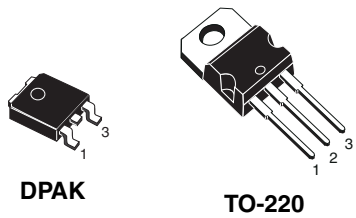
STD78N75F4
STP78N75F4

N-channel 75 V, 0.0092 Ω, 78 A TO-220, DPAK STripFET™ DeepGATE™ Power MOSFET

Features

Type	V_{DSS}	$R_{DS(on)}$ max	I_D
STD78N75F4	75 V	< 0.011 Ω	70 A
STP78N75F4	75 V	< 0.011 Ω	78 A

- N-channel enhancement mode
- 100% avalanched rated
- Low gate charge
- Very low on-resistance



Application

- Switching applications

Description

This STripFET™ DeepGATE™ Power MOSFET technology is among the latest improvements, which have been especially tailored to minimize on-state resistance, with a new gate structure, providing superior switching performances.

Figure 1. Internal schematic diagram

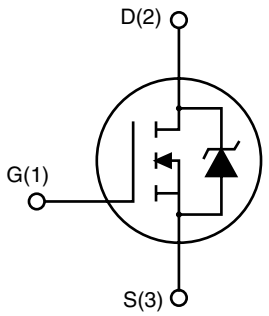


Table 1. Device summary

Order codes	Marking	Package	Packaging
STD78N75F4	78N75F4	DPAK	Tape and reel
STP78N75F4	78N75F4	TO-220	Tube

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2 Electrical characteristics 4

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3 Test circuit 8

4 Package mechanical data 9

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220	DPAK	
V_{DS}	Drain-source voltage (V_{GS} = 0)	75		V
V_{GS}	Gate-source voltage	± 20		V
I_D	Drain current (continuous) at T_C = 25 °C	78	70	A
I_D	Drain current (continuous) at T_C = 100 °C	55	50	A
I_{DM} (1)	Drain current (pulsed)	312	280	A
P_{TOT}	Total dissipation at T_C = 25 °C	150	125	W
	Derating factor	1	0.83	W/°C
E_{AS} (2)	Single pulse avalanche energy	185		mJ
T_{stg}	Storage temperature	– 55 to 175		°C
T_j	Operating junction temperature			

1. Pulse width limited by safe operating area
2. Starting T_j = 25 °C, I_D= 35 A, V_{DD}= 50 V

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		TO-220	DPAK	
$R_{thj\text{-}case}$	Thermal resistance junction-case max	1	1.2	°C/W
$R_{thj\text{-}a}$	Thermal resistance junction-ambient max	62.5		°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb max		50	°C/W
T_l	Maximum lead temperature for soldering purpose	300		°C

1. When mounted on FR-4 board of 1 inch², 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 = 250 µA, V_{GS} = 0	75			V
I_{DSS}	Zero gate voltage Drain current (V_{GS} = 0)	V_{DS} = max rating			1	µA
		V_{DS} = max rating,T_C=125 °C			100	µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 20 V			100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2		4	V
$R_{DS(on)}$	Static drain-source on resistance	For DPAK V_{GS} = 10 V, I_D = 35 A		0.0092	0.011	Ω
		For TO-220 V_{GS} = 10 V, I_D = 39 A				

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0	-	5015	-	pF
C_{oss}	Output capacitance			382		pF
C_{rss}	Reverse transfer capacitance			218		pF
Q_g	Total gate charge	V_{DD} = 37.5 V, I_D = 78 A, V_{GS} = 10 V *(see Figure 14)*	-	76	-	nC
Q_{gs}	Gate-source charge			23		nC
Q_{gd}	Gate-drain charge			18.5		nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	V_{DD} = 37.5 V, I_D = 39 A R_G = 4.7 Ω V_{GS} = 10 V *(see Figure 13)*	-	25 33	-	ns ns
$t_{d(off)}$ t_f	Turn-off-delay time Fall time		-	61 14	-	ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
I_{SD}	Source-drain current	TO-220	-		78	A
		DPAK	-		70	A
I_{SDM} (1)	Source-drain current (pulsed)	TO-220	-		312	A
		DPAK	-		280	A
V_{SD} (2)	Forward on voltage	For TO-220 I_{SD} = 78 A, V_{GS} = 0	-		1.5	V
		For DPAK I_{SD} = 70 A, V_{GS} = 0				
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 78 A, V_{DD} = 60 V di/dt = 100 A/µs, T_j = 150 °C *(see Figure 15)*	-	67 183 5.5		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 2. Safe operating area

