e-Front runners

# FMI05N60E

FUJI POWER MOSFET

## Super FAP-E$^3$ series

N-CHANNEL SILICON POWER MOSFET

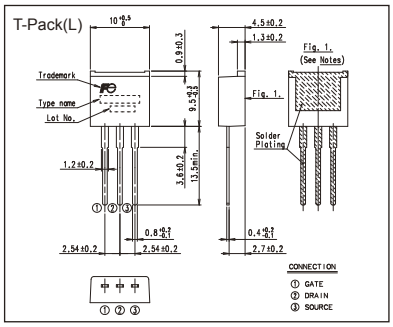
### Features

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±0.5V)
High avalanche durability

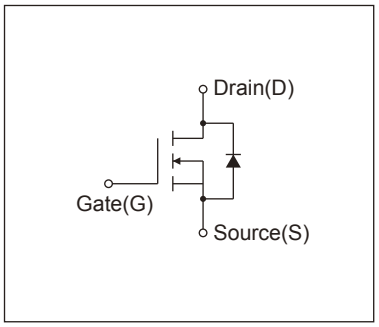
### Applications

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

### Outline Drawings [mm]




### Equivalent circuit schematic




### Maximum Ratings and Characteristics

#### ● Absolute Maximum Ratings at Tc=25°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 | $I_D$ | ±5.5 | A | |
| Pulsed Drain Current | $I_{DP}$ | ±22 | A | |
| Gate-Source Voltage | $V_{GS}$ | ±30 | V | |
| Repetitive and Non-Repetitive Maximum AvalancheCurrent | $I_{AR}$ | 5.5 | A | Note*1 |
| Non-Repetitive Maximum Avalanche Energy | $E_{AS}$ | 262 | mJ | Note*2 |
| Repetitive Maximum Avalanche Energy | $E_{AR}$ | 9.0 | mJ | Note*3 |
| Peak Diode Recovery dV/dt | dV/dt | 4.2 | kV/μs | Note*4 |
| Peak Diode Recovery -di/dt | -di/dt | 100 | A/μs | Note*5 |
| Maximum Power Dissipation | $P_D$ | 1.67 | W | Ta=25°C |
| | | 90 | | Tc=25°C |
| Operating and Storage Temperature range | $T_{ch}$ | 150 | °C | |
| | $T_{stg}$ | -55 to + 150 | °C | |

