STB18N55M5, STD18N55M5, STF18N55M5, STP18N55M5

N-channel 550 V, 0.150 Ω typ., 16 A, MDmesh™ V Power MOSFETs in D²PAK, DPAK, TO-220FP and TO-220 packages

Datasheet - production data

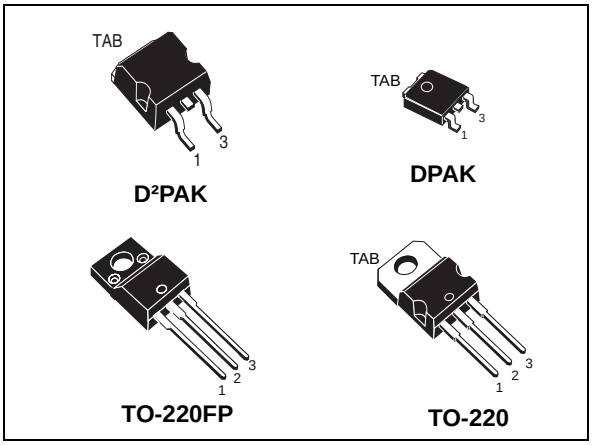
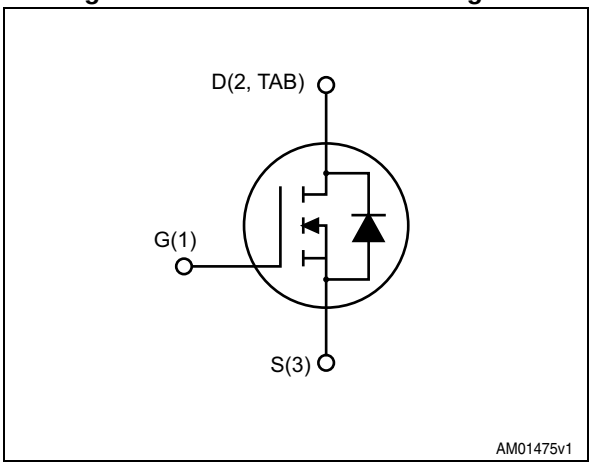


Figure 1. Internal schematic diagram



Features

Order codes	V_{DS} @ T_{Jmax}	$R_{DS(on)}$ max	I_D
STB18N55M5	600 V	0.192 Ω	16 A
STD18N55M5			
STF18N55M5			
STP18N55M5			

- Higher V_{DSS} rating
- High dv/dt capability
- Excellent switching performance
- Easy to drive
- 100% avalanche tested

Applications

- Switching applications

Description

These devices are N-channel MDmesh™ V Power MOSFETs based on an innovative proprietary vertical process technology, which is combined with STMicroelectronics' well-known PowerMESH™ horizontal layout structure. The resulting product has extremely low on-resistance, which is unmatched among silicon-based Power MOSFETs, making it especially suitable for applications which require superior power density and outstanding efficiency.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STB18N55M5	18N55M5	D²PAK	Tape and reel
STD18N55M5		DPAK	
STF18N55M5		TO-220FP	Tube
STP18N55M5		TO-220	

This is information on a product in full production. www.st.com

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220, DPAK, D²PAK	TO-220FP	
V_{GS}	Gate-source voltage	± 25		V
I_D	Drain current (continuous) at T_C = 25 °C	16	16 (1)	A
I_D	Drain current (continuous) at T_C = 100 °C	10	10 (1)	A
I_{DM} (2)	Drain current (pulsed)	64	64 (1)	A
P_{TOT}	Total dissipation at T_C = 25 °C	110	25	W
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	4		A
E_{AS}	Single pulse avalanche energy (starting T_j = 25°C, I_D = I_{AR}, V_{DD} = 50 V)	210		mJ
dv/dt (3)	Peak diode recovery voltage slope	15		V/ns
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; Tc = 25 °C)		2500	V
T_{stg}	Storage temperature	- 55 to 150		°C
T_j	Max. operating junction temperature	150		°C

1. Limited by maximum junction temperature.
2. Pulse width limited by safe operating area.
3. I_{SD} ≤ 16 A, di/dt ≤ 400 A/µs, V_{Peak} < $V_{(BR)DSS}$, V_{DD} = 340 V.

Table 3. Thermal data

Symbol	Parameter	Value				Unit
		D²PAK	DPAK	TO-220	TO-220FP	
$R_{thj\text{-}case}$	Thermal resistance junction-case max	1.14			5	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max			62.5		°C/W
$R_{thj\text{-}pcb}$	Thermal resistance junction-pcb max	30	50			°C/W

2 Electrical characteristics

(T_C = 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 = 1 mA, V_{GS} = 0	550			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 550 V			1	µA
		V_{DS} = 550 V, T_C=125 °C			100	µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 25 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 A		0.150	0.192	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 100 V, f = 1 MHz, V_{GS} = 0	-	1260	-	pF
C_{oss}	Output capacitance		-	42	-	pF
C_{rss}	Reverse transfer capacitance		-	3.6	-	pF
$C_{o(tr)}$(1)	Equivalent capacitance time related	V_{DS} = 0 to 440 V	-	103	-	pF
$C_{o(er)}$(2)	Equivalent capacitance energy related		-	35	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain	-	2.8	-	Ω
Q_g	Total gate charge	V_{DD} = 440 V, I_D = 8 A, V_{GS} = 10 V (see *Figure 20*)	-	31	-	nC
Q_{gs}	Gate-source charge		-	8.3	-	nC
Q_{gd}	Gate-drain charge		-	14.2	-	nC

1. $C_{oss\ eq.}$ time related 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}
2. $C_{oss\ eq.}$ energy related is defined as a constant equivalent capacitance giving the same stored energy as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(v)}$	Voltage delay time	V_{DD} = 400 V, I_D = 10.5 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 19*, *Figure 24*)	-	37	-	ns
$t_{r(v)}$	Voltage rise time		-	7	-	ns
$t_{f(i)}$	Current fall time		-	8.3	-	ns
$t_{c(off)}$	Crossing time		-	10.3	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		16	A
I_{SDM} (1)	Source-drain current (pulsed)		-		64	A
V_{SD} (2)	Forward on voltage	I_{SD} = 16 A, V_{GS} = 0	-		1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 16 A, di/dt = 100 A/µs V_{DD} = 100 V (see *Figure 21*)	-	244		ns
Q_{rr}	Reverse recovery charge		-	2.8		µC
I_{RRM}	Reverse recovery current		-	23		A
t_{rr}	Reverse recovery time	I_{SD} = 16 A, di/dt = 100 A/µs V_{DD} = 100 V, T_j = 150 °C (see *Figure 21*)	-	295		ns
Q_{rr}	Reverse recovery charge		-	3.7		µC
I_{RRM}	Reverse recovery current		-	25		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 D²PAK and TO-220

