# LED Driver

# BCR320U / BCR321U

## Datasheet

Revision 2.0, 2012-05-04

Power Management & Multimarket

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| Revision History | |
|---|---|
| **Page or Item** | **Subjects (major changes since previous revision)** |
| **Revision 2.0, 2012-05-04** | |
| All | Datasheet layout updated |
| **Table 2-3** | $R_{int}$ limits tightened |
| **Table 2-3** | $I_{out}$ limits tightened |

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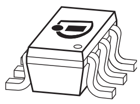
# 1 LED Driver

## 1.1 Features



SC74-3D

- LED drive current preset to 10 mA
- Continuous output current up to 250 mA with an external resistor
- Easy paralleling of drivers to increase current
- Supply voltage up to 25 V
- Low side current control
- Digital PWM input up to 10 kHz frequency (BCR321U)
- Up to 1 W power dissipation in a small SC74 package
- Negative thermal coefficient of -0.2 %/K reduces output current at higher temperatures
- RoHS compliant (Pb-free) package
- Automotive qualified according AEC Q101

AEC Qualified RoHS HAL

## 1.2 Applications

- Architectural LED lighting
- Channel letters for advertising, LED strips for decorative lighting
- Retail lighting in fridge, freezer case and vending machines
- Emergency lighting (e.g. steps lighting, exit way signs etc.)

## 1.3 General Description

The BCR320U / BCR321U provides a low-cost solution for driving 0.5 W LEDs with a typical LED current of 150 mA to 200 mA. Internal breakdown voltage is higher than 16 V which is the maximum voltage the LED driver can sustain when the output is directly connected to supply voltage.

The BCR320U / BCR321U can be operated with a supply voltage of more than 16 V considering the voltage drop of the LED load which reduces the output voltage to the maximum rating of the driver.

The enable pin of BCR320U can withstand a maximum voltage of 25 V which can be increased adding a series resistor in front of the enable pin reducing the voltage at the enable pin below 25 V.

The digital input pin of BCR321U allows dimming via a micro controller with frequencies up to 10 kHz.

A reduction of the output current at higher temperatures is the result of the negative temperature coefficient of -0.2 %/K of the LED driver.

With no need for additional external components like inductors, capacitors and free wheeling diodes, the BCR320U / BCR321U LED drivers are a cost-efficient and PCB-area saving solution for driving 0.5 W LEDs.

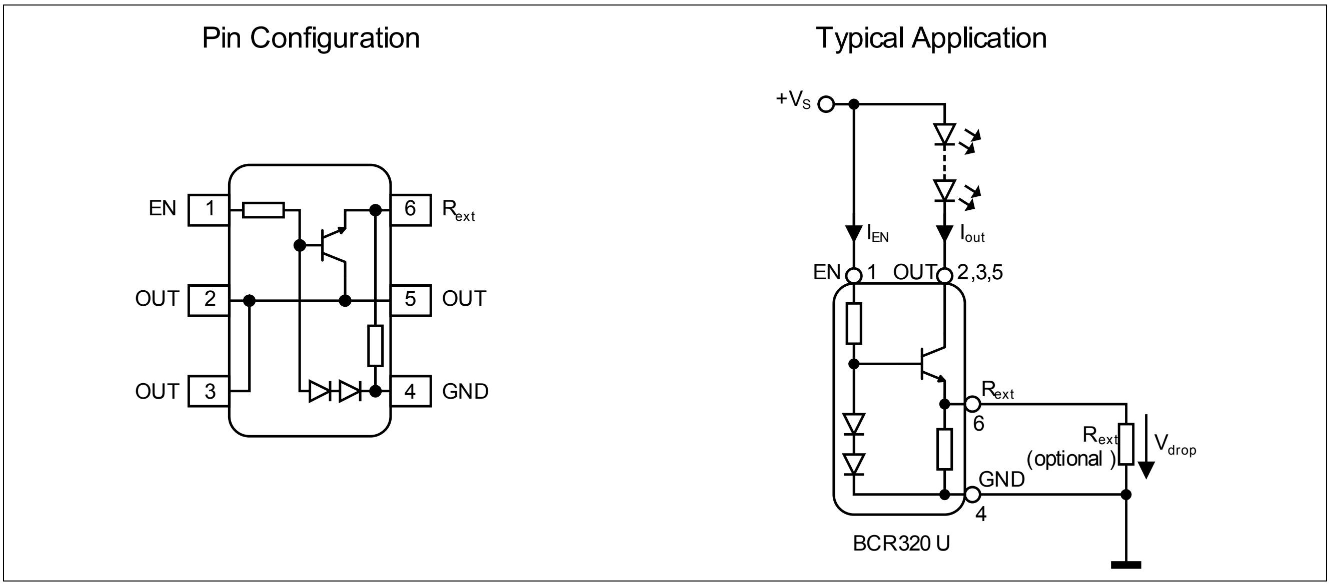



**Figure 1-1 Pin configuration and typical application**

| Type | Marking | Pin Configuration | | | | Package |
|---|---|---|---|---|---|---|
| BCR320U | 30 | 1 = EN | 2; 3; 5 = OUT | 4 = GND | 6 = $R_{ext}$ | SC74 |
| BCR321U | 31 | 1 = EN | 2; 3; 5 = OUT | 4 = GND | 6 = $R_{ext}$ | SC74 |

# 2 Electrical Characteristics

**Table 2-1 Maximum Ratings at $T_A$ = 25 °C, unless otherwise specified**

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Enable voltage<br>BCR320U<br>BCR321U | $V_{EN}$ | <br>-<br>- | <br>-<br>- | <br>25<br>4.5 | V | |
| Output current | $I_{out}$ | - | - | 300 | mA | |
| Output voltage | $V_{out}$ | - | - | 16 | V | |
| Reverse voltage between all terminals | $V_R$ | - | - | 0.5 | V | |
| Total power dissipation | $P_{tot}$ | - | - | 1000 | mW | $T_S \leq 100$ °C |
| Junction temperature | $T_J$ | - | - | 150 | °C | |
| Storage temperature range | $T_{STG}$ | -65 | - | 150 | °C | |

***Attention:** Stresses above the max. values listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the integrated circuit.*

**Table 2-2 Thermal Resistance at $T_A$ = 25 °C, unless otherwise specified**

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Junction - soldering point[1)] | $R_{thJS}$ | - | - | 50 | K/W | |

1) For calculation of $R_{thJA}$ please refer to Application Note AN077 (Thermal Resistance Calculation)

**Table 2-3 Electrical Characteristics at $T_A$ = 25 °C, unless otherwise specified**

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Collector-emitter breakdown voltage | $V_{BR(CEO)}$ | 16 | - | - | V | $I_C$ = 1 mA, $I_B$ = 0 |
| Enable current<br>BCR320U<br>BCR321U | $I_{EN}$ | <br>-<br>- | <br>1.2<br>1.2 | <br>-<br>- | mA | <br>$V_{EN}$ = 12 V<br>$V_{EN}$ = 3.3 V |
| DC current gain | $h_{FE}$ | 200 | 350 | 500 | - | $I_C$ = 50 mA, $V_{CE}$ = 1 V |
| Internal resistor | $R_{int}$ | 85 | 95 | 105 | Ω | $I_{Rint}$ = 10 mA |
| Bias resistor<br>BCR320U<br>BCR321U | $R_B$ | <br>-<br>- | <br>10<br>1.5 | <br>-<br>- | kΩ | |

**Table 2-3 Electrical Characteristics at $T_A$ = 25 °C, unless otherwise specified** (cont'd)

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Output current | $I_{out}$ | | | | mA | $V_{out}$ = 1.4 V |
| BCR320U | | 9 | 10 | 11 | | $V_{EN}$ = 12 V |
| BCR321U | | 9 | 10 | 11 | | $V_{EN}$ = 3.3 V |
| Output current at $R_{ext}$ = 3 Ω | | | | | | $V_{out}$ > 1.4 V |
| BCR320U | | - | 250 | - | | $V_{EN}$ = 12 V |
| BCR321U | | - | 250 | - | | $V_{EN}$ = 3.3 V |
| Voltage drop ($V_{Rext}$) | $V_{drop}$ | 0.85 | 0.95 | 1.05 | V | $I_{out}$ = 10 mA |

**Table 2-4 DC Characteristics with stabilized LED load at $T_A$ = 25 °C, unless otherwise specified**

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Lowest sufficient supply voltage overhead | $V_{Smin}$ | - | 1.4 | - | V | $I_{out}$ > 18 mA |
| Output current change versus $T_A$ | $\Delta I_{out}/I_{out}$ | | | | %/K | $V_{out}$ > 2.0 V |
| BCR320U | | - | -0.2 | - | | $V_{EN}$ = 12 V |
| BCR321U | | - | -0.2 | - | | $V_{EN}$ = 3.3 V |
| Output current change versus $V_S$ | $\Delta I_{out}/I_{out}$ | | | | %/V | $V_{out}$ > 2.0 V |
| BCR320U | | - | 1 | - | | $V_{EN}$ = 12 V |
| BCR321U | | - | 1 | - | | $V_{EN}$ = 3.3 V |

