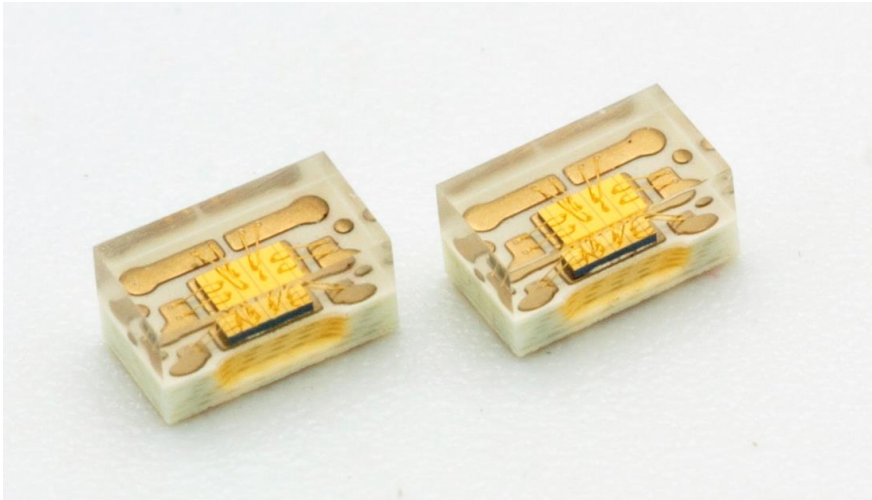


Surface Mount 905 nm Pulsed Semiconductor Laser 4-channel Array High Power Laser-Diode Family for LiDAR and Range Finding



Excelitas' pulsed semiconductor laser array produces very high peak optical pulses centered at a wavelength of 905 nm.

Excelitas Technologies' pulsed semiconductor laser array is a monolithic array of 4 individual 905nm InGaAs/GaAs strained quantum well lasers. Each laser is a structure of three single cavities grown on a GaAs substrate and connected in series by a low resistance connector, known as a tunnel junction. Each laser has current injection width $W = 235\mu\text{m}$ and height $H = 10\mu\text{m}$. Each channel is individually addressable with no electronic crosstalk within the array. The current injection and channel design is such that the output from the channels will combine to appear as one large laser when fired together.

The laser diode is mounted on an FR4 substrate leadless laminate carrier (LLC) with excellent thermal management, ideally suited for both surface mount applications and hybrid integration. The encapsulate material is a molded epoxy resin for low cost and high-volume manufacturing.

The package design and assembly processing techniques are such that the die positioning is well controlled to the reference surfaces. With all four (4) channels being part of the same monolithic chip growth, positioning and alignment channel-to-channel are controlled by the mask design and lithographic processes, and are thus accurate to micron-level tolerances.

Quantum well laser design offers rise and fall times of $<1\text{ ns}$ however, the drive circuit layout and package inductance play a dominant role and should be designed accordingly.



Near field profile, each channel

Key Features

- Concentrated emitting source size for high power into aperture
- Multi-Epi Quantum well structure
- Two versions available – one with the channels close together allowing the lasers to be operated as one large laser with no gaps between channels in the near field, the other version with each channel individually addressable
- The addressable version can be operated as one large laser but there will be spaces between the channels
- Sustains large reverse voltage levels
- Excellent power stability with temperature
- RoHS compliant

Applications

- LiDAR
- Adaptive cruise control
- Autonomous vehicles
- Range finding
- Safety light curtains
- Laser therapy

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High Power Laser-Diode Family for LiDAR and Range Finding

Table 1: Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Peak Reverse Voltage	V_{RM}		6	V
Pulse Duration	t_W		100	ns
Duty Factor	du		0.1	%
Storage Temperature	T_S	-40	105	°C
Operating Temperature	T_{OP}	-40	85	°C
Soldering for 5 Seconds			260	°C

Table 2: General Electro-optical Specifications at 23°C

Parameter	Symbol	Minimum	Typical	Maximum	Units
Centre Wavelength of Spectral Envelope	λ_c	895	905	915	nm
Spectral Bandwidth at 50% Intensity Points	$\Delta\lambda$		5		nm
Wavelength Temperature Coefficient	$\Delta T/\Delta\lambda$		0.25		nm/°C
Beam Spread (50% Intensity Points) Parallel to Junction Plane	$\theta_{ }$		10		degrees
Beam Spread (50% Intensity Points) Perpendicular to Junction Plane	θ_{\perp}		25		degrees

Table 3: Electro-optical Specifications at 23°C

Test Conditions: 50ns, 1 kHz

Characteristics (per channel)	Symbol	Minimum	Typical	Maximum	Units
Emitting Area			235 X 10		μm
Optical Power Output	P_O	70	75		W
Drive Current	i_{FM}		30		A
Forward Voltage at i_{FM}^1	V_F		13.5		V
Threshold Current	i_{TH}		1.75		A
Series Resistance	R_s		0.23		Ω
Bandgap Voltage Drop	V_g		6.5		V

Note 1: As estimated by $V_F = R_S i_F + V_g$.

