

AERD-N1AB/N1BB/N1CB/N1DB

Infrared SMT Round Lamps

Overview

The LEDs in the Broadcom[®] infrared LED series are essentially conventional infrared through-hole LEDs in the form of surface-mount devices. The LEDs can be assembled using common SMT assembly processes and are compatible with an industrial reflow soldering process.

Besides being packaged in a surface mount platform enabling solder reflow, the IR SMT lamps also offer a multiple range of optics design to address different applications needs. The IR SMT lamp is made with an advanced optical grade epoxy for superior performance in outdoor applications. Package stability and robustness boost the product's reliability to withstand critical outdoor conditions while exhibiting longevity features needed for semiconductor components.

Features

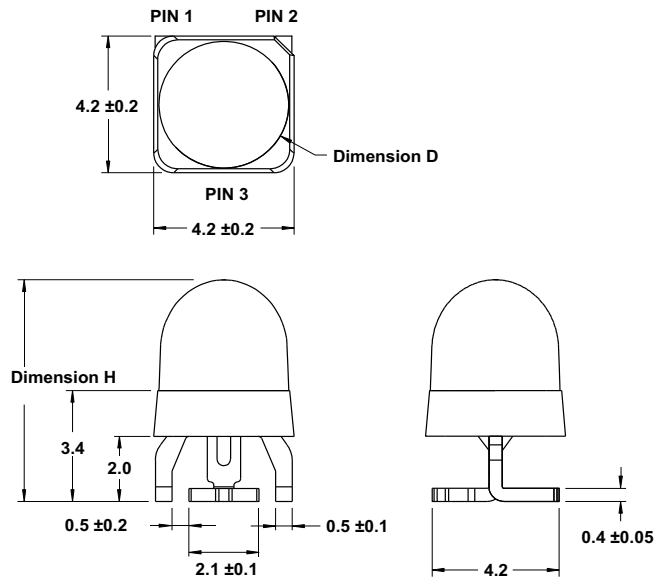
- Clear lens
- Tall package for easier potting
- Low power consumption
- Typical peak wavelength: 850 nm
- Typical viewing angle: 10°, 18°, 30°, and 40°

Applications

- Light curtains
- Traffic control
- Industrial sensing
- Office automation

CAUTION! The LED must be kept in a moisture barrier bag with <5% relative humidity (RH) when not in use because prolonged exposure to the environment might cause the leads to tarnish or rust, which might cause difficulties in soldering.

Figure 1: Package Drawing



| Part Number | Dimension D | Dimension H |
|-------------|-------------|-------------|
| AERD-N1AB | 3.48 | 7.25 |
| AERD-N1BB | 3.90 | 7.20 |
| AERD-N1CB | 3.90 | 7.05 |
| AERD-N1DB | 3.90 | 6.80 |

| Lead Configuration | |
|--------------------|---------|
| Pin 1 | Anode |
| Pin 2 | Cathode |
| Pin 3 | Anode |

NOTE:

1. All dimensions are in millimeters (mm).
2. Tolerance is ±0.5 mm unless otherwise specified.

Device Selection Guide ($T_J = 25^\circ\text{C}$, $I_F = 100\text{ mA}$)

| Part Number | Die Type | Radiant Intensity, I_e (mW/sr) ^{a, b, c} | | | Viewing Angle, $2\theta_{1/2}$ ($^\circ$) ^d |
|-----------------|----------|---|------|------|--|
| | | Min. | Typ. | Max. | Typ. |
| AERD-N1AB-00010 | AlGaAs | 200 | 400 | 600 | 10 |
| AERD-N1BB-00010 | AlGaAs | 100 | 200 | 320 | 18 |
| AERD-N1CB-00010 | AlGaAs | 90 | 140 | 220 | 30 |
| AERD-N1DB-00010 | AlGaAs | 50 | 85 | 140 | 40 |

- Radiant intensity, I_e is measured at the mechanical axis of the package with a single current pulse condition ($t_p = 20\text{ ms}$).
- The optical axis is closely aligned with the package mechanical axis.
- Tolerance for each bin limit is $\pm 15\%$.
- $\theta_{1/2}$ is the off-axis angle where the luminous intensity is half of the on-axis intensity.

