NCR402U

20 mA LED driver in SOT457

Rev. 1 — 10 December 2013 Product data sheet

1. Product profile

1.1 General description

LED driver consisting of resistor-equipped PNP transistor with two diodes on one chip in an SOT457 (SC-74) plastic package.

1.2 Features and benefits

- Stabilized output current of 20 mA
- High current accuracy at supply voltage variation
- Low voltage overhead of 1.4 V
- Qualified according to AEC-Q101
- Reduces component count and board space
- High power dissipation of 750 mW
- Stabilized output current adjustable up to 65 mA when an external resistor is used

1.3 Applications

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

1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{out}	stabilized output current	V_S = 10 V; V_{out} = 8.6 V	17	20	23	mA
V_S	supply voltage		-	-	40	V

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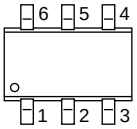
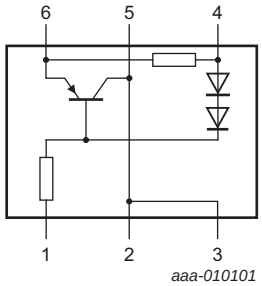
2. Pinning information

Table 2. Pinning

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	GND	ground		
2	IOUT	output current		
3	IOUT	output current		
4	VS	supply voltage		
5	IOUT	output current		
6	REXT	external resistor		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
NCR402U	SC-74 (TSOP6)	plastic surface-mounted package; 6 leads	SOT457

4. Marking

Table 4. Marking codes

Type number	Marking code
NCR402U	DB

5. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
I_{out}	stabilized output current if external resistor is used			-	65	mA
V_S	supply voltage			-	40	V
V_{out}	output voltage	V_S = 40 V		-	38	V
V_R	reverse voltage		[1]	-	0.5	V
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[2]	-	475	mW
		$T_{amb} \leq 25$ °C	[3]	-	650	mW
		$T_{amb} \leq 25$ °C	[4]	-	750	mW
		$T_{amb} \leq 25$ °C	[5]	-	1100	mW
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			–55	+150	°C
T_{stg}	storage temperature			–65	+150	°C

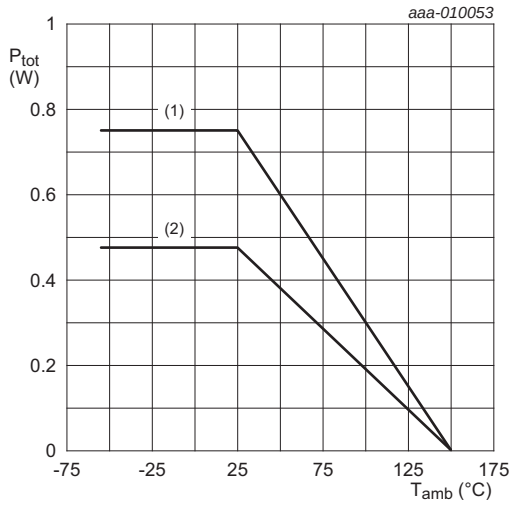
[1] Between all terminals.

[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 cm^2.

[4] Device mounted on an FR4 PCB; 4-layer copper; tin-plated and standard footprint.

[5] Device mounted on an FR4 PCB; 4-layer copper; tin-plated and mounting pad for output 1 cm^2.



(1) FR4 PCB, 4-layer copper; standard footprint.

(2) FR4 PCB, single-sided copper; standard footprint.

