FMP13N60S1

FUJI POWER MOSFET

Super J-MOS series

N-Channel enhancement mode power MOSFET

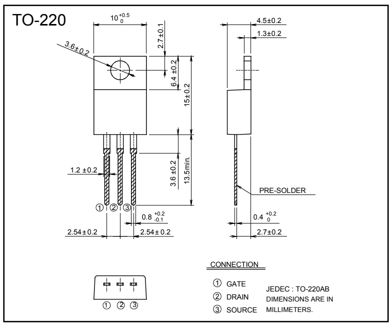
■ Features

Low on-state resistance
Low switching loss
easy to use (more controllabe switching dV/dt by R_g)

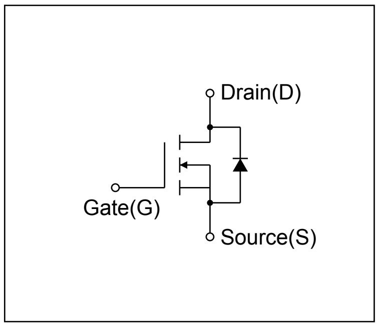
■ Applications

UPS
Server
Telecom
Power conditioner system
Power supply

■ Outline Drawings [mm]



■ Equivalent circuit schematic



■ Absolute Maximum Ratings at T_C=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	Tc=25°C Note*1
		±8.2	A	Tc=100°C Note*1
Pulsed Drain Current	I_{DP}	±39	A	
Gate-Source Voltage	V_{GS}	±30	V	
Repetitive and Non-Repetitive Maximum Avalanche Current	I_{AR}	3.4	A	Note *2
Non-Repetitive Maximum Avalanche Energy	E_{AS}	452.1	mJ	Note *3
Maximum Drain-Source dV/dt	dV_{DS}/dt	50	kV/µs	V_{DS}≤ 600V
Peak Diode Recovery dV/dt	dV/dt	15	kV/µs	Note *4
Peak Diode Recovery -di/dt	-di/dt	100	A/µs	Note *5
Maximum Power Dissipation	P_D	2.02	W	T_a=25°C
		120		T_C=25°C
Operating and Storage Temperature range	T_{ch}	150	°C	
	T_{stg}	-55 to +150	°C	

Note *1 : Limited by maximum channel temperature.
Note *2 : T_{ch}≤150°C, See Fig.1 and Fig.2
Note *3 : Starting T_{ch}=25°C, I_{AS}=2.1A, L=188mH, V_{DD}=60V, R_G=50Ω, See Fig.1 and Fig.2
E_{AS} limited by maximum channel temperature and avalanche current.
Note *4 : I_F≤-I_D, -di/dt=100A/µs, V_{DD}≤400V, V_{peak}≤BV_{DSS}, T_{ch}≤150°C.
Note *5 : I_F≤-I_D, dV/dt=15kV/µs, V_{DD}≤400V, V_{peak}≤BV_{DSS}, T_{ch}≤150°C.

■ Electrical Characteristics at T_C=25°C (unless otherwise specified)

• Static Ratings

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=6.5A V_{GS}=10V		-	0.237	0.28	Ω
Gate resistance	R_G	f=1MHz, open drain		-	3.5	-	Ω

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SEPTEMBER 2013

• Dynamic Ratings

Description	Symbol	Conditions	min.	typ.	max.	Unit
Input Capacitance	C_{iss}	V_{DS}=10V V_{GS}=0V f=1MHz	-	1010	-	pF
Output Capacitance	C_{oss}		-	2160	-	
Reverse Transfer Capacitance	C_{rss}		-	200	-	
Effective output capacitance, energy related (Note *6)	$C_{o(er)}$	V_{GS}=0V V_{DS}=0…480V	-	70	-	
Effective output capacitance, time related (Note *7)	$C_{o(tr)}$	V_{GS}=0V V_{DS}=0…480V ID=constant	-	220	-	
Turn-On Time	$t_{d(on)}$	V_{DD}=400V, V_{GS}=10V/0V I_D=6.5A, R_G=24Ω See Fig.3 and Fig.4	-	13	-	ns
	t_r		-	38	-	
Turn-Off Time	$t_{d(off)}$		-	104	-	
	t_f		-	16	-	
Total Gate Charge	Q_G	V_{DD}=480V, I_D=13A V_{GS}=10V See Fig.5	-	35	-	nC
Gate-Source Charge	Q_{GS}		-	10	-	
Gate-Drain Charge	Q_{GD}		-	10.5	-	
Drain-Source crossover Charge	Q_{SW}		-	6.5	-	

Note *6 : $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% BV_{DSS}.
Note *7 : $C_{o(tr)}$ is a fixed capacitance that gives the same charging times as C_{oss} while V_{DS} is rising from 0 to 80% BV_{DSS}.

