

## N-CHANNEL SILICON POWER MOS-FET

### ■ Features

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

### ■ Applications

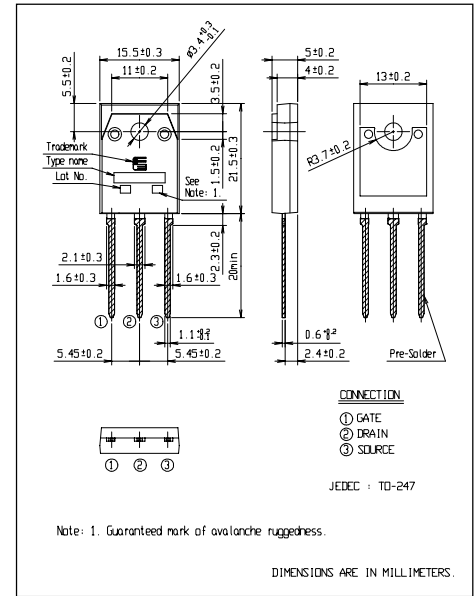
- Switching regulators
- UPS (Uninterruptible Power Supply)
- DC-DC converters

### ■ Maximum ratings and characteristic Absolute maximum ratings

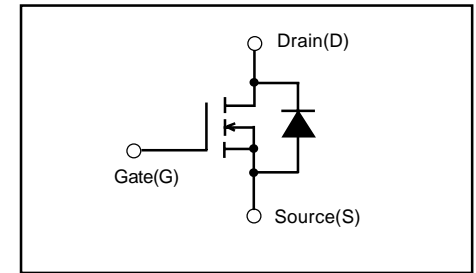
● (T<sub>c</sub>=25°C unless otherwise specified)

| Item                                    | Symbol                              | Rating              | Unit |
|---|-------------------------------------|---------------------|------|
| Drain-source voltage                    | V <sub>DS</sub>                     | 400                 | V    |
| Continuous drain current                | I <sub>D</sub>                      | ±23                 | A    |
| Pulsed drain current                    | I <sub>D</sub> (puls)               | ±92                 | A    |
| Gate-source voltage                     | V <sub>GS</sub>                     | ±30                 | V    |
| Repetitive or non-repetitive            | IAR *2                              | 23                  | A    |
| Maximum Avalanche Energy                | EAV *1                              | 545                 | mJ   |
| Max. power dissipation                  | P <sub>D</sub>                      | 295                 | W    |
| Operating and storage temperature range | T <sub>ch</sub><br>T <sub>stg</sub> | +150<br>-55 to +150 | °C   |

