Big Chip LED™
PT-54-TE

Thermally Enhanced
LED Projection Chipset

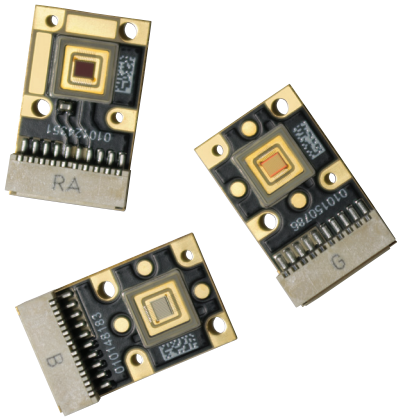

Table of Contents

Features:

- Matched RGB Chipset with 5.4 mm^2 emitting area designed for LED projector applications
- Aspect ratio optimized and compatible with SVGA, XGA, WXGA micro-display
- Ultra low thermal resistance package enables high performance applications [operation up to 16.2 A ($3A/mm^2$)].
- Photonic lattice technology for very high surface brightness and uniform surface emission
- Wide color gamut: Red-Amber 613 nm, Green 525 nm, Blue 460 nm typical dominant wavelength
- Single emitting area per color allows for collection with single lens for simplified optics
- High precision LED placement on copper core PCB for easier thermal management and optical integration
- Environmentally friendly: RoHS and REACH compliant

Applications

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

Packaging Technology

Thermal management is critical in high power LED applications. With a thermal resistance from junction to case of 0.7° C/W, Luminus PT-54 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.

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Ordering Information

Ordering Part Number [1]	Color	Min Flux or Power Bin [2]	Description
PT-54-RA-L31-MPF	Red-Amber (Common Anode)	4E	Red-Amber LED, consisting of a 5.4 mm² Red-Amber LED chip thermistor and connector mounted on a copper-core PCB (Common Anode).
PT-54-RA-L31-MPG		4F	
PT-54-RA-L31-MPH		4G	
PT-54-RAX-L35-MPH	Red-Amber (Common Cathode)	4G	Red-Amber LED, consisting of a 5.4 mm² Red-Amber LED chip, thermistor and connector mounted on a copper-core PCB (Common Cathode).
PT-54-RAX-L35-MPJ		4H	
PT-54-RAX-L35-MPK		4J	
PT-54-RAX-L35-MPL		4K	
PT-54-G-L31-MPH	Green	4G	Green LED, consisting of a 5.4 mm² Green LED chip and connector mounted on a copper-core PCB.
PT-54-G-L31-MPJ		4H	
PT-54-G-L31-MPK		4J	
PT-54-B-L31-EPD	Blue	4F	Blue LED, consisting of a 5.4 mm² Blue LED chip and connector mounted on a copper-core PCB.
PT-54-B-L31-EPE		4G	
PT-54-B-L31-EPF		4H	

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

PT — mm — XXXX — L3X — XYZ

Product Family	Chip Area	Color	Package Configuration	Bin Kit [1]
PT: Metal Coreboard PCB	54: 5.4 mm²	RA= Red-Amber RAX= Red-Amber G= Green B= Blue	L31: 26.5mm x 16.0 mm (common anode package,10-pin connector) L35: 26.5mm x 16.0 mm (common cathode package,10-pin connector) 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-G-L31-MPJ i s comprised of Red-Amber Flux Bins 4H, 4J, 4K, 4L, 4M.

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PT-54 Bin Kit[1] and Flux Bin[2,3,4,5] Definitions

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

Red-Amber (common anode) Flux Bins	Bin 4E	Bin 4F	Bin 4G	Bin 4H	Bin 4J	Bin 4K	Bin 4L	Bin 4M
Red-Amber Bin Flux Range[4] (lm)	850-925	925-990	990-1055	1055-1125	1125-1200	1200-1275	1275-1355	1355-1435
PT-54-RA-L31-MPF	☑	☑	☑	☑	☑			
PT-54-RA-L31-MPG		☑	☑	☑	☑	☑		
PT-54-RA-L31-MPH			☑	☑	☑	☑	☑	
RAX (common cathode) Flux Bins		Bin 4G	Bin 4H	Bin 4J	Bin 4K	Bin 4L	Bin 4M	Bin 4N
RAX Bin Flux Range[4] (lm)		990-1055	1055-1125	1125-1200	1200-1275	1275-1355	1355-1435	1435-1520
PT-54-RAX-L35-MPH		☑	☑	☑	☑	☑	☑	
PT-54-RAX-L35-MPJ			☑	☑	☑	☑	☑	☑
PT-54-RAX-L35-MPK				☑	☑	☑	☑	☑
PT-54-RAX-L35-MPL					☑	☑	☑	☑
Green Flux Bins	Bin 4G	Bin 4H	Bin 4J	Bin 4K	Bin 4L	Bin 4M	Bin 4N	
Green Bin Flux Range[4] (lm)	1900-2000	2000-2150	2150-2300	2300-2450	2450-2625	2625-2800	2800-3000	
PT-54-G-L31-MPH	☑	☑	☑	☑	☑			
PT-54-G-L31-MPJ		☑	☑	☑	☑	☑		
PT-54-G-L31-MPK			☑	☑	☑	☑	☑	
Blue Flux Bins	Bin 4F	Bin 4G	Bin 4H	Bin 4J	Bin 4K	Bin 4L	Bin 4M	
Blue Bin Flux Range[5] (lm)	350-375	375-400	400-440	440-475	475-510	510-550	550-590	
PT-54-B-L31-EPD	☑	☑	☑	☑	☑			
PT-54-B-L31-EPE		☑	☑	☑	☑	☑		
PT-54-B-L31-EPF			☑	☑	☑	☑	☑	

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 orderable.

