



STD70N10F4 STP70N10F4, STW70N10F4

N-channel 100 V, 0.015 Ω , 60 A TO-220, DPAK, TO-247
STripFET™ DeepGATE™ Power MOSFET

Features

Type	V _{DSS}	R _{DS(on)} max	I _D
STD70N10F4	100 V	< 0.0195 Ω	60 A
STP70N10F4	100 V	< 0.0195 Ω	65 A
STW70N10F4	100 V	< 0.0195 Ω	65 A

- Exceptional dv/dt capability
- Extremely low on-resistance R_{DS(on)}
- 100% avalanche tested

Application

- Switching applications

Description

This Power MOSFET is among the latest developments that use an advanced technology (STripFET™ DeepGATE™ technology), which has been especially tailored to minimize on-state resistance, provide superior switching performance and withstand high energy pulse in avalanche and commutation mode. 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.

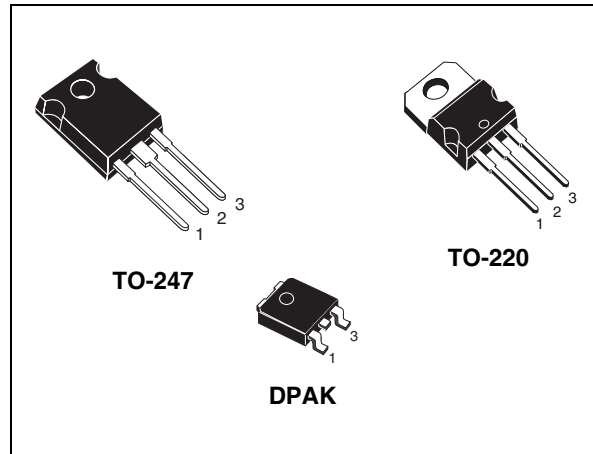


Figure 1. Internal schematic diagram

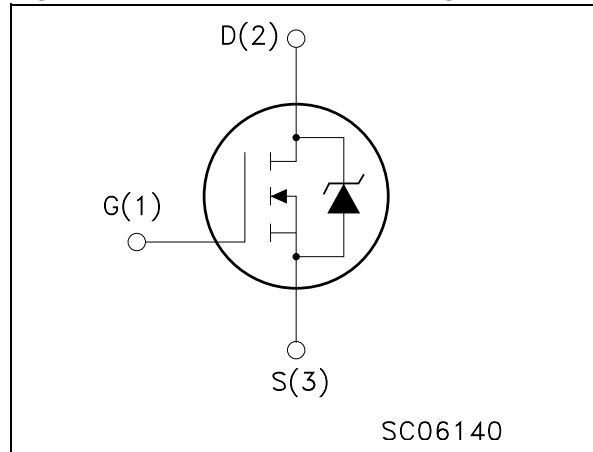


Table 1. Device summary

Order codes	Marking	Package	Packaging
STD70N10F4	70N10F4	DPAK	Tape and reel
STP70N10F4	70N10F4	TO-220	Tube
STW70N10F4	70N10F4	TO-247	Tube

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
	2.1 Electrical characteristics (curves)	6
3	Test circuit	8
4	Package mechanical data	9
5	Packaging mechanical data	13
6	Revision history	14

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220, TO-247	DPAK	
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	100		V
V_{GS}	Gate- source voltage	± 20		V
I_D	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	65	60	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	46	43	A
$I_{DM}^{(1)}$	Drain current (pulsed)	260	240	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	150	125	W
	Derating factor	1	0.83	W/ $^\circ\text{C}$
$E_{AS}^{(2)}$	Single pulse avalanche energy	120		mJ
T_{stg}	Storage temperature	- 55 to 175		$^\circ\text{C}$
T_j	Max. operating junction temperature			

1. Pulse width limited by safe operating area
2. Starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = 32.5\text{ A}$, $V_{DD} = 45\text{ V}$

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		TO-220, TO-247	DPAK	
$R_{thj-case}$	Thermal resistance junction-case max	1	1.2	$^\circ\text{C/W}$
R_{thj-a}	Thermal resistance junction-ambient max	62.5	50 ⁽¹⁾	$^\circ\text{C/W}$
T_l	Maximum lead temperature for soldering purpose	300		$^\circ\text{C}$