\*1 L=1.89mH, V<sub>cc</sub>=40V \*2 T<sub>ch</sub>=150°C



### ■ Equivalent circuit schematic



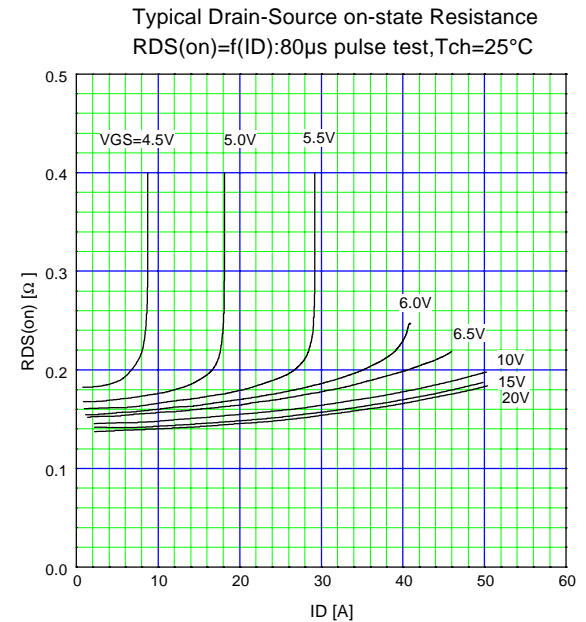
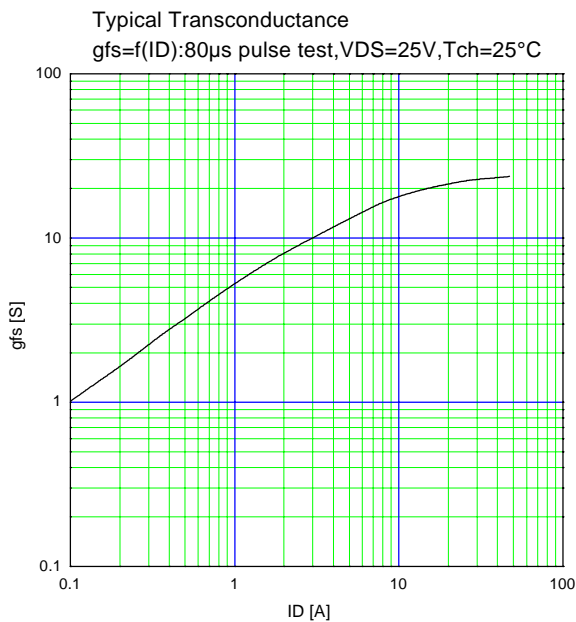
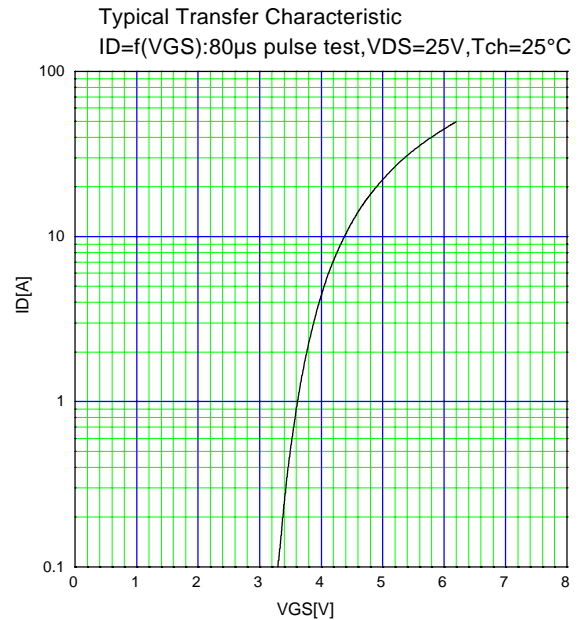
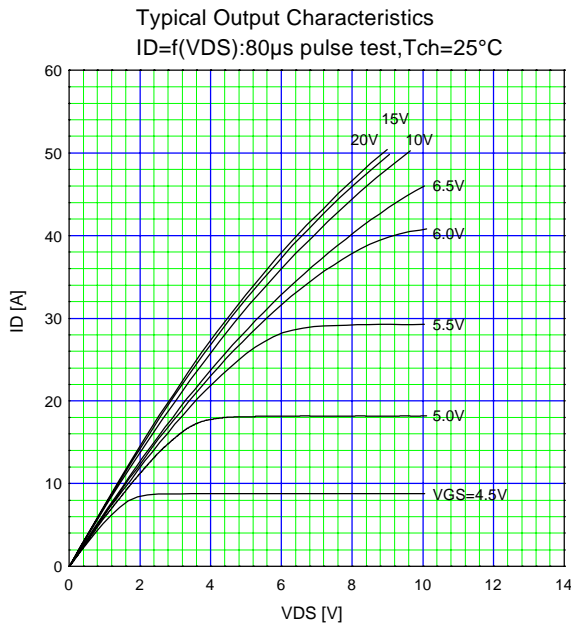
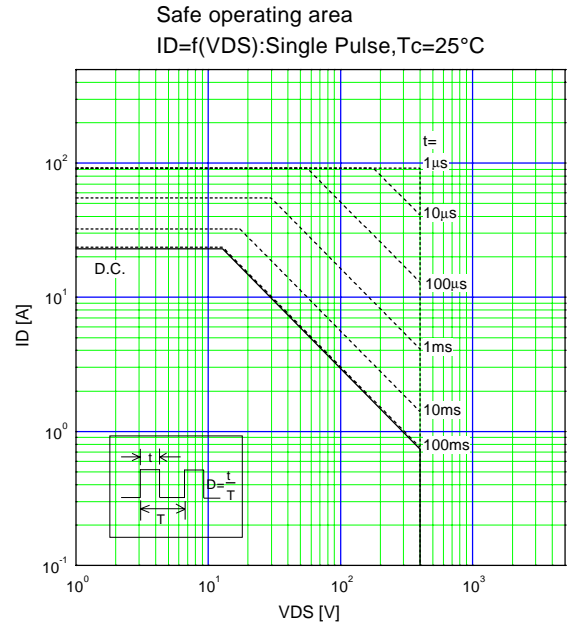
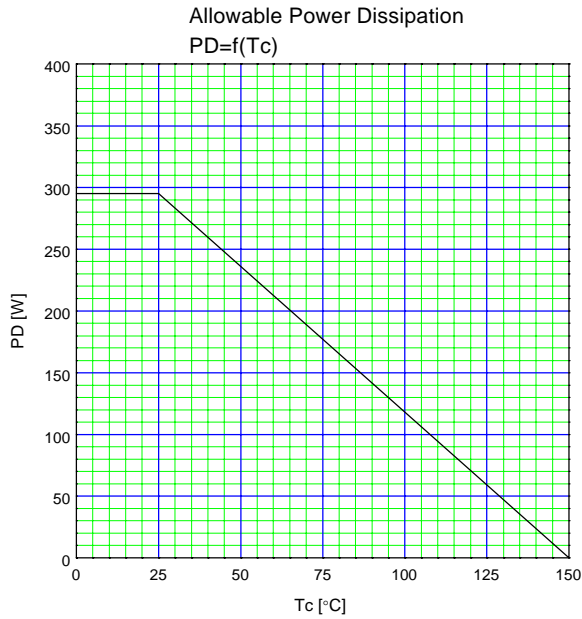
### ● Electrical characteristics (T<sub>c</sub> =25°C unless otherwise specified)

