LCP12

Protection IC for ringing SLICs

Features

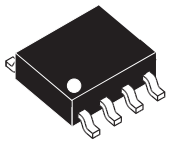
- Protection IC recommended for ringing SLICs
- Wide firing voltage range: -120 V to +120 V
- Low gate triggering current: I_G = 5 mA max
- Peak pulse current: I_{PP} = 45 A (10/1000 µs)
- Holding current: I_H = 150 mA min

Applications

- Dual battery supply voltage SLICs
  - negative battery supply configuration
  - negative and positive battery supply configuration
- Central office (CO)
- Private branch exchange (PBX)
- Digital loop carrier (DLC)
- Digital subscriber line access multiplexer (DSLAM)
- Fiber in the Loop (FITL)
- Wireless local loop (WLL)
- Hybrid fiber coax (HFC)
- ISDN terminal adapter
- Cable modem

Description

The LCP12 has been developed to protect SLICs operating on both negative and positive battery supplies, as well as high voltage SLICs. It provides crowbar mode protection for both TIP and RING lines. The surge suppression is assumed for each wire by two thyristor structures, one dedicated to positive surges the second one for negative surges. Both positive and negative threshold levels are programmable by two gates (Gn and Gp). The use of transistors decreases the battery currents during surge suppression.



SO-8 wide
LCP12

Figure 1. Functional diagram

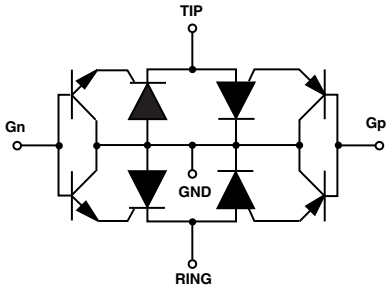
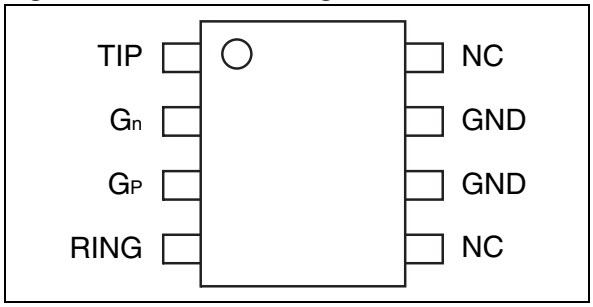


Figure 2. Pin-out configuration



LCP12 can be used to help equipment to meet various standards such as UL1950, IEC 60950 / CSAC22.2, UL1459 and TIA-968-A (formerly FCC part68). A Trisil™ meets UL94 V0. (Trisils are UL497B approved - file: E136224).

TM: Trisil is a trademark of STMicroelectronics

1 Characteristics

Table 1. Compliant with the following standards

Standard	Peak Surge Voltage (V)	Voltage Waveform	Required peak current (A)	Current Waveform	Minimum series resistor to meet standard (Ω)
GR-1089 Core First level	2500 1000	2/10 µs 10/1000 µs	500 100	2/10 µs 10/1000 µs	12 13
GR-1089 Core Second level	5000	2/10 µs	500	2/10 µs	24
GR-1089 Core Intra-building	1500	2/10 µs	100	2/10 µs	0
ITU-T-K20/K21	6000 4000 1500	10/700 µs	150 100 37.5	5/310 µs	40 14 0
ITU-T-K20 (IEC61000-4-2)	8000 15000	1/60 ns	ESD contact discharge ESD air discharge		0 0
VDE0433	4000 2000	10/700 µs	100 50	5/310 µs	14 0
VDE0878	4000 2000	1.2/50 µs	100 50	1/20 µs	0 0
IEC61000-4-5	4000 4000	10/700 µs 1.2/50 µs	100 100	5/310 µs 8/20 µs	14 0
TIA-968-A (formerly FCC part 68) **type A**	1500 800	10/160 µs 10/560 µs	200 100	10/160 µs 10/560 µs	20 15
TIA-968-A (formerly FCC part 68) **type B**	1000	9/720 µs	25	5/320 µs	0

Table 2. Absolute maximum ratings (T_{amb} = 25 °C)

