STARPOWER

SEMICONDUCTOR **IGBT**

GD800AXS100F6S

1000V/800A 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.

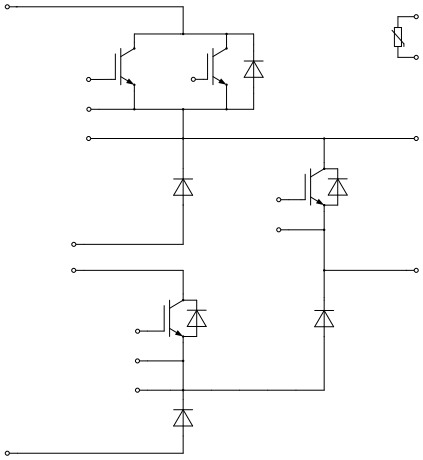
Features

- 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
- UPS systems

Equivalent Circuit Schematic



Absolute Maximum Ratings T_C=25°C unless otherwise noted

Outer IGBT (T1a+T1b)

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	1000	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=80°C	540	A
I_{CM}	Pulsed Collector Current t_p=1ms	1600	A
P_D	Maximum Power Dissipation @ T_j=175°C	2173	W

Inner IGBT (T2)

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	1000	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=80°C	385	A
I_{CM}	Pulsed Collector Current t_p=1ms	1200	A
P_D	Maximum Power Dissipation @ T_j=175°C	1530	W

Neutral Point IGBT (T6)

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	1000	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=80°C	255	A
I_{CM}	Pulsed Collector Current t_p=1ms	600	A
P_D	Maximum Power Dissipation @ T_j=175°C	903	W

Inverse Diode (D1b,D2b,D6b)

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1000	V
I_F	Diode Continuous Forward Current @ T_C=80°C	64	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	200	A

Diode (D3a,D4a)

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1000	V
I_F	Diode Continuous Forward Current @ T_C=80°C	175	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	600	A

Neutral Point Diode (D5a)

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1000	V
I_F	Diode Continuous Forward Current T_C=80°C	240	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	800	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	175	°C
T_{jop}	Operating Junction Temperature	-40 to +150	°C
T_{STG}	Storage Temperature Range	-40 to +125	°C
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=1min	3200	V

Outer IGBT Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=800A,V_{GE}=15V, T_j=25°C		1.90	2.35	V
		I_C=800A,V_{GE}=15V, T_j=125°C		2.25		
		I_C=800A,V_{GE}=15V, T_j=150°C		2.30		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=12.00mA,V_{CE}=V_{GE}, T_j=25°C	3.25	4.0	4.75	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25°C			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25°C			400	nA
R_{Gint}	Internal Gate Resistance			0.4		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=100kHz, V_{GE}=0V		68.0		nF
C_{oes}	Onput Capacitance			1.92		nF
C_{res}	Reverse Transfer Capacitance			1.08		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		4.56		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=50A, R_{Gon}=10Ω,R_{Goff}=22Ω, V_{GE}=-9V/+15V, T_j=25°C		312		ns
t_r	Rise Time			131		ns
$t_{d(off)}$	Turn-Off Delay Time			2173		ns
t_f	Fall Time			103		ns
E_{on}	Turn-On Switching Loss			33.6		mJ
E_{off}	Turn-Off Switching Loss			19.2		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=50A, R_{Gon}=10Ω,R_{Goff}=22Ω, V_{GE}=-9V/+15V, T_j=125°C		260		ns
t_r	Rise Time			135		ns
$t_{d(off)}$	Turn-Off Delay Time			2271		ns
t_f	Fall Time			100		ns
E_{on}	Turn-On Switching Loss			41.2		mJ
E_{off}	Turn-Off Switching Loss			18.9		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=50A, R_{Gon}=10Ω,R_{Goff}=22Ω, V_{GE}=-9V/+15V, T_j=150°C		259		ns
t_r	Rise Time			134		ns
$t_{d(off)}$	Turn-Off Delay Time			2315		ns
t_f	Fall Time			99		ns
E_{on}	Turn-On Switching Loss			44.7		mJ
E_{off}	Turn-Off Switching Loss			19.5		mJ

