

# N0609N

N-channel MOSFET

60 V, 120 A, 3.0 mΩ

R07DS1294EJ0100

Rev.1.00

2019.9.30

## Features

- Low on-state resistance :  $R_{DS(on)} = 3.0 \text{ m}\Omega$  max. (  $V_{GS} = 10 \text{ V}$ ,  $I_D = 60 \text{ A}$  )
- Low  $C_{iss}$  :  $C_{iss} = 11300 \text{ pF}$  typ. (  $V_{DS} = 25 \text{ V}$  )
- High current :  $I_{D(DC)} = \pm 120 \text{ A}$
- RoHS Compliant
- Quality Grade : Standard
- Applications : For high current switching

## Ordering Information

Orderable Part Number	Package	Packing
N0609N-S19-AY	TO-220AB, Pb-free <sup>Note1</sup>	50 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 ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	60	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 20$	V
Drain Current (DC) ( $T_C = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 120$	A
Drain Current (pulse) <sup>Note2</sup>	$I_{D(pulse)}$	$\pm 480$	A
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_{T1}$	282	W
Total Power Dissipation ( $T_A = 25^\circ\text{C}$ )	$P_{T2}$	1.8	W
Channel Temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to 150	$^\circ\text{C}$
Single Avalanche Current <sup>Note3</sup>	$I_{AS}$	65	A
Single Avalanche Energy <sup>Note3</sup>	$E_{AS}$	420	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  $T_{ch} = 25^\circ\text{C}$ ,  $V_{DD} = 30 \text{ V}$ ,  $R_G = 25 \Omega$ ,  $V_{GS} = 20 \rightarrow 0 \text{ V}$ ,  $L = 100 \mu\text{H}$

## Thermal Resistance

Item	Symbol	Max. Value <sup>Note4</sup>	Unit
Channel to Case Thermal Resistance	$R_{th(ch-C)}$	0.44	$^\circ\text{C/W}$
Channel to Ambient Thermal Resistance	$R_{th(ch-A)}$	69.3	$^\circ\text{C/W}$

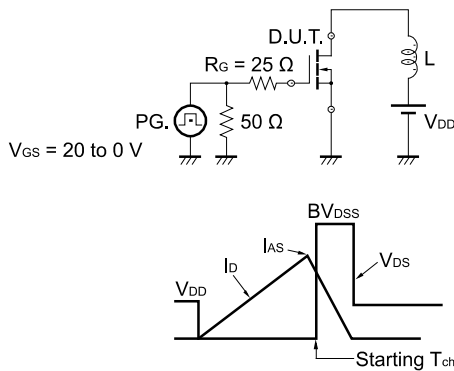
Notes: 4. This data is the designed target maximum value on Renesas's measurement condition. (Not tested)

Electrical Characteristics (T<sub>A</sub> = 25°C)

