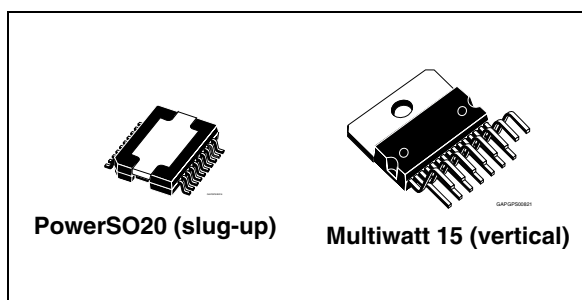


Multifunction voltage regulator for car radio

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

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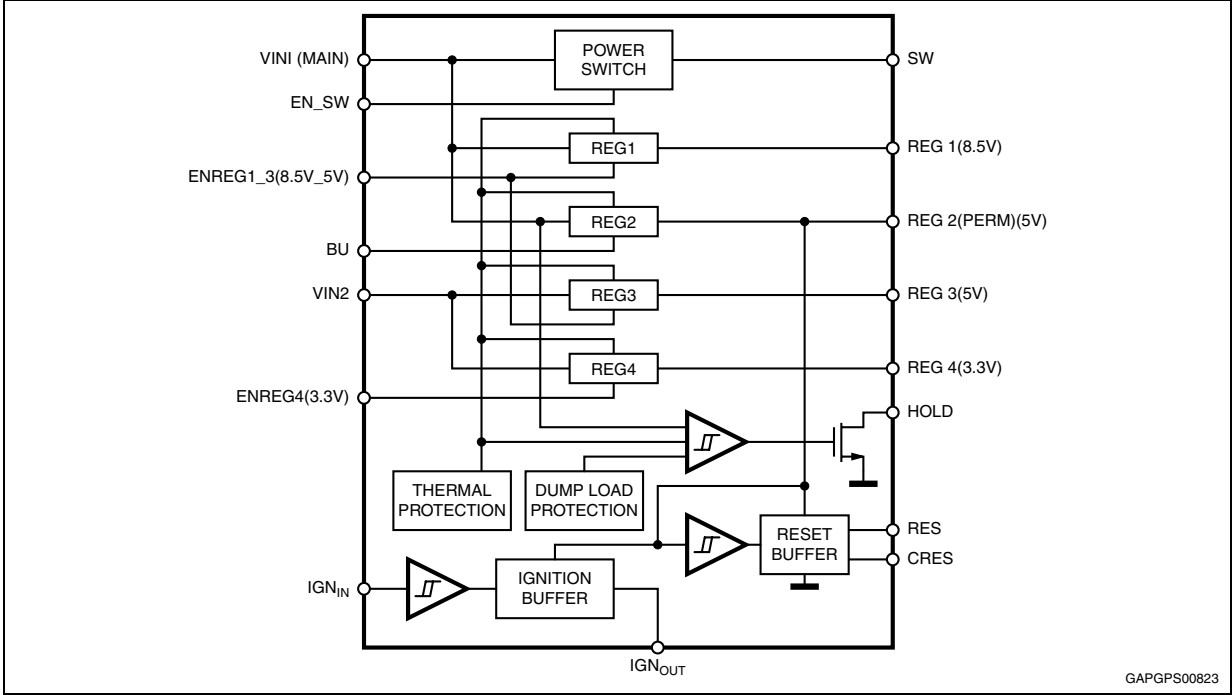
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1 Block diagram and pins description

