# ILH100

## Hermetic Phototransistor Optocoupler

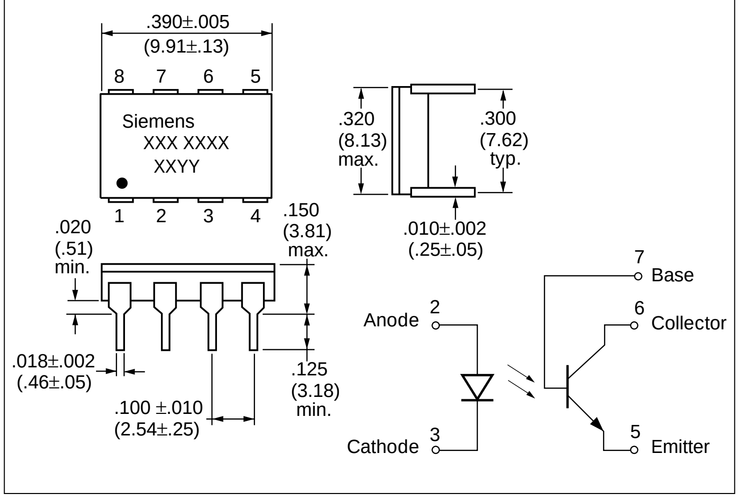
### FEATURES

- **Operating Temperature Range, –55°C to +125°C**
- **Current Transfer Ratio Guaranteed from –55°C to +100°C Ambient Temperature Range**
- **High Current Transfer Ratio at Low Input Current**
- **Isolation Test Voltage, 3000 $V_{DC}$**
- **Base Lead Available for Transistor Biasing**
- **Standard 8 Pin DIP Package**

### DESCRIPTION

The ILH100 is designed especially for hi-rel applications requiring optical isolation with high current transfer ratio and low saturation $V_{CE}$. Each optocoupler consists of a light emitting diode and a NPN silicon phototransistor mounted and coupled in an 8 pin hermetically sealed DIP package. The ILH100's low input current makes it well suited for direct CMOS to LSTTL/TTL interfaces.

Dimensions in inches (mm)




### Maximum Ratings

| | |
|---|---|
| **Emitter** | |
| Reverse Voltage | 6.0 V |
| Forward Current | 60 mA |
| Peak Forward Current(1) | 1.0 A |
| Power Dissipation | 150 mW |
| Derate Linearly from 25°C | 1.5 mW/°C |
| **Detector** | |
| Collector–Emitter Voltage | 70 V |
| Emitter–Base Voltage | 7.0 V |
| Collector–Base Voltage | 70 V |
| Continuous Collector Current | 50 mA |
| Power Dissipation | 300 mW |
| Derate Linearly from 25°C | 3.0 mW/°C |
| **Package** | |
| Input–Output Isolation Test Voltage(2) | 3000 VDC |
| Storage Temperature Range | –65°C to +150°C |
| Operating Temperature Range | –55°C to +125°C |
| Junction Temperature | 150°C |
| Soldering Time at 240°C, 1.6 mm from case | 10 sec. |
| Power Dissipation | 350 mW |
| Derate Linearly from 25°C | 3.5 mW/°C |

Notes:

1. Values applies for $P_W \leq 1.0$ ms, PRR≤300 pps.
2. Measured between pins 1,2,3 and 4 shorted together and pins 5,6,7 and 8 shorted together. $T_A$=25°C and duration=1.0 second, RH=45%.

