# DIO8242E
# Adaptive 100/120 Hz Current Ripple Remover
# Max Input Current ≤ 60 mA

## Features

- Regulator for adaptive 100/120 Hz current ripple remove
- Built-in zener diode for input voltage clamping
- Built-in 100 V power MOSFET
- Programmable amplitude LED current ripple
- Programmable maximum cathode voltage of LED
- Programmable maximum LED current
- Optimized for TRIAC dimming, 1% brightness without flicker
- The current ripple is less than ±1%
- SOT23-3，SOT89-3 packages

## Descriptions

DIO8242E is a regulator for driving internal NMOSFET to remove the 100/120 Hz LED string current ripple on AC/DC power.

Patented control strategies are optimized for remover current ripple. Novel circuit design makes a lower BOM and high cost-effective for flickerless filament.

## Applications

- LED lighting

## Ordering Information

| Ordering Part No. | Top Marking | MSL | RoHS | $T_A$ | Package | |
|---|---|---|---|---|---|---|
| DIO8242EST3 | 1016 | 3 | Green | -40 to 125°C | SOT23-3 | Tape & Reel,3000 |
| DIO8242ETC3 | 1016 | 3 | Green | -40 to 125°C | SOT89-3 | Tape & Reel,2500 |

## Pin Assignment

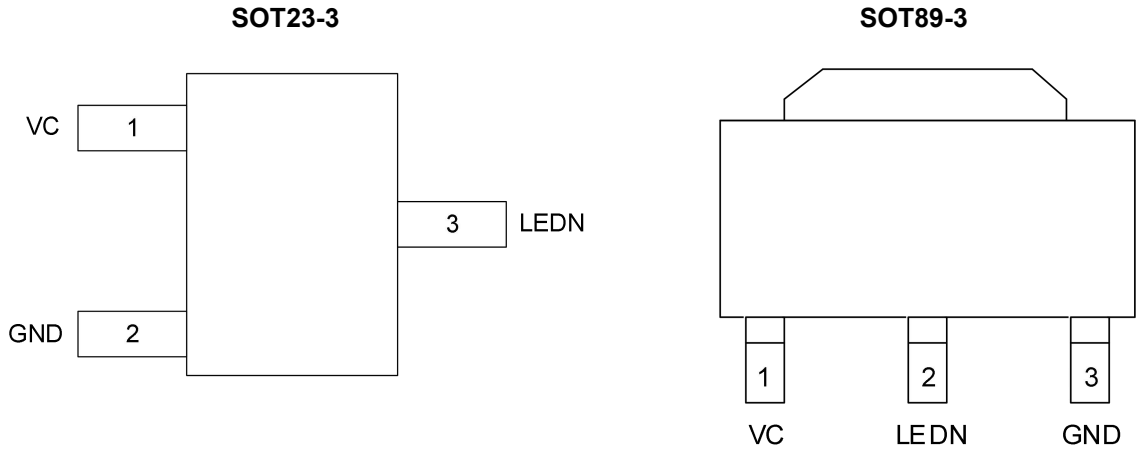



**Figure 1. Top view**

## Pin Descriptions

| Pin Name | Description |
|---|---|
| GND | Power ground |
| VC | LED current ripple programming |
| LEDN | Connect to the cathode of LED string |

## Absolute Maximum Ratings

Stresses beyond those listed under “Absolute Maximum Rating” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maxim rating conditions for extended periods may affect device reliability.

| Symbol | Parameter | | Rating | Unit |
|---|---|---|---|---|
| $V_{LEDN}$ | LEDN | | 100 | V |
| $V_{VC}$ | VC | | -0.3 to 6 | V |
| $T_J$ | Junction temperature | | 150 | °C |
| $T_L$ | Lead temperature | | 260 | °C |
| $T_{STG}$ | Storage temperature | | -65 to 150 | °C |
| $R_{\theta JA}$ | Thermal resistance | SOT23-3 | 220 | °C/W |
| | | SOT89-3 | 80 | |
| $R_{\theta JC}$ | Thermal resistance | SOT23-3 | 130 | °C/W |
| | | SOT89-3 | 25 | |

