

|                     |        |
|---------------------|--------|
| $V_{DSS}$           | -20V   |
| $R_{DS(on)}$ (Max.) | 1.2Ω   |
| $I_D$               | -200mA |
| $P_D$               | 150mW  |

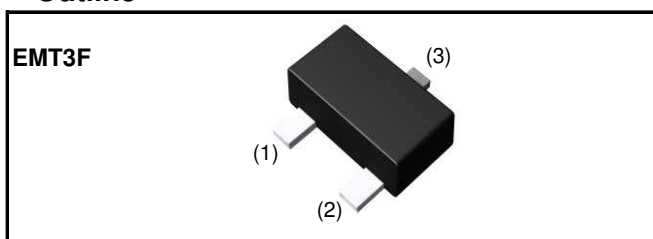
#### ●Features

- 1) Low voltage drive(1.2V) makes this device ideal for portable equipment.
- 2) Drive circuits can be simple.
- 3) Built-in G-S Protection Diode.

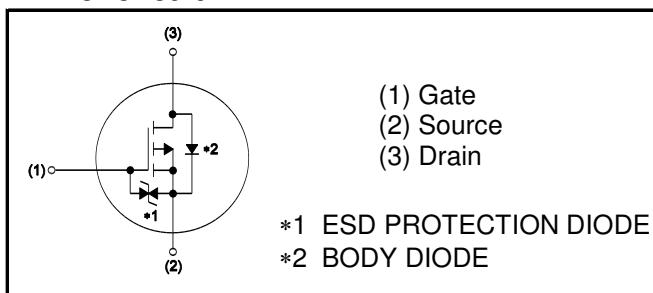
#### ●Application

Switching

#### ●Outline



#### ●Inner circuit



#### ●Packaging specifications

| Type | Packaging                 | Taping |
|------|---------------------------|--------|
|      | Reel size (mm)            | 180    |
|      | Tape width (mm)           | 8      |
|      | Basic ordering unit (pcs) | 3,000  |
|      | Taping code               | TL     |
|      | Marking                   | YK     |

#### ●Absolute maximum ratings( $T_a = 25^\circ\text{C}$ )

| Parameter                    | Symbol             | Value       | Unit |
|------------------------------|--------------------|-------------|------|
| Drain - Source voltage       | $V_{DSS}$          | -20         | V    |
| Continuous drain current     | $I_D^{*1}$         | ±200        | mA   |
| Pulsed drain current         | $I_{D,pulse}^{*2}$ | ±800        | mA   |
| Gate - Source voltage        | $V_{GSS}$          | ±10         | V    |
| Power dissipation            | $P_D^{*3}$         | 150         | mW   |
| Junction temperature         | $T_j$              | 150         | °C   |
| Range of storage temperature | $T_{stg}$          | -55 to +150 | °C   |

#### ●Thermal resistance

| Parameter                              | Symbol          | Values |      |      | Unit |
|--|-----------------|--------|------|------|------|
|  |                 | Min.   | Typ. | Max. |      |
| Thermal resistance, junction - ambient | $R_{thJA}^{*3}$ | -      | -    | 833  | °C/W |

●Electrical characteristics( $T_a = 25^\circ\text{C}$ ) ,unless otherwise specified

| Parameter                                   | Symbol          | Conditions  | Values |      |          | Unit          |
|---|-----------------|---|--------|------|----------|---------------|
|   |                 |   | Min.   | Typ. | Max.     |               |
| Drain - Source breakdown voltage            | $V_{(BR)DSS}$   | $V_{GS} = 0V, I_D = -1mA$                               | -20    | -    | -        | V             |
| Zero gate voltage drain current             | $I_{DSS}$       | $V_{DS} = -20V, V_{GS} = 0V$                            | -      | -    | -1       | $\mu\text{A}$ |
| Gate - Source leakage current               | $I_{GSS}$       | $V_{GS} = \pm 10V, V_{DS} = 0V$                         | -      | -    | $\pm 10$ | $\mu\text{A}$ |
| Gate threshold voltage                      | $V_{GS(th)}$    | $V_{DS} = -10V, I_D = -100\mu\text{A}$                  | -0.3   | -    | -1       | V             |
| Static drain - source on - state resistance | $R_{DS(on)}$ *4 | $V_{GS} = -4.5V, I_D = -200mA$                          | -      | 0.8  | 1.2      | $\Omega$      |
|   |                 | $V_{GS} = -2.5V, I_D = -100mA$                          | -      | 1.0  | 1.5      |               |
|   |                 | $V_{GS} = -1.8V, I_D = -100mA$                          | -      | 1.3  | 2.2      |               |
|   |                 | $V_{GS} = -1.5V, I_D = -40mA$                           | -      | 1.6  | 3.5      |               |
|   |                 | $V_{GS} = -1.2V, I_D = -10mA$                           | -      | 2.4  | 9.6      |               |
|   |                 | $V_{GS} = -4.5V, I_D = -200mA, T_j = 125^\circ\text{C}$ | -      | 1.1  | 1.6      |               |
| Transconductance                            | $g_{fs}$ *4     | $V_{DS} = -10V, I_D = -200mA$                           | 200    | -    | -        | mS            |

\*1 Limited only by maximum temperature allowed.