**Characteristics** $T_A$=25°C, unless otherwise specified

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| **Emitter** | | | | | | |
| Forward Voltage | $V_F$ | — | 1.45 | 1.7 | V | $I_F$=60 mA |
| Reverse Breakdown Voltage | $V_{BR}$ | 6.0 | — | — | | $I_R$=10 µA |
| Reverse Current | $I_R$ | — | 0.01 | 10 | µA | $V_R$=6.0 V |
| Capacitance | $C_J$ | | 20 | — | pF | $V_F$=0 V, f=1.0 MHz |
| Thermal Resistance | $R_{TH}$ | | 220 | | °C/W | Junction to Lead |
| Detector | | | | | | |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | — | 0.25 | 0.4 | V | $I_B$=20µA, $I_{CE}$=1.0 mA |
| Base-Emitter Voltage | $V_{BE}$ | | 0.65 | — | | $I_B$=20µA |
| Collector-Emitter Leakage Current | $I_{CEO}$ | | 5.0 | 50 | nA | $V_{CE}$=10 V |
| DC Forward Current Gain | HFE | 250 | 400 | 750 | — | $V_{CE}$=10 V, $I_B$=20 µA |
| Saturated DC Forward Gain | $HFE_{(sat)}$ | 125 | 200 | 325 | — | $V_{CE}$=0.4 V, $I_B$=20 µA |
| Capacitance | $C_{CE}$ | — | 6.8 | — | pF | $V_{CE}$=5.0 V, f=1.0 MHz |
| | $C_{CB}$ | | 8.5 | | | |
| | $C_{EB}$ | | 11 | | | |
| Thermal Resistance | $R_{TH}$ | — | 220 | — | °C/W | Junction to Lead |
| **Coupled Characteristics (–55°C to 100° C)** | | | | | | |
| Saturated Current Transfer Ratio | $CTR_{(sat)}$ | 70 | 210 | 250 | % | $I_F$=10 mA, $V_{CE}$=0.4 V |
| Current Transfer Ratio, Collector-Emitter | $CTE_{ce}$ | 100 | 300 | 450 | % | $I_F$=10 mA, $V_{CE}$=10 V |
| Current Transfer Ratio, Collector-Base | $CTR_{cb}$ | 0.4 | 0.7 | 0.9 | | $I_F$=10 mA, $V_{CB}$=9.3 V |
| **Isolation and Insulation** | | | | | | |
| Common Mode Rejection Output High | $CM_H$ | 1000 | 2000 | — | V/µs | $V_{CM}$=500 $V_{p-p}$, $V_{CC}$=5.0 V, $R_L$=1.0 KΩ, $I_F$=0 mA |
| Common Mode Rejection Output Low | $CM_L$ | 1000 | 2000 | | V/µs | $V_{CM}$=500 $V_{p-p}$, $V_{CC}$=5.0 V, $R_L$=1.0 KΩ, $I_F$=10 mA |
| Package Capacitance | $C_{IO}$ | — | 1.5 | | pF | $V_{IO}$=0 V, 1.0 MHz |
| Insulation Resistance | $R_{IO}$ | $10^{11}$ | $10^{14}$ | | W | $V_{IO}$=500 VDC |
| Leakage Current, Input-Output | $I_{IO}$ | — | — | 10 | µA | Relative Humidity ≤50%, $V_{IO}$ 3000 VDC, 5.0 sec. |

**Typical Switching Speeds** $T_A$=25°C

| Non-Saturated Switching | Symbol | Typ. | Max. | Unit | Test Condition |
|---|---|---|---|---|---|
| Delay | $t_d$ | 0.8 | 2.0 | µs | — |
| Rise | $t_r$ | 2.0 | 5.0 | | $V_{CC}$=5.0 V |
| Storage | $t_s$ | 0.4 | 1.5 | | $R_L$=75 Ω |
| Fall | $t_f$ | 2.0 | 5.0 | | $I_F$=10 mA |
| Propagation-High to Low | $t_{pHL}$ | 1.0 | 3.0 | | 50% of $V_{PP}$ |
| Propagation-Low to High | $t_{pLH}$ | 1.5 | 4.0 | | $R_{BE}$=open |
| **Saturated Switching(1)** | **Symbol** | **Typ.** | **Max.** | | **Test Condition** |
| Delay | $t_d$ | 0.7 | 2.0 | | $V_{CE}$=0.4 V |
| Rise | $t_r$ | 1.0 | 3.0 | | $V_{CE}$=0.4 V |
| Storage | $t_s$ | 13.5 | 30 | | $R_L$=1.0 KΩ |
| Fall | $t_f$ | 12 | | | $I_F$=10 mA |
| Propagation-High to Low | $t_{pHL}$ | 1.4 | 5.0 | | $V_{CC}$=5.0 V<br>$V_{TH}$=1.5 V |
| Propagation-Low to High | $t_{pLH}$ | 15 | 40 | | $R_{BE}$=open |

