

# 10V Drive Nch MOSFET

## R5013ANX

### ●Structure

Silicon N-channel MOSFET

### ●Features

- 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.

### ●Applications

Switching

### ●Packaging specifications

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

### ●Absolute maximum ratings ( $T_a=25^\circ C$ )

Parameter	Symbol	Limits	Unit	
Drain-source voltage	$V_{DS}$	500	V	
Gate-source voltage	$V_{GS}$	$\pm 30$	V	
Drain current	Continuous	$I_D$ *3	$\pm 13$	A
	Pulsed	$I_{DP}$ *1	$\pm 52$	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 ( $T_c=25^\circ C$ )	$P_D$	50	W	
Channel temperature	$T_{ch}$	150	$^\circ C$	
Range of storage temperature	$T_{stg}$	-55 to +150	$^\circ C$	

\*1  $P_w \leq 10 \mu s$ , Duty cycle  $\leq 1\%$

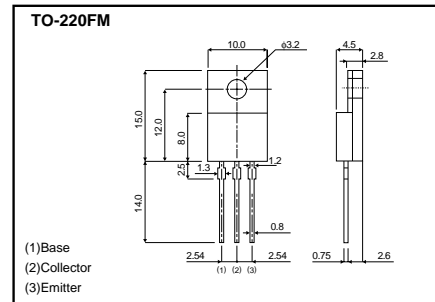
\*2  $L = 500 \mu H$ ,  $V_{DD} = 50V$ ,  $R_G = 25 \Omega$ , Starting,  $T_{ch} = 25^\circ C$

\*3 Limited only by maximum temperature allowed

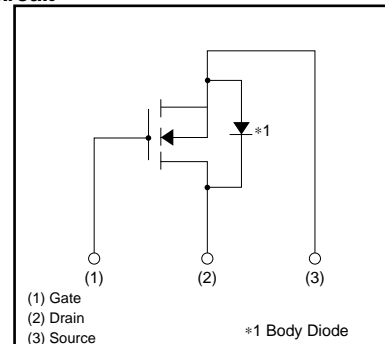
### ●Thermal resistance

Parameter	Symbol	Limits	Unit
Channel to case	$R_{th(ch-c)}$	2.5	$^\circ C/W$

### ●Dimensions (Unit : mm)



### ●Inner circuit



## Transistors

## ●Electrical characteristics (Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Gate-source leakage	I <sub>GSS</sub>	–	–	±100	nA	V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V
Drain-source breakdown voltage	V <sub>(BR)DSS</sub>	500	–	–	V	I <sub>D</sub> =1mA, V <sub>GS</sub> =0V
Zero gate voltage drain current	I <sub>DSS</sub>	–	–	100	μA	V <sub>DS</sub> =500V, V <sub>GS</sub> =0V
Gate threshold voltage	V <sub>GS(th)</sub>	2.5	–	4.5	V	V <sub>DS</sub> =10V, I <sub>D</sub> =1mA
Static drain-source on-state resistance	R <sub>DS(on)</sub> *	–	0.29	0.38	Ω	I <sub>D</sub> =6.5A, V <sub>GS</sub> =10V
Forward transfer admittance	Y <sub>fs</sub>  *	4.0	–	–	S	I <sub>D</sub> =6.5A, V <sub>DS</sub> =10V
Input capacitance	C <sub>iss</sub>	–	1300	–	pF	V <sub>DS</sub> =25V
Output capacitance	C <sub>oss</sub>	–	500	–	pF	V <sub>GS</sub> =0V
Reverse transfer capacitance	C <sub>rss</sub>	–	40	–	pF	f=1MHz
Turn-on delay time	t <sub>d(on)</sub> *	–	30	–	ns	I <sub>D</sub> =6.5A, V <sub>DD</sub> ≒250V
Rise time	t <sub>r</sub> *	–	32	–	ns	V <sub>GS</sub> =10V
Turn-off delay time	t <sub>d(off)</sub> *	–	90	–	ns	R <sub>L</sub> =38.5Ω
Fall time	t <sub>f</sub> *	–	30	–	ns	R <sub>G</sub> =10Ω
Total gate charge	Q <sub>g</sub> *	–	35	–	nC	V <sub>DD</sub> ≒250V
Gate-source charge	Q <sub>gs</sub> *	–	8	–	nC	I <sub>D</sub> =13A
Gate-drain charge	Q <sub>gd</sub> *	–	15	–	nC	V <sub>GS</sub> =10V R <sub>L</sub> =19.2Ω / R <sub>G</sub> =10Ω

