

PT39 LEDs

Thermally Enhanced

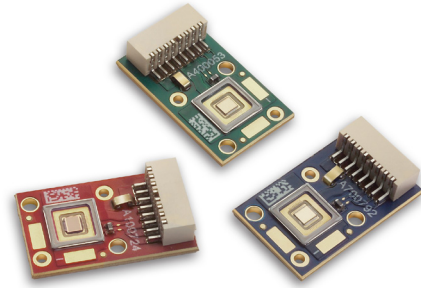


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Features:

- Matched RGB Chipset with 3.9 mm² emitting area designed for LED projector applications
- Enhanced thermal performance allows for operation up to 12 A (3A/mm²)
- Ultra low thermal resistance, common anode copper-core PCB package
- Photonic lattice technology for very high surface brightness and uniform surface emission
- Wide color gamut: Red-Amber 613nm, GREEN 525 nm, Blue 460nm typical dominant wavelength
- Single emitting area per color allows for collection with single lens for simplified optics
- LED mounted on MC-PCB for easier thermal and optical integration
- Aspect ratio optimized and compatible with micro-display diagonal sizes ranging from 0.45" to 0.55"
- 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 0.45" to 0.55"
- Suitable for DLP™ (0.45" WXGA, 0.55" SVGA), LCoS and HTPS /3LCD microdisplays

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 1.0° C/W, Luminus PT39 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 rated 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 20 ms 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.

Ordering Information

| Ordering Part Number ¹ | Color | Min Flux or Power Bin ² | Description |
|-----------------------------------|-----------------------------|------------------------------------|---|
| PT-39-RA-L21-MPF | Red-Amber (Discontinued) | 2E | Red-Amber LED, consisting of a 3.9 mm ² Red-Amber LED chip, thermistor and connector mounted on a copper-core PCB. |
| PT-39-RA-L21-MPG | | 2F | |
| PT-39-RA-L21-MPH | | 2G | |
| PT-39-RA-L21-MPJ | | 2H | |
| PT-39-G-L21-MPF | Green | 2F | Green LED, consisting of a 3.9 mm ² Green LED chip, thermistor and connector mounted on a copper-core PCB. |
| PT-39-G-L21-MPG | | 2G | |
| PT-39-G-L21-MPH | | 2H | |
| PT-39-G-L21-MPJ | | 2J | |
| PT-39-B-L21-EPD | Blue | 2G | Blue LED, consisting of a 3.9 mm ² Blue LED chip, thermistor and connector mounted on a copper-core PCB. |
| PT-39-B-L21-EPE | | 2H | |

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 | 39: 3.9 mm ² | RA= Red -Amber (615nm, typ) G= Green B= Blue | L21: 26.5mm x 16.0 mm (standard) L22: 26.5mm x 16.0 mm (die-rotated configuration) 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.

EXAMPLE:

PT-39-RA-L21-MPF is comprised of Red-Amber Flux Bins 2E, 2F, 2G, 2H, 2J.

