THBT15011, THBT20011, THBT27011

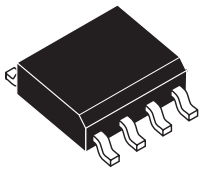
Tripolar overvoltage protection for telecom line

Features

- bidirectional crowbar protection between TIP and GND, RING and GND and between TIP and RING
- peak pulse current:
  I_{PP} = 30 A for 10/1000 µs surge
- holding current: I_H = 150 mA

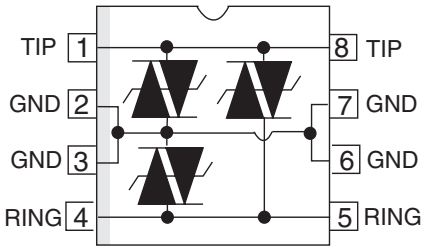
Complies with Bellcore standard

- TR-NWT-001089-Core, (second level) with line series resistors:
  - 10/1000 µs, 1000 V
  - 2/10 µs, 2500 V (first level)
  - 2/10 µs, 5000 V



SO-8

Figure 1. Schematic diagram



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 to meet the SLIC maximum ratings.

1 Characteristics

Table 1. Absolute maximum ratings (T_{amb} = 25 °C)

Symbol	Parameter		Value	Unit
I_{PP}	Peak pulse current(1) (2)	10 / 1000 µs	30	A
I_{TSM}	Non repetitive surge peak on-state current (F = 50 Hz)	t_p = 10 ms t = 1 s	8 3.5	A
Tstg Tj	Storage temperature range Maximum junction temperature		- 40 to + 150 150	°C
T_L	Maximum lead temperature for soldering during 10s		260	°C

1. For pulse waveform see *Figure 2*
2. See *Figure 7: Test circuit 4 for I_{PP} parameter*

Figure 2. Pulse waveform

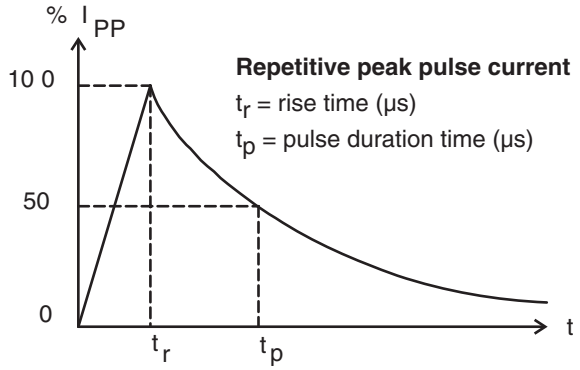


Figure 3. Surge peak current versus overload duration

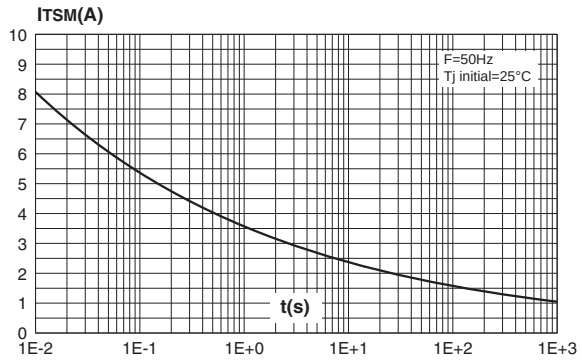


Table 2. Thermal resistance

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

Table 3. Electrical characteristics (T_{amb} = 25 °C)

Symbol	Parameter
V_{RM}	Stand-off voltage
I_{RM}	Leakage current at stand-off voltage
V_R	Continuos 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

