TDA7391PD

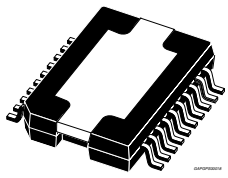
32 W bridge car radio amplifier

Features

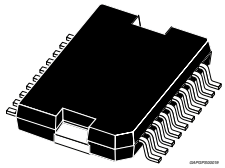
- High power capability:
  - 40 W/3.2 Ω EIAJ
  - 32 W/3.2 Ω @ V_S = 14.4 V, f = 1 kHz, d = 10 %
  - 26 W/4 Ω @ V_S = 14.4 V, f = 1 kHz, d = 10 %
- Differential inputs (either single ended or differential input signal are accepted)
- Minimum external component count:
  - No bootstrap capacitors
  - No 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



PowerSO20 (slug-up)



PowerSO20

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

1 Test and application circuit, block diagram

Figure 1. Test and application circuit

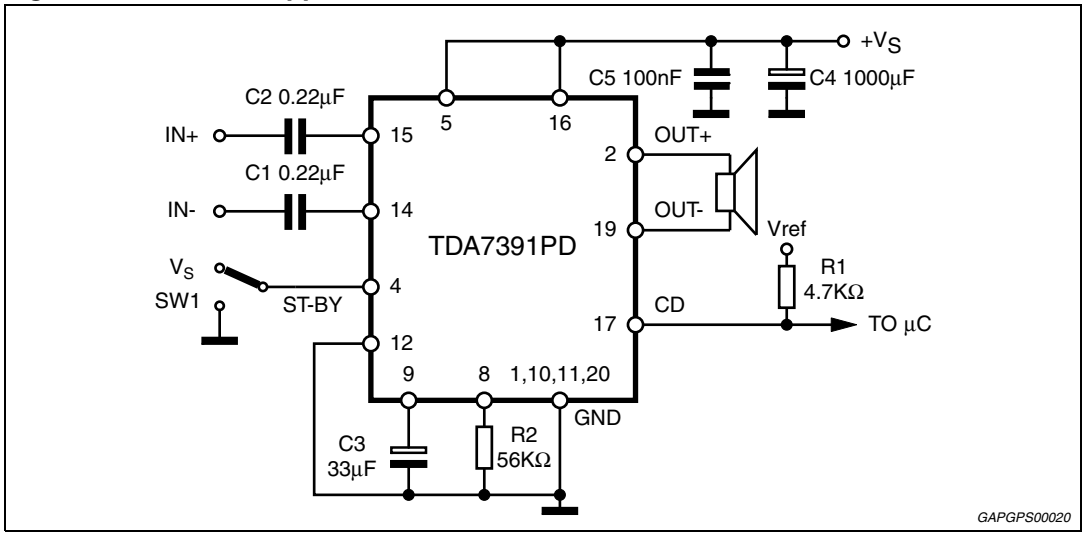
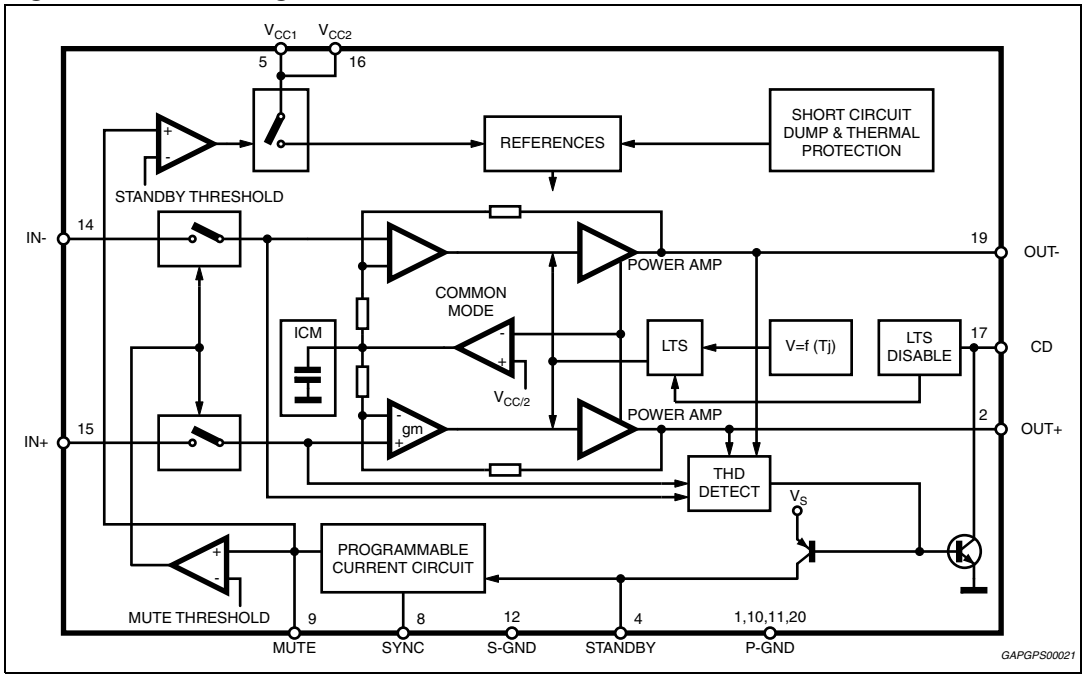


