RJF0619JPE

60V, 30A Silicon N Channel Thermal FET
Power Switching

R07DS1072EJ0100
Rev.1.00
May 22, 2013

Description

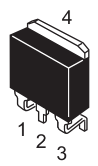
This FET has the over temperature shut-down capability sensing to the junction temperature. This FET has the built-in over temperature shut-down circuit in the gate area. And this circuit operation to shut-down the gate voltage in case of high junction temperature like applying over power consumption, over current etc..

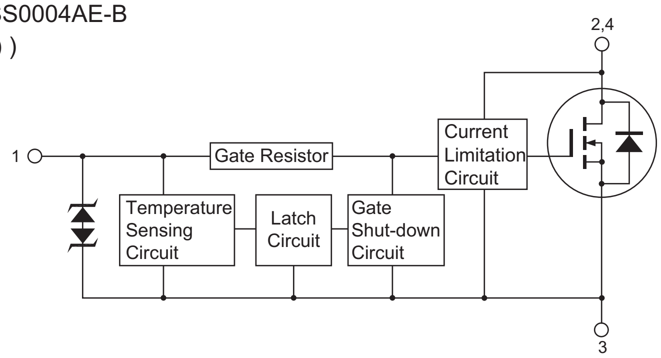
Features

- Logic level operation (4 V Gate drive).
- Built-in the over temperature shut-down circuit.
- High endurance capability against to the short circuit.
- Latch type shut down operation (need 0 voltage recovery).
- Built-in the current limitation circuit.
- Power supply voltage applies 12 V and 24 V.
- AEC-Q101 Compliant
- High endurance capability against to ESD.

Outline

RENESAS Package code: PRSS0004AE-B
(Package name: LDPAK (S)-(1))





1. Gate
2. Drain
3. Source
4. Drain

Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSS}	60	V
Gate to source voltage	V_{GSS}	16	V
Gate to source voltage	V_{GSS}	–2.5	V
Drain current	I_D Note3	30	A
Body-drain diode reverse drain current	I_{DR}	30	A
Avalanche current	I_{AP} Note 2	6.7	A
Avalanche energy	E_{AR} Note 2	192	mJ
Channel dissipation	Pch Note 1	50	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

Notes: 1. Value at Tc = 25°C
2. Tch = 25°C, Rg ≥ 50 Ω
3. It provides by the current limitation lower bound value.

Typical Operation Characteristics

(Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Input voltage	V_{IH}	3.5	—	—	V	
	V_{IL}	—	—	1.2	V	
Input current (Gate non shut down)	I_{IH1}	—	—	100	μA	Vi = 8 V, V_{DS} = 0
	I_{IH2}	—	—	50	μA	Vi = 3.5 V, V_{DS} = 0
	I_{IL}	—	—	1	μA	Vi = 1.2 V, V_{DS} = 0
Input current (Gate shut down)	$I_{IH(sd)1}$	—	0.8	—	mA	Vi = 8 V, V_{DS} = 0
	$I_{IH(sd)2}$	—	0.35	—	mA	Vi = 3.5 V, V_{DS} = 0
Shut down temperature	Tsd	—	175	—	°C	Channel temperature
Gate operation voltage	Vop	3.5	—	12	V	
Drain current (Current limitation value)	$I_{D\ limt}$	30	—	—	A	V_{GS} = 5 V, V_{DS} = 10 V Note 4