Table 4: Part Numbering

Each channel individually addressable	TPGAD1S09A-4A
All channels fired together	TPGAD1S09A-4C

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Electro-Optical Characteristics

Figure 1:

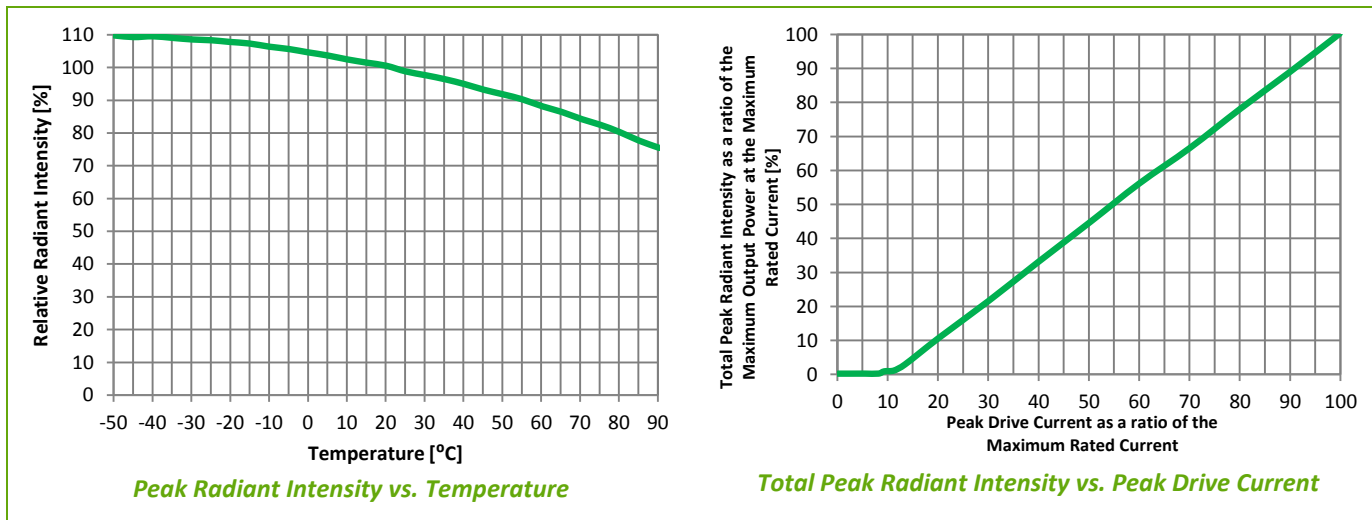


Figure 2:

