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 Telcordia standards

- Telcordia GR-1089-Core, (second level) with line series resistors
  - 10/1000 µs, 1000 V
  - 2/10 µs, 2500 V (first level)
  - 2/10 µs, 5000 V

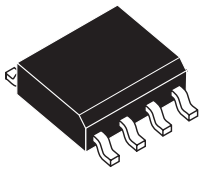
Description

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.

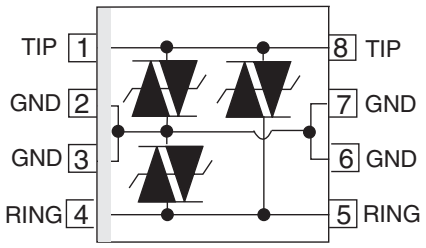
A particular attention has been given to the internal wire bonding. The “4-point” configuration ensures a reliable protection, eliminating overvoltages introduced by the parasitic inductances of the wiring (Ldi/dt), especially for very fast transient overvoltages.

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



SO-8

Figure 1. Schematic diagram



1 Characteristics

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

Symbol	Parameter		Value	Unit
I_{PP}	Peak pulse current(1)	10 / 1000 µs	30	A
I_{TSM}	Non repetitive surge peak on-state current (F = 50 Hz)	tp = 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*

Figure 2. Pulse waveform 10/1000 µs, tr = 10 µs, tp = 1000 µs

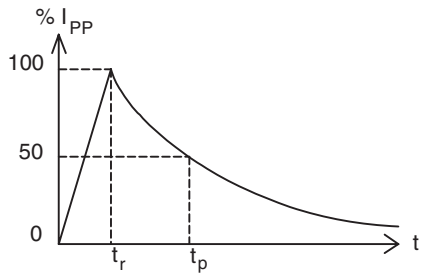


Figure 3. Test circuit for I_{PP}

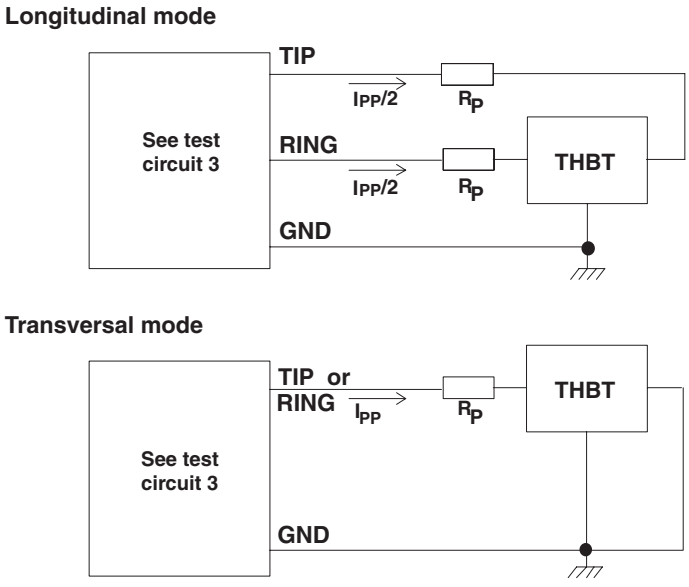


Table 2. Thermal resistance

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	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

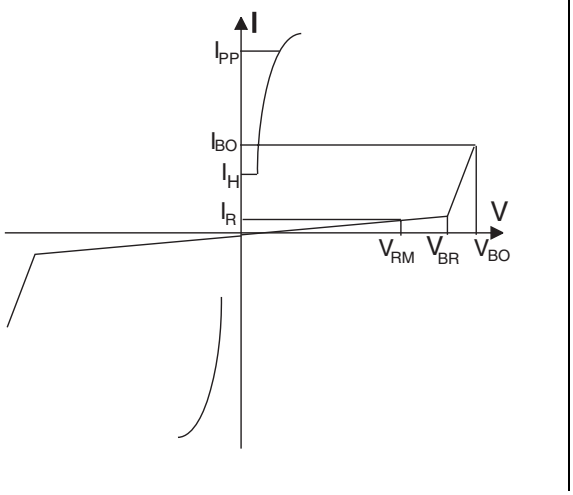


Table 4. Static parameters

Type	I_{RM} @ V_{RM} max.		I_R @ V_R max. (1)		V_{BO} @ I_{BO} max. (2)	min.		I_H min. (3)	C max. (4)
	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

