



## Features

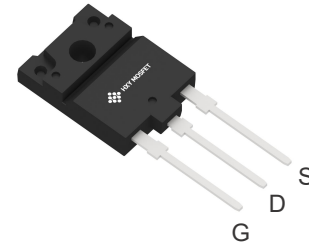
- Low on-resistance
- Fast switching speed
- Long creepage distance
- Simple to drive
- Pb-free lead plating; RoHS compliant

## Applications

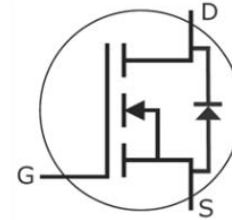
- Auxiliay power supplies
- Switch mode power supplies



| Ordering Part Number | Package | Brand      |
|----------------------|---------|------------|
| 2SK3747-1E           | TO-3PF  | HXY MOSFET |



TO-3PF  
Package



## Absolute Maximum Ratings (T<sub>c</sub> = 25°C unless otherwise specified)

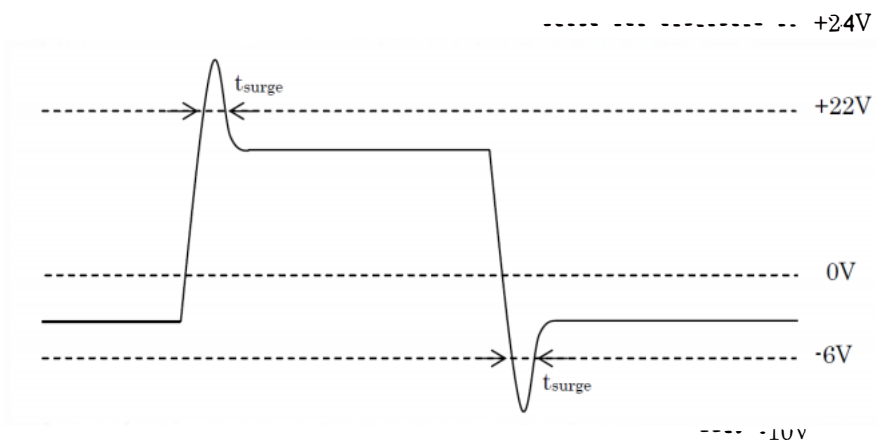
| Parameter                                                 |                        | Symbol                               | Value       | Unit |
|-----------------------------------------------------------|------------------------|--------------------------------------|-------------|------|
| Drain - Source voltage                                    |                        | V <sub>DSS</sub>                     | 1500        | V    |
| Continuous drain current                                  | T <sub>c</sub> = 25°C  | I <sub>D</sub> <sup>*1</sup>         | 3.7         | A    |
|                                                           | T <sub>c</sub> = 100°C | I <sub>D</sub> <sup>*1</sup>         | 2.6         | A    |
| Pulsed drain current                                      |                        | I <sub>D,pulse</sub> <sup>*2</sup>   | 9.2         | A    |
| Gate - Source voltage (DC)                                |                        | V <sub>GSS</sub>                     | -4 to 20    | V    |
| Gate - Source surge voltage (t <sub>surge</sub> <300nsec) |                        | V <sub>GSS,surge</sub> <sup>*3</sup> | -10 to 22   | V    |
| Power dissipation (T <sub>c</sub> = 25°C)                 |                        | P <sub>D</sub>                       | 35          | W    |
| Virtual Junction temperature                              |                        | T <sub>vj</sub>                      | 175         | °C   |
| Range of storage temperature                              |                        | T <sub>stg</sub>                     | -55 to +175 | °C   |



**Electrical Characteristics ( $T_C=25^{\circ}\text{C}$  unless otherwise specified)**

| Parameter                       | Symbol        | Conditions                                                                               | Values |            |      | Unit          |
|---------------------------------|---------------|------------------------------------------------------------------------------------------|--------|------------|------|---------------|
|                                 |               |                                                                                          | Min.   | Typ.       | Max. |               |
| Drain-Source breakdown voltage  | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=1mA$                                                                     | 1500   |            |      | V             |
| Zero gate voltage drain current | $I_{DSS}$     | $V_{DS}=1500V, V_{GS}=0V$<br>$T_{vj}=25^{\circ}\text{C}$<br>$T_{vj}=150^{\circ}\text{C}$ |        | 0.1<br>0.2 | 10   | $\mu\text{A}$ |
| Gate-Source leakage current     | $I_{GSS+}$    | $V_{GS}=+20V, V_{DS}=0V$                                                                 |        |            | 100  | nA            |
| Gate- Source leakage current    | $I_{GSS-}$    | $V_{GS}=-4V, V_{DS}=0V$                                                                  |        |            | -100 | nA            |
| Gate threshold voltage          | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_o=0.41mA$                                                              | 1.8    | 2.8        | 4.0  | V             |

- \*1 Limited by maximum  $T_{vj}$  and for Max. $R_{thJC}$
- \*2  $PW \leq 10\mu s$ , Duty cycles  $\leq 1\%$
- \*3 Example of acceptable  $V_{GS}$  waveform



