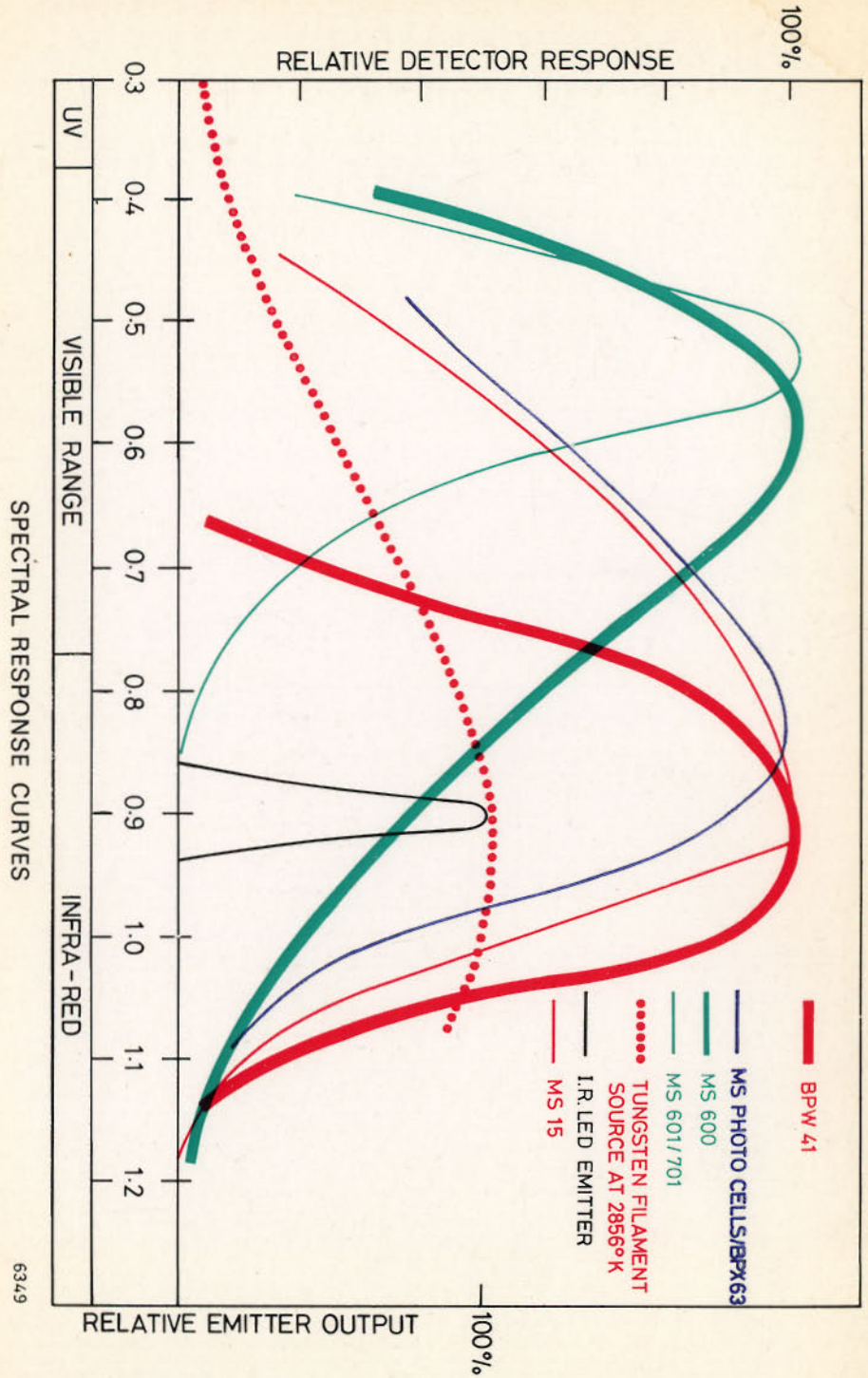
# Opto-electronic devices

FERRANTI
semiconductors




SPECTRAL RESPONSE CURVES

6349

# Opto-electronic devices

## CONTENTS

# MS SERIES

## SILICON MESA PHOTOCELLS

A range of silicon photovoltaic cells of mesa construction available in sizes from micro-miniature to large active area for general purpose use.

Unencapsulated cells are coated with a special varnish to protect against contamination and moisture ingress.

Encapsulated cells are set into tough bakelite or epoxy housings with stud or pin mountings (suffix E).

