# 10 to 100mA LED CONSTANT CURRENT REGULATOR in SOT26

## Description

The BCR401U monolithically integrates a transistor, diodes and resistors to function as a Constant Current Regulator (CCR) for LED driving. The device regulates with a preset 10mA nominal that can be adjusted with external resistor up to 100mA. It is designed for driving LEDs in strings and will reduce current at increasing temperatures to self-protect. Operating as a series linear CCR for LED string current control, it can be used in applications with supply voltages up to 40V.

With no need for additional external components, this CCR is fully integrated into a SOT26 minimizing PCB area and component count.

## Applications

Constant current regulation (CCR) in:

- Emergency lighting
- Signage, advertising, decorative and architectural lighting
- Retail lighting in fridge, freezer case and vending machines

## Features

- LED Constant Current Regulator Using PNP Emitter-Follower with Emitter Resistor to Current Limit
- $I_{OUT}$ = 10mA ± 10% constant current (Preset)
- $I_{OUT}$ up to 100mA adjustable with an external resistor
- Negative temperature coefficient (NTC) reduces Iout with increasing temperature
- Parallel devices to increase regulated current
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

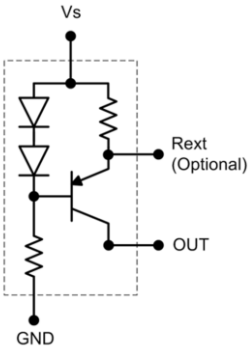
## Mechanical Data

- Case: SOT26 (SC-74)
- Case Material: Molded Plastic. "Green" Molding Compound. UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.018 grams (Approximate)

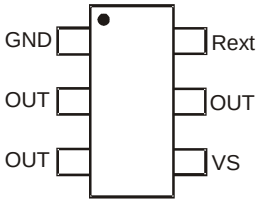
SOT26 (SC-74)



Top View




Internal Device Schematic




Top View
Pin-Out

| Pin Name | Pin Function |
|---|---|
| Vs | Supply Voltage |
| OUT | Regulated Output Current |
| Rext | External resistor for adjusting Output Current |
| GND | Power Ground |

## Ordering Information (Note 4)

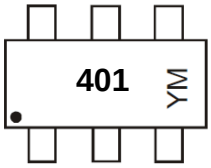
| Product | Marking | Reel size (inches) | Tape width (mm) | Quantity per reel |
|---|---|---|---|---|
| BCR401UW6-7 | 401 | 7 | 8 | 3,000 |

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. For packaging details, go to our website at http://www.diodes.com/products/packages.html.


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## Marking Information

SOT26 (SC-74)




401 = Part Marking (See Ordering Information)
YM = Date Code Marking
Y = Year (ex: D = 2016)
M = Month (ex: 9 = September)

Date Code Key

| Year | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|
| Code | D | E | F | G | H | I | J |

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | O | N | D |

## Absolute Maximum Ratings (Voltage relative to GND, @$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Supply Voltage | $V_S$ | 40 | V |
| Output Current | $I_{OUT}$ | 100 | mA |
| Output Voltage | $V_{OUT}$ | 40 | V |
| Reverse voltage between all terminals | $V_R$ | 0.5 | V |

## Thermal Characteristics

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Power Dissipation | (Note 5) | $P_D$ | 1,190 | mW |
| | (Note 6) | | 912 | |
| Thermal Resistance, Junction to Ambient | (Note 5) | $R_{\theta JA}$ | 105 | °C/W |
| | (Note 6) | | 137 | |
| Thermal Resistance, Junction to Lead | (Note 7) | $R_{\theta JL}$ | 50 | |
| Recommended Operating Junction Temperature Range | | $T_J$ | -55 to +150 | °C |
| Maximum Operating Junction and Storage Temperature Range | | $T_J$ , $T_{STG}$ | -65 to +150 | |