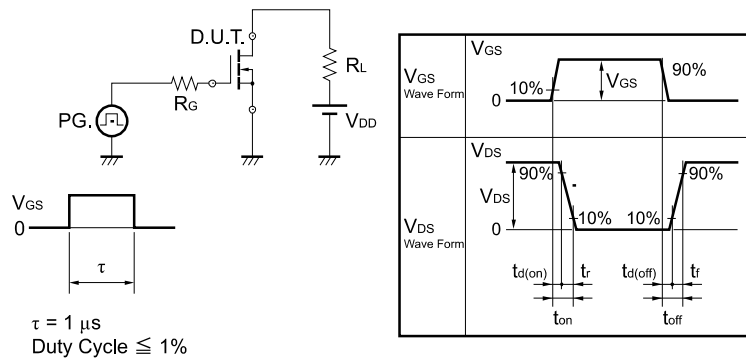
Item	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Zero Gate Voltage Drain Current	I <sub>DSS</sub>			1	μA	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V
Gate Leakage Current	I <sub>GSS</sub>			±100	nA	V <sub>GS</sub> = ± 20 V, V <sub>DS</sub> = 0 V
Gate to Source Cut-off Voltage	V <sub>GS(off)</sub>	2.0		4.0	V	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA
Forward Transfer Admittance <sup>Note5</sup>	y <sub>fs</sub>		78		S	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 60 A
Drain to Source On-state Resistance <sup>Note5</sup>	R <sub>DS(on)</sub>		2.5	3.0	mΩ	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 60 A
Input Capacitance	C <sub>iss</sub>		11300		pF	V <sub>DS</sub> = 25 V V <sub>GS</sub> = 0 V f = 1 MHz
Output Capacitance	C <sub>oss</sub>		800		pF	
Reverse Transfer Capacitance	C <sub>rss</sub>		480		pF	
Turn-on Delay Time	t <sub>d(on)</sub>		40		ns	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 60 A V <sub>GS</sub> = 10 V R <sub>G</sub> = 0 Ω
Rise Time	t <sub>r</sub>		15		ns	
Turn-off Delay Time	t <sub>d(off)</sub>		140		ns	
Fall Time	t <sub>f</sub>		16		ns	
Total Gate Charge	Q <sub>G</sub>		210		nC	V <sub>DD</sub> = 48 V V <sub>GS</sub> = 10 V I <sub>D</sub> = 120 A
Gate to Source Charge	Q <sub>GS</sub>		45		nC	
Gate to Drain Charge	Q <sub>GD</sub>		70		nC	
Body Diode Forward Voltage <sup>Note5</sup>	V <sub>F(S-D)</sub>			1.5	V	I <sub>F</sub> = 120 A, V <sub>GS</sub> = 0 V
Reverse Recovery Time	t <sub>rr</sub>		53		ns	I <sub>F</sub> = 90 A, V <sub>GS</sub> = 0 V di/dt = 100 A/μs
Reverse Recovery Charge	Q <sub>rr</sub>		47		nC	

Notes: 5. Pulsed test

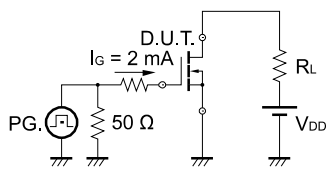
TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME

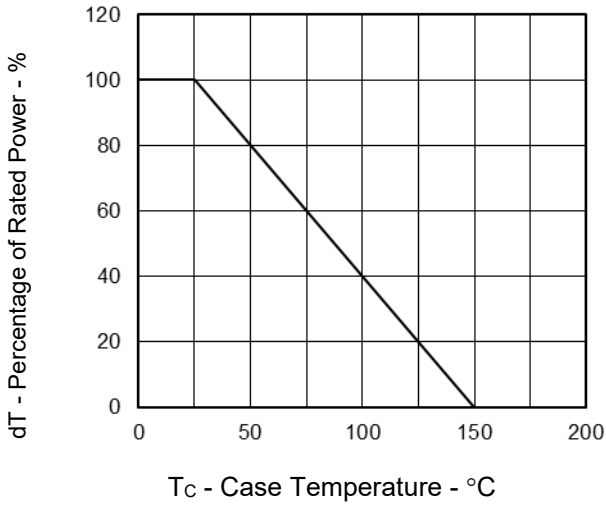


TEST CIRCUIT 3 GATE CHARGE

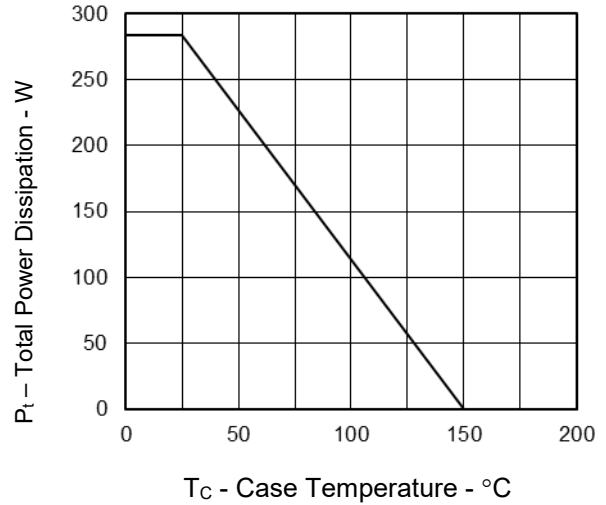


Typical Characteristics Note6

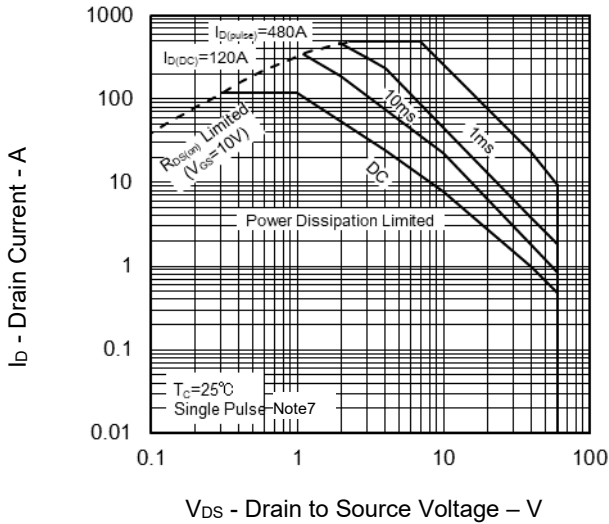
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



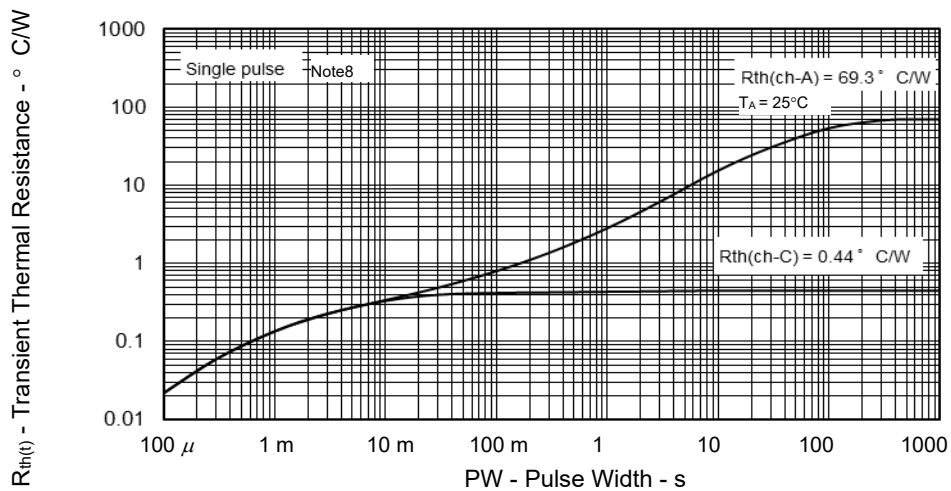
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



