

# PVR100AD-B series

Voltage regulator series

Rev. 01 — 31 October 2006

Product data sheet

## 1. Product profile

### 1.1 General description

Integrated Zener diode and NPN bipolar transistor in one package.

Table 1. Product overview

Type number	Package		SOT223 complement
	NXP	JEITA	
PVR100AD-B2V5	SOT457	SC-74	PVR100AZ-B2V5
PVR100AD-B3V0			PVR100AZ-B3V0
PVR100AD-B3V3			PVR100AZ-B3V3
PVR100AD-B5V0			PVR100AZ-B5V0
PVR100AD-B12V			PVR100AZ-B12V

### 1.2 Features

- Integrated Zener diode and bipolar transistor
- Output voltage options: 2.5 V, 3 V, 3.3 V, 5 V and 12 V
- Output power dissipation capability: 380 mW
- Small Surface-Mounted Device (SMD) plastic package

### 1.3 Applications

- Linear voltage regulation

### 1.4 Quick reference data

Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>NPN transistor</b>						
$V_{CE0}$	collector-emitter voltage	open base	-	-	45	V
$I_C$	collector current		-	-	0.1	A
$h_{FE}$	DC current gain	$V_{CE} = 1\text{ V}; I_C = 100\text{ mA}$	160	-	400	

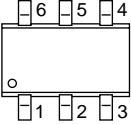
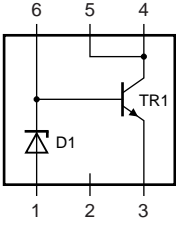
Table 2. Quick reference data ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Zener diode</b>						
$V_Z$	working voltage	$I_Z = 5 \text{ mA}$				
	PVR100AD-B2V5		3.23	3.3	3.37	V
	PVR100AD-B3V0		3.53	3.6	3.67	V
	PVR100AD-B3V3		3.82	3.9	3.98	V
	PVR100AD-B5V0		5.49	5.6	5.71	V
	PVR100AD-B12V		12.7	13	13.3	V
<b>Voltage regulator</b>						
$V_O$	output voltage	$I_O = 10 \text{ mA}$				[1]
	PVR100AD-B2V5	$V_I = 4.5 \text{ V}; I_{\text{ctrl}} = 3.5 \text{ mA}$	2.25	2.5	2.75	V
	PVR100AD-B3V0	$V_I = 5 \text{ V}; I_{\text{ctrl}} = 6.5 \text{ mA}$	2.7	3	3.3	V
	PVR100AD-B3V3	$V_I = 5.3 \text{ V}; I_{\text{ctrl}} = 6.5 \text{ mA}$	3.07	3.3	3.53	V
	PVR100AD-B5V0	$V_I = 7 \text{ V}; I_{\text{ctrl}} = 10 \text{ mA}$	4.65	5	5.35	V
	PVR100AD-B12V	$V_I = 14 \text{ V}; I_{\text{ctrl}} = 5 \text{ mA}$	11.4	12.3	13.2	V
<b>Line regulation</b>						
$\Delta V_O/V_O$	relative output voltage variation	$I_O = 10 \text{ mA}$				[1]
	PVR100AD-B2V5	$4.5 \text{ V} \leq V_I \leq 40 \text{ V}; I_{\text{ctrl}} = 3.5 \text{ mA}$	-10	-	+10	%
	PVR100AD-B3V0	$5 \text{ V} \leq V_I \leq 40 \text{ V}; I_{\text{ctrl}} = 6.5 \text{ mA}$	-10	-	+10	%
	PVR100AD-B3V3	$5.3 \text{ V} \leq V_I \leq 40 \text{ V}; I_{\text{ctrl}} = 6.5 \text{ mA}$	-7	-	+7	%
	PVR100AD-B5V0	$7 \text{ V} \leq V_I \leq 40 \text{ V}; I_{\text{ctrl}} = 10 \text{ mA}$	-7	-	+7	%
	PVR100AD-B12V	$14 \text{ V} \leq V_I \leq 40 \text{ V}; I_{\text{ctrl}} = 5 \text{ mA}$	-7	-	+7	%
<b>Load regulation</b>						
$\Delta V_O/V_O$	relative output voltage variation	$5 \text{ mA} \leq I_O \leq 100 \text{ mA}$				[1]
	PVR100AD-B2V5	$V_I = 4.5 \text{ V}; I_{\text{ctrl}} = 3.5 \text{ mA}$	-10	-	+10	%
	PVR100AD-B3V0	$V_I = 5 \text{ V}; I_{\text{ctrl}} = 6.5 \text{ mA}$	-10	-	+10	%
	PVR100AD-B3V3	$V_I = 5.3 \text{ V}; I_{\text{ctrl}} = 6.5 \text{ mA}$	-7	-	+7	%
	PVR100AD-B5V0	$V_I = 7 \text{ V}; I_{\text{ctrl}} = 10 \text{ mA}$	-7	-	+7	%
	PVR100AD-B12V	$V_I = 14 \text{ V}; I_{\text{ctrl}} = 5 \text{ mA}$	-7	-	+7	%

[1] Pulse test:  $t_p \leq 300 \mu\text{s}$ ;  $\delta \leq 0.02$ .

