

## DUAL FULL BRIDGE

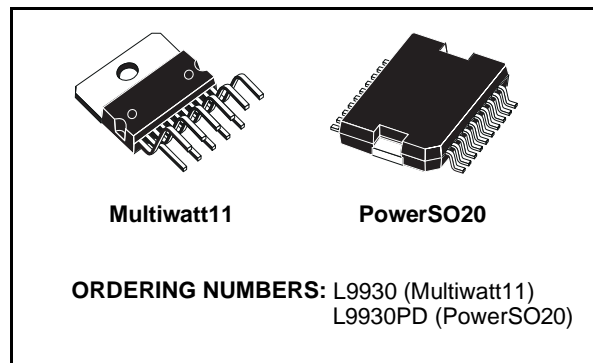
- $R_{DS\ ON} = 2\Omega$
- INTERNAL CLAMPING VOLTAGE = 32V
- INTERNAL FREE WHEELING DIODES
- PARALLEL DRIVE CAPABILITY
- RESISTIVE OR INDUCTIVE LOAD

### PROTECTION:

- TEMPERATURE PROTECTION
- SHORT-CIRCUIT PROTECTION ( $V_{bat}$ , LOAD, GND)

### DETECTION:

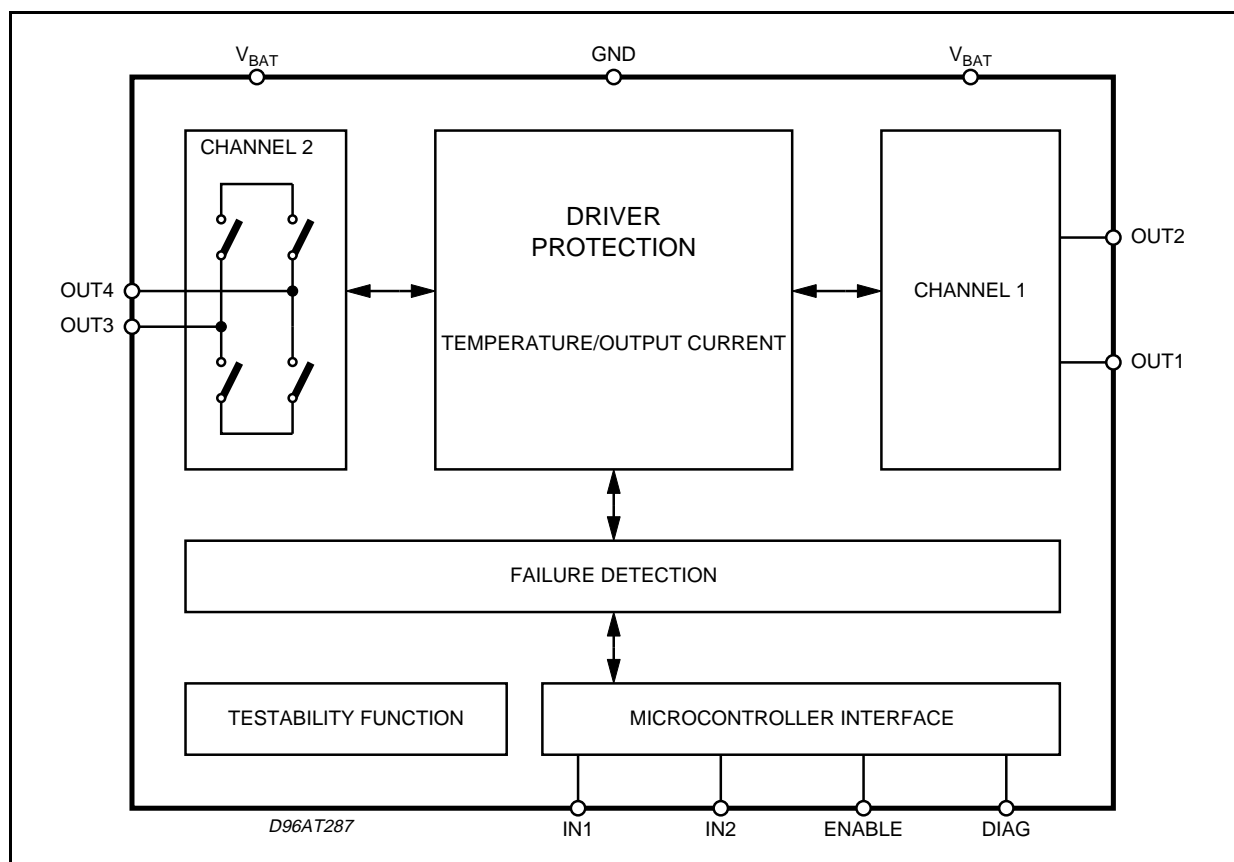
- SHORTED LOAD
- OPEN LOAD
- OVERTEMPERATURE



### DESCRIPTION

The L9930 is a dual full-bridge. The output stages are Power Mos switches.

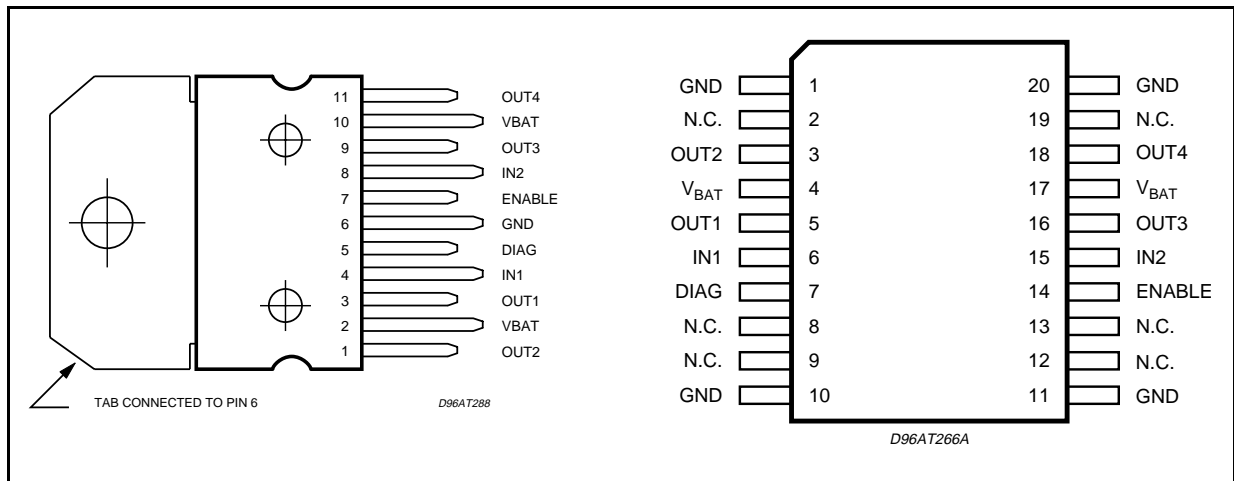
### BLOCK DIAGRAM



**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
E	Clamped Energy at the Switching off	6 (max)	mJ
V <sub>out DC</sub>	Continuous Output Voltage	24 (max)	V
V <sub>out tr</sub>	Transient Output Voltage	32 (max)	V
V <sub>bat DC</sub>	Continuous Battery Voltage	8 to 24	V
V <sub>bat tr</sub>	Transient Battery Voltage	45 (max)	V
I <sub>out</sub>	Reverse Output Current	- 2 (max)	A
f <sub>in</sub>	Input Frequency	500 (max)	Hz
V <sub>in</sub>	Input Voltage	- 0.3 to +7	V
V <sub>diag</sub>	Diagnostic Voltage	- 0.3 to +7	V
T <sub>s</sub>	Storage Temperature	- 55 to 150	°C
T <sub>j</sub>	Operating Junction Temperature	- 40 to 150	°C
V <sub>ESD</sub>	V <sub>ESD</sub> (Note MIL STD 883C)	3000	V

