



CLP30-200B1

Application Specific Discretes
A.S.D™

OVERVOLTAGE & OVERCURRENT PROTECTION FOR TELECOM LINE

MAIN APPLICATIONS

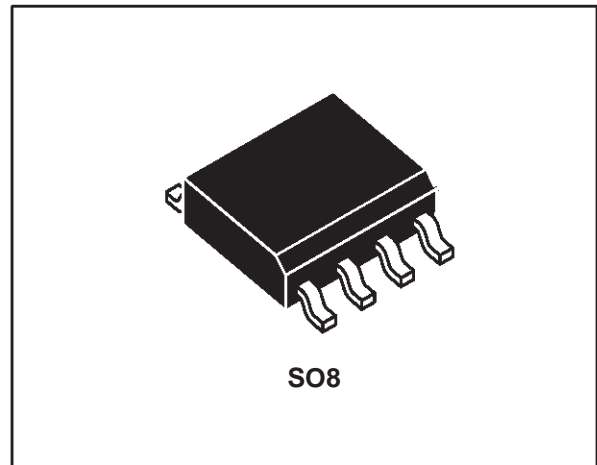
Any telecom equipment submitted to transient overvoltages and lightning strikes such as :

- Analog and ISDN line cards
- PABX

DESCRIPTION

The CLP30-200B1 is designed to protect telecommunication equipment. It provides both a transient overvoltage protection and an overcurrent protection.

The external components (balanced resistors, ring relays contact, ...) needed by the CLP30-200B1 protection concept require very low power rating. This results in a very cost effective protection solution.



SO8

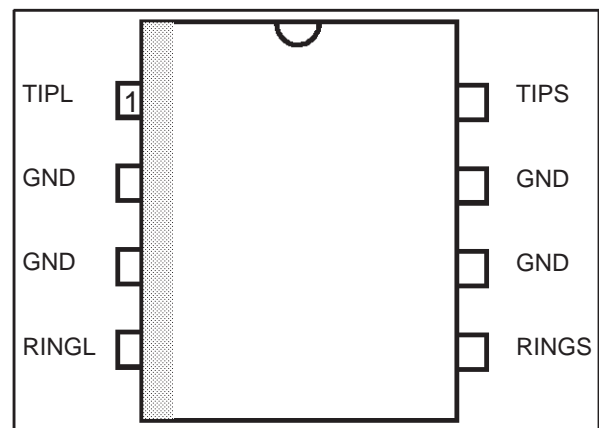
FEATURES

- Dual bidirectional protection device.
- High peak pulse current :
 $I_{PP} = 40A$ (5/310 μs SURGE)
 $I_{PP} = 30A$ (10/1000 μs SURGE)
- Max. voltage at switching-on : 290V
- Min. current at switching-off : 150mA

BENEFITS

- Voltage and current controlled suppression.
- Surface Mounting with SO8 package.
- Very low power rating of external components on line card : balanced resistors, ring relay, low voltage SLIC protection.

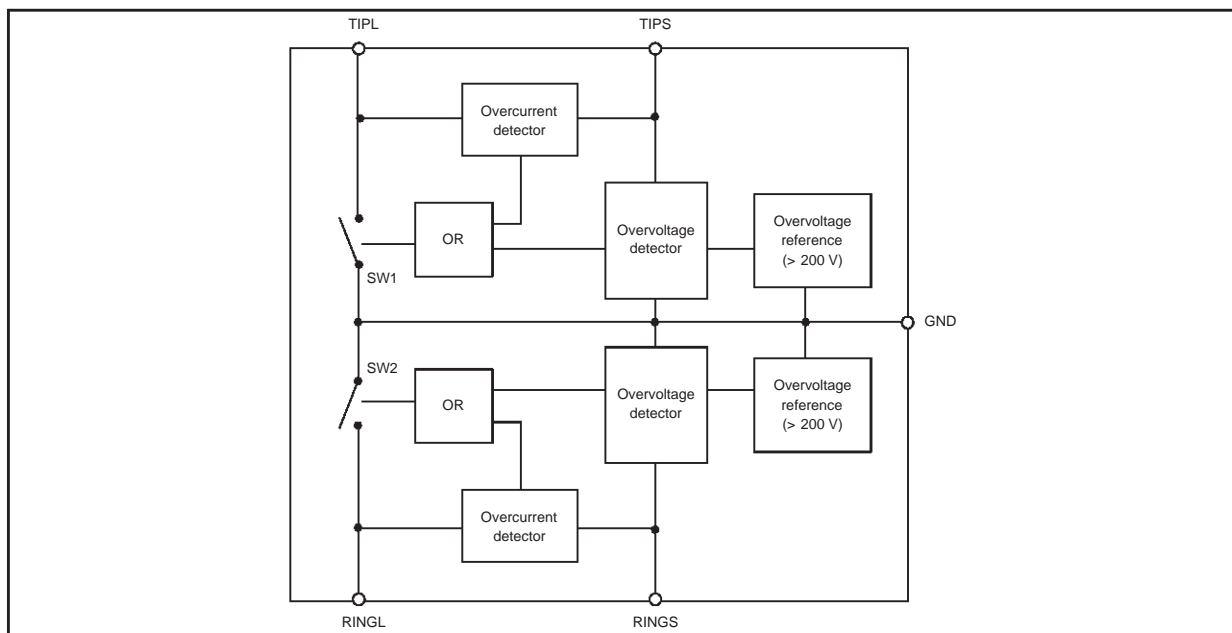
SCHEMATIC DIAGRAM (Top view)



