

# STARPOWER

SEMICONDUCTOR

**IGBT**

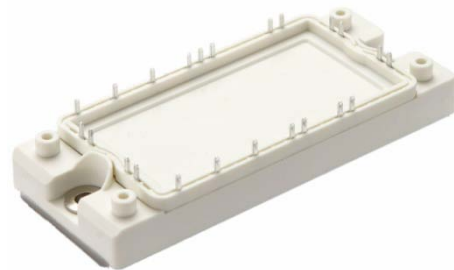
## GD35PIT120C5SN\_G8

Molding Type Module

**1200V/35A 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	GD35PIT120C5SN_G8	Units
$V_{CES}$	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	1200	V
$V_{GES}$	Gate-Emitter Voltage @ $T_j=25^\circ\text{C}$	$\pm 30$	V
$I_C$	Collector Current @ $T_C=25^\circ\text{C}$	70	A
	@ $T_C=100^\circ\text{C}$	35	
$I_{CM}$	Pulsed Collector Current $t_p=1\text{ms}$	70	A
$P_{tot}$	Total Power Dissipation @ $T_j=175^\circ\text{C}$	239	W

**Off Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$T_j=25^\circ\text{C}$	1200			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	$I_C=1.4\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.0		6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=35\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.70	2.15	V
		$I_C=35\text{A}, V_{GE}=15\text{V}, T_j=175^\circ\text{C}$		2.10		

**Switching Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=35A,$ $R_G=13\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		156		ns
$t_r$	Rise Time			28		ns
$t_{d(off)}$	Turn-Off Delay Time			215		ns
$t_f$	Fall Time			323		ns
$E_{on}$	Turn-On Switching Loss			1.94		mJ
$E_{off}$	Turn-Off Switching Loss			2.50		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=35A,$ $R_G=13\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		156		ns
$t_r$	Rise Time			30		ns
$t_{d(off)}$	Turn-Off Delay Time			229		ns
$t_f$	Fall Time			507		ns
$E_{on}$	Turn-On Switching Loss			2.40		mJ
$E_{off}$	Turn-Off Switching Loss			3.80		mJ
$C_{ies}$	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		3.20		nF
$C_{res}$	Reverse Transfer Capacitance			0.10		nF
$Q_G$	Gate Charge	$V_{CC}=600V, I_C=35A,$ $V_{GE}=15V$		210		nC
$I_{SC}$	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=900V,$ $V_{CEM} \leq 1200V$		TBD		A

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

Symbol	Description	GD35PIT120C5SN_G8	Units
$V_{RRM}$	Repetitive Peak Reverse Voltage @ $T_j=25^\circ C$	1200	V
$I_F$	DC Forward Current	35	A
$I_{FRM}$	Repetitive Peak Forward Current $t_p=1ms$	70	A

**Characteristics Values**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_F$	Diode Forward Vd tage	$I_F=35A, V_{GE}=0V$	$T_j=25^\circ C$	2.00	2.40	V
			$T_j=125^\circ C$	1.90		
$Q_r$	Recovered Charge	$I_F=35A,$ $V_R=600V,$ $R_G=13\Omega,$ $V_{GE}=-15V$	$T_j=25^\circ C$	1.9		$\mu C$
			$T_j=125^\circ C$	3.1		
$I_{RM}$	Peak Reverse Recovery Current	$V_R=600V,$ $R_G=13\Omega,$ $V_{GE}=-15V$	$T_j=25^\circ C$	42		A
			$T_j=125^\circ C$	51		
$E_{rec}$	Reverse Recovery Energy	$V_R=600V,$ $R_G=13\Omega,$ $V_{GE}=-15V$	$T_j=25^\circ C$	1.01		mJ
			$T_j=125^\circ C$	2.37		



**On Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.0mA, V_{CE}=V_{GE}, T_j=25^\circ C$	5.0		6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=25A, V_{GE}=15V, T_j=25^\circ C$		1.70	2.15	V
		$I_C=25A, V_{GE}=15V, T_j=175^\circ C$		2.10		

