

FMC13N60ES

FUJI POWER MOSFET

Super FAP-E^{3S} series

N-CHANNEL SILICON POWER MOSFET

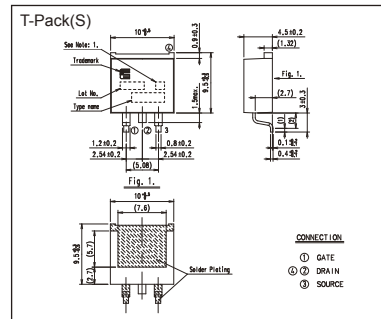
■ Features

- 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 ($4.2 \pm 0.5V$)
- High avalanche durability

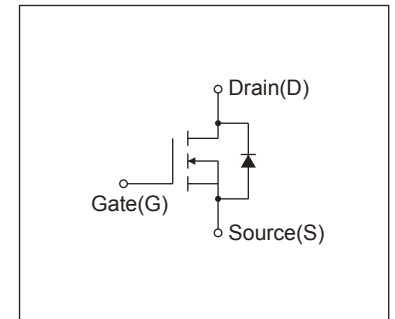
■ Applications

- 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} | 600 | V | |
| | V_{DSX} | 600 | V | $V_{GS} = -30V$ |
| Continuous Drain Current | I_D | ± 13 | A | |
| Pulsed Drain Current | I_{DP} | ± 52 | A | |
| Gate-Source Voltage | V_{GS} | ± 30 | V | |
| Repetitive and Non-Repetitive Maximum Avalanche Current | I_{AR} | 13 | A | Note*1 |
| Non-Repetitive Maximum Avalanche Energy | E_{AS} | 471.5 | mJ | Note*2 |
| Repetitive Maximum Avalanche Energy | E_{AR} | 22.5 | mJ | Note*3 |
| Peak Diode Recovery dV/dt | dV/dt | 4.7 | kV/ μs | Note*4 |
| Peak Diode Recovery $-di/dt$ | $-di/dt$ | 100 | A/ μs | Note*5 |
| Maximum Power Dissipation | P_D | 1.67 | W | $T_a=25^\circ C$ |
| | | 225 | | $T_c=25^\circ C$ |
| Operating and Storage Temperature range | T_{ch} | 150 | $^\circ C$ | |
| | T_{stg} | -55 to +150 | $^\circ C$ | |

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

| Description | Symbol | Conditions | min. | typ. | max. | Unit |
|----------------------------------|--------------|---|------|------|------|----------|
| Drain-Source Breakdown Voltage | BV_{DSS} | $I_D=250\mu A, V_{GS}=0V$ | 600 | - | - | V |
| Gate Threshold Voltage | $V_{GS(th)}$ | $I_D=250\mu A, V_{DS}=V_{GS}$ | 3.7 | 4.2 | 4.7 | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=600V, V_{GS}=0V$ | - | - | 25 | μA |
| | | $V_{DS}=480V, V_{GS}=0V$ | - | - | 250 | |
| Gate-Source Leakage Current | I_{GSS} | $V_{GS}=\pm 30V, V_{DS}=0V$ | - | 10 | 100 | nA |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $I_D=6.5A, V_{GS}=10V$ | - | 0.50 | 0.58 | Ω |
| Forward Transconductance | g_{fs} | $I_D=6.5A, V_{DS}=25V$ | 5 | 10 | - | S |
| Input Capacitance | C_{iss} | $V_{DS}=25V$ | - | 1700 | 2550 | pF |
| Output Capacitance | C_{oss} | $V_{GS}=0V$ | - | 190 | 285 | |
| Reverse Transfer Capacitance | C_{rss} | $f=1MHz$ | - | 10 | 15 | |
| Turn-On Time | $t_d(on)$ | $V_{cc}=300V$ | - | 38 | 57 | ns |
| | t_r | $V_{GS}=10V$ | - | 24 | 36 | |
| Turn-Off Time | $t_d(off)$ | $I_D=6.5A$ | - | 86 | 129 | |
| | t_f | $R_G=18\Omega$ | - | 16 | 24 | |
| Total Gate Charge | Q_G | | - | 48 | 72 | nC |
| Gate-Source Charge | Q_{GS} | $V_{cc}=300V$ | - | 16 | 24 | |
| Gate-Drain Charge | Q_{GD} | $I_D=13A$ | - | 16 | 24 | |
| Gate-Drain Crossover Charge | Q_{SW} | $V_{GS}=10V$ | - | 7 | 10.5 | |
| Avalanche Capability | I_{AV} | $L=2.36mH, T_{ch}=25^\circ C$ | 13 | - | - | A |
| Diode Forward On-Voltage | V_{SD} | $I_F=13A, V_{GS}=0V, T_{ch}=25^\circ C$ | - | 0.90 | 1.08 | V |
| Reverse Recovery Time | t_{rr} | $I_F=13A, V_{GS}=0V$ | - | 0.7 | - | 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 | | | 0.560 | $^\circ C/W$ |
| | $R_{th(ch-a)}$ | Channel to ambient | | | 75.0 | $^\circ C/W$ |

