

Application Specific Discretes
A.S.D.™

OVERVOLTAGE AND OVERCURRENT PROTECTION FOR TELECOM LINE

MAIN APPLICATIONS

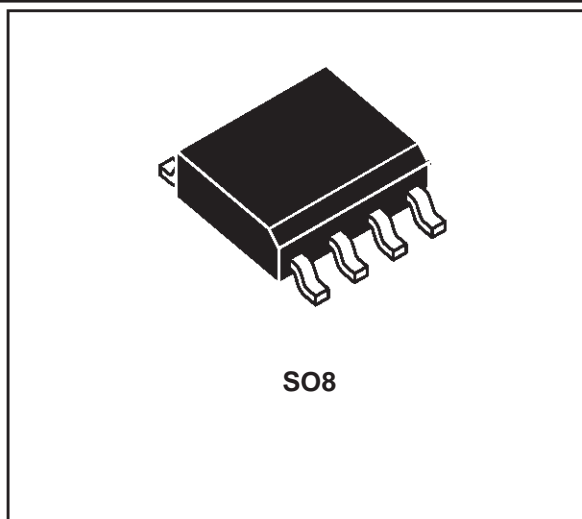
Any telecom equipment submitted to transient overvoltages and lightning strikes such as :

- 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.



FEATURES

- DUAL BIDIRECTIONAL PROTECTION DEVICE.
- HIGH PEAK PULSE CURRENT :
 $I_{PP} = 40A$ (10/700 μs SURGE)
 $I_{PP} = 30A$ (10/1000 μs SURGE)
- MAX. VOLTAGE AT SWITCHING-ON : 290V
- MIN. CURRENT AT SWITCHING-OFF : 150mA

BENEFITS

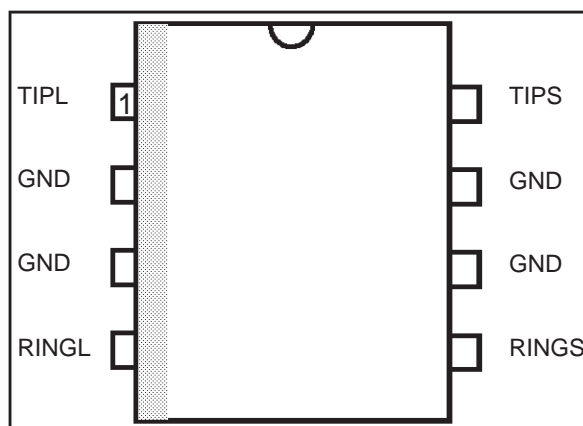
- Voltage and current controlled suppression.
- Surface Mounting with SO8 package.
- Very low power rating of external components on line card : balanced resistors, ring relay, low voltage SLIC protection.

COMPLIES WITH THE FOLLOWING STANDARDS :

CCITT K20	10/700 μs 5/310 μs	1 kV $I_{pp}=25 A$
VDE0433	10/700 μs 5/310 μs	2 kV $I_{pp}=40 A$ (*)
VDE0878	1.2/50 μs 1/20 μs	1.5 kV $I_{pp}=40 A$
Bellcore TR-1089-CORE	2/10 μs	2.5 kV
FCC Part 68	2/10 μs	$I_{pp}=75 A$ (*)
Bellcore TR-NWT-000	10/1000 μs 10/1000 μs	1 kV $I_{pp}=30 A$ (*)

