



# M4N25

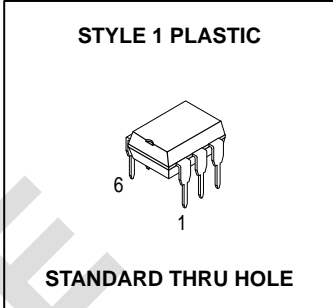
## 6-Pin DIP Optoisolators Transistor Output

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



### MAXIMUM RATINGS (T<sub>A</sub> = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
<b>INPUT LED</b>			
Reverse Voltage	V <sub>R</sub>	3	Volts
Forward Current — Continuous	I <sub>F</sub>	60	mA
LED Power Dissipation @ T <sub>A</sub> = 25°C with Negligible Power in Output Detector Derate above 25°C	P <sub>D</sub>	100	mW
		1.41	mW/°C

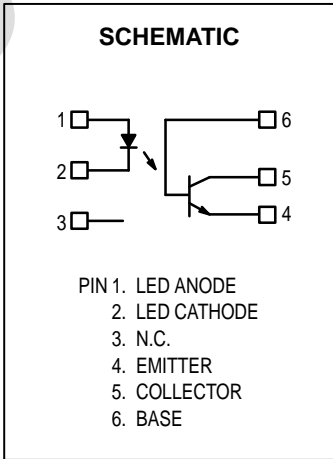
### OUTPUT TRANSISTOR

Collector–Emitter Voltage	V <sub>CEO</sub>	30	Volts
Emitter–Collector Voltage	V <sub>ECO</sub>	7	Volts
Collector–Base Voltage	V <sub>CBO</sub>	70	Volts
Collector Current — Continuous	I <sub>C</sub>	50	mA
Detector Power Dissipation @ T <sub>A</sub> = 25°C with Negligible Power in Input LED Derate above 25°C	P <sub>D</sub>	150	mW
		1.76	mW/°C

### TOTAL DEVICE

Isolation Surge Voltage <sup>(1)</sup> (Peak ac Voltage, 60 Hz, 1 sec Duration)	V <sub>ISO</sub>	7500	Vac(pk)
Total Device Power Dissipation @ T <sub>A</sub> = 25°C Derate above 25°C	P <sub>D</sub>	250 2.94	mW mW/°C
Ambient Operating Temperature Range <sup>(2)</sup>	T <sub>A</sub>	–55 to +100	°C
Storage Temperature Range <sup>(2)</sup>	T <sub>stg</sub>	–55 to +150	°C
Soldering Temperature (10 sec, 1/16" from case)	T <sub>L</sub>	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.



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## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)<sup>(1)</sup>

Characteristic	Symbol	Min	Typ <sup>(1)</sup>	Max	Unit
<b>INPUT LED</b>					
Forward Voltage (I <sub>F</sub> = 10 mA)	V <sub>F</sub>	—	1.15	1.5	Volts
T <sub>A</sub> = 25°C		—	1.3	—	
T <sub>A</sub> = -55°C		—	1.05	—	
Reverse Leakage Current (V <sub>R</sub> = 3 V)	I <sub>R</sub>	—	—	100	μA
Capacitance (V = 0 V, f = 1 MHz)	C <sub>J</sub>	—	18	—	pF

## OUTPUT TRANSISTOR

Collector–Emitter Dark Current (V <sub>CE</sub> = 10 V, T <sub>A</sub> = 25°C)	I <sub>CEO</sub>	—	1	50	nA
(V <sub>CE</sub> = 10 V, T <sub>A</sub> = 100°C)	I <sub>CEO</sub>	—	1	—	μA
Collector–Base Dark Current (V <sub>CB</sub> = 10 V)	I <sub>CBO</sub>	—	0.2	—	nA
Collector–Emitter Breakdown Voltage (I <sub>C</sub> = 1 mA)	V <sub>(BR)CEO</sub>	30	45	—	Volts
Collector–Base Breakdown Voltage (I <sub>C</sub> = 100 μA)	V <sub>(BR)CBO</sub>	70	100	—	Volts
Emitter–Collector Breakdown Voltage (I <sub>E</sub> = 100 μA)	V <sub>(BR)ECO</sub>	7	7.8	—	Volts
Collector–Emitter Capacitance (f = 1 MHz, V <sub>CE</sub> = 0)	C <sub>CE</sub>	—	7	—	pF
Collector–Base Capacitance (f = 1 MHz, V <sub>CB</sub> = 0)	C <sub>CB</sub>	—	19	—	pF
Emitter–Base Capacitance (f = 1 MHz, V <sub>EB</sub> = 0)	C <sub>EB</sub>	—	9	—	pF

