

DUAL FULL BRIDGE

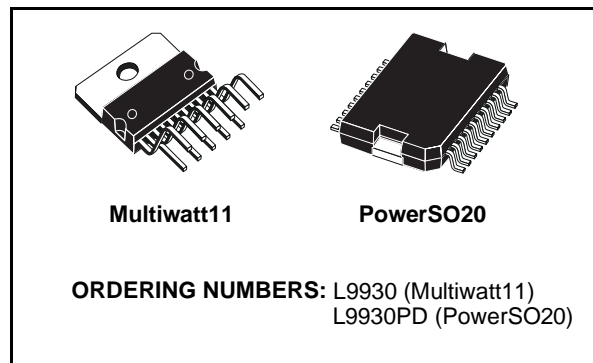
- $R_{DS\ ON} = 2\Omega$
- INTERNAL CLAMPING VOLTAGE = 32V
- INTERNAL FREE WHEELING DIODES
- PARALLEL DRIVE CAPABILITY
- RESISTIVE OR INDUCTIVE LOAD

PROTECTION:

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

DETECTION:

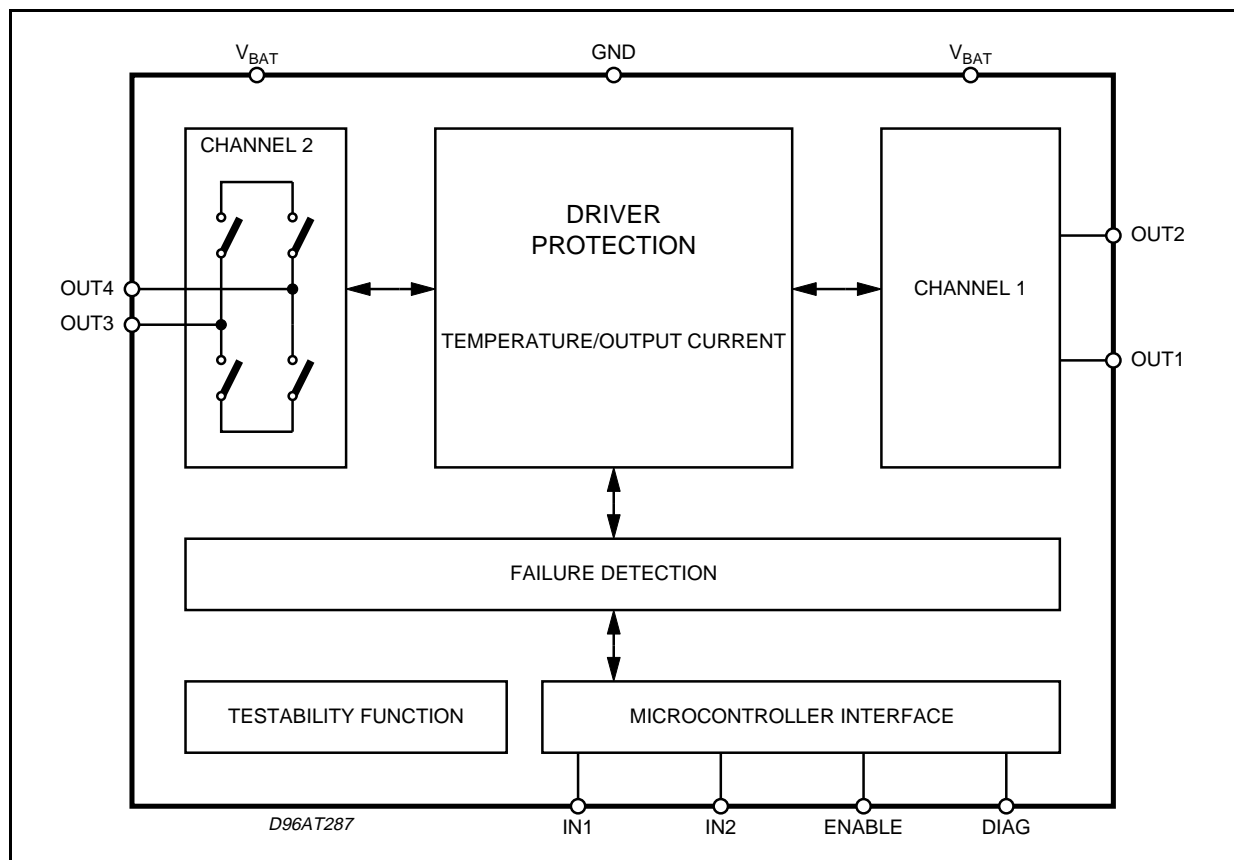
- SHORTED LOAD
- OPEN LOAD
- OVERTEMPERATURE



DESCRIPTION

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

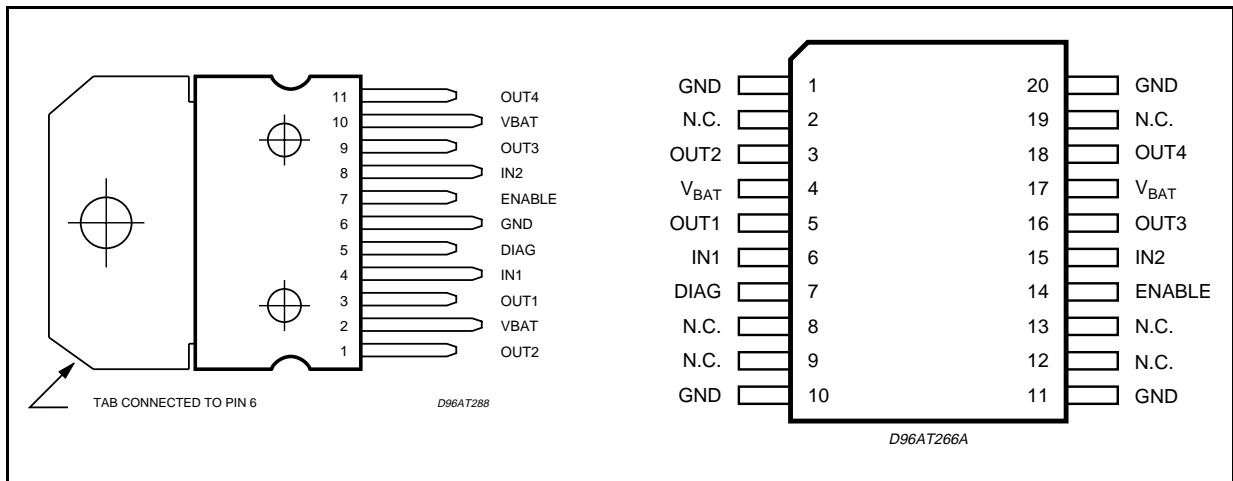
BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---------------------|--------------------------------------|-------------|------|
| E | Clamped Energy at the Switching off | 6 (max) | mJ |
| V _{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 |

