



# NMB2227A

40 V, 600 mA NPN/PNP general-purpose transistors

15 September 2016

Product data sheet

## 1. General description

NPN/PNP general-purpose transistors in a small SOT457 (SC-74) Surface-Mounted Device (SMD) plastic package.

## 2. Features and benefits

- General-purpose transistor
- High current
- Reduces component count on Printed-Circuit Board (PCB)
- Reduces pick and place costs
- AEC-Q101 qualified

## 3. Applications

- General-purpose switching and amplification
- Complementary driver
- Half-bridge and full-bridge driver

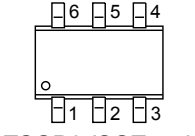
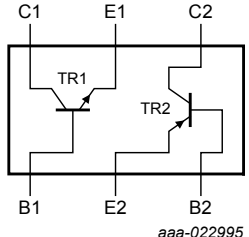
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>TR1 (NPN)</b>						
$V_{CEO}$	collector-emitter voltage	open base	-	-	40	V
$h_{FE}$	DC current gain	$V_{CE} = 10\text{ V}; I_C = 150\text{ mA}; \text{pulsed}; t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	100	-	300	
<b>TR2 (PNP)</b>						
$V_{CEO}$	collector-emitter voltage	open base	-	-	-60	V
$h_{FE}$	DC current gain	$V_{CE} = -10\text{ V}; I_C = -150\text{ mA}; \text{pulsed}; t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	100	-	300	
<b>Per transistor; for the PNP transistor with negative polarity</b>						
$I_C$	collector current		-	-	600	mA

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B1	base TR1	 <p>TSOP6 (SOT457)</p>	 <p>aaa-022995</p>
2	E2	emitter TR2		
3	B2	base TR2		
4	C2	collector TR2		
5	E1	emitter TR1		
6	C1	collector TR1		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
NMB2227A	TSOP6	plastic surface-mounted package (TSOP6); 6 leads	SOT457

## 7. Marking

Table 4. Marking codes

Type number	Marking code
NMB2227A	3B

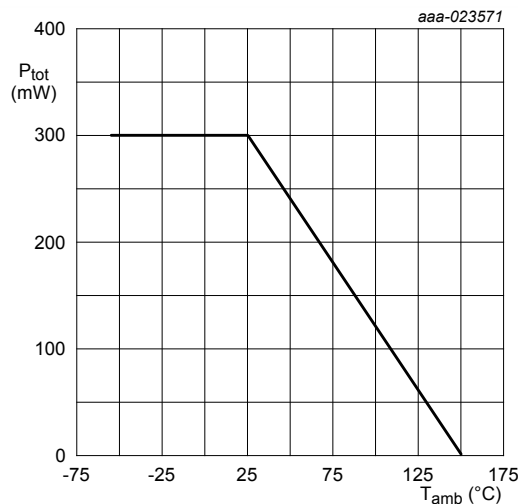
## 8. Limiting values

**Table 5. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
<b>TR1 (NPN)</b>					
$V_{CBO}$	collector-base voltage	open emitter	-	75	V
$V_{CEO}$	collector-emitter voltage	open base	-	40	V
<b>TR2 (PNP)</b>					
$V_{CBO}$	collector-base voltage	open emitter	-	-60	V
$V_{CEO}$	collector-emitter voltage	open base	-	-60	V
<b>Per transistor; for the PNP transistor with negative polarity</b>					
$V_{EBO}$	emitter-base voltage	open collector	-	6	V
$I_C$	collector current		-	600	mA
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	800	mA
$I_{BM}$	peak base current		-	200	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	200	mW
<b>Per device</b>					
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	300	mW
$T_j$	junction temperature		-	150	°C
$T_{amb}$	ambient temperature		-55	150	°C
$T_{stg}$	storage temperature		-65	150	°C

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



FR4 PCB; standard footprint

**Fig. 1. Power derating curve**

## 9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Per transistor</b>							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	625	K/W
<b>Per device</b>							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	417	K/W

