STB18NM80, STF18NM80, STP18NM80, STW18NM80

N-channel 800 V, 0.25 Ω, 17 A, MDmesh™ Power MOSFET in D²PAK, TO-220FP, TO-220 and TO-247 packages

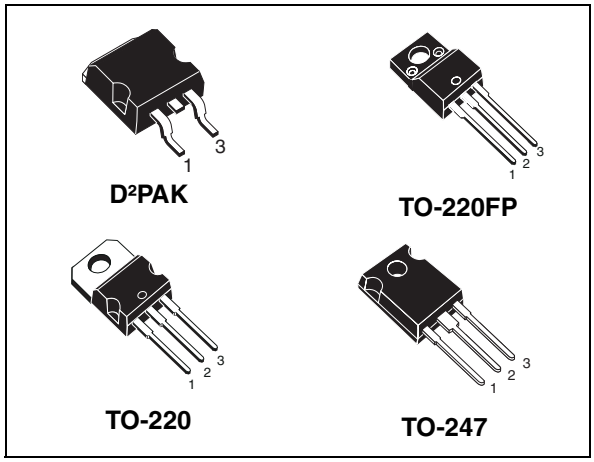
Datasheet — production data

Features

Order codes	V_{DSS}	$R_{DS(on)}$ max	I_D
STB18NM80	800 V	< 0.295 Ω	17 A
STF18NM80	800 V	< 0.295 Ω	17 A (1)
STP18NM80	800 V	< 0.295 Ω	17 A
STW18NM80	800 V	< 0.295 Ω	17 A

1. Limited only by maximum temperature allowed

- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance



Application

- Switching applications

Description

These N-channel Power MOSFETs are developed using STMicroelectronics' revolutionary MDmesh™ technology, which associates the multiple drain process with the company's PowerMESH™ horizontal layout. These devices offer extremely low on-resistance, high dv/dt and excellent avalanche characteristics. Utilizing ST's proprietary strip technique, these Power MOSFETs boast an overall dynamic performance which is superior to similar products on the market.

Figure 1. Internal schematic diagram

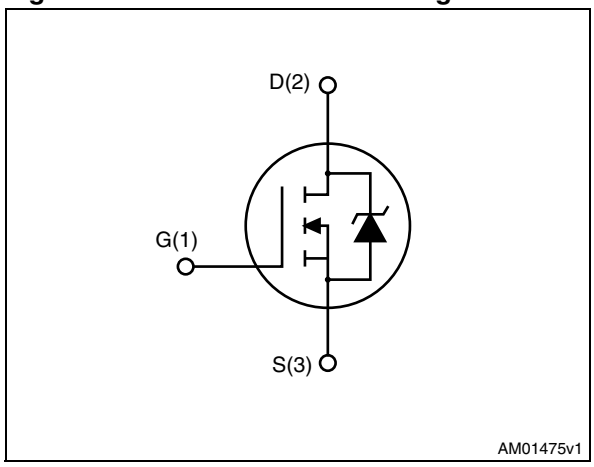


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB18NM80	18NM80	D²PAK	Tape and reel
STF18NM80		TO-220FP	Tube
STP18NM80		TO-220	
STW18NM80		TO-247	

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value				Unit
		TO-220	D²PAK	TO-247	TO-220FP	
V_{DS}	Drain-source voltage	800				V
V_{GS}	Gate-source voltage	± 30				V
I_D	Drain current (continuous) at T_C = 25 °C	17			17 (1)	A
I_D	Drain current (continuous) at T_C = 100 °C	10.71			10.71 (1)	A
I_{DM} (2)	Drain current (pulsed)	68			68 (1)	A
P_{TOT}	Total dissipation at T_C = 25 °C	190			40	W
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s;T_C = 25 °C)				2500	V
T_{stg}	Storage temperature	-65 to 150				°C
T_j	Max. operating junction temperature	150				°C

1. Limited only by maximum temperature allowed
2. Pulse width limited by safe operating area

Table 3. Thermal data

Symbol	Parameter	Value				Unit
		TO-220	D²PAK	TO-247	TO-220FP	
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.66			3.13	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-amb	62.5		50	62.5	°C/W
$R_{thj\text{-}pcb}$	Thermal resistance junction-pcb		30			°C/W
T_l	Maximum lead temperature for soldering purpose	300				°C

Table 4. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by Tj max)	4	A
E_{AS}	Single pulse avalanche energy (starting Tj = 25 °C, I_D = I_{AS}, V_{DD} = 50 V)	600	mJ

2 Electrical characteristics

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

Table 5. 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	800			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 800 V, V_{DS} = 800 V,Tc = 125 °C			10 100	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ± 30 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 8.5 A		0.25	0.295	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS} = 15 V, I_D= 8.5 A	-	14	-	S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0	-	2070 210 29	-	pF pF pF
$C_{oss\ eq.}$ (2)	Equivalent output capacitance	V_{GS} = 0, V_{DS} = 0 to 640 V	-	316	-	pF
R_G	Gate input resistance	f = 1 MHz Gate DC Bias = 0 Test Signal Level = 20 mV Open Drain	-	4	-	Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 640 V, I_D = 17 A V_{GS} = 10 V *(see Figure 17)*	-	70 13 40	-	nC nC nC

1. Pulsed: pulse duration = 300µs, duty cycle 1.5%
2. $C_{oss\ eq.}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 400 V, I_D = 8.5 A,	-	18	-	ns
t_r	Rise time	R_G = 4.7 Ω, V_{GS} = 10 V		28		ns
$t_{d(off)}$	Turn-off delay time	*(see Figure 16 and Figure 21)*		96		ns
t_f	Fall time			50		ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		17	A
I_{SDM} (1)	Source-drain current (pulsed)				68	A
V_{SD} (2)	Forward on voltage	I_{SD} = 17 A, V_{GS} = 0	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 17 A, di/dt = 100 A/µs, V_{DD} = 100 V, *(see Figure 18)*	-	618		ns
Q_{rr}	Reverse recovery charge			9.6		µC
I_{RRM}	Reverse recovery current			31.2		A
t_{rr}	Reverse recovery time	I_{SD} = 17 A, di/dt = 100 A/µs, V_{DD} = 100 V, Tj=150°C *(see Figure 18)*	-	822		ns
Q_{rr}	Reverse recovery charge			13		µC
I_{RRM}	Reverse recovery current			31.8		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, D²PAK