## Recommend Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. DIOO does not recommend exceeding them or designing to Absolute Maximum Ratings.

| Symbol | Parameter | | Rating | Unit |
|---|---|---|---|---|
| $V_{LEDN}$ | LEDN | | < 100 | V |
| $T_J$ | Junction temperature | | 125 | °C |
| | Under point $V_{LEDN}$ | | 0.8~1.2 | V |
| | Power consumption | SOT23-3 | < 300 | mW |
| | | SOT89-3 | < 650 | |

# Electrical Characteristics

Typical value: Vcc = 3.6 V, $T_A$ = 25°C, unless otherwise specified.

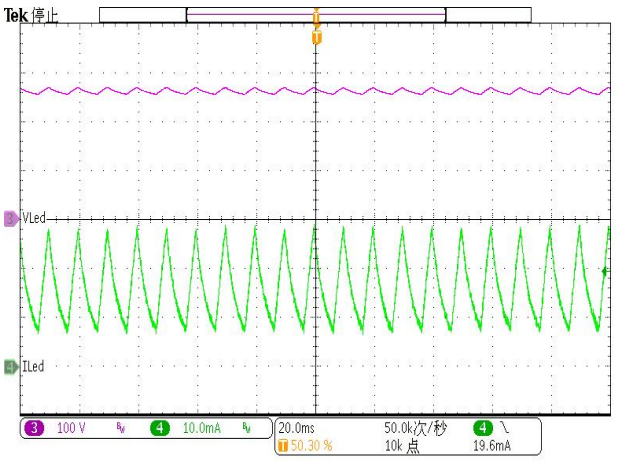
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{ST}$ | Start-up current | | | | 1 | uA |
| $V_{REF}$ | LEDN compare voltage | | | 9 | | V |
| $I_{CLMT}$ | LED current limit | | | | 60 | mA |
| $R_{DS(ON)}$ | MOS $R_{DS(ON)}$ | | | 16 | | Ω |
| BV | Breakdown voltage | | 100 | | | V |

**Note：**

(1) Specifications subject to change without notice.

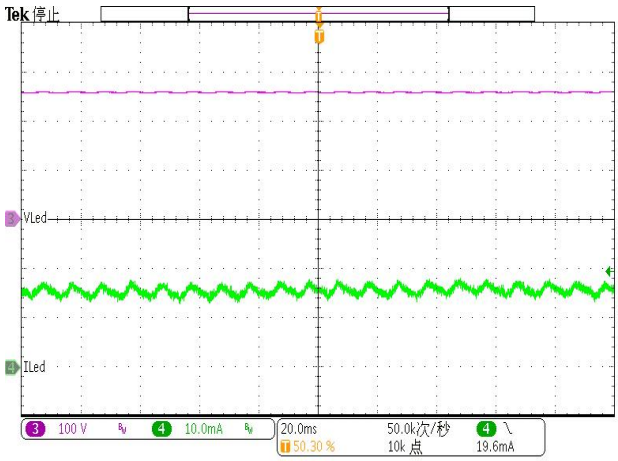
# Typical Performance Characteristics

$C_{VC}$ = 1 μF, $C_{EC}$ = 8.2 μF, unless otherwise specified.



