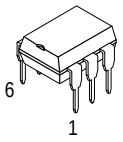
UL | CSA | SETI | BABT

# M4N25

# 6-Pin DIP Optoisolators Transistor Output

**STYLE 1 PLASTIC**




**STANDARD THRU HOLE**

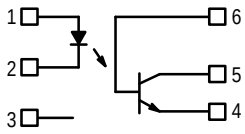
The M4N25 device consists of a gallium arsenide infrared emitting diode optically coupled to a silicon NPN phototransistor detector.

- Most Economical Optoisolator Choice for Medium Speed, Switching Applications
- Meets or Exceeds All JEDEC Registered Specifications

### Applications

- General Purpose Switching Circuits
- Interfacing and coupling systems of different potentials and impedances
- I/O Interfacing
- Solid State Relays

**SCHEMATIC**




PIN 1. LED ANODE
2. LED CATHODE
3. N.C.
4. EMITTER
5. COLLECTOR
6. BASE



**MAXIMUM RATINGS** ($T_A$ = 25°C unless otherwise noted)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| **INPUT LED** | | | |
| Reverse Voltage | $V_R$ | 3 | Volts |
| Forward Current — Continuous | $I_F$ | 60 | mA |
| LED Power Dissipation @ $T_A$ = 25°C<br>with Negligible Power in Output Detector<br>Derate above 25°C | $P_D$ | 100<br><br>1.41 | mW<br><br>mW/°C |
| **OUTPUT TRANSISTOR** | | | |
| Collector–Emitter Voltage | $V_{CEO}$ | 30 | Volts |
| Emitter–Collector Voltage | $V_{ECO}$ | 7 | Volts |
| Collector–Base Voltage | $V_{CBO}$ | 70 | Volts |
| Collector Current — Continuous | $I_C$ | 50 | mA |
| Detector Power Dissipation @ $T_A$ = 25°C<br>with Negligible Power in Input LED<br>Derate above 25°C | $P_D$ | 150<br><br>1.76 | mW<br><br>mW/°C |
| **TOTAL DEVICE** | | | |
| Isolation Surge Voltage(1)<br>(Peak ac Voltage, 60 Hz, 1 sec Duration) | $V_{ISO}$ | 7500 | Vac(pk) |
| Total Device Power Dissipation @ $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 250<br>2.94 | mW<br>mW/°C |
| Ambient Operating Temperature Range(2) | $T_A$ | –55 to +100 | °C |
| Storage Temperature Range(2) | $T_{stg}$ | –55 to +150 | °C |
| Soldering Temperature (10 sec, 1/16″ from case) | $T_L$ | 260 | °C |

1. Isolation surge voltage is an internal device dielectric breakdown rating. For this test, Pins 1 and 2 are common, and Pins 4, 5 and 6 are common.
2. Refer to Quality and Reliability Section in Opto Data Book for information on test conditions.