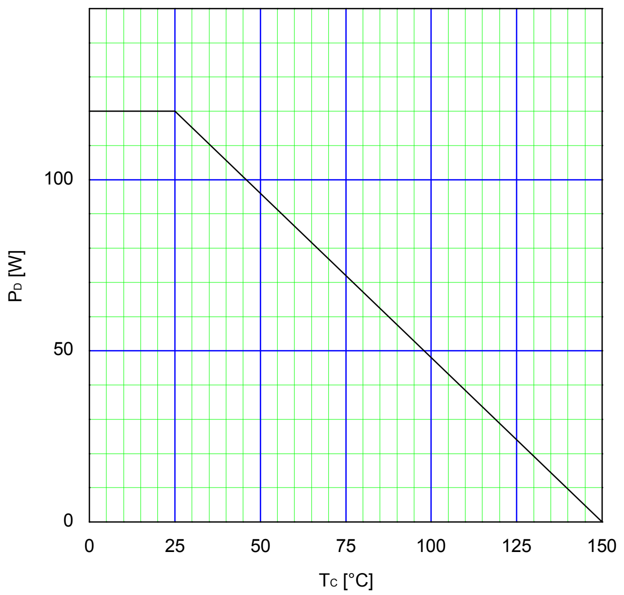
• Reverse Diode

Description	Symbol	Conditions	min.	typ.	max.	Unit
Avalanche Capability	I_{AV}	L=44.3mH, T_{ch}=25°C See Fig.1 and Fig.2	3.4	-	-	A
Diode Forward On-Voltage	V_{SD}	I_F=13A, V_{GS}=0V T_{ch}=25°C	-	0.9	1.35	V
Reverse Recovery Time	t_{rr}	I_F=13A, V_{DD}=400V -di/dt=100A/μs $V_{GS(Q1)}$=short, $V_{GS(Q2)}$=10V/0V R_G=330Ω T_{ch}=25°C See Fig.6 and Fig.7		330	-	ns
Reverse Recovery Charge	Q_{rr}		-	4.5	-	μC
Peak Reverse Recovery Current	I_{rp}		-	25	-	A

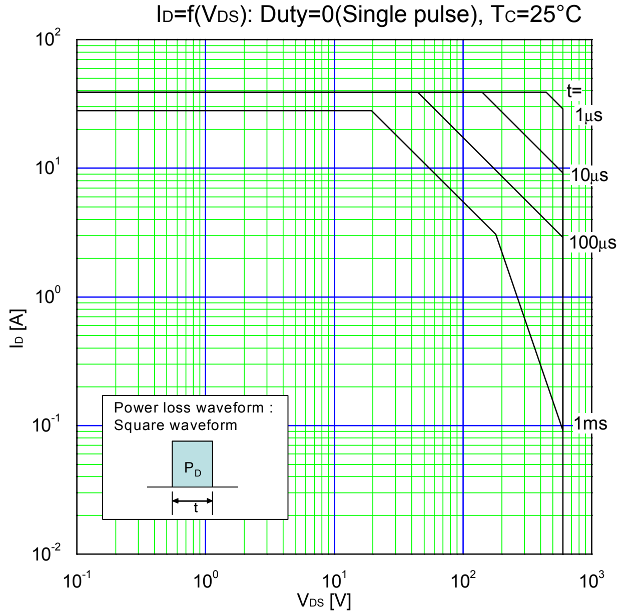
■ Thermal Resistance

Parameter	Symbol	min.	typ.	max.	Unit
Channel to Case	$R_{th(ch-c)}$	-	-	1.04	°C/W
Channel to Ambient	$R_{th(ch-a)}$	-	-	62	°C/W

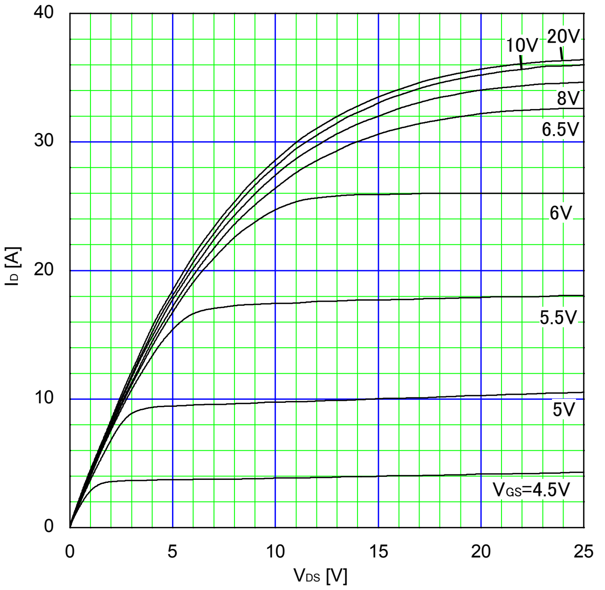
Allowable Power Dissipation
PD= f(TC)