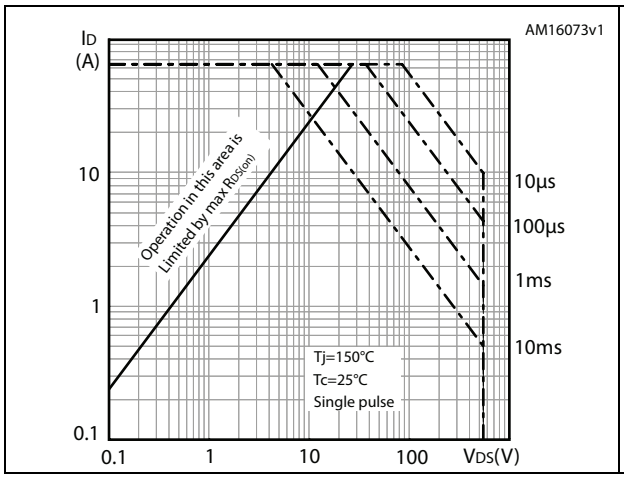


Figure 3. Thermal impedance for D²PAK and TO-220

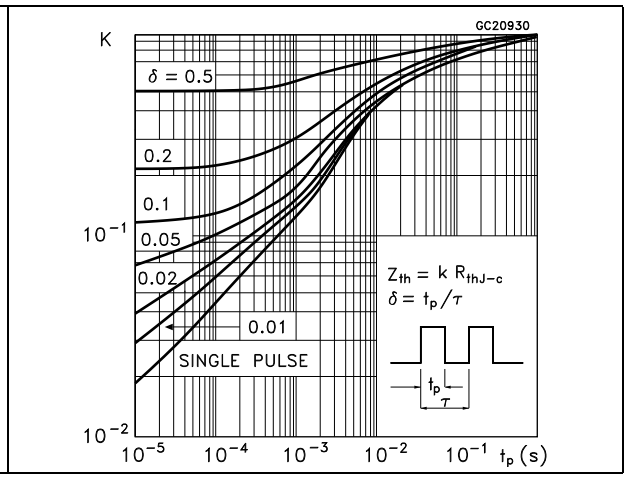


Figure 4. Safe operating area for DPAK

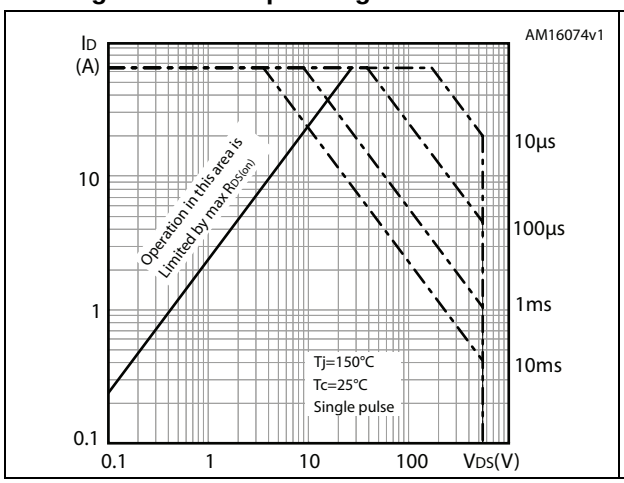


Figure 5. Thermal impedance for DPAK

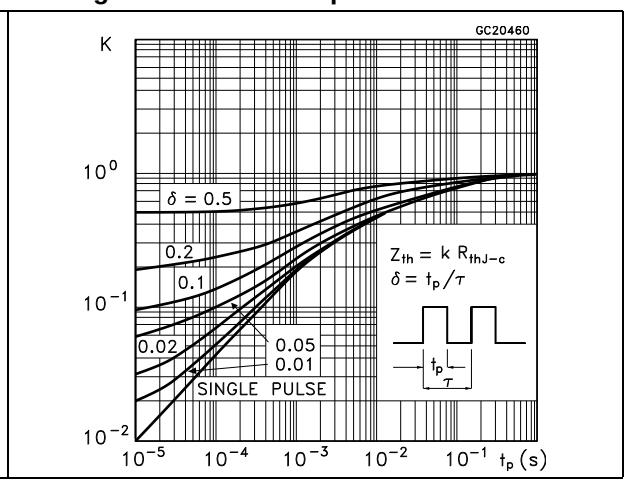


Figure 6. Safe operating area TO220FP

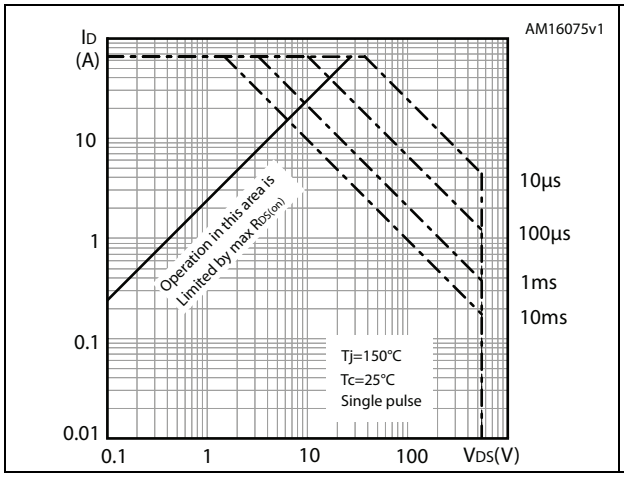


Figure 7. Thermal impedance for TO-220FP

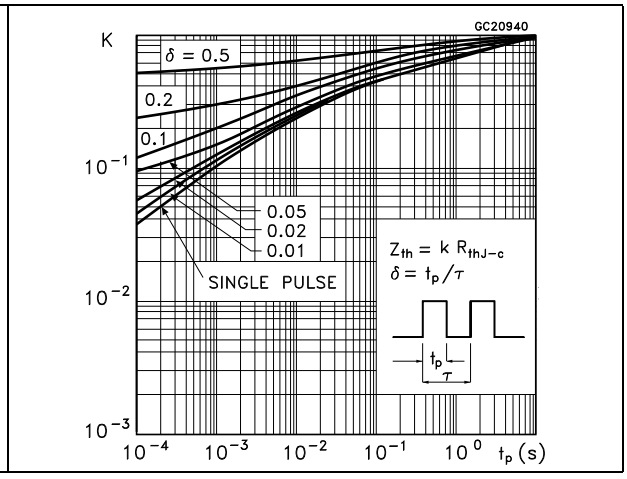


Figure 8. Output characteristics

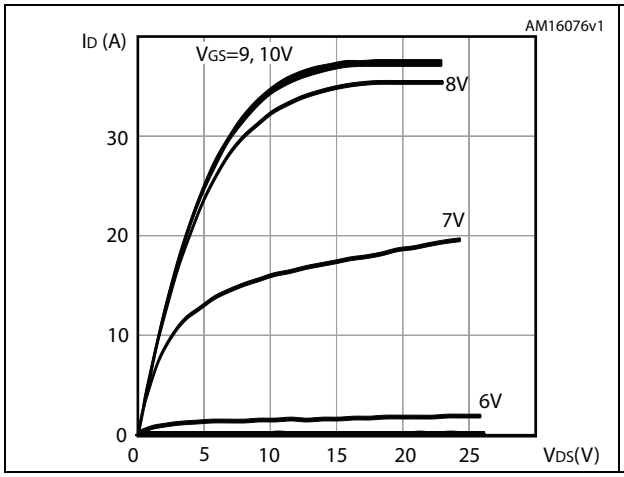


Figure 9. Transfer characteristics

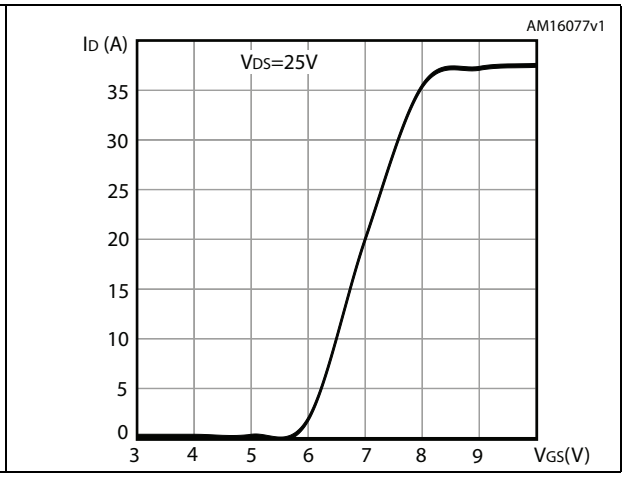


Figure 10. Gate charge vs gate-source voltage

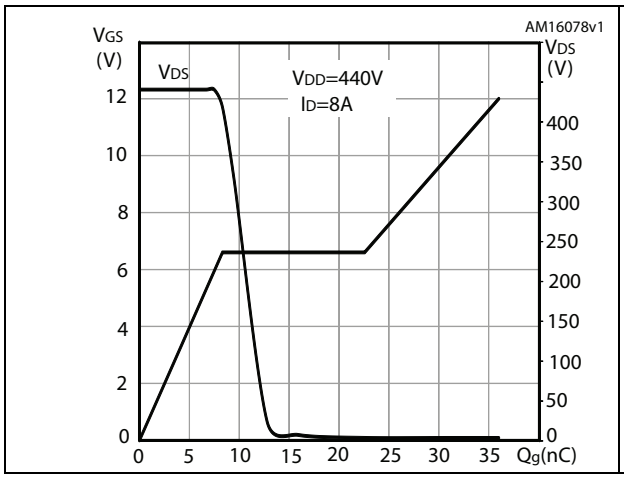


