

# PEMD2; PIMD2; PUMD2

NPN/PNP resistor-equipped transistors;  
R1 = 22 k $\Omega$ , R2 = 22 k $\Omega$

Rev. 8 — 14 November 2013

Product data sheet

## 1. Product profile

### 1.1 General description

NPN/PNP double 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
	NXP	JEITA			
PEMD2	SOT666	-	PEMB1	PEMH1	ultra small and flat lead
PIMD2	SOT457	SC-74	-	-	small
PUMD2	SOT363	SC-88	PUMB1	PUMH1	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

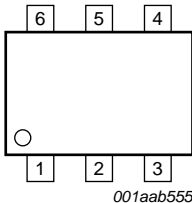
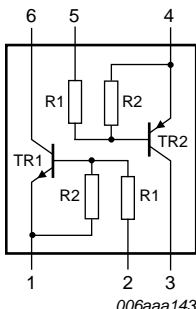
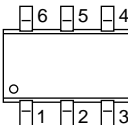
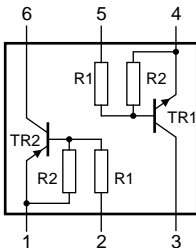
Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per transistor; for the PNP transistor with negative polarity						
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-	50	V
I <sub>O</sub>	output current		-	-	100	mA
R1	bias resistor 1 (input)		15.4	22	28.6	k $\Omega$
R2/R1	bias resistor ratio		0.8	1	1.2	



## 2. Pinning information

Table 3. Pinning

Pin	Description	Simplified outline	Graphic symbol
<b>PEMD2 (SOT666); PUMD2 (SOT363)</b>			
1	GND (emitter) TR1	 001aab555	 006aaa143
2	input (base) TR1		
3	output (collector) TR2		
4	GND (emitter) TR2		
5	input (base) TR2		
6	output (collector) TR1		
<b>PIMD2 (SOT457)</b>			
1	GND (emitter) TR2	 001aab555	 006aab235
2	input (base) TR2		
3	output (collector) TR1		
4	GND (emitter) TR1		
5	input (base) TR1		
6	output (collector) TR2		

## 3. Ordering information

Table 4. Ordering information

Type number	Package		
	Name	Description	Version
PEMD2	-	plastic surface-mounted package; 6 leads	SOT666
PIMD2	SC-74	plastic surface-mounted package (TSOP6); 6 leads	SOT457
PUMD2	SC-88	plastic surface-mounted package; 6 leads	SOT363

