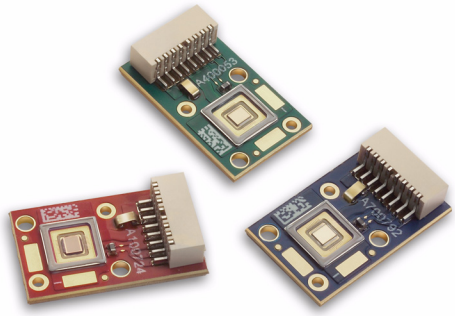
PRODUCT SUMMARY DATA SHEET

PhlatLight™ PT54

Projection Chipset, Production



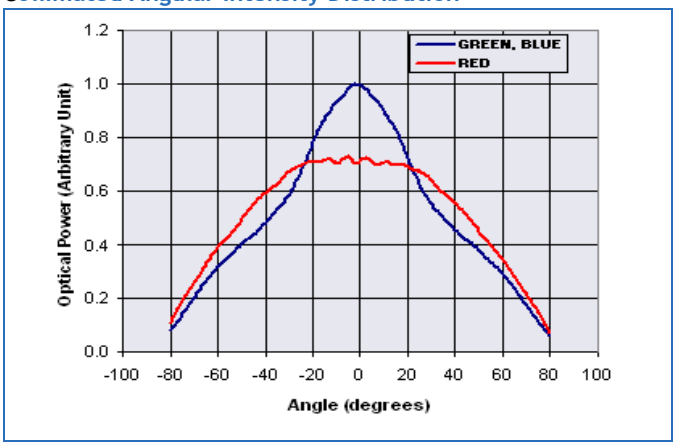
Technology Overview

Luminus Devices' Projection Technology is an innovative solid-state light source created to replace arc lamps in projection systems. Enabled by unique use of Photonic Lattice technology, PhlatLight chipsets represent a major breakthrough in brightness that delivers all the benefits of solid state light sources in projections applications:

- Wide color gamut for vivid colors, exceeds NTSC.
- Instant turn-on, no more wait time.
- High reliability; no lamp replacement
- Environmentally friendly technology - Mercury-free.
- Electronic control of color points and light intensity on a frame by frame basis

PhlatLight products benefit from numerous innovations in the domain of packaging, thermal management and optical coupling that allow designers to achieve efficient light engine designs and deliver high screen brightness.

Collimated Angular Intensity Distribution



Features

- Matched RGB Chipset with 5.4mm^2 emitting area designed for small projector applications
- Photonic lattice technology for very high surface brightness
- Wide color gamut: RED 623 nm, GREEN 526 nm, BLUE 462 nm, EP-Blue 460nm typical dominant wavelength
- Single emitting area per color allows for collection with single lens for simplified optics
- 4:3 Aspect ratio optimized for SVGA and XGA micro-displays
- Over 1575 emitted white lumens at 8000K color temperature from single chipset under Continuous Wave Operation
- Uniform surface emission
- Thermally efficient Type CX Common Anode package
- RoHS compliant (EU-2002/95/EC Directive)

Applications

- Specifically engineered for high brightness pocket-size, ultra portable front projectors, head-up projection displays
- Optimized for Micro-Display diagonal sizes ranging from 0.4" to 0.6" with 4:3 aspect ratio.

Suitable for DLP™ (0.55" SVGA and XGA), LCoS , 3LCD (0.55" SVGA and XGA) and HTPS microdisplays

PT-54 Ordering Part Numbers

Customer [1] Part Number	Color	Bin Kit [2]	Min Flux Bin	Availbility	Description
PT-54-R-C21-MPB	Red	MPB	4A	Now	Red Bin Kit, PhlatLight PT54 consisting of a 5.4 mm^2 LED, thermistor and connector mounted on a type CX copper-core PCB
PT-54-R-C21-MPC		MPC	4B	Now	
PT-54-G-C21-MPB	Green	MPB	4A	Now	Green Bin Kit, PhlatLight PT54 consisting of a 5.4 mm^2 LED, thermistor and connector mounted on a type CX copper-core PCB
PT-54-G-C21-MPC		MPC	4B	Now	
PT-54-G-C21-MPD		MPD	4C	Now	
PT-54-B-C21-MPB[3]	MP-Blue	MPA	4A	Now	MP- Blue Bin Kit, PhlatLight PT54 consisting of a 5.4 mm^2 LED, thermistor and connector mounted on a type CX copper-core PCB
PT-54-B-C21-EPA	EP-Blue	EPA	4C	Now	EP- Blue Bin Kit, PhlatLight PT54 consisting of a 5.4 mm^2 LED, thermistor and connector mounted on a type CX copper-core PCB
PT-54-B-C21-EPB		EPB	4D	Now	

Note 1: Ordering part numbers represent bin kits (group of bins that are shippable for a given ordering part number)
Note 2: See Bin Kit and Flux bin definitions on page 3.
Note 3: PT-54-B-C21-MPB are not recommended for new designs.

