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®

L9930

DUAL FULL BRIDGE

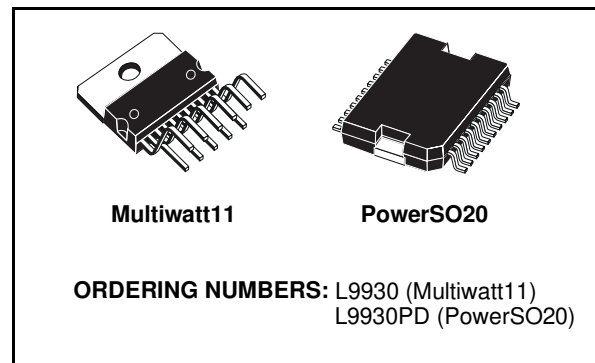- $R_{DS\ ON} = 2\Omega$
- INTERNAL CLAMPING VOLTAGE = 32V
- INTERNAL FREE WHEELING DIODES
- PARALLEL DRIVE CAPABILITY
- RESISTIVE OR INDUCTIVE LOAD

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

DETECTION:
- SHORTED LOAD
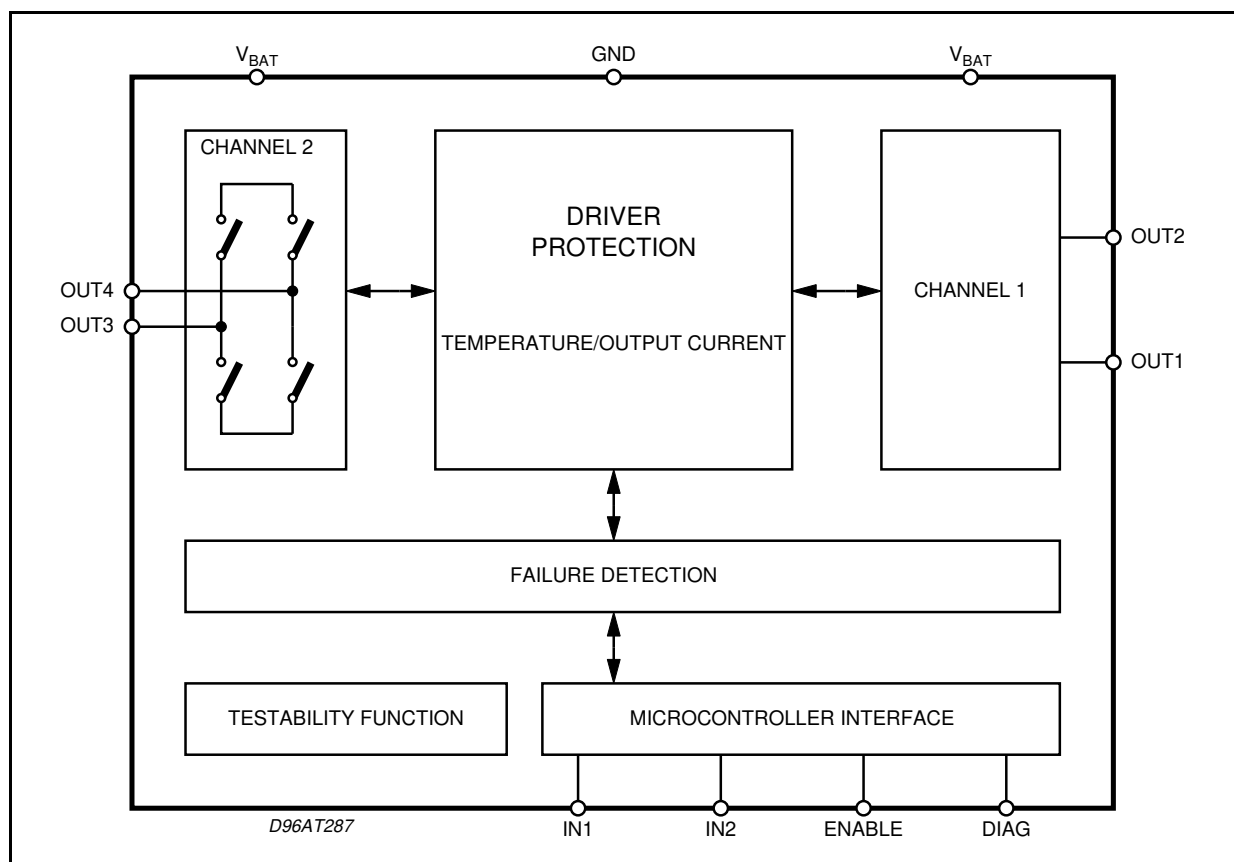- OPEN LOAD
- OVERTEMPERATURE

Multiwatt11   **PowerSO20**

ORDERING NUMBERS: L9930 (Multiwatt11)
L9930PD (PowerSO20)

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

BLOCK DIAGRAM

ABSOLUTE MAXIMUM RATINGS
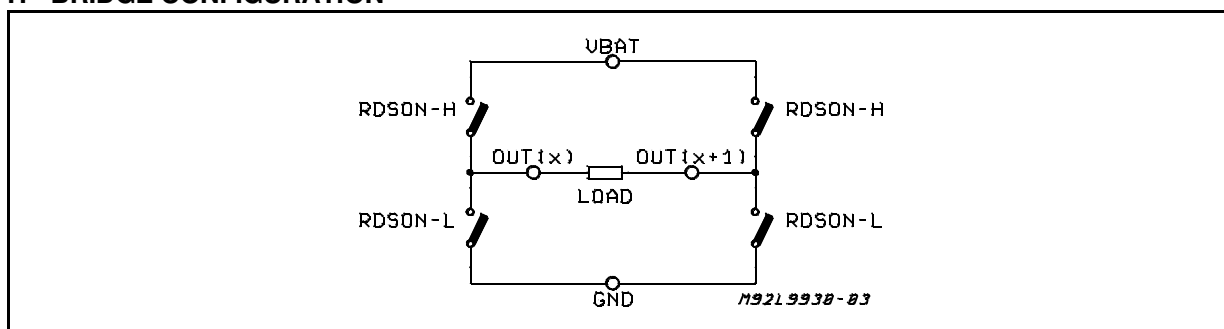
Symbol	Parameter	Value	Unit
E	Clamped Energy at the Switching off	6 (max)	mJ
$V_{out\ DC}$	Continuous Output Voltage	24 (max)	V
$V_{out\ tr}$	Transient Output Voltage	32 (max)	V
$V_{bat\ DC}$	Continuous Battery Voltage	8 to 24	V
$V_{bat\ tr}$	Transient Battery Voltage	45 (max)	V
I_{out}	Reverse Output Current	$-$ 2 (max)	A
f_{in}	Input Frequency	500 (max)	Hz
V_{in}	Input Voltage	$-$ 0.3 to +7	V
V_{diag}	Diagnostic Voltage	$-$ 0.3 to +7	V
T_s	Storage Temperature	$-$ 55 to 150	°C
T_j	Operating Junction Temperature	$-$ 40 to 150	°C
V_{ESD}	V_{ESD} (Note MIL STD 883C)	3000	V

