NEC

MOS FIELD EFFECT TRANSISTOR
2SK3057

SWITCHING
N-CHANNEL POWER MOS FET
INDUSTRIAL USE

DESCRIPTION

The 2SK3057 product is N-Channel MOS Field Effect Transistor designed for high current switching application.

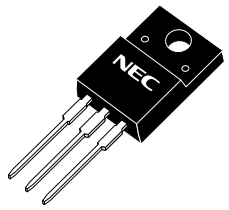
ORDERING INFORMATION

PART NUMBER	PACKAGE
2SK3057	Isolated TO-220

FEATURES

- Low on-state resistance
  $R_{DS(on)1}$ = 17 mΩ MAX. (V_{GS} = 10 V, I_D = 23 A)
  $R_{DS(on)2}$ = 27 mΩ MAX. (V_{GS} = 4 V, I_D = 23 A)
- Low C_{iss}: C_{iss} = 2100 pF TYP.
- Built-in gate protection diode
- Isolated TO-220 package

★ (Isolated TO-220)



ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Drain to Source Voltage (V_{GS} = 0 V)	V_{DSS}	60	V
Gate to Source Voltage (V_{DS} = 0 V)	$V_{GSS(AC)}$	±20	V
Gate to Source Voltage (V_{DS} = 0 V)	$V_{GSS(DC)}$	+20, –10	V
Drain Current (DC) (T_C = 25°C)	$I_{D(DC)}$	±45	A
Drain Current (pulse) Note1	$I_{D(pulse)}$	±150	A
Total Power Dissipation (T_C = 25°C)	P_T	30	W
Total Power Dissipation (T_A = 25°C)	P_T	2.0	W
Channel Temperature	T_{ch}	150	°C
Storage Temperature	T_{stg}	–55 to +150	°C
Single Avalanche Current Note2	I_{AS}	22.5	A
Single Avalanche Energy Note2	E_{AS}	50.6	mJ

Notes 1. PW ≤ 10 μs, Duty Cycle ≤ 1%

★ **2.** Starting T_{ch} = 25°C, V_{DD} = 30 V, R_G = 25 Ω, V_{GS} = 20 → 0 V

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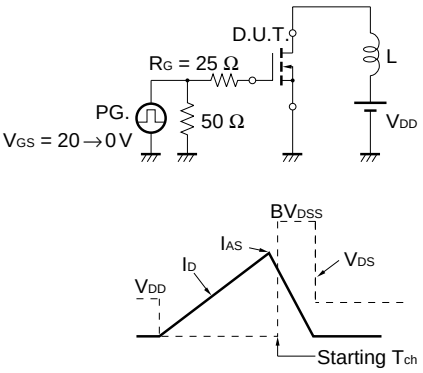
The mark ★ shows major revised points.

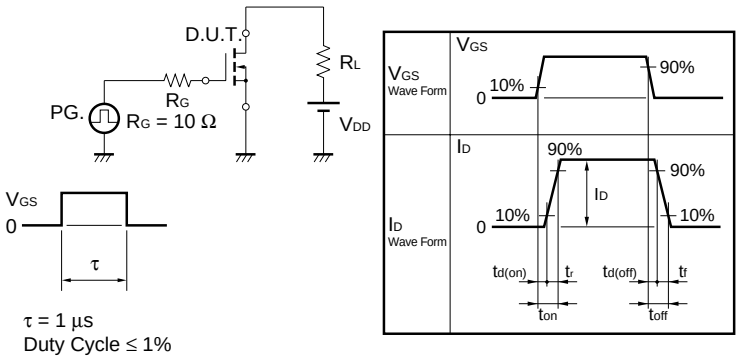
ELECTRICAL CHARACTERISTICS (T_A = 25°C)

	CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
	Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 60 V, V_{GS} = 0 V			10	μA
	Gate Leakage Current	I_{GSS}	V_{GS} = ±20 V, V_{DS} = 0 V			±10	μA
	Gate Cut-off Voltage	$V_{GS(off)}$	V_{DS} = 10 V, I_D = 1 mA	1.0	1.6	2.0	V
	Forward Transfer Admittance	$\|y_{fs}\|$	V_{DS} = 10 V, I_D = 23 A	13	42		S
	Drain to Source On-state Resistance	$R_{DS(on)1}$	V_{GS} = 10 V, I_D = 23 A		12	17	mΩ
		$R_{DS(on)2}$	V_{GS} = 4 V, I_D = 23 A		17	27	mΩ
	Input Capacitance	C_{iss}	V_{DS} = 10 V		2100		pF
	Output Capacitance	C_{oss}	V_{GS} = 0 V		550		pF
	Reverse Transfer Capacitance	C_{rss}	f = 1 MHz		220		pF
	Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 30 V, I_D = 23 A		35		ns
★	Rise Time	t_r	V_{GS} = 10 V		410		ns
	Turn-off Delay Time	$t_{d(off)}$	R_G = 10 Ω		120		ns
	Fall Time	t_f			200		ns
	Total Gate Charge	Q_G	V_{DD} = 48 V		45		nC
★	Gate to Source Charge	Q_{GS}	V_{GS} = 10 V		7.0		nC
	Gate to Drain Charge	Q_{GD}	I_D = 45 A		13		nC
	Body Diode Forward Voltage	$V_{F(S-D)}$	I_F = 45 A, V_{GS} = 0 V		1.0		V
	Reverse Recovery Time	t_{rr}	I_F = 45 A, V_{GS} = 0 V		60		ns
	Reverse Recovery Charge	Q_{rr}	di/dt = 100 A/μs		100		nC

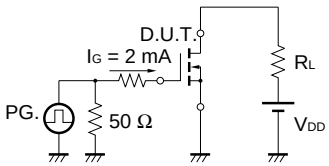
TEST CIRCUIT 1 AVALANCHE CAPABILITY



★ TEST CIRCUIT 2 SWITCHING TIME

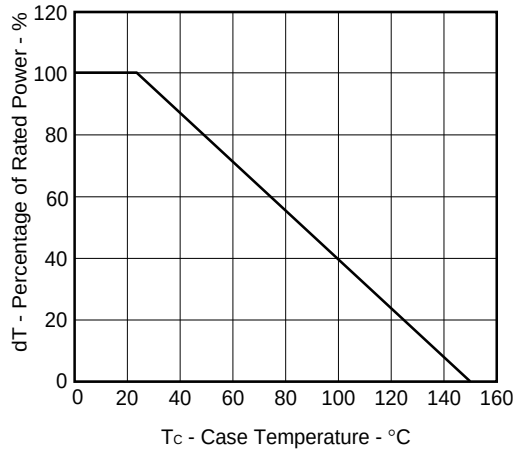


TEST CIRCUIT 3 GATE CHARGE

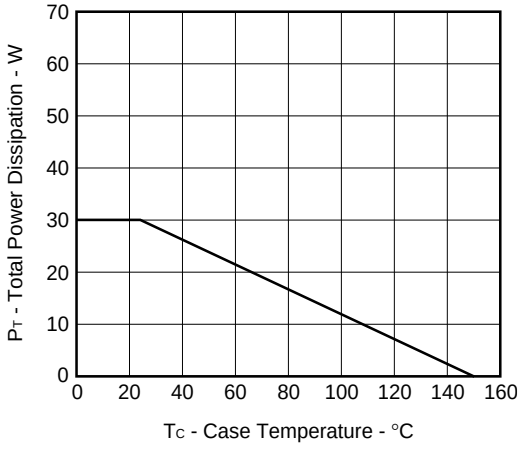


TYPICAL CHARACTERISTICS (T_A = 25°C)