\*2  $P_w \leq 10\mu\text{s}$ , Duty cycle  $\leq 1\%$

\*3 Each terminal mounted on a recommended land

\*4 Pulsed

**●Electrical characteristics**( $T_a = 25^\circ\text{C}$ )

| Parameter                    | Symbol            | Conditions  | Values |      |      | Unit |
|------------------------------|-------------------|---|--------|------|------|------|
|                              |                   |   | Min.   | Typ. | Max. |      |
| Input capacitance            | $C_{iss}$         | $V_{GS} = 0\text{V}$                                | -      | 115  | -    | pF   |
| Output capacitance           | $C_{oss}$         | $V_{DS} = -10\text{V}$                              | -      | 10   | -    |      |
| Reverse transfer capacitance | $C_{rss}$         | $f = 1\text{MHz}$                                   | -      | 6    | -    |      |
| Turn - on delay time         | $t_{d(on)}^{*4}$  | $V_{DD} \approx -10\text{V}, V_{GS} = -4.5\text{V}$ | -      | 6    | -    | ns   |
| Rise time                    | $t_r^{*4}$        | $I_D = -100\text{mA}$                               | -      | 4    | -    |      |
| Turn - off delay time        | $t_{d(off)}^{*4}$ | $R_L = 100\Omega$                                   | -      | 17   | -    |      |
| Fall time                    | $t_f^{*4}$        | $R_G = 10\Omega$                                    | -      | 17   | -    |      |

**●Body diode electrical characteristics** (Source-Drain)( $T_a = 25^\circ\text{C}$ )

| Parameter                 | Symbol        | Conditions                                | Values |      |      | Unit |
|---------------------------|---------------|---|--------|------|------|------|
|                           |               |   | Min.   | Typ. | Max. |      |
| Continuous source current | $I_S^{*1}$    | $T_c = 25^\circ\text{C}$                  | -      | -    | -100 | mA   |
| Pulsed source current     | $I_{SM}^{*2}$ |   | -      | -    | -800 | mA   |
| Forward voltage           | $V_{SD}^{*4}$ | $V_{GS} = 0\text{V}, I_S = -200\text{mA}$ | -      | -    | -1.2 | V    |

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

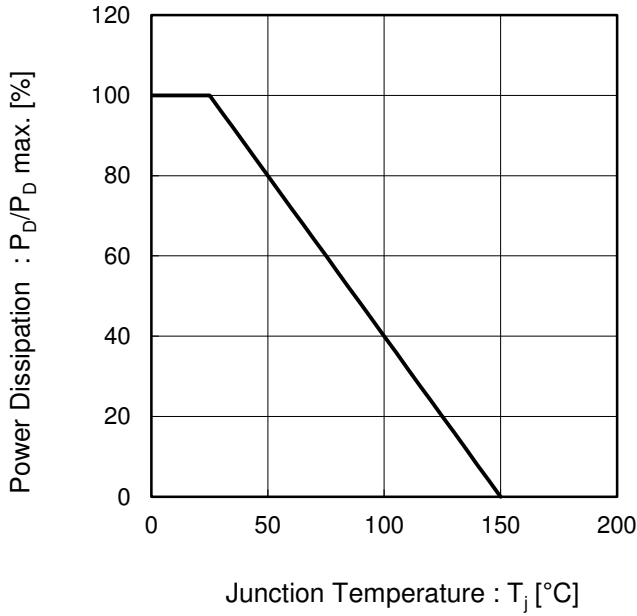


Fig.2 Drain Current Derating Curve

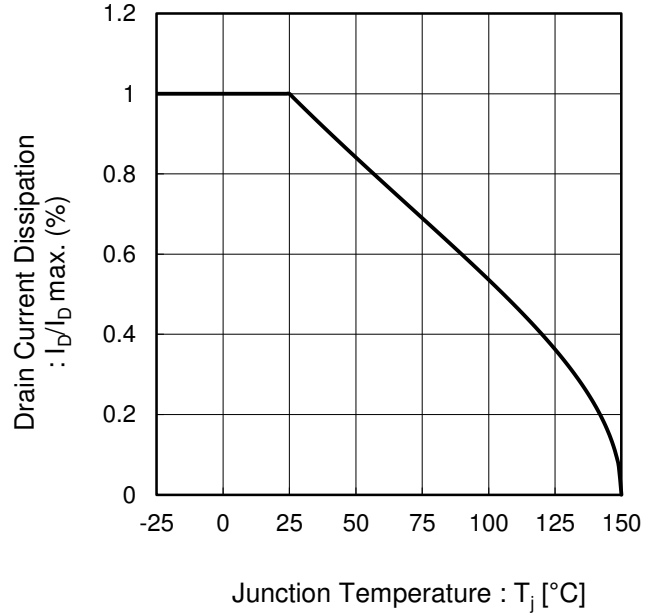


Fig.3 Typical Output Characteristics(I)

