STD45N10F7, STI45N10F7, STP45N10F7

N-channel 100 V, 0.0145 Ω typ., 45 A, STripFET™ F7 Power MOSFETs in DPAK, I²PAK and TO-220 packages

Datasheet - production data

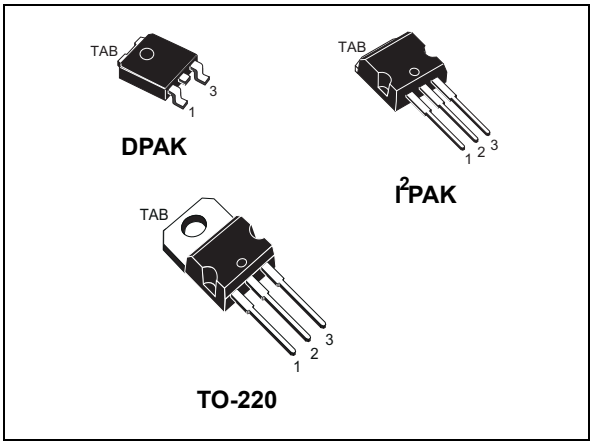
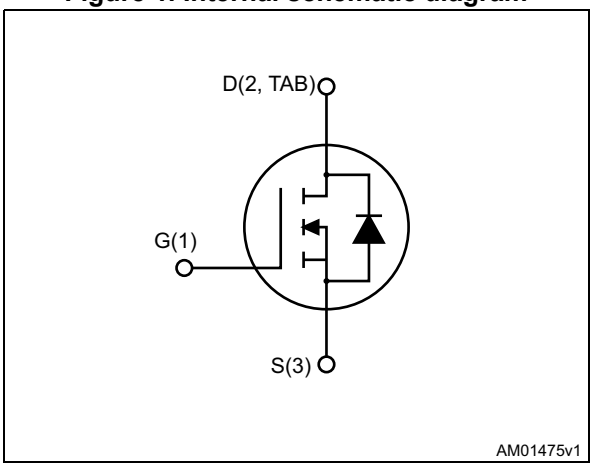


Figure 1. Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D	P_{TOT}
STD45N10F7	100 V	0.018 Ω	45 A	60 W
STI45N10F7				
STP45N10F7				

- Among the lowest $R_{DS(on)}$ on the market
- Excellent figure of merit (FoM)
- Low C_{rss}/Ci_{ss} ratio for EMI immunity
- High avalanche ruggedness

Applications

- Switching applications

Description

These N-channel Power MOSFETs utilize STripFET™ F7 technology with an enhanced trench gate structure that results in very low on-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Table 1. Device summary

Order code	Marking	Package	Packing
STD45N10F7	45N10F7	DPAK	Tape and reel
STI45N10F7		I²PAK	Tube
STP45N10F7		TO-220	

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	100	V
V_{GS}	Gate-source voltage	±20	V
I_D	Drain current (continuous) at T_C = 25 °C	45	A
I_D	Drain current (continuous) at T_C = 100 °C	32	A
I_{DM}(1)	Drain current (pulsed)	180	A
P_{TOT}	Total dissipation at T_c = 25 °C	60	W
E_{AS}(2)	Single pulse avalanche energy	190	mJ
T_J	Operating junction temperature	-55 to 175	°C
T_{stg}	Storage temperature		°C

1. Pulse width limited by safe operating area.
2. Starting T_J = 25°C, I_d = 10 A, V_{dd} = 50 V

Table 3. Thermal resistance

Symbol	Parameter	Value		Unit
		DPAK	TO-220 I^2PAK	
$R_{thj\text{-}case}$	Thermal resistance junction-case	2.5	2.5	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient		62.5	°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb	31.2		°C/W

1. When mounted on FR-4 board of 1inch², 2oz Cu, t < 10 sec.

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 (V_{GS}= 0)	I_D = 1 mA	100		-	V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 100 V			10	µA
		V_{DS} = 100 V; T_C =125 °C			100	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	2.5		4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 22.5 A		0.0145	0.018	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 50 V, f =1 MHz, V_{GS} = 0	-	1640	-	pF
C_{oss}	Output capacitance		-	360	-	pF
C_{rss}	Reverse transfer capacitance		-	25	-	pF
Q_g	Total gate charge	V_{DD} = 50 V, I_D = 45 A V_{GS} = 10 V *Figure 14*	-	25	-	nC
Q_{gs}	Gate-source charge		-	5.1	-	nC
Q_{gd}	Gate-drain charge		-	12.2	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 50 V, I_D = 22.5 A, R_G = 4.7 Ω, V_{GS} = 10 V *Figure 13*	-	15	-	ns
t_r	Rise time		-	17	-	ns
$t_{d(off)}$	Turn-off delay time		-	24	-	ns
t_f	Fall time		-	8	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		45	A
I_{SDM}(1)	Source-drain current (pulsed)		-		180	A
V_{SD}(2)	Forward on voltage	I_{SD} = 45 A, V_{GS} = 0	-		1.1	V
t_{rr}	Reverse recovery time	I_{SD} = 45 A, di/dt = 100 A/µs, V_{DD} = 80 V, T_j = 150 °C	-	53		ns
Q_{rr}	Reverse recovery charge		-	67		nC
I_{RRM}	Reverse recovery current		-	2.5		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

