



STB70N10F4, STD70N10F4 STP70N10F4, STW70N10F4

N-channel 100 V, 0.015 Ω , 60 A, STripFET™ DeepGATE™
Power MOSFET in TO-220, DPAK, TO-247, D²PAK

Features

Type	V _{DSS}	R _{DS(on)} max	I _D
STB70N10F4	100 V	< 0.0195 Ω	65 A
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 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 performance.

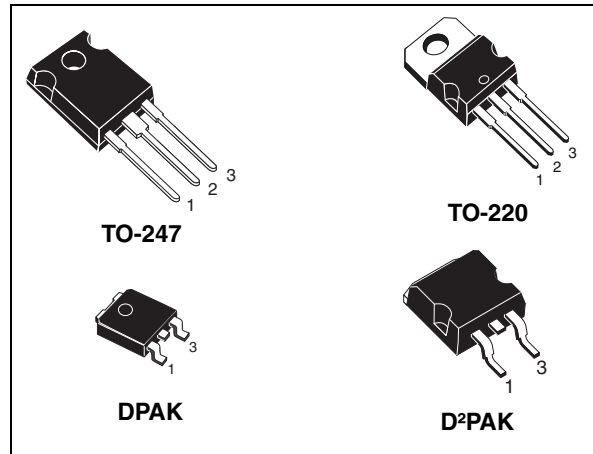


Figure 1. Internal schematic diagram

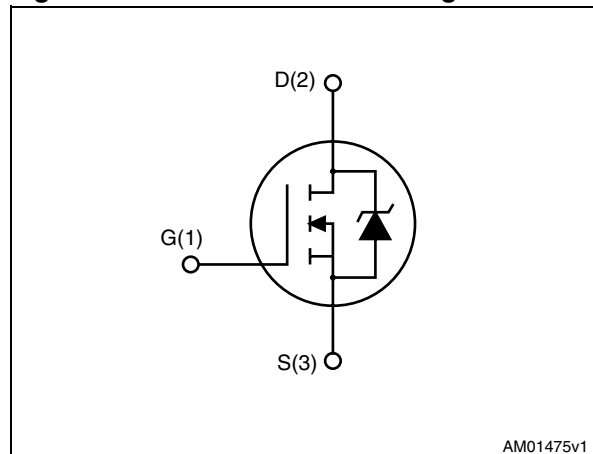


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB70N10F4	70N10F4	D ² PAK	Tape and reel
STD70N10F4	70N10F4	DPAK	Tape and reel
STP70N10F4	70N10F4	TO-220	Tube
STW70N10F4	70N10F4	TO-247	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220, TO-247, D ² PAK	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, D ² PAK	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

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown voltage	$I_D = 250\text{ }\mu\text{A}$, $V_{GS} = 0$	100			V
I_{DSS}	Zero gate voltage Drain current ($V_{GS} = 0$)	$V_{DS} = \text{max rating}$ $V_{DS} = \text{max rating}$, $T_C = 125\text{ }^{\circ}\text{C}$			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	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	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	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	5800		pF
C_{oss}	Output capacitance			300	-	pF
C_{rss}	Reverse transfer capacitance			190		pF
Q_g	Total gate charge	$V_{DD} = 80\text{ V}$, $I_D = 65\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 16)	-	85		nC
Q_{gs}	Gate-source charge			20	-	nC
Q_{gd}	Gate-drain charge			25		nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 50\text{ V}$, $I_D = 30\text{ A}$ $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 15)	-	30	-	ns
t_r	Rise time			20		ns
$t_{d(off)}$	Turn-off-delay time	$V_{DD} = 50\text{ V}$, $I_D = 30\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 15)	-	65	-	ns
t_f	Fall time			20		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, D²PAK

