

FMR23N50E

FUJI POWER MOSFET

Super FAP-E³ series

N-CHANNEL SILICON POWER MOSFET

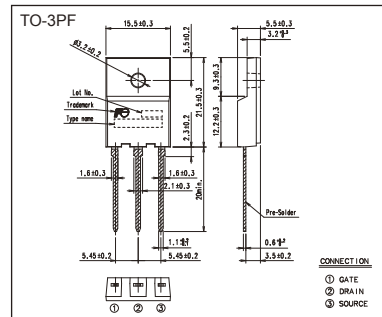
■ Features

- Maintains both low power loss and low noise
- Lower $R_{DS(on)}$ characteristic
- More controllable switching dv/dt by gate resistance
- Smaller V_{GS} ringing waveform during switching
- Narrow band of the gate threshold voltage ($3.0 \pm 0.5V$)
- High avalanche durability

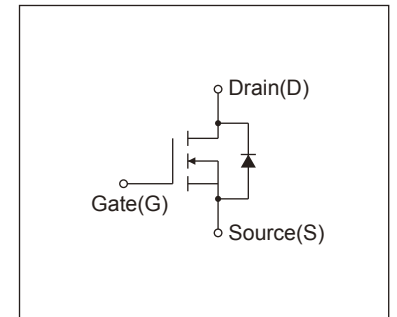
■ Applications

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

■ Outline Drawings [mm]



■ Equivalent circuit schematic



■ Maximum Ratings and Characteristics

● Absolute Maximum Ratings at $T_c=25^\circ C$ (unless otherwise specified)

| Description | Symbol | Characteristics | Unit | Remarks |
|---|-----------|-----------------|-------------|-----------------------|
| Drain-Source Voltage | V_{DS} | 500 | V | |
| | V_{DSX} | 500 | V | $V_{GS} = -30V$ |
| Continuous Drain Current | I_D | ± 23 | A | |
| Pulsed Drain Current | I_{DP} | ± 92 | A | |
| Gate-Source Voltage | V_{GS} | ± 30 | V | |
| Repetitive and Non-Repetitive Maximum Avalanche Current | I_{AR} | 23 | A | Note*1 |
| Non-Repetitive Maximum Avalanche Energy | E_{AS} | 767.3 | mJ | Note*2 |
| Repetitive Maximum Avalanche Energy | E_{AR} | 15 | mJ | Note*3 |
| Peak Diode Recovery dV/dt | dV/dt | 9.3 | kV/ μs | Note*4 |
| Peak Diode Recovery $-di/dt$ | $-di/dt$ | 100 | A/ μs | Note*5 |
| Maximum Power Dissipation | P_D | 3.13 | W | $T_a=25^\circ C$ |
| | | 150 | | $T_c=25^\circ C$ |
| Operating and Storage | T_{ch} | 150 | $^\circ C$ | |
| Temperature range | T_{slg} | -55 to + 150 | $^\circ C$ | |
| Isolation Voltage | V_{ISO} | 2 | kVrms | $t = 60sec, f = 60Hz$ |

● Electrical Characteristics at $T_c=25^\circ C$ (unless otherwise specified)

