STB160N75F3
STP160N75F3 - STW160N75F3

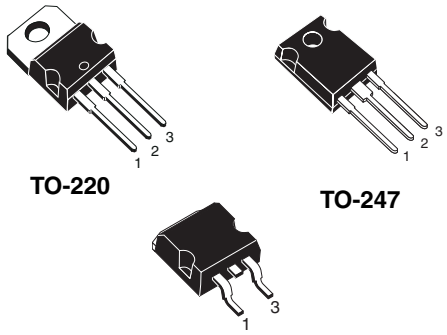
N-channel 75V - 3.5mΩ - 120A - TO-220 - TO-247 - D²PAK
STripFET™ Power MOSFET

Features

Type	V_{DSS}	$R_{DS(on)}$ (max.)	I_D
STB160N75F3	75V	3.7 mΩ	120 A(1)
STP160N75F3	75V	4 mΩ	120 A(1)
STW160N75F3	75V	4 mΩ	120 A(1)

1. Current limited by package

- Ultra low on-resistance
- 100% Avalanche tested



Application

- Switching applications

Description

This N-channel enhancement mode Power MOSFET is the latest refinement of ST's STripFET™ process. The resulting transistor shows extremely high packing density for low on resistance, rugged avalanche characteristics and low gate charge.

Figure 1. Internal schematic diagram

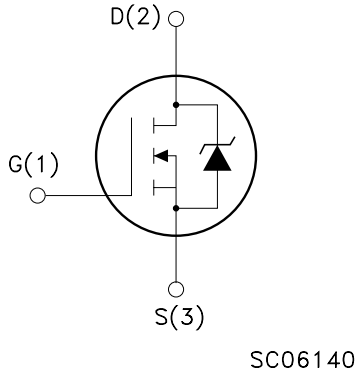


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB160N75F3	160N75F3	D²PAK	Tape & reel
STP160N75F3	160N75F3	TO-220	Tube
STW160N75F3	160N75F3	TO-247	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS} = 0)	75	V
V_{GS}	Gate-source voltage	± 20	V
I_D (1)	Drain current (continuous) at T_C = 25°C	120	A
I_D (1)	Drain current (continuous) at T_C = 100°C	120	A
I_{DM}(2)	Drain current (pulsed)	480	A
P_{TOT}	Total dissipation at T_C = 25°C	330	W
	Derating factor	2.2	W/°C
dv/dt (3)	Peak diode recovery voltage slope	20	V/ns
E_{AS} (4)	Single pulse avalanche energy	600	mJ
T_j T_{stg}	Operating junction temperature Storage temperature	-55 to 175	°C

1. Current limited by package
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 120A$, di/dt ≤ 1100 A/µs, $V_{DD} \leq 60V$, $T_J \leq T_{JMAX}$
4. Starting TJ = 25°C, I_D = 60A, V_{DD} = 25V

Table 3. Thermal resistance

Symbol	Parameter	Value			Unit
		TO-220	TO-247	D²PAK	
Rthj-case	Thermal resistance junction-case max	0.45			°C/W
Rthj-amb	Thermal resistance junction-ambient max	62.5	50	--	°C/W
Rthj-pcb(1)	Thermal resistance junction-pcb	--	--	50	°C/W
T_l	Maximum lead temperature for soldering purpose	300			°C

1. When mounted on 1 inch² FR4 2 oz Cu

2 Electrical characteristics

(T_{CASE}=25°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 = 250µA, V_{GS}= 0		75			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max rating, V_{DS} = Max rating,@125°C				10 100	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ±20V				±200	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS}= V_{GS}, I_D = 250µA		2		4	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS}= 10V, I_D= 60A	**TO-220** **TO-247** **D²PAK**		3.5 3.2	4 3.7	mΩ mΩ

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} =25V, f=1 MHz, V_{GS}=0		6750 1080 40		pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD}=37.5V, I_D = 120A V_{GS} =10V *(see Figure 16)*		85 27 26		nC nC nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	V_{DD}=37.5 V, I_D= 60A, R_G=4.7Ω, V_{GS}=10V, *(see Figure 18)*		22 65 100 15		ns ns ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM}(1)	Source-drain current Source-drain current (pulsed)				120 480	A A
V_{SD}(2)	Forward on voltage	I_{SD}=120A, V_{GS}=0			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD}=120A, V_{DD}= 20 V, di/dt = 100 A/µs, Tj=25°C *(see Figure 17)*		70 150 4.2		ns nC A