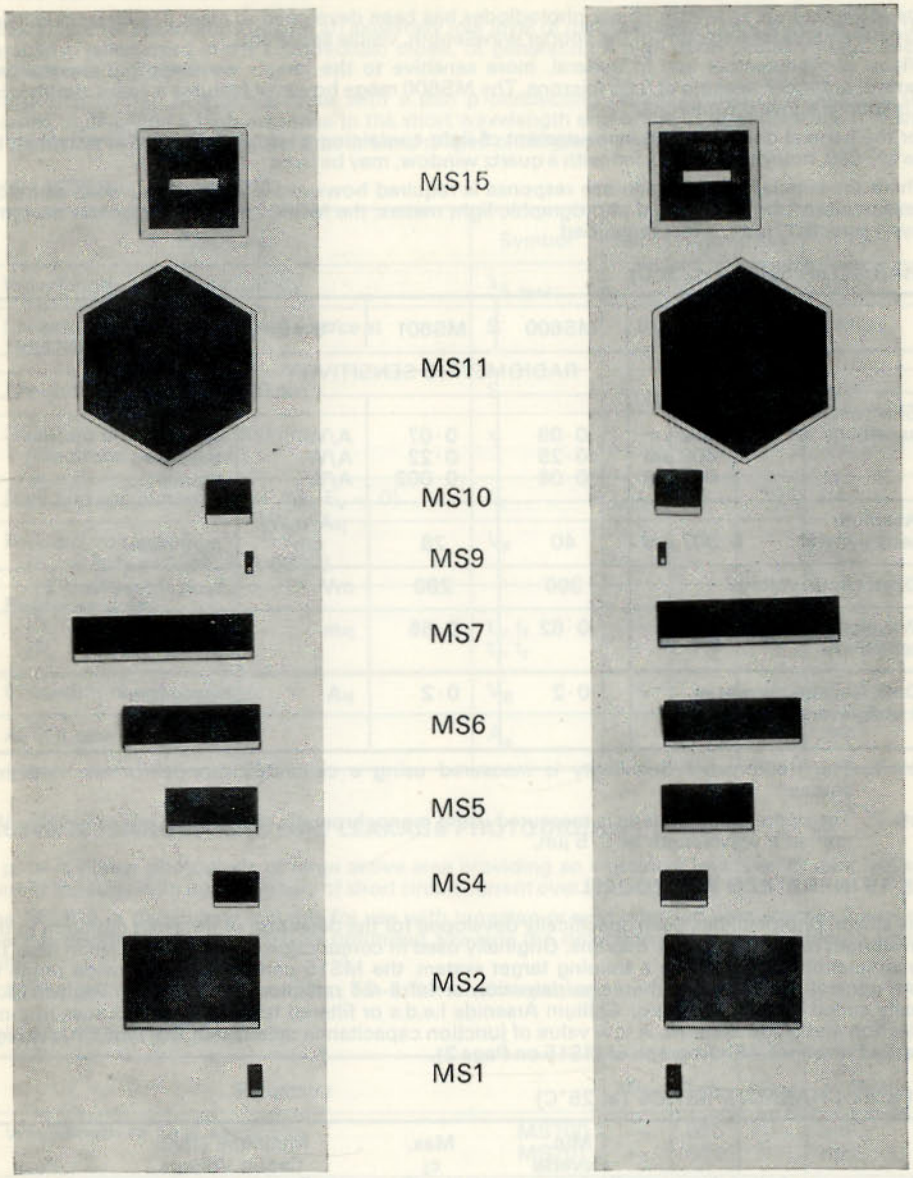
Devices are graded for standard use under both high (suffix A) and low (suffix B) light levels.

TYPICAL CHARACTERISTICS (at 25°C)

| Type | Active Area mm | 3000 lumens/sq. ft. | | 200 lumens/sq. ft. | | Comments |
|---|---|---|---|---|---|---|
| | | Voc mV | Isc mA | Voc mV | Isc mA | |
| MS1A | 3·48 × 1·83 | 500 | 1·0 | — | — | Miniature for punched tape or punched card reading systems |
| MS1AE | 3·48 × 1·83 | 500 | 1·0 | — | — | |
| MS1B | 3·48 × 1·83 | 500 | 1·0 | 350 | 0·065 | |
| MS1BE | 3·48 × 1·83 | 500 | 1·0 | 350 | 0·065 | |
| MS2A | 18·85 × 11·63 | 500 | 27 | — | — | |
| MS2AE | 18·85 × 11·63 | 500 | 31 | — | — | |
| MS2B | 18·85 × 11·63 | 500 | 31 | 400 | 2·0 | |
| MS2BE | 18·85 × 11·63 | 500 | 34 | 400 | 2·3 | |
| MS3B | 10·11 × 1·68 | 500 | 2·6 | 350 | 0·17 | |
| MS4A | 6·15 × 5·26 | 500 | 5 | — | — | Photovoltaic for high and low light level applications |
| MS4B | 6·15 × 5·26 | 500 | 5 | 350 | 0·33 | |
| MS5A | 12·5 × 5·26 | 500 | 10 | — | — | |
| MS5B | 12·5 × 5·26 | 500 | 10 | 350 | 0·66 | |
| MS6A | 18·85 × 5·26 | 500 | 15 | — | — | |
| MS6B | 18·85 × 5·26 | 500 | 15 | 350 | 0·99 | |
| MS7A | 25·2 × 5·26 | 500 | 20 | — | — | |
| MS7B | 25·2 × 5·26 | 500 | 20 | 350 | 1·32 | |
| MS9A | 2·13 × 0·99 | 500 | 0·3 | — | — | Micro-miniature for punched tape or punched card reading systems for high light level applications |
| MS9AE | 2·13 × 0·99 | 500 | 0·3 | — | — | |
| MS9B | 2·13 × 0·99 | 500 | 0·3 | 350 | 0·02 | |
| MS9BE | 2·13 × 0·99 | 500 | 0·3 | 350 | 0·02 | |
| MS10 | 5·0 × 4·6 | 500 | 2·0 | 350 | 0·1 | |
| MS11A | 23·4 | 500 | 48 | — | — | Large area photovoltaic |
| MS11AE | 23·4 | 500 | 54 | — | — | |
| MS11B | 23·4 | 550 | 54 | 330† | 3·6 | |
| MS11BE | 23·4 | 550 | 60 | 330† | 4·0 | |

†Minimum.






