### Absolute Maximum Ratings ($T_A$ = 25° C unless otherwise noted)

| | |
|---|---|
| Storage Temperature Range<br>4N22, 4N22A, 4N23, 4N23A, 4N24, 4N24A (COTS, TX, TXV)<br>4N47, 4N47A, 4N48, 4N48A, 4N49, 4N49A (COTS, TX, TXV) | <br>-65° C to +125° C<br>-55° C to +150° C |
| Operating Temperature Range<br>4N22, 4N22A, 4N23, 4N23A, 4N24, 4N24A (COTS, TX, TXV)<br>4N47, 4N47A, 4N48, 4N48A, 4N49, 4N49A (COTS, TX, TXV) | <br>-65° C to +125° C<br>-55° C to +125° C |
| Input-to-Output Isolation Voltage | ± 1.00 kVDC(1) |
| Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 seconds with soldering iron] | 260° C(2) |

**Input Diode**

| | |
|---|---|
| Forward DC Current (65° C or below) | 40 mA |
| Reverse Voltage | 2 V |
| Peak Forward Current (1 µs pulse width, 300 pps)<br>4N22, 4N22A, 4N23, 4N23A, 4N24, 4N24A (COTS, TX, TXV) | 1 A |
| Power Dissipation | 60 mW(3) |

**Output Sensor** (4N22, 4N22A, 4N23, 4N23A, 4N24, 4N24A )

| | |
|---|---|
| Continuous Collector Current | 50 mA |
| Collector-Emitter Voltage | 35 V |
| Collector-Base Voltage | 35 V |
| Emitter-Base Voltage | 4 V |
| Power Dissipation | 300 mW(4) |

**Output Phototransistor** (4N47, 4N47A, 4N48, 4N48A, 4N49, 4N49A )

| | |
|---|---|
| Continuous Collector Current | 50 mA |
| Collector-Emitter Voltage | 40 V |
| Collector-Base Voltage | 45 V |
| Emitter-Base Voltage | 7.0 V |
| Power Dissipation | 300 mW(4) |

Notes:
1. Measured with input leads shorted together and output leads shorted together.
2. RMA flux is recommended. Duration can be extended to 10 seconds maximum when flow soldering.
3. Derate linearly 1.0 mW/° C above 65° C.
4. Derate linearly 3.0 mW/° C above 25° C.

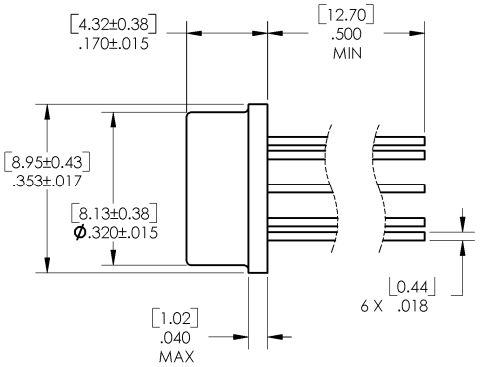


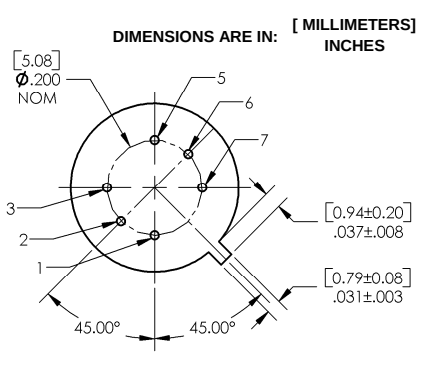

**OPTEK Technology Inc. —** 1645 Wallace Drive, Carrollton, Texas 75006
Phone: (972) 323-2200 or (800) 341-4747 FAX: (972) 323-2396 sensors@optekinc.com www.optekinc.com

