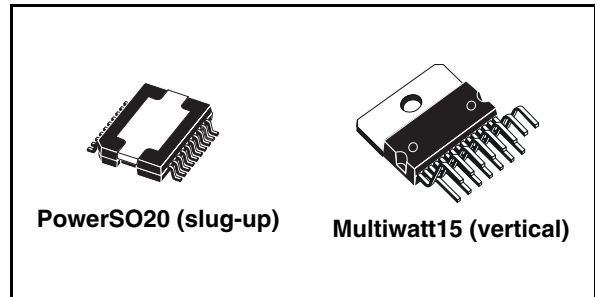


Multifunction voltage regulator for car radio

Features

- Four outputs:
 - 8.5V @ 500mA
 - 5V @ 300mA Permanent
 - 5V @ 800mA
 - 3.3V @ 800mA
- 2A 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 stand-by.

Table 1. Device summary

Order code	Package	Packing
L5956	Multiwatt-15 (vertical)	Tube
L5956PD	PowerSO-20	Tube
L5956PDTR	PowerSO-20	Tape and reel

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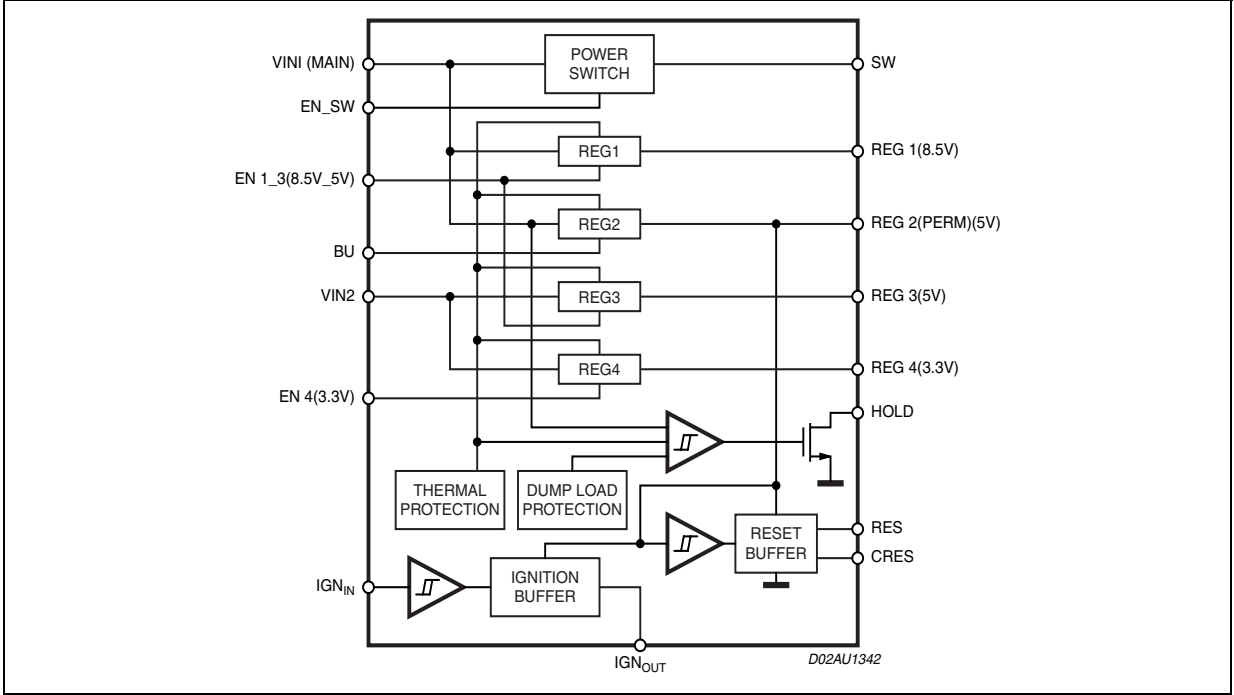
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1 Block diagram and pins description