1. When mounted on FR-4 board of 1 inch², 2 oz Cu

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown voltage	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0$	100			V
I_{DSS}	Zero gate voltage Drain current ($V_{GS} = 0$)	$V_{DS} = \text{max rating}$ $V_{DS} = \text{max rating}$, $T_C = 125\text{ °C}$			1 100	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		4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 30\text{ A}$		0.015	0.0195	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance			5800		pF
C_{oss}	Output capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$		300		pF
C_{rss}	Reverse transfer capacitance			190		pF
Q_g	Total gate charge	$V_{DD} = 80\text{ V}$, $I_D = 65\text{ A}$, $V_{GS} = 10\text{ V}$		85		nC
Q_{gs}	Gate-source charge	$V_{GS} = 10\text{ V}$ (see Figure 16)		20		nC
Q_{gd}	Gate-drain charge			25		nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	$V_{DD} = 50\text{ V}$, $I_D = 30\text{ A}$ $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 15)		30 20		ns ns
$t_{d(off)}$ t_f	Turn-off-delay time Fall time	$V_{DD} = 50\text{ V}$, $I_D = 30\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 15)		65 20		ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
I_{SD}	Source-drain current				60	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				240	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 60 \text{ A}$, $V_{GS} = 0$			1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 60 \text{ A}$, $V_{DD} = 25 \text{ V}$ $di/dt = 100 \text{ A}/\mu\text{s}$, $T_j = 150 \text{ }^\circ\text{C}$ <i>(see Figure 17)</i>		80		ns
Q_{rr}	Reverse recovery charge			280		nC
I_{RRM}	Reverse recovery current			6.7		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 for TO-220, TO-247

