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.

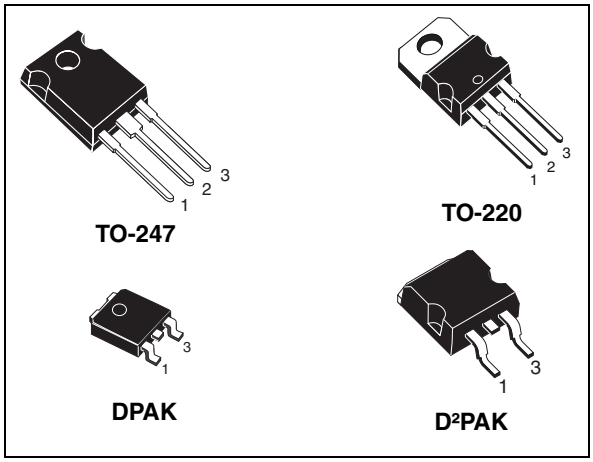


Figure 1. Internal schematic diagram

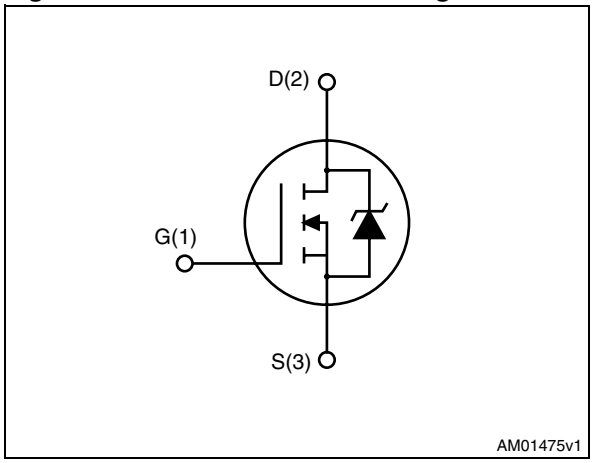


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB70N10F4	70N10F4	D²PAK	Tape and reel
STD70N10F4	70N10F4	DPAK	Tape and reel
STP70N10F4	70N10F4	TO-220	Tube
STW70N10F4	70N10F4	TO-247	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220, TO-247, D²PAK	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 °C	65	60	A
I_D	Drain current (continuous) at T_C = 100 °C	46	43	A
I_{DM} (1)	Drain current (pulsed)	260	240	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	120		mJ
T_{stg}	Storage temperature	– 55 to 175		°C
T_j	Max. operating junction temperature			

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

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		TO-220, TO-247, D²PAK	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	50 (1)	°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	100			V
I_{DSS}	Zero gate voltage Drain current (V_{GS} = 0)	V_{DS} = max rating V_{DS} = max rating,T_C=125 °C			1 100	µA 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	V_{GS} = 10 V, I_D = 30 A		0.015	0.0195	Ω

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	-	5800	-	pF
C_{oss}	Output capacitance			300		pF
C_{rss}	Reverse transfer capacitance			190		pF
Q_g	Total gate charge	V_{DD} = 80 V, I_D = 65 A, V_{GS} = 10 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
$t_{d(on)}$ t_r	Turn-on delay time Rise time	V_{DD} = 50 V, I_D = 30 A R_G = 4.7 Ω V_{GS} = 10 V *(see Figure 15)*	-	30 20	-	ns ns
$t_{d(off)}$ t_f	Turn-off-delay time Fall time	V_{DD} = 50 V, I_D = 30 A, R_G = 4.7 Ω, V_{GS} = 10 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 A, V_{GS} = 0	-		1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 60 A, V_{DD} = 25 V di/dt = 100 A/µs, T_j = 150 °C *(see Figure 17)*	-	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