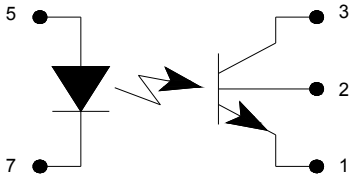
### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Input Diode** | | | | | | |
| $V_F$ | Forward Voltage | | | | | |
| | 4N22, 4N23, 4N24 [A] (COTS, TX, TXV) | 0.80 | - | 1.30 | V | $I_F$ = 10.0 mA |
| | 4N22, 4N23, 4N24 [A] (COTS, TX, TXV) | 1.00 | - | 1.50 | V | $I_F$ = 10.0 mA, $T_A$ = -55° C(1) |
| | 4N22, 4N23, 4N24 [A] (COTS, TX, TXV) | 0.70 | - | 1.20 | V | $I_F$ = 10.0 mA, $T_A$ = -100° C(1) |
| | 4N47, 4N48, 4N49 [A] (COTS, TX, TXV) | 0.80 | - | 1.50 | V | $I_F$ = 10.0 mA |
| | 4N47, 4N48, 4N49 [A] (COTS, TX, TXV) | 1.00 | - | 1.70 | V | $I_F$ = 10.0 mA, $T_A$ = -55° C(1) |
| | 4N47, 4N48, 4N49 [A] (COTS, TX, TXV) | 0.70 | - | 1.30 | V | $I_F$ = 10.0 mA, $T_A$ = -100° C(1) |
| $I_R$ | Reverse Current | - | - | 100 | µA | $V_R$= 2.0 V |
| **Output Phototransistor** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | | | | | |
| | 4N22, 4N23, 4N24 [A] (COTS, TX, TXV) | 35 | - | - | V | $I_C$ = 1.0 mA, $I_B$= 0, $I_F$= 0 |
| | 4N47, 4N48, 4N49 [A] (COTS, TX, TXV) | 40 | - | - | V | $I_C$ = 1.0 mA, $I_B$= 0, $I_F$= 0 |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | | | | | |
| | 4N22, 4N23, 4N24 [A] (COTS, TX, TXV) | 35 | - | - | V | $I_C$ = 100 µA, $I_B$= 0, $I_F$= 0 |
| | 4N47, 4N48, 4N49 [A] (COTS, TX, TXV) | 45 | - | - | V | $I_C$ = 100 µA, $I_B$= 0, $I_F$= 0 |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | | | | | |
| | 4N22, 4N23, 4N24 [A] (COTS, TX, TXV) | 4 | - | - | V | $I_E$ = 100 µA, $I_C$= 0, $I_F$= 0 |
| | 4N47, 4N48, 4N49 [A] (COTS, TX, TXV) | 7 | - | - | V | $I_E$ = 100 µA, $I_C$= 0, $I_F$= 0 |
| $I_{CEO}$ | Collector-Emitter Dark Current | | | | | |
| | 4N22, 4N23, 4N24 [A] (COTS, TX, TXV) | - | - | 100 | nA | $V_{CE}$ = 20 V, $I_B$= 0, $I_F$= 0 |
| | 4N47, 4N48, 4N49 [A] (COTS, TX, TXV) | - | - | 100 | nA | $V_{CE}$ = 20 V, $I_B$= 0, $I_F$= 0, $T_A$ = 100° C(2) |
| $I_{C(OFF)}$ | Collector-Emitter Dark Current | | | | | |
| | 4N22, 4N23, 4N24 [A] (COTS, TX, TXV) | - | - | 100 | nA | $V_{CE}$ = 20 V, $I_B$= 0, $I_F$= 0 |
| | 4N47, 4N48, 4N49 [A] (COTS, TX, TXV) | - | - | 100 | µA | $V_{CE}$ = 20 V, $I_B$= 0, $I_F$= 0, $T_A$ = 100° C(1) |
| $I_{CB(OFF)}$ | Collector-Base Dark Current | | | | | |
| | 4N22, 4N23, 4N24 [A] (COTS, TX, TXV) | - | - | 10 | nA | $V_{CB}$ = 20 V, $I_E$= 0, $I_F$= 0 |
| | 4N47, 4N48, 4N49 [A] (COTS, TX, TXV) | - | - | 10 | nA | |

Notes:
1. Guaranteed but not tested.
2. Sample tested, LTPD = 10.




| Pin # | Function | Pin # | Function |
|---|---|---|---|
| 1 | Emitter | 5 | Anode |
| 2 | Base | 6 | Open |
| 3 | Collector | 7 | Cathode |

OPTEK reserves the right to make changes at any time in order to improve design and to supply the best product possible.

### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Coupled** | | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | | | | mA | |
| | 4N22, 4N22A (COTS, TX, TXV) | 0.15 | - | - | | $I_F$ = 2.0 mA , $V_{CE}$ = 5 V, $I_B$ = 0 |
| | 4N22, 4N22A (COTS, TX, TXV) | 2.50 | - | - | | $I_F$ = 10.0 mA , $V_{CE}$ = 5 V, $I_B$ = 0 |
| | 4N22, 4N22A (COTS, TX, TXV) | 1.00 | - | - | | $I_F$ = 10.0 mA , $V_{CE}$ = 5 V, $I_B$ = 0, $T_A$ = -55° C(1) |
| | 4N22, 4N22A (COTS, TX, TXV) | 1.00 | - | - | | $I_F$ = 10.0 mA , $V_{CE}$ = 5 V, $I_B$ = 0, $T_A$ = 100° C(1) |
| | 4N23, 4N23A (COTS, TX, TXV) | 0.20 | - | - | | $I_F$ = 2.0 mA , $V_{CE}$ = 5 V, $I_B$ = 0 |
| | 4N23, 4N23A (COTS, TX, TXV) | 6.00 | - | - | | $I_F$ = 10.0 mA , $V_{CE}$ = 5 V, $I_B$ = 0 |
| | 4N23, 4N23A (COTS, TX, TXV) | 2.50 | - | - | | $I_F$ = 10.0 mA , $V_{CE}$ = 5 V, $I_B$ = 0, $T_A$ = -55° C(1) |
| | 4N23, 4N23A (COTS, TX, TXV) | 2.50 | - | - | | $I_F$ = 10.0 mA , $V_{CE}$ = 5 V, $I_B$ = 0, $T_A$ = 100° C(1) |
| | 4N24, 4N24A (COTS, TX, TXV) | 0.40 | - | - | | $I_F$ = 2.0 mA , $V_{CE}$ = 5 V, $I_B$ = 0 |
| | 4N24, 4N24A (COTS, TX, TXV) | 10.0 | - | - | | $I_F$ = 10.0 mA , $V_{CE}$ = 5 V, $I_B$ = 0 |
| | 4N24, 4N24A (COTS, TX, TXV) | 4.00 | - | - | | $I_F$ = 10.0 mA , $V_{CE}$ = 5 V, $I_B$ = 0, $T_A$ = -55° C(1) |
| | 4N24, 4N24A (COTS, TX, TXV) | 4.00 | - | - | | $I_F$ = 10.0 mA , $V_{CE}$ = 5 V, $I_B$ = 0, $T_A$ = 100° C(1) |
| | 4N47, 4N47A (COTS, TX, TXV) | 0.50 | - | - | | $I_F$ = 1.0 Ma, $V_{CE}$ = 5.0 V, $I_B$ = 0 |
| | 4N47, 4N47A (COTS, TX, TXV) | 0.70 | - | - | | $I_F$ = 2.0 mA, $V_{CE}$ = 5.0 V, $I_B$ = 0, $T_A$ = -55° C(1) |
| | 4N47, 4N47A (COTS, TX, TXV) | 0.50 | - | - | | $I_F$ = 2.0 mA, $V_{CE}$ = 5.0 V, $I_B$ = 0, $T_A$ = 100° C(1) |
| | 4N48, 4N48A (COTS, TX, TXV) | 1.00 | - | 5 | | $I_F$ = 1.0 mA, $V_{CE}$ = 5.0 V, $I_B$ = 0 |
| | 4N48, 4N48A (COTS, TX, TXV) | 1.40 | - | - | | $I_F$ = 2.0 mA, $V_{CE}$ = 5.0 V, $I_B$ = 0, $T_A$ = -55° C(1) |
