STARPOWER

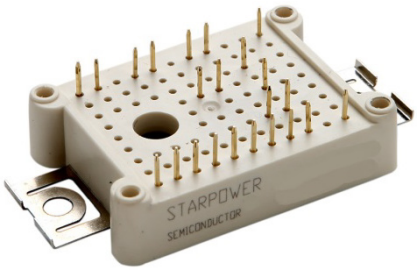
SEMICONDUCTOR **IGBT**

GD20PJT60L2S

600V/20A PIM 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.



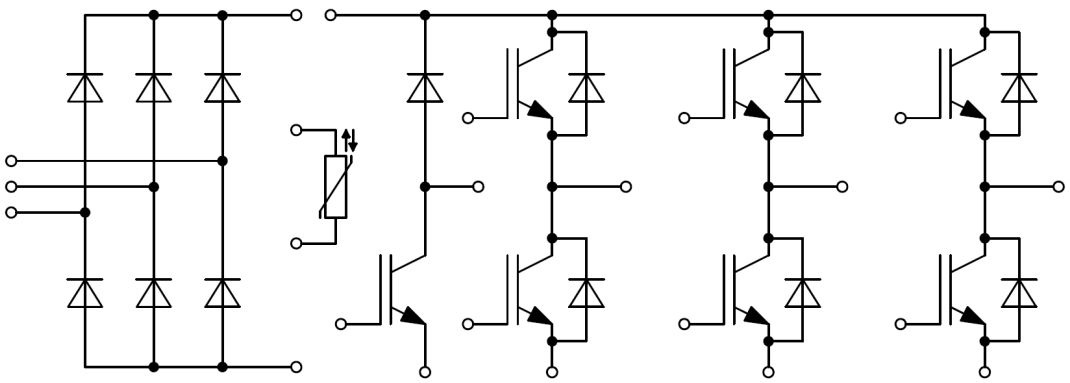
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- Low switching loss
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated heatsink 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°C unless otherwise noted

IGBT-inverter

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	600	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=25°C @ T_C=100°C	35 20	A
I_{CM}	Pulsed Collector Current t_p=1ms	40	A
P_D	Maximum Power Dissipation @ T_j=175°C	109	W

Diode-inverter

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	600	V
I_F	Diode Continuous Forward Current	20	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	40	A

Diode-rectifier

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1600	V
I_O	Average Output Current 50Hz/60Hz,sine wave	20	A
I_{FSM}	Surge Forward Current V_R=0V,t_p=10ms,T_j=45°C	270	A
I^2t	I^2t-value,V_R=0V,t_p=10ms,T_j=45°C	360	A^2s

IGBT-brake

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	600	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=25°C @ T_C=100°C	35 20	A
I_{CM}	Pulsed Collector Current t_p=1ms	40	A
P_D	Maximum Power Dissipation @ T_j=175°C	111	W

Diode-brake

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	600	V
I_F	Diode Continuous Forward Current	20	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	40	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature(inverter,brake) Maximum Junction Temperature (rectifier)	175 150	°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	2500	V

IGBT-inverter 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=20A,V_{GE}=15V, T_j=25°C		1.55	2.00	V
		I_C=20A,V_{GE}=15V, T_j=125°C		1.70		
		I_C=20A,V_{GE}=15V, T_j=150°C		1.80		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=0.29mA,V_{CE}=V_{GE}, T_j=25°C	5.0	5.8	6.5	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			/		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		1.10		nF
C_{res}	Reverse Transfer Capacitance			0.03		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.20		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=20A, R_G=18Ω,V_{GE}=±15V, T_j=25°C		20		ns
t_r	Rise Time			131		ns
$t_{d(off)}$	Turn-Off Delay Time			118		ns
t_f	Fall Time			72		ns
E_{on}	Turn-On Switching Loss			0.33		mJ
E_{off}	Turn-Off Switching Loss			0.43		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=20A, R_G=18Ω,V_{GE}=±15V, T_j=125°C		21		ns
t_r	Rise Time			162		ns
$t_{d(off)}$	Turn-Off Delay Time			142		ns
t_f	Fall Time			96		ns
E_{on}	Turn-On Switching Loss			0.43		mJ
E_{off}	Turn-Off Switching Loss			0.57		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=20A, R_G=18Ω,V_{GE}=±15V, T_j=150°C		22		ns
t_r	Rise Time			169		ns
$t_{d(off)}$	Turn-Off Delay Time			153		ns
t_f	Fall Time			102		ns
E_{on}	Turn-On Switching Loss			0.50		mJ
E_{off}	Turn-Off Switching Loss			0.58		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_j=150°C,V_{CC}=360V, V_{CEM}≤600V		100		A