Note; 4. Pulse test

Electrical Characteristics

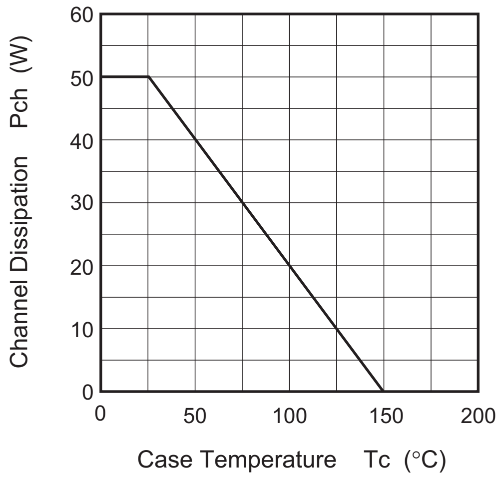
(Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	I_{D1}	—	—	45	A	V_{GS} = 3.5 V, V_{DS} = 10 V
	I_{D2}	—	—	10	mA	V_{GS} = 1.2 V, V_{DS} = 10 V
	I_{D3}	30	—	—	A	V_{GS} = 5 V, V_{DS} = 10 V Note 5
Drain to source breakdown voltage	$V_{(BR)DSS}$	60	—	—	V	I_D = 10 mA, V_{GS} = 0
Gate to source breakdown voltage	$V_{(BR)GSS}$	16	—	—	V	I_G = 800 μA, V_{DS} = 0
	$V_{(BR)GSS}$	–2.5	—	—	V	I_G = –100 μA, V_{DS} = 0
Gate to source leak current	I_{GSS1}	—	—	100	μA	V_{GS} = 8 V, V_{DS} = 0
	I_{GSS2}	—	—	50	μA	V_{GS} = 3.5 V, V_{DS} = 0
	I_{GSS3}	—	—	1	μA	V_{GS} = 1.2 V, V_{DS} = 0
	I_{GSS4}	—	—	–100	μA	V_{GS} = –2.4 V, V_{DS} = 0
Input current (shut down)	$I_{GS(OP)1}$	—	0.8	—	mA	V_{GS} = 8 V, V_{DS} = 0
	$I_{GS(OP)2}$	—	0.35	—	mA	V_{GS} = 3.5 V, V_{DS} = 0
Zero gate voltage drain current	I_{DSS}	—	—	10	μA	V_{DS} = 32 V, V_{GS} = 0, Tc = 110°C
Gate to source cutoff voltage	$V_{GS(off)}$	1.1	—	2.1	V	V_{DS} = 10 V, I_D = 1 mA
Forward transfer admittance	$\|y_{fs}\|$	12	27	—	S	I_D = 15 A, V_{DS} = 10 V Note 5
Static drain to source on state resistance	$R_{DS(on)}$	—	33	40	mΩ	I_D = 15 A, V_{GS} = 4 V Note 5
	$R_{DS(on)}$	—	25	30	mΩ	I_D = 15 A, V_{GS} = 10 V Note 5
Output capacitance	Coss	—	523	—	pF	V_{DS} = 10 V, V_{GS} = 0, f = 1MHz
Turn-on delay time	$t_{d(on)}$	—	3.8	—	μs	V_{GS} = 10 V, I_D= 15 A, R_L = 2 Ω
Rise time	t_r	—	13.5	—	μs	
Turn-off delay time	$t_{d(off)}$	—	4.1	—	μs	
Fall time	t_f	—	7.3	—	μs	
Body-drain diode forward voltage	V_{DF}	—	0.9	—	V	I_F = 30 A, V_{GS} = 0
Body-drain diode reverse recovery time	t_{rr}	—	110	—	ns	I_F = 30 A, V_{GS} = 0 di_F/dt = 50 A/μs
Over load shut down operation time Note 6	t_{os1}	—	0.34	—	ms	V_{GS} = 5 V, V_{DD} = 16 V
	t_{os2}	—	0.23	—	ms	V_{GS} = 5 V, V_{DD} = 24 V

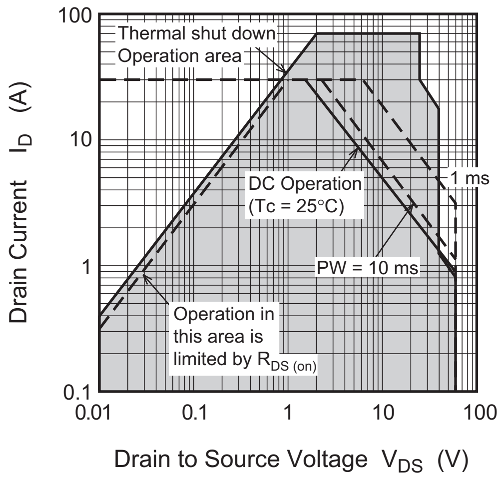
Notes: 5. Pulse test
6. Including the junction temperature rise of the over loaded condition.