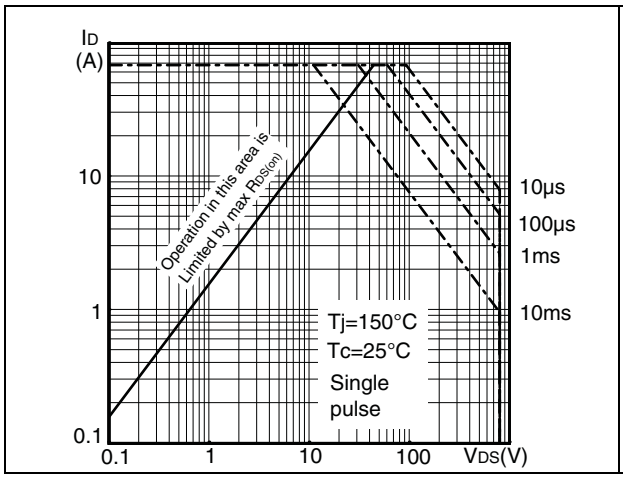


Figure 3. Thermal impedance for TO-220, D²PAK

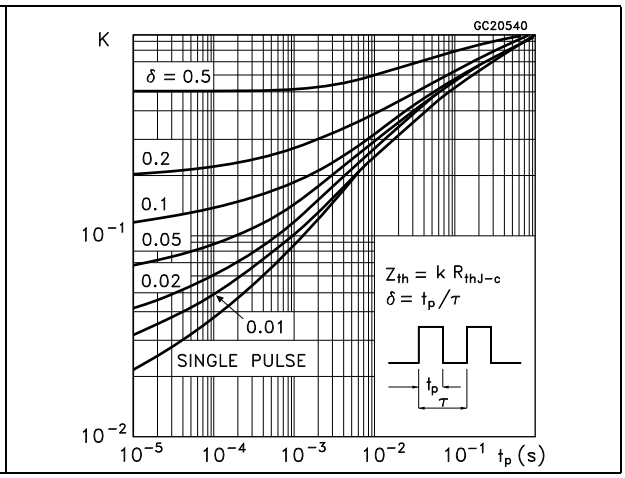


Figure 4. Safe operating area for TO-247

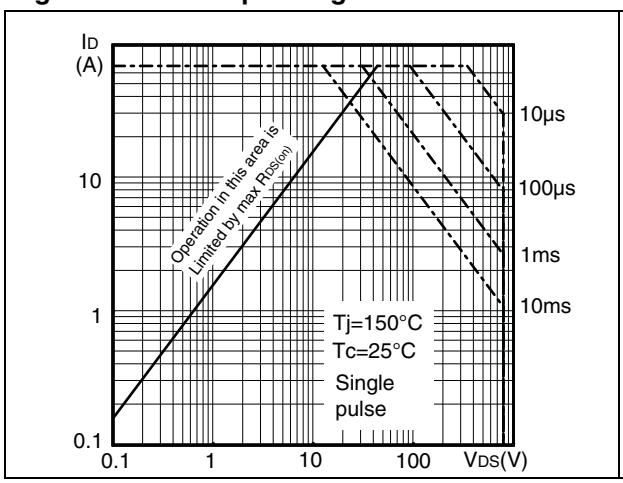


Figure 5. Thermal impedance for TO-247

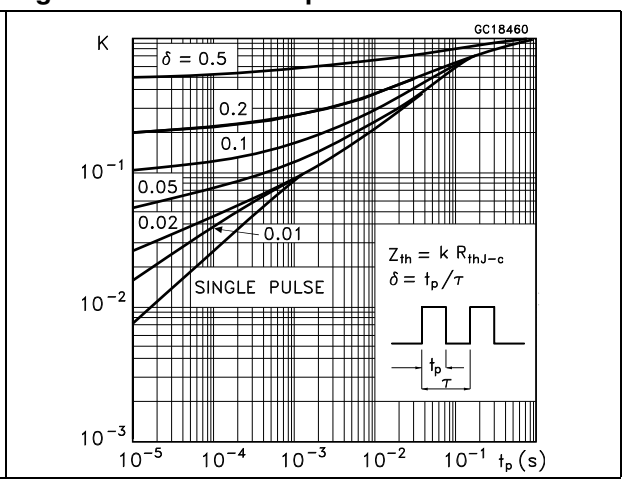


Figure 6. Safe operating area for TO-220FP

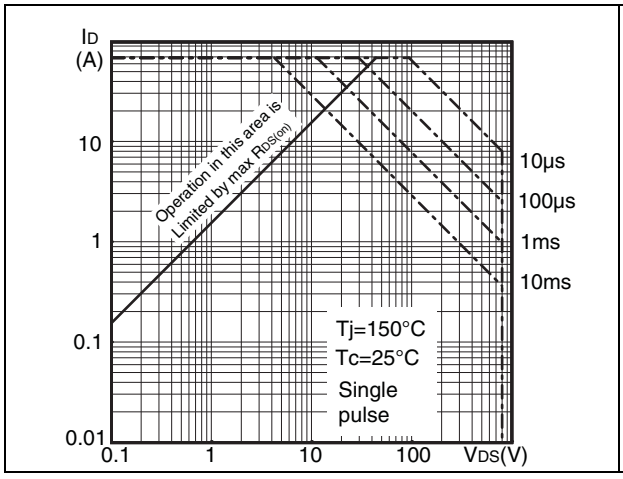


Figure 7. Thermal impedance for TO-220FP

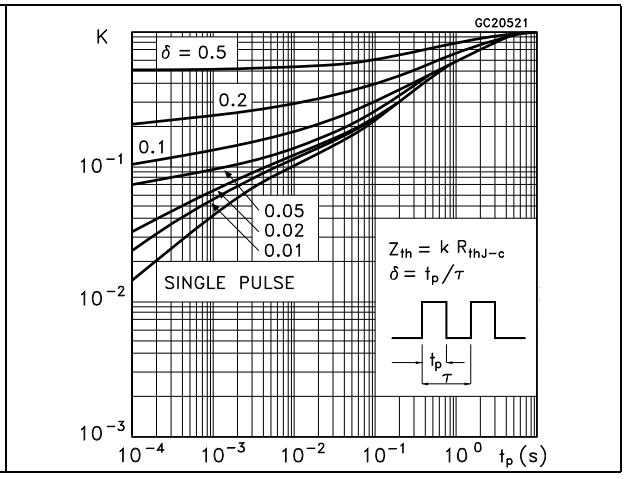


Figure 8. Output characteristics

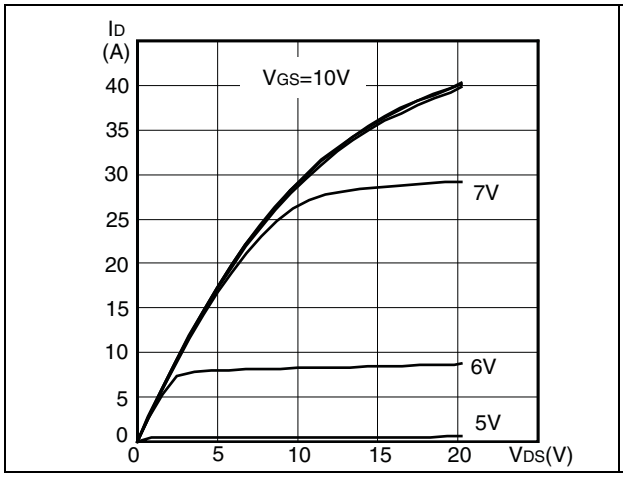