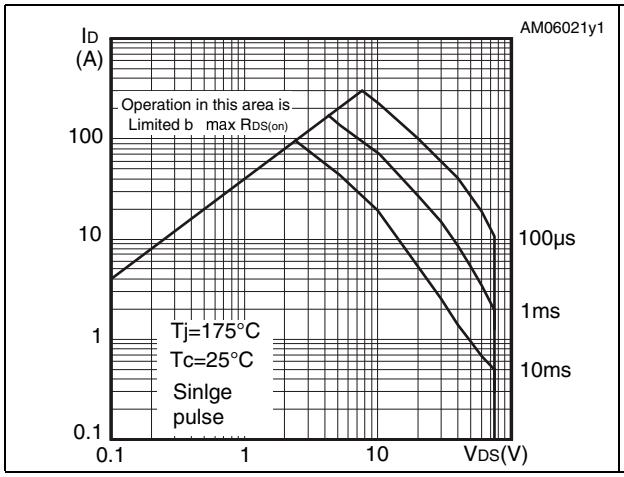


Figure 3. Thermal impedance

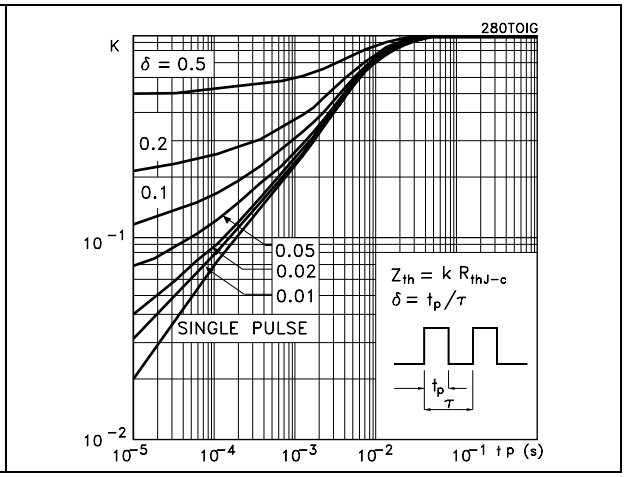


Figure 4. Output characteristics

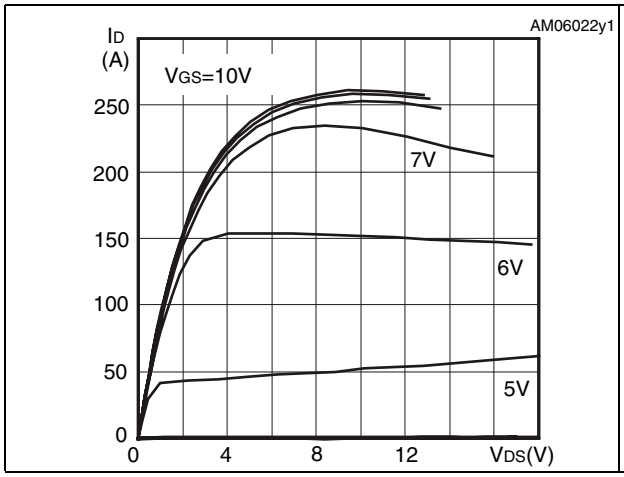


Figure 5. Transfer characteristics

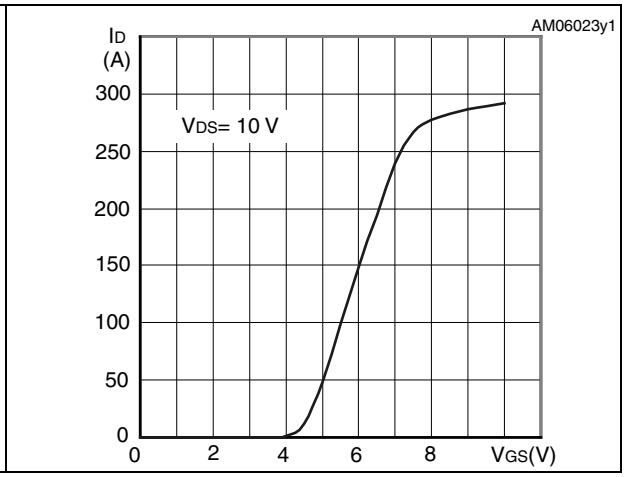


