

| | |
|---------------------|---------------|
| V_{DSS} | 600V |
| $R_{DS(on)}$ (Max.) | 0.22 Ω |
| I_D | 20A |
| P_D | 50W |

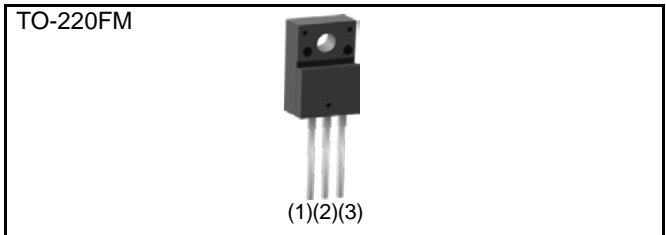
●Features

- 1) Low on-resistance.
- 2) Fast switching speed.
- 3) Gate-source voltage (V_{GSS}) guaranteed to be $\pm 30V$.
- 4) Drive circuits can be simple.
- 5) Parallel use is easy.
- 6) Pb-free lead plating ; RoHS compliant

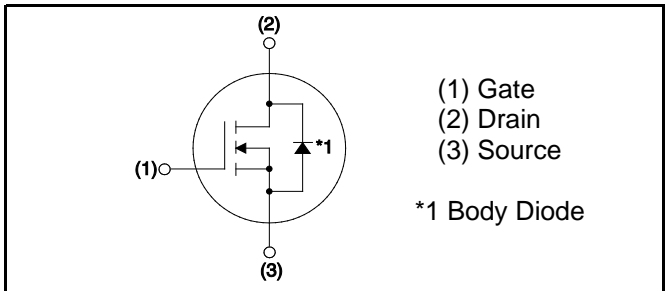
●Application

Switching Power Supply

●Outline



●Inner circuit



●Packaging specifications

| Type | Packing | Bulk |
|------|---------------------------|----------|
| | Reel size (mm) | - |
| | Tape width (mm) | - |
| | Basic ordering unit (pcs) | 500 |
| | Taping code | - |
| | Marking | R6020ANX |

●Absolute maximum ratings ($T_a = 25^\circ C$)

| Parameter | Symbol | Value | Unit | |
|--|---------------------|-------------|------------|---|
| Drain - Source voltage | V_{DSS} | 600 | V | |
| Continuous drain current | $T_c = 25^\circ C$ | I_D^{*1} | ± 20 | A |
| | $T_c = 100^\circ C$ | I_D^{*1} | ± 9.7 | A |
| Pulsed drain current | $I_{D,pulse}^{*2}$ | ± 80 | A | |
| Gate - Source voltage | V_{GSS} | ± 30 | V | |
| Avalanche energy, single pulse | E_{AS}^{*3} | 26.7 | mJ | |
| Avalanche energy, repetitive | E_{AR}^{*4} | 3.5 | mJ | |
| Avalanche current | I_{AR}^{*3} | 10 | A | |
| Power dissipation ($T_c = 25^\circ C$) | P_D | 50 | W | |
| Junction temperature | T_j | 150 | $^\circ C$ | |
| Range of storage temperature | T_{stg} | -55 to +150 | $^\circ C$ | |
| Reverse diode dv/dt | dv/dt ^{*5} | 15 | V/ns | |

●Absolute maximum ratings

| Parameter | Symbol | Conditions | Values | Unit |
|------------------------------|--------|---|--------|------|
| Drain - Source voltage slope | dv/dt | $V_{DS} = 480V, I_D = 20A$ $T_j = 125^\circ C$ | 50 | V/ns |

●Thermal resistance

| Parameter | Symbol | Values | | | Unit |
|--|------------|--------|------|------|--------------|
| | | Min. | Typ. | Max. | |
| Thermal resistance, junction - case | R_{thJC} | - | - | 2.5 | $^\circ C/W$ |
| Thermal resistance, junction - ambient | R_{thJA} | - | - | 70 | $^\circ C/W$ |
| Soldering temperature, wavesoldering for 10s | T_{sold} | - | - | 265 | $^\circ C$ |

●Electrical characteristics ($T_a = 25^\circ C$)

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|-------------------|--|--------|------|-----------|----------|
| | | | Min. | Typ. | Max. | |
| Drain - Source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = 1mA$ | 600 | - | - | V |
| Drain - Source avalanche breakdown voltage | $V_{(BR)DS}$ | $V_{GS} = 0V, I_D = 20A$ | - | 700 | - | V |
| Zero gate voltage drain current | I_{DSS} | $V_{DS} = 600V, V_{GS} = 0V$ $T_j = 25^\circ C$ | - | 0.1 | 100 | μA |
| | | $T_j = 125^\circ C$ | - | - | 1000 | |
| Gate - Source leakage current | I_{GSS} | $V_{GS} = \pm 30V, V_{DS} = 0V$ | - | - | ± 100 | nA |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS} = 10V, I_D = 1mA$ | 2.5 | - | 4.5 | V |
| Static drain - source on - state resistance | $R_{DS(on)}^{*6}$ | $V_{GS} = 10V, I_D = 10A$ $T_j = 25^\circ C$ | - | 0.17 | 0.22 | Ω |
| | | $T_j = 125^\circ C$ | - | 0.36 | - | |
| Gate input resistance | R_G | f = 1MHz, open drain | - | 13.8 | - | Ω |

●Electrical characteristics (T_a = 25°C)

| Parameter | Symbol | Conditions | Values | | | Unit |
|--|-------------------|---|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Transconductance | g_{fs}^{*6} | $V_{DS} = 10V, I_D = 10A$ | 7 | 14 | - | S |
| Input capacitance | C_{iss} | $V_{GS} = 0V$ | - | 2040 | - | pF |
| Output capacitance | C_{oss} | $V_{DS} = 25V$ | - | 1660 | - | |
| Reverse transfer capacitance | C_{rss} | $f = 1MHz$ | - | 70 | - | |
| Effective output capacitance, energy related | $C_{o(er)}$ | $V_{GS} = 0V$ $V_{DS} = 0V \text{ to } 480V$ | - | 104 | - | pF |
| Effective output capacitance, time related | $C_{o(tr)}$ | | - | 104 | - | |
| Turn - on delay time | $t_{d(on)}^{*6}$ | $V_{DD} \approx 300V, V_{GS} = 10V$ | - | 40 | - | ns |
| Rise time | t_r^{*6} | $I_D = 10A$ | - | 60 | - | |
| Turn - off delay time | $t_{d(off)}^{*6}$ | $R_L = 30\Omega$ | - | 230 | 460 | |
| Fall time | t_f^{*6} | $R_G = 10\Omega$ | - | 70 | 140 | |