PIN CONNECTION

TAB CONNECTED TO PIN 6   D96AT288

D96AT266A
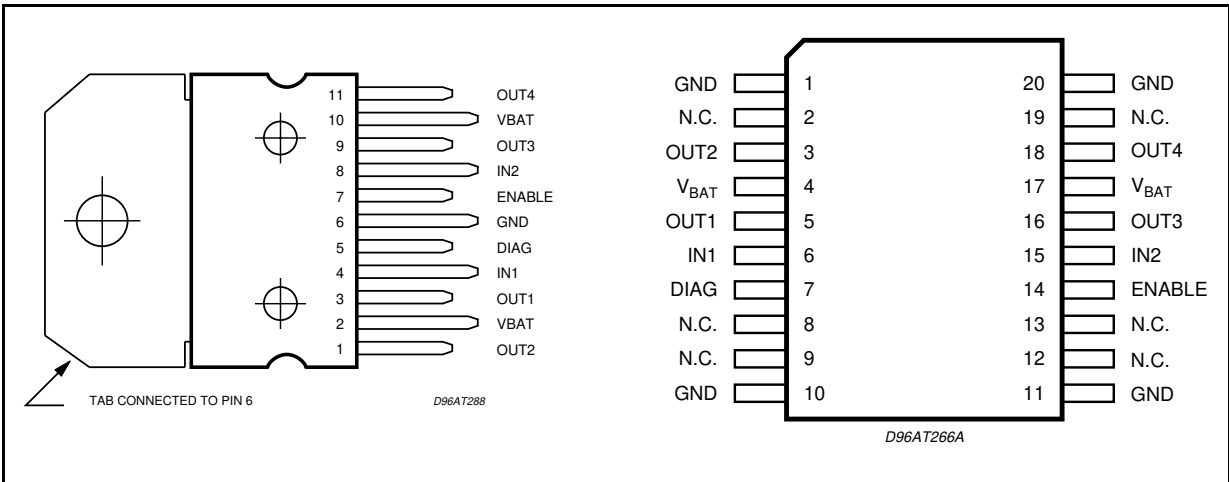
PIN FUNCTIONS

MW11	PowerSO20	Name	Function
1	3	OUT 2	Output Channel 1
2	4	V_{BAT}	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_{BAT}	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.		°C/W
$R_{th\ j-amb}$	Thermal resistance Junction to Ambient	max.		°C/W

ELECTRICAL CHARACTERISTICS (V_{bat} = 8 to 18V tJ = − 40 to +150°C, unless otherwise specified.)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
R_{DSon-H}	ON Resistance	I_{out} = 0.5A		2	4.3	Ω
R_{DSon-L}	ON Resistance	I_{out} = 0.5A		2	4.3	Ω
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	µs
T_F	Output Voltage Fall Time	Vout; 0.9 to 0.1 V_{out} (see fig. 1) NOT LOADED		50	100	µs
T_{DR}	Input to Output Rising edge Delay	0.5 V_{IN} to 0.1 V_{out} (see fig. 1) NOT LOADED			50	µs
T_{DF}	Input to Output Falling Edge Delay	0.5 VIN to 0.9 V_{out} (see fig. 1) NOT LOADED			50	µs

OUTPUT PROTECTIONS CHARACTERISTICS

I_{SC}	Short Circuit Typical Application (see fig 2)	T_{amb} = -40°C	0.45		2.6	A
		T_{amb} = 25°C	0.38		2.6	A
		T_{amb} = 125°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			°C
T_{HYST}	Temperature Hysteresis			20		°C

These protections switch off the full bridge.

OUTPUT DETECTIONS CHARACTERISTICS

R_{OPL-L}	Open-load Threshold Resistor		80			Ω
R_{OPL-H}			100			Ω

SUPPLY CHARACTERISTICS

I_{QHI}	Supply Current	R_{LOAD1} = R_{LOAD2} = ∞ V_{BAT} = 14V, IN1 = IN2 = ENABLE = 5V			15	mA
I_{QLO}		R_{load1} = R_{load2} = 50Ω 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_{NHI}	Input Current 1	$V_{IN} = 4V$			200	µA
I_{NLO}	Input Current 2	$V_{IN} = 1V$			50	µA

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	µA

INITIALIZATION CHARACTERISTICS

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

FILTER CHARACTERISTICS

T_{FILTER}			64	112	170	µs
T_{DIAG}			4	6	10	µs
T_{SYNC}			4	6	10	µs

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:
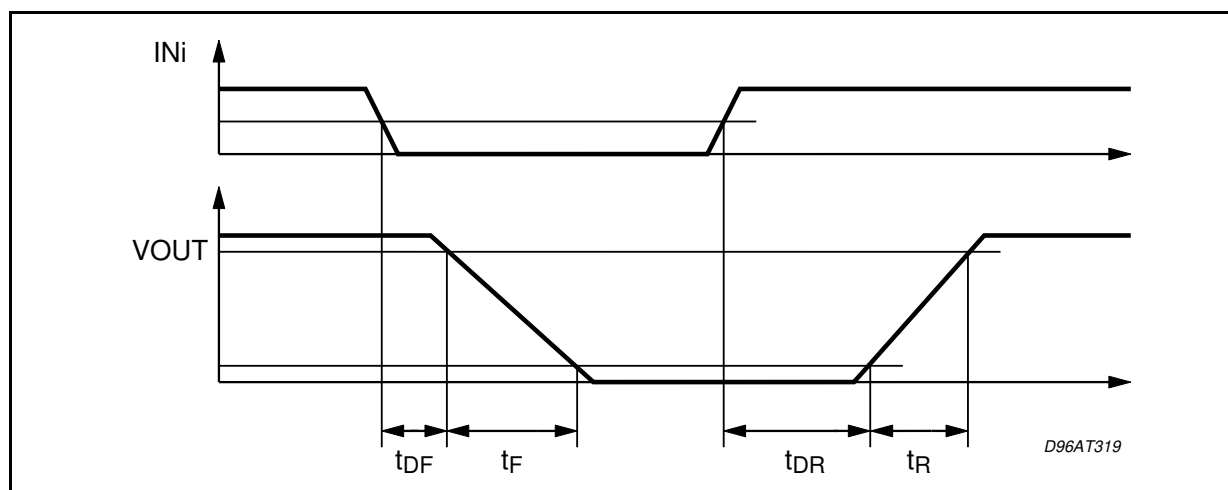
Figure 2: Typical Application