PT39 Bin Kit¹ and Flux Bin^{2,3,4} Definitions

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

| Red -Amber Flux Bins | Bin 2E | Bin 2F | Bin 2G | Bin 2H | Bin 2J | Bin 2K | Bin 2L | Bin 2M | |
|--|---------------|---------------|---------------|---------------|---------------|---------------|-----------|-----------|--|
| Red -Amber Bin Flux Range (lm) (Discontinued) | 635-690 | 690-745 | 745-800 | 800-860 | 860-925 | 925-990 | 990-1055 | 1055-1125 | |
| PT-39-RA-L21-MPF | ☑ | ☑ | ☑ | ☑ | ☑ | | | | |
| PT-39-RA-L21-MPG | | ☑ | ☑ | ☑ | ☑ | ☑ | | | |
| PT-39-RA-L21-MPH | | | ☑ | ☑ | ☑ | ☑ | ☑ | | |
| PT-39-RA-L21-MPJ | | | | ☑ | ☑ | ☑ | ☑ | ☑ | |
| Green Flux Bins | Bin 2F | Bin 2G | Bin 2H | Bin 2J | Bin 2K | Bin 2L | 2M | | |
| Green Bin Flux Range (lm) | 1250-1330 | 1330-1450 | 1450-1550 | 1550-1660 | 1660-1780 | 1780-1900 | 1900-2020 | | |
| PT-39-G-L21-MPF | ☑ | ☑ | ☑ | ☑ | ☑ | | | | |
| PT-39-G-L21-MPG | | ☑ | ☑ | ☑ | ☑ | ☑ | | | |
| PT-39-G-L21-MPH | | | ☑ | ☑ | ☑ | ☑ | ☑ | | |
| PT-39-G-L21-MPJ | | | | ☑ | ☑ | ☑ | ☑ | | |
| Blue Flux Bins | Bin 2G | Bin 2H | Bin 2J | Bin 2K | Bin 2L | Bin 2M | | | |
| Blue Bin Flux Range (lm) | 255-280 | 280-300 | 300-320 | 320-345 | 345-370 | 370-400 | | | |
| PT-39-B-L21-EPD | ☑ | ☑ | ☑ | ☑ | ☑ | | | | |

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: PT39 LEDs are tested for luminous flux at 9.8 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%.

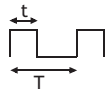
Note 4: Blue Flux bin limits are defined at reference dominant wavelength of 462nm. See table on page 7 for Blue bin limits at other dominant wavelengths.

Optical & Electrical Characteristics

| General Characteristics | | Symbol | Red -Amber (Discontinued) | Green | Blue | Unit |
|--|-----|-------------------|------------------------------|-------------|-------------|-----------------|
| Emitting Area | | x | 3.9 | 3.9 | 3.9 | mm ² |
| Emitting Area Dimensions | | x | 2.09 x 1.87 | 2.09 x 1.87 | 2.09 x 1.87 | mmxmm |
| Characteristics at Recommended Test Drive Current , I_f^{1,2} | | | | | | |
| Reference Duty Cycle ³ | | | 25 | 50 | 25 | % |
| Test Peak Drive Current ^{1,2,4} | typ | I _F | 9.8 | 9.8 | 9.8 | A |
| Peak Luminous Flux ^{1,2,5} | typ | Φ _v | 800 | 1660 | 300 | lm |
| Peak Radiometric Flux ^{1,2} | typ | Φ _r | 3.2 | 3.5 | 6.2 | W |
| Dominant Wavelength | min | λ _{dmin} | 609 | 516 | 450 | nm |
| | typ | λ _d | 613 | 525 | 460 | nm |
| | max | λ _{dmax} | 620 | 540 | 468 | nm |
| FWHM- Spectral bandwidth at 50% of Φ _r | typ | | 19 | 34 | 20 | nm |
| Chromaticity Coordinates ^{6,7} | typ | x | 0.675 | 0.167 | 0.147 | |
| | typ | y | 0.325 | 0.704 | 0.033 | |
| Forward Voltage | min | V _{Fmin} | 2.2 | 3.5 | 3.2 | V |
| | typ | V _F | 2.6 | 5.2 | 3.9 | V |
| | max | V _{Fmax} | 3.2 | 5.9 | 5.2 | V |
| Dynamic Resistance | typ | | 0.1 | 0.12 | 0.09 | Ω |
| Device Thermal Characteristics | | | | | | |
| Thermal Coefficient of Photometric Flux | typ | | -1.0 | -0.2 | ~0 | % / °C |
| Thermal Coefficient of Radiometric Flux | typ | | -0.7 | -0.2 | -0.2 | % / °C |
| Forward Voltage Temperature Coefficient | typ | | -2 | -4.7 | -3 | mV/ °C |
| Characteristics at Reference Continuous Drive Current I_F (continuous wave)¹ | | | | | | |
| Reference Drive Current | typ | I _F | 5.9 | 5.9 | 5.9 | A |
| Luminous Flux | typ | Φ _v | 450 | 1175 | 210 | lm |
| Radiometric Flux | typ | Φ _r | 1.8 | 2.5 | 4.3 | W |
| Dominant Wavelength | typ | λ _d | 612 | 528 | 461 | nm |
| FWHM -Spectral bandwidth at 50% of Φ _r | typ | | 18 | 36 | 21 | nm |
| Chromaticity Coordinates ^{6,7} | typ | x | 0.677 | 0.177 | 0.144 | nm |
| | typ | y | 0.322 | 0.713 | 0.034 | nm |
| Forward Voltage | typ | V _F | 2.3 | 4.5 | 3.4 | V |

