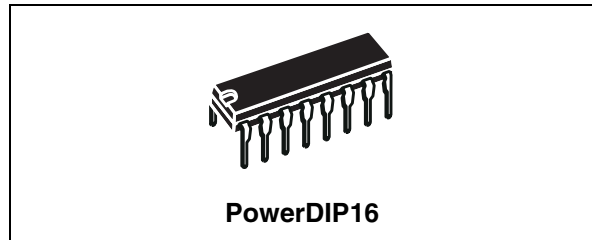


### Features

- Dual or bridge connection modes
- Few external components
- Supply voltage 3 V to 15 V
- High channel separation
- Very low switch-on/off noise
- Max gain of 45 dB with adjustable external resistor
- Soft clipping
- Thermal protection
- $P_O = 2 \cdot 1 \text{ W}$ ,  $V_S = 6 \text{ V}$ ,  $R_L = 4 \Omega$
- $P_O = 2 \cdot 2.3 \text{ W}$ ,  $V_S = 9 \text{ V}$ ,  $R_L = 4 \Omega$
- $P_O = 2 \cdot 0.1 \text{ W}$ ,  $V_S = 3 \text{ V}$ ,  $R_L = 4 \Omega$



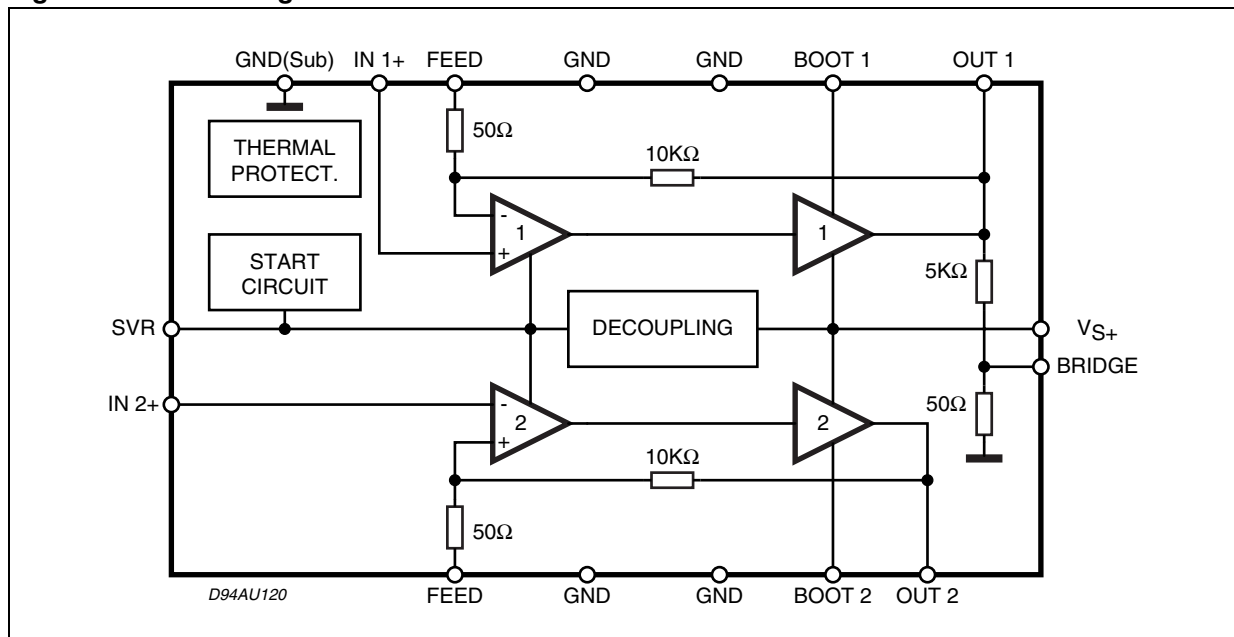
### Description

The TEA2025B is a monolithic integrated circuit housed in the 12+2+2 PowerDIP16 package, intended for use as a dual or bridge power audio amplifier in portable radio cassette players.