Diode-inverter Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=20A,V_{GE}=0V,T_j=25°C		1.30	1.75	V
		I_F=20A,V_{GE}=0V,T_j=125°C		1.25		
		I_F=20A,V_{GE}=0V,T_j=150°C		1.25		
Q_r	Recovered Charge	V_R=600V,I_F=20A, -di/dt=650A/μs,V_{GE}=-15V T_j=25°C		1.2		μC
I_{RM}	Peak Reverse Recovery Current			20		A
E_{rec}	Reverse Recovery Energy			0.29		mJ
Q_r	Recovered Charge	V_R=600V,I_F=20A, -di/dt=650A/μs,V_{GE}=-15V T_j=125°C		1.7		μC
I_{RM}	Peak Reverse Recovery Current			22		A
E_{rec}	Reverse Recovery Energy			0.39		mJ
Q_r	Recovered Charge	V_R=600V,I_F=20A, -di/dt=650A/μs,V_{GE}=-15V T_j=150°C		1.9		μC
I_{RM}	Peak Reverse Recovery Current			23		A
E_{rec}	Reverse Recovery Energy			0.45		mJ

Diode-rectifier Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=20A,T_j=150°C		1.04		V
I_R	Reverse Current	T_j=150°C,V_R=1600V			1.0	mA

IGBT-brake 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=20A,V_{GE}=15V, T_j=25°C		1.55	2.00	V
		I_C=20A,V_{GE}=15V, T_j=125°C		1.70		
		I_C=20A,V_{GE}=15V, T_j=150°C		1.80		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=0.29mA,V_{CE}=V_{GE}, T_j=25°C	5.0	5.8	6.5	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			/		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		1.10		nF
C_{res}	Reverse Transfer Capacitance			0.03		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.20		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=20A, R_G=18Ω,V_{GE}=±15V, T_j=25°C		20		ns
t_r	Rise Time			131		ns
$t_{d(off)}$	Turn-Off Delay Time			118		ns
t_f	Fall Time			72		ns
E_{on}	Turn-On Switching Loss			0.33		mJ
E_{off}	Turn-Off Switching Loss			0.43		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=20A, R_G=18Ω,V_{GE}=±15V, T_j=125°C		21		ns
t_r	Rise Time			162		ns
$t_{d(off)}$	Turn-Off Delay Time			142		ns
t_f	Fall Time			96		ns
E_{on}	Turn-On Switching Loss			0.43		mJ
E_{off}	Turn-Off Switching Loss			0.57		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=20A, R_G=18Ω,V_{GE}=±15V, T_j=150°C		22		ns
t_r	Rise Time			169		ns
$t_{d(off)}$	Turn-Off Delay Time			153		ns
t_f	Fall Time			102		ns
E_{on}	Turn-On Switching Loss			0.50		mJ
E_{off}	Turn-Off Switching Loss			0.58		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_j=150°C,V_{CC}=360V, V_{CEM}≤600V		100		A

Diode-brake Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=20A,V_{GE}=0V,T_j=25°C		1.30	1.75	V
		I_F=20A,V_{GE}=0V,T_j=125°C		1.25		
		I_F=20A,V_{GE}=0V,T_j=150°C		1.25		
Q_r	Recovered Charge	V_R=600V,I_F=20A, -di/dt=650A/μs,V_{GE}=-15V T_j=25°C		1.2		μC
I_{RM}	Peak Reverse Recovery Current			20		A
E_{rec}	Reverse Recovery Energy			0.29		mJ
Q_r	Recovered Charge	V_R=600V,I_F=20A, -di/dt=650A/μs,V_{GE}=-15V T_j=125°C		1.7		μC
I_{RM}	Peak Reverse Recovery Current			22		A
E_{rec}	Reverse Recovery Energy			0.39		mJ
Q_r	Recovered Charge	V_R=600V,I_F=20A, -di/dt=650A/μs,V_{GE}=-15V T_j=150°C		1.9		μC
I_{RM}	Peak Reverse Recovery Current			23		A
E_{rec}	Reverse Recovery Energy			0.45		mJ

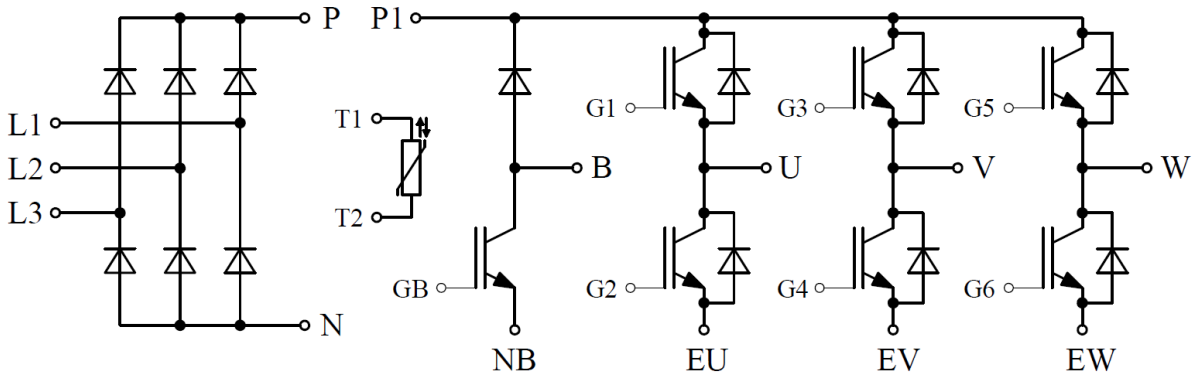
NTC Characteristics T_C=25°C unless otherwise noted