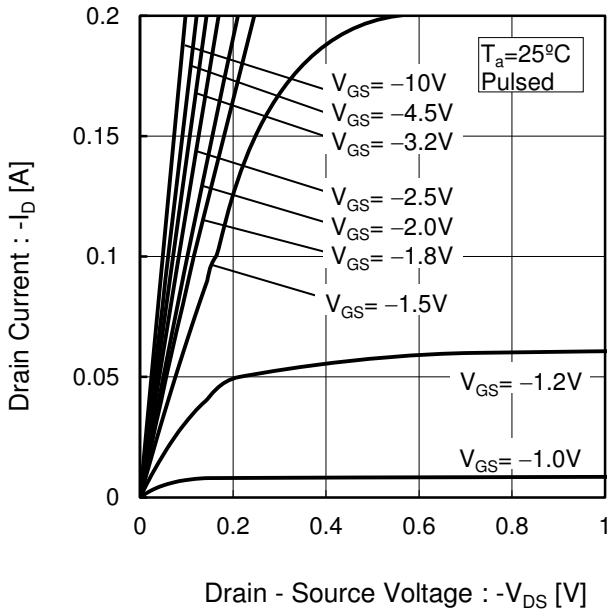
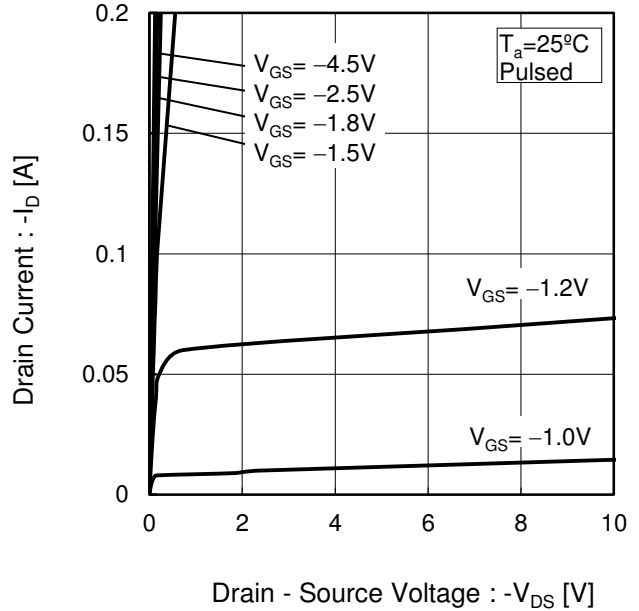


Fig.4 Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.5 Breakdown Voltage vs. Junction Temperature

