e-Front runners

FMH23N50E

FUJI POWER MOSFET

Super FAP-E^3 series

N-CHANNEL SILICON POWER MOSFET

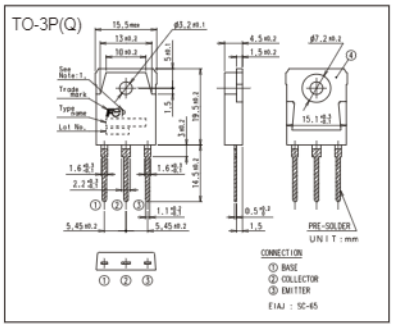
■ Features

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

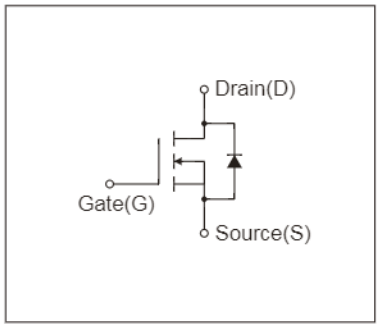
■ Applications

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}	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}	31.5	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	2.50	W	Ta=25°C
		315		Tc=25°C
Operating and Storage	T_{ch}	150	°C	
Temperature range	T_{stg}	-55 to + 150	°C	

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

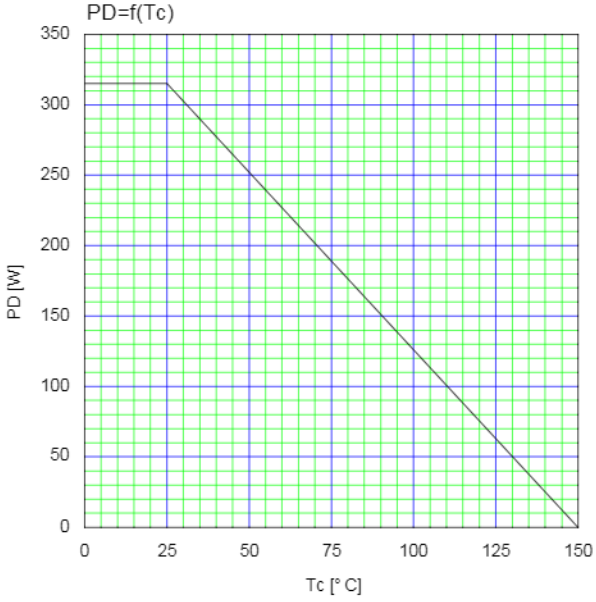
Description	Symbol	Conditions		min.	typ.	max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	I_D=250μA, V_{GS}=0V		500	-	-	V
Gate Threshold Voltage	V_{GS} (th)	I_D=250μA, V_{DS}=V_{GS}		2.5	3.0	3.5	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=500V, V_{GS}=0V	T_{ch}=25°C	-	-	25	μA
		V_{DS}=400V, V_{GS}=0V	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=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	Ciss	V_{DS}=25V		-	3500	5250	pF
Output Capacitance	Coss	V_{GS}=0V		-	330	495	
Reverse Transfer Capacitance	Crss	f=1MHz		-	24	36	
Turn-On Time	td(on)	V_{cc}=300V		-	24	36	ns
	tr	V_{GS}=10V		-	13	19.5	
Turn-Off Time	td(off)	I_D=11.5A		-	150	225	
	tf	R_{GS}=5.6Ω		-	20	30	
	Q_{th}	V_{cc}=250V		-	11	16.5	nC
Total Gate Charge	Q_G	I_D=23A		-	93	139.5	
Gate-Source Charge	Q_{GS}	V_{GS}=10V		-	24	36	
Gate-Drain Charge	Q_{GD}			-	30	45	
Avalanche Capability	I_{AV}	L=1.16mH, T_{ch}=25°C		23	-	-	A
Diode Forward On-Voltage	V_{SD}	I_F=23A, V_{GS}=0V, T_{ch}=25°C		-	0.90	1.35	V
Reverse Recovery Time	trr	I_F=23A, V_{GS}=0V		-	0.5	-	μs
Reverse Recovery Charge	Qrr	-di/dt=100A/μs, Tch=25°C		-	8	-	μC

