PT54 LEDs

Table of Contents

Technology Overview 2
Understanding Big Chip Test Specifications 2
Ordering Information 3
Flux /Power Bin Definition . .4
Optical & Electrical Characteristics 5- 6
Blue Flux Bin Ranges by Wavelength 7
Parametric Graphs 8-9
Thermal Resistance 10
Mechanical Dimensions11-12
Shipping Tray Outline 13
Packing and Shipping Specifications 14
History of Changes 15

Features:

- Matched RGB Chipset with 5.4mm^2 emitting area designed for LED projector applications
- Photonic lattice technology for very high surface brightness and uniform surface emission
- Wide color gamut: RED 623 nm, Red-Amber 615nm, GREEN 526 nm, Blue 460nm typical dominant wavelength
- Single emitting area per color allows for collection with single lens for simplified optics
- Aspect ratio optimized and compatible with SVGA, XGA and WXGA micro-displays
- Thermally efficient Common Anode copper-core PCB package
- RoHS (EU-2002/95/EC Directive) and REACH compliant

Applications

- Specifically engineered for high brightness pocket-size, ultra portable front projectors, head-up projection displays and hybrid projectors
- Optimized for Micro-Display diagonal sizes ranging from 0.4" to 0.6"
- Suitable for DLP™ (0.45"WXGA, 0.55" SVGA and XGA), LCoS , 3LCD and HTPS microdisplays

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Technology Overview

Luminus Big Chip LEDs™ benefit from a suite of innovations in the fields of chip technology, packaging and thermal management. These breakthroughs allow illumination engineers and system designers to achieve solutions that are high brightness and high efficiency.

Photonic Lattice Technology

Luminus' photonic lattice technology enables large area LED chips with uniform brightness over the entire LED chip surface. The optical power and brightness produced by these large monolithic chips enable solutions which replace arc and halogen lamps where arrays of traditional high power LEDs cannot.

For red, green and blue LEDs, the photonic lattice structures extract more light and create radiation patterns that are more collimated than traditional LEDs. (Having higher collimation from the source increases optical collection efficiencies and simplifies optical designs.)

Packaging Technology

Thermal management is critical in high power LED applications. With a thermal resistance from junction to case of 1.0° C/W, Luminus PT54 LEDs can be driven at higher current densities while maintaining a low junction temperature, thereby resulting in brighter solutions and longer lifetimes.

Reliability

For high power operation, Luminus Big Chip LEDs are one of the most reliable light sources in the world today. Big Chip LEDs have passed a rigorous suite of environmental and mechanical stress tests, including mechanical shock, vibration, temperature cycling and humidity, and have been fully qualified for use in extreme high power and high current applications. With very low failure rates and median lifetimes that typically exceed 60,000 hours, Luminus Big Chip LEDs are ready for even the most demanding applications. (Please refer to Luminus' Reliability application note for more information.)

Environmental Benefits

Luminus LEDs help reduce power consumption and the amount of hazardous waste entering the environment. All Big Chip LED products manufactured by Luminus are RoHS and REACH compliant and free of hazardous materials, including lead and mercury.

Understanding Big Chip LED Test Specifications

Every Luminus LED is extensively tested at full current to ensure that it meets the high quality standards expected from Luminus' products.

Testing of Big Chip LEDs

Luminus core board products are typically measured in such a way that the characteristics reported agree with how the devices will actually perform when incorporated into a system. This measurement is accomplished by mounting the devices on a 40°C heat sink and allowing the device to reach thermal equilibrium while fully powered. Only after the device reaches equilibrium are the measurements taken. This method of measurement ensures that Luminus Big Chip LEDs perform in the field just as they are specified.

Luminus surface mount LEDs are typically tested with a 20mSec input pulse and a junction temperature of 25°C. Expected flux values in real world operation can be extrapolated based on the information contained within this product data sheet.

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Ordering Information

Ordering Part Number [1]	Color	Min Flux or Power Bin [2]	Description
PT-54-R-C21-MPC	Red	4B	Red LED, consisting of a 5.4 mm2 Red LED chip, thermistor and connector mounted on a copper-core PCB.
PT-54-R-C21-MPD		4C	
PT-54-RA-C21-MPD	Red Amber	4C	Red-Amber LED, consisting of a 5.4 mm2 Red-Amber LED chip, thermistor and connector mounted on a copper-core PCB.
PT-54-RA-C21-MPE		4D	
PT-54-RA-C21-MPF		4E	
PT-54-G-C21-MPC	Green	4B	Green LED, consisting of a 5.4 mm2 Green LED chip, thermistor and connector mounted on a copper-core PCB.
PT-54-G-C21-MPD		4C	
PT-54-G-C21-MPE		4D	
PT-54-G-C21-MPF		4E	
PT-54-B-C21-EPA	Blue	4C	Blue LED, consisting of a 5.4 mm2 Blue LED chip, thermistor and connector mounted on a copper-core PCB.
PT-54-B-C21-EPB		4D	
PT-54-B-C21-EPC		4E	