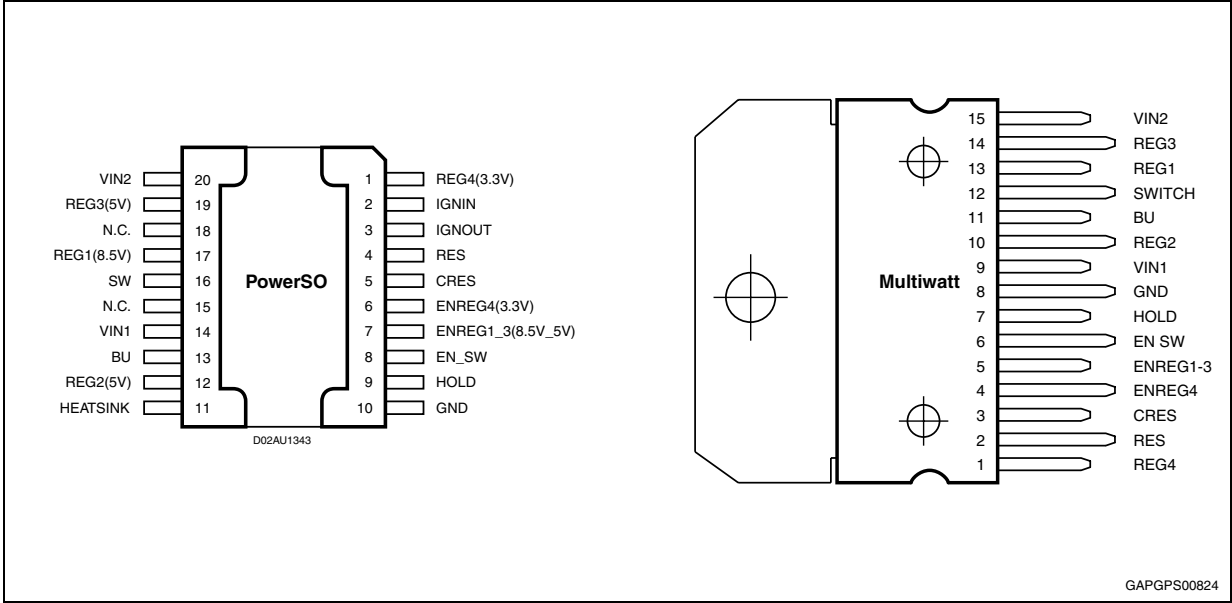
1.1 Block diagram

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