## COUPLED

Output Collector Current (I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10 V)	I <sub>C</sub> (CTR) <sup>(2)</sup>	2 (20)	7 (70)	—	mA (%)
Collector–Emitter Saturation Voltage (I <sub>C</sub> = 2 mA, I <sub>F</sub> = 50 mA)	V <sub>CE(sat)</sub>	—	0.15	0.5	Volts
Turn–On Time (I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 10 V, R <sub>L</sub> = 100 Ω) <sup>(3)</sup>	t <sub>on</sub>	—	2.8	—	μs
Turn–Off Time (I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 10 V, R <sub>L</sub> = 100 Ω) <sup>(3)</sup>	t <sub>off</sub>	—	4.5	—	μs
Rise Time (I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 10 V, R <sub>L</sub> = 100 Ω) <sup>(3)</sup>	t <sub>r</sub>	—	2	—	μs
Fall Time (I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 10 V, R <sub>L</sub> = 100 Ω) <sup>(3)</sup>	t <sub>f</sub>	—	2	—	μs
Isolation Voltage (f = 60 Hz, t = 1 sec) <sup>(4)</sup>	V <sub>ISO</sub>	7500	—	—	Vac(pk)
Isolation Resistance (V = 500 V) <sup>(4)</sup>	R <sub>ISO</sub>	10 <sup>11</sup>	—	—	Ω
Isolation Capacitance (V = 0 V, f = 1 MHz) <sup>(4)</sup>	C <sub>ISO</sub>	—	0.2	—	pF

1. Always design to the specified minimum/maximum electrical limits (where applicable).
2. Current Transfer Ratio (CTR) = I<sub>C</sub>/I<sub>F</sub> × 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.

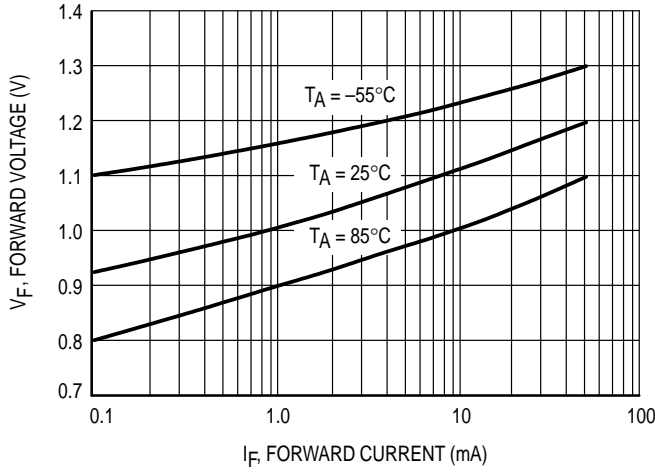


Figure 1. Forward Voltage vs. Forward Current

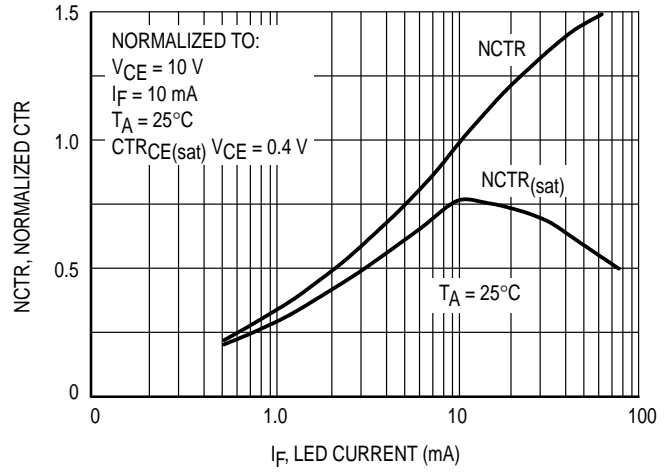


Figure 2. Normalized Non-Saturated and Saturated CTR,  $T_A = 25^\circ\text{C}$  vs. LED Current

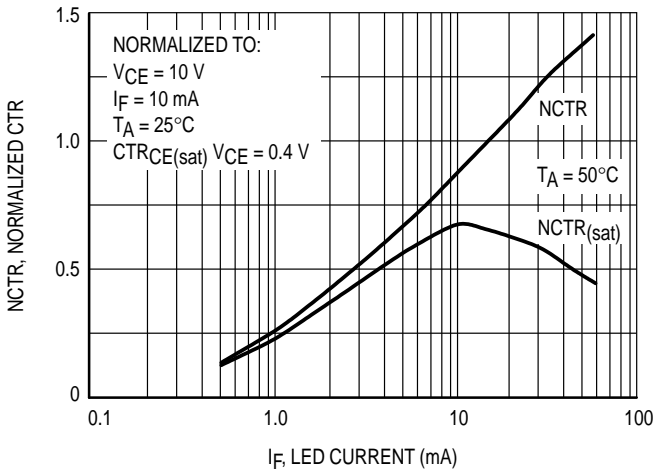


Figure 3. Normalized Non-Saturated and Saturated CTR,  $T_A = 50^\circ\text{C}$  vs. LED Current