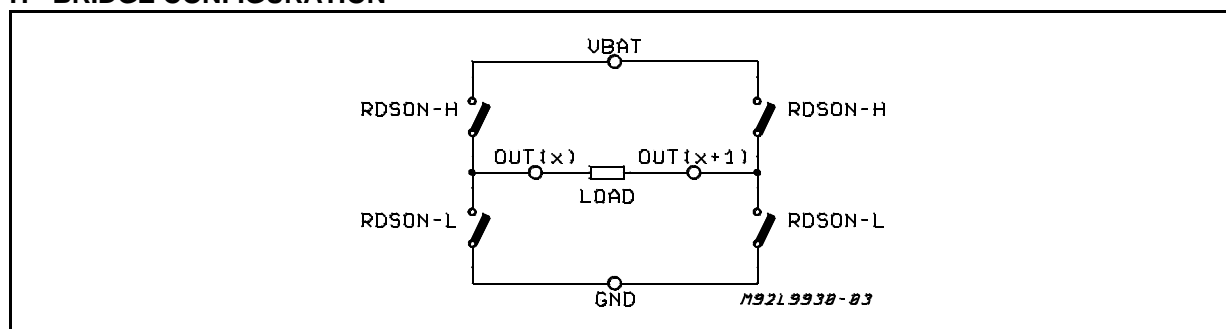
**PIN CONNECTION**



**PIN FUNCTIONS**

MW11	PowerSO20	Name	Function
1	3	OUT 2	Output Channel 1
2	4	V <sub>BAT</sub>	Power Supply
3	5	OUT 1	Output Channel 1
4	6	IN 1	Input Channel 1
5	7	DIAG	Diagnostic Output Common for the 2 Channels
6	1, 10, 11, 20	GND	Ground
7	14	ENABLE	Enable
8	15	IN 2	Input Channel 2
9	16	OUT 3	Output Channel 2
10	17	V <sub>BAT</sub>	Power Supply
11	18	OUT 4	Output Channel 2
	2, 8, 9, 12, 13, 19	NC	Not Connected

## H - BRIDGE CONFIGURATION



## THERMAL DATA

Symbol	Parameter	Value	Unit
$R_{th\ j-case}$	Thermal Resistance Junction to Case	max.	$^{\circ}C/W$
$R_{th\ j-amb}$	Thermal resistance Junction to Ambient	max.	$^{\circ}C/W$

ELECTRICAL CHARACTERISTICS ( $V_{bat} = 8$  to  $18V$   $t_J = -40$  to  $+150^{\circ}C$ , unless otherwise specified.)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$R_{DSon-H}$	ON Resistance	$I_{out} = 0.5A$		2	4.3	$\Omega$
$R_{DSon-L}$	ON Resistance	$I_{out} = 0.5A$		2	4.3	$\Omega$
$V_{OCL}$	Clamping Voltage	$I_{out} = 0.1A$		32		V
$V_F$	Clamp Diode Forward Voltage	$I_{out} = 0.5A$		1.3		V
$T_R$	Output Voltage Rise Time	$V_{out}$ ; 0.1 to 0.9 $V_{out}$ (see fig. 1) NOT LOADED		50	100	$\mu s$
$T_F$	Output Voltage Fall Time	$V_{out}$ ; 0.9 to 0.1 $V_{out}$ (see fig. 1) NOT LOADED		50	100	$\mu s$
$T_{DR}$	Input to Output Rising edge Delay	0.5 $V_{IN}$ to 0.1 $V_{out}$ (see fig. 1) NOT LOADED			50	$\mu s$
$T_{DF}$	Input to Output Falling Edge Delay	0.5 $V_{IN}$ to 0.9 $V_{out}$ (see fig. 1) NOT LOADED			50	$\mu s$

## OUTPUT PROTECTIONS CHARACTERISTICS

$I_{SC}$	Short Circuit Typical Application (see fig 2)	$T_{amb} = -40^{\circ}C$	0.45		2.6	A
		$T_{amb} = 25^{\circ}C$	0.38		2.6	A
		$T_{amb} = 125^{\circ}C$	0.28		2.6	A
$I_{SC}$	Short Circuit Typical Application with Shottky Diodes (see fig 3)		0.8		2.6	A
$T_{SD}$	Temperature		160			$^{\circ}C$
$T_{HYST}$	Temperature Hysteresis			20		$^{\circ}C$

These protections switch off the full bridge.

## OUTPUT DETECTIONS CHARACTERISTICS

$R_{OPL-L}$	Open-load Threshold Resistor	80			$\Omega$
$R_{OPL-H}$		100			$\Omega$

## SUPPLY CHARACTERISTICS

$I_{QHI}$	Supply Current	$R_{LOAD1} = R_{LOAD2} = \infty$ $V_{BAT} = 14V$ , $IN1 = IN2 = ENABLE = 5V$			15	mA
$I_{QLO}$		$R_{load1} = R_{load2} = 50\Omega$ $V_{BAT} = 12V$ , $ENABLE = 0V$ $IN1 = IN2 = 0V$			0.5	mA

**ELECTRICAL CHARACTERISTICS**

INPUTS CHARACTERISTICS (normal and standby mode)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$V_{IH}$	High Threshold				4	V
$V_{IL}$	Low Threshold		1			V
$I_{NH1}$	Input Current 1	$V_{IN} = 4V$			200	$\mu A$
$I_{NLO}$	Input Current 2	$V_{IN} = 1V$			50	$\mu A$

DIAGNOSTIC CHARACTERISTICS

$V_{DIAGL}$	Low Level Voltage	$I_{DIAG} = 2mA$		0.6	0.8	V
$I_{DIAGH}$	Leakage Current	$V_{DIAG} = 5.25V$		5	10	$\mu A$

INITIALIZATION CHARACTERISTICS

$T_{INIT}$	Initialization Timing	$V_{BAT} = 12V$	10			$\mu s$
$T_{STUP}$	Start-Up Timing	$V_{BAT} = 12V$	1			ms
$T_{RESET}$	Reset		10			$\mu s$

FILTER CHARACTERISTICS

$T_{FILTER}$			64	112	170	$\mu s$
$T_{DIAG}$			4	6	10	$\mu s$
$T_{SYNC}$			4	6	10	$\mu s$

**TRUE TABLE**

ENAB	IN1	IN2	OUT1	OUT2	OUT3	OUT4	MODE	DIAG
0	0	0	HZ	HZ	HZ	HZ	STANDBY	?
0	0	1	HZ	HZ	HZ	HZ	NORMAL	?
0	1	0	HZ	HZ	HZ	HZ	NORMAL	?
0	1	1	HZ	HZ	HZ	HZ	NORMAL	?
1	0	0	HSD	LSD	HSD	LSD	NORMAL	VALID
1	0	1	HSD	LSD	LSD	HSD	NORMAL	VALID
1	1	0	LSD	HSD	HSD	LSD	NORMAL	VALID
1	1	1	LSD	HSD	LSD	HSD	NORMAL	VALID

