

CITIZEN

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Original

for ENERGY STAR certification of lighting products. It addresses luminous and radiant flux maintenance and color maintenance (“maintenance”) testing and reporting for LED packages, LED arrays, and LED modules

Rationale

The “maintenance” has already been defined before this sentence.

Proposed Change

It addresses luminous and radiant flux maintenance and color maintenance (“maintenance”) testing ...



It addresses maintenance testing ...

Original

90 days after final publication of this document, these requirements for reporting of LM-80 test data apply to all issued or revised reports. Preexisting test reports issued prior to that date may be referenced as existing without any changes.

Rationale

The Preexisting test reports should be applicable without any changes 90 days after final publication of this document since it's burdensome to revise all the preexisting reports.

Proposed Change

Preexisting test reports issued prior to that date may be referenced as existing without any changes.



Preexisting test reports issued prior to that date are applicable without any changes.

Original

Series: subcomponents marketed with naming that implies common construction processes and materials, and common performance attributes. Where this is not the case, series-related provisions detailed in this document must not be employed.

Rationale

As long as the requirements in this document are met, LEDs can be successors or COBs can be covered by LM-80 tested products whatever the subcomponents naming is. Furthermore, whether the requirements are met or not is justified by the LM-80 testing report with the information of current-per-die, power density and so on.

Proposed Change

Remove this provision

Original

- a. Photometric performance (i.e. maintenance and luminous flux) greater than or equal to the performance detailed in the referenced original LM-80 test report;

Rationale

When the lumen maintenance is almost 100% in LM-80 testing, there is a possibility the successor gives slightly lower lumen maintenance. For example, our tested COB gave 99.5% lumen maintenance at 55C and 6kH. If the successor would give 99.49%, it would fail as the successor in this rule, but it may happen even though the actual lifetime of successor is longer than that of the original one.

Proposed Change

- a. Photometric performance (i.e. maintenance and luminous flux) greater than the performance minus 1% detailed in the referenced original LM-80 test report;

Original

- g. Equal or lower thermal resistance of the subcomponent;

Rationale

In general, as LED PKG has more dies, its thermal resistance is less. Therefore, as long as the above requirement is existing, less die PKGs can not be the successor of more die PKGs even though the power dissipation per PKG and current density per LED die for less die PKGs are far lower than those of more die PKGs.

Proposed Change

Remove this requirement.

Original

- h. Equal or lower tested subcomponent power dissipation; and,
- i. Equal or lower average current density per LED die (i.e. mA/mm²).

Rationale

Because LM-80-15 is now including AC driving as right, it should be also taken into consideration.

Proposed Change

- h. Equal or lower tested subcomponent power dissipation for DC driving or effective power dissipation for AC driving; and
- i. Equal or lower average current density per LED die for DC driving or average RMS current density per LED die for AC driving (i.e. mA/mm²).

5.6 AC Regulated Voltage Drive

5.6.1 Circuit Arrangement DUTs shall be driven individually with dedicated drivers, or in parallel circuits. The AC drive shall operate at the same frequency throughout the maintenance test. External current regulating components such as resistors may be used per the manufacturer's recommendation. At photometric and electrical measurement intervals, DUT RMS current shall be measured and reported.

Extracted from LM-80-15

Original

- g. Chromaticity shift value ($\Delta u'v'$) on the CIE 1976 diagram at each measurement point for each subcomponent in the sample set;

Rationale

If the elapsed testing time is 10kHz with 20pcs subcomponents, there are a total of $11 \times 20 = 220$ plots on the CIE 1976 diagram for only one Tc. It must be actually impossible to see the color shift values from the diagram because of too many plots.

Proposed Change

- g. Average chromaticity shift values ($\Delta u'v'$) in the sample set at each measurement point on the CIE 1976 diagram;

Original

h. Average current density per LED die (i.e., mA/mm²); and,

Rationale

Because LM-80-15 is now including AC driving, it should be also taken into consideration.

Proposed Change

h. Average current density per LED die for DC driving or average RMS current density per LED die for AC driving (i.e. mA/mm²).

Original

- i. Color Rendering Index (R_a) and R₉, or spectral power distribution (SPD) for wavelengths from 380 nm to 780 nm (at a minimum), with an interval not greater than 5 nm.