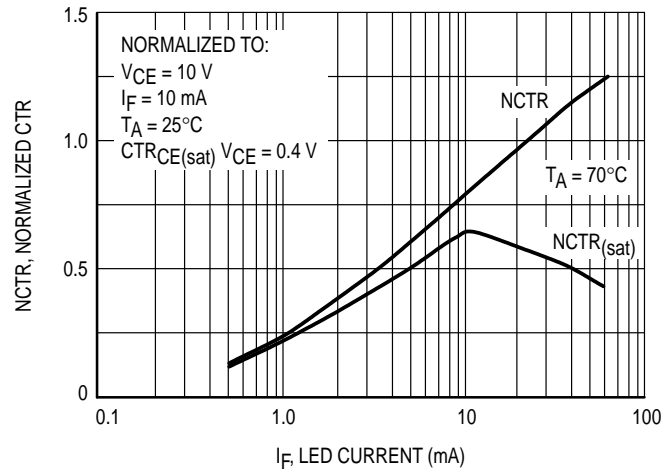


Figure 4. Normalized Non-Saturated and Saturated CTR,  $T_A = 70^\circ\text{C}$  vs. LED Current

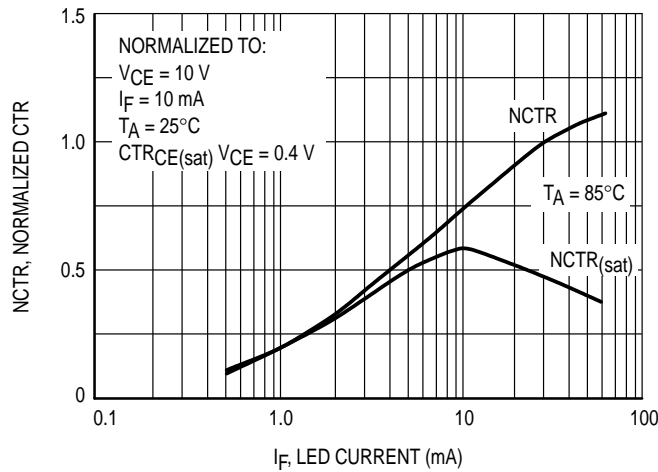
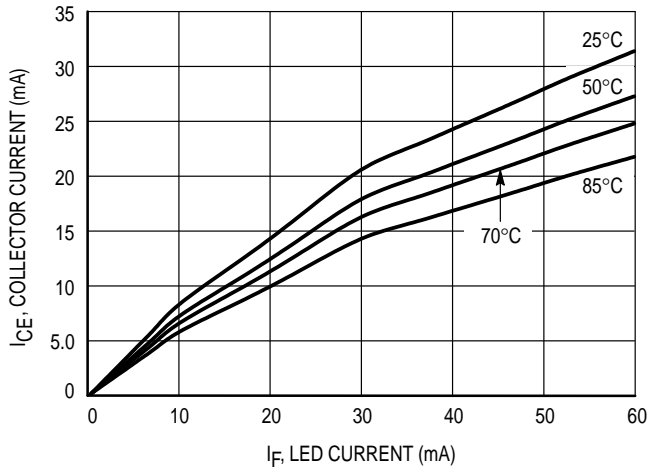
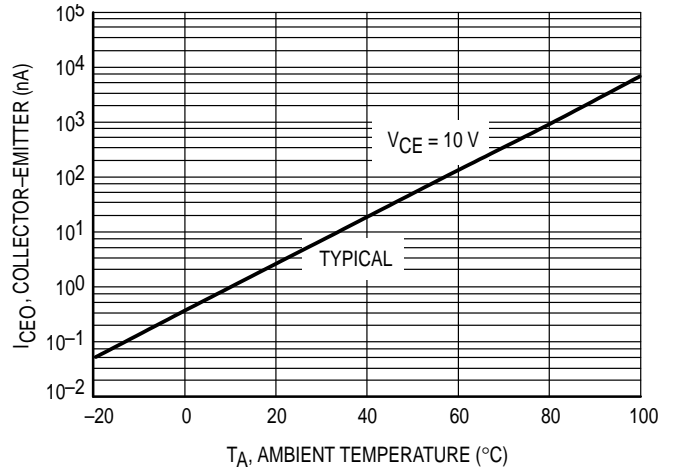


