

STARPOWER

SEMICONDUCTOR

IGBT

GD800AYS100F6S

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.

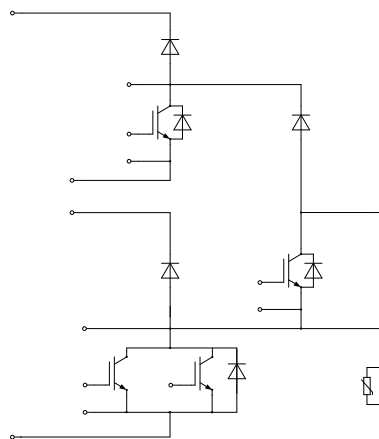
Features

- 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 $T_C=25^{\circ}\text{C}$ unless otherwise noted**Outer IGBT (T4a+T4b)**

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

Inner IGBT (T3)

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

Neutral Point IGBT (T5)

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

Inverse Diode (D3b,D4b,D5b)

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

Diode (D1a,D2a)

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

Neutral Point Diode (D6a)

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1000	V
I_F	Diode Continuous Forward Current $T_C=80^{\circ}\text{C}$	240	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	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 $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=800\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.90	2.35	V
		$I_C=800\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		2.25		
		$I_C=800\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		2.30		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=12.00\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	3.25	4.0	4.75	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			0.4		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=100\text{kHz}, V_{GE}=0\text{V}$		68.0		nF
C_{oes}	Onput Capacitance			1.92		nF
C_{res}	Reverse Transfer Capacitance			1.08		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		4.56		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=50\text{A}, R_{Gon}=10\Omega, R_{Goff}=22\Omega, V_{GE}=-9\text{V}/+15\text{V}, T_j=25^{\circ}\text{C}$		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	$V_{CC}=600\text{V}, I_C=50\text{A}, R_{Gon}=10\Omega, R_{Goff}=22\Omega, V_{GE}=-9\text{V}/+15\text{V}, T_j=125^{\circ}\text{C}$		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	$V_{CC}=600\text{V}, I_C=50\text{A}, R_{Gon}=10\Omega, R_{Goff}=22\Omega, V_{GE}=-9\text{V}/+15\text{V}, T_j=150^{\circ}\text{C}$		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 $T_c=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=600\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.90	2.35	V
		$I_C=600\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		2.25		
		$I_C=600\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.30		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=9.00\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	3.25	4.0	4.75	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			0.5		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=100\text{kHz}, V_{GE}=0\text{V}$		51.0		nF
C_{oes}	Onput Capacitance			1.44		nF
C_{res}	Reverse Transfer Capacitance			0.81		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		3.42		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=50\text{A}, R_{Gon}=10\Omega, R_{Goff}=22\Omega, V_{GE}=-9\text{V}/+15\text{V}, T_j=25^\circ\text{C}$		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	$V_{CC}=600\text{V}, I_C=50\text{A}, R_{Gon}=10\Omega, R_{Goff}=22\Omega, V_{GE}=-9\text{V}/+15\text{V}, T_j=125^\circ\text{C}$		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	$V_{CC}=600\text{V}, I_C=50\text{A}, R_{Gon}=10\Omega, R_{Goff}=22\Omega, V_{GE}=-9\text{V}/+15\text{V}, T_j=150^\circ\text{C}$		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 $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.50	1.95	V
		$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		1.75		
		$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		1.85		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=5.40\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	4.90	5.50	6.10	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		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=100\text{kHz}, V_{GE}=0\text{V}$		25.0		nF
C_{oes}	Onput Capacitance			0.89		nF
C_{res}	Reverse Transfer Capacitance			0.14		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		1.75		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=50\text{A}, R_{Gon}=10\Omega, R_{Goff}=22\Omega, V_{GE}=-9\text{V}/+15\text{V}, T_j=25^{\circ}\text{C}$		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	$V_{CC}=600\text{V}, I_C=50\text{A}, R_{Gon}=10\Omega, R_{Goff}=22\Omega, V_{GE}=-9\text{V}/+15\text{V}, T_j=125^{\circ}\text{C}$		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	$V_{CC}=600\text{V}, I_C=50\text{A}, R_{Gon}=10\Omega, R_{Goff}=22\Omega, V_{GE}=-9\text{V}/+15\text{V}, T_j=150^{\circ}\text{C}$		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 $T_C=25^{\circ}\text{C}$ unless otherwise noted

