



Optoelectronics

DESIGN GUIDE





The use of optoelectronic displays in electronic devices is increasing dramatically in both consumer and industrial electronics, and the technology is constantly advancing. It can be hard to keep abreast of all of these changes and determine which is the most suitable optoelectronic device for your product or application.

When it comes to selecting the right display technology, you want to be sure that you have chosen the right product, that it is going to meet or exceed your performance criteria, be easy to programme and design in to your new product. A lot of time and money can be wasted at initial project stages if the incorrect product or technology is chosen.

That's why we have created this Optoelectronics Design Guide. Its purpose is to help simplify the selection process for you. We have the technical expertise to be able to assist you in your choice of optoelectronic product, but it's also good to be able to evaluate the different technologies and understand the differences between them before making your final decision.

This guide provides details on the different technologies available, their features and benefits and performance criteria and recommendations as to the applications they are most suited for.

Technical Support

We have the technical expertise and resources to help you to design, select and purchase the display product that best suits your requirements. Our portfolio of products embraces the spectrum of displays, from the simplest segment LCD through to the latest optoelectronic technology.

We can offer you complete design support including:-

- › Product selection & design solutions
- › Prototyping
- › Low volume production for test builds
- › Product supply – including buffer stock

The earlier we can work with you in your new product development process, the more value we can add. There are a number of factors that need to be taken into consideration when choosing the display for your product design: cost is obviously a major factor but ease of programming, mechanical fixing and flexibility of circuit design can also have a significant impact on the overall product cost.

Using this Guide

This guide is intended to help you evaluate the different optoelectronic products and assess their suitability for your specific application. You may find that more than one technology will meet your requirements. This is an ideal time to talk through your requirements with one of our technical experts who will be able to assist you with your final selection process. We have dedicated technical resources that focus specifically on optoelectronic technology, keeping abreast of the latest technological developments.

Key Technical Terms Explained

If you are new to optoelectronics, some of the technical terms can seem a little overwhelming. We have included a glossary of terms on page 7 and this provides a definition of all the terms that are used in this guide.

What do you need to consider when specifying an optoelectronic display product?

Cost is an obvious factor when selecting your product, but there are a number of other factors you need to take into consideration when making your choice:

- › What size of display is required?
- › Power – will the product be powered by battery or mains?
- › Environment – what environment will the finished product be used in? Factors here include vibration and operating temperature.
- › Does your display need to be readable in direct sunlight?
- › Backlight – does the display need to be visible when the backlight is turned off?
- › What viewing angle do you require for the display – and how important is this?
- › Connectivity – how do you plan to connect the display to your PCB?
- › Programming – will you be doing this in-house or will you need to outsource it?
- › What is the expected life of the finished product?





Overview of Optoelectronic Technologies

There are many different optoelectronic technologies available, and often different options to choose from within those technologies. This section provides a short overview of the most popular technologies that cover the broadest range of customer applications.

Custom Glass



- › Low end, low cost technology, with no on-board intelligence
- › 7 segment digits and icons (where the 7 segments make up a letter or digit)
- › Typically reflective viewing mode
- › TN, STN and FSTN technology
- › Low power drive via battery
- › Easy to interface, not much memory required



Typical Applications

- › Vending Machines
- › Medical Electronics
- › Industrial Electronics
- › Telecoms

Character Module



- › Defined as a display with a number of rows, each with a number of characters for example 2x16, 2x20
- › Characters consist of 5 x 8 dots in a matrix which gives 40 dots per character
- › Typically COB technology
- › Available in negative or positive mode
- › User-friendly interface via MPU, typically a parallel interface
- › Integral fixing holes for easy mechanical fixing
- › 5V drive typically



Typical Applications

- › Industrial Electronics
- › Instrumentation
- › Medical Electronics
- › Telecoms

