



# STD12NF06 STD12NF06T4

N-channel 60 V, 0.08Ω, 12 A, DPAK, IPAK  
STripFET™ II Power MOSFET

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STD12NF06	60V	<0.1Ω	12A
STD12NF06T4	60V	<0.1Ω	12A

- Exceptional dv/dt capability
- Low gate charge

## Applications

- Switching application

## Description

This Power MOSFET is the latest development of STMicroelectronics unique "single feature size" strip-based 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.

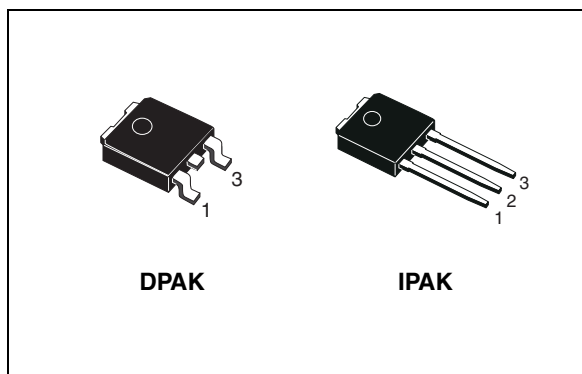


Figure 1. Internal schematic diagram

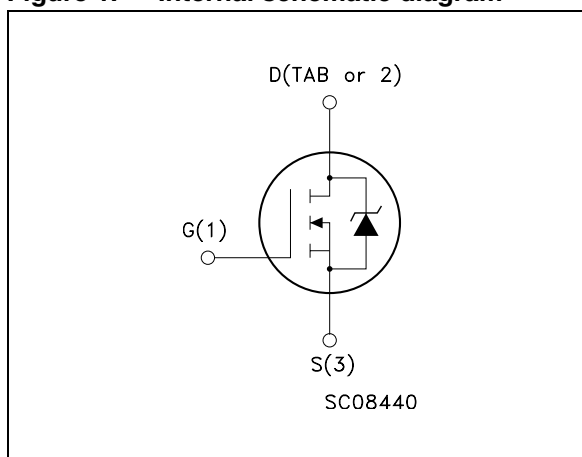


Table 1. Device summary

Order codes	Marking	Package	Packaging
STD12NF06T4T4	D12NF06	DPAK	Tape and reel
STD12NF06T4-1	D12NF06	IPAK	Tube

# Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>3</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>4</b>
2.1	Electrical characteristics (curves) .....	6
<b>3</b>	<b>Test circuits</b> .....	<b>8</b>
<b>4</b>	<b>Package mechanical data</b> .....	<b>9</b>
<b>5</b>	<b>Packaging mechanical data</b> .....	<b>12</b>
<b>6</b>	<b>Revision history</b> .....	<b>13</b>

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	60	V
$V_{DGR}$	Drain-gate voltage ( $R_{GS} = 20K\Omega$ )	60	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25^\circ C$	12	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ C$	8.5	A
$I_{DM}^{(1)}$	Drain current (pulsed)	48	A
$P_{TOT}$	Total dissipation at $T_C = 25^\circ C$	30	W
	Derating factor	0.2	W/ $^\circ C$
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
$E_{AS}^{(3)}$	Single pulse avalanche energy	140	mJ
$T_{stg}$	Storage temperature	-55 to 175	$^\circ C$
$T_J$	Max. operating junction temperature		

1. Pulse width limited by safe operating area
2.  $I_{SD} \leq 12$  A,  $di/dt \leq 200$  A/ $\mu s$ ,  $V_{DS} \leq V_{(BR)DSS}$ ,  $T_J \leq T_{JMAX}$
3. Starting  $T_J = 25^\circ C$ ,  $I_D = 6$  A,  $V_{DD} = 30$  V

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance junction-case Max	5	$^\circ C/W$
$R_{thJA}$	Thermal resistance junction-ambient Max	100	$^\circ C/W$
$T_I$	Maximum lead temperature for soldering purpose	275	$^\circ C$

