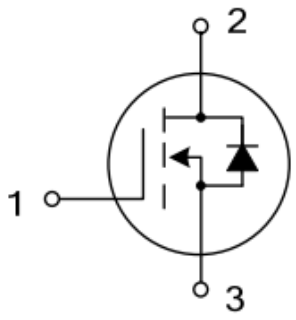
N-Channel Enhancement Mode Power MOSFET

Description

SMIRF13N50 is an N-channel enhancement mode power MOS field effect transistor. The improved planar stripe cell and the improved guard ring terminal have been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode.

These devices are widely used in AC-DC power suppliers, DCDC converters and H-bridge PWM motor drivers.

I_D	13A
V_{DSS}	500V
$R_{dson\ (max)}$	0.48Ω(V_{GS}=10V, I_D=6.5A)
Q_g	40nC



1.Gate 2.Drain 3.Source

General Features

- 13A,500V,$R_{DS(on)(typ.)}$= 0.4ohm@V_{GS}=10V
- Low Gate charge
- Low Crss
- Fast Switching
- Improved dv/dt Capability

Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply

TO-220

TO-220F

Order Information

Order Information	Marking ID	Package	Packing Type Supplied As
SMIRF13N50T2TL	IRF13N50	TO220F-3L	1000 units on Box、5000 units on Carton
SMIRF13N50T1TL	IRF13N50	TO220-3L	1000 units on Box、5000 units on Carton

Absolute Maximum Ratings Ta=25 ºC unless otherwise noted

Parameter		Symbol	Value	Unit
Drain-source Voltage		V_{DS}	500	V
Gate-source Voltage		V_{GS}	±30	V
Continuous Drain Current(Ta=25℃)		I_D	13	A
Drain Current-Pulsed		I_{DM}	52	A
Total Dissipation(Ta=25℃)	TO220	P_D	212	W
	TO220F		60	
Junction Temperature		T_J	150	ºC
Storage Temperature		T_{STG}	-55 to 150	ºC
Single Pulse Avalanche Energy		E_{AS}	850	mJ
ESD HBM(Human Body Mode)			≥2000	V
ESD MM(Machine Mode)			≥200	V

Electrical Characteristics Ta = 25ºC

PARAMETER	Symbol	Test Condition	MIN	TYP	MAX	UNIT
Drain-source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_D=250μA	500			V
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS}=V_{DS} ,I_D=250μA	2.0	3.0	4.0	V
Drain-source Leakage Current	I_{DSS}	V_{DS}=500V,V_{GS}=0V			1	uA
Gate-body Leakage Current (V_{DS} = 0)	I_{GSS}	V_{GS}=±30V			±100	nA
Static Drain-source On Resistance	$R_{DS(ON)}$	V_{GS}=10V,I_D=6.5A		0.4	0.48	Ω

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant in temperature etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum rating

Thermal Characteristics Ta=25℃

PARAMETER		Symbol	TYP	MAX	UNIT
Maximum Junction-to-case	TO220F,TO220	$R_{\theta JC}$		2.4	ºC/W
Maximum Junction-to-Ambient	TO220F,TO220	$R_{\theta JA}$		62.5	

Note1: Ensure that the channel temperature does not exceed 150ºC

Note2: V_{DD}=50V,Tch=25 ºC(initial),I_{AS}=13A, Rg=25Ω

Note3: This transistor is sensitive to electrostatic and should be handled with care

Dynamic Characteristics Ta = 25 ºC

PARAMETER	Symbol	Test Condition	MIN	TYP	MAX	UNIT
Input Capacitance	C_{iss}	V_{DS}=25V,V_{GS}=0V,f=1.0MHZ		1800		pF
output Capacitance	C_{oss}			190		pF
Reverse Transfer Capacitance	C_{rss}			18		pF