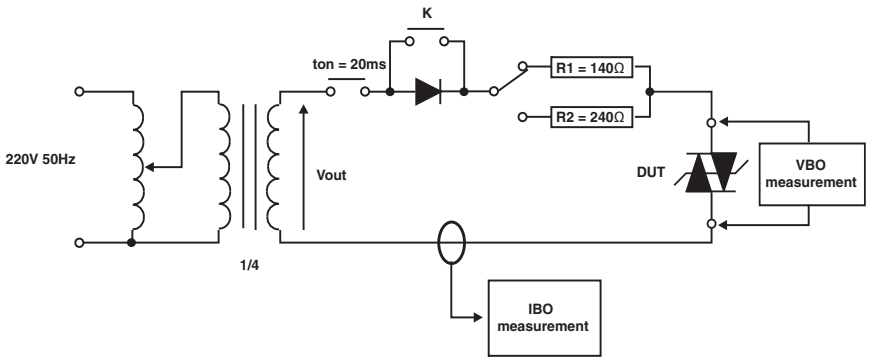
1. I_R measured at V_R guarantee V_{BR} min ≥ V_R
2. Measured at 50 Hz (1 cycle) - See test circuit 1 (*Figure 4*).
3. See the reference test circuit 2 (*Figure 5*).
4. V_R = 1 V bias, V_{RMS} = 1 V, F = 1 MHz.

Table 5. Dynamic breakover voltages (transversal mode)

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



TEST PROCEDURE

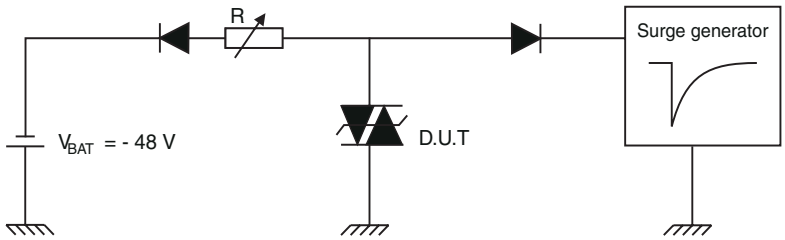
Pulse test duration (tp = 20ms):

- for Bidirectional devices = Switch K is closed
- for Unidirectional devices = Switch K is open

V_{OUT} selection:

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

Figure 5. Test circuit 2 for I_H parameter



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

TEST 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} = 10 A,10/1000 µs.

3/ The D.U.T. will come back off-state within 50 ms maximum.

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

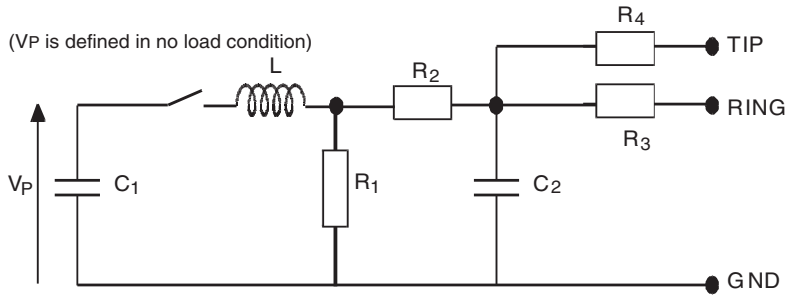
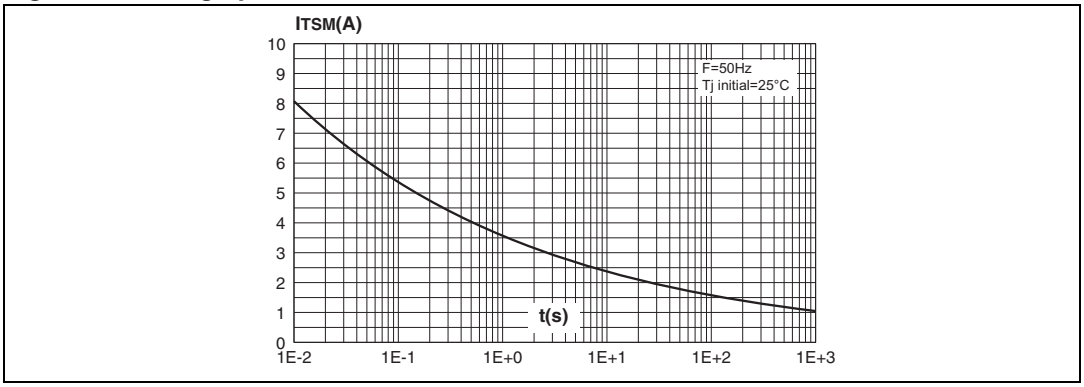