# 3 Typical characteristics

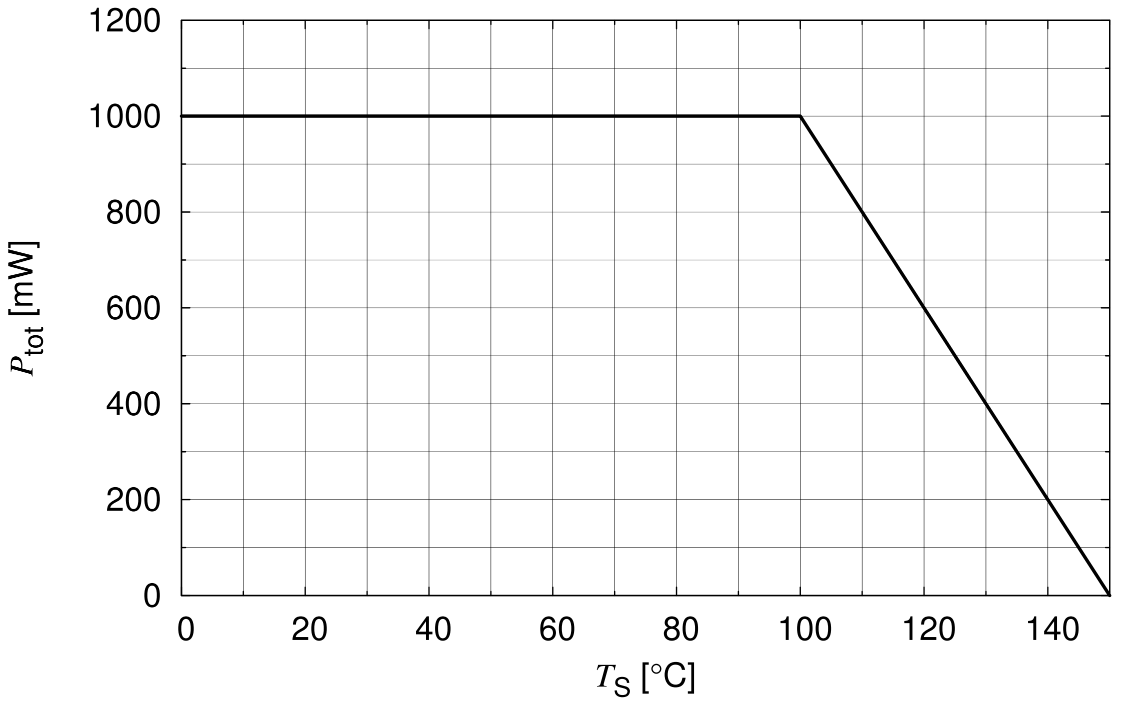



**Figure 3-1 Total Power Dissipation** $P_{tot} = f(T_S)$

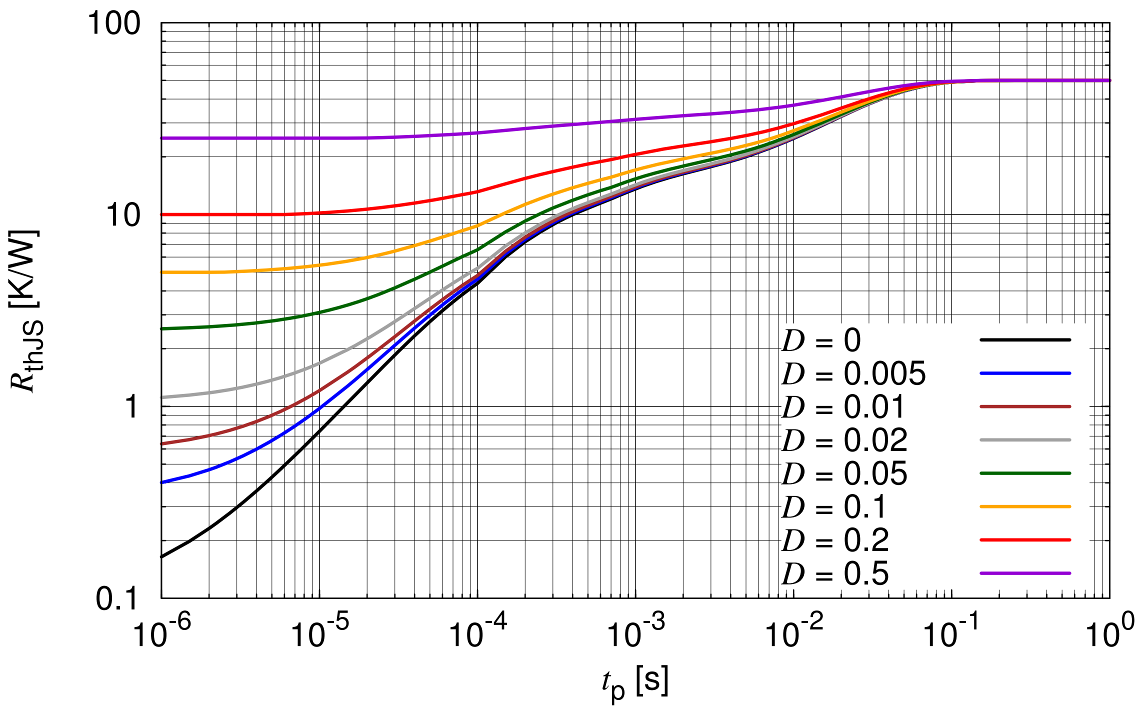



**Figure 3-2 Permissible Pulse Load** $R_{thJS} = f(t_p)$

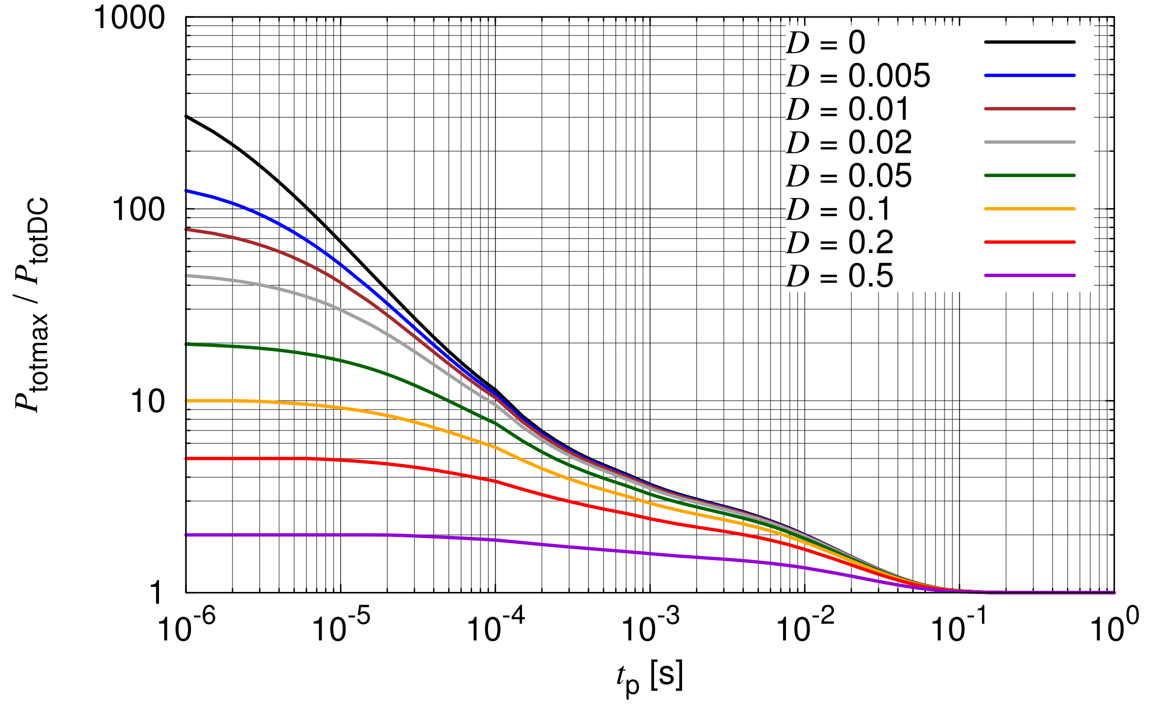



**Figure 3-3 Permissible Pulse Load** $P_{totmax}$ / $P_{totDC}$= $f(t_p)$

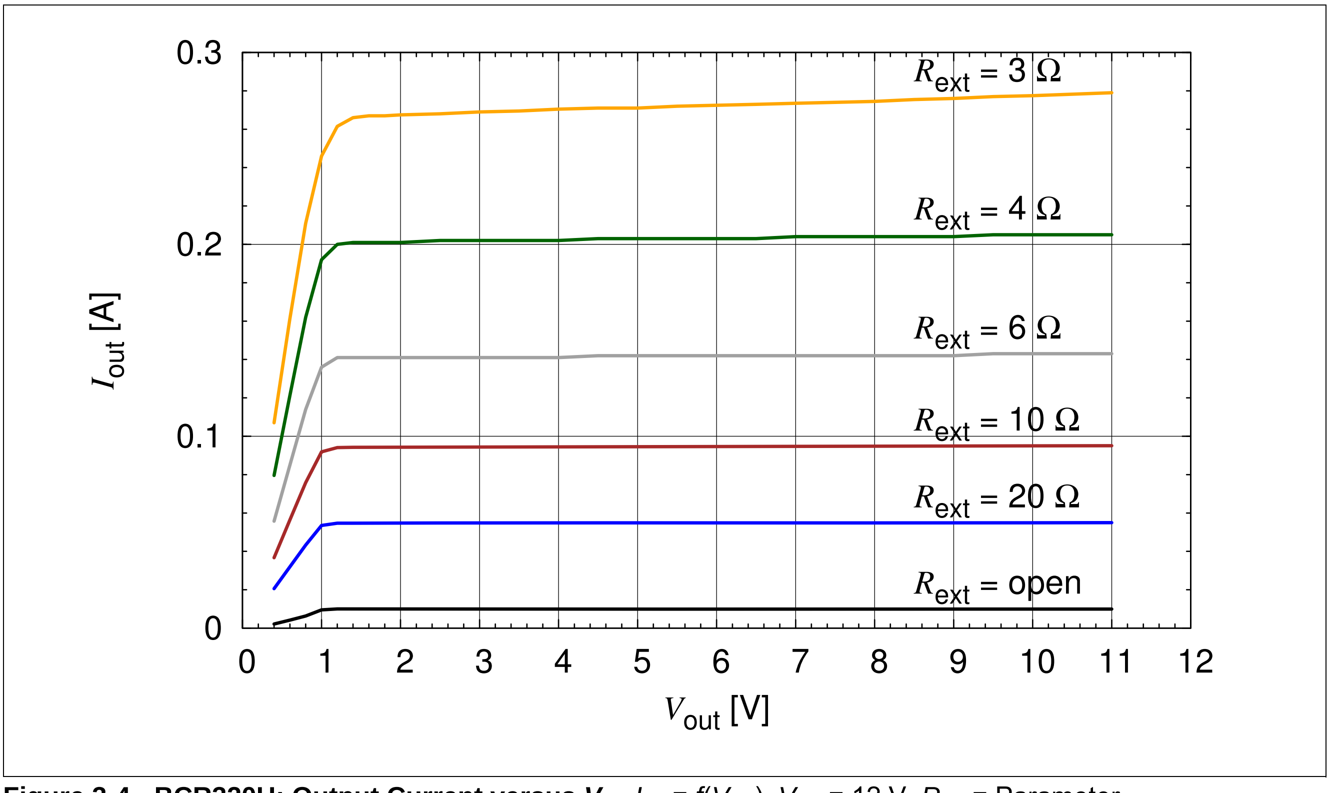



**Figure 3-4 BCR320U: Output Current versus $V_{out}$** $I_{out} = f(V_{out})$, $V_{EN}$ = 12 V, $R_{ext}$ = Parameter

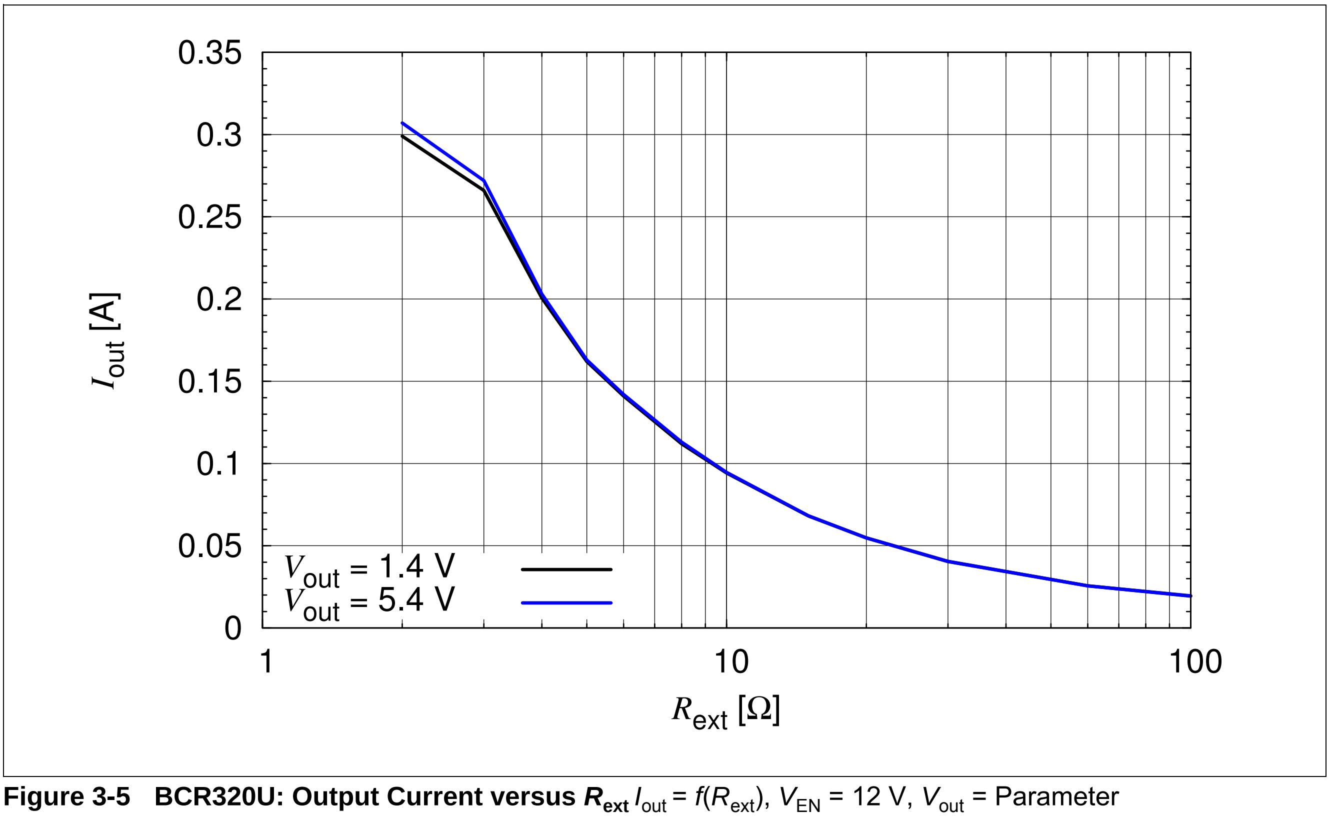



