

# MBB400TX12A

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 on IGBT.

## 2. ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub>=25°C)

Item	Symbol	Unit	Specification
Collector Emitter Voltage	V <sub>CEs</sub>	V	1200
Gate Emitter Voltage	V <sub>GES</sub>	V	±20
Collector Current	DC	I <sub>C</sub>	400
	1ms	I <sub>CM</sub>	800
Forward Current	DC	I <sub>F</sub>	400
	1ms	I <sub>FM</sub>	800
Maximum Junction Temperature	T <sub>vj max</sub>	°C	175
Temperature under switching conditions	T <sub>vj op</sub>	°C	-40 ~ +150
Storage Temperature	T <sub>stg</sub>	°C	-40 ~ +125
Isolation Voltage	V <sub>ISO</sub>	V <sub>RMS</sub>	2,500 (AC 1 minute)
Screw Torque	Terminals (M6)	-	6.0 (1)
	Mounting (M5)	-	4.0 (2)
	PCB Mounting (M3 Tapping Screw)	-	TBD

Notes: Recommended Value (1)5.5±0.5N·m (2)3.5±0.5N·m

## 3. ELECTRICAL CHARACTERISTICS

Item	Symbol	Unit	Min.	Typ.	Max.	Test Conditions	
Collector Emitter Cut-Off Current	I <sub>CEs</sub>	μA	-	-	200	V <sub>CE</sub> =1200V, V <sub>GE</sub> =0V, T <sub>vj</sub> =25°C	
Gate Emitter Leakage Current	I <sub>GES</sub>	nA	-	-	±500	V <sub>GE</sub> =±20V, V <sub>CE</sub> =0V, T <sub>vj</sub> =25°C	
Collector Emitter Saturation Voltage	V <sub>CEsat</sub>	V	-	1.65	TBD	I <sub>C</sub> =400A, V <sub>GE</sub> =15V, T <sub>vj</sub> =25°C	
			-	1.9	-	I <sub>C</sub> =400A, V <sub>GE</sub> =15V, T <sub>vj</sub> =150°C	
Gate Emitter Threshold Voltage	V <sub>GE(th)</sub>	V	(6.1)	6.8	(7.6)	V <sub>CE</sub> =5V, I <sub>C</sub> =400mA, T <sub>vj</sub> =25°C	
Input Capacitance	C <sub>ies</sub>	nF	-	16	-	V <sub>CE</sub> =10V, V <sub>GE</sub> =0V, f=100kHz, T <sub>vj</sub> =25°C	
Turn On Delay Time	t <sub>d(on)</sub>	μs	-	0.17	TBD	V <sub>CC</sub> =600V, I <sub>C</sub> =400A, L <sub>S</sub> =40nH, R <sub>G</sub> (on/off)=3.3/4.7Ω, V <sub>GE</sub> =+15V/-15V, T <sub>vj</sub> =150°C	
Rise Time	t <sub>r</sub>		-	0.07	TBD		
Turn Off Delay Time	t <sub>d(off)</sub>		-	0.38	TBD		
Fall Time	t <sub>f</sub>		-	0.26	TBD		
Peak Forward Voltage Drop	V <sub>F</sub>	V	-	2.2	TBD	I <sub>F</sub> =400A, V <sub>GE</sub> =0V, T <sub>vj</sub> =25°C	
			-	2.2	-	I <sub>F</sub> =400A, V <sub>GE</sub> =0V, T <sub>vj</sub> =150°C	
Reverse Recovery Time	t <sub>rr</sub>	μs	-	0.36	TBD	V <sub>CC</sub> =600V, I <sub>C</sub> =400A, L <sub>S</sub> =40nH, R <sub>G</sub> (on/off)=3.3/4.7Ω, V <sub>GE</sub> =+15V/-15V, T <sub>vj</sub> =150°C	
Turn On Loss	E <sub>on</sub>	mJ/P	-	32	TBD	Inductive load	
Turn Off Loss	E <sub>off</sub>	mJ/P	-	47	TBD		
Reverse Recovery Loss	E <sub>rr</sub>	mJ/P	-	33	TBD		
Temperature Sensing Diode	Forward Voltage Drop	V <sub>FT</sub>	V	(2.7)	2.85	(3.0)	T <sub>C</sub> =25°C, I <sub>FT</sub> =0.2mA
				(1.85)	2.0	(2.15)	T <sub>C</sub> =150°C, I <sub>FT</sub> =0.2mA
Thermal Resistance	IGBT	R <sub>th(j-w)</sub>	°C/W	-	-	0.128	Junction to water/fin, 10l/min, 50%LLC (per 1 arm)
	FWD	R <sub>th(j-w)</sub>	°C/W	-	-	0.165	