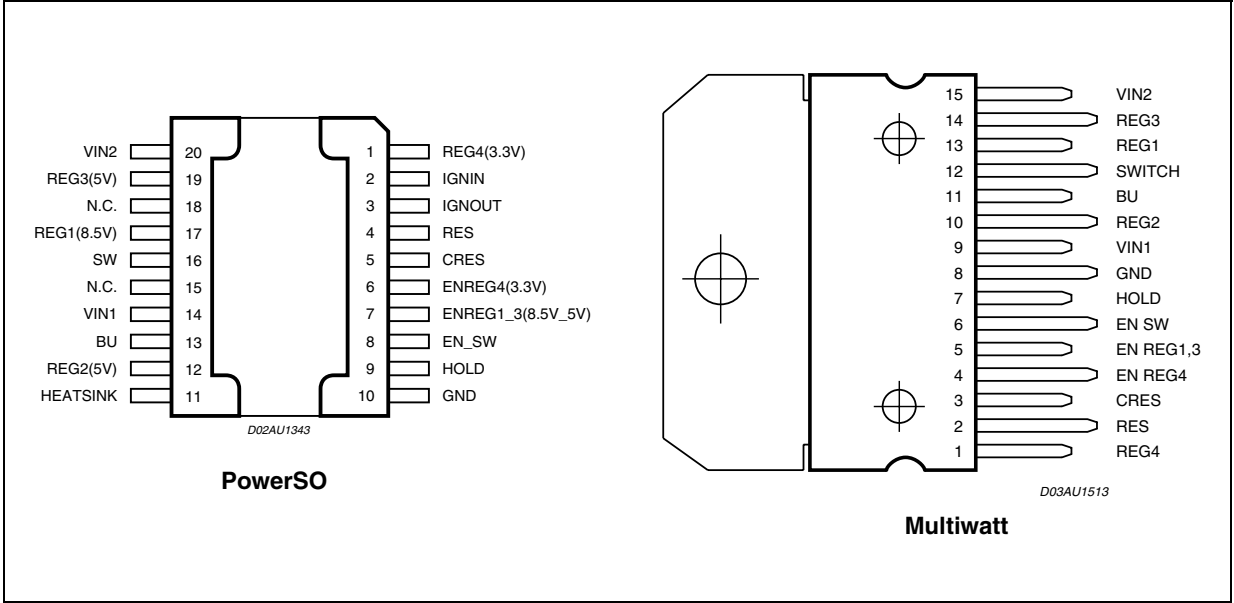
1.1 Block diagram

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 $T_{case} = 85^{\circ}\text{C}$	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

Table 4. Electrical characteristics

($V_S = 14.4\text{V}$; $T_{amb} = 25^{\circ}\text{C}$; unless otherwise specified)

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			
V_{in2}	Input supply voltage 2	Reverse polarity	non operating			
I_q	Total quiescent current	Stand-by (-20°C to 85°C) $IGN_{IN} = 5\text{V}$			60	μA
		$REGx = 5\text{V}$, $REGsw = 5\text{V}$, $IGN_{IN} = 5\text{V}$		5		mA
		Stand-by (-20°C to 85°C) $IGN_{IN} = 5\text{V}$, $V_{CC} = 18\text{V}$		100	170	μA
Load dump V_{in1}	Battery overvoltage	V_{in1}	18	20	22	V

Table 4. Electrical characteristics (continued) $(V_S = 14.4V; T_{amb} = 25^\circ C; \text{ unless otherwise specified})$

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
Load dump V_{in2}	Battery overvoltage	V_{in2}	18	20	22	V
REGULATOR 1						
V_o (REG 1)	Output voltage 8.5V		8	8.5	9	V
ΔV	Line regulation	$V_{in1} = 10 \text{ to } 18V; I = 500mA$			50	mV
ΔV	Line regulation	$V_{in1} = 9.3 \text{ to } 18V; I = 10mA$			50	mV
ΔV_i	Load regulation	$I_{reg1} = 1 \text{ to } 500mA$			100	mV
I_q	Quiescent current	$I_{reg1} = 10mA$			5	mA
PSRR	Supply voltage ripple rejection	$f = 1KHz; V_{in1} = 1.5V_{pp}; I_o = 500mA$	50			dB
V_{drop}	Drop out voltage	$I_{reg1} = 500mA (1)$			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 5V		4.75	5	5.25	V
ΔV	Line regulation	$V_{in1} = 7 \text{ to } 18V; I = 300mA$			50	mV
ΔV	Line regulation	$V_{in1} = 6 \text{ to } 18V; I = 10mA$			50	mV
ΔV_i	Load regulation	$I_{reg2} = 1 \text{ to } 300mA$			100	mV
I_q	Quiescent current	$I_{reg2} = 10mA$			3	mA
PSRR	Supply voltage ripple rejection	$f = 1KHz; V_{in1} = 1.5V_{pp}; I_o = 300mA$	50			dB
V_{drop}	Drop out voltage	$I_{reg2} = 300mA (1)$			1.5	V
V_{drop}	Drop out voltage	$I_{reg2} = 100mA (1)$			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	$V_{in2} = 7 \text{ to } 18V; I = 800mA$			50	mV
ΔV	Line regulation	$V_{in2} = 6 \text{ to } 18V; I = 10mA$			50	mV
ΔV_i	Load regulation	$I_{reg3} = 1 \text{ to } 800mA$			100	mV
I_q	Quiescent current	$I_{reg3} = 10mA$			5	mA
PSRR	Supply voltage ripple rejection	$f = 1KHz; V_{in1} = 1.5V_{pp}; I_o = 800mA$	50			dB
V_{drop}	Drop out voltage	$I_{reg3} = 800mA (1)$			1.5	V
I_m	Current limit	$R_{short} = 0.5\Omega$	1		2	A