**Figure 3-5 BCR320U: Output Current versus $R_{ext}$** $I_{out} = f(R_{ext})$, $V_{EN}$ = 12 V, $V_{out}$ = Parameter

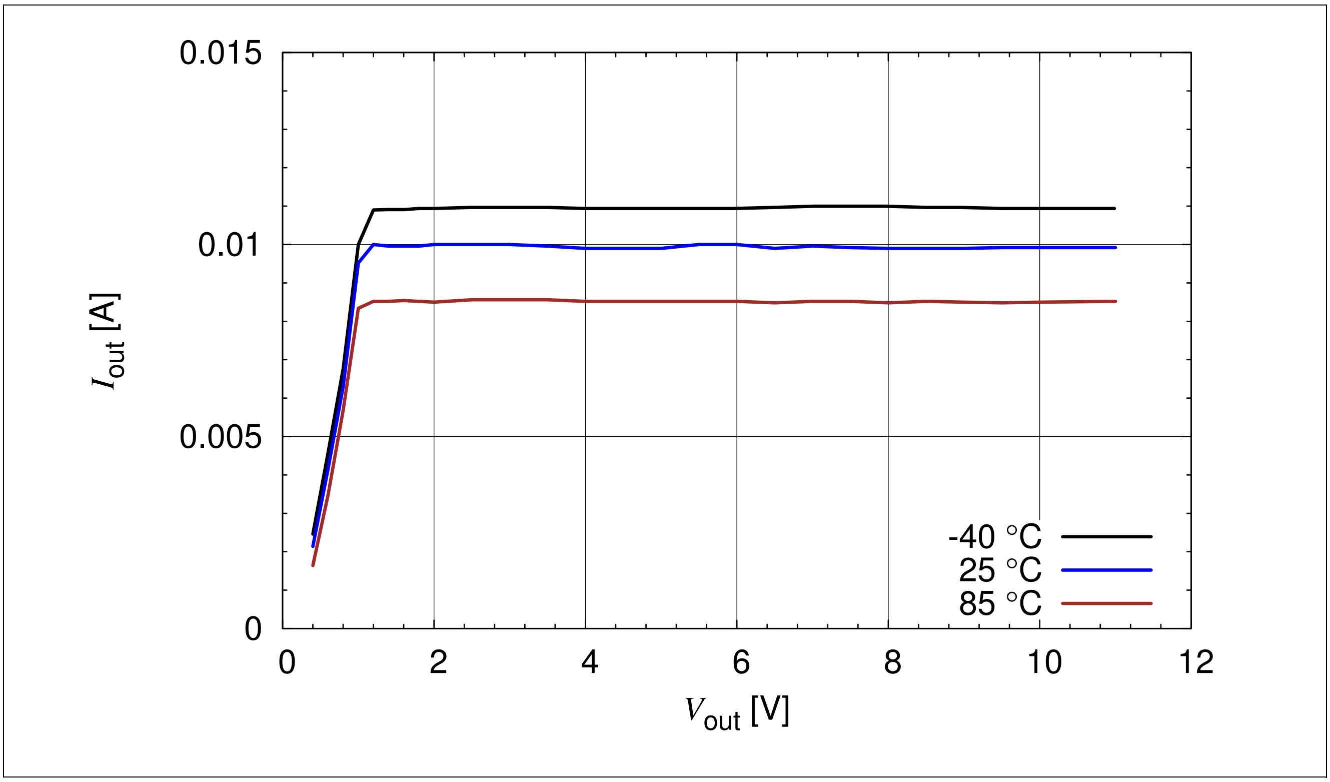



**Figure 3-6 BCR320U: Output Current versus $V_{out}$** $I_{out} = f(V_{out})$, $V_{EN}$ = 12 V, $R_{ext}$ = open, $T_A$ = Parameter

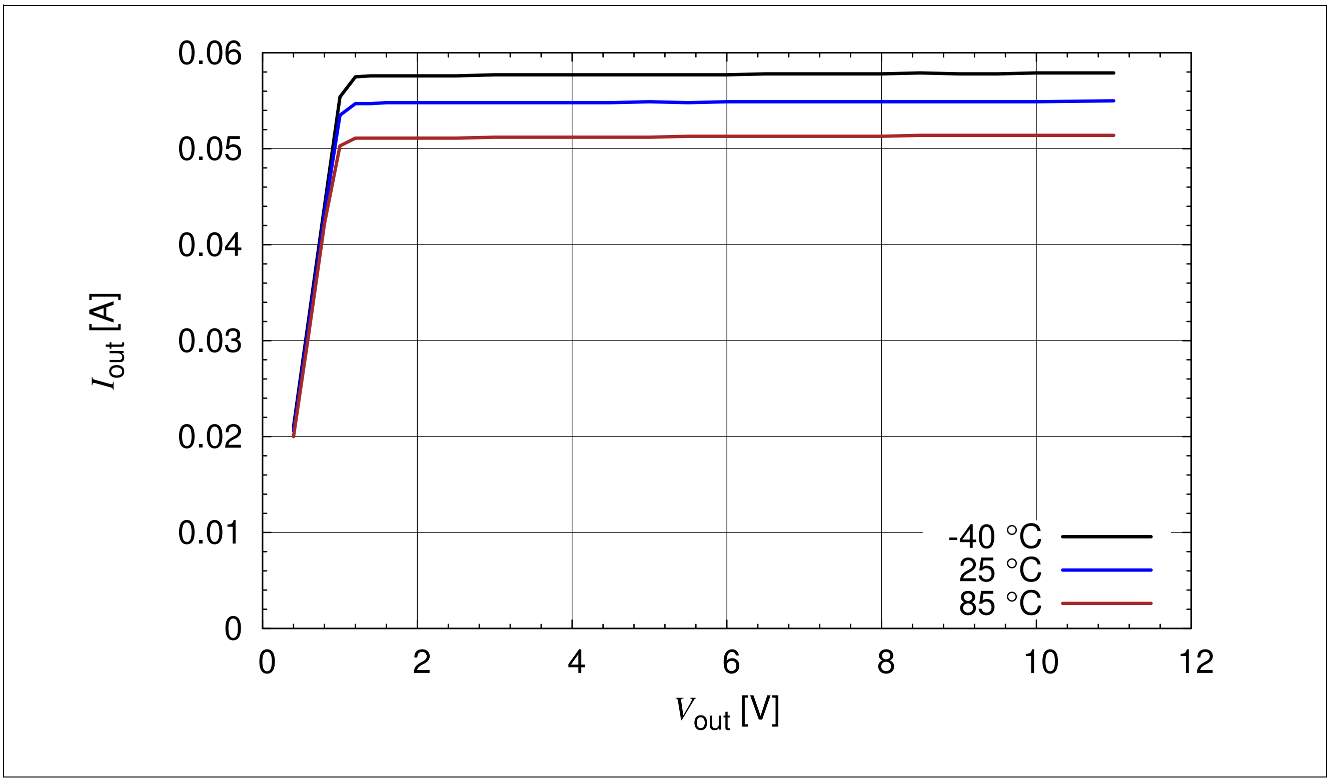



**Figure 3-7 BCR320U: Output Current versus $V_{out}$** $I_{out} = f(V_{out})$, $V_{EN}$ = 12 V, $R_{ext}$ = 20 Ω, $T_A$ = Parameter

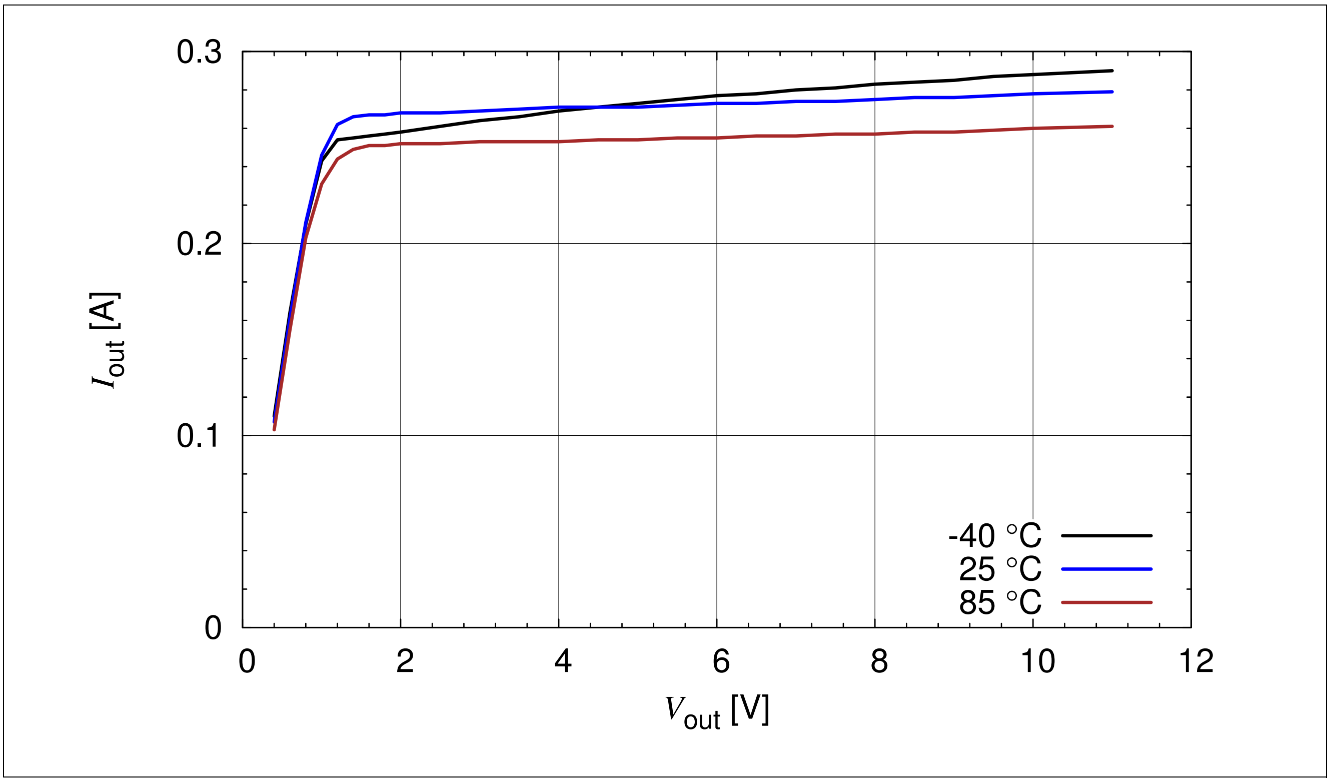



**Figure 3-8 BCR320U: Output Current versus $V_{out}$** $I_{out} = f(V_{out})$, $V_{EN}$ = 12 V, $R_{ext}$ = 3 Ω, $T_A$ = Parameter

