



# LCP1511D

Application Specific Discretes  
A.S.D.<sup>TM</sup>

## PROGRAMMABLE TRANSIENT VOLTAGE SUPPRESSOR FOR SLIC PROTECTION

### FEATURES

- DUAL PROGRAMMABLE TRANSIENT SUPPRESSOR.
- WIDE NEGATIVE FIRING VOLTAGE RANGE :  
 $V_{MGL} = -80V$  max.
- LOW DYNAMIC SWITCHING VOLTAGES :  
 $V_{FP}$  and  $V_{DGL}$ .
- LOW GATE TRIGGERING CURRENT :  
 $I_{GT} = 5mA$  max.
- PEAK PULSE CURRENT :  
 $I_{PP} = 30A$  for 10/100 $\mu s$  surge.
- HOLDING CURRENT :  
 $I_H = 150mA$ .

### DESCRIPTION

This device has been especially designed to protect subscriber line card interfaces (SLIC) against transient overvoltages.

Positive overloads are clipped with 2 diodes. Negative surges are suppressed by 2 thyristors, their breakdown voltage being referenced to  $-V_{BAT}$  through the gate.

This component presents a very low gate triggering current ( $I_{GT}$ ) in order to reduce the current consumption on printed circuit board during the firing phase.

A particular attention has been given to the internal wire bonding. The "4-point" configuration ensures reliable protection, eliminating the overvoltage introduced by the parasitic inductances of the wiring ( $Ldi/dt$ ), especially for very fast transients.

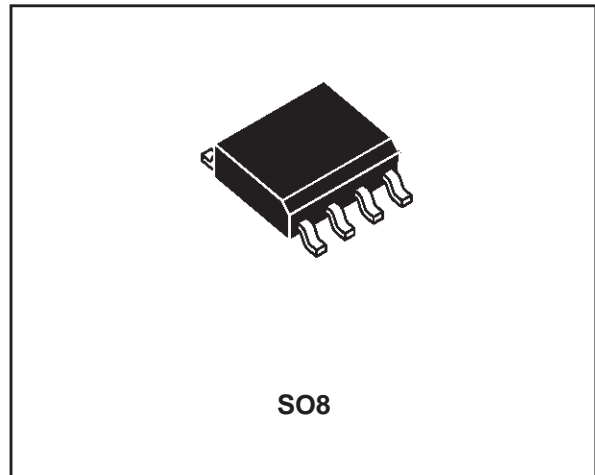
### COMPLIES WITH THE FOLLOWING STANDARDS :

|                      |                 |          |
|----------------------|-----------------|----------|
| <b>CCITT K20 :</b>   | 10/700 $\mu s$  | 1kV      |
|                      | 5/310 $\mu s$   | 25A      |
| <b>VDE 0433 :</b>    | 10/700 $\mu s$  | 2kV      |
|                      | 5/310 $\mu s$   | 38A (*)  |
| <b>VDE 0878 :</b>    | 1.2/50 $\mu s$  | 1.5kV    |
|                      | 1/20 $\mu s$    | 40A      |
| <b>I3124 :</b>       | 0.5/700 $\mu s$ | 1kV      |
|                      | 0.2/310 $\mu s$ | 25A      |
| <b>FCC part 68 :</b> | 2/10 $\mu s$    | 2.5kV    |
|                      | 2/10 $\mu s$    | 170A (*) |