Symbol	Parameter		Value	Unit
I_{PP}	Peak pulse current	10/1000 µs 5/310 µs 2/10µs	45 75 150	A
I_{TSM}	Non repetitive surge peak on-state current (F = 50 Hz) I_{TSM} value specified for each line I_{TSM} value can be applied on both lines at the same time (GND capability is twice the line I_{TSM})	t_p = 0.2 s t_p = 1 s t_p = 15 min	11 7.5 3	A
V_{GN} max V_{GP} max	Maximum negative battery voltage range Maximum positive battery voltage range		-120 to 0 0 to +120	V
T_{op}	Operating temperature range		-40 to +125	°C
T_{stg}	Storage temperature range		-55 to +150	°C
T_L	Lead solder temperature (10 s duration)		260	°C

Figure 3. Pulse waveform

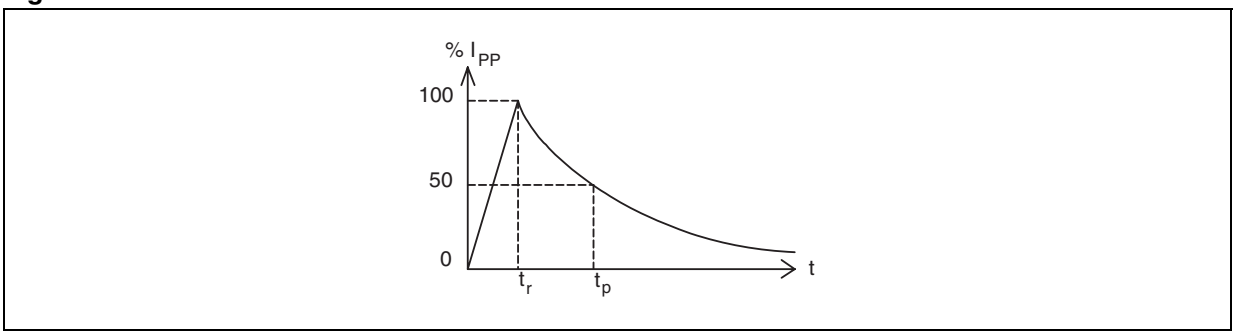


Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{th(j-a)}$	Junction to ambient	150	°C/W

Table 4. Parameters related to the negative suppressor

Symbol	Parameter	Test conditions	Min.	Max.	Unit
I_{Gn}	Negative gate trigger current	$V_{gn/GND}$ = -60 V Measured at 50 Hz		5	mA
I_{H-}	Holding current (see *Figure 4*)	Go-No Go test, V_{Gn} = -60 V	150		mA
V_{DGL-}	Dynamic switching voltage Gn / Line(1)	$V_{gn/GND}$ = -60 V 10/700 µs 2 kV R_P = 25 Ω I_{PP} = 30 A 1.2/50 µs 2 kV R_P = 25 Ω I_{PP} = 30 A		8 12	V

1. The V_{DGL} value is the difference between the peak line voltage during the surge and the programmed gate voltage.

Table 5. Parameters related to the positive suppressor

Symbol	Parameter	Test conditions	Min.	Max.	Unit
I_{Gp}	Positive gate trigger current	$V_{gp/GND}$ = 60 V, measured at 50 Hz		5	mA
V_{DGL+}	Dynamic switching voltage Gn / Line(1)	$V_{gp/GND}$ = 60 V 10/700 µs 2 kV R_P = 25 Ω I_{PP} = 30 A 1.2/50 µs 2 kV R_P = 25 Ω I_{PP} = 30 A		8 20	V

1. The V_{DGL} value is the difference between the peak line voltage during the surge and the programmed gate voltage.

Table 6. Parameters related to line/gnd

Symbol	Parameter	Test conditions	Min.	Max.	Unit
I_R	Reverse leakage current	T_j = 25 °C V_{LINE} = +120 V $V_{GP/LINE}$= +1 V T_j = 25 °C V_{LINE} = -120 V $V_{GN/LINE}$= -1 V		5 5	µA
C_{off}	Capacitance LINE/GND	V_R = -3 V, F =1 MHz, V_{Gp} = 60 V, V_{Gn} = -60 V		60	pF