#### ● Electrical Characteristics at Tc=25°C (unless otherwise specified)

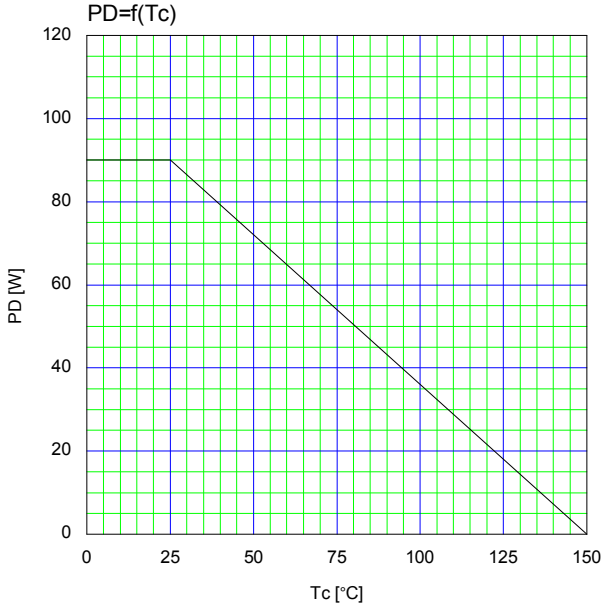
| Description | Symbol | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $I_D$=250μA, $V_{GS}$=0V | | 600 | - | - | V |
| Gate Threshold Voltage | $V_{GS}$ (th) | $I_D$=250μA, $V_{DS}$=$V_{GS}$ | | 2.5 | 3.0 | 3.5 | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=600V, $V_{GS}$=0V | $T_{ch}$=25°C | - | - | 25 | μA |
| | | $V_{DS}$=480V, $V_{GS}$=0V | $T_{ch}$=125°C | - | - | 250 | |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±30V, $V_{DS}$=0V | | - | 10 | 100 | nA |
| Drain-Source On-State Resistance | $R_{DS}$ (on) | $I_D$=2.8A, $V_{GS}$=10V | | - | 1.11 | 1.30 | Ω |
| Forward Transconductance | $g_{fs}$ | $I_D$=2.8A, $V_{DS}$=25V | | 3 | 6 | - | S |
| Input Capacitance | Ciss | $V_{DS}$=25V | | - | 1020 | 1530 | pF |
| Output Capacitance | Coss | $V_{GS}$=0V | | - | 95 | 143 | |
| Reverse Transfer Capacitance | Crss | f=1MHz | | - | 7 | 10.5 | |
| Turn-On Time | td(on) | $V_{cc}$=300V | | - | 11 | 16.5 | ns |
| | tr | $V_{GS}$=10V | | - | 8.5 | 13 | |
| Turn-Off Time | td(off) | $I_D$=2.8A | | - | 80 | 120 | |
| | tf | $R_G$=24Ω | | - | 17 | 25.5 | |
| Total Gate Charge | $Q_G$ | $V_{cc}$=300V | | - | 33 | 50 | nC |
| Gate-Source Charge | $Q_{GS}$ | $I_D$=5.5A | | - | 8.5 | 13 | |
| Gate-Drain Charge | $Q_{GD}$ | $V_{GS}$=10V | | - | 9.5 | 14.5 | |
| Avalanche Capability | $I_{AV}$ | L=6.35mH, $T_{ch}$=25°C | | 5.5 | - | - | A |
| Diode Forward On-Voltage | $V_{SD}$ | $I_F$=5.5A, $V_{GS}$=0V, $T_{ch}$=25°C | | - | 0.86 | 1.30 | V |
| Reverse Recovery Time | trr | $I_F$=5.5A, $V_{GS}$=0V | | - | 0.4 | - | μS |
| Reverse Recovery Charge | Qrr | -di/dt=100A/μs, Tch=25°C | | - | 3.0 | - | μC |

#### ● Thermal Characteristics

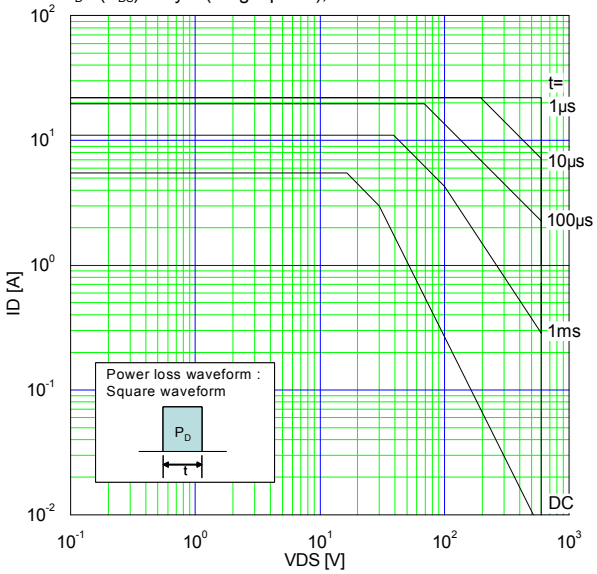
| Description | Symbol | Test Conditions | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| Thermal resistance | Rth (ch-c) | Channel to Case | | | 1.390 | °C/W |
| | Rth (ch-a) | Channel to Ambient | | | 75.0 | °C/W |

Note *1 : Tch≤150°C
Note *2 : Stating Tch=25°C, $I_{AS}$=2.2A, L=99.2mH, Vcc=60V, $R_G$=50Ω
$E_{AS}$ 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 Themal impeadance' graph.
Note *4 : $I_F$≤-$I_D$, -di/dt=100A/μs, Vcc≤$BV_{DSS}$, Tch≤150°C.
Note *5 : $I_F$≤-$I_D$, dv/dt=4.2kV/μs, Vcc≤$BV_{DSS}$, Tch≤150°C.

