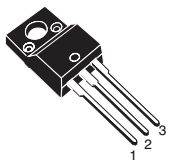
STD20NF20
STF20NF20 - STP20NF20

N-channel 200V - 0.10Ω -18A- DPAK/TO-220/TO-220FP
Low gate charge STripFET™ Power MOSFET

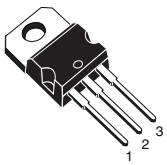
Features

Type	V_{DSS}	$R_{DS(on)}$	I_D	P_W
STD20NF20	200V	<0.125Ω	18A	90W
STF20NF20	200V	<0.125Ω	18A	25W
STP20NF20	200V	<0.125Ω	18A	90W

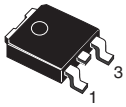
- Exceptional dv/dt capability
- Low gate charge
- 100% avalanche tested



TO-220FP



TO-220



DPAK

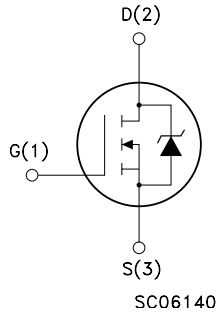
Description

This Power MOSFET series realized with STMicroelectronics unique STripFET™ process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency isolated DC-DC converters.

Application

- Switching application

Internal schematic diagram



Order codes

Part number	Marking	Package	Packaging
STD20NF20	20NF20	DPAK	Tape & reel
STF20NF20	20NF20	TO-220FP	Tube
STP20NF20	20NF20	TO-220	Tube

Contents

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220/DPAK	TO-220FP	
V_{DS}	Drain-source voltage (V_{GS} = 0)	200		V
V_{GS}	Gate- source voltage	± 20		V
I_D	Drain current (continuous) at T_C = 25°C	18		A
I_D	Drain current (continuous) at T_C = 100°C	11		A
I_{DM} (1)	Drain current (pulsed)	72		A
P_{TOT}	Total dissipation at T_C = 25°C	90	25	W
	Derating factor	0.72	0.2	W/°C
dv/dt (2)	Peak diode recovery voltage slope	15		V/ns
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1s; Tc = 25°C)	--	2500	V
T_{stg}	Storage temperature	-55 to 150		°C
T_j	Max. operating junction temperature			

1. Pulse width limited by safe operating area
2. $I_{SD} \leq 18A$, di/dt ≤ 400A/µs, $V_{DD} \leq V_{(BR)DSS}$

Table 2. Thermal data

Symbol	Parameter	TO-220	DPAK	TO-220FP	Unit
Rthj-case	Thermal resistance junction-case max	1.38	1.38	5	°C/W
Rthj-amb	Thermal resistance junction-ambient max	62.5	50 (1)	62.5	°C/W
T_l	Maximum lead temperature for soldering purpose	300			°C

1. When mounted on 1inch² FR-4, 2 Oz copper board.

Table 3. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	18	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, $I_D = I_{AR}$, V_{DD} = 50 V)	110	mJ

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 = 1 mA, V_{GS} = 0	200			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0) V_{DS} = Max rating V_{DS} = Max rating, T_C = 125°C				1 10	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 20V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10V, I_D = 10 A		0.10	0.125	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS} = 25 V, I_D= 10 A		13		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25V, f = 1 MHz, V_{GS} = 0		940 197 30		pF pF pF
$t_{d(on)}$ t_r $t_{d(off)}$ t_r	Turn-on delay time Rise time Turn-off delay time Fall time	V_{DD} = 100 V, I_D = 10 A, R_G= 4.7 Ω V_{GS} = 10 V *(see Figure 14)*		15 30 40 10		ns ns ns ns
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 160V, I_D = 20 A, V_{GS} = 10V *(see Figure 15)*		28 5.6 14.5	39	nC nC nC

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

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM}(1)	Source-drain current Source-drain current (pulsed)				18 72	A A
V_{SD}(2)	Forward on voltage	I_{SD} = 20 A, V_{GS} = 0			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 20 A, di/dt = 100A/µs V_{DD} = 50V, T_j = 25°C *(see Figure 19)*		155 775 10		ns nC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 20 A, di/dt = 100A/µs V_{DD} = 50V, T_j = 150°C *(see Figure 19)*		183 1061 11.6		ns nC A

