



# THBT15011, THBT20011, THBT27011

## Tripolar overvoltage protection for telecom line

### Features

- Bidirectional crowbar protection between tip and gnd, ring and gnd and between tip and ring
- Peak pulse current:  
 $I_{PP} = 30 \text{ A}$  for 10/1000  $\mu\text{s}$  surge
- Holding current:  $I_H = 150 \text{ mA}$

### Complies with Telcordia standards

- Telcordia GR-1089-Core, (second level) with line series resistors
  - 10/1000  $\mu\text{s}$ , 1000 V
  - 2/10  $\mu\text{s}$ , 2500 V (first level)
  - 2/10  $\mu\text{s}$ , 5000 V

### Description

Dedicated to telecommunication equipment protection, these devices provide a triple bidirectional protection function.

They ensure the same protection capability with the same breakdown voltage both in longitudinal mode and transversal mode.

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

Dynamic characteristics have been defined for several types of surges, in order to meet the SLIC maximum ratings.

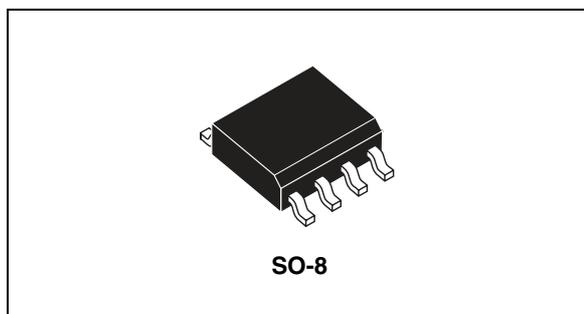
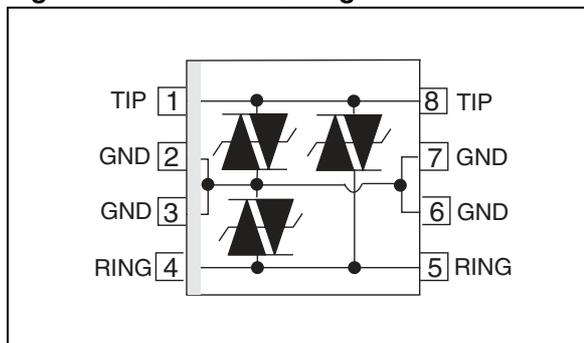


