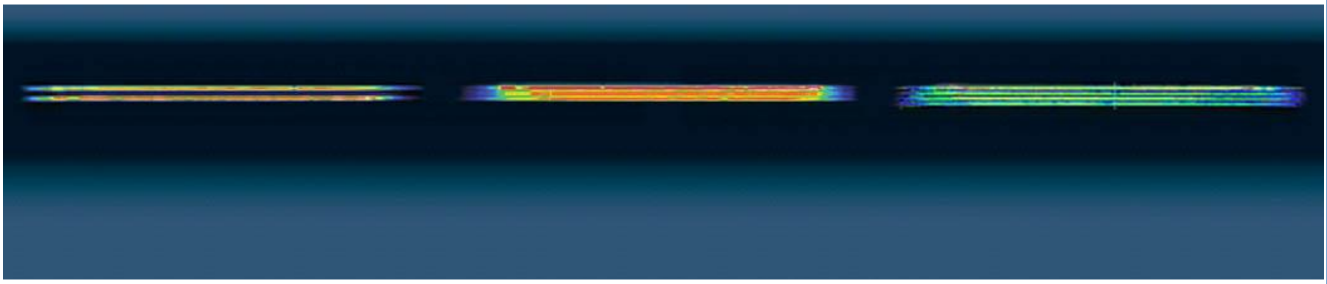
SENSOR SOLUTIONS

DATASHEET

High Power Laser-Diode Family for Industrial Range Finding

PGA Series of 905 nm Pulsed Semiconductor Lasers



Introduction

The PerkinElmer PGA pulsed laser family consists of hermetically packaged devices having up to four active lasing layers, which are epitaxially grown on a single GaAs substrate chip. This multi-layer design multiplies the output power by the number of epi-layers. For example, the QPGA quad laser at 225 µm active layer width which has four epitaxially grown lasing layers, delivers an output peak power >100 W and, by additionally stacking three quad chips into a single package, the usable device power even exceeds 300 W.

The laser chips of the PGA family feature stripe widths of 75 and 225 µm and come as single (PGA), double (DPGA), triple (TPGA), or quadruple (QPGA) epi-layer version, which in addition can be stacked to increase the output power further.

The PGA series possesses a 25º beam divergence in the direction perpendicular to chip surface and a 10° beam spread within the junction plane. The power output shows an excellent stability over the full MIL specification temperature range. Structures are fabricated using metal organic chemical vapour deposition (MOCVD).

Recognizing that different applications require different packages, six standard package options are available, including the traditional stud designs as well as 5.6 and 9 mm CD packages and ceramic substrates. Since pulse widths in applications have decreased and optical coupling has become even more important, the newer packages – boasting reduced inductance and thinner, flatter windows – have gained popularity.

Additionally where fiber coupling applications are concerned, the transverse spacing of the EPI cavity active areas concentrates more optical power into a smaller geometry allowing for increased optical power coupling into optical fibers.

Features and Benefits

- Doubling, tripling or quadrupling of the output power from a single EPI-cavity chip with a small active area: Peak power exceeds 100 W at 30 A drive current and 100 ns pulse width.
- Peak power >300 W at 30 A drive current and 100 ns pulse width for 3 physically stacked quad EPI-cavity chips.
- Extremely high reliability.
- The PGA EPI-cavity lasers family has been proven in safety applications since early 1990s.
- Range of single element and stacked devices.
- Choice of 6 standard packages.
- 80% power retention at 85ºC ambient.
- Flexibility in customization for different applications.
- Small emitting areas allow ease of fiber coupling.
- RoHS compliant

Applications

- Laser range finding.
- Laser safety curtains (laser scanning).
- Infrared night illumination
- Laser speed measurement (LIDAR).
- Automotive adaptive cruise control (ACC).
- Material excitation in medical and other analytical applications.
- Weapon simulation.

www.perkinelmer.com

PerkinElmer
For the Better

PGA Pulsed Laser Family Selection Table

The following table lists the preferred chip and stacking options. For other configurations please inquire.

