

STARPOWER

SEMICONDUCTOR

IGBT

GD20PJT60L1S

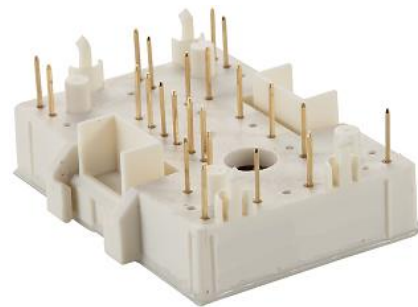
Molding Type Module**600V/20A PIM in one-package**

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	GD20PJT60L1S	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 20	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	40	A
P_{tot}	Total Power Dissipation @ $T_j=175^{\circ}\text{C}$	112	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	GD20PJT60L1S	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 =20A, V _{GE} =0V	T _j =25°C		1.30	1.75	V
			T _j =125°C		1.25		
			T _j =150°C		1.25		
Q _t	Recovered Charge	I _F =20A, V _R =300V, -di/dt=650A/μs, V _{GE} =-15V	T _j =25°C		1.2		μC
			T _j =125°C		1.7		
			T _j =150°C		1.9		
I _{RM}	Peak Reverse Recovery Current		T _j =25°C		20		A
			T _j =125°C		23		
			T _j =150°C		23		
E _{rec}	Reverse Recovery Energy		T _j =25°C		0.29		mJ
			T _j =125°C		0.39		
			T _j =150°C		0.45		

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

Symbol	Description	GD20PJT60L1S	Unit
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^{\circ}\text{C}$	1600	V
I_O	Average Output Current	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	$I_F=20\text{A}$	$T_j=150^{\circ}\text{C}$		1.04		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	GD20PJT60L1S	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 20	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	40	A
P_{tot}	Total Power Dissipation @ $T_j=175^{\circ}\text{C}$	112	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	GD20PJT60L1S	Unit
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_J=25^{\circ}\text{C}$	600	V
I_F	DC Forward Current	10	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	20	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
V _F	Diode Forward Voltage	I _F =10A, V _{GE} =0V	T _J =25°C		1.20	1.65	V
			T _J =125°C		1.10		
			T _J =150°C		1.10		
Q _r	Recovered Charge	I _F =10A, V _R =300V, -di/dt=700A/μs, V _{GE} =-15V	T _J =25°C		0.5		μC
			T _J =125°C		0.8		
			T _J =150°C		0.9		
I _{RM}	Peak Reverse Recovery Current		T _J =25°C		16		A
			T _J =125°C		17		
			T _J =150°C		19		
E _{rec}	Reverse Recovery Energy		T _J =25°C		0.10		mJ
			T _J =125°C		0.19		
			T _J =150°C		0.24		

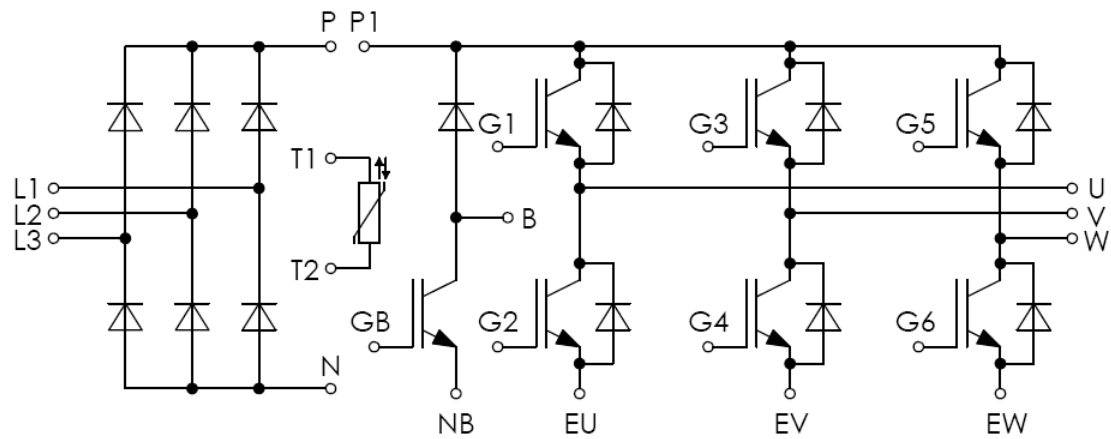
Electrical Characteristics of NTC $T_C=25^{\circ}\text{C}$ unless otherwise noted