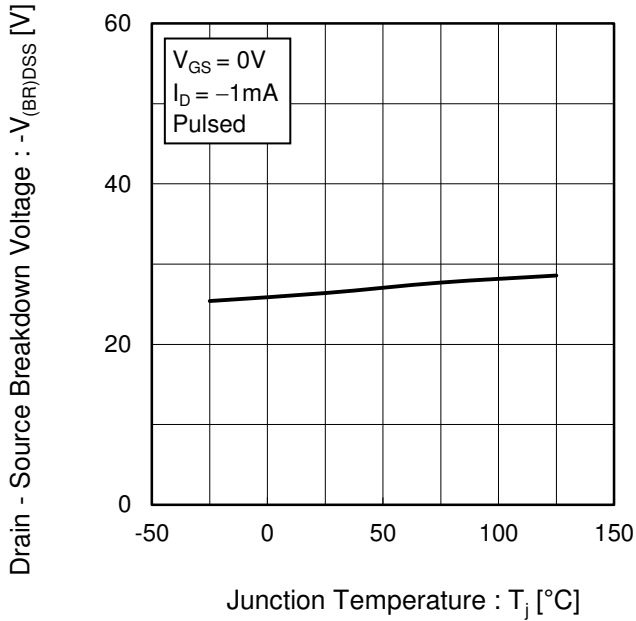


Fig.6 Typical Transfer Characteristics

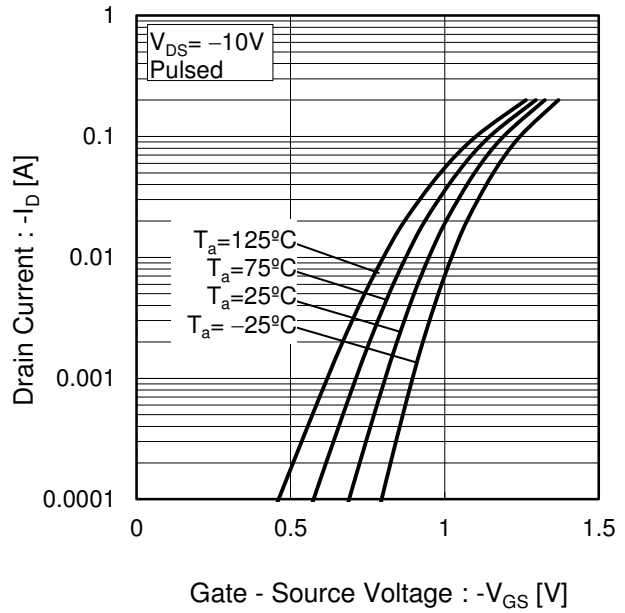


Fig.7 Gate Threshold Voltage vs. Junction Temperature

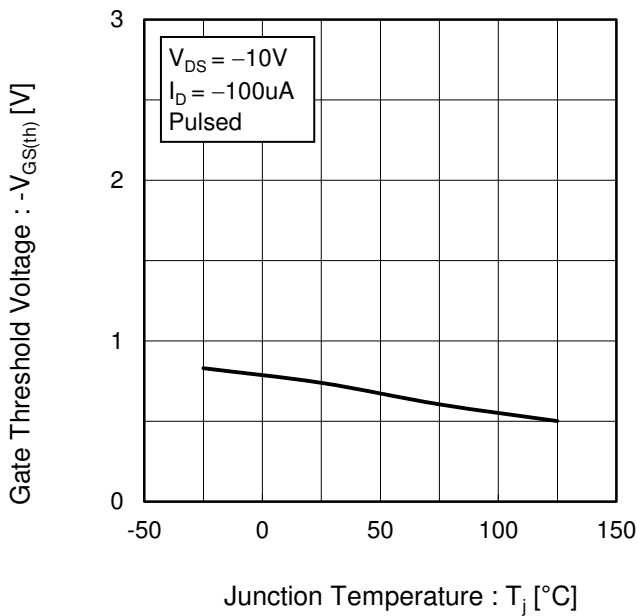
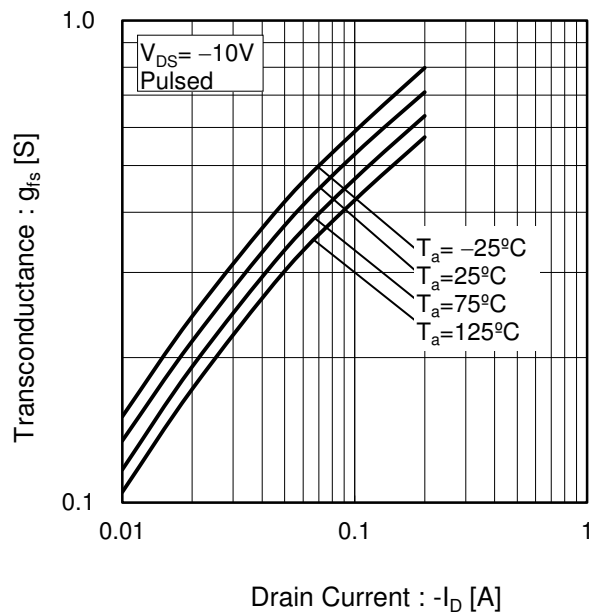


Fig.8 Transconductance vs. Drain Current



●Electrical characteristic curves

Fig.9 Static Drain - Source On - State Resistance vs. Gate Source Voltage

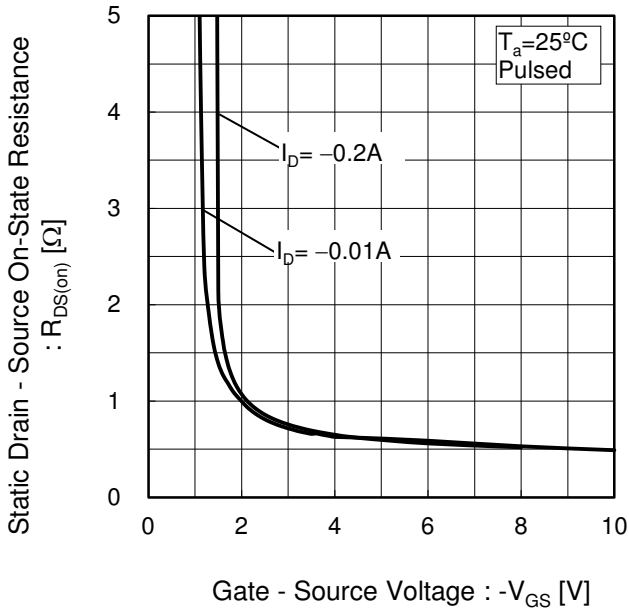


Fig.10 Static Drain - Source On - State Resistance vs. Drain Current(I)