Figure 1:

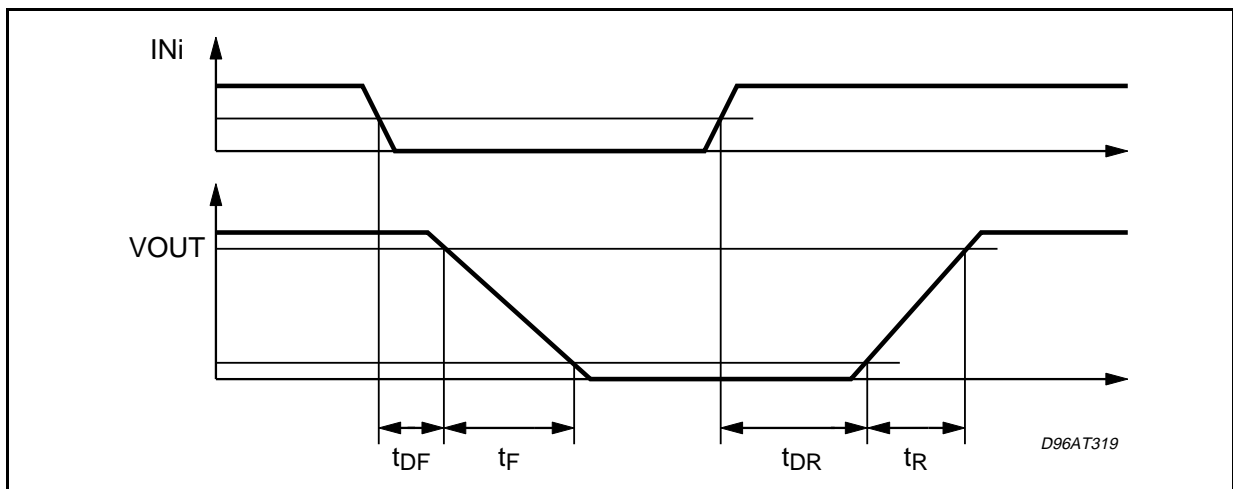


Figure 2: Typical Application

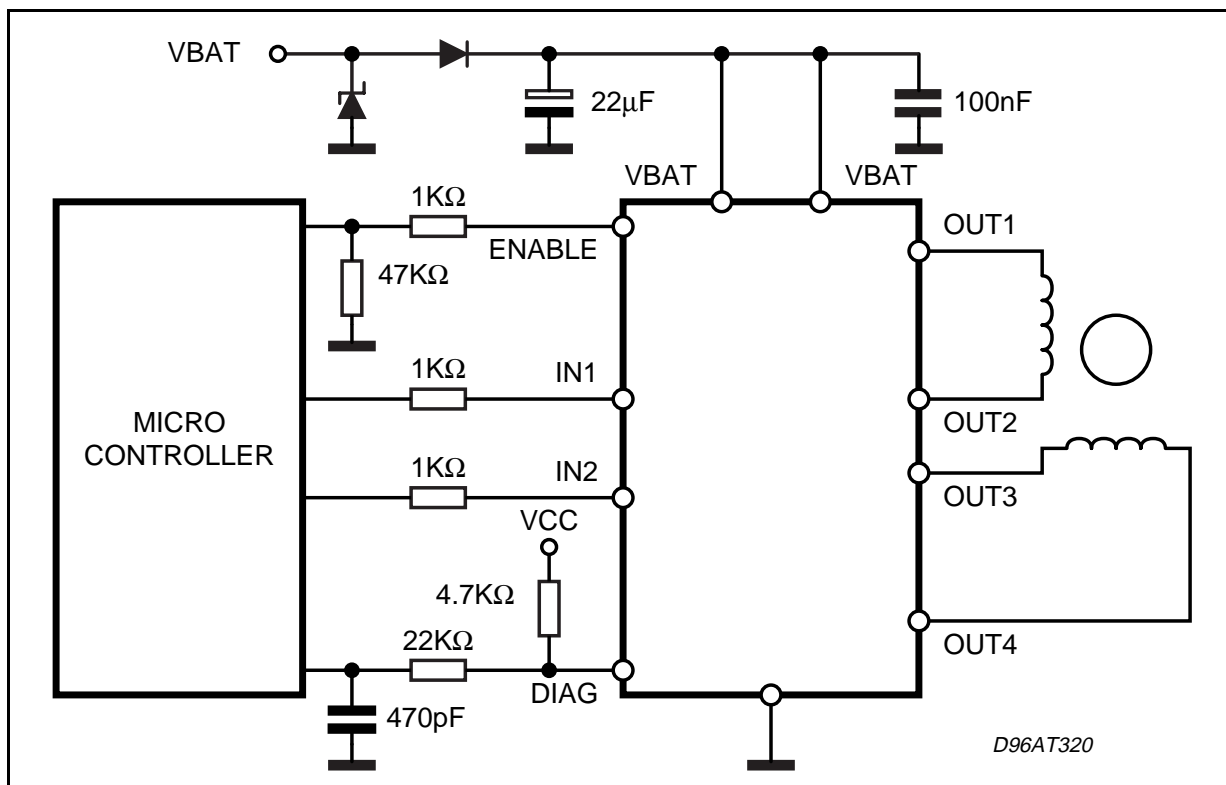


Figure 3: Typical Application with Shottky Diodes

