



STD12NF06-1 STD12NF06

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

General features

Type	V _{DSSS}	R _{DS(on)}	I _D
STD12NF06	60V	<0.1Ω	12A
STD12NF06-1	60V	<0.1Ω	12A

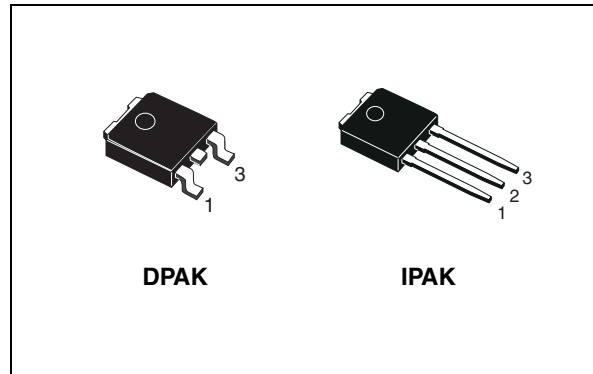
- Exceptional dv/dt capability
- Low gate charge

Description

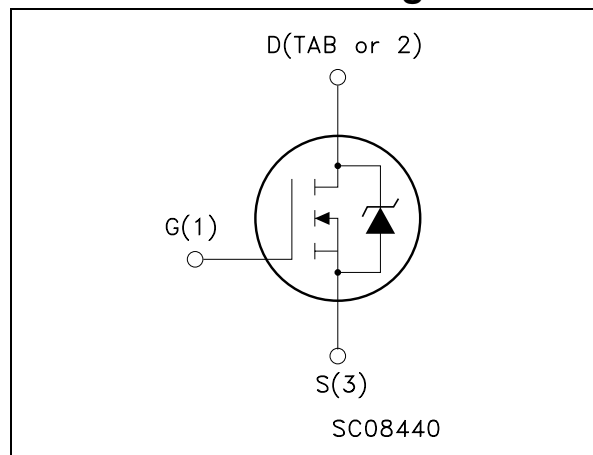
This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing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

Applications

- Switching application



Internal schematic diagram



Order codes

Part number	Marking	Package	Packaging
STD12NF06T4	D12NF06	DPAK	Tape & reel
STD12NF06-1	D12NF06	IPAK	Tube

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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_{DGR}	Drain-gate voltage ($R_{GS} = 20K\Omega$)	60	V
V_{GS}	Gate-source voltage	± 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. $I_{SD} \leq 12A$, $di/dt \leq 200A/\mu s$, $V_{DS} \leq V_{(BR)DSS}$, $T_J \leq T_{JMAX}$

3. Starting $T_J = 25^\circ C$, $I_D = 6A$, $V_{DD} = 30V$

Table 2. 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

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

Table 3. On /off states

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

Table 4. Dynamic

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

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

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30\text{V}$, $I_D = 6\text{A}$, $R_G = 4.7\Omega$, $V_{GS} = 10\text{V}$ <i>Figure 13 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 6. 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} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 12A,$ $di/dt = 100A/\mu s,$ $V_{DD} = 30V, T_J = 150^\circ C$ Figure 15 on page 8		50 65 3.5		ns μC A