## 2. Pinning information

**Table 3. Pinning**

Pin	Symbol	Description	Simplified outline	Symbol
1	GND	ground		
2	n.c.	not connected		
3	VO	output voltage		
4	VI	input voltage		
5	VI	input voltage		
6	REXT	base		

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## 3. Ordering information

**Table 4. Ordering information**

Type number	Package		
	Name	Description	Version
PVR100AD-B2V5	SC-74	plastic surface-mounted package (TSOP6); 6 leads	SOT457
PVR100AD-B3V0			
PVR100AD-B3V3			
PVR100AD-B5V0			
PVR100AD-B12V			

## 4. Marking

**Table 5. Marking codes**

Type number	Marking code
PVR100AD-B2V5	T1
PVR100AD-B3V0	T2
PVR100AD-B3V3	T3
PVR100AD-B5V0	T4
PVR100AD-B12V	T5

## 5. Limiting values

**Table 6. Limiting values**

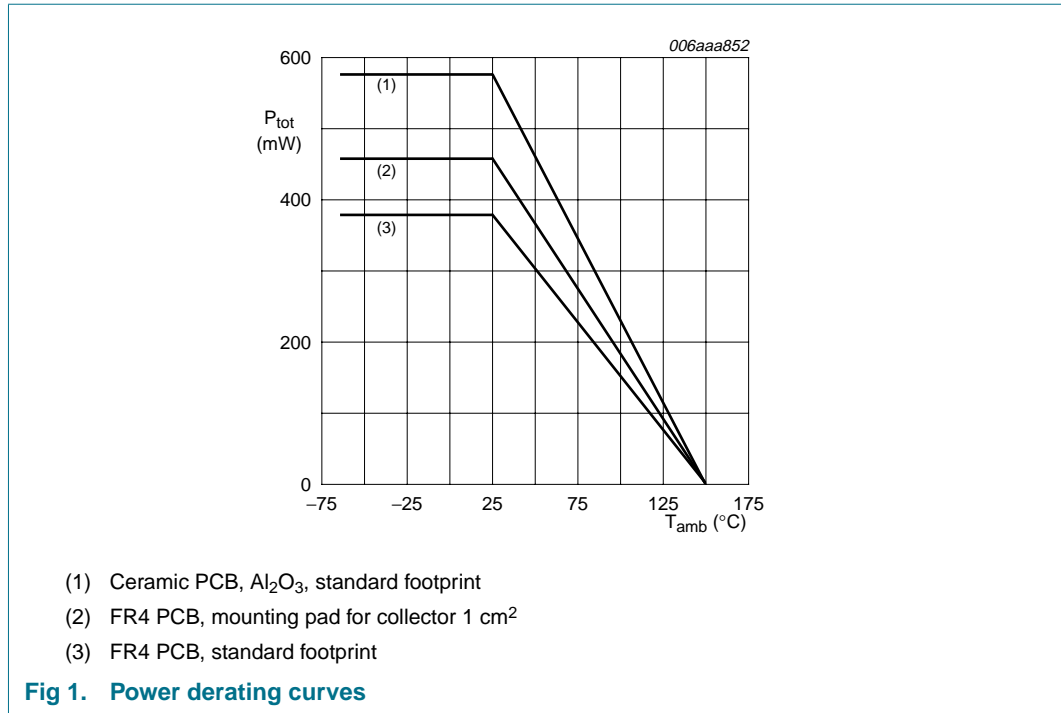
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

Symbol	Parameter	Conditions	Min	Max	Unit	
<b>NPN transistor</b>						
$V_{CBO}$	collector-base voltage	open emitter	-	50	V	
$V_{CEO}$	collector-emitter voltage	open base	-	45	V	
$V_{EBO}$	emitter-base voltage	open collector	-	5	V	
$I_C$	collector current		-	0.1	A	
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	0.2	A	
$I_{BM}$	peak base current	single pulse; $t_p \leq 1$ ms	-	0.2	A	
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	300	mW
			[2]	-	380	mW
			[3]	-	480	mW
<b>Zener diode</b>						
$I_F$	forward current		-	200	mA	
$I_{ZSM}$	non-repetitive peak reverse current	$V_Z < 6$ V	-	6	A	
		$V_Z = 13$ V	-	2.5	A	
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	140	mW
<b>Voltage regulator</b>						
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	380	mW
			[2]	-	460	mW
			[3]	-	580	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.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

[3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.



