

PN: K0-0940M-0000-00011
Die/Assy; 940; MM; Y12X45; 2W; 0.87mm X 0.87mm

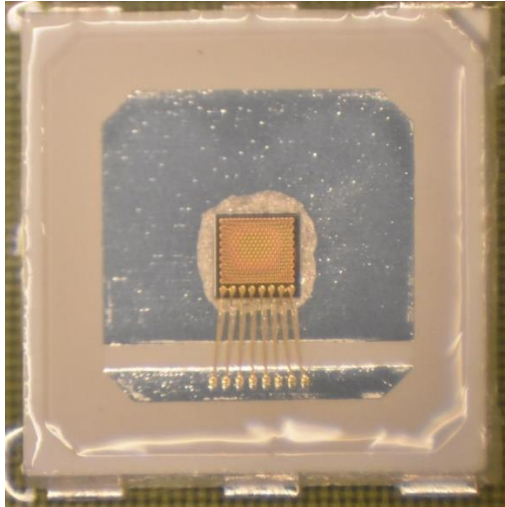


Figure 1 PLCC2 package with encapsulant

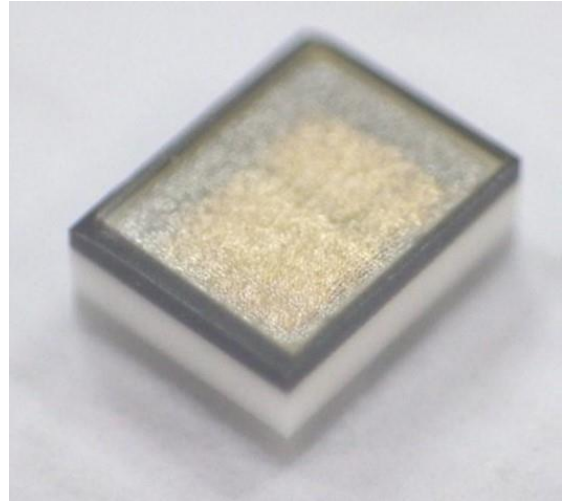


Figure 2 Ceramic package with diffuser

Near Infra-Red Vertical Cavity Surface Emitting Laser (VCSEL)

Model: Multi Mode Array VCSEL

Center wavelength: 940nm

Optical power without diffuser: 2 Watts

Applications

- Motion Control
- Time of Flight
- Automotive Sensing
- 3D Scanning
- Gesture Recognition
- IR illumination for Security



COMPLIES WITH IEC 60825-1, 2nd Edition 2007.
COMPLIES WITH 21 CFR 1040.10 AND 1040-10.11 EXCEPT FOR DEVIATIONS PURSUANT TO LASER NOTICE NO.50 DATED 27 MAY 2001.

Absolute Maximum Ratings

Parameter	Rating	Notes
Storage temperature	-40°C to 100 °C	
Operating temperature (VCSEL)	0°C to 85 °C	
Maximum package SMT solder reflow temperature	260°C, 10 seconds	
Maximum pulsed current	6A	≤ 200 μs pulse width, ≤ 1% duty cycle, Temp ≤ 40 °C,
ESD damage threshold	±2kV	MIL_STD-883D, Method 3015.7 human body model,

Note Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated for extended periods of time may affect device reliability.

Electro-Optical Characteristics

VCSEL Operating Temp (T_v) = 25 °C, Test condition: 100μs pulse width & 1% duty cycle unless otherwise noted. Die performance parameters require the VCSEL die to have adequate heat sinking and proper thermal management.

Parameter	Symbol	Units	Without Diffuser			With Diffuser			Notes
			Min	Typ.	Max	Min	Typ.	Max	
Threshold current	I _{th}	A	--	0.35	--	--	0.35	--	
Differential resistance	R _s	Ω	--	0.3	--	--	0.3	--	
Operating voltage	V _f	V	--	2.2	--	--	2.2	--	at I = 3 A
Optical operating power	L _{op}	W	--	2.7	--	--	2.3	--	at I = 3 A
Slope efficiency	SE	W/A	--	1.00	--	--	0.80	--	at I = 3 A
Power conversion efficiency	PCE	%	40	44	--	--	35	--	at I = 3 A
Breakdown voltage	V _{rb}	V	--	-10	-8	--	-10	-8	I _{rb} = -1 μA
Beam divergence	FWHM	deg	--	17	--	N/A	N/A	N/A	For parts with diffusers, see diffuser angle table
Beam divergence	1/e ²	deg	--	22	--	N/A	N/A	N/A	
Operating peak wavelength	WL _{peak}	nm	930	940	950	930	940	950	
Wavelength-Temp tuning		nm/°C	--	0.066	--	--	0.066	--	
Rise time		ps	--	--	800	--	--	--	20%-80%, Note 1
Fall time		ps	--	--	1000	--	--	--	20%-80% Note 1

