Emitter And Sensor Matched Pair Arrays

Optoelectronic Products

FPA100
FPA101
FPA102

General Description

The FPA100, FPA101 and FPA102 are source/sensor arrays each of which consists of a set of two modules: one, an array of infrared emitters, and two, an array of infrared sensors.

The source module consists of an array of GaAs infrared-emitting diodes. When forward biased, these diodes emit an intense narrow band of infrared (non-visible) radiation at a wavelength of 900 nm. The sensor modules consist of an array of npn phototransistors which are sensitive to visible as well as infrared radiation (400 to 1100 nm). They are most sensitive to infrared radiation; therefore, the source module's emission wavelength is very nearly perfect for maximum coupling efficiency. The source and sensor modules of each set are identical in construction; when the modules are placed facing one another, each infrared emitting diode has a photo-transistor directly opposite it.

The FPA100 has nine source/sensor pairs in a single line on 0.100-inch centers, matching the format of standard-punched paper tape. The FPA101 has 12 source/sensor pairs in a single line on 0.250-inch centers, matching the row spacing of standard tab cards. The FPA102 has 10 source/sensor pairs in a single line on 0.087-inch centers, matching the column spacing of standard tab cards.

Reduces Mechanical Design And Packaging Problems
Low Temperature Coefficient
Designed For Reading Punched Cards And Punched Tapes With The Sensor
Outputs Operable Directly Into Standard Digital ICs
Applications: Transmissible Reading Shaft Encoding and Multi-Channel Optical Coupling

Absolute Maximum Ratings

Maximum Temperatures and Humidity

Storage Temperature	−40°C to +100°C
Operating Temperature	−40°C to +100°C
Pin Temperature (Soldering, 10 s)	260°C
Relative Humidity at 65°C	85%

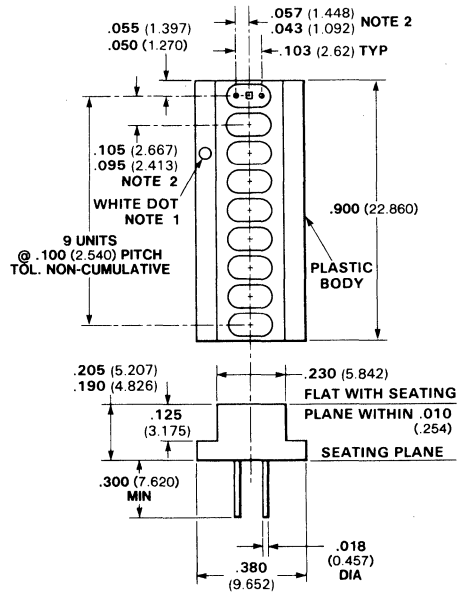
Maximum Power Dissipation (Note 1)

Total Dissipation at T_A = 25°C for Source Array	110 mW/cell
Derate Linearly from 25°C	1.47 mW/°C
Total Dissipation at T_A = 25°C for Sensor Array	167 mW/cell
Derate Linearly from 25°C	2.22 mW/°C

Maximum Voltage and Currents

Source Array		
I_F	Forward dc Current/Cell	75 mA
V_R	Reverse Voltage	3.0 V
Sensor Array		
$V_{CE(Sus)}$	Collector-to-Emitter Sustaining Voltage (Note 2)	12 V
I_C	Collector Current	25 mA

Package Outline
FPA100



Notes

1. Emitter terminal side of phototransistor (sensor array) or anode terminal side of diode (source array) defined by white dot.
2. The center of each element is aligned to ±**.010** along the length and ±**.005** across the width.
3. All dimensions in inches **bold** and millimeters (parentheses).
4. Tolerance unless specified = ±**0.15** (0.381).
5. Other packages following.

Typical Electrical Characteristics

FPA100
FPA101
FPA102

Electrical Characteristics—Source Array $T_A = 25°C$

Symbol	Characteristic	Min	Typ	Max	Units	Test Conditions
V_F	Forward Voltage		1.25	1.50	V	$I_F = 50$ mA
BV_R	Reverse Breakdown Voltage	3.0	6.0		V	$I_R = 100\ \mu A$

Sensor Array

Symbol	Characteristic	Min	Typ	Max	Units	Test Conditions
$V_{CEO(sus)}$	Sustaining Voltage (Notes 2 and 3)	12	20		V	$I_C = 1.0$ mA, pulsed
BV_{ECO}	Emitter-to-Collector Breakdown Voltage (Note 2)		5.0		V	$I_{EC} = 100\ \mu A$
$V_{CE(sat)}$	Saturation Voltage (Note 4)		0.4		V	$I_C = 4$ mA, $H = 10$ mW/cm² (GaAs)
I_{CEO}	Collector Dark Current (Note 2)		10	100	nA	$V_{CE} = 5.0$ V, $H \leq 0.1\ \mu W/cm^2$
$I_{CE(lt)}$	Photo Current (Note 4)		4.5		mA	$V_{CE} = 5.0$ V, $H = 1.0$ mW/cm² (GaAs)