Figure 11. Static drain-source on-resistance

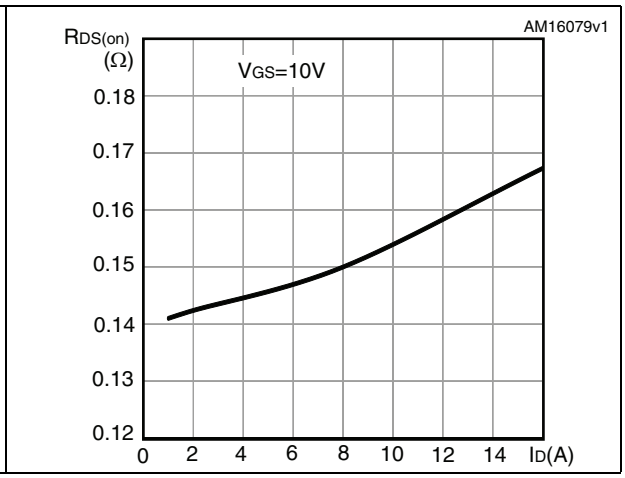


Figure 12. Capacitance variations

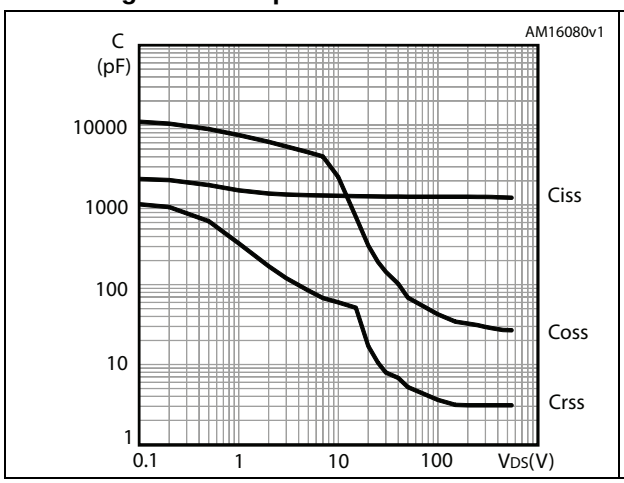


Figure 13. Output capacitance stored energy

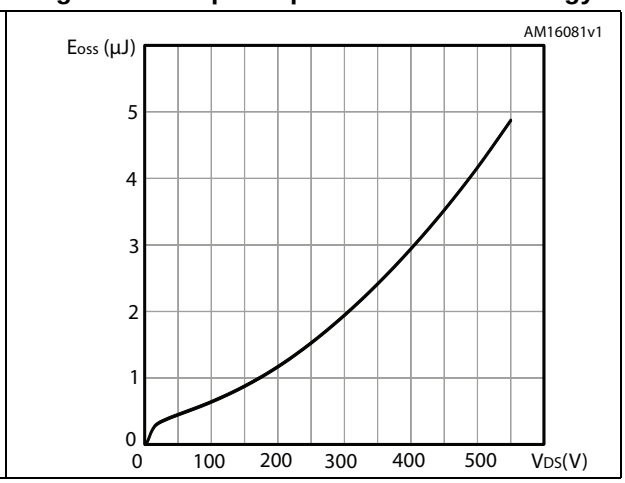


Figure 14. Normalized gate threshold voltage vs. temperature

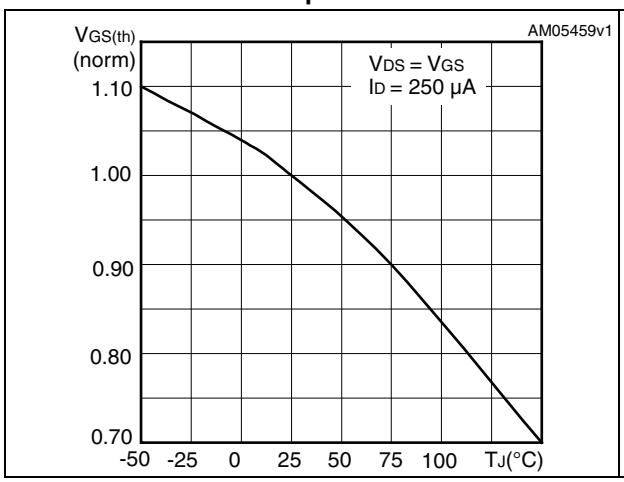


Figure 15. Normalized on-resistance vs. temperature

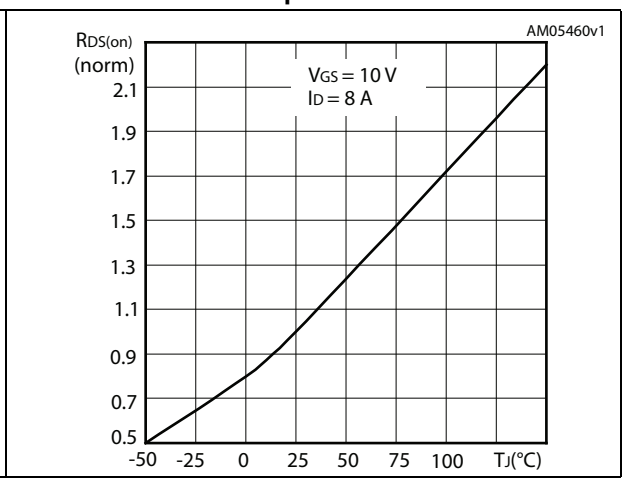


Figure 16. Drain-source diode forward characteristics

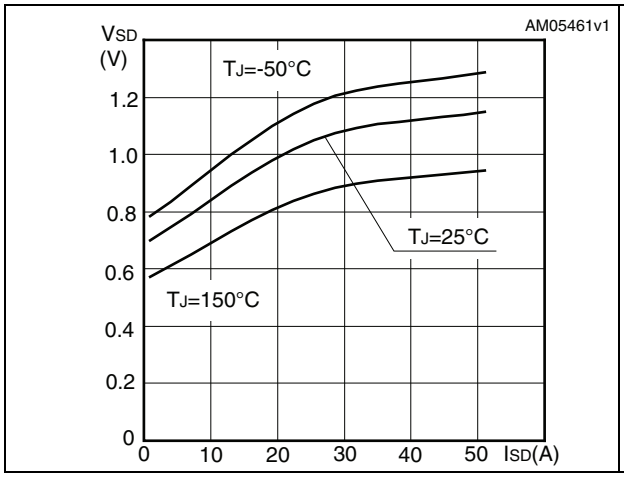


Figure 17. Normalized V_{DS} vs. temperature

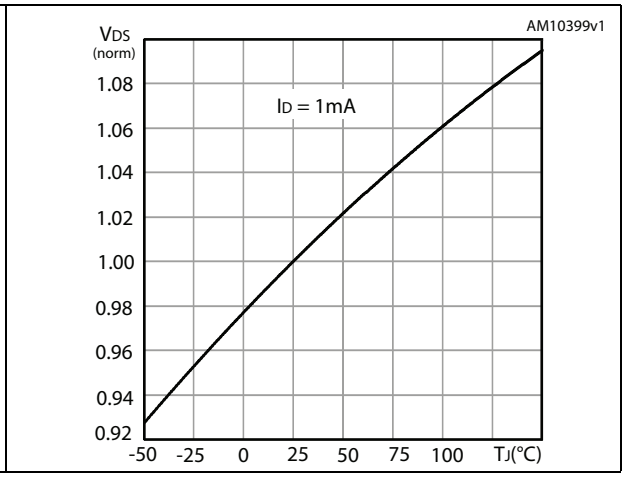
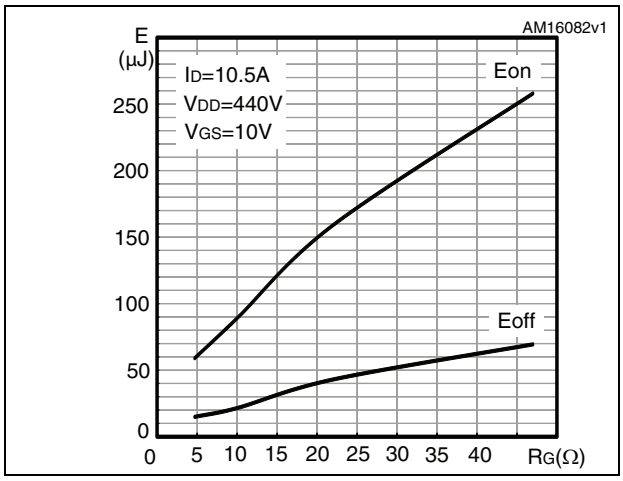


Figure 18. Switching losses vs. gate resistance (1)



