



# STD20NF06L STD20NF06L-1

N-channel 60V - 0.032Ω - 24A - DPAK - IPAK  
STripFET™ II Power MOSFET

## General features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STD20NF06L	60V	<0.040Ω	24A
STD20NF06L-1	60V	<0.040Ω	24A

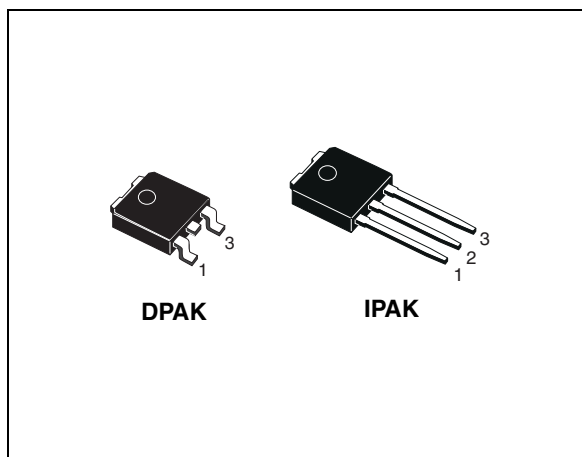
- Exceptional dv/dt capability
- 100% avalanche tested
- Application oriented characterization

## Description

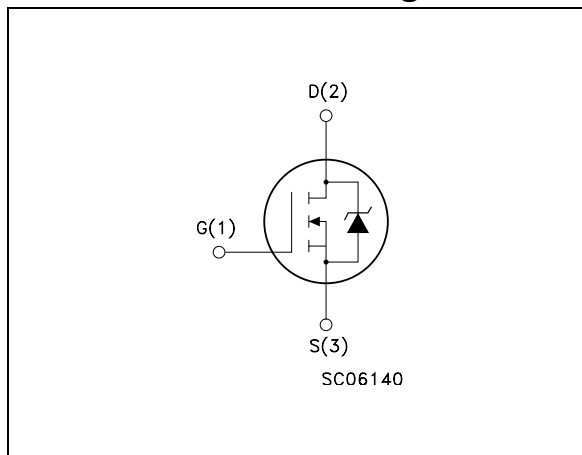
This Power MOSFET is the latest development of STMicroelectronics unique “Single Feature Size™” stripbased process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

## Applications

- Switching application



## Internal schematic diagram



## Order codes

Part number	Marking	Package	Packaging
STD20NF06L	D20NF06L	DPAK	Tape & reel
STD20NF06L-1	D20NF06L-1	IPAK	Tube

# Contents

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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	60	V
$V_{GS}$	Gate-source voltage	$\pm 18$	V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	24	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	17	A
$I_{DM}^{(1)}$	Drain current (pulsed)	96	A
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	60	W
	Derating factor	0.4	W/°C
$dv/dt^{(2)}$	Peak diode recovery voltage slope	10	V/ns
$E_{AS}^{(3)}$	Single pulse avalanche energy	225	mJ
$T_j$ $T_{stg}$	Operating junction temperature Storage temperature	-55 to 175	°C

1. Pulse width limited by safe operating area
2.  $I_{SD} \leq 24\text{A}$ ,  $di/dt \leq 300\text{A/ns}$ ,  $V_{DD} = 80\% V_{(BR)DSS}$
3. Starting  $T_j = 25^\circ\text{C}$ ,  $I_D = I_{AR}$ ,  $V_{DD} = 60\text{V}$

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case Max	2.5	°C/W
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb Max	50	°C/W
$T_l$	Maximum lead temperature for soldering purpose	275	°C

1. When mounted on 1 inch<sup>2</sup> FR-4 board, 2 oz of Cu

## 2 Electrical characteristics

(T<sub>case</sub> = 25°C unless otherwise specified)