Figure 9. Transfer characteristics

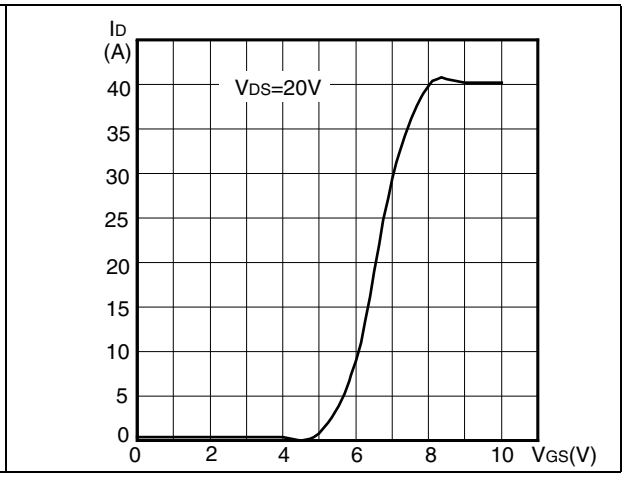


Figure 10. Normalized B_{VDSS} vs temperature

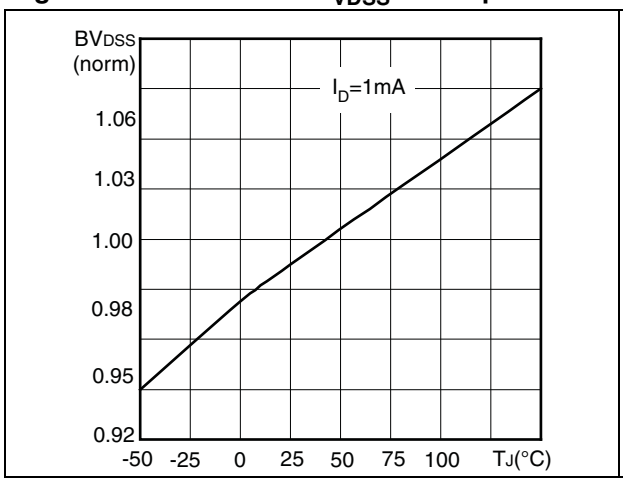


Figure 11. Static drain-source on-resistance

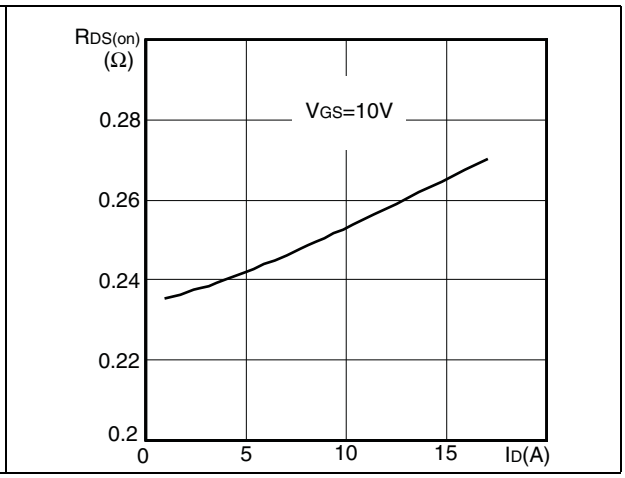


Figure 12. Gate charge vs gate-source voltage

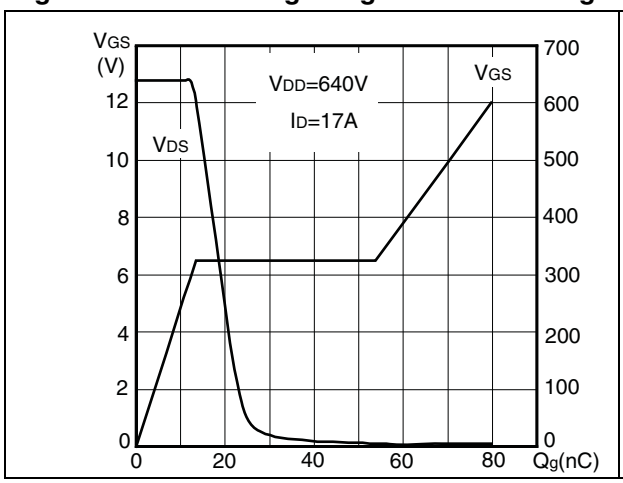


Figure 13. Capacitance variations

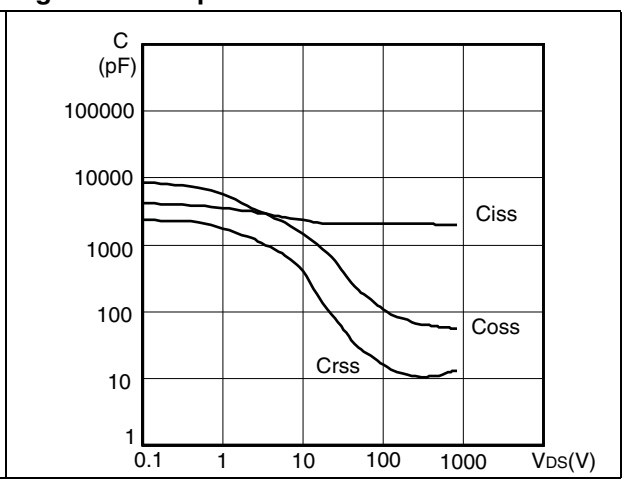


Figure 14. Normalized gate threshold voltage vs temperature

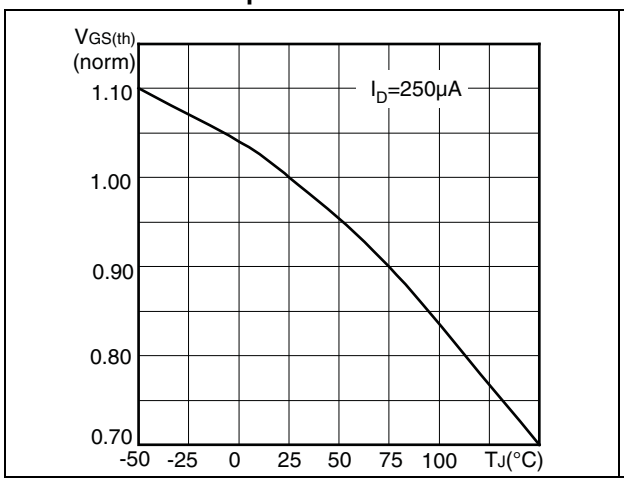
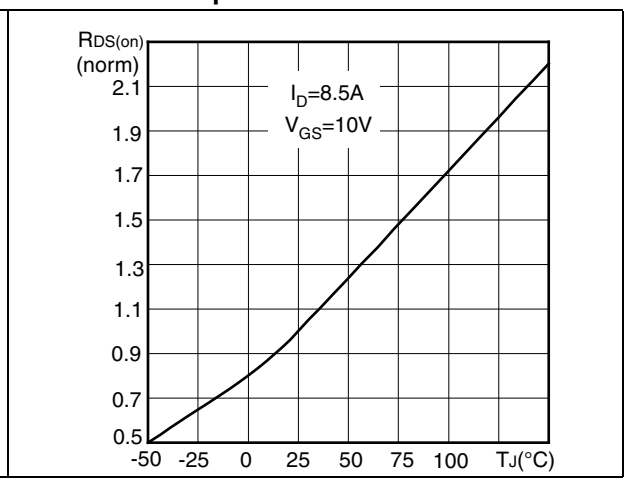