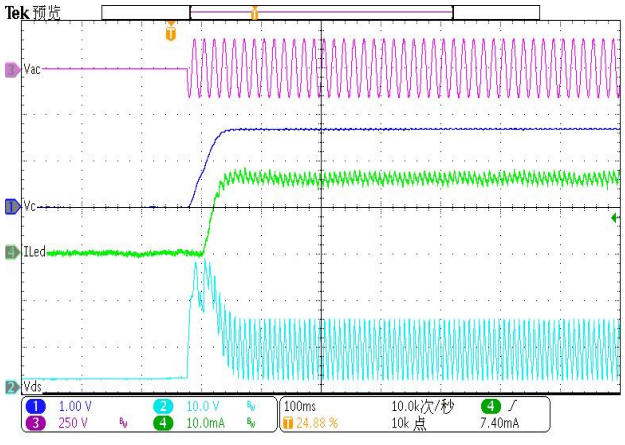

($V_{AC}$ = 220 V, $V_{LED}$ = 250 V, $I_{LED}$ = 15 mA)

**Figure 2. LED current ripple without DIO8242E**



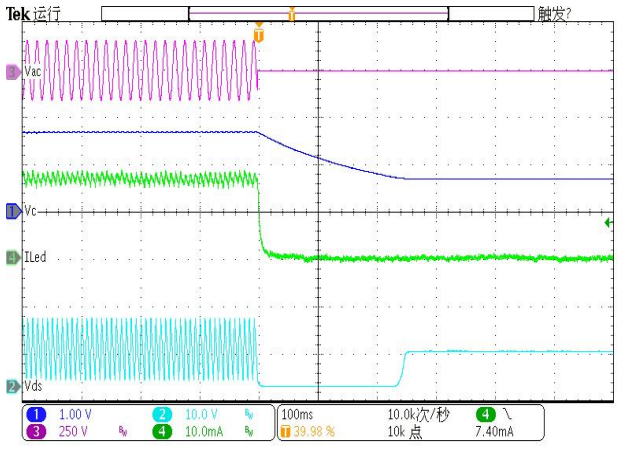

($V_{AC}$ = 220 V, $V_{LED}$ = 250 V,$I_{LED}$ = 15 mA)

**Figure 3. LED current ripple with DIO8242E**




($V_{AC}$ = 120 V, $V_{LED}$ = 125 V, $I_{LED}$ = 15 mA)

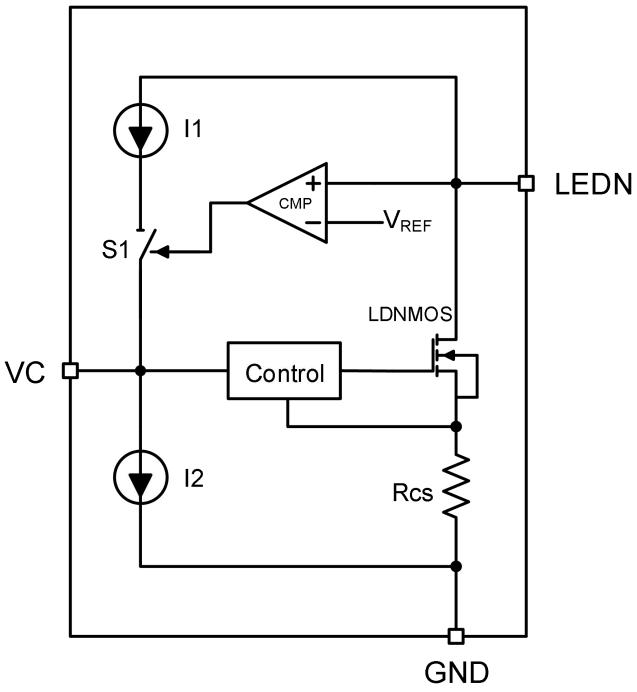
**Figure 4. AC source power ON**




($V_{AC}$ = 120 V, $V_{LED}$ = 125 V, $I_{LED}$ = 15 mA)

**Figure 5. AC source power OFF**

## Block Diagram




## Function Description

The DIO8242E is designed for driving one LED string and removing the 100/120 Hz LED current ripple.

### Theory of operation

The LED string and DIO8242E are both supplied by an AC/DC current source. The drain of internal NMOSFET is connected to the cathode of LED string. A sensing resistor Rcs is connected between the source of NMOSFET and GND. The DIO8242E drives NMOSFET to transfer the LED current ripple to voltage ripple on NMOSFET, and ensures the constant voltage across LED string and the constant current flow through LED string. The scalable adaptive function of DIO8242E can regulate the cathode voltage of LED string to minimum to improve the efficiency of the system.