## 6. Thermal characteristics

**Table 7. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>NPN transistor</b>							
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	417	K/W
			[2]	-	-	329	K/W
			[3]	-	-	260	K/W
R <sub>th(j-sp)</sub>	thermal resistance from junction to solder point		-	-	125	K/W	
<b>Zener diode</b>							
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	893	K/W
<b>Voltage regulator</b>							
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	329	K/W
			[2]	-	-	272	K/W
			[3]	-	-	216	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, mounting pad for collector 1 cm<sup>2</sup>.

[3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.

## 7. Characteristics

**Table 8. Characteristics**
*T<sub>amb</sub> = 25 °C unless otherwise specified.*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>NPN transistor</b>							
I <sub>CBO</sub>	collector-base cut-off current	V <sub>CB</sub> = 20 V; I <sub>E</sub> = 0 A	-	-	100	nA	
		V <sub>CB</sub> = 20 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C	-	-	5	μA	
I <sub>EBO</sub>	emitter-base cut-off current	V <sub>EB</sub> = 5 V; I <sub>C</sub> = 0 A	-	-	100	nA	
h <sub>FE</sub>	DC current gain	V <sub>CE</sub> = 1 V; I <sub>C</sub> = 100 mA	160	-	400		
V <sub>BE</sub>	base-emitter voltage	V <sub>CE</sub> = 1 V; I <sub>C</sub> = 10 mA	-	0.72	-	V	
<b>Zener diode</b>							
V <sub>F</sub>	forward voltage	I <sub>F</sub> = 10 mA	-	-	0.9	V	
I <sub>R</sub>	reverse current	PVR100AD-B2V5	V <sub>R</sub> = 1 V	-	-	5	μA
		PVR100AD-B3V0	V <sub>R</sub> = 1 V	-	-	5	μA
		PVR100AD-B3V3	V <sub>R</sub> = 1 V	-	-	3	μA
		PVR100AD-B5V0	V <sub>R</sub> = 2 V	-	-	1	μA
		PVR100AD-B12V	V <sub>R</sub> = 8 V	-	-	0.1	μA
		V <sub>Z</sub>	working voltage		I <sub>Z</sub> = 5 mA		
PVR100AD-B2V5				3.23	3.3	3.37	V
PVR100AD-B3V0				3.53	3.6	3.67	V
PVR100AD-B3V3				3.82	3.9	3.98	V
PVR100AD-B5V0				5.49	5.6	5.71	V
PVR100AD-B12V				12.7	13	13.3	V
r <sub>dif</sub>	differential resistance		I <sub>Z</sub> = 1 mA				
		PVR100AD-B2V5		-	350	600	Ω
		PVR100AD-B3V0		-	375	600	Ω
		PVR100AD-B3V3		-	400	600	Ω
		PVR100AD-B5V0		-	80	400	Ω
		PVR100AD-B12V		-	50	170	Ω
r <sub>dif</sub>	differential resistance		I <sub>Z</sub> = 5 mA				
		PVR100AD-B2V5		-	85	95	Ω
		PVR100AD-B3V0		-	85	90	Ω
		PVR100AD-B3V3		-	85	90	Ω
		PVR100AD-B5V0		-	15	40	Ω
		PVR100AD-B12V		-	10	30	Ω

**Table 8. Characteristics ...continued**  
 $T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$S_z$	temperature coefficient	$I_z = 5\text{ mA}$				
	PVR100AD-B2V5		-3.5	-2.4	0	mV/K
	PVR100AD-B3V0		-3.5	-2.4	0	mV/K
	PVR100AD-B3V3		-3.5	-2.5	0	mV/K
	PVR100AD-B5V0		-2	1.2	2.5	mV/K
	PVR100AD-B12V		7	9.4	11	mV/K

**Voltage regulator**

$V_O$	output voltage	$I_O = 10\text{ mA}$	<a href="#">[1]</a>			
	PVR100AD-B2V5	$V_I = 4.5\text{ V};$ $I_{ctrl} = 3.5\text{ mA}$	2.25	2.5	2.75	V
	PVR100AD-B3V0	$V_I = 5\text{ V};$ $I_{ctrl} = 6.5\text{ mA}$	2.7	3	3.3	V
	PVR100AD-B3V3	$V_I = 5.3\text{ V};$ $I_{ctrl} = 6.5\text{ mA}$	3.07	3.3	3.53	V
	PVR100AD-B5V0	$V_I = 7\text{ V};$ $I_{ctrl} = 10\text{ mA}$	4.65	5	5.35	V
	PVR100AD-B12V	$V_I = 14\text{ V};$ $I_{ctrl} = 5\text{ mA}$	11.4	12.3	13.2	V