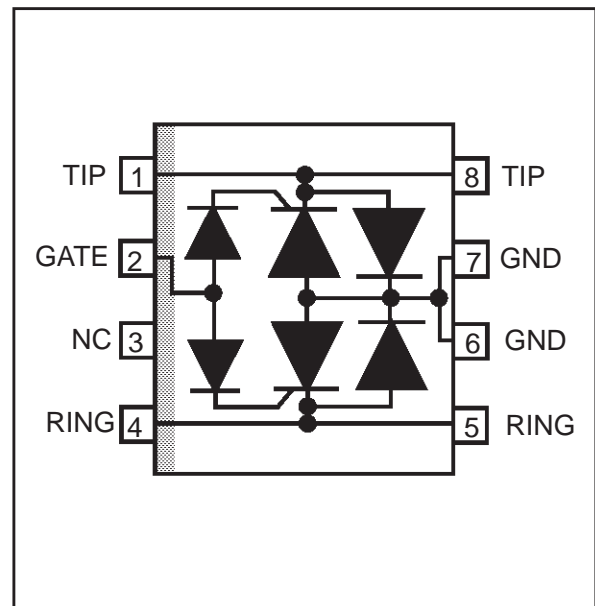
### BELLCORE

|                        |              |          |
|------------------------|--------------|----------|
| <b>TR-NWT-001089 :</b> | 2/10 $\mu s$ | 2.5kV    |
|                        | 2/10 $\mu s$ | 170A (*) |

(\*) with series resistors or PTC.



### SCHEMATIC DIAGRAM



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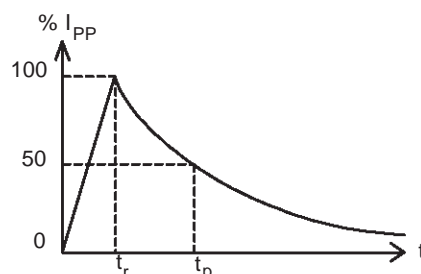
## LCP1511D

### ABSOLUTE MAXIMUM RATINGS (T<sub>amb</sub> = 25 °C)

| Symbol                               | Parameter  | Value                           | Unit                 |    |
|--------------------------------------|--|---------------------------------|----------------------|----|
| I <sub>PP</sub>                      | Peak pulse current<br>(see note 1)                           | 10/1000μs<br>5/310μs<br>2/10μs  | 30<br>38<br>170      | A  |
| I <sub>TSM</sub>                     | Non repetitive surge peak on-state current<br>(F = 50Hz)     | t <sub>p</sub> = 10ms<br>t = 1s | 8<br>3.5             | A  |
| I <sub>GSM</sub>                     | Maximum gate current (half sine wave t <sub>p</sub> = 10ms)  |                                 | 2                    | A  |
| V <sub>MLG</sub><br>V <sub>MGL</sub> | Maximum voltage LINE / GROUND<br>Maximum voltage GATE / LINE |                                 | -100<br>-80          | V  |
| T <sub>stg</sub><br>T <sub>j</sub>   | Storage temperature range<br>Maximum junction temperature    |                                 | - 55 to + 150<br>150 | °C |
| T <sub>L</sub>                       | Maximum lead temperature for soldering during 10s            |                                 | 260                  | °C |

Note 1 : Pulse waveform :

|           |                      |                        |
|-----------|----------------------|------------------------|
| 10/1000μs | t <sub>r</sub> =10μs | t <sub>p</sub> =1000μs |
| 5/310μs   | t <sub>r</sub> =5μs  | t <sub>p</sub> =310μs  |
| 2/10μs    | t <sub>r</sub> =2μs  | t <sub>p</sub> =10μs   |

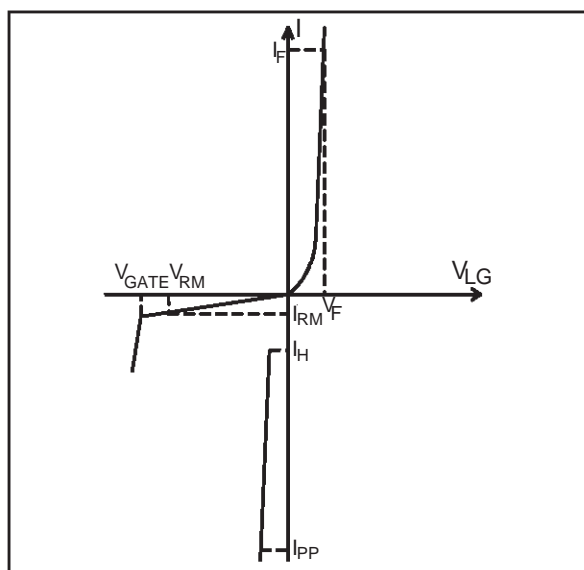


### THERMAL RESISTANCE

| Symbol               | Parameter           | Value | Unit |
|----------------------|---------------------|-------|------|
| R <sub>th(j-a)</sub> | Junction to ambient | 170   | °C/W |

