



LCP02-150M

A.S.D.™

PROGRAMMABLE TRANSIENT VOLTAGE SUPPRESSOR FOR RINGING SLICs

FEATURES

- Protection IC recommended for ringing SLICs.
- Wide firing voltage range: from -110V to +95V.
- Low gate triggering current
- Peak pulse current: $I_{PP} = 100A$ (10/1000 μ s).
- Holding current: $I_H = 150mA$ min.
- High power dissipation capability
- UL497B approved (file E136224)

MAIN APPLICATIONS

- Dual battery supply voltage SLICs
 - negative battery supply configuration
 - negative & positive battery supply configuration
- Central Office (CO)
- Private Branch Exchange (PBX)
- Digital Loop Carrier (DLC)
- Asymmetrical Digital Subscriber Line (ADSL)
- Fiber in the Loop (FITL)
- Wireless Local Loop (WLL)
- Hybrid Fiber Coax (HFC)
- ISDN Terminal Adapter
- Cable modem

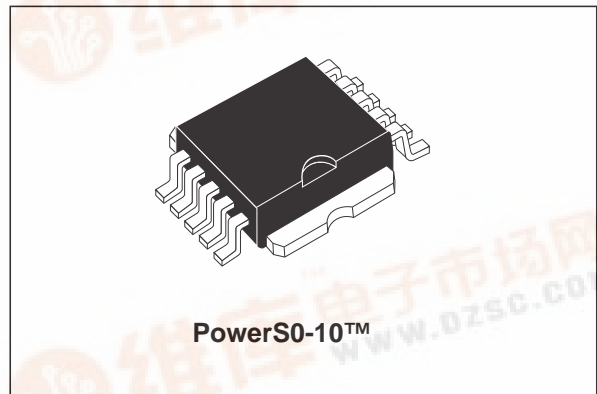
DESCRIPTION

The LCP02-150M has been developed to protect SLICs operating on both negative and positive supplies, as well as on high voltage SLICs. It provides crowbar mode protection for both TIP and RING lines. Surge suppression is assumed for each wire by two thyristor structures, one dedicated to positive surges, the second one to 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.

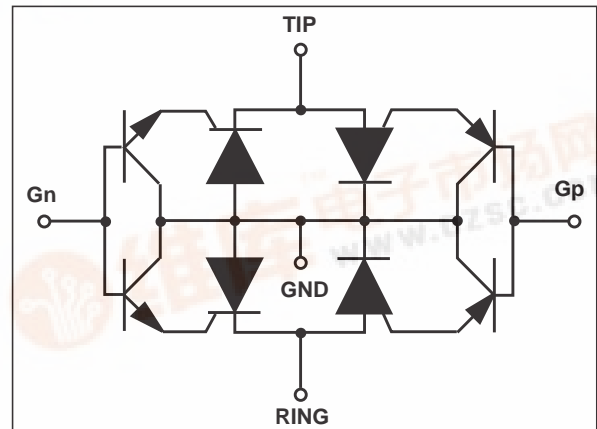
The LCP02-150M has high Bellcore Core, ITU-T and FCC Part 68 lightning surge ratings, ensuring rugged performance in the field.

The choice of the PowerSo-10™ package is driven by its high power dissipation capability.

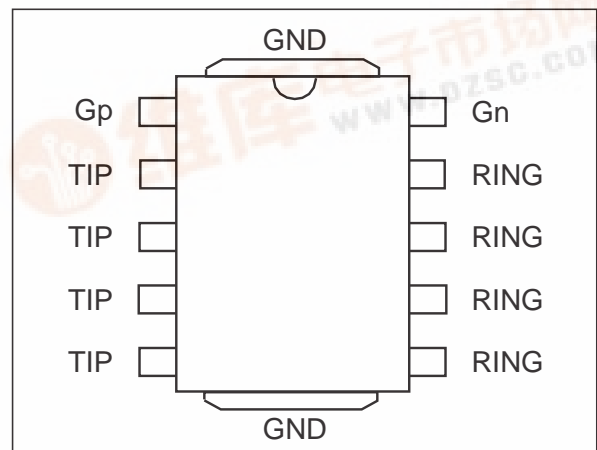
In addition, the LCP02-150M is also specified to assist a designer to comply with UL1950, IEC950 and CSA C22.2. It is UL 497B approved (file E136224), and has UL94-V0 resin approved



