PEMD3; PIMD3; PUMD3

NPN/PNP resistor-equipped transistors; R1 = 10 kΩ, R2 = 10 kΩ

Rev. 11 — 25 September 2013 Product data sheet

1. Product profile

1.1 General description

NPN/PNP Resistor-Equipped Transistors (RET) in Surface-Mounted Device (SMD) plastic packages.

Table 1. Product overview

Type number	Package		PNP/PNP complement	NPN/NPN complement	Package configuration
	Nexperia	JEITA			
PEMD3	SOT666	-	PEMB11	PEMH11	ultra small and flat lead
PIMD3	SOT457	SC-74	-	-	small
PUMD3	SOT363	SC-88	PUMB11	PUMH11	very small

1.2 Features and benefits

- 100 mA output current capability
- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs
- AEC-Q101 qualified

1.3 Applications

- Low current peripheral driver
- Control of IC inputs
- Replaces general-purpose transistors in digital applications

1.4 Quick reference data

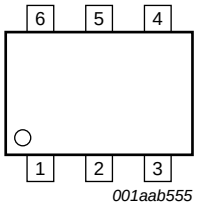
Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per transistor; for the PNP transistor (TR2) with negative polarity						
V_{CEO}	collector-emitter voltage	open base	-	-	50	V
I_O	output current		-	-	100	mA
R1	bias resistor 1 (input)		7	10	13	kΩ
R2/R1	bias resistor ratio		0.8	1	1.2	

2. Pinning information

Table 3. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	GND (emitter) TR1		
2	input (base) TR1		
3	output (collector) TR2		
4	GND (emitter) TR2		
5	input (base) TR2		
6	output (collector) TR1		



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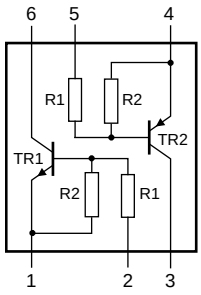

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3. Ordering information

Table 4. Ordering information

Type number	Package		
	Name	Description	Version
PEMD3	-	plastic surface-mounted package; 6 leads	SOT666
PIMD3	SC-74	plastic surface-mounted package (TSOP6); 6 leads	SOT457
PUMD3	SC-88	plastic surface-mounted package; 6 leads	SOT363

4. Marking

Table 5. Marking codes

Type number	Marking code[1]
PEMD3	D3
PIMD3	M7
PUMD3	D*3

[1] * = placeholder for manufacturing site code.

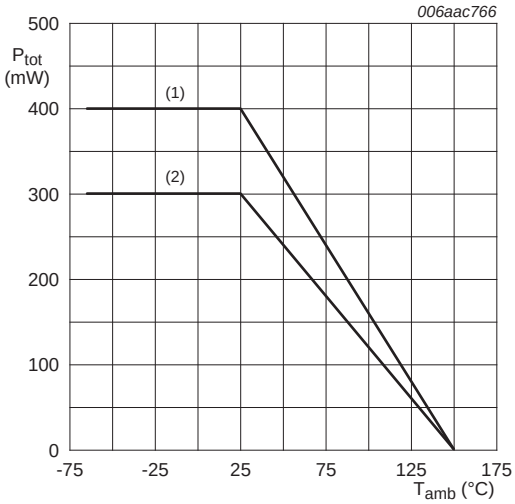
5. Limiting values

Table 6. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
Per transistor; for the PNP transistor (TR2) with negative polarity						
V_{CBO}	collector-base voltage	open emitter		-	50	V
V_{CEO}	collector-emitter voltage	open base		-	50	V
V_{EBO}	emitter-base voltage	open collector		-	10	V
V_I	input voltage TR1					
	positive			-	+40	V
	negative			-	−10	V
	input voltage TR2					
	positive			-	+10	V
	negative			-	−40	V
I_O	output current			-	100	mA
I_{CM}	peak collector current			-	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]			
	PEMD3 (SOT666)			-	200	mW
	PIMD3 (SOT457)			-	250	mW
	PUMD3 (SOT363)			-	200	mW
Per device						
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]			
	PEMD3 (SOT666)			-	300	mW
	PIMD3 (SOT457)			-	400	mW
	PUMD3 (SOT363)			-	300	mW
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			−65	+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.