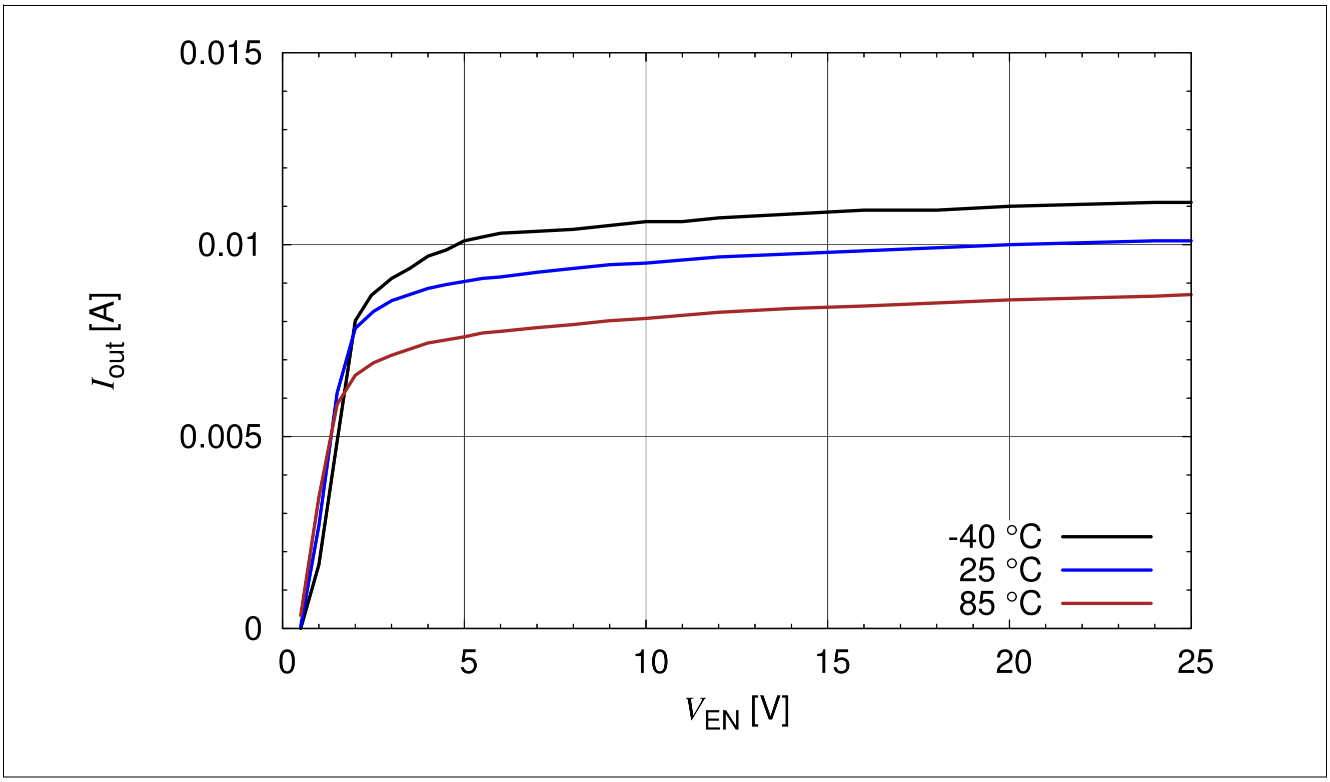



**Figure 3-9 BCR320U: Output Current versus $V_{EN}$** $I_{out} = f(V_{EN})$, $V_{out}$ = 2 V, $R_{ext}$ = open, $T_A$ = Parameter

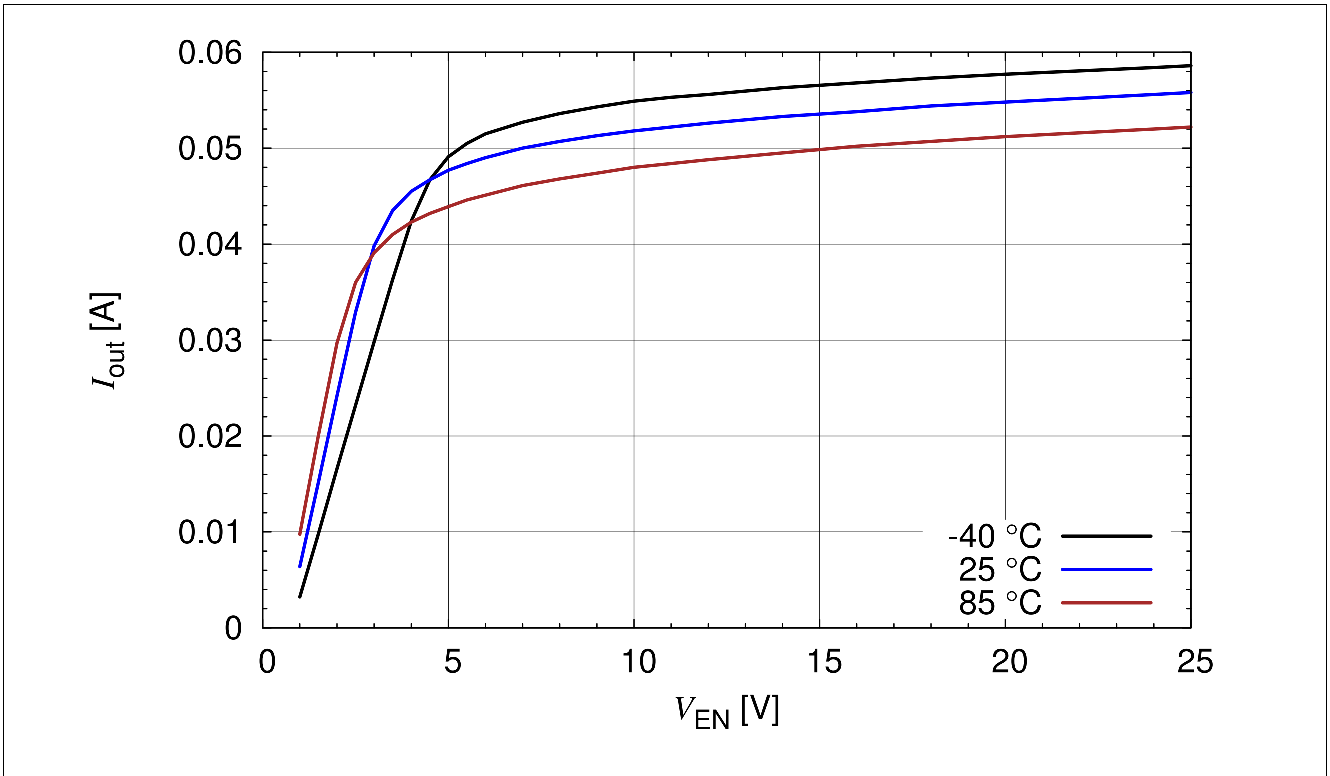



**Figure 3-10 BCR320U: Output Current versus $V_{EN}$** $I_{out} = f(V_{EN})$, $V_{out}$ = 2 V, $R_{ext}$ = 20 Ω, $T_A$ = Parameter

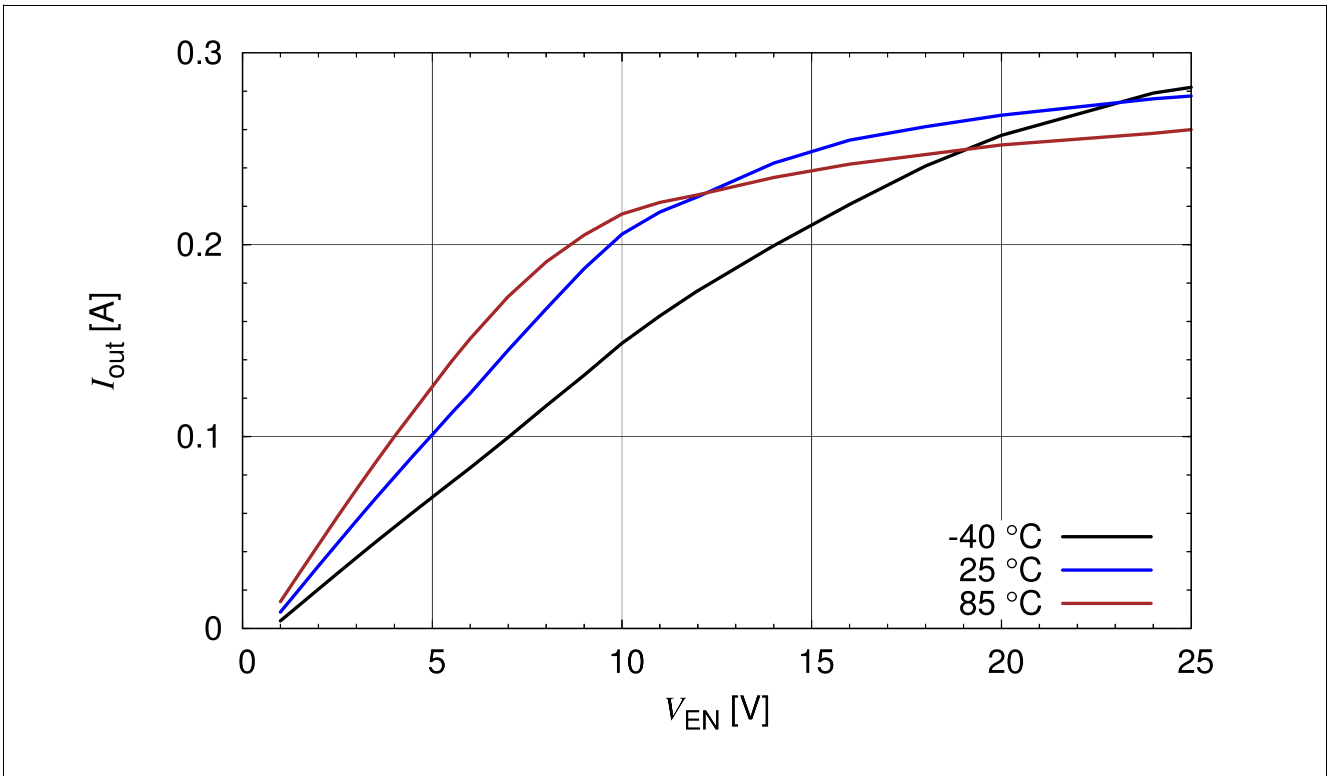



**Figure 3-11 BCR320U: Output Current versus $V_{EN}$** $I_{out} = f(V_{EN})$, $V_{out}$ = 2 V, $R_{ext}$ = 3 Ω, $T_A$ = Parameter