| Description | Symbol | Conditions | min. | typ. | max. | Unit |
|----------------------------------|--------------|---|------|------|-------|----------|
| Drain-Source Breakdown Voltage | BV_{DSS} | $I_D=250\mu A, V_{GS}=0V$ | 500 | - | - | V |
| Gate Threshold Voltage | $V_{GS(th)}$ | $I_D=250\mu A, V_{DS}=V_{GS}$ | 2.5 | 3.0 | 3.5 | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=500V, V_{GS}=0V$ | - | - | 25 | μA |
| | | $V_{DS}=400V, V_{GS}=0V$ | - | - | 250 | |
| Gate-Source Leakage Current | I_{GSS} | $V_{GS}=\pm 30V, V_{DS}=0V$ | - | 10 | 100 | nA |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $I_D=11.5A, V_{GS}=10V$ | - | 0.21 | 0.245 | Ω |
| Forward Transconductance | g_{fs} | $I_D=11.5A, V_{DS}=25V$ | 14 | 28 | - | S |
| Input Capacitance | C_{iss} | $V_{DS}=25V$ | - | 3500 | 5250 | pF |
| Output Capacitance | C_{oss} | $V_{GS}=0V$ | - | 330 | 495 | |
| Reverse Transfer Capacitance | C_{rss} | $f=1MHz$ | - | 24 | 36 | |
| Turn-On Time | $t_d(on)$ | $V_{cc}=300V$ | - | 24 | 36 | ns |
| | t_r | $V_{GS}=10V$ | - | 13 | 19.5 | |
| Turn-Off Time | $t_d(off)$ | $I_D=11.5A$ | - | 150 | 225 | |
| | t_f | $R_{GS}=5.6\Omega$ | - | 20 | 30 | |
| Total Gate Charge | Q_G | $V_{cc}=250V$ | - | 11 | 16.5 | nC |
| Gate-Source Charge | Q_{GS} | $I_D=23A$ | - | 93 | 139.5 | |
| Gate-Drain Charge | Q_{GD} | $V_{GS}=10V$ | - | 24 | 36 | |
| Avalanche Capability | I_{AV} | $L=1.16mH, T_{ch}=25^\circ C$ | 23 | - | - | |
| Diode Forward On-Voltage | V_{SD} | $I_F=23A, V_{GS}=0V, T_{ch}=25^\circ C$ | - | 0.90 | 1.35 | V |
| Reverse Recovery Time | t_{rr} | $I_F=23A, V_{GS}=0V$ | - | 0.5 | - | μs |
| Reverse Recovery Charge | Q_{rr} | $-di/dt=100A/\mu s, T_{ch}=25^\circ C$ | - | 8 | - | μC |

● Thermal Characteristics

| Description | Symbol | Test Conditions | min. | typ. | max. | Unit |
|--------------------|----------------|--------------------|------|------|------|--------------|
| Thermal resistance | $R_{th(ch-c)}$ | Channel to case | | | 0.83 | $^\circ C/W$ |
| | $R_{th(ch-a)}$ | Channel to ambient | | | 40.0 | $^\circ C/W$ |