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

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>TR1 (NPN)</b>						
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 60 \text{ V}; I_E = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	10	nA
		$V_{CB} = 60 \text{ V}; I_E = 0 \text{ A}; T_j = 125 \text{ }^\circ\text{C}$	-	-	10	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5 \text{ V}; I_C = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	10	nA
$h_{FE}$	DC current gain	$V_{CE} = 10 \text{ V}; I_C = 1 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	50	-	-	
		$V_{CE} = 10 \text{ V}; I_C = 10 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	75	-	-	
		$V_{CE} = 10 \text{ V}; I_C = 150 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	100	-	300	
		$V_{CE} = 10 \text{ V}; I_C = 500 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	40	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 150 \text{ mA}; I_B = 15 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	300	mV
		$I_C = 500 \text{ mA}; I_B = 50 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	1	V
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 150 \text{ mA}; I_B = 15 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	0.6	-	1.2	V
		$I_C = 500 \text{ mA}; I_B = 50 \text{ mA}; \text{pulsed}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	2	V
$t_d$	delay time	$I_C = 150 \text{ mA}; I_{Bon} = 15 \text{ mA}; I_{Boff} = -15 \text{ mA}; V_{CC} = 10 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	15	ns
$t_r$	rise time		-	-	20	ns
$t_{on}$	turn-on time		-	-	35	ns
$t_s$	storage time		-	-	200	ns
$t_f$	fall time		-	-	60	ns
$t_{off}$	turn-off time		-	-	250	ns
$C_C$	collector capacitance		$V_{CB} = 10 \text{ V}; I_E = 0 \text{ A}; i_e = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	8
$C_E$	emitter capacitance	$V_{EB} = 500 \text{ mV}; I_C = 0 \text{ A}; i_c = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	25	pF
$f_T$	transition frequency	$V_{CE} = 20 \text{ V}; I_C = 20 \text{ mA}; f = 100 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	300	-	-	MHz
<b>TR2 (PNP)</b>						
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -50 \text{ V}; I_E = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	-10	nA
		$V_{CB} = -50 \text{ V}; I_E = 0 \text{ A}; T_j = 125 \text{ }^\circ\text{C}$	-	-	-10	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -5 \text{ V}; I_C = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	-50	nA
$h_{FE}$	DC current gain	$V_{CE} = -10 \text{ V}; I_C = -0.1 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	75	-	-	
		$V_{CE} = -10 \text{ V}; I_C = -1 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	100	-	-	
		$V_{CE} = -10 \text{ V}; I_C = -10 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	100	-	-	

40 V, 600 mA NPN/PNP general-purpose transistors

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		$V_{CE} = -10\text{ V}; I_C = -150\text{ mA}; \text{pulsed}; t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25\text{ }^\circ\text{C}$	100	-	300	
		$V_{CE} = -10\text{ V}; I_C = -500\text{ mA}; \text{pulsed}; t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25\text{ }^\circ\text{C}$	50	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -150\text{ mA}; I_B = -15\text{ mA}; \text{pulsed}; t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25\text{ }^\circ\text{C}$	-	-	-400	mV
		$I_C = -500\text{ mA}; I_B = -50\text{ mA}; \text{pulsed}; t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25\text{ }^\circ\text{C}$	-	-	-1.6	V
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -150\text{ mA}; I_B = -15\text{ mA}; \text{pulsed}; t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25\text{ }^\circ\text{C}$	-	-	-1.3	V
		$I_C = -500\text{ mA}; I_B = -50\text{ mA}; \text{pulsed}; t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25\text{ }^\circ\text{C}$	-	-	-2.6	V
$t_d$	delay time	$I_C = -150\text{ mA}; I_{B\text{on}} = -15\text{ mA}; I_{B\text{off}} = 15\text{ mA}; V_{CC} = -10\text{ V}; T_{\text{amb}} = 25\text{ }^\circ\text{C}$	-	-	12	ns
$t_r$	rise time		-	-	30	ns
$t_{\text{on}}$	turn-on time		-	-	40	ns
$t_s$	storage time		-	-	300	ns
$t_f$	fall time		-	-	65	ns
$t_{\text{off}}$	turn-off time		-	-	365	ns
$C_C$	collector capacitance	$V_{CB} = -10\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A}; f = 1\text{ MHz}; T_{\text{amb}} = 25\text{ }^\circ\text{C}$	-	-	8	pF
$C_E$	emitter capacitance	$V_{EB} = -2\text{ V}; I_C = 0\text{ A}; i_c = 0\text{ A}; f = 1\text{ MHz}; T_{\text{amb}} = 25\text{ }^\circ\text{C}$	-	-	30	pF
$f_T$	transition frequency	$V_{CE} = -20\text{ V}; I_C = -50\text{ mA}; f = 100\text{ MHz}; T_{\text{amb}} = 25\text{ }^\circ\text{C}$	200	-	-	MHz

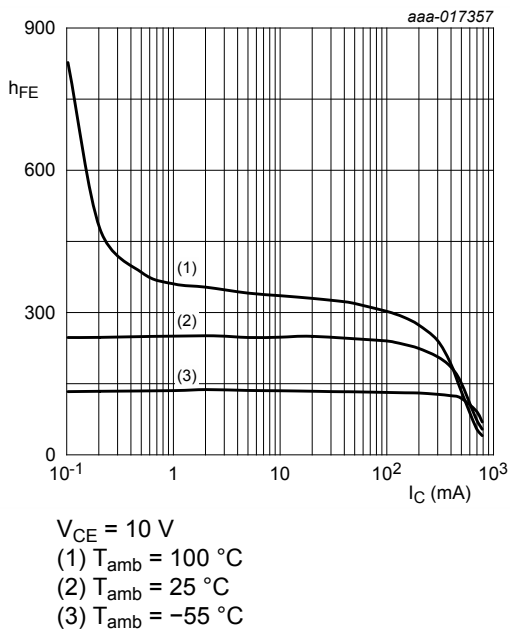


Fig. 2. NPN transistor: DC current gain as a function of collector current; typical values

