

1 Scope

The present specifications shall apply to SanKen silicon power MOSFET with built-in temperature compensation diodes, SAPM01N, a complementary device of the SAPM01P, for audio amplifier applications.

2 Appearance and outline drawings

2-1 Appearance

The body shall be clean and shall not bear any stain, rust or flaw.

2-2 Outline drawings

Refer to Fig.1

2-3 Marking

The type number and lot number shall be marked by white-ink on the body and shall not be erased easily.

3 Ratings

3-1 Absolute Maximum Ratings (Ta=25°C)

SAPM01N

| Parameter | Symbol | Ratings | Unit |
|---------------------------|--------------------------|---------------|------|
| Drain to Source Voltage | V_{DSS} | 150 | V |
| Gate to Source Voltage | V_{GSS} | ± 20 | V |
| Continuous Drain Current | I_D | ± 20 | A |
| Pulsed Drain Current | $I_D(\text{pulse})^{*1}$ | ± 80 | A |
| Maximum Power Dissipation | P_D | 150 (Tc=25°C) | W |
| Diode Forward Current | $D_1 I_F$ | 10 | mA |
| Channel Temperature | T_{ch} | 150 | °C |
| Storage Temperature | T_{stg} | -40 ~ +150 | °C |

*1 $P_W \leq 100 \mu \text{ sec}$, duty cycle $\leq 1\%$

3-2 Electrical Characteristics (Ta=25°C)

SAPM01N

| Parameter | Symbol | Test Conditions | Limits | | | Unit |
|--|---------------|--|--------|------|-----------|---------------|
| | | | MIN | TYP | MAX | |
| Drain to Source Breakdown Voltage | $V_{(BR)DSS}$ | $I_D=100\ \mu\text{A}, V_{GS}=0\text{V}$ | 150 | | | V |
| Gate to Source Leakage Current | I_{GSS} | $V_{GS}=\pm 20\text{V}$ | | | ± 100 | nA |
| Drain to Source Leakage Current | I_{DSS} | $V_{DS}=150\text{V}, V_{GS}=0\text{V}$ | | | 100 | μA |
| Gate Threshold Voltage | V_{TH} | $V_{DS}=10\text{V}, I_D=250\ \mu\text{A}$ | 3.0 | 3.5 | 4.0 | V |
| Forward Transconductance | $R_{e(yfs)}$ | $V_{DS}=50\text{V}, I_D=10\text{A}$ | 7.0 | 10 | | S |
| Static Drain to Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}=10\text{V}, I_D=10\text{A}$ | | 0.12 | 0.2 | Ω |
| Input Capacitance | C_{iss} | $V_{DS}=25\text{V}$ $f=1.0\text{MHz}$ $V_{GS}=0\text{V}$ | | 1800 | | pF |
| Output Capacitance | C_{oss} | | | 330 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 80 | | |
| Turn-On Delay Time | $t_{d(on)}$ | | | 80 | | |
| Rise Time | t_r | $I_D=10\text{A}$ $V_{DD}\approx 50\text{V}$ $R_L=5\ \Omega$ $V_{GS}=10\text{V}$ | | 210 | | ns |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 360 | | |
| Fall Time | t_f | | | 105 | | |
| Diode Forward Voltage | $D_i V_F$ | $I_F=3\text{mA}$ | | 5.8 | | V |