## 4. Marking

Table 5. Marking codes

Type number	Marking code <sup>[1]</sup>
PEMD2	D4
PIMD2	M5
PUMD2	D*2

[1] \* = placeholder for manufacturing site code

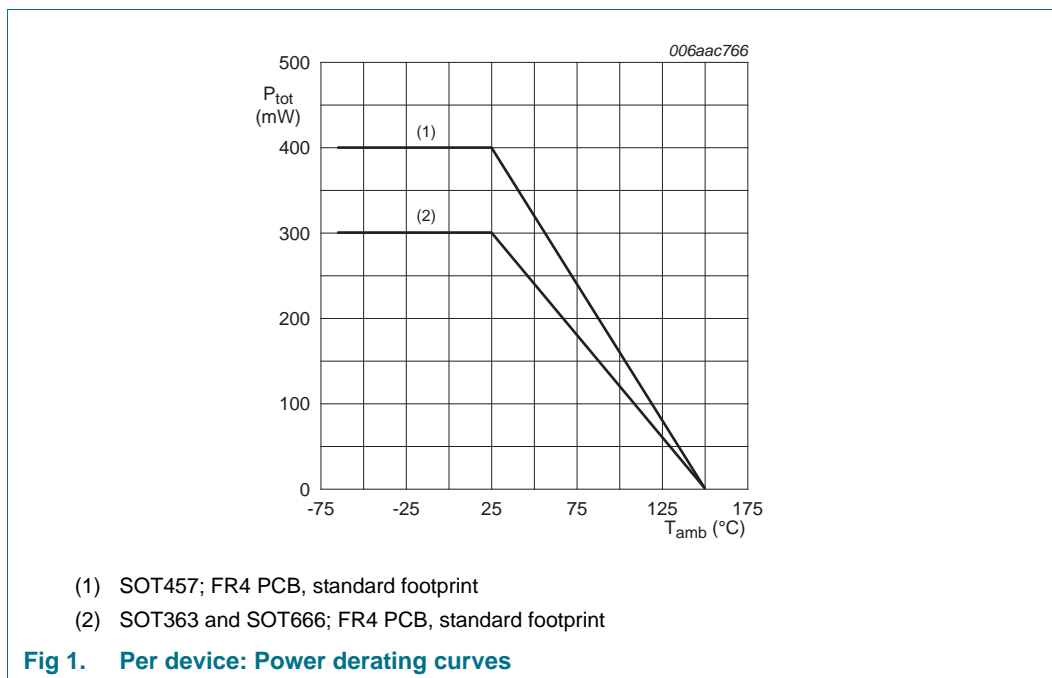
## 5. Limiting values

**Table 6. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
<b>Per transistor; for the PNP transistor with negative polarity</b>					
V <sub>CBO</sub>	collector-base voltage	open emitter	-	50	V
V <sub>CEO</sub>	collector-emitter voltage	open base	-	50	V
V <sub>EBO</sub>	emitter-base voltage	open collector	-	10	V
V <sub>I</sub>	input voltage TR1				
	positive		-	+40	V
	negative		-	-10	V
	input voltage TR2				
	positive			+10	
	negative			-40	
I <sub>O</sub>	output current		-	100	mA
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms	-	100	mA
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C			
	PEMD2 (SOT666)		[1] -	200	mW
	PIMD2 (SOT457)		[1]	250	mW
	PUMD2 (SOT363)		[1] -	200	mW
<b>Per device</b>					
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C			
	PEMD2 (SOT666)		[1] -	300	mW
	PIMD2 (SOT457)		[1]	400	mW
	PUMD2 (SOT363)		[1] -	300	mW
T <sub>j</sub>	junction temperature		-	150	°C
T <sub>amb</sub>	ambient temperature		-55	+150	°C
T <sub>stg</sub>	storage temperature		-65	+150	°C

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

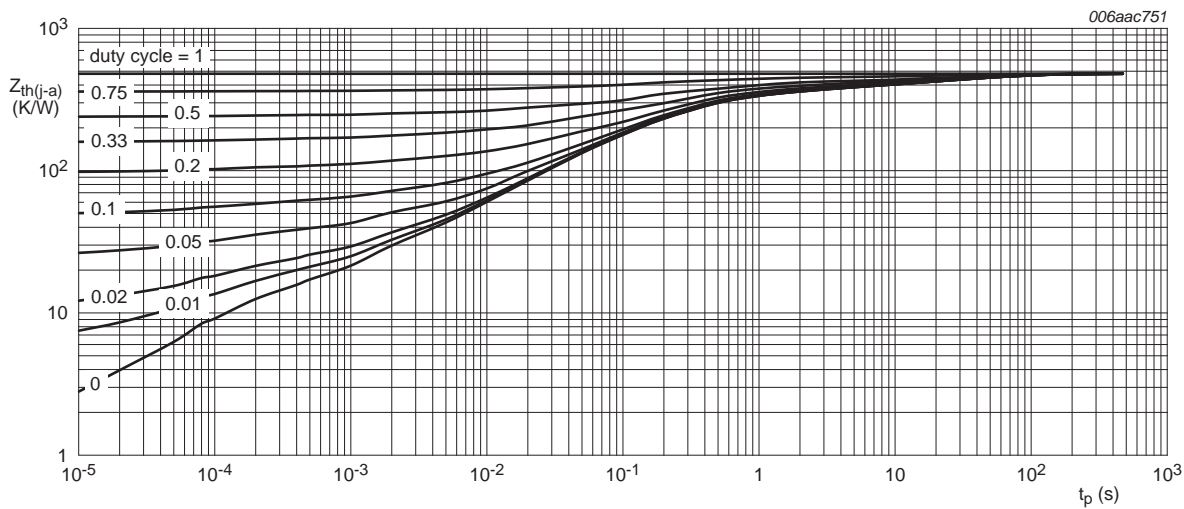


## 6. Thermal characteristics

**Table 7. Thermal characteristics**

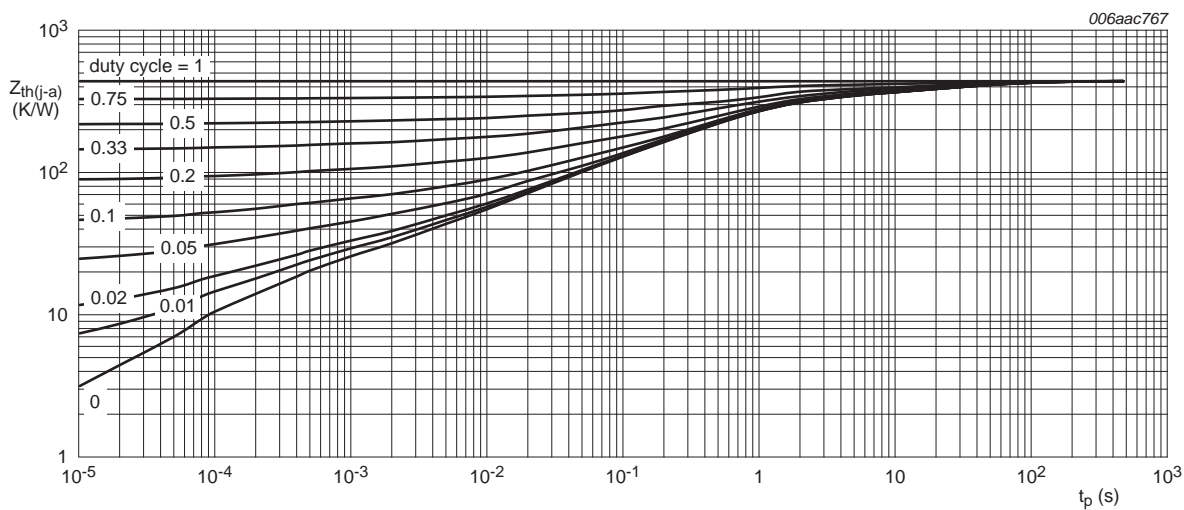
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor</b>						
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air				
	PEMD2 (SOT666)		[1]	-	625	K/W
	PIMD2 (SOT457)		[1]	-	500	K/W
	PUMD2 (SOT363)		[1]	-	625	K/W
<b>Per device</b>						
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air				
	PEMD2 (SOT666)		[1]	-	417	K/W
	PIMD2 (SOT457)		[1]	-	313	K/W
	PUMD2 (SOT363)		[1]	-	417	K/W

