

# STARPOWER

SEMICONDUCTOR

**IGBT**

## GD225MJS120L6S

**1200V/225A 3-level 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 3-level-application.

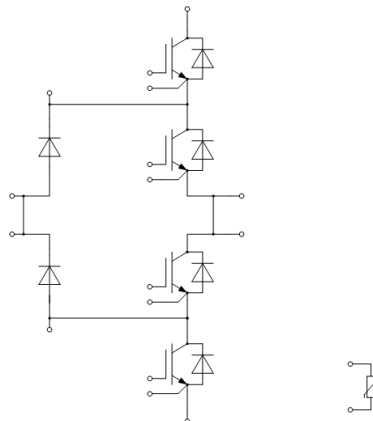
### Features

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

### Typical Applications

- Solar power
- 3-level-application

### Equivalent Circuit Schematic



**Absolute Maximum Ratings**  $T_C=25^{\circ}\text{C}$  unless otherwise noted**T1-T4 IGBT**

Symbol	Description	Value	Unit
$V_{CES}$	Collector-Emitter Voltage	1200	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_{CN}$	Implemented Collector Current	225	A
$I_C$	Collector Current @ $T_C=100^{\circ}\text{C}$	110	A
$I_{CM}$	Pulsed Collector Current $t_p=1\text{ms}$	450	A

**D1/D4 Diode**

Symbol	Description	Value	Unit
$V_{RRM}$	Repetitive Peak Reverse Voltage	1200	V
$I_{FN}$	Implemented Forward Current	225	A
$I_F$	Diode Continuous Forward Current	300	A
$I_{FM}$	Diode Maximum Forward Current $t_p=1\text{ms}$	450	A

**D2/D3 Diode**

Symbol	Description	Value	Unit
$V_{RRM}$	Repetitive Peak Reverse Voltage	1200	V
$I_{FN}$	Implemented Forward Current	225	A
$I_F$	Diode Continuous Forward Current	225	A
$I_{FM}$	Diode Maximum Forward Current $t_p=1\text{ms}$	450	A

**D5/D6 Diode**

Symbol	Description	Value	Unit
$V_{RRM}$	Repetitive Peak Reverse Voltage	1200	V
$I_{FN}$	Implemented Forward Current	225	A
$I_F$	Diode Continuous Forward Current	300	A
$I_{FM}$	Diode Maximum Forward Current $t_p=1\text{ms}$	450	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, $f=50\text{Hz}, t=1\text{min}$	3200	V

**T1-T4 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	$I_C=225\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		2.00	2.45	V
		$I_C=225\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		2.70		
		$I_C=225\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.90		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=9.00\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.6	6.2	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			1.7		$\Omega$
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}, f=100\text{kHz}, V_{GE}=0\text{V}$		38.1		nF
$C_{res}$	Reverse Transfer Capacitance			0.66		nF
$Q_G$	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		2.52		$\mu\text{C}$
$t_{d(on)}$	Turn-On Delay Time	TBD		TBD		ns
$t_r$	Rise Time			TBD		ns
$t_{d(off)}$	Turn-Off Delay Time			TBD		ns
$t_f$	Fall Time			TBD		ns
$E_{on}$	Turn-On Switching Loss			TBD		mJ
$E_{off}$	Turn-Off Switching Loss			TBD		mJ
$t_{d(on)}$	Turn-On Delay Time	TBD		TBD		ns
$t_r$	Rise Time			TBD		ns
$t_{d(off)}$	Turn-Off Delay Time			TBD		ns
$t_f$	Fall Time			TBD		ns
$E_{on}$	Turn-On Switching Loss			TBD		mJ
$E_{off}$	Turn-Off Switching Loss			TBD		mJ
$t_{d(on)}$	Turn-On Delay Time	TBD		TBD		ns
$t_r$	Rise Time			TBD		ns
$t_{d(off)}$	Turn-Off Delay Time			TBD		ns
$t_f$	Fall Time			TBD		ns
$E_{on}$	Turn-On Switching Loss			TBD		mJ
$E_{off}$	Turn-Off Switching Loss			TBD		mJ

**D1/D4 Diode Characteristics**  $T_c=25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_F$	Diode Forward Voltage	$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.85	2.30	V
		$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.90		
		$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.95		
$Q_r$	Recovered Charge	TBD		TBD		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			TBD		A
$E_{rec}$	Reverse Recovery Energy			TBD		mJ
$Q_r$	Recovered Charge	TBD		TBD		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			TBD		A
$E_{rec}$	Reverse Recovery Energy			TBD		mJ
$Q_r$	Recovered Charge	TBD		TBD		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			TBD		A
$E_{rec}$	Reverse Recovery Energy			TBD		mJ