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

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area for TO-220/ DPAK

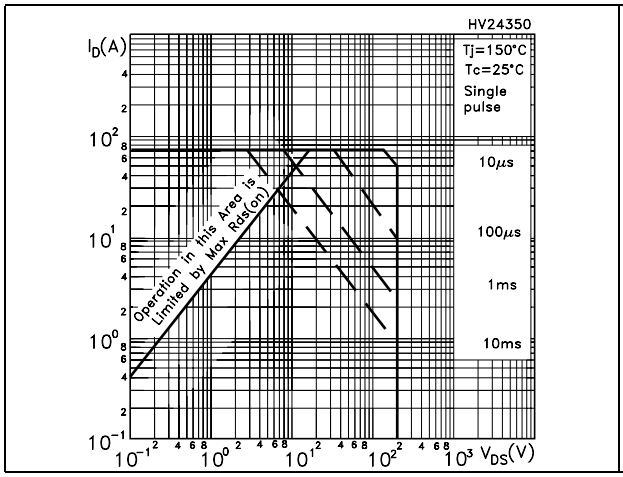


Figure 2. Thermal impedance area for TO-220/ DPAK

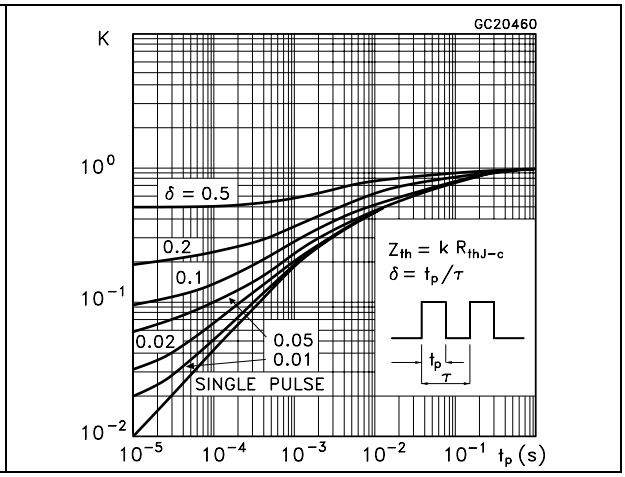


Figure 3. Safe operating area for TO-220FP

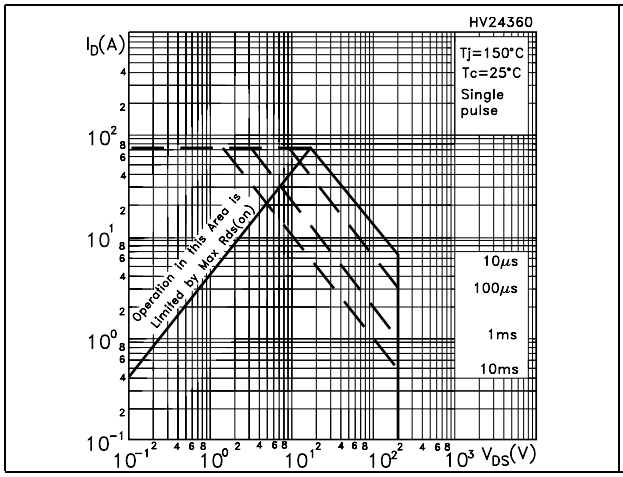


Figure 4. Thermal impedance for TO-220FP