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



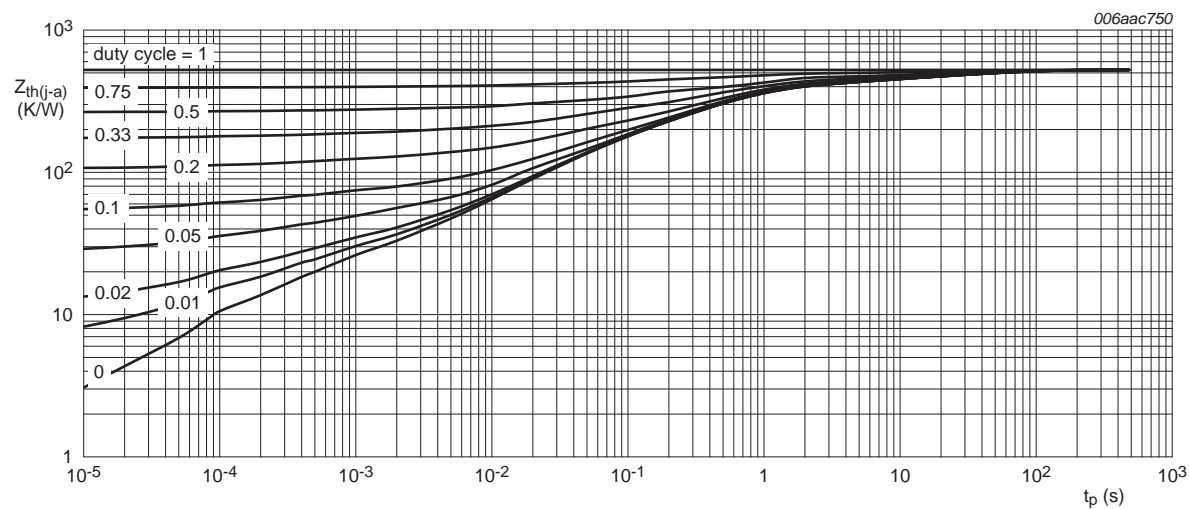
FR4 PCB, standard footprint

**Fig 2. Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration for PEMD2 (SOT666); typical values**



FR4 PCB, standard footprint

**Fig 3. Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration for PIMD2 (SOT457); typical values**



FR4 PCB, standard footprint

**Fig 4. Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration for PUMD2 (SOT363); typical values**

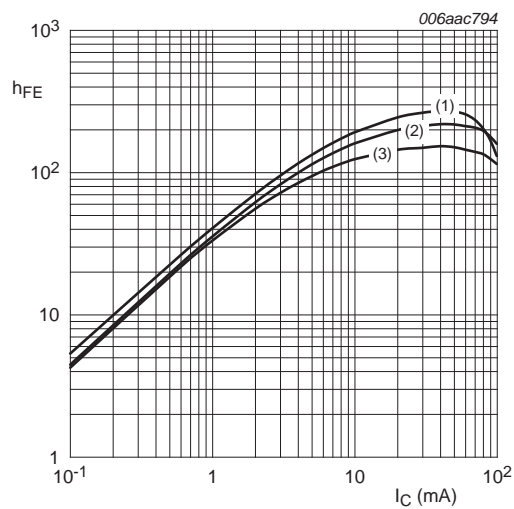
## 7. Characteristics

**Table 8. Characteristics**

$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

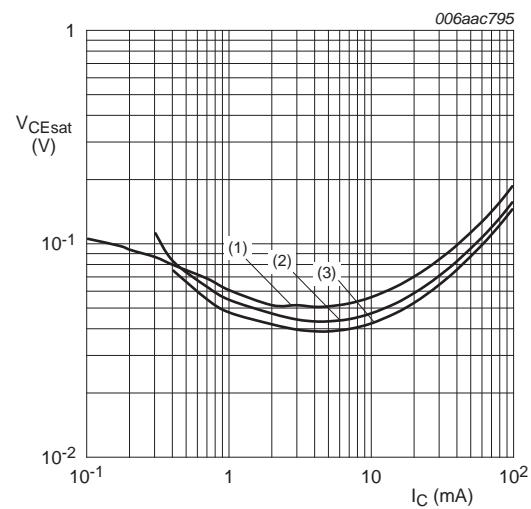
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor; for the PNP transistor with negative polarity</b>						
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 50\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
$I_{CEO}$	collector-emitter cut-off current	$V_{CE} = 30\text{ V}; I_B = 0\text{ A}$	-	-	100	nA
		$V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	5	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	180	$\mu\text{A}$
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V}; I_C = 5\text{ mA}$	60	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10\text{ mA}; I_B = 0.5\text{ mA}$	-	-	150	mV
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5\text{ V}; I_C = 100\text{ }\mu\text{A}$	-	1.1	0.8	V
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3\text{ V}; I_C = 5\text{ mA}$	2.5	1.7	-	V
R1	bias resistor 1 (input)		15.4	22	28.6	kΩ
R2/R1	bias resistor ratio		0.8	1	1.2	
$C_c$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$				
	TR1 (NPN)		-	-	2.5	pF
	TR2 (PNP)		-	-	3	
$f_T$	transition frequency	$V_{CE} = 5\text{ V}; I_C = 10\text{ mA}; f = 100\text{ MHz}$ <a href="#">[1]</a>				
	TR1 (NPN)		-	230	-	MHz
	TR2 (PNP)		-	180	-	MHz

