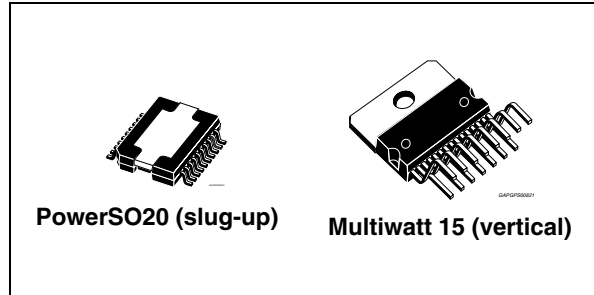


Multifunction voltage regulator for car radio

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



Description

The L5956 contains a triple voltage regulator and a power switch.

The IC includes a monitoring circuit for detection.

The IC features a very low quiescent under standby.

Table 1. Device summary

Order code	Package	Packing
L5956	Multiwatt 15 (vertical)	Tube
L5956PD	PowerSO20	Tube
L5956PDTR	PowerSO20	Tape and reel

Contents

1 Block diagram and pins description 5

 1.1 Block diagram 5

 1.2 Pins description 5

2 Electrical specifications 6

 2.1 Absolute maximum ratings 6

 2.2 Thermal data 6

 2.3 Electrical characteristics 6

3 Timing diagrams 11

4 Package information 14

5 Revision history 16



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 16

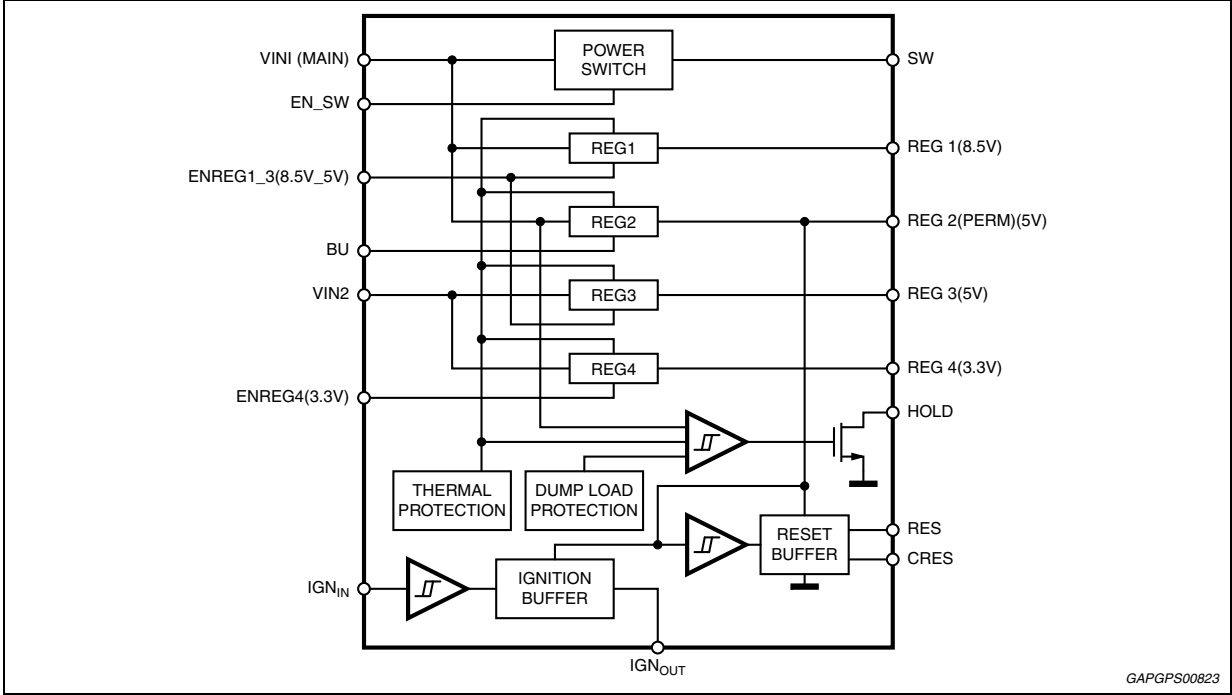
List of figures

Figure 1.	Block diagram	5
Figure 2.	Pins connection (top view)	5
Figure 3.	Typical application circuit	10
Figure 4.	Maximum ESR for stability valid for all the regulators outputs	10
Figure 5.	Timing diagram of regulators and power switch	11
Figure 6.	Backup and reset diagram	11
Figure 7.	Hold and thermal protection	12
Figure 8.	Ignition buffer diagram	12
Figure 9.	Protection of the power switch	12
Figure 10.	Short circuit diagram	13
Figure 11.	PowerSO20 (slug-up) mechanical data and package dimensions	14
Figure 12.	Multiwatt 15 (vertical) mechanical data and package dimensions	15

