

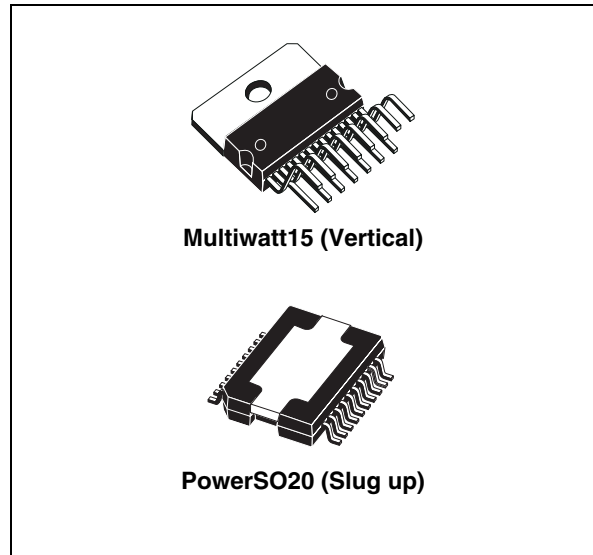
Multifunction voltage regulator for car radio

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

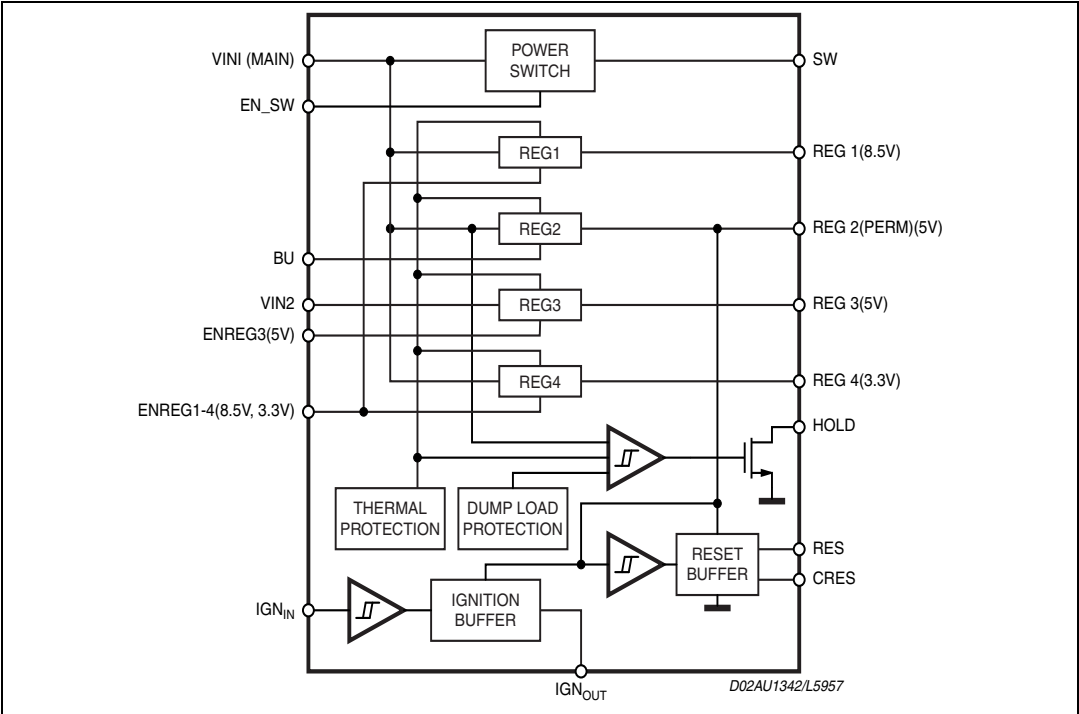
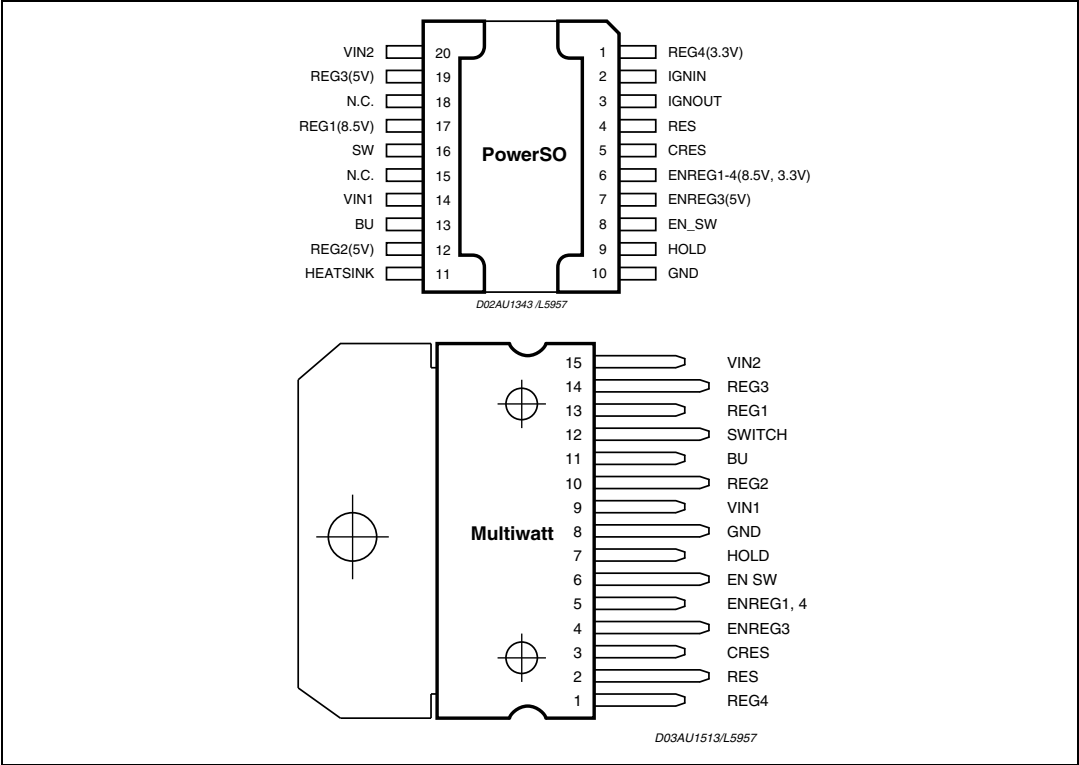