(1) SOT457; FR4 PCB, standard footprint

(2) SOT363 and SOT666; FR4 PCB, standard footprint

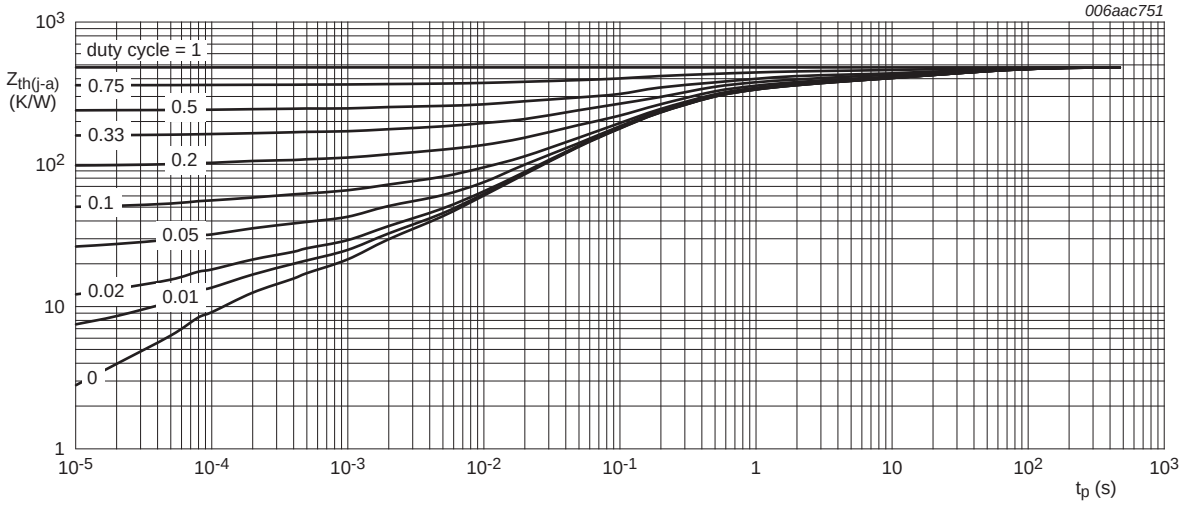
Fig 1. Per device: Power derating curves

6. Thermal characteristics

Table 7. Thermal characteristics

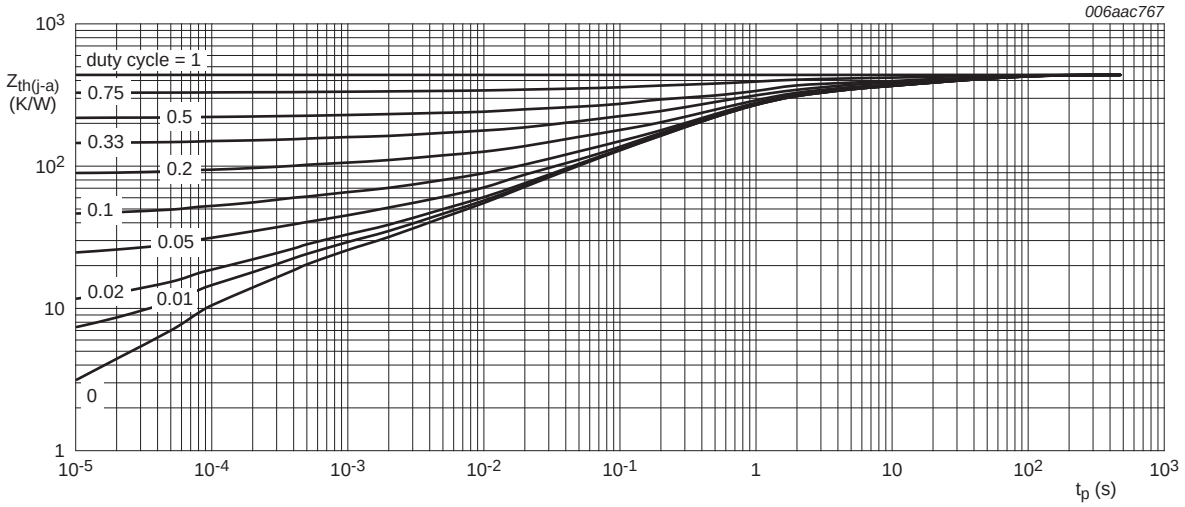
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]				
	PEMD3 (SOT666)			-	-	625	K/W
	PIMD3 (SOT457)			-	-	500	K/W
	PUMD3 (SOT363)			-	-	625	K/W
Per device							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]				
	PEMD3 (SOT666)			-	-	417	K/W
	PIMD3 (SOT457)			-	-	313	K/W
	PUMD3 (SOT363)			-	-	417	K/W

