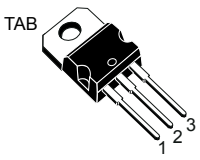
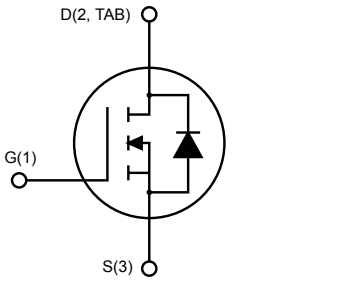
N-channel 250 V, 0.195 Ω typ., 14 A STripFET™ II Power MOSFET in TO-220 package



TO-220



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D	Package
STP16NF25	250 V	0.235 Ω	14 A	TO-220

- Exceptional dv/dt capability
- 100% avalanche tested
- Low gate charge

Applications

- Switching applications

Description

This Power MOSFET series has been developed using STMicroelectronics' unique STripFET™ process, which is specifically designed to minimize input capacitance and gate charge. This renders the device suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.

STPOWER

Product status link
STP16NF25

Product summary	
Order code	STP16NF25
Marking	16NF25
Package	TO-220
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	250	V
V_{GS}	Gate-source voltage	±20	V
I_D	Drain current (continuous) at T_C = 25 °C	14	A
I_D	Drain current (continuous) at T_C = 100 °C	8.8	A
I_{DM} (1)	Drain current (pulsed)	56	A
P_{TOT}	Total power dissipation at T_C = 25 °C	85	W
dv/dt (2)	Peak diode recovery voltage slope	15	V/ns
T_j	Operating junction temperature range	-55 to 150	°C
T_{stg}	Storage temperature range		

1. *Pulse width limited by safe operating area.*
2. *I_{SD} ≤ 13 A, di/dt ≤ 300 A/µs, V_{DD} = 80% $V_{(BR)DSS}$, T_j ≤ T_{JMAX}.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	1.47	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	62.5	

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR} (1)	Avalanche current, repetitive or not-repetitive	13	A
E_{AS} (2)	Single pulse avalanche energy	100	mJ

1. *Pulse width limited by T_{jmax}.*
2. *Starting T_j = 25°C, I_D = I_{AR}, V_{DD} = 50 V.*

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 V, I_D = 1 mA	250			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 250 V			1	µA
		V_{GS} = 0 V, V_{DS} = 250 V, T_C = 125 °C (1)			10	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±20 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 6.5 A		0.195	0.235	Ω

1. *Defined by design, not subject to production test.*

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0 V	-	680	-	pF
C_{oss}	Output capacitance			125		
C_{rss}	Reverse transfer capacitance			20		
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{GS} = 0 V, V_{DS} = 0 V to 200 V	-	48	-	pF
R_G	Gate input resistance	f = 1 MHz, I_D = 0 A	-	2.1	-	Ω
Q_g	Total gate charge	V_{DD} = 200 V, I_D = 13 A, V_{GS} = 0 to 10 V (see Figure 14. Test circuit for gate charge behavior)	-	18	-	nC
Q_{gs}	Gate-source charge			3		
Q_{gd}	Gate-drain charge			9		

1. *$C_{oss\ eq.}$ 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 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 125 V, I_D = 6.5 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 13. Test circuit for resistive load switching times and Figure 18. Switching time waveform)	-	9	-	ns
t_r	Rise time			17		
$t_{d(off)}$	Turn-off delay time			35		
t_f	Fall time			17		

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		14	A
I_{SDM} (1)	Source-drain current (pulsed)		-		56	
V_{SD} (2)	Forward on voltage	I_{SD} = 13 A, V_{GS} = 0 V	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 13 A, di/dt = 100 A/µs	-	133		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 60 V (see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	651		µC
I_{RRM}	Reverse recovery current		-	10		A
t_{rr}	Reverse recovery time	I_{SD} = 13 A, di/dt = 100 A/µs	-	157		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 60 V, T_j = 150 °C (see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	895		nC
I_{RRM}	Reverse recovery current		-	11		A

1. *Pulse width is limited by safe operating area.*
2. *Pulsed: pulse duration = 300 µs, duty cycle 1.5%.*