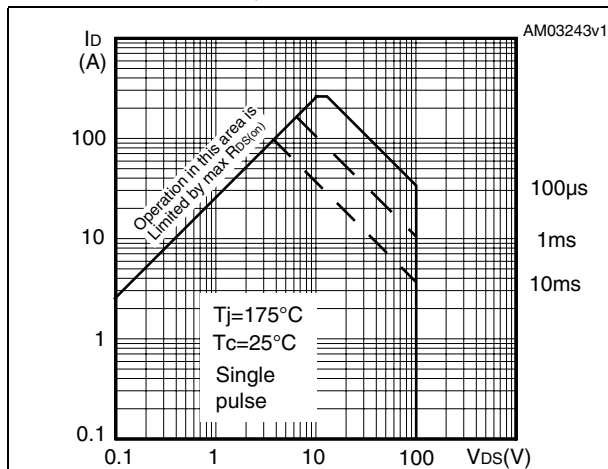


Figure 3. Thermal impedance for TO-220, TO-247, D²PAK

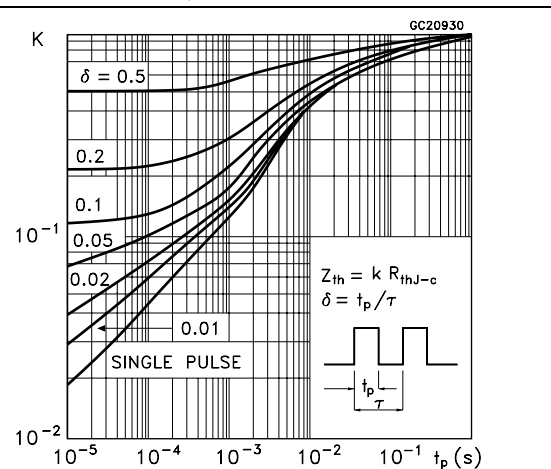


Figure 4. Safe operating area for DPAK

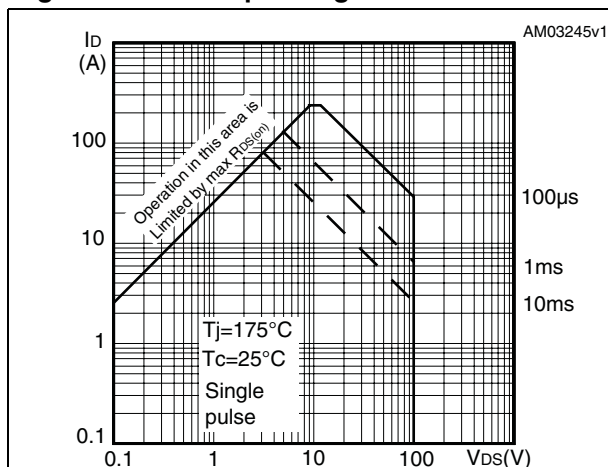


Figure 5. Thermal impedance for DPAK

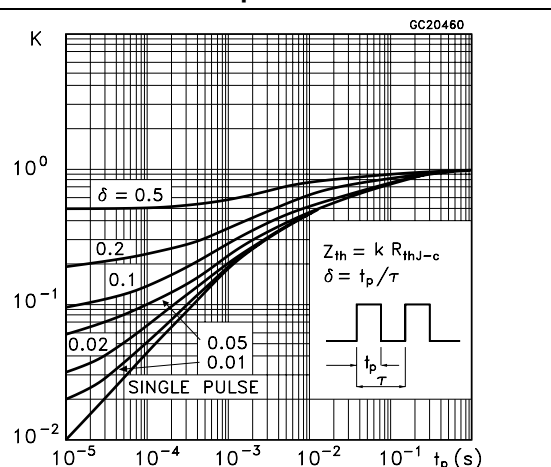


Figure 6. Output characteristics

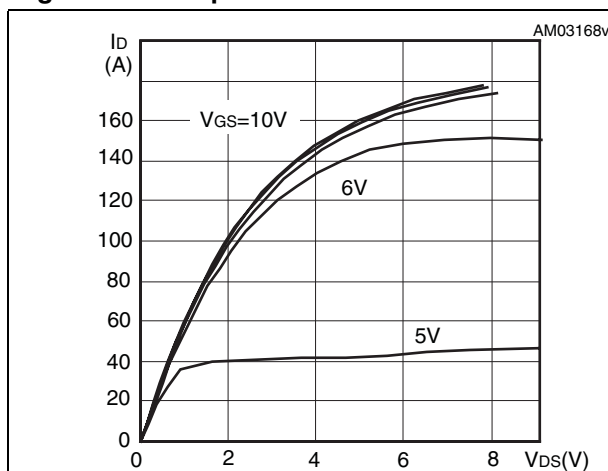


Figure 7. Transfer characteristics

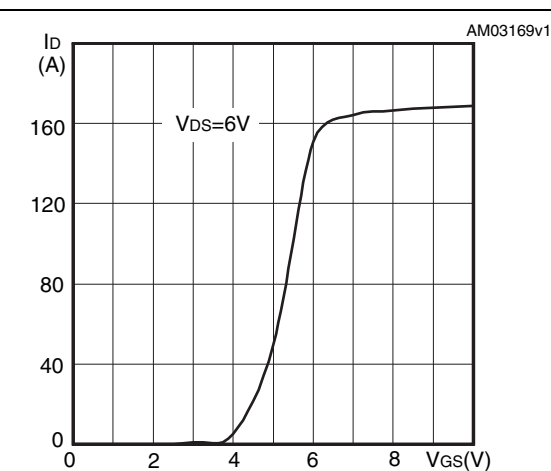


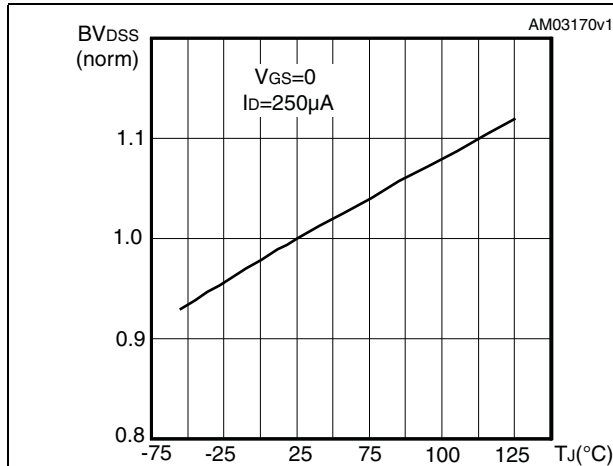
Figure 8. Normalized $B_{V_{DSS}}$ vs temperature

