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VN808-E

Octal channel high-side driver

Datasheet - production data

PowerSO-36

Features

Type	$R_{DS(on)}$ (1)	I_{OUT}	V_{CC}
VN808-E	150 mΩ	0.7 A	45 V

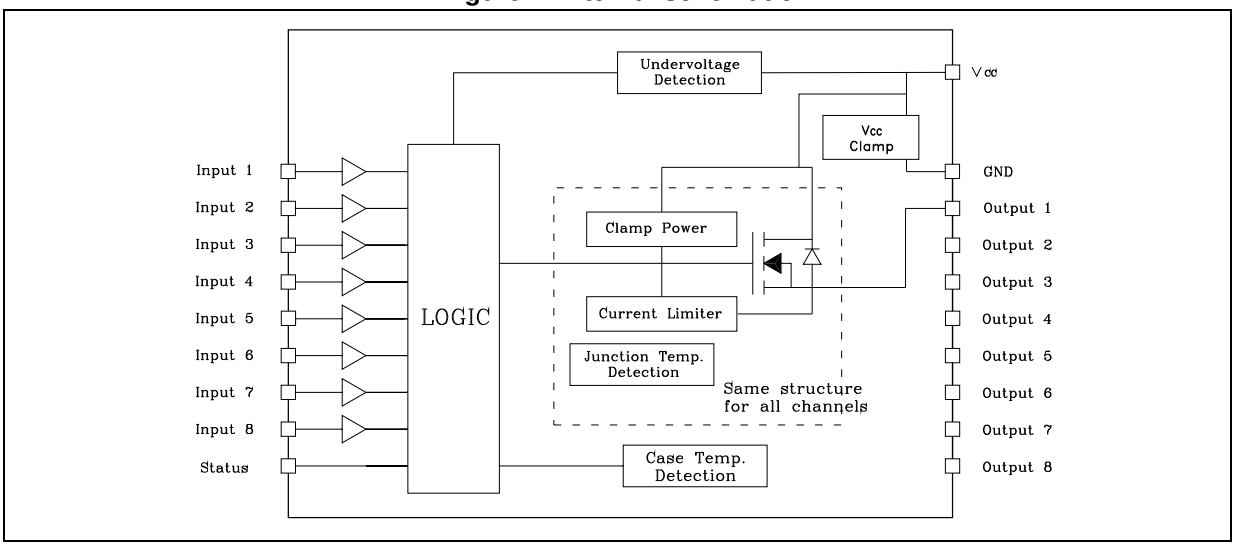
1. Per channel

- V_{CC}/2 compatible input
- Junction overtemperature protection
- Case overtemperature protection for thermal independence of the channels
- Current limitation
- Short-circuit load protection
- Undervoltage shutdown
- Protection against loss of ground
- Very low standby current
- Compliance to 61000-4-4 IEC test up to 4 kV

Description

The VN808-E is a monolithic device, realized in STMicroelectronics VIPower M0-3 technology, intended to drive any kind of load with one side connected to ground. Active current limitation combined with thermal shutdown and automatic restart, protect the device against overload. In overload conditions, the channel turns OFF and ON again automatically in order to maintain the junction temperature between T_{TSD} and T_R. If this condition makes case temperature reach T_{CSD}, overloaded channels are turned OFF and restart only when case temperature decreases down to T_{CR}. Non-overloaded channels continue to operate normally. The device automatically turns OFF in case of ground pin disconnection. This device is especially suitable for industrial applications conform to IEC 61131.

Figure 1. Internal schematic



Contents

1 Maximum ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	DC supply voltage	45	V
$-I_{GND}$	DC ground reverse current TRAN ground reverse current (pulse duration < 1 ms)	-250 -6	mA A
I_{OUT}	DC output current	Internally limited	A
$-I_{OUT}$	Reverse DC output current	-2	A
I_{IN}	DC input current	± 10	mA
V_{IN}	Input voltage range	$-3/+V_{CC}$	V
V_{ESD}	Electrostatic discharge (R = 1.5 kΩ; C = 100 pF)	2000	V
P_{TOT}	Power dissipation at T_C = 25 °C	96	W
EAS	Single pulse avalanche energy per channel 8 channels driven simultaneously (T_{AMB} = 125 °C, I_{OUT} = 0.6 A per channel)	1.15	J
T_J	Junction operating temperature	Internally limited	°C
T_C	Case operating temperature	Internally limited	°C
T_{STG}	Storage temperature	-40 to 150	°C

Table 2. Thermal data

Symbol	Parameter		Value	Unit
$R_{th(JC)}$	Thermal resistance junction-case	Max.	1.3	°C/W
$R_{th(JA)}$	Thermal resistance junction-ambient(1)	Max.	50	°C/W

1. When mounted on FR4 printed circuit board with 0.5 cm^2 of copper area (at least 35 µm think) connected to all TAB pins.

2 Electrical characteristics

10.5 V < V_{CC} < 32 V; - 40 °C < T_J < 125 °C; unless otherwise specified.

Table 3. Power section

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{CC}	Operating supply voltage		10.5		45	V
V_{USD}	Undervoltage shutdown		7		10.5	V
R_{ON}	On-state resistance	I_{OUT} = 0.5 A; T_J = 25 °C I_{OUT} = 0.5 A; T_J = 125 °C		150	185 280	mΩ mΩ
I_S	Supply current	Off-state; V_{CC} = 24 V; T_{CASE} = 25 °C On-state (all channels ON); V_{CC} = 24 V, T_{CASE} = 100 °C			150 12	µA mA
I_{LGND}	Output current at turn-off	V_{CC} = V_{STAT} = V_{IN} = V_{GND} = 24 V V_{OUT} = 0 V			1	mA
$I_{L(off)}$	Off-state output current	V_{IN} = V_{OUT} = 0 V;	0		5	µA
$V_{OUT(off)}$	Off-state output voltage	V_{IN} = 0 V, I_{OUT} = 0 A			3	V
$t_{d(Vccon)}$	Power-on delay time from V_{CC} rising edge	*Figure 7 on page 10*		1		ms

