

STARPOWER

SEMICONDUCTOR

IGBT

GD450HFT65C6S

650V/450A 2 in one-package

General Description

STARPOWER IGBT Power Module provides ultra low conduction loss as well as short circuit ruggedness. They are designed for the applications such as inverters and UPS.

Features

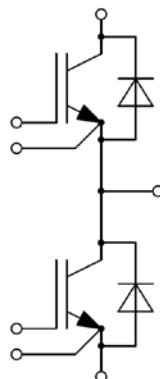
- Low $V_{CE(sat)}$ Trench IGBT technology
- $V_{CE(sat)}$ with positive temperature coefficient
- 6 μ s short circuit capability
- Maximum junction temperature 175 °C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

Equivalent Circuit Schematic



Absolute Maximum Ratings $T_C=25^{\circ}\text{C}$ unless otherwise noted**IGBT**

Symbol	Description	Values	Unit
V_{CES}	Collector-Emitter Voltage	650	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$ @ $T_C=60^{\circ}\text{C}$	550 450	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	900	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	1339	W

Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	450	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	900	A

Module

Symbol	Description	Values	Unit
T_{jmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
T_{jop}	Operating Junction Temperature	-40 to +150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40 to +125	$^{\circ}\text{C}$
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	4000	V
M	Terminal Connection Torque, Screw M5 Mounting Torque, Screw M6	3.0 to 6.0 3.0 to 6.0	N.m

IGBT Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=450\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.45	1.90	V
		$I_C=450\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		1.60		
		$I_C=450\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=7.2\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.1	5.8	6.4	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$			5.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^{\circ}\text{C}$			400	nA
R_{Gint}	Internal Gate Resistance			0.67		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		27.7		nF
C_{res}	Reverse Transfer Capacitance			0.82		nF
Q_G	Gate Charge	$V_{GE}=-15 \dots +15\text{V}$		4.80		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=450\text{A}, R_G=1.5\Omega, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		74		ns
t_r	Rise Time			64		ns
$t_{d(off)}$	Turn-Off Delay Time			468		ns
t_f	Fall Time			71		ns
E_{on}	Turn-On Switching Loss			4.97		mJ
E_{off}	Turn-Off Switching Loss			14.8		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=450\text{A}, R_G=1.5\Omega, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		81		ns
t_r	Rise Time			68		ns
$t_{d(off)}$	Turn-Off Delay Time			502		ns
t_f	Fall Time			94		ns
E_{on}	Turn-On Switching Loss			6.31		mJ
E_{off}	Turn-Off Switching Loss			17.4		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=450\text{A}, R_G=1.5\Omega, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		84		ns
t_r	Rise Time			75		ns
$t_{d(off)}$	Turn-Off Delay Time			512		ns
t_f	Fall Time			98		ns
E_{on}	Turn-On Switching Loss			6.88		mJ
E_{off}	Turn-Off Switching Loss			18.5		mJ
I_{SC}	SC Data	$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=360\text{V}, V_{CEM} \leq 650\text{V}$		2300		A

Diode Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_C=450\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.55	1.95	V
		$I_C=450\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.50		
		$I_C=450\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.45		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=450\text{A}, R_G=1.5\Omega, V_{GE}=-15\text{V}, T_j=25^{\circ}\text{C}$		16.4		μC
I_{RM}	Peak Reverse Recovery Current			232		A
E_{rec}	Reverse Recovery Energy			3.74		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=450\text{A}, R_G=1.5\Omega, V_{GE}=-15\text{V}, T_j=125^{\circ}\text{C}$		30.2		μC
I_{RM}	Peak Reverse Recovery Current			291		A
E_{rec}	Reverse Recovery Energy			7.51		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=450\text{A}, R_G=1.5\Omega, V_{GE}=-15\text{V}, T_j=150^{\circ}\text{C}$		34.8		μC
I_{RM}	Peak Reverse Recovery Current			308		A
E_{rec}	Reverse Recovery Energy			9.02		mJ

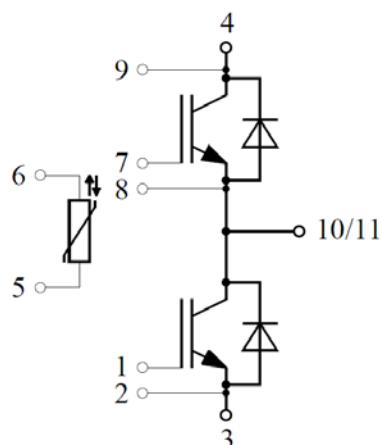
NTC Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			5.0		$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$T_C=100^{\circ}\text{C}, R_{100}=493.3\Omega$	-5		5	%
P_{25}	Power Dissipation				20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		3375		K

