



# NCR402T

20 mA LED driver in SOT23

16 October 2015

Product data sheet

## 1. General description

LED driver consisting of a resistor-equipped PNP transistor with two diodes on one chip in a small SOT23 plastic package.

## 2. Features and benefits

- Stabilized output current of 20 mA
- High current accuracy at supply voltage variation
- Reduces component count and board space
- Qualified according to AEC-Q101

## 3. Applications

- Constant current LED driver
- Generic constant current source
- Automotive applications

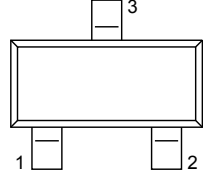
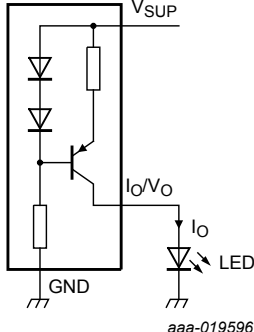
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_O$	output current	$V_{SUP} = 10\text{ V}$ ; $V_O = 8.6\text{ V}$ ; $T_{amb} = 25\text{ °C}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$	17	20	23	mA
$V_{SUP}$	supply voltage		-	-	18	V

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	GND	ground	 <p>TO-236AB (SOT23)</p>	 <p>aaa-019596</p>
2	V <sub>SUP</sub>	supply voltage		
3	I <sub>O</sub> /V <sub>O</sub>	output current/output voltage		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
NCR402T	TO-236AB	plastic surface-mounted package; 3 leads	SOT23

## 7. Marking

Table 4. Marking codes

Type number	Marking code
NCR402T	BF

## 8. Limiting values

**Table 5. Limiting values**

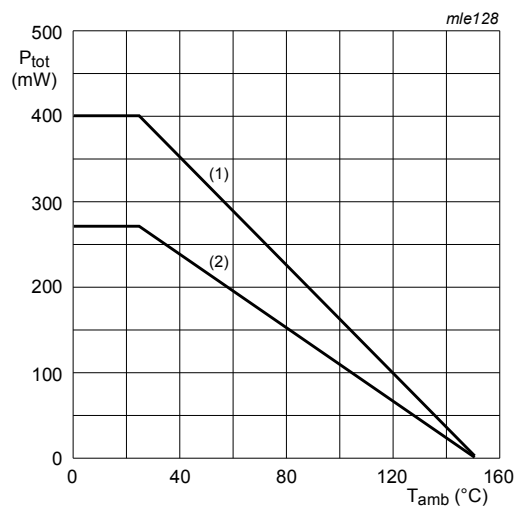
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
$V_{SUP}$	supply voltage			-	18	V
$V_O$	output voltage	$V_{SUP} = 18\text{ V}$		-	16	V
$V_R$	reverse voltage		[1]	-	0.5	V
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[2]	-	270	mW
			[3]	-	400	mW
$T_j$	junction temperature			-	150	°C
$T_{amb}$	ambient temperature			-55	150	°C
$T_{stg}$	storage temperature			-65	150	°C

[1] Between all terminals.

[2] Device mounted on an FR4 Printed-Circuit Board (PCB); single-sided copper; tin-plated and standard footprint.

[3] Device mounted on an FR4 PCB; single-sided copper; tin-plated and mounting pad for output  $1\text{ cm}^2$ .