### ELECTRICAL CHARACTERISTICS (T<sub>amb</sub> = 25 °C)

| Symbol            | Parameter                           |
|-------------------|-------------------------------------|
| I <sub>GT</sub>   | Gate triggering current             |
| I <sub>H</sub>    | Holding current                     |
| I <sub>RM</sub>   | Reverse leakage current LINE/GND    |
| I <sub>RG</sub>   | Reverse leakage current GATE/LINE   |
| V <sub>RM</sub>   | Reverse voltage LINE/GND            |
| V <sub>F</sub>    | Forward drop voltage LINE/GND       |
| V <sub>GT</sub>   | Gate triggering voltage             |
| V <sub>FP</sub>   | Peak forward voltage LINE/GND       |
| V <sub>DGL</sub>  | Dynamic switching voltage GATE/LINE |
| V <sub>GATE</sub> | GATE/GND voltage                    |
| V <sub>LG</sub>   | LINE/GND voltage                    |
| C                 | Off-state capacitance LINE/GND      |



**1 - PARAMETERS RELATED TO THE DIODE LINE/GND** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

| Symbol   | Test conditions  | Maximum      | Unit |
|----------|--|--------------|------|
| $V_F$    | $I_F=5\text{A}$ $t_p=500\mu\text{s}$   | 3            | V    |
| $V_{FP}$ | $10/700\mu\text{s}$ $1.5\text{kV}$ $R_p=10\Omega$<br>$1.2/50\mu\text{s}$ $1.5\text{kV}$ $R_p=10\Omega$ (see note 1)<br>$2/10\mu\text{s}$ $2.5\text{kV}$ $R_p=62\Omega$ | 5<br>7<br>12 | V    |

**Note 1 :** See test circuit 2 for  $V_{FP}$ ;  $R_p$  is the protection resistor located on the line card.

**2 - PARAMETERS RELATED TO THE PROTECTION THYRISTOR** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

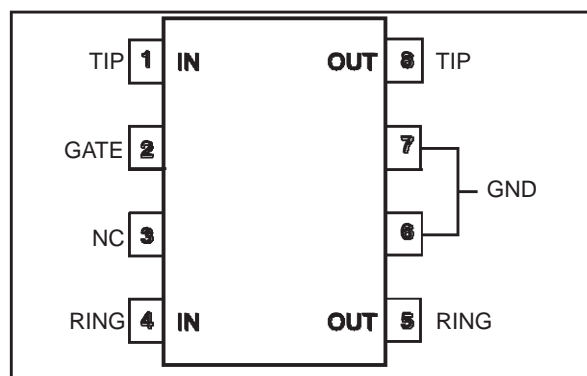
| Symbol    | Test conditions  | Min. | Max.           | Unit          |
|-----------|--|------|----------------|---------------|
| $I_{GT}$  | $V_{GND/LINE} = -48\text{V}$   | 0.2  | 5              | mA            |
| $I_H$     | $V_{GATE} = -48\text{V}$ (see note 2)  | 150  |                | mA            |
| $V_{GT}$  | at $I_{GT}$  |      | 2.5            | V             |
| $I_{RG}$  | $T_c=25\text{ }^{\circ}\text{C}$ $V_{RG} = -75\text{V}$<br>$T_c=70\text{ }^{\circ}\text{C}$ $V_{RG} = -75\text{V}$   |      | 5<br>50        | $\mu\text{A}$ |
| $V_{DGL}$ | $V_{GATE} = -48\text{V}$ (see note 3)<br>$10/700\mu\text{s}$ $1.5\text{kV}$ $R_p=10\Omega$ $I_{PP}=30\text{A}$<br>$1.2/50\mu\text{s}$ $1.5\text{kV}$ $R_p=10\Omega$ $I_{PP}=30\text{A}$<br>$2/10\mu\text{s}$ $2.5\text{kV}$ $R_p=62\Omega$ $I_{PP}=38\text{A}$ |      | 10<br>20<br>25 | V             |