FORWARD BIAS SAFE OPERATING AREA

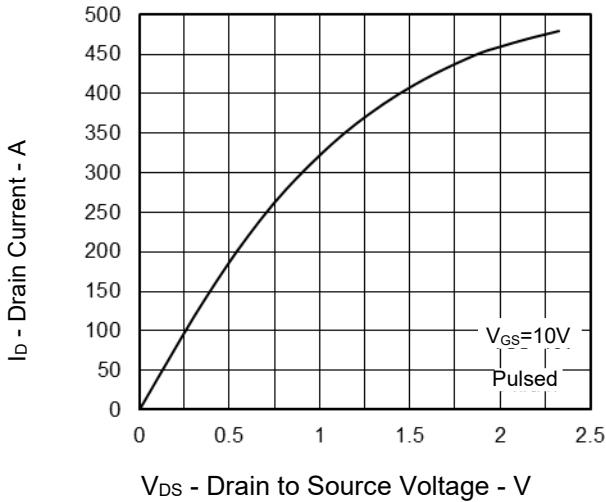


TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

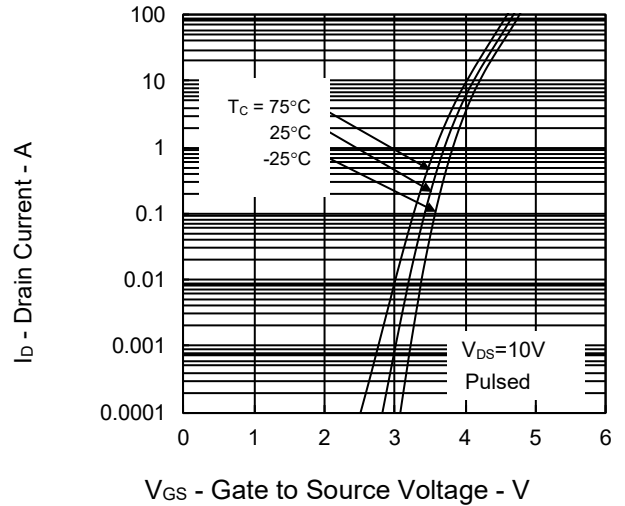


- Notes: 6. Designed target value on Renesas measurement condition. (T<sub>c</sub> = 25°C, unless otherwise specified)  
 7. This data is the designed value on Renesas's measurement condition. Renesas recommends that operating conditions are designed according to a document "Power MOSFET/IGBT Attention of Handling Semiconductor Devices (R07ZZ0010)".  
 8. This data is the designed target maximum value on Renesas's measurement condition.

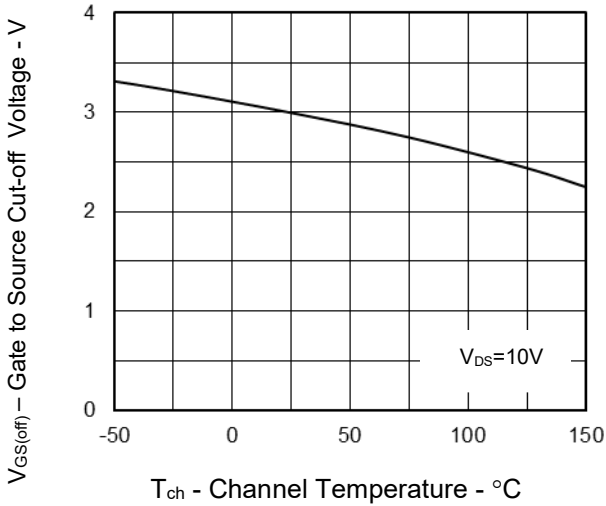
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