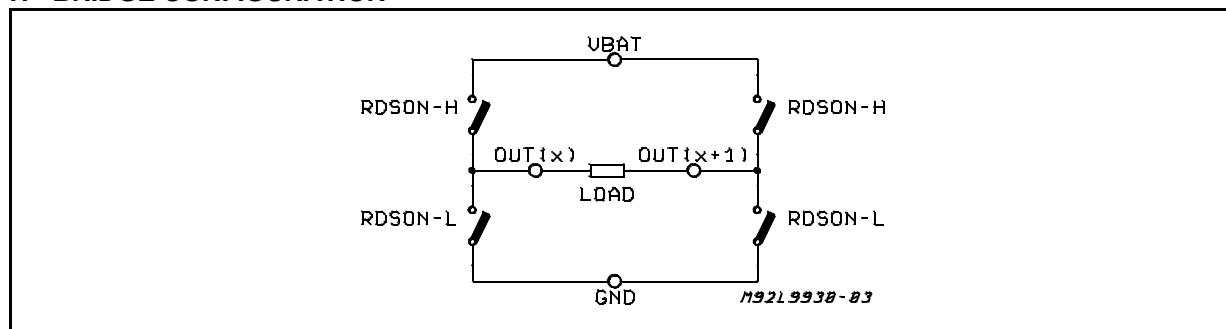
PIN CONNECTION



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. | $^{\circ}C/W$ |
| $R_{th\ j-amb}$ | 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 | 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 | V_{out} ; 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 V_{IN} to 0.9 V_{out} (see fig. 1) NOT LOADED | | | 50 | μs |

OUTPUT PROTECTIONS CHARACTERISTICS

| | | | | | | |
|------------|---|--------------------------|------|----|-----|-------------|
| I_{SC} | Short Circuit Typical Application (see fig 2) | $T_{amb} = -40^{\circ}C$ | 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 | | | Ω |
| R_{OPL-H} | | 100 | | | Ω |

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 | 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:

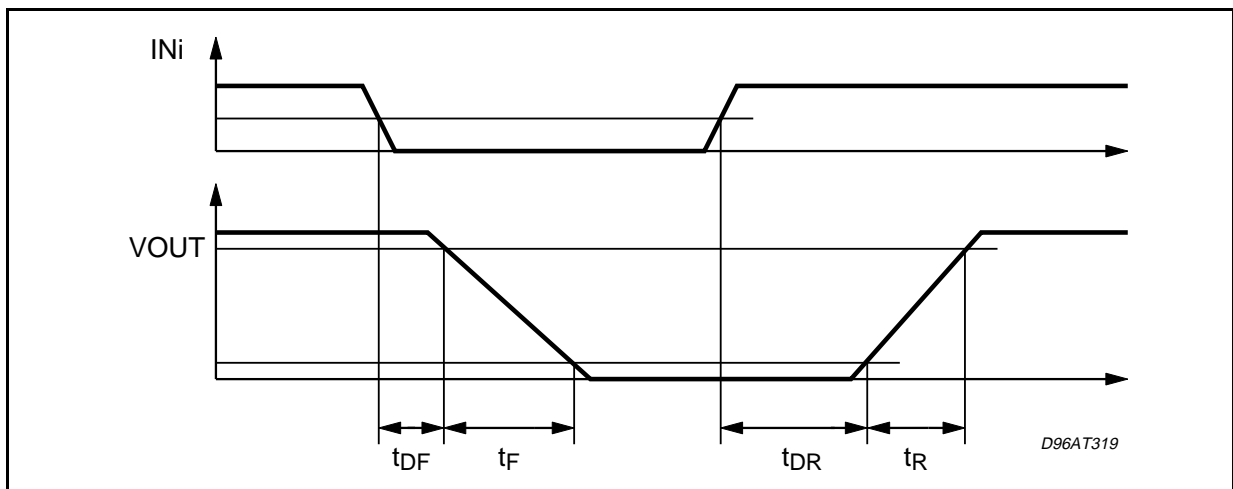


Figure 2: Typical Application

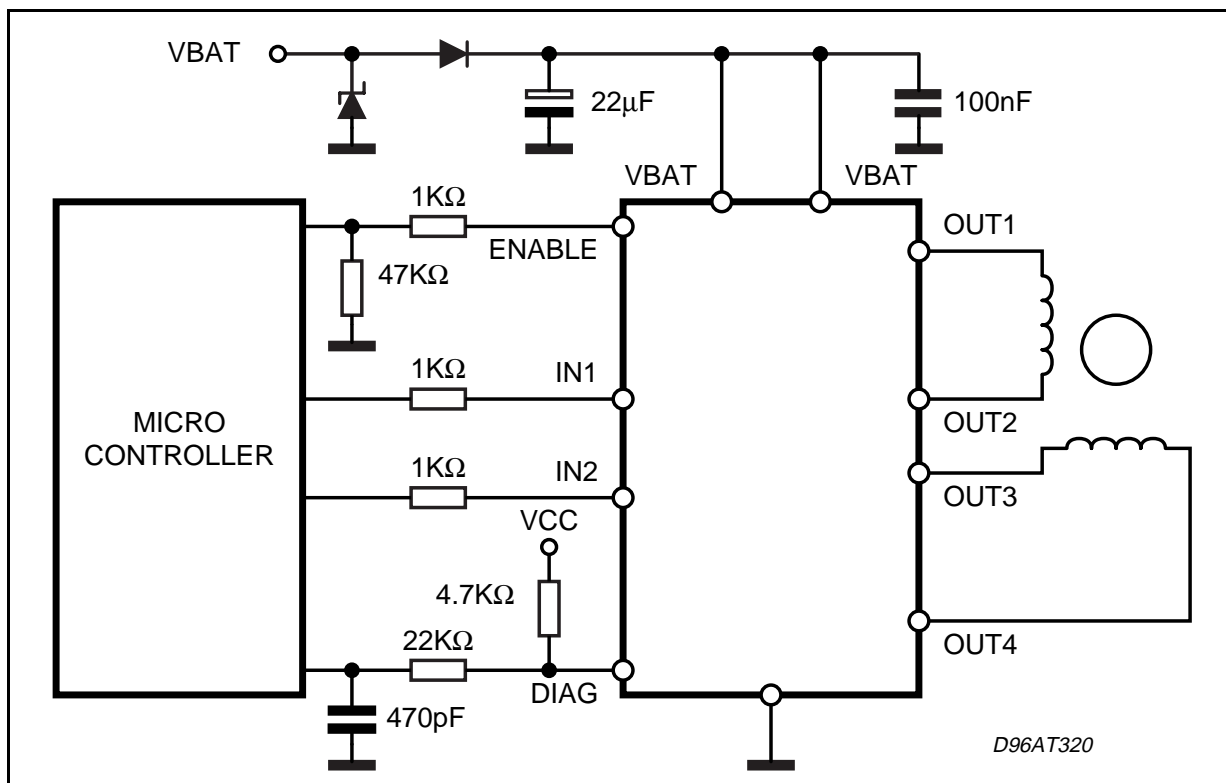


Figure 3: Typical Application with Schottky Diodes

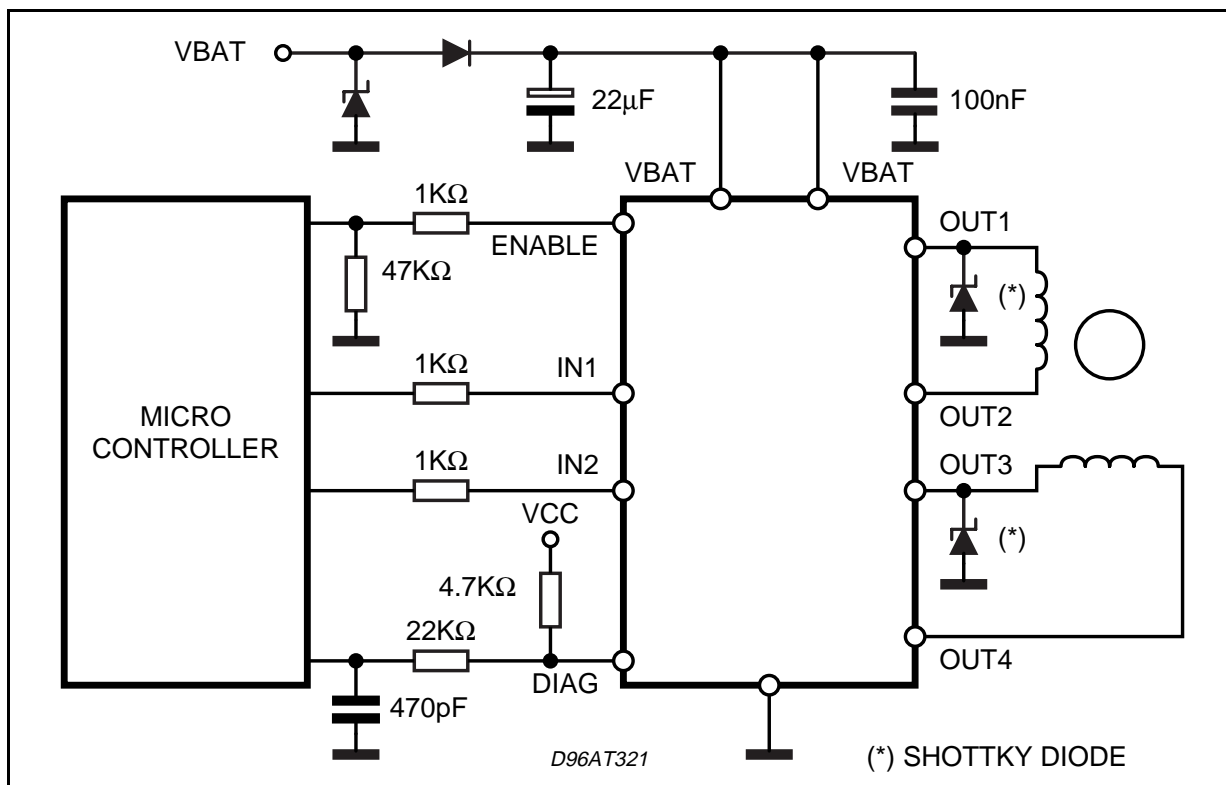


Figure 4: Initialization.