**MS RANGE OF SILICON PHOTOCELLS**

## MS600/601 VISIBLE SPECTRUM PHOTODETECTORS

The MS600 range of silicon, planar photodiodes has been developed to meet a wide cross-section of requirements for detectors of the shorter wavelength, visible spectrum.

Silicon photodetectors are, in general, more sensitive to the longer wavelengths, the standard Ferranti photocell peaking at 0.85 microns. The MS600 range however features a major suppression of response above 0.6 microns.

For the general detection and measurement of light containing a high level of visible wavelengths the MS600, housed in a TO-5 can with a quartz window, may be used.

Where the simulation of human eye response is required however, in applications such as colour measurement, photometry and photographic light meters, the MS601, having a specially designed "eye-corrected" filter, is recommended.

CHARACTERISTICS (at 25°C)

| Parameter | MS600 | MS601 | Units | Notes |
|---|---|---|---|---|
| | RADIOMETRIC SENSITIVITY | | | see Note 1 |
| Short circuit photo-current sensitivity at: 0·412 μm | 0·09 | 0·07 | A/W | typical |
| 0·500 μm | 0·25 | 0·22 | A/W | typical |
| 1·035 μm | 0·06 | 0·002 | A/W | typical |
| Absolute sensitivity at: 0·607 μm | 40 | 28 | μA/mW/cm² | minimum |
| Open circuit voltage | 300 | 280 | mV | typical (see Note 2) |
| Wavelength of peak sensitivity | 0·62 | 0·56 | μm | typical |
| Dark leakage current at 1 volt reverse bias | 0·2 | 0·2 | μA | maximum |

Note 1. The Radiometric Sensitivity is measured using a calibrated monochromatic radiation source.

Note 2. The open circuit voltage is measured using monochromatic radiation of intensity 100 μW/cm² at a wavelength of 0·5 μm.

## MS-15 INFRA-RED PHOTOCELL

This silicon photocell has been specifically developed for the detection of Infra-red radiation in the wavelength range 0.75 to 1.1 microns. Originally used in conjunction with a Helium Neon laser for the simulation of gun-fire in a training target system, the MS15 can be used in a wide range of more general applications where the detection of Infra-red radiation is necessary. The MS15 is ideally suited for the sensing of Gallium Arsenide l.e.d.s or filtered tungsten light sources in most detection and alarm systems. A low value of junction capacitance means that the MS15 has a high speed of response. (Photograph of MS15 on Page 2).

TYPICAL CHARACTERISTICS (at 25°C)

| Type | Active Area | Min. Reverse Resistance $V_R = 4·5V$ | Max. $c_j$ $V = 0$ $f = 1$ kHz | Minimum Open Circuit Voltage Source Intensity (foot candles)* | | | Peak Spectral Response |
|---|---|---|---|---|---|---|---|
| | mm | ohms | pF | 0·5 | 1·0 | 1·5 | 0·9μ |
| MS15 | 12·7 × 12·7 | 75000 | 8000 | 28 mV | 35 mV | 40 mV | |

*This is the illumination intensity of a tungsten source at 2870°K; cells covered with 2 mm thickness of Chance Bros. infra-red filter type OX5; radiation limited to wavelengths beyond 0·75 μm.



## BPX63 LOW LEAKAGE PHOTODIODE

A silicon planar photodiode having an extremely low level of dark leakage current together with the capability, when used in the photovoltaic mode, of generating a high open circuit voltage under low illumination intensities.

The device has an n-type substrate with a thin p-conducting region limited to a depth of 0.8 microns, thus giving a high response to the short wavelength end of the visible spectrum. It is well suited therefore for use in exposure meters and related photographic equipment.

CHARACTERISTICS (at 25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Wavelength of peak sensitivity | $\lambda_{S\ max}$ | — | 800 | — | nm |
| Sensitivity (Tungsten filament source at 2854°K) | S | 8 | 10 | — | nA/lux. |
| Absolute sensitivity, at 800 nm | S | — | 0.47 | — | A/W |
| Quantum efficiency, at 800 nm (Electrons per photon) | $\eta$ | — | 0.73 | — | |
| Dark leakage current ($V_R = 1V$, $E_V = 0$) | $I_R$ | — | 5 | 20 | pA |
| Forward voltage ($E_V = 0$, $I_F = 1$ pA, T = 50°C) | $V_F$ | 0.5 | 1 | — | mV |
| Response times ($R_L = 1$ kΩ, $V_R = 0V$) | $t_r$, $t_f$ | — | 1.3 | — | μs |
| ($R_L = 1$ kΩ, $V_R = 5V$) | $t_r$, $t_f$ | — | 1.0 | — | μs |
| Maximum reverse voltage | $V_R$ | — | — | 7 | V |
| Active area | $A_a$ | — | 1 | — | mm² |

## MS700/701 LARGE AREA, LOW LEAKAGE PHOTODIODES

A p on n, planar photodiode of large active area providing an extremely low level of dark leakage current together with good linearity of short circuit current over the range $10^{-3}$ to $10^3$ lux.

The MS700 is particularly suitable for use with tungsten or near infra-red light sources whilst the spectral response of the MS701 is optimised towards the detection of lower wavelength visible light.

Both devices are available in hermetic, TO-5, flat window packages.