CLP30-200B1

| Standard | Peak surge voltage (V) | Voltage waveform | Required peak current (A) | Current waveform | Minimum serial resistor to meet standard (Ω) |
|--|------------------------|--|--|---|---|
| Bellcore TR-NWT-1089 First level | 2500 1000 | 2/10 μ s 10/100 μ s | 500 100 | 2/10 μ s 10/1000 μ s | 20 25 |
| Bellcore TR-NWT-1089 Second level | 5000 | 2/10 μ s | 500 | 2/10 μ s | 40 |
| ITU-T-K20 / K21 | 4000 1000 | 10/700 μ s | 100 25 | 5/310 μ s | 50 0 |
| ITU-T-K20 (IEC61000-4-2) | 6000 8000 | 1/60 ns | ESD contact discharge ESD air discharge | | 0 0 |
| VDE0433 | 4000 2000 | 10/700 μ s | 100 50 | 5/310 μ s | 50 5 |
| VDE0878 | 4000 2000 | 1.2/50 μ s | 100 50 | 1/20 μ s | 22 0 |
| IEC61000-4-5 | 4000 2000 4000 | 10/700 μ s 1.2/50 μ s 1.2/50 μ s | 100 50 100 | 5/310 μ s 8/20 μ s 8/20 μ s | 50 0 22 |
| FCC Part 68, lightning surge type A | 1500 800 | 10/160 μ s 10/560 μ s | 200 100 | 10/160 μ s 10/560 μ s | 17.5 12 |
| FCC Part 68, lightning surge type B | 1000 | 9/720 μ s | 25 | 5/320 μ s | 0 |

BLOCK DIAGRAM



| Pin | Symbol | Description |
|---------------|--------|------------------|
| 1 | TIPL | TIP (Line side) |
| 2 / 3 / 6 / 7 | GND | Ground |
| 4 | RINGL | RING (Line side) |
| 5 | RINGS | RING (SLIC side) |
| 8 | TIPS | TIP (SLIC side) |

APPLICATION NOTE

1.INTRODUCTION

The aim of this section is to show the behavior of our new telecom line protection device.

Fig.1 : Subscriber line protection topology

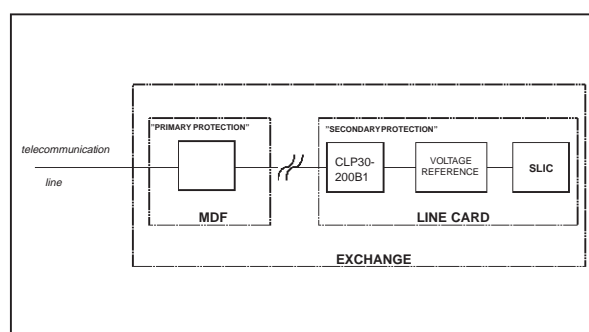


Figure 1 is a simplified block diagram of a subscriber line protection that is mainly used so far.

This shows two different things :

- A “primary protection” located on the Main Distribution Frame (MDF) eliminates coarsely the high energy environmental disturbances (lightning transients and AC power mains disturbances) for which the ITU-T-K20 requires a 4kV 10/700 μ s test. This can be assumed either by gas-tubes or silicon protection such as the TLPxxM.
- A “secondary protection” located on the line card eliminates finely the remaining transients that have not been totally suppressed by the first stage. The ITU-T-K20 requires a 1 kV 10/700 μ s test. At this stage, the protection is managed by the CLP30-200B1.

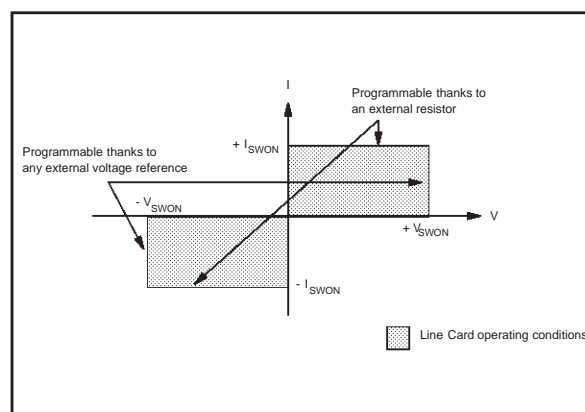
2. STMicroelectronics CLP30-200B1 CONCEPT

2.1 Evolution of the SLIC protection

Over the years, the performances of the SLICs considerably increased and therefore the need of the protection has also evolved.