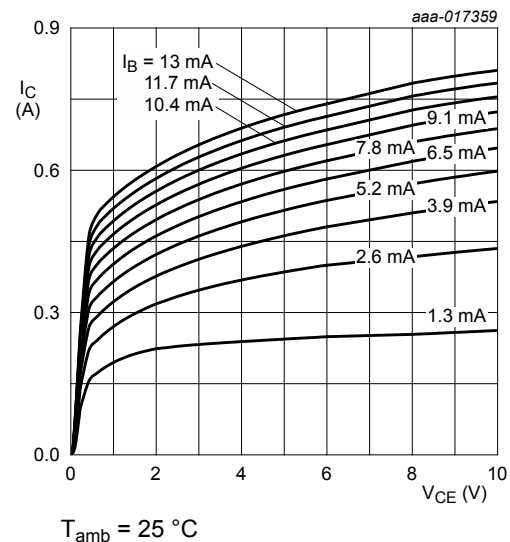
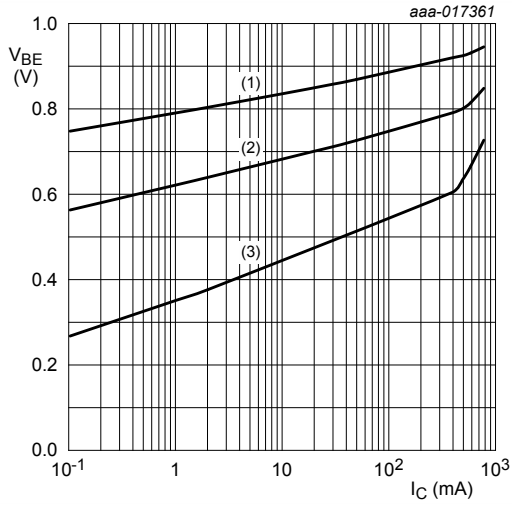
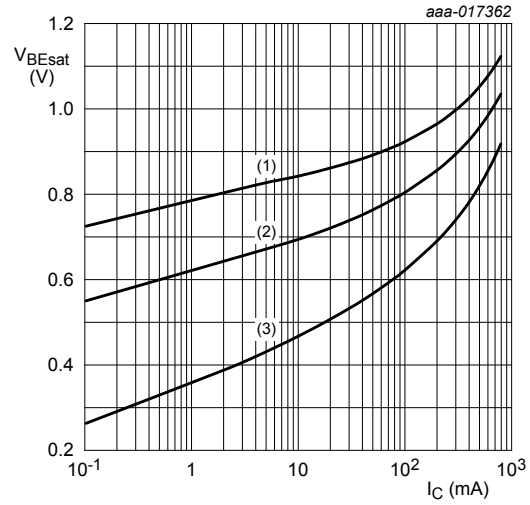


Fig. 3. NPN transistor: Collector current as a function of collector-emitter voltage; typical values



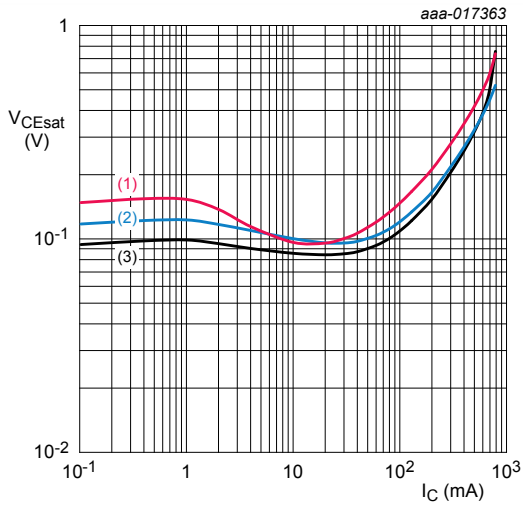
$V_{CE} = 10\text{ V}$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 150\text{ °C}$

**Fig. 4. NPN transistor: Base-emitter voltage as a function of collector current; typical values**



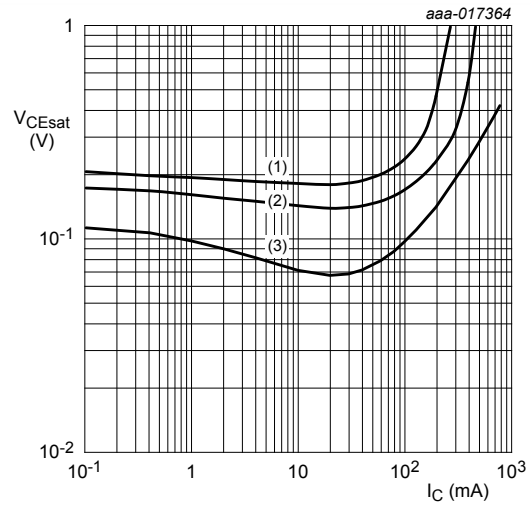
$I_C/I_B = 10$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 150\text{ °C}$

**Fig. 5. NPN transistor: Base-emitter saturation voltage as a function of collector current; typical values**



$I_C/I_B = 20$   
 (1)  $T_{amb} = 150\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig. 6. NPN transistor: Collector-emitter saturation voltage as a function of collector current; typical values**