**Note 2 :** See the functional holding current ( $I_H$ ) test circuit 2.

**Note 3 :** See test circuit 1 for  $V_{DGL}$ .  
The oscillations with a time duration lower than 50ns are not taken into account.

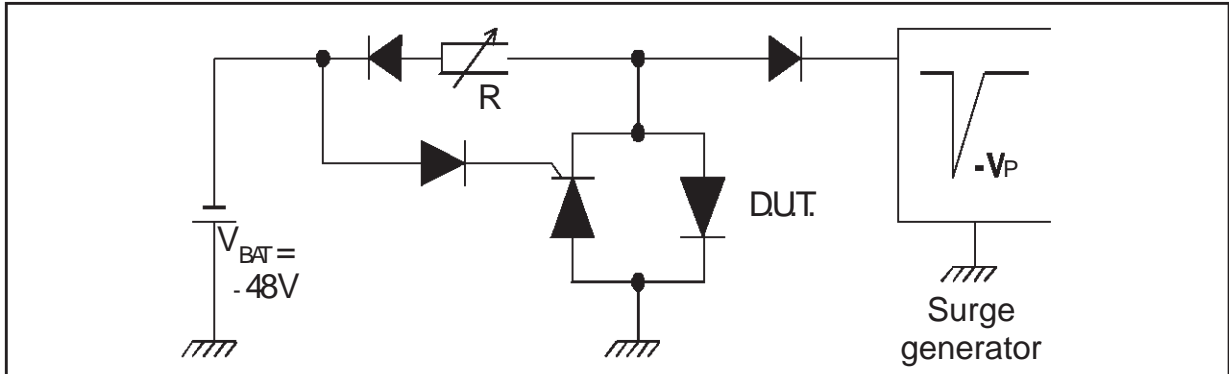
**3 - PARAMETERS RELATED TO DIODE AND PROTECTION THYRISTOR** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

| Symbol   | Test conditions  | Maximum   | Unit          |
|----------|--|-----------|---------------|
| $I_{RM}$ | $T_c=25\text{ }^{\circ}\text{C}$ $V_{GATE/LINE} = -1\text{V}$ $V_{RM} = -75\text{V}$<br>$T_c=70\text{ }^{\circ}\text{C}$ $V_{GATE/LINE} = -1\text{V}$ $V_{RM} = -75\text{V}$ | 5<br>50   | $\mu\text{A}$ |
| C        | $V_R = -3\text{V}$ $F=1\text{MHz}$<br>$V_R = -48\text{V}$ $F=1\text{MHz}$  | 100<br>50 | pF            |

**APPLICATION NOTE**

In order to take advantage of the "4 point" structure of the LCP, the TIP and RING lines go across the device. In such case, the device will eliminate the overvoltages generated by the parasitic inductances of the wiring ( $Ldi/dt$ ), especially for very fast transients.