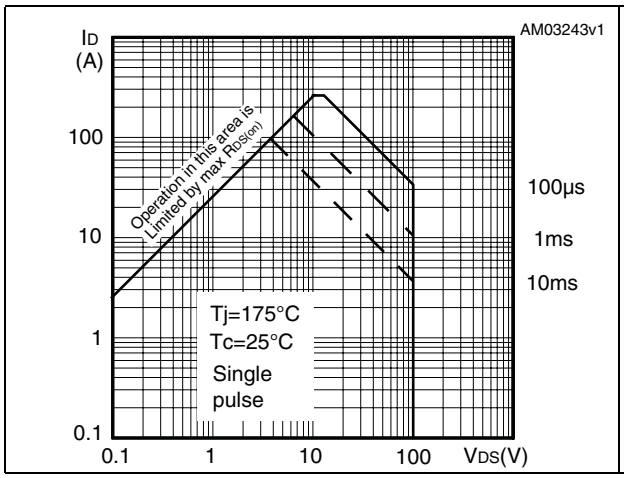


Figure 3. Thermal impedance for TO-220, TO-247, D²PAK

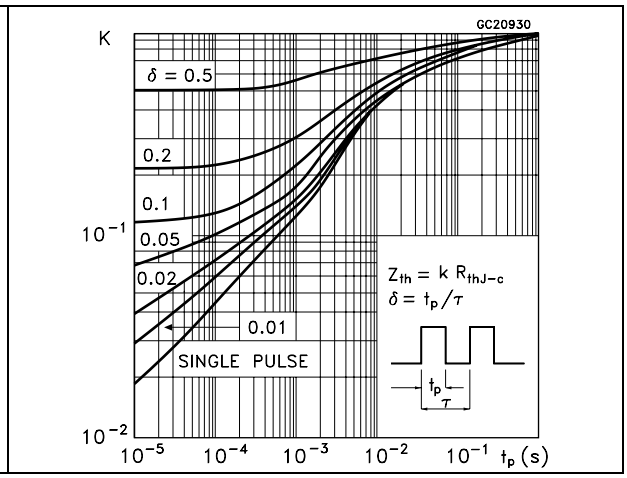


Figure 4. Safe operating area for DPAK

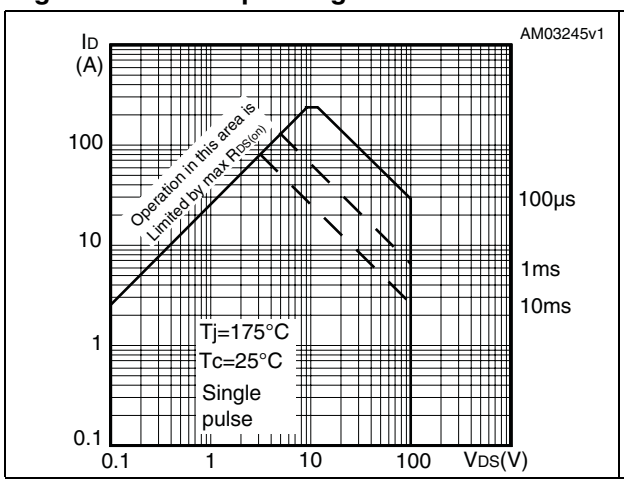


Figure 5. Thermal impedance for DPAK

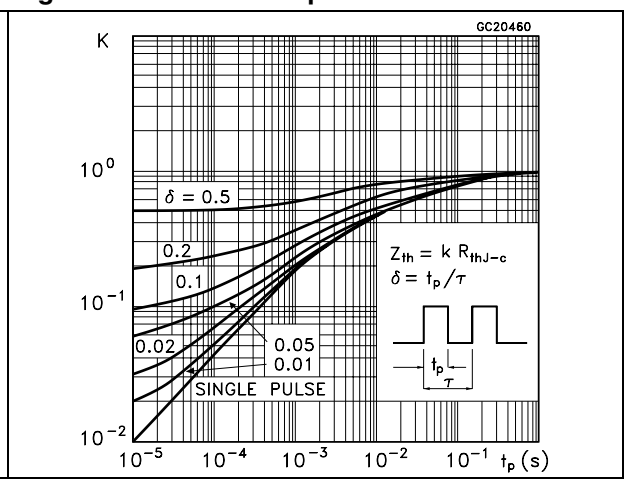


Figure 6. Output characteristics