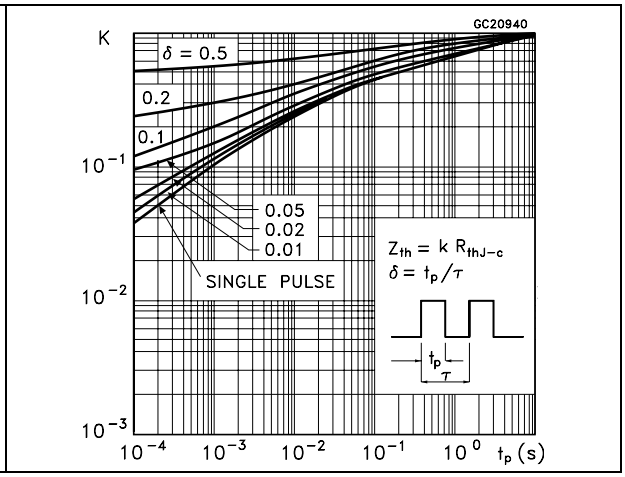


Figure 5. Output characteristics

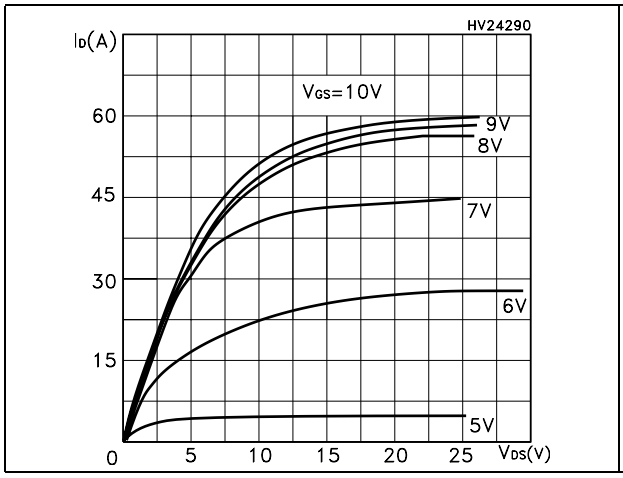


Figure 6. Transfer characteristics

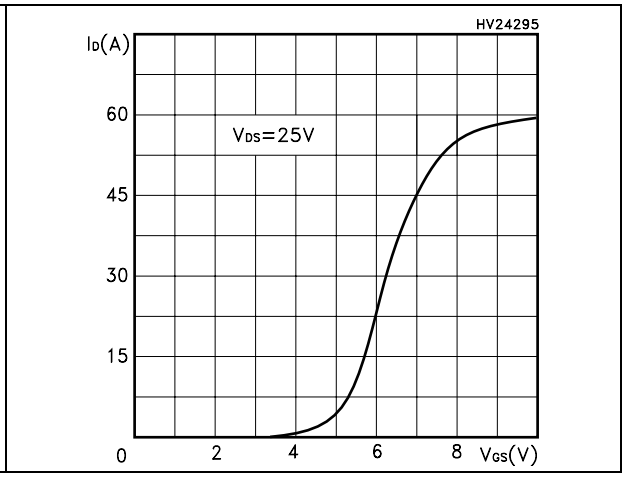


Figure 7. Transconductance

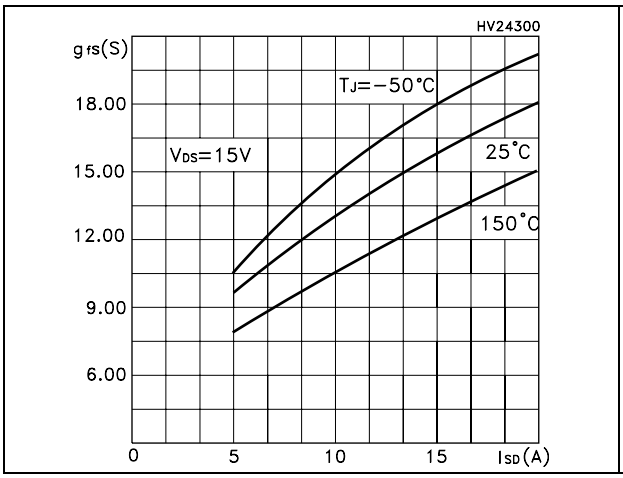


Figure 8. Static drain-source on resistance

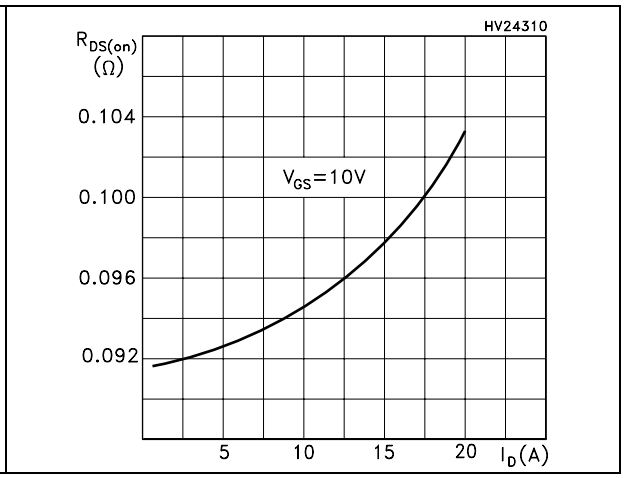