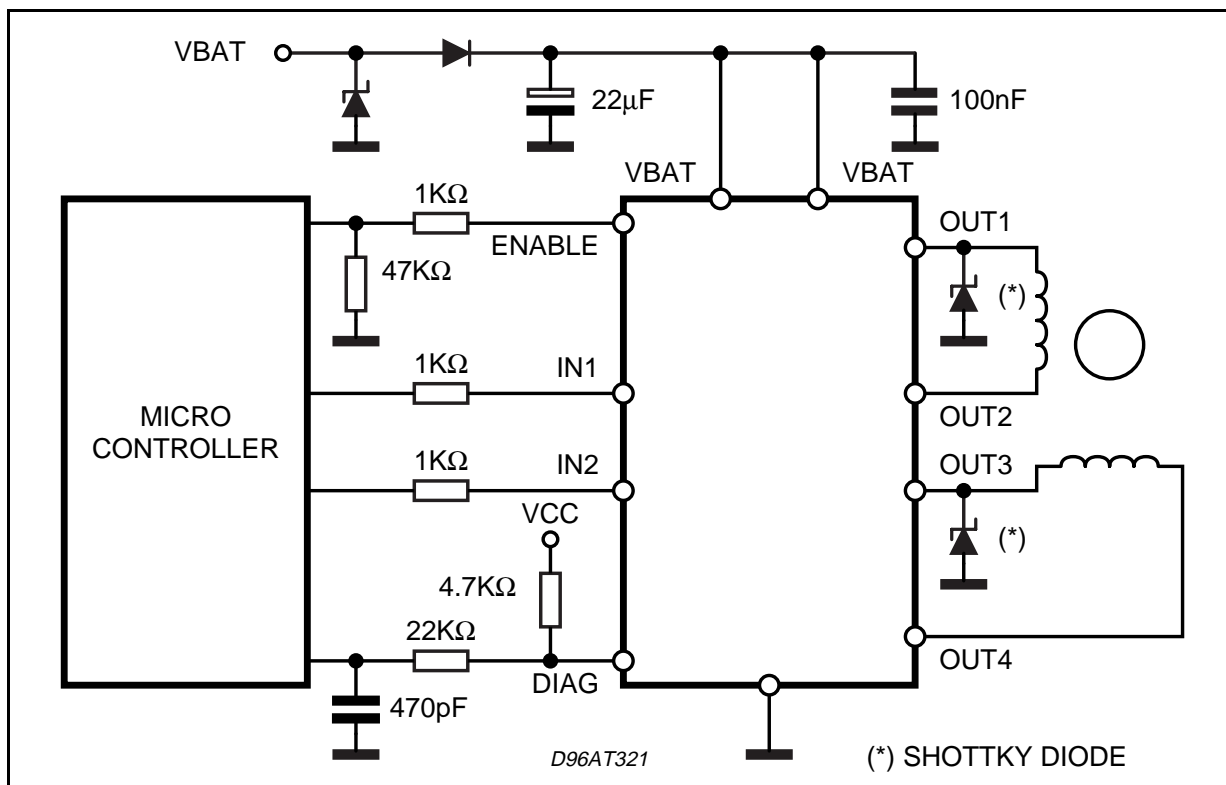


Figure 4: Initialization.

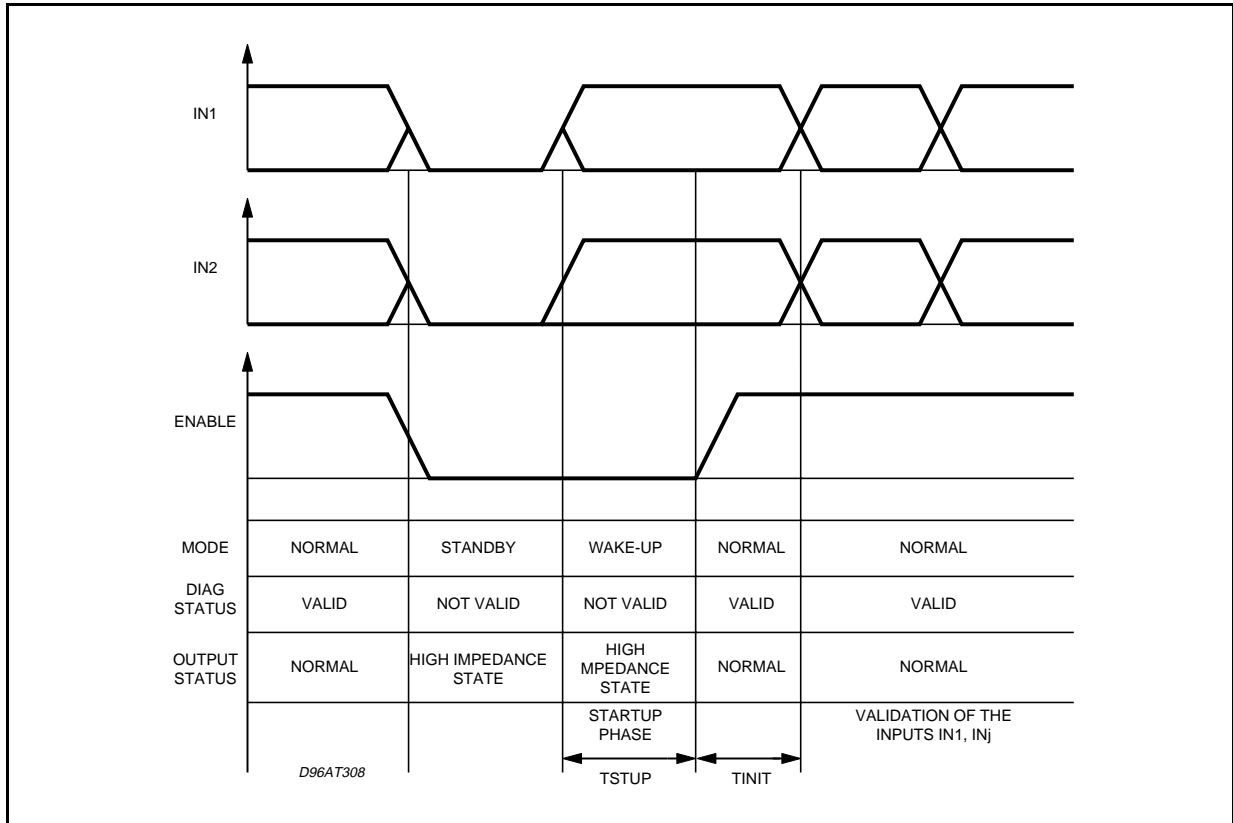


Figure 5: Normal Condition.

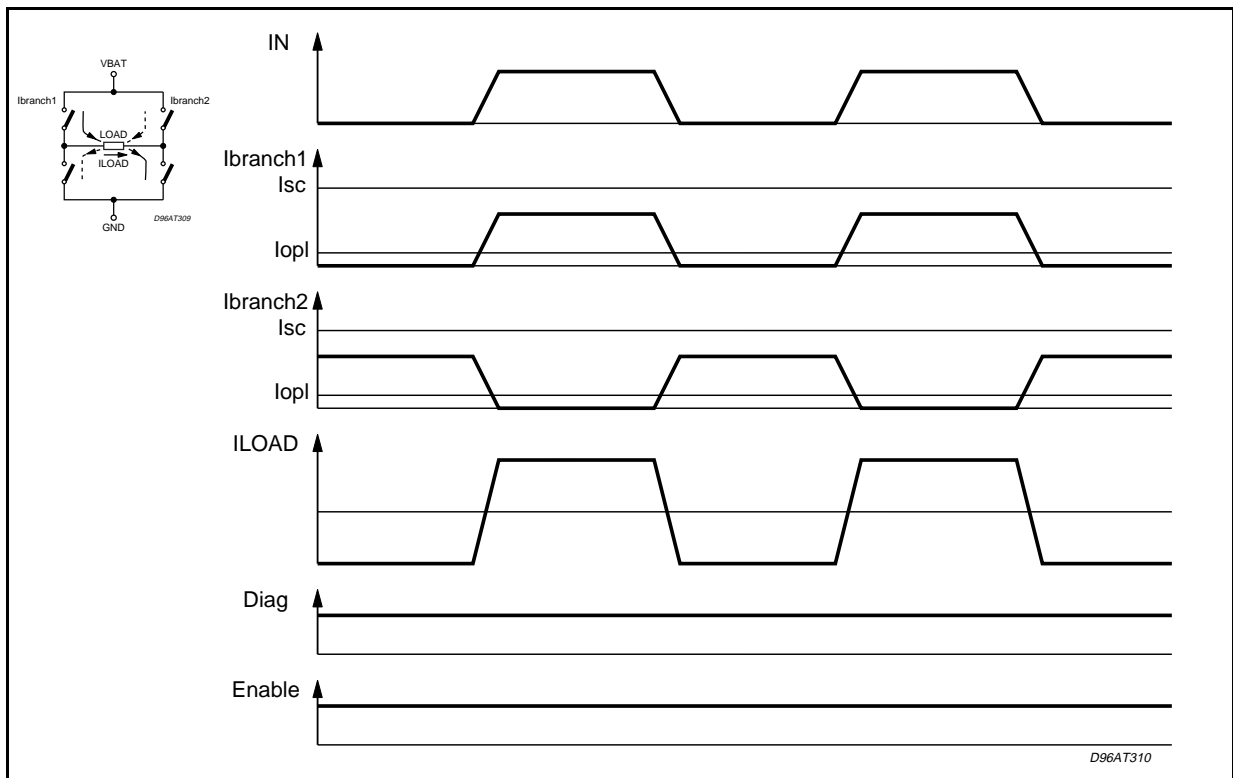


Figure 6: Short-circuit Condition.