Note 2: PT-54 LEDs are tested for luminous flux at 13.5 A 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 currently populated.

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

Note 4: Red and Green Flux bin limits apply across entire dominant wavelength range. Dominant wavelength range for Red Amber and Green devices are specified on the Optical & Electrical Characteristics section.

Note 5: Blue Flux bin limits are defined at reference dominant wavelength of 462 nm. See table on page 7 for Blue bin limits at other dominant wavelengths.

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Optical & Electrical Characteristics

General Characteristics		Symbol	Red-Amber (Common Anode)	Red-Amber (Common Cathode) (Preliminary)	Green	Blue	Unit
Emitting Area			5.4	5.4	5.4	5.4	mm^2
Emitting Area Dimensions			2.7 x 2.0	2.7 x 2.0	2.7x 2.0	2.7x 2.0	mmxmm
Characteristics at Reference 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	1000	1190	2250	400	lm
Peak Radiometric Flux [1,2]	typ	Φ_r	3.7	4.1	4.8	9.0	W
Dominant Wavelength	min	λ_{dmin}	609	609	516	450	nm
	typ	λ_d	613	613	525	460	nm
	max	λ_{dmax}	620	620	540	468	nm
FWHM- Spectral bandwidth at 50% of Φv	typ		19	19	34	20	nm
Chromaticity Coordinates [6,7]	typ	x	0.675	0.675	0.167	0.147	
	typ	y	0.325	0.325	0.704	0.033	
Forward Voltage	min	$V_{F\,min}$	2.2	2.4	3.5	3.0	V
	typ	V_F	2.6	3.0	5.2	3.7	V
	max	$V_{F\,max}$	3.2	3.7	5.9	4.5	V
Dynamic Resistance	typ		0.05	0.05	0.08	0.05	Ω
Device Thermal Characteristics							
Thermal Coefficient of Photometric Flux	typ		-1	-1	-0.2	~0	% / °C
Thermal Coefficient of Radiometric Flux	typ		-0.7	-0.7	-0.2	-0.2	% / °C
Forward Voltage Temperature Coefficient	typ		-1.7	-1.7	-3.3	-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	560	675	1590	290	lm
Radiometric Flux	typ	Φ_r	2.1	2.3	3.2	5.9	W
Dominant Wavelength	typ	λ_d	614	614	528	461	nm
FWHM -Spectral bandwidth at 50% of Φv	typ		18	18	36	21	nm
Chromaticity Coordinates [6,7]	typ	x	0.677	0.677	0.177	0.144	nm
	typ	y	0.322	0.322	0.713	0.034	nm
Forward Voltage	typ	V_F	2.3	2.7	4.7	3.3	V

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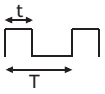
Optical & Electrical Characteristics

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

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



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

Note 7: For Reference only

Absolute Maximum Ratings

	Symbol	Red-Amber	Red-Amber Common Cathode (Preliminary)	Green	Blue	Unit
Absolute Minimum Current (CW or Pulsed)[1]		200	200	200	200	mA
Absolute Maximum Current (CW) [2]		11.9	11.9	11.9	11.9	A
Absolute Maximum Current (Pulsed) [2,3] (frequency > 240Hz, duty cycle <70%)		16.2	16.2	16.2	16.2	A
Absolute Maximum Surge Current [2,3] (Frequency > 240 Hz, duty cycle =10%, t=1ms)		18.9	18.9	18.9	18.9	A
Maximum Operating Junction Temperature [4]	T_j	100	100	140	130	ºC
Absolute Maximum Junction Temperature [4]	$T_{j\ abs.\ max}$	125	125	170	170	ºC
Storage Temperature Range		-40 / +100	-40 / +100	-40 / +100	-40 / +100	ºC

Note 1: Product performance and lifetime data is specified at recommended forward drive currents. Sustained operation at or near absolute minimum currents may result in a reduction of device performance and device lifetime compared to recommended forward currents.

Note 2: Maximum forward drive current conditions for continuous operation are 11.9 A, CW (2.2 A/mm^2), and 16.2 A, f>240 Hz, duty cycle <70% (3.0 A/mm^2). Sustained operation above maximum currents is not recommended and will result in a reduction of device lifetime compared to specified maximum forward drive currents. Device lifetimes will depend on junction temperature. (See Reliability Application Note, APN-001444 for product lifetimes as function of junction temperature.) Please refer to lifetime de-rating curves (available from Luminus) for further information.

Note 3: In pulsed operation, rise time from 10 to 90% of forward current should be larger than 0.5 microseconds.

Note 4: Sustained operation at or above Absolute Maximum Operating Junction Temperature (T_{jmax}) will result in reduced device life time. Device lifetimes will depend on junction temperature. (See Reliability Application Note, APN-001444 for product lifetimes as function of junction temperature.) Please refer to lifetime de-rating curves (available from Luminus) for further information.