● Thermal Characteristics

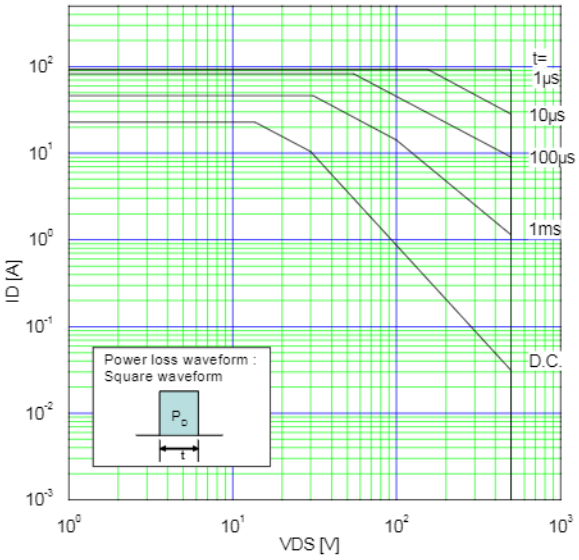
Description	Symbol	Test Conditions	min.	typ.	max.	Unit
Thermal resistance	Rth (ch-c)	Channel to case			0.40	°C/W
	Rth (ch-a)	Channel to ambient			50.0	°C/W

Note *1 : Tch≤150°C
Note *2 : Stating Tch=25°C, I_{AS}=10A, L=14.1mH, V_{CC}=50V, 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, V_{CC}≤BV_{DSS}, Tch≤150°C.
Note *5 : I_F≤-I_D, dv/dt=5.0kV/μs, V_{CC}≤BV_{DSS}, Tch≤150°C.

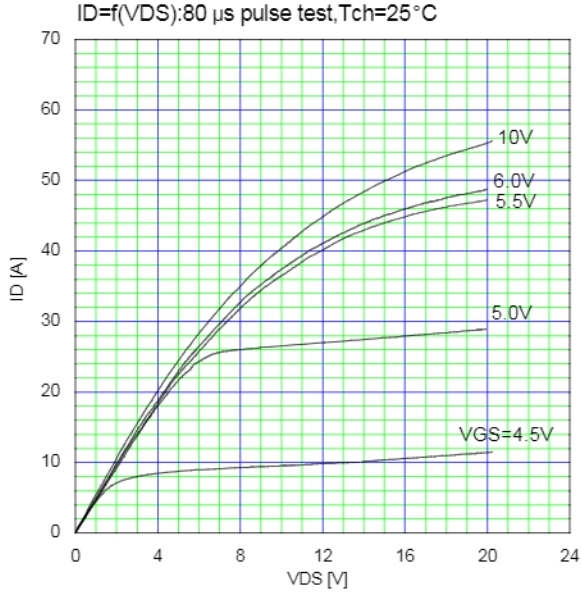
Allowable Power Dissipation
PD=f(Tc)



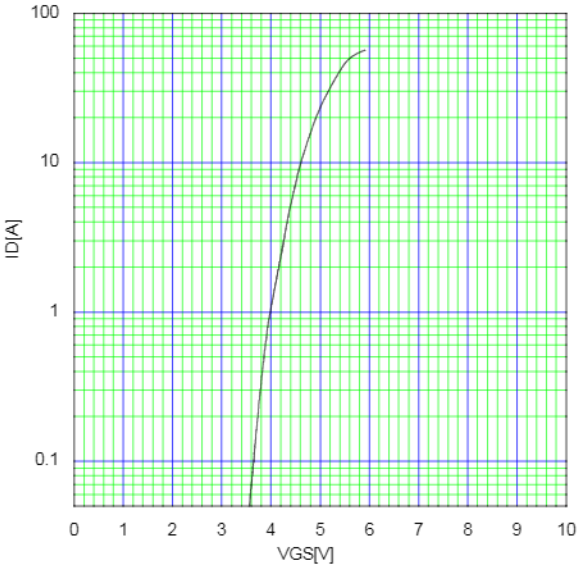
Safe Operating Area
I_D=f(V_{DS}):Duty=0(Single pulse),Tc=25°C