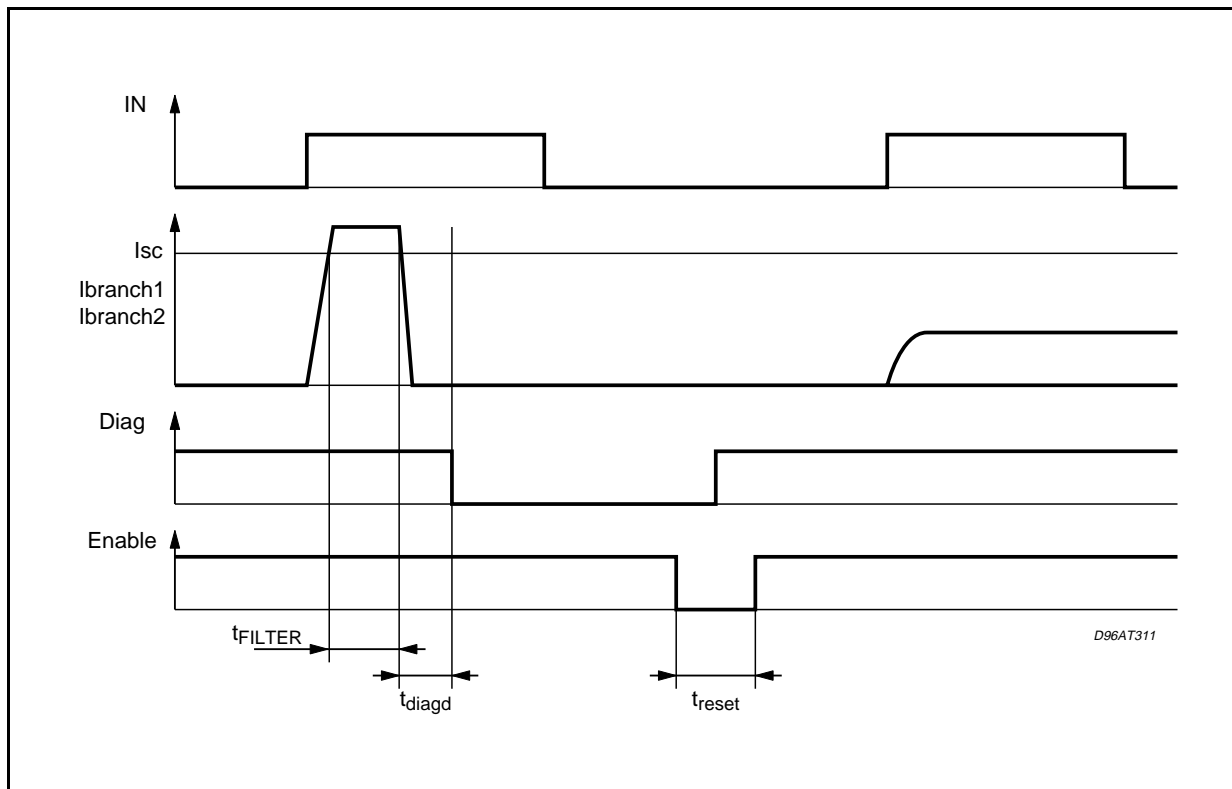


Figure 7: short circuit condition: no detection (NOT TESTED)