PhlatLight Ordering Part Number Nomenclature

PT	-	nn	-	X	-	CXX	-	XYZ	-
Product Family		**Chip Area**		**Color**		**Package Configuration**		**Bin Kit [1]**	
PT: Copper -core PCB		54: 5.4mm^2		R=Red G=Green B=Blue		C21: 26.5mm X 16.0mm C22: 26.5mm X 16.0mm (die rotated configuration) See drawing on p11.		See page 3 for Bin Kit definition	

Note 1: A Bin Kit represents a group of individual flux or power bins that are shippable for a given ordering part number. In order to ensure availability, individual flux or power bins are not orderable.

EXAMPLES:

PT-54-R-C21-MPC is comprised of Red Flux Bins 4B,4C,4D,4E,4F.

PT-54-R-C22-MPC is comprised of Red Flux Bins 4B,4C,4D,4E,4F (Die rotated package configuration).

•

PT-54 Bin Kit[1] Flux Bin [2,3] Definitions

Note: Please refer to ordering part number table on page 2 for Bin Kit availability

Red Flux Bins	Bin 4A	Bin 4B	Bin 4C	Bin 4D	Bin 4E	Bin 4F	Bin4G	Bin 4H	Bin 4J		
Red Bin Flux Range (lm)	600-650	650-700	700-775	775-850	850-950	950-1050	1050-1150	1150-1275	1275-1400		
PT-54-R-C21-MPB	☑	☑	☑	☑	☑						
PT-54-R-C21-MPC		☑	☑	☑	☑	☑					
Green Flux Bins	**Bin 4A**	**Bin 4B**	**Bin 4C**	**Bin 4D**	**Bin 4E**	**Bin 4F**	**Bin 4G**	**Bin 4H**	**Bin 4J**		
Green Bin Flux Range (lm)	**1275-1400**	**1400-1500**	**1500-1600**	**1600-1700**	**1700-1800**	**1800-1900**	**1900-2000**	**2000-2150**	**2150-2300**		
PT-54-G-C21-MPB	☑	☑	☑	☑	☑						
PT-54-G-C21-MPC		☑	☑	☑	☑	☑	☑				
PT-54-G-C21-MPD			☑	☑	☑	☑	☑	☑			
Blue Flux Bins	**Bin 4A**	**Bin 4B**	**Bin 4C**	**Bin 4D**	**Bin 4E**	**Bin 4F**	**Bin 4G**	**Bin 4H**	**Bin 4J**	**Bin 4K**	
Blue Bin Flux Range[4]	**215-250**	**250-275**	**275-300**	**300-325**	**325-350**	**350-375**	**375-400**	**400-440**	**440-480**	**480-525**	
PT-54-B-C21-MPB	☑	☑	☑	☑	☑						
PT-54-B-C21-EPA			☑	☑	☑	☑	☑	☑			
PT-54-B-C21-EPB				☑	☑	☑	☑	☑	☑		

Note 1: Bin Kits are defined by a group of flux or power bins. Only one flux bin will be shipped in each individual pack. A shipment will contain packs of different allowed flux bins for a particular ordering part number. In order to ensure availability, individual Flux or Power bins are not ordereable.

Note 2: PT54 LEDs are tested for luminous flux at 13.5A at 25% duty cycle for Red and Blue and at 50% duty cycle for Green. Devices are-placed into one of the above flux bins. Flux bins have been defined, but not all defined bins are currently populated.

Note 3: Flux bins are defined to +/- 6 % accuracy.

Note 4: Blue Flux bin limits for MP-Blue, EP-Blue are defined at dominant wavelength, 462nm.

Optical and Electrical Characteristics

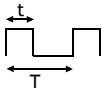
		Symbol	Red	Green	MPB-Blue	EP-Blue	Unit
Emitting Area			5.4	5.4	5.4	5.4	mm^2
Emitting Area Dimensions			2.7x2.0	2.7x2.0	2.7x2.0	2.7x2.0	mmxmm
Characteristics at Reference Pulsed Drive Current I_F[1,2]							
Reference Duty Cycle[3]			25	50	25	25	%
Recommended Peak Drive Current [4]	typ	I_F	13.5	13.5	13.5	13.5	A
Peak Luminous Flux[5]	typ	Φ_v	750	1650	275	325	lm
Peak Radiometric Power	typ	Φ_r	4.2	3.5	5.6	7.7	W
Dominant Wavelength	min	λ_{dmin}	619	516	455	450	nm
	typ	λ_d	623	525	462	460	nm
	max	λ_{dmax}	630	535	469	468	nm
FWHM - Spectral bandwidth at 50% of Φ_v	typ	$\Delta\lambda_d$	19	36	25	20	nm
Chromaticity Coordinates[6,7]	typ	x	0.697	0.191	0.144	0.146	
	typ	y	0.303	0.695	0.040	0.034	
Forward Voltage	min	V_{Fmin}	2.2	3.5	3.5	3.2	V
	typ	V_F	2.6	4.9	4.9	4.0	V
	max	V_{Fmax}	3.4	5.9	5.9	5.2	V
Dynamic Resistance	typ	Ω_{dyn}	0.05	0.09	0.07	0.05	Ω
Device Thermal Characteristics							
Thermal Coefficien of Photometric Flux	typ		-1.0	-0.2	~0	~0	% / °C
Thermal Coefficient of Radiometric Flux	typ		-0.6	-0.2	-0.2	-0.2	% / °C
Forward Voltage Temperature Coefficient	typ		-1.5	-1.0	-3.0	-3.0	mV / °C
Characteristics at Reference Continuous Drive Current I_F(continuous wave)[1]							
Reference Drive Current	typ	I_F	8.1	8.1	8.1	8.1	A
Luminous Flux	typ	Φ_v	420	1155	200	235	lm
Radiometric Flux	typ	Φ_r	2.3	2.3	3.7	5.1	W
Dominant Wavelength	typ	λ_d	624	528	464	462	nm
FWHM - Spectral bandwidth at 50% of Φ_v	typ	$\Delta\lambda_d$	18	36	26	21	nm
Chromaticity Coordinates[6,7]	typ	x	0.698	0.183	0.141	0.145	
	typ	y	0.301	0.703	0.044	0.035	
Forward Voltage	min	V_{Fmin}	2.0	3.1	3.1	2.8	V
	typ	V_F	2.3	4.4	4.4	3.6	V
	max	V_{Fmax}	3.0	5.3	5.3	4.6	V

