# QH8MA3

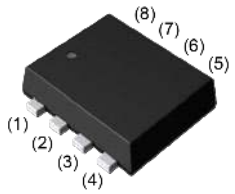
30V Nch+Pch Middle Power MOSFET

Datasheet

| Symbol | Tr1:Nch | Tr2:Pch |
|---|---|---|
| $V_{DSS}$ | 30V | -30V |
| $R_{DS(on)}$(Max.) | 29mΩ | 48mΩ |
| $I_D$ | ±7.0A | ±5.5A |
| $P_D$ | 2.5W | |

## ●Outline

TSMT8

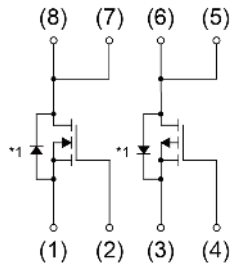



## ●Features

1) Low on - resistance.
2) Small Surface Mount Package (TSMT8).
3) Pb-free lead plating ; RoHS compliant.
4) Halogen Free.

## ●Inner circuit

(1) Tr1 (Nch) Source
(2) Tr1 (Nch) Gate
(3) Tr2 (Pch) Source
(4) Tr2 (Pch) Gate
(5) Tr2 (Pch) Drain
(6) Tr2 (Pch) Drain
(7) Tr1 (Nch) Drain
(8) Tr1 (Nch) Drain
*1 Body Diode




## ●Application

Switching

## ●Packaging specifications

| | | |
|---|---|---|
| Type | Packing | Embossed Tape |
| | Reel size (mm) | 180 |
| | Tape width (mm) | 8 |
| | Basic ordering unit (pcs) | 3000 |
| | Taping code | TR |
| | Marking | MA3 |

## ●Absolute maximum ratings ($T_a$ = 25°C) ,unless otherwise specified.

| Parameter | | Symbol | Value | | Unit |
|---|---|---|---|---|---|
| | | | Tr1:Nch | Tr2:Pch | |
| Drain - Source voltage | | $V_{DSS}$ | 30 | -30 | V |
| Continuous drain current | | $I_D$*1 | ±7.0 | ±5.5 | A |
| Pulsed drain current | | $I_{D,pulse}$*2 | ±18 | ±18 | A |
| Gate - Source voltage | | $V_{GSS}$ | ±20 | ±20 | V |
| Avalanche energy, single pulse | | $E_{AS}$*4 | 1.8 | 1.1 | mJ |
| Avalanche current | | $I_{AS}$*4 | 5.0 | -4.0 | A |
| Power dissipation | total | $P_D$*1 | 2.5 | | W |
| | total | $P_D$*3 | 1.5 | | |
| | element | $P_D$*3 | 1.25 | | |
| Junction temperature | | $T_j$ | 150 | | ℃ |
| Range of storage temperature | | $T_{stg}$ | -55 to +150 | | ℃ |

## ●Thermal resistance

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Thermal resistance, junction - ambient | $R_{thJA}$ *3 | - | 83.3 | - | |

## ●Electrical characteristics ($T_a$ = 25°C) , unless otherwise specified

| Parameter | Symbol | Type | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Drain - Source breakdown voltage | $V_{(BR)DSS}$ | Tr1 | $V_{GS}$ = 0V, $I_D$ = 1mA | 30 | - | - | V |
| | | Tr2 | $V_{GS}$ = 0V, $I_D$ = -1mA | -30 | - | - | |
| Breakdown voltage temperature coefficient | $\frac{\Delta V_{(BR)DSS}}{\Delta T_j}$ | Tr1 | $I_D$ = 1mA, referenced to 25°C | - | 21 | - | mV/°C |
| | | Tr2 | $I_D$ = -1mA, referenced to 25°C | - | -22 | - | |
| Zero gate voltage drain current | $I_{DSS}$ | Tr1 | $V_{DS}$ = 30V, $V_{GS}$ = 0V | - | - | 1 | μA |
| | | Tr2 | $V_{DS}$ = -30V, $V_{GS}$ = 0V | - | - | -1 | |
| Gate - Source leakage current | $I_{GSS}$ | Tr1 | $V_{DS}$ = 0V, $V_{GS}$ = ±20V | - | - | ±100 | nA |
| | | Tr2 | $V_{DS}$ = 0V, $V_{GS}$ = ±20V | - | - | ±100 | |
| Gate threshold voltage | $V_{GS(th)}$ | Tr1 | $V_{DS}$ = $V_{GS}$, $I_D$ = 1mA | 1.0 | - | 2.5 | V |
| | | Tr2 | $V_{DS}$ = $V_{GS}$, $I_D$ = -1mA | -1.0 | - | -2.5 | |
| Gate threshold voltage temperature coefficient | $\frac{\Delta V_{GS(th)}}{\Delta T_j}$ | Tr1 | $I_D$ = 1mA, referenced to 25°C | - | -3 | - | mV/°C |
| | | Tr2 | $I_D$ = -1mA, referenced to 25°C | - | 2.9 | - | |
| Static drain - source on - state resistance | $R_{DS(on)}$ *5 | Tr1 | $V_{GS}$ = 10V, $I_D$ = 7.0A | - | 22 | 29 | mΩ |
| | | | $V_{GS}$ = 4.5V, $I_D$ = 5.0A | - | 35 | 46 | |
| | | Tr2 | $V_{GS}$ = -10V, $I_D$ = -5.5A | - | 37 | 48 | |
| | | | $V_{GS}$ = -4.5V, $I_D$ = -4.0A | - | 55 | 72 | |
| Transconductance | $g_{fs}$ *5 | Tr1 | $V_{DS}$ = 5V, $I_D$ = 5A | 2.7 | - | - | S |
| | | Tr2 | $V_{DS}$ = -5V, $I_D$ = -4A | 3.3 | - | - | |

*1 Pw ≦ 1s, Limited only by maximum temperature allowed.

*2 Pw ≦ 10μs, Duty cycle ≦ 1%

*3 MOUNTED ON A CERAMIC BOARD

*4 Tr1: L ≃ 100μH, $V_{DD}$ = 15V, $R_G$ = 25Ω, STARTING $T_{ch}$ = 25°C Fig.3-1,3-2

Tr2: L ≃ 100μH, $V_{DD}$ = -15V, $R_G$ = 25Ω, STARTING $T_{ch}$ = 25°C Fig.6-1,6-2

*5 Pulsed

## ●Electrical characteristics ($T_a$ = 25°C)

**<Tr1>**

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Input capacitance | $C_{iss}$ | $V_{GS}$ = 0V | - | 300 | - | pF |
| Output capacitance | $C_{oss}$ | $V_{DS}$ = 15V | - | 50 | - | |
| Reverse transfer capacitance | $C_{rss}$ | f = 1MHz | - | 40 | - | |
| Turn - on delay time | $t_{d(on)}$ *5 | $V_{DD}$ ≃ 15V, $V_{GS}$ = 10V | - | 7.2 | - | ns |
| Rise time | $t_r$ *5 | $I_D$ = 3.5A | - | 8.0 | - | |
| Turn - off delay time | $t_{d(off)}$ *5 | $R_L$ = 4.3Ω | - | 12 | - | |
| Fall time | $t_f$ *5 | $R_G$ = 10Ω | - | 5.7 | - | |

**<Tr2>**

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Input capacitance | $C_{iss}$ | $V_{GS}$ = 0V | - | 480 | - | pF |
| Output capacitance | $C_{oss}$ | $V_{DS}$ = -15V | - | 85 | - | |
| Reverse transfer capacitance | $C_{rss}$ | f = 1MHz | - | 65 | - | |
| Turn - on delay time | $t_{d(on)}$ *5 | $V_{DD}$ ≃ -15V, $V_{GS}$ = -10V | - | 8.0 | - | ns |
| Rise time | $t_r$ *5 | $I_D$ = -2.25A | - | 12 | - | |
| Turn - off delay time | $t_{d(off)}$ *5 | $R_L$ = 6.7Ω | - | 40 | - | |
| Fall time | $t_f$ *5 | $R_G$ = 10Ω | - | 20 | - | |

## ●Gate charge characteristics ($T_a$ = 25°C)

**<Tr1>**

| Parameter | Symbol | Conditions | | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Total gate charge | $Q_g$*5 | $V_{DD}$ ≃ 15V<br>$I_D$ = 7A | $V_{GS}$ = 10V | - | 7.2 | - | nC |
| | | | $V_{GS}$ = 4.5V | - | 3.7 | - | |
| Gate - Source charge | $Q_{gs}$*5 | | | - | 1.4 | - | |
| Gate - Drain charge | $Q_{gd}$*5 | | | - | 1.3 | - | |

**<Tr2>**

| Parameter | Symbol | Conditions | | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Total gate charge | $Q_g$*5 | $V_{DD}$ ≃ -15V<br>$I_D$ = -5.5A | $V_{GS}$ = -10V | - | 10 | - | nC |
| | | | $V_{GS}$ = -4.5V | - | 5.2 | - | |
| Gate - Source charge | $Q_{gs}$*5 | | | - | 1.6 | - | |
| Gate - Drain charge | $Q_{gd}$*5 | | | - | 1.9 | - | |

## ●Body diode electrical characteristics (Source-Drain) ($T_a$ = 25°C)

**<Tr1>**

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Body diode continuous forward current | $I_S$ | $T_a$ = 25℃ | - | - | 1.0 | A |
| Body diode pulse current | $I_{SP}$*2 | | - | - | 18 | |
| Forward voltage | $V_{SD}$*5 | $V_{GS}$ = 0V, $I_S$ = 1A | - | - | 1.2 | V |

**<Tr2>**

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Body diode continuous forward current | $I_S$ | $T_a$ = 25℃ | - | - | -1.0 | A |
| Body diode pulse current | $I_{SP}$*2 | | - | - | -18 | |
| Forward voltage | $V_{SD}$*5 | $V_{GS}$ = 0V, $I_S$ = -1A | - | - | -1.2 | V |