Figure 2. Block diagram



2 Pins description

Figure 3. Pins connection (top view)

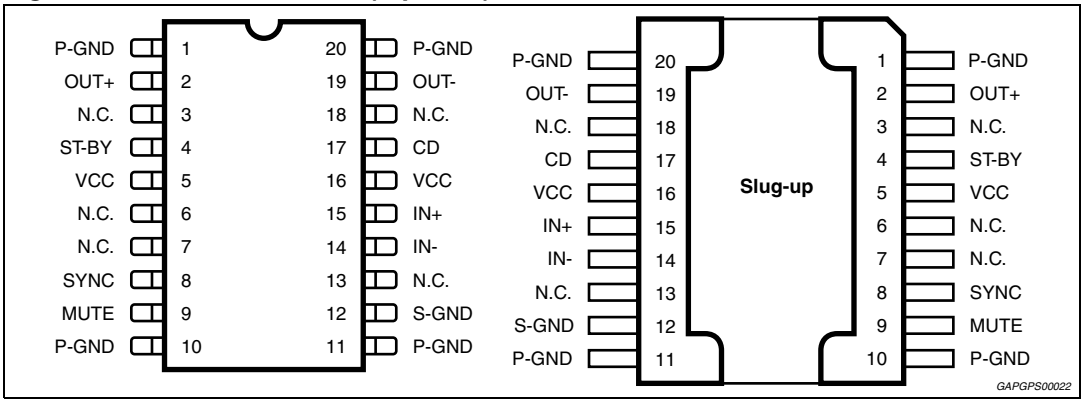


Table 2. Pins function

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%). 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_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. 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 °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
$R_{th\ j\text{-}case}$	Thermal resistance junction-to-case	Max.	2	°C/W

3.3 Electrical characteristics

V_S = 14.4 V; R_L = 4 Ω, f = 1 kHz, T_{amb} = 25 °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	$V_{ST\text{-}BY}$ = 1.5 V	-	-	100	µA
I_{SBin}	Standby input Bias current	$V_{ST\text{-}BY}$ = 5 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 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 Ω	-	32	-	W
$P_{O\ EIAJ}$	EIAJ output power (*)	V_S = 13.7 V	-	40	-	W
d	Distortion	-	-	0.06	-	%
		P_O = 0.1 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	-	kΩ
		Single Ended	30	55	-	kΩ
E_{IN}	Input noise voltage	R_g = 0 Ω; f = 22 Hz to 22 kHz	-	4	-	mV
CMRR	Input common mode rejection	f = 1 kHz; V_{IN} = 1 V_{rms}	-	65	-	dB
SVR	Supply voltage rejection	R_g = 0 Ω; V_r = 1 Vrms	-	60	-	dB
CDL	Clipping detection level	-	-	10	-	%
T_{sd}	Absolute thermal shutdown junction temperature	-	-	160	-	°C