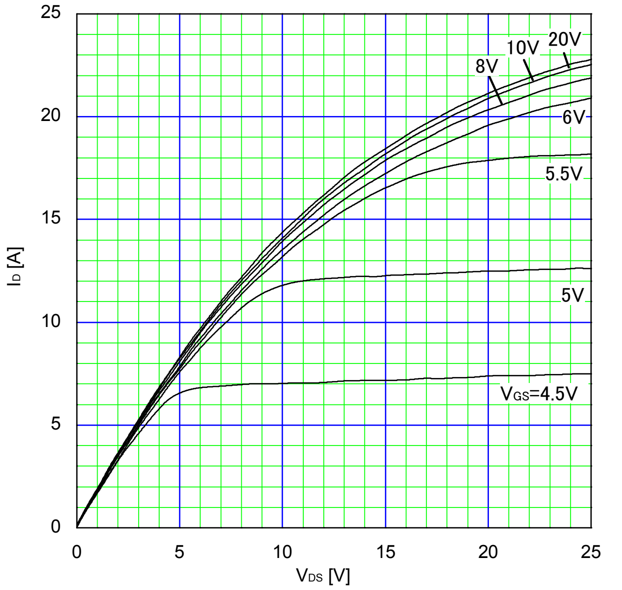
Safe Operating Area
ID=f(VDS): Duty=0(Single pulse), TC=25°C



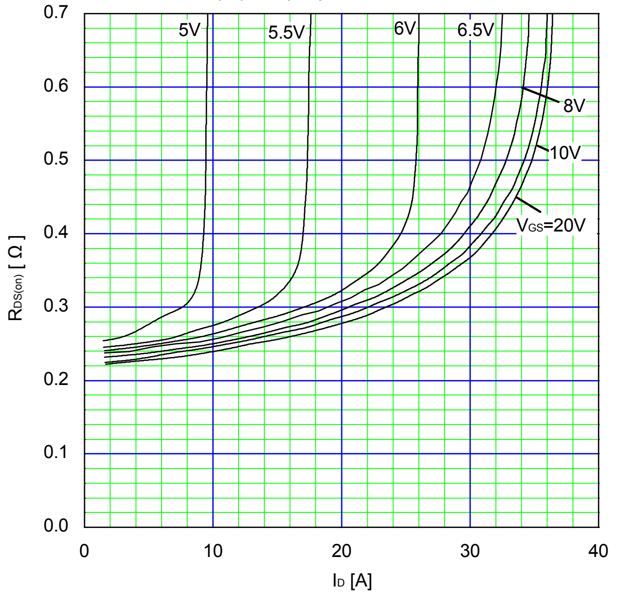
Typical Output Characteristics
ID=f(VDS): 80μs pulse test, Tch=25°C



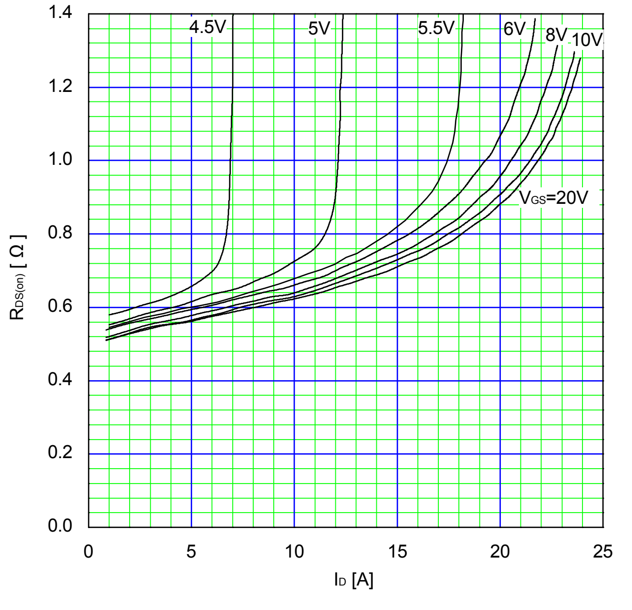
Typical Output Characteristics
ID=f(VDS): 80μs pulse test, Tch=150°C



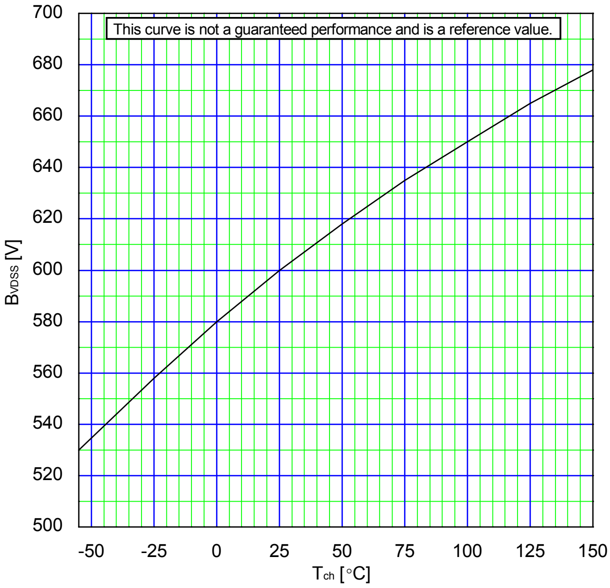
Typical Drain-Source on-state Resistance
RDS(on)= f(ID): 80μs pulse test, Tch=25°C