Optical and Electrical Characteristics

		Symbol	Red	Green	MPB-Blue	EP-Blue	Unit
Dynamic Resistance	typ	Ω_{dyn}	0.02	0.03	0.02	0.05	Ω

Note 1: All ratings are based on operation with a constant heat sink temperature T_{hs} = 40ºC. See Thermal Resistance section for T_{hs} definition.

Note 2: Parameters rated at typical duty cycle and Pulsed operation frequency f>240Hz; $DC = \frac{t}{T}$



Note 3: Duty Cycle used to specify device ratings under Pulsed operation. PhlatLight devices can operate at duty cycles ranging from 1% to 100%. At higher duty cycles, drive current should be adjusted to maintain the junction temperature at desired levels to meet the application lifetime requirements.

Note 4: In pulsed operation, rise time from 10 to 90% of forward current should be larger than 0.5 microseconds

Note 5: For Blue and EP-Blue devices, total flux from emitting area at typical dominant wavelength. Refer to page 6 for brightness specifications at other wavelengths.

Note 6: In CIE 1931 chromaticity diagram coordinates, normalized to X+Y+Z=1

Note 7: For Reference only

Absolute Maximum Ratings

		Symbol	Red	Green	Blue	EP-Blue	Unit
Maximum Current[1]	Max		16	16	16	16	A
Absolute Maximum Junction Temperature[2]	Max	T_{jmax}	110	170	170	170	ºC
Storage Temperature Range			-40/+100	-40/+100	-40/+100	-40/+100	ºC

Note 1: Luminus PhlatLight LEDs are designed for operation to an absolute maximum forward drive current density of 2.5A/mm2 cw, and 3A/mm2 pulsed (f>240Hz, duty cycle < 60%). Please refer to absolute maximum rating table above for specific absolute maximum currents for the products covered in this datasheet.
Product lifetime data is specified at recommended forward drive currents. Sustained operation at absolute maximum currents will result in a reduction of device lifetime compared to recommended forward drive currents. Actual device lifetimes will also depend on junction temperature. Refer to the lifetime derating curves for further information.
In pulsed operation, rise time from 10 to 90% of forward current should be larger than 0.5 microseconds.

Note 2: Sustained operation at or above Maximum Operating Junction Temperature (T_{jmax}) will result in reduced device life time.

Wavelength and Brightness Distributions for MP-Blue

λ dom (nm)		Φ min (lm)	Φ max (lm)
455		150	245
456		160	260
457		165	275
458		175	290
459		185	305
460		195	320
461		205	335
462	*	215	350
463		220	365
464		230	380
465		240	395
466		250	410
467		260	425
468		265	435
469		275	450

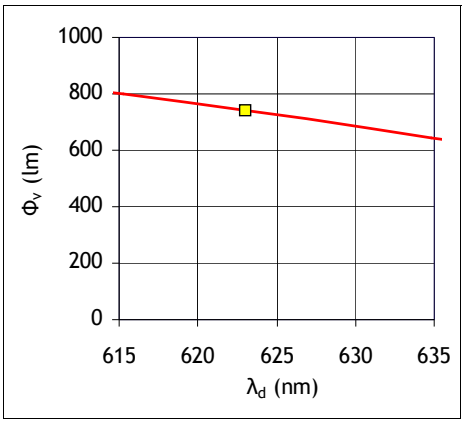
* Reference wavelengths used in Optical and Electrical Characteristics

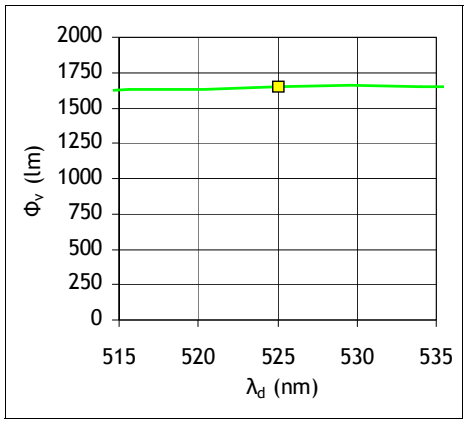
Wavelength and Brightness Distributions for EP-BLUE)