Figure 2. Pins connection



2 Electrical specifications

2.1 Absolute maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{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 $T_{case} = 85\text{ °C}$	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
I_q	Total quiescent current	Standby (-20 °C to 85 °C) $IGN_{IN} = 5\text{ V}$	-	-	70	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	-	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	$V_{in1} = 10 \text{ to } 18 \text{ V}; I = 500 \text{ mA}$	-	-	50	mV
		$V_{in1} = 9.3 \text{ to } 18 \text{ V}; I = 10 \text{ mA}$	-	-	50	mV
ΔV_i	Load regulation	$I_{reg1} = 1 \text{ to } 500 \text{ mA}$	-	-	100	mV
I_q	Quiescent current	$I_{reg1} = 10 \text{ mA}$	-	-	5	mA
PSRR	Supply voltage ripple rejection	$f = 1 \text{ kHz}; V_{in1} = 1.5 \text{ Vpp}; I_o = 500 \text{ mA}$	50	-	-	dB
V_{drop}	Drop out voltage	$I_{reg1} = 500 \text{ mA}^{(1)}$	-	-	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	-	4.7	5	5.3	V
ΔV	Line regulation	$V_{in1} = 7 \text{ to } 18 \text{ V}; I = 300 \text{ mA}$	-	-	50	mV
		$V_{in1} = 6 \text{ to } 18 \text{ V}; I = 10 \text{ mA}$	-	-	50	mV
ΔV_i	Load regulation	$I_{reg2} = 1 \text{ to } 300 \text{ mA}$	-	-	100	mV
I_q	Quiescent Current	$I_{reg2} = 10 \text{ mA}$	-	-	3	mA
PSRR	Supply voltage ripple rejection	$f = 1 \text{ kHz}; V_{in1} = 1.5 \text{ Vpp}; I_o = 300 \text{ mA}$	50	-	-	dB
V_{drop}	Drop out voltage	$I_{reg2} = 300 \text{ mA}^{(1)}$	-	-	1.5	V
		$I_{reg2} = 100 \text{ mA}^{(1)}$	-	-	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	$V_{in2} = 7 \text{ to } 18 \text{ V}; I = 800 \text{ mA}$	-	-	50	mV
		$V_{in2} = 6 \text{ to } 18 \text{ V}; I = 10 \text{ mA}$	-	-	50	mV
ΔV_i	Load regulation	$I_{reg3} = 1 \text{ to } 800 \text{ mA}$	-	-	100	mV
I_q	Quiescent current	$I_{reg3} = 10 \text{ mA}$	-	-	5	mA
PSRR	Supply voltage ripple rejection	$f = 1 \text{ kHz}; V_{in1} = 1.5 \text{ Vpp}; I_o = 800 \text{ mA}$	50	-	-	dB
V_{drop}	Drop out voltage	$I_{reg3} = 800 \text{ mA}^{(1)}$	-	-	1.5	V
I_m	Current limit	$R_{short} = 0.5 \Omega$	1	-	2	A
Regulator 4						
V_o (REG 4)	Output voltage 3.3V	-	3.10	3.3	3.50	V
ΔV	Line regulation	$V_{in2} = 6 \text{ to } 18 \text{ V}; I = 800 \text{ mA}$	-	-	50	mV
ΔV	Line regulation	$V_{in2} = 6 \text{ to } 18 \text{ V}; I = 10 \text{ mA}$	-	-	50	mV

