

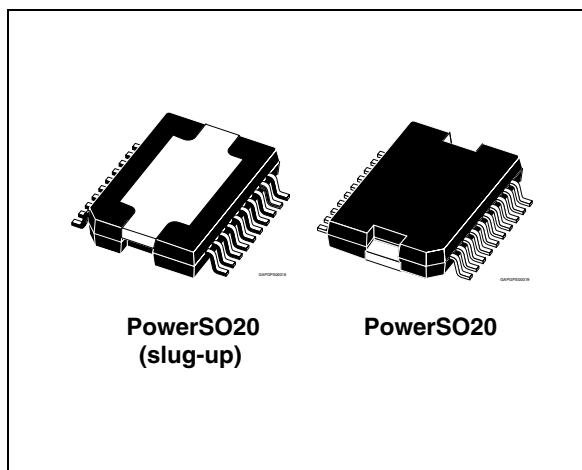
## 32 W bridge car radio amplifier

### 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**

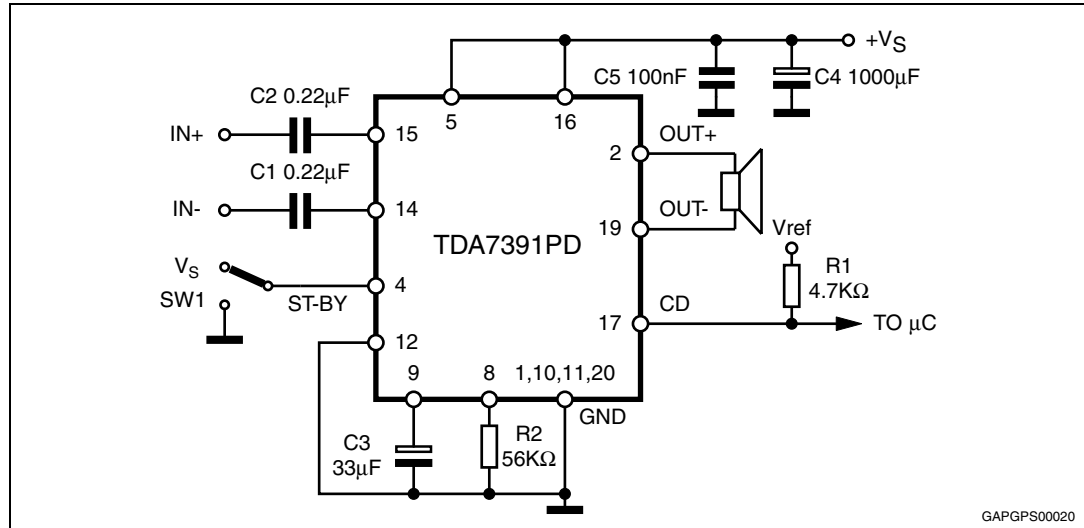
Order code	Package	Packing
E-TDA7391PD	PowerSO20	Tube
E-TDA7391PDTR	PowerSO20	Tape and reel
TDA7391PDU	PowerSO20 (slug-up)	Tube
TDA7391PDUTR	PowerSO20 (slug-up)	Tape and reel

# Contents

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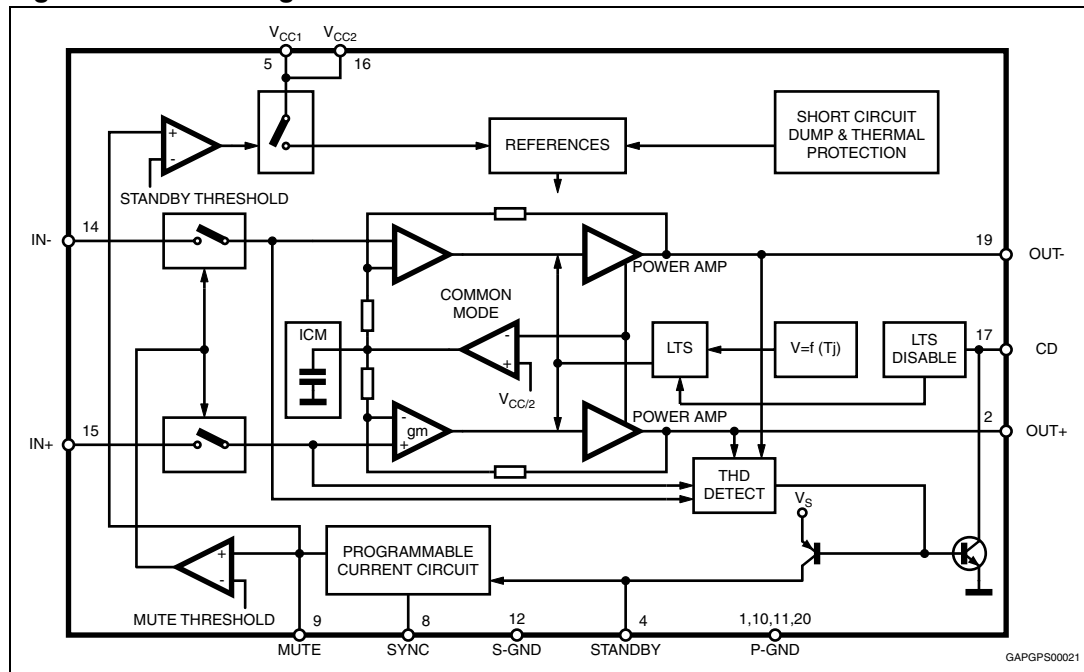
# 1 Test and application circuit, block diagram