Device	Description	Total # of emitting stripes	Typical peak power at 30 A, 100 ns	
			75 µm (3 mils) stripe width	225 µm (9 mils) stripe width
PGAx1	Single chip laser – 1 epi-layer	1	8 W	23 W
DPGAx1	Single chip laser – 2 epi layers: Double EPI-cavity laser	2	15 W	50 W
TPGAx1	Single chip laser – 3 epi-layers: Triple EPI-cavity laser	3	23 W	75 W
QPGAx1	Single chip laser – 4 epi-layers: Quad EPI-cavity laser	4	33 W	105 W
TPGAx2	Double chip laser – 2 x 3 epi-layers: Double stacked triple EPI-cavity laser	6	45 W	148 W
QPGAx2	Double chip laser – 2 x 4 epi-layers: Double stacked quad EPI-cavity laser	8	65 W	208 W
QPGAx3	Triple chip laser – 3 x 4 epi-layers: Triple stacked quad EPI-cavity laser	12	95 W	310 W

'x' = package type. Preferred package: S-type

Operating Conditions

The laser is operated by pulsing in the forward bias direction.

The PerkinElmer warranty applies only to devices operated within the maximum rating, as specified. Exceeding these conditions is likely to cause permanent "burn off" damage to the laser facet and consequently a significant reduction in optical power.

Operating the devices at increased duty cycles will ultimately and irreparably damage the crystal structure due to internal heating effects. Diodes are static sensitive and suitable precautions should be taken when removing the units from their antistatic containers. Circuits should be designed to protect the diodes from high current and reverse voltage transients. Voltages exceeding the reverse breakdown of the semiconductor junction are particularly damaging and have been shown to cause degradation of power output. Although the devices will continue to perform well at elevated temperatures for some thousands of hours, defect mechanisms are accelerated.

Optimum long term reliability will be attained with the semiconductor at or below room temperature. Adequate heat sinking should be employed, particularly for the larger stacks and when operated at maximum duty factor.

Forward Voltage

The forward voltage of the device is a combination of: a static voltage drop resulting from band gaps and material characteristics, a dynamic series resistance resulting from the contact area dimensions, the resistivity of the contact layers, and the inductive voltage drop of the package. Voltages due to the inductive elements are additional and, therefore, are considered separately since they depend on the package inductance, the pulse rise time and the peak current.

Package Inductance

When narrow pulse widths are required, the system designer must take care that circuit inductance is kept to a minimum (note inductance on package list). Using the lower inductance packages will reduce the peak voltage required to obtain the desired drive current.

For example, to obtain approximate Gaussian pulse shapes for the "C" and "U" packages:

1. DPGAC1S12H:

t_w = 40 ns P_{rr} = 25 kHz, t_r = 20 ns,

i_r = 60 A, L_{CPKG} = 12 nH

VL = L_{PKG} X di/dt

V_{CPKG} = 12 x 10^{-9} X 60/20 X 10^{-9} =36 V

2. DPGAU1S12H:

t_w = 40 ns P_{rr} = 25 kHz, t_r = 20 ns,

i_r = 60 A, L_{CPKG} = 5 nH

VL = L_{PKG} X di/dt

V_{CPKG} = 5 x 10^{-9} X 60/20 X 10^{-9} =15 V

Note: These voltage drops are merely to overcome the inductance of the package and do not include the series package and chip static resistances.

Other circuit elements typically increase voltage requirements to 3 X V_{PKG}, therefore the location of components to minimize lead length is critical.

Maximum Ratings

Parameter	Symbol	Min	Max	Units
Peak reverse voltage	V_{RM}		2	V
Pulse duration	t_W		100	ns
Duty factor	du		0.1	%
Storage temperature	T_S	-55	105	°C
Operating temperature	T_{op}	-55	85	°C
Soldering for 5 seconds (leads only)			+260	°C

Generic Electro Optical Specifications at 23°C

Parameter	Symbol	Min	Typ	Max	Units
Center wavelength of spectral envelope	λC	895	905	915	nm
Spectral bandwidth at 50% intensity points	Δλ		5		nm
Wavelength temperature coefficient	Δλ/ΔT		0.25		nm/°C
Beam spread (50% peak intensity) parallel to junction plane	ΘH		10		degrees
Beam spread (50% peak intensity) perpendicular to junction	ΘH		25		degrees

PGA 75 µm Stripe Width Family: Characteristics at 23°C, 10 A, 100 ns, 0.1% duty cycle

