

N0531N

N-channel MOSFET

55 V, 180 A, 1.9 mΩ

R07DS1468EJ0100

Rev.1.00

2019.9.30

Features

- Low on-state resistance : $R_{DS(on)} = 1.9 \text{ m}\Omega$ max. ($V_{GS} = 10 \text{ V}$, $I_D = 90 \text{ A}$)
- Low C_{iss} : $C_{iss} = 13000 \text{ pF}$ typ. ($V_{DS} = 25 \text{ V}$)
- High current : $I_{D(DC)} = \pm 180 \text{ A}$
- RoHS Compliant
- Quality Grade : Standard
- Applications : For high current switching

Ordering Information

Orderable Part Number	Package	Packing
N0531N-S34-AY	TO-247A, Pb-free ^{Note1}	25 pcs / Magazine (Tube)

Note: 1. Pb-free means that this product does not contain lead in the external electrode.

Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$)

Item	Symbol	Ratings	Unit
Drain to Source Voltage ($V_{GS} = 0 \text{ V}$)	V_{DSS}	55	V
Gate to Source Voltage ($V_{DS} = 0 \text{ V}$)	V_{GSS}	± 20	V
Drain Current (DC) ($T_C = 25^\circ\text{C}$)	$I_{D(DC)}$	± 180	A
Drain Current (pulse) ^{Note2}	$I_{D(pulse)}$	± 720	A
Total Power Dissipation ($T_C = 25^\circ\text{C}$)	P_{T1}	250	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	$^\circ\text{C}$
Single Avalanche Current ^{Note3}	I_{AS}	66	A
Single Avalanche Energy ^{Note3}	E_{AS}	435	mJ

Note: Continuous heavy condition (e.g. high temperature/voltage/current or high variation of temperature) may affect a reliability even if it is within the absolute maximum ratings. Please consider derating condition for appropriate reliability in reference Renesas Semiconductor Reliability Handbook (Recommendation for Handling and Usage of Semiconductor Devices) and individual reliability data.

Notes: 2. $PW \leq 10 \mu\text{s}$, Duty Cycle $\leq 1\%$

3. Starting $T_{ch} = 25^\circ\text{C}$, $V_{DD} = 28 \text{ V}$, $R_G = 25 \Omega$, $V_{GS} = 20 \rightarrow 0 \text{ V}$, $L = 100 \mu\text{H}$

Thermal Resistance

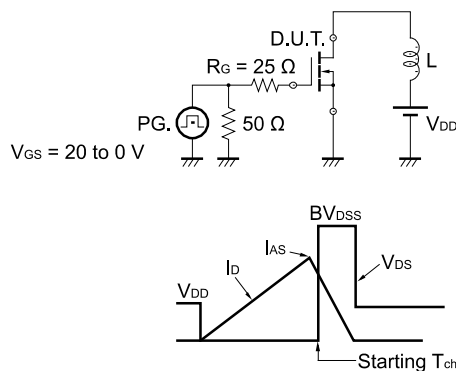
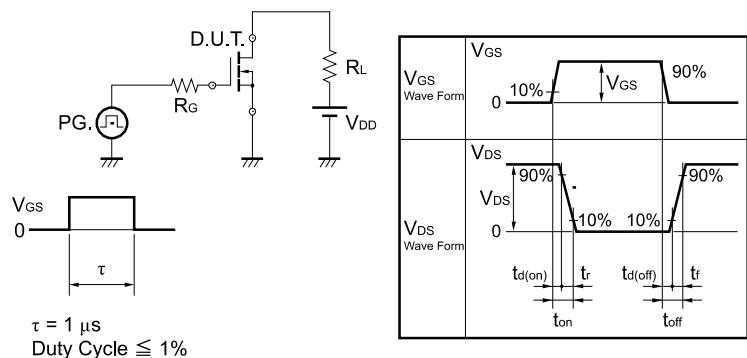
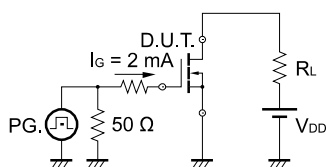
Item	Symbol	Max. Value ^{Note4}	Unit
Channel to Case Thermal Resistance	$R_{th(ch-C)}$	0.5	$^\circ\text{C/W}$
Channel to Ambient Thermal Resistance	$R_{th(ch-A)}$	41.7	$^\circ\text{C/W}$

