NEC

MOS FIELD EFFECT TRANSISTOR
2SK3404

SWITCHING
N-CHANNEL POWER MOS FET
INDUSTRIAL USE

DESCRIPTION

The 2SK3404 is N-Channel MOS FET device that features a low on-state resistance and excellent switching characteristics, designed for low voltage high current applications such as DC/DC converter with synchronous rectifier.

ORDERING INFORMATION

PART NUMBER	PACKAGE
2SK3404	TO-220AB
2SK3404-ZK	TO-263(MP-25ZK)
2SK3404-ZJ	TO-263(MP-25ZJ)

FEATURES

- 4.5-V drive available
- Low on-state resistance
  $R_{DS(on)1}$ = 14 mΩ MAX. (V_{GS} = 10 V, I_D = 20 A)
- Low gate charge
  Q_G = 25 nC TYP. (I_D = 40 A, V_{DD} = 24 V, V_{GS} = 10 V)
- Built-in gate protection diode
- Surface mount device available

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Drain to Source Voltage (V_{GS} = 0 V)	V_{DSS}	30	V
Gate to Source Voltage (V_{DS} = 0 V)	V_{GSS}	±20	V
Drain Current (DC) (T_C = 25°C)	$I_{D(DC)}$	±40	A
Drain Current (Pulse) **Note**	$I_{D(pulse)}$	±160	A
Total Power Dissipation (T_A = 25°C)	P_{T1}	1.5	W
Total Power Dissipation (T_C = 25°C)	P_{T2}	40	W
Channel Temperature	T_{ch}	150	°C
Storage Temperature	T_{stg}	–55 to +150	°C

Note PW ≤ 10 μs, Duty Cycle ≤ 1%

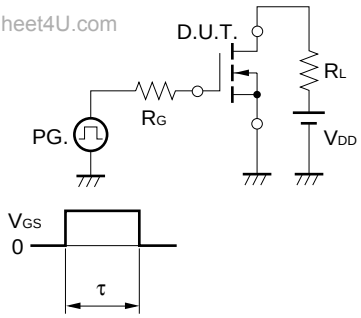
Document No. D14638EJ2V0DS00 (2nd edition)
Date Published May 2001 NS CP(K)
Printed in Japan

The mark ★ shows major revised points.

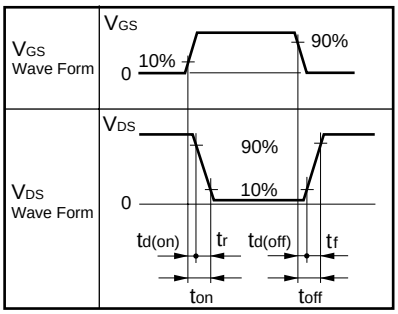
ELECTRICAL CHARACTERISTICS(T_A = 25°C)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Drain Leakage Current	I_{DSS}	V_{DS} = 30 V, V_{GS} = 0 V			10	μA
Gate Leakage Current	I_{GSS}	V_{GS} = ±20 V, V_{DS} = 0 V			±10	μA
Gate to Source Cut-off Voltage	$V_{GS(off)}$	V_{DS} = 10 V, I_D = 1 mA	1.5		2.5	V
Forward Transfer Admittance	$\|y_{fs}\|$	V_{DS} = 10 V, I_D = 20 A	8.0			S
Drain to Source On-state Resistance	$R_{DS(on)1}$	V_{GS} = 10 V, I_D = 20 A		11	14	mΩ
	$R_{DS(on)2}$	V_{GS} = 4.5 V, I_D = 20 A		15	21	mΩ
Input Capacitance	C_{iss}	V_{DS} = 10 V		1400		pF
Output Capacitance	C_{oss}	V_{GS} = 0 V		410		pF
Reverse Transfer Capacitance	C_{rss}	f = 1 MHz		180		pF
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 15 V , I_D = 20 A		20		ns
Rise Time	t_r	$V_{GS(on)}$ = 10 V		9		ns
Turn-off Delay Time	$t_{d(off)}$	R_G = 10 Ω		50		ns
Fall Time	t_f			14		ns
Total Gate Charge	Q_G	V_{DD} = 24 V		25		nC
Gate to Source Charge	Q_{GS}	V_{GS} = 10 V		5.0		nC
Gate to Drain Charge	Q_{GD}	I_D = 40 A		7.0		nC
Diode Forward Voltage	$V_{F(S-D)}$	I_F = 40 A, V_{GS} = 0 V		1.0		V
Reverse Recovery Time	t_{rr}	I_F = 40 A, V_{GS} = 0 V		31		ns
Reverse Recovery Charge	Q_{rr}	di/dt = 100 A/μs		28		nC