Figure 1. Test and application circuit



GAPGPS00020

Figure 2. Block diagram



GAPGPS00021

## 2 Pins description

Figure 3. Pins connection (top view)

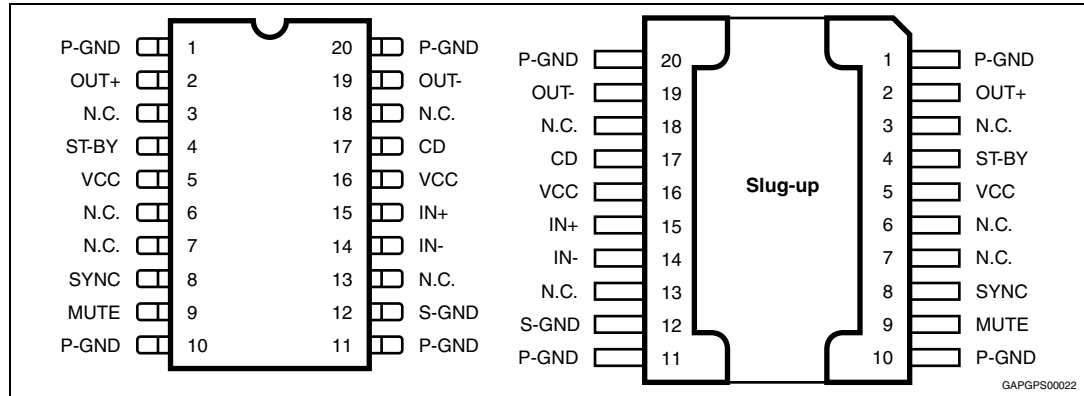


Table 2. Pins function

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 <sub>S</sub>	Supply voltage.
17	CD	The TDA7391PD is equipped with a diagnostic circuitry able to detect the clipping in the Output Signal (distortion = 10%). 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. A rail to rail output voltage swing is achieved without need of bootstrap capacitors. 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 <sub>2</sub> ) has to be connect between pin 8 and GND in order to program the current that flows in the C <sub>3</sub> capacitor (pin 9). The values of C <sub>3</sub> and R <sub>2</sub> determine the time required to bias the amplifier.
9	MUTE	The pin will have a capacitor (C <sub>3</sub> ) tied to GND to set the MUTE/STAND-BY time. 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 ( $T_{case} = 85\text{ }^\circ\text{C}$ )	32	W
$T_{stg}, T_j$	Storage and junction temperature	-40 to 150	$^\circ\text{C}$

### 3.2 Thermal data

Table 4. Thermal data

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

### 3.3 Electrical characteristics

Table 5. Electrical characteristics

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

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	$\mu\text{A}$
$I_{SBin}$	Standby input Bias current	$V_{ST-BY} = 5\text{ V}$	-	-	10	$\mu\text{A}$
$V_{SBon}$	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	$\mu\text{A}$
$A_M$	Mute attenuation	-	-	90	-	dB

