



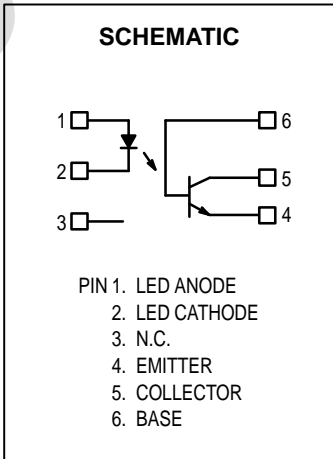
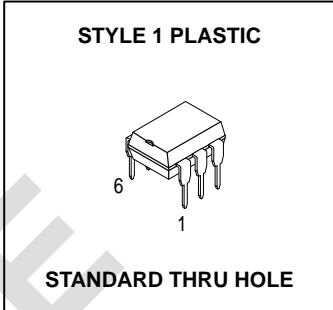
**MTIL117**

**6-Pin DIP Optoisolator  
Transistor Output**

The MTIL117 device consists of a gallium arsenide infrared emitting diode optically coupled to a monolithic silicon phototransistor detector.

**Applications**

- Appliances, Measuring Instruments
- General Purpose Switching Circuits
- Programmable Controllers
- Portable Electronics
- Interfacing and coupling systems of different potentials and impedances
- Telecommunications Equipment



**MAXIMUM RATINGS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Rating	Symbol	Value	Unit
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**INPUT LED**

Reverse Voltage	$V_R$	6	Volts
Forward Current — Continuous	$I_F$	60	mA
LED Power Dissipation @ $T_A = 25^\circ\text{C}$ with Negligible Power in Output Detector Derate above $25^\circ\text{C}$	$P_D$	100	mW
		1.41	mW/ $^\circ\text{C}$

**OUTPUT TRANSISTOR**

Collector–Emitter Voltage	$V_{CEO}$	30	Volts
Emitter–Base Voltage	$V_{EBO}$	7	Volts
Collector–Base Voltage	$V_{CBO}$	70	Volts
Collector Current — Continuous	$I_C$	50	mA
Detector Power Dissipation @ $T_A = 25^\circ\text{C}$ with Negligible Power in Input LED Derate above $25^\circ\text{C}$	$P_D$	50	mW
		1.76	mW/ $^\circ\text{C}$

**TOTAL DEVICE**

Isolation Surge Voltage <sup>(1)</sup> (Peak ac Voltage, 60 Hz, 1 sec Duration)	$V_{ISO}$	7500	Vac(pk)
Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	250 2.94	mW mW/ $^\circ\text{C}$
Ambient Operating Temperature Range <sup>(2)</sup>	$T_A$	-55 to +100	$^\circ\text{C}$
Storage Temperature Range <sup>(2)</sup>	$T_{stg}$	-55 to +150	$^\circ\text{C}$
Soldering Temperature (10 sec, 1/16" from case)	$T_L$	260	$^\circ\text{C}$

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.

# MTIL117

## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)<sup>(1)</sup>

Characteristic	Symbol	Min	Typ <sup>(1)</sup>	Max	Unit
<b>INPUT LED</b>					
Forward Voltage ( $I_F = 16\text{ mA}$ ) $T_A = 0\text{--}70^\circ\text{C}$ $T_A = -55^\circ\text{C}$ $T_A = 100^\circ\text{C}$	$V_F$	— — —	1.15 1.3 1.05	1.4 — —	Volts
Reverse Leakage Current ( $V_R = 3\text{ V}$ )	$I_R$	—	0.05	10	$\mu\text{A}$
Capacitance ( $V = 0\text{ V}$ , $f = 1\text{ MHz}$ )	$C_J$	—	18	—	pF