●Gate Charge characteristics (T_a = 25°C)

| Parameter | Symbol | Conditions | Values | | | Unit |
|----------------------|-----------------|----------------------------------|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Total gate charge | Q_g^{*6} | $V_{DD} \approx 300V$ | - | 65 | - | nC |
| Gate - Source charge | Q_{gs}^{*6} | $I_D = 20A$ | - | 10 | - | |
| Gate - Drain charge | Q_{gd}^{*6} | $V_{GS} = 10V$ | - | 25 | - | |
| Gate plateau voltage | $V_{(plateau)}$ | $V_{DD} \approx 300V, I_D = 20A$ | - | 6.0 | - | V |

*1 Limited only by maximum temperature allowed.

*2 $PW \leq 10\mu s$, Duty cycle $\leq 1\%$

*3 $L \approx 500\mu H$, $V_{DD} = 50V$, $R_G = 25\Omega$, starting $T_j = 25^\circ C$

*4 $L \approx 500\mu H$, $V_{DD} = 50V$, $R_G = 25\Omega$, starting $T_j = 25^\circ C$, $f = 10kHz$

*5 Reference measurement circuits Fig.5-1.

*6 Pulsed

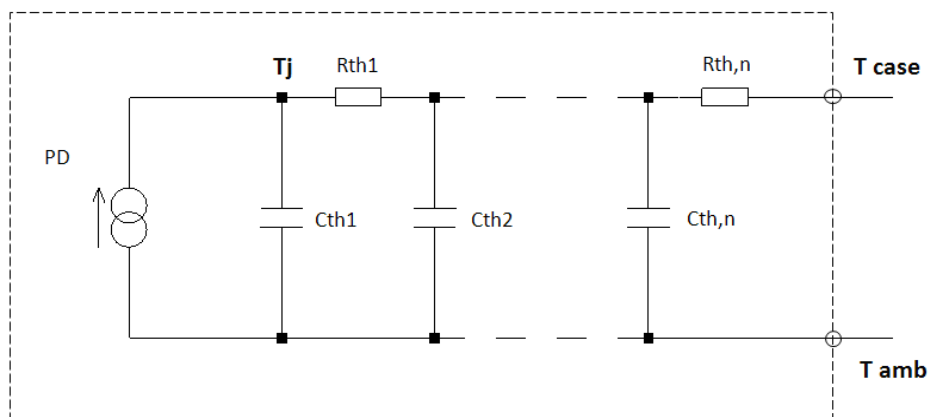
●Body diode electrical characteristics (Source-Drain) ($T_a = 25^\circ\text{C}$)

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|----------------|---|--------|------|------|------------------------|
| | | | Min. | Typ. | Max. | |
| Inverse diode continuous, forward current | I_S^{*1} | $T_c = 25^\circ\text{C}$ | - | - | 20 | A |
| Inverse diode direct current, pulsed | I_{SM}^{*2} | | - | - | 80 | A |
| Forward voltage | V_{SD}^{*6} | $V_{GS} = 0\text{V}, I_S = 10\text{A}$ | - | - | 1.5 | V |
| Reverse recovery time | t_{rr}^{*6} | $I_S = 20\text{A}$ $di/dt = 100\text{A}/\mu\text{s}$ | - | 486 | - | ns |
| Reverse recovery charge | Q_{rr}^{*6} | | - | 7.8 | - | μC |
| Peak reverse recovery current | I_{rrm}^{*6} | | - | 32 | - | A |
| Peak rate of fall of reverse recovery current | di_{rr}/dt | $T_j = 25^\circ\text{C}$ | - | 800 | - | $\text{A}/\mu\text{s}$ |

●Typical Transient Thermal Characteristics

| Symbol | Value | Unit |
|-----------|--------|------|
| R_{th1} | 0.0789 | K/W |
| R_{th2} | 0.579 | |
| R_{th3} | 2.17 | |

| Symbol | Value | Unit |
|-----------|---------|------|
| C_{th1} | 0.00458 | Ws/K |
| C_{th2} | 0.0603 | |
| C_{th3} | 0.549 | |