## 2 Electrical characteristics

( $T_{CASE}=25^{\circ}C$  unless otherwise specified)

**Table 4. On /off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 25mA, V_{GS} = 0$	60			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating}, T_C = 125^{\circ}C$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20V$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10V, I_D = 6A$		0.08	0.1	W

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15V, I_D = 6A$	-	5		S
$C_{iss}$	Input capacitance	$V_{DS} = 25V, f = 1 \text{ MHz},$ $V_{GS} = 0$	-	315		pF
$C_{oss}$	Output capacitance			70		pF
$C_{rss}$	Reverse transfer capacitance			30		pF
$Q_g$	Total gate charge	$V_{DD} = 48V, I_D = 12A$ $V_{GS} = 10V$	-	10	12	nC
$Q_{gs}$	Gate-source charge			3.0		nC
$Q_{gd}$	Gate-drain charge			3.5		nC

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

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30V, I_D = 6A,$ $R_G = 4.7\Omega, V_{GS} = 10V$ <i>Figure 14 on page 8</i>	-	7		ns
$t_r$	Rise time			18		ns
$t_{d(off)}$	Turn-off delay time			17		ns
$t_f$	Fall time			6		ns

**Table 7. Source drain diode**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$I_{SD}$	Source-drain current		-		12	A
$I_{SDM}$	Source-drain current (pulsed)		-		48	A
$V_{SD}^{(1)}$	Forward on voltage	$I_{SD} = 12A, V_{GS} = 0$	-		1.3	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 12A,$ $di/dt = 100A/\mu s,$ $V_{DD} = 30V, T_J = 150^\circ C$ <a href="#">Figure 16 on page 8</a>	-	50		ns
$Q_{rr}$	Reverse recovery charge			65		nC
$I_{RRM}$	Reverse recovery current			3.5		A