3.4 Electrical characteristics curves

Figure 4. Quiescent current vs. supply voltage

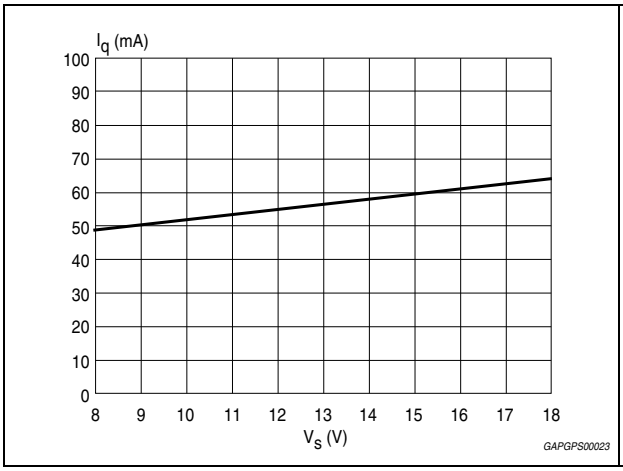


Figure 5. EIAJ power vs. supply voltage

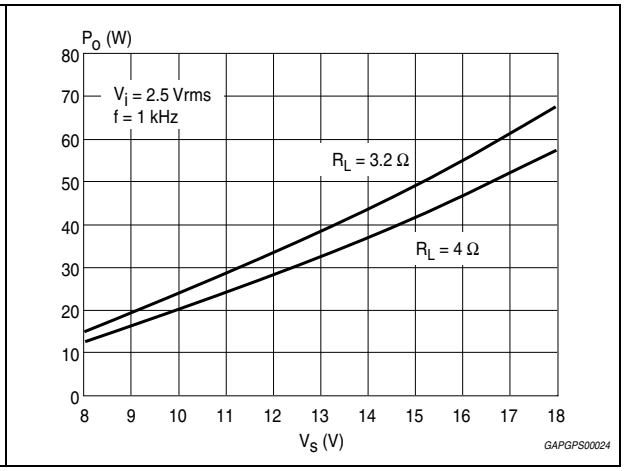


Figure 6. Output power vs. supply voltage (@R_L = 4Ω)

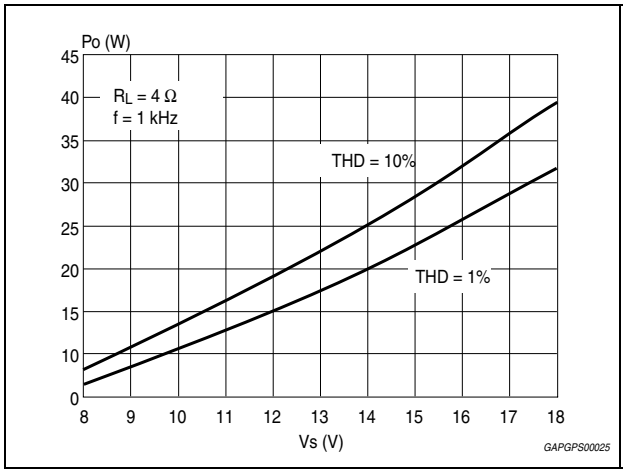


Figure 7. Distortion vs. frequency (@ R_L = 4Ω)

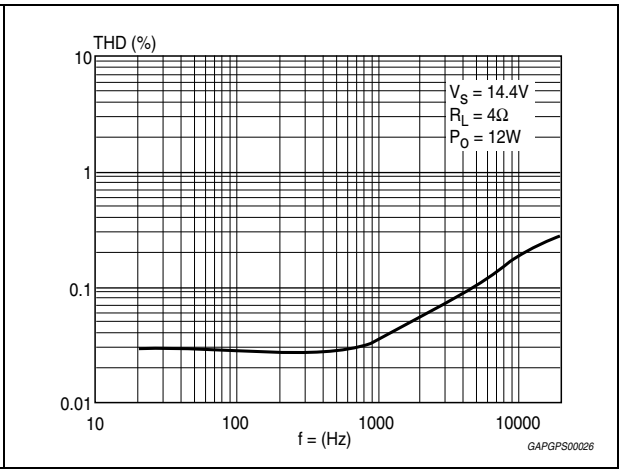


Figure 8. Output power vs. supply voltage (@R_L = 3.2Ω)

