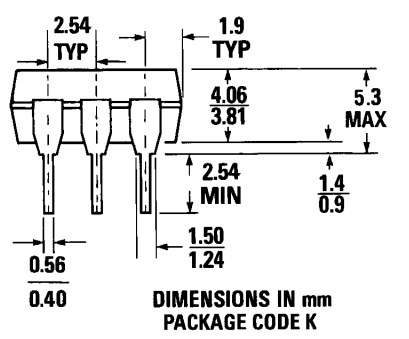
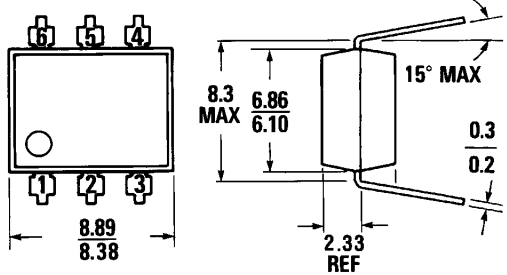
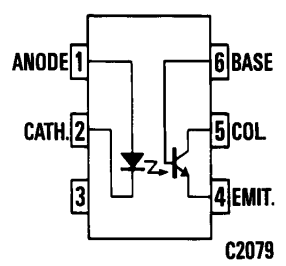


**PACKAGE DIMENSIONS**



ST1603A



Equivalent Circuit

**DESCRIPTION**

The MCT270 is a phototransistor-type optically coupled isolator. A gallium arsenide infrared emitting diode is selectively coupled with an NPN silicon phototransistor.

**FEATURES**

- Minimum current transfer ratio of 50%
- Maximum turn-on, turn-off time 10μ seconds specified
- Underwriters Laboratory (UL) recognized File E90700

**APPLICATIONS**

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs
- Appliance sensor systems
- Power supply regulators
- Industrial controls

| <b>ABSOLUTE MAXIMUM RATINGS</b>                          |                |
|--|----------------|
| <b>TOTAL PACKAGE</b>                                     |                |
| Storage temperature                                      | -55°C to 150°C |
| Operating temperature                                    | -55°C to 100°C |
| Lead tempertaure (soldering, 10 sec)                     | 260°C          |
| Total package power dissipation @ 25 (LED plus detector) | 260 mW         |
| Derate linearly from 25°C                                | 3.5 mW/°C      |
| <b>INPUT DIODE</b>                                       |                |
| Forward DC current                                       | 90 mA          |
| Reverse voltage  | 3 V            |
| Peak forward current (1 μs pulse, 300 pps)               | 3.0 A          |
| Power dissipation 25°C ambient                           | 135 mW         |
| Derate linearly from 25°C                                | 1.8 mW/°C      |
| <b>OUTPUT TRANSISTOR</b>                                 |                |
| Power dissipation @ 25°C                                 | 200 mW         |
| Derate linearly from 25°C                                | 2.67 mW/°C     |