## ●Electrical characteristic curves <Tr1>

Fig.1 Power Dissipation Derating Curve

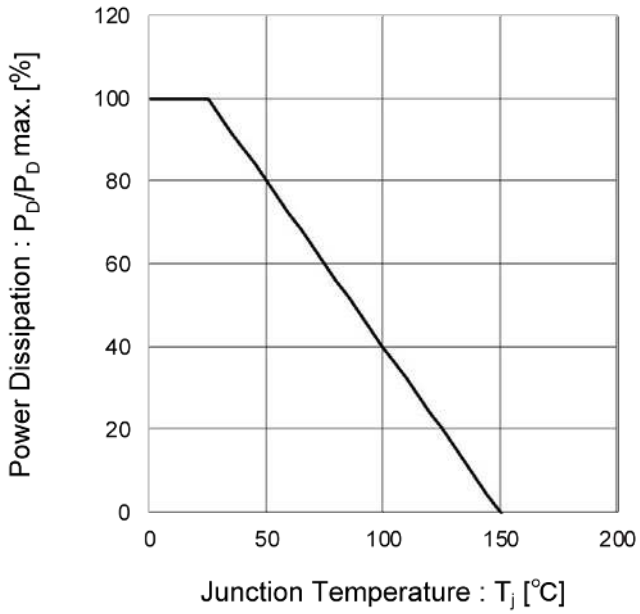



Fig.2 Maximum Safe Operating Area

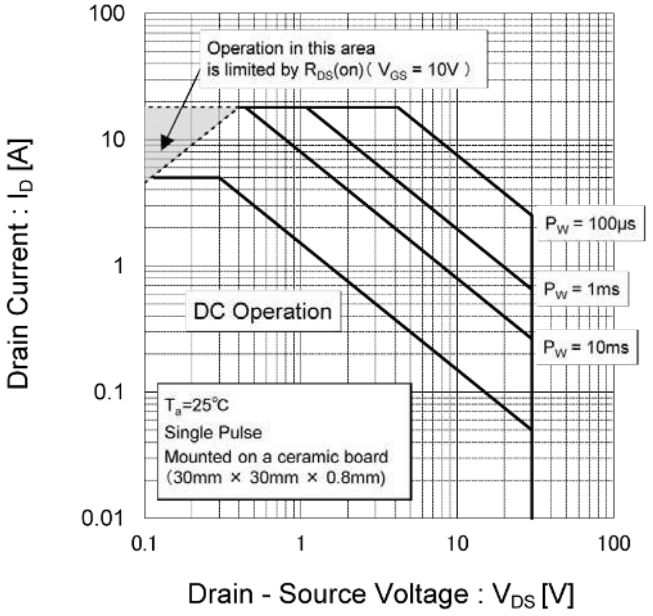



Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

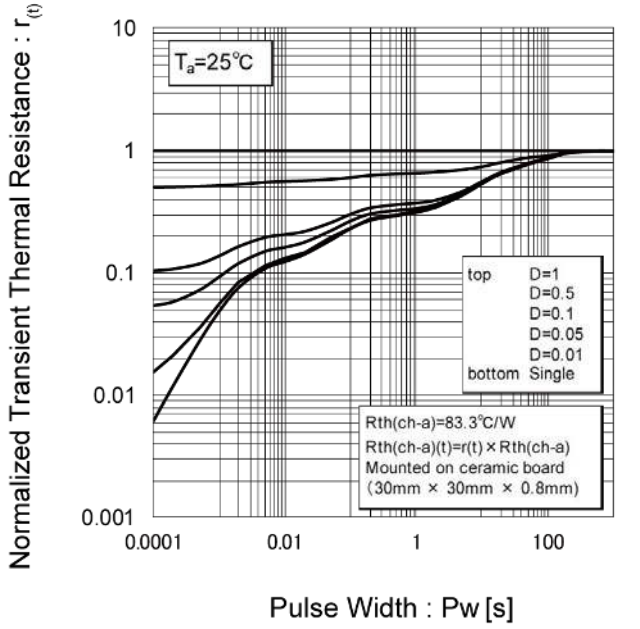
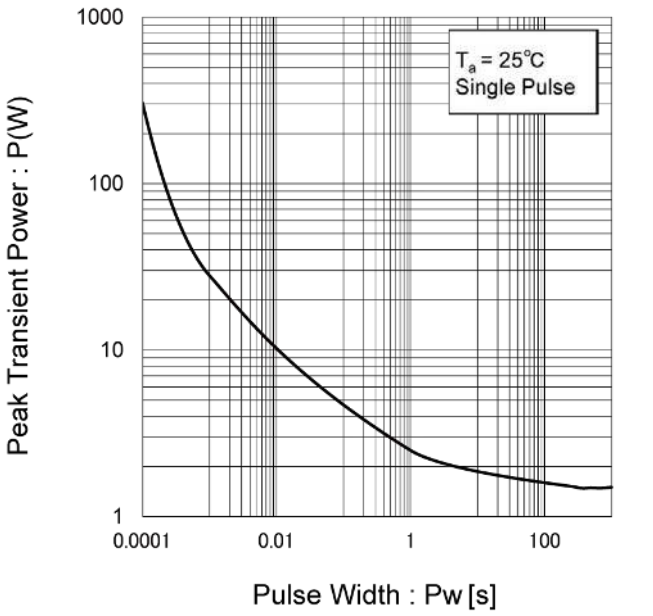



Fig.4 Single Pulse Maximum Power dissipation



## ●Electrical characteristic curves <Tr1>

Fig.5 Typical Output Characteristics(I)

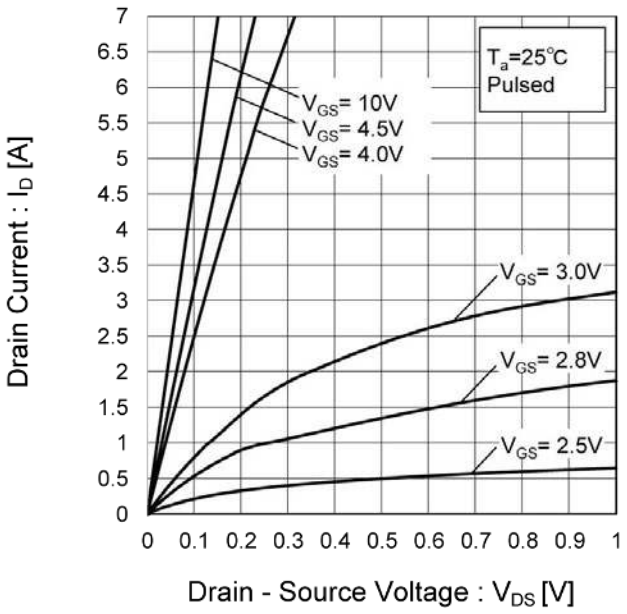



Fig.6 Typical Output Characteristics(II)

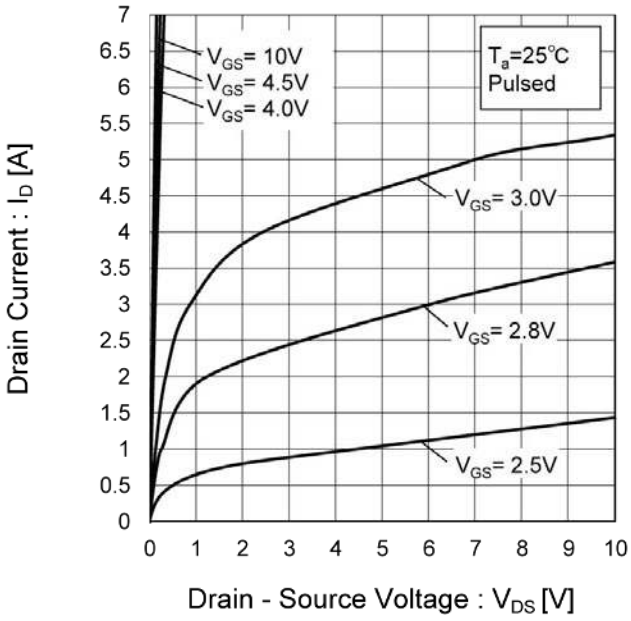
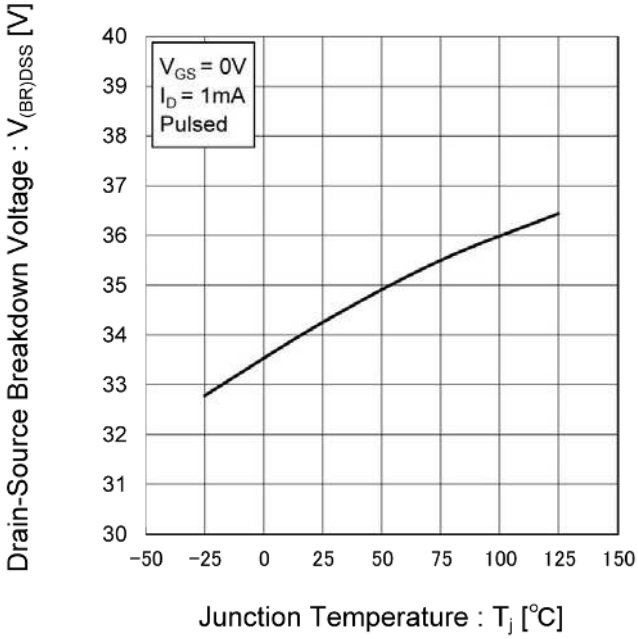