Absolute Maximum Ratings

| Parameters | AERD-N1xB | Unit |
|-----------------------------------|-------------|------------------|
| DC Forward Current ^a | 100 | mA |
| Peak Forward Current ^b | 1000 | mA |
| Power Dissipation | 195 | mW |
| LED Junction Temperature | 100 | $^\circ\text{C}$ |
| Operating Temperature Range | -40 to +85 | $^\circ\text{C}$ |
| Storage Temperature Range | -40 to +100 | $^\circ\text{C}$ |

- Derate linearly as shown in [Figure 4](#).
- Duty factor = 1%, $t_p = 100\text{ }\mu\text{s}$ at $T_S = 25^\circ\text{C}$.

Optical and Electrical Characteristics ($T_J = 25^\circ\text{C}$)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Test Conditions |
|--|-------------------------|------|-------|------|----------------------------|--|
| Radiant Flux ^a | Φ_e | — | 58 | — | mW | $I_F = 100\text{ mA}$, $t_p = 20\text{ ms}$ |
| Peak Wavelength | λ_{PEAK} | — | 850 | — | nm | $I_F = 100\text{ mA}$, $t_p = 20\text{ ms}$ |
| Temperature Coefficient of Brightness | TC_{I_e} | — | -0.38 | — | $\%/^\circ\text{C}$ | $I_F = 100\text{ mA}$ |
| Temperature Coefficient of λ_p | TC_{λ_p} | — | 0.27 | — | $\text{nm}/^\circ\text{C}$ | $I_F = 100\text{ mA}$ |
| Spectral Line Half-Width | $\Delta\lambda_{1/2}$ | — | 37 | — | nm | $I_F = 100\text{ mA}$, $t_p = 20\text{ ms}$ |
| Forward Voltage ^b | V_F | — | 1.60 | 1.95 | V | $I_F = 100\text{ mA}$ |
| Temperature Coefficient of V_F | TC_{V_F} | — | -1.62 | — | $\text{mV}/^\circ\text{C}$ | $I_F = 100\text{ mA}$ |
| Reverse Voltage ^c | V_R | 5 | — | — | V | $I_R = 10\text{ }\mu\text{A}$ |
| Rise Time | t_r | — | 15 | — | ns | $I_F = 100\text{ mA}$ |
| Fall Time | t_f | — | 16 | — | ns | $I_F = 100\text{ mA}$ |
| Thermal Resistance | $R_{\theta J-S}$ | — | 270 | — | $^\circ\text{C}/\text{W}$ | LED junction to pin |

- The radiant flux, Φ_e , is the total flux output as measured with an integrating sphere at a single current pulse condition ($t_p = 20\text{ ms}$).
- Forward voltage tolerance is $\pm 0.1\text{V}$.
- Indicates product final test condition. Long-term reverse bias is not recommended.

