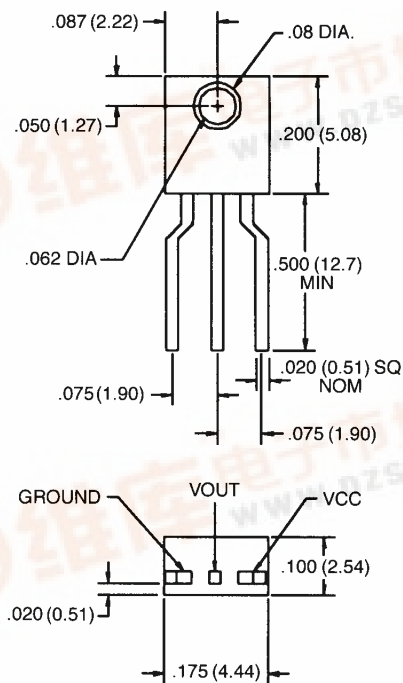


**FAIRCHILD**  
SEMICONDUCTOR™

**OPTOLOGIC™**

**QSE156/157/158/159**

### PACKAGE DIMENSIONS



ST2151

### NOTES:

1. DIMENSIONS ARE IN INCHES (mm).
2. TOLERANCE IS  $\pm 0.10$  (.25) UNLESS OTHERWISE SPECIFIED.

### 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 dark red epoxy packaging system is designed to optimize the mechanical resolution, coupling efficiency, cost, and reliability.

### FEATURES

- High noise immunity.
- Direct TTL/LSTTL interface.
- Steel lead frames for improved solder mounting.
- Reception angle of  $\pm 25^\circ$ .

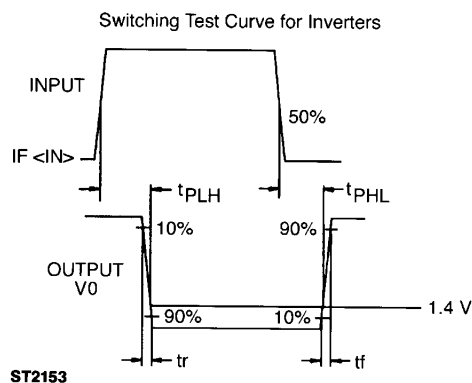
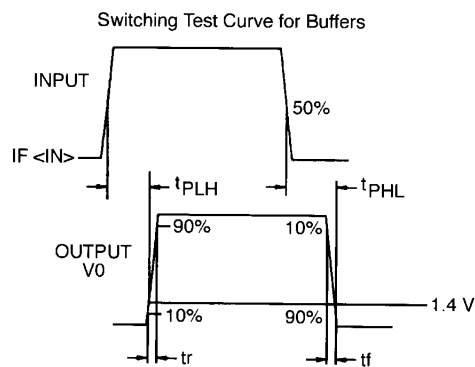
**ABSOLUTE MAXIMUM RATINGS** ( $T_A = 25^\circ\text{C}$  Unless Otherwise Specified)

|                                      |                                                     |
|--------------------------------------|-----------------------------------------------------|
| Supply Voltage, $V_{CC}$             | 18 volts                                            |
| Storage Temperature                  | $-40^\circ\text{C} + 100^\circ\text{C}$             |
| Operating Temperature                | $-40^\circ\text{C}$ to $+85^\circ\text{C}$          |
| Soldering:                           |                                                     |
| Lead Temperature (Iron)              | $240^\circ\text{C}$ for 5 sec. <sup>(2,3,4,5)</sup> |
| Lead Temperature (Flow)              | $260^\circ\text{C}$ for 10 sec. <sup>(2,3,5)</sup>  |
| Power Dissipation                    | 100 mW <sup>(1)</sup>                               |
| Duration of Output short to $V_{CC}$ | 1.00 sec.                                           |
| Voltage at Output                    | 35 volts                                            |
| Sinking Current                      | 50 mA                                               |
| Sourcing Current (QSE156, QSE157)    | 10 mA                                               |
| Irradiance                           | 3.0 mW/cm <sup>2</sup>                              |