Inner IGBT Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=600A,V_{GE}=15V, T_j=25°C		1.90	2.35	V
		I_C=600A,V_{GE}=15V, T_j=125°C		2.25		
		I_C=600A,V_{GE}=15V, T_j=150°C		2.30		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=9.00mA,V_{CE}=V_{GE}, T_j=25°C	3.25	4.0	4.75	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25°C			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25°C			400	nA
R_{Gint}	Internal Gate Resistance			0.5		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=100kHz, V_{GE}=0V		51.0		nF
C_{oes}	Onput Capacitance			1.44		nF
C_{res}	Reverse Transfer Capacitance			0.81		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		3.42		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=50A, R_{Gon}=10Ω,R_{Goff}=22Ω, V_{GE}=-9V/+15V, T_j=25°C		272		ns
t_r	Rise Time			116		ns
$t_{d(off)}$	Turn-Off Delay Time			1710		ns
t_f	Fall Time			131		ns
E_{on}	Turn-On Switching Loss			24.7		mJ
E_{off}	Turn-Off Switching Loss			15.4		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=50A, R_{Gon}=10Ω,R_{Goff}=22Ω, V_{GE}=-9V/+15V, T_j=125°C		239		ns
t_r	Rise Time			1201		ns
$t_{d(off)}$	Turn-Off Delay Time			1801		ns
t_f	Fall Time			123		ns
E_{on}	Turn-On Switching Loss			28.2		mJ
E_{off}	Turn-Off Switching Loss			16.2		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=50A, R_{Gon}=10Ω,R_{Goff}=22Ω, V_{GE}=-9V/+15V, T_j=150°C		234		ns
t_r	Rise Time			117		ns
$t_{d(off)}$	Turn-Off Delay Time			1818		ns
t_f	Fall Time			116		ns
E_{on}	Turn-On Switching Loss			28.1		mJ
E_{off}	Turn-Off Switching Loss			15.7		mJ

Neutral Point IGBT Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=300A,V_{GE}=15V, T_j=25°C		1.50	1.95	V
		I_C=300A,V_{GE}=15V, T_j=125°C		1.75		
		I_C=300A,V_{GE}=15V, T_j=150°C		1.85		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=5.40mA,V_{CE}=V_{GE}, T_j=25°C	4.90	5.50	6.10	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25°C			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25°C			400	nA
R_{Gint}	Internal Gate Resistance			1.7		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=100kHz, V_{GE}=0V		25.0		nF
C_{oes}	Onput Capacitance			0.89		nF
C_{res}	Reverse Transfer Capacitance			0.14		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		1.75		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=50A, R_{Gon}=10Ω,R_{Goff}=22Ω, V_{GE}=-9V/+15V, T_j=25°C		165		ns
t_r	Rise Time			49		ns
$t_{d(off)}$	Turn-Off Delay Time			587		ns
t_f	Fall Time			103		ns
E_{on}	Turn-On Switching Loss			16.4		mJ
E_{off}	Turn-Off Switching Loss			7.38		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=50A, R_{Gon}=10Ω,R_{Goff}=22Ω, V_{GE}=-9V/+15V, T_j=125°C		159		ns
t_r	Rise Time			54		ns
$t_{d(off)}$	Turn-Off Delay Time			644		ns
t_f	Fall Time			140		ns
E_{on}	Turn-On Switching Loss			19.5		mJ
E_{off}	Turn-Off Switching Loss			10.5		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=50A, R_{Gon}=10Ω,R_{Goff}=22Ω, V_{GE}=-9V/+15V, T_j=150°C		155		ns
t_r	Rise Time			56		ns
$t_{d(off)}$	Turn-Off Delay Time			666		ns
t_f	Fall Time			139		ns
E_{on}	Turn-On Switching Loss			20.2		mJ
E_{off}	Turn-Off Switching Loss			10.7		mJ