Table 6. Parameters for selected pulse characteristics

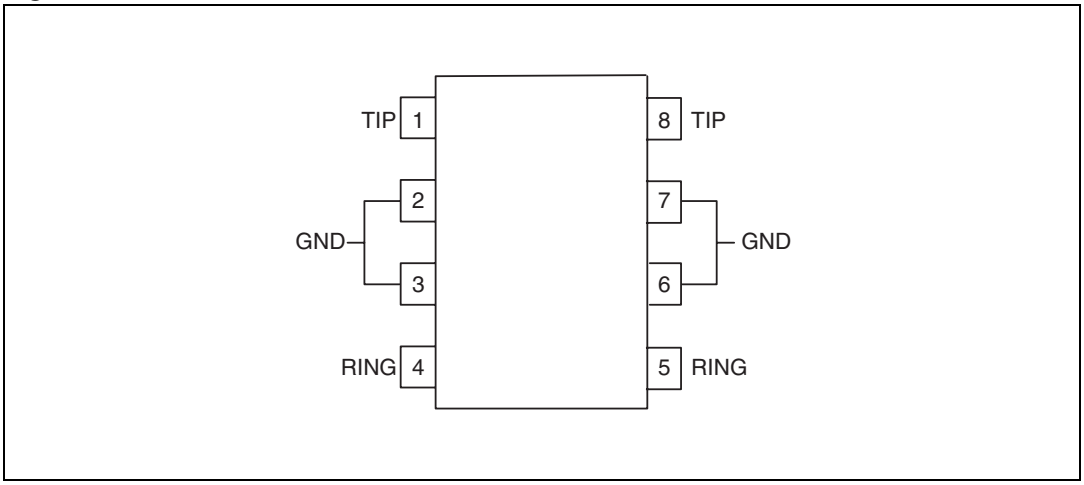
Pulse (µs)		V_p (V)	C_1 (µF)	C_2 (nF)	L (µH)	R_1 (Ω)	R_2 (Ω)	R_3 (Ω)	R_4 (Ω)	I_{PP} (A)	R_p (Ω)
tr	tp										
10	700	1500	20	200	0	50	15	25	25	30	10
1.2	50	1500	1	33	0	76	13	25	25	30	10
2	10	2500	10	0	1.1	1.3	0	3	3	38	62

