

SWITCHING
N-CHANNEL POWER MOS FET
INDUSTRIAL USE

DESCRIPTION

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

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

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

Notes 1. $PW \leq 10 \mu\text{s}$, Duty Cycle $\leq 1 \%$

2. Starting $T_{ch} = 25^\circ\text{C}$, $R_G = 25 \Omega$, $V_{GS} = 20 \text{ V} \rightarrow 0$

THERMAL RESISTANCE

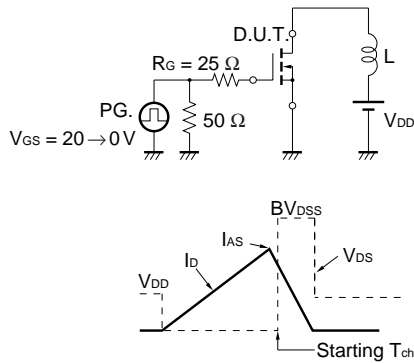
Channel to Case	$R_{th(ch-c)}$	4.17	$^\circ\text{C/W}$
Channel to Ambient	$R_{th(ch-a)}$	62.5	$^\circ\text{C/W}$

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 Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

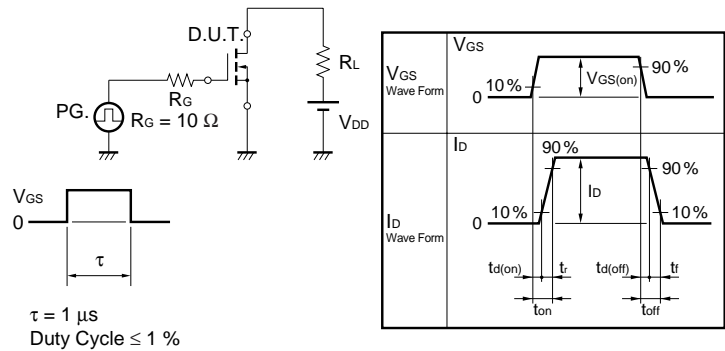
ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
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
Gate to Source 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 Leakage Current	I _{DSS}	V _{DS} = 60 V, V _{GS} = 0 V			10	μA
Gate to Source Leakage Current	I _{GSS}	V _{GS} = ±20 V, V _{DS} = 0 V			±10	μA
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)}	I _D = 23 A		35		ns
Rise Time	t _r	V _{GS(on)} = 10 V		410		ns
Turn-off Delay Time	t _{d(off)}	V _{DD} = 30 V		120		ns
Fall Time	t _f	R _G = 10 Ω		200		ns
Total Gate Charge	Q _G	I _D = 45 A		45		nC
Gate to Source Charge	Q _{GS}	V _{DD} = 48 V		7.0		nC
Gate to Drain Charge	Q _{GD}	V _{GS(on)} = 10 V		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

