MBB500TX7B

Preliminary Specification

Silicon N-channel IGBT

1. FEATURES

* High speed, low loss IGBT module.
* Low driving power:
  Low input capacitance advanced IGBT.
* Low thermal impedance due to direct liquid cooling.
* High reliability, high durability module.
* Temperature sensor with NTC thermistor.

2. ABSOLUTE MAXIMUM RATINGS (Tc=25ºC)

Item		Symbol	Unit	Specification	
Collector Emitter Voltage		V_{CES}	V	750	(4)
Gate Emitter Voltage		V_{GES}	V	±20	
Collector Current	DC	I_C	A	500	
	1ms	I_{Cp}		1000	
Forward Current	DC	I_F	A	500	
	1ms	I_{FM}		1000	
Maximum Junction Temperature		T_{jmax}	ºC	175	
Temperature under switching conditions		T_{jop}	ºC	-40 ~ +175	
Storage Temperature		T_{stg}	ºC	-40 ~ +125	
Isolation Voltage		V_{ISO}	V_{RMS}	2,500 (AC 1 minute)	
Screw Torque	Terminals (M6)	-	N·m	6.0	(1)
	Mounting (M5)	-		4.0	(2)
	PCB Mounting (M3)	-		0.8	(3)

Notes: Recommended Value (1)5.5±0.5N·m, (2)3.5±0.5N·m, (3)0.65±0.15N·m.
(4)Please refer to figure of V_{CES} vs. Tc on the section 6. Static characteristics.

3. ELECTRICAL CHARACTERISTICS

Item		Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Collector Emitter Cut-Off Current		I_{CES}	mA	-	-	1.0	Vce=750V, Vge=0V, Tj=25ºC
Gate Emitter Leakage Current		I_{GES}	nA	-	-	±500	Vge=±20V, Vce=0V, Tj=25ºC
Collector Emitter Saturation Voltage		V_{CEsat}	V	-	1.46	1.88	Ic=500A, Vge=15V, Tj=25ºC
				-	1.65	-	Ic=500A, Vge=15V, Tj=150ºC
				-	1.67	-	Ic=500A, Vge=15V, Tj=175ºC
Gate Emitter Threshold Voltage		$V_{GE(th)}$	V	6.0	6.5	7.0	Vce=5V, Ic=500mA, Tj=25ºC
Input Capacitance		C_{ies}	nF	-	7.7	-	Vce=10V, Vge=0V, f=100kHz, Tj=25ºC
Switching Times	Rise Time	t_r	μs	-	0.09	0.23	Vcc=400V, Ic=500A, Ls=30nH, R(ext)(on/off)=15Ω/15Ω, Cge=0nF Vge=+15V/-15V, Tj=150ºC Inductive load
	Turn On Time	t_{on}		-	0.26	0.48	
	Fall Time	t_f		-	0.12	0.46	
	Turn Off Time	t_{off}		-	0.44	0.74	
Peak Forward Voltage Drop		V_F	V	-	1.57	1.98	If=500A, V_{GE}=0V, Tj=25ºC
				-	1.55	-	If=500A, V_{GE}=0V, Tj=150ºC
				-	1.51	-	If=500A, V_{GE}=0V, Tj=175ºC
Reverse Recovery Time		t_{rr}	μs	-	0.35	0.74	V_{CC}=400V, Ic=500A, Ls=30nH, Rg(ext)(on/off)=15Ω/15Ω, Cge=0nF Vge=+15V/-15V, Tj=150ºC Inductive load
Turn On Loss		E_{on}	mJ/P	-	16	42	
Turn Off Loss		E_{off}	mJ/P	-	34	49	
Reverse Recovery Loss		E_{rr}	mJ/P	-	25	48	
Thermistor Resistance		R	kΩ	-	5	-	Tc=25 ºC
				-	0.16	-	Tc=150 ºC
Leakage Current between Thermistor and Other Terminals			mA	-	-	0.1	V=750Vp
SC data		Isc	A	-	2400	-	Vcc=400V, Vge≦15V, Tj=150 ºC, Rg(ext)(on/off)≧15Ω/15Ω, tsc≦6μs
Thermal Resistance	IGBT	$R_{th(j-w)}$	K/W	-	-	0.216	Junction to water/fin, 10l/min, 50%LLC (per 1 arm)
	FWD	$R_{th(j-w)}$	K/W	-	-	0.275	

* Please contact our representatives at order.
* For improvement, specifications are subject to change without notice.
* For actual application, please confirm this spec sheet is the newest revision.
* ELECTRICAL CHARACTERISTIC items shown in above table are according to IEC 60747–2 and IEC 60747–9.
* Switching loss depends on Ls, gate driver, Cge, Vge, etc.
  Please optimize those values so that switching surge voltage does not exceed the rating voltage.