1. Eon including reverse recovery of a SiC diode

3 Test circuits

Figure 19. Switching times test circuit for resistive load

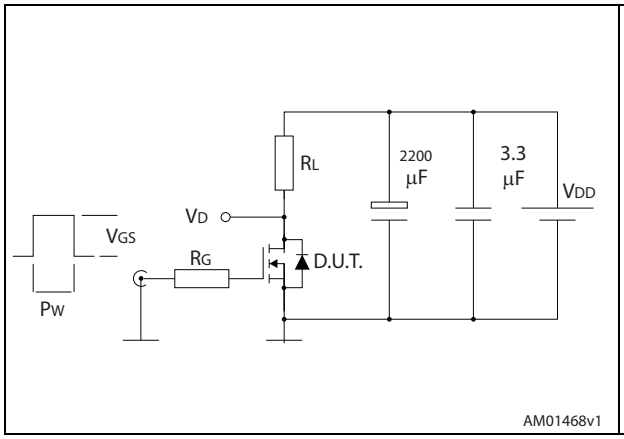


Figure 20. Gate charge test circuit

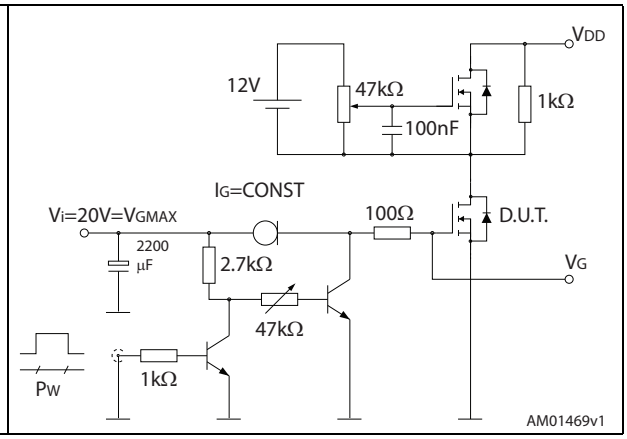


Figure 21. Test circuit for inductive load switching and diode recovery times

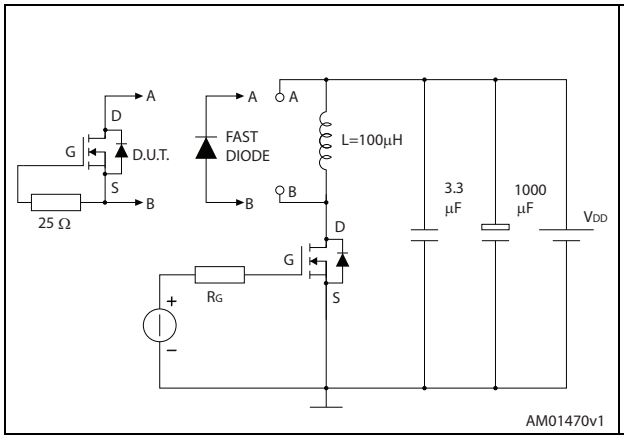


Figure 22. Unclamped inductive load test circuit