Figure 15. Normalized on-resistance vs temperature



3 Test circuits

Figure 16. Switching times test circuit for resistive load

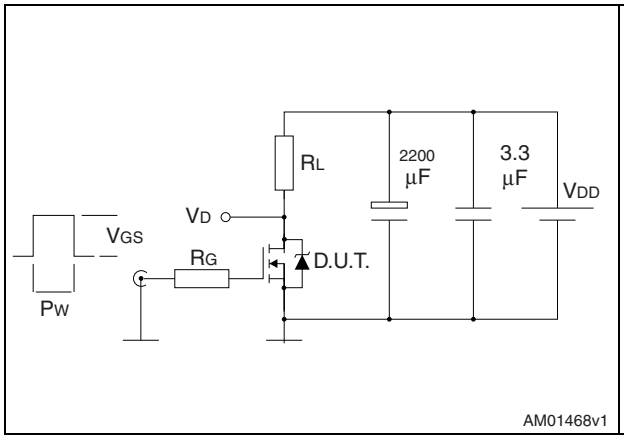


Figure 17. Gate charge test circuit

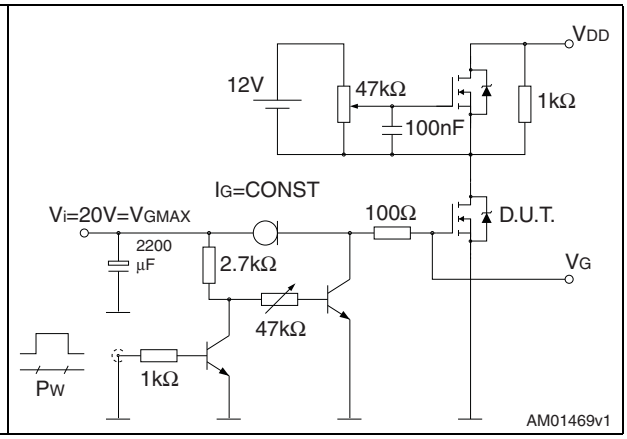


Figure 18. Test circuit for inductive load switching and diode recovery times

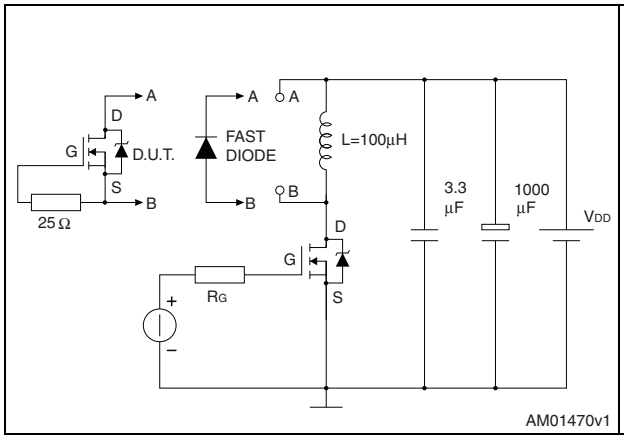


Figure 19. Unclamped inductive load test circuit

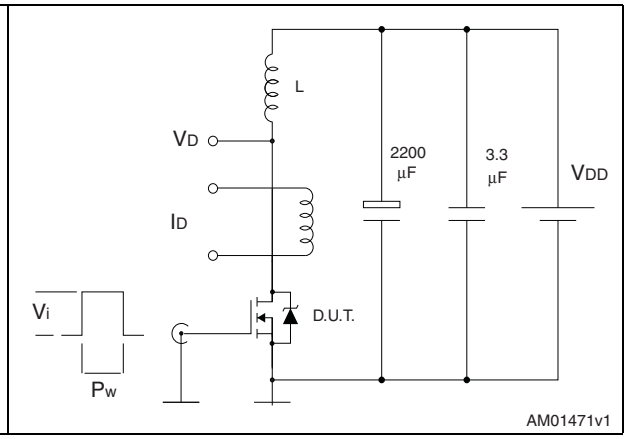