- \*4 Pulsed



**Electrical Characteristics ( $T_C=25^\circ\text{C}$  unless otherwise specified)**

| Parameter                                       | Symbol            | Conditions                                                                                                  | Values |      |      | Unit          |
|-------------------------------------------------|-------------------|-------------------------------------------------------------------------------------------------------------|--------|------|------|---------------|
|                                                 |                   |                                                                                                             | Min.   | Typ. | Max. |               |
| Static drain - source<br>on - state resistance  | $R_{DS(on)}^{*4}$ | $V_{GS} = 18\text{V}, I_D = 1.1\text{A}$                                                                    |        |      |      | $\Omega$      |
|                                                 |                   | $T_{vj} = 25^\circ\text{C}$                                                                                 | -      | 1.15 | 1.50 |               |
|                                                 |                   | $T_{vj} = 125^\circ\text{C}$                                                                                | -      | 1.71 | -    |               |
| Gate input resistance                           | $R_G$             | $f = 1\text{MHz}$ , open drain                                                                              | -      | 64   | -    | $\Omega$      |
| Transconductance                                | $g_{fs}^{*4}$     | $V_{DS} = 10\text{V}, I_D = 1.1\text{A}$                                                                    | -      | 0.4  | -    | S             |
| Input capacitance                               | $C_{iss}$         | $V_{GS} = 0\text{V}$                                                                                        | -      | 184  | -    | pF            |
| Output capacitance                              | $C_{oss}$         | $V_{DS} = 800\text{V}$                                                                                      | -      | 16   | -    |               |
| Reverse transfer capacitance                    | $C_{rss}$         | $f = 1\text{MHz}$                                                                                           | -      | 6    | -    |               |
| Effective output capacitance,<br>energy related | $C_{o(er)}$       | $V_{GS} = 0\text{V}$<br>$V_{DS} = 0\text{V to } 800\text{V}$                                                | -      | 17   | -    | pF            |
| Turn - on delay time                            | $t_{d(on)}^{*4}$  | $V_{DD} = 500\text{V}, I_D = 1.1\text{A}$                                                                   | -      | 16   | -    | ns            |
| Rise time                                       | $t_r^{*4}$        | $V_{GS} = 18\text{V}/0\text{V}$                                                                             | -      | 21   | -    |               |
| Turn - off delay time                           | $t_{d(off)}^{*4}$ | $R_L = 455\Omega$                                                                                           | -      | 35   | -    |               |
| Fall time                                       | $t_f^{*4}$        | $R_G = 0\Omega$                                                                                             | -      | 74   | -    |               |
| Turn - on switching loss                        | $E_{on}^{*4}$     | $V_{DD} = 800\text{V}, I_D=1.1\text{A}$<br>$V_{GS} = 18\text{V}/0\text{V}$<br>$R_G = 0\Omega, L=2\text{mH}$ | -      | 57   | -    | $\mu\text{J}$ |
| Turn - off switching loss                       | $E_{off}^{*4}$    | * $E_{on}$ includes diode<br>reverse recovery                                                               | -      | 32   | -    |               |

**Thermal resistance**

| Parameter                           | Symbol     | Values |      |      | Unit |
|-------------------------------------|------------|--------|------|------|------|
|                                     |            | Min.   | Typ. | Max. |      |
| Thermal resistance, junction - case | $R_{thJC}$ | -      | 3.32 | 4.32 | K/W  |



**Gate Charge Characteristics ( $T_c=25^\circ\text{C}$  unless otherwise specified)**

| Parameter            | Symbol                 | Conditions                              | Values |      |      | Unit |
|----------------------|------------------------|-----------------------------------------|--------|------|------|------|
|                      |                        |                                         | Min.   | Typ. | Max. |      |
| Total gate charge    | $Q_g^{*4}$             | $V_{DD} = 500\text{V}$                  | -      | 14   | -    | nC   |
| Gate - Source charge | $Q_{gs}^{*4}$          | $I_D = 1\text{A}$                       | -      | 4    | -    |      |
| Gate - Drain charge  | $Q_{gd}^{*4}$          | $V_{GS} = 18\text{V}$                   | -      | 5    | -    |      |
| Gate plateau voltage | $V_{(\text{plateau})}$ | $V_{DD} = 500\text{V}, I_D = 1\text{A}$ | -      | 10.5 | -    | V    |

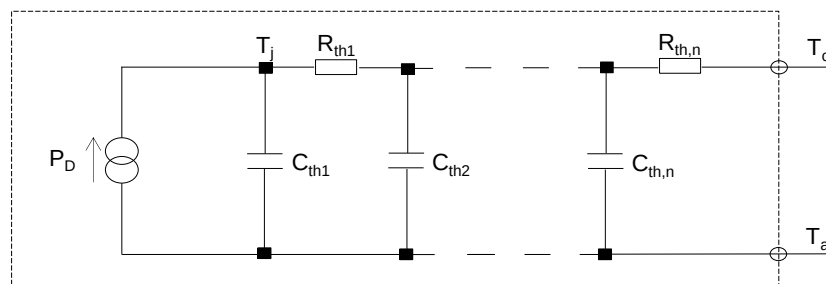
**Body diode electrical Characteristics (Source-Drain) ( $T_c=25^\circ\text{C}$  unless otherwise specified)**

| Parameter                                 | Symbol         | Conditions                                                                  | Values |      |      | Unit |
|-------------------------------------------|----------------|-----------------------------------------------------------------------------|--------|------|------|------|
|                                           |                |                                                                             | Min.   | Typ. | Max. |      |
| Inverse diode continuous, forward current | $I_S^{*1}$     | $T_c = 25^\circ\text{C}$                                                    | -      | -    | 3.7  | A    |
| Inverse diode direct current, pulsed      | $I_{SM}^{*2}$  |                                                                             | -      | -    | 9.2  | A    |
| Forward voltage                           | $V_{SD}^{*4}$  | $V_{GS} = 0\text{V}, I_S = 1.1\text{A}$                                     | -      | 4.3  | -    | V    |
| Reverse recovery time                     | $t_{rr}^{*4}$  | $I_F = 1.1\text{A}, V_R = 800\text{V}$<br>$di/dt = 300\text{A}/\mu\text{s}$ | -      | 21   | -    | ns   |
| Reverse recovery charge                   | $Q_{rr}^{*4}$  |                                                                             | -      | 13   | -    | nC   |
| Peak reverse recovery current             | $I_{rrm}^{*4}$ |                                                                             | -      | 1.1  | -    | A    |