Fig 1. Power derating curve

6. Thermal characteristics

Table 6. Thermal characteristics

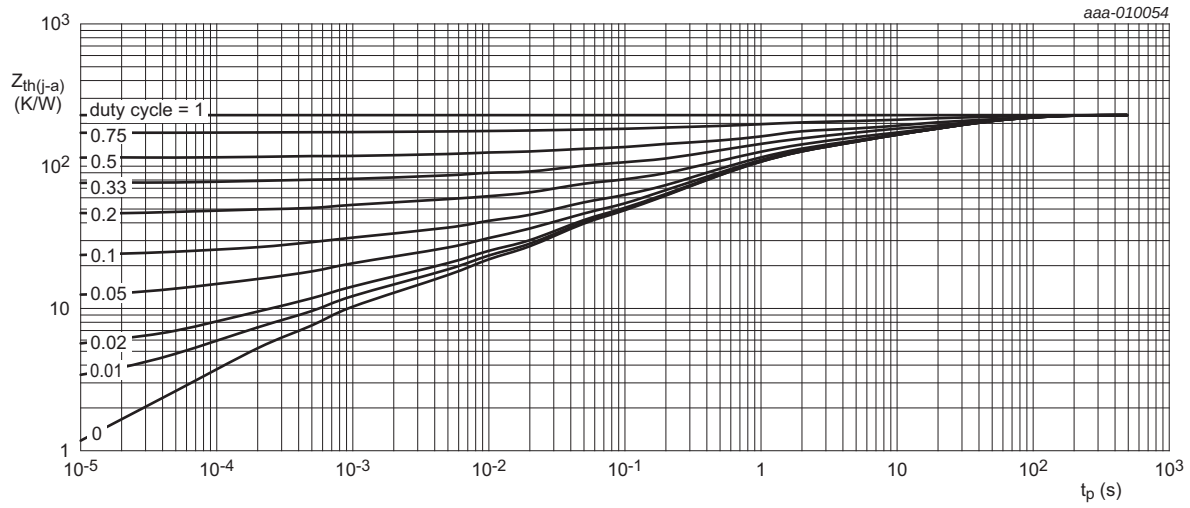
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	265	K/W
			[2]	-	-	190	K/W
			[3]	-	-	165	K/W
			[4]	-	-	115	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point	in free air		-	-	50	K/W

[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 output 1 cm^2.

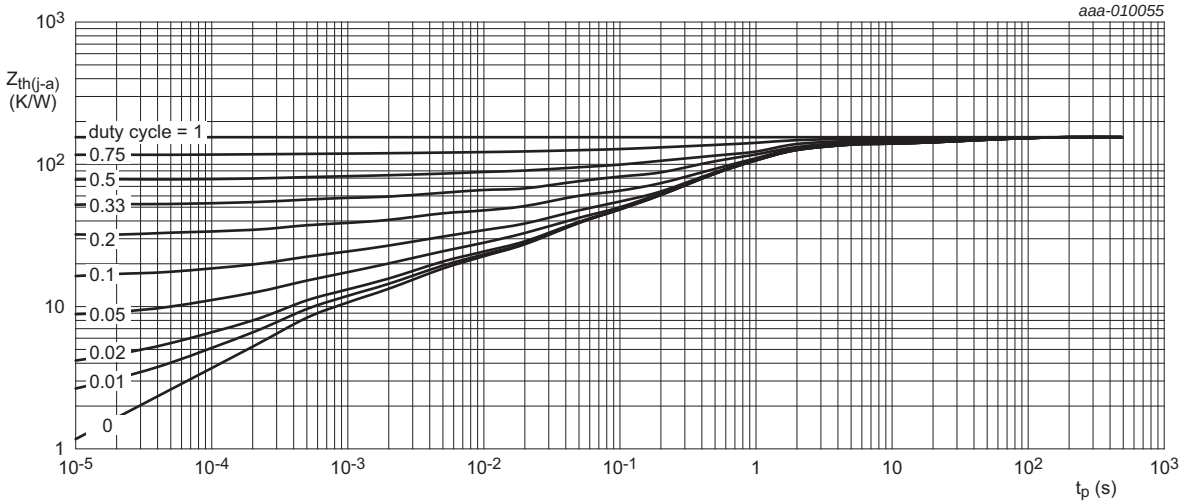
[3] Device mounted on an FR4 PCB; single-sided copper; tin-plated and standard footprint.

[4] Device mounted on an FR4 PCB; 4-layer copper; tin-plated and mounting pad for output 1 cm^2.



