LOW PROFILE LIGHT

BACKGROUND OF THE INVENTION

[0001] The present disclosure relates generally to lighting, particularly to low profile lighting, and more particularly to low profile downlighting for retrofit applications.

[0002] Light fixtures come in many shapes and sizes, with some being configured for new work installations while others are configured for old work installations. New work installations are not limited to as many constraints as old work installations, which must take into account the type of electrical fixture/enclosure or junction box existing behind a ceiling or wall panel material. With recessed ceiling lighting, sheet metal can-type light fixtures are typically used, while surface-mounted ceiling and wall lighting typically use metal or plastic junction boxes of a variety of sizes and depths. With the advent of LED (light emitting diode) lighting, there is a great need to not only provide new work LED light fixtures, but to also provide LED light fixtures that are suitable for old work applications, thereby enabling retrofit installations. One way of providing old work LED lighting is to configure an LED luminaire in such a manner as to utilize the volume of space available within an existing fixture (can-type fixture or junction box). However, such configurations typically result in unique designs for each type and size of fixture. Accordingly, there is a need in the art for an LED lighting apparatus that overcomes these drawbacks.

[0003] This background information is provided to reveal information believed by the applicant to be of possible relevance to the present invention. No admission is necessarily intended, nor should be construed, that any of the preceding information constitutes prior art against the present invention.

BRIEF DESCRIPTION OF THE INVENTION

[0004] An embodiment of the invention includes a luminaire having a heat spreader, a heat sink thermally coupled to and disposed diametrically outboard of the heat spreader, an outer optic securely retained relative to at least one of the heat spreader and the heat sink, a light source disposed in thermal communication with the heat spreader, and an electrical supply line disposed in electrical communication with the light source. The heat spreader, heat sink and outer optic,

in combination, have an overall height H and an overall outside dimension D such that the ratio of H/D is equal to or less than 0.25. The defined combination is configured and sized so as to: cover an opening defined by a nominally sized four-inch can light fixture; and, cover an opening defined by a nominally sized four-inch electrical junction box.

[0005] An embodiment of the invention includes a luminaire having a housing with a light unit and a trim unit. The light unit includes a light source, and the trim unit is mechanically separable from the light unit. A means for mechanically separating the trim unit from the light unit provides a thermal conduction path therebetween. The light unit has sufficient thermal mass to spread heat generated by the light source to the means for mechanically separating, and the trim unit has sufficient thermal mass to serve as a heat sink to dissipate heat generated by the light source.

[0006] An embodiment of the invention includes a luminaire for retrofit connection to an installed light fixture having a concealed in-use housing. The luminaire includes a housing having a light unit and a trim unit, the light unit having a light source, and the trim unit being mechanically separable from the light unit. The trim unit defines a heat sinking thermal management element, configured to dissipate heat generated by the light source, that is completely 100% external of the concealed in-use housing of the installed light fixture.

[0007] An embodiment of the invention includes a product having any feature described herein, explicitly, implicitly or equivalently, either individually or in combination with any other feature, in any configuration, and a method of forming the product, made by any process or sub-process described herein, explicitly, implicitly or equivalently, in any order, using any modality suitable for the purpose disclosed herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Referring to the exemplary drawings wherein like elements are numbered alike in the accompanying Figures, abbreviated in each illustration as "Fig.":

[0009] Figure 1 depicts an isometric top view of a luminaire in accordance with an embodiment of the invention;

[0010] Figure 2 depicts a top view of the luminaire of Figure 1;

[0011] Figure 2 depicts a bottom view of the luminaire of Figure 1;

[0012] Figure 4 depicts a side view of the luminaire of Figure 1;

[0013] Figure 5 depicts a top view of a heat spreader assembly, a heat sink, and an outer optic in accordance with an embodiment of the invention;

[0014] Figure 6 depicts an isometric view of the heat spreader of Figure 5;

[0015] Figure 7 depicts a partial isometric view of the heat sink of Figure 5;

[0016] Figure 8 depicts a top view of an alternative heat spreader assembly in accordance with an embodiment of the invention;

[0017] Figure 9 depicts a top view of another alternative heat spreader assembly in accordance with an embodiment of the invention;

[0018] Figure 10 depicts a top view of yet another alternative heat spreader assembly in accordance with an embodiment of the invention;

[0019] Figure 11 depicts a bottom view of a heat spreader having a power conditioner in accordance with an embodiment of the invention;

[0020] Figure 12 depicts a section view of a luminaire in accordance with an embodiment of the invention;

[0021] Figure 13 depicts a bottom view of a heat sink having recesses in accordance with an embodiment of the invention;

[0022] Figures 14-18 depict isometric views of existing electrical can-type light fixtures and electrical junction boxes for use in accordance with an embodiment of the invention;

[0023] Figures 19-21 depict a side view, top view and bottom view, respectively, of a luminaire similar but alternative to that of Figures 2-4, in accordance with an embodiment of the invention;

[0024] Figures 22-23 depict top and bottom views, respectively, of a heat spreader having an alternative power conditioner in accordance with an embodiment of the invention; and

[0025] Figure 24-26 depict in isometric, top and side views, respectively, an alternative reflector to that depicted in Figures 10 and 12.