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

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

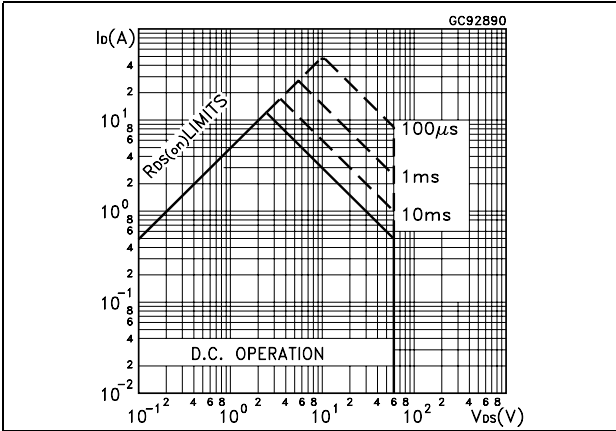


Figure 2. Thermal impedance

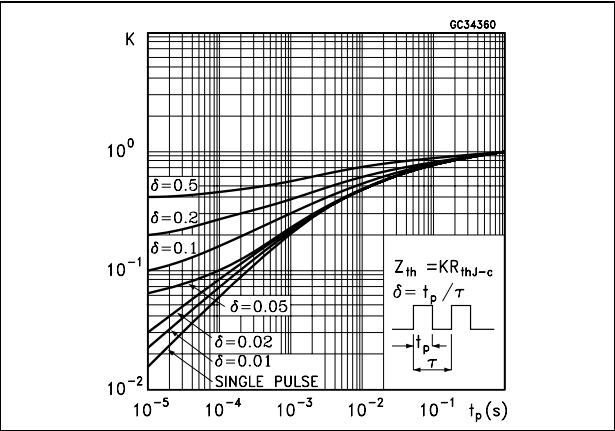


Figure 3. Output characteristics

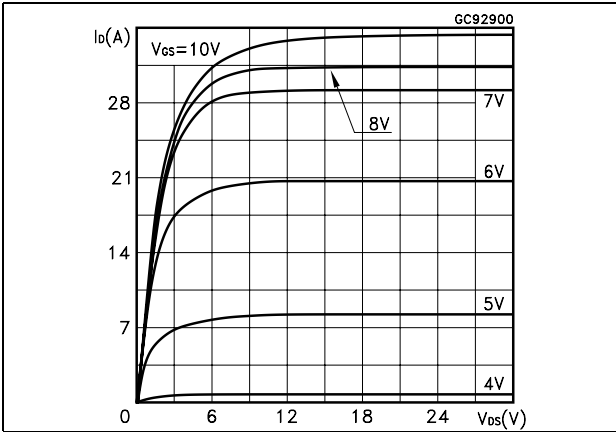


Figure 4. Transfer characteristics

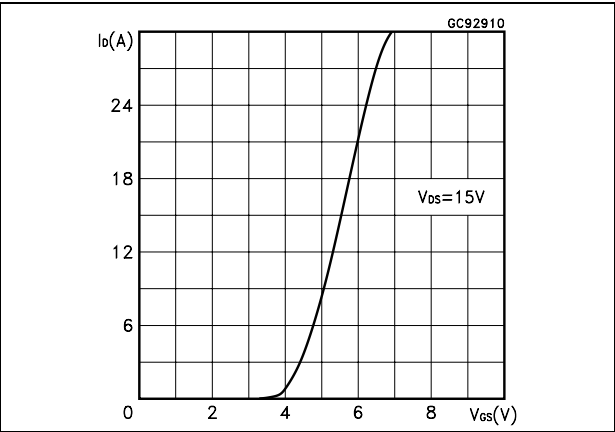