Note *1 : $T_{ch} \leq 150^\circ C$

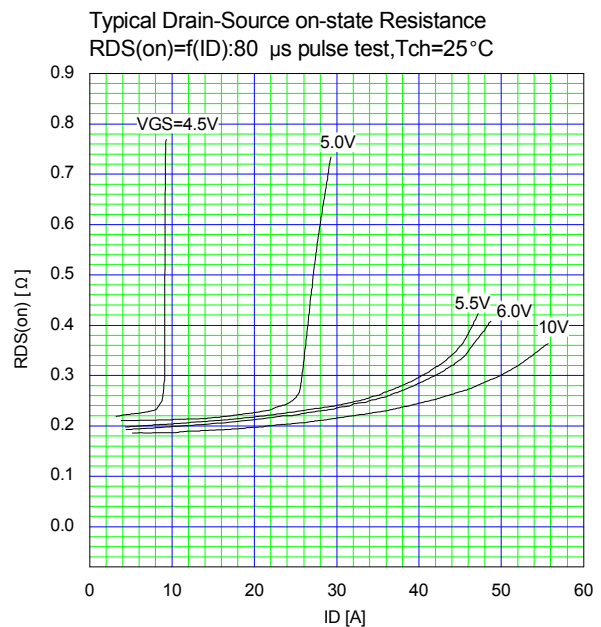
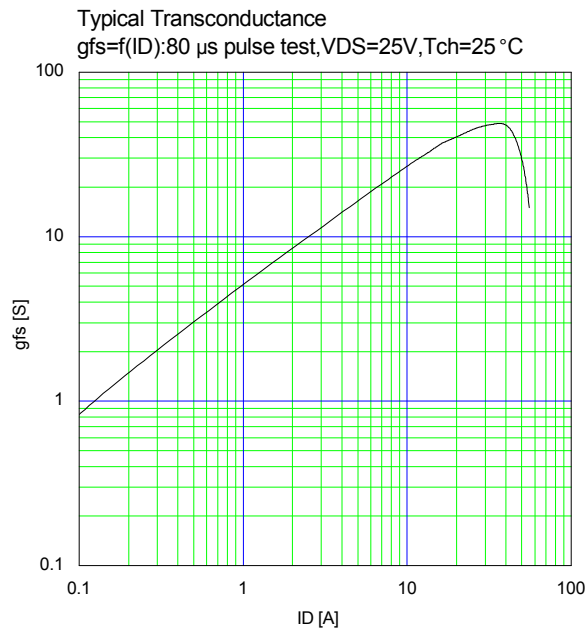
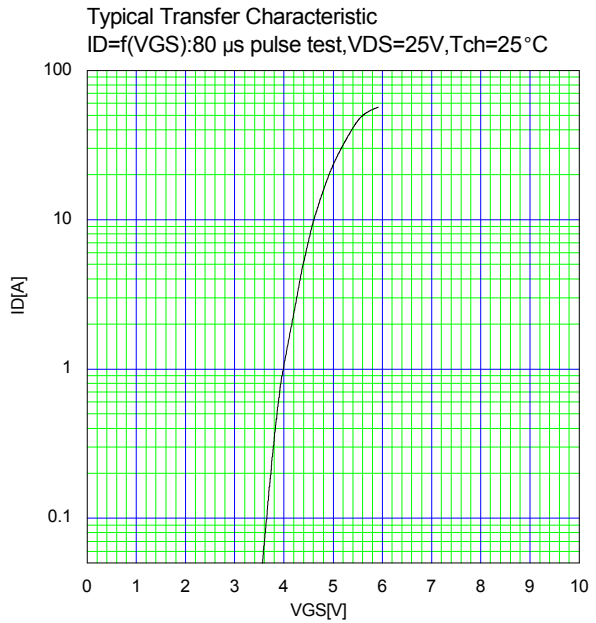
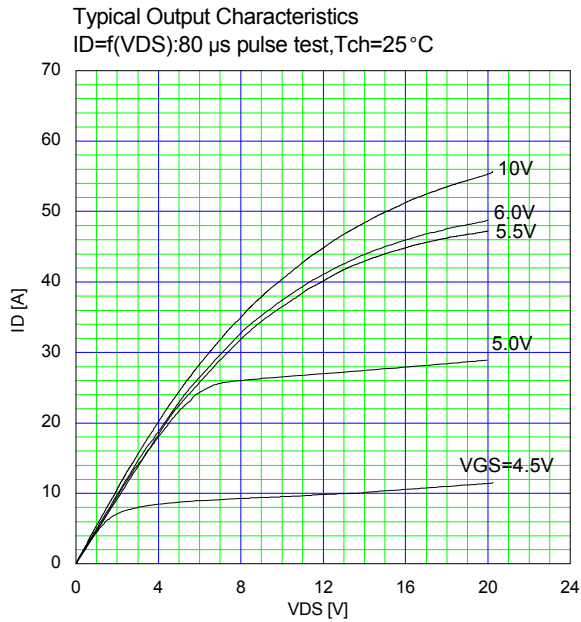
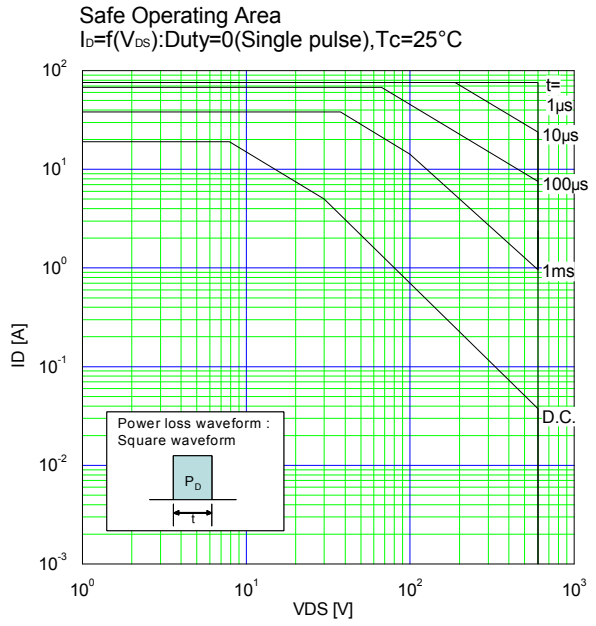
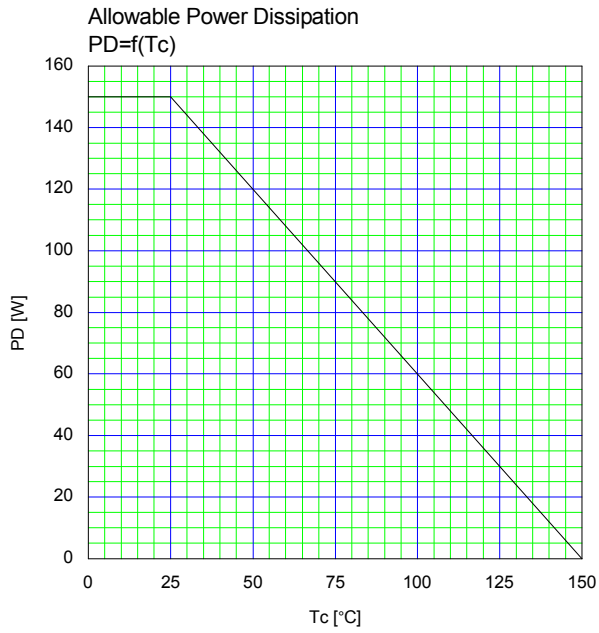
Note *2 : Stating $T_{ch}=25^\circ C, I_{AS}=10A, L=14.1mH, V_{cc}=50V, R_G=50\Omega$
 E_{AS} limited by maximum channel temperature and avalanche current.
 See to 'Avalanche Energy' graph.