$\Delta V_O / (V_O \times \Delta T_{amb})$	relative output voltage variation over ambient temperature	$I_O = 100\text{ mA};$ $T_{amb} = -55\text{ }^{\circ}\text{C}$ to $150\text{ }^{\circ}\text{C}$	<a href="#">[1]</a>			
	PVR100AD-B2V5	$V_I = 4.5\text{ V}$	-	38	-	$10^{-6}/\text{K}$
	PVR100AD-B3V0	$V_I = 5\text{ V}$	-	-78	-	$10^{-6}/\text{K}$
	PVR100AD-B3V3	$V_I = 5.3\text{ V}$	-	-61	-	$10^{-6}/\text{K}$
	PVR100AD-B5V0	$V_I = 7\text{ V}$	-	634	-	$10^{-6}/\text{K}$
	PVR100AD-B12V	$V_I = 14\text{ V}$	-	892	-	$10^{-6}/\text{K}$

**Line regulation**

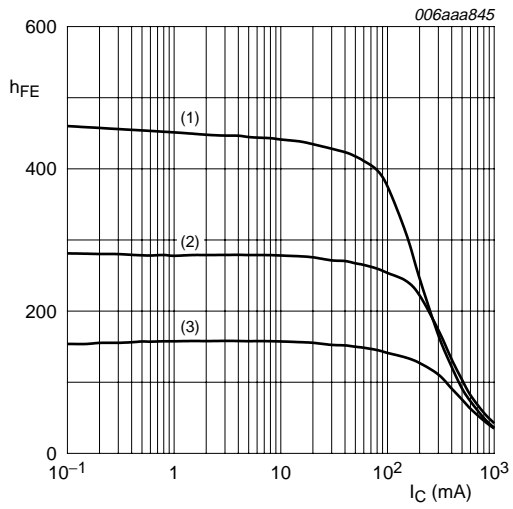
$\Delta V_O / V_O$	relative output voltage variation	$I_O = 10\text{ mA}$	<a href="#">[1]</a>			
	PVR100AD-B2V5	$4.5\text{ V} \leq V_I \leq 40\text{ V};$ $I_{ctrl} = 3.5\text{ mA}$	-10	-	+10	%
	PVR100AD-B3V0	$5\text{ V} \leq V_I \leq 40\text{ V};$ $I_{ctrl} = 6.5\text{ mA}$	-10	-	+10	%
	PVR100AD-B3V3	$5.3\text{ V} \leq V_I \leq 40\text{ V};$ $I_{ctrl} = 6.5\text{ mA}$	-7	-	+7	%
	PVR100AD-B5V0	$7\text{ V} \leq V_I \leq 40\text{ V};$ $I_{ctrl} = 10\text{ mA}$	-7	-	+7	%
	PVR100AD-B12V	$14\text{ V} \leq V_I \leq 40\text{ V};$ $I_{ctrl} = 5\text{ mA}$	-7	-	+7	%

**Table 8. Characteristics ...continued**  
 $T_{amb} = 25^{\circ}C$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$\Delta V_O / (V_O \times \Delta V_I)$	relative output voltage variation over input voltage	$I_O = 10 \text{ mA}$	[1]			
	PVR100AD-B2V5	$4.5 \text{ V} \leq V_I \leq 40 \text{ V};$ $I_{ctrl} = 3.5 \text{ mA}$	-	100	-	$10^{-6}/V$
	PVR100AD-B3V0	$5 \text{ V} \leq V_I \leq 40 \text{ V};$ $I_{ctrl} = 6.5 \text{ mA}$	-	80	-	$10^{-6}/V$
	PVR100AD-B3V3	$5.3 \text{ V} \leq V_I \leq 40 \text{ V};$ $I_{ctrl} = 6.5 \text{ mA}$	-	70	-	$10^{-6}/V$
	PVR100AD-B5V0	$7 \text{ V} \leq V_I \leq 40 \text{ V};$ $I_{ctrl} = 10 \text{ mA}$	-	40	-	$10^{-6}/V$
	PVR100AD-B12V	$14 \text{ V} \leq V_I \leq 40 \text{ V};$ $I_{ctrl} = 5 \text{ mA}$	-	20	-	$10^{-6}/V$
<b>Load regulation</b>						
$\Delta V_O / V_O$	relative output voltage variation	$5 \text{ mA} \leq I_O \leq 100 \text{ mA}$	[1]			
	PVR100AD-B2V5	$V_I = 4.5 \text{ V};$ $I_{ctrl} = 3.5 \text{ mA}$	-10	-	+10	%
	PVR100AD-B3V0	$V_I = 5 \text{ V};$ $I_{ctrl} = 6.5 \text{ mA}$	-10	-	+10	%
	PVR100AD-B3V3	$V_I = 5.3 \text{ V};$ $I_{ctrl} = 6.5 \text{ mA}$	-7	-	+7	%
	PVR100AD-B5V0	$V_I = 7 \text{ V};$ $I_{ctrl} = 10 \text{ mA}$	-7	-	+7	%
	PVR100AD-B12V	$V_I = 14 \text{ V};$ $I_{ctrl} = 5 \text{ mA}$	-7	-	+7	%
$\Delta V_O / (V_O \times \Delta I_O)$	relative output voltage variation over output current	$5 \text{ mA} \leq I_O \leq 100 \text{ mA}$	[1]			
	PVR100AD-B2V5	$V_I = 4.5 \text{ V};$ $I_{ctrl} = 3.5 \text{ mA}$	-	-840	-	$10^{-6}/\text{mA}$
	PVR100AD-B3V0	$V_I = 5 \text{ V};$ $I_{ctrl} = 6.5 \text{ mA}$	-	-630	-	$10^{-6}/\text{mA}$
	PVR100AD-B3V3	$V_I = 5.3 \text{ V};$ $I_{ctrl} = 6.5 \text{ mA}$	-	-540	-	$10^{-6}/\text{mA}$
	PVR100AD-B5V0	$V_I = 7 \text{ V};$ $I_{ctrl} = 10 \text{ mA}$	-	-320	-	$10^{-6}/\text{mA}$
	PVR100AD-B12V	$V_I = 14 \text{ V};$ $I_{ctrl} = 5 \text{ mA}$	-	-130	-	$10^{-6}/\text{mA}$