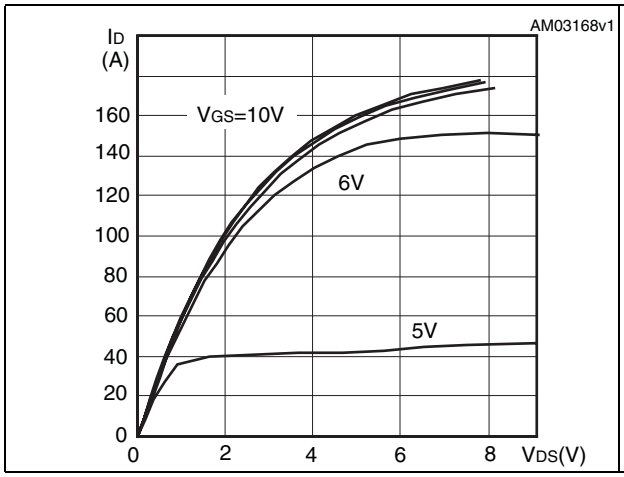


Figure 7. Transfer characteristics

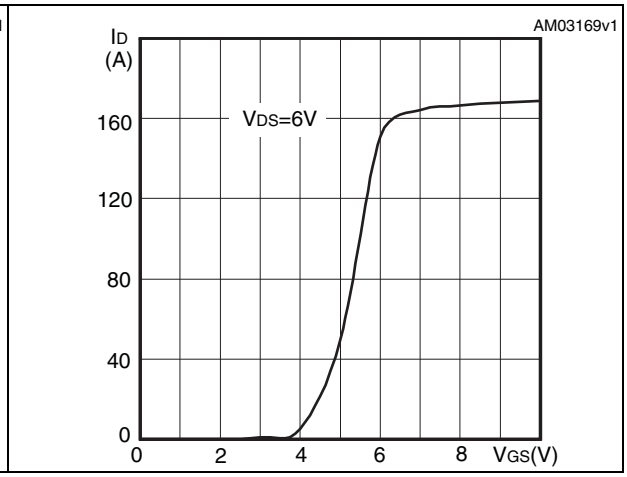


Figure 8. Normalized B_{VDSS} vs temperature

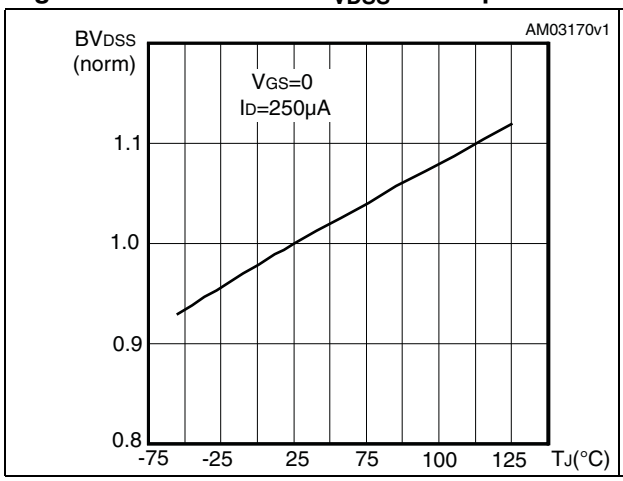


Figure 9. Static drain-source on resistance

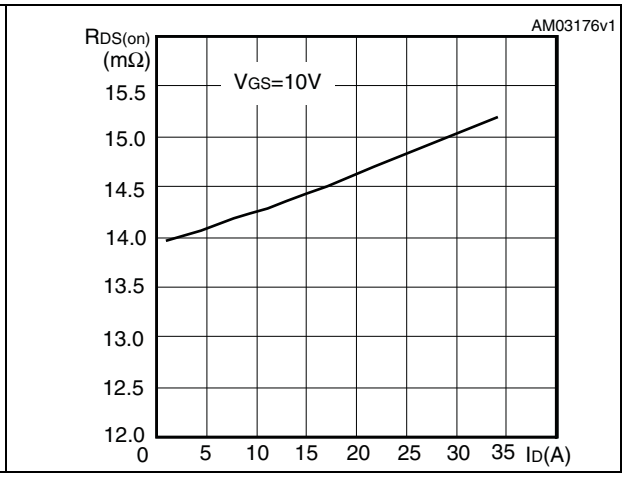


Figure 10. Gate charge vs gate-source voltage