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

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

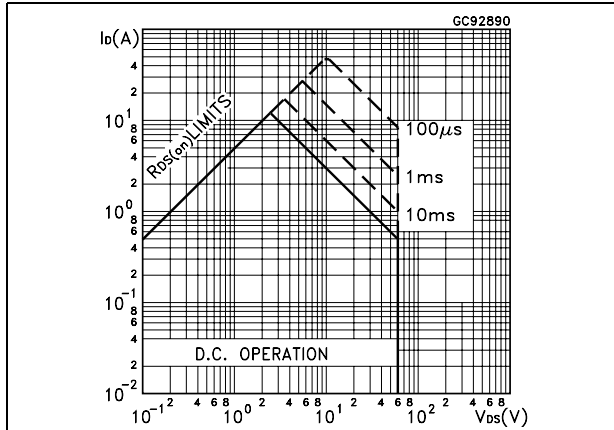


Figure 3. Thermal impedance

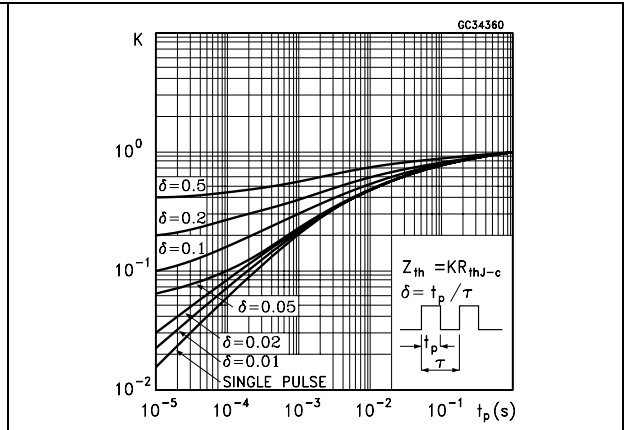


Figure 4. Output characteristics

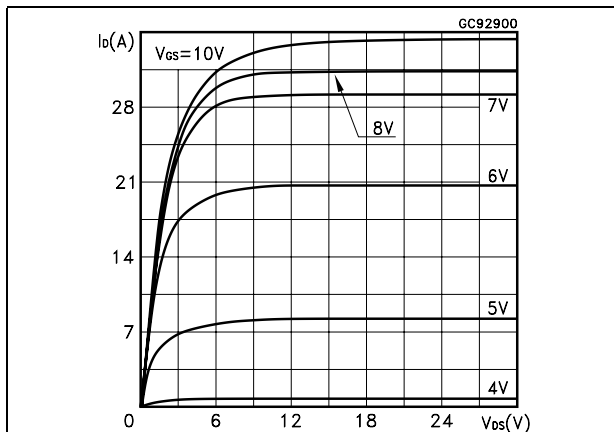


Figure 5. Transfer characteristics

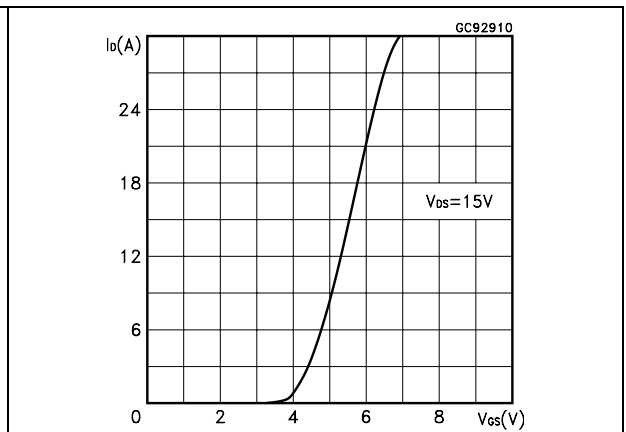


Figure 6. Transconductance

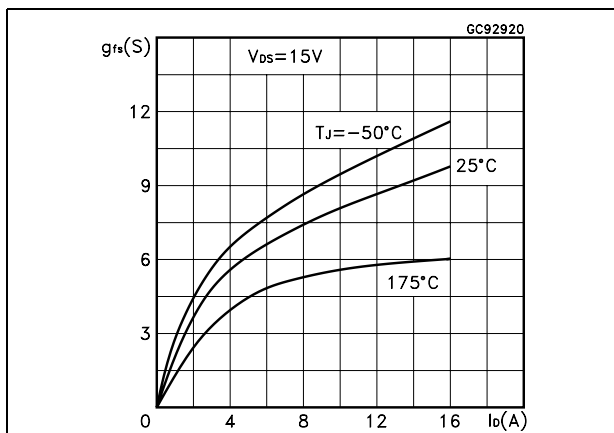
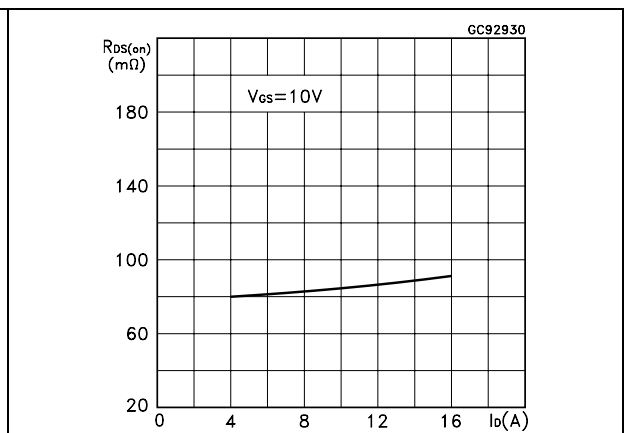
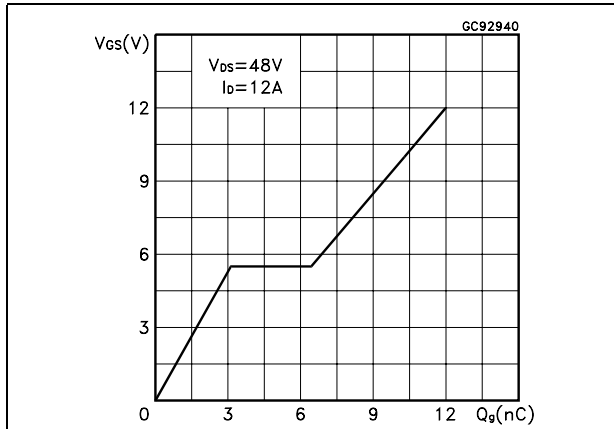