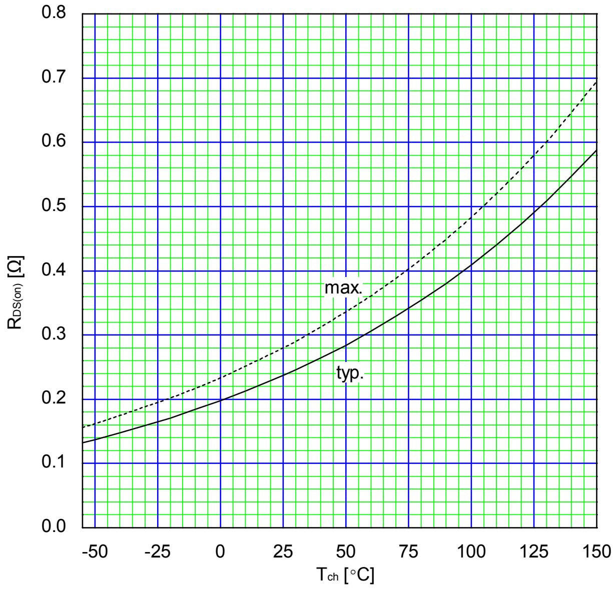
Typical Drain-Source on-state Resistance
RDS(on)= f(ID): 80μs pulse test, Tch=150°C



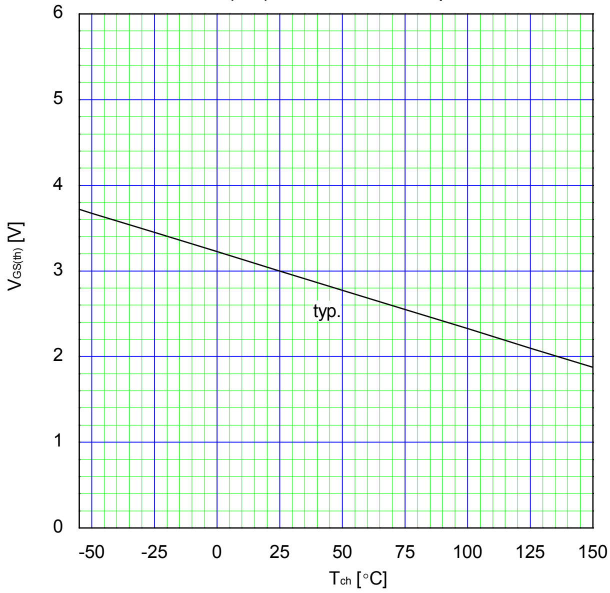
Drain-Source Breakdown Voltage
$BV_{DSS}=f(T_{ch})$:I_D=10mA,V_{GS}=0V



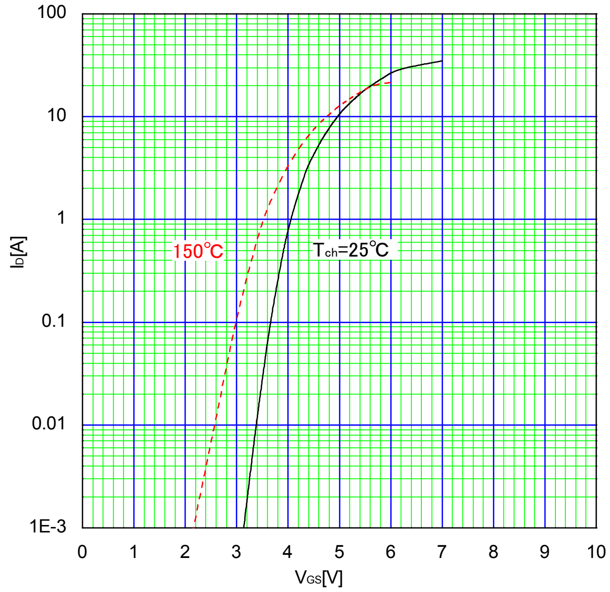
Drain-Source On-state Resistance
$R_{DS(on)}=f(T_{ch})$:I_D=6.5A,V_{GS}=10V



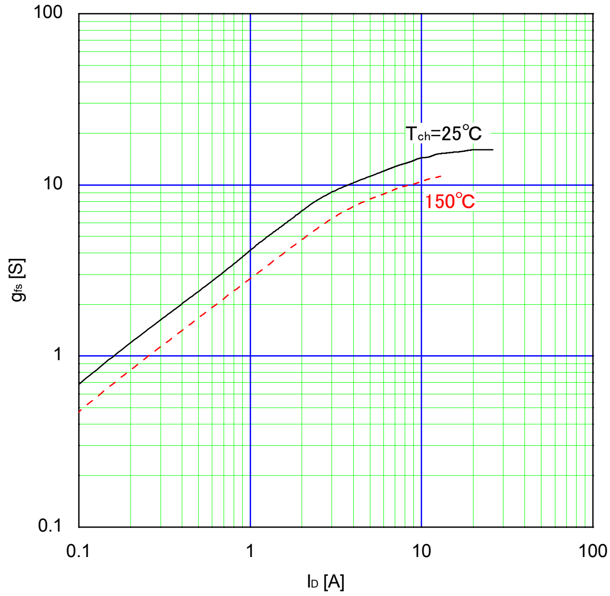
Gate Threshold Voltage vs. T_{ch}
$V_{GS(th)}=f(T_{ch})$:$V_{DS}=V_{GS}$,I_D=250μA