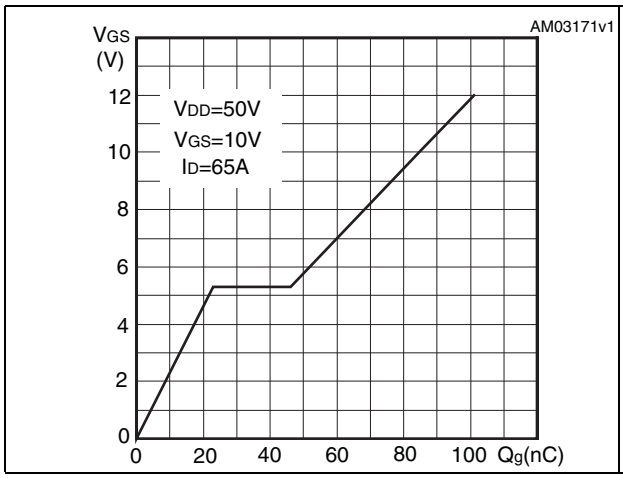


Figure 11. Capacitance variations

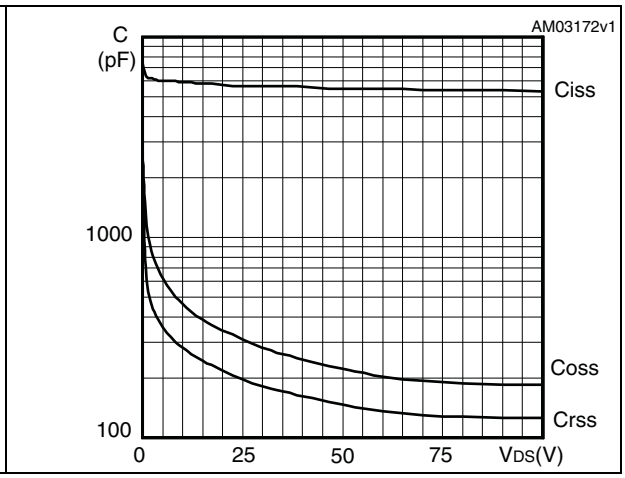


Figure 12. Normalized gate threshold voltage vs temperature

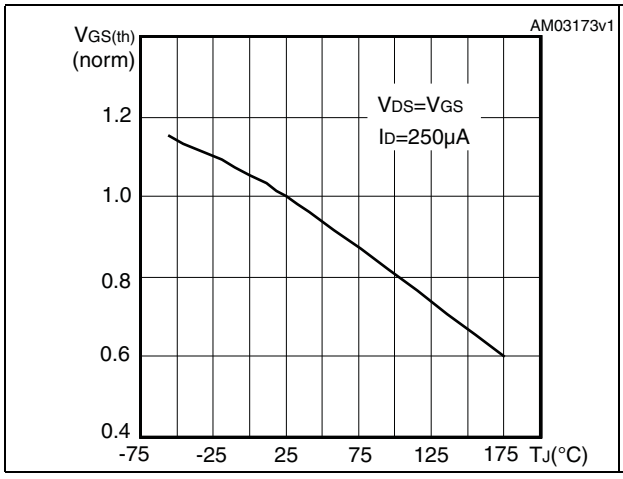


Figure 13. Normalized on resistance vs temperature

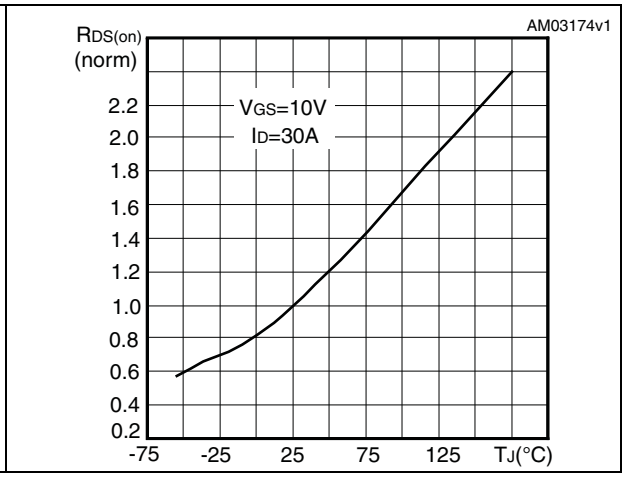
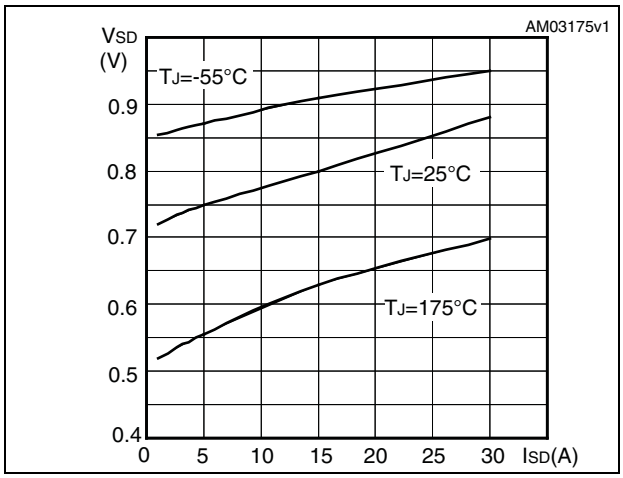