Table 4. Switching (V_{CC} = 24 V)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{ON}	Turn-on time	R_L = 48 Ω from 80% V_{OUT} (see *Figure 6*)	-	50	100	µs
t_{OFF}	Turn-off time	R_L = 48 Ω to 10% V_{OUT} (see *Figure 6*)	-	75	150	µs
dVOUT/dt(on)	Turn-on voltage slope	R_L = 48 Ω from V_{OUT} = 2.4 V to V_{OUT} = 19.2 V (see *Figure 6*)	-	0.7		V/µs
dVOUT/dt(off)	Turn-off voltage slope	R_L = 48 Ω from V_{OUT} = 21.6 V to V_{OUT} = 2.4 V (see *Figure 6*)	-	1.5		V/µs

Table 5. Input pin

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{INL}	Input low level				V_{CC} /2-1	V
I_{INL}	Low level input current	$V_{IN} = V_{CC}$ / 2 - 1 V	80		650	µA
V_{INH}	Input high level		V_{CC} /2+1			V
I_{INH}	High level input current	$V_{IN} = V_{CC}$ / 2 + 1 V		150	260	µA
$V_{I(HYST)}$	Input hysteresis voltage			0.6		V
I_{IN}	Input current	$V_{IN} = V_{CC}$ = 32 V			300	µA

Table 6. Protection

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
T_{CSD}	Case shutdown temperature		125	130	135	°C
T_{CR}	Case reset temperature		110			°C
T_{CHYST}	Case thermal hysteresis		7	15		°C
T_{TSD}	Junction shutdown temperature		150	175	200	°C
T_R	Junction reset temperature		135			°C
T_{HYST}	Junction thermal hysteresis		7	15		°C
I_{lim}	DC short-circuit current per channel	V_{CC} = 24 V; R_{LOAD} = 10 mΩ	0.7		1.7	A
V_{demag}	Turn-off output clamp voltage	I_{OUT} = 0.5 A; L = 6 mH	V_{CC}-57	V_{CC}-52	V_{CC}-47	V

Table 7. Status pin

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{HSTAT}	High level output current	V_{CC} = 18...32 V; R_{STAT} = 1 kΩ (Fault condition)	2	3	4	mA
I_{LSTAT}	Leakage current	Normal operation; V_{CC} = 32 V			0.1	µA
V_{CLSTAT}	Clamp voltage	I_{STAT} = 1 mA I_{STAT} = -1 mA	6.0	6.8 -0.7	8.0	V V

3 Pin connections

Figure 2. Connection diagram (top view)

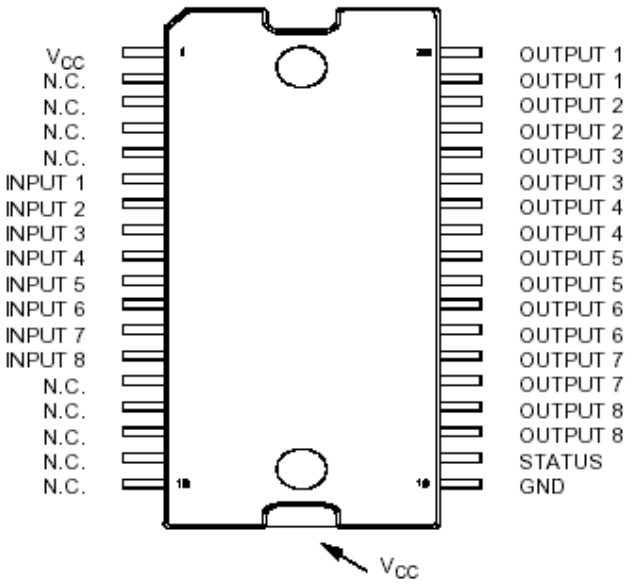


Table 8. Pin functions

Pin	Symbol	Function
TAB	V_{CC}	Positive power supply voltage
1	V_{CC}	Positive power supply voltage
2,3,4,5	NC	Not connected
6	Input 1	Input of channel 1
7	Input 2	Input of channel 2
8	Input 3	Input of channel 3
9	Input 4	Input of channel 4
10	Input 5	Input of channel 5
11	Input 6	Input of channel 6
12	Input 7	Input of channel 7
13	Input 8	Input of channel 8
14,15,16,17,18	NC	Not connected
19	GND	Logic ground
20	STATUS	Common open source diagnostic for overtemperature
21,22	Output 8	High-side output of channel 8
23,24	Output 7	High-side output of channel 7
25, 26	Output 6	High-side output of channel 6

Table 8. Pin functions (continued)

Pin	Symbol	Function
27. 28	Output 5	High-side output of channel 5
29, 30	Output 4	High-side output of channel 4
31, 32	Output 3	High-side output of channel 3
33, 34	Output 2	High-side output of channel 2
35, 36	Output 1	High-side output of channel 1