## ESD Ratings (Note 8)

| Characteristics | Symbols | Value | Unit | JEDEC Class |
|---|---|---|---|---|
| Electrostatic Discharge – Human Body Model | ESD HBM | 800 | V | 1B |
| Electrostatic Discharge – Machine Model | ESD MM | 300 | V | B |

Notes:
5. For a device mounted with the OUT leads on 50mm x 50mm 2oz copper that is on a single-sided 1.6mm FR4 PCB; device is measured under still air conditions while operating in steady-state.
6. Same as Note 5, except mounted on 15mm x 15mm 1oz copper.
7. $R_{\theta JL}$ = Thermal resistance from junction to solder-point (at the end of the OUT leads).
8. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

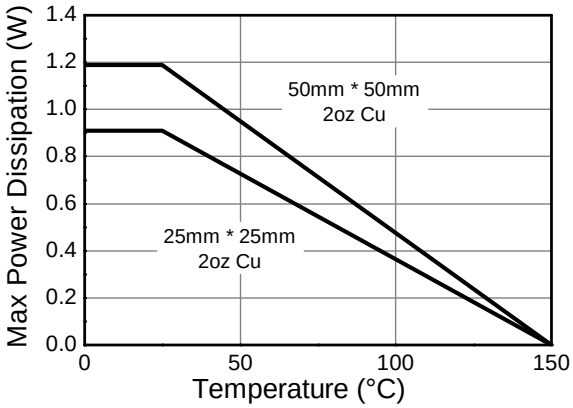

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## Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

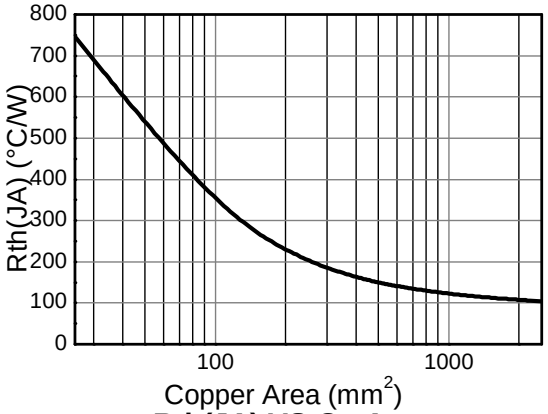
| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Collector-Emitter Breakdown Voltage | $BV_{CEO}$ | 40 | - | - | V | $I_C$ = 1mA |
| GND (Enable) Current | $I_{GND}$ | 340 | 420 | 500 | µA | $V_S$ = 10V; $V_{OUT}$ = open |
| GND (Enable) Current | $I_{GND}$ | - | 380 | - | µA | $V_S$ = 10V; $V_{OUT}$ = 8.6V |
| DC Current Gain | $h_{FE}$ | 100 | 220 | 470 | - | $I_C$ = 50mA; $V_{CE}$ = 1V |
| Internal Resistor | $R_{int}$ | 78 | 91 | 104 | Ω | $I_{Rint}$ = 10mA |
| Output Current (nominal) | $I_{OUT}$ | 9 | 10 | 11 | mA | $V_{OUT}$ = 8.6V; $V_S$ = 10V |
| Voltage Drop ($V_{Rext}$) | $V_{drop}$ | - | 0.91 | - | V | $I_{OUT}$ = 10mA |
| Lowest Sufficient Supply Voltage ($V_S$-$V_{OUT}$) | $V_{Smin}$ | - | 1.4 | - | V | $I_{OUT}$ > 8mA |
| Output Current Change vs. Temperature | $\Delta I_{OUT}/I_{OUT}$ | - | -0.25 | - | %/°C | $V_S$ = 10V |
| Output Current Change vs. Supply Voltage | $\Delta I_{OUT}/I_{OUT}$ | - | 1 | - | %/V | $V_S$ = 10V |