FUNCTIONAL DIAGRAM



PIN-OUT CONFIGURATION



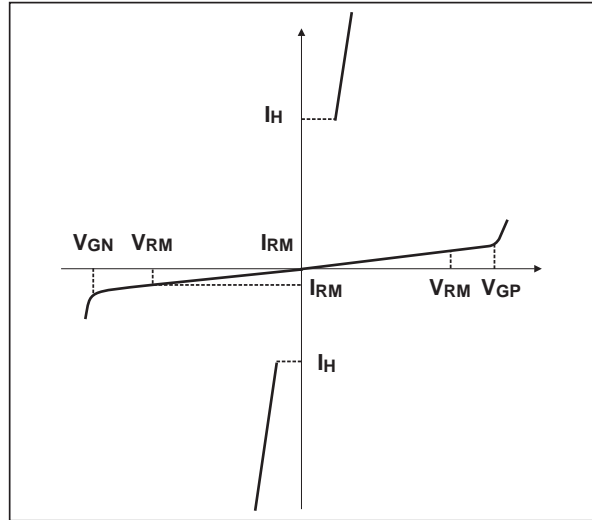
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LCP02-150M

ELECTRICAL CHARACTERISTICS (Tamb = 25°C)

| Symbol | Parameter |
|-------------------|---------------------------------------|
| I _{GP} | Positive gate triggering current |
| I _{GN} | Negative gate triggering current |
| I _H | Holding current |
| I _{RG} | Reverse leakage current GATE / LINE |
| I _{RM} | Reverse leakage current |
| V _{RM} | Reverse voltage LINE/ GND |
| V _{DGL} | Dynamic switching voltage GATE / LINE |
| V _{GATE} | GATE / GND voltage |
| V _{RG} | Reverse voltage GATE / LINE |
| C | Capacitance LINE / GND |