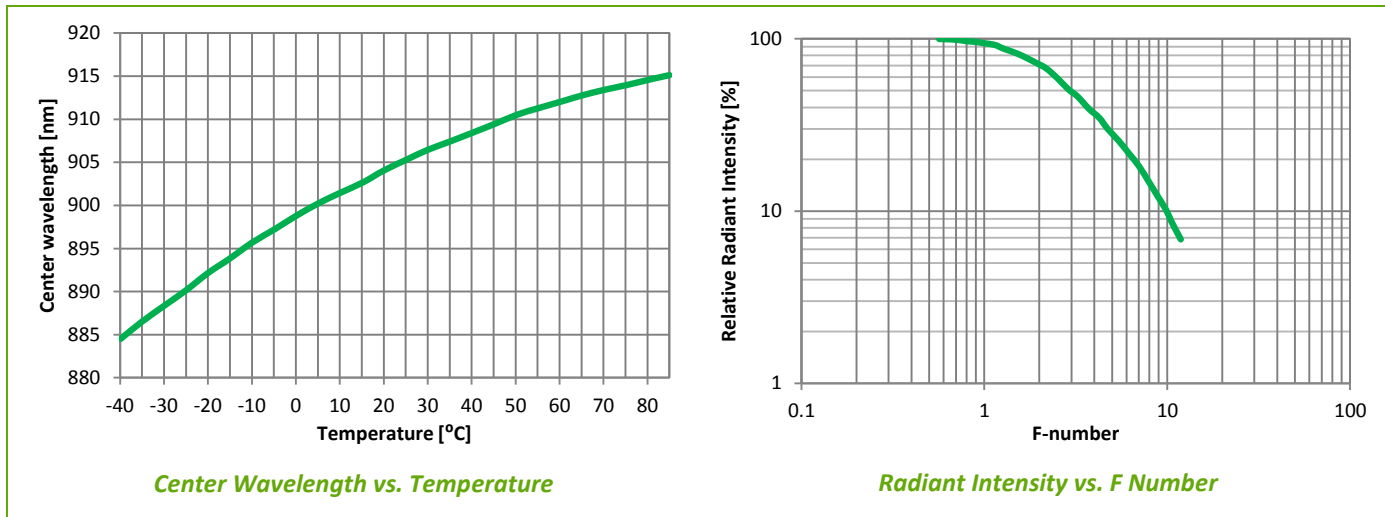
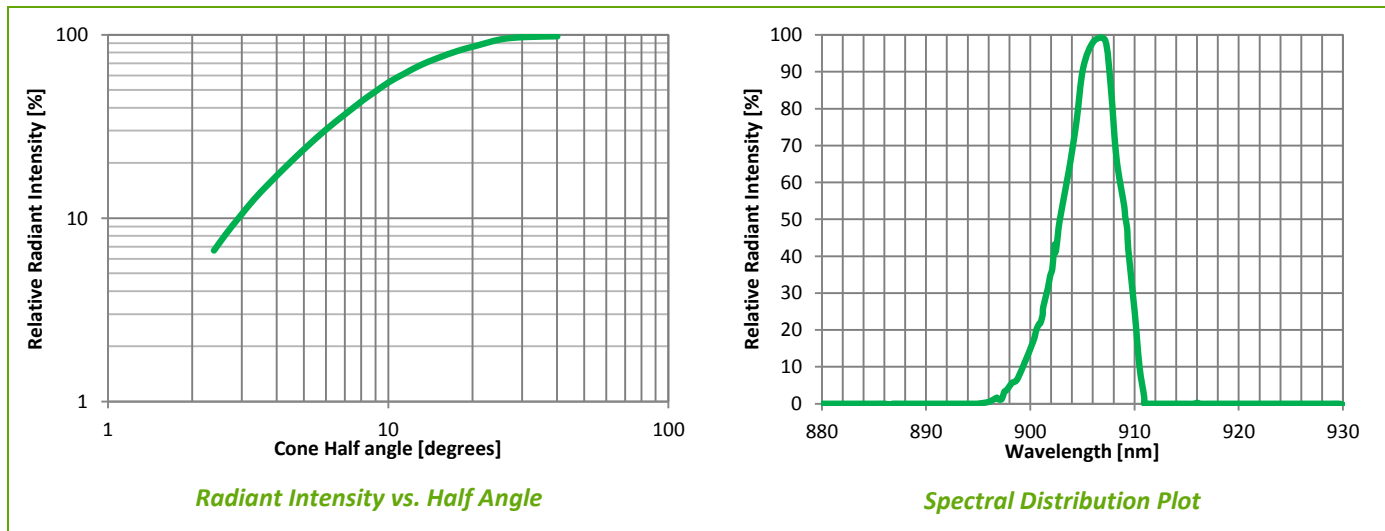


Figure 3:



Surface Mount 905 nm Pulsed Semiconductor Laser 4-channel Array

High Power Laser-Diode Family for LiDAR and Range Finding

Figure 4:

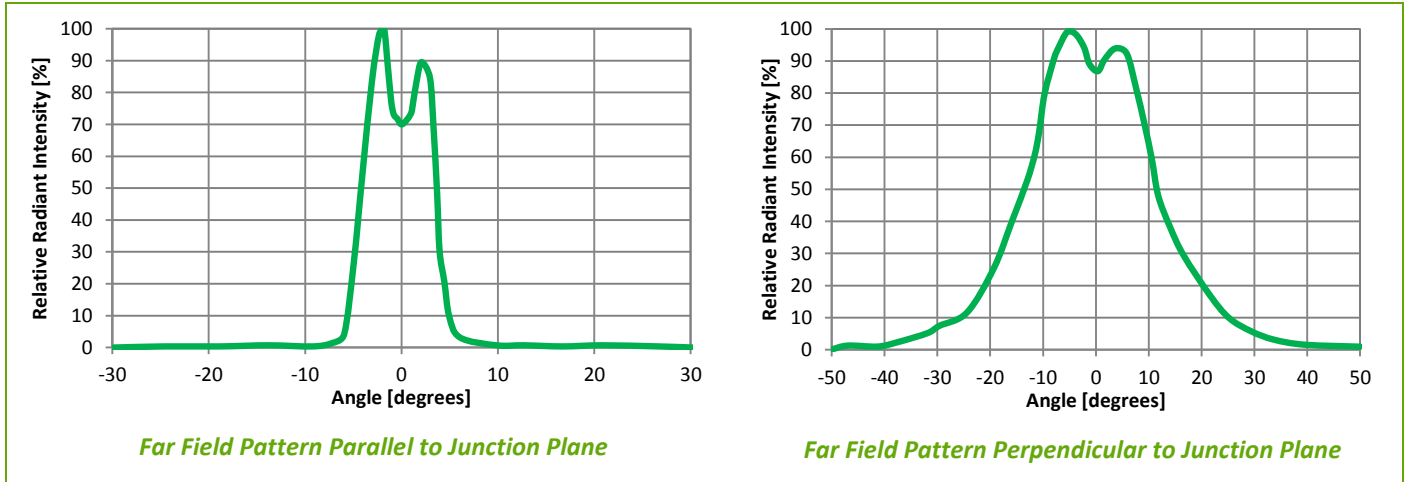
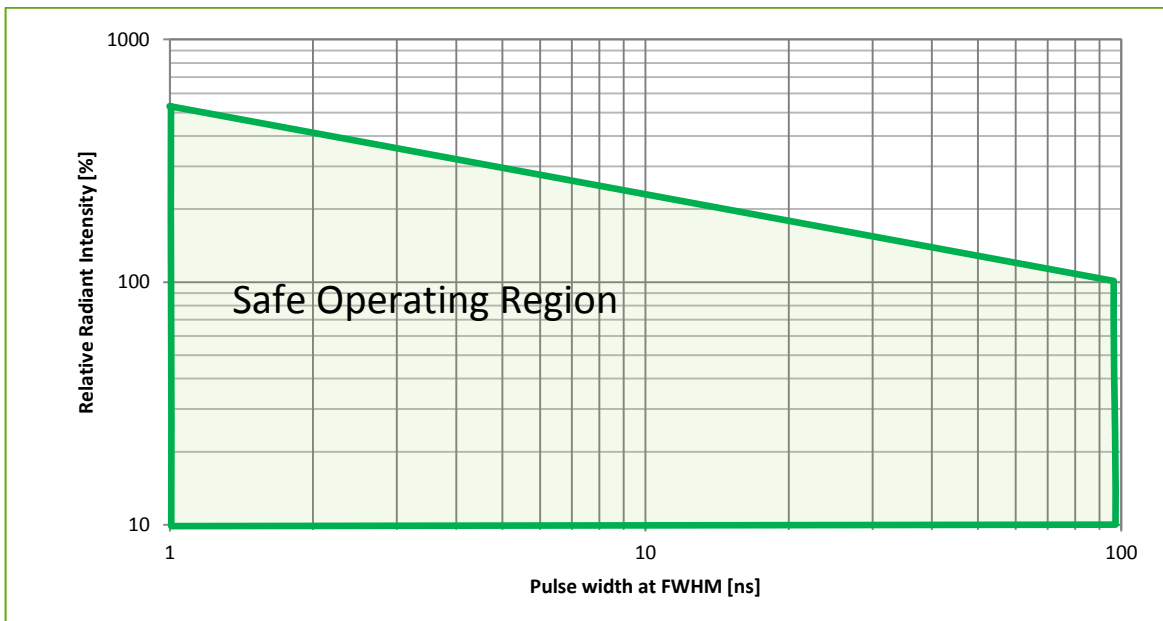