Note: Parameters “Without Diffuser” is under development. Parameters “With Diffuser” is based on expected performance. Actual performance is subjected to review.

Note 1: Rise and Fall time will vary depending on driver board and electrical layout.

1. Electro-Optical Characteristics of photodiode only – not as sensor

Power monitoring photodiode (PMD) Operating Temp (Top) =25°C. Values are taken directly from the photodiode’s datasheet and don’t reflect its operation as a sensor in the integrated custom package.

Parameter	Symbol	Units	Minimum	Typical	Maximum	Notes
Reverse Dark Current		nA		0.5	6	VR=5V, Ee=0mW/cm2
Rise Time		ns		5	100	VR=10V, RL=50ohm
Fall Time		ns		5	100	
Passband Filter		nm FWHM	n.a.	n.a.	n.a.	No custom filter for photodiode
Responsivity (840 to 860 nm)		A/W	.25	.40		Note: only a fraction of the total VCSEL power will be re-directed to the photodiode
Reverse Breakdown Voltage		V	20	40		

2. Power Monitoring Diode Sensor Performance

Unless otherwise stated the Operating Temp (Top) =25°C for the sensor results. Sensor performance parameters are effective over the designated optical operating power (Lop) range listed in the section “electro-optical characteristics of VCSEL”.

Parameter	Symbol	Units	Min	Typ	Max	Notes	Verification-Note 2
PMD Full Scale	PFS	μA		2645		Limited by max vcsel power	Final test & Qualification
PMD Sensitivity	Ps	μA/mW	0.9	1.2	1.5	Lop = 1.7 to 2.3W	Final test & Qualification
PMD Linearity	Plin	%PFS	-03.5%		3.5%	Lop = 1.7 to 2.3W	Qualification
PMD Repeatability	Prep	%	-	-	-	To be tested	
PMD Sensitivity Drift	dPs_dT	μA/mW /K				Limited testing	Qualification

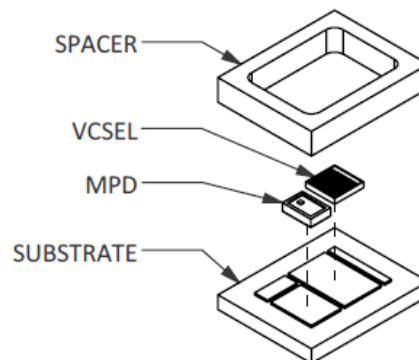


Figure 3 Sample image of K0-0940M-0000-00032

Diffuser characteristics

Parameter	Symbol	Units	Diffuser Angle						Notes
			72X58			60X45			
			Min	Typ	Max	Min	Typ	Max	
FOV aligned to short length of diffuser	FOVS	deg	--	58	--	--	45	--	FWHM defined by manufacturer
FOV aligned to longer length of diffuser	FOVL	deg	--	72	--	--	60	--	FWHM defined by manufacturer
Diffuser Uniformity	U	%	--	80	-	--	80	-	Note 2
Diffuser Efficiency	%Eff	%	80	90	-	80	90	-	Total transmission efficiency without AR Coating

Note 2: The uniformity is measured by projecting the VCSEL with diffuser onto a flat surface and capturing a high-resolution image of the beam profile. Over all the pixels in the eFOV on the image, the mean and standard deviation is calculated. The uniformity is calculated by dividing the difference of the mean and standard deviation by the mean. This is represented as a percentage.