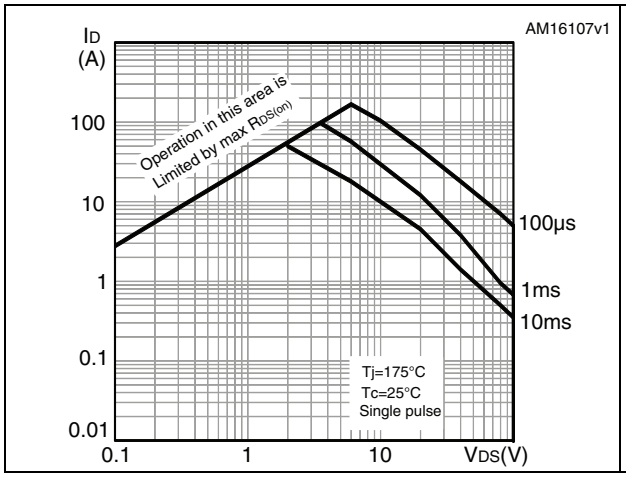


Figure 3. Thermal impedance

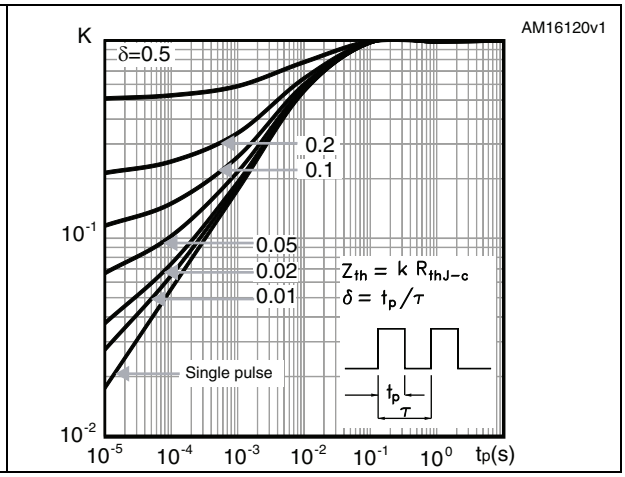


Figure 4. Output characteristics

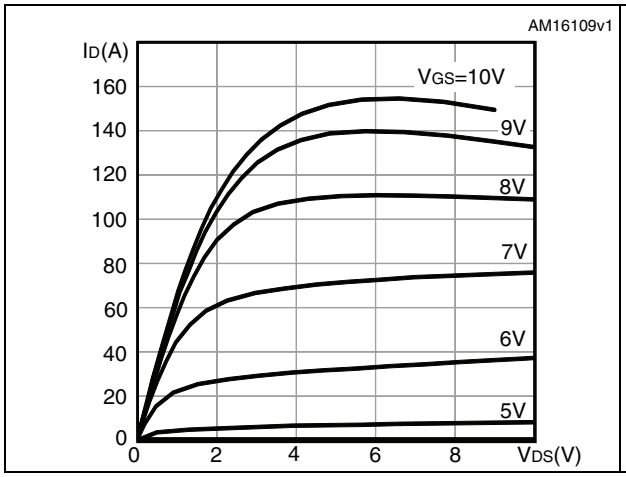


Figure 5. Transfer characteristics

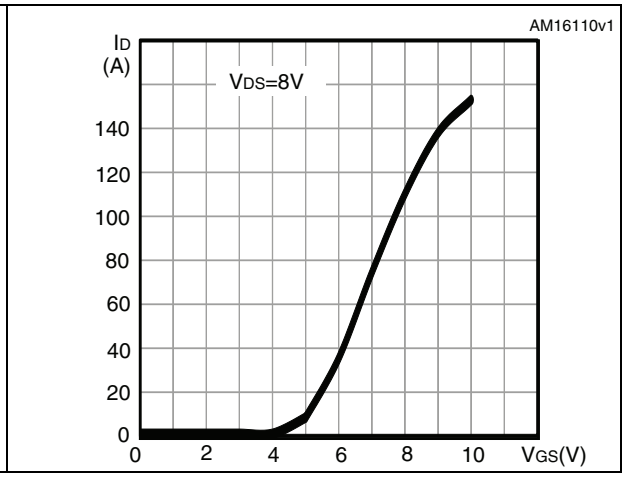


Figure 6. Gate charge vs gate-source voltage

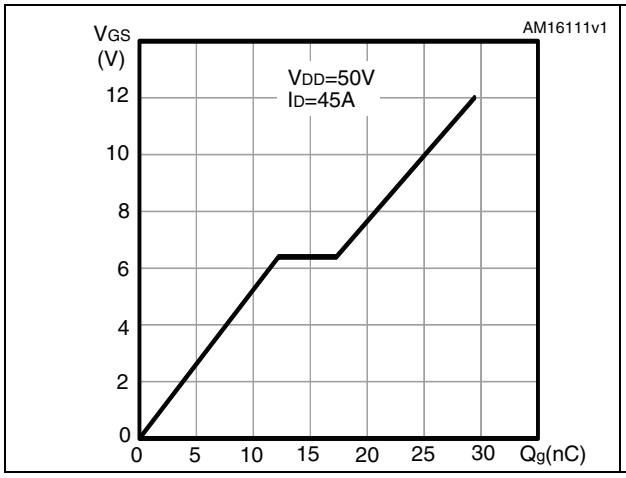


Figure 7. Static drain-source on-resistance

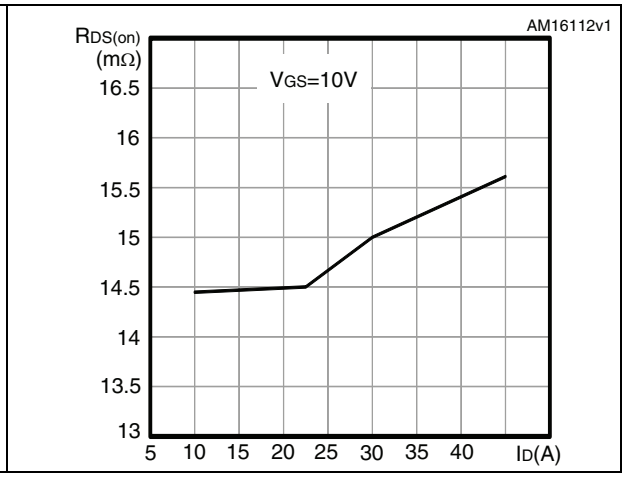