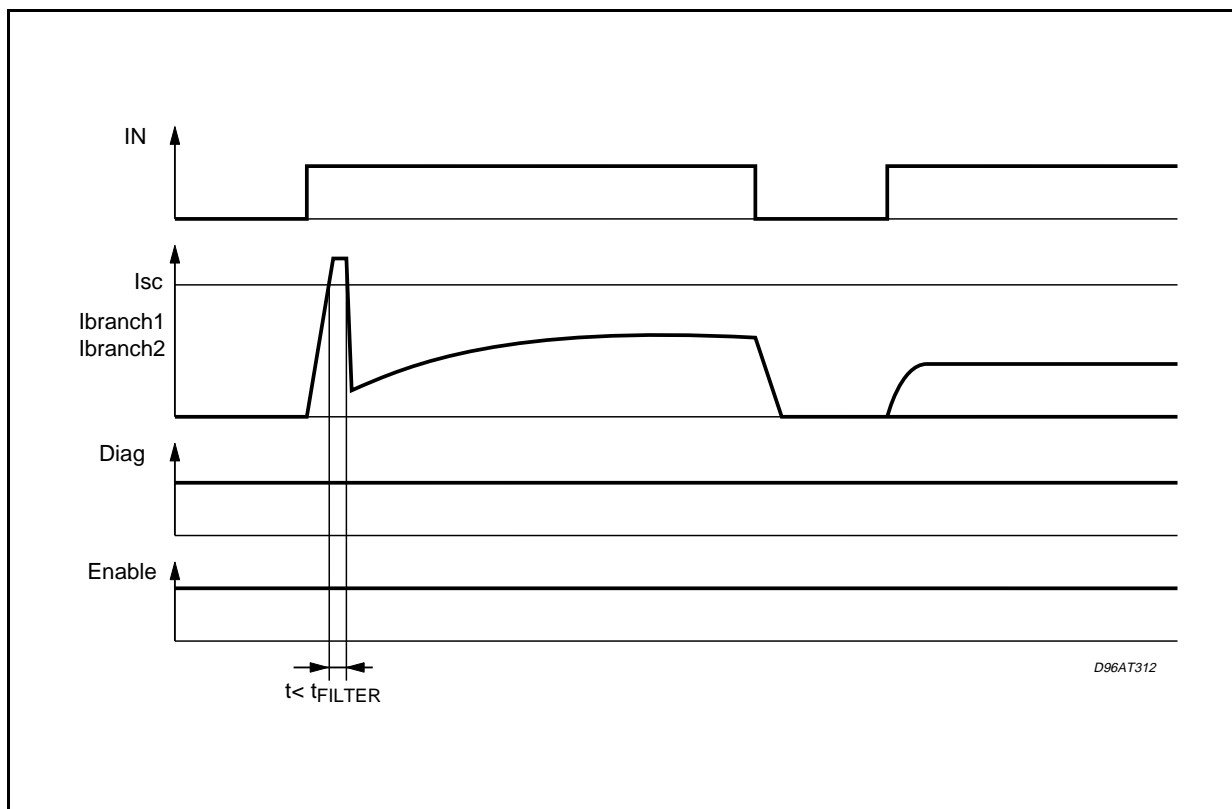


Figure 8: Open Load Condition 1: Detection

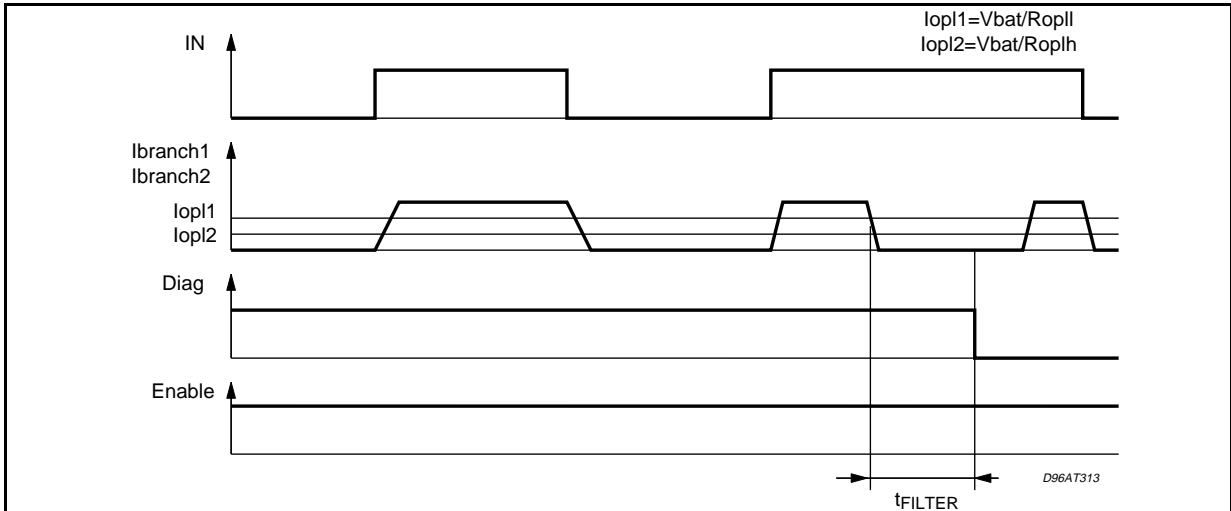


Figure 9: Open Load Condition 1: No Detection (NOT TESTED)

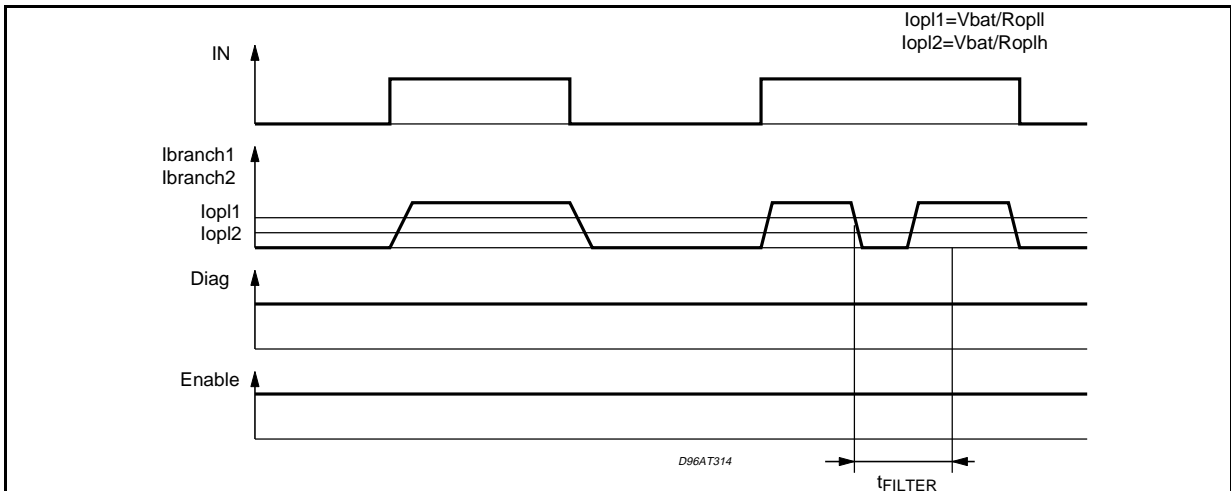


Figure 10: Open Load Condition 2: No Current after (ENABLE)