Optical & Electrical Characteristics

Note 1: All ratings are based on testing conditions with a constant heat sink temperature $T_{hs} = 40^{\circ}C$. 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: In CIE 1931 chromaticity diagram coordinates, normalized to $X+Y+Z=1$

Note 7: For Reference only

Absolute Maximum Ratings

| | Symbol | Red -Amber (Discontinued) | Green | Blue | Unit |
|---|------------|------------------------------|------------|------------|-------------|
| Absolute Minimum Current (CW or Pulsed) ¹ | | 200 | 200 | 200 | mA |
| Absolute Maximum Current (CW) ² | | 9.8 | 9.8 | 9.8 | A |
| Absolute Maximum Current (Pulsed) ^{2,3} (frequency > 240Hz, duty cycle <50%) | | 13.7 | 13.7 | 13.7 | A |
| Absolute Maximum Surge Current ^{2,3} (Frequency > 240 Hz, duty cycle =tbd, t=tbd) | | TBD | TBD | TBD | A |
| Absolute Maximum Junction Temperature ⁴ | T_{jmax} | 125 | 170 | 170 | $^{\circ}C$ |
| Storage Temperature Range | | -40 / +100 | -40 / +100 | -40 / +100 | $^{\circ}C$ |

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 drive currents.

Note 2: Luminus LEDs' absolute maximum forward drive current density is 2.5 A/mm² CW, and 3.5A/mm² pulsed ($f > 240$ Hz, duty cycle <50%). 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. (See Reliability Application Note, APN-001444.) Sustained operation at or above 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. Please refer to lifetime derating 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.

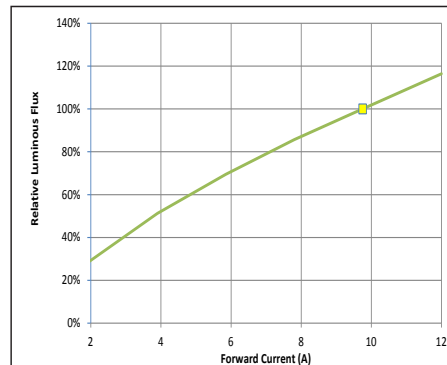
Note 4: Sustained operation at or above Maximum Operating Junction Temperature (T_{jmax}) will result in reduced device life time.