_D96AT320_
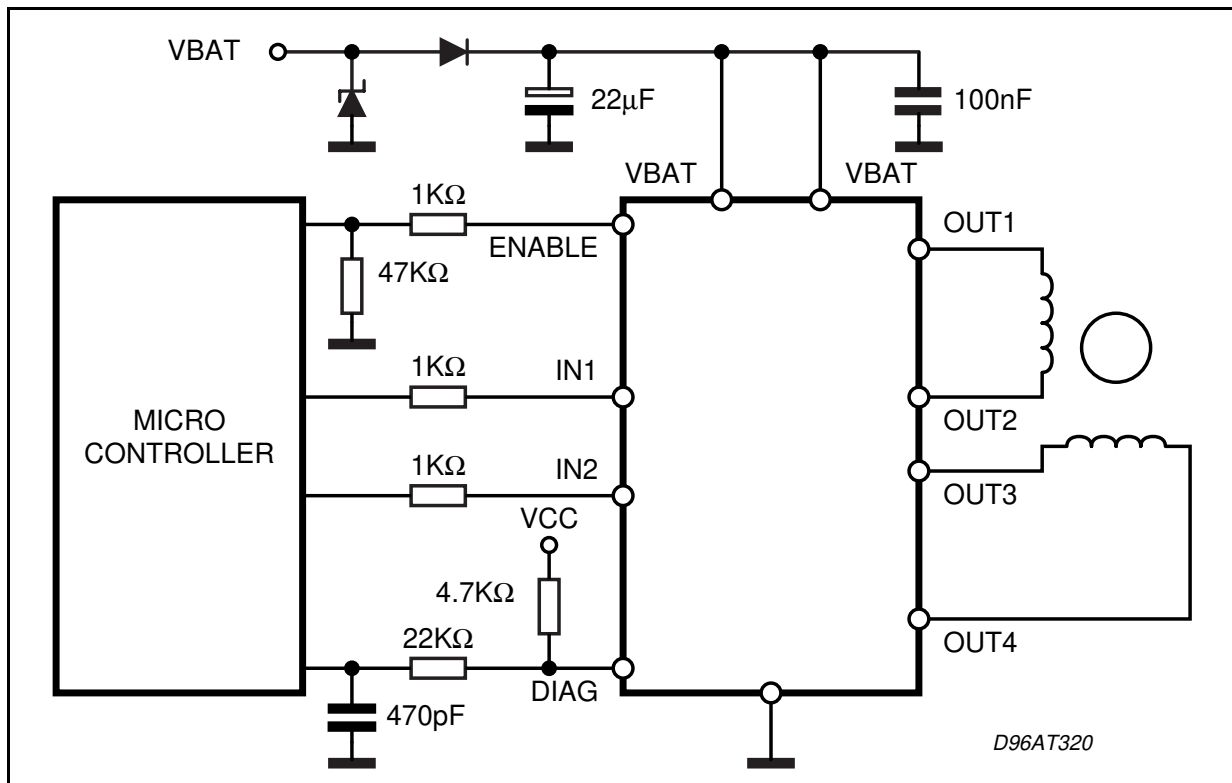
Figure 3: Typical Application with Shottky Diodes

_D96AT321_   (*) SHOTTKY DIODE
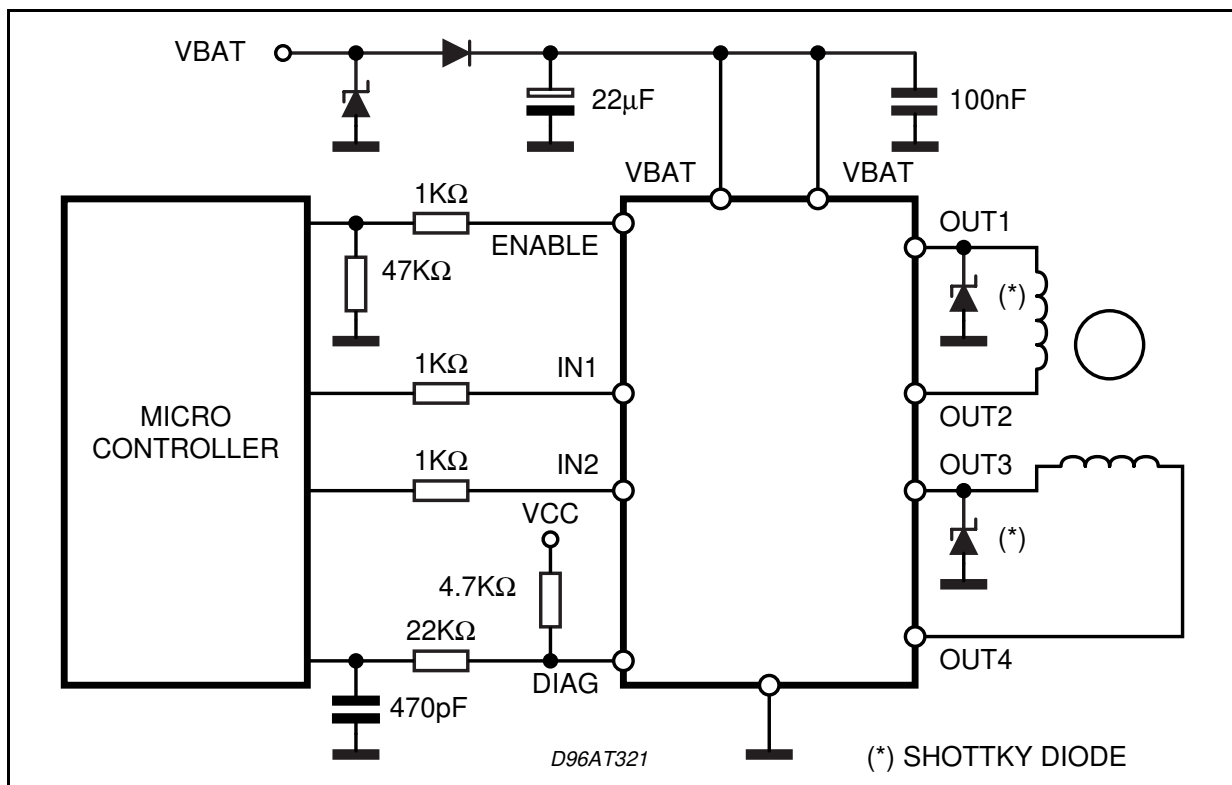
Figure 4: Initialization.