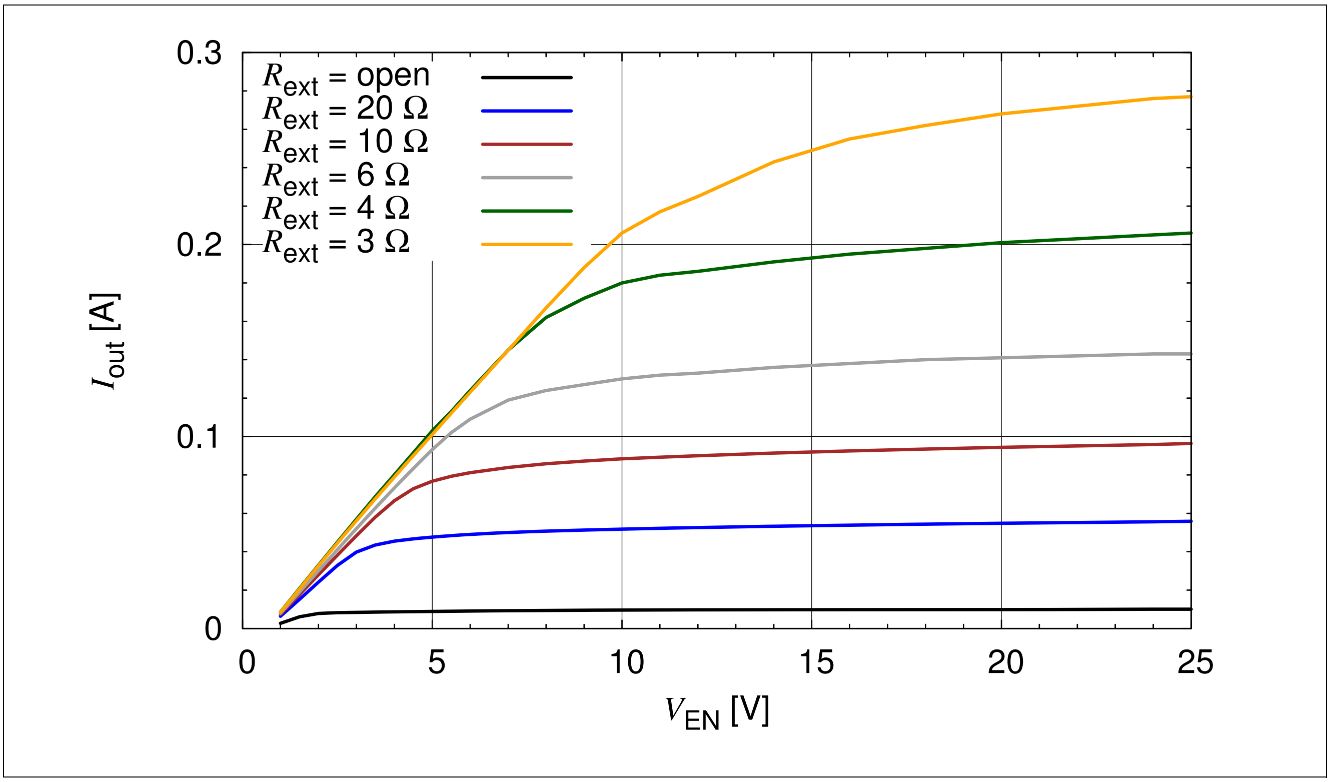



**Figure 3-12 BCR320U: Output Current versus $V_{EN}$** $I_{out} = f(V_{EN})$, $V_{out}$ = 2 V, $R_{ext}$ = Parameter

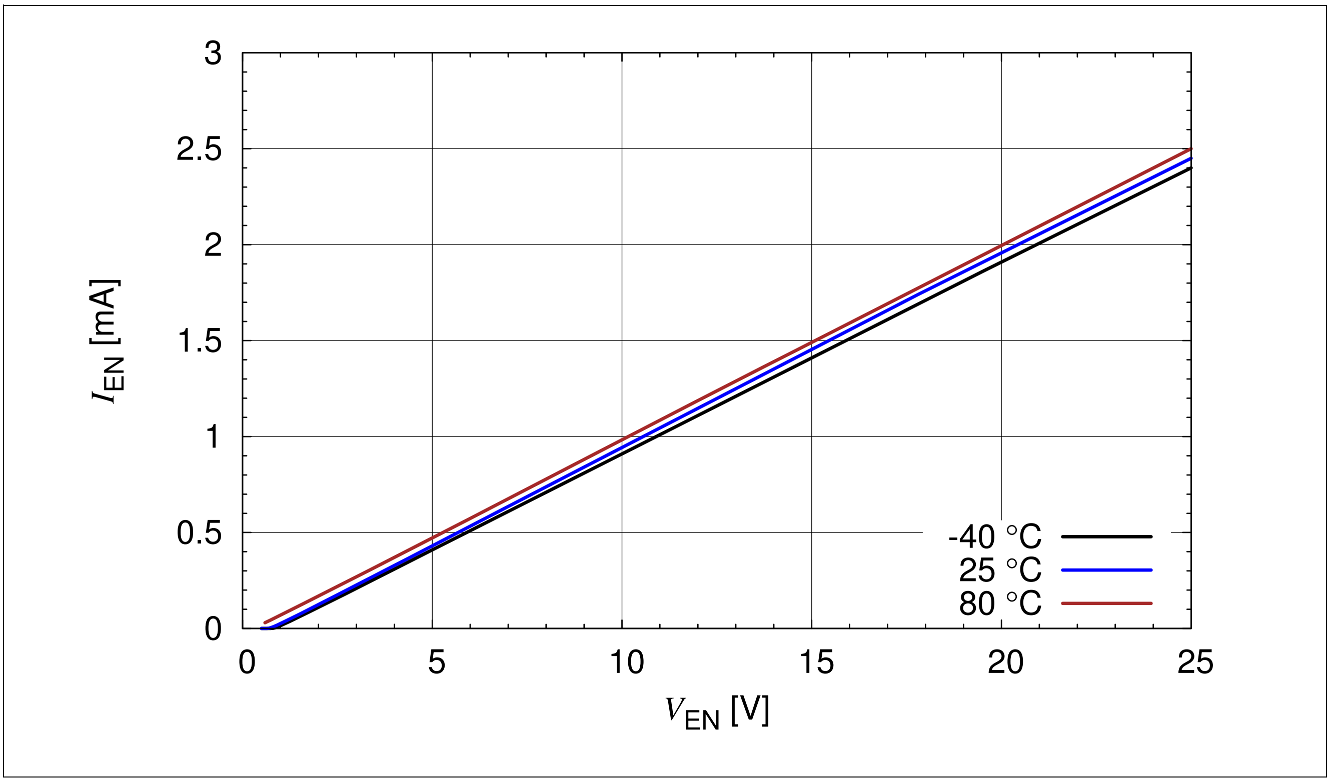



**Figure 3-13 BCR320U: Enable Current versus $V_{EN}$** $I_{EN} = f(V_{EN})$, $R_{ext}$ = open, $I_{out}$ = 0 A, $T_A$ = Parameter