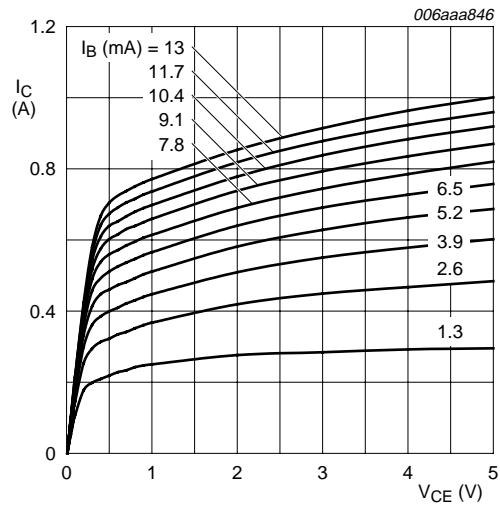
[1] Pulse test:  $t_p \leq 300 \mu\text{s}; \delta \leq 0.02$ .





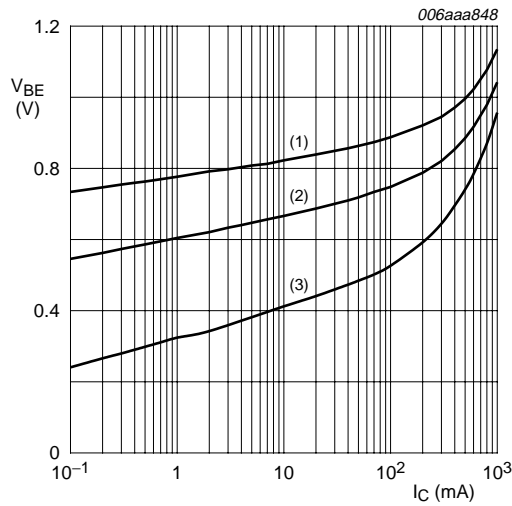
$V_{CE} = 1\text{ V}$   
 (1)  $T_{amb} = 150\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



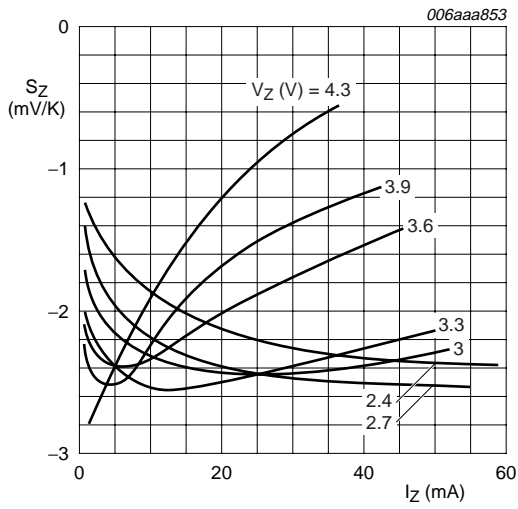
$T_{amb} = 25\text{ °C}$

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



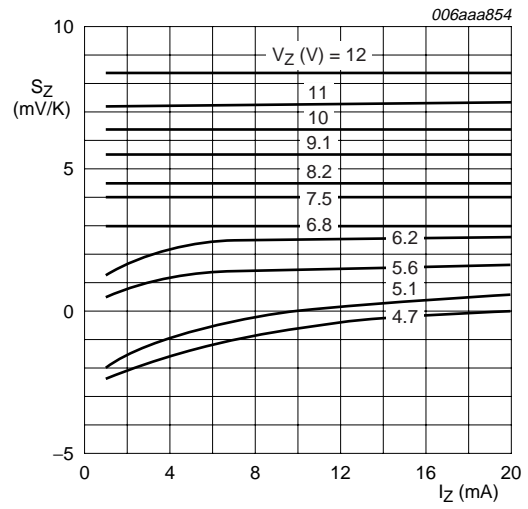
$V_{CE} = 1\text{ V}$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 150\text{ °C}$