**Table 3. On /off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source breakdown voltage	I <sub>D</sub> = 250μA, V <sub>GS</sub> = 0	60			V
I <sub>DSS</sub>	Zero gate voltage drain current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max rating, V <sub>DS</sub> = Max rating, T <sub>c</sub> = 125°C			1 10	μA μA
I <sub>GSS</sub>	Gate body leakage current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ±18V			±100	nA
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	1		2.5	V
R <sub>DS(on)</sub>	Static drain-source on resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 12A V <sub>GS</sub> = 5V, I <sub>D</sub> = 12A		0.032	0.040 0.050	Ω Ω

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub> <sup>(1)</sup>	Forward transconductance	V <sub>DS</sub> = 25V, I <sub>D</sub> = 12A		20		S
C <sub>iss</sub>	Input capacitance	V <sub>DS</sub> = 25V, f = 1MHz, V <sub>GS</sub> = 0		660		pF
C <sub>oss</sub>	Output capacitance			170		pF
C <sub>rss</sub>	Reverse transfer capacitance			70		pF
Q <sub>g</sub>	Total gate charge	V <sub>DD</sub> = 30V, I <sub>D</sub> = 20A		13		nC
Q <sub>gs</sub>	Gate-source charge	V <sub>GS</sub> = 10V		3.5		nC
Q <sub>gd</sub>	Gate-drain charge	(see Figure 12)		8		nC

1. Pulsed: pulse duration = 300μs, duty cycle 1.5%

**Table 5. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD}=30V, I_D=10A,$ $R_G=4.7\Omega, V_{GS}=10V$ <i>(see Figure 13)</i>		11		ns
$t_r$	Rise time			50		ns
$t_{d(off)}$	Turn-off delay time			20		ns
$t_f$	Fall time			12		ns

**Table 6. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current				24	A
$I_{SDM}$	Source-drain current (pulsed)				96	A
$V_{SD}^{(1)}$	Forward on voltage	$I_{SD}=20A, V_{GS}=0$			1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD}=20A, di/dt = 100A/\mu s,$ $V_{DD}=20V, T_j=150^\circ C$ <i>(see Figure 16)</i>		56		ns
$Q_{rr}$	Reverse recovery charge			108		nC
$I_{RRM}$	Reverse recovery current			4		A