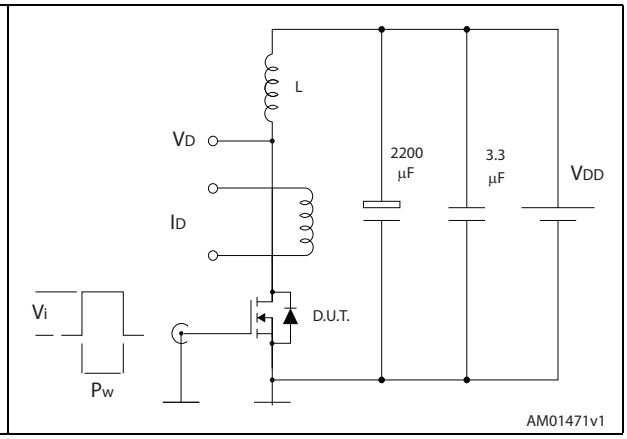


Figure 23. Unclamped inductive waveform

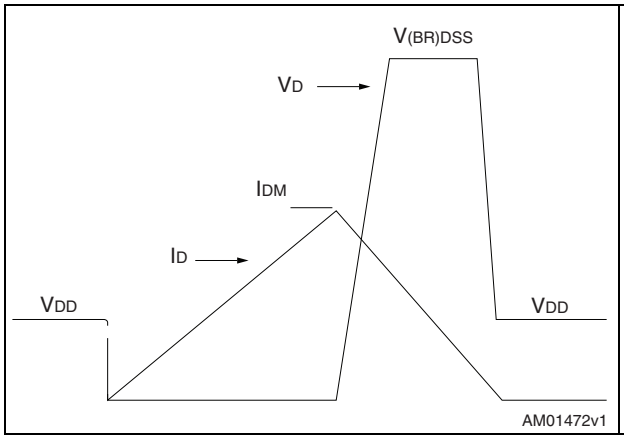
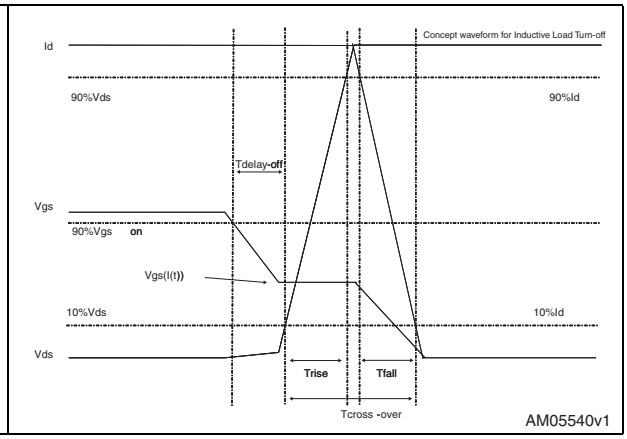


Figure 24. Switching time waveform



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 8. 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 25. D²PAK (TO-263) drawing

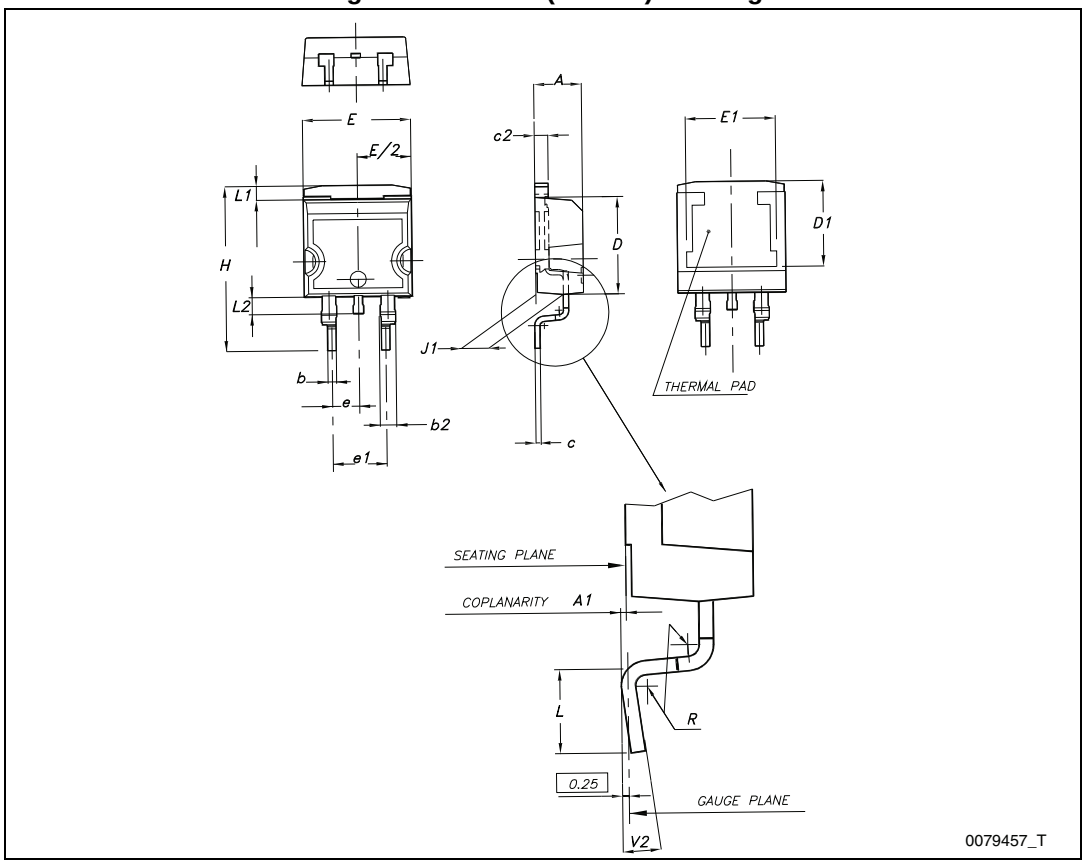
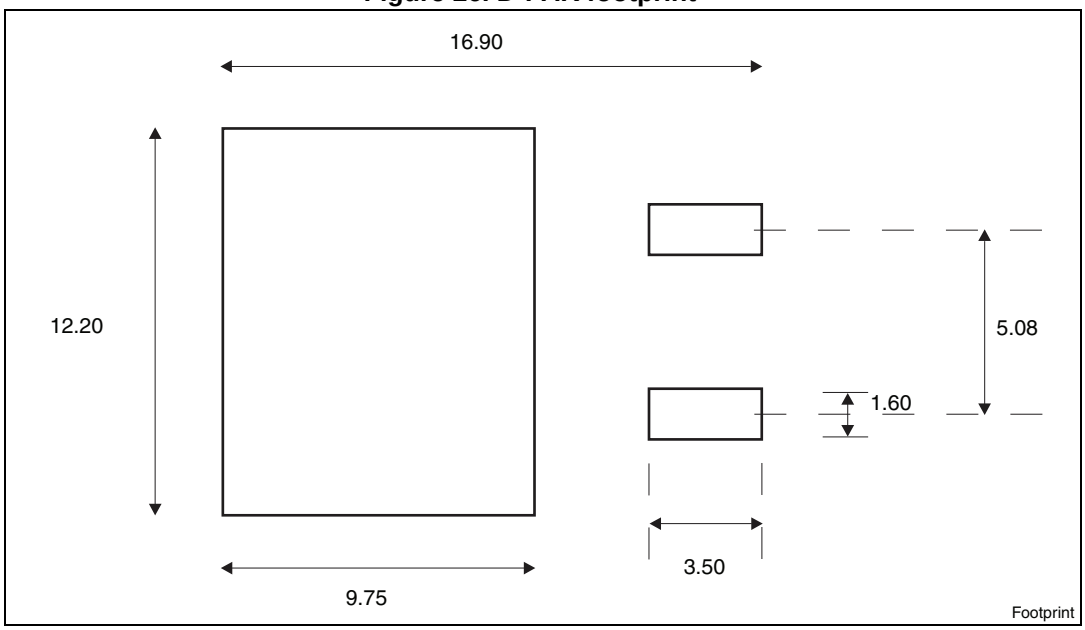


