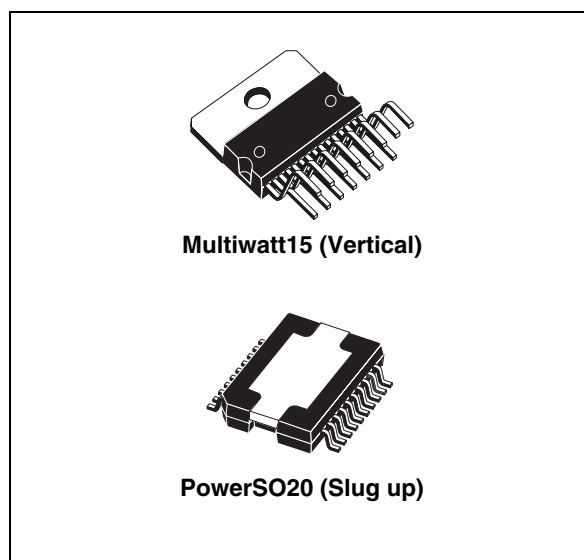


## Multifunction voltage regulator for car radio

### 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 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

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# 1 Block and pins connection diagrams

Figure 1. Block diagram

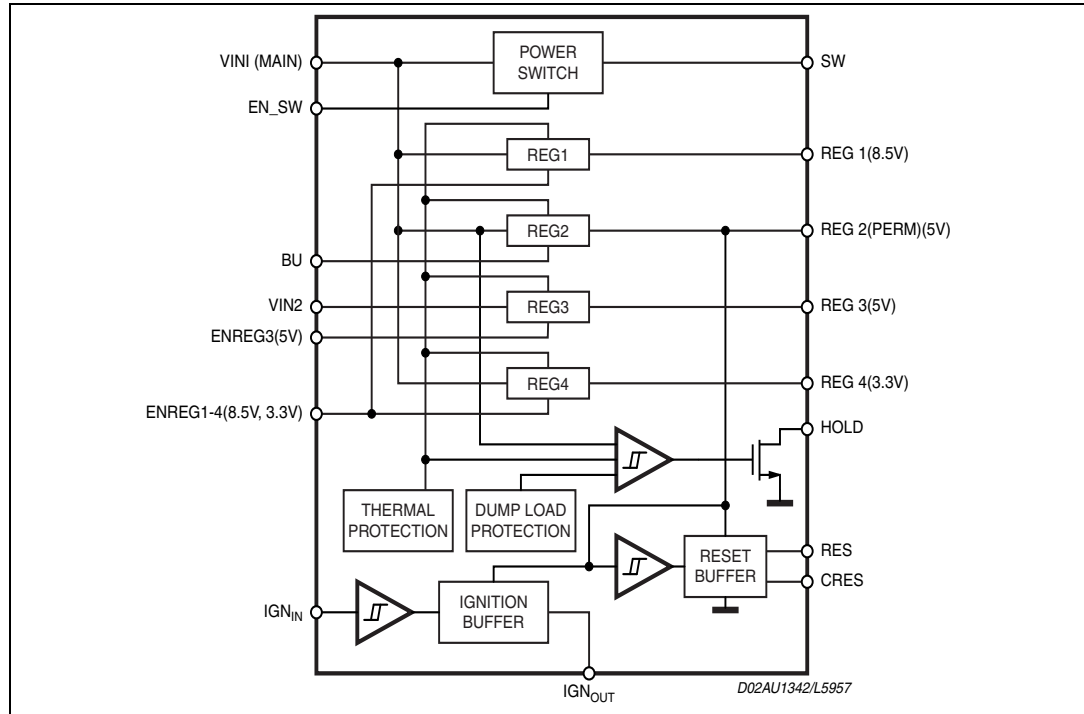
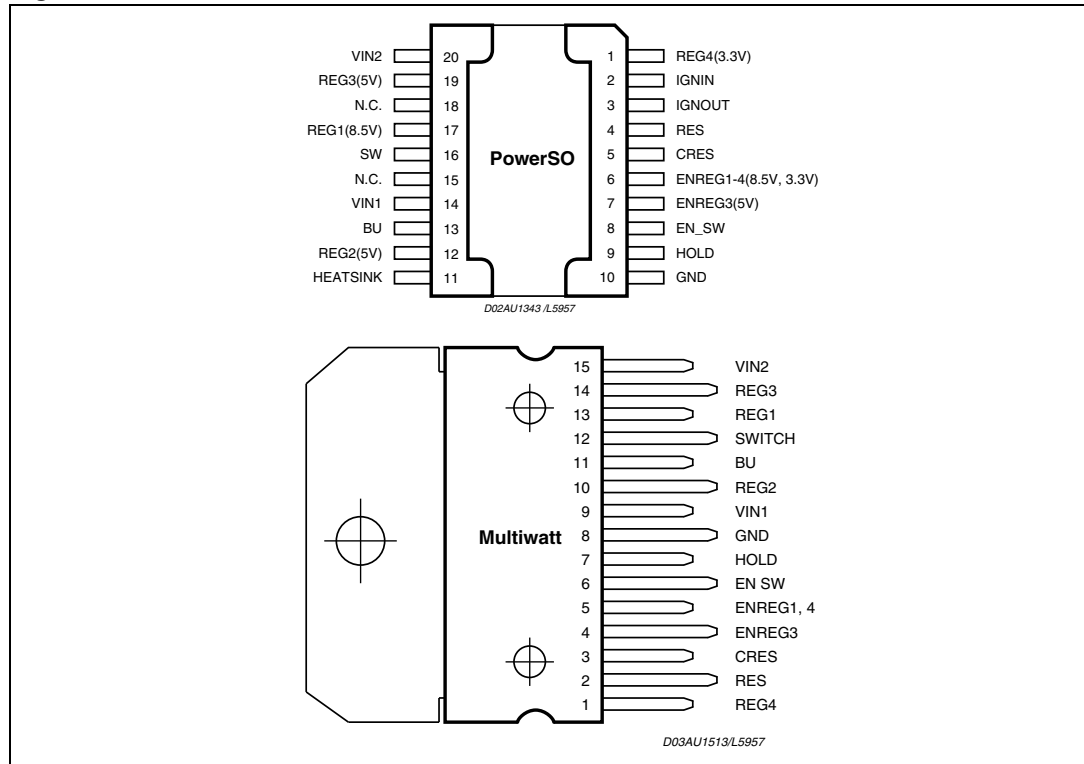


