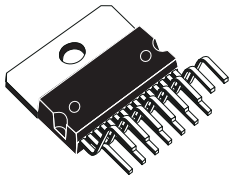
L5957

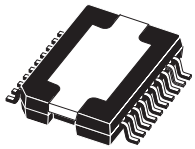
Multifunction voltage regulator for car radio

Features

- Four outputs:
  - 8.5 V @ 500 mA
  - 5 V @ 300 mA Permanent
  - 5 V @ 800 mA
  - 3.3 V @ 800 mA
- 2 A high side driver
- Reset function
- Ignition comparator
- Load dump protection
- Thermal shutdown
- Overcurrent limitation
- All pins ESD protected



Multiwatt15 (Vertical)



PowerSO20 (Slug up)

Description

The L5957 contains a triple voltage regulator and a power switch.

The IC includes a monitoring circuit for detection.

The IC features a very low quiescent current in standby.

Table 1. Device summary

Order code	Package	Packing
L5957PD	PowerSO20 (slug up)	Tube
L5957PDTR	PowerSO20 (slug up)	Tape and reel
L5957	Multiwatt15 (Vertical)	Tube

Contents

1 Block and pins connection diagrams 5

2 Electrical specifications 6

2.1 Absolute maximum ratings 6

2.2 Thermal data 6

2.3 Electrical characteristics 6

3 Package information 13

4 Revision history 15

List of tables

Table 1. Device summary 1
Table 2. Absolute maximum ratings 6
Table 3. Thermal data 6
Table 4. Electrical characteristics 6
Table 5. Document revision history 15

List of figures

Figure 1. Block diagram . . . 5
Figure 2. Pins connection . . . 5
Figure 3. Typical application circuit . . . 9
Figure 4. Maximum ESR for stability valid for all the regulators outputs . . . 10
Figure 5. Timing diagram of regulators and power switch . . . 10
Figure 6. Backup and reset diagram . . . 11
Figure 7. Hold and thermal protection . . . 11
Figure 8. Ignition buffer diagram . . . 12
Figure 9. Protection of the power switch . . . 12
Figure 10. Short circuit diagram . . . 12
Figure 11. PowerSO20 (slug up) mechanical data and package dimensions . . . 13
Figure 12. Multiwatt15 (vertical) mechanical data and package dimensions . . . 14

1 Block and pins connection diagrams

Figure 1. Block diagram

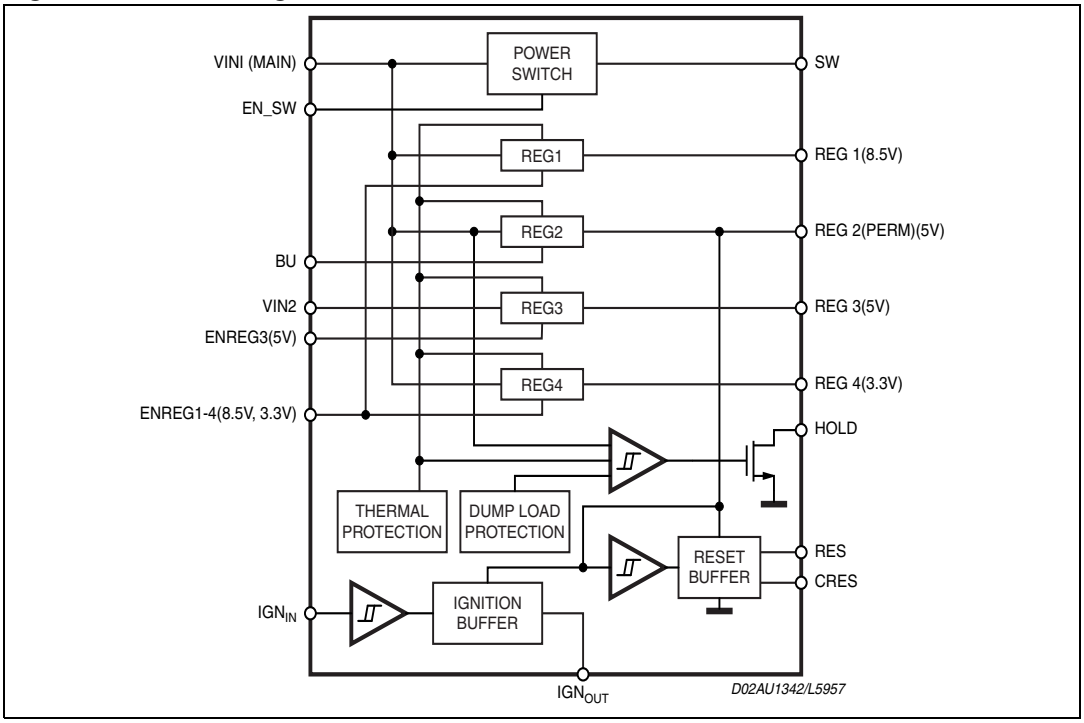
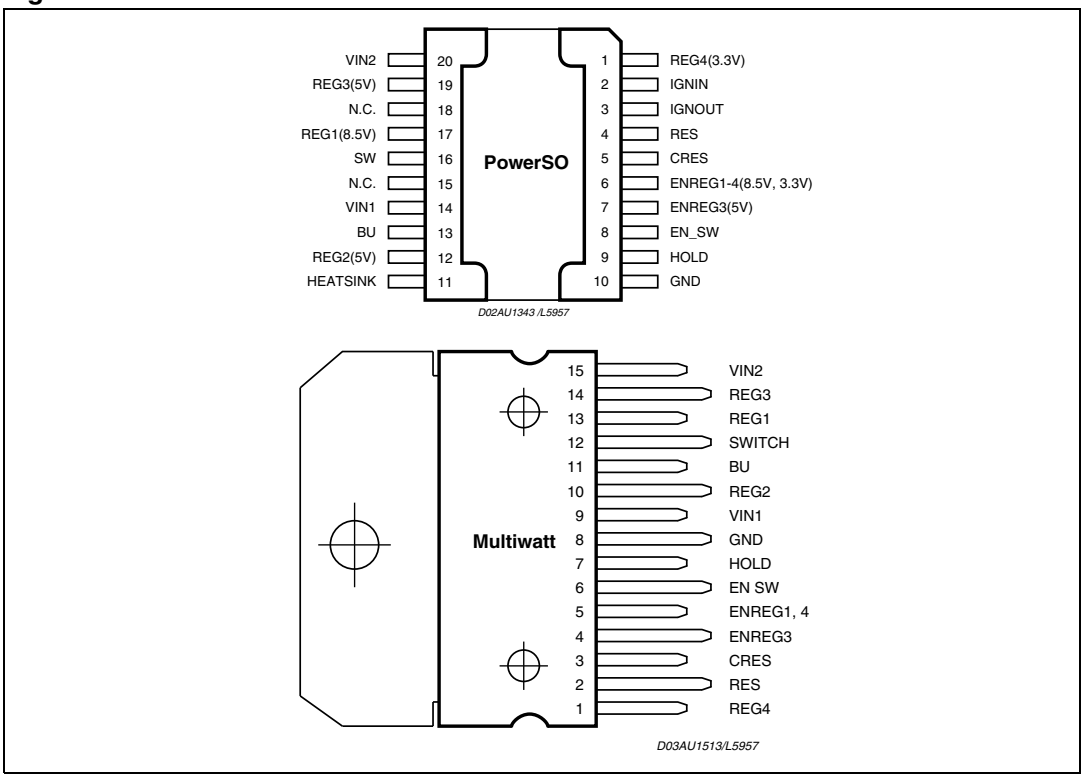