CHARACTERISTICS (at 25°C)

| Parameter | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Wavelength of peak sensitivity | MS700 | — | 850 | — | nm |
| | MS701 | — | 550 | — | nm |
| Sensitivity to Standard Illuminant 'A' (Tungsten filament lamp at 2856°K) | MS700 | 20 | 33 | — | na/lux |
| | MS701 | 5 | 10 | — | na/lux |
| Dark leakage current at $V_R = 1V$ | | — | 40 | 100 | pA |
| Reverse voltage | | — | — | 10 | V |

# SILICON PLANAR PHOTOTRANSISTORS

### ZM100 SERIES TO-18 HERMETIC (ZM100/110, BPX25/29)

A range of phototransistors/photodarlingtons housed in a hermetic TO-18 type package with either a glass lens or plane window.

The lensed device provides high sensitivity with a narrow acceptance angle for improved discrimination.

### ZMX130 SERIES – MICRO-E PLASTIC (ZMX130/131/132/133)

A phototransistor/photodarlington encapsulated in a clear plastic micro-miniature package especially suitable for mounting onto p.c.b.s down to 0.1 inch centres. The absence of a lens simplifies the design of the optical interface.

### ZMX140 SERIES – TO-18 PLASTIC LENS (ZMX140/141)

A phototransistor/photodarlington mounted in an economical TO-18 header having a clear plastic lens for general purpose applications.

### ZMX150 SERIES – MICRO-P PLASTIC (ZMX150/151)

A two lead micro-miniature package, housing a photodarlington/phototransistor specifically designed for array building where a high packing density is required.

A lens is provided to increase sensitivity and reduce channel to channel cross-talk.

### GENERAL APPLICATIONS OF FERRANTI PHOTOTRANSISTORS

Alarm Systems, Process Control, Edge and Position Sensing, Optical Character Recognition, Tape Readers, Card Readers, Electronic Flash Control, etc.

CHARACTERISTICS (at 25°C)

| Type | Maximum Ratings | | | Maximum Collector Dark Current at 25°C (μA) | Typical Sensitivity* μA/lumen/sq. ft. |
|---|---|---|---|---|---|
| | $V_{CEO}$ (V) | $V_{EBO}$ (V) | $P_{tot}$ (mW) | | |
| ZM100 | 35 | 10 | 300 | 1.0 | 2000 |
| ZM110 | 35 | 5 | 300 | 0.025 | 200 |
| BPX25 | 32 | 5 | 300 | 0.1 | 200 |
| BPX29 | 32 | 5 | 300 | 0.1 | 8 |
| ZMX130/1† | 35 | 6 | 100 | 0.025 | 8 |
| ZMX132/3† | 35 | 10 | 100 | 1.0 | 50 |
| ZMX140 | 35 | 10 | 200 | 1.0 | 125 |
| ZMX141 | 35 | 5 | 200 | 0.025 | 20 |
| ZMX150 | 35 | — | 100 | 1.0 | 320 |
| ZMX151 | 35 | — | 100 | 0.025 | 26 |

†ZMX131 and ZMX133 are provided without a base connection.

*Illumination source is a tungsten filament lamp at 2856°K colour temperature.



# ZNP100 SERIES

### PROGRAMMABLE LIGHT ACTIVATED PHOTOSWITCHES

A range of monolithic integrated circuit photoswitches capable of providing a logic output when illuminated at a pre-determined light level, the level being set by adjustment of an external RC network.

Operating from a single 5 volt supply each light activated switch provides a TTL compatible output, an output drive of 4.8 mA and a variable sensitivity capability. The option exists for operation with either a fixed or variable hysteresis.

The ZNP100 is packaged in a hermetic, 8-pin TO-5 can with glass window, and allows complete programming on all options, whilst the ZNP102 and 103 are available with 30% fixed hysteresis in 4 lead TO-72 cans with glass window.

For economic applications the ZNP108 and 109 are available packaged in a 4 lead TO-72 can with a plastic lens.

CHARACTERISTICS (at 25°C)

| Parameter | Min. | Typ. | Max. | Units | Test conditions |
|---|---|---|---|---|---|
| Supply voltage ($V_{CC}$) | 4.75 | — | 5.25 | Volts | |
| Supply current ($I_C$) | — | 16 | 22 | mA | $V_{CC} = 5.0V$ |
| Logical 1 output voltage | 2.4 | — | — | Volts | $V_{CC} = 4.75V$<br>$I_L = 120\ \mu A$ |
| Logical 0 output voltage | — | — | 0.4 | Volts | $V_{CC} = 4.75V$<br>$I_{sink} = 4.8\ mA$ |
| Light level range of operation<br>ZNP100/2/3<br>ZNP108/9 | 10*<br>2.9 | —<br>— | 10,000†<br>2,900 | $\mu W/cm^2$ | See Note 1 |
| Capacitive component in time constant | 2,200 | — | — | pF | $V_{CC} = 5.0V$ |
| Resistive component in time constant | 3 | — | 100 | kΩ | $V_{CC} = 5.0V$ |
| Maximum switching frequency | — | 50 | — | kHz | At 10,000 $\mu A/cm^2$ illumination level |
| Variation in sensitivity threshold ($\mu W/cm^2$) with $V_{CC}$ | —<br>—<br>— | +5<br>0<br>–5 | —<br>—<br>— | %<br>%<br>% | $V_{CC} = 5.25V$<br>$V_{CC} = 5.0V$<br>$V_{CC} = 4.75V$ |
| Variation in sensitivity threshold with temperature | — | –0.6 | — | %/°C | $V_{CC} = 5.0V$ |
| Operating temperature<br>ZNP100/2/3<br>ZNP108/9 | —<br>— | —<br>— | 70<br>60 | °C | |

*Typical RC = 40k × 100,000 pF. †Typical RC = 3k × 2,200 pF.

