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	Тур	Max	Unit		
TR1 (NPN)	TR1 (NPN)							
V_{CEO}	collector-emitter voltage	open base	-	-	40	V		
h _{FE}	DC current gain	V_{CE} = 10 V; I_{C} = 150 mA; pulsed; $t_{p} \le$ 300 µs; $\delta \le$ 0.02 ; T_{amb} = 25 °C	100	-	300			
TR2 (PNP)	·							
V_{CEO}	collector-emitter voltage	open base	-	-	-60	V		
h _{FE}	DC current gain	V_{CE} = -10 V; I_{C} = -150 mA; pulsed; $t_{p} \le$ 300 µs; $\delta \le$ 0.02 ; T_{amb} = 25 °C	100	-	300			
Per transist	tor; for the PNP transist	or with negative polarity	'	'		,		
I _C	collector current		-	-	600	mA		



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

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B1	base TR1	<u> </u>	C1 E1 C2
2	E2	emitter TR2		
3	B2	base TR2	<u>0</u> <u>1 1 2 1</u> 3	TR1 TR2
4	C2	collector TR2	TSOP6 (SOT457)	
5	E1	emitter TR1		D4 50 00
6	C1	collector TR1		B1 E2 B2 aaa-022995

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

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

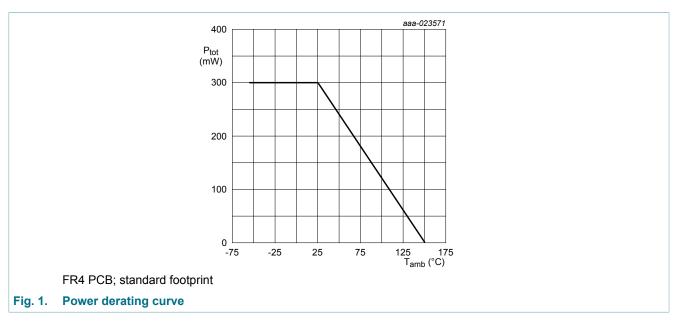
8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
TR1 (NPN)						
V _{CBO}	collector-base voltage	open emitter		-	75	V
V _{CEO}	collector-emitter voltage	open base		-	40	V
TR2 (PNP)						
V _{CBO}	collector-base voltage	open emitter		-	-60	V
V _{CEO}	collector-emitter voltage	open base		-	-60	V
Per transisto	or; for the PNP transistor wit	h negative polarity				
V _{EBO}	emitter-base voltage	open collector		-	6	V
I _C	collector current			-	600	mA
I _{CM}	peak collector current	single pulse; t _p ≤ 1 ms		-	800	mA
I _{BM}	peak base current			-	200	mA
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1]	-	200	mW
Per device			·	·		
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1]	-	300	mW
Tj	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.



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

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Тур	Max	Unit
Per transisto	or						
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	625	K/W
Per device							
$R_{th(j-a)}$	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.