| Item                             | Symbol               | Test Conditions   | Min.                   | Typ. | Max. | Units |
|----------------------------------|----------------------|---|------------------------|------|------|-------|
| Drain-source breakdown voltage   | V <sub>(BR)DSS</sub> | I <sub>D</sub> =1mA V <sub>GS</sub> =0V                                     | 400                    |      |      | V     |
| Gate threshold voltage           | V <sub>GS(th)</sub>  | I <sub>D</sub> =1mA V <sub>DS</sub> =V <sub>GS</sub>                        | 2.5                    | 3.0  | 3.5  | V     |
| Zero gate voltage drain current  | I <sub>DSS</sub>     | V <sub>DS</sub> =400V<br>V <sub>GS</sub> =0V                                | T <sub>ch</sub> =25°C  | 10   | 500  | μA    |
|                                  |                      |   | T <sub>ch</sub> =125°C | 0.2  | 1.0  | mA    |
| Gate-source leakage current      | I <sub>GSS</sub>     | V <sub>GS</sub> =±30V V <sub>DS</sub> =0V                                   |                        | 10   | 100  | nA    |
| Drain-source on-state resistance | R <sub>DS(on)</sub>  | I <sub>D</sub> =11.5A V <sub>GS</sub> =10V                                  |                        | 0.16 | 0.2  | Ω     |
| Forward transconductance         | g <sub>fs</sub>      | I <sub>D</sub> =11.5A V <sub>DS</sub> =25V                                  | 8.5                    | 17   |      | S     |
| Input capacitance                | C <sub>iss</sub>     | V <sub>DS</sub> =25V  |                        | 2650 | 3975 | pF    |
| Output capacitance               | C <sub>oss</sub>     | V <sub>GS</sub> =0V   |                        | 500  | 750  | pF    |
| Reverse transfer capacitance     | C <sub>rss</sub>     | f=1MHz  |                        | 230  | 345  | pF    |
| Turn-on time t <sub>on</sub>     | td(on)               | V <sub>CC</sub> =300V I <sub>D</sub> =23A                                   |                        | 22   | 35   | ns    |
|                                  | t <sub>r</sub>       | V <sub>GS</sub> =10V  |                        | 105  | 160  |       |
| Turn-off time t <sub>off</sub>   | td(off)              | R <sub>GS</sub> =10Ω  |                        | 225  | 340  | ns    |
|                                  | t <sub>f</sub>       |   |                        | 120  | 180  |       |
| Total gate charge                | Q <sub>G</sub>       | V <sub>CC</sub> =200V   |                        | 137  | 210  | nC    |
| Gate-Source charge               | Q <sub>GS</sub>      | I <sub>D</sub> =23A   |                        | 36   | 55   |       |
| Gate-Drain charge                | Q <sub>GD</sub>      | V <sub>GS</sub> =10V  |                        | 48   | 75   |       |
| Avalanche capability             | I <sub>AV</sub>      | L=1.89mH T <sub>ch</sub> =25°C  | 23                     |      |      | A     |
| Diode forward on-voltage         | V <sub>SD</sub>      | I <sub>F</sub> =2xI <sub>DR</sub> V <sub>GS</sub> =0V T <sub>ch</sub> =25°C |                        | 1.15 | 1.73 | V     |
| Reverse recovery time            | t <sub>rr</sub>      | I <sub>F</sub> =I <sub>DR</sub> V <sub>GS</sub> =0V                         |                        | 450  |      | ns    |
| Reverse recovery charge          | Q <sub>rr</sub>      | -di/dt=100A/μs T <sub>ch</sub> =25°C  |                        | 8.6  |      | μC    |