1. Pulsed: pulse duration = 300 $\mu s$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

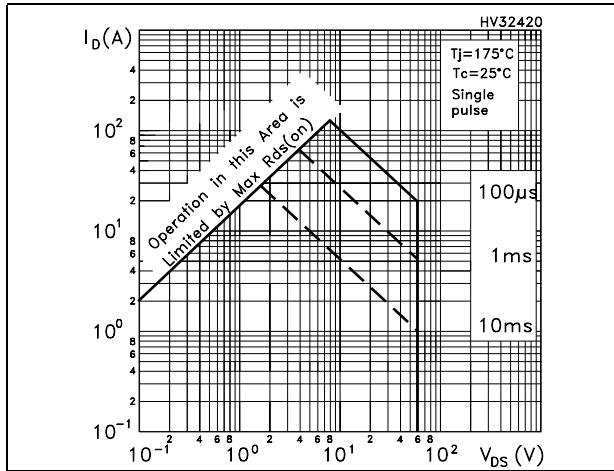


Figure 2. Thermal impedance

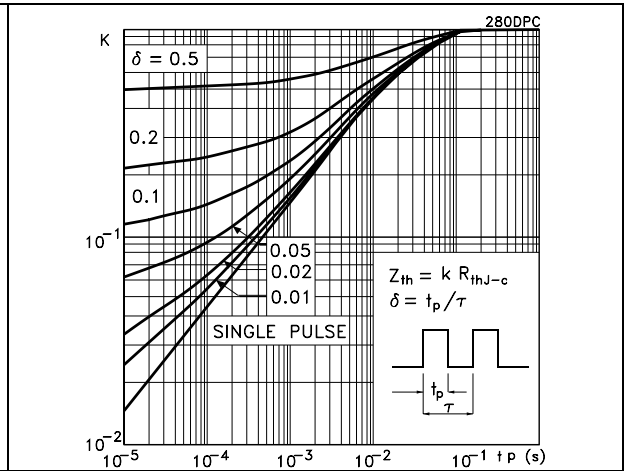


Figure 3. Output characteristics

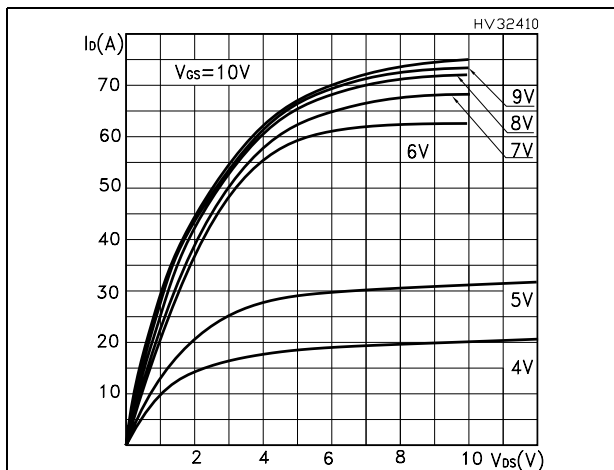


Figure 4. Transfer characteristics