| | 4N48, 4N48A (COTS, TX, TXV) | 1.00 | - | - | | $I_F$ = 2.0 mA, $V_{CE}$ = 5.0 V, $I_B$ = 0, $T_A$ = 100° C(1) |
| | 4N49, 4N49A (COTS, TX, TXV) | 2.00 | - | 10 | | $I_F$ = 1.0 mA, $V_{CE}$ = 5.0 V, $I_B$ = 0 |
| | 4N49, 4N49A (COTS, TX, TXV) | 2.80 | - | - | | $I_F$ = 2.0 mA, $V_{CE}$ = 5.0 V, $I_B$ = 0, $T_A$ = -55° C(1) |
| | 4N49, 4N49A (COTS, TX, TXV) | 2.00 | - | - | | $I_F$ = 2.0 mA, $V_{CE}$ = 5.0 V, $I_B$ = 0, $T_A$ = 100° C(1) |
| $I_{CB(ON)}$ | On-State Collector Base | | | | µA | |
| | 4N47, 4N48, 4N49 [A] (COTS, TX, TXV) | 30 | - | - | | $V_{CB}$ = 5 V, $I_E$ = 0, $I_F$ = 10 mA |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | | | V | |
| | 4N22, 4N23, 4N24 [A] (COTS, TX, TXV) | - | - | 0.30 | | $I_F$ = 20 mA , $I_C$ = 2.5 mA, $I_B$ = 0 |
| | 4N22, 4N23, 4N24 [A] (COTS, TX, TXV) | - | - | 0.30 | | $I_F$ = 20 mA , $I_C$ = 5.0 mA, $I_B$ = 0 |
| | 4N22, 4N23, 4N24 [A] (COTS, TX, TXV) | - | - | 0.30 | | $I_F$ = 20 mA , $I_C$ = 10.0 mA, $I_B$ = 0 |
| | 4N47, 4N47A (COTS, TX, TXV) | - | - | 0.30 | | $I_F$ = 2.0 mA, $I_C$ = 0.5 mA, $I_B$ = 0 |
| | 4N48, 4N48A (COTS, TX, TXV) | - | - | 0.30 | | $I_F$ = 2.0 mA, $I_C$ = 1.0 mA, $I_B$ = 0 |
| | 4N49, 4N49A (COTS, TX, TXV) | - | - | 0.30 | | $I_F$ = 2.0 mA, $I_C$ = 2.0 mA, $I_B$ = 0 |
| $H_{FE}$ | DC Current Gain | | | | V | |
| | 4N22, 4N22A (COTS, TX, TXV) | 200 | - | - | | $V_{CE}$ = 5.0 V , $I_C$ = 10.0 mA, $I_F$ = 0 mA |
| | 4N23, 4N23A (COTS, TX, TXV) | 300 | - | - | | $V_{CE}$ = 5.0 V , $I_C$ = 10.0 mA, $I_F$ = 0 mA |
| | 4N24, 4N24A (COTS, TX, TXV) | 400 | - | - | | $V_{CE}$ = 5.0 V , $I_C$ = 10.0 mA, $I_F$ = 0 mA |
| | 4N47, 4N48, 4N49 [A] (COTS, TX, TXV) | 100 | - | - | | $V_{CE}$ = 5.0 V , $I_C$ = 10.0 mA, $I_F$ = 0 mA |
| $R_{IO}$ | Resistance (Input-to-Output) | | | | Ω | |
| | 4N22, 4N23, 4N24 [A] (COTS, TX, TXV) | $10^{11}$ | - | - | | $V_{10}$ = ± 1.0 VDC(3) |
| | 4N47, 4N48, 4N49 [A] (COTS, TX, TXV) | $10^{11}$ | - | - | | $V_{I-O}$ = ± 1000 VDC(3) |
| $C_{IO}$ | Capacitance (Input-to-Output) | - | - | 5 | pF | $V_{I-O}$ = 0 V, f = 1.0 MHz(3) |