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



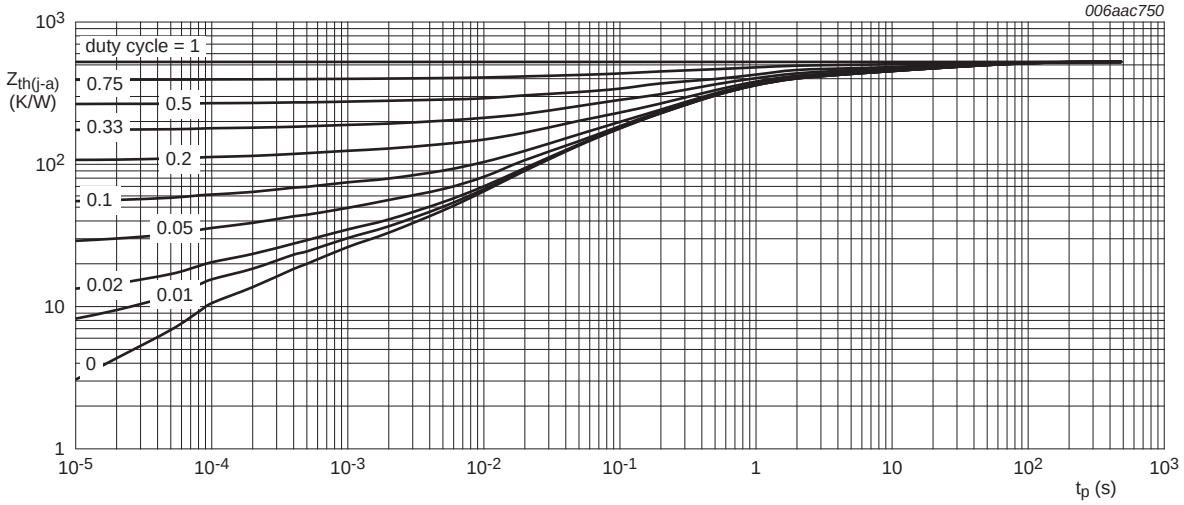
FR4 PCB, standard footprint

Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration for PEMD3 (SOT666); typical values



FR4 PCB, standard footprint

Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration for PIMD3 (SOT457); typical values



FR4 PCB, standard footprint

Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration for PUMD3 (SOT363); typical values

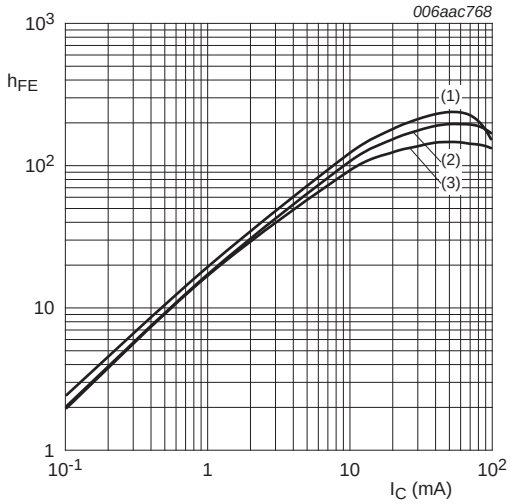
7. Characteristics

Table 8. Characteristics

T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor; for the PNP transistor (TR2) with negative polarity							
I_{CBO}	collector-base cut-off current	V_{CB} = 50 V; I_E = 0 A		-	-	100	nA
I_{CEO}	collector-emitter cut-off current	V_{CE} = 30 V; I_B = 0 A		-	-	1	µA
		V_{CE} = 30 V; I_B = 0 A; T_j = 150 °C		-	-	5	µA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0 A		-	-	400	µA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 5 mA		30	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA		-	-	150	mV
$V_{I(off)}$	off-state input voltage	V_{CE} = 5 V; I_C = 100 µA		-	1.1	0.8	V
$V_{I(on)}$	on-state input voltage	V_{CE} = 0.3 V; I_C = 10 mA		2.5	1.8	-	V
R1	bias resistor 1 (input)			7	10	13	kΩ
R2/R1	bias resistor ratio			0.8	1	1.2	
C_c	collector capacitance	V_{CB} = 10 V; I_E = i_e = 0 A; f = 1 MHz					
	TR1 (NPN)			-	-	2.5	pF
	TR2 (PNP)			-	-	3	pF
f_T	transition frequency	V_{CB} = 5 V; I_C = 10 mA; f = 100 MHz	[1]				
	TR1 (NPN)			-	230	-	MHz
	TR2 (PNP)			-	180	-	MHz

[1] Characteristics of built-in transistor.