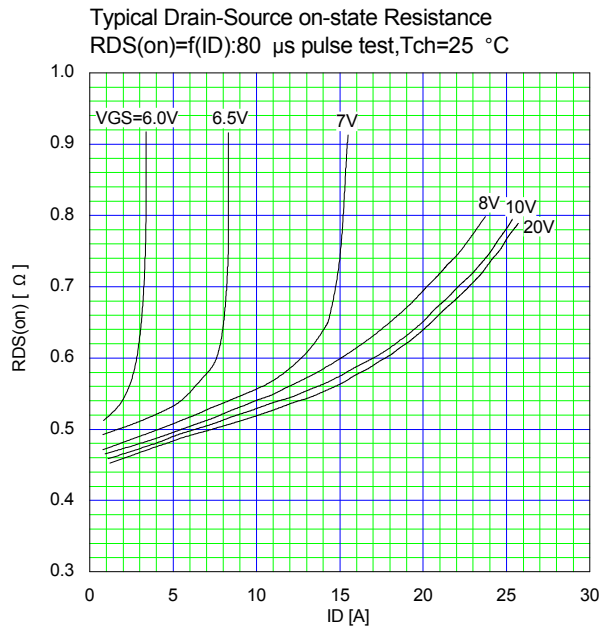
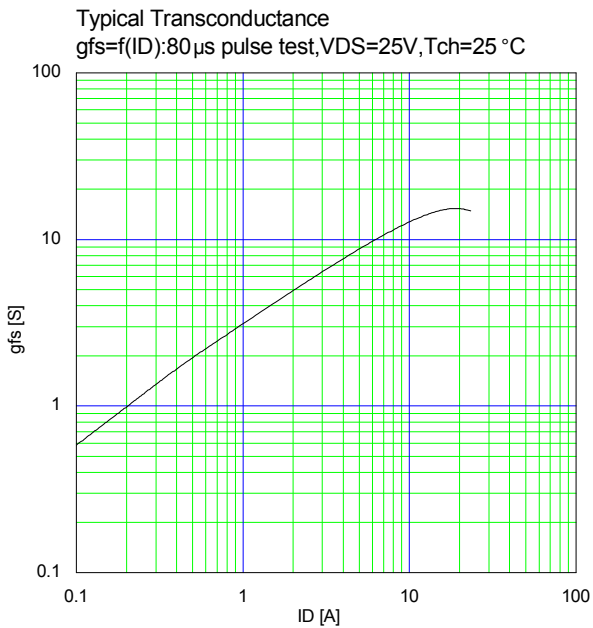
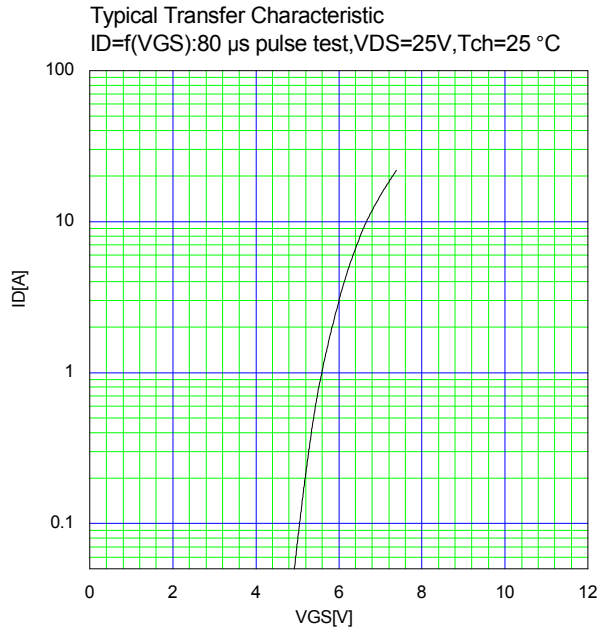
