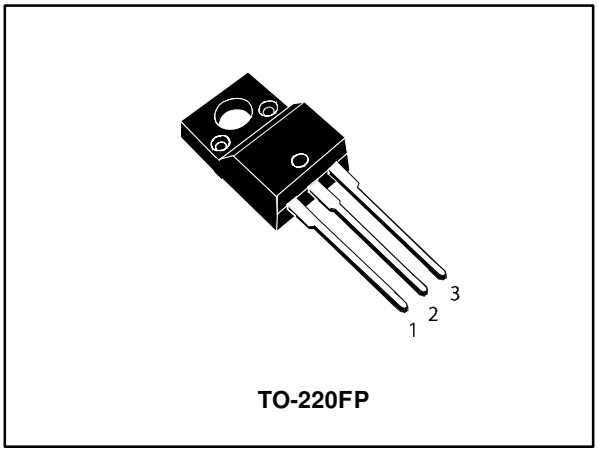
STF140N6F7

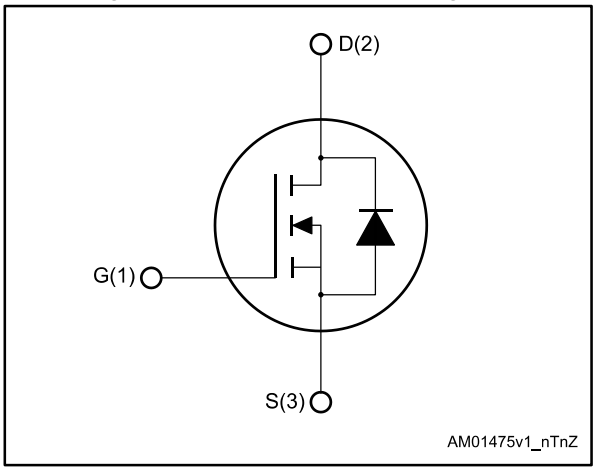
N-channel 60 V, 0.0031 Ω typ., 70 A STripFET™ F7 Power MOSFET in a TO-220FP package

Datasheet - production data



TO-220FP

Figure 1: Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D	P_{TOT}
STF140N6F7	60 V	0.0035 Ω	70 A	33 W

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

Applications

- Switching applications

Description

This N-channel Power MOSFET utilizes 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
STF140N6F7	140N6F7	TO-220FP	Tube

Contents

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	60	V
V_{GS}	Gate-source voltage	±20	V
I_D (1)	Drain current (continuous) at T_{case} = 25 °C	70	A
	Drain current (continuous) at T_{case} = 100 °C	50	
I_{DM} (2)	Drain current (pulsed)	280	A
P_{TOT}	Total dissipation at T_{case} = 25 °C	33	W
E_{AS} (3)	Single pulse avalanche energy	250	mJ
dV/dt (4)	Drain-body diode dynamic dV/dt ruggedness	7.1	V/ns
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T_c = 25 °C)	2500	V
T_{stg}	Storage temperature	-55 to 175	°C
T_j	Maximum junction temperature	175	

Notes:

(1) Current is limited by package.

(2) Pulse width is limited by safe operating area.

(3) Starting T_j = 25°C, I_D = 20 A, V_{DD} = 30 V.

(4) I_{SD}= 70 A; di/dt = 600 A/µs; V_{DD} = 48 V; $T_j < T_{jmax}$

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	4.5	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	62.5	

2 Electrical characteristics

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

Table 4: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V, I_D = 1 mA	60			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 60 V			1	µA
		V_{GS} = 0 V, V_{DS} = 60 V, T_j = 125 °C			100	
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		4	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 35 A		0.0031	0.0035	Ω

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	-	3100	-	pF
C_{oss}	Output capacitance		-	1520	-	
C_{rss}	Reverse transfer capacitance		-	193	-	
Q_g	Total gate charge	V_{DD} = 30 V, I_D = 70 A, V_{GS} = 10 V (see *Figure 14: "Test circuit for gate charge behavior"*)	-	55	-	nC
Q_{gs}	Gate-source charge		-	19	-	
Q_{gd}	Gate-drain charge		-	18	-	