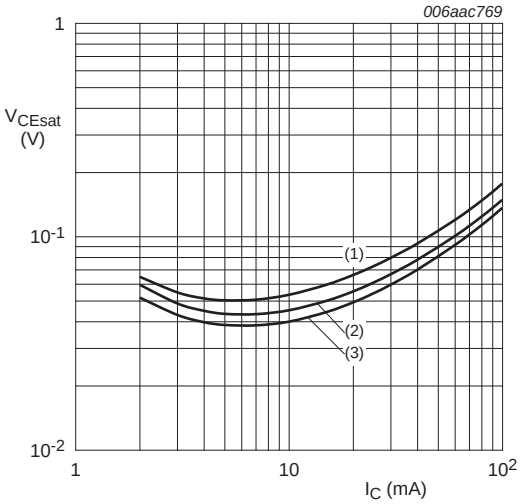
V_{CE} = 5 V

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −40 °C

Fig 5. TR1 (NPN): DC current gain as a function of collector current; typical values



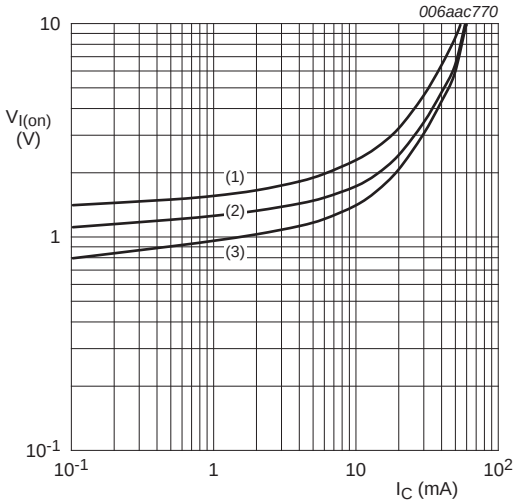
I_C/I_B = 20

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −40 °C

Fig 6. TR1 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values



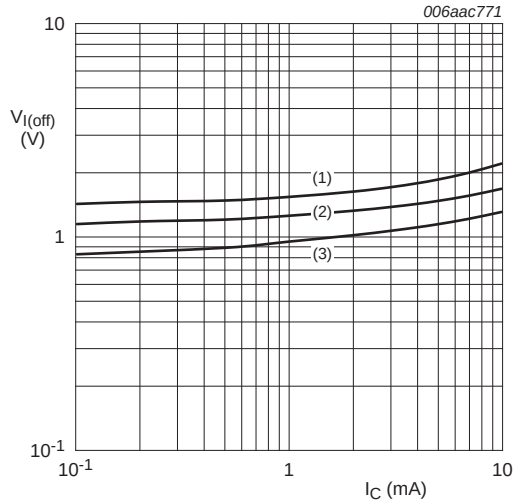
V_{CE} = 0.3 V

(1) T_{amb} = −40 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

Fig 7. TR1 (NPN): On-state input voltage as a function of collector current; typical values



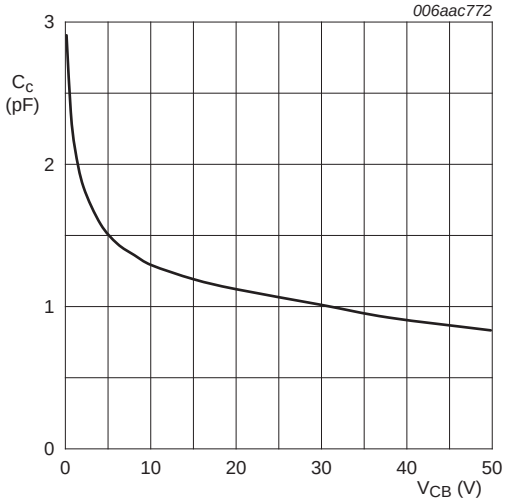
V_{CE} = 5 V

(1) T_{amb} = −40 °C

(2) T_{amb} = 25 °C

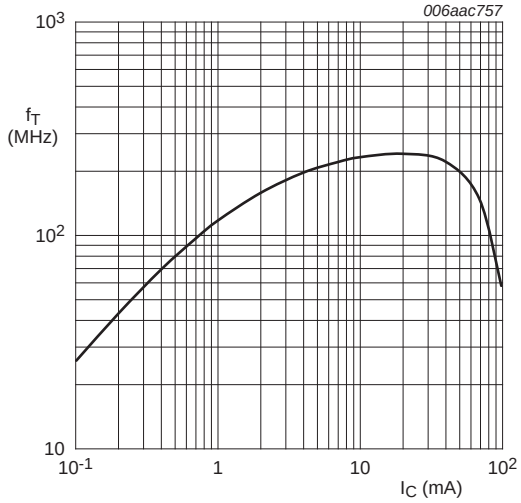
(3) T_{amb} = 100 °C

Fig 8. TR1 (NPN): Off-state input voltage as a function of collector current; typical values



