To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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RENESAS

MOS FIELD EFFECT POWER TRANSISTOR

2SK1594

Phase-out/Discontinued

SWITCHING
N-CHANNEL POWER MOS FET
INDUSTRIAL USE

DESCRIPTION

The 2SK1594 is N-channel MOS Field Effect Transistor designed for solenoid, motor and lamp driver.

FEATURES

- Low On-state Resistance
  $R_{DS(on)} \leqq 0.080\ \Omega$ (V_{GS} = 4 V, I_D = 10 A)
  $R_{DS(on)} \leqq 0.045\ \Omega$ (V_{GS} = 10 V, I_D = 10 A)
- Low C_{iss} C_{iss} = 1 200 pF TYP.
- Built-in G-S Gate Protection Diode

QUALITY GRADE

Standard

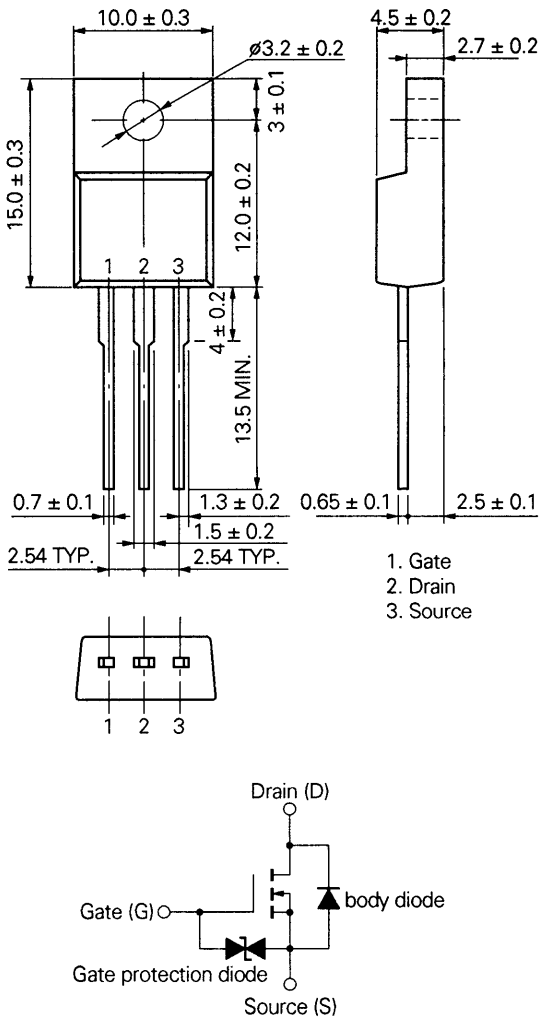
Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

ABSOLUTE MAXIMUM RATINGS (T_a = 25 °C)

Drain to Source Voltage	V_{DSS}	30	V
Gate to Source Voltage	$V_{GSS\ (AC)}$	±20	V
Drain Current (DC)	$I_{D(DC)}$	±20	A
Drain Current (pulse)	$I_{D(pulse)}$*	±80	A
Total Power Dissipation (T_C = 25 °C)	P_{T1}	30	W
Total Power Dissipation (T_a = 25 °C)	P_{T2}	2.0	W
Channel Temperature	T_{ch}	150	°C
Storage Temperature	T_{stg}	−55 to +150	°C

* PW ≦ 10 μs, Duty Cycle ≦ 2 %

PACKAGE DIMENSIONS
(in millimeters)



