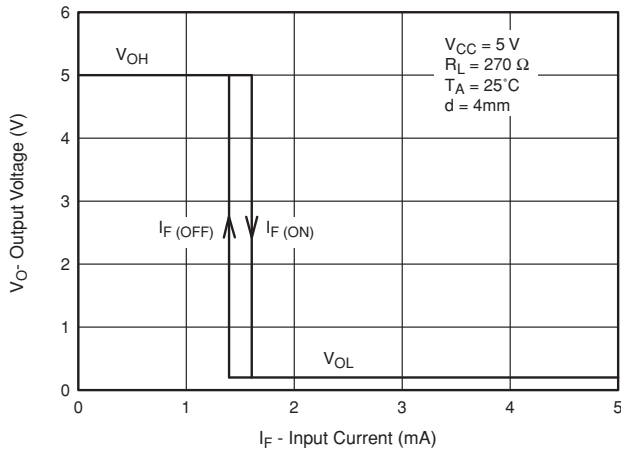
**ELECTRICAL / OPTICAL CHARACTERISTICS** ( $T_A = -40^\circ\text{C}$  to +85 $^\circ\text{C}$ ,  $V_{CC} = 4.5$  to 16 volts)

Parameter	Symbol	Min	Typ	Max	Units	Test Conditions
Positive Going Threshold Irradiance <sup>(5)</sup>	Ee (+)	0.025		0.250	mW/cm <sup>2</sup>	$T_A = 25^\circ\text{C}$
Hysteresis Ratio	Ee (+)/Ee (-)	1:10		2.00		
Supply Current	$I_{CC}$			5.0	mA	Ee = 0 or .3 mW/cm <sup>2</sup> ( <sup>5</sup> )
Peak to peak ripple which will cause false triggering				2.00	V	f = DC to 50 MHz
<b>QSE156 (BUFFER TOTEM POLE)</b>						
High Level Output Voltage	$V_{OH}$	$V_{CC}-2.1$		—	V	Ee = .3 mW/cm <sup>2</sup> , $I_{OH} = -1.0\text{mA}$ ( <sup>5</sup> )
Low Level Output Voltage	$V_{OL}$	—		0.40	V	Ee = 0, $I_{OL} = 16 \text{ mA}$
<b>QSE157 (INVERTER TOTEM POLE)</b>						
High Level Output Voltage	$V_{OH}$	$V_{CC}-2.1$		—	V	Ee = 0, $I_{OH} = -1.0\text{mA}$
Low Level Output Voltage	$V_{OL}$	—		0.40	V	Ee = .3 mW/cm <sup>2</sup> , $I_{OL} = 16\text{mA}$ ( <sup>5</sup> )
<b>QSE158 (BUFFER OPEN COLLECTOR)</b>						
High Level Output Current	$I_{OH}$	—		100	$\mu\text{A}$	Ee = .3mW/cm <sup>2</sup> , $V_{OH} = 30\text{V}$ ( <sup>5</sup> )
Low Level Output Voltage	$V_{OL}$	—		0.40	V	Ee = 0, $I_{OL} = 16\text{mA}$
<b>QSE159 (INVERTER OPEN COLLECTOR)</b>						
High Level Output Current	$I_{OH}$	—		100	$\mu\text{A}$	Ee = 0, $V_{OH} = 30\text{V}$
Low Level Output Voltage	$V_{OL}$	—		0.40	V	Ee = .3mW/cm <sup>2</sup> , $I_{OL} = 16\text{mA}$ ( <sup>5</sup> )
<b>QSE156, QSE157</b>						
Output rise, fall times	tr, tf	—		70	nS	Ee = 0 or .3 mW/cm <sup>2</sup> , f = 10KHz
Propagation delay	tphl, tplh		6.0		$\mu\text{S}$	DC = 50%, $R_L = 360\Omega$ ( <sup>5</sup> )
<b>QSE158, QSE159</b>						
Output rise, fall times	tr, tf	—		100	nS	Ee = 0 or .3 mW/cm <sup>2</sup> , f = 10KHz
Propagation delay	tphl, tplh		6.0		$\mu\text{S}$	DC = 50%, $R_L = 360\Omega$ ( <sup>5</sup> )