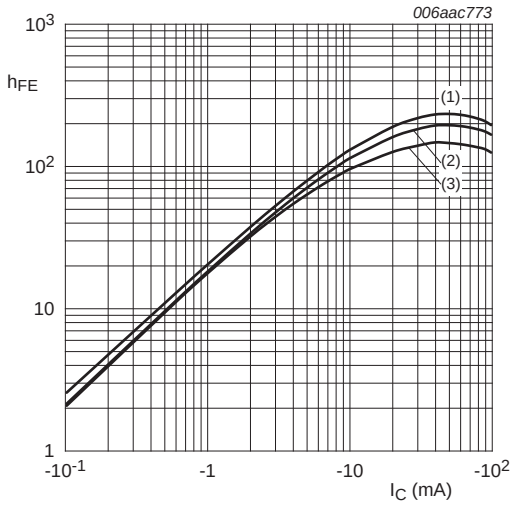
f = 1 MHz; T_{amb} = 25 °C

Fig 9. TR1 (NPN): Collector capacitance as a function of collector-base voltage; typical values



V_{CE} = 5 V; T_{amb} = 25 °C

Fig 10. TR1 (NPN): Transition frequency as a function of collector current; typical values of built-in transistor



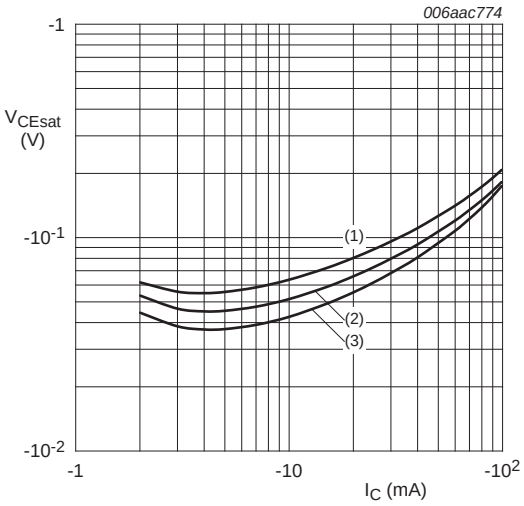
V_{CE} = −5 V

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −40 °C

Fig 11. TR2 (PNP): DC current gain as a function of collector current; typical values



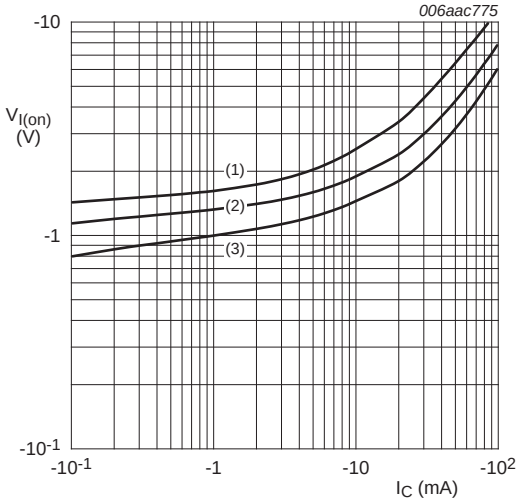
I_C/I_B = 20

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −40 °C

Fig 12. TR2 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values



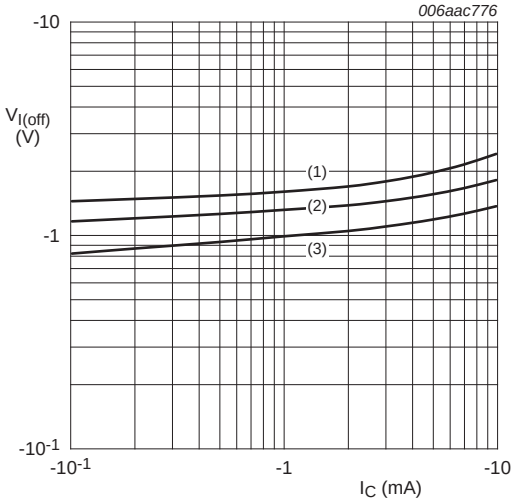
V_{CE} = –0.3 V

(1) T_{amb} = –40 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

Fig 13. TR2 (PNP): On-state input voltage as a function of collector current; typical values



