

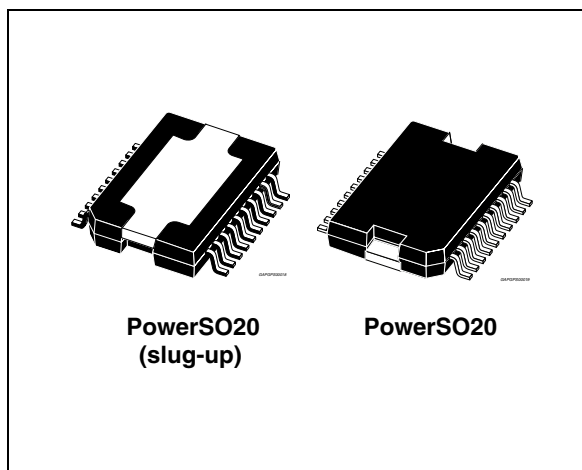
## 32 W bridge car radio amplifier

### Features

- High power capability:
  - 40 W/3.2  $\Omega$  EIAJ
  - 32 W/3.2  $\Omega$  @  $V_S = 14.4$  V,  $f = 1$  kHz,  $d = 10$  %
  - 26 W/4  $\Omega$  @  $V_S = 14.4$  V,  $f = 1$  kHz,  $d = 10$  %
- Differential inputs (either single ended or differential input signal are accepted)
- Minimum external component count:
  - No bootstrap capacitors
  - No Boucherot cells
  - Internally fixed gain (30 dB)
  - No SVR capacitor
- Standby function (CMOS compatible)
- Programmable turn-on/off delay
- No audible pop during mute and stand-by operations

### Protections

- Short circuit (to GND, to  $V_S$ , across the load)
- Very inductive loads
- Chip over temperature
- Load dump
- Open GND
- ESD



### Description

The TDA7391PD is a bridge class AB audio power amplifier specially intended for car radio high power applications.

The high power capability together with the possibility to operate either in differential input mode or single ended input mode makes it suitable for boosters and high end car radio equipment. The exclusive fully complementary output stage and the internal fixed gain configuration drop the external component count.

The on board clipping detector allows easy implementation of gain compression systems.

**Table 1. Device summary**

| Order code    | Package             | Packing       |
|---------------|---------------------|---------------|
| E-TDA7391PD   | PowerSO20           | Tube          |
| E-TDA7391PDTR | PowerSO20           | Tape and reel |
| TDA7391PDU    | PowerSO20 (slug-up) | Tube          |
| TDA7391PDUTR  | PowerSO20 (slug-up) | Tape and reel |

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# 1 Test and application circuit, block diagram