Figure 2. Pins connection



## 2 Electrical specifications

### 2.1 Absolute maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V <sub>SDC</sub>	DC operating supply voltage	30	V
V <sub>STR</sub>	Transient supply voltage	50	V
I <sub>O</sub>	Output current	internally limited	
T <sub>op</sub>	Operating temperature range	-40 to 85	°C
T <sub>stg</sub>	Storage temperature	-55 to 150	°C
T <sub>j</sub>	Junction temperature	-55 to 150	°C
P <sub>d</sub>	Power dissipation T <sub>case</sub> = 85 °C	43	W

### 2.2 Thermal data

Table 3. Thermal data

Symbol	Parameter	PowerSO	Multiwatt	Unit
R <sub>th j-case</sub>	Thermal resistance junction-to-case	Max. 1.5	1.8	°C/W

### 2.3 Electrical characteristics

V<sub>S</sub> = 14.4 V; T<sub>amb</sub> = 25 °C; unless otherwise specified.

Table 4. Electrical characteristics

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
<b>Input supplies</b>						
V <sub>in1</sub>	Input supply voltage 1	Operating	9	-	18	V
V <sub>in2</sub>	Input supply voltage 2	Operating	6	-	18	V
I <sub>q</sub>	Total quiescent current	Standby (-20 °C to 85 °C) IGN <sub>IN</sub> = 5 V	-	-	70	μA
		REGx = 5 V, REGsw = 5 V, IGN <sub>IN</sub> = 5 V	-	5	-	mA
		Standby (-20 °C to 85 °C) IGN <sub>IN</sub> = 5 V, V <sub>CC</sub> = 18 V	-	100	-	μA
Load Dump V <sub>in1</sub>	Battery over voltage	V <sub>in1</sub>	18	20	22	V
Load Dump V <sub>in2</sub>		V <sub>in2</sub>	18	20	22	V

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
<b>Regulator 1</b>						
$V_o$ (REG 1)	Output voltage 8.5 V	-	8	8.5	9	V
$\Delta V$	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
$\Delta V_i$	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 <sup>(1)</sup>	-	-	0.6	V
$I_m$	Current limit	$R_{short} = 0.5 \Omega$	0.6	-	1.2	A
<b>Regulator 2</b>						
$V_o$ (ST BY)	Output voltage 5 V	-	4.7	5	5.3	V
$\Delta V$	Line regulation	$V_{in1} = 7$ to 18 V; $I = 300$ mA	-	-	50	mV
		$V_{in1} = 6$ to 18 V; $I = 10$ mA	-	-	50	mV
$\Delta V_i$	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 <sup>(1)</sup>	-	-	1.5	V
		$I_{reg2} = 100$ mA <sup>(1)</sup>	-	-	0.6	V
$I_m$	Current limit	$R_{short} = 0.5 \Omega$	400	-	800	mA
<b>Regulator 3</b>						
$V_o$ (REG 3)	Output voltage 5V	-	4.75	5	5.25	V
$\Delta V$	Line regulation	$V_{in2} = 7$ to 18 V; $I = 800$ mA	-	-	50	mV
		$V_{in2} = 6$ to 18 V; $I = 10$ mA	-	-	50	mV
$\Delta V_i$	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 <sup>(1)</sup>	-	-	1.5	V
$I_m$	Current limit	$R_{short} = 0.5 \Omega$	1	-	2	A
<b>Regulator 4</b>						
$V_o$ (REG 4)	Output voltage 3.3V	-	3.10	3.3	3.50	V
$\Delta V$	Line regulation	$V_{in2} = 6$ to 18 V; $I = 800$ mA	-	-	50	mV
$\Delta V$	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
$\Delta V_i$	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	48	-	-	dB
$V_{drop}$	Drop out voltage	$I_{reg4} = 800$ mA <sup>(1)</sup>	-	-	2.65	V
$I_m$	Current limit	$R_{short} = 0.5 \Omega$	0.9	-	2	A
<b>Power switch</b>						
$V_{dropSW}$	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
<b>Reset buffer (with push-pull buffer)</b>						
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	-	200	mV
$I_{Hsource(RES)}$	High level source current	Reset = 0 V	1000	1300	1600	$\mu$ A
$I_{Lsink(RES)}$	Low level sink current	Reset = 5 V	14	16	18	mA
$RES_{delay}$	$C_{res} = 47$ nF	-	10	-	60	ms
$\Delta T_{RES}$	Reset rise and fall time	$R = 10$ k $\Omega$ $C = 15$ pF	-	-	50	$\mu$ s
$I_{Charge}$	Charge current	$C_{RES} = 0$ V	3	5	10	$\mu$ 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
<b>Hold signal</b>						
$V_{lowl}$	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