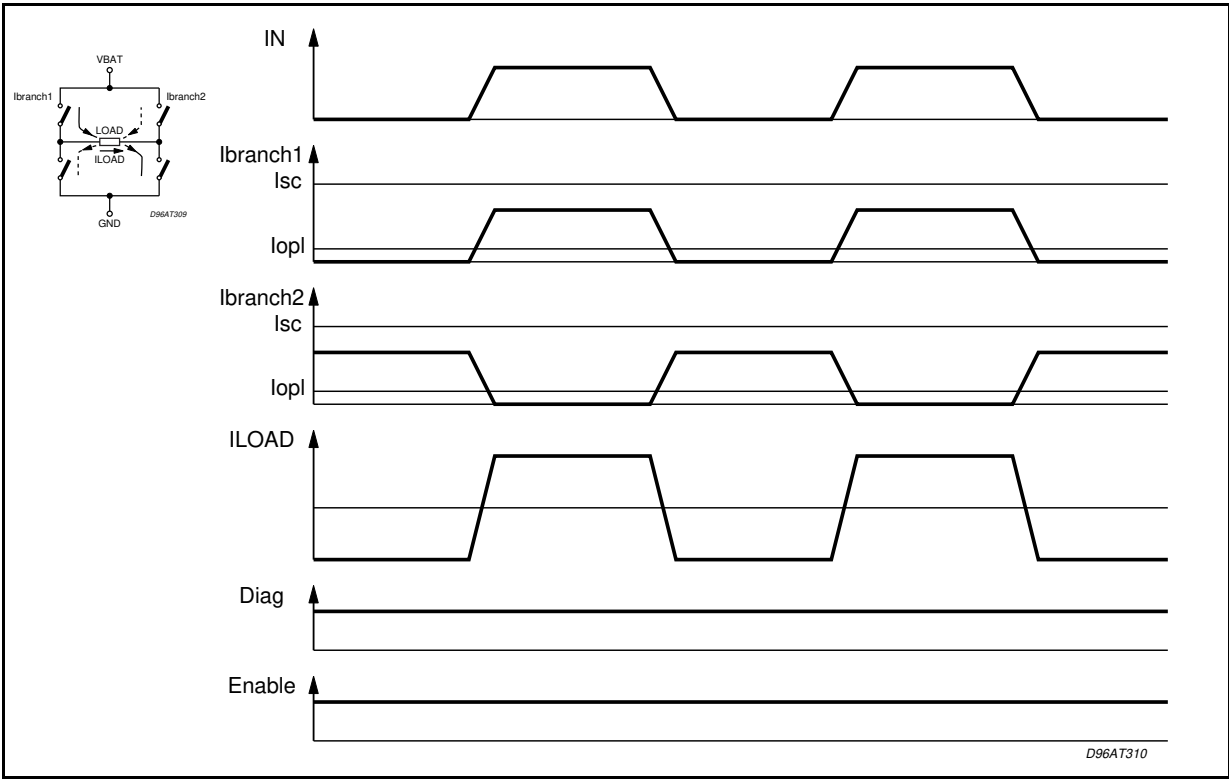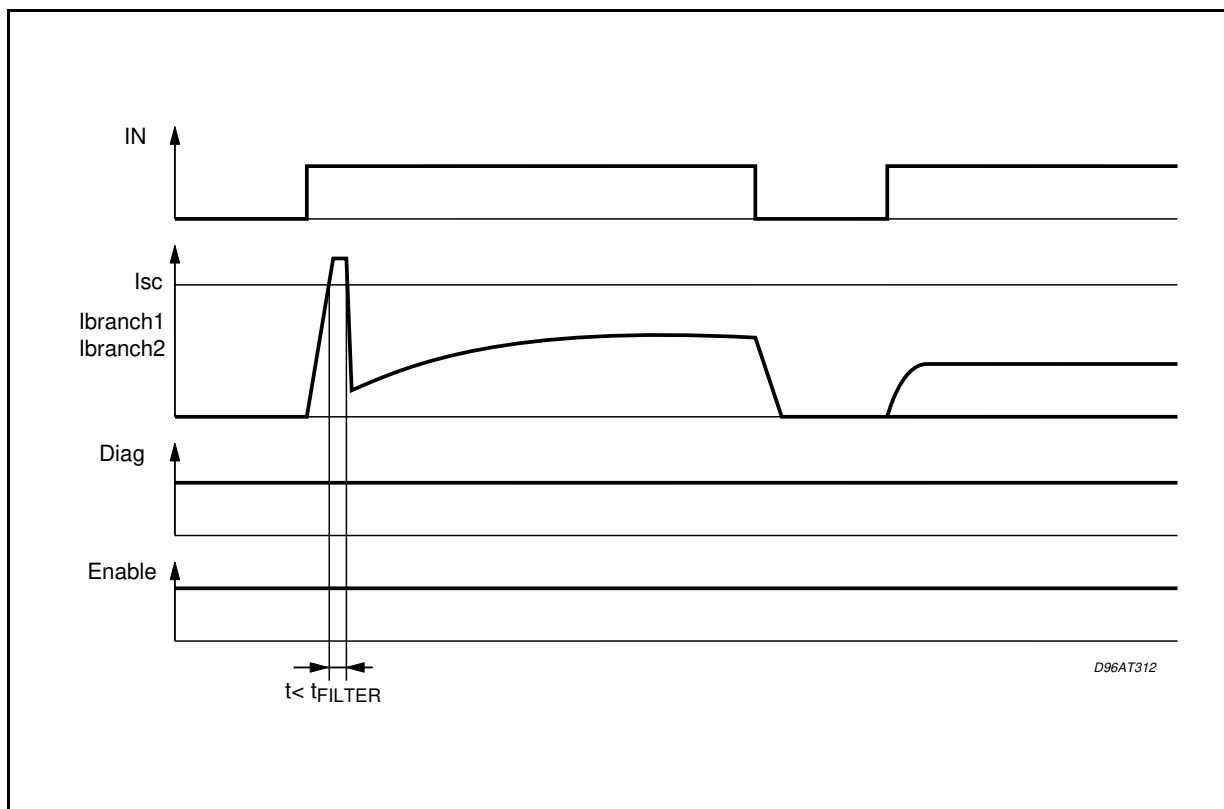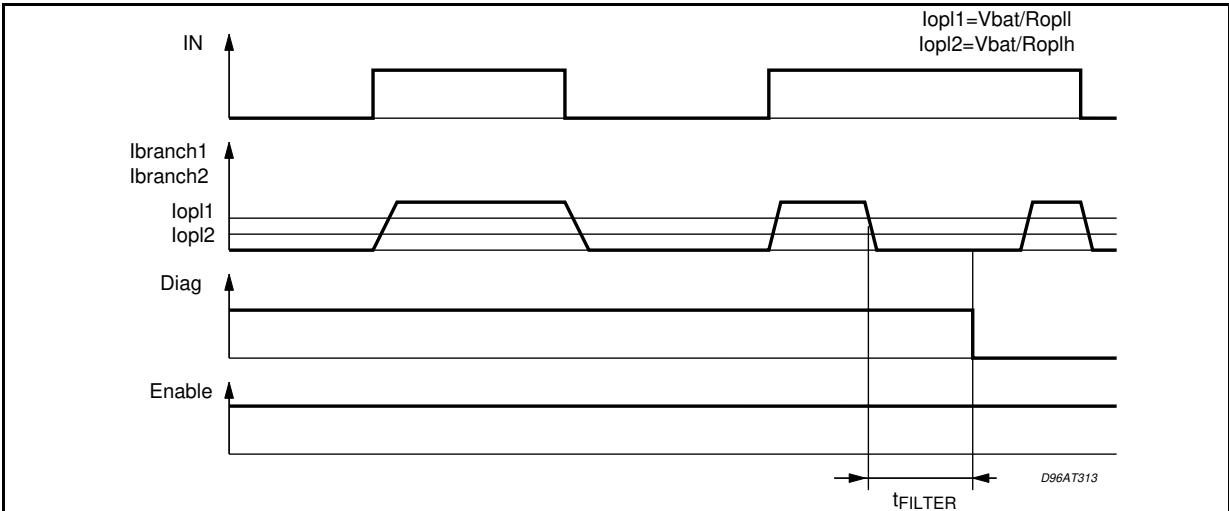| MODE	NORMAL	STANDBY	WAKE-UP	NORMAL	NORMAL
DIAG STATUS	VALID	NOT VALID	NOT VALID	VALID	VALID
OUTPUT STATUS	NORMAL	HIGH IMPEDANCE STATE	HIGH MPEDANCE STATE	NORMAL	NORMAL