- \* 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 L<sub>s</sub>, gate driver, C<sub>ge</sub>, V<sub>ge</sub>, etc.
- Please optimize those values so that switching surge voltage does not exceed the rating voltage.

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## 4. PACKAGE OUTLINE DRAWING

**TENTATIVE**

Unit in mm

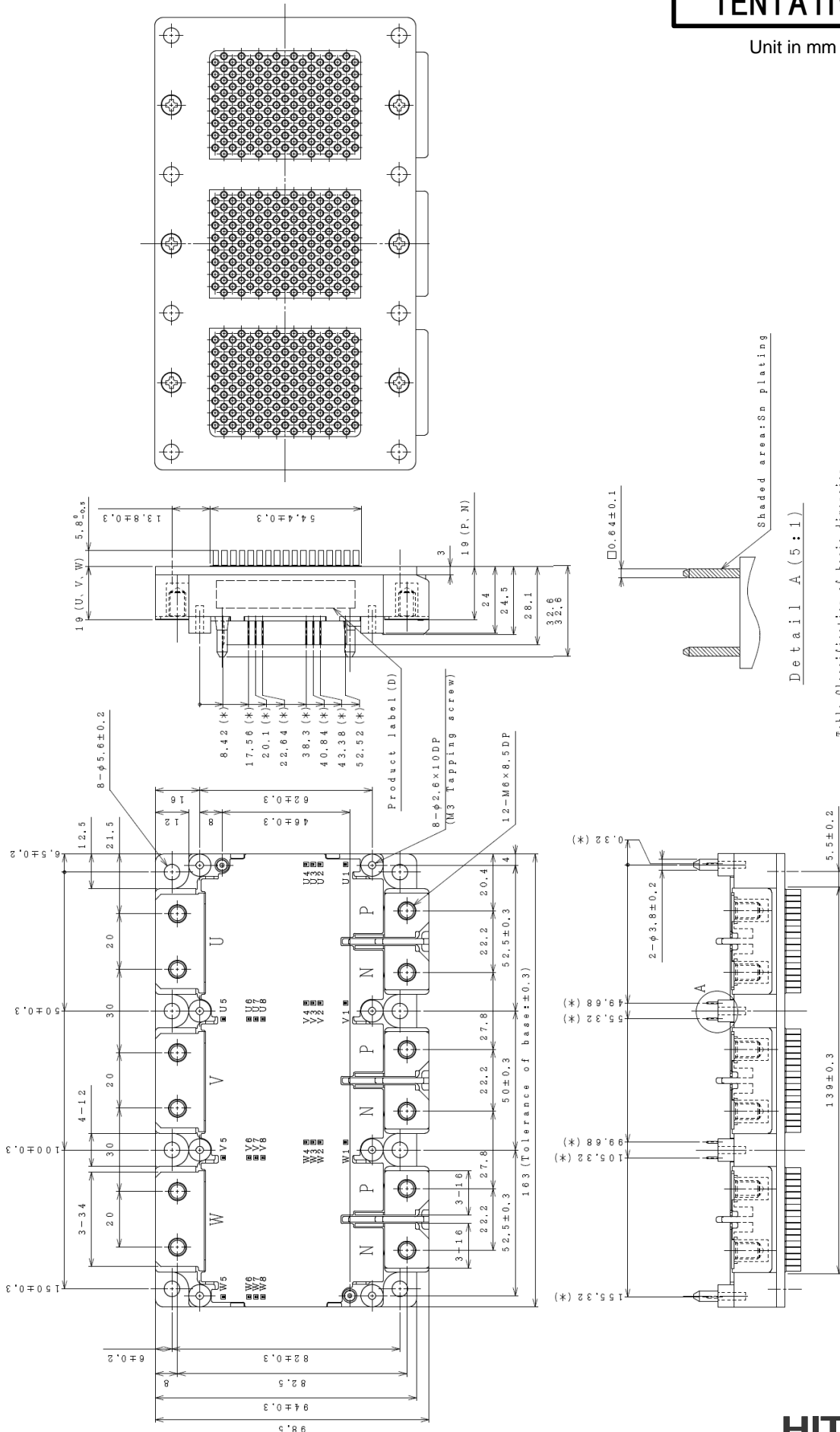


Table Classification of basic dimension

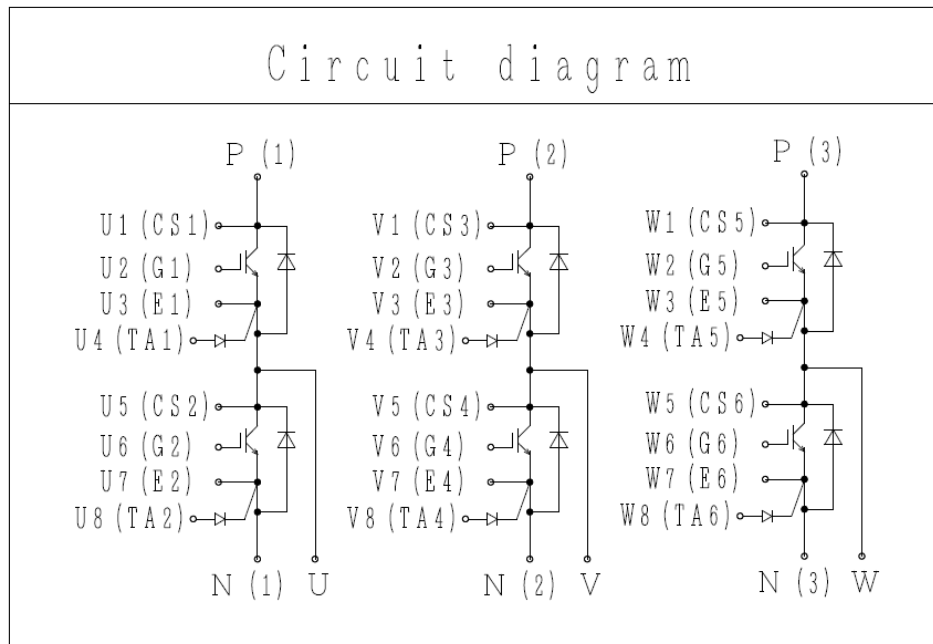