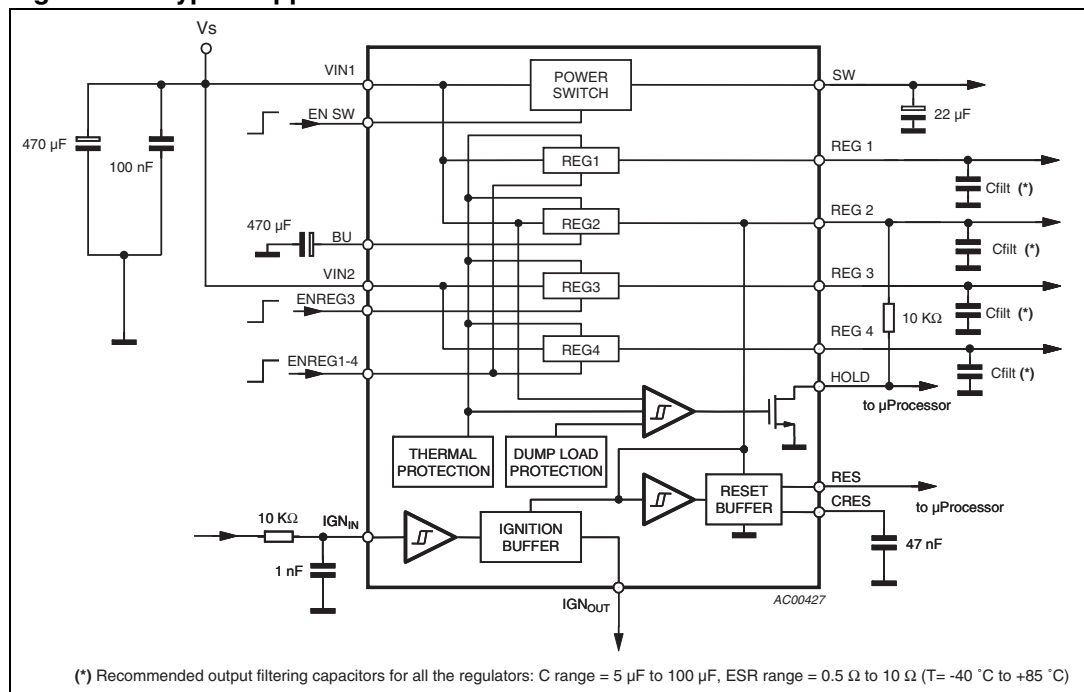


Table 4. Electrical characteristics (continued)