D96AT308
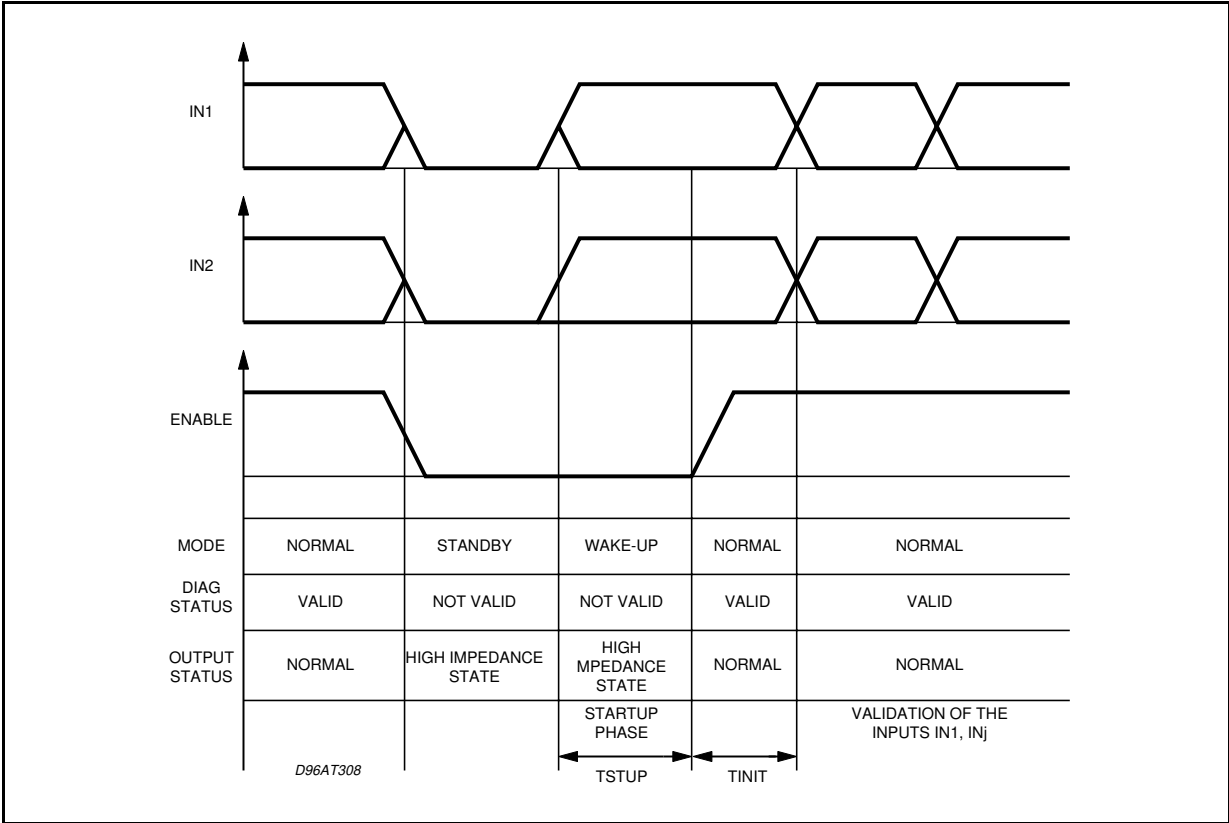
Figure 5: Normal Condition.