1. Pulse with limited by safe operating area
2. Pulsed: pulse duration = 300µs, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220 / TO-247

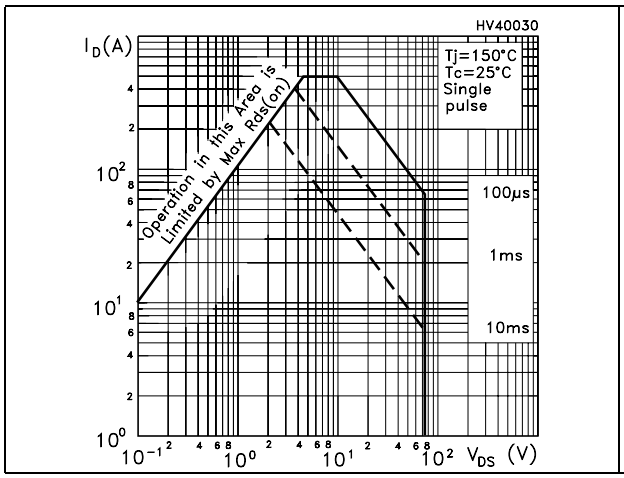


Figure 3. Thermal impedance for TO-220 / TO-247

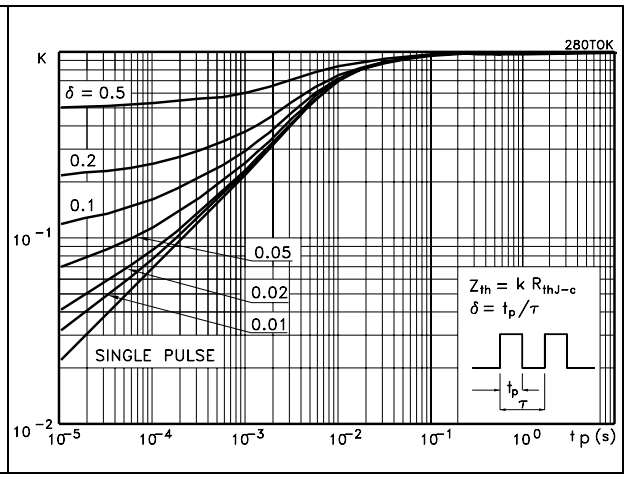


Figure 4. Safe operating area for D²PAK

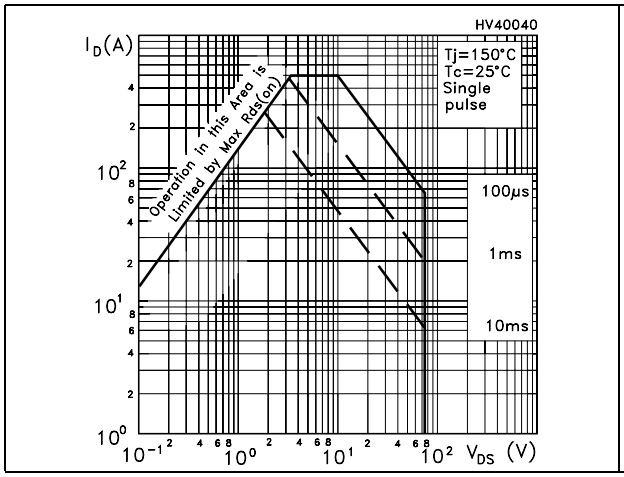


Figure 5. Thermal impedance for D²PAK