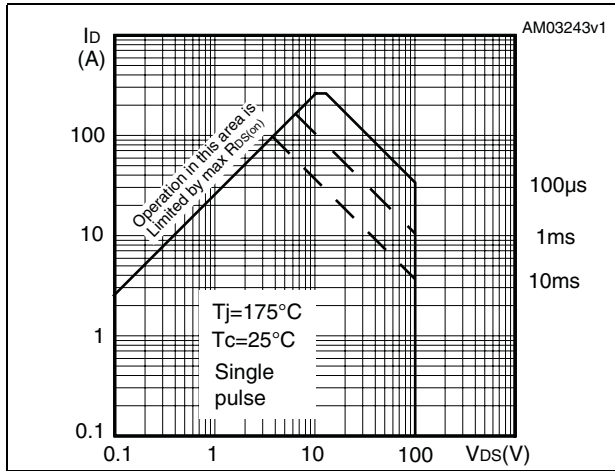


Figure 3. Thermal impedance for TO-220, TO-247

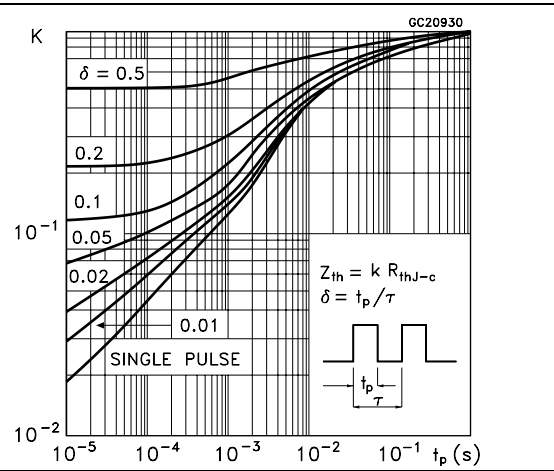


Figure 4. Safe operating area for DPAK

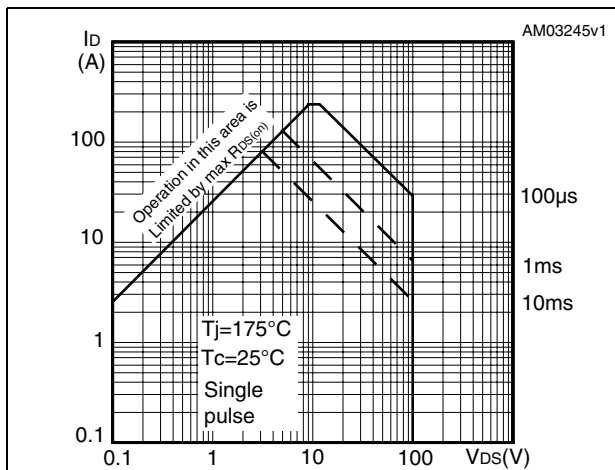


Figure 5. Thermal impedance for DPAK

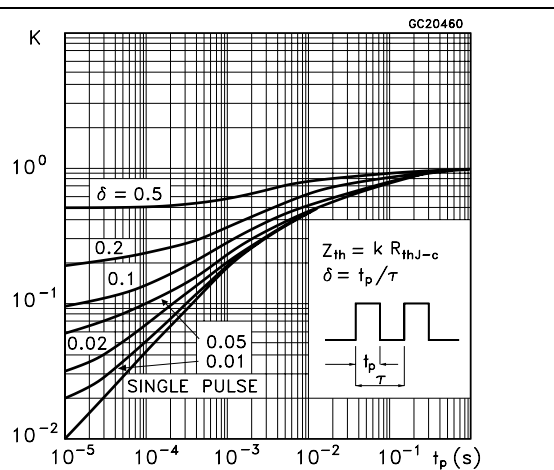


Figure 6. Output characteristics

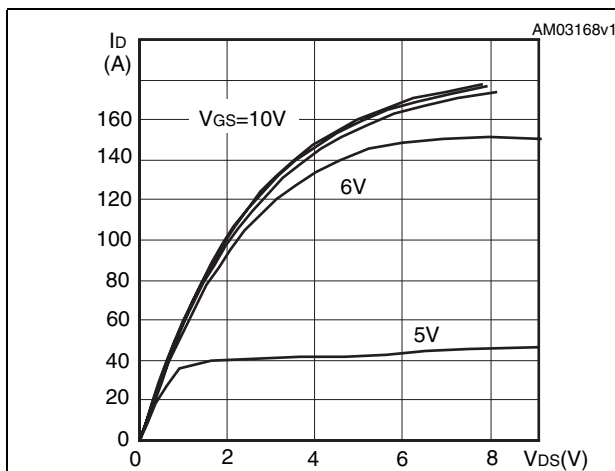


Figure 7. Transfer characteristics

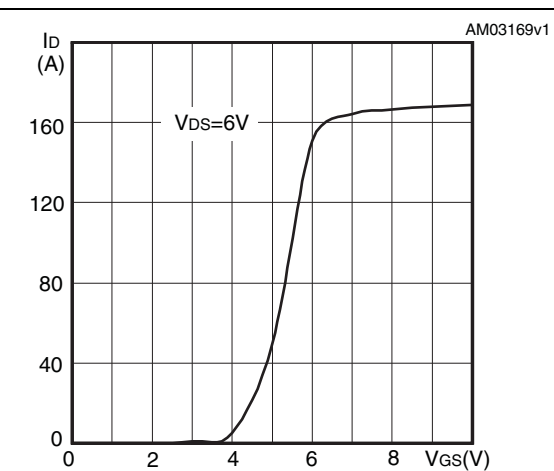


Figure 8. Normalized B_{VDSS} vs temperature Figure 9. Static drain-source on resistance