Inverse Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=100A,V_{GE}=0V,T_j=25°C		2.10	2.55	V
		I_F=100A,V_{GE}=0V,T_j=125°C		2.25		
		I_F=100A,V_{GE}=0V,T_j=150°C		2.20		

Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=300A,V_{GE}=0V,T_j=25°C		2.10	2.55	V
		I_F=300A,V_{GE}=0V,T_j=125°C		2.25		
		I_F=300A,V_{GE}=0V,T_j=150°C		2.20		
Q_r	Recovered Charge	V_R=600V,I_F=200A, -di/dt=2304A/μs,V_{GE}=-15V T_j=25°C		9.55		μC
I_{RM}	Peak Reverse Recovery Current			80		A
E_{rec}	Reverse Recovery Energy			2.00		mJ
Q_r	Recovered Charge	V_R=600V,I_F=200A, -di/dt=2269A/μs,V_{GE}=-15V T_j=125°C		19.7		μC
I_{RM}	Peak Reverse Recovery Current			104		A
E_{rec}	Reverse Recovery Energy			5.95		mJ
Q_r	Recovered Charge	V_R=600V,I_F=200A, -di/dt=2328A/μs,V_{GE}=-15V T_j=150°C		22.4		μC
I_{RM}	Peak Reverse Recovery Current			110		A
E_{rec}	Reverse Recovery Energy			6.78		mJ

Neutral Point Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=400A,V_{GE}=0V,T_i=25°C		2.10	2.55	V
		I_F=400A,V_{GE}=0V,T_j=125°C		2.25		
		I_F=400A,V_{GE}=0V,T_j=150°C		2.20		
Q_r	Recovered Charge	V_R=600V,I_F=200A, -di/dt=2214A/μs,V_{GE}=-15V T_j=25°C		10.6		μC
I_{RM}	Peak Reverse Recovery Current			107		A
E_{rec}	Reverse Recovery Energy			2.32		mJ
Q_r	Recovered Charge	V_R=600V,I_F=200A, -di/dt=2293A/μs,V_{GE}=-15V T_j=125°C		23.3		μC
I_{RM}	Peak Reverse Recovery Current			122		A
E_{rec}	Reverse Recovery Energy			5.09		mJ
Q_r	Recovered Charge	V_R=600V,I_F=200A, -di/dt=2415A/μs,V_{GE}=-15V T_j=150°C		27.3		μC
I_{RM}	Peak Reverse Recovery Current			128		A
E_{rec}	Reverse Recovery Energy			5.99		mJ

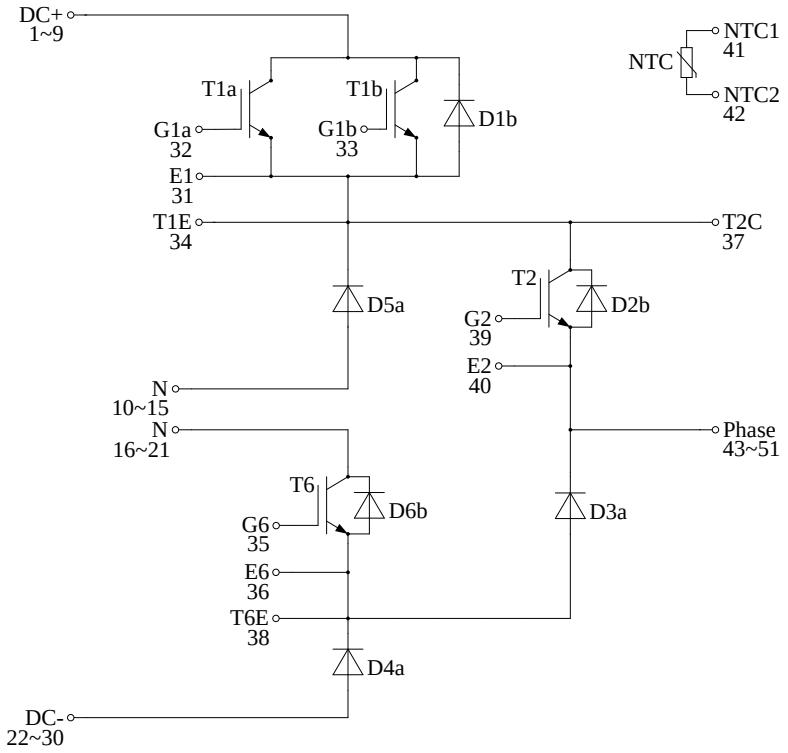
NTC Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			22.0		kΩ
ΔR/R	Deviation of R_{100}	T_C=100°C,R_{100}=1486.1Ω	-5		5	%
P_{25}	Power Dissipation				200	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		4000		K