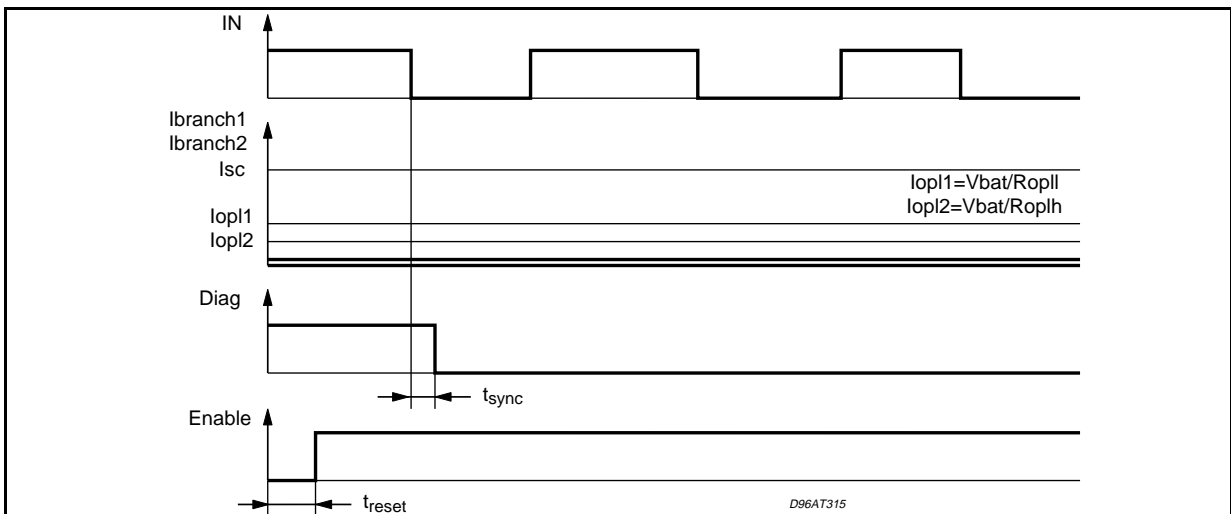




Figure 11: Open Load Condition 3

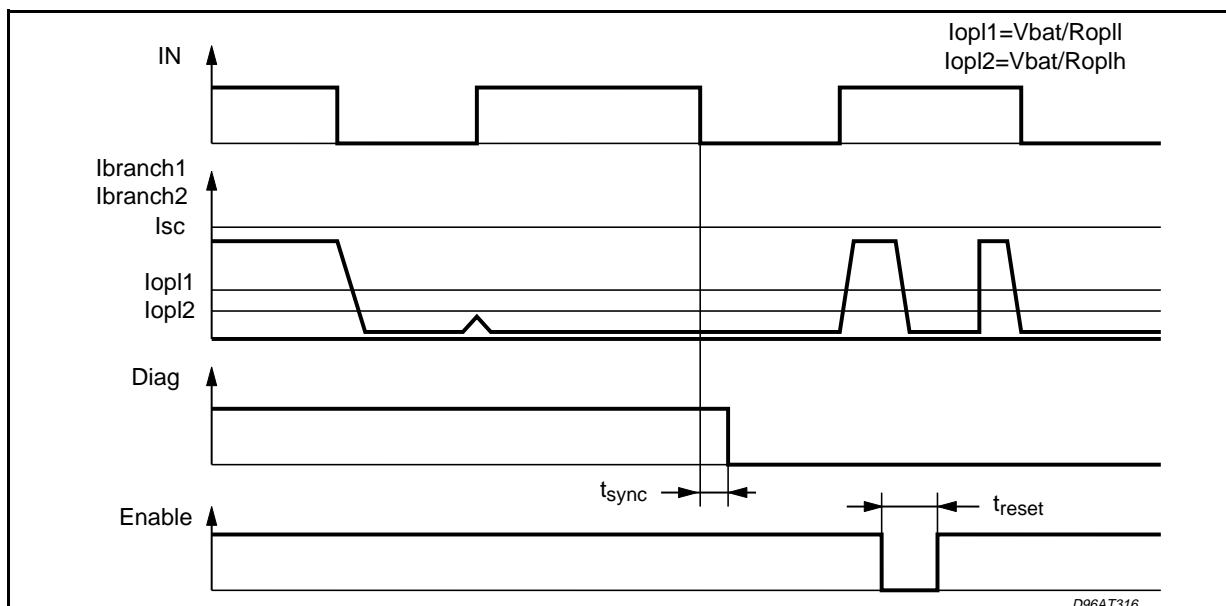


Figure 12: Open Load Condition 4: No Detection

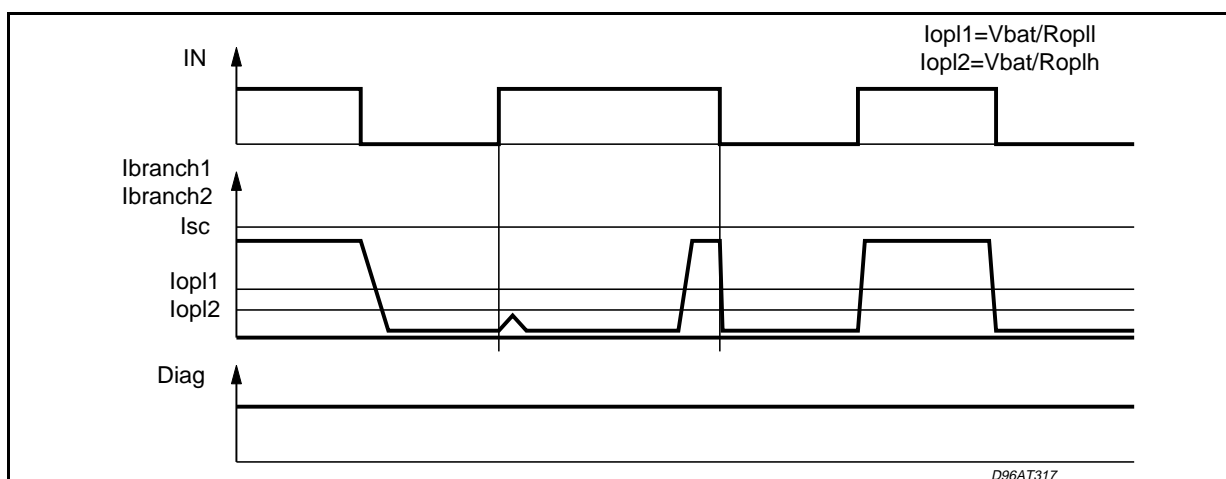
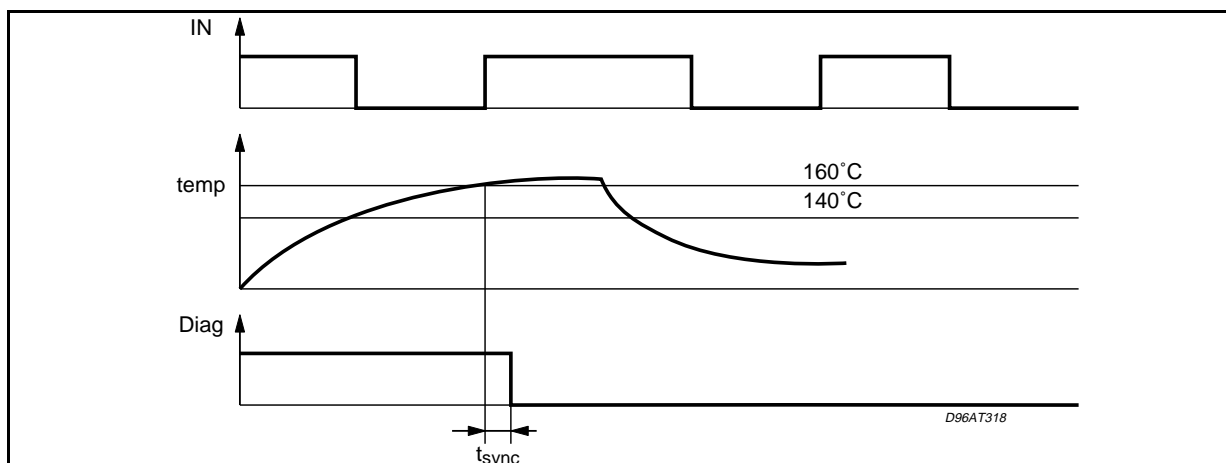
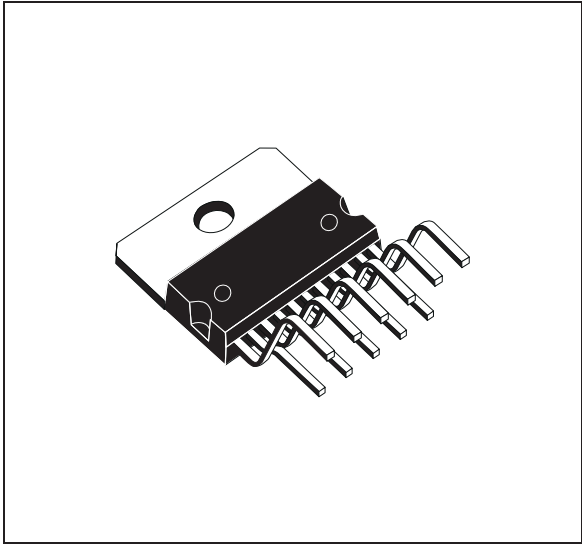