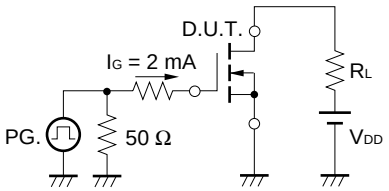
TEST CIRCUIT 1 SWITCHING TIME



τ = 1 μs
Duty Cycle ≤ 1%

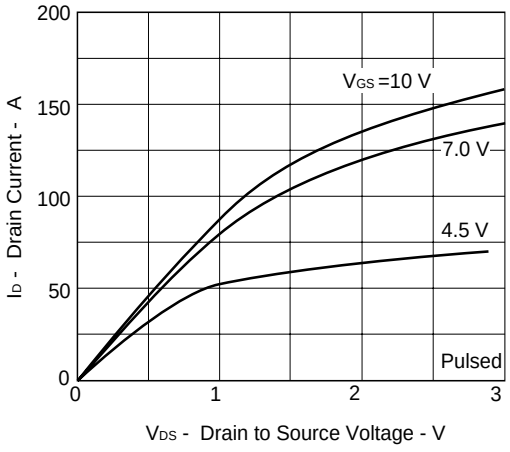


TEST CIRCUIT 2 GATE CHARGE

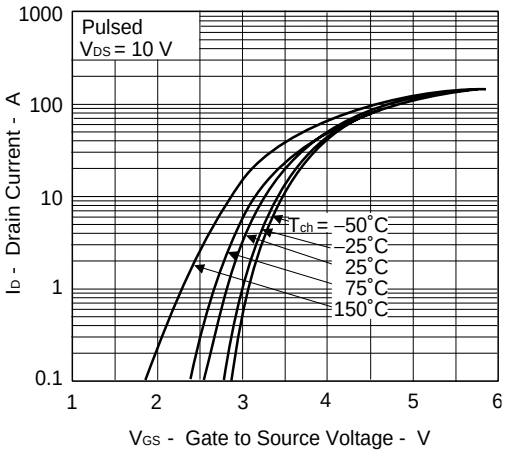


TYPICAL CHARACTERISTICS (T_A = 25°C)

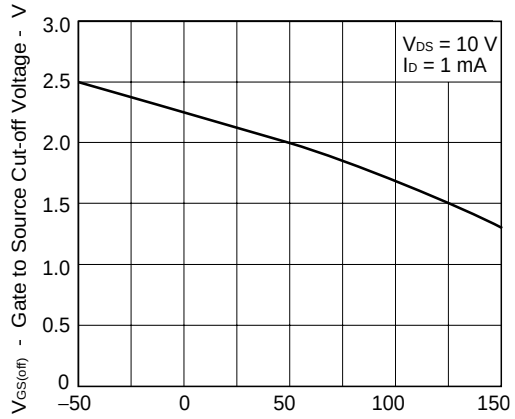
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



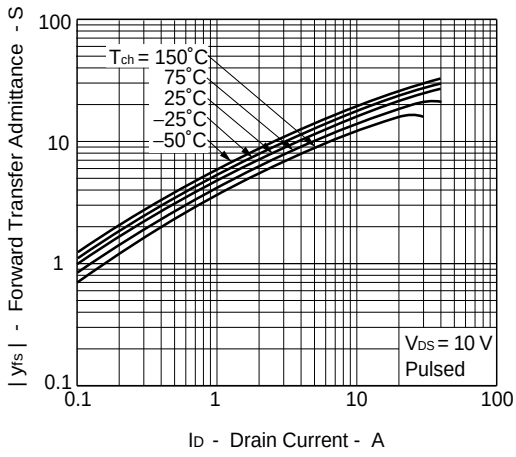
FORWARD TRANSFER CHARACTERISTICS



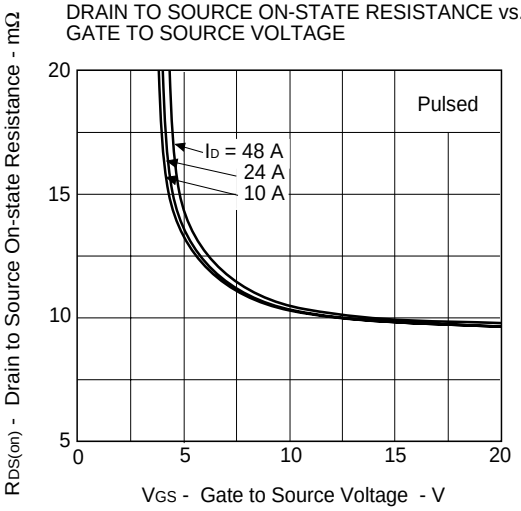
GATE TO SOURCE CUT-OFF VOLTAGE vs.
CHANNEL TEMPERATURE