Switching Characteristics Ta=25 ºC

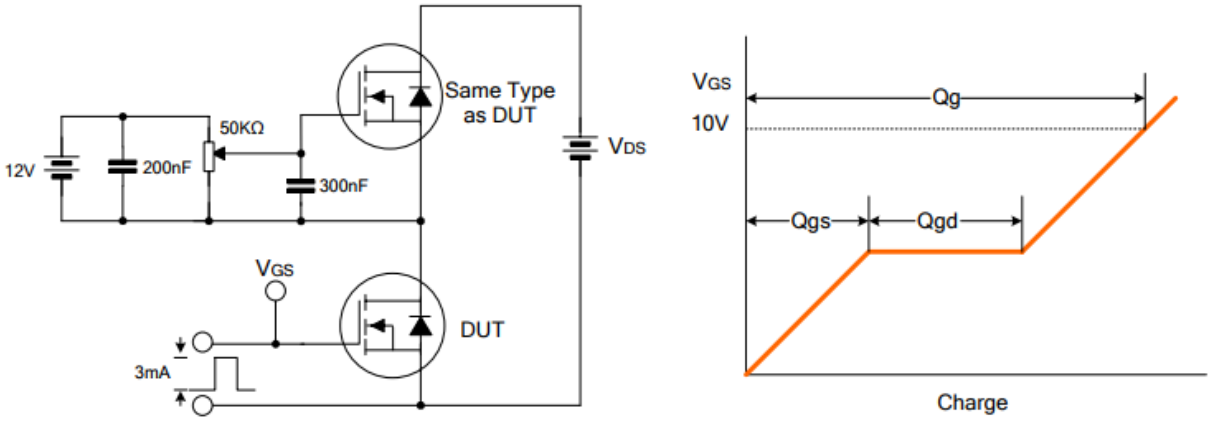
PARAMETER	Symbol	Test Condition	MIN	TYP	MAX	UNIT
Turn-On Delay Time	$T_{d(on)}$	V_{DS}=250V,I_D=13A, V_{GS}=10V ,R_G=25Ω		20	45	nS
Turn-On Rise Time	T_r			50	90	nS
Turn-Off Delay Time	$T_{d(off)}$			100	200	nS
Turn-Off Rise Time	T_f			55	110	nS
Total Gate Charge	Q_g	V_{DS}=400V，I_D=13A,V_{GS}=10V		30	40	nC
Gate-Source Charge	Q_{gs}			8		nC
Gate-Drain Charge	Q_{gd}			9		nC

Drain-Source Diode Maximum Ratings and Characteristics Ta=25 ºC

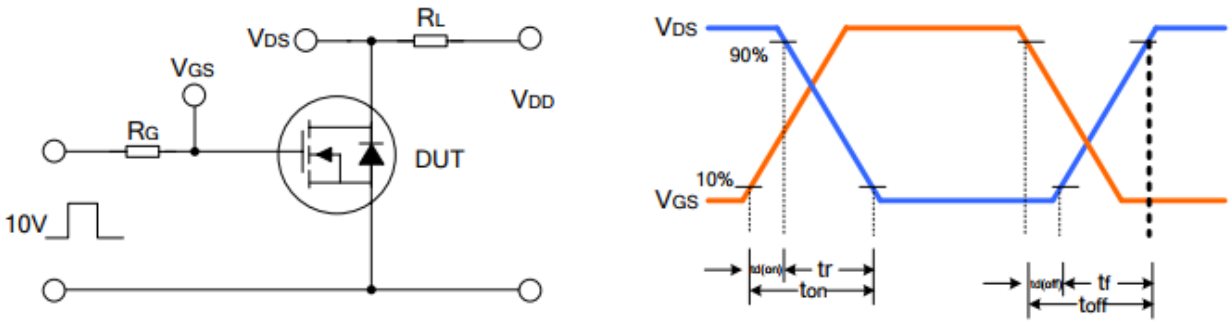
PARAMETER	Symbol	Test Condition	MIN	TYP	MAX	UNIT
Max. Diode Forward Current	I_S	Integral Reverse P-N Junction Diode in the MOSFET			13	A
Pulsed Source Current	I_{SM}				50	A
Diode Forward Voltage	V_{SD}	V_{GS}=0V,I_S=13A			1.5	V
Reverse Recovery Time	t_{rr}	V_{GS}=0V,I_S=13A, dIF/dt=100A/μs		380		nS
Reverse Recovery Charge	Q_{rr}			3.0		μC