## OUTPUT TRANSISTOR

Collector–Emitter Dark Current ( $V_{CE} = 10\text{ V}$ , $T_A = 25^\circ\text{C}$ ) ( $V_{CB} = 30\text{ V}$ , $T_A = 70^\circ\text{C}$ )	$I_{CEO}$	—	3	50	nA
	$I_{CEO}$	—	0.05	50	$\mu\text{A}$
Collector–Base Dark Current ( $V_{CB} = 10\text{ V}$ )	$I_{CBO}$	—	0.2	20	nA
Collector–Emitter Breakdown Voltage ( $I_C = 1\text{ mA}$ )	$V_{(BR)CEO}$	30	45	—	Volts
Collector–Base Breakdown Voltage ( $I_C = 10\text{ }\mu\text{A}$ )	$V_{(BR)CBO}$	70	100	—	Volts
Emitter–Base Breakdown Voltage ( $I_E = 10\text{ }\mu\text{A}$ )	$V_{(BR)EBO}$	7	7.8	—	Volts
DC Current Gain ( $I_C = 1\text{ mA}$ , $V_{CE} = 5\text{ V}$ ) (Typical Value)	$h_{FE}$	—	600	—	—
Collector–Emitter Capacitance ( $f = 1\text{ MHz}$ , $V_{CE} = 0$ )	$C_{CE}$	—	7	—	pF
Collector–Base Capacitance ( $f = 1\text{ MHz}$ , $V_{CB} = 0$ )	$C_{CB}$	—	19	—	pF
Emitter–Base Capacitance ( $f = 1\text{ MHz}$ , $V_{EB} = 0$ )	$C_{EB}$	—	9	—	pF

## COUPLED

Output Collector Current ( $I_F = 10\text{ mA}$ , $V_{CE} = 10\text{ V}$ )	$I_C$ (CTR) <sup>(2)</sup>	0.5 (50)	1 (100)	—	mA (%)
Collector–Emitter Saturation Voltage ( $I_C = 100\text{ }\mu\text{A}$ , $I_F = 1\text{ mA}$ )	$V_{CE(sat)}$	—	0.22	0.5	Volts
Turn–On Time ( $I_C = 2\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\text{ }\Omega$ ) <sup>(3)</sup>	$t_{on}$	—	—	10	$\mu\text{s}$
Turn–Off Time ( $I_C = 2\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\text{ }\Omega$ ) <sup>(3)</sup>	$t_{off}$	—	—	10	$\mu\text{s}$
Rise Time ( $I_C = 2\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\text{ }\Omega$ ) <sup>(3)</sup>	$t_r$	—	3.8	—	$\mu\text{s}$
Fall Time ( $I_C = 2\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\text{ }\Omega$ ) <sup>(3)</sup>	$t_f$	—	5.6	—	$\mu\text{s}$
Isolation Voltage ( $f = 60\text{ Hz}$ , $t = 1\text{ sec}$ ) <sup>(4)</sup>	$V_{ISO}$	7500	—	—	Vac(pk)
Isolation Resistance ( $V = 500\text{ V}$ ) <sup>(4)</sup>	$R_{ISO}$	$10^{11}$	—	—	$\Omega$
Isolation Capacitance ( $V = 0\text{ V}$ , $f = 1\text{ MHz}$ ) <sup>(4)</sup>	$C_{ISO}$	—	0.2	2	pF

1. Always design to the specified minimum/maximum electrical limits (where applicable).
2. Current Transfer Ratio (CTR) =  $I_C/I_F \times 100\%$ .
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.