### Current ripple removing

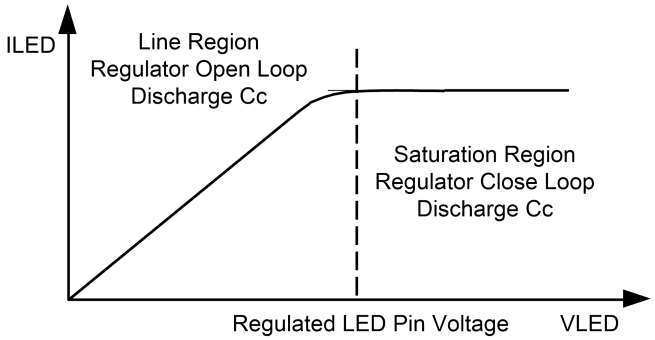
The capacitor $C_C$ between VC and GND is an integral capacitor. DIO8242E transform the voltage on Cc to a reference voltage. The current regulator regulates LED current via negative feedback control.

$C_C$ should be large enough in order to remove the current ripple of the LED string. However, too large capacitor may slow down the dynamic response.

### Adaptive regulation

The DIO8242E controls the voltage on $C_C$ by monitoring the operation state of built-in N-MOSFET. The efficiency of system is relatively low when N-MOSFET always works in the saturation region. The DIO8242E detects it and charges $C_C$ to raise the $V_{VC}$ and $I_{LED}$, then the output voltage of power supply is reduced, and the voltage drop on N-MOSFET decreases.

Conversely, when N-MOSFET is working in the linear region, LED current regulation loop is open. The DIO8242E detects it and discharges $C_C$ to reduce the $V_{VC}$ and $I_{LED}$, then the output voltage of power supply is raised, and the LED current regulation loop is closed.

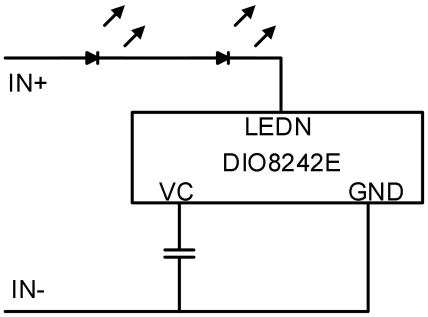



**PCB design guideline**

1. The DIO8242E should be placed far away from the power devices for better thermal performance.
2. The area of LED current loop should be as small as possible.