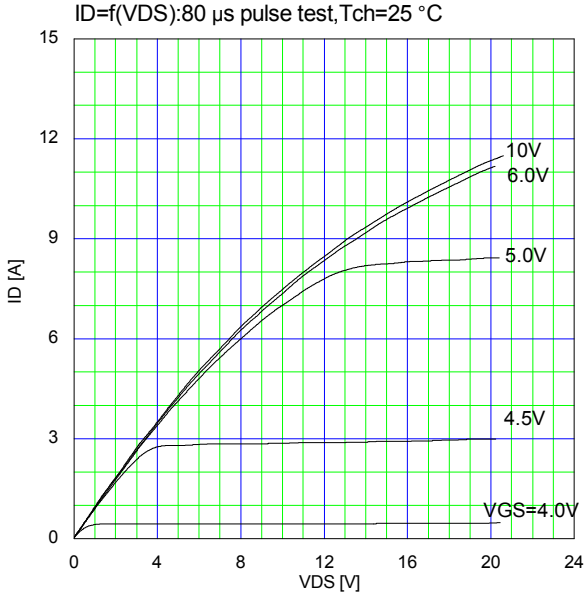
Allowable Power Dissipation
PD=f(Tc)



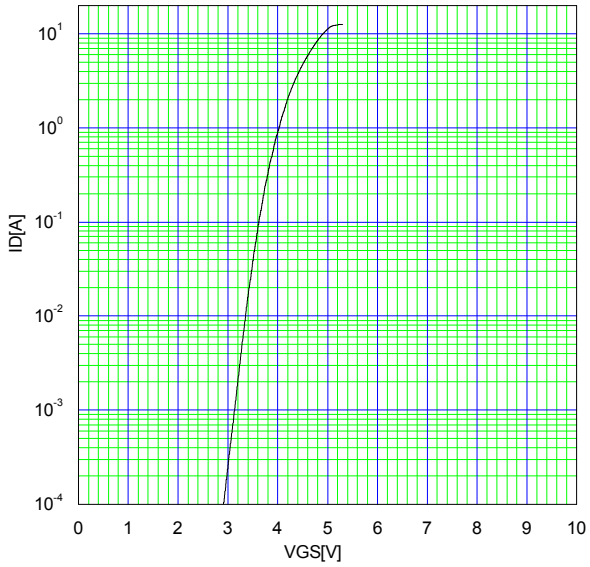

Safe Operating Area
$I_D=f(V_{DS})$:Duty=0(Single pulse),Tc=25 °c



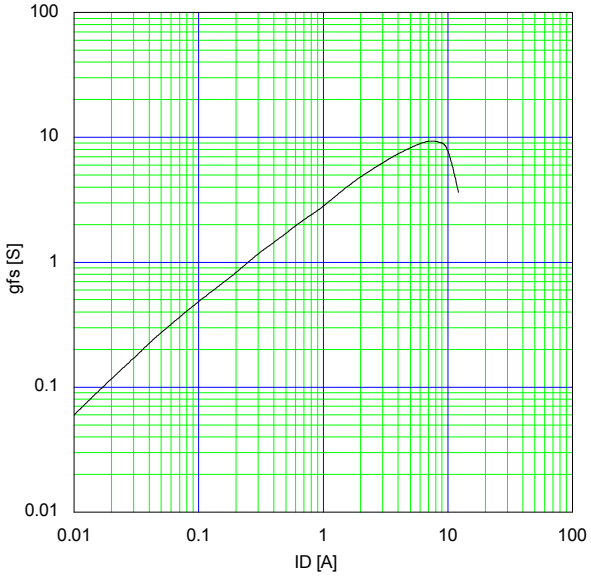

Typical Output Characteristics
ID=f(VDS):80 µs pulse test,Tch=25 °C



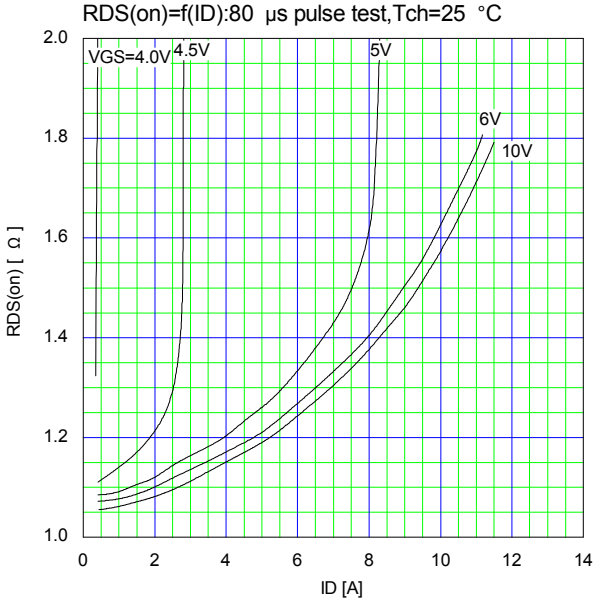