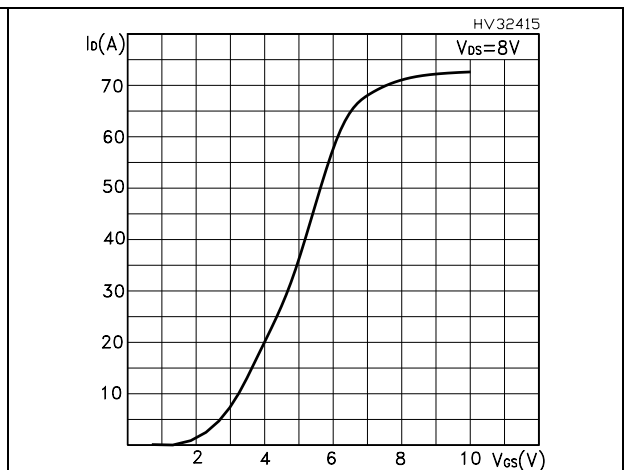


Figure 5. Normalized  $B_{V_{DS}}$  vs temperature

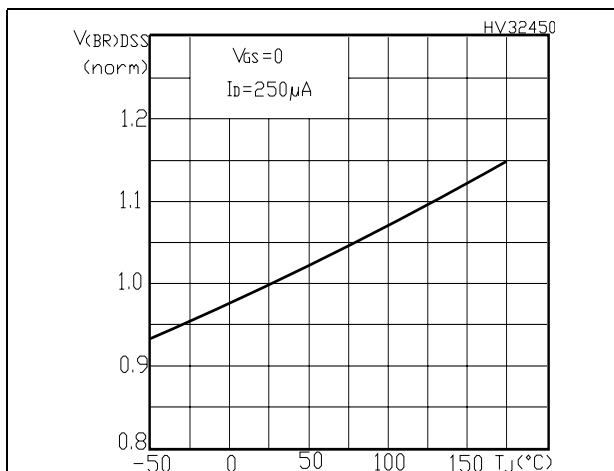


Figure 6. Static drain-source on resistance

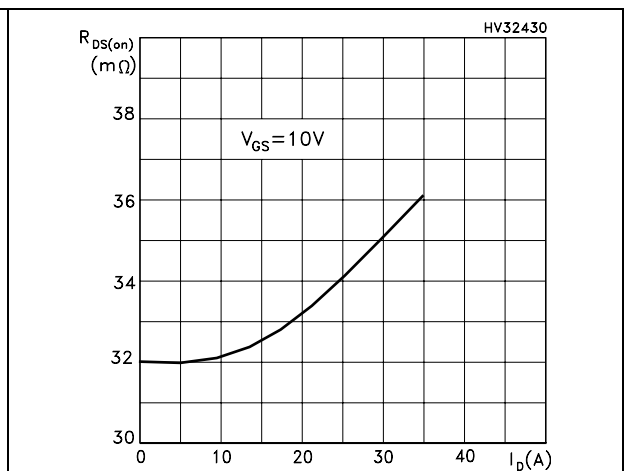


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

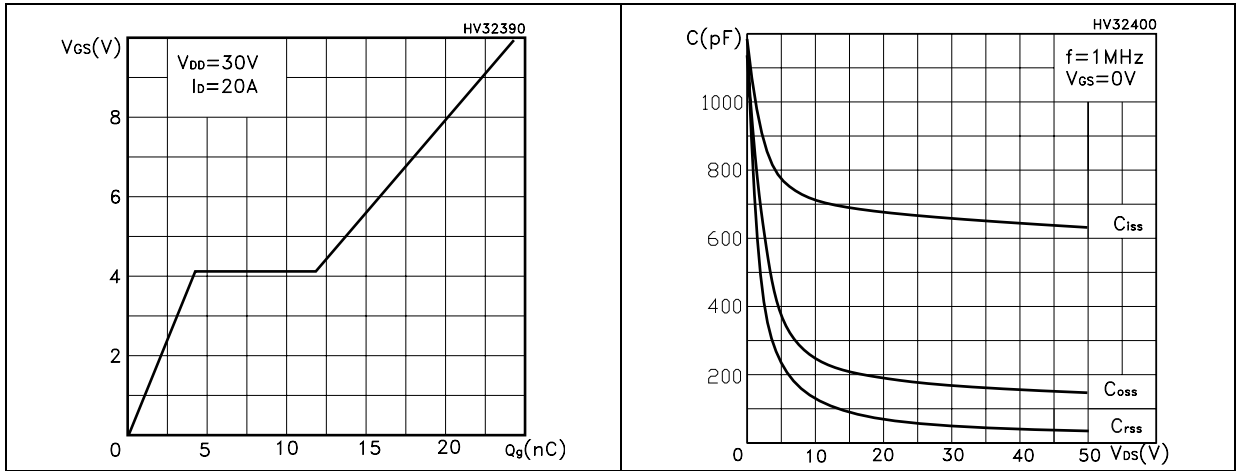
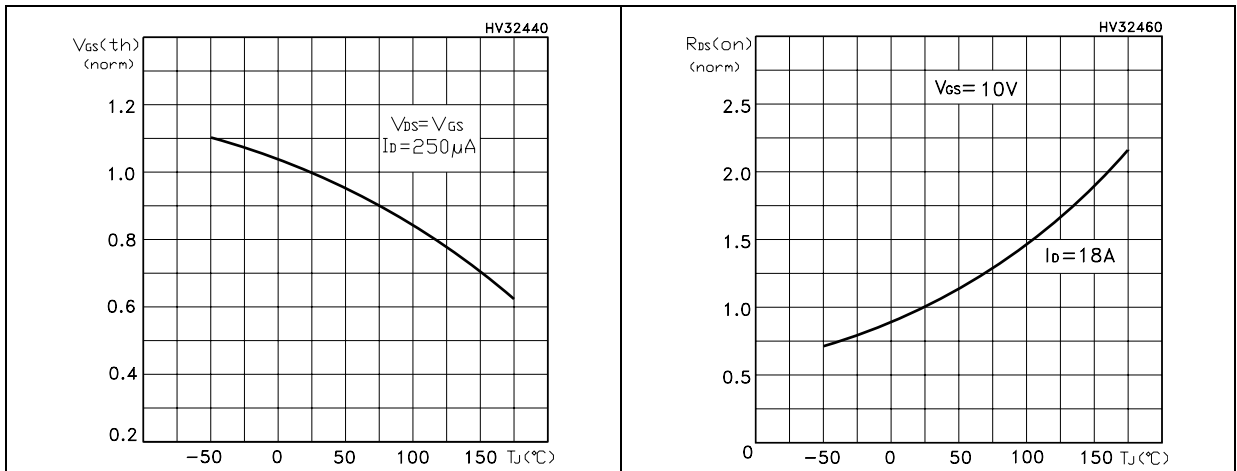