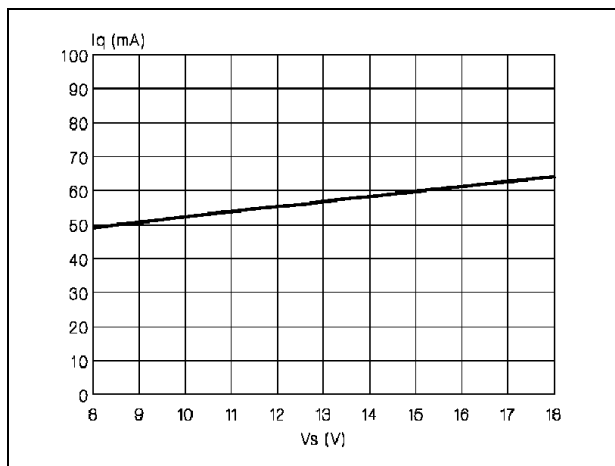
**Table 5. Electrical characteristics (continued)**

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

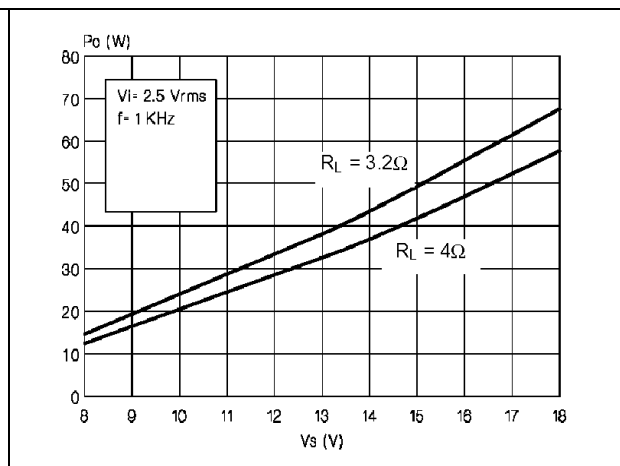
Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$P_O$	Output power	$d = 10\%$	20	26	-	W
		$d = 1\%$	-	21	-	W
		$d = 10\%$ ; $R_L = 3.2\ \Omega$	-	32	-	W
$P_{O\ EIAJ}$	EIAJ output power (*)	$V_S = 13.7\text{ V}$	-	40	-	W
$d$	Distortion	-	-	0.06	-	%
		$P_O = 0.1\text{ to }15\text{ W}$	-	0.03	-	%
$G_V$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

### 3.4 Electrical characteristics curves

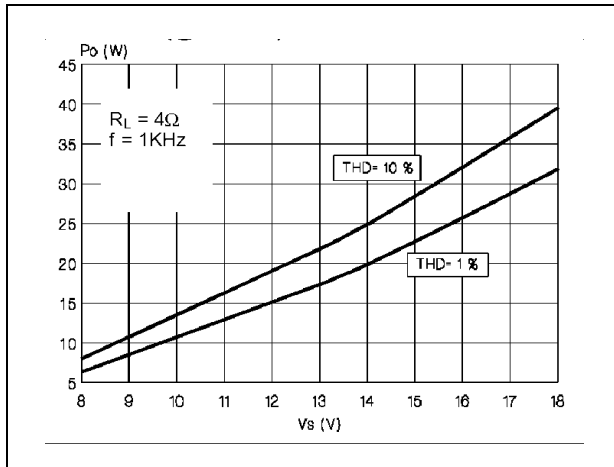
**Figure 4. Quiescent current vs. supply voltage**



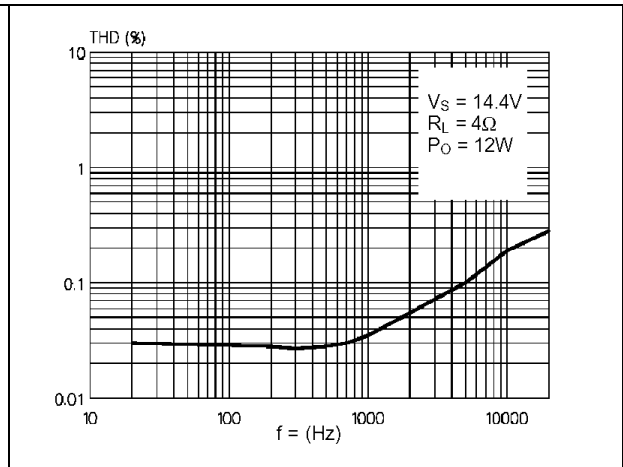
**Figure 5. EIAJ power vs. supply voltage**