Figure 14. Source-drain diode forward characteristics



3 Test circuits

Figure 15. Switching times test circuit for resistive load

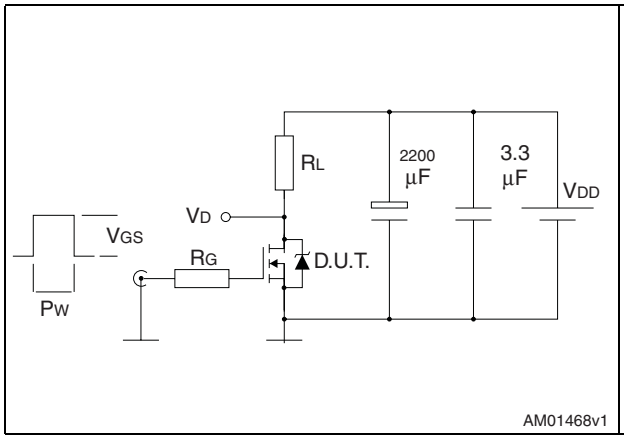


Figure 16. Gate charge test circuit

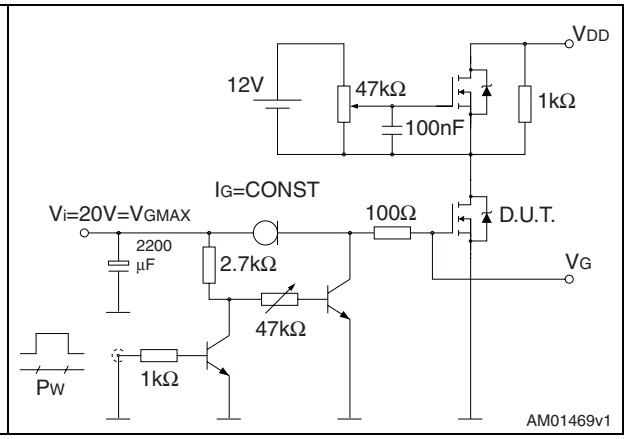


Figure 17. Test circuit for inductive load switching and diode recovery times

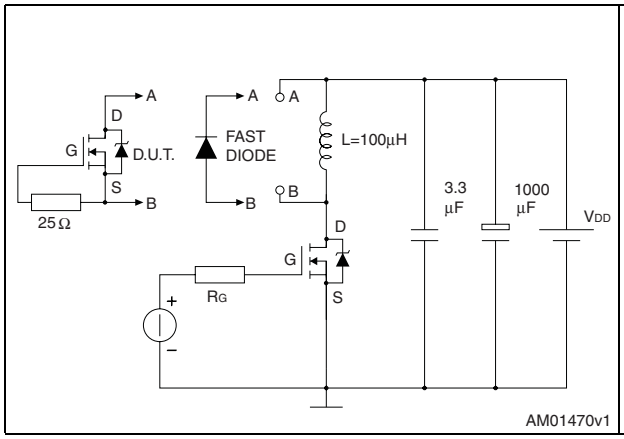


Figure 18. Unclamped inductive load test circuit

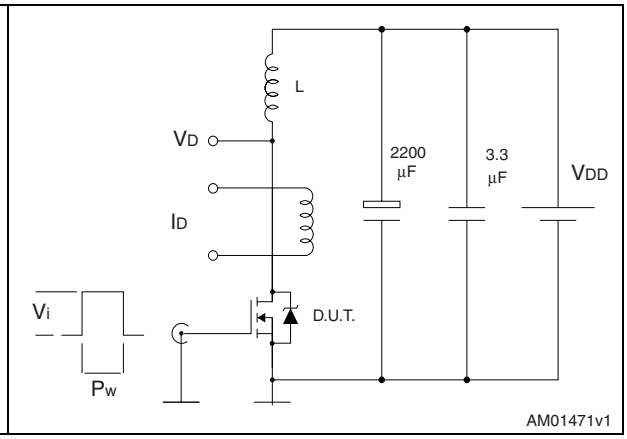


Figure 19. Unclamped inductive waveform

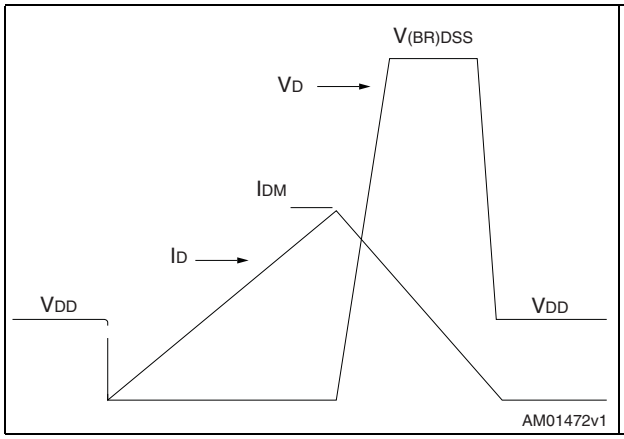
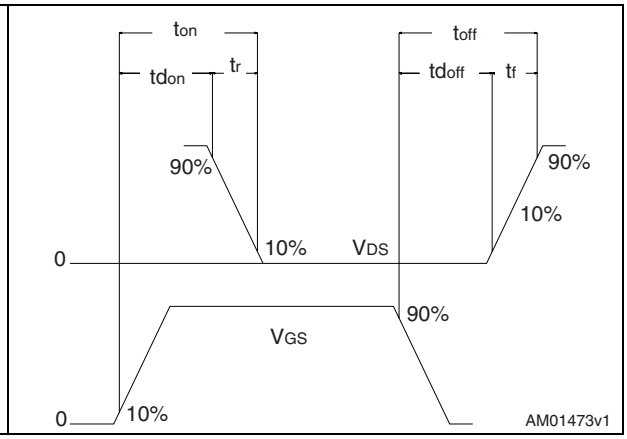