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

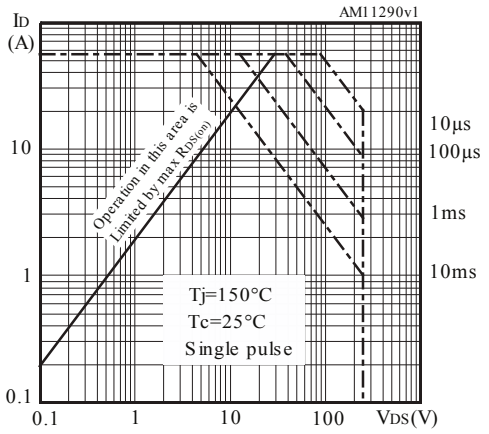


Figure 2. Thermal impedance

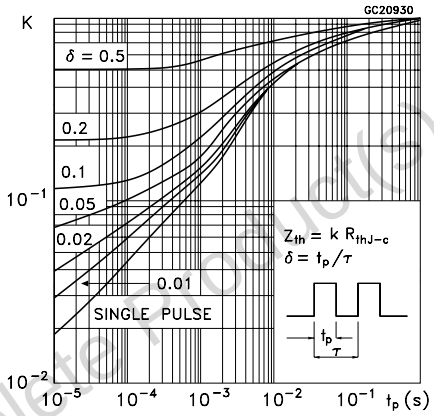


Figure 3. Output characterisics

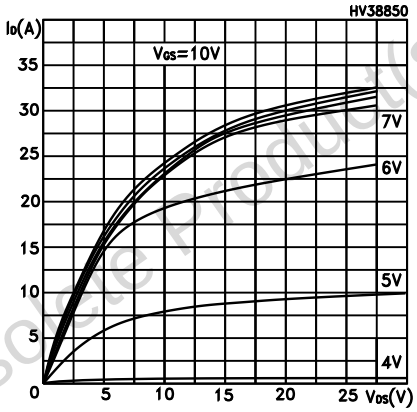


Figure 4. Transfer characteristics

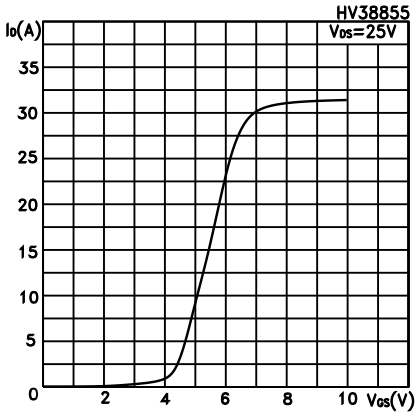


Figure 5. Normalized $V_{(BR)DSS}$ vs temperature

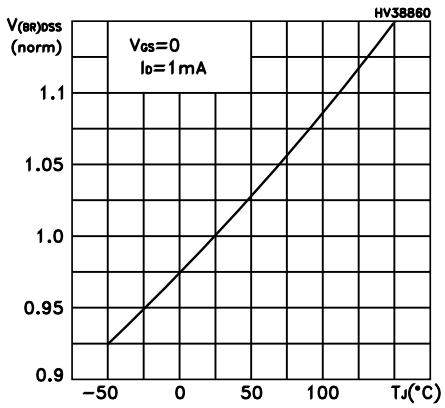


Figure 6. Static drain-source on resistance

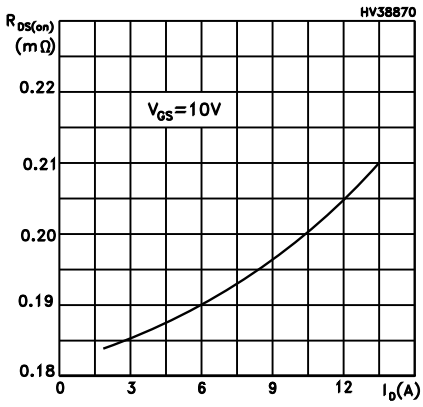


