

STARPOWER

SEMICONDUCTOR™

IGBT

GD50PJT60L3S

Preliminary

Molding Type Module**600V/50A PIM in one-package**

General Description

STARPOWER IGBT Power Module provides ultra low conduction 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 losses
- 5 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology

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	GD50PJT60L3S	Units
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 @ $T_C=25^{\circ}\text{C}$	90	A
	@ $T_C=80^{\circ}\text{C}$	50	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	100	A
P_{tot}	Total Power Dissipation @ $T_J=175^{\circ}\text{C}$	242	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$T_J=25^{\circ}\text{C}$	600			V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V},$ $T_J=25^{\circ}\text{C}$			5.0	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.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.4\text{mA}, V_{CE}=V_{GE},$ $T_J=25^{\circ}\text{C}$	4.0		6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=50\text{A}, V_{GE}=15\text{V},$ $T_J=25^{\circ}\text{C}$		1.65	2.10	V
		$I_C=50\text{A}, V_{GE}=15\text{V},$ $T_J=125^{\circ}\text{C}$		2.05		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Q_G	Gate charge	$V_{CC}=400\text{V}, I_C=50\text{A},$ $V_{GE}=15\text{V}$		95		nC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400\text{V}, I_C=50\text{A},$ $R_G=10\Omega, V_{GE}=15\text{V},$ $T_J=25^{\circ}\text{C}$		60		ns
t_r	Rise Time			40		ns
$t_{d(off)}$	Turn-Off Delay Time			145		ns
t_f	Fall Time			35		ns
E_{on}	Turn-On Switching Loss			6.25		mJ
E_{off}	Turn-Off Switching Loss			12.8		mJ

$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=50A,$ $R_G=10\Omega, V_{GE}=15V,$ $T_J=125^\circ C$		55		ns
t_r	Rise Time			45		ns
$t_{d(off)}$	Turn-Off Delay Time			165		ns
t_f	Fall Time			45		ns
E_{on}	Turn-On Switching Loss			1.63		mJ
E_{off}	Turn-Off Switching Loss			1.59		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		3025		pF
C_{oes}	Output Capacitance			245		pF
C_{res}	Reverse Transfer Capacitance			90		pF
I_{SC}	SC Data	$T_P \leq 5\mu s, V_{GE}=15V,$ $T_J=125^\circ C, V_{CC}=360V,$ $V_{CEM} \leq 600V$		TBD		A

DIODE-inverter $T_C=25^\circ C$ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD50PJT60L3S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_J=25^\circ C$	600	V
I_F	DC Forward Current @ $T_C=80^\circ C$	50	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1ms$	100	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V _F	Diode Forward Voltage	I _F =50A,V _{GE} =0V	T _j =25°C		1.35	1.75	V
			T _j =125°C		1.35		
Q _r	Recovered Charge	V _R =300V, I _F =50A, R _G =10Ω, V _{GE} =-15V	T _j =25°C		2.7		μC
			T _j =125°C		3.7		
I _{RM}	Peak Reverse Recovery Current		T _j =25°C		47		A
			T _j =125°C		51		
E _{rec}	Reverse Recovery Energy		T _j =25°C		0.58		mJ
			T _j =125°C		0.89		

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

Symbol	Description	GD50PJT60L3S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_J=25^{\circ}\text{C}$	1600	V
$I_{F(AV)}$	Average On-state Current @ $T_C=100^{\circ}\text{C}$	31	A
I_{RMSM}	Maximum RMS Current at Rectifier Output @ $T_C=80^{\circ}\text{C}$	60	A
I_{FSM}	Surge Forward Current $V_R=0\text{V}, t_p=10\text{ms}, T_J=150^{\circ}\text{C}$	280	A
I^2t	I^2t -value, $V_R=0\text{V}, t_p=10\text{ms}, T_J=150^{\circ}\text{C}$	390	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=50\text{A}$	$T_J=150^{\circ}\text{C}$			1.40	V
I_R	Reverse Current	$T_J=150^{\circ}\text{C}, V_R=1600\text{V}$				2.0	mA

