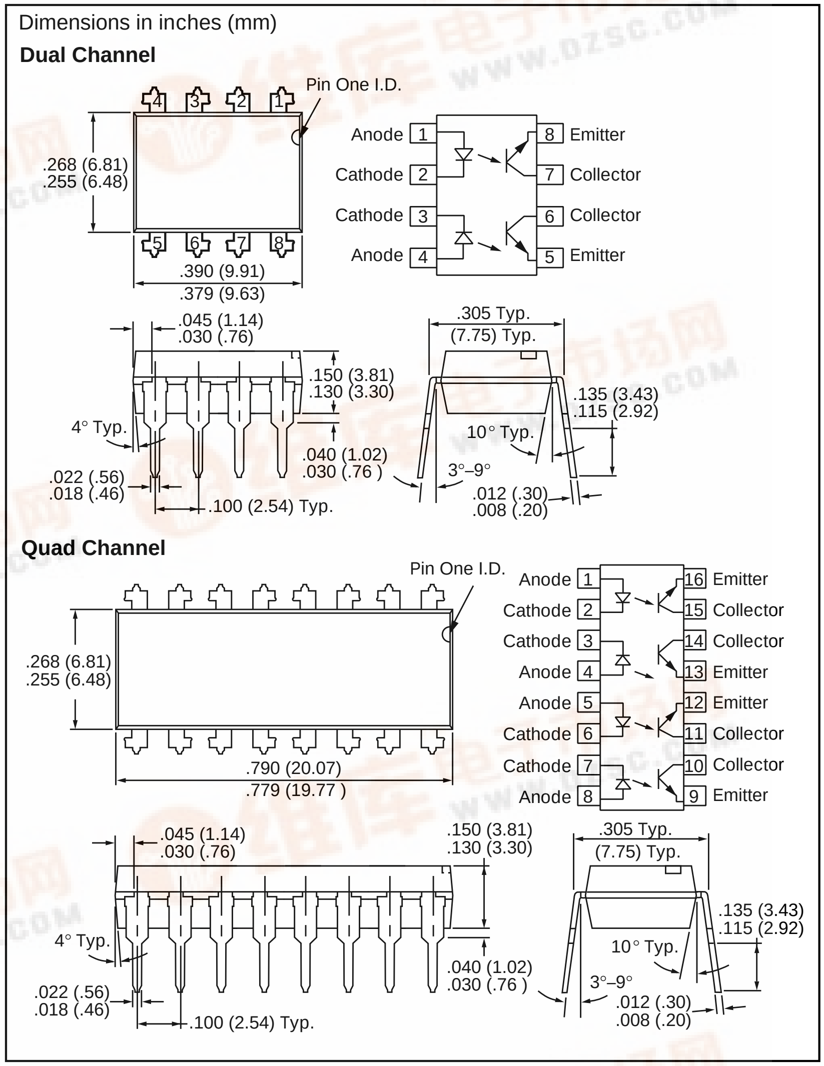
SIEMENS

# DUAL CHANNEL ILD1/2/5
# QUAD CHANNEL ILQ1/2/5
# PHOTOTRANSISTOR OPTOCOUPLER

## FEATURES

- **Current Transfer Ratio at $I_F$=10 mA**
  **ILD/Q1, 20% Min.**
  **ILD/Q2, 100% Min.**
  **ILD/Q5, 50% Min.**
- **High Collector-Emitter Voltage**
  **ILD/Q1: $BV_{CEO}$=50 V**
  **ILD/Q2, ILD/Q5: $BV_{CEO}$=70 V**
- **Field-Effect Stable by TRansparent IOn Shield (TRIOS) Isolation Test Voltage, 5300 $VAC_{RMS}$**
- **Underwriters Lab File #E52744**
- **VDE 0884 Available with Option 1**




## Maximum Ratings (Each Channel)

### Emitter

Reverse Voltage ............................................6 V
Forward Current ..........................................60 mA
Surge Current ............................................... 2.5 A
Power Dissipation.....................................100 mW
Derate Linearly from 25°C.................... 1.3 mW/°C

### Detector

Collector-Emitter Reverse Voltage
ILD/Q1 ......................................................... 50 V
ILD/Q2, ILD/Q5...............................................70 V
Collector Current ......................................... 50 mA
Collector Current (t<1 ms)..........................400 mA
Power Dissipation.....................................200 mW
Derate Linearly from 25°C.....................2.6 mW/°C