Figure 6. Normalized BV_{DSS} vs temperature

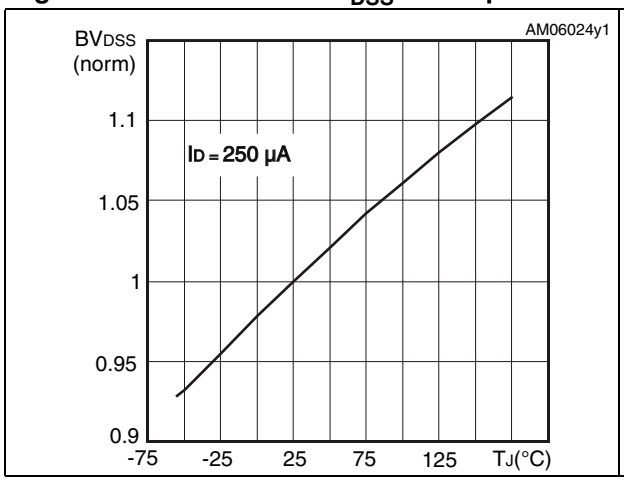


Figure 7. Static drain-source on resistance

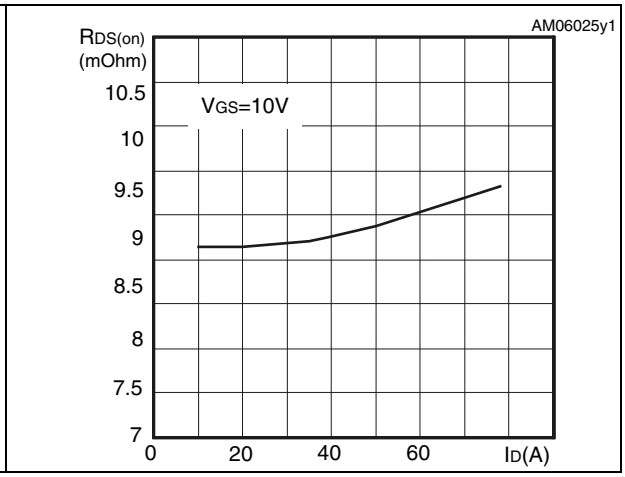


Figure 8. Gate charge vs gate-source voltage

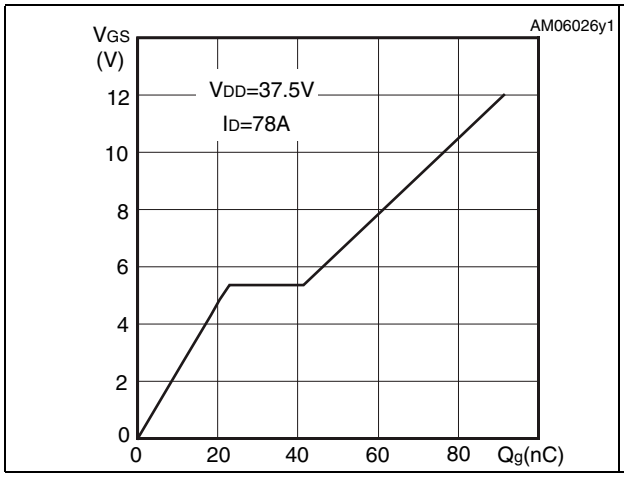


Figure 9. Capacitance variations