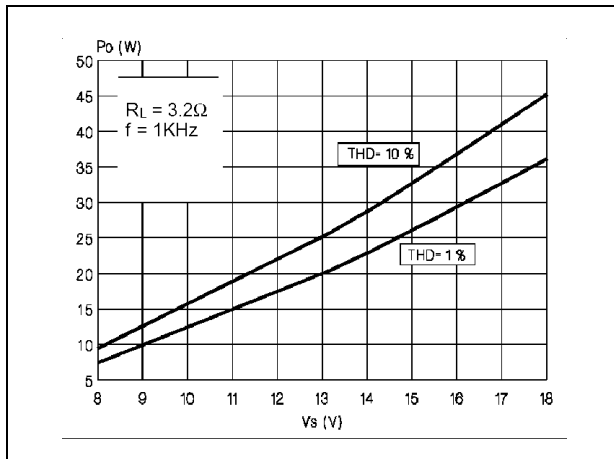
**Figure 6. Output power vs. supply voltage (@ $R_L = 4\Omega$ )**



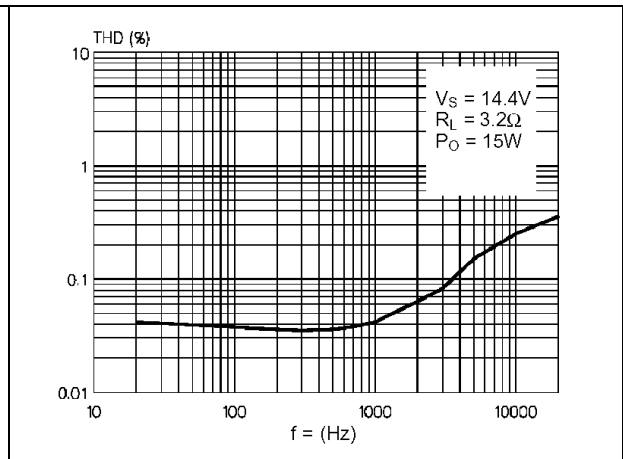
**Figure 7. Distortion vs. frequency (@  $R_L = 4\Omega$ )**



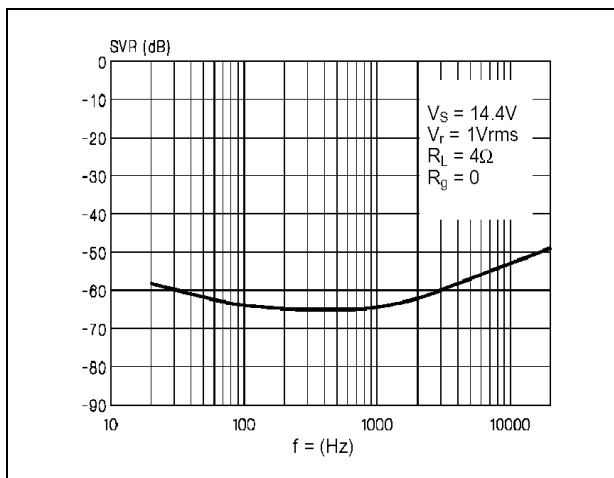
**Figure 8. Output power vs. supply voltage (@ $R_L = 3.2\Omega$ )**



**Figure 9. Distortion vs. frequency (@  $R_L = 3.2\Omega$ )**



**Figure 10. Supply voltage rejection vs. frequency**



**Figure 11. Common mode rejection vs. frequency**

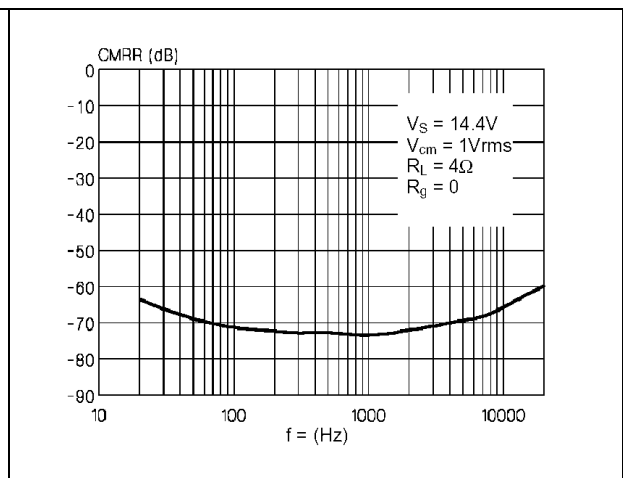


Figure 12. Total power dissipation and effic. vs. output power (@ $R_L = 4\Omega$ )