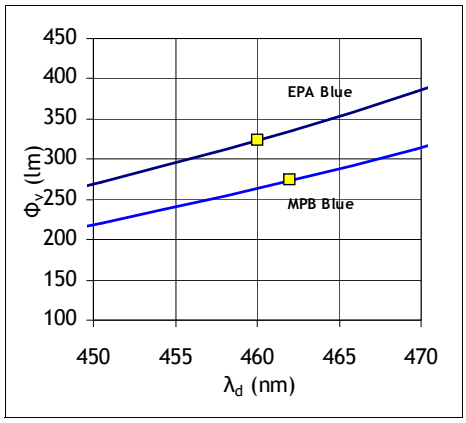
λ dom (nm)		Φ min (lm)	Φ max (lm)
450		140	230
451		150	245
452		160	265
453		175	280
454		185	300
455		195	315
456		205	330
457		215	350
458		225	365
459		235	380
460	*	250	400
461		260	415
462		270	435
463		280	450
464		290	465
465		300	485
466		310	500
467		320	520
468		335	535

* Reference wavelengths used in Optical and Electrical Characteristics

Luminous Flux variation with Wavelength: $\Phi_v = f(\lambda_d)$ at Recommended Operating Current I_F

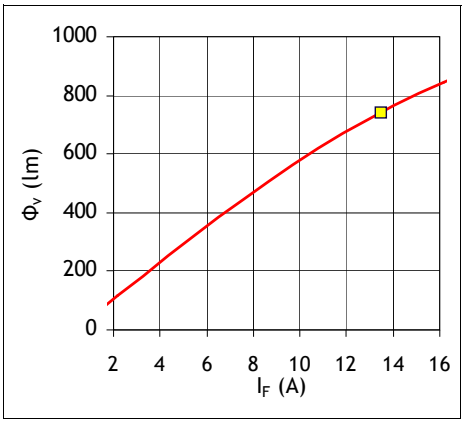


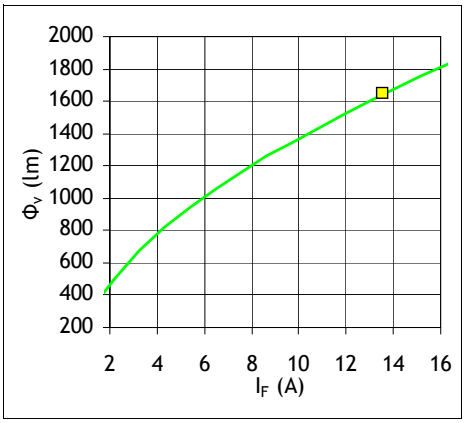


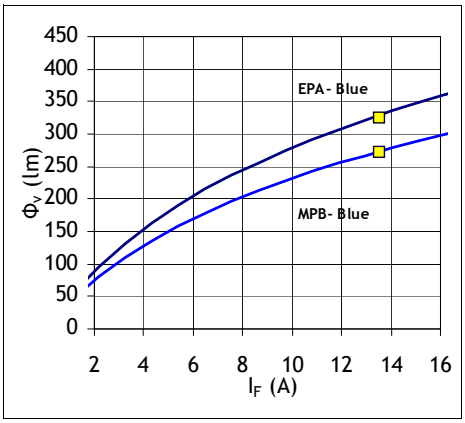


See note 1,2 on page 8.