Figure 1. Test and application circuit

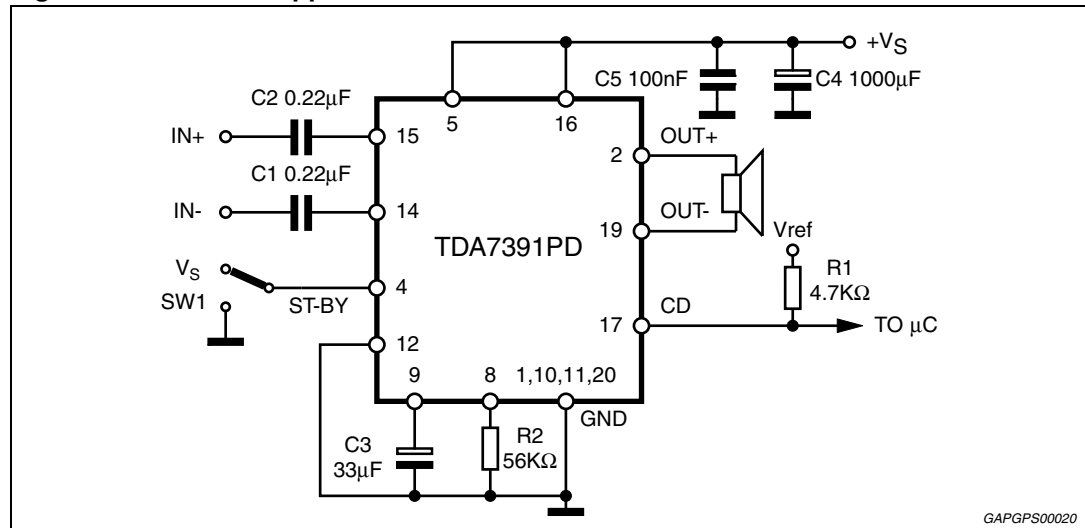
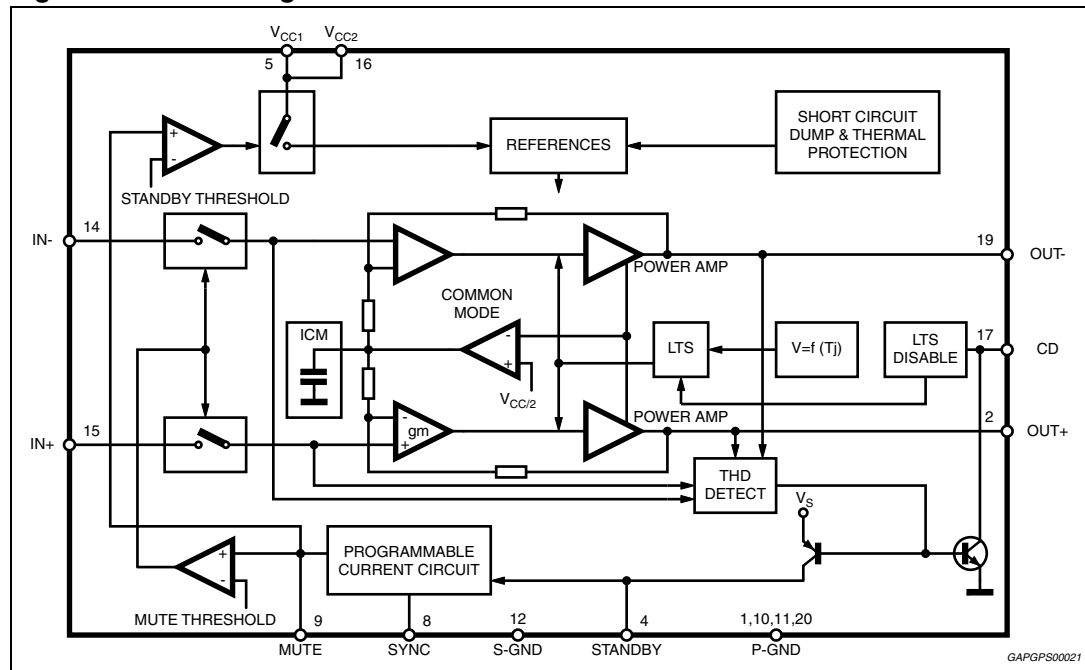
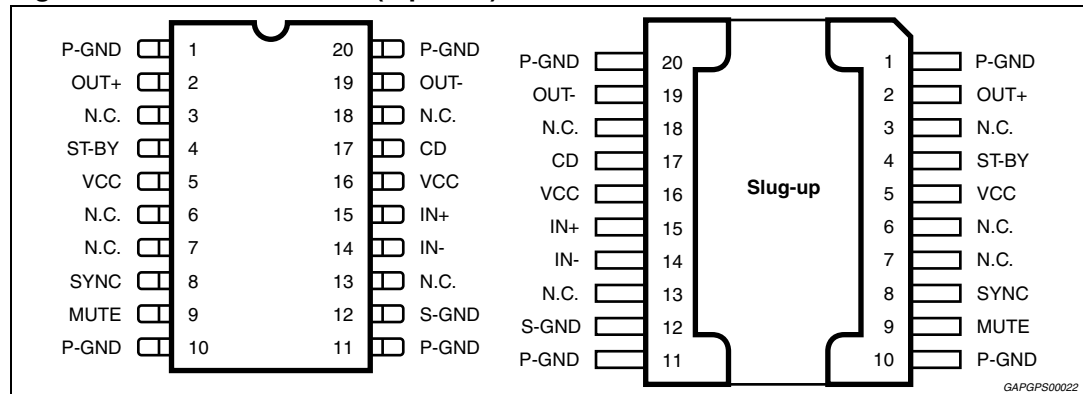