Classification of basic dimension (x) (unit:mm)	Tolerance
0.5 ≤ (x) ≤ 3	±0.2
3 < (x) ≤ 6	±0.3
6 < (x) ≤ 30	±0.5
30 < (x) ≤ 120	±0.8
120 < (x) ≤ 400	±1.2

(Note 1) Dimension of (\*) is that of the root portion of terminal. (Tolerance:±0.5)  
 (Note 2) Dimensional tolerance follows the right table, if not described.

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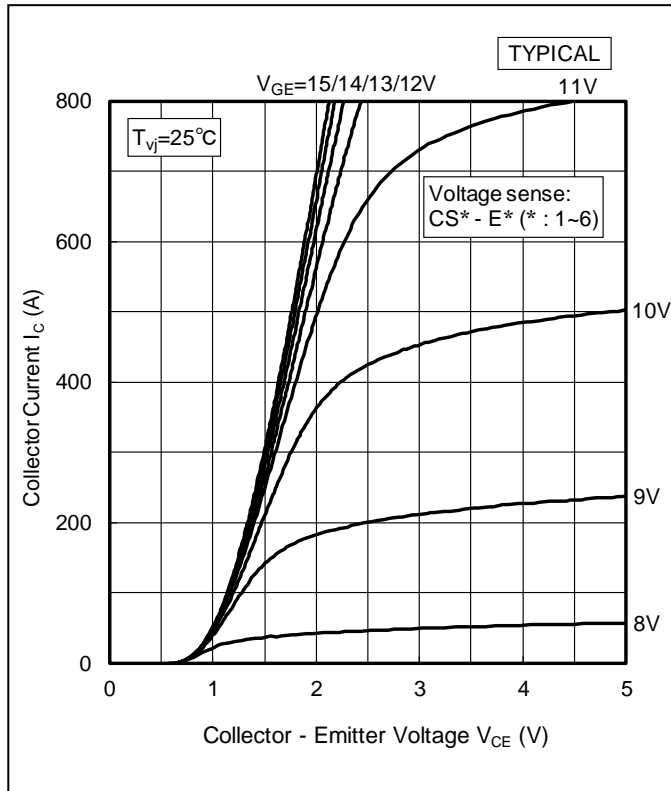
## 5. CIRCUIT DIAGRAM