[1] Characteristics of built-in transistor



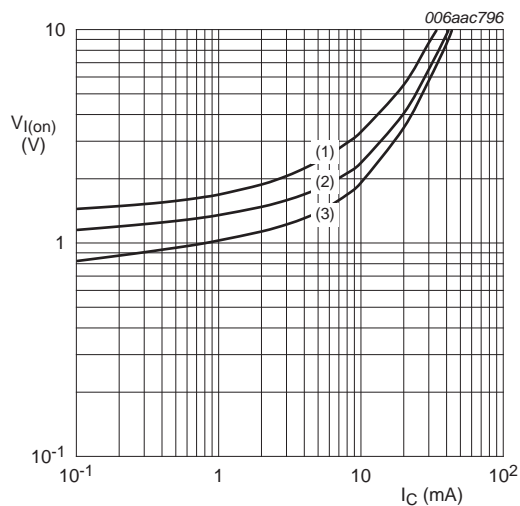
- $V_{CE} = 5\text{ V}$
- (1)  $T_{amb} = 100^\circ\text{C}$
  - (2)  $T_{amb} = 25^\circ\text{C}$
  - (3)  $T_{amb} = -40^\circ\text{C}$

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



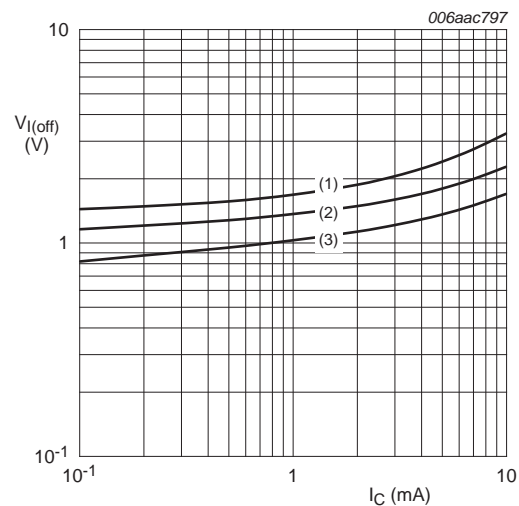
- $I_C/I_B = 20$
- (1)  $T_{amb} = 100^\circ\text{C}$
  - (2)  $T_{amb} = 25^\circ\text{C}$
  - (3)  $T_{amb} = -40^\circ\text{C}$

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



- $V_{CE} = 0.3\text{ V}$
- (1)  $T_{amb} = -40^\circ\text{C}$
  - (2)  $T_{amb} = 25^\circ\text{C}$
  - (3)  $T_{amb} = 100^\circ\text{C}$

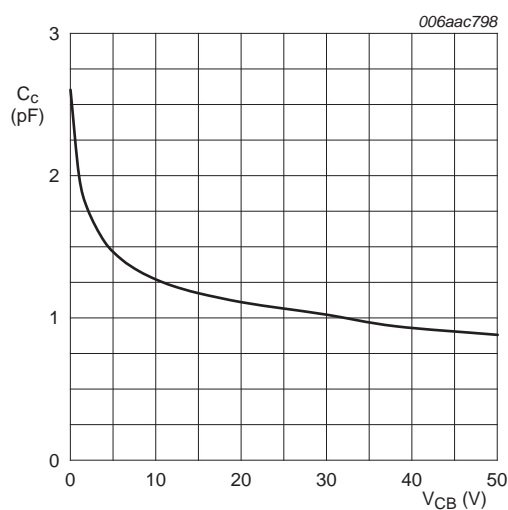
Fig 7. TR1 (NPN): On-state input voltage as a function of collector current; typical values



- $V_{CE} = 5\text{ V}$
- (1)  $T_{amb} = -40^\circ\text{C}$
  - (2)  $T_{amb} = 25^\circ\text{C}$
  - (3)  $T_{amb} = 100^\circ\text{C}$

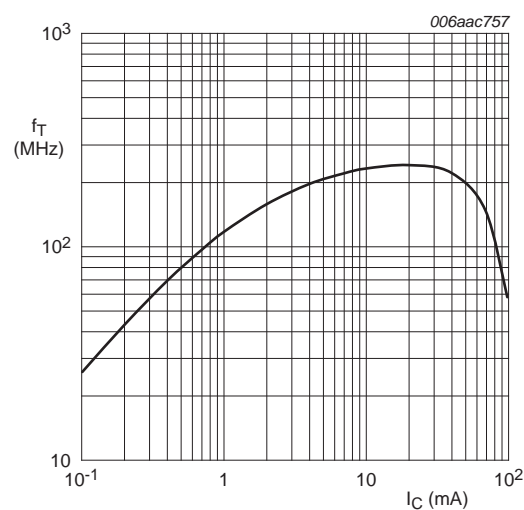
Fig 8. TR1 (NPN): Off-state input voltage as a function of collector current; typical values