Figure 8. Capacitance variations

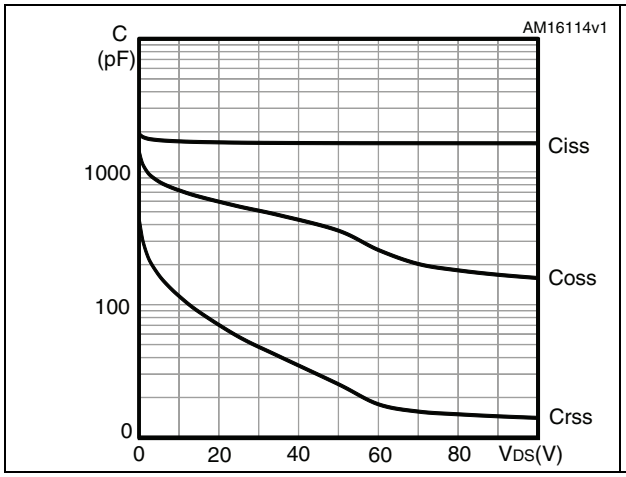


Figure 9. Normalized gate threshold voltage vs temperature

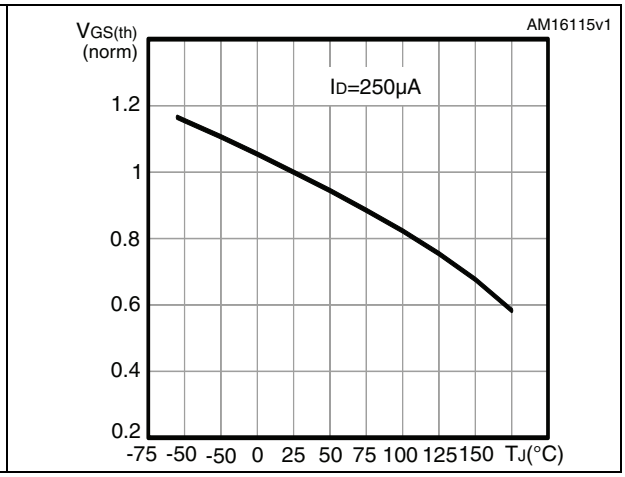


Figure 10. Normalized on-resistance vs temperature

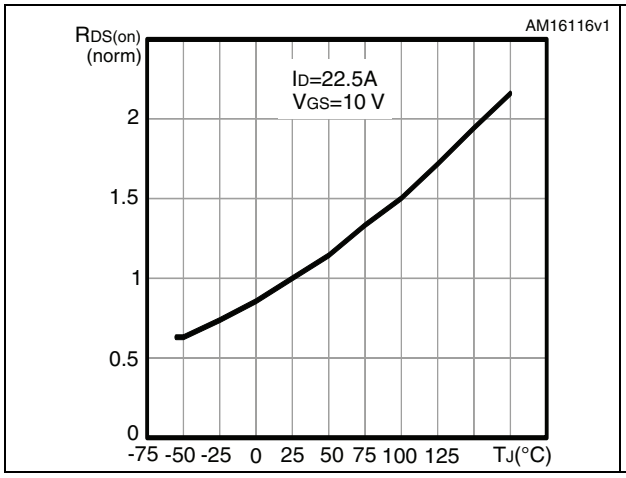


Figure 11. Source-drain diode forward characteristics

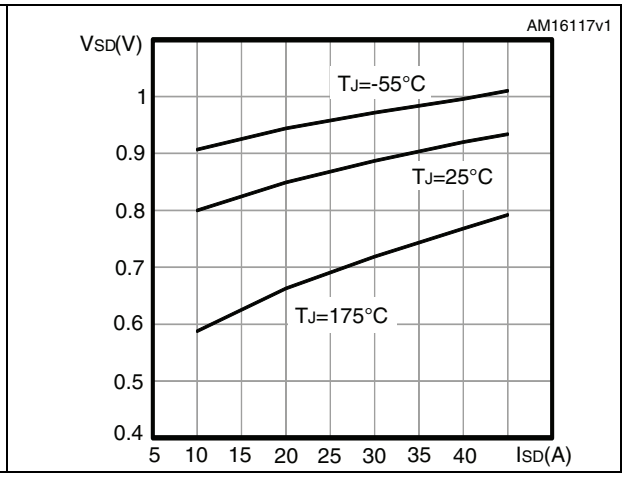
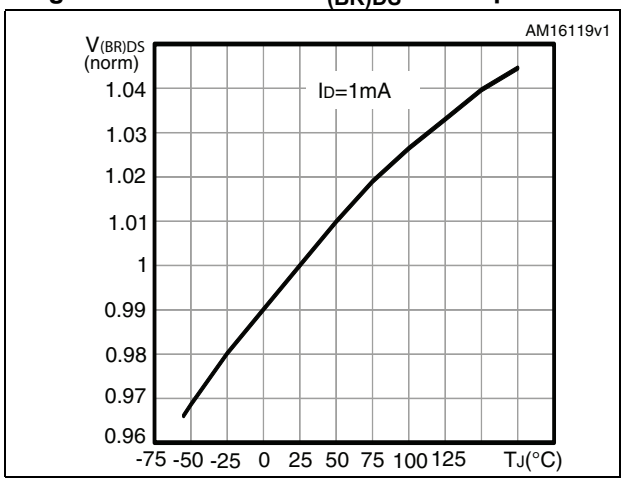