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 30 V, I_D = 35 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"*)	-	24	-	ns
t_r	Rise time		-	68	-	
$t_{d(off)}$	Turn-off delay time		-	39	-	
t_f	Fall time		-	20	-	

Table 7: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD} (1)	Forward on voltage	V_{GS} = 0 V, I_{SD} = 70 A	-		1.2	V
t_{rr}	Reverse recovery time	I_{SD} = 70 A, di/dt = 100 A/µs, V_{DD} = 48 V (see *Figure 15: "Test circuit for inductive load switching and diode recovery times"*)	-	42.4		ns
Q_{rr}	Reverse recovery charge		-	38.2		nC
I_{RRM}	Reverse recovery current		-	1.8		A

Notes:

(1) Pulse test: pulse duration = 300 µs, duty cycle 1.5%.

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

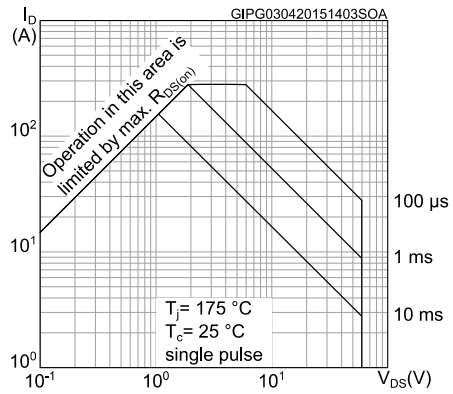


Figure 3: Thermal impedance

