

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

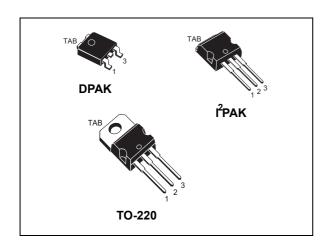
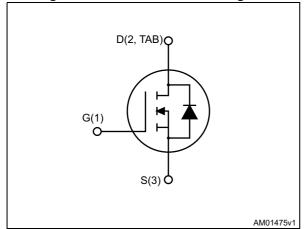


Figure 1. Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STD45N10F7				
STI45N10F7	100 V	0.018 Ω	45 A	60 W
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 onstate 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		DPAK	Tape and reel
STI45N10F7	45N10F7	I ² PAK	Tube
STP45N10F7		TO-220	Tube

Contents

1	Electrical ratings 3
2	Electrical characteristics4
	2.1 Electrical characteristics (curves)
3	Test circuits 8
4	Package information
	4.1 DPAK (TO-252) package information
	4.2 I ² PAK (TO-262) package information
	4.3 TO-220 type A package information
5	Packing mechanical data16
6	Revision history

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	Α
I _D	Drain current (continuous) at T _C = 100 °C	32	Α
I _{DM} ⁽¹⁾	Drain current (pulsed)	180	Α
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	-55 to 175	°C

^{1.} Pulse width limited by safe operating area.

Table 3. Thermal resistance

		V	alue	
Symbol Parameter		DPAK	TO-220 I ² PAK	Unit
R _{thj-case}	Thermal resistance junction-case	2.5	2.5	°C/W
R _{thj-amb}	Thermal resistance junction-ambient		62.5	°C/W
R _{thj-pcb} (1)	Thermal resistance junction-pcb			°C/W

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

^{2.} Starting $T_J = 25$ °C, $I_d = 10$ A, $V_{dd} = 50$ V

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
V _{(BR)DSS}	Drain-source breakdown voltage (V _{GS} = 0)	I _D = 1 mA	100		-	V
1	Zero gate voltage drain	V _{DS} = 100 V			10	μA
I _{DSS}	current (V _{GS} = 0)	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	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	2.5		4.5	٧
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.	Тур.	Max.	Unit
C _{iss}	Input capacitance		-	1640	-	pF
C _{oss}	Output capacitance	$V_{DS} = 50 \text{ V, f} = 1 \text{ MHz,}$ $V_{GS} = 0$ $V_{DD} = 50 \text{ V, I}_{D} = 45 \text{ A}$ $V_{GS} = 10 \text{ V}$	-	360	ı	pF
C _{rss}	Reverse transfer capacitance		-	25	-	pF
Qg	Total gate charge		-	25	ı	nC
Q _{gs}	Gate-source charge		-	5.1	-	nC
Q_{gd}	Gate-drain charge	Figure 14	-	12.2	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
t _{d(on)}	Turn-on delay time		-	15	-	ns
t _r	Rise time	$V_{DD} = 50 \text{ V}, I_{D} = 22.5 \text{ A},$ $R_{G} = 4.7 \Omega, V_{GS} = 10 \text{ V}$ Figure 13	-	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.	Тур.	Max.	Unit
I _{SD}	Source-drain current		-		45	Α
I _{SDM} ⁽¹⁾	Source-drain current (pulsed)		-		180	Α
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,	-	53		ns
Q _{rr}	Reverse recovery charge	di/dt = 100 A/µs,	-	67		nC
I _{RRM}	Reverse recovery current	$V_{DD} = 80 \text{ V}, T_j = 150 \text{ °C}$	-	2.5		Α

