

|                     |       |
|---------------------|-------|
| $V_{DSS}$           | 1200V |
| $R_{DS(on)}$ (Typ.) | 105mΩ |
| $I_D^{*1}$          | 24A   |
| $P_D$               | 134W  |

### ●Features

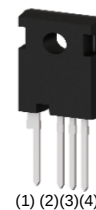
- 1) Low on-resistance
- 2) Fast switching speed
- 3) Fast reverse recovery
- 4) Easy to parallel
- 5) Simple to drive
- 6) Pb-free lead plating ; RoHS compliant

### ●Application

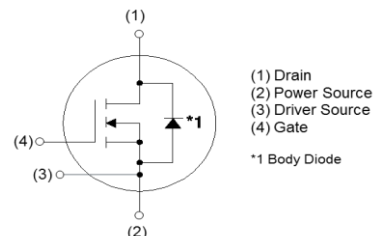
- Solar inverters
- DC/DC converters
- Switch mode power supplies
- Induction heating
- Motor drives

### ●Outline

TO-247-4L



### ●Inner circuit



Please note Driver Source and Power Source are not exchangeable. Their exchange might lead to malfunction.

### ●Packaging specifications

|      |                           |           |
|------|---------------------------|-----------|
| Type | Packing                   | Tube      |
|      | Reel size (mm)            | -         |
|      | Tape width (mm)           | -         |
|      | Basic ordering unit (pcs) | 30        |
|      | Taping code               | C14       |
|      | Marking                   | SCT3105KR |

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

| Parameter                                                  |                           | Symbol               | Value       | Unit             |
|------------------------------------------------------------|---------------------------|----------------------|-------------|------------------|
| Drain - Source Voltage                                     |                           | $V_{DSS}$            | 1200        | V                |
| Continuous Drain current                                   | $T_c = 25^\circ\text{C}$  | $I_D^{*1}$           | 24          | A                |
|                                                            | $T_c = 100^\circ\text{C}$ | $I_D^{*1}$           | 17          | A                |
| Pulsed Drain current                                       |                           | $I_{D,pulse}^{*2}$   | 60          | A                |
| Gate - Source voltage (DC)                                 |                           | $V_{GSS}$            | -4 to +22   | V                |
| Gate - Source surge voltage ( $t_{surge} < 300\text{ns}$ ) |                           | $V_{GSS,surge}^{*3}$ | -4 to +26   | V                |
| Recommended drive voltage                                  |                           | $V_{GS,op}^{*4}$     | 0 / +18     | V                |
| Junction temperature                                       |                           | $T_j$                | 175         | $^\circ\text{C}$ |
| Range of storage temperature                               |                           | $T_{stg}$            | -55 to +175 | $^\circ\text{C}$ |

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

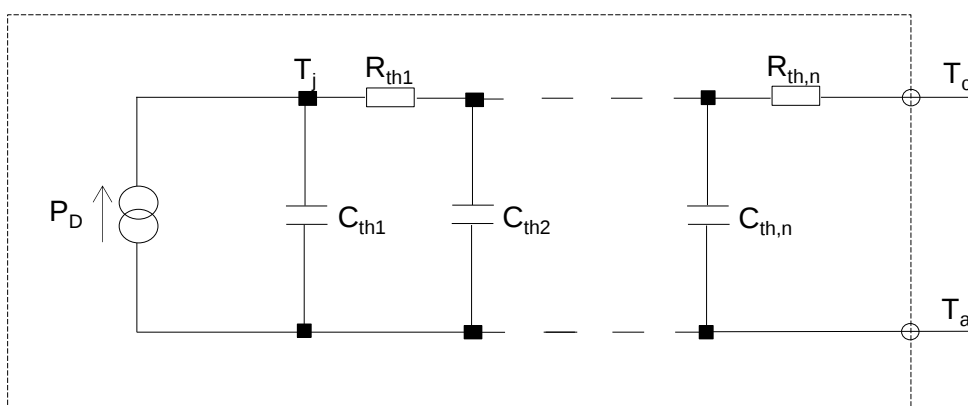
| Parameter                                   | Symbol            | Conditions                                                                             | Values       |            |          | Unit          |
|---------------------------------------------|-------------------|----------------------------------------------------------------------------------------|--------------|------------|----------|---------------|
|                                             |                   |                                                                                        | Min.         | Typ.       | Max.     |               |
| Drain - Source breakdown voltage            | $V_{(BR)DSS}$     | $V_{GS} = 0V, I_D = 1mA$<br>$T_j = 25^\circ\text{C}$<br>$T_j = -55^\circ\text{C}$      | 1200<br>1200 | -<br>-     | -<br>-   | V             |
| Zero Gate voltage Drain current             | $I_{DSS}$         | $V_{GS} = 0V, V_{DS} = 1200V$<br>$T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | -<br>-       | 1<br>2     | 10<br>-  | $\mu\text{A}$ |
| Gate - Source leakage current               | $I_{GSS+}$        | $V_{GS} = +22V, V_{DS} = 0V$                                                           | -            | -          | 100      | nA            |
| Gate - Source leakage current               | $I_{GSS-}$        | $V_{GS} = -4V, V_{DS} = 0V$                                                            | -            | -          | -100     | nA            |
| Gate threshold voltage                      | $V_{GS(th)}$      | $V_{DS} = 10V, I_D = 3.81mA$                                                           | 2.7          | -          | 5.6      | V             |
| Static Drain - Source on - state resistance | $R_{DS(on)}^{*5}$ | $V_{GS} = 18V, I_D = 7.6A$<br>$T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$    | -<br>-       | 105<br>179 | 137<br>- | m $\Omega$    |
| Gate input resistance                       | $R_G$             | $f = 1\text{MHz}, \text{open drain}$                                                   | -            | 13         | -        | $\Omega$      |

**●Thermal resistance**

| Parameter                           | Symbol     | Values |      |      | Unit               |
|-------------------------------------|------------|--------|------|------|--------------------|
|                                     |            | Min.   | Typ. | Max. |                    |
| Thermal resistance, junction - case | $R_{thJC}$ | -      | 0.86 | 1.12 | $^\circ\text{C/W}$ |

