

# STARPOWER

SEMICONDUCTOR

**IGBT**

## GD75PIT170C6S

**Molding Type Module****1700V/75A 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 $\mu$ 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	GD75PIT170C6S	Units
$V_{CES}$	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	1700	V
$V_{GES}$	Gate-Emitter Voltage @ $T_j=25^\circ\text{C}$	$\pm 20$	V
$I_C$	Collector Current @ $T_C=25^\circ\text{C}$ @ $T_C=100^\circ\text{C}$	120 75	A
$I_{CM}$	Pulsed Collector Current $t_p=1\text{ms}$	150	A
$P_{tot}$	Total Power Dissipation @ $T_j=175^\circ\text{C}$	524	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	$I_C=3.0\text{mA}, V_{CE}=V_{GE},$ $T_j=25^\circ\text{C}$	5.2	5.8	6.4	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=75\text{A}, V_{GE}=15\text{V},$ $T_j=25^\circ\text{C}$		2.00	2.45	V
		$I_C=75\text{A}, V_{GE}=15\text{V},$ $T_j=125^\circ\text{C}$		2.40		

**Switching Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900V, I_C=75A,$ $R_G=6.8\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		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				16.5		mJ
$E_{off}$	Turn-Off Switching Loss				16.0		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900V, I_C=75A,$ $R_G=6.8\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		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				24.0		mJ
$E_{off}$	Turn-Off Switching Loss				23.5		mJ
$C_{ies}$	Input Capacitance	$V_{CE}=25V, f=1Mhz,$ $V_{GE}=0V$		6.80		nF	
$C_{res}$	Reverse Transfer Capacitance			0.22		nF	
$Q_G$	Gate Charge	$V_{CC}=900V, I_C=75A,$ $V_{GE}=-15 \dots +15V$		0.90		nC	
$R_{Gint}$	Internal Gate Resistor			8.5		$\Omega$	
$I_{SC}$	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=1000V,$ $V_{CEM} \leq 1700V$		300		A	

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

Symbol	Description	GD75PIT170C6S	Units
$V_{RRM}$	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	1700	V
$I_F$	DC Forward Current	75	A
$I_{FRM}$	Repetitive Peak Forward Current $t_p=1\text{ms}$	150	A

**Characteristics Values**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_F$	Diode Forward Voltage	$I_F=75\text{A}, V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$	1.80	2.20	V
			$T_j=125^\circ\text{C}$	1.90		
$Q_r$	Recovered Charge	$I_F=75\text{A}, V_R=900\text{V}, R_G=6.8\Omega, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	22.0		$\mu\text{C}$
			$T_j=125^\circ\text{C}$	36.5		
$I_{RM}$	Peak Reverse Recovery Current	$I_F=75\text{A}, V_R=900\text{V}, R_G=6.8\Omega, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	115		A
			$T_j=125^\circ\text{C}$	125		
$E_{rec}$	Reverse Recovery Energy	$I_F=75\text{A}, V_R=900\text{V}, R_G=6.8\Omega, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	11.5		mJ
			$T_j=125^\circ\text{C}$	20.5		

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

Symbol	Description	GD75PIT170C6S	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	$\text{A}^2\text{s}$

**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	GD75PIT170C6S	Units
$V_{CES}$	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	1700	V
$V_{GES}$	Gate-Emitter Voltage @ $T_j=25^\circ\text{C}$	$\pm 20$	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		$\Omega$
$I_{SC}$	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	GD75PIT170C6S	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	$I_F=50A,$ $V_R=900V,$ $R_G=8.0\Omega,$ $V_{GE}=-15V$	$T_j=25^\circ C$	14.5		$\mu C$
			$T_j=125^\circ C$	24.5		
$I_{RM}$	Peak Reverse Recovery Current	$V_R=900V,$ $R_G=8.0\Omega,$ $V_{GE}=-15V$	$T_j=25^\circ C$	76.5		A
			$T_j=125^\circ C$	83.5		
$E_{rec}$	Reverse Recovery Energy	$V_R=900V,$ $R_G=8.0\Omega,$ $V_{GE}=-15V$	$T_j=25^\circ C$	7.60		mJ
			$T_j=125^\circ C$	13.5		

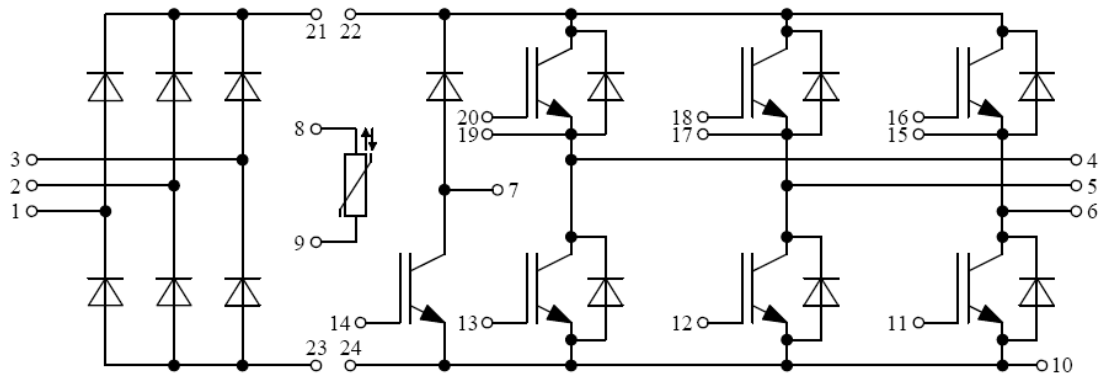
**Electrical Characteristics of NTC**  $T_C=25^{\circ}\text{C}$  unless otherwise noted