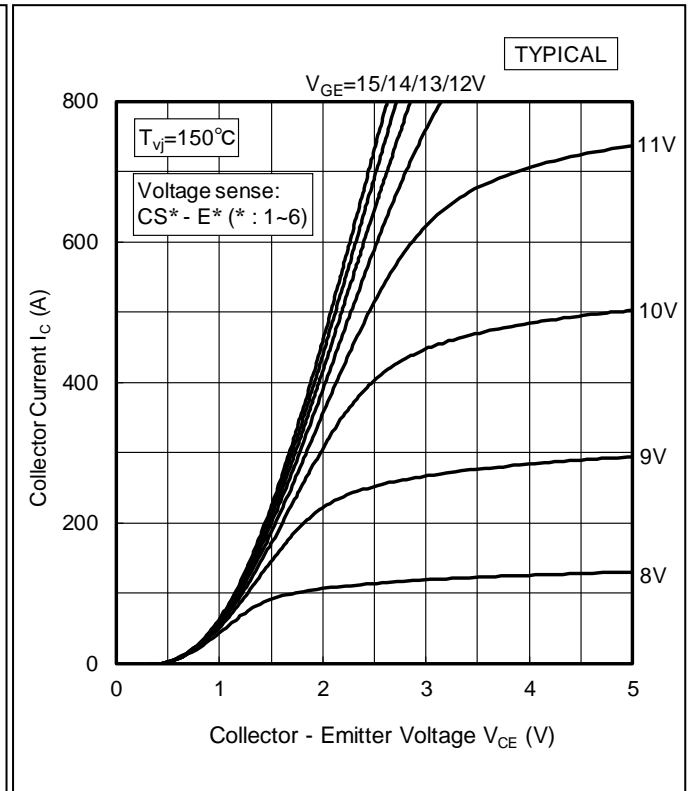
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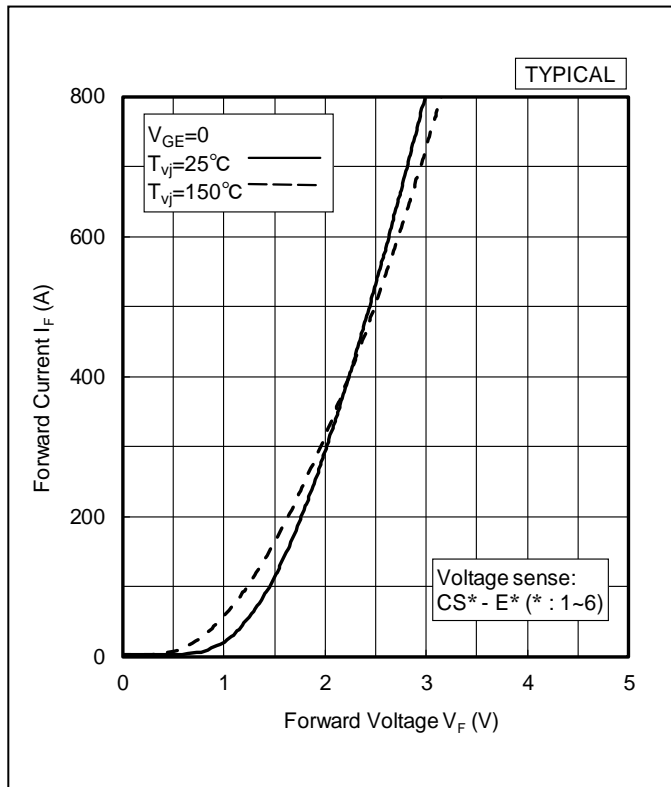
## 6. STATIC CHARACTERISTICS