Figure 7. Gate charge vs gate-source voltage

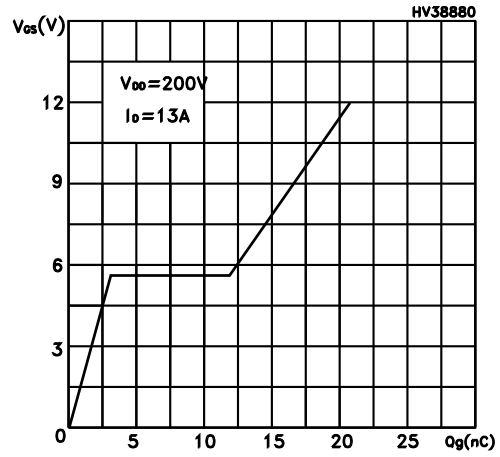


Figure 8. Capacitance variations

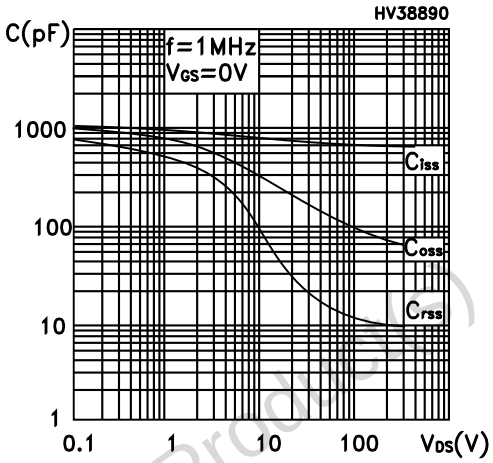


Figure 9. Normalized gate threshold voltage vs temperature

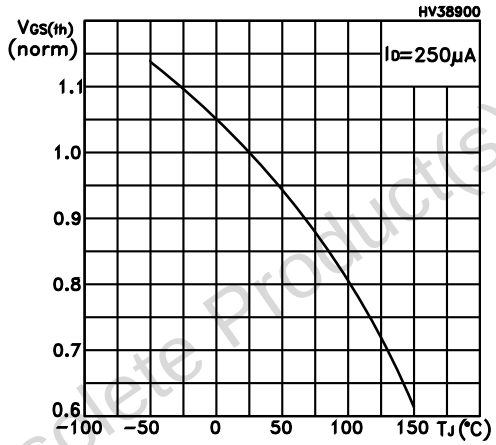


Figure 10. Normalized on resistance vs temperature

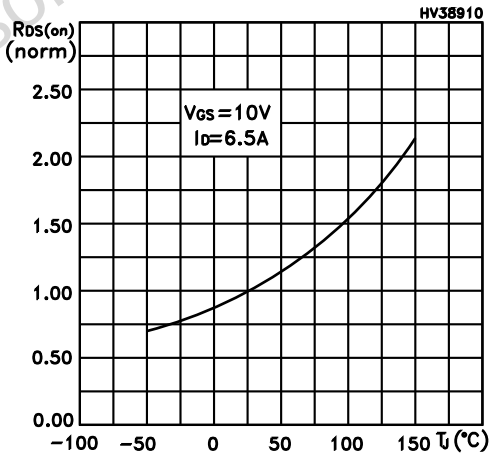


Figure 11. Source-drain diode forward characteristics

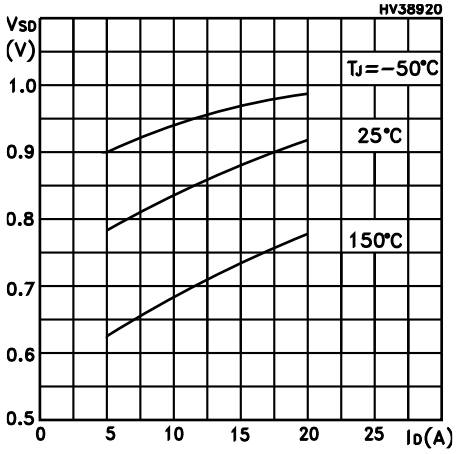
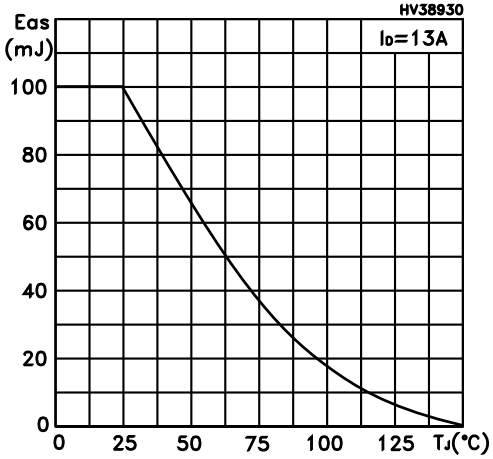