**●Typical Transient Thermal Characteristics**

| Symbol    | Value                 | Unit | Symbol    | Value                 | Unit |
|-----------|-----------------------|------|-----------|-----------------------|------|
| $R_{th1}$ | $1.14 \times 10^{-1}$ | K/W  | $C_{th1}$ | $5.02 \times 10^{-4}$ | Ws/K |
| $R_{th2}$ | $5.07 \times 10^{-1}$ |      | $C_{th2}$ | $4.91 \times 10^{-3}$ |      |
| $R_{th3}$ | $2.51 \times 10^{-1}$ |      | $C_{th3}$ | $4.99 \times 10^{-2}$ |      |



●Electrical characteristics (T<sub>a</sub> = 25°C)

| Parameter                                    | Symbol            | Conditions                                                          | Values |      |      | Unit    |
|----------------------------------------------|-------------------|---------------------------------------------------------------------|--------|------|------|---------|
|                                              |                   |                                                                     | Min.   | Typ. | Max. |         |
| Transconductance                             | $g_{fs}^{*5}$     | $V_{DS} = 10V, I_D = 7.6A$                                          | -      | 3.4  | -    | S       |
| Input capacitance                            | $C_{iss}$         | $V_{GS} = 0V$                                                       | -      | 574  | -    | pF      |
| Output capacitance                           | $C_{oss}$         | $V_{DS} = 800V$                                                     | -      | 59   | -    |         |
| Reverse transfer capacitance                 | $C_{rss}$         | $f = 1MHz$                                                          | -      | 28   | -    |         |
| Effective output capacitance, energy related | $C_{o(er)}$       | $V_{GS} = 0V$<br>$V_{DS} = 0V \text{ to } 600V$                     | -      | 159  | -    | pF      |
| Total Gate charge                            | $Q_g^{*5}$        | $V_{DS} = 600V$<br>$I_D = 7.6A$                                     | -      | 51   | -    | nC      |
| Gate - Source charge                         | $Q_{gs}^{*5}$     | $V_{GS} = 18V$                                                      | -      | 10   | -    |         |
| Gate - Drain charge                          | $Q_{gd}^{*5}$     | See Fig. 1-1.                                                       | -      | 25   | -    |         |
| Turn - on delay time                         | $t_{d(on)}^{*5}$  | $V_{DS} = 600V$<br>$I_D = 7.6A$                                     | -      | 4    | -    | ns      |
| Rise time                                    | $t_r^{*5}$        | $V_{GS} = 0V/+18V$                                                  | -      | 12   | -    |         |
| Turn - off delay time                        | $t_{d(off)}^{*5}$ | $R_G = 0\Omega, L = 750\mu H$<br>$L_\sigma = 50nH, C_\sigma = 10pF$ | -      | 16   | -    |         |
| Fall time                                    | $t_f^{*5}$        | See Fig. 2-1, 2-2, 2-3.                                             | -      | 10   | -    |         |
| Turn - on switching loss                     | $E_{on}^{*5}$     | $E_{on}$ includes diode reverse recovery.                           | -      | 125  | -    | $\mu J$ |
| Turn - off switching loss                    | $E_{off}^{*5}$    |                                                                     | -      | 8    | -    |         |

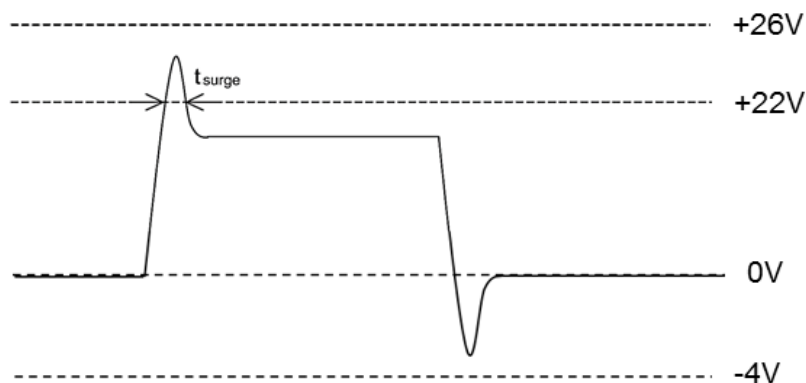
**●Body diode electrical characteristics (Source-Drain) ( $T_a = 25^\circ\text{C}$ )**

| Parameter                              | Symbol         | Conditions                                                                                                                                                 | Values |      |      | Unit |
|----------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|------|------|
|                                        |                |                                                                                                                                                            | Min.   | Typ. | Max. |      |
| Body diode continuous, forward current | $I_S^{*1}$     | $T_c = 25^\circ\text{C}$                                                                                                                                   | -      | -    | 24   | A    |
| Body diode direct current, pulsed      | $I_{SM}^{*2}$  |                                                                                                                                                            | -      | -    | 60   | A    |
| Forward voltage                        | $V_{SD}^{*5}$  | $V_{GS} = 0\text{V}, I_D = 7.6\text{A}$                                                                                                                    | -      | 3.2  | -    | V    |
| Reverse recovery time                  | $t_{rr}^{*5}$  | $I_F = 7.6\text{A}$<br>$V_R = 600\text{V}$<br>$di/dt = 2500\text{A}/\mu\text{s}$<br>$L_\sigma = 50\text{nH}, C_\sigma = 10\text{pF}$<br>See Fig. 3-1, 3-2. | -      | 13   | -    | ns   |
| Reverse recovery charge                | $Q_{rr}^{*5}$  |                                                                                                                                                            | -      | 175  | -    | nC   |
| Peak reverse recovery current          | $I_{rrm}^{*5}$ |                                                                                                                                                            | -      | 22   | -    | A    |

\*1 Limited by maximum temperature allowed.

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

\*3 Example of acceptable  $V_{GS}$  waveform



Please note especially when using driver source that  $V_{GSS\_surge}$  must be in the range of absolute maximum rating.

\*4 Please be advised not to use SiC-MOSFETs with  $V_{GS}$  below 13V as doing so may cause thermal runaway.