**Typical Transient Thermal Characteristics**

| Symbol    | Value | Unit |
|-----------|-------|------|
| $R_{th1}$ | 816m  | K/W  |
| $R_{th2}$ | 1939m |      |
| $R_{th3}$ | 567m  |      |

| Symbol    | Value     | Unit |
|-----------|-----------|------|
| $C_{th1}$ | 127 $\mu$ | Ws/K |
| $C_{th2}$ | 1.64m     |      |
| $C_{th3}$ | 64.5m     |      |





## Typical Performance

Fig.1 Power Dissipation Derating Curve

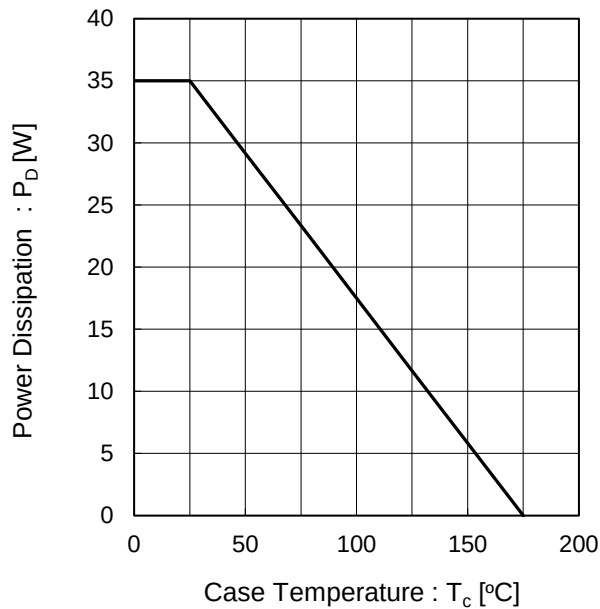


Fig.2 Maximum Safe Operating Area

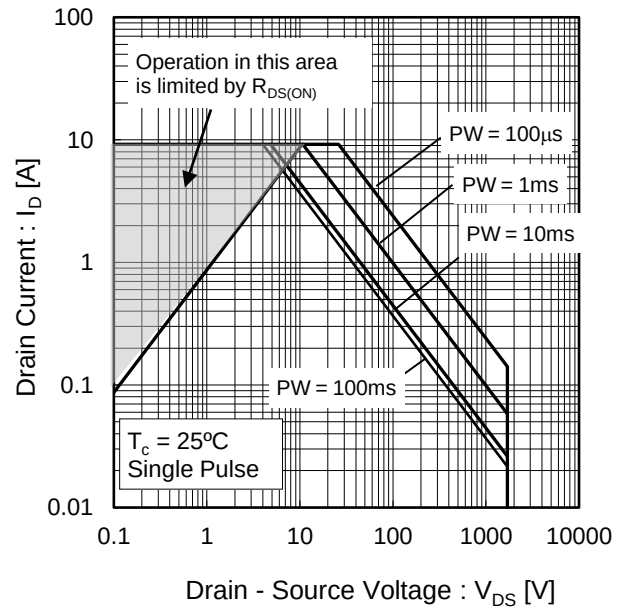
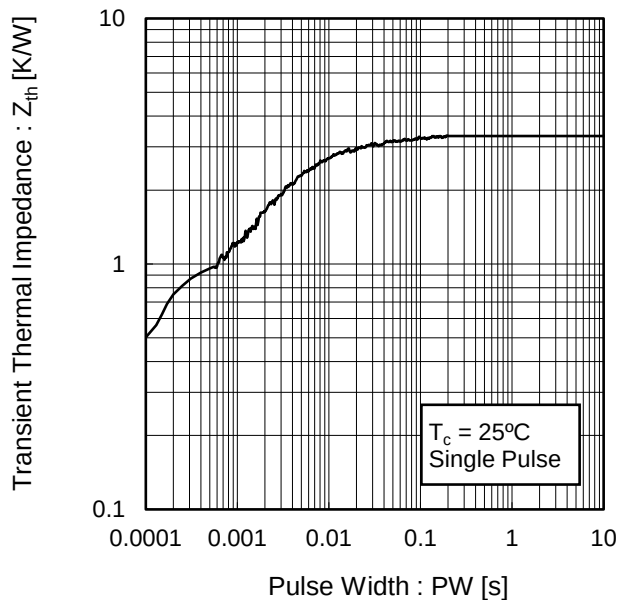


Fig.3 Typical Transient Thermal Impedance vs. Pulse Width





## Electrical Characteristic Curves

Fig.4 Typical Output Characteristics(I)

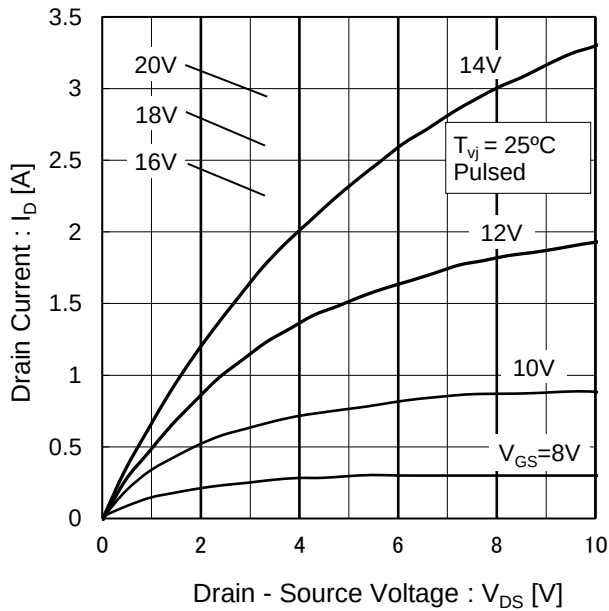


Fig.5 Typical Output Characteristics(II)

