

# 2SK3870-01

N-CHANNEL SILICON POWER MOSFET

**FUJI**  
ELECTRIC

## FUJI POWER MOSFET Super FAP-G Series

### Features

High speed switching      Low on-resistance  
No secondary breakdown      Low driving power  
Avalanche-proof

### Applications

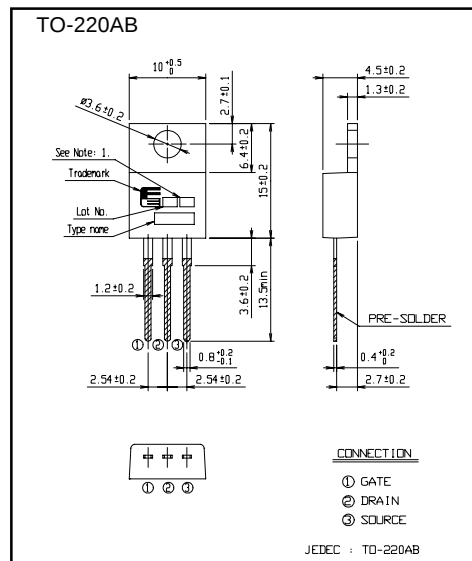
Switching regulators      DC-DC converters  
UPS (Uninterruptible Power Supply)

### Maximum ratings and characteristic

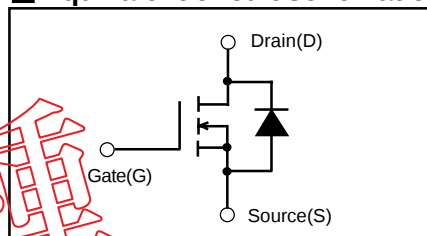
#### Absolute maximum ratings (T<sub>c</sub>=25°C unless otherwise specified)

| Item                                    | Symbol                              | Ratings     | Unit  | Remarks               |
|-----------------------------------------|-------------------------------------|-------------|-------|-----------------------|
| Drain-source voltage                    | V <sub>DS</sub>                     | 230         | V     |                       |
|                                         | V <sub>DSX</sub>                    | 230         | V     | V <sub>GS</sub> =-30V |
| Continuous Drain Current                | I <sub>D</sub>                      | 40          | A     |                       |
| Pulsed Drain Current                    | I <sub>D</sub> (puls)               | ±160        | A     |                       |
| Gate-Source Voltage                     | V <sub>GS</sub>                     | ±30         | V     |                       |
| Maximum Avalanche current               | I <sub>AR</sub>                     | 40          | A     | Note *1               |
| Non-Repetitive                          | E <sub>AS</sub>                     | 63.1        | mJ    | Note *2               |
| Maximum Avalanche Energy                |                                     |             |       |                       |
| Repetitive                              | E <sub>AR</sub>                     | 27          | mJ    | Note *3               |
| Maximum Avalanche Energy                |                                     |             |       |                       |
| Maximum Drain-Source dV/dt              | dV <sub>DS</sub> /dt                | 20          | kV/μs | V <sub>DS</sub> ≤230V |
| Peak Diode Recovery dV/dt               | dV/dt                               | 5           | kV/μs | Note *4               |
| Max. Power Dissipation                  | P <sub>D</sub>                      | 270         | W     | T <sub>c</sub> =25°C  |
|                                         |                                     | 2.02        | W     | T <sub>a</sub> =25°C  |
| Operating and Storage Temperature range | T <sub>ch</sub><br>T <sub>stg</sub> | +150        | °C    |                       |
|                                         |                                     | -55 to +150 | °C    |                       |

### Outline Drawings (mm) 200406



### Equivalent circuit schematic



Note \*1: T<sub>ch</sub>≤150°C, Repetitive and Non-repetitive

Note \*2: Starting T<sub>ch</sub>=25°C, I<sub>AS</sub>=16A, L=4.09mH,

V<sub>GS</sub>=48V, R<sub>G</sub>=50Ω

E<sub>AS</sub> limited by maximum channel temperature and Avalanche current.

See to the 'Avalanche Energy' graph

Note \*3: Repetitive rating: Pulse width limited by maximum channel temperature.

See to the 'Transient Thermal impedance' graph.