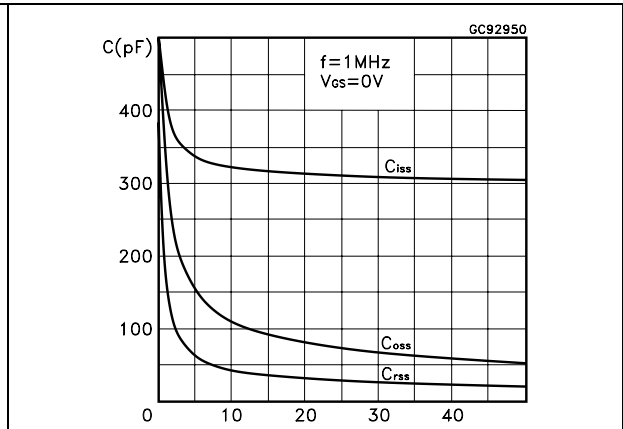
Figure 7. Static drain-source on resistance



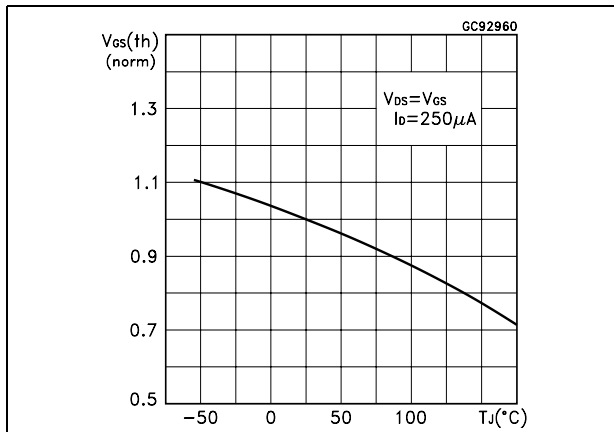
**Figure 8. Gate charge vs. gate-source voltage**



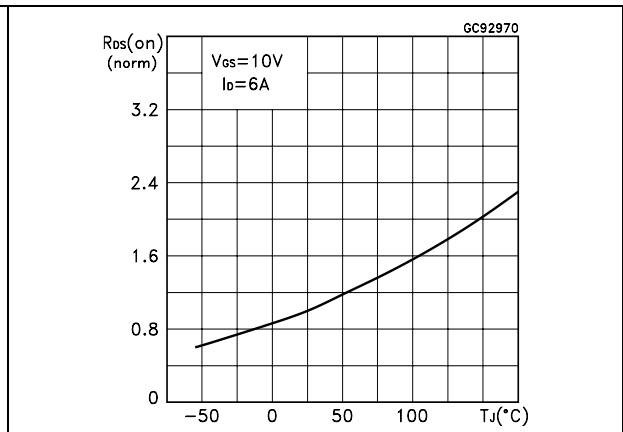
**Figure 9. Capacitance variations**



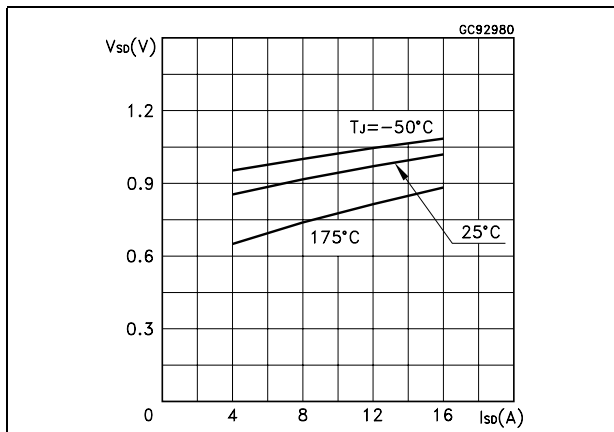
**Figure 10. Normalized gate threshold voltage vs. temperature**