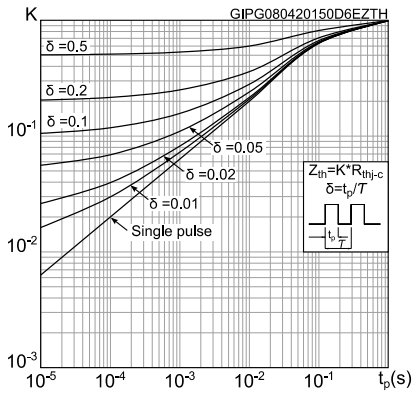


Figure 4: Output characteristics

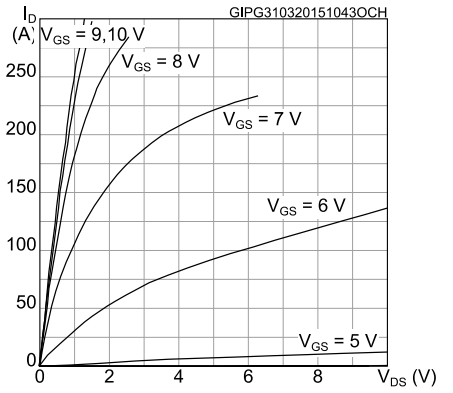


Figure 5: Transfer characteristics

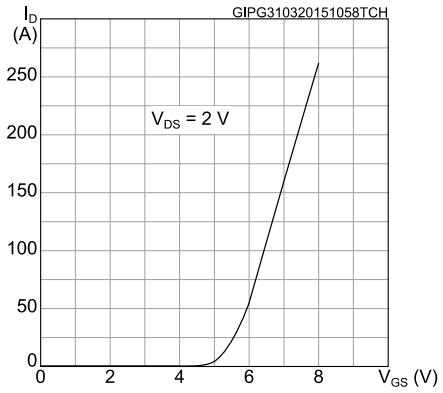


Figure 6: Gate charge vs gate-source voltage

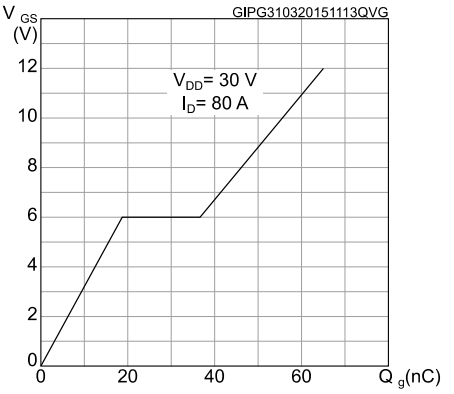


Figure 7: Static drain-source on-resistance

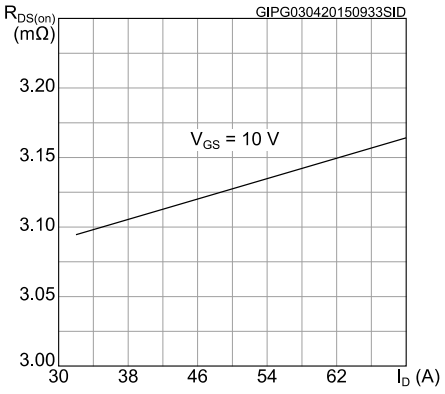


Figure 8: Capacitance variations

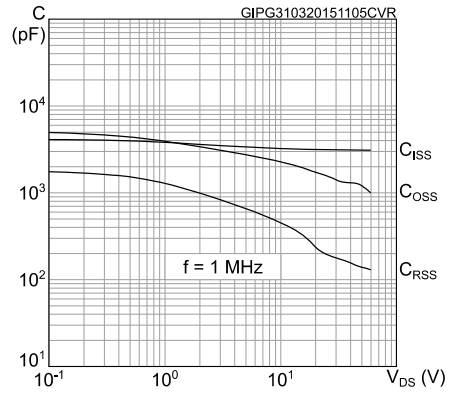


Figure 9: Normalized gate threshold voltage vs temperature

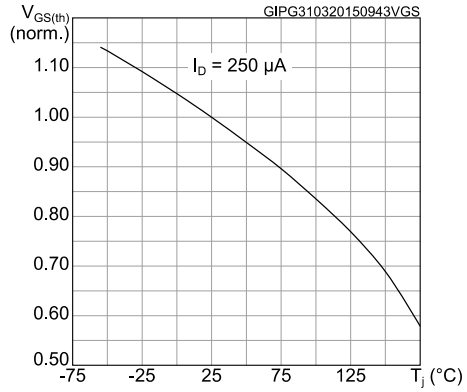


Figure 10: Normalized on-resistance vs temperature

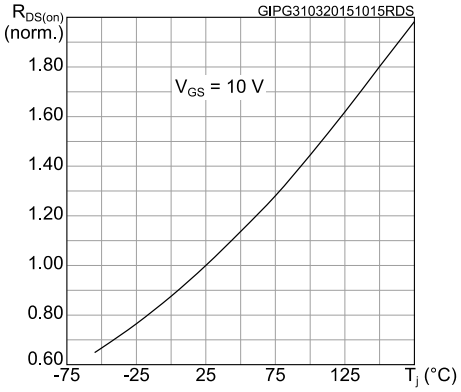


Figure 11: Normalized V(BR)DSS vs temperature

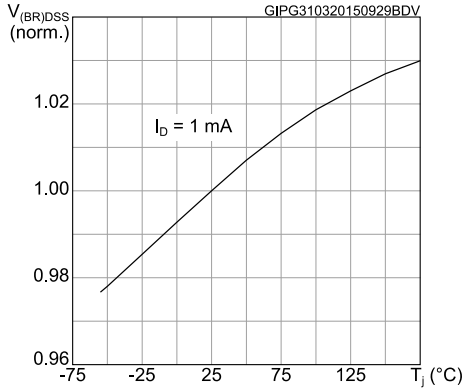
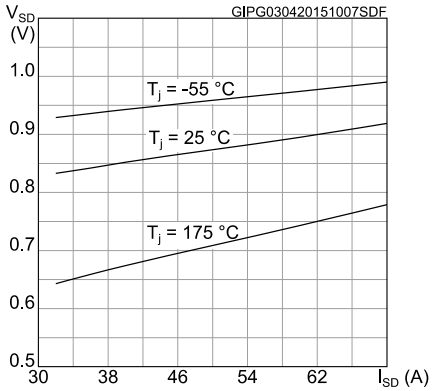