Test Circuit

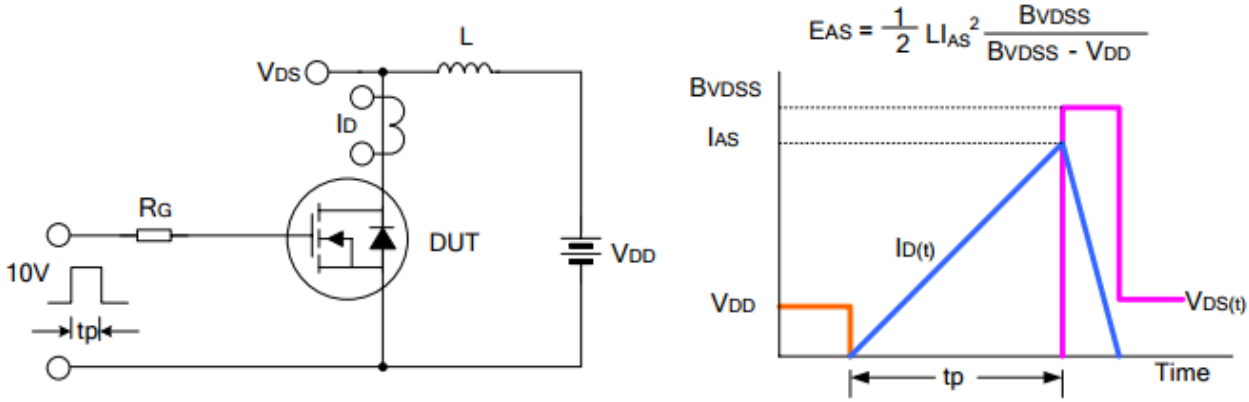
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform



Unclamped Inductive Switching Test Circuit & Waveform



Typical Characteristics Curves

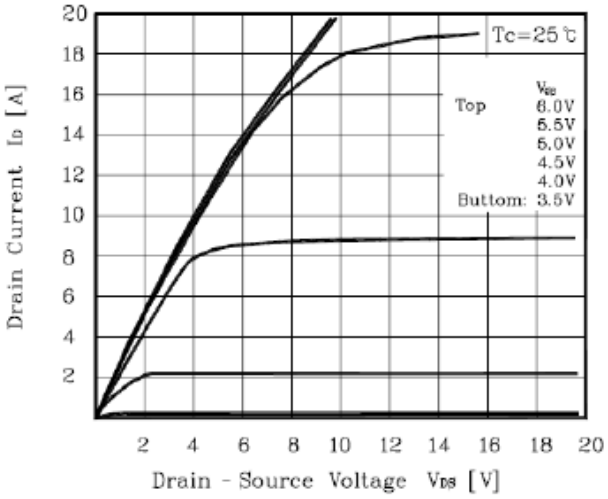


Figure 1: Output Characteristics

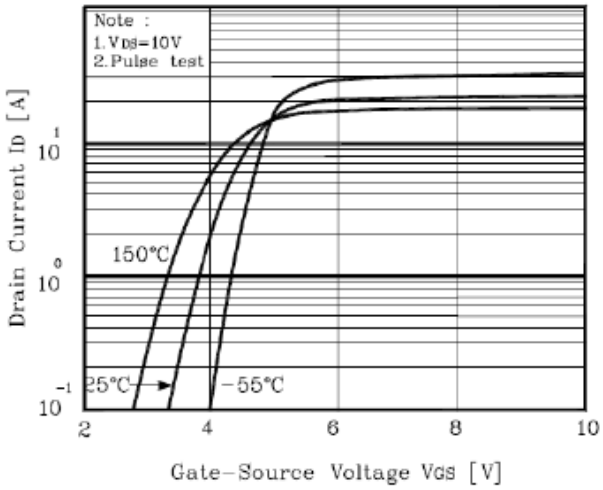


Figure 2: Transfer Characteristics

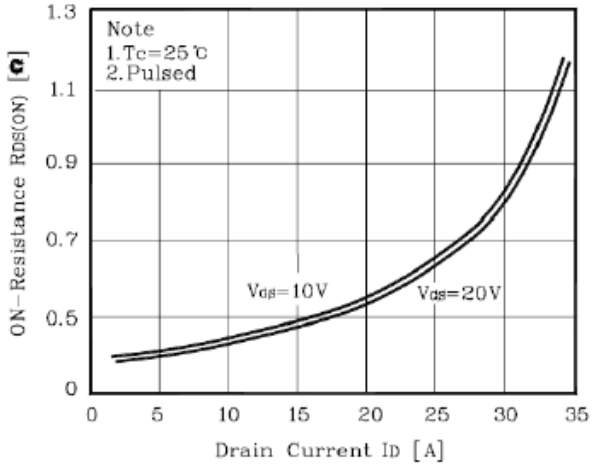


Figure 3: On Resistance Vs Drain Current

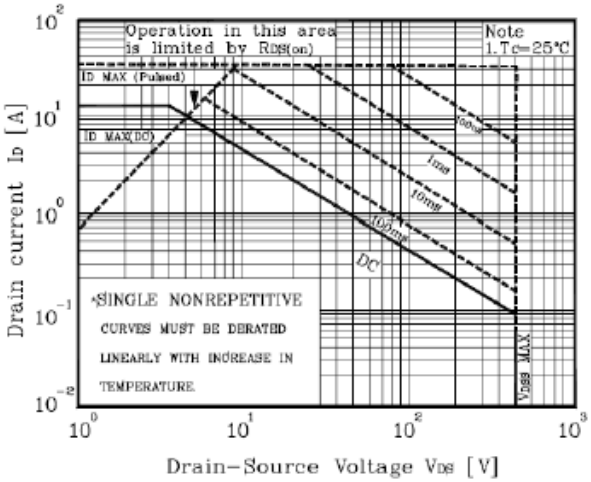
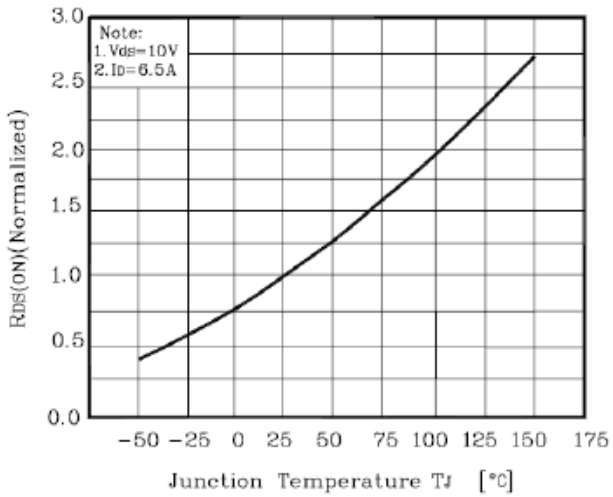
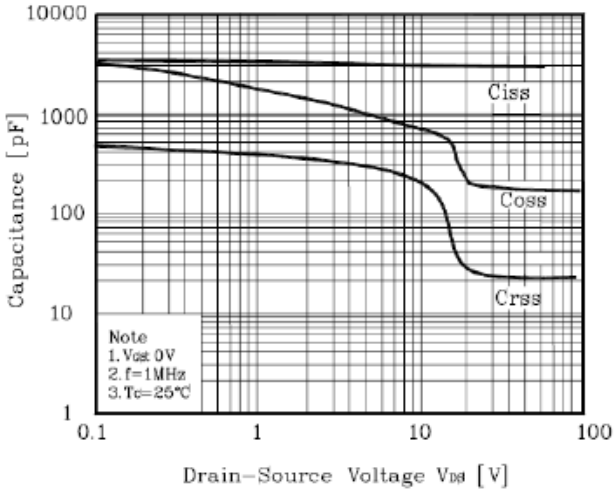