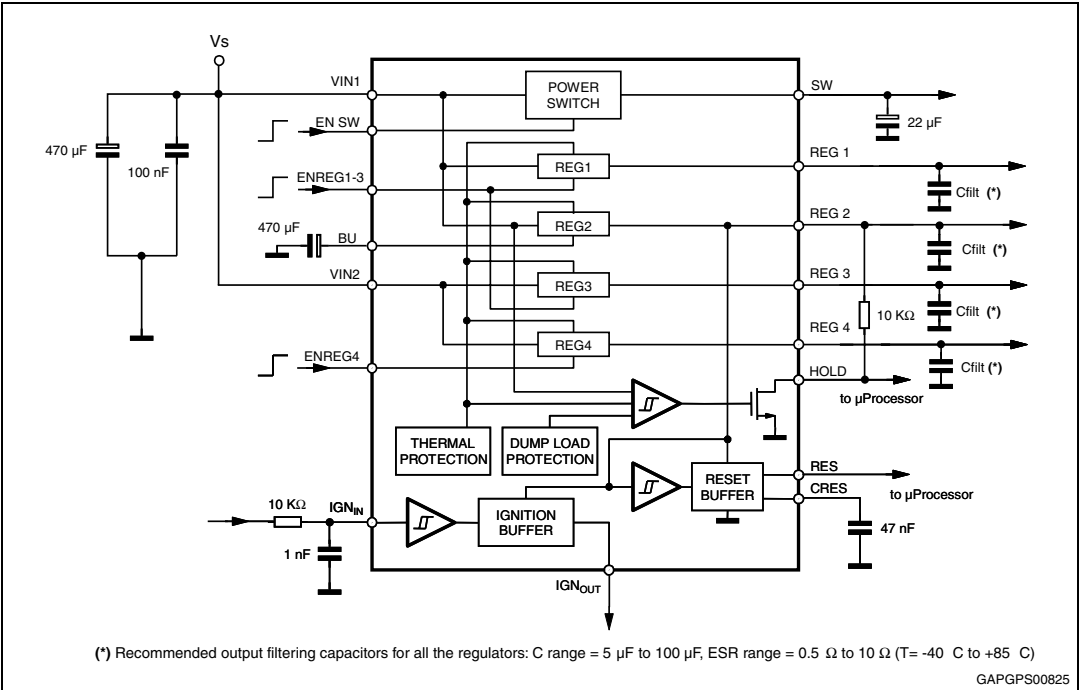
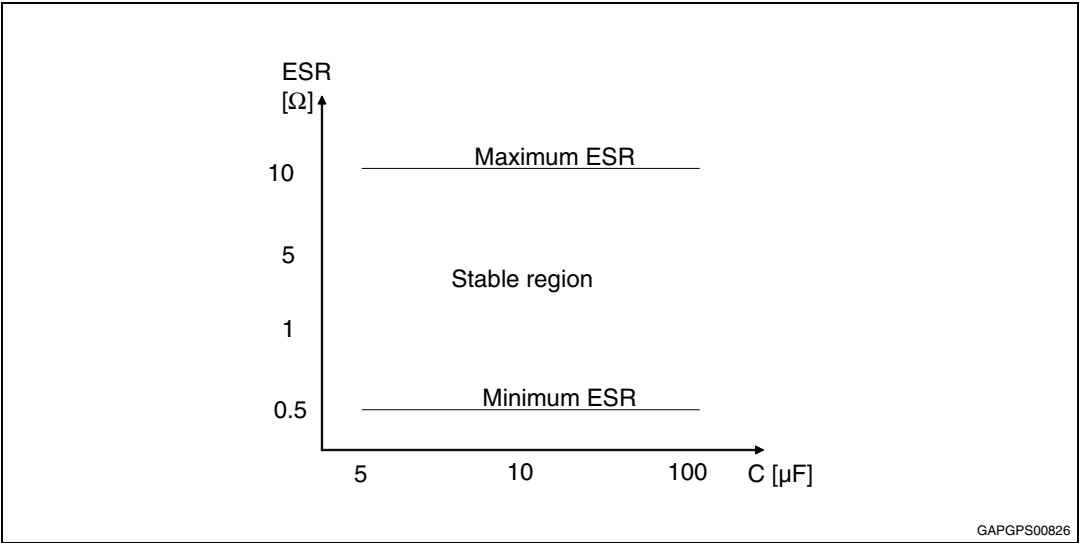


