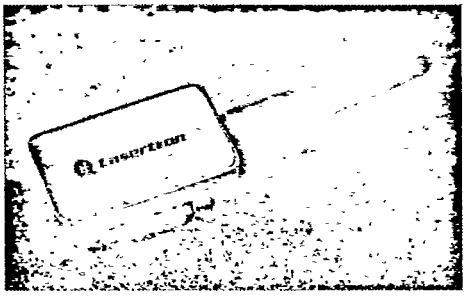
QDFM

Wide Dynamic Range pinFET Receiver



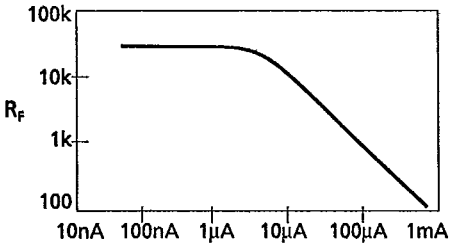
- *Telecom trunk, access and junction applications*
- *GaAs integrated circuitry*
- *Bandwidths from 10 to 125 MHz*
- *Industry-standard 14-pin DIL package, multimode fiber*
- *Variable transimpedance circuit configuration*

Description

The QDFM pinFET module contains a GaAs integrated circuit preamplifier and circuitry used to control its effective transimpedance. The use of a GaAs IC, with its associated large values of gain bandwidth product, makes it possible to change the gain/transimpedance of the amplifier while ensuring complete stability over a broad range of transimpedance values. For low optical inputs, the QDFM is operated as a conventional transimpedance pinFET with the transimpedance value chosen to be as large as possible (for high sensitivity) while providing a bandwidth adequate for the intended data rate. At high optical input, the operation of the QDFM differs from the conventional transimpedance pinFET since the transimpedance of the QDFM is reduced by the internal AGC circuitry at high optical input. By reducing the transimpedance, the overload of the amplifier is avoided until much larger optical inputs are reached.

(Model QDFM-025-201)

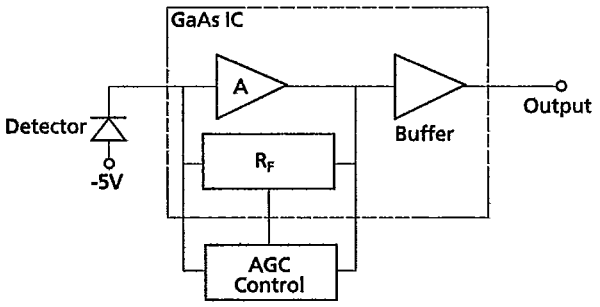
TYPICAL TRANSIMPEDANCE vs. PHOTOCURRENT



Applications

The output of the QDFM increases linearly with input until the AGC loop begins to reduce the transimpedance. Consequently, the QDFM output voltage increases from a few mV at the sensitivity limit up to about a volt at the highest optical input. This range of output voltages occurs over a broad range of transimpedance values. The wide dynamic range of the QDFM reflects the range over which the output S/N is sufficient to achieve BER $<10^{-9}$ (the "normal" dynamic range of a fixed transimpedance pinFET) plus the increased range resulting from having a low transimpedance at high optical input due to the action of the internal AGC loop.

FUNCTIONAL BLOCK DIAGRAM

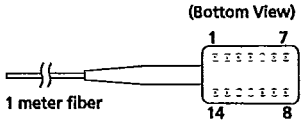


Ordering Information

	Suffix			
Base Model	**No Connector**	**FC/PC**	**Biconic**	**ST**
QDFM-010	-201	-250	-251	-252
QDFM-010	-301	-350	-351	-352
QDFM-015	-301	-350	-351	-352
QDFM-025	-201	-250	-251	-252
QDFM-025	-301	-350	-351	-352
QDFM-040	-201	-250	-251	-252
QDFM-040	-301	-350	-351	-352
QDFM-100	-201	-250	-251	-252
QDFM-125	-201	-250	-251	-252

Pin Connections

1	Detector bias (-5 V)	8	NC
2	AC Ground	9	NC
3	Case Ground	10	+5 V
4	-5 V	11	Case Ground
5	Case Ground	12	Output
6	Case Ground	13	Case Ground
7	NC	14	Case Ground