\* Pulsed

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward voltage	V <sub>SD</sub> *	–	–	1.5	V	I <sub>S</sub> = 13A, V <sub>GS</sub> =0V

\* Pulsed

Transistors

●Electrical characteristic curves

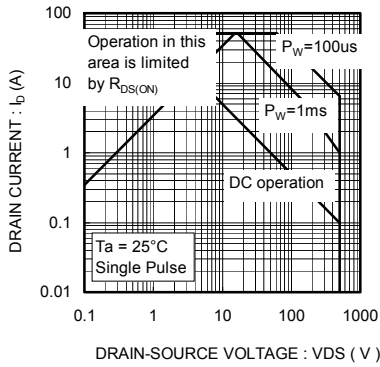


Fig.1 Maximum Safe Operating Area

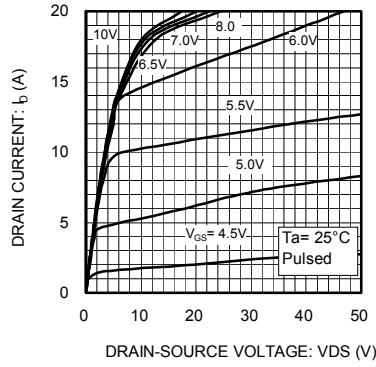


Fig.2: Typical Output Characteristics (I)

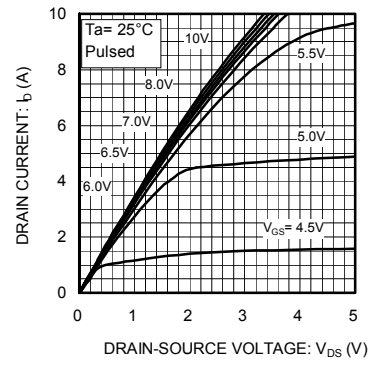


Fig.3: Typical Output Characteristics (II)

