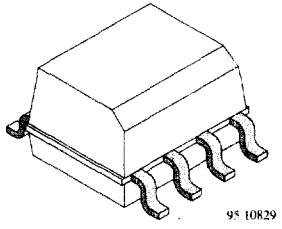
# TCMT1020 Series

## Surface Mount Optocoupler with Phototransistor Output

**Order Nos. and Classification table is on sheet 2.**

## Description

The TCMT1020 series consists of a gallium arsenid infrared-emitting diode, optically coupled to a silicon NPN epitaxial planar transistor in an 8-lead SOIC package (small outline).



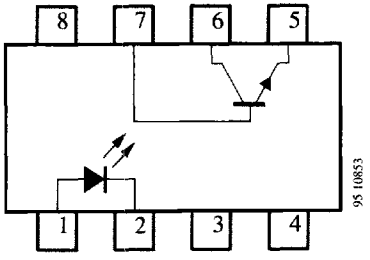

## Applications

- Computer peripheral interface
- Microprocessor system interface
- Hybride substrates that require high density mounting
- DC/DC converter

## Features

- Current Transfer Ratio (CTR) selected into 4 groups, specified at $I_F$ = 10 mA
- Test isolation voltage between input and output $V_{IO}$ (RMS): 2.5 kV
- 8-lead package, similar to SOIC-8
- Minimum $V_{(BR)CEO}$ of 90 V guaranteed
- Suitable for cleaning process without chemical solvent
- Soldering methods according to CECC 00802 table 1, class B or C
- Low temperature coefficient of CTR
- Base connected

## Pin Connection



## Order Schematic

| Part Numbers | CTR-Ranking |
|---|---|
| TMCT1020/ TCMT1020-GS12 | >40% |
| TMCT1021/ TCMT1021-GS12 | 40 to 80% |
| TMCT1022/ TCMT1022-GS12 | 65 to 125% |
| TMCT1023/ TCMT1023-GS12 | 100 to 200% |
| TMCT1024/ TCMT1024-GS12 | 160 to 320% |

Suffix: GS12 = Taped and reeled version

## Absolute Maximum Ratings

### Input (Emitter)

| Parameters | Test Conditions | Symbol | Value | Unit |
|---|---|---|---|---|
| Reverse voltage | | $V_R$ | 5 | V |
| Forward current | | $I_F$ | 60 | mA |
| Forward surge current | $t_p \leq 10\ \mu s$ | $I_{FSM}$ | 3 | A |
| Power dissipation | $T_{amb} \leq 25°C$ | $P_{tot}$ | 100 | mW |
| Junction temperature | | $T_j$ | 125 | °C |

### Output (Detector)

| Parameters | Test Conditions | Symbol | Value | Unit |
|---|---|---|---|---|
| Collector base voltage | | $V_{CBO}$ | 90 | V |
| Collector emitter voltage | | $V_{CEO}$ | 90 | V |
| Emitter collector voltage | | $V_{ECO}$ | 7 | V |
| Collector current | | $I_C$ | 50 | mA |
| Collector peak current | $t_p/T = 0.5, t_p \leq 10$ ms | $I_{CM}$ | 100 | mA |
| Power dissipation | $T_{amb} \leq 25°C$ | $P_{tot}$ | 150 | mW |
| Junction temperature | | $T_j$ | 125 | °C |

### Coupler

| Parameters | Test Conditions | Symbol | Value | Unit |
|---|---|---|---|---|
| AC isolation test voltage (RMS) | | $V_{IO}$ [1] | 2.5 | kV |
| Total power dissipation | $T_{amb} \leq 25°C$ | $P_{tot}$ | 250 | mW |
| Ambient temperature range | | $T_{amb}$ | –55 to +100 | °C |
| Storage temperature range | | $T_{stg}$ | –55 to +125 | °C |
| Soldering classification | Single wave, $t \leq 10$ s | $T_{sd}$ | 260 | °C |