Note 3: For all other diffuser options contact Vixar at sales@vixarinc.com

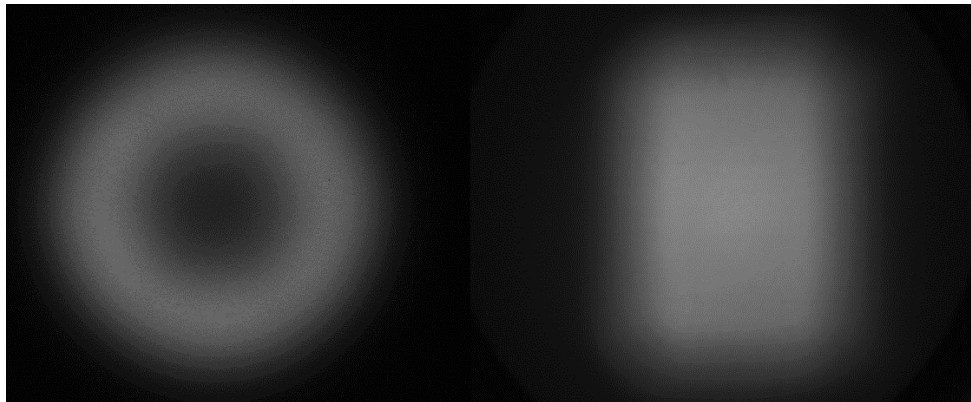


Figure 4 Left, Beam profile without diffuser. Right, Beam profile with rectangular diffuser.