Figure 2. Block diagram



## 2 Pins description

**Figure 3. Pins connection (top view)**



**Table 2. Pins function**

| Pin           | Function | Description                                                                                                                                                                                                                                                                              |
|---------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 14, 15        | INPUTS   | The input stage is a high impedance type also capable of operation in single ended mode with one input capacitively coupled to the signal GND. The impedance seen by the inverting and non inverting input pins must be matched.                                                         |
| 5, 16         | $+V_S$   | Supply voltage.                                                                                                                                                                                                                                                                          |
| 17            | CD       | The TDA7391PD is equipped with a diagnostic circuitry able to detect the clipping in the Output Signal (distortion = 10%).<br>The CD pin (open collector) gives out low level signal during clipping.                                                                                    |
| 2, 19         | OUTPUTS  | The output stage is a bridge type able to drive loads as low as 3.2Ω. It consists of two class AB fully complementary PNP/NPN stages fully protected.<br>A rail to rail output voltage swing is achieved without need of bootstrap capacitors.<br>No external compensation is necessary. |
| 1, 10, 11, 20 | GND      | Power Ground.                                                                                                                                                                                                                                                                            |
| 12            | S-GND    | Signal ground.                                                                                                                                                                                                                                                                           |
| 4             | STAND-BY | The device features a ST-BY function which shuts down all the internal bias supplies when the ST-BY pin is low. In ST-BY mode the amplifier sinks a small current (in the range of few μA). When the ST-BY pin is high the IC becomes fully operational.                                 |
| 8             | SYNC     | A resistor ( $R_2$ ) has to be connect between pin 8 and GND in order to program the current that flows in the $C_3$ capacitor (pin 9). The values of $C_3$ and $R_2$ determine the time required to bias the amplifier.                                                                 |
| 9             | MUTE     | The pin will have a capacitor ( $C_3$ ) tied to GND to set the MUTE/STAND-BY time.<br>An automatic Mute during turn on/off is provided to prevent noisy transients.                                                                                                                      |

## 3 Electrical specifications

### 3.1 Absolute maximum ratings

**Table 3. Absolute maximum ratings**

| Symbol         | Parameter                                       | Value      | Unit |
|----------------|-------------------------------------------------|------------|------|
| $V_S$          | DC supply voltage                               | 28         | V    |
| $V_{OP}$       | Operating supply voltage                        | 18         | V    |
| $V_{PEAK}$     | Peak supply voltage (t = 50 ms)                 | 50         | V    |
| $I_O$          | Output peak current repetitive (f > 10 Hz)      | 4.5        | A    |
|                | Output peak current non repetitive              | 6          | A    |
| $P_{tot}$      | Power dissipation ( $T_{case} = 85\text{ °C}$ ) | 32         | W    |
| $T_{stg}, T_j$ | Storage and junction temperature                | -40 to 150 | °C   |

### 3.2 Thermal data

**Table 4. Thermal data**

| Symbol           | Parameter                                | Value | Unit |
|------------------|------------------------------------------|-------|------|
| $R_{th\ j-case}$ | Thermal resistance junction-to-case Max. | 2     | °C/W |

### 3.3 Electrical characteristics

$V_S = 14.4\text{ V}$ ;  $R_L = 4\ \Omega$ ,  $f = 1\text{ kHz}$ ,  $T_{amb} = 25\text{ °C}$ , unless otherwise specified.

**Table 5. Electrical characteristics**

| Symbol          | Parameter                     | Test condition              | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|-----------------------------|------|------|------|------|
| $V_S$           | Supply voltage range          | -                           | 8    | -    | 18   | V    |
| $I_q$           | Total quiescent current       | -                           | -    | 60   | 150  | mA   |
| $V_{OS}$        | Output offset voltage         | -                           | -    | -    | 120  | mV   |
| $I_{SB}$        | Standby current               | $V_{ST-BY} = 1.5\text{ V}$  | -    | -    | 100  | μA   |
| $I_{SBin}$      | Standby input Bias current    | $V_{ST-BY} = 5\text{ V}$    | -    | -    | 10   | μA   |
| $V_{SBon}$      | Standby on threshold voltage  | -                           | -    | -    | 1.5  | V    |
| $V_{SBoff}$     | Standby off threshold voltage | -                           | 3.5  | -    | -    | V    |
| $ATT_{Standby}$ | Standby attenuation           | -                           | -    | 90   | -    | dB   |
| $I_{M\ in}$     | Mute input bias current       | ( $V_{MUTE} = 5\text{ V}$ ) | -    | -    | 10   | μA   |
| $A_M$           | Mute attenuation              | -                           | -    | 90   | -    | dB   |