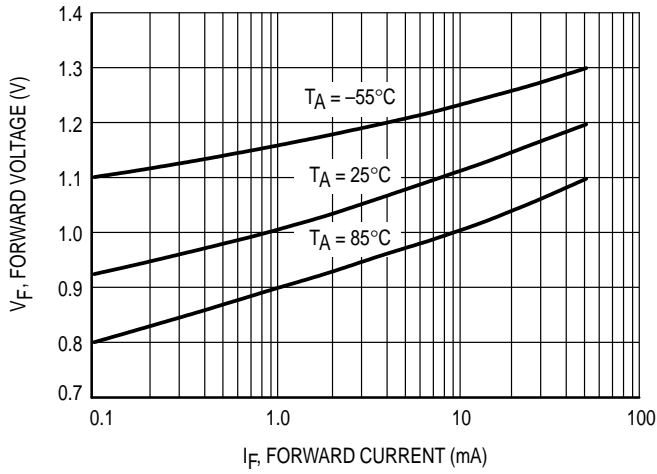


Figure 1. Forward Voltage vs. Forward Current

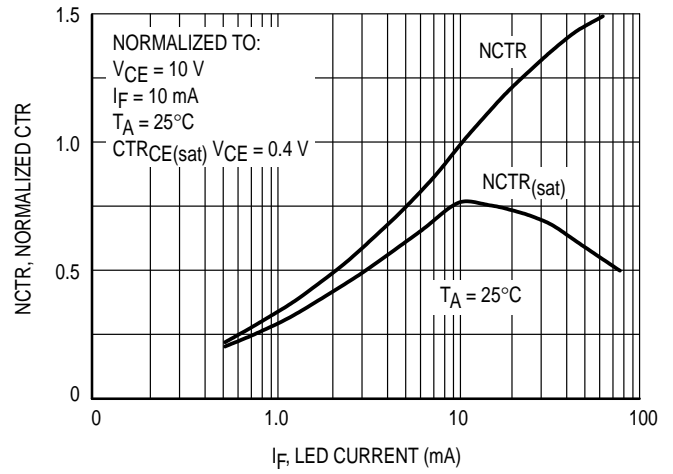


Figure 2. Normalized Non-Saturated and Saturated CTR,  $T_A = 25^\circ\text{C}$  vs. LED Current

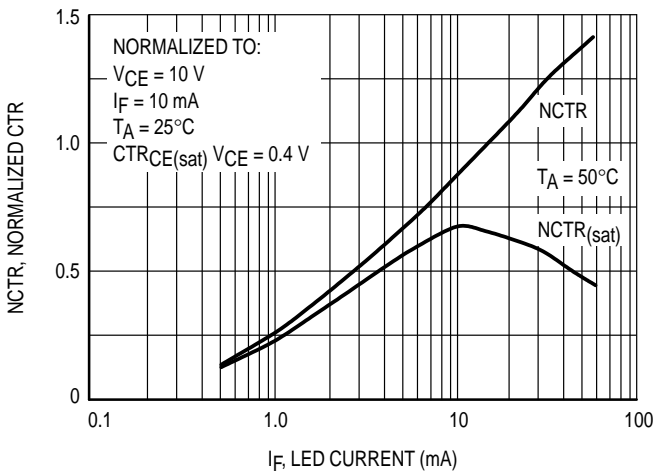


Figure 3. Normalized Non-Saturated and Saturated CTR,  $T_A = 50^\circ\text{C}$  vs. LED Current

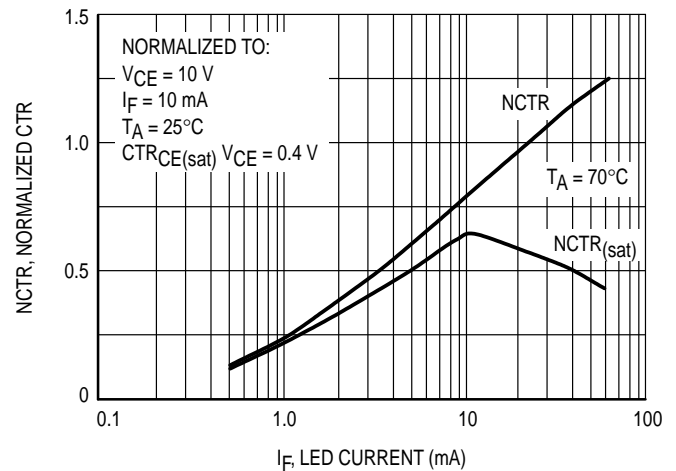


Figure 4. Normalized Non-Saturated and Saturated CTR,  $T_A = 70^\circ\text{C}$  vs. LED Current

