

STARPOWER

SEMICONDUCTOR

IGBT

GD50PIT170C6S

Molding Type Module**1700V/50A 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
- 10 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	GD50PIT170C6S	Units
V_{CES}	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	1700	V
V_{GES}	Gate-Emitter Voltage @ $T_j=25^\circ\text{C}$	± 20	V
I_C	Collector Current @ $T_C=25^\circ\text{C}$ @ $T_C=100^\circ\text{C}$	88 50	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	100	A
P_{tot}	Total Power Dissipation @ $T_j=175^\circ\text{C}$	393	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$T_j=25^\circ\text{C}$	1700			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	$I_C=2.0\text{mA}, V_{CE}=V_{GE},$ $T_j=25^\circ\text{C}$	5.2	5.8	6.4	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=50\text{A}, V_{GE}=15\text{V},$ $T_j=25^\circ\text{C}$		2.00	2.45	V
		$I_C=50\text{A}, V_{GE}=15\text{V},$ $T_j=125^\circ\text{C}$		2.40		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900V, I_C=50A,$ $R_G=8.0\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		370		ns	
t_r	Rise Time			40		ns	
$t_{d(off)}$	Turn-Off Delay Time			650		ns	
t_f	Fall Time			180		ns	
E_{on}	Turn-On Switching Loss				11.0		mJ
E_{off}	Turn-Off Switching Loss				10.5		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900V, I_C=50A,$ $R_G=8.0\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		400		ns	
t_r	Rise Time			50		ns	
$t_{d(off)}$	Turn-Off Delay Time			800		ns	
t_f	Fall Time			300		ns	
E_{on}	Turn-On Switching Loss				16.0		mJ
E_{off}	Turn-Off Switching Loss				15.5		mJ
C_{ies}	Input Capacitance	$V_{CE}=25V, f=1Mhz,$ $V_{GE}=0V$		4.50		nF	
C_{oes}	Output Capacitance			0.18		nF	
C_{res}	Reverse Transfer Capacitance			0.15		nF	
Q_G	Gate Charge	$V_{CC}=900V, I_C=50A,$ $V_{GE}=-15 \dots +15V$		0.60		nC	
R_{Gint}	Internal Gate Resistor			9.5		Ω	
I_{SC}	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=1000V,$ $V_{CEM} \leq 1700V$		200		A	

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

Symbol	Description	GD50PIT170C6S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	1700	V
I_F	DC Forward Current	50	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	100	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=50\text{A}, V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$		1.80	2.20	V
			$T_j=125^\circ\text{C}$		1.90		
Q_r	Recovered Charge	$I_F=50\text{A}, V_R=900\text{V}, R_G=8.0\Omega, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$		14.5		μC
			$T_j=125^\circ\text{C}$		24.5		
I_{RM}	Peak Reverse Recovery Current	$I_F=50\text{A}, V_R=900\text{V}, R_G=8.0\Omega, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$		76.5		A
			$T_j=125^\circ\text{C}$		83.5		
E_{rec}	Reverse Recovery Energy	$I_F=50\text{A}, V_R=900\text{V}, R_G=8.0\Omega, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$		7.60		mJ
			$T_j=125^\circ\text{C}$		13.5		

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

Symbol	Description	GD50PIT170C6S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	1600	V
$I_{F(AV)}$	Average On-state Current @ $T_C=100^\circ\text{C}$	78	A
I_{RMSM}	Maximum RMS Current At Rectifier Output @ $T_C=80^\circ\text{C}$	120	A
I_{FSM}	Surge Forward Current $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^\circ\text{C}$	1100	A
I^2t	I^2t -value, $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^\circ\text{C}$	6050	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=75\text{A}$	$T_j=150^\circ\text{C}$		1.10		V
I_R	Reverse Current	$T_j=150^\circ\text{C}, V_R=1600\text{V}$				3.0	mA