$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

**Fig. 7. NPN transistor: Collector-emitter saturation voltage as a function of collector current; typical values**

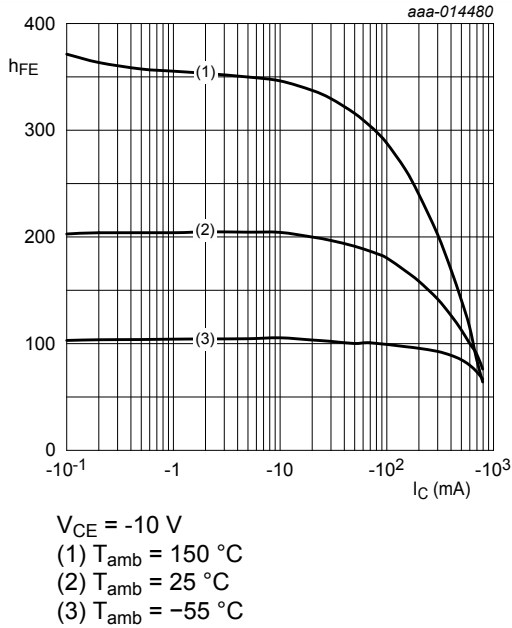


Fig. 8. PNP transistor: DC current gain as a function of collector current; typical values

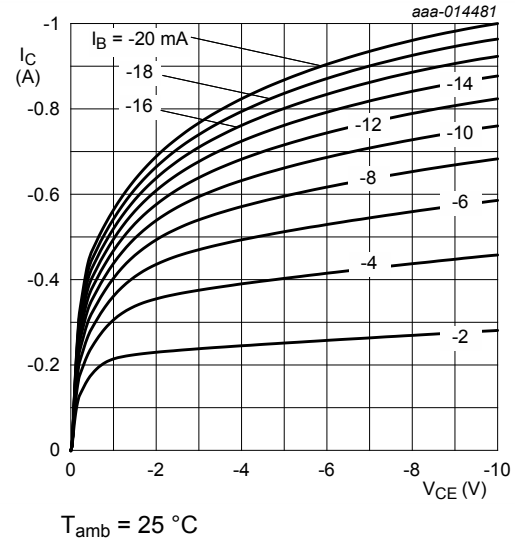


Fig. 9. PNP transistor: Collector current as a function of collector-emitter voltage; typical values

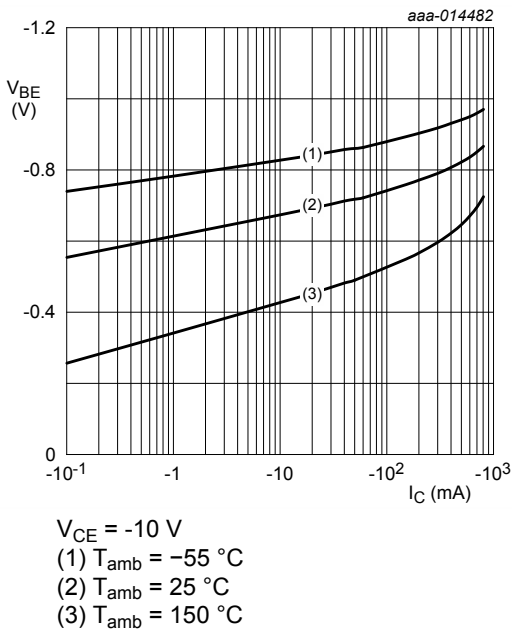


Fig. 10. PNP transistor: Base-emitter voltage as a function of collector current; typical values

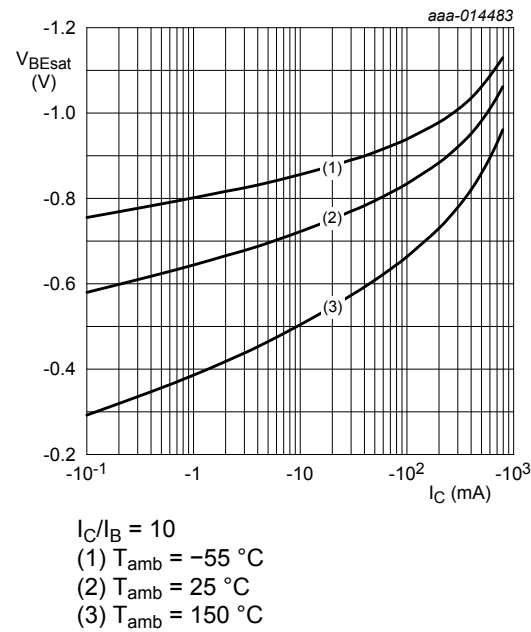
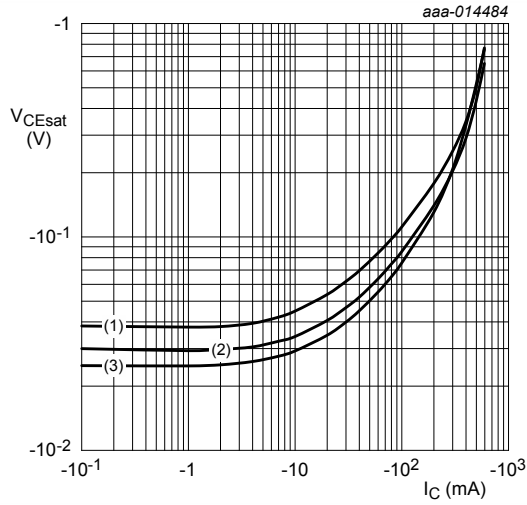


