

# MOS FIELD EFFECT TRANSISTOR 2SJ331

## SWITCHING P-CHANNEL POWER MOS FET

### DESCRIPTION

The 2SJ311 is P-Channel MOS Field Effect Transistor designed for solenoid, motor and lamp driver.

### FEATURES

- Low on-state resistance  
 $R_{DS(on)1} = 26 \text{ m}\Omega$  TYP. ( $V_{GS} = -10 \text{ V}$ ,  $I_D = -15 \text{ A}$ )  
 $R_{DS(on)2} = 40 \text{ m}\Omega$  TYP. ( $V_{GS} = -4 \text{ V}$ ,  $I_D = -12 \text{ A}$ )
- Low input capacitance  $C_{iss} = 4300 \text{ pF}$  TYP.
- Built-in G-S gate protection diodes

### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	-60	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS(AC)}$	$\pm 20$	V
	$V_{GSS(DC)}$	-20, +10	V
Drain Current (DC)	$I_{D(DC)}$	$\pm 30$	A
Drain Current (pulse) <sup>Note</sup>	$I_{D(pulse)}$	$\pm 120$	A
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_{T1}$	150	W
Total Power Dissipation ( $T_A = 25^\circ\text{C}$ )	$P_{T2}$	3.0	W
Channel Temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$

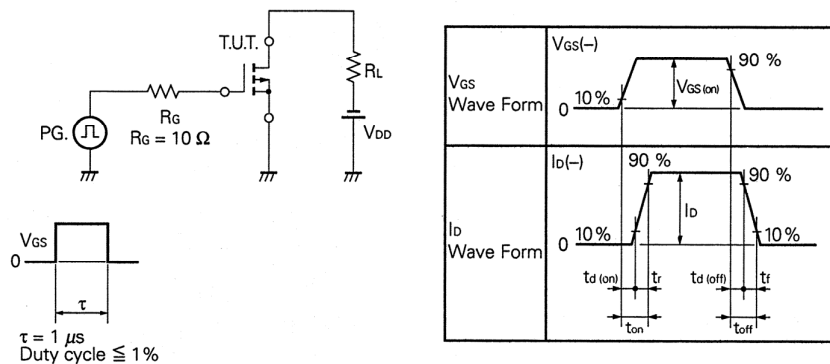
**Note**  $PW \leq 10 \mu\text{s}$ , Duty cycle  $\leq 1\%$

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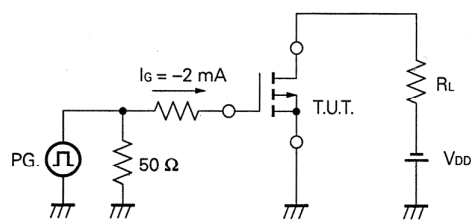
**ELECTRICAL CHARACTERISTICS (T<sub>a</sub> = 25 °C)**

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Drain to Source On-state Resistance	R <sub>DS(on)1</sub>		26	30	mΩ	V <sub>GS</sub> = -10 V, I <sub>D</sub> = -15 A
Drain to Source On-state Resistance	R <sub>DS(on)2</sub>		40	55	mΩ	V <sub>GS</sub> = -4 V, I <sub>D</sub> = -12 A
Gate to Source Cutoff Voltage	V <sub>GS(off)</sub>	-1.0	-1.5	-2.0	V	V <sub>DS</sub> = -10 V, I <sub>D</sub> = -1 mA
Forward Transfer Admittance	y <sub>fs</sub>	15	23		S	V <sub>DS</sub> = -10 V, I <sub>D</sub> = -15 A
Drain Leakage Current	I <sub>DSS</sub>			-10	μA	V <sub>DS</sub> = -60 V, V <sub>GS</sub> = 0
Gate to Source Leakage Current	I <sub>GSS</sub>			±10	μA	V <sub>GS</sub> = ±16 V, V <sub>DS</sub> = 0
Input Capacitance	C <sub>iss</sub>		4 300		pF	V <sub>DS</sub> = -10 V V <sub>GS</sub> = 0 f = 1 MHz
Output Capacitance	C <sub>oss</sub>		2 300		pF	
Reverse Transfer Capacitance	C <sub>rss</sub>		1 100		pF	
Turn-On Delay Time	t <sub>d(on)</sub>		60		ns	V <sub>GS(on)</sub> = -10 V V <sub>DD</sub> = -30 V I <sub>D</sub> = -15 A, R <sub>G</sub> = 10 Ω R <sub>L</sub> = 2.0 Ω
Rise Time	t <sub>r</sub>		320		ns	
Turn-Off Delay Time	t <sub>d(off)</sub>		490		ns	
Fall Time	t <sub>f</sub>		470		ns	
Total Gate Charge	Q <sub>G</sub>		160		nC	V <sub>GS</sub> = -10 V I <sub>D</sub> = -30 A V <sub>DD</sub> = -48 V
Gate to Source Charge	Q <sub>GS</sub>		12		nC	
Gate to Drain Charge	Q <sub>GD</sub>		66		nC	
Diode Forward Voltage	V <sub>SD</sub>		1.1		V	I <sub>F</sub> = 30 A, V <sub>GS</sub> = 0
Reverse Recovery Time	t <sub>rr</sub>		150		ns	I <sub>F</sub> = 30 A, V <sub>GS</sub> = 0
Reverse Recovery Charge	Q <sub>rr</sub>		300		nC	di/dt = 50 A/μs