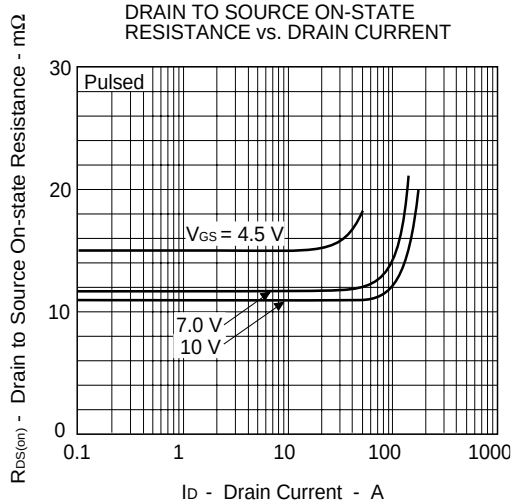
FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



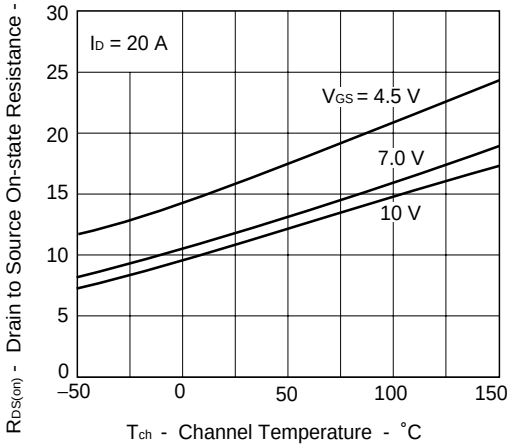
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE



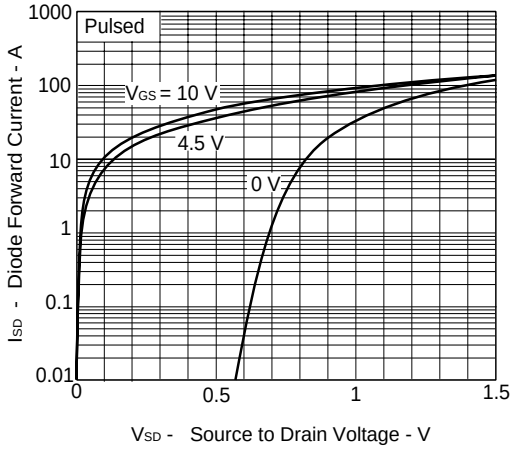
DRAIN TO SOURCE ON-STATE
RESISTANCE vs. DRAIN CURRENT



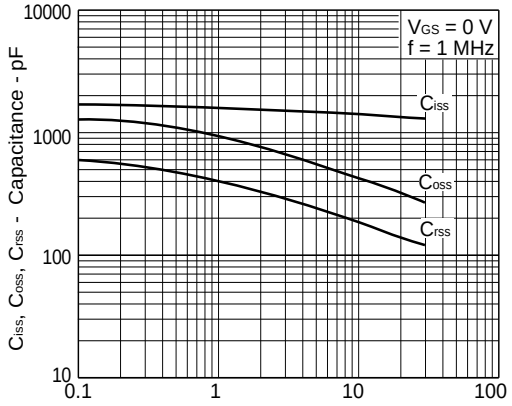
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



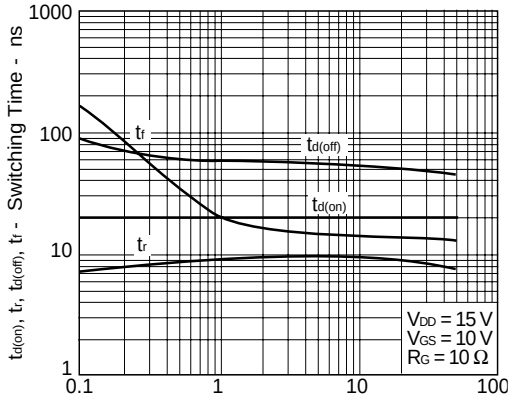
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



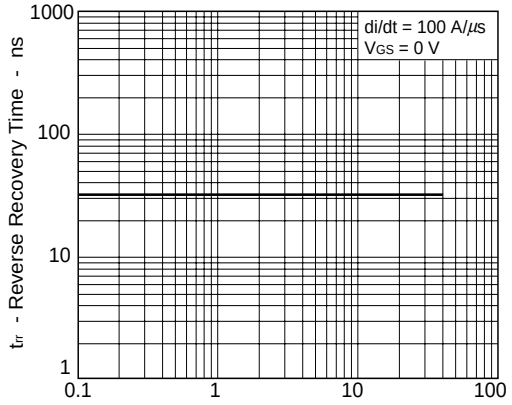
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