●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

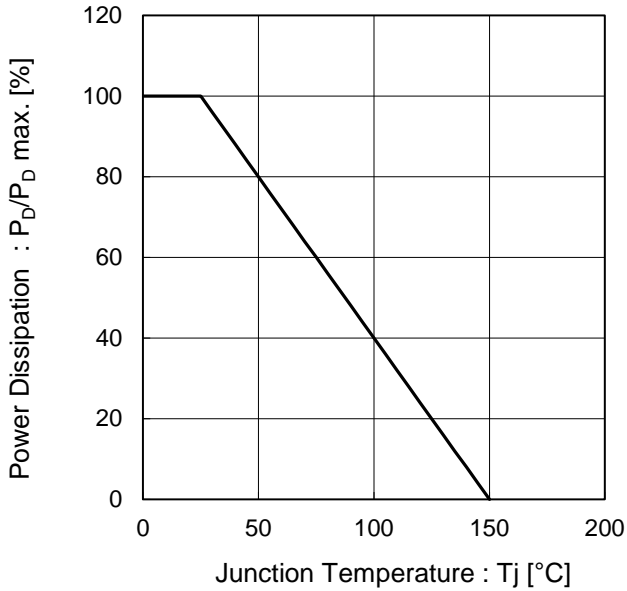


Fig.2 Maximum Safe Operating Area

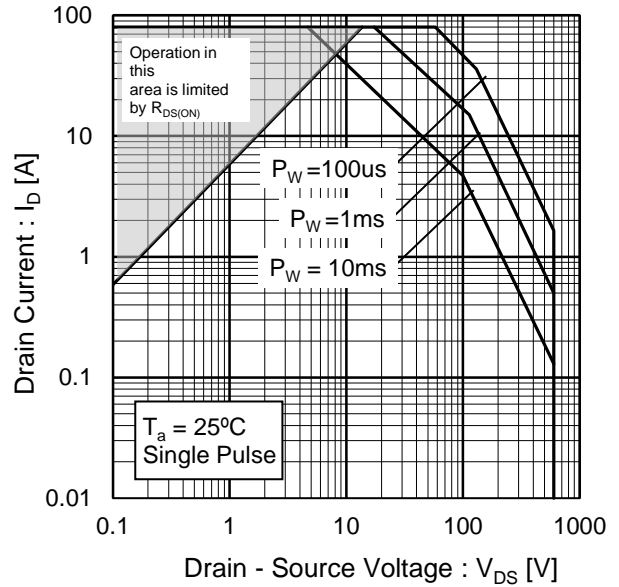
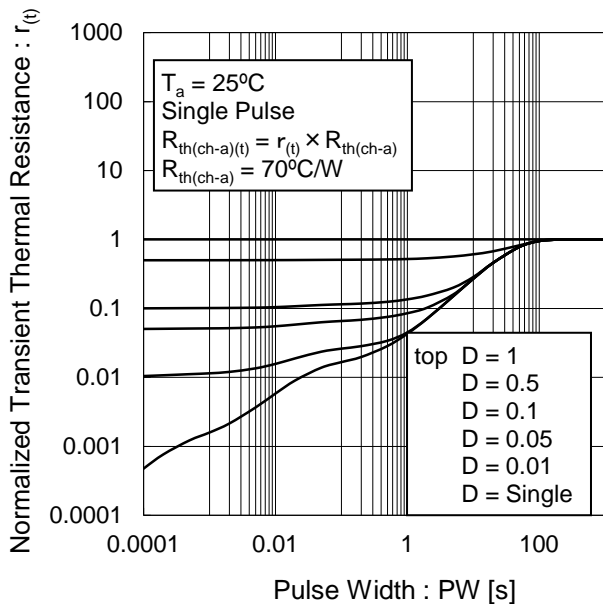


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Avalanche Current vs Inductive Load

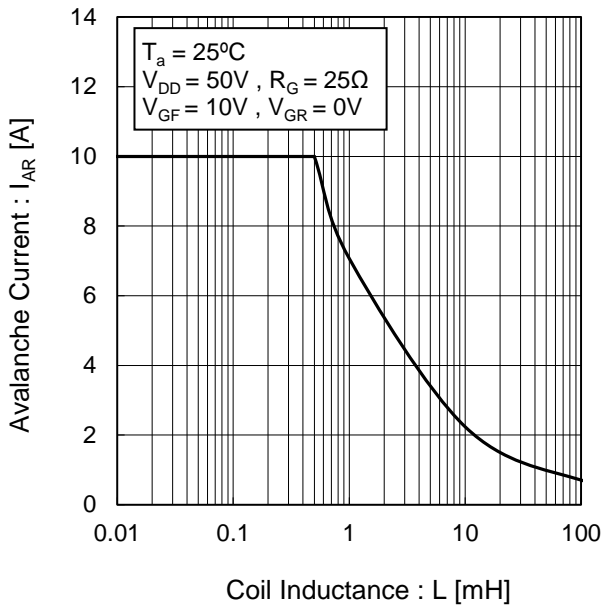


Fig.5 Avalanche Power Losses

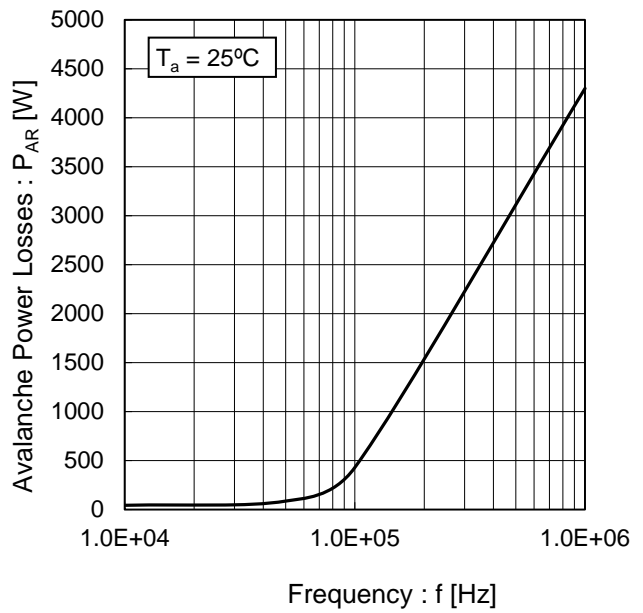
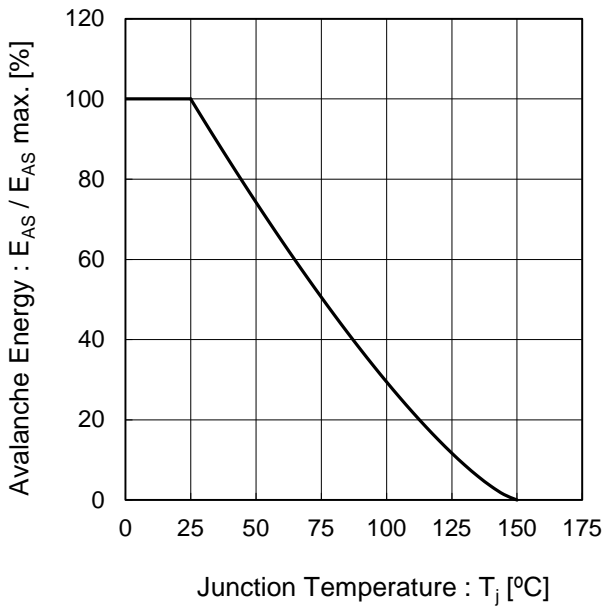


Fig.6 Avalanche Energy Derating Curve vs Junction Temperature



●Electrical characteristic curves

Fig.7 Typical Output Characteristics(I)

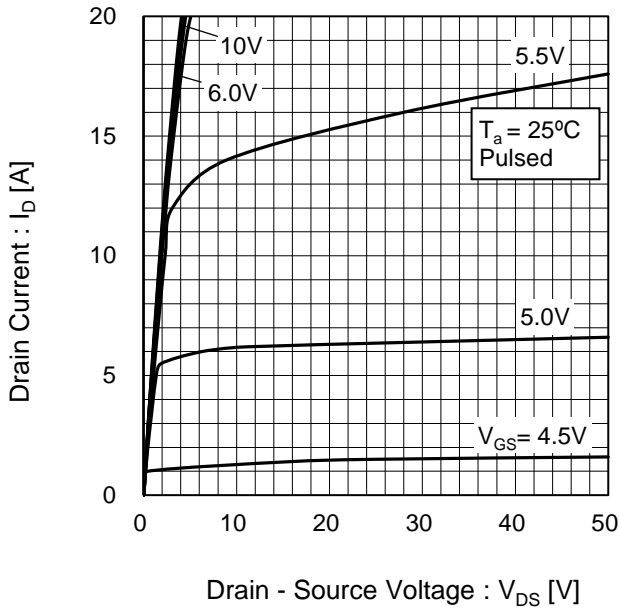


Fig.8 Typical Output Characteristics(II)