FR4 PCB, single-sided copper, standard footprint

Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, 4-layer copper, standard footprint

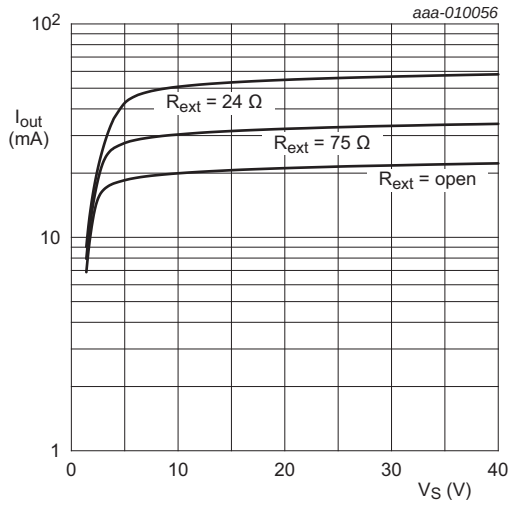
Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

7. Characteristics

Table 7. Characteristics

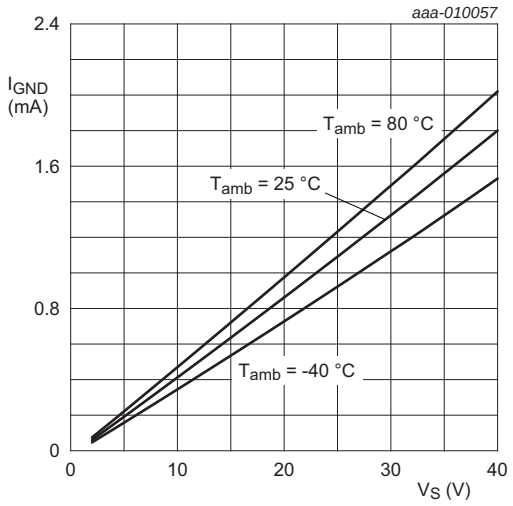
T_{amb} = 25 °C; pulse test: $t_P \leq 300\ \mu s$; $\delta = 0.02$; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{out}	stabilized output current	V_S = 10 V; V_{out} = 8.6 V	17	20	23	mA
I_{GND}	ground current	V_S = 10 V; I_{out} = 0 A	340	420	500	µA
R_{int}	internal resistance	I_{Rint} = 20 mA	36	42	52	Ω
V_{Rint}	voltage drop at internal resistance R_{int}	I_{out} = 20 mA	-	0.85	-	V
V_{Smin}	lowest sufficient supply voltage overhead $V_S - V_{out}$	I_{out} > 17 mA	-	1.4	-	V
$\Delta I_{out} / (I_{out} \times \Delta T_{amb})$	stabilized output current change over ambient temperature	V_S = 10 V; V_{out} = 8.6 V	-	–0.3	-	%/K
$\Delta I_{out} / (I_{out} \times \Delta V_S)$	stabilized output current change over supply voltage	V_S = 10 V; $V_S - V_{out}$ = 1.4 V	-	0.8	-	%/V



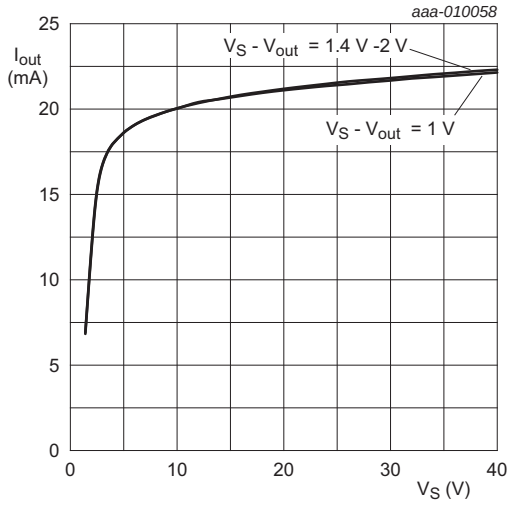
$V_S - V_{out}$ = 1.4 V; T_{amb} = 25 °C