^{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

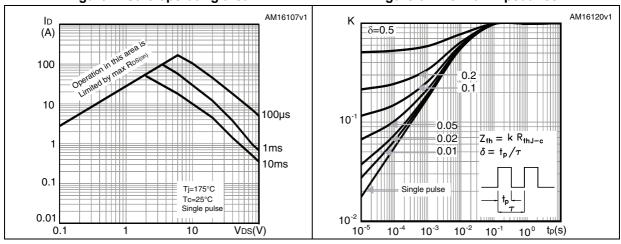


Figure 4. Output characteristics

Figure 5. Transfer characteristics

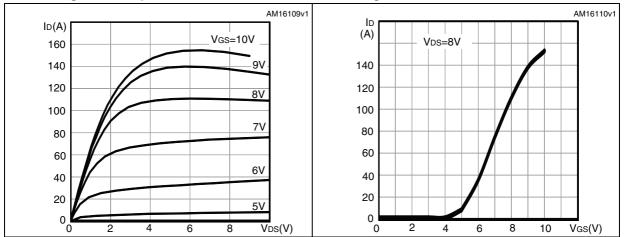


Figure 6. Gate charge vs gate-source voltage

Figure 7. Static drain-source on-resistance

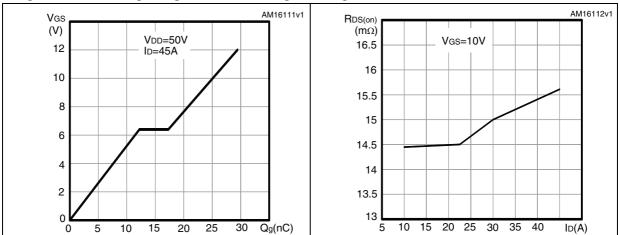
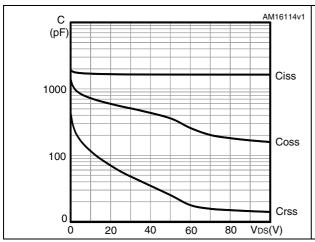


Figure 8. Capacitance variations

Figure 9. Normalized gate threshold voltage vs temperature



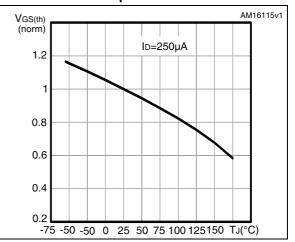
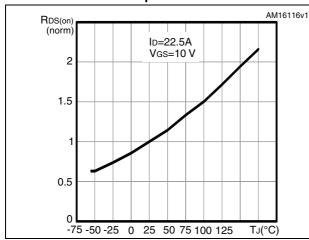


Figure 10. Normalized on-resistance vs temperature

Figure 11. Source-drain diode forward characteristics



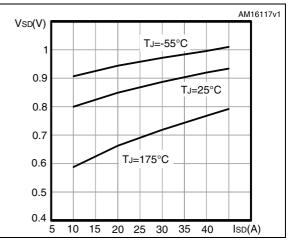
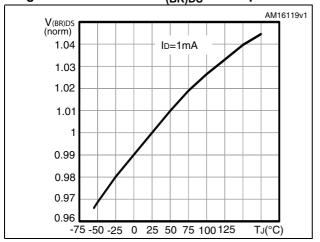


Figure 12. Normalized $V_{(BR)DS}$ vs temperature





3 Test circuits

Figure 13. Switching times test circuit for resistive load

Figure 14. Gate charge test circuit

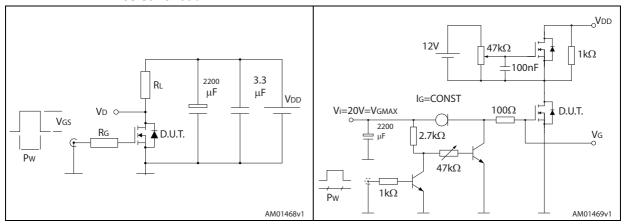


Figure 15. Test circuit for inductive load switching and diode recovery times

Figure 16. Unclamped inductive load test circuit

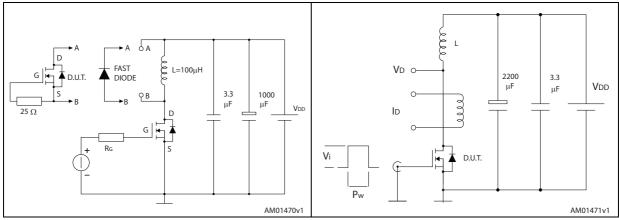
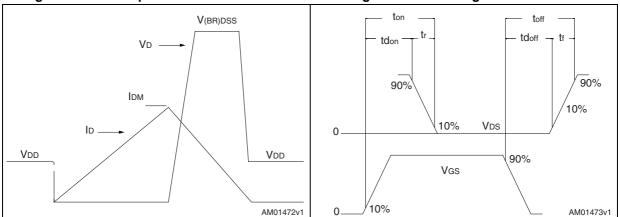