Note 1. The illumination source is an unfiltered tungsten filament at a colour temperature of 2856°K.

# BPW41

## INFRA-RED PHOTODETECTOR

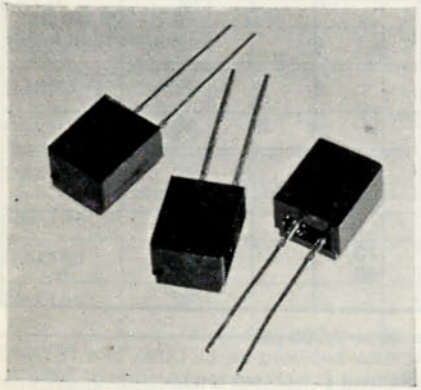
The BPW41 is a large area, silicon p.i.n. photodiode having a low junction capacitance and consequently capable of fast response times. The active chip is packaged in a plastic moulding which contains a near infra-red transmissive filter such that the device is sensitive to infra-red radiation only, and has a high rejection of wavelengths below 700 nm. The BPW41 is therefore eminently suitable for use in I.R. remote control links.

### ELECTRICAL CHARACTERISTICS IN PHOTOCONDUCTIVE MODE (at 25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| Reverse dark current | $I_R$ | — | 2 | 30 | nA | $V_R = 10V$, $E = 0$ |
| Light current | $I_L$ | — | 75 | — | μA | $V_R = 5V$, $E_v = 1000$ lux (See note 1) |
| | | 25 | 45 | — | μA | $V_R = 5V$<br>$E_e = 1$ mW/cm²<br>$\lambda p = 950$ nm<br>(See note 2) |
| Reverse breakdown voltage | $V_{BR}$ | 32 | — | — | V | $I_R = 100$ μA, $E = 0$ |
| Junction capacitance | $C_j$ | — | 25 | 40 | pF | $V_R = 3V$, $f = 1$ MHz<br>$E = 0$ |
| Noise equivalent power | N.E.P. | — | $10^{-14}$ | — | W Hz$^{-0.5}$ | |
| Turn-on time | $t_{on}$ | — | 50 | — | ns | $V_R = 10V$ $R_L = 1$ kΩ |
| Turn-off time | $t_{off}$ | — | 50 | — | ns | |

Note 1. The illumination source is Standard Illuminant 'A' (an unfiltered tungsten filament lamp at 2856°K colour temperature).

Note 2. The illumination source is a GaAs l.e.d. emitting at 950 nm.



### I.R. REMOTE CONTROL APPLICATIONS ADVICE

Advice is available on complete I.R. remote control systems for applications such as those listed below. The combination of I.R. emitting diode, photodetector and detector electronics is critical in defining the performance of a remote control system, and advice is freely available as to the best system combination for a given application.

### SUITABLE APPLICATIONS FOR I.R. REMOTE CONTROL

Television, Hi-Fi Systems, Slide Projectors, Model Cars, Trains, etc., Garage Doors, Domestic Appliances.

(See inside front cover for spectral response).



## PHOTODETECTORS FOR FIBRE-OPTIC DATA TRANSMISSION SYSTEMS

Fibre-Optic data transmission systems are now widely accepted as a technically and economically viable means of reliably transmitting information in either analogue or digital form. Discrete infra-red p.i.n. photodetectors are currently under development for use in either fibre-optic terminal connectors or terminal modules, and advice is available as to the type of photodetectors currently available, or those under development.

## ZME SERIES, GaAs I.R. LIGHT EMITTING DIODES

Infra-red light emitting diodes for use as sources in fibre-optic data transmission links and I.R. remote control systems. The diode package is similar to that used for the Ferranti phototransistor range, a fact which simplifies the physical interfacing of emitter and detector in certain applications (e.g. card readers, tape readers, opto-couplers etc.). For advice on the matching of emitters and detectors please contact Discrete Component Marketing.

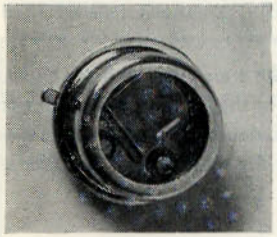
## OPTO-ELECTRONIC SEMICONDUCTOR DICE

The majority of Ferranti Opto-electronic semiconductors are available as unencapsulated dice or in wafer form, details of which can be obtained on request from Discrete Component Marketing.

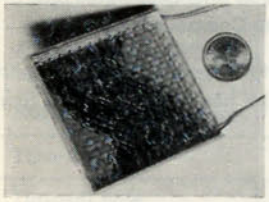
Information concerning phototransistor dice, their specifications and inspection routes together with the various testing and shipping options is contained within the hand-book "Active Semiconductors for Hybrid Circuits" also available on request.