Blue Bin Flux Ranges by Dominant Wavelength ^{1,2}

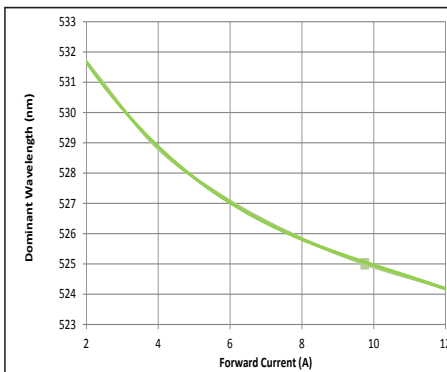
| DWL (nm) | Bin 2G | | Bin2H | | Bin 2J | | Bin 2K | | Bin 2L | | Bin 2M | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| | Min (lm) | Max (lm) | Min (lm) | Max (lm) | Min (lm) | Max (lm) | Min (lm) | Max (lm) | Min (lm) | Max (lm) | Min (lm) | Max (lm) |
| 450 | 125 | 137 | 137 | 147 | 147 | 156 | 156 | 169 | 169 | 181 | 181 | 196 |
| 451 | 136 | 149 | 149 | 159 | 159 | 170 | 170 | 183 | 183 | 197 | 197 | 213 |
| 452 | 146 | 161 | 161 | 172 | 172 | 184 | 184 | 198 | 198 | 212 | 212 | 230 |
| 453 | 157 | 173 | 173 | 185 | 185 | 197 | 197 | 213 | 213 | 228 | 228 | 247 |
| 439 | 168 | 185 | 185 | 198 | 198 | 211 | 211 | 227 | 227 | 244 | 244 | 264 |
| 455 | 179 | 197 | 197 | 211 | 211 | 225 | 225 | 242 | 242 | 260 | 260 | 281 |
| 456 | 190 | 208 | 208 | 223 | 223 | 238 | 238 | 257 | 257 | 275 | 275 | 298 |
| 457 | 201 | 220 | 220 | 236 | 236 | 252 | 252 | 272 | 272 | 291 | 291 | 315 |
| 458 | 212 | 232 | 232 | 249 | 249 | 265 | 265 | 286 | 286 | 307 | 307 | 332 |
| 459 | 222 | 244 | 244 | 262 | 262 | 279 | 279 | 301 | 301 | 323 | 323 | 349 |
| 460 | 233 | 256 | 256 | 274 | 274 | 293 | 293 | 316 | 316 | 338 | 338 | 366 |
| 461 | 244 | 268 | 268 | 287 | 287 | 306 | 306 | 330 | 330 | 354 | 354 | 383 |
| 462 | 255 | 280 | 280 | 300 | 300 | 320 | 320 | 345 | 345 | 370 | 370 | 400 |
| 463 | 266 | 292 | 292 | 313 | 313 | 334 | 334 | 360 | 360 | 386 | 386 | 417 |
| 464 | 277 | 304 | 304 | 326 | 326 | 347 | 347 | 374 | 374 | 402 | 402 | 434 |
| 465 | 288 | 316 | 316 | 338 | 338 | 361 | 361 | 389 | 389 | 417 | 417 | 451 |
| 466 | 298 | 328 | 328 | 351 | 351 | 375 | 375 | 404 | 404 | 433 | 433 | 468 |
| 467 | 309 | 340 | 340 | 364 | 364 | 388 | 388 | 418 | 418 | 449 | 449 | 485 |
| 468 | 320 | 352 | 352 | 377 | 377 | 402 | 402 | 433 | 433 | 465 | 465 | 502 |

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.

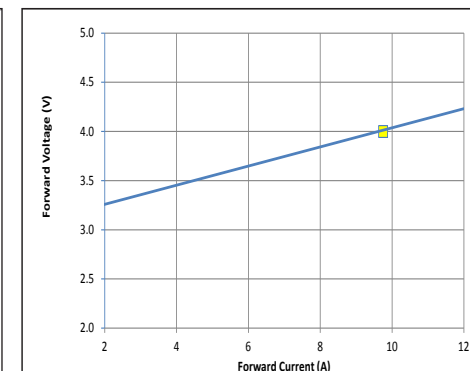
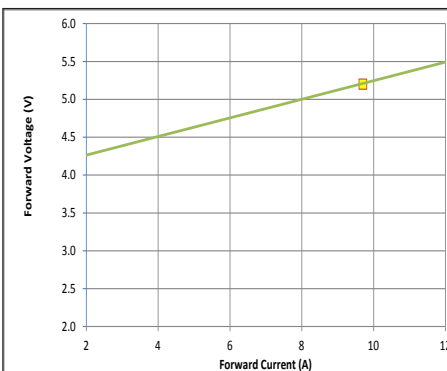
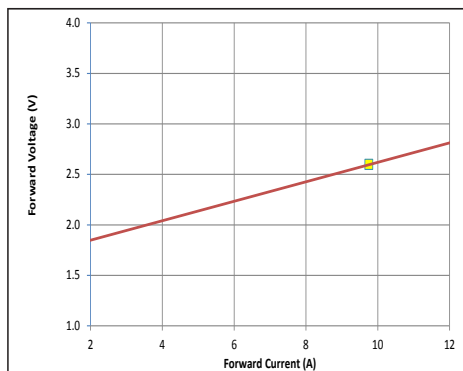
Note 2: Luminus maintains a test measurement accuracy for LED flux and power of +/- 6%.