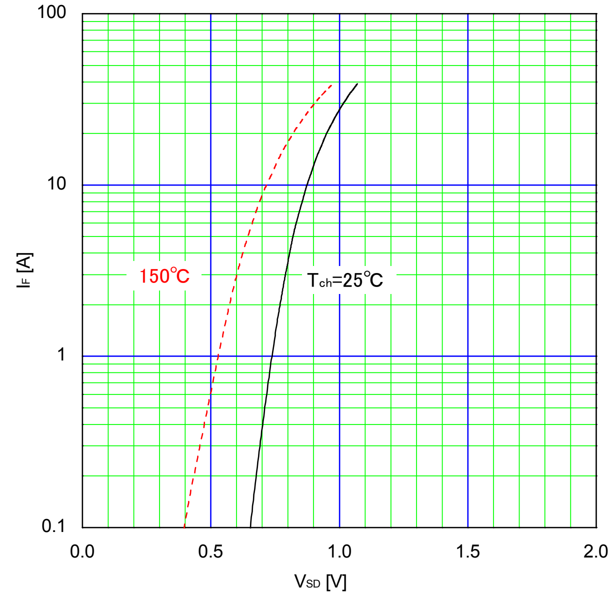
Typical Transfer Characteristic
$I_D=f(V_{GS})$:80μs pulse test,V_{DS}=25V



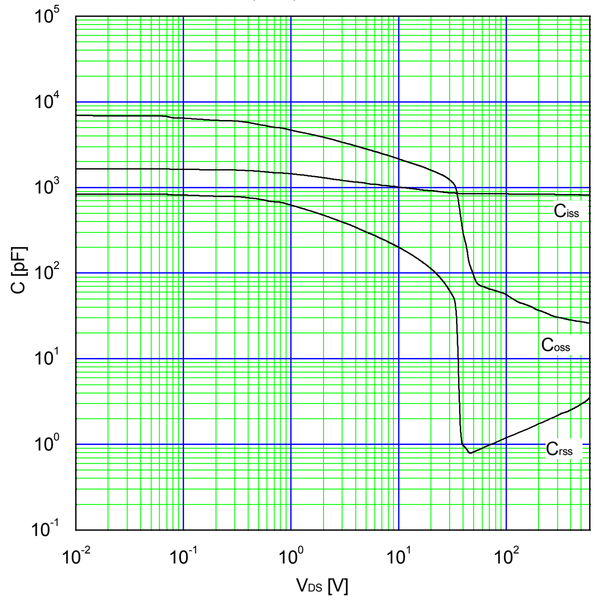
Typical Transconductance
$g_{fs}=f(I_D)$:80μs pulse test,V_{DS}=25V



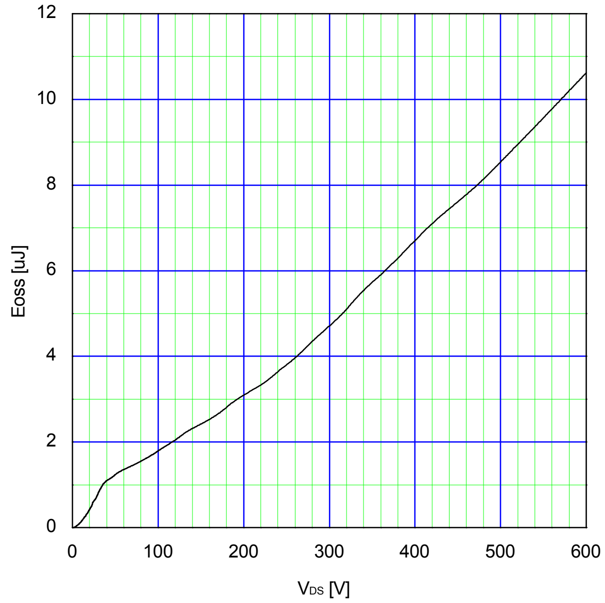
Typical Forward Characteristics of Reverse Diode
$I_F=f(V_{SD})$:80μs pulse test



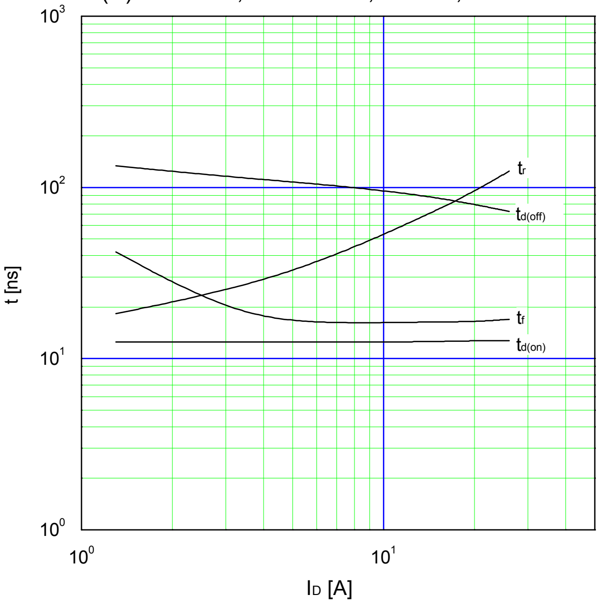
Typical Capacitance
C=f(VDS):VGS=0V,f=1MHz



