SPECIFICATION

Device Name : IGBT MODULE

(RoHS compliant product)

Type Name : 2MBI300U4N-120-50

Spec. No. : MS5F 6509

	DATE	NAME	APPROVED
DRAWN	Feb. -14 -'06	H.Kaneda	T.Miyasaka
CHECKED	Feb. -14 -'06	M.Watanabe	
CHECKED	- -	K.Yamada	

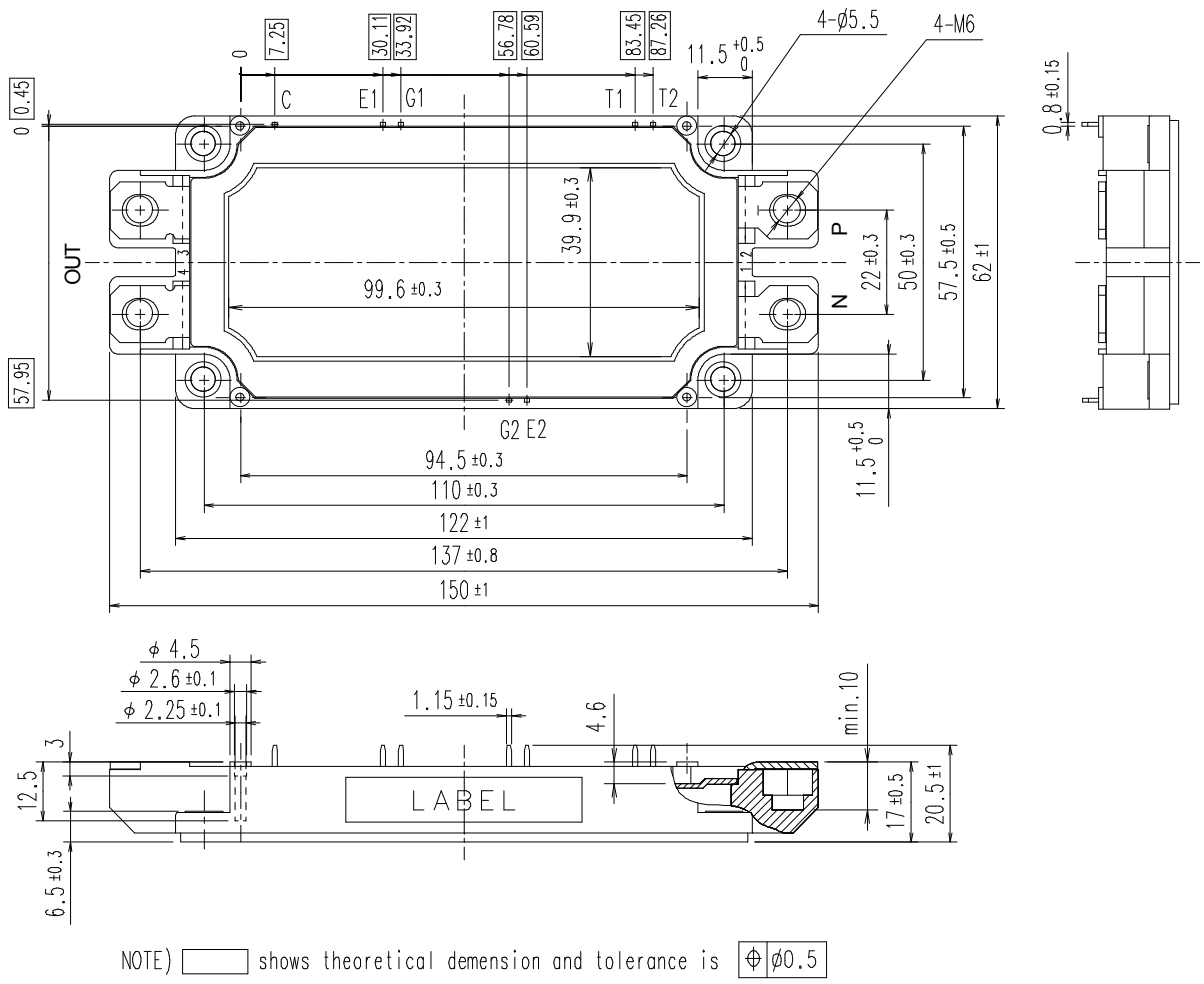
Fuji Electric Device Technology Co.,Ltd.

DWG.NO. MS5F6509 1/14 a

Revised Records

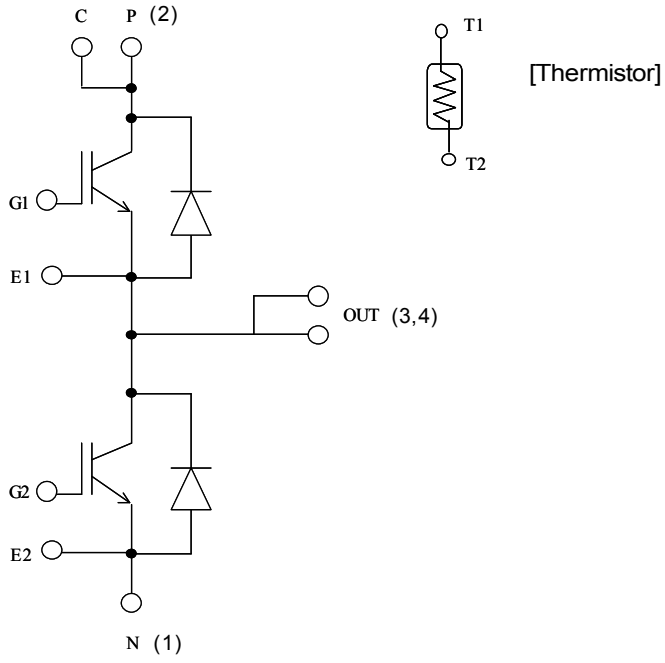
Date	Classi-fication	Ind.	Content	Applied date	Drawn	Checked	Checked	Approved
Feb. -14 -'06	Enactment	—	————	Issued date	—	M.Watanabe	K.Yamada	T.Miyasaka
Sep. -20 -'07	Revision	a	Revised Outline Drawing (P3/14)		T.Koga	S.Miyashita	K.Yamada	T.Miyasaka