COMPLIES WITH FOLLOWING STANDARDS

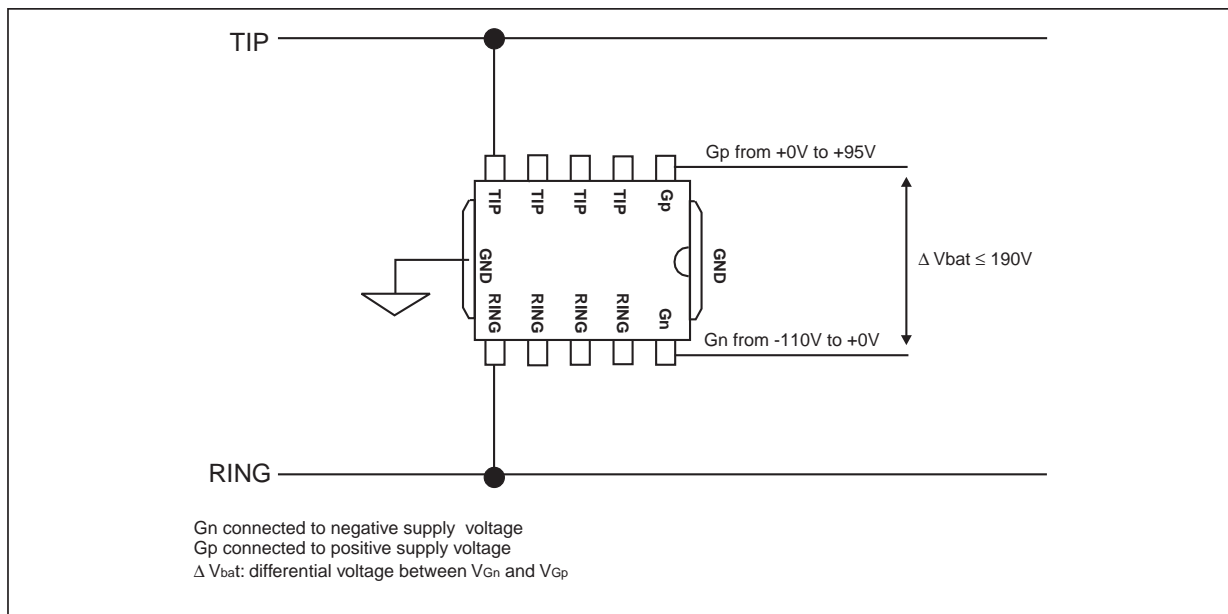
| | Peak surge voltage (V) | Voltage waveform (µs) | Required peak current (A) | Current waveform (µs) | Minimum serial resistor to meet standard (Ω) |
|------------------------------------|------------------------|-----------------------|---------------------------|-----------------------|--|
| ITU-T K20 | 6000 | 10/700 | 150 | 5/310 | - |
| | 1500 | 10/700 | 37.5 | 5/310 | - |
| ITU-T K21 | 6000 | 10/700 | 150 | 5/310 | - |
| | 1500 | 10/700 | 37.5 | 5/310 | - |
| VDE0433 | 2000 | 10/700 | 50 | 5/310 | - |
| VDE0878 | 2000 | 1.2/50 | 50 | 1/20 | - |
| IEC61000-4-5 | level 4 | 10/700 | 100 | 5/310 | - |
| | level 4 | 1.2/50 | 100 | 8/20 | - |
| FCC Part 68 lightning surge type A | 1500 | 10/160 | 200 | 10/160 | - |
| | 800 | 10/560 | 100 | 10/560 | - |
| FCC Part 68 lightning surge type B | 1000 | 9/720 | 25 | 5/320 | - |
| BELLCORE GR-1089-CORE First level | 2500 | 2/10 | 500 | 2/10 | - |
| | 1000 | 10/1000 | 100 | 10/1000 | - |
| BELLCORE GR-1089-CORE Second level | 5000 | 2/10 | 500 | 2/10 | - |

ABSOLUTE RATINGS ($T_{amb} = 25\text{ }^{\circ}\text{C}$)

| Symbol | Parameter | Value | Unit |
|--|--|---------------|------------------------------|
| I _{PP} | Peak pulse current | 10/1000μs | 100 |
| | | 8/20μs | 250 |
| | | 10/560μs | 120 |
| | | 5/310μs | 150 |
| | | 10/160μs | 200 |
| | | 1/20μs | 250 |
| | | 2/10μs | 500 |
| I _{TSM} | Non repetitive surge peak on-state current (sinusoidal) | t = 0.2 s | 13 |
| | | t = 1s | 10 |
| | | t = 15 min | 3.5 |
| V _{GN} max V _{GP} max Δ V _{bat} max | Maximum negative battery voltage range Maximum positive battery voltage range Total battery supply voltage | See fig.1 | -110 to 0 0 to +95 190 |
| T _{op} | Operating temperature range (see note 1) | -20 to +85 | °C |
| T _{stg} | Storage temperature range | - 55 to + 150 | °C |
| T _L | Maximum lead temperature for soldering during 10s | 260 | °C |

Note 1: Within the Top range, the LCP02-150M keeps on operating. The impacts of the ambient temperature are given by derating curves.

Fig. 1: Test circuit



THERMAL RESISTANCE

| Symbol | Parameter | Value | Unit |
|----------------------|---------------------|-------|------|
| R _{th(j-a)} | Junction to ambient | 60 | °C/W |

LCP02-150M

ELECTRICAL CHARACTERISTICS ($T_{amb} = 25^{\circ}\text{C}$)