Combination Source/Sensor Array

Symbol	Characteristic	Min	Typ	Max	Units	Test Conditions
I_{OUT}	Output Current	4.5	9.0	13.5	mA	$I_{IN} = 50$ mA, d = .050-inch, $V_{CE} = 5.0$ V
$\frac{I_{OUT(min)}}{I_{OUT(max)}}$	Matching Factor	0.5	0.65			$I_{IN} = 50$ mA, d = .050-inch $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Saturation Voltage		0.4	0.7	V	$I_{IN} = 50$ mA, d = .050-inch, $I_{OUT} = 3.7$ mA
t_r	Light Current Fall Time (Note 5)		40		μs	$I_{IN} = 50$ mA, d = .050-inch
t_f	Light current Rise Time (Note 5)		40		μs	$I_{IN} = 50$ mA, d = .050-inch

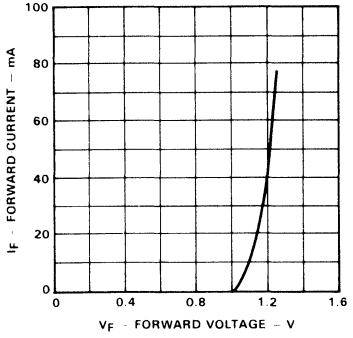
Notes

1. These are steady-state limits. The factory should be consulted on applications involving pulsed or low duty cycle operation.
2. Measured with radiation flux intensity of less than 0.1 $\mu W/cm^2$ over the spectrum from 0.1 micron to 1.5 microns.
3. Rating refers to a high current point where collector-to-emitter voltage is lowest.
4. Measured at an irradiance of 5.0 mW/cm² as emitted from a gallium arsenide diode.
5. Rise time is defined as the time required for I_{CE} to rise from 10% to 90% of the peak value. Fall time is defined as the time required for I_{CE} to decrease from 90% to 10% of the peak value.

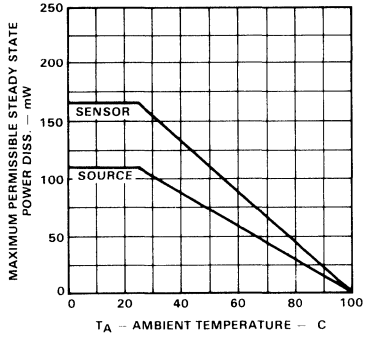
Typical Electrical Characteristic Curves

FPA100
FPA101
FPA102

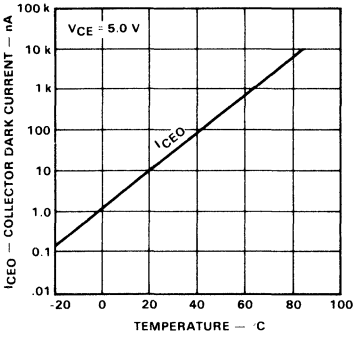
Forward Current vs Forward Voltage (dc)



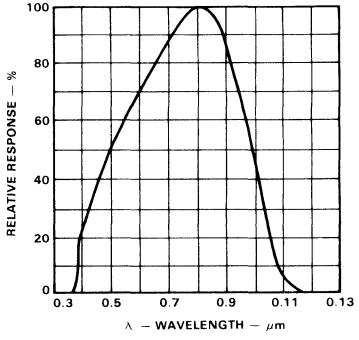
Maximum P_D vs Ambient Temperature



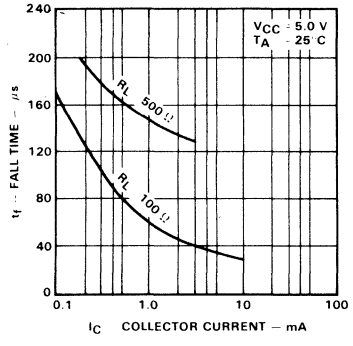
Collector Dark Current vs Temperature

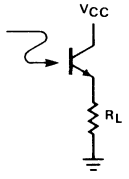


Relative Spectral Response

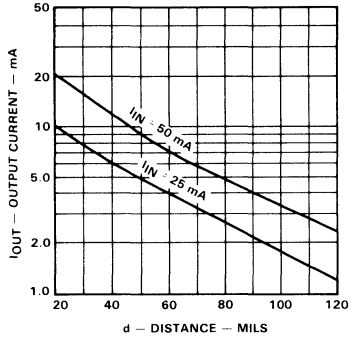


Rise and Fall Time vs Collector Current





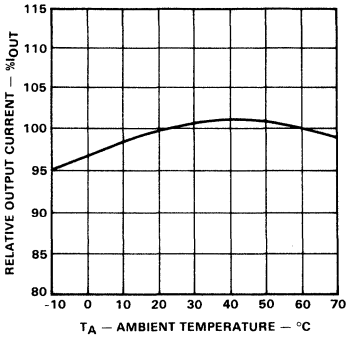
Output Current vs Distance



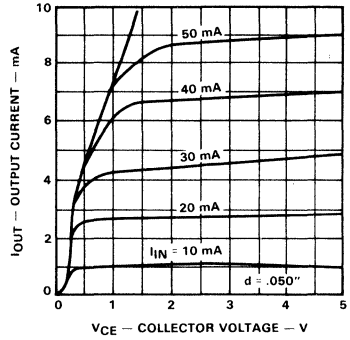
Typical Electrical Characteristic Curves Typical Circuits

