

STARPOWER

SEMICONDUCTOR

IGBT

GD35PIT120C5S

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 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	GD35PIT120C5S	Units
V_{CES}	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	1200	V
V_{GES}	Gate-Emitter Voltage @ $T_j=25^\circ\text{C}$	± 30	V
I_C	Collector Current @ $T_C=25^\circ\text{C}$ @ $T_C=100^\circ\text{C}$	68 35	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	70	A
P_{tot}	Total Power Dissipation @ $T_j=175^\circ\text{C}$	265	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	$I_C=1.7\text{mA}, V_{CE}=V_{GE},$ $T_j=25^\circ\text{C}$	5.0		7.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=35\text{A}, V_{GE}=15\text{V},$ $T_j=25^\circ\text{C}$		1.90	2.35	V
		$I_C=35\text{A}, V_{GE}=15\text{V},$ $T_j=125^\circ\text{C}$		2.30		
		$I_C=35\text{A}, V_{GE}=15\text{V},$ $T_j=150^\circ\text{C}$		2.40		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=35A,$ $R_G=24\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		291		ns
t_r	Rise Time			66		ns
$t_{d(off)}$	Turn-Off Delay Time			248		ns
t_f	Fall Time			205		ns
E_{on}	Turn-On Switching Loss			4.29		mJ
E_{off}	Turn-Off Switching Loss			1.64		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=35A,$ $R_G=24\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		295		ns
t_r	Rise Time			69		ns
$t_{d(off)}$	Turn-Off Delay Time			260		ns
t_f	Fall Time			242		ns
E_{on}	Turn-On Switching Loss			4.76		mJ
E_{off}	Turn-Off Switching Loss			2.57		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=35A,$ $R_G=24\Omega, V_{GE}=\pm 15V,$ $T_j=150^\circ C$		296		ns
t_r	Rise Time			72		ns
$t_{d(off)}$	Turn-Off Delay Time			260		ns
t_f	Fall Time			251		ns
E_{on}	Turn-On Switching Loss			4.96		mJ
E_{off}	Turn-Off Switching Loss			2.75		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		4.12		nF
C_{oes}	Output Capacitance			0.16		nF
C_{res}	Reverse Transfer Capacitance			0.10		nF
Q_G	Gate Charge	$V_{CC}=600V, I_C=35A,$ $V_{GE}=15V$		170		nC
I_{sc}	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=900V,$ $V_{CEM} \leq 1200V$		350		A

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

Symbol	Description	GD35PIT120C5S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	1200	V
I_F	DC Forward Current	35	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	70	A

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=35\text{A}, V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$	2.00	2.40	V
			$T_j=125^\circ\text{C}$		1.90	
			$T_j=150^\circ\text{C}$		1.87	
Q_r	Recovered Charge	$I_F=35\text{A}, V_R=600\text{V}, R_G=24\Omega, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	2.2		μC
			$T_j=125^\circ\text{C}$	4.2		
			$T_j=150^\circ\text{C}$	4.4		
I_{RM}	Peak Reverse Recovery Current	$I_F=35\text{A}, V_R=600\text{V}, R_G=24\Omega, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	19		A
			$T_j=125^\circ\text{C}$	23		
			$T_j=150^\circ\text{C}$	25		
E_{rec}	Reverse Recovery Energy	$I_F=35\text{A}, V_R=600\text{V}, R_G=24\Omega, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	1.20		mJ
			$T_j=125^\circ\text{C}$	2.23		
			$T_j=150^\circ\text{C}$	2.32		