### Package

Isolation Test Voltage (between emitter and detector referred to standard climate 23°C/50%RH, DIN 50014) ..................................5300 $VAC_{RMS}$
Creepage ............................................. min. 7 mm
Clearance............................................. min. 7 mm
Isolation Resistance
$V_{IO}$=500 V, $T_A$=25°C ....................... $R_{IO}=10^{12}\ \Omega$
$V_{IO}$=500 V, $T_A$=100°C ...................... $R_{IO}=10^{11}\Omega$
Package Power Dissipation ..................... 250 mW
Derate Linearly from 25°C..................... 3.3 mW/°C
Storage Temperature.................. –40°C to +150°C
Operating Temperature ................–40°C to +100°C
Junction Temperature...................................100°C
Soldering Temperature
(2 mm from case bottom) .........................260°C

## DESCRIPTION

The ILD/Q1/2/5 are optically coupled isolated pairs employing GaAs infrared LEDs and silicon NPN phototransistor. Signal information, including a DC level, can be transmitted by the drive while maintaining a high degree of electrical isolation between input and output. The ILD/Q1/2/5 are especially designed for driving medium-speed logic and can be used to eliminate troublesome ground loop and noise problems. Also these couplers can be used to replace relays and transformers in many digital interface applications such as CRT modulation. The ILD1/2/5 has two isolated channels in a single DIP package and the ILQ1/2/5 has four isolated channels per package.

See Appnote 45, "How to Use Optocoupler Normalized Curves."

### Characteristics

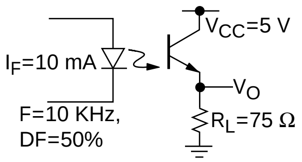
| | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| **Emitter** | | | | | | |
| Forward Voltage | $V_F$ | | 1.25 | 1.65 | V | $I_F$=60 mA |
| Reverse Current | $I_R$ | | 0.01 | 10 | µA | $V_R$=6 V |
| Capacitance | $C_0$ | | 25 | | pF | $V_R$=0 V, f=1 MHz |
| Thermal Resistance, Junction to Lead | $R_{THJL}$ | | 750 | | °C/W | |
| **Detector** | | | | | | |
| Capacitance | $C_{CE}$ | | 6.8 | | pF | $V_{CE}$=5 V, f=1 MHz |
| Leakage Current, Collector-Emitter | $I_{CEO}$ | | 5 | 50 | nA | $V_{CE}$=10 V |
| Saturation Voltage, Collector-Emitter | $V_{CESAT}$ | | 0.25 | 0.4 | | $I_{CE}$=1 mA, $I_B$=20 µA |
| DC Forward Current Gain | HFE | 200 | 650 | 1800 | | $V_{CE}$= 10 V, $I_B$=20 µA |
| Saturated DC Forward Current Gain | $HFE_{SAT}$ | 120 | 400 | 600 | | $V_{CE}$= 0.4 V, $I_B$=20 µA |
| Thermal Resistance, Junction to Lead | $R_{THJL}$ | | 500 | | °C/W | |

### Package Transfer Characteristics (Each Channel)

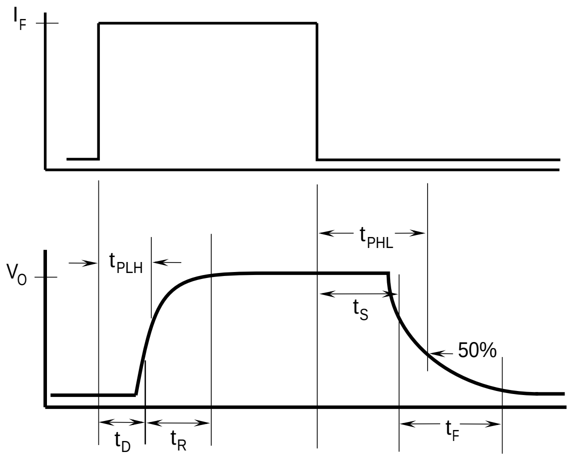
| | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| **ILD/Q1** | | | | | | |
| Saturated Current Transfer Ratio (Collector-Emitter) | $CTR_{CESAT}$ | | 75 | | % | $I_F$=10 mA, $V_{CE}$=0.4 V |
| Current Transfer Ratio (Collector-Emitter) | $CTR_{CE}$ | 20 | 90 | 300 | % | $I_F$=10 mA, $V_{CE}$=10 V |
| **ILD/Q2** | | | | | | |
| Saturated Current Transfer Ratio (Collector-Emitter) | $CTR_{CESAT}$ | | 170 | | % | $I_F$=10 mA, $V_{CE}$=0.4 V |
| Current Transfer Ratio (Collector-Emitter) | $CTR_{CE}$ | 100 | 200 | 500 | % | $I_F$=10 mA, $V_{CE}$=10 V |
| **ILD/Q5** | | | | | | |
| Saturated Current Transfer Ratio (Collector-Emitter) | $CTR_{CESAT}$ | | 100 | | % | $I_F$=10 mA, $V_{CE}$=0.4 V |
| Current Transfer Ratio (Collector-Emitter) | $CTR_{CE}$ | 50 | 130 | 400 | % | $I_F$=10 mA, $V_{CE}$ =10 V |
| **Isolation and Insulation** | | | | | | |
| Common Mode Rejection, Output High | $C_{MH}$ | | 5000 | | V/µs | $V_{CM}$=50 $V_{P-P}$, $R_L$=1 kΩ, $I_F$=0 mA |
| Common Mode Rejection, Output Low | $C_{ML}$ | | 5000 | | V/µs | $V_{CM}$=50 $V_{P-P}$, $R_L$=1 kΩ, $I_F$=10 mA |
| Common Mode Coupling Capacitance | $C_{CM}$ | | 0.01 | | pF | |
| Package Capacitance | $C_{IO}$ | | 0.8 | | pF | $V_{IO}$=0 V, f=1 MHz |