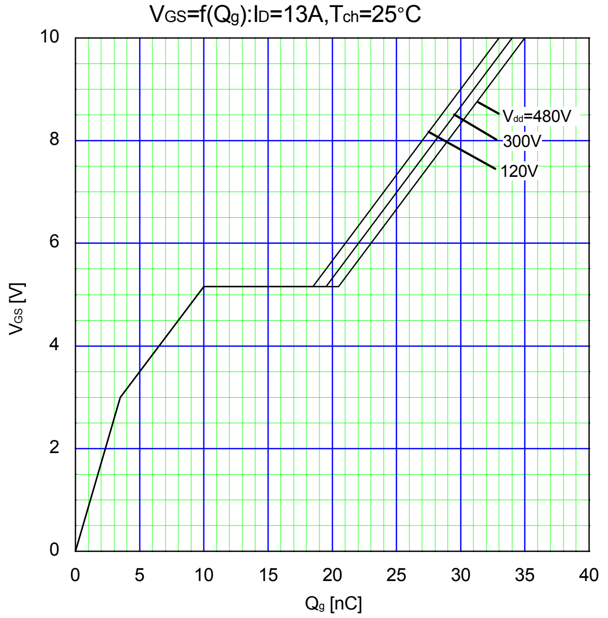
Typical Coss stored energy



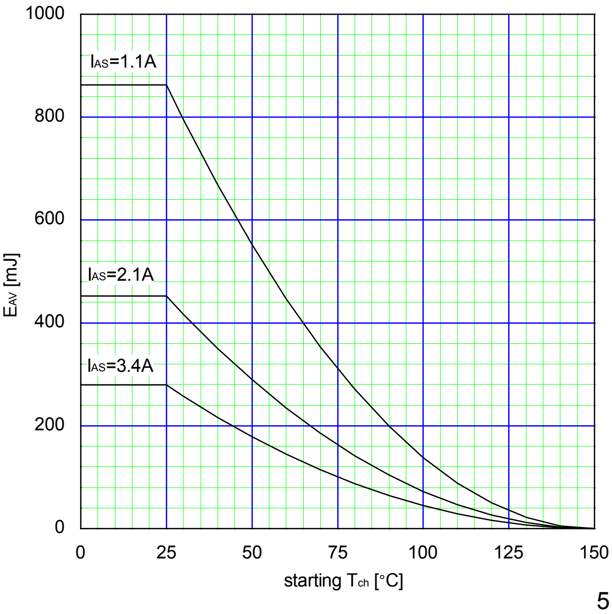
Typical Switching Characteristics vs. ID Tch=25°C
t=f(ID):Vdd=400V,VGS=10V/0V,RG=24Ω, L=500uH



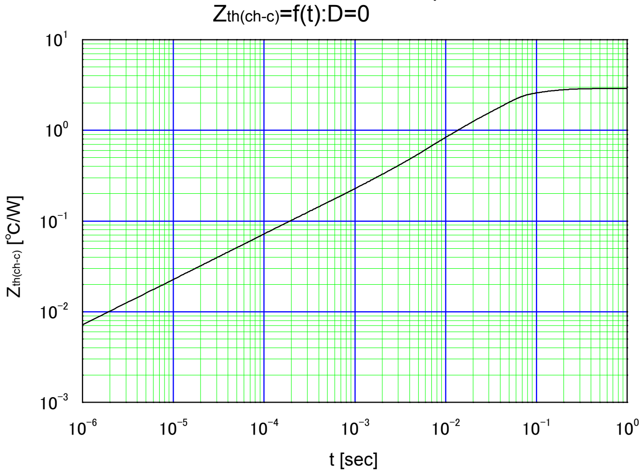
Typical Gate Charge Characteristics
VGS=f(Qg):ID=13A,Tch=25°C



Maximum Avalanche Energy vs. startingTch
E(AV)=f(starting Tch):VCC=60V,I(AV)<=3.4A