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

Symbol	Description	GD50PIT170C6S	Units
V_{CES}	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	1700	V
V_{GES}	Gate-Emitter Voltage @ $T_j=25^\circ\text{C}$	± 20	V
I_C	Collector Current @ $T_C=25^\circ\text{C}$ @ $T_C=100^\circ\text{C}$	88 50	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	100	A
P_{tot}	Total Power Dissipation @ $T_j=150^\circ\text{C}$	393	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$T_j=25^\circ\text{C}$	1700			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	$I_C=2.0\text{mA}, V_{CE}=V_{GE},$ $T_j=25^\circ\text{C}$	5.2	5.8	6.4	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=50\text{A}, V_{GE}=15\text{V},$ $T_j=25^\circ\text{C}$		2.00	2.45	V
		$I_C=50\text{A}, V_{GE}=15\text{V},$ $T_j=125^\circ\text{C}$		2.40		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900V, I_C=50A,$ $R_G=8.0\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		370		ns
t_r	Rise Time			40		ns
$t_{d(off)}$	Turn-Off Delay Time			650		ns
t_f	Fall Time			180		ns
E_{on}	Turn-On Switching Loss			11.0		mJ
E_{off}	Turn-Off Switching Loss			10.5		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900V, I_C=50A,$ $R_G=8.0\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		400		ns
t_r	Rise Time			50		ns
$t_{d(off)}$	Turn-Off Delay Time			800		ns
t_f	Fall Time			300		ns
E_{on}	Turn-On Switching Loss			16.0		mJ
E_{off}	Turn-Off Switching Loss			15.5		mJ
C_{ies}	Input Capacitance	$V_{CE}=25V, f=1Mhz,$ $V_{GE}=0V$		4.50		nF
C_{oes}	Output Capacitance			0.18		nF
C_{res}	Reverse Transfer Capacitance			0.15		nF
Q_G	Gate Charge	$V_{CC}=900V, I_C=50A,$ $V_{GE}=-15 \dots +15V$		0.60		nC
R_{Gint}	Internal Gate Resistor			9.5		Ω
I_{SC}	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=1000V,$ $V_{CEM} \leq 1700V$		200		A

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

Symbol	Description	GD50PIT170C6S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ C$	1700	V
I_F	DC Forward Current	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	$I_F=50A, V_{GE}=0V$	$T_j=25^\circ C$		1.80	2.20	V
			$T_j=125^\circ C$		1.90		
Q_r	Recovered Charge	$I_F=50A,$	$T_j=25^\circ C$		14.5		μC
			$T_j=125^\circ C$		24.5		
I_{RM}	Peak Reverse Recovery Current	$V_R=900V,$ $R_G=8.0\Omega,$	$T_j=25^\circ C$		76.5		A
			$T_j=125^\circ C$		83.5		
E_{rec}	Reverse Recovery Energy	$V_{GE}=-15V$	$T_j=25^\circ C$		7.60		mJ
			$T_j=125^\circ C$		13.5		

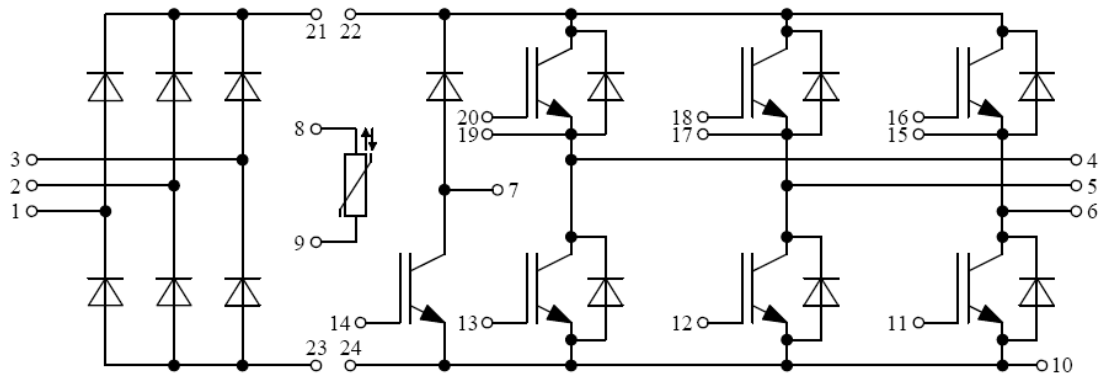
Electrical Characteristics of NTC $T_C=25^{\circ}\text{C}$ unless otherwise noted

