

# General-Purpose Silicon Planar Phototransistor

Optoelectronic Products

# FPT100/A/B FPT110/A/B

## General Description

The FPT100 and FPT110 are 3-terminal npn Planar phototransistors with exceptionally stable characteristics and high illumination sensitivity. The availability of the base pin gives wide latitude for flexible circuit design. The case is a special plastic compound with transparent resin encapsulation that exhibits stable characteristics under high humidity conditions. The controlled sensitivities offered in the A and B versions give the circuit designer increased flexibility.

## Exceptionally Stable Characteristics Controlled Sensitivities

## Absolute Maximum Ratings

### Maximum Temperature and Humidity

|                                  |                 |
|----------------------------------|-----------------|
| Storage Temperature              | -55°C to +100°C |
| Operating Temperature            | -55°C to +85°C  |
| Pin Temperature (Soldering, 5 s) | 260°C           |
| Relative Humidity at 65°C        | 85%             |

### Maximum Power Dissipation (Notes 1 and 2)

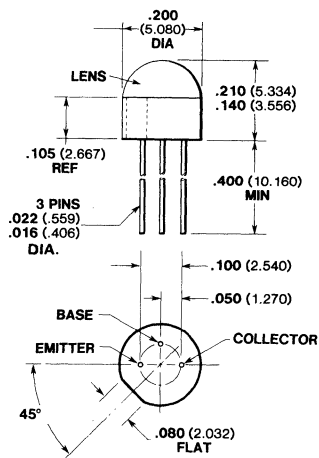
|   |        |
|---|--------|
| Total Dissipation at $T_C = 25^\circ\text{C}$ | 200 mW |
| Total Dissipation at $T_A = 25^\circ\text{C}$ | 100 mW |

### Maximum Voltages and Current (Note 5)

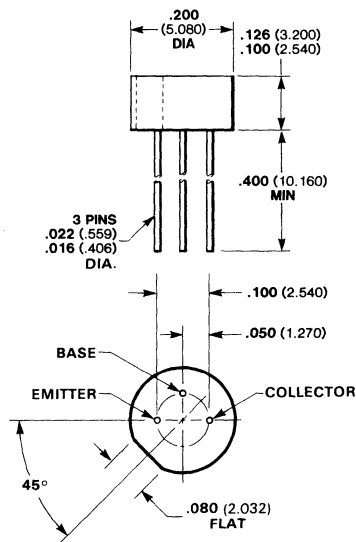
|  |       |
|--|-------|
| $V_{CB}$ Collector-to-Base Voltage                           | 50 V  |
| $V_{CE}$ Collector-to-Emitter<br>Sustaining Voltage (Note 3) | 30 V  |
| $I_C$ Collector Current                                      | 25 mA |

## Package Outlines

### FPT100/A/B



### FPT110/A/B



## Notes

All dimensions in inches bold and millimeters (parentheses)  
Tolerance unless specified =  $\pm .015$  ( $\pm .381$ )