Parameter		Symbol	PGA S1S03H	DPGA S1S03H	TPGA S1S03H	QPGA S1S03H	TPGA S2S03H	QPGA S2S03H	QPGA S3S03H	Units
Po at i_{FM}	min	Po_{min}	7	14	21	29	42	58	87	W
	typical	Po_{typ}	8	15	23	33	45	65	95	W
# of emitting stripes			1	2	3	4	6	8	12	
# of laser chips			1	1	1	1	2	2	3	
Emitting area	typical		75 x 1	75 x 10	75 x 10	75 x 15	75 x 175	75 x 200	75 x 400	µm
Maximum peak forward current		i_{FM}	10	10	10	10	10	10	10	A
Threshold current	typical	i_{th}	0.5	1.0	1.0	1.0	1.0	1.0	1.0	A
Forward voltage[1] @ i_{FM}	typical	V_f	4	7	10	15	18	30	45	V
Preferred packages			S,Y	S,Y	S,Y	S,Y	S,Y	S,Y	S,Y	
Optional packages			U,C,F,R	U,C,F,R	U,C,F,R	U,C,F,R	U,C,F,R	U,C,F,R	U,C,F,R	

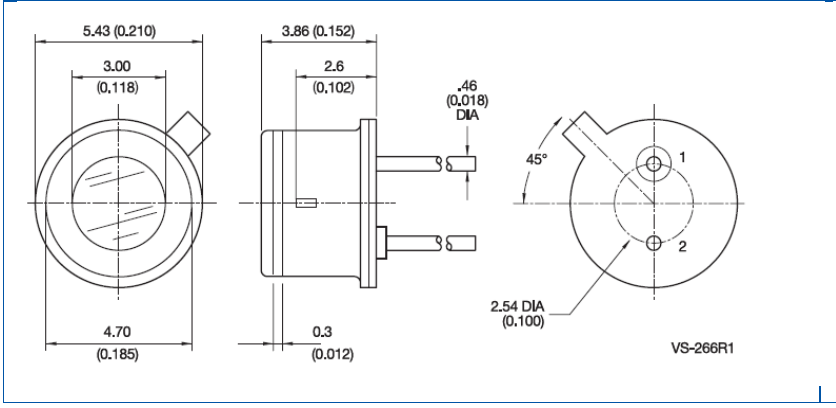
1) Excluding the voltage drop contribution due to the inductive element of the package.

PGA 225 µm Stripe Width Family: Characteristics at 23°C, 30 A, 100 ns, 0.1% duty cycle

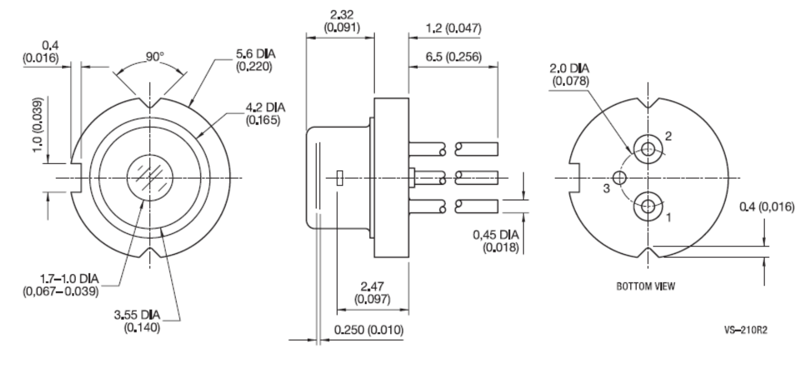
Parameter		Symbol	PGA S1S09H	DPGA S1S09H	TPGA S1S09H	QPGA S1S09H	TPGA S2S09H	QPGA S2S09H	QPGA S3S09H	Units
Po at i_{FM}	min	Po_{min}	20	46	70	95	140	190	285	W
	typical	Po_{typ}	23	50	75	105	148	205	310	W
# of emitting stripes			1	2	3	4	6	8	12	
# of laser chips			1	1	1	1	2	2	3	
Emitting area	typical		225 x 1	225 x 10	225 x 10	225 x 15	225 x 175	225 x 200	225 x 400	µm
Maximum peak forward current		i_{FM}	30	30	30	30	30	30	30	A
Threshold current	typical	i_{th}	1.5	1.5	1.5	1.5	1.5	1.5	1.5	A
Forward voltage[1] @ i_{FM}	typical	V_f	5	8.5	12.6	20	22	40	60	V
Preferred packages			S,Y	S,Y	S,Y	S,Y	S,Y	S,Y	S,Y	
Optional packages			U,C,F,R	U,C,F,R	U,C,F,R	U,C,F,R	U,C,F,R	U,C,F,R	U,C,F,R	

1) Excluding the voltage drop contribution due to the inductive element of the package.