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

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
TR1 (NPN)	,					
I _{CBO}	collector-base cut-off	V _{CB} = 60 V; I _E = 0 A; T _{amb} = 25 °C	-	-	10	nA
	current	V _{CB} = 60 V; I _E = 0 A; T _j = 125 °C	-	-	10	μA
I _{EBO}	emitter-base cut-off current	$V_{EB} = 5 \text{ V}; I_{C} = 0 \text{ A}; T_{amb} = 25 ^{\circ}\text{C}$	-	-	10	nA
h _{FE}	DC current gain	V _{CE} = 10 V; I _C = 1 mA; T _{amb} = 25 °C	50	-	-	
		V _{CE} = 10 V; I _C = 10 mA; T _{amb} = 25 °C	75	-	-	
		V_{CE} = 10 V; I_{C} = 150 mA; pulsed; $t_{p} \le$ 300 μs; δ ≤ 0.02 ; T_{amb} = 25 °C	100	-	300	
		V_{CE} = 10 V; I_{C} = 500 mA; pulsed; $t_{p} \le$ 300 µs; $\delta \le 0.02$; T_{amb} = 25 °C	40	-	-	
V _{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; pulsed; $t_p \le$ 300 µs; $\delta \le 0.02$; T_{amb} = 25 °C	-	-	300	mV
		I_C = 500 mA; I_B = 50 mA; pulsed; $t_p \le$ 300 µs; $\delta \le$ 0.02 ; T_{amb} = 25 °C	-	-	1	V
V _{BEsat} base-emi	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; pulsed; $t_p \le$ 300 μs; δ ≤ 0.02 ; T_{amb} = 25 °C	0.6	-	1.2	V
		I_C = 500 mA; I_B = 50 mA; pulsed; $t_p \le$ 300 µs; $\delta \le 0.02$; T_{amb} = 25 °C	-	-	2	V
t _d	delay time	I _C = 150 mA; I _{Bon} = 15 mA; I _{Boff} = -15 mA; V _{CC} = 10 V; T _{amb} = 25 °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 V; I_{E} = 0 A; i_{e} = 0 A; f = 1 MHz; T_{amb} = 25 °C	-	-	8	pF
C _E	emitter capacitance	V_{EB} = 500 mV; I_{C} = 0 A; i_{c} = 0 A; f = 1 MHz; T_{amb} = 25 °C	-	-	25	pF
f _T	transition frequency	V_{CE} = 20 V; I_{C} = 20 mA; f = 100 MHz; T_{amb} = 25 °C	300	-	-	MHz
TR2 (PNP)		'		1	1	
I _{CBO}	collector-base cut-off	V _{CB} = -50 V; I _E = 0 A; T _{amb} = 25 °C	-	-	-10	nA
	current	V _{CB} = -50 V; I _E = 0 A; T _j = 125 °C	-	-	-10	μA
I _{EBO}	emitter-base cut-off current	V _{EB} = -5 V; I _C = 0 A; T _{amb} = 25 °C	-	-	-50	nA
h _{FE}	DC current gain	V _{CE} = -10 V; I _C = -0.1 mA; T _{amb} = 25 °C	75	-	-	
		V _{CE} = -10 V; I _C = -1 mA; T _{amb} = 25 °C	100	-	-	
		V _{CE} = -10 V; I _C = -10 mA; T _{amb} = 25 °C	100	-	-	

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

Symbol	Parameter	Conditions	I	Min	Тур	Max	Unit
		V_{CE} = -10 V; I_{C} = -150 mA; pulsed; $t_{p} \le$ 300 μ s; $\delta \le$ 0.02 ; T_{amb} = 25 °C		100	-	300	
		V_{CE} = -10 V; I_{C} = -500 mA; pulsed; $t_{p} \le$ 300 μ s; $\delta \le$ 0.02 ; T_{amb} = 25 °C	ţ	50	-	-	
V _{CEsat} collector-emitter saturation voltage		I_C = -150 mA; I_B = -15 mA; pulsed; t_p ≤ 300 μs; δ ≤ 0.02 ; T_{amb} = 25 °C	-	-	-	-400	mV
	I_C = -500 mA; I_B = -50 mA; pulsed; t_p ≤ 300 μs; δ ≤ 0.02 ; T_{amb} = 25 °C	-	-	-	-1.6	V	
DESGL	base-emitter saturation voltage	I_C = -150 mA; I_B = -15 mA; pulsed; t_p ≤ 300 μs; δ ≤ 0.02 ; T_{amb} = 25 °C	-	-	-	-1.3	V
		I_C = -500 mA; I_B = -50 mA; pulsed; $t_p \le$ 300 µs; $\delta \le$ 0.02 ; T_{amb} = 25 °C	-	-	-	-2.6	V
t _d	delay time	$I_C = -150 \text{ mA}; I_{Bon} = -15 \text{ mA};$	-	-	-	12	ns
t _r	rise time	I_{Boff} = 15 mA; V_{CC} = -10 V; T_{amb} = 25 °C	-	-	-	30	ns
t _{on}	turn-on time	· amb = 0	-	-	-	40	ns
t _s	storage time		-	-	-	300	ns
t _f	fall time		-	-	-	65	ns
t _{off}	turn-off time		-	-	-	365	ns
C _C	collector capacitance	V_{CB} = -10 V; I_{E} = 0 A; i_{e} = 0 A; f = 1 MHz; T_{amb} = 25 °C	-	-	-	8	pF
C _E	emitter capacitance	V_{EB} = -2 V; I_{C} = 0 A; i_{c} = 0 A; f = 1 MHz; T_{amb} = 25 °C	-	-	-	30	pF
f _T	transition frequency	V_{CE} = -20 V; I_{C} = -50 mA; f = 100 MHz; T_{amb} = 25 °C	2	200	-	-	MHz