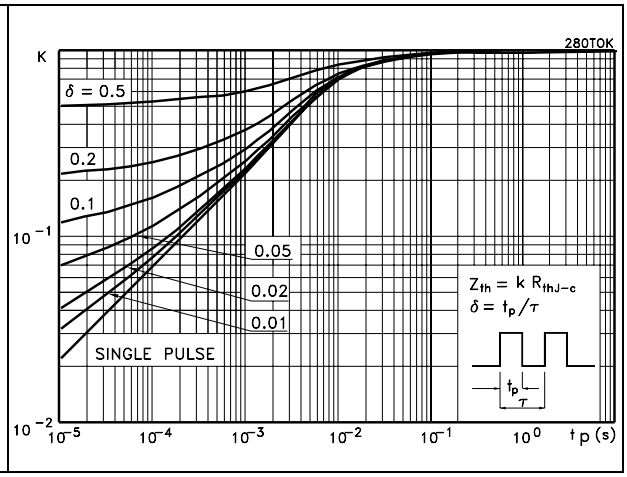


Figure 6. Output characteristics

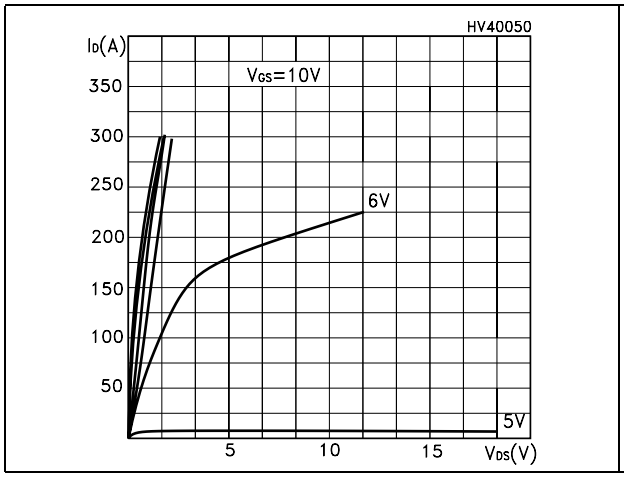


Figure 7. Transfer characteristics

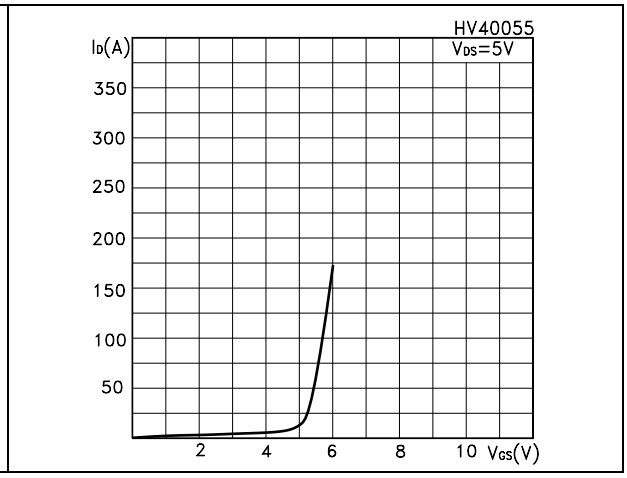


Figure 8. Normalized BV_{DSS} vs temperature

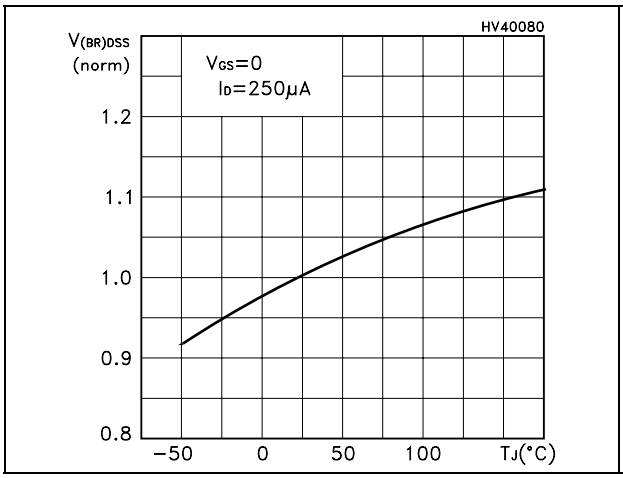


Figure 9. Static drain-source on resistance

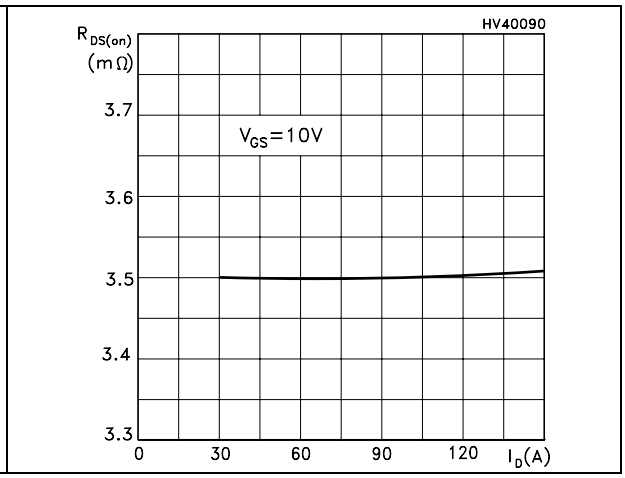