Figure 2: Relative Radiant Intensity vs. Mono Pulse Current

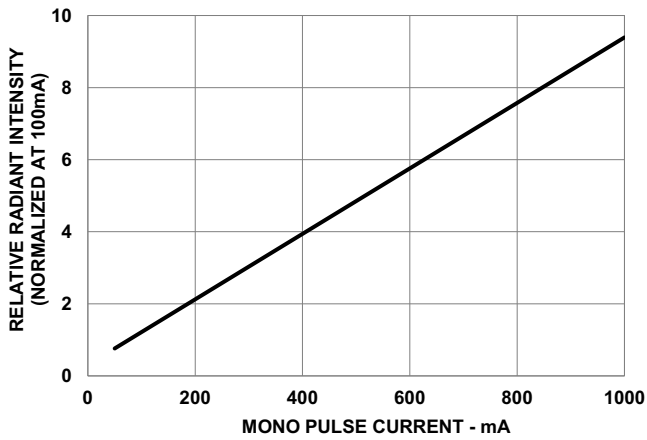


Figure 3: Forward Current vs. Forward Voltage

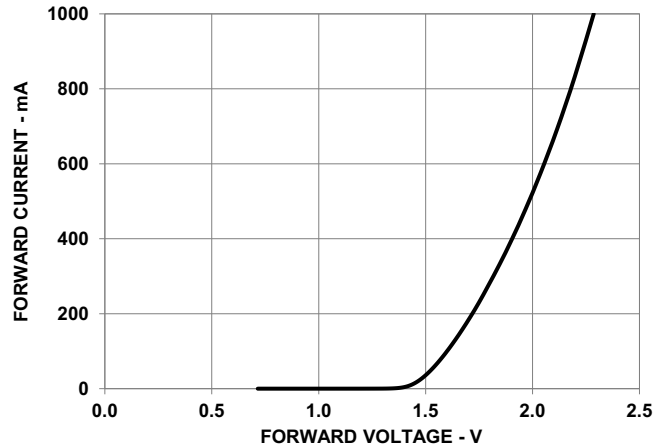


Figure 4: Maximum Forward Current vs. Ambient Temperature

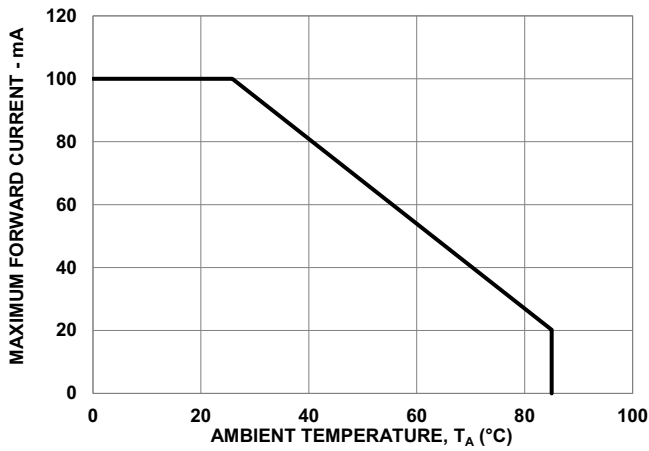


Figure 5: Spectral Distribution

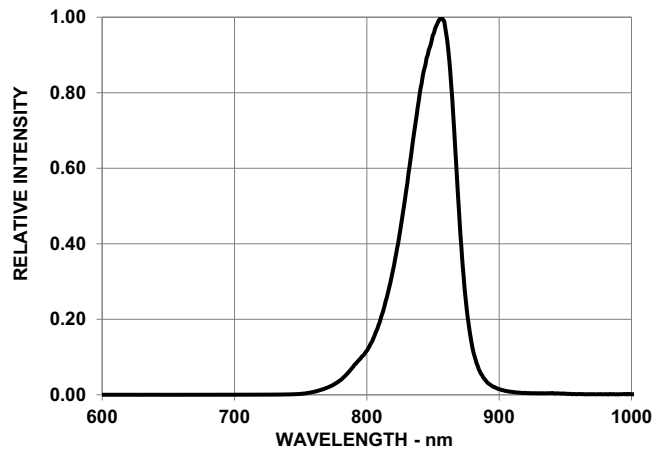