Table 7. Recommended gate capacitance

Symbol	Component	Min.	Typ.	Max.	Unit
C_G	Gate decoupling capacitance	100	220		nF

Figure 4. Relative variation of holding current versus junction temperature

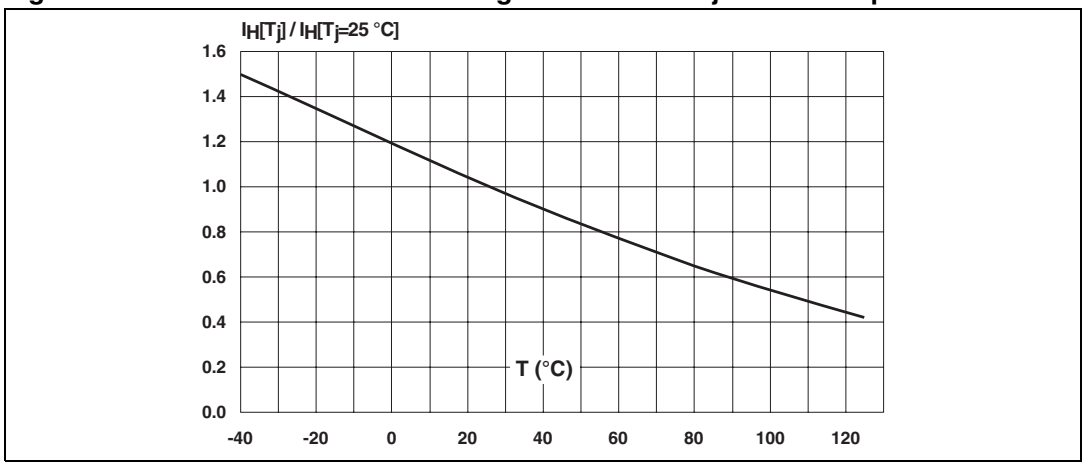


Figure 5. Maximum non repetitive surge peak on state current versus overload duration

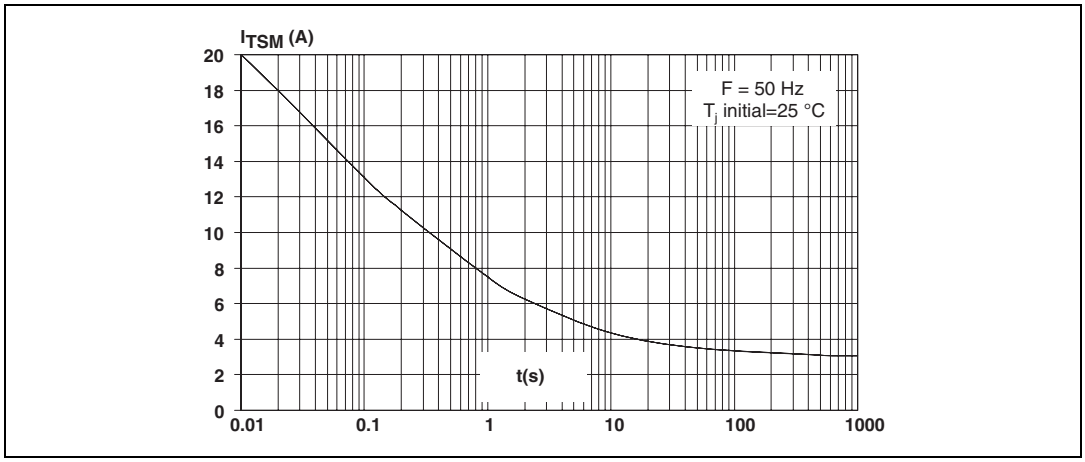
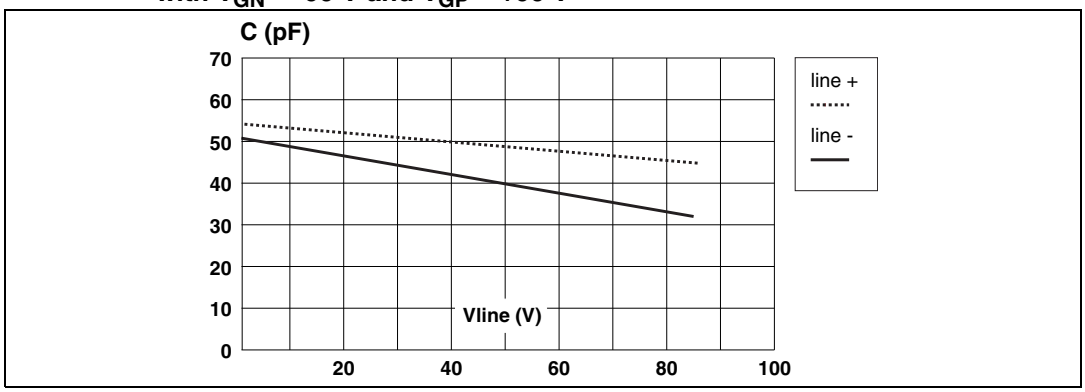


Figure 6. Capacitance versus reverse applied voltage (typical values) with V_{GN} = -90 V and V_{GP} = +90 V



2 Technical information

Figure 7. LCP12 concept behavior.