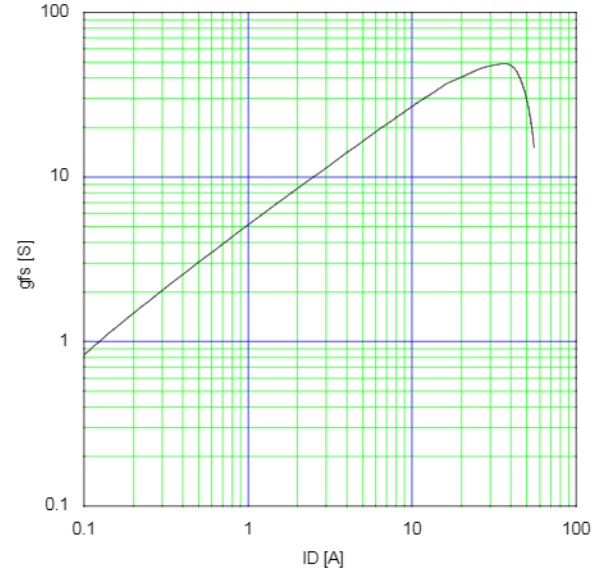
Typical Output Characteristics
ID=f(VDS):80 μs pulse test,Tch=25°C



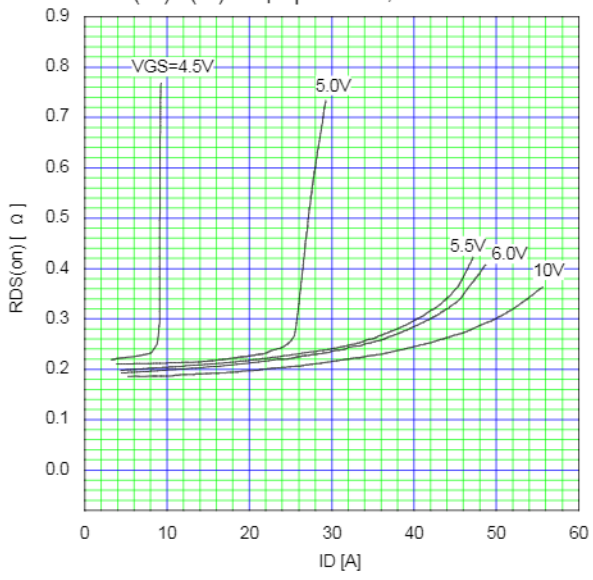
Typical Transfer Characteristic
ID=f(VGS):80 μs pulse test,VDS=25V,Tch=25°C



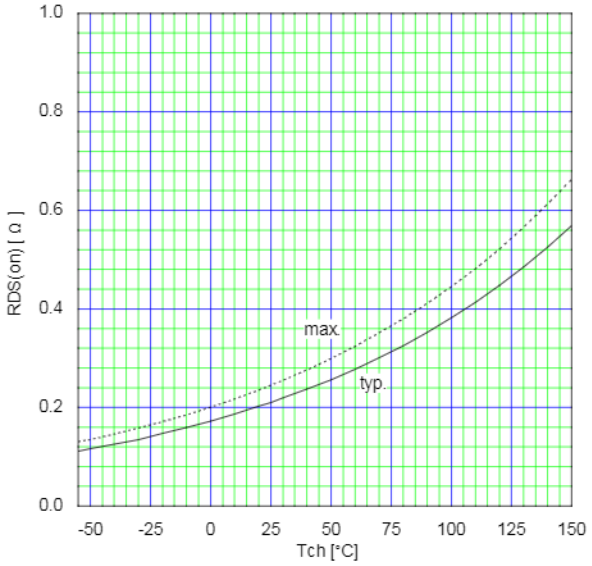
Typical Transconductance
gfs=f(ID):80 μs pulse test,VDS=25V,Tch=25°C