Normalized Luminous Flux variation with Forward Current: $\Phi_V / \Phi_F = f(I_F)$


See notes 1, 2 on page 9.

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


See notes 1, 2 on page 9.

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


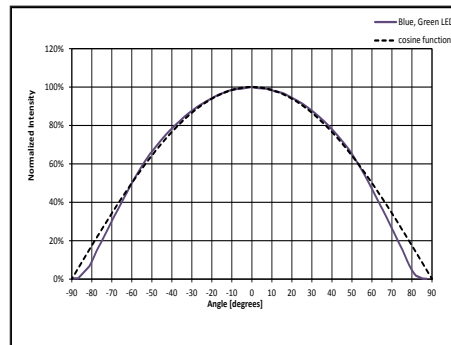
See notes 1, 2 on page 9.

Optical Spectrum (Typical)



See notes 1, 3 on page 9.

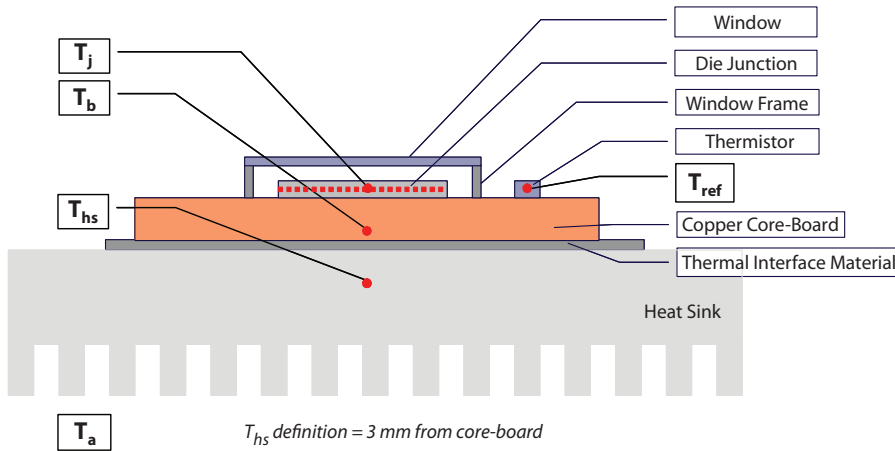
Angular Intensity Distribution (Typical)



See note 4 on page 9.

- Note 1: For Pulsed operation, the reference R,G, and B duty cycles used are 25%, 50% and 25% respectively ($T_{HS}=40^{\circ}\text{C}$; Frequency = 720 Hz).
- Note 2: Square on curves indicate device operating current point (9.8A) 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: Curves (solid) represent the angular radiation pattern of a typical (Red, Green or Blue) device. Discontinuous line represents cosine function. For any specific device, slight variations may be expected.

Thermal Resistance



Typical Thermal Resistance

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

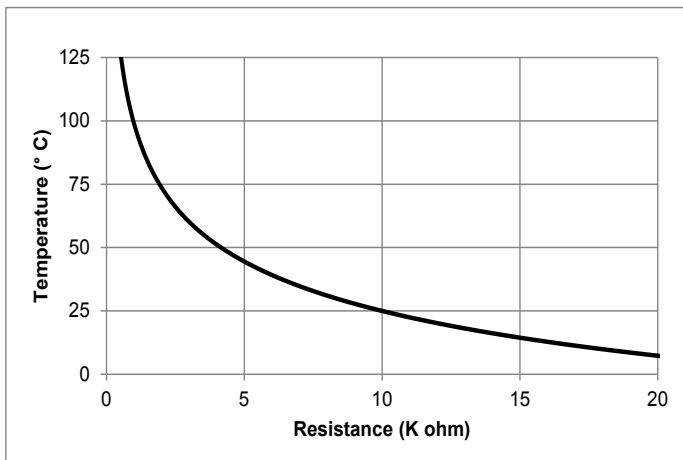
Note 1: Thermal resistance values are based on modeled results correlated to measured $R_{\theta j-hs}$ data using the wavelength shift method. Verification of compliance with the recent releases of JEDEC Standards JESD51-14 and JESD51-5x series is pending.

