



# GTR400HF65A5H

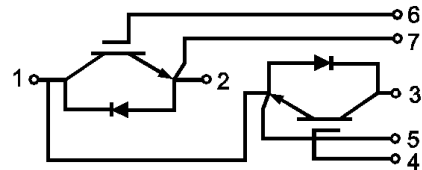
## IGBT Module

Preliminary Data

### Features:

- Field Stop Trench Gate IGBT
- Short Circuit Rated > 5 $\mu$ s
- Low Saturation Voltage
- Low Switching Loss
- 100% RBSOA Tested (2xI<sub>c</sub>)
- Low Stray Inductance
- Lead Free, Compliant with RoHS Requirement

### Circuit Diagram



### Applications:

- High Power Converters
- Industrial Motor Drives
- UPS Systems

### IGBT, Inverter

#### Maximum Rated Values of IGBT

V <sub>CES</sub>	Collector-Emitter Blocking Voltage	T <sub>J</sub> =25°C	650	V
V <sub>GES</sub>	Gate-Emitter Voltage		±20	V
I <sub>c</sub>	Continuous Collector Current	T <sub>C</sub> =100°C	400	A
		T <sub>C</sub> =25°C	800	A
I <sub>CM</sub>	Repetitive Peak Collector Current	t <sub>p</sub> =1ms	800	A
t <sub>sc</sub>	Short Circuit Withstand Time		>5	μs
P <sub>D</sub>	Maximum Power Dissipation per IGBT	T <sub>C</sub> =25°C T <sub>Jmax</sub> =175°C	1470	W



## Electrical Characteristics of IGBT

### Static Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=6.4mA, V_{CE}=V_{GE}$	5.2		6.6	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=400A, V_{GE}=15V$	$T_J=25^\circ C$	1.90	2.25	V
			$T_J=150^\circ C$	2.40		V
			$T_J=175^\circ C$	2.50		V
$I_{CES}$	Collector-Emitter Leakage Current	$V_{GE}=0V, V_{CE}=V_{CES}, T_J=25^\circ C$			1	mA
$I_{GES}$	Gate-Emitter Leakage Current	$V_{GE}=\pm 20V, V_{CE}=V_{CES}, T_J=25^\circ C$			$\pm 500$	nA
$C_{ies}$	Input Capacitance	$V_{CE}=25V, V_{GE}=0V, f=100kHz$		34		nF
$C_{res}$	Reveres Transfer Capacitance			0.46		nF

### Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=300V, I_C=400A, R_{Gon}=4.1\Omega, R_{Goff}=4.1\Omega, V_{GE}=\pm 15V, \text{Inductive Load}$	$T_J=25^\circ C$		150		ns
$t_r$	Rise Time		$T_J=25^\circ C$		77		ns
$t_{d(off)}$	Turn-off Delay Time		$T_J=25^\circ C$		305		ns
$t_f$	Fall Time		$T_J=25^\circ C$		50		ns
$R_{g\ internal}$	Internal Gate Resistance		$T_J=25^\circ C$		0.85		$\Omega$
RBSOA	$I_C=800A, V_{CC}=600V, V_p=650V, R_G=4.1\Omega, V_{GE}=+15V \text{ to } 0V, T_J=150^\circ C$			Trapezoid			
SCSOA	$V_{CC}=300V, V_{GE}=15V, T_J=150^\circ C$			5			$\mu s$
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case (per IGBT)					0.102	$^\circ C/W$

## Diode, Inverter Maximum Rated Values

$V_{RRM}$	Repetitive Peak Reverse Voltage	$T_J=25^\circ C$	650	V
$I_F$	Diode Continuous Forward Current		400	A
$I_{FM}$	Peak FWD Current Repetitive	$t_p=1ms$	800	A