Figure 9. Gate charge vs gate-source voltage

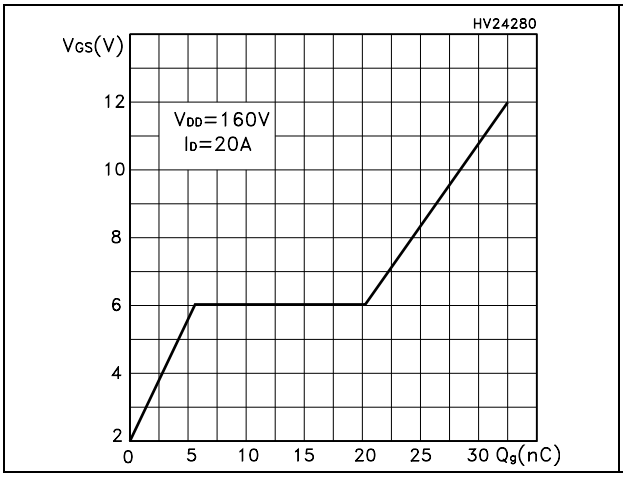


Figure 10. Capacitance variations

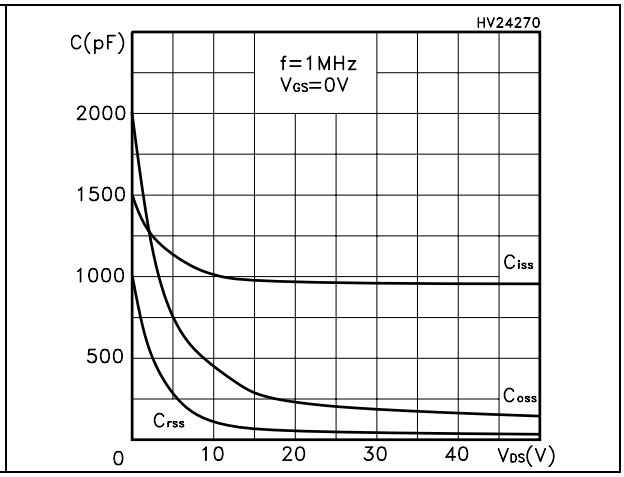


Figure 11. Normalized gate threshold voltage vs temperature

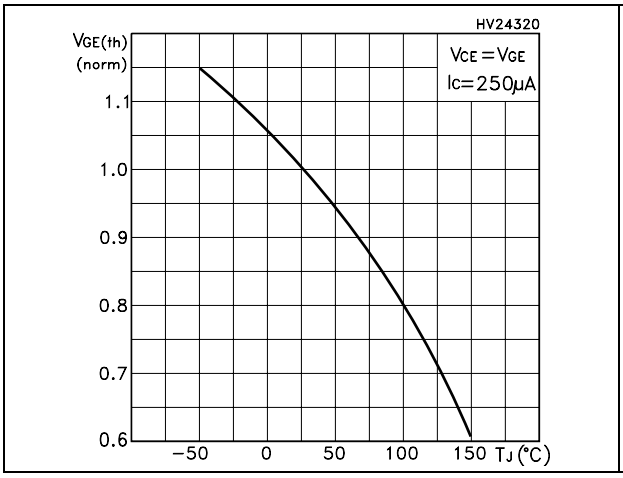


Figure 12. Normalized on resistance vs temperature

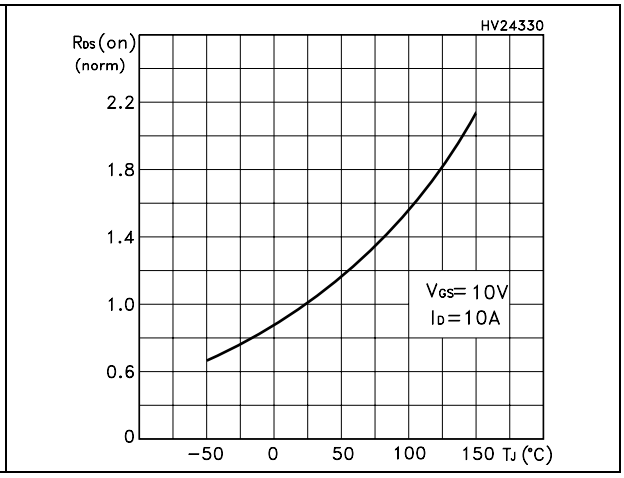
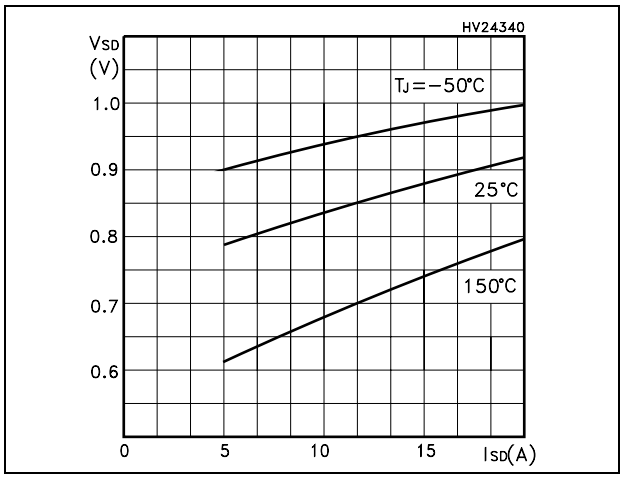