Figure 5. Transconductance

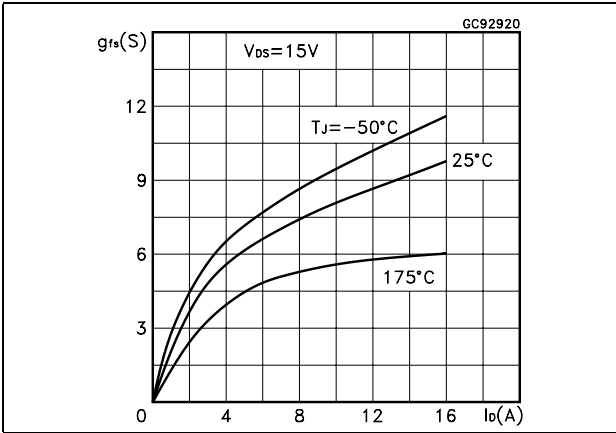


Figure 6. Static drain-source on resistance

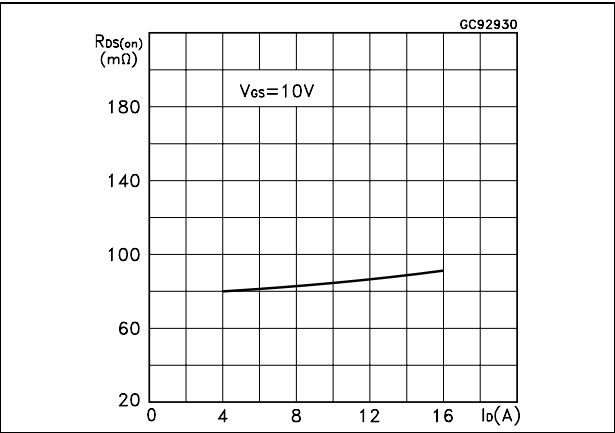


Figure 7. Gate charge vs. gate-source voltage Figure 8. Capacitance variations

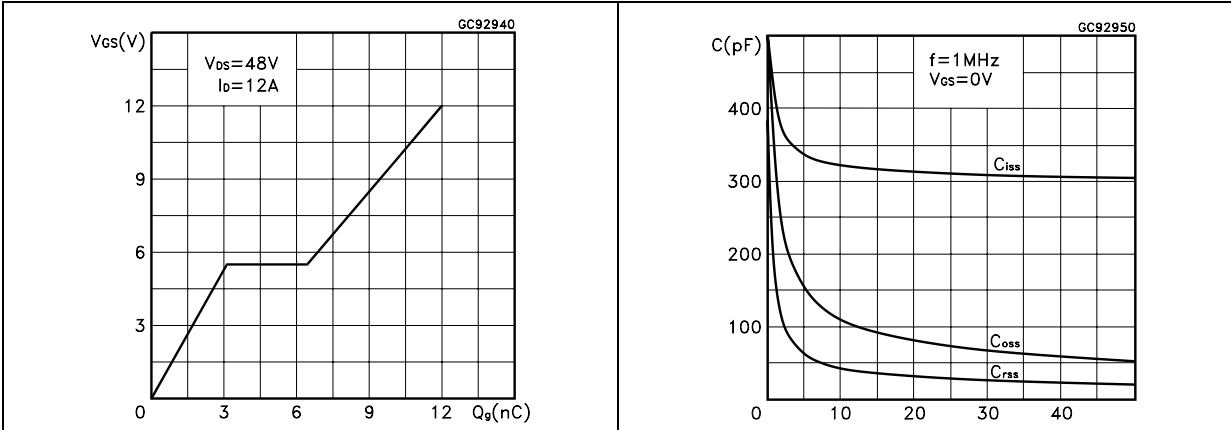


Figure 9. Normalized gate threshold voltage vs. temperature Figure 10. Normalized on resistance vs. temperature