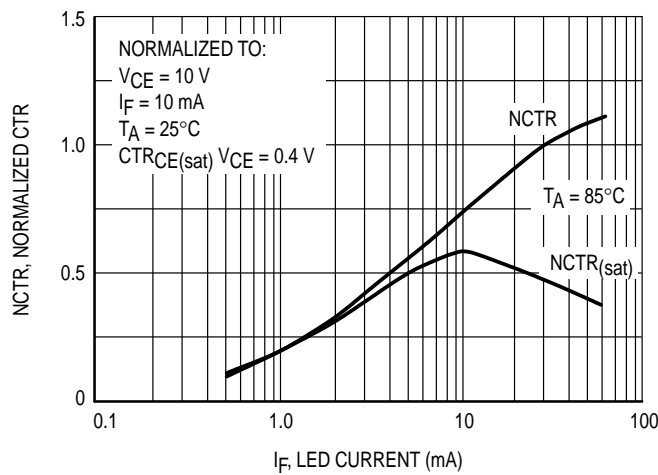
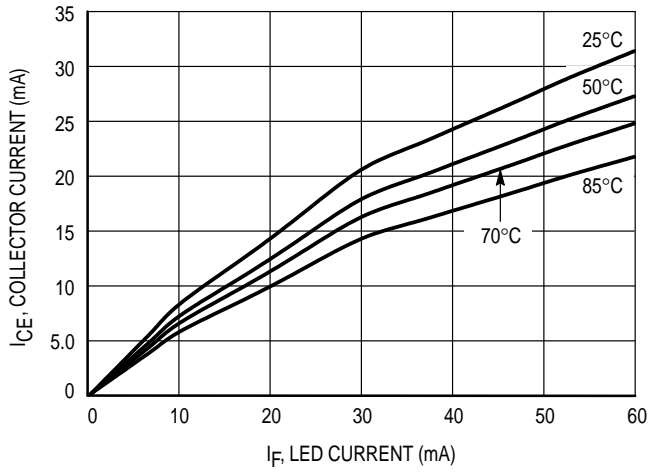
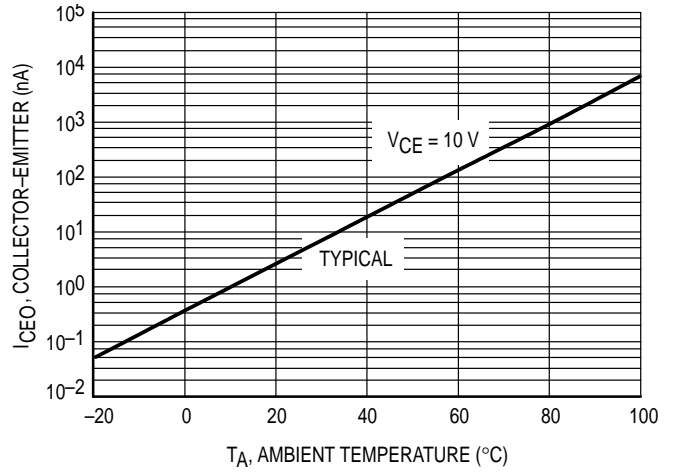


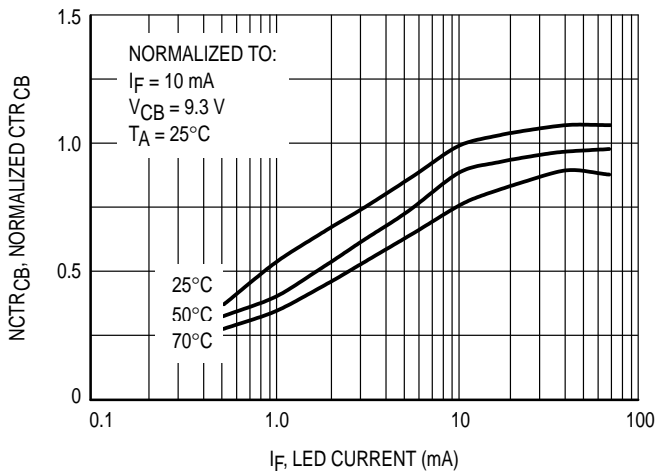
Figure 5. Normalized Non-Saturated and Saturated CTR,  $T_A = 85^\circ\text{C}$  vs. LED Current