Figure 2. Pins connection



2 Electrical specifications

2.1 Absolute maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{SDC}	DC operating supply voltage	30	V
V_{STR}	Transient supply voltage	50	V
I_O	Output current	internally limited	
T_{op}	Operating temperature range	-40 to 85	°C
T_{stg}	Storage temperature	-55 to 150	°C
T_j	Junction temperature	-55 to 150	°C
P_d	Power dissipation T_{case} = 85 °C	43	W

2.2 Thermal data

Table 3. Thermal data

Symbol	Parameter	PowerSO	Multiwatt	Unit
$R_{th\ j\text{-}case}$	Thermal resistance junction-to-case Max.	1.5	1.8	°C/W

2.3 Electrical characteristics

V_S = 14.4 V; T_{amb} = 25 °C; unless otherwise specified.

Table 4. Electrical characteristics

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
Input supplies						
V_{in1}	Input supply voltage 1	Operating	9	-	18	V
V_{in2}	Input supply voltage 2	Operating	6	-	18	V
I_q	Total quiescent current	Standby (-20 °C to 85 °C) IGN_{IN} = 5 V	-	-	70	µA
		REGx = 5 V, REGsw = 5 V, IGN_{IN} = 5 V	-	5	-	mA
		Standby (-20 °C to 85 °C) IGN_{IN} = 5 V, V_{CC} = 18 V	-	100	-	µA
Load Dump V_{in1}	Battery over voltage	V_{in1}	18	20	22	V
Load Dump V_{in2}		V_{in2}	18	20	22	V

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
Regulator 1						
$V_{o\ (REG\ 1)}$	Output voltage 8.5 V	-	8	8.5	9	V
ΔV	Line regulation	V_{in1} = 10 to 18 V; I = 500 mA	-	-	50	mV
		V_{in1} = 9.3 to 18 V; I = 10 mA	-	-	50	mV
ΔVi	Load regulation	I_{reg1} = 1 to 500 mA	-	-	100	mV
I_q	Quiescent current	I_{reg1} = 10 mA	-	-	5	mA
PSRR	Supply voltage ripple rejection	f = 1 kHz; V_{in1} = 1.5 Vpp; I_o = 500 mA	50	-	-	dB
V_{drop}	Drop out voltage	I_{reg1} = 500 mA (1)	-	-	0.6	V
I_m	Current limit	R_{short} = 0.5 Ω	0.6	-	1.2	A
Regulator 2						
$V_{o\ (ST\ BY)}$	Output voltage 5 V	-	4.7	5	5.3	V
ΔV	Line regulation	V_{in1} = 7 to 18 V; I = 300 mA	-	-	50	mV
		V_{in1} = 6 to 18 V; I = 10 mA	-	-	50	mV
ΔVi	Load regulation	I_{reg2} = 1 to 300 mA	-	-	100	mV
I_q	Quiescent Current	I_{reg2} = 10 mA	-	-	3	mA
PSRR	Supply voltage ripple rejection	f = 1 kHz; V_{in1} = 1.5 Vpp; I_o = 300 mA	50	-	-	dB
V_{drop}	Drop out voltage	I_{reg2} = 300 mA (1)	-	-	1.5	V
		I_{reg2} = 100 mA (1)	-	-	0.6	V
I_m	Current limit	R_{short} = 0.5 Ω	400	-	800	mA
Regulator 3						
$V_{o\ (REG\ 3)}$	Output voltage 5V	-	4.75	5	5.25	V
ΔV	Line regulation	V_{in2} = 7 to 18 V; I = 800 mA	-	-	50	mV
		V_{in2} = 6 to 18 V; I = 10 mA	-	-	50	mV
ΔVi	Load regulation	I_{reg3} = 1 to 800 mA	-	-	100	mV
I_q	Quiescent current	I_{reg3} = 10 mA	-	-	5	mA
PSRR	Supply voltage ripple rejection	f = 1 kHz; V_{in1} = 1.5 Vpp; I_o = 800 mA	50	-	-	dB
V_{drop}	Drop out voltage	I_{reg3} = 800 mA (1)	-	-	1.5	V
I_m	Current limit	R_{short} = 0.5 Ω	1	-	2	A
Regulator 4						
$V_{o\ (REG\ 4)}$	Output voltage 3.3V	-	3.10	3.3	3.50	V
ΔV	Line regulation	V_{in2} = 6 to 18 V; I = 800 mA	-	-	50	mV
ΔV	Line regulation	V_{in2} = 6 to 18 V; I = 10 mA	-	-	50	mV

