

● Outline

Toshiba has developed a new 2500V-1000A insulated-gate bipolar transistor (IGBT) product. The product offers longer lifetime and improved reliability, and features a flat compression-bonded encapsulation package, a World first. It is suitable for high-power and high-voltage applications.

Toshiba has developed a unique assembly method which allows manufacture of flat compression-bonded encapsulation packages for IGBTs for high power and voltage applications. For such applications, module assembly has been the conventional assembly method up until now. The new product eliminates the bonding wire and soldering required for module assembly. It is expected to deliver long life and high reliability.

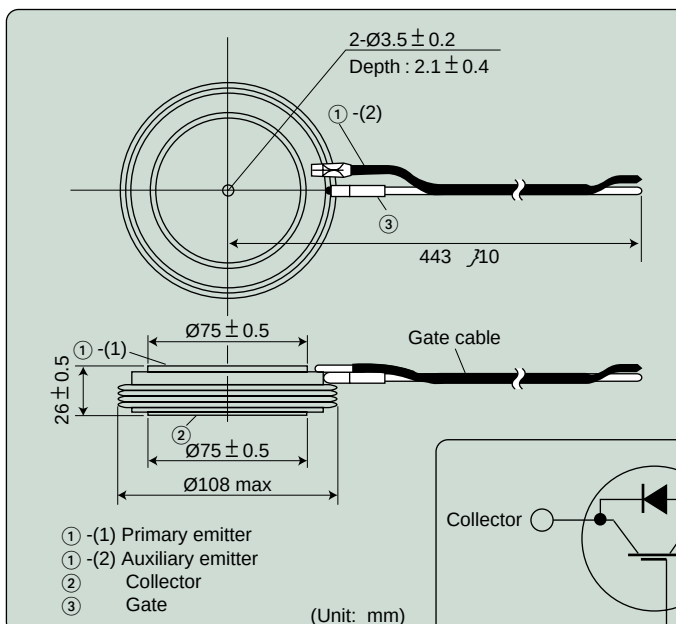
This IGBT is intended for use in inverters which control motors in a wide variety of applications. These range from motors for air conditioners which require relatively low current and voltage, to motors for driving electric train which need high current and voltage.

Compared to GTO thyristors with the same functions, IGBTs offer high switching speed and fast response, giving greater control sensitivity and reducing motor noise. Because of these features, demand for IGBTs is increasing in high-power and high-voltage applications where GTO thyristors are currently used. In applications related to social infrastructure, such as for emergency response services, where high reliability is required, the best available packaging method is compression-bonded encapsulation, which does not use bonding wire or soldering.

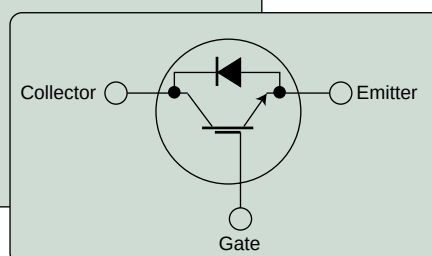
● Features

- All electrical connections are compression-bonded, and so will withstand thermal fatigue very well.
- When IGBTs are connected in series, electrical safety is assured, even if electrical breakdown occurs inside one device so that it is shorted.
- The hermetically sealed ceramic-and-metal package allows the device to be immersed in coolant fluid for efficient cooling.

● Package Dimension



● Equivalent Circuit



● Technical specification

● Maximum Ratings

Characteristic		Symbol	Rating	Unit
Collector-Emitter voltage		V_{CES}	2500	V
Gate-Emitter voltage		V_{GES}	± 20	V
Collector current	DC	I_C	1000	A
	1ms	I_{CP}	2000	A
Forward current	DC	I_F	1000	A
	1ms	I_{FM}	2000	A
Collector Power Dissipation ($T_c=25^\circ\text{C}$)		P_c	5550	W
Junction Temperature		T_j	$-20\sim 125$	$^\circ\text{C}$
Storage Temperature Range		T_{stg}	$-40\sim 125$	$^\circ\text{C}$
Mounting Force		—	31.5 ± 3.2	kN

● Electrical Characteristics

Characteristic		Symbol	Test condition	Min	Typ.	Max	Unit
Collector cut-off current		I_{CES}	$V_{CE}=2500\text{V}, V_{GE}=0\text{V}$	—	—	200	mA
Gate-Emitter cut-off voltage		$V_{GE(off)}$	$V_{CE}=5\text{V}, I_C=1\text{A}$	3.0	—	6.0	V
Collector-Emitter Saturation voltage		$V_{CE(sat)}$	$I_C=1000\text{A}, V_{GE}=15\text{V}$	—	5.5	—	V
Input Capacitance		C_{ies}	$V_{CE}=10\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$	—	200	—	nF
Switching Time	Rise time	t_r	Inductive load, $V_{CC}=1500\text{V},$ $I_C=1000\text{A},$ $V_{GG}=\pm 15\text{V}, R_G=5\Omega$	—	0.3	—	μs
	Turn-on time	t_{on}		—	2.2	—	μs
	Fall time	t_f		—	0.3	—	μs
	Turn-off time	t_{off}		—	1.5	—	μs
Forward voltage		V_F	$I_F=1000\text{A}, V_{GE}=0\text{V}$	—	2.7	—	V
Reverse recovery time		t_{rr}	$I_F=1000\text{A}, V_{GE}=-15\text{V},$ $di / dt=2000\text{A} / \mu\text{s}$	—	0.6	—	μs
Thermal Resistance	Transistor part	$R_{th(j-f)}$	DC	—	—	18	$^\circ\text{C}/\text{kW}$
	Diode part	$R_{th(j-f)}$	DC	—	—	45	$^\circ\text{C}/\text{kW}$

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