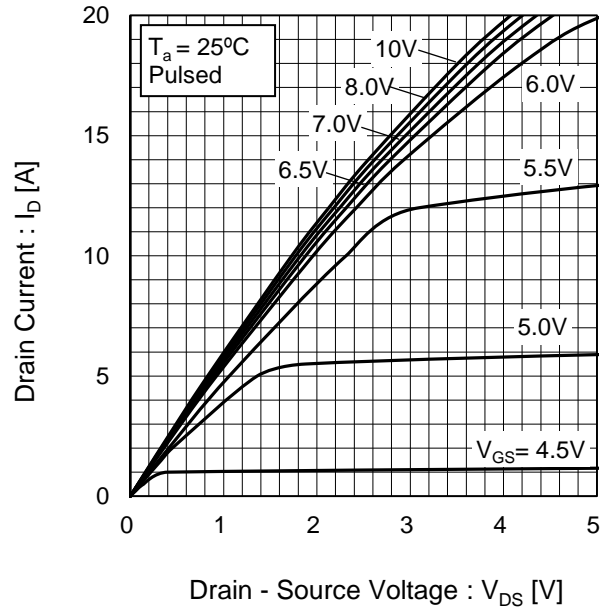


Fig.9 $T_j = 150^\circ\text{C}$ Typical Output Characteristics(I)

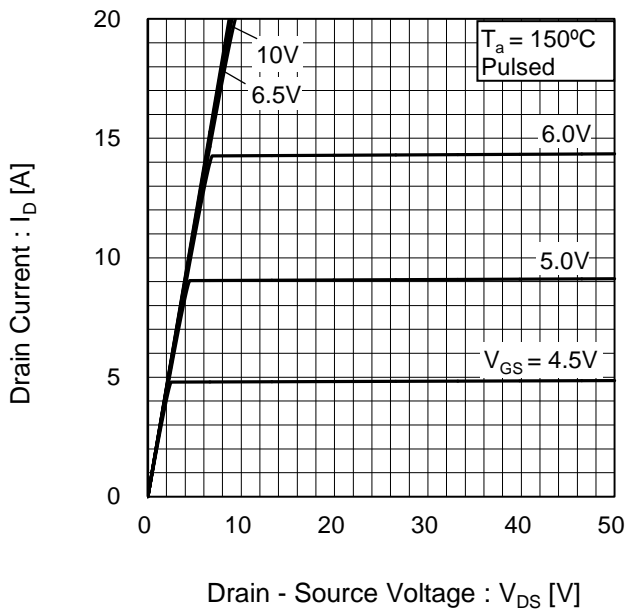
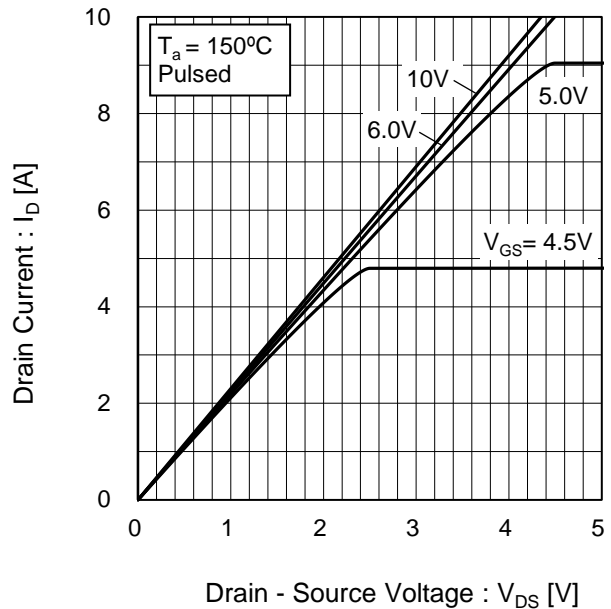


Fig.10 $T_j = 150^\circ\text{C}$ Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.11 Breakdown Voltage vs. Junction Temperature