Fig.7 Breakdown Voltage vs. Junction Temperature



## ●Electrical characteristic curves <Tr1>

Fig.8 Typical Transfer Characteristics

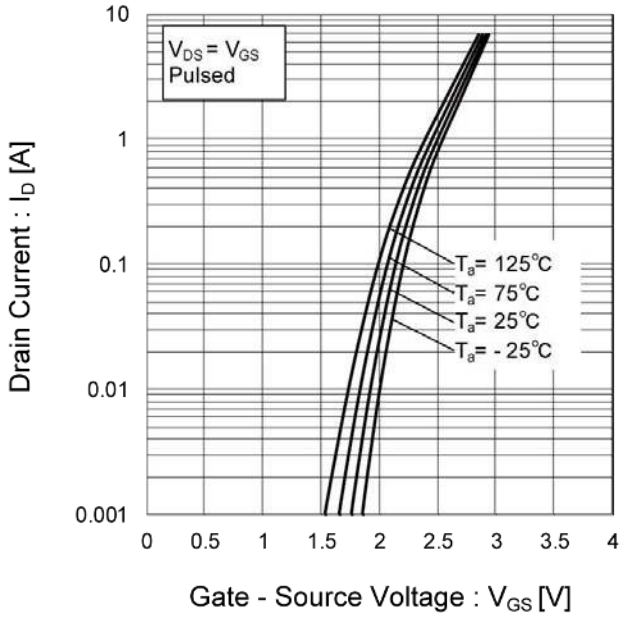



Fig.9 Gate Threshold Voltage vs. Junction Temperature

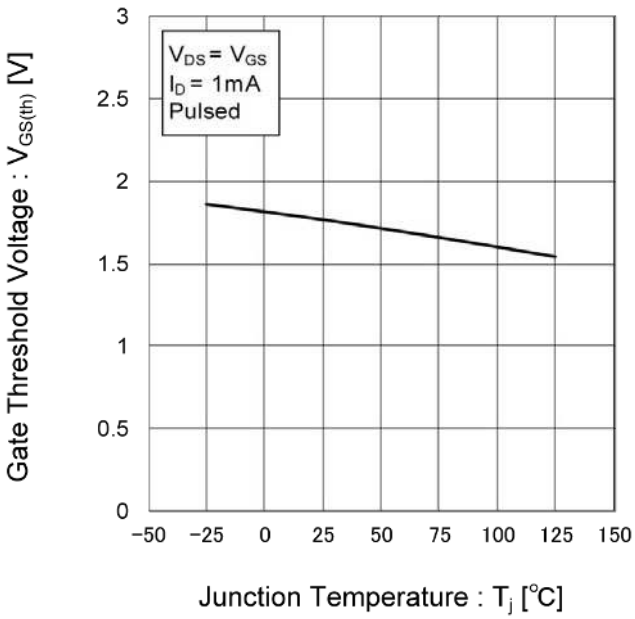
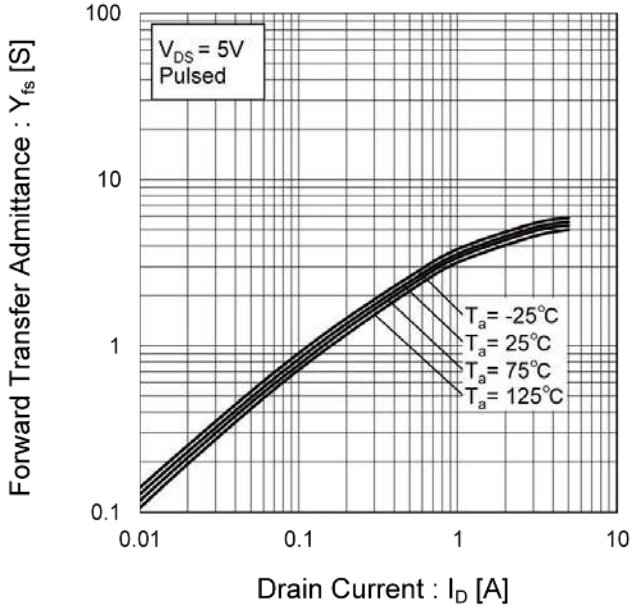



Fig.10 Tranceconductance vs. Drain Current



## ●Electrical characteristic curves <Tr1>

Fig.11 Drain Current Derating Curve

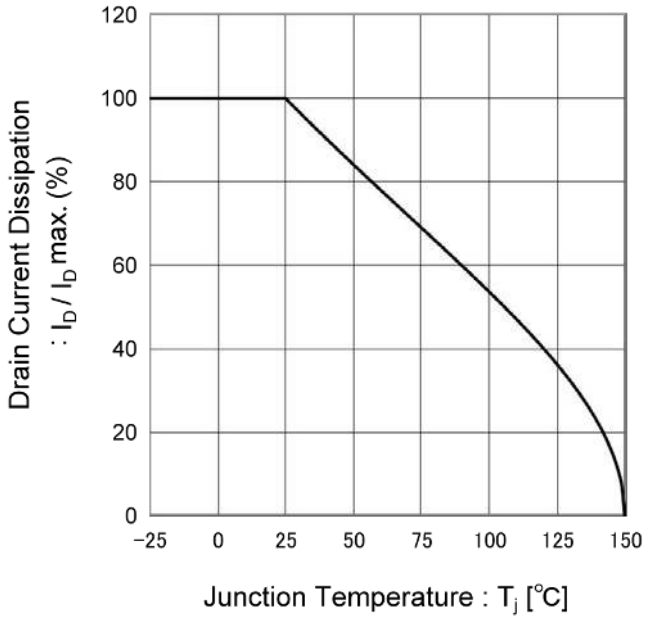



Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

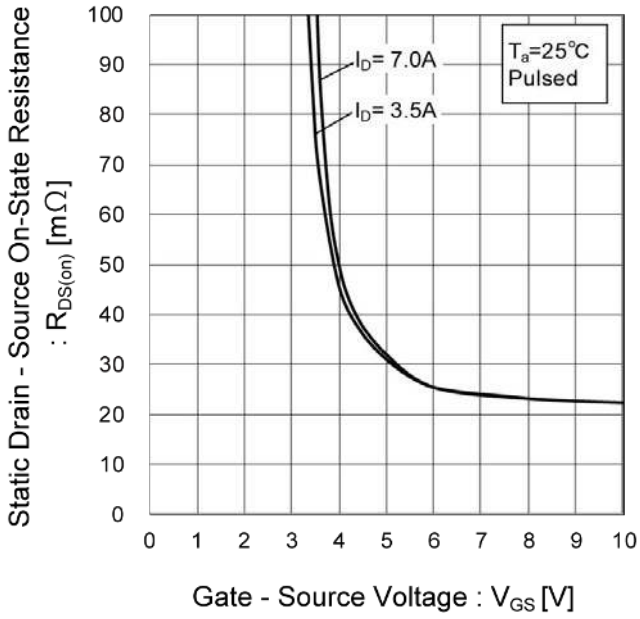
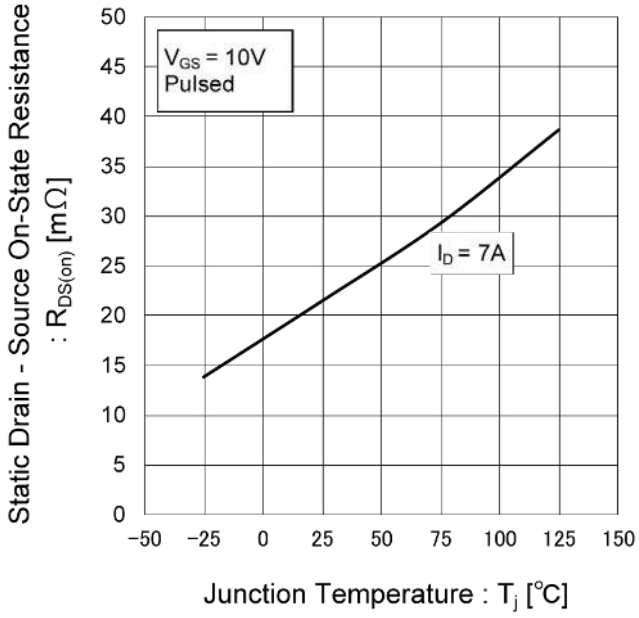



Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature



## ●Electrical characteristic curves <Tr1>

Fig.14 Static Drain - Source On - State Resistance vs. Drain Current(I)