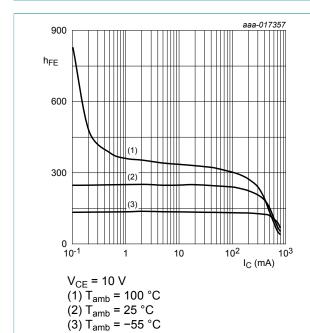


Fig. 2. NPN transistor: DC current gain as a function of collector current; typical values

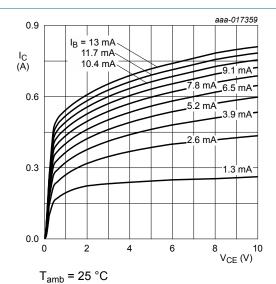


Fig. 3. NPN transistor: Collector current as a function of collector-emitter voltage; typical values

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

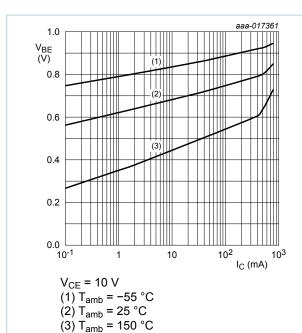


Fig. 4. NPN transistor: Base-emitter voltage as a function of collector current; typical values

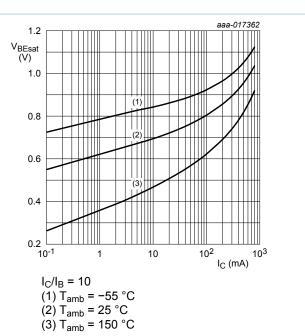


Fig. 5. NPN transistor: Base-emitter saturation voltage as a function of collector current; typical values

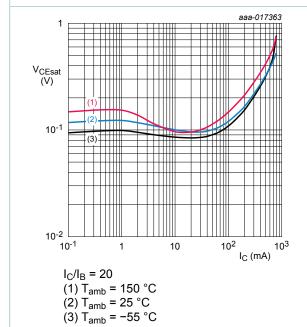
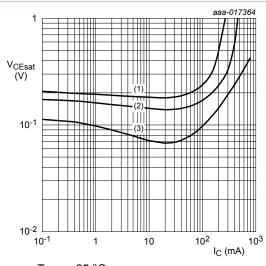


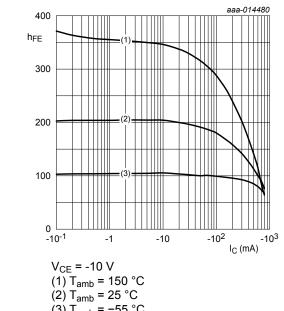
Fig. 6. NPN transistor: Collector-emitter saturation voltage as a function of collector current; typical values



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

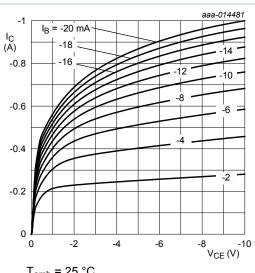
Fig. 7. NPN transistor: Collector-emitter saturation voltage as a function of collector current; typical values