**Switching Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=25A, R_G=18\Omega, V_{GE}=\pm 15V, T_j=25^\circ C$		147		ns	
$t_r$	Rise Time			26		ns	
$t_{d(off)}$	Turn-Off Delay Time			201		ns	
$t_f$	Fall Time			337		ns	
$E_{on}$	Turn-On Switching Loss				1.64		mJ
$E_{off}$	Turn-Off Switching Loss			1.65		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=25A, R_G=18\Omega, V_{GE}=\pm 15V, T_j=125^\circ C$		143		ns	
$t_r$	Rise Time			28		ns	
$t_{d(off)}$	Turn-Off Delay Time			216		ns	
$t_f$	Fall Time			400		ns	
$E_{on}$	Turn-On Switching Loss				1.93		mJ
$E_{off}$	Turn-Off Switching Loss				2.38		mJ
$C_{ies}$	Input Capacitance	$V_{CE}=30V, f=1Mhz, V_{GE}=0V$		2.40		nF	
$C_{res}$	Reverse Transfer Capacitance			0.08		nF	
$Q_G$	Gate Charge	$V_{CC}=600V, I_C=25A, V_{GE}=15V$		180		nC	
$I_{SC}$	SC Data	$t_p \leq 10\mu s, V_{GE}=15V, T_j=125^\circ C, V_{CC}=900V, V_{CEM} \leq 1200V$		TBD		A	

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

Symbol	Description	GD35PIT120C5SN_G8	Units
$V_{RRM}$	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	1200	V
$I_F$	DC Forward Current	25	A
$I_{FRM}$	Repetitive Peak Forward Current $t_p=1\text{ms}$	50	A

**Characteristics Values**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_F$	Diode Forward Voltage	$I_F=25\text{A}, V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$	2.10	2.50	V
			$T_j=125^\circ\text{C}$	2.15		
$Q_r$	Recovered Charge	$I_F=25\text{A},$ $V_R=600\text{V},$ $R_G=18\Omega,$ $V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	1.3		$\mu\text{C}$
			$T_j=125^\circ\text{C}$	2.0		
$I_{RM}$	Peak Reverse Recovery Current	$I_F=25\text{A},$ $V_R=600\text{V},$ $R_G=18\Omega,$ $V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	31		A
			$T_j=125^\circ\text{C}$	38		
$E_{rec}$	Reverse Recovery Energy	$I_F=25\text{A},$ $V_R=600\text{V},$ $R_G=18\Omega,$ $V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	0.68		mJ
			$T_j=125^\circ\text{C}$	1.45		

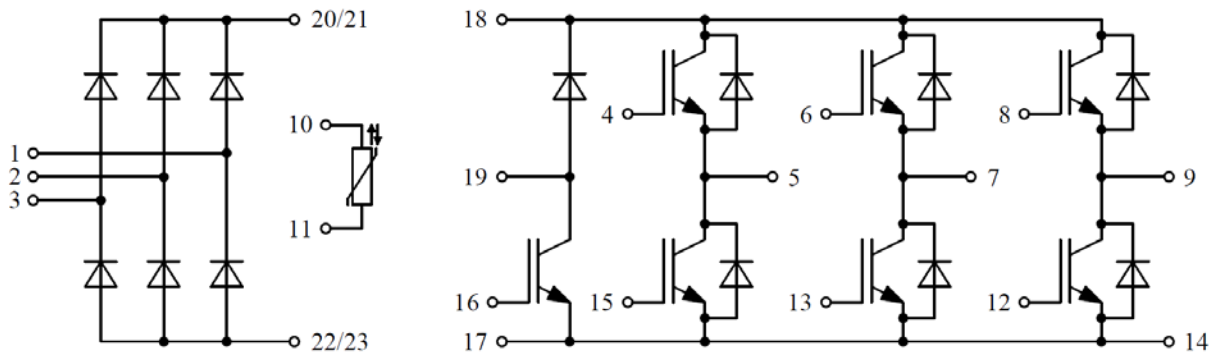
**Electrical Characteristics of NTC**  $T_C=25^\circ\text{C}$  unless otherwise noted