Figure 26. D²PAK footprint[a]



a. All dimension are in millimeters

Table 9. DPAK (TO-252) type A 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	1.00		1.50
(L1)		2.80	
L2		0.80	
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 27. DPAK (TO-252) type A drawing

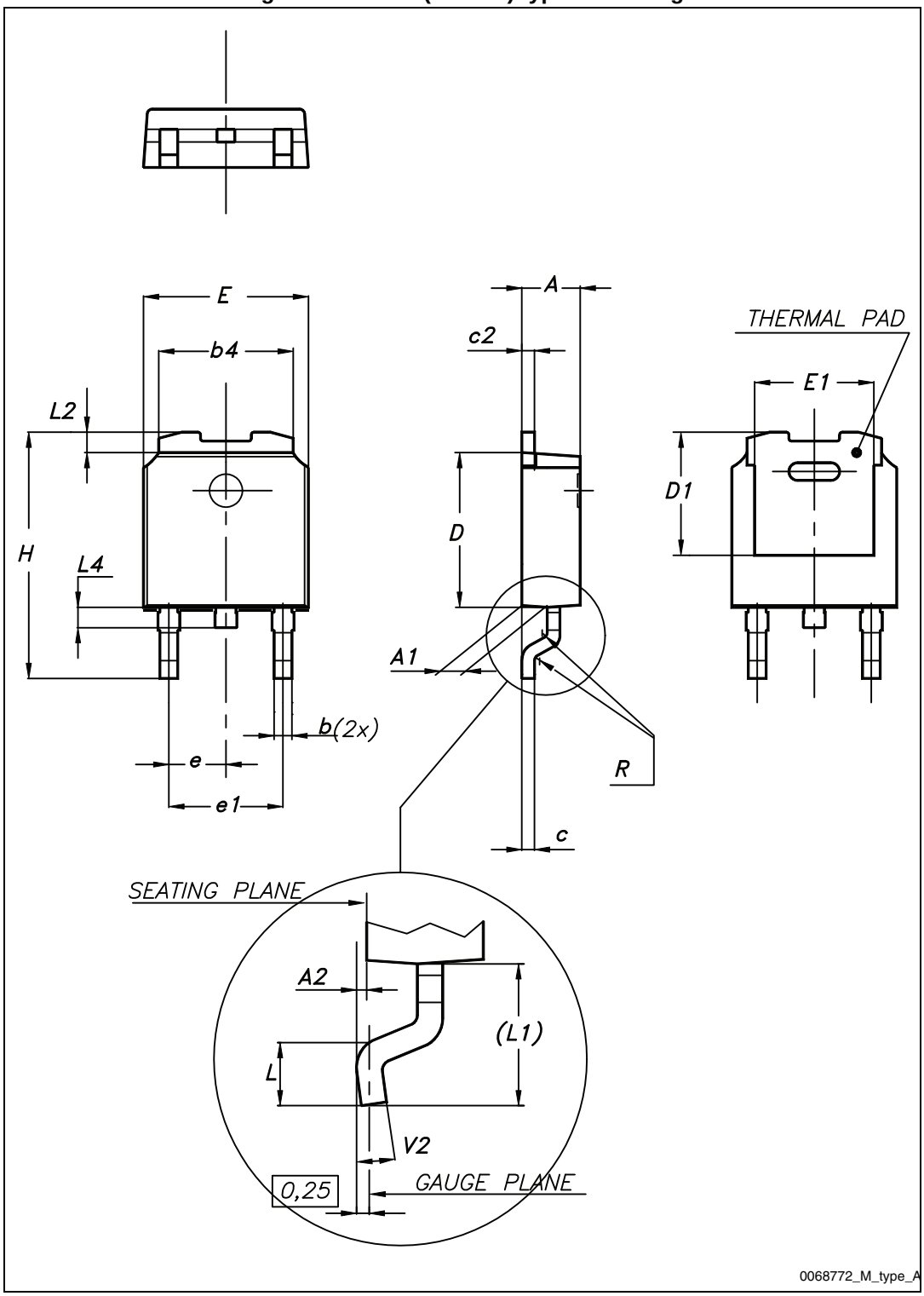
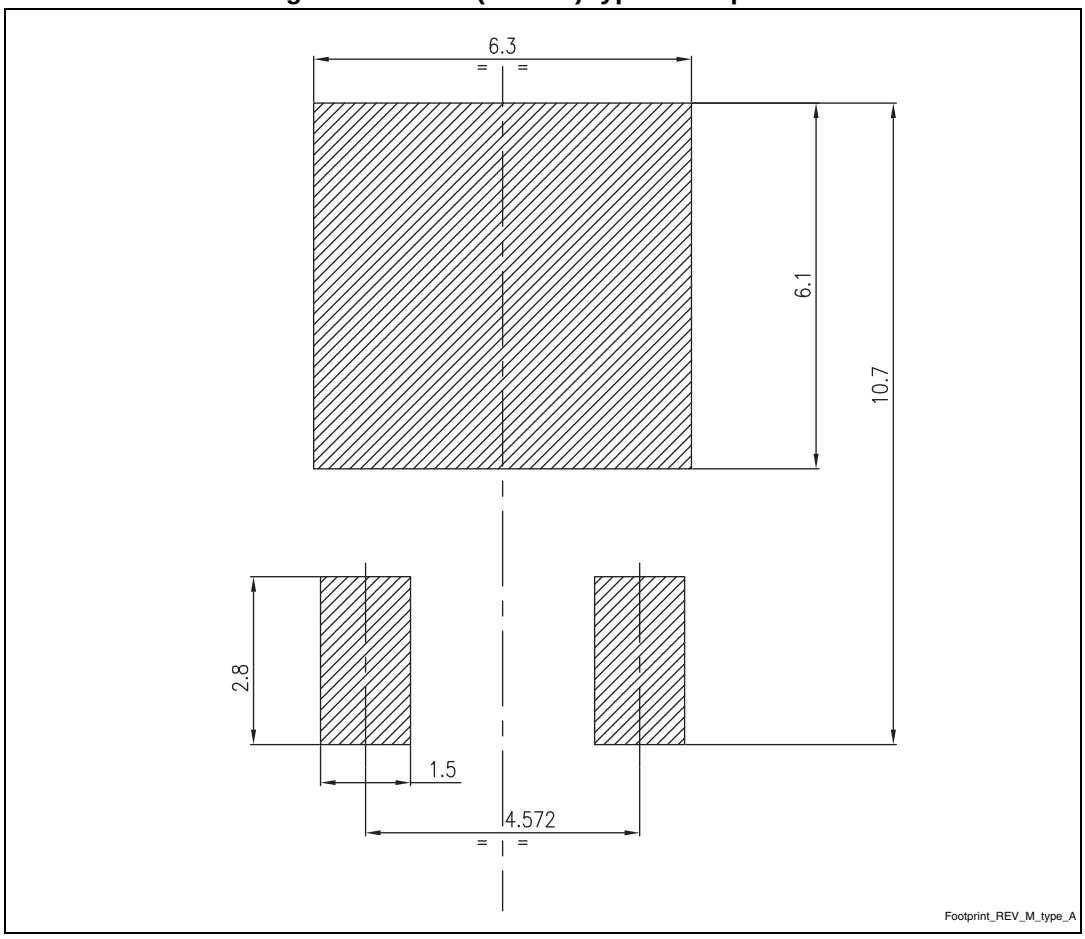