Main Characteristics

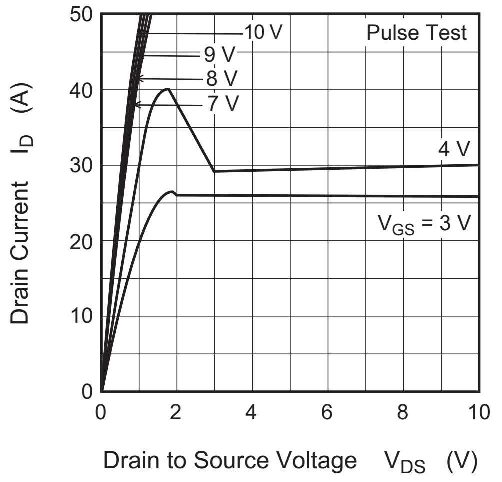
Power vs. Temperature Derating



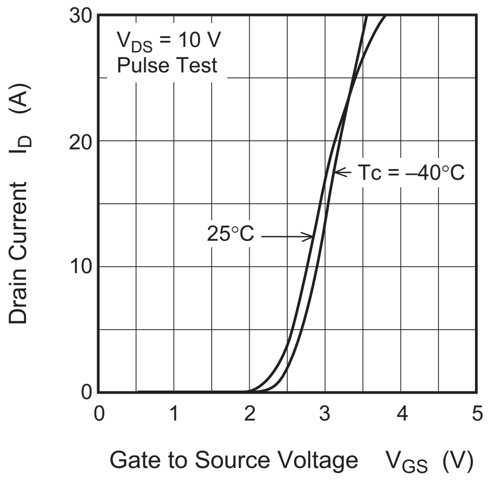
Maximum Safe Operation Area



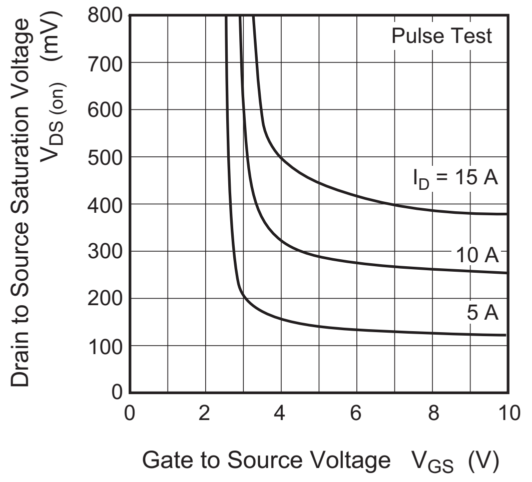
Typical Output Characteristics



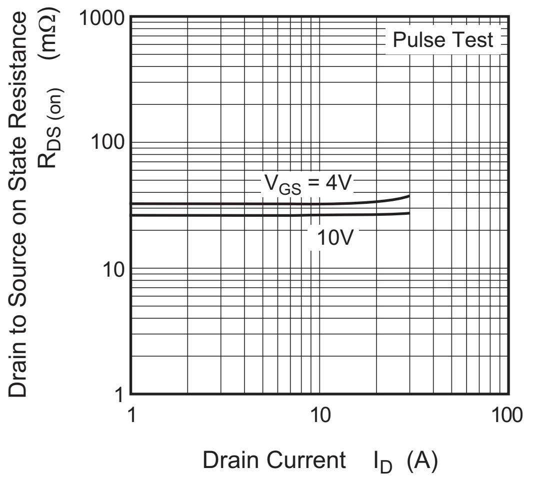
Typical Transfer Characteristics