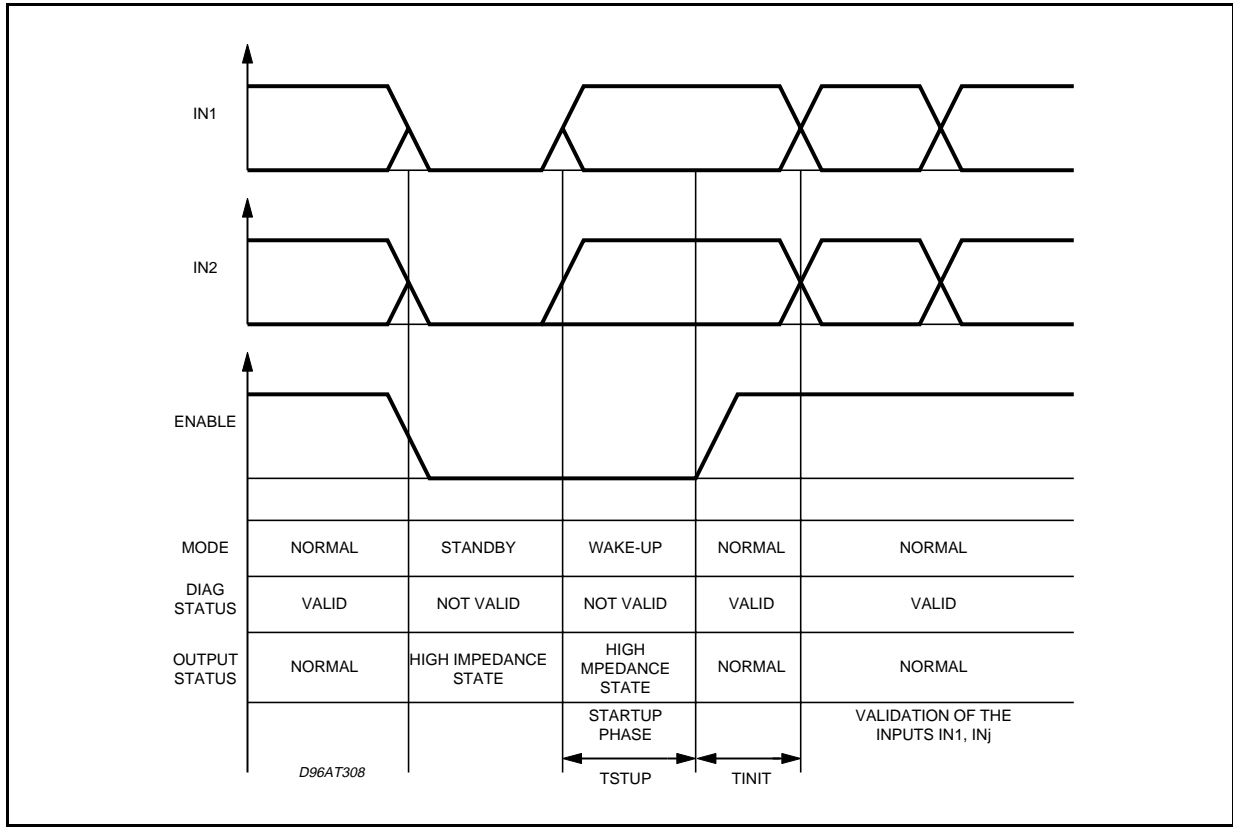


Figure 5: Normal Condition.

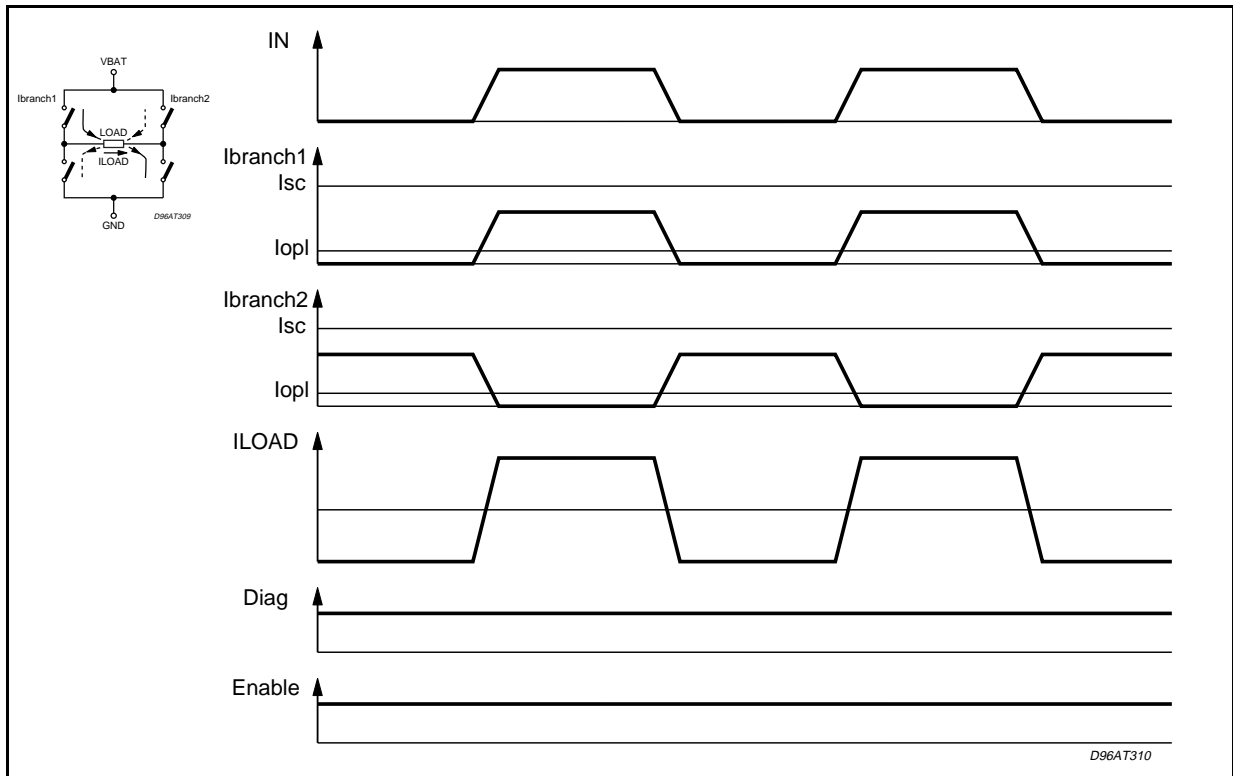


Figure 6: Short-circuit Condition.