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

Symbol	Description	GD35PIT120C5S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	1600	V
$I_{F(AV)}$	Average On-state Current @ $T_C=100^\circ\text{C}$	42	A
I_{RMSM}	Maximum RMS Current At Rectifier Output @ $T_C=80^\circ\text{C}$	60	A
I_{FSM}	Surge Forward Current $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^\circ\text{C}$	600	A
I^2t	I^2t -value, $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^\circ\text{C}$	1800	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=35\text{A}$ $T_j=150^\circ\text{C}$		1.15		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	GD35PIT120C5S	Units
V_{CES}	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	1200	V
V_{GES}	Gate-Emitter Voltage @ $T_j=25^\circ\text{C}$	± 20	V
I_C	Collector Current @ $T_C=25^\circ\text{C}$ @ $T_C=100^\circ\text{C}$	30 15	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	30	A
P_{tot}	Total Power Dissipation @ $T_j=175^\circ\text{C}$	158	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	$I_C=600\mu\text{A}, V_{CE}=V_{GE},$ $T_j=25^\circ\text{C}$	5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=15\text{A}, V_{GE}=15\text{V},$ $T_j=25^\circ\text{C}$		1.70	2.15	V
		$I_C=15\text{A}, V_{GE}=15\text{V},$ $T_j=125^\circ\text{C}$		2.00		
		$I_C=15\text{A}, V_{GE}=15\text{V},$ $T_j=150^\circ\text{C}$		2.10		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=15A,$ $R_G=75\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		84		ns
t_r	Rise Time			31		ns
$t_{d(off)}$	Turn-Off Delay Time			420		ns
t_f	Fall Time			65		ns
E_{on}	Turn-On Switching Loss			1.51		mJ
E_{off}	Turn-Off Switching Loss			1.27		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=15A,$ $R_G=75\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		91		ns
t_r	Rise Time			45		ns
$t_{d(off)}$	Turn-Off Delay Time			522		ns
t_f	Fall Time			90		ns
E_{on}	Turn-On Switching Loss			2.12		mJ
E_{off}	Turn-Off Switching Loss			1.48		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=15A,$ $R_G=75\Omega, V_{GE}=\pm 15V,$ $T_j=150^\circ C$		91		ns
t_r	Rise Time			46		ns
$t_{d(off)}$	Turn-Off Delay Time			550		ns
t_f	Fall Time			110		ns
E_{on}	Turn-On Switching Loss			2.43		mJ
E_{off}	Turn-Off Switching Loss			1.64		mJ
C_{ies}	Input Capacitance	$V_{CE}=25V, f=1Mhz,$ $V_{GE}=0V$		1.10		nF
C_{oes}	Output Capacitance			0.06		nF
C_{res}	Reverse Transfer Capacitance			0.05		nF
Q_G	Gate Charge	$V_{CC}=600V, I_C=15A,$ $V_{GE}=-15 \dots +15V$		150		nC
I_{SC}	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=150^\circ C, V_{CC}=900V,$ $V_{CEM} \leq 1200V$		60		A

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

Symbol	Description	GD35PIT120C5S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	1200	V
I_F	DC Forward Current	15	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	30	A

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=15\text{A}, V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$	2.05	2.50	V
			$T_j=125^\circ\text{C}$		2.20	
			$T_j=150^\circ\text{C}$		2.24	
Q_r	Recovered Charge	$I_F=15\text{A}, V_R=600\text{V}, R_G=68\Omega, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	0.6		μC
			$T_j=125^\circ\text{C}$		2.1	
			$T_j=150^\circ\text{C}$		3.0	
I_{RM}	Peak Reverse Recovery Current	$I_F=15\text{A}, V_R=600\text{V}, R_G=68\Omega, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	10		A
			$T_j=125^\circ\text{C}$		12	
			$T_j=150^\circ\text{C}$		16	
E_{rec}	Reverse Recovery Energy	$I_F=15\text{A}, V_R=600\text{V}, R_G=68\Omega, V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	0.47		mJ
			$T_j=125^\circ\text{C}$		0.86	
			$T_j=150^\circ\text{C}$		1.22	

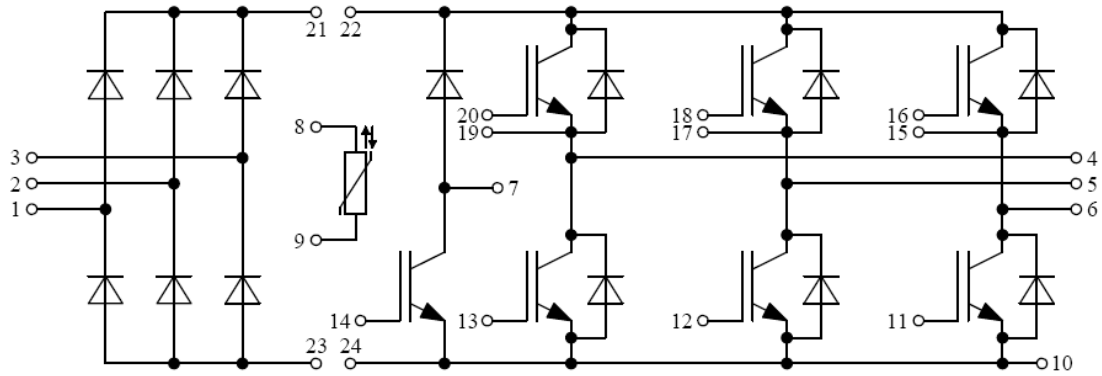
Electrical Characteristics of NTC $T_C=25^\circ\text{C}$ unless otherwise noted

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