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

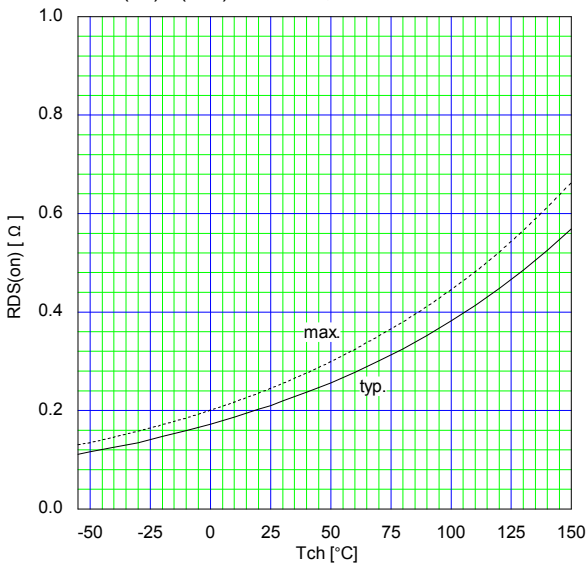
See to the 'Transient Thermal Impedance' graph.

Note *4 : $I_F \leq I_D, -di/dt=100A/\mu s, V_{cc} \leq BV_{DSS}, T_{ch} \leq 150^\circ C$.

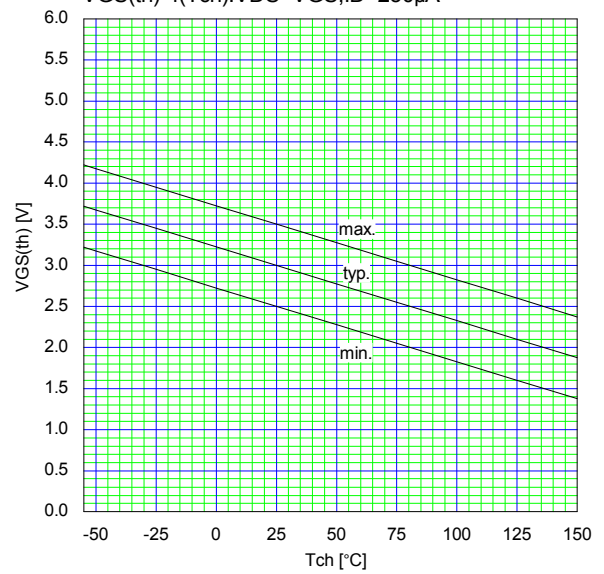
Note *5 : $I_F \leq I_D, dv/dt=5.0kV/\mu s, V_{cc} \leq BV_{DSS}, T_{ch} \leq 150^\circ C$.



