

R5013ANX

Silicon N-channel MOSFET

- 1) Low on-resistance.
- 2) Fast switching speed.
- 3) Wide SOA (safe operating area).
- 4) Gate-source voltage (V_{GS}) guaranteed to be $\pm 30V$.
- 5) Drive circuits can be simple.
- 6) Parallel use is easy.

Switching

Type	Package	Bulk
	Code	—
	Basic ordering unit (pieces)	500
R5013ANX		○

Parameter		Symbol	Limits	Unit
Drain-source voltage		V _{DSS}	500	V
Gate-source voltage		V _{GSS}	±30	V
Drain current	Continuous	I _D *3	±13	A
	Pulsed	I _{DP} *1	±52	A
Source current (Body Diode)	Continuous	I _S *3	13	A
	Pulsed	I _{SP} *1	52	A
Avalanche Current		I _{AS} *2	13	A
Avalanche Energy		E _{AS} *2	46	mJ
Total power dissipation (Tc=25°C)		P _D	50	W
Channel temperature		T _{ch}	150	°C
Range of storage temperature		T _{stg}	−55 to +150	°C

*3 Limited only by maximum temperature allowed

Parameter	Symbol	Limits	Unit
Channel to case	Rth(ch-c)	2.5	°C/W

Technical drawing of the TO-220FM package showing front and side views with dimensions in millimeters.

Front View Dimensions:

- Top width: 10.0
- Top hole diameter: $\phi 3.2$
- Left side height: 15.0
- Left side distance from top: 12.0
- Left side distance from base: 8.0
- Bottom left distance: 2.5
- Bottom center distance: 1.3
- Bottom right distance: 1.2
- Bottom width: 2.54
- Bottom hole diameter: $\phi 0.8$

Side View Dimensions:

- Top width: 4.5
- Top distance: 2.8
- Bottom distance: 0.75
- Bottom width: 2.6

Pin Labels: (1) Base, (2) Collector, (3) Emitter

(1) Gate
(2) Drain
(3) Source

*1 Body Diode

Transistors

●Electrical characteristics (Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Gate-source leakage	I_{GSS}	—	—	±100	nA	$V_{GS}=\pm 30V$, $V_{DS}=0V$
Drain-source breakdown voltage	$V_{(BR)DSS}$	500	—	—	V	$I_D=1mA$, $V_{GS}=0V$
Zero gate voltage drain current	I_{DSS}	—	—	100	μA	$V_{DS}=500V$, $V_{GS}=0V$
Gate threshold voltage	$V_{GS(th)}$	2.5	—	4.5	V	$V_{DS}=10V$, $I_D=1mA$
Static drain-source on-state resistance	$R_{DS(on)}^*$	—	0.29	0.38	Ω	$I_D=6.5A$, $V_{GS}=10V$
Forward transfer admittance	$ Y_{fs} ^*$	4.0	—	—	S	$I_D=6.5A$, $V_{DS}=10V$
Input capacitance	C_{iss}	—	1300	—	pF	$V_{DS}=25V$
Output capacitance	C_{oss}	—	500	—	pF	$V_{GS}=0V$
Reverse transfer capacitance	C_{rss}	—	40	—	pF	$f=1MHz$
Turn-on delay time	$t_{d(on)}^*$	—	30	—	ns	$I_D=6.5A$, $V_{DD} \approx 250V$
Rise time	t_r^*	—	32	—	ns	$V_{GS}=10V$
Turn-off delay time	$t_{d(off)}^*$	—	90	—	ns	$R_L=38.5\Omega$
Fall time	t_f^*	—	30	—	ns	$R_G=10\Omega$
Total gate charge	Q_g^*	—	35	—	nC	$V_{DD} \approx 250V$
Gate-source charge	Q_{gs}^*	—	8	—	nC	$I_D=13A$
Gate-drain charge	Q_{gd}^*	—	15	—	nC	$V_{GS}=10V$ $R_L=19.2\Omega$ / $R_G=10\Omega$

* Pulsed

●Body diode characteristics (Source-drain) (Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward voltage	V_{SD}^*	—	—	1.5	V	$I_S=13A$, $V_{GS}=0V$