Typical Performance

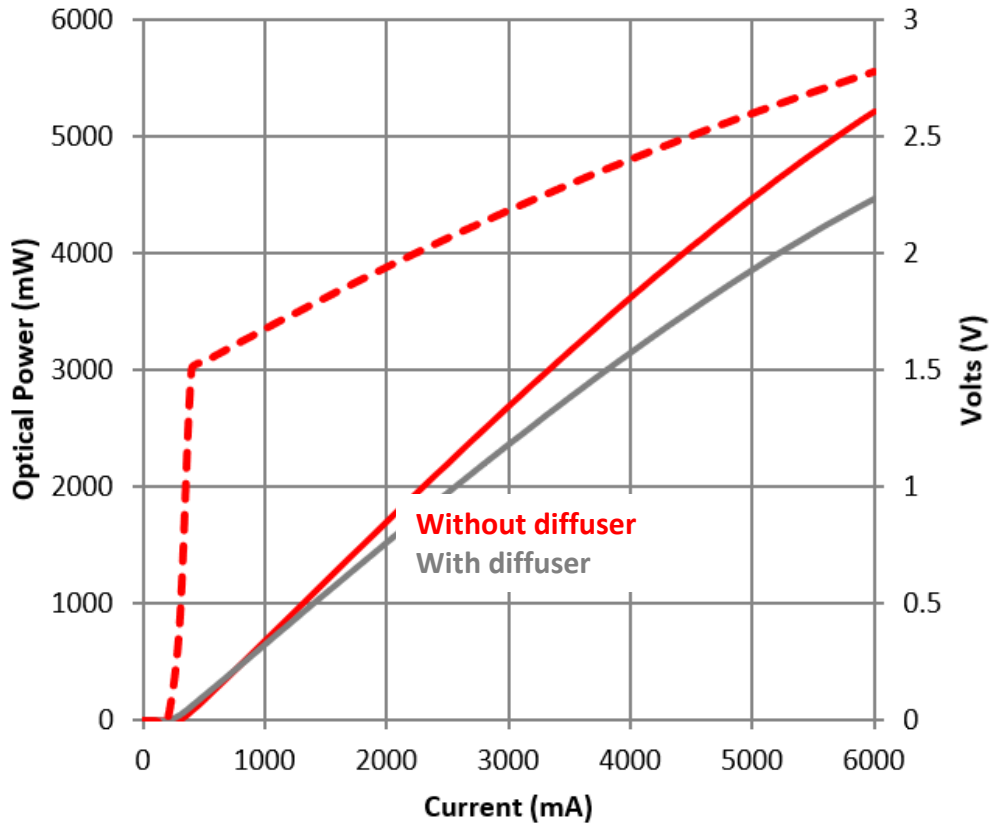


Figure 5 Typical 940nm 2W LIV at 25°C, 100µs pulse, 1% duty cycle

Beam Profile

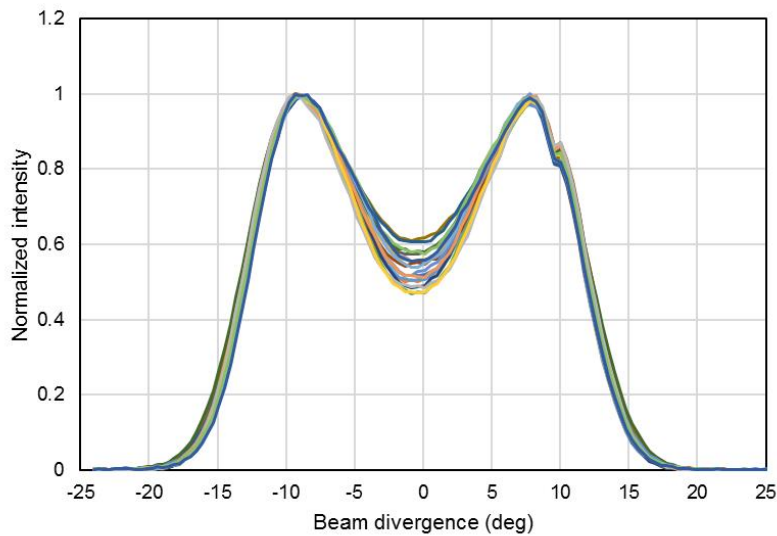


Figure 6 Typical beam divergence of bare die at 40°C, 3A

Note: Beam divergence data for many VCSEL arrays are shown.

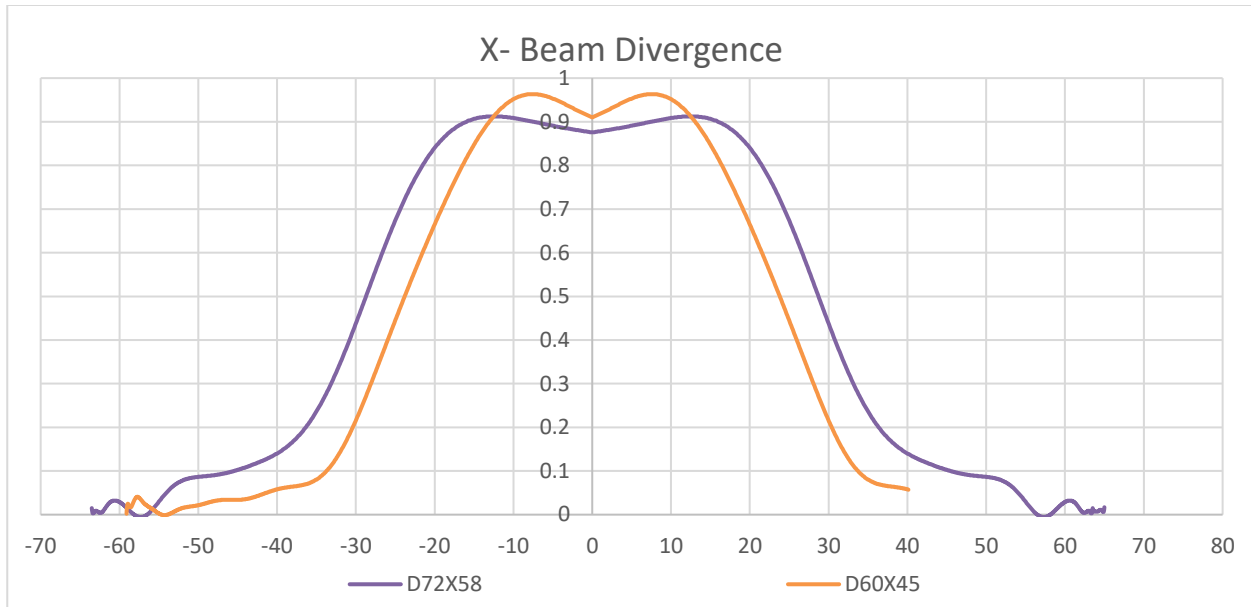


Figure 7 X-direction beam divergence with their respective diffuser at 25°C, 3A. Operational Mode: 100µS 1% Duty Cycle