Figure 13. Source-drain diode forward characteristics



3 Test circuit

Figure 14. Switching times test circuit for resistive load

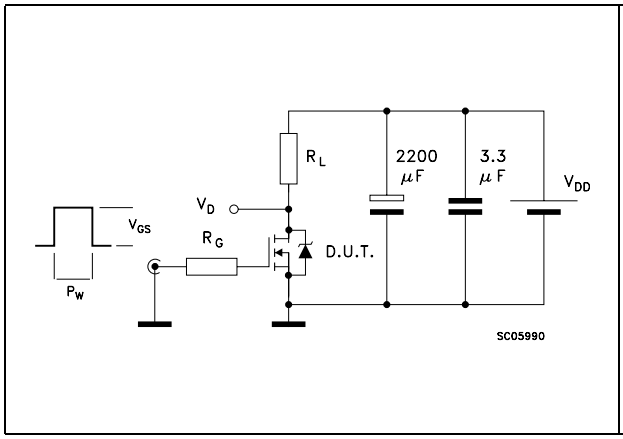


Figure 15. Gate charge test circuit

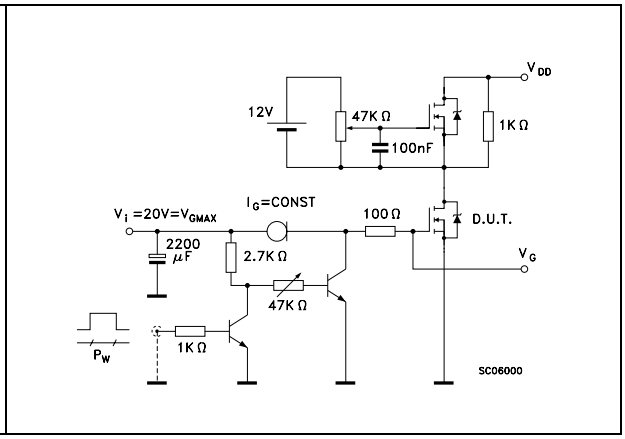


Figure 16. Test circuit for inductive load switching and diode recovery times