Figure 10. Gate charge vs gate-source voltage

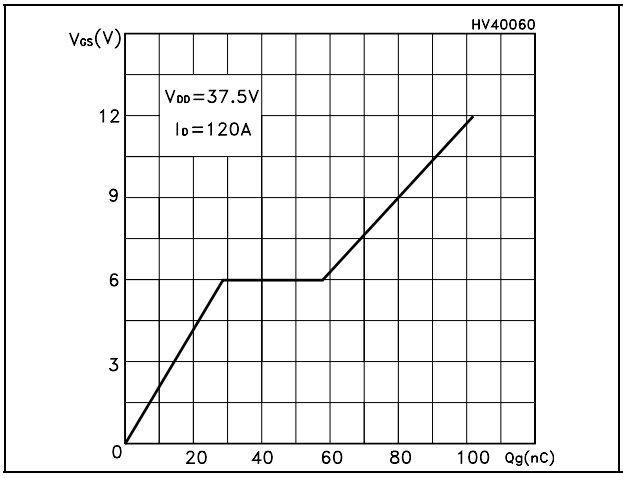


Figure 11. Capacitance variations

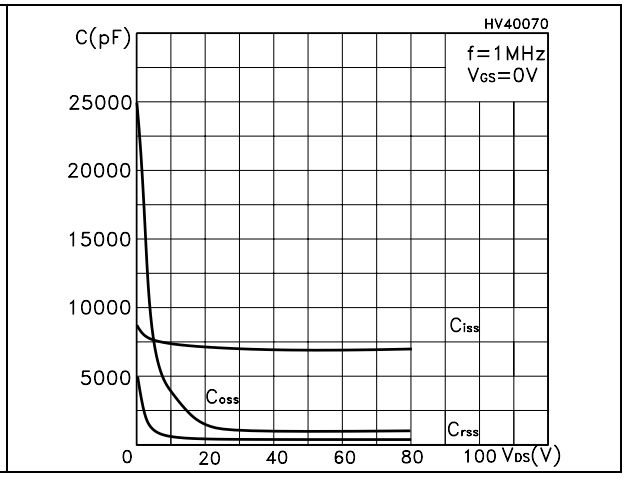


Figure 12. Normalized gate threshold voltage vs temperature

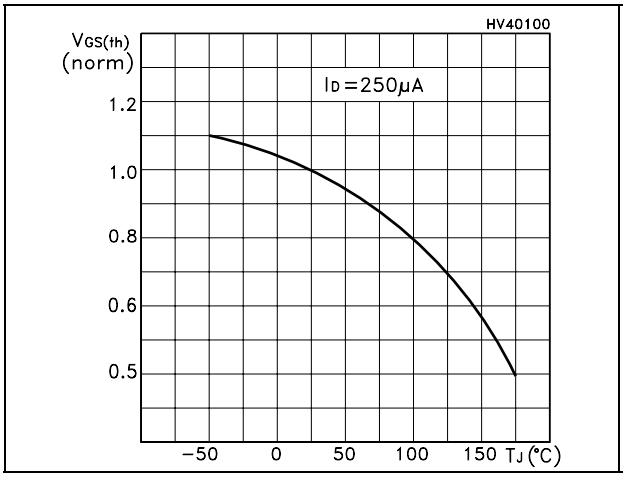


Figure 13. Normalized on resistance vs temperature

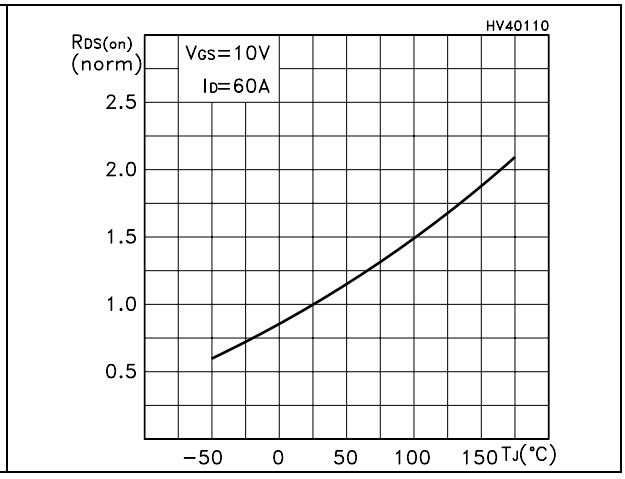
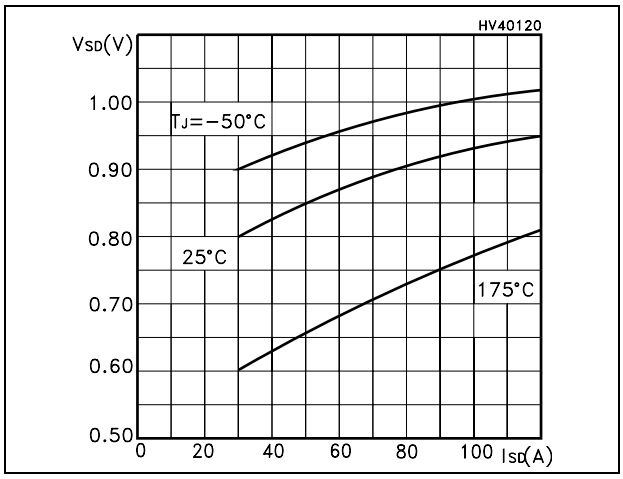