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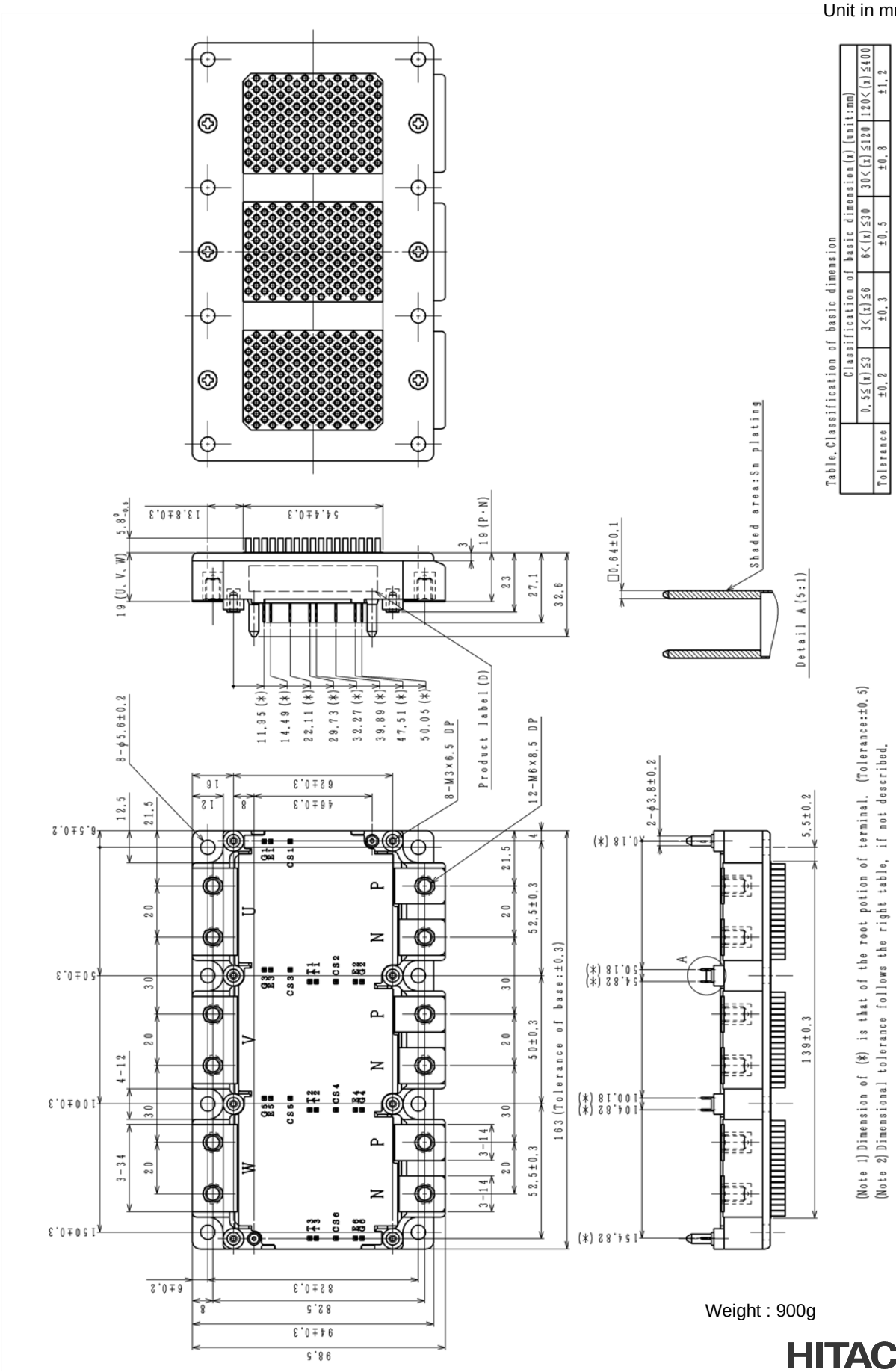
4. PACKAGE OUTLINE DRAWING

Unit in mm



Weight : 900g

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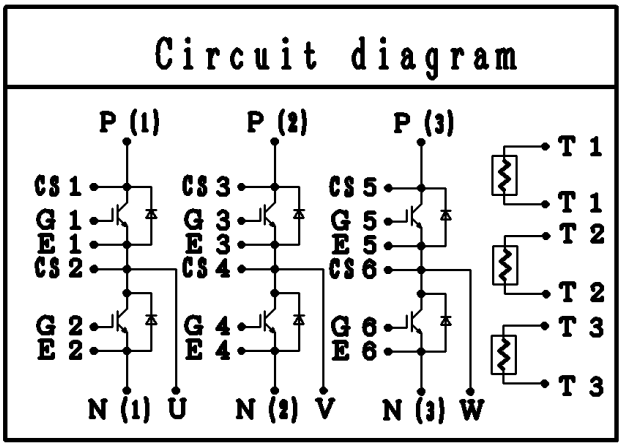
5. CIRCUIT DIAGRAM



Thermistor T1, T2 and T3 are located on the same ceramic substrate with the IGBT and diode chips of phase U, V and W, respectively.

Note: This temperature measurement is not suitable for the short circuit or short term over-load detection and should be used only for the module protection against long term overload or malfunction of the cooling system.