# CUSTOM DESIGN SERVICE

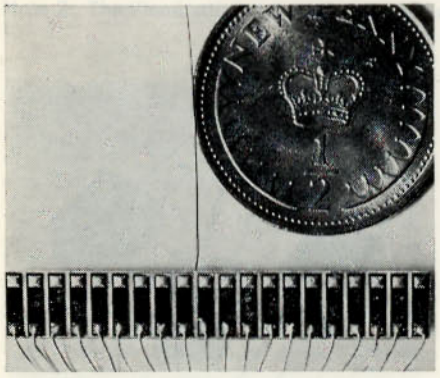
The Ferranti opto-electronic custom design service exists to provide customers with advice on the design and assembly of opto-electronic products and systems that are non standard within the Ferranti range. Advice is available concerning the compatibility of components to form complete systems, on the development of new devices to fulfill specific requirements, and on the photovoltaic cell side, multi cell arrays can be assembled and encapsulated to suit the power requirements of given applications. Examples of custom built devices and arrays are given below.



1. This is a 'n' on 'p' photocell of planar construction measuring 1 mm × 1 mm and housed in a metal TO-5 can. The device has been developed for monitoring the individual blade temperatures in modern jet aero engines. The device operates under conditions of high temperature and severe vibration, and manufacturing integrity of the highest level has been attained. An extremely fast response time enables the device to measure individual blade temperature whilst the engine is in operation. Improved monitoring and hence safety standards are a direct result of this development.



2. Two MST7 photovoltaic cells are used in this custom designed unit and are connected in series to provide an output current of 150 mA at 1V. The cells are packaged in a moulded plastic casing, which in this instance is supplied by the customer. The completed assembly is used to power a small motor unit which in turn drives a range of children's toys.

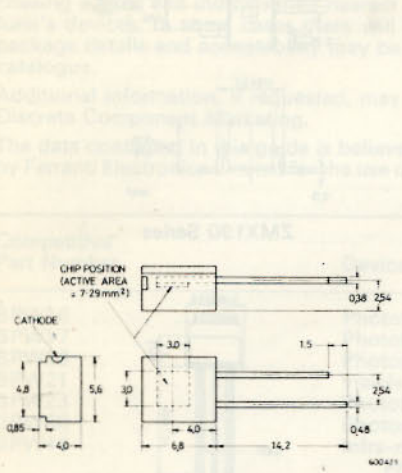


3. This is a monolithic array of 20 small photovoltaic cells used as a position sensor for components in an automated assembly machine. By monolithic is meant that the cells are formed on a common silicon substrate, and therefore share the same base both physically and electrically. Arrays formed in this way have a lower cost than arrays constructed out of discrete devices, require less wiring and have greater reliability.

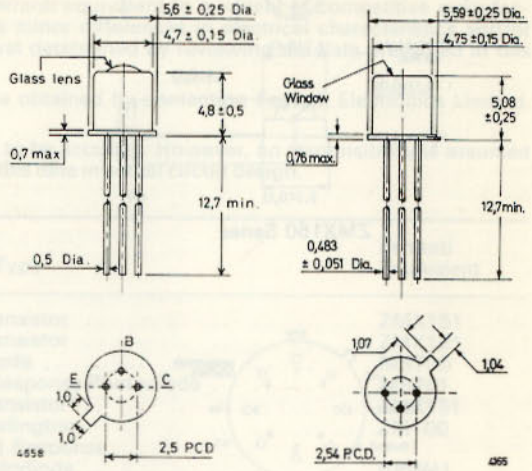
Contact our opto-electronic marketing department for quick advice on your requirements.