4 Current, voltage conventions and internal diagram

Figure 3. Current and voltage conventions

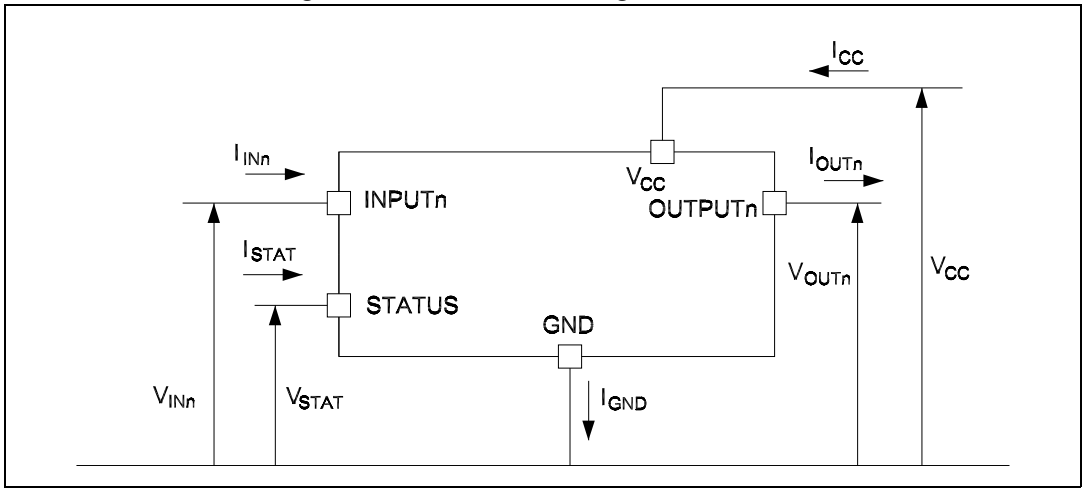


Figure 4. Equivalent internal block diagram (same structure for all channels)

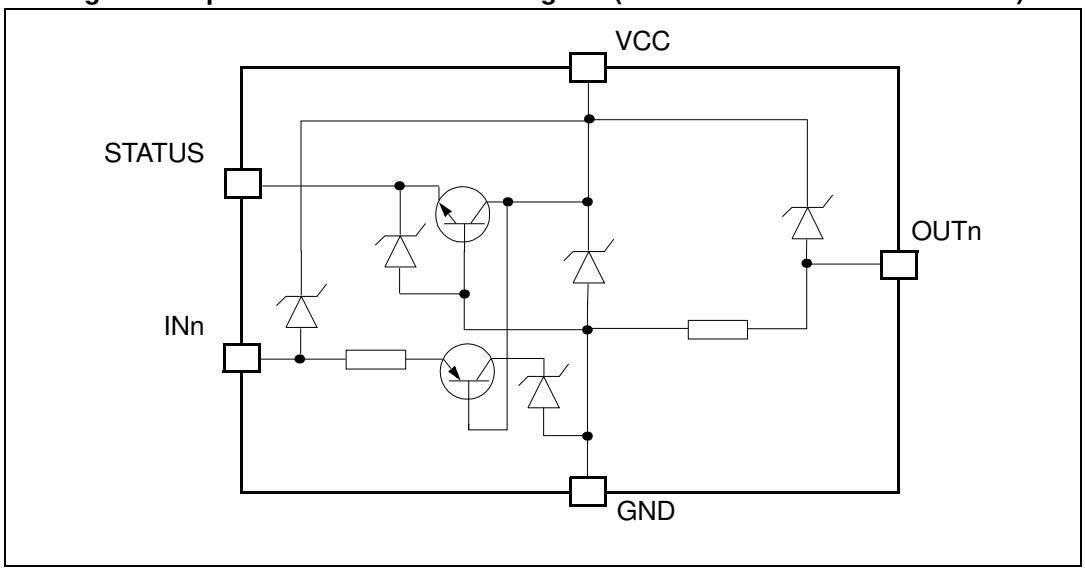


Figure 5. Application example

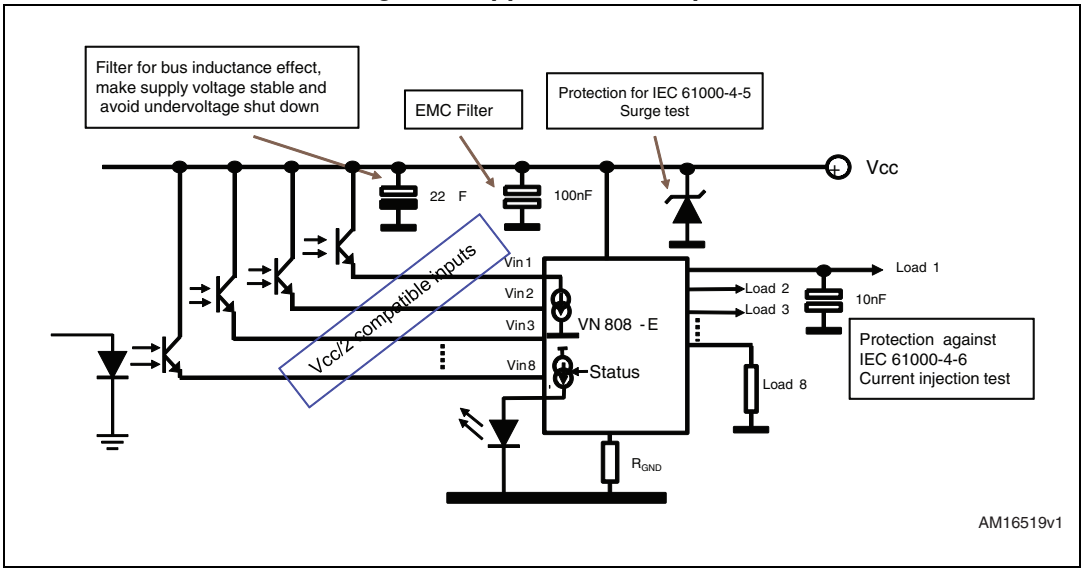


Table 9. Truth table

Conditions	INPUTn	OUTPUTn	STATUS
Normal operation	L H	L H	L L
Current limitation	L H	L X	L L
Overtemperature (see waveforms 3, 4 *Figure 8*) -> $T_J > T_{TSD}$	L H	L L	L H
Undervoltage	L H	L L	X X