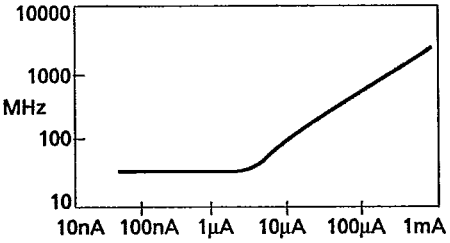


At the lowest optical input the bandwidth of the QDFM reflects the highest value of electrically-controlled transimpedance of the GaAs IC. This value is electrically set for the data rate of interest by a resistor in the module which is not the actual transimpedance resistance. The transfer characteristic of a QDFM conforms to a single pole rolloff to ±1 dB over its full frequency range which extends from <10 kHz to the maximum frequency determined by the module transimpedance, a frequency which can exceed 2 GHz (-3 dB) for certain versions.

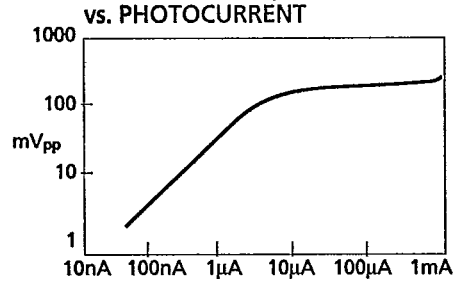
At high optical input the effective transimpedance is reduced to as low as a few hundred Ohms (depending on module type) to limit the output voltage to <1 V_{pp}. In the QDFM, saturation occurs when the transimpedance has been reduced to a very low value and the bandwidth is exceptionally high; the earliest evidence of saturation is a clipped output signal, which results in pulse width distortion.

The output drive characteristics are similar for the industry-standard QDFT and the QDFM; both use a low-impedance emitter or source follower output. QDFT and QDFM output impedances are approximately 10 Ohms and 75 Ohms, respectively. The QDFM is able to drive either 50 Ohms or 75 Ohms directly but with a resulting reduction (60% or 50%) in signal size. A high impedance should therefore be used if signal size is of primary importance. At high optical input, the bandwidth of the QDFM increases significantly as the transimpedance is lowered by the internal AGC loop. Thus, the noise bandwidth of the pinFET will increase, contributing additional noise to the following receiver. Despite the increase in noise, the pinFET output signal-to-noise ratio (S/N) increases with optical input since the QDFM bandwidth increases sublinearly with optical input power. With a filter, the additional noise (though not degrading sensitivity) will not be passed onto the receiver post-amplifier.

(Model QDFM-025-201)
TYPICAL BANDWIDTH vs. PHOTOCURRENT



(Model QDFM-025-201)
TYPICAL OUTPUT VOLTAGE vs. PHOTOCURRENT

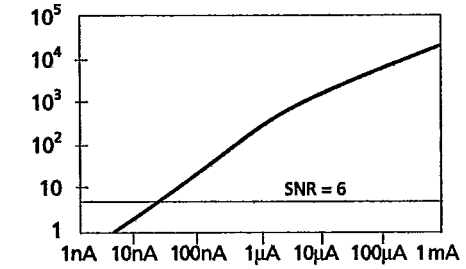


Specifications

QDFM-	010-2XX	010-3XX	015-3XX	025-2XX	025-3XX	040-2XX	040-3XX	100-2XX	125-2XX
Min. pinFET bandwidth (MHz)	10	10	15	25	25	40	40	100	125
Min. noise filter bandwidth (MHz)	9	9	11	25	25	34	34	95	95
Sensitivity (dBm, Avg.): Min.	-47	-49	-47	-44	-45	-42	-45	-36	-35
Typ.	-48.5	-50	-48.5	-45	-47	-44	-45.5	-37	-37
Typ. transimpedance (K Ohm)	53	110	70	30	70	25	55	5	5
Max. input (dBm, Avg.)	-3	-8	-8	-3	-8	-3	-8	-3	-3