# PACKAGE OUTLINES



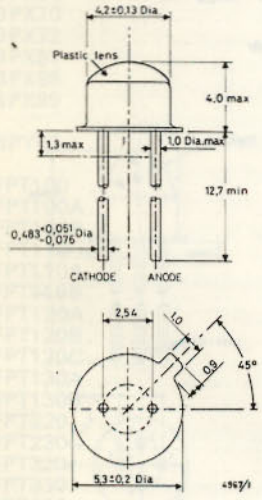

BPW41



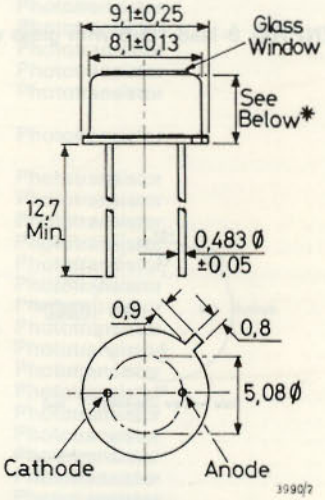

BPX25
ZM100
ZM110




BPX29

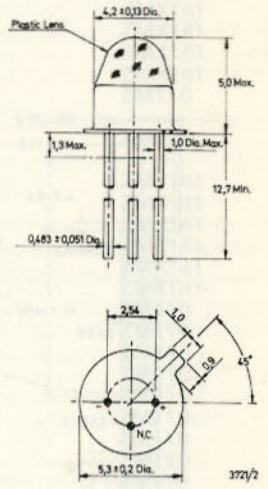



BPX63



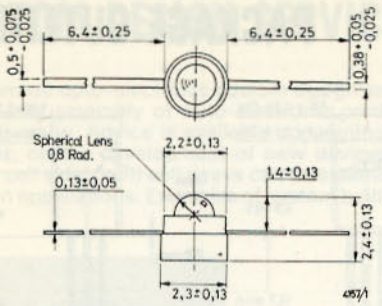

MS600/601
MS700/701

MS600/700 Height = 4.8 ±0.4
MS601/701 Height = 6.7 ±0.4

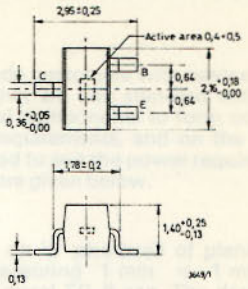



ZMX140 Series

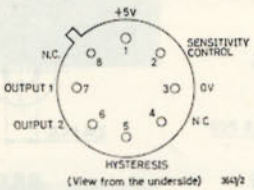
All dimensions in millimetres



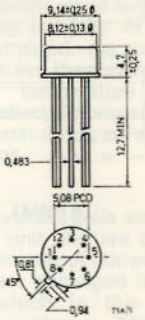

ZMX150 Series



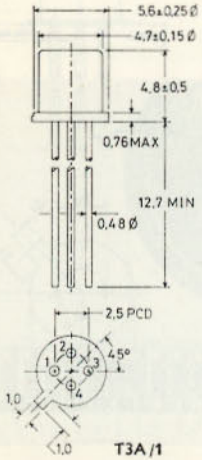

ZMX130 Series



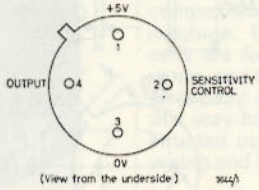

External Hysteresis Resistor connected between pins 5 and 7

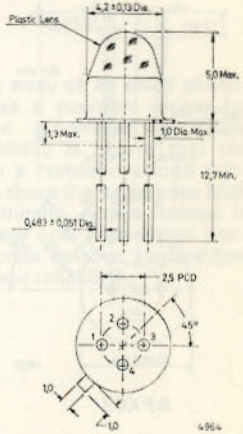



ZNP100 8-lead TO-5 with glass window




ZNP102, ZNP103
4-lead TO-72 with glass window




ZNP108, ZNP109
4-lead TO-18 with resin lens

All dimensions in millimetres



# COMPETITOR CROSS REFERENCE LIST

The following cross-reference list has been compiled as a guide for design engineers and purchasing agents and indicates the nearest Ferranti equivalent to a variety of competitive manufacturer's devices. In some cases there will be minor differences in electrical characteristics and/or package details and acceptability may be first determined by reviewing the data presented in this catalogue.

Additional information, if requested, may be obtained by contacting Ferranti Electronics Limited, Discrete Component Marketing.

The data contained in this guide is believed to be accurate. However, no responsibility is assumed by Ferranti Electronics Limited for the use of this data in actual circuit design.

| Competitive Part Number | Device Type | Ferranti Equivalent |
|---|---|---|
| BPW16 | Phototransistor | ZMX151 |
| BPW17 | Phototransistor | ZMX151 |
| BPW20 | Photodiode | MS700 |
| BPW21 | Visible Response Photodiode | MS701 |
| BPW23 | Phototransistor | ZMX151 |
| BPW30 | Photodarlington | ZM100 |
| BPW41 | Infra-red Response Photodiode | BPW41 |
| BPX25 | Phototransistor | BPX25 |
| BPX29 | Phototransistor | BPX29 |
| BPX31 | Phototransistor | ZM110 |
| BPX43 | Phototransistor | ZM110 |
| BPX63 | Low leakage Photodiode | BPX63 |
| BPX70 | Phototransistor | ZMX141 |
| BPX72 | Phototransistor | ZMX141 |
| BPX81 | Phototransistor | ZMX151 |
| BPX95 | Phototransistor | ZMX141 |
| BPX99 | Phototransistor | ZM110 |
| BPY62 | Phototransistor | ZM110 |
| FPT100 | Phototransistor | ZMX141 |
| FPT100A | Phototransistor | ZMX141 |
| FPT100B | Phototransistor | ZMX141 |
| FPT110 | Phototransistor | ZMX141 |
| FPT110A | Phototransistor | ZMX141 |
| FPT110B | Phototransistor | ZMX141 |
| FPT120A | Phototransistor | ZM110 |
| FPT120B | Phototransistor | ZM110 |
| FPT120C | Phototransistor | ZM110 |
| FPT130A | Phototransistor | ZM110 |
| FPT130B | Phototransistor | ZM110 |
| FPT220 | Phototransistor | ZM110 |
| FPT230 | Phototransistor | ZM110 |
| FPT320 | Phototransistor | ZM110 |
| FPT330 | Phototransistor | ZM110 |
| FPT400 | Phototransistor | ZM110 |
| FPT410 | Phototransistor | ZM110 |
| FPT500 | Phototransistor | ZM110 |
| FPT530 | Phototransistor | ZM110 |
| FPT560 | Photodarlington | ZM100 |
| FPT630 | Phototransistor | ZMX151 |

| Competitive Part Number | Device Type | Ferranti Equivalent |
|---|---|---|
| IPL15 | Light Activated Photoswitch | ZNP108/109 |
| IPL17 | Light Activated Photoswitch | ZNP108/109 |
| MRD150 | Phototransistor | ZMX151 |
| MRD300 | Phototransistor | ZM110 |
| MRD310 | Phototransistor | ZM110 |
| MRD370 | Photodarlington | ZM100 |
| MRD450 | Phototransistor | ZMX151 |
| MRD810 | Phototransistor | ZM110 |
| MRD3050 | Phototransistor | BPX29 |
| MRD3051 | Phototransistor | BPX29 |
| MRD3052 | Phototransistor | BPX29 |
| MRD3053 | Phototransistor | BPX29 |
| MRD3054 | Phototransistor | ZM110 |
| MRD3055 | Phototransistor | ZM110 |
| MRD3056 | Phototransistor | ZM110 |
| MT1 | Phototransistor | ZM110 |
| MT2 | Phototransistor | ZM110 |
| MT8020 | Phototransistor | ZMX151 |
| OSD5-3 | Photodiode | MS700 |
| OSD5-5 | Photodiode | MS700 |
| OSD5-E | Visible Response Photodiode | MS601 |
| SFH205 | Infra-red Response Photodiode | BPW41 |
| TIL78 | Phototransistor | ZMX151 |
| TIL81 | Phototransistor | ZM110 |
| TIL100 | Infra-red Response Photodiode | BPW41 |