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

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

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

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

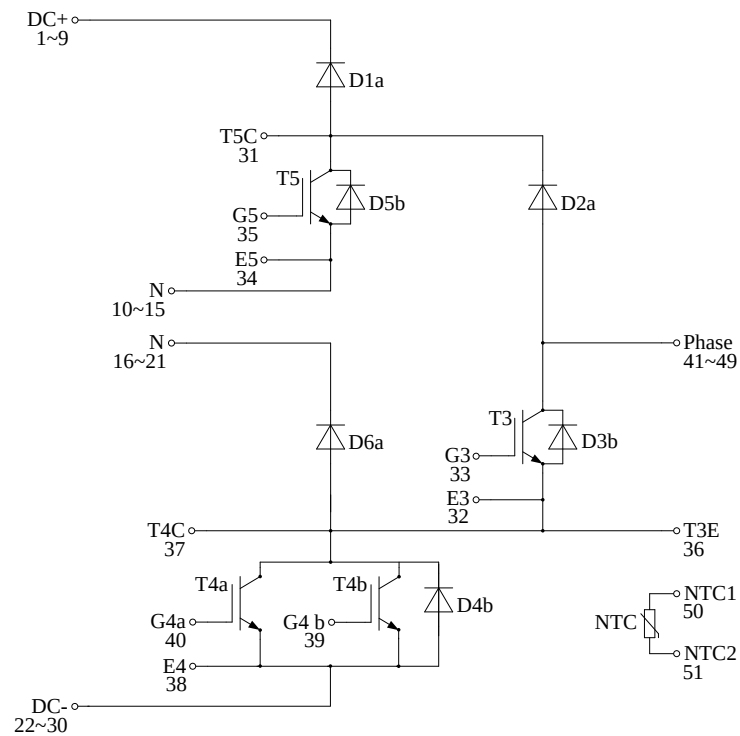
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=400\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		2.10	2.55	V
		$I_F=400\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		2.25		
		$I_F=400\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		2.20		
Q_r	Recovered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

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

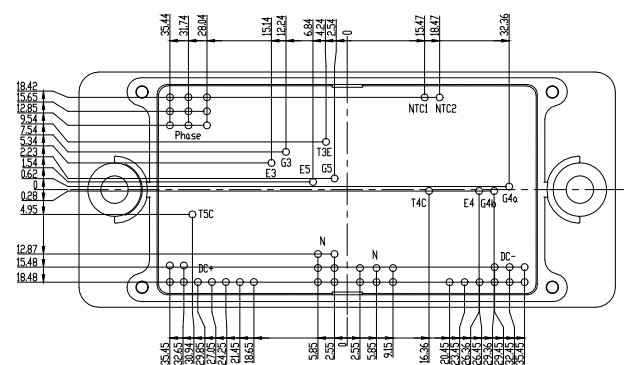
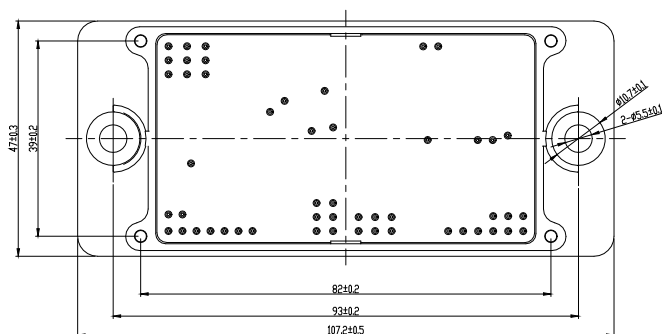
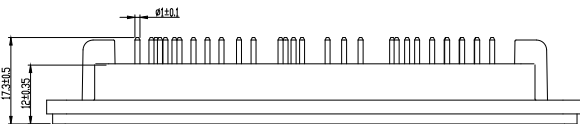
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			22.0		$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$T_C=100^{\circ}\text{C}, R_{100}=1486.1\Omega$	-5		5	%
P_{25}	Power Dissipation				200	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$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

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

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



Dimensions in Millimeters



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This product data sheet is describing the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively pursuant the terms and conditions of the supply agreement. There will be no guarantee of any kind for the product and its characteristics.

Should you require product information in excess of the data given in this product data sheet or which concerns the specific application of our product, please contact the sales office, which is responsible for you (see www.powersemi.cc), For those that are specifically interested we may provide application notes.

Due to technical requirements our product may contain dangerous substances. For information on the types in question please contact the sales office, which is responsible for you.

Should you intend to use the Product in aviation applications, in health or live endangering or life support applications, please notify.

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