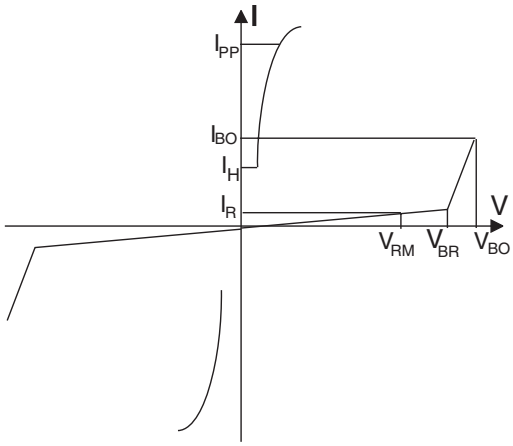


Table 4. Static parameters

Order code	I_{RM} @ V_{RM} max.		I_R(1) @ V_R max.		V_{BO}(2) @ I_{BO} max.	min.	max.	I_H(3) min.	C(4) max.
	µA	V	µA	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 ≥ V_R
2. Measured at 50 Hz (1 cycle) - See *Figure 4: Test circuit 1 for IBO and VBO parameters*.
3. See *Figure 5: Test circuit 2 for dynamic IH parameter*.
4. V_R = 1 V, F = 1 MHz.

Table 5. Dynamic breakover voltages (transversal mode)

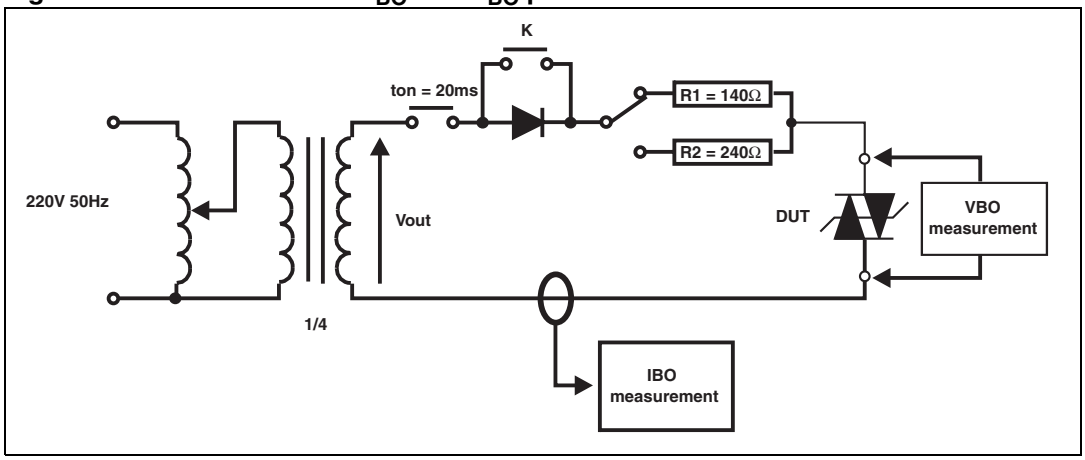
Type	Symbol	Test conditions(1)				Max	Unit
THBT15011D	V_{BO}	10/700 µs	1.5 kV	R_p = 10 Ω	I_{PP} = 30 A	190	V
		1.2/50 µs	1.5 kV	R_p = 10 Ω	I_{PP} = 30 A	190	
		2/10µs	2.5 kV	R_p = 62 Ω	I_{PP} = 38 A	200	
THBT20011D	V_{BO}	10/700 µs	1.5 kV	R_p = 10 Ω	I_{PP} = 30 A	270	V
		1.2/50 µs	1.5 kV	R_p = 10 Ω	I_{PP} = 30 A	270	
		2/10 µs	2.5 kV	R_p = 62 Ω	I_{PP} = 38 A	280	
THBT27011D	V_{BO}	10/700 µs	1.5 kV	R_p = 10 Ω	I_{PP} = 30 A	360	V
		1.2/50 µs	1.5 kV	R_p = 10 Ω	I_{PP} = 30 A	360	
		2/10 µs	2.5 kV	R_p = 62 Ω	I_{PP} = 38 A	400	

1. See *Figure 6: Test circuit 3 for V_{BO} parameters*. R_p is the protection resistor located on the line card.

2 Test circuits

2.1 Test procedure for test circuit 1 for I_{BO} and V_{BO} parameters

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



Pulse test duration (t_p = 20 ms):