Figure 1. Schematic diagram



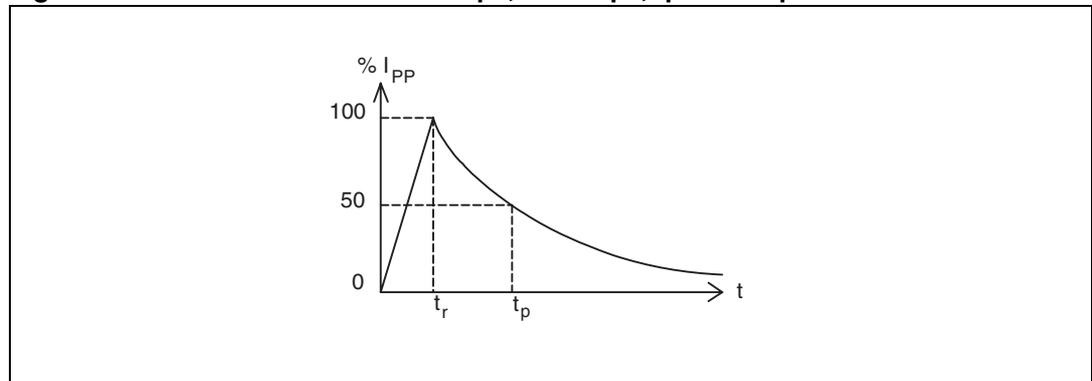
# 1 Characteristics

**Table 1. Absolute maximum ratings ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )**

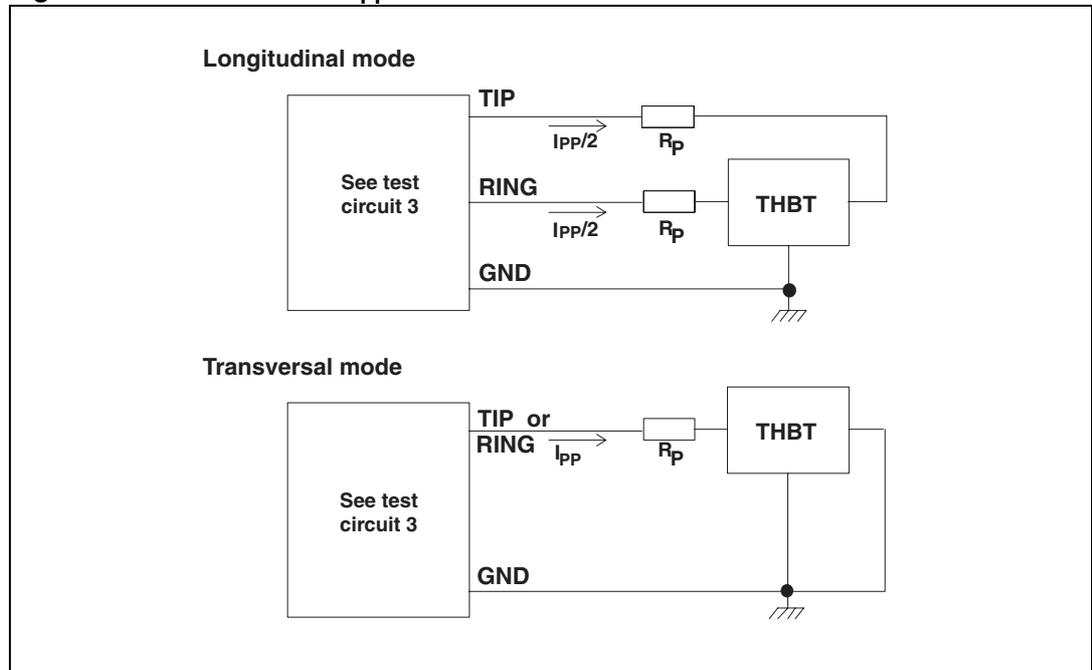
Symbol	Parameter	Value	Unit
$I_{PP}$	Peak pulse current <sup>(1)</sup>	10 / 1000 $\mu\text{s}$	A
$I_{TSM}$	Non repetitive surge peak on-state current ( $F = 50\text{ Hz}$ )	$t_p = 10\text{ ms}$ $t = 1\text{ s}$	A
$T_{stg}$	Storage temperature range	- 40 to + 150	$^{\circ}\text{C}$
$T_j$	Maximum junction temperature	150	$^{\circ}\text{C}$
$T_L$	Maximum lead temperature for soldering during 10s	260	$^{\circ}\text{C}$

1. For pulse waveform see [Figure 2](#)

**Figure 2. Pulse waveform 10/1000  $\mu\text{s}$ ,  $t_r = 10\text{ }\mu\text{s}$ ,  $t_p = 1000\text{ }\mu\text{s}$**



**Figure 3. Test circuit for  $I_{pp}$**



**Table 2. Thermal resistance**

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

**Table 3. Electrical characteristics ( $T_{amb} = 25^{\circ}C$ )**

Symbol	Parameter
$V_{RM}$	Stand-off voltage
$I_{RM}$	Leakage current at stand-off voltage
$V_R$	Continuous reverse voltage
$V_{BR}$	Breakdown voltage
$V_{BO}$	Breakover voltage
$I_H$	Holding current
$I_{BO}$	Breakover current
$V_F$	Forward voltage drop
$I_{PP}$	Peak pulse current
C	Capacitance

**Table 4. Static parameters**

Type	$I_{RM} @ V_{RM}$		$I_R @ V_R$		$V_{BO} @ I_{BO}$			$I_H$	C
	max.		max.		max.	min.		min.	max.
	$\mu A$	V	$\mu A$	V	V	V	mA	mA	pF
THBT15011D	5	135	50	150	210	50	400	150	80
THBT20011D	5	180	50	200	290	50	400	150	80
THBT27011D	5	240	50	270	380	50	400	150	80

1.  $I_R$  measured at  $V_R$  guarantee  $V_{BR} min \geq V_R$
2. Measured at 50 Hz (1 cycle) - See test circuit 1 (Figure 4).
3. See the reference test circuit 2 (Figure 5).
4.  $V_R = 1 V$  bias,  $V_{RMS} = 1 V$ ,  $F = 1 MHz$ .