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



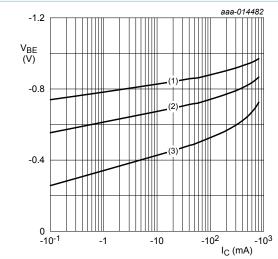
(3) $T_{amb} = -55 \, ^{\circ}C$

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



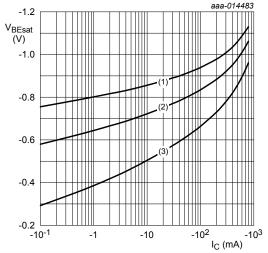
 $T_{amb} = 25 \, ^{\circ}C$

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



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

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



 $I_C/I_B = 10$ (1) $T_{amb} = -55$ °C

(2) T_{amb} = 25 °C (3) T_{amb} = 150 °C

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

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

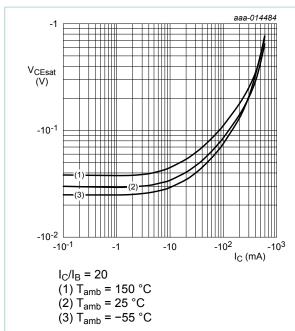


Fig. 12. PNP transistor: Collector-emitter saturation voltage as a function of collector current; typical values

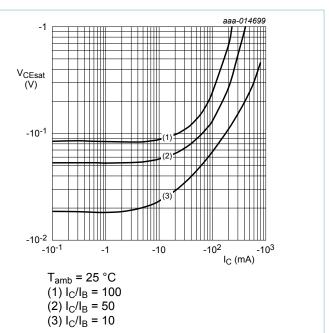


Fig. 13. PNP transistor: Collector-emitter saturation voltage as a function of collector current; typical values

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

11. Test information

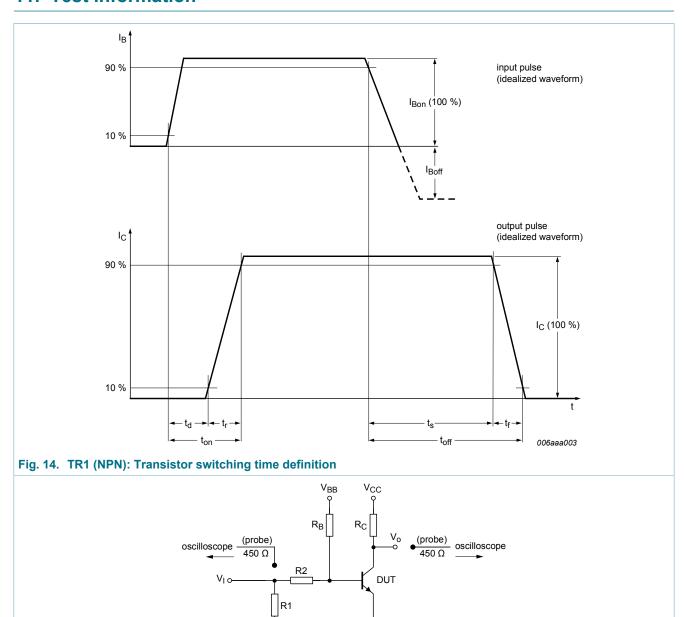
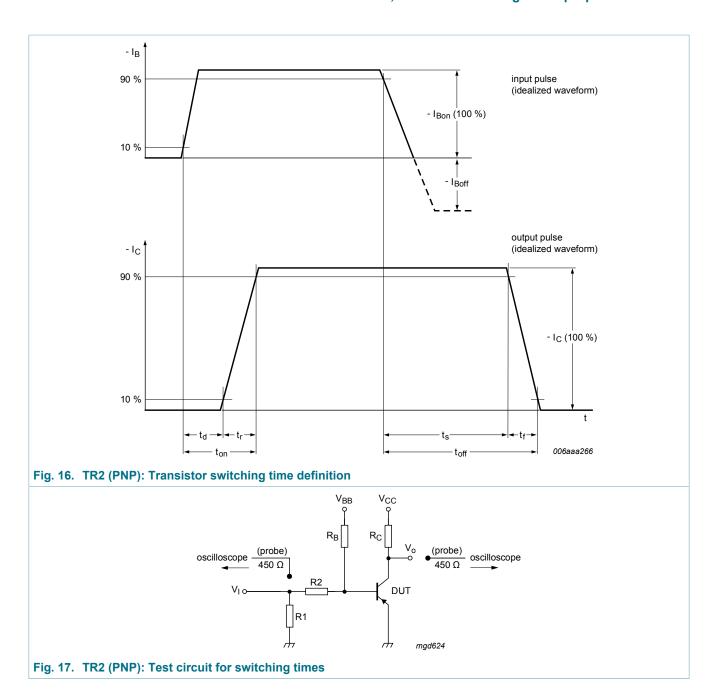