1. Outline Drawing (Unit : mm) ⓐ



NOTE) ☐ shows theoretical demension and tolerance is ⌖ φ0.5

2. Equivalent circuit



3. Absolute Maximum Ratings (at Tc= 25°C unless otherwise specified)

Items		Symbols	Conditions		Maximum Ratings	Units
Collector-Emitter voltage		VCES			1200	V
Gate-Emitter voltage		VGES			±20	V
Collector current		Ic	Continuous	Tc=25°C	450	A
				Tc=80°C	300	
		Icp	1ms	Tc=25°C	900	
				Tc=80°C	600	
		-Ic			300	
		-Ic pulse	1ms		600	
Collector Power Dissipation		Pc	1 device		1385	W
Junction temperature		Tj			+150	°C
Storage temperature		Tstg			-40 to +125	
Isolation voltage	between terminal and copper base (*1)	Viso	AC : 1min.		2500	VAC
	between thermistor and others (*2)					
Screw Torque	Mounting (*3)	-			3.5	N m
	Terminals (*4)				4.5	

(*1) All terminals should be connected together when isolation test will be done.
(*2) Two thermistor terminals should be connected together, each other terminals should be connected together and shorted to base plate when isolation test will be done.
(*3) Recommendable Value : 2.5 to 3.5 Nm (M5)
(*4) Recommendable Value : 3.5 to 4.5 Nm (M6)

4. Electrical characteristics (at Tj= 25°C unless otherwise specified)

Items		Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Inverter	Zero gate voltage collector current	ICES	VCE=1200V VGE=0V		-	-	3.0	mA
	Gate-Emitter leakage current	IGES	VCE=0V VGE=±20V		-	-	600	nA
	Gate-Emitter threshold voltage	VGE(th)	VCE=20V Ic=300mA		4.5	6.5	8.5	V
	Collector-Emitter saturation voltage	VCE(sat) (terminal)	Ic=300A VGE=15V	Tj=25°C	-	2.30	2.45	V
				Tj=125°C	-	2.50	-	
		VCE(sat) (chip)		Tj=25°C	-	1.90	2.05	
				Tj=125°C	-	2.10	-	
	Input capacitance	Cies	VCE=10V,VGE=0V,f=1MHz		-	34	-	nF
	Turn-on time	ton	Vcc=600V Ic=300A VGE=±15V RG=2.0Ω		-	0.32	1.20	us
		tr			-	0.10	0.60	
		tr(i)			-	0.03	-	
	Turn-off time	toff			-	0.41	1.00	
		tf			-	0.07	0.30	
	Forward on voltage	VF (terminal)	IF=300A VGE=0V	Tj=25°C	-	2.00	2.15	V
				Tj=125°C	-	2.10	-	
		VF (chip)		Tj=25°C	-	1.65	1.80	
				Tj=125°C	-	1.75	-	
	Reverse recovery time	trr	IF=300A		-	-	0.35	us
	Lead resistance, terminal-chip (*5)	R lead			-	1.00	-	mΩ
Thermistor	Resistance	R	T=25°C		-	5000	-	Ω
			T=100°C		465	495	520	
	B value	B	T=25/50°C		3305	3375	3450	K

(*5) Biggest internal terminal resistance among arm.

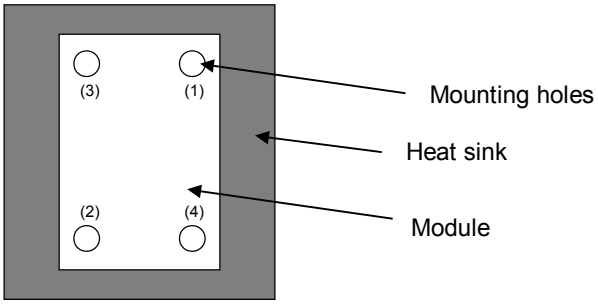
5. Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics min.	Characteristics typ.	Characteristics max.	Units
Thermal resistance(1device)	Rth(j-c)	IGBT	-	-	0.09	°C/W
		FWD	-	-	0.15	
Contact Thermal resistance (1 device) (*6)	Rth(c-f)	with Thermal Compound	-	0.0167	-	

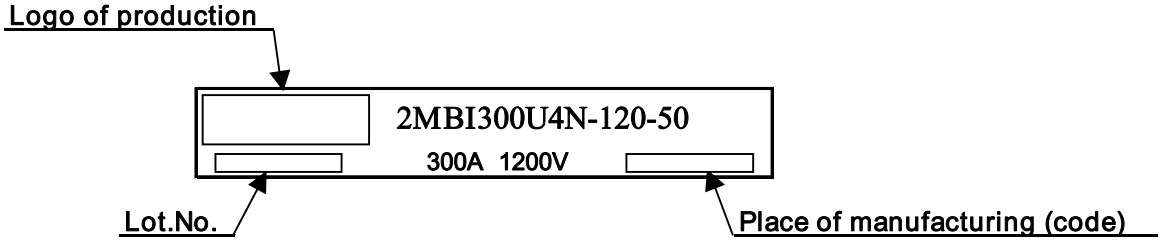
(*6) This is the value which is defined mounting on the additional cooling fin with thermal compound.

6.Recommend way of module mounting to Heat sink Clamping

(1) Initial : 1/3 specified torque, sequence (1)→(2)→(3)→(4)
(2) Final : Full specified torque (3.5 Nm),sequence(4)→(3)→(2)→(1)



7. Indication on module



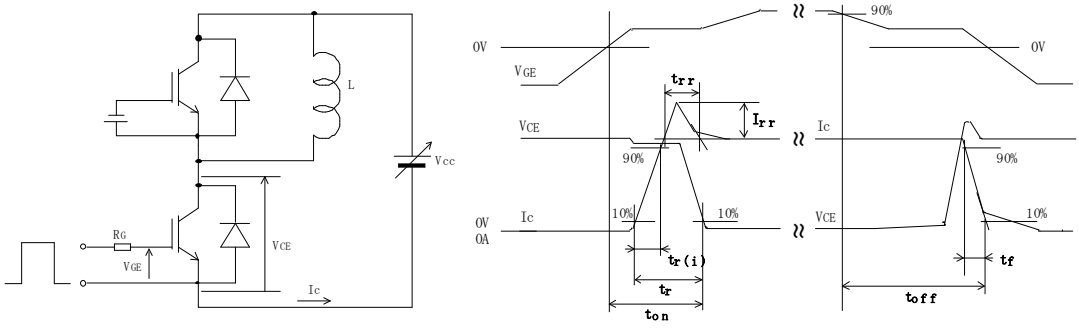
8. Applicable category

This specification is applied to IGBT-Module named 2MBI300U4N-120-50.