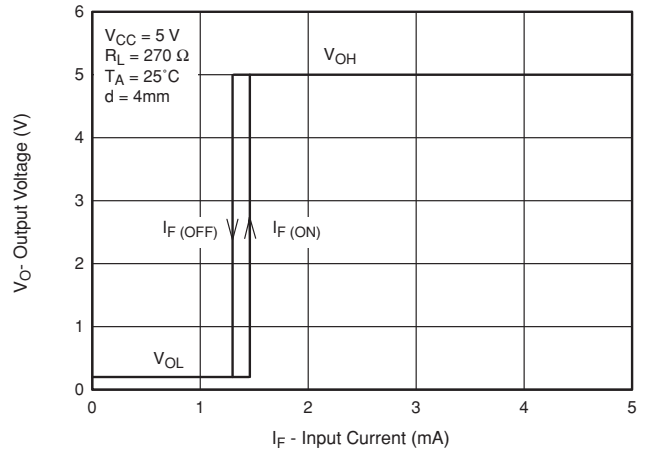
**QSE156 QSE157 QSE158 QSE159**

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

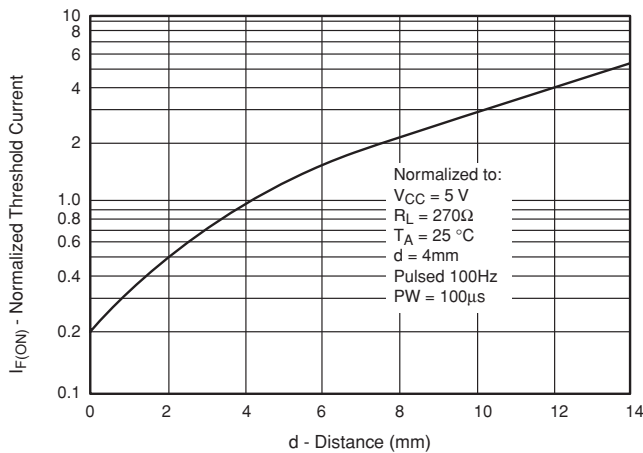
**Fig. 1 Output Voltage vs. Input Current (Inverters)**



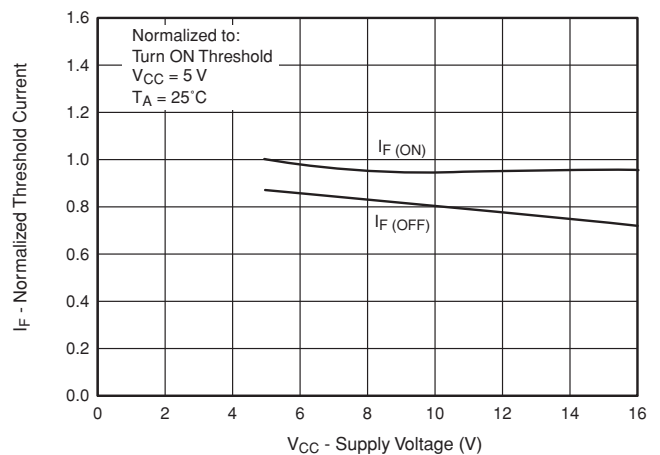
**Fig. 2 Output Voltage vs. Input Current (Buffers)**