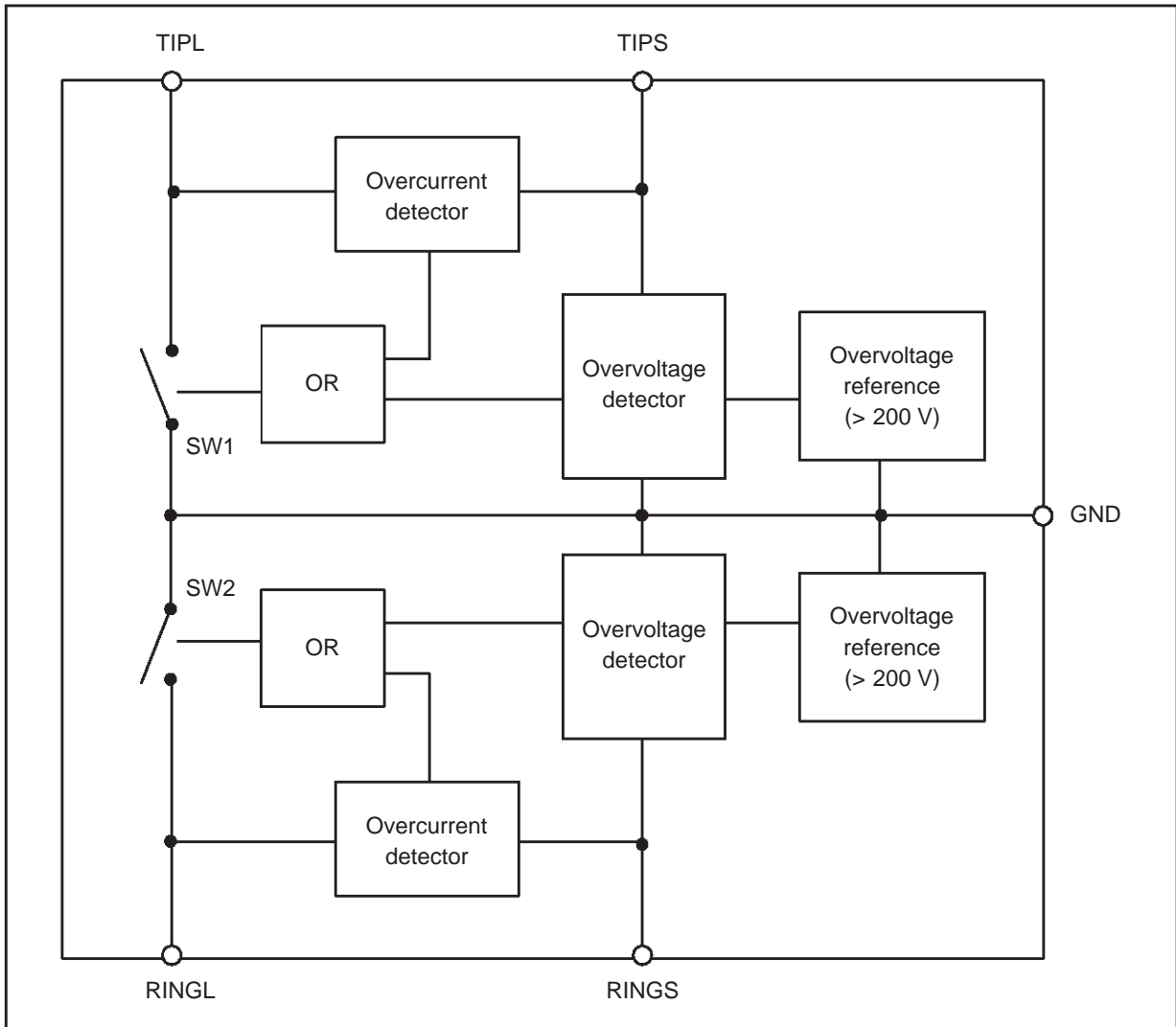
(*) with series resistors or PTC.

SCHEMATIC DIAGRAM (Top view)



CLP30-200B1

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

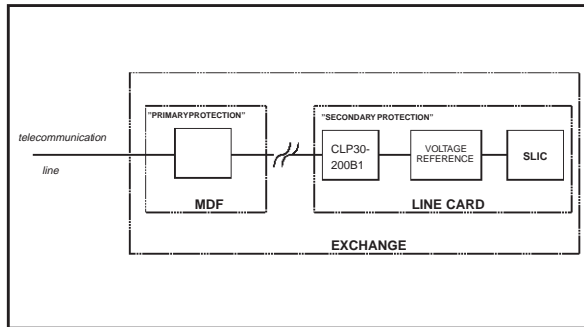


Figure 1 is a simplified block diagram of a subscriber line protection that is mainly used so far.

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 CCITT 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 CCITT K20 requires a 1 kV 10/700 μ s test. At this stage, the protection is managed by the CLP30-200B1.