9. Storage and transportation notes

- The module should be stored at a standard temperature of 5 to 35°C and humidity of 45 to 75% . Be careful to solderability of the terminals if the module has passed over one year from manufacturing date, under the above storage condition.
- Store modules in a place with few temperature changes in order to avoid condensation on the module surface.
- Avoid exposure to corrosive gases and dust.
- Avoid excessive external force on the module.
- Store modules with unprocessed terminals.
- Do not drop or otherwise shock the modules when transporting.

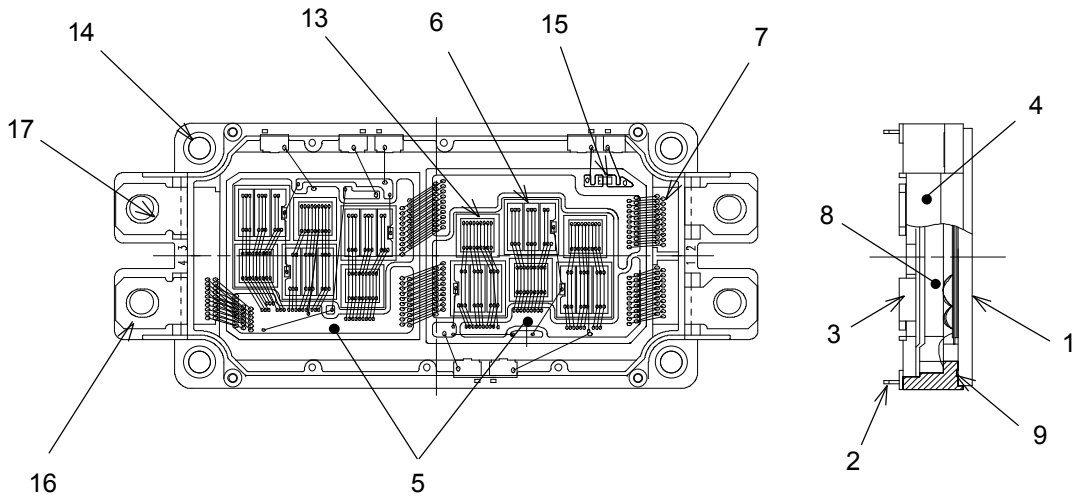
10. Definitions of switching time



11. Packing and Labeling

Display on the packing box
- Logo of production
- Type name
- Lot No
- Products quantity in a packing box

12. List of material （材料リスト）



13. RoHS Directive Compliance （RoHS 指令適用について）

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14. Reliability test results

Reliability Test Items

Test categories		Test items	Test methods and conditions	Reference norms EIAJ ED-4701 (Aug.-2001 edition)	Number of sample	Acceptance number
Mechanical Tests	1	Terminal Strength (Pull test)	Pull force : 20N (Control terminal) 40N (Main terminal) Test time : 10±1 sec.	Test Method 401 Method>	5	(0 : 1)
	2	Mounting Strength	Screw torque : 2.5 ~ 3.5 N·m (M5) 3.5 ~ 4.5 N·m (M6) Test time : 10±1 sec.	Test Method 402 method>	5	(0 : 1)
	3	Vibration	Range of frequency : 10 ~ 500Hz Sweeping time : 15 min. Acceleration : 100m/s^2 Sweeping direction : Each X,Y,Z axis Test time : 6 hr. (2hr./direction)	Test Method 403 Reference 1 Condition code B	5	(0 : 1)
	4	Shock	Maximum acceleration : 5000m/s^2 Pulse width : 1.0msec. Direction : Each X,Y,Z axis Test time : 3 times/direction	Test Method 404 Condition code B	5	(0 : 1)
	5	Solderabitlity	Solder temp. : 245±5 = Immersion time : 5±0.5sec. Test time : 1 time Solder Alloy : Sn-Ag-Cu Each terminal should be Immersed in solder within 1~1.5mm from the body.	Test Method 303	5	(0 : 1)
	6	Resistance to Soldering Heat	Solder temp. : 260±5 = Immersion time : 10±1sec. Test time : 1 time Each terminal should be Immersed in solder within 1~1.5mm from the body.	Test Method 302 Condition code A	5	(0 : 1)
Environment Tests	1	High Temperature Storage	Storage temp. : 125±5 = Test duration : 1000hr.	Test Method 201	5	(0 : 1)
	2	Low Temperature Storage	Storage temp. : -40±5 = Test duration : 1000hr.	Test Method 202	5	(0 : 1)
	3	Temperature Humidity Storage	Storage temp. : 85±2 = Relative humidity : 85±5% Test duration : 1000hr.	Test Method 103 Test code C	5	(0 : 1)
	4	Unsaturated Pressurized Vapor	Test temp. : 120: 2 = Test humidity : 85±5% Test duration : 96hr.	Test Method 103 Test code E	5	(0 : 1)
	5	Temperature Cycle	Test temp. : Low temp. -40: 5 = High temp. 125 : 5 = RT 5 ~ 35 = Dwell time : High ~ RT ~ Low ~ RT 1hr. 0.5hr. 1hr. 0.5hr. Number of cycles : 100 cycles	Test Method 105	5	(0 : 1)
	6	Thermal Shock	Test temp. : High temp. 100^{+0}_{-5} = Low temp. 0^{+5}_{-0} = Used liquid : Water with ice and boiling water Dipping time : 5 min. par each temp. Transfer time : 10 sec. Number of cycles : 10 cycles	Test Method 307 method > Condition code A	5	(0 : 1)