## Electrical Characteristics of Diode

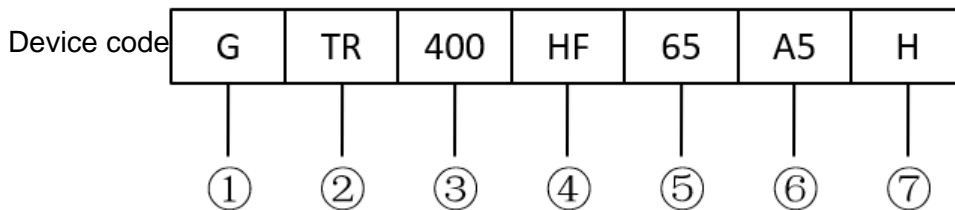
Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V <sub>FM</sub>	Forward Voltage	I <sub>F</sub> =400A	T <sub>J</sub> =25°C		2.00	V
			T <sub>J</sub> =125°C		2.00	
			T <sub>J</sub> =150°C		2.10	
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> =400A, -di <sub>F</sub> /dt=1271A/μs(T <sub>J</sub> =150°C), V <sub>R</sub> =300V, V <sub>GE</sub> =-15V	T <sub>J</sub> =25°C		184	ns
			T <sub>J</sub> =125°C		249	
			T <sub>J</sub> =150°C		277	
I <sub>rr</sub>	Peak Reverse Recovery Current	I <sub>F</sub> =400A, -di <sub>F</sub> /dt=1271A/μs(T <sub>J</sub> =150°C), V <sub>R</sub> =300V, V <sub>GE</sub> =-15V	T <sub>J</sub> =25°C		69	A
			T <sub>J</sub> =125°C		119	
			T <sub>J</sub> =150°C		131	
Q <sub>rr</sub>	Reverse Recovery Charge	I <sub>F</sub> =400A, -di <sub>F</sub> /dt=1271A/μs(T <sub>J</sub> =150°C), V <sub>R</sub> =300V, V <sub>GE</sub> =-15V	T <sub>J</sub> =25°C		7.8	μC
			T <sub>J</sub> =125°C		18.3	
			T <sub>J</sub> =150°C		22.5	
E <sub>rec</sub>	Reverse Recovery Energy	I <sub>F</sub> =400A, -di <sub>F</sub> /dt=1271A/μs(T <sub>J</sub> =150°C), V <sub>R</sub> =300V, V <sub>GE</sub> =-15V	T <sub>J</sub> =25°C		0.86	mJ
			T <sub>J</sub> =125°C		3.17	
			T <sub>J</sub> =150°C		4.37	
R <sub>θJC</sub>	Diode Thermal Resistance: Junction-To-Case (per Diode)				0.148	°C/W



## Module

Symbol	Description	Min.	Typ.	Max.	Units
V <sub>iso</sub>	Isolation Voltage (All Terminals Shorted)	RMS, f=50Hz, 30s	4500		V
T <sub>J</sub>	Maximum Junction Temperature			175	°C
T <sub>JOP</sub>	Maximum Operating Junction Temperature Range	-40		+150	°C
T <sub>stg</sub>	Storage Temperature	-40		+125	°C
CTI	Comparative Tracking Index	200			
R <sub>θCS</sub>	Case-To-Sink Thermally (Conductive Grease Applied)			0.05	°C/W
T	Power Terminals Screw:M5	3.0		5.0	N·m
T	Mounting Screw:M6	4.0		6.0	N·m
G	Weight		200		g

## Ordering Information Table



- ① - IGBT Module
- ② - Field Stop Trench Gate IGBT
- ③ - Rated Current (400=400A)
- ④ - Circuit Configuration: HF(Half Bridge)
- ⑤ - Rated Voltage (65=650V)
- ⑥ - Package Type
- ⑦ - Test Level (Pass the Important Reliability Test-Industrial Grade)

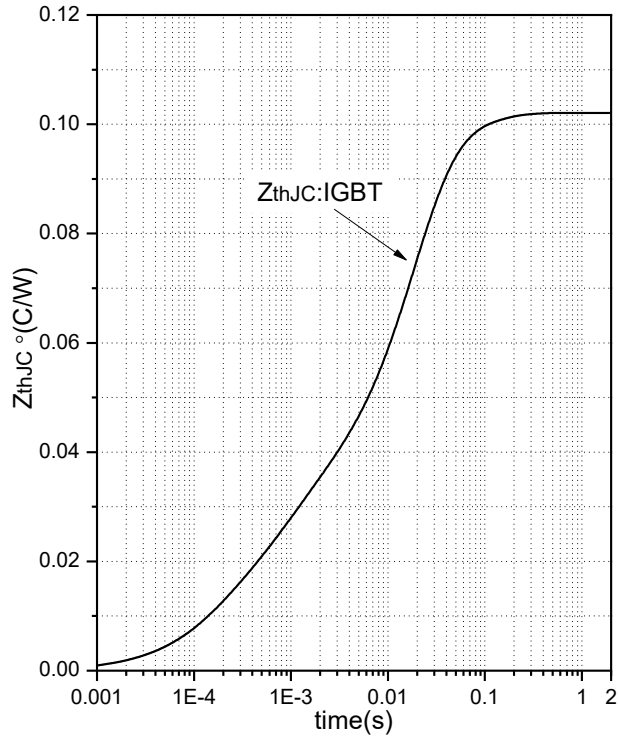


Fig.1 Transient Thermal Impedance (IGBT)