Common Specifications	Min	Typ	Max
Sensitivity change 25 to 65°C (dB)		1.5	
Gain flatness 10 MHz to 3 dB bandwidth (measured into a 1K Ohm load, dB)			±1
Detector dark current (nA)		5	20
Detector capacitance -5 V bias (pF)		0.3	0.5
Load impedance (Ohms)		1000	
Output voltage at Pmax (V)		1	
Measured output impedance (Ohms)		50	
Responsivity 1300 nm and -5 V bias (A/W)	0.75	0.85	
Responsivity change (dB, 25 to 65°C)		0.1	0.5
Power consumption: +5 V supply (mW)		300	
-5 V supply (mW)		150	
Operating temperature range (°C)	-20		70
Storage temperature range (°C)	-40		85

TYPICAL SNR vs. PHOTOCURRENT



Absolute Maximum Ratings

Fiber coupled power (mW)	5
Reverse photocurrent (mA)	5
Reverse bias voltage (V)	15
Forward current (mA)	2
Lead soldering temperature (°C)	260
Lead soldering duration (sec)	10
Fiber yield strength (N, min)	10
Fiber bend radius (mm, min)	35

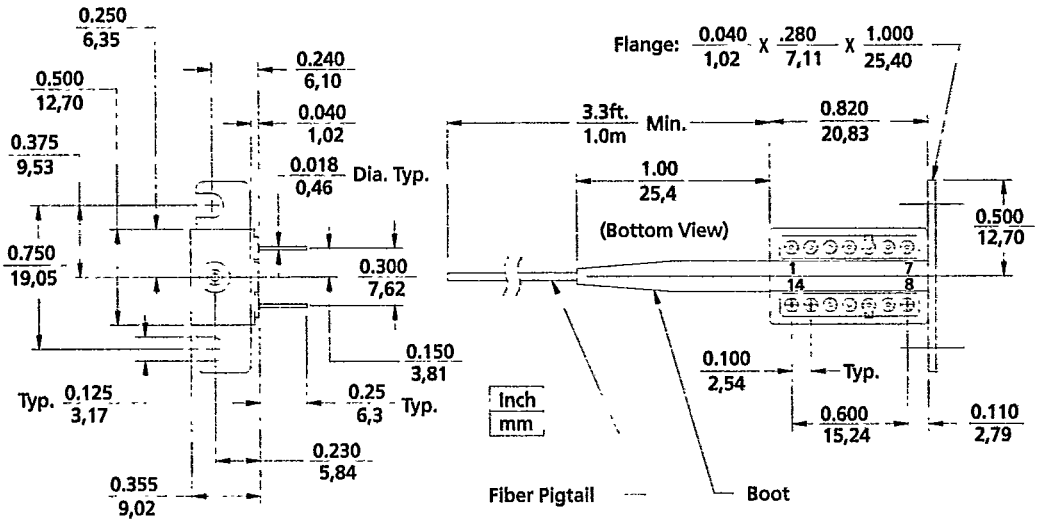
Package Specifications

T-91-20

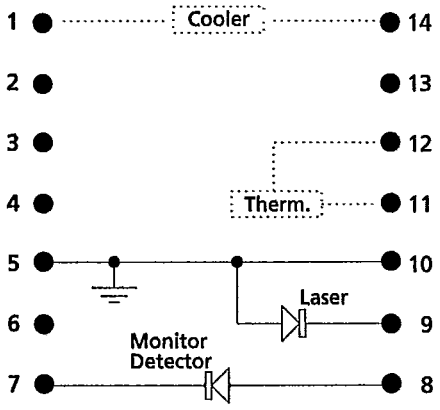
Lasertron uses a variety of industry-standard packages to house its products. The dimensions indicated here are common to all like packages; however, pin connections may differ between product families. Product-specific pin connections are provided in the individual data sheets in the Product Information section of this Product Guide.