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature



### 3 Test circuits

Figure 11. Switching times test circuit for resistive load

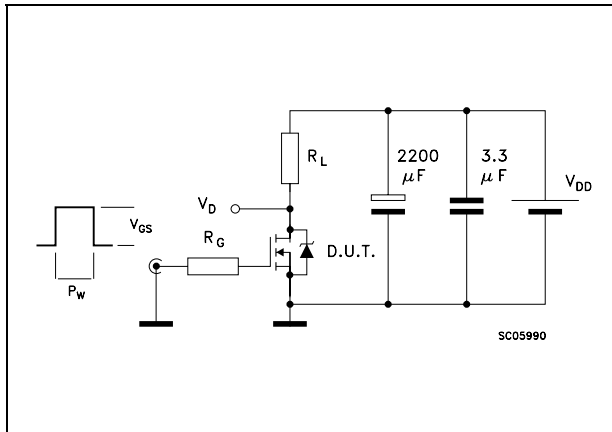


Figure 12. Gate charge test circuit

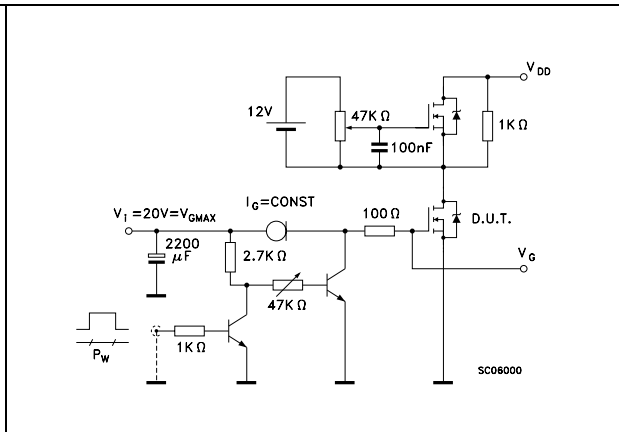


Figure 13. Test circuit for inductive load switching and diode recovery times

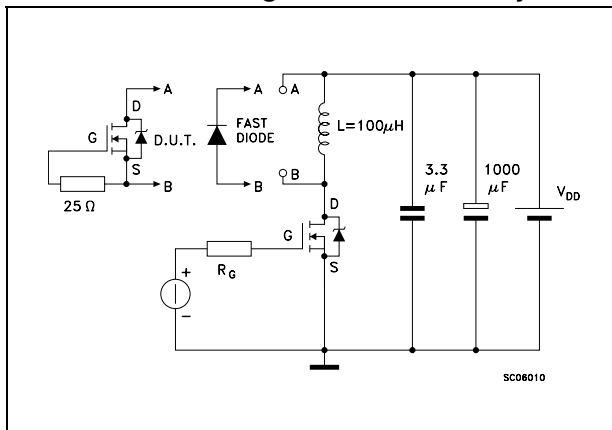