#### Electrical characteristics (T<sub>c</sub>=25°C unless otherwise specified)

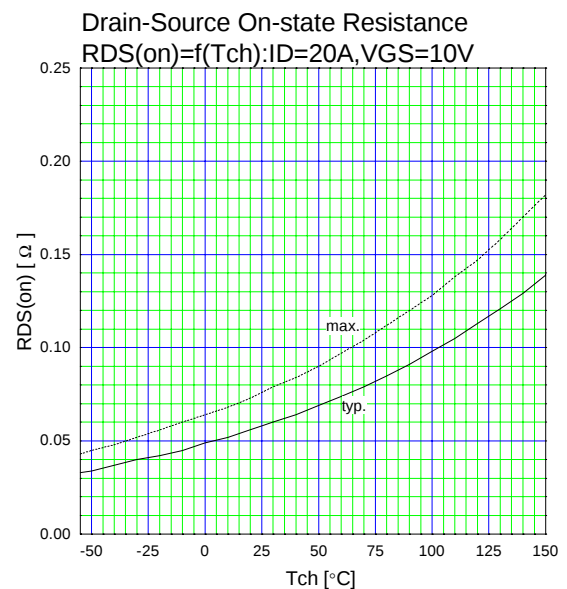
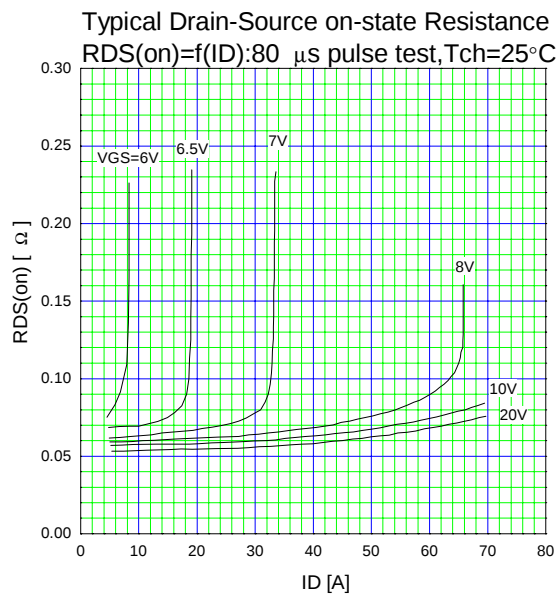
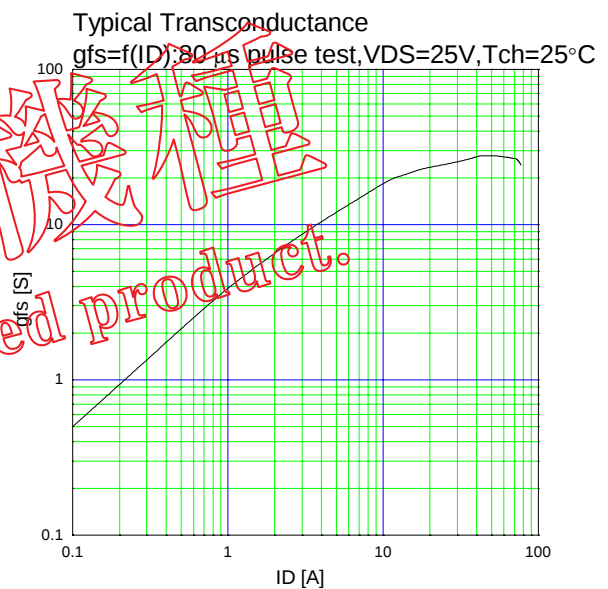
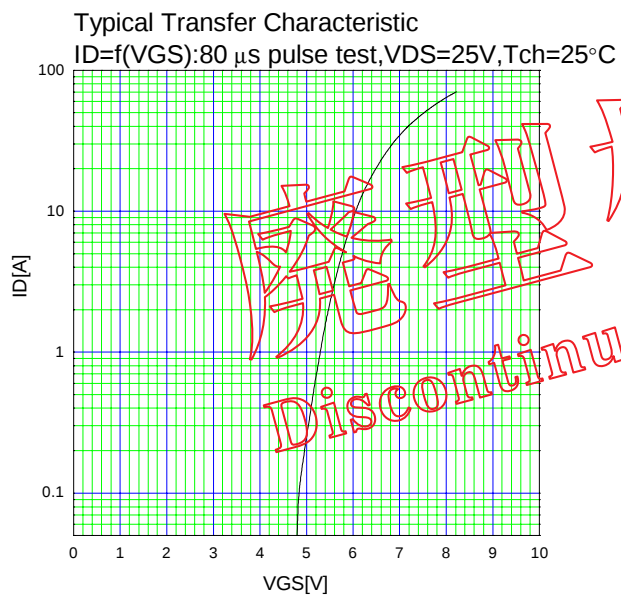
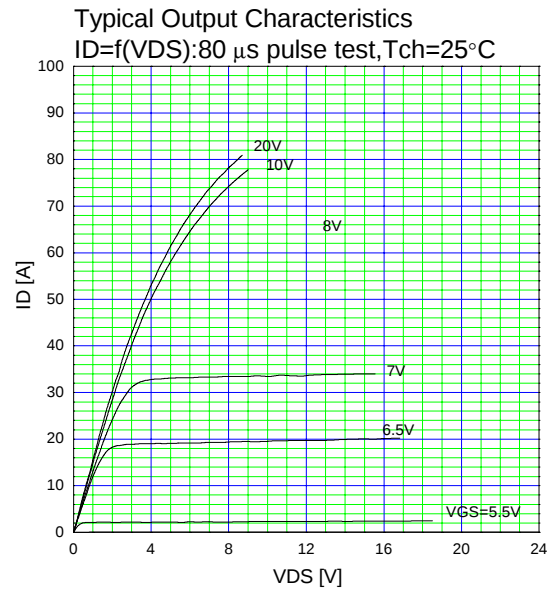
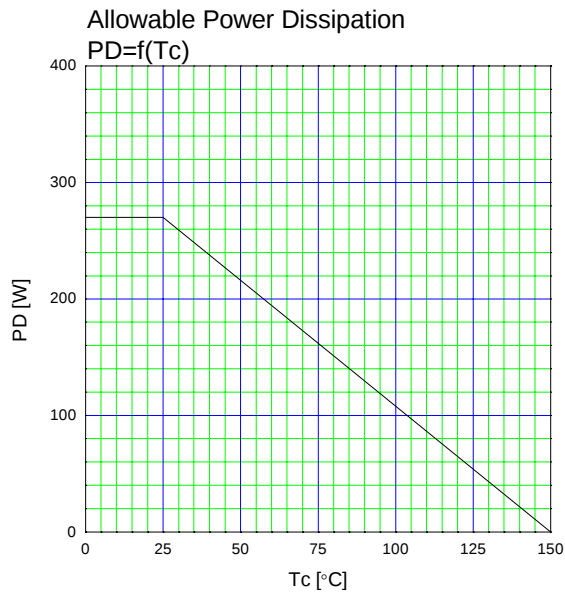
Note \*4: I<sub>F</sub>≤-I<sub>D</sub>, -di/dt=50A/μs, V<sub>CC</sub>≤BV<sub>DSS</sub>, T<sub>ch</sub>≤150°C