\*5 Pulsed

## ●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

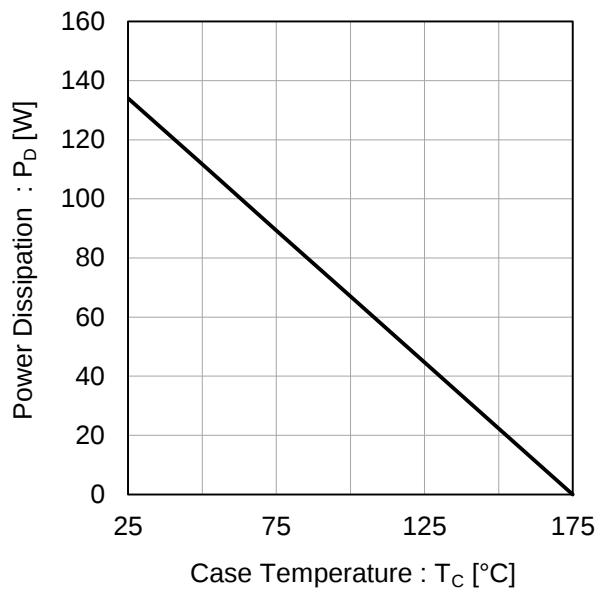


Fig.2 Maximum Safe Operating Area

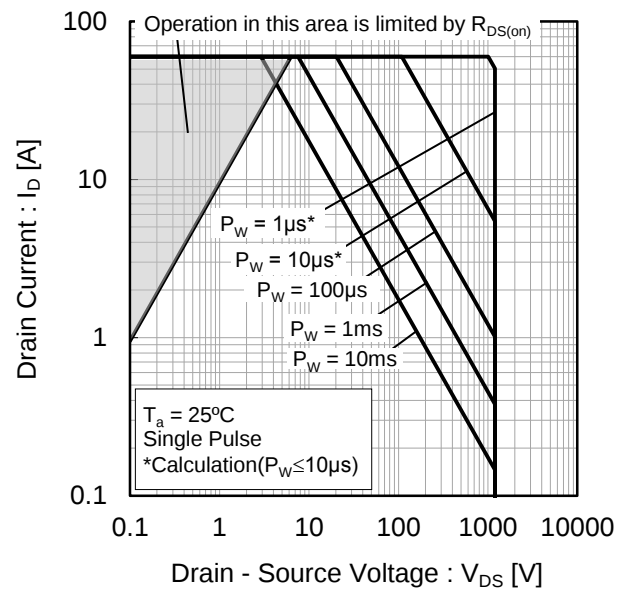
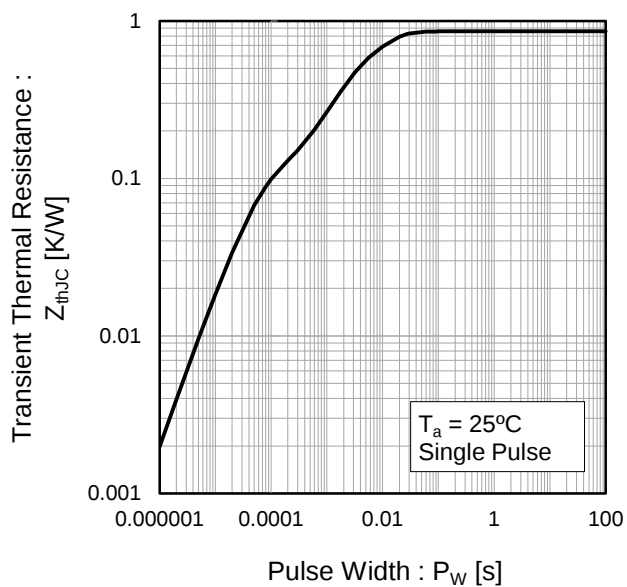


Fig.3 Typical Transient Thermal Resistance vs. Pulse Width



## ●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

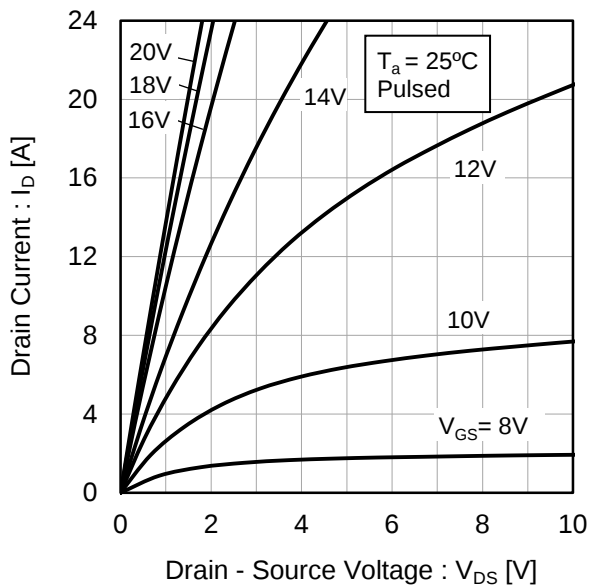
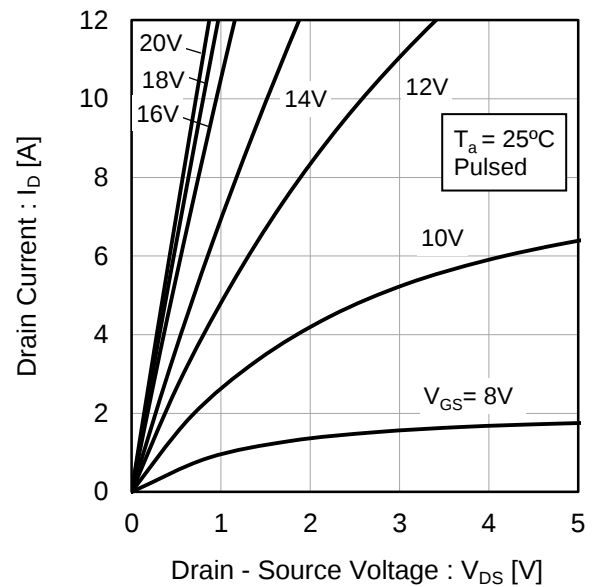
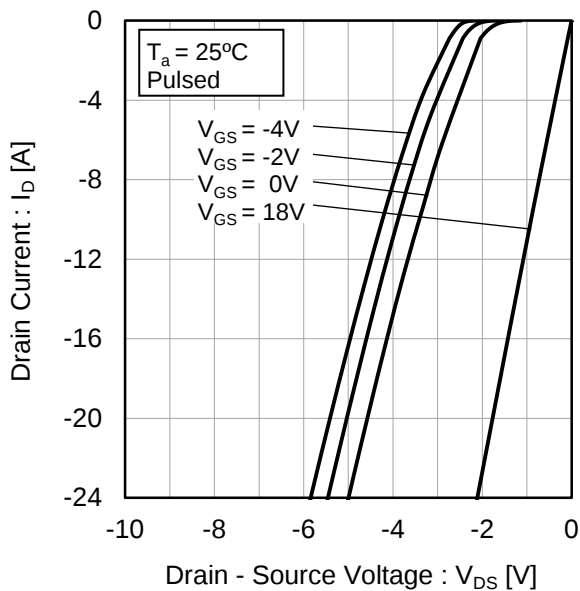