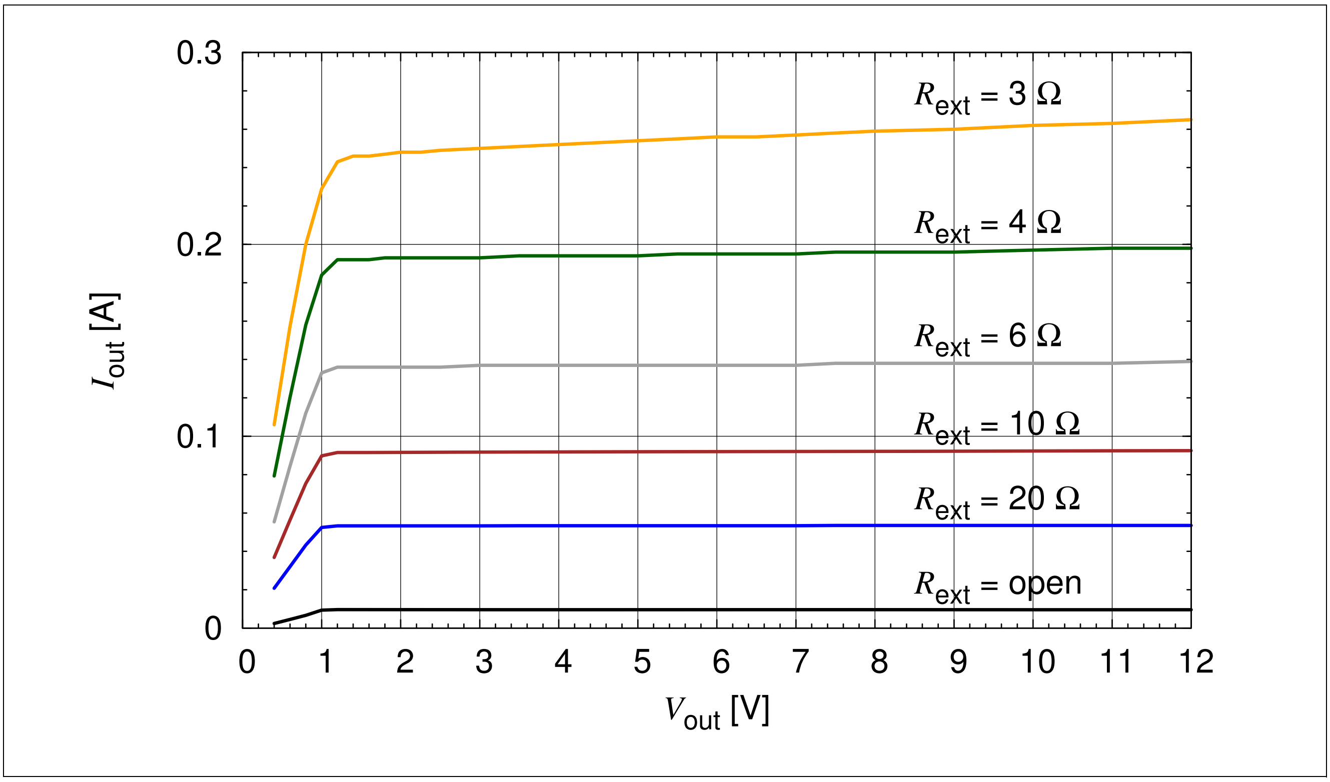



**Figure 3-14 BCR321U: Output Current versus $V_{out}$** $I_{out} = f(V_{out})$, $V_{EN}$ = 3.3 V, $R_{ext}$ = Parameter

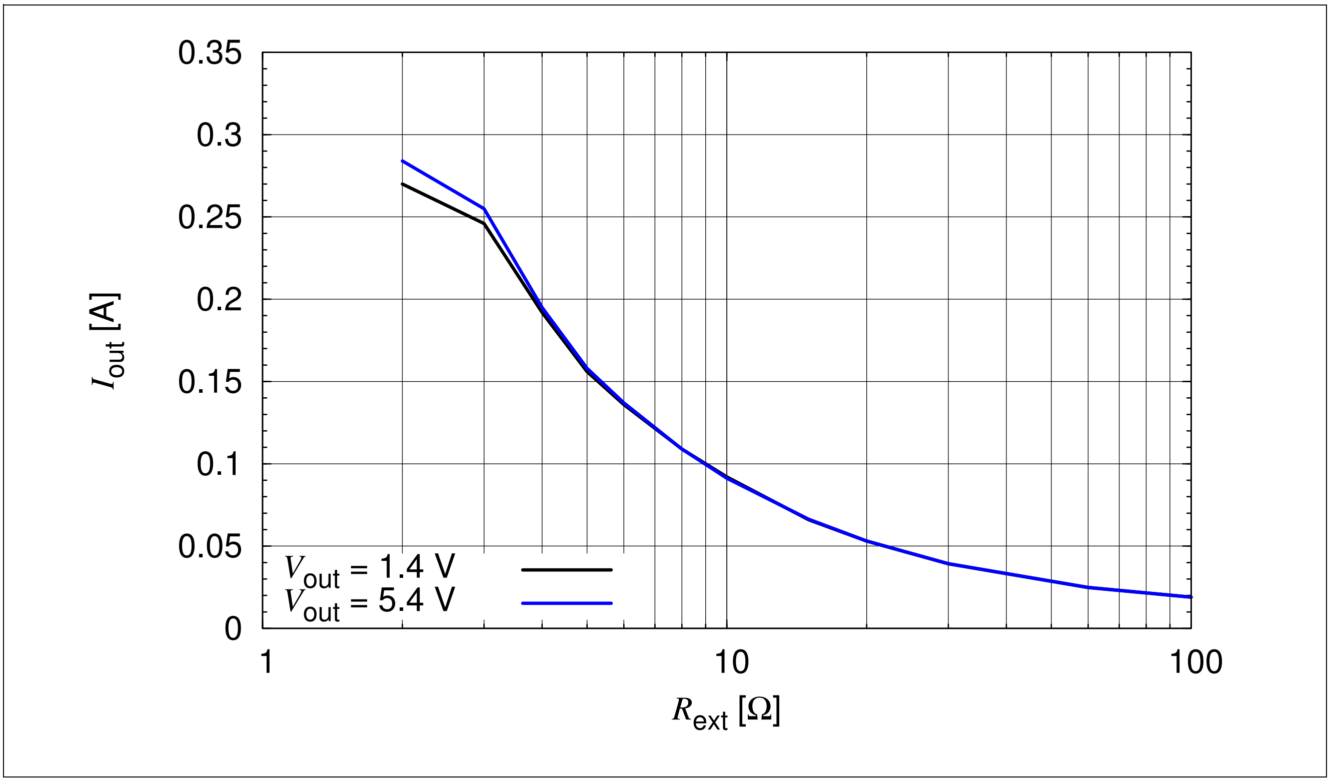



**Figure 3-15 BCR321U: Output Current versus $R_{ext}$** $I_{out} = f(R_{ext})$, $V_{EN}$ = 3.3 V, $V_{out}$ = Parameter

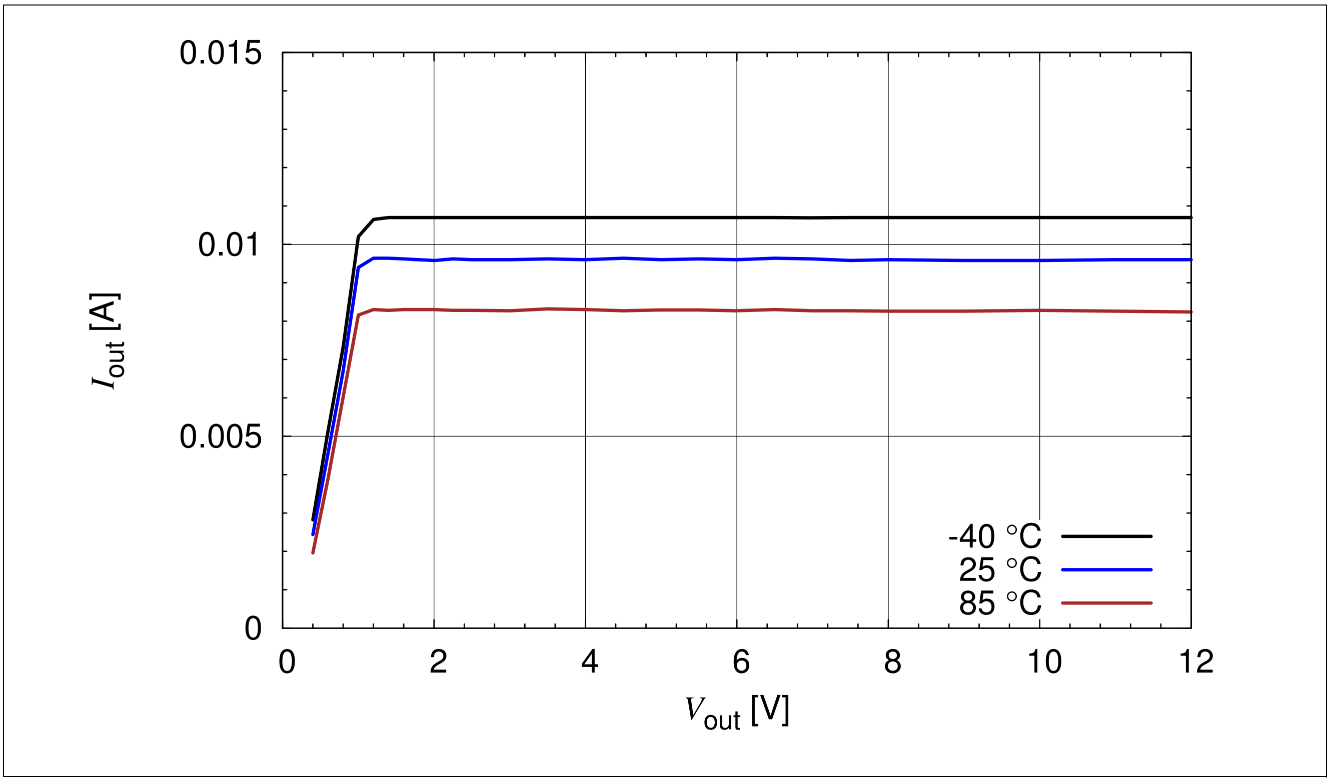



**Figure 3-16 BCR321U: Output Current versus $V_{out}$** $I_{out} = f(V_{out})$, $V_{EN}$ = 3.3 V, $R_{ext}$ = open, $T_A$ = Parameter

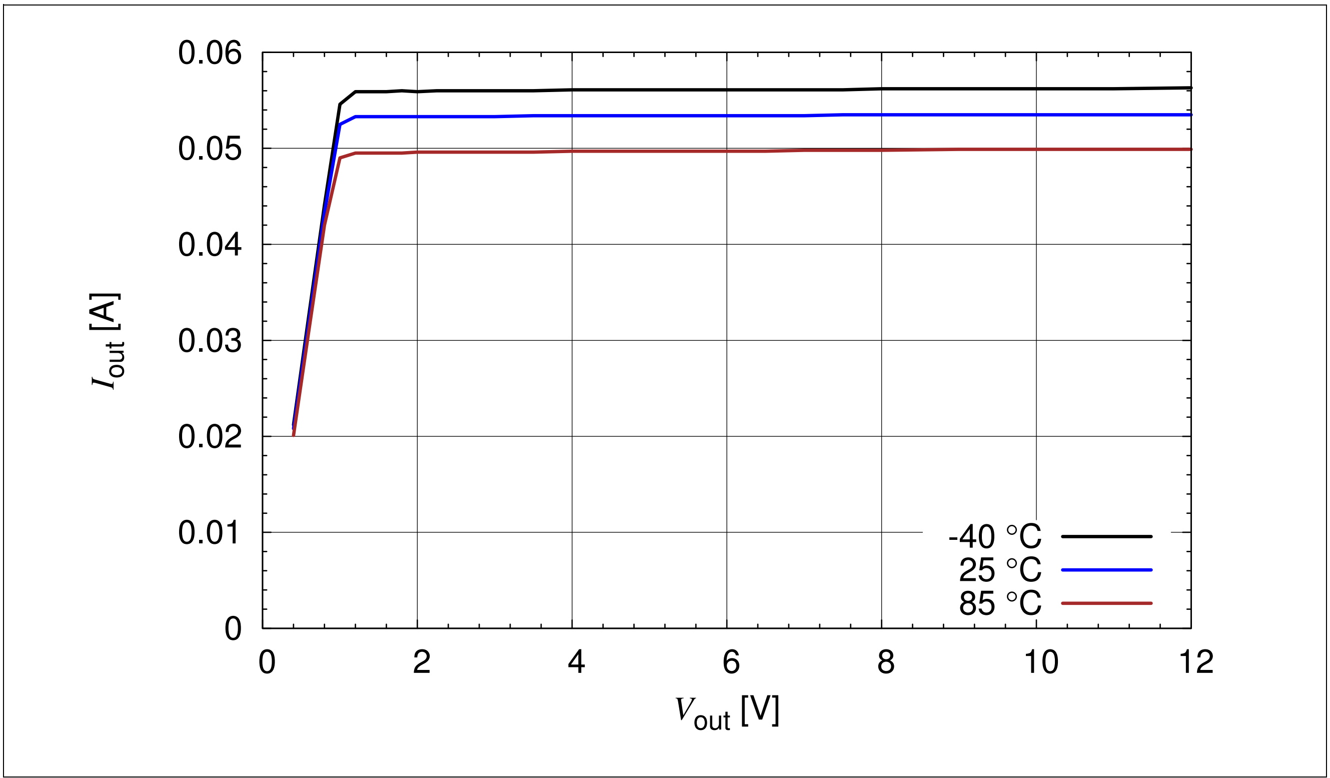



**Figure 3-17 BCR321U: Output Current versus $V_{out}$** $I_{out} = f(V_{out})$, $V_{EN}$ = 3.3 V, $R_{ext}$ = 20 Ω, $T_A$ = Parameter

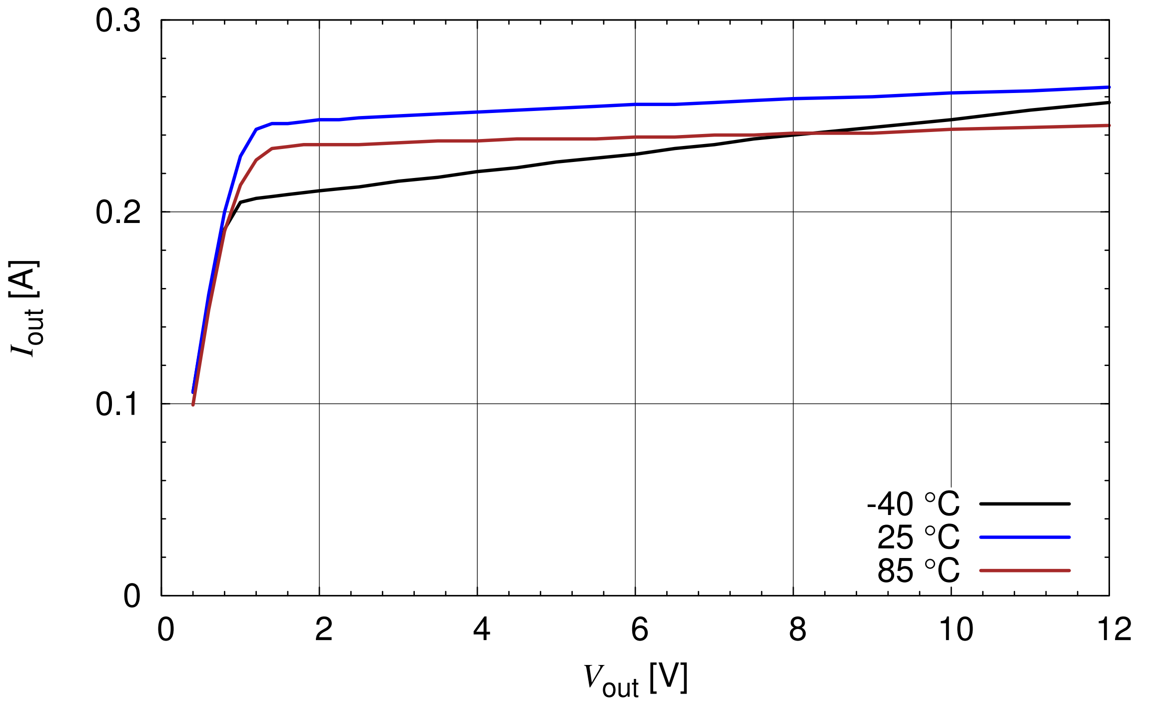



**Figure 3-18 BCR321U: Output Current versus $V_{out}$** $I_{out} = f(V_{out})$, $V_{EN}$ = 3.3 V, $R_{ext}$ = 3 Ω, $T_A$ = Parameter