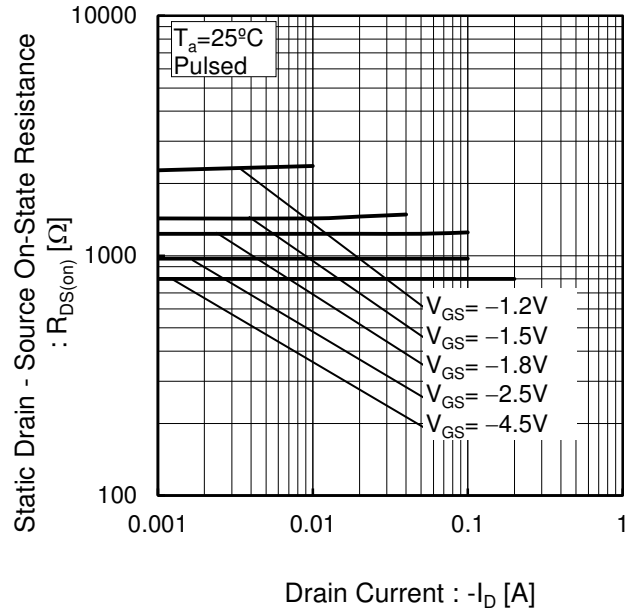


Fig.11 Static Drain - Source On - State Resistance vs. Junction Temperature

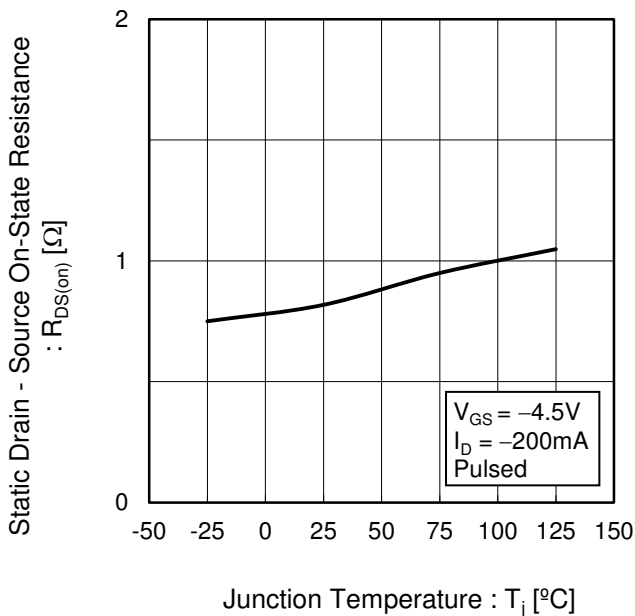
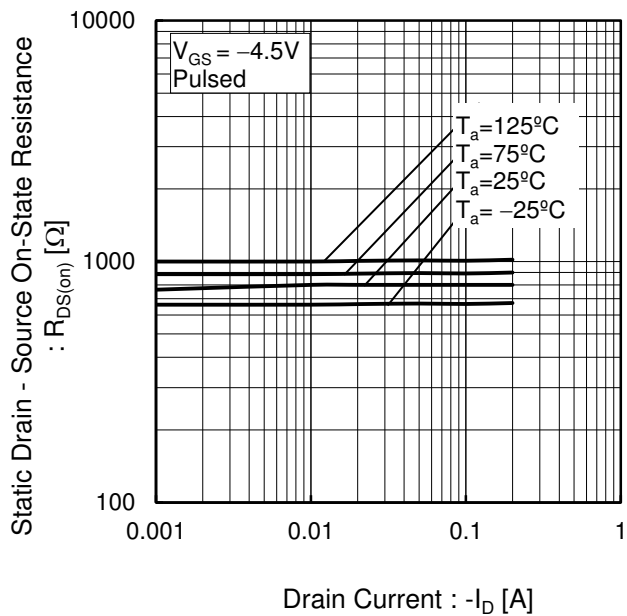


Fig.12 Static Drain - Source On - State Resistance vs. Drain Current(II)



●Electrical characteristic curves

Fig.13 Static Drain-Source On-State Resistance vs. Drain Current(III)