Table 5. Electrical characteristics (continued)

| Symbol        | Parameter                                      | Test condition                                             | Min. | Typ. | Max. | Unit               |
|---------------|------------------------------------------------|------------------------------------------------------------|------|------|------|--------------------|
| $P_O$         | Output power                                   | $d = 10\%$                                                 | 20   | 26   | -    | W                  |
|               |                                                | $d = 1\%$                                                  | -    | 21   | -    | W                  |
|               |                                                | $d = 10\%$ ; $R_L = 3.2\ \Omega$                           | -    | 32   | -    | W                  |
| $P_{O\ EIAJ}$ | EIAJ output power (*)                          | $V_S = 13.7\ V$                                            | -    | 40   | -    | W                  |
| $d$           | Distortion                                     | -                                                          | -    | 0.06 | -    | %                  |
|               |                                                | $P_O = 0.1\ \text{to}\ 15\ W$                              | -    | 0.03 | -    | %                  |
| $G_V$         | Voltage gain                                   | -                                                          | 29.5 | 30   | 30.5 | dB                 |
| $f_H$         | High frequency rolloff                         | $P_O = 1\ W$ ; -3 dB                                       | 75   | -    | -    | kHz                |
| $R_{IN}$      | Input Impedance                                | Differential                                               | 36   | 60   | -    | k $\Omega$         |
|               |                                                | Single Ended                                               | 30   | 55   | -    | k $\Omega$         |
| $E_{IN}$      | Input noise voltage                            | $R_g = 0\ \Omega$ ; $f = 22\ \text{Hz to } 22\ \text{kHz}$ | -    | 4    | -    | mV                 |
| CMRR          | Input common mode rejection                    | $f = 1\ \text{kHz}$ ; $V_{IN} = 1\ V_{rms}$                | -    | 65   | -    | dB                 |
| SVR           | Supply voltage rejection                       | $R_g = 0\ \Omega$ ; $V_r = 1\ V_{rms}$                     | -    | 60   | -    | dB                 |
| CDL           | Clipping detection level                       | -                                                          | -    | 10   | -    | %                  |
| $T_{sd}$      | Absolute thermal shutdown junction temperature | -                                                          | -    | 160  | -    | $^{\circ}\text{C}$ |

### 3.4 Electrical characteristics curves

Figure 4. Quiescent current vs. supply voltage

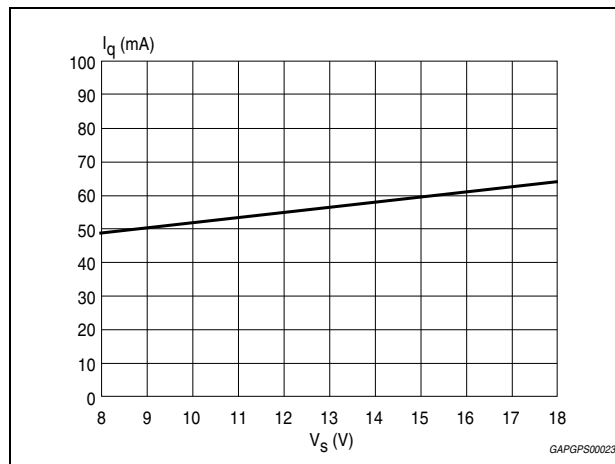
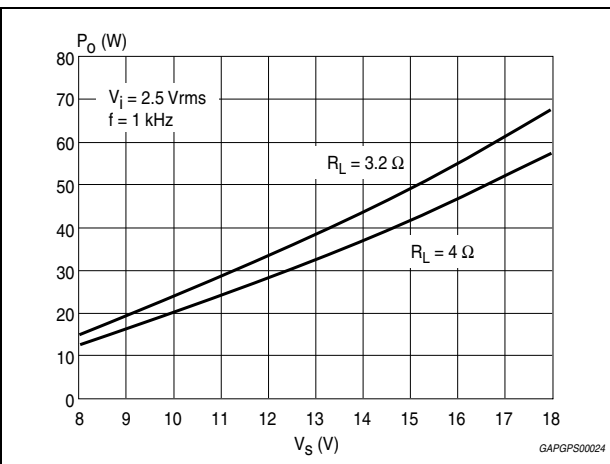