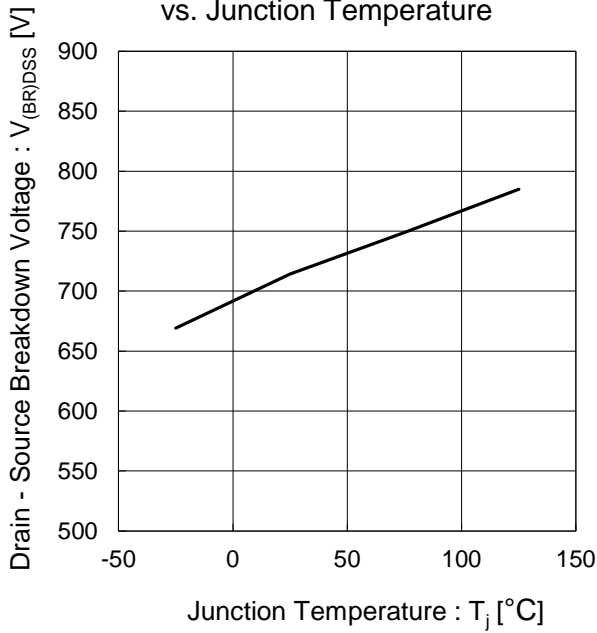


Fig.12 Typical Transfer Characteristics

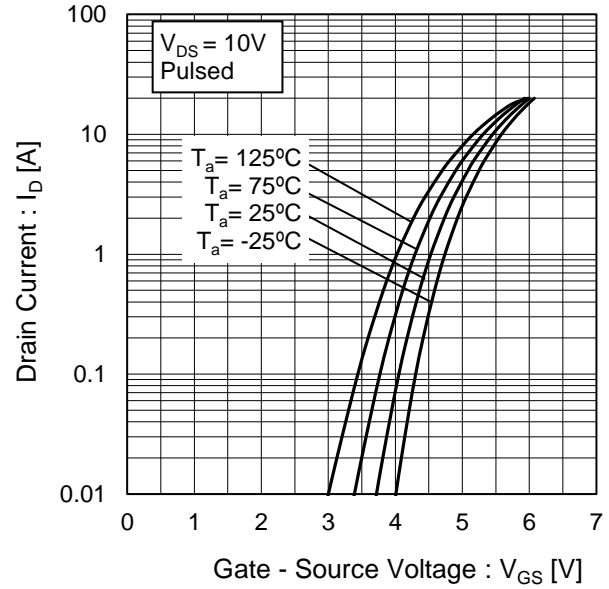


Fig.13 Gate Threshold Voltage vs. Junction Temperature

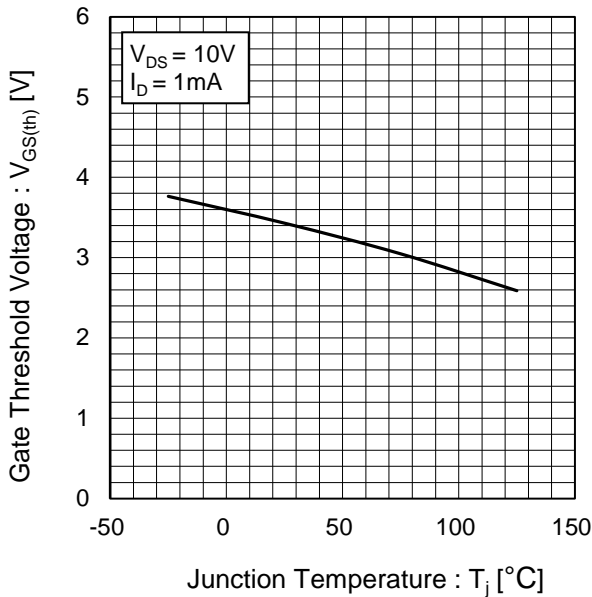
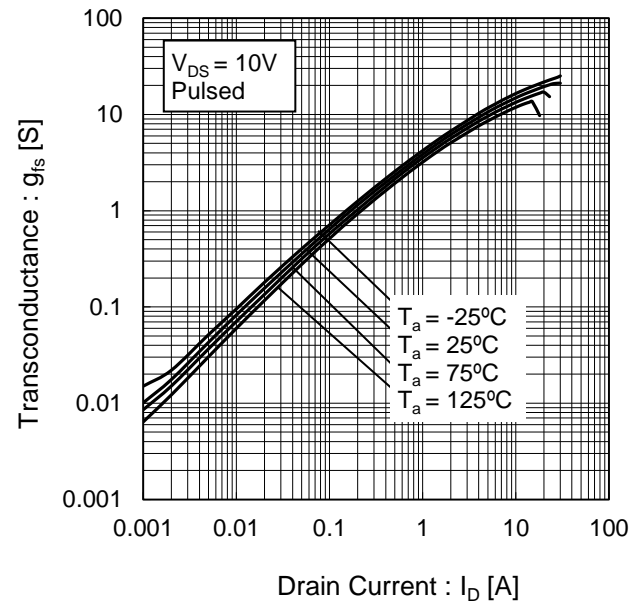


Fig.14 Transconductance vs. Drain Current



●Electrical characteristic curves

Fig.15 Static Drain - Source On - State Resistance vs. Gate Source Voltage

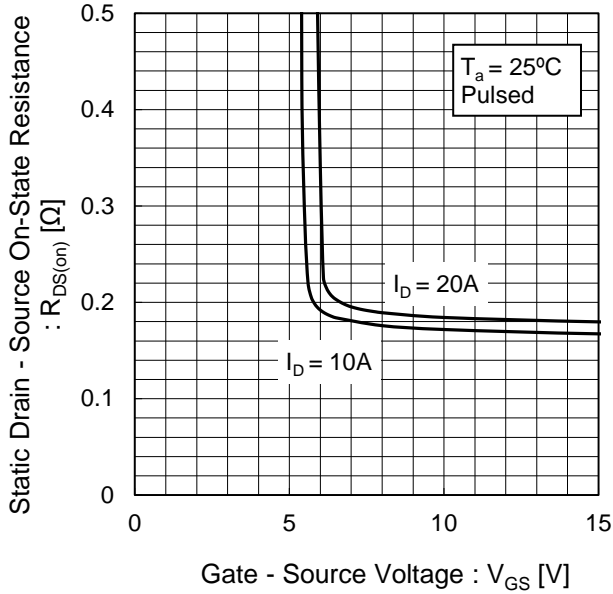


Fig.16 Static Drain - Source On - State Resistance vs. Junction Temperature

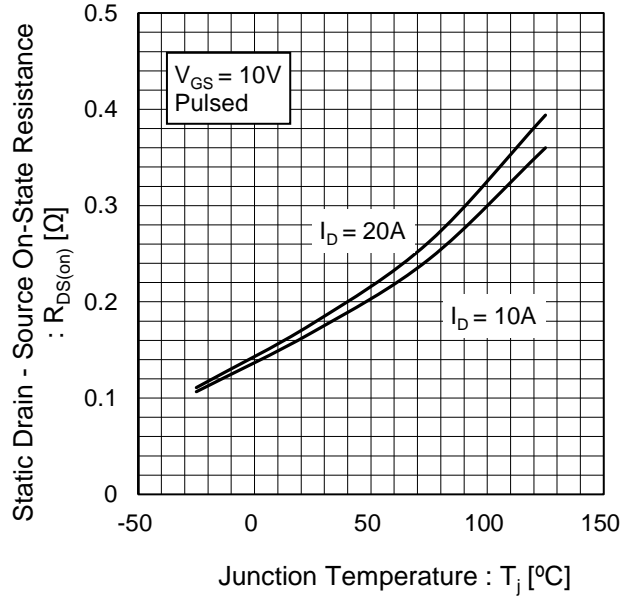
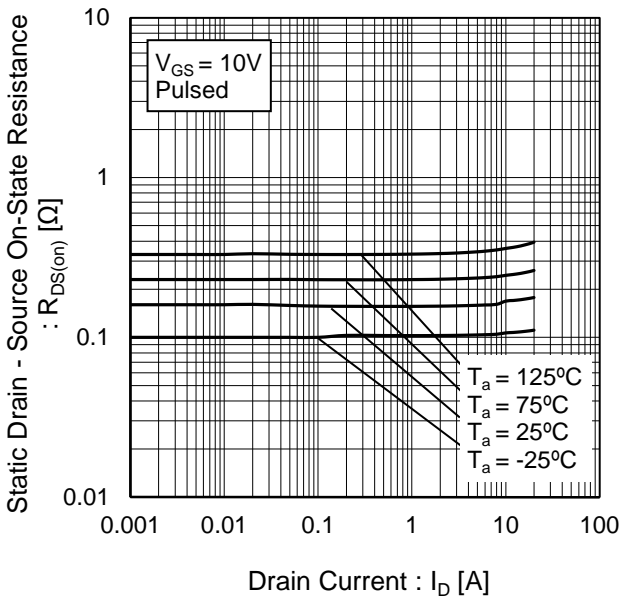