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



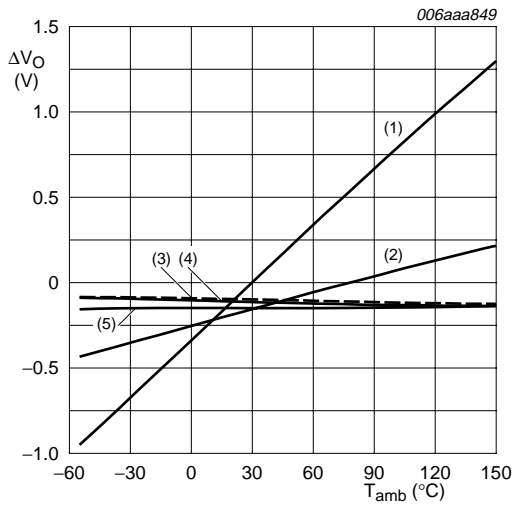
$T_j = 25\text{ }^\circ\text{C}$  to  $150\text{ }^\circ\text{C}$

**Fig 5. Zener diode: Temperature coefficient as a function of working current; typical values**



$T_j = 25\text{ }^\circ\text{C}$  to  $150\text{ }^\circ\text{C}$

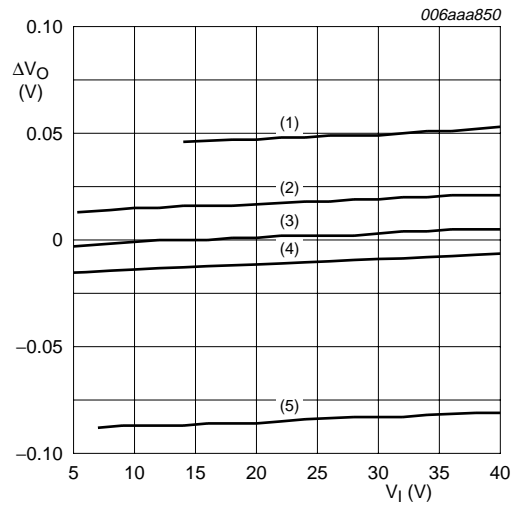
**Fig 6. Zener diode: Temperature coefficient as a function of working current; typical values**



$V_I = V_{O(\text{typ})} + 2 \text{ V}$ ;  $I_O = 100 \text{ mA}$ ;  
 $T_{\text{amb}} = -55 \text{ °C to } 150 \text{ °C}$

- (1) PVR100AD-B12V
- (2) PVR100AD-B5V0
- (3) PVR100AD-B3V3
- (4) PVR100AD-B3V0
- (5) PVR100AD-B2V5

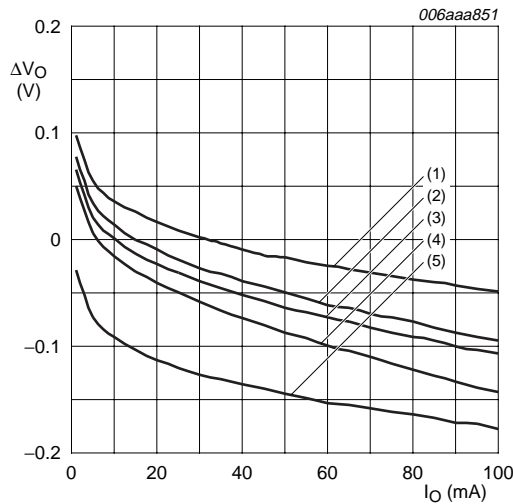
**Fig 7. Voltage regulator: Output voltage variation as a function of ambient temperature; typical values**



$T_{\text{amb}} = 25 \text{ °C}$ ;  $I_O = 10 \text{ mA}$

- (1) PVR100AD-B12V;  $I_{\text{ctrl}} = 5 \text{ mA}$
- (2) PVR100AD-B3V3;  $I_{\text{ctrl}} = 6.5 \text{ mA}$
- (3) PVR100AD-B3V0;  $I_{\text{ctrl}} = 6.5 \text{ mA}$
- (4) PVR100AD-B2V5;  $I_{\text{ctrl}} = 3.5 \text{ mA}$
- (5) PVR100AD-B5V0;  $I_{\text{ctrl}} = 10 \text{ mA}$