Figure 5. EIAJ power vs. supply voltage



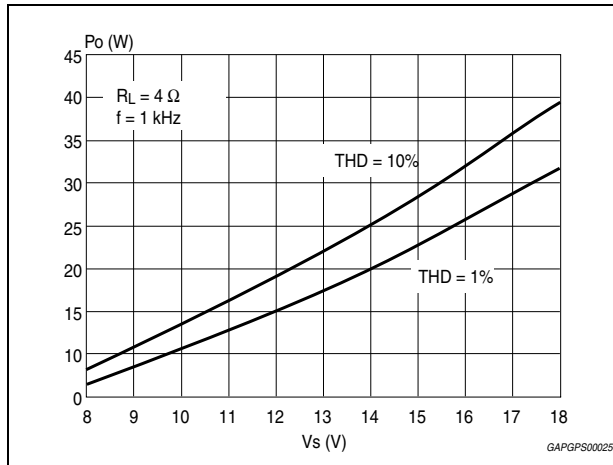
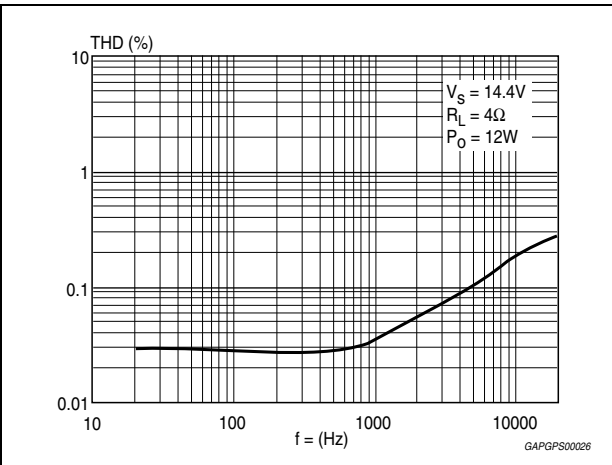
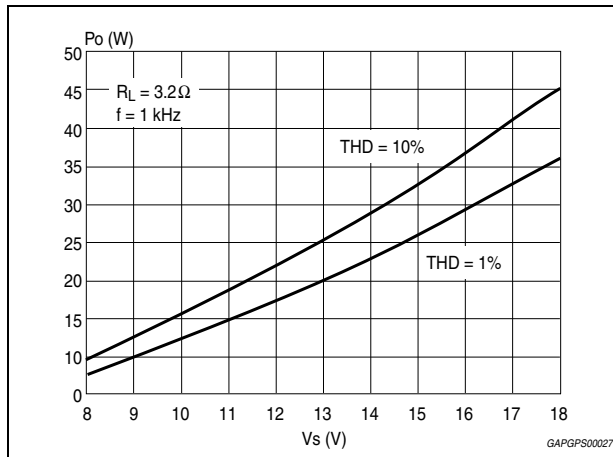
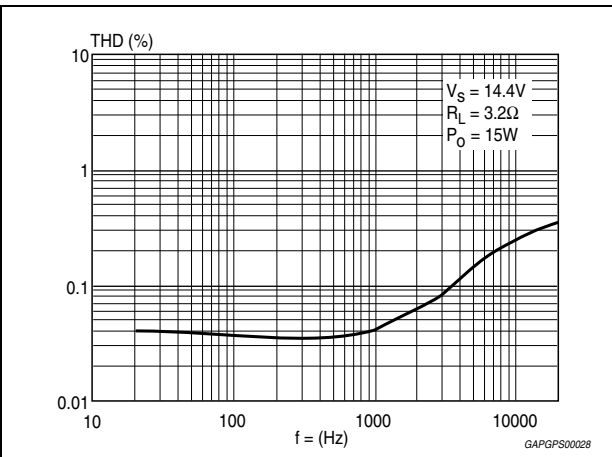
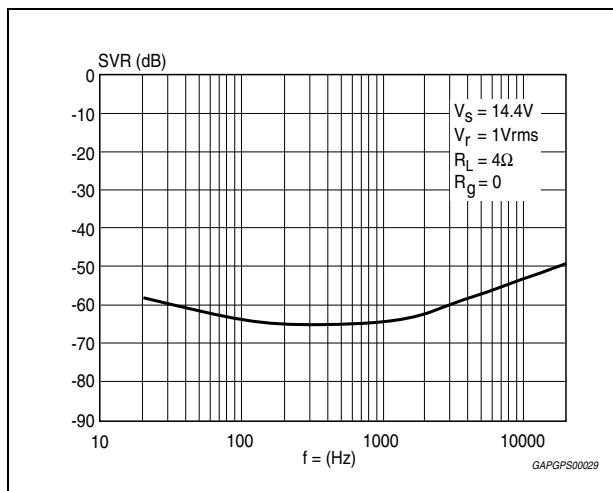
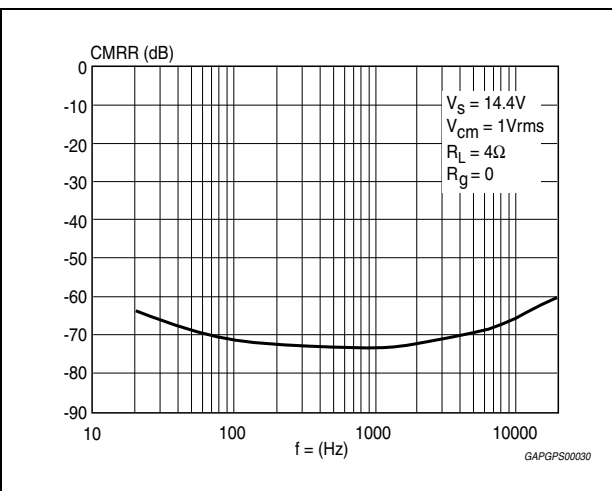
**Figure 6. Output power vs. supply voltage  
(@  $R_L = 4\Omega$ )****Figure 7. Distortion vs. frequency (@  $R_L = 4\Omega$ )****Figure 8. Output power vs. supply voltage  
(@  $R_L = 3.2\Omega$ )****Figure 9. Distortion vs. frequency  
(@  $R_L = 3.2\Omega$ )****Figure 10. Supply voltage rejection vs.  
frequency****Figure 11. Common mode rejection vs.  
frequency**