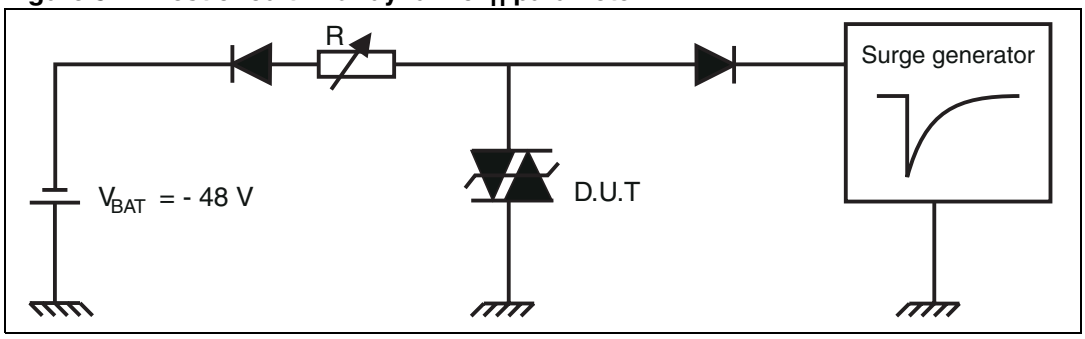
- For bidirectional devices switch K is closed.
- For unidirectional devices switch K is open.

V_{OUT} selection:

- For device with V_{BO} < 200 V, V_{OUT} = 250 V_{RMS}, R1 = 140 Ω.
- For device with V_{BO} ≥ 200 V, V_{OUT} = 480 V_{RMS}, R2 = 240 Ω.

2.2 Test procedure for test circuit 2 for dynamic I_H parameter

Figure 5. Test circuit 2 for dynamic I_H parameter



This is a go no-go test, which can confirm the holding current (I_H) level.

Procedure

1. Adjust the current level at the I_H value by short circuiting the AK of the D.U.T.
2. Fire the D.U.T. with a surge current I_{PP} = 10A, 10/1000µs.
3. The D.U.T. will come back off-state within 50 ms maximum.

2.3 Test circuit 3 for V_{BO} parameters

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

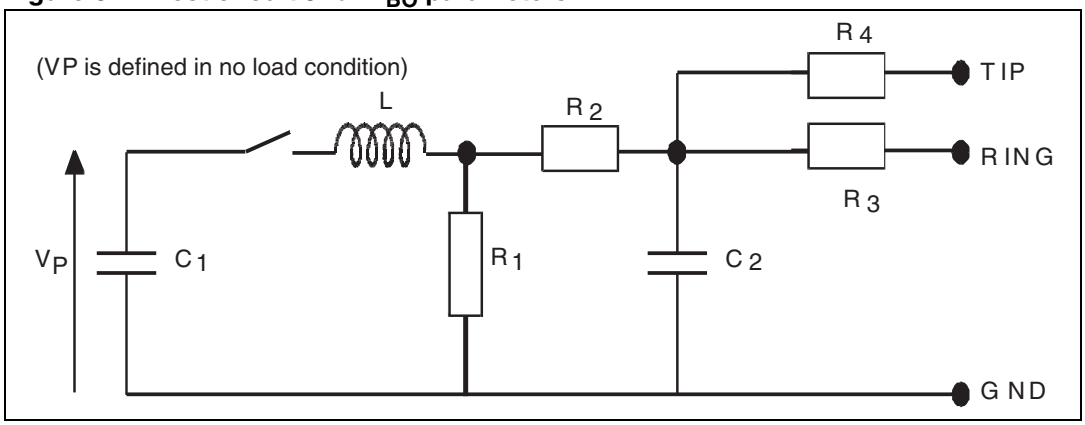
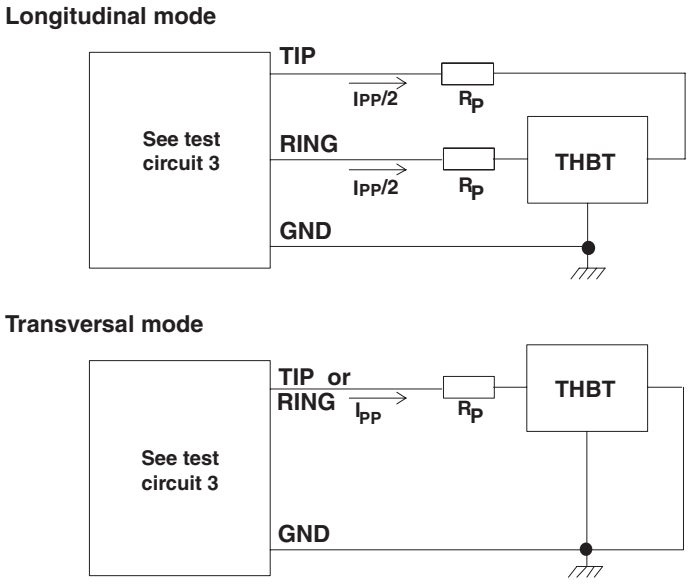