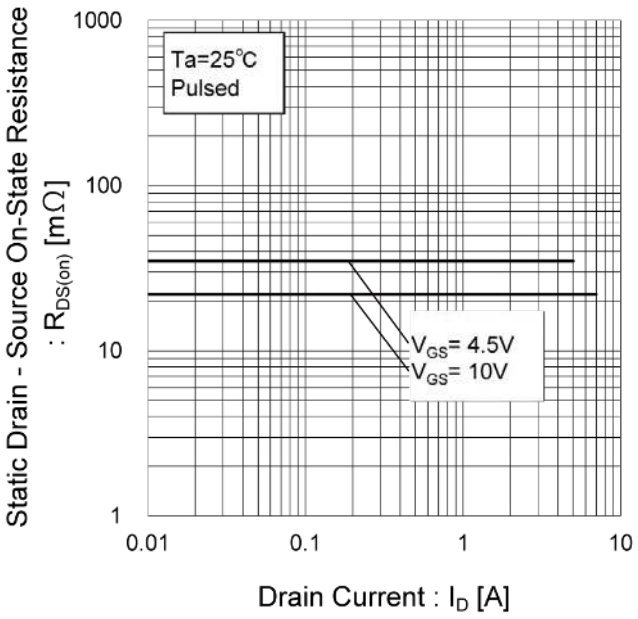



Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

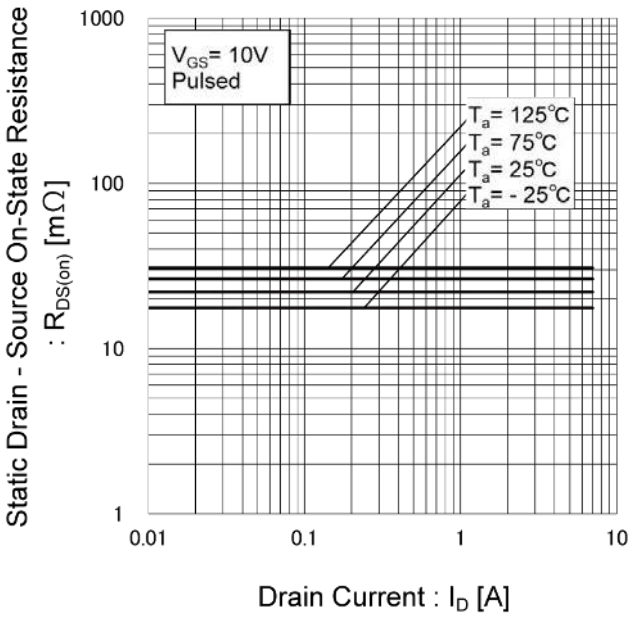
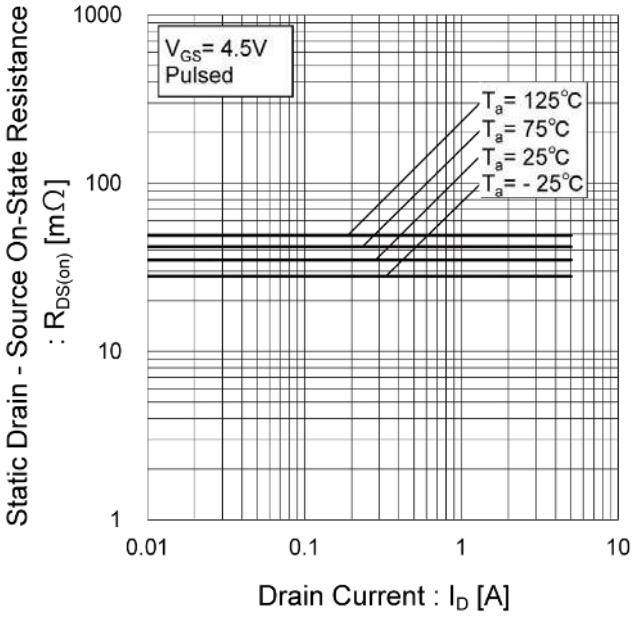



Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)



## ●Electrical characteristic curves <Tr1>

Fig.17 Typical Capacitance vs. Drain - Source Voltage

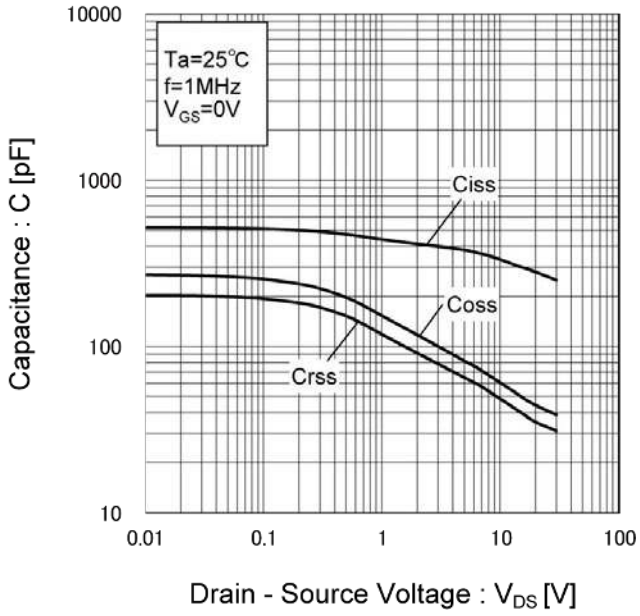



Fig.18 Switching Characteristics

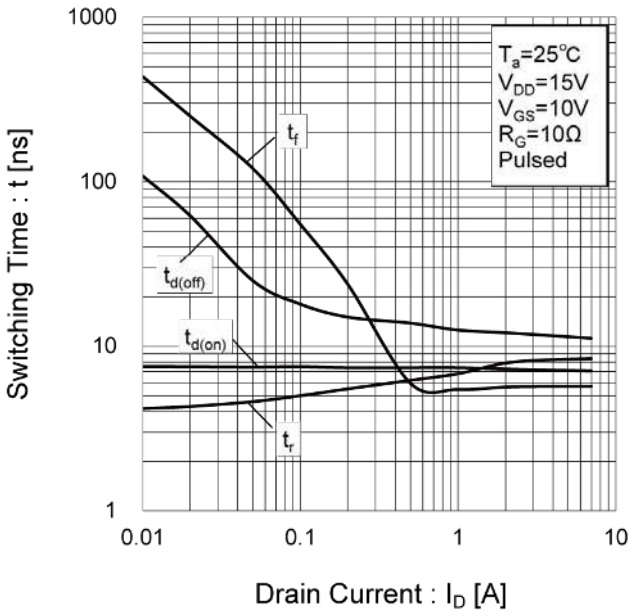



Fig.19 Dynamic Input Characteristics

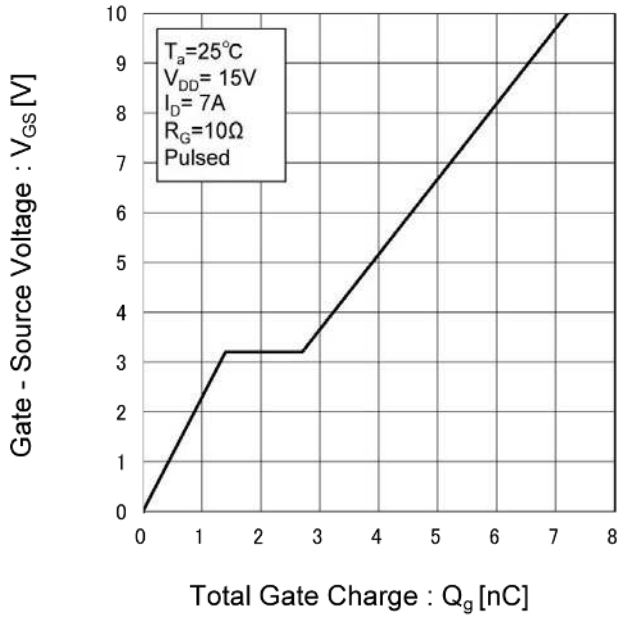
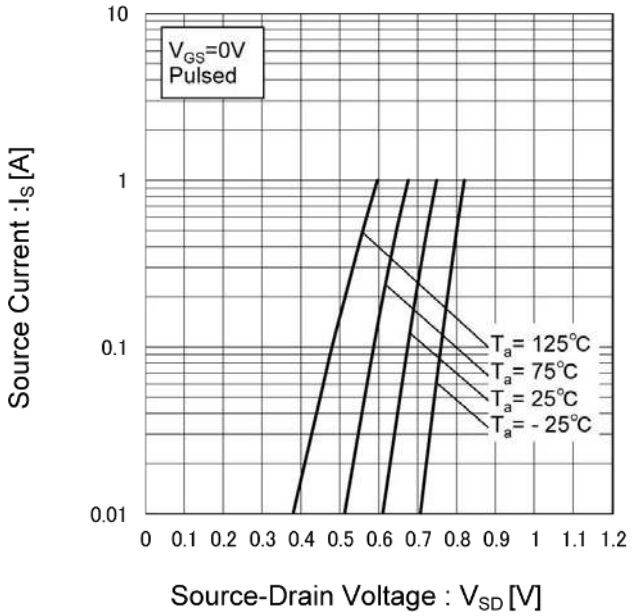