Figure 9. Static drain-source on resistance

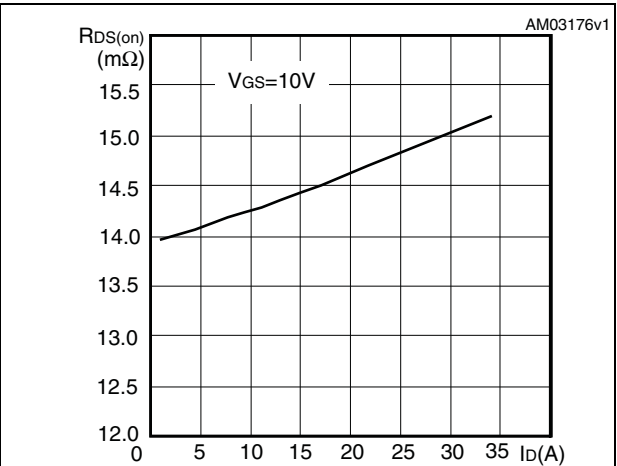


Figure 10. Gate charge vs gate-source voltage

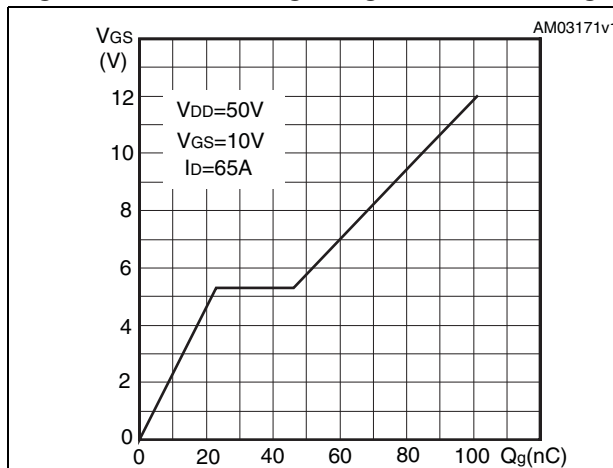


Figure 11. Capacitance variations

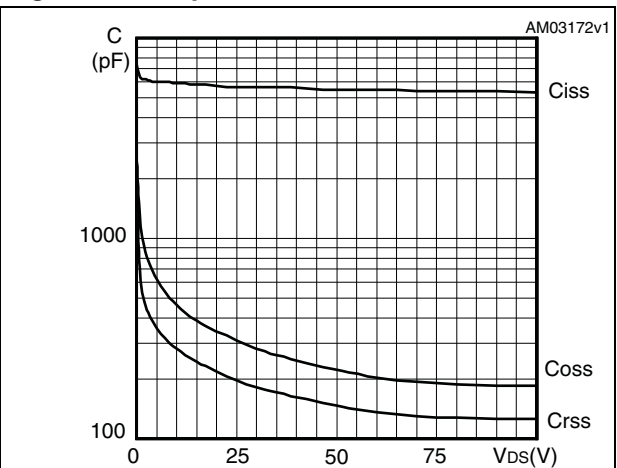


Figure 12. Normalized gate threshold voltage vs temperature

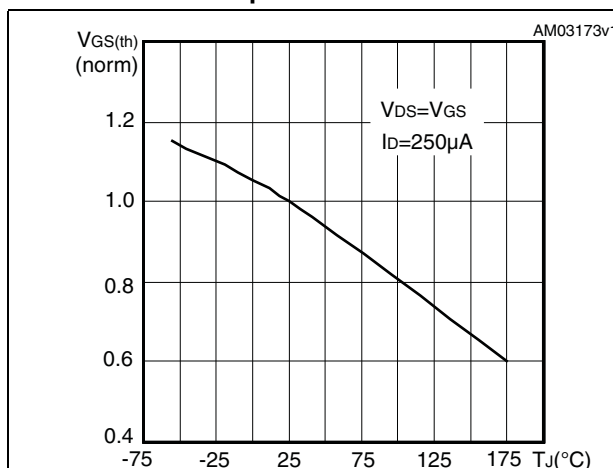


Figure 13. Normalized on resistance vs temperature

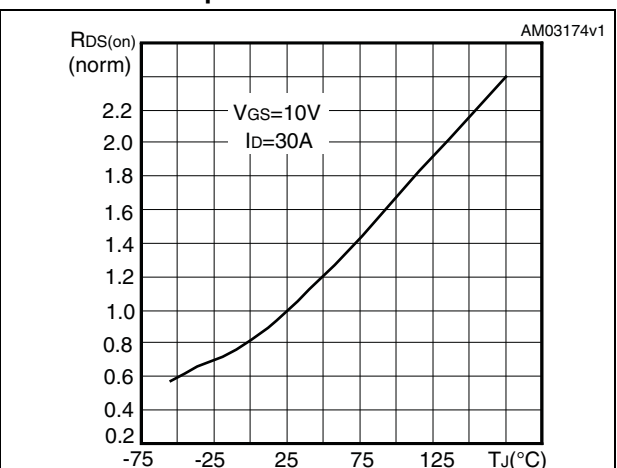
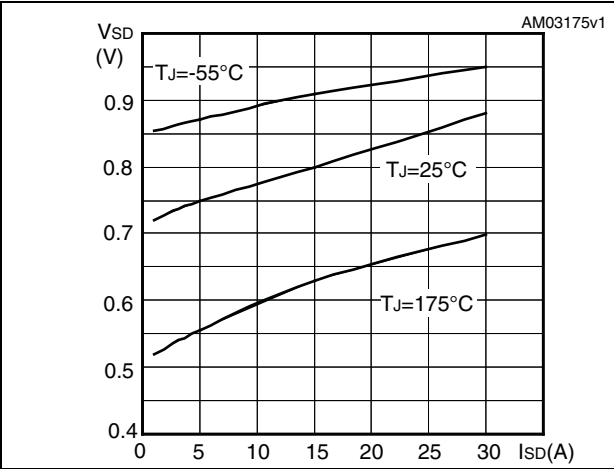