Table 4. Electrical characteristics (continued) $(V_S = 14.4V; T_{amb} = 25^{\circ}C; \text{ unless otherwise specified})$

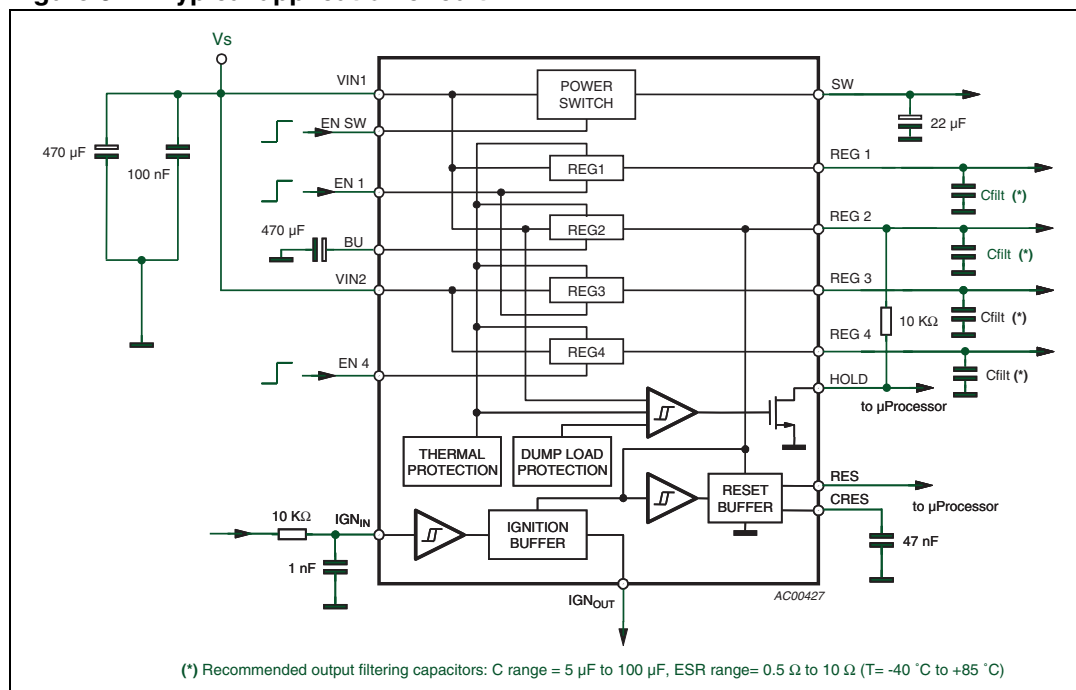
Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
REGULATOR 4						
V_o (REG 4)	Output voltage 3.3V		3.15	3.3	3.45	V
ΔV	Line regulation	$V_{in2} = 6 \text{ to } 18V; I = 800mA$			50	mV
ΔV	Line regulation	$V_{in2} = 6 \text{ to } 18V; I = 10mA$			50	mV
ΔV_i	Load regulation	$I_{reg4} = 1 \text{ to } 800mA$			100	mV
I_q	Quiescent current	$I_{reg4} = 10mA$			5	mA
PSRR	Supply voltage ripple rejection	$f = 1KHz; V_{in1} = 1.5V_{pp}; I_o = 800mA$	50			dB
V_{drop}	Drop out voltage	$I_{reg4} = 800mA^{(1)}$			2.5	V
I_m	Current limit	$R_{short} = 0.5\Omega$	1		2	A
POWER SWITCH						
V_{dropSW}	Drop voltage power switch	$I_{dcSW} = 1.8A \text{ max.}$			0.5	V
I_{pSW1}	Peak current power switch	Peak time < 15ms	2		3.5	A
I_{pSW2}	Peak current power switch	Peak time > 40ms	1		2	A
SW_{DEL}	Delay protection		15		40	ms
RESET BUFFER (with push-pull buffer)						
RES	RES falling	$V_{reg2} = 5V$	4.6	4.7	4.8	V
RES	RES rising	$V_{reg2} = 5V$	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 = 0V	1000	1300	1600	μA
$I_{Lsink(RES)}$	Low level sink current	Reset = 5V	14	16	18	mA
RES_{delay}	$C_{res} = 47nF$		10		60	ms
ΔT_{RES}	Reset rise and fall time	$R = 10k\Omega \quad C = 15pF$			50	μs
I_{Charge}	Charge current	$C_{RES} = 0V$	3	5	10	μA
$I_{Discharge}$	Discharge current	$C_{RES} = 5V$	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	$I_{SINK(RES)} = 1mA$		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

