

STARPOWER

SEMICONDUCTOR

IGBT

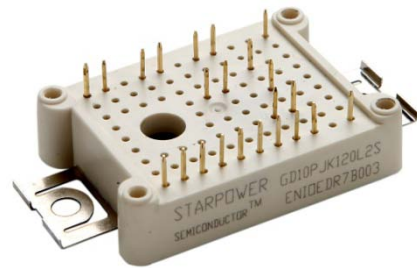
GD20PJT60L2S

Molding Type Module

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
- 5 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175 °C
- Fast & soft reverse recovery anti-parallel FWD

Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

IGBT-inverter $T_C=25^\circ\text{C}$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD20PJT60L2S	Unit
V_{CES}	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	600	V
V_{GES}	Gate-Emitter Voltage @ $T_j=25^\circ\text{C}$	± 20	V
I_C	Collector Current @ $T_C=25^\circ\text{C}$ @ $T_C=100^\circ\text{C}$	32	A
		20	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	40	A
P_{tot}	Total Power Dissipation @ $T_j=175^\circ\text{C}$	114	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$T_j=25^\circ\text{C}$	600			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

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=500\mu\text{A}, V_{CE}=V_{GE},$ $T_j=25^\circ\text{C}$	4.0	5.5	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=20\text{A}, V_{GE}=15\text{V},$ $T_j=25^\circ\text{C}$		1.85	2.30	V
		$I_C=20\text{A}, V_{GE}=15\text{V},$ $T_j=125^\circ\text{C}$		2.10		
		$I_C=20\text{A}, V_{GE}=15\text{V},$ $T_j=150^\circ\text{C}$		2.15		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300V, I_C=20A,$ $R_G=15\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		45		ns
t_r	Rise Time			33		ns
$t_{d(off)}$	Turn-Off Delay Time			54		ns
t_f	Fall Time			110		ns
E_{on}	Turn-On Switching Loss			0.71		mJ
E_{off}	Turn-Off Switching Loss			0.16		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300V, I_C=20A,$ $R_G=15\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		45		ns
t_r	Rise Time			37		ns
$t_{d(off)}$	Turn-Off Delay Time			54		ns
t_f	Fall Time			127		ns
E_{on}	Turn-On Switching Loss			0.78		mJ
E_{off}	Turn-Off Switching Loss			0.21		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300V, I_C=20A,$ $R_G=15\Omega, V_{GE}=\pm 15V,$ $T_j=150^\circ C$		48		ns
t_r	Rise Time			38		ns
$t_{d(off)}$	Turn-Off Delay Time			54		ns
t_f	Fall Time			133		ns
E_{on}	Turn-On Switching Loss			0.78		mJ
E_{off}	Turn-Off Switching Loss			0.24		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		1.04		nF
C_{oes}	Output Capacitance			0.09		nF
C_{res}	Reverse Transfer Capacitance			0.03		nF
Q_G	Gate Charge	$V_{CC}=400V, I_C=20A,$ $V_{GE}=15V$		40		nC
R_{Gint}	Internal Gate Resister			/		Ω
I_{SC}	SC Data	$t_p \leq 5\mu s, V_{GE}=15V,$ $T_j=150^\circ C, V_{CC}=400V,$ $V_{CEM} \leq 600V$		162		A

Diode-inverter $T_C=25^\circ\text{C}$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD20PJT60L2S	Unit
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	600	V
I_F	DC Forward Current	20	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	40	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=20\text{A}, V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$		1.30	1.75	V
			$T_j=125^\circ\text{C}$		1.25		
			$T_j=150^\circ\text{C}$		1.25		
Q_r	Recovered Charge	$I_F=20\text{A}, V_R=300\text{V}, -di/dt=650\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$		1.2		μC
			$T_j=125^\circ\text{C}$		1.7		
			$T_j=150^\circ\text{C}$		1.9		
I_{RM}	Peak Reverse Recovery Current	$I_F=20\text{A}, V_R=300\text{V}, -di/dt=650\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$		20		A
			$T_j=125^\circ\text{C}$		23		
			$T_j=150^\circ\text{C}$		23		
E_{rec}	Reverse Recovery Energy	$I_F=20\text{A}, V_R=300\text{V}, -di/dt=650\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$		0.29		mJ
			$T_j=125^\circ\text{C}$		0.39		
			$T_j=150^\circ\text{C}$		0.45		

Diode-rectifier $T_C=25^\circ\text{C}$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD20PJT60L2S	Unit
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	1600	V
I_O	Average Output Current @ $T_C=100^\circ\text{C}$	20	A
I_{FSM}	Surge Forward Current $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^\circ\text{C}$	270	A
I^2t	I^2t -value, $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^\circ\text{C}$	360	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=20\text{A}$	$T_j=150^\circ\text{C}$		1.05		V
I_R	Reverse Current	$T_j=150^\circ\text{C}, V_R=1600\text{V}$				1.0	mA