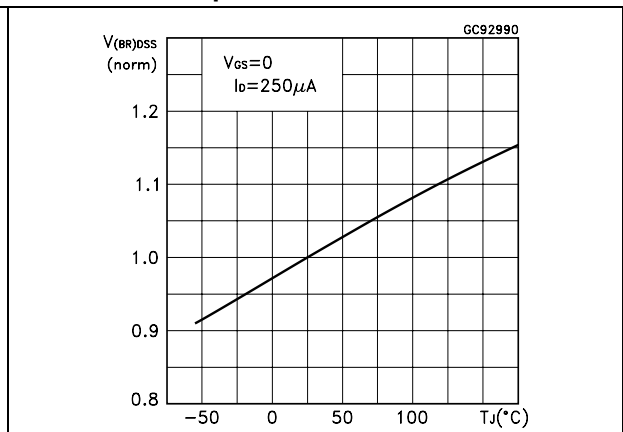
**Figure 11. Normalized on resistance vs. temperature**



**Figure 12. Source-drain diode forward characteristics**



**Figure 13. Normalized breakdown voltage vs. temperature**



### 3 Test circuits

Figure 14. Switching times test circuit for resistive load

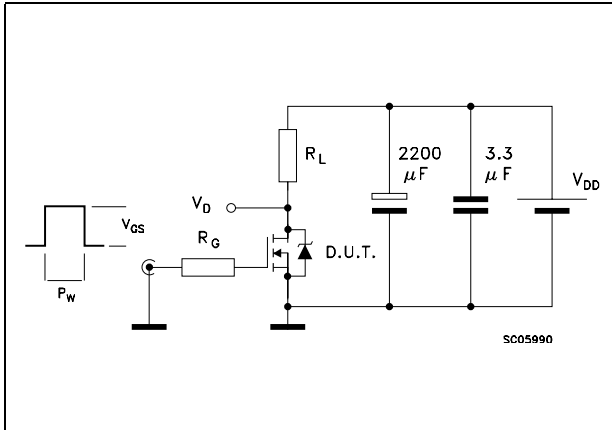


Figure 15. Gate charge test circuit

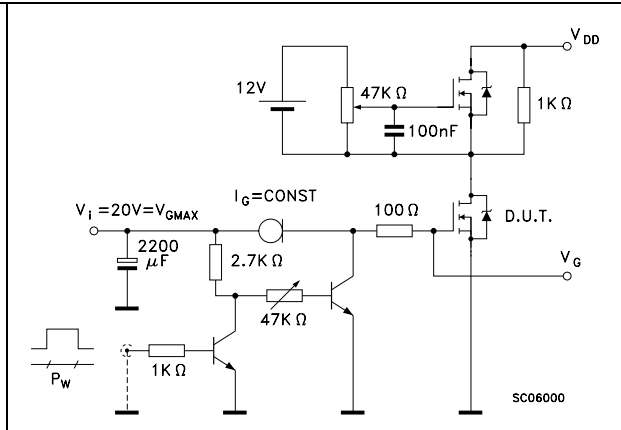