The CLP30-200B1 is especially designed for the protection of this new generation of SLIC. For this, it is based on both overvoltage and overcurrent protection modes.

Fig.2 : Line card protection



The **figure 2** summarises the performance of the CLP30-200B1 which basically holds the SLIC inside its correct voltage and current values.

APPLICATION CIRCUIT : CLP30-200B1 in line card

Fig.3 : CLP30-200B1 in line card

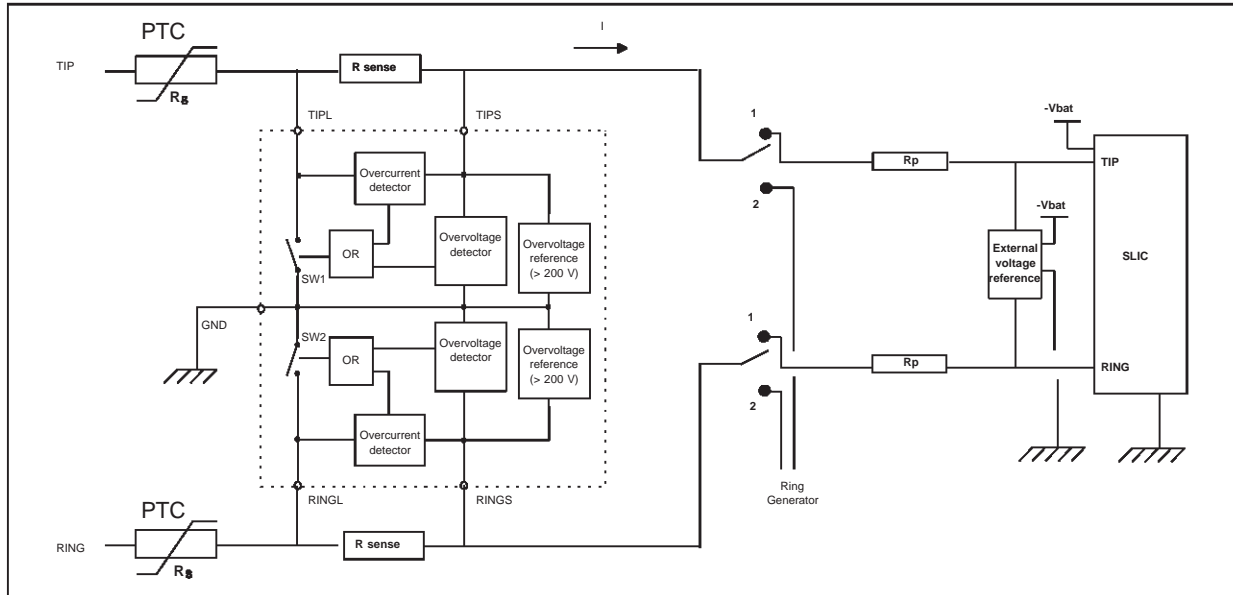
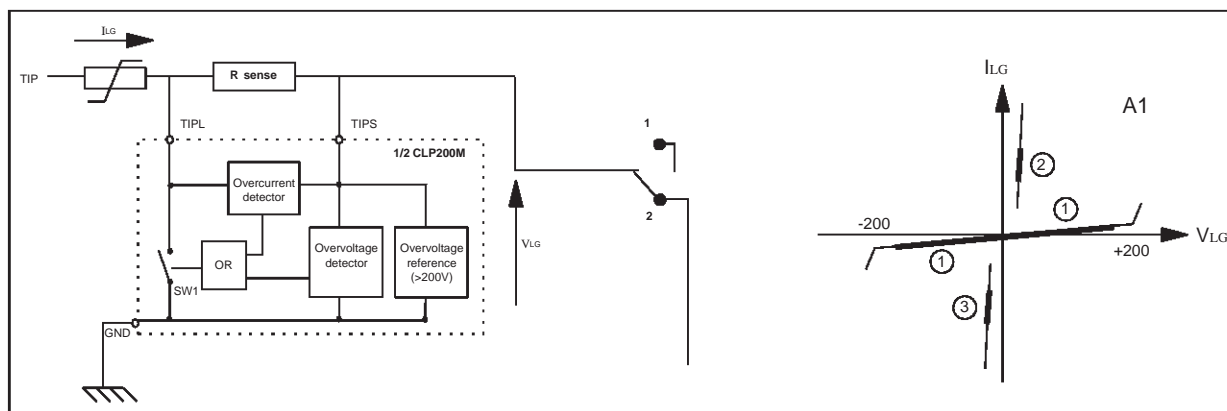


Figure above shows the topology of a protected analog subscriber line at the line card side.