Source Packages

14-pin DIL "Longhorn" (Lasers, LEDs)



LONGHORN SCHEMATIC

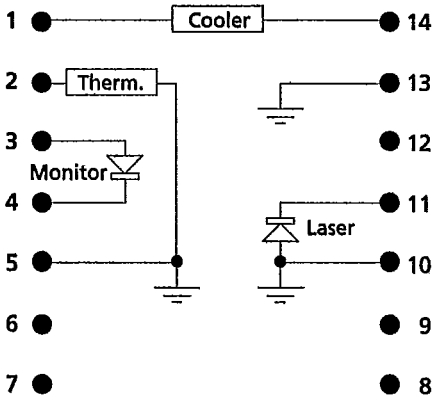


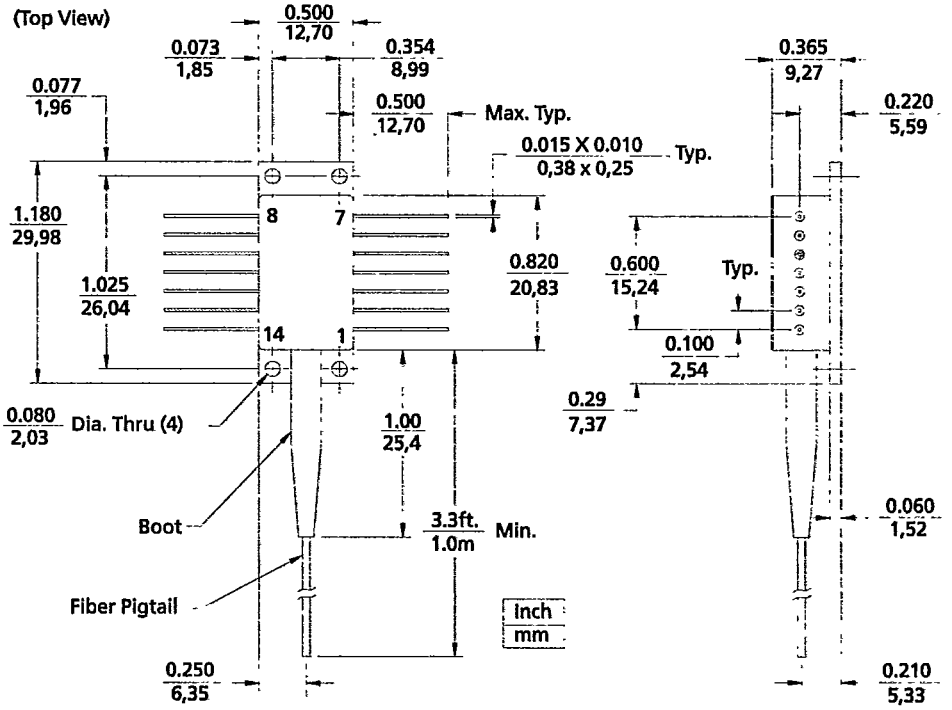
Note: Cooler and thermistor are not included in all modules.

Source Packages *(continued)*

14-pin "Butterfly"