Figure 16. Test circuit for inductive load switching and diode recovery times

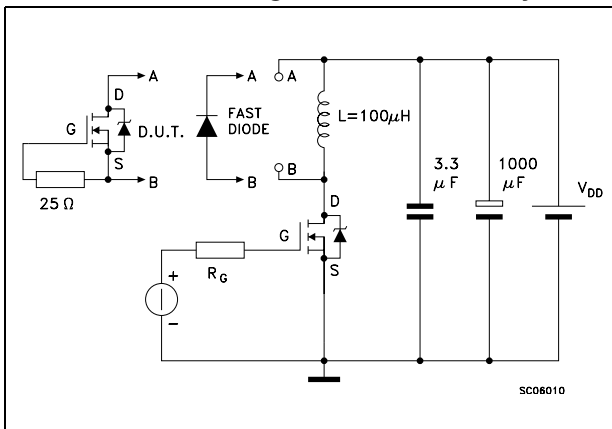


Figure 17. Unclamped inductive load test circuit

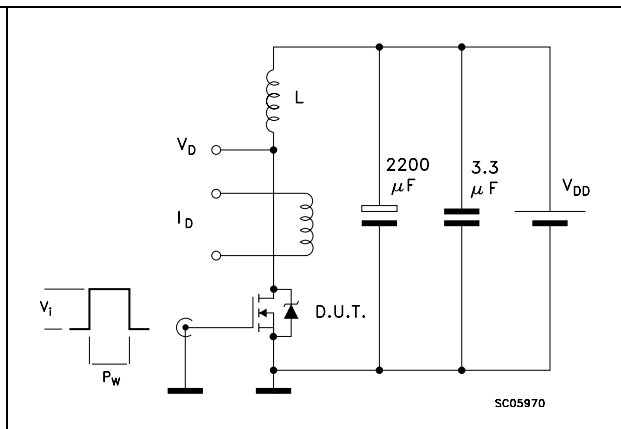
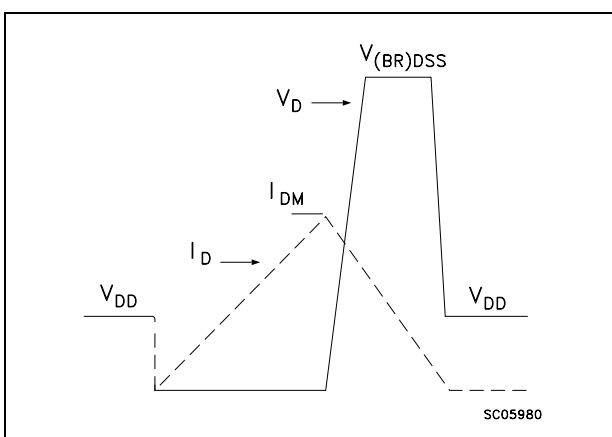


Figure 18. Unclamped inductive waveform



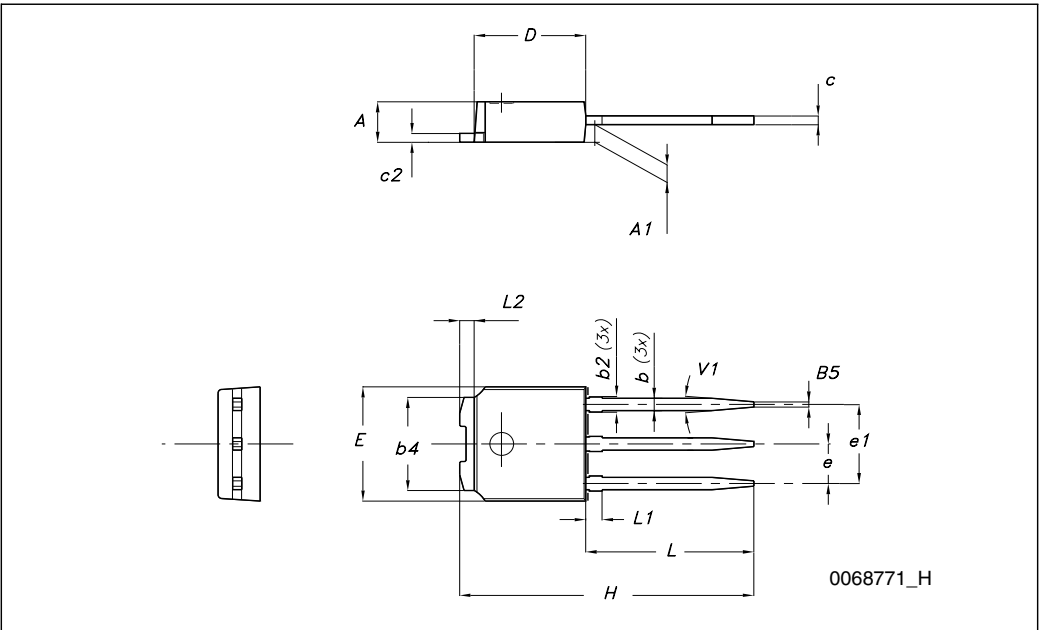


## 4 Package mechanical data

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](http://www.st.com). ECOPACK is an ST trademark.