Figure 14. Source-drain diode forward characteristics



3 Test circuit

Figure 15. Switching times test circuit for resistive load

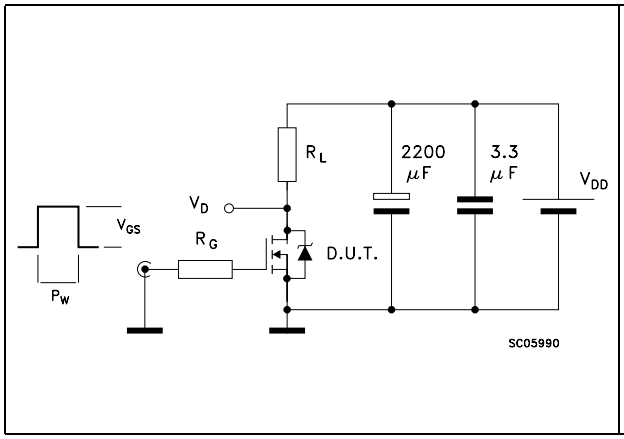


Figure 16. Gate charge test circuit

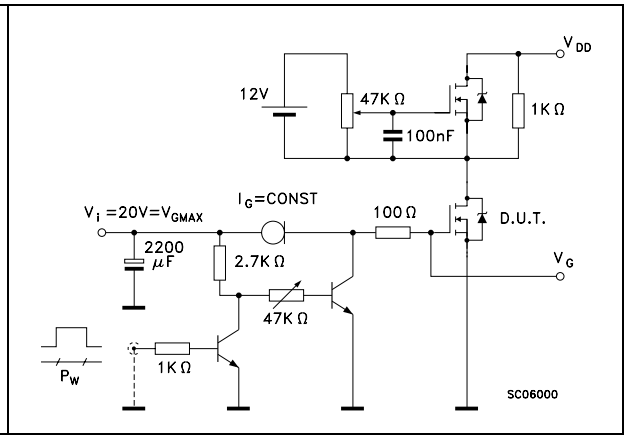


Figure 17. Test circuit for inductive load switching and diode recovery times

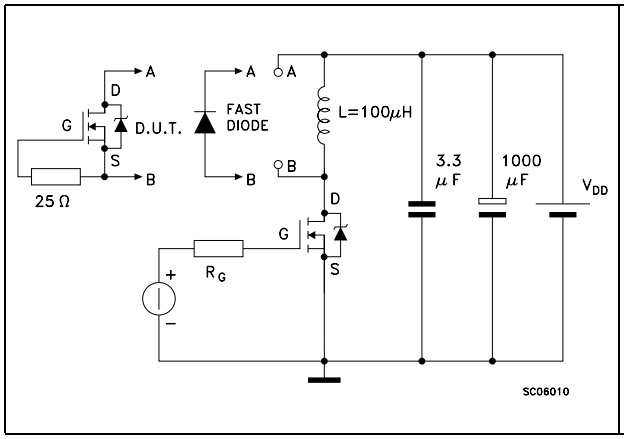


Figure 18. Unclamped inductive load test circuit

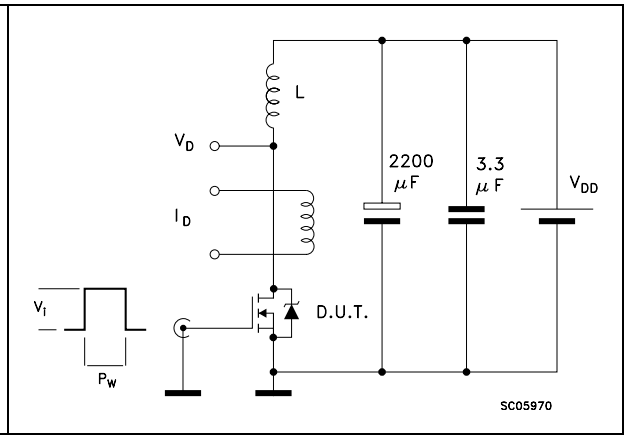


Figure 19. Unclamped inductive waveform

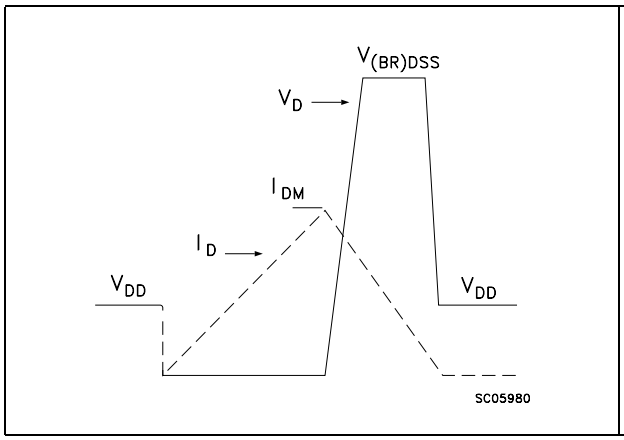
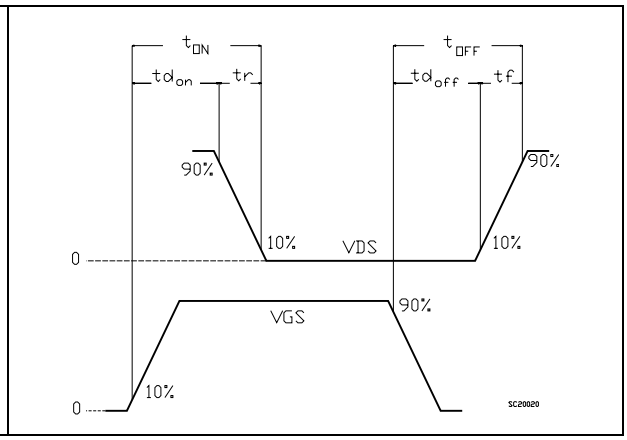