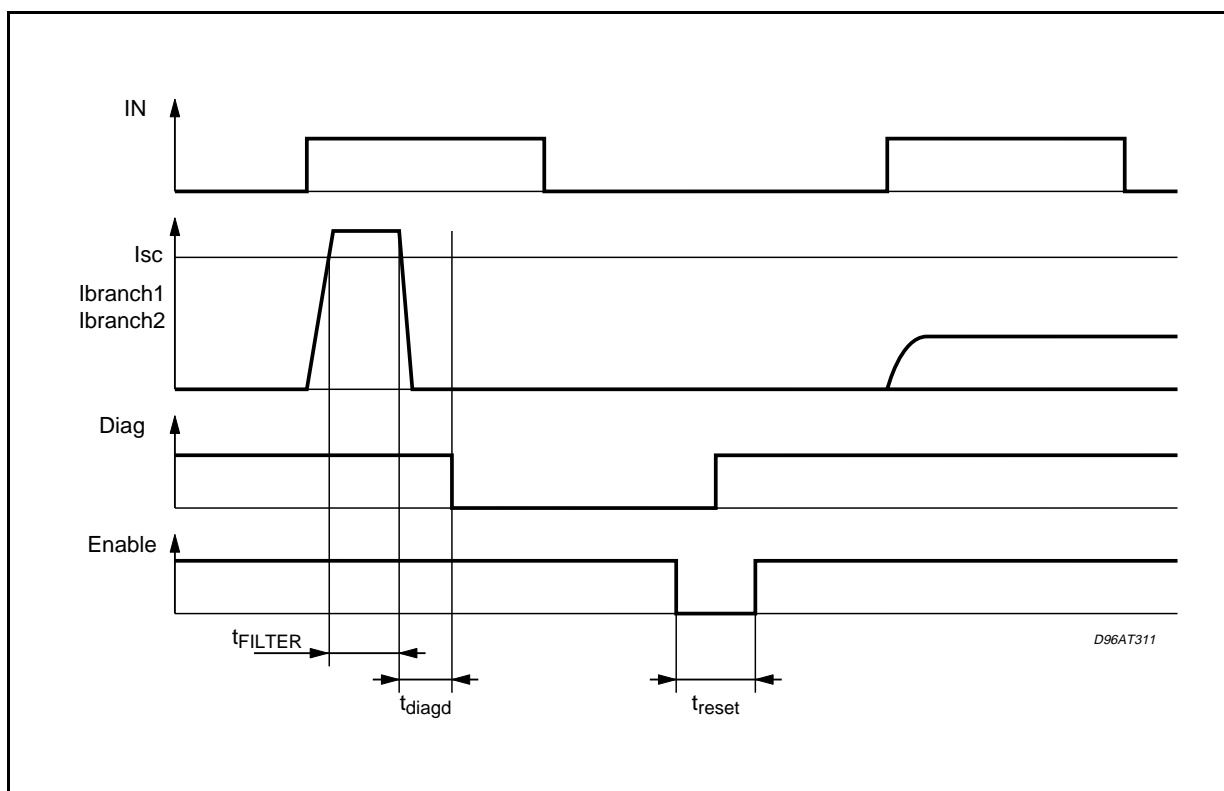


Figure 7: short circuit condition: no detection (NOT TESTED)

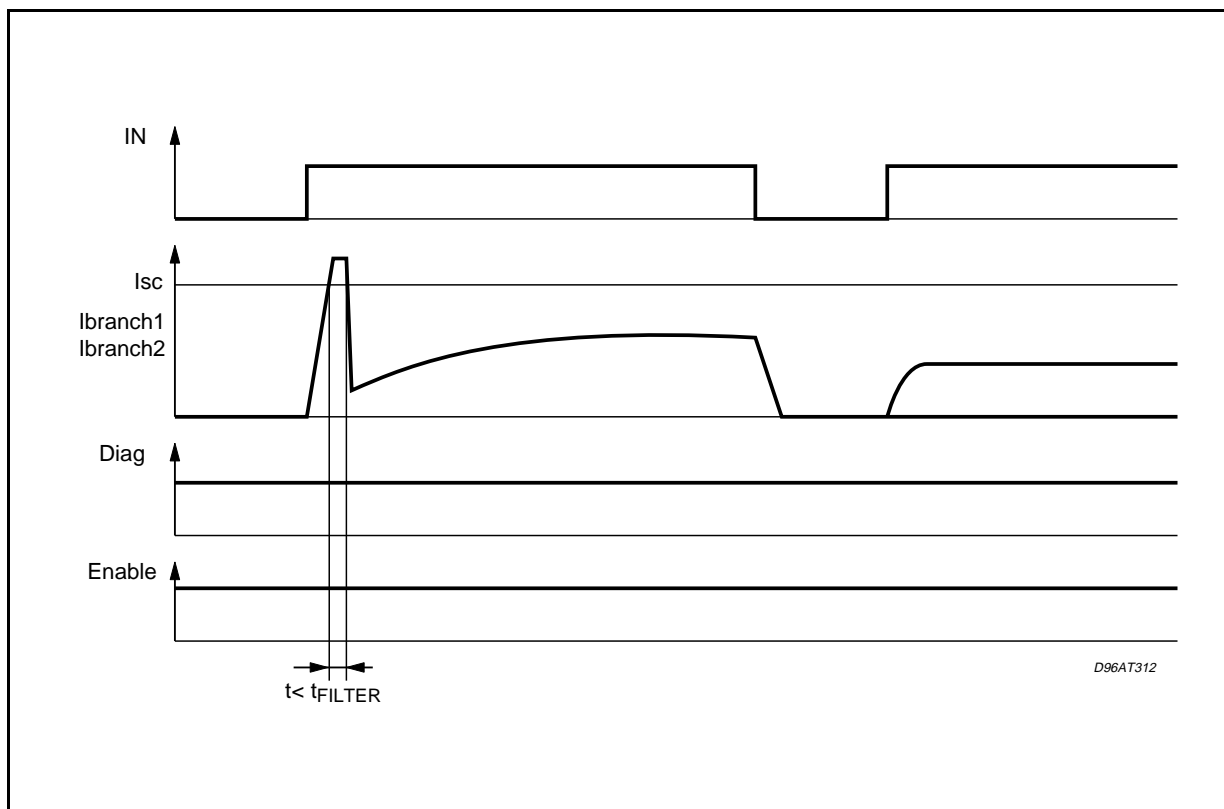


Figure 8: Open Load Condition 1: Detection

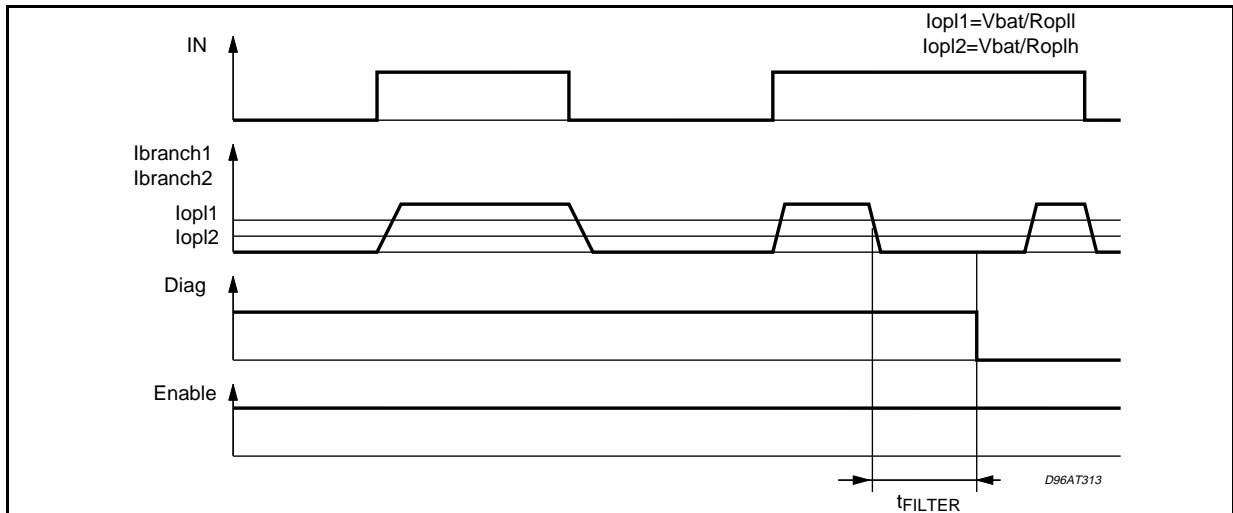


Figure 9: Open Load Condition 1: No Detection (NOT TESTED)