Typical Transfer Characteristic
ID=f(VGS):80 µs pulse test,VDS=25V,Tch=25 °C



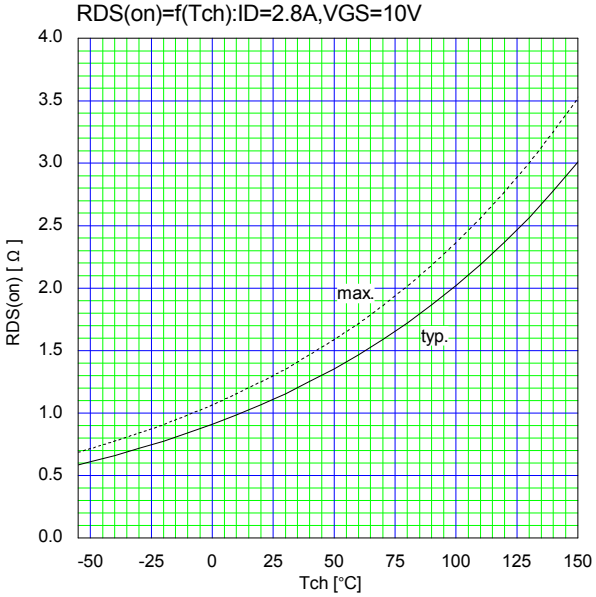

Typical Transconductance
gfs=f(ID):80 µs pulse test,VDS=25V,Tch=25 °C



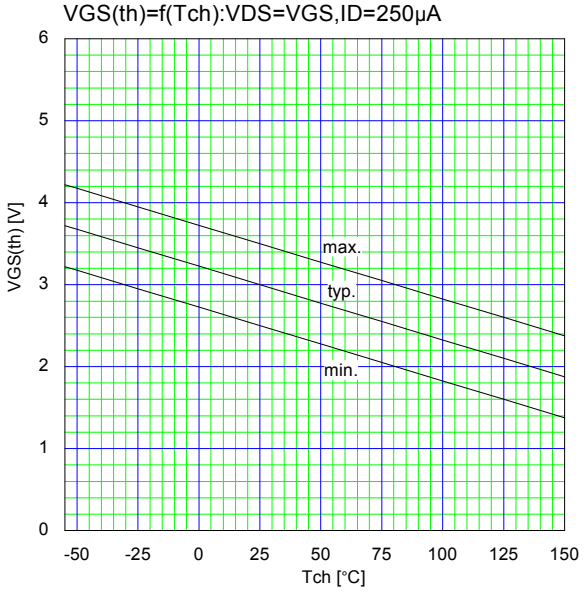

Typical Drain-Source on-state Resistance
RDS(on)=f(ID):80 µs pulse test,Tch=25 °C