Figure 12. Normalized $V_{(BR)DS}$ vs temperature



3 Test circuits

Figure 13. Switching times test circuit for resistive load

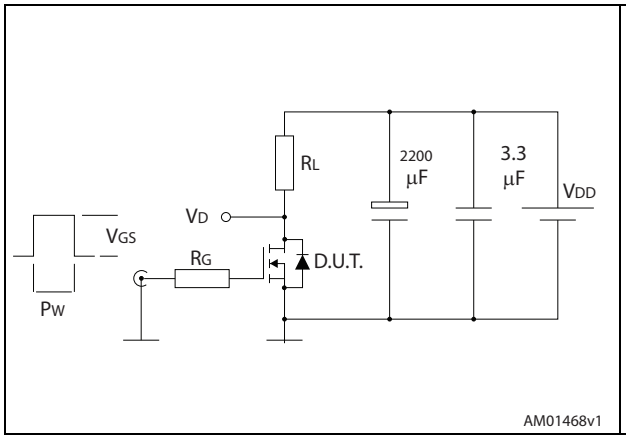


Figure 14. Gate charge test circuit

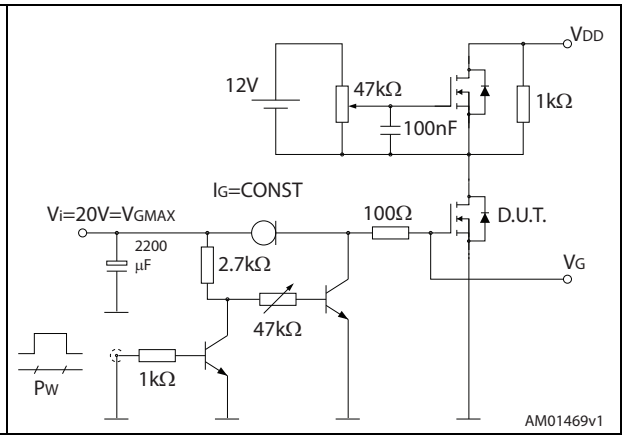


Figure 15. Test circuit for inductive load switching and diode recovery times

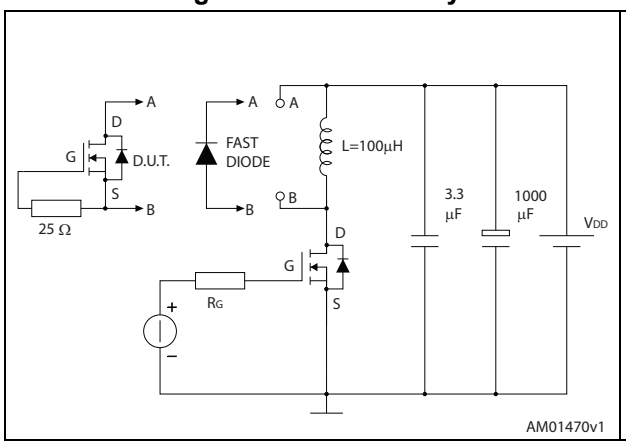


Figure 16. Unclamped inductive load test circuit

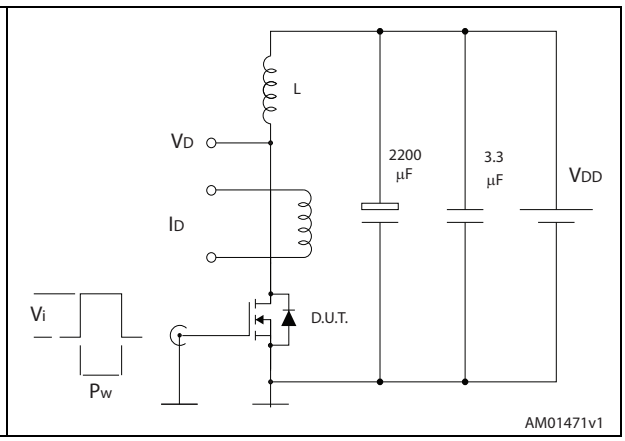


Figure 17. Unclamped inductive waveform

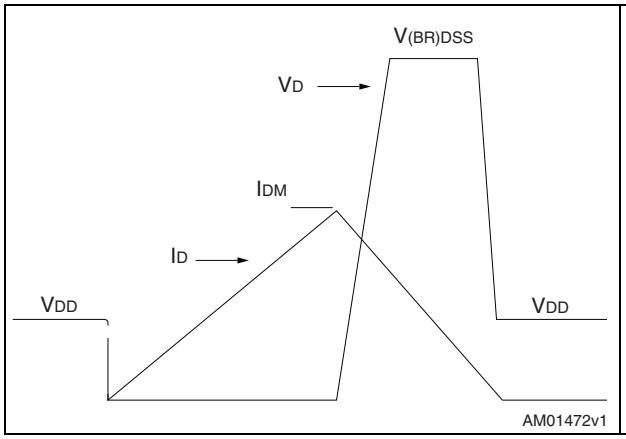
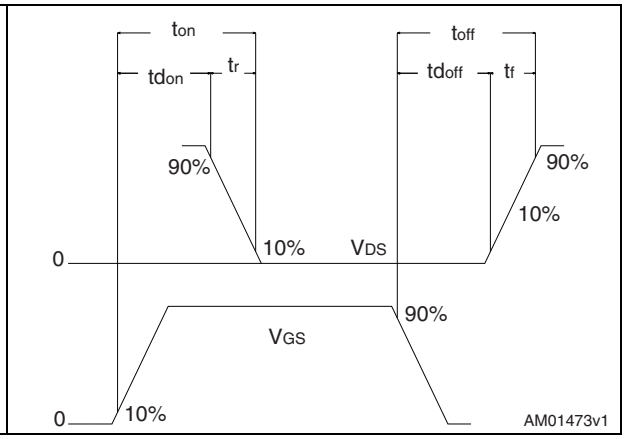