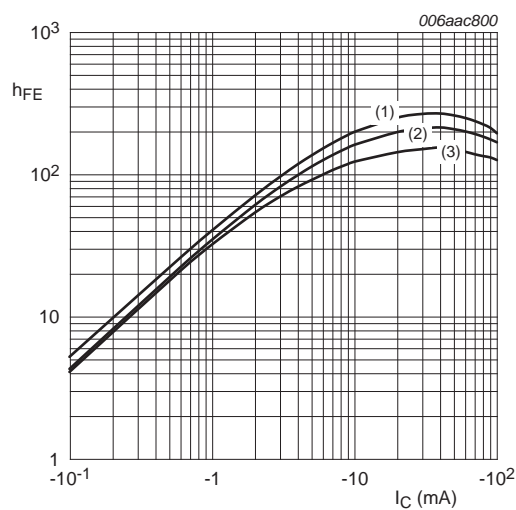
$f = 1 \text{ MHz}$ ;  $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$

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



$V_{CE} = 5 \text{ V}$ ;  $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$

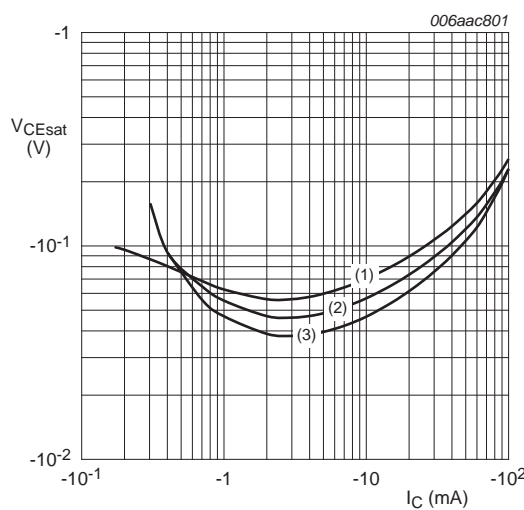
Fig 10. TR1 (NPN): Transition frequency as a function of collector current; typical values of built-in transistor



$V_{CE} = -5 \text{ V}$

- (1)  $T_{\text{amb}} = 100 \text{ }^\circ\text{C}$
- (2)  $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$
- (3)  $T_{\text{amb}} = -40 \text{ }^\circ\text{C}$

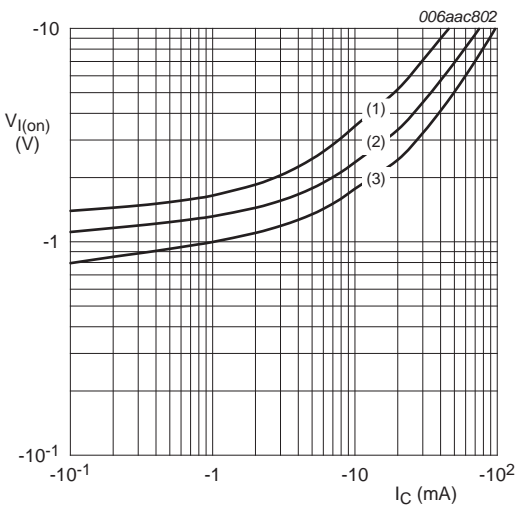
Fig 11. TR2 (PNP): DC current gain as a function of collector current; typical values



$I_C/I_B = 20$

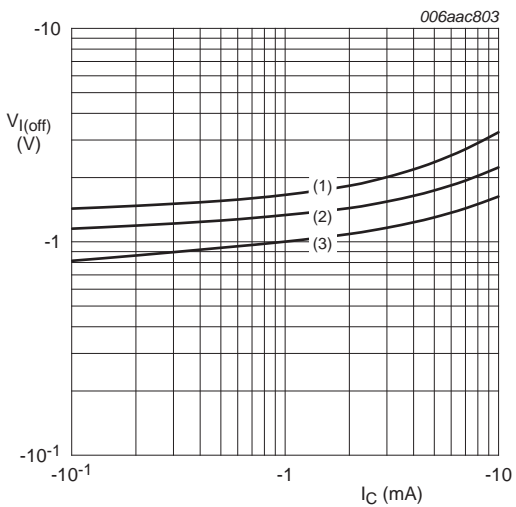
- (1)  $T_{\text{amb}} = 100 \text{ }^\circ\text{C}$
- (2)  $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$
- (3)  $T_{\text{amb}} = -40 \text{ }^\circ\text{C}$

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



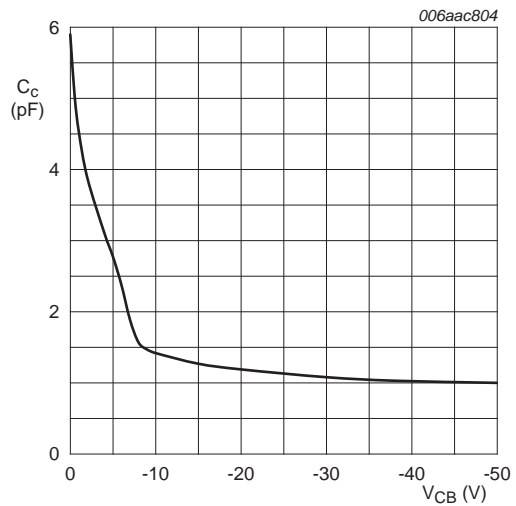
- $V_{CE} = -0.3\text{ V}$
- (1)  $T_{amb} = -40^\circ\text{C}$
  - (2)  $T_{amb} = 25^\circ\text{C}$
  - (3)  $T_{amb} = 100^\circ\text{C}$