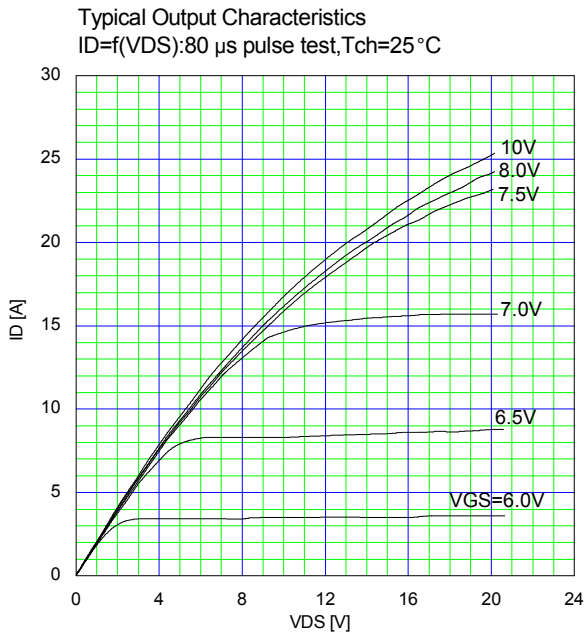
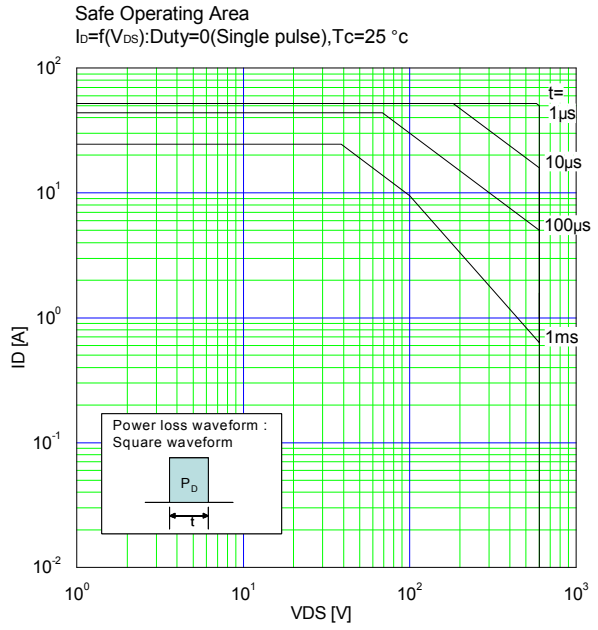
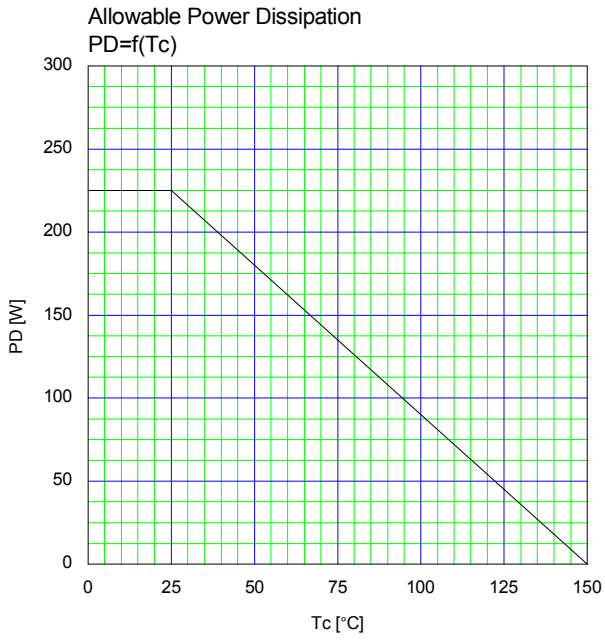
Note *1 : $T_{ch} \leq 150^\circ C$