Figure 18. Switching time waveform



4 Package information

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.

4.1 DPAK (TO-252) package information

Figure 19. DPAK (TO-252) type A package outline

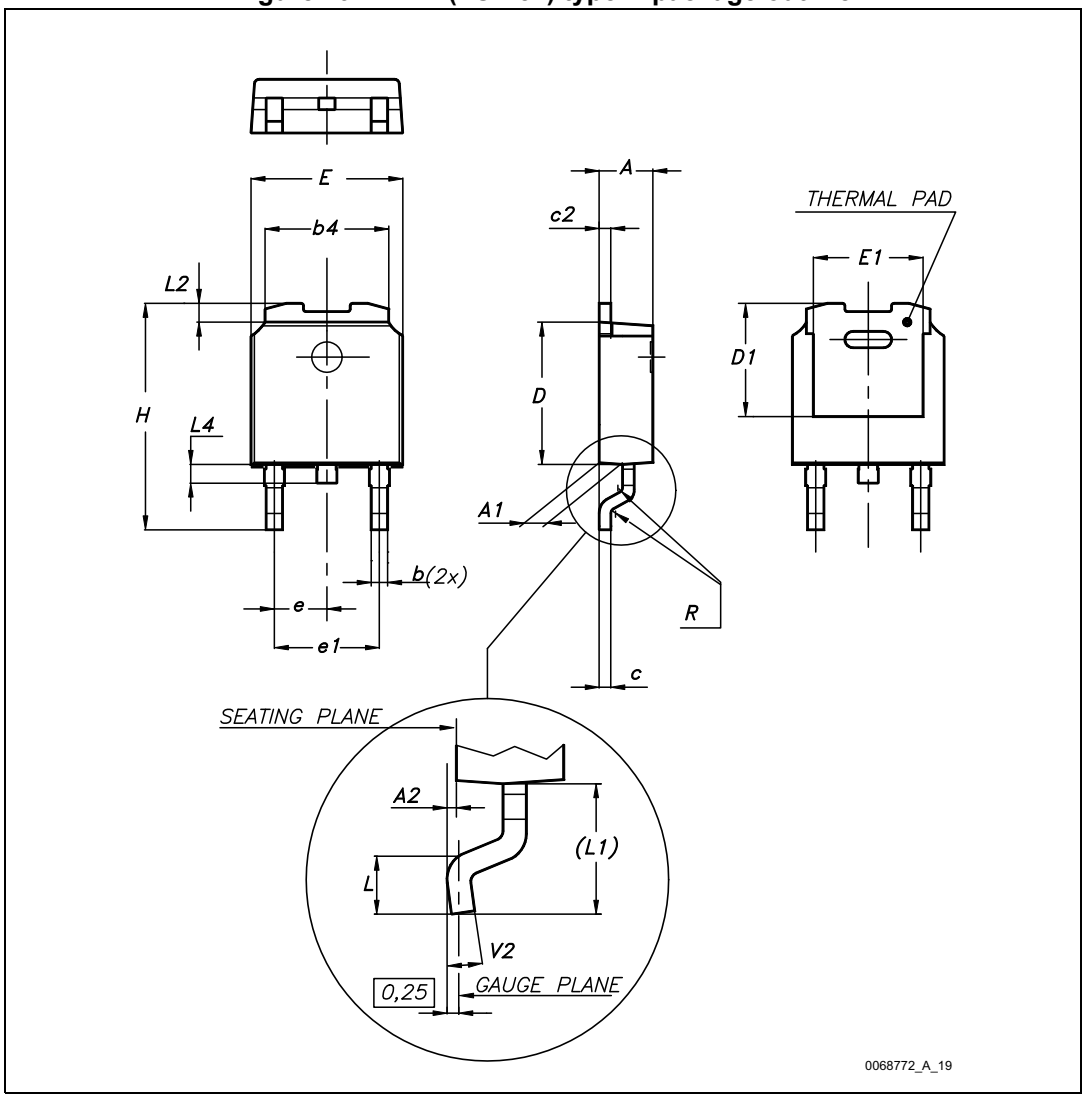
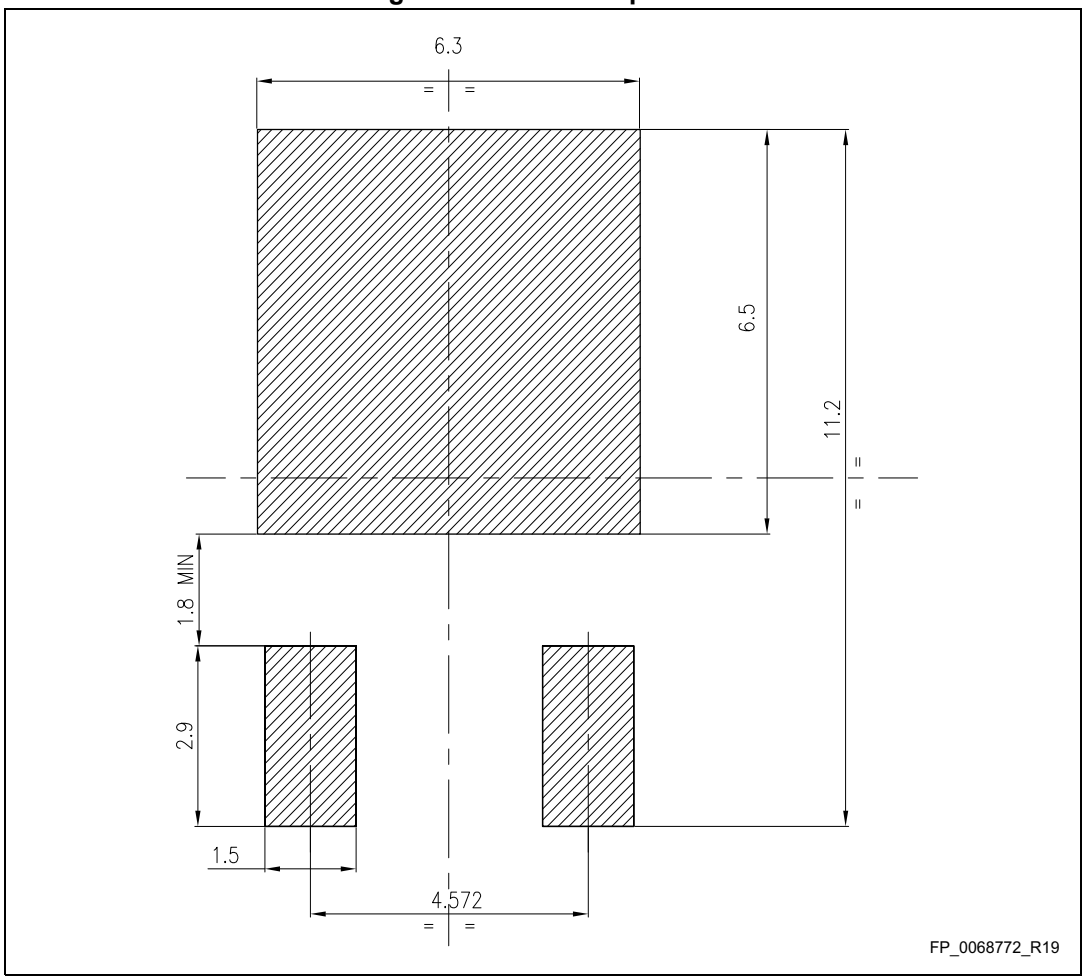


