

# **IRF520**

# N-CHANNEL 100V - 0.115 Ω - 10A TO-220 LOW GATE CHARGE STripFET™ II POWER MOSFET

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
IRF520	100 V	<0.27 Ω	10 A

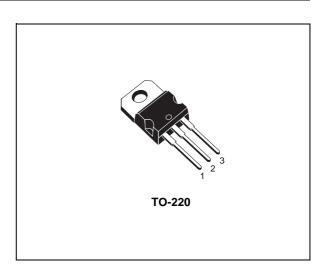
- TYPICAL  $R_{DS}(on) = 0.115\Omega$
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175 °C OPERATING TEMPERATURE

#### **DESCRIPTION**

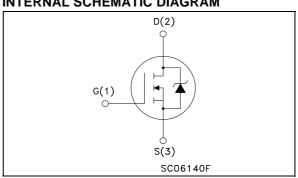
This MOSFET series realized with STMicroelectronics unique STripFET™ process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency, high-frequency isolated converters for Telecom and Computer applications. It is also intended for any applications with low gate drive requirements.

#### **APPLICATIONS**

- HIGH CURRENT, HIGH SWITCHING SPEED
- SOLENOID AND RELAY DRIVERS
- REGULATOR
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, etc.)



#### **INTERNAL SCHEMATIC DIAGRAM**



#### **ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source Voltage (V <sub>GS</sub> = 0)	100	V
$V_{DGR}$	Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)	100	V
$V_{GS}$	Gate- source Voltage	± 20	V
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 25°C	10	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 100°C	7	A
I <sub>DM</sub> (•)	Drain Current (pulsed)	40	A
P <sub>tot</sub>	Total Dissipation at T <sub>C</sub> = 25°C	60	W
	Derating Factor	0.4	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	20	V/ns
E <sub>AS</sub> (2)	Single Pulse Avalanche Energy	100	mJ
T <sub>stg</sub>	Storage Temperature	-55 to 175	°C
Tj	Operating Junction Temperature	-55 to 175	

<sup>(•)</sup> Pulse width limited by safe operating area.

<sup>(1)</sup>  $I_{SD} \le 10A$ ,  $di/dt \le 300A/\mu s$ ,  $V_{DD} \le V_{(BR)DSS}$ ,  $T_j \le T_{JMAX}$ 

<sup>(2)</sup> Starting  $T_i = 25$  °C,  $I_D = 10A$ ,  $V_{DD} = 50V$ 

## THERMAL DATA

	,	Thermal Resistance Junction-case Thermal Resistance Junction-ambient Maximum Lead Temperature For Soldering Purpose	Max Max	2.5 62.5 300	°C/W %C/W	
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## **ELECTRICAL CHARACTERISTICS** (T<sub>case</sub> = 25 °C unless otherwise specified)

## OFF

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source Breakdown Voltage	$I_D = 250 \ \mu A, \ V_{GS} = 0$	60			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0)	$V_{DS} = Max Rating$ $V_{DS} = Max Rating T_C = 100^{\circ}C$			1 10	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 20 V			±100	nA

## ON (\*)

Symbol	Parameter	Test Co	onditions	Min.	Тур.	Max.	Unit
V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{DS} = V_{GS}$	$I_D = 250 \ \mu A$	2	3	4	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 7 A		0.115	0.27	Ω

## DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
9fs <sup>(*)</sup>	Forward Transconductance	V <sub>DS</sub> = 15 V I <sub>D</sub> = 7 A		20		S
C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub>	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25V$ , $f = 1$ MHz, $V_{GS} = 0$		460 70 30		pF pF pF

## **ELECTRICAL CHARACTERISTICS** (continued)

#### **SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
t <sub>d(on)</sub> t <sub>r</sub>	Turn-on Delay Time Rise Time	$\begin{array}{ccc} V_{DD} = 50 \text{ V} & I_D = 7 \text{ A} \\ R_G = 4.7 \ \Omega & V_{GS} = 10 \text{ V} \\ \text{(Resistive Load, Figure 3)} \end{array}$		16 25		ns ns
Q <sub>g</sub> Q <sub>gs</sub> Q <sub>gd</sub>	Total Gate Charge Gate-Source Charge Gate-Drain Charge	V <sub>DD</sub> = 80V I <sub>D</sub> = 10A V <sub>GS</sub> = 10V		16 4 5	22	nC nC nC