Figure 4. Maximum ESR for stability valid for all the regulators outputs



3 Timing diagrams

Figure 5. Timing diagram of regulators and power switch

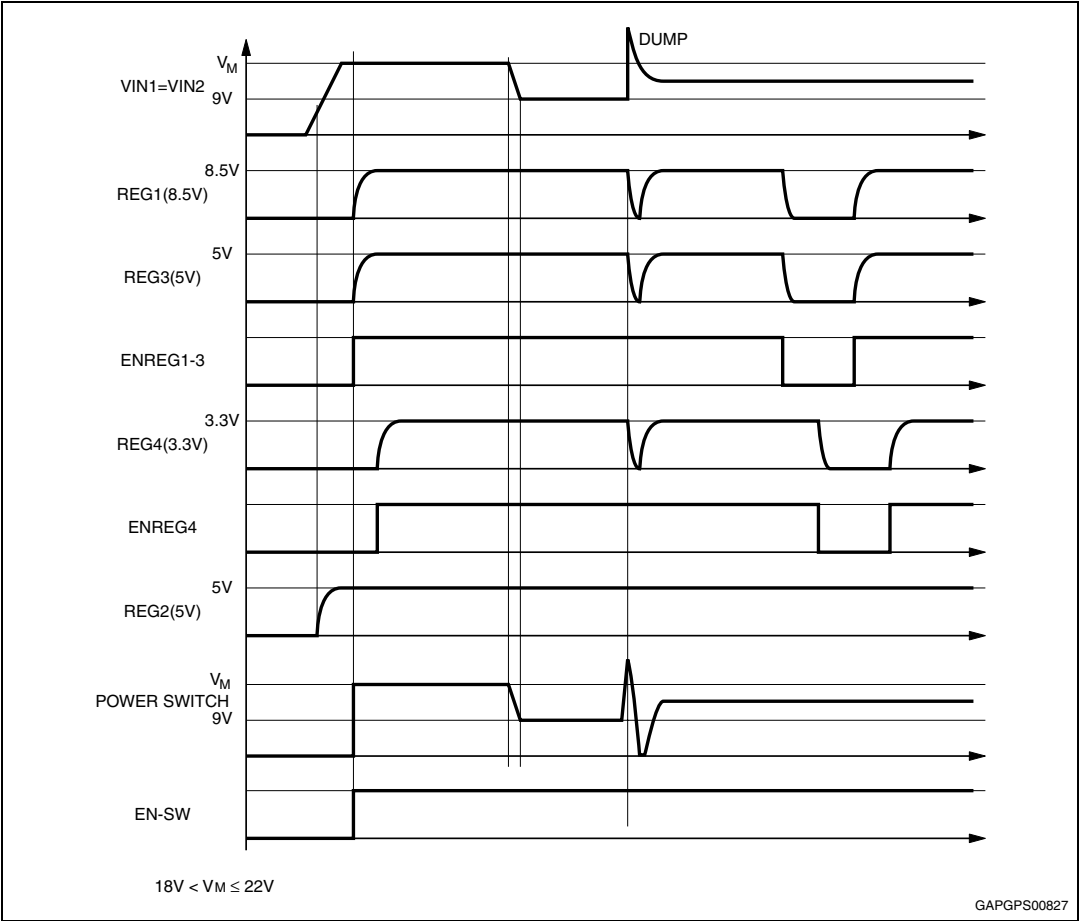


Figure 6. Backup and reset diagram