**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted)(1)

| Characteristic | | Symbol | Min | Typ(1) | Max | Unit |
|---|---|---|---|---|---|---|
| **INPUT LED** | | | | | | |
| Forward Voltage ($I_F$ = 10 mA) | $T_A$ = 25°C<br>$T_A$ = –55°C<br>$T_A$ = 100°C | $V_F$ | —<br>—<br>— | 1.15<br>1.3<br>1.05 | 1.5<br>—<br>— | Volts |
| Reverse Leakage Current ($V_R$ = 3 V) | | $I_R$ | — | — | 100 | μA |
| Capacitance (V = 0 V, f = 1 MHz) | | $C_J$ | — | 18 | — | pF |
| **OUTPUT TRANSISTOR** | | | | | | |
| Collector–Emitter Dark Current ($V_{CE}$ = 10 V, $T_A$ = 25°C) | | $I_{CEO}$ | — | 1 | 50 | nA |
| ($V_{CE}$ = 10 V, $T_A$ = 100°C) | | $I_{CEO}$ | — | 1 | — | μA |
| Collector–Base Dark Current ($V_{CB}$ = 10 V) | | $I_{CBO}$ | — | 0.2 | — | nA |
| Collector–Emitter Breakdown Voltage ($I_C$ = 1 mA) | | $V_{(BR)CEO}$ | 30 | 45 | — | Volts |
| Collector–Base Breakdown Voltage ($I_C$ = 100 μA) | | $V_{(BR)CBO}$ | 70 | 100 | — | Volts |
| Emitter–Collector Breakdown Voltage ($I_E$ = 100 μA) | | $V_{(BR)ECO}$ | 7 | 7.8 | — | Volts |
| Collector–Emitter Capacitance (f = 1 MHz, $V_{CE}$ = 0) | | $C_{CE}$ | — | 7 | — | pF |
| Collector–Base Capacitance (f = 1 MHz, $V_{CB}$ = 0) | | $C_{CB}$ | — | 19 | — | pF |
| Emitter–Base Capacitance (f = 1 MHz, $V_{EB}$ = 0) | | $C_{EB}$ | — | 9 | — | pF |
| **COUPLED** | | | | | | |
| Output Collector Current ($I_F$ = 10 mA, $V_{CE}$ = 10 V) | | $I_C$ (CTR)(2) | 2 (20) | 7 (70) | — | mA (%) |
| Collector–Emitter Saturation Voltage ($I_C$ = 2 mA, $I_F$ = 50 mA) | | $V_{CE(sat)}$ | — | 0.15 | 0.5 | Volts |
| Turn–On Time ($I_F$ = 10 mA, $V_{CC}$ = 10 V, $R_L$ = 100 Ω)(3) | | $t_{on}$ | — | 2.8 | — | μs |
| Turn–Off Time ($I_F$ = 10 mA, $V_{CC}$ = 10 V, $R_L$ = 100 Ω)(3) | | $t_{off}$ | — | 4.5 | — | μs |
| Rise Time ($I_F$ = 10 mA, $V_{CC}$ = 10 V, $R_L$ = 100 Ω)(3) | | $t_r$ | — | 2 | — | μs |
| Fall Time ($I_F$ = 10 mA, $V_{CC}$ = 10 V, $R_L$ = 100 Ω)(3) | | $t_f$ | — | 2 | — | μs |
| Isolation Voltage (f = 60 Hz, t = 1 sec)(4) | | $V_{ISO}$ | 7500 | — | — | Vac(pk) |
| Isolation Resistance (V = 500 V)(4) | | $R_{ISO}$ | $10^{11}$ | — | — | Ω |
| Isolation Capacitance (V = 0 V, f = 1 MHz)(4) | | $C_{ISO}$ | — | 0.2 | — | pF |

1. Always design to the specified minimum/maximum electrical limits (where applicable).
2. Current Transfer Ratio (CTR) = $I_C/I_F$ x 100%.
3. For test circuit setup and waveforms, refer to Figure 14.
4. For this test, Pins 1 and 2 are common, and Pins 4, 5 and 6 are common.