Note *2 : Stating $T_{ch}=25^\circ C, I_{AS}=6A, L=24.0mH, V_{cc}=60V, R_G=50\Omega$
 E_{AS} limited by maximum channel temperature and avalanche current.
 See to 'Avalanche Energy' graph.

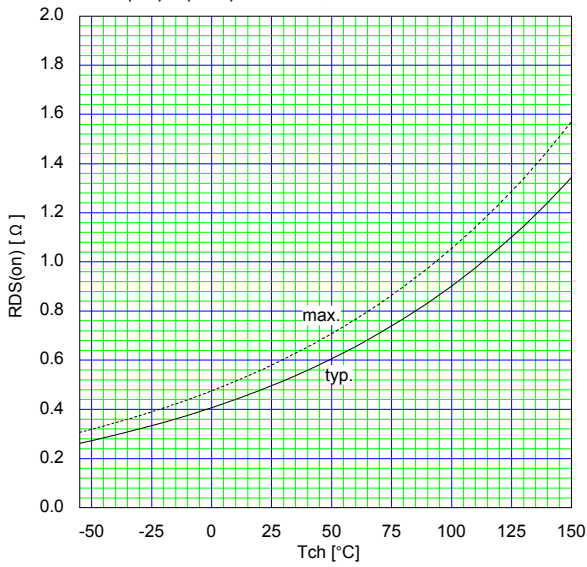
Note *3 : Repetitive rating : Pulse width limited by maximum channel temperature.
 See to the 'Transient Thermal impedance' graph.

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

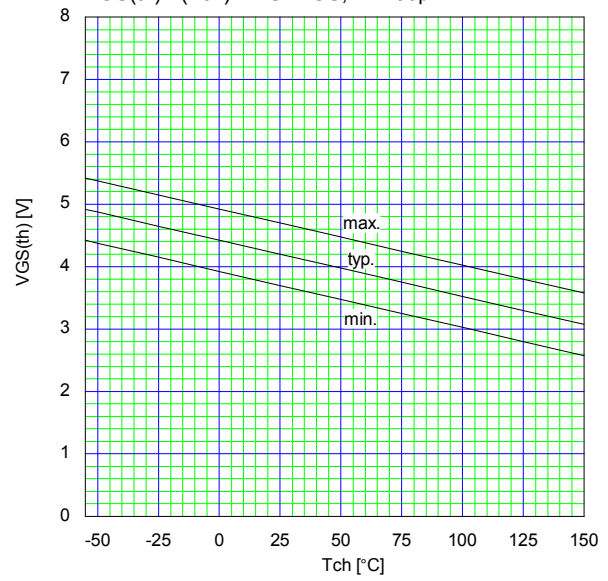
Note *5 : $I_F \leq I_D, dv/dt=4.7kV/\mu s, V_{cc} \leq BV_{DSS}, T_{ch} \leq 150^\circ C$.