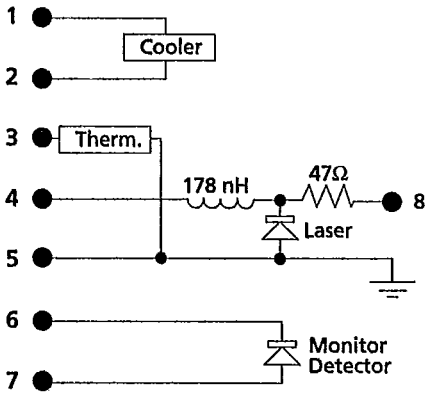
BUTTERFLY SCHEMATIC

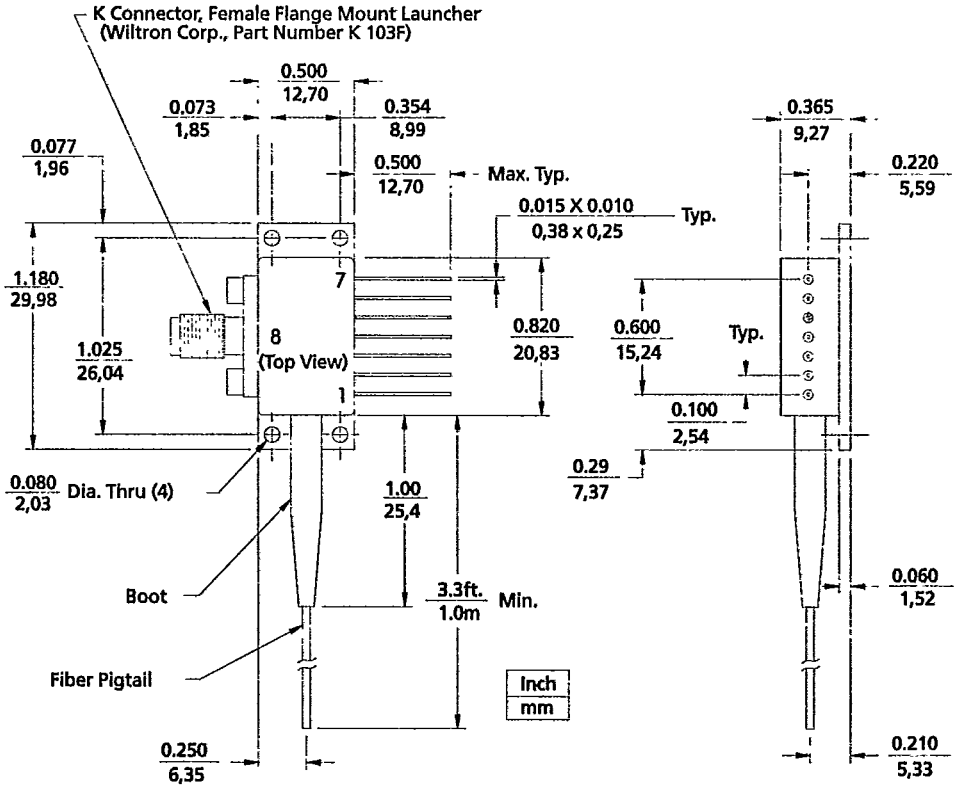




Microwave Laser

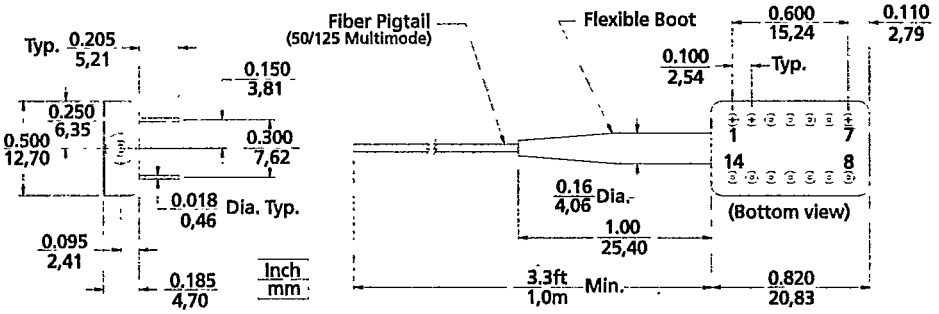
MICROWAVE LASER SCHEMATIC



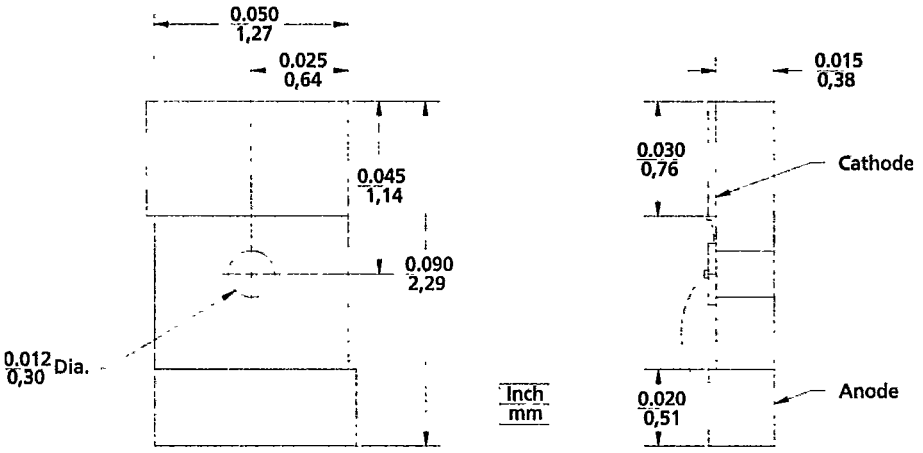