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 / Power bin definitions on page 4

Ordering Part Number Nomenclature

XXX — 00 — XXXX — X00 — XXX

Product Family	Chip Area	Color	Package Configuration	Bin Kit [1]
PT: Metal Coreboard PCB	54: 5.4 mm^2	R= Red (623nm, typ) RA= Red -Amber (615nm, typ) G= Green B= Blue	C21: 26.5mm x 16.0 mm (standard) C22: 26.5mm x 16.0 mm (die rotated) See Mechanical Drawing section	See page 4 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. Individual flux 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).

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PT54 Bin Kit[1] and Flux Bin[2,3,4] Definitions

Note: Please refer to ordering part number table on page 3 for Bin Kit availability

Red Flux Bins	Bin 4B	Bin 4C	Bin 4D	Bin 4E	Bin 4F	Bin 4G	Bin 4H	Bin 4J	Bin 4K
Red Bin Flux Range (lm)	650-700	700-775	775-850	850-925	925-990	990-1055	1055-1125	1125-1200	1200-1275
PT-54-R-C21-MPC	☑	☑	☑	☑	☑				
PT-54-R-C21-MPD		☑	☑	☑	☑	☑			
Red -Amber Flux Bins	**Bin 4B**	**Bin 4C**	**Bin 4D**	**Bin 4E**	**Bin 4F**	**Bin 4G**	**Bin 4H**	**Bin 4J**	**Bin 4K**
Red -Amber Bin Flux Range (lm)	650-700	700-775	775-850	850-925	925-990	990-1055	1055-1125	1125-1200	1200-1275
PT-54-RA-C21-MPD		☑	☑	☑	☑	☑			
PT-54-RA-C21-MPE			☑	☑	☑	☑	☑		
PT-54-RA-C21-MPF				☑	☑	☑	☑	☑	
Green Flux Bins	**Bin 4B**	**Bin 4C**	**Bin 4D**	**Bin 4E**	**Bin 4F**	**Bin 4G**	**Bin 4H**	**Bin 4J**	**Bin 4K**
Green Bin Flux Range (lm)	1400-1500	1500-1600	1600-1700	1700-1800	1800-1900	1900-2000	2000-2150	2150-2300	2300-2450
PT-54-G-C21-MPC	☑	☑	☑	☑	☑	☑			
PT-54-G-C21-MPD		☑	☑	☑	☑	☑	☑		
PT-54-G-C21-MPE			☑	☑	☑	☑	☑	☑	
PT-54-G-C21-MPF				☑	☑	☑	☑	☑	☑
Blue Power Bins	**Bin 4C**	**Bin 4D**	**Bin 4E**	**Bin 4F**	**Bin 4G**	**Bin 4H**	**Bin 4J**	**Bin 4K**	**Bin 4L**
Blue Bin Flux Range (lm)	275-300	300-325	325-350	350-375	375-400	400-440	440-475	475-510	510-550
PT-54-B-C21-EPA	☑	☑	☑	☑	☑				
PT-54-B-C21-EPB		☑	☑	☑	☑	☑			
PT-54-B-C21-EPC			☑	☑	☑	☑	☑		

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. 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, Red-Amber and Blue. and at 50% duty cycle for Green Devices. Devices are sorted and packed by flux bin. Not all flux bins are are currrently populated.

Note 3: Luminus maintains a test measurement accuracy for LED flux and power of +/- 6%.

Note 4: Blue Flux bin limits are defined at reference dominant wavelength of 462nm. See table on page 7 for Blue bin limits at other dominant wavelengths.

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Optical & Electrical Characteristics