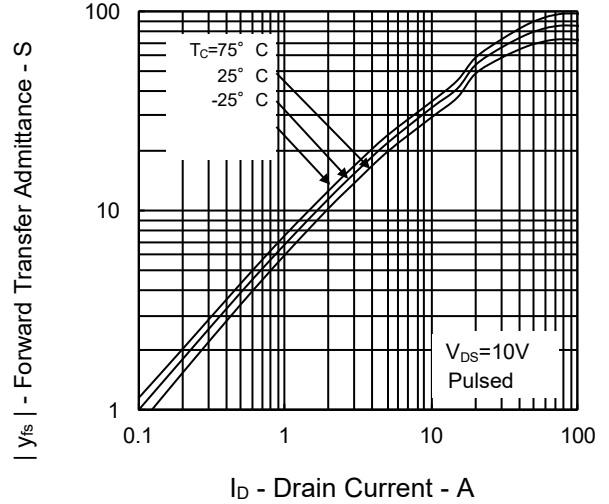
FORWARD TRANSFER CHARACTERISTICS



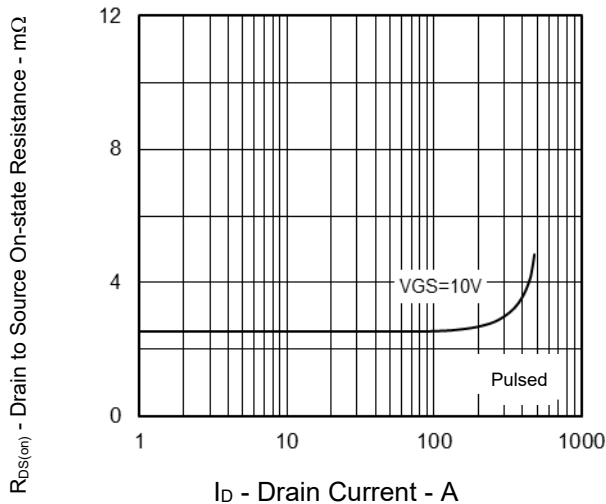
GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



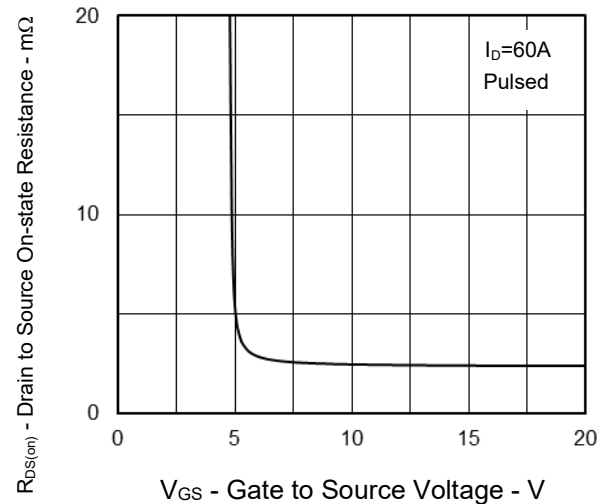
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT

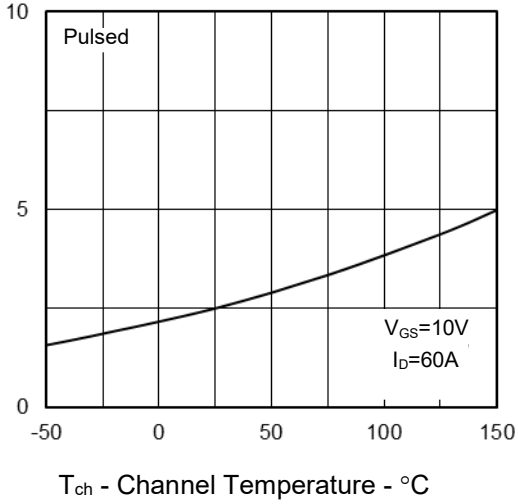


DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



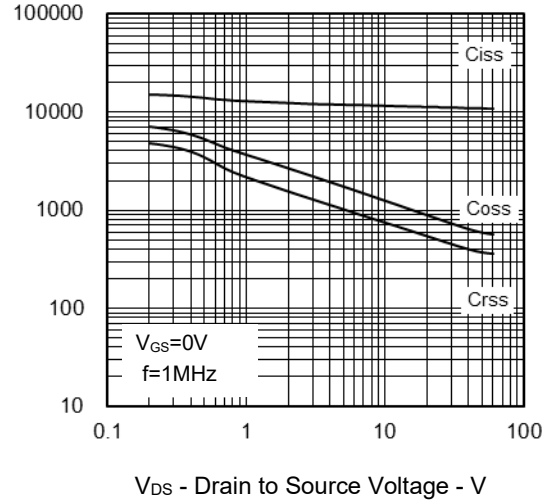
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE

$R_{DS(on)}$  - Drain to Source On-state Resistance - m $\Omega$



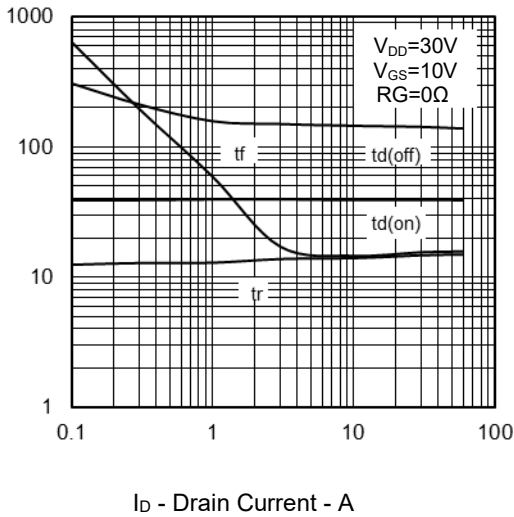
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE

$C_{iss}$ ,  $C_{oss}$ ,  $C_{rss}$  - Capacitance - pF



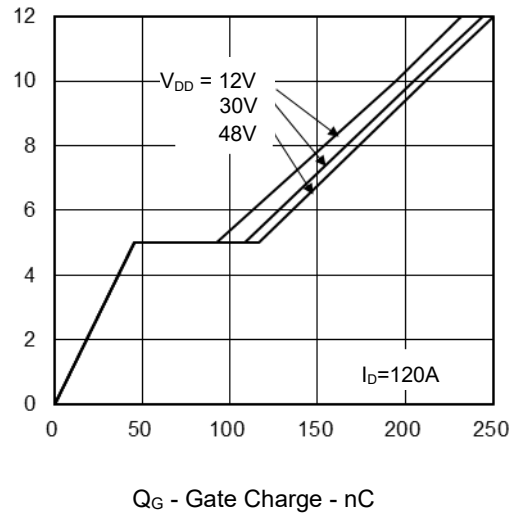
SWITCHING CHARACTERISTICS

$t_d(on)$ ,  $t_r$ ,  $t_d(off)$ ,  $t_f$  - Switching Time - ns



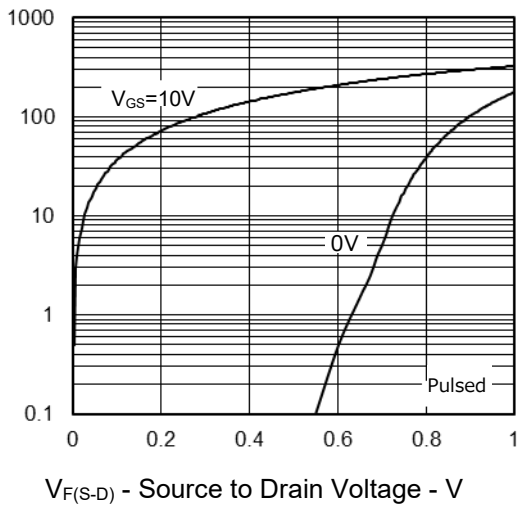
DYNAMIC INPUT CHARACTERISTICS

$V_{GS}$  - Gate to Source Voltage - V



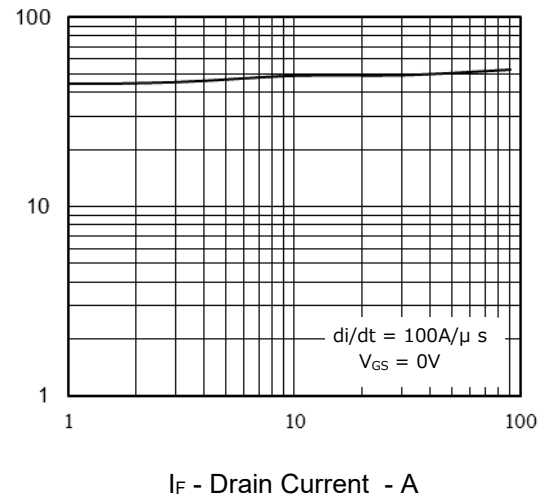