**FUNCTIONAL HOLDING CURRENT ( $I_H$ ) TEST CIRCUIT 1 : GO-NO GO TEST**

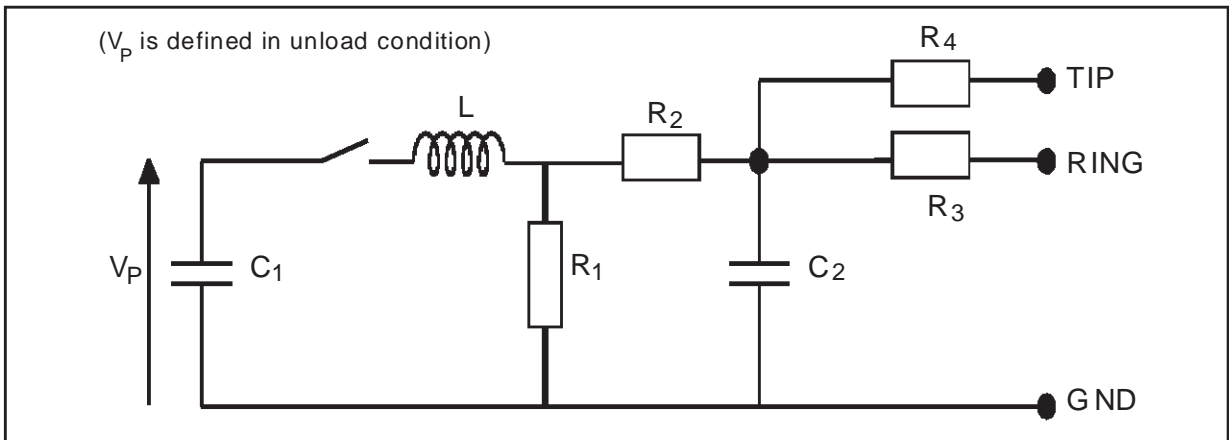


This is a GO-NO GO test which allows to confirm the holding current ( $I_H$ ) level in a functional test circuit.

**TEST PROCEDURE :**

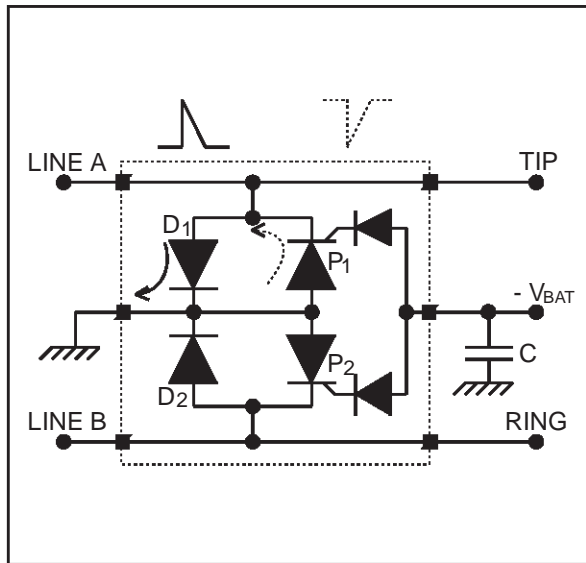
- Adjust the current level at the  $I_H$  value by short circuiting the D.U.T.
- Fire the D.U.T. with a surge current :  $I_{PP} = 10A, 10/1000\mu s$ .
- The D.U.T. will come back to the off-state within a duration of 50ms max.

**TEST CIRCUIT 2 FOR  $V_{FP}$  AND  $V_{DGL}$  PARAMETERS**



| Pulse ( $\mu s$ ) |       | $V_p$<br>(V) | $C_1$<br>( $\mu F$ ) | $C_2$<br>(nF) | L<br>( $\mu H$ ) | $R_1$<br>( $\Omega$ ) | $R_2$<br>( $\Omega$ ) | $R_3$<br>( $\Omega$ ) | $R_4$<br>( $\Omega$ ) | $I_{PP}$<br>(A) | $R_p$<br>( $\Omega$ ) |
|-------------------|-------|--------------|----------------------|---------------|------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|-----------------------|
| $t_r$             | $t_p$ |              |                      |               |                  |                       |                       |                       |                       |                 |                       |
| 10                | 700   | 1500         | 20                   | 200           | 0                | 50                    | 15                    | 25                    | 25                    | 30              | 10                    |
| 1.2               | 50    | 1500         | 1                    | 33            | 0                | 76                    | 13                    | 25                    | 25                    | 30              | 10                    |
| 2                 | 10    | 2500         | 10                   | 0             | 1.1              | 1.3                   | 0                     | 3                     | 3                     | 38              | 62                    |