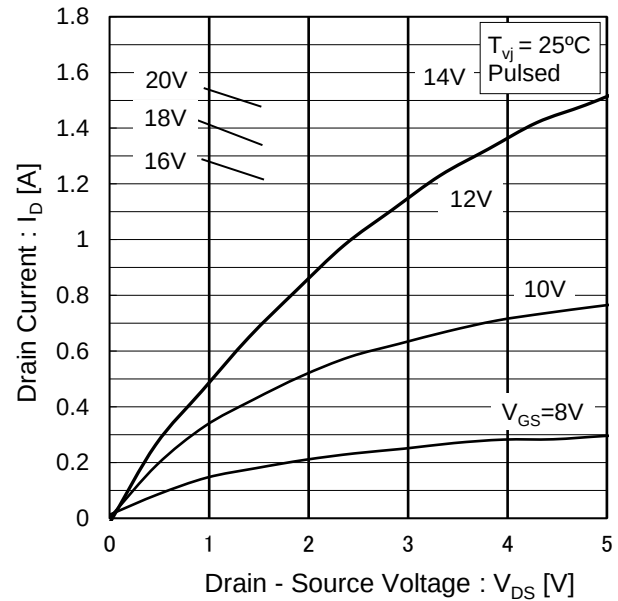


Fig.6  $T_{vj} = 150^\circ\text{C}$  Typical Output Characteristics(I)

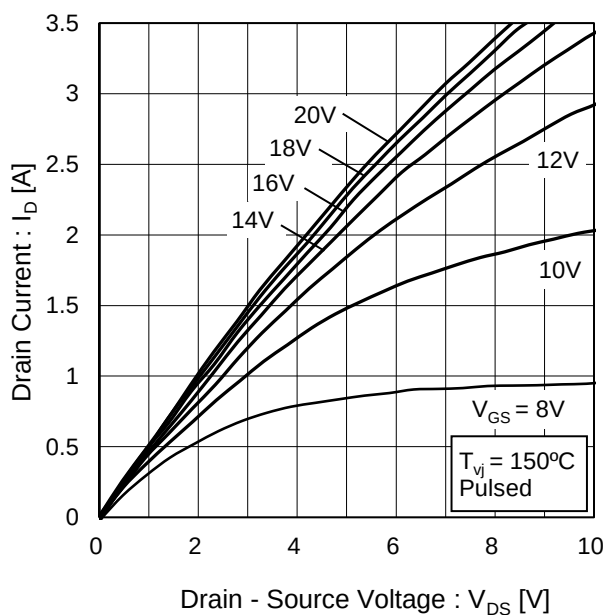


Fig.7  $T_{vj} = 150^\circ\text{C}$  Typical Output Characteristics(II)

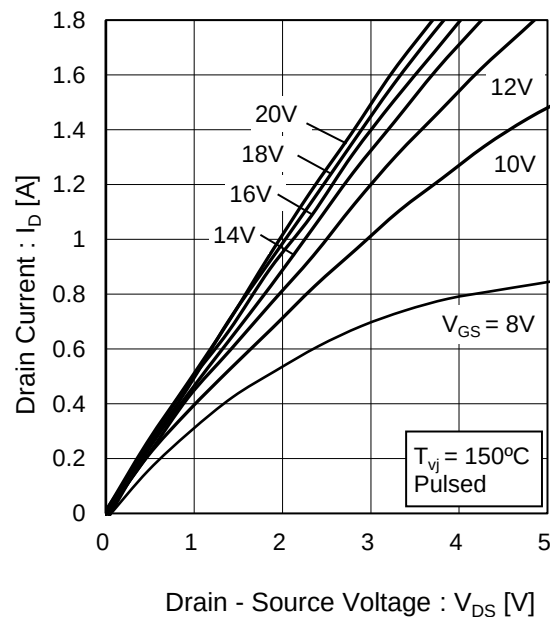




Fig.8 Typical Transfer Characteristics (I)

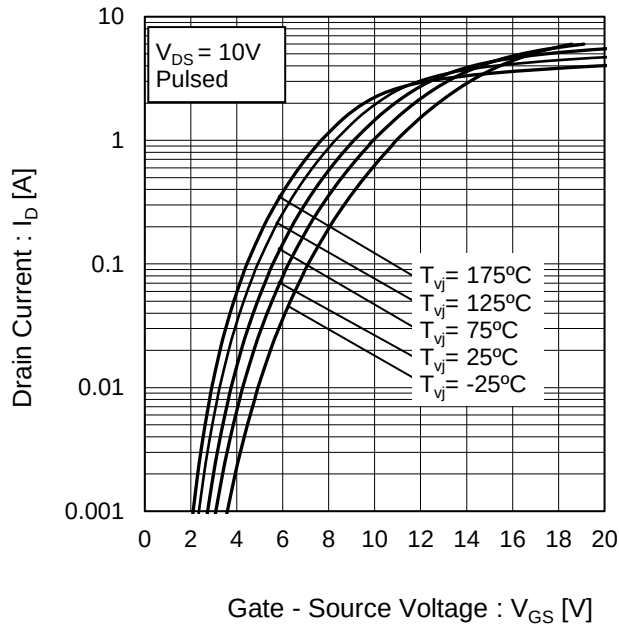


Fig.9 Typical Transfer Characteristics (II)