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

	Bin 4F		Bin 4G		Bin 4H		Bin 4J		Bin 4K		Bin 4L		Bin 4M	
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	171	183	183	195	195	214	214	232	232	249	249	269	269	288
451	185	199	199	212	212	233	233	252	252	271	271	292	292	314
452	200	215	215	229	229	252	252	273	273	293	293	316	316	339
453	215	231	231	246	246	271	271	293	293	314	314	339	339	364
454	230	247	247	263	263	290	290	313	313	336	336	363	363	389
455	245	263	263	280	280	308	308	333	333	358	358	386	386	414
456	260	279	279	297	297	327	327	354	354	380	380	409	409	439
457	275	295	295	315	315	346	346	374	374	401	401	433	433	464
458	290	311	311	332	332	365	365	394	394	423	423	456	456	489
459	305	327	327	349	349	384	384	414	414	445	445	480	480	515
460	320	343	343	366	366	402	402	435	435	467	467	503	503	540
461	335	359	359	383	383	421	421	455	455	488	488	527	527	565
462	350	375	375	400	400	440	440	475	475	510	510	550	550	590
463	365	391	391	417	417	459	459	495	495	532	532	573	573	615
464	380	407	407	434	434	478	478	515	515	553	553	597	597	640
465	395	423	423	451	451	496	496	536	536	575	575	620	620	665
466	410	439	439	468	468	515	515	556	556	597	597	644	644	691
467	425	455	455	485	485	534	534	576	576	619	619	667	667	716
468	440	471	471	503	503	553	553	596	596	640	640	691	691	741

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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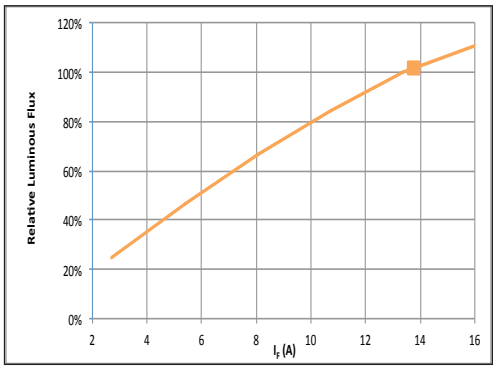
Normalized Luminous Flux variation with Forward Current: $\Phi_v(I_F) / \Phi_v$ (13.5A)

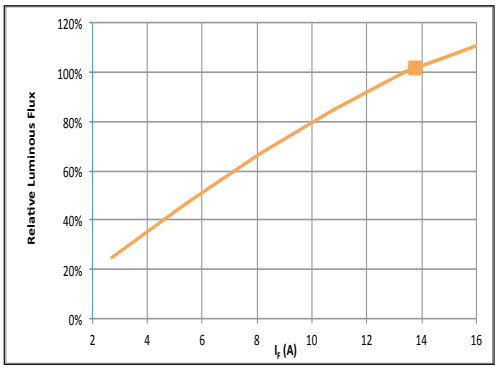
Red-Amber

RA

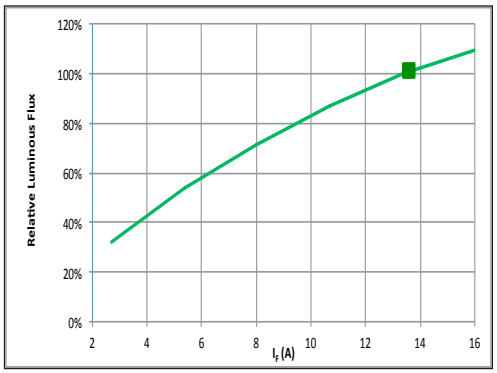


Red-Amber

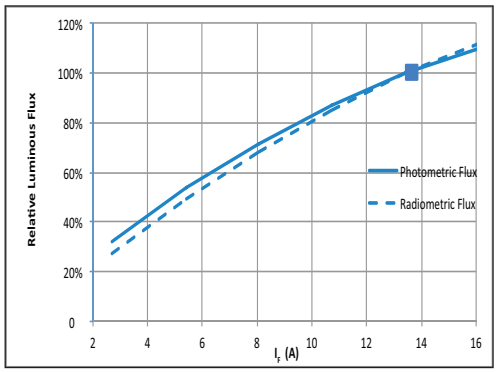
RAX



Green



Blue

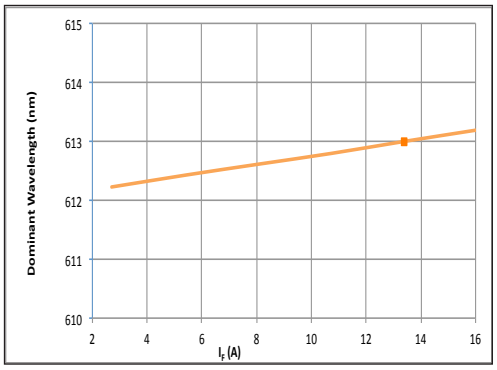


See notes 1, 2 on page 10.