The explanations which follow are basically

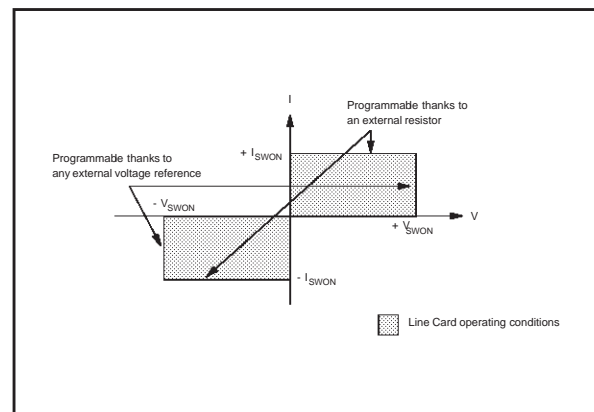
2. SGS-THOMSON CLP30-200B1 CONCEPT

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.

CLP30-200B1

APPLICATION CIRCUIT : CLP30-200B1 in line card

Fig.3 : CLP30-200B1 in line card

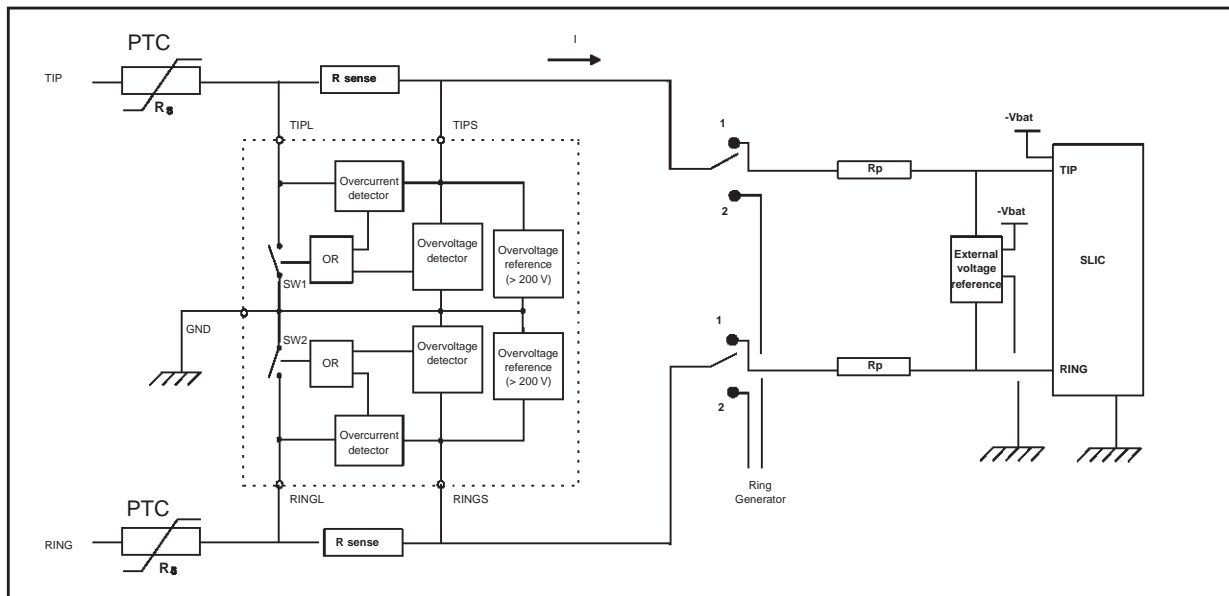
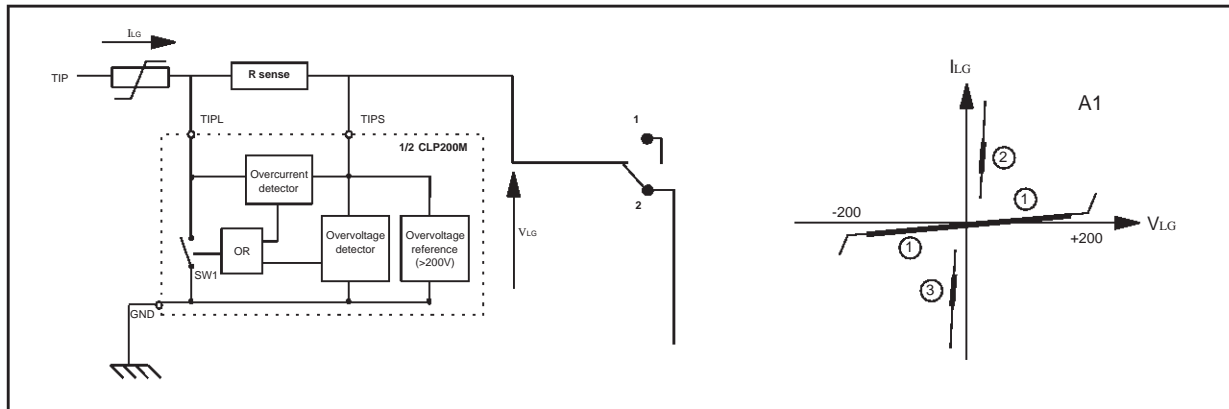


Figure above shows the topology of a protected analog subscriber line at the line card side.