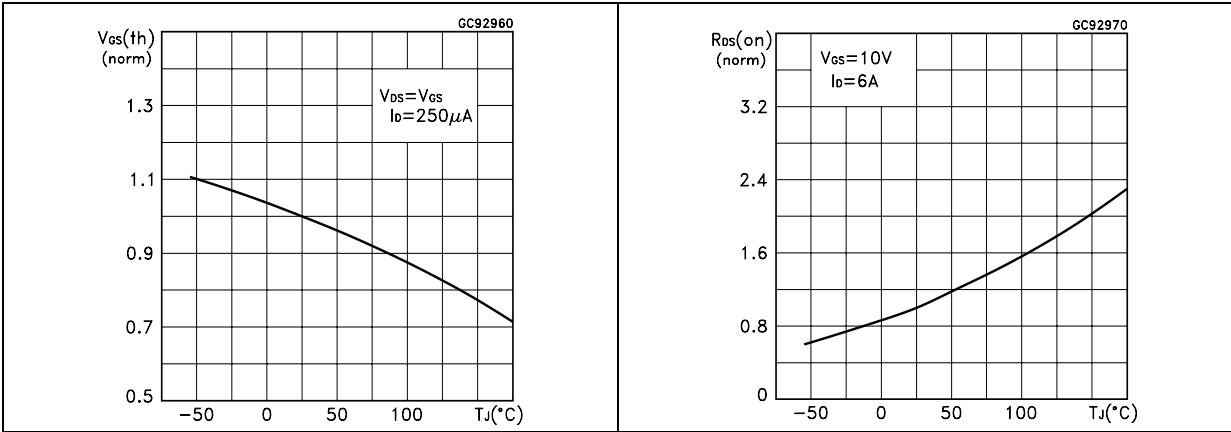
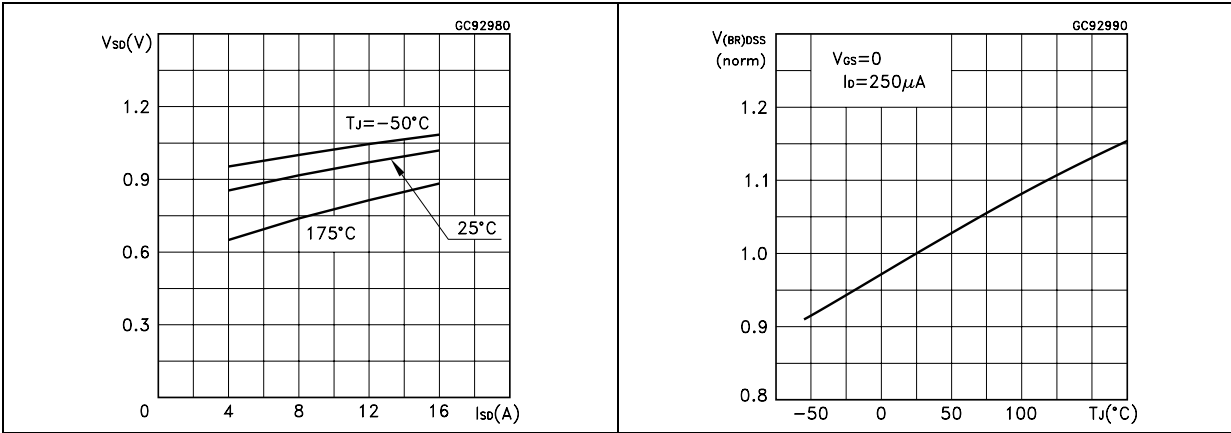


Figure 11. Source-drain diode forward characteristics Figure 12. Normalized breakdown voltage vs. temperature