Table 4. Electrical characteristics (continued)

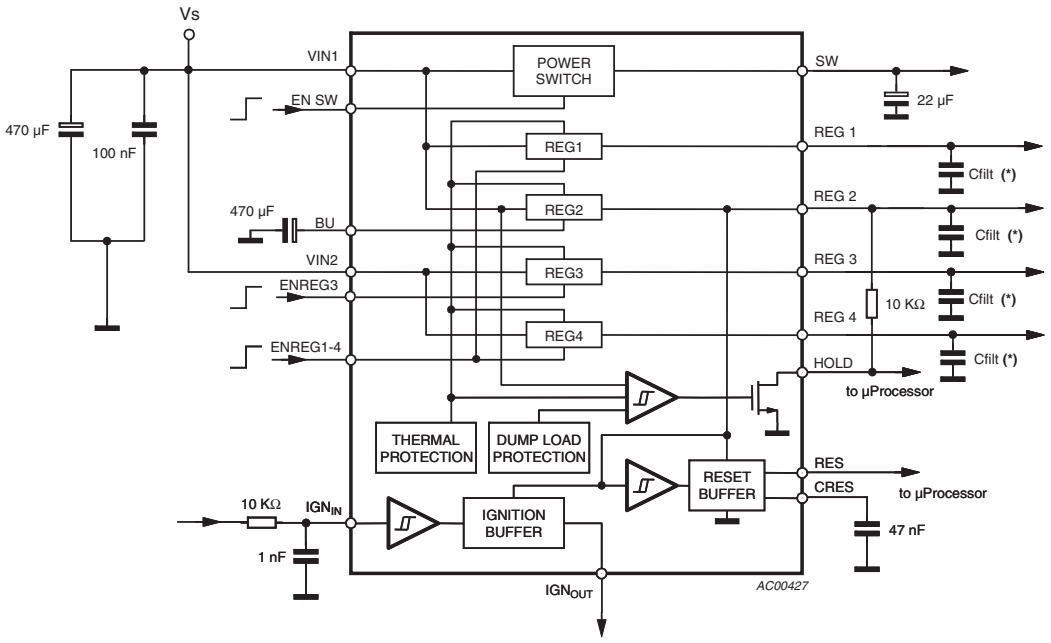
Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
ΔVi	Load regulation	I_{reg4} = 1 to 800 mA	-	-	100	mV
I_q	Quiescent current	I_{reg4} = 10 mA	-	-	5	mA
PSRR	Supply voltage ripple rejection	f = 1 kHz; V_{in1} = 1.5 Vpp; I_o = 800 mA	48	-	-	dB
V_{drop}	Drop out voltage	I_{reg4} = 800 mA (1)	-	-	2.65	V
I_m	Current limit	R_{short} = 0.5 Ω	0.9	-	2	A
Power switch						
V_{dropSW}	Drop voltage power switch	I_{dcSW} = 1.8 A max.	-	-	0.5	V
I_{pSW1}	Peak current power switch	Peak time < 10 ms	2	-	3.5	A
I_{pSW2}		Peak time > 40 ms	1	-	2	A
SW_{DEL}	Delay Protection	-	15	-	45	ms
Reset buffer (with push-pull buffer)						
RES	RES falling	Vreg2 = 5 V	4.6	4.7	4.8	V
RES	RES rising	Vreg2 = 5 V	4.65	4.8	4.95	V
$V_{HYS(RES)}$	Hysteresis of reset buffer	-	50	-	200	mV
$IH_{source\ (RES)}$	High level source current	Reset = 0 V	1000	1300	1600	µA
$IL_{sink\ (RES)}$	Low level sink current	Reset = 5 V	14	16	18	mA
RES_{delay}	Cres = 47nF	-	10	-	60	ms
$\Delta TRES$	Reset rise and fall time	R = 10 kΩ C = 15 pF	-	-	50	µs
I_{Charge}	Charge current	C_{RES} = 0 V	3	5	10	µA
$I_{Discharge}$	Discharge current	C_{RES} = 5 V	1	-	3	mA
$V_{TH(F)}$	Falling voltage threshold	-	1	1.2	1.4	V
$V_{TH(R)}$	Rising voltage threshold	-	2.5	2.8	3.5	V
V_{ol}	Low level	$I_{SINK(RES)}$ = 1 mA		0.3	0.5	V
V_{oh}	High level	-	4.5	Vreg2	5.5	V
Hold signal						
V_{lowl}	Hold output low for V_{in1} low	Low detection	-	-	9	V
V_{lowh}	Hold output high for V_{in1} normal	Normal high detection	10	-	18	V
V_{lowl}	Hold output low for V_{in1} high	low detection	22	-	-	V
$V_{HOLD\ R}$	Low V_{IN1} threshold	V_{IN1} Low TH.	9	9.5	10	V
$V_{HYS\ (HOLD_L)}$	Hysteresis low TH.	-	50	150	200	mV
$V_{HOLD\ F}$	High V_{IN1} threshold	V_{IN1} High TH.	18	20	22	V
$V_{HYS\ (HOLD_M)}$	Hysteresis high TH.	-	50	150	250	mV