| Item                             | Symbol              | Test Conditions                                                                        | Min. | Typ. | Max. | Units |
|----------------------------------|---------------------|----------------------------------------------------------------------------------------|------|------|------|-------|
| Drain-Source Breakdown Voltage   | BV <sub>DSS</sub>   | I <sub>D</sub> =250μA V <sub>GS</sub> =0V                                              | 230  |      |      | V     |
| Gate Threshold Voltage           | V <sub>GS(th)</sub> | I <sub>D</sub> =250μA V <sub>DS</sub> =V <sub>GS</sub>                                 | 3.0  |      | 5.0  | V     |
| Zero Gate Voltage Drain Current  | I <sub>DSS</sub>    | V <sub>DS</sub> =230V V <sub>GS</sub> =0V<br>V <sub>DS</sub> =184V V <sub>GS</sub> =0V |      |      | 25   | μA    |
|                                  |                     | T <sub>ch</sub> =25°C                                                                  |      |      |      |       |
|                                  |                     | T <sub>ch</sub> =125°C                                                                 |      |      | 250  |       |
| Gate-Source Leakage Current      | I <sub>GSS</sub>    | V <sub>GS</sub> =±30V V <sub>DS</sub> =0V                                              |      |      | 100  | nA    |
| Drain-Source On-State Resistance | R <sub>DS(on)</sub> | I <sub>D</sub> =20A V <sub>GS</sub> =10V                                               |      | 58   | 76   | mΩ    |
| Forward Transconductance         | g <sub>fs</sub>     | I <sub>D</sub> =20A V <sub>DS</sub> =25V                                               | 12   | 24   |      | S     |
| Input Capacitance                | C <sub>iss</sub>    | V <sub>DS</sub> =75V                                                                   |      | 1880 | 2820 | pF    |
| Output Capacitance               | C <sub>oss</sub>    | V <sub>GS</sub> =0V                                                                    |      | 230  | 345  |       |
| Reverse Transfer Capacitance     | C <sub>rss</sub>    | f=1MHz                                                                                 |      | 12   | 18   |       |
| Turn-On Time t <sub>on</sub>     | t <sub>d(on)</sub>  | V <sub>CC</sub> =180V I <sub>D</sub> =20A                                              |      | 28   | 42   | ns    |
|                                  | t <sub>r</sub>      | V <sub>GS</sub> =10V                                                                   |      | 8.4  | 12.6 |       |
| Turn-Off Time t <sub>off</sub>   | t <sub>d(off)</sub> | R <sub>GS</sub> =10Ω                                                                   |      | 56   | 84   |       |
|                                  | t <sub>f</sub>      |                                                                                        |      | 6    | 9    |       |
| Total Gate Charge                | Q <sub>G</sub>      | V <sub>CC</sub> =115V                                                                  |      | 42.0 | 63.0 | nC    |
| Gate-Source Charge               | Q <sub>GS</sub>     | I <sub>D</sub> =40A                                                                    |      | 18.0 | 27.0 |       |
| Gate-Drain Charge                | Q <sub>GD</sub>     | V <sub>GS</sub> =10V                                                                   |      | 12.0 | 18.0 |       |
| Diode forward on-voltage         | V <sub>SD</sub>     | I <sub>F</sub> =40A V <sub>GS</sub> =0V T <sub>ch</sub> =25°C                          |      | 1.10 | 1.50 | V     |
| Reverse recovery time            | t <sub>rr</sub>     | I <sub>F</sub> =40A V <sub>GS</sub> =0V                                                |      | 230  |      | ns    |
| Reverse recovery charge          | Q <sub>rr</sub>     | -di/dt=100A/μs T <sub>ch</sub> =25°C                                                   |      | 2.5  |      | μC    |