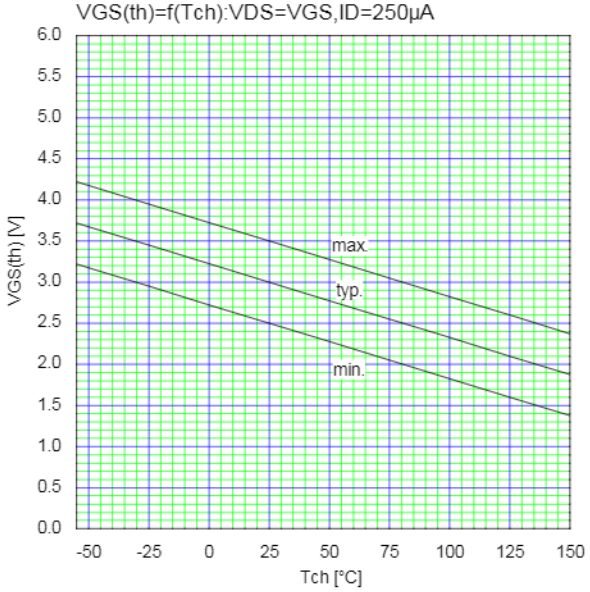
Typical Drain-Source on-state Resistance
RDS(on)=f(ID):80 μs pulse test,Tch=25°C



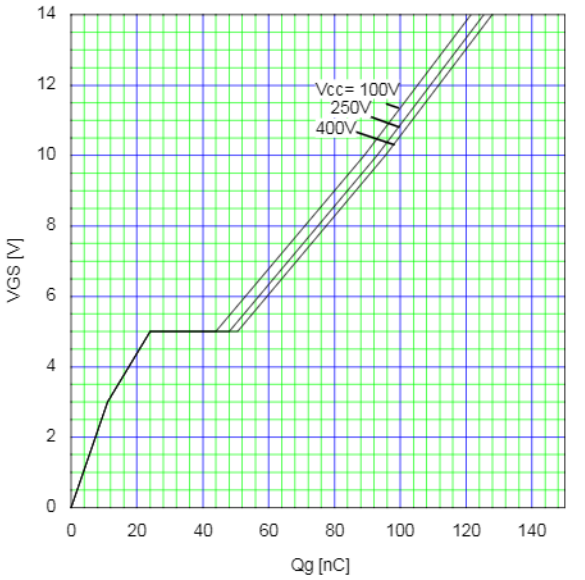
Drain-Source On-state Resistance
RDS(on)=f(Tch):ID=11.5A,VGS=10V



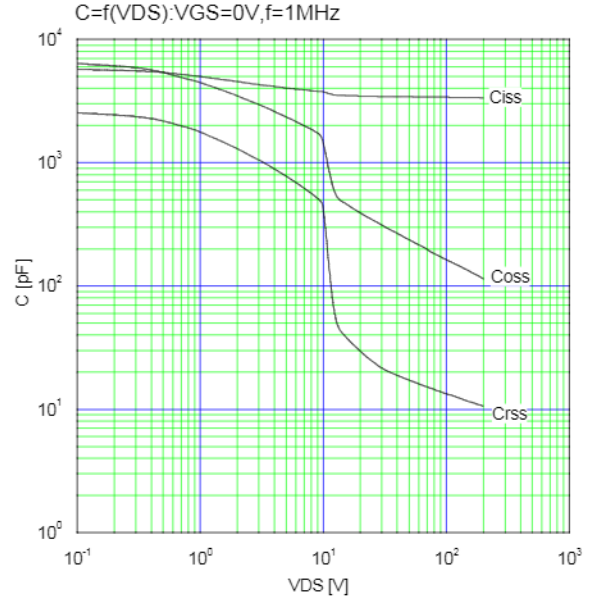
Gate Threshold Voltage vs. Tch
VGS(th)=f(Tch):VDS=VGS,ID=250μA