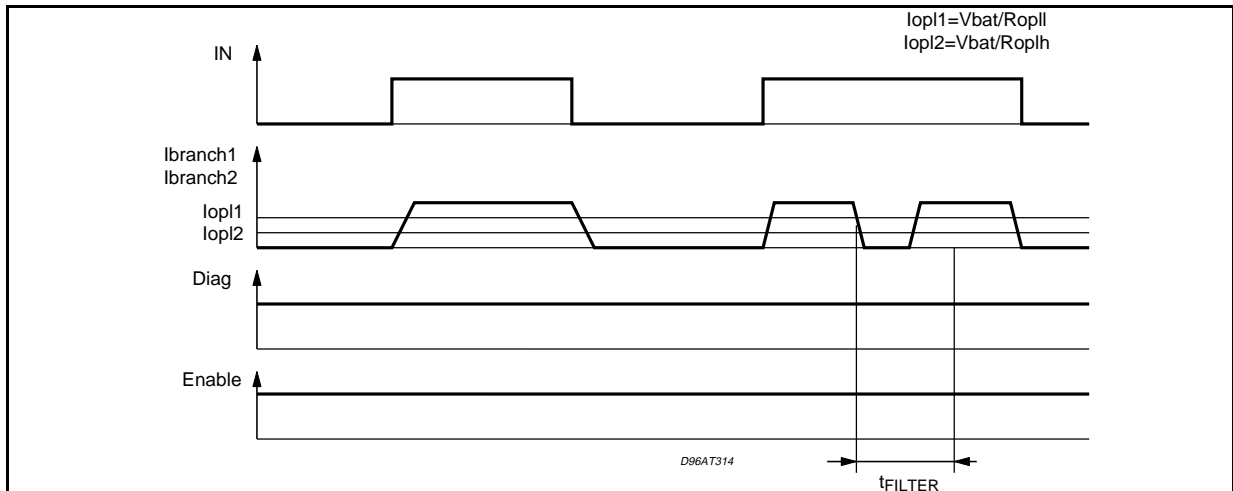


Figure 10: Open Load Condition 2: No Current after (ENABLE)

