

STARPOWER

SEMICONDUCTOR

IGBT

GD450HFY120C6S

1200V/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 general inverters and UPS.

Features

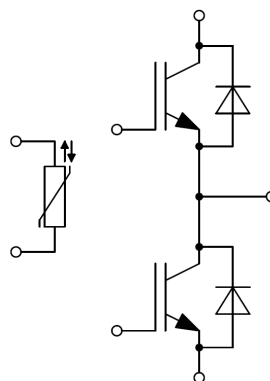
- Low $V_{CE(sat)}$ Trench IGBT technology
- 10 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



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	Value	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	675	A
	@ $T_C=100^{\circ}\text{C}$	450	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	900	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	2142	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	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	Value	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, $f=50\text{Hz}$, $t=1\text{min}$	2500	V

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	$I_C=450\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.65	2.10	V	
		$I_C=450\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		1.95			
		$I_C=450\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.00			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=18.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.2	6.0	6.8	V	
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$			1.0	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			0.7		Ω	
C_{ies}	Input Capacitance	$V_{CE}=30\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		44.7		nF	
C_{res}	Reverse Transfer Capacitance				1.41		nF
Q_G	Gate Charge	$V_{GE}=15\text{V}$		2.55		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=450\text{A}, R_G=1.5\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		310		ns	
t_r	Rise Time			140		ns	
$t_{d(off)}$	Turn-Off Delay Time			543		ns	
t_f	Fall Time			124		ns	
E_{on}	Turn-On Switching Loss			6.78		mJ	
E_{off}	Turn-Off Switching Loss			46.1		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=600\text{V}, I_C=450\text{A}, R_G=1.5\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		339		ns
t_r	Rise Time				151		ns
$t_{d(off)}$	Turn-Off Delay Time			608		ns	
t_f	Fall Time			177		ns	
E_{on}	Turn-On Switching Loss			11.4		mJ	
E_{off}	Turn-Off Switching Loss			58.4		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=450\text{A}, R_G=1.5\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$			340		ns
t_r	Rise Time				153		ns
$t_{d(off)}$	Turn-Off Delay Time			621		ns	
t_f	Fall Time			192		ns	
E_{on}	Turn-On Switching Loss			12.4		mJ	
E_{off}	Turn-Off Switching Loss			61.9		mJ	
I_{SC}	SC Data		$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$		1800		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	$I_F=450\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.80	2.25	V
		$I_F=450\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.85		
		$I_F=450\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.85		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=450\text{A},$ $-di/dt=2850\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^\circ\text{C}$		40.0		μC
I_{RM}	Peak Reverse Recovery Current			278		A
E_{rec}	Reverse Recovery Energy			20.9		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=450\text{A},$ $-di/dt=2850\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^\circ\text{C}$		72.7		μC
I_{RM}	Peak Reverse Recovery Current			356		A
E_{rec}	Reverse Recovery Energy			37.3		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=450\text{A},$ $-di/dt=2850\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^\circ\text{C}$		83.7		μC
I_{RM}	Peak Reverse Recovery Current			380		A
E_{rec}	Reverse Recovery Energy			43.0		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_{thJC}	Junction-to-Case (per IGBT)			0.070	K/W
	Junction-to-Case (per Diode)			0.096	
R_{thCH}	Case-to-Heatsink (per IGBT)		0.031		K/W
	Case-to-Heatsink (per Diode)		0.043		
	Case-to-Heatsink (per Module)		0.009		
M	Mounting Torque, Screw M6	3.0		6.0	N.m
G	Weight of Module		350		g

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