4 Trimming process

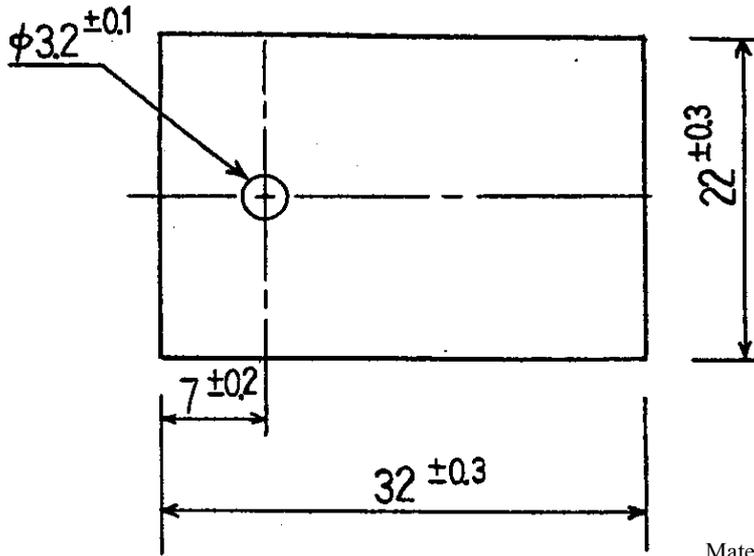
$|V_{GS} - (V_F + V_R) + 2.9| \leq 0.035$ shall be satisfied. (Reference value : Idling current $100\text{mA} \pm 20\%$)
(at 50V/100mA) (at 3mA)

* V_R : Both ends voltage of the resistor after being trimmed

- Measurement values have temperature coefficient; therefore, the frame temperature is controlled and detected to be 25°C in order to appropriately trim the resistor value.
- For inspection, equipments with accuracy of 0.5%, which is checked and corrected regularly, are used.

*Plastic molded transistor accessories

MICA-37 (2GR)



Material: MICA

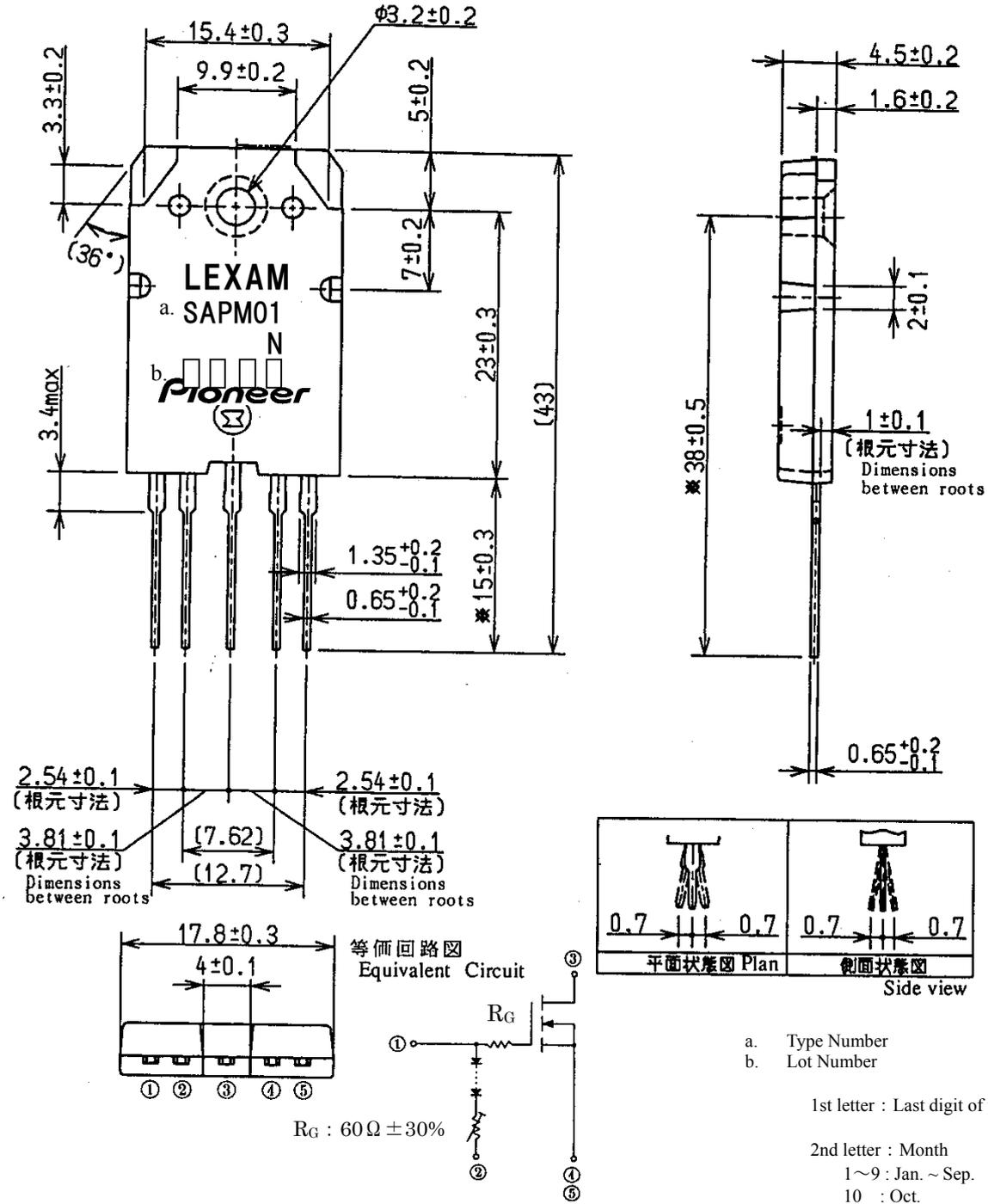
Thickness: $0.06 \begin{smallmatrix} +0.045 \\ -0.005 \end{smallmatrix}$ mm

