FML13N60ES

FUJI POWER MOSFET

Super FAP-E^3 series

N-CHANNEL SILICON POWER MOSFET

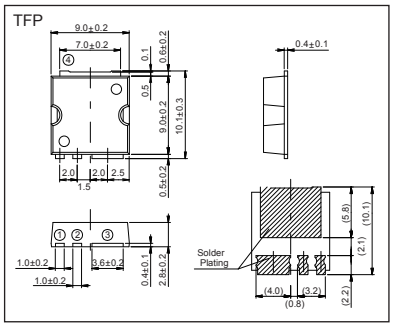
Features

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 (4.2±0.5V)
High avalanche durability

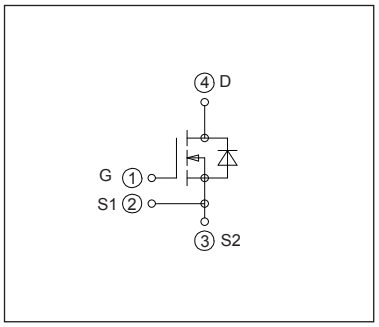
Applications

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	±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	1.44	W	Ta=25°C
		225		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)

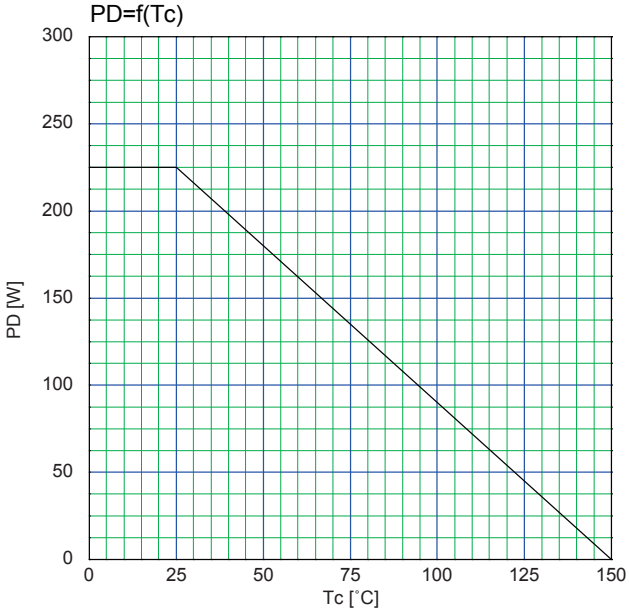
Description	Symbol	Conditions		min.	typ.	max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	I_D=250μA, V_{GS}=0V		600	-	-	V
Gate Threshold Voltage	V_{GS} (th)	I_D=250μA, V_{DS}=V_{GS}		3.7	4.2	4.7	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=600V, V_{GS}=0V	T_{ch}=25°C	-	-	25	μA
		V_{DS}=480V, V_{GS}=0V	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=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	Ciss	V_{DS}=25V		-	1700	2550	pF
Output Capacitance	Coss	V_{GS}=0V		-	190	285	
Reverse Transfer Capacitance	Crss	f=1MHz		-	10	15	
Turn-On Time	td(on)	V_{cc}=300V		-	38	57	ns
	tr	V_{GS}=10V		-	24	36	
Turn-Off Time	td(off)	I_D=6.5A		-	86	129	
	tf	R_G=18Ω		-	16	24	
Total Gate Charge	Q_G	V_{cc}=300V		-	48	56	nC
Gate-Source Charge	Q_{GS}	I_D=13A		-	16	24	
Drain-Source Crossover Charge	Q_{SW}	V_{GS}=10V		-	7	10.5	
Gate-Drain Charge	Q_{GD}			-	16	24	
Avalanche Capability	I_{AV}	L=2.36mH, T_{ch}=25°C		13	-	-	A
Diode Forward On-Voltage	V_{SD}	I_F=13A, V_{GS}=0V, T_{ch}=25°C		-	0.90	1.08	V
Reverse Recovery Time	trr	I_F=13A, V_{GS}=0V		-	0.7	-	μS
Reverse Recovery Charge	Qrr	-di/dt=100A/μs, Tch=25°C		-	8	-	μC