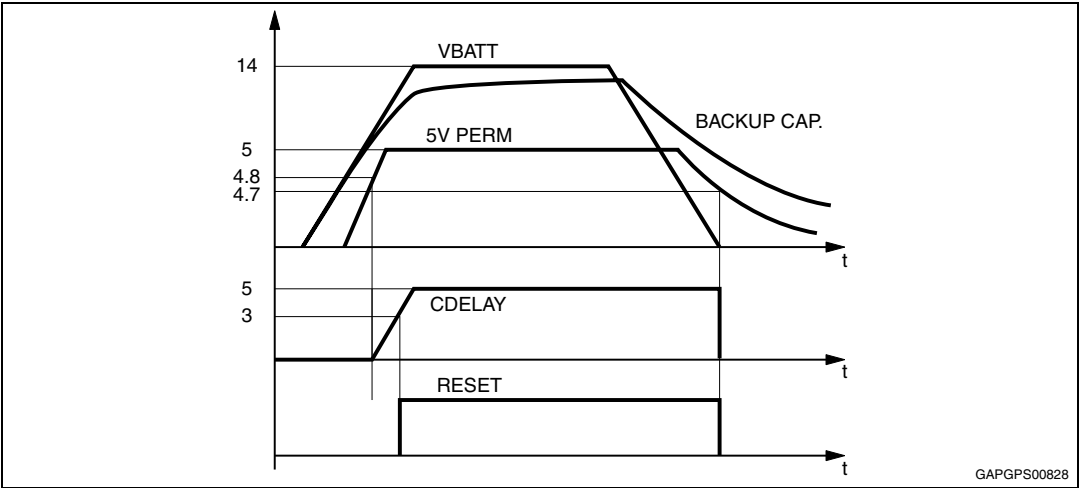


Figure 7. Hold and thermal protection

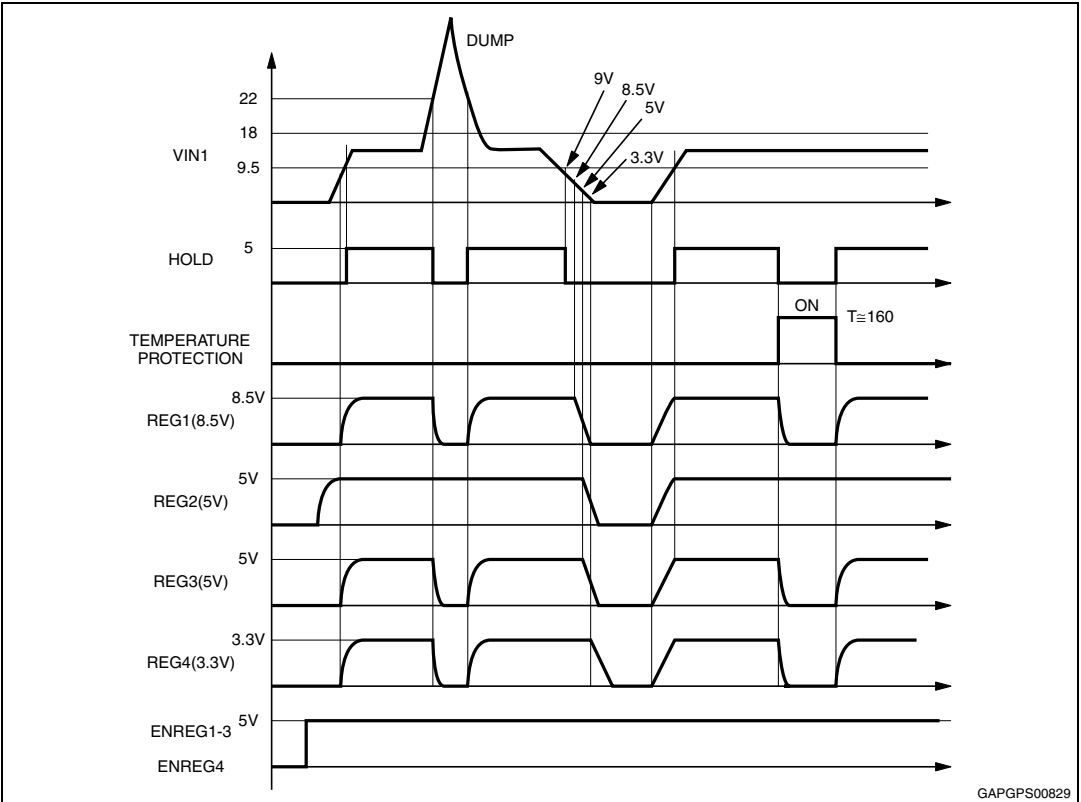


Figure 8. Ignition buffer diagram

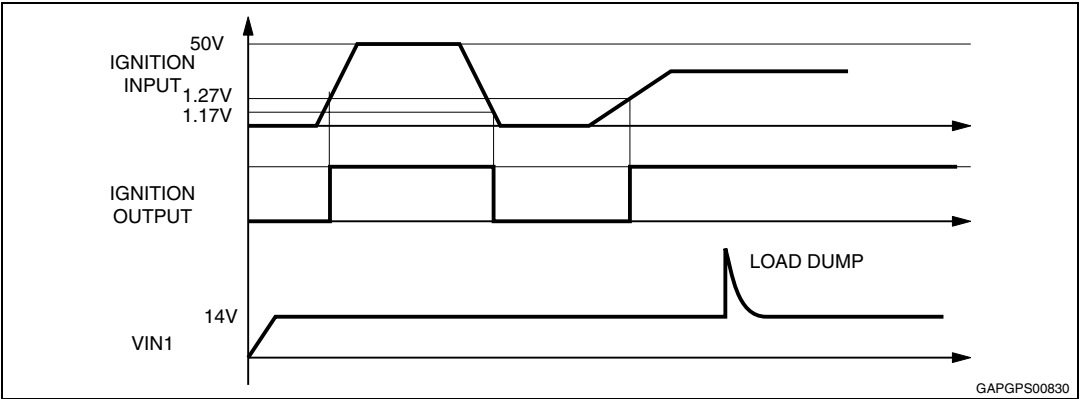