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

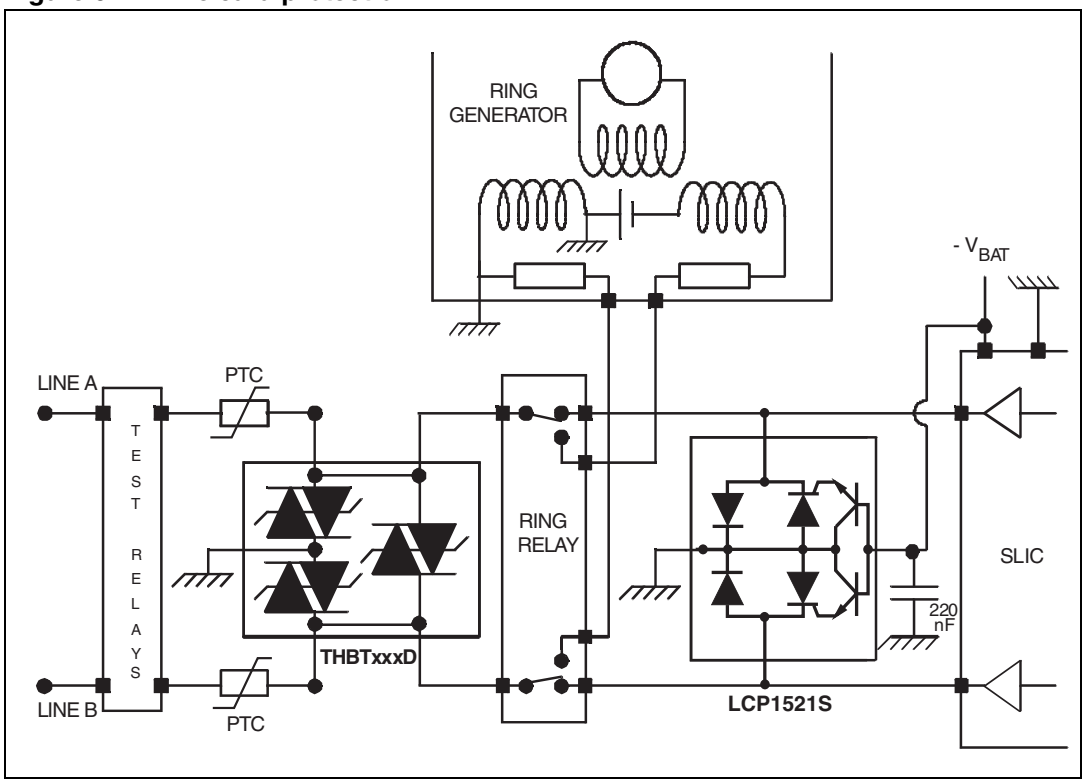
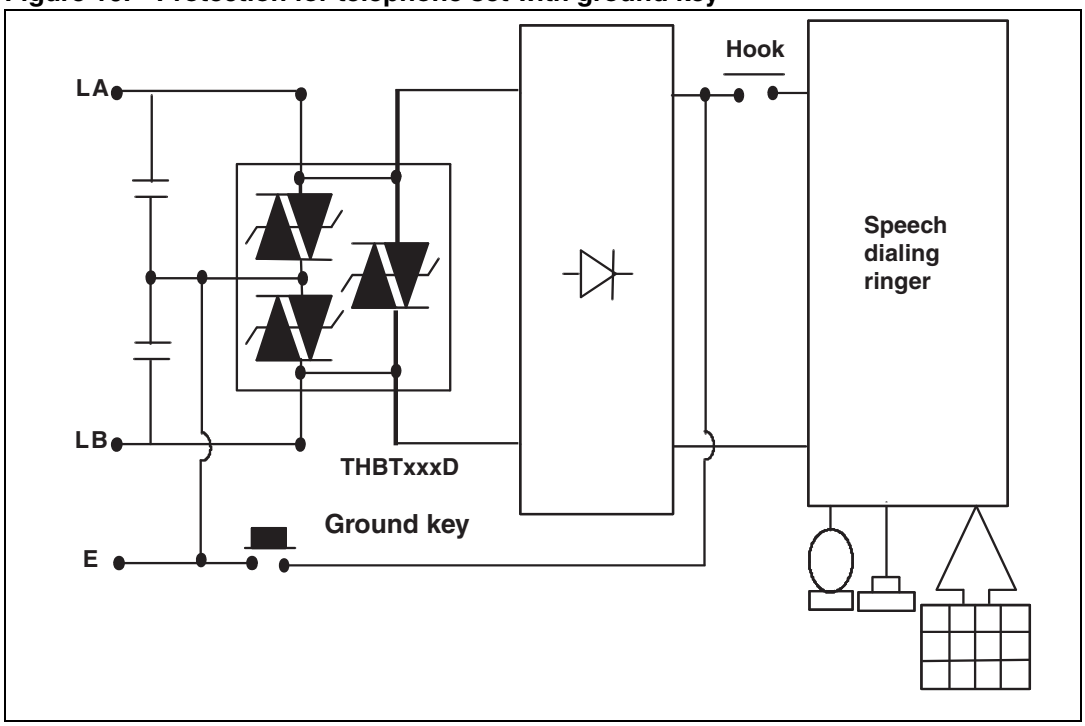