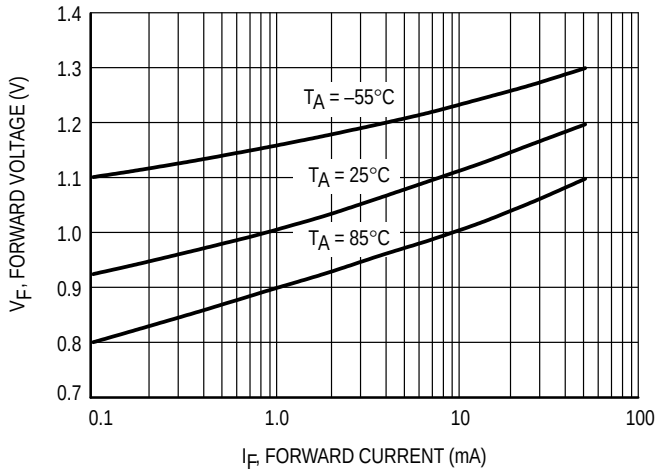



**Figure 1. Forward Voltage vs. Forward Current**

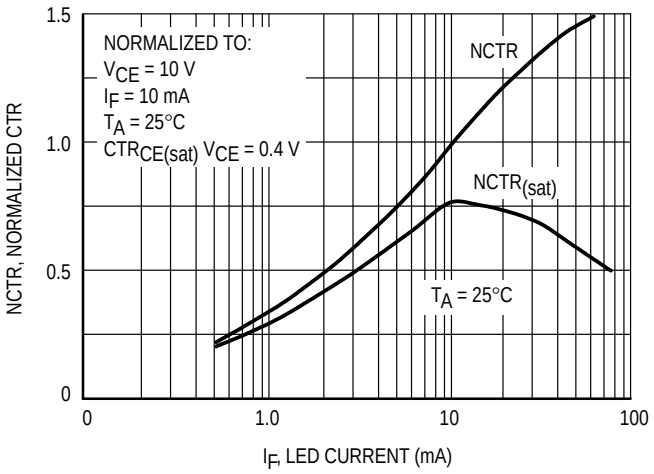



**Figure 2. Normalized Non–Saturated and Saturated CTR, $T_A$ = 25°C vs. LED Current**

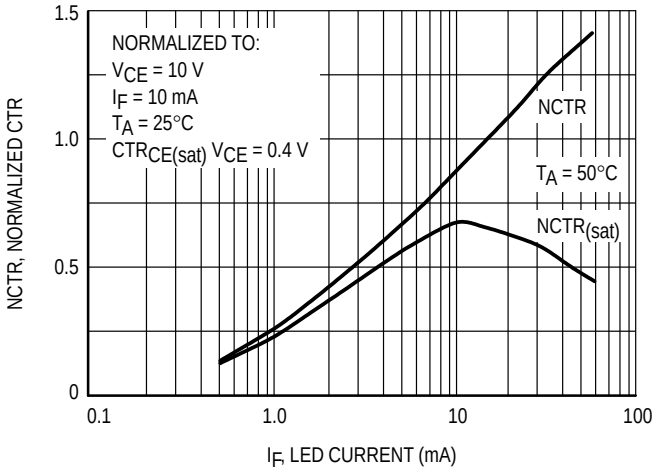



**Figure 3. Normalized Non–Saturated and Saturated CTR, $T_A$ = 50°C vs. LED Current**

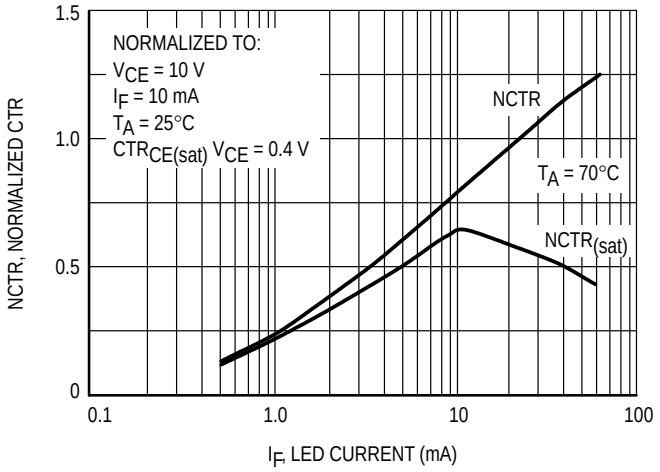