## Typical Switching Times

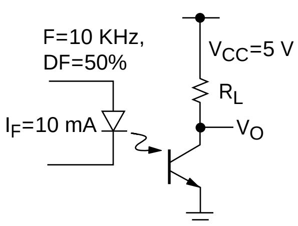
### Figure 1. Non-saturated switching timing



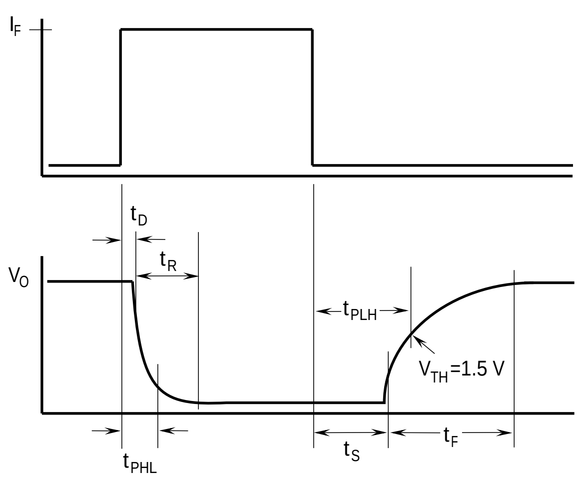

### Figure 2. Non-saturated switching timing




### Figure 3. Saturated switching timing



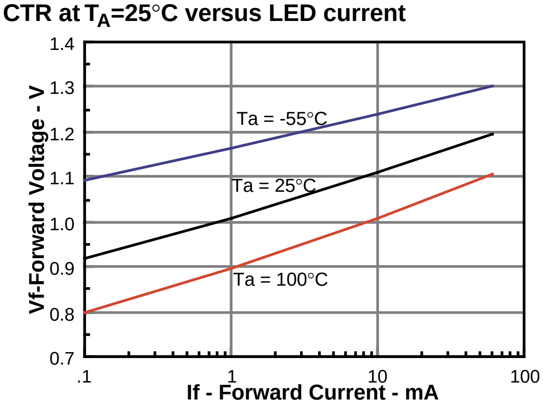

### Figure 4. Saturated switching timing




| Characteristic | ILD/Q1 $I_F$=20 mA | ILD/Q2 $I_F$=5 mA | ILD/Q5 $I_F$=10 mA | Unit | Condition |
|---|---|---|---|---|---|
| Delay, $t_D$ | 0.8 | 1.7 | 1.7 | µs | $V_{CE}$=5 V<br>$R_L$=75 kΩ<br>50% of $V_{PP}$ |
| Rise time, $t_R$ | 1.9 | 2.6 | 2.6 | µs | |
| Storage, $t_S$ | 0.2 | 0.4 | 0.4 | µs | |
| Fall Time, $t_F$ | 1.4 | 2.2 | 2.2 | µs | |
| Propagation H-L, $t_{PHL}$ | 0.7 | 1.2 | 1.1 | µs | |
| Propagation L-H, $t_{PLH}$ | 1.4 | 2.3 | 2.5 | µs | |

| Characteristic | ILD/Q1 $I_F$=20 mA | ILD/Q2 $I_F$=5 mA | ILD/Q5 $I_F$=10 mA | Unit | Condition |
|---|---|---|---|---|---|
| Delay, $t_D$ | 0.8 | 1 | 1.7 | µs | $V_{CE}$=0.4 V<br>$R_L$=1 kΩ<br>$V_{CC}$=5 V<br>$V_{TH}$=1.5 V |
| Rise time, $t_R$ | 1.2 | 2 | 7 | µs | |
| Storage, $t_S$ | 7.4 | 5.4 | 4.6 | µs | |
| Fall Time, $t_F$ | 7.6 | 13.5 | 20 | µs | |
| Propagation H-L, $t_{PHL}$ | 1.6 | 5.4 | 2.6 | µs | |
| Propagation L-H, $t_{PLH}$ | 8.6 | 7.4 | 7.2 | µs | |