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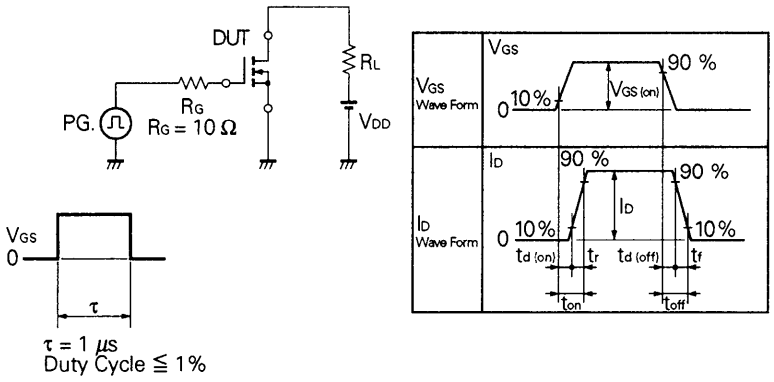
Date Published August 1993 M
Printed in Japan

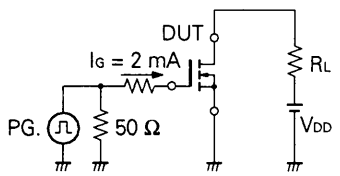
ELECTRICAL CHARACTERISTICS (T_a = 25 °C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Drain to Source On-state Resistance	$R_{DS(on)}$		0.045	0.08	Ω	V_{GS} = 4 V, I_D = 10 A
Drain to Source On-state Resistance	$R_{DS(on)}$		0.03	0.045	Ω	V_{GS} = 10 V, I_D = 10 A
Gate to Source Cutoff Voltage	$V_{GS(off)}$	1.0		2.5	V	V_{DS} = 10 V, I_D = 1 mA
Forward Transfer Admittance	$\|y_{fs}\|$	7			S	V_{DS} = 10 V, I_D = 10 A
Drain Leakage Current	I_{DSS}			10	μA	V_{DS} = 30 V, V_{GS} = 0
Gate to Source Leakage Current	I_{GSS}			±10	μA	V_{GS} = ±20 V, V_{DS} = 0
Input Capacitance	C_{iss}		1 200		pF	V_{DS} = 10 V V_{GS} = 0 f = 1 MHz
Output Capacitance	C_{oss}		750		pF	
Reverse Transfer Capacitance	C_{rss}		280		pF	
Turn-On Delay Time	$t_{d(on)}$		30		ns	$V_{GS(on)}$ = 10 V V_{DD} = 15 V I_D = 10 A, R_G = 10 Ω R_L = 1.5 Ω
Rise Time	t_r		360		ns	
Turn-Off Delay Time	$t_{d(off)}$		190		ns	
Fall Time	t_f		220		ns	
Total Gate Charge	Q_G		35		nC	V_{GS} = 10 V I_D = 20 A V_{DD} = 30 V
Gate to Source Charge	Q_{GS}		4		nC	
Gate to Drain Charge	Q_{GD}		12		nC	
Diode Forward Voltage	V_{SD}		1.0		V	I_F = 20 A, V_{GS} = 0
Reverse Recovery Time	t_{rr}		110		ns	I_F = 20 A, V_{GS} = 0 di/dt = 50 A/μs
Reverse Recovery Charge	Q_{rr}		200		nC	