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

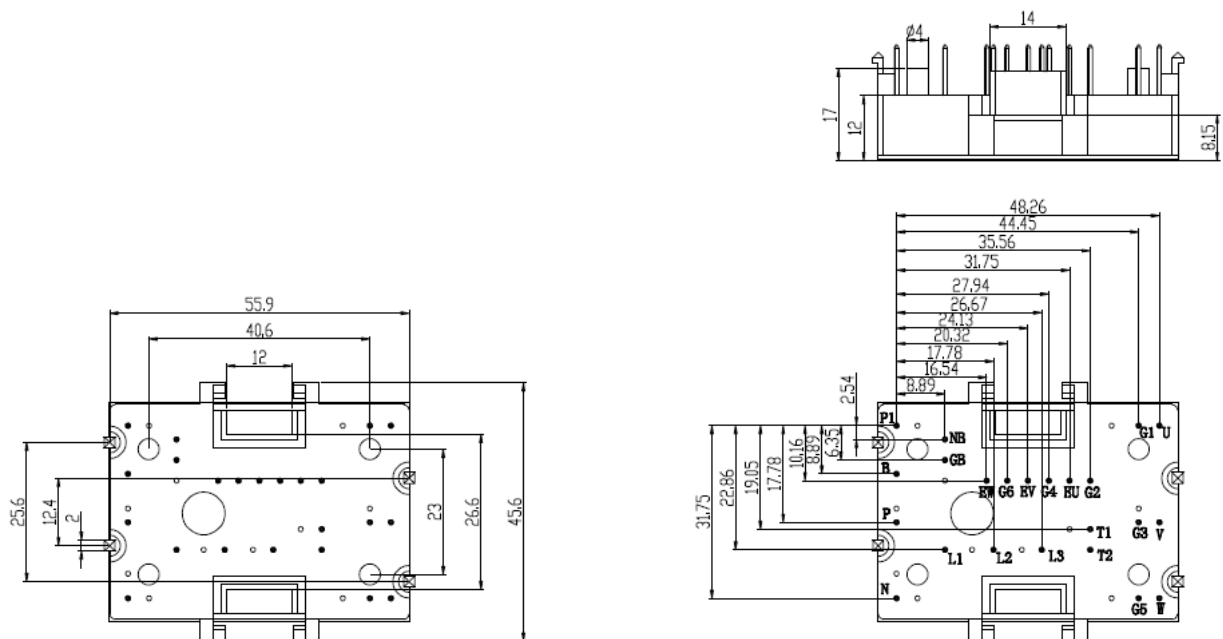
Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	2500			V
L_{CE}	Stray Inductance		40		nH
$R_{\text{CC}'+\text{EE}'}$ $R_{\text{AA}'+\text{CC}'}$	Module Lead Resistance, Terminal to Chip		10.0 7.00		m Ω
$R_{\theta\text{JC}}$	Junction-to-Case (per IGBT-inverter)		1.220	1.342	K/W
	Junction-to-Case (per Diode-inverter)		1.949	2.144	
	Junction-to-Case (per Diode-rectifier)		1.074	1.181	
	Junction-to-Case (per IGBT-brake-chopper)		1.220	1.342	
	Junction-to-Case (per Diode-brake-chopper)		2.471	2.718	
$R_{\theta\text{CS}}$	Case-to-Sink (per IGBT-inverter)		0.542		K/W
	Case-to-Sink (per Diode-inverter)		0.866		
	Case-to-Sink (per Diode-rectifier)		0.477		
	Case-to-Sink (per IGBT-brake-chopper)		0.542		
	Case-to-Sink (per Diode-brake-chopper)		1.098		
$R_{\theta\text{CS}}$	Case-to-Sink (Conductive grease applied)		0.030		K/W
T_{jmax}	Maximum Junction Temperature (inverter,brake)			175	$^{\circ}\text{C}$
	Maximum Junction Temperature(rectifier)			150	
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	40		80	N
G	Weight of Module		36		g

Equivalent Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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