1) Related to standard climate 23/50 DIN 50014

## Electrical Characteristics

$T_{amb}$ = 25°C

### Input (Emitter)

| Parameters | Test Conditions | Type | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Forward voltage | $I_F$ = 50 mA | | $V_F$ | | 1.25 | 1.6 | V |
| Breakdown voltage | $I_R$ = 100 µA | | $V_{(BR)}$ | 5 | | | V |
| Junction capacitance | $V_R$ = 0, f = 1 MHz | | $C_j$ | | 50 | | pF |

### Output (Detector)

| Parameters | Test Conditions | Type | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Collector base breakdown voltage | $I_C$ = 100 µA | | $V_{(BR)CB0}$ | 90 | | | V |
| Collector emitter breakdown voltage | $I_C$ = 1 mA | | $V_{(BR)CEO}$ | 90 | | | V |
| Emitter collector breakdown voltage | $I_E$ = 100 µA | | $V_{(BR)ECO}$ | 7 | | | V |
| Collector emitter cut-off current | $V_{CE}$ = 10 V, $I_F$ = 0 | | $I_{CEO}$ | | | 50 | nA |

### Coupler

| Parameters | Test Conditions | Type | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| AC isolation test voltage (RMS) | f = 50 Hz, t = 1 s | | $V_{IO}$ | 2.5 | | | kV |
| Collector emitter saturation voltage | $I_F$ = 10 mA, $I_C$ = 1 mA | | $V_{CEsat}$ | | | 0.3 | V |
| Cut-off frequency | $V_{CE}$ = 5 V, $I_F$ = 10 mA, $R_L$ = 100 Ω | | $f_C$ | | 110 | | kHz |
| Coupling capacitance | f = 1 MHz | | $C_k$ | | 0.3 | | pF |

## Current Transfer Ratio (CTR)

| Parameters | Test Conditions | Type | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $I_C/I_F$ | $V_{CE}$ = 5 V, $I_F$ = 10 mA | TCMT1020 | | 0.2 | | | |
| | | TCMT1021 | | 0.4 | | 0.8 | |
| | | TCMT1022 | CTR | 0.65 | | 1.25 | |
| | | TCMT1023 | | 1 | | 2 | |
| | | TCMT1024 | | 1.6 | | 3.2 | |

## Switching Characteristics (Typical Values)

$V_S = 5$ V

| Type | $R_L = 100\ \Omega$ (see figure 1) | | | | | | |
|---|---|---|---|---|---|---|---|
| | $t_d$[µs] | $t_r$[µs] | $t_{on}$[µs] | $t_s$[µs] | $t_f$[µs] | $t_{off}$[µs] | $I_C$[mA] |
| TCMT1020/ TCMT1020–GS12 | >0.70 | >1.35 | >1.70 | >0.15 | >1.35 | >1.50 | 5 |
| TCMT1021/ TCMT1021–GS12 | 0.70 | 1.35 | 1.70 | 0.15 | 1.35 | 1.50 | 5 |
| TCMT1022/ TCMT1022–GS12 | 1.20 | 190 | 2.80 | 0.20 | 1.90 | 2.10 | 5 |
| TCMT1023/ TCMT1023–GS12 | 1.60 | 2.90 | 4.10 | 0.30 | 2.90 | 3.20 | 5 |
| TCMT1024/ TCMT1024–GS12 | 2.20 | 4.80 | 5.90 | 0.40 | 4.80 | 5.20 | 5 |