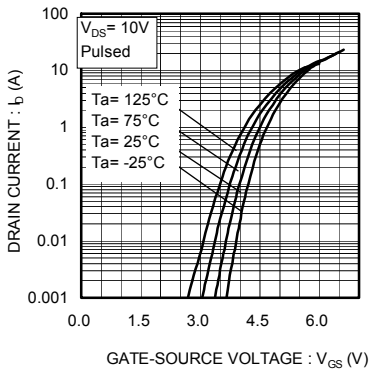


Fig.4 Typical Transfer Characteristics

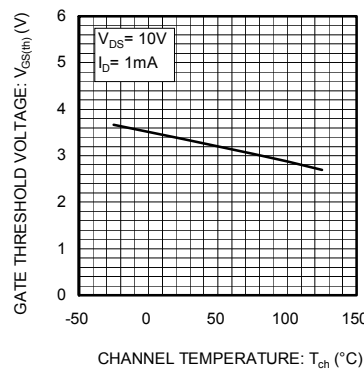


Fig.5 Gate Threshold Voltage vs. Channel

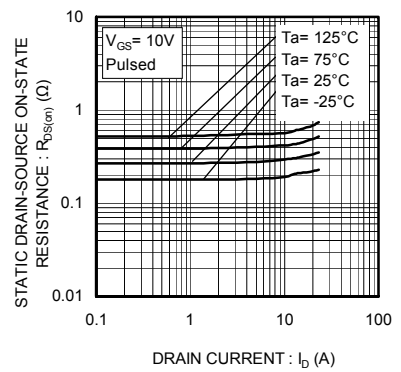


Fig.6 Static Drain-Source On-State Resistance vs. Drain Current

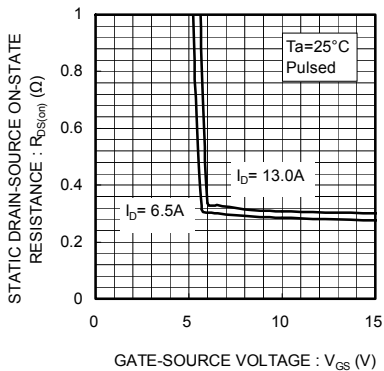


Fig.7 Static Drain-Source On-State Resistance vs. Gate Source

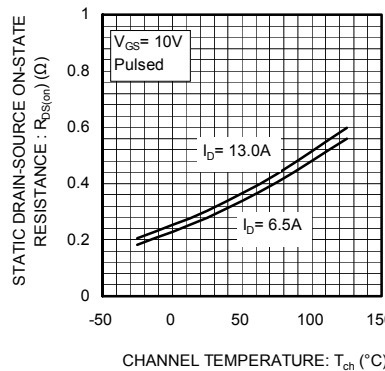


Fig.8 Static Drain-Source On-State Resistance vs. Channel

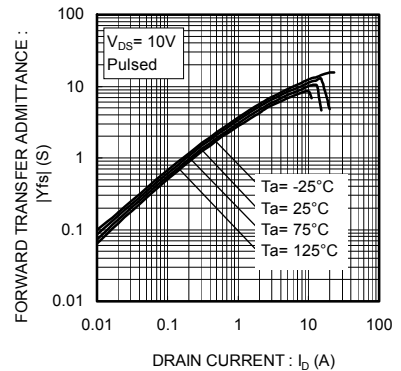


Fig.9 Forward Transfer Admittance vs. Drain Current

Transistors

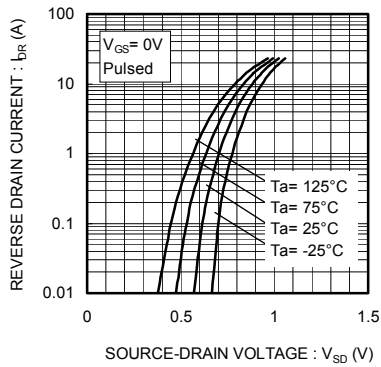


Fig.10 Reverse Drain Current vs. Source-Drain Voltage

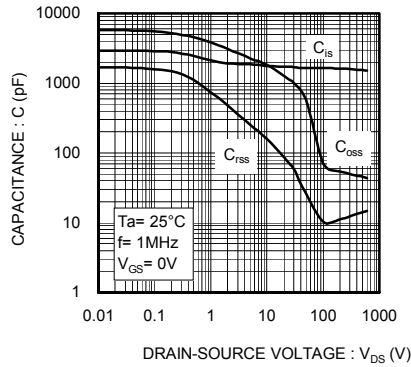


Fig.11 Typical Capacitance vs. Drain-Source Voltage

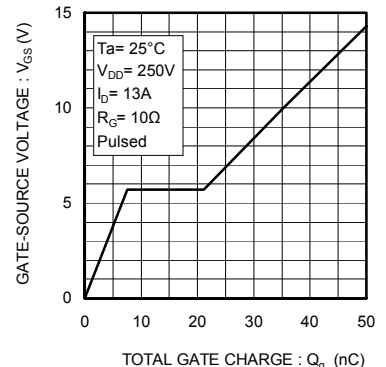


Fig.12 Dynamic Input Characteristics