**Table 1. Device summary**

Part number	Package
TEA2025B	PowerDIP16 (12+2+2)

**Figure 1. Block diagram**

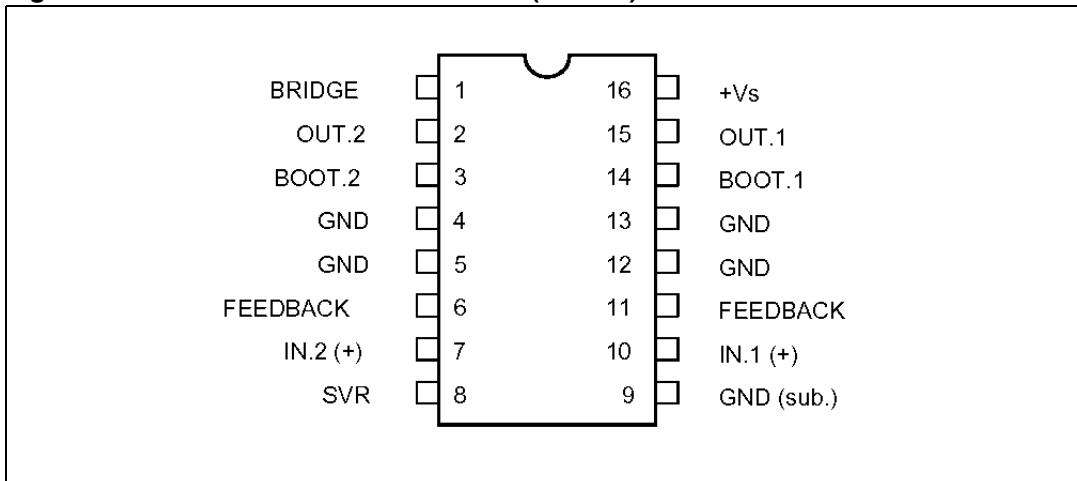


# 1 Device overview and electrical specifications

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_S$	Supply voltage	15	V
$I_O$	Output peak current	1.5	A
$T_J$	Junction temperature	150	°C
$T_{stg}$	Storage temperature	150	°C

**Figure 2. Pin connections PowerDIP16 (12+2+2)**



**Table 3. Thermal data**

Symbol	Description		PowerDIP16 (12+2+2) <sup>(1)</sup>	Unit
$R_{th\ j-case}$	Thermal resistance junction-case	Max	15	°C/W
$R_{th\ j-amb}$	Thermal resistance junction-ambient	Max	60	°C/W

1.  $R_{th\ j-amb}$  is measured on devices bonded on a 10 x 5 x 0.15 cm glass-epoxy substrate with a 35 mm thick copper surface of 5 cm<sup>2</sup>.

**Table 4. Electrical characteristics** ( $T_{amb} = 25\text{ °C}$ ,  $V_S = 9\text{ V}$ , stereo unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
$V_S$	Supply voltage		3		12	V	
$I_Q$	Quiescent current			35	50	mA	
$V_O$	Quiescent output voltage			4.5		V	
$A_V$	Voltage gain	Stereo	43	45	47	dB	
		Bridge	49	51	53	dB	
$\Delta A_V$	Voltage gain difference				$\pm 1$	dB	
$R_i$	Input Impedance			30		k $\Omega$	
$P_O$	Output power (d = 10%)	Stereo 8 (per channel)	9 V 4 $\Omega$	1.7	2.3		W
			9 V 8 $\Omega$		1.3		W
			6 V 4 $\Omega$	0.7	1		W
			6 V 8 $\Omega$		0.6		W
			6 V 16 $\Omega$		0.25		W
			6 V 32 $\Omega$		0.13		W
			3 V 4 $\Omega$		0.1		W
			3 V 32 $\Omega$		0.02		W
		Bridge	12 V 8 $\Omega$		2.4		W
			9 V 8 $\Omega$		4.7		W
			6 V 4 $\Omega$		2.8		W
			6 V 8 $\Omega$		1.5		W
			3 V 16 $\Omega$		0.18		W
			3 V 32 $\Omega$		0.06		W
d	Distortion	$V_S = 9\text{ V}$ ; $R_L = 4\text{ }\Omega$		0.3 0.5	1.5	%	
SVR	Supply voltage rejection	$f = 100\text{ Hz}$ , $V_R = 0.5\text{ V}$ , $R_G = 0$	40	46		dB	
$E_{N(IN)}$	Input noise voltage	$R_G = 0$		1.5	3	mV	
		$R_G = 10\text{ k}\Omega$		3	6	mV	
CT	Crosstalk	$f = 1\text{ kHz}$ , $R_g = 10\text{ k}\Omega$	40	52		dB	