Figure 14. Source-drain diode forward characteristics



3 Test circuits

Figure 15. Switching times test circuit for resistive load

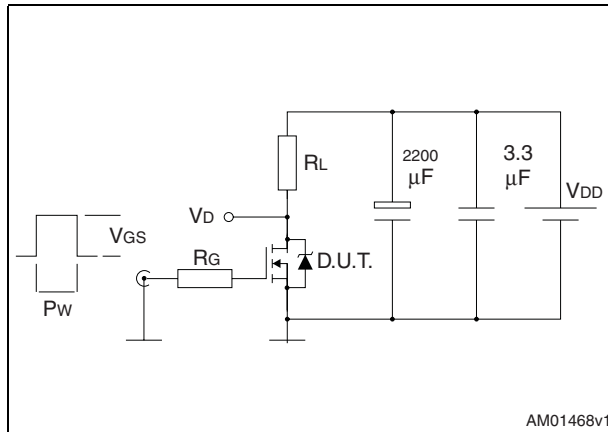


Figure 16. Gate charge test circuit

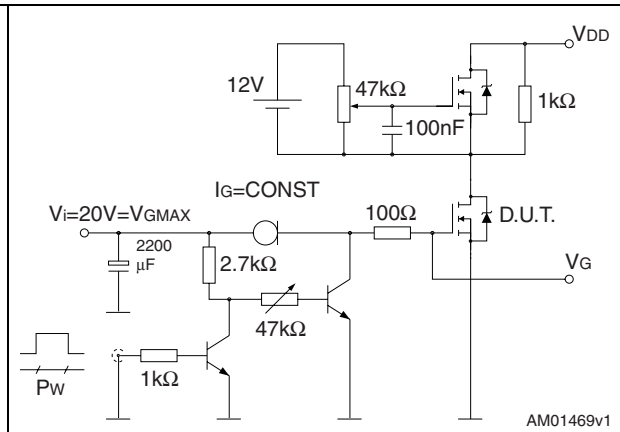


Figure 17. Test circuit for inductive load switching and diode recovery times

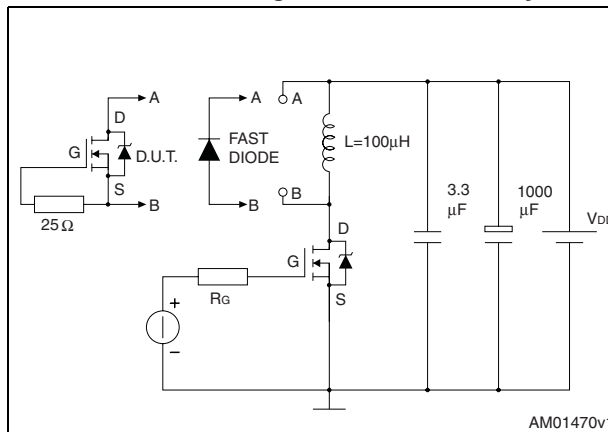


Figure 18. Unclamped inductive load test circuit