IGBT-brake-chopper $T_C=25^\circ\text{C}$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD20PJT60L2S	Unit
V_{CES}	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	600	V
V_{GES}	Gate-Emitter Voltage @ $T_j=25^\circ\text{C}$	± 20	V
I_C	Collector Current @ $T_C=25^\circ\text{C}$ @ $T_C=100^\circ\text{C}$	32	A
		20	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	40	A
P_{tot}	Total Power Dissipation @ $T_j=175^\circ\text{C}$	115	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$T_j=25^\circ\text{C}$	600			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

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=500\mu\text{A}, V_{CE}=V_{GE},$ $T_j=25^\circ\text{C}$	4.0	5.5	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=20\text{A}, V_{GE}=15\text{V},$ $T_j=25^\circ\text{C}$		1.85	2.30	V
		$I_C=20\text{A}, V_{GE}=15\text{V},$ $T_j=125^\circ\text{C}$		2.10		
		$I_C=20\text{A}, V_{GE}=15\text{V},$ $T_j=150^\circ\text{C}$		2.15		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300V, I_C=20A,$ $R_G=15\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		45		ns
t_r	Rise Time			33		ns
$t_{d(off)}$	Turn-Off Delay Time			54		ns
t_f	Fall Time			110		ns
E_{on}	Turn-On Switching Loss			0.71		mJ
E_{off}	Turn-Off Switching Loss			0.16		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300V, I_C=20A,$ $R_G=15\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		45		ns
t_r	Rise Time			37		ns
$t_{d(off)}$	Turn-Off Delay Time			54		ns
t_f	Fall Time			127		ns
E_{on}	Turn-On Switching Loss			0.78		mJ
E_{off}	Turn-Off Switching Loss			0.21		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300V, I_C=20A,$ $R_G=15\Omega, V_{GE}=\pm 15V,$ $T_j=150^\circ C$		48		ns
t_r	Rise Time			38		ns
$t_{d(off)}$	Turn-Off Delay Time			54		ns
t_f	Fall Time			133		ns
E_{on}	Turn-On Switching Loss			0.78		mJ
E_{off}	Turn-Off Switching Loss			0.24		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		1.04		nF
C_{oes}	Output Capacitance			0.09		nF
C_{res}	Reverse Transfer Capacitance			0.03		nF
Q_G	Gate Charge	$V_{CC}=400V, I_C=20A,$ $V_{GE}=15V$		40		nC
R_{Gint}	Internal Gate Resister			/		Ω
I_{SC}	SC Data	$t_p \leq 5\mu s, V_{GE}=15V,$ $T_j=150^\circ C, V_{CC}=400V,$ $V_{CEM} \leq 600V$		162		A

Diode-brake-chopper $T_C=25^\circ\text{C}$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD20PJT60L2S	Unit
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	600	V
I_F	DC Forward Current	20	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	40	A

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=20\text{A}, V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$	1.30	1.75	V
			$T_j=125^\circ\text{C}$	1.25		
			$T_j=150^\circ\text{C}$	1.25		
Q_r	Recovered Charge	$I_F=20\text{A}, V_R=300\text{V}, -di/dt=650\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	1.2		μC
			$T_j=125^\circ\text{C}$	1.7		
			$T_j=150^\circ\text{C}$	1.9		
I_{RM}	Peak Reverse Recovery Current	$I_F=20\text{A}, V_R=300\text{V}, -di/dt=650\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	20		A
			$T_j=125^\circ\text{C}$	23		
			$T_j=150^\circ\text{C}$	23		
E_{rec}	Reverse Recovery Energy	$I_F=20\text{A}, V_R=300\text{V}, -di/dt=650\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	0.29		mJ
			$T_j=125^\circ\text{C}$	0.39		
			$T_j=150^\circ\text{C}$	0.45		

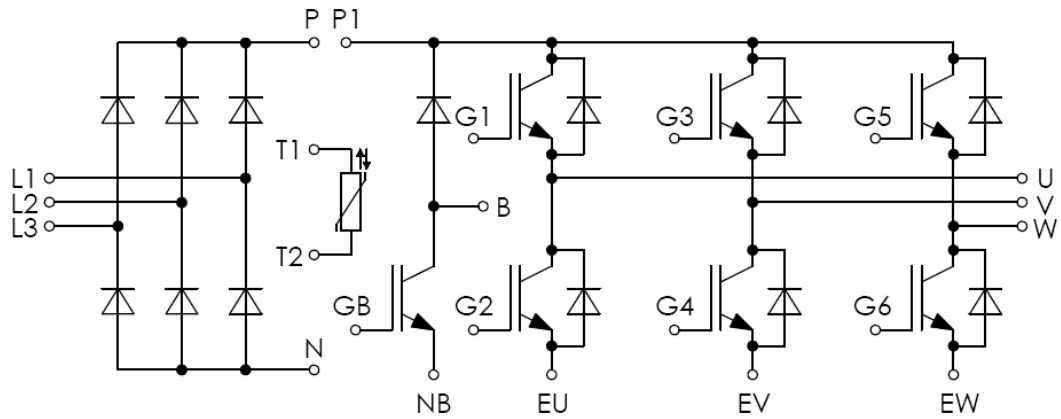
Electrical Characteristics of NTC $T_C=25^\circ\text{C}$ unless otherwise noted