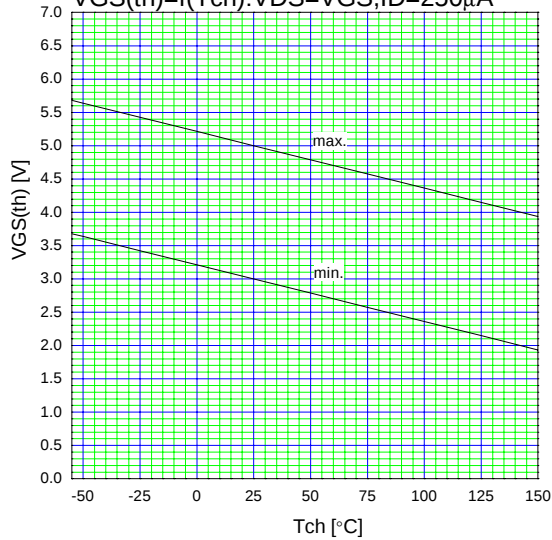
#### Thermal characteristics

| Item               | Symbol                | Test Conditions    | Min. | Typ. | Max.  | Units |
|--------------------|-----------------------|--------------------|------|------|-------|-------|
| Thermal resistance | R <sub>th(ch-c)</sub> | channel to case    |      |      | 0.463 | °C/W  |
|                    | R <sub>th(ch-a)</sub> | channel to ambient |      |      | 62    | °C/W  |