5 Switching time waveforms

Figure 6. Turn-ON and turn-OFF

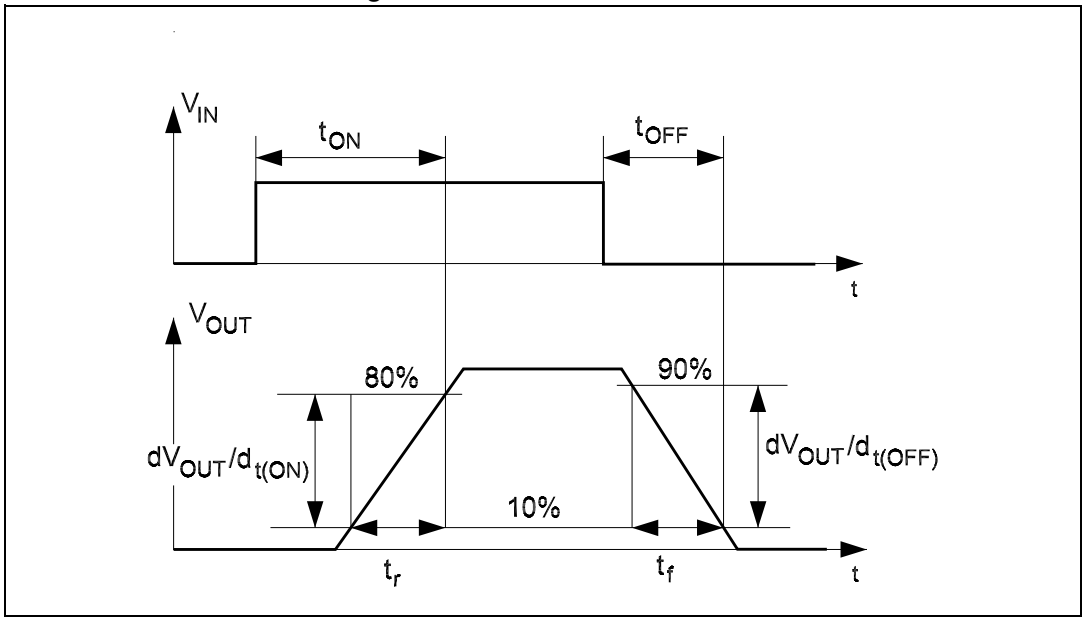


Figure 7. V_{CC} turn-ON

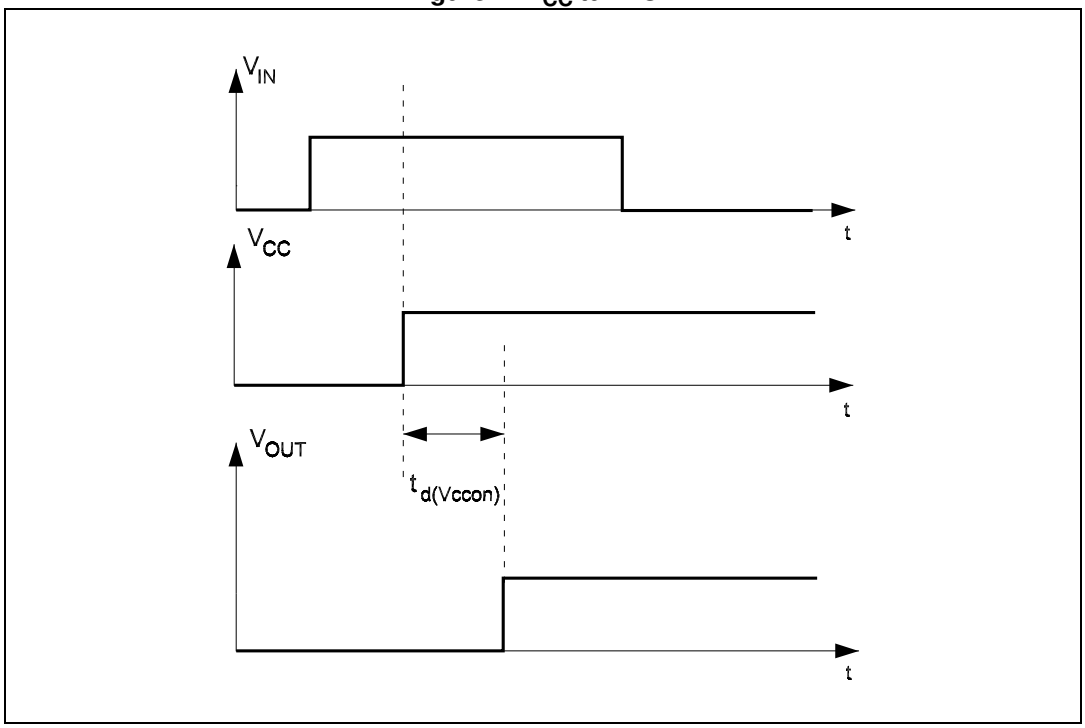


Figure 8. Waveforms

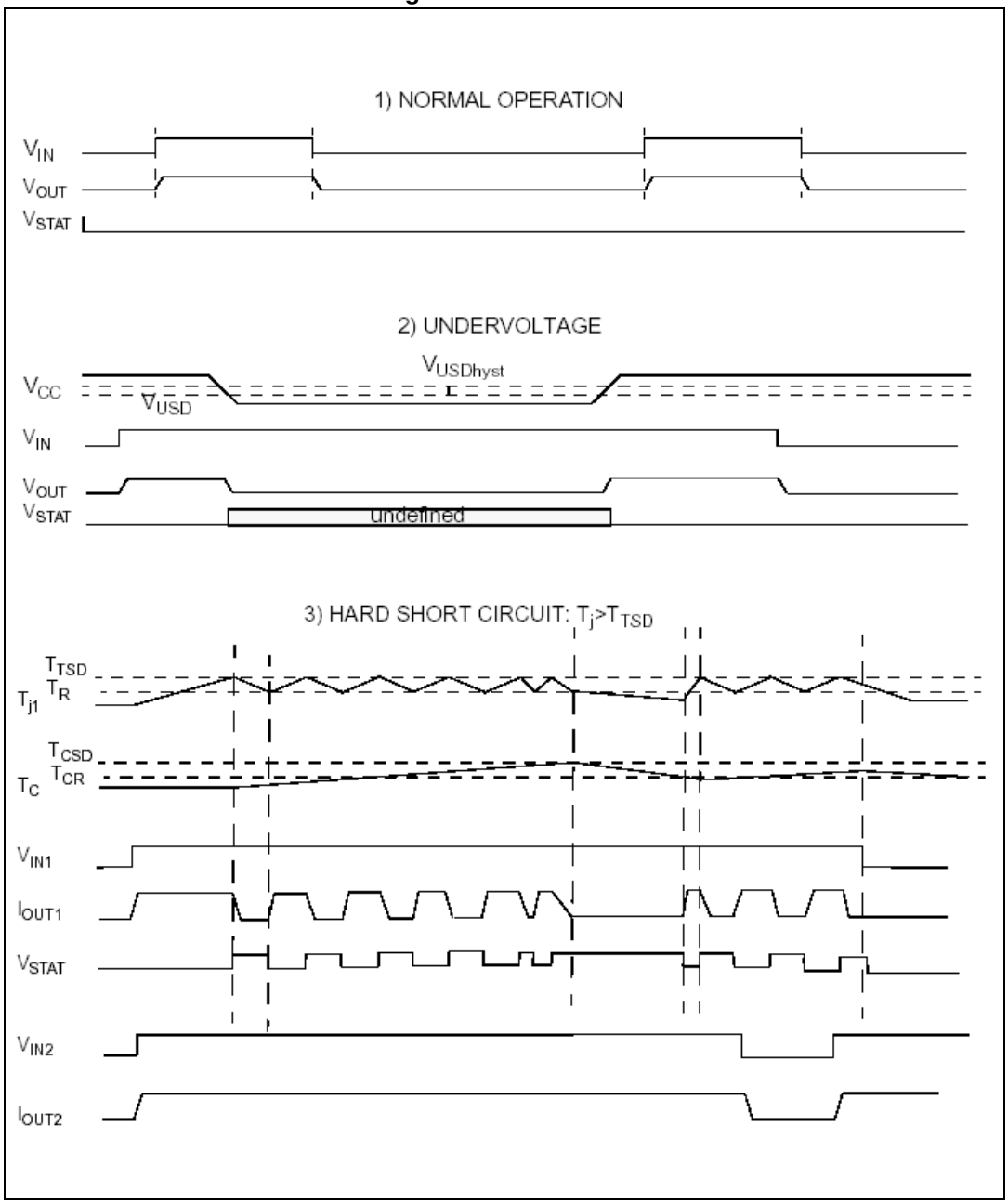
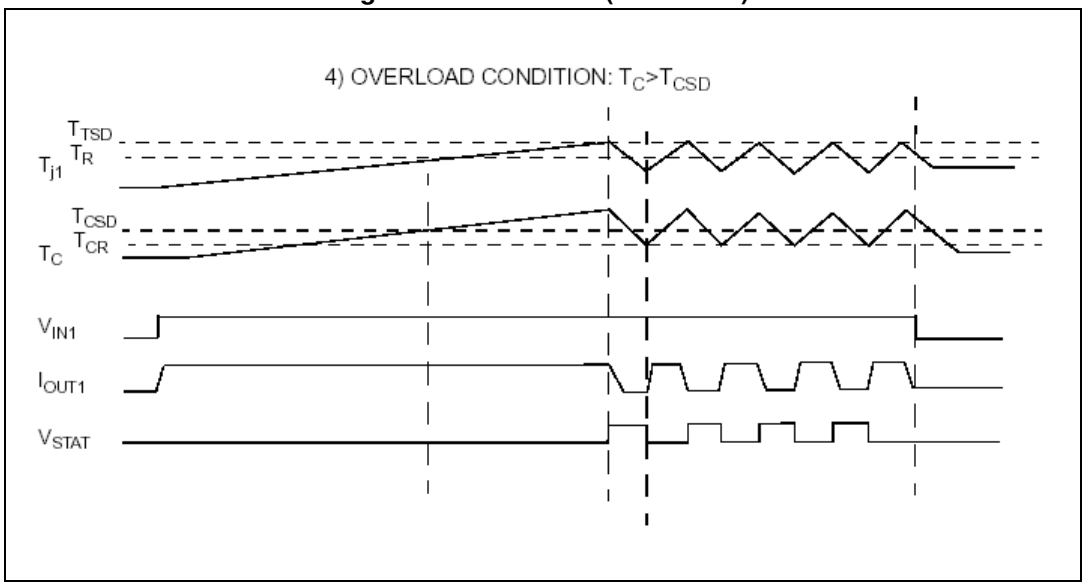


Figure 9. Waveforms (continued)



6 Reverse polarity protection

Reverse polarity protection can be implemented on board using two different solutions:

1. Placing a resistor (R_{GND}) between IC GND pin and load GND
2. Placing a diode between IC GND pin and load GND

If option 1 is selected, the minimum resistance value has to be selected according to the following equation:

Equation 1

$R_{GND} \geq V_{CC}/I_{GND}$

where I_{GND} is the DC reverse ground pin current and can be found in *Section 1: Maximum ratings* of this datasheet.