● Thermal Characteristics

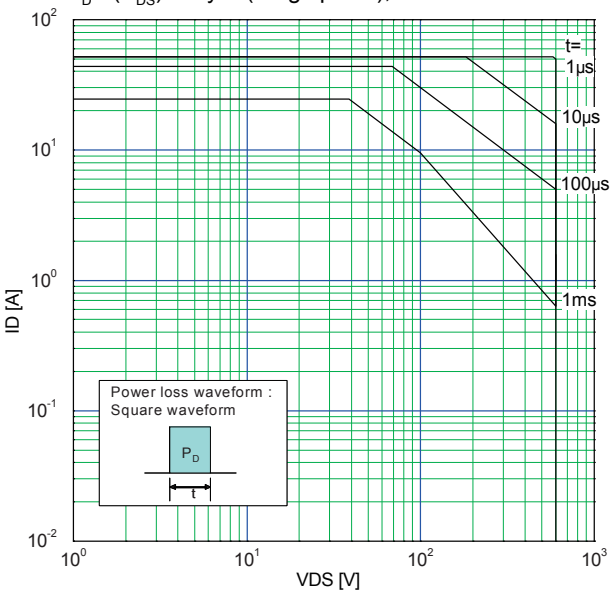
Description	Symbol	Test Conditions	min.	typ.	max.	Unit
Thermal resistance	Rth (ch-c)	Channel to case			0.56	°C/W
	Rth (ch-a)	Channel to Ambient			87	°C/W
	Rth (ch-a)	Channel to Ambient Note*6			52	°C/W

Note *1 : Tch≤150°C
Note *2 : Stating Tch=25°C, I_{AS}=5A, L=33.8mH, Vcc=50V, R_G=10Ω,
E_{AS} limited by maximum channel temperature and avalanche current.
Note *3 : Repetitive rating : Pulse width limited by maximum channel temperature.
Note *4 : I_F≤-I_D, -di/dt=100A/μs, Vcc≤BV_{DSS}, Tch≤150°C.
Note *5 : I_F≤-I_D, dv/dt=6.3kV/μs, Vcc≤BV_{DSS}, Tch≤150°C.
Note *6 : Surface mounted on 1000mm^2, t=1.6mm FR-4 PCB (Drain pad area : 500mm^2)

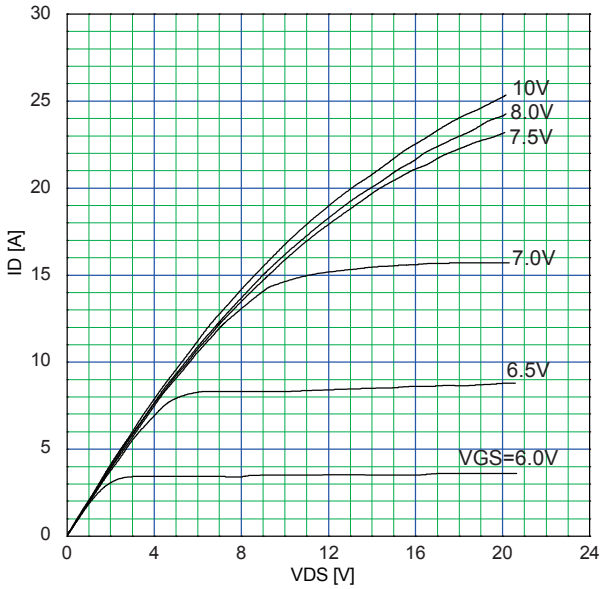
Allowable Power Dissipation
PD=f(Tc)



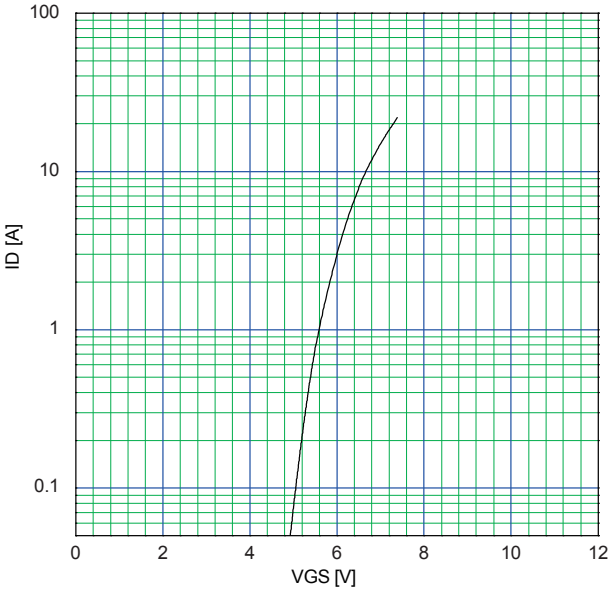
Safe Operating Area
$I_D=f(V_{DS})$:Duty=0(Singlepulse), Tc=25˚c