**Fig 8. Voltage regulator: Output voltage variation as a function of input voltage; typical values**

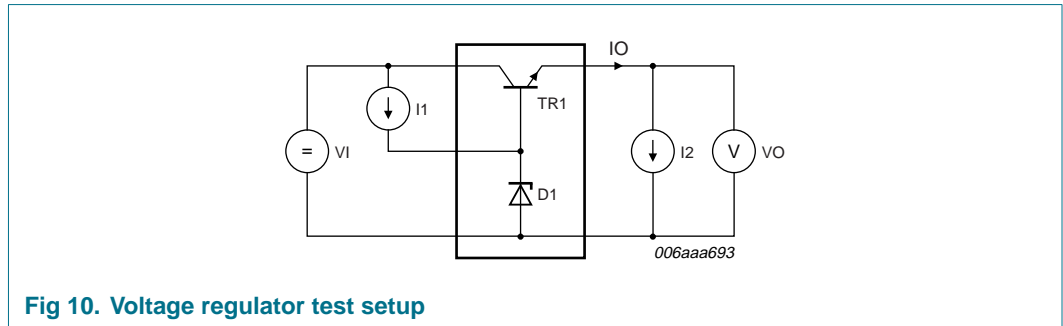


$T_{\text{amb}} = 25 \text{ °C}$ ;  $V_I = V_{O(\text{typ})} + 2 \text{ V}$

- (1) PVR100AD-B12V;  $I_{\text{ctrl}} = 5 \text{ mA}$
- (2) PVR100AD-B3V3;  $I_{\text{ctrl}} = 6.5 \text{ mA}$
- (3) PVR100AD-B3V0;  $I_{\text{ctrl}} = 6.5 \text{ mA}$
- (4) PVR100AD-B2V5;  $I_{\text{ctrl}} = 3.5 \text{ mA}$
- (5) PVR100AD-B5V0;  $I_{\text{ctrl}} = 10 \text{ mA}$

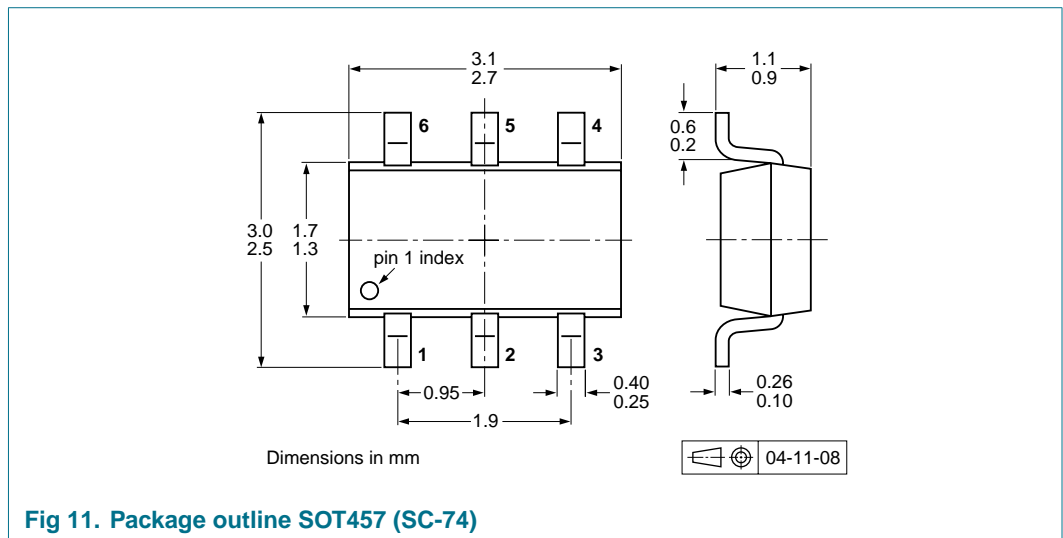
**Fig 9. Voltage regulator: Output voltage variation as a function of output current; typical values**