DETAILED DESCRIPTION OF THE INVENTION

[0026] Although the following detailed description contains many specifics for the purposes of illustration, anyone of ordinary skill in the art will appreciate that many variations

and alterations to the following details are within the scope of the invention. Accordingly, the following preferred embodiments of the invention are set forth without any loss of generality to, and without imposing limitations upon, the claimed invention.

[0027] An embodiment of the invention, as shown and described by the various figures and accompanying text, provides a low profile downlight, more generally referred to as a luminaire, having an LED light source disposed on a heat spreader, which in turn is thermally coupled to a heat sink that also serves as the trim plate of the luminaire. The luminaire is configured and dimensioned for retrofit installation on standard can-type light fixtures used for recessed ceiling lighting, and on standard ceiling or wall junction boxes (J-boxes) used for ceiling or wall mounted lighting. The luminaire is also suitable for new work installation.

[0028] While embodiments of the invention described and illustrated herein depict an example luminaire for use as a downlight when disposed upon a ceiling, it will be appreciated that embodiments of the invention also encompass other lighting applications, such as a wall sconce for example.

[0029] While embodiments of the invention described and illustrated herein depict example power conditioners having visually defined sizes, it will be appreciated that embodiments of the invention also encompass other power conditioners having other sizes as long as the power conditioners fall within the ambit of the invention disclosed herein.

[0030] Referring to Figures 1-26 collectively, a luminaire 100 includes a heat spreader 105, a heat sink 110 thermally coupled to and disposed diametrically outboard of the heat spreader, an outer optic 115 securely retained relative to at least one of the heat spreader 105 and the heat sink 110, a light source 120 disposed in thermal communication with the heat spreader 105, and an electrical supply line 125 disposed in electrical communication with the light source 120. To provide for a low profile luminaire 100, the combination of the heat spreader 105, heat sink 110 and outer optic 115, have an overall height H and an overall outside dimension D such that the ratio of H/D is equal to or less than 0.25. In an example embodiment, height H is 1.5-inches, and outside dimension D is a diameter of 7-inches. Other dimensions for H and D are contemplated such that the combination of the heat spreader 105, heat sink 110 and outer optic 115, are configured and sized so as to; (i) cover an opening defined by an industry standard can-type light fixture having nominal sizes from three-inches to six-inches (see Figures 14 and 15 for

example); and, (ii) cover an opening defined by an industry standard electrical junction box having nominal sizes from three-inches to six-inches (see Figures 16 and 17 for example). Since can-type light fixtures and ceiling/wall mount junction boxes are designed for placement behind a ceiling or wall material, an example luminaire has the back surface of the heat spreader 105 substantially planar with the back surface of the heat sink 110, thereby permitting the luminaire 100 to sit substantially flush on the surface of the ceiling/wall material. Alternatively, small standoffs 200 (see Figure 12 for example) may be used to promote air movement around the luminaire 100 for improved heat transfer to ambient, which will be discussed further below. Securement of the luminaire 100 to a junction box may be accomplished by using suitable fasteners through appropriately spaced holes 150 (see Figure 8 for example), and securement of the luminaire 100 to a can-type fixture may be accomplished by using extension springs 205 fastened at one end to the heat spreader 105 (see Figure 12 for example) and then hooked at the other end onto an interior detail of the can-type fixture.

[0031] In an embodiment, the light source 120 includes a plurality of light emitting diodes (LEDs) (also herein referred to as an LED chip package), which is represented by the "checkered box" in Figures 5, 6 and 8-10. In application, the LED chip package generates heat at the junction of each LED die. To dissipate this heat, the LED chip package is disposed in suitable thermal communication with the heat spreader 105, which in an embodiment is made using aluminum, and the heat spreader is disposed in suitable thermal communication with the heat sink 110, which in an embodiment is also made using aluminum. To provide for suitable heat transfer from the heat spreader 105 to the heat sink 110, an embodiment employs a plurality of interconnecting threads 130, 135, which when tightened provide suitable surface area for heat transfer thereacross.

[0032] Embodiments of luminaire 100 may be powered by DC voltage, while other embodiments may be powered by AC voltage. In a DC-powered embodiment, the electrical supply lines 125, which receive DC voltage from a DC supply, are directly connected to the plurality of LEDs 120. Holes 210 (see Figure 9 for example) in the heat spreader 105 permit passage of the supply lines 125 from the back side of the heat spreader 105 to the front side. In an AC-powered embodiment, a suitable power conditioner 140, 160, 165 (see Figures 8, 9 and 11 for example) is used.

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