SPECIFICATION

Device Name : Intelligent power MOSFET

Type Name : F5042-S

Spec. No. : MS5F06899

Date : Aug.-08-2007

Fuji Electric Device Technology Co., Ltd.
Semiconductors Group

	DATE	NAME	APPROVED
DRAWN	Aug.-08-2007	H. Ishiuchi	
CHECKED	Aug.-08-2007	S. Kiuchi	
CHECKED	Aug.-08-2007	M. Aruga	

Fuji Electric Device Technology Co.,Ltd.

DWG.NO. MS5F06899 1/19

Revised Records

Date	Classi-fication	Ind.	Content	Applied date	Drawn	Check-ed	Check-ed	Ap-proved
Aug.-08-2007	Enactment	—	————	Issued date	S. Yamashina M. Fukuoka	T. Kiuchi	M. Araga	

0. Cautions

- Although Fuji Electric Device Technology is continually improving product quality and reliability, a small percentage of semiconductor products may become faulty. When using Fuji Electric Device Technology semiconductor products in your equipment, you are requested to take adequate safety measures to prevent the equipment from causing physical injury, fire, or other problem in case any of the products fail. It is recommended to make your design fail-safe, flame retardant, and free of malfunction.
- The products described in this specification are designed and manufactured in order to use automotive switching applications. If you're considering a special use of these products in case of equipment or system for ship, aerospace, medical, nuclear control, submarine repeater and the like, contact Fuji Electric Device Technology and obtain our consent.

0-1. Warnings

- The MOSFETs shall be used in products within their absolute maximum rating (voltage, current, temperature, and so forth). The MOSFETs may be destroyed if used beyond the absolute maximum rating, or may cause dynamic destruction by means of unexpected mechanical stress.
- We only guarantee the non-repetitive and repetitive avalanche capability and not for the continuous avalanche capability which can be assumed as abnormal condition. Please note the device may be destructed from the avalanche over the specified maximum rating.
- Do not directly touch the leads or package of the MOSFETs while power is supplied or during operation, in order to avoid electric shock and burns.
- The MOSFETs are made of incombustible material. However, if a MOSFET fails, it may emit smoke or flame. Also, operating the MOSFETs near any flammable place or material may cause the MOSFETs to emit smoke or flame in case the MOSFETs become even hotter during operation. Design the arrangement to prevent the spread of fire.
- The MOSFETs should not be used in an environment in the presence of acid, organic matter, or corrosive gas (hydrogen sulfide, sulfurous acid gas, and other corrosive gas).
- The MOSFETs should not be used in an irradiated environment since they are not radiation-proof.

0-2. Warnings for designing

- Design the MOSFETs to be operated within the specified absolute maximum ratings (voltage, current, temperature, and so forth) to prevent possible failure or destruction of devices.
- Consider the possible temperature rise not only for the channel and case but also for the outer leads.
- The equipment containing MOSFETs should have adequate fuses or circuit breakers to prevent the equipment from causing secondary destruction such as fire and explosion.
- Use the MOSFETs within their reliability and lifetime under certain environments or conditions. The MOSFETs may fail before the target lifetime of your products if not used under certain reliability conditions, especially in the severe condition with corrosive gas or of high temperature and high humidity.
- Be careful when handling MOSFETs for ESD damage (It is an important consideration.).
- When handling MOSFETs, hold them by the case (package) and do not touch the leads and terminals.
- It is recommended that any handling of MOSFETs is done on grounded electrically conductive floor and tablemats.

・Before touching a MOSFET terminal, discharge any static electricity from your body and clothes by grounding out through a high impedance resistor (about 1MΩ).
・When soldering, in order to protect the MOSFETs from static electricity, ground the soldering iron and soldering bath through a low impedance resistor.

0-3. Warnings for installation

・Soldering involves temperatures which exceed the device storage temperature rating. To avoid device damage and to ensure reliability, follow the description of resistance to soldering heat for surface mounting devices as stated in 12 reliability test items.
・Devices shall not be exposed by any chemicals or physical damage.

0-4. Warnings for storage

・The MOSFETs must be stored at a standard temperature of 5 to 35℃ and relative humidity of 45 to 75%.
・The MOSFETs should not be subjected to rapid changes in temperature to avoid condensation on the surface of the MOSFETs. Therefore store the MOSFETs in a place where the temperature is steady.
・The MOSFETs should not be stored on top of each other, since this may cause excessive external force on the case.
・The MOSFETs should be stored with the lead terminals remaining unprocessed. Rust may cause presoldered connections to fail during later processing.
・The MOSFETs should be stored in antistatic containers or shipping bags.

0-5. Compliance towards restricted substances

・This products do not contain PBBs (polybrominated biphenyls), and PBDEs (polybrominated diphenyl ethers).
・This products do not contain Class-I ODS (Ozone-Depleting Substances) and Class-II ODS substances set force by “Clean Air Act of U.S.” law.

・If you have any questions about any part of this specification, please contact Fuji Electric Device Technology or its sales agent before using the product.
・Neither Fuji nor its agents shall be held liable for any injury caused by using the products not in accordance with the instructions.
・The application examples described in this specification are merely typical uses of Fuji Electric Device Technology products.
・This specification does not confer any industrial property rights or other rights, nor constitute a license for such rights.

1. Scope This specifies Fuji Electric Device Technology Intelligent power MOSFET F5042-S.

2. Construction Silicon planer type
Circuit part ; Self isolation structure
Output part ; N-channel enhancement mode power MOSFET

3. Application For switching

4. Outview K-PACK s-type (EIAJ SC-63) Outview See to 18/19 Page
Taping specification See to MS5C8435
Packing specification See to MS5Q0025
See the internal structure on Page 19/19.