- A first stage based on CLP30-200B1 manages the high power issued from the external surges. When used in ringing mode, the CLP30-200B1 operates in voltage mode and provides a symmetrical and bidirectional overvoltage protection above 200 V on both TIP and RING lines. When used in speech mode, the CLP30-200B1 operates in current mode and the activation current of the CLP30-200B1 is adjusted by R_{SENSE} .
- A second stage which is the external voltage reference device defines the firing threshold voltage during the speech mode and also assumes a residual power overvoltage suppression. This stage can be either a fixed or programmable device such as LCP1511D.

2.3 Ringing mode

Fig.4 : Switching by voltage during ringing mode.



In ringing mode (Ring relay in position 2), the only protection device involved is the CLP30-200B1.

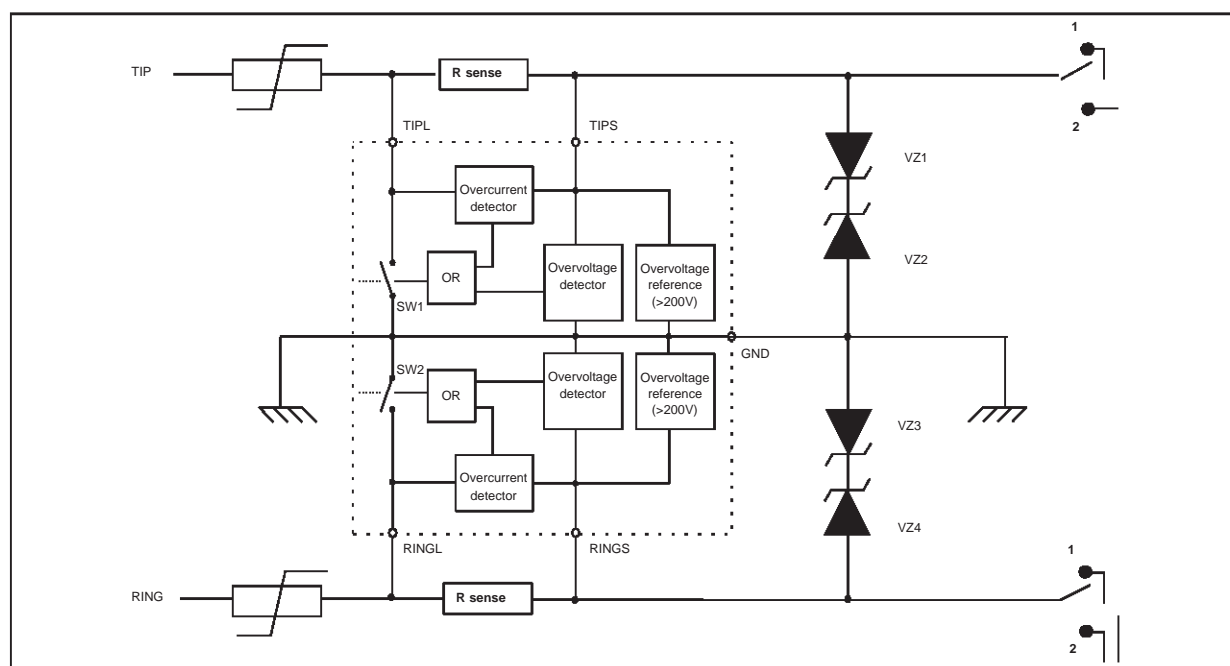
In normal conditions, the CLP30-200B1 operates in region 1 of **A1** curve, and is idle.

If an overvoltage occurring between TIP (or RING) and GND reaches the internal overvoltage reference (+/- 200V), the CLP30-200B1 acts and the line is short-circuited to GND. At this time the operating point moves to region 2 for positive surges (region 3 for negative surges). Once the surge current disappears, the device returns to its initial state (region 1).

For surges occurring between TIP and RING, the CLP30-200B1 acts in the same way. This means that the CLP30-200B1 ensures a tripolar protection.