(1) FR4 PCB mounting pad for collector  $1\text{ cm}^2$

(2) FR4 PCB, standard footprint

**Fig. 1. Power derating curves**

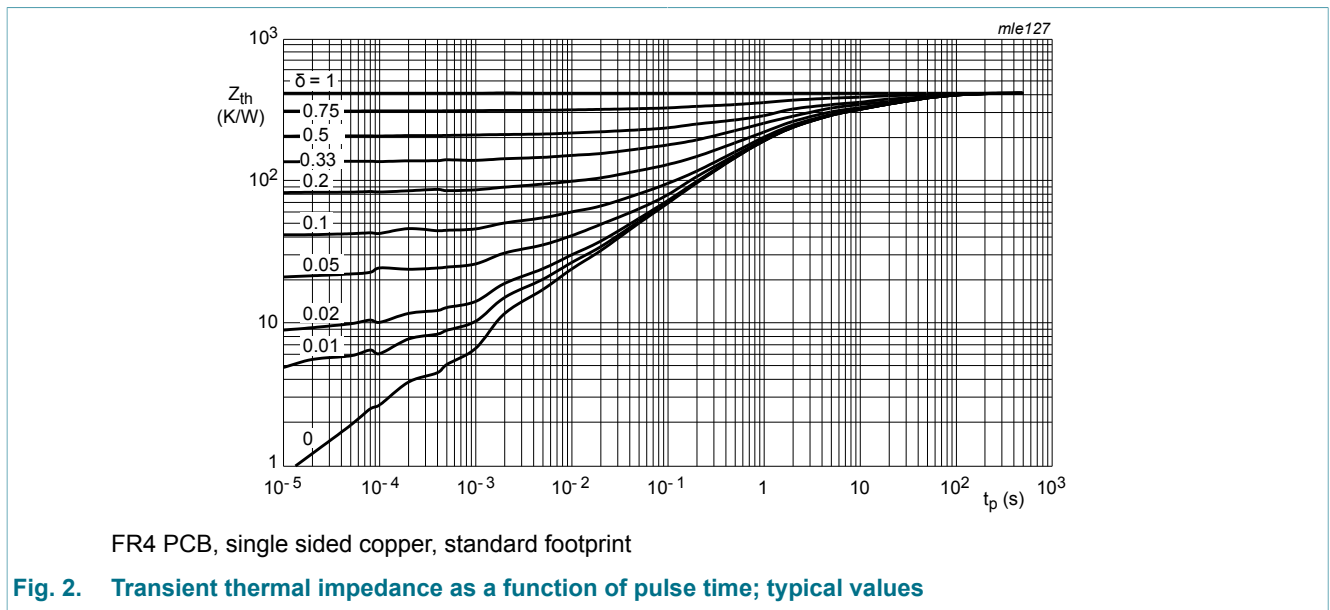
## 9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	465	K/W
			[2]	-	-	312	K/W

[1] Device mounted on an FR4 PCB; single-sided copper; tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB; single-sided copper; tin-plated and mounting pad for collector 1 cm<sup>2</sup>.



## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_O$	output current	$V_{SUP} = 10\text{ V}$ ; $V_O = 8.6\text{ V}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$	17	20	23	mA
$I_{GND}$	ground current	$V_{SUP} = 10\text{ V}$ ; $I_O = 0\text{ A}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$	340	420	500	$\mu\text{A}$
$V_{(V_{SUP}-V_O)min}$	minimum voltage between supply voltage and output voltage	$I_O > 17\text{ mA}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$	-	1.4	-	V
$\Delta I_O / (I_O \times \Delta T_{amb})$	relative output current variation with ambient temperature	$V_{SUP} = 10\text{ V}$ ; $V_O = 8.6\text{ V}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$	-	-0.3	-	%/K
$\Delta I_O / (I_O \times \Delta V_{SUP})$	relative output current variation with supply voltage	$V_{SUP} = 10\text{ V}$ ; $V_{SUP} - V_O = 1.4\text{ V}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$	-	0.8	-	%/V