1 Block diagram and pins description

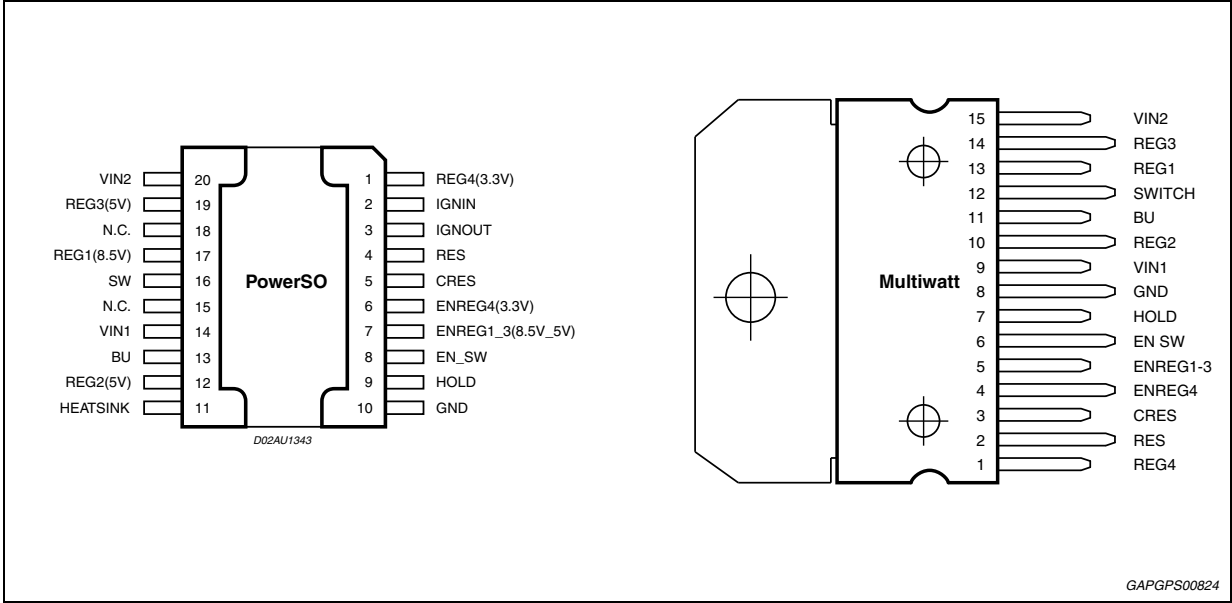
1.1 Block diagram

Figure 1. Block diagram



1.2 Pins description

Figure 2. Pins connection (top view)



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 at $T_{case} = 85\text{ °C}$	43	W

2.2 Thermal data

Table 3. Thermal data

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

2.3 Electrical characteristics

$V_S = 14.4\text{ V}$; $T_{amb} = 25\text{ °C}$; 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
V_{in1}	Input supply voltage 1	Reverse polarity	Non operating ⁽¹⁾			
V_{in2}	Input supply voltage 2	Reverse polarity	Non operating ⁽¹⁾			
I_q	Total quiescent current	Standby (-20° C to 85 °C) $IGN_{IN} = 5\text{ V}$	-	-	60	μA
		REGx = 5 V, REGsw = 5 V, $IGN_{IN} = 5\text{ V}$	-	5	-	mA
		Standby (-20 °C to 85 °C) $IGN_{IN} = 5\text{ V}$, $V_{CC} = 18\text{ V}$	-	100	170	μA

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
Load dump V_{in1}	Battery overvoltage	V_{in1}	18	20	22	V
Load dump V_{in2}	Battery overvoltage	V_{in2}	18	20	22	V
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
ΔV	Line regulation	$V_{in1} = 9.3$ to 18 V; $I = 10$ mA	-	-	50	mV
ΔV_i	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 ⁽²⁾	-	-	0.6	V
I_m	Current limit	$R_{short} = 0.5 \Omega$	0.6	-	1.2	A
REGULATOR 2						
V_o (ST BY)	Output voltage 5 V	-	4.75	5	5.25	V
ΔV	Line regulation	$V_{in1} = 7$ to 18 V; $I = 300$ mA	-	-	50	mV
ΔV	Line regulation	$V_{in1} = 6$ to 18 V; $I = 10$ mA	-	-	50	mV
ΔV_i	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 ⁽²⁾	-	-	1.5	V
V_{drop}	Drop out voltage	$I_{reg2} = 100$ mA ⁽²⁾	-	-	0.6	V
I_m	Current limit	$R_{short} = 0.5 \Omega$	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
ΔV	Line regulation	$V_{in2} = 6$ to 18 V; $I = 10$ mA	-	-	50	mV
ΔV_i	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 ⁽²⁾	-	-	1.5	V
I_m	Current limit	$R_{short} = 0.5 \Omega$	1	-	2	A