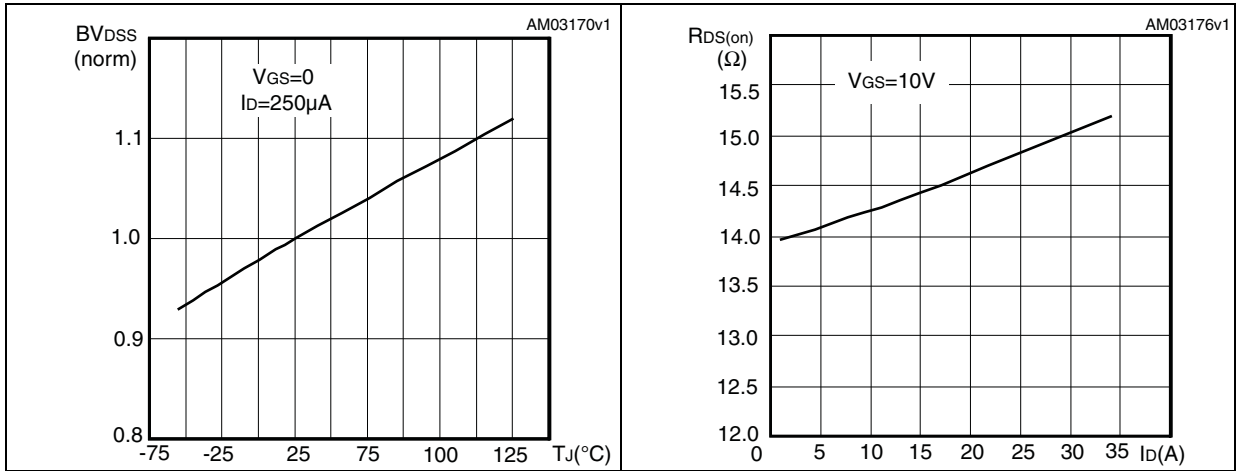


Figure 10. Gate charge vs gate-source voltage Figure 11. Capacitance variations

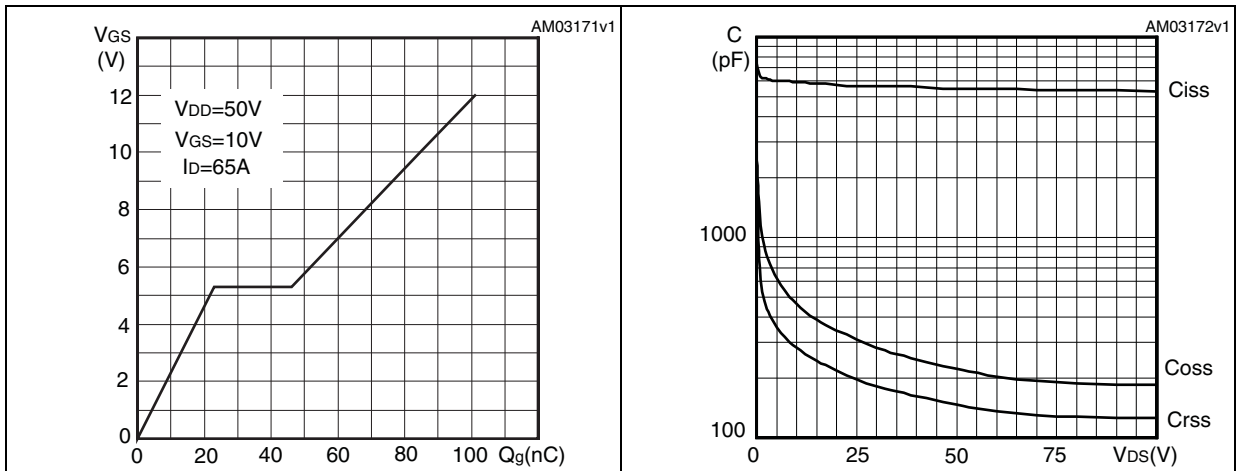