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

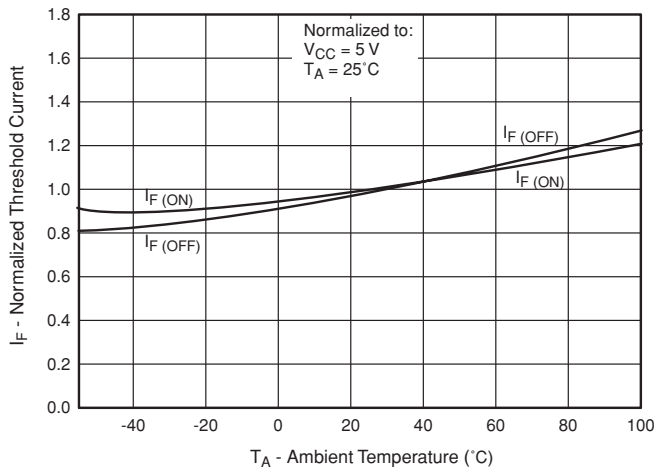


**Fig. 4 Normalized Threshold Current vs. Supply Voltage**

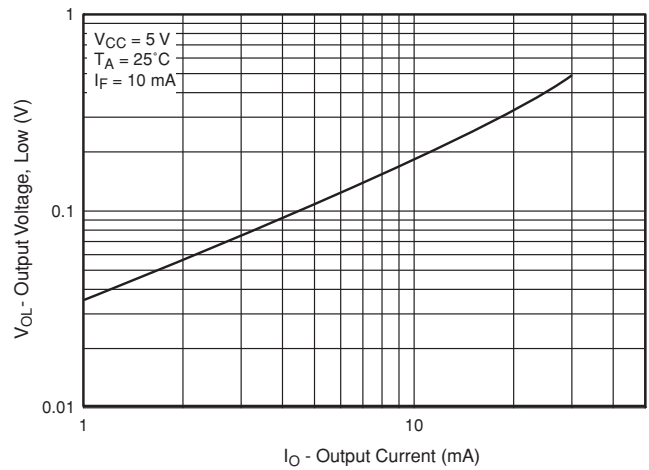


**QSE156 QSE157 QSE158 QSE159**

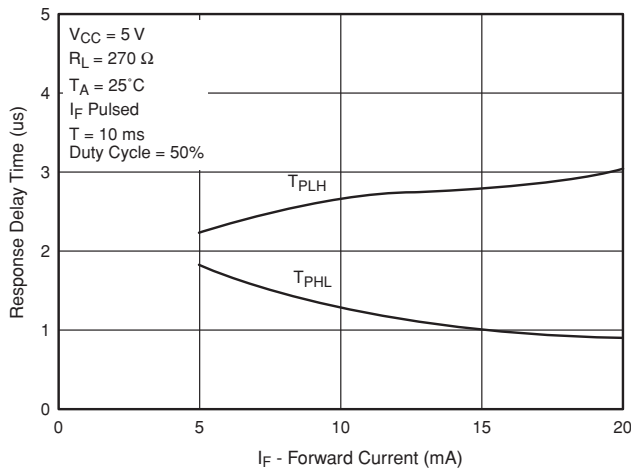
**Fig. 5 Normalized Threshold Current vs. Ambient Temperature**



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

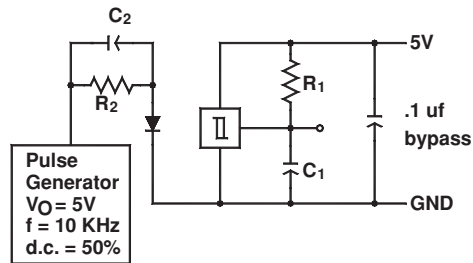


**Fig. 7 Response Time vs. Forward Current**



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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

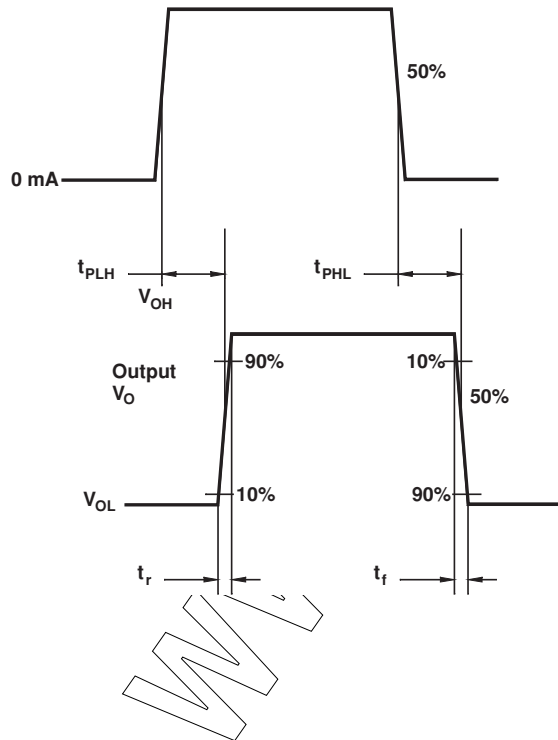
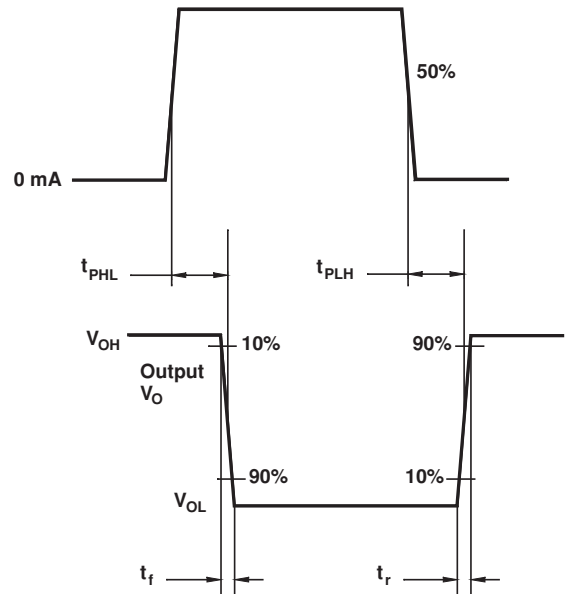


Fig. 10 Switching Times Definition for Inverters



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**QSE156 QSE157 QSE158 QSE159**

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