CONVERSION OF PHOTOMETRIC ILLUMINANCE UNITS

| Unit Required | Unit Given | | |
|---|---|---|---|
| | Phot ($lm/cm^2$) | Lux ($lm/m^2$) | Foot-candle ($lm/ft^2$) |
| Phot ($lm/cm^2$) | 1 | $10^{-4}$ | $1.076 \times 10^{-3}$ |
| Lux ($lm/m^2$) | $10^4$ | 1 | 10.76 |
| Foot-candle ($lm/ft^2$) | 929.4 | 0.0929 | 1 |



# GLOSSARY OF TERMS

Å Angstrom.

*Absolute Spectral Response* Output or response at absolute power levels against wavelength.

*Angstrom* Unit of length used in the measurement of electromagnetic radiation. One angstrom = $10^{-10}$ metres.

*Blackbody* A standard for all irradiance measurements being a 100% efficient radiator and absorber of radiant energy.

*Boltzman's constant* ($k$) $1.38 \times 10^{-16}$ ergs per degree Kelvin.

*Candela* Unit of luminous intensity evaluated in terms of the luminous intensity of a black body at the temperature of the solidification of platinum (2,046°K).

*Candela/cm²* Unit of luminance known as a "stilb".

*C.I.E.* International Commission on illumination.

*Collimated light* Light having rays travelling in a parallel beam.

*Colour Temperature* The equivalent absolute temperature in °K of a black body whose wavelength distribution is closest to that of the non-black body (light source) being measured, thus defining its spectral density.

*Dark Current* Leakage of current across the junction or across the surface of a photodetector when there is no incident radiation.

*Detector quantum efficiency* Ratio of $\frac{\text{number of carriers generated}}{\text{number of photons absorbed}}$

*E* Photometric unit of illuminance in lumens/square foot ($lm/ft^2$)

*Foot Candle* 1 foot candle is equal to 1 lumen per square foot.

*Foot lambert* A measure of brightness corresponding to an emission of 1 lumen per square foot for a perfectly diffused source.

*H* Radiometric unit of irradiance or radiation flux density in watts/$cm^2$ ($W/cm^2$).

*Illumination* The density of luminous flux incident on a surface and expressed in lux (lumens/$m^2$), phot (lumens/$cm^2$) or lumens/$ft^2$ (see conversion table).

*Incident* Falling, striking or landing on.

*Irradiance* Radiant energy striking a given surface being the radiometric equivalent to illumination and expressed as Watts/$cm^2$.

*Lumen* The luminous flux from a point source of one candela within a solid angle of one steradian.

*Lux* A unit of illuminance in the metric system equivalent to lumens/$m^2$.

*Micron* ($\mu$) A unit of length used in the measurement of electromagnetic wavelength. One micron = $10^{-6}$ metres.

*Monochromatic* Radiation of a single or very narrow band of wavelengths.

*Noise Equivalent Power* (N.E.P.) That quantity of light incident upon a photodiode that produces a signal equal to the noise level internally generated by the photodiode.

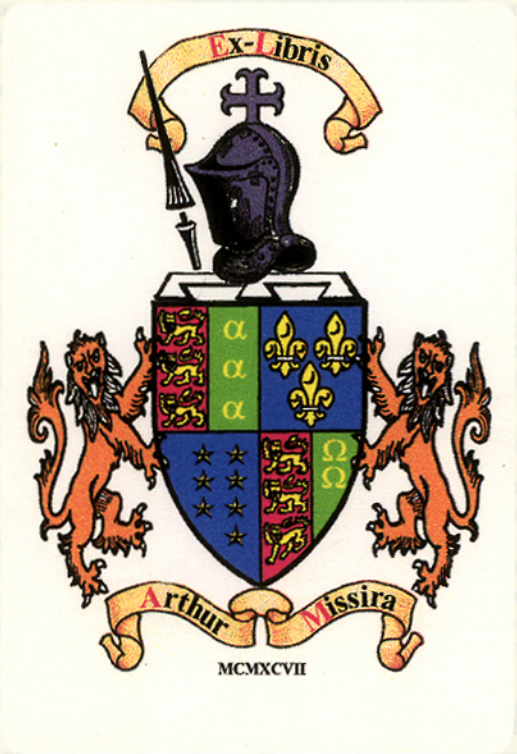
*Peak Spectral Emission/Output* Generally used to define that wavelength at which a source/sensor produces its highest output.

*Photoconductive Devices* Components which undergo a change in resistivity by a change in incident light intensity.

*Photovoltaic Devices* Components which, when absorbing incident light, generate a voltage across their junction.

*Point Source* A radiation (or light) source having a maximum dimension being less than one-tenth the distance from source to detector.

*Steradian* The solid angle subtended at the centre of a sphere of radius r by an area of $r^2$ on its surface. A complete sphere comprises 4 steradians.



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