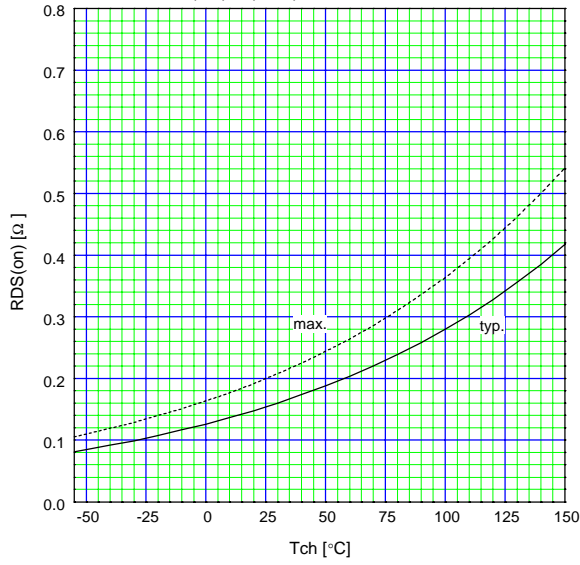
### ● Thermal characteristics

| Item               | Symbol                | Test Conditions    | Min. | Typ. | Max.  | Units |
|--------------------|-----------------------|--------------------|------|------|-------|-------|
| Thermal resistance | R <sub>th(ch-c)</sub> | channel to case    |      |      | 0.424 | °C/W  |
|                    | R <sub>th(ch-a)</sub> | channel to ambient |      |      | 50.0  | °C/W  |