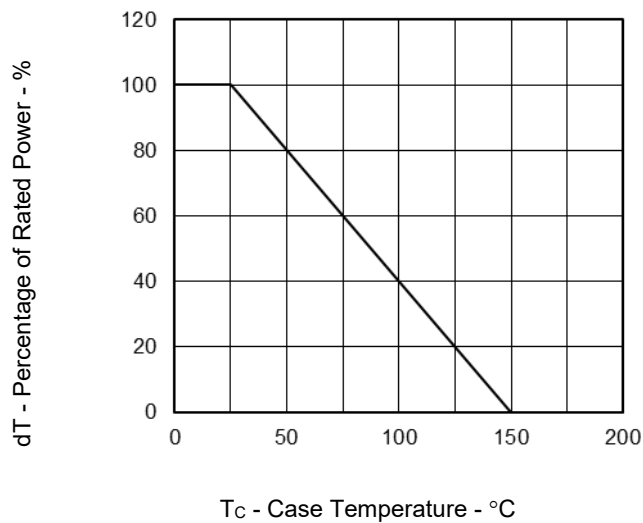
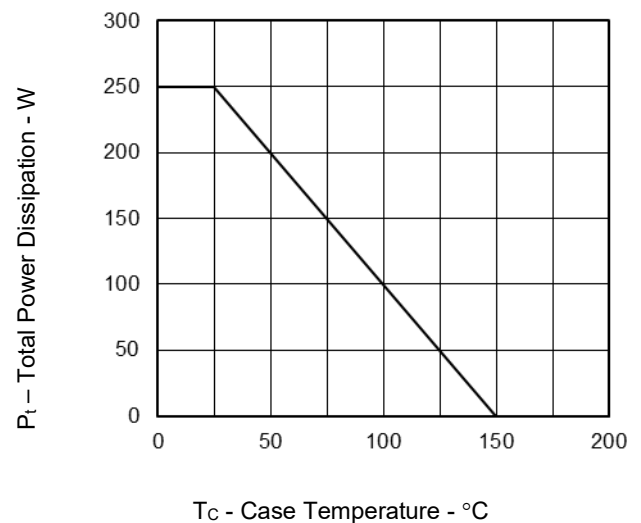
Notes: 4. This data is the designed target maximum value on Renesas's measurement condition. (Not tested)

Electrical Characteristics (T_A = 25°C)