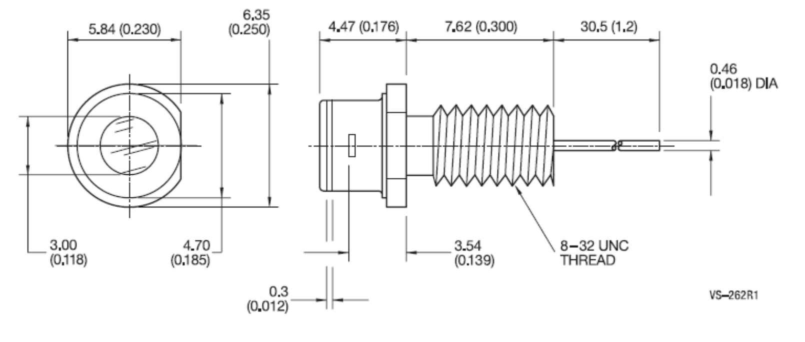
Package Drawings



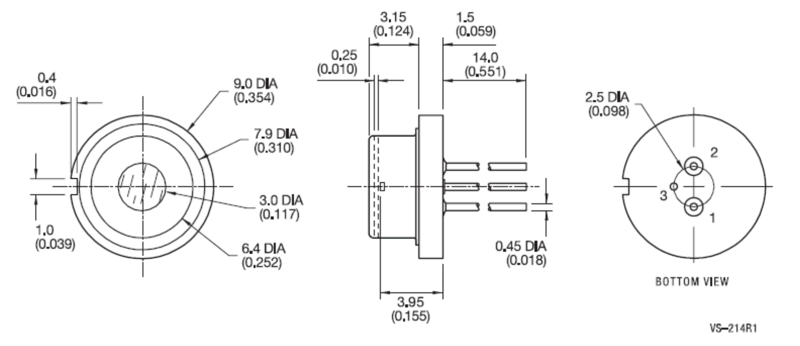
Package S:
Pin out 1. LD Anode (+), 2. LD Cathode (-) Case, Inductance 5.2 nH



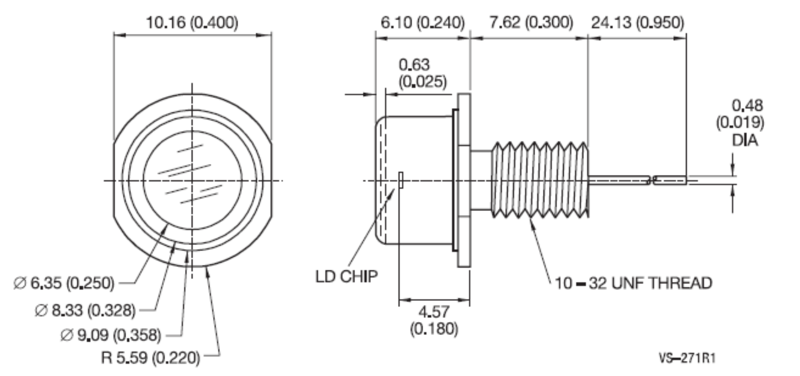
Package U:
Pin out 1. LD Anode (+), 2. NC, 3. LD Cathode (-) Case, Inductance 5.0 nH



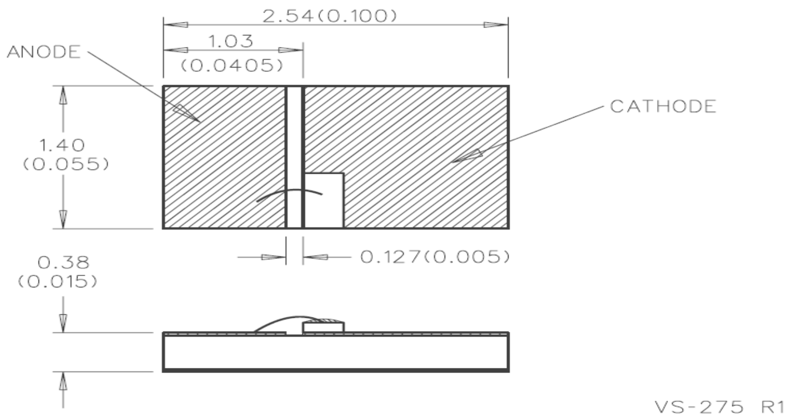
Package C:
Pin out: LD Cathode (-) Case, Pin LD Anode (+), Inductance 12 nH