Figure 6: Radiation Pattern: 10°

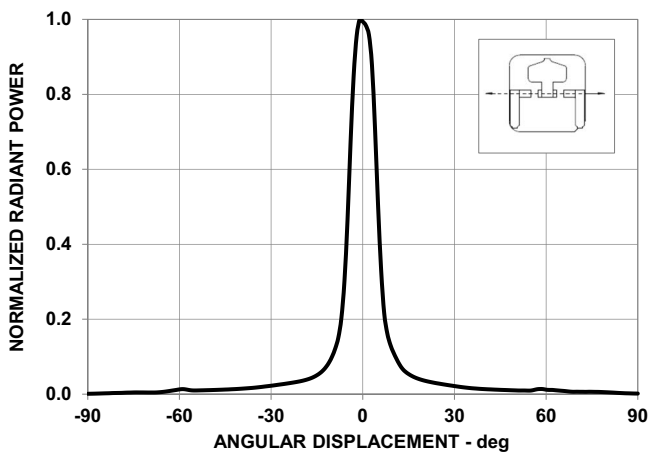


Figure 7: Radiation Pattern: 18°

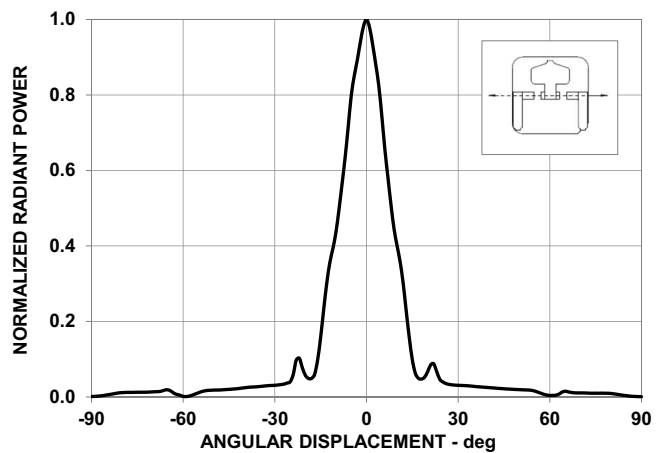


Figure 8: Radiation Pattern: 30°

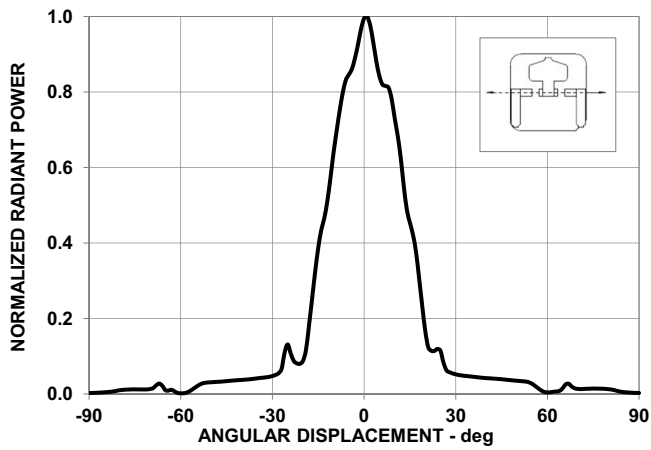


Figure 9: Radiation Pattern: 40°

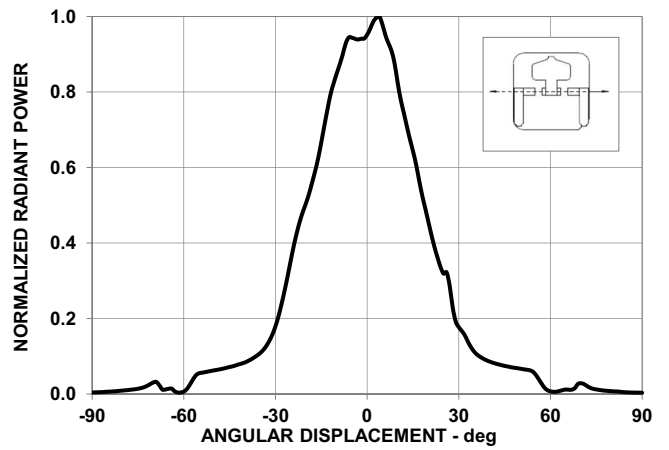
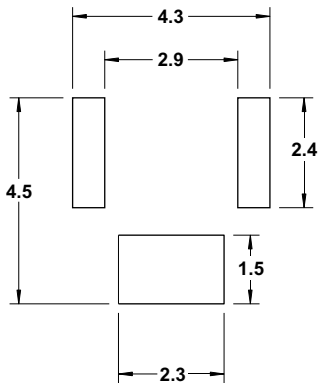


Figure 10: Recommended Soldering Land Pattern



NOTE:

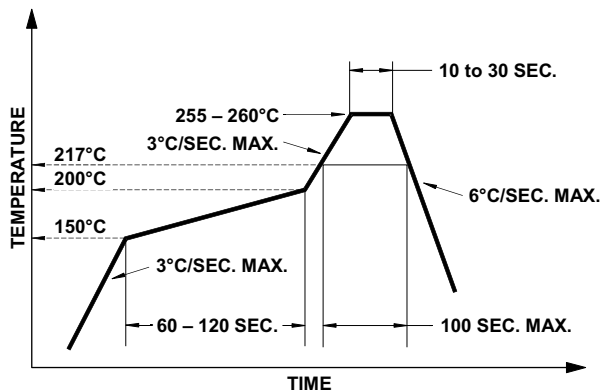
1. All dimensions are in millimeters (mm).
2. Recommended stencil thickness is 0.1524 mm (6 mil) minimum and above.

Precautionary Notes

Soldering

- Do not perform reflow soldering more than twice. Observe necessary precautions for handling moisture-sensitive device as stated in the following section.
- Do not apply any pressure or force on the LED during reflow and after reflow when the LED is still hot.
- Use reflow soldering to solder the LED. Use hand soldering only for rework if unavoidable, but it must be strictly controlled to the following conditions:
 - Soldering iron tip temperature = 315°C maximum
 - Soldering duration = 3 seconds maximum
 - Number of cycles = 1 only
 - Power of soldering iron = 50W maximum
- Do not touch the LED package body with the soldering iron except for the soldering terminals, as it may cause damage to the LED.
- Confirm beforehand whether the functionality and performance of the LED is affected by soldering with hand soldering.

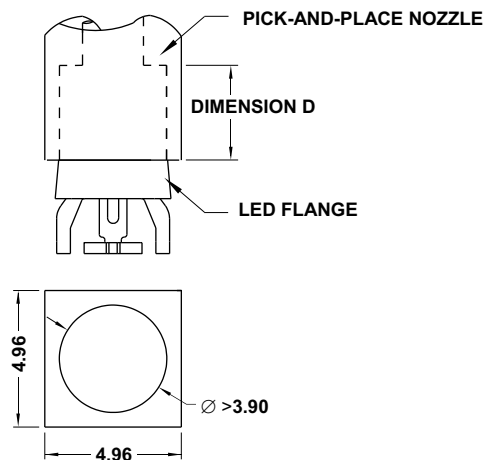
Figure 13: Recommended Lead-Free Reflow Soldering Profile



Handling Precautions

For automated pick-and-place, Broadcom has tested the following nozzle size to work with this LED. However, due to the possibility of variations in other parameters such as pick and place machine maker/model, and other settings of the machine, verify that the selected nozzle performs as per requirements.

Figure 14: Recommended Nozzle Dimension



| Part Number | Dimension D (mm) |
|-------------|------------------|
| AERD-N1AB | >4.35 |
| AERD-N1BB | >4.30 |
| AERD-N1CB | >4.15 |
| AERD-N1DB | >3.90 |

Handling of Moisture-Sensitive Devices

This product has a Moisture Sensitive Level 3 rating per JEDEC J-STD-020. Refer to Broadcom Application Note AN5305, *Handling of Moisture Sensitive Surface Mount Devices*, for additional details and a review of proper handling procedures.

- Before use:
 - An unopened moisture barrier bag (MBB) can be stored at $40^{\circ}\text{C}/90\% \text{ RH}$ for 12 months. If the actual shelf life has exceeded 12 months and the Humidity Indicator Card (HIC) indicates that baking is not required, then it is safe to reflow the LEDs per the original MSL rating.
 - Do not open the MBB prior to assembly (for example, for IQC). If unavoidable, MBB must be properly resealed with fresh desiccant and HIC. The exposed duration must be taken in as floor life.
- Control after opening the MBB:
 - Read the HIC immediately upon opening of MBB.
 - Keep the LEDs at $30^{\circ}\text{C}/60\% \text{ RH}$ at all times, and complete all high temperature-related processes, including soldering, curing, or rework within 168 hours.
- Control for unfinished reel:

Store unused LEDs in a sealed MBB with desiccant or a desiccator at $5\% \text{ RH}$.
- Control of assembled boards:

If the PCB soldered with the LEDs is to be subjected to other high-temperature processes, store the PCB in a sealed MBB with desiccant or desiccator at $5\% \text{ RH}$ to ensure that all LEDs have not exceeded their floor life of 168 hours.
- Baking is required if:
 - The HIC indicator indicates a change in color for 10% and 5%, as stated on the HIC.
 - The LEDs are exposed to conditions of $30^{\circ}\text{C}/60\% \text{ RH}$ at any time.
 - The LED's floor life exceeded 168 hours.