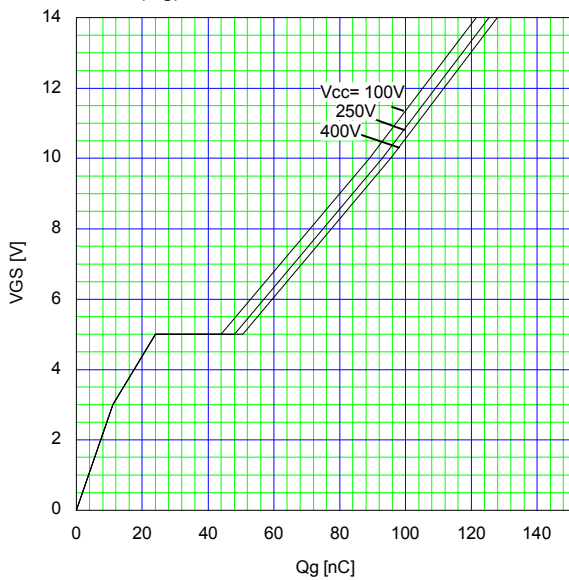
Drain-Source On-state Resistance
 $R_{DS(on)}=f(T_{ch}):I_D=11.5A, V_{GS}=10V$



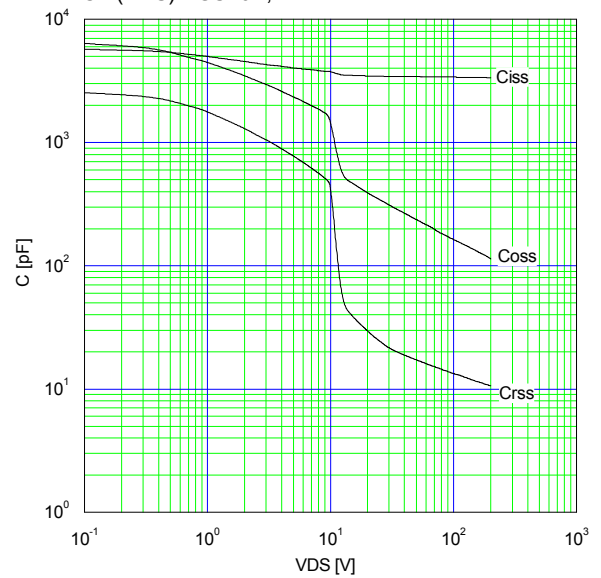
Gate Threshold Voltage vs. T_{ch}
 $V_{GS(th)}=f(T_{ch}):V_{DS}=V_{GS}, I_D=250\mu A$



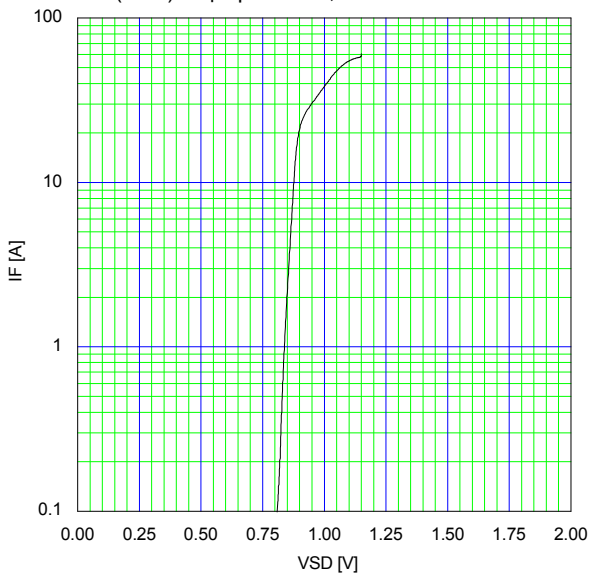
Typical Gate Charge Characteristics
 $V_{GS}=f(Q_g):I_D=23A, T_{ch}=25^{\circ}C$