Figure 20. Switching time waveform

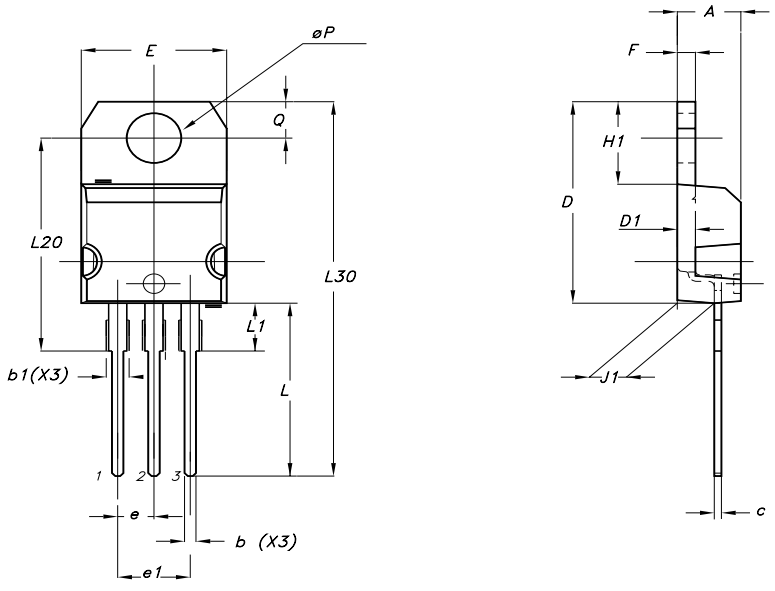


4 Package mechanical data

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*

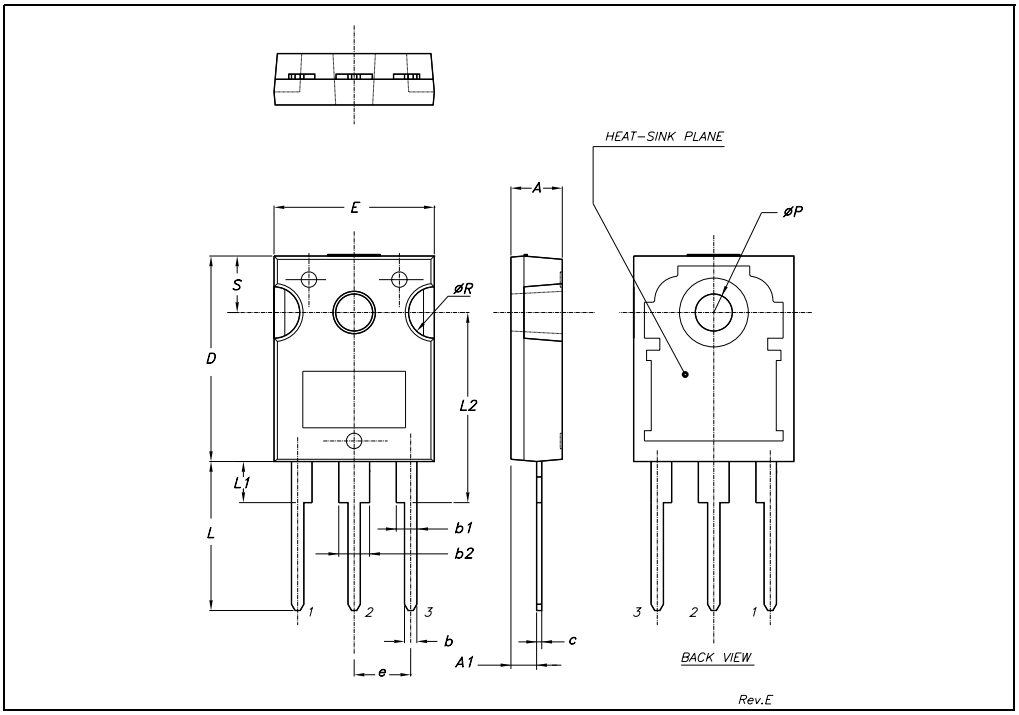
TO-220 mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.051
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
∅P	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



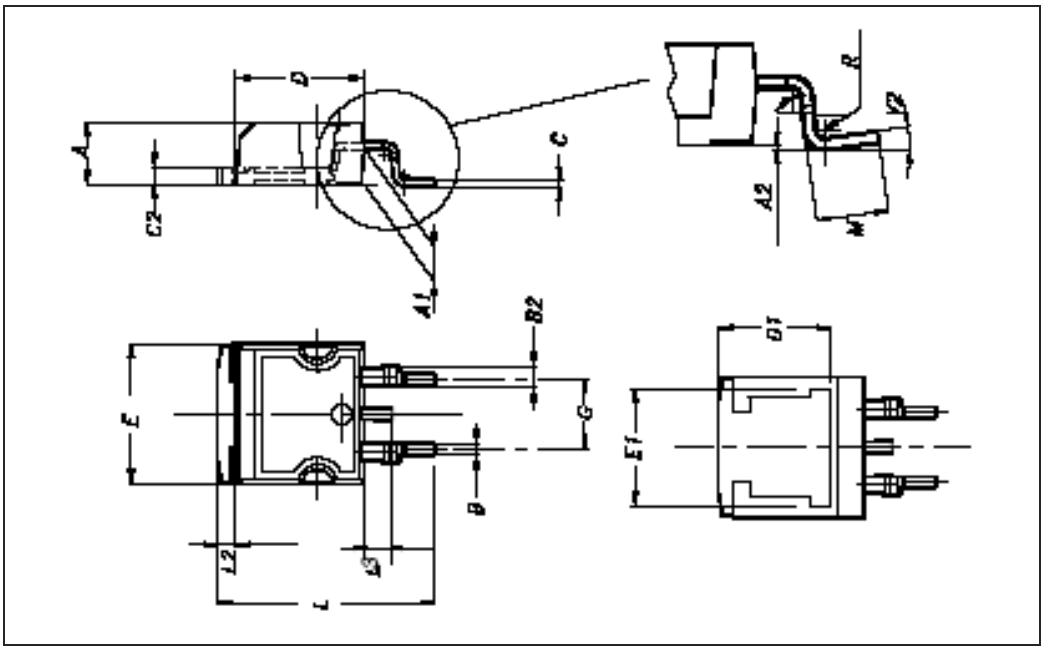
TO-247 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.85		5.15	0.19		0.20
A1	2.20		2.60	0.086		0.102
b	1.0		1.40	0.039		0.055
b1	2.0		2.40	0.079		0.094
b2	3.0		3.40	0.118		0.134
c	0.40		0.80	0.015		0.03
D	19.85		20.15	0.781		0.793
E	15.45		15.75	0.608		0.620
e		5.45			0.214	
L	14.20		14.80	0.560		0.582
L1	3.70		4.30	0.14		0.17
L2		18.50			0.728	
øP	3.55		3.65	0.140		0.143
øR	4.50		5.50	0.177		0.216
S		5.50			0.216	