**Table 5. Dynamic breakover voltages (transversal mode)**

Type	Symbol	Test conditions <sup>(1)</sup>				Max	Unit
THBT15011D	$V_{BO}$	10/700 $\mu$ s	1.5kV	$R_p=10\Omega$	$I_{pp}=30A$	190	V
		1.2/50 $\mu$ s	1.5kV	$R_p=10\Omega$	$I_{pp}=30A$	190	
		2/10 $\mu$ s	2.5kV	$R_p=62\Omega$	$I_{pp}=38A$	200	
THBT20011D	$V_{BO}$	10/700 $\mu$ s	1.5kV	$R_p=10\Omega$	$I_{pp}=30A$	270	V
		1.2/50 $\mu$ s	1.5kV	$R_p=10\Omega$	$I_{pp}=30A$	270	
		2/10 $\mu$ s	2.5kV	$R_p=62\Omega$	$I_{pp}=38A$	280	
THBT27011D	$V_{BO}$	10/700 $\mu$ s	1.5kV	$R_p=10\Omega$	$I_{pp}=30A$	360	V
		1.2/50 $\mu$ s	1.5kV	$R_p=10\Omega$	$I_{pp}=30A$	360	
		2/10 $\mu$ s	2.5kV	$R_p=62\Omega$	$I_{pp}=38A$	400	