Power dissipated by R_{GND} (when $V_{CC} < 0$: during reverse polarity situations) is:

Equation 2

$P_D = (V_{CC})^2/R_{GND}$

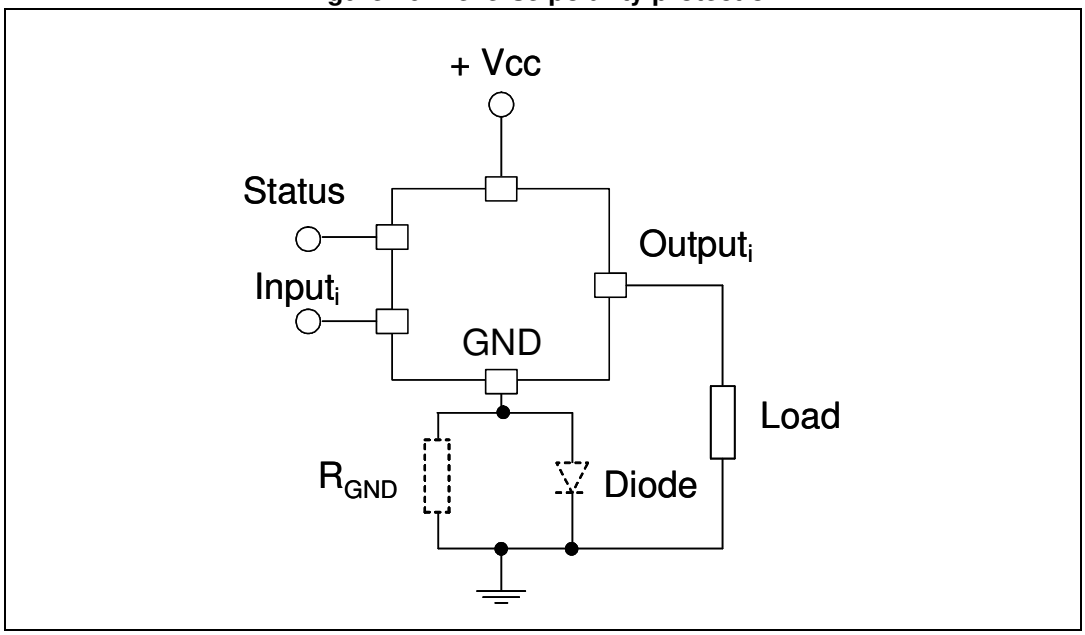
If option 2 is selected, the diode has to be chosen by taking into account VRRM $>|V_{cc}|$ and its power dissipation capability:

Equation 3

$P_D \geq I_S * V_f$

Note: In normal conditions (no reverse polarity) due to the diode, there is a voltage drop between GND of the device and GND of the system.

Figure 10. Reverse polarity protection



This schematic can be used with any type of load.

7 Package mechanical data

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.

Figure 11. PowerSO-36 drawings

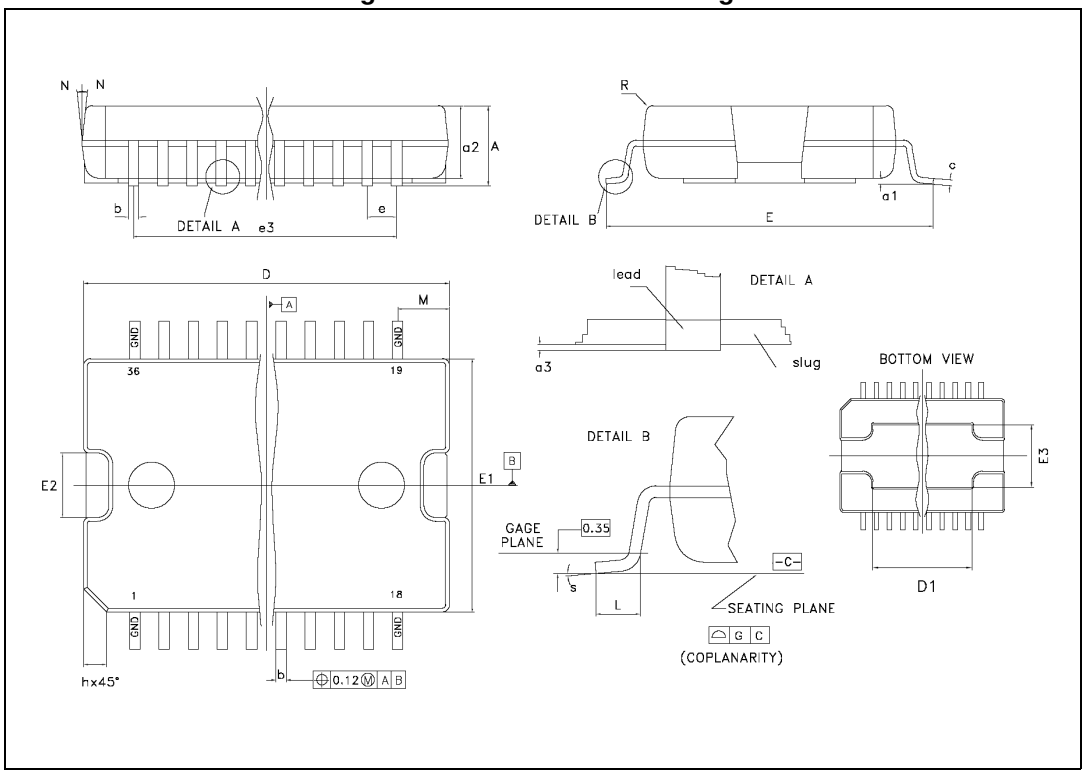


Table 10. PowerSO-36 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			3.60
a1	0.10		0.30
a2			3.30
a3	0		0.10
b	0.22		0.38
c	0.23		0.32
D (1)	15.80		16.00
D1	9.40		9.80
E	13.90		14.50
E1 (1)	10.90		11.10
E2			2.90
E3	5.8		6.2
e		0.65	
e3		11.05	
G	0		0.10
H	15.50		15.90
h			1.10
L	0.80		1.10
N			10°
S	0°		8°