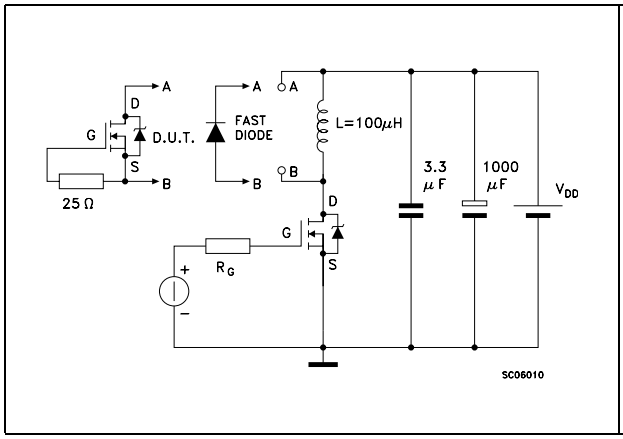


Figure 17. Unclamped Inductive load test circuit

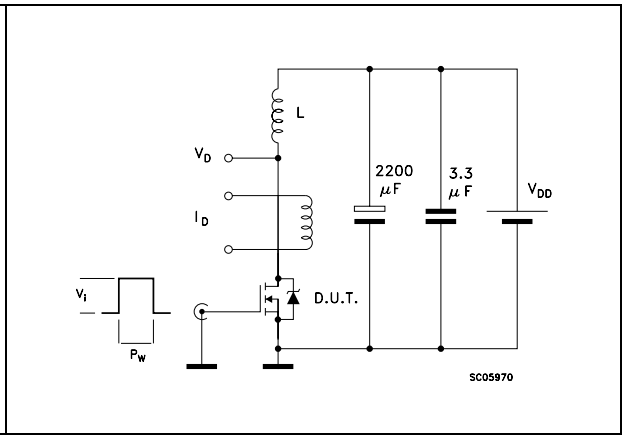


Figure 18. Unclamped inductive waveform

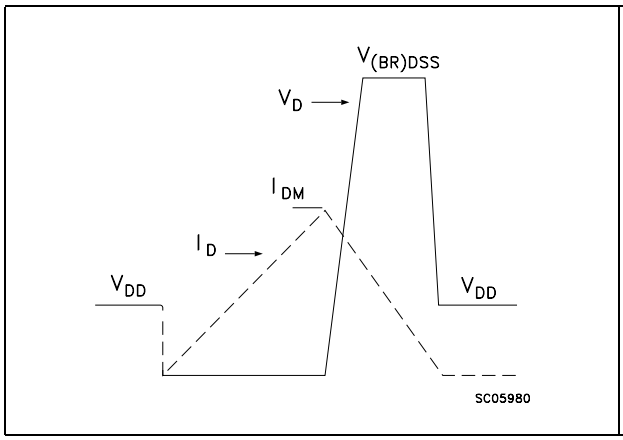
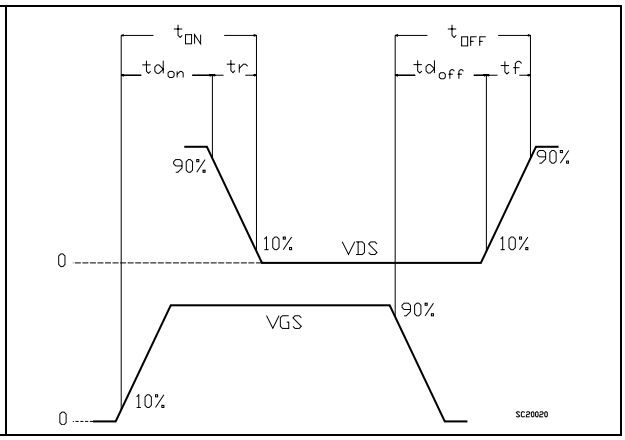