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
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	48	-	-	dB
V_{drop}	Drop out voltage	$I_{reg4} = 800$ mA ⁽¹⁾	-	-	2.65	V
I_m	Current limit	$R_{short} = 0.5 \Omega$	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	$V_{reg2} = 5$ 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	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
$V_{HOLD R}$	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
I _{Hsource} (IGNout)	High level source current	I _{GNout} = 0 V	1000	1500	2000	μA
I _{Lsink} (IGNout)	Low level sink current	I _{GNout} = 5 V	10	15	20	mA
V _{ol}	Low level	I _{Lsink} (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

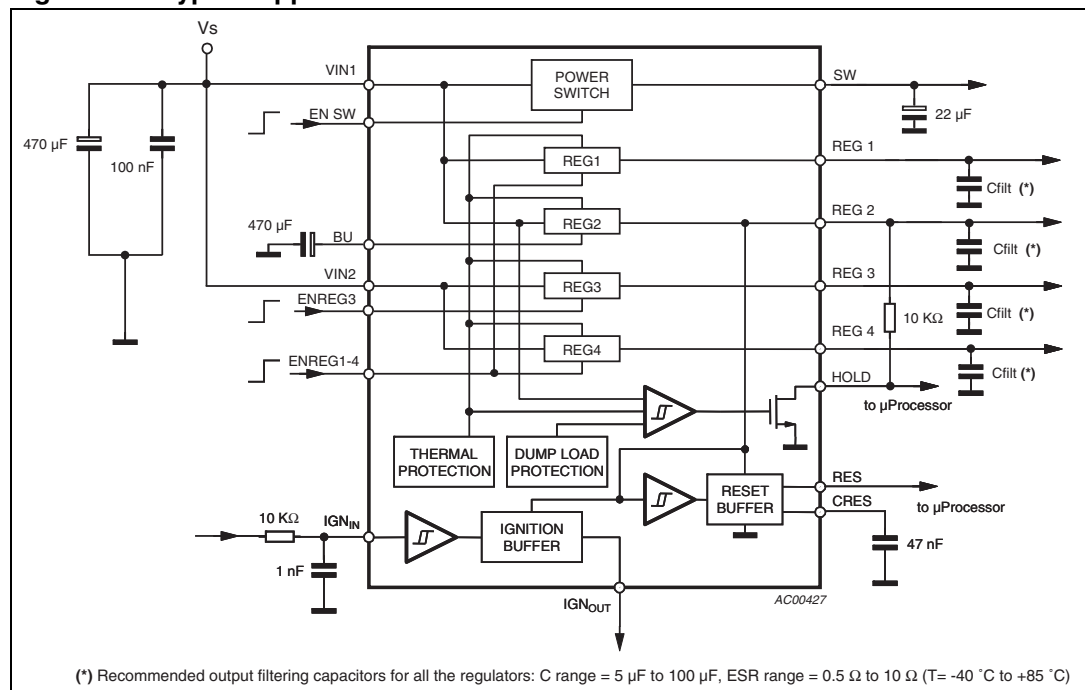


Figure 4. Maximum ESR for stability valid for all the regulators outputs

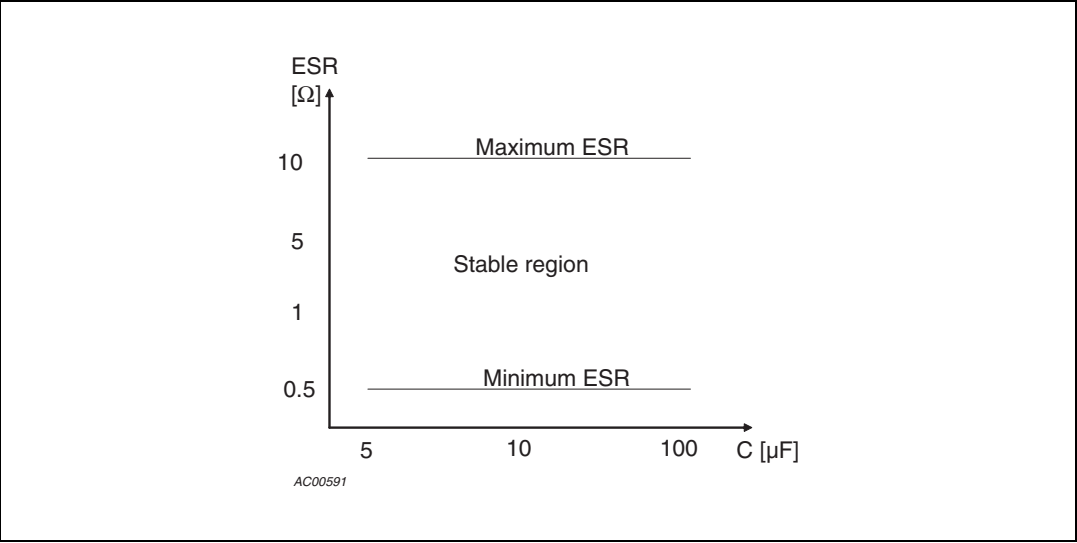