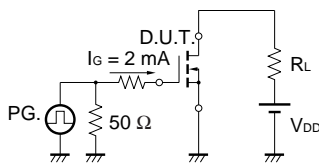
TEST CIRCUIT 1 AVALANCHE CAPABILITY



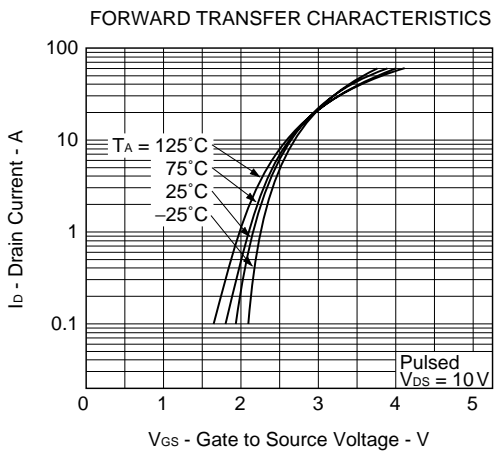
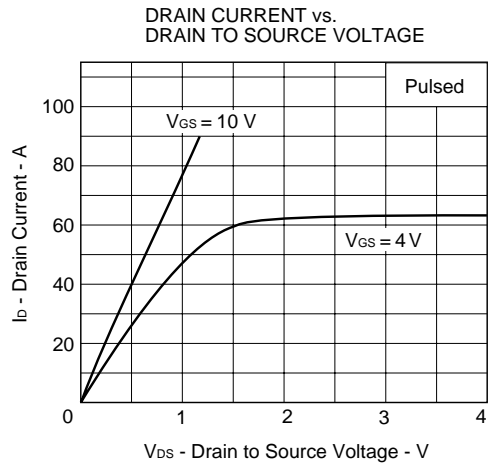
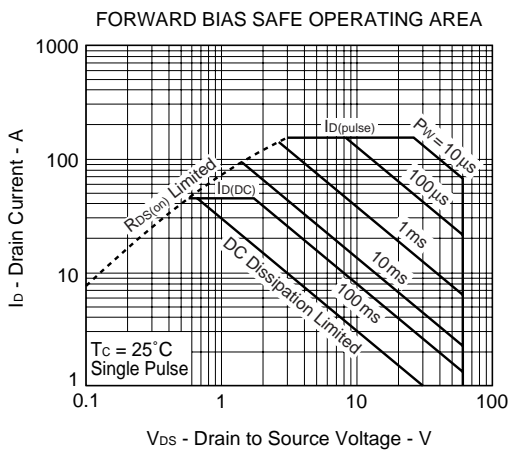
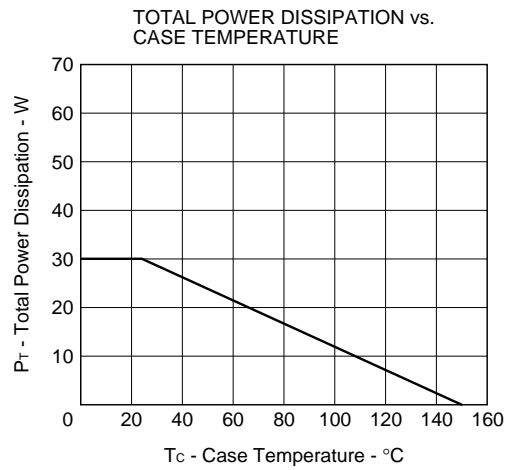
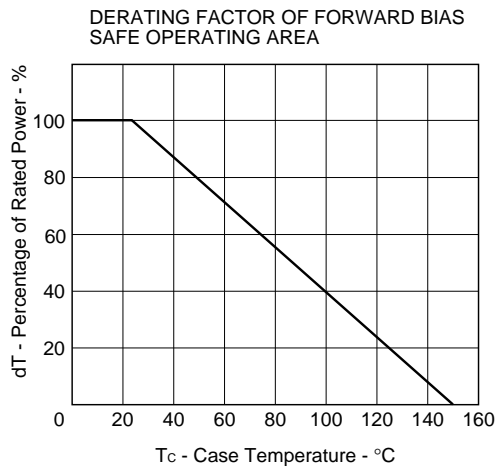
TEST CIRCUIT 2 SWITCHING TIME