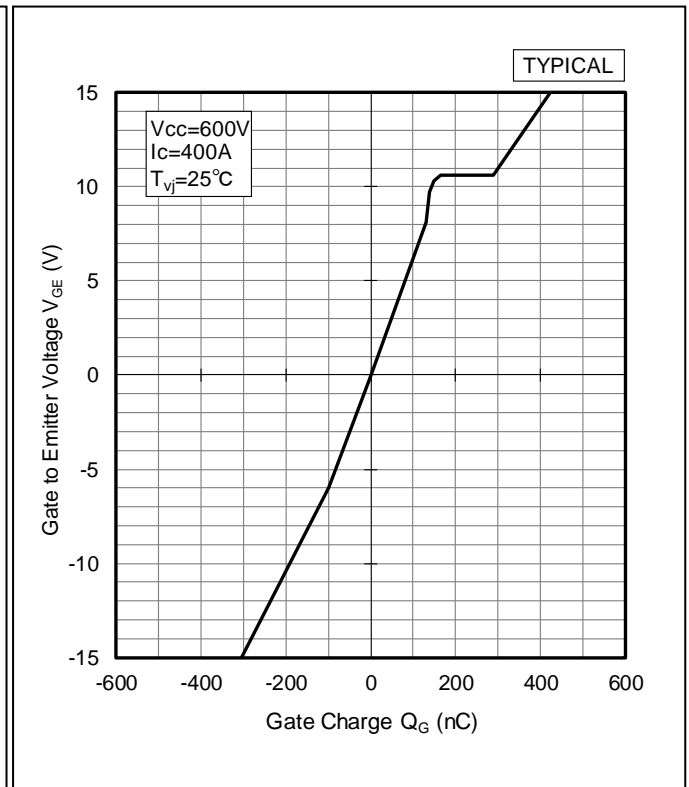
Collector Current vs. Collector - Emitter Voltage