Table 4. Electrical characteristics (continued)
($V_S = 14.4V$; $T_{amb} = 25^{\circ}C$; unless otherwise specified)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$V_{\text{HOLD F}}$	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
$\text{IH}_{\text{source(IGNout)}}$	High level source current	$\text{I}_{\text{GNout}} = 0\text{V}$	1000	1500	2000	μA
$\text{IL}_{\text{sink(IGNout)}}$	Low level sink current	$\text{I}_{\text{GNout}} = 5\text{V}$	10	15	20	mA
V_{ol}	Low level	$\text{IL}_{\text{sink (IGNout)}} = 1\text{mA}$		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. 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



3 Timing diagrams

Figure 4. Timing diagram of regulators and power switch

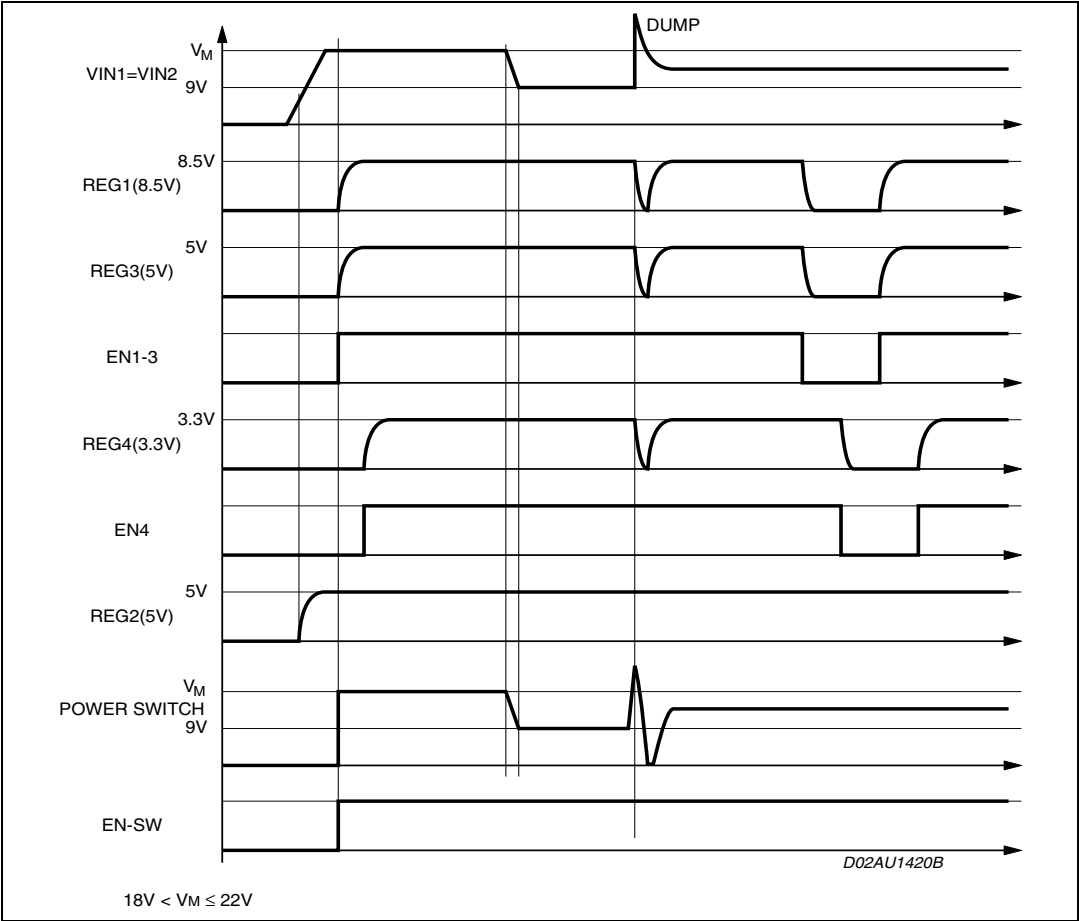


Figure 5. Backup and reset diagram

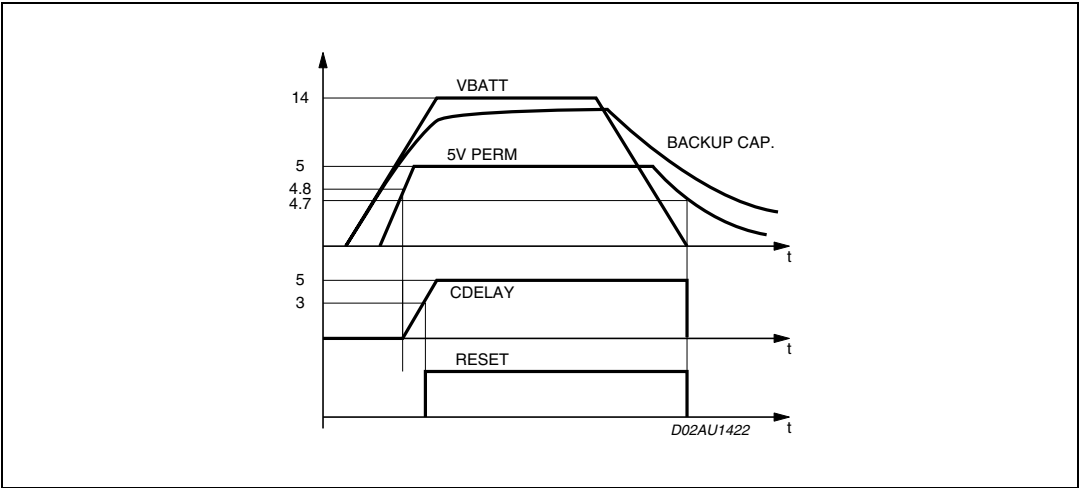


Figure 6. Hold and thermal protection

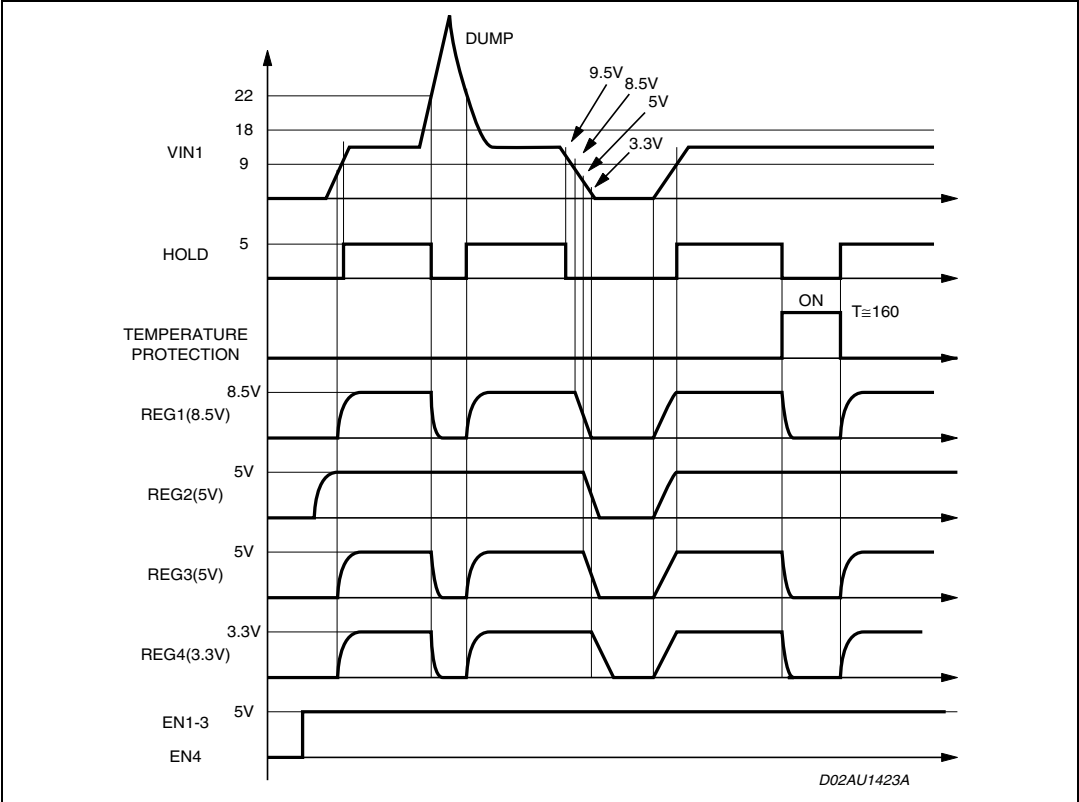