**Figure 1. Switching time waveform and test schematic—non-saturated test condition**

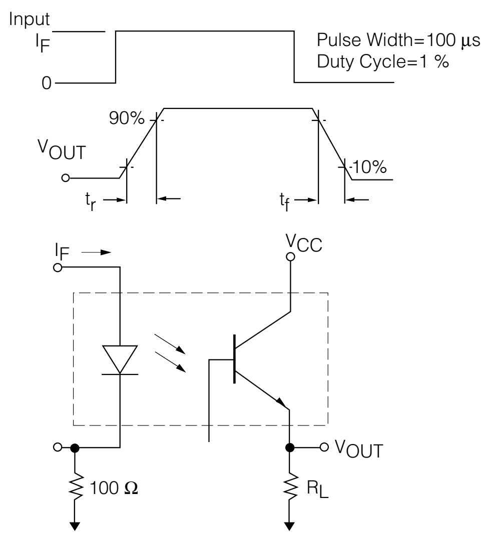



**Figure 2. Forward current versus forward voltage and temperature**

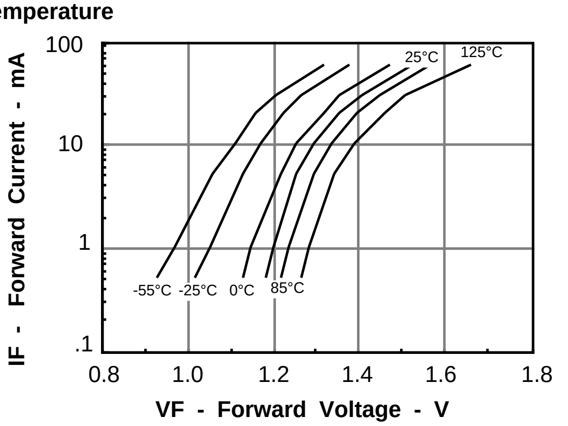



**Figure 3. Peak LED current versus duty factor refresh rate and temperature**

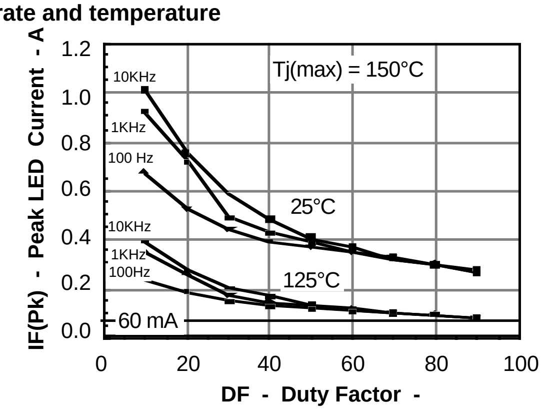



**Figure 4. Normalized non-saturated current transfer ratio versus temperature and LED current**

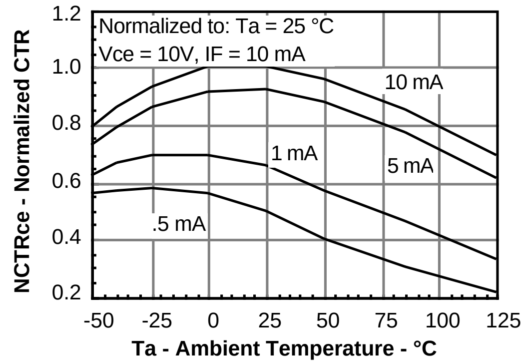



**Figure 5. Normalized saturated current transfer ratio versus temperature and LED current**

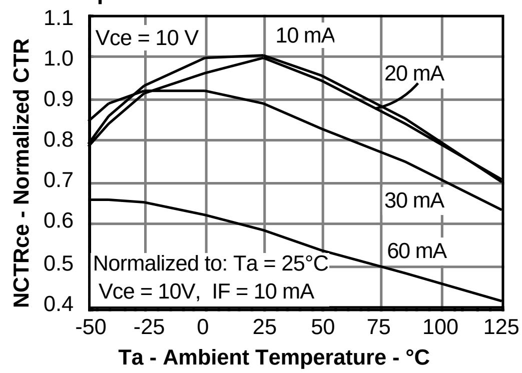