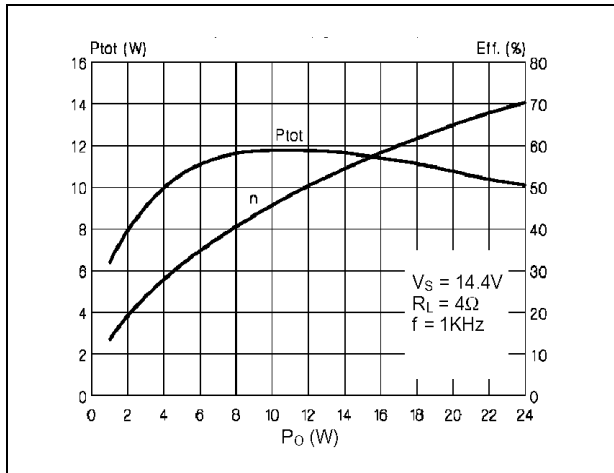
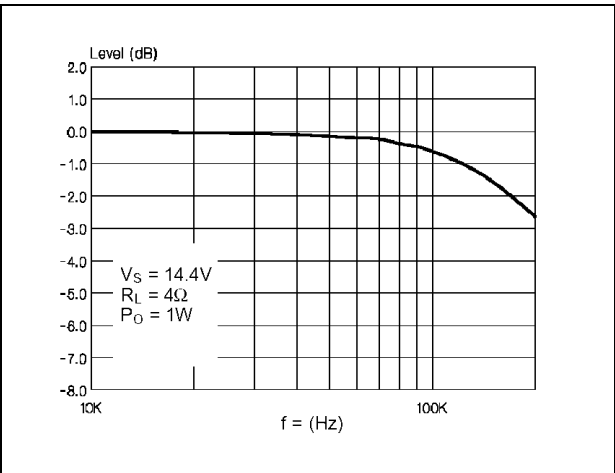


Figure 13. Power bandwidth





# 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**

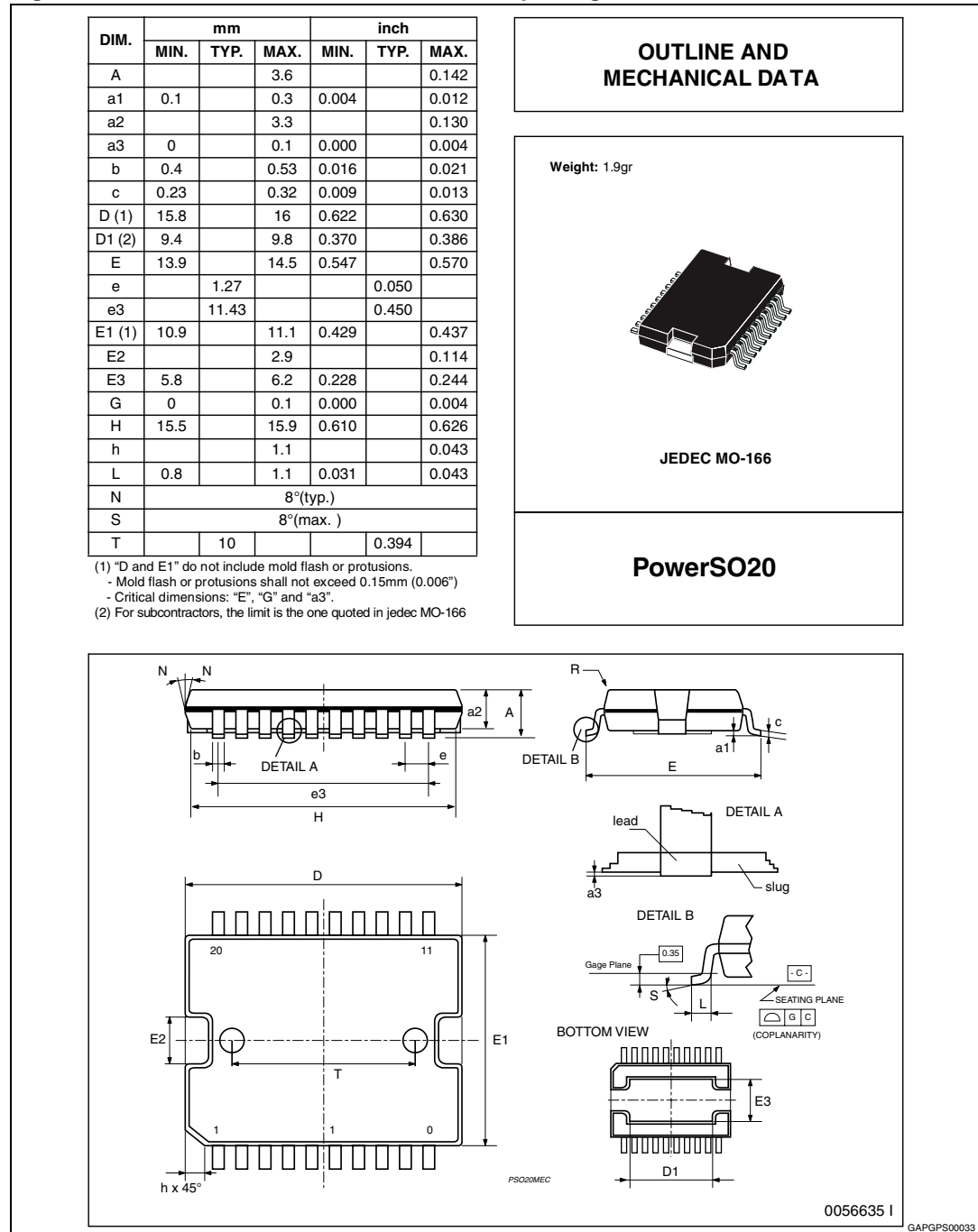
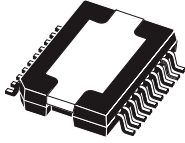