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

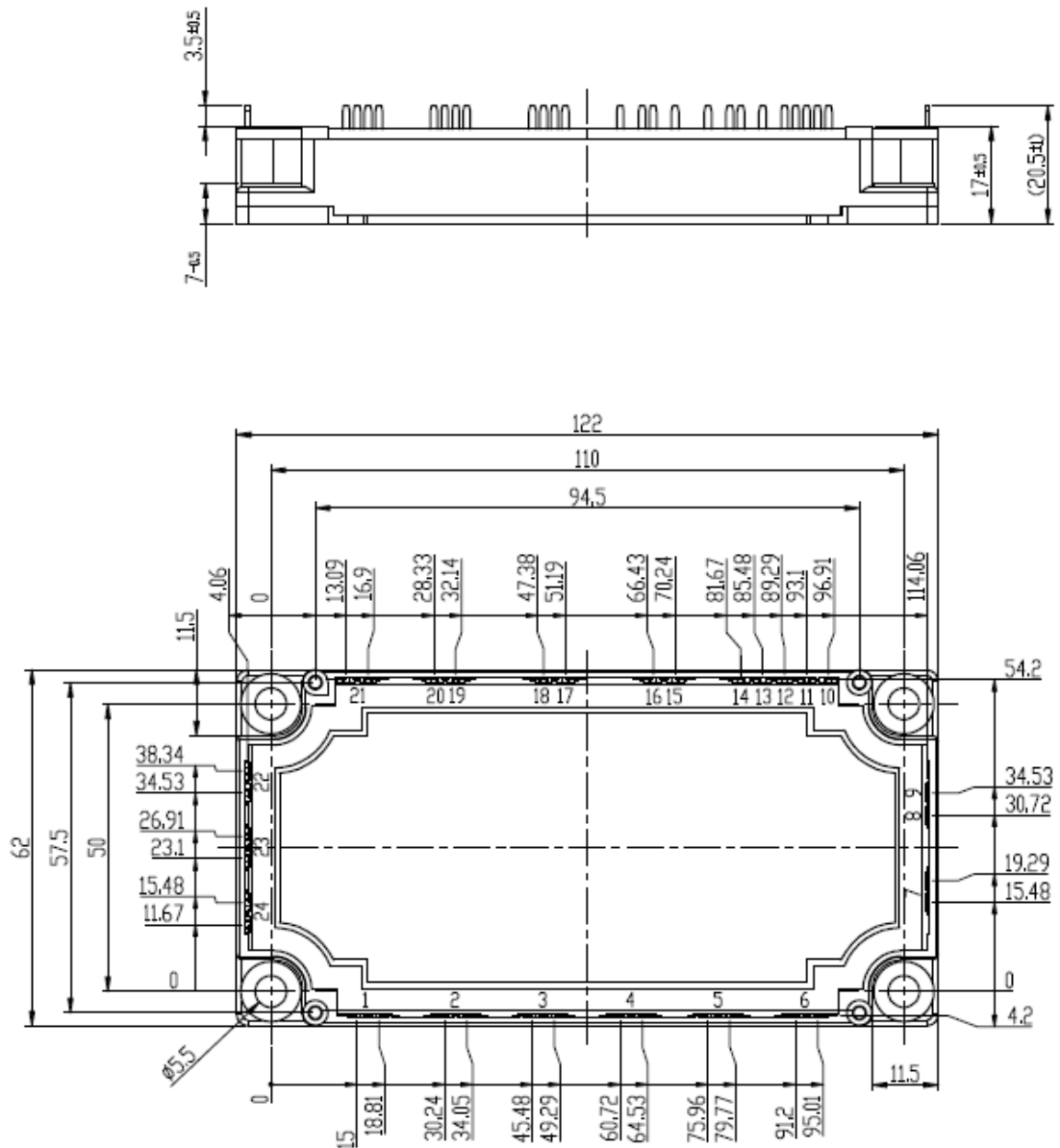
Symbol	Parameter	Min.	Typ.	Max.	Units
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}, t=1\text{min}$	4000			V
L_{CE}	Stray Inductance		60		nH
$R_{\text{CC}'+\text{EE}'}$ $R_{\text{AA}'+\text{CC}'}$	Module Lead Resistance, Terminal to Chip @ $T_C=25^{\circ}\text{C}$		4.00 2.00		$\text{m}\Omega$
$R_{\theta\text{JC}}$	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)			0.382 0.668 0.535 0.382 0.535	K/W
$R_{\theta\text{CS}}$	Case-to-Sink (Conductive grease applied)		0.009		K/W
T_{jmax}	Maximum Junction Temperature(inverter) Maximum Junction Temperature (rectifier,brake)			175 150	$^{\circ}\text{C}$
T_{jop}	Operating Junction Temperature	-40		150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40		125	$^{\circ}\text{C}$
Mounting Torque	Mounting Screw:M5	3.0		6.0	N.m
G	Weight of Module		300		g

Equivalent Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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