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

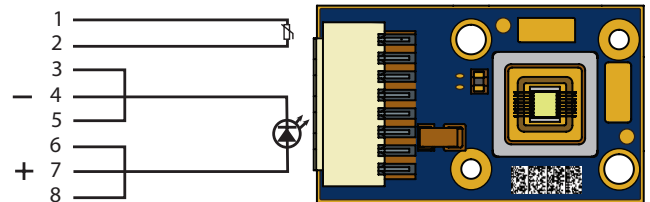
Thermistor Information

The thermistor used in PT39 devices are mounted on coreboards is from Murata Manufacturing Co. The global part number is NCP15XH103J03RC.

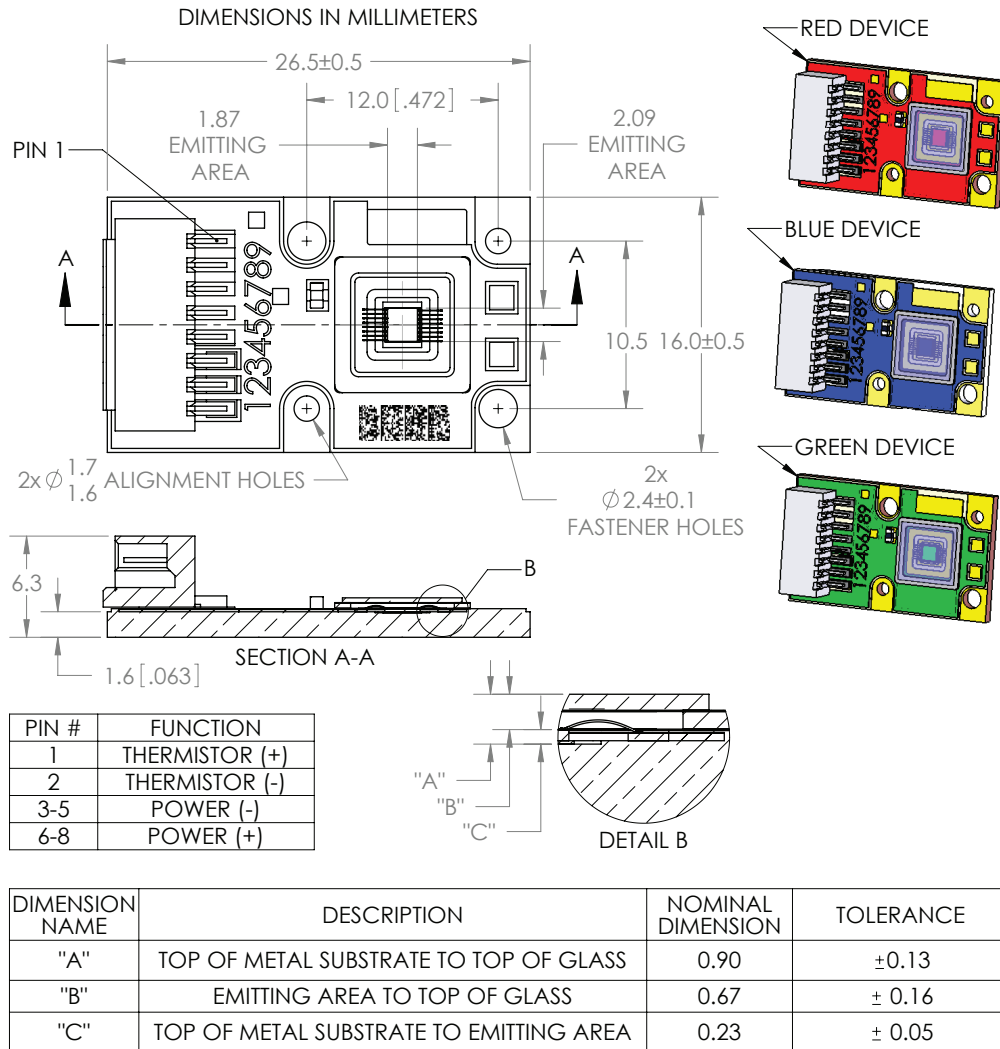
Please contact Luminus for information on use of the thermistor and for data in Excel format for temperature vs. resistance plot below.