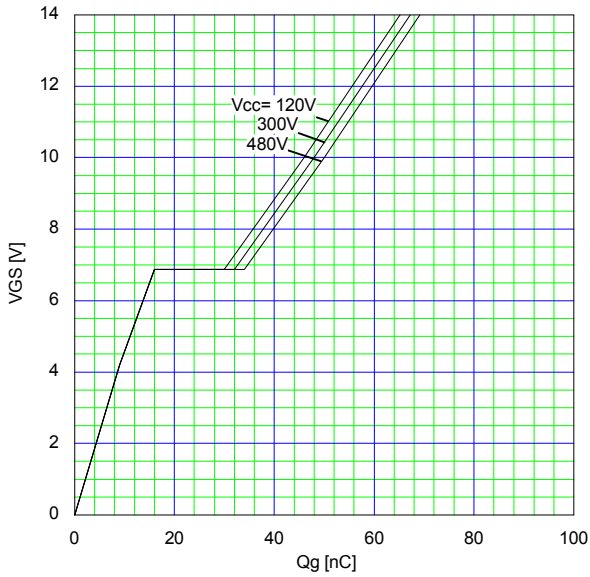
Drain-Source On-state Resistance
 $R_{DS(on)}=f(T_{ch}):I_D=6.5A, V_{GS}=10V$



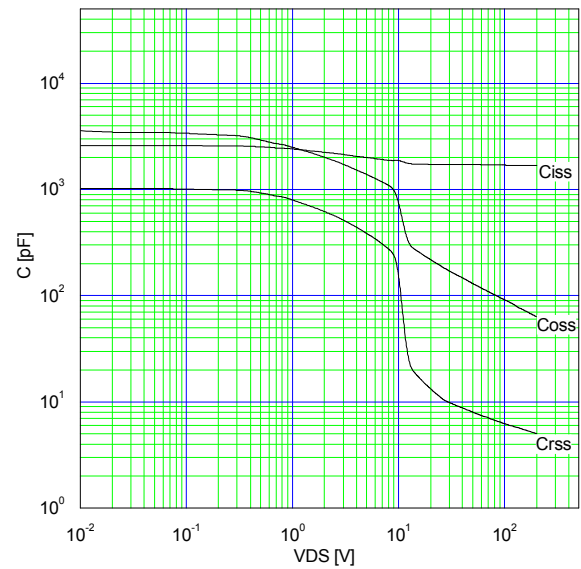
Gate Threshold Voltage vs. T_{ch}
 $V_{GS(th)}=f(T_{ch}):V_{DS}=V_{GS}, I_D=250\mu A$



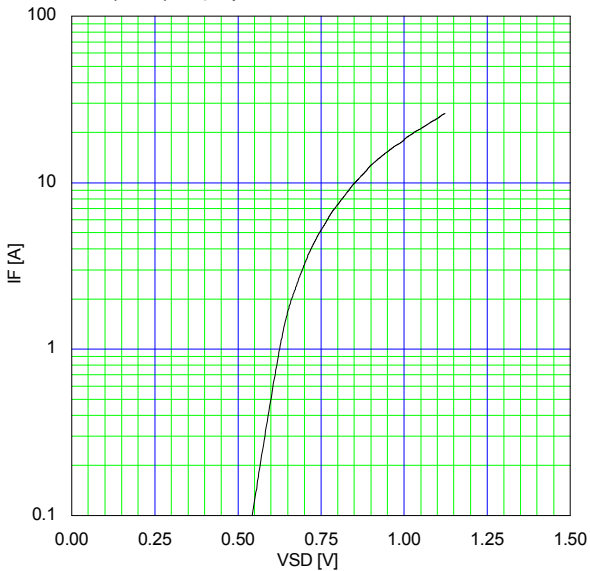
Typical Gate Charge Characteristics
 $V_{GS}=f(Q_g):I_D=13A, T_{ch}=25^\circ C$