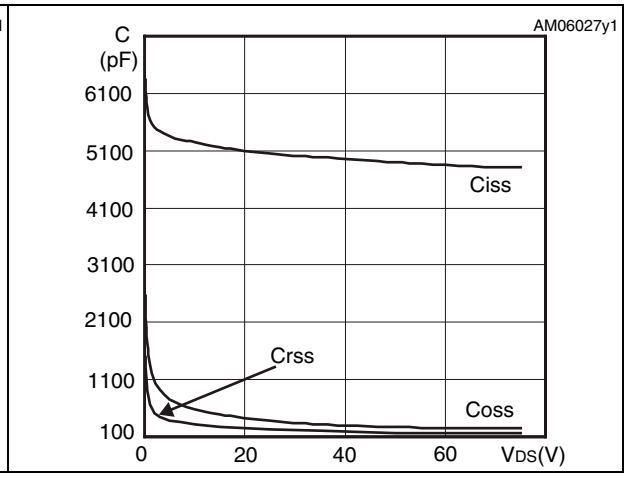


Figure 10. Normalized on resistance vs temperature

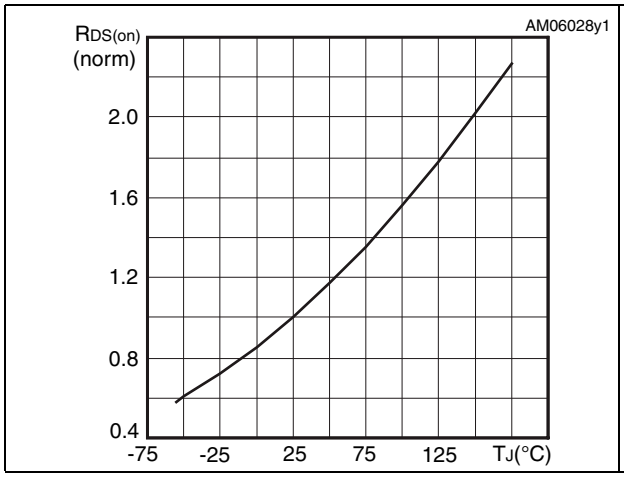


Figure 11. Normalized gate threshold voltage vs temperature

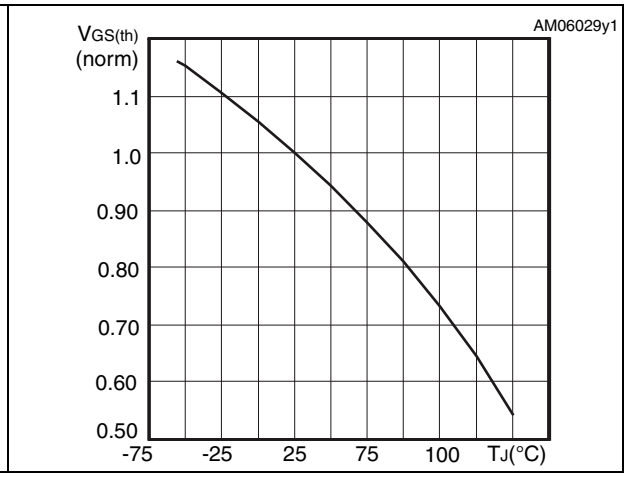
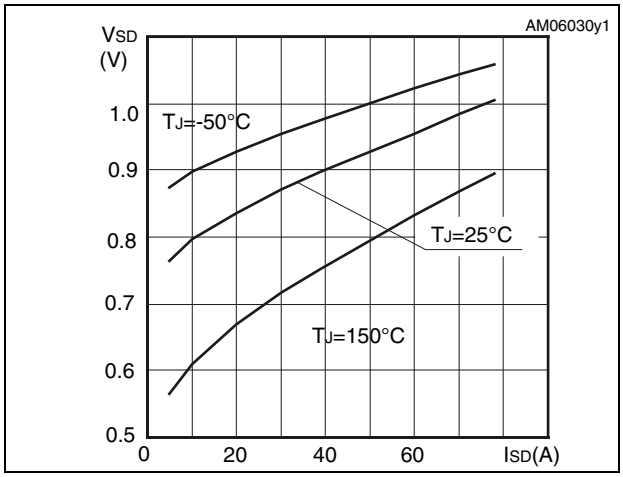