**Test Circuit 1: Switching Time**

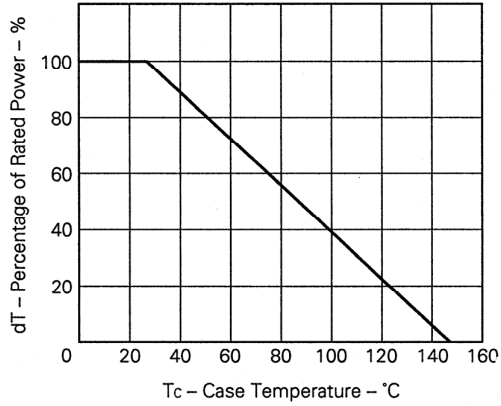


**Test Circuit 2: Gate Charge**

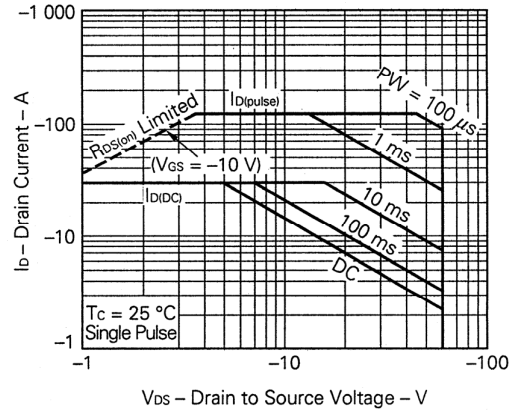


ELECTRICAL CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ )

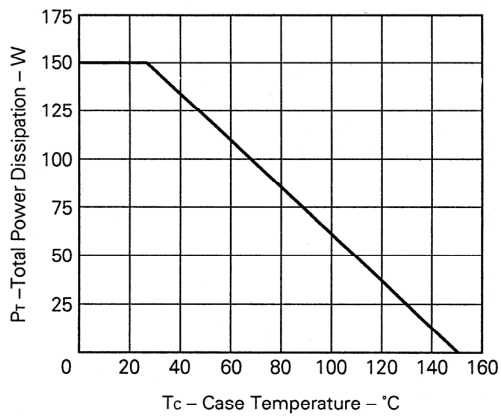
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