3 Test circuit

Figure 13. Switching times test circuit for resistive load

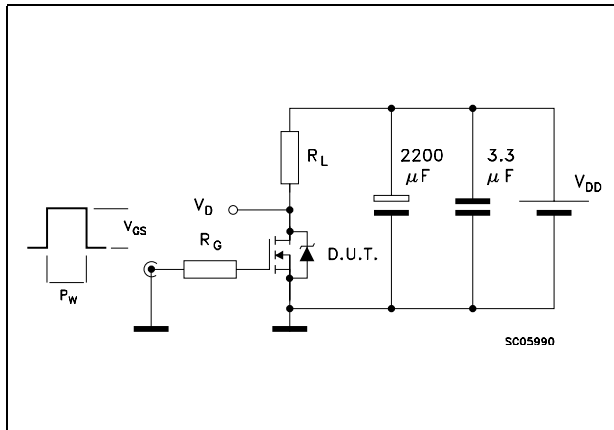


Figure 14. Gate charge test circuit

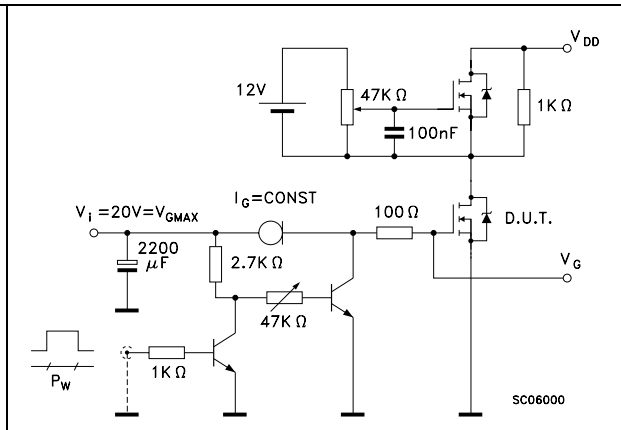


Figure 15. Test circuit for inductive load switching and diode recovery times

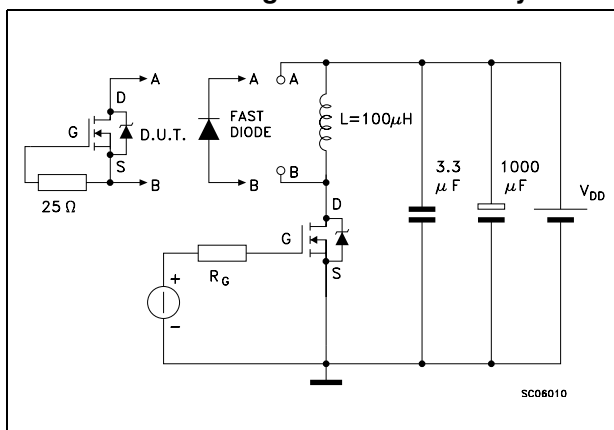


Figure 16. Unclamped Inductive load test circuit

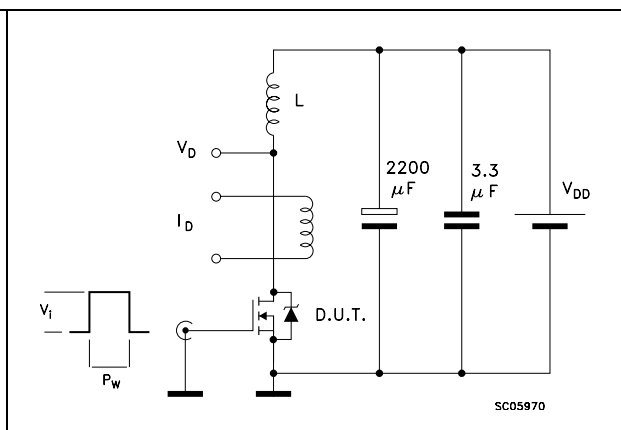
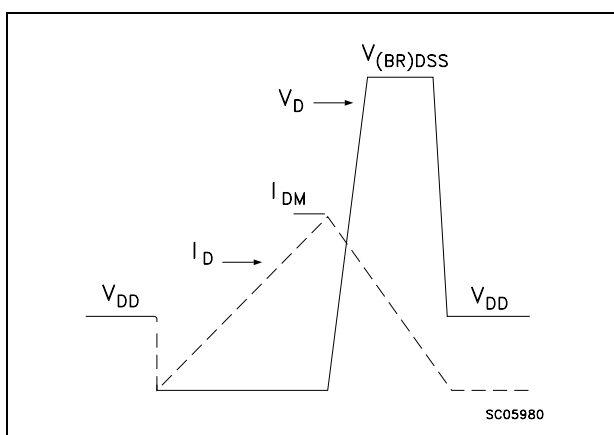