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

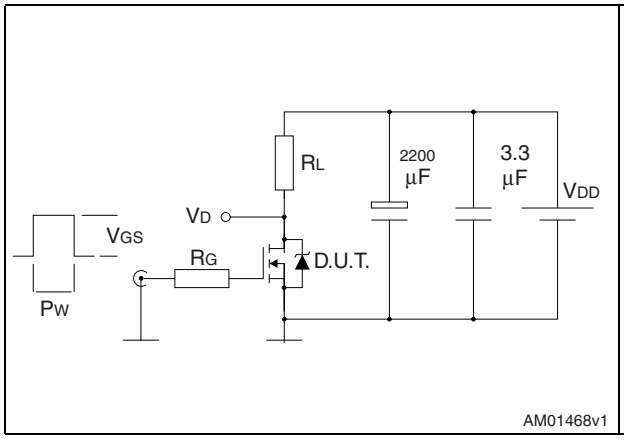


Figure 14. Gate charge test circuit

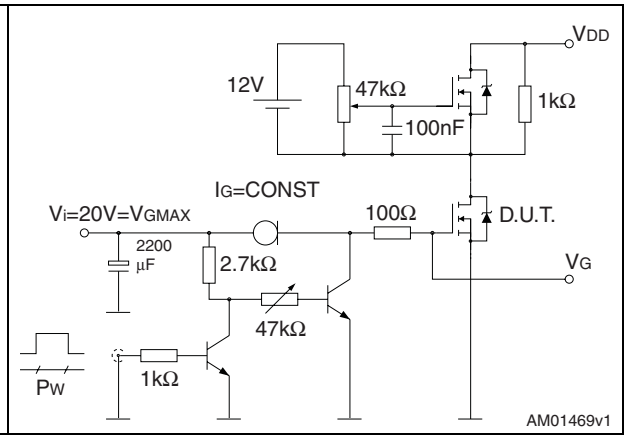


Figure 15. Test circuit for inductive load switching and diode recovery times

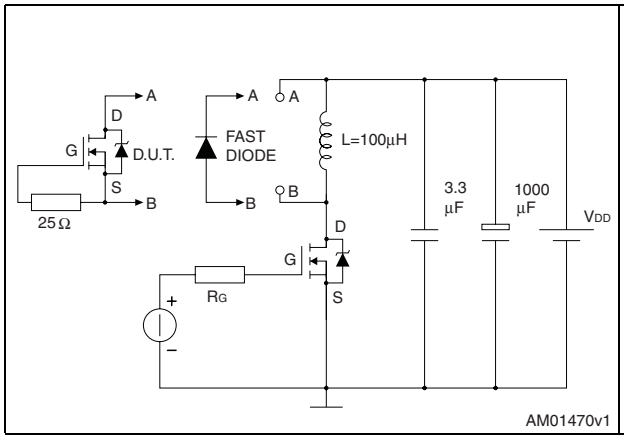


Figure 16. Unclamped inductive load test circuit

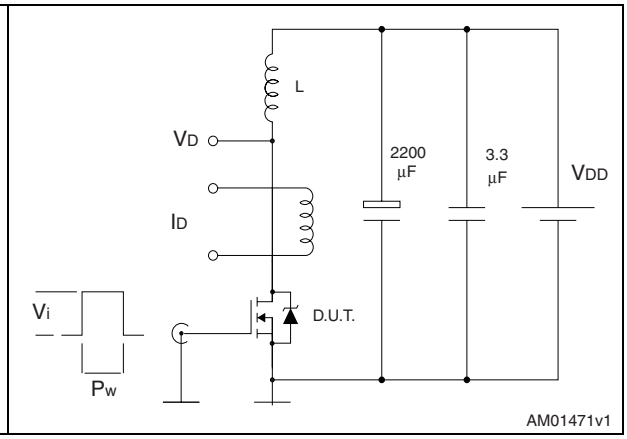


Figure 17. Unclamped inductive waveform

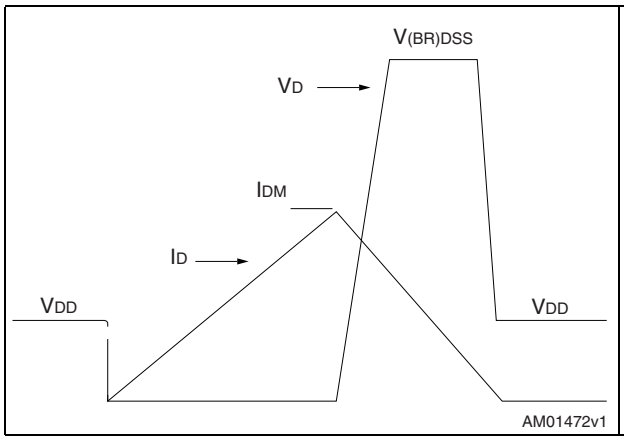
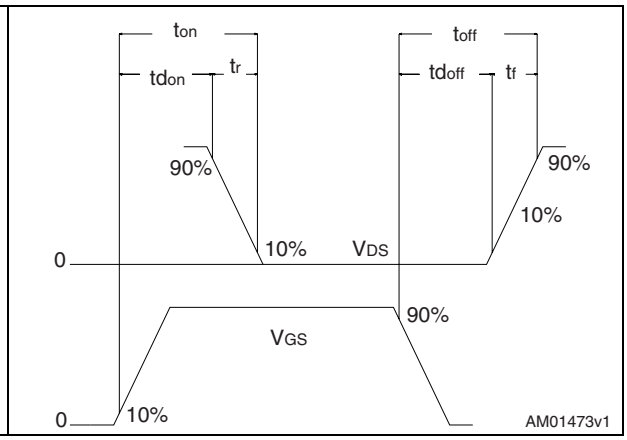