Rationale

If the elapsed testing time is 10kH with 20pcs subcomponents at 3 case temperatures, a total of $11 \times 20 \times 3 = 660$ SPD data is required on one LM-80 report. It must be too much from volume as well as data study perspective. Average SPD at each measurement point would work.

Proposed Change

Average spectral power distribution (SPD) in the sample set at each measurement point for wavelengths from 380nm to 780nm (at a minimum), with an interval not greater than 5nm.

Original

4. LM-80 test reports must include a minimum of one close up perspective view photograph or isometric view

Rationale

“isometric” is not realistic when large LED modules are tested.

Proposed Change

Remove “isometric”.

Original

5. LM-80 test reports must include a minimum of one reported case temperature (T_s). Test reports need not include three T_s values as required by LM-80, except as required to estimate a product's rated lumen maintenance life value using temperature data interpolation (as applicable; see IES TM-21-11 section 6 and its Addendum B⁴).

Rationale

LM-80-15 is not requiring three T_s anymore.

Proposed Change

Test reports need not include three T_s values as required by LM-80,



Test reports need not include multiple T_s values,

Original

- b. the average calculated current-per-die of the tested model or series is reported; and,

Rationale

- Common word instead of “Average calculated current-per-die” should be used in the same document.
- Because LM-80-15 is now including AC driving, it should be also taken into consideration.

Proposed Change

- b. Average current density per LED die for DC driving or average RMS current density per LED die for AC driving (i.e. mA/mm²) of the tested model or series is reported; and,

Original

- i. electrical power density (i.e. W/mm² of PCB or substrate total area, or equivalent calculation) less than or equal to the tested LED package; and,

Rationale

Because LM-80-15 is now including AC driving, it should be also taken into consideration.

Proposed Change

- i. electrical power density (i.e. W/mm² ...



- i. electrical power density based on power dissipation for DC driving or effective power dissipation for AC driving (i.e. W/mm² ...

Original

- ii. average current density per LED die (i.e. mA/mm² of epitaxial structures) less than or equal to the tested LED package; and,

Rationale

Because LM-80-15 is now including AC driving, it should be also taken into consideration.

Proposed Change

- ii. average current density per LED die for DC driving or average RMS current density per LED die for AC driving (i.e. mA/mm²) less than or equal to the tested LED package; and,

Original

8. For LED arrays constructed as an assembly of LED packages on a printed circuit board (PCB), each with their own phosphor layer:

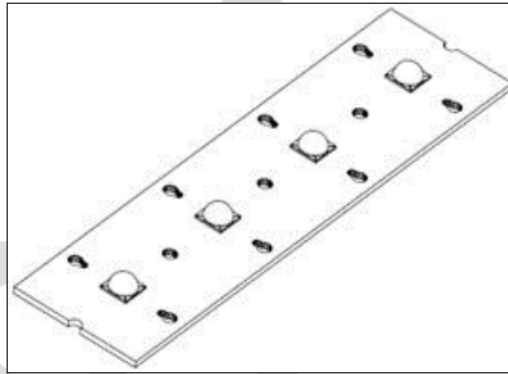


Figure 2: LED Module Employing 4 LED Packages

LM-80 test reports must be available either:

- a. for the individual LED packages; or,
- b. for the entire LED array, with current density-per-LED package reported.

Rationale

Multi COB panels should be included.

Proposed Change

8. For LED arrays constructed as an assembly of LED packages on a printed circuit board (PCB) or multi COB panels which have more than one light emitting surface (LES) on a board, each package or each LES with their own phosphor layer:

LM-80 test reports must be available either:

- a. For the individual LED packages or individual LESs; or
- b. For the entire LED array with current density-per-LED package or the entire multi COB panel with current density-per-LES reported.

Original

1. LM-80 test reports issued or revised on or after (90 days after final publication of this document) and referenced to support product certification must comply with section 3 of this document. Preexisting test reports issued or revised prior to (90 days after final publication of this document) may be referenced as existing without changes.

Rationale

The Preexisting test reports should be applicable without any changes 90 days after final publication of this document since it's burdensome to revise all the preexisting report.