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
Ignition buffer (push-pull with schmitt trigger)						
IGN_{IN}	$IGN_{out\ falling}$	-	1.03	1.17	1.28	V
IGN_{IN}	$IGN_{out\ rising}$	-	1.18	1.27	1.33	V
$V_{hys(IGNout)}$	Hysteresis of ignition buffer	-	30	50	100	mV
$IH_{source(IGNout)}$	High level source current	I_{GNout} = 0 V	1000	1500	2000	µA
$IL_{sink(IGNout)}$	Low level sink current	I_{GNout} = 5 V	10	15	20	mA
V_{ol}	Low level	$IL_{sink\ (IGNout)}$ = 1 mA	-	0.3	0.5	V
V_{oh}	High level	-	4.5	Vreg2	5.5	V
IGN_{RISE}	Rising time	C = 15 pF	-	-	10	µs
IGN_{FALL}	Fall time	C = 15 pF	-	-	10	µs
I_{CLAMP}	Input clamp current	$V_{CC} < V_{IGN} < 50$ V	-	-	2	mA
IGN_{IN}	Input voltage	Operative	0	-	50	V
Enable input (regulators 1,3,4 and power switch)						
V_{TH}	Voltage threshold	-	1.3	-	2.3	V
EN_{IN}	Input voltage	Operative	0	-	5	V

1. Drop condition means that the supply voltage drop down to 100 mV from the regulated output and the regulator is sourcing its maximal load current.

Figure 3. Typical application circuit



(*) Recommended output filtering capacitors for all the regulators: C range = 5 µF to 100 µF, ESR range = 0.5 Ω to 10 Ω (T= -40 °C to +85 °C)