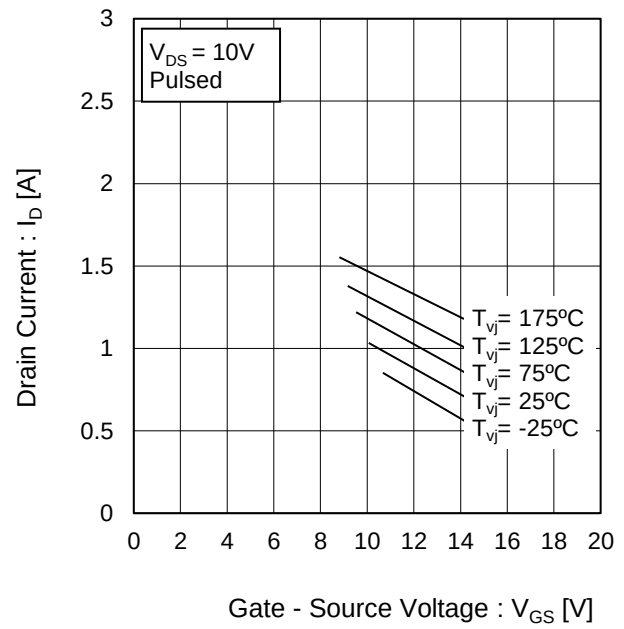


Fig.10 Gate Threshold Voltage vs. Virtual Junction Temperature

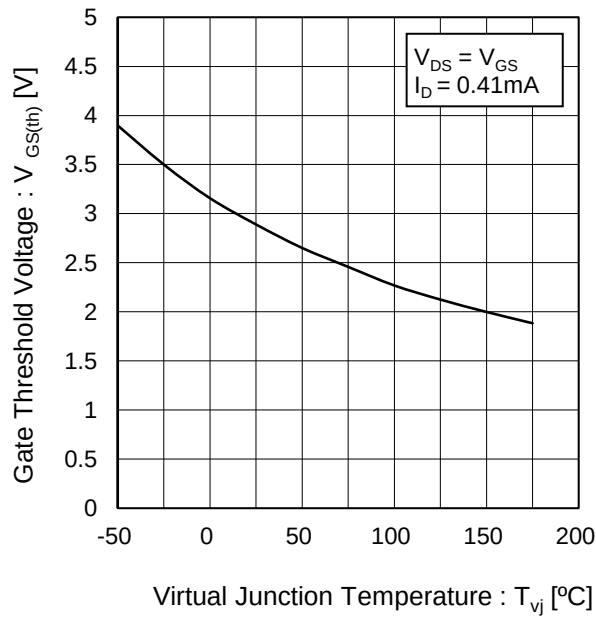


Fig.11 Transconductance vs. Drain Current

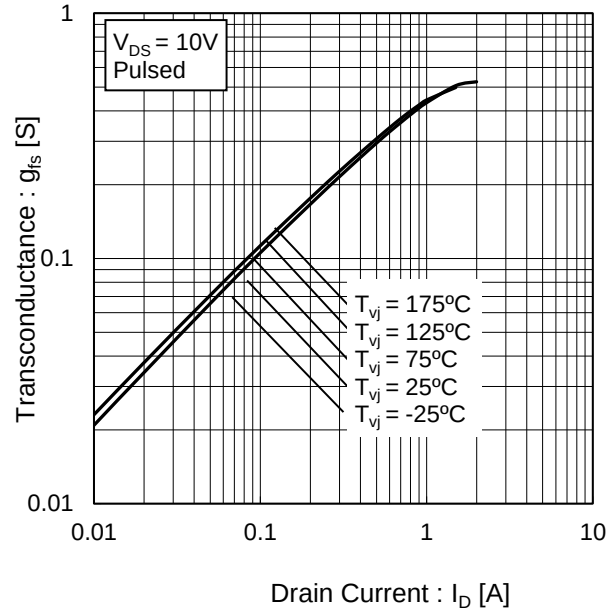




Fig.12 Static Drain - Source On - State Resistance vs. Gate - Source Voltage

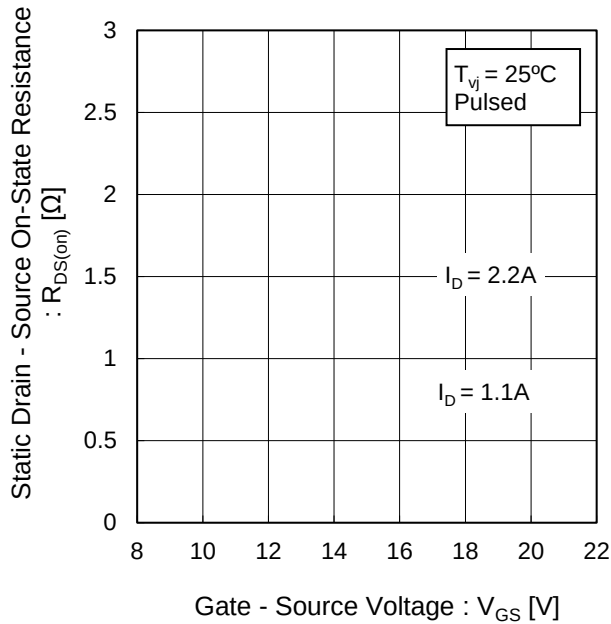


Fig.13 Static Drain - Source On - State Resistance vs. Virtual Junction Temperature