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
REGULATOR 4						
$V_{O(REG\ 4)}$	Output voltage 3.3 V	-	3.15	3.3	3.45	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
ΔV_i	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	50	-	-	dB
V_{drop}	Drop out voltage	$I_{reg4} = 800$ mA ⁽²⁾	-	-	2.5	V
I_m	Current limit	$R_{short} = 0.5\ \Omega$	1	-	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 < 15 ms	2	-	3.5	A
I_{pSW2}	Peak current power switch	Peak time > 40 ms	1	-	2	A
SW_{DEL}	Delay protection	-	15	-	40	ms
RESET BUFFER (with push-pull buffer)						
RES	RES falling	$V_{reg2} = 5$ V	4.6	4.7	4.8	V
RES	RES rising	$V_{reg2} = 5$ V	4.65	4.8	4.95	V
$V_{HYS(RES)}$	Hysteresis of reset buffer	-	50	100	200	mV
$I_{Hsource(RES)}$	High level source current	Reset = 0 V	1000	1300	1600	μ A
$I_{Lsink(RES)}$	Low level sink current	Reset = 5 V	14	16	18	mA
RES_{delay}	$C_{res} = 47$ nF	-	10	-	60	ms
ΔT_{RES}	Reset rise and fall time	$R = 10$ k Ω , $C = 15$ pF	-	-	50	μ s
I_{Charge}	Charge current	$C_{RES} = 0$ V	3	5	10	μ A
$I_{Discharge}$	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	V_{reg2}	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

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$V_{\text{HOLD R}}$	Low V_{IN1} threshold	V_{IN1} Low TH.	9	9.5	10	V
$V_{\text{HYS (HOLD_L)}}$	Hysteresis low TH.	-	50	150	200	mV
$V_{\text{HOLD F}}$	High V_{IN1} threshold	V_{IN1} High TH.	18	20	22	V
$V_{\text{HYS (HOLD_M)}}$	Hysteresis high TH.	-	200		500	mV
IGNITION BUFFER (push-pull with Schmidt 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
$V_{\text{hys(IGNout)}}$	Hysteresis of ignition buffer	-	-	50	-	mV
$I_{\text{Hsource(IGNout)}}$	High level source current	$I_{\text{GNout}} = 0 \text{ V}$	1000	1500	2000	μA
$I_{\text{Lsink(IGNout)}}$	Low level sink current	$I_{\text{GNout}} = 5 \text{ V}$	10	15	20	mA
V_{ol}	Low level	$I_{\text{Lsink (IGNout)}} = 1 \text{ mA}$	-	0.3	0.5	V
V_{oh}	High level	-	4.5	V_{reg2}	5.5	V
IGN_{RISE}	Rising time	$C = 15 \text{ pF}$	-	-	10	μs
IGN_{FALL}	Fall time	$C = 15 \text{ pF}$	-	-	10	μs
I_{CLAMP}	Input clamp current	$V_{\text{CC}} < V_{\text{IGN}} < 50 \text{ V}$	-	-	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	1.8	2.3	V
EN_{IN}	Input voltage	Operative	0	-	5	V

1. "Non operating" should be intended as a condition outside the absolute maximum ratings defined for the IC. As such, if the device is operated under such conditions, it is not guaranteed that the electrical parameters are inside the specification range.
2. 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