Dimensions in mm

DWG. No.: TB-1014

Outline Drawing of Lead Forming No.500

Fig.1



a. Type Number
 b. Lot Number

1st letter : Last digit of year
 2nd letter : Month
 1~9 : Jan. ~ Sep.
 10 : Oct.
 11 : Nov.
 12 : Dec.

3rd & 4th letter : Day
 01~31: Arabic Numerals

c. hFE rank

Weight : Approx. 8.3g
 Dimensions in mm

| Description | Material | Specification |
|---------------|----------|----------------------------------|
| Lead terminal | Cu | Ni plating, solder dip treatment |
| Heat sink | Cu | Ni plating |

Notes

----- shows the location where gate burr of 0.3mm max is produced.
 (The flash may appear at the opposite side.)

DWG. No.: TG3C-0501

CAUTION / WARNING**1. Pinouts**

The product enables to shorten the board layout pattern by arranging the N-ch and P-ch device pinouts symmetrically. Each product has two SOURCE terminals, and be sure to use both terminals as SOURCE by having both SOURCE terminals shorted.

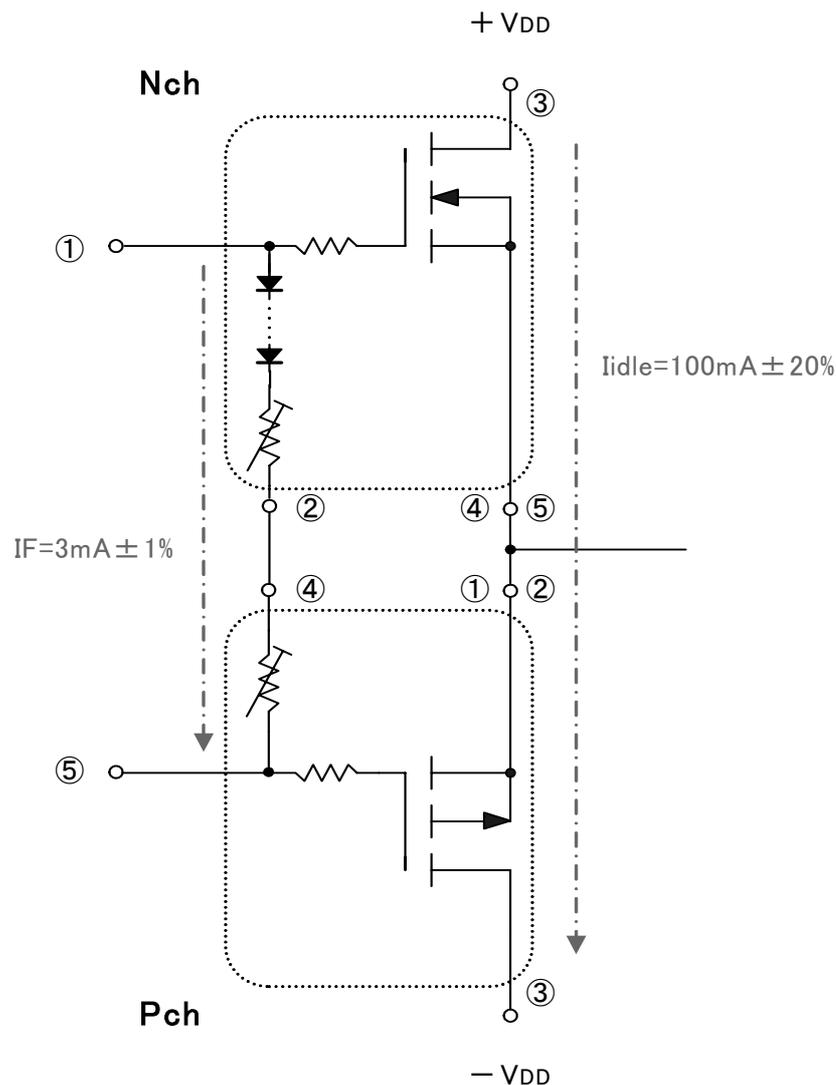
(In case of the N-ch device, pin 4. and 5 are to be shorted, and in case of P-ch device, pin 1 and 2 are to be shorted.)

2. Restrictions to realize non-adjustment of the idling current

The idling current adjustment with external components is not required by setting the I_F at 3mA, and that is characterized to constantly gain $100\text{mA} \pm 20\%$.

In order to realize the non-adjustment, care should be taken as follows;

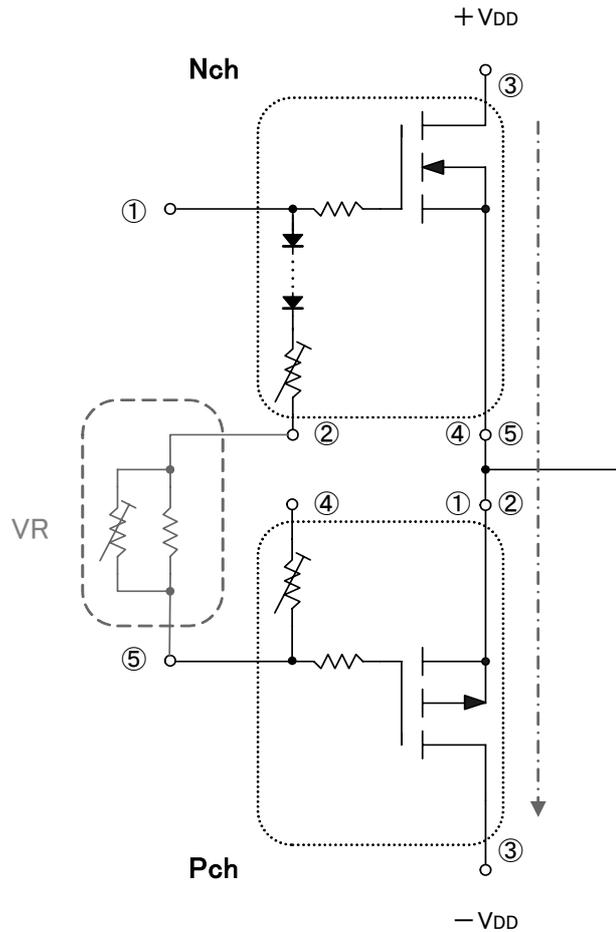
The trimmed thick film resistor is incorporated in each package for the purpose of absorbing the characteristic variation of the components. The sum of the resistors values ranges between 400 ohms and 1300 ohms, big enough to affect the idling current by even a slight variation of the I_F , ending up with being unable to gain the target value. Therefore, the I_F should be set at 3mA with an accuracy of $\pm 1\%$.