Figure 4: On Resistance Vs Gate Source Voltage





Typical Characteristics Curves

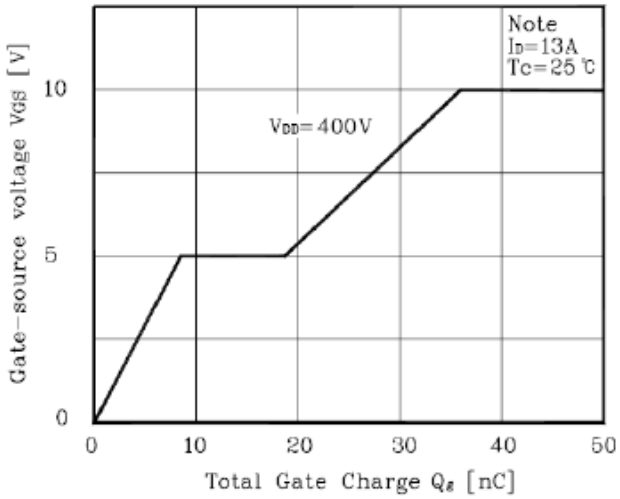


Figure7: Gate Charge Waveform

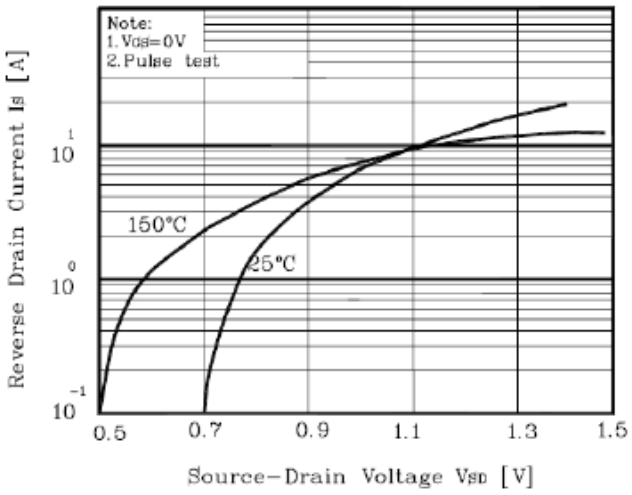


Figure8: Source-Drain Diode Forward Voltage

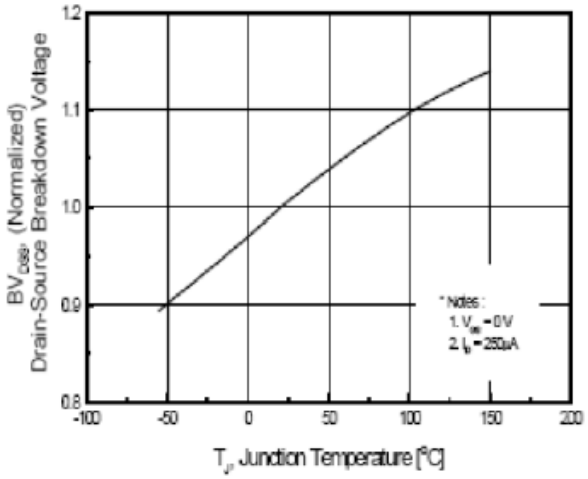
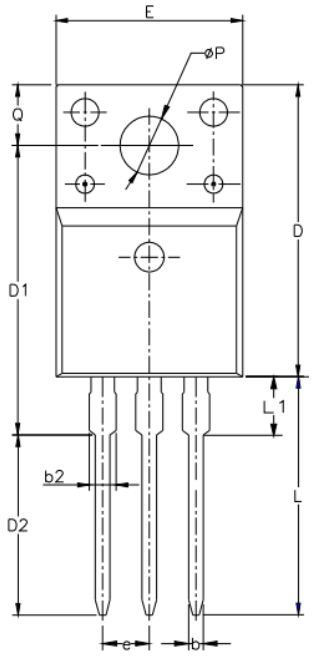
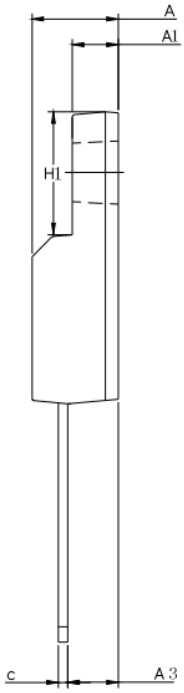