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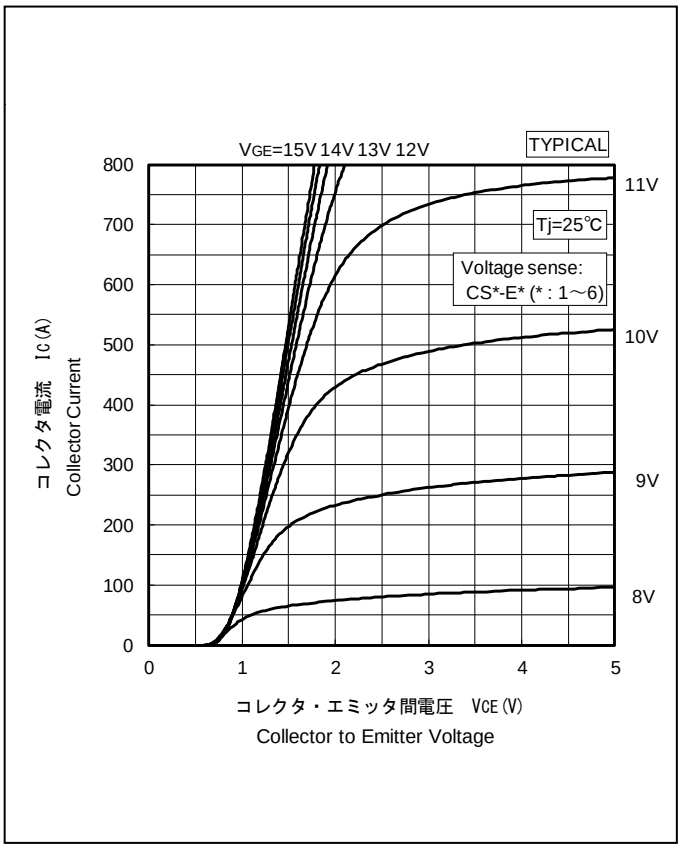
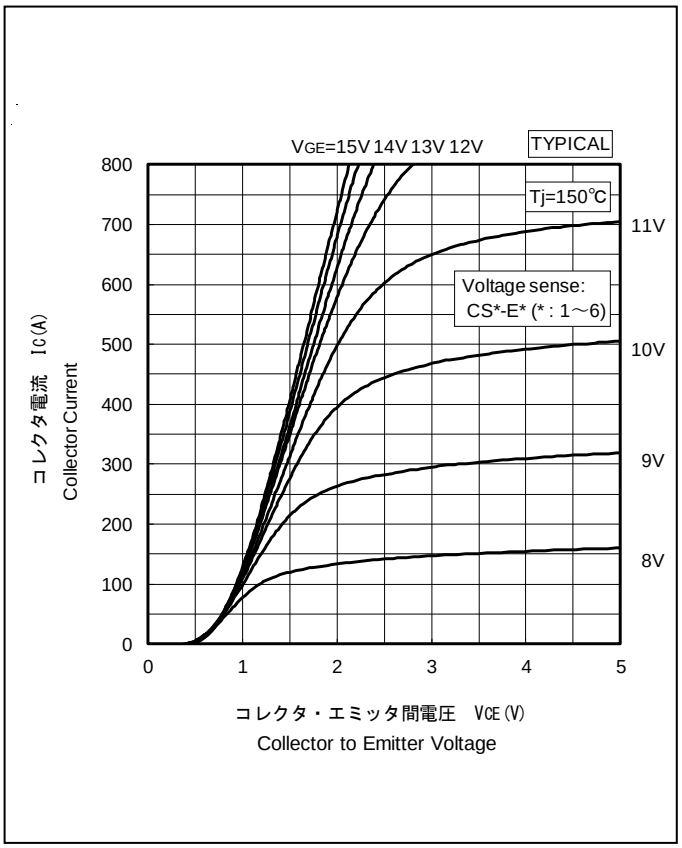
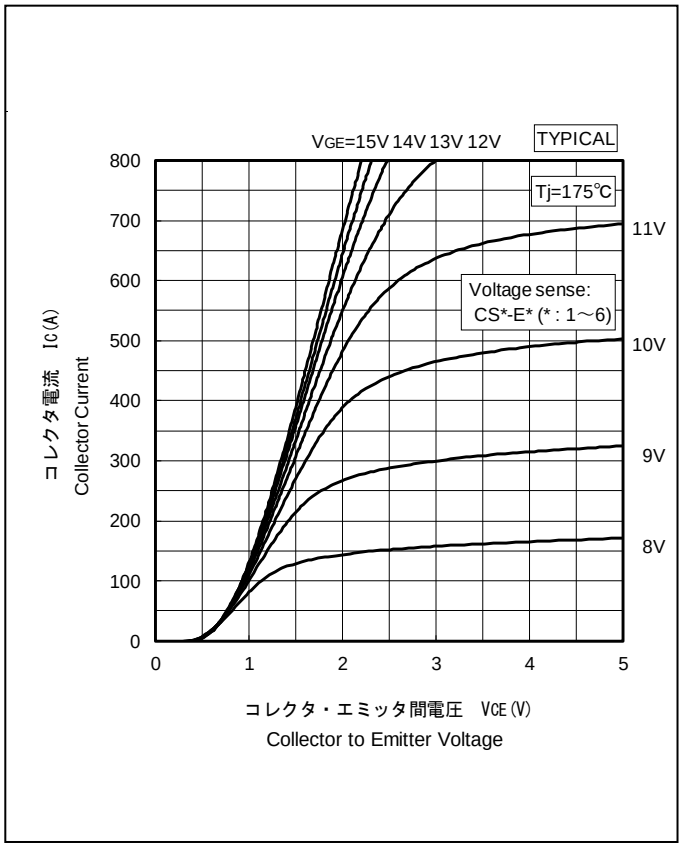
6. STATIC CHARACTERISTICS



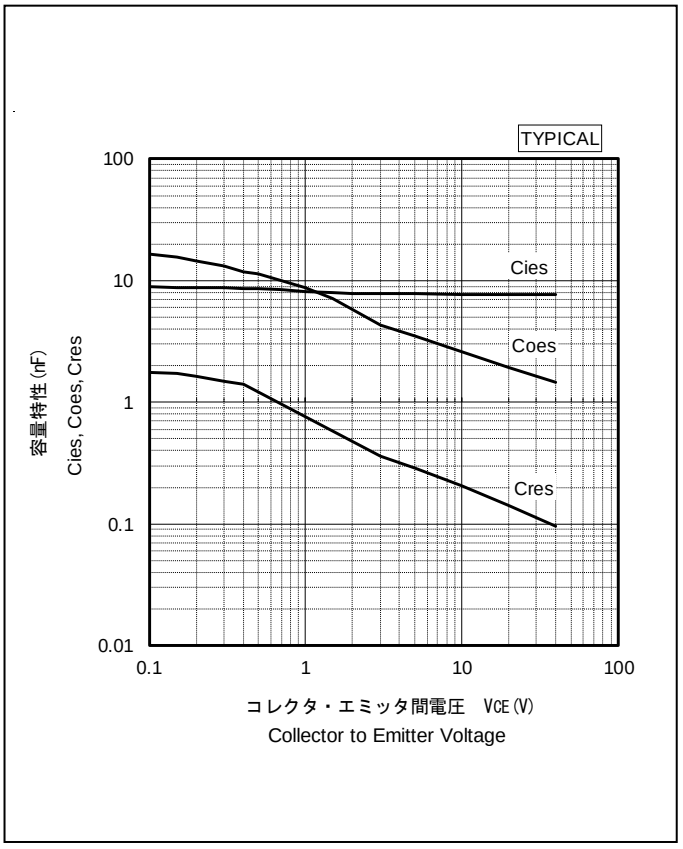
Collector Current vs. Collector to Emitter Voltage