Term. N° (PowerDIP16)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DC volt. (V)	0.04	4.5	8.9	0	0	0.6	0.04	8.5	0	0.04	0.6	0	0	8.9	4.5	9

Figure 3. Bridge application

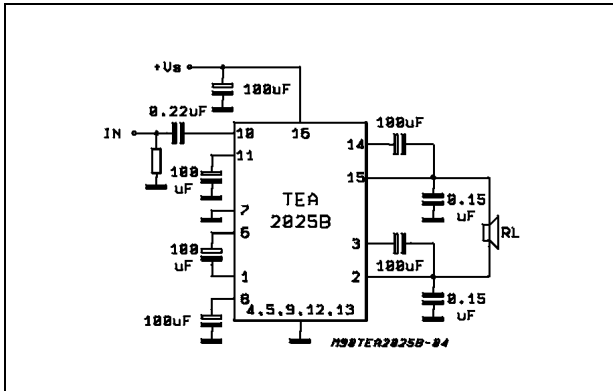


Figure 4. Stereo application

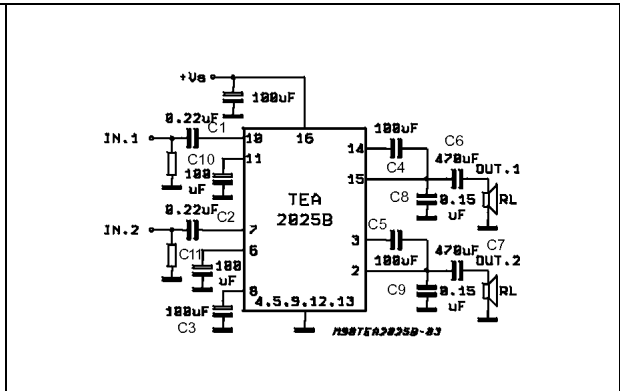


Figure 5. Supply current vs. supply voltage ( $R_L = 4 \Omega$ )

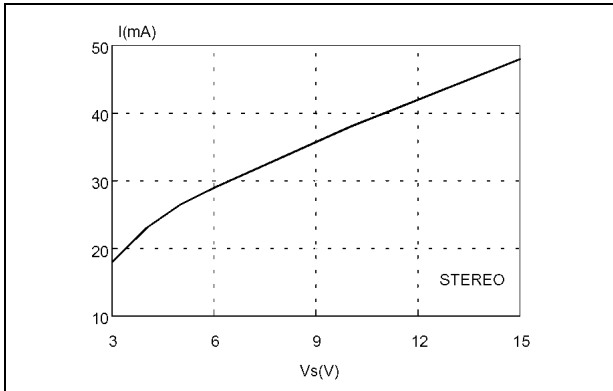


Figure 6. Output voltage vs. supply voltage

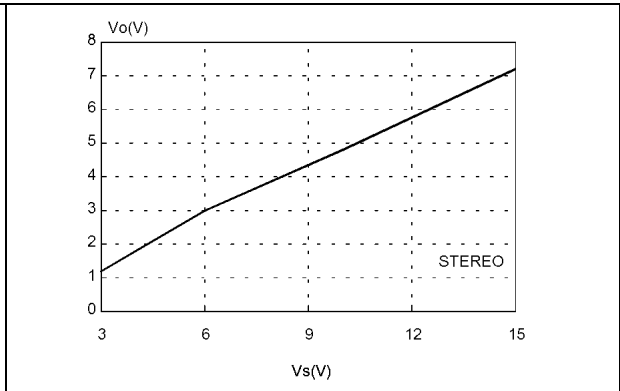


Figure 7. Output power vs. supply voltage (THD = 10%,  $f = 1 \text{ kHz}$ )