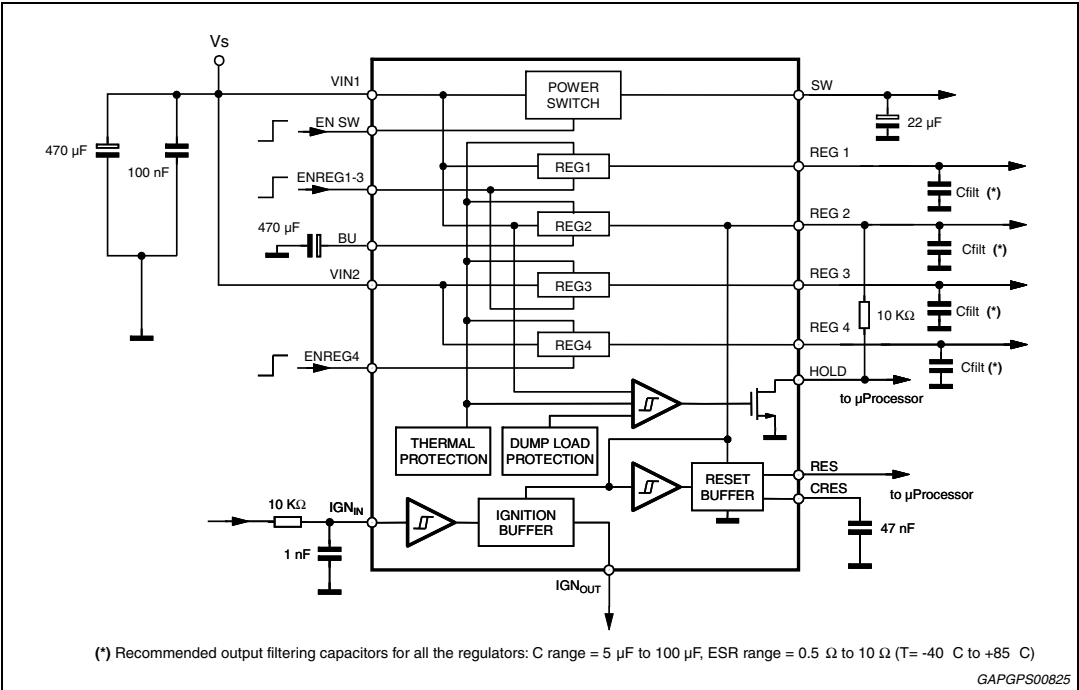
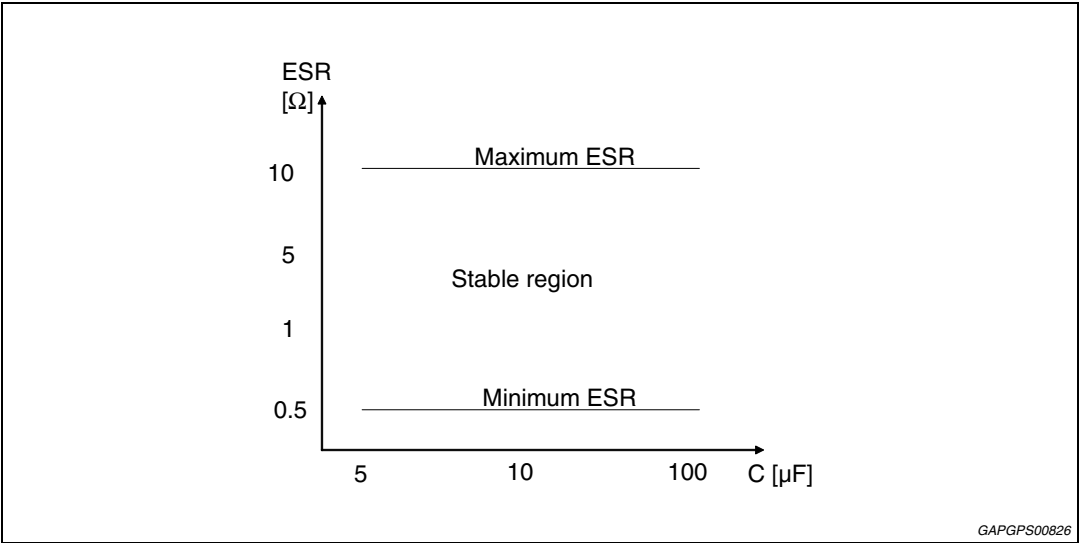