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



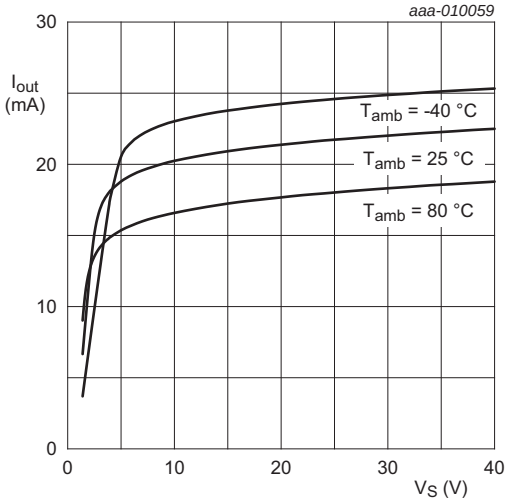
I_{out} = 0 mA

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



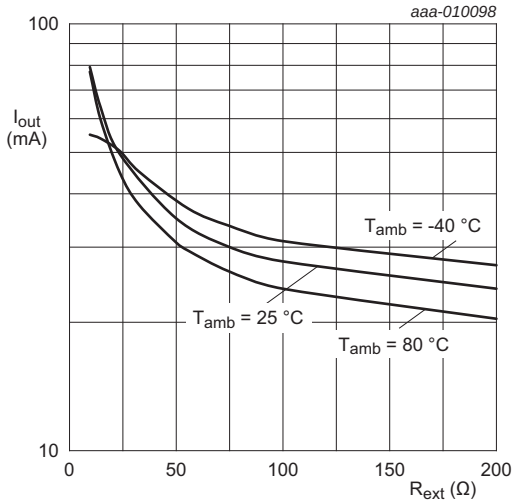
R_{ext} = open; T_{amb} = 25 °C

Fig 6. Output current as a function of supply voltage; typical values



$V_S - V_{out}$ = 1.4 V; R_{ext} = open

Fig 7. Output current as a function of supply voltage; typical values



V_S = 10 V; V_{out} = 8.6 V

Fig 8. Output current as a function of external resistor; typical values

8. Application information

Figure 9 shows a typical application circuit for an LED driver. The constant current ensures a constant LED brightness. The output current can be adjusted between 20 mA and 65 mA by connecting an external resistor R_{ext}. Figure 8 gives a first indication for choosing the external resistor R_{ext}. The output current slightly decreases when the power load at LED driver increases. This effect is due to the self heating of the device and the negative thermal coefficient of the output current.

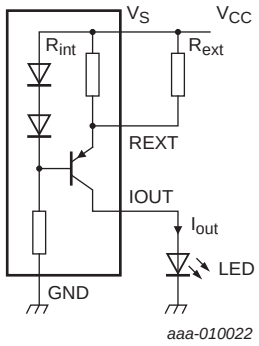


Fig 9. LED driver application diagram

The output can be switched ON and OFF by connecting a Resistor-Equipped Transistor (RET), e.g. PDTC124XU; see Figure 10.