Module Characteristics T_C=25°C unless otherwise noted

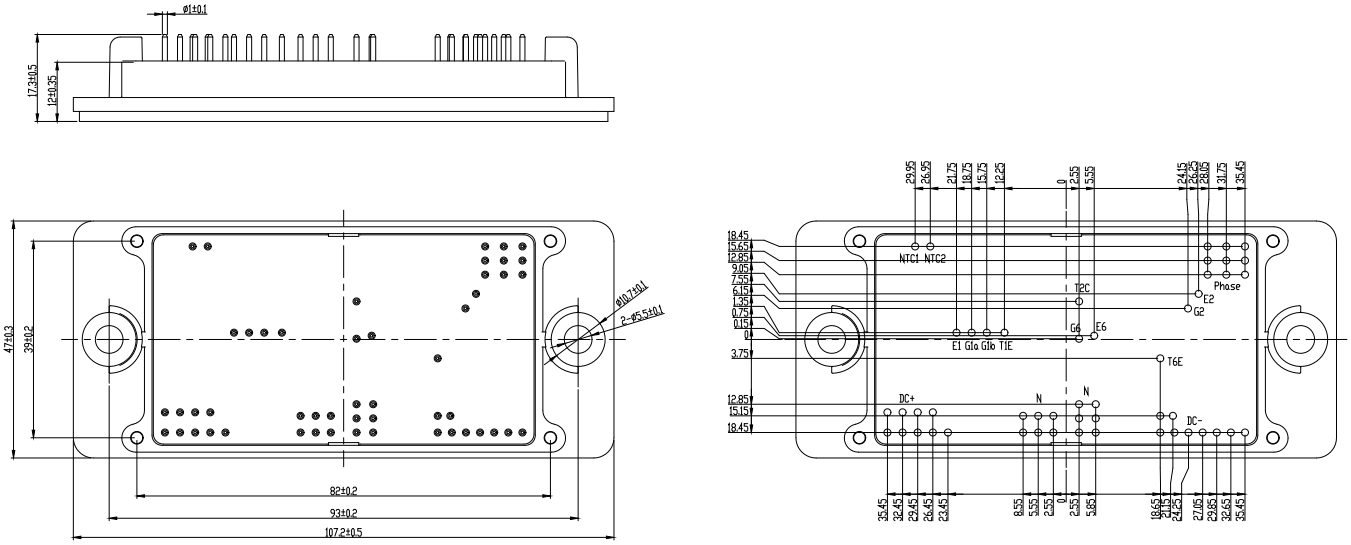
Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case (per Outer IGBT) Junction-to-Case (per Inner IGBT) Junction-to-Case (per Neutral Point IGBT) Junction-to-Case (per Inverse Diode) Junction-to-Case (per Diode) Junction-to-Case (per Neutral Point Diode)			0.069 0.098 0.166 0.645 0.239 0.175	K/W
R_{thCH}	Case-to-Heatsink (per Outer IGBT) Case-to-Heatsink (per Inner IGBT) Case-to-Heatsink (per Neutral Point IGBT) Case-to-Heatsink (per Inverse Diode) Case-to-Heatsink (per Diode) Case-to-Heatsink (per Neutral Point Diode)		0.021 0.037 0.049 0.086 0.057 0.040		K/W
M	Mounting Torque, Screw:M5	3.0		5.0	N.m
G	Weight of Module		250		g

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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