Figure 5. Normalized Non-Saturated and Saturated CTR,  $T_A = 85^\circ\text{C}$  vs. LED Current

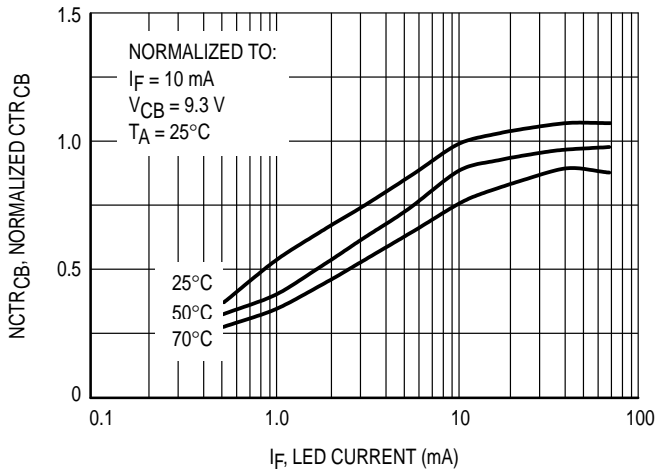
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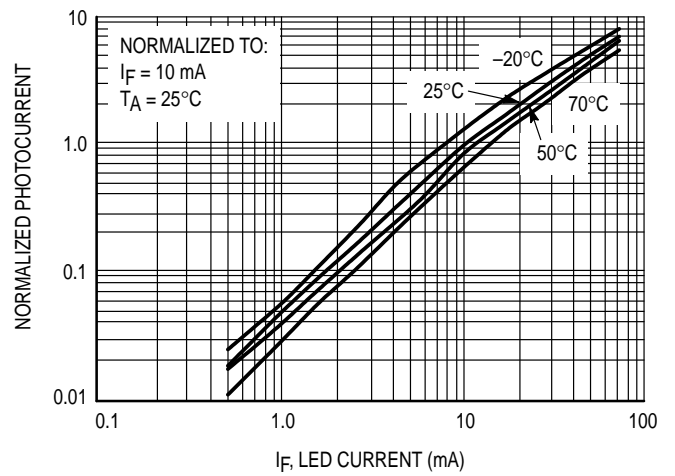
**Figure 6. Collector–Emitter Current vs. Temperature and LED Current**



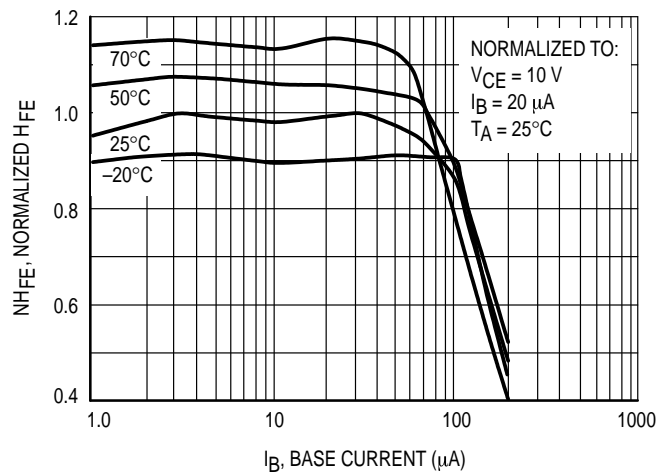
**Figure 7. Collector–Emitter Leakage Current vs. Temperature**