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



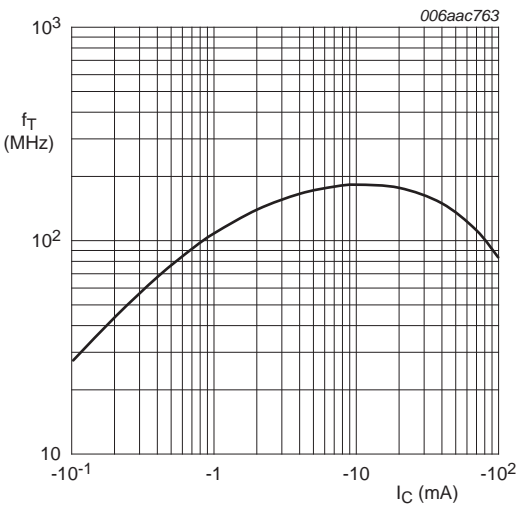
- $V_{CE} = -5\text{ V}$
- (1)  $T_{amb} = -40^\circ\text{C}$
  - (2)  $T_{amb} = 25^\circ\text{C}$
  - (3)  $T_{amb} = 100^\circ\text{C}$

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



$f = 1\text{ MHz}$ ;  $T_{amb} = 25^\circ\text{C}$

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



$V_{CE} = -5\text{ V}$ ;  $T_{amb} = 25^\circ\text{C}$

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

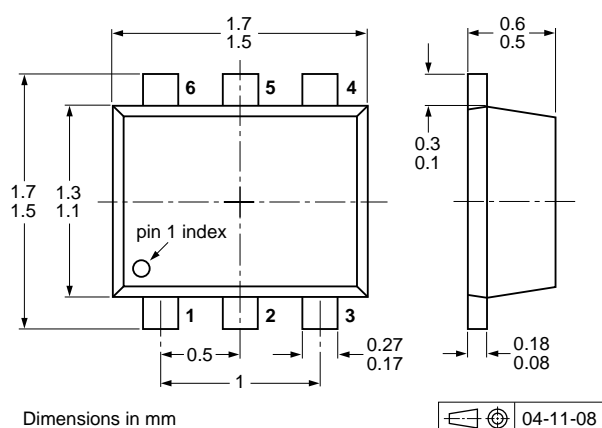


Fig 17. Package outline PEMD2 (SOT666)

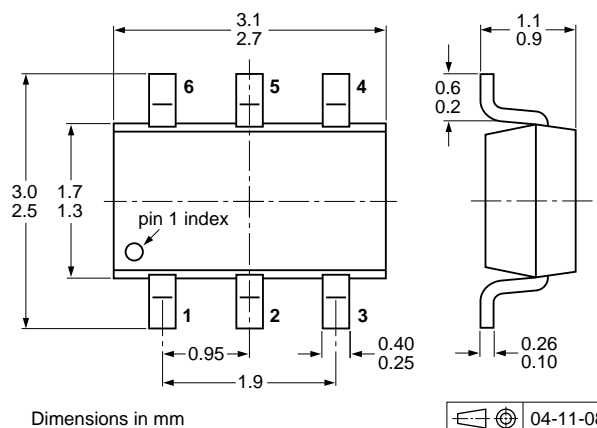


Fig 18. Package outline PIMD2 (SOT457)

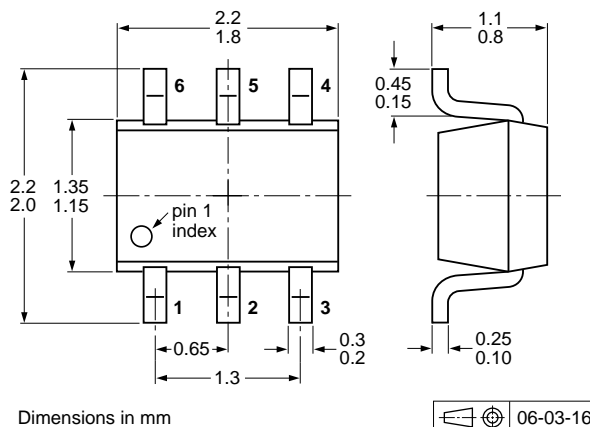


Fig 19. Package outline PUMD2 (SOT363)