Table 8. DPAK (TO-252) type A mechanical data

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	4.95	5.10	5.25
E	6.40		6.60
E1	4.60	4.70	4.80
e	2.16	2.28	2.40
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
(L1)	2.60	2.80	3.00
L2	0.65	0.80	0.95
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 20. DPAK footprint [(a)]



a. All dimensions are in millimeters

4.2 I²PAK (TO-262) package information

Figure 21. I²PAK (TO-262) package outline

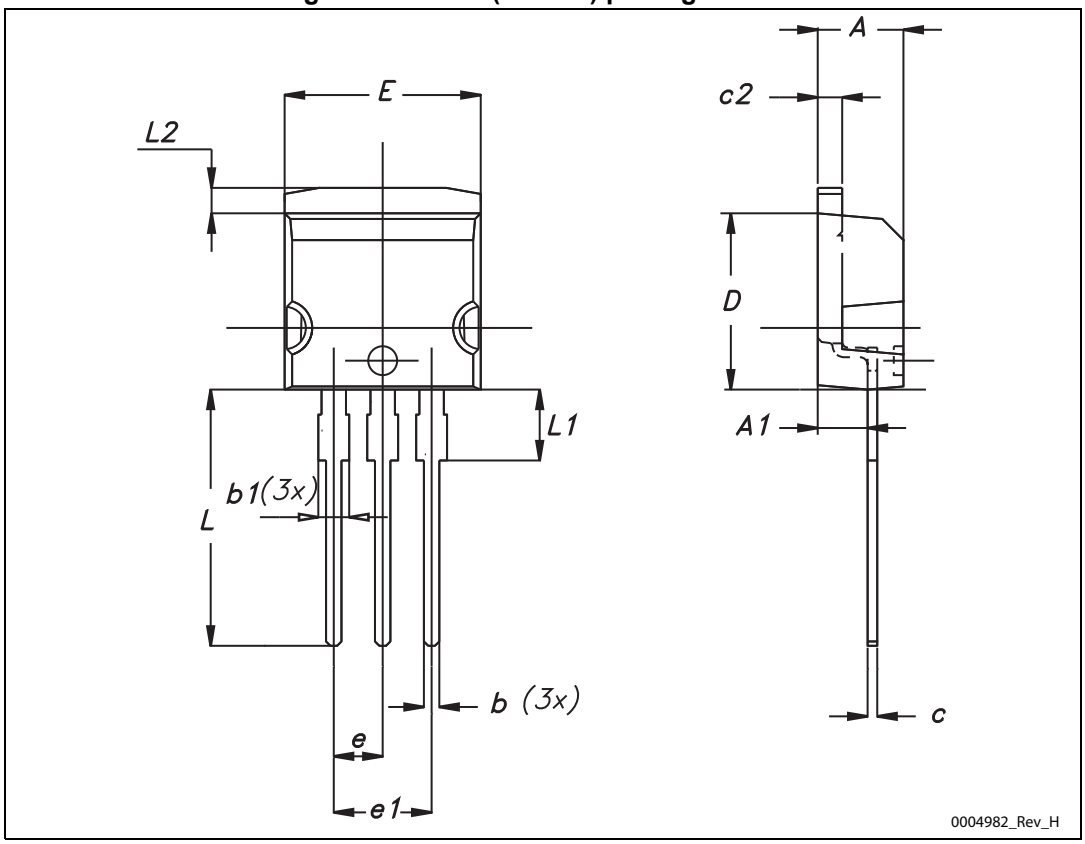


Table 9. I²PAK (TO-262) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	2.40		2.72
b	0.61		0.88
b1	1.14		1.70
c	0.49		0.70
c2	1.23		1.32
D	8.95		9.35
e	2.40		2.70
e1	4.95		5.15
E	10		10.40
L	13		14
L1	3.50		3.93
L2	1.27		1.40