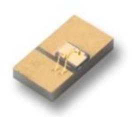


Package R:
Pin out 1. LD Anode (+), 2. NC, 3. LD Cathode (-) Case, Inductance 6.8 nH



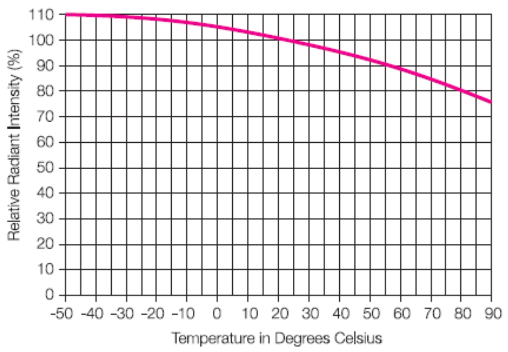
Package F:
Pin out: LD Cathode (-) Case, Pin LD Anode (+), Inductance 11 nH





Package Y:
Pin out 1. LD Cathode (-) chip bottom, 2. LD Anode (+) chip top, Inductance 1.6 nH

Electro-Optical Characteristics



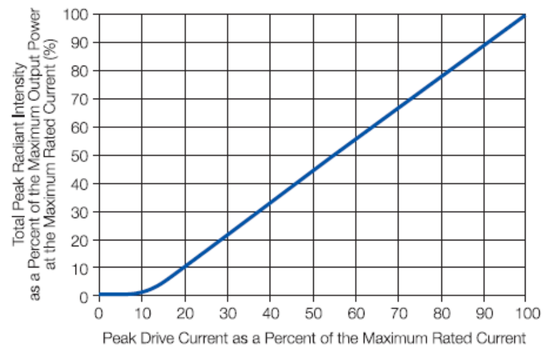


Figure 1

LEFT: Peak Radiant Intensity vs. Temperature

RIGHT: Total Peak Radiant Intensity vs. Peak Drive Current

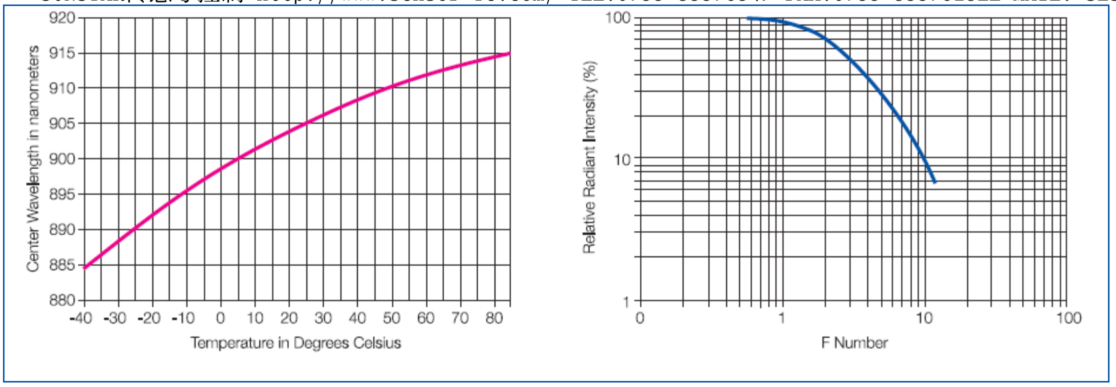


Figure 2

LEFT: Center Wavelength vs. Temperature

RIGHT: Radiant Intensity vs. F Number

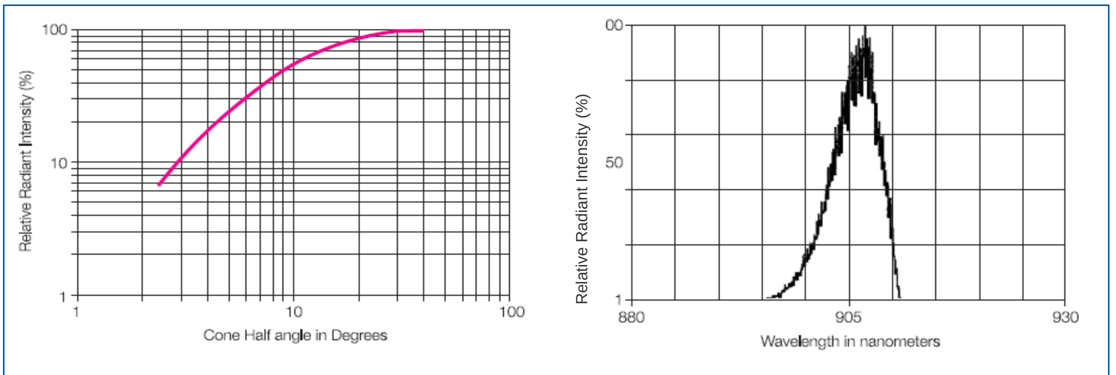


Figure 3

LEFT: Radiant Intensity vs. Half Angle

RIGHT: Spectral Plot Distribution

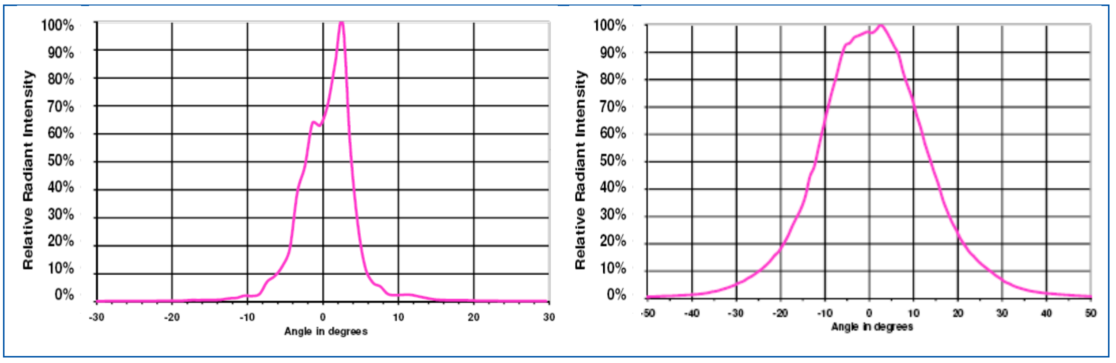


Figure 4

LEFT: DPGA Far Field Pattern Parallel to Junction Plane

RIGHT: DPGA Far Field Pattern Perpendicular to Junction Plane

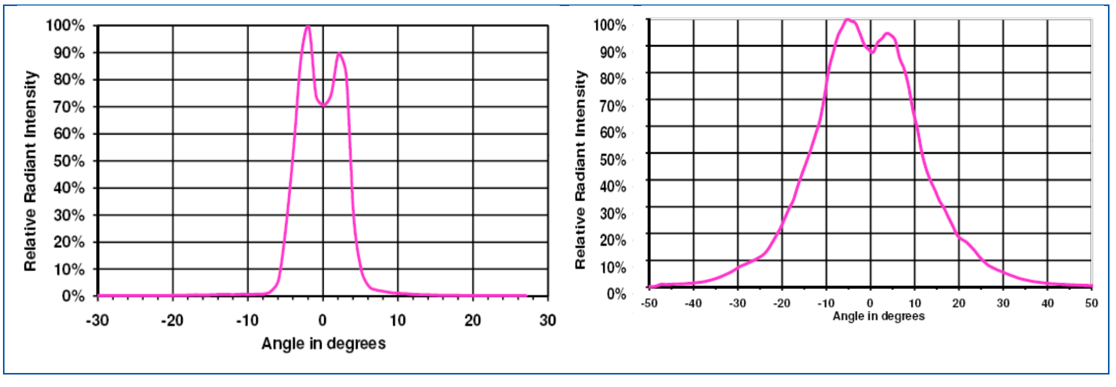


Figure 5

LEFT: TPGA & QPGA Far Field Pattern Parallel to Junction Plane

RIGHT: TPGA & QPGA Far Field Pattern Perpendicular to Junction Plan

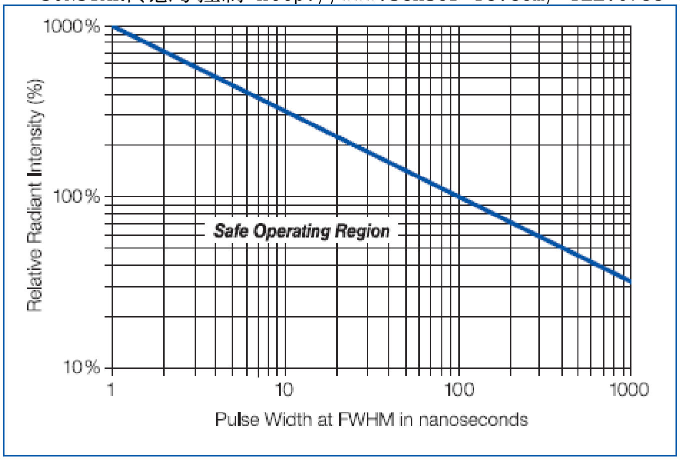


Figure 6

Radiant Intensity vs. Pulse Width for Safe Operation

For Your Safety

Laser Radiation: Under operation, these devices produce invisible electromagnetic radiation that may be harmful to the human eye.

To ensure that these laser components meet the requirements of Class IIIb laser products, they must not be operated outside their maximum ratings. Power supplies used with these components must be such that the maximum peak forward current cannot be exceeded. It is feasible to operate the diodes within Class I laser operation, but it is the responsibility of the user incorporating a laser into a system to certify the Class of use and ensure that it meets the requirements of the DHHS or appropriate authority.