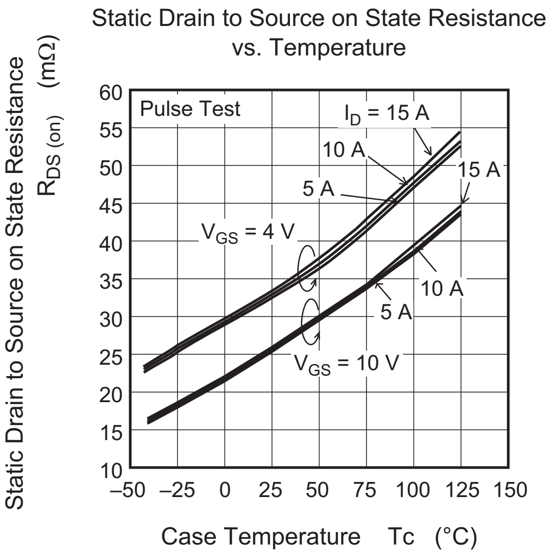


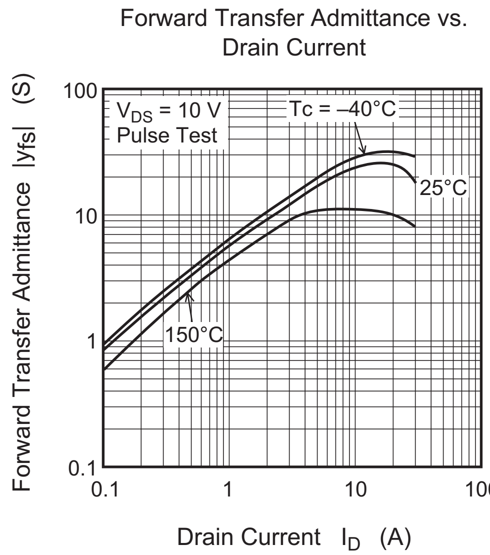
Drain to Source Saturation Voltage vs.
Gate to Source Voltage

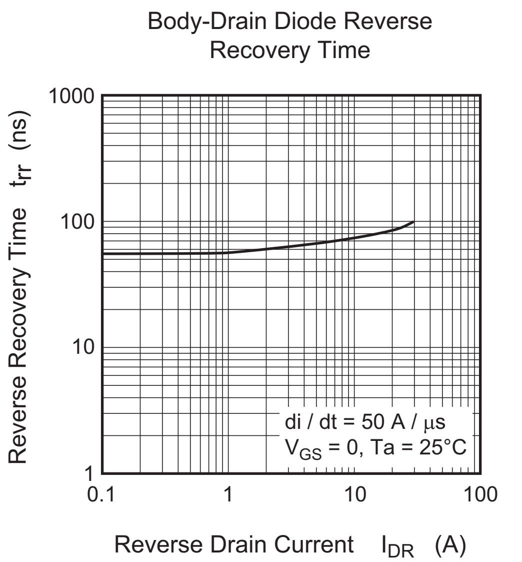


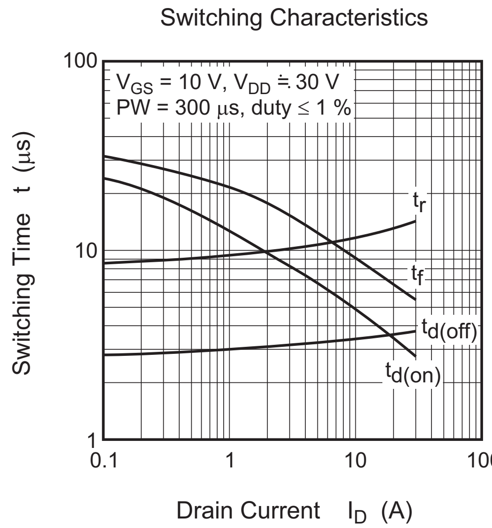
Static Drain to Source on State Resistance
vs. Drain Current