**ELECTRO-OPTICAL CHARACTERISTICS** (25°C Temperature Unless Otherwise Specified)

**INDIVIDUAL COMPONENT CHARACTERISTICS**

| CHARACTERISTIC                            | SYMBOL                          | MIN. | TYP.     | MAX. | UNITS         | TEST CONDITIONS  |
|---|---------------------------------|------|----------|------|---------------|--|
| <b>INPUT DIODE</b>                        |                                 |      |          |      |               |  |
| Forward voltage                           | $V_f$                           |      | 1.3      | 1.50 | V             | $I_f = 20 \text{ mA}$  |
| Forward voltage temp. coefficient         | $\frac{\Delta V_f}{\Delta T_A}$ |      | -1.8     |      | mV/°C         |  |
| Reverse voltage                           | $V_R$                           | 3.0  | 25       |      | V             | $I_R = 10 \text{ } \mu\text{A}$  |
| Junction capacitance                      | $C_J$                           |      | 50<br>65 |      | pF<br>pF      | $V_f = 0 \text{ V}, f = 1 \text{ MHz}$<br>$V_f = 1 \text{ V}, f = 1 \text{ MHz}$ |
| Reverse leakage current                   | $I_R$                           |      | 0.35     | 10   | $\mu\text{A}$ | $V_R = 3.0 \text{ V}$  |
| <b>OUTPUT TRANSISTOR</b>                  |                                 |      |          |      |               |  |
| DC forward current gain                   | $h_{FE}$                        | 100  | 500      |      |               | $V_{CE} = 5 \text{ V}, I_C = 100 \text{ } \mu\text{A}$                           |
| Breakdown voltage<br>Collector to emitter | $BV_{CEO}$                      | 30   | 45       |      | V             | $I_C = 1.0 \text{ mA}, I_F = 0$  |
| Collector to base                         | $BV_{CBO}$                      | 70   | 130      |      | V             | $I_C = 10 \text{ } \mu\text{A}, I_F = 0$   |
| Emitter to base                           | $BV_{EBO}$                      | 5    | 7        |      | V             | $I_E = 100 \text{ } \mu\text{A}, I_F = 0$  |
| Leakage current<br>Collector to emitter   | $I_{CEO}$                       |      | 5        | 50   | nA            | $V_{CE} = 10 \text{ V}, I_F = 0$   |
| Collector to base                         | $I_{CBO}$                       |      |          | 20   | nA            | $V_{CB} = 10 \text{ V}, I_F = 0$   |
| Capacitance<br>Collector to emitter       |                                 |      | 8        |      | pF            | $V_{CE} = 0, f = 1 \text{ MHz}$  |
| Collector to base                         |                                 |      | 20       |      | pF            | $V_{CB} = 5, f = 1 \text{ MHz}$  |
| Emitter to base                           |                                 |      | 10       |      | pF            | $V_{EB} = 0, f = 1 \text{ MHz}$  |

**TRANSFER CHARACTERISTICS**

| DC CHARACTERISTICS                              | SYMBOL        | MIN.  | TYP. | MAX. | UNITS | TEST CONDITIONS                              |
|---|---------------|-------|------|------|-------|--|
| Current transfer ratio,<br>collector to emitter | $CTR_{CE}$    | 50    | 115  |      | %     | $I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}$ |
| Current transfer ratio,<br>collector to base    | $CTR_{CB}$    | 0.045 | 0.15 |      | %     | $I_F = 16 \text{ mA}; V_{CB} = 10 \text{ V}$ |
| Saturation voltage                              | $V_{CE(SAT)}$ |       | .21  | .40  | V     | $I_F = 10 \text{ mA}; I_C = 2 \text{ mA}$    |

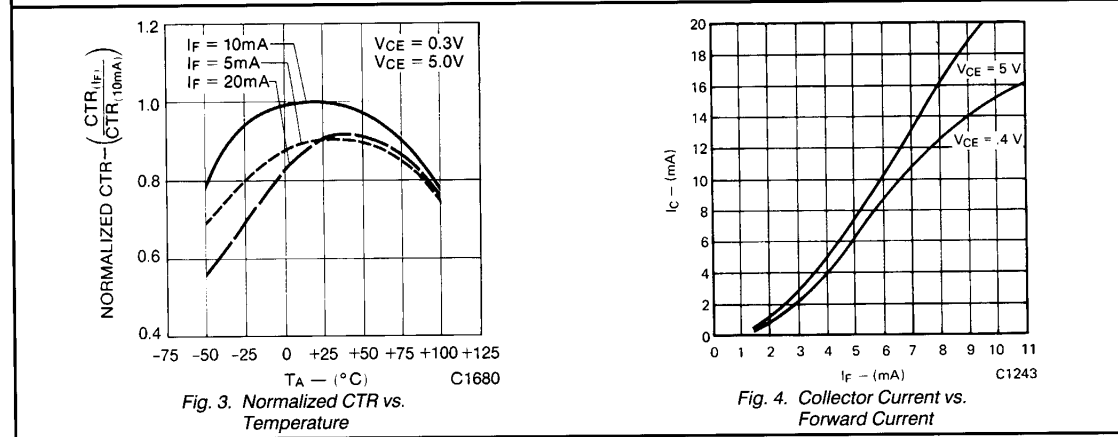
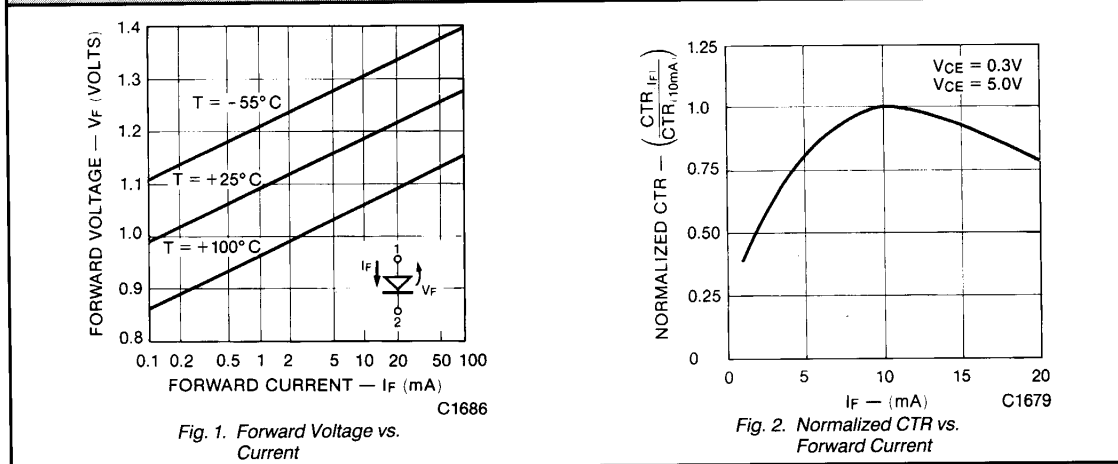
**TRANSFER CHARACTERISTICS**