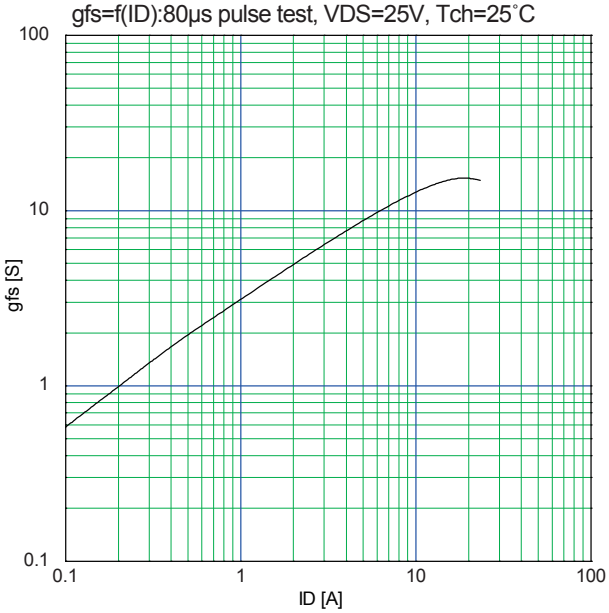
Typical Output Characteristics
ID=f(VDS):80µs pulse test, Tch=25˚C



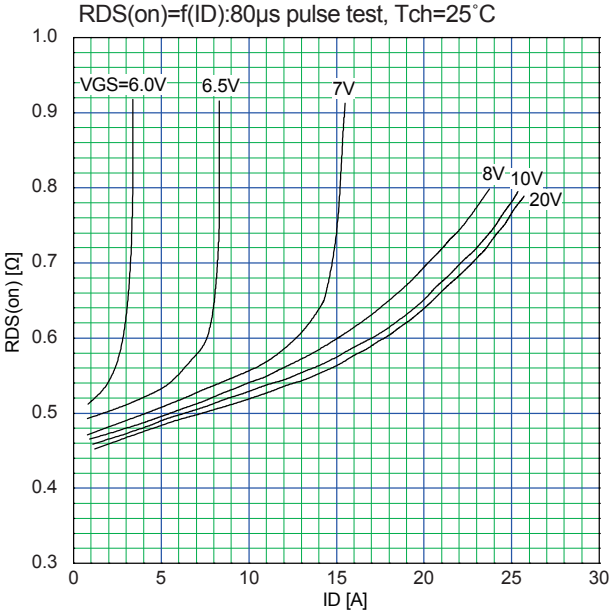
Typical Transfer Characteristic
ID=f(VGS):80µs pulse test, VDS=25V, Tch=25˚C



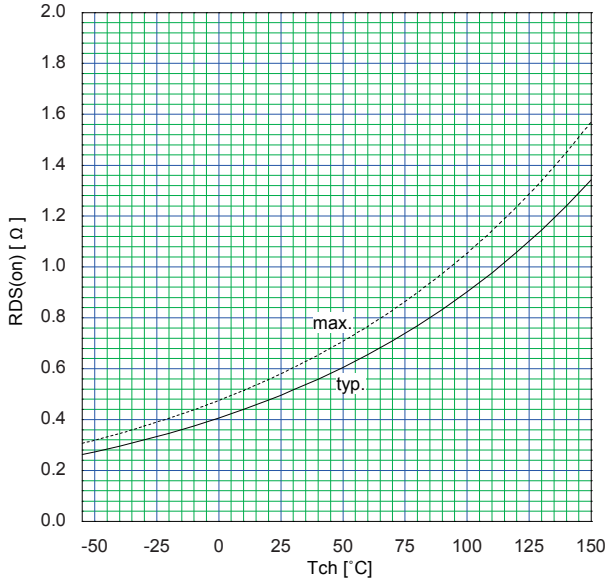
Typical Transconductance
gfs=f(ID):80µs pulse test, VDS=25V, Tch=25˚C