**Figure 4. Normalized Non–Saturated and Saturated CTR, $T_A$ = 70°C vs. LED Current**

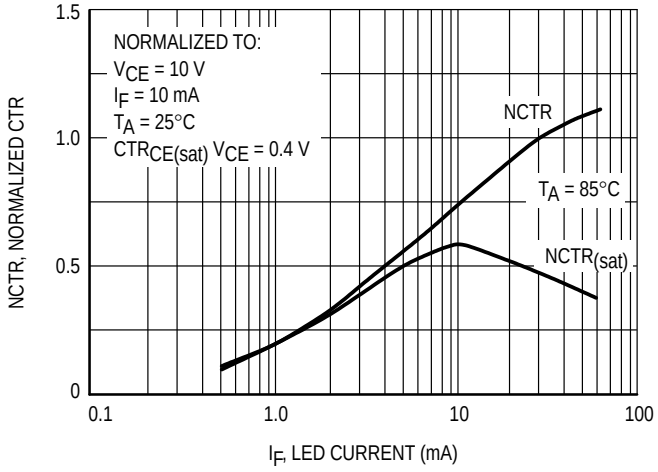



**Figure 5. Normalized Non–Saturated and Saturated CTR, $T_A$ = 85°C vs. LED Current**

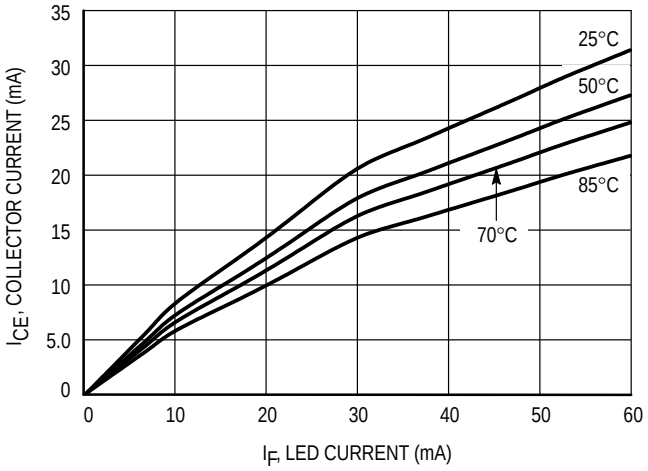



**Figure 6. Collector–Emitter Current vs. Temperature and LED Current**

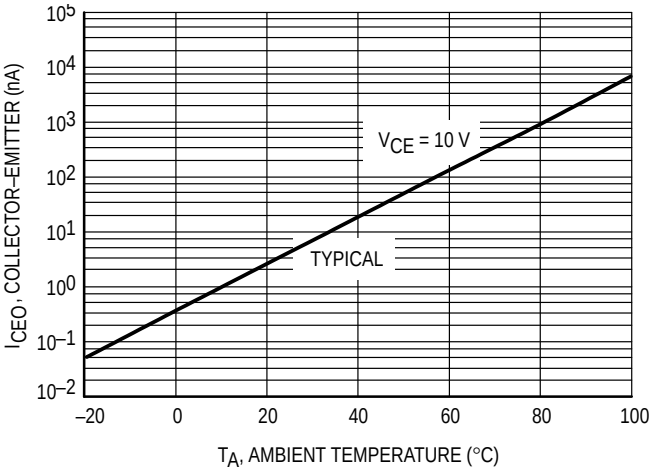



**Figure 7. Collector–Emitter Leakage Current vs. Temperature**

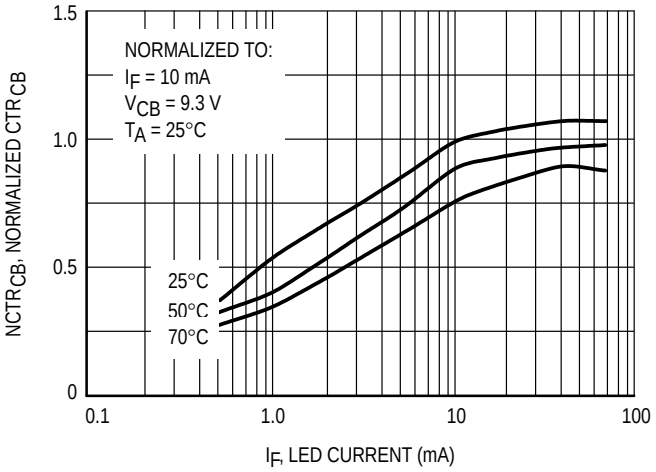