Figure 4. Maximum ESR for stability valid for all the regulators outputs



3 Timing diagrams

Figure 5. Timing diagram of regulators and power switch

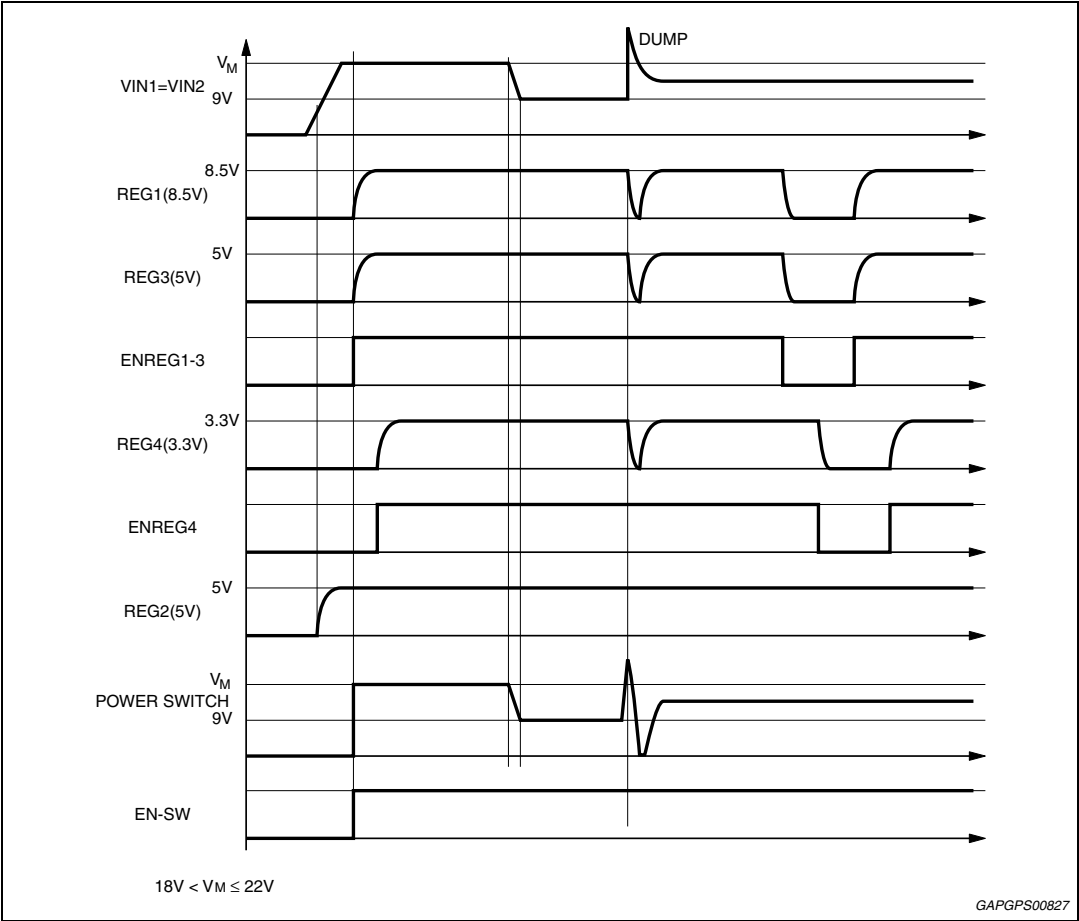


Figure 6. Backup and reset diagram

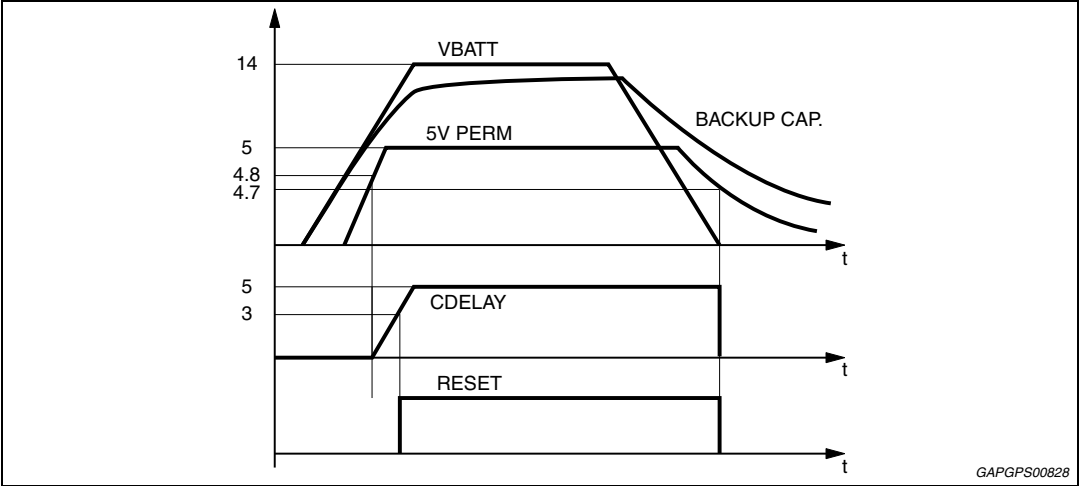