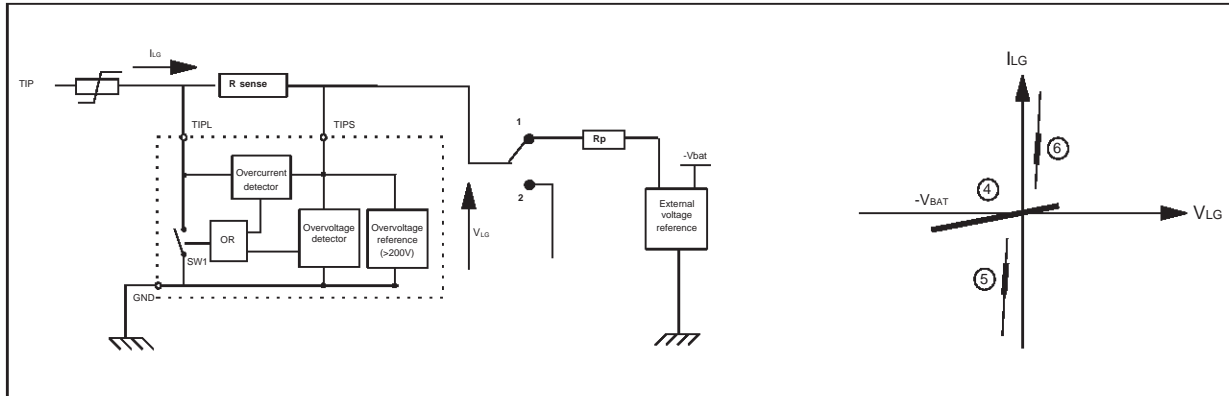
When used alone, the CLP30-200B1 acts at the internal overvoltage reference level (+/- 200 V). Furthermore, it is possible to adjust this threshold level to a lower voltage by using up to 4 fixed external voltage reference (VZ1 to VZ4) (see fig.5).

Fig.5 : Methode to adjust the reference voltage.



2.4 Speech mode

Fig.6 : Switching by current during speech mode.



In speech mode (Ring relay in position 1), the protection is provided by the combination of both CLP30-200B1 and the external voltage reference device (for example LCP1511D).

In normal conditions, the working point of this circuit is located in region 4 of **A2** curve : the CLP30-200B1 is idle.

When a surge occurs on the line, the external voltage reference device clamps at GND or $-V_{bat}$ respectively for positive and negative surges. This generates a current which is detected by R_{sense} and causes the protection to act : the line is short-circuited to GND. The operating point moves to region 6 for positive surges or region 5 for negative surges.

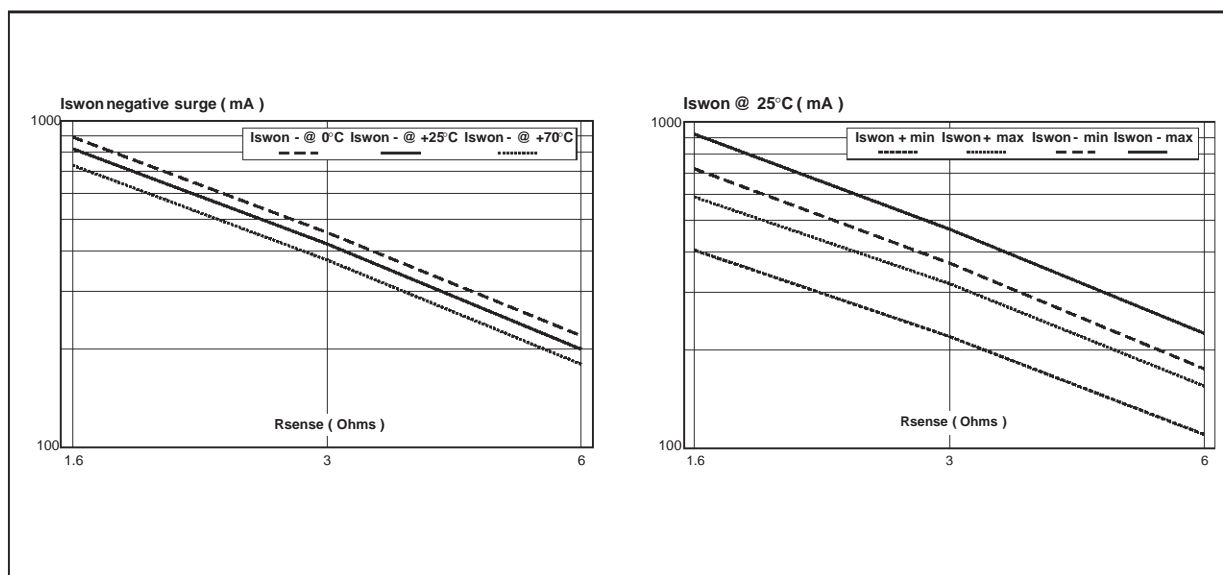
Once the surge current falls below the switching-off current I_{SWOFF} , the CLP30-200B1 returns to its initial state (region 4).

Furthermore, the CLP30-200B1 switches when an overvoltage, either positive or negative, occurs either :

- simultaneously on both TIP and RING lines versus GND.
- between TIP and RING.
- on TIP (or RING) versus GND.

The choice of the switching-on current is function of the R_{SENSE} resistors.

Fig . 7a and 7b : Switching-on current versus R_{SENSE}



This current (typically above 150 mA) should not activate the protection device CLP30-200B1.

Therefore the level of activation is to be chosen just below this limit (typically 200mA). This level is adjusted through R_{SENSE} .

Figures 7a and 7b enable the designers to choose the right R_{SENSE} value.

Example: The choice of $R_{\text{SENSE}} = 3 \Omega$ ensures a negative triggering of -280 mA min and -380mA max. In this case, the positive triggering will be 220mA min and 320mA max.