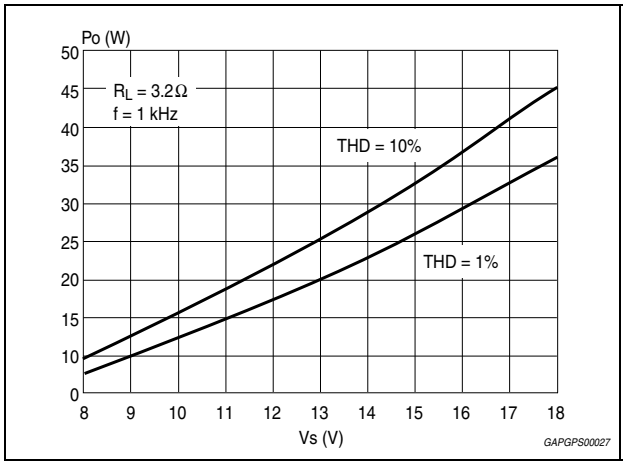


Figure 9. Distortion vs. frequency (@ R_L = 3.2Ω)

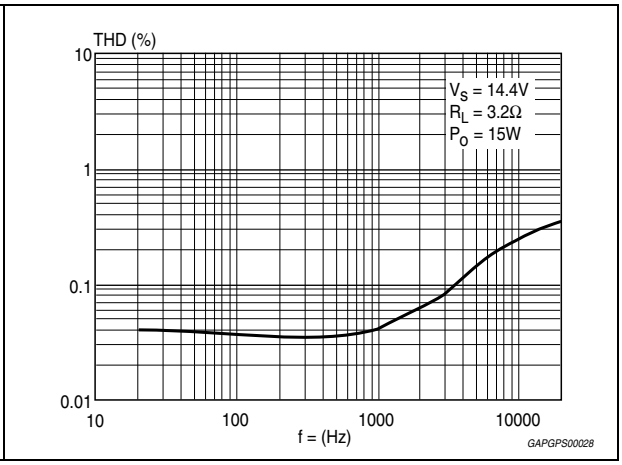


Figure 10. Supply voltage rejection vs. frequency

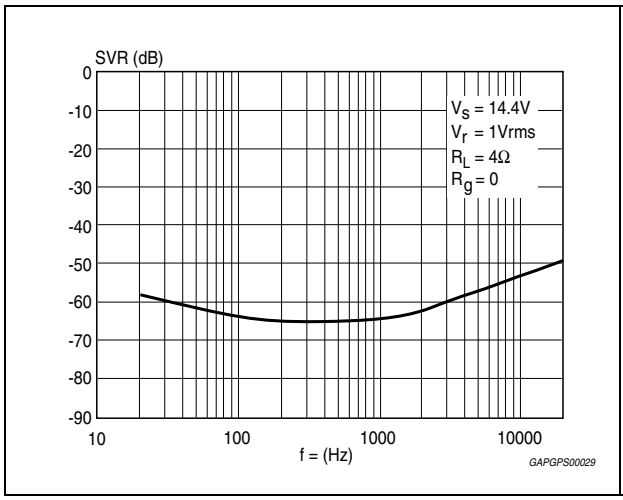


Figure 11. Common mode rejection vs. frequency

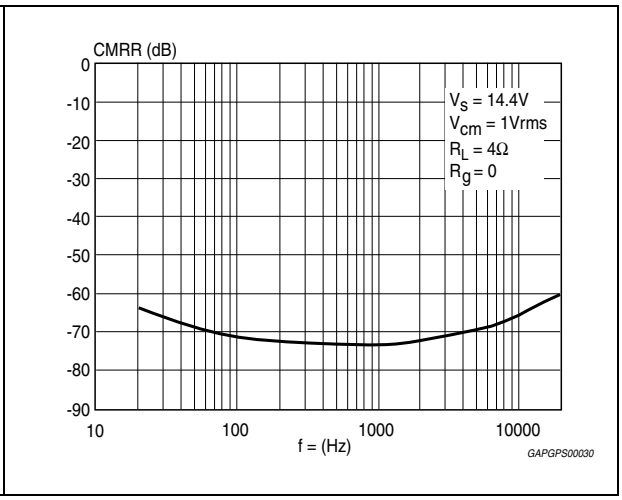


Figure 12. Total power dissipation and effic. vs. output power (@R_L = 4Ω)