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current



●Electrical characteristic curves

Fig.18 Typical Capacitance vs. Drain - Source Voltage

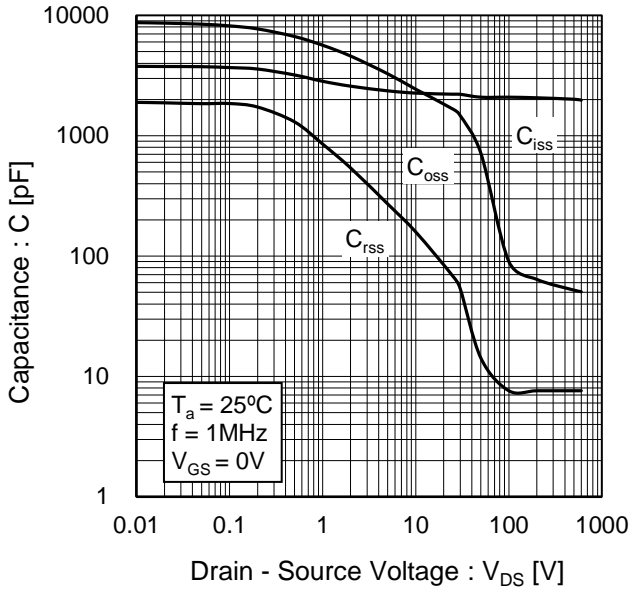


Fig.19 Coss Stored Energy

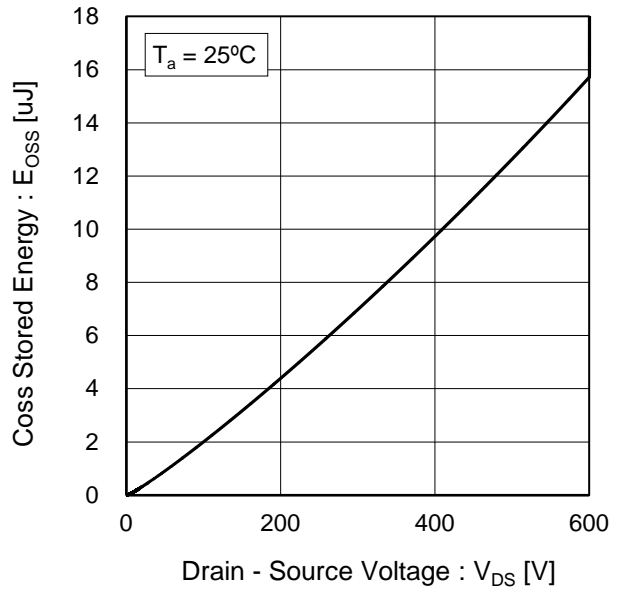


Fig.20 Switching Characteristics

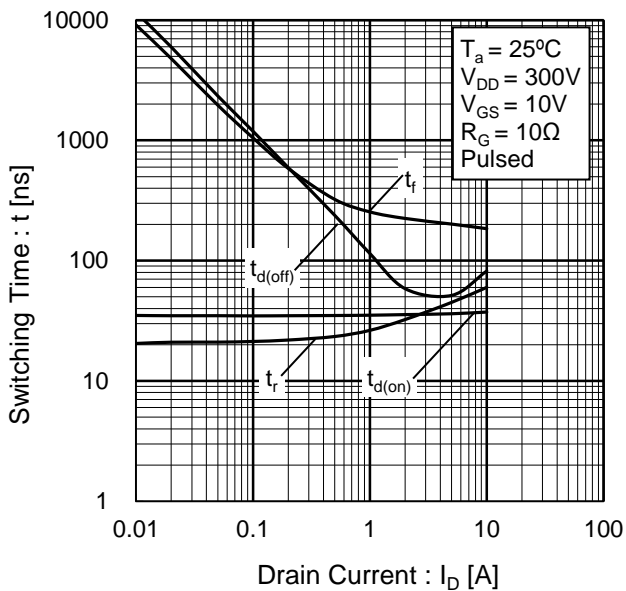
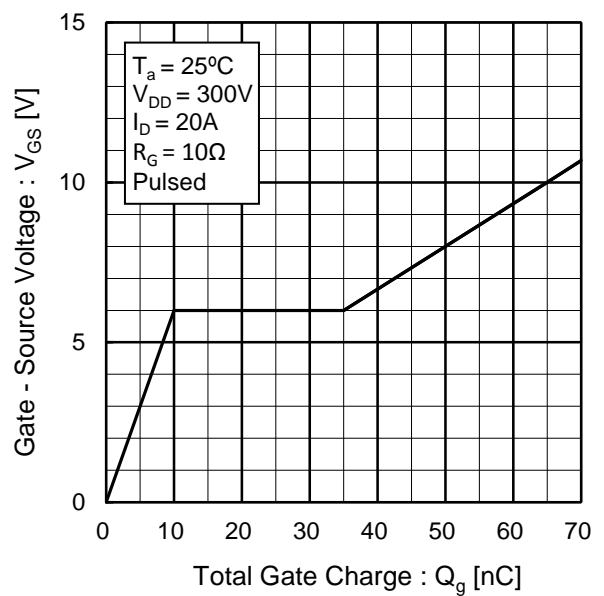


Fig.21 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.22 Inverse Diode Forward Current vs. Source - Drain Voltage