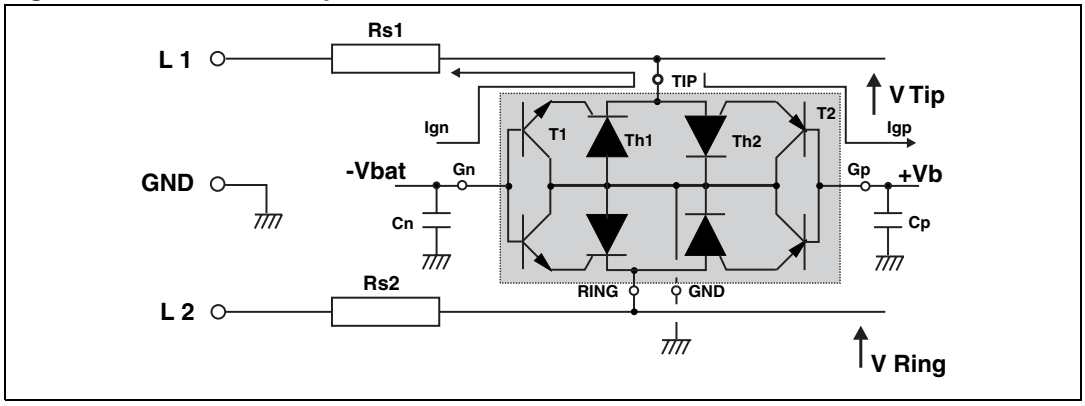


Figure 7 shows the classical protection circuit using the LCP12 crowbar concept. This topology has been developped to protect the new two-battery voltage SLICs. It allows both positive and negative firing thresholds to be programmed. The LCP12 has two gates (Gn and Gp). Gn is biased to negative battery voltage $-V_{bat}$, while Gp is biased to the positive battery voltage $+V_b$.

When a negative surge occurs on one wire (L1 for example), a current I_{gn} flows through the base of the transistor T1 and then injects a current in the gate of the thyristor Th1 which fires. All the surge current flows through the ground. After the surge, when the current flowing through Th1 becomes less negative than the negative holding current I_{H-}, Th1 switches off. This holding current I_{H-} is temperature dependant as per *Figure 4*

When a positive surge occurs on one wire (L1 for example), a current Igp flows through the base of the transistor T2 and then injects a current in the gate of the thyristor Th2 which fires. All the surge current flows through the ground. After the surge, when the current flowing through Th2 becomes less positive than the positive holding current Ih+, Th2 switches off. This holding current I_{H+}, typically 20 mA at 25 °C, is temperature dependant and the same *Figure 4* also applies.

The capacitors Cn and Cp are used to speed up the crowbar structure firing during the fast rise or fall edges. This allows to minimize the dynamical breakover voltage at the SLIC Tip and Ring inputs during fast surges. Please note that these capacitors are generally available around the SLIC. To be efficient they have to be as close as possible to the LCP12-150B1 gate pins (Gn and Gp) and to the reference ground track (or plan). The optimized value for Cn and Cp is 220 nF.

The series resistors Rs1 and Rs2 shown in *Figure 7* represent the fuse resistors or the PTCs which are needed to withstand the power contact or the power induction tests imposed by the country standards. Taking this factor into account, the actual lightning surge current flowing through the LCP12-150B1 is equal to :

I surge = Vsurge / (Rg + Rs)

With

V surge = peak surge voltage imposed by the standard.

Rg = series resistor of the surge generator

Rs = series resistor of the line card (e.g. PTC)

For a line card with 50 Ω of series resistors which has to be qualified under Bellcore 1000 V 10/1000 µs surge, the present current through the LCP12 is equal to:

I surge = 1000 / (10 + 50) = **17 A**

The LCP12-150B1 topology is particularly optimized for the new telecom applications such as fiber in the loop, WLL systems, and decentralized central office, for example.

Figure 8. Protection of SLIC with positive and negative battery voltages.