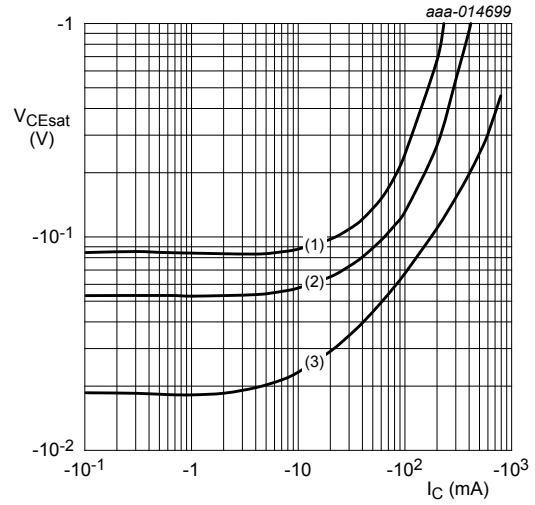
Fig. 11. PNP transistor: Base-emitter saturation voltage as a function of collector current; typical values





$I_C/I_B = 20$   
 (1)  $T_{amb} = 150\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig. 12. PNP transistor: Collector-emitter saturation voltage as a function of collector current; typical values**



$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

**Fig. 13. PNP transistor: Collector-emitter saturation voltage as a function of collector current; typical values**

### 11. Test information

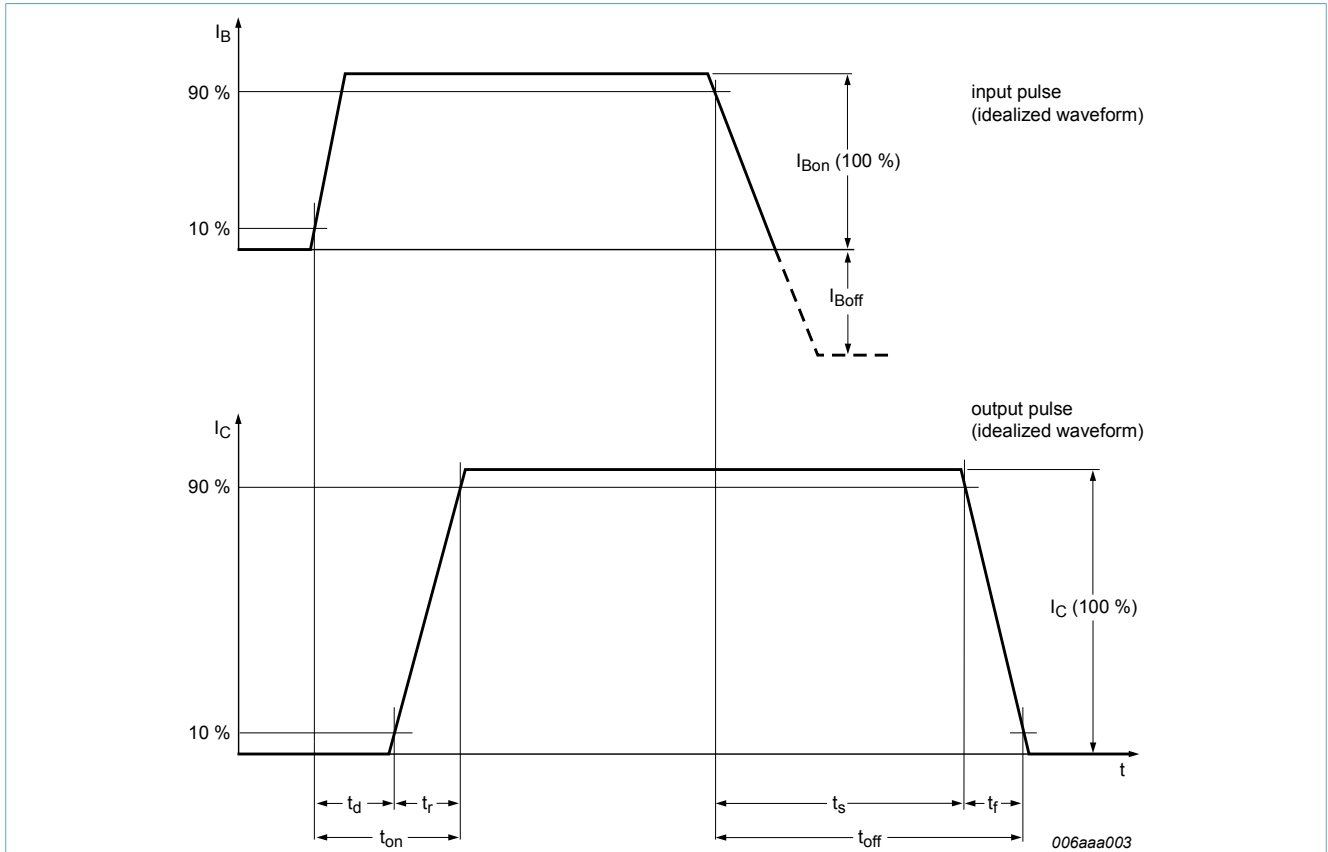


Fig. 14. TR1 (NPN): Transistor switching time definition

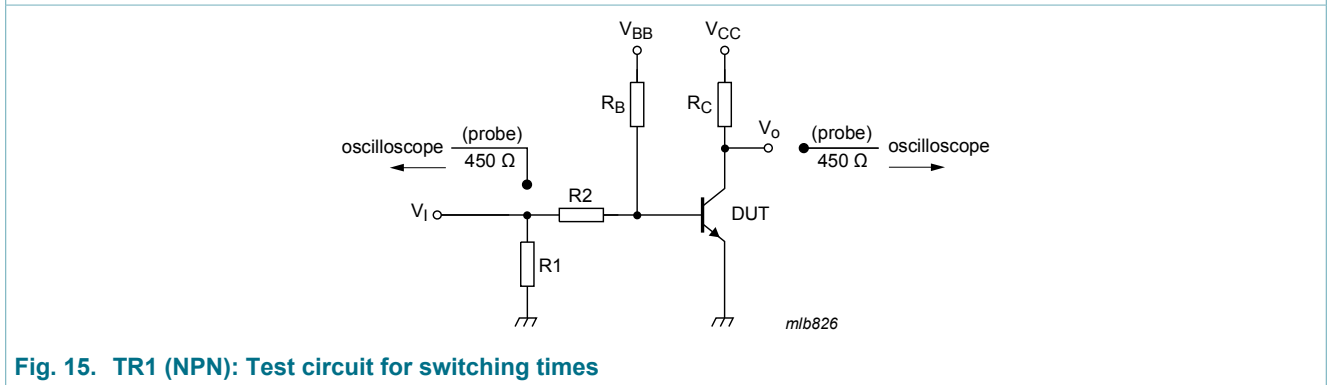


Fig. 15. TR1 (NPN): Test circuit for switching times