**Figure 6. Normalized saturated current transfer ratio versus temperature and LED current**

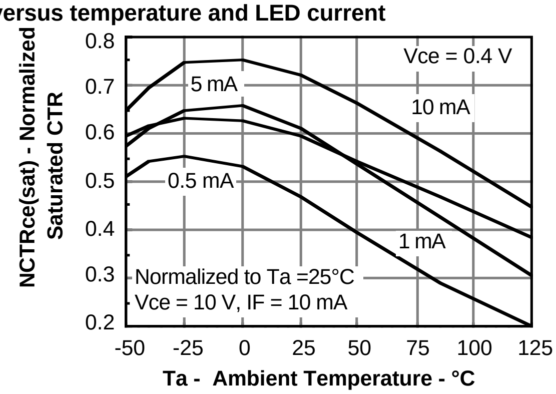



**Figure 7. Collector-emitter current versus temperature and LED current**

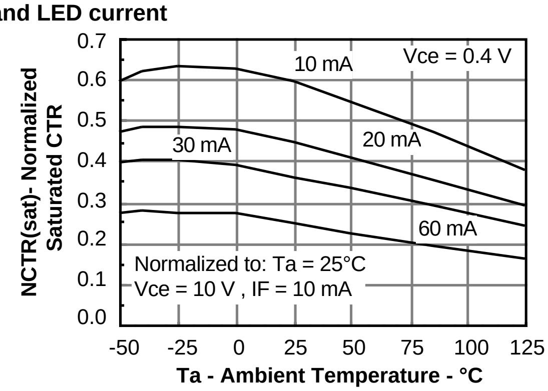


**Figure 8. Collector-emitter current versus temperature and LED current**

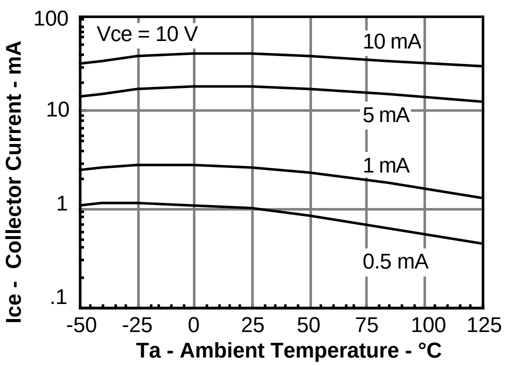



**Figure 9. Collector-emitter current versus temperature and LED current**

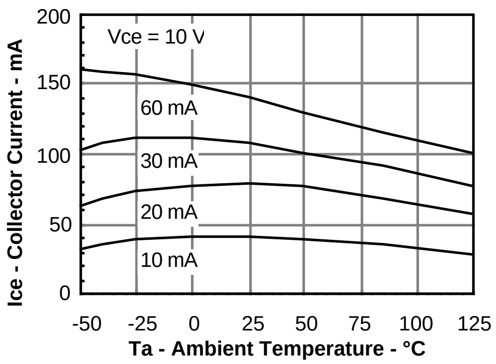



**Figure 10. Saturated collector-emitter current versus temperature and LED current**

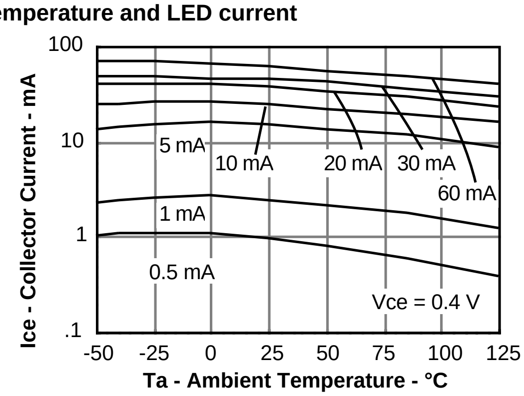



**Figure 11. Saturated collector-emitter current versus temperature and LED current**

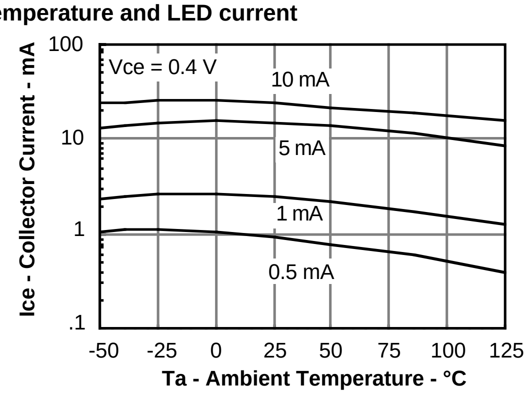