1 - PARAMETERS RELATED TO THE NEGATIVE SUPPRESSOR

| Symbol | Test conditions | Min. | Max. | Unit |
|------------|--|------|---------------|---------------|
| I_{Gn} | $V_{Gn/GND} = -60\text{V}$ Measured at 50Hz | | 5 | mA |
| I_{H-} | Go-No Go test, $V_{Gn} = -60\text{V}$ | 150 | | mA |
| I_{RGL-} | $T_j = 25^{\circ}\text{C}$, $V_{Gn/line} = -190\text{V}$ | | 5 | μA |
| V_{DGL-} | $V_{Gn/GND} = -60\text{V}$ 10/1000 μs 1kV $R_P = 25\Omega$ $I_{PP} = 30\text{A}$ 10/700 μs 2kV $R_P = 25\Omega$ $I_{PP} = 30\text{A}$ 1.2/50 μs 2kV $R_P = 25\Omega$ $I_{PP} = 30\text{A}$ | | 10 6 12 | V |

2 - PARAMETERS RELATED TO THE POSITIVE SUPPRESSOR

| Symbol | Test conditions | Min. | Max. | Unit |
|------------|--|------|---------------|---------------|
| I_{Gp} | $V_{Gp/GND} = 60\text{V}$ Measured at 50Hz | | 10 | mA |
| I_{RGL+} | $T_j = 25^{\circ}\text{C}$, $V_{Gp/line} = +190\text{V}$ | | 5 | μA |
| V_{DGL+} | $V_{Gp/GND} = +60\text{V}$ 10/1000 μs 1kV $R_P = 25\Omega$ $I_{PP} = 30\text{A}$ 10/700 μs 2kV $R_P = 25\Omega$ $I_{PP} = 30\text{A}$ 1.2/50 μs 2kV $R_P = 25\Omega$ $I_{PP} = 30\text{A}$ | | 12 8 18 | V |

3 - PARAMETERS RELATED TO LINE/GND

| Symbol | Test conditions | Typ. | Max. | Unit |
|-----------|---|------|--------|---------------|
| I_R | $T_j = 25^{\circ}\text{C}$, $V_{LINE} = +90\text{V}$, $V_{GP/LINE} = +1\text{V}$ $T_j = 25^{\circ}\text{C}$, $V_{LINE} = -105\text{V}$, $V_{GN/LINE} = -1\text{V}$ | | 5 5 | μA |
| C_{off} | $V_R = -3\text{V}$, $F = 1\text{MHz}$, $V_{Gp} = 60\text{V}$, $V_{Gn} = -60\text{V}$ | 150 | | pF |

Fig. 2: Non repetitive surge peak on state current versus overload duration (T_j initial = 25°C).

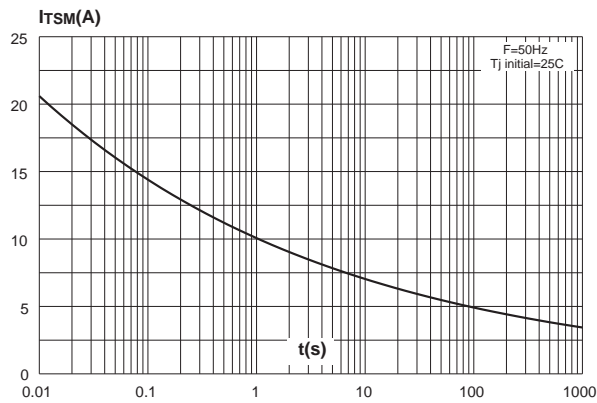


Fig. 3: Relative variation of holding current versus junction temperature.