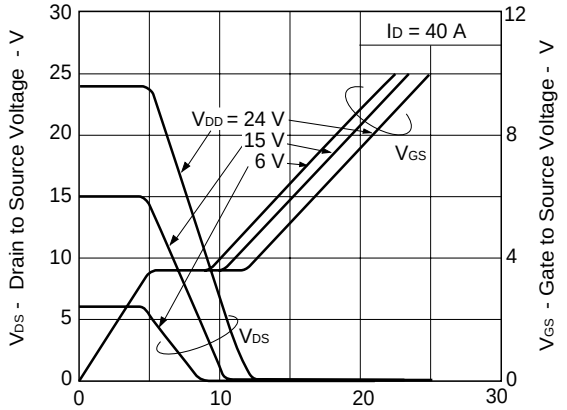
SWITCHING CHARACTERISTICS



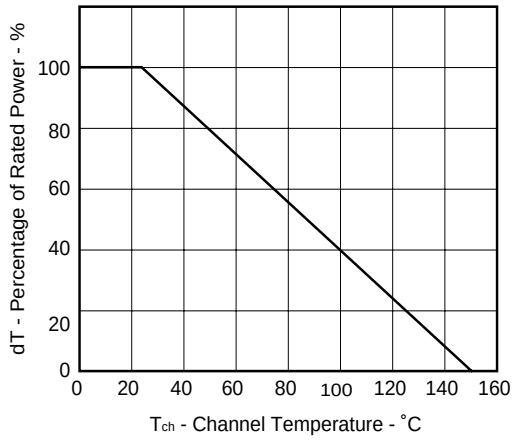
REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT



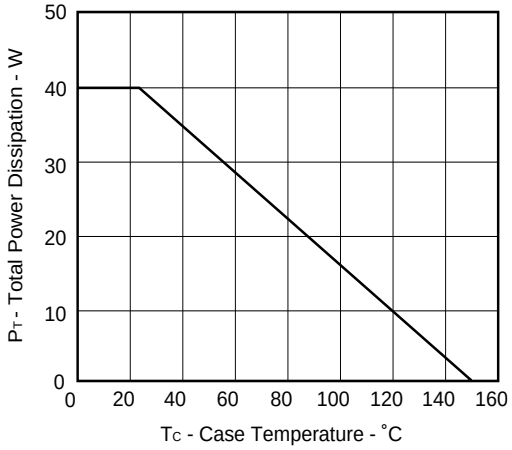
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



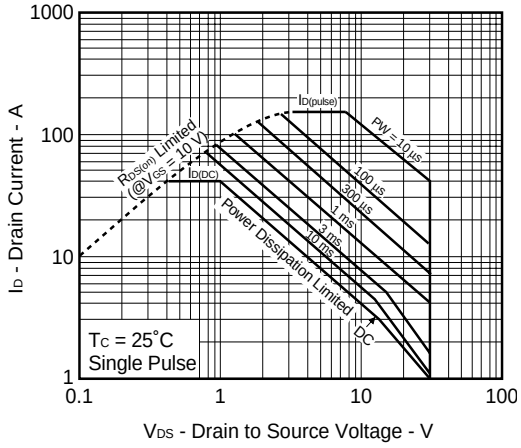
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



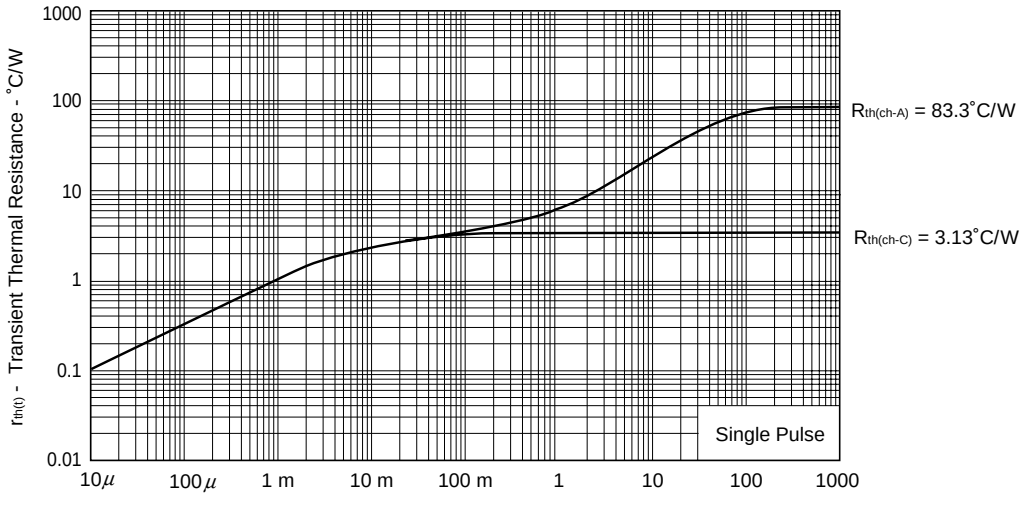
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