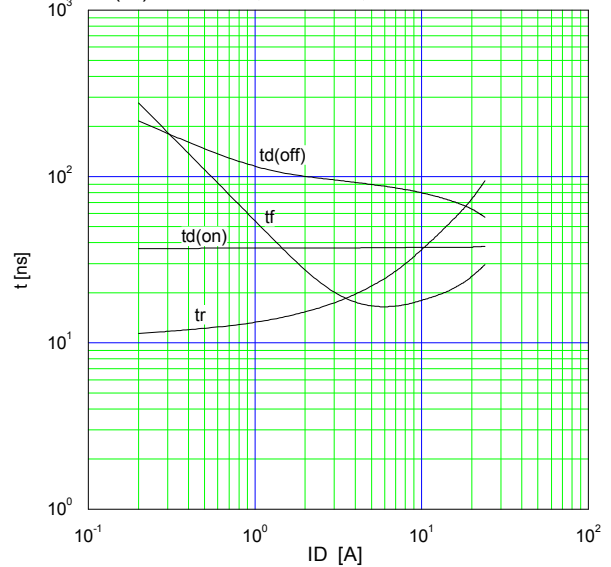
Typical Capacitance
 $C=f(V_{DS}):V_{GS}=0V, f=1MHz$



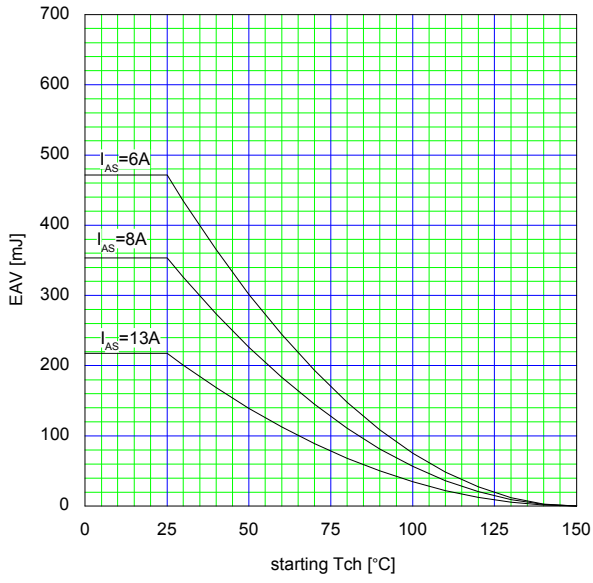
Typical Forward Characteristics of Reverse Diode
 $I_F=f(V_{SD}):80\mu s \text{ pulse test}, T_{ch}=25^\circ C$



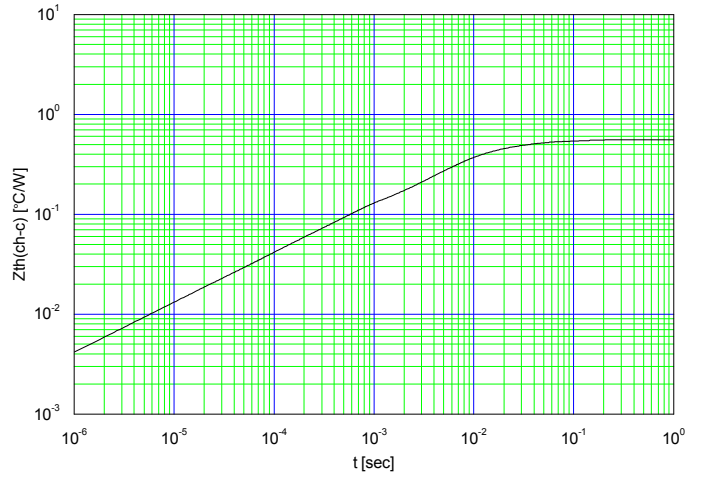
Typical Switching Characteristics vs. I_D
 $t=f(I_D):V_{cc}=300V, V_{GS}=10V, R_G=18\Omega$



Maximum Avalanche Energy vs. starting Tch
 $E(AV)=f(\text{starting Tch}):V_{CC}=60V, I(AV)\leq 13A$



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



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