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

Symbol	Description	GD50PJT60L3S	Units
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 @ $T_C=25^{\circ}\text{C}$ @ $T_C=80^{\circ}\text{C}$	60 30	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	60	A
P_{tot}	Total Power Dissipation @ $T_J=150^{\circ}\text{C}$	202	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$T_J=25^{\circ}\text{C}$	600			V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_J=25^{\circ}\text{C}$			5.0	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.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=250\mu A, V_{CE}=V_{GE}, T_J=25^\circ C$	3.5		5.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=30A, V_{GE}=15V, T_J=25^\circ C$		1.95	2.40	V
		$I_C=30A, V_{GE}=15V, T_J=125^\circ C$		2.35		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Q_G	Gate charge	$V_{CC}=400V, I_C=30A, V_{GE}=15V$		102		nC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=30A, R_G=10\Omega, V_{GE}=15V, T_J=25^\circ C$		47		ns
t_r	Rise Time			30		ns
$t_{d(off)}$	Turn-Off Delay Time			190		ns
t_f	Fall Time			30		ns
E_{on}	Turn-On Switching Loss			0.35		mJ
E_{off}	Turn-Off Switching Loss			0.83		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=30A, R_G=10\Omega, V_{GE}=15V, T_J=125^\circ C$		49		ns
t_r	Rise Time			30		ns
$t_{d(off)}$	Turn-Off Delay Time			205		ns
t_f	Fall Time			33		ns
E_{on}	Turn-On Switching Loss			0.64		mJ
E_{off}	Turn-Off Switching Loss			1.15		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz, V_{GE}=0V$		1750		pF
C_{oes}	Output Capacitance			160		pF
C_{res}	Reverse Transfer Capacitance			60		pF
I_{SC}	SC Data	$T_P \leq 10\mu s, V_{GE}=15V, T_J=125^\circ C, V_{CC}=360V, V_{CEM} \leq 600V$		TBD		A

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

Symbol	Description	GD50PJT60L3S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_J=25^{\circ}\text{C}$	600	V
I_F	DC Forward Current @ $T_C=80^{\circ}\text{C}$	30	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	60	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V _F	Diode Forward Voltage	I _F =30A,V _{GE} =0V	T _j =25℃		1.30	1.70	V
			T _j =125℃		1.25		
Q _r	Recovered Charge	V _R =300V, I _F =30A, R _G =10Ω, V _{GE} =-15V	T _j =25℃		1.3		μC
			T _j =125℃		2.3		
I _{RM}	Peak Reverse Recovery Current		T _j =25℃		35		A
			T _j =125℃		39		
E _{rec}	Reverse Recovery Energy		T _j =25℃		0.35		mJ
			T _j =125℃		0.55		

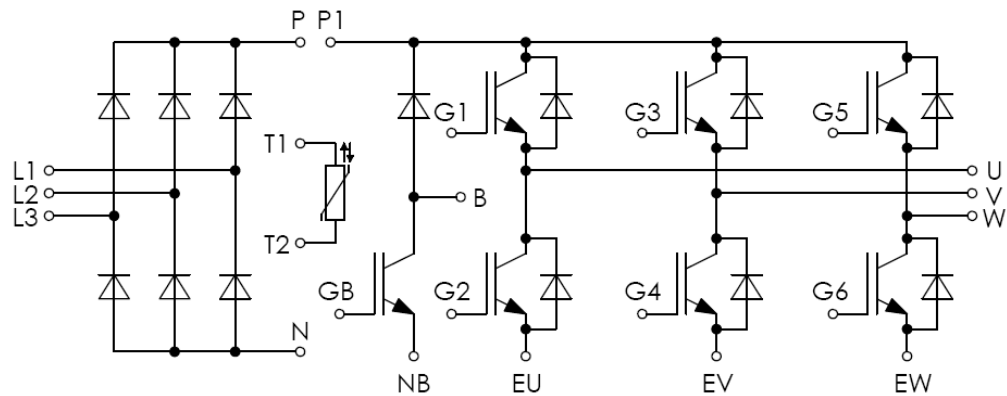
Electrical Characteristics of NTC $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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