General Characteristics		Symbol	Red	Red -Amber Preliminary	Green	Blue	Unit
Emitting Area		x	5.4	5.4	5.4	5.4	mm^2
Emitting Area Dimensions		x	2.7x 2.0	2.7x 2.0	2.7x 2.0	2.7x 2.0	mmxmm
Characteristics at Recommended Test Drive Current , I_f [1, 2]							
Reference Duty Cycle [3]			25	25	50	25	%
Test Peak Drive Current [1,2,4]	typ	I_F	13.5	13.5	13.5	13.5	A
Peak Luminuous Flux [1,2,5]	typ	Φ_v	750	950	1900	350	lm
Peak Radiometric Flux [1,2]	typ	Φ_r	4.2	4.1	4.1	7.5	W
Dominant Wavelength	min	λ_{dmin}	619	611	516	450	nm
	typ	λ_d	623	615	525	460	nm
	max	λ_{dmax}	630	622	535	468	nm
FWHM- Spectral bandwidth at 50% of Φv	typ		19	19	34	20	nm
Chromaticity Coordinates [6,7]	typ	x	0.698	0.680	0.167	0.147	
	typ	y	0.302	0.320	0.714	0.033	
Forward Voltage	min	$V_{F\,min}$	2.2	2.2	3.5	3.2	V
	typ	V_F	2.6	2.6	4.9	3.9	V
	max	$V_{F\,max}$	3.2	3.2	5.9	5.2	V
Dynamic Resistance	typ		0.05	0.05	0.09	0.05	Ω
Device Thermal Characteristics							
Thermal Coefficient of Photometric Flux	typ		-1.0	tbd	-0.2	~0	% / °C
Thermal Coefficient of Radiometric Flux	typ		-0.6	tbd	-0.2	-0.2	% / °C
Forward Voltage Temperature Coefficient	typ		-1.5	tbd	-1.0	-3	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	530	1330	250	lm
Radiometric Flux	typ	Φ_r	2.4	2.3	2.7	5.0	W
Dominant Wavelength	typ	λ_d	624	616	528	462	nm
FWHM -Spectral bandwidth at 50% of Φv	typ		18	18	36	21	nm
Chromaticity Coordinates [6,7]	typ	x	0.700	0.682	0.171	0.145	nm
	typ	y	0.300	0.318	0.702	0.036	nm
Forward Voltage	typ	V_F	2.3	2.3	4.4	3.4	V

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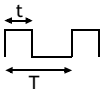
Optical & Electrical Characteristics

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

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



Note 3: Duty Cycle used to specify device ratings under Pulsed operation. Big Chip LED 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 devices, total flux from emitting area at typical dominant wavelength. Refer to page 7 for brightness specifications at other wavelength

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

Note 7: For Reference only

Absolute Maximum Ratings

	Symbol	Red	Red -Amber	Green	Blue	Unit
Minimum Current (CW or Pulsed)[1]		200	200	200	200	mA
Maximum Current (CW) [2]		13.5	13.5	13.5	13.5	A
Maximum Current (Pulsed) [1,2] (t<=2.5ms, frequency > 240Hz, duty cycle <60%)		16	16	16	16	A
Absolute Maximum Junction Temperature [2]	T_{jmax}	110	110	170	170	°C
Storage Temperature Range		-40 / +100	-40 / +100	-40 / +100	-40 / +100	°C

Note 1: Luminus Big Chip LEDs are designed for operation to an absolute maximum forward drive current density of 2.5A/mm^2 cw, and 3A/mm^2 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 termperature (see note 2 below). Refer to lifetime derating curves for further information.

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

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Blue Bin Flux Ranges by Dominant Wavelength [1,2]

	Bin 4C		Bin 4D		Bin 4E		Bin 4F		Bin 4G		Bin 4H		Bin 4J	
DWL	Min (lm)	Max (lm)	Min (lm)	Max (lm)	Min (lm)	Max (lm)	Min (lm)	Max (lm)	Min (lm)	Max (lm)	Min (lm)	Max (lm)	Min (lm)	Max (lm)
450	134	146	146	158	158	171	171	183	183	195	195	214	214	231
451	146	159	159	172	172	185	185	199	199	212	212	233	233	252
452	157	172	172	186	186	200	200	215	215	229	229	252	252	272
453	169	185	185	200	200	215	215	231	231	246	246	271	271	292
454	181	197	197	214	214	230	230	247	247	263	263	290	290	313
455	193	210	210	228	228	245	245	263	263	280	280	308	308	333
456	204	223	223	242	242	260	260	279	279	297	297	327	327	353
457	216	236	236	256	256	275	275	295	295	315	315	346	346	374
458	228	249	249	269	269	290	290	311	311	332	332	365	365	394
459	240	262	262	283	283	305	305	327	327	349	349	384	384	414
460	251	274	274	297	297	320	320	343	343	366	366	402	402	434
461	263	287	287	311	311	335	335	359	359	383	383	421	421	455
462	275	300	300	325	325	350	350	375	375	400	400	440	440	475
463	287	313	313	339	339	365	365	391	391	417	417	459	459	495
464	299	326	326	353	353	380	380	407	407	434	434	478	478	516
465	310	338	338	367	367	395	395	423	423	451	451	496	496	536
466	322	351	351	381	381	410	410	439	439	468	468	515	515	556
467	334	364	364	394	394	425	425	455	455	485	485	534	534	576
468	346	377	377	408	408	440	440	471	471	503	503	553	553	597

Note 1: Flux Min, Max values are continuous as function of dominant wavelength values. For illustration purposes, flux Min and Max values are provided at discrete dominant wavelength values.