#### **SWITCHING OFF**

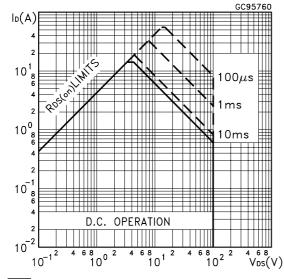
Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
t <sub>d(off)</sub>	Turn-off Delay Time Fall Time	$V_{DD} = 50 \text{ V}$ $I_D = 7 \text{ A}$ $R_G = 4.7\Omega,  V_{GS} = 10 \text{ V}$ (Resistive Load, Figure 3)		32 8		ns ns

#### SOURCE DRAIN DIODE

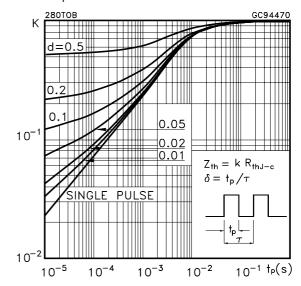
Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
I <sub>SD</sub>	Source-drain Current Source-drain Current (pulsed)				10 40	A A
V <sub>SD</sub> (*)	Forward On Voltage	I <sub>SD</sub> = 10 A V <sub>GS</sub> = 0			1.5	V
t <sub>rr</sub> Q <sub>rr</sub> I <sub>RRM</sub>	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$\begin{split} I_{SD} &= 10 \text{ A} & \text{di/dt} = 100 \text{A/}\mu\text{s} \\ V_{DD} &= 40 \text{V} & T_j = 150 ^{\circ}\text{C} \\ \text{(see test circuit, Figure 5)} \end{split}$		95 230 5		ns nC A

<sup>(\*)</sup>Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %. (•)Pulse width limited by safe operating area.

#### Safe Operating Area

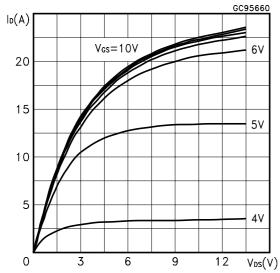


#### Thermal Impedance

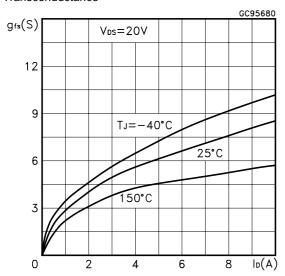


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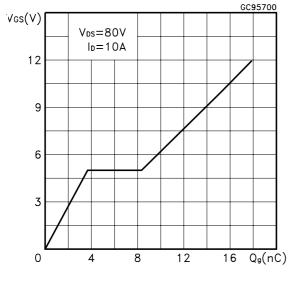
## **Output Characteristics**