Figure 7. Hold and thermal protection

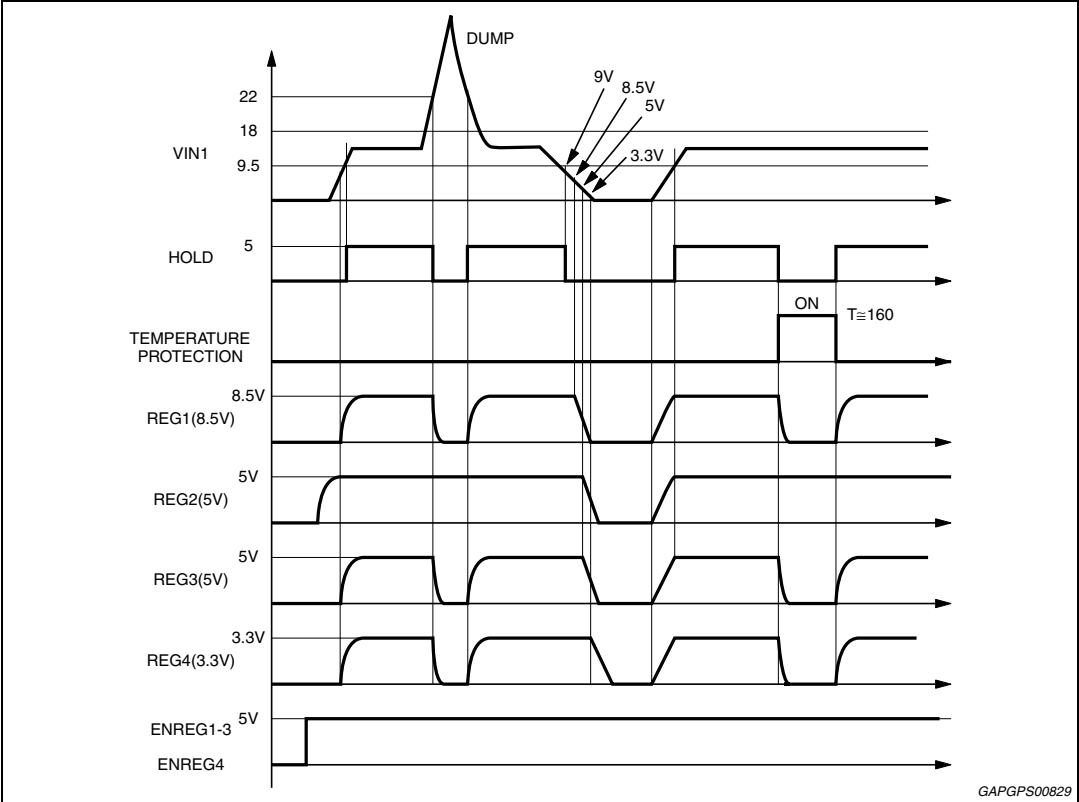


Figure 8. Ignition buffer diagram

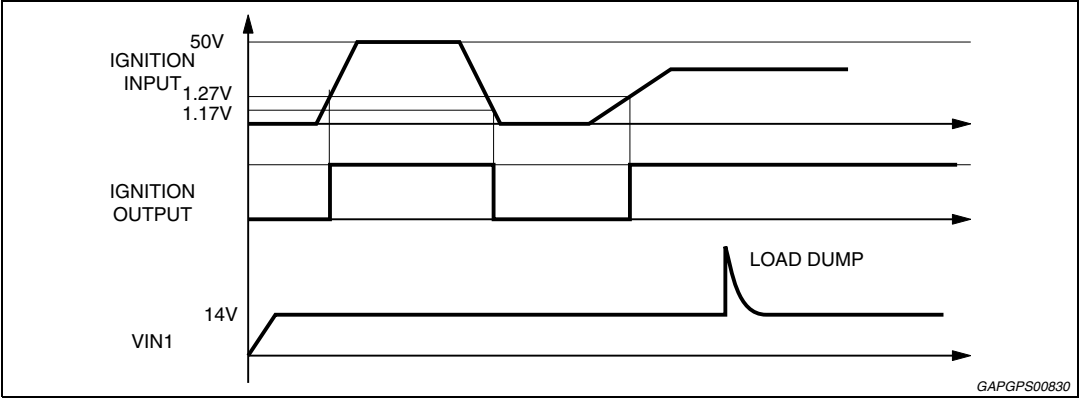


Figure 9. Protection of the power switch

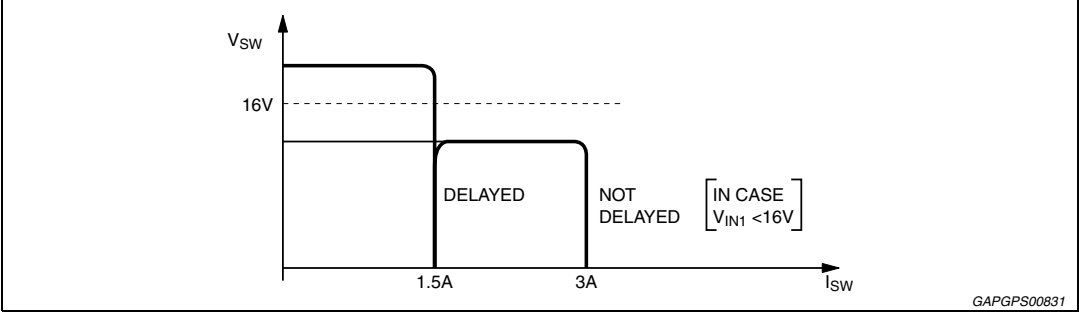