Figure 10. Protection for telephone set with ground key

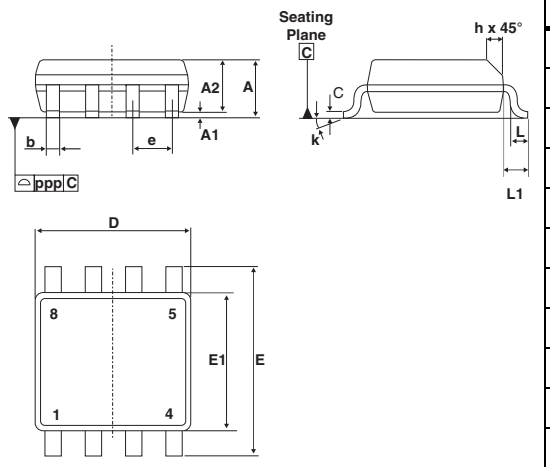


3 Package information

- 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*.

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)

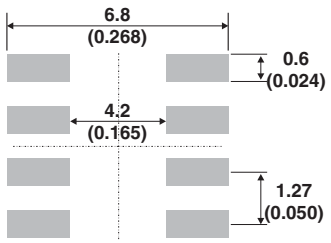
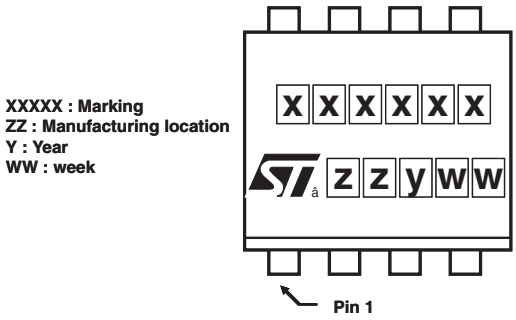
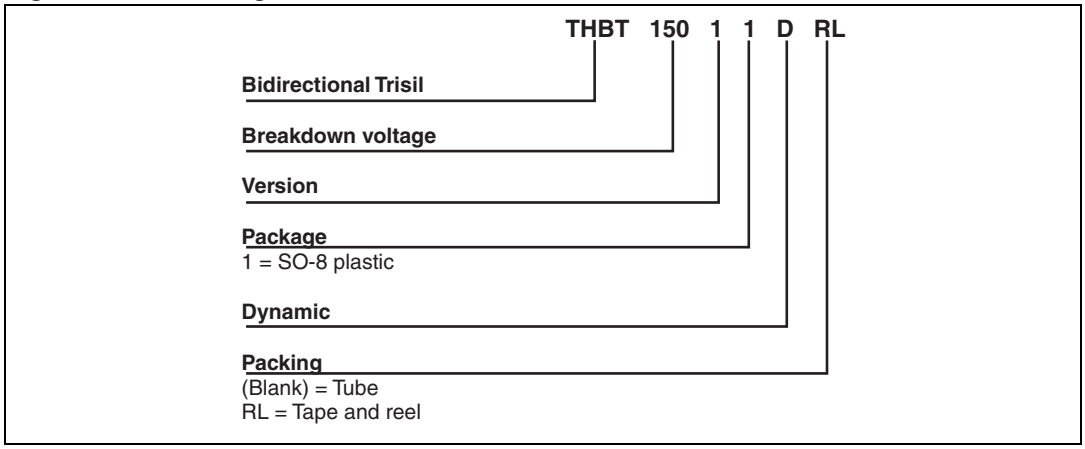


Figure 12. Marking



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 *Table 4* and *Table 8*. Updated *Figure 4*, *Figure 5*, and *Figure 9*. Added ECOPACK paragraph in *Section 3*. Added *Figure 12: Marking*.

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