# Typical Electrical Characteristics

# FPT100/A/B FPT110/A/B

**Electrical Characteristics**  $T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol         | Characteristic                          | Min | Typ   | Max  | Units                   | Test Conditions  |
|----------------|---|-----|-------|------|-------------------------|--|
| $I_{CBO}$      | Collector Dark Current                  |     | 0.25  | 25   | nA                      | $V_{CB} = 10\text{ V}$<br>(Note 5)                               |
| $I_{CBO}$      | Collector Dark Current                  |     | 0.025 | 0.5  | $\mu\text{A}$           | $V_{CB} = 10\text{ V}$ ,<br>$T_A = 65^\circ\text{C}$<br>(Note 5) |
| $I_{CEO}$      | Collector Dark Current                  |     | 2.0   | 100  | nA                      | $V_{CE} = 5.0\text{ V}$<br>(Note 5)                              |
| $R_{CB}$       | Responsivity (Tungsten)                 |     |       |      |                         |  |
|                | FPT100/A/B                              | 0.6 | 1.6   |      | $\mu\text{A}/$          | $V_{CB} = 10\text{ V}$   |
|                | FPT110/A/B                              | 0.6 | 1.0   |      | $\text{mW}/\text{cm}^2$ | (Notes 3 and 8)  |
| $R_{CB}$       | Responsivity (GaAs)                     |     |       |      |                         |  |
|                | FPT100/A/B                              | 1.8 | 4.8   |      | $\mu\text{A}/$          | $V_{CB} = 10\text{ V}$   |
|                | FPT110/A/B                              | 1.8 | 3.0   |      | $\text{mW}/\text{cm}^2$ | (Notes 4 and 8)  |
| $I_{CE(I)}$    | Photo Current (Tungsten)                |     |       |      |                         |  |
|                | FPT100/A/B                              | 0.2 | 1.4   |      | mA                      | $V_{CE} = 5.0\text{ V}$  |
|                | FPT110/A/B                              | 0.2 | 0.88  |      |                         | $H = 5.0\text{ mW}/\text{cm}^2$<br>(Notes 3 and 7)               |
| $I_{CE(I)}$    | Photo Current (GaAs)                    |     |       |      |                         |  |
|                | FPT100/A/B                              | 0.6 | 4.2   |      | mA                      | $V_{CE} = 5.0\text{ V}$  |
|                | FPT110/A/B                              | 0.6 | 2.7   |      |                         | $H = 5.0\text{ mW}/\text{cm}^2$<br>(Notes 4 and 7)               |
| $t_r$          | Light Current Rise Time                 |     | 2.8   |      | $\mu\text{s}$           | (Note 6)   |
| $t_f$          | Light Current Fall Time                 |     | 2.8   |      | $\mu\text{s}$           | (Note 6)   |
| $V_{CEO(sat)}$ | Collector-to-Emitter Saturation Voltage |     |       |      |                         |  |
|                | FPT100/A/B                              |     | 0.16  | 0.3  | V                       | $I_C = 500\text{ }\mu\text{A}$                                   |
|                | FPT110/A/B                              |     | 0.16  | 0.33 |                         | $H = 20\text{ mW}/\text{cm}^2$                                   |
| $BV_{CBO}$     | Collector-to-Base Breakdown Voltage     | 50  | 120   |      | V                       | $I_C = 100\text{ }\mu\text{A}$<br>(Note 5)                       |
| $V_{CEO(sus)}$ | Collector-to-Emitter Sustaining Voltage | 30  | 50    |      | V                       | $I_C = 1.0\text{ mA}$<br>(pulsed) (Note 5)                       |
| $BV_{ECO}$     | Emitter-to-Collector Breakdown          |     | 7.0   |      | V                       | $I_E = 100\text{ }\mu\text{A}$<br>(Note 5)                       |

The following values affect the A and B versions only:

| Symbol      | Characteristic                  | Min | Typ | Max | Units | Test Conditions                     |
|-------------|---------------------------------|-----|-----|-----|-------|-------------------------------------|
| $I_{CE(I)}$ | Photo Current (Tungsten Source) |     |     |     |       |                                     |
|             | FPT100A                         | 1.0 |     | 3.0 | mA    | $V_{CE} = 5.0\text{ V}$<br>(Note 3) |
|             | FPT110A                         | 0.6 |     | 1.8 |       | $H = 5.0\text{ mW}/\text{cm}^2$     |
| $I_{CE(I)}$ | Photo Current (Tungsten Source) |     |     |     |       |                                     |
|             | FPT100B                         | 1.3 |     | 2.6 | mA    | $V_{CE} = 5.0\text{ V}$<br>(Note 3) |
|             | FPT110B                         | 0.8 |     | 1.6 |       | $H = 5.0\text{ mW}/\text{cm}^2$     |

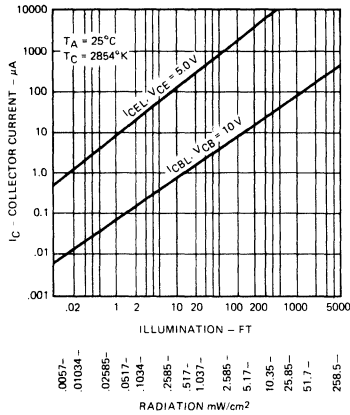
**Notes**

- These are steady-state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
- These ratings give a maximum junction temperature of  $85^\circ\text{C}$  and junction-to-case thermal resistance of  $300^\circ\text{C}/\text{W}$  (derating factor of  $3.33\text{ mW}/^\circ\text{C}$ ), and a junction-to-ambient thermal resistance of  $600^\circ\text{C}/\text{W}$  (derating factor of  $1.67\text{ mW}/^\circ\text{C}$ ).
- Measured at noted irradiance as emitted from a tungsten filament lamp at a color temperature of  $2854^\circ\text{K}$ . The effective photosensitive area is typically  $1.25\text{ mm}^2$  (FPT100A/B) and  $0.78\text{ mm}^2$  (FPT110A/B).
- These are values obtained at noted irradiance as emitted from a GaAs source at  $900\text{ nm}$ .
- Measured with radiation flux intensity of less than  $0.1\text{ }\mu\text{W}/\text{cm}^2$  over the spectrum from  $100$  to  $1500\text{ nm}$ .
- Rise time is defined as the time required for  $I_{CE}$  to rise from 10% to 90% of peak value. Fall time is defined as the time required for  $I_{CE}$  to decrease from 90% to 10% of peak value. Test conditions are:  $I_{CE} = 4.0\text{ mA}$ ,  $V_{CE} = 5.0\text{ V}$ ,  $R_L = 100\text{ }\Omega$ , GaAs source.
- No electrical connection to base lead.
- No electrical connection to emitter lead.