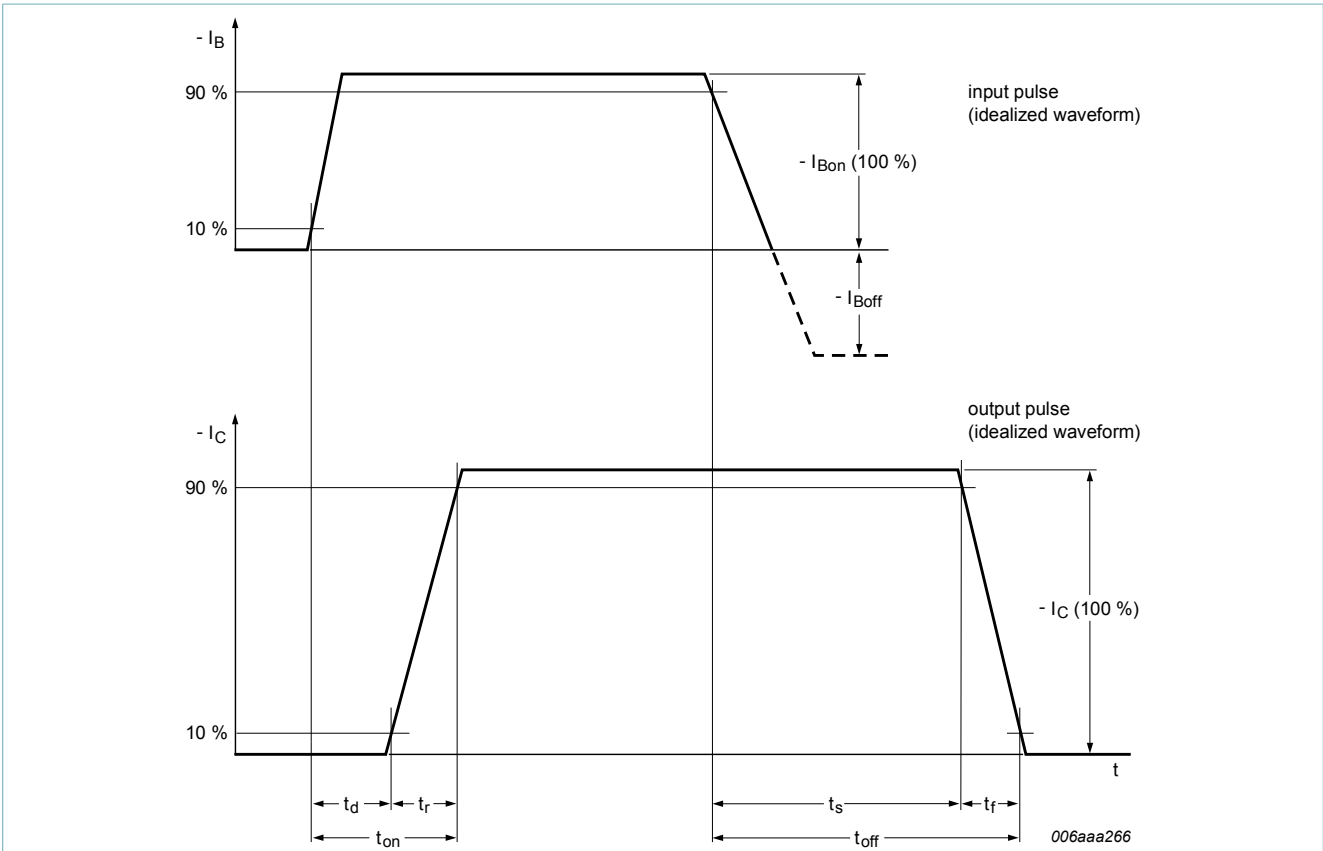


Fig. 16. TR2 (PNP): Transistor switching time definition

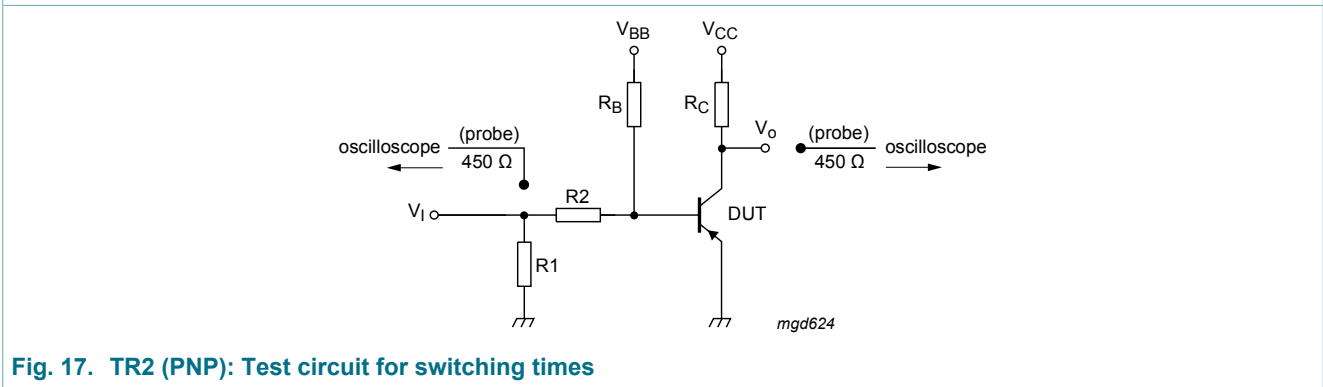


Fig. 17. TR2 (PNP): Test circuit for switching times

**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.

## 12. Package outline

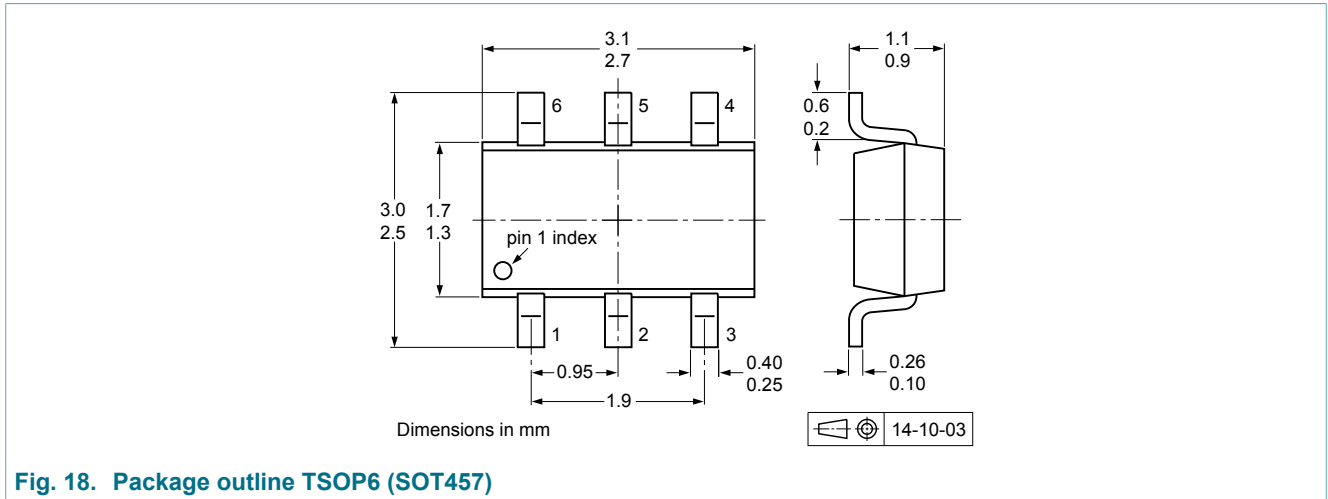


Fig. 18. Package outline TSOP6 (SOT457)