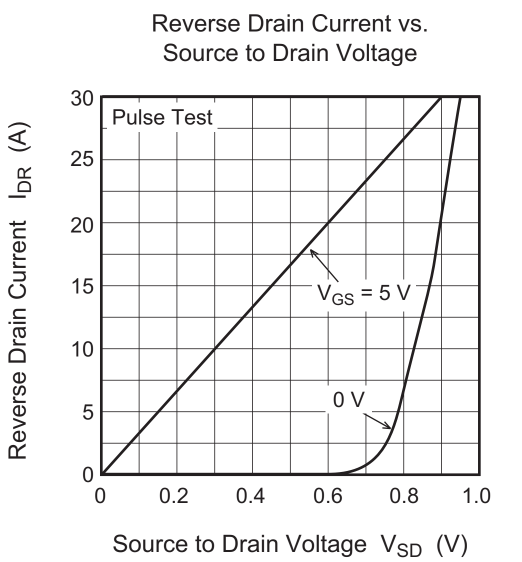


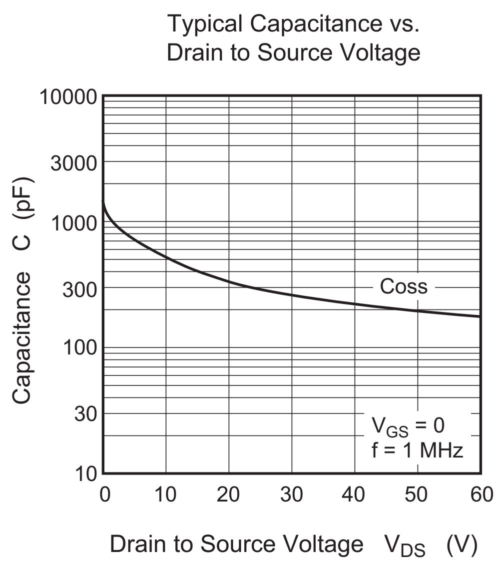

Static Drain to Source on State Resistance vs. Temperature
Static Drain to Source on State Resistance $R_{DS (on)}$ (mΩ)
Pulse Test
I_D = 15 A
10 A
5 A
15 A
V_{GS} = 4 V
10 A
5 A
V_{GS} = 10 V
Case Temperature Tc (°C)

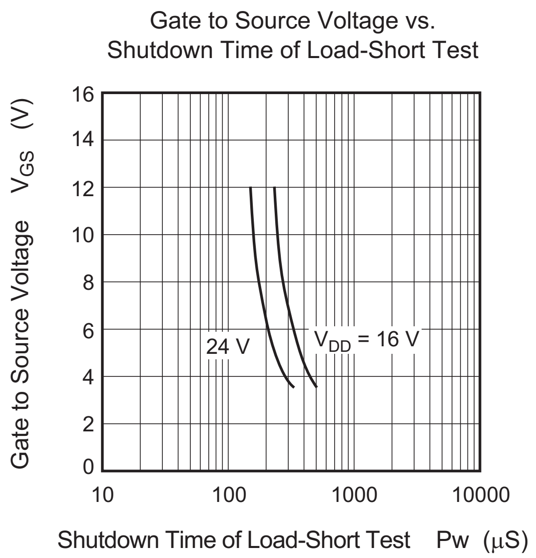

Forward Transfer Admittance vs. Drain Current
Forward Transfer Admittance |yfs| (S)
V_{DS} = 10 V
Pulse Test
Tc = –40°C
25°C
150°C
Drain Current I_D (A)

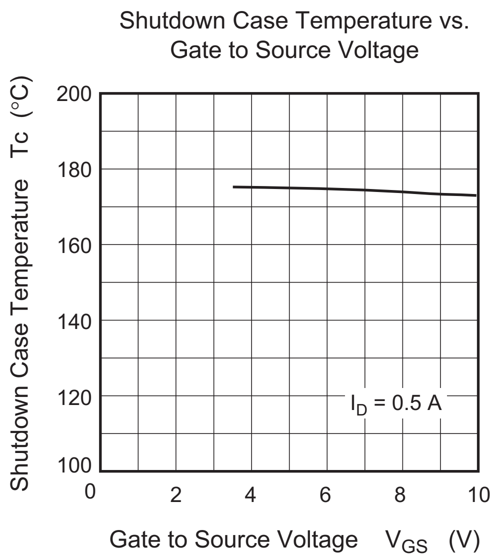

Body-Drain Diode Reverse Recovery Time
Reverse Recovery Time trr (ns)
di / dt = 50 A / µs
V_{GS} = 0, Ta = 25°C
Reverse Drain Current I_{DR} (A)