4.3 TO-220 type A package information

Figure 22. TO-220 type A package outline

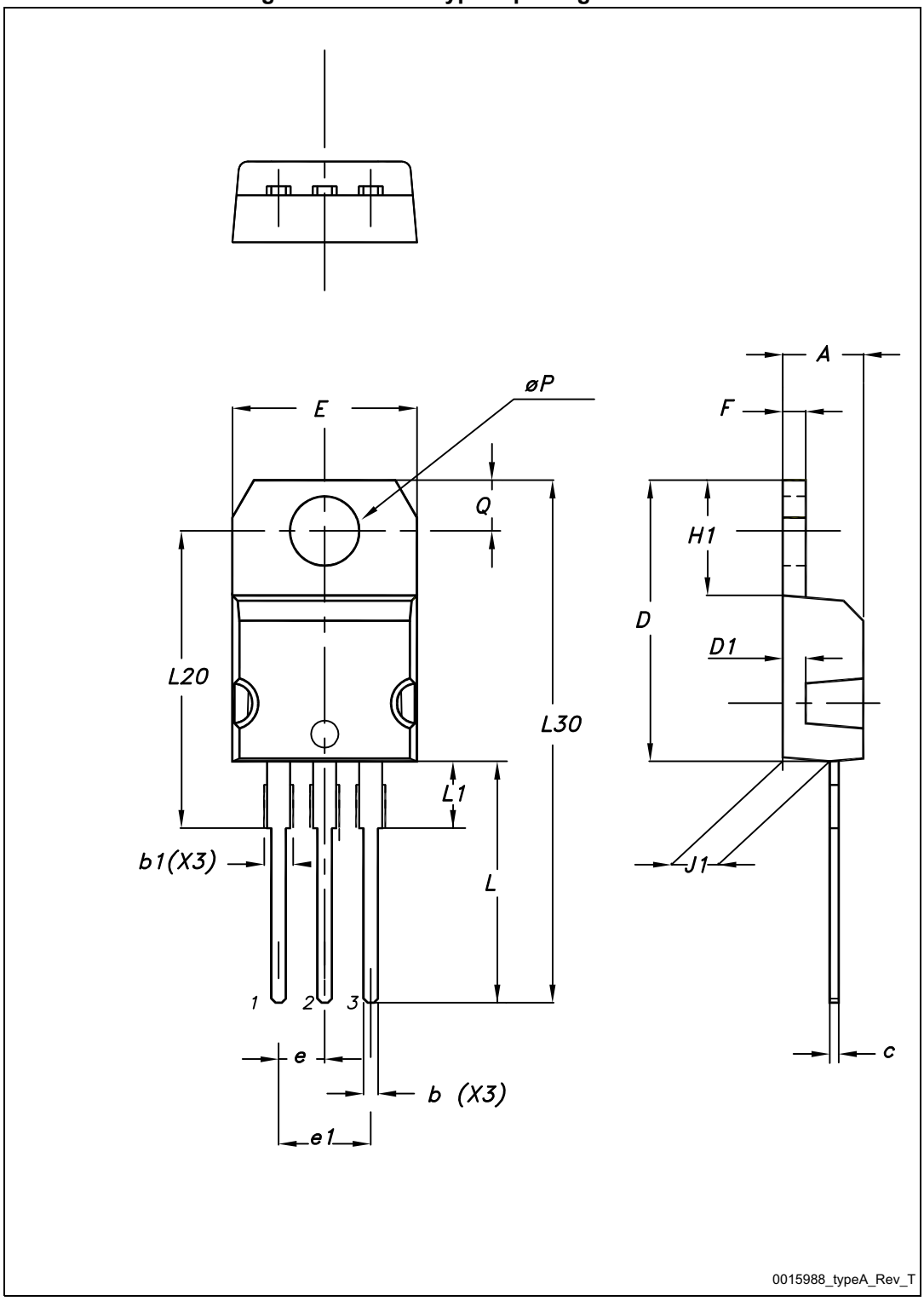


Table 10. TO-220 type A mechanical data

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

5 Packing mechanical data

Figure 23. Tape

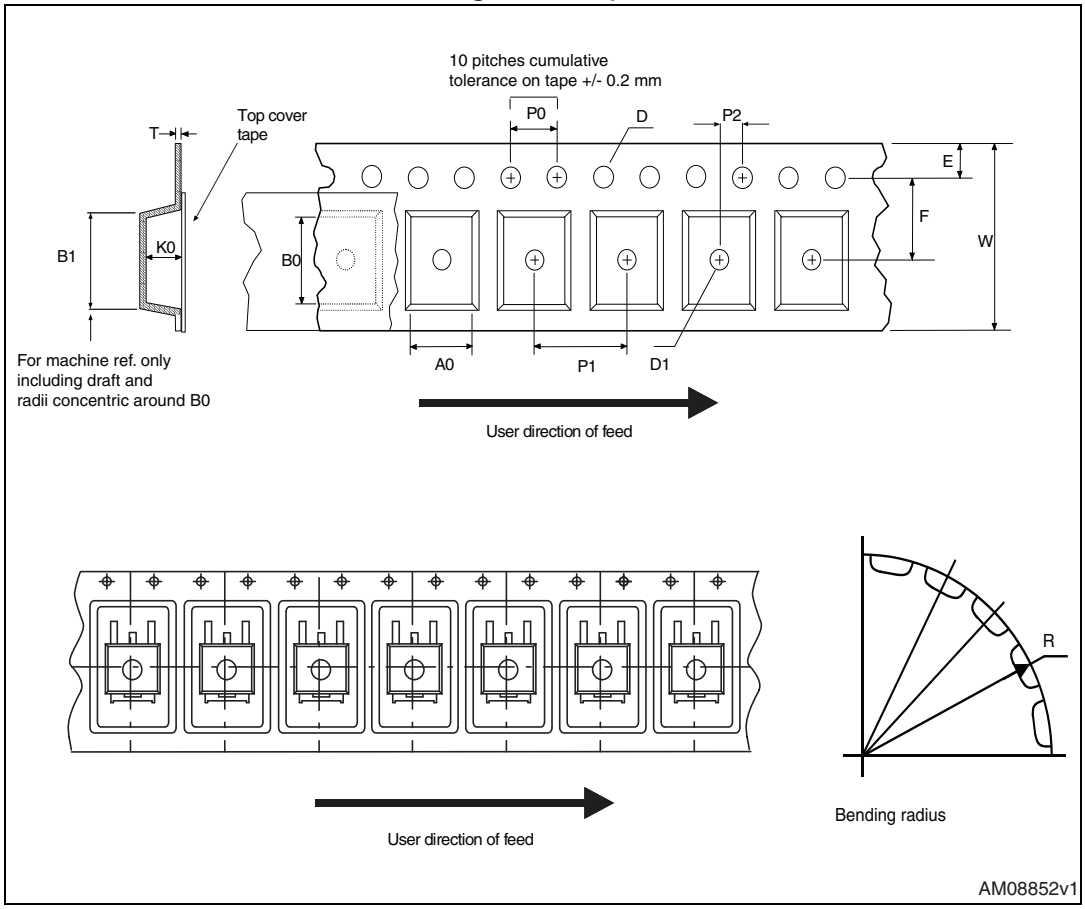


Figure 24. Reel

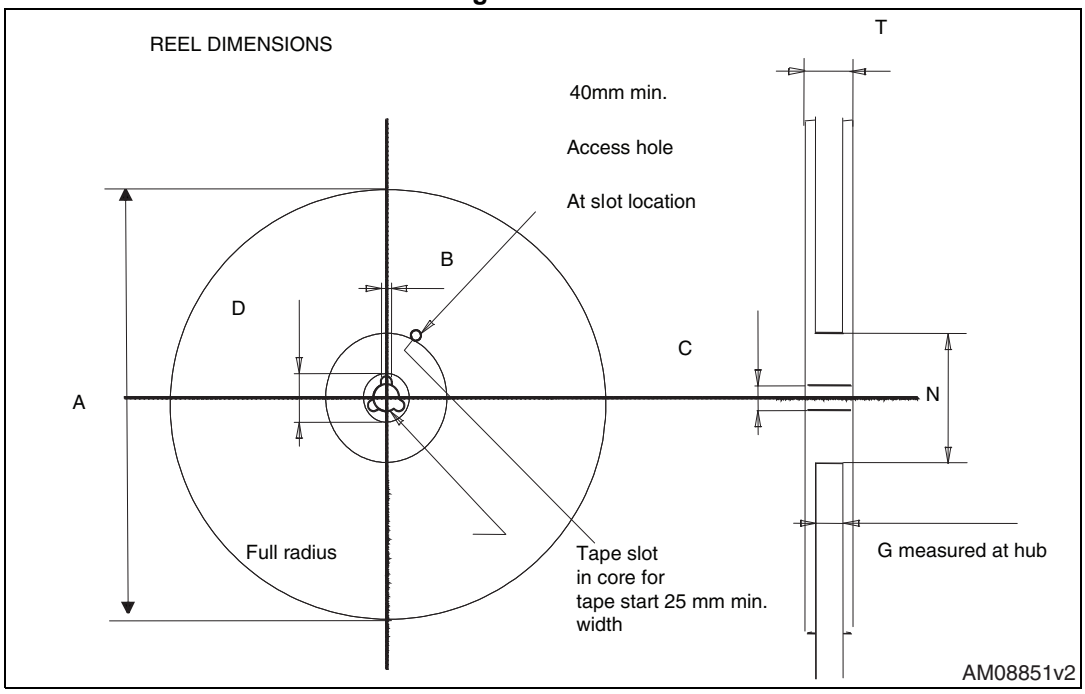


Table 11. DPAK (TO-252) tape and reel mechanical data

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			

6 Revision history

Table 12. Document revision history

Date	Revision	Changes
10-Oct-2013	1	First release.
08-Sep-2015	2	Updated title, features and description in cover page Updated *Table 2.: Absolute maximum ratings* Updated *4.1: DPAK (TO-252) package information* Minor text changes.