Collector Current vs. Collector to Emitter Voltage



Collector Current vs. Collector to Emitter Voltage



Capacitance Characteristics

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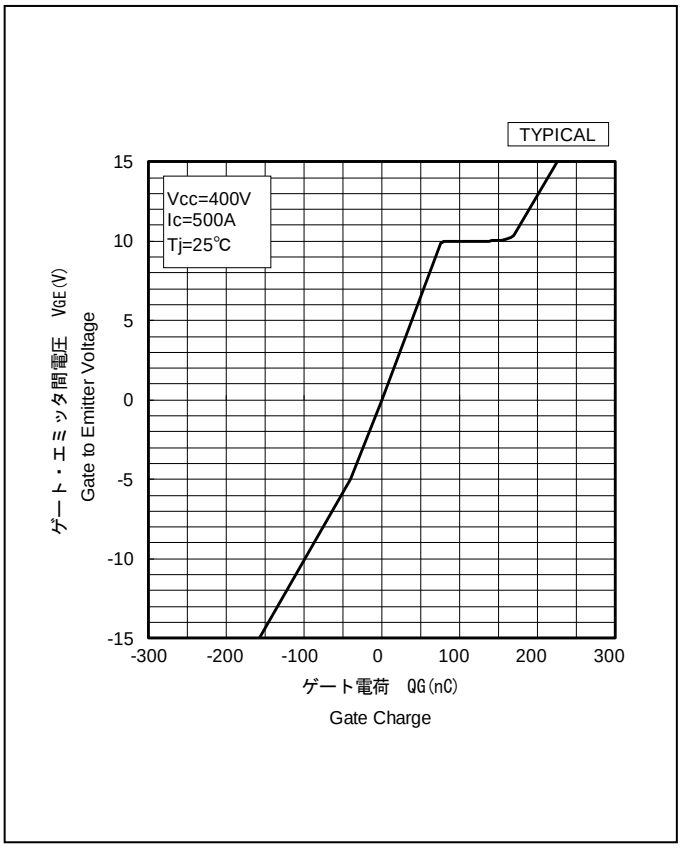
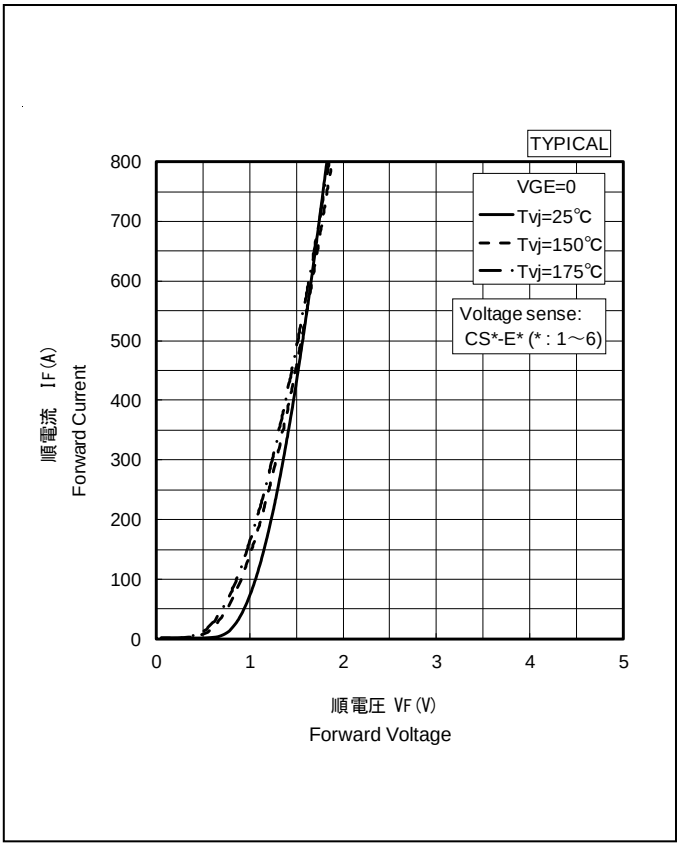
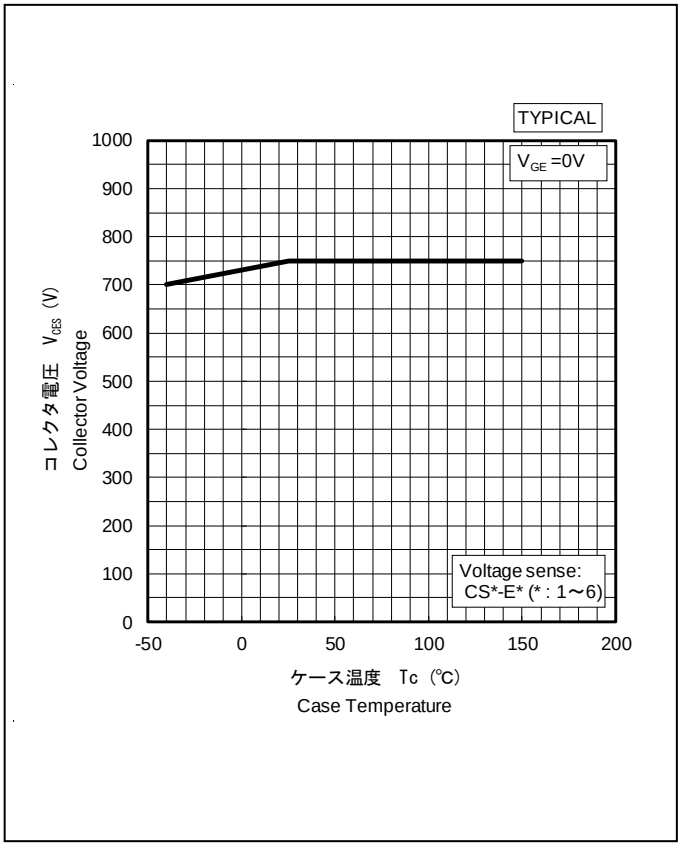