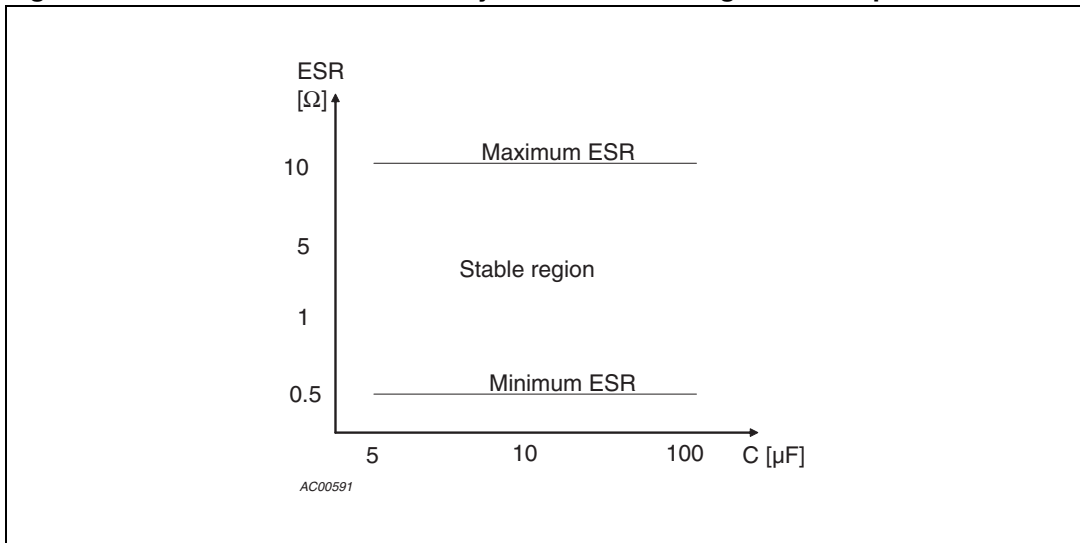
Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
<b>Ignition buffer (push-pull with schmitt trigger)</b>						
IGN <sub>IN</sub>	IGN <sub>out</sub> falling	-	1.03	1.17	1.28	V
IGN <sub>IN</sub>	IGN <sub>out</sub> rising	-	1.18	1.27	1.33	V
V <sub>hys</sub> (IGN <sub>out</sub> )	Hysteresis of ignition buffer	-	30	50	100	mV
I <sub>Hsource</sub> (IGN <sub>out</sub> )	High level source current	I <sub>GNout</sub> = 0 V	1000	1500	2000	μA
I <sub>Lsink</sub> (IGN <sub>out</sub> )	Low level sink current	I <sub>GNout</sub> = 5 V	10	15	20	mA
V <sub>ol</sub>	Low level	I <sub>Lsink</sub> (IGN <sub>out</sub> ) = 1 mA	-	0.3	0.5	V
V <sub>oh</sub>	High level	-	4.5	V <sub>reg2</sub>	5.5	V
IGN <sub>RISE</sub>	Rising time	C = 15 pF	-	-	10	μs
IGN <sub>FALL</sub>	Fall time	C = 15 pF	-	-	10	μs
I <sub>CLAMP</sub>	Input clamp current	V <sub>CC</sub> < V <sub>IGN</sub> < 50 V	-	-	2	mA
IGN <sub>IN</sub>	Input voltage	Operative	0	-	50	V
<b>Enable input (regulators 1,3,4 and power switch)</b>						
V <sub>TH</sub>	Voltage threshold	-	1.3	-	2.3	V
EN <sub>IN</sub>	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