**Figure 8. Normalized CTR<sub>cb</sub> 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**

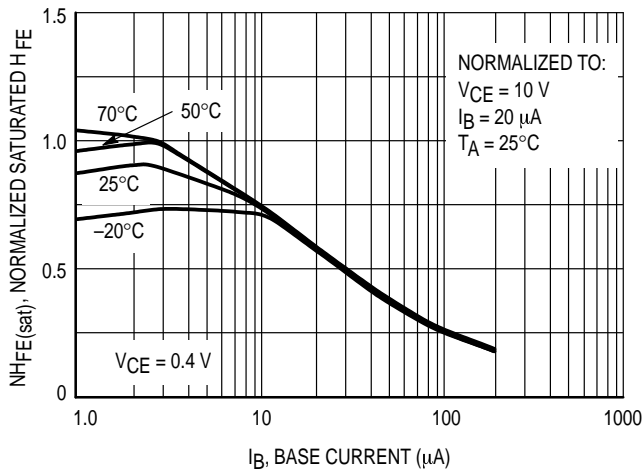


Figure 11. Normalized  $H_{FE}$  vs. Base Current and Temperature

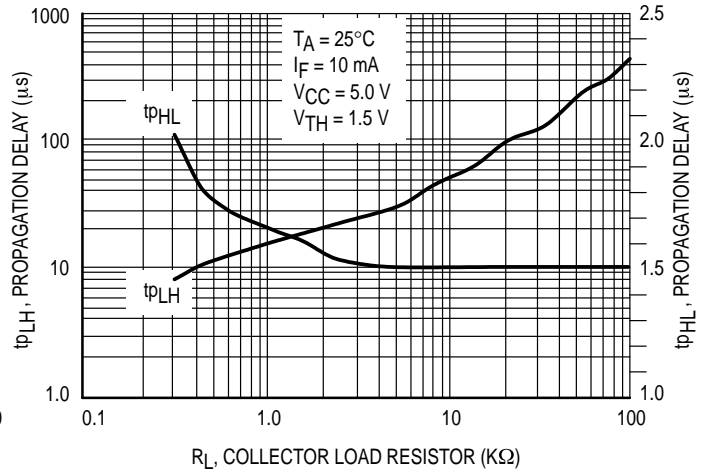


Figure 12. Propagation Delay vs. Collector Load Resistor

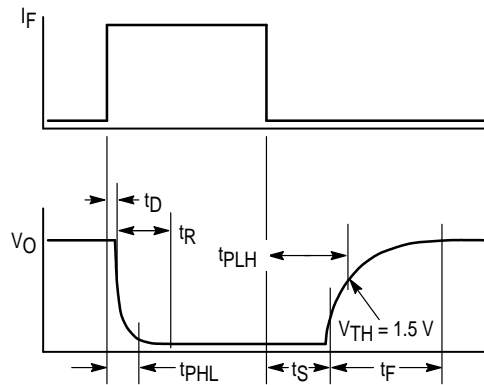


Figure 13. Switching Timing

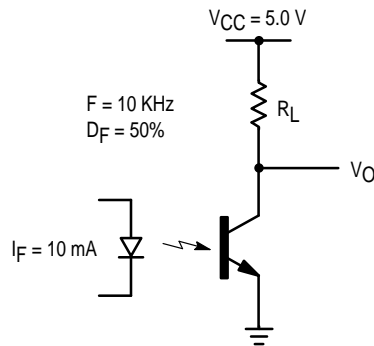
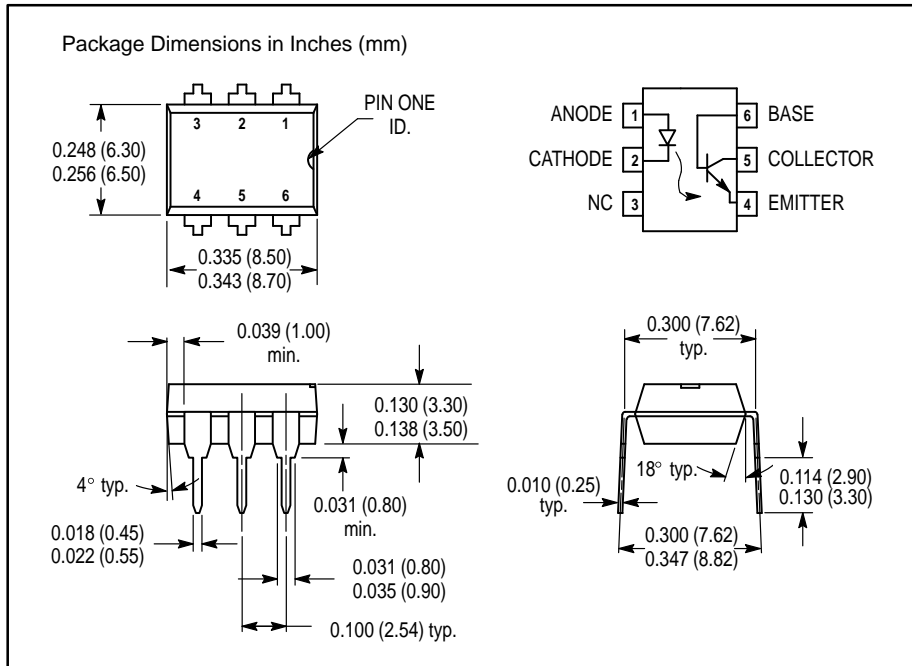



Figure 14. Switching Schematic

# M4N25



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