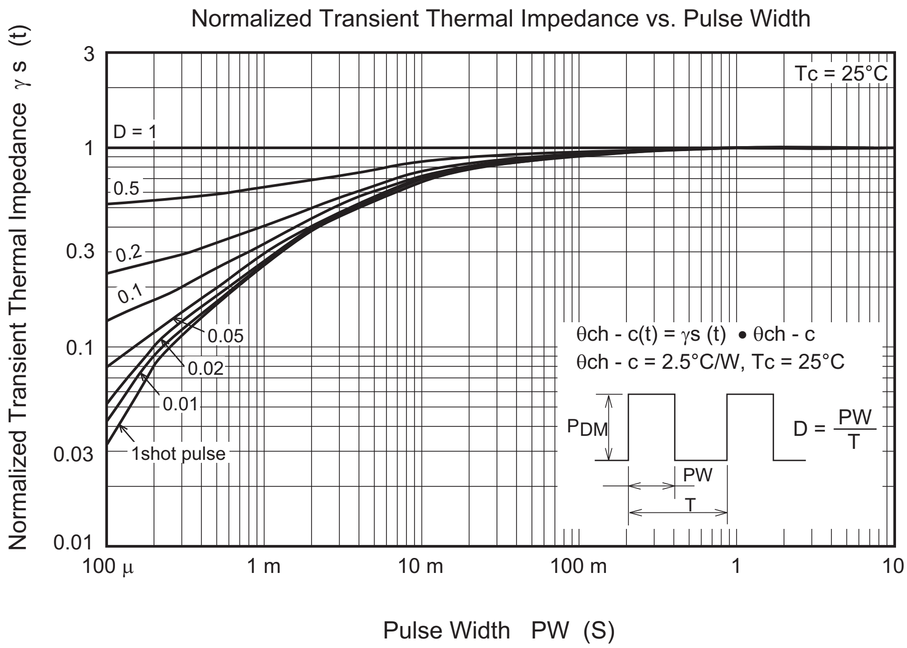

Switching Characteristics
Switching Time t (µs)
V_{GS} = 10 V, V_{DD} ≒ 30 V
PW = 300 µs, duty ≤ 1 %
t_r
t_f
$t_{d(off)}$
$t_{d(on)}$
Drain Current I_D (A)


Reverse Drain Current vs. Source to Drain Voltage
Reverse Drain Current I_{DR} (A)
Pulse Test
V_{GS} = 5 V
0 V
Source to Drain Voltage V_{SD} (V)

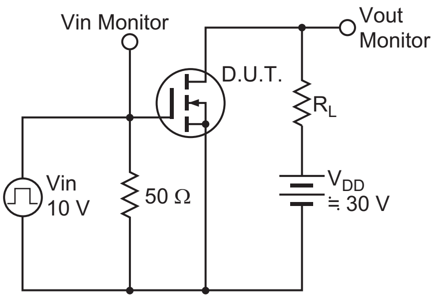

Typical Capacitance vs. Drain to Source Voltage
Capacitance C (pF)
Coss
V_{GS} = 0
f = 1 MHz
Drain to Source Voltage V_{DS} (V)


Gate to Source Voltage vs.
Shutdown Time of Load-Short Test
Gate to Source Voltage V_{GS} (V)
16
14
12
10
8
6
4
2
0
24 V
V_{DD} = 16 V
10
100
1000
10000
Shutdown Time of Load-Short Test Pw (µS)