Figure 20. Unclamped inductive waveform

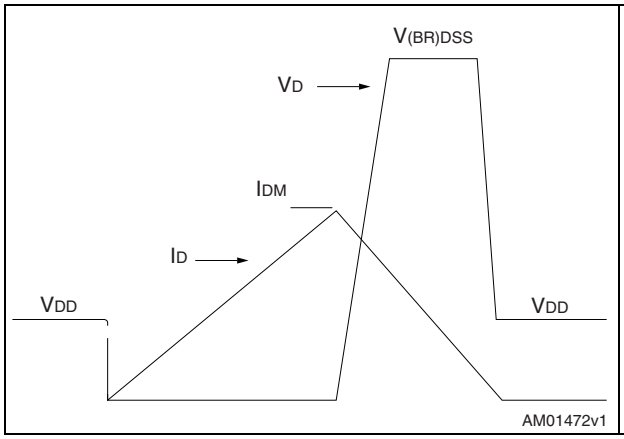
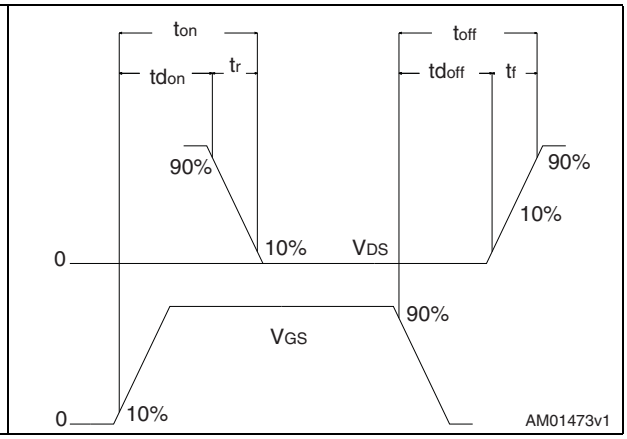


Figure 21. Switching time waveform



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.

Table 9. D²PAK (TO-263) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50		
E	10		10.40
E1	8.50		
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 22. D²PAK (TO-263) drawing

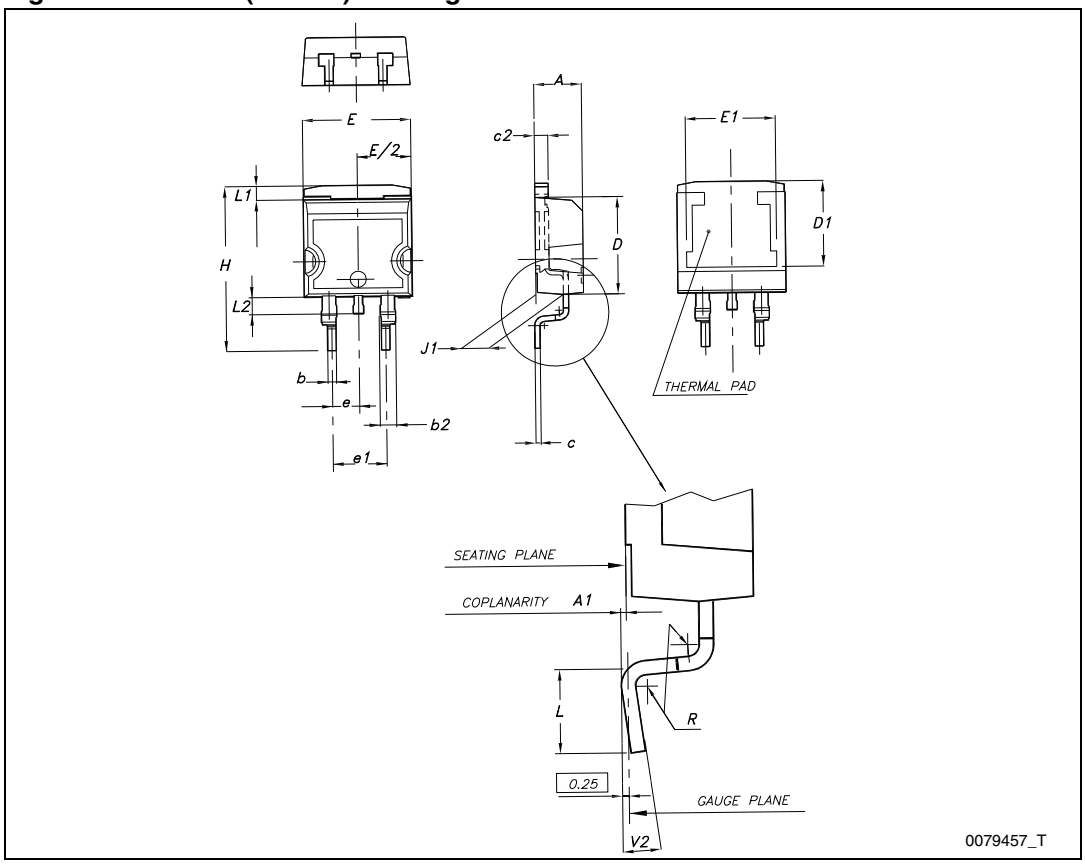
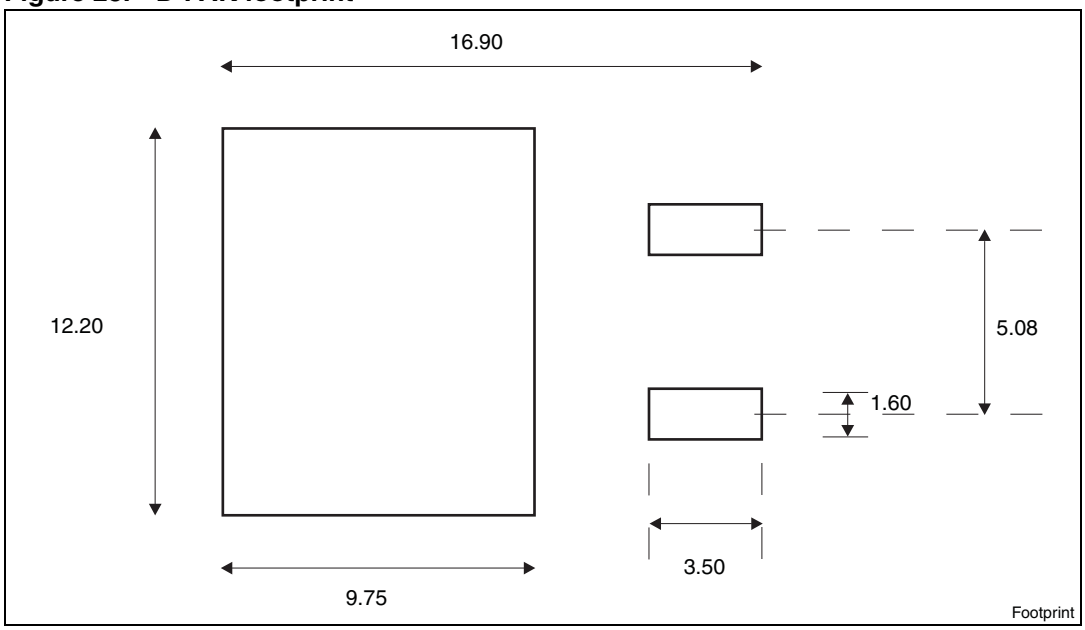