Fig.5 Typical Output Characteristics(II)

Fig.6  $T_j = 25^\circ\text{C}$  3rd Quadrant Characteristics

# ●Electrical characteristic curves

Fig.7  $T_j = 150^\circ\text{C}$  Typical Output Characteristics(I)

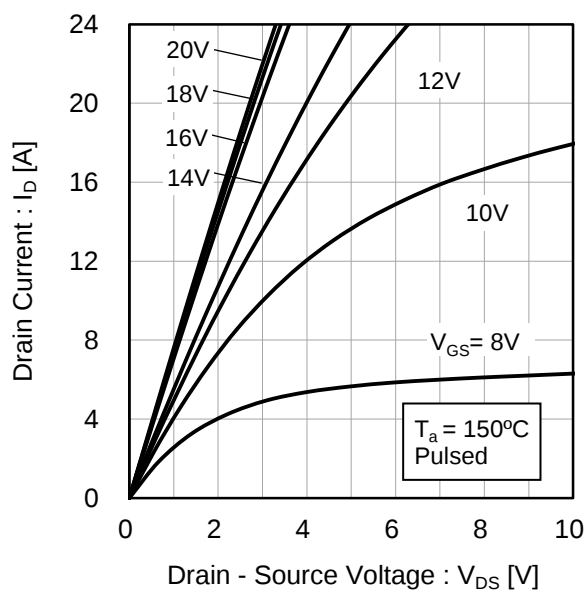


Fig.8  $T_j = 150^\circ\text{C}$  Typical Output Characteristics(II)

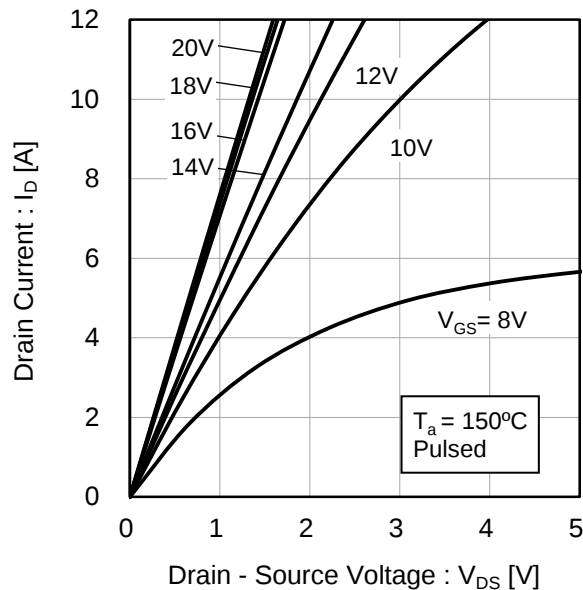


Fig.9  $T_j = 150^\circ\text{C}$  3rd Quadrant Characteristics

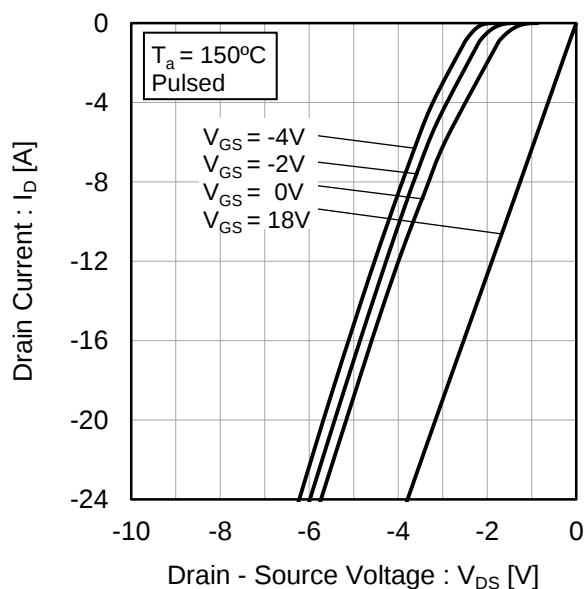
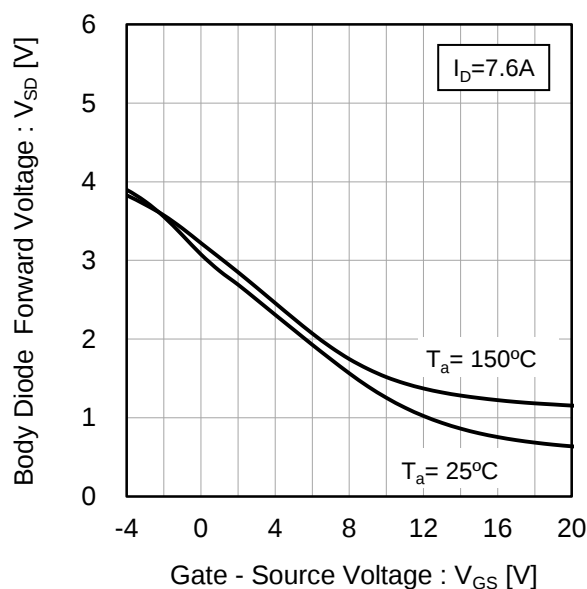