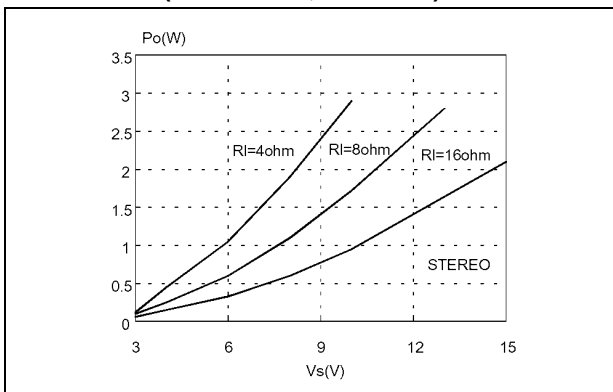
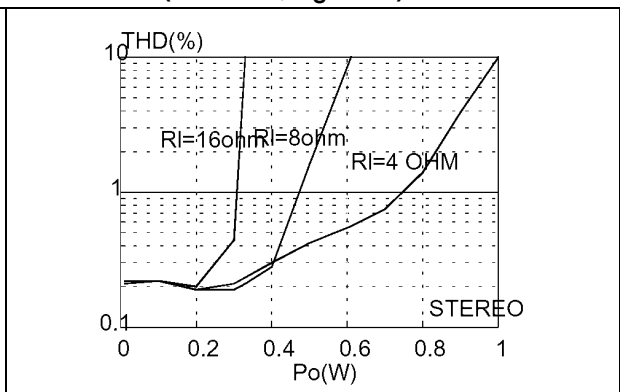


Figure 8. THD vs. output power ( $f = 1 \text{ kHz}, V_S = 6 \text{ V}$ )



## 2 Application information

### 2.1 Input capacitor

The input capacitor is PNP type allowing the source to be referenced to ground. In this way no input coupling capacitor is required. However, a series capacitor (0.22  $\mu\text{F}$ ) to the input side can be useful in case of noise due to variable resistor contact.

### 2.2 Bootstrap

The bootstrap connection allows increasing the output swing.

The recommended value for the bootstrap capacitors (100  $\mu\text{F}$ ) avoids a reduction of the output signal also at low frequencies and low supply voltages.

### 2.3 Voltage gain adjustment

#### 2.3.1 Stereo mode

The voltage gain is determined by on-chip resistors R1 and R2 together with the external RfC1 series connected between pin 6 (11) and ground. The frequency response is approximated by:

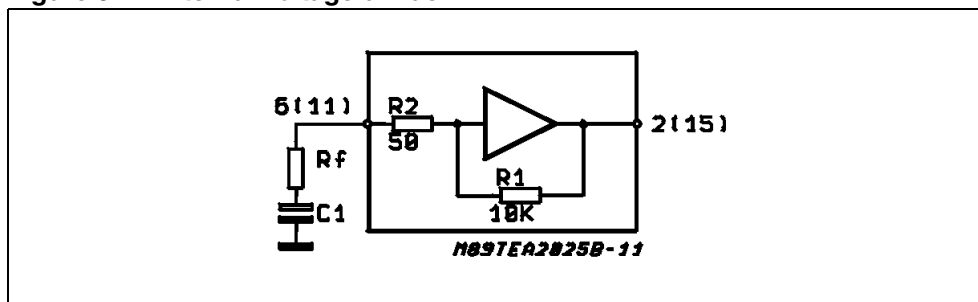
$$\frac{V_{\text{OUT}}}{V_{\text{IN}}} = \frac{R1}{Rf + R2 + \frac{1}{JWC1}}$$

With  $Rf = 0$ ,  $C1 = 100 \mu\text{F}$ , the gain results in 46 dB with pole at  $f = 32 \text{ Hz}$ .

The purpose of Rf is to reduce the gain. It is recommended to not reduce it under 36 dB.