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

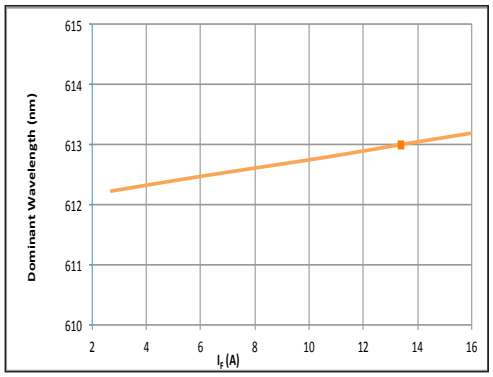
Red-Amber

(RA)



Red-Amber

(RAX)



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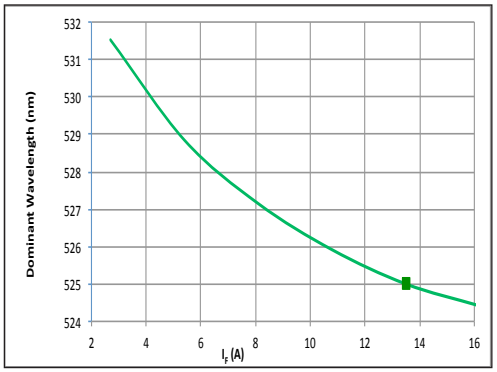
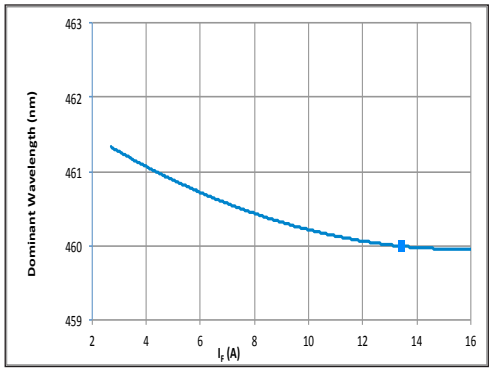


Blue



See notes 1, 2 on page 10.

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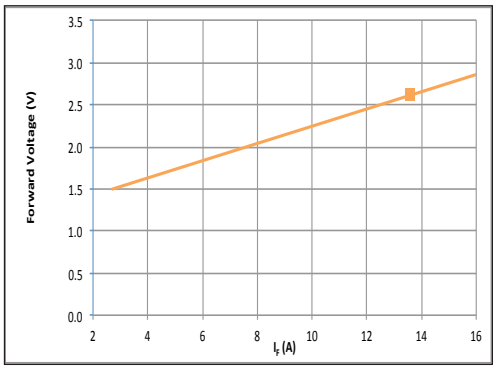
Forward Voltage variation with Drive current - $V_F = f(I_F)$ - Typical

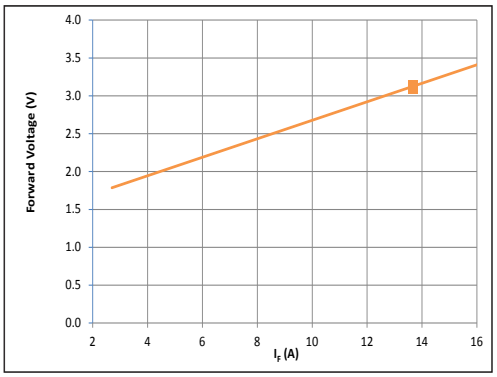
Red-Amber

RA

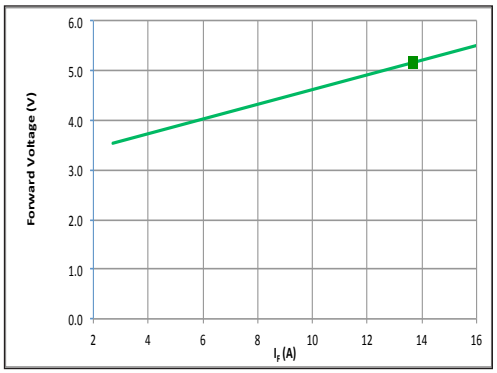


Red-Amber

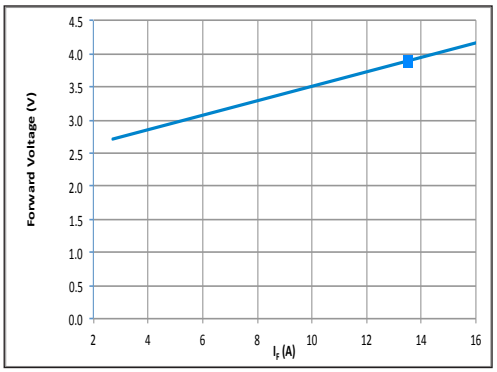
(RAX)



Green

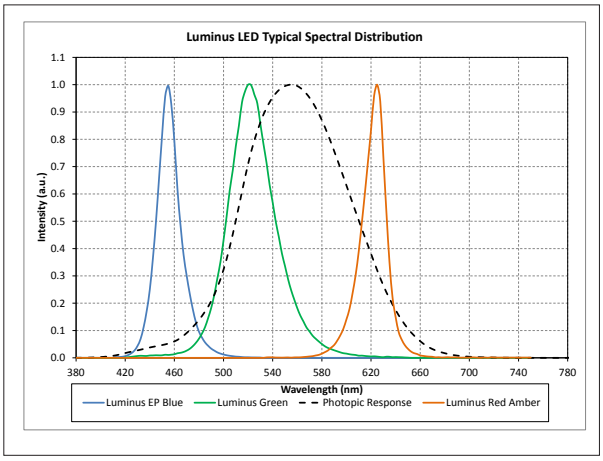


Blue



See notes 1, 2 on page 10.