10. Soldering

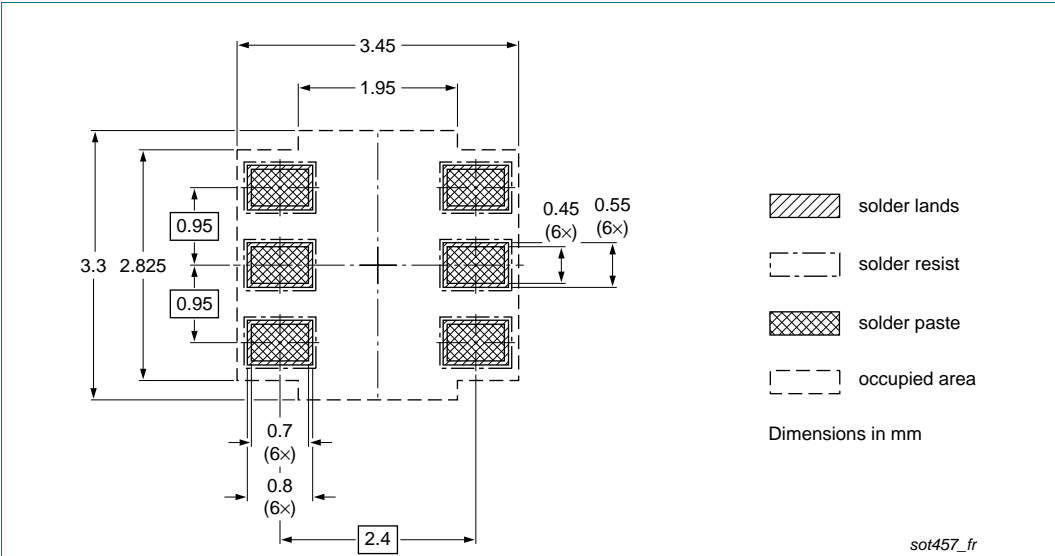


Fig 20. Reflow soldering footprint PIMD2 (SOT457)

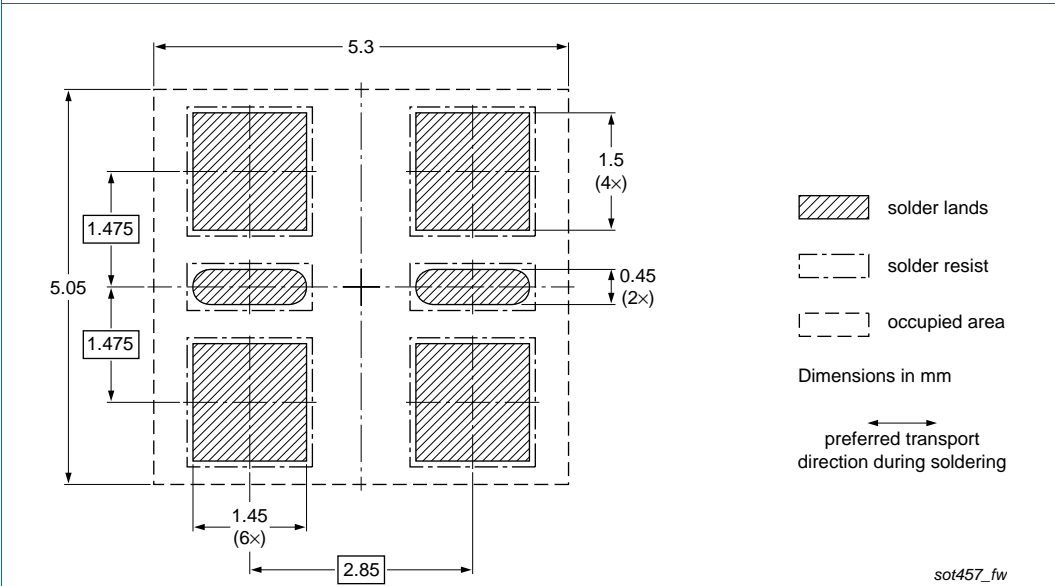


Fig 21. Wave soldering footprint PIMD2 (SOT457)

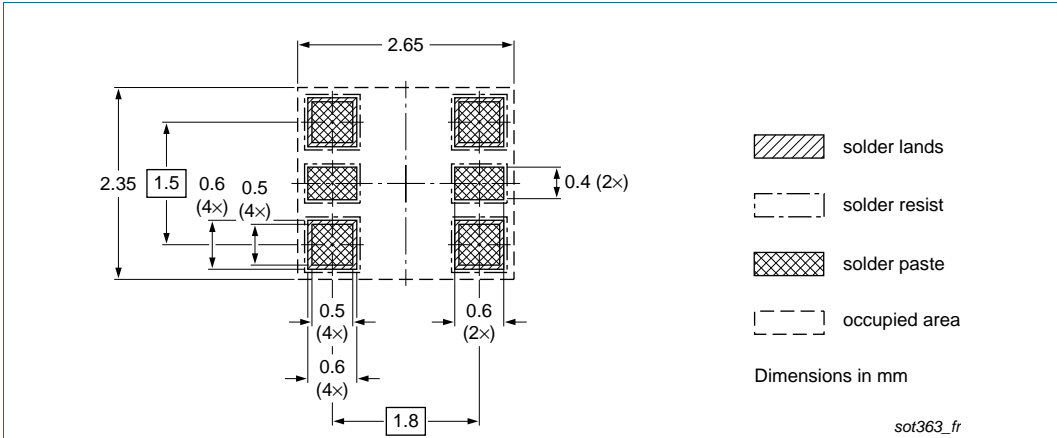


Fig 22. Reflow soldering footprint PUMD2 (SOT363)