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**

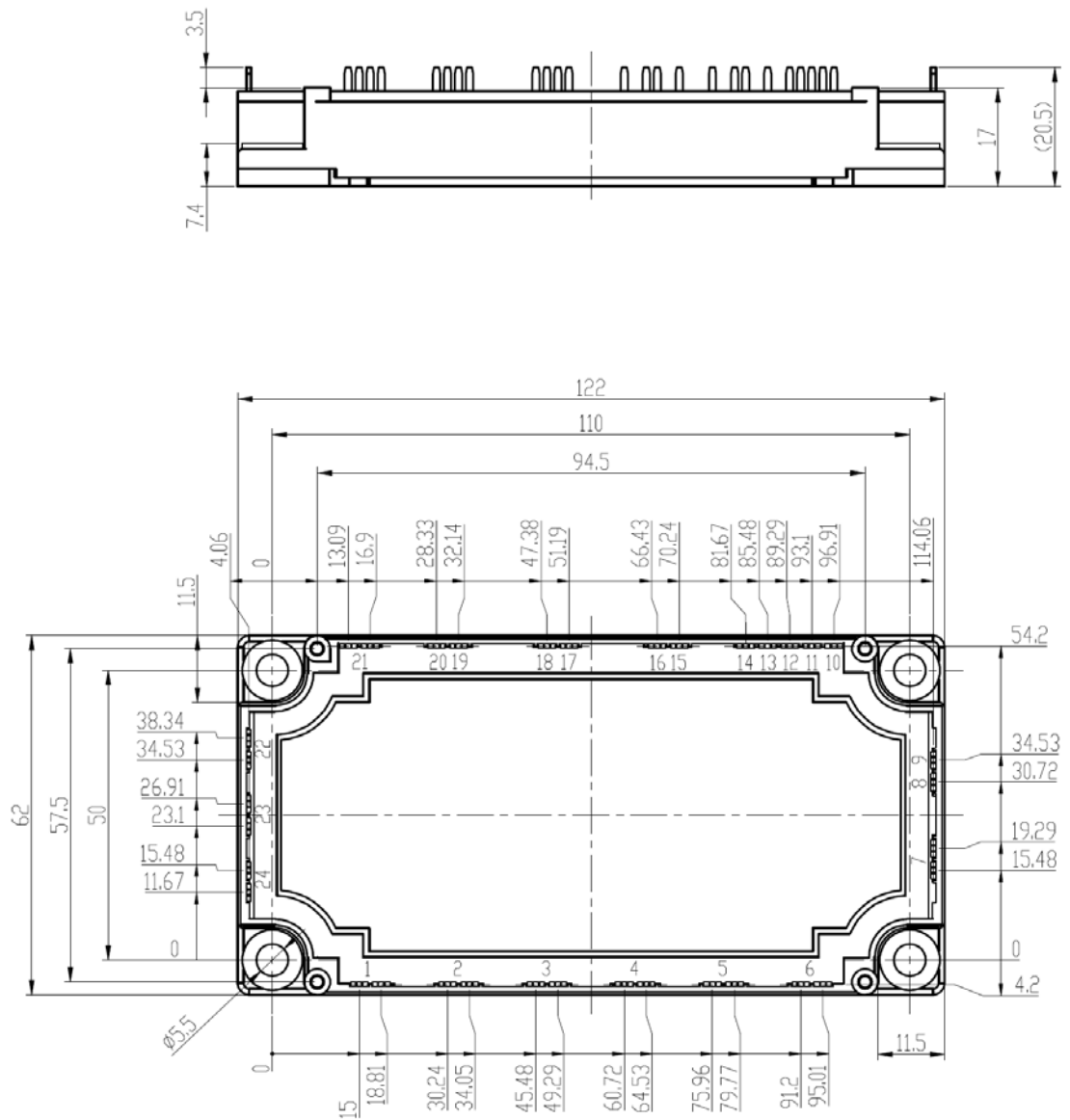
Symbol	Parameter	Min.	Typ.	Max.	Units
$V_{\text{ISO}}$	Isolation Voltage RMS, $f=50\text{Hz}, t=1\text{min}$	4000			V
$L_{\text{CE}}$	Stray Inductance		60		nH
$R_{\text{CC}'+\text{EE}'}$ $R_{\text{AA}'+\text{CC}'}$	Module Lead Resistance, Terminal to Chip @ $T_C=25^{\circ}\text{C}$		4.00 2.00		$\text{m}\Omega$
$R_{\theta\text{JC}}$	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)			0.286 0.531 0.548 0.398 0.686	K/W
$R_{\theta\text{CS}}$	Case-to-Sink (Conductive grease applied)		0.009		K/W
$T_{\text{jmax}}$	Maximum Junction Temperature(inverter) Maximum Junction Temperature (rectifier,brake)			175 150	$^{\circ}\text{C}$
$T_{\text{jop}}$	Operating Junction Temperature	-40		150	$^{\circ}\text{C}$
$T_{\text{STG}}$	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





## Terms and Conditions of Usage

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