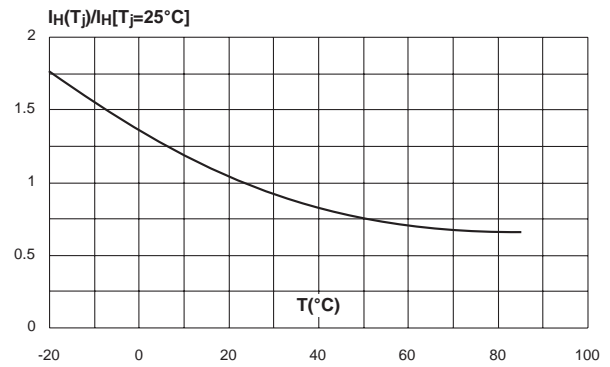
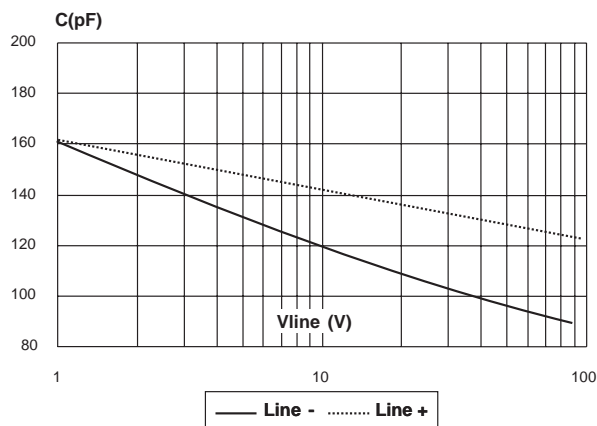


Fig. 4: Variation of junction capacitance versus reverse voltage applied (typical values) with: $V_{GN} = -90V$ and $V_{GP} = +90V$.



LCP02-150M

TECHNICAL INFORMATION

Fig. 5: LCP02 concept behavior.

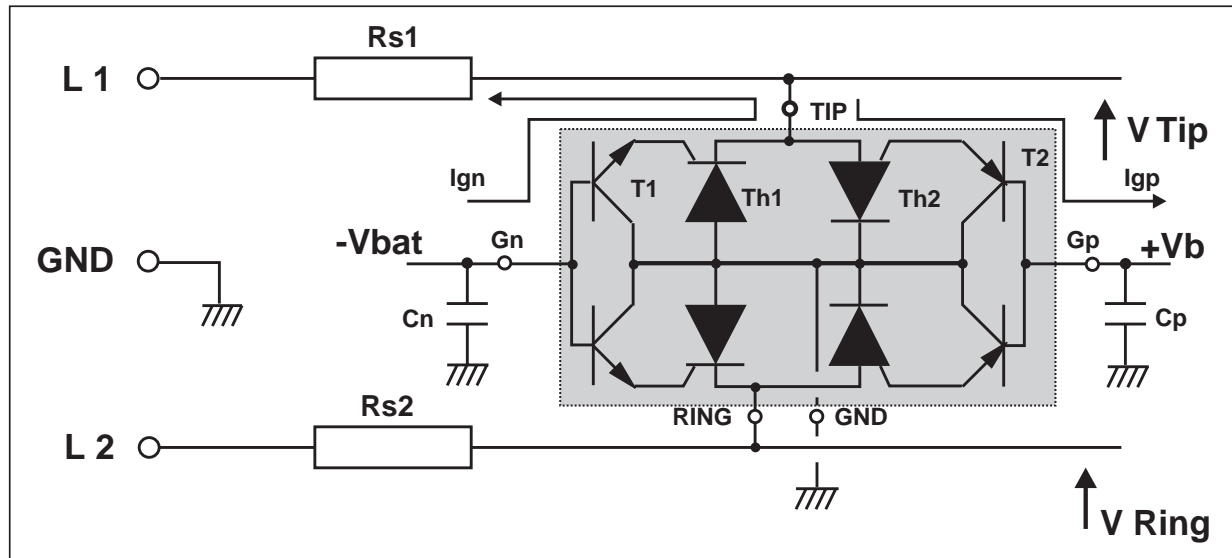


Figure 5 shows the classical protection circuit using the LCP02-150M crowbar concept. This topology has been developed to protect the new two-battery voltage SLICs. It allows both positive and negative firing thresholds to be programmed. The LCP02-150M has two gates (Gn and Gp). Gn is biased to negative battery voltage -Vbat, while Gp is biased to the positive battery voltage +Vb.

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. The entire surge current flows through the ground. After the surge, when the current flowing through Th1 becomes less negative than the negative holding current, Th1 switches off. This holding current I_{H-} is temperature dependant as per figure 2.