Figure 12. Maximum avalanche energy vs temperature



3 Test circuits

Figure 13. Test circuit for resistive load switching times

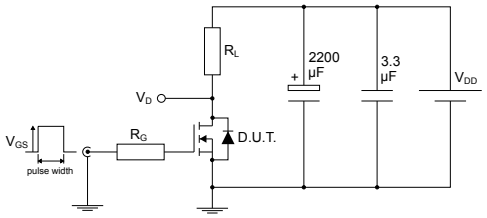


Figure 14. Test circuit for gate charge behavior

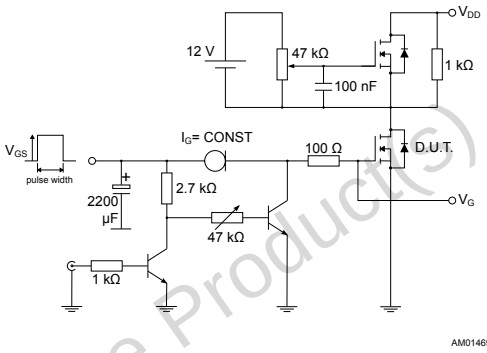


Figure 15. Test circuit for inductive load switching and diode recovery times

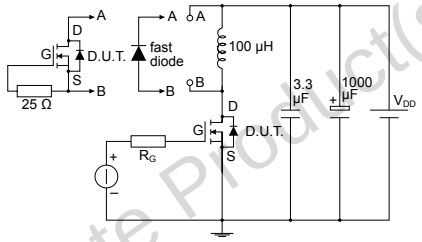


Figure 16. Unclamped inductive load test circuit

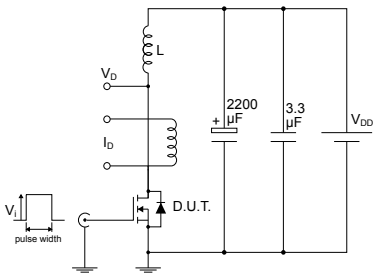


Figure 17. Unclamped inductive waveform

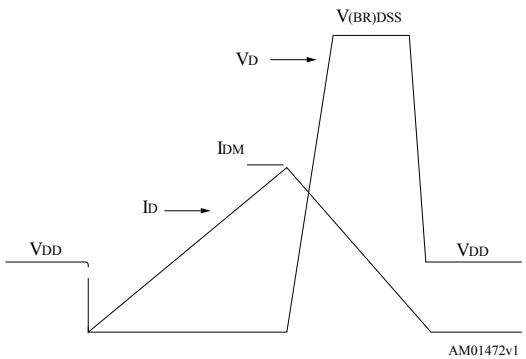
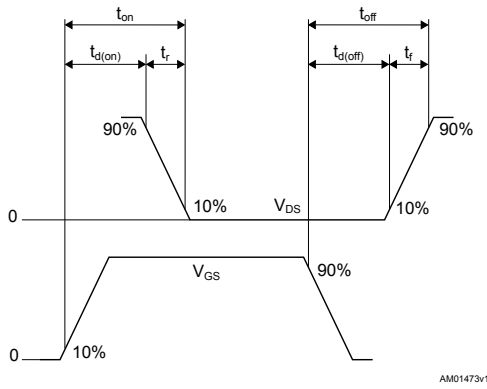


Figure 18. Switching time waveform



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 TO-220 type A package information