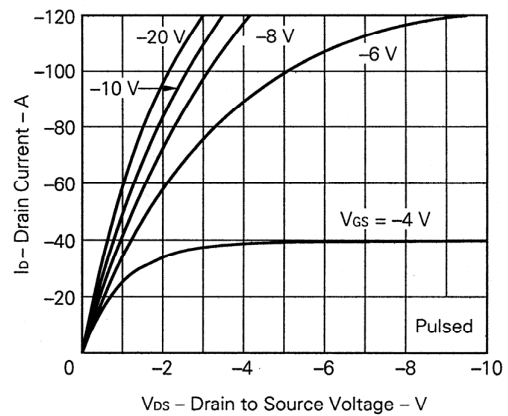
FORWARD BIAS SAFE OPERATING AREA



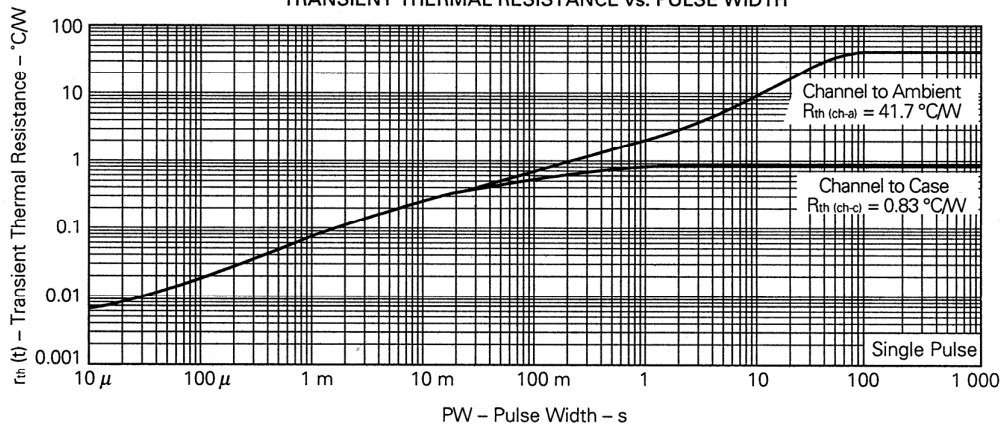
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE

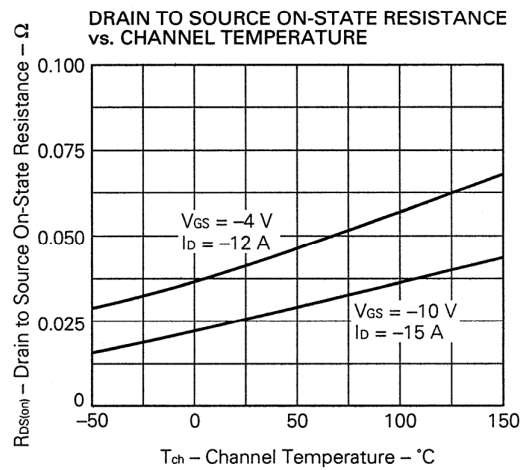
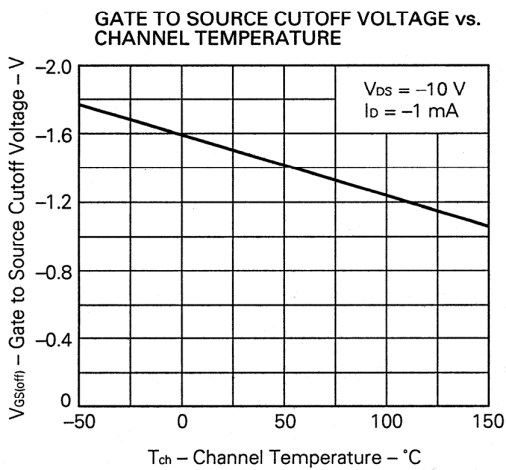
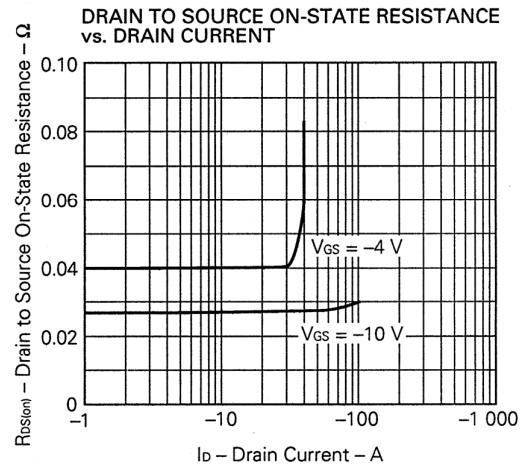
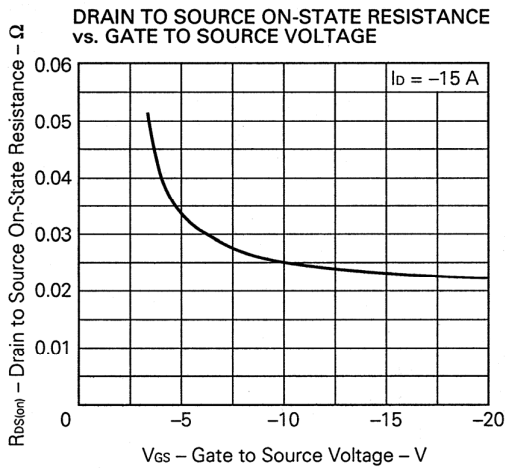
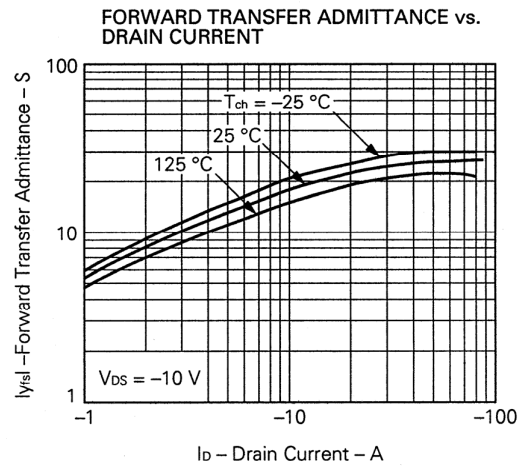
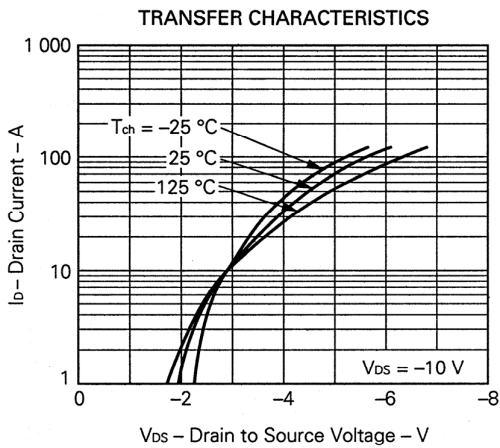


DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE

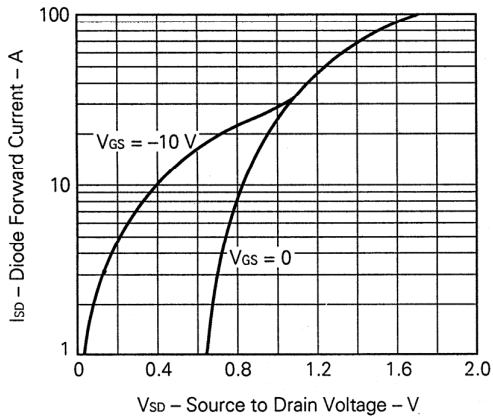


TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

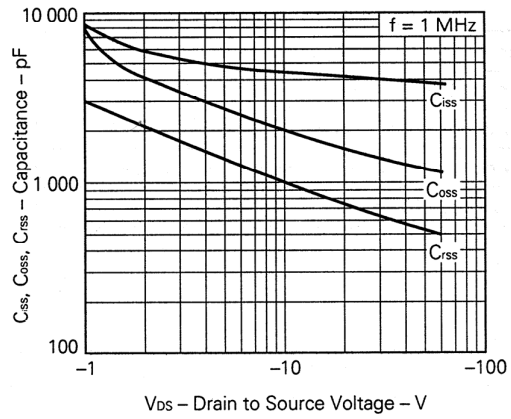




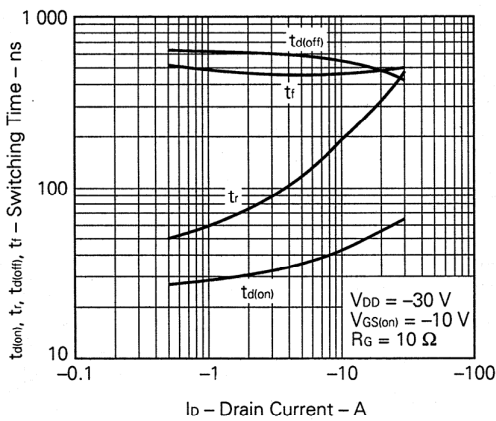
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