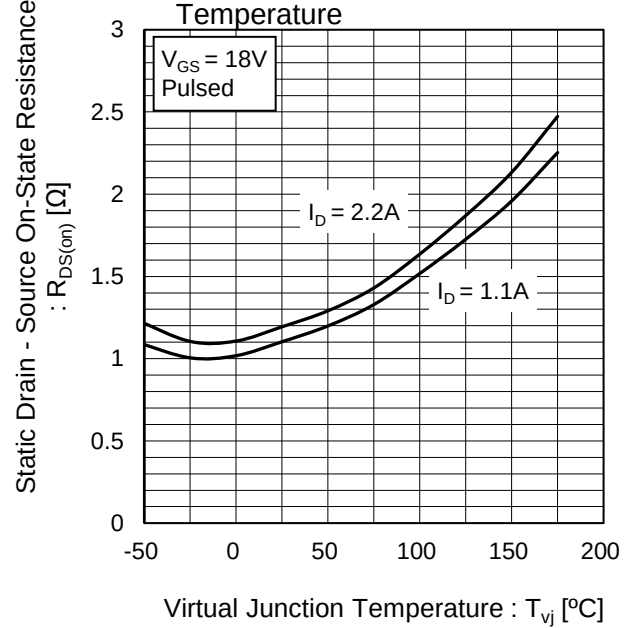


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current

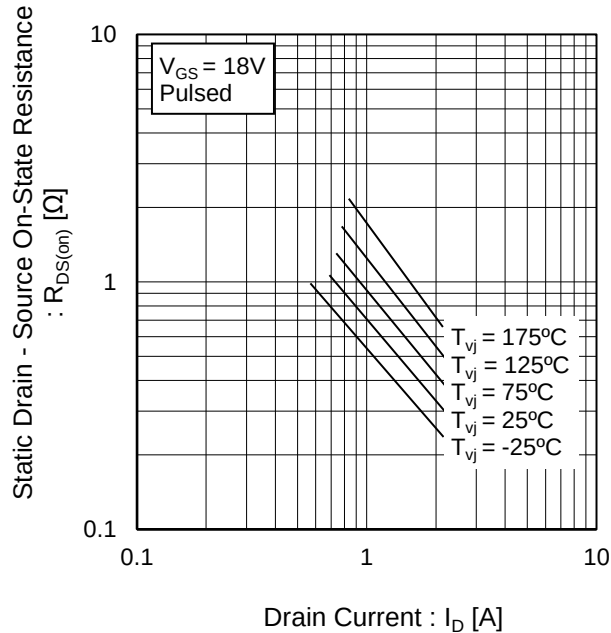


Fig.15 Typical Capacitance vs. Drain - Source Voltage

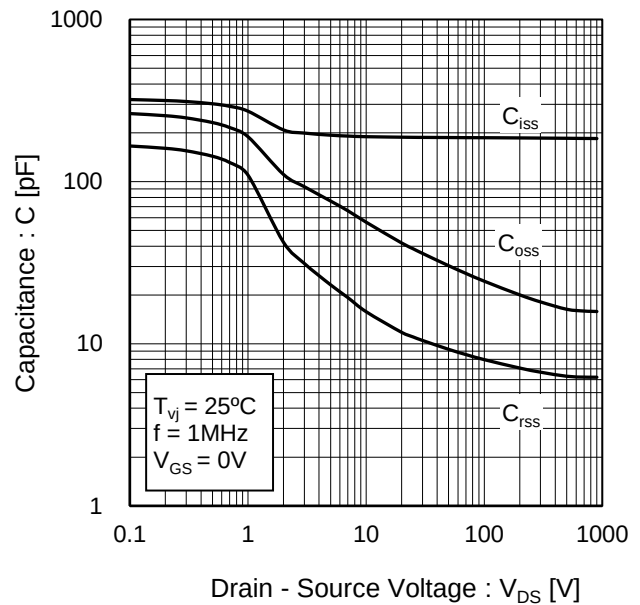






Fig.16 Coss Stored Energy

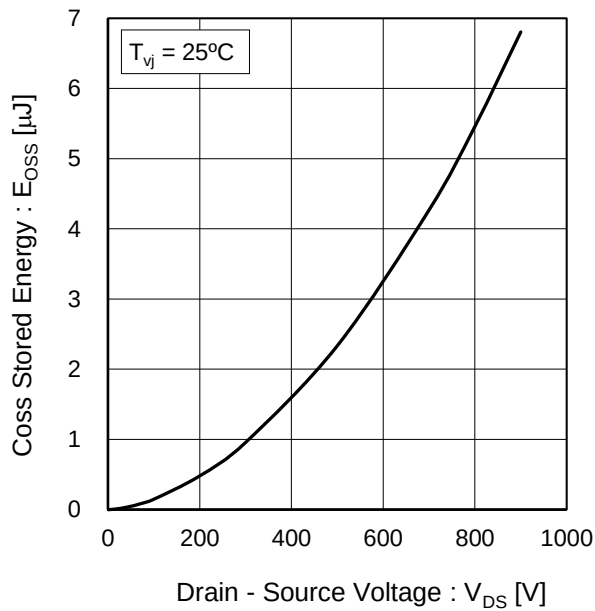


Fig.17 Switching Characteristics

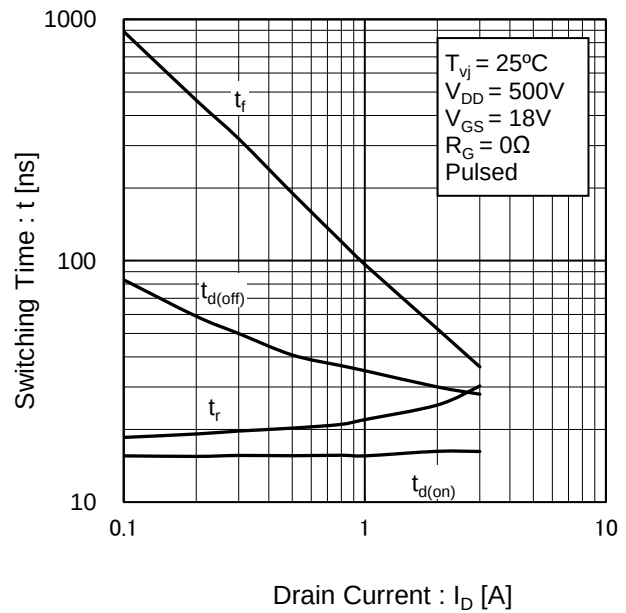


Fig.18 Dynamic Input Characteristics

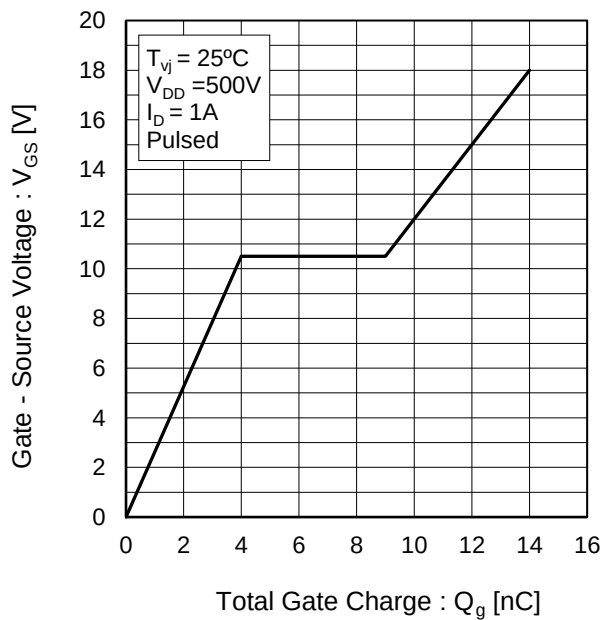


Fig.19 Typical Switching Loss vs. Drain - Source Voltage

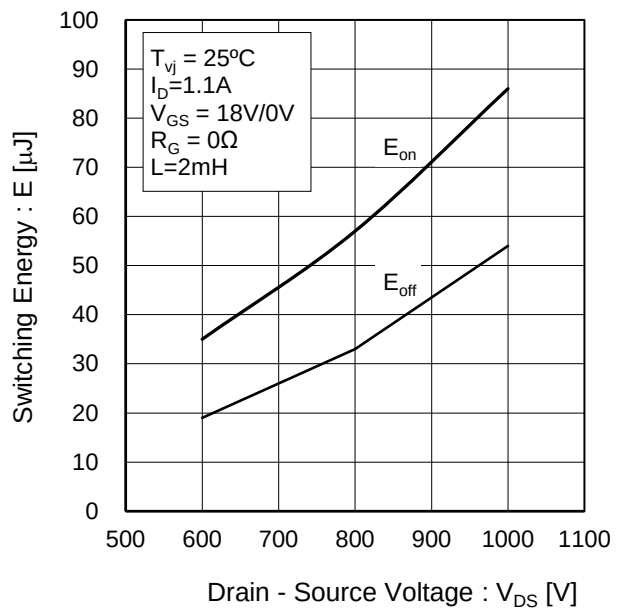




Fig.20 Typical Switching Loss  
vs. Drain Current