When a positive surge occurs on one wire (L1 for example), a current I_{gp} flows through the base of the transistor T2 and then injects a current in the gate of the thyristor Th2 which fires. The entire surge current flows through the ground. After the surge, when the current flowing through Th2 becomes less positive than the positive holding current I_{H+} , Th2 switches off. This holding current I_{H+} is temperature dependant and is equal to 30mA at 25°C.

The capacitors Cn and Cp are used to speed up the crowbar structure firing during the fast surge rise or falling 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 LCP02-150M gate pins (Gn and Gp) and to the reference ground track (or plan). The optimized value for Cn and Cp is 220nF.

The series resistors Rs1 and Rs2 represent the fuse, 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 LCP02-150M is equal to :

$$I_{surge} = V_{surge} / (R_g + R_s)$$

With V_{surge} = peak surge voltage imposed by the standard.

R_g = series resistor of the surge generator

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

The LCP02-150M topology is particularly optimized for the new telecom applications such as cable modem, fiber in the loop, WLL systems, and decentralized central office for example. The schematics of figures 6 and 7 give the 2 most frequent topologies used for these emergent applications.

Fig. 6: Protection of SLIC with positive and negative battery voltages.

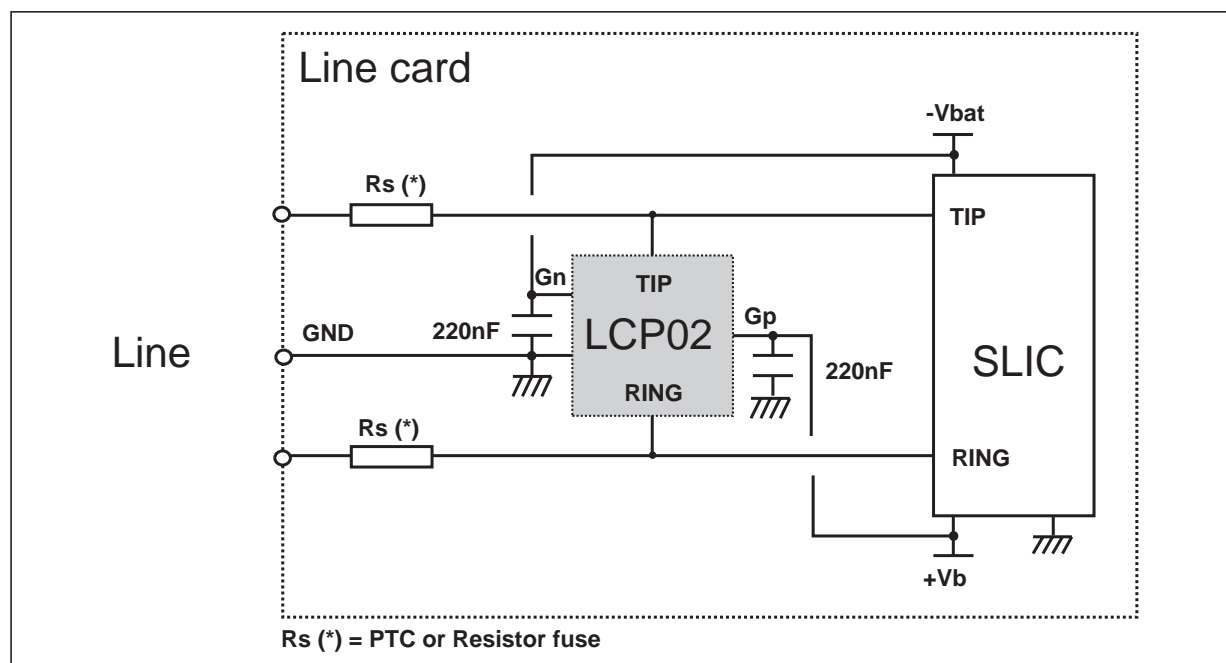


Fig. 7: Protection of high voltage SLIC

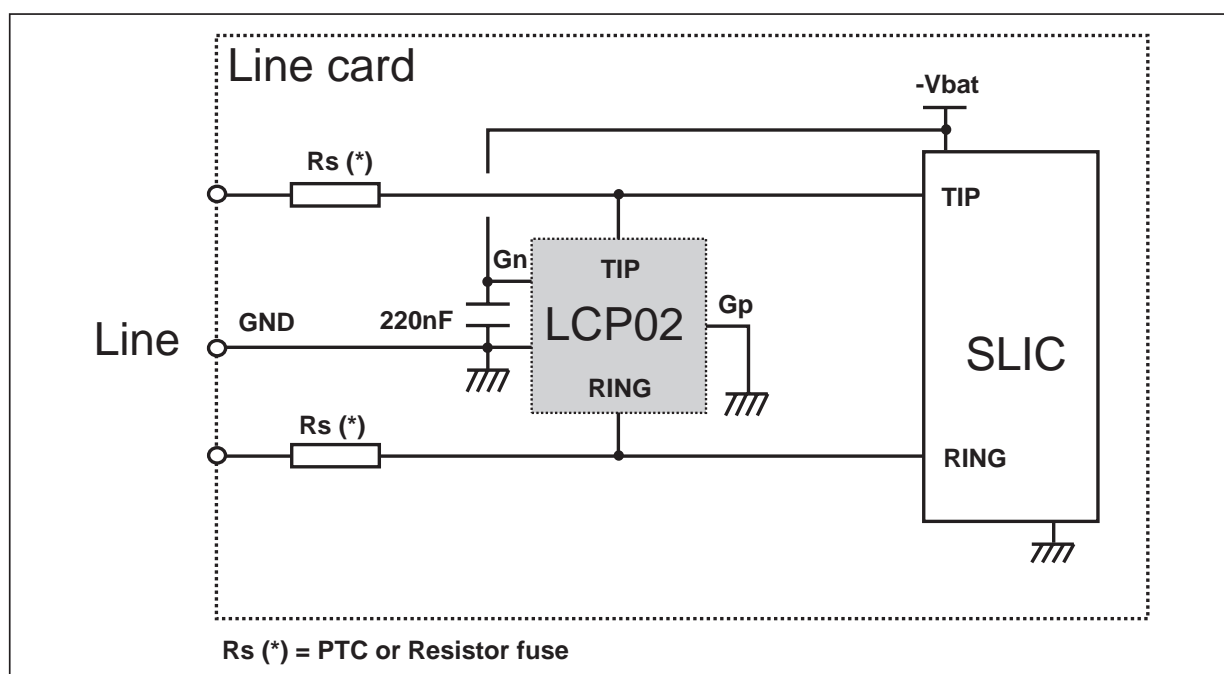


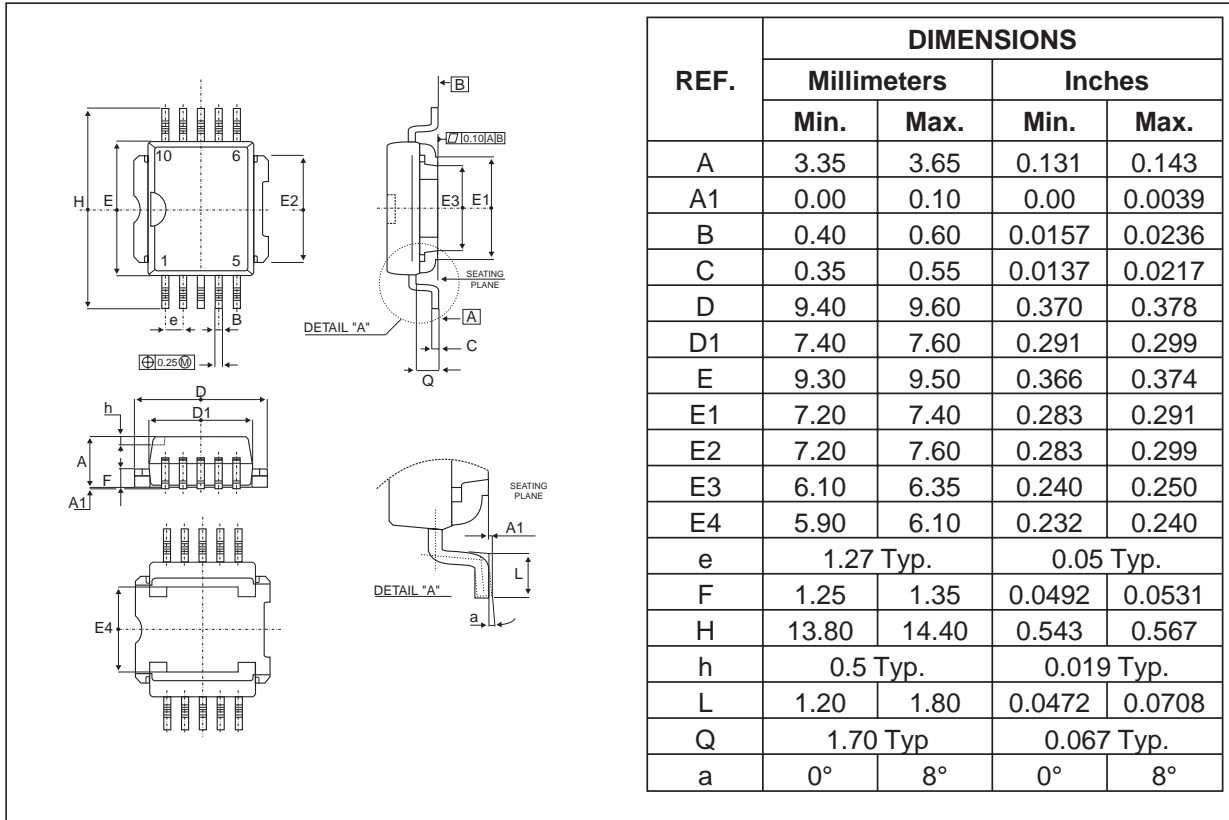
Figure 6 shows the classical protection topology for SLIC using both positive and negative battery voltages. With such a protection