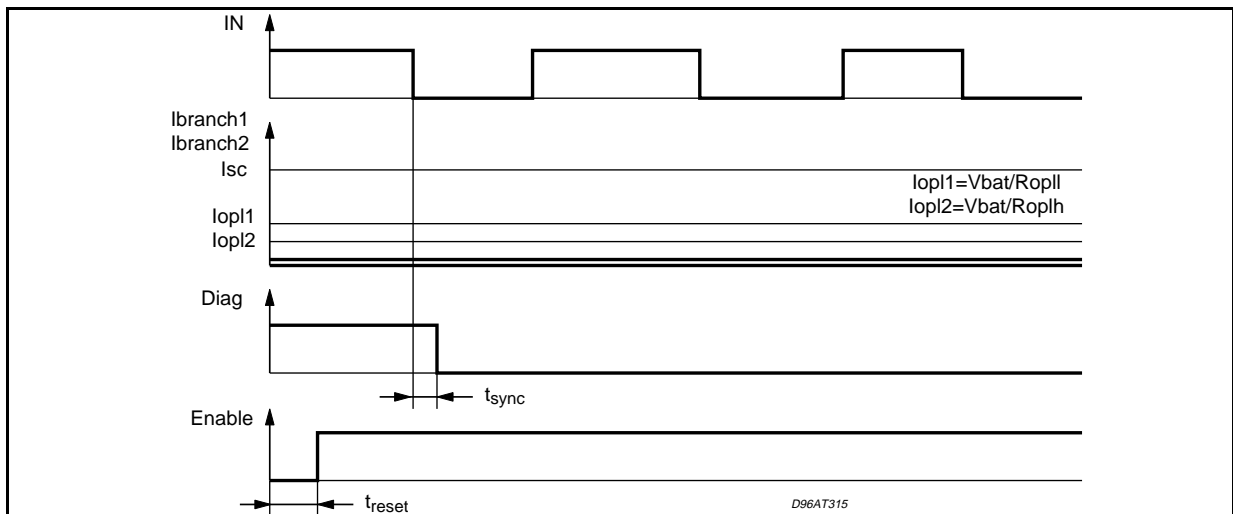


Figure 11: Open Load Condition 3

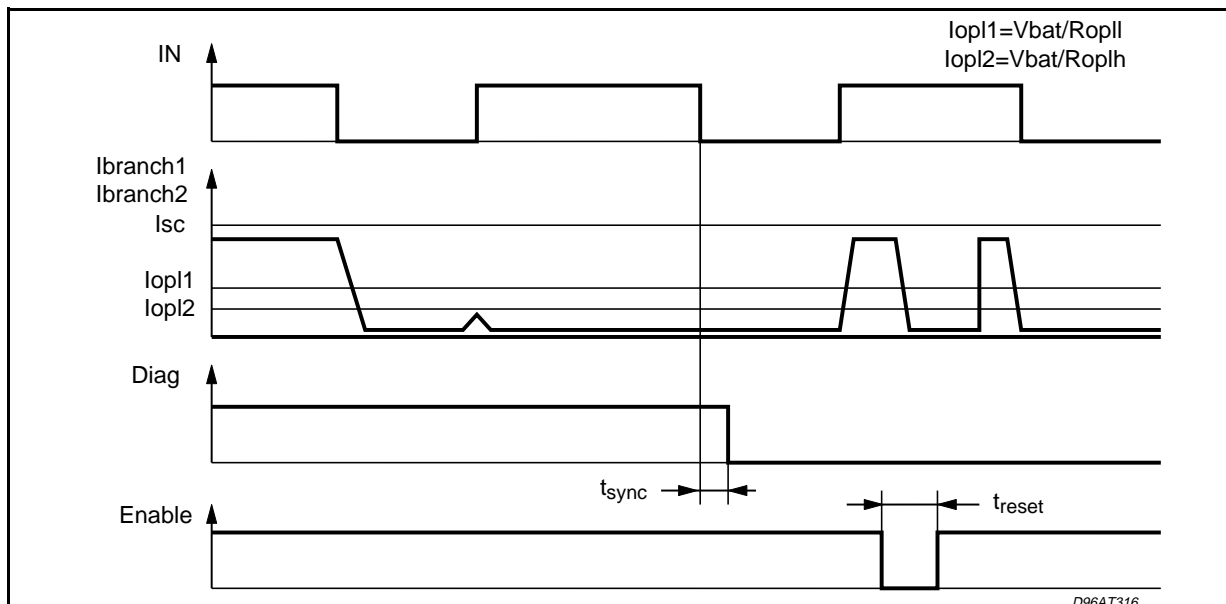


Figure 12: Open Load Condition 4: No Detection

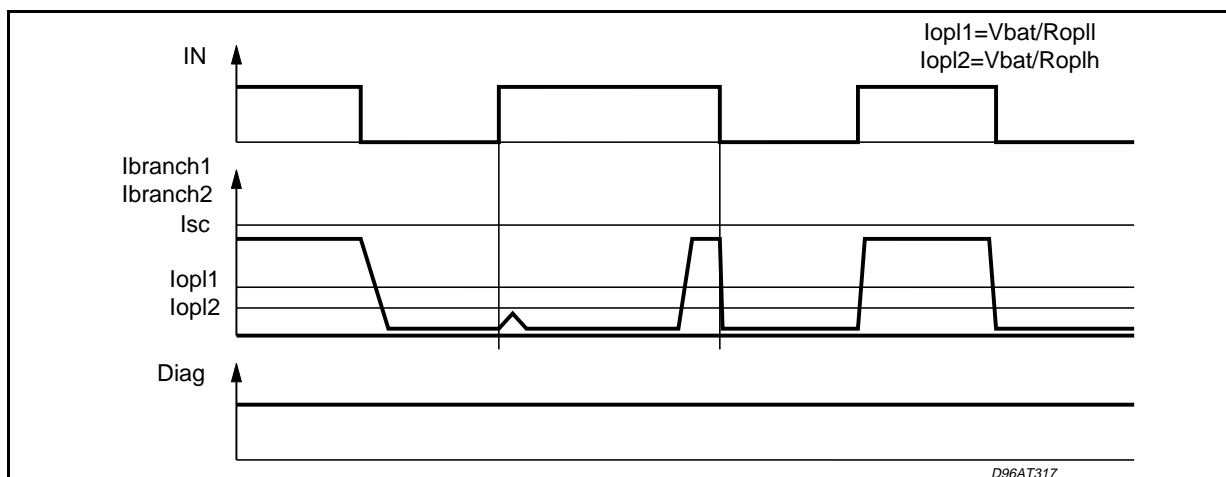
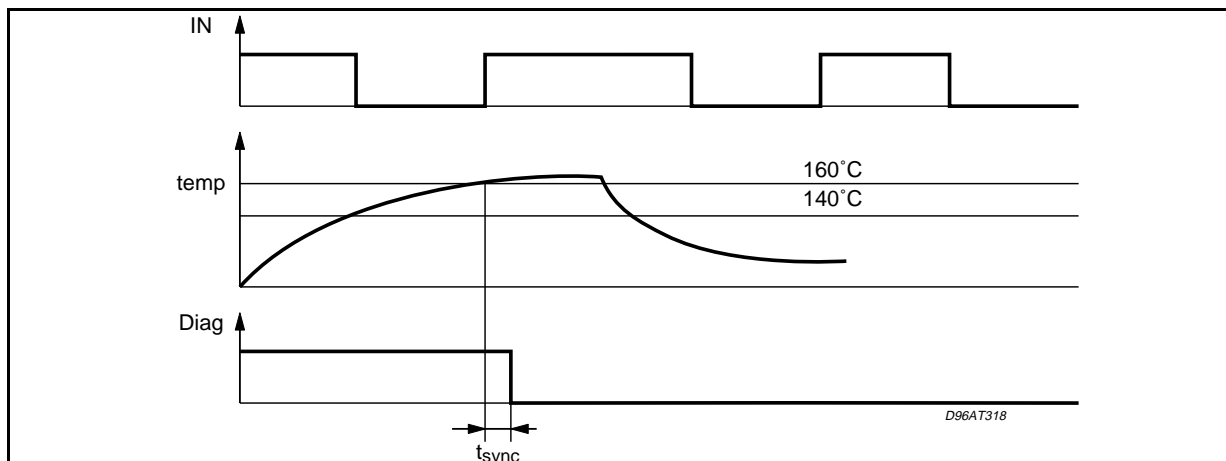
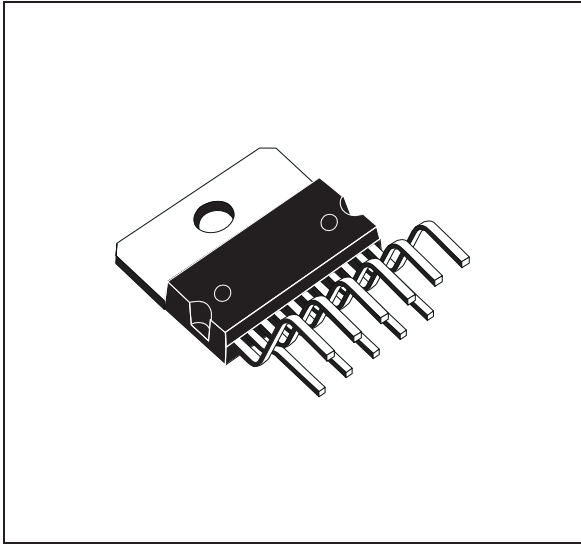