Reliability Test Items

Test categories		Test items	Test methods and conditions	Reference norms EIAJ ED-4701 (Aug.-2001 edition)	Number of sample	Acceptance number
Endurance Tests	1	High temperature Reverse Bias (for Collector-Emitter)	Test temp. : Ta = 125: 5 = (Tj > 150 =) Bias Voltage : VC = 0.8×VCES Bias Method : Applied DC voltage to C-E VGE = 0V Test duration : 1000hr.	Test Method 101	5	(0 : 1)
	2	High temperature Bias (for gate)	Test temp. : Ta = 125: 5 = (Tj > 150 =) Bias Voltage : VC = VGE = +20V or -20V Bias Method : Applied DC voltage to G-E VCE = 0V Test duration : 1000hr.	Test Method 101	5	(0 : 1)
	3	Temperature Humidity Bias	Test temp. : 85: 2 °C Relative humidity : 85: 5% Bias Voltage : VC = 0.8×VCES Bias Method : Applied DC voltage to C-E VGE = 0V Test duration : 1000hr.	Test Method 102 Condition code C	5	(0 : 1)
	4	Intermitted Operating Life (Power cycle) (for IGBT)	ON time : 2 sec. OFF time : 18 sec. Test temp. : Δ Tj=100±5 deg Tj > 150 = , Ta=25±5 = Number of cycles : 15000 cycles	Test Method 106	5	(0 : 1)

Failure Criteria

Item	Characteristic		Symbol	Failure criteria Lower limit	Failure criteria Upper limit	Unit	Note
Electrical characteristic	Leakage current		ICES	-	USL×2	mA	
			±IGES	-	USL×2	μA	
	Gate threshold voltage		VGE(th)	LSL×0.8	USL×1.2	mA	
	Saturation voltage		VCE(sat)	-	USL×1.2	V	
	Forward voltage		VF	-	USL×1.2	V	
	Thermal resistance	IGBT	Δ VGE or Δ VCE	-	USL×1.2	mV	
		FWD	Δ VF	-	USL×1.2	mV	
	Isolation voltage		Viso	Broken insulation		-	
Visual inspection	Visual inspection ┌ Peeling ┌ Plating └ and the others		-	The visual sample		-	

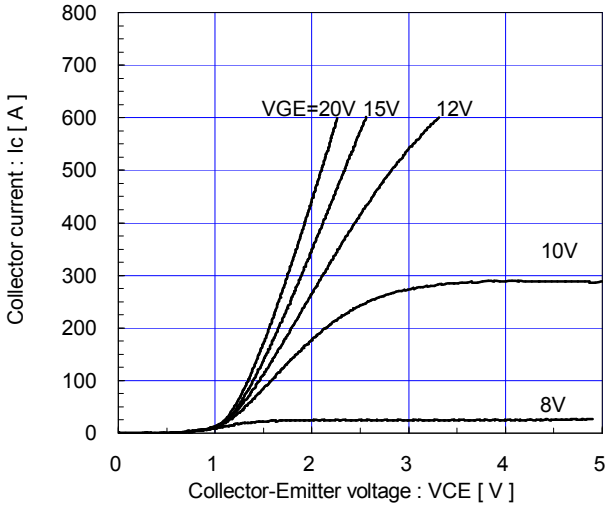
LSL : Lower specified limit.
USL : Upper specified limit.

Note: Each parameter measurement read-outs shall be made after stabilizing the components at room ambient for 2 hours minimum, 24 hours maximum after removal from the tests. And in case of the wetting tests, for example, moisture resistance tests, each component shall be made wipe or dry completely before the measurement.

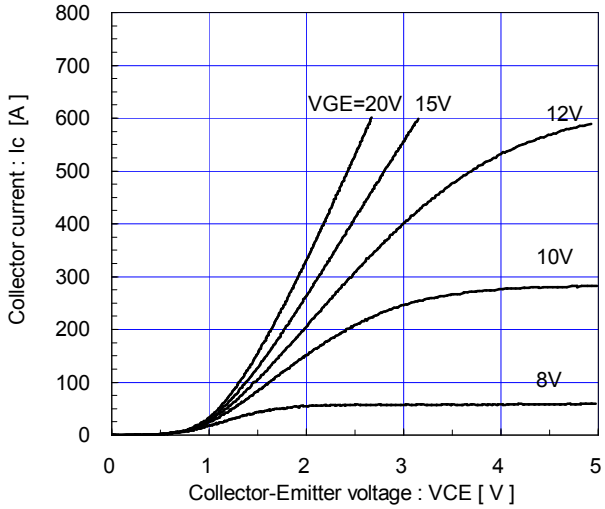
Reliability Test Results

Test categories		Test items	Reference norms EIAJ ED-4701 (Aug.-2001 edition)	Number of test sample	Number of failure sample
Mechanical Tests	1	Terminal Strength (Pull test)	Test Method 401 Method>	5	0
	2	Mounting Strength	Test Method 402 method>	5	0
	3	Vibration	Test Method 403 Condition code B	5	0
	4	Shock	Test Method 404 Condition code B	5	0
	5	Solderabitlity	Test Method 303	5	0
	6	Resistance to Soldering Heat	Test Method 302 Condition code A	5	0
Environment Tests	1	High Temperature Storage	Test Method 201	5	0
	2	Low Temperature Storage	Test Method 202	5	0
	3	Temperature Humidity Storage	Test Method 103 Test code C	5	0
	4	Unsaturated Pressurized Vapor	Test Method 103 Test code E	5	0
	5	Temperature Cycle	Test Method 105	5	0
	6	Thermal Shock	Test Method 307 method > Condition code A	5	0
Endurance Tests	1	High temperature Reverse Bias	Test Method 101	5	0
	2	High temperature Bias (for gate)	Test Method 101	5	0
	3	Temperature Humidity Bias	Test Method 102 Condition code C	5	0
	4	Intermitted Operating Life (Power cycling) (for IGBT)	Test Method 106	5	0