**Figure 12. Normalized collector base CRT versus temperature and LED current**

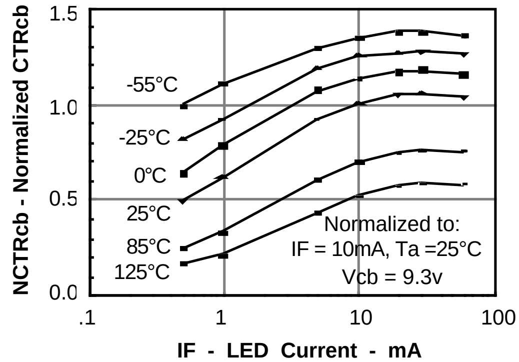



**Figure 13. Normalizied Icb photocurrent versus temperature and LED current**

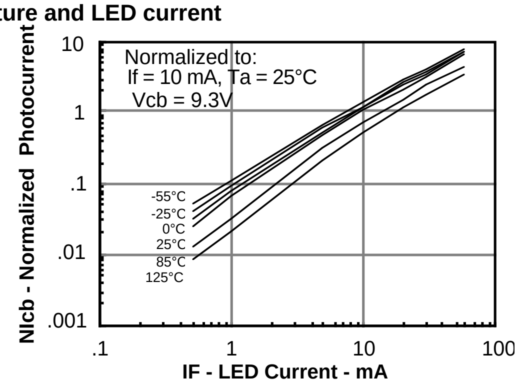



**Figure 14. Normalized non-saturated and saturated HFE at $T_A$=25°C versus base current**

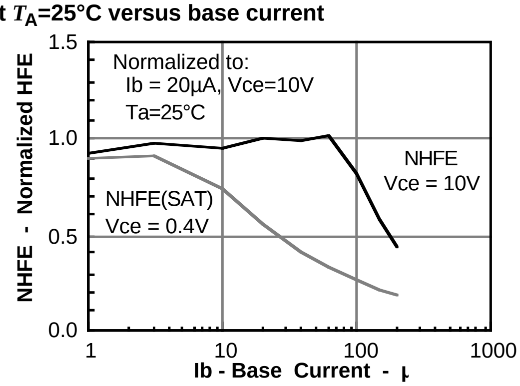



**Figure 15. Normalizied non-saturated and saturated HFE at $T_A$=50°C versus base current**

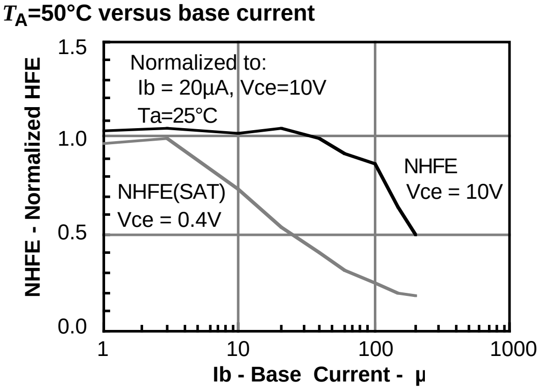


Figure 16. Normalized non-saturated and saturated HFE at $T_A$=70°C versus base current