Figure 23. D²PAK footprint[a]



a. All dimensions are in millimeters

Table 10. TO-220FP mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2

Figure 24. TO-220FP drawing

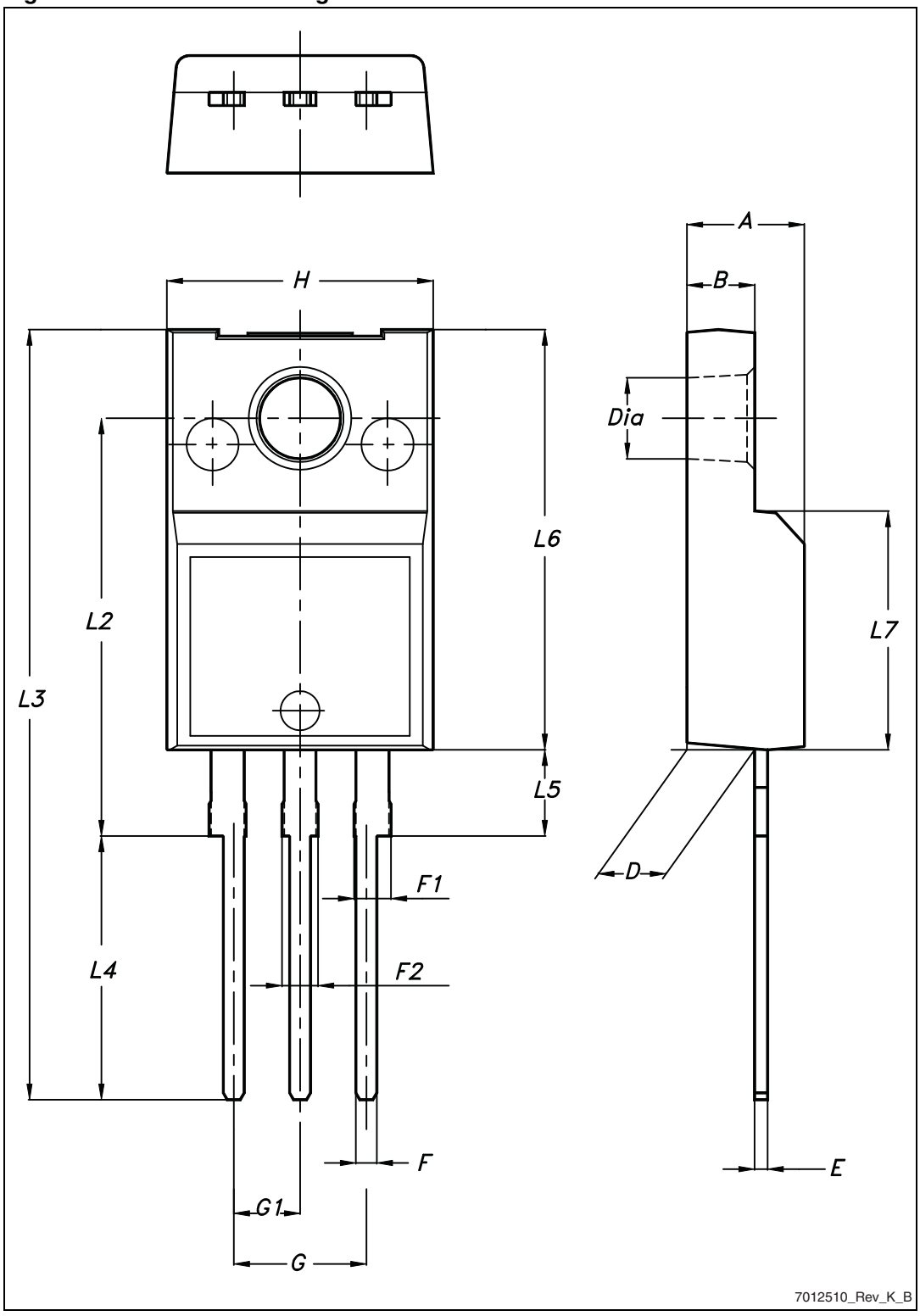


Table 11. TO-220 type A mechanical data

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