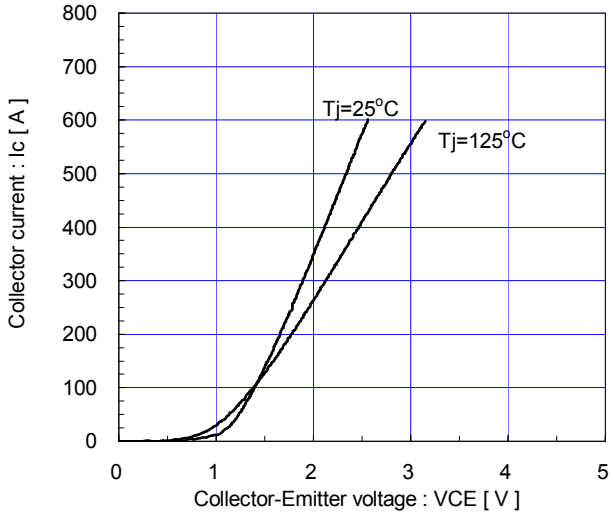
Collector current vs. Collector-Emitter voltage (typ.)
Tj=25°C / chip



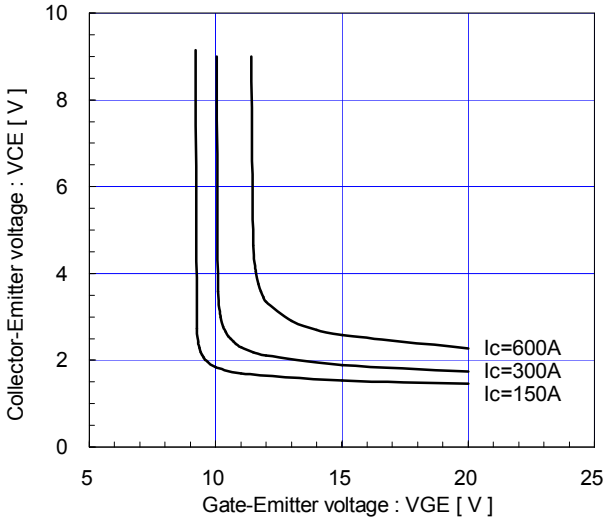
Collector current vs. Collector-Emitter voltage (typ.)
Tj=125°C / chip



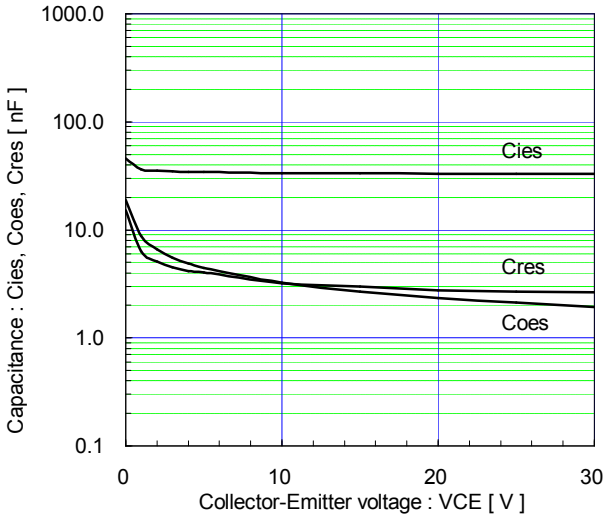
Collector current vs. Collector-Emitter voltage (typ.)
VGE=15V / chip



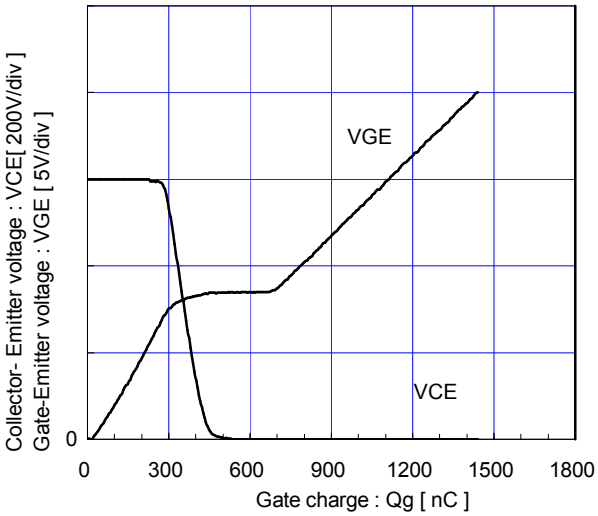
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
Tj=25°C / chip



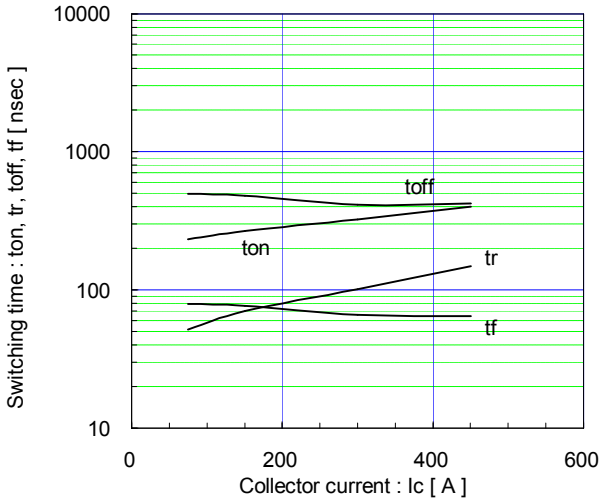
Capacitance vs. Collector-Emitter voltage (typ.)
VGE=0V, f=1MHz, Tj=25°C



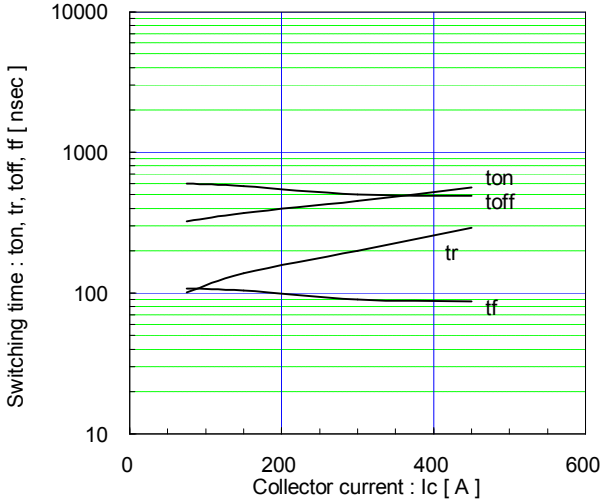
Dynamic Gate charge (typ.)
Vcc=600V, Ic=300A, Tj=25°C