Figure 20. Switching time waveform

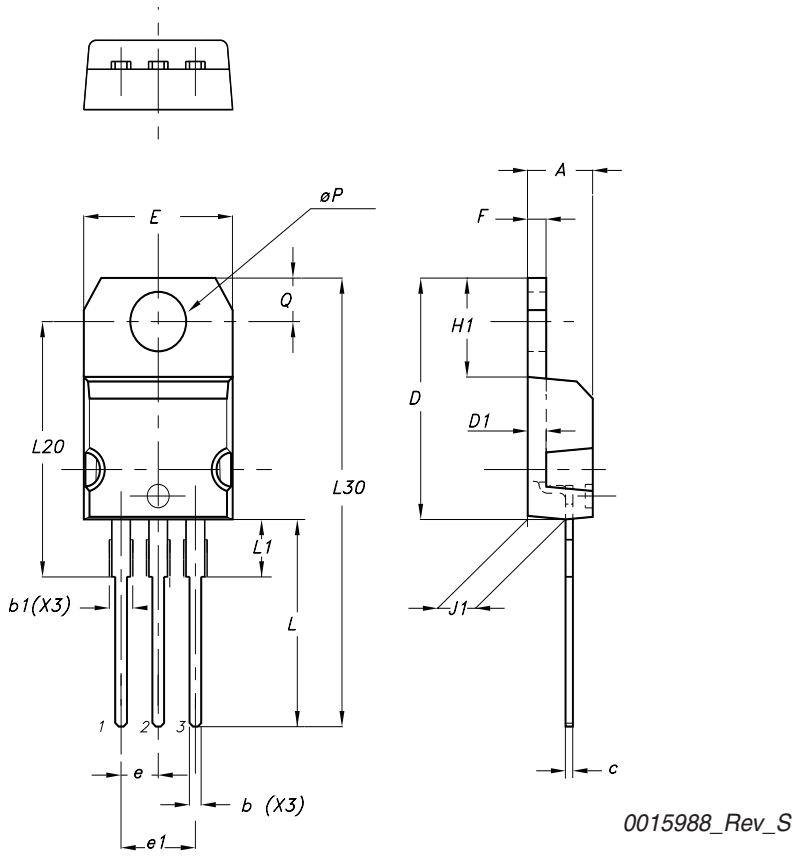


4 Package mechanical data

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.

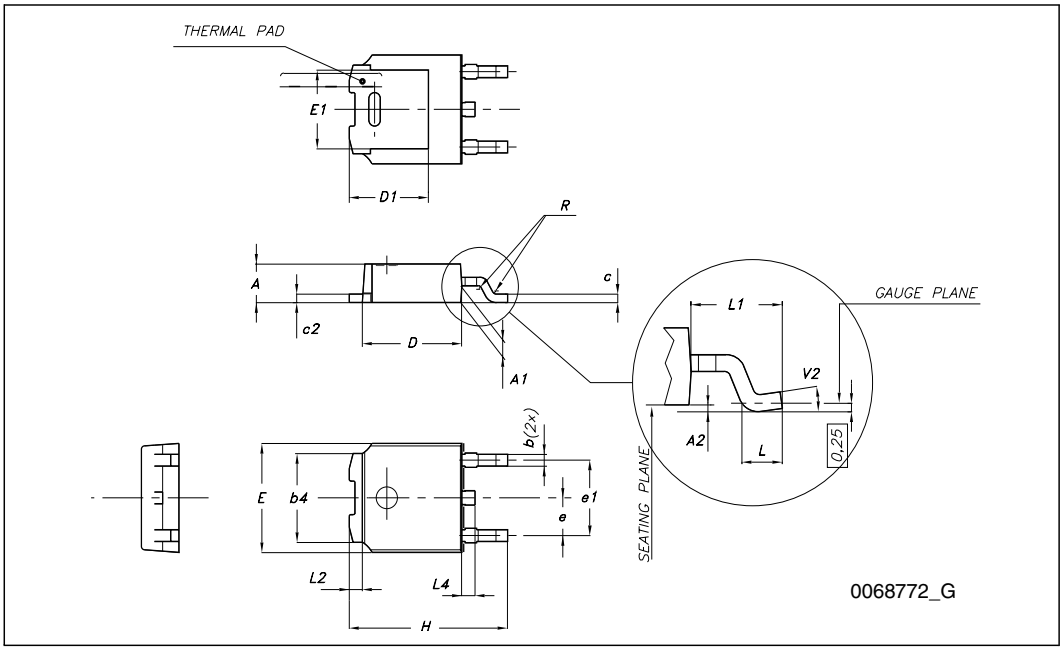
TO-220 type A mechanical data

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	
∅P	3.75		3.85
Q	2.65		2.95