Figure 4. Maximum ESR for stability valid for all the regulators outputs

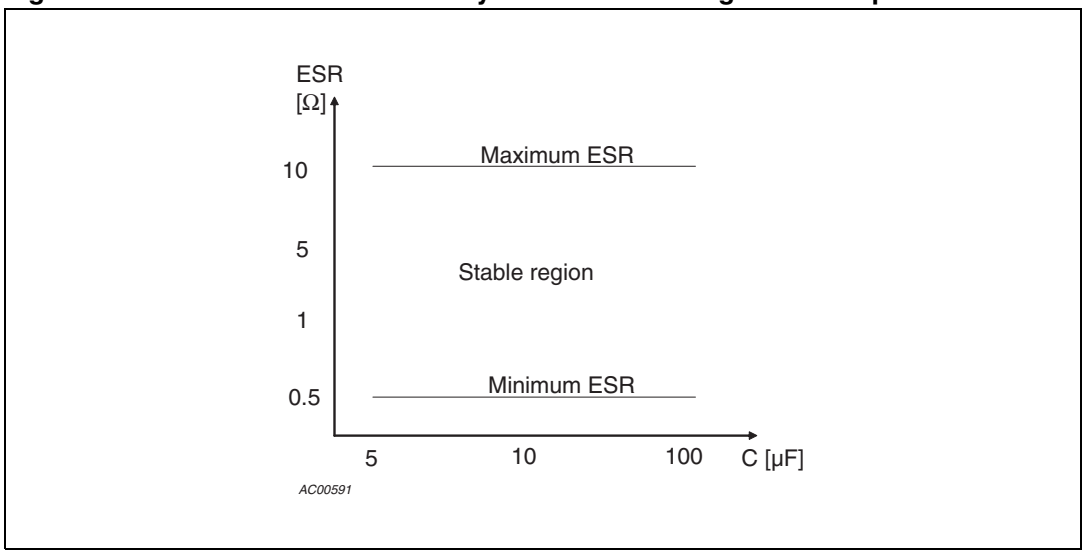


Figure 5. Timing diagram of regulators and power switch

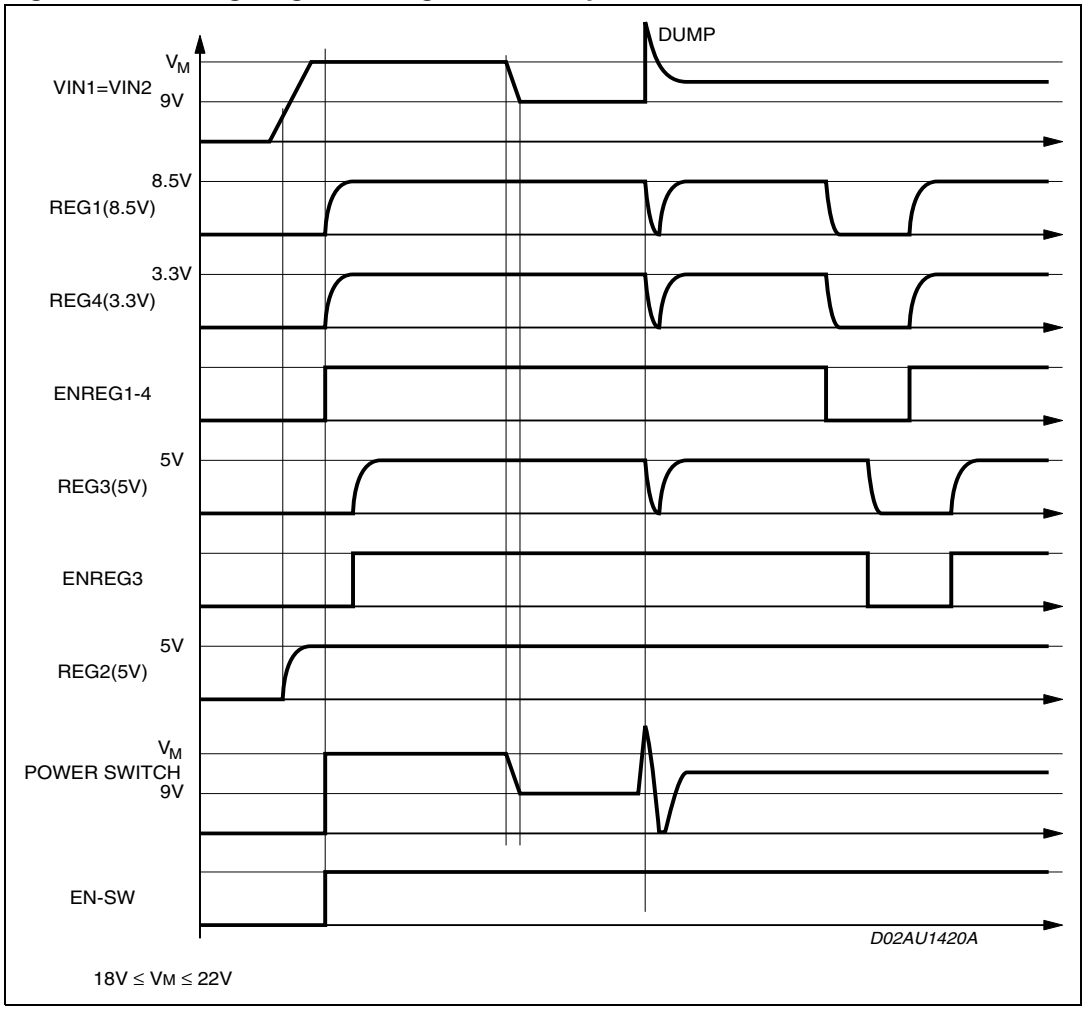


Figure 6. Backup and reset diagram

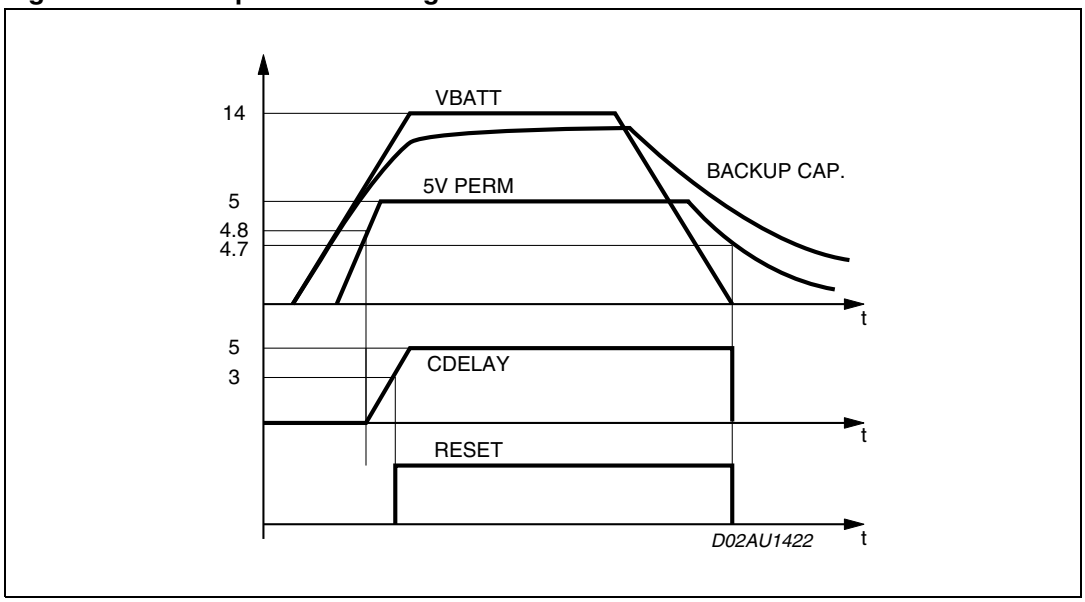


Figure 7. Hold and thermal protection

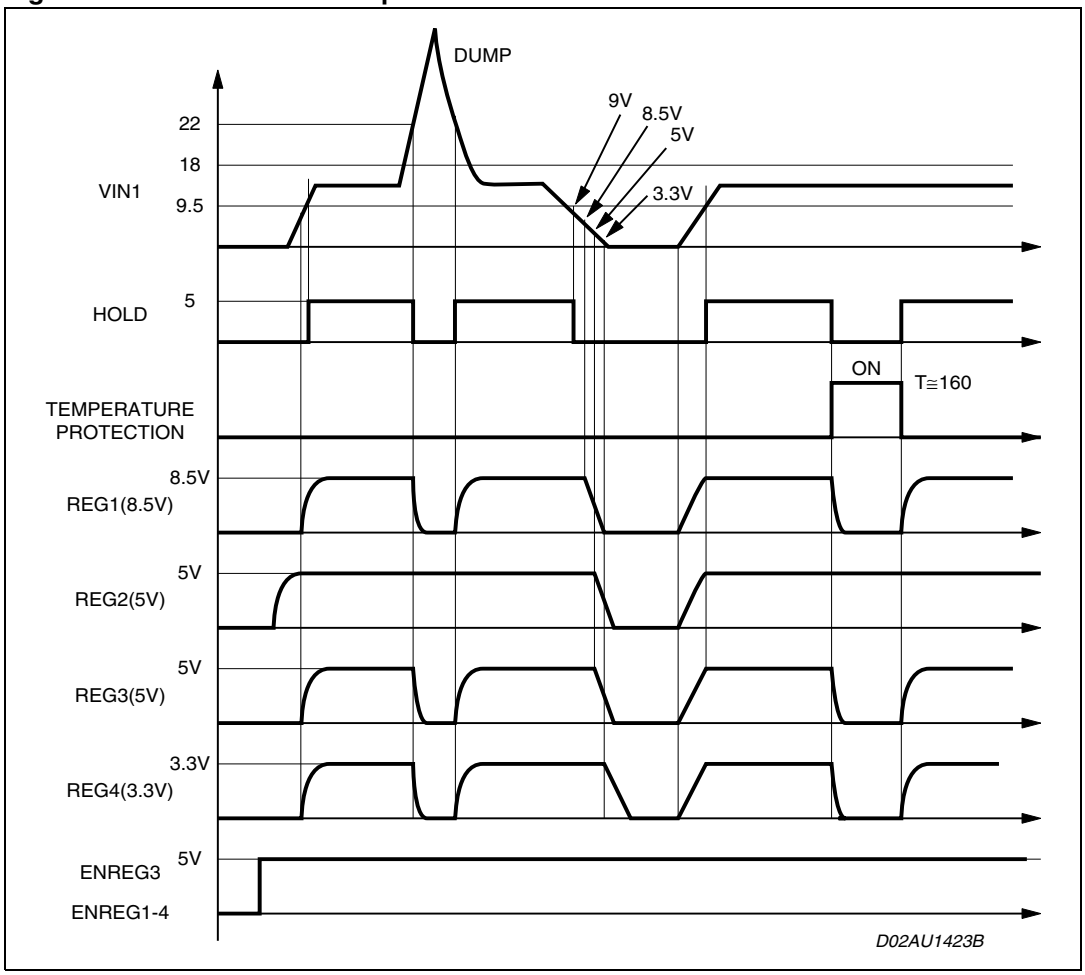