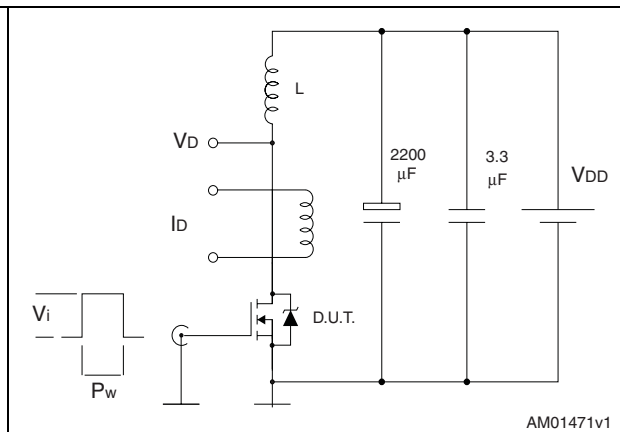


Figure 19. Unclamped inductive waveform

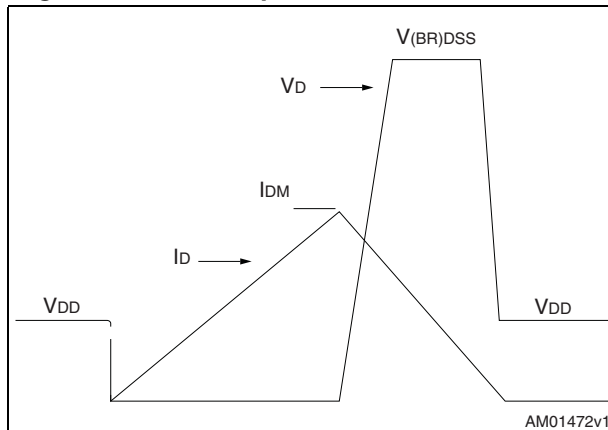
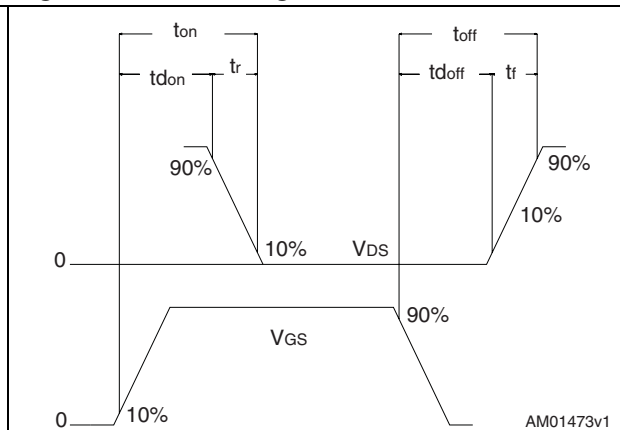


Figure 20. Switching time waveform

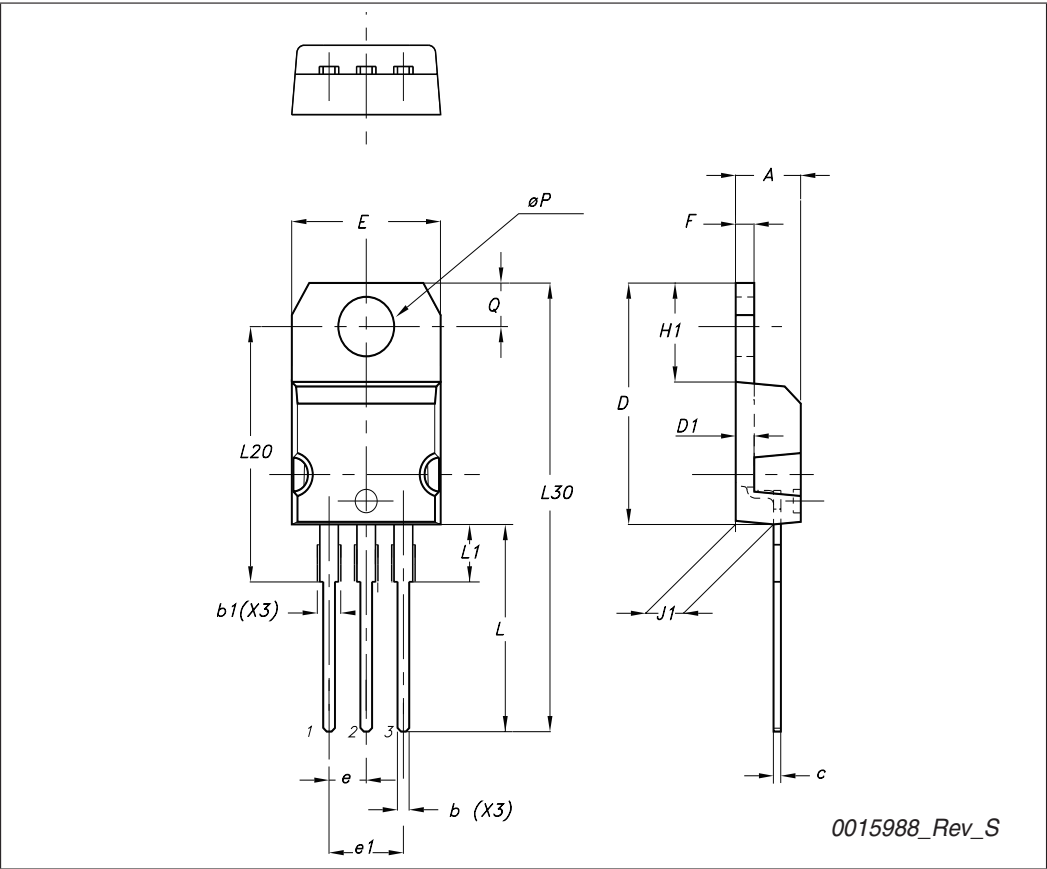


4 **Package mechanical data**

In order to meet environmental requirements, ST offers these devices in 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.