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



**Figure 5. Timing diagram of regulators and power switch**

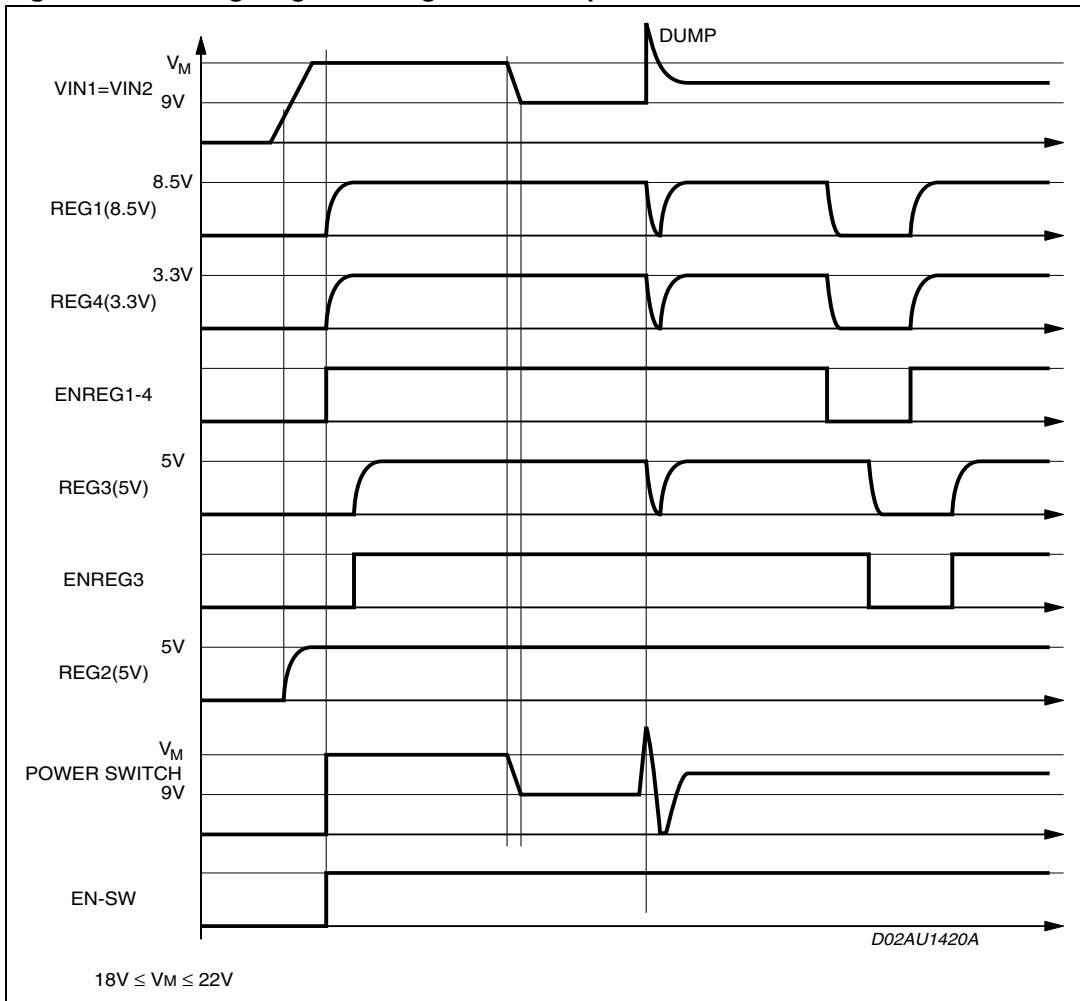