**Figure 8. Normalized CTRcb vs. LED Current and Temperature**

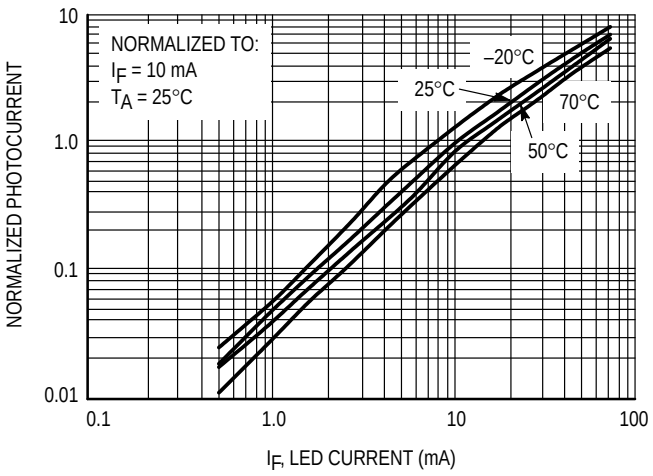



**Figure 9. Normalized Photocurrent vs. $I_F$ and Temperature**

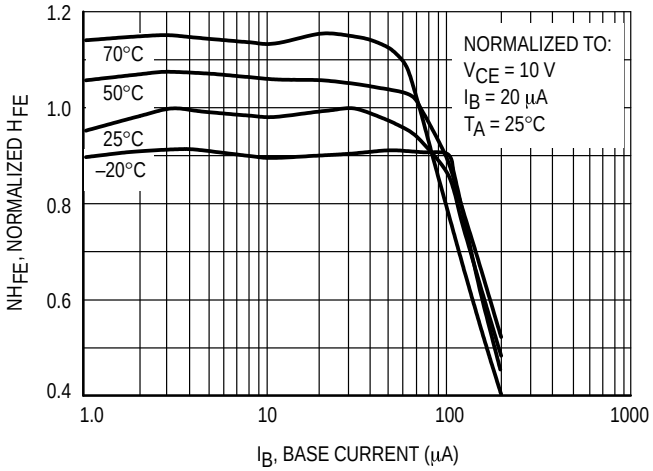



**Figure 10. Normalized Non–Saturated $H_{FE}$ vs. Base Current and Temperature**

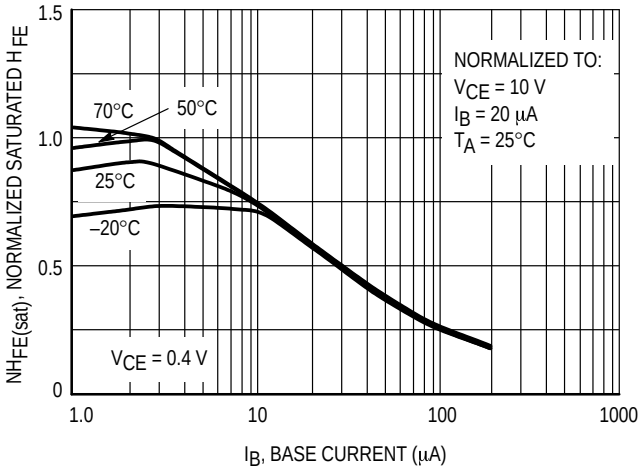