5. Absolute maximum ratings (at Tc=25℃, unless otherwise specified.)

Descriptions	Symbols	Characteristics	Units	Conditions
Drain-Source Voltage	V_{DSS}	40	V	DC
Gate-Source Voltage	V_{GSS}	-0.3 ~ 7.0	V	DC
Continuous Drain Current	I_D	8	A	-
Maximum Power Dissipation	P_D	15	W	-
Operating Junction Temperature	T_j	150	℃	-
Storage Temperature Range	T_{stg}	-55 ~ 150	℃	-
Single Pulse Inductive Load Switch-Off Energy Dissipation	E_{CL}	100	mJ	T_j=150℃, L=5mH, I_D=8A Single Pulse, dv/dt≦10V/μs

6. Electrical characteristics (at Tc=25℃, unless otherwise specified.)

Descriptions	Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Drain-Source Clamp Voltage	V_{DSS}	I_D=1mA	V_{GS}=0V	40	-	60	V
Gate Threshold Voltage	$V_{GS(th)}$	I_D=10mA	V_{DS}=13V	1.0	-	2.8	V
Operation Gate Voltage (protection circuit operates)	$V_{GS(p)}$	———		3.0	-	7.0	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=13V	V_{GS}=0V	-	-	100	μA
		V_{DS}=30V	V_{GS}=0V	-	-	1	mA
Gate-Source Leakage Current	$I_{GS(n)}$	V_{GS}=5V	**	-	-	500	μA
	$I_{GS(un)}$		***	-	-	800	μA
Drain-Source On-State Resistance	$R_{DS(on)}$	I_D=5A	V_{GS}=5V	-	-	140	mΩ

** Under normal operation
*** Under self protection

Descriptions	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Turn-On Time	t_{on}	V_{DS}=13V I_D=5A	-	-	50	μs
Turn-Off Time	t_{off}	V_{GS}=5V	-	-	50	μs
Over-Temperature Protection	T_{trip}	V_{GS}=5V	150	-	-	℃
Short Circuit Protection	I_{oc}	V_{GS}=5V	12	-	-	A

7. Electrical characteristics (at Tc=-40~105℃,unless otherwise specified.)

Descriptions	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Drain-Source Clamp Voltage	V_{DSS}	I_D=1mA V_{GS}=0V	38	-	62	V
Gate Threshold Voltage	$V_{GS(th)}$	I_D=10mA V_{DS}=13V	1.0	-	3.0	V
Operation Gate Voltage (protection circuit operates)	$V_{GS(p)}$	————	3.0	-	6.7	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=13V V_{GS}=0V	-	-	170	μA
		V_{DS}=30V V_{GS}=0V	-	-	1.6	mA
Gate-Source Leakage Current	$I_{GS(n)}$	V_{GS}=5V *	-	-	600	μA
	$I_{GS(un)}$	V_{GS}=5V Tj>150℃ **	-	-	940	μA
Drain-Source On-State Resistance	$R_{DS(on)}$	I_D=5A V_{GS}=5V	-	-	205	mΩ
Turn-On Time	t_{on}	V_{DS}=13V I_D=5A	-	-	62	μs
Turn-Off Time	t_{off}	V_{GS}=5V	-	-	52	μs
Short Circuit Protection	I_{oc}	V_{GS}=5V	8.4	-	-	A

* Under normal operation

** Under self protection (Short Circuit ~ Short Circuit Protection ~ Over-Temperature Protection)

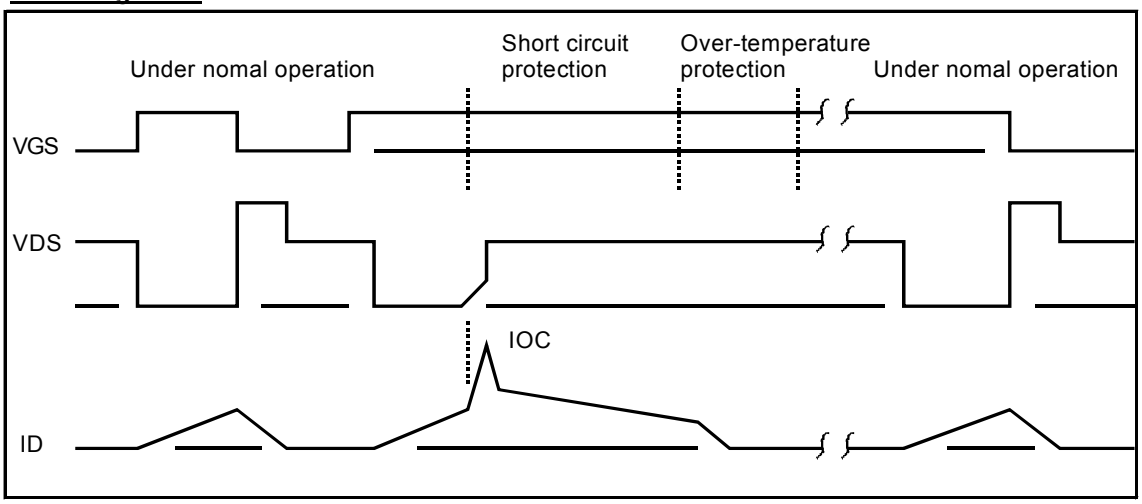
8. Thermal resistance

Description	Symbol	Condition	Characteristics			Unit
			min.	typ.	max.	
Thermal Resistance	$R_{th(j-c)}$	Junction - case	-	-	8.3	℃/W
Thermal Resistance	$R_{th(j-a)}$	Junction - Ambient	-	-	125	℃/W