| CHARACTERISTICS                                  | SYMBOL    | MIN. | TYP. | MAX. | UNITS         | TEST CONDITIONS   |
|--|-----------|------|------|------|---------------|---|
| <b>SWITCHING TIMES</b>                           |           |      |      |      |               |   |
| Non-saturated                                    |           |      |      |      |               |   |
| Turn-on time                                     | $t_{on}$  |      | 6.0  | 10   | $\mu\text{s}$ | $R_L = 100\Omega; I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}$ |
| Turn-off time                                    | $t_{off}$ |      | 5.5  | 10   | $\mu\text{s}$ | See Figs. 10, 11  |
| Saturated  |           |      |      |      |               |   |
| Turn-on time                                     | $t_{on}$  |      | 3.9  |      | $\mu\text{s}$ | $I_F = 16 \text{ mA}; R_L = 1.9 \text{ K}\Omega$            |
| Turn-off time                                    | $t_{off}$ |      | 48   |      | $\mu\text{s}$ | See Figs. 10, 11  |
| (Approximates a typical TTL interface)           |           |      |      |      |               |   |
| Turn-on time                                     | $t_{on}$  |      | 3.9  |      | $\mu\text{s}$ | $I_F = 16 \text{ mA}; R_L = 4.7 \text{ K}\Omega$            |
| Turn-off time                                    | $t_{off}$ |      | 110  |      | $\mu\text{s}$ | See Figs. 10, 11  |
| (Approximates a typical low power TTL interface) |           |      |      |      |               |   |

**ELECTRO-OPTICAL CHARACTERISTICS**  
(25°C Temperature Unless Otherwise Specified) (Cont'd)

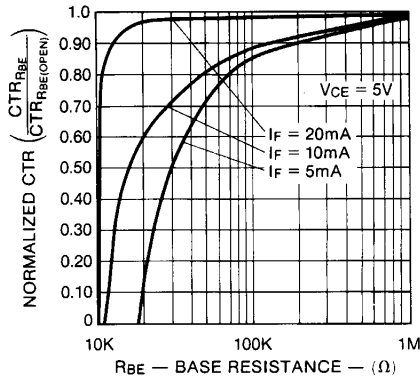
| <b>ISOLATION CHARACTERISTICS</b> |           |           |      |      |          |                                  |
|----------------------------------|-----------|-----------|------|------|----------|----------------------------------|
| CHARACTERISTICS                  | SYMBOL    | MIN.      | TYP. | MAX. | UNITS    | TEST CONDITIONS                  |
| Steady state isolation           | $V_{iso}$ | 7500      |      |      | VAC-PEAK | $I_{CO} \leq 1 \mu A$ , 1 minute |
|                                  |           | 5300      |      |      | VAC-rms  | $I_{CO} \leq 1 \mu A$ , 1 minute |
| Isolation resistance             | $R_{iso}$ | $10^{11}$ |      |      | ohms     | $V_{FO} = 500$ VDC               |
| Isolation capacitance            | $C_{iso}$ |           | 0.5  |      | pF       | $f = 1$ MHz                      |