**8. Test information**



**Fig 10. Voltage regulator test setup**

**9. Package outline**



**Fig 11. Package outline SOT457 (SC-74)**

## 10. Packing information

**Table 9. Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

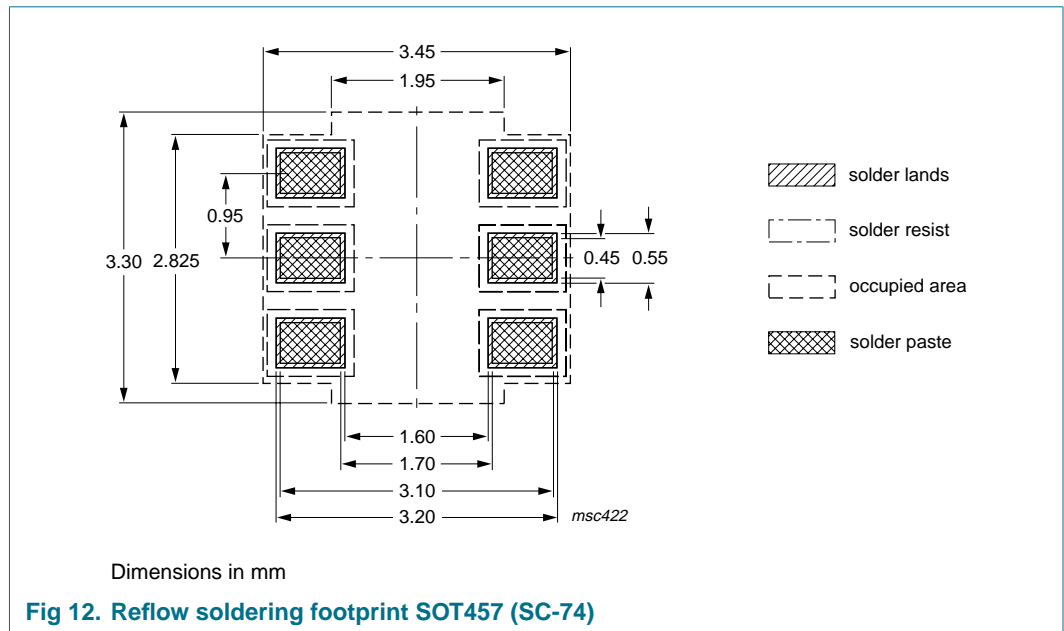
Type number	Package	Description	Packing quantity	
			3000	10000
PVR100AD-B2V5	SOT457	4 mm pitch, 8 mm tape and reel; T1	[2] -115	-135
		4 mm pitch, 8 mm tape and reel; T2	[3] -125	-165
PVR100AD-B3V0	SOT457	4 mm pitch, 8 mm tape and reel; T1	[2] -115	-135
		4 mm pitch, 8 mm tape and reel; T2	[3] -125	-165
PVR100AD-B3V3	SOT457	4 mm pitch, 8 mm tape and reel; T1	[2] -115	-135
		4 mm pitch, 8 mm tape and reel; T2	[3] -125	-165
PVR100AD-B5V0	SOT457	4 mm pitch, 8 mm tape and reel; T1	[2] -115	-135
		4 mm pitch, 8 mm tape and reel; T2	[3] -125	-165
PVR100AD-B12V	SOT457	4 mm pitch, 8 mm tape and reel; T1	[2] -115	-135
		4 mm pitch, 8 mm tape and reel; T2	[3] -125	-165

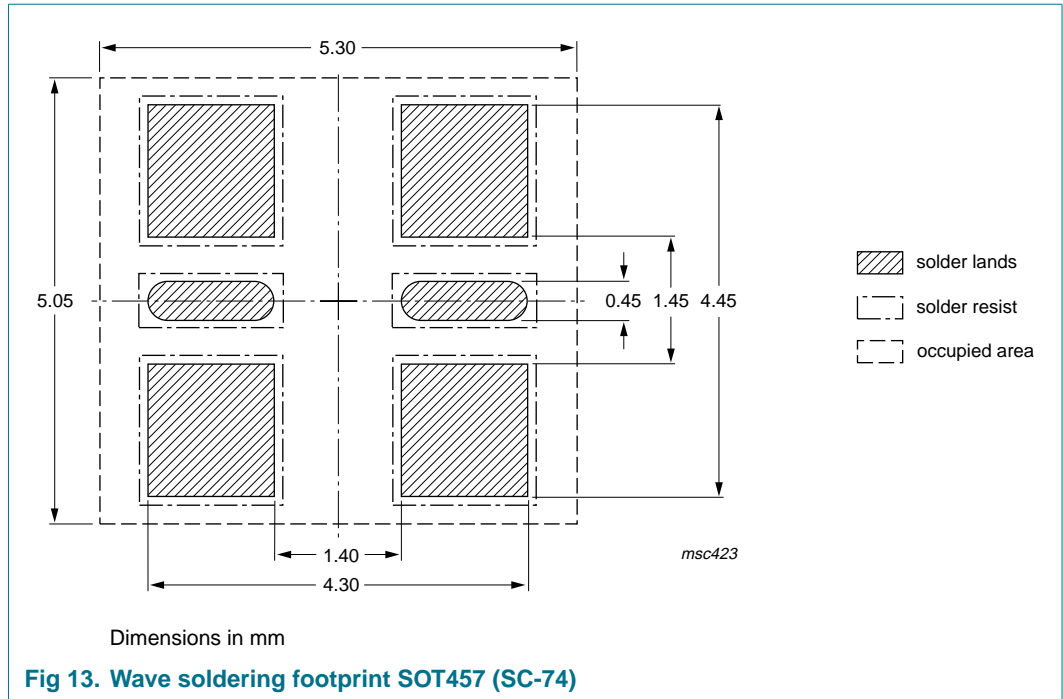
[1] For further information and the availability of packing methods, see [Section 14](#).

[2] T1: normal taping

[3] T2: reverse taping

## 11. Soldering





## 12. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PVR100AD-B_SER_1	20061031	Product data sheet	-	-

## 13. Legal information

### 13.1 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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