* Pulsed

Transistors

●Electrical characteristic curves

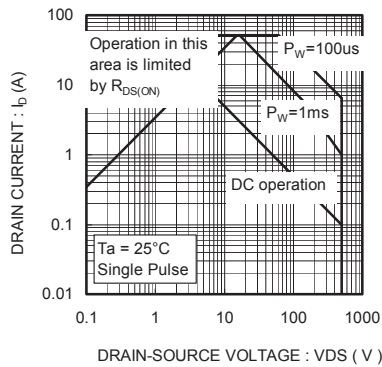


Fig.1 Maximum Safe Operating Area

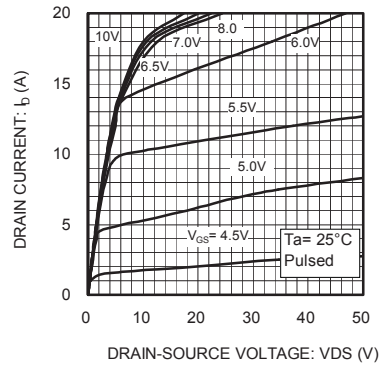


Fig.2: Typical Output Characteristics(I)

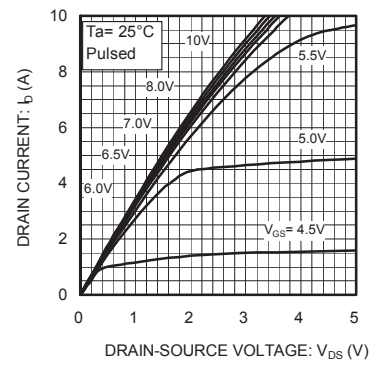


Fig.3: Typical Output Characteristics(II)