Optical Spectrum (Typical)



See notes 1, 3 on page 10.

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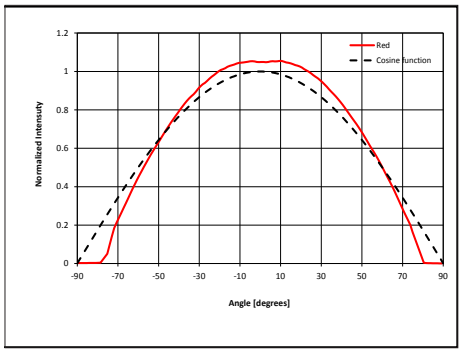
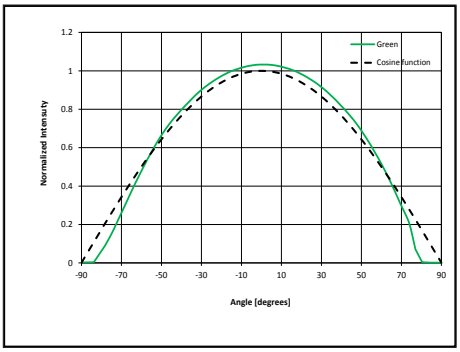
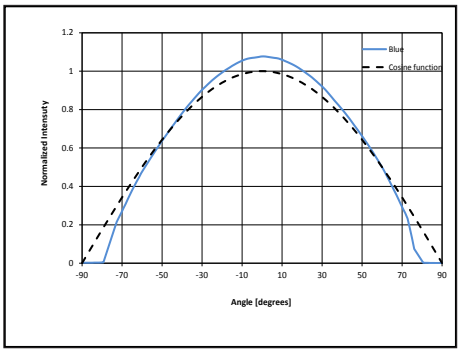
Angular Intensity Distribution (Typical)







See note 4 on page 10.

Note 1: For Pulsed operation, the reference R, G, and B duty cycles used are 25%, 50% and 25% respectively (T_{hs}=40° C; Frequency =720 Hz).

Note 2: Square on curves indicate device operating current point (30 A) under reference conditions listed in the Optical and Electrical Characteristics table.

Note 3: Typical spectrum at recommended peak drive current. Please contact Luminus to obtain data in Excel format.

Note 4: For any specific device, slight variations in angular intensity distribution may be expected.

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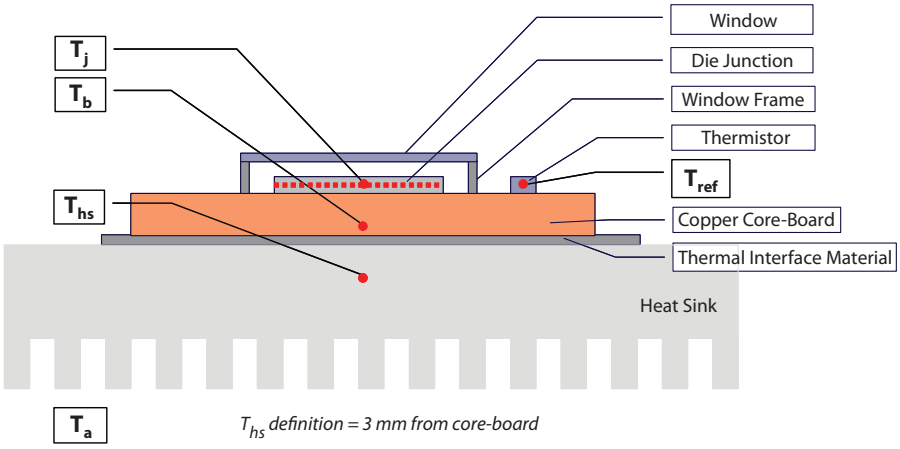
Thermal Resistance



Typical Thermal Resistance

$R_{\theta j\text{-}b}$ [1]	0.7°C/W
$R_{\theta b\text{-}hs}$ [2]	0.2 °C/W
$R_{\theta j\text{-}hs}$ [1,2]	0.9 °C/W
$R_{\theta j\text{-}ref}$ [2,3]	0.7 °C/W

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

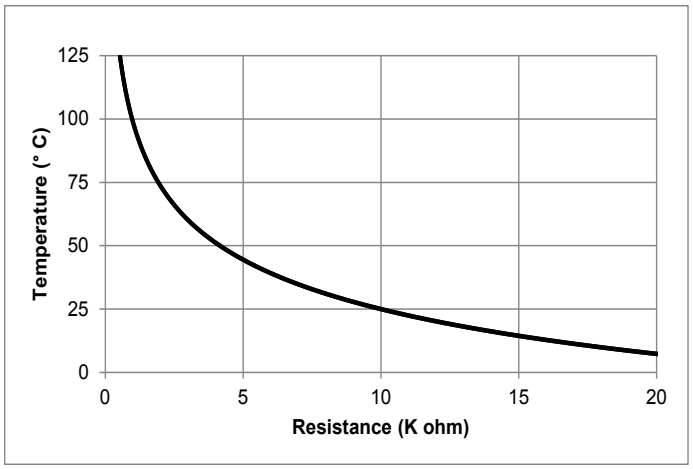
Note 2: Thermal Resistance is based on eGraf 1205 Thermal interface.