Figure 6: Short-circuit Condition.
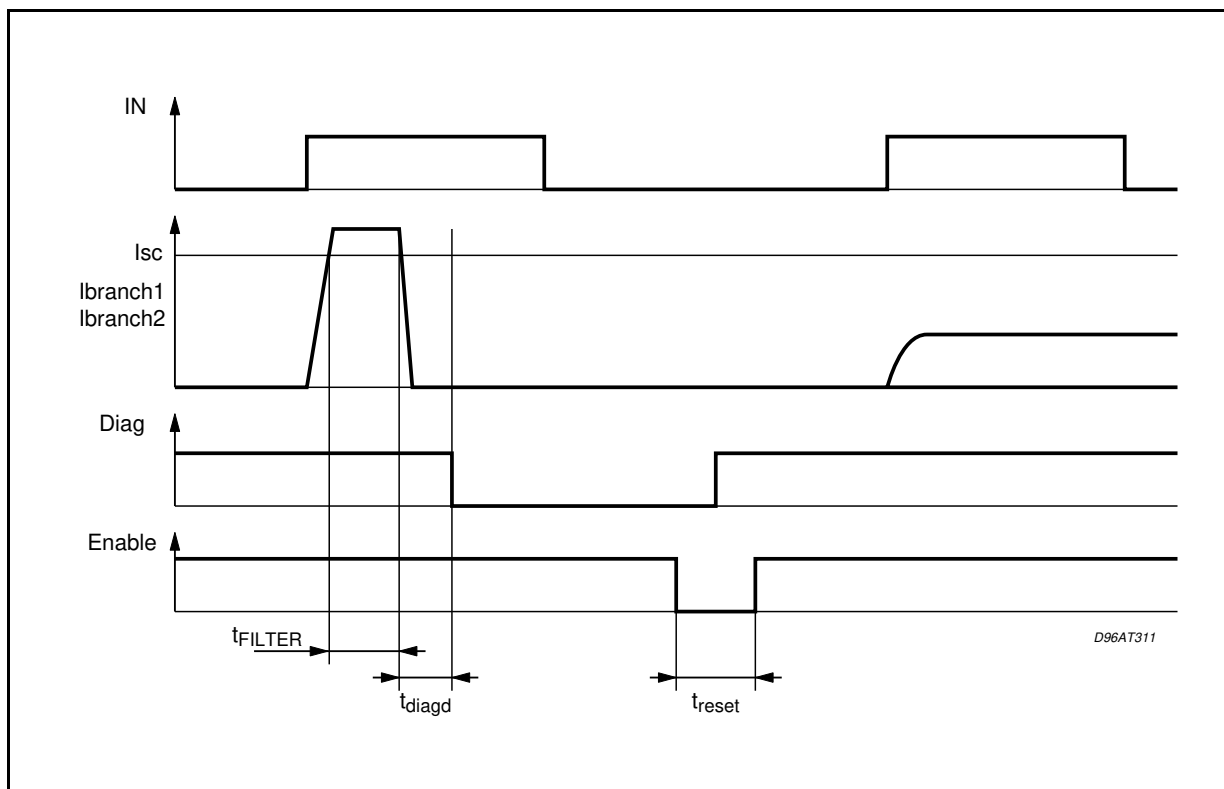
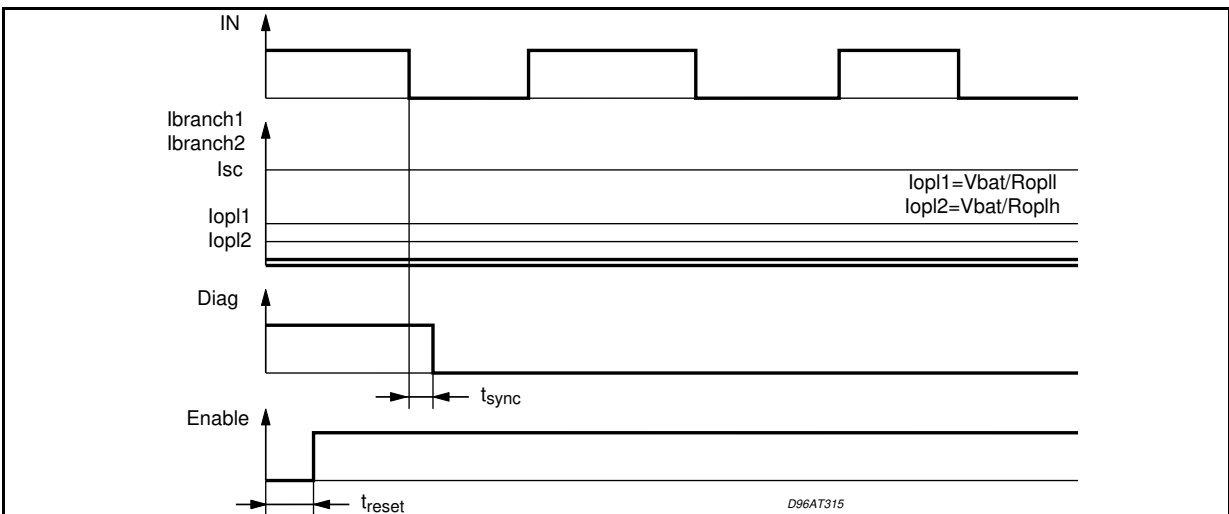**Figure 7:** short circuit condition: no detection (NOT TESTED)