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

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

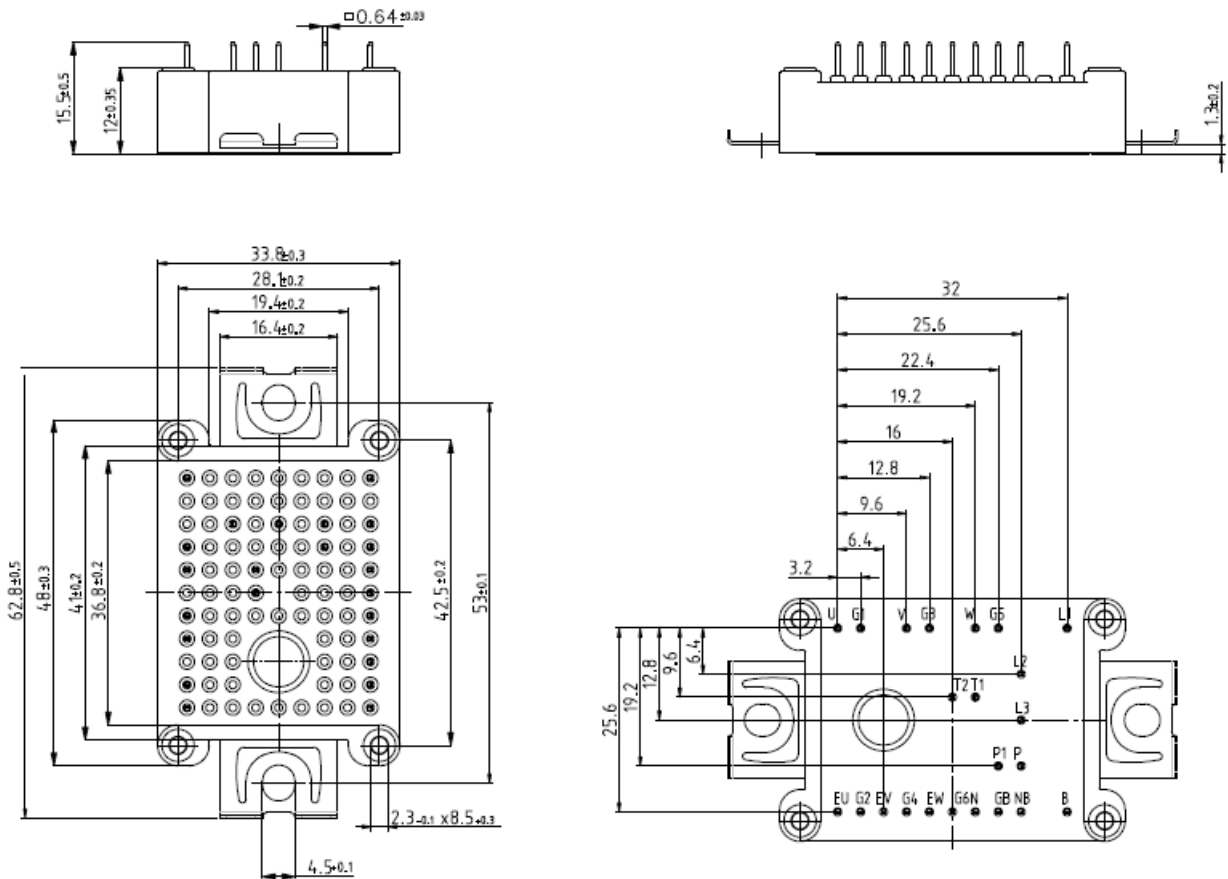
Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	2500			V
L_{CE}	Stray Inductance		30		nH
$R_{CC'+EE'}$ $R_{AA'+CC'}$	Module Lead Resistance, Terminal to Chip		8.00 6.00		m Ω
$R_{\theta JC}$	Junction-to-Case (per IGBT-inverter) Junction-to-Case (per Diode-inverter) Junction-to-Case (per Diode-rectifier) Junction-to-Case (per IGBT-brake-chopper) Junction-to-Case (per Diode-brake-chopper)			1.321 2.206 1.221 1.305 2.117	K/W
$R_{\theta CS}$	Case-to-Sink (per IGBT-inverter) Case-to-Sink (per Diode-inverter) Case-to-Sink (per Diode-rectifier) Case-to-Sink (per IGBT-brake-chopper) Case-to-Sink (per Diode-brake-chopper)		1.028 1.716 0.950 1.015 1.647		K/W
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)		0.058		K/W
T_{jmax}	Maximum Junction Temperature (inverter,brake) Maximum Junction Temperature(rectifier)			175 150	$^{\circ}\text{C}$
T_{jop}	Operating Junction Temperature	-40		150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40		125	$^{\circ}\text{C}$
F	Mounting Force Per Clamp	20		50	N
G	Weight of Module		24		g

Equivalent Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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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.

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