**ELECTRICAL 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                                                        |
|-------------------------------------------------------|-----------------|----------------|------|-------|--------------------|------------------------------------------------------------------------|
| Operating Supply Voltage                              | $V_{CC}$        | 4.5            |      | 16.0  | V                  |                                                                        |
| Positive Going Threshold Irradiance <sup>(6)</sup>    | $E_e (+)$       | 0.025          |      | 0.250 | mW/cm <sup>2</sup> | $T_A = 25^\circ\text{C}$                                               |
| Hysteresis Ratio                                      | $E_e(+)/E_e(-)$ | 1.10           |      | 2.00  |                    |                                                                        |
| Supply Current                                        | $I_{CC}$        | —              |      | 12.0  | mA                 | $E_e = 0$ or .3 mW/cm <sup>2</sup> <sup>(6)</sup>                      |
| Peak to peak ripple which will cause false triggering |                 | —              |      | 2.00  | V                  | $f = \text{DC to } 50 \text{ MHz}$                                     |
| <b>QSE156 (BUFFER TOTEM POLE)</b>                     |                 |                |      |       |                    |                                                                        |
| High Level Output Voltage                             | $V_{OH}$        | $V_{CC} - 2.1$ |      | —     | V                  | $E_e = .3 \text{ mW/cm}^2$ , $I_{OH} = -1.0 \text{ mA}$ <sup>(6)</sup> |
| Low Level Output Voltage                              | $V_{OL}$        | —              |      | 0.40  | V                  | $E_e = 0$ , $I_{OL} = 16 \text{ mA}$                                   |
| <b>QSE157 (INVERTER TOTEM POLE)</b>                   |                 |                |      |       |                    |                                                                        |
| High Level Output Voltage                             | $V_{OH}$        | $V_{CC} - 2.1$ |      | —     | V                  | $E_e = 0$ , $I_{OH} = -1.0 \text{ mA}$                                 |
| Low Level Output Voltage                              | $V_{OL}$        | —              |      | 0.40  | V                  | $E_e = .3 \text{ mW/cm}^2$ , $I_{OL} = 16 \text{ mA}$ <sup>(6)</sup>   |
| <b>QSE158 (BUFFER OPEN COLLECTOR)</b>                 |                 |                |      |       |                    |                                                                        |
| High Level Output Current                             | $I_{OH}$        | —              |      | 100   | $\mu\text{A}$      | $E_e = .3 \text{ mW/cm}^2$ , $V_{OH} = 30 \text{ V}$ <sup>(6)</sup>    |
| Low Level Output Voltage                              | $V_{OL}$        | —              |      | 0.40  | V                  | $E_e = 0$ , $I_{OL} = 16 \text{ mA}$                                   |
| <b>QSE159 (INVERTER OPEN COLLECTOR)</b>               |                 |                |      |       |                    |                                                                        |
| High Level Output Current                             | $I_{OH}$        | —              |      | 100   | $\mu\text{A}$      | $E_e = 0$ , $V_{OH} = 30 \text{ V}$                                    |
| Low Level Output Voltage                              | $V_{OL}$        | —              |      | 0.40  | V                  | $E_e = .3 \text{ mW/cm}^2$ , $I_{OL} = 16 \text{ mA}$ <sup>(6)</sup>   |