Figure 12. Total power dissipation and eff. vs. output power (@ $R_L = 4\Omega$ )

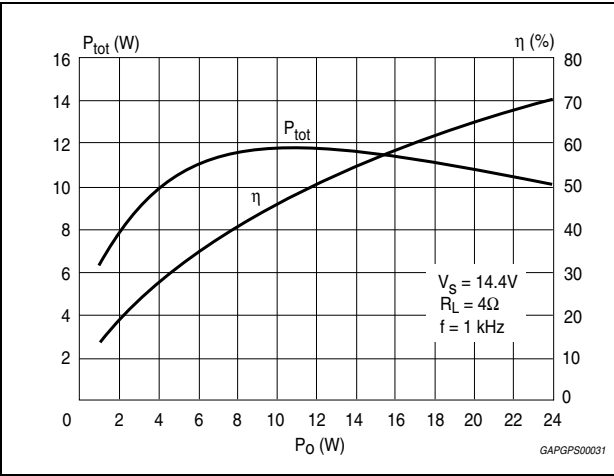
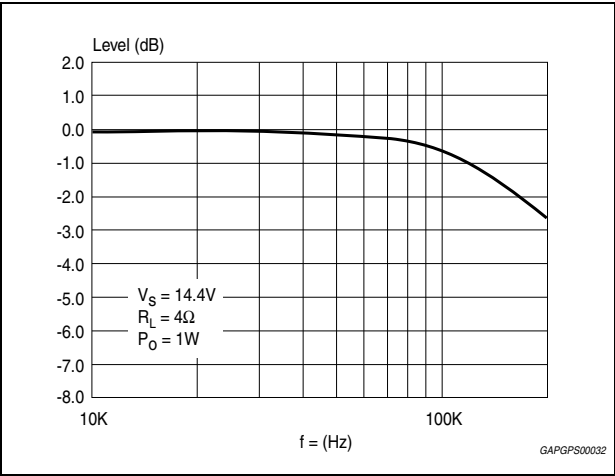


Figure 13. Power bandwidth



## 4 Package information

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).

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**Figure 14. PowerSO20 mechanical data and package dimensions**