Luminous Flux variation with Drive Current - $\Phi_v = f(I_F)$ - Typical

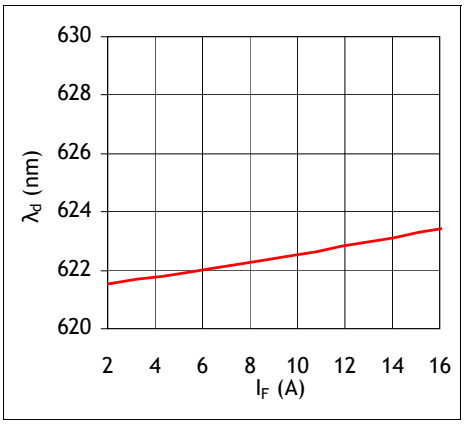


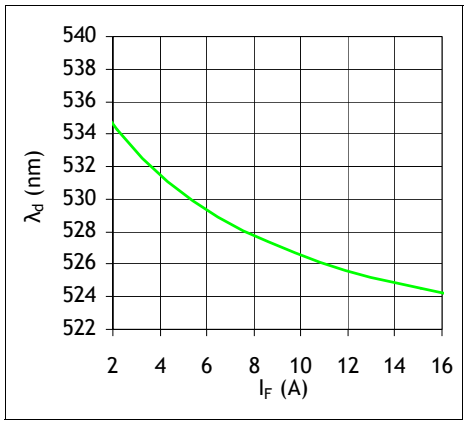


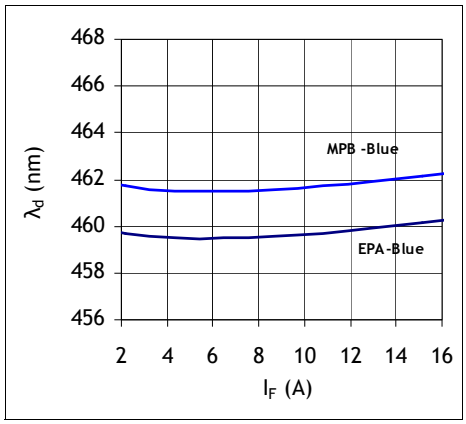


See notes 1,2 on page 8.

Dominant Wavelength variation with Forward Current - $\lambda_d = f(I_F)$ - Typical

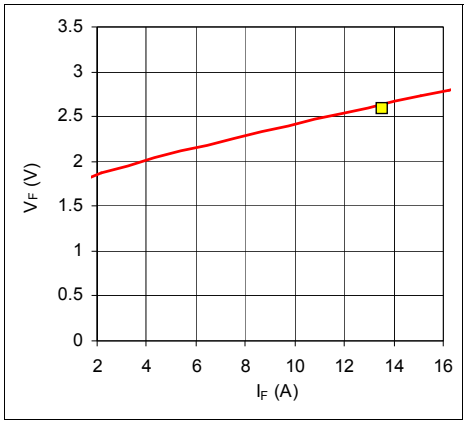


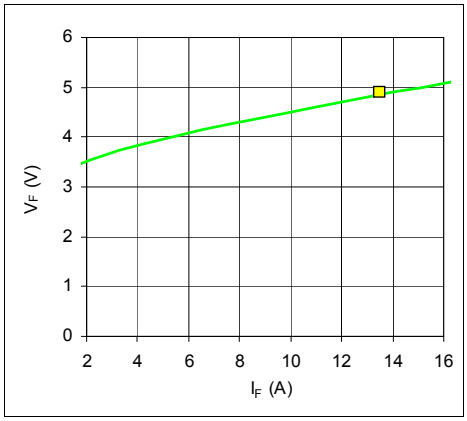


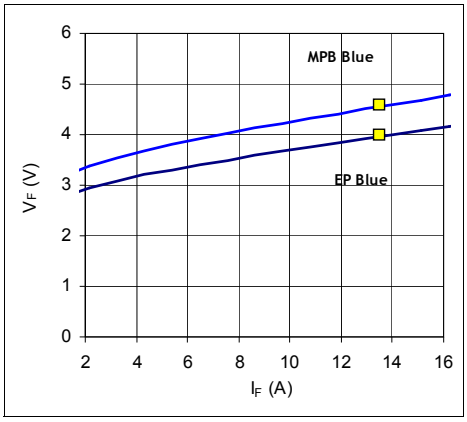


See notes 1,2 on page 8.

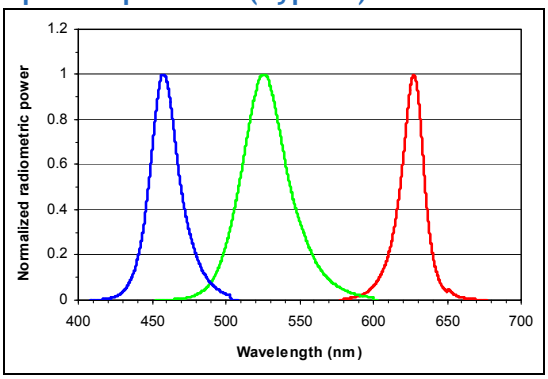
Forward Voltage variation with Drive current - $V_F = f(I_F)$ - Typical







Optical Spectrum (Typical)



See note 3 on page 8.

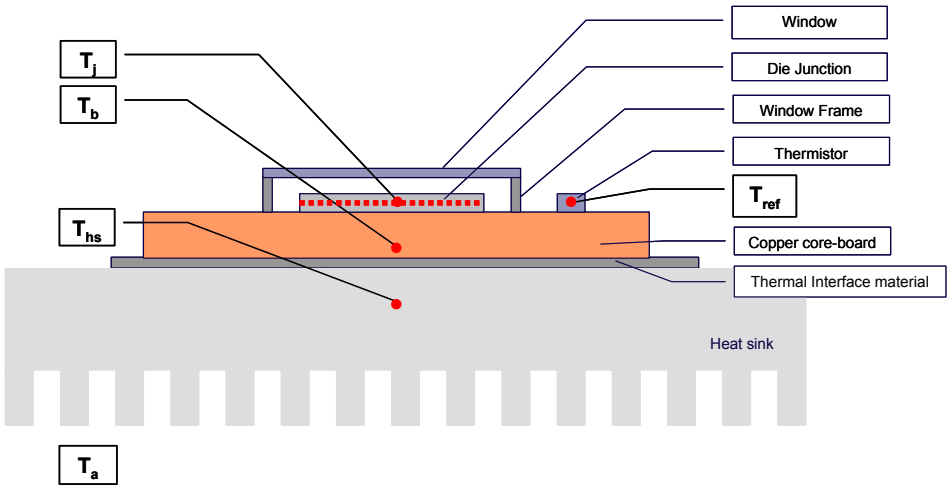
Chart Notes

Note 1: *For Pulsed operation, typical RGB duty cycles used are 25%, 50% and 25% respectively (T_{hs}=40°C).*