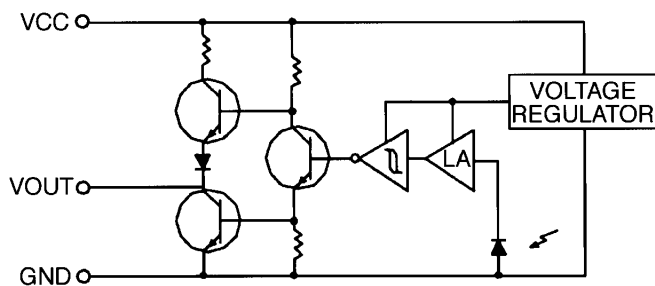
| ELECTRICAL CHARACTERISTICS (T <sub>A</sub> = -40°C to +85°C)<br>(V <sub>CC</sub> = 4.5 to 16 volts) |            |      |      |      |       |                                                                                     |
|-----------------------------------------------------------------------------------------------------|------------|------|------|------|-------|-------------------------------------------------------------------------------------|
| PARAMETER                                                                                           | SYMBOL     | MIN. | TYP. | MAX. | UNITS | TEST CONDITIONS                                                                     |
| QSE156, QSE157                                                                                      |            |      |      |      |       |                                                                                     |
| Output rise, fall times                                                                             | tr, tf     | —    |      | 70   | nS    | Ee=0 or .3 mW/cm², f=10K Hz<br>DC=50%, R <sub>L</sub> = 10 TTL loads <sup>(6)</sup> |
| Propagation delay                                                                                   | tphl, tplh |      | 6.0  |      | μS    |                                                                                     |
| QSE158, QSE159                                                                                      |            |      |      |      |       |                                                                                     |
| Output rise, fall times                                                                             | tr, tf     | —    |      | 100  | nS    | Ee=0 or .3 mW/cm², f=10K Hz<br>DC=50%, R <sub>L</sub> = 300Ω <sup>(6)</sup> .       |
| Propagation delay                                                                                   | tphl, tplh |      | 6.0  |      | μS    |                                                                                     |



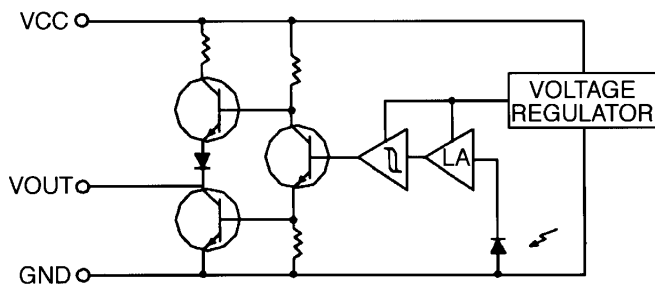
## NOTES

1. Derate power dissipation linearly  $4.00 \text{ mW}/^\circ\text{C}$  above  $25^\circ\text{C}$ .
2. RMA flux is recommended.
3. Methanol or Isopropyl alcohols are recommended as cleaning agents.
4. Soldering iron tip  $\frac{1}{16}$ " (1.6 mm) minimum from housing.
5. As long as leads are not under any stress or spring tension.
6. Irradiance measurements are made with an AlGaAs LED emitting light at a peak wavelength of 880 nm.

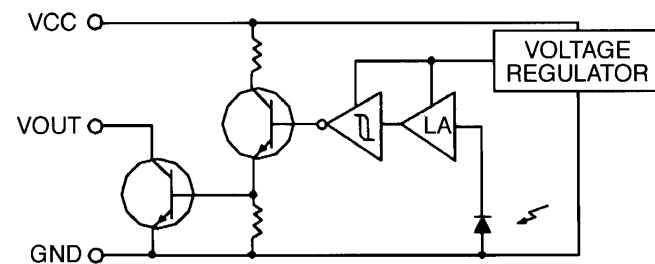
**CIRCUIT SCHEMATICS**



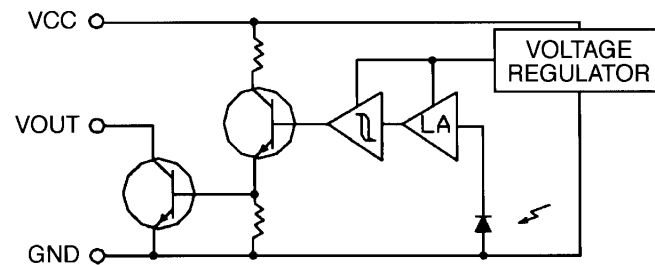
**QSE156**  
Totem-Pole Output Buffer



**QSE157**  
Totem-Pole Output Inverter



**QSE158**  
Open-Collector Output Buffer



**QSE159**  
Open-Collector Output Inverter

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