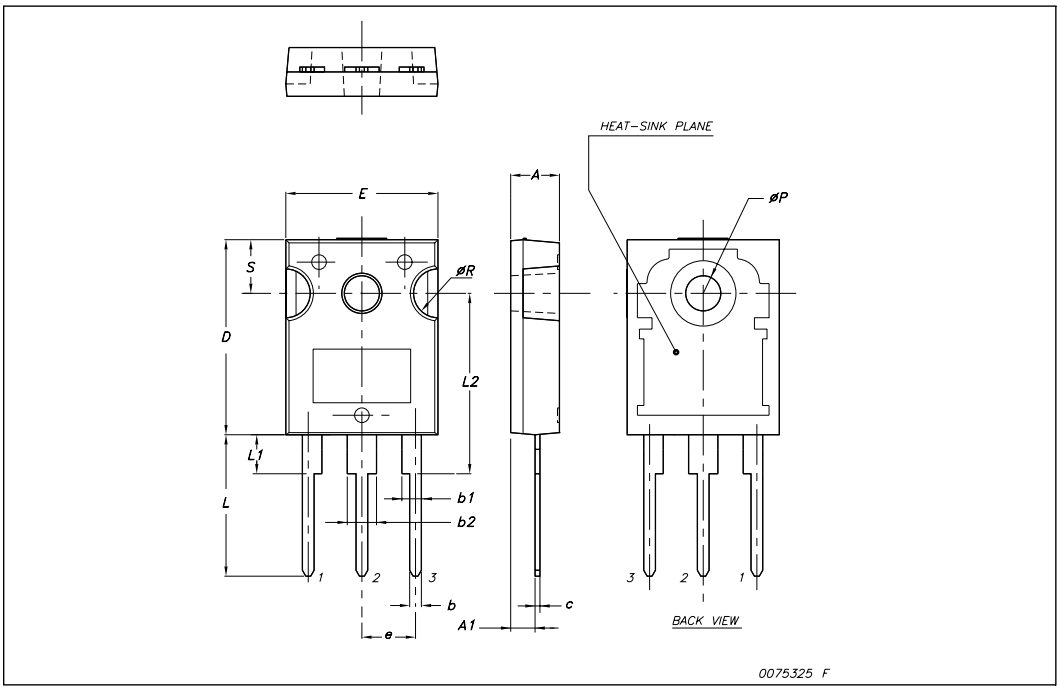
TO-252 (DPAK) mechanical data

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 °



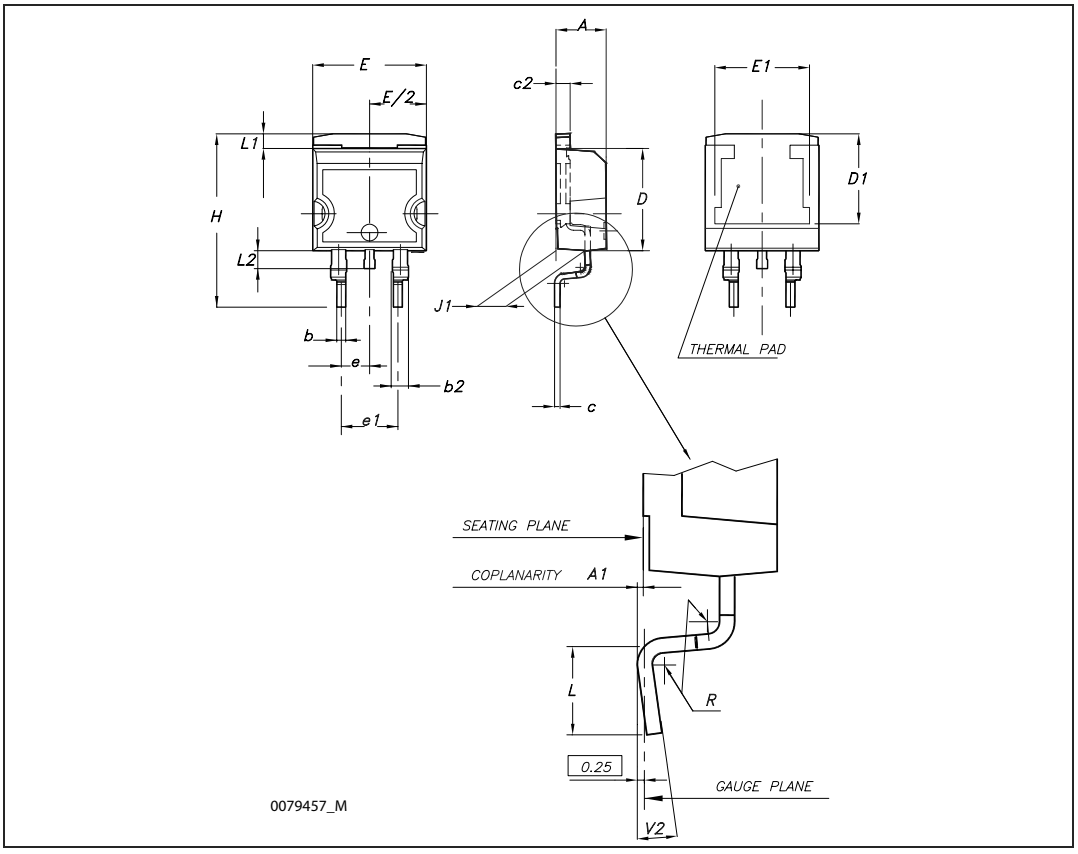
TO-247 Mechanical data

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	



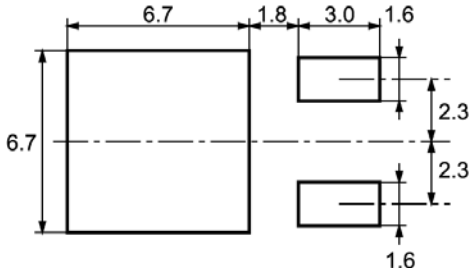
D²PAK (TO-263) mechanical data

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°



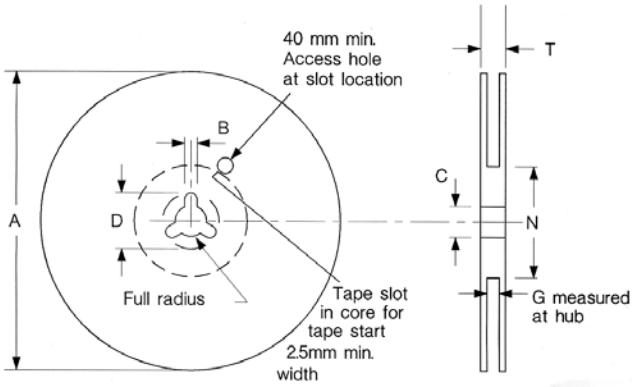
5 Packaging mechanical data

DPAK FOOTPRINT



All dimensions are in millimeters

TAPE AND REEL SHIPMENT



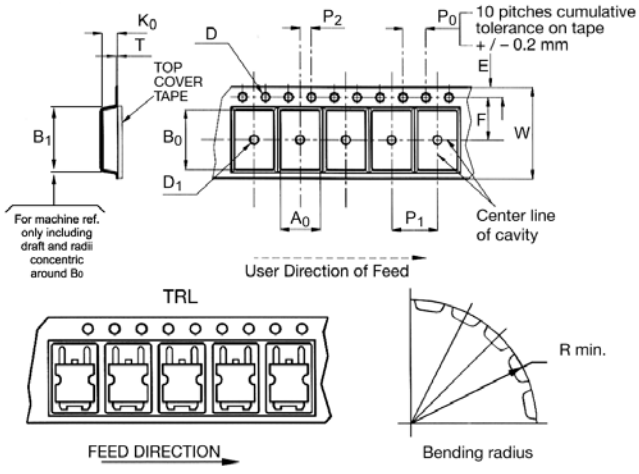
REEL MECHANICAL DATA

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

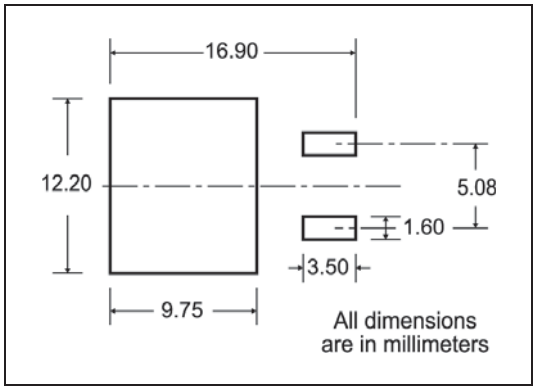
BASE QTY	BULK QTY
2500	2500

TAPE MECHANICAL DATA