Note 3: For Red devices, thermistor is reference point. (Green, and Blue devices do not have a thermistor, but one of three circular thermocouple pads can provide a temperature reference point.)

Thermistor Information

The thermistor used in PT-54 RA and RAX devices are mounted on coreboards is from Murata Manufacturing Co. The global part number is NCP18XH103J03RB. Please see http://www.murata.com/ for details on calculating thermistor temperature.

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



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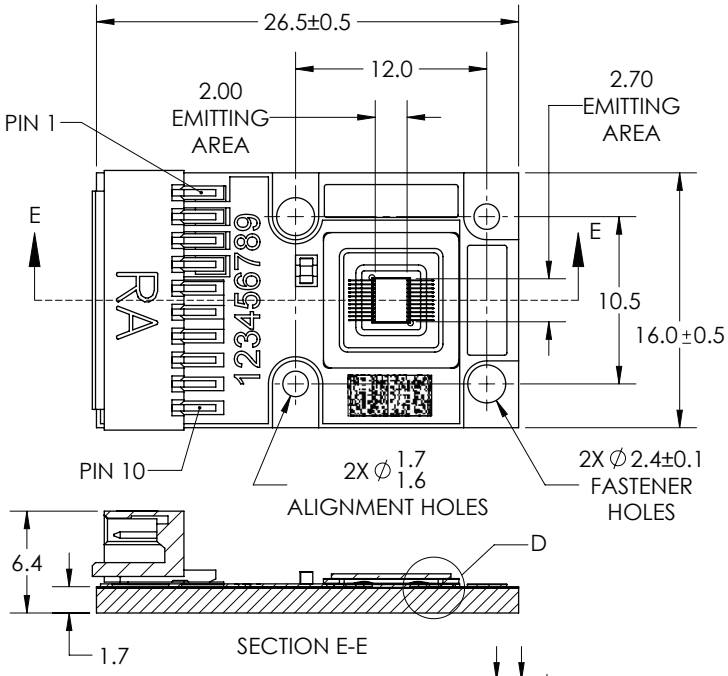
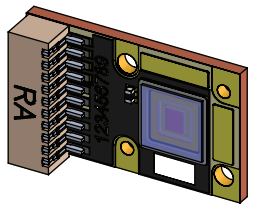
Mechanical Dimensions - PT-54 -RA (Common Anode) Package

DIMENSIONS IN MILLIMETERS





RED AMBER LED DEVICE

PIN NO(S).	ASSIGNMENT
1-4	ANODE (+)
5	THERMISTOR (+)
6	THERMISTOR (-)
7-10	CATHODE (-)

DIMENSION NAME	DESCRIPTION	NOMINAL DIMENSION	TOLERANCE
"A"	TOP OF METAL SUBSTRATE TO TOP OF WINDOW	0.88	±0.13
"B"	TOP OF DIE EMITTING AREA TO TOP OF WINDOW	0.65	±0.11
"C"	TOP OF METAL SUBSTRATE TO TOP OF DIE EMITTING AREA	0.23	±0.02

DWG-002018

Notes:

1) PT-54-RA 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. Please refer to the latest revision of the DWG-002018 package outline mechanical specifications.

Connector Information:

Manufacturer: Molex; Part Number: 78048-1043.

Manufacturer: Tarng-Yu; Part Number: TU1502WNR-10S-M8-NL-A

Mating Connector Information:

Manufacturer: Molex; Part Number: 87439-1000

Manufacturer: Tarng-Yu; Part Number: TU1502HNO-10-M5

PT-54-TE Mating Connector Cable Assembly ordering part number (small quantity orders for evaluation purposes only): 960040

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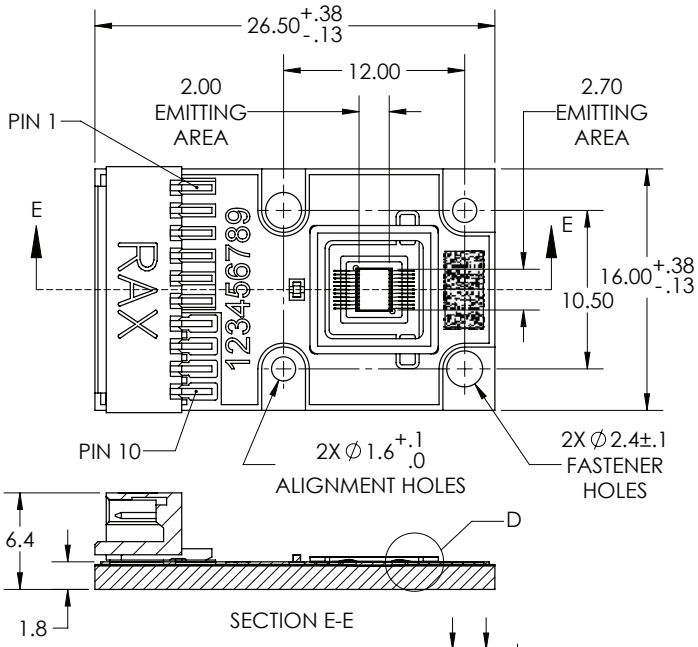
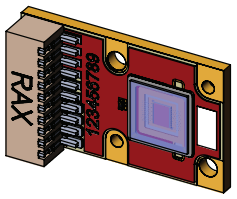
Mechanical Dimensions - PT-54 -RAX -Common Cathode Package