Fig.10 Body Diode Forward Voltage vs. Gate - Source Voltage



# ●Electrical characteristic curves

Fig.11 Typical Transfer Characteristics (I)

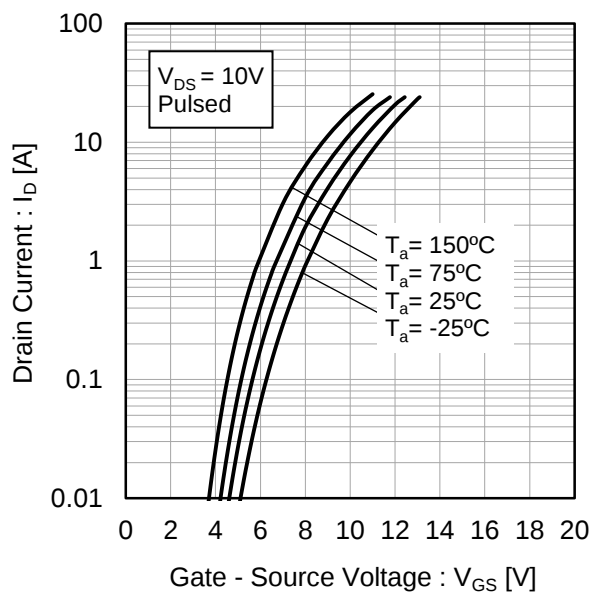


Fig.12 Typical Transfer Characteristics (II)

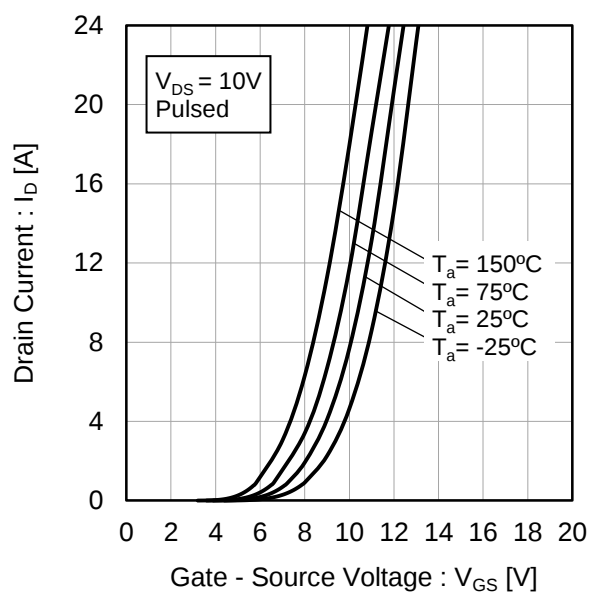


Fig.13 Gate Threshold Voltage vs. Junction Temperature

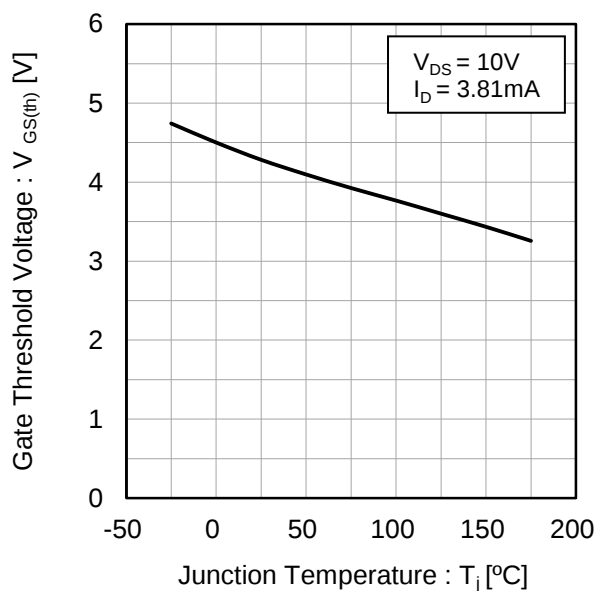
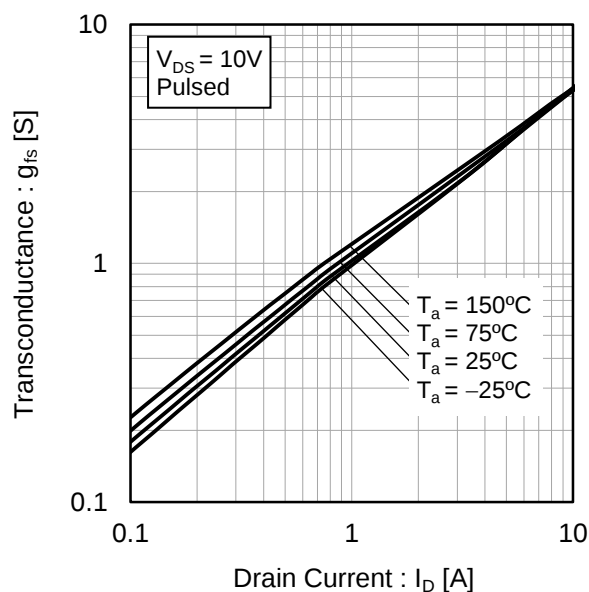