Figure 9. Protection of the power switch

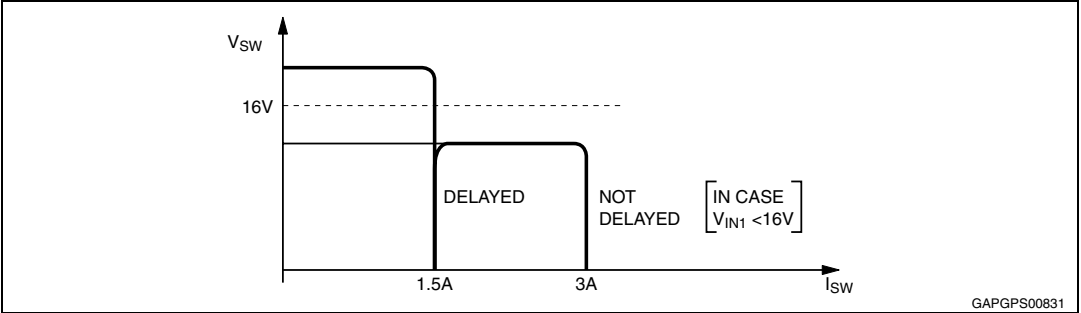
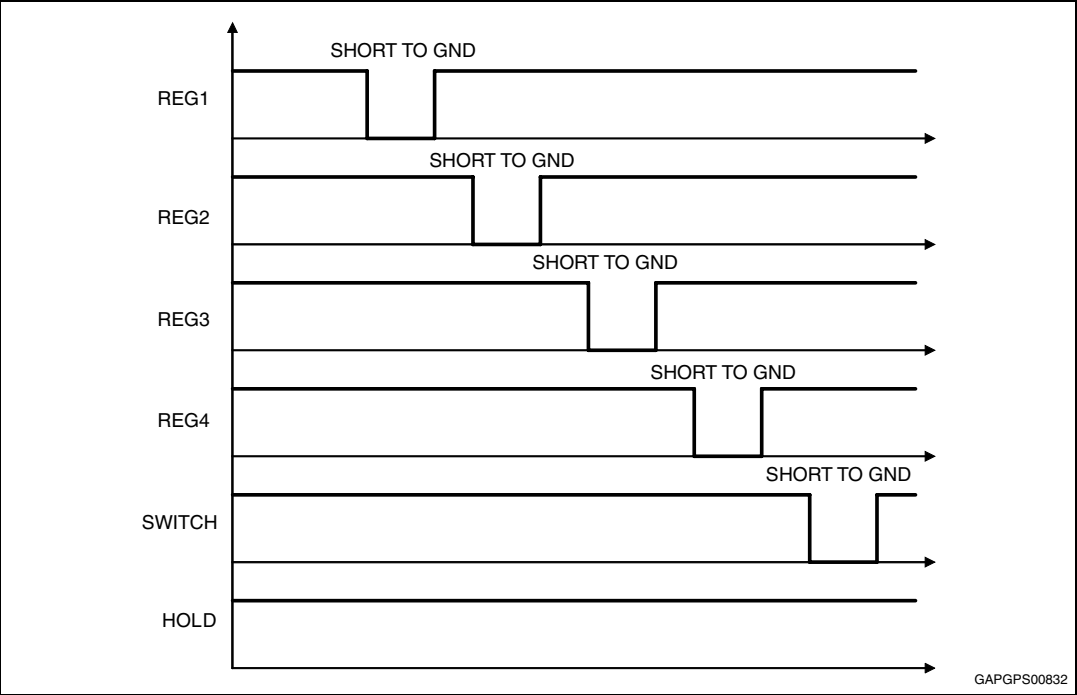


Figure 10. Short circuit diagram



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.