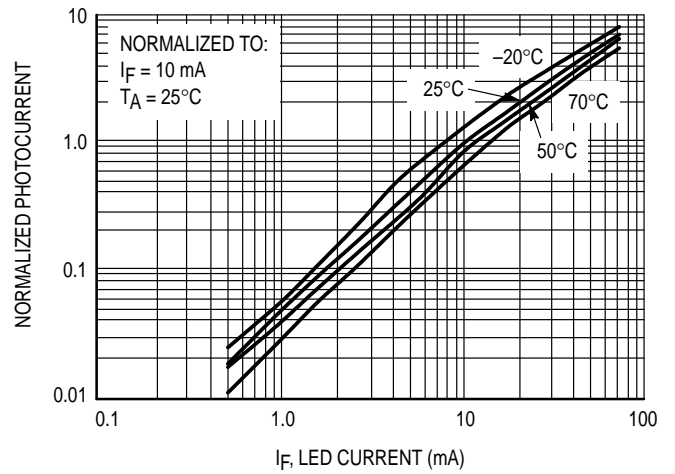
**Figure 6. Collector–Emitter Current vs. Temperature and LED Current**



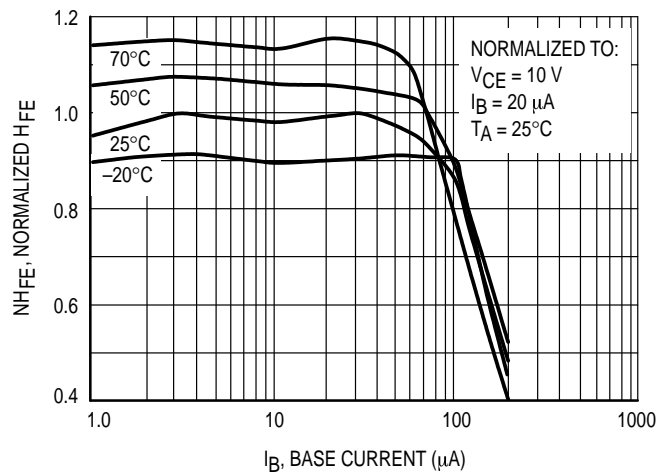
**Figure 7. Collector–Emitter Leakage Current vs. Temperature**