3. External adjustment of the idling current.

In order to make an external adjustment of the idling current, pin 4 (of the SAPM01P) should be left "OPEN" and a variable resistor (VR) is inserted between pin 5 (of the SAPM01P) and pin 2 (of the SAPM01N).

With the 200 to 700 ohms of the VR the idling current is to set at 100mA. Note, however, that the idling current is subject to the variation of the $I_F (=3\text{mA})$. Be sure to confirm the exact value at an actual application.





CAUTION/ WARNING

Since reliability can be affected adversely by improper storage environment and handling methods during Characteristic tests, please observe the following cautions.

(1) Cautions for Storage

- Ensure that storage conditions comply with the standard temperature (5 to 35°C) and the standard relative humidity (around 40 to 75%) and avoid storage locations that experience extreme changes in temperature or humidity.
- Avoid locations where dust or harmful gases are present and avoid direct sunlight.
- Reinspect parts stored for a long time for rust leads and solderability.

(2) Cautions for Characteristic Tests and Handling

- When characteristic tests are carried out during inspection testing and other standard tests periods, protect the Power Transistors from surge of power from the testing device, shorts between the leads and from misconnection..

(3) Silicone Grease

- When using a heatsink, please coat the back surface of the Power Transistors and both surfaces of the insulating plate with a thin layer of silicone grease to improve heat transfer between the Power Transistors and the heatsink. There are types of silicone grease of which oil ingredients may permeate the inside of products. Since there is a possibility that it may shorten the lifetime of the products, please pay sufficient attention to the choice of the silicone grease.

Recommended Silicone grease

- G746 (Shin-Etsu Chemical Co., Ltd.)
- YG6260 (Toshiba Silicone Co., Ltd.)
- SC102 (Dow Corning Toray Silicone Co., Ltd.)

(4) Mounting Method of Heatsink

● Torque when Tightening Screws

Thermal resistance increases when tightening torque is small, and radiation effects are decreased. When the torque is too high, the screw can cut, the heatsink can be deformed, and / or distortion can arise in the product's frame. To avoid these problems, Table 1 shows the recommended tightening torques for each product type.

Table 1. Screw Tightening Torques

| Package | Screw Tightening Torques |
|----------------------------------|--|
| MT25 FM20 (TO-220 & Full Mold) | 0.490 to 0.686 N · m (5 to 7 kgf · cm) |
| MT100 FM100 (TO-3P & Full Mold) | 0.686 to 0.882 N · m (7 to 9 kgf · cm) |
| MT200 (TO-3P Wide 2Screw Type) | 0.686 to 0.882 N · m (7 to 9 kgf · cm) |
| 2GR (5-Pin SIP) | 0.686 to 0.882 N · m (7 to 9 kgf · cm) |
| SLA | 0.588 to 0.784 N · m (6 to 8 kgf · cm) |

● Diameter of hole of heatsink: Less than 4mm ϕ

As the slack of press mold for making the hole might become the cause of resin crack when tightening screws, please pay special attention to it.

(5) Soldering Temperature

● When soldering the products, please be sure to minimize the working time under the following conditions.

- 260°C 10sec. (Reflow or flow Soldering)
- 350°C 3sec. (Soldering iron)

Soldering shall not be performed at an area of 1.5mm from the main body.