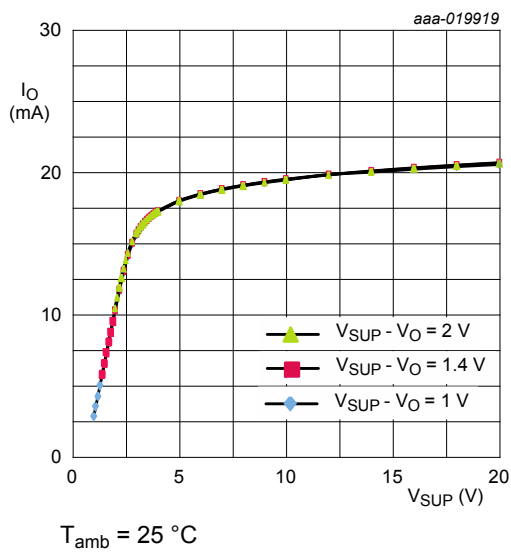


Fig. 3. Output current as a function of supply voltage; typical values

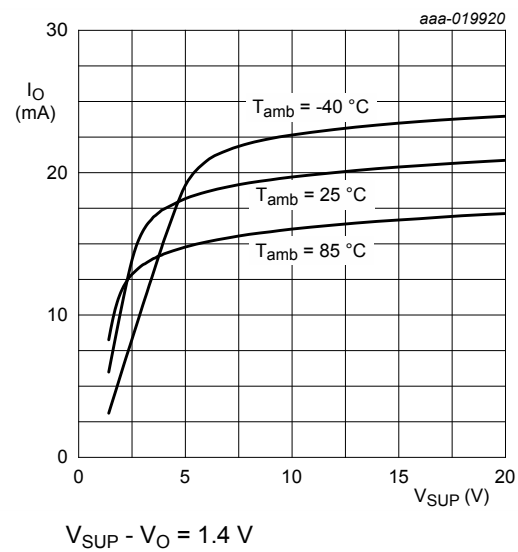
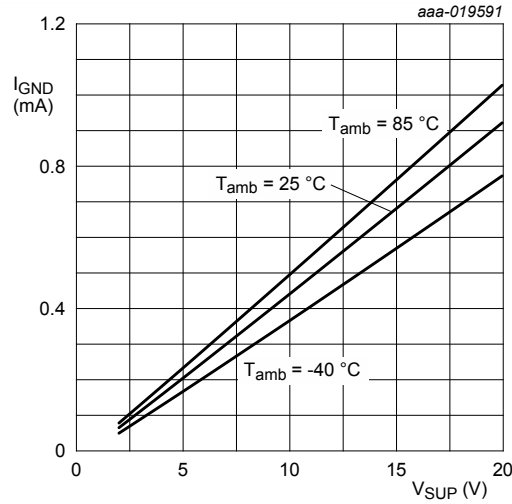


Fig. 4. Output current as a function of supply voltage; typical values



$I_O = 0\text{ A}$

Fig. 5. Ground current as a function of supply voltage; typical values

## 11. Application information

Fig. 6 shows a typical application circuit for an LED driver. The constant current ensures a constant LED brightness. The output current slightly decreases when the power load at the LED driver increases. This effect is due to self heating of the device and the negative thermal coefficient of the output current.

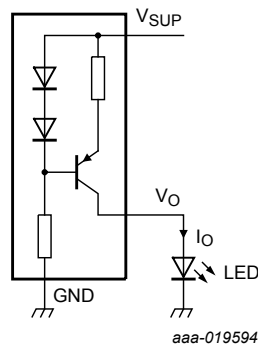


Fig. 6. LED driver application diagram

The output can be switched ON and OFF by connecting a Resistor-Equipped Transistor (RET), e.g. PDTC124XU; see Fig. 7

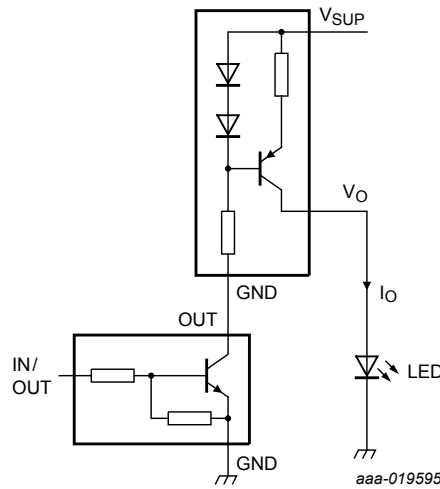


Fig. 7. Switching current ON/OFF; application diagram

## 12. Test information

### 12.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Stress test qualification for discrete semiconductors, and is suitable for use in automotive applications.