Figure 14. Unclamped inductive load test circuit

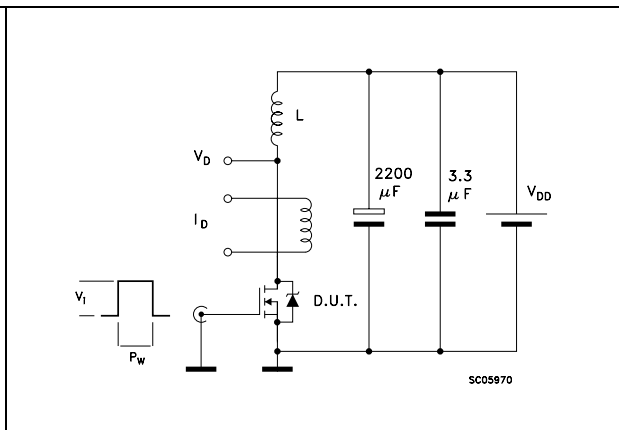


Figure 15. Unclamped inductive waveform

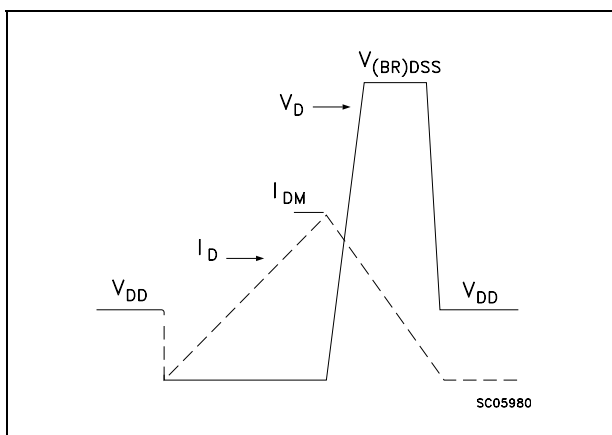
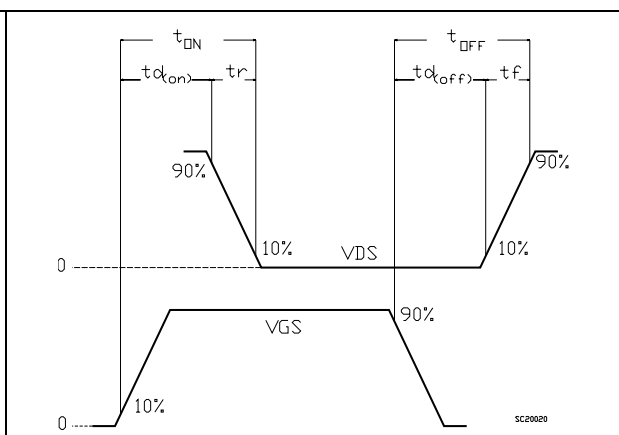


Figure 16. Switching time waveform



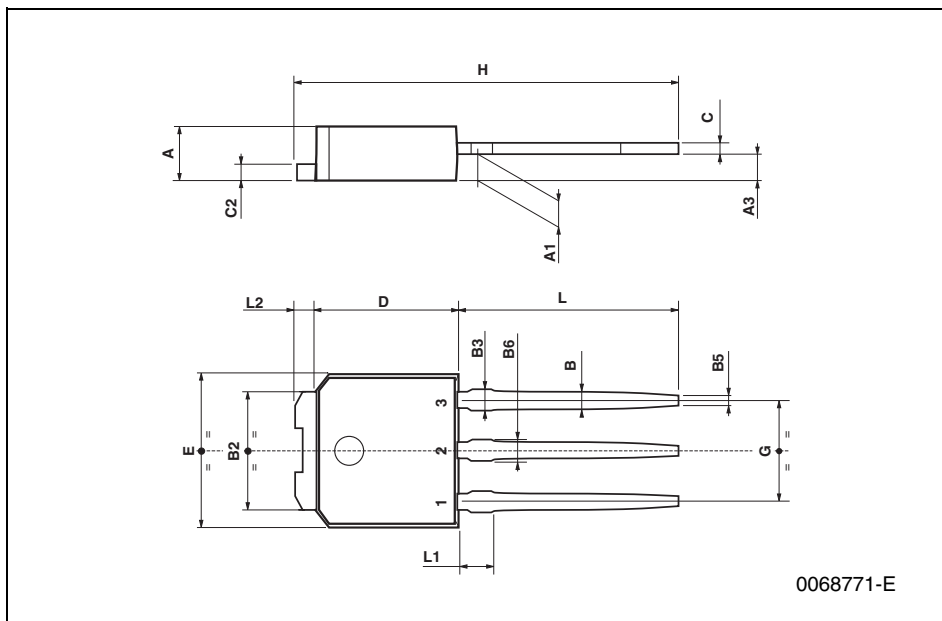


## 4 Package mechanical data

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)