Figure 7. Ignition buffer diagram

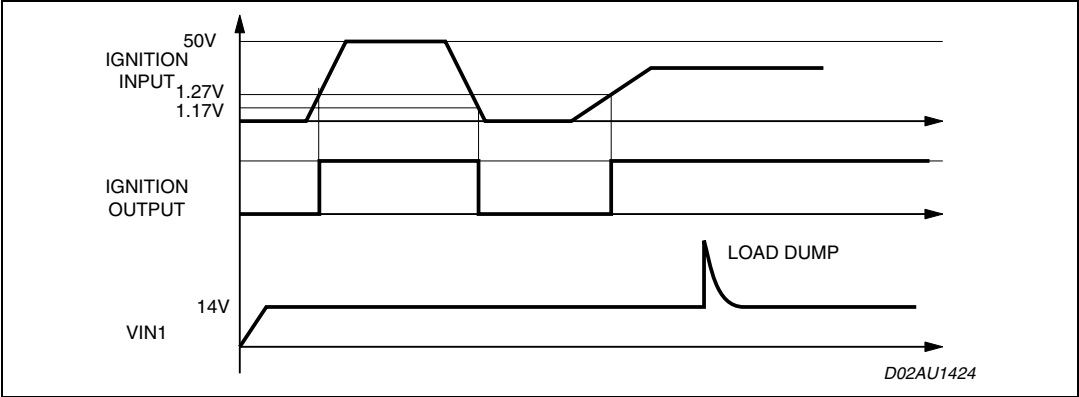


Figure 8. Protection of the power switch

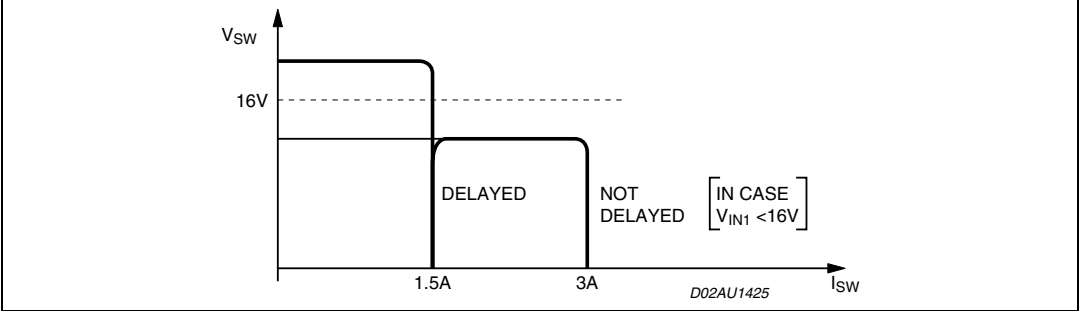
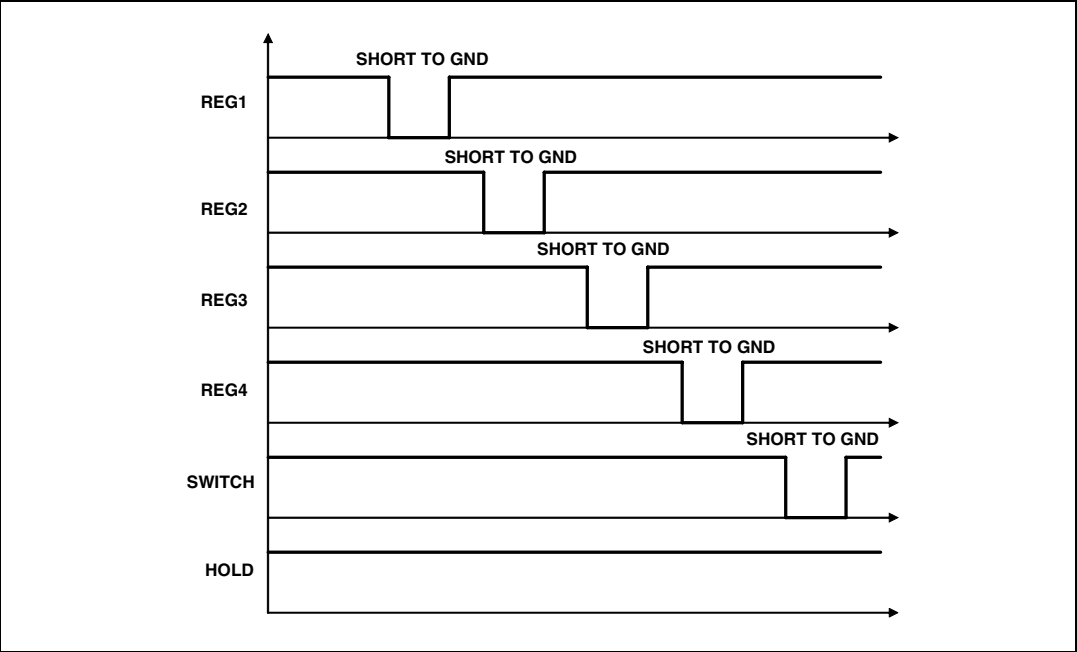


Figure 9. Short circuit diagram



4 Package information

In order to meet environmental requirements, ST offers this device in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark.

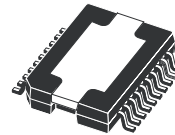
ECOPACK specifications are available at: www.st.com.

Figure 10. 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 _i (max)					
R		0.6			0.024	
S	0 _i (min.) 8 _j (max.)					
V	5 _i (min.) 7 _j (max.)					

(1) OD and EID do not include mold flash or protusions.
- Mold flash or protusions shall not exceed 0.15mm (0.006").
- Critical dimensions: $\overline{EO}$, $\overline{AIO}$, $\overline{EOe}$ and $\overline{OC}$.

OUTLINE AND MECHANICAL DATA



PowerSO20 (SLUG UP)