Fig.20 Source Current vs. Source Drain Voltage



## ●Electrical characteristic curves <Tr2>

Fig.1 Power Dissipation Derating Curve

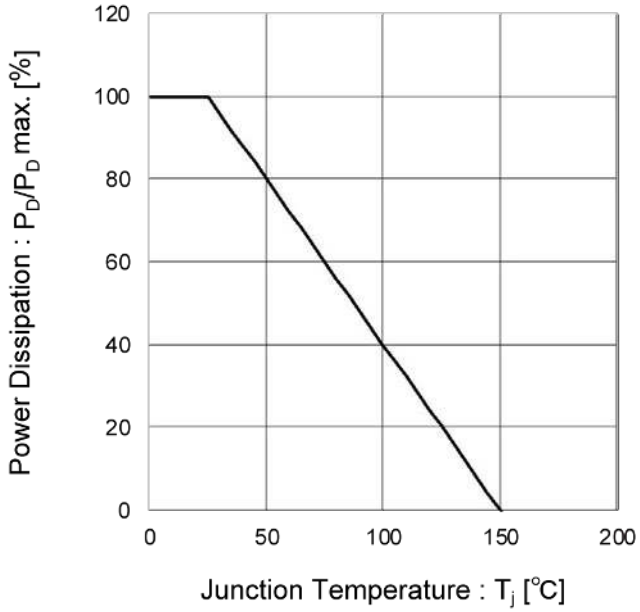



Fig.2 Maximum Safe Operating Area

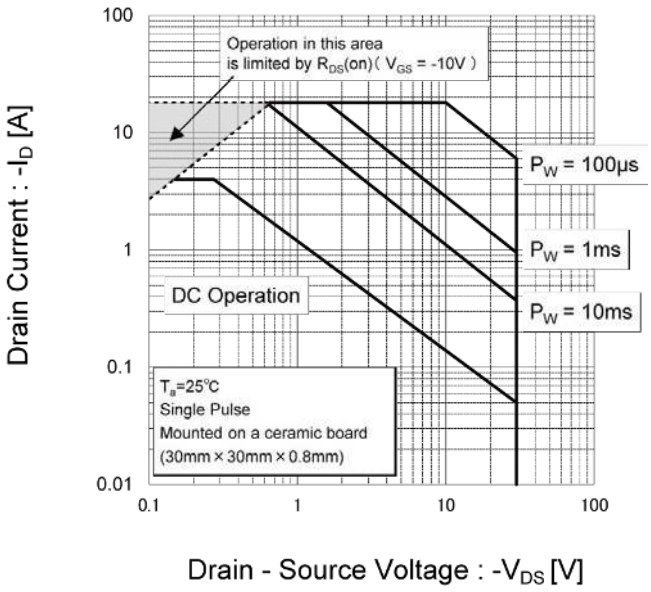



Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

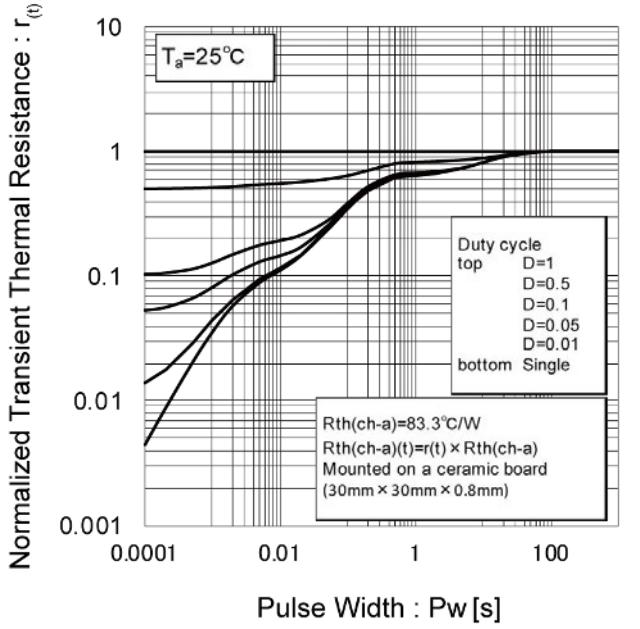
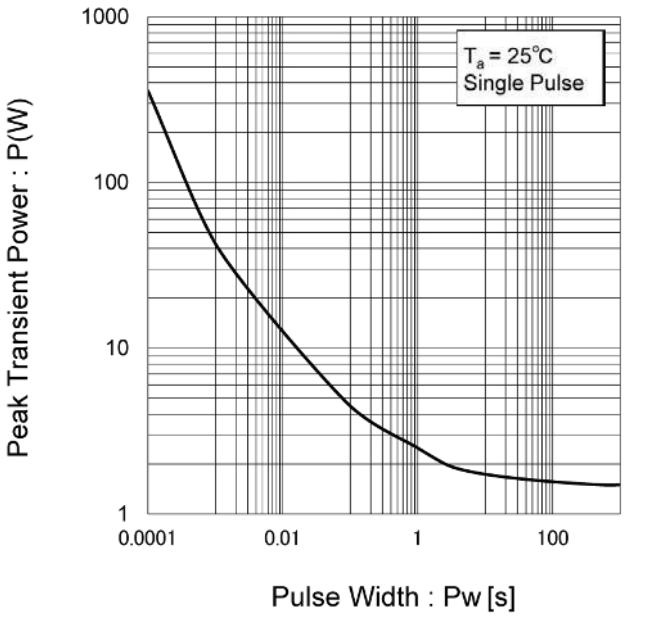



Fig.4 Single Pulse Maximum Power dissipation



## ●Electrical characteristic curves <Tr2>

Fig.5 Typical Output Characteristics(I)

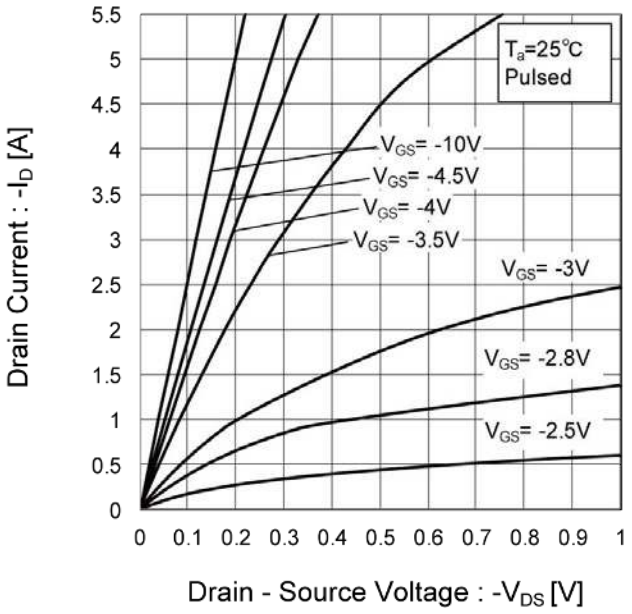



Fig.6 Typical Output Characteristics(II)

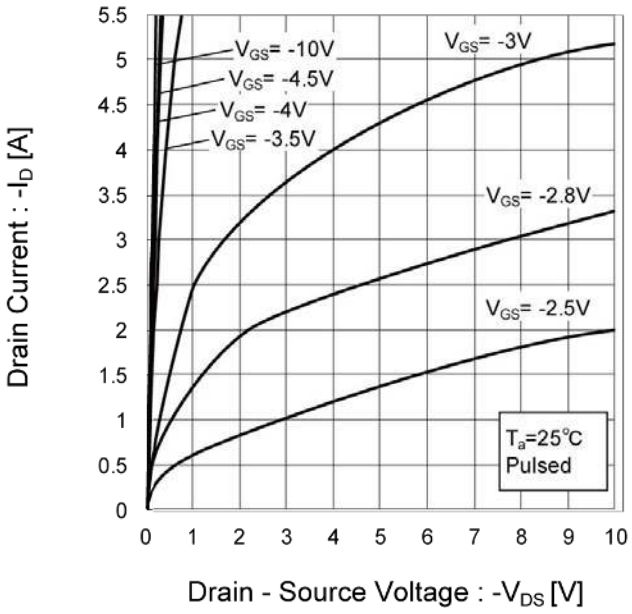
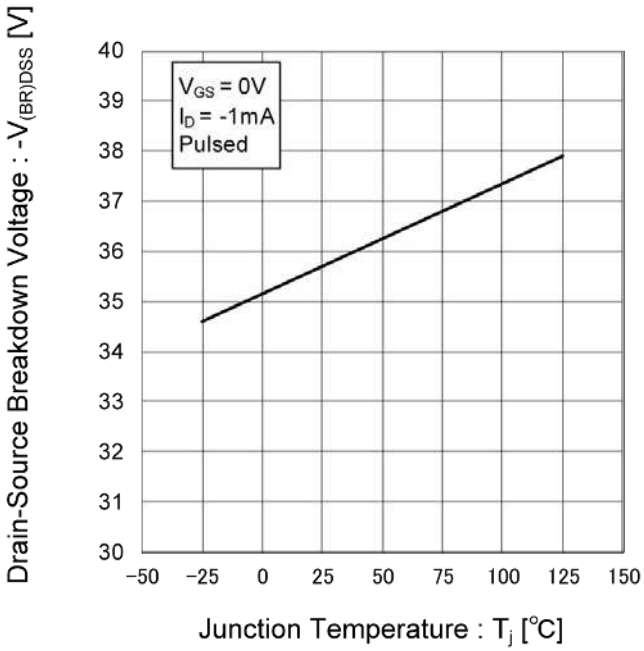



Fig.7 Breakdown Voltage vs. Junction Temperature



## ●Electrical characteristic curves <Tr2>

Fig.8 Typical Transfer Characteristics

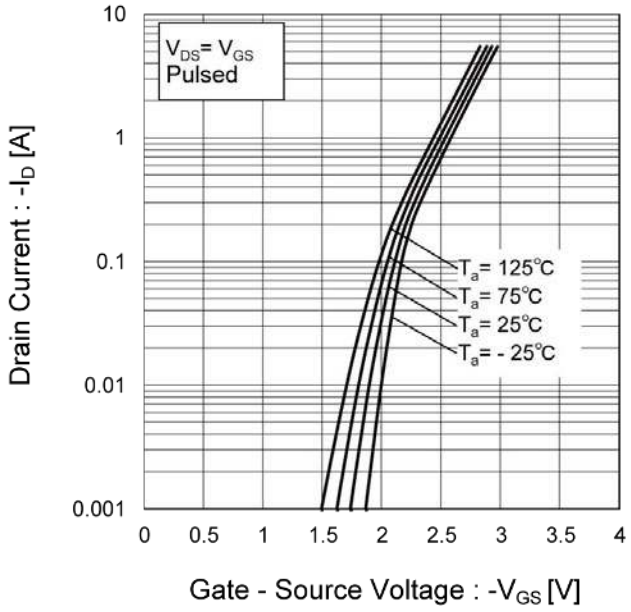



Fig.9 Gate Threshold Voltage vs. Junction Temperature

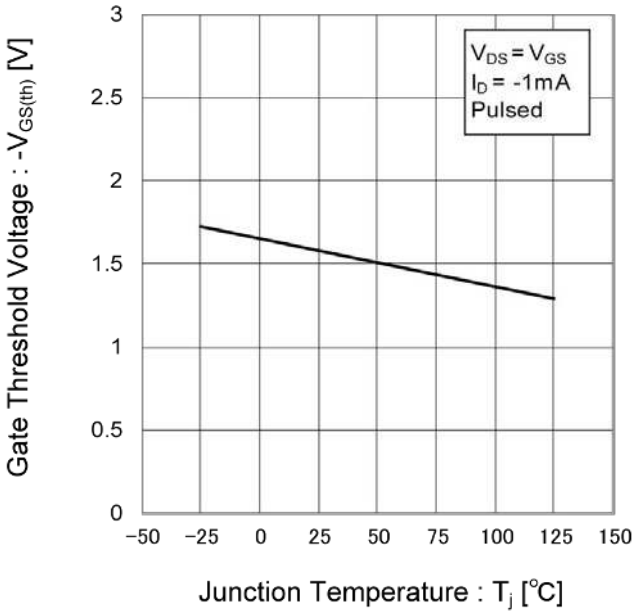
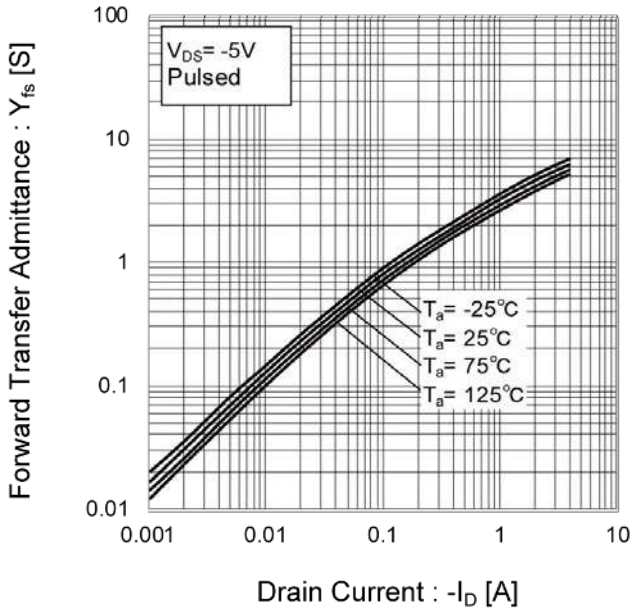



Fig.10 Tranceconductance vs. Drain Current



## ●Electrical characteristic curves <Tr2>

Fig.11 Drain Current Derating Curve

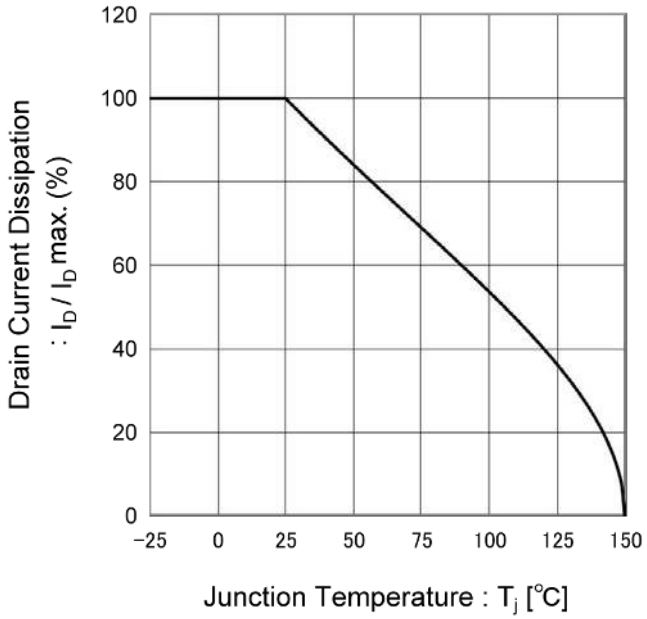



Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

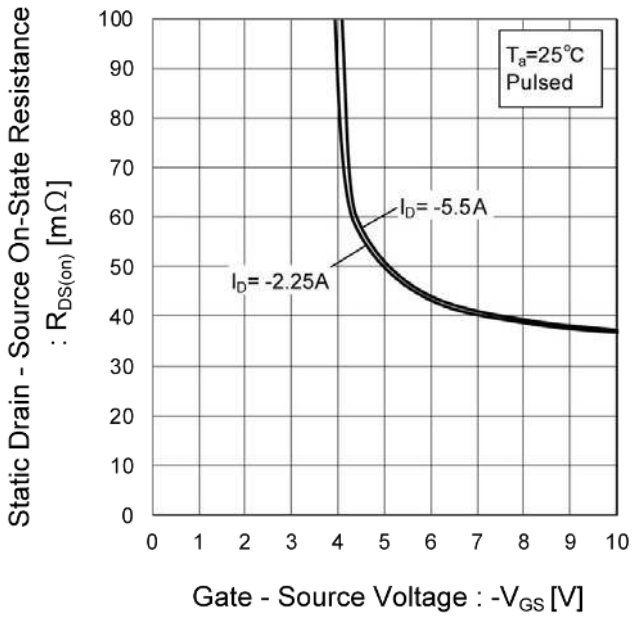
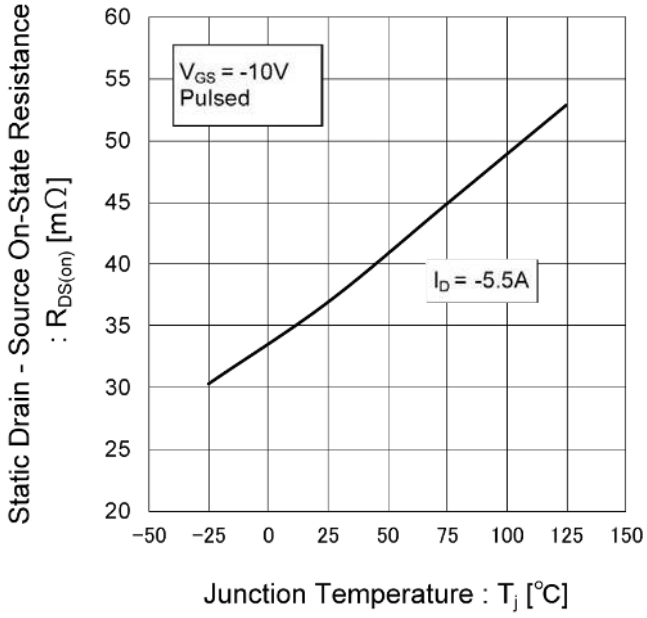



Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature



## ●Electrical characteristic curves <Tr2>

Fig.14 Static Drain - Source On - State Resistance vs. Drain Current(I)

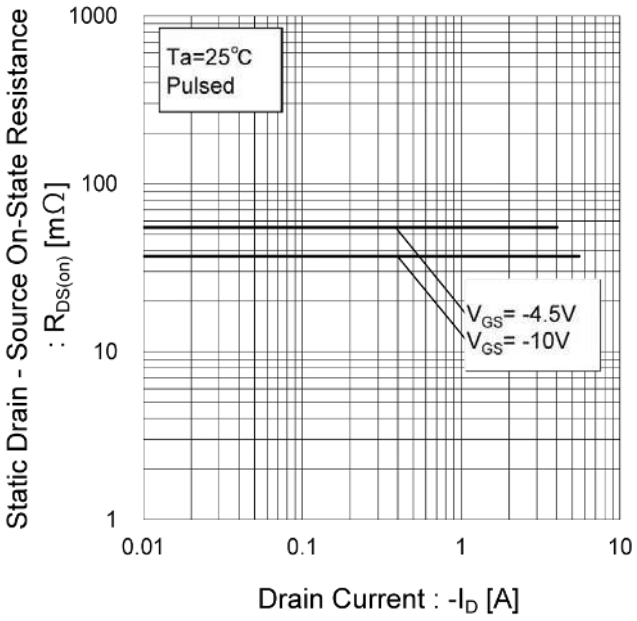



Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

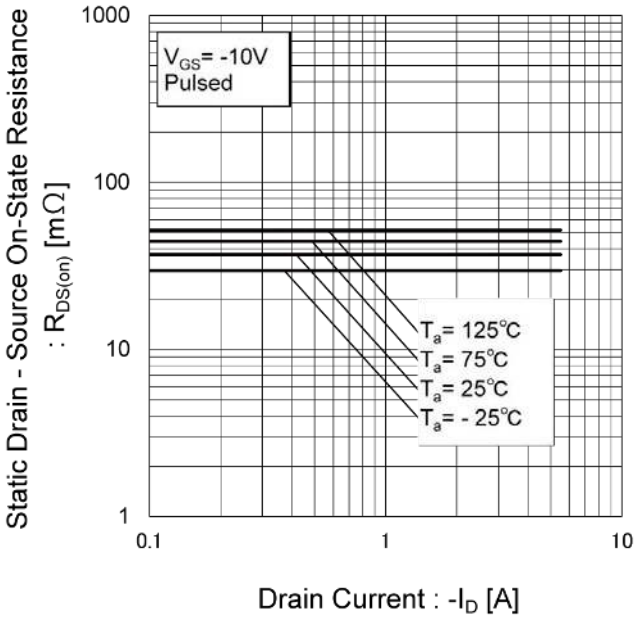
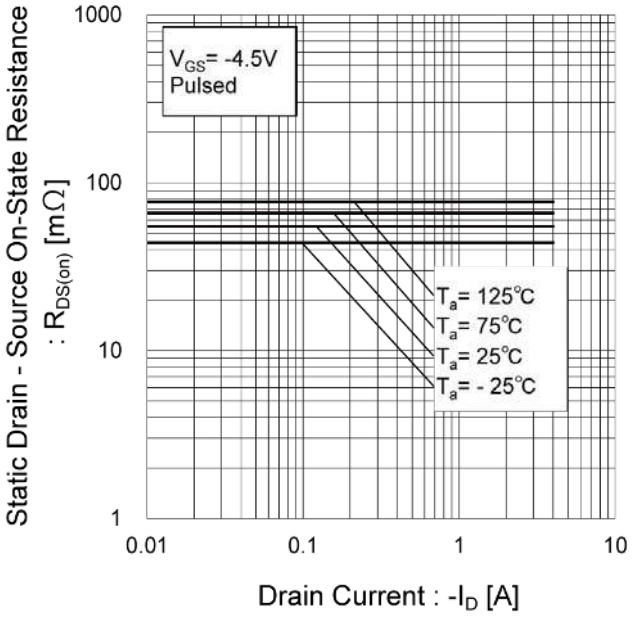



Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)



## ●Electrical characteristic curves <Tr2>

Fig.17 Typical Capacitance vs. Drain - Source Voltage

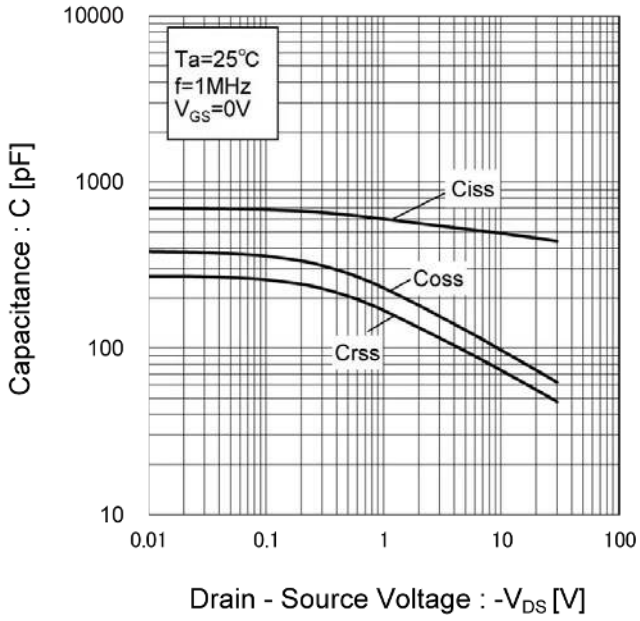



Fig.18 Switching Characteristics

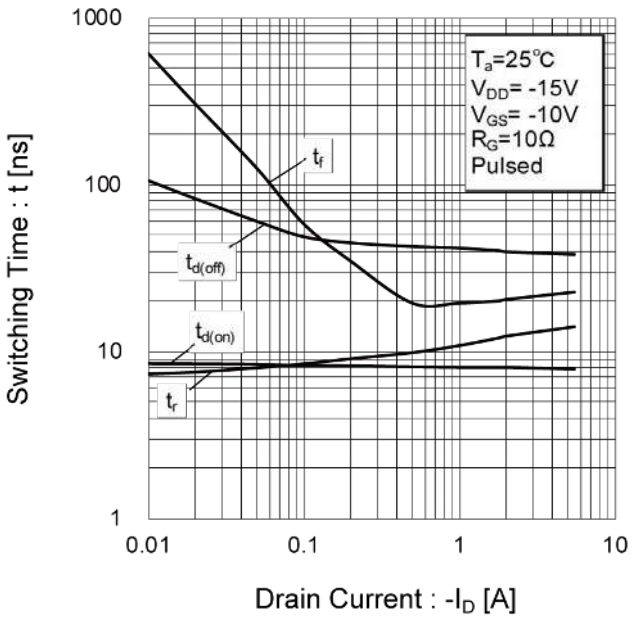



Fig.19 Dynamic Input Characteristics

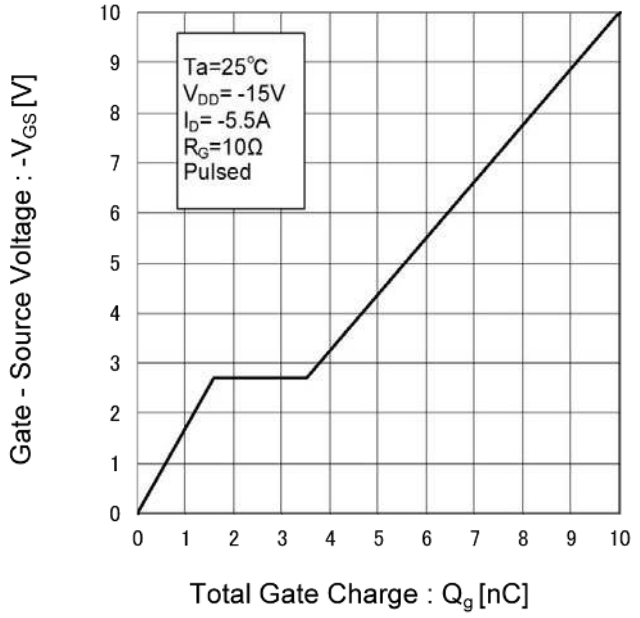
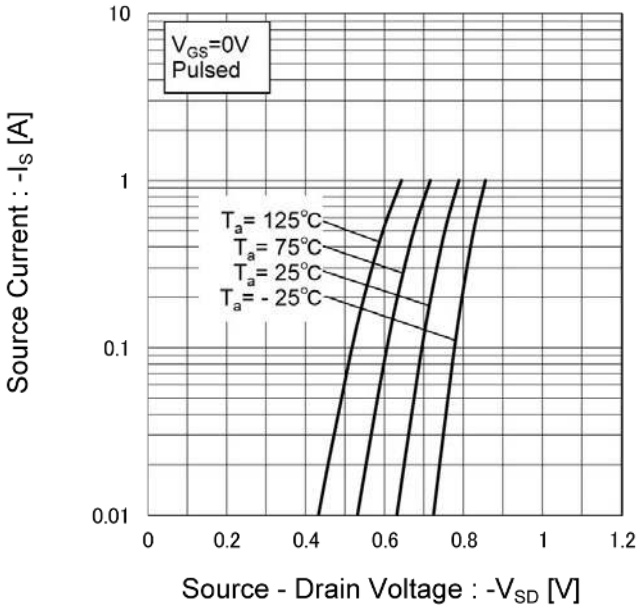



Fig.20 Source Current vs. Source Drain Voltage



## ●Measurement circuits <Tr1>

Fig.1-1 Switching Time Measurement Circuit

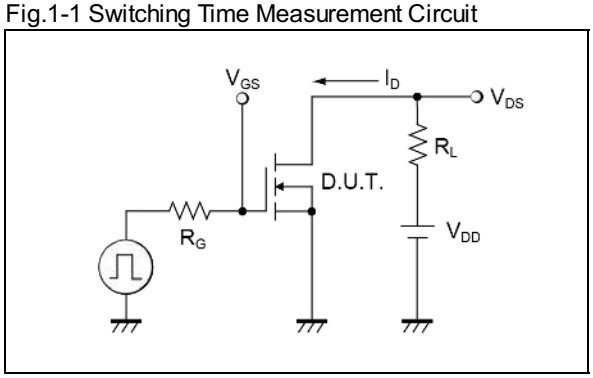



Fig.1-2 Switching Waveforms

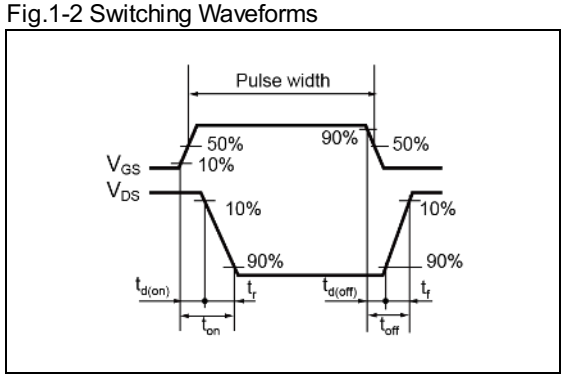



Fig.2-1 Gate Charge Measurement Circuit

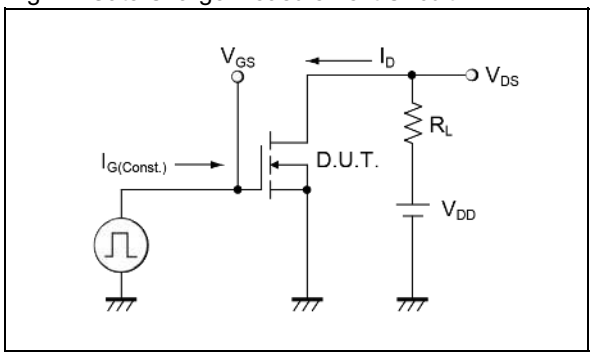



Fig.2-2 Gate Charge Waveform

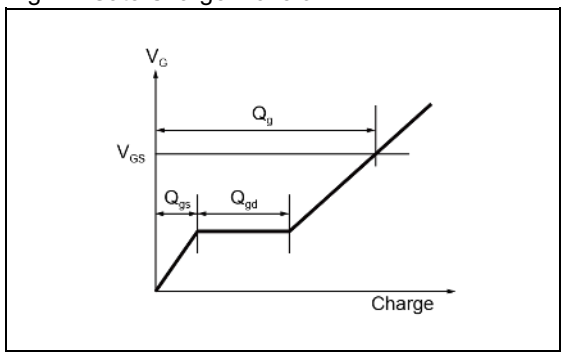



Fig.3-1 Avalanche Measurement Circuit

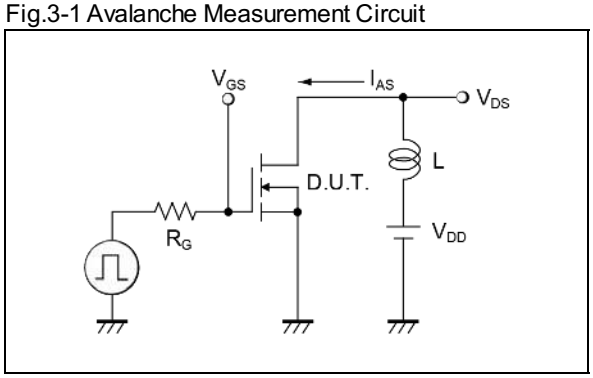
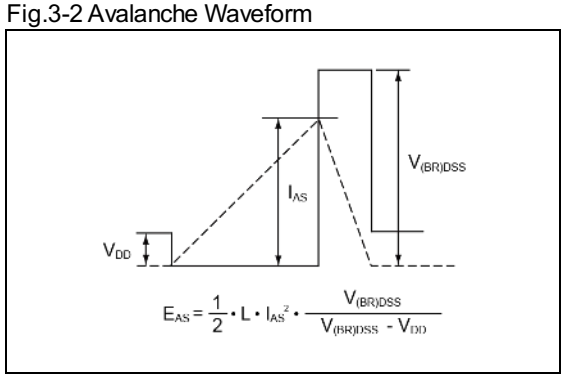



Fig.3-2 Avalanche Waveform



## ●Measurement circuits <Tr2>

Fig.4-1 Switching Time Measurement Circuit

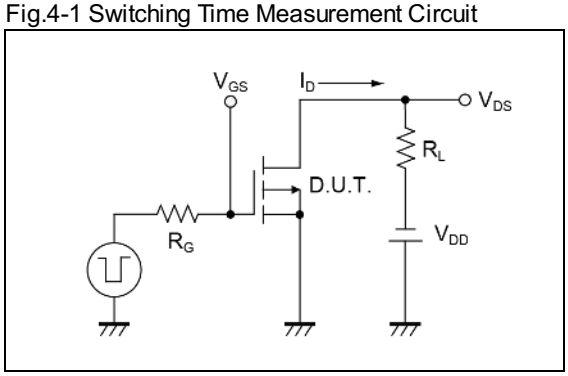



Fig.4-2 Switching Waveforms

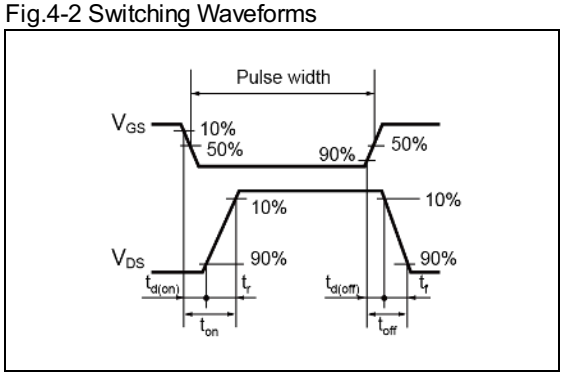



Fig.5-1 Gate Charge Measurement Circuit

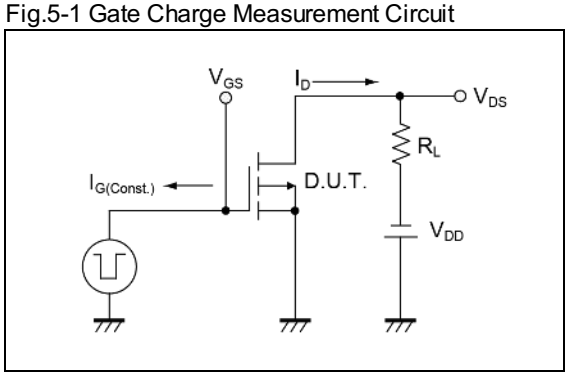



Fig.5-2 Gate Charge Waveform

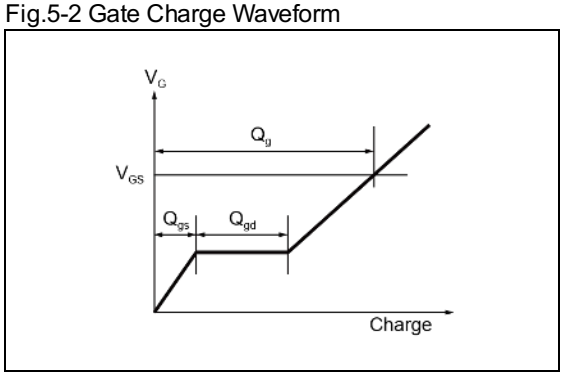



Fig.6-1 Avalanche Measurement Circuit

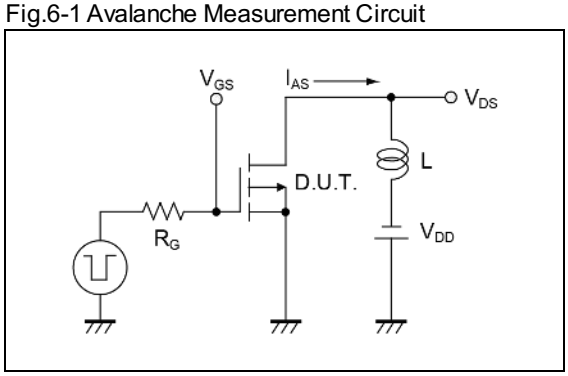
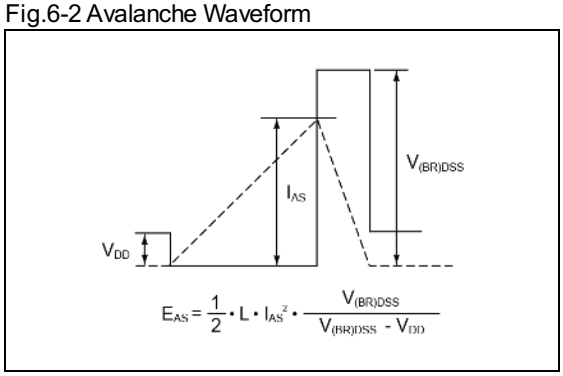



Fig.6-2 Avalanche Waveform

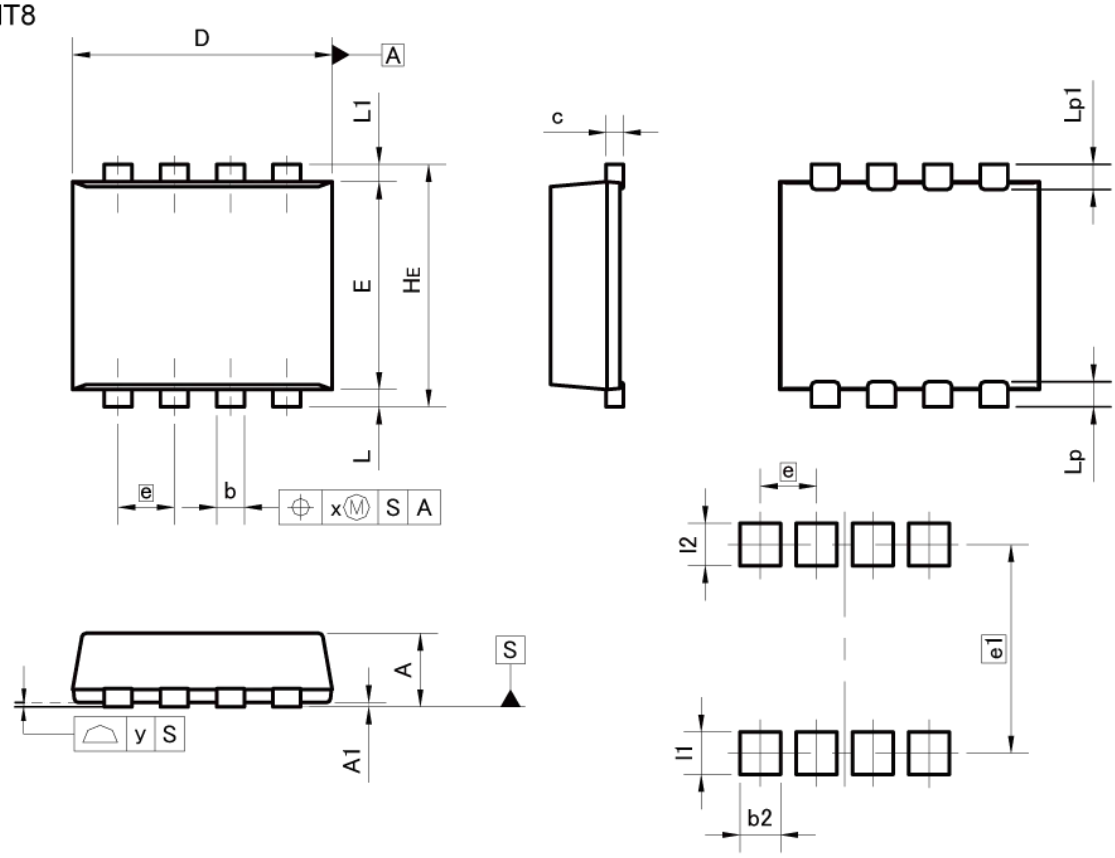



## ●Notice

This product might cause chip aging and breakdown under the large electrified environment.
Please consider to design ESD protection circuit.

## ●Dimensions

TSMT8




Pattern of terminal position areas
[Not a pattern of soldering pads]

| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.75 | 0.85 | 0.030 | 0.033 |
| A1 | 0.00 | 0.05 | 0.000 | 0.002 |
| b | 0.27 | 0.37 | 0.011 | 0.015 |
| c | 0.12 | 0.22 | 0.005 | 0.009 |
| D | 2.90 | 3.10 | 0.114 | 0.122 |
| E | 2.30 | 2.50 | 0.091 | 0.098 |
| e | 0.65 | | 0.026 | |
| HE | 2.70 | 2.90 | 0.106 | 0.114 |
| L | 0.10 | 0.30 | 0.004 | 0.012 |
| L1 | 0.10 | 0.30 | 0.004 | 0.012 |
| Lp | 0.19 | 0.39 | 0.007 | 0.015 |
| Lp1 | 0.19 | 0.39 | 0.007 | 0.015 |
| x | – | 0.10 | – | 0.004 |
| y | – | 0.10 | – | 0.004 |

| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| b2 | – | 0.47 | – | 0.019 |
| e1 | 2.41 | | 0.095 | |
| l1 | – | 0.49 | – | 0.019 |
| l2 | – | 0.49 | – | 0.019 |

Dimension in mm/inches

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2) Before you use our Products, please contact our sales representative and verify the latest specifications :

3) Although ROHM is continuously working to improve product reliability and quality, semiconductors can break down and malfunction due to various factors.
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4) Examples of application circuits, circuit constants and any other information contained herein are provided only to illustrate the standard usage and operations of the Products. The peripheral conditions must be taken into account when designing circuits for mass production.

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