Figure 18. Switching time waveform

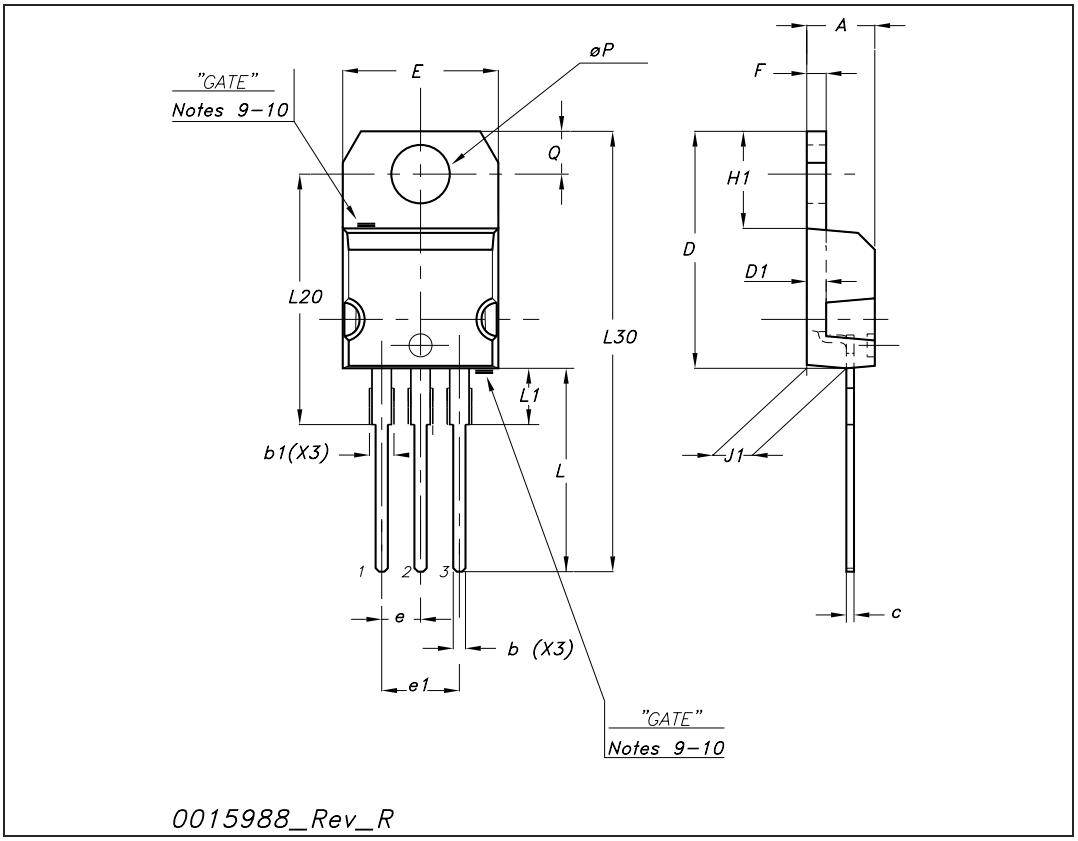


4 Package mechanical data

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. ECOPACK is an ST trademark.