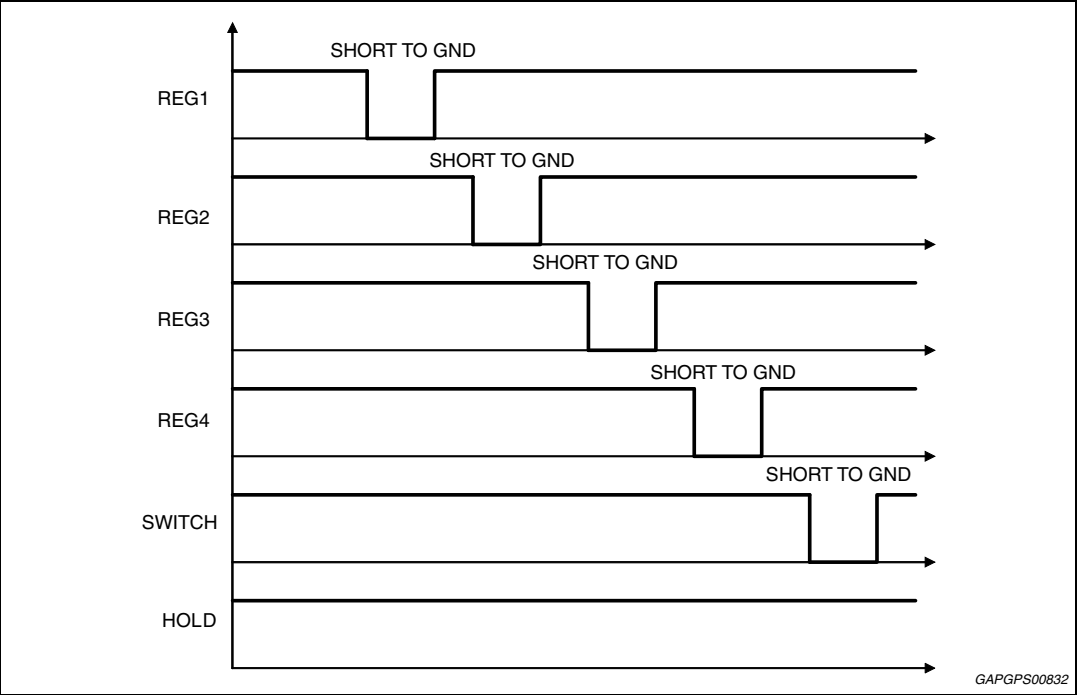


Figure 10. Short circuit diagram



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.

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Figure 11. PowerSO20 (slug-up) mechanical data and package dimensions