The recommended baking condition is $60^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for 20 hours.

Baking can only be done once.
- Storage:

The soldering terminals of these Broadcom LEDs are silver plated. If the LEDs are exposed in ambient environment for too long, the silver plating might be oxidized, thus affecting its solderability performance. As such, keep unused LEDs in a sealed MBB with desiccant or in a desiccator at $5\% \text{ RH}$.

Application Precautions

- The drive current of the LED must not exceed the maximum allowable limit across temperature as stated in the data sheet. Constant current driving is recommended to ensure consistent performance.
- Circuit design must cater to the whole range of forward voltage (V_F) of the LEDs to ensure the intended drive current can always be achieved.
- The LED exhibits slightly different characteristics at different drive currents, which can result in a larger variation of performance (meaning: intensity, wavelength, and forward voltage). Set the application current as close as possible to the test current to minimize these variations.
- The LED is not intended for reverse bias. Use other appropriate components for such purposes. When driving the LED in matrix form, ensure that the reverse bias voltage does not exceed the allowable limit of the LED.
- Avoid rapid changes in ambient temperature, especially in high-humidity environments, because they cause condensation on the LED.
- If the LED is intended to be used in harsh or outdoor environments, protect the LED against damages caused by rain water, water, dust, oil, corrosive gases, external mechanical stresses, and so on.
- The number of reflow cycles and reflow temperature conditions used may affect the optical characteristics of the LED. Use LEDs with the same number of reflow cycles and the same reflow temperature conditions within the same finished good.

Thermal Management

Optical, electrical, and reliability characteristics of the LED are affected by temperature. Keep the junction temperature (T_J) of the LED below the allowable limit at all times. T_J can be calculated as follows:

$$T_J = T_A + R_{\theta J-A} \times I_F \times V_{Fmax}$$

where:

T_A = Ambient temperature ($^{\circ}\text{C}$)

$R_{\theta J-A}$ = Thermal resistance from LED junction to ambient ($^{\circ}\text{C}/\text{W}$)

I_F = Forward current (A)

V_{Fmax} = Maximum forward voltage (V)

The complication of using this formula lies in T_A and $R_{\theta J-A}$. Actual T_A is sometimes subjective and hard to determine. $R_{\theta J-A}$ varies from system to system depending on design and is usually not known.

Another way of calculating T_J is by using the solder point temperature, T_S , as follows:

$$T_J = T_S + R_{\theta J-S} \times I_F \times V_{Fmax}$$

where:

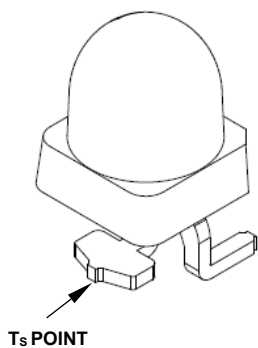
T_S = LED solder point temperature as shown in [Figure 15](#) ($^{\circ}\text{C}$).

$R_{\theta J-S}$ = Thermal resistance from junction to solder point ($^{\circ}\text{C}/\text{W}$)

I_F = Forward current (A)

V_{Fmax} = Maximum forward voltage (V)

Figure 15: Solder Point Temperature on PCB



T_S can be easily measured by mounting a thermocouple on the soldering joint as shown in [Figure 15](#), while $R_{\theta J-S}$ is provided in this data sheet. Verify the T_S of the LED in the final product to ensure that the LEDs are operating within all maximum ratings stated in this data sheet.

Eye Safety Precautions

LEDs may pose optical hazards when in operation. Do not look directly at operating LEDs because it might be harmful to the eyes. For safety reasons, use appropriate shielding or personal protective equipment.

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Lead (Pb) Free
RoHS Compliant