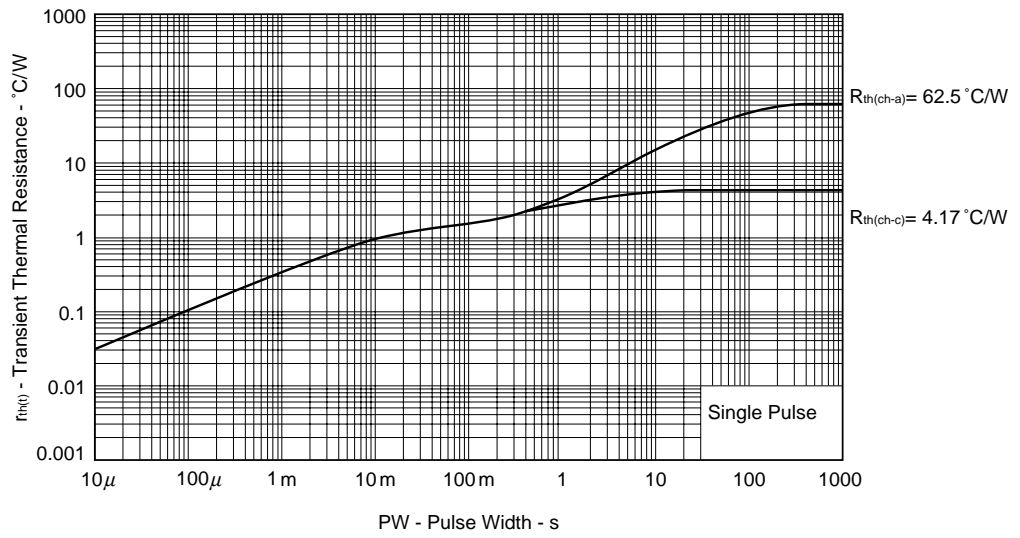
TEST CIRCUIT 3 GATE CHARGE



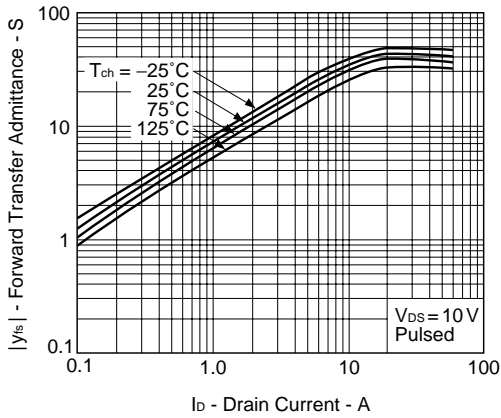
TYPICAL CHARACTERISTICS (T_A = 25 °C)



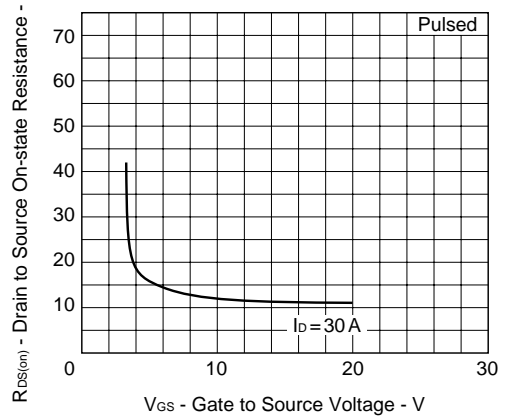
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



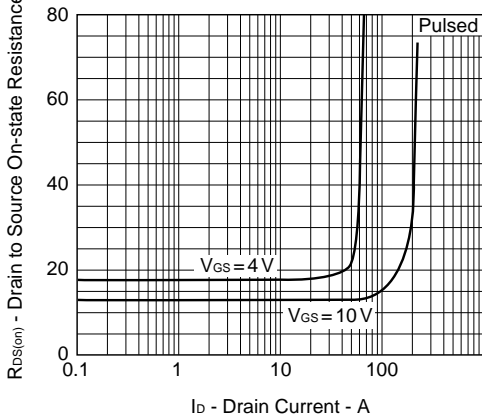
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



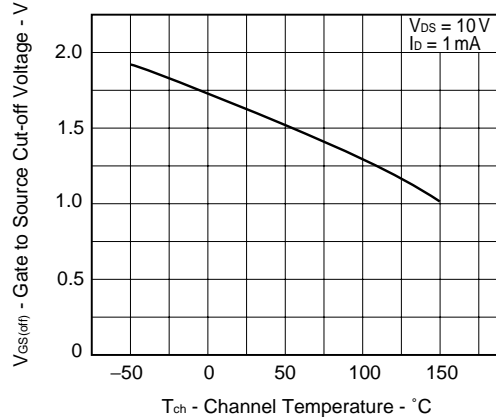
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