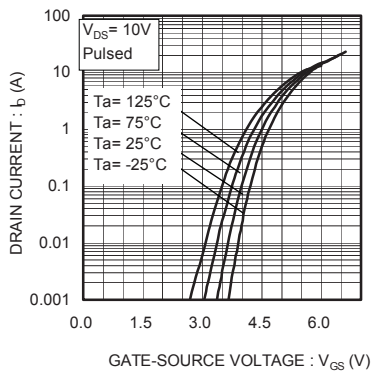


Fig.4 Typical Transfer Characteristics

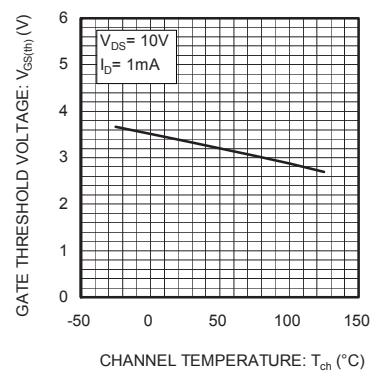


Fig.5 Gate Threshold Voltage vs. Channel

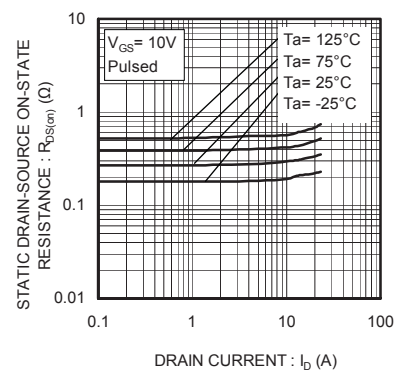


Fig.6 Static Drain-Source On-State Resistance vs. Drain Current

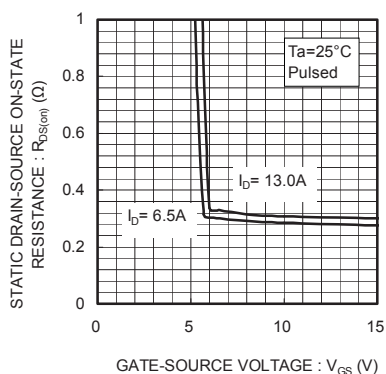


Fig.7 Static Drain-Source On-State Resistance vs. Gate Source

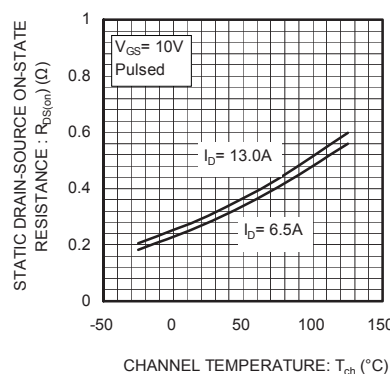


Fig.8 Static Drain-Source On-State Resistance vs. Channel

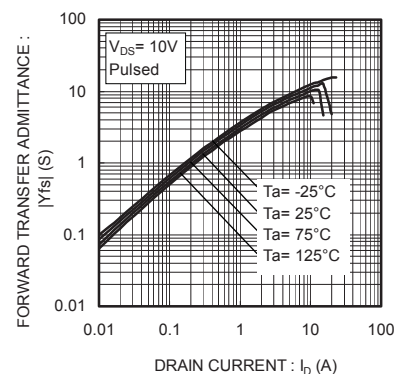


Fig.9 Forward Transfer Admittance vs. Drain Current

Transistors

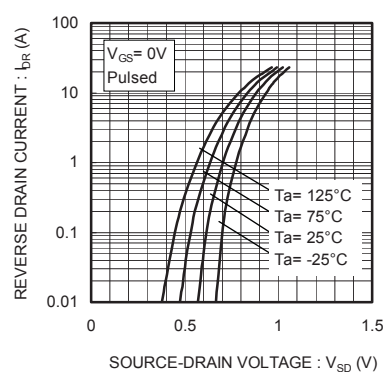


Fig.10 Reverse Drain Current vs. Source-Drain Voltage

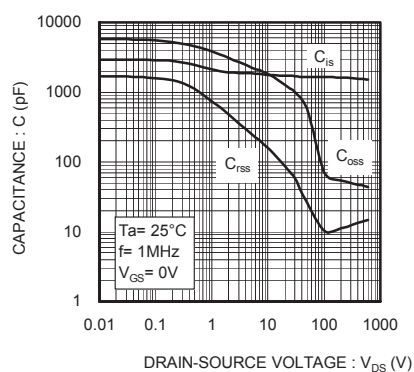


Fig.11 Typical Capacitance vs. Drain-Source Voltage

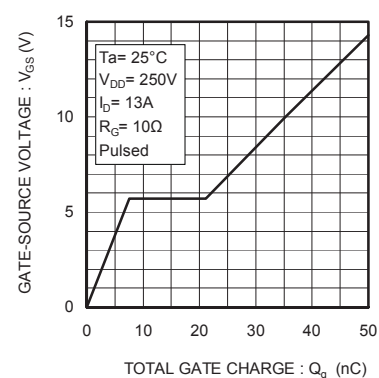


Fig.12 Dynamic Input Characteristics

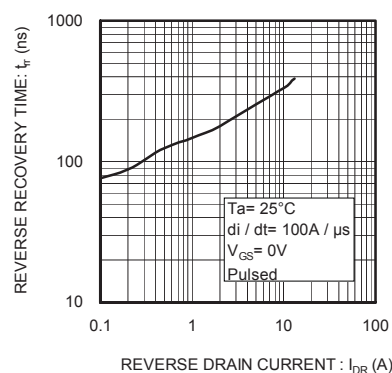


Fig.13 Reverse Recovery Time vs. Reverse Drain Current

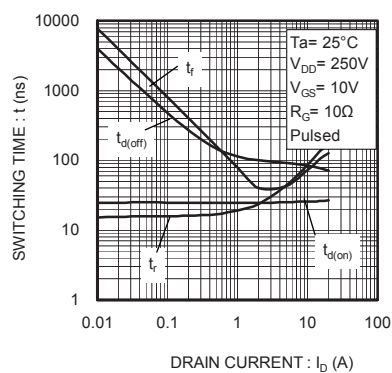


Fig.14 Switching Characteristics

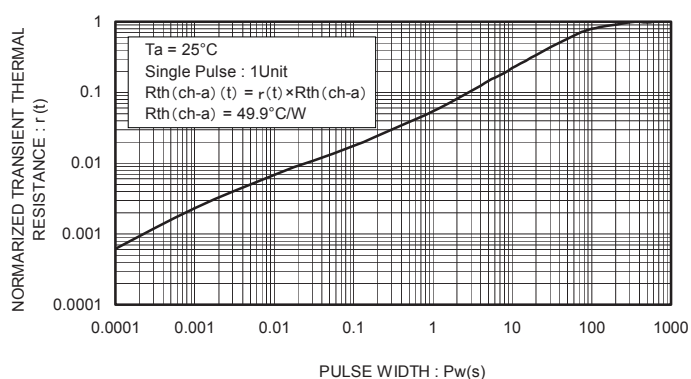


Fig.15 Normalized Transient Thermal Resistance vs. Pulse Width

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● Switching characteristics measurement circuit