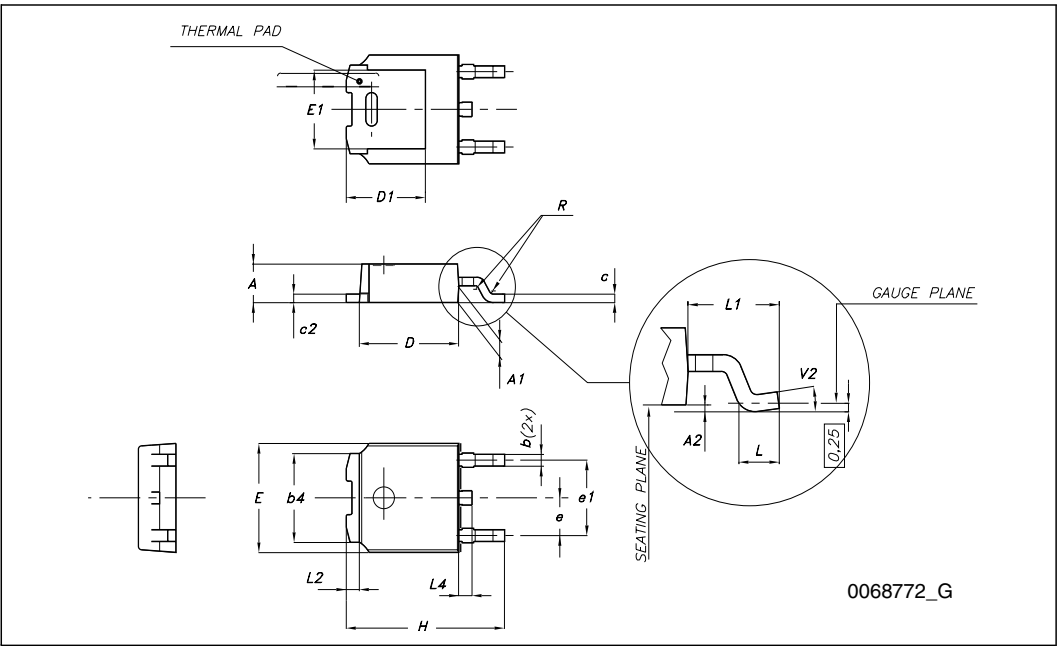
TO-220 type A mechanical data

Dim	mm		
	Min	Typ	Max
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95



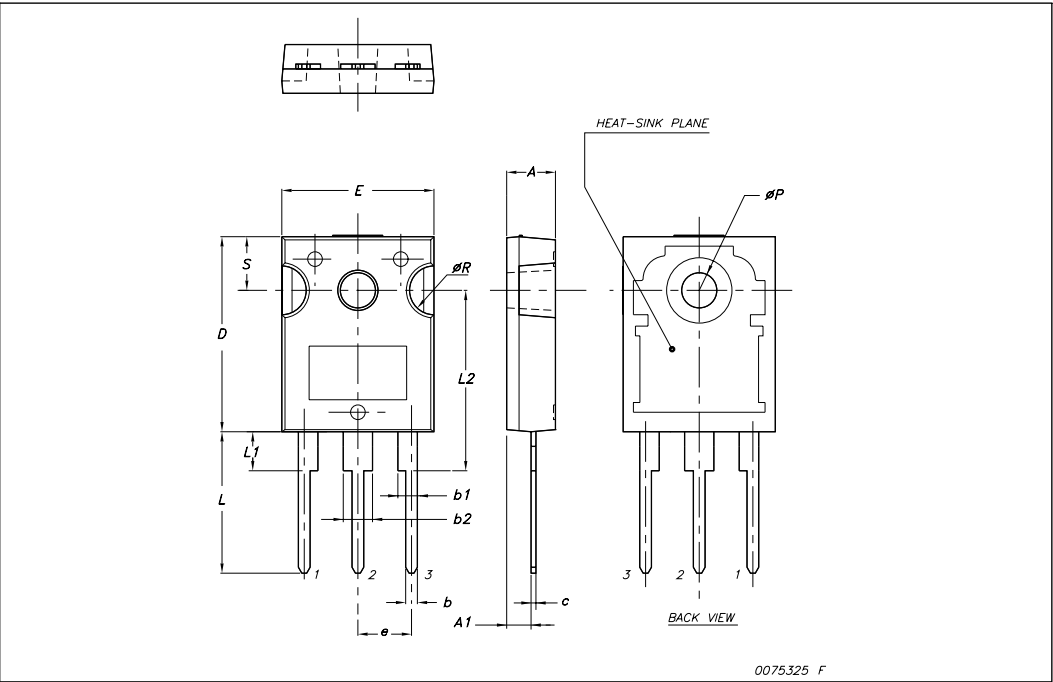
TO-252 (DPAK) mechanical data

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°



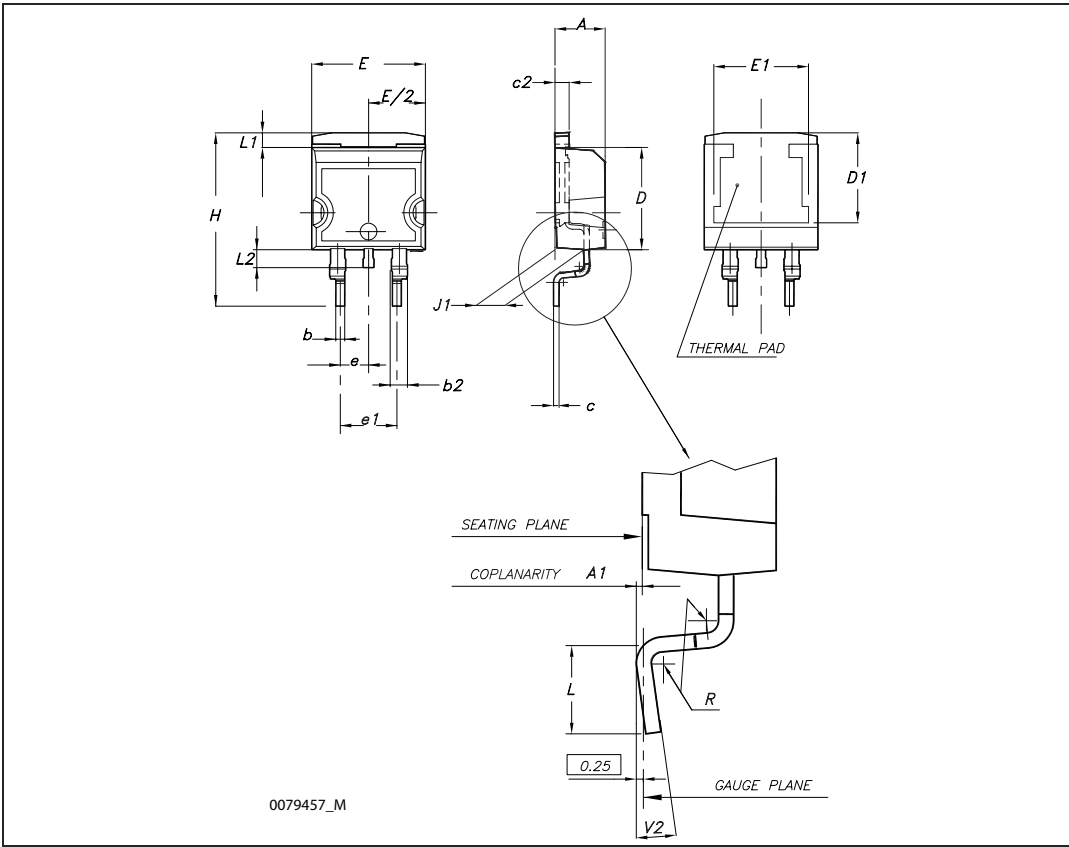
TO-247 Mechanical data

Dim.	mm.		
	Min.	Typ	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
øP	3.55		3.65
øR	4.50		5.50
S		5.50	



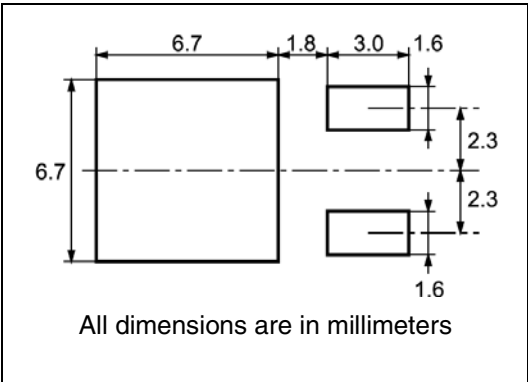
D²PAK (TO-263) mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
A1	0.03		0.23	0.001		0.009
b	0.70		0.93	0.027		0.037
b2	1.14		1.70	0.045		0.067
c	0.45		0.60	0.017		0.024
c2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1	7.50			0.295		
E	10		10.40	0.394		0.409
E1	8.50			0.334		
e		2.54			0.1	
e1	4.88		5.28	0.192		0.208
H	15		15.85	0.590		0.624
J1	2.49		2.69	0.099		0.106
L	2.29		2.79	0.090		0.110
L1	1.27		1.40	0.05		0.055
L2	1.30		1.75	0.051		0.069
R		0.4			0.016	
V2	0°		8°	0°		8°