Figure 12: Source-drain diode forward characteristics



3 Test circuits

Figure 13: Test circuit for resistive load switching times

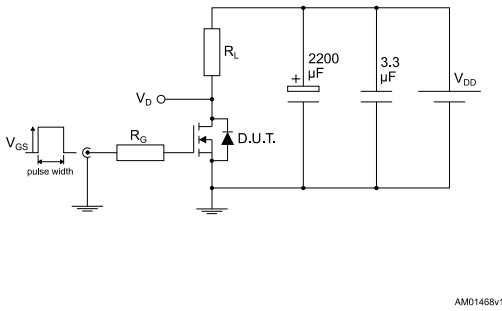


Figure 14: Test circuit for gate charge behavior

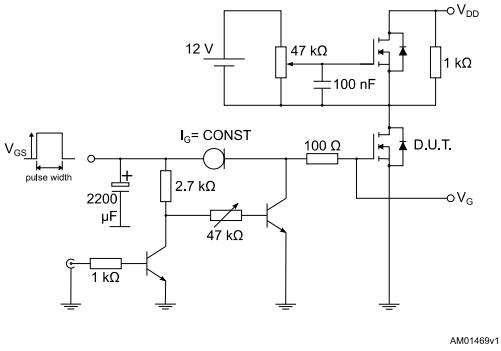


Figure 15: Test circuit for inductive load switching and diode recovery times

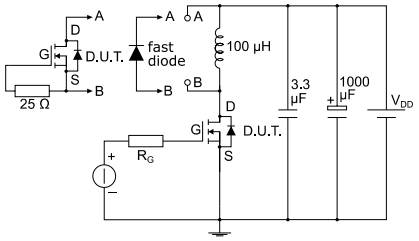


Figure 16: Unclamped inductive load test circuit

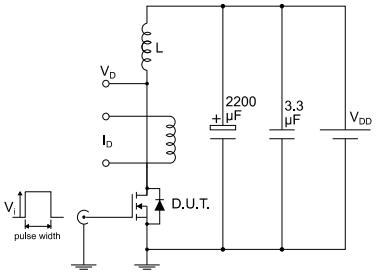


Figure 17: Unclamped inductive waveform

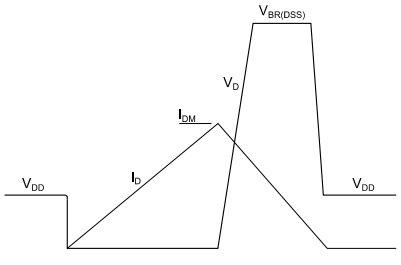
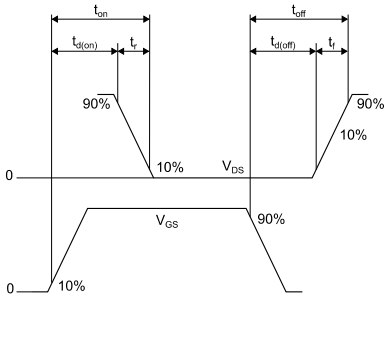