★ FORWARD BIAS SAFE OPERATING AREA

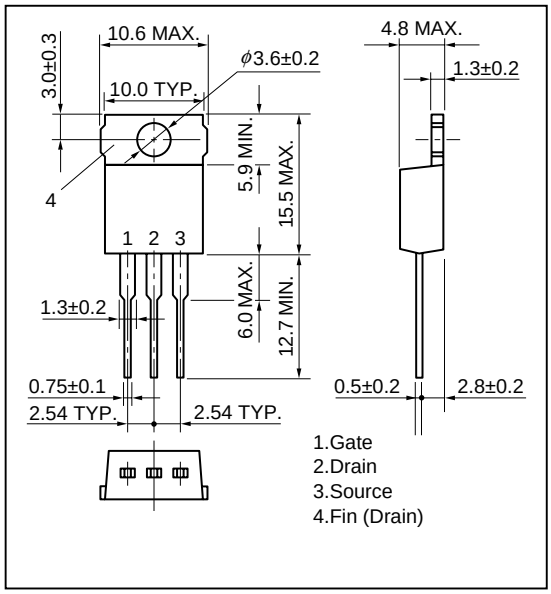


TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

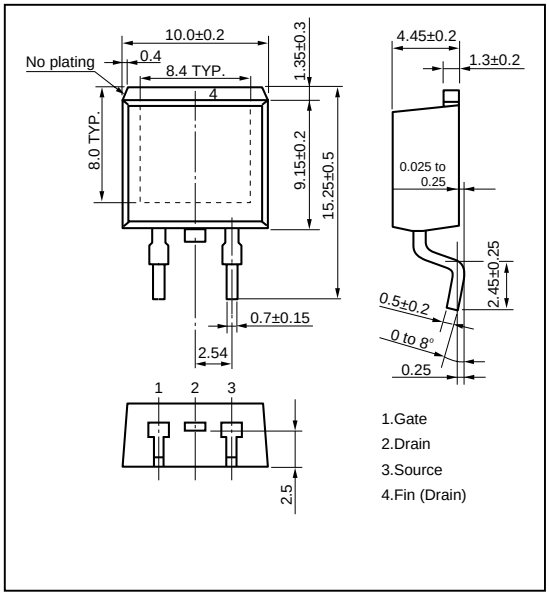


PACKAGE DRAWINGS (Unit : mm)

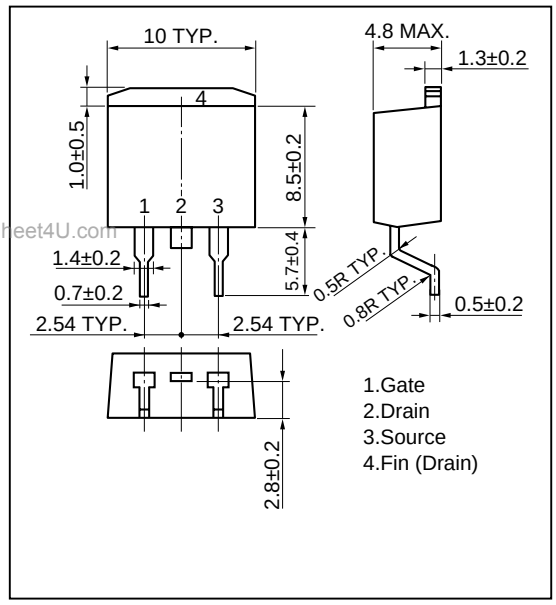
★ **1)TO-220AB (MP-25)**



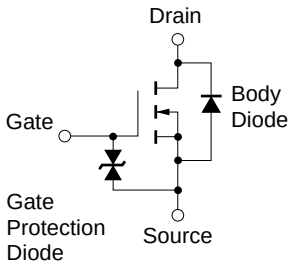
2)TO-263 (MP-25ZK)



★ **3)TO-263 (MP-25ZJ)**



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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