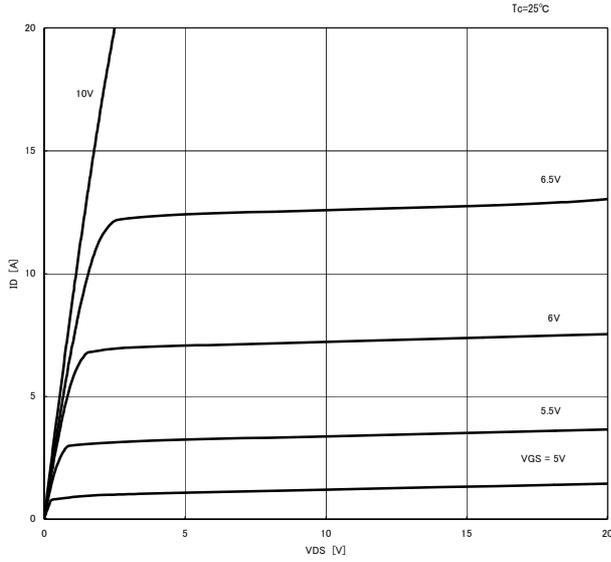
(6) Considerations to protect Power MOSFETs from Electrostatic Discharge

- When handling power MOSFETs device, operator must be grounded. Grounded wrist straps be worn and should have at least 1M Ω of resistance near operators to ground to prevent shock hazard.
- Workbenches where the devices are handled should be grounded and be provided with conductive table and floor mats.
- When using measuring equipment such as a curve tracer, the equipment should also be grounded.
- When soldering the devices, the head of a soldering iron or a solder bath must be grounded in order to prevent leak voltage from being applied to the devices.
- The devices should always be stored and transported in our shipping containers or conductive containers, or be wrapped up in aluminum foil.

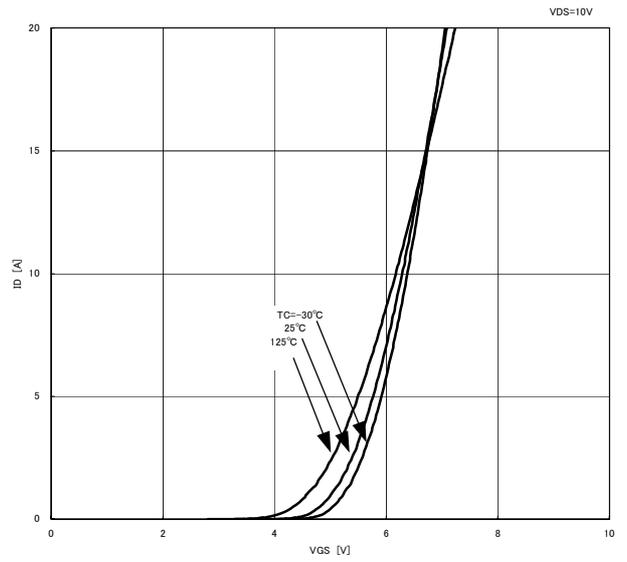
(7) Others

- Application and operation examples described in this document are given for reference only and SanKen assumes no responsibility for any infringement of industrial property rights, intellectual property rights or any other rights of SanKen or any third party which may result from its use.
- When using the products herein, the applicability and suitability of such products for the intended purpose object shall be reviewed at the users responsibility.
- Although SanKen undertakes to enhance the quality and reliability of its products, the occurrence of failure and defect of semiconductor products at a certain rate is inevitable. Users of SanKen products are requested to take, at their own risk, preventative measures including safety design of the equipment or systems against any possible injury, death fires of or damages to the society due to device failure or malfunction.
- SanKen products listed in document are designed and intended for the use as components in general purpose electronic equipment or apparatus (home appliances, office equipment, telecommunication equipment, measuring equipment, etc.). Please return to us this document with your signature(s) or seal(s) prior to the use of the products herein.
When considering the use of SanKen products in the applications where higher reliability is required (transportation equipment, and its control systems, traffic signal control systems or equipment, fire / crime alarm systems, various safety devices, etc.), please contact your nearest SanKen sales representative to discuss, and then return to us this document with your signature(s) or seal(s) prior to the use of the products herein.
The use of SanKen products without the written consent of SanKen in the applications where extremely high reliability is required (aerospace equipment, nuclear power control systems, life support systems, etc.) is strictly prohibited.
- Anti radioactive ray design is not considered for the products listed herein.