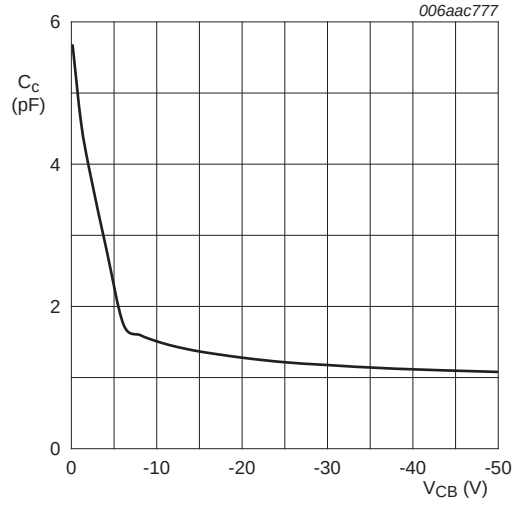
V_{CE} = –5 V

(1) T_{amb} = –40 °C

(2) T_{amb} = 25 °C

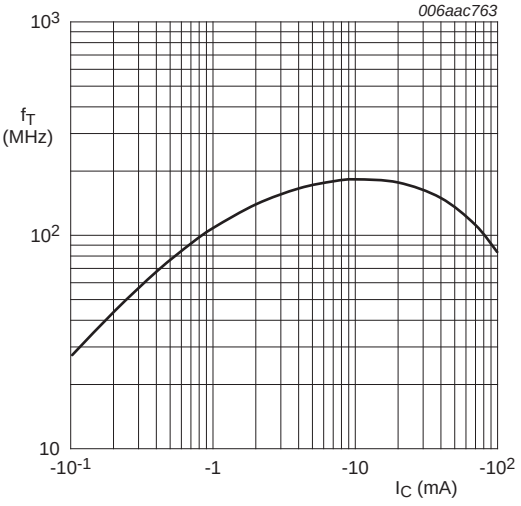
(3) T_{amb} = 100 °C

Fig 14. TR2 (PNP): Off-state input voltage as a function of collector current; typical values



f = 1 MHz; T_{amb} = 25 °C

Fig 15. TR2 (PNP): Collector capacitance as a function of collector-base voltage; typical values



V_{CE} = –5 V; T_{amb} = 25 °C

Fig 16. TR2 (PNP): Transition frequency as a function of collector current; typical values of built-in transistor

8. Test information

8.1 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.

9. Package outline

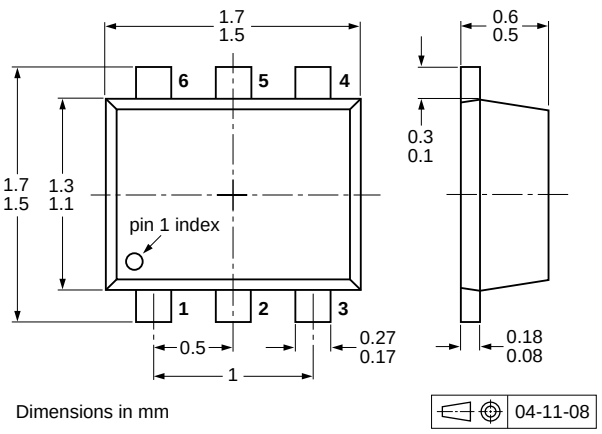


Fig 17. Package outline PEMD3 (SOT666)

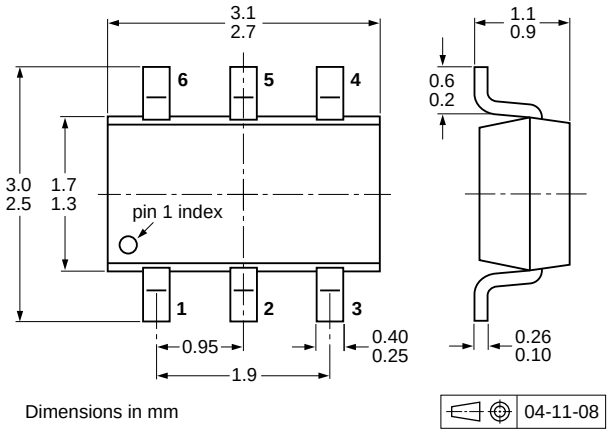


Fig 18. Package outline PIMD3 (SOT457/SC-74)

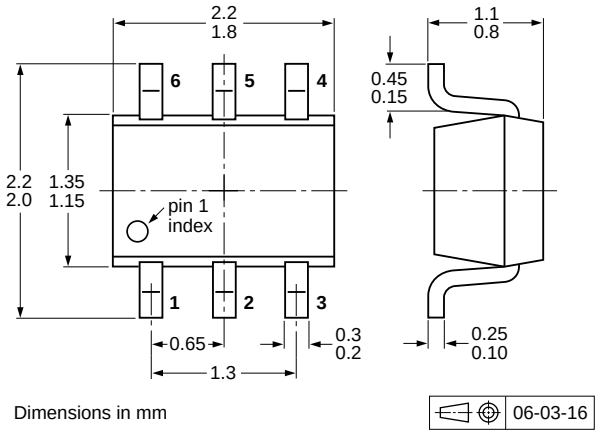


Fig 19. Package outline PUMD3 (SOT363/SC-88)