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



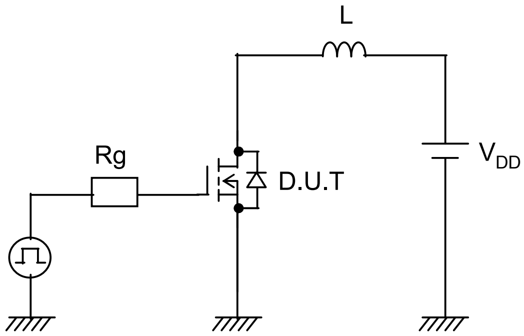


Fig.1 Avalanche Test circuit

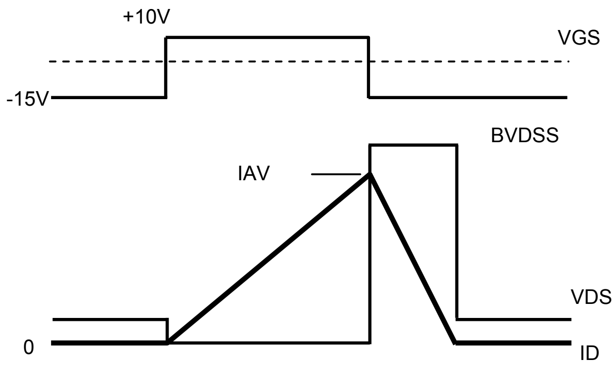


Fig.2 Operating waveforms of Avalanche Test

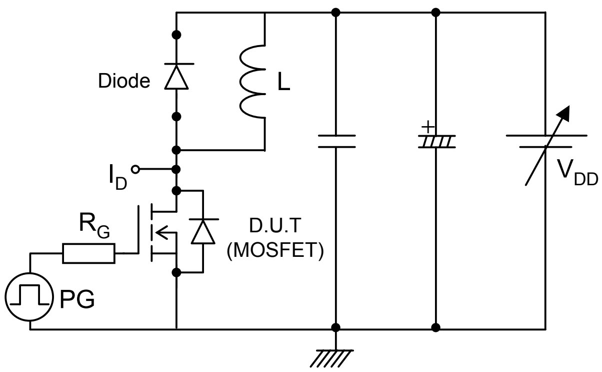


Fig.3 Switching Test circuit

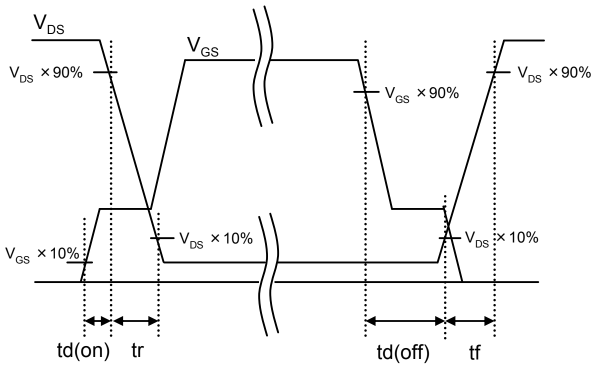


Fig.4 Operating waveform of Switching Test

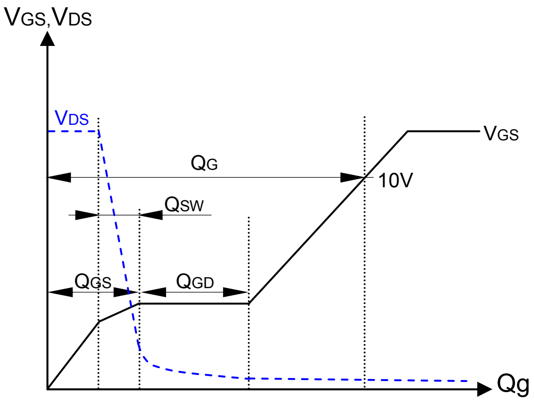


Fig.5 Operating waveform of Gate charge Test

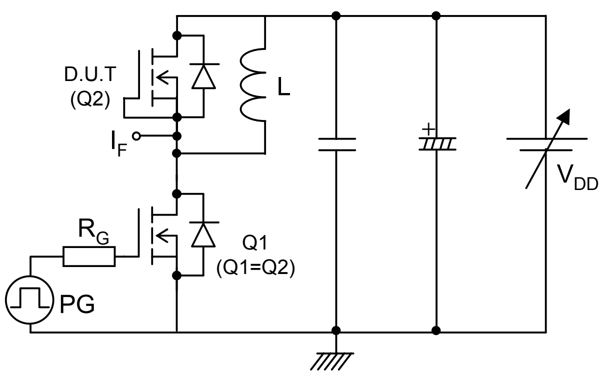


Fig.6 Reverse recovery Test circuit

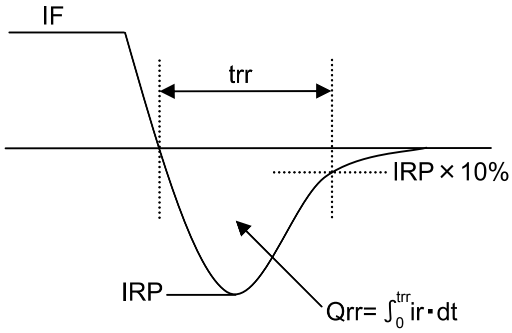
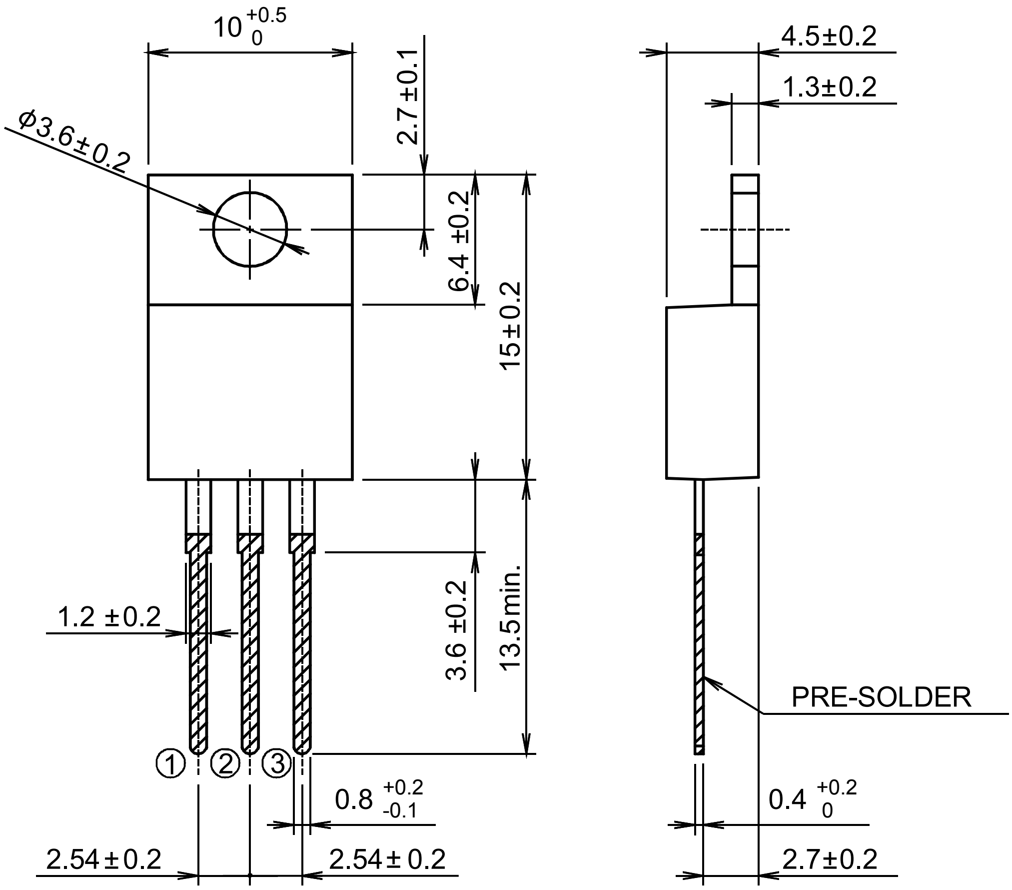
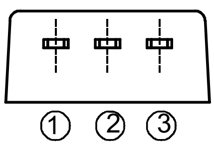


Fig.7 Operating waveform of Reverse recovery Test

■ Outview: TO-220 Package





CONNECTION

① GATE

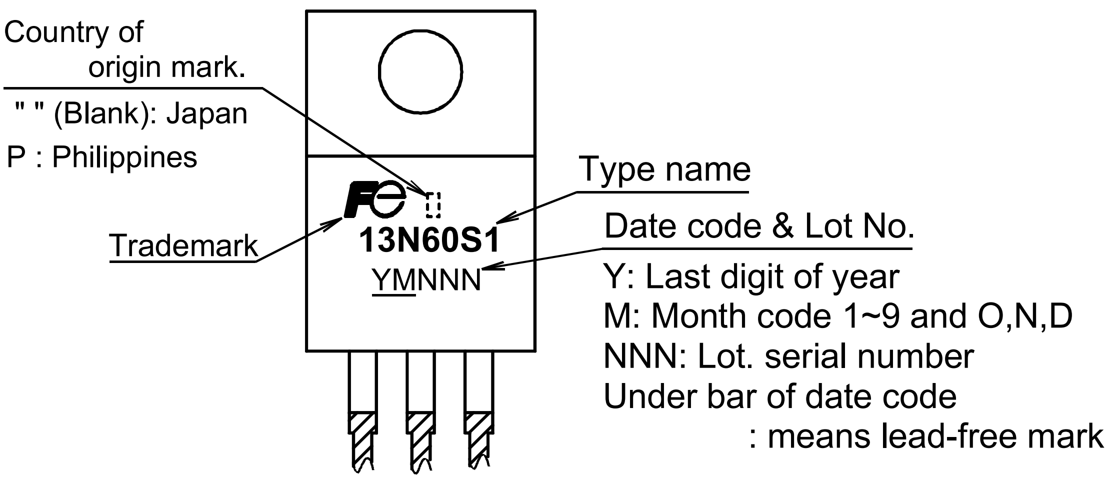
② DRAIN

③ SOURCE

JEDEC : TO-220AB

DIMENSIONS ARE IN MILLIMETERS.

■ Marking



* The font (font type,size) and the trademark-size might be actually different.

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- Communications equipment (terminal devices)
- Measurement equipment
- Machine tools
- Audiovisual equipment
- Electrical home appliances
- Personal equipment
- Industrial robots etc.

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- Traffic-signal control equipment
- Gas leakage detectors with an auto-shut-off feature
- Emergency equipment for responding to disasters and anti-burglary devices
- Safety devices
- Medical equipment

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- Aeronautic equipment
- Nuclear control equipment
- Submarine repeater equipment

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