Table 6. Parameters for test crcuit 3 for selected pulse characteristics

Pulse (µs)		V_p (V)	C_1 (µF)	C_2 (nF)	L (µH)	R_1 (Ω)	R_2 (Ω)	R_3 (Ω)	R_4 (Ω)	I_{PP} (A)	R_p (Ω)
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

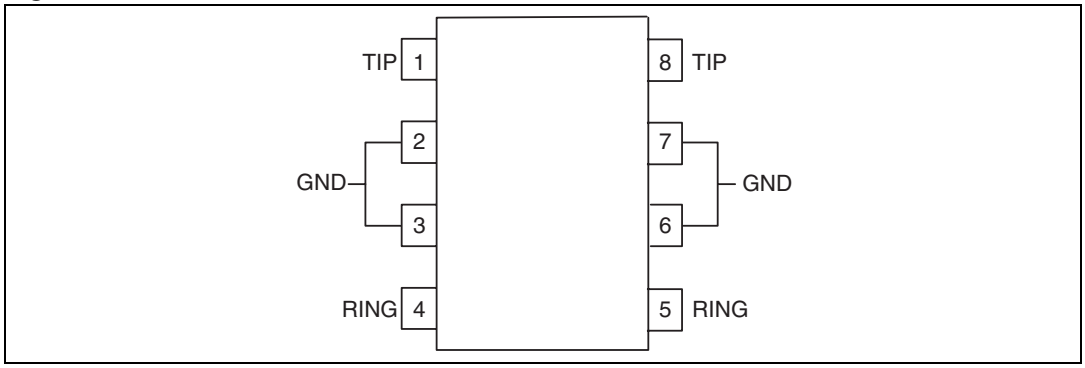
2.4 Test circuit 4 for I_{PP} parameter

Figure 7. Test circuit 4 for I_{PP} parameter



3 Application information

Figure 8. Device connections



Connect pins 2, 3, 6 and 7 to ground to guarantee a good surge current capability for long duration disturbances.

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.