10. Soldering

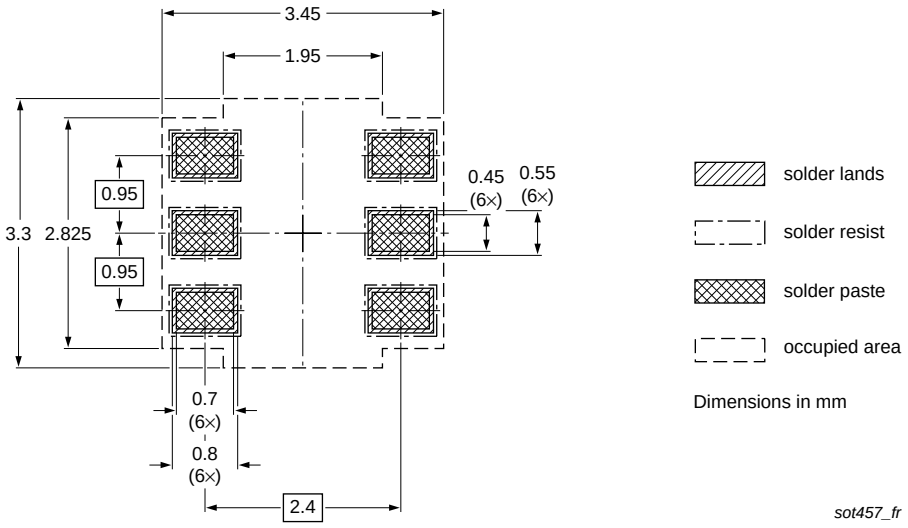


Fig 20. Reflow soldering footprint PIMD3 (SOT457/SC-74)

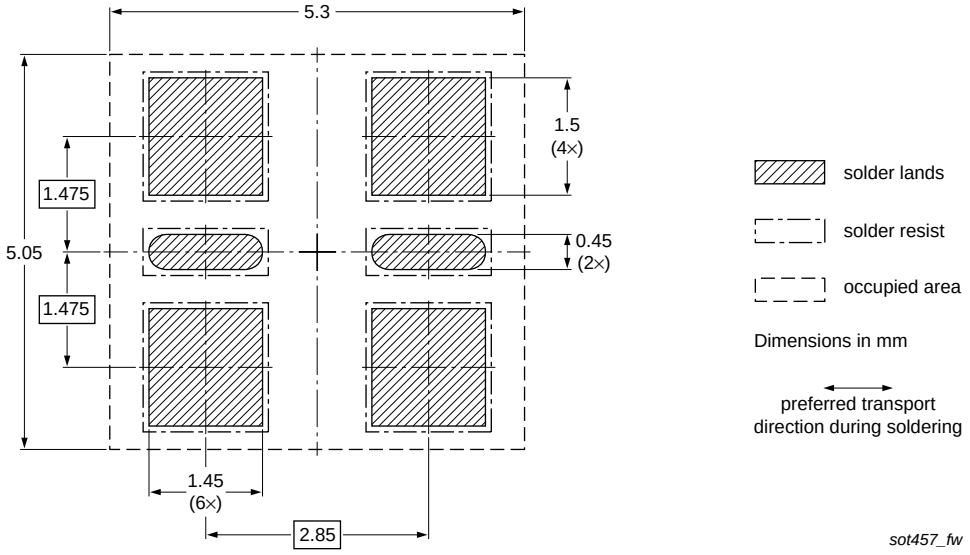


Fig 21. Wave soldering footprint PIMD3 (SOT457/SC-74)

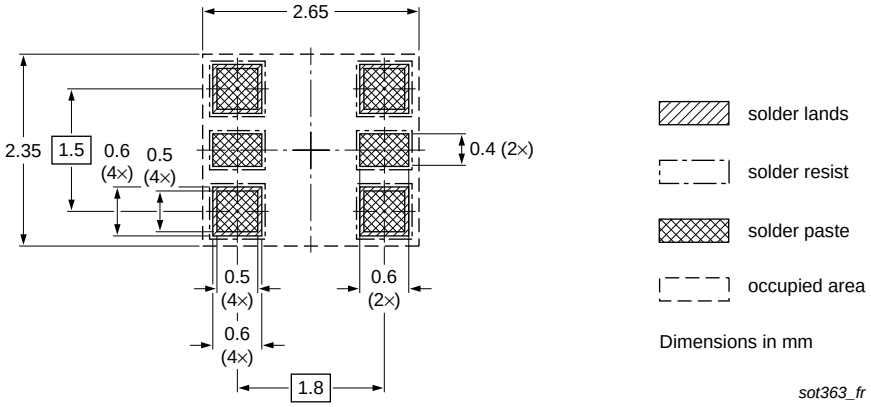


Fig 22. Reflow soldering footprint PUMD3 (SOT363/SC-88)