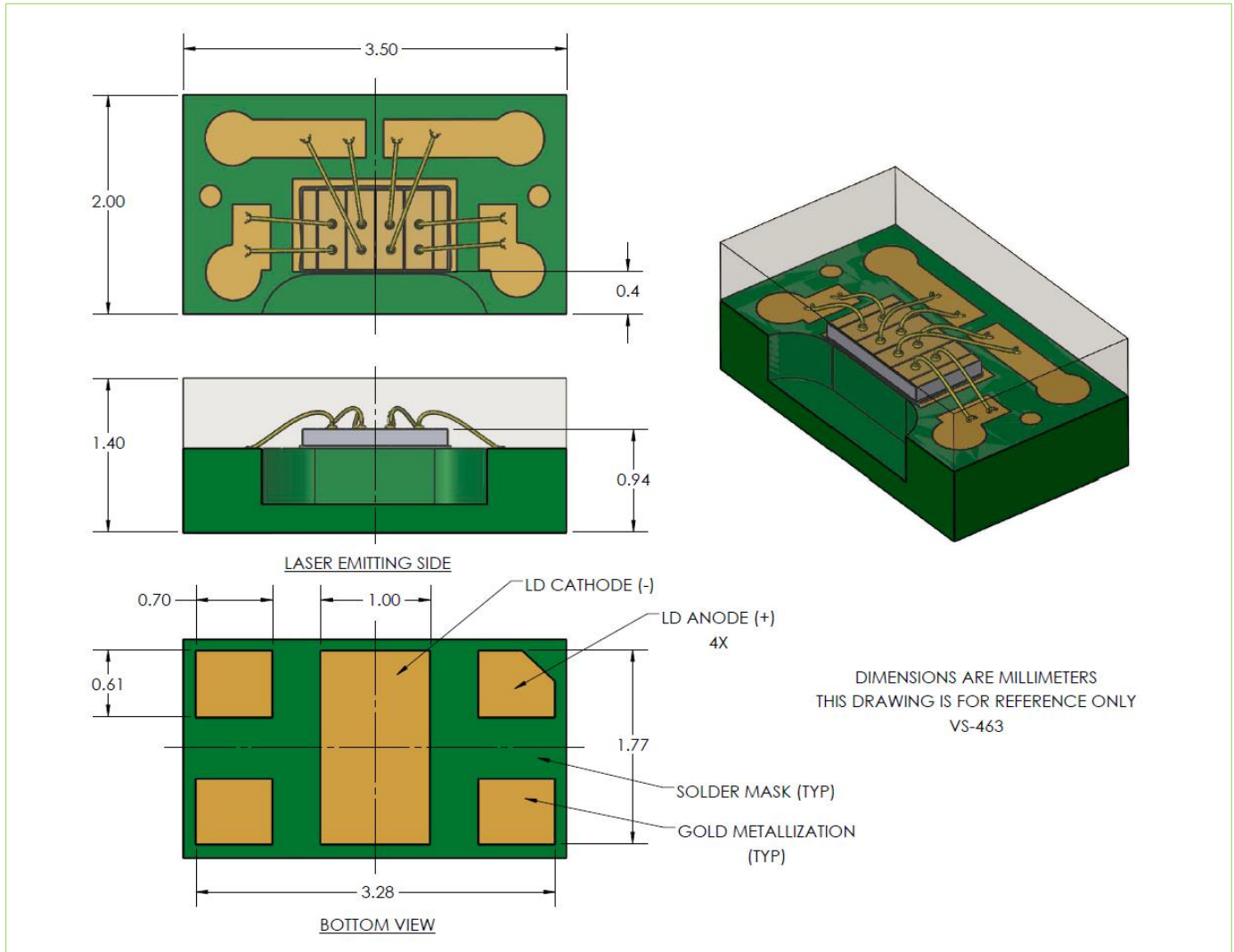
Figure 5: Radiant Intensity vs. Pulse Width for Safe Operation