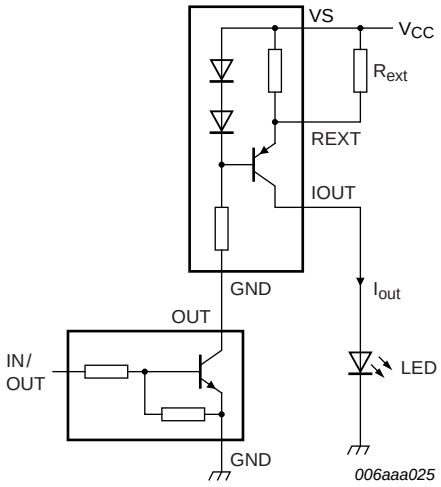


Fig 10. Switching the current ON/OFF; application diagram

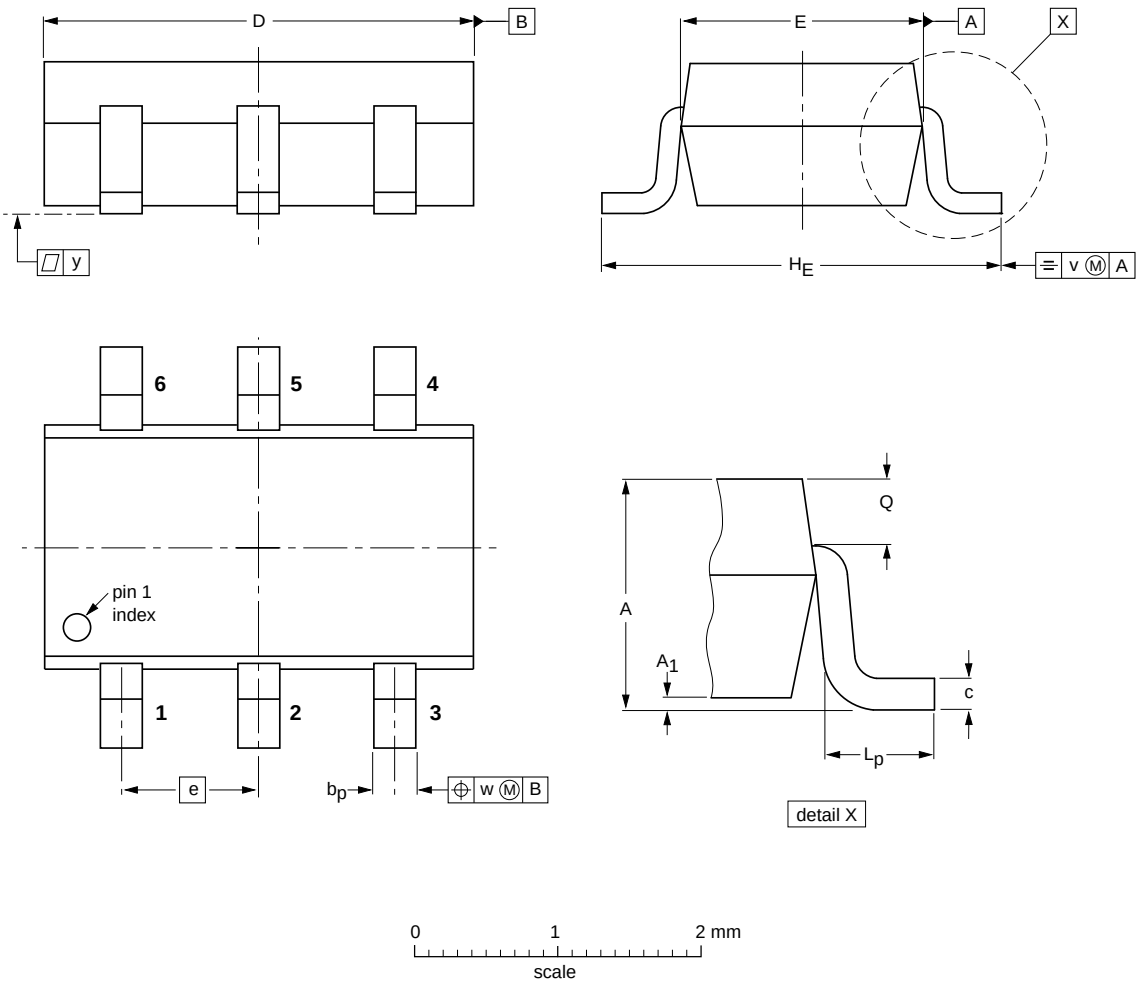
9. Test information

9.1 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.