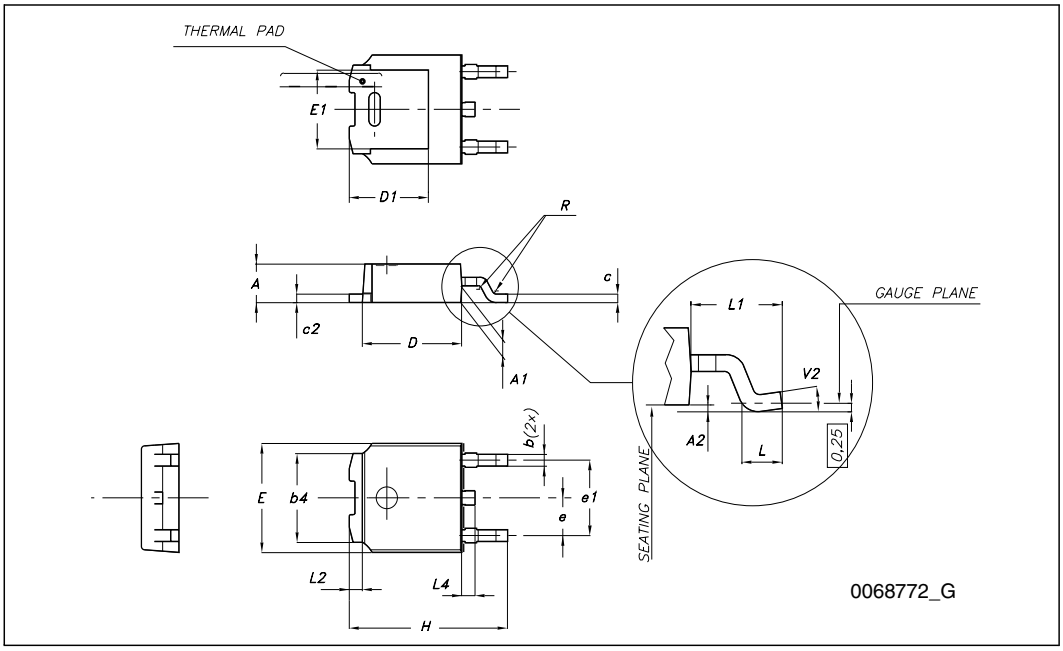
TO-220 mechanical data

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	0.48		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



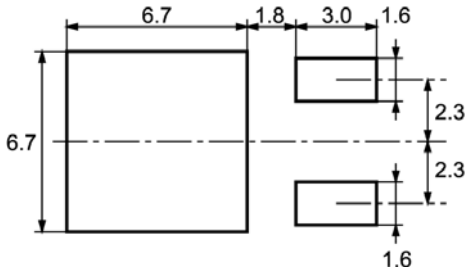
TO-252 (DPAK) mechanical data

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 °



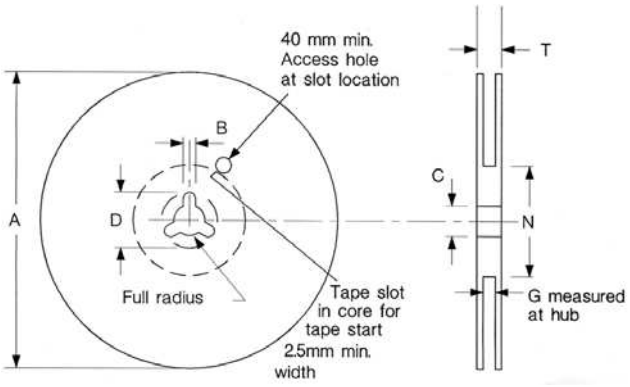
5 Packaging mechanical data

DPAK FOOTPRINT



All dimensions are in millimeters

TAPE AND REEL SHIPMENT



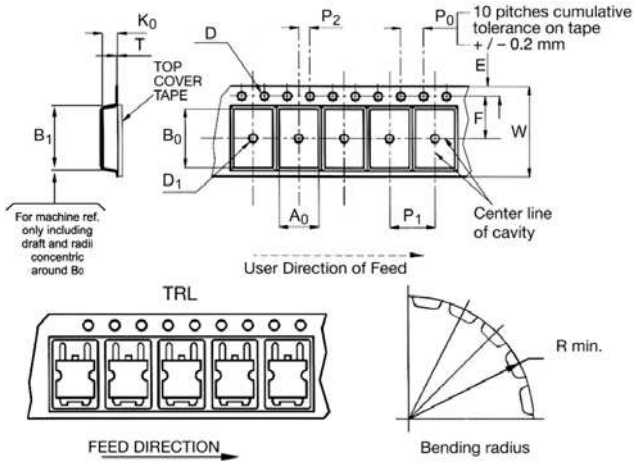
REEL MECHANICAL DATA

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 8. Document revision history

Date	Revision	Changes
12-May-2009	1	First release.
26-Nov-2009	2	Document status promoted from preliminary data to datasheet (see *Section 2.1: Electrical characteristics (curves)*).

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