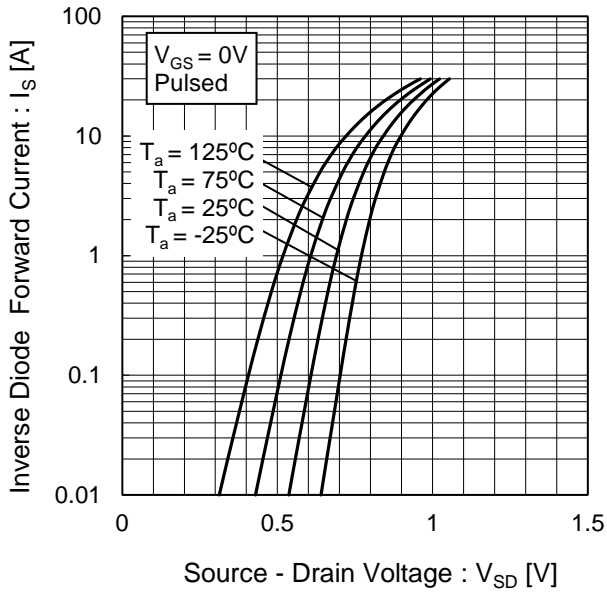
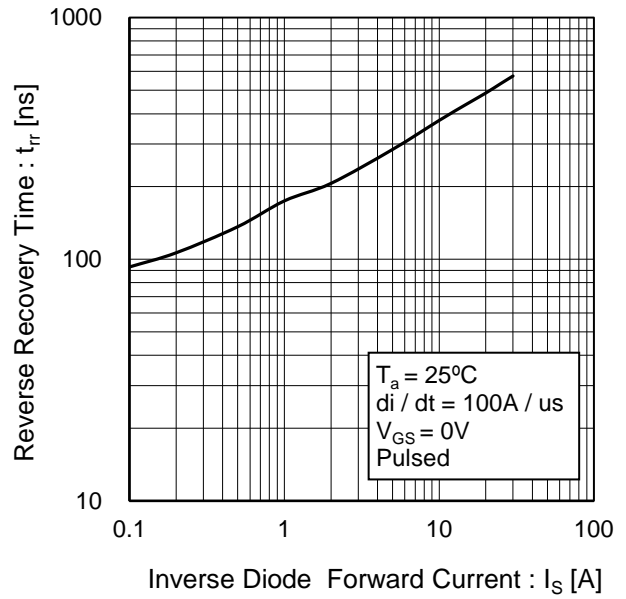