Fig.14 Transconductance vs. Drain Current



# ●Electrical characteristic curves

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

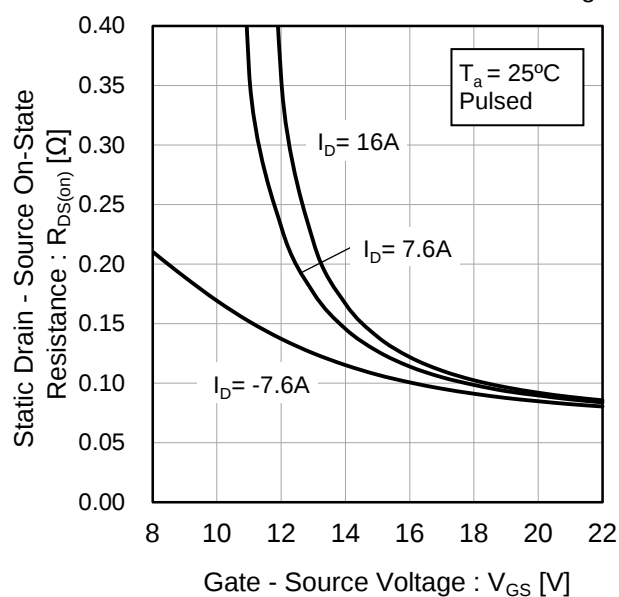


Fig.16 Static Drain - Source On - State Resistance vs. Junction Temperature

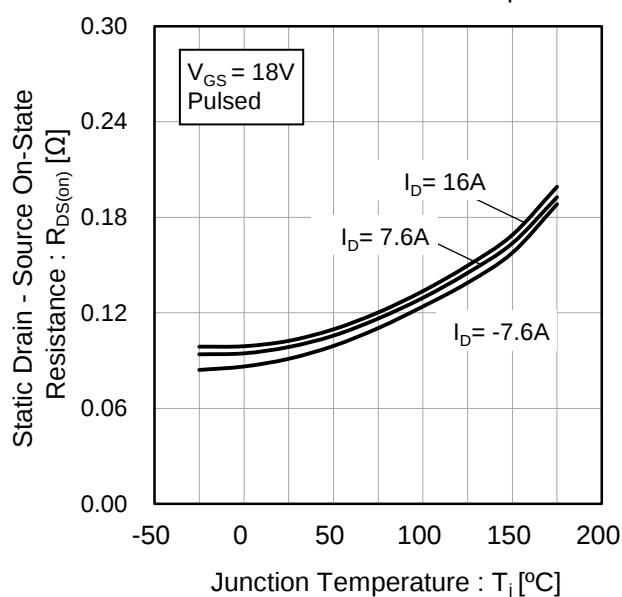


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current

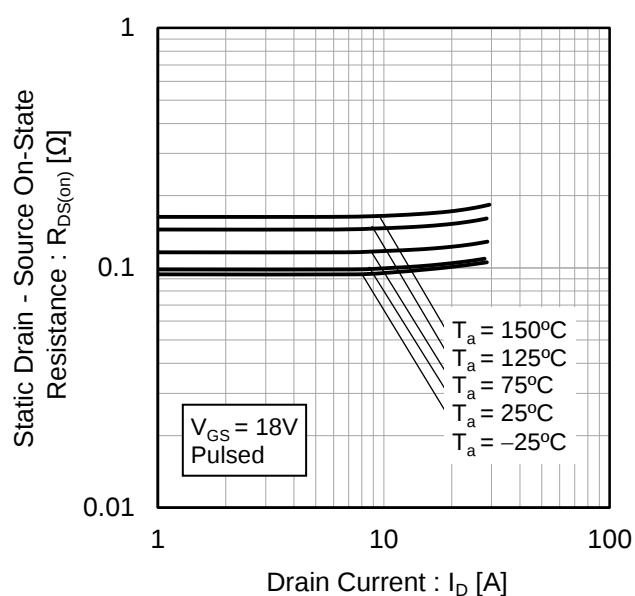
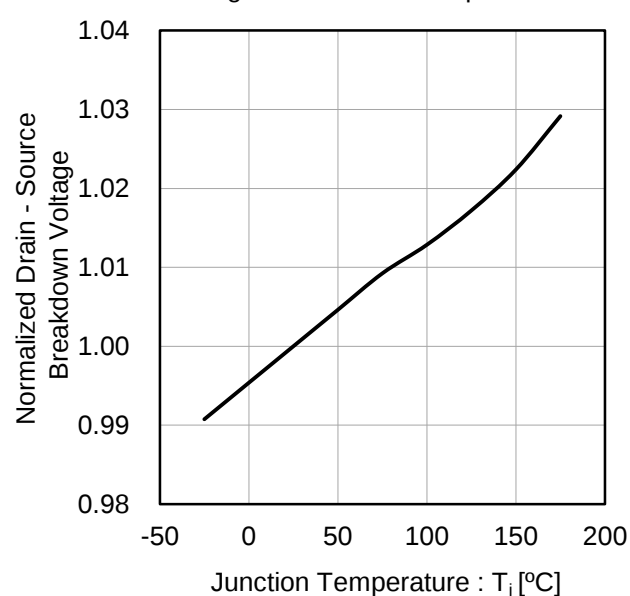