Figure 19. TO-220 type A package outline

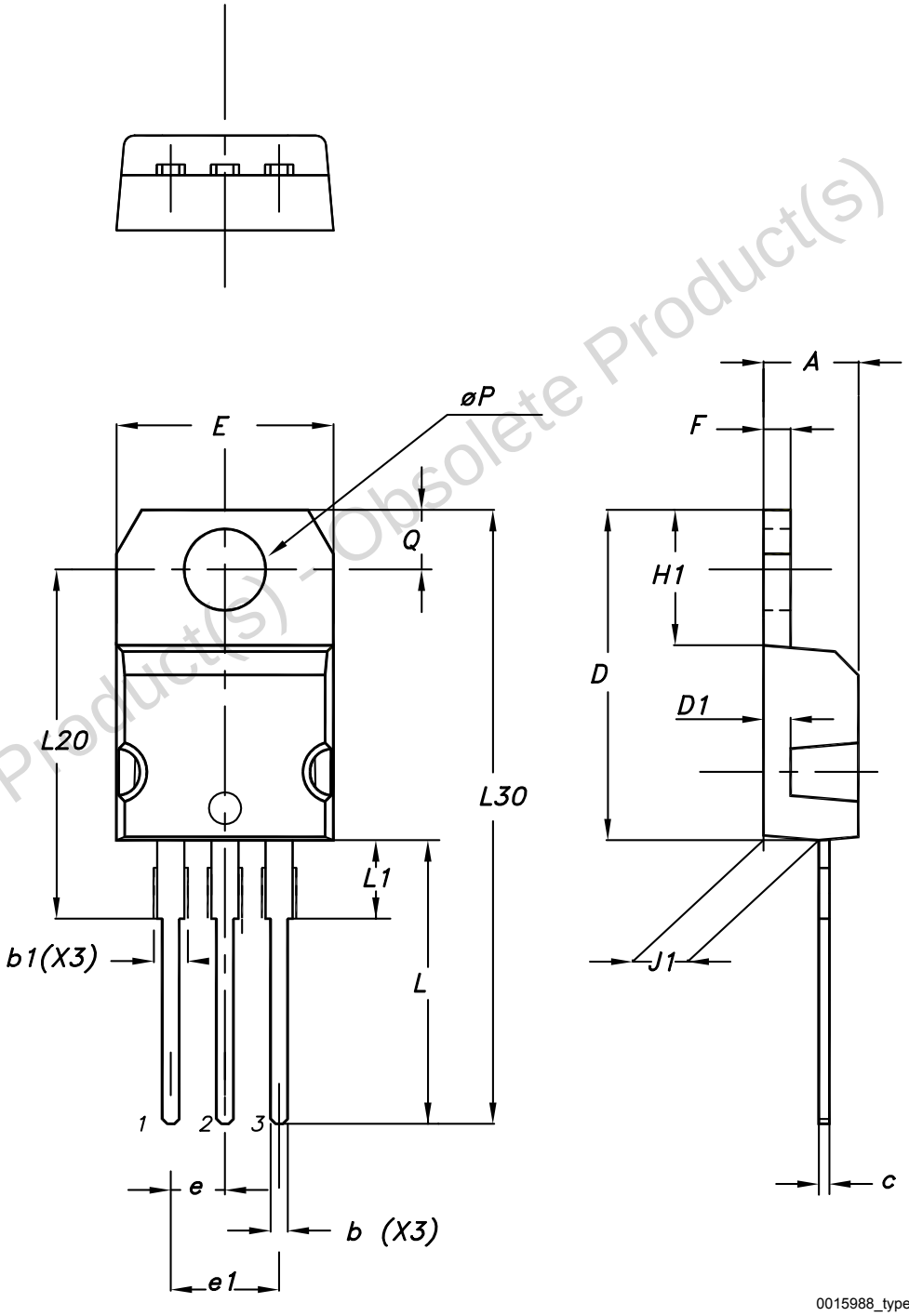


Table 8. **TO-220 type A package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.55
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10.00		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	13.00		14.00
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95

Revision history

Table 9. **Document revision history**

Date	Version	Changes
21-Feb-2019	1	First release. Part number previously included in datasheet DocID14007.

Contents