1. See test circuit 3 for  $V_{BO}$  dynamic parameters;  $R_p$  is the protection resistor located on the line card.

**Figure 4. Test circuit 1 for  $I_{BO}$  and  $V_{BO}$  parameters**

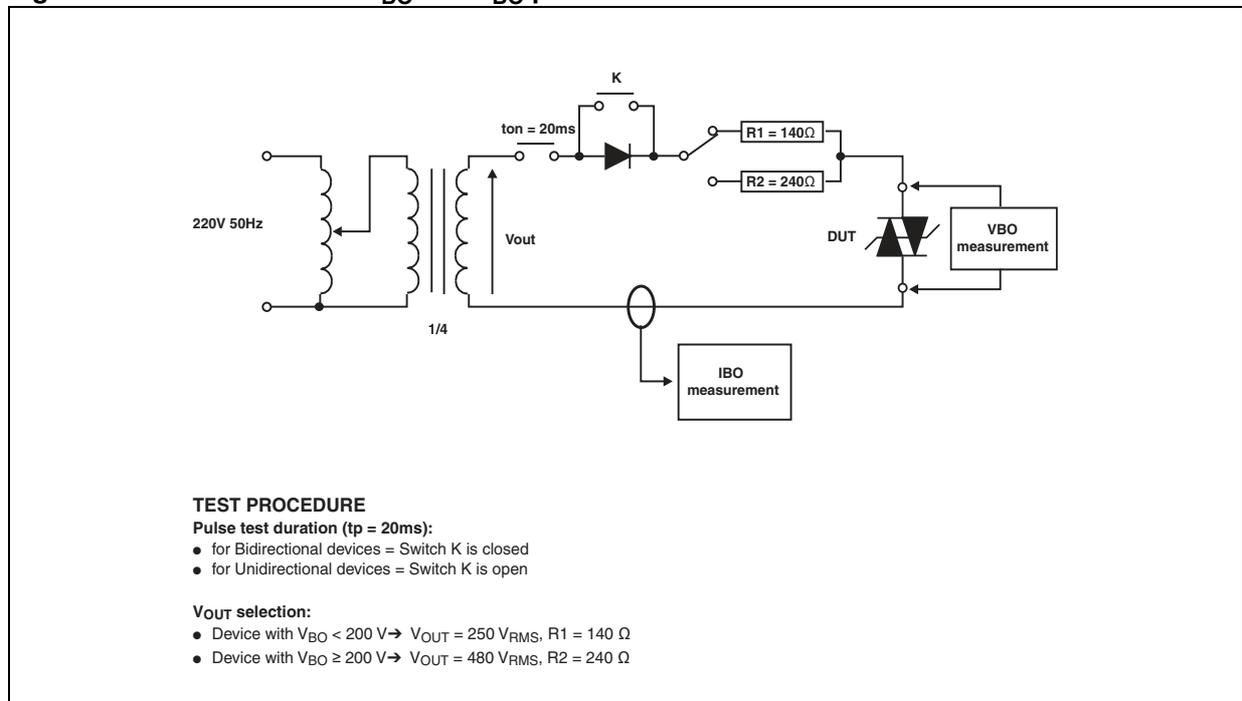


Figure 5. Test circuit 2 for  $I_H$  parameter

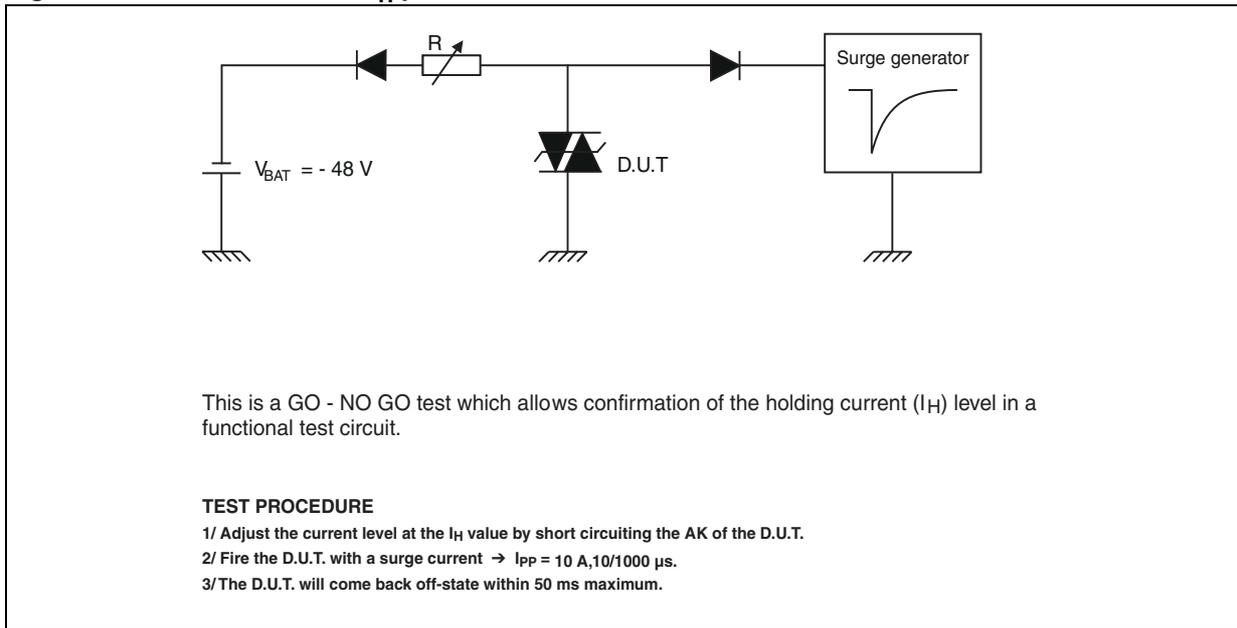


Figure 6. Test circuit 3 for  $V_{BO}$  parameters

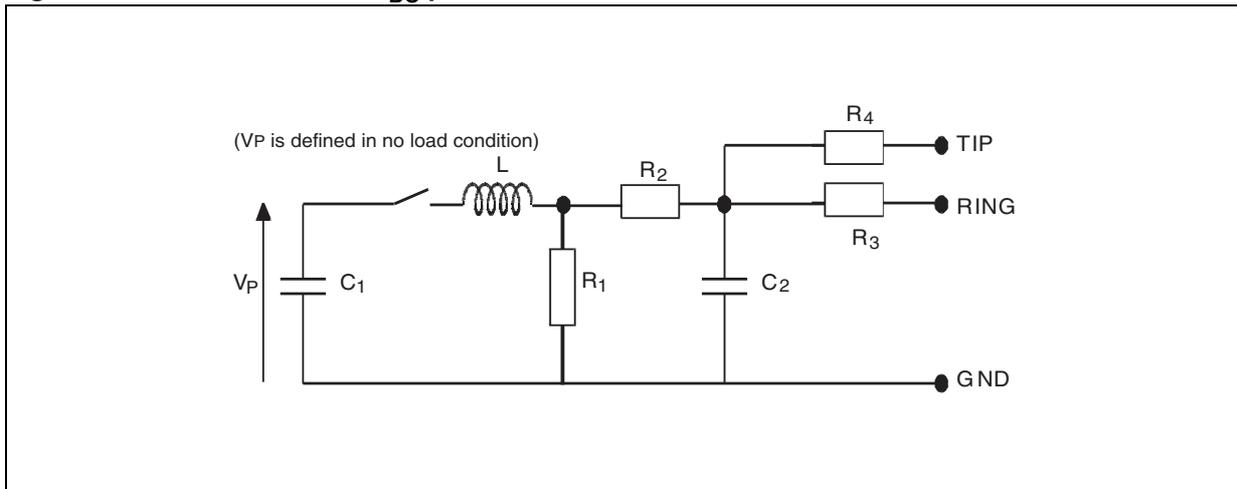
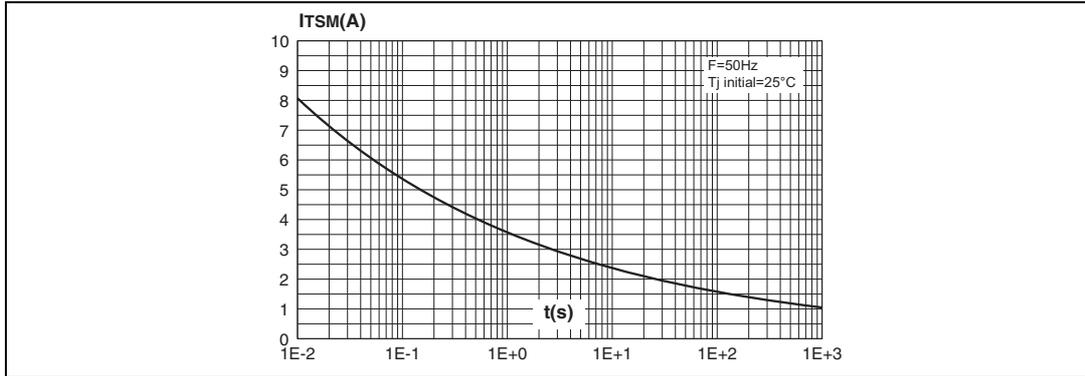


Table 6. Parameters for selected pulse characteristics

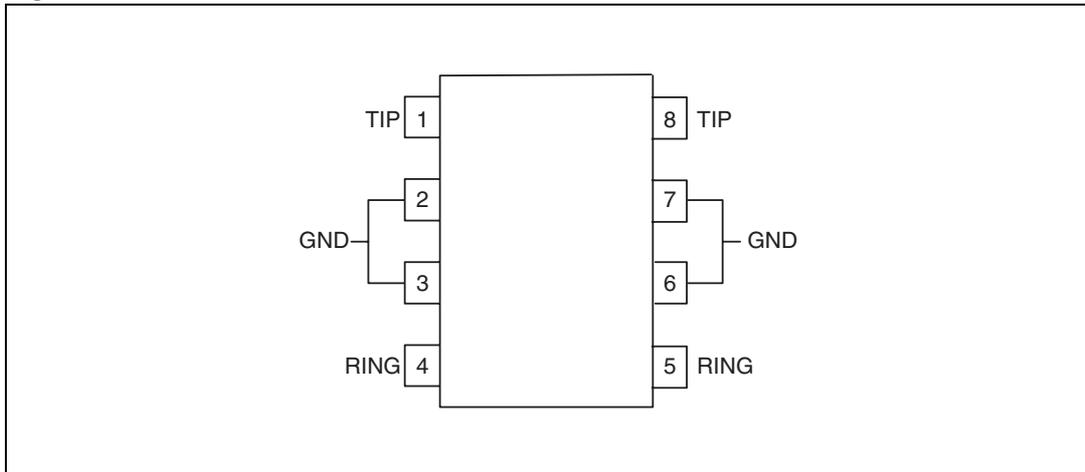
Pulse ( $\mu\text{s}$ )		$V_p$ (V)	$C_1$ ( $\mu\text{F}$ )	$C_2$ (nF)	$L$ ( $\mu\text{H}$ )	$R_1$ ( $\Omega$ )	$R_2$ ( $\Omega$ )	$R_3$ ( $\Omega$ )	$R_4$ ( $\Omega$ )	$I_{PP}$ (A)	$R_p$ ( $\Omega$ )
tr	tp										
10	700	1500	20	200	0	50	15	25	25	30	10
1.2	50	1500	1	33	0	76	13	25	25	30	10
2	10	2500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

Figure 7. Surge peak current versus overload duration



## 2 Application information

Figure 8. Device connections



1. Connect pins 2, 3, 6 and 7 to Ground to guarantee a good surge current capability for long duration disturbances.
2. To take advantage of the "4-point" structure of the THBT, the TIP and RING lines have to cross the device. In this case, the device will eliminate the overvoltages generated by the parasitic inductances of the wiring ( $Ldi/dt$ ), especially for very fast transients.