Fig.18 Normalized Drain - Source Breakdown Voltage vs. Junction Temperature



## ●Electrical characteristic curves

Fig.19 Typical Capacitance  
vs. Drain - Source Voltage

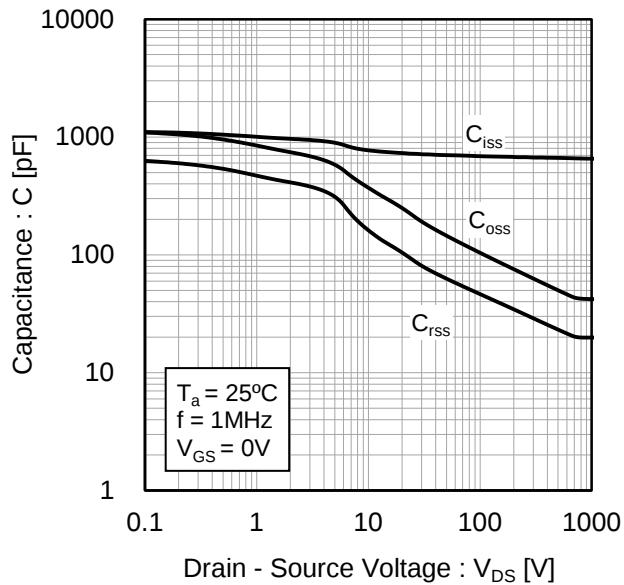


Fig.20  $C_{oss}$  Stored Energy

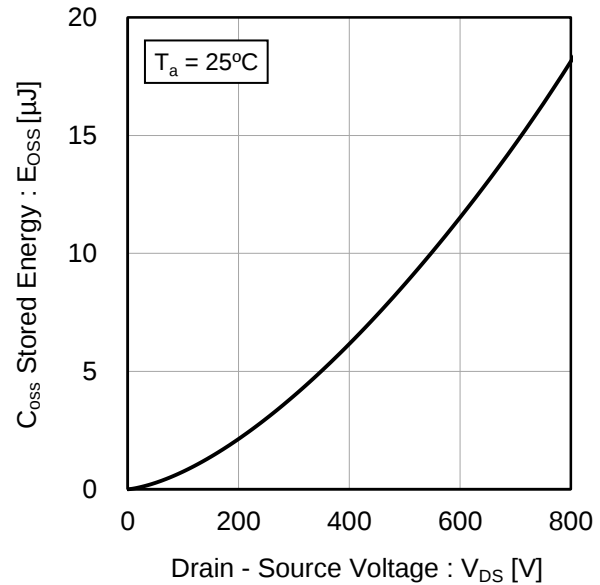
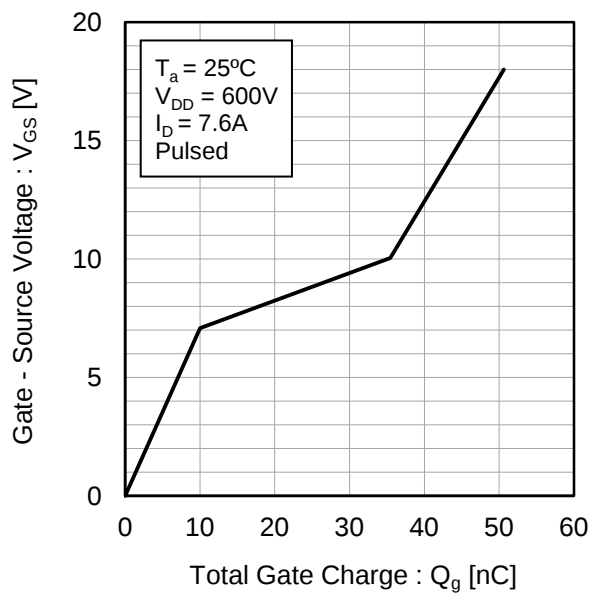
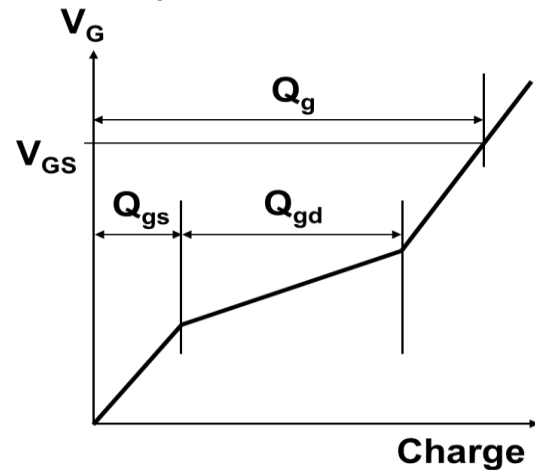