**FUNCTIONAL DESCRIPTION**



**LINE A PROTECTION :**

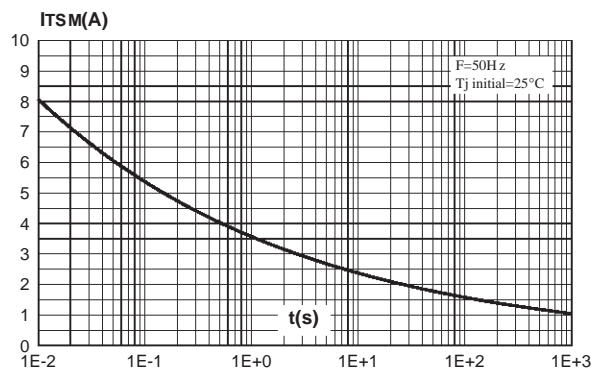
- For positive surges versus GND, the diode D1 will conduct.
- For negative surges versus GND, the protection device P1 will trigger at a voltage fixed by the -VBAT reference.

**LINE B PROTECTION :**

- For surges on line B, the operating mode is the same, D2 or P2 is activated.

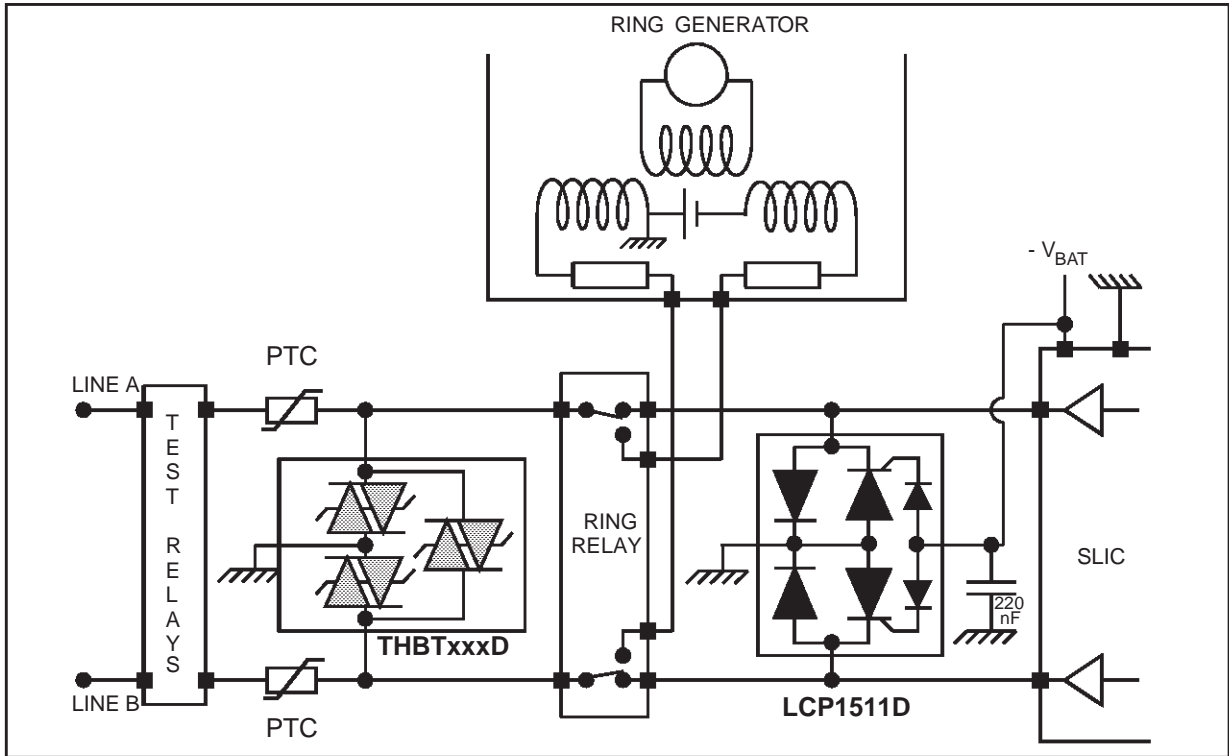
It is recommended to add a capacitor (C=220nF) close to the gate of the LCP, in order to speed up the triggering.