Note 2: Luminus maintains a test measurement accuracy for LED flux and power of +/- 6%.

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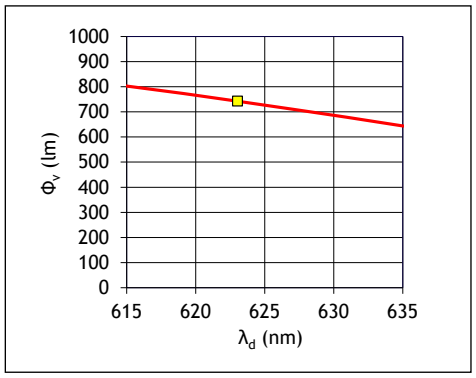
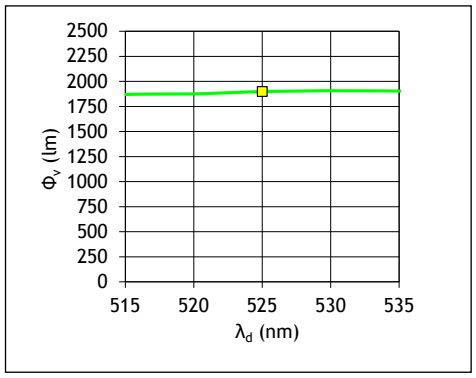
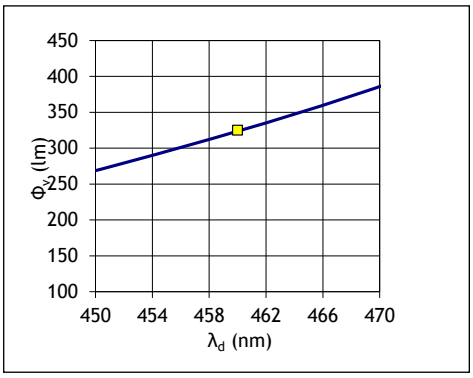
Luminous Flux variation with Wavelength: $\Phi_v = f(\lambda_d)$ at Test Drive Current $I_F = 13.5$ A

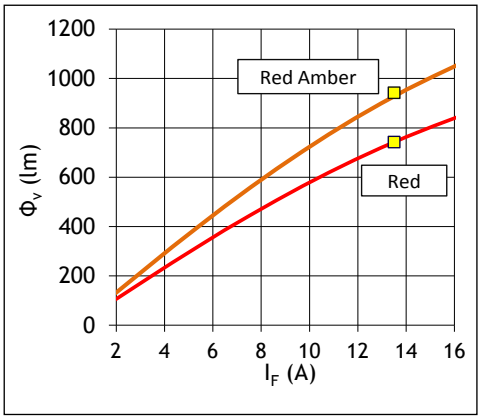


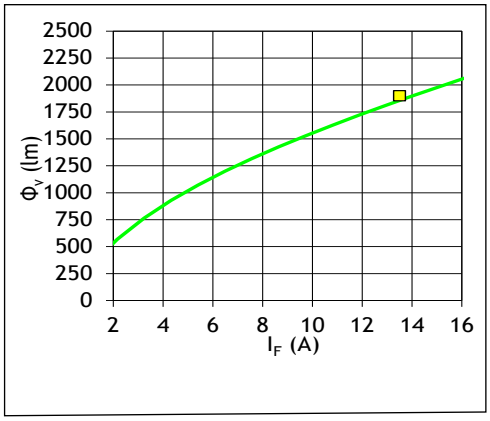


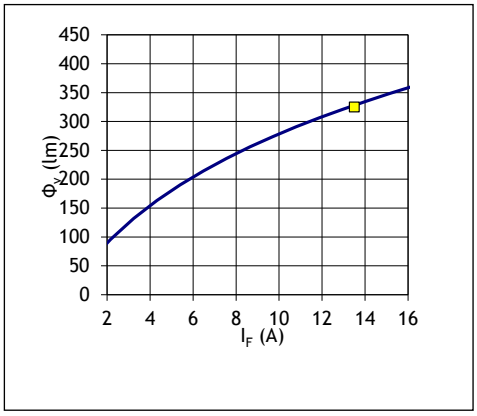


See notes 1,2, 3 on page 9. See note 4 on page 9 regarding Red-Amber.