Figure 8. Ignition buffer diagram

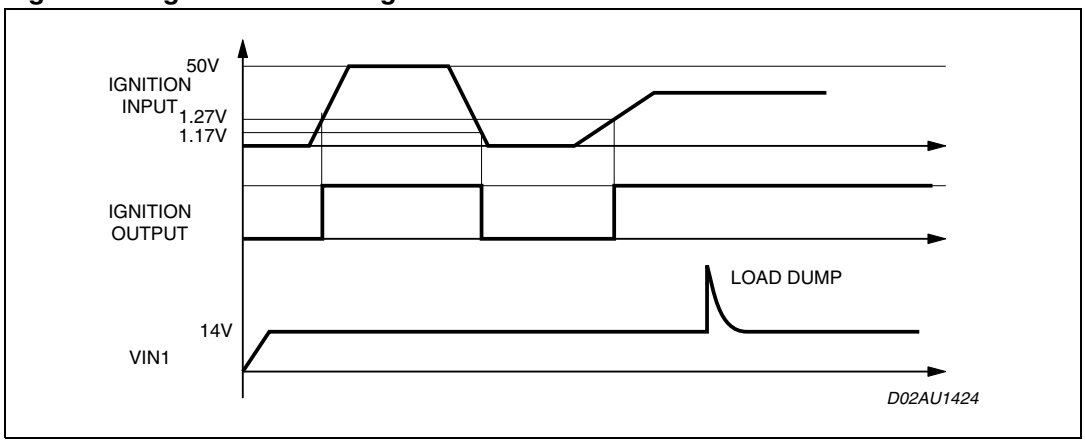


Figure 9. Protection of the power switch

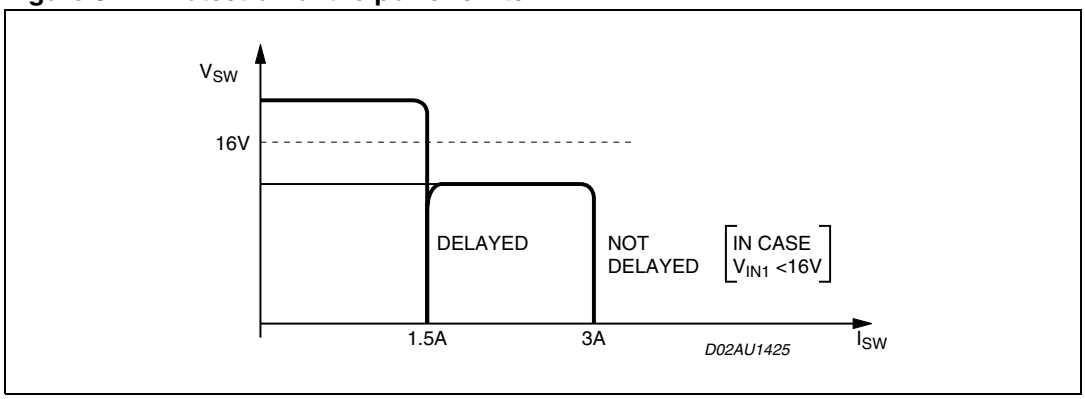
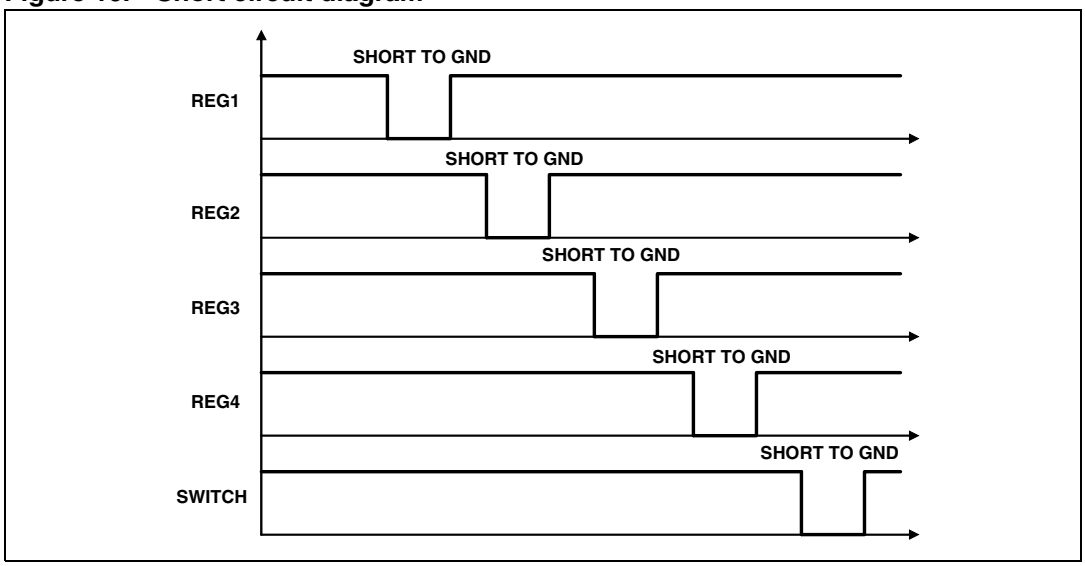


Figure 10. Short circuit diagram



3 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*.

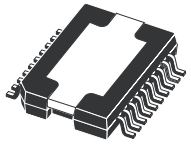
ECOPACK® is an ST trademark.