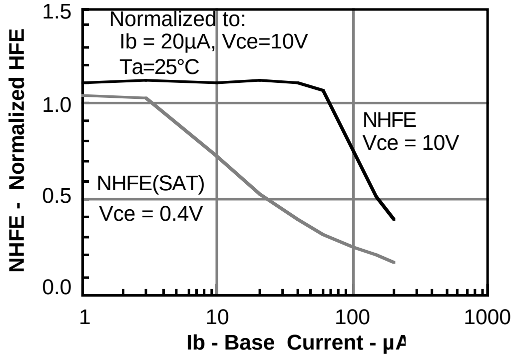



Figure 17. Collector-emitter leakage current versus temperature

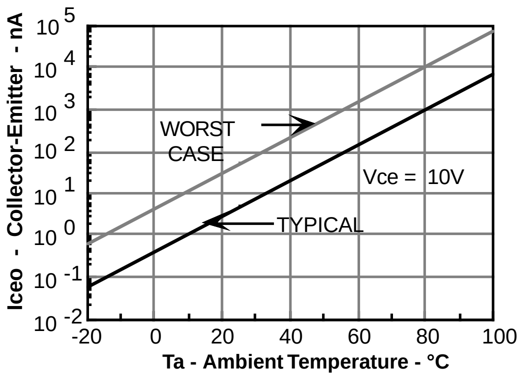



Figure 18. Base emitter voltage versus base current

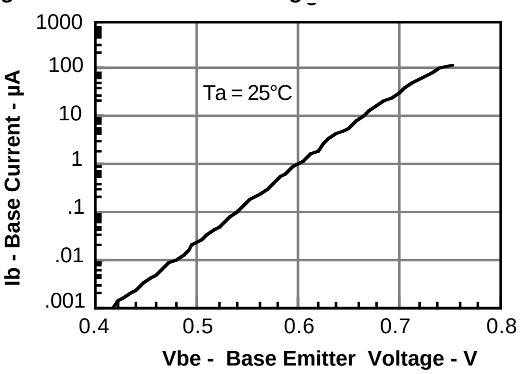



Figure 19. Base emitter capacitance versus base emitter voltage

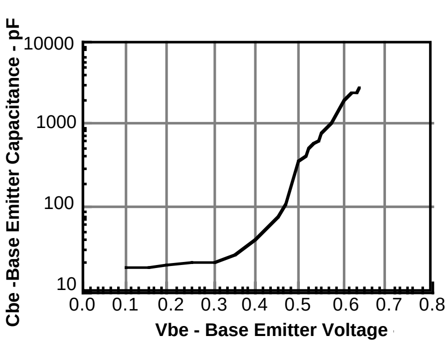



Figure 20. Propagation delay versus temperature and collector load resistance for $I_F$=5.0 mA

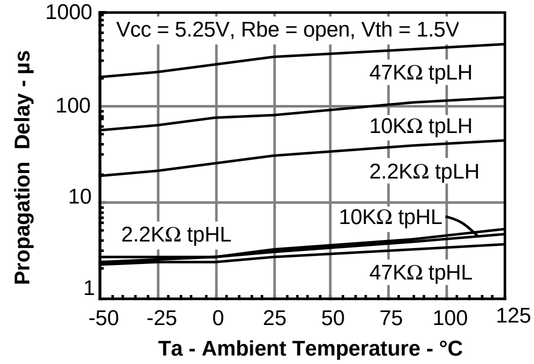



Figure 21. Propagation delay versus temperature and collector load resistance for $I_F$=10 mA

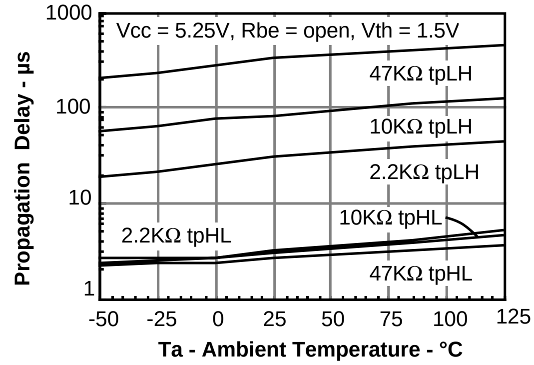



Figure 22. Propagation delay versus temperature and collector load resistance for $I_F$=20 mA

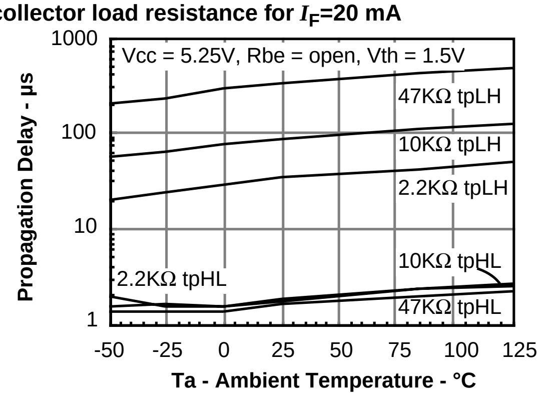



Figure 23. Propagation delay versus temperature and collector load resistance for $I_F$=5.0 mA