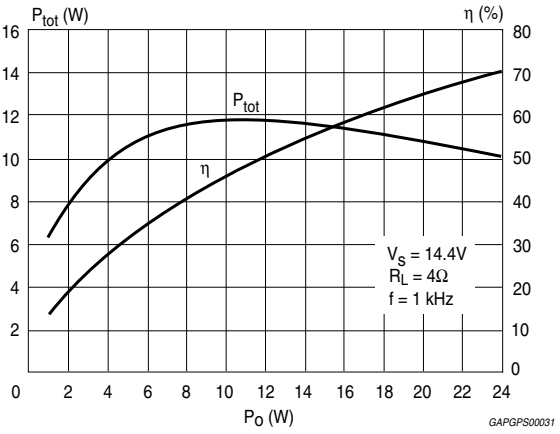
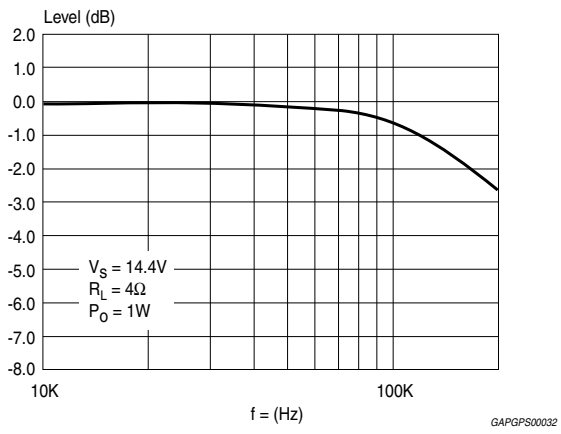


Figure 13. Power bandwidth



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*.

ECOPACK® is an ST trademark.

Figure 14. PowerSO20 mechanical data and package dimensions

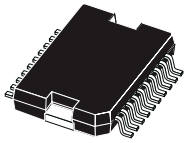
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A1			3.6			0.142
a1	0.1		0.3	0.004		0.012
a2			3.3			0.130
a3	0		0.1	0.000		0.004
b	0.4		0.53	0.016		0.021
c	0.23		0.32	0.009		0.013
D (1)	15.8		16	0.622		0.630
D1 (2)	9.4		9.8	0.370		0.386
E	13.9		14.5	0.547		0.570
e		1.27			0.050	
e3		11.43			0.450	
E1 (1)	10.9		11.1	0.429		0.437
E2			2.9			0.114
E3	5.8		6.2	0.228		0.244
G	0		0.1	0.000		0.004
H	15.5		15.9	0.610		0.626
h			1.1			0.043
L	0.8		1.1	0.031		0.043
N	8° (Typ.)					
S	8° (Max.)					
T		10			0.394	

(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", "G" and "a3".