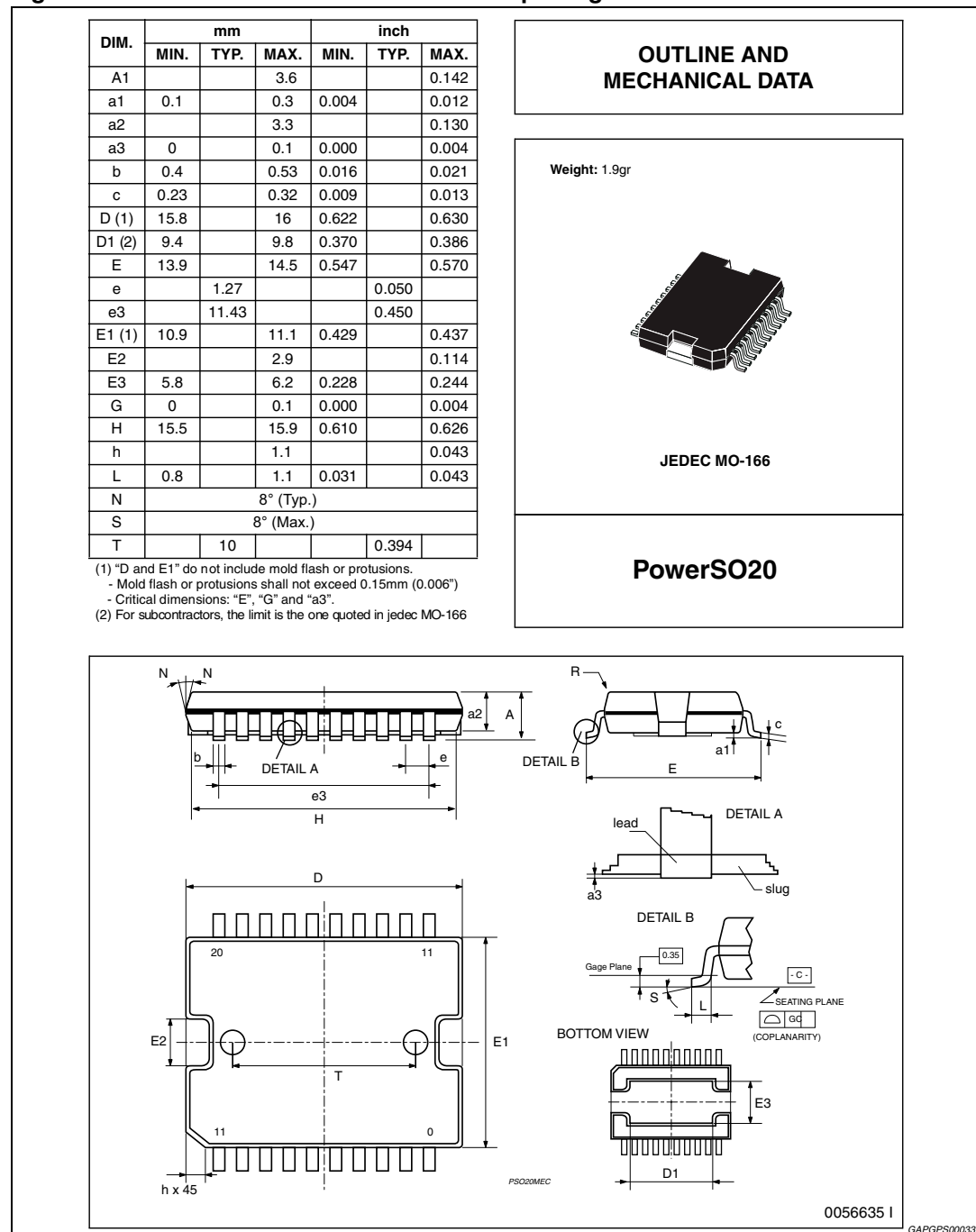
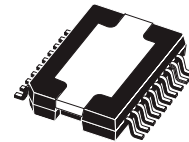