Gate Charge Characteristics



Forward Voltage of Free-Wheeling Diode



Collector Emitter Voltage vs. Case Temperature

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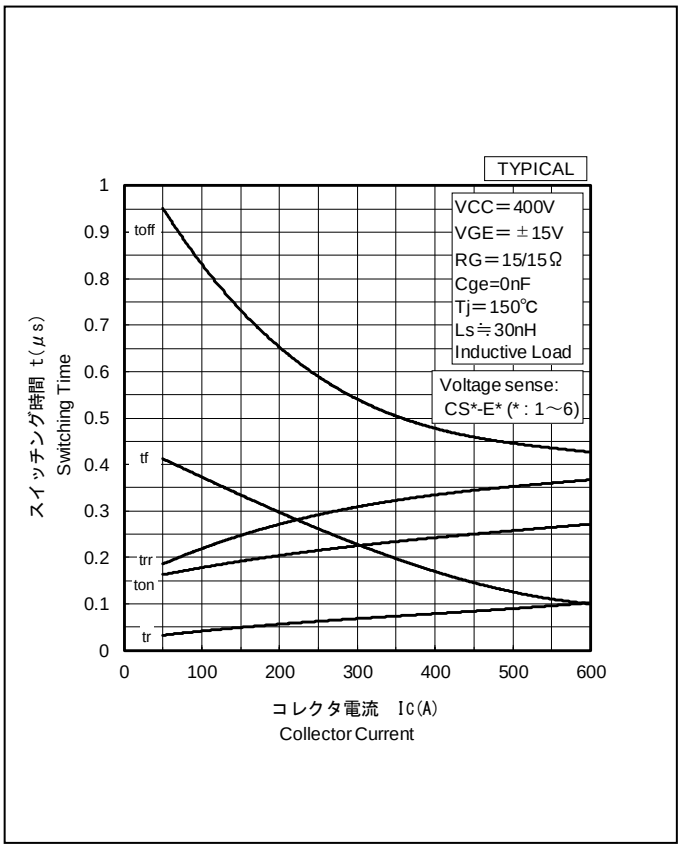
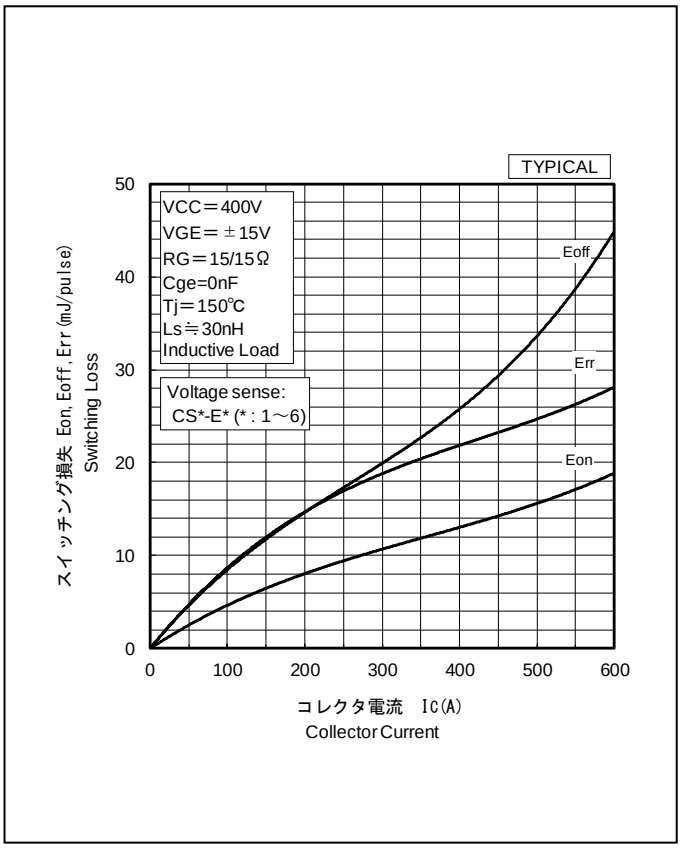
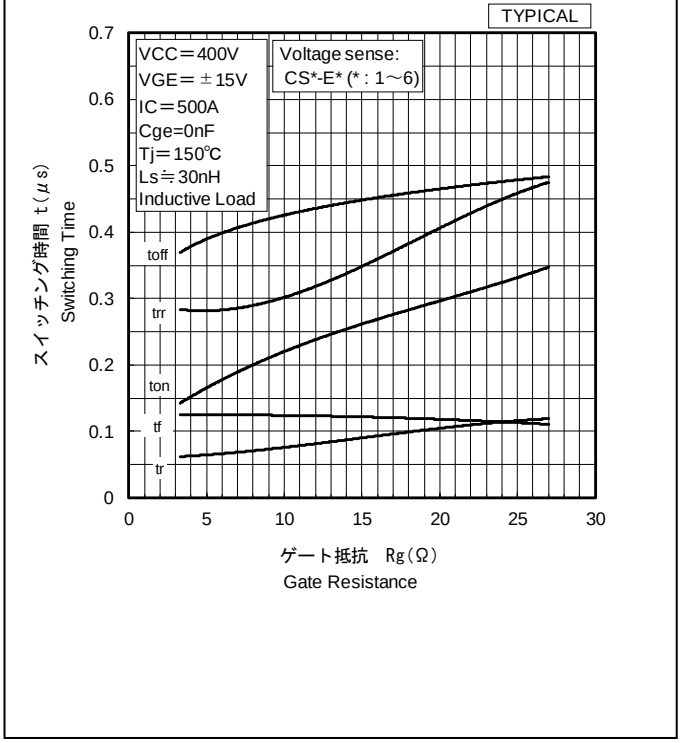
7. DYNAMIC CHARACTERISTICS