**Figure 11. Normalized $H_{FE}$ vs. Base Current and Temperature**

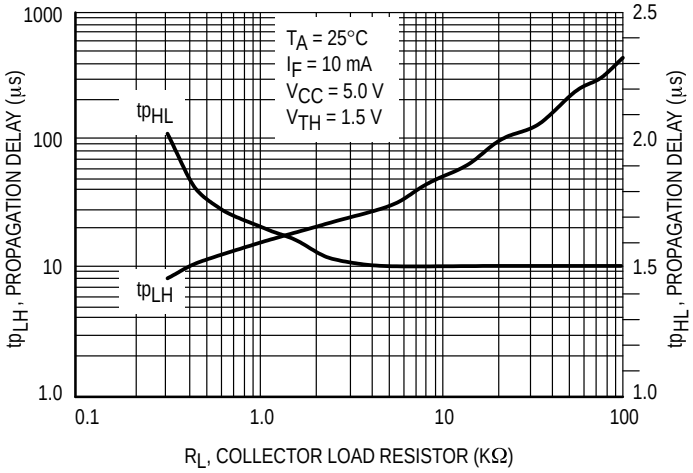



**Figure 12. Propagation Delay vs. Collector Load Resistor**

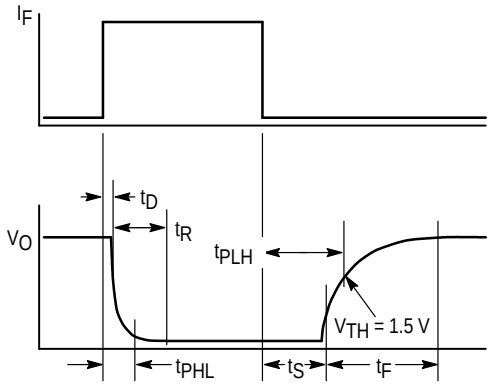



**Figure 13. Switching Timing**

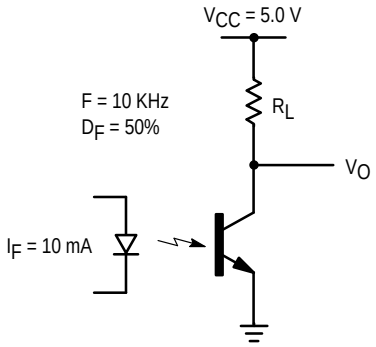
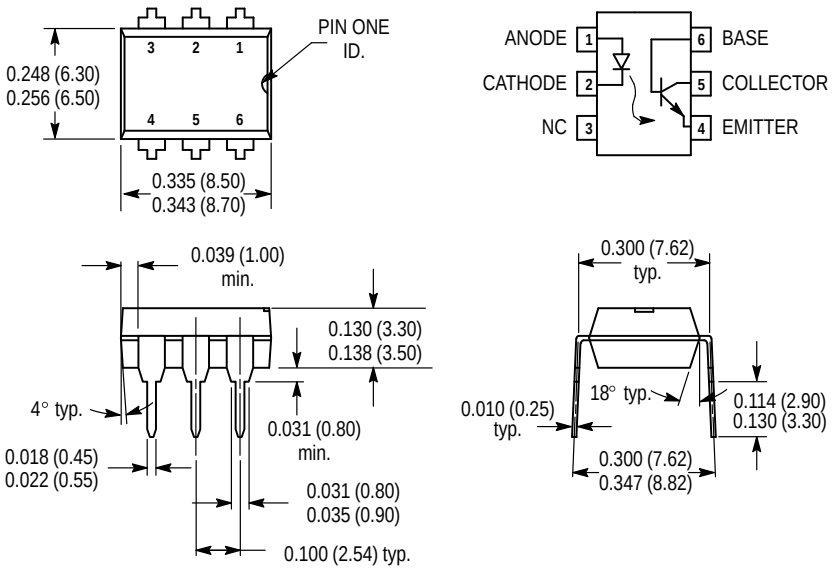



**Figure 14. Switching Schematic**

Package Dimensions in Inches (mm)



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