- 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.

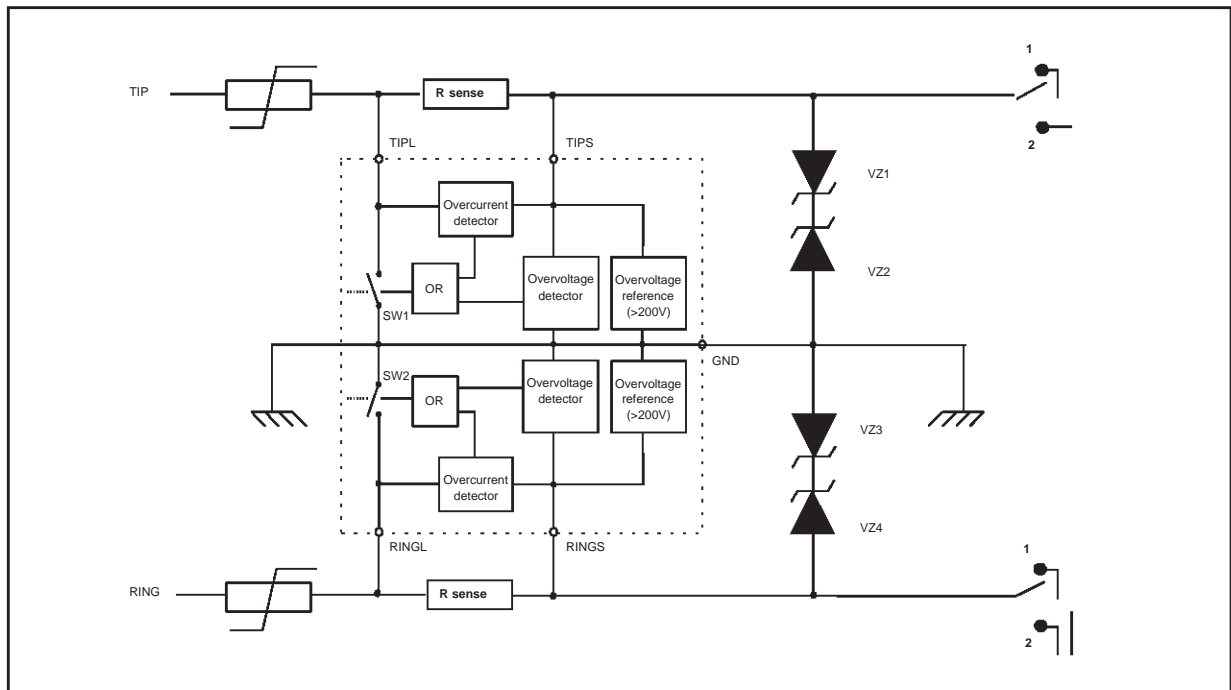
In normal conditions, the CLP30-200B1 operates in region 1 of A1 curve, and is idle.

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).