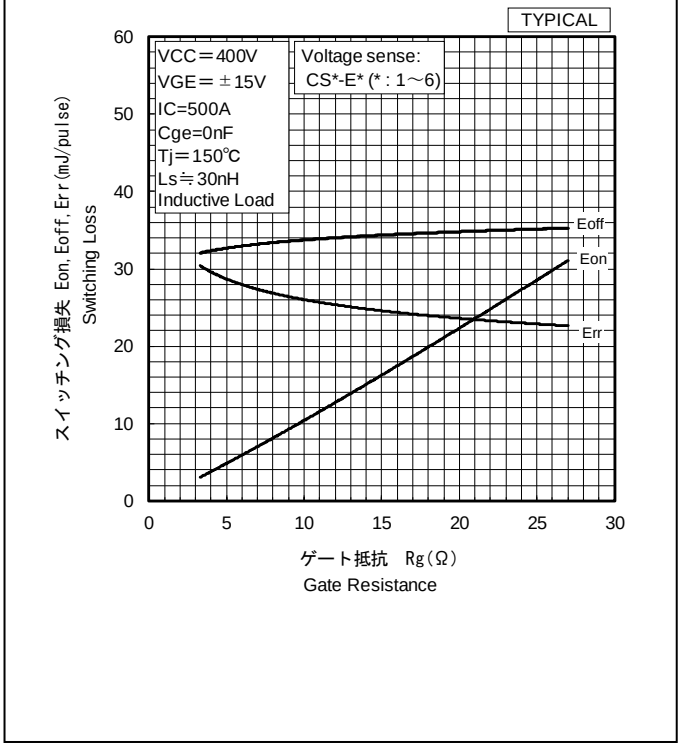
Switching Time vs. Collector Current



Switching Loss vs. Collector Current



Switching Time vs. Gate Resistance



Switching Loss vs. Gate Resistance

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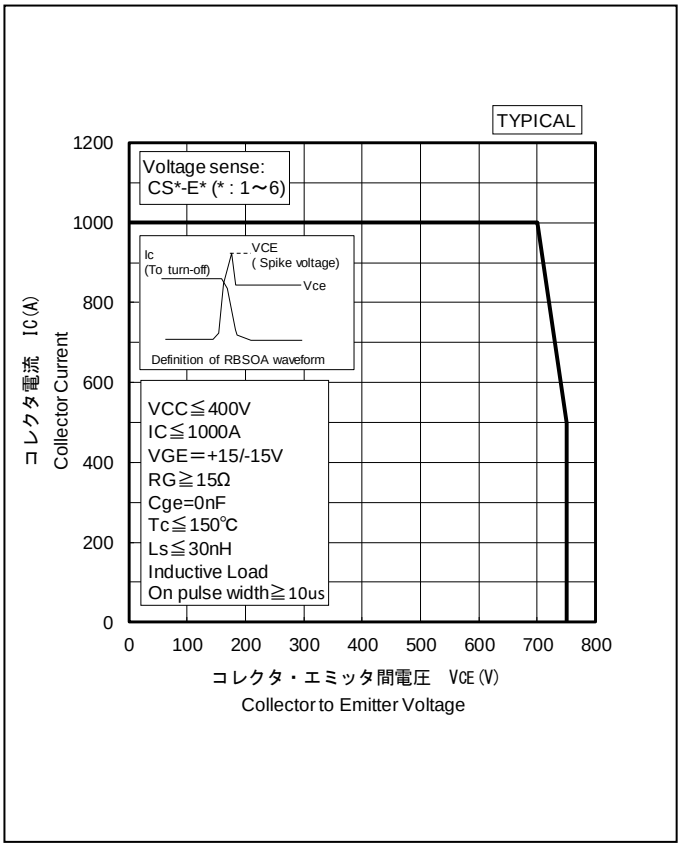
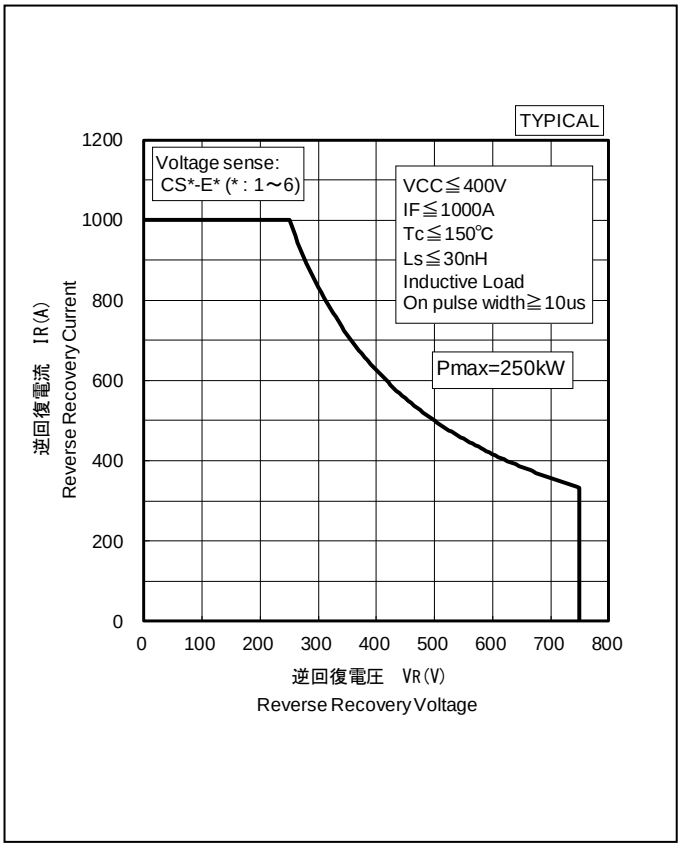