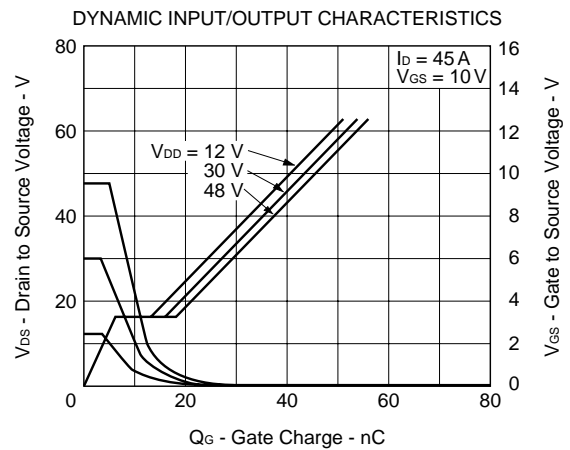
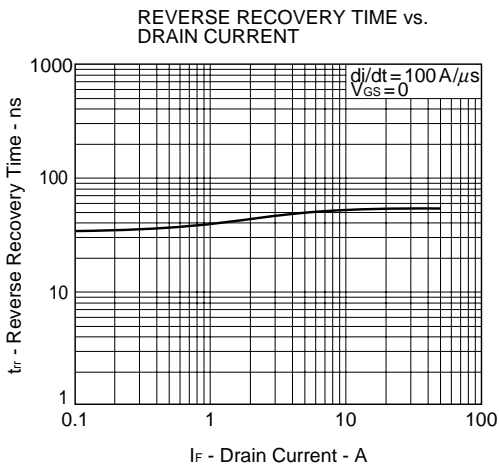
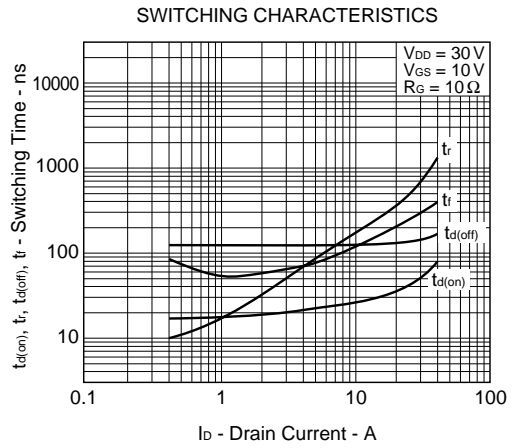
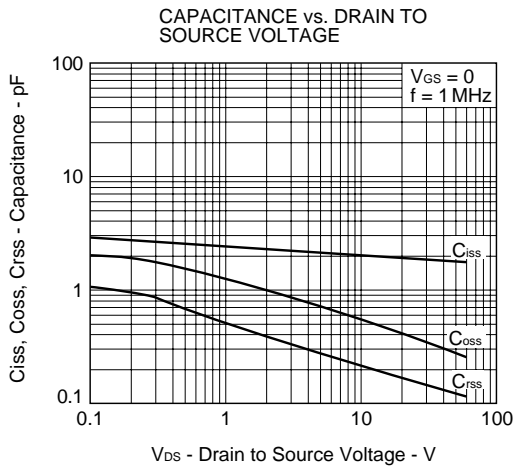
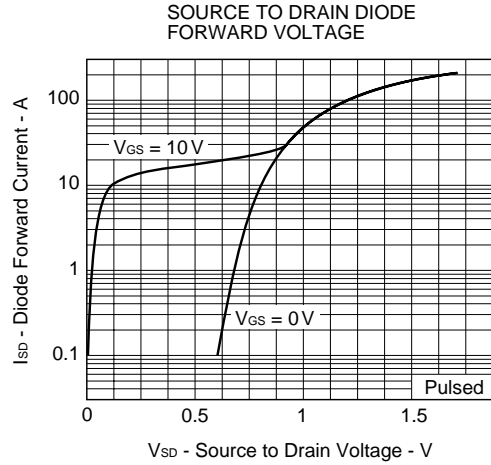
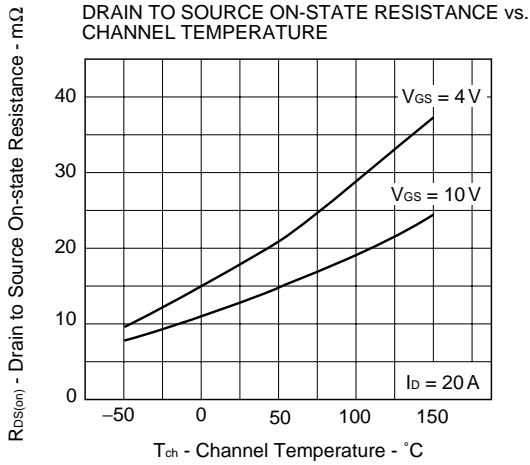