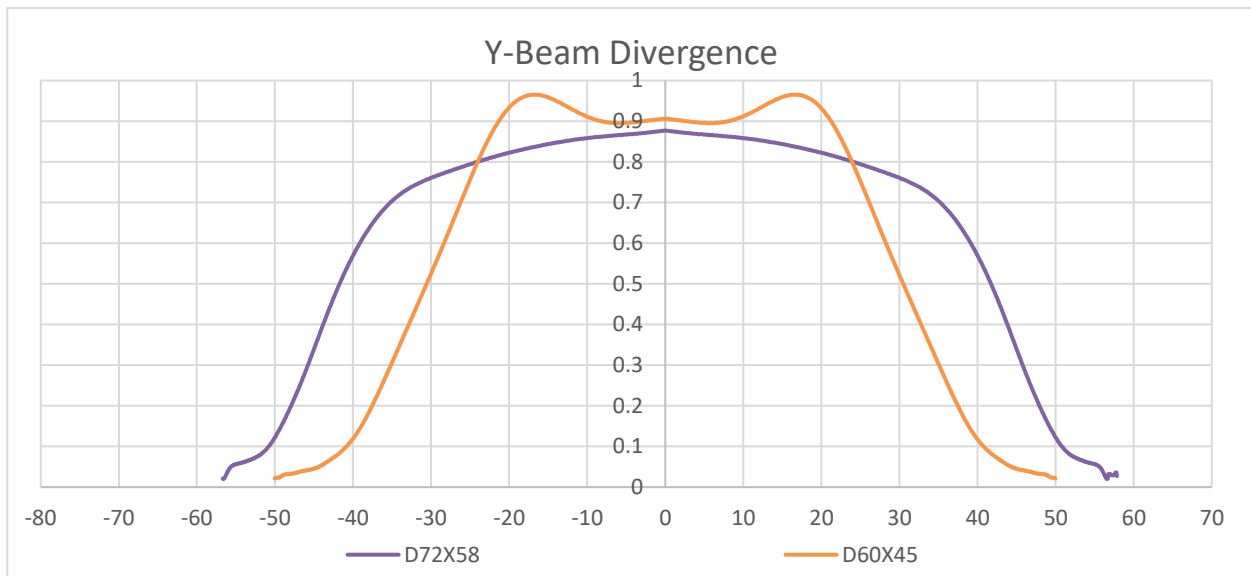
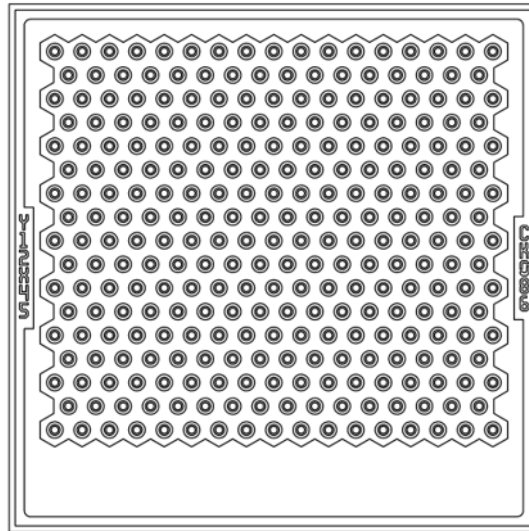


Figure 8 Y-direction beam divergence with their respective diffuser at 25°C, 3A. Operational Mode: 100µS 1% Duty Cycle

VCSEL Mechanical Specification



Parameter	Specification
Die size (x / y) final	0.870 mm X 0.870 mm
Number of Apertures	281
Die thickness	150µm

Ordering Information

Description	Part Number
Assy; 940nm; M; Y12x45; 2W; 0.87mmx0.87mm; C2835-2L; D60x45	K0-0940M-0000-00002
Die; 940; MM; 3B; Y12X45; 2W; 0.87mm X 0.87mm	K0-0940M-0000-00011
Assy; 940; M; 3B; Y12x45; 2W; 0.87mmx0.87mm; C2835-4L; D60x45/MPD	K0-0940M-0000-00014
Assy; 940; M; 3B; Y12x45; 2W; 0.87mmx0.87mm; C2835-2L; D72X58	K0-0940M-0000-00070
Assy; 940; M; 3B; Y12x45; 2W; 0.87mmx0.87mm; C2835-2L; D72X58/MPD	K0-0940M-0000-00071
Assy; 940; M; 3B; Y12x45; 2W; 0.87mmx0.87mm; PLCC5052	I0-0940M-0000-OP05

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