Reverse Biased Safety Operating Area



Reverse Recovery Safety Operating Area

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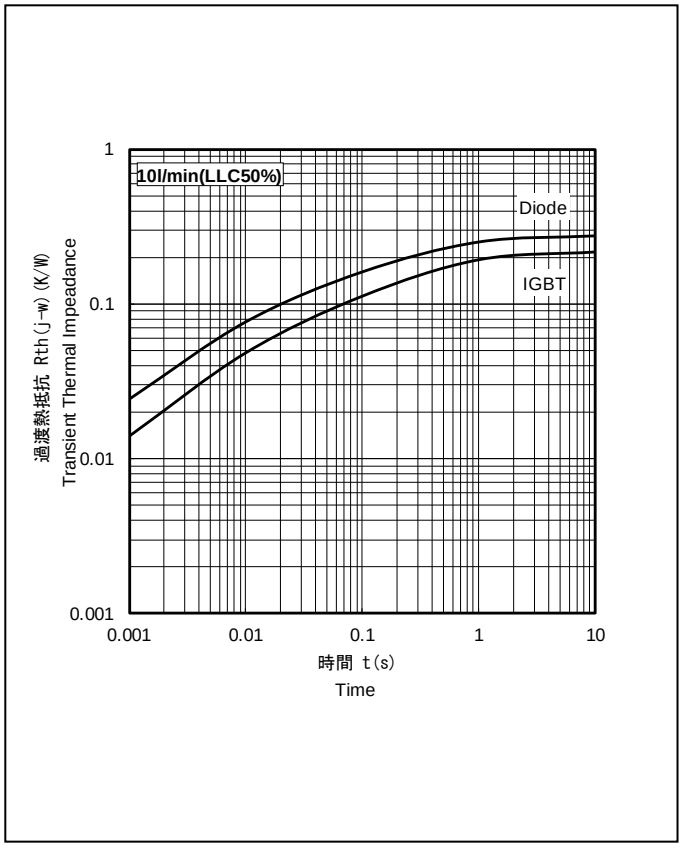
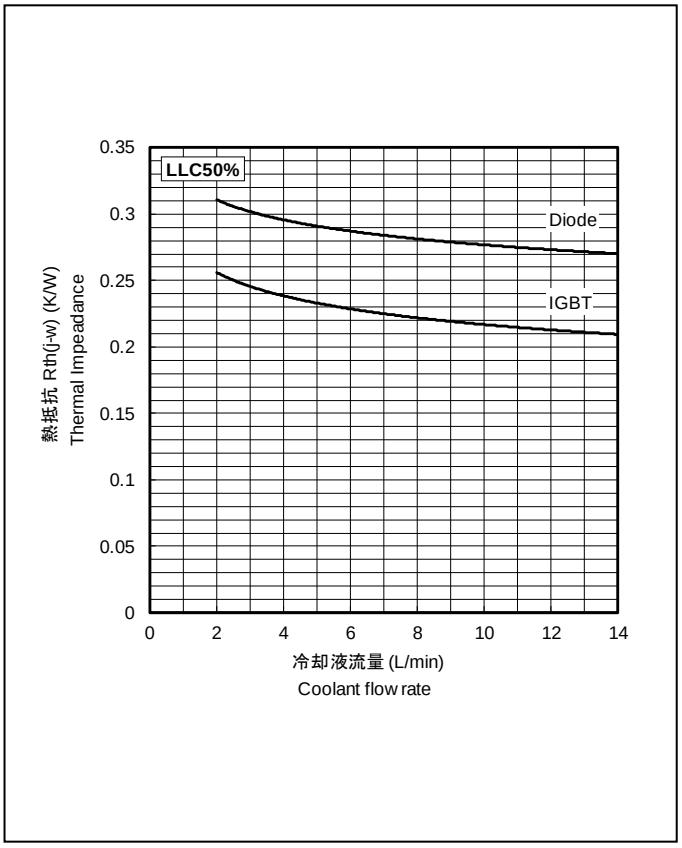
8. THERMAL CHARACTERISTICS