#### 2.3.2 Bridge mode

Figure 9. Internal voltage divider



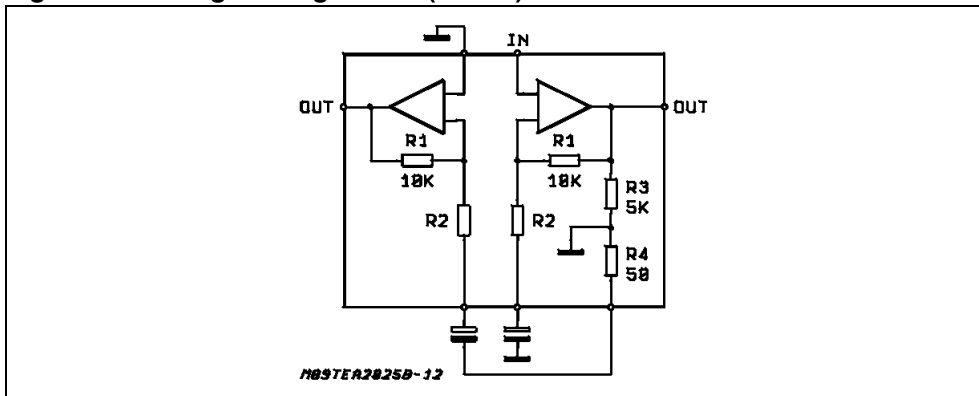
The bridge configuration is realized very easily thanks to an internal voltage divider which provides (at pin 1) the CH 1 output signal after reduction.

It is sufficient to connect pin 6 (inverting input of CH 2) with a capacitor to pin 1 and to connect pin 7 to ground. The total gain of the bridge is given by:

$$\frac{V_{OUT}}{V_{IN}} = \frac{R1}{Rf + R2 + \frac{1}{JWC1}} \left( 1 + \frac{R3}{R4} \frac{R1}{R2 + R4 + \frac{1}{JWC1}} \right)$$

and with the recommended values (C1 = C2 = 100 µF, Rf= 0), then Gv = 52 dB with first pole at f = 32 Hz

Figure 10. Bridge configuration (stereo)



## 2.4 Output capacitors

The low cutoff frequency due to the output capacitor depending on the load is given by:

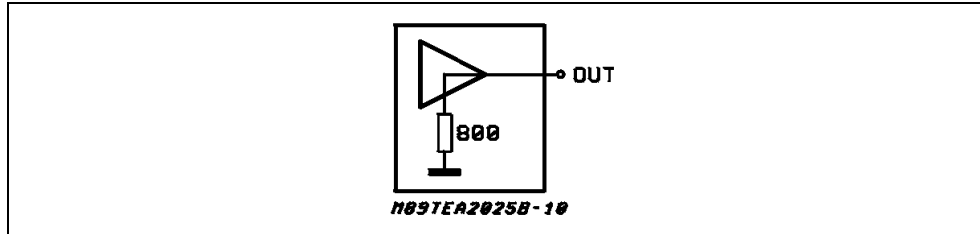
$$F_L = \frac{1}{2\pi C_{OUT} \cdot R_L}$$

with C<sub>OUT</sub> 470 µF and R<sub>L</sub> = 4 ohm, then F<sub>L</sub> = 80 Hz.

## 2.5 Pop noise

Most amplifiers similar to the TEA2025B need external resistors between the DC outputs and ground in order to minimize pop on/off noise and crossover distortion.

**Figure 11. Internal resistor**



The TEA2025B requires less components as these resistors (800 ohm) are in the device.

## 2.6 Stability

A good layout is recommended in order to avoid oscillations.

Generally the designer must pay attention to the following points:

- Short wires of components and short connections.
  - No ground loops
  - Bypass of supply voltage with capacitors as close as possible to the supply IC pin. The low value (polyester) capacitors must have suitable temperature and frequency characteristics.
  - No sockets
- The heatsink can have a smaller factor of safety compared with that of a conventional circuit. There is no device damage in the case of excessive junction temperature:  $P_O$  (and therefore  $P_{tot}$ ) and  $I_d$  are simply reduced.

### 3 Application suggestions

The recommended values of the components are those shown in the stereo application circuit of [Figure 4](#), although different values can be used (refer to the following table).