Collector Current vs. Collector - Emitter Voltage



Forward Voltage of Free-Wheeling Diode

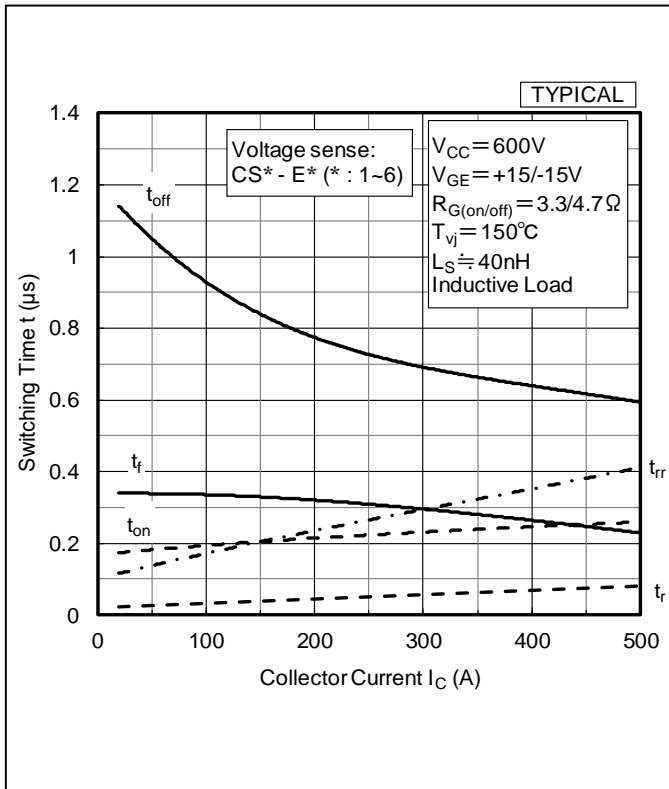


Gate to Emitter Voltage vs. Gate Charge

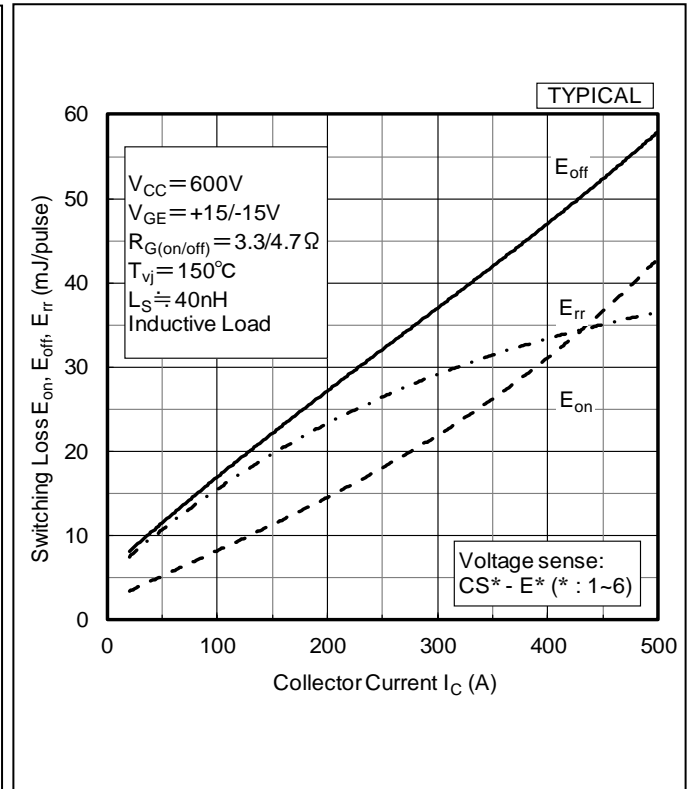
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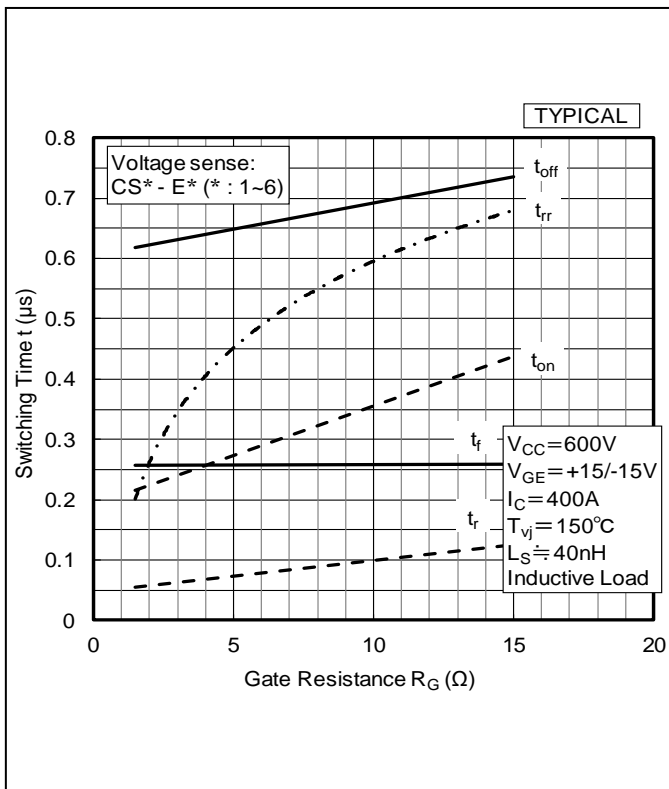
### 7. DYNAMIC CHARACTERISTICS