Test Circuit 1: Switching Time

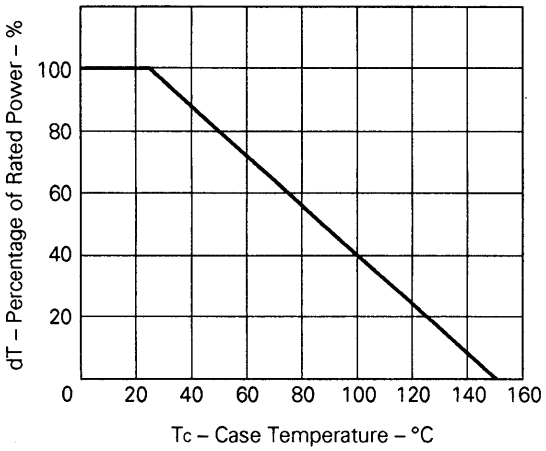


Test Circuit 2: Gate Charge

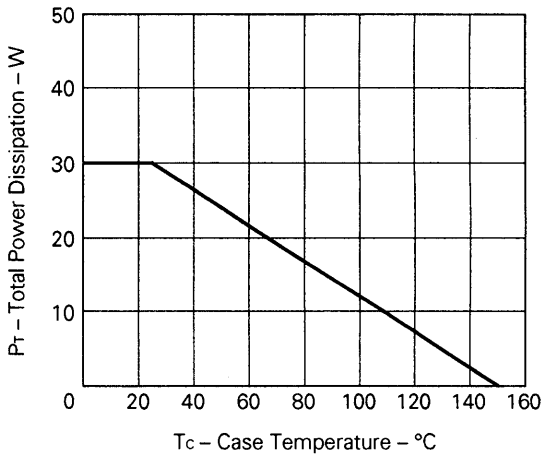


TYPICAL CHARACTERISTICS (T_a = 25 °C)

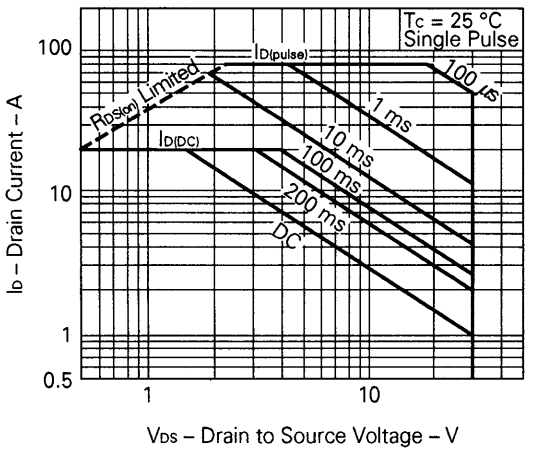
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



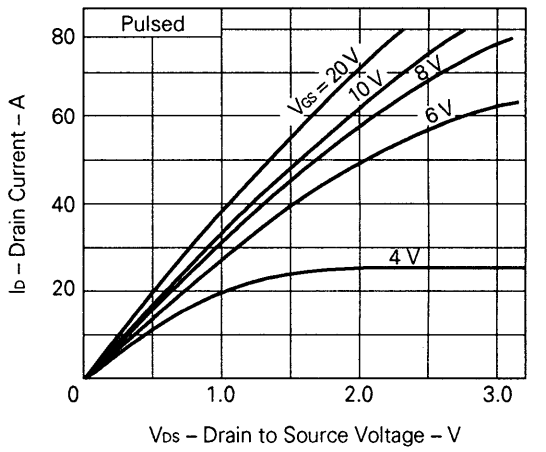
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



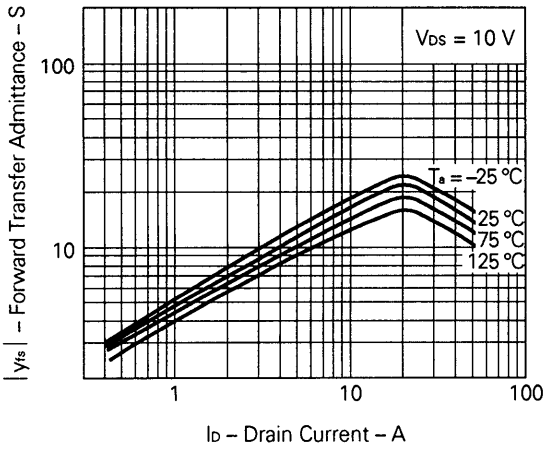
FORWARD BIAS SAFE OPERATING AREA



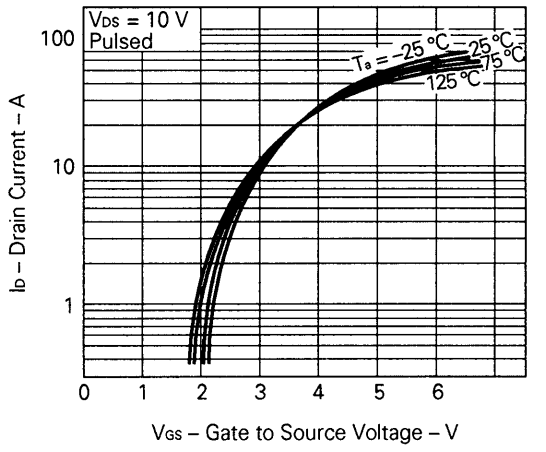
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