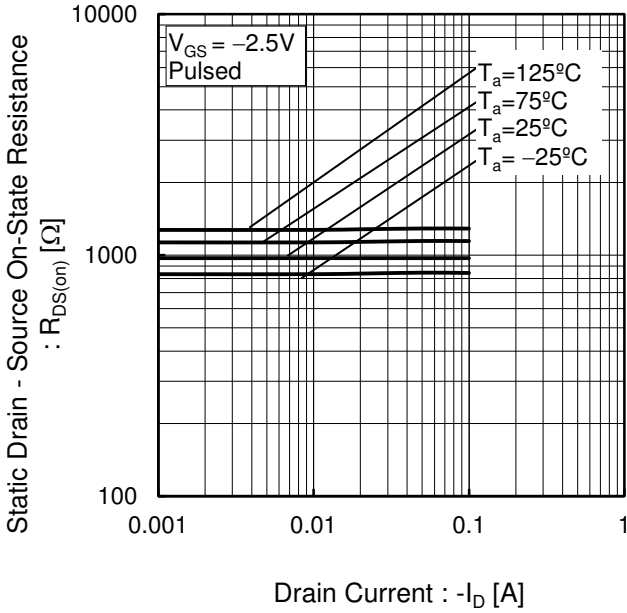


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current(IV)

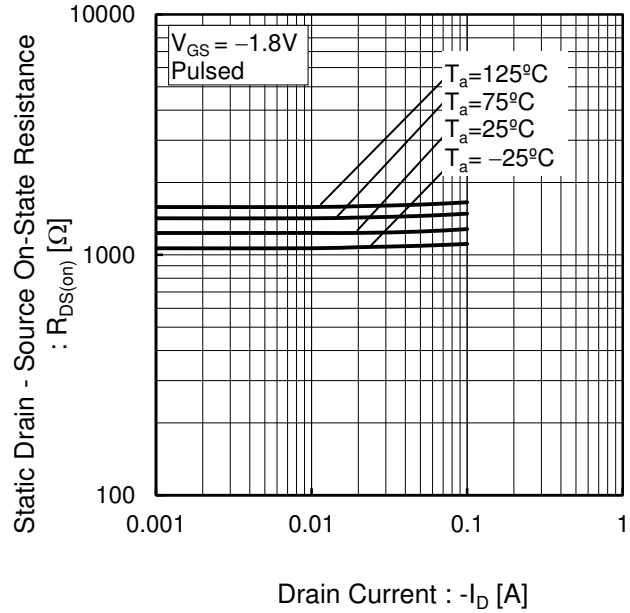


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(V)

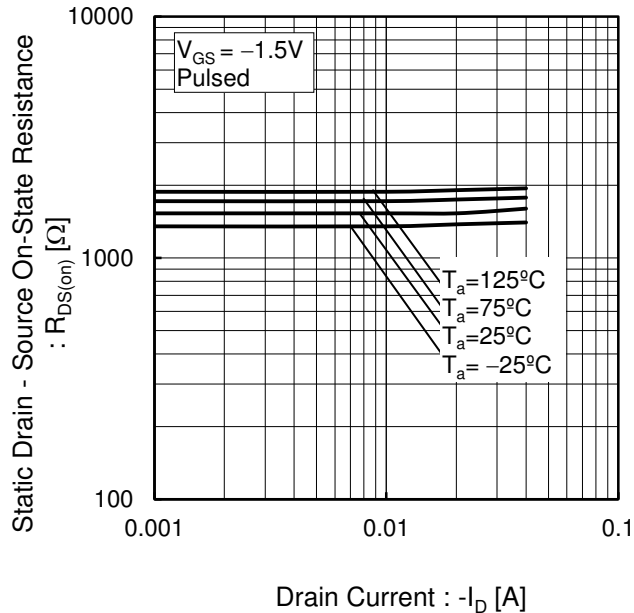
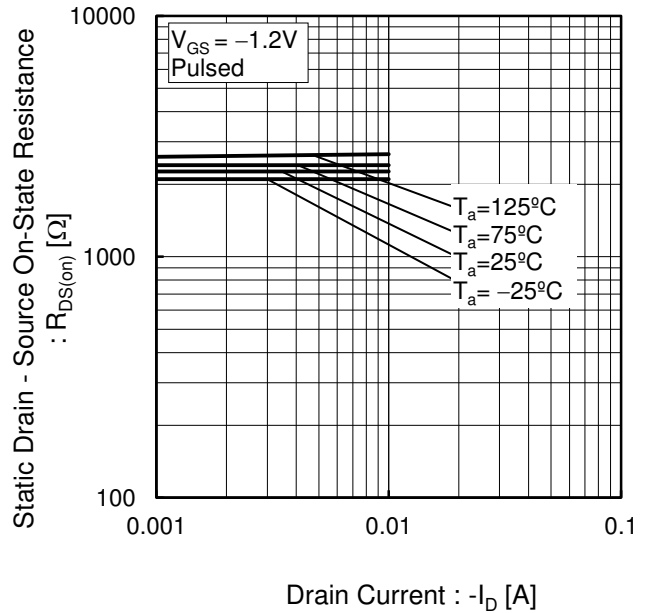


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(VI)