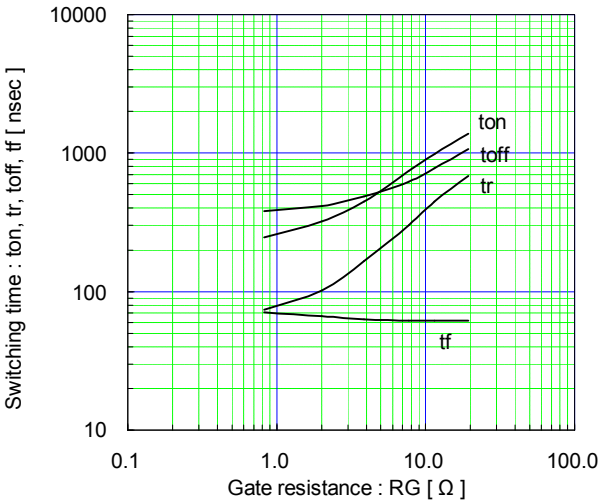
Switching time vs. Collector current (typ.)
Vcc=600V, VGE=±15V, RG=2.0Ω, Tj=25°C



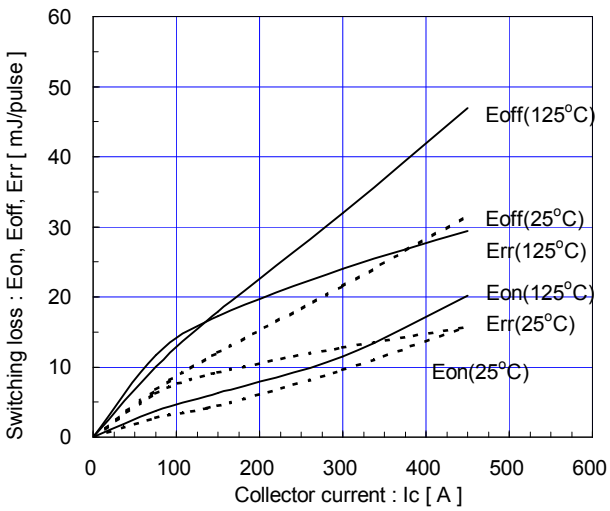
Switching time vs. Collector current (typ.)
Vcc=600V, VGE=±15V, RG=2.0Ω, Tj=125°C



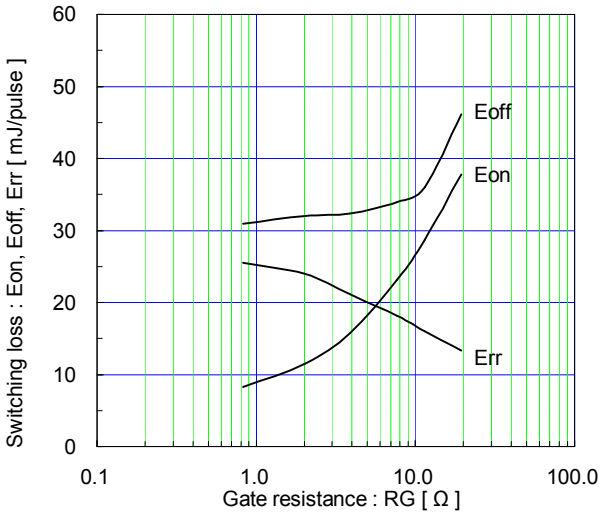
Switching time vs. Gate resistance (typ.)
Vcc=600V, Ic=300A, VGE=±15V, Tj=25°C



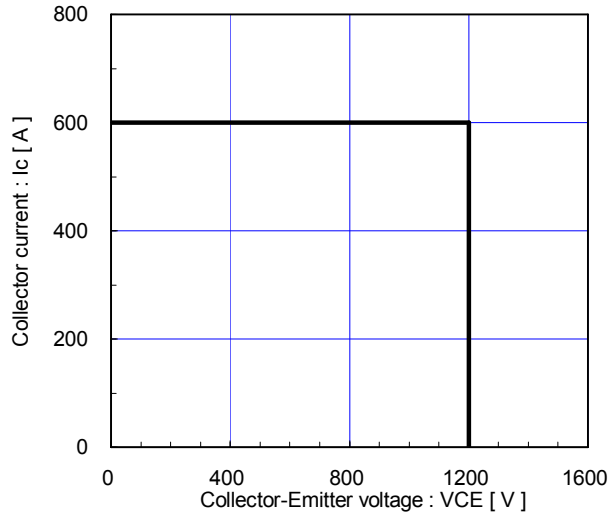
Switching loss vs. Collector current (typ.)
Vcc=600V, VGE=±15V, RG=2.0Ω



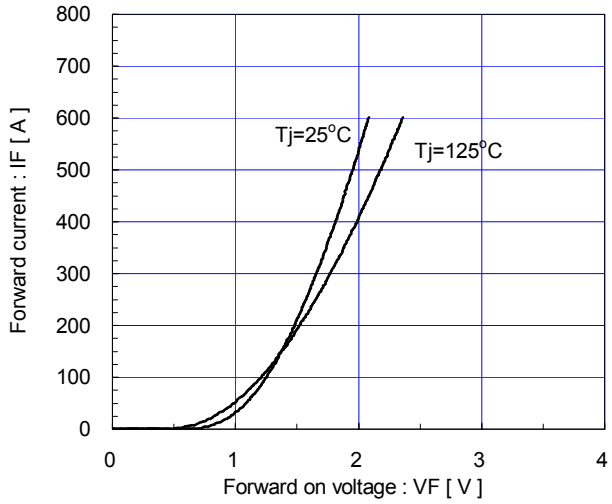
Switching loss vs. Gate resistance (typ.)
Vcc=600V, Ic=300A, VGE=±15V, Tj=125°C