Figure 6. Backup and reset diagram

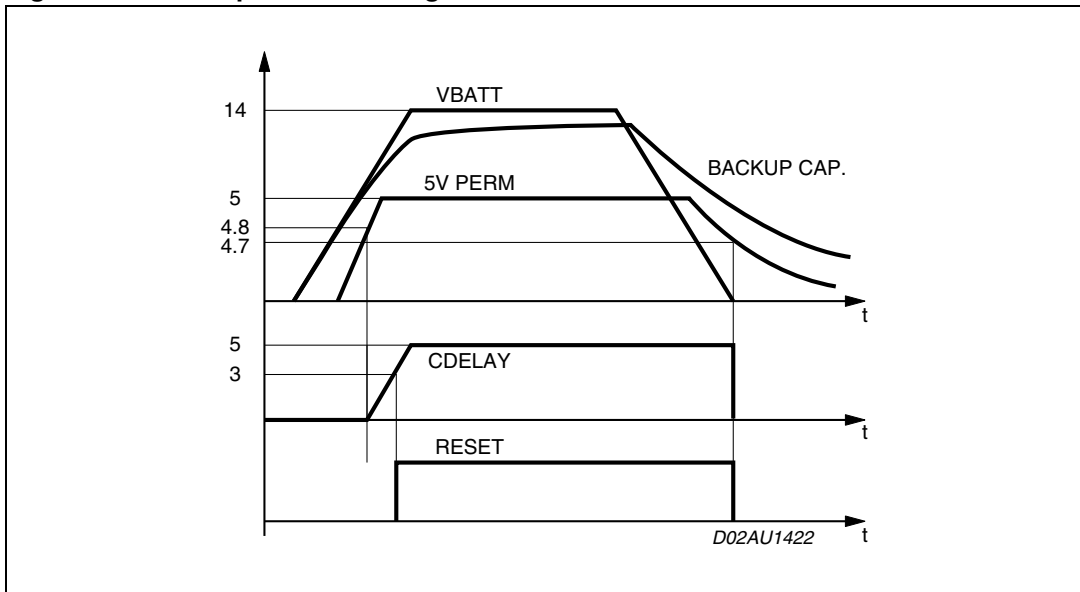
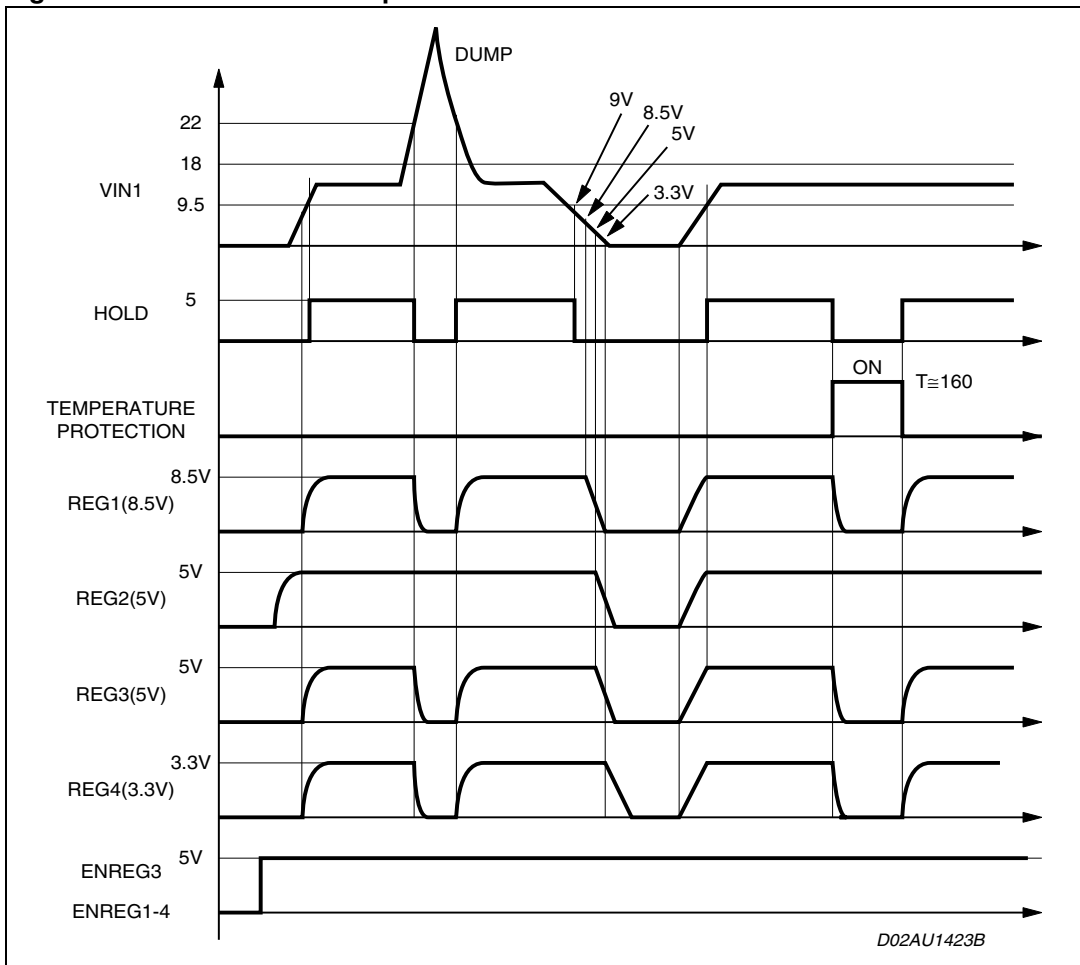
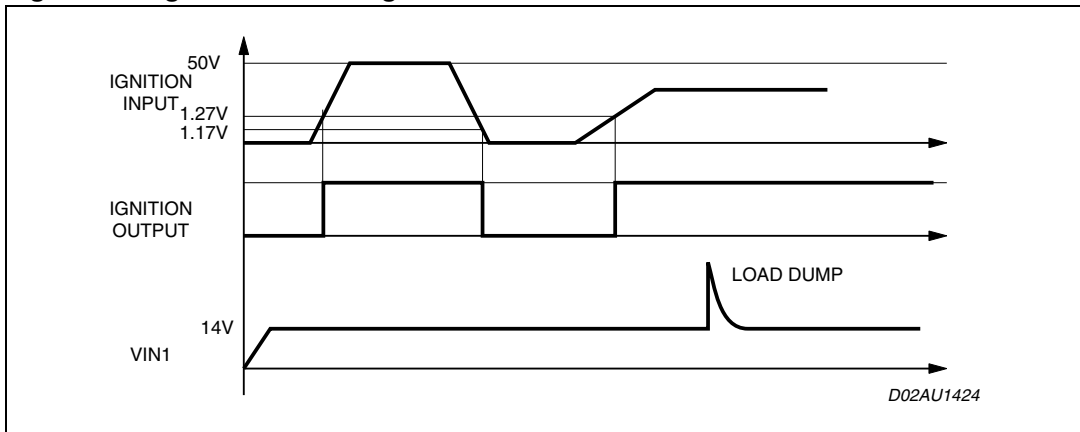