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

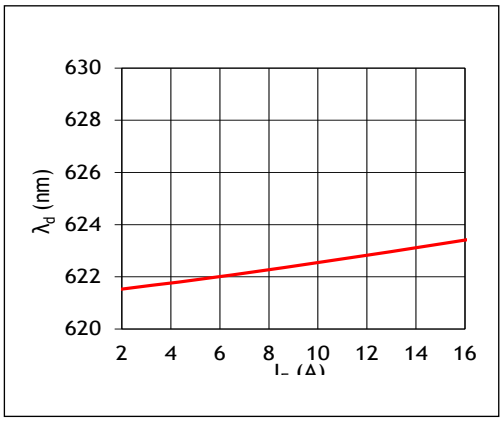


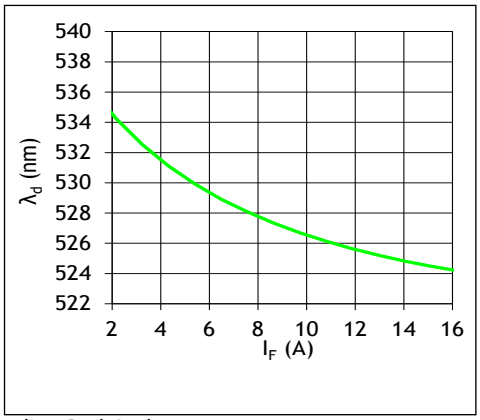


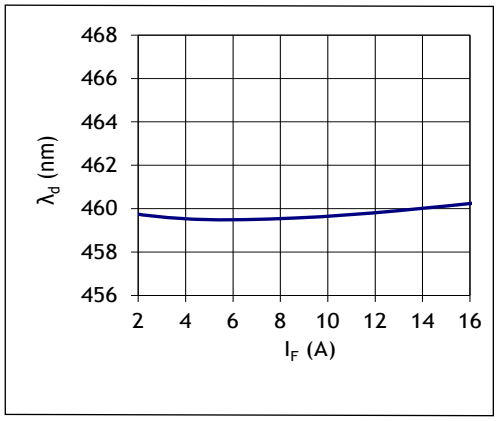


See notes 1,2, 3 on page 9

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







See notes 1,2, 3 on page 9. See note 4 on page 9 regarding Red-Amber.

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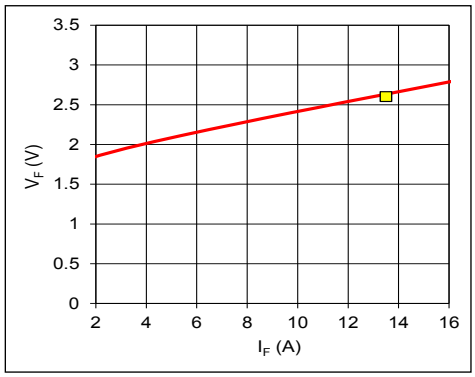
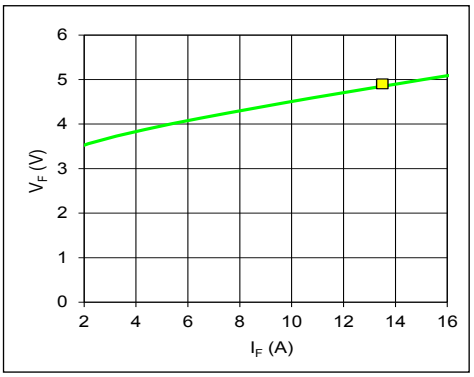
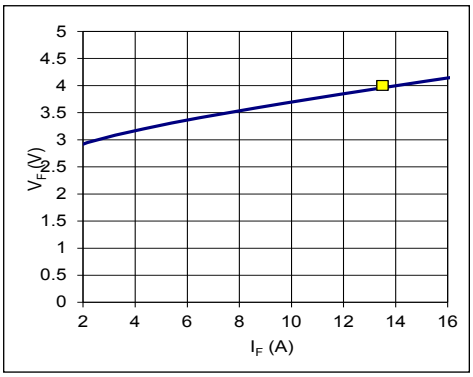
Forward Voltage variation with Drive current - $V_F = f(I_F)$ - Typical

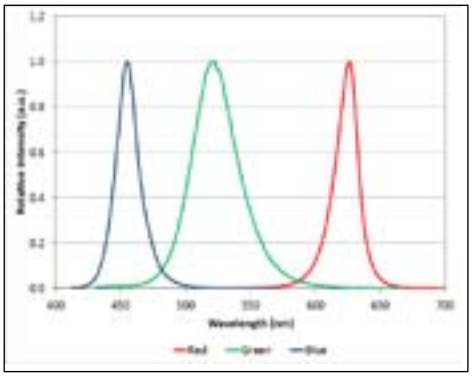






See notes 1,2, 3 on page 9

Optical Spectrum (Typical)



See notes 1,2, 4 on page 9

Note 1: For Pulsed operation, the reference 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: Parametric graphs for Red-Amber are TBD. These will be added as they become available.

Note 4: Typical spectrum at recommended peak drive current . (Typical Spectrum is also available for Red, Red-Amber, Green and Blue in tabulated format.)