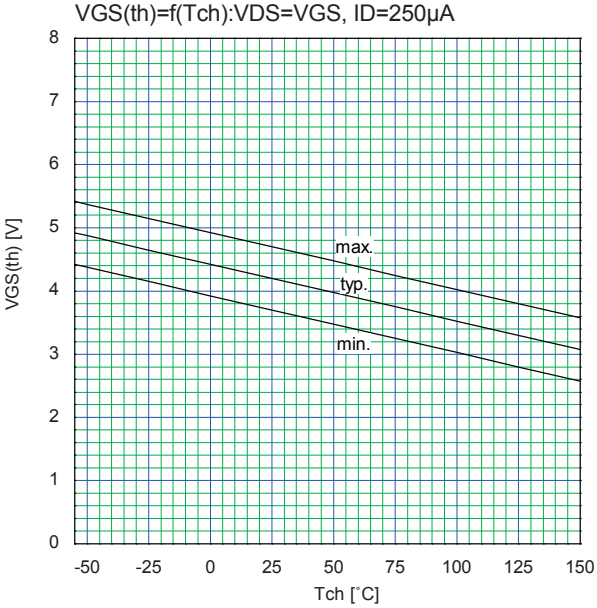
Typical Drain-Source on-state Resistance
RDS(on)=f(ID):80µs pulse test, Tch=25˚C



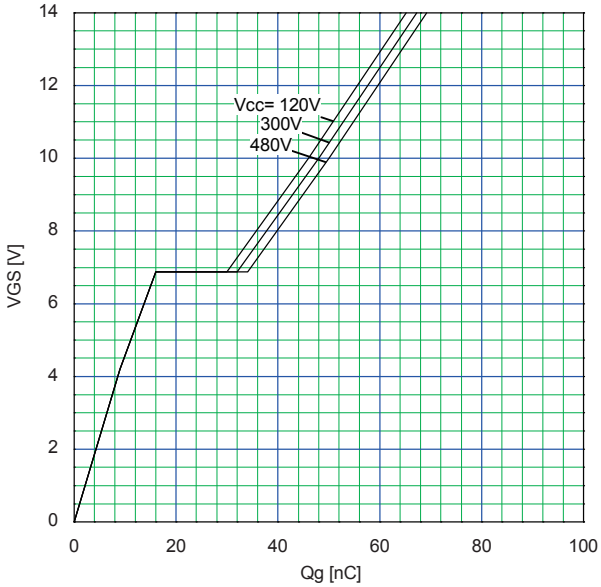
Drain-Source On-state Resistance
RDS(on)=f(Tch):ID=6.5A,VGS=10V



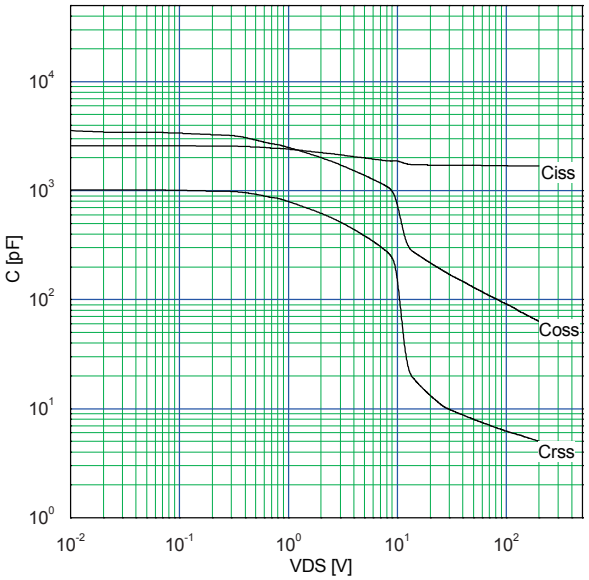
Gate Threshold Voltage vs. Tch
VGS(th)=f(Tch):VDS=VGS, ID=250μA



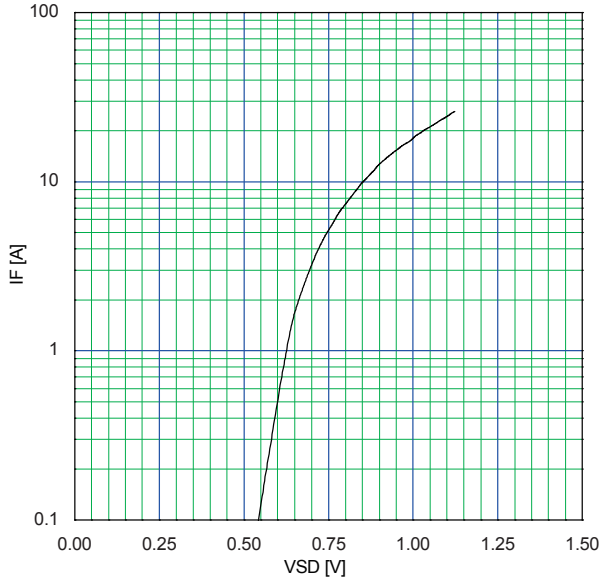
Typical Gate Charge Characteristics
VGS=f(Qg):ID=13A, Tch=25˚C