Figure 11. 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) ÒDÓ and E1Ó do not include mold flash or protusions.
- Mold flash or protusions shall not exceed 0.15mm (0.006Ó)
- Critical dimensions: ÒEÓ, Òa1Ó, Òe3Ó and ÒGÓ.

OUTLINE AND MECHANICAL DATA



PowerSO20 (SLUG UP)

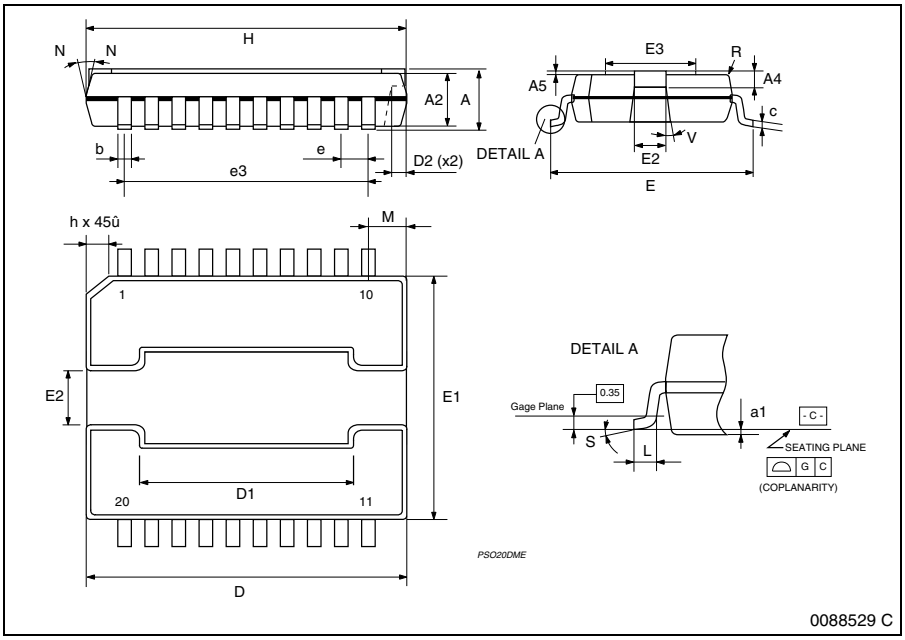
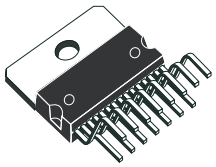