Figure 15. PowerSO20 (slug-up) mechanical data and package dimensions

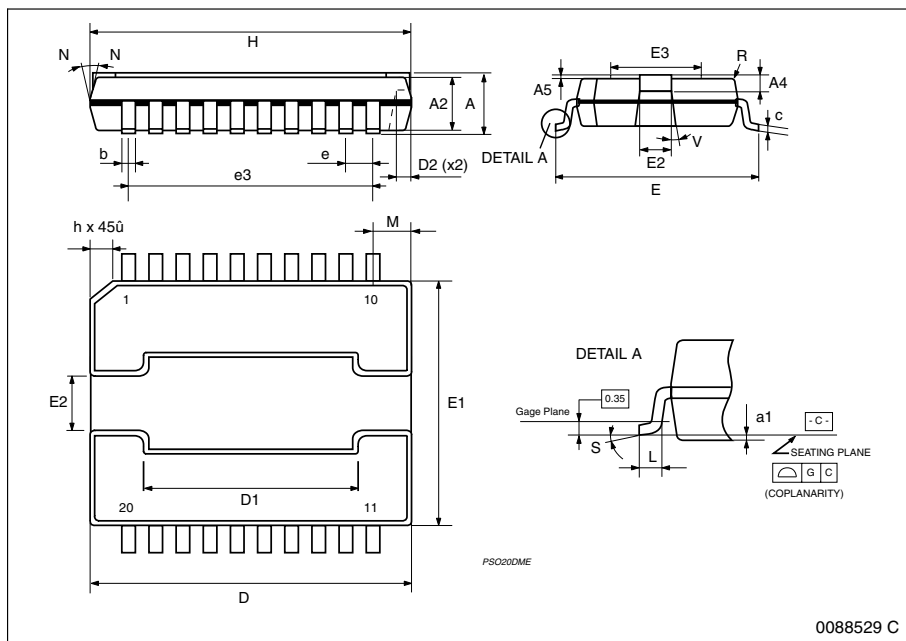
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	3.25		3.5	0.128		0.138
A2	3	3.15	3.3	0.118	0.124	0.130
A4	0.8		1	0.031		0.039
A5	0.15	0.2	0.25	0.006	0.008	0.010
a1	0.030		-0.040	0.0012		-0.0016
b	0.4		0.53	0.016		0.021
c	0.23		0.32	0.009		0.012
D (1)	15.8		16	0.622		0.630
D1	9.4		9.8	0.370		0.385
D2		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 <sub>i</sub> (max)					
R		0.6			0.024	
S	0 <sub>i</sub> (min.) 8 <sub>i</sub> (max.)					
V	5 <sub>j</sub> (min.) 7 <sub>i</sub> (max.)					

(1)  $\phi D$  and  $E1$  do not include mold flash or protrusions.  
 - Mold flash or protrusions shall not exceed 0.15mm (0.006 $\phi$ )  
 - Critical dimensions:  $\phi O$ ,  $\phi A1$ ,  $\phi e$  and  $\phi \phi$ .

**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. Document status promoted from product preview to datasheet. Added <a href="#">Table 1: Device summary</a> . 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> . Added PowerSO20 (slug-up) drawing in <a href="#">Figure 3</a> . Added PowerSO20 (slug-up) in <a href="#">Section 4: Package information</a> .

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