7.1 Footprint recommended data

Figure 12. Footprint recommended data

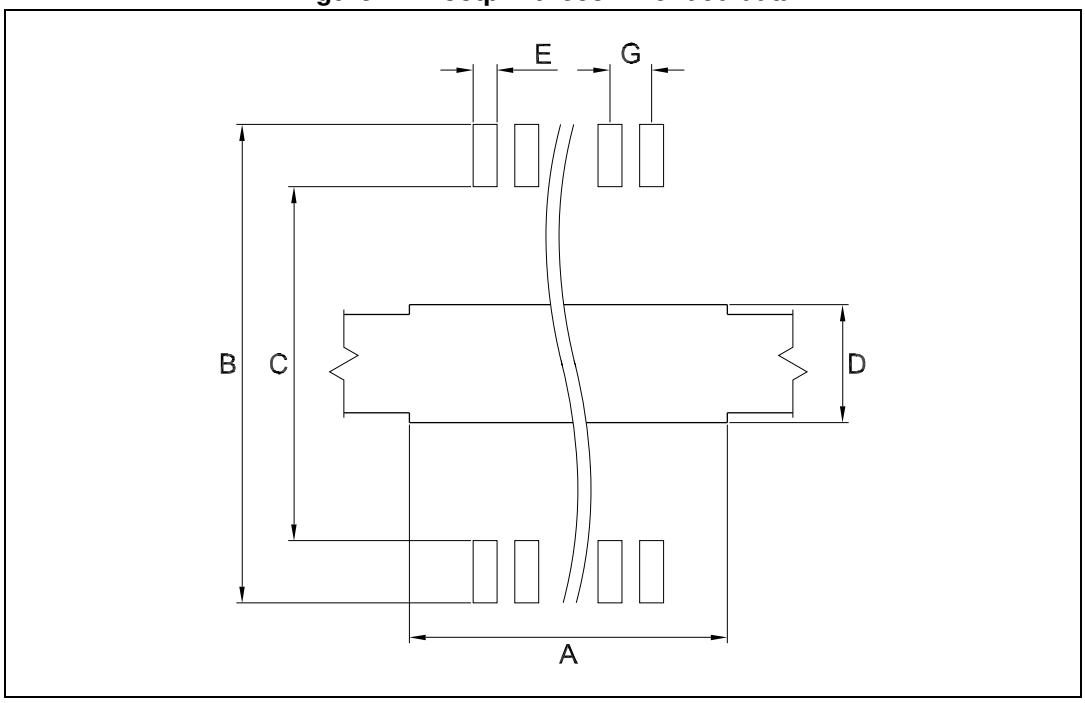


Table 11. Footprint data

Dim.	mm
A	9.5
B	14.7-15.0
C	12.5-12.7
D	6.3
E	0.42
G	0.65

7.2 Tube shipment information

Figure 13. Tube shipment information

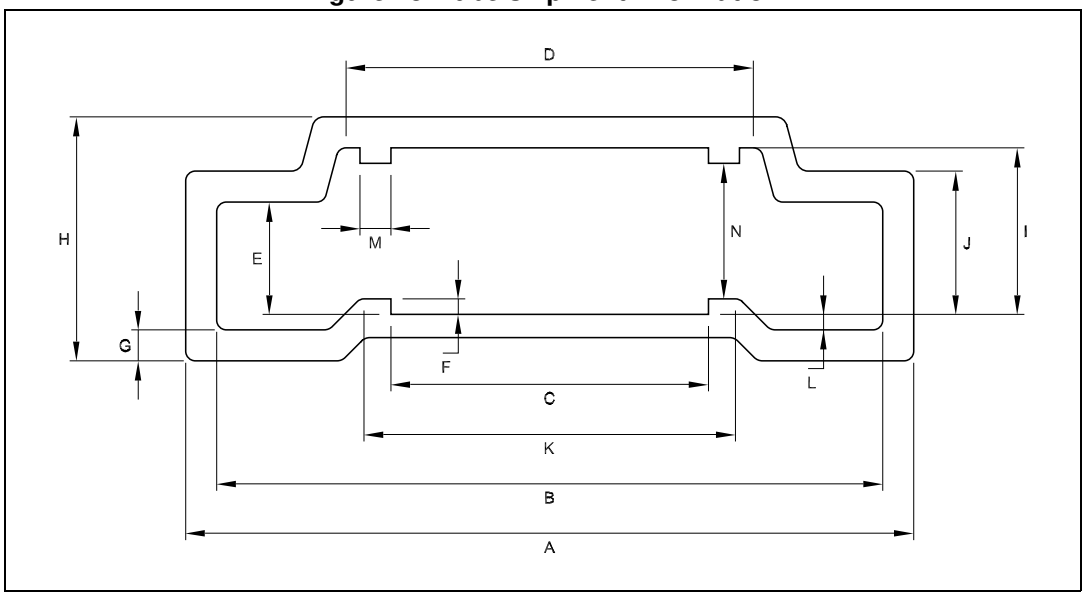


Table 12. Tube mechanical data

Dim.	mm
A	18.80
B	17.2 ±0.2
C	8.20 ±0.2
D	10.90 ±0.2
E	2.90 ±0.2
F	0.40
G	0.80
H	6.30
I	4.30 ±0.2
J	3.7 ±0.2
K	9.4
L	0.40
M	0.80
N	3.50 ±0.2