Figure 13: Overtemperature Detection

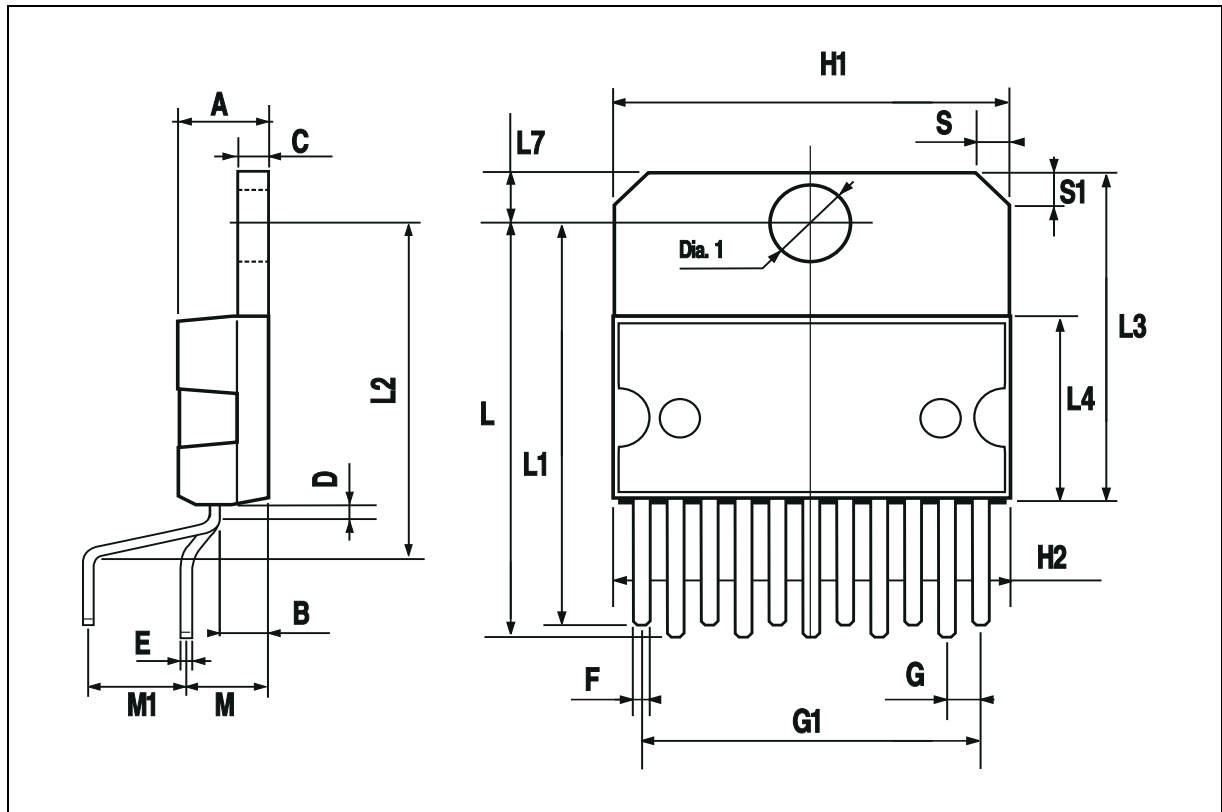


DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			5			0.197
B			2.65			0.104
C			1.6			0.063
D		1			0.039	
E	0.49		0.55	0.019		0.022
F	0.88		0.95	0.035		0.037
G	1.45	1.7	1.95	0.057	0.067	0.077
G1	16.75	17	17.25	0.659	0.669	0.679
H1	19.6			0.772		
H2			20.2			0.795
L	21.9	22.2	22.5	0.862	0.874	0.886
L1	21.7	22.1	22.5	0.854	0.87	0.886
L2	17.4		18.1	0.685		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

**OUTLINE AND MECHANICAL DATA**



**Multiwatt11 V**

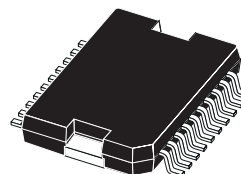


DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			3.6			0.142
a1	0.1		0.3	0.004		0.012
a2			3.3			0.130
a3	0		0.1	0.000		0.004
b	0.4		0.53	0.016		0.021
c	0.23		0.32	0.009		0.013
D (1)	15.8		16	0.622		0.630
D1	9.4		9.8	0.370		0.386
E	13.9		14.5	0.547		0.570
e		1.27			0.050	
e3		11.43			0.450	
E1 (1)	10.9		11.1	0.429		0.437
E2			2.9			0.114
E3	5.8		6.2	0.228		0.244
G	0		0.1	0.000		0.004
H	15.5		15.9	0.610		0.626
h			1.1			0.043
L	0.8		1.1	0.031		0.043
N	8° (typ.)					
S	8° (max.)					
T		10			0.394	

(1) "D and E1" do not include mold flash or protusions.  
 - Mold flash or protusions shall not exceed 0.15mm (0.006")  
 - Critical dimensions: "E", "G" and "a3".

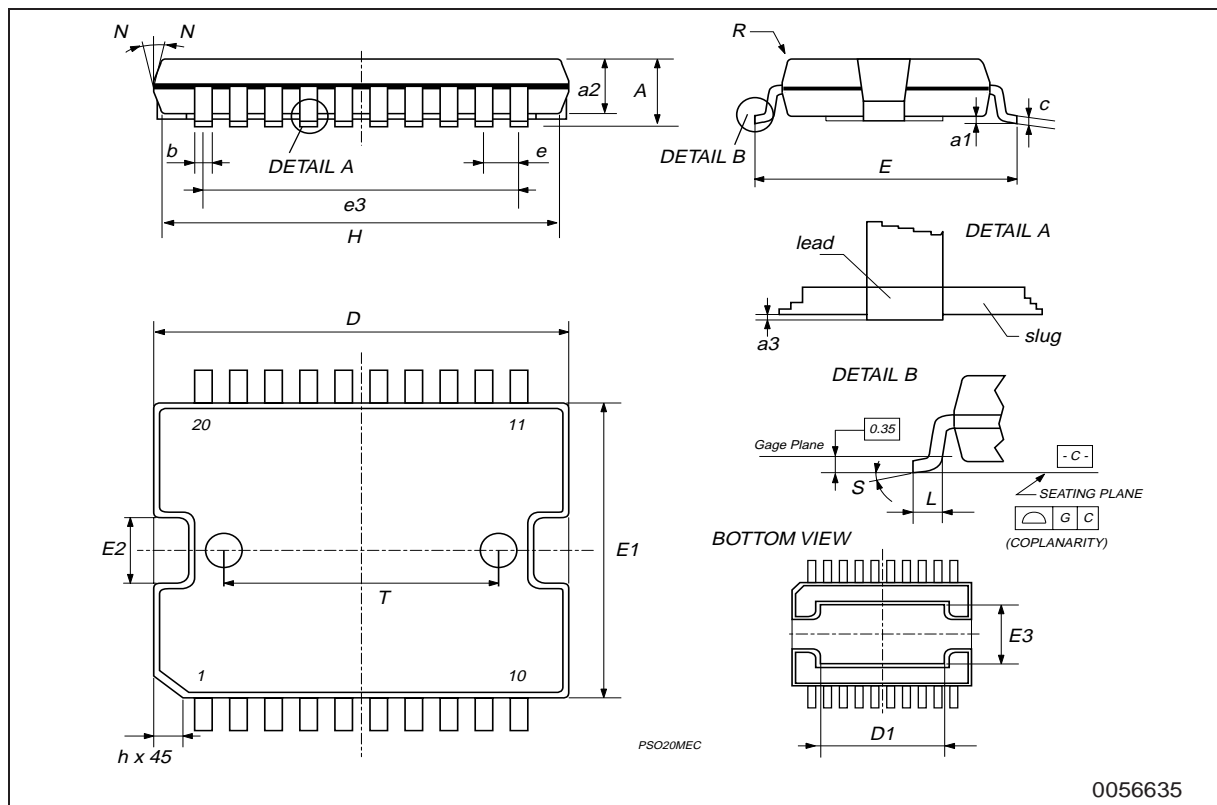
## OUTLINE AND MECHANICAL DATA

Weight: 1.9gr



JEDEC MO-166

### PowerSO20



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