Proposed Change

Preexisting test reports issued prior to (90 days after final publication of this document) may be referenced as existing without any changes.



Preexisting test reports issued prior to (90 days after final publication of this document) are applicable as existing without any changes.

Original

3. The correlated color temperature(s) of the LM-80 sample set may differ from the certified product as follows:

CCT of LM-80 Sample Set	CCT of Certified Product
2200K, 2500K, 2700K	any nominal CCT \geq 2200K covered by the specification
3000K, 3500K	any nominal <u>CCT \geq 2700K</u> covered by the specification
4000K, 5000K	any nominal CCT \geq 4000K covered by the specification

Rationale

It should be CCT \geq 3000K, since 2700K is not tested.

Proposed Change

“CCT \geq 2700K” \longrightarrow “CCT \geq 3000K”

Original

3. The correlated color temperature(s) of the LM-80 sample set may differ from the certified product as follows:

CCT of LM-80 Sample Set	CCT of Certified Product
2200K, 2500K, 2700K	any nominal CCT \geq 2200K covered by the specification
3000K, 3500K	any nominal CCT \geq 2700K covered by the specification
4000K, 5000K	any nominal CCT \geq 4000K covered by the specification

Rationale

Since ANSI C78.377-2015 defines 5700K and 6500K as well, they should be also included.

Proposed Change

Add the following.

5700K, 6500K	Any nominal CCT \geq 5700K covered by the specification
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Original

6. For chip-on-board LED packages the LM-80 test report referenced to support certification of a product must:
 - a. Include the LED package model or series number employed in the product; and,
 - b. Demonstrate that the average current density per LED die (i.e. mA/mm² of epitaxial structures) in the tested LED package model or series is greater than or equal to the current density per LED die employed in the product.

Rationale

Because LM-80-15 is now including AC driving, it should be also taken into consideration.

Proposed Change

The average current density per LED die (i.e. mA/mm² of epitaxial structures) in ...



The average current density per LED die for DC driving or average RMS current density per LED die for AC driving (i.e. mA/mm²) in ...

Original

6. For chip-on-board LED packages the LM-80 test report referenced to support certification of a product must:
 - a. Include the LED package model or series number employed in the product; and,
 - b. Demonstrate that the average current density per LED die (i.e. mA/mm² of epitaxial structures) in the tested LED package model or series is greater than or equal to the current density per LED die employed in the product.

Rationale

Electrical power density should be included.

Proposed Change

Add below.

- c. Demonstrate that the electrical power density based on power dissipation for DC driving or effective power dissipation for AC driving (i.e. W/mm²) in the tested LED package model or series is greater than or equal to the power density per LED package employed in the product.

Original

7. For LED arrays constructed as an assembly of LED packages on a printed circuit board, each with their own phosphor layer, the *in situ* temperature at the LED temperature measurement point (TMP_{LED}) of the hottest package in the array must be used for luminous or radiant flux maintenance projection purposes.

Rationale

Multi COB panels should be included.

Proposed Change

7. For LED arrays constructed as an assembly of LED packages on a printed circuit board (PCB) or multi COB panels which have more than one light emitting surface (LES) on a board, each package or each LES with their own phosphor layer, the *in situ* temperature at the LED temperature measurement point (TMP_{LED}) of the hottest package in the array or LES in the panel must be used for luminous or radiant flux maintenance projection purposes.

Original

- i. initial luminous flux greater than or equal to the original subcomponent;
- ii. lumen maintenance and color maintenance greater than or equal to the original subcomponent at 3,000 hours and after 6,000 hours of LM-80 testing;

Rationale

- When the lumen maintenance is almost 100% in LM-80 testing, there is a possibility the successor gives slightly lower lumen maintenance. For example, our tested COB gave 99.5% lumen maintenance at 55C and 6kH. If the successor would give 99.49%, it would fail as the successor in this rule even though the actual lifetime of successor is longer than that of the original one..

Proposed Change

- i. initial luminous flux greater than the performance minus 1% to the original subcomponent;
- ii. Lumen maintenance and color maintenance greater than the performance minus 1% to the original subcomponent at 3,000 hours and after 6,000 hours of LM-80 testing;

Thank you

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