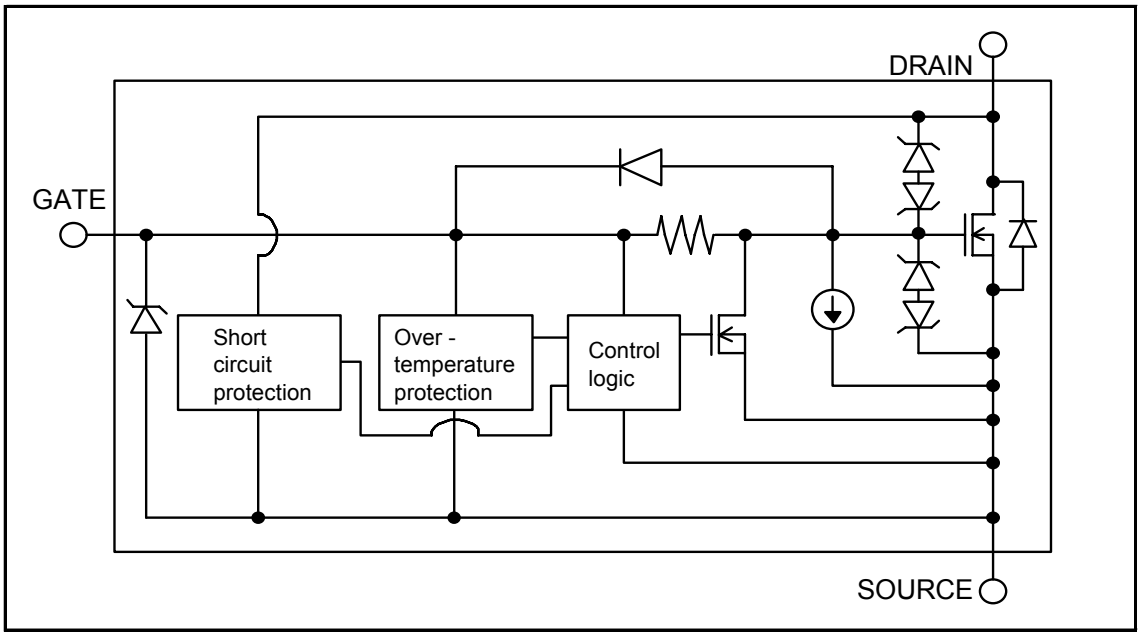
9. Electrostatic discharge

Descriptions	Conditions	Characteristics			Units
		min.	typ.	max.	
Drain-Source	150pF, 150Ω	± 15	-	-	kV
Gate-Source		± 0.5	-	-	kV

10.Timing chart



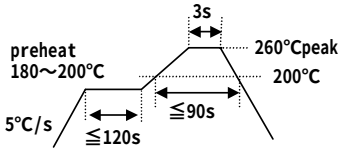
11.Block diagram



12. Reliability test items

**** Carry out following preparations in the test items of "※" mark

(1) Baking treatment : 150±5℃,24hours
(2) Humidification treatment : 85±2℃, 85±5%RH, 168±24hours
(3) Soldering heat for surface mounting : reflow soldering,
temperature profile is shown in environmental test item No.1, Number of times : 2 times

Test categories	No.	Descriptions	Testing method and conditions	Reference norms EIAJ ED-4701	Sampling number	Acceptance number
Environmental tests	1	Resistance to soldering heat for surface mounting devices	Reflow, Number of times : 2 times  Preparation : ①Baking 150℃, 24hours ②Humidification treatment : 85℃, 85%RH, 24 hours	-	15	(0:1)
	2	Solderability	Number of times : 1time Solder temperature : 245±3℃ Immersion time : 3s Preparation : ①Baking 150℃, 24hours ②Humidification treatment : 85℃, 85%RH, 24 hours	-	15	
	3 ※	Thermal shock	Used liquid : Water with ice and boiling water. 0 $^{+5}_{-0}$ ~ 100 $^{+0}_{-5}$℃ (5min.) (≦10s) (5min.) Number of cycles : 1000cycles	B-141A	22	
	4 ※	Temperature cycle	-55±3-5℃ ~ 150±5℃ (30min.) (30min.) Number of cycles : 1000cycles	B-131A	22	
	5	Vibration	Frequency range : 100 ~ 2000Hz Acceleration : 200m/s^2(20G) 4 cycles of each X,Y,Z directions Sweeping time : 48min	A-121A	15	
	6	Shock	Acceleration : 15000m/s^2 Pulse width : 0.5ms 3 times for each X1,Y1,Y2,Z1 directions Times：3times/direction	A-122A	15	
	7	Drop	Height : 75 cm, Number of times : 3 times The test specimens are dropped on a wood plate on the prescribed direction and times.	A-124A	15	
	8	Terminal strength	Force to be applied : 10N in a lead terminal axis direction. Force maintaining duration : 10±1sec.	A-111A	15	

Test categories	No.	Descriptions	Testing method and conditions	Reference norms EIAJ ED-4701	Sampling number	Acceptance number
Endurance tests	9 ※	High temperature storage	Storage temperature : 150±5℃ Test duration : 1000hours	B-111	22	(0:1)
	10 ※	Low temperature storage	Storage temperature : -55±5℃ Test duration : 1000hours	B-112A	22	
	11 ※	Intermittent operating life (Thermal cycling load)	Tj≦Tj(max.) ΔTc=90℃(Drain terminal temperature) Number of cycles : 10000cycles	-	22	
	12 ※	Pressure cooker (Saturated pressurized vapour)	Test temperature : 121℃ Pressure : 2.0×10^5 Pa Test duration : 96hours	-	22	
	13 ※	Temperature humidity storage	Test temperature : 85±2℃ Relative humidity : 85±5%RH Test duration : 1000hours	B-121	22	
	14 ※	Steady state operating life	VDS=16V,VGS=5V Test temperature : 150℃ Test duration : 1000hours		22	
	15 ※	High temperature bias (D-S)	VDS=28V Test temperature : 150℃ Test duration : 1000hours	-	22	
	16 ※	High temperature bias (G-S)	VGS=7V Test temperature : 150℃ Test duration : 1000hours	-	22	
	17 ※	Temperature humidity bias (D-S)	VDS=28V Test temperature : 85±2℃ Relative humidity : 85±5%RH Test duration : 1000hours	B-122	22	
	18 ※	Temperature humidity bias (G-S)	VGS=7V Test temperature : 85±2℃ Relative humidity : 85±5%RH Test duration : 1000hours	B-122	22	

13. Failure criteria

Descriptions		Symbols	Failure criteria		Units
			Lower limits	Upper limits	
Electrical characteristics	Drain-Source Clamp Voltage	V_{DSS}	S x 0.8	-	V
	Gate Threshold Voltage	$V_{GS(th)}$	S x 0.8	S x 1.2	V
	Zero Gate Voltage Drain Current	I_{DSS}	-	S x 2	μA
	Gate-Source Leakage Current	$I_{GS(n)}$	-	S x 2	μA
	Drain-Source On-State Resistance	$R_{DS(on)}$	S x 0.8	S x 1.2	mΩ
	Short Circuit Protection	I_{oc}	S x 0.8	S x 1.2	A
	Thermal Resistance	R_{th}	-	S x 1.2	℃/W
Outview		-	Normal		-

S : First Characteristics

14. Marking

The lot number is made up of five characters. The first is the last digit of the year.
The next is the month, October through December are indicated by the first initial letter of the month, O, N, and D.
The last three are digits indicating the assembly lot number.
Upper two of five underlined in the products signifies Lead-free external terminals.