ECOPACK[®] is an ST trademark.

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

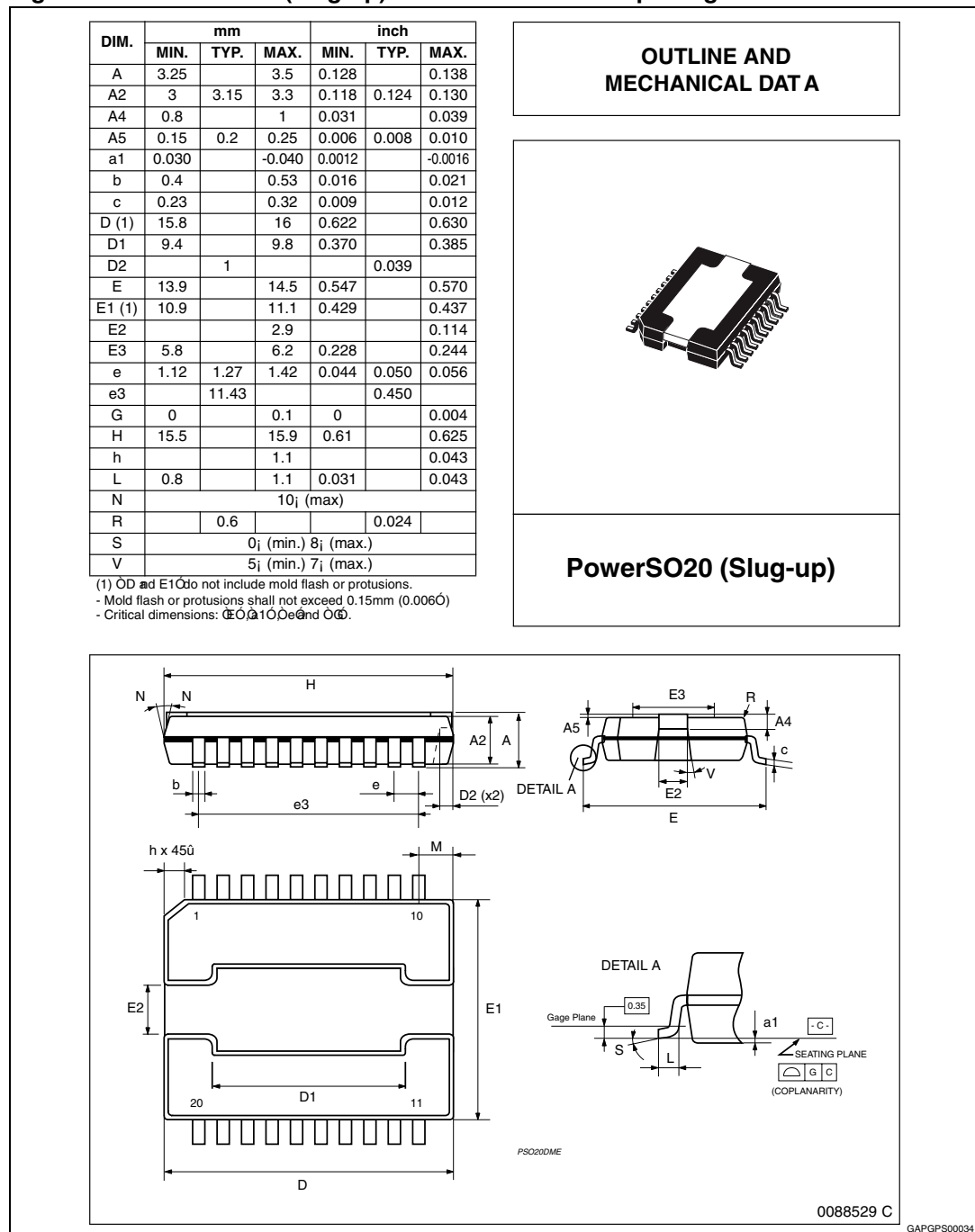
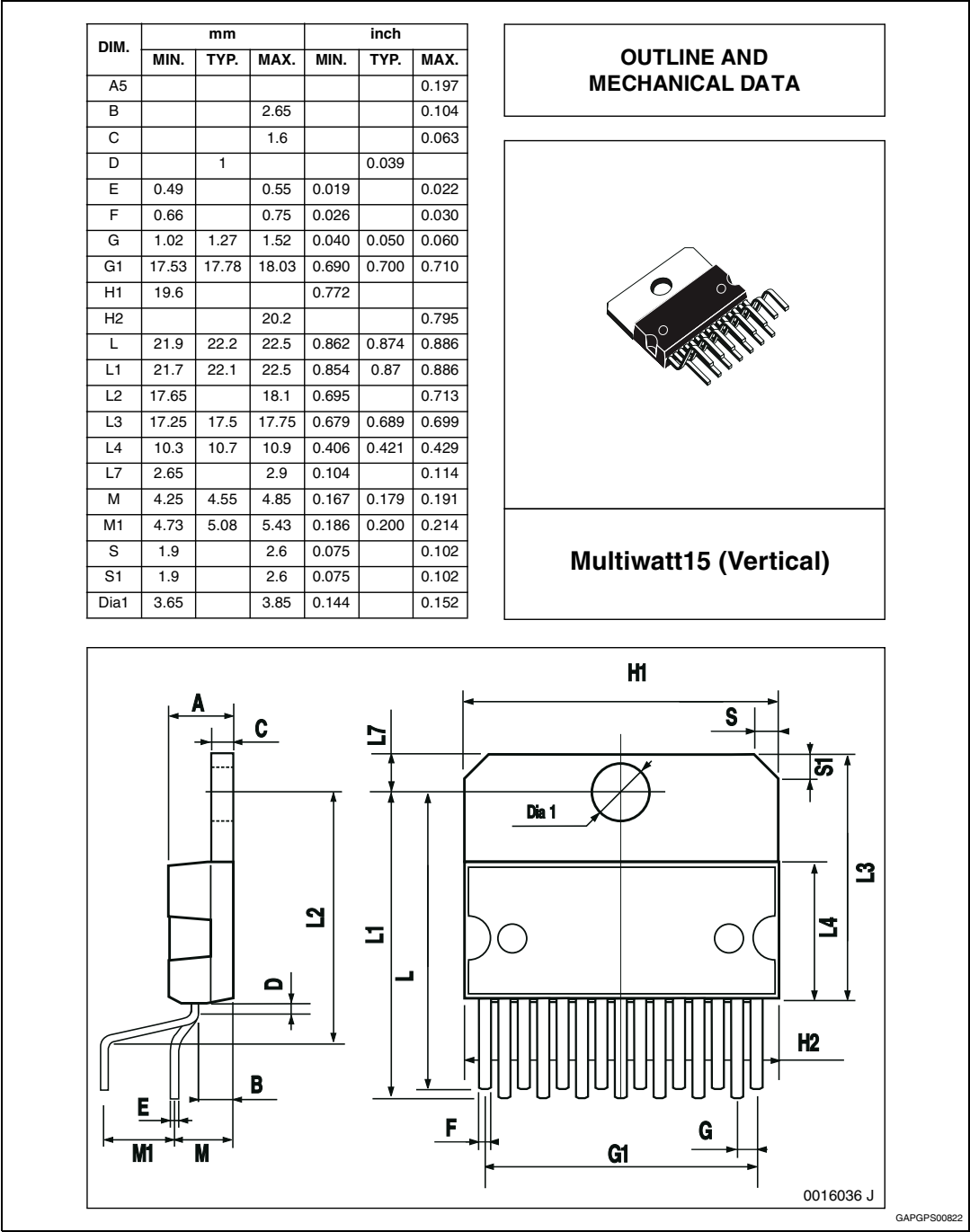


Figure 12. Multiwatt 15 (vertical) mechanical data and package dimensions



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> .

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