### Figure 5. Normalized non-saturated and saturated CTR at $T_A$=25°C versus LED current




### Figure 6. Normalized non-saturated and saturated CTR at $T_A$=25°C versus LED current

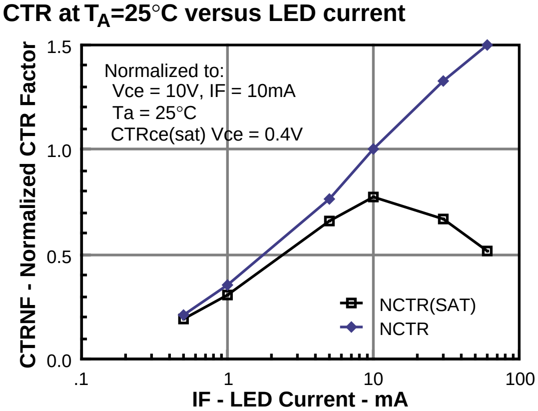


**Figure 7. Normalized non-saturated and saturated CTR at $T_A$=50°C versus LED current**

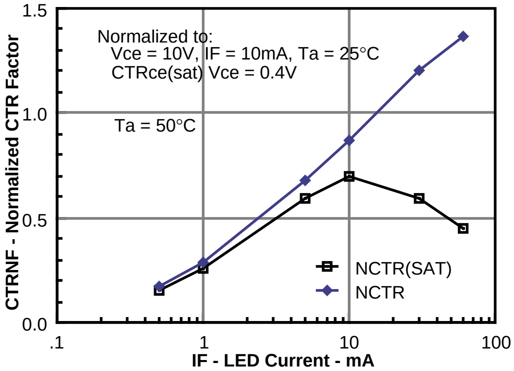



**Figure 8. Normalized non-saturated and saturated CTR at $T_A$=70°C versus LED current**

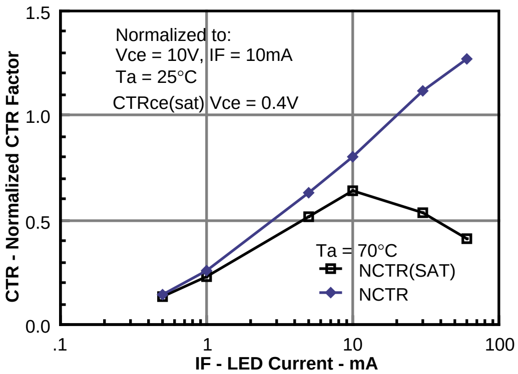



**Figure 9. Normalized non-saturated and saturated CTR at $T_A$=85°C versus LED current**

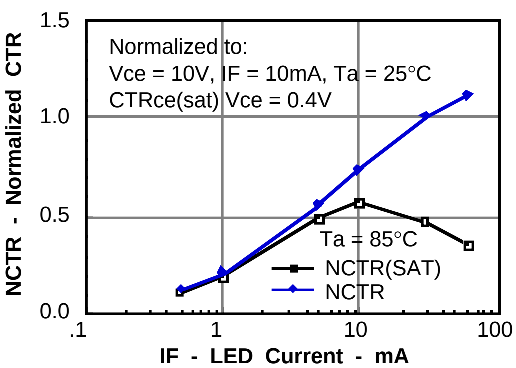



**Figure 10. Collector-emitter current versus temperature and LED current**

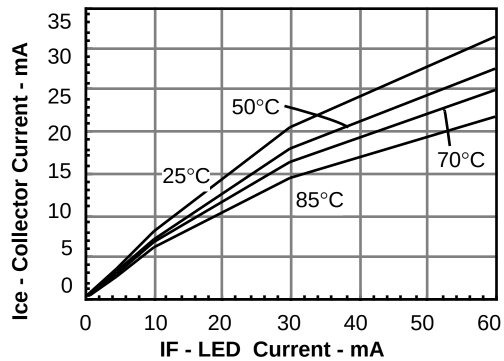



**Figure 11. Collector-emitter leakage current versus temperature**

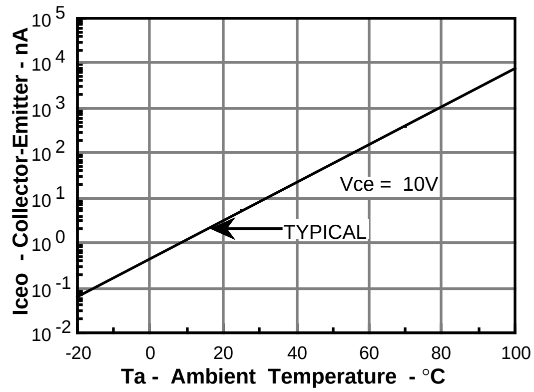



**Figure 12. Propagation delay versus collector load resistor**