Figure 15. PowerSO20 (slug-up) mechanical data and package dimensions

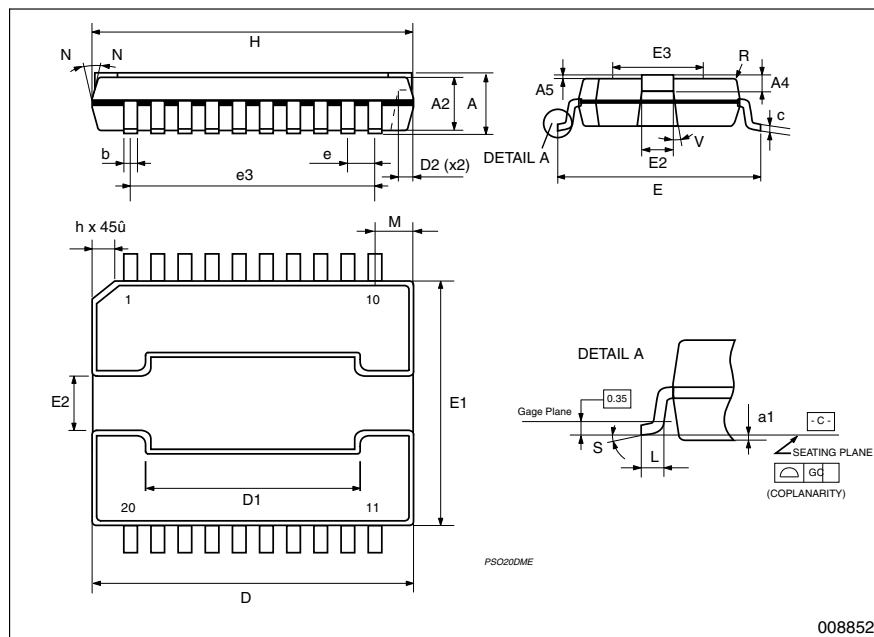
| DIM.   | mm                  |       |        | inch   |       |         |
|--------|---------------------|-------|--------|--------|-------|---------|
|        | MIN.                | TYP.  | MAX.   | MIN.   | TYP.  | MAX.    |
| A      | 3.25                |       | 3.5    | 0.128  |       | 0.138   |
| A2     | 3                   | 3.15  | 3.3    | 0.118  | 0.124 | 0.130   |
| A4     | 0.8                 |       | 1      | 0.031  |       | 0.039   |
| A5     | 0.15                | 0.2   | 0.25   | 0.006  | 0.008 | 0.010   |
| a1     | 0.030               |       | -0.040 | 0.0012 |       | -0.0016 |
| b      | 0.4                 |       | 0.53   | 0.016  |       | 0.021   |
| c      | 0.23                |       | 0.32   | 0.009  |       | 0.012   |
| D (1)  | 15.8                |       | 16     | 0.622  |       | 0.630   |
| D1     | 9.4                 |       | 9.8    | 0.370  |       | 0.385   |
| D2     |                     | 1     |        |        | 0.039 |         |
| E      | 13.9                |       | 14.5   | 0.547  |       | 0.570   |
| E1 (1) | 10.9                |       | 11.1   | 0.429  |       | 0.437   |
| E2     |                     |       | 2.9    |        |       | 0.114   |
| E3     | 5.8                 |       | 6.2    | 0.228  |       | 0.244   |
| e      | 1.12                | 1.27  | 1.42   | 0.044  | 0.050 | 0.056   |
| e3     |                     | 11.43 |        |        | 0.450 |         |
| G      | 0                   |       | 0.1    | 0      |       | 0.004   |
| H      | 15.5                |       | 15.9   | 0.61   |       | 0.625   |
| h      |                     |       | 1.1    |        |       | 0.043   |
| L      | 0.8                 |       | 1.1    | 0.031  |       | 0.043   |
| N      | 10° (max)           |       |        |        |       |         |
| R      |                     | 0.6   |        |        | 0.024 |         |
| S      | 0° (min.) 8° (max.) |       |        |        |       |         |
| V      | 5° (min.) 7° (max.) |       |        |        |       |         |

(1) "D and E1" do not include mold flash or protusions.  
 - Mold flash or protusions shall not exceed 0.15mm (0.006")  
 - Critical dimensions: "E", "a1", "e" and "G".

### OUTLINE AND MECHANICAL DATA



### PowerSO20 (Slug-up)



## 5 Revision history

**Table 6. Document revision history**

| Date        | Revision | Changes                                                                                                                                                                                                                  |
|-------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10-Oct-1998 | 1        | Initial release.                                                                                                                                                                                                         |
| 02-Jul-2008 | 2        | Document reformatted.<br>Document status promoted from product preview to datasheet.<br>Added <a href="#">Table 1: Device summary</a> .<br>Added ECOPACK description in <a href="#">Section 5: Package information</a> . |
| 19-Apr-2010 | 3        | Updated <a href="#">Table 1: Device summary</a> .                                                                                                                                                                        |
| 26-Jan-2011 | 4        | Updated <a href="#">Table 1: Device summary</a> .<br>Added PowerSO20 (slug-up) drawing in <a href="#">Figure 3</a> .<br>Added PowerSO20 (slug-up) in <a href="#">Section 4: Package information</a> .                    |
| 16-Sep-2013 | 5        | Updated Disclaimer.                                                                                                                                                                                                      |

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