Detector Packages

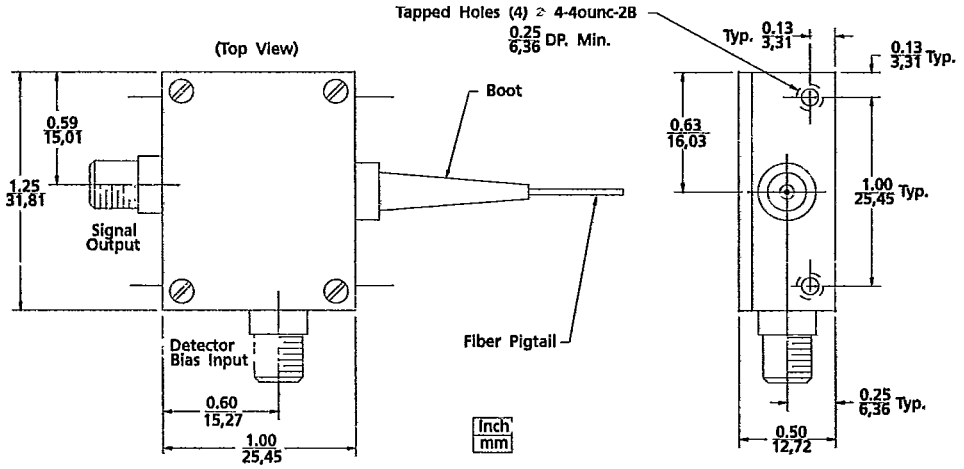
14-pin DIL PIN/pinFET



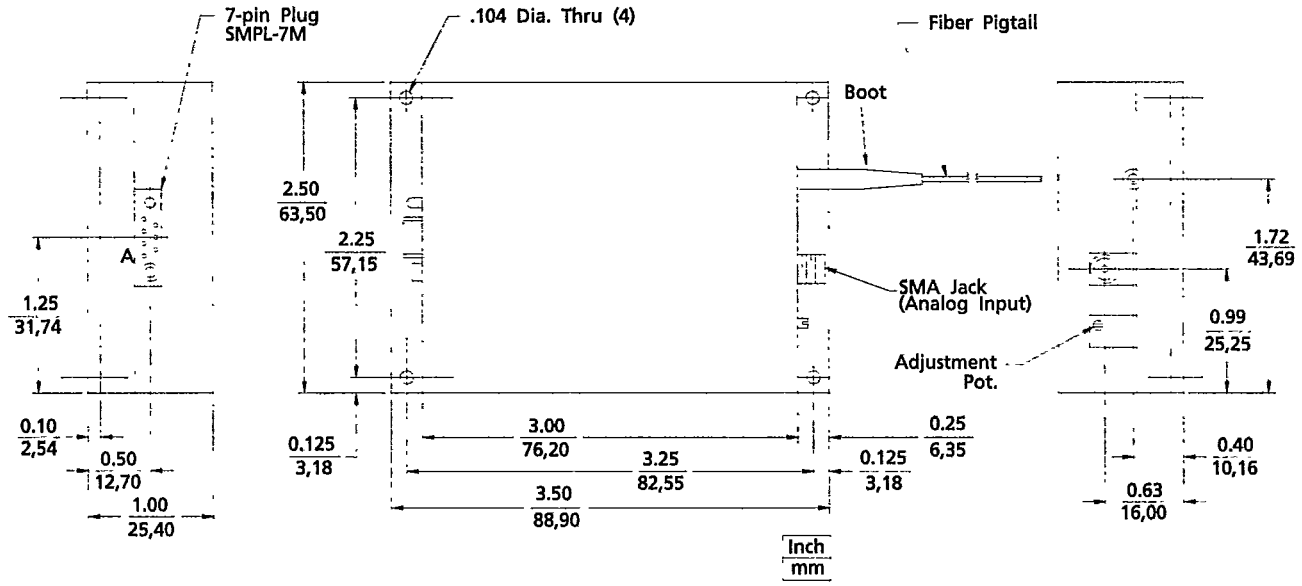
QDE035, QDE075



QDEMW1, QDEMW3 Microwave Detector



QTX Transmitter



QLXSMW Microwave Transmitter