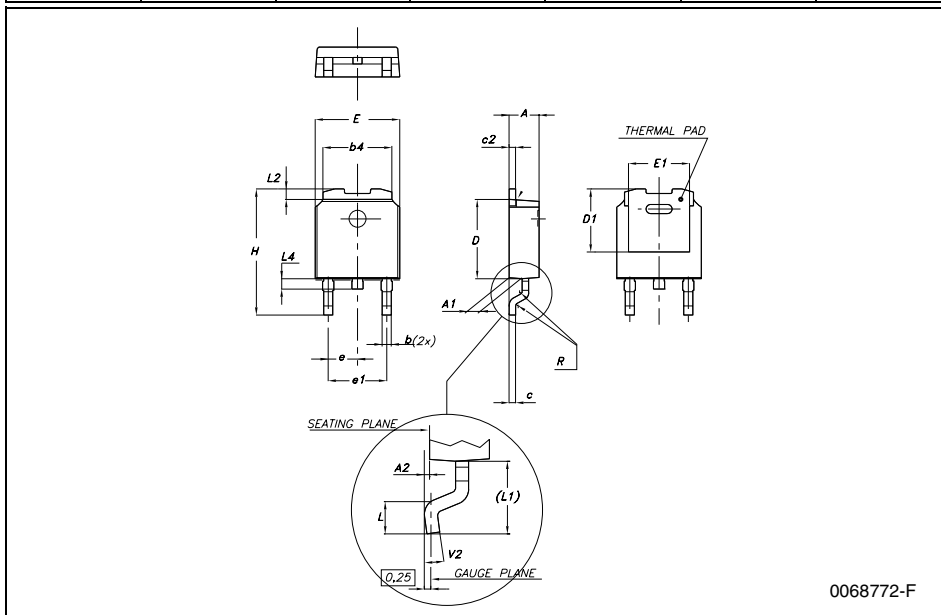
**TO-251 (IPAK) MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A3	0.7		1.3	0.027		0.051
B	0.64		0.9	0.025		0.031
B2	5.2		5.4	0.204		0.212
B3			0.85			0.033
B5		0.3			0.012	
B6			0.95			0.037
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	15.9		16.3	0.626		0.641
L	9		9.4	0.354		0.370
L1	0.8		1.2	0.031		0.047
L2		0.8	1		0.031	0.039



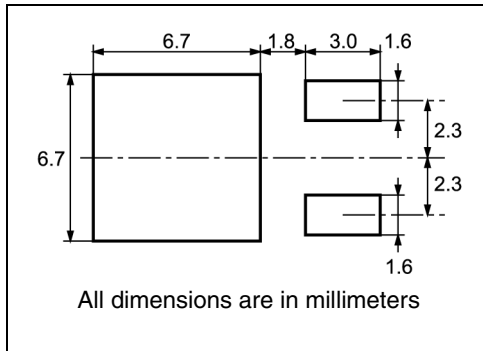
**DPAK MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
b4	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
D1		5.1			0.200	
E	6.4		6.6	0.252		0.260
E1		4.7			0.185	
e		2.28			0.090	
e1	4.4		4.6	0.173		0.181
H	9.35		10.1	0.368		0.397
L	1			0.039		
(L1)		2.8			0.110	
L2		0.8			0.031	
L4	0.6		1	0.023		0.039
R		0.2			0.008	
V2	0°		8°	0°		8°



# 5 Packing mechanical data

## DPAK FOOTPRINT



## TAPE AND REEL SHIPMENT

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	16.4	18.4	0.645	0.724
N	50		1.968	
T		22.4		0.881

BASE QTY	BULK QTY
2500	2500

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	6.8	7	0.267	0.275
B0	10.4	10.6	0.409	0.417
B1		12.1		0.476
D	1.5	1.6	0.059	0.063
D1	1.5		0.059	
E	1.65	1.85	0.065	0.073
F	7.4	7.6	0.291	0.299
K0	2.55	2.75	0.100	0.108
P0	3.9	4.1	0.153	0.161
P1	7.9	8.1	0.311	0.319
P2	1.9	2.1	0.075	0.082
R	40		1.574	
W	15.7	16.3	0.618	0.641

TOP COVER TAPE

User Direction of Feed

Center line of cavity

10 pitches cumulative tolerance on tape +/- 0.2 mm

Bending radius

For machine ref. only including draft and radii concentric around B0

## 6 Revision history

**Table 7. Revision history**

<b>Date</b>	<b>Revision</b>	<b>Changes</b>
19-Apr-2005	2	Added package IPAK
08-Jun-2006	3	Graphical updates
03-Jul-2006	4	New template, no content change

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