## 13. Soldering

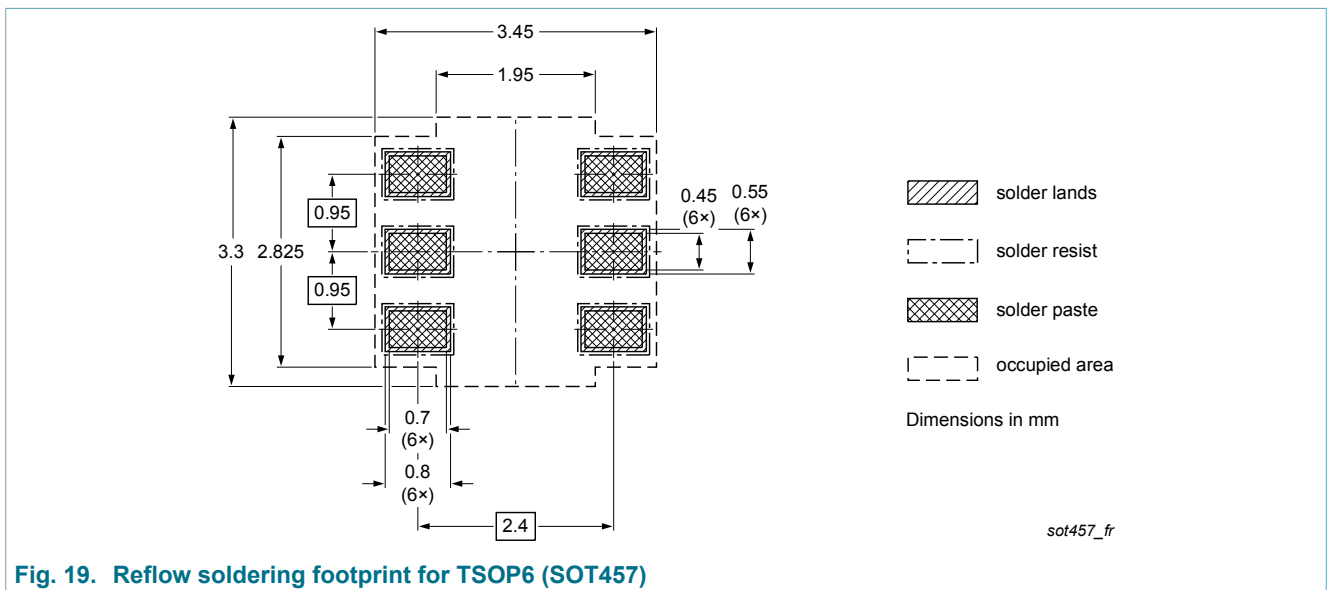


Fig. 19. Reflow soldering footprint for TSOP6 (SOT457)

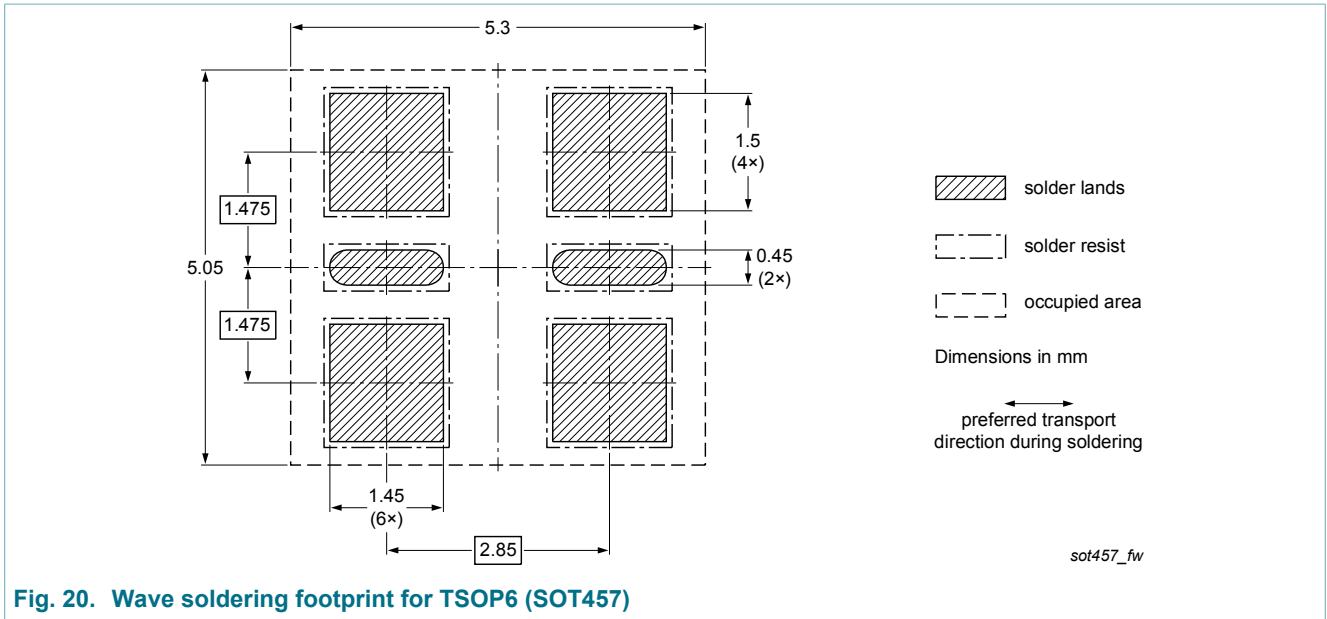


Fig. 20. Wave soldering footprint for TSOP6 (SOT457)

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
NMB2227A v.1	20160915	Product data sheet	-	-

## 15. Legal information

### 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.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

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## 16. Contents

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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. Test information.....	10
12. Package outline.....	12
13. Soldering.....	12
14. Revision history.....	14
15. Legal information.....	15

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