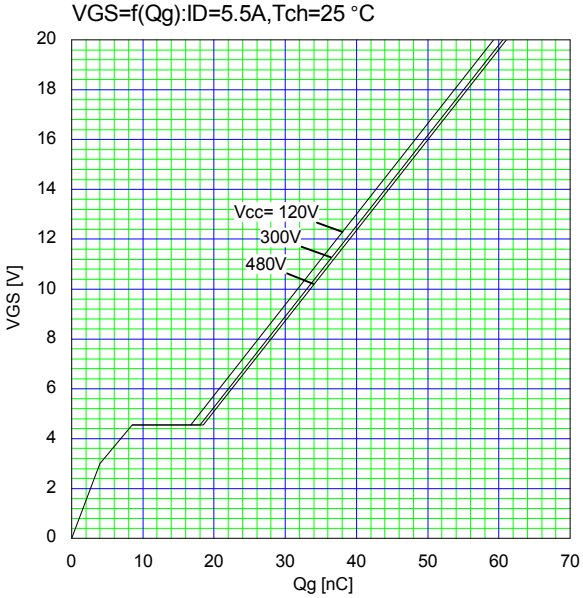
Drain-Source On-state Resistance
RDS(on)=f(Tch):ID=2.8A,VGS=10V



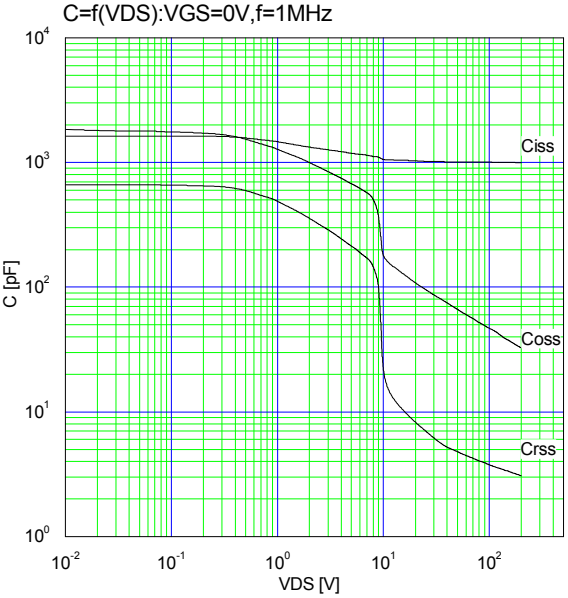

Gate Threshold Voltage vs. Tch
VGS(th)=f(Tch):VDS=VGS,ID=250μA



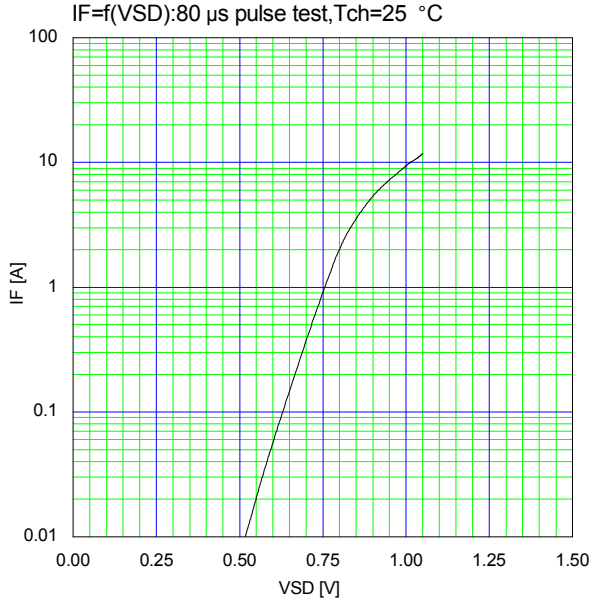

Typical Gate Charge Characteristics
VGS=f(Qg):ID=5.5A,Tch=25 °C



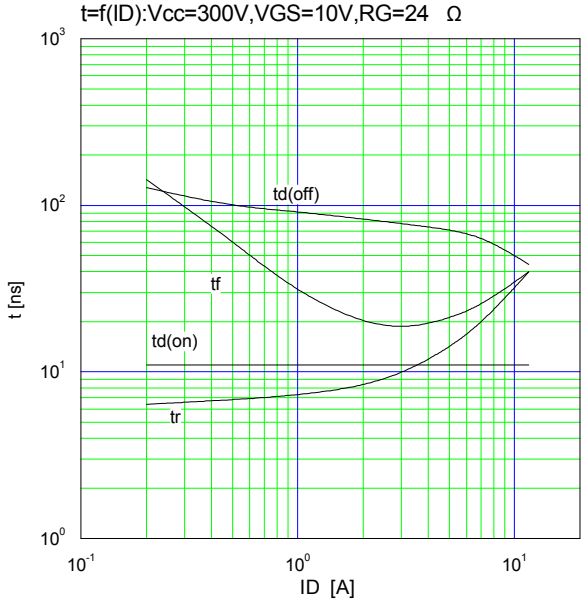

Typical Capacitance
C=f(VDS):VGS=0V,f=1MHz