Note 2: *Yellow square indicate device operating point under reference conditions listed in the Optical and Electrical Characteristics table.*

Note 3: *Typical Spectrum at recommended peak drive current.*

Thermal Resistance



T_{hs} definition = 3 mm from core-board

Typical Thermal Resistance

$R_{\theta j\text{-}b}$ [1]	1.0 °C/W
$R_{\theta b\text{-}hs}$ [2]	0.2 °C/W
$R_{\theta j\text{-}hs}$ [1,2]	1.2 °C/W
$R_{\theta j\text{-}ref}$ [2]	1.0 °C/W

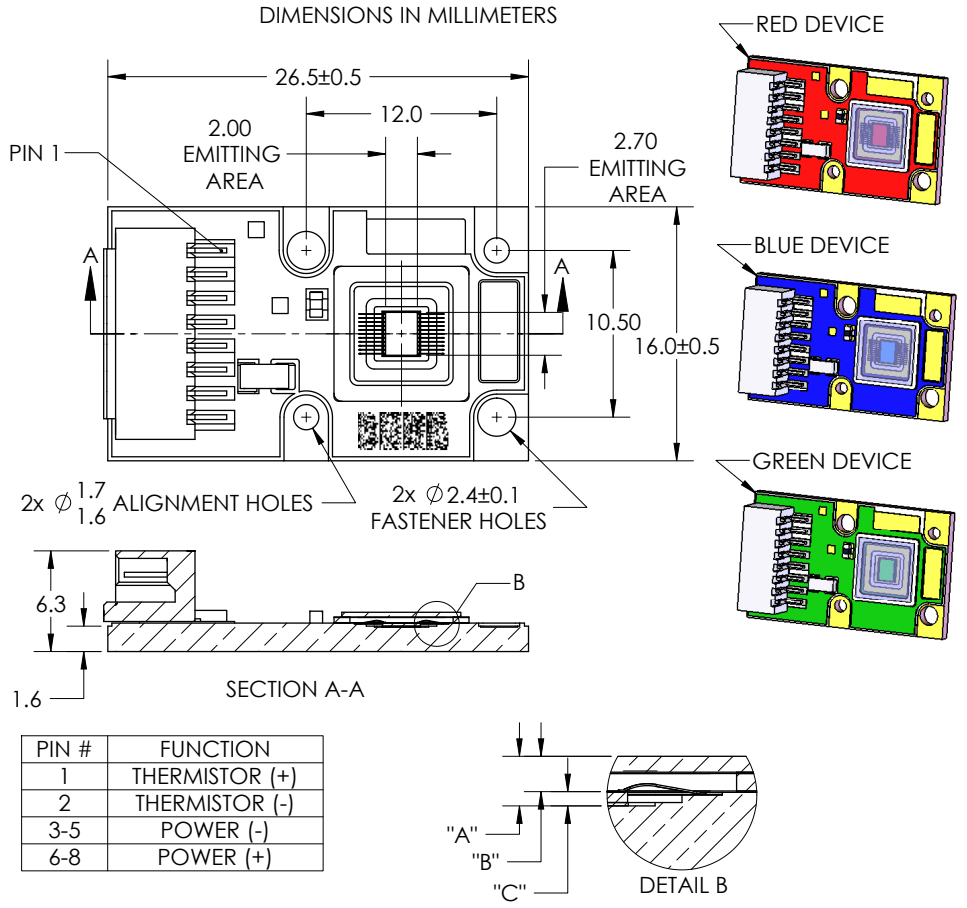
Note 1: Thermal resistance values are based on finite element analysis model results correlated to measured $R_{\theta j\text{-}hs}$ data.

Note 2: Thermal Resistance is based on eGraph 1205 Thermal interface.

Thermistor Information

The thermistor used in PhlatLight™ devices mounted on core-boards is from Murata Manufacturing Co. The global part number is NCP15XH103J03RC. Please see http://www.murata.com/ or http://www.murata.co.jp for details on calculating thermistor temperature.