## 13. Package outline

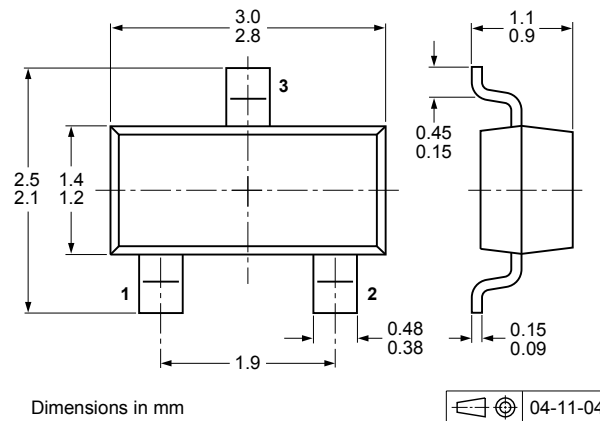


Fig. 8. Package outline TO-236AB (SOT23)

### 14. Soldering

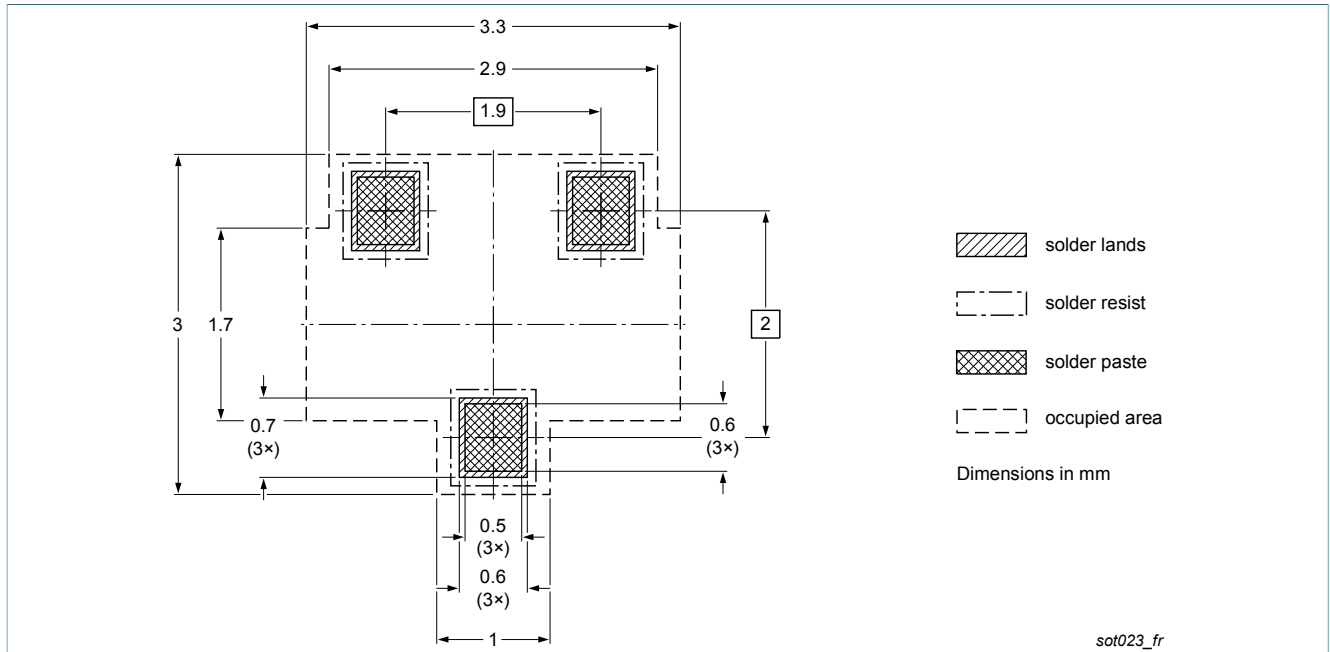


Fig. 9. Reflow soldering footprint for TO-236AB (SOT23)