DIMENSIONS IN MILLIMETERS





RED AMBER LED DEVICE

PIN NO(S).	ASSIGNMENT
1-4	ANODE (+)
5	THERMISTOR (+)
6	THERMISTOR (-)
7-10	CATHODE (-)

DIMENSION NAME	DESCRIPTION	NOMINAL DIMENSION	TOLERANCE
"A"	TOP OF METAL SUBSTRATE TO TOP OF WINDOW	0.88	±0.13
"B"	TOP OF DIE EMITTING AREA TO TOP OF WINDOW	0.65	±0.11
"C"	TOP OF METAL SUBSTRATE TO TOP OF DIE EMITTING AREA	0.23	±0.02

DWG-002173

Notes:

1) PT-54 RAX LEDs are individually assembled into a common cathode copper core- board with a footprint of 26.5 mm x 16 mm.

2) Dimensions above are for information only. Please refer to the latest revision of the DWG-002173 package outline mechanical specifications.

Connector Information:

Manufacturer: Molex; Part Number: 78048-1043.

Manufacturer: Tarng-Yu; Part Number: TU1502WNR-10S-M8-NL-A

Mating Connector Information:

Manufacturer: Molex; Part Number: 87439-1000

Manufacturer: Tarng-Yu; Part Number: TU1502HNO-10-M5

PT-54-TE Mating Connector Cable Assembly ordering part number (small quantity orders for evaluation purposes only): 960040

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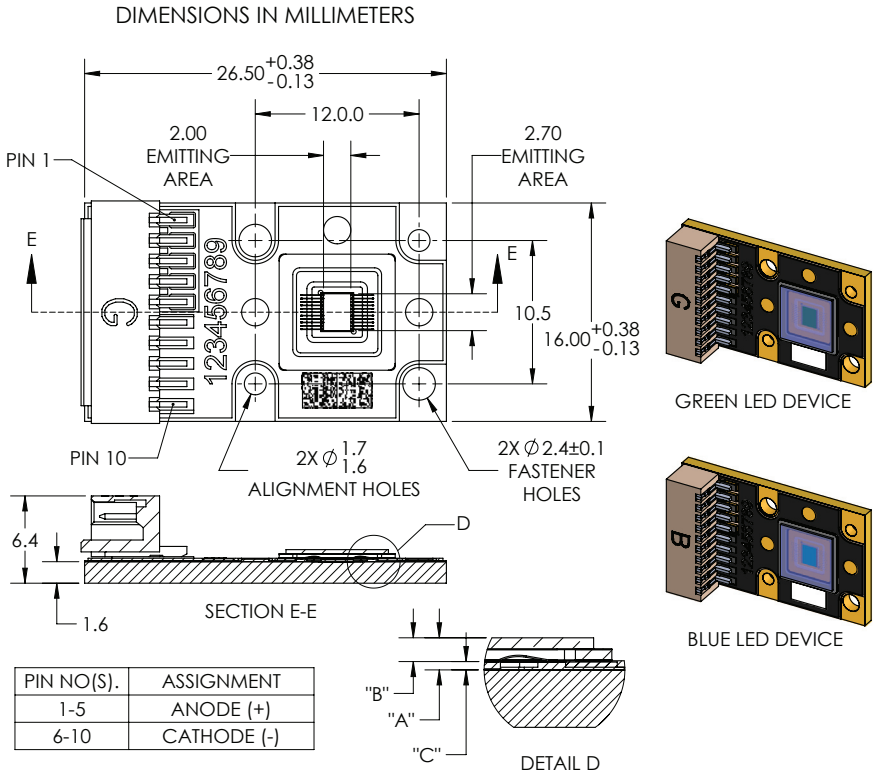
Mechanical Dimensions -PT-54 Green and Blue Devices



PIN NO(S).	ASSIGNMENT
1-5	ANODE (+)
6-10	CATHODE (-)

DIMENSION NAME	DESCRIPTION	NOMINAL DIMENSION	TOLERANCE
"A"	TOP OF METAL SUBSTRATE TO TOP OF WINDOW	0.88	±0.13
"B"	TOP OF DIE EMITTING AREA TO TOP OF WINDOW	0.65	±0.11
"C"	TOP OF METAL SUBSTRATE TO TOP OF DIE EMITTING AREA	0.23	±0.02

DWG-002121

Notes:

1) Green and Blue PT-54 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. Please refer to the latest revision of the DWG- 002121 package outline mechanical specifications.

Connector Information:

Manufacturer: Molex; Part Number: 78048-1043.