Figure 18: Switching time waveform



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-220FP package information

Figure 19: TO-220FP package outline

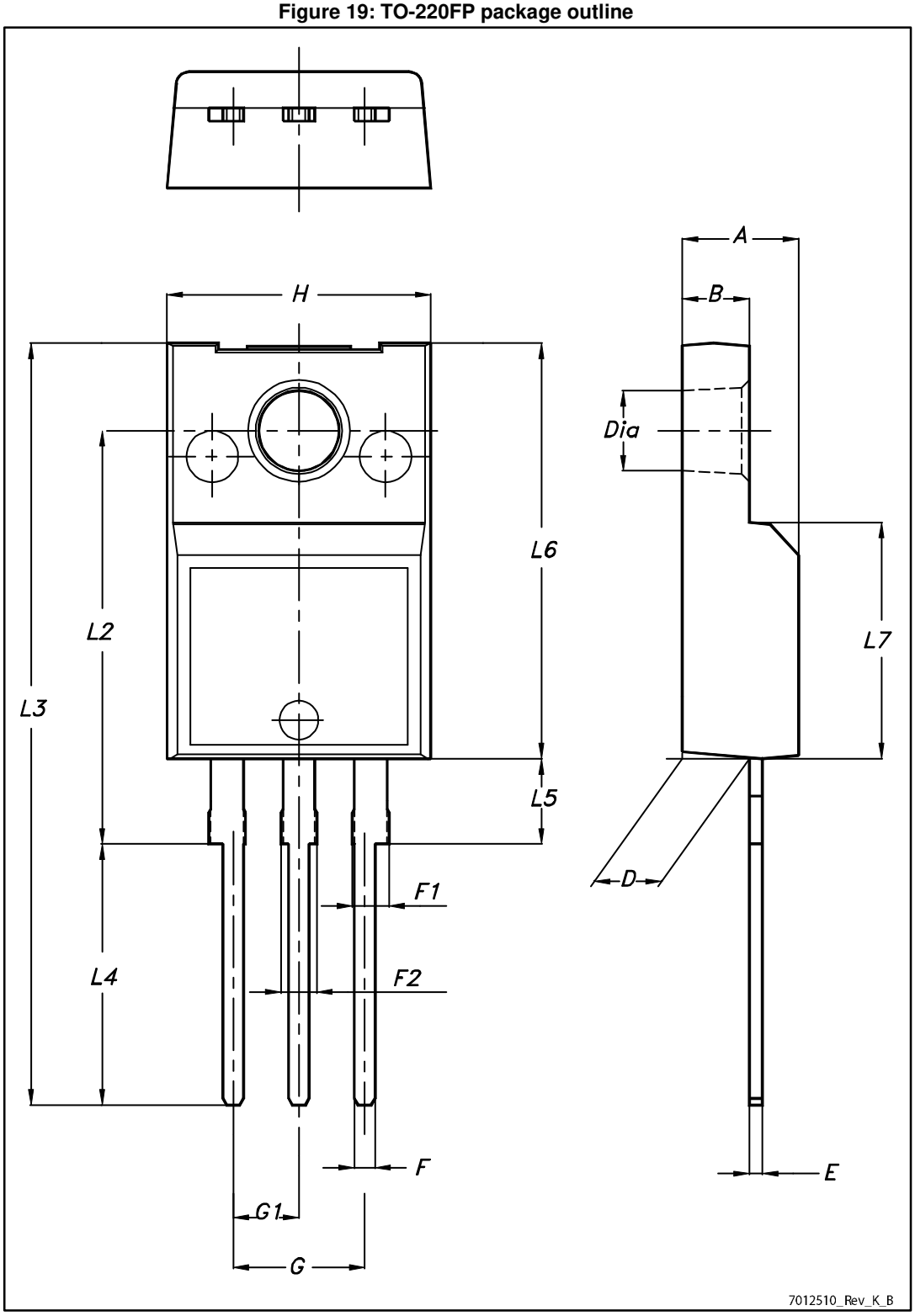


Table 8: TO-220FP package mechanical data

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

5 Revision history

Table 9: Document revision history

Date	Revision	Changes
09-Apr-2015	1	First release.
17-Apr-2015	2	Throughout document: - minor text edits - updated drain-source on-resistance values
14-Jan-2016	3	Updated *Table 2: "Absolute maximum ratings"*.

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