**D2/D3 Diode Characteristics**  $T_c=25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_F$	Diode Forward Voltage	$I_F=225\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.85	2.30	V
		$I_F=225\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.90		
		$I_F=225\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.95		
$Q_r$	Recovered Charge	TBD		TBD		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			TBD		A
$E_{rec}$	Reverse Recovery Energy			TBD		mJ
$Q_r$	Recovered Charge	TBD		TBD		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			TBD		A
$E_{rec}$	Reverse Recovery Energy			TBD		mJ
$Q_r$	Recovered Charge	TBD		TBD		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			TBD		A
$E_{rec}$	Reverse Recovery Energy			TBD		mJ

**D5/D6 Diode Characteristics**  $T_C=25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_F$	Diode Forward Voltage	$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.85	2.30	V
		$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.90		
		$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.95		
$Q_r$	Recovered Charge	TBD		TBD		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			TBD		A
$E_{rec}$	Reverse Recovery Energy			TBD		mJ
$Q_r$	Recovered Charge	TBD		TBD		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			TBD		A
$E_{rec}$	Reverse Recovery Energy			TBD		mJ
$Q_r$	Recovered Charge	TBD		TBD		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			TBD		A
$E_{rec}$	Reverse Recovery Energy			TBD		mJ

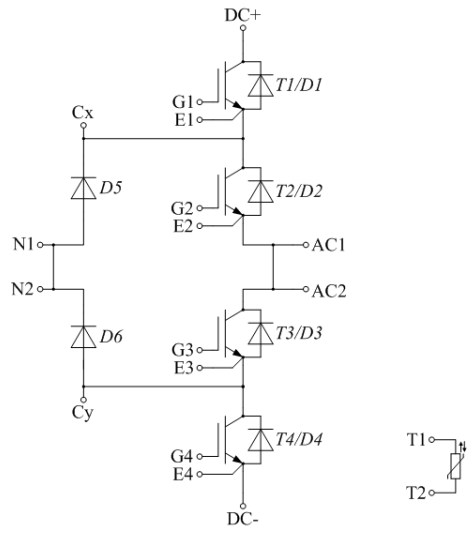
**NTC Characteristics**  $T_C=25^\circ\text{C}$  unless otherwise noted

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
$B_{25/80}$	B-value	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15\text{K}))]$		3411		K
$B_{25/100}$	B-value	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15\text{K}))]$		3433		K

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

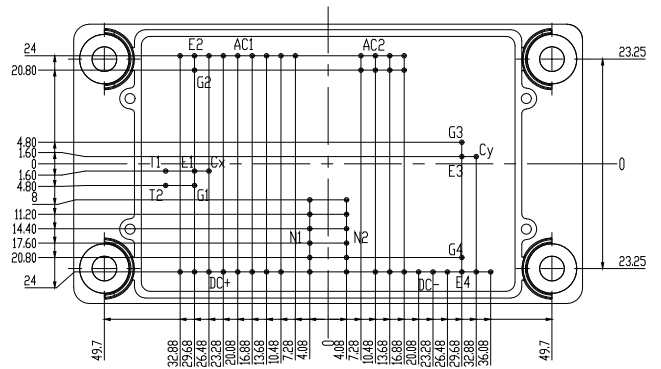
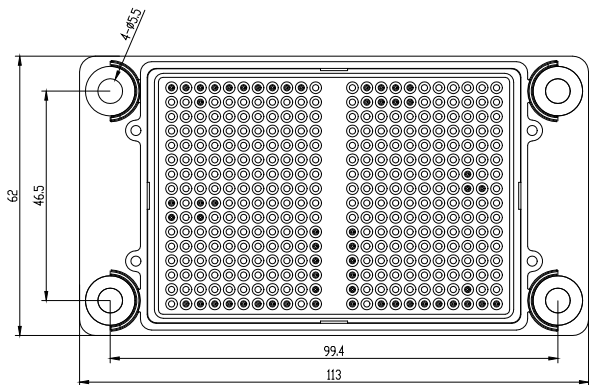
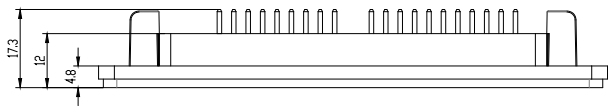
Symbol	Parameter	Min.	Typ.	Max.	Unit
$L_{CE}$	Stray Inductance		15		nH
$R_{thJC}$	Junction-to-Case (per T1-T4 IGBT)			0.231	K/W
	Junction-to-Case (per D1/D4 Diode)			0.338	
	Junction-to-Case (per D2/D3 Diode)			0.373	
	Junction-to-Case (per D5/D6 Diode)			0.338	
$M$	Mounting Torque, Screw:M5	3.0		5.0	N.m
$G$	Weight of Module		250		g

### Circuit Schematic



### Package Dimensions

Dimensions in Millimeters



## Terms and Conditions of Usage

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