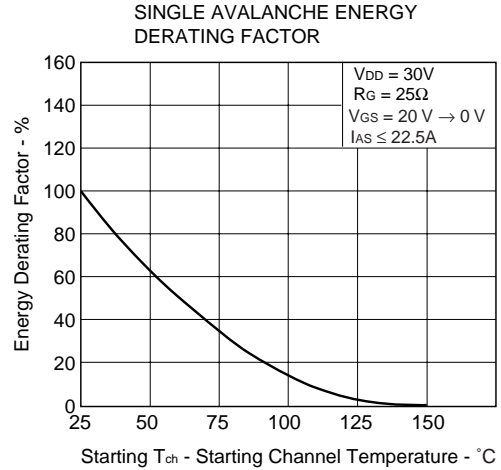
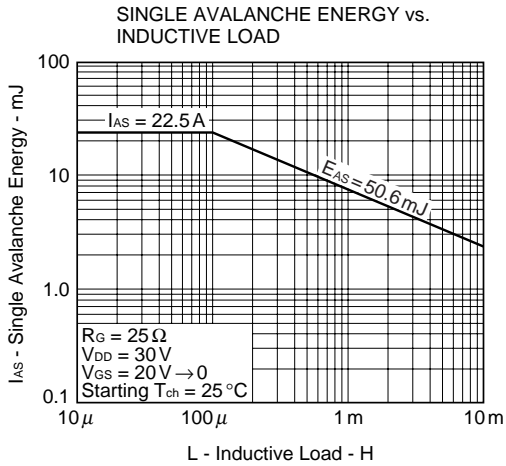
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE

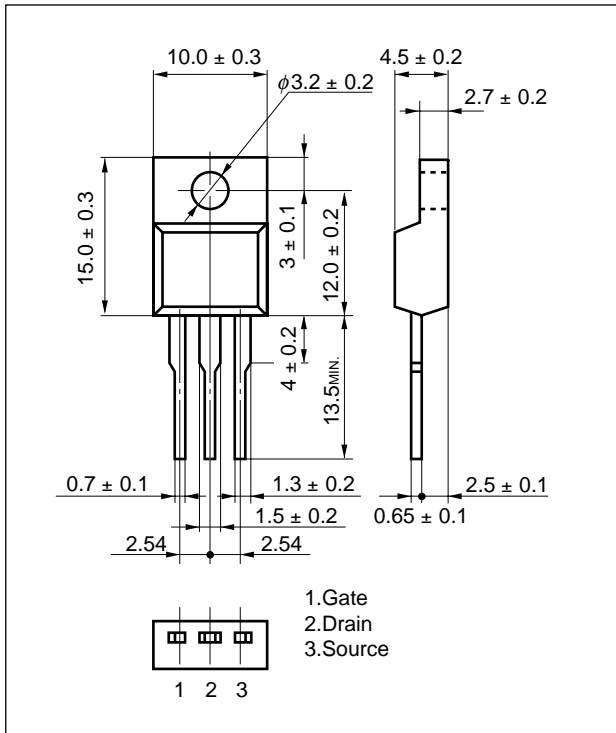




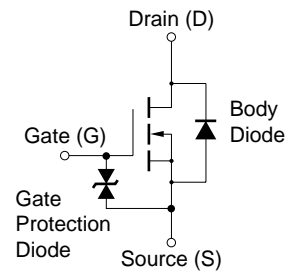


PACKAGE DRAWING (Unit : mm)

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.

[MEMO]

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