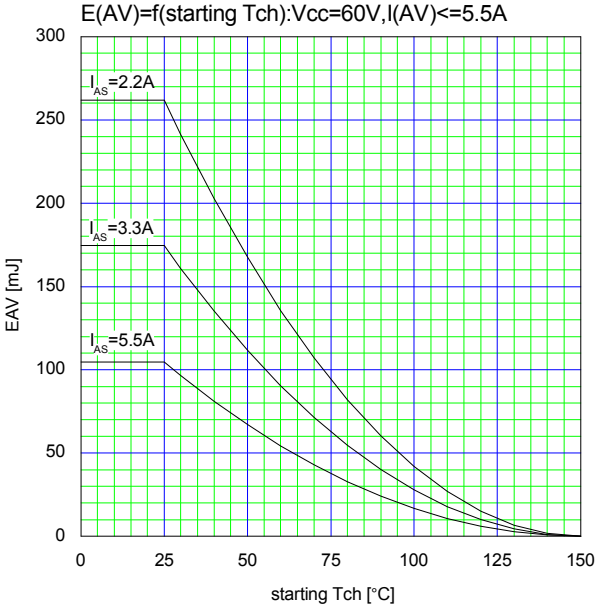

Typical Forward Characteristics of Reverse Diode
IF=f(VSD):80 μs pulse test,Tch=25 °C



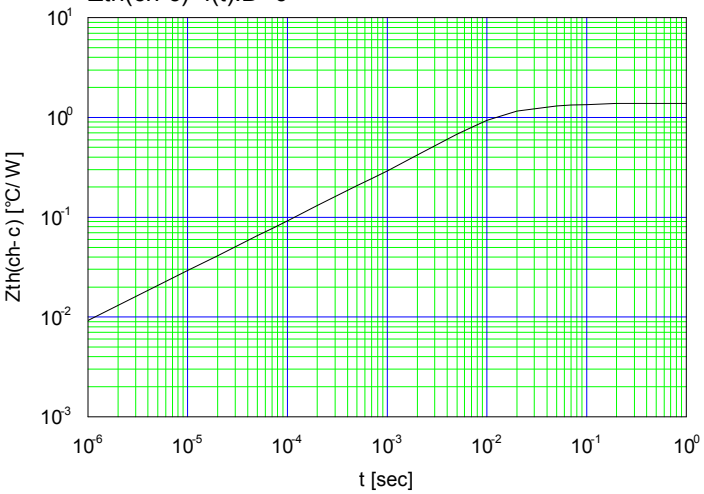

Typical Switching Characteristics vs. ID
t=f(ID):Vcc=300V,VGS=10V,RG=24 Ω



Maximum Avalanche Energy vs. starting Tch
E(AV)=f(starting Tch):Vcc=60V,I(AV)<=5.5A




Transient Thermal Impedance
Zth(ch-c)=f(t):D=0



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