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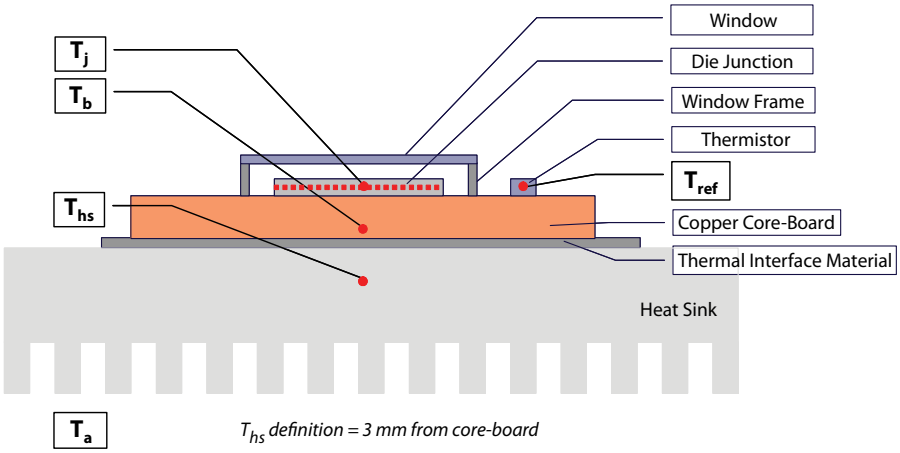
Thermal Resistance



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 FEA model results correlated to measured $R_{\theta j\text{-}hs}$ data.

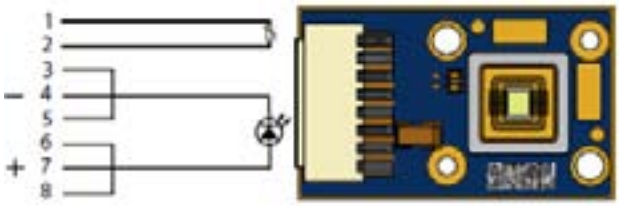
Note 2: Thermal Resistance is based on eGraf 1205 Thermal interface.

Thermistor Information

The thermistor used in PT54 devices are mounted on coreboards is from Murata Manufacturing Co. The global part number is NCP15XH103J03RC. Please see http://www.murata.com/ for details on calculating thermistor temperature.

For more information on use of the thermistor, please contact Luminus directly.

Electrical Pinout



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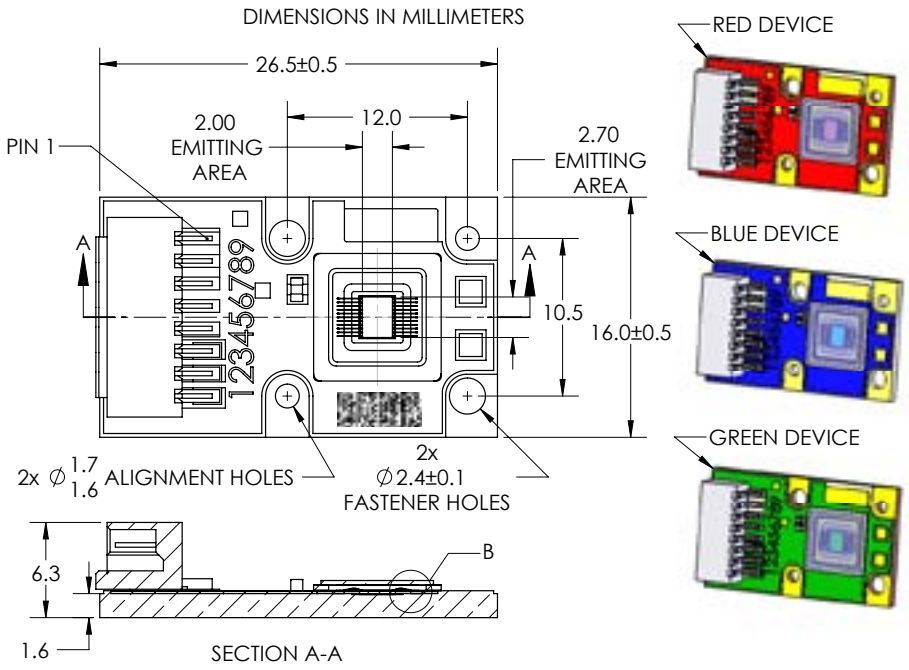
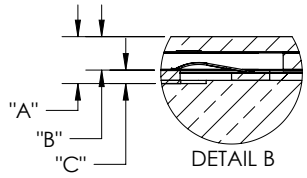
Mechanical Dimensions -Standard Die Configuration



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-001702

Notes:
1) Red, Green and Blue PT54 Big Chip LEDs are individually assembled into a common anode copper core- board with a footprint of 26.5 mm x 16 mm.
2) Dimensions above are for information only. Refer to the latest revision of the DWG- 001702 for package outline and mechanical specifications (For legacy coreboard with interconnect clip, please see DWG-001262).
3) Connector- MOLEX Part Number: 874380843 or Global Part Number: WTB16-081SF. Please refer to DWG-001702, mechanical specification for pin-out information.