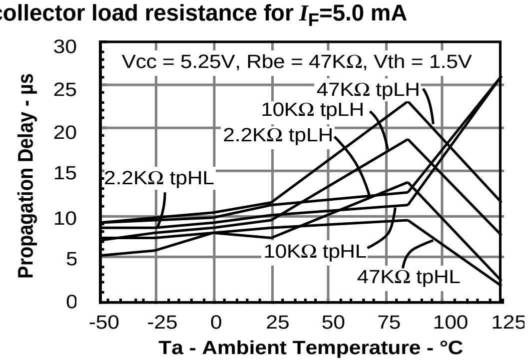


**Figure 1. Switching time waveform and test schematic—saturated test condition**

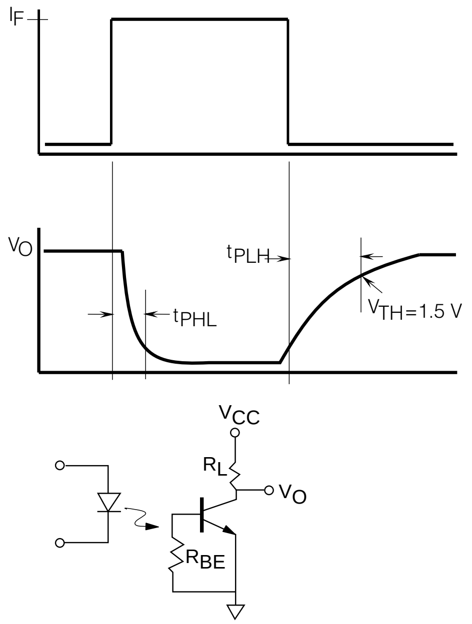



**Figure 2. Propagation delay versus temperature and collector load resistance for $I_F$=10 mA**

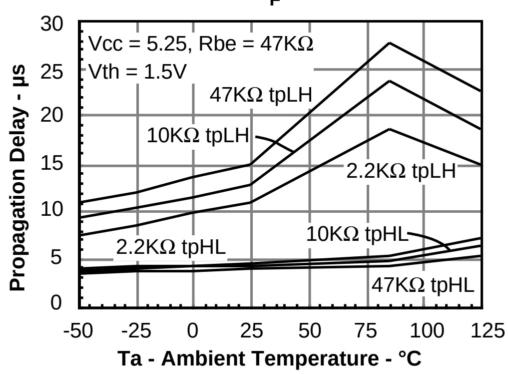



**Figure 3. Propagation delay versus temperature and collector load resistance for $I_F$=20 mA**

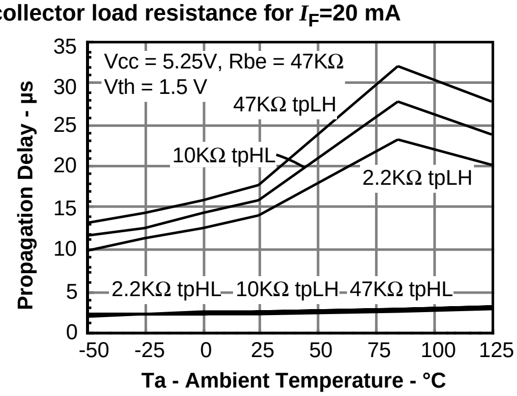



**Figure 4. Propagation delay versus collector load and base-emitter resistance for $I_F$=5.0 mA**

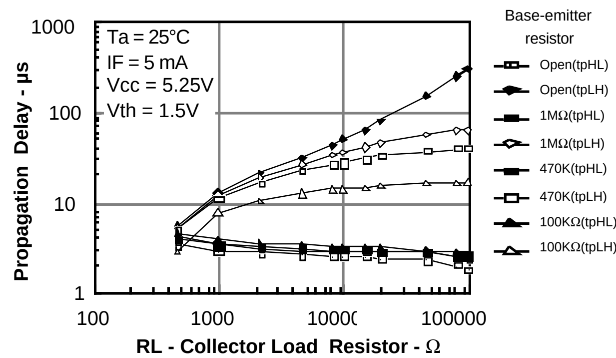



**Figure 5. Propagation delay versus collector load and base-emitter resistance for $I_F$=5.0 mA**

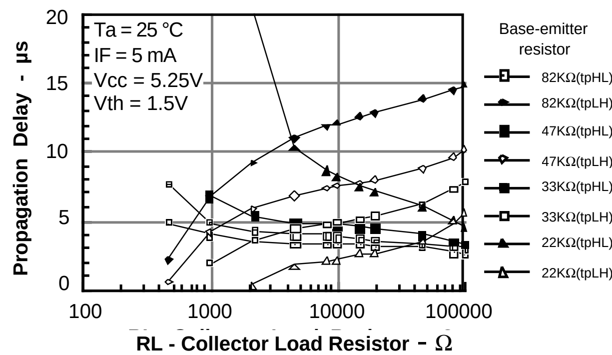



**Figure 6. Propagation delay versus collector load and base-emitter resistance for $I_F$=10 mA**

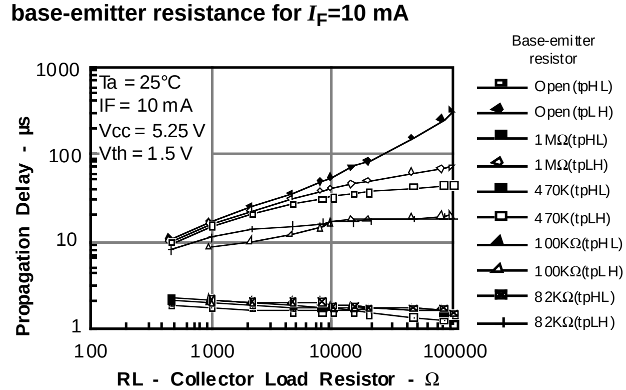