Figure 25. TO-220 type A drawing

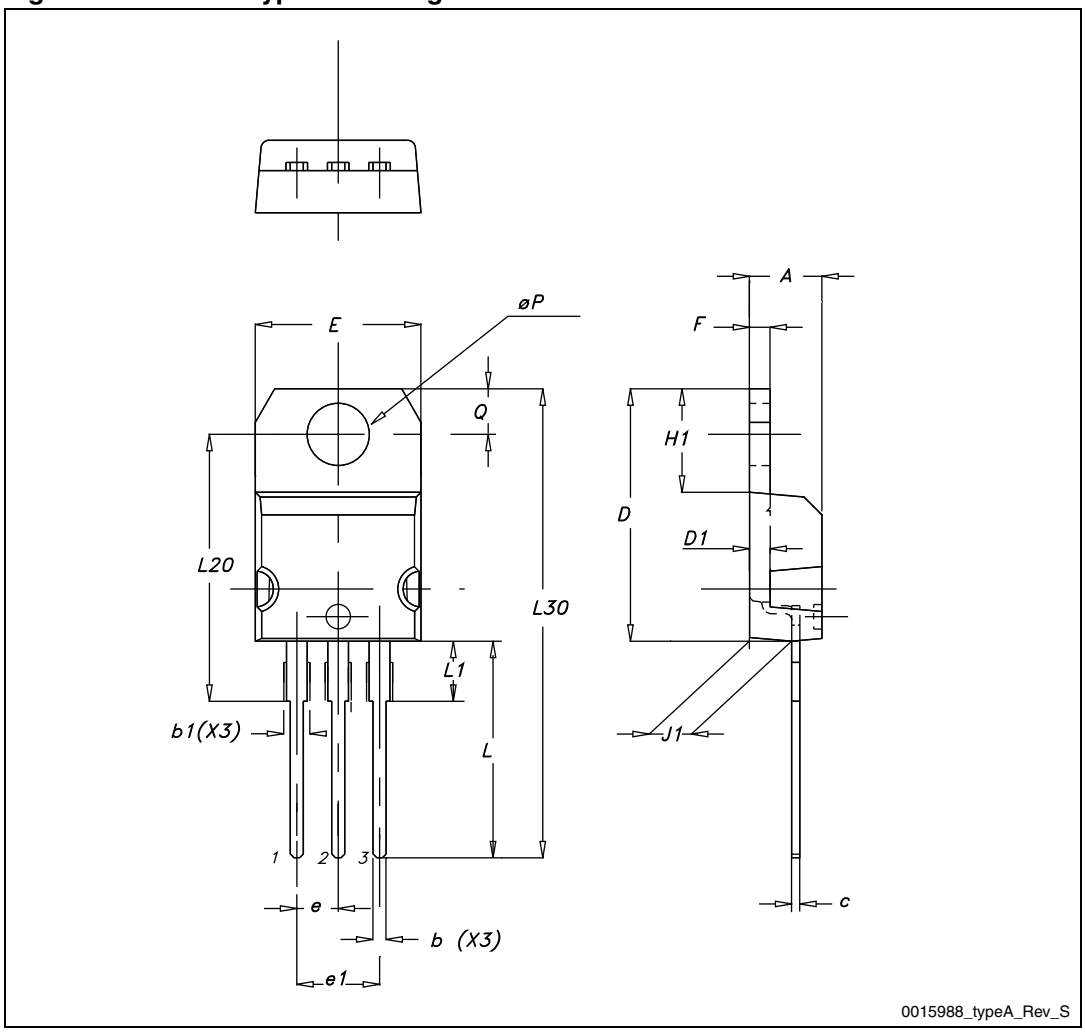
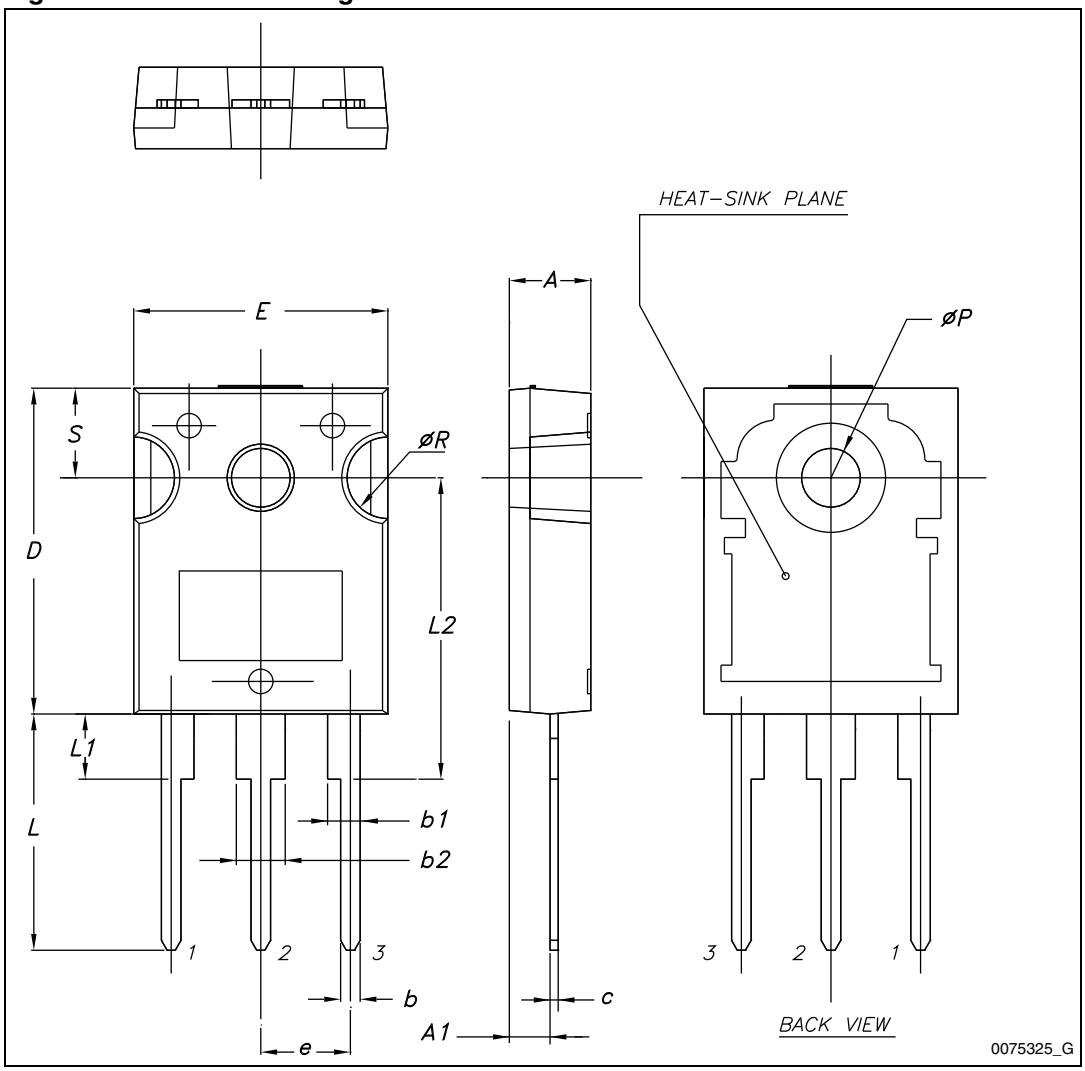


Table 12. TO-247 mechanical data

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	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
∅P	3.55		3.65
∅R	4.50		5.50
S	5.30	5.50	5.70