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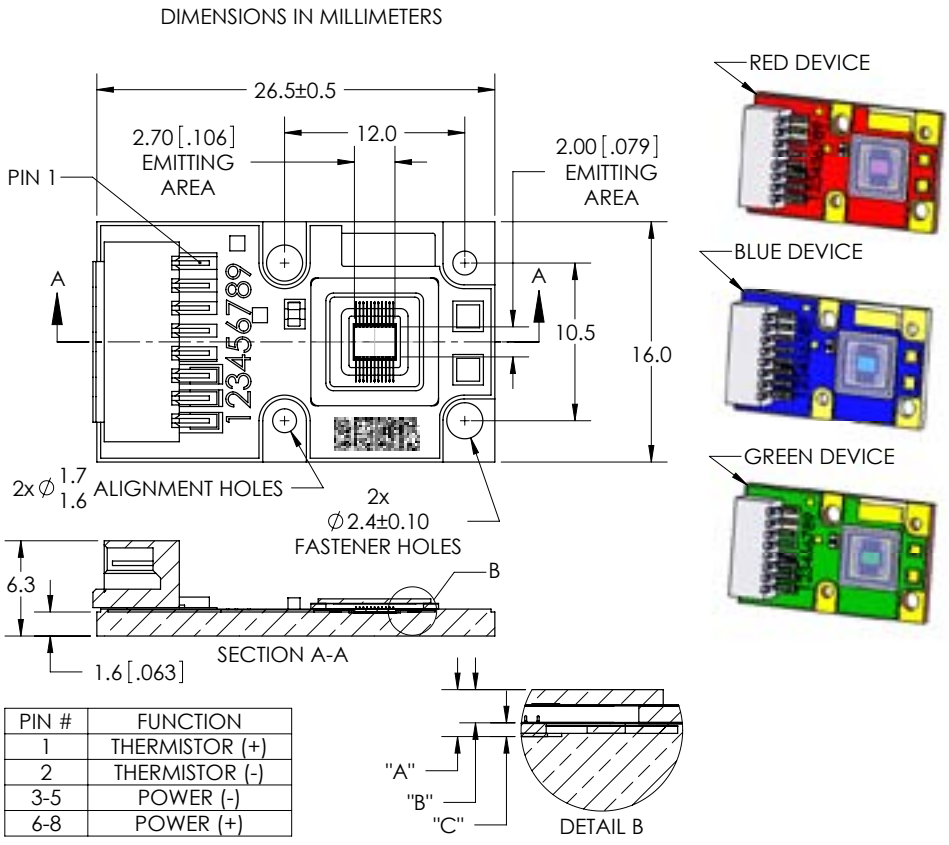
Mechanical Dimensions –Rotated Die Configuration



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-001704

Notes:
1) Red, Green and Blue PT54 Big Chip LEDs are individually assembled into a common anode copper core- board with a footprint of 26.5 mm x 16 mm.
2) Dimensions above are for information only. Refer to the latest revision of the DWG- 001702 for package outline and mechanical specifications. (For legacy coreboard with interconnect clip, please see DWG-001264)
3) Connector- MOLEX Part Number: 874380843 or Global Part Number: WTB16-081SF. Please refer to DWG-001704, mechanical specification for pin-out information