Figure 17. Unclamped inductive waveform

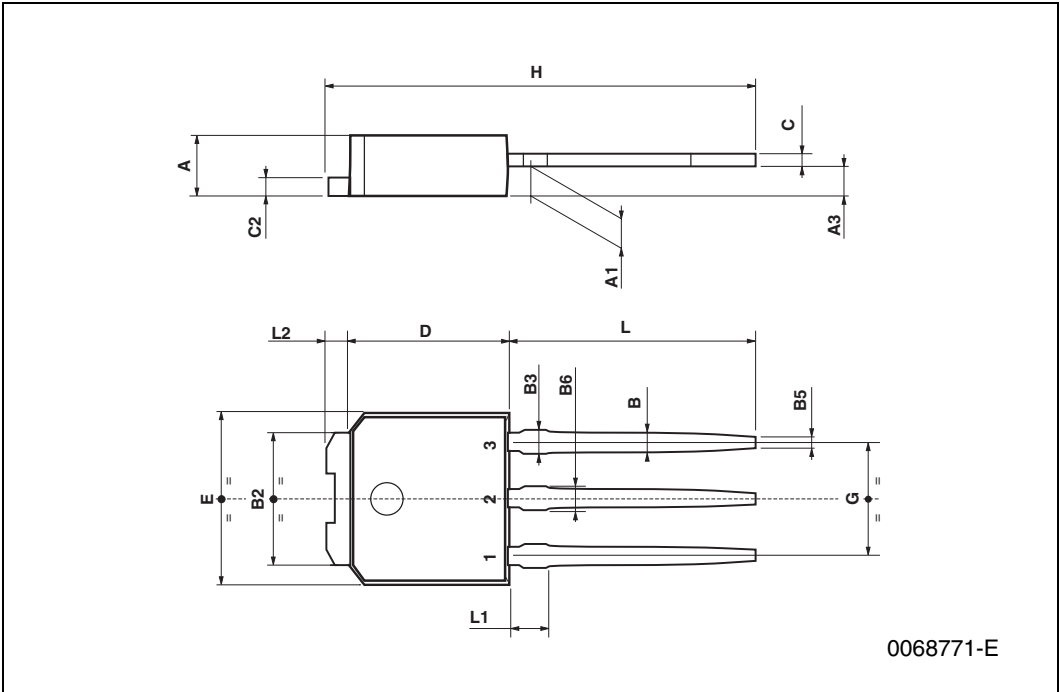


4 Package mechanical data

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

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

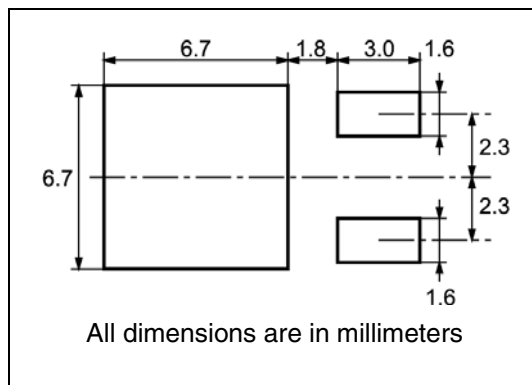


DPAK MECHANICAL DATA						
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
b4	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
D1		5.1			0.200	
E	6.4		6.6	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°

The mechanical drawing illustrates the DPAK package geometry. The top view shows dimensions E (width), b4 (lead width), and L2 (lead length). The side view shows dimensions A (height), c2 (lead height), D (body height), and L4 (lead length). A detail view of the lead shows dimensions A1 (lead thickness), b(2x) (lead width), e (lead pitch), e1 (lead width), and L (lead length). Another detail view shows the thermal pad with dimensions E1 (pad width) and D1 (pad height). The bottom view shows the seating plane and gauge plane with dimensions A2 (lead thickness), L (lead length), and V2 (lead angle). A dimension of 0.25 is also indicated for the lead thickness.

0068772-F

DPAK FOOTPRINT



40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start

25mm min. width

G measured at hub

Reel Mechanical Data Table:

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

Tape Mechanical Data Table:

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: 2500, Bulk Qty: 2500

Technical drawing of a reel tape showing top and side views with dimensions A, B, C, D, G, N, T. Labels include '40 mm min. Access hole at slot location', 'Full radius', 'Tape slot in core for tape start', '25mm min. width', and 'G measured at hub'.

Technical drawing of a reel tape showing top and side views with dimensions A0, B0, B1, D, D1, E, F, K0, P0, P1, P2, R, T, W. Labels include 'TOP COVER TAPE', 'User Direction of Feed', 'Center line of cavity', 'Bending radius', and 'FEED DIRECTION'.

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

10 pitches cumulative tolerance on tape ± 0.2 mm

Center line of cavity

User Direction of Feed

FEED DIRECTION

Bending radius

R min.

6 Revision history

Table 7. 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

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