Electrical Pinout



Mechanical Dimensions - Standard Die Configuration



DWG-001989

Notes:

- 1) Red, Green and Blue PT39 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. Please refer to the latest revision of the DWG- 001989 package outline mechanical specifications.
- 3) Connector- MOLEX Part Number: 874380843 or Global Part Number: WTB16-0815F.

Mechanical Dimensions – Rotated Die Configuration

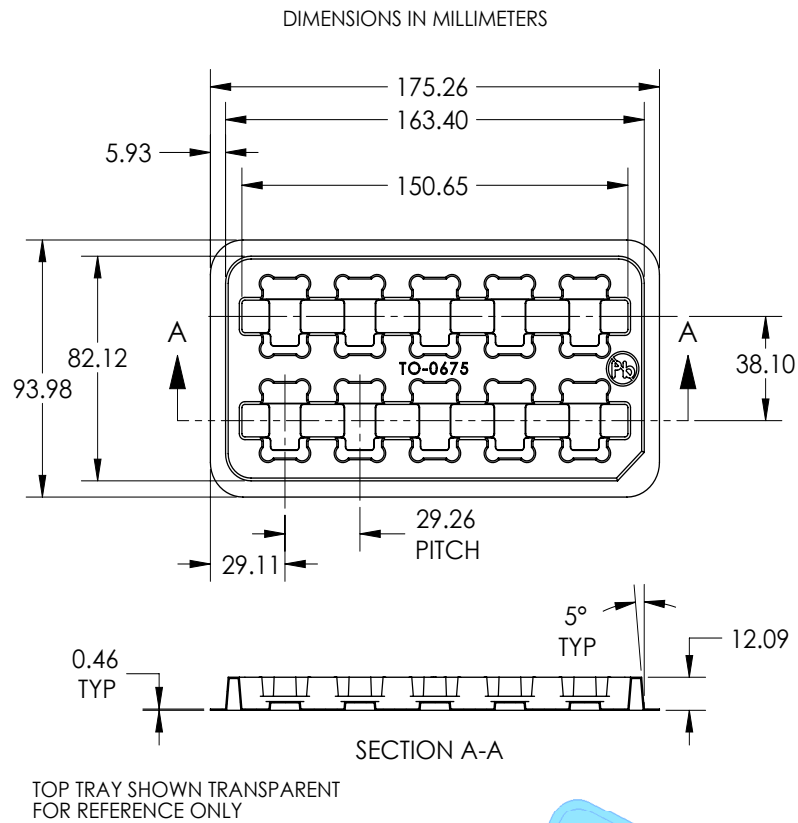


DWG-001991

Notes:

- 1) Red, Green and Blue PT39 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- 001991, package outline mechanical specifications
- 3) Connector- MOLEX Part Number: 874380843 or Global Part Number: WTB16-081SF.

Shipping Tray Outline



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

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





BP-012345

 Box number


PT-39-G-L21-MPH

 Luminus part number

12345678

 Customer part number

2J

 Bin

Qty: 50


Rev 01




for traceability peel off label and attach

RoHS Compliant

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 |

History of Changes

| Rev | Date | Description of Change |
|-----|----------|---|
| X | 03/23/12 | Preliminary Draft |
| 01 | 05/15/12 | Preliminary Specification |
| 02 | 08/28/12 | Add product characterization curves |
| 03 | 02/17/15 | Update address and year, remove preliminary marks |

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