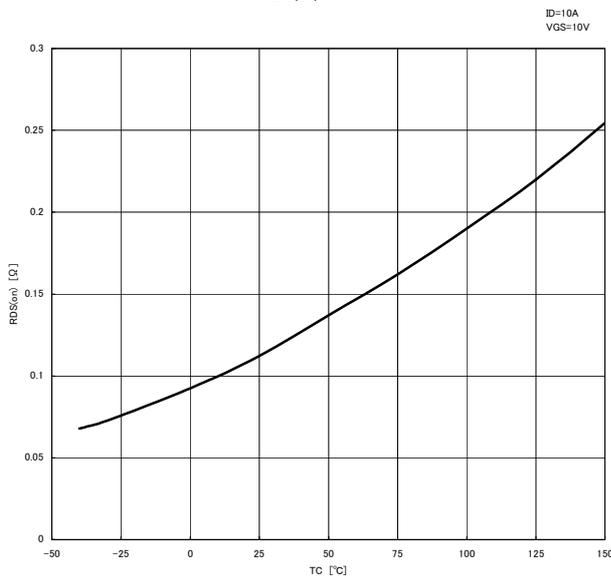
ID - VDS



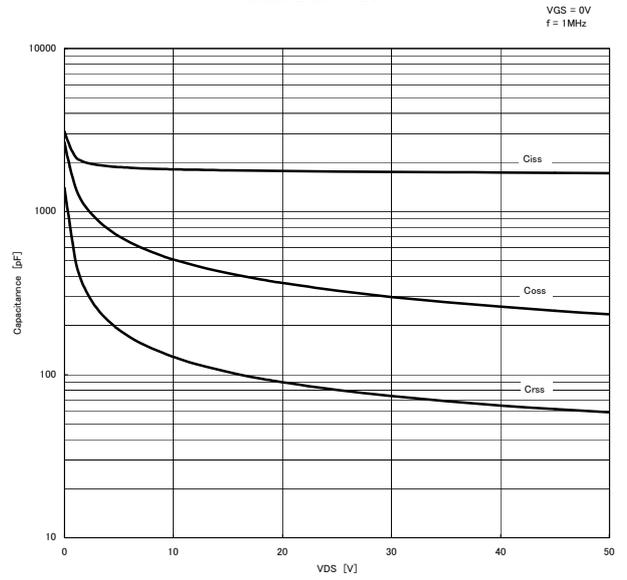
ID - VGS



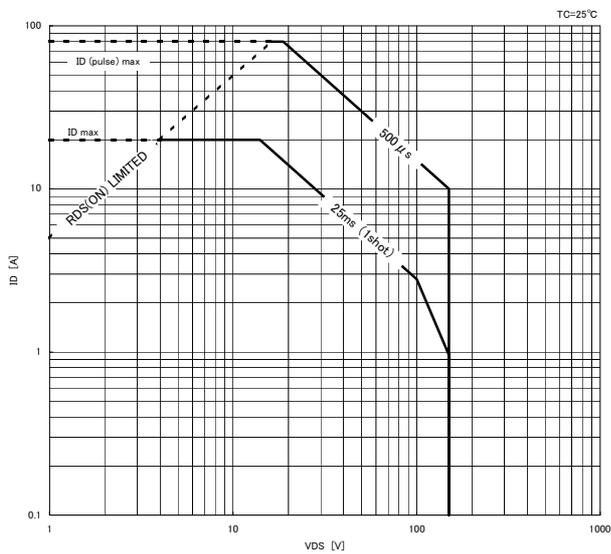
RDS(on) - TC



Capacitance - VDS



A.S.O.



fch-c - PW