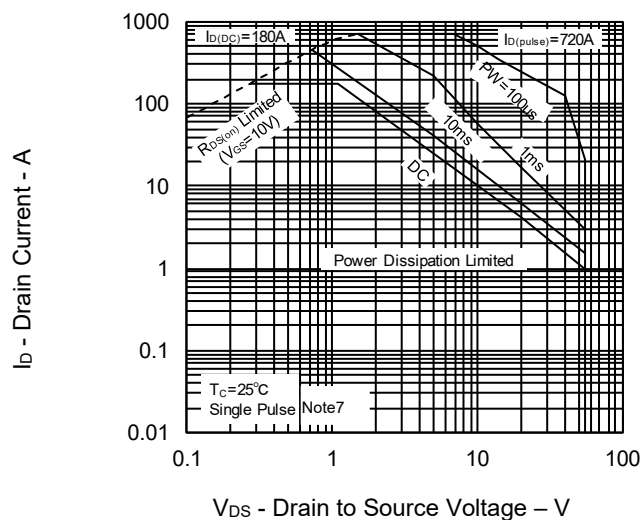
Item	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Zero Gate Voltage Drain Current	I _{DSS}			1	μA	V _{DS} = 55 V, V _{GS} = 0 V
Gate Leakage Current	I _{GSS}			±100	nA	V _{GS} = ± 20 V, V _{DS} = 0 V
Gate to Source Cut-off Voltage	V _{GS(off)}	2.0		4.0	V	V _{DS} = 10 V, I _D = 1 mA
Forward Transfer Admittance ^{Note5}	y _{fs}		154		S	V _{DS} = 5 V, I _D = 55 A
Drain to Source On-state Resistance ^{Note5}	R _{DS(on)}		1.5	1.9	mΩ	V _{GS} = 10 V, I _D = 90 A
Input Capacitance	C _{iss}		13000		pF	V _{DS} = 25 V V _{GS} = 0 V f = 1 MHz
Output Capacitance	C _{oss}		1200		pF	
Reverse Transfer Capacitance	C _{rss}		400		pF	
Turn-on Delay Time	t _{d(on)}		40		ns	V _{DD} = 28 V, I _D = 55 A V _{GS} = 10 V R _G = 0 Ω
Rise Time	t _r		14		ns	
Turn-off Delay Time	t _{d(off)}		160		ns	
Fall Time	t _f		13		ns	
Total Gate Charge	Q _G		220		nC	V _{DD} = 44 V V _{GS} = 10 V I _D = 180 A
Gate to Source Charge	Q _{GS}		50		nC	
Gate to Drain Charge	Q _{GD}		55		nC	
Body Diode Forward Voltage ^{Note5}	V _{F(S-D)}			1.5	V	I _F = 180 A, V _{GS} = 0 V
Reverse Recovery Time	t _{rr}		76		ns	I _F = 90 A, V _{GS} = 0 V di/dt = 100 A/μs
Reverse Recovery Charge	Q _{rr}		96		nC	

Notes: 5. Pulsed test

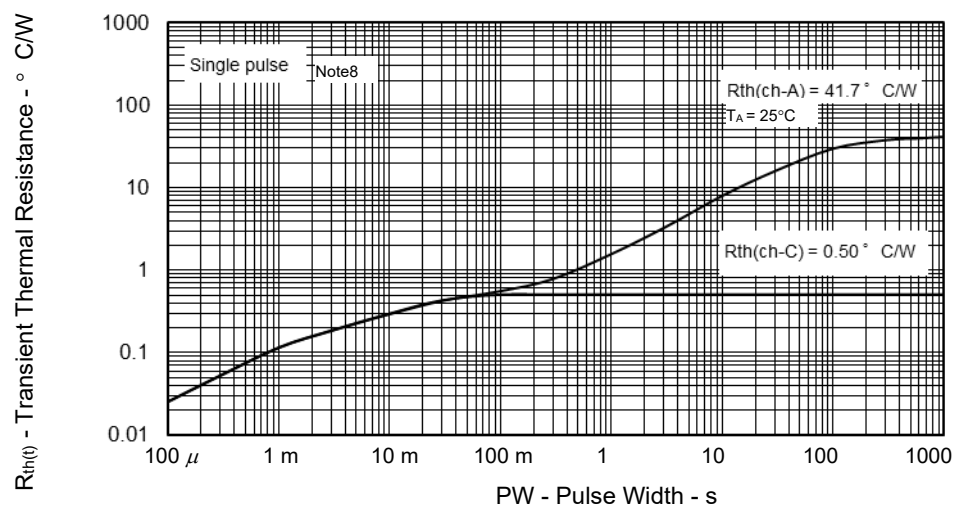
TEST CIRCUIT 1 AVALANCHE CAPABILITY

TEST CIRCUIT 2 SWITCHING TIME

TEST CIRCUIT 3 GATE CHARGE


Typical Characteristics Note6DERATING FACTOR OF FORWARD BIAS
SAFE OPERATING AREATOTAL POWER DISSIPATION vs.
CASE TEMPERATURE