15. Labeling

Pb symbol represents "Lead-free" external terminals.

16. Environmental issues

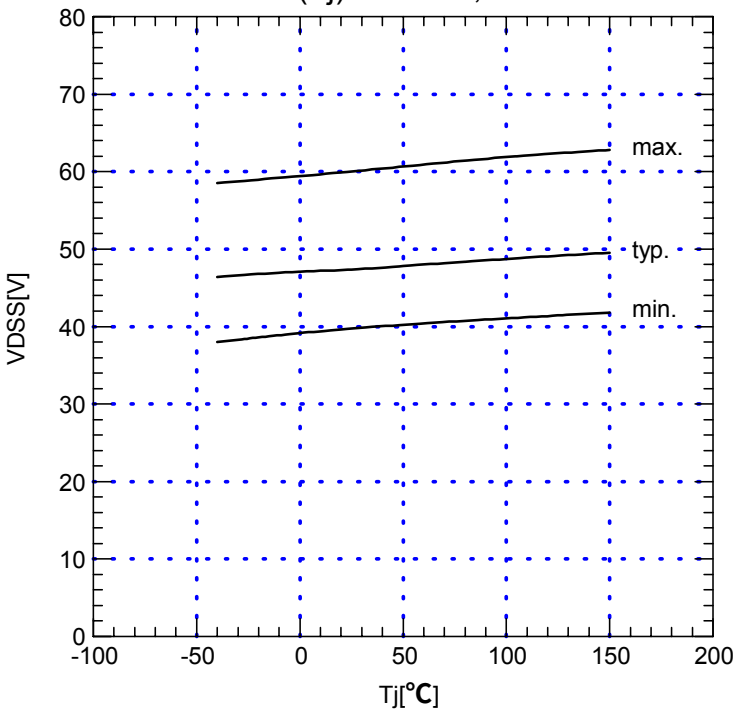
Complete elimination of specified CFCs and trichloroethane.

17. Recommended reflow profile

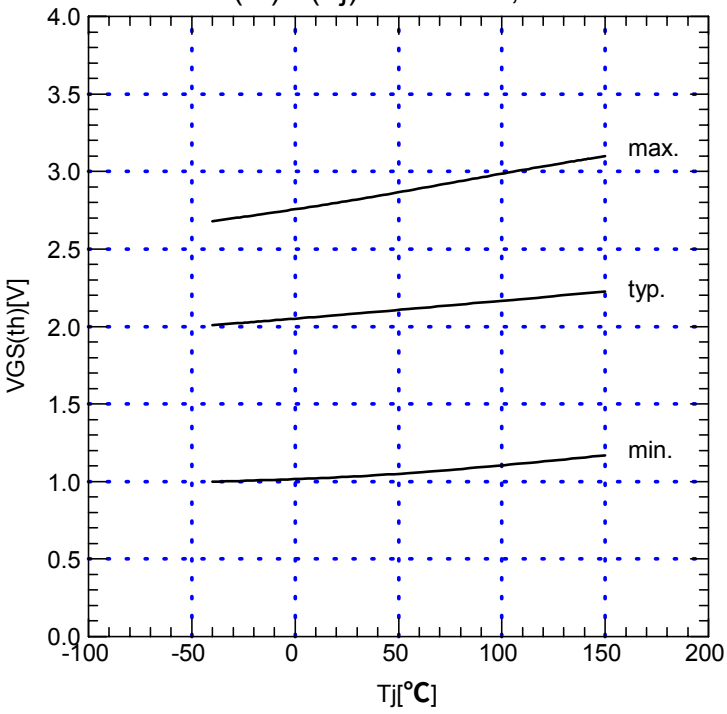
See the temperature profile in the test No.1 on Page 8/19.

18.Characteristics

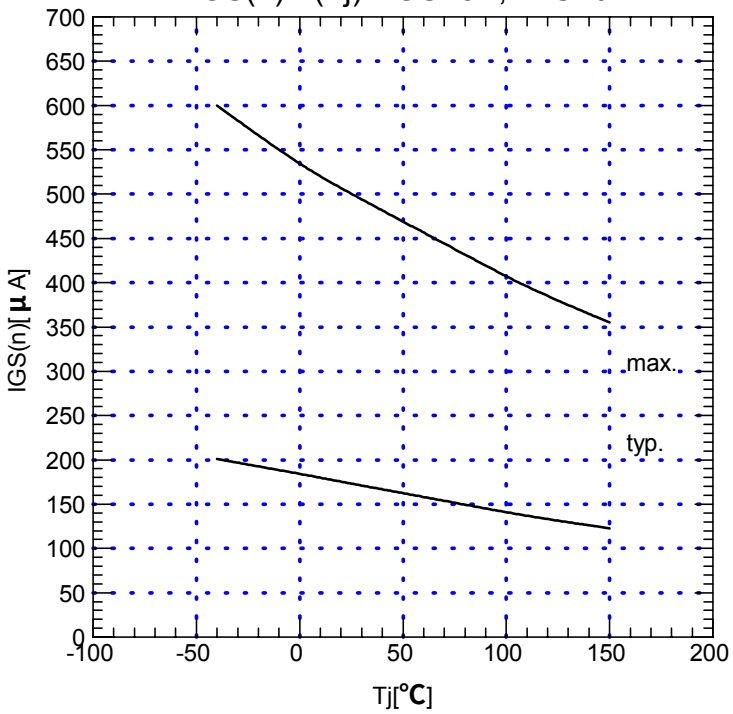
Drain-source clamp voltage
VDSS=f(Tj):ID=1mA,VGS=0V