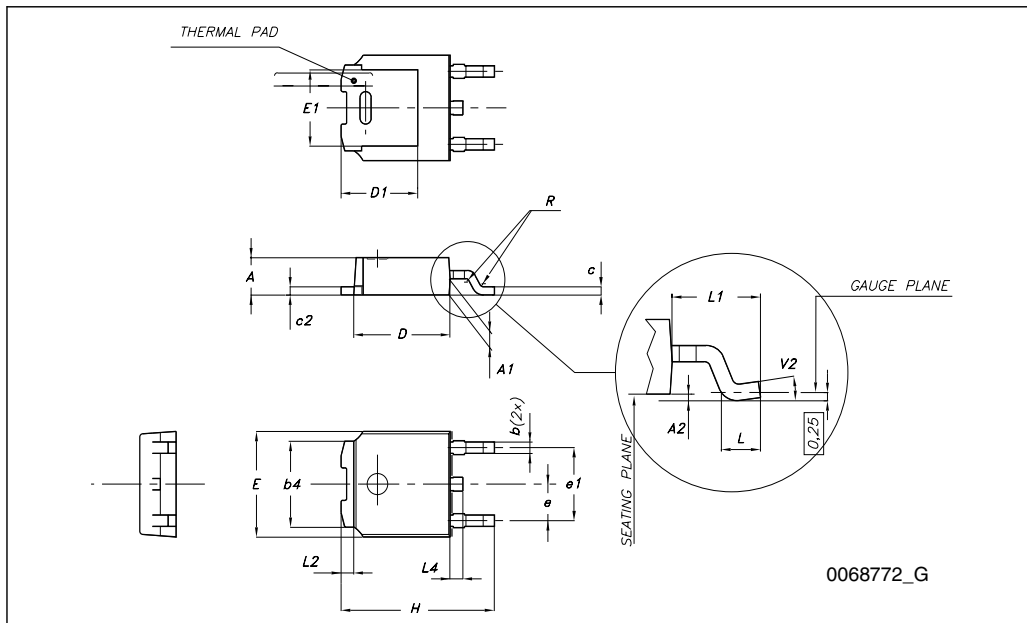
**TO-251 (IPAK) mechanical data**

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
(L1)	0.80		1.20
L2		0.80	
V1		10°	



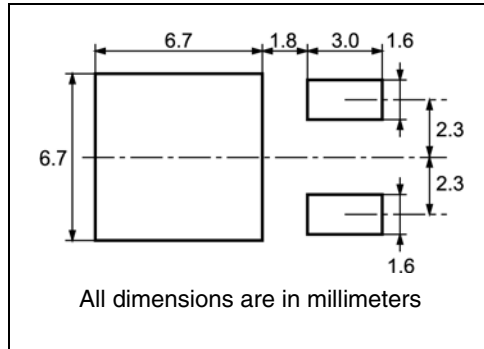
**TO-252 (DPAK) mechanical data**

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0°		8°



# 5 Packaging mechanical data

## DPAK FOOTPRINT



## TAPE AND REEL SHIPMENT

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

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

BASE QTY	BULK QTY
2500	2500

## 6 Revision history

**Table 8. Document revision history**

Date	Revision	Changes
09-Sep-2004	3	Complete document
07-Aug-2006	4	The document has been reformatted
19-Feb-2007	5	Typo mistake on page 1
15-Apr-2009	6	<a href="#">Table 1: Device summary</a> has been updated Mechanical data updated
26-Nov-2009	7	Updated $Q_{rr}$ in <a href="#">Table 7: Source drain diode</a> .

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