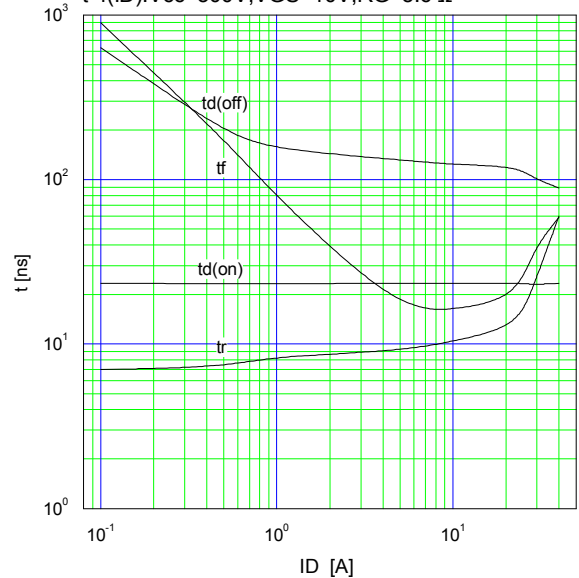
Typical Capacitance
 $C=f(V_{DS}):V_{GS}=0V, f=1MHz$



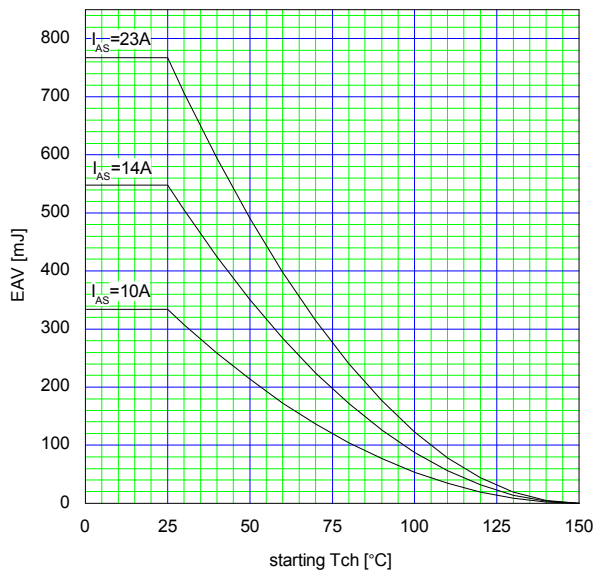
Typical Forward Characteristics of Reverse Diode
 $I_F=f(V_{SD}):80\mu s$ pulse test, $T_{ch}=25^{\circ}C$



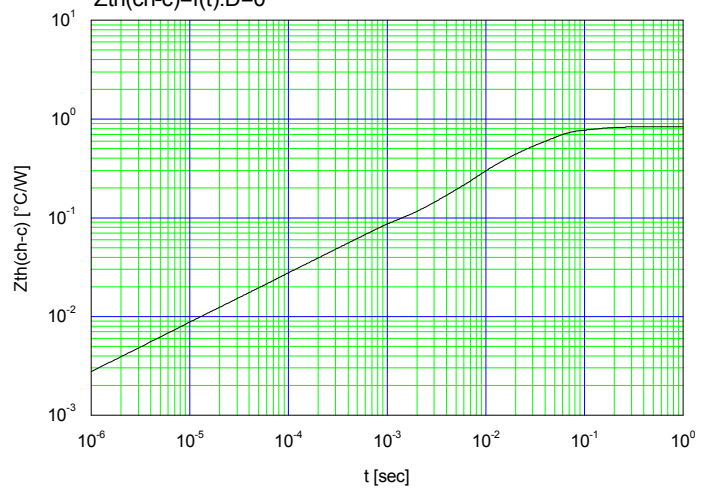
Typical Switching Characteristics vs. I_D
 $t=f(I_D):V_{CC}=300V, V_{GS}=10V, R_G=5.6\Omega$



Maximum Avalanche Energy vs. starting Tch
 $E(AV)=f(\text{starting Tch}):V_{CC}=50V, I(AV)\leq 23A$



Maximum Transient Thermal Impedance
 $Z_{th}(ch-c)=f(t):D=0$



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