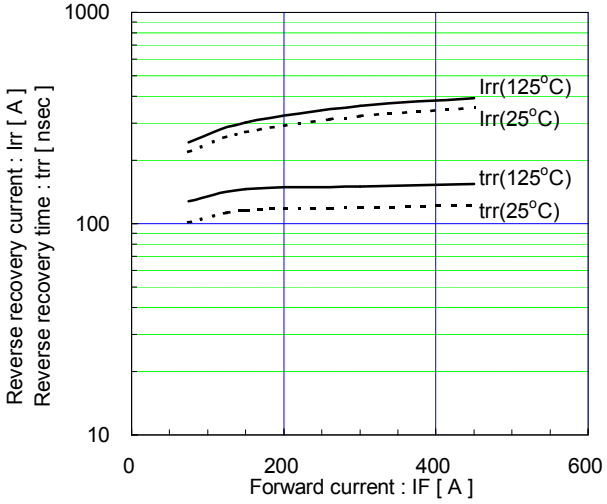
Reverse bias safe operating area (max.)
+VGE=15V, -VGE <= 15V, RG >= 2.0Ω, Tj <= 125°C
Stray inductance <= 100nH



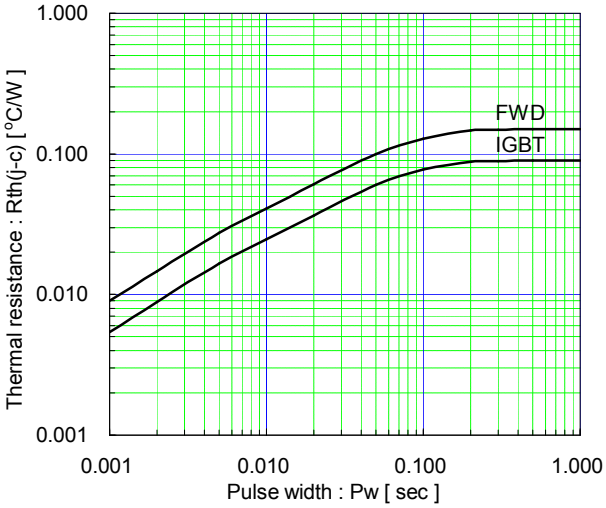
Forward current vs. Forward on voltage (typ.)
chip



Reverse recovery characteristics (typ.)
Vcc=600V, VGE=±15V, RG=2.0Ω

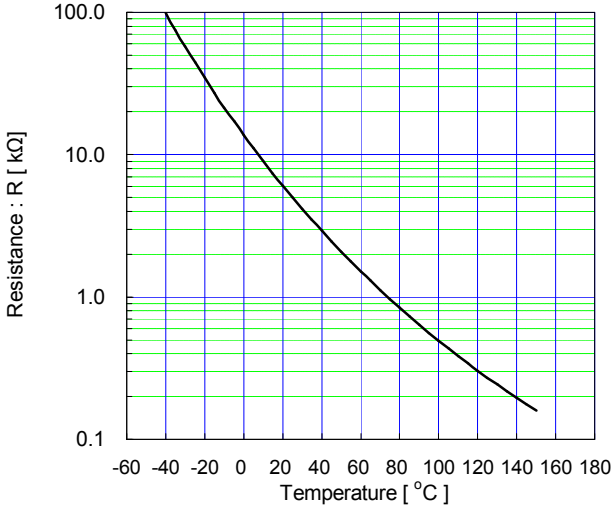


Transient thermal resistance (max.)



[Thermistor]

Temperature characteristic (typ.)



Warnings

- This product shall be used within its absolute maximum rating (voltage, current, and temperature).AThis product may be broken in case of using beyond the ratings.
-~ B1 o p B5 B5 y B 2 %IBB1%] B* BBA o p BU B) BBN+A 6 B BBN ' BBBMA

- Connect adequate fuse or protector of circuit between three-phase line and this product to prevent the equipment from causing secondary destruction, such as fire, its spreading, or explosion.
B1 B1P B* 6 B BB ' BU(BA 5 B+ -~ B14FB.1 B- 2 B1BBB Bu B2B B B BfB BU B B)+ 4 B Bg ~ %IB1B4 BU4 B B*BB BBA

- Use this product after realizing enough working on environment and considering of product's reliability life. This product may be broken before target life of the system in case of using beyond the product's reliability life.
-~ B1 c BU B. BA-~ B1> 5 H n B) / B*BBN . B1 A -~ BU BB) BBA-~ B1> 5 H n BU B) BB ' A-] ' B1 n BKM B. 6 B BBN ' BBBMA

- If the product had been used in the environment with acid, organic matter, and corrosive gas (hydrogen sulfide, sulfurous acid gas), the product's performance and appearance can not be ensured easily.
2DB- B(6)H BgBtB B] 2DBgBt%BBUe BCc B* BBCB ' A-~ (B - %IB1 .=B2B*BBAB\A

- Use this product within the power cycle curve (Technical Rep.No. : MT5F12959). Power cycle capability is classified to delta-Tj mode which is stated as above and delta-Tc mode. Delta-Tc mode is due to rise and down of case temperature (Tc), and depends on cooling design of equipment which use this product. In application which has such frequent rise and down of Tc, well consideration of product life time is necessary.
-~ B2AB B B BpB BjB n BfB B B* BB:: -/ ±: : :::w: : : : : : : :AB B B BpB BjB (42 B.B2BB1<1: :B.BKN ' B1 B.A<1: : B.BKN ' B BBBMA ABBCB2BIB Bt 2 :: : :B1 4 B.BKN BtBB BtB*BBW -~ BUB BBN4 B1 .3 .B.= BBAB ABIB Bt 2 B1 4 B 5 'e B./ BBN ' B2A-~ n B. BB)B BB\A

- Never add mechanical stress to deform the main or control terminal. The deformed terminal may cause poor contact problem.
%%5 B6 %5 B. BU B) BB B-B B* BB AA%5 B1 B.BKW .) B-B,BU B/ BB ' BBBMA