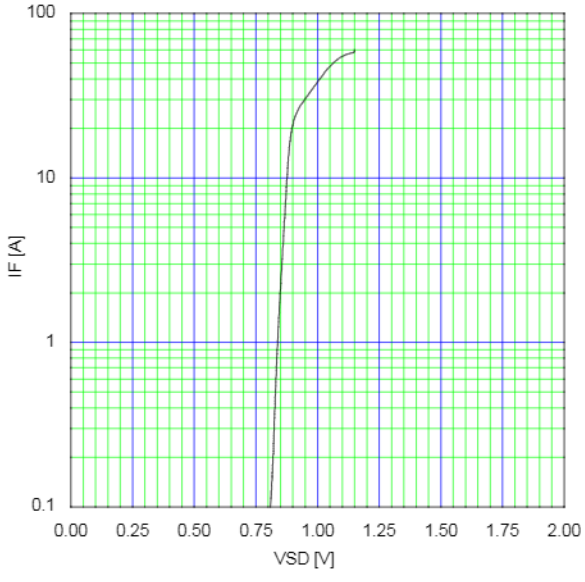
Typical Gate Charge Characteristics
VGS=f(Qg):ID=23A,Tch=25°C



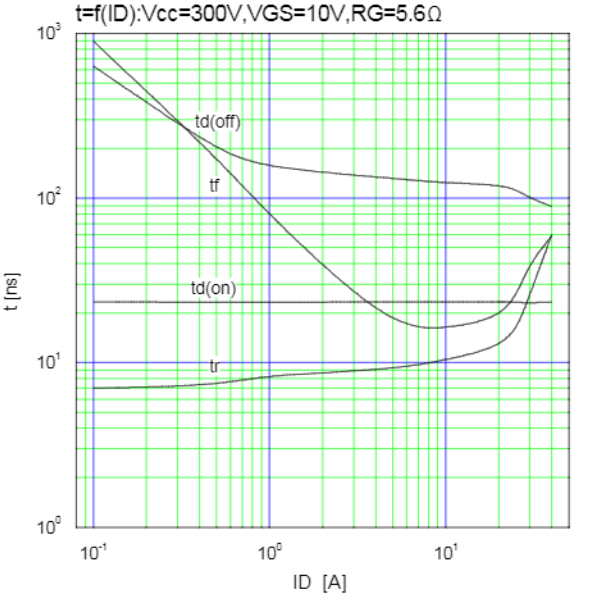
Typical Capacitance
C=f(VDS):VGS=0V,f=1MHz



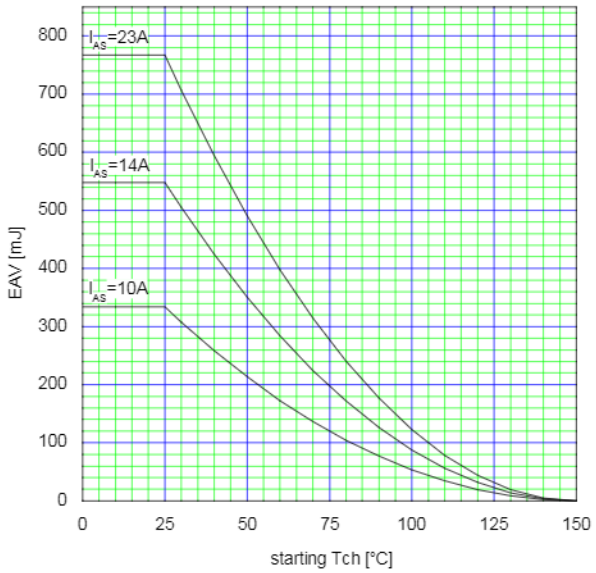
Typical Forward Characteristics of Reverse Diode
IF=f(VSD):80 μs pulse test,Tch=25 °C