**TYPICAL ELECTRICAL CHARACTERISTIC CURVES**  
(25°C Free Air Temperature Unless Otherwise Specified)



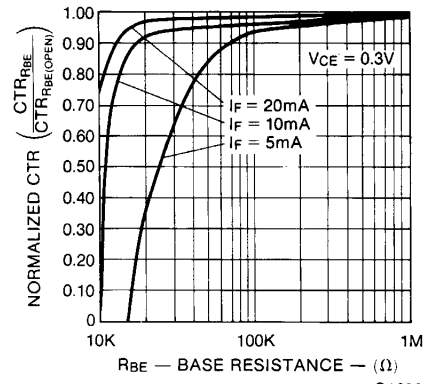
**TYPICAL ELECTRICAL CHARACTERISTIC CURVES**

(25°C Free Air Temperature Unless Otherwise Specified) (Cont'd)



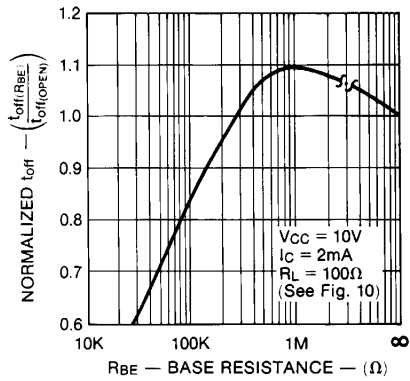
C1681

Fig. 5. CTR vs. RBE (Unsaturated)



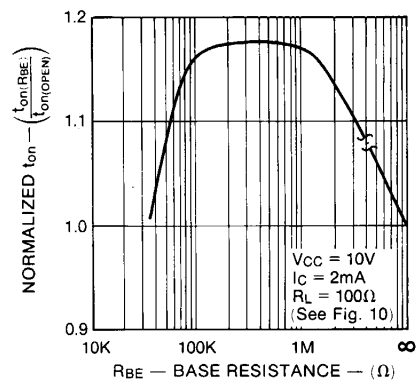
C1682

Fig. 6. CTR vs. RBE (Saturated)



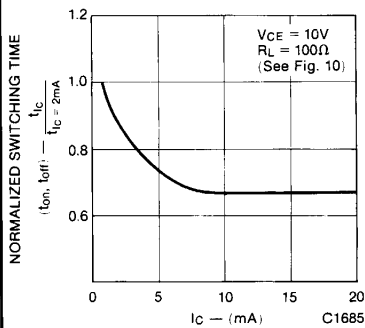
C1683

Fig. 7. Normalized  $T_{off}$  vs. RBE



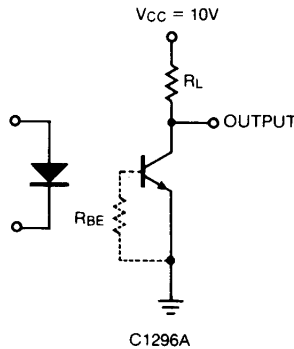
C1684

Fig. 8. Normalized  $T_{on}$  vs. RBE



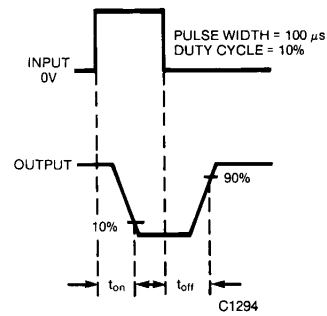
C1685

Fig. 9. Switching Time vs.  $I_C$



C1296A

Fig. 10. Switching Time Test Circuit



C1294

Fig. 11. Switching Time Waveforms



## PHOTOTRANSISTOR OPTOCOUPERS

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