Thanks to the CLP30-200B1 topology, the surge current in the line is reduced after it.

Because the remaining surge energy is low, the power ratings of R_P , the relay contacts and the external voltage reference device may be kept low. This results in a significant cost reduction for the whole system.

CLP30-200B1**ABSOLUTE MAXIMUM RATINGS** ($R_{\text{SENSE}} = 3\ \Omega$, $T_{\text{amb}} = 25^{\circ}\text{C}$)

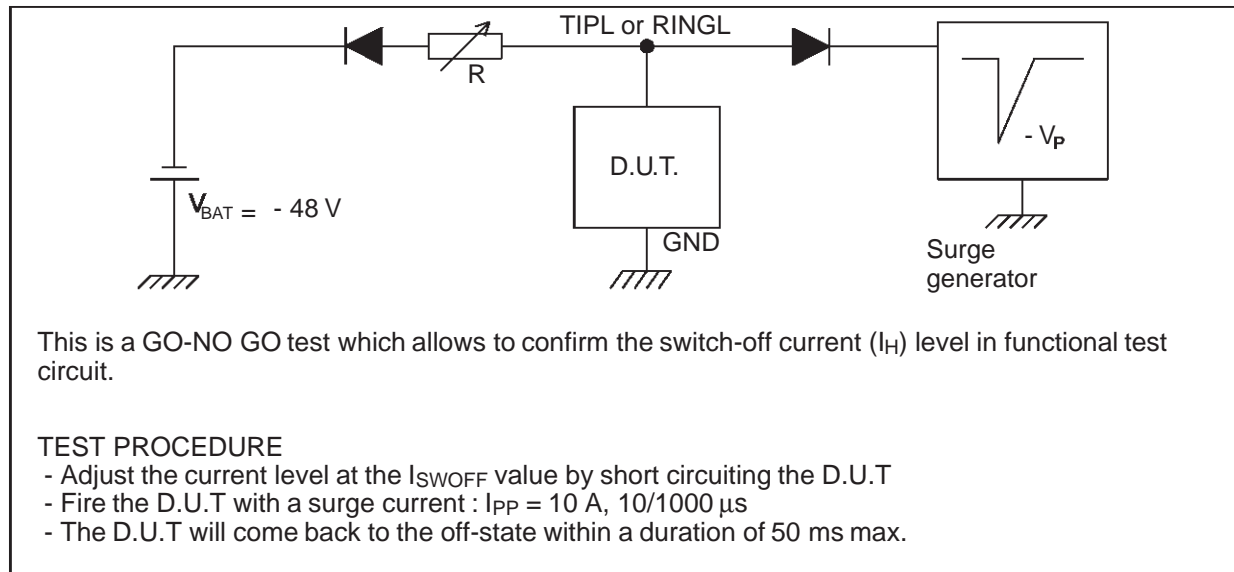
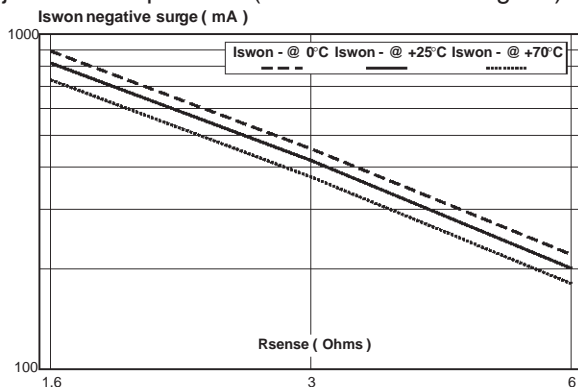
| Symbol | Parameter | Value | Unit |
|---------------------------|---|--|------------------------|
| I_{PP} | Line to GND peak pulse current 10/1000 μs (open circuit voltage wave shape 10/1000 μs) 5/310 μs (open circuit voltage wave shape 10/700 μs) | 30 45 | A |
| I_{TSM} | Non repetitive surge peak on-state current $F = 50\ \text{Hz}$ | $t_p = 10\ \text{ms}$ $t_p = 200\ \text{ms}$ $t_p = 1\ \text{s}$ | 8.5 4.5 3.5 A |
| T_{stg} T_j | Storage temperature range Maximum junction temperature | -40 to +150 150 | $^{\circ}\text{C}$ |
| T_L | Lead temperature for soldering during 10 s. | 260 | $^{\circ}\text{C}$ |