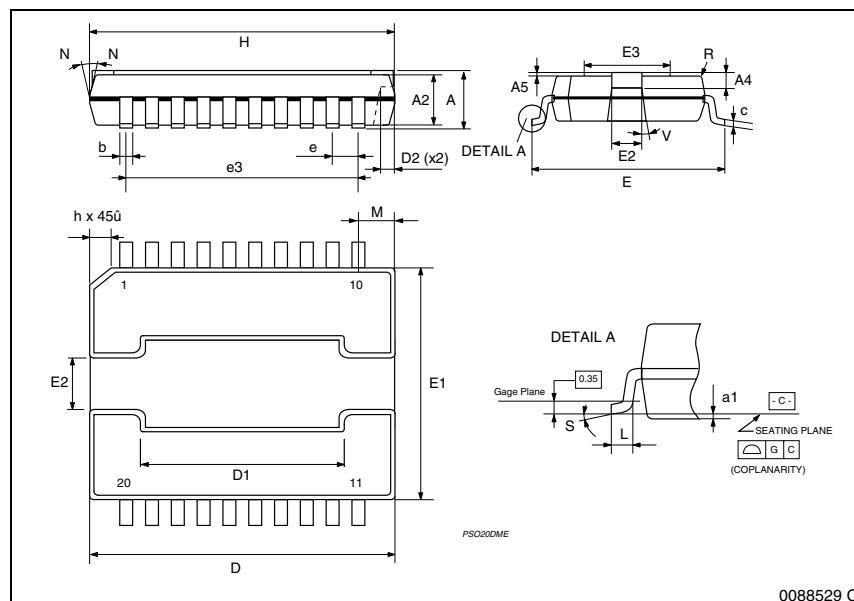
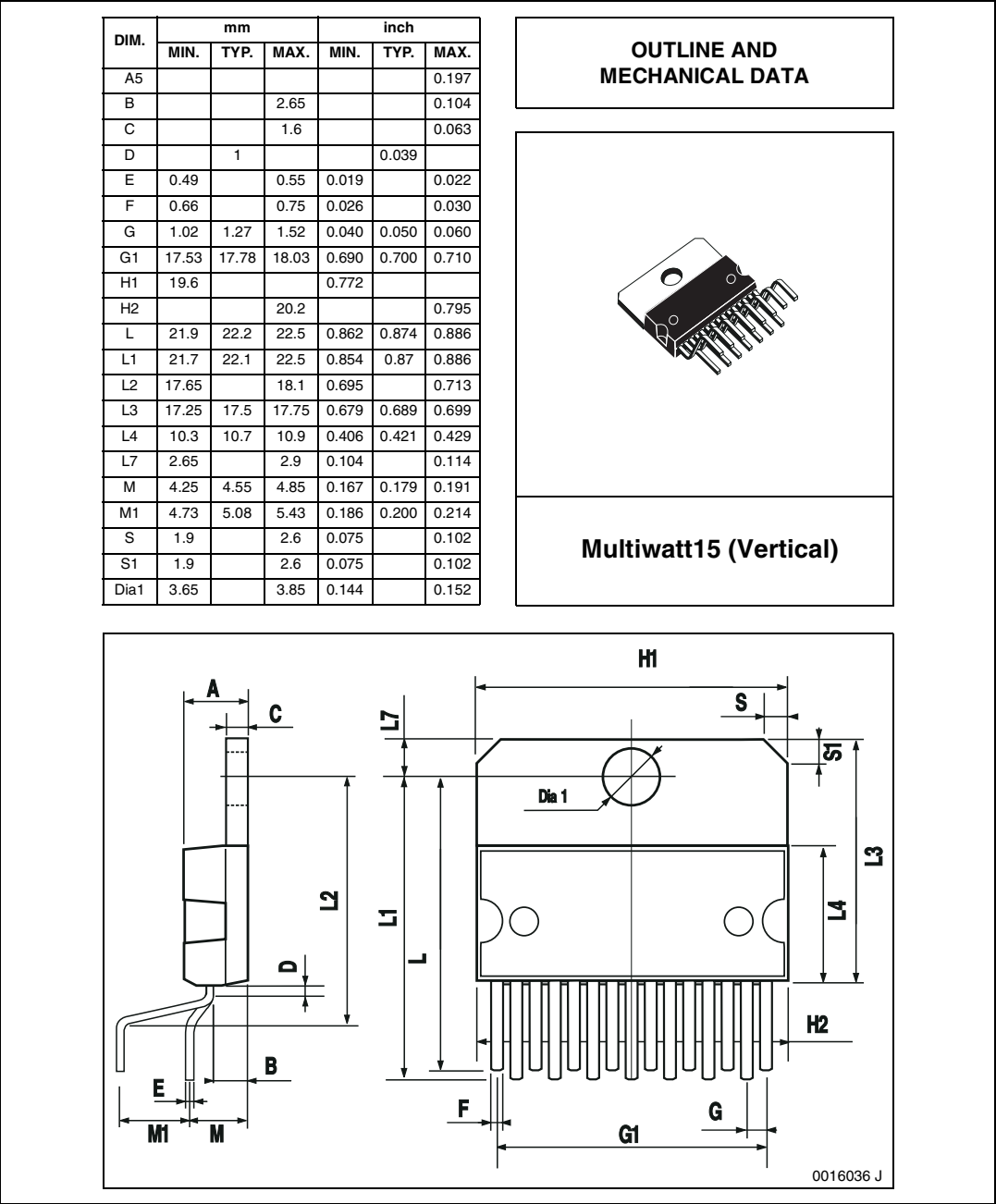


Figure 11. Multiwatt 15 (vertical) mechanical data and package dimensions



5 Revision history

Table 5. Document revision history

Date	Revision	Changes
29-Aug-2007	1	Initial release.

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