Figure 12. Normalized gate threshold voltage vs temperature Figure 13. Normalized on resistance vs temperature

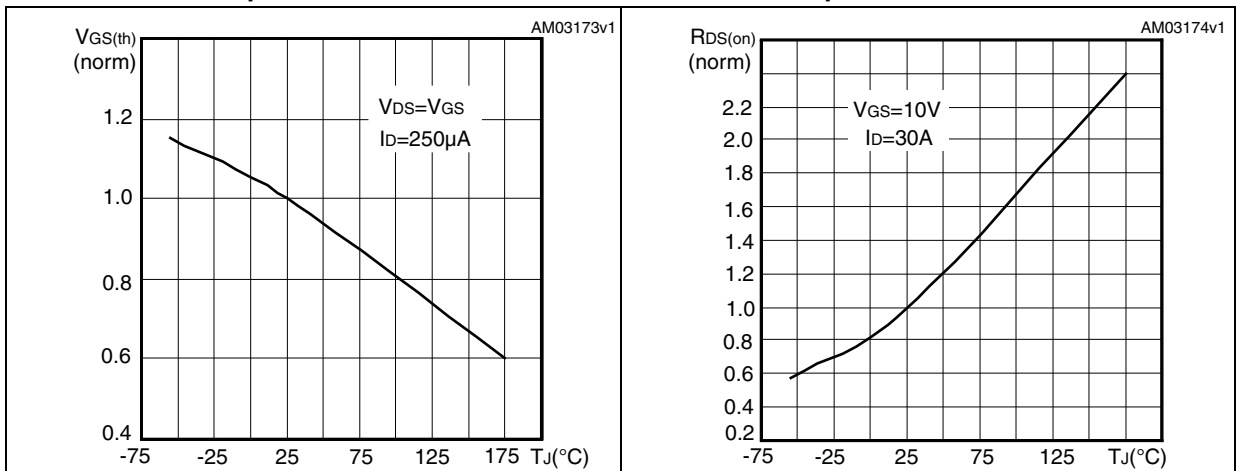
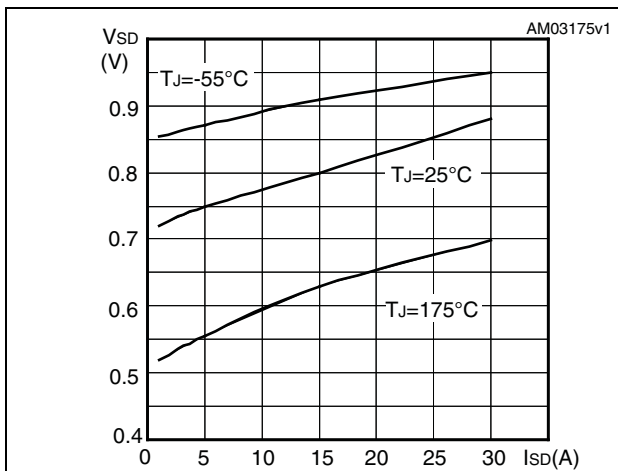