Surge peak current versus overload duration.

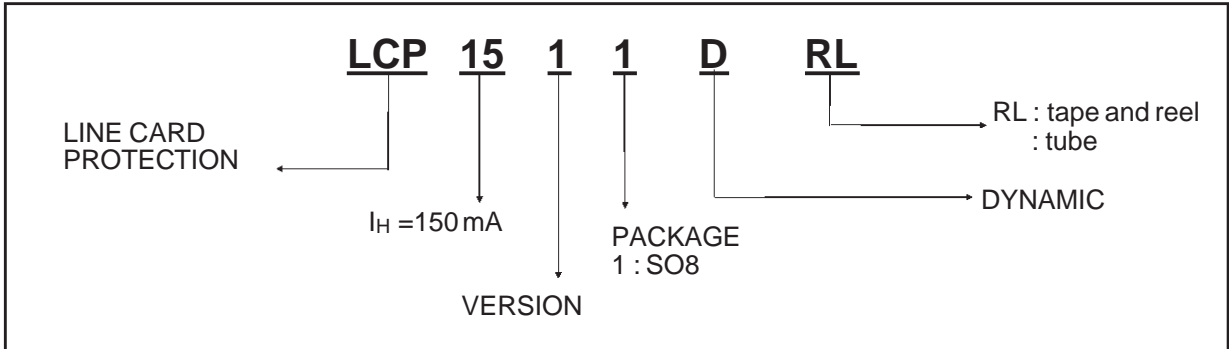


# LCP1511D

## APPLICATION CIRCUIT : typical SLIC protection concept

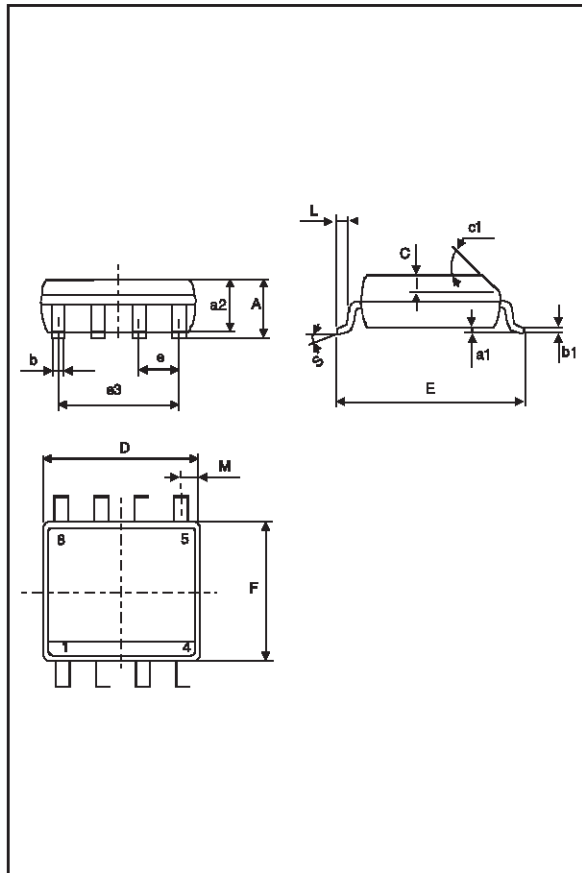


## ORDER CODE



## MARKING

| Package | Type     | Marking |
|---------|----------|---------|
| SO8     | LCP1511D | CP151D  |

**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)    |      |      |        |       |       |

**Weight** = 0.08 g.

**Packaging:** Product supplied in antistatic tubes or tape and reel.

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