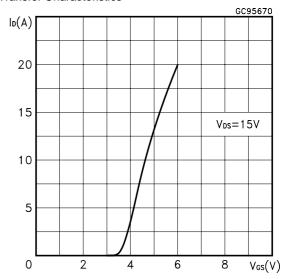
#### Transconductance



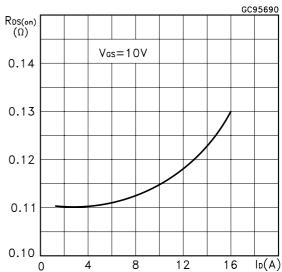
Gate Charge vs Gate-source Voltage



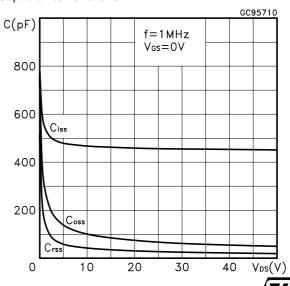
#### Transfer Characteristics



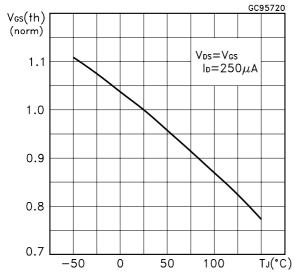
Static Drain-source On Resistance



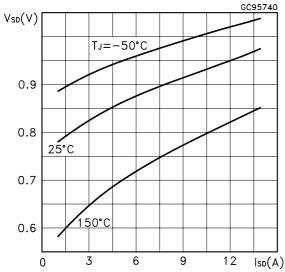
## Capacitance Variations



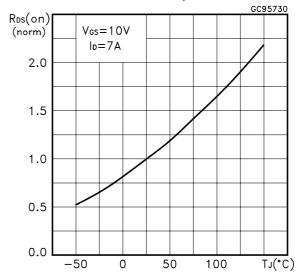
## Normalized Gate Threshold Voltage vs Temperature



#### Source-drain Diode Forward Characteristics



#### Normalized on Resistance vs Temperature



#### Normalized Breakdown Voltage vs Temperature

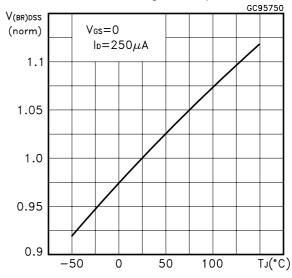


Fig. 1: Unclamped Inductive Load Test Circuit

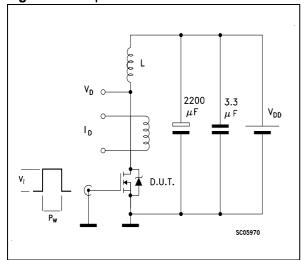
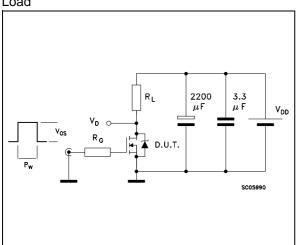


Fig. 3: Switching Times Test Circuits For Resistive Load



**Fig. 5:** Test Circuit For Inductive Load Switching And Diode Recovery Times

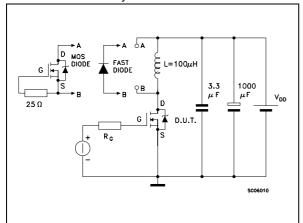


Fig. 2: Unclamped Inductive Waveform

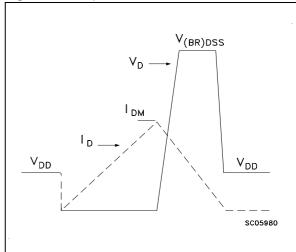
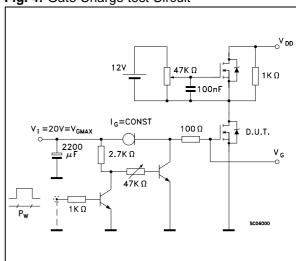
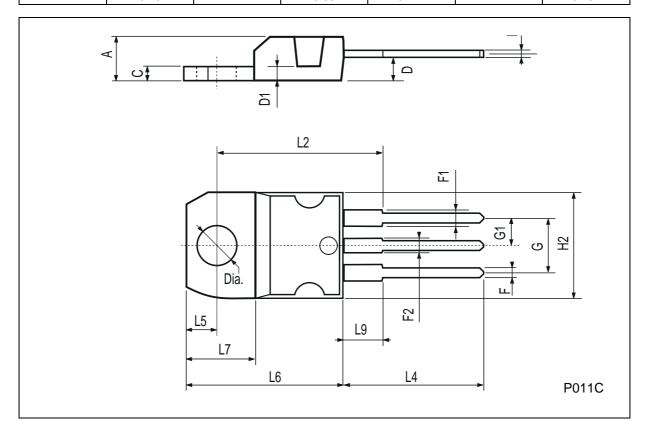


Fig. 4: Gate Charge test Circuit



## **TO-220 MECHANICAL DATA**

DIM.		mm			inch	
Dim.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
А	4.40		4.60	0.173		0.181
С	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
Е	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151



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