Figure 14. Source-drain diode forward characteristics



3 Test circuit

Figure 15. Switching times test circuit for resistive load

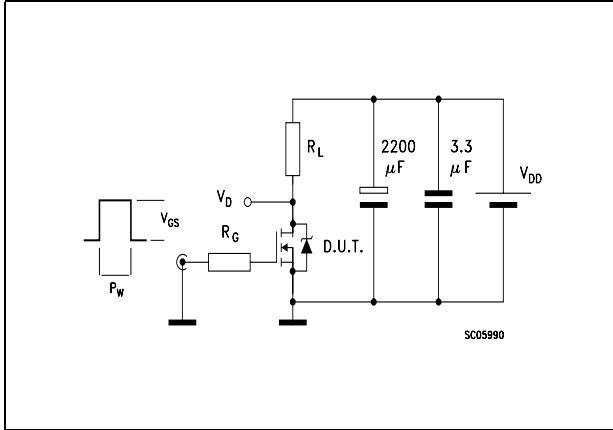


Figure 16. Gate charge test circuit

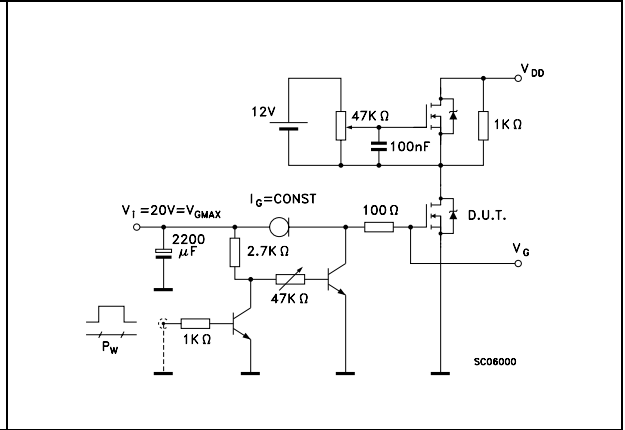


Figure 17. Test circuit for inductive load switching and diode recovery times

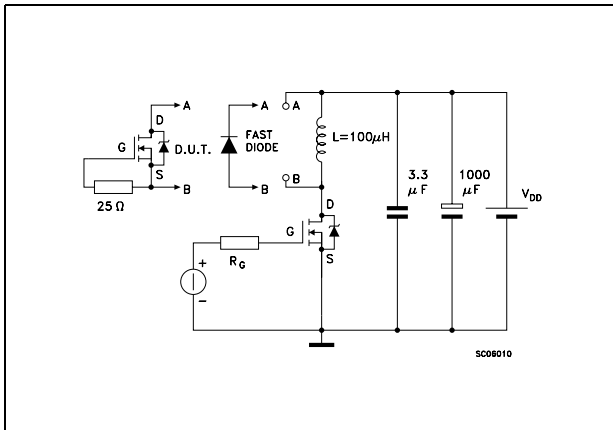


Figure 18. Unclamped inductive load test circuit

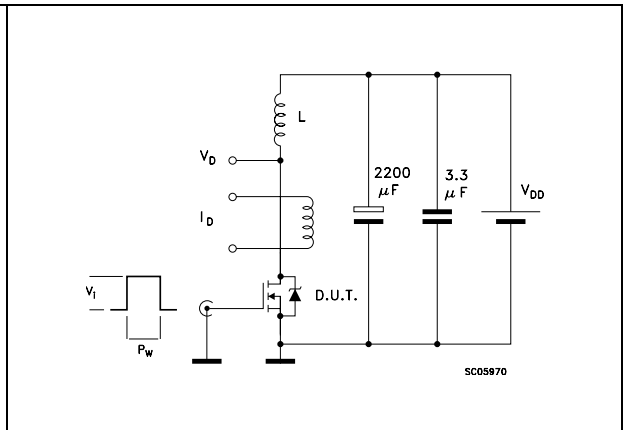


Figure 19. Unclamped inductive waveform

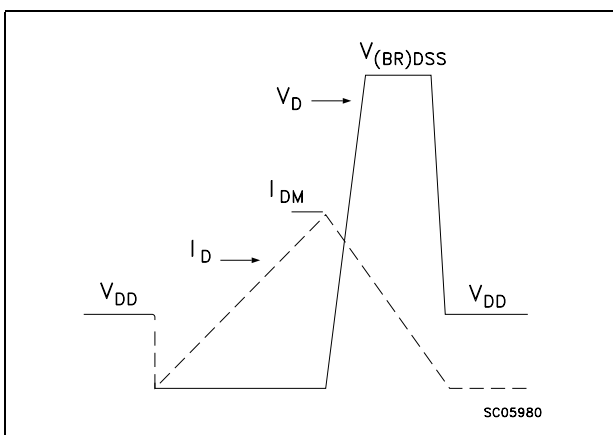
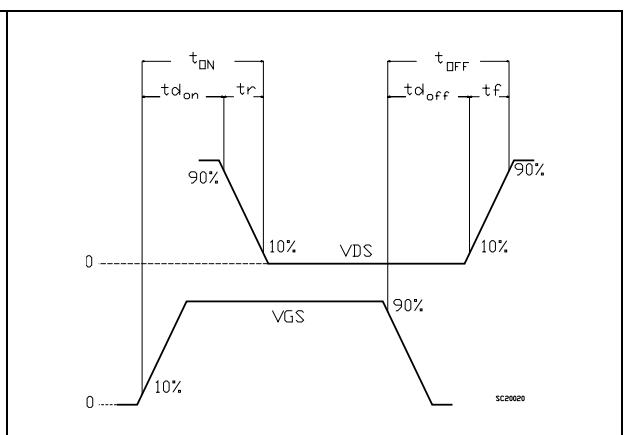


