Contents

1	Electrical ratings
2	Electrical characteristics4
	2.1 Electrical characteristics (curves) 6
3	Test circuits
4	Package information
	4.1 TO-220FP package information
	4.2 I2PAKFP (TO-281) package information
5	Revision history



1 Electrical ratings

Symbol	Deremeter	Value		Unit
Symbol	Parameter	TO-220FP	I ² PAKFP	Unit
V _{DS}	Drain source voltage	65	50	V
V _{GS}	Gate source voltage	±	25	V
۱ _D	Drain current continuous Tc = 25 °C	12	(1)	А
Ι _D	Drain current continuous Tc = 100 °C	7.56		А
I _{DM} ⁽²⁾	Drain current pulsed	48		А
P _{TOT}	Total dissipation at Tc = 25 °C	30		W
dv/dt ⁽³⁾	Peak diode recovery voltage slope	1	5	V/ns
V _{ISO}	V_{ISO} Insulation withstand voltage (RMS from all three leads to external heatsink (t = 1 s; T _C = 25 °C)		00	V
T _J Operating junction temperature range		55 to 450		°C
T _{stg}	Storage temperature range	-55 to 150		

Table 2. Absolute maximum ratings

1. Limited by maximum junction temperature.

2. Pulse width limited by safe operating area.

3. ISD ≤12 A, di/dt ≤ 400 A/µs, VDSpeak ≤ $V_{(BR)DSS}$, VDD = 80 % $V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameters	Va	Unit	
Symbol	Farameters	TO-220FP	I ² PAKFP	Unit
R _{thjc}	Thermal resistance junction-case	4.	17	°C/W
R _{thj-amb}	Thermal resistance junction-ambient	62.5		°C/W

Table 4. Avalanche characteristics

Symbol	Parameters	Value	Unit
I _{AS}	Avalanche current, repetitive or not- repetitive (pulse width limited by T _{jmax})	3	А
E _{AS}	Single pulse avalanche energy (starting $T_J = 25 \text{ °C}, I_D = I_{AR}, V_{DD} = 50 \text{ V}$)	187	mJ



2 Electrical characteristics

 $(T_{CASE} = 25 \text{ °C unless otherwise specified}).$

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
V _{(BR)DSS}	Drain-source breakdown voltage	$V_{GS} = 0$, $I_D = 1$ mA	650			V
		$V_{DD} = 650 \text{ V}, \text{ V}_{GS} = 0$			1	μA
I _{DSS}	Zero gate voltage drain current	$V_{DD} = 650 \text{ V}, V_{GS} = 0$ $T_{C} = 125 \text{ °C}^{(1)}$			100	μA
I _{GSS}	Gate body leakage	V_{GS} = ±25 V, V_{DS} = 0 V			±100	nA
V _{GS(th)}	Gate threshold voltage	I _D = 250 μA, V _{GS =} V _{DS}	2	3	4	V
R _{DS(on)}	Static drain-source on- resistance	I _D = 6 A, V _{GS} = 10V		0.35	0.38	Ω

Table :	5. On/	off	states
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1. Defined by design, not subject to production test

Symbol	Parameter	Test conditions	Min.	Тур.	Ma.	Unit
C _{iss}	Input capacitance		-	983	-	pF
C _{oss}	Output capacitance	$V_{DS} = 50 \text{ V}, \text{ f} = 1 \text{ MHz},$	-	57	-	pF
C _{rss}	Reverse capacitance	GS-0V	-	4.5	-	pF
C _{osseq} ⁽¹⁾	Equivalent output. capacitance	$V_{DS} = 0$ V to 520 V, $V_{GS} = 0$ V	-	146	-	pF
Rg	Intrinsic gate resistance	$f = 1MHz I_D = 0 A$	-	4.6	-	Ω
Qg	Total gate charge	V _{DD} = 520 V, I _D =12 A,	-	33.3	-	nC
Q _{gs}	Gate source charge	V_{GS} = 10 V (see <i>Figure 13</i> :	-	5.7	-	nC
Q _{gd}	Gate-drain charge	Gate charge test circuit)	-	17	-	nC