Mechanical Dimensions (Standard Die Configuration)



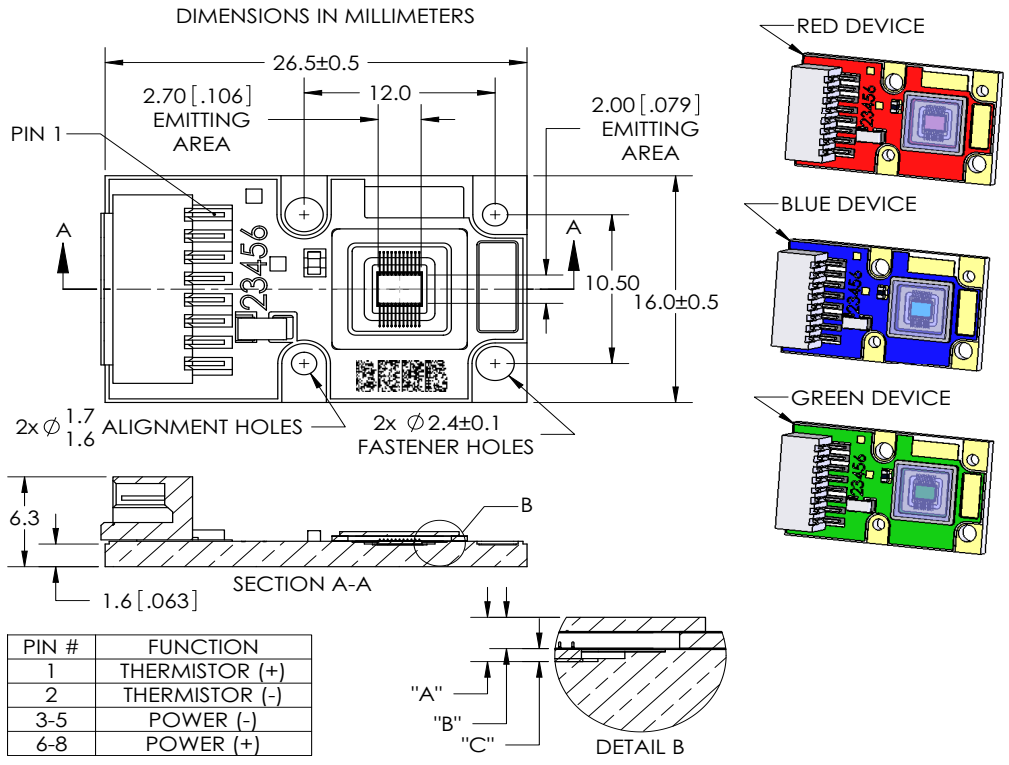
PIN #	FUNCTION
1	THERMISTOR (+)
2	THERMISTOR (-)
3-5	POWER (-)
6-8	POWER (+)

DIMENSION NAME	DESCRIPTION	NOMINAL DIMENSION	TOLERANCE
"A"	TOP OF METAL SUBSTRATE TO TOP OF GLASS	0.94	±0.13
"B"	EMITTING AREA TO TOP OF GLASS	0.67	±0.16
"C"	TOP OF METAL SUBSTRATE TO EMITTING AREA	0.27	±0.05

DWG-001262

- *Red, Green and Blue PT54 PhlatLight™ LEDs are individually assembled into a Type CX, Common Anode Copper Core-Board with a footprint of 26.5 mm x 16 mm.*
- *Dimension above for information only. For detailed dimensions, always refer to the latest revision of the DWG-001262 package outline*
- *Connector: MOLEX. Part Number: 874380843. Please refer to DWG-001262 (separate document) for pin-out information*

Mechanical Dimension (Rotated Die Configuration)



PIN #	FUNCTION
1	THERMISTOR (+)
2	THERMISTOR (-)
3-5	POWER (-)
6-8	POWER (+)

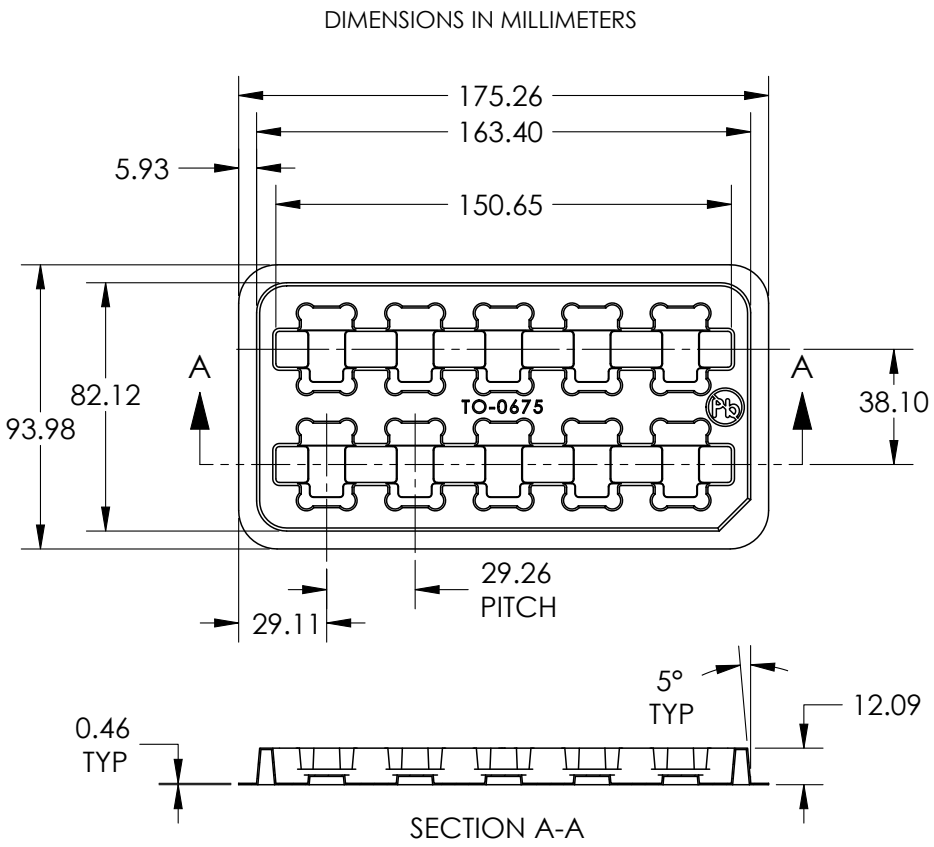
DIMENSION NAME	DESCRIPTION	NOMINAL DIMENSION	TOLERANCE
"A"	TOP OF METAL SUBSTRATE TO TOP OF GLASS	0.94	±0.13
"B"	EMITTING AREA TO TOP OF GLASS	0.67	± 0.16
"C"	TOP OF METAL SUBSTRATE TO EMITTING AREA	0.27	± 0.05