Figure 26. TO-247 drawing



5 Packaging mechanical data

Table 13. D²PAK (TO-263) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base qty		1000
P2	1.9	2.1	Bulk qty		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

Figure 27. Tape

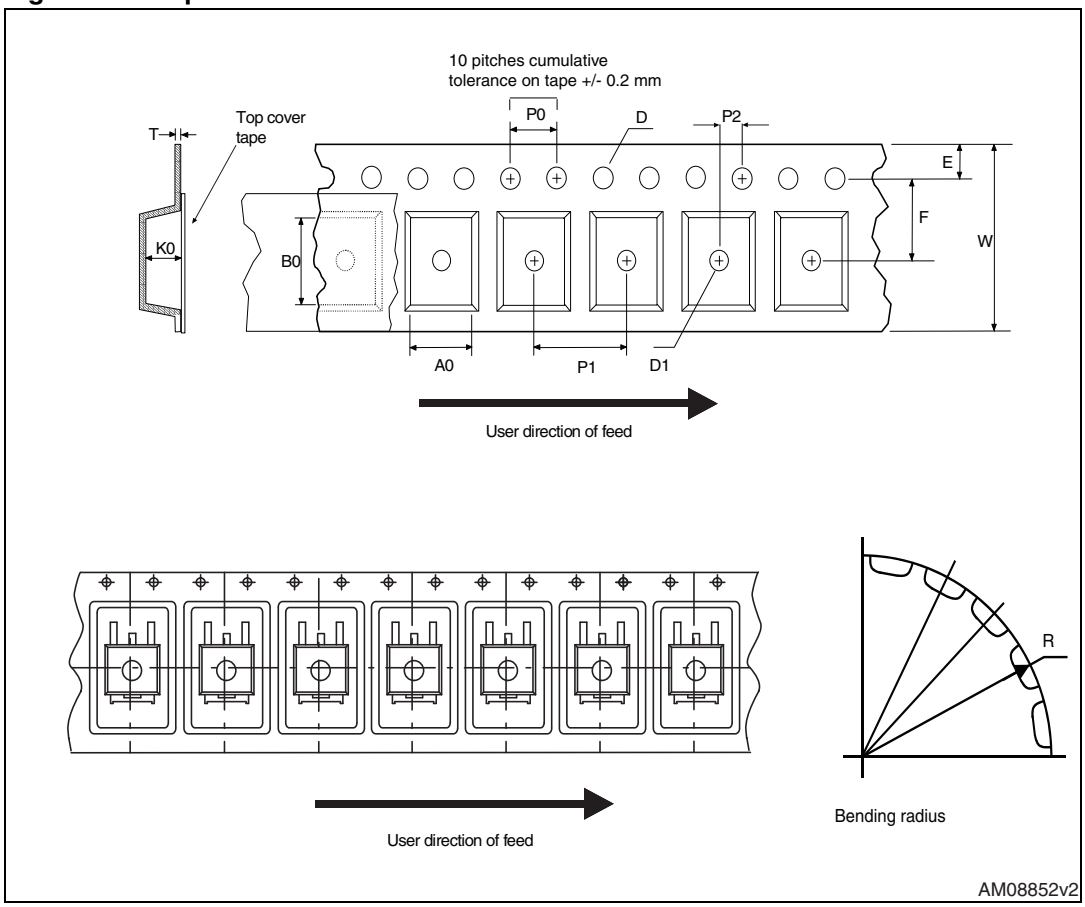
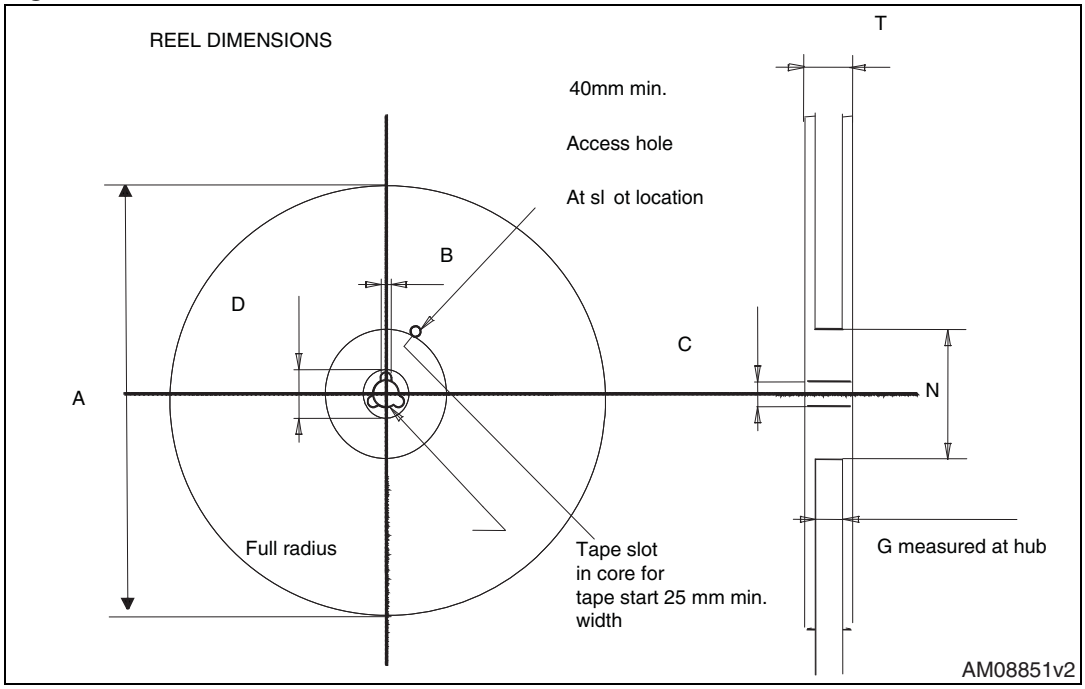


Figure 28. Reel



6 Revision history

Table 14. Document revision history

Date	Revision	Changes
25-Feb-2009	1	First release.
07-Apr-2009	2	*Section 4: Package mechanical data* has been modified.
20-Apr-2009	3	$R_{DS(on)}$ max value has been corrected.
09-Sep-2009	4	Document status promoted from preliminary data to datasheet.
25-May-2012	5	*Figure 12: Gate charge vs gate-source voltage* has been updated. Minor text changes.