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**

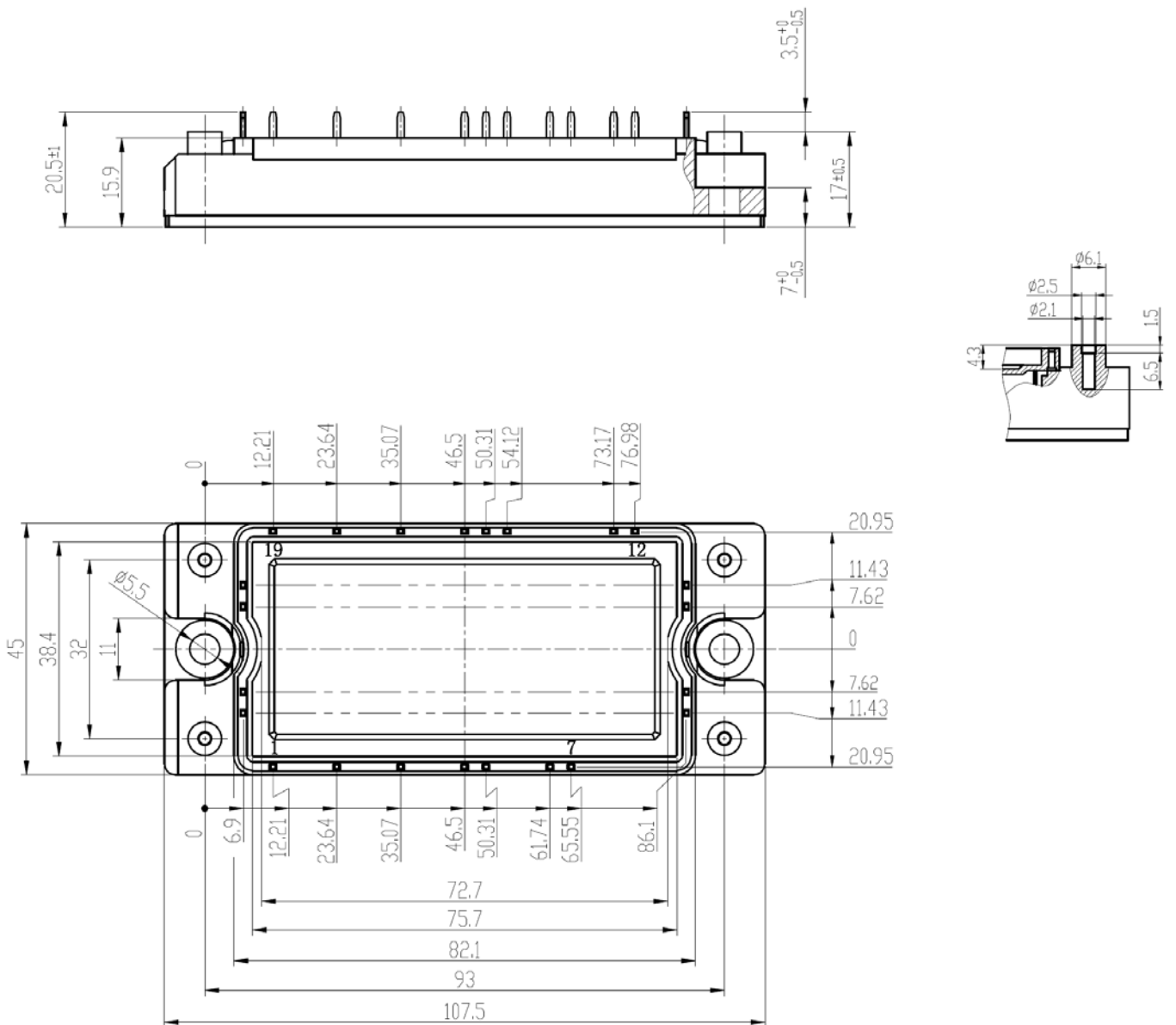
Symbol	Parameter	Min.	Typ.	Max.	Units
V <sub>ISO</sub>	Isolation Voltage RMS, f=50Hz, t=1 min	4000			V
L <sub>CE</sub>	Stray Inductance		60		nH
R <sub>CC'+EE'</sub> R <sub>AA'+CC'</sub>	Module Lead Resistance, Terminal to Chip @ T <sub>C</sub> =25°C		4.00 2.00		mΩ
R <sub>θJC</sub>	Junction-to-Case (per 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)			0.628 1.068 1.114 0.780 1.326	K/W
R <sub>θCS</sub>	Case-to-Sink (Conductive grease applied)		0.02		K/W
T <sub>jmax</sub>	Maximum Junction Temperature (inverter, brake) Maximum Junction Temperature(rectifier)			175 150	°C
T <sub>jop</sub>	Operating Junction Temperature (inverter, brake) Operating Junction Temperature(rectifier)	-40 -40		150 125	°C
T <sub>STG</sub>	Storage Temperature Range	-40		125	°C
M	Mounting Torque, Screw:M5	3.0		6.0	N.m
G	Weight of Module		180		g

**Equivalent Circuit Schematic**



**Package Dimensions**

Dimensions in Millimeters





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