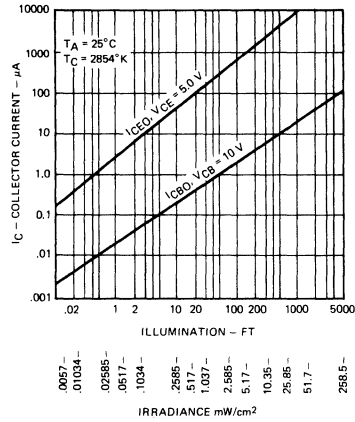
# Typical Electrical Characteristic Curves

# FPT100/A/B FPT110/A/B

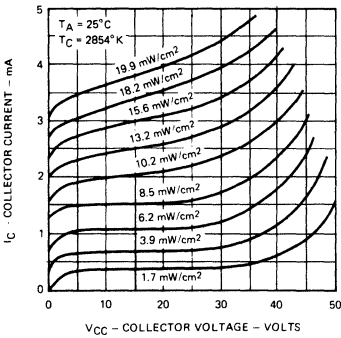
**FPT100/A/B Photo Current Characteristics**



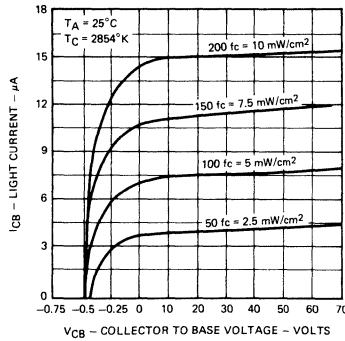
**FPT110/A/B Photo Current Characteristics**



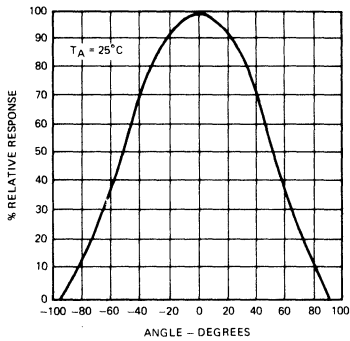
**Collector Current vs Collector Voltage**



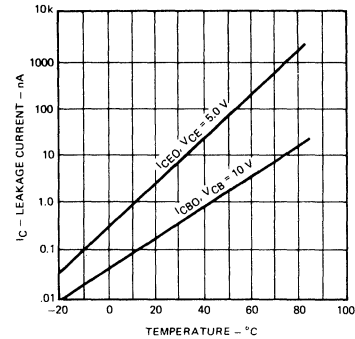
**Collector Base Characteristics**



**Angular Response**



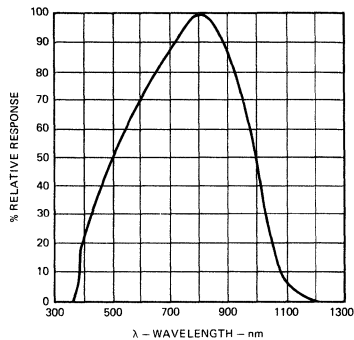
**Collector Dark Current vs Temperature**



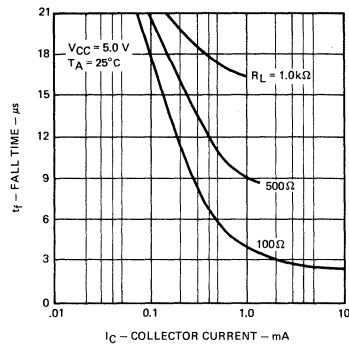
# Typical Electrical Characteristic Curves Circuits

# FPT100/A/B FPT110/A/B

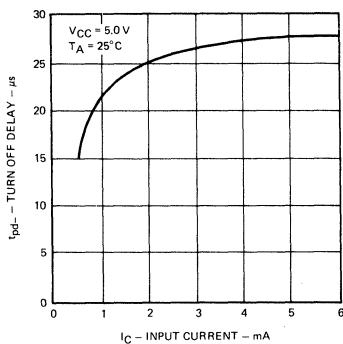
## Spectral Characteristics



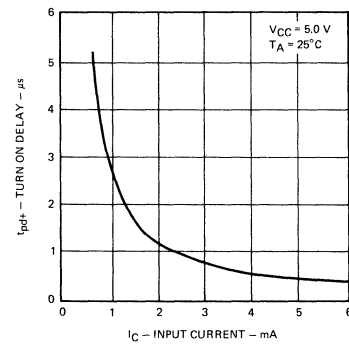
## Rise And Fall Time vs Collector Current



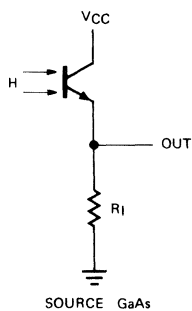
## Turn-Off Delay Times For Circuit



## Turn-On Delay Times For Circuit



## Switching Circuit For Rise And Fall Times



## Circuit For Turn-On And Turn-Off Data