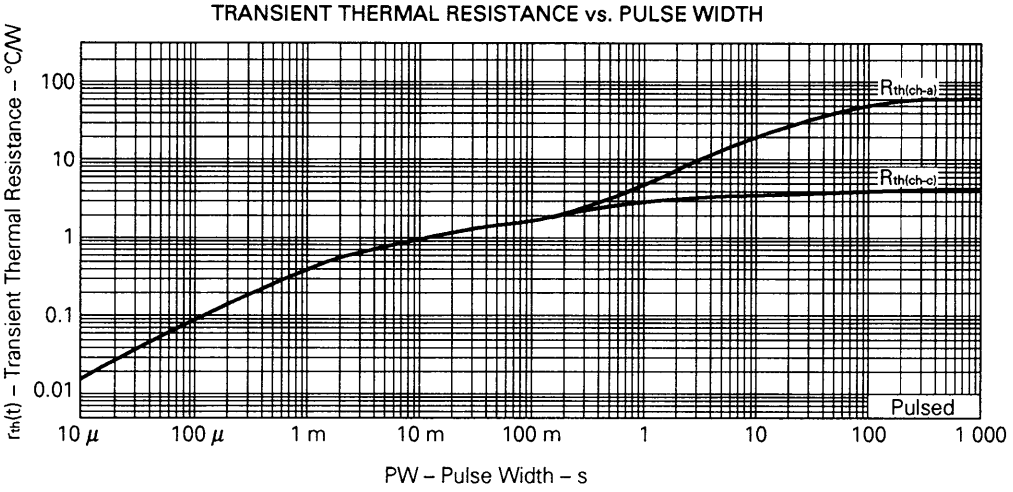
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



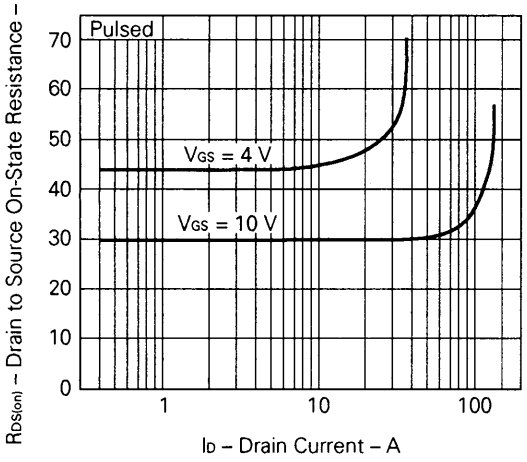
TRANSFER CHARACTERISTICS



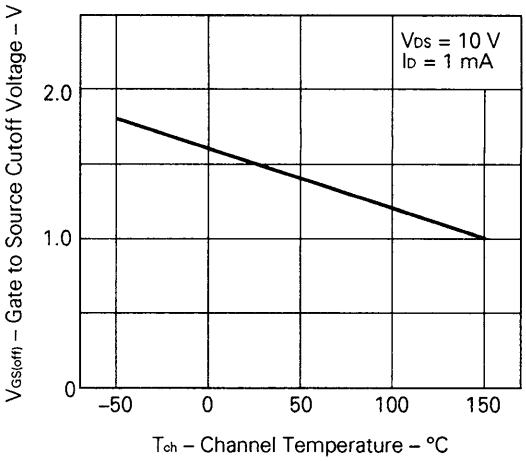
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