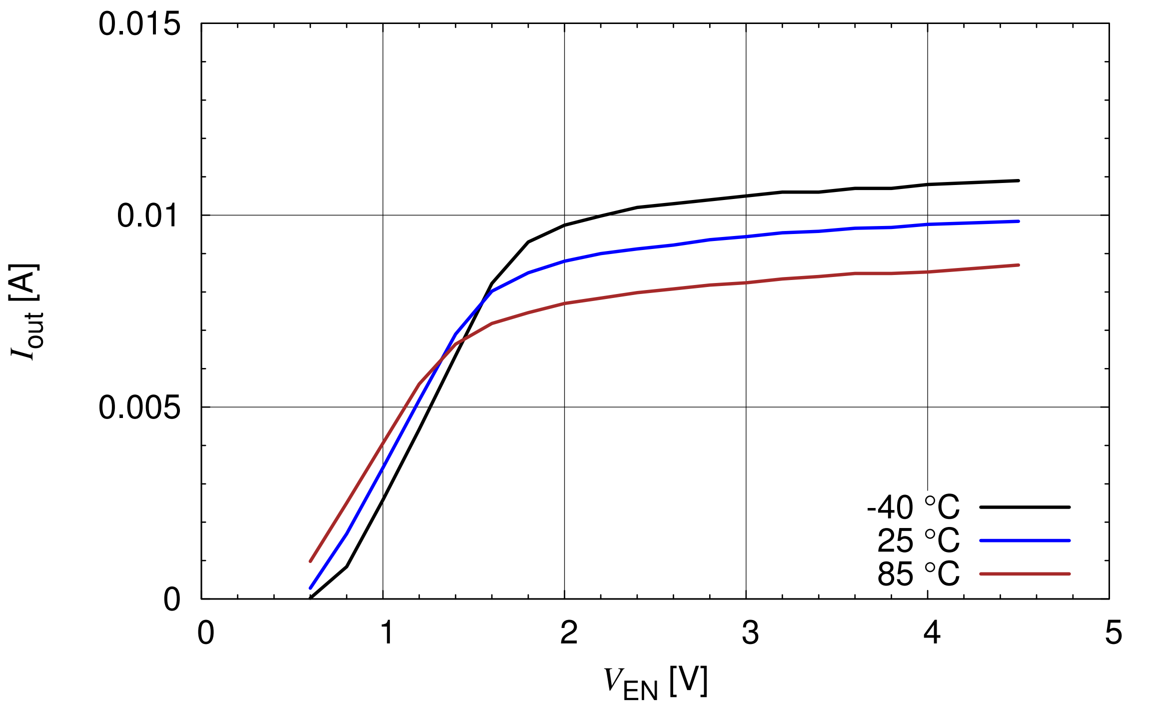



**Figure 3-19 BCR321U: Output Current versus $V_{EN}$** $I_{out} = f(V_{EN})$, $V_{out}$ = 2 V, $R_{ext}$ = open, $T_A$ = Parameter

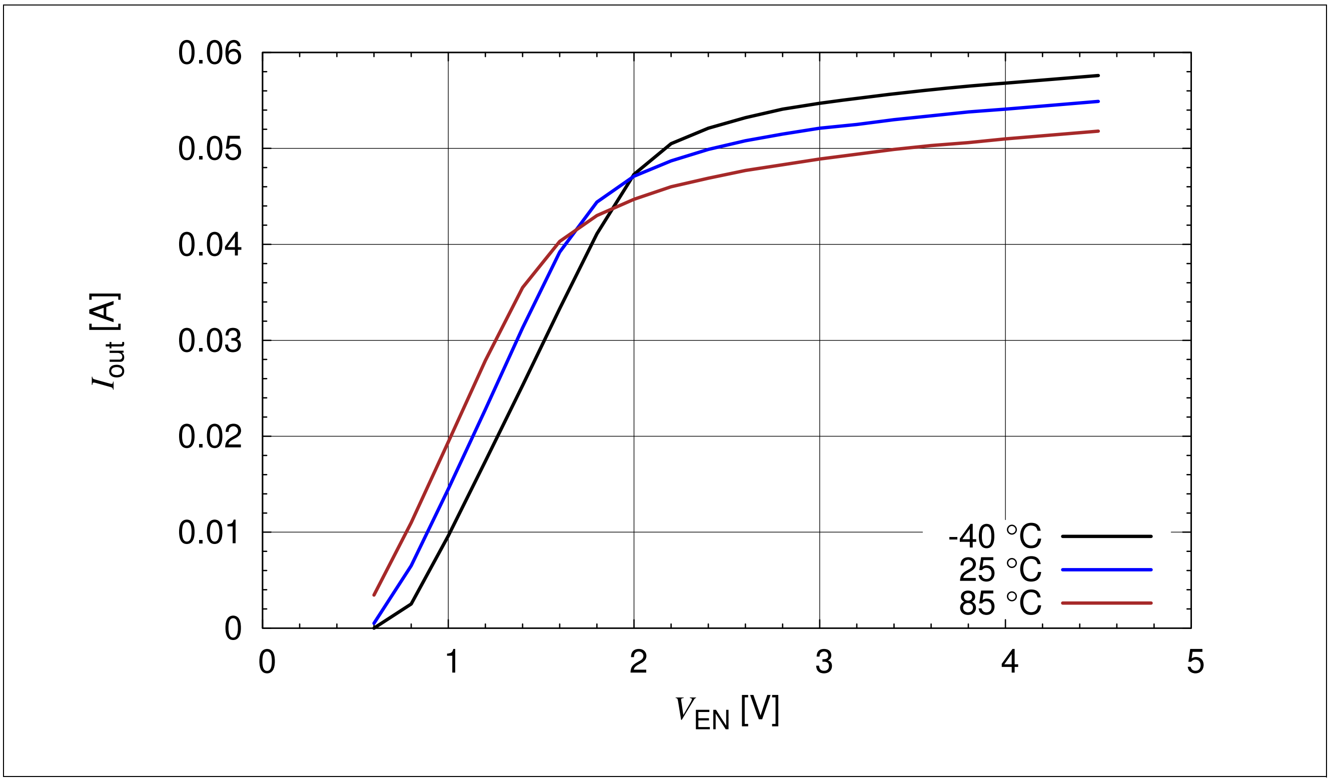



**Figure 3-20 BCR321U: Output Current versus $V_{EN}$** $I_{out} = f(V_{EN})$, $V_{out}$ = 2 V, $R_{ext}$ = 20 Ω, $T_A$ = Parameter

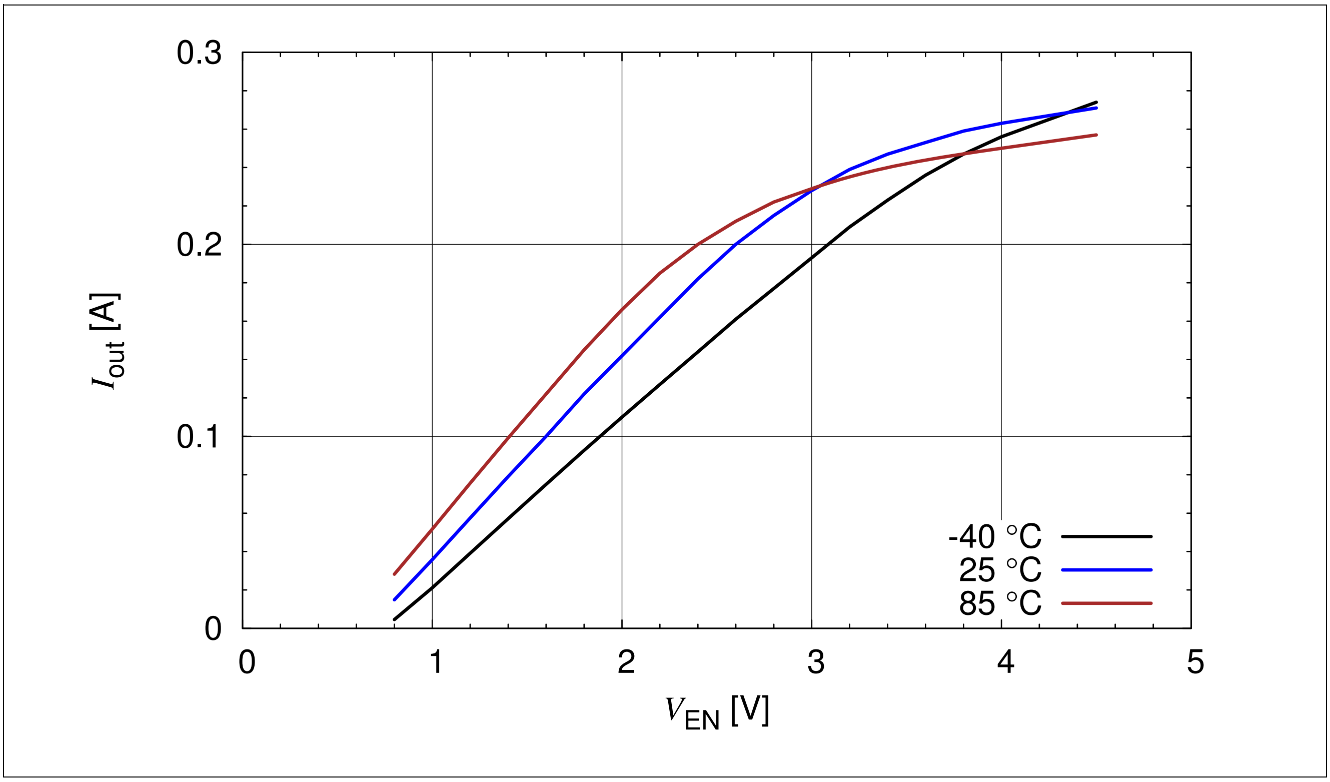



**Figure 3-21 BCR321U: Output Current versus $V_{EN}$** $I_{out} = f(V_{EN})$, $V_{out}$ = 2 V, $R_{ext}$ = 3 Ω, $T_A$ = Parameter