FORWARD BIAS SAFE OPERATING AREA



TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

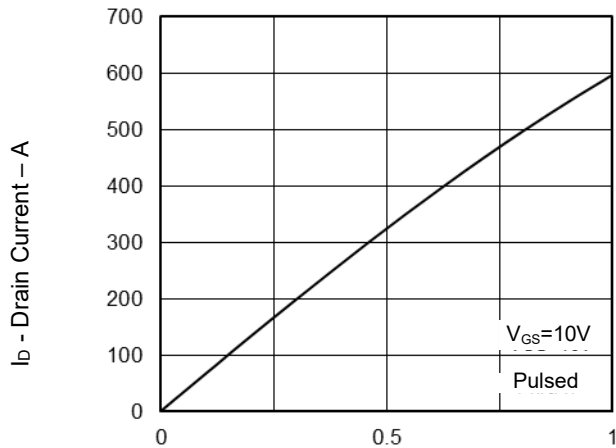


Notes: 6. Designed target value on Renesas measurement condition. ($T_C = 25^\circ C$, unless otherwise specified)

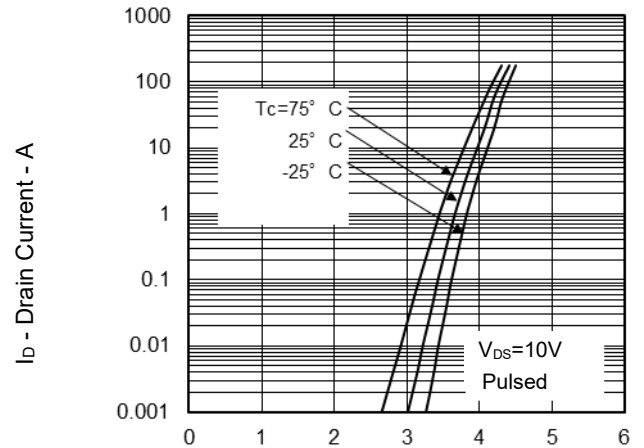
7. This data is the designed value on Renesas's measurement condition. Renesas recommends that operating conditions are designed according to a document "Power MOSFET/IGBT Attention of Handling Semiconductor Devices (R07ZZ0010)".

8. This data is the designed target maximum value on Renesas's measurement condition.

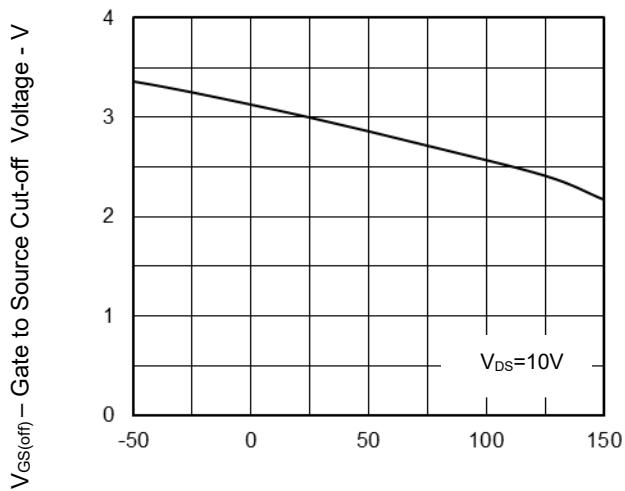
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