## 2.1 Application circuits

Figure 9. Line card protection

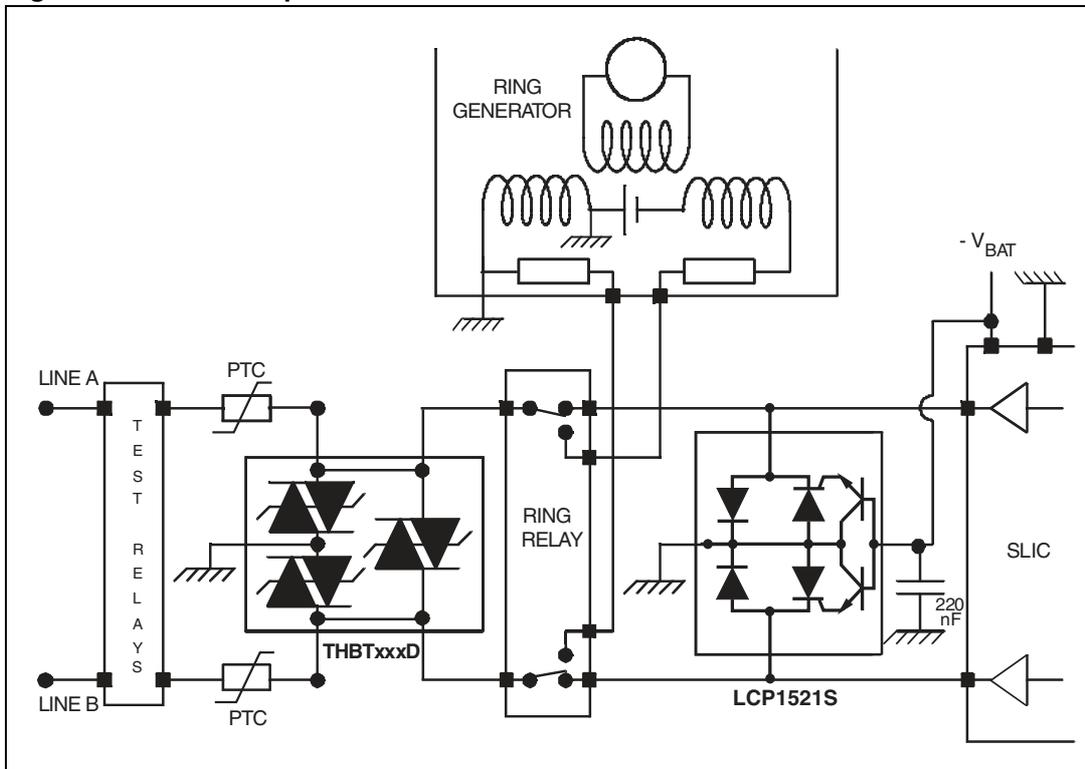
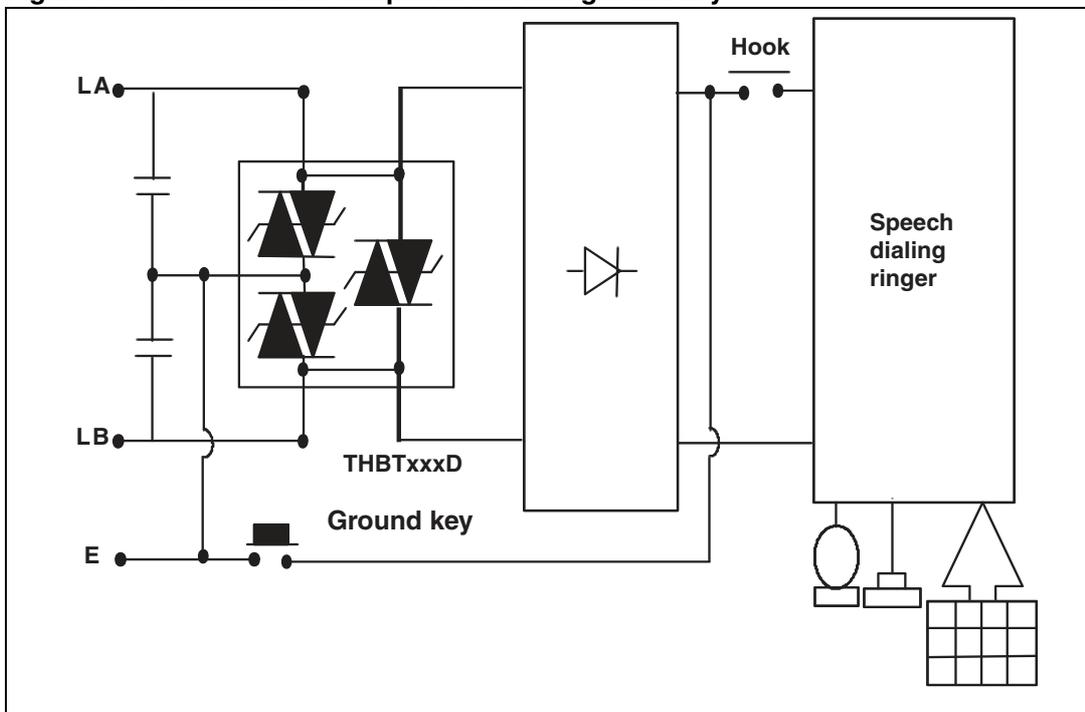