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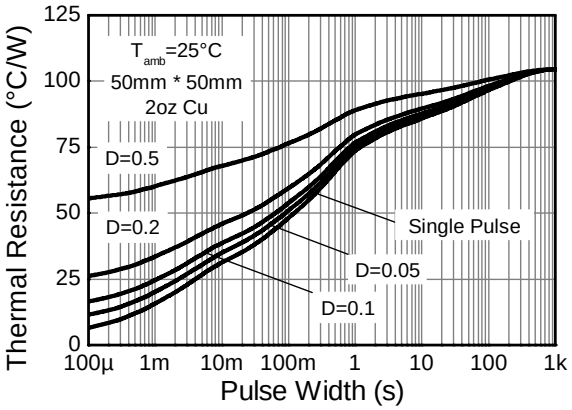
## Typical Thermal Characteristics (@$T_A$ = +25°C, unless otherwise specified.)



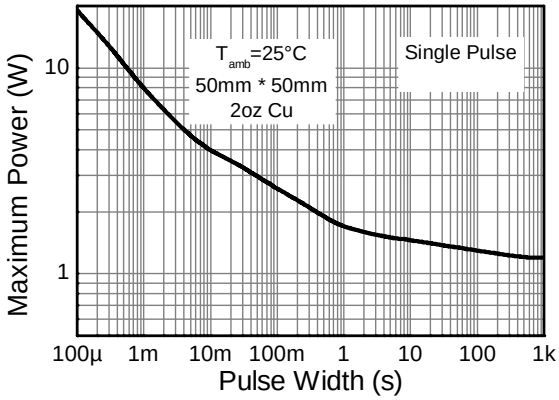

**Derating Curve**



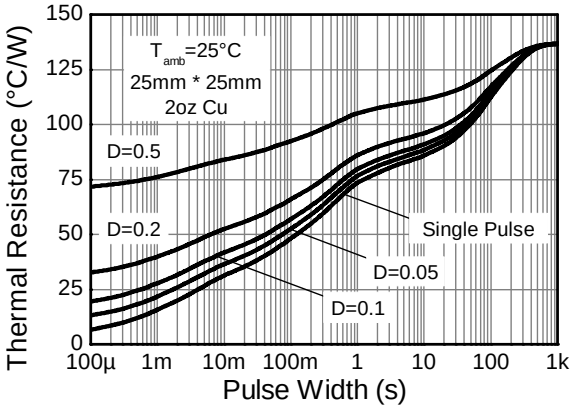

**Rth(JA) VS Cu Area**



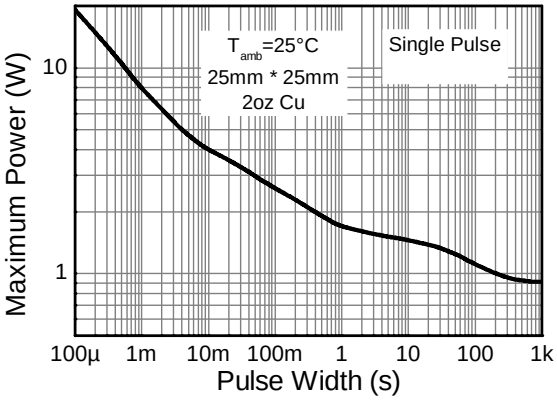