Figure 5. Timing diagram of regulators and power switch

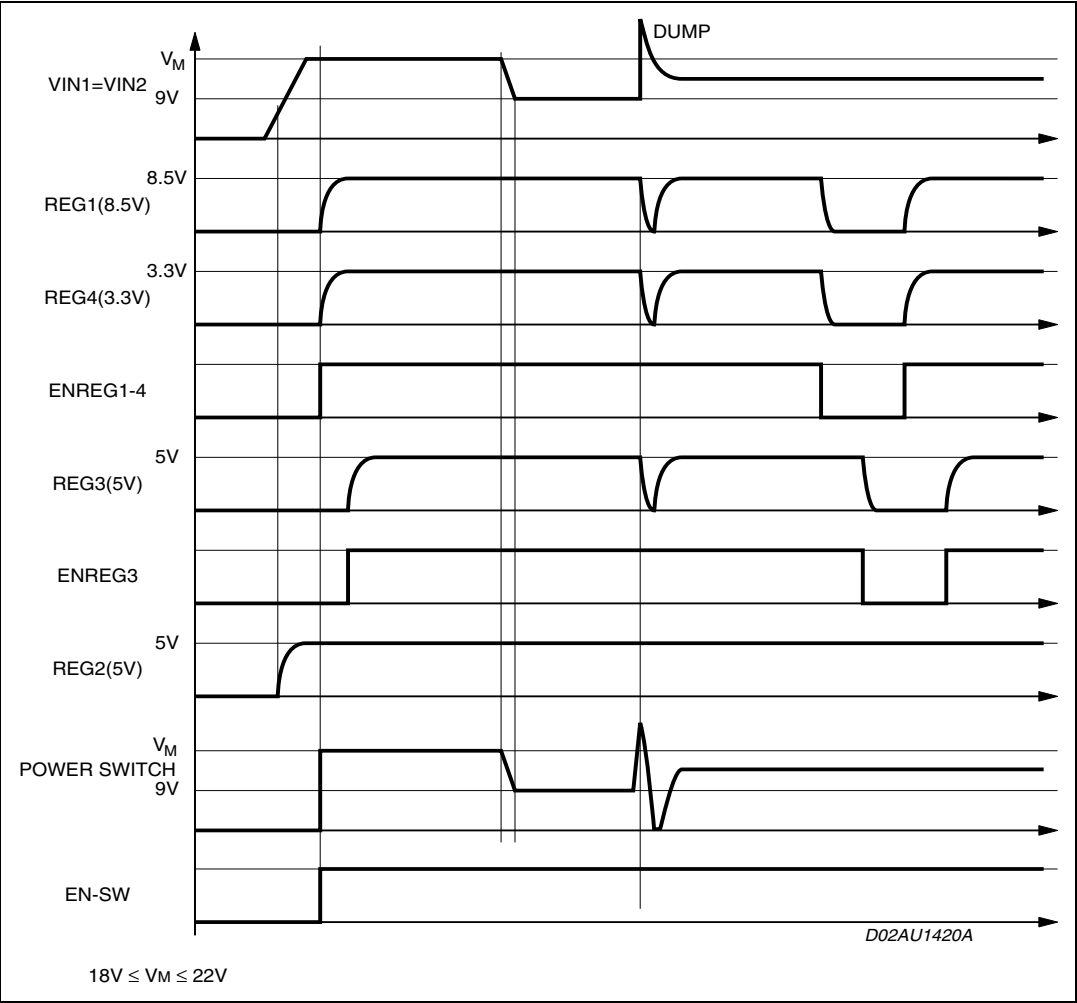


Figure 6. Backup and reset diagram

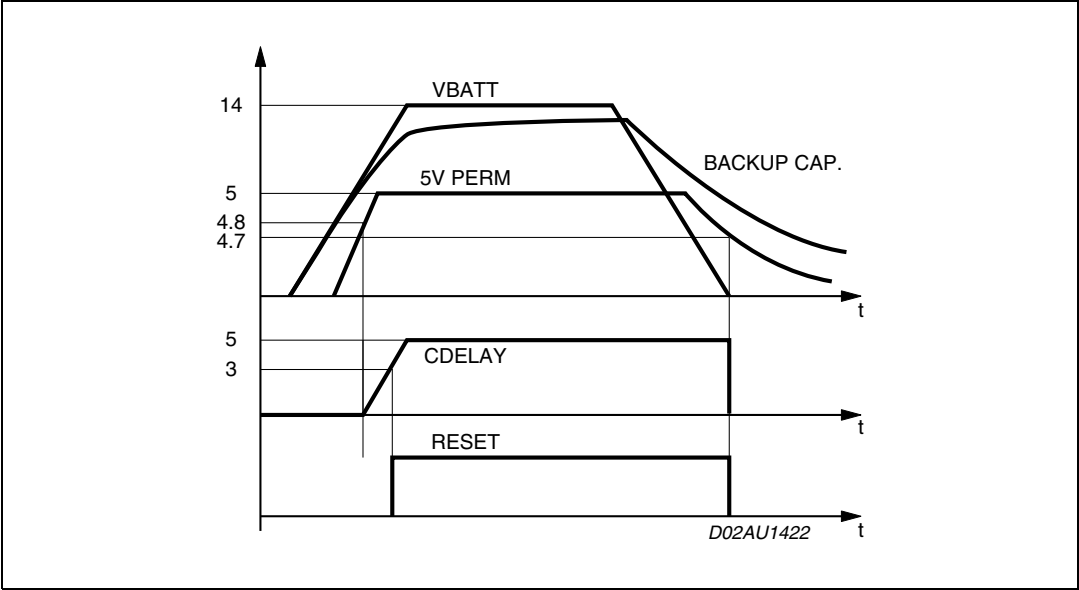


Figure 7. Hold and thermal protection

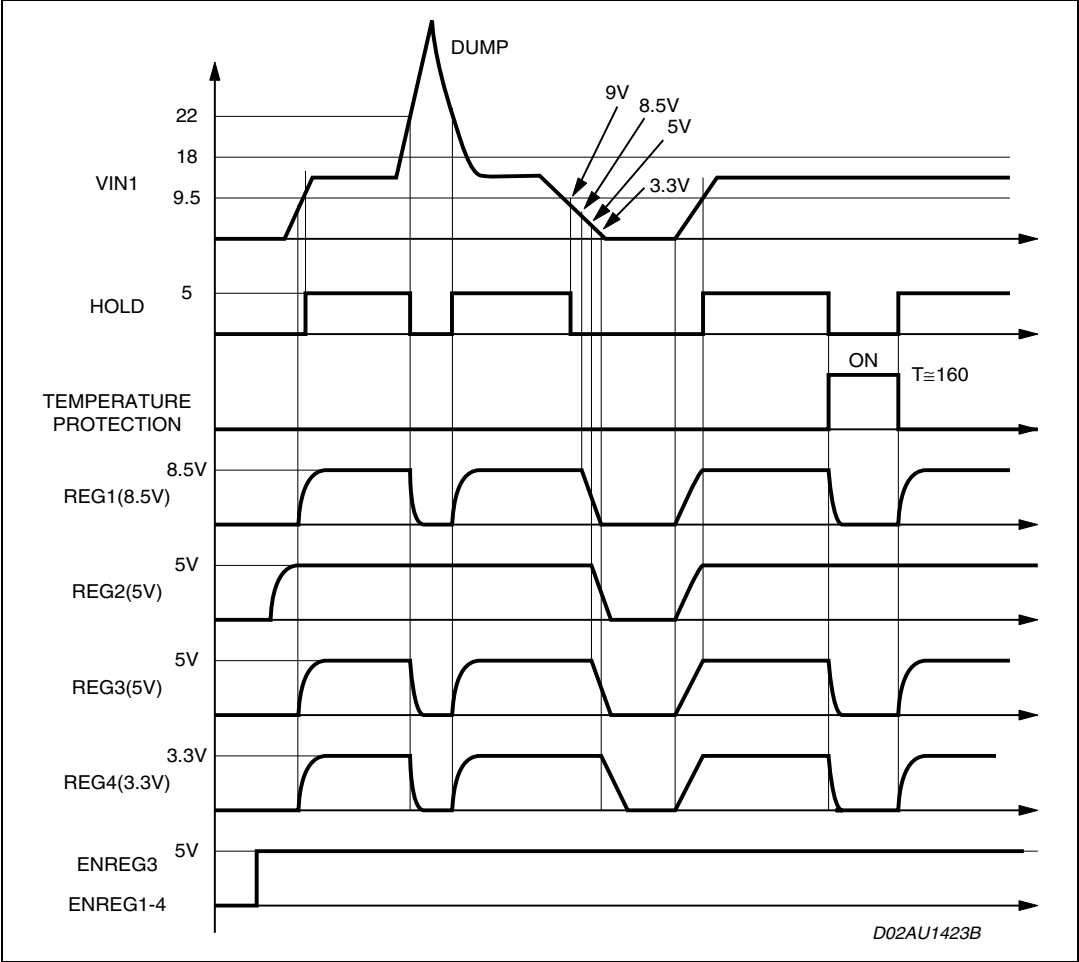


Figure 8. Ignition buffer diagram

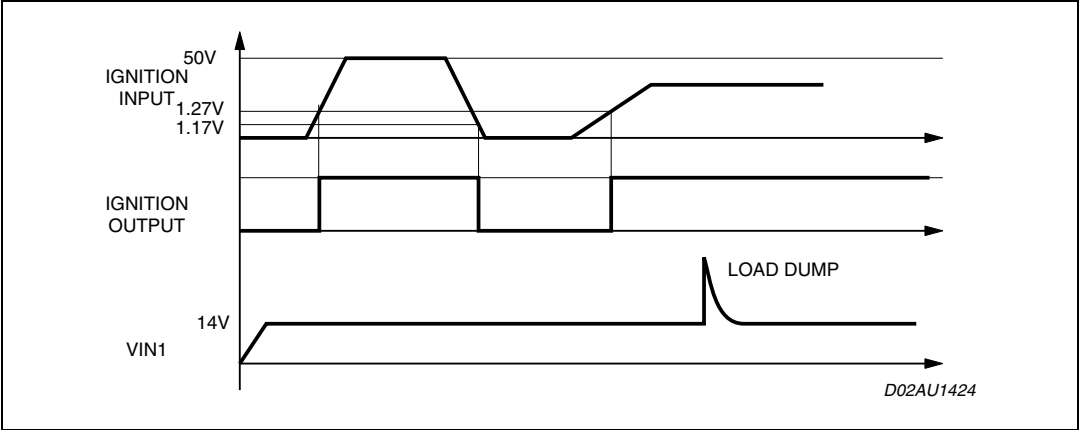


Figure 9. Protection of the power switch

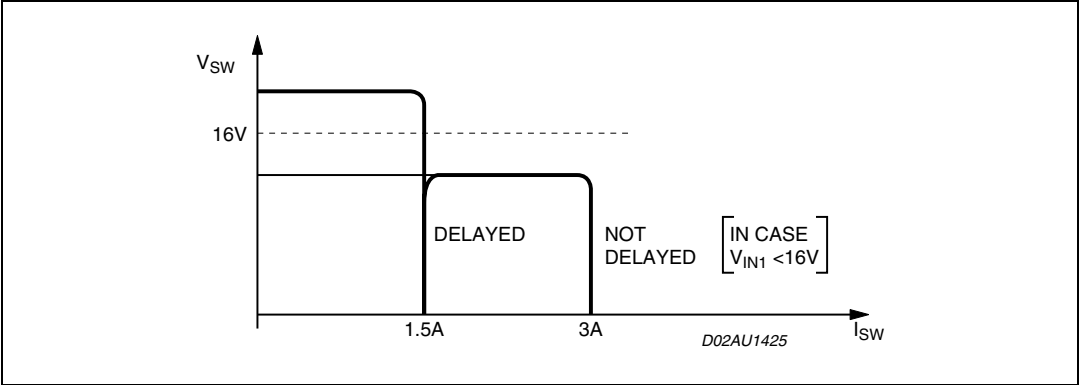
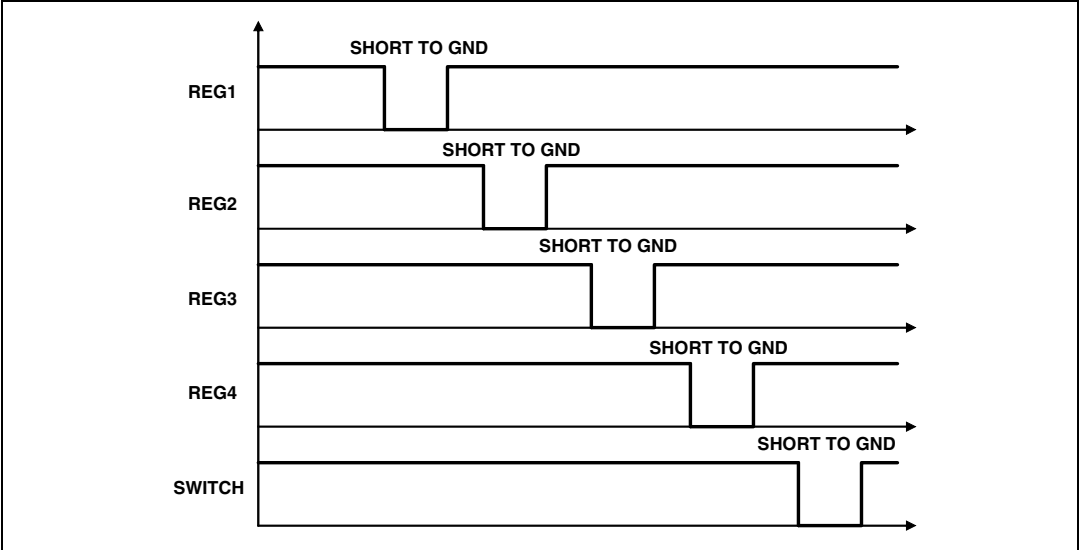


Figure 10. Short circuit diagram



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.

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

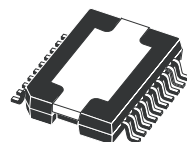
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	3.25		3.5	0.128		0.138
A2	3	3.15	3.3	0.118	0.124	0.130
A4	0.8		1	0.031		0.039
A5	0.15	0.2	0.25	0.006	0.008	0.010
a1	0.030		-0.040	0.0012		-0.0016
b	0.4		0.53	0.016		0.021
c	0.23		0.32	0.009		0.012
D (1)	15.8		16	0.622		0.630
D1	9.4		9.8	0.370		0.385
D2		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 _j (max)					
R		0.6			0.024	
S	0 _j (min.) 8 _j (max.)					
V	5 _j (min.) 7 _j (max.)					

(1) OD and E1 OD do not include mold flash or protusions.

- Mold flash or protusions shall not exceed 0.15mm (0.006")

- Critical dimensions: $\leq 100\mu\text{m}$ and $\leq 60\mu\text{m}$.

OUTLINE AND MECHANICAL DATA



PowerSO20 (SLUG UP)