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

Module Characteristics T_C=25°C unless otherwise noted

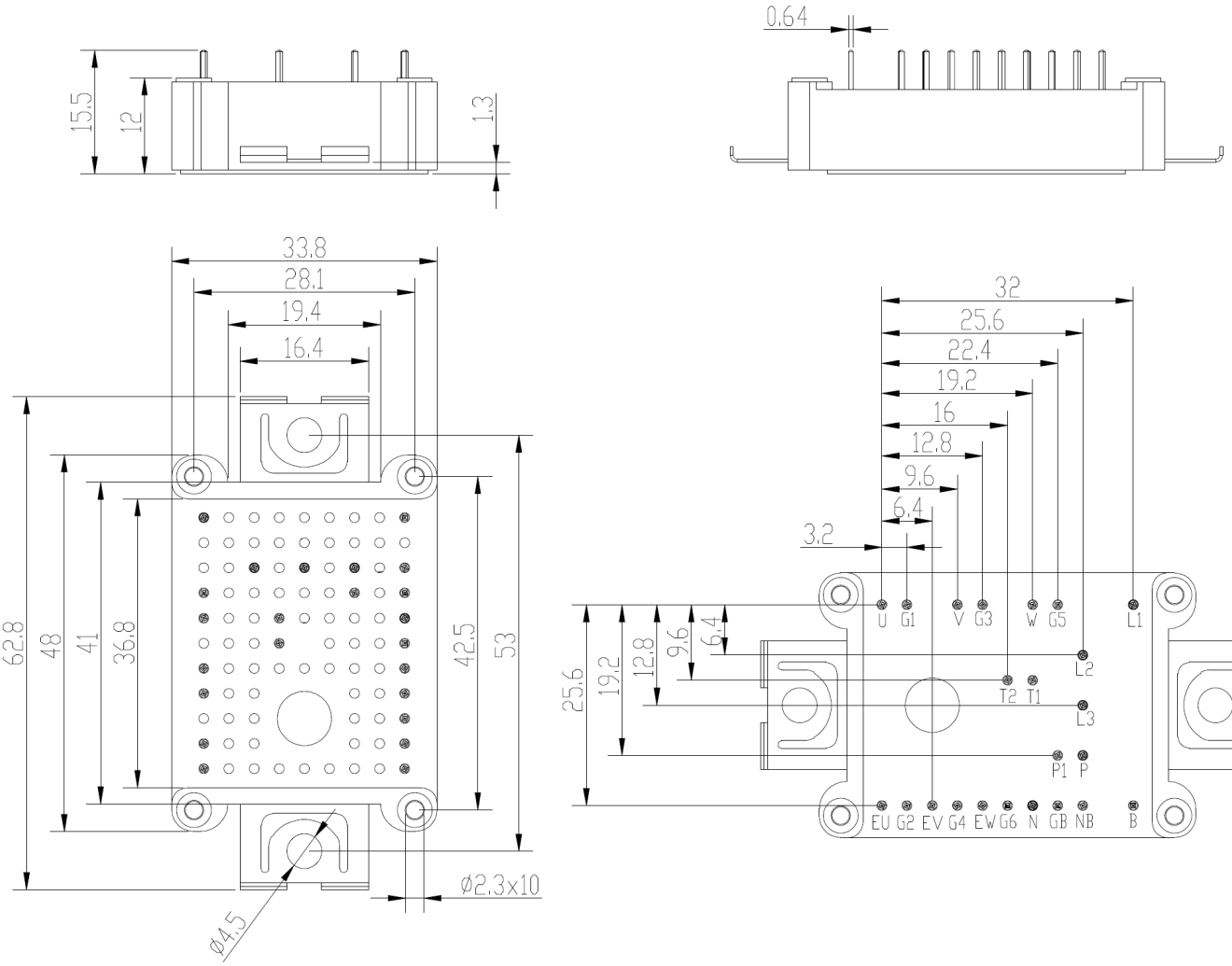
Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		30		nH
$R_{CC'+EE'}$ $R_{AA'+CC'}$	Module Lead Resistance,Terminal to Chip		8.00 6.00		mΩ
R_{thJC}	Junction-to-Case (per IGBT-inverter) Junction-to-Case (per Diode-inverter) Junction-to-Case (per Diode-rectifier) Junction-to-Case (per IGBT-brake) Junction-to-Case (per Diode-brake)		1.240 2.005 1.110 1.218 1.925	1.364 2.206 1.221 1.340 2.117	K/W
R_{thCH}	Case-to-Heatsink (per IGBT-inverter) Case-to-Heatsink (per Diode-inverter) Case-to-Heatsink (per Diode-rectifier) Case-to-Heatsink (per IGBT-brake) Case-to-Heatsink (per Diode-brake) Case-to-Sink (per Module)		1.048 1.695 0.938 1.030 1.627 0.058		K/W
F	Mounting Force Per Clamp	20		50	N
G	Weight of Module		24		g

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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