Further details may be obtained in the publication FDA 88-8035: US Department of Health and Human Services Food and Drug Administration Center for Devices and Radiological Health 1390 Picard Drive Rockville, MD 20850 U.S.A.

PerkinElmer has used the data in the above document to calculate “Accessible Emission Limits” in terms of radiation power output and plotted them against pulse width for 850 nm and 1500 nm lasers. Ask for Technical Report “A Comparison of the Accessible Emission Limits (AEL’s) for Laser Radiation at 850 nm and 1500 nm”.

Ordering Information

The “preferred package” options on the list will normally be offered at lower cost and with shorter delivery times. To keep the costs down the standard devices are tested and burned-in under standard conditions.

While the devices are warranted over the entire specification, for a quantity purchase, customers are advised to discuss their requirements in advance so that any special test needs can be accommodated and yields optimized.

PerkinElmer has been routinely supplying multi active EPI-cavity lasers for military applications since the early 1990s. These diodes benefit from long years of experience from screened laser diodes to European and North American military specifications. Though the commercial products are not continuously screened, they are designed to meet demanding environmental conditions.

Typical qualification of these parts would include:

High Temperature Storage
Hermetic Seal
Thermal Shock
Random Vibration
Acceleration
Mechanical Shock

PerkinElmer is pleased to assist with advice and test procedures for your specific environmental needs.

RoHS Compliance

This series of laser diodes are designed and built to be fully compliant with the European Union Directive 2002/95EEC – Restriction of the use of certain Hazardous Substances in Electrical and Electronic equipment.

Ordering Guide

	X	P	G	A	X	X	S	XX	H
Double active area	D								
Triple active area	T								
Quadruple active area	Q								
Pulsed		P							
905 nm wavelength			G						
+/-10 nm spectral width				A					
Preferred S package					S				
Preferred Y package					Y				
Optional U package					U				
Optional C package					C				
Optional R package					R				
Optional F package					F				
Single chip stack						1			
Double chip stack						2			
Triple chip stack						3			
Stackable chip							S		
0.003'' wide laser stripe (75 µm)								03	
0.009'' wide laser stripe (225 µm)								09	
RoHS compliance									H

North America
Customer Support Hub
PerkinElmer Canada
22001 Dumberry Road
Vaudreuil-Dorion, Québec
Canada J7V 8P7
Telephone: +1 450-424-3300,
(+1) 866-574-6786 (toll-free)
Fax: +1 450-424-3345
Email: opto@perkinelmer.com
www.perkinelmer.com

European Headquarters
PerkinElmer
Wenzel-Jaksch-Str. 31
65199 Wiesbaden, Germany
Telephone: (+49) 611-492-247
Fax: (+49) 611-492-170
Email: opto.Europe@perkinelmer.com

Asia Headquarters
PerkinElmer
47 Ayer Rajah Crescent #06-12
Singapore 139947
Telephone: (+65) 6775-2022
Fax: (+65) 6775-1008
Email: opto.Asia@perkinelmer.com

PerkinElmer
For the Better

For a complete listing of our global offices, visit www.optoelectronics.perkinelmer.com

600170_xx DTSxxxx