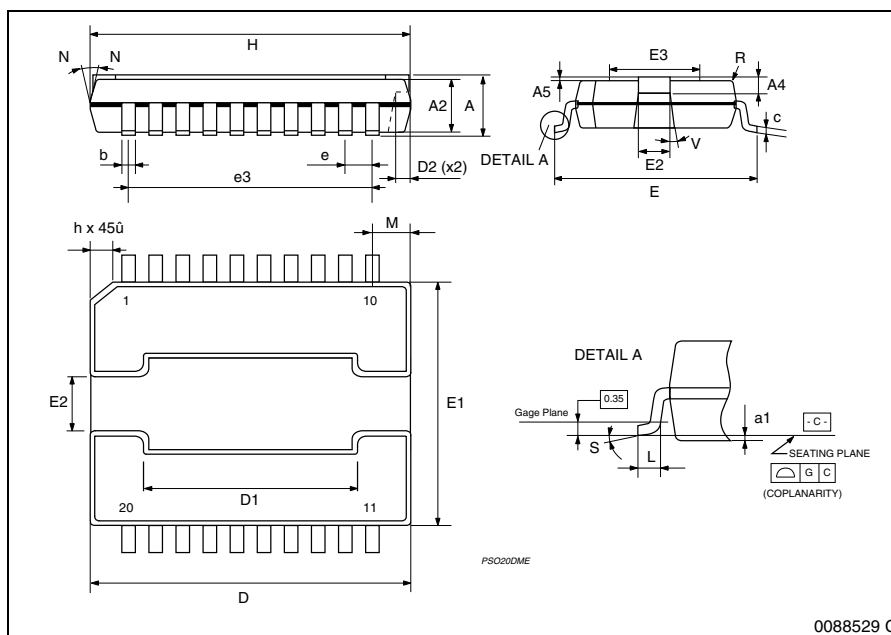
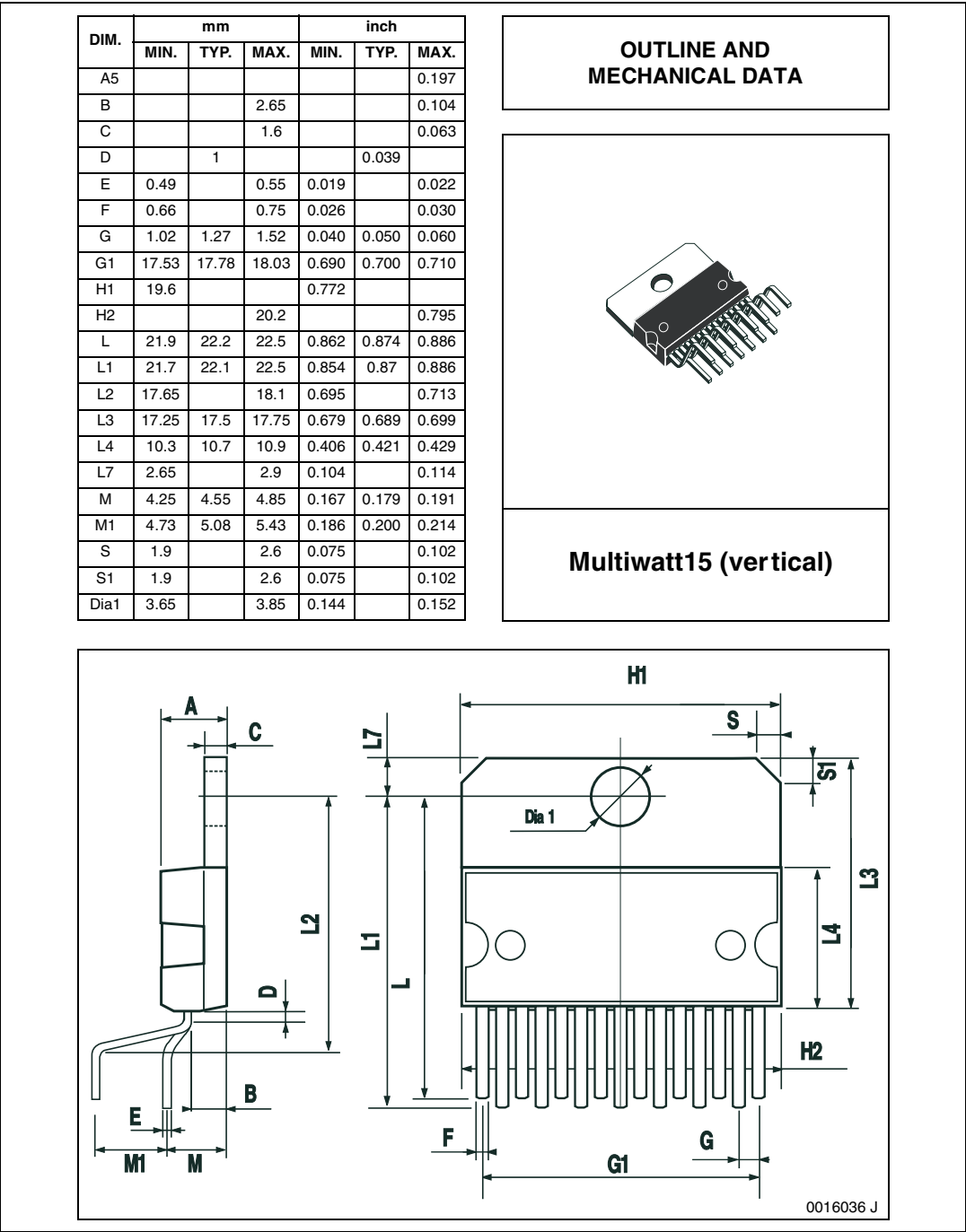


Figure 12. Multiwatt15 (vertical) mechanical data and package dimensions



4 Revision history

Table 5. Document revision history

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

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Email amall@ameya360.com

QQ 800077892

Skype ameyasales1 ameyasales2

➤ Customer Service :

Email service@ameya360.com

➤ Partnership :

Tel +86 (21) 64016692-8333

Email mkt@ameya360.com