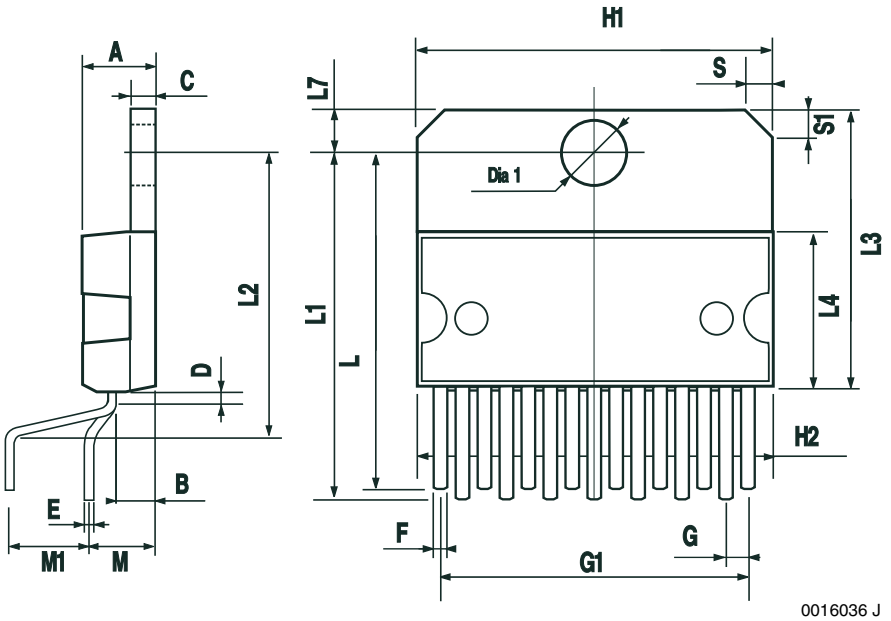
Figure 12. Multiwatt15 (vertical) mechanical data and package dimensions

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A5						0.197
B			2.65			0.104
C			1.6			0.063
D		1			0.039	
E	0.49		0.55	0.019		0.022
F	0.66		0.75	0.026		0.030
G	1.02	1.27	1.52	0.040	0.050	0.060
G1	17.53	17.78	18.03	0.690	0.700	0.710
H1	19.6			0.772		
H2			20.2			0.795
L	21.9	22.2	22.5	0.862	0.874	0.886
L1	21.7	22.1	22.5	0.854	0.87	0.886
L2	17.65		18.1	0.695		0.713
L3	17.25	17.5	17.75	0.679	0.689	0.699
L4	10.3	10.7	10.9	0.406	0.421	0.429
L7	2.65		2.9	0.104		0.114
M	4.25	4.55	4.85	0.167	0.179	0.191
M1	4.73	5.08	5.43	0.186	0.200	0.214
S	1.9		2.6	0.075		0.102
S1	1.9		2.6	0.075		0.102
Dia1	3.65		3.85	0.144		0.152

OUTLINE AND MECHANICAL DATA



Multiwatt15 (vertical)



4 Revision history

Table 5. Document revision history

Date	Revision	Changes
11-Feb-2008	1	Initial release.
08-Jan-2010	2	Updated *Section 1: Block and pins connection diagrams on page 5*. Updated *Figure 3*, *5* and *6*.
20-Sep-2013	3	Updated disclaimer.

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST’s terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST’S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

ST PRODUCTS ARE NOT DESIGNED OR AUTHORIZED FOR USE IN: (A) SAFETY CRITICAL APPLICATIONS SUCH AS LIFE SUPPORTING, ACTIVE IMPLANTED DEVICES OR SYSTEMS WITH PRODUCT FUNCTIONAL SAFETY REQUIREMENTS; (B) AERONAUTIC APPLICATIONS; (C) AUTOMOTIVE APPLICATIONS OR ENVIRONMENTS, AND/OR (D) AEROSPACE APPLICATIONS OR ENVIRONMENTS. WHERE ST PRODUCTS ARE NOT DESIGNED FOR SUCH USE, THE PURCHASER SHALL USE PRODUCTS AT PURCHASER’S SOLE RISK, EVEN IF ST HAS BEEN INFORMED IN WRITING OF SUCH USAGE, UNLESS A PRODUCT IS EXPRESSLY DESIGNATED BY ST AS BEING INTENDED FOR “AUTOMOTIVE, AUTOMOTIVE SAFETY OR MEDICAL” INDUSTRY DOMAINS ACCORDING TO ST PRODUCT DESIGN SPECIFICATIONS. PRODUCTS FORMALLY ESCC, QML OR JAN QUALIFIED ARE DEEMED SUITABLE FOR USE IN AEROSPACE BY THE CORRESPONDING GOVERNMENTAL AGENCY.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.
Information in this document supersedes and replaces all information previously supplied.
The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2013 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com