Manufacturer: Tarng-Yu; Part Number: TU1502WNR-10S-M8-NL-A

Mating Connector Information:

Manufacturer: Molex; Part Number: 87439-1000

Manufacturer: Tarng-Yu; Part Number: TU1502HNO-10-M5

PT-54-TE Mating Connector Cable Assembly ordering part number (small quantity orders for evaluation purposes only): 960040

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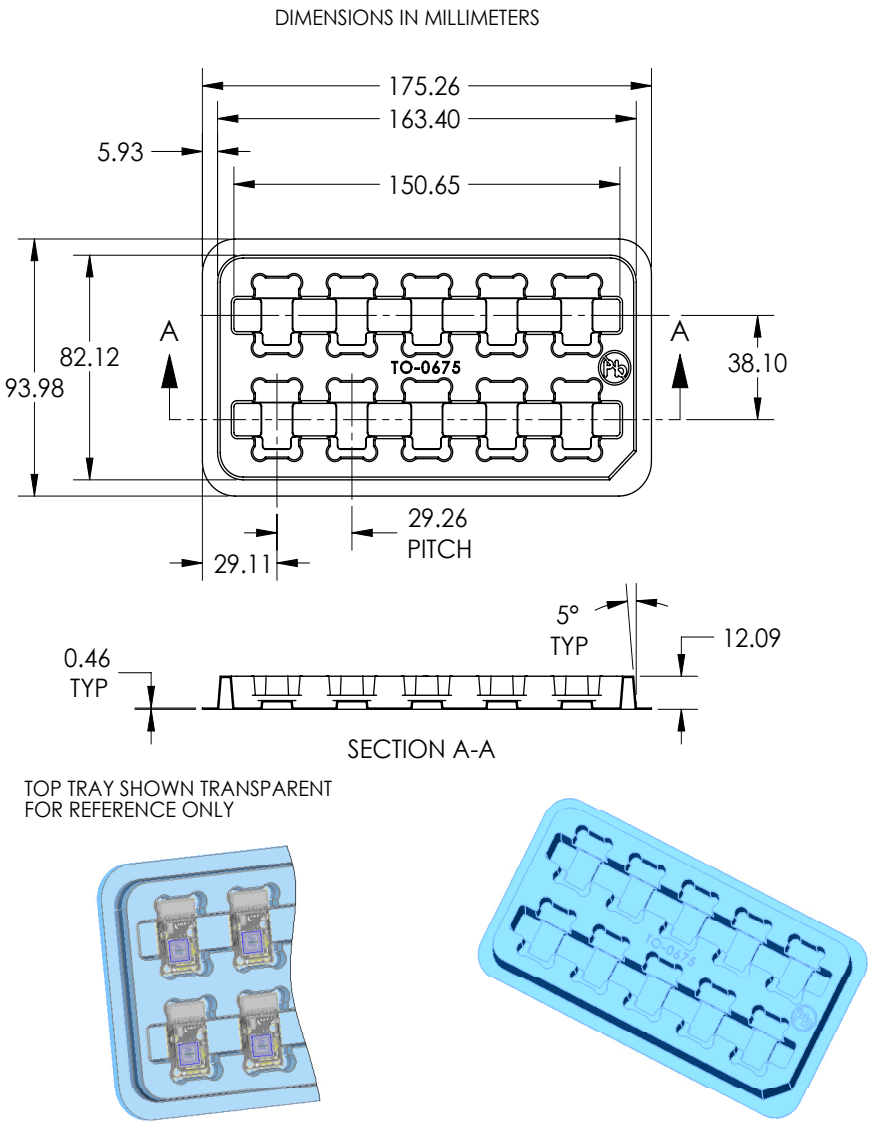
Shipping Tray Outline



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

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Packing and Shipping Specifications

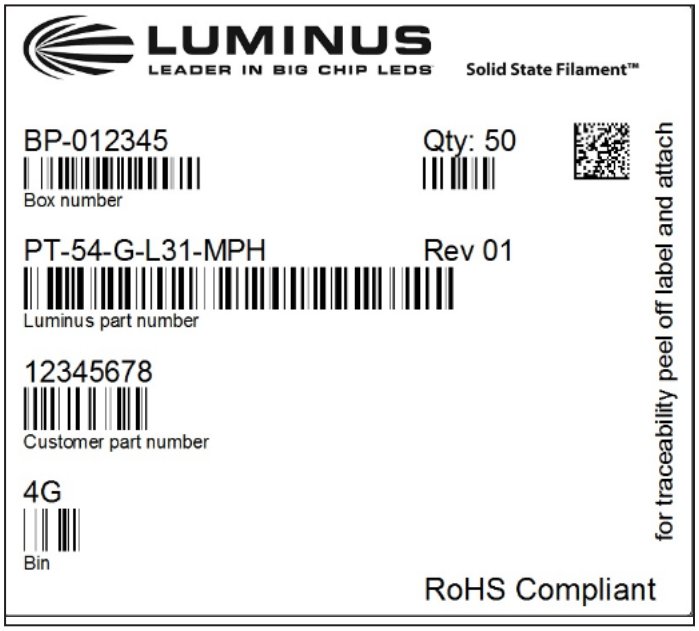
Packing Specification

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
- 2D Bar code



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	05/15/12	Preliminary Draft
02	11/12/12	Preliminary Datasheet
03	03/18/13	Released Datasheet
04	6/28/13	Add preliminary specification for PT-54 Red-Amber (RAX) Common Cathode Package Product
05	11/7/13	Edit PT54 RAX bin kits to include additional higher bins
06	02/12/15	Edit to include higher bins, update to new address, and (c) notice.

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