Base quantity 31 pcs

Bulk quantity 310 pcs

7.3 Tape and reel shipment information

Figure 14. Tape specifications

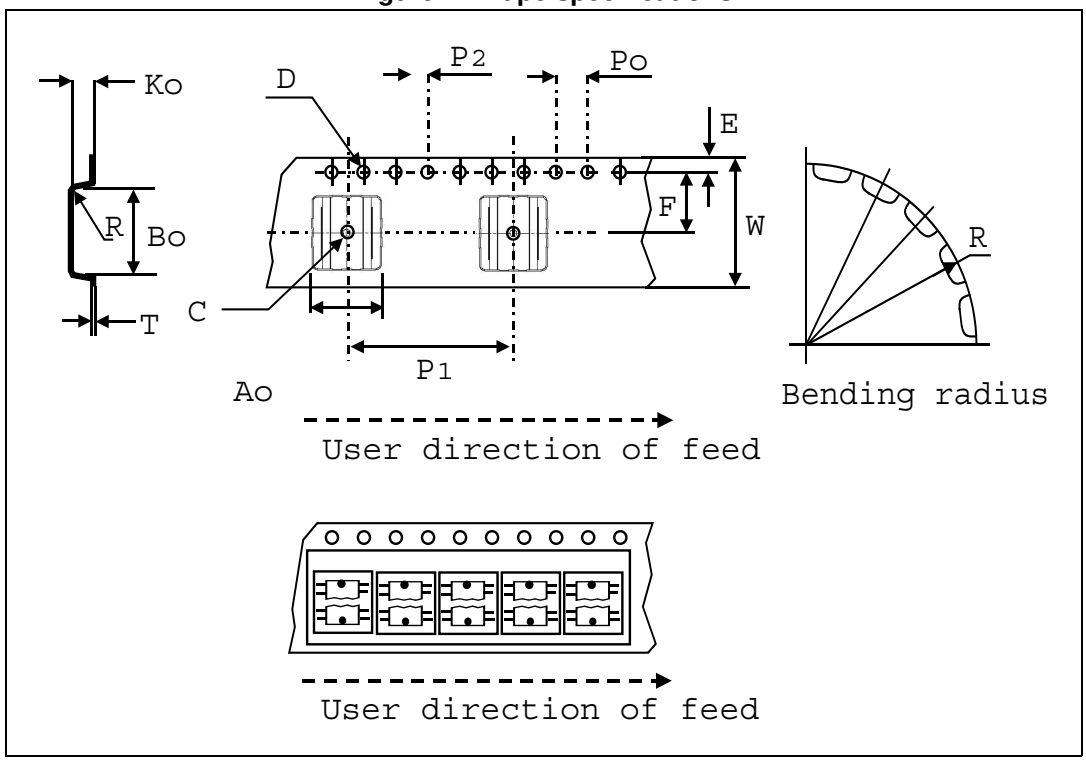


Table 13. Tape mechanical data

Dim.	mm
D	1.50 +0.1/0
E	1.75 ±0.1
Po	4.00 ±0.1
T max.	0.40
D1 min.	1.50
F	11.5 ±0.05
K max.	6.50
P2	2.00 ±0.1
R	50
W	24.00 ±0.30
P1	24.00
Ao, Bo, Ko	0.05 min. to 1.0 max.

Base quantity 600 pcs

Bulk quantity 600 pcs

Figure 15. Reel specifications

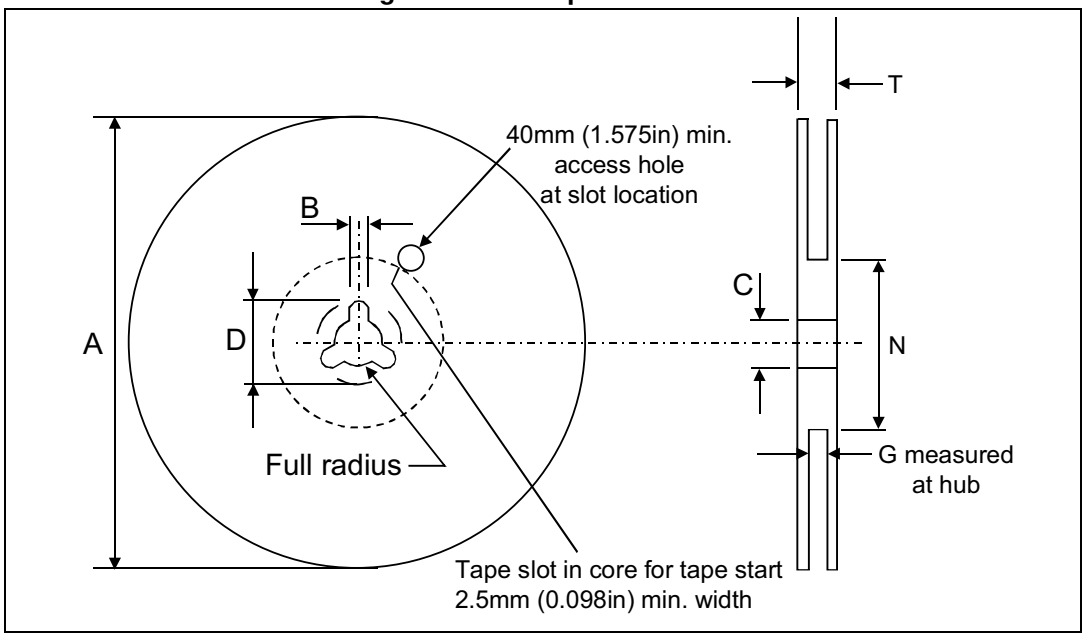


Table 14. Reel mechanical data

Dim.	mm
Tape size	24.0 ±0.30
A max.	330.0
B min.	1.5
C	13.0 ±0.20
D min.	20.2
N min.	60
G	24.4 +2/-0
T max.	30.4

8 Ordering information

Table 15. Order code

Order code	Package	Packaging
VN808-E	PowerSO-36	Tube
VN808TR-E	PowerSO-36	Tape and reel

9 Revision history

Table 16. Document revision history

Date	Revision	Changes
13-Sep-2005	1	Initial release
1-Mar-2007	2	Document reformatted
12-Mar-2007	3	Typo in *Figure 3.*
26-Mar-2007	4	Typo note *Table 2.*
07-Jul-2008	5	Added: *Section 6 on page 13*
04-Aug-2008	6	Added: *Figure 12: Footprint recommended data on page 16*
25-Aug-2009	7	Updated *Section 6: Reverse polarity protection*
24-Feb-2010	8	Updated *Section 7: Package mechanical data*
08-Nov-2012	9	Changed *Figure 5*. Minor text changes to improve the readability.
19-Nov-2012	10	Added maximum value to I_{INL} parameter in *Table 5*.
31-Jul-2013	11	Updated *Section 7.1: Footprint recommended data*.
18-Dec-2013	12	Replaced L_{MAX} parameter by EAS parameter in *Table 1*. Added T_J condition to *Table 3*. Updated *Section 6*.

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