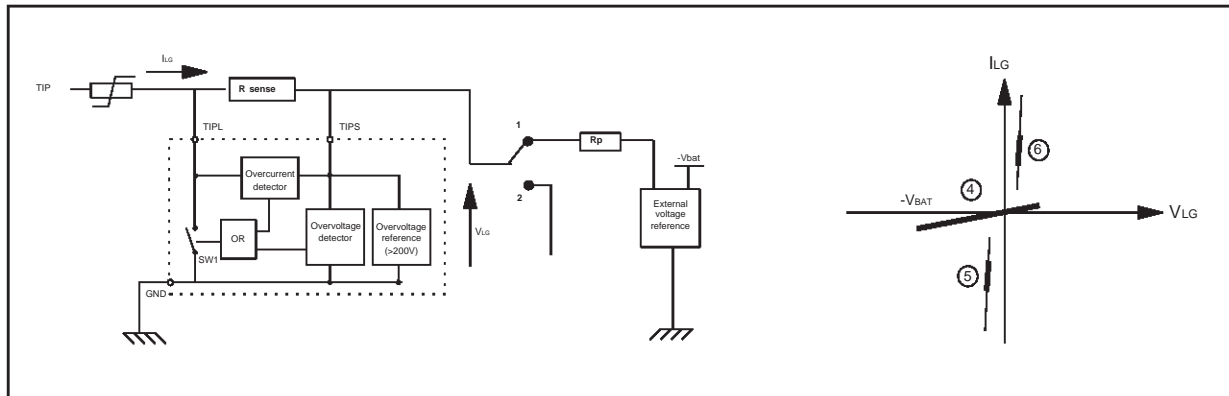
Fig.5 : Methode to adjust the reference voltage.



CLP30-200B1

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.

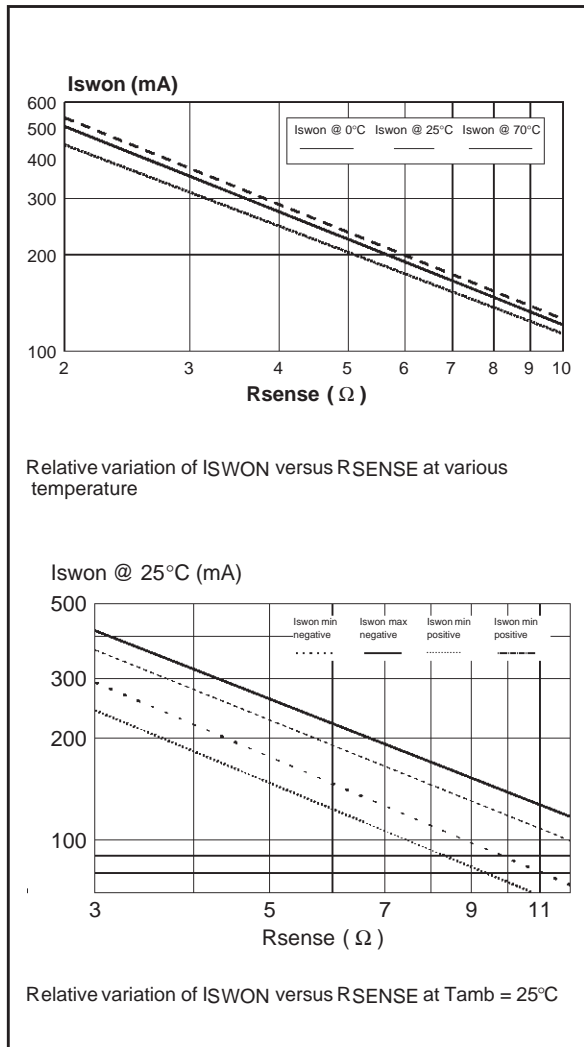
Once the surge current falls below the switching-off current I_{SWOFF} , the CLP30-200B1 returns to its initial state (region 4).

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

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

Symbol	Parameter	Test conditions	Min	Max	Unit
I_{LGL}	Line to GND leakage current	$V_{LG} = 200 \text{ V}$ 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	220 280	320 380	mA
C	Line to GND capacitance	$V_{LG} = 0 \text{ V}$ $V_{OSC} = 200 \text{ mV}_{RMS}$ $F = 1 \text{ MHz}$		100	pF