Table 6. Dynamic

1. Cross eq: 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
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Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
t _{d(on)}	Turn-on delay time	V_{DD} = 325 V, I_{D} = 6 A	-	55.5	-	ns
t _r	Rise time	$R_g = 4.7 \Omega$, $V_{GS} = 10 V$ (see Figure 12: Switching times	-	8.5	-	ns
t _{d(off)}	Turn-off-delay time	test circuit for resistive	-	14	-	ns
t _f	Fall time	load and Figure 17: Switching time waveform)	-	11.4	-	ns



Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
I _{SD}	Source drain current		-		12	А
I _{SDM} ⁽¹⁾	Source drain current (pulsed)		-		48	А
V _{SD} ⁽²⁾	Forward on voltage	$I_{SD} = 12 \text{ A}, V_{GS} = 0 \text{ V}$	-		1.6	V
t _{rr}	Reverse recovery time	I _{SD} = 12 A, di/dt = 100 A/µs	-	428		ns
Q _{rr}	Reverse recovery charge	V _{DD} = 60 V(see <i>Figure 14:</i> <i>Test circuit for inductive</i>	-	4.7		μC
I _{RRM}	Reverse recovery current	load switching and diode recovery times)	-	21.5		А
t _{rr}	Reverse recovery time	I _{SD} = 12 A, di/dt = 100 A/µs	-	570		ns
Q _{rr}	Reverse recovery charge	$V_{DD} = 60 \text{ V}, \text{ T}_j = 150 \text{ °C}$ (see Figure 14: Test circuit	-	6.2		μC
I _{RRM}	Reverse recovery current	for inductive load switching and diode recovery times)	-	22		A

Table 8. Source drain diode

1. Pulse width limited by safe operating area.

2. Pulsed: pulse duration = $300 \ \mu$ s, duty cycle 1.5 %



2.1 Electrical characteristics (curves)



DocID13853 Rev 4







Figure 11. Normalized V_{DS} vs temperature





Test circuits 3

Figure 12. Switching times test circuit for resistive load



Figure 14. Test circuit for inductive load switching and diode recovery times



Figure 16. Unclamped inductive waveform

VD

ldм

lр

V(BR)DSS











Vdd

DocID13853 Rev 4

Vdd



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 TO-220FP package information



Figure 18. TO-220FP package outline



DocID13853 Rev 4



		mm	
Dim.	Min.	Тур.	Max.
А	4.4		4.6
В	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
н	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

Table 9. TO-220FP package mechanical data



4.2 I²PAKFP (TO-281) package information



Figure 19. I²PAKFP (TO-281) package outline



Dim		mm					
Dini.	Min.	Тур.	Max.				
A	4.40		4.60				
В	2.50		2.70				
D	2.50		2.75				
D1	0.65		0.85				
E	0.45		0.70				
F	0.75		1.00				
F1			1.20				
G	4.95		5.20				
н	10.00		10.40				
L1	21.00		23.00				
L2	13.20		14.10				
L3	10.55		10.85				
L4	2.70		3.20				
L5	0.85		1.25				
L6	7.50	7.60	7.70				

Table 10. I²PAKFP (TO-281) package mechanical data



5 Revision history

Date	Revision	Changes
11-May-2011	1	Initial release.
21-Jun-2011	2	Document status promoted form preliminary data to datasheet, added Section 2.1: Electrical characteristics (curves).
17-Jul-2013	3	 Added: I²PAKFP package Added: Table 10 and Figure 22 Updated: Section 4: Package information Minor text changes.
25-Jul-2016	4	The part number STP15NM65N has been moved to a separate datasheet. Minor text changes.

Table 11. Document revision history



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DocID13853 Rev 4