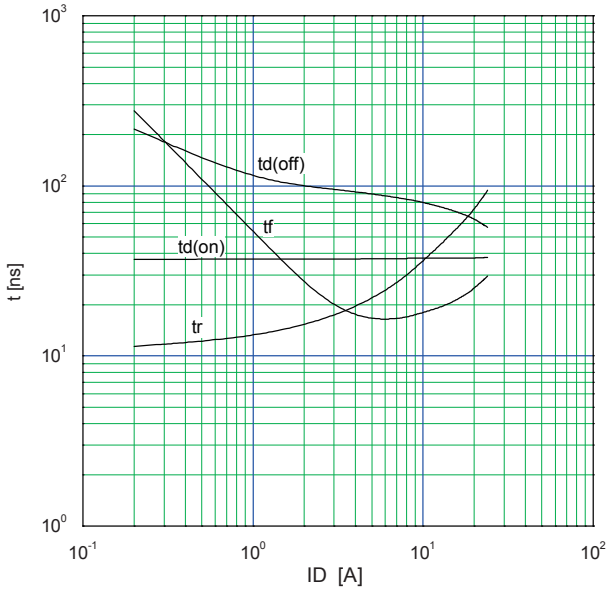
Typical Capacitance
C=f(VDS):VGS=0V, f=1MHz



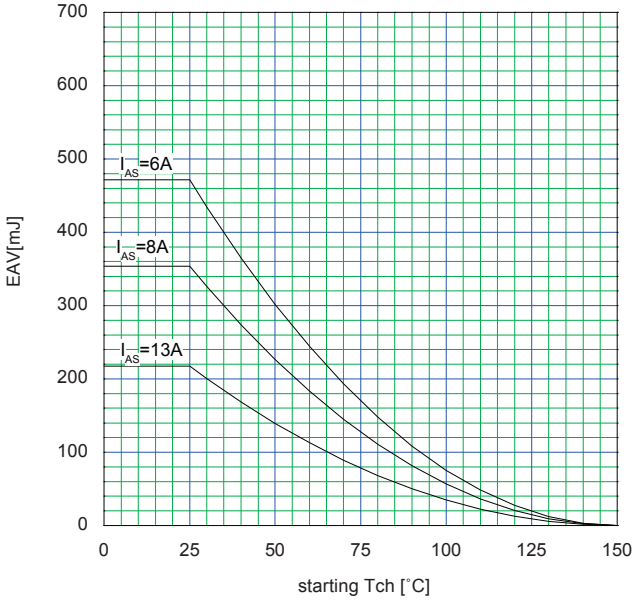
Typical Forward Characteristics of Reverse Diode
IF=f(VSD):80μs pulse test, Tch=25˚C



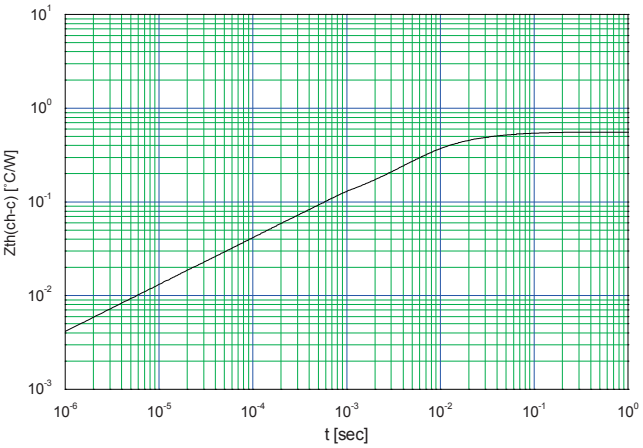
Typical Switching Characteristics vs. ID
t=f(ID):Vcc=300V, VGS=10V, RG=18Ω



Maximum Avalanche Energy vs. starting Tch
E(AV)=f(starting Tch):Vcc=60V, I(AV)<=13A



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



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