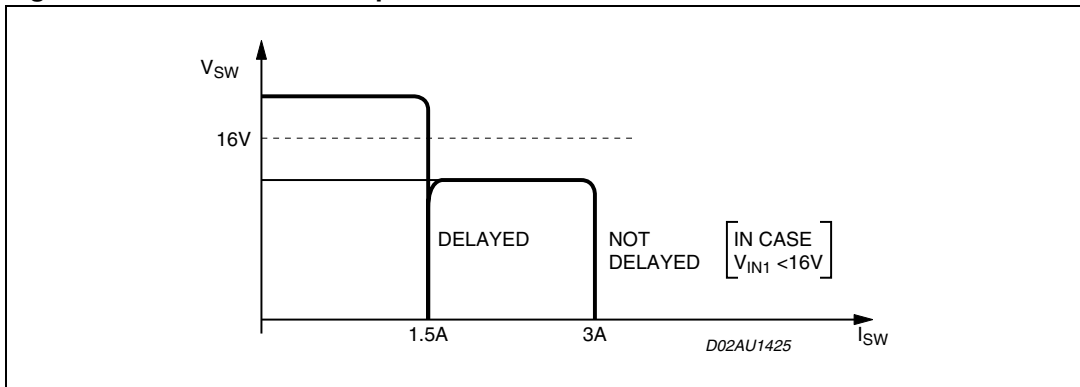
Figure 7. Hold and thermal protection



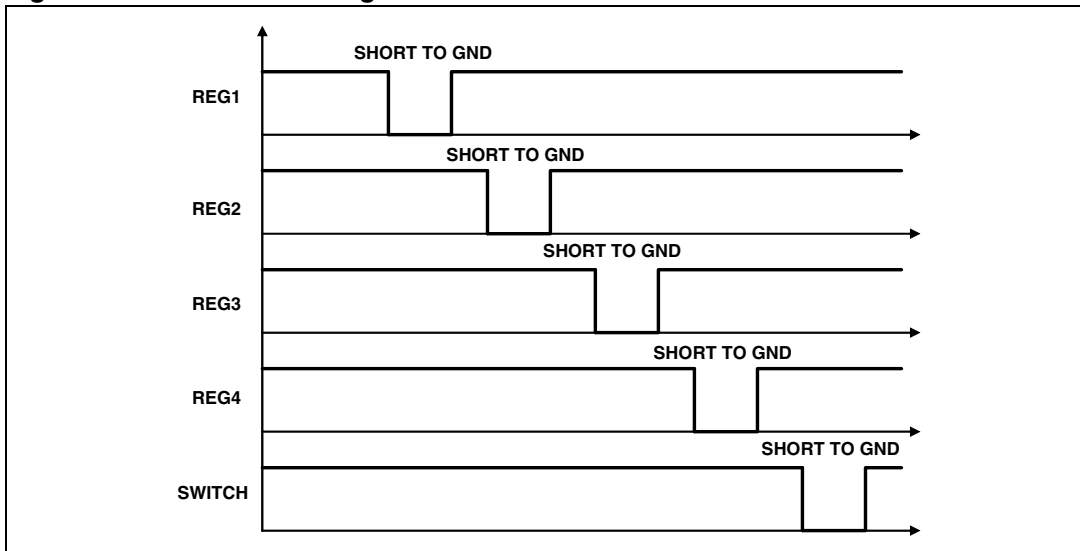
**Figure 8. Ignition buffer diagram**



**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](http://www.st.com).

ECOPACK® is an ST trademark.