**Figure 7. Propagation delay versus collector load and base-emitter resistance for $I_F$=10 mA**

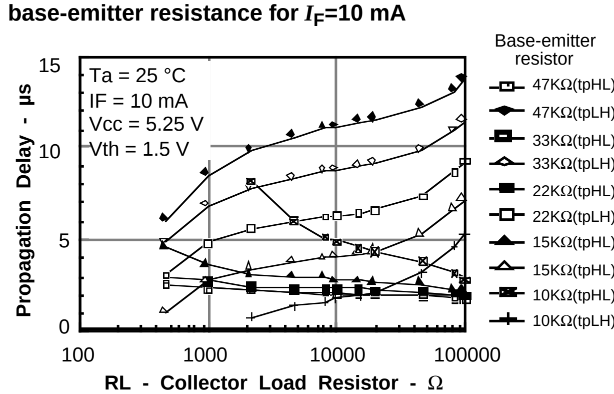


**Figure 8. Propagation delay versus collector load and base-emitter resistance for $I_F$=15 mA**

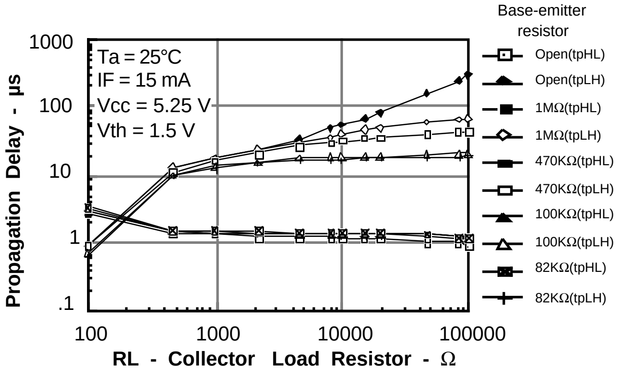



**Figure 9. Propagation delay versus collector load and base-emitter resistance for $I_F$=15 mA**

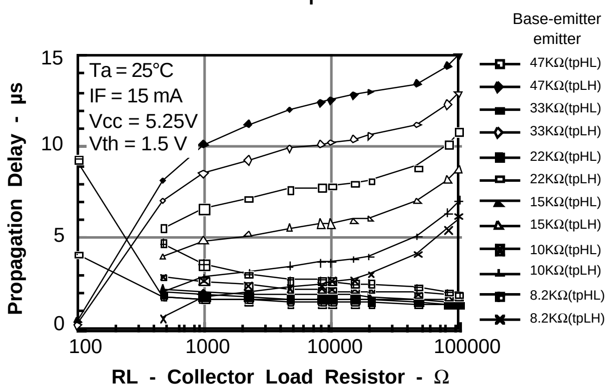



**Figure 10. Propagation delay versus collector load and base-emitter resistance for $I_F$=15 mA**

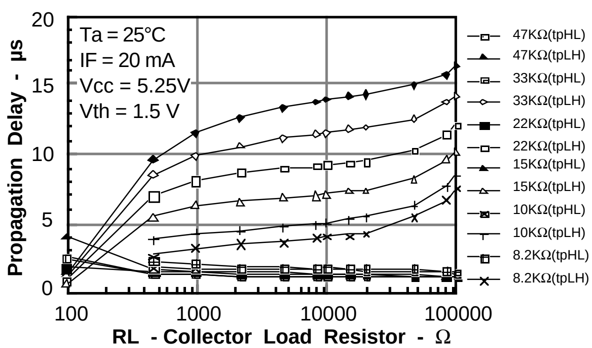



**Figure 11. Propagation delay versus collector load and base-emitter resistance for $I_F$=15 mA**

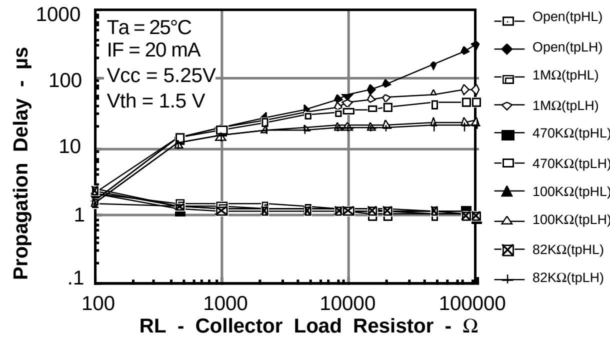



**Figure 12. Common mode transient rejection**