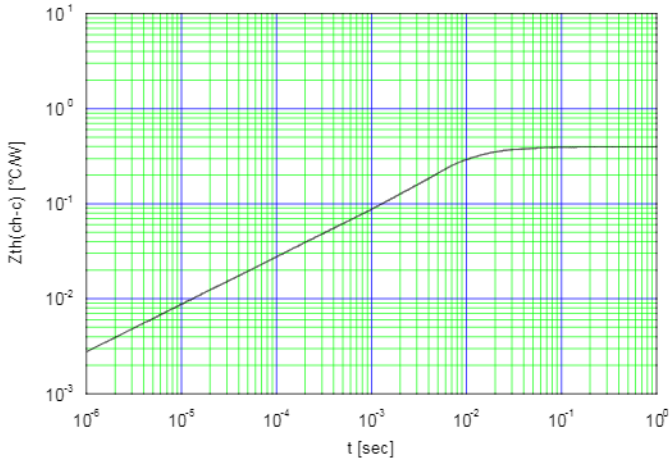
Typical Switching Characteristics vs. ID
t=f(ID):Vcc=300V,VGS=10V,RG=5.6Ω



Maximum Avalanche Energy vs. starting Tch
E(AV)=f(starting Tch):Vcc=50V,I(AV)<=23A



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



WARNING

1. This Catalog contains the product specifications, characteristics, data, materials, and structures as of October 2008.
   The contents are subject to change without notice for specification changes or other reasons. When using a product listed in this Catalog, be sure to obtain the latest specifications.

2. All applications described in this Catalog exemplify the use of Fuji's products for your reference only. No right or license, either express or implied, under any patent, copyright, trade secret or other intellectual property right owned by Fuji Electric Device Technology Co., Ltd. is (or shall be deemed) granted. Fuji Electric Device Technology Co., Ltd. makes no representation or warranty, whether express or implied, relating to the infringement or alleged infringement of other's intellectual property rights which may arise from the use of the applications described herein.

3. Although Fuji Electric Device Technology Co., Ltd. is enhancing product quality and reliability, a small percentage of semiconductor products may become faulty. When using Fuji Electric semiconductor products in your equipment, you are requested to take adequate safety measures to prevent the equipment from causing a physical injury, fire, or other problem if any of the products become faulty. It is recommended to make your design fail-safe, flame retardant, and free of malfunction.

4. The products introduced in this Catalog are intended for use in the following electronic and electrical equipment which has normal reliability requirements.
   • Computers • OA equipment • Communications equipment (terminal devices) • Measurement equipment
   • Machine tools • Audiovisual equipment • Electrical home appliances • Personal equipment • Industrial robots etc.

5. If you need to use a product in this Catalog for equipment requiring higher reliability than normal, such as for the equipment listed below, it is imperative to contact Fuji Electric Device Technology Co., Ltd. to obtain prior approval. When using these products for such equipment, take adequate measures such as a backup system to prevent the equipment from malfunctioning even if a Fuji's product incorporated in the equipment becomes faulty.
   • Transportation equipment (mounted on cars and ships) • Trunk communications equipment
   • 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

6. Do not use products in this Catalog for the equipment requiring strict reliability such as the following and equivalents to strategic equipment (without limitation).
   • Space equipment • Aeronautic equipment • Nuclear control equipment
   • Submarine repeater equipment

7. Copyright ©1996-2008 by Fuji Electric Device Technology Co., Ltd. All rights reserved.
   No part of this Catalog may be reproduced in any form or by any means without the express permission of Fuji Electric Device Technology Co., Ltd.

8. If you have any question about any portion in this Catalog, ask Fuji Electric Device Technology Co., Ltd. or its sales agents before using the product.
   Neither Fuji Electric Device Technology Co., Ltd. nor its agents shall be liable for any injury caused by any use of the products not in accordance with instructions set forth herein.