- Use this product with keeping the cooling fin's flatness between screw holes within 100um at 100mm and the roughness within 10um. Also keep the tightening torque within the limits of this specification. Too large convex of cooling fin may cause isolation breakdown and this may lead to a critical accident. On the other hand, too large concave of cooling fin makes gap between this product and the fin bigger, then, thermal conductivity will be worse and over heat destruction may occur.
B BBB B2B Bs BM B ' 4FB* 2 BU100mmB*100um A-+5YB1 BB210um B.BB) BB AA1 B- BM B BBB BBMBN+ -~ B '< BU BBA2 P. B. BBN ' BBBMA ABA A1 B- BBGBIB BB%IB BBN+A -~ B+ BBBB14FB. 4×B BB) B BB-BW B.'I BBN BBBBMA

- In case of mounting this product on cooling fin, use thermal compound to secure thermal conductivity. If the thermal compound amount was not enough or its applying method was not suitable, its spreading will not be enough, then, thermal conductivity will be worse and thermal run away destruction may occur.
Confirm spreading state of the thermal compound when its applying to this product.
(Spreading state of the thermal compound can be confirmed by removing this product after mounting.)
6 BU BBB B. BM B BM4 B.B2A BU BBN BBB1BB BaB B%BUB BB BBA A 2 B / BB BW : B 1 B B BBMBN+A BB BaB BBU BBM4 B.B2A-~ K 5YB.BB BaB BB B) BBN BU .z BB) BB BA BB B. 6 BU BM2B BB BaB BB1 B BM ' BU .z BBN B BA: :s -] BB B. 6 BU BM2B BB BaB BB1 B BM ' BU .z BBN B BA:

- It shall be confirmed that IGBT's operating locus of the turn-off voltage and current are within the RBSOA specification. This product may be broken if the locus is out of the RBSOA.
B2B B BaB 5 B5 y B1G 0 0 B : : : :] B.BBN BU .z BB) BB A: : : : B1% BU B) BBN+ 6 B BBN (H B BBMA

- If excessive static electricity is applied to the control terminals, the devices may be broken. Implement some countermeasures against static electricity.
%5 B.1 B-5F5 B BB B ' A 6 B BBN ' BBBMA BM B(B25F5 %BU BB) BB A

Warnings

- Never add the excessive mechanical stress to the main or control terminals when the product is applied to equipments. The module structure may be broken.
  6 BU J ' B.s -] B BN4 B.A%%5 BG %5 B.1 B- BU BB-B B* BB A%5 t 1g B BN (H B B BMAB A
- In case of insufficient -VGE, erroneous turn-on of IGBT may occur. -VGE shall be set enough value to prevent this malfunction. (Recommended value : -VGE = -15V)
  1R B B]BtBrB B5 : :-: : B / BBAB B+ P BU BB (H B B BMAB A. P BU BBB-B Q B.: :-: : B2 B-o B* .3 o BB) BB AAB Q o :ww.-: : :w.w. : :-:
- In case of higher turn-on dv/dt of IGBT, erroneous turn-on of opposite arm IGBT may occur. Use this product in the most suitable drive conditions, such as +VGE, -VGE, RG to prevent the malfunction.
  B2 B B BeB :w. : : : :w 7 B B+ B]B B B1CCCB. P BU BB (H B B BMAB A. P BU BBB-B Q B1 1 B-BB B B B :-: : : :w.-: : : :w: %BB*B BB A
- This product may be broken by avalanche in case of VCE beyond maximum rating VCES is applied between C-E terminals. Use this product within its absolute maximum voltage.
  :-: : : BV B B 5 B B BBOB ' AB]B B B BrBBV BBB) 6 B B! ' B B BMAB A:-: : B2 B o p B1%] B*B BB A

: : : : :: : :

- Fuji Electric Device Technology is constantly making every endeavor to improve the product quality and reliability. However, semiconductor products may rarely happen to fail or malfunction. To prevent accidents causing injury or death, damage to property like by fire, and other social damage resulted from a failure or malfunction of the Fuji Electric Device Technology semiconductor products, take some measures to keep safety such as redundant design, spread-fire-preventive design, and malfunction-protective design.
  5 B B BBtB BjBB BsB B2 B B-~ B1 / B 5 H B10 B. BDB)B BAB ABB BA -~ B2 4 B BB BW . G B BN ' B B BMAB A 5 B B BBtB BjBB BsB -~ -~ B1 4 BAB B2 G B A B+BB)q 0 P B+ 4 %lB.BK3Kw B. B BN BG B- BU BBB-B BK3B.I 43.3 . Bg ~ 4 [.3 . B. G 4 [.3 . B-B, K B1B BDB1 BU BB) BB A
- The application examples described in this specification only explain typical ones that used the Fuji Electric Device Technology products. This specification never ensure to enforce the industrial property and other rights, nor license the enforcement rights.
  B..%0 BB)B BN B2A 5 B B BBtB BjBB BsB -~ BU BB -+ B- BU B BMBB1B*B BW
  B.BK3B) : - +- AB B1 +- B1s B. B BN 4 BAB B2s +- B1 5 . BU BBB1B*B2B BMAB B\A
- The product described in this specification is not designed nor made for being applied to the equipment or systems used under life-threatening situations. When you consider applying the product of this specification to particular used, such as vehicle-mounted units, shipboard equipment, aerospace equipment, medical devices, atomic control systems and submarine relaying equipment or systems,Aplease apply after confirmation of this product to be satisfied about system construction and required reliability.
  B..%0 BBOB -~ B2Aq n B.B BRBNK3B- A+ B* BBOBN z B BNB B2BrBtB B B. B BBOBNB B+BU B+BB).3 . B-~1g BBOB BB1B*B2B BMAB B\A B1-~ BU0 z A))~A)v] n A n z A 6 A) z B BNB B2BrBtB B B-B,A v 1 B B1B BU B . B14 B2ABrBtB B t B6- / B.) / B BNB B+BB .z B1 AB B BB A

If there is any unclear matter in this specification, please contact Fuji Electric Device Technology Co.,Ltd.