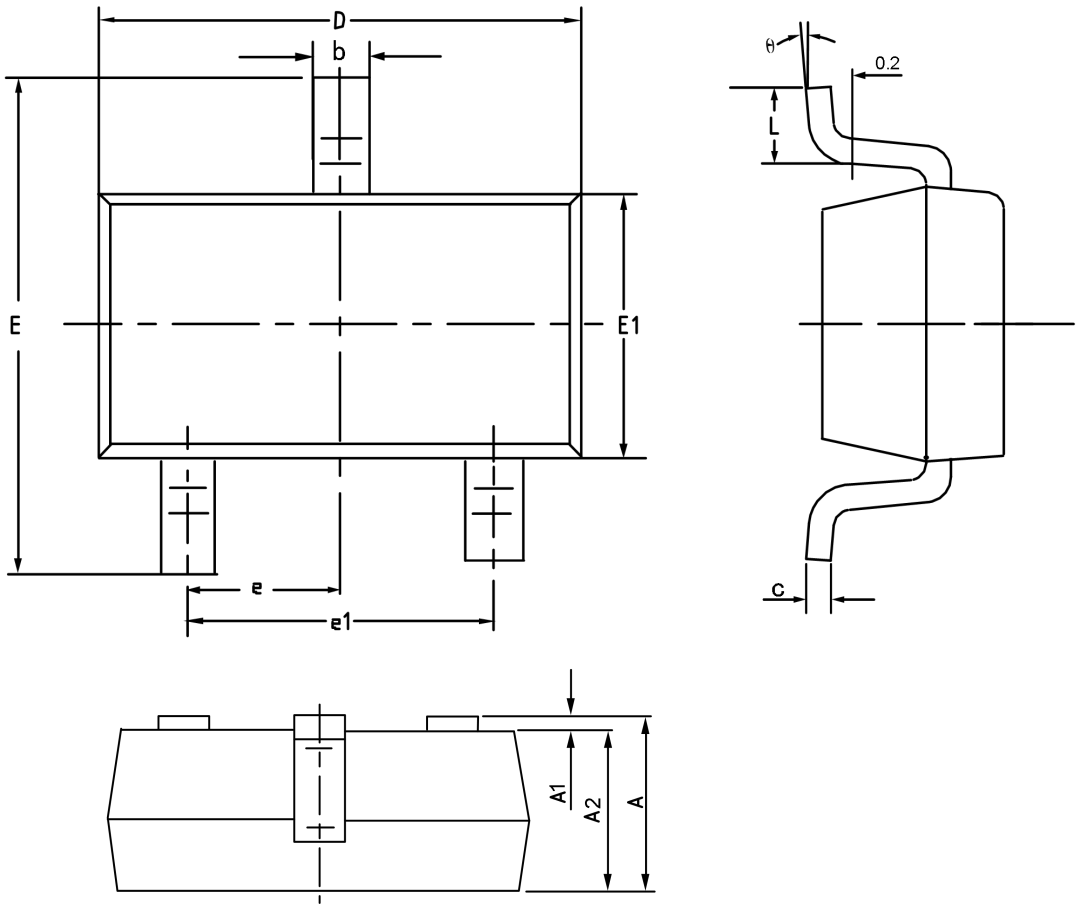
## Application Information

**The DIO8242E design guide:**



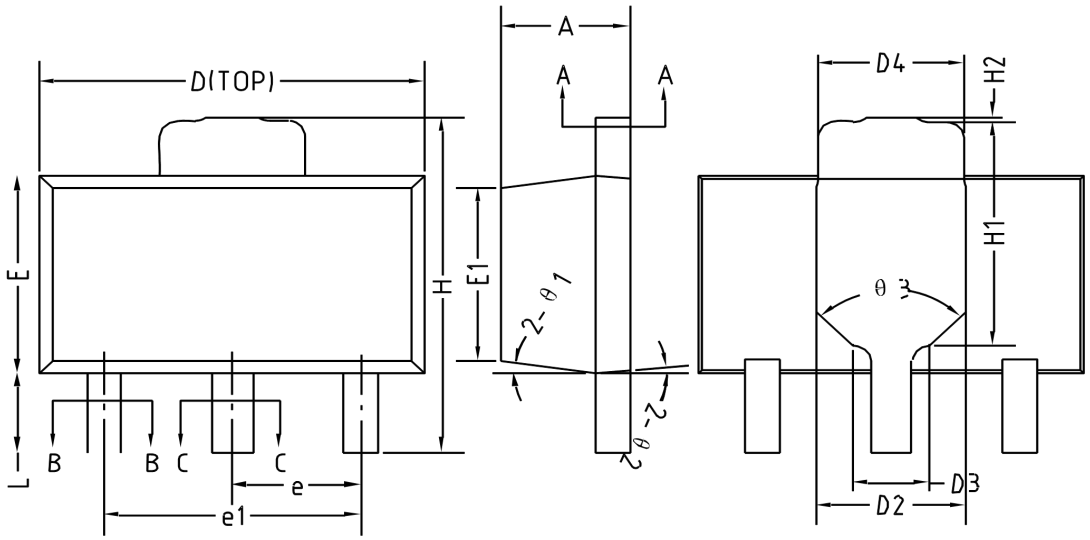

The value of the capacitor between VC and GND can determine the final amplitude of the current ripple. It should be large enough in order to remove the current ripple of the LED string. However, too large capacitor may low down the dynamic response.