Fig. 15. TR1 (NPN): Test circuit for switching times

mlb826

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

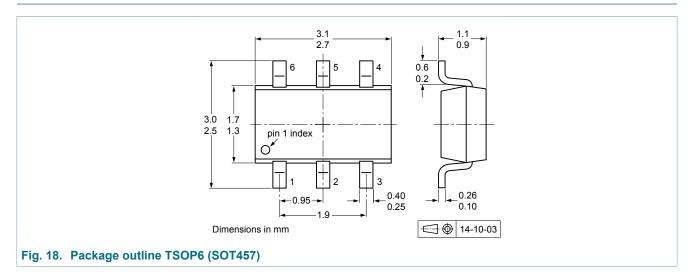


Quality information

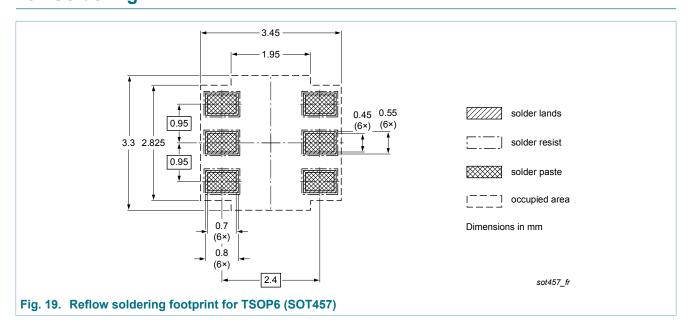
This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101* - *Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

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

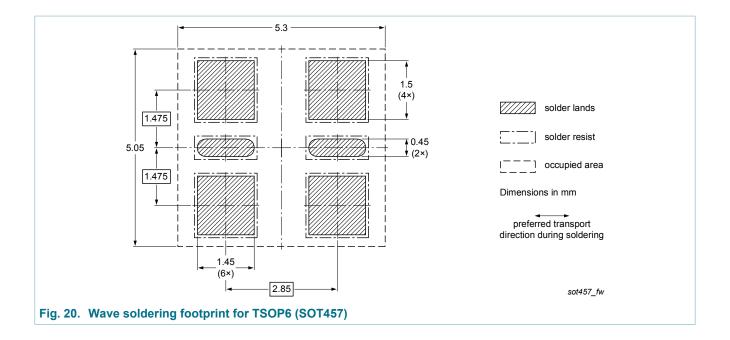
12. Package outline



13. Soldering



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



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

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	-	-

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

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.

- Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
- 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.

Definitions

Preview — The document is a preview version only. The document is still subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, Nexperia does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Nexperia takes no responsibility for the content in this document if provided by an information source outside of Nexperia.

In no event shall Nexperia be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Nexperia's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of Nexperia.

Right to make changes — Nexperia reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use in automotive applications — This Nexperia product has been qualified for use in automotive applications. Unless otherwise agreed in writing, the product is not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of a Nexperia product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Nexperia and its suppliers accept no liability for inclusion and/or use of Nexperia products in such equipment or applications and therefore such inclusion and/or use is at the customer's own rick.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. Nexperia makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Nexperia products, and Nexperia accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Nexperia product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Nexperia does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Nexperia products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Nexperia does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — Nexperia products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nexperia.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Nexperia hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Nexperia products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

NMB2227A

All information provided in this document is subject to legal disclaimers

© Nexperia B.V. 2017. All rights reserved

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

Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

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

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

For more information, please visit: http://www.nexperia.com For sales office addresses, please send an email to: salesaddresses@nexperia.com Date of release: 15 September 2016

[©] Nexperia B.V. 2017. All rights reserved