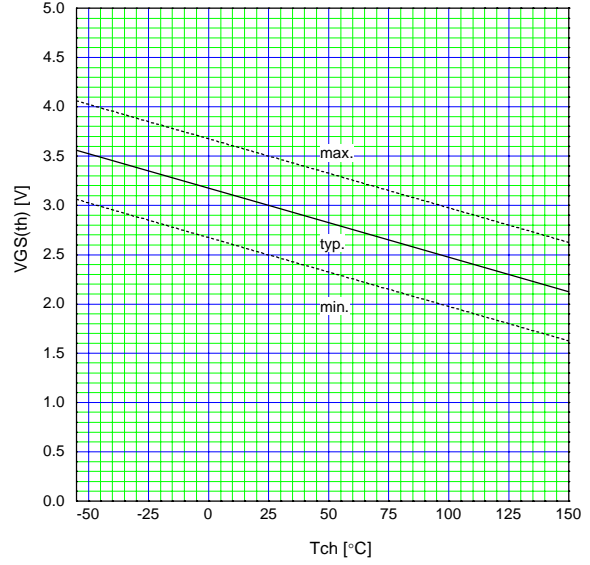
Characteristics



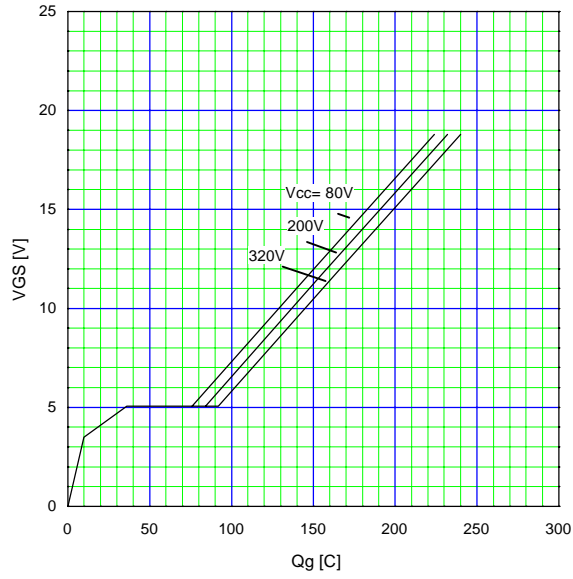
Drain-Source On-state Resistance  
 $R_{DS(on)}=f(T_{ch}):I_D=11.5A, V_{GS}=10V$



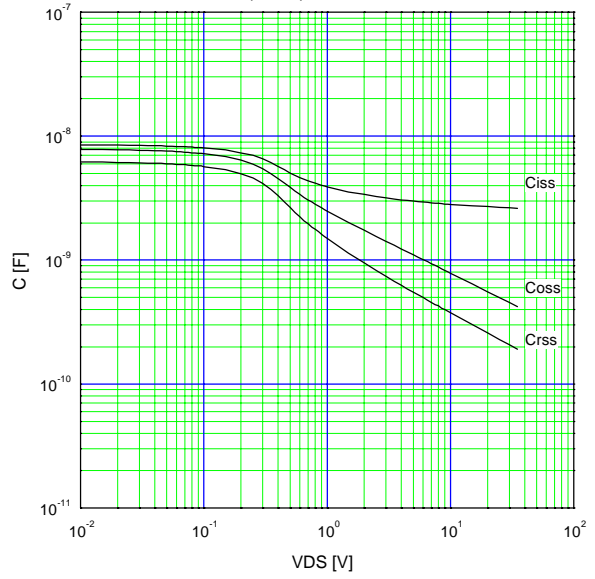
Gate Threshold Voltage vs.  $T_{ch}$   
 $V_{GS(th)}=f(T_{ch}):V_{DS}=V_{GS}, I_D=1mA$



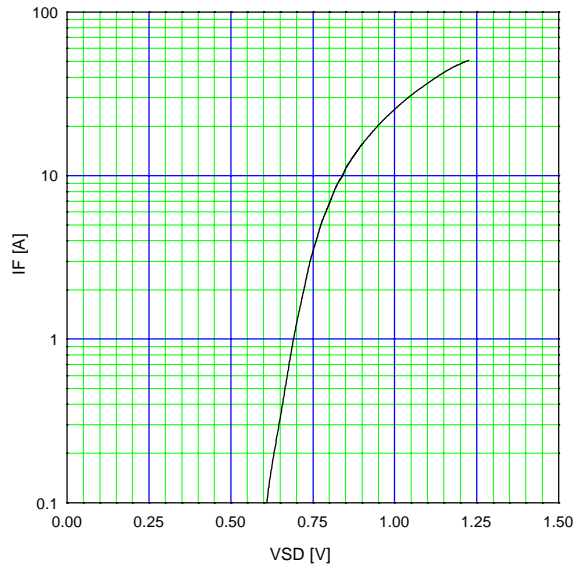
Typical Gate Charge Characteristics  
 $V_{GS}=f(Q_g):I_D=23A, T_{ch}=25^{\circ}C$



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.  $I_D$   
 $t=f(I_D):V_{CC}=300V, V_{GS}=10V, R_G=10\Omega$