Module Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

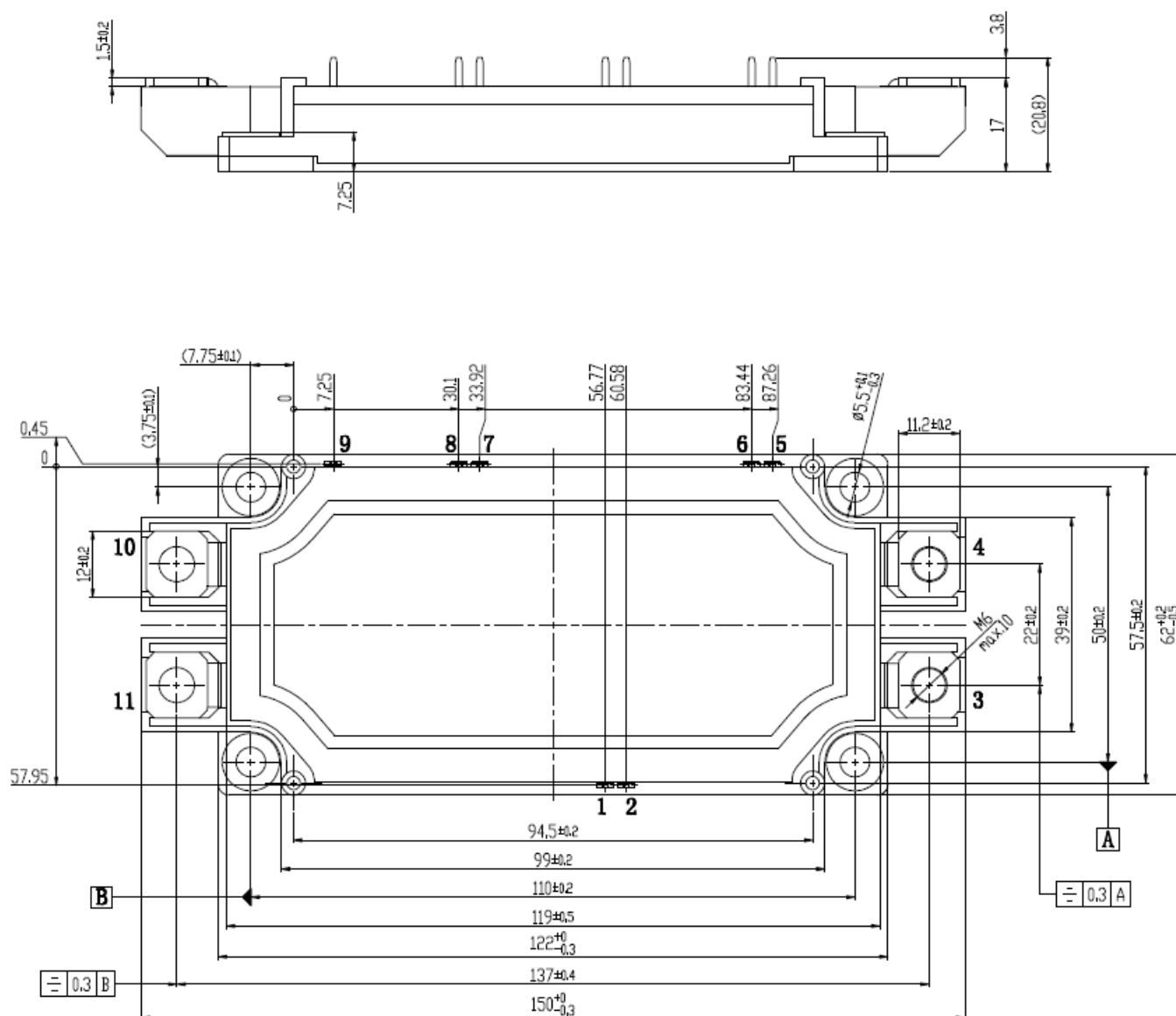
Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		20		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		1.10		$\text{m}\Omega$
$R_{\theta JC}$	Junction-to-Case (per IGBT) Junction-to-Case (per Diode)			0.112 0.185	K/W
$R_{\theta CS}$	Case-to-Sink (per IGBT) Case-to-Sink (per Diode)		0.014 0.024		K/W
$R_{\theta CS}$	Case-to-Sink		0.009		K/W
G	Weight of Module		350		g

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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