Figure 19. Switching time waveform

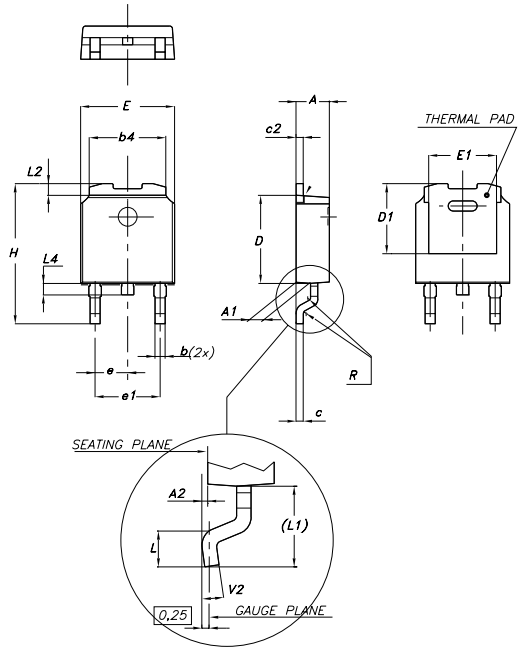


4 Package mechanical data

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*

DPAK MECHANICAL DATA

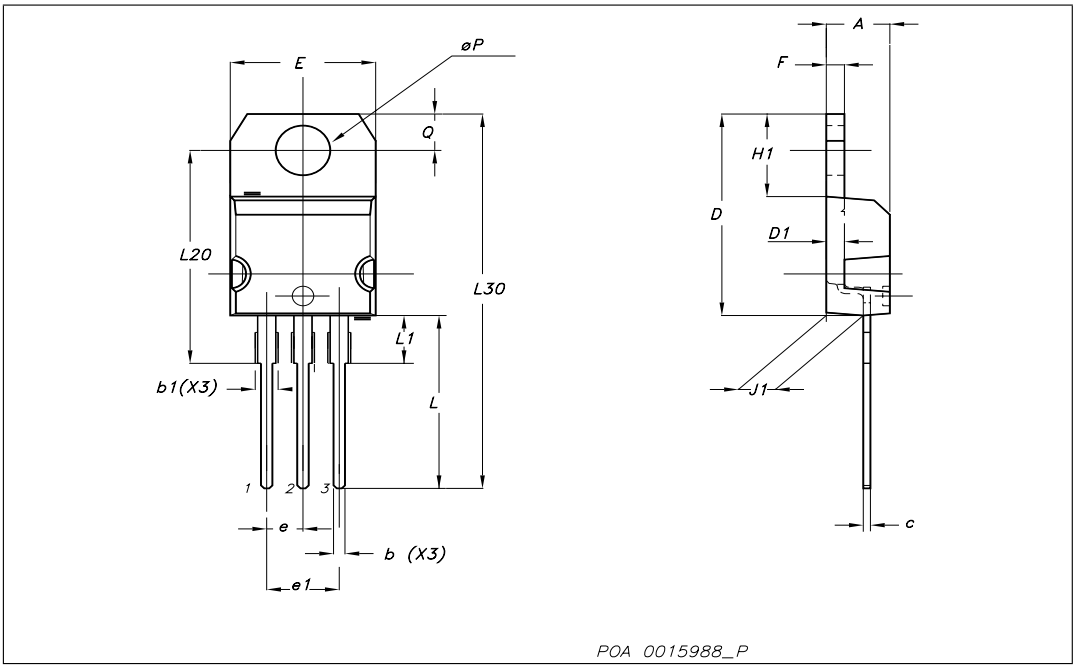
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
b4	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
D1		5.1			0.200	
E	6.4		6.6	0.252		0.260
E1		4.7			0.185	
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°