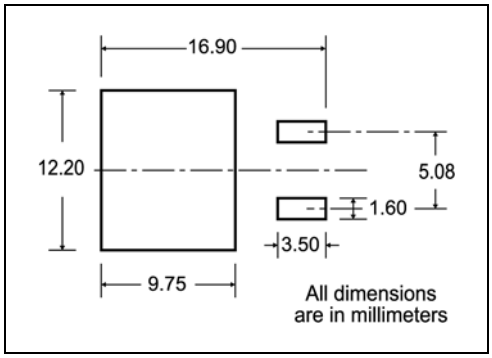
D²PAK mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		0.409
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.50		0.55
L3	1.4		1.75	0.055		0.68
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		4°			

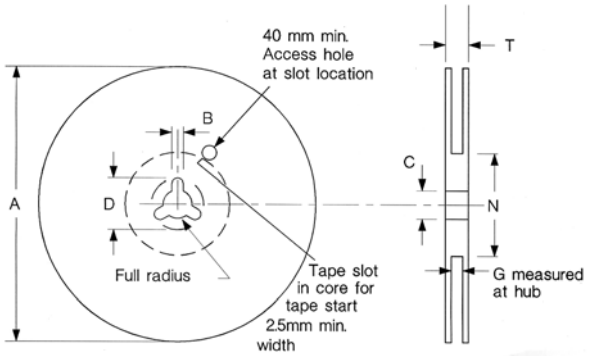


5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



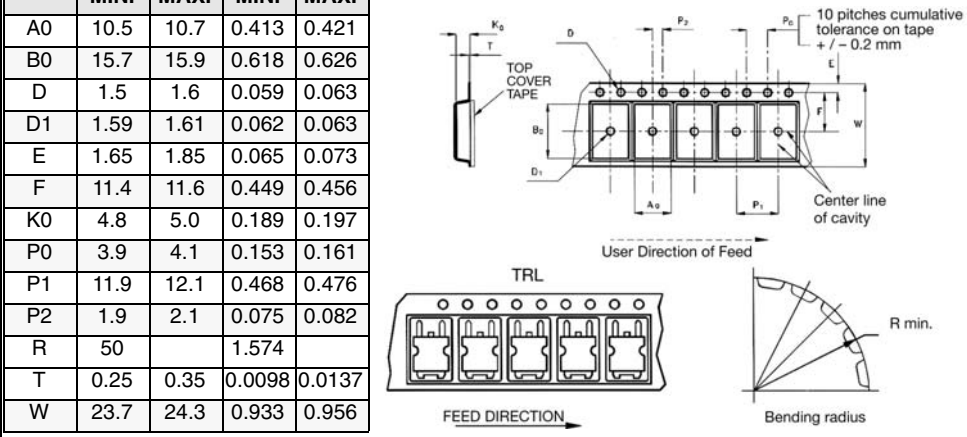
REEL MECHANICAL DATA

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		0795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	10.5	10.7	0.413	0.421
B0	15.7	15.9	0.618	0.626
D	1.5	1.6	0.059	0.063
D1	1.59	1.61	0.062	0.063
E	1.65	1.85	0.065	0.073
F	11.4	11.6	0.449	0.456
K0	4.8	5.0	0.189	0.197
P0	3.9	4.1	0.153	0.161
P1	11.9	12.1	0.468	0.476
P2	1.9	2.1	0.075	0.082
R	50		1.574	
T	0.25	0.35	0.0098	0.0137
W	23.7	24.3	0.933	0.956



* on sales type

6 Revision history

Table 8. Document revision history

Date	Revision	Changes
07-Feb-2007	1	First release
02-Oct-2007	2	New section has been added: *Electrical characteristics (curves)*