THERMAL RESISTANCE

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

Fig.8 : TEST CIRCUIT FOR ISWOFF PARAMETER: GO- NOGO TEST

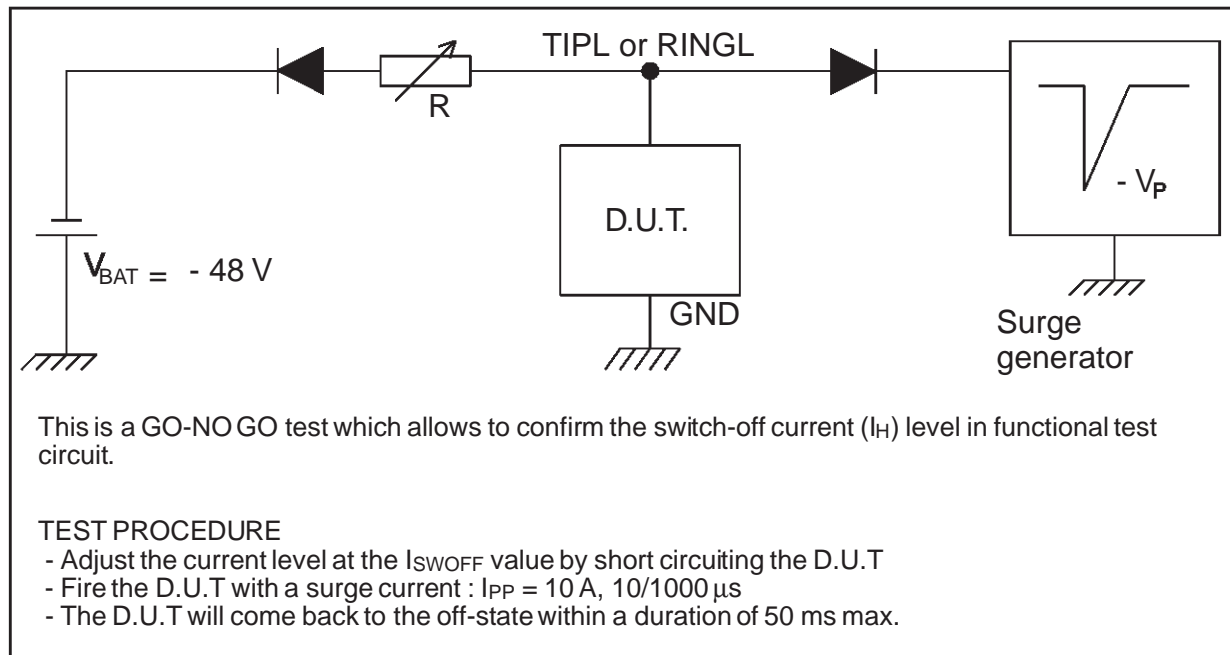


Fig. 9 : Typical variation of switching-on current (positive or negative) versus R_{SENSE} resistor and junction temperature (see test condition Fig. 11).

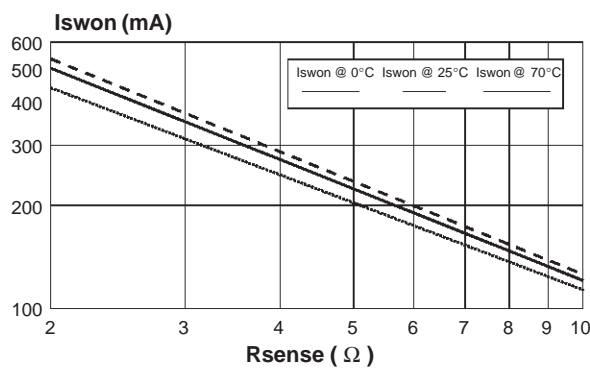


Fig. 11 : ISWON MEASUREMENT

- $ISWON = I1$ when the CLP30-200B1 switches on ($I1$ is progressively increased using R)
- Both TIP and RING sides of the CLP30-200B1 are checked
- $R_L = 10\ \Omega$.

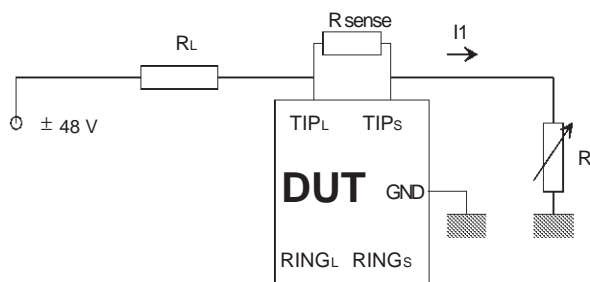


Fig. 10 : Variation of switching-on current versus R_{SENSE} at 25 °C.