Graphic Module



- › This technology gives flexibility in design by virtue of the software control
- › Font sizes/languages/graphs/pictures are available via the software
- › More complex serial or parallel interface
- › Passive technology - each row and column of the display are multiplexed or addressed in turn
- › Modules can be supplied with or without an integral negative voltage generator, if not supplied via the module, it needs to be supplied via an external source
- › Typically 5V drive



Typical Applications

- › Industrial Electronics
- › Instrumentation
- › Telecoms
- › Medical Electronics

COG (Chip on Glass) Module (has no PCB)



- › This technology is typically used for graphic displays, but can still provide character or segment display format
- › Low profile & compact display module – ideal where space is limited
- › Low cost solution, typically requires only 1 IC controller
- › Cost effective when compared to traditional COB graphic modules
- › Drive voltage 3.3V
- › In-house programming is relatively easy
- › Interface via pins or FPC
- › IC controller is bonded directly to glass



Typical Applications

- › POS Units
- › DAB Radio
- › Bluetooth Equipment
- › Data Loggers
- › Consumer Electronics

Passive Mono OLED

- › No backlight required, making module very thin and low in power usage
- › Passive technology - each row and column of the display are multiplexed or addressed in turn
- › Brightness is controlled by software
- › Excellent viewing angles and very fast response time
- › High contrast ratio and extended operating temp -40°C to +80°C
- › Interface via parallel, serial, SPI and I2C
- › Connectivity via FPC to ZIF connector
- › Typically uses COG or TAB technology

Typical Applications

- › POS Units
- › Utility Meters
- › Consumer Electronics
- › Instrumentation
- › Automotive Electronics



FS Colour (Field Sequential)

- › Low cost, colour solution, TN technology.
- › Technology allows 7 segment characters and icons
- › Available in positive or negative mode
- › Very good contrast ratio and viewing angles and fast response time
- › Drive voltage is between 3-5V, and is dependent on COG or COB technology
- › Low cost alternative to TFT, in both price and engineering resource required
- › Connectivity via pins, FPC, & zebra strip
- › 320 segments enabled using 1 IC controller

Typical Applications

- › Industrial Controllers
- › Medical Electronics
- › Utility Meters
- › Automotive Electronics
- › Consumer Electronics



TFT Transmissive

- › Full colour active matrix graphical display
- › Small to medium industry standard sizes range from 1.8" to 8"
- › Available with a variety of resolution options
- › Fast response time and high contrast ratio
- › Low power and white LED backlight required
- › Interface via serial, parallel, LVDS or Digital 18-bit RGB
- › Connectivity via FPC cable
- › Good brightness and viewing angles
- › Certain sizes are available with integral ASIC controller, simplifying interface via processor
- › Drive voltage varies and is dependent on module size
- › Can be use in conjunction with touchscreens

Typical Applications

- › POS Units
- › Consumer Electronics
- › Instrumentation
- › Medical Electronics
- › Security Systems



TFT Transflective

- › Full colour TFT, with added semi-transparent mirror filter to give sunlight readability
- › Has all the optical performance of transmissive TFT's with the addition of sunlight readability
- › Can be viewed indoors as normal and outdoors in transflective mode
- › Low power consumption when used in transflective mode
- › Typically used in outdoor applications
- › Interface via serial, parallel, LVDS or Digital 18-bit RGB
- › Drive voltage varies and is dependent on module size
- › Can be use in conjunction with touchscreens

Typical Applications

- › Industrial Electronics
- › Medical Electronics
- › Instrumentation





AMOLED

- › High end active matrix technology, with extremely fast pixel switching response time
- › Currently considered the most advanced display technology
- › No backlight required, making module very thin and low in power usage
- › Extremely good viewing angles and very high contrast ratio
- › Very fast response times
- › Drive voltage 3.3- 8V
- › Interface via serial, parallel and LVDS
- › Connectivity via FPC

Typical Applications

- › Industrial Electronics
- › Military
- › Audio
- › Consumer Electronics
- › Instrumentation

Technology Comparison Table

The table below has been developed to help you identify which technology may be appropriate for your specific application. It details the most popular technologies and provides detail on their typical performance criteria.