Notes:
1. Guaranteed but not tested.
2. Sample tested, LTPD = 10.
3. Measured with input leads shorted together and output leads shorted together.

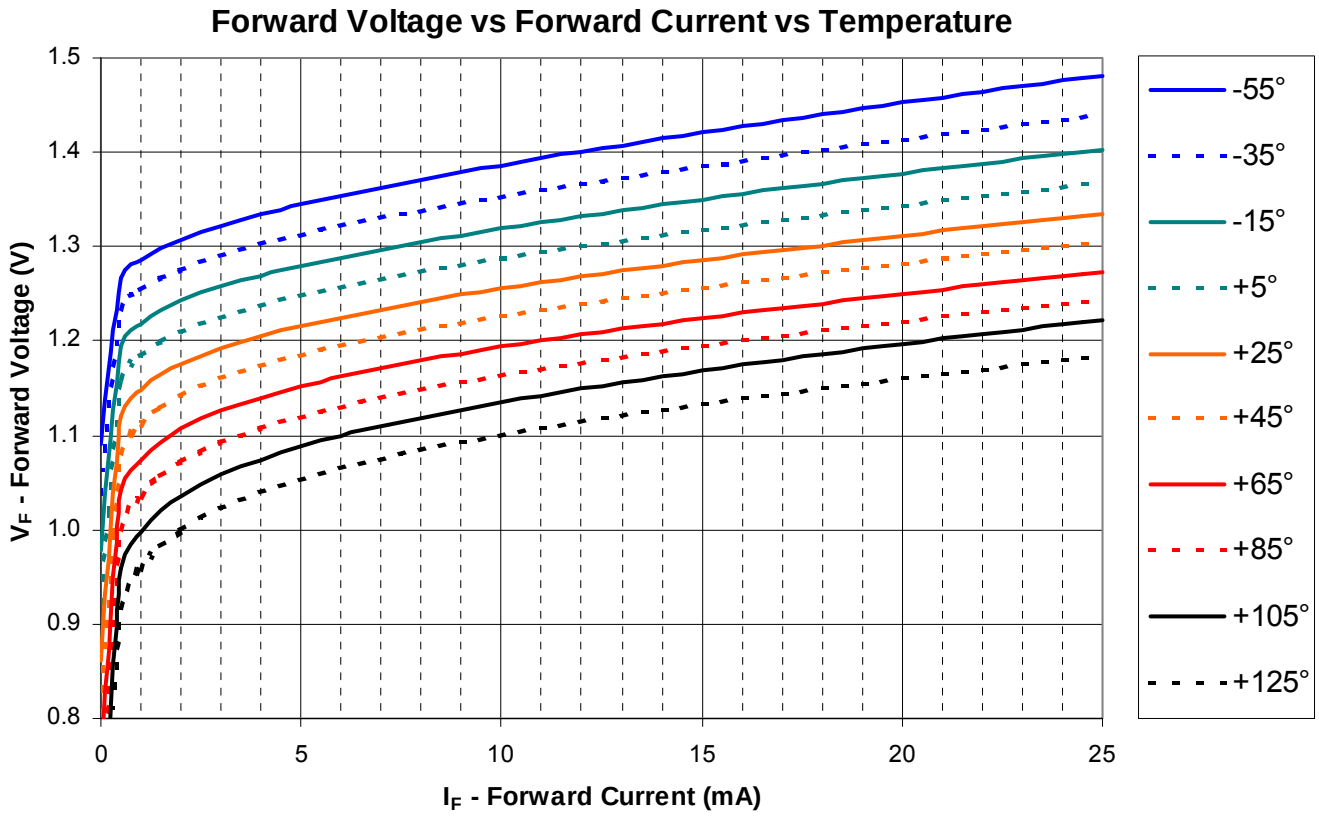



**OPTEK Technology Inc.** — 1645 Wallace Drive, Carrollton, Texas 75006
Phone: (972) 323-2200 or (800) 341-4747 FAX: (972) 323-2396 sensors@optekinc.com www.optekinc.com

### Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **Coupled** | | | | | | |
| $T_R$ | Output Rise Time | | | | | |
| | 4N22A (TX, TXV) | - | - | 15 | | $V_{CC}$ = 10.0 V , $I_F$ = 10.0 mA, $R_L$ = 100 mA |
| | 4N23A (TX, TXV) | - | - | 15 | | $V_{CC}$ = 10.0 V , $I_F$ = 10.0 mA, $R_L$ = 100 mA |
| | 4N24A (TX, TXV) | - | - | 20 | µs | $V_{CC}$ = 10.0 V , $I_F$ = 10.0 mA, $R_L$ = 100 mA |
| | 4N47 (TX. TXV) | - | - | 20 | | $V_{CC}$ = 10.0 V , $I_F$ = 5.0 mA, $R_L$ = 100 Ω |
| | 4N48 (TX. TXV) | - | - | 20 | | $V_{CC}$ = 10.0 V , $I_F$ = 5.0 mA, $R_L$ = 100 Ω |
| | 4N49 (TX. TXV) | - | - | 25 | | $V_{CC}$ = 10.0 V , $I_F$ = 5.0 mA, $R_L$ = 100 Ω |
| $T_F$ | Output Fall Time | | | | | |
| | 4N22A (TX, TXV) | - | - | 15 | | $V_{CC}$ = 10.0 V , $I_F$ = 10.0 mA, $R_L$ = 100 Ω |
| | 4N23A (TX, TXV) | - | - | 15 | | $V_{CC}$ = 10.0 V , $I_F$ = 10.0 mA, $R_L$ = 100 Ω |
| | 4N24A (TX, TXV) | - | - | 20 | µs | $V_{CC}$ = 10.0 V , $I_F$ = 10.0 mA, $R_L$ = 100 Ω |
| | 4N47 (TX. TXV) | - | - | 20 | | $V_{CC}$ = 10.0 V , $I_F$ = 5.0 mA, $R_L$ = 100 Ω |
| | 4N48 (TX. TXV) | - | - | 20 | | $V_{CC}$ = 10.0 V , $I_F$ = 5.0 mA, $R_L$ = 100 Ω |
| | 4N49 (TX. TXV) | - | - | 25 | | $V_{CC}$ = 10.0 V , $I_F$ = 5.0 mA, $R_L$ = 100 Ω |