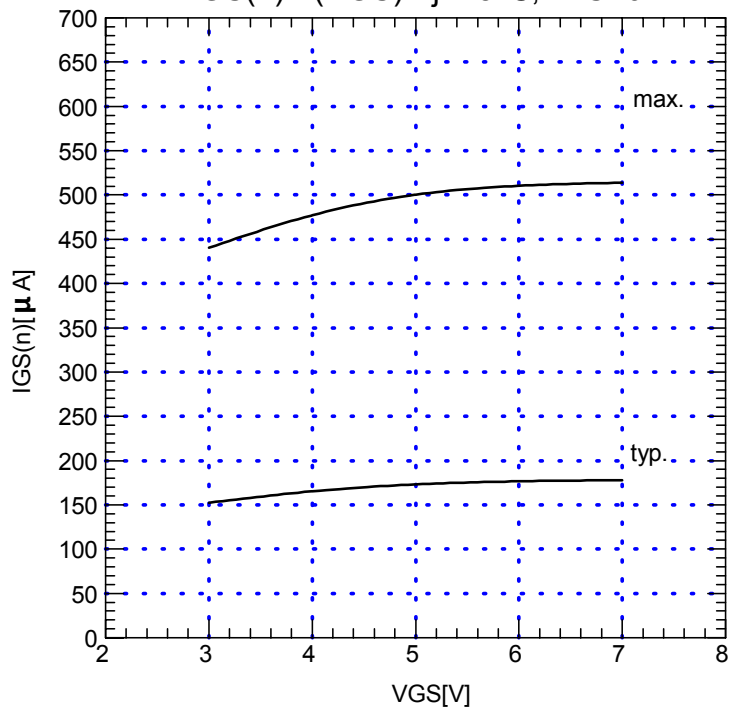
Gate threshold voltage
VGS(th)=f(Tj):VDS=13V,ID=10mA



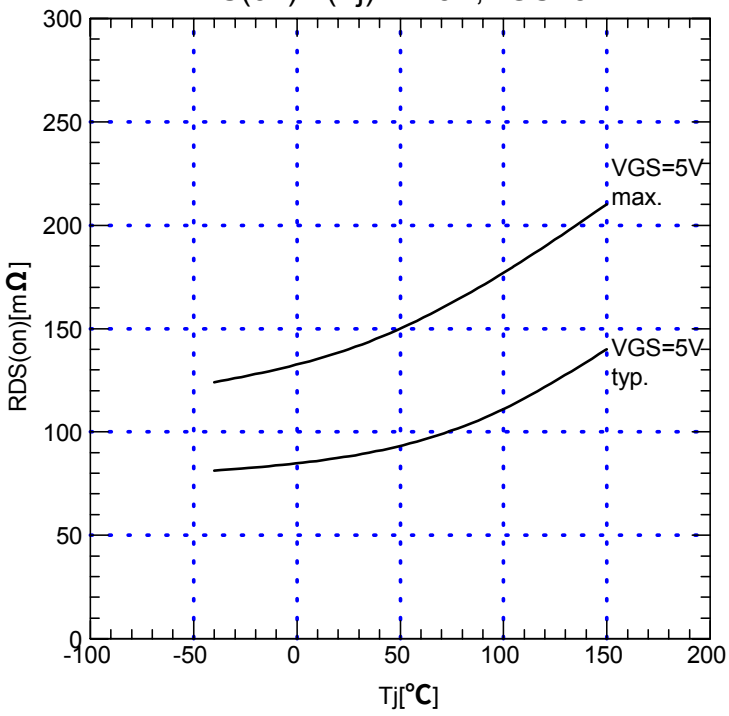
Gate-source leakage current
IGS(n)=f(Tj):VGS=5V,VDS=0V



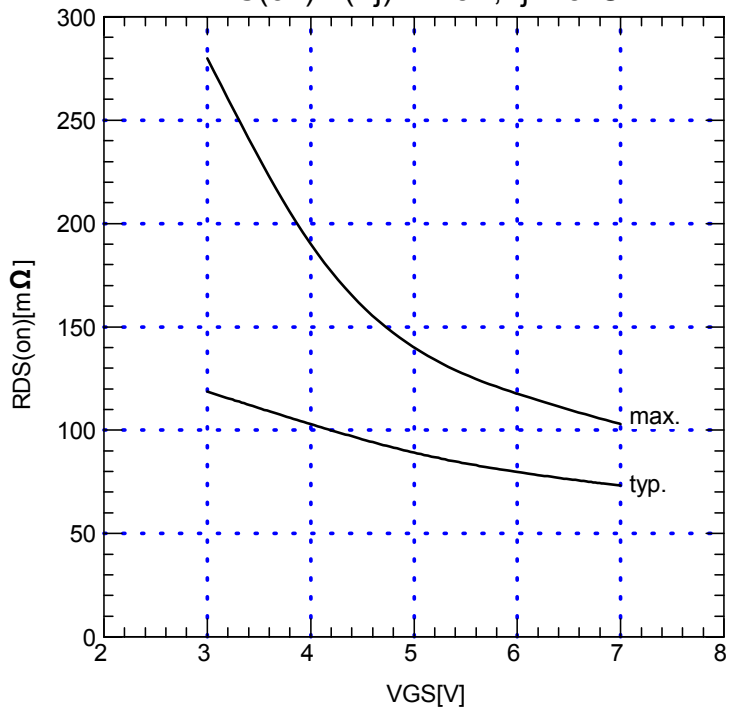
Gate-source leakage current
IGS(n)=f(VGS):Tj=25°C,VDS=0V