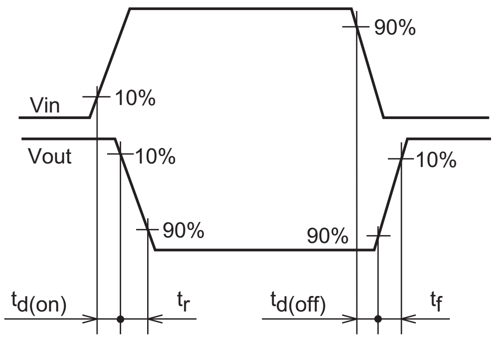

Shutdown Case Temperature vs.
Gate to Source Voltage
Shutdown Case Temperature Tc (°C)
200
180
160
140
120
100
I_D = 0.5 A
0
2
4
6
8
10
Gate to Source Voltage V_{GS} (V)


Normalized Transient Thermal Impedance vs. Pulse Width
Normalized Transient Thermal Impedance γ s (t)
3
1
0.3
0.1
0.03
0.01
Tc = 25°C
D = 1
0.5
0.2
0.1
0.05
0.02
0.01
1shot pulse
θch - c(t) = γs (t) • θch - c
θch - c = 2.5°C/W, Tc = 25°C
P_{DM}
PW
T
D = PW / T
100 µ
1 m
10 m
100 m
1
10
Pulse Width PW (S)

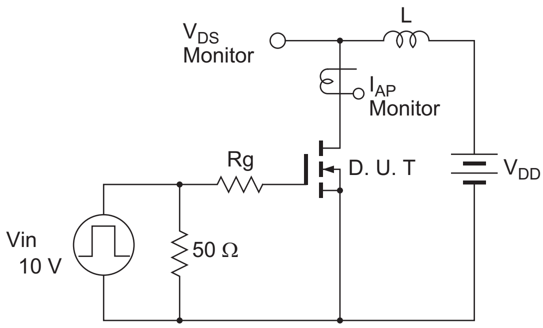
Switching Time Test Circuit



Waveform

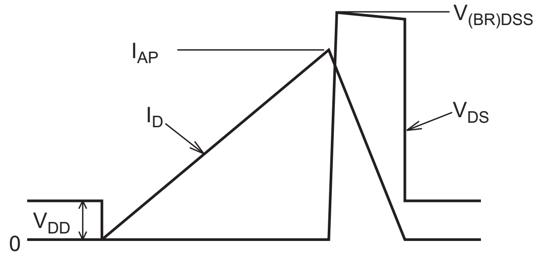


Avalanche Test Circuit



Avalanche Waveform

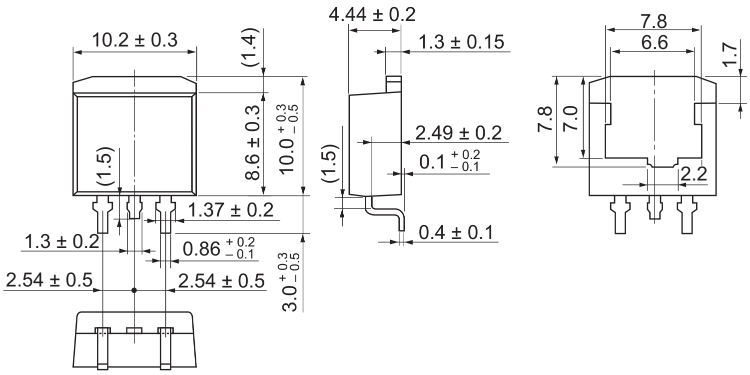
$$E_{AR} = \frac{1}{2} L \bullet I_{AP}^2 \bullet \frac{V_{(BR)DSS}}{V_{(BR)DSS} - V_{DD}}$$



Package Dimensions

Package Name	JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
LDPAK(S)-(1)	SC-83	PRSS0004AE-B	LDPAK(S)-(1) / LDPAK(S)-(1)V	1.30g

Unit: mm



Ordering Information

Orderable Part Number	Quantity	Shipping Container
RJF0619JPE-00-J3	1000 pcs	Taping

Note: The symbol of 2nd "-" is occasionally presented as "#".

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