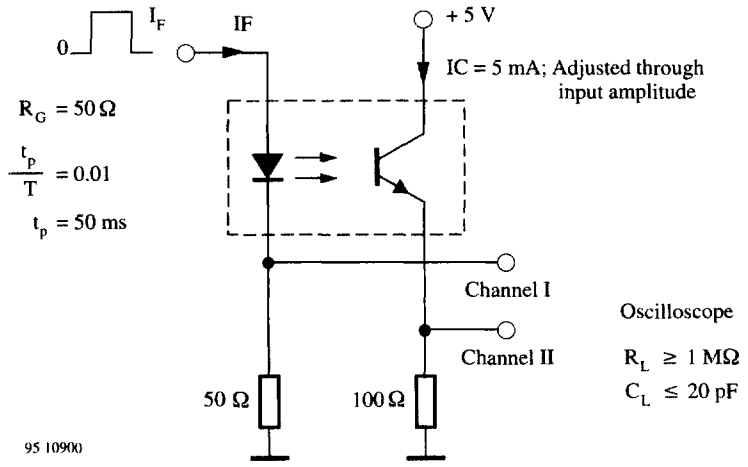



Figure 1. Test circuit, non-saturated operation

## Typical Characteristics ($T_{amb}$ = 25°C, unless otherwise specified)

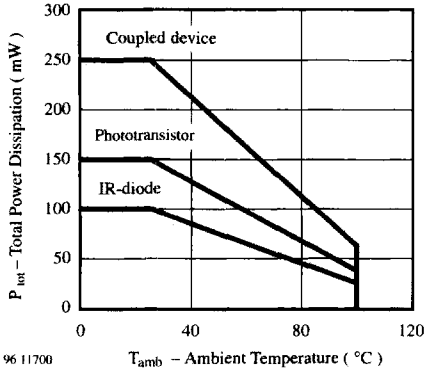



Figure 1. Total Power Dissipation vs. Ambient Temperature

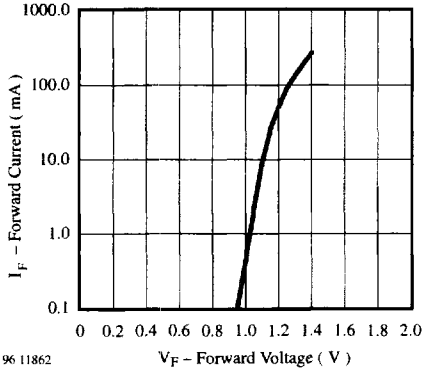



Figure 2. Forward Current vs. Forward Voltage

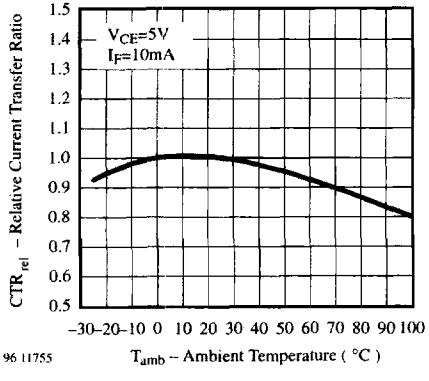



Figure 3. Rel. Current Transfer Ratio vs. Ambient Temp.