Figure 28. DPAK (TO-252) type A footprint [(b)]



b. 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 29. TO-220FP drawing

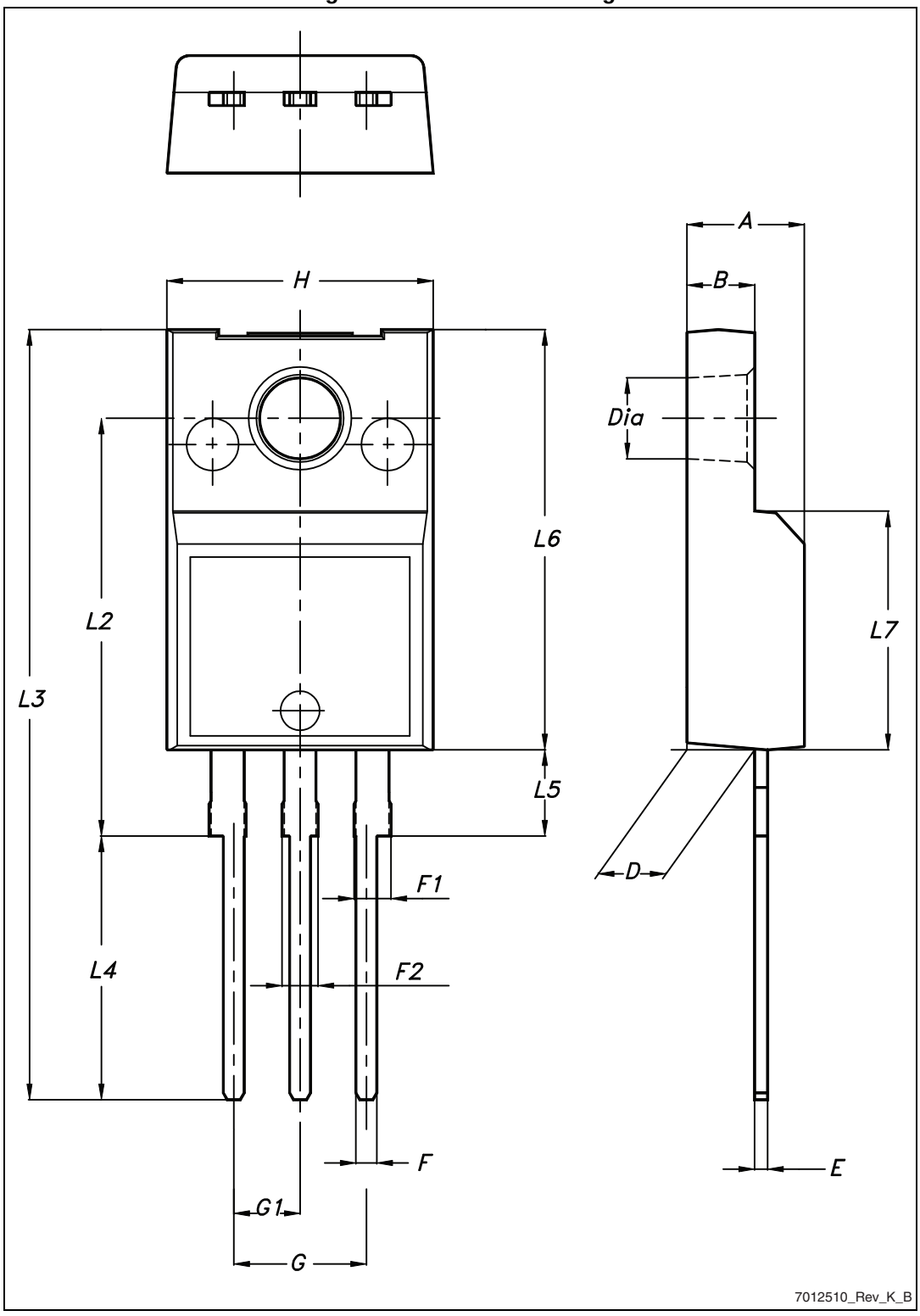
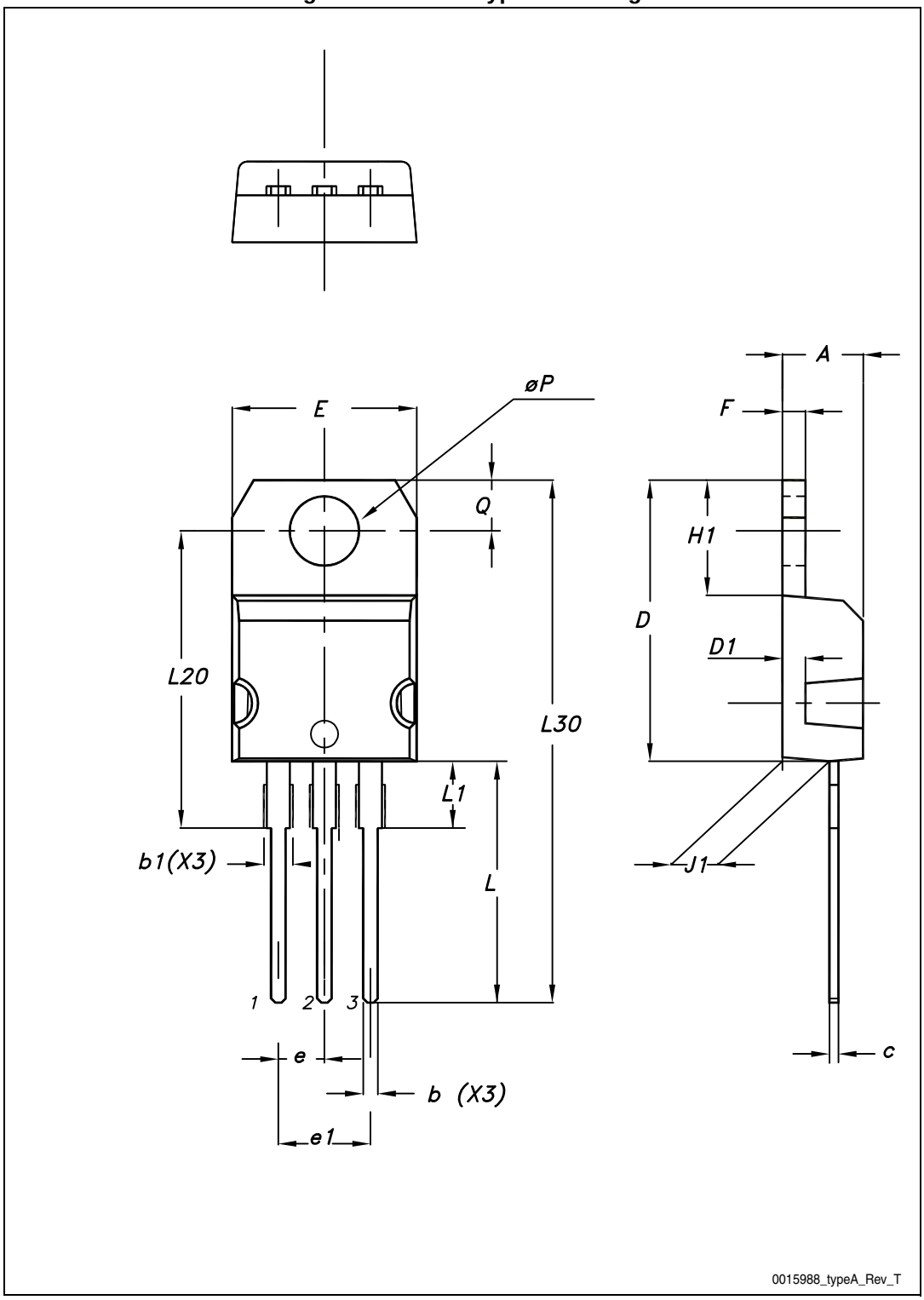