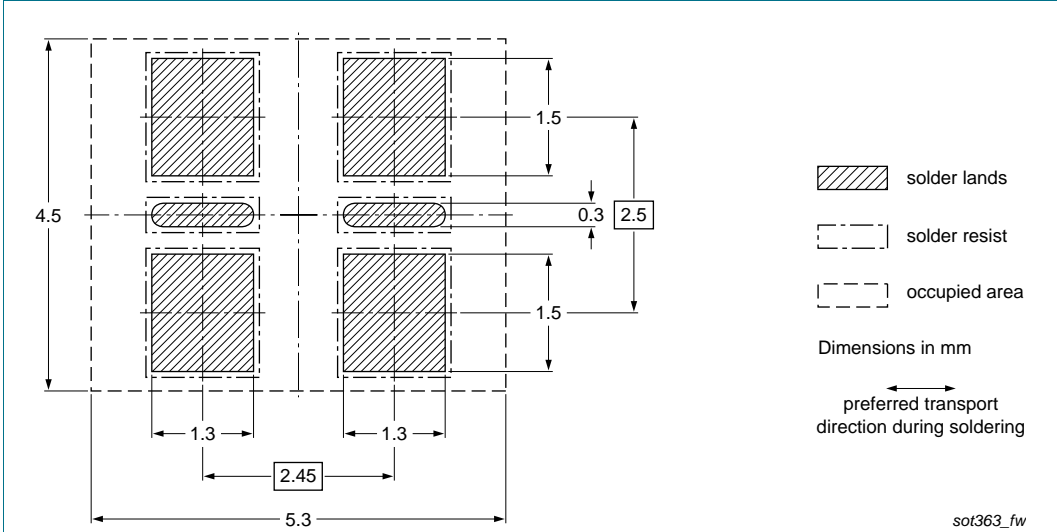
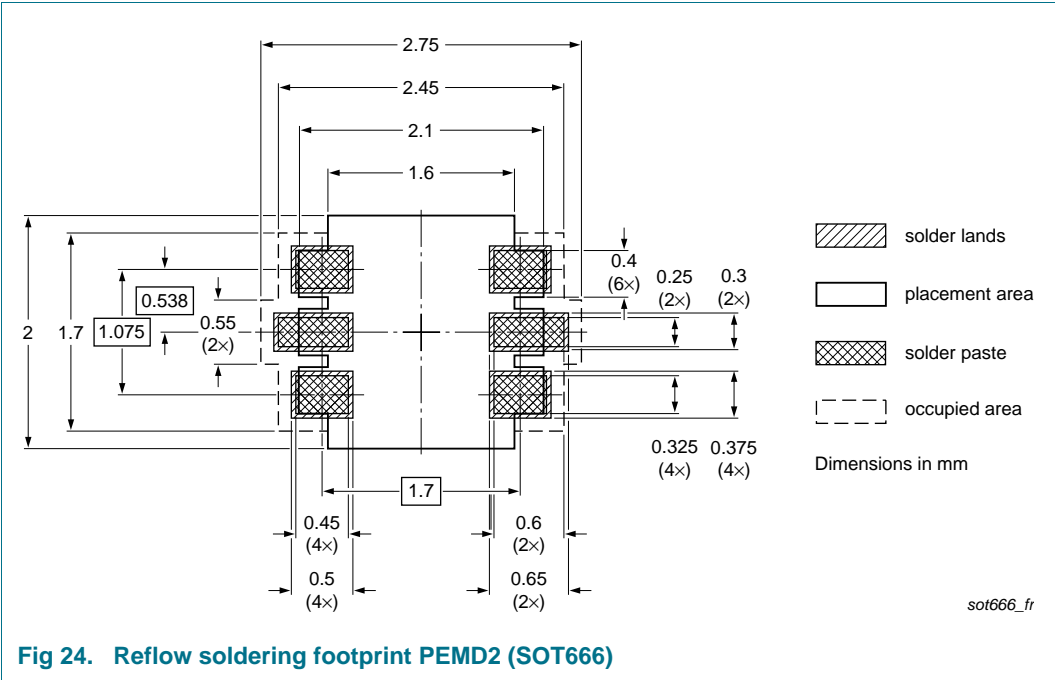


Fig 23. Wave soldering footprint PUMD2 (SOT363)



## 11. Revision history

**Table 9.** Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PEMD2_PIMD2_PUMD2 v.8	20131114	Product data sheet	-	PEMD2_PIMD2_PUMD2 v.7
Modifications: <ul style="list-style-type: none"> <li>• <a href="#">Section 1 “Product profile”</a>: updated</li> <li>• <a href="#">Section 4 “Marking”</a>: updated</li> <li>• <a href="#">Figure 1</a> to <a href="#">4</a>, <a href="#">9</a>, <a href="#">10</a>, <a href="#">15</a> and <a href="#">16</a>: added</li> <li>• <a href="#">Section 5 “Limiting values”</a>: updated</li> <li>• <a href="#">Section 6 “Thermal characteristics”</a>: updated</li> <li>• <a href="#">Figure 5</a> to <a href="#">8</a> and <a href="#">11</a> to <a href="#">14</a>: updated</li> <li>• <a href="#">Table 8 “Characteristics”</a>: I<sub>CEO</sub> updated, f<sub>T</sub> added</li> <li>• <a href="#">Section 8 “Test information”</a>: added</li> <li>• <a href="#">Section 12 “Legal information”</a>: updated</li> </ul>				
PEMD2_PIMD2_PUMD2 v.7	20080924	Product data sheet	-	PEMD2_PIMD2_PUMD2 v.6
PEMD2_PIMD2_PUMD2 v.6	20042104	Product specification	-	PEMD2_PIMD2_PUMD2 v.5
PEMD2_PIMD2_PUMD2 v.5	20030606	Product specification	-	-

## 12. Legal information

### 12.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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.nxp.com>.

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