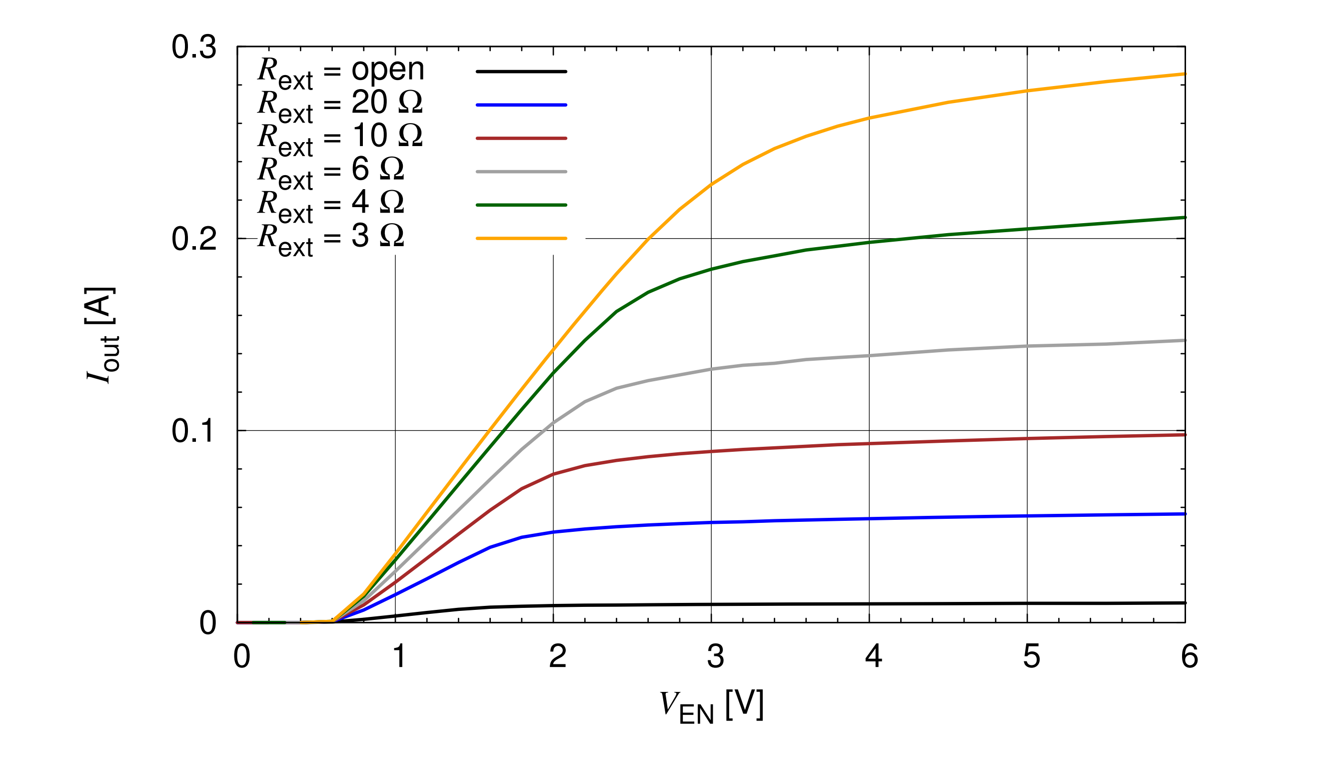



**Figure 3-22 BCR321U: Output Current versus $V_{EN}$** $I_{out} = f(V_{EN})$, $V_{out}$ = 2 V, $R_{ext}$ = Parameter

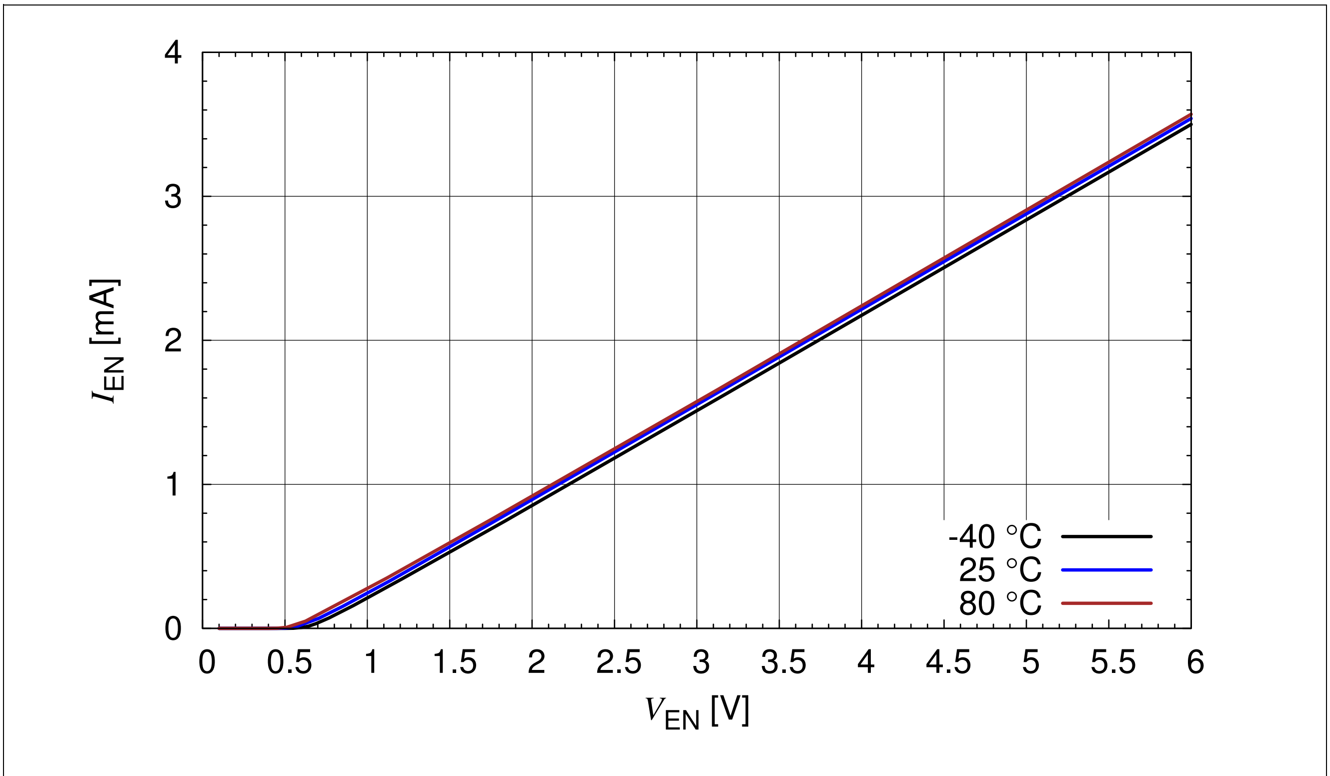



**Figure 3-23 BCR321U: Enable Current versus $V_{EN}$** $I_{EN} = f(V_{EN})$, $R_{ext}$ = open, $I_{out}$ = 0 A, $T_A$ = Parameter

# 4 Application hints

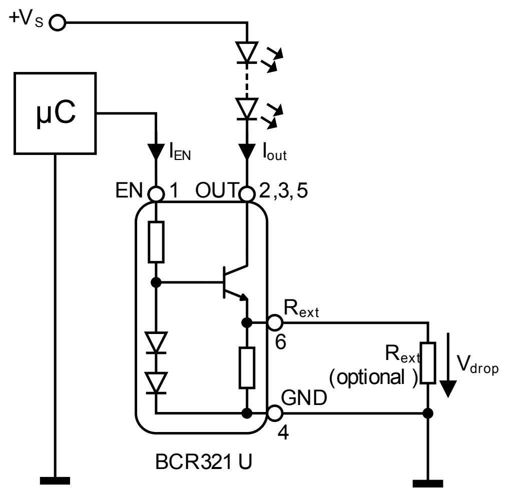



**Figure 4-1 Application Circuit: Enabling / PWM by Micro Controller**

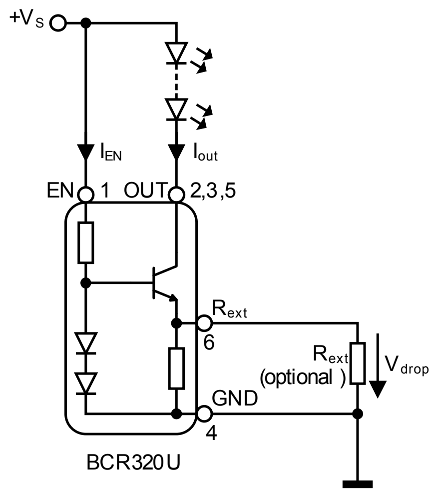



**Figure 4-2 Application Circuit: Enabling by Connecting to $V_S$**

### Application hints

BCR320U / BCR321U serve as an easy to use constant current sources for LEDs. In stand alone application an external resistor can be connected to adjust the current from 10 mA to 250 mA. $R_{ext}$ can be determined by using **Figure 3-5** or **Figure 3-15**. Connecting a low tolerance resistor $R_{ext}$ will improve the overall accuracy of the current sense resistance formed by the parallel connection of $R_{int}$ and $R_{ext}$ leading to an improved current accuracy. Please take into account that the resulting output currents will be slightly lower due to the self heating of the component and the negative thermal coefficient.

Please visit our web site **www.infineon.com/lowcostleddriver** for application notes and for up-to-date application information.

# 5 Package

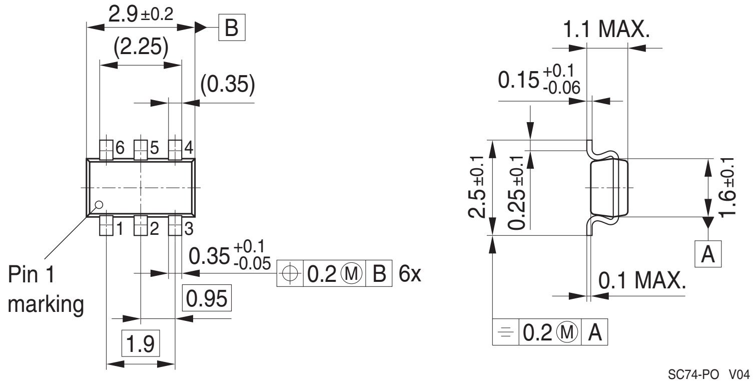



**Figure 5-1 Package Outline for SC74 (dimensions in mm)**

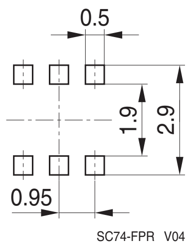



**Figure 5-2 Package Footprint for SC74 (dimensions in mm)**

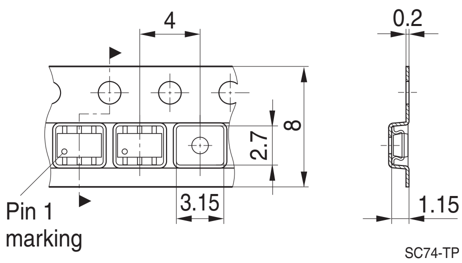



**Figure 5-3 Tape and Reel Information for SC74 (dimensions in mm)**

# Terminology

| | |
|---|---|
| $\Delta I_{out}/I_{out}$ | Output current change |
| $h_{FE}$ | DC current gain |
| $I_{EN}$ | Enable current |
| $I_{out}$ | Output current |
| $I_{R}$ | Reverse current |
| LED | Light Emitting Diode |
| PCB | Printed Circuit Board |
| $P_{tot}$ | Total power dissipation |
| PWM | Pulse Width Modulation |
| $R_{B}$ | Bias resistor |
| $R_{ext}$ | External resistor |
| $R_{int}$ | Internal resistor |
| RoHs | Restriction of Hazardous Substance directive |
| $R_{thJS}$ | Thermal resistance junction to soldering point |
| $T_{A}$ | Ambient temperature |
| $T_{J}$ | Junction temperature |
| $T_{S}$ | Soldering point temperature |
| $T_{stg}$ | Storage temperature |
| $V_{BR(CEO)}$ | Collector-emitter breakdown voltage |
| $V_{BR}$ | Breakdown voltage |
| $V_{drop}$ | Voltage drop |
| $V_{EN}$ | Enable voltage |
| $V_{out}$ | Output voltage |
| $V_{R}$ | Reverse voltage |
| $V_{S}$ | Supply voltage |
| $V_{Smin}$ | Lowest sufficient supply voltage overhead |

w w w . i n f i n e o n . c o m

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- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.


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