Table 11. TO-220 type A mechanical data

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 30. TO-220 type A drawing



5 Packaging mechanical data

Table 12. 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			

Table 13. DPAK (TO-252) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1	Base qty.		2500
P1	7.9	8.1	Bulk qty.		2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

Figure 31. Tape for D²PAK and DPAK

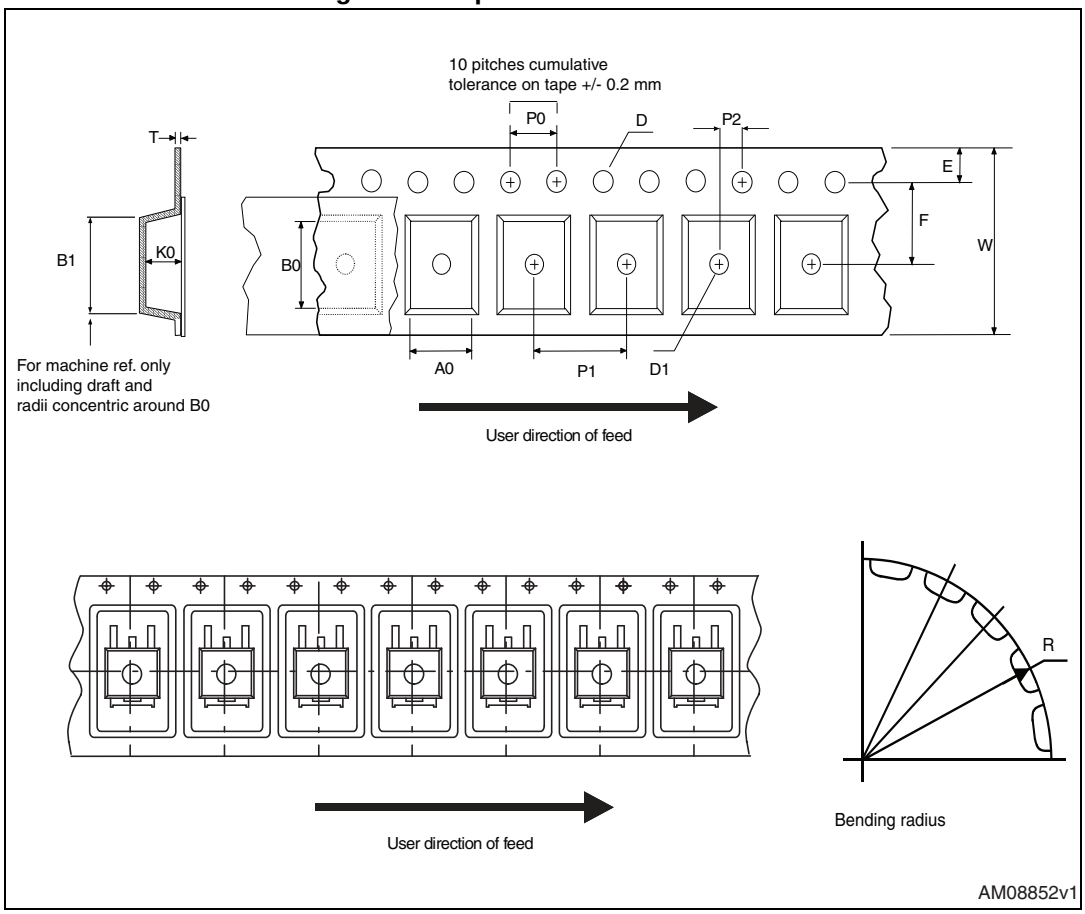
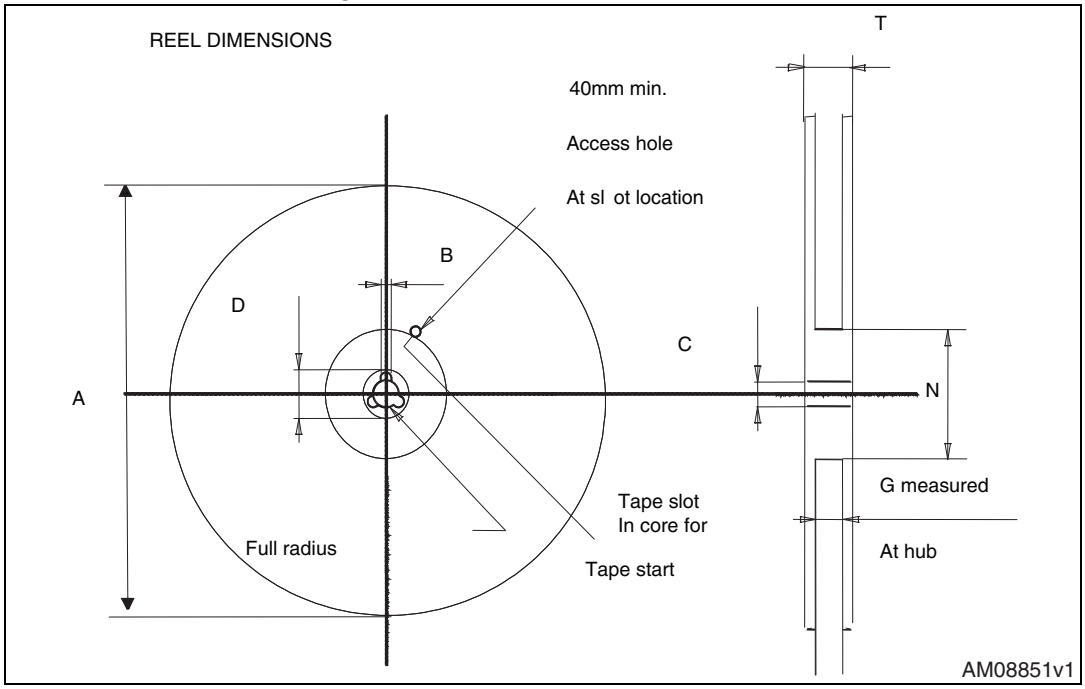


Figure 32. Reel for D²PAK and DPAK



6 Revision history

Table 14. Document revision history

Date	Revision	Changes
09-Feb-2010	1	First release.
04-Mar-2011	2	– Document status promoted from preliminary data to datasheet; – Added new package, mechanical data: D²PAK.
22-Nov-2013	3	– Updated: title on the cover page and $R_{DS(on)}$ values. – Modified: E_{AS} value and note *3* in *Table 2* – Modified: $R_{DS(on)}$ value in *Table 4*, typical values in *Table 5* and *7* – Updated: the entire *Table 5* – Added: *Section 2.1: Electrical characteristics (curves)* – Updated: *Section 4: Package mechanical data* and *Section 5: Packaging mechanical data* – Updated: *Figure 11* and *18* – Minor text changes.

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