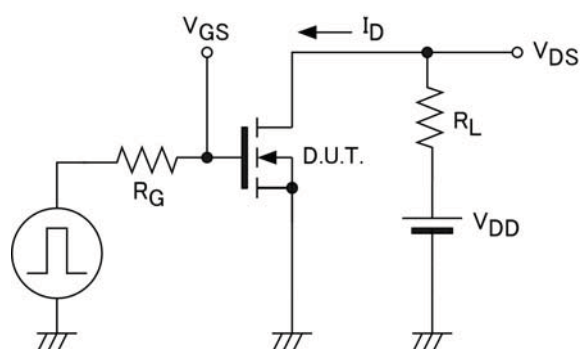


Fig.1 Switching time measurement circuit

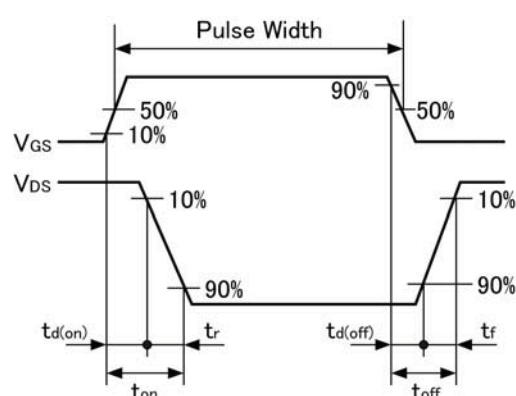


Fig.2 Switching waveforms

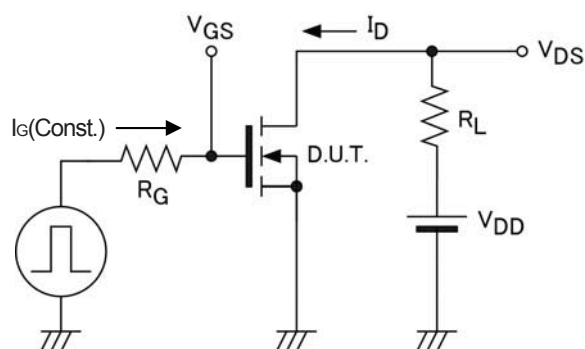


Fig.3 Gate charge measurement circuit

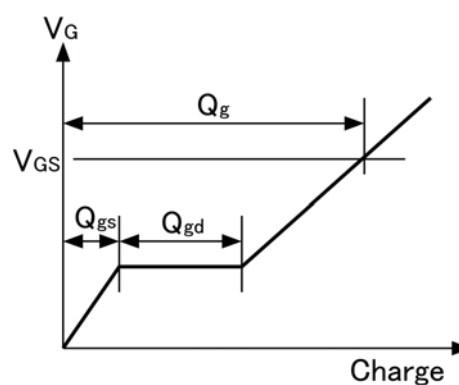


Fig.4 Gate charge waveform

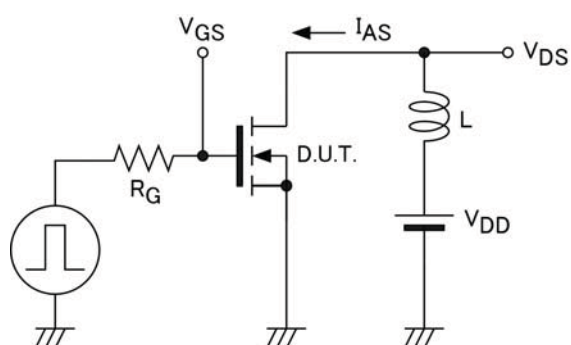


Fig.5 Avalanche measurement circuit

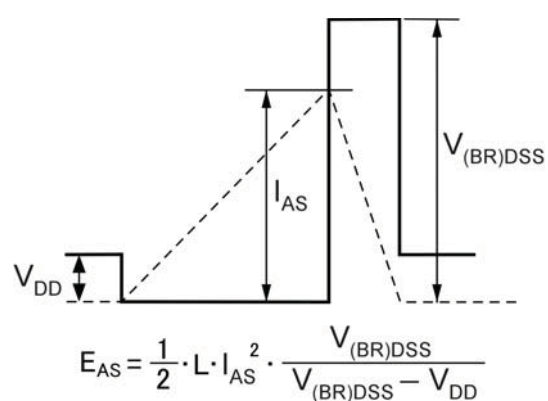


Fig.6 Avalanche waveform

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