3.1 Application circuits

Figure 9. Line card protection

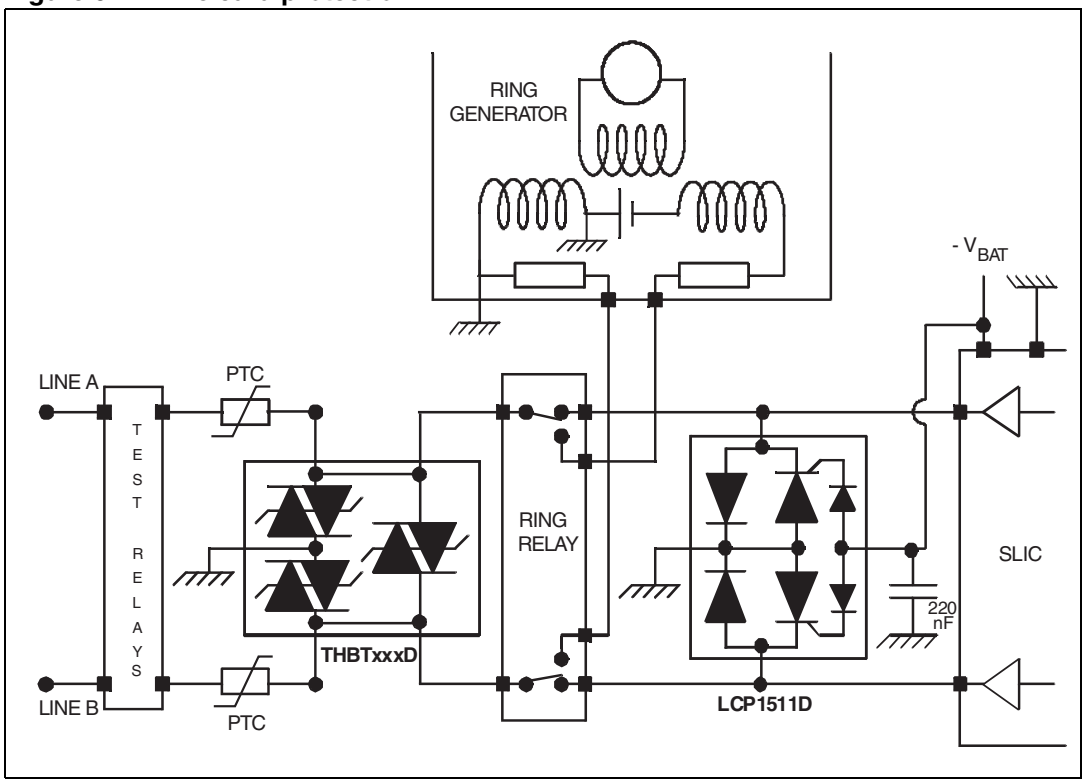
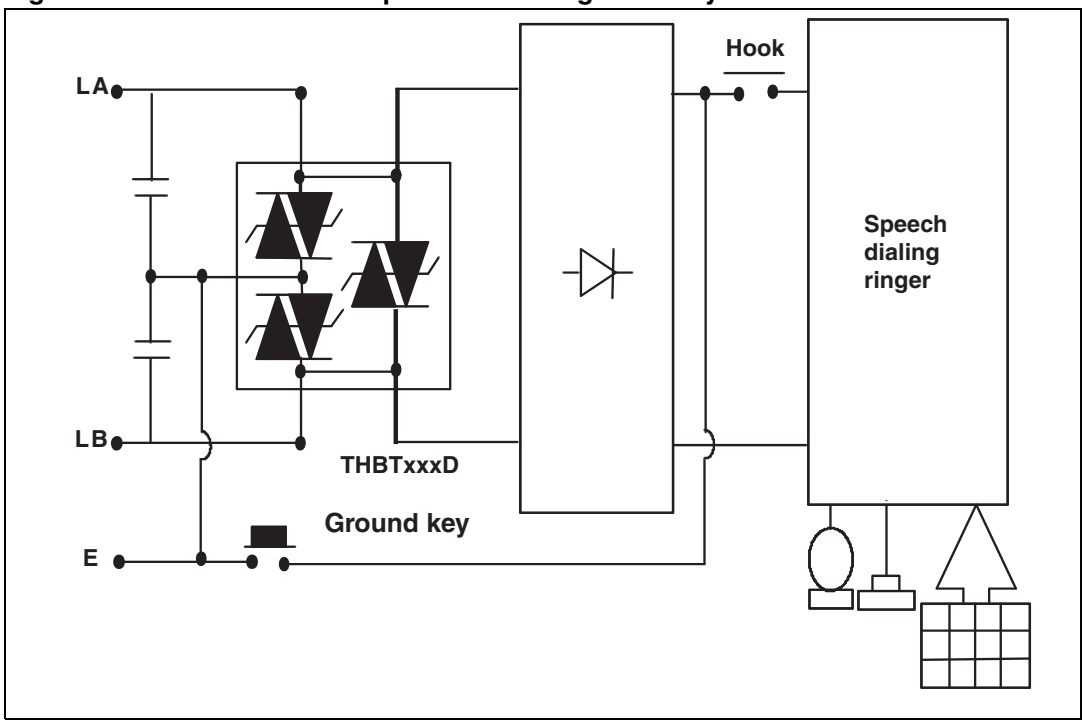
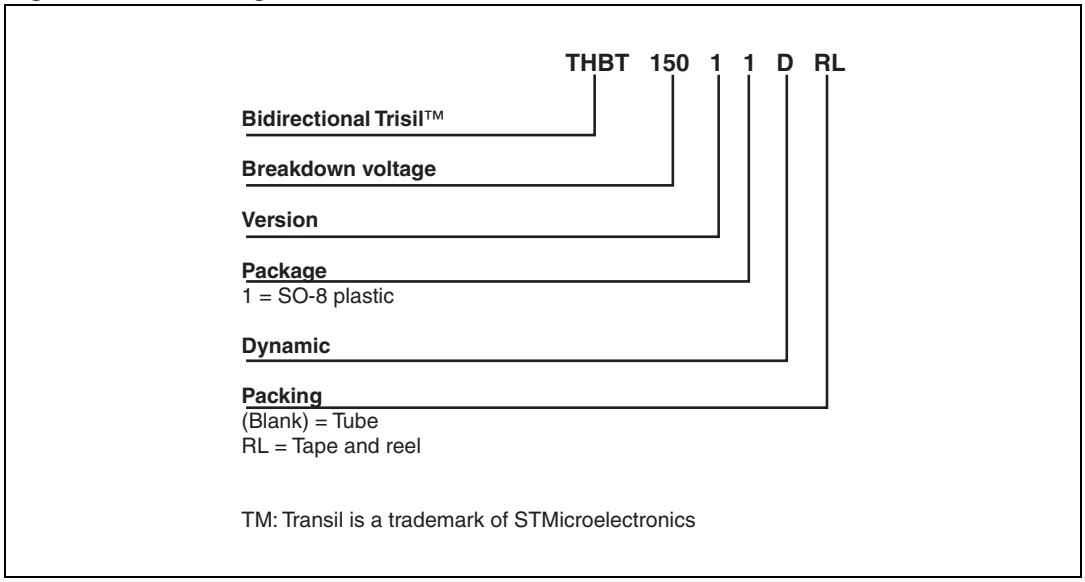