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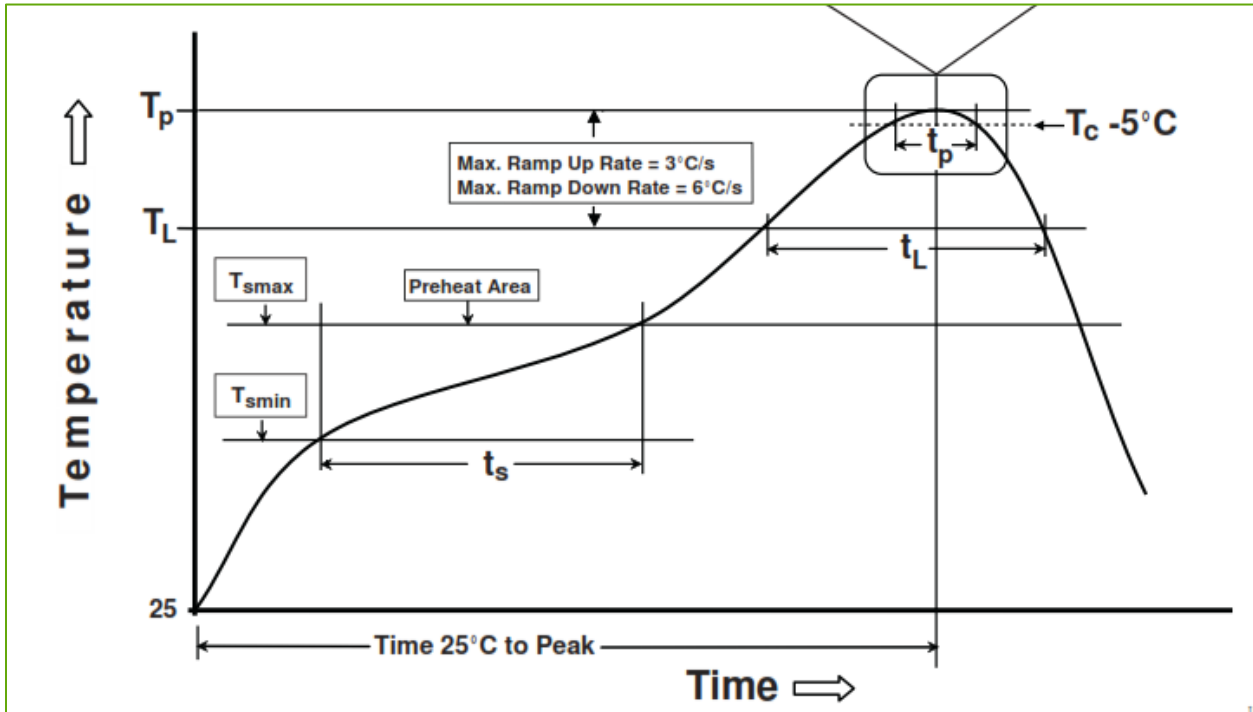
Figure 5: Package Mechanical Dimensions



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Figure 6: Recommended Typical Solder Reflow Profile (Specific reflow soldering parameters depend on solder alloy used).



Profile Feature	Symbol	Value	Units
Pre-heat			
Temperature min	T_{smin}	150	°C
Temperature max	T_{smax}	200	°C
Time (T_{smin} to T_{smax})	t_s	75	seconds
Temperature maintained above	T_L	217	°C
Time maintained above	t_L	65	seconds
Peak temperature	T_p	244	°C
Time within 5°C of the actual peak temperature (T_p)		25	seconds
Ramp down rate		2	°C/second
Time 25°C to peak temperature		4	Minutes

Surface Mount 905 nm Pulsed Semiconductor Laser 4-channel Array

High Power Laser-Diode Family for LiDAR and Range Finding

MLS Rating

This series of laser diodes comply with a Moisture Sensitivity Level (MSL) rating of three (3) as defined in IPC/JEDEC- J-STD-033C. This allows for up to 168 hour floor life at $\leq 30^{\circ}\text{C}$ / 60%RH once removed from the sealed reel packaging. For complete details, refer to the IPC/JEDEC- J-STD-033C specification.

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 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 ANSI or appropriate authority.

Further details may be obtained in the following publications:

21CFR 1040.10 – “Performance Standards for Light Emitting Products (Laser Products)”

ANSI Z136.1 – “American National Standard for Safe use of Lasers”

IEC 60825-1 – “Safety of Laser Products”

RoHS Compliance

This series of laser diodes are designed and built to be fully compliant with the European Union Directive 2011/65/EU – Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment.



Warranty

A standard 12-month warranty following shipment applies.

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About Excelitas Technologies

Excelitas Technologies is a global technology leader focused on delivering innovative, customized solutions to meet the lighting, detection and other high-performance technology needs of OEM customers.

Excelitas has a long and rich history of serving our OEM customer base with optoelectronic sensors and modules for more than 45 years beginning with PerkinElmer, EG&G, and RCA. The constant throughout has been our innovation and commitment to delivering the highest quality solutions to our customers worldwide.

From aerospace and defense to analytical instrumentation, clinical diagnostics, medical, industrial, and safety and security applications, Excelitas Technologies is committed to enabling our customers' success in their specialty end-markets. Excelitas Technologies has approximately 5,500 employees in North America, Europe and Asia, serving customers across the world.

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