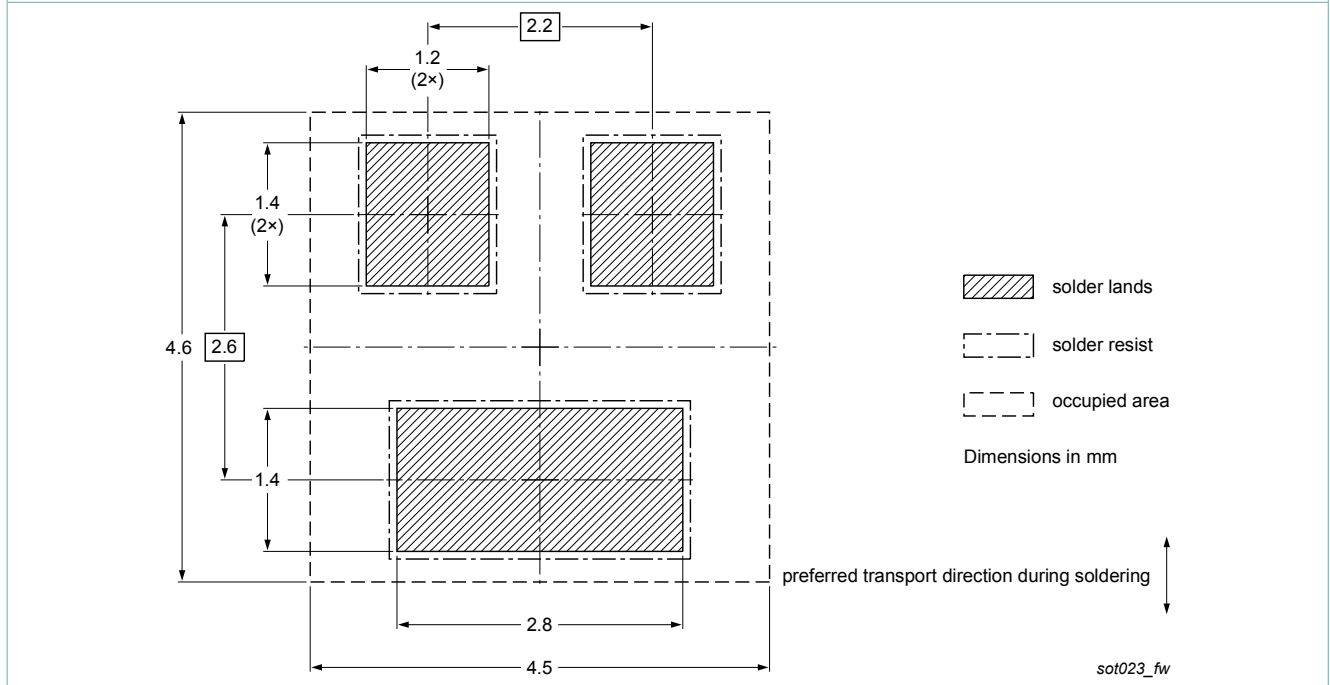


Fig. 10. Wave soldering footprint for TO-236AB (SOT23)



## 15. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
NCR402T v.1	20151016	Product data sheet	-	-

## 16. Legal information

### 16.1 Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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## 17. Contents

1	General description .....	1
2	Features and benefits .....	1
3	Applications .....	1
4	Quick reference data .....	1
5	Pinning information .....	2
6	Ordering information .....	2
7	Marking .....	2
8	Limiting values .....	3
9	Thermal characteristics .....	4
10	Characteristics .....	5
11	Application information .....	6
12	Test information .....	7
12.1	Quality information .....	7
13	Package outline .....	7
14	Soldering .....	8
15	Revision history .....	9
16	Legal information .....	10
16.1	Data sheet status .....	10
16.2	Definitions .....	10
16.3	Disclaimers .....	10
16.4	Trademarks .....	11

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