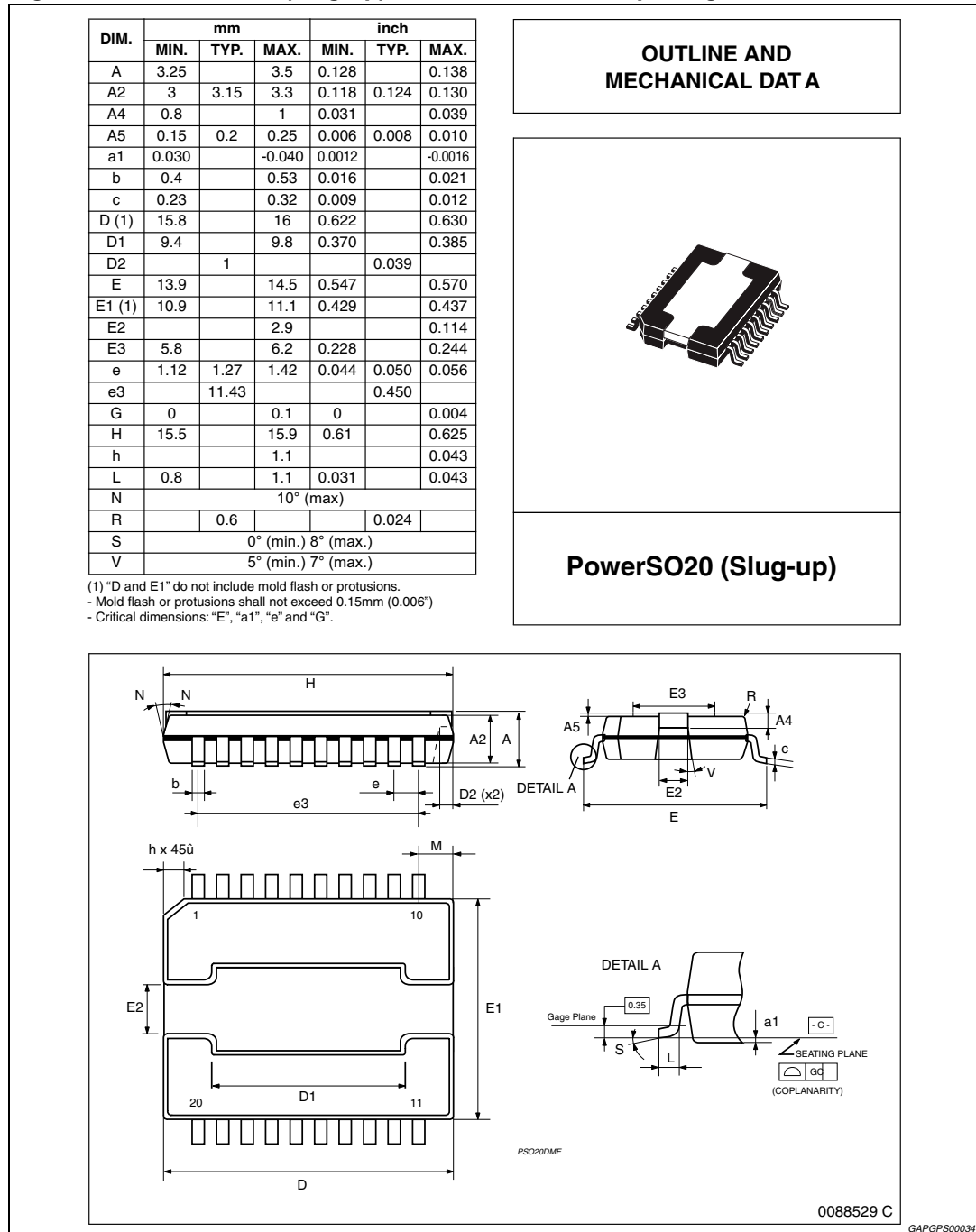
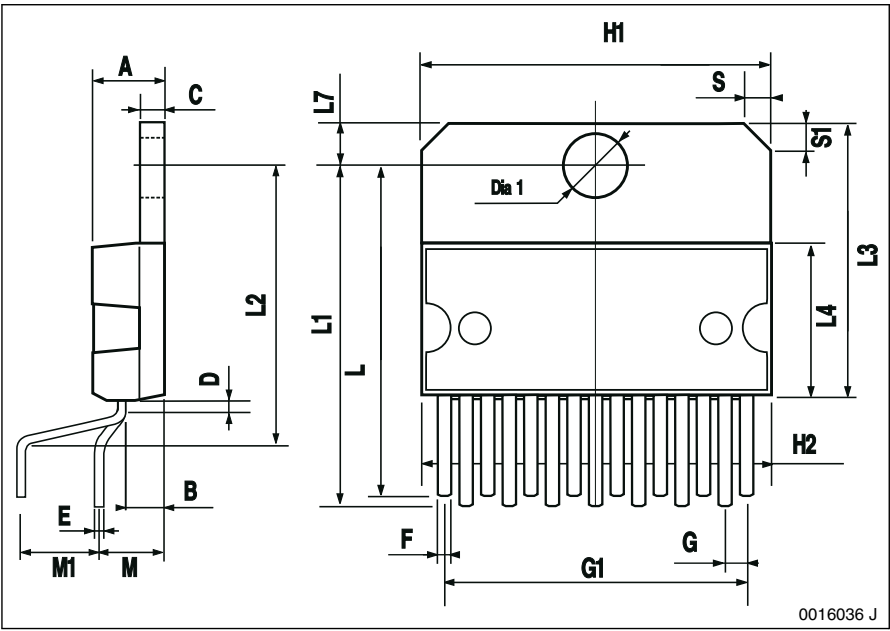
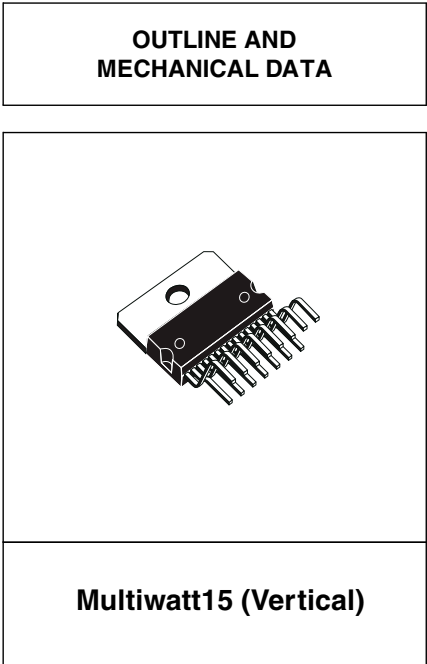


Figure 12. Multiwatt 15 (vertical) mechanical data and package dimensions

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			5			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



GAPGPS00822

5 Revision history

Table 5. Document revision history

Date	Revision	Changes
29-Aug-2007	1	Initial release.
08-Jan-2010	2	Updated <i>Figure 1, 2, 3, 5 and 7</i> . Added <i>Figure 4: Maximum ESR for stability valid for all the regulators outputs on page 10</i> .
27-Jun-2011	3	Added <i>Note 1 on page 9</i> .
17-Sep-2013	4	Updated Disclaimer.

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