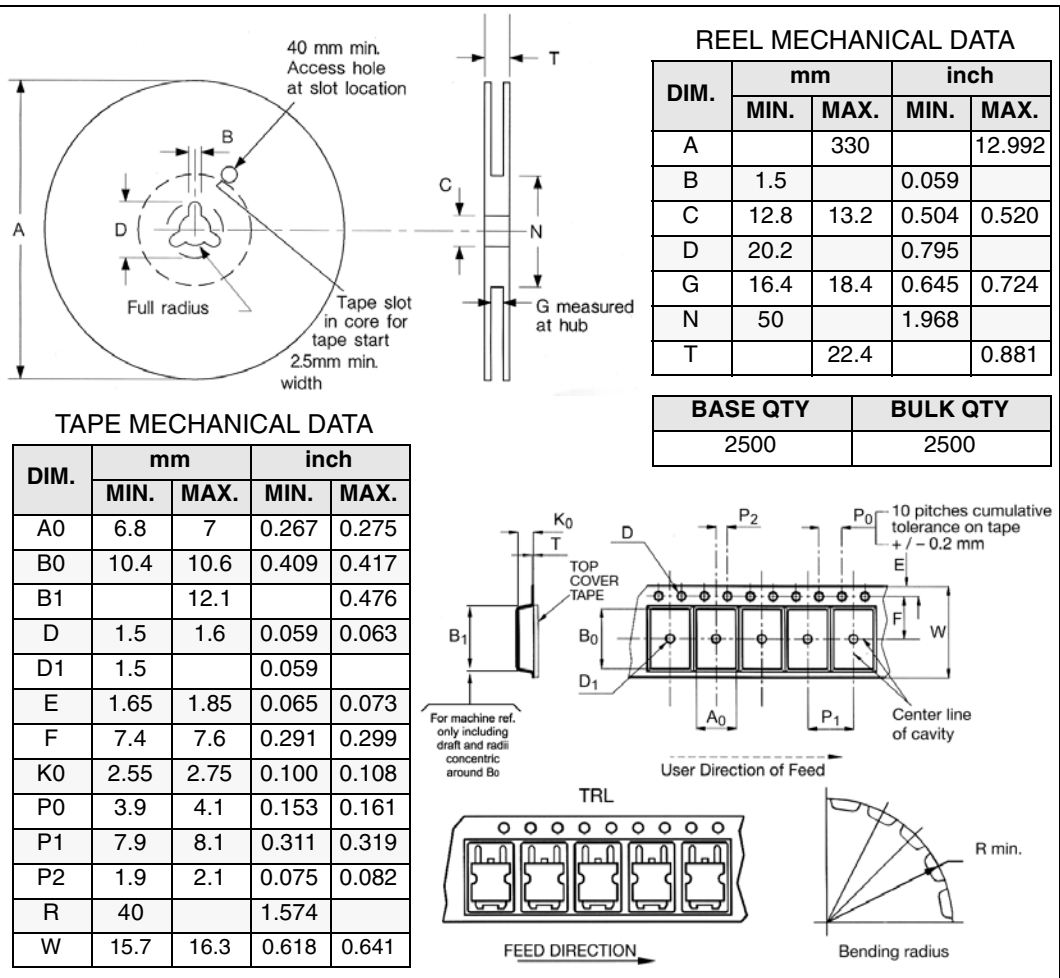


5 Packaging mechanical data

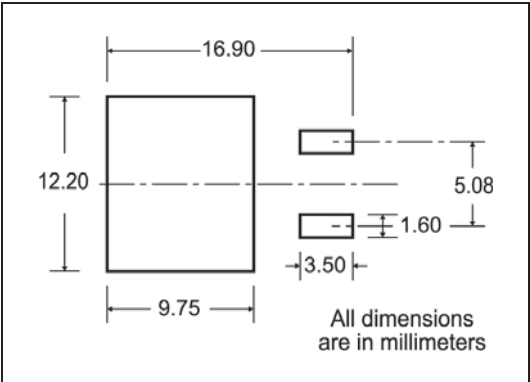
DPAK FOOTPRINT



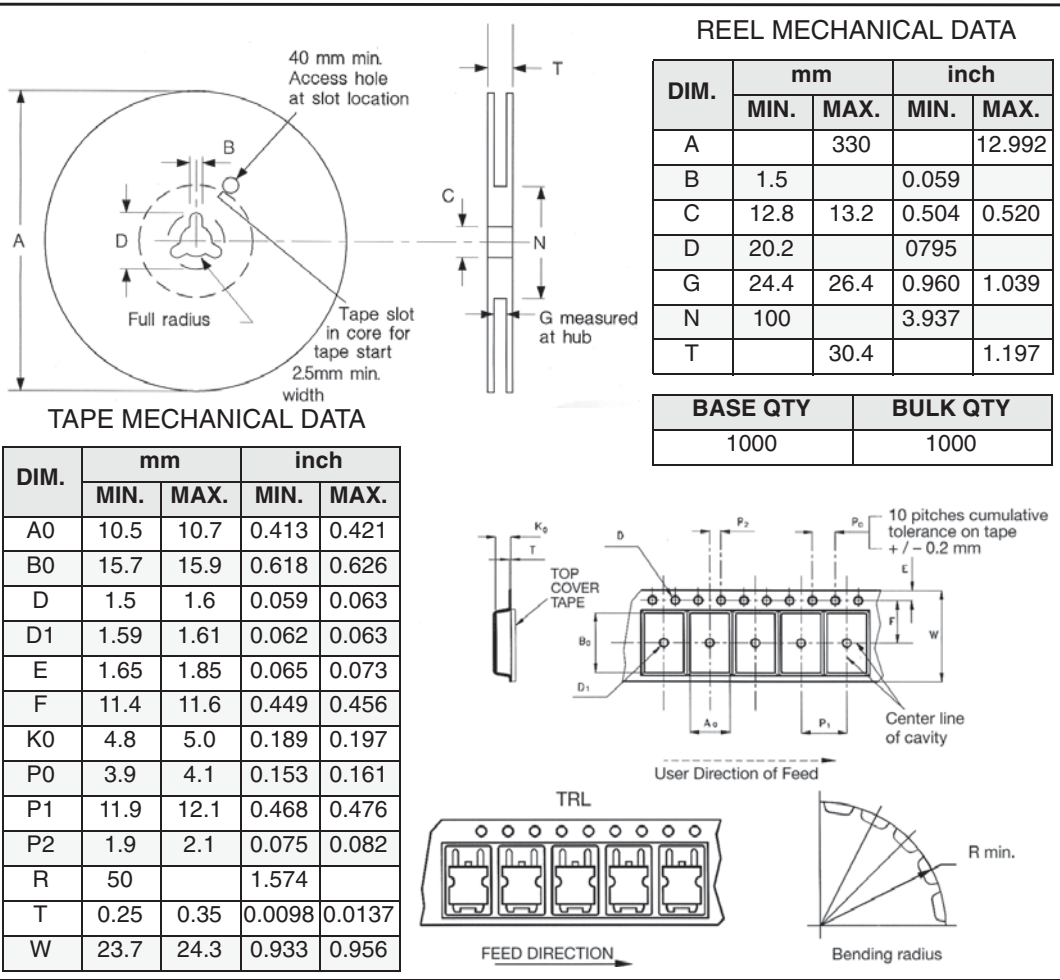
TAPE AND REEL SHIPMENT



D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



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 DPAK
09-Oct-2009	3	Added new package, mechanical data D ² PAK

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