Figure 13: Overtemperature Detection

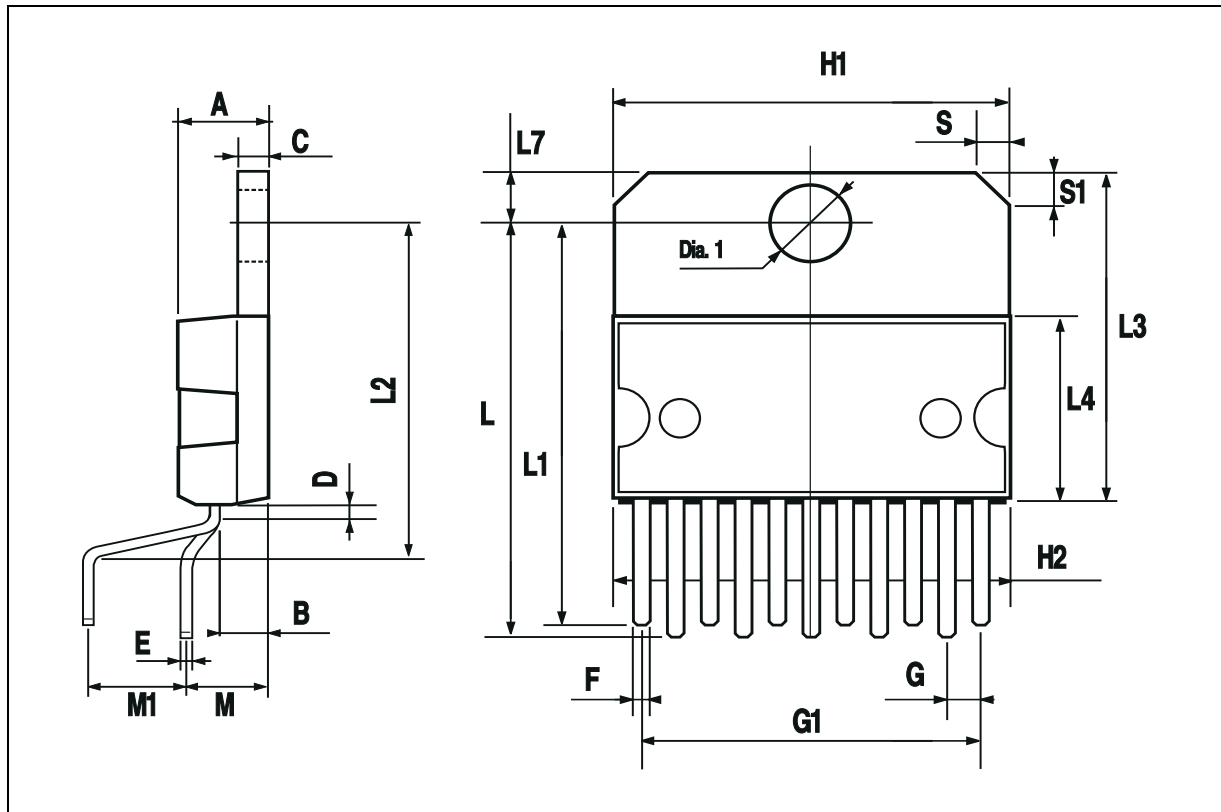


| DIM. | mm | | | inch | | |
|------|-------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 5 | | | 0.197 |
| B | | | 2.65 | | | 0.104 |
| C | | | 1.6 | | | 0.063 |
| D | | 1 | | | 0.039 | |
| E | 0.49 | | 0.55 | 0.019 | | 0.022 |
| F | 0.88 | | 0.95 | 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

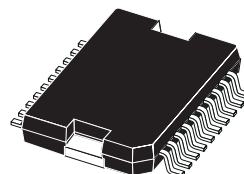


| DIM. | mm | | | inch | | |
|--------|-----------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 3.6 | | | 0.142 |
| a1 | 0.1 | | 0.3 | 0.004 | | 0.012 |
| a2 | | | 3.3 | | | 0.130 |
| a3 | 0 | | 0.1 | 0.000 | | 0.004 |
| b | 0.4 | | 0.53 | 0.016 | | 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 protrusions.
 - Mold flash or protrusions shall not exceed 0.15mm (0.006")
 - Critical dimensions: "E", "G" and "a3".

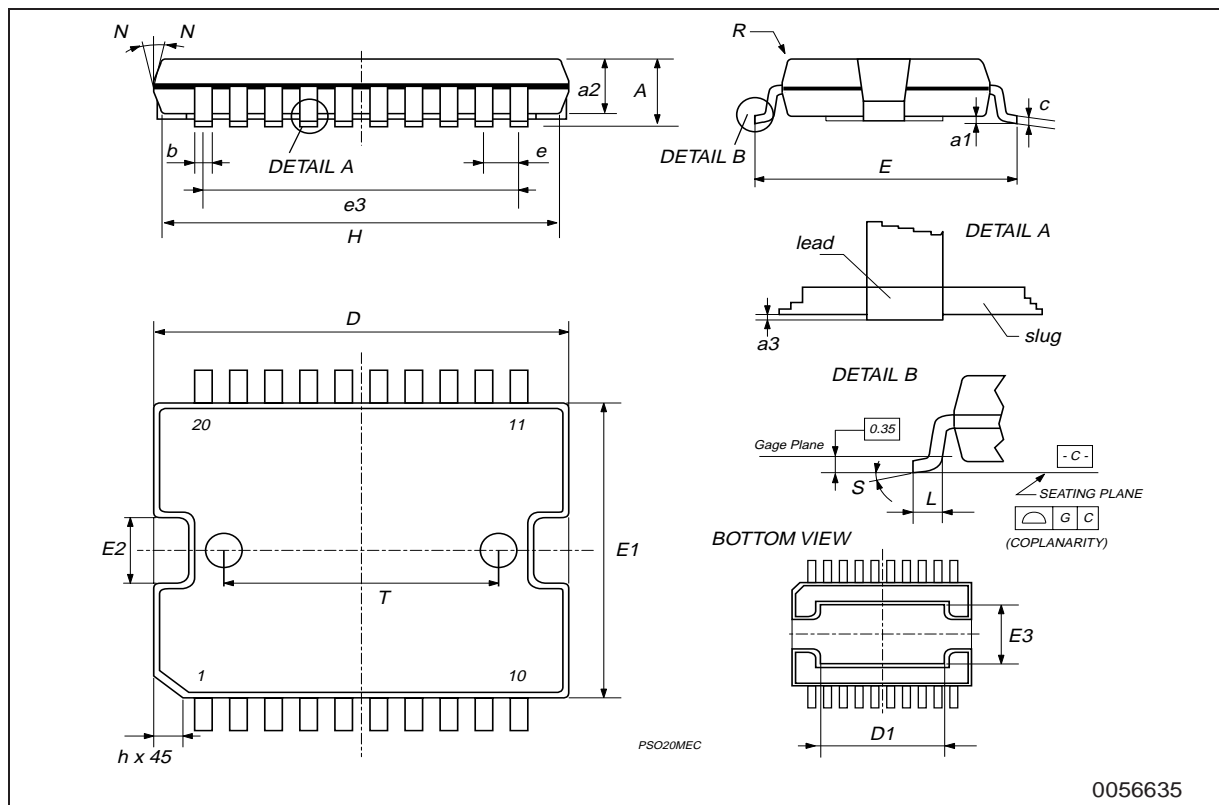
OUTLINE AND MECHANICAL DATA

Weight: 1.9gr



JEDEC MO-166

PowerSO20



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