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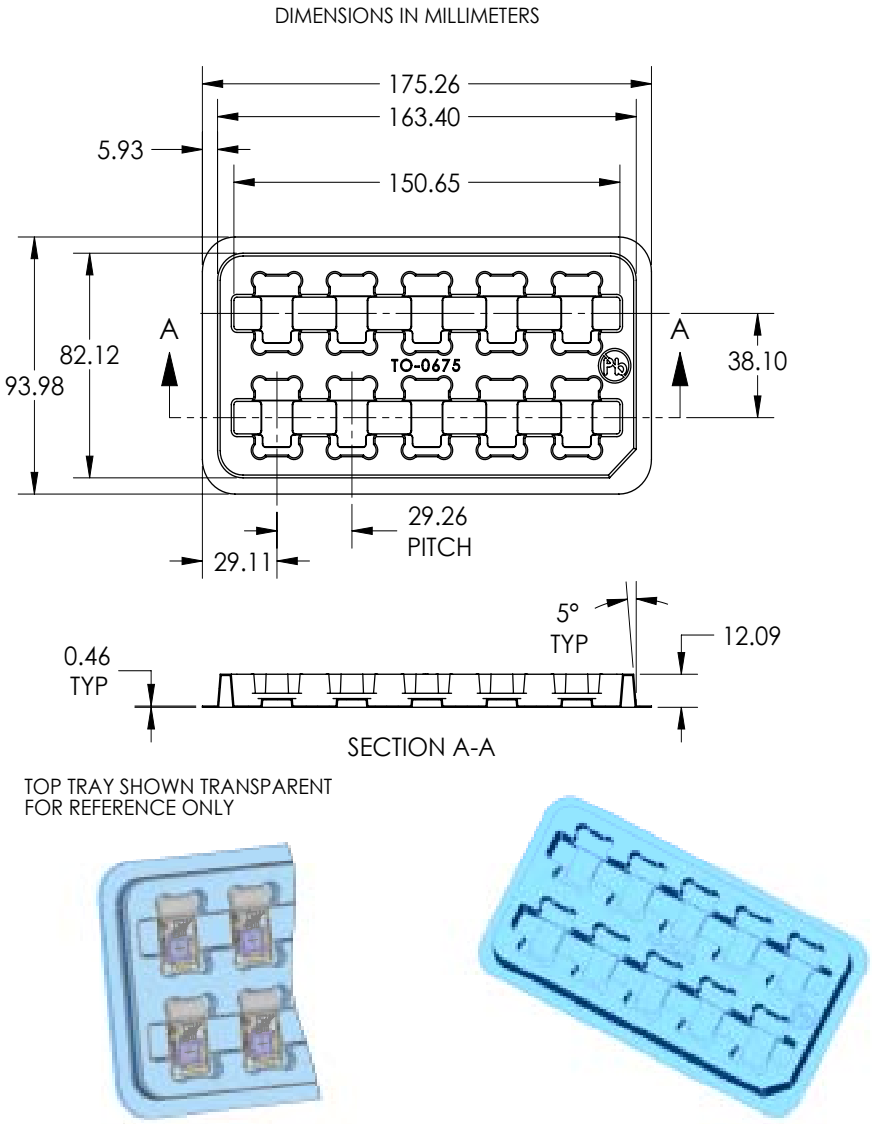
Shipping Tray Outline



For detailed drawing of shipping trays, please refer to document TO-0675 , available upon request.

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Packing and Shipping Specifications

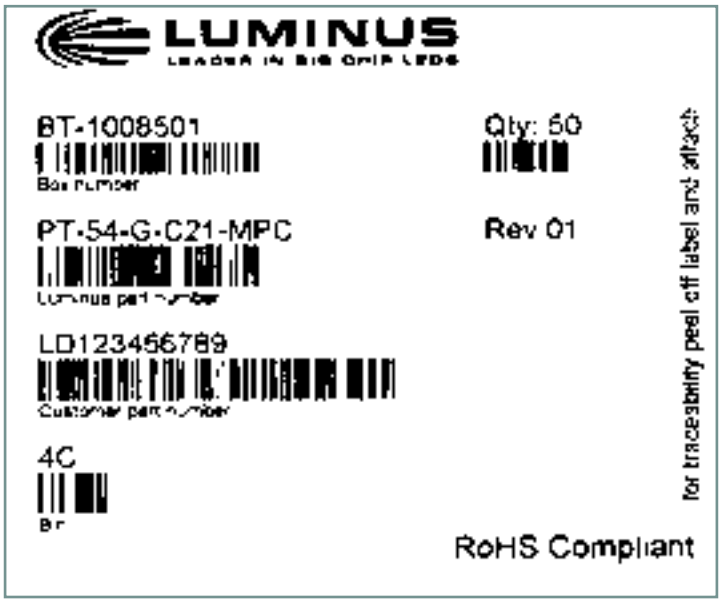
Packing Specification

Packing Configuration	Qty /Pack	Reel Dimensions (diameter x W, mm)	Gross Weight (kg)
Stack of 5 trays with 10 devices per tray Each pack is enclosed in ESD bag	50	95 x 176 x 50	0.45

Product Label Specification

Label Fields:

- 6-8 digit Box number (for Luminus internal use)
- Luminus ordering part number
- Quantity of devices in pack
- Part number revision (for Luminus internal use)
- Customer's part number (optional)
- Flux Bin



Sample label –for illustration only

Shipping Box

Shipping Box	Quantity	Material	Dimensions (L x W x H, mm)
Carton Box	1 -20 packs	S4651	560 x 560 x 200

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History of Changes

Rev	Date	Description of Change
01	01/29/09	Preliminary product specification
02	07/10/09	Add outline drawing and ordering part numbers for rotated -die configuration
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
06	01/28/11	Add bin and binkit definitions
07	01/27/12	Update mechanical drawings; Introduce ordering part numbers for PT-54 Red-Amber product and preliminary specifications; Implement new corporate logo

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