(2) For subcontractors, the limit is the one quoted in jedec MO-166

OUTLINE AND MECHANICAL DATA

Weight: 1.9gr



JEDEC MO-166

PowerSO20

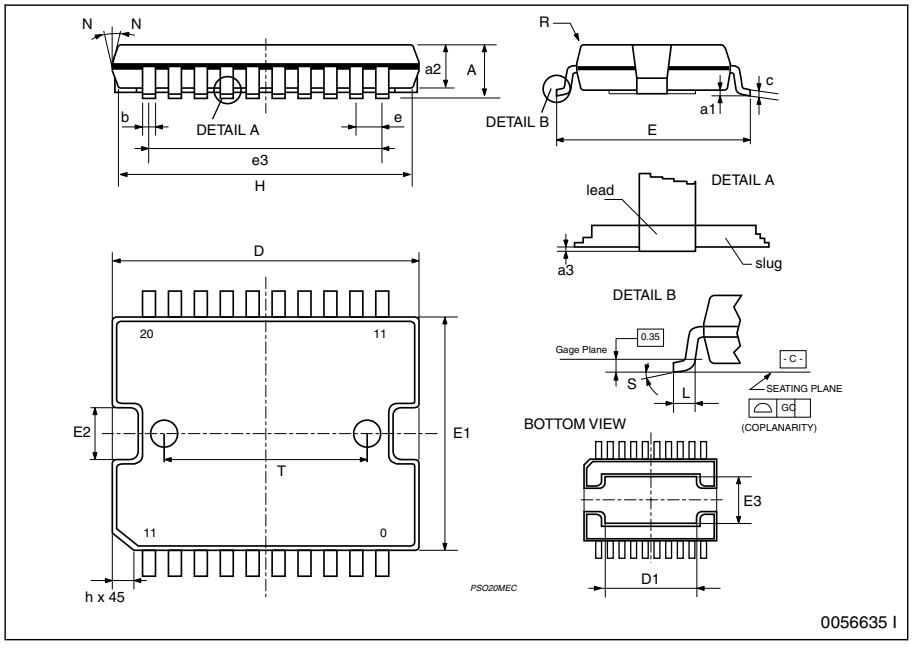
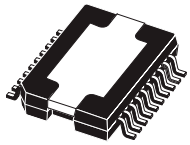


Figure 15. PowerSO20 (slug-up) mechanical data and package dimensions

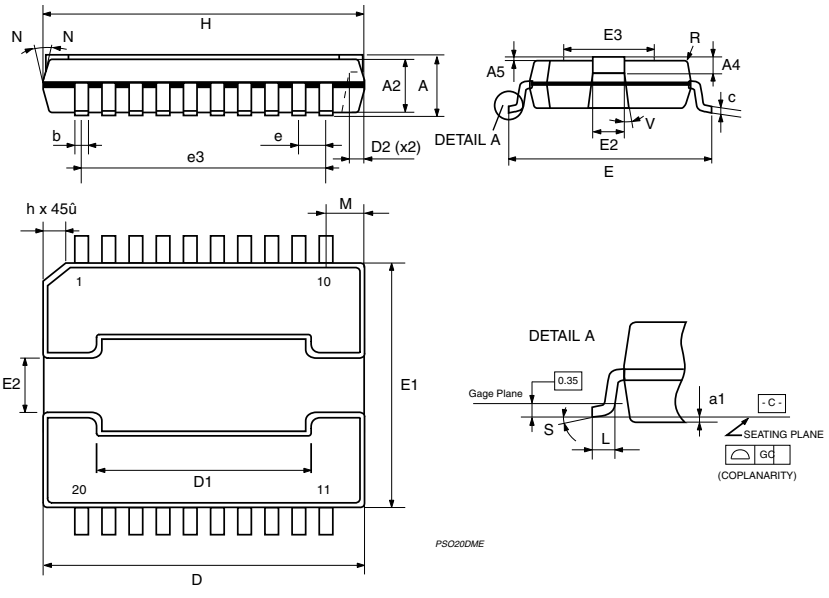
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	3.25		3.5	0.128		0.138
A2	3	3.15	3.3	0.118	0.124	0.130
A4	0.8		1	0.031		0.039
A5	0.15	0.2	0.25	0.006	0.008	0.010
a1	0.030		-0.040	0.0012		-0.0016
b	0.4		0.53	0.016		0.021
c	0.23		0.32	0.009		0.012
D (1)	15.8		16	0.622		0.630
D1	9.4		9.8	0.370		0.385
D2		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)



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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 *Table 1: Device summary*. Added ECOPACK description in *Section 5: Package information*.
19-Apr-2010	3	Updated *Table 1: Device summary*.
26-Jan-2011	4	Updated *Table 1: Device summary*. Added PowerSO20 (slug-up) drawing in *Figure 3*. Added PowerSO20 (slug-up) in *Section 4: Package information*.
16-Sep-2013	5	Updated Disclaimer.

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