Figure 10. Protection for telephone set with ground key



4 Ordering information scheme

Figure 11. Ordering information scheme

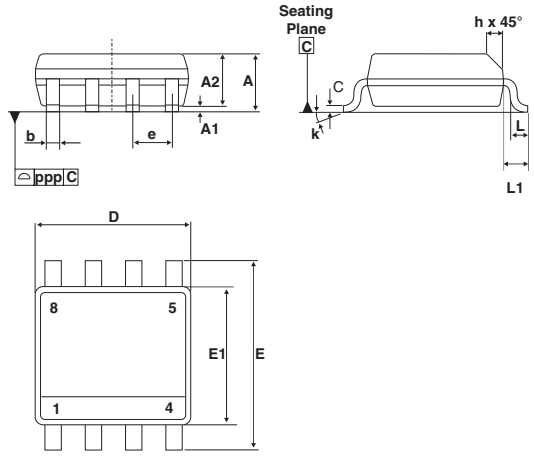


5 Package information

- 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 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 12. Footprint, dimensions in mm (inches)

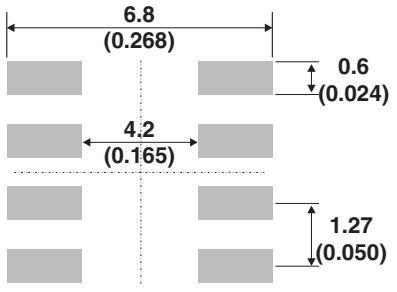
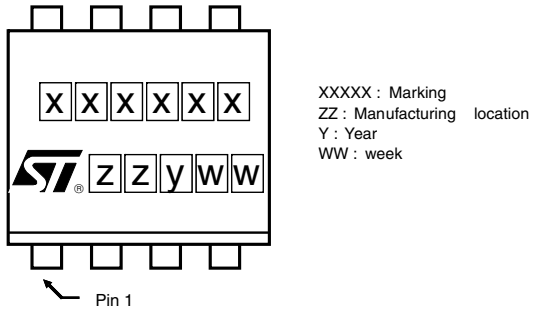


Figure 13. Marking



6 Ordering information

Table 8. Ordering information

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

7 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 *Table 4* and *Table 8*. Updated *Figure 4*, *Figure 5*, and *Figure 9*. Added ECOPACK paragraph in *Section 5*. Added *Figure 13: Marking*.
09-Dec-2010	9	Restructured for conformity with other products in this class. Updated trademark statement for Trisil in *Figure 11*.

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