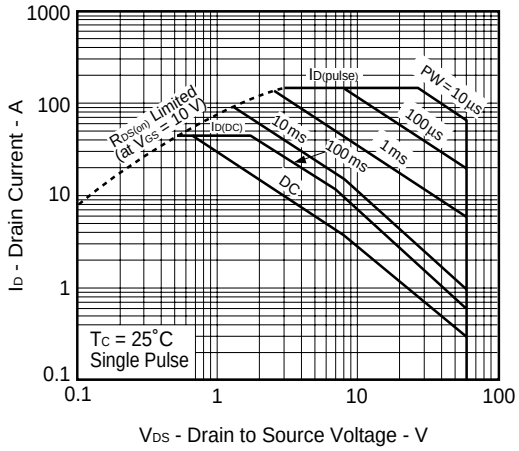
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



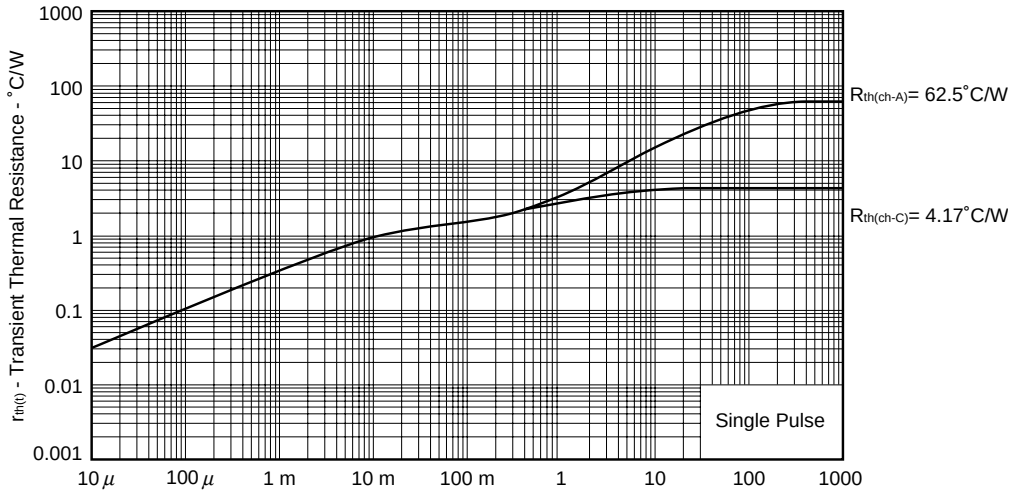
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



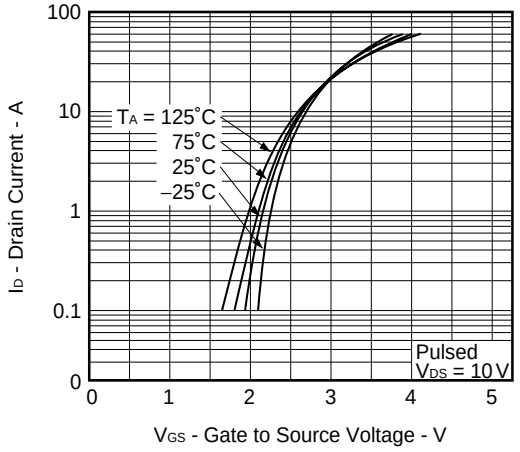
★ FORWARD BIAS SAFE OPERATING AREA



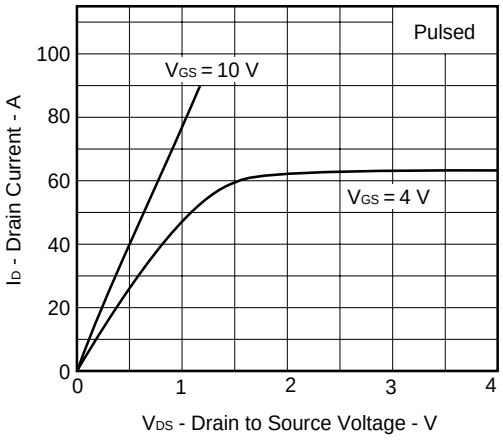
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