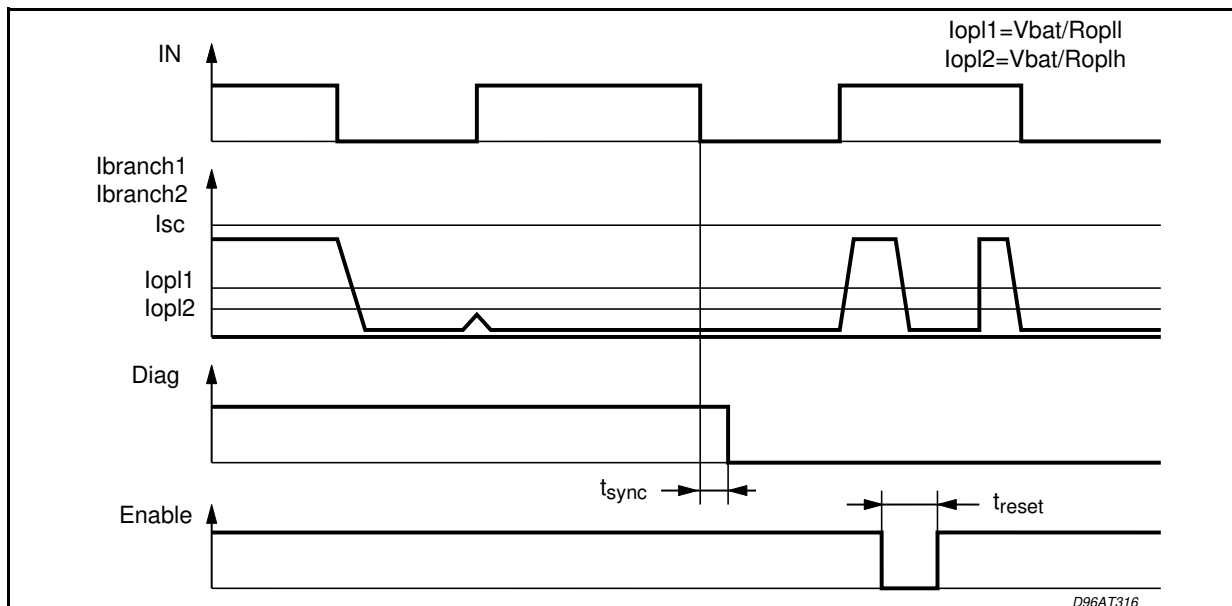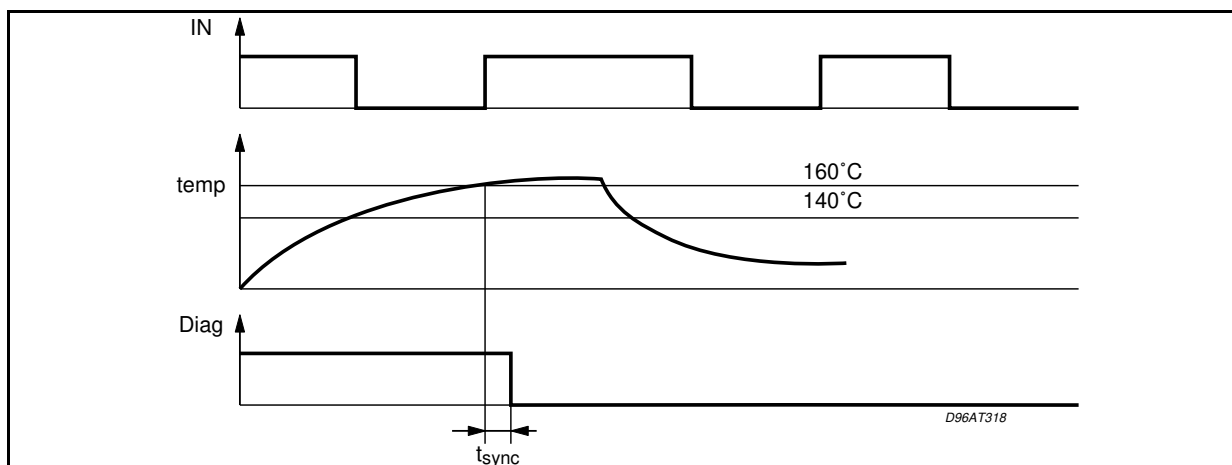**Figure 8:** Open Load Condition 1: Detection

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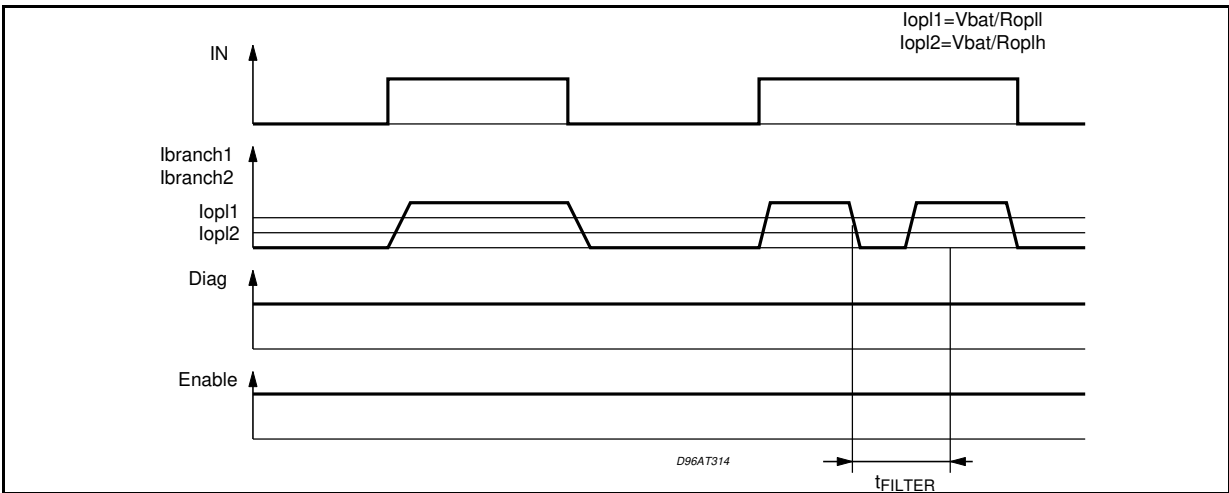

Figure 10: Open Load Condition 2: No Current after ($\overline{\text{ENABLE}}$)