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

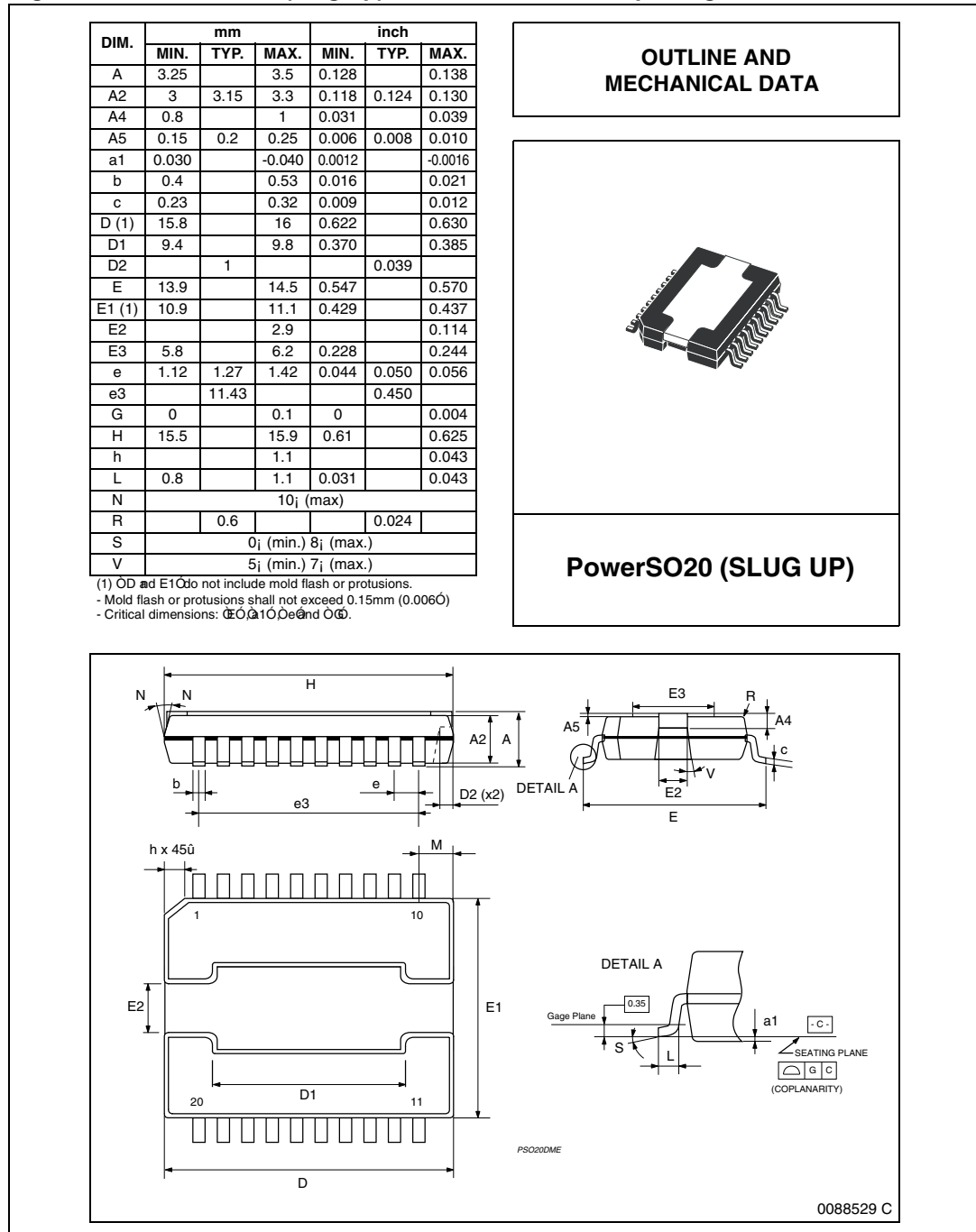
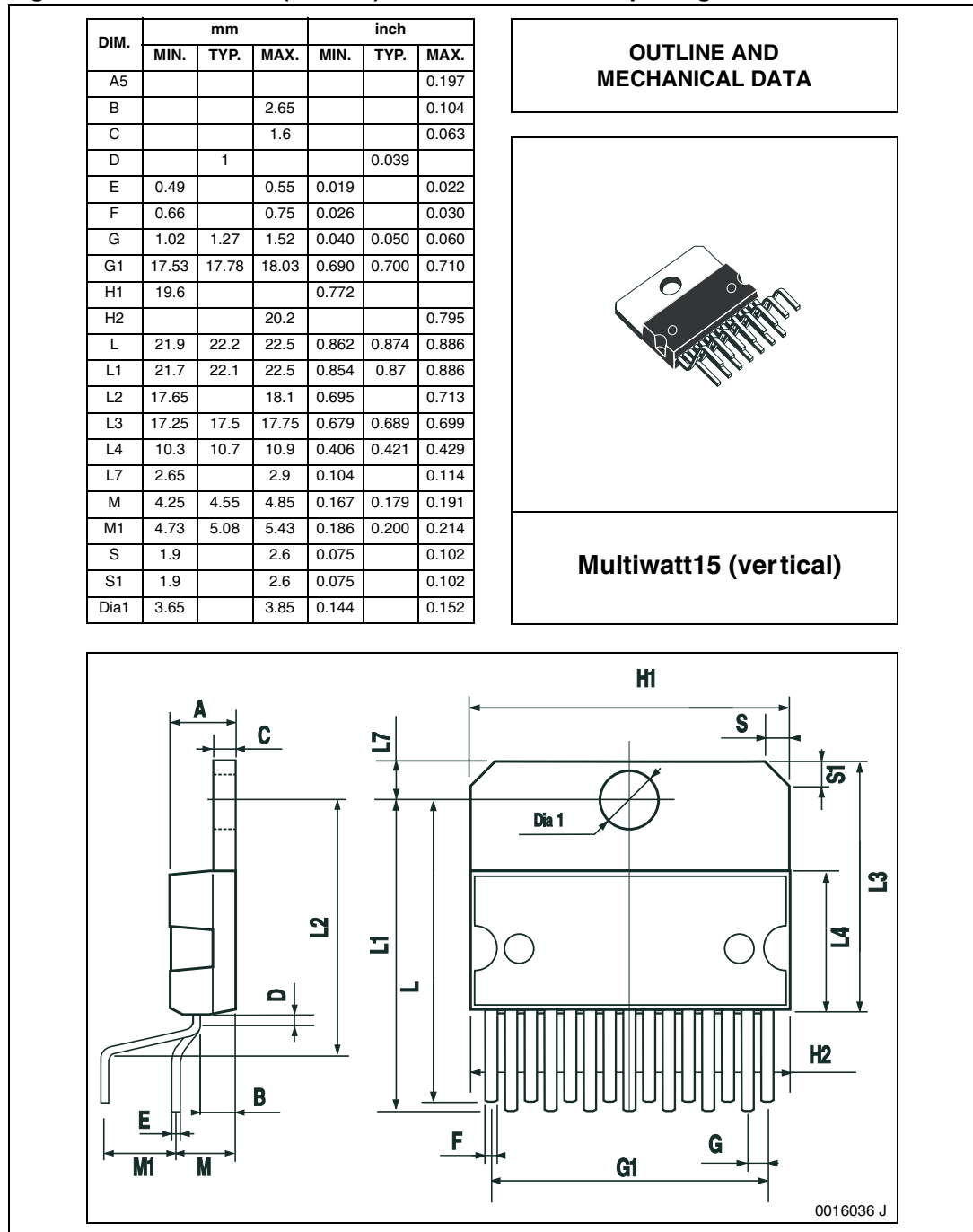


Figure 12. Multiwatt15 (vertical) mechanical data and package dimensions



## 4 Revision history

**Table 5. Document revision history**

Date	Revision	Changes
11-Feb-2008	1	Initial release.
08-Jan-2010	2	Updated <a href="#">Section 1: Block and pins connection diagrams on page 5</a> . Updated <a href="#">Figure 3, 5 and 6</a> .
20-Sep-2013	3	Updated disclaimer.