**Transient Thermal Impedance**




**Pulse Power Dissipation**



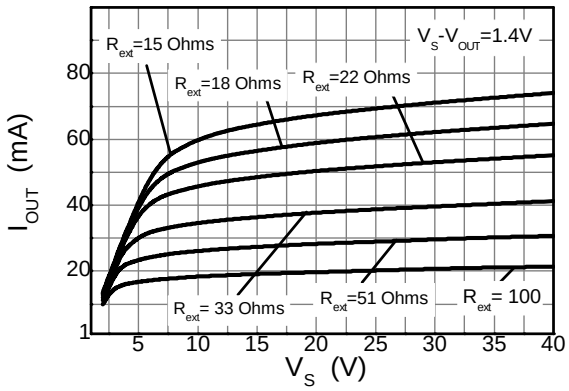

**Transient Thermal Impedance**



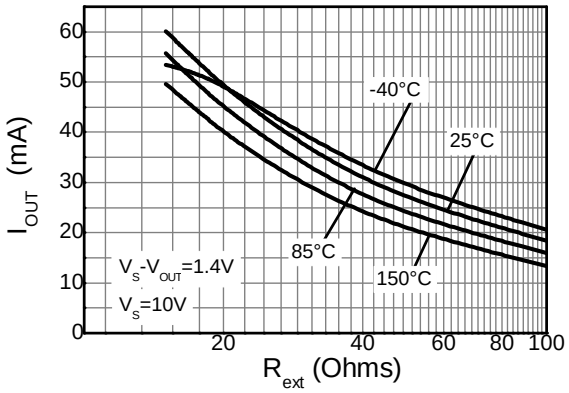

**Pulse Power Dissipation**


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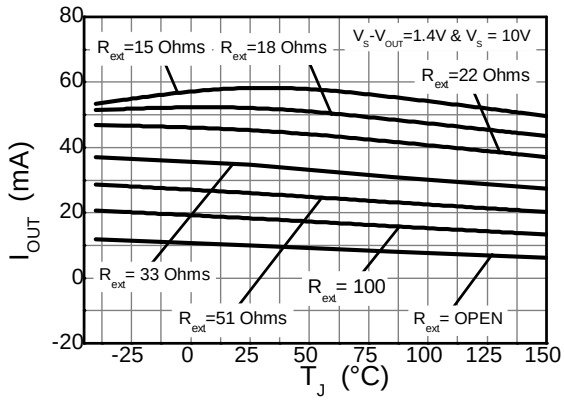
## Typical Electrical Characteristics (continued) (@$T_A$ = +25°C, unless otherwise specified.)