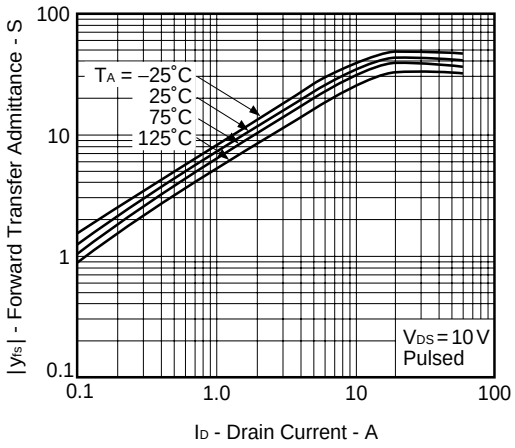
FORWARD TRANSFER CHARACTERISTICS



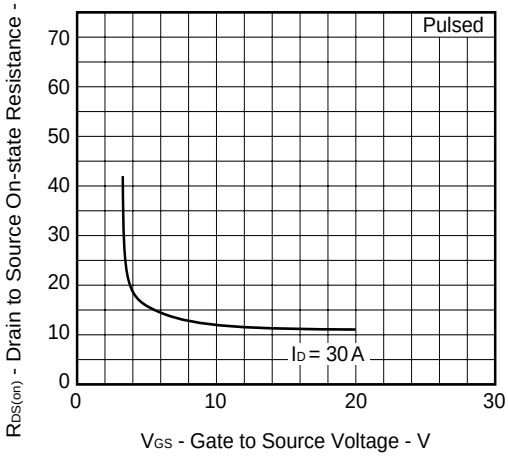
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



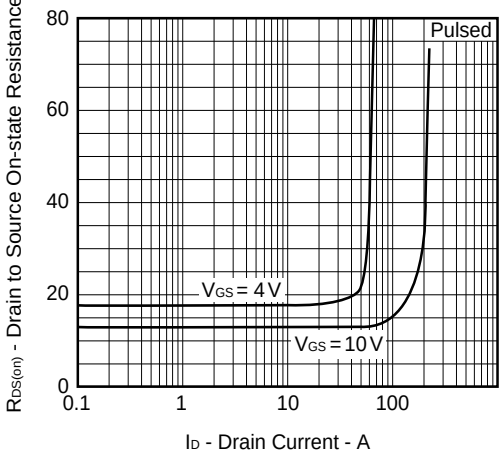
FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



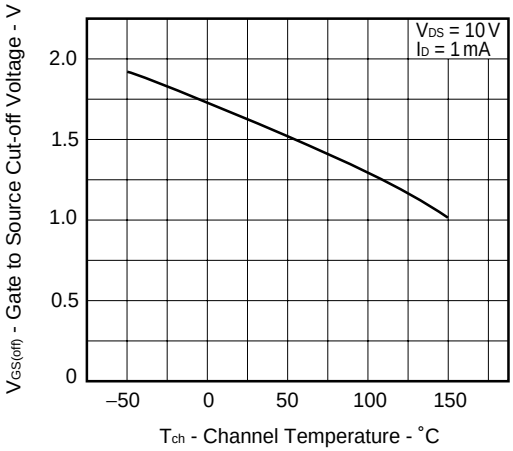
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE



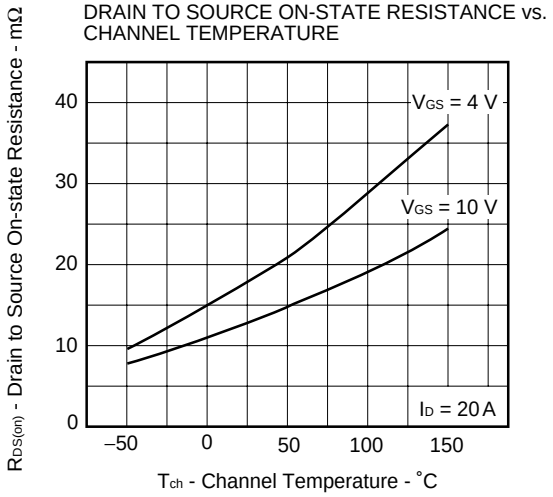
DRAIN TO SOURCE ON-STATE
RESISTANCE vs. DRAIN CURRENT



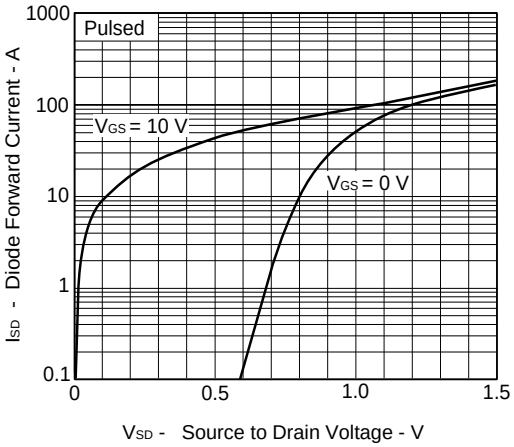
GATE TO SOURCE CUT-OFF VOLTAGE vs.
CHANNEL TEMPERATURE



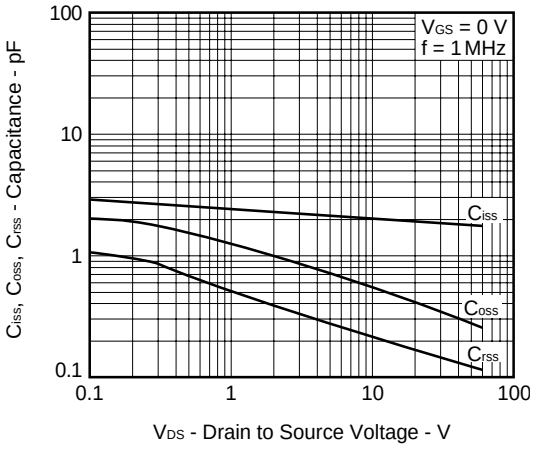
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



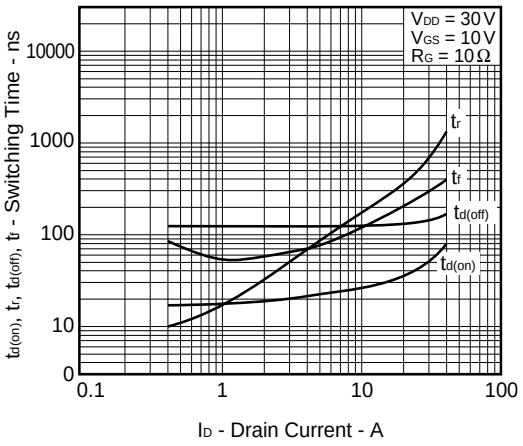
★ SOURCE TO DRAIN DIODE FORWARD VOLTAGE



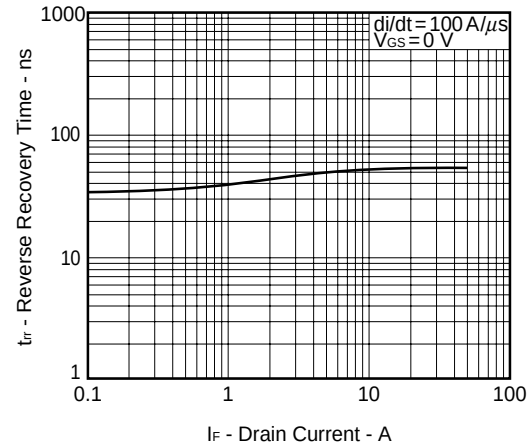
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