**Table 5. Recommended values for stereo applications**

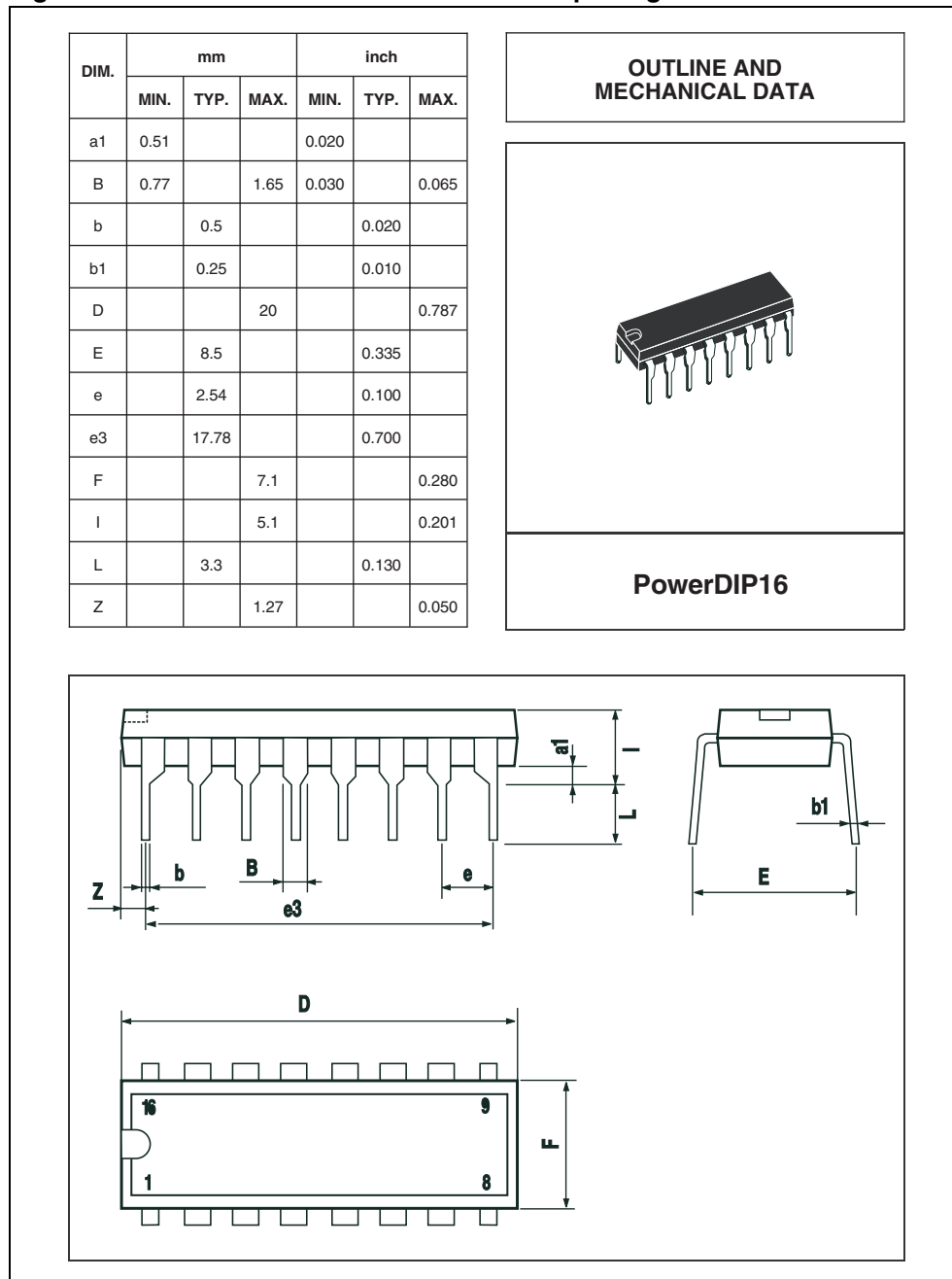
Component	Recommended value	Purpose	Larger than	Smaller than
C1, C2	0.22 $\mu$ F	Input DC decoupling in case of slider contact noise of variable resistor		
C3	100 $\mu$ F	Ripple rejecton		Degradation of SVR, increase of at low frequency and low voltage
C4, C5	100 $\mu$ F	Bootstrap		
C6, C7	470 $\mu$ F	Output DC decoupling		Increase of low frequency cutoff
C8, C9	0.15 $\mu$ F	Frequency stability		Danger of oscillations
C10, C11	100 $\mu$ F	Inverting input DC decoupling		Increase of low frequency cutoff



## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK® is an ST trademark.

**Figure 12. PowerDIP16 mechanical data and package dimensions**



## 5 Revision history

**Table 6. Revision history**

Date	Revision	Changes
September 2003	2	Updates not recorded
30-Apr-2010	3	Updated title and added environmental compliance statement for package
01-Oct-2012	4	Removed SO20 package option from datasheet Minor textual updates Revised document presentation

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