Fig.23 Reverse Recovery Time vs. Inverse Diode Forward Current



●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

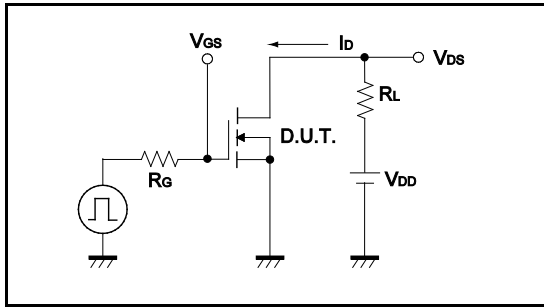


Fig.1-2 Switching Waveforms

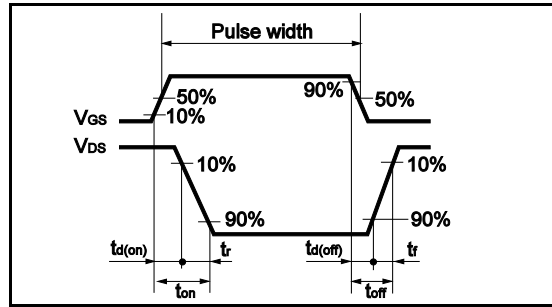


Fig.2-1 Gate Charge Measurement Circuit

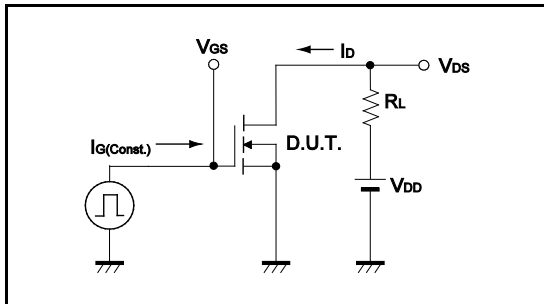


Fig.2-2 Gate Charge Waveform

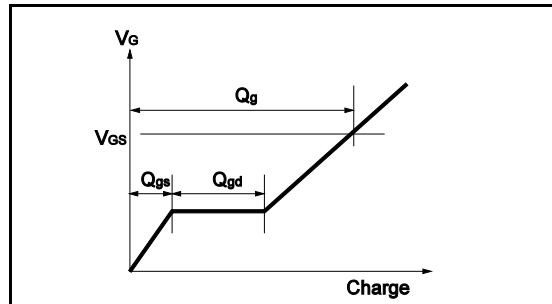


Fig.3-1 Avalanche Measurement Circuit

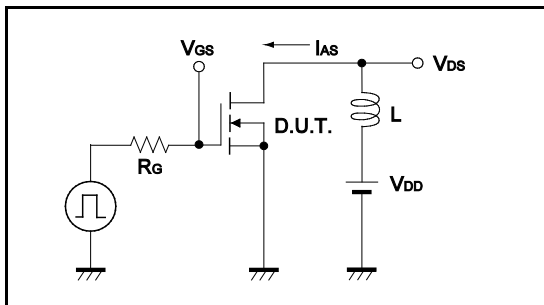


Fig.3-2 Avalanche Waveform

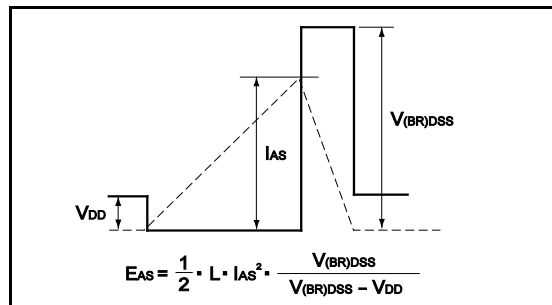


Fig.4-1 dv/dt Measurement Circuit

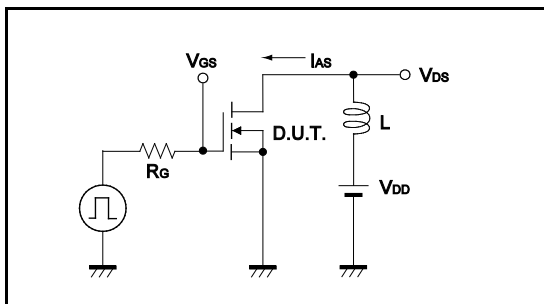


Fig.4-2 dv/dt Waveform

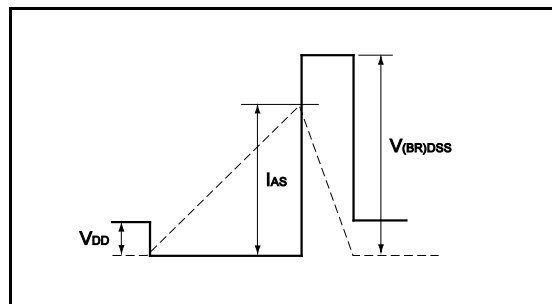


Fig.5-1 di/dt Measurement Circuit

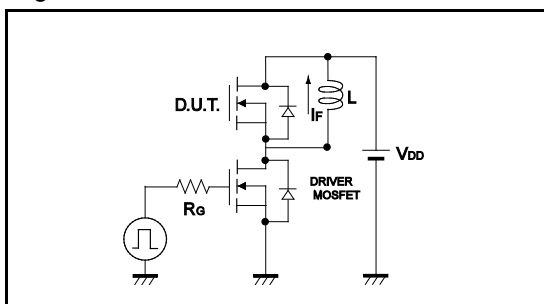
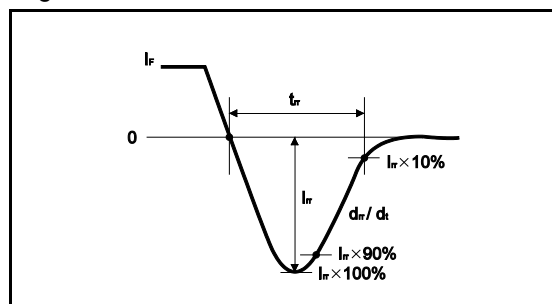
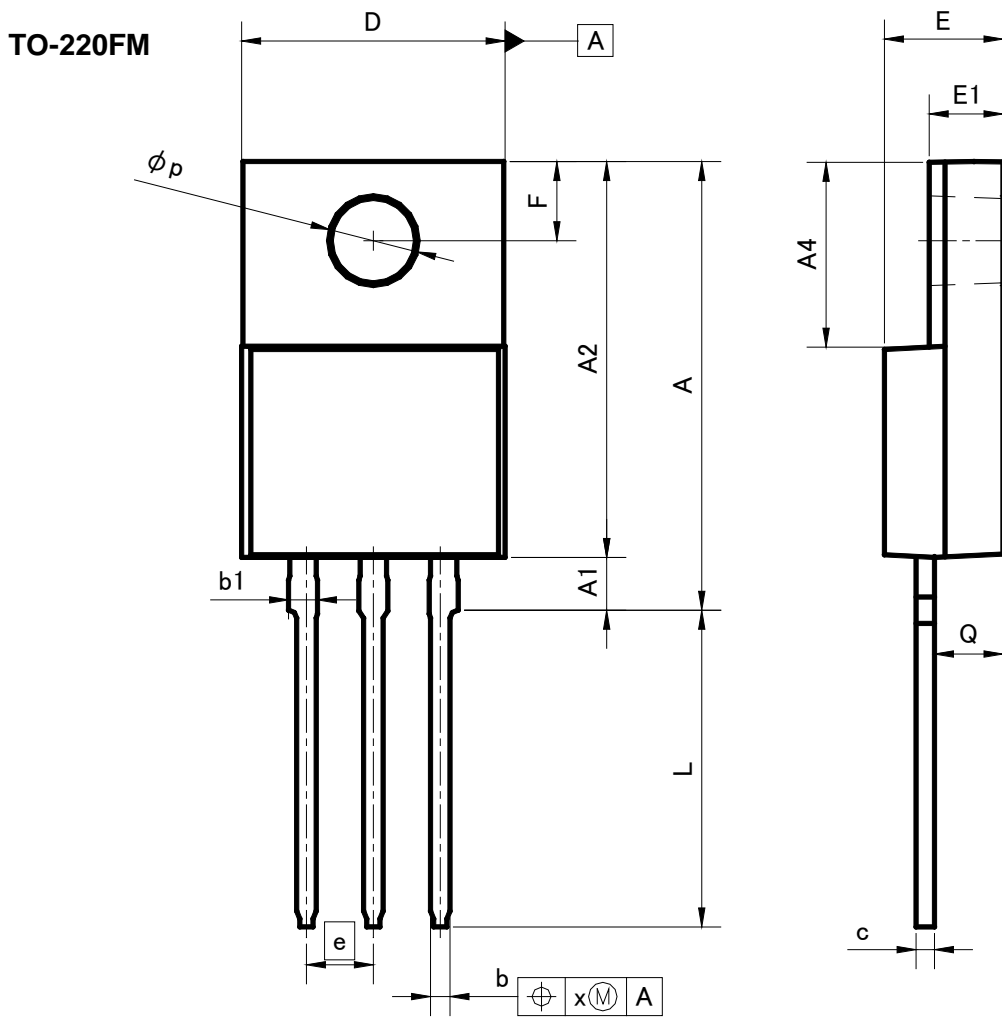


Fig.5-2 di/dt Waveform



●Dimensions (Unit : mm)



| DIM | MILIMETERS | | INCHES | |
|-----|------------|-------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 16.60 | 17.60 | 0.654 | 0.693 |
| A1 | 1.80 | 2.20 | 0.071 | 0.087 |
| A2 | 14.80 | 15.40 | 0.583 | 0.606 |
| A4 | 6.80 | 7.20 | 0.268 | 0.283 |
| b | 0.70 | 0.85 | 0.028 | 0.033 |
| b1 | 1.10 | 1.50 | 0.043 | 0.059 |
| c | 0.70 | 0.85 | 0.028 | 0.033 |
| D | 9.90 | 10.30 | 0.39 | 0.406 |
| E | 4.40 | 4.80 | 0.173 | 0.189 |
| e | 2.54 | | 0.10 | |
| E1 | 2.70 | 3.00 | 0.106 | 0.118 |
| F | 2.80 | 3.20 | 0.11 | 0.126 |
| L | 11.50 | 12.50 | 0.453 | 0.492 |
| p | 3.00 | 3.40 | 0.118 | 0.134 |
| Q | 2.10 | 3.10 | 0.083 | 0.122 |
| x | - | 0.381 | - | 0.015 |

Dimension in mm/inches

Notes

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