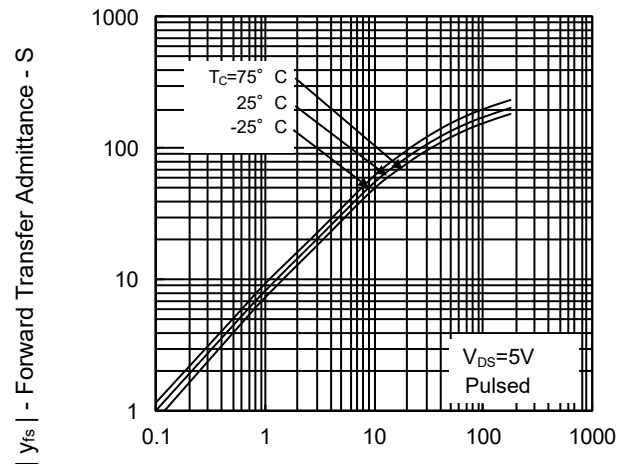
FORWARD TRANSFER CHARACTERISTICS



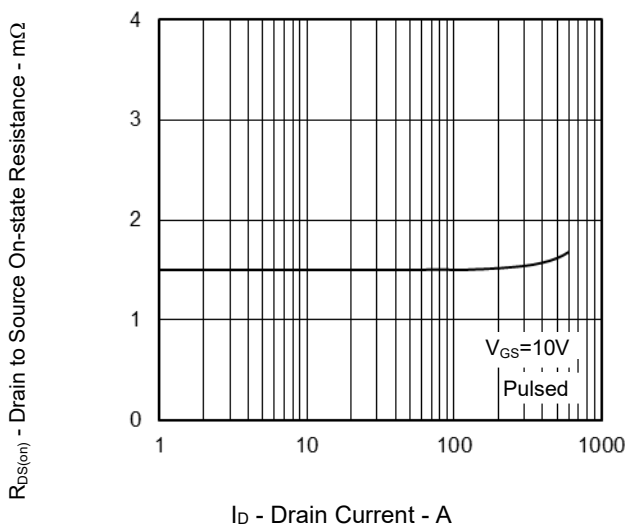
GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



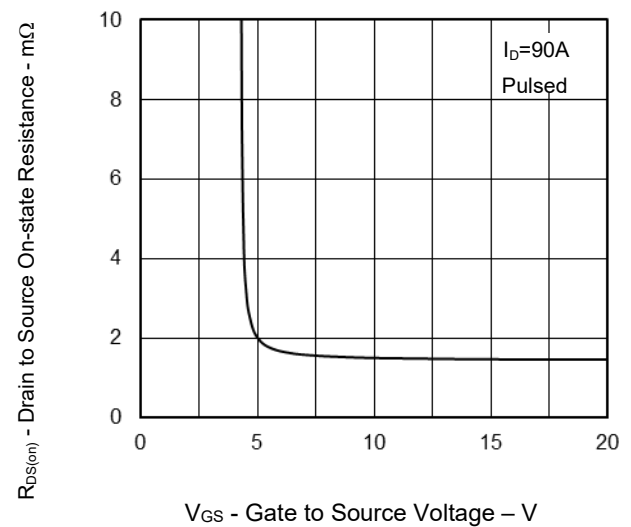
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT

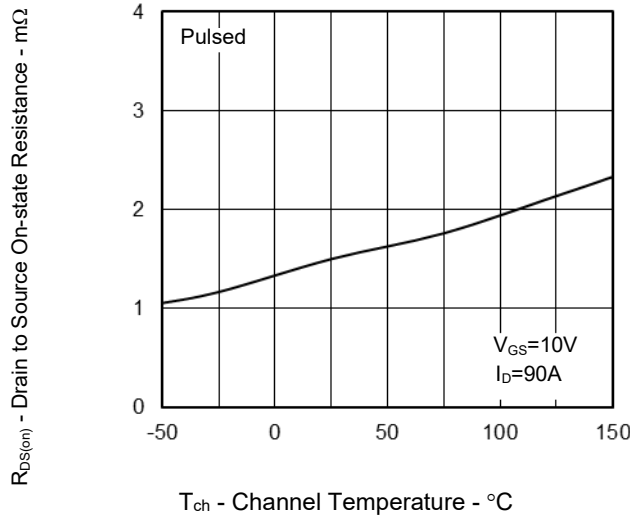
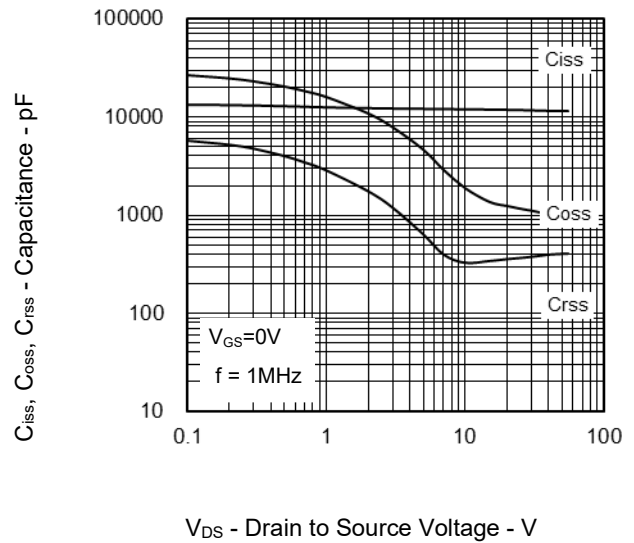


DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT

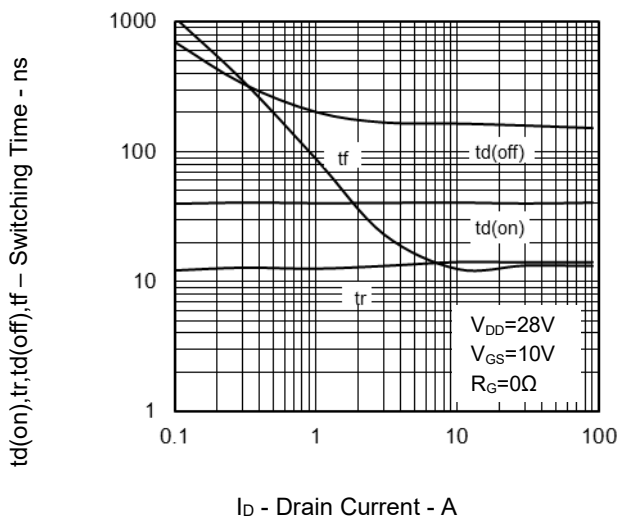


DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

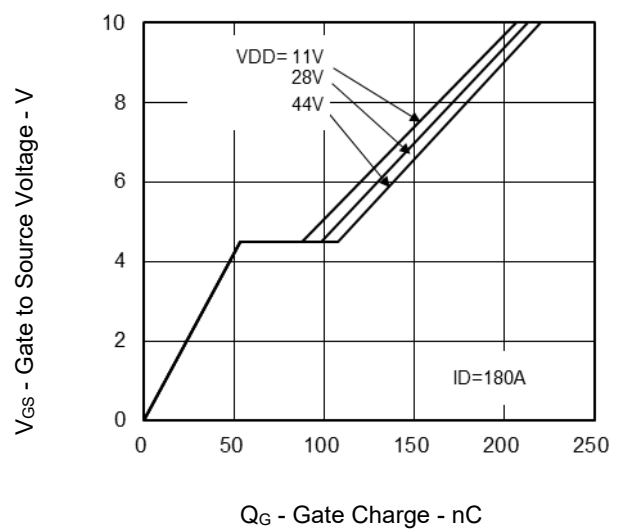
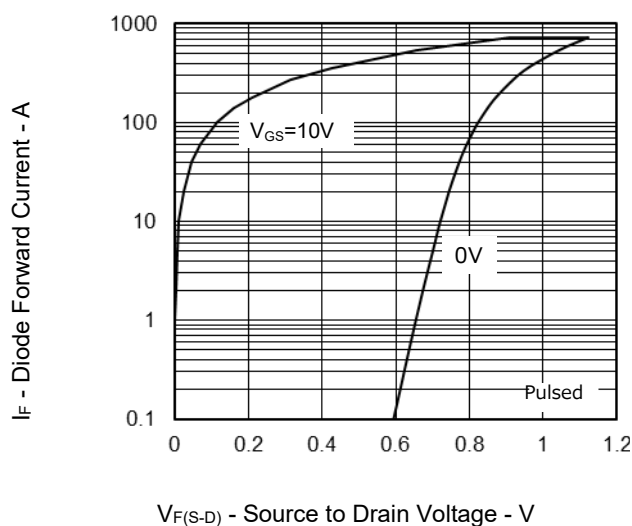
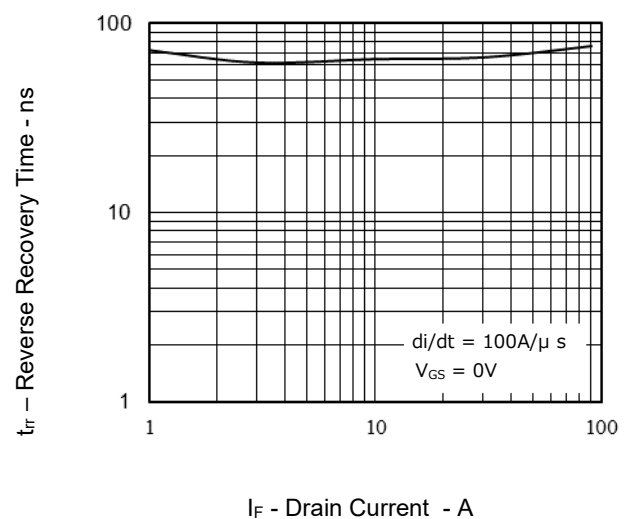