the SLIC is protected against surge over $+V_b$ and lower than $-V_{bat}$. In this case, $+V_b$ can be programmed up to $+95V$ while $-V_{bat}$ can be programmed down to $-110V$. Please note that the differential voltage does not exceed $\Delta V_{bat\ max}$ at $190V$.

Figure 7 gives the protection topology for the new SLIC using high negative voltage down to $-110V$.

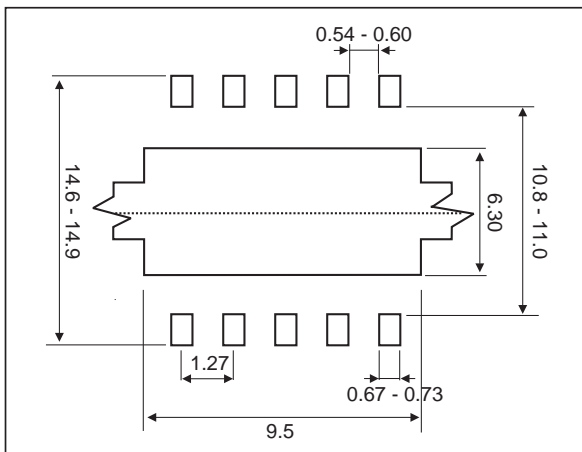
LCP02-150M

PACKAGE MECHANICAL DATA

PowerSO-10™ (Plastic)



FOOTPRINT DIMENSIONS (in millimeters)



ORDER CODE

| Ordering Type | Marking | Package | Weight | Base qty | Delivery mode |
|----------------------|----------------|----------------|---------------|-----------------|----------------------|
| LCP02-150M | LCP02-150M | PowerSO-10 | 1.02 g | 50 | Tube |
| LCP02-150M-TR | | | | 600 | Tape & Reel |

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