Figure 10. Protection for telephone set with ground key



### 3 Package information

- Epoxy meets UL94, V0

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at [www.st.com](http://www.st.com).

Table 7. SO-8 dimensions

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
A1	0.1		0.25	0.004		0.010
A2	1.25			0.049		
b	0.28		0.48	0.011		0.019
C	0.17		0.23	0.007		0.009
D	4.80	4.90	5.00	0.189	0.193	0.197
E	5.80	6.00	6.20	0.228	0.236	0.244
E1	3.80	3.90	4.00	0.150	0.154	0.157
e		1.27			0.050	
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
L1		1.04			0.041	
k	0°		8°	0°		8°
ppp			0.10			0.004

Figure 11. Footprint dimensions in mm (inches)

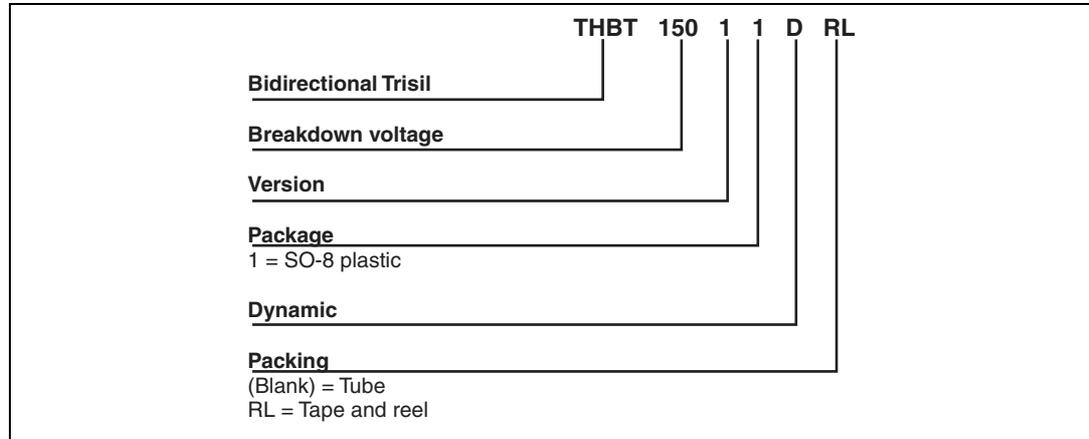
Figure 12. Marking

XXXXX : Marking  
 ZZ : Manufacturing location  
 Y : Year  
 WW : week



## 4 Ordering information scheme

Figure 13. Ordering information scheme



## 5 Ordering information

Table 8. Ordering information

Order code	Marking	Package	Weight
THBT15011D	BT151D	SO-8	0.077 g
THBT20011D	BT201D		
THBT27011D	BT271D		

## 6 Revision history

Table 9. Document revision history

Date	Revision	Changes
Oct-2003	7A	Previous release
19-Feb-2008	8	Reformatted to current standards. Removed THBT16011D from <a href="#">Table 4</a> and <a href="#">Table 8</a> . Updated <a href="#">Figure 4</a> , <a href="#">Figure 5</a> , and <a href="#">Figure 9</a> . Added ECOPACK paragraph in <a href="#">Section 3</a> . Added <a href="#">Figure 12: Marking</a> .

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