DRAIN TO SOURCE ON-STATE RESISTANCE
vs. CHANNEL TEMPERATURECAPACITANCE vs. DRAIN TO SOURCE
VOLTAGE

SWITCHING CHARACTERISTICS



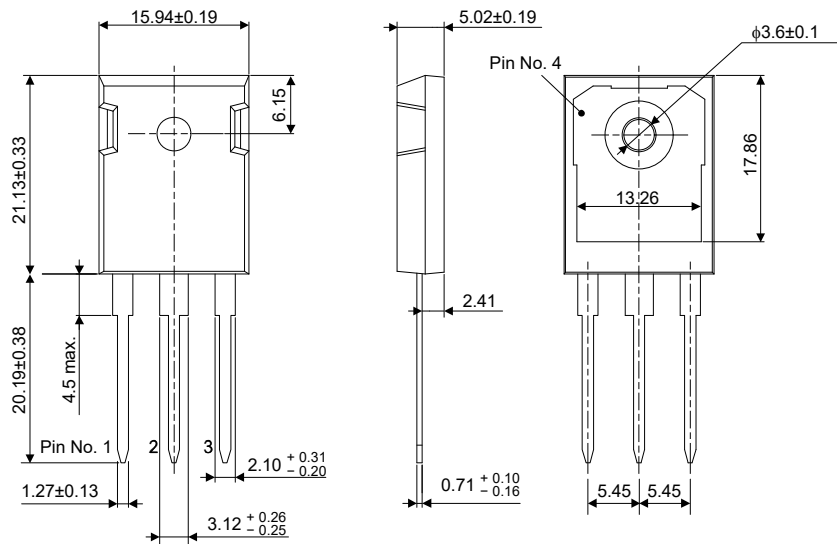
DYNAMIC INPUT CHARACTERISTICS

SOURCE TO DRAIN DIODE FORWARD
VOLTAGEREVERSE RECOVERY TIME vs.
DRAIN CURRENT

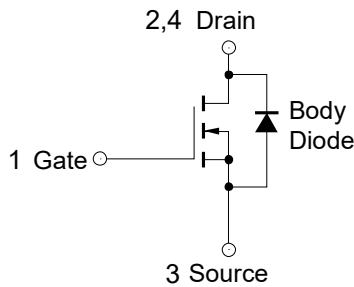
Package Drawings (Unit: mm)

JEDEC Package Code	RENESAS Code	Previous Code	MASS (Typ) [g]
TO-247A	PRSS0003ZH-A	—	6.14

Unit: mm



Equivalent Circuit



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Renesas Electronics America Inc.
1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.
Tel: +1-408-432-8888, Fax: +1-408-434-5351

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 101-T01, Floor 1, Building 7, Yard No. 7, 8th Street, Shangdi, Haidian District, Beijing 100085, China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai 200333, China
Tel: +86-21-2226-0888, Fax: +86-21-2226-0599

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852-2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886-2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #03-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit No 3A-1 Level 3A Tower 8 UOA Business Park, No 1 Jalan Pengaturcara U1/51A, Seksyen U1, 40150 Shah Alam, Selangor, Malaysia
Tel: +60-3-5022-1298, Fax: +60-3-5022-1290

Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India
Tel: +91-80-67208700

Renesas Electronics Korea Co., Ltd.
17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5338

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