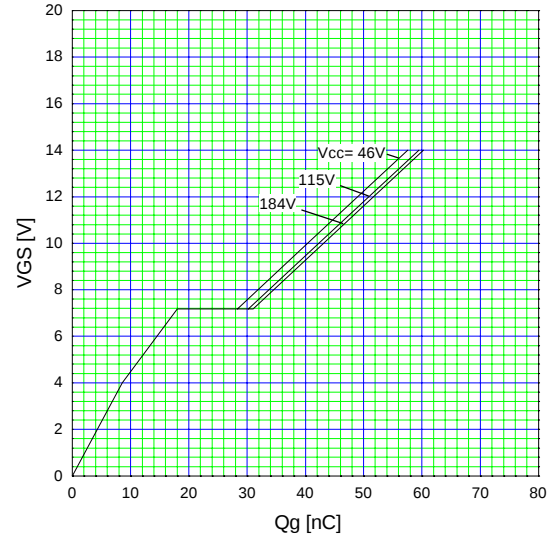
## Characteristics



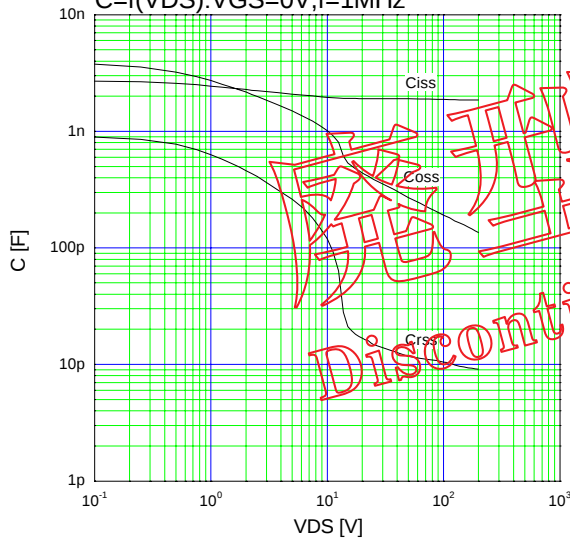
Gate Threshold Voltage vs. T<sub>ch</sub>  
 $V_{GS(th)} = f(T_{ch})$ :  $V_{DS} = V_{GS}$ ,  $I_D = 250\mu A$



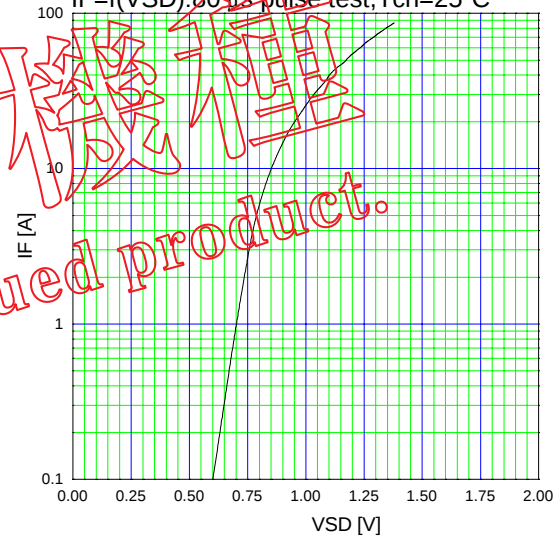
Typical Gate Charge Characteristics  
 $V_{GS} = f(Q_g)$ :  $I_D = 40A$ ,  $T_{ch} = 25^\circ C$



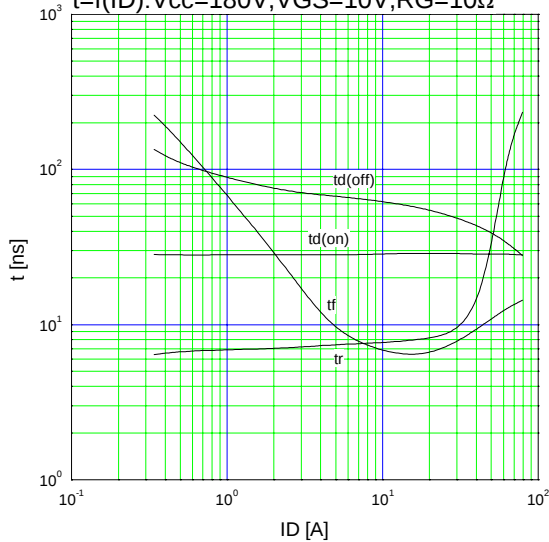
Typical Capacitance  
 $C = f(V_{DS})$ :  $V_{GS} = 0V$ ,  $f = 1MHz$



Typical Forward Characteristics of Reverse Diode  
 $I_F = f(V_{SD})$ : 80- $\mu s$  pulse test,  $T_{ch} = 25^\circ C$



Typical Switching Characteristics vs.  $I_D$   
 $t = f(I_D)$ :  $V_{CC} = 180V$ ,  $V_{GS} = 10V$ ,  $R_G = 10\Omega$



Maximum Avalanche Energy vs. starting  $T_{ch}$   
 $E_{AV} = f(\text{starting } T_{ch})$ :  $V_{CC} = 48V$ ,  $I_{(AV)} \leq 40A$