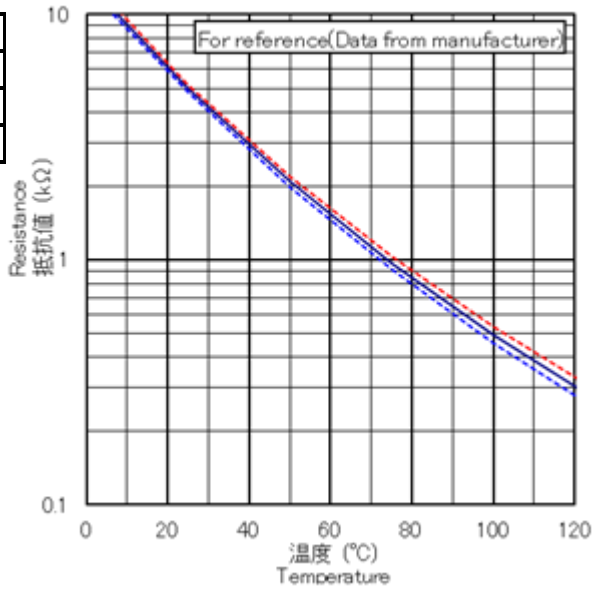
Transient Thermal Impedance Characteristics



Transient Thermal Impedance vs. Coolant flow rate

Table1 Specifications of Thermistor(For reference)

Nominal zero-power resistance	5kΩ±3%(25℃)
B value	3375K±2%(25～50℃)
Operating temperature range	-50～150℃
Thermal time constant(in still air)	Approx. 10 sec.



Resistance vs. Temperature

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9. PRECAUTIONS

9-1. Storage and Shipping Precautions

Important Notices

(1) IGBT modules should always be stored under the following conditions.

- ●Temperature：40 degrees Celsius, maximum.
- ●Humidity：60％ Relative Humidity, maximum.
- ●Dust：Avoid storing the module in locations subject to dust.
- ●Harmful substances：The installation location should be free of corrosive gases such as sulfur dioxide and chlorine gas.
- ●Other：Do not remove the conductive sponges or tapes attached to the signal gate and emitter gate.

(2) Shipping Method

- ●To prevent the case cracking and/or the electrode bending, appropriate consideration should be given to properly insulate the shipping container from mechanical shock or sever vibration situation.
- ●Do not throw or drop the case while shipping. Treat them with care. The devices may break if they are not handled with care. Please do not use the IGBT modules that were dropped or damaged.
- ●Appropriate labeling on the outside of the shipping container should always be present.
- ●The shipping container itself should always be properly protected from both rain and water.

9-2. Precautions against Electrostatic Failure

Important Notices

Because the IGBT has a MOS gate structure and temperature sensing diode, you should always take the following precautions as measures to avoid generating static electricity.

- ●Before starting operation, do not remove the conductive sponge mounted between terminals of gate, emitter, collector, temperature sensing anode and cathode.
- ●When handling the IGBT module, ground our body via a high-value resistor (between 100kΩ and 1MΩ), hold the package body, and do not touch the terminals of gate, temperature sensing anode and cathode.
- ●Be sure to ground any parts which the IGBT module may touch, such as the work table or soldering iron.
- ●Before testing or inspection, be sure to check that any residual electric charge in measuring instruments has been removed. Apply voltage to each terminal starting at 0V and return to 0V when finishing.

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HITACHI POWER SEMICONDUCTORS

Notices

1. Since mishandling of semiconductor devices may cause malfunctions, please be sure to read "Precautions for Safe Use and Notices" in the individual brochure before use.
2. When designing an electronic circuit using semiconductor devices, please do not exceed the absolute maximum rating specified for the device under any external fluctuations. And for pulse applications, please also do not exceed the "Safe Operating Area (SOA)".
3. Semiconductor devices may sometimes break down by accidental or unexpected surge voltage, so please be careful about the safety design such as redundant design and malfunction prevention design which don't cause the damage expand even if they break down.
4. In cases where extremely high reliability is required (such as use in nuclear power control, aerospace and aviation, traffic equipment, life-support-related medical equipment, fuel control equipment and various kinds of safety equipment), safety should be ensured by using semiconductor devices that feature assured safety or by means of users' fail-safe precautions or other arrangement. Or consult with Hitachi's sales department staff. (When semiconductor devices fail, as a result the semiconductor devices or wiring, wiring pattern may smoke, ignite, or the semiconductor devices themselves may burst.)
5. A semi-processed article is done now using solder which contains lead inside the semiconductor devices. There is possibility of the regulation substance depend on the applied models, so please check before using.
6. This specification is a material for component selection, which describes specifications of power semiconductor devices (hereinafter referred to as products), characteristic charts, and external dimension drawings.
7. The information given herein, including the specifications and dimensions, is subject to change without prior notice to improve product characteristics. Before ordering, purchasers are advised to contact with Hitachi power semiconductor sales department for the latest version of this data sheets.
8. For handling other than described in this manual, follow the handling instructions (IGBT-HI-00002).

■ For inquiries relating to the products, please contact nearest representatives which is located "Inquiry" portion on the top page of a home page.

Hitachi power semiconductor home page address

http://www.hitachi-power-semiconductor-device.co.jp/

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Usage

1. HPSD warrants that the HPSD products have the specified performance according to the respective specifications at the time of its sale. Testing and other quality control techniques of the HPSD products by HPSD are utilized to the extent HPSD needs to meet the specifications described in this document. Not every device of the HPSD products is specifically tested on all parameters, except those mandated by relevant laws and/or regulations.
2. Following any claim regarding the failure of a product to meet the performance described in this document made within one month of product delivery, all the products in relevant lot(s) shall be re-tested and re-delivered. The HPSD products delivered more than one month before such a claim shall not be counted for such response.
3. HPSD assumes no obligation nor makes any promise of compensation for any fault which should be found in a customer's goods incorporating the products in the market. If a product failure occurs for reasons obviously attributable to HPSD and a claim is made within six months of product delivery, HPSD shall offer free replacement or payment of compensation. The maximum compensation shall be the amount paid for the products, and HPSD shall not assume responsibility for any other compensation.
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