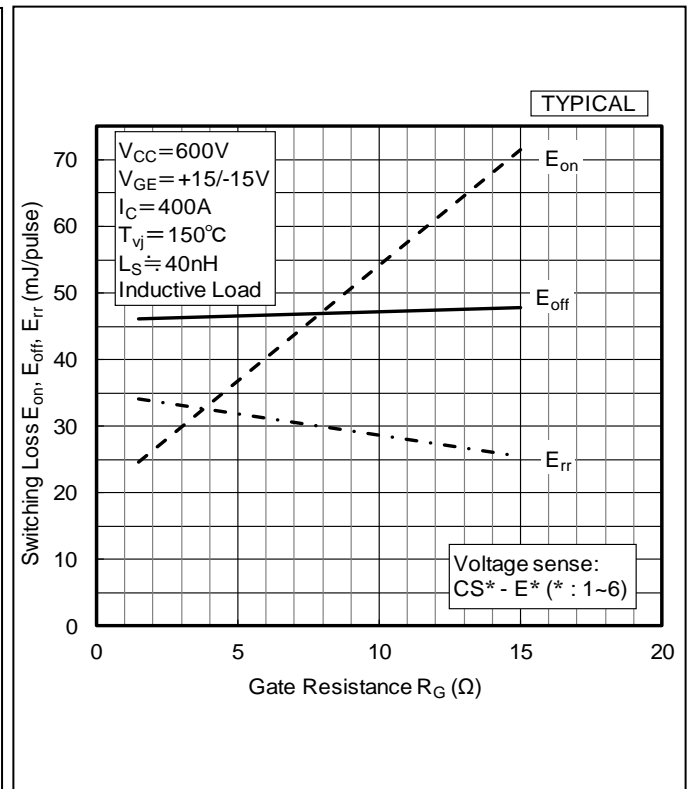
Switching Time vs. Collector Current



Switching Loss vs. Collector Current



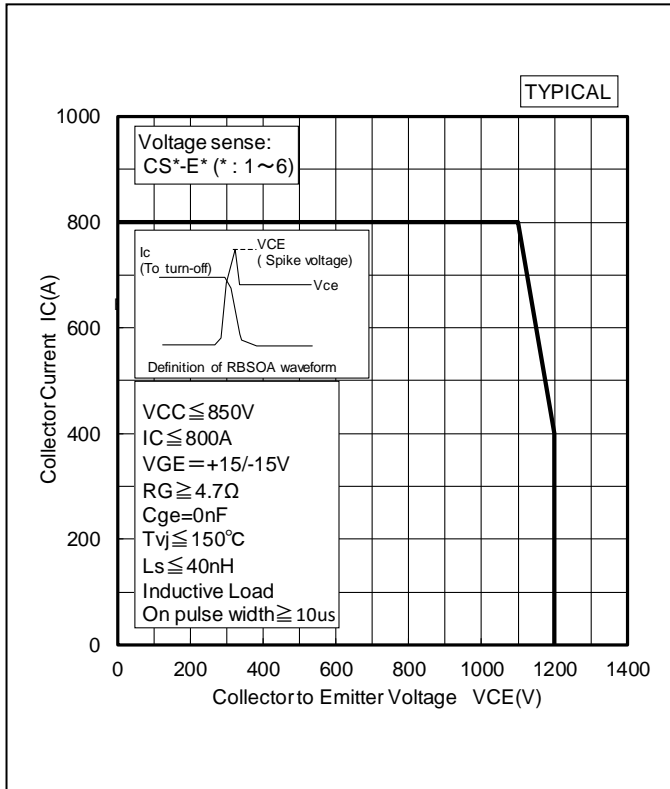
Switching Time vs. Gate Resistance



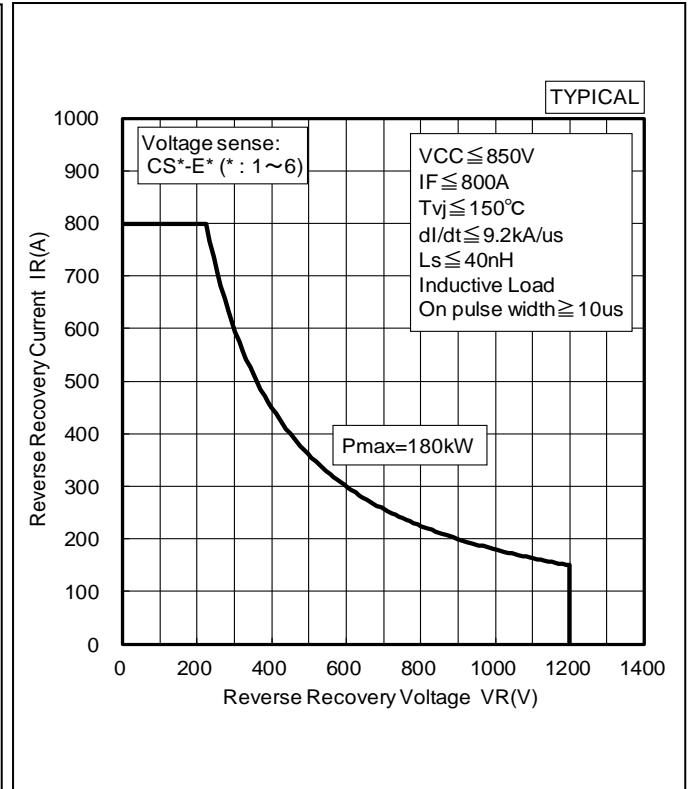
Switching Loss vs. Gate Resistance

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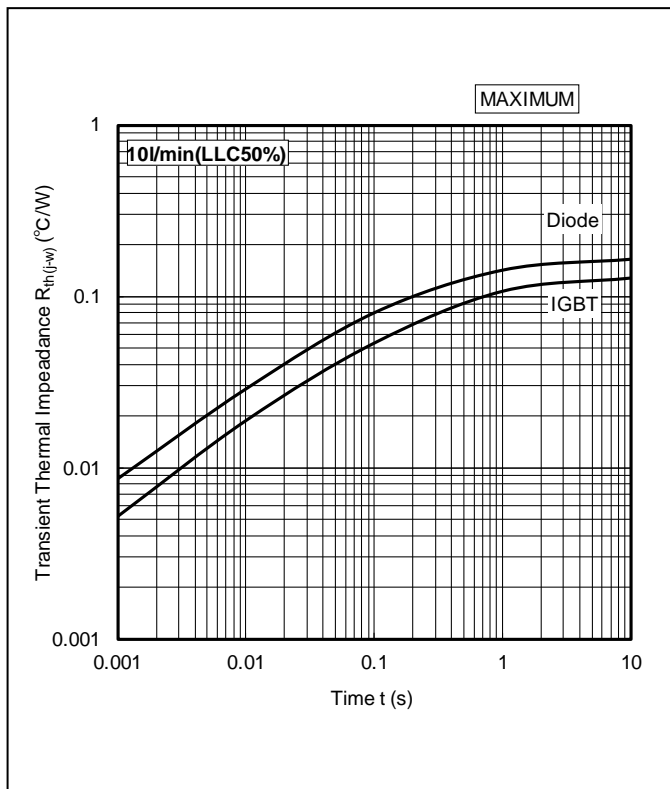


Reverse Biased Safety Operating Area

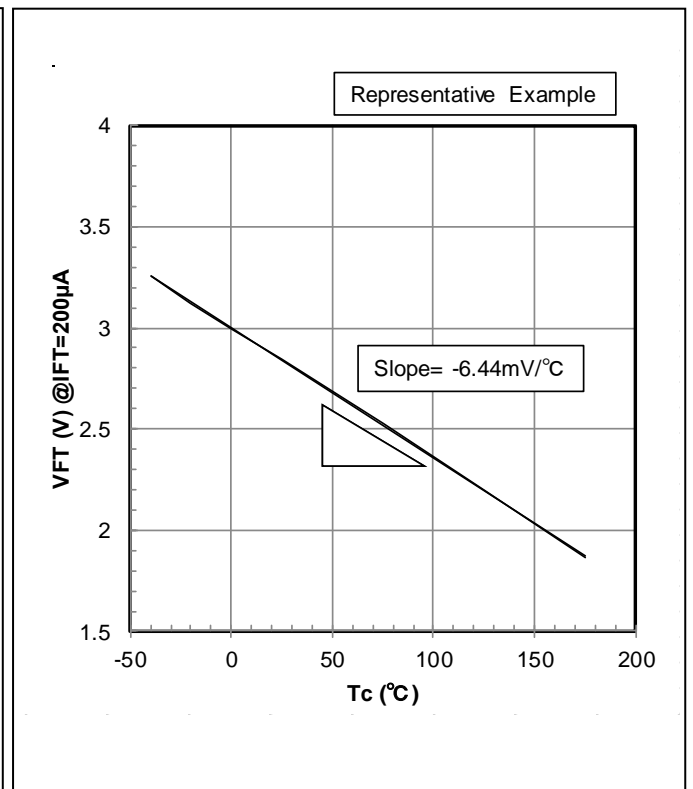


Reverse Recovery Safety Operating Area

## 8. THERMAL CHARACTERISTICS



Transient Thermal Impedance Characteristics



On-chip Temperature Sensing Diode Characteristic

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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 mounted between terminals of gate, emitter, collector, temperature sensing anode.
- (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 severe 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.
- When handling the IGBT module, ground our body via a high-value resistor (between 100k $\Omega$  and 1M $\Omega$ ), 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

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