Figure 17. Unclamped inductive waveform

Figure 18. Switching time waveform



577

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

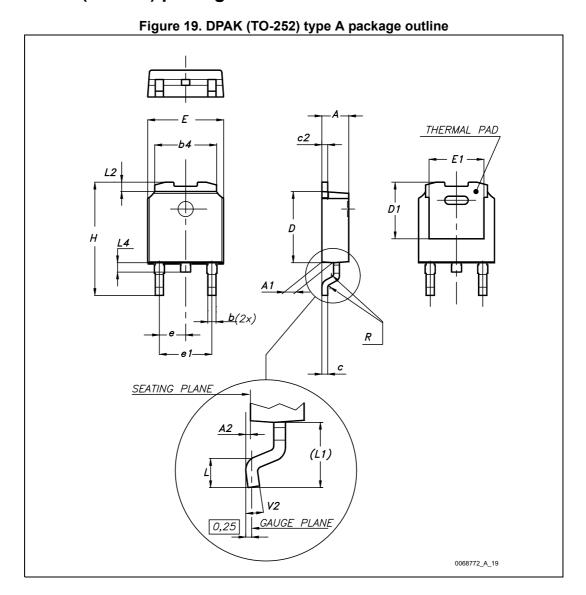




Table 8. DPAK (TO-252) type A mechanical data

Dim	1000001217111(10	mm	
Dim.	Min.	Тур.	Max.
А	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
С	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
е	2.16	2.28	2.40
e1	4.40		4.60
Н	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°

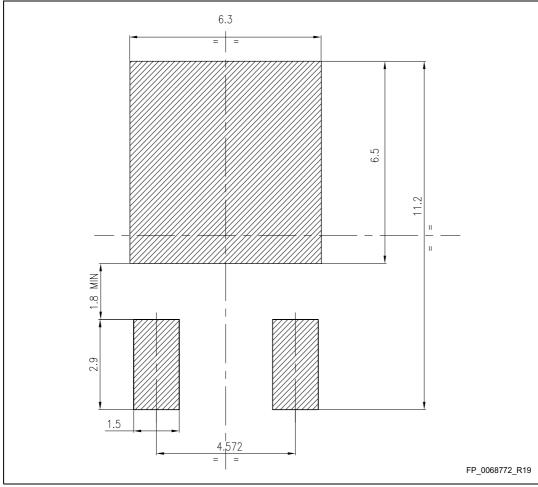


Figure 20. DPAK footprint (a)

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	
Dim.	Min.	Тур.	Max.
Α	4.40		4.60
A1	2.40		2.72
b	0.61		0.88
b1	1.14		1.70
С	0.49		0.70
c2	1.23		1.32
D	8.95		9.35
е	2.40		2.70
e1	4.95		5.15
Е	10		10.40
L	13		14
L1	3.50		3.93
L2	1.27		1.40

4.3 TO-220 type A package information

øΡ H1 <u>D1</u> L20 L30 <u>L</u>1 b1(X3) b (X3) .e1__

Figure 22. TO-220 type A package outline

577

0015988_typeA_Rev_T

Table 10. TO-220 type A mechanical data

Dim		mm	
Dim.	Min.	Тур.	Max.
А	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
С	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
е	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

Packing mechanical data 5

Figure 23. Tape 10 pitches cumulative tolerance on tape +/- 0.2 mm P0 Top cover \oplus _K0_ B1 For machine ref. only Α0 D1 including draft and radii concentric around B0 User direction of feed Bending radius User direction of feed

AM08852v1

REEL DIMENSIONS

T

40mm min.

Access hole

At slot location

Tape slot in core for tape start 25 mm min. width

AM08851v2

Figure 24. Reel

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

Tape				Reel		
Dim.	mm		Dim.	mm		
	Min.	Max.	ווווט.	Min.	Max.	
A0	6.8	7	Α		330	
В0	10.4	10.6	В	1.5		
B1		12.1	С	12.8	13.2	
D	1.5	1.6	D	20.2		
D1	1.5		G	16.4	18.4	
Е	1.65	1.85	N	50		
F	7.4	7.6	Т		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					
Т	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.	



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