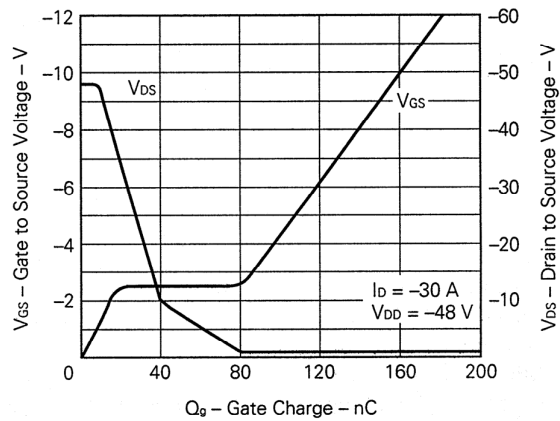
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



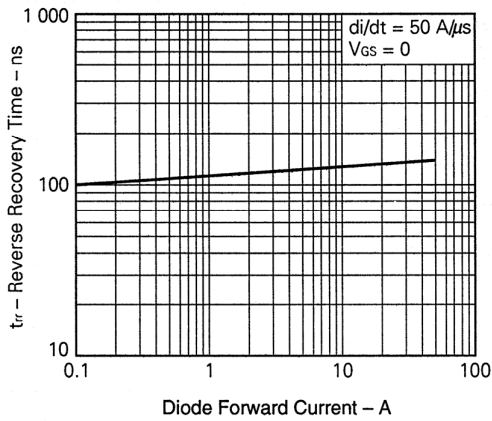
SWITCHING CHARACTERISTICS



DYNAMIC INPUT/OUTPUT CHARACTERISTICS

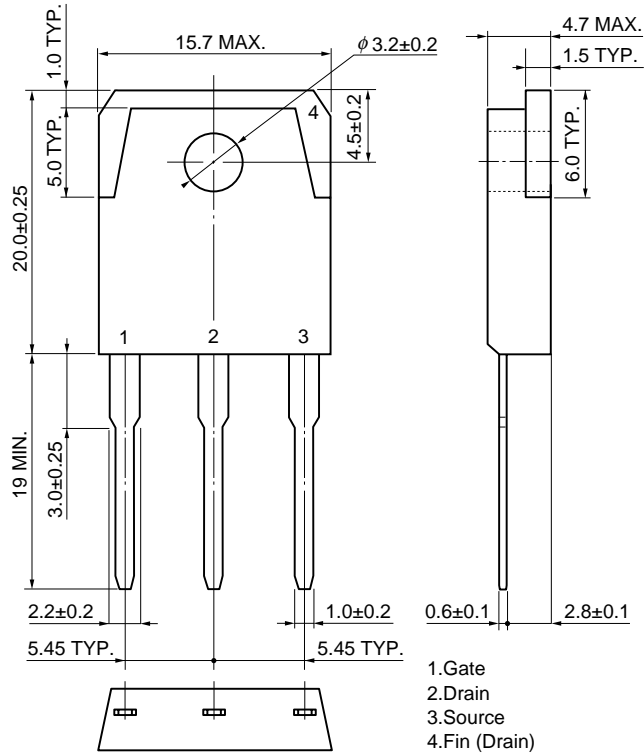


REVERSE RECOVERY TIME vs. REVERSE DRAIN CURRENT

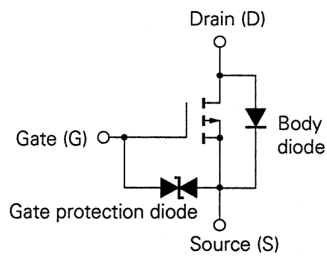


PACKAGE DRAWING (Unit: mm)

<R> TO-3P (MP-88)



EQUIVALENT CIRCUIT



**Remark** The diode connected between the gate and source of the transistor serves as a protector against ESD. When this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

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