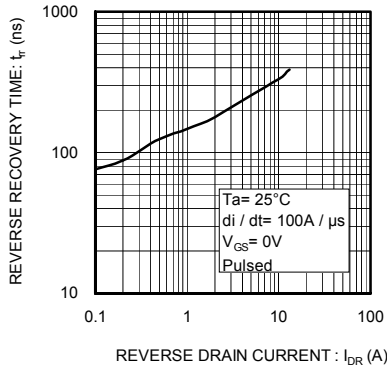


Fig.13 Reverse Recovery Time vs. Reverse Drain Current

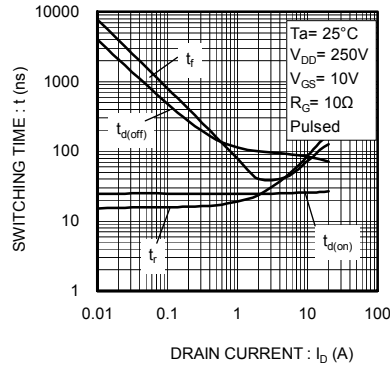


Fig.14 Switching Characteristics

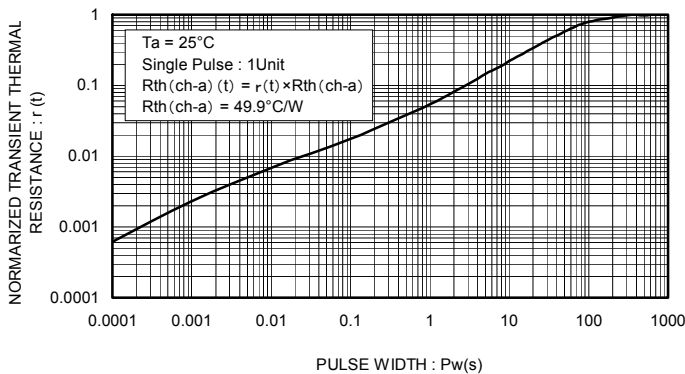


Fig.15 Normalized Transient Thermal Resistance vs. Pulse Width

Transistors

●Switching characteristics measurement circuit

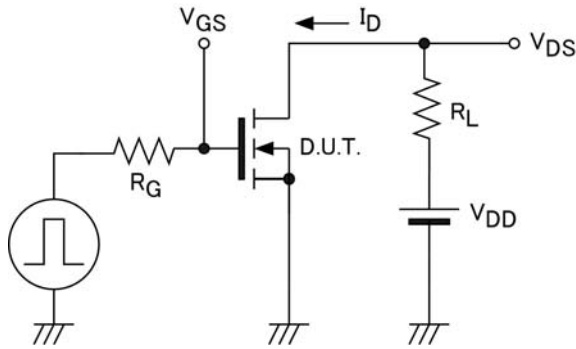


Fig.1 Switching time measurement circuit

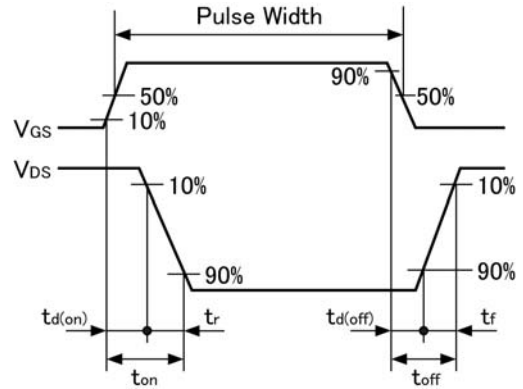


Fig.2 Switching waveforms

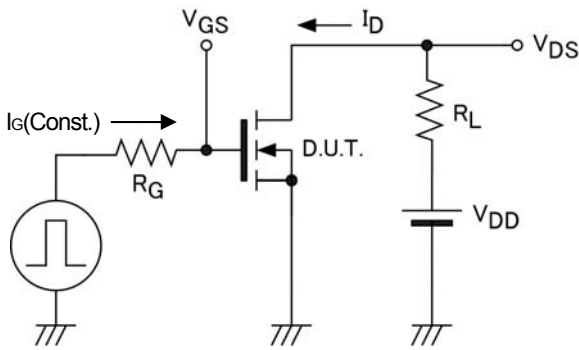


Fig.3 Gate charge measurement circuit

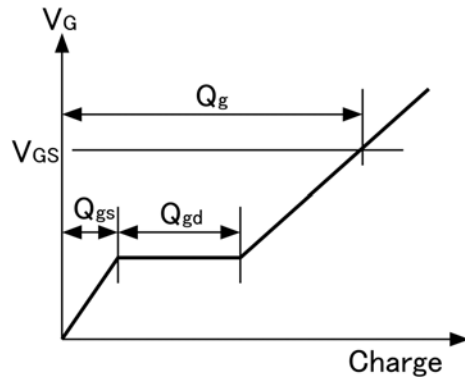


Fig.4 Gate charge waveform

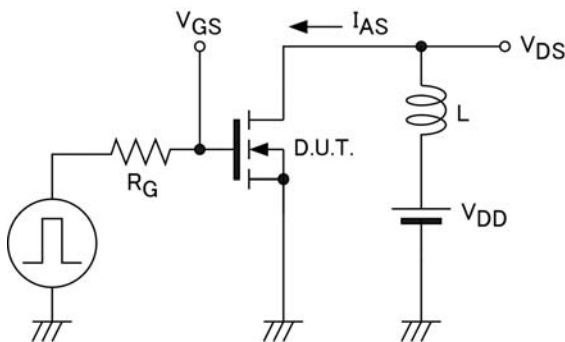


Fig.5 Avalanche measurement circuit

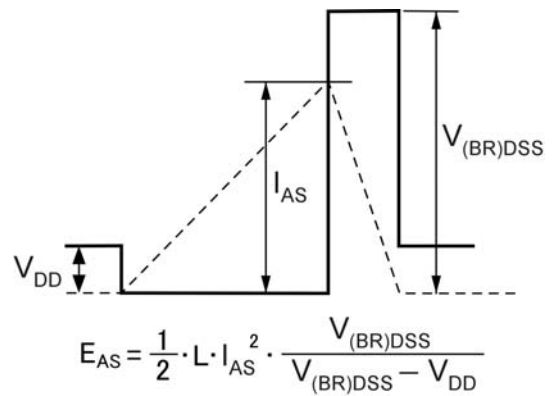


Fig.6 Avalanche waveform

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