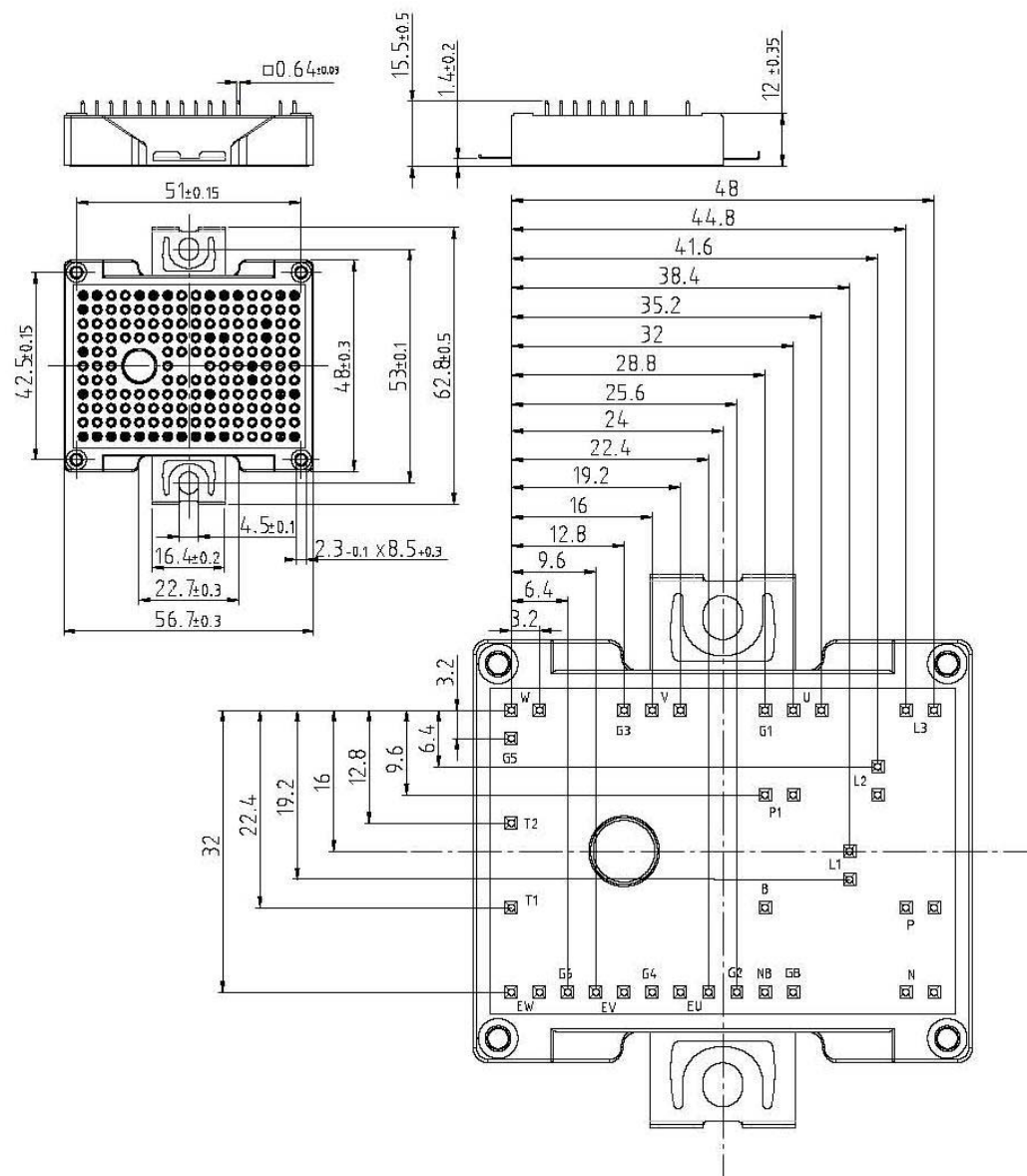
Symbol	Parameter	Min.	Typ.	Max.	Units
V _{ISO}	Isolation Voltage RMS, f=50Hz, t=1min	2500			V
L _{CE}	Stray Inductance		30		nH
R _{CC'+EE'}	Module Lead Resistance, Terminal to Chip @ T _C =25°C		5.0		mΩ
R _{θJC}	Junction-to-Case (per IGBT-inverter)			0.62	K/W
	Junction-to-Case (per DIODE-inverter)			0.84	
	Junction-to-Case (per DIODE-rectifier)			1.18	
	Junction-to-Case (per IGBT-brake-chopper)			0.62	
	Junction-to-Case (per DIODE-brake-chopper)			0.79	
R _{θCS}	Case-to-Sink (Conductive grease applied)		0.04		K/W
T _j	Maximum Junction Temperature			175	°C
T _{STG}	Storage Temperature Range	-40		125	°C
F	Mounting Force Per Clamp	40		80	N
G	Weight of Module		39		g

Equivalent Circuit Schematic



Package Dimension

Dimensions in Millimeters



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