ELECTRICAL CHARACTERISTICS ($R_{\text{SENSE}} = 3\ \Omega$, and $T_{\text{amb}} = 25\ ^{\circ}\text{C}$)

| Symbol | Parameter | Test conditions | Min | Max | Unit |
|--------------------|--|---|------------|------------|---------------|
| I_{LGL} | Line to GND leakage current | $V_{\text{LG}} = 200\ \text{V}$ Measured between TIP (or RING) and GND | | 10 | μA |
| V_{LG} | Line to GND operating voltage | | 200 | | V |
| V_{SWON} | Line to GND voltage at SW1 or SW2 switching-on | Measured at 50 Hz between TIPL (or RINGL) and GND, one cycle | | 290 | V |
| I_{SWOFF} | Line to GND negative current at SW1 or SW2 switching-off | Refer to test circuit fig 9 | 150 | | mA |
| I_{SWON} | Line current at SW1 or SW2 switching-on | Positive surge Negative surge | 220 370 | 320 470 | mA |
| C | Line to GND capacitance | $V_{\text{LG}} = 0\ \text{V}$ $V_{\text{OSC}} = 200\ \text{mV}_{\text{RMS}}$ $F = 1\ \text{MHz}$ | | 100 | pF |

THERMAL RESISTANCE

| Symbol | Parameter | Value | Unit |
|----------------------|---------------------|-------|----------------------|
| $R_{\text{th(j-a)}}$ | Junction to ambient | 170 | $^{\circ}\text{C/W}$ |

Fig.8 : TEST CIRCUIT FOR I_{SWOFF} PARAMETER : GO - NO GO TEST**Fig. 9 :** Typical variation of switching-on current (positive or negative) versus R_{SENSE} resistor and junction temperature (see test condition Fig. 11).**Fig. 11 : I_{SWON} MEASUREMENT**

- $I_{SWON} = I_1$ when the CLP30-200B1 switches on (I_1 is progressively increased using R)
- Both TIP and RING sides of the CLP30-200B1 are checked
- $R_L = 10 \Omega$.

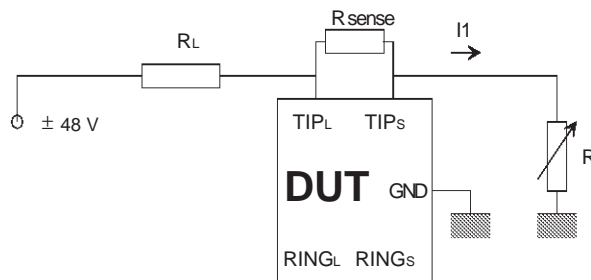
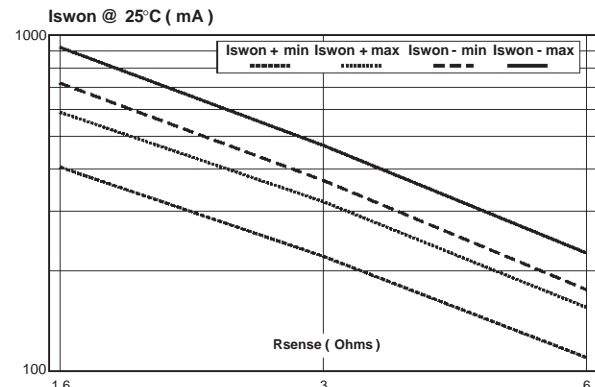
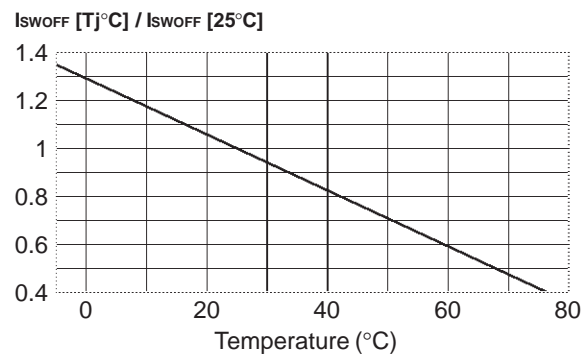
**Fig. 10 :** Variation of switching-on current versus R_{SENSE} at 25 °C.**fig. 12 :** Relative variation of switching-off current versus junction temperature (for R_{SENSE} between 3 and 10Ω).

Fig. 13 : Relative variation of switching-off current versus R_{SENSE} (between 3 and 10 Ω).

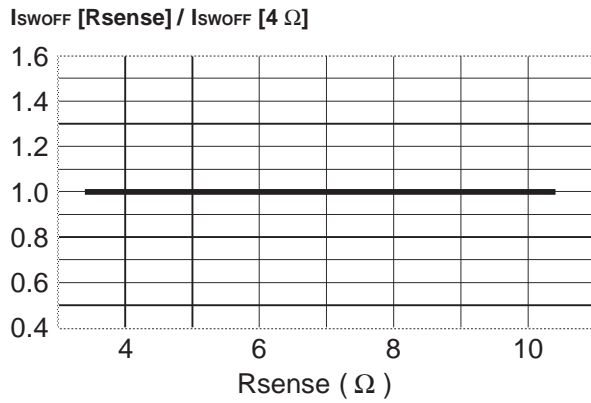


Fig. 15 : Relative variation of internal reference voltage versus junction temperature ($I_{LG} = 1\text{mA}$).