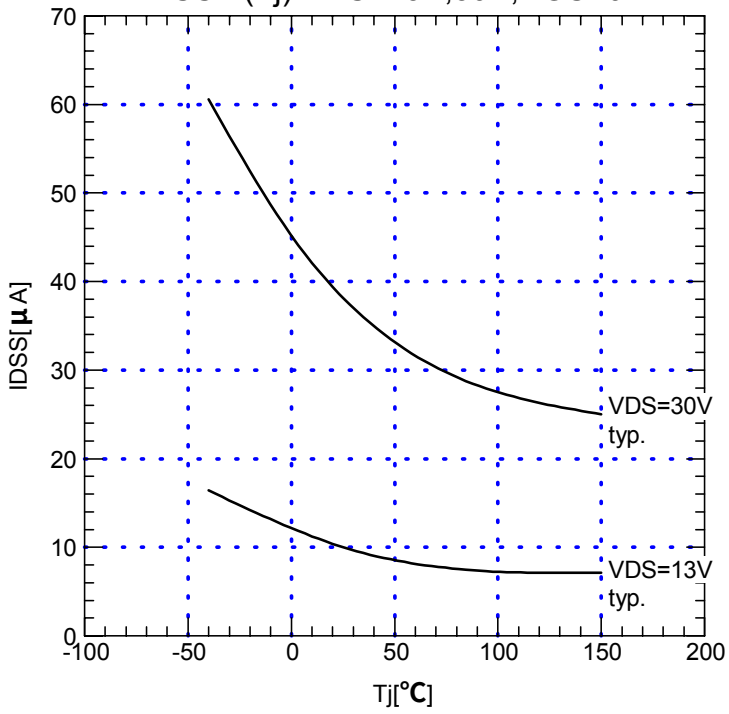
Drain-source on-state resistance
RDS(on)=f(Tj):ID=5A,VGS=5V



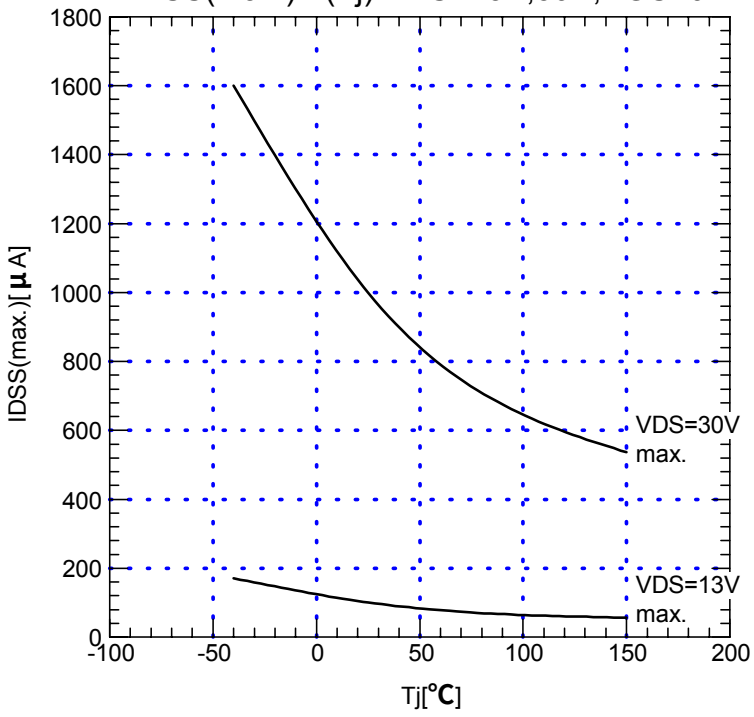
Drain-source on-state resistance
RDS(on)=f(Tj):ID=5A,Tj=25℃



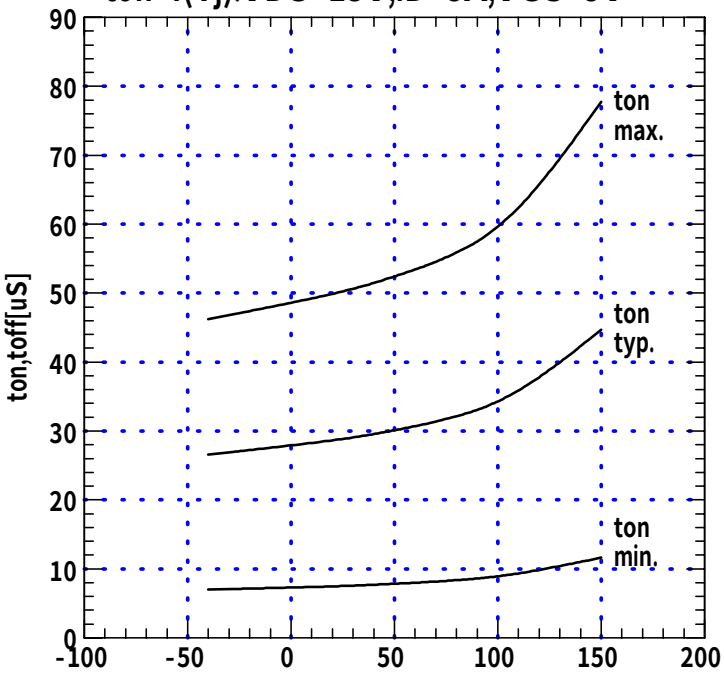
Zero gate voltage drain current
IDSS=f(Tj):VDS=13V,30V,VGS=0V



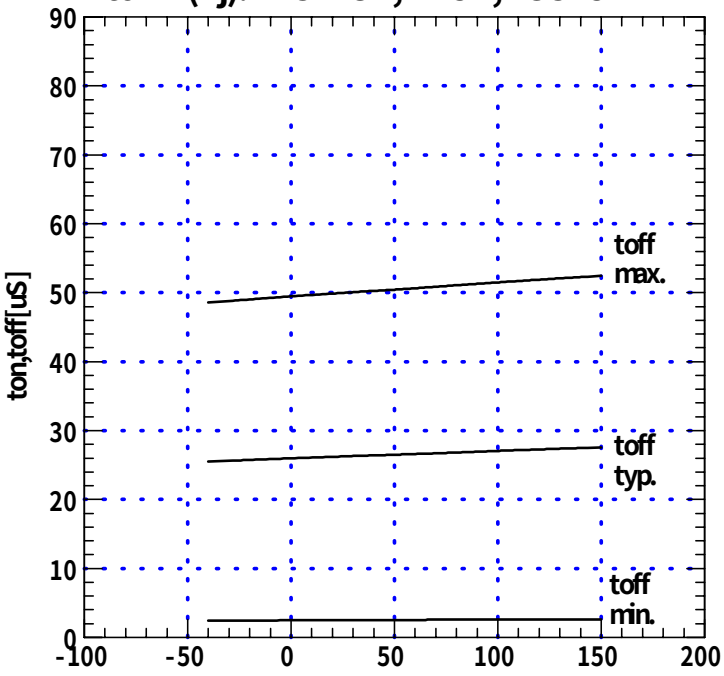
Zero gate voltage drain current
IDSS(max.)=f(Tj):VDS=13V,30V,VGS=0V