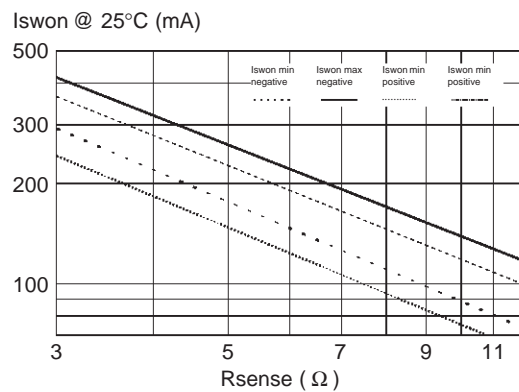
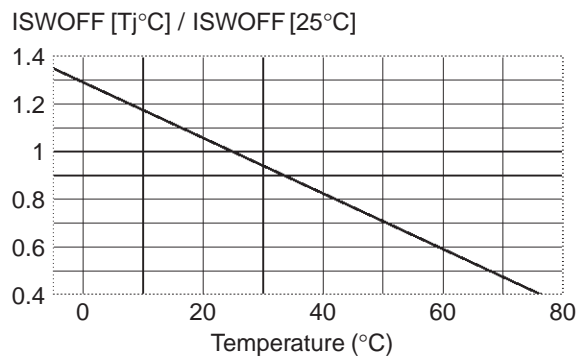


fig. 12 : Relative variation of switching-off current versus junction temperature (for R_{SENSE} between 3 and 10 Ω).



CLP30-200B1

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

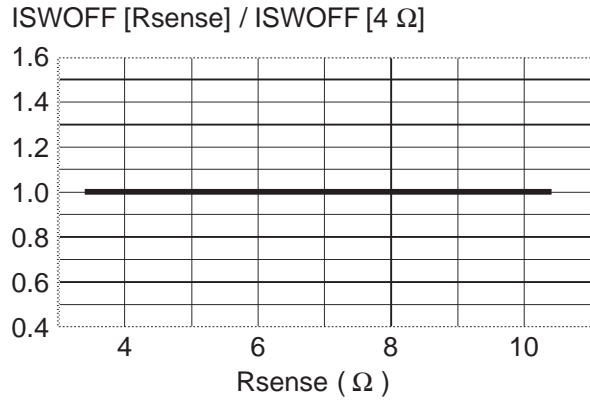


Fig. 15 : Relative variation of internal reference voltage versus junction temperature ($I_{LG} = 1mA$).

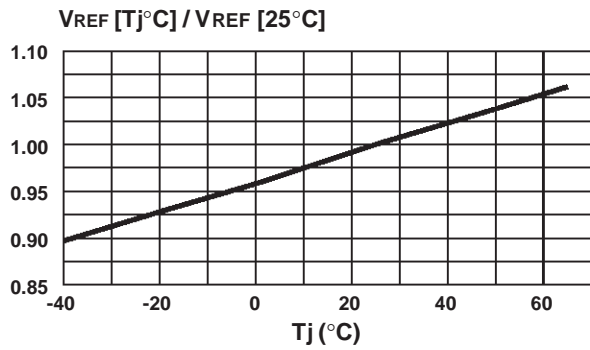


Fig. 17 : Surge peak current versus overload duration (maximum values).

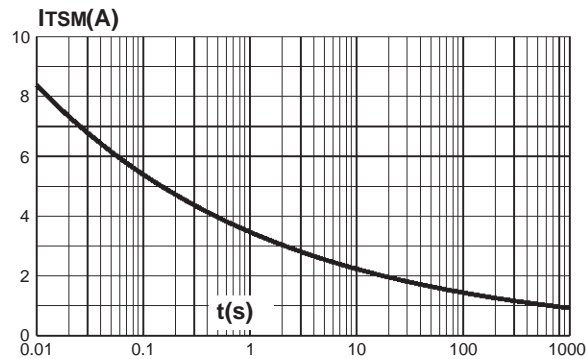


Fig. 14 : Relative variation of switching-on voltage versus dV/dt with an external resistor of 3 Ω .