Figure9: Breakdown Voltage Vs Junction Temperature

Note: The above characteristics curves are presented for reference only and not guaranteed by production test unless otherwise noted

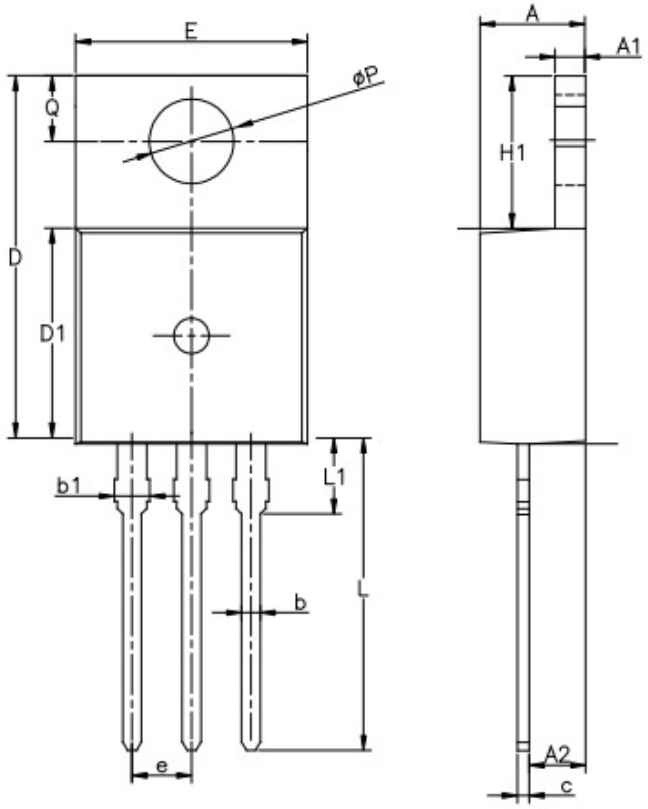
Outline Information (TO220F-3L) Unit:mm





SYMBOL	MIN	NOM	MAX
A	4.42	4.70	5.02
A1	2.30	2.54	2.80
A3	2.50	2.76	3.10
b	0.70	0.80	0.90
b2	—	—	1.47
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	15.30	15.75	16.30
D2	9.30	9.80	10.30
E	9.73	10.16	10.36
e		2.54BCS	
H1	6.40	6.68	7.00
L	12.48	12.98	13.48
L1	/	/	3.50
øP	3.00	3.18	3.40
Q	3.05	3.30	3.55

Outline Information (TO220-3L) Unit:mm



SYMBOL	MIN	NOM	MAX
A	4.30	4.50	4.70
A1	1.00	1.30	1.50
A2	1.80	2.40	2.80
b	0.60	0.80	1.00
b1	1.00	—	1.60
c	0.30	—	0.70
D	15.10	15.70	16.10
D1	8.10	9.20	10.00
E	9.60	9.90	10.40
e		2.54BSC	
H1	6.10	6.50	7.00
L	12.60	13.08	13.60
L1	—	—	3.95
ΦP	3.40	3.70	3.90
Q	2.60	—	3.20

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