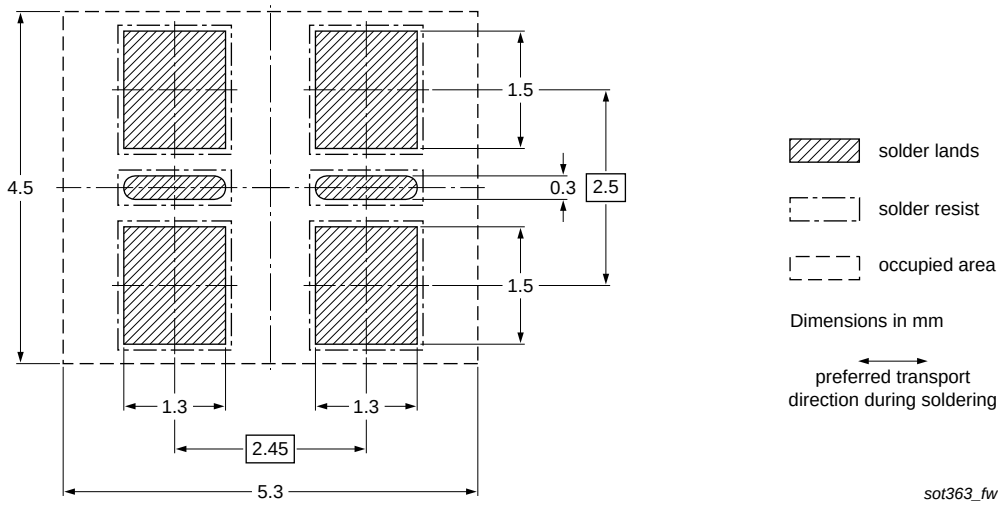


Fig 23. Wave soldering footprint PUMD3 (SOT363/SC-88)

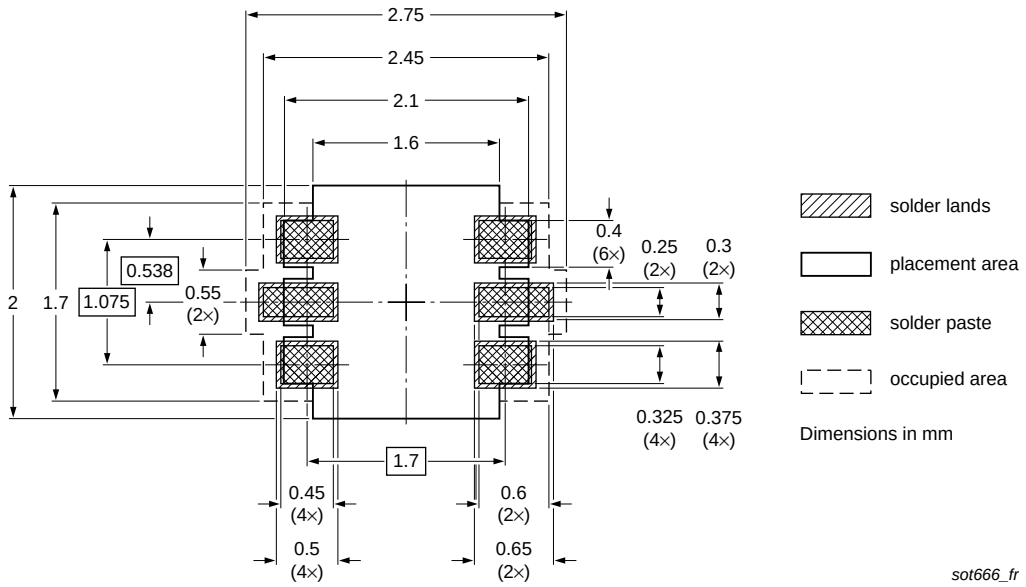


Fig 24. Reflow soldering footprint PEMD3 (SOT666)

11. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PEMD3_PIMD3_ PUMD3 v.11	20130925	Product data sheet	-	PEMD3_PIMD3_ PUMD3 v.10
Modifications:	• Section 1 “Product profile”: updated • Section 4 “Marking”: updated • Table 6 “Limiting values”: P_{tot} updated according to the latest measurements • Table 7 “Thermal characteristics”: updated according to the latest measurements • Table 8 “Characteristics”: I_{CEO} updated according to the latest measurements, f_T added • Figure 1 to 3, 9, 10, 15 and 16: added • Figure 5 to 8 and Figure 11 to 14: updated • Section 8 “Test information”: added • Section 10 “Soldering”: added • Section 12 “Legal information”: updated			
PEMD3_PIMD3_ PUMD3 v.10	20091115	Product data sheet	-	PEMD3_PIMD3_ PUMD3 v.9
PEMD3_PIMD3_ PUMD3 v.9	20050518	Product data sheet	-	PEMD3_PIMD3_ PUMD3 v.8
PEMD3_PIMD3_ PUMD3 v.8	20041206	Product data sheet	-	PEMD3_PUMD3 v.7

12. Legal information

12.1 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.

[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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13. Contact information

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14. Contents

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