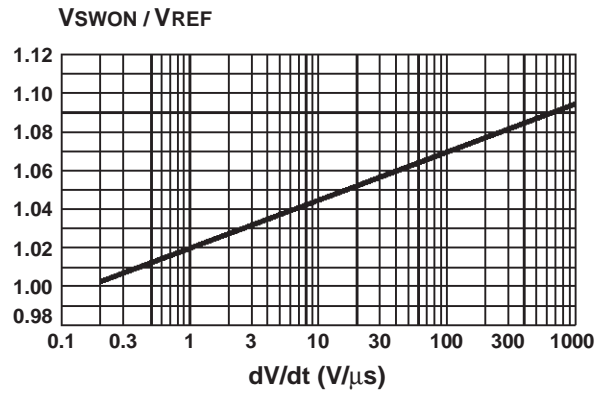
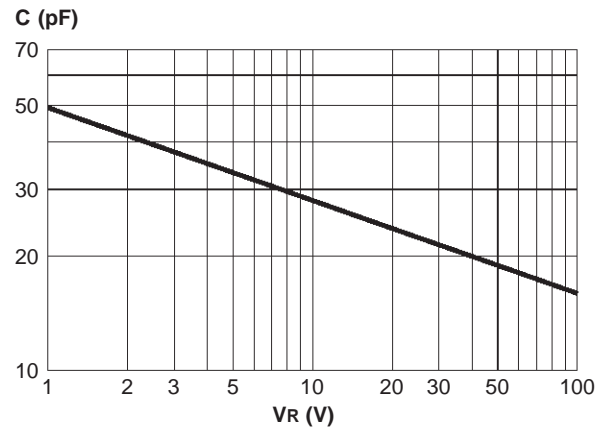
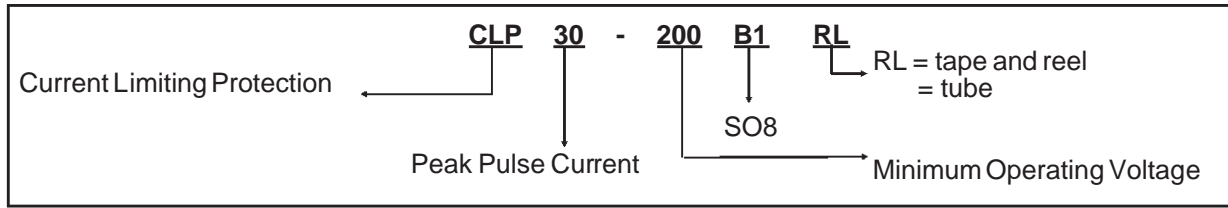


Fig. 16 : Capacitance (TIP/GND) versus applied voltage (typical values).



ORDER CODE

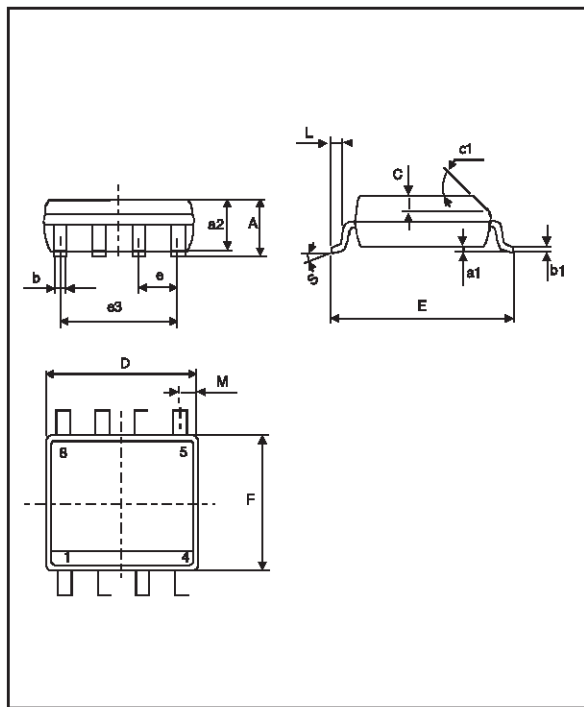


MARKING

Package	Type	Marking
SO8	CLP30-200B1	CLP30

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
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C		0.50			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)					

Packaging : Product supplied in antistatic tubes or tape and reel

Weight : 0.08g

Information furnished is believed to be accurate and reliable. However, SGS-THOMSON Microelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of SGS-THOMSON Microelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. SGS-THOMSON Microelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of SGS-THOMSON Microelectronics.

© 1998 SGS-THOMSON Microelectronics - Printed in Italy - All rights reserved.

SGS-THOMSON Microelectronics GROUP OF COMPANIES

Australia - Brazil - Canada - China - France - Germany - Italy - Japan - Korea - Malaysia - Malta - Morocco
The Netherlands - Singapore - Spain - Sweden - Switzerland - Taiwan - Thailand - United Kingdom - U.S.A.