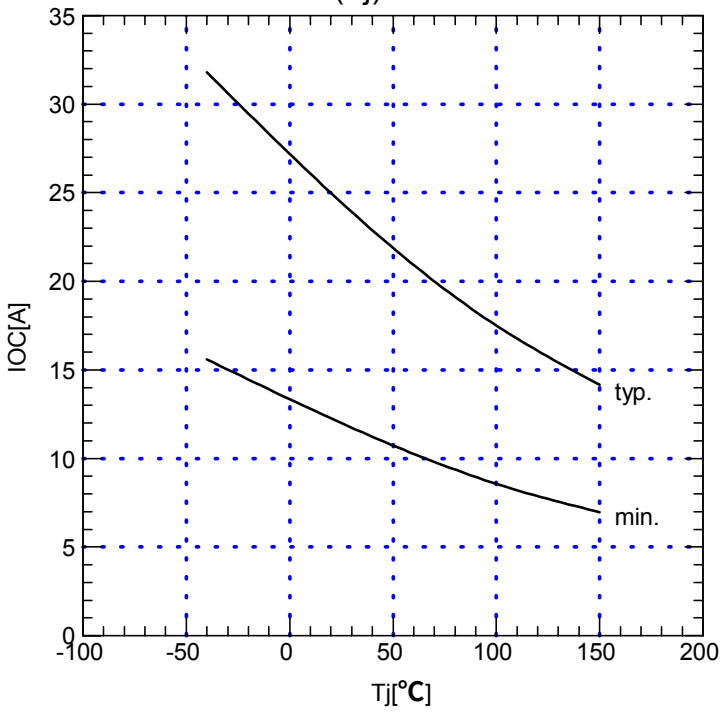
Turn-on time
ton=f(Tj):VDS=13V,ID=5A,VGS=5V



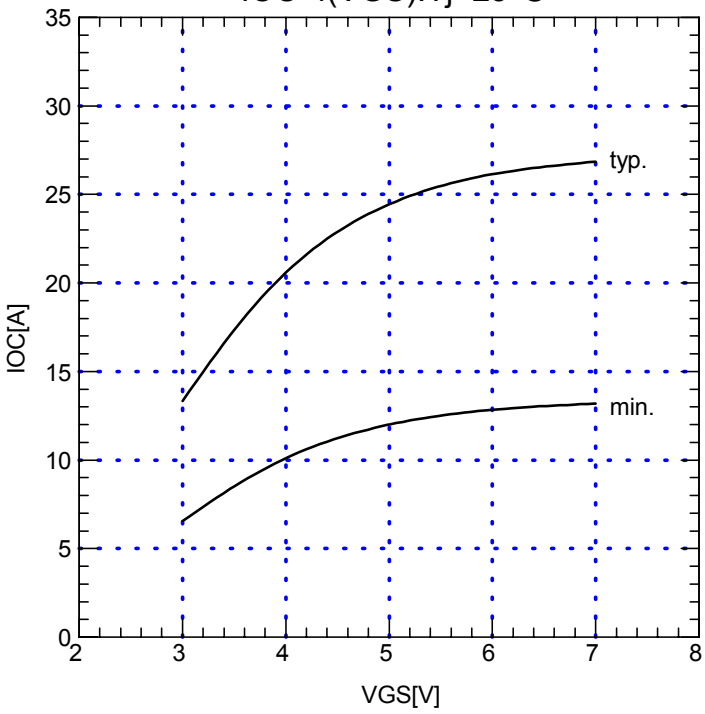
Turn-off time
toff=f(Tj):VDS=13V,ID=5A,VGS=5V



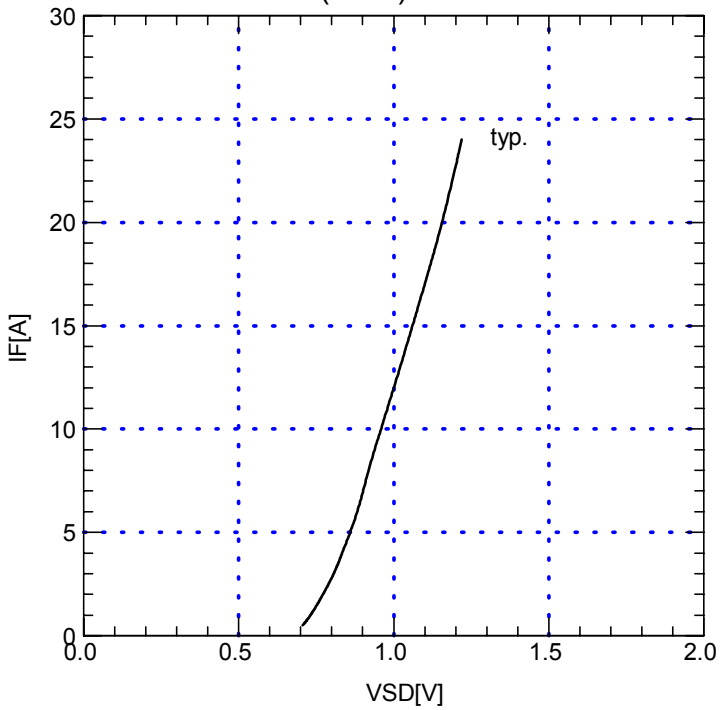
Short circuit detection
IOC=f(Tj):VGS=5V



Short circuit detection
IOC=f(VGS):Tj=25℃



Forward on voltage
IF=f(VSD)