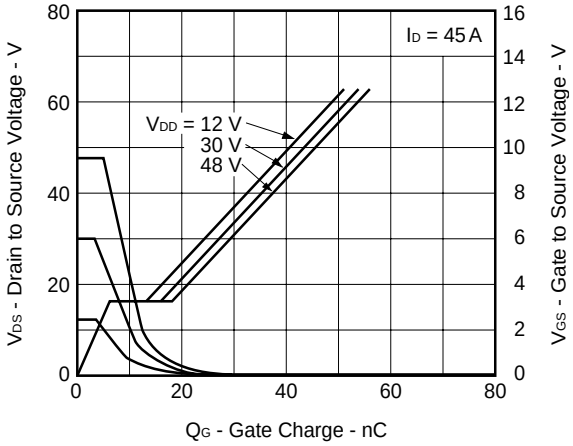
SWITCHING CHARACTERISTICS



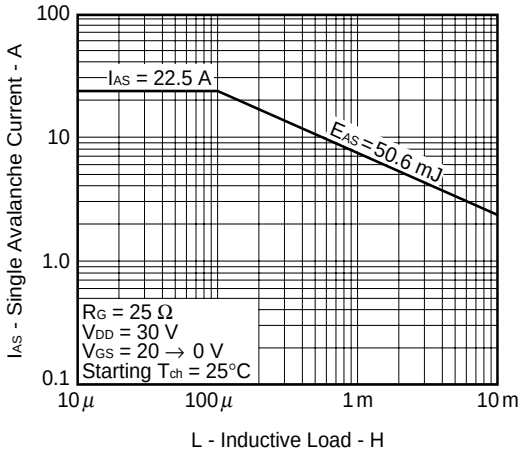
REVERSE RECOVERY TIME vs. DRAIN CURRENT



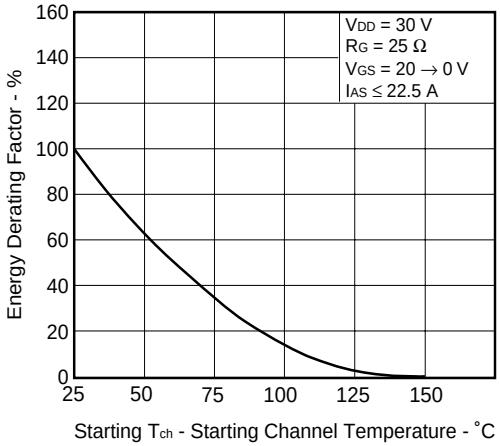
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



★ SINGLE AVALANCHE CURRENT vs. INDUCTIVE LOAD

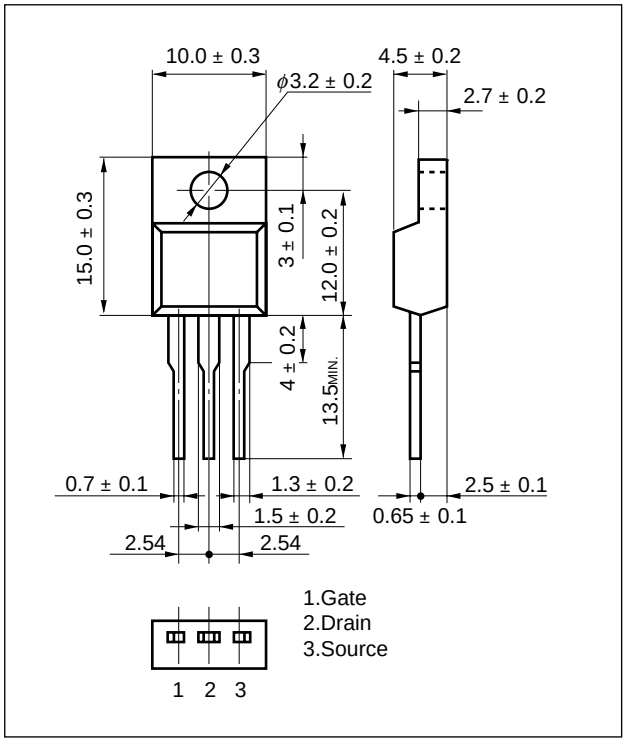


SINGLE AVALANCHE ENERGY DERATING FACTOR

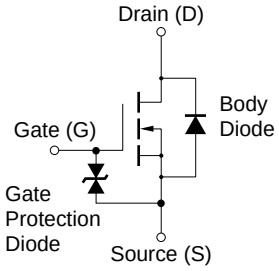


PACKAGE DRAWING (Unit: mm)

Isolated TO-220 (MP-45F)



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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