0068772-F

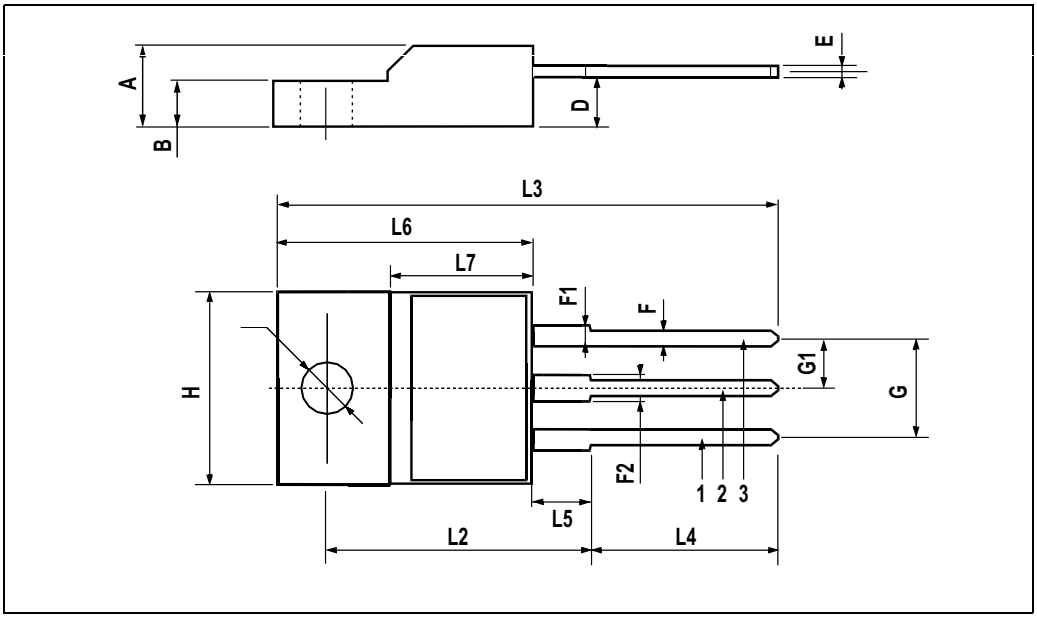
TO-220 mechanical data

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	
θP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



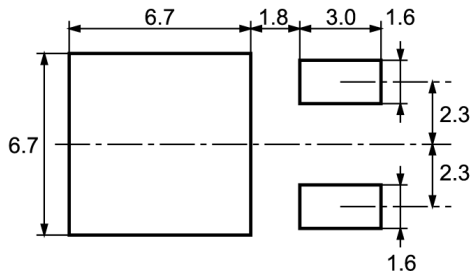
TO-220FP MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	.0385		0.417
L5	2.9		3.6	0.114		0.141
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126



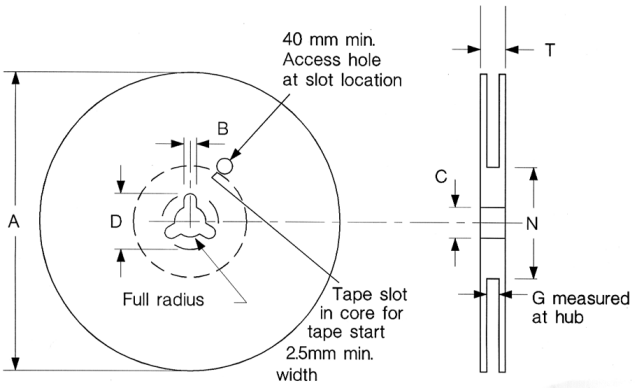
5 Packaging mechanical data

DPAK FOOTPRINT



All dimensions are in millimeters

TAPE AND REEL SHIPMENT



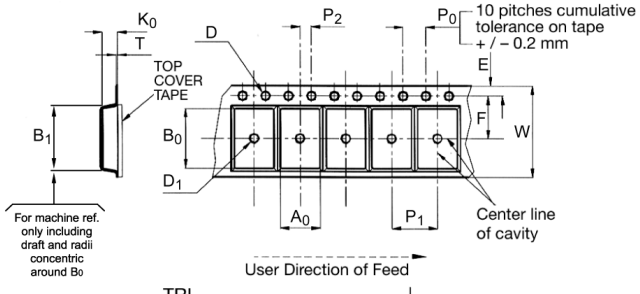
REEL MECHANICAL DATA

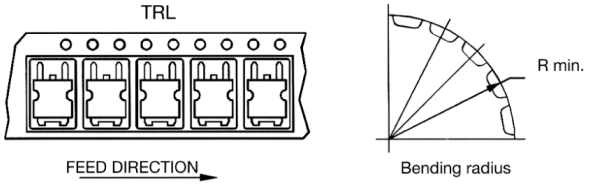
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	16.4	18.4	0.645	0.724
N	50		1.968	
T		22.4		0.881

BASE QTY	BULK QTY
2500	2500

TAPE MECHANICAL DATA

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





6 Revision history

Table 7. Revision history

Date	Revision	Changes
25-Jan-2007	1	First release
20-Mar-2007	2	Typo mistake in first page (order codes)
17-Apr-2007	3	Updates on *Table 5: Dynamic*