Fig.21 Dynamic Input Characteristics



\*Gate Charge Waveform



# ●Electrical characteristic curves

Fig.22 Typical Switching Time  
vs. External Gate Resistance

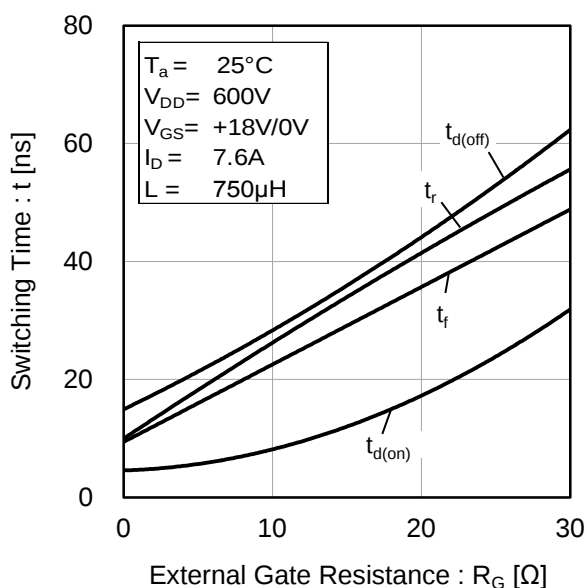


Fig.23 Typical Switching Loss  
vs. Drain - Source Voltage

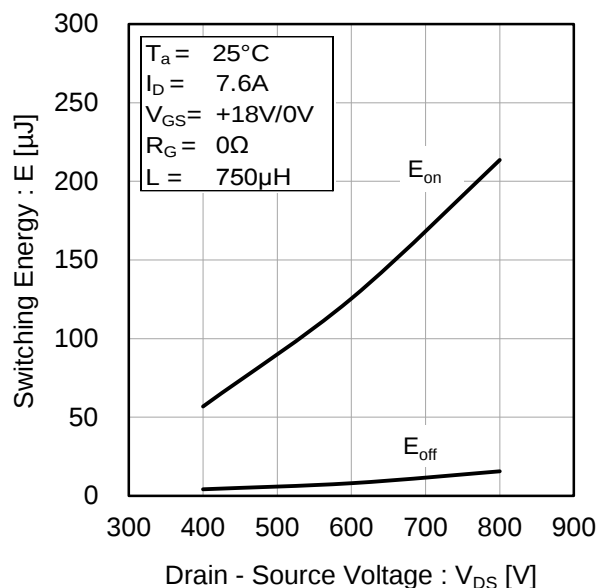


Fig.24 Typical Switching Loss  
vs. Drain Current

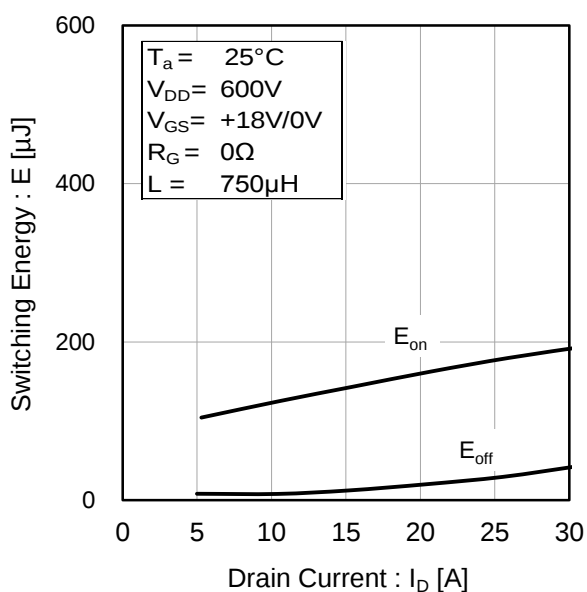
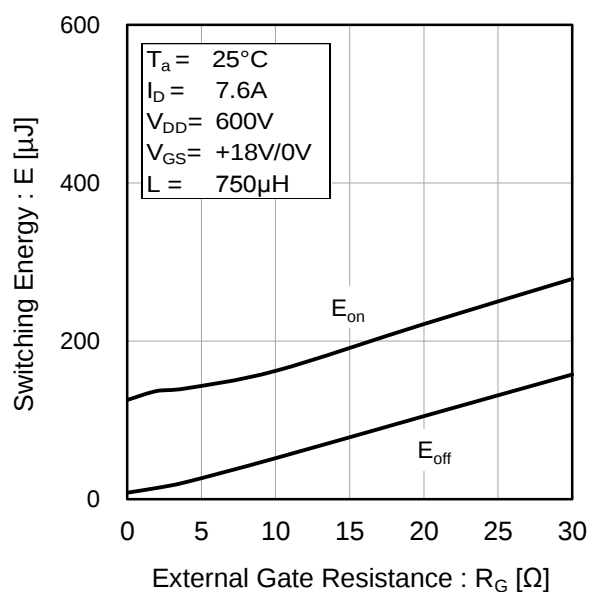


Fig.25 Typical Switching Loss  
vs. External Gate Resistance



## ●Measurement circuits and waveforms

Fig.1-1 Gate Charge Measurement Circuit

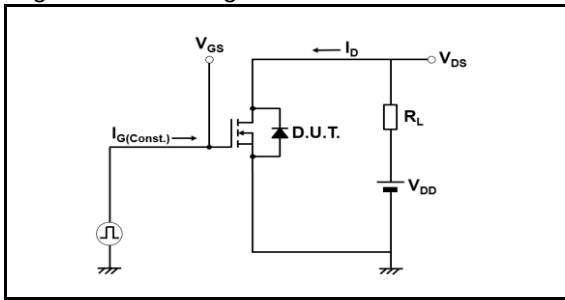


Fig.2-1 Switching Characteristics Measurement Circuit

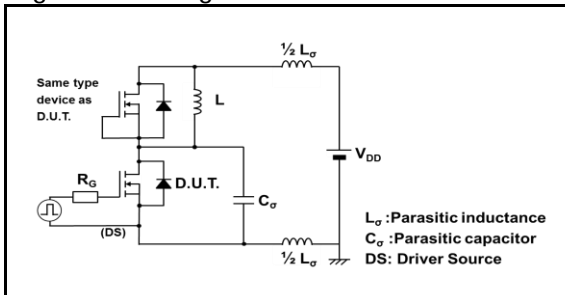


Fig.2-2 Waveforms for Switching Time

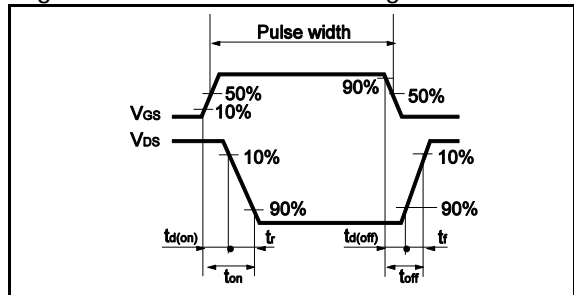


Fig.2-3 Waveforms for Switching Energy Loss

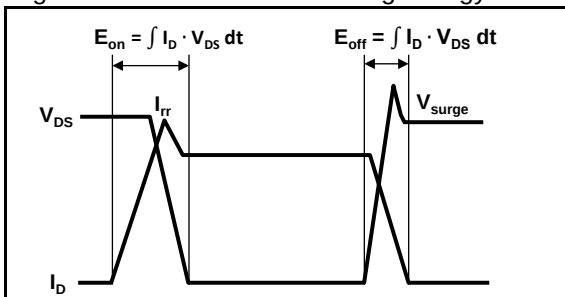


Fig.3-1 Reverse Recovery Time Measurement Circuit

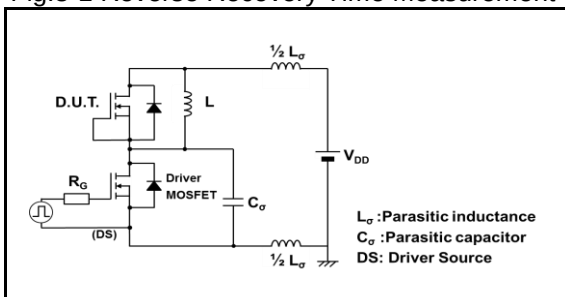
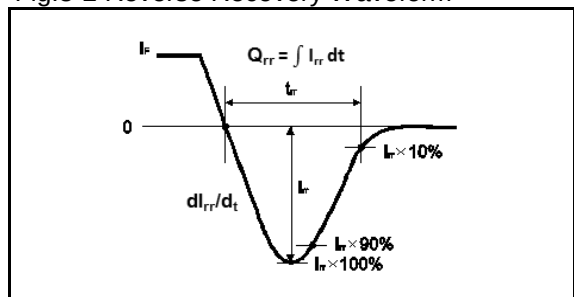


Fig.3-2 Reverse Recovery Waveform



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|                             |           |
|-----------------------------|-----------|
| Part Number                 | SCT3105KR |
| Package                     | TO-247-4L |
| Unit Quantity               | 450       |
| Minimum Package Quantity    | 30        |
| Packing Type                | Tube      |
| Constitution Materials List | inquiry   |
| RoHS                        | Yes       |