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
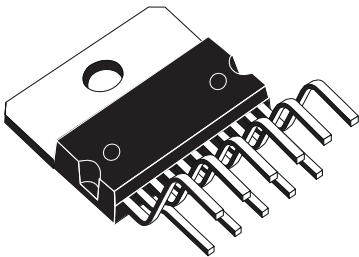
Multiwatt11 V
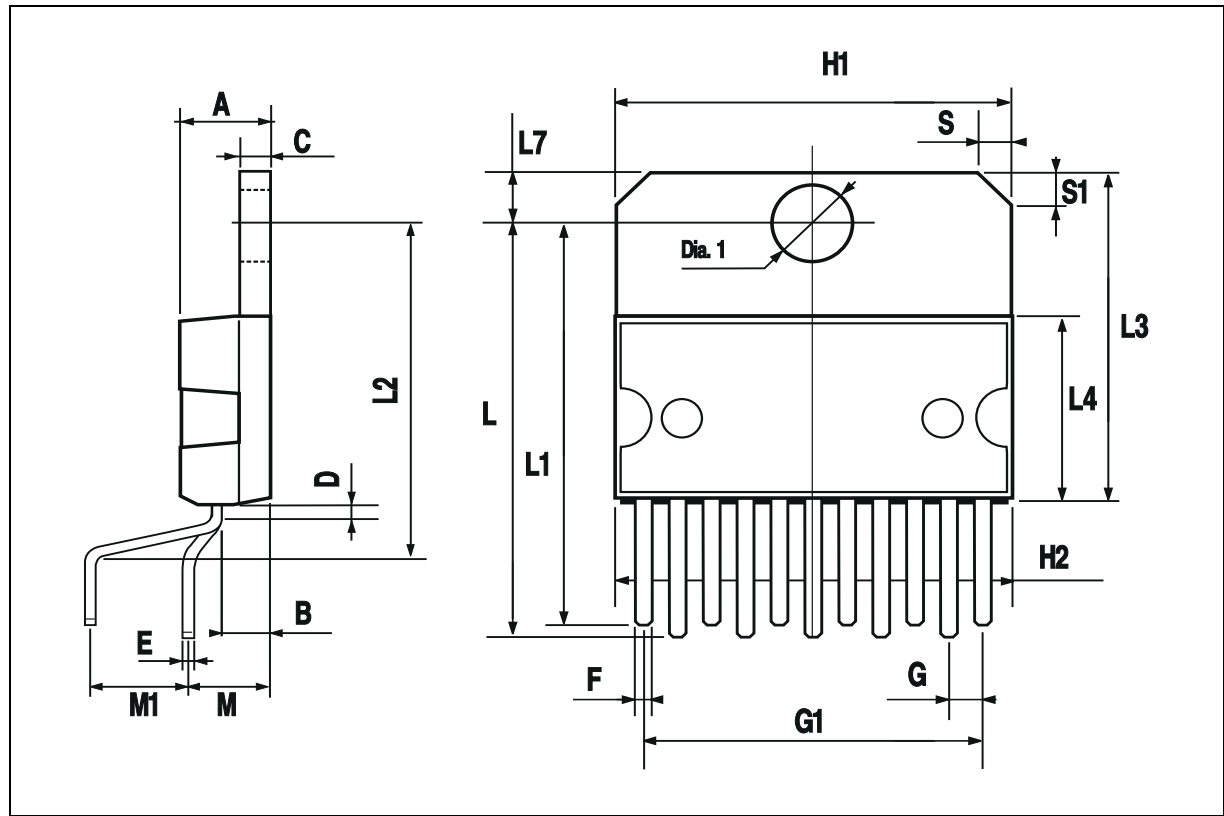
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			3.6			0.142
a1	0.1		0.3	0.004		0.012
a2			3.3			0.130
a3	0		0.1	0.000		0.004
b	0.4		0.53	0.016		0.021
c	0.23		0.32	0.009		0.013
D (1)	15.8		16	0.622		0.630
D1	9.4		9.8	0.370		0.386
E	13.9		14.5	0.547		0.570
e		1.27			0.050	
e3		11.43			0.450	
E1 (1)	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")
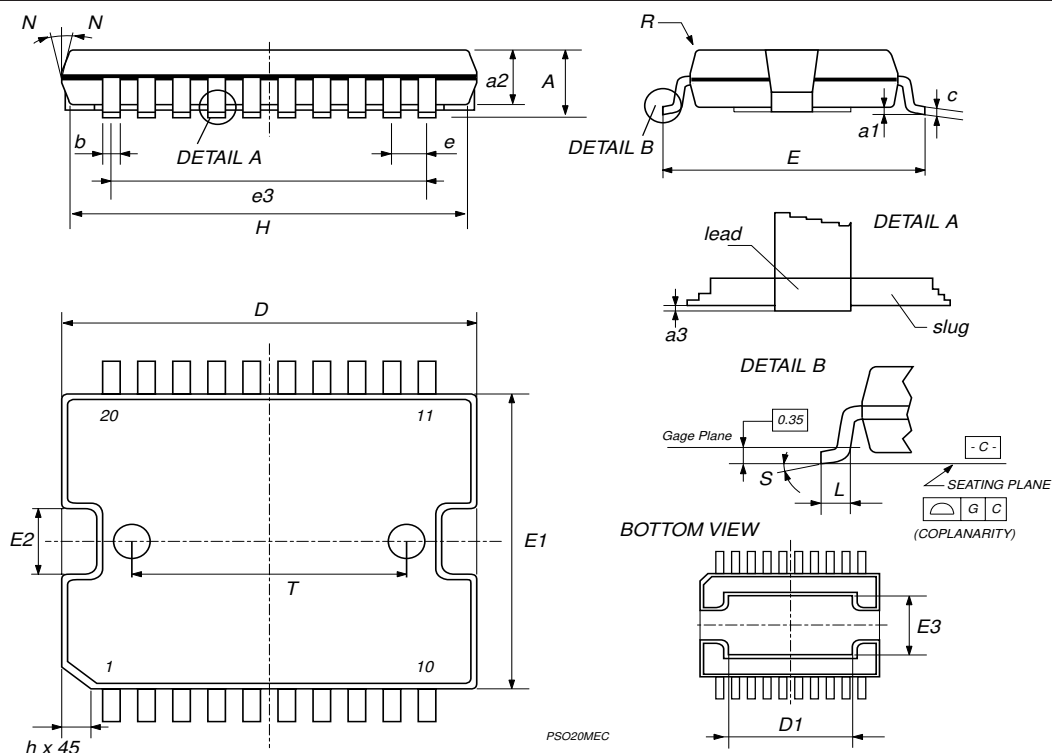- Critical dimensions: "E", "G" and "a3".

OUTLINE AND MECHANICAL DATA

Weight: 1.9gr
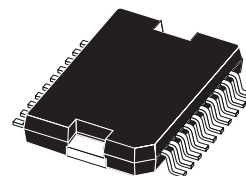
JEDEC MO-166

PowerSO20

PSO20MEC

0056635

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