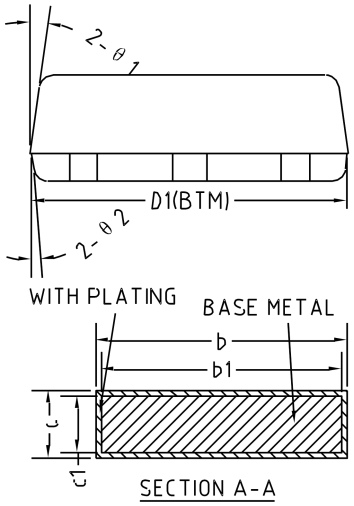
## Physical Dimensions: SOT23-3

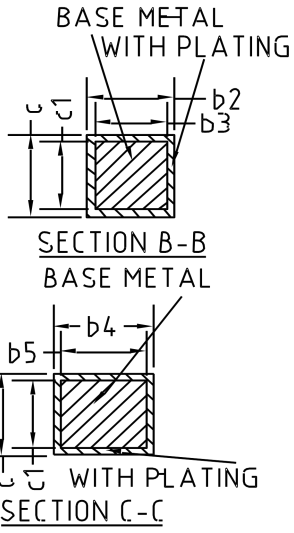



| Common Dimensions (Units of measure = Millimeter) | | |
|---|---|---|
| **Symbol** | **Min** | **Max** |
| A | 1.05 | 1.25 |
| A1 | 0.00 | 0.10 |
| A2 | 1.05 | 1.15 |
| b | 0.30 | 0.50 |
| c | 0.10 | 0.20 |
| D | 2.82 | 3.02 |
| E1 | 1.50 | 1.70 |
| E | 2.65 | 2.95 |
| e | 0.95 BSC | |
| e1 | 1.80 | 2.00 |
| L | 0.30 | 0.60 |
| Θ | 0° | 8° |

## Physical Dimensions: SOT89-3




| Common Dimensions (Units of measure = Millimeter) | | | |
|---|---|---|---|
| **Symbol** | **Min** | **Nom** | **Max.** |
| A | 1.40 | 1.50 | 1.60 |
| b | 1.68 | - | 1.77 |
| b1 | 1.67 | 1.70 | 1.73 |
| b2 | 0.38 | - | 0.47 |
| b3 | 0.37 | 0.40 | 0.43 |
| b4 | 0.46 | - | 0.55 |
| b5 | 0.45 | 0.48 | 0.51 |
| c | 0.40 | - | 0.44 |
| c1 | 0.39 | 0.40 | 0.41 |
| D | 4.40 | 4.50 | 4.60 |
| D1 | 4.35 | 4.45 | 4.55 |
| D2 | 1.60 | 1.75 | 1.90 |
| D3 | 0.75 | 0.90 | 1.05 |
| D4 | 1.60 | 1.70 | 1.80 |
| E | 2.40 | 2.50 | 2.60 |
| E1 | 2.13 | - | 2.19 |
| e | 1.50BSC | | |
| e1 | 3.00BSC | | |
| H | 4.05 | - | 4.25 |
| H1 | 2.70 | - | 3.00 |
| H2 | 0 | - | 0.10 |
| L | 0.89 | - | 1.20 |
| θ1 | 6° | 8° | 10° |
| θ2 | 3° | 5° | 7° |
| θ3 | 85° | 90° | 95° |

## CONTACT US

Dioo is a professional design and sales corporation for high-quality and performance analog semiconductors. The company focuses on industry markets, such as, cell phone, handheld products, laptop, and medical equipment and so on. Dioo's product families include analog signal processing and amplifying, LED drivers and charger IC. Go to http://www.dioo.com for a complete list of Dioo product families.

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