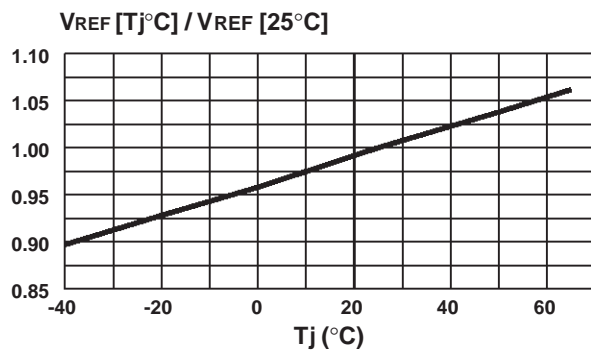


Fig. 17 : Surge peak current versus overload duration (maximum values).

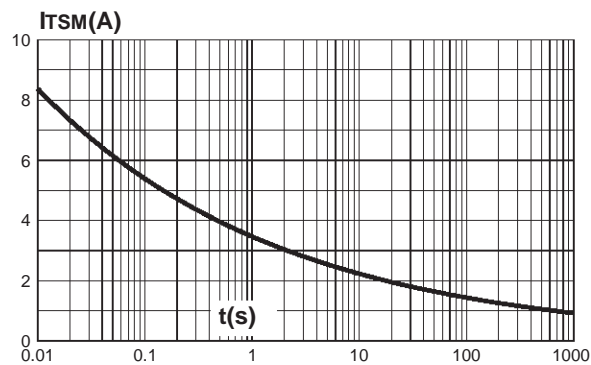


Fig. 14 : Relative variation of switching-on voltage versus dV/dt with an external resistor of 3 Ω .

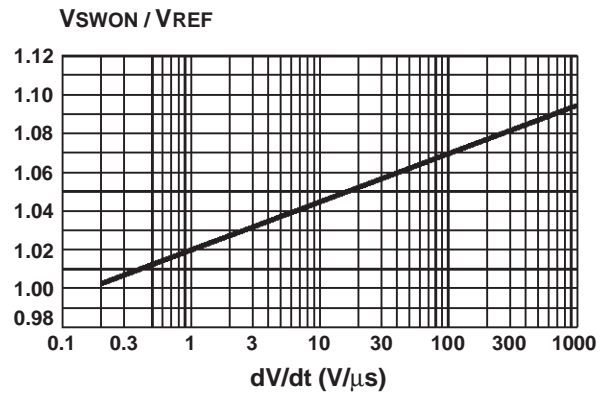
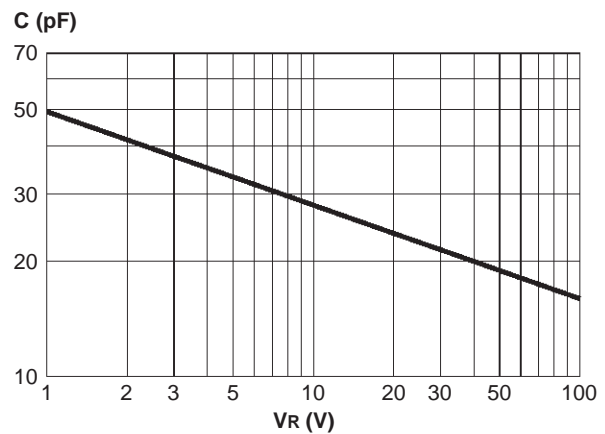


Fig. 16 : Capacitance (TIP/GND) versus applied voltage (typical values).



PACKAGE MECHANICAL DATA
SO8 plastic

| REF. | DIMENSIONS | | | | | |
|------|-------------|------|------|--------|-------|-------|
| | Millimetres | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 1.75 | | | 0.069 |
| a1 | 0.1 | | 0.25 | 0.004 | | 0.010 |
| a2 | | | 1.65 | | | 0.065 |
| a3 | 0.65 | | 0.85 | 0.025 | | 0.033 |
| b | 0.35 | | 0.48 | 0.014 | | 0.019 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | 0.25 | 0.50 | 0.50 | 0.010 | | 0.020 |
| c1 | 45° (typ) | | | | | |
| D | 4.8 | | 5.0 | 0.189 | | 0.197 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 3.81 | | | 0.150 | |
| F | 3.8 | | 4.0 | 0.15 | | 0.157 |
| L | 0.4 | | 1.27 | 0.016 | | 0.050 |
| M | | | 0.6 | | | 0.024 |
| S | 8° (max) | | | | | |

MARKING

| Ordering code | Marking | Package | Weight | Base qty | Delivery mode |
|---------------|---------|---------|--------|----------|---------------|
| CLP30-200B1 | CLP30 | SO-8 | 0.08g | 100 | Tube |
| CLP30-200B1RL | CLP30 | SO-8 | 0.08g | 2500 | Tape & Reel |

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