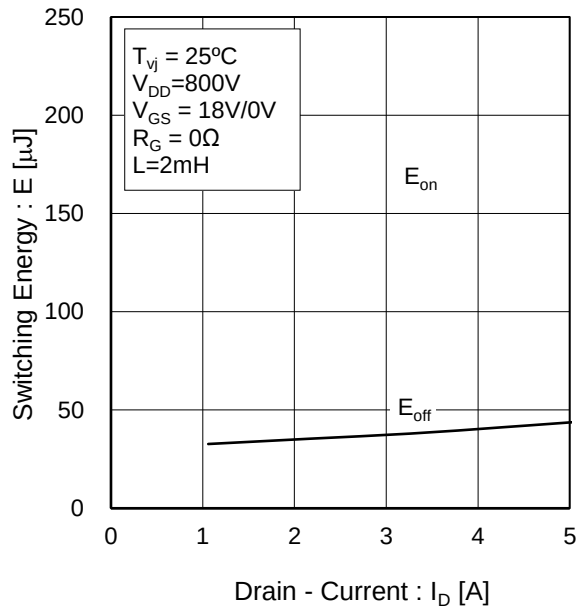


Fig.21 Typical Switching Loss  
vs. External Gate Resistance

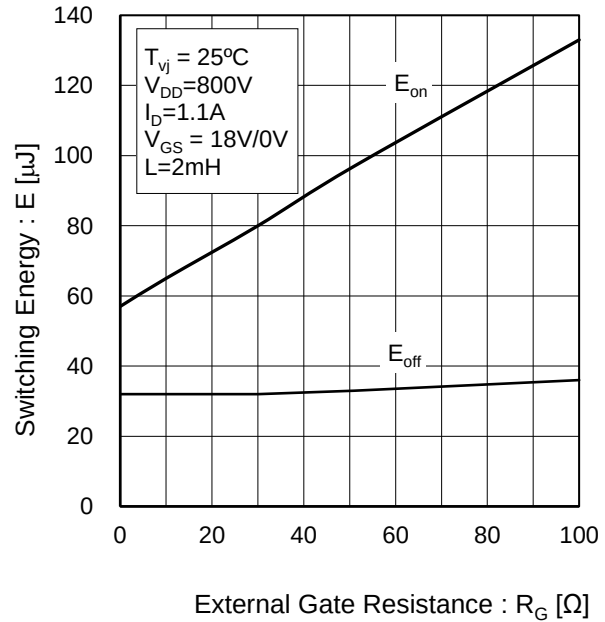


Fig.22 Inverse Diode Forward Current  
vs. Source - Drain Voltage

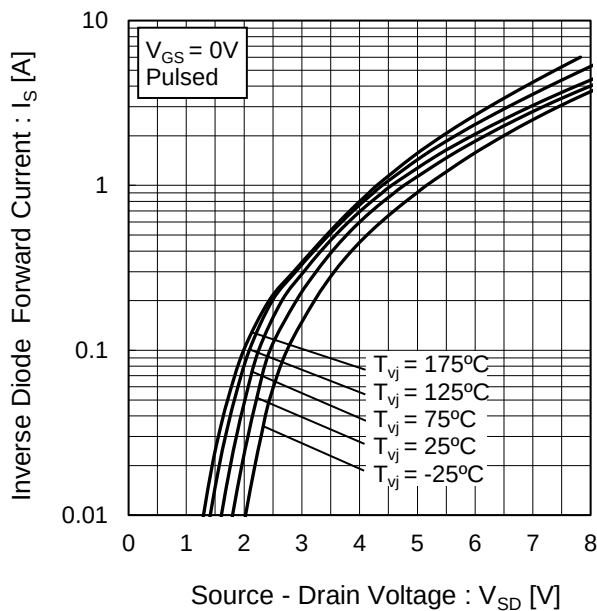
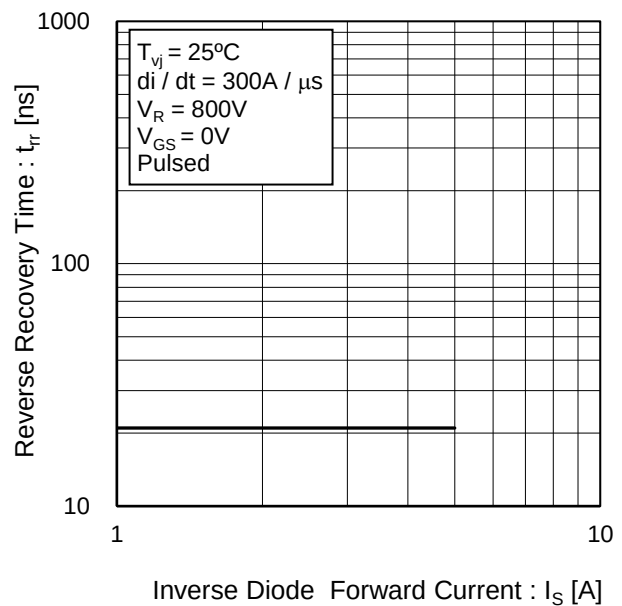


Fig.23 Reverse Recovery Time  
vs. Inverse Diode Forward Current





## Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

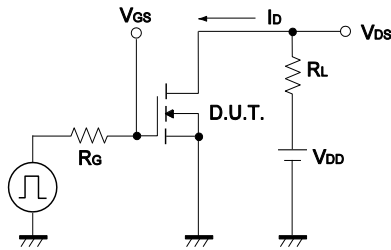


Fig.1-2 Switching Waveforms

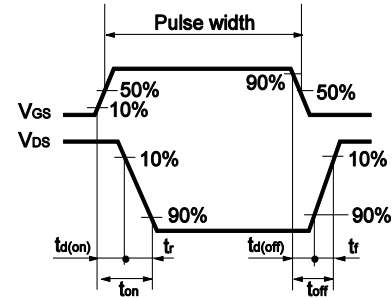


Fig.2-1 Gate Charge Measurement Circuit

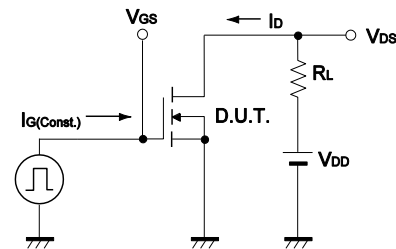