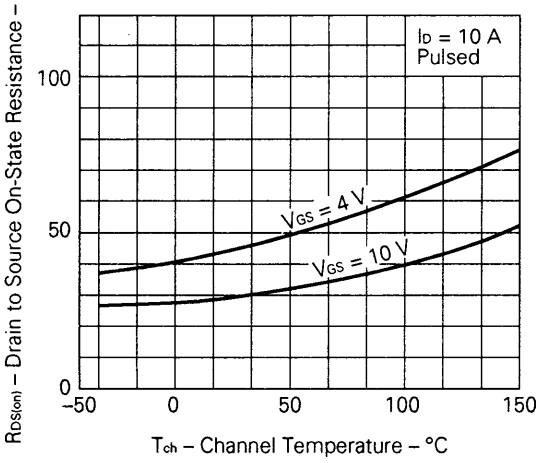
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



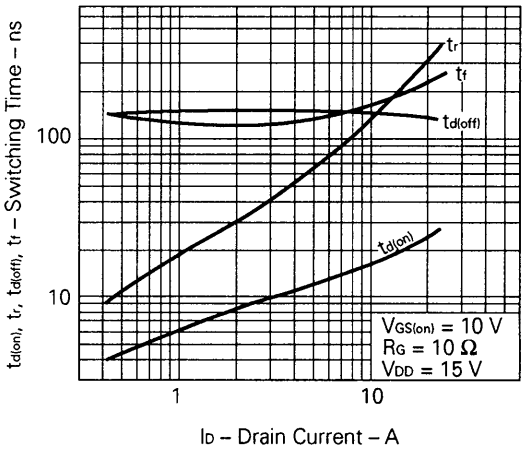
GATE TO SOURCE CUTOFF VOLTAGE vs. CHANNEL TEMPERATURE



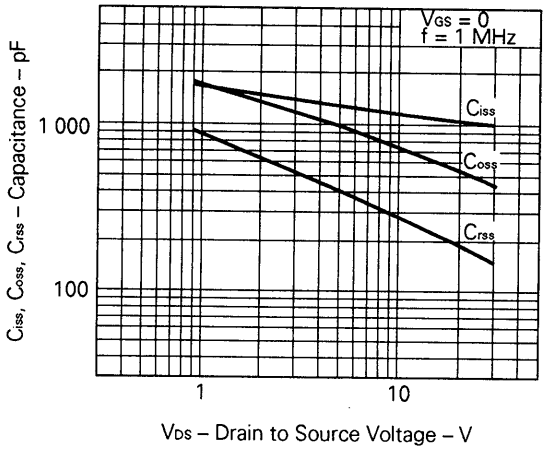
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



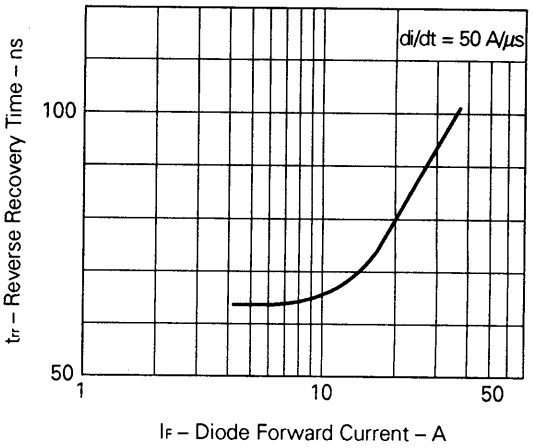
SWITCHING CHARACTERISTICS



CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT



Reference

Application note name	No.
Safe operating area of Power MOS FET.	TEA-1034
Application circuit using Power MOS FET.	TEA-1035
Quality control of NEC semiconductors devices.	TEI-1202
Quality control guide of semiconductors devices.	MEI-1202
Assembly manual of semiconductors devices.	IEI-1207

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