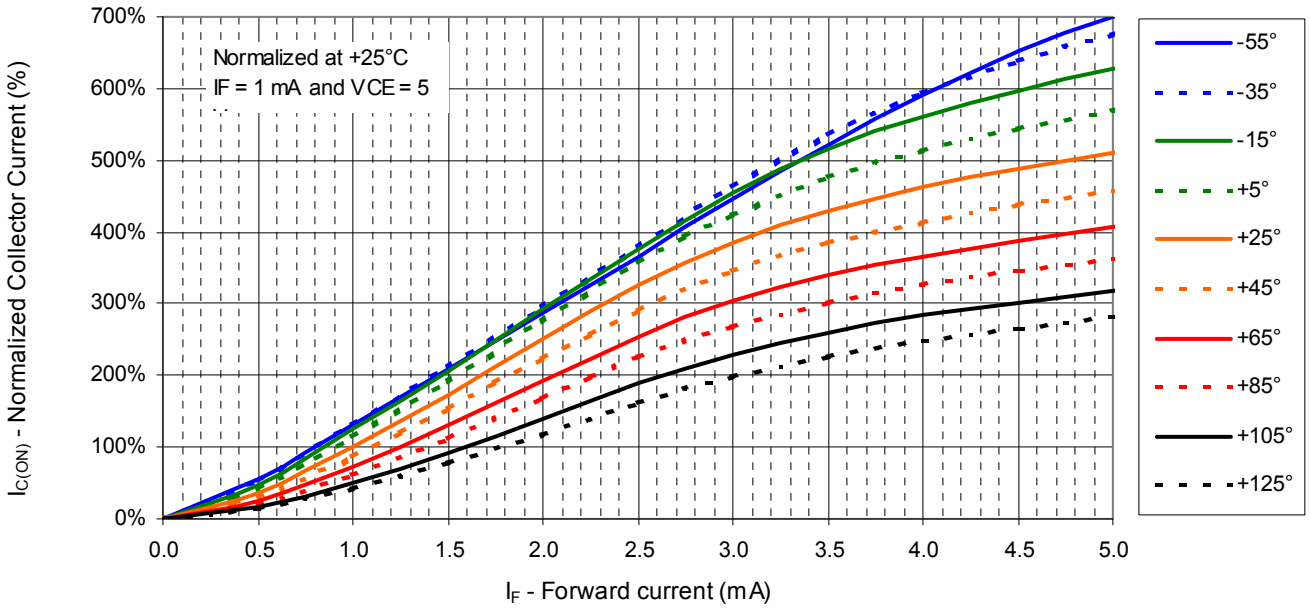
### Typical Performance Curves



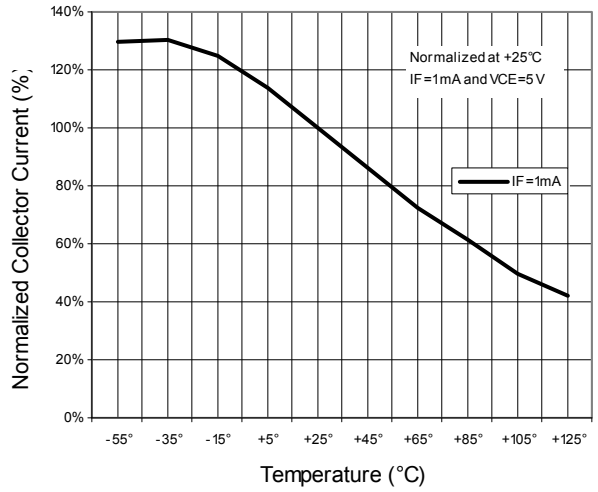

OPTEK reserves the right to make changes at any time in order to improve design and to supply the best product possible.

### Typical Performance Curves

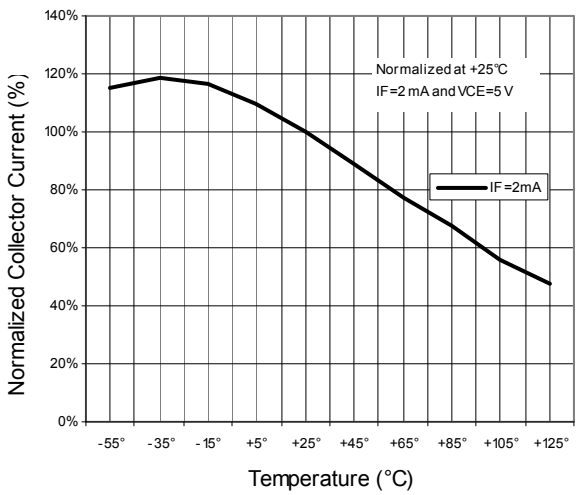
**Collector Current vs Forward Current vs Temperature**




Normalized Collector Current Vs Temperature




Normalized Collector Current Vs Temperature







**OPTEK Technology Inc.** — 1645 Wallace Drive, Carrollton, Texas 75006
Phone: (972) 323-2200 or (800) 341-4747 FAX: (972) 323-2396 sensors@optekinc.com www.optekinc.com