FUJI INTELLIGENT POWER MOS FET

Type: F5042-S□□SC

OUT VIEW

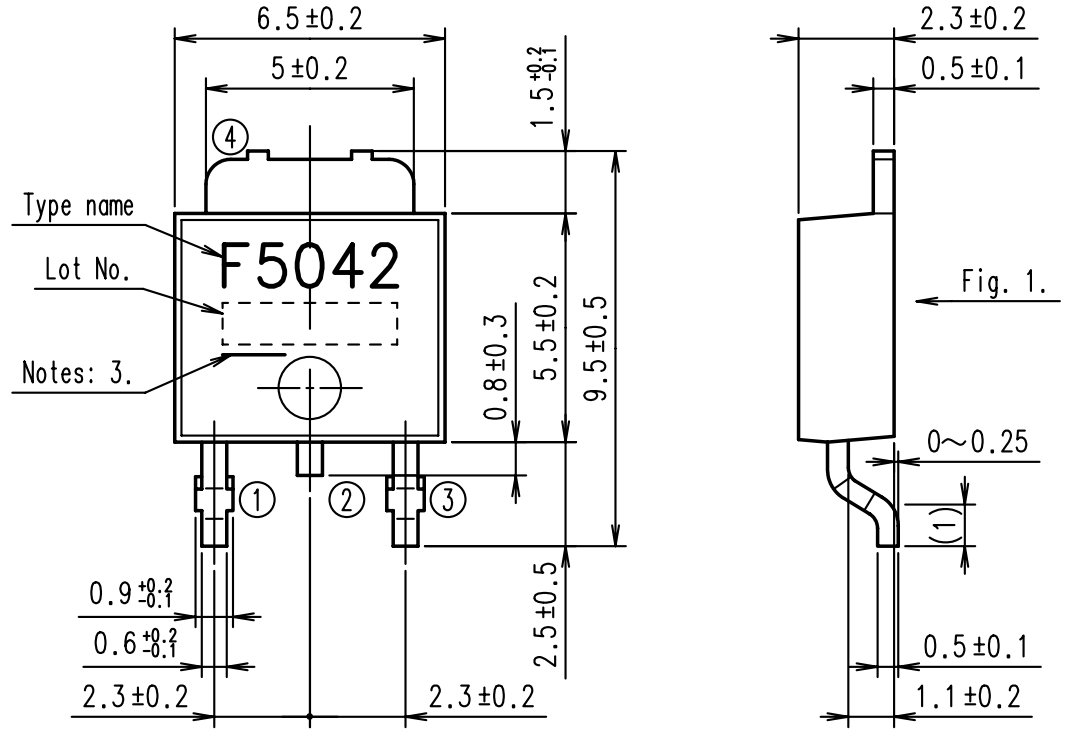
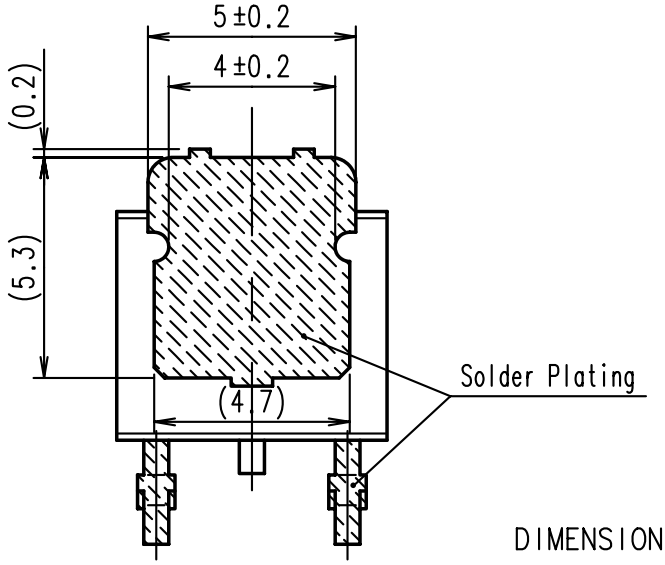


Fig. 1.



CONNECTION

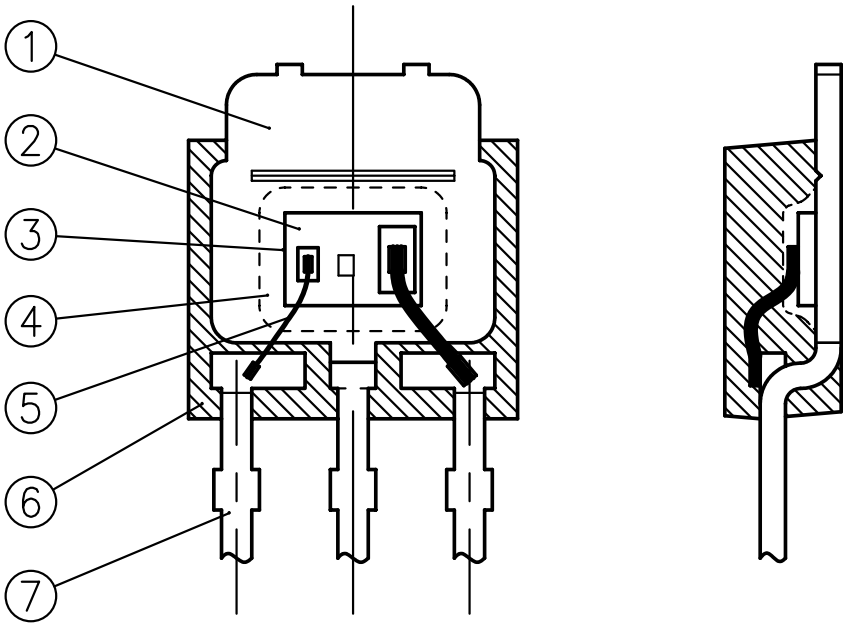
① GATE
②④ DRAIN
③ SOURCE

JEDEC: TO-252
EIAJ: SC-63

DIMENSIONS ARE IN MILLIMETERS.

Notes: 1. ( ) : Reference dimensions.
2. The metal part is covered with the solder plating, part of cutting is without the solder plating.
3. Mark of the Lead-Free Solder.(Solder plating which covers the metal)

MOS FET
TYPE : F5042-S/-L□□SC
STRUCTURE & MATERIALS



No.	Parts Name	Material	Dimension etc
1	Lead Frame	Copper	————
2	MOS FET Chip	Silicon	2.698×1.834 mm
3	Solder	Pb-Sn-Ag	————
4	Junction Coating Resin	Silicone	————
5	Inner Lead Wire	Aluminum	Gate---φ150μm×1wire Source-φ300μm×1wire
6	Resin	Epoxy Resin	UL Flame Class V-0
7	Pre-Solder	Sn-Ag	Lead-Free Type