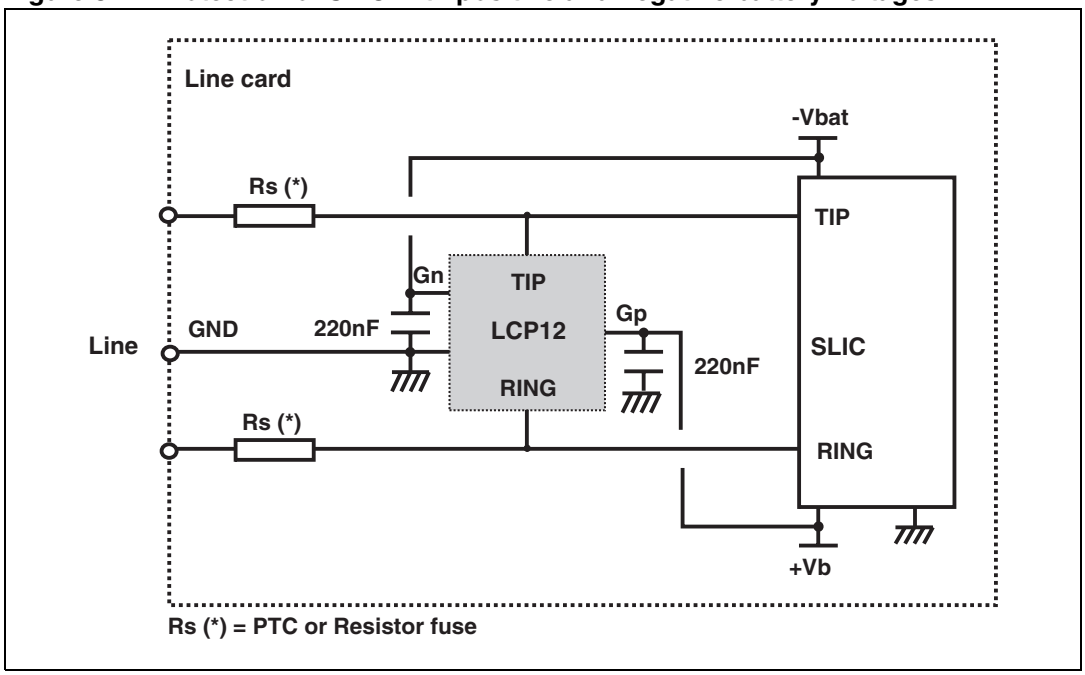


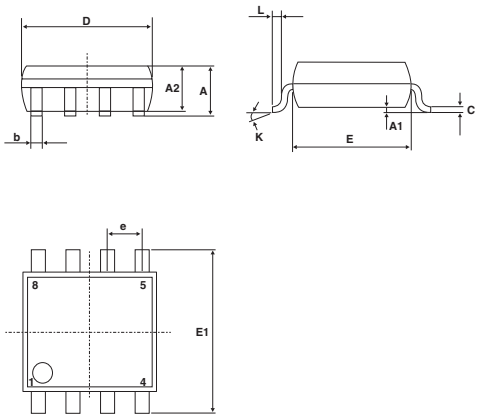
Figure 8 shows the classical protection topology for SLIC using both positive and negative battery voltages. With such a topology the SLIC is protected against surge over $+V_b$ and lower than $-V_{bat}$. In this case, $+V_b$ can be programmed up to +120 V while $-V_{bat}$ can be programmed down to -120 V.

3 Package information

- Epoxy meets UL94, V0
- Lead-free package

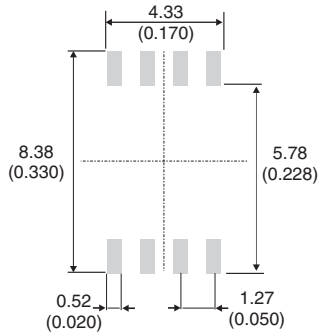
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

Table 8. SO-8 wide dimensions



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			2.50			0.099
A1	0.00		0.25	0.000		0.010
A2	1.51		2.00	0.059		0.079
b	0.35	0.40	0.51	0.013	0.016	0.020
c	0.10	0.20	0.35	0.003	0.008	0.014
D			6.05			0.239
E	5.02		6.22	0.197		0.245
E1	7.62		8.89	0.30		0.35
e		1.27			0.05	
K	0°		10	0°		10°
L	0.50		0.80	0.019		0.032

Figure 9. SO-8 wide footprint measurements in mm (inches)



4 Ordering information

Table 9. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
LCP12-150B1RL	LCP12	SO-8 wide	0.13g	1500	Tape and reel

5 Revision history

Table 10. Document revision history

Date	Revision	Changes
14-May-2010	1	Initial release.