10. Package outline

Plastic surface-mounted package (TSOP6); 6 leads **SOT457**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	c	D	E	e	H_E	L_p	Q	v	w	y
mm	1.1 0.9	0.1 0.013	0.40 0.25	0.26 0.10	3.1 2.7	1.7 1.3	0.95	3.0 2.5	0.6 0.2	0.33 0.23	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT457			SC-74			~~05-11-07~~ 06-03-16

Fig 11. Package outline SOT457 (SC-74)

11. Soldering

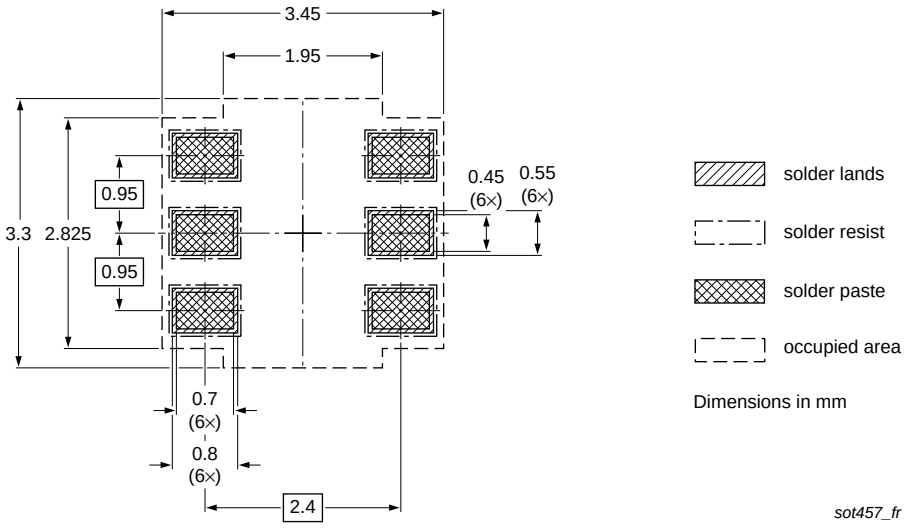


Fig 12. Reflow soldering footprint for SOT457 (SC-74)

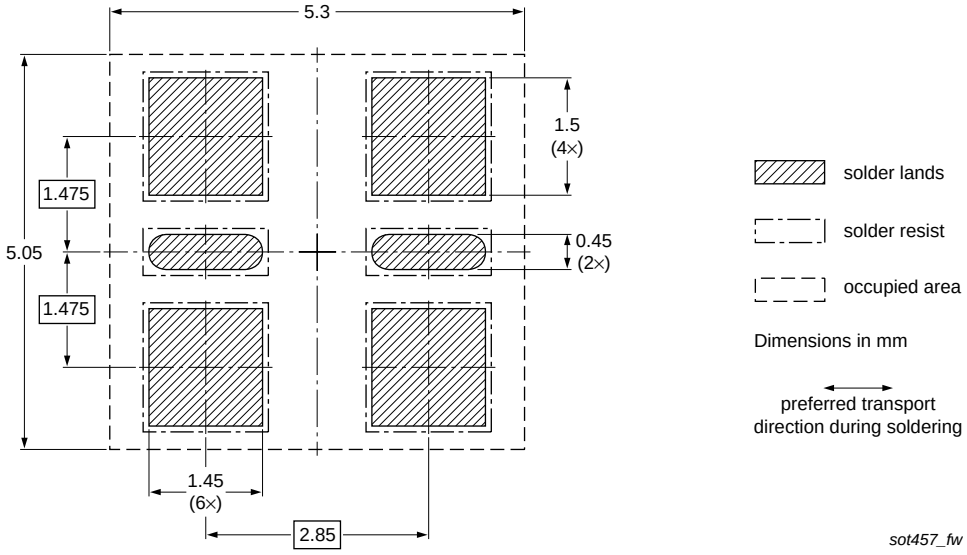


Fig 13. Wave soldering footprint for SOT457 (SC-74)

12. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
NCR402U v.1	20131210	Product data sheet	-	-

13. Legal information

13.1 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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[2] The term 'short data sheet' is explained in section "Definitions".

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15. Contents

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