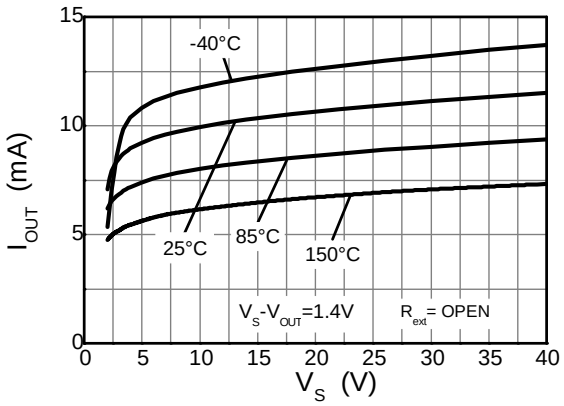

**$V_S$ vs $I_{OUT}$**



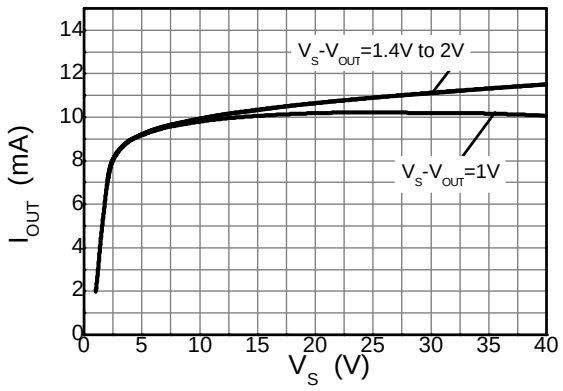

**$R_{ext}$ (Ohms)vs $I_{OUT}$**



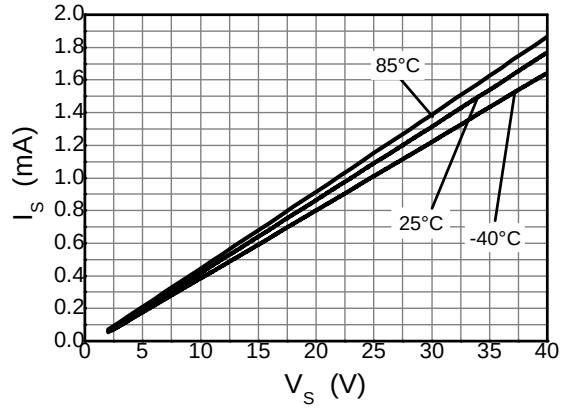

**$T_J$ vs $I_{OUT}$**




**$V_S$ vs $I_{OUT}$**




**$V_S$ vs $I_{OUT}$**



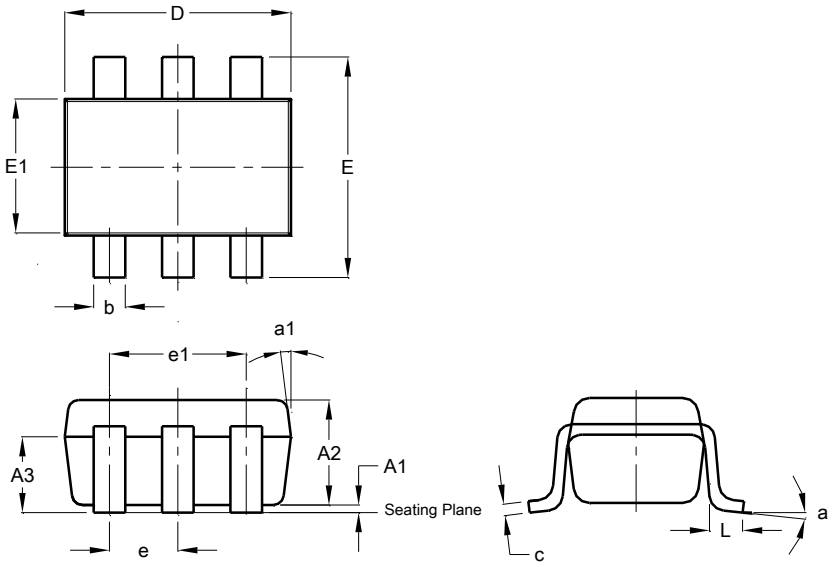

**$V_S$ vs $I_S$**


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## Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

**SOT26 (SC74R)**

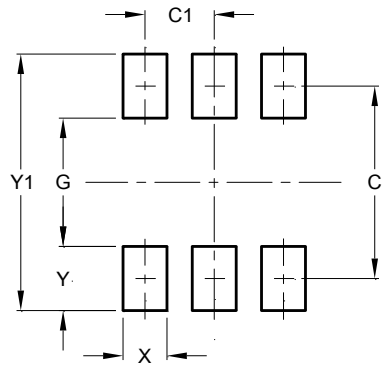



| SOT26 (SC74R) | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A1** | 0.013 | 0.10 | 0.05 |
| **A2** | 1.00 | 1.30 | 1.10 |
| **A3** | 0.70 | 0.80 | 0.75 |
| **b** | 0.35 | 0.50 | 0.38 |
| **c** | 0.10 | 0.20 | 0.15 |
| **D** | 2.90 | 3.10 | 3.00 |
| **e** | - | - | 0.95 |
| **e1** | - | - | 1.90 |
| **E** | 2.70 | 3.00 | 2.80 |
| **E1** | 1.50 | 1.70 | 1.60 |
| **L** | 0.35 | 0.55 | 0.40 |
| **a** | - | - | 8° |
| **a1** | - | - | 7° |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

**SOT26 (SC74R)**




| Dimensions | Value (in mm) |
|---|---|
| **C** | 2.40 |
| **C1** | 0.95 |
| **G** | 1.60 |
| **X** | 0.55 |
| **Y** | 0.80 |
| **Y1** | 3.20 |


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