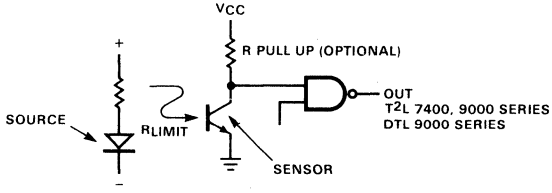
FPA100 FPA101 FPA102

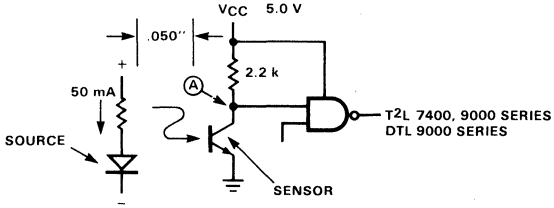
Relative Output vs Ambient Temperature

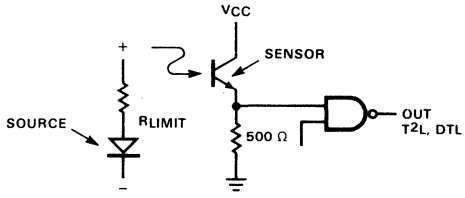


Output Current vs Collector Voltage



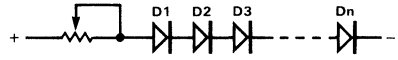




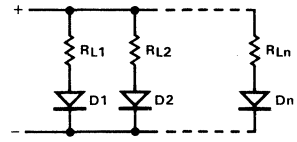


For a "hole" condition, point A for all sensors will be less than 0.8 V. For a "no hole" condition (where signal due to tape transmission is ≤ 15% of "hole"), point A will be greater than 2.0 V. These are the worst case conditions required to switch this type of logic.

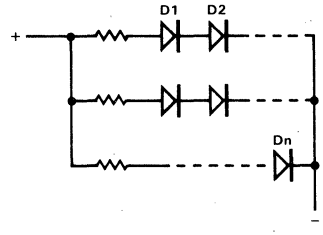
Source Circuits



Note
Use where $V_{supply} > 1.5$ n and transmission < 20%.



Note
Use where $V_{supply} < 1.5$ n and transmission < 20%. Rows must contain equal number of diodes.



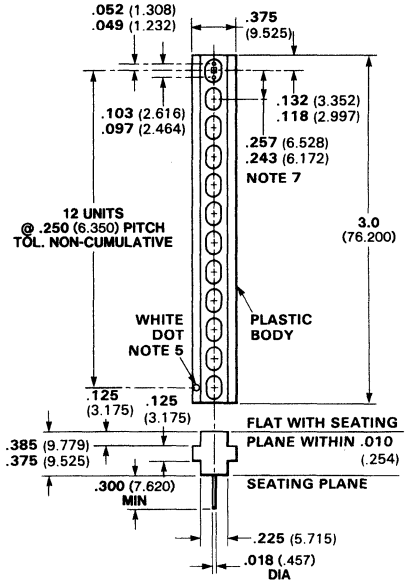
Note
Use where $V_{supply} < 1.5$ n and transmission > 20%. R_L may be adjusted so outputs of sensors are perfectly matched.

Typical Circuits (Cont'd)
Package Outlines

FPA100
FPA101
FPA102

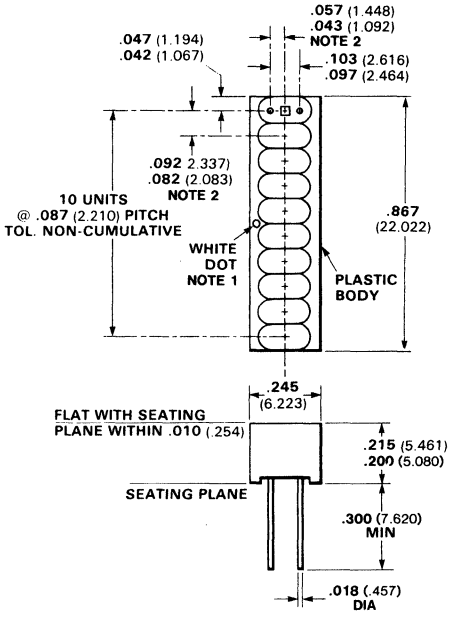
Package Outlines

FPA101



Notes
1. Emitter terminal side of phototransistor (sensor array) or anode terminal side of diode (source array) defined by white dot.
2. Leads alternate from emitter to collector (sensor) or anode to cathode (source), beginning from this end of the package.
3. All dimensions in inches **bold** and millimeters (parentheses).
4. Tolerance unless specified = ±**0.15** (0.381).

FPA102



Notes
1. Emitter terminal side of phototransistor (sensor array) or anode terminal side of diode (source array) defined by white dot.
2. The center of each element is aligned to ±**.010** along the length and ±**.005** across the width.
3. All dimensions in inches **bold** and millimeters (parentheses).
4. Tolerance unless specified = ±**0.15** (0.381).