DWG-001264

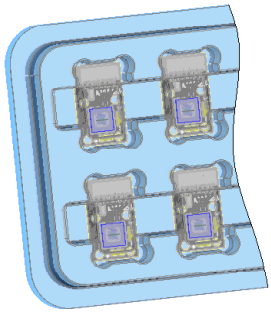
- *Red, Green and Blue PT54 PhlatLight™ LEDs are individually assembled into a Type CX, Common Anode Copper Core-Board with a footprint of 26.5 mm x 16 mm.*
- *Dimension above for information only. For detailed dimensions, always refer to the latest revision of the DWG-001264 package outline*
- *Connector: MOLEX. Part Number: 874380843. Please refer to DWG-001264 (separate document) for pin-out information*

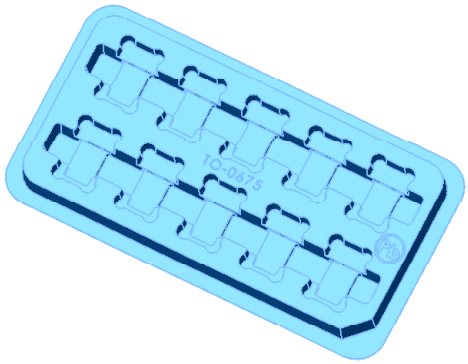
Shipping Tray Outline

For detailed drawing of shipping trays, please refer to TO-0675 document



TOP TRAY SHOWN TRANSPARENT
FOR REFERENCE ONLY



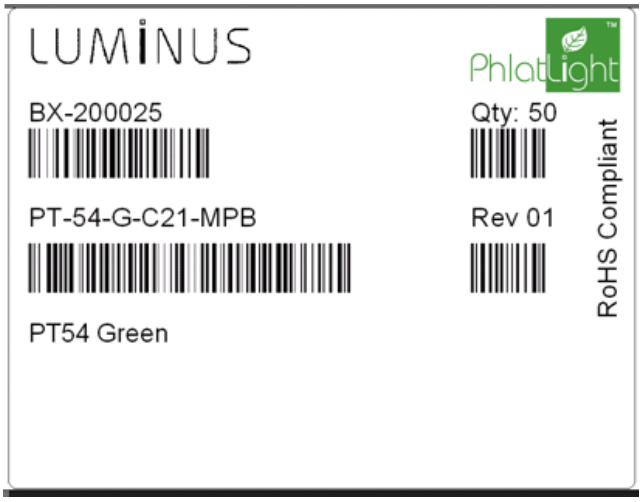


Packing Specification

Pack

Packing Case	Qty/Pack	Dimensions (WxLxH, mm)	Gross Weight (kg)
Pack (Stack of 5 Trays with 10 devices each) (Pack is enclosed in ESD bag)	50	95 x 176 x 50	0.45

Pack Labels (example)



Sample labels - For illustration only

- **Pack Label Fields:** (Label fields are subject to change)
- 6-digit Pack Number: (Luminus Internal Use)
- Luminus Ordering Part Number
- Luminus_Product_Description: (Device Type and Color)
- Quantity of devices in the pack
- Part Number Revision: (Luminus Internal Use)
- Optional Fields may include Customer's Part Number

Shipping Box

Shipping Box	Quantity	Material	Dimensions (WxLxH, mm)
Carton Box	1 - 20 Packs (50 - 1000 Devices)	S4651	560 x 560 x 200

History of Changes

Rev	Date	Description of Change
01	01/12/09	Preliminary Production Specification
02	07/10/09	Add outline drawing and ordering part numbers for rotated-die option
03	09/09/09	Update Thermal Coefficients Update Blue Vf Specification Update Blue and Green Luminuous Flux Max. Specification
04	03/05/10	Add EP-Blue specifications and ordering part numbers
05	07/19/10	Add MPC-Green specifications and ordering part numbers
06	1/28/11	Add bin and binkit definitions