Fig.2-2 Gate Charge Waveform

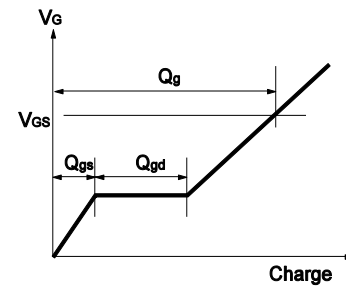


Fig.3-1 Switching Energy Measurement Circuit

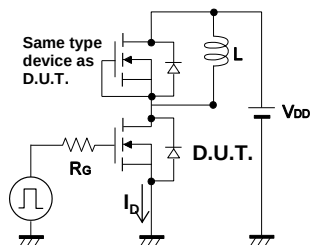


Fig.3-2 Switching Waveforms

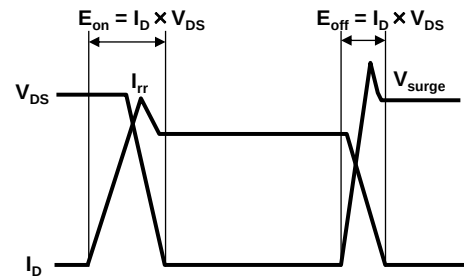


Fig.4-1 Reverse Recovery Time Measurement Circuit

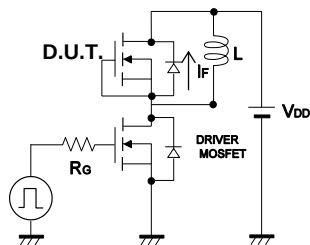
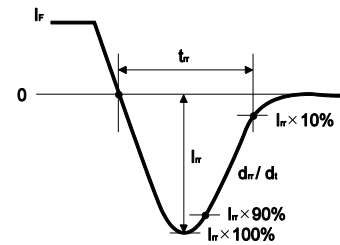
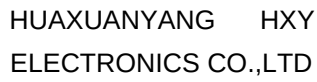


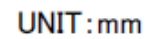
Fig.4-2 Reverse Recovery Waveform





## SiC Power MOSFET N-Channel Enhancement Mode

## Package TO-3PF





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