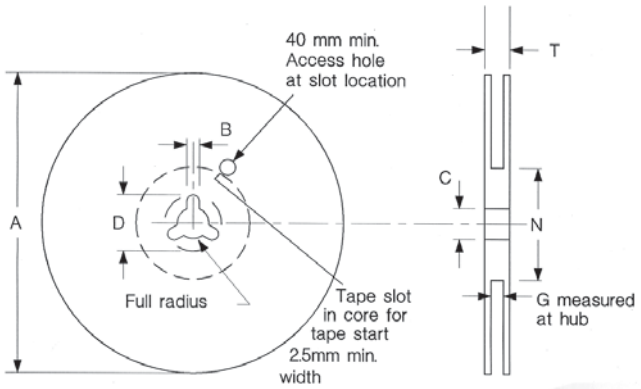
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	6.8	7	0.267	0.275
B0	10.4	10.6	0.409	0.417
B1		12.1		0.476
D	1.5	1.6	0.059	0.063
D1	1.5		0.059	
E	1.65	1.85	0.065	0.073
F	7.4	7.6	0.291	0.299
K0	2.55	2.75	0.100	0.108
P0	3.9	4.1	0.153	0.161
P1	7.9	8.1	0.311	0.319
P2	1.9	2.1	0.075	0.082
R	40		1.574	
W	15.7	16.3	0.618	0.641



D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



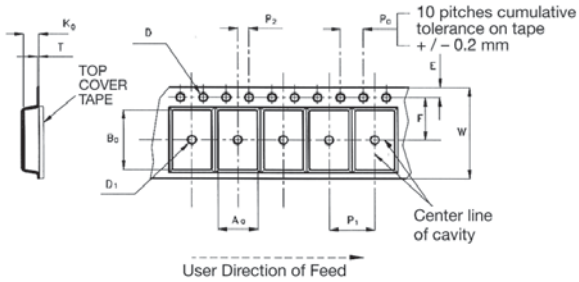
REEL MECHANICAL DATA

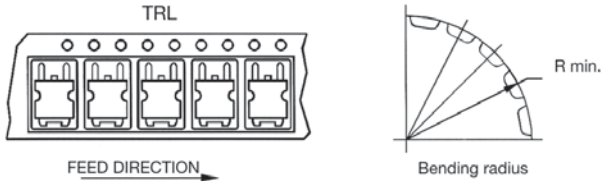
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

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





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 D²PAK

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