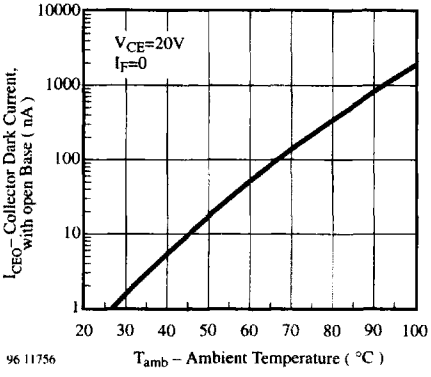



Figure 4. Collector Dark Current vs. Ambient Temperature

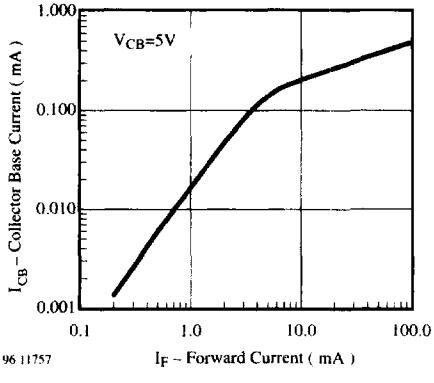



Figure 5. Collector Base Current vs. Forward Current

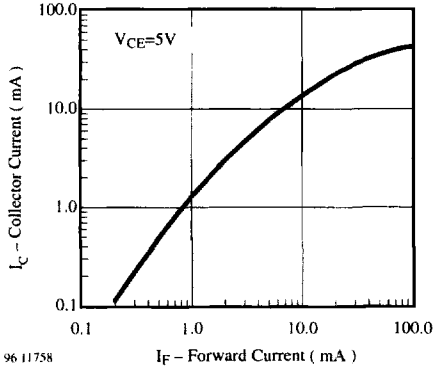



Figure 6. Collector Current vs. Forward Current

## Typical Characteristics ($T_{amb}$ = 25°C, unless otherwise specified)

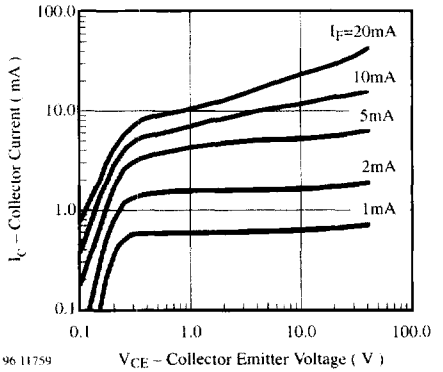



Figure 7. Collector Current vs. Collector Emitter Voltage

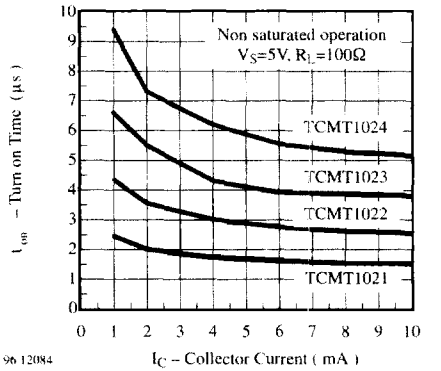



Figure 10. Turn on Time vs. Collector Current

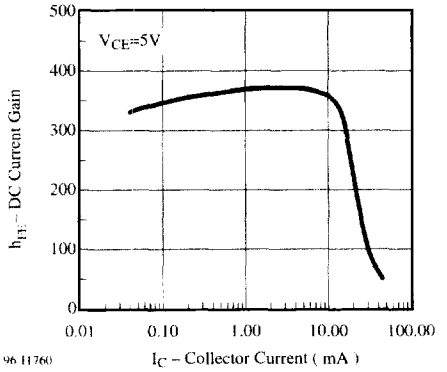



Figure 8. DC Current Gain vs. Collector Current

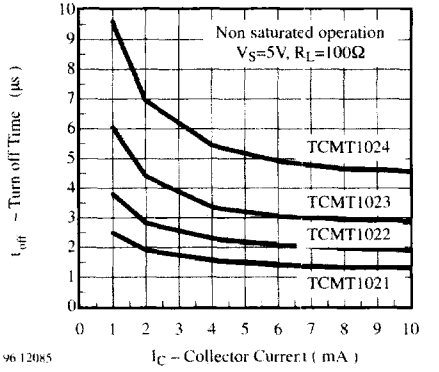



Figure 11. Turn off Time vs. Collector Current

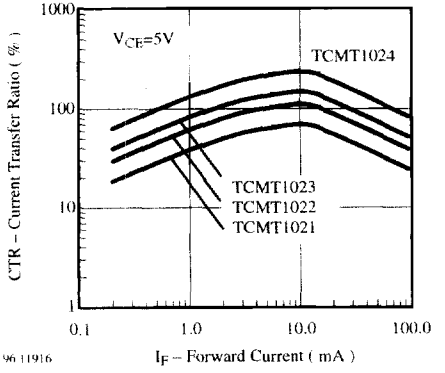



Figure 9. Current Transfer Ratio vs. Forward Current

## Dimensions in mm