You can use this table to "short list" the technologies you feel are best suited to your requirements. Once you have identified those technologies that you feel are most suitable, why not call our technical experts to discuss your requirements in more detail. They can talk you through your options and ensure that your chosen technology is the best fit for you. They can also assist you with the connector and cable options for your display.

FEATURES	CUSTOM GLASS	CHARACTER MODULE	GRAPHIC MODULE	COG MODULE	MONO OLED	FS COLOUR	TFT TRANSMISSIVE	TFT TRANS-FLECTIVE	AMOLED
LOW POWER	●	●	●	●	●	●	●	●	●
MONO	●	●	●	●	●	●	●	●	●
COLOUR	●	●	●	●	●	●	●	●	●
OPERATING TEMP (°C)	-30/+85	-20/+70	-20/+70	-30/+80	-40/+80	0/70	-30/+80	-20/+70	-20/+70
SUNLIGHT READABLE	YES (FSTN)	YES (FSTN)	YES (FSTN)	YES (FSTN)	NO	NO	NO	YES	NO
VIEWING ANGLES	●	●	●	●	●	●	●	●	●
CONTRAST	●	●	●	●	●	●	●	●	●
TECHNOLOGY	N/A	COB	COB/TCP	COG	COG/TCP	GOC/COB	COG/TCP	COG/TCP	COG
BACKLIGHT REQUIRED	OPTIONAL	OPTIONAL	OPTIONAL	OPTIONAL	NO	OPTIONAL	YES	YES	NO
TN/STN	●	●	●	●	●	●	●	●	●
FSTN	●	●	●	●	●	●	●	●	●
REFLECTIVE	●	●	●	●	●	●	●	●	●
TRANSMISSIVE	●	●	●	●	●	●	●	●	●
TRANSFLECTIVE	●	●	●	●	●	●	●	●	●
CONNECTIVITY	PIN'S	●	●	●	●	●	●	●	●
	THROUGH HOLE PCB	●	●	●	●	●	●	●	●
	FPC/FFC	●	●	●	●	●	●	●	●
	ZEBRA STRIP	●	●	●	●	●	●	●	●

● Excellent/Available ● Good/Available ● Poor/Not available

GLOSSARY OF TERMS

The A-Z of Optoelectronics

Active	Each pixel is driven by a thin film transistor in the LCD glass
Backlight	A light source that is positioned behind the display
Brightness	The light intensity of the display - this is expressed in candela per square metre (cd/m2)
COB	Chip on Board
COG	Chip on Glass
Contrast Ratio	The ratio between the lightest and darkest pixels in the display
FFC	Flat Flex Cable
FPC	Flexible Printed Circuit
FS Colour	A technique used in TN segment displays where the primary colours are presented as a series of successive images. This happens so quickly the human eye sees one image
FSTN	Film compensated STN
I2C	Inter- integrated circuit
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LVDS	Low-voltage differential signalling
Mono	Also referred to as Monochrome, meaning single colour
MPU	Micro Processor Unit
Negative Mode	Light characters on a dark background
OLED	Organic Light Emitting Diode
Passive	Passive technology - each row and column of the display are multiplexed or addressed in turn
Pixel	An individual dot on the display
Positive Mode	Dark characters on a light background
Reflective	Viewing mode which uses ambient light only
Resolution	Pixel count, for example 800 x 480 (800 pixels across and 480 pixels down)
SPI	Serial Peripheral Interface
STN	Super Twisted Nematic
TAB	Chip on Tab
TFT	Thin Film Transistor
TN	Twisted Nematic
Transflective	Viewing mode which can use backlighting or natural light for display illumination
Transmissive	Viewing mode which relies on backlighting for display illumination
Viewing Angle	The angle or angles from which the display can be viewed clearly
Zebra Strip	Conductive rubber strip - used to connect LCD's to printed circuit boards
ZIF	Zero Insertion Force



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