**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**

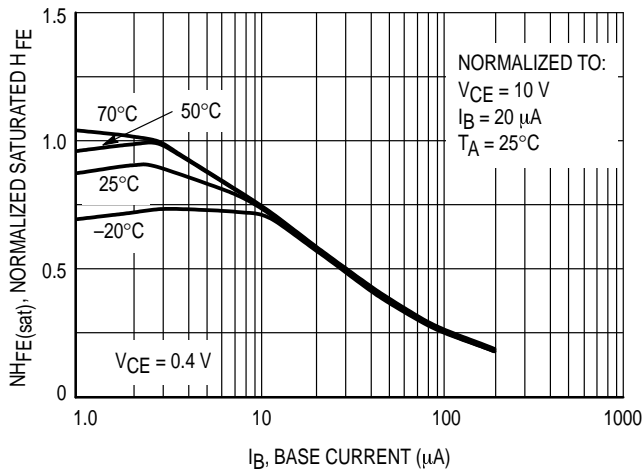


Figure 11. Normalized  $H_{FE}$  vs. Base Current and Temperature

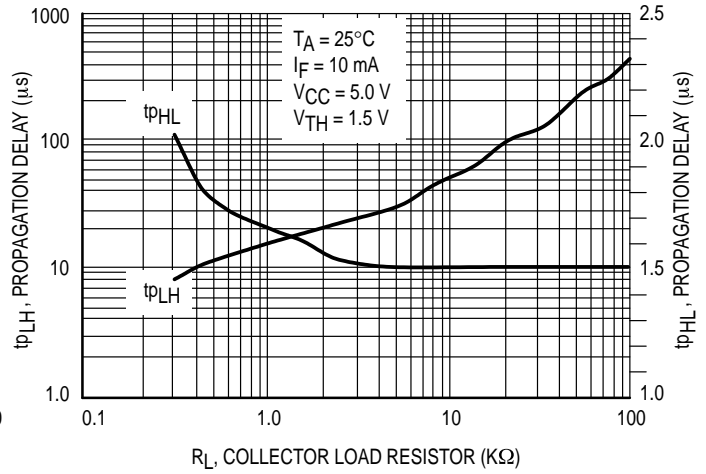


Figure 12. Propagation Delay vs. Collector Load Resistor

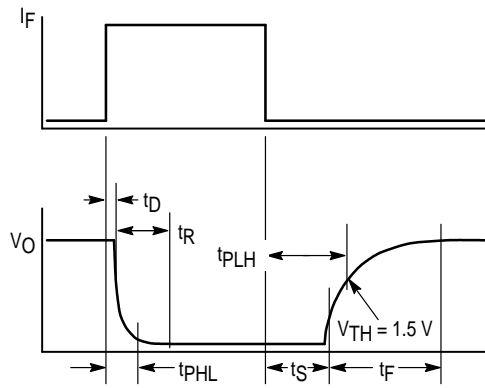
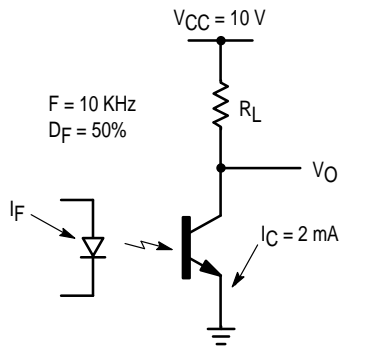
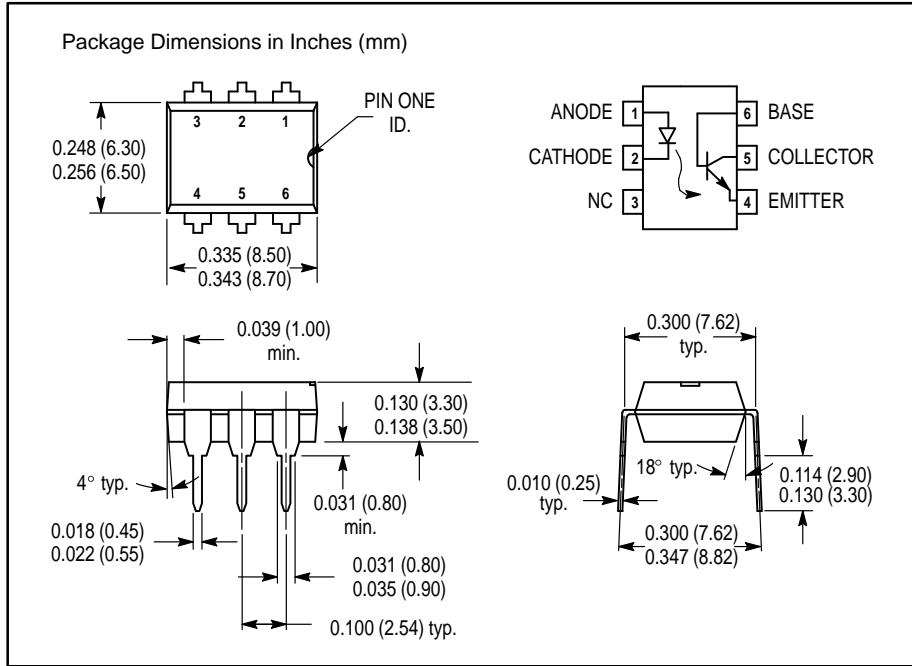



Figure 13. Switching Timing



$I_F = \text{As necessary to get } I_C = 2 \text{ mA}$

Figure 14. Switching Schematic



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