Figure 20. Switching time waveform

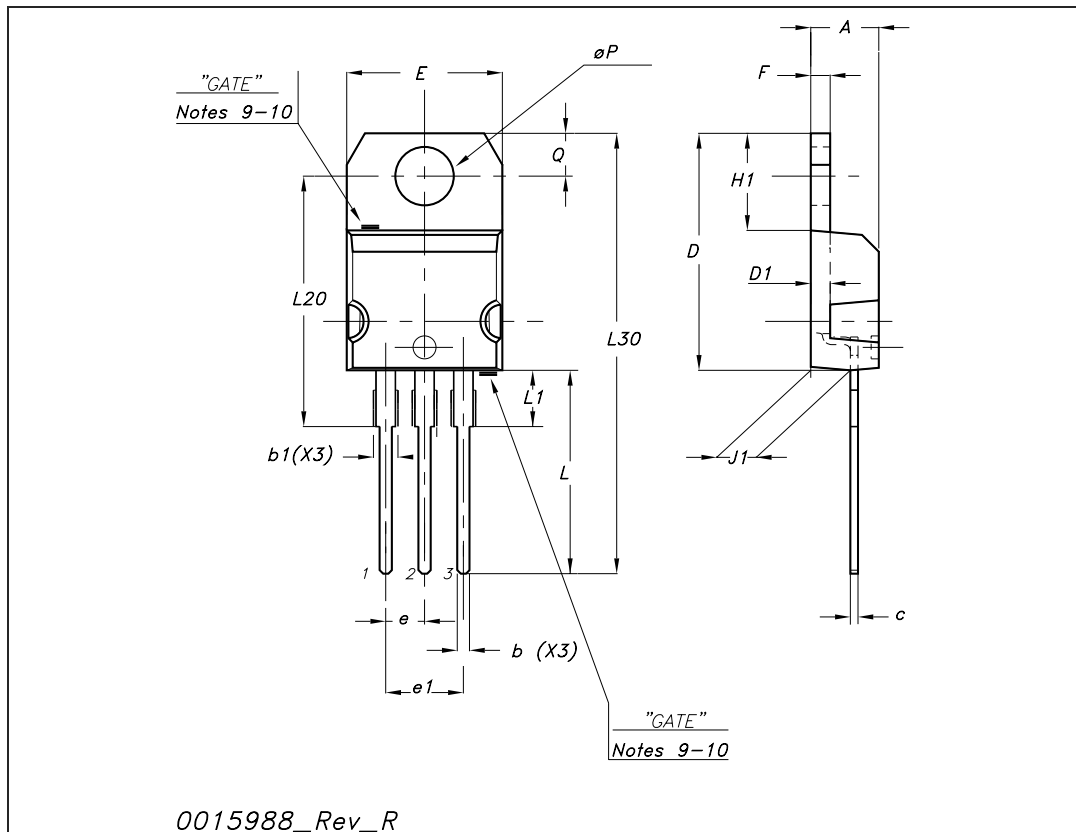


4 Package mechanical data

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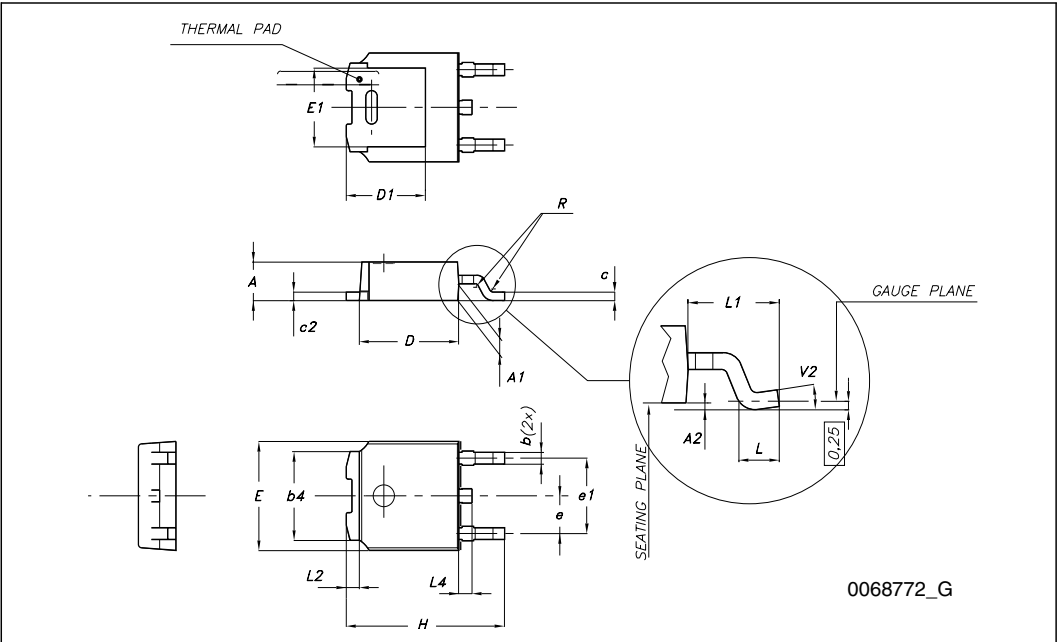
TO-220 mechanical data

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



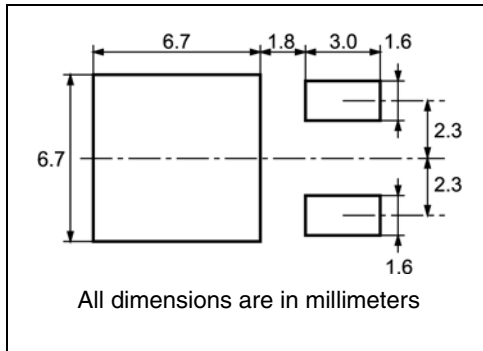
TO-252 (DPAK) mechanical data

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



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

BASE QTY		BULK QTY	
2500		2500	

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-Nov-2008	1	First release
14-Jan-2009	2	Added new package, mechanical data

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