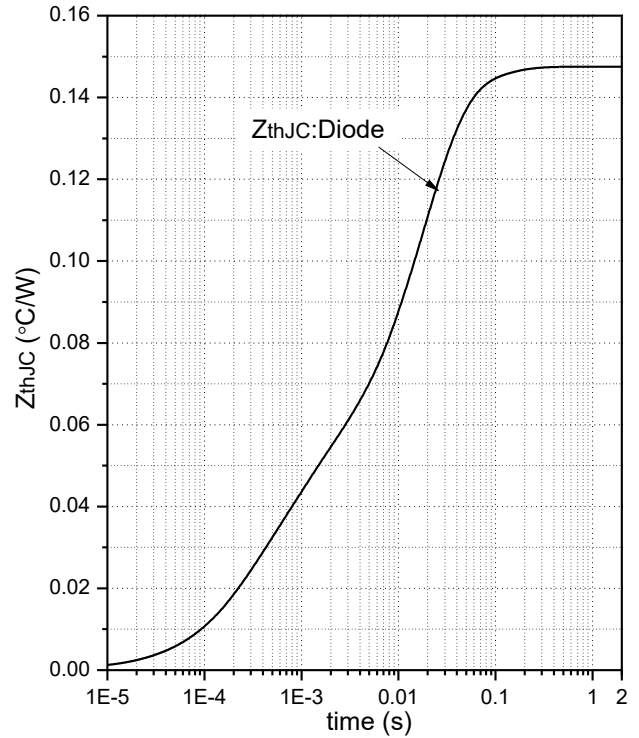
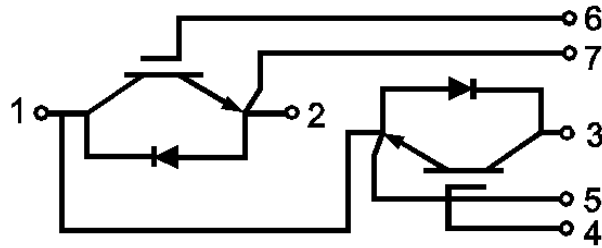


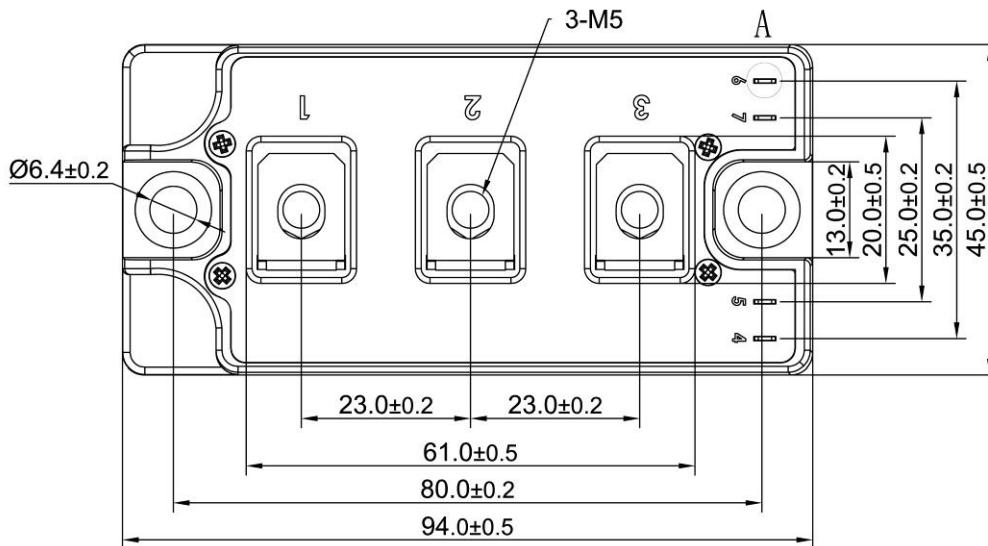
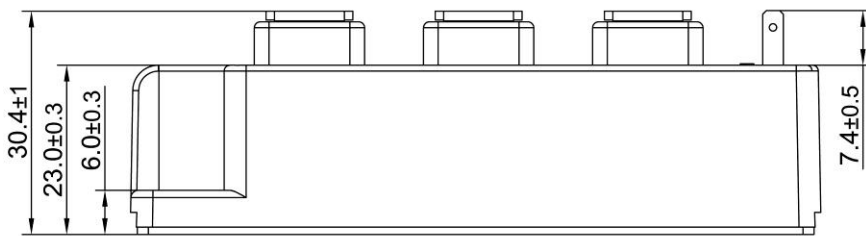
Fig.2 Transient Thermal Impedance (Diode)



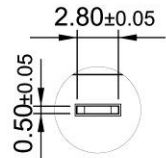
## Internal Circuit



## Package Outline (Unit: mm):



View A  
scale 3:1





Date	Revision	Notes
09/05/2023	01	Initial Release

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