●Electrical characteristic curves

Fig.17 Typical Capacitance vs. Drain - Source Voltage

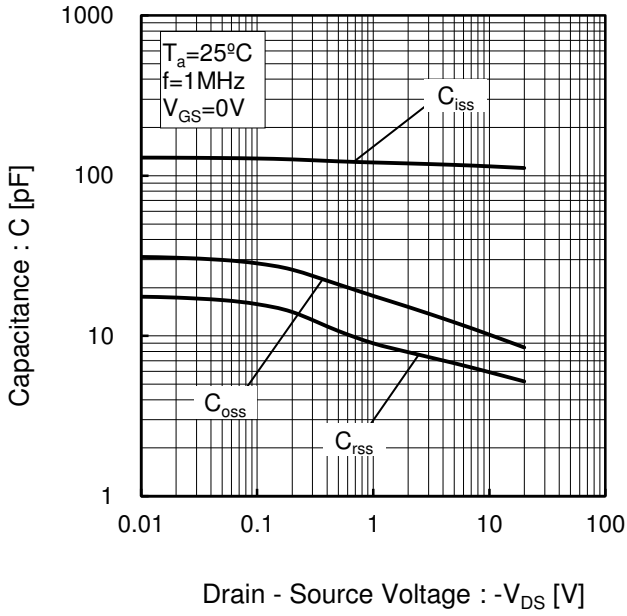


Fig.18 Switching Characteristics

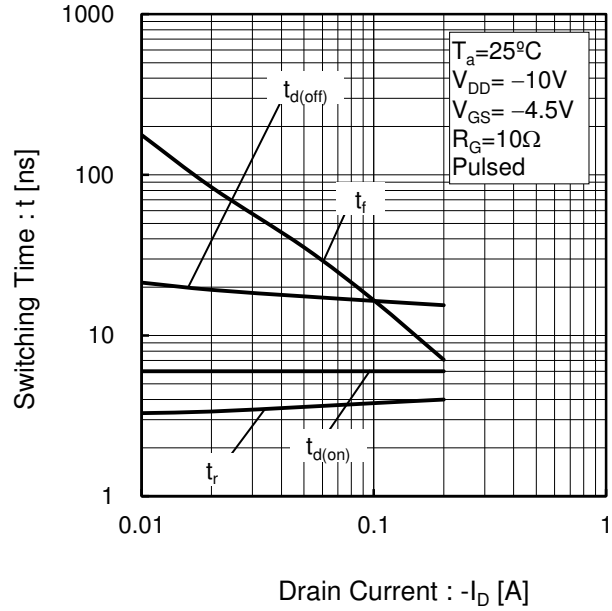
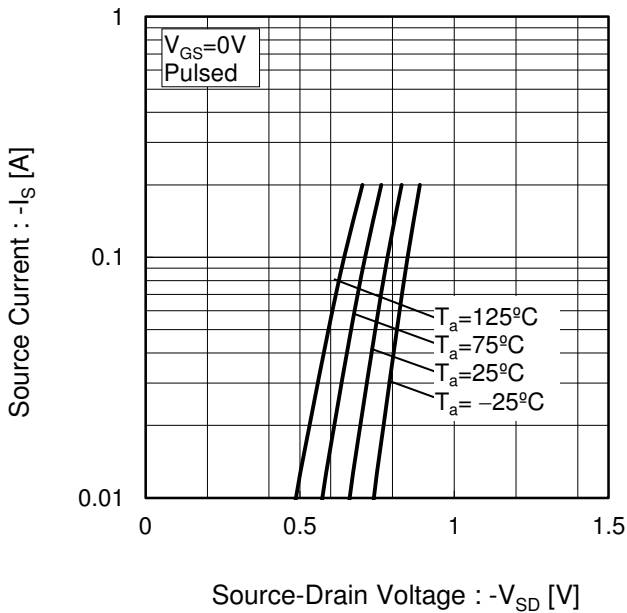


Fig.19 Source Current vs. Source Drain Voltage





## ●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

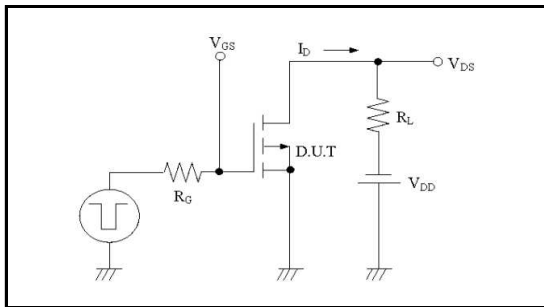
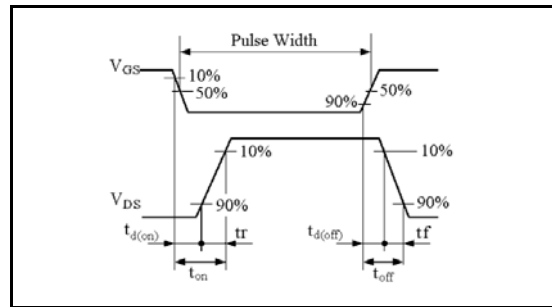