SOURCE TO DRAIN DIODE FORWARD VOLTAGE

$I_F$  - Diode Forward Current - A



REVERSE RECOVERY TIME vs. DRAIN CURRENT

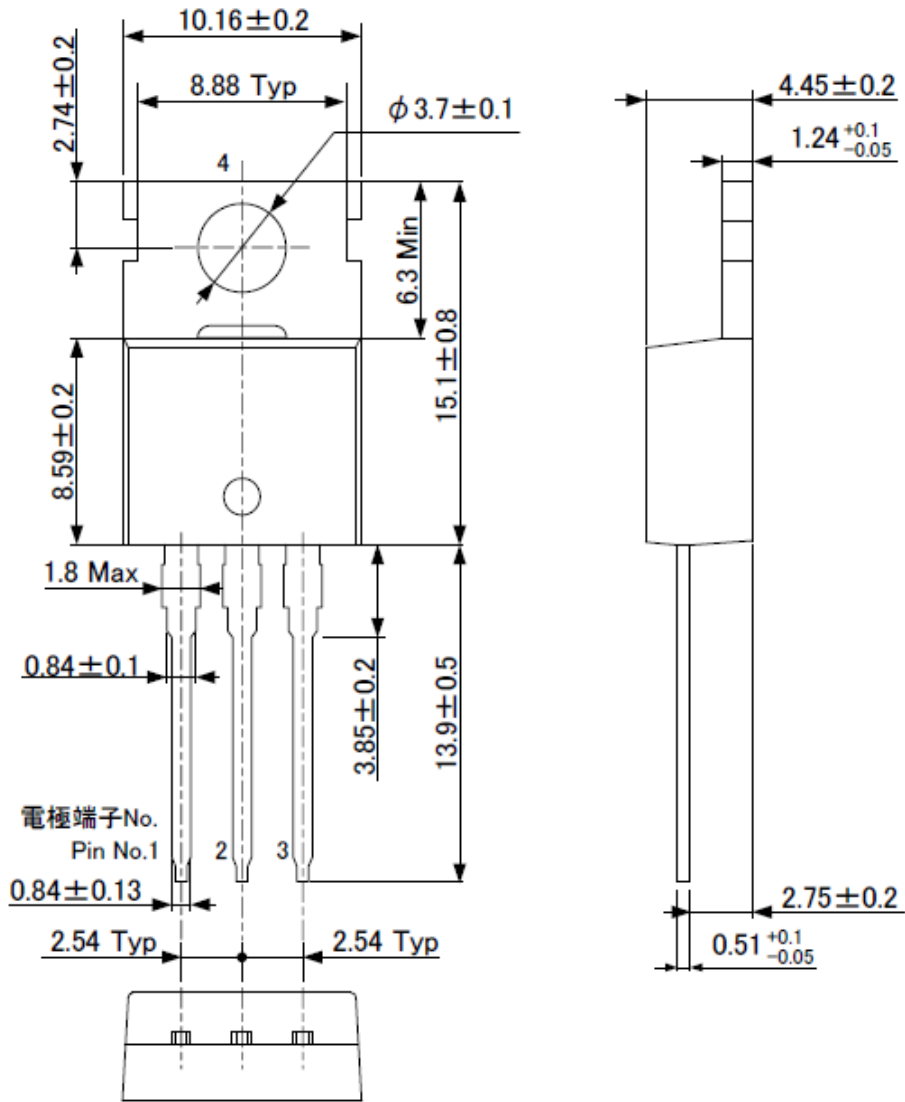
$t_{rr}$  - Reverse Recovery Time - ns



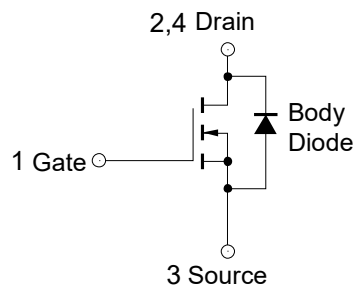
Package Drawings (Unit: mm)

JEDEC Package Code	RENESAS Code	Previous Code	MASS (Typ) [g]
TO-220AB	PRSS0004AU-A	TO-220ABB	2.1

Unit: mm



Equivalent Circuit



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(Rev.4.0-1 November 2017)



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