Fig.1-2 Switching Waveforms



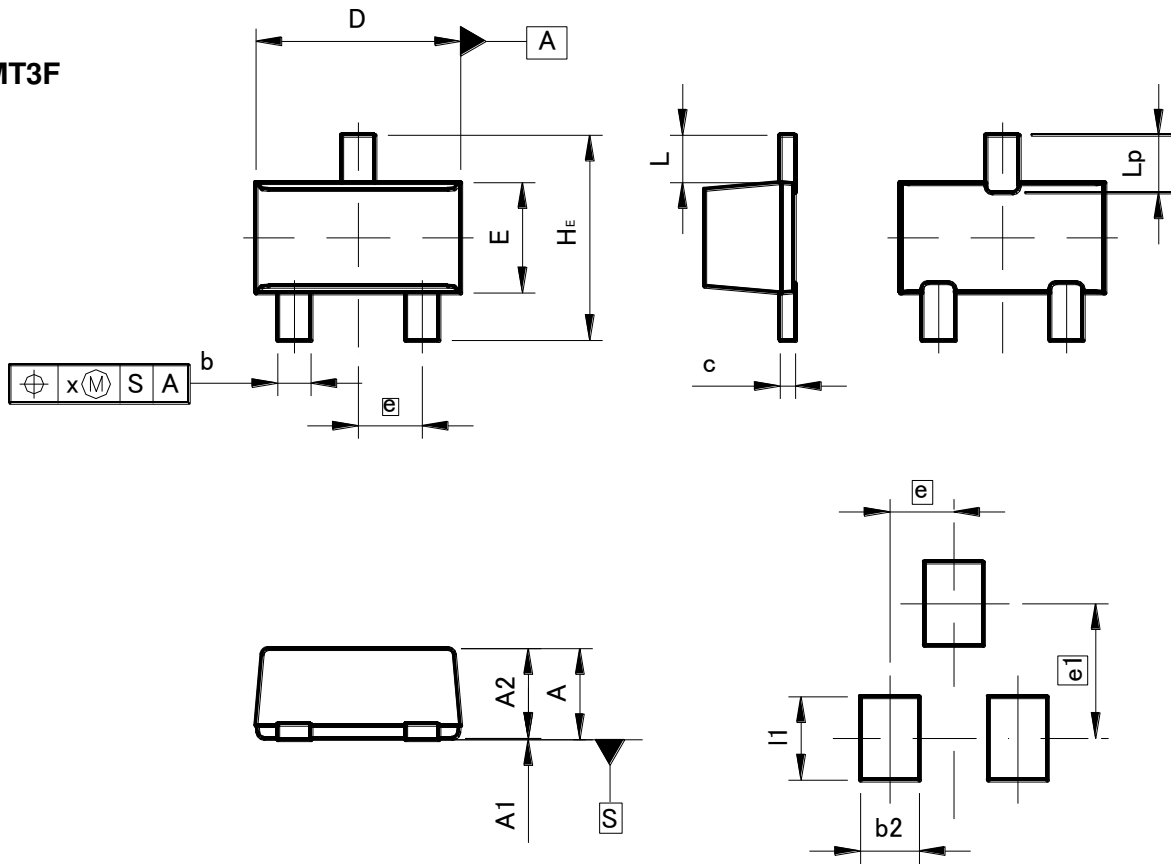
## ●Notice

This product might cause chip aging and breakdown under the large electrified environment.

Please consider to design ESD protection circuit.

●Dimensions (Unit : mm)

EMT3F



**Pattern of terminal position areas**

| DIM | MILIMETERS |      | INCHES |       |
|-----|------------|------|--------|-------|
|     | MIN        | MAX  | MIN    | MAX   |
| A   | 0.65       | 0.85 |        |       |
| A1  | 0.00       | 0.10 | 0      | 0.004 |
| A2  | 0.60       | 0.80 | 0.024  | 0.031 |
| b   | 0.21       | 0.36 | 0.008  | 0.014 |
| c   | 0.08       | 0.18 | 0.003  | 0.007 |
| D   | 1.50       | 1.70 | 0.059  | 0.067 |
| E   | 0.76       | 0.96 | 0.03   | 0.038 |
| e   | 0.50       |      | 0.02   |       |
| HE  | 1.50       | 1.70 | 0.059  | 0.067 |
| L   | 0.37       |      | 0.015  |       |
| Lp  | 0.35       | 0.55 | 0.014  | 0.022 |
| x   | -          | 0.10 | -      | 0.004 |

| DIM | MILIMETERS |      | INCHES |       |
|-----|------------|------|--------|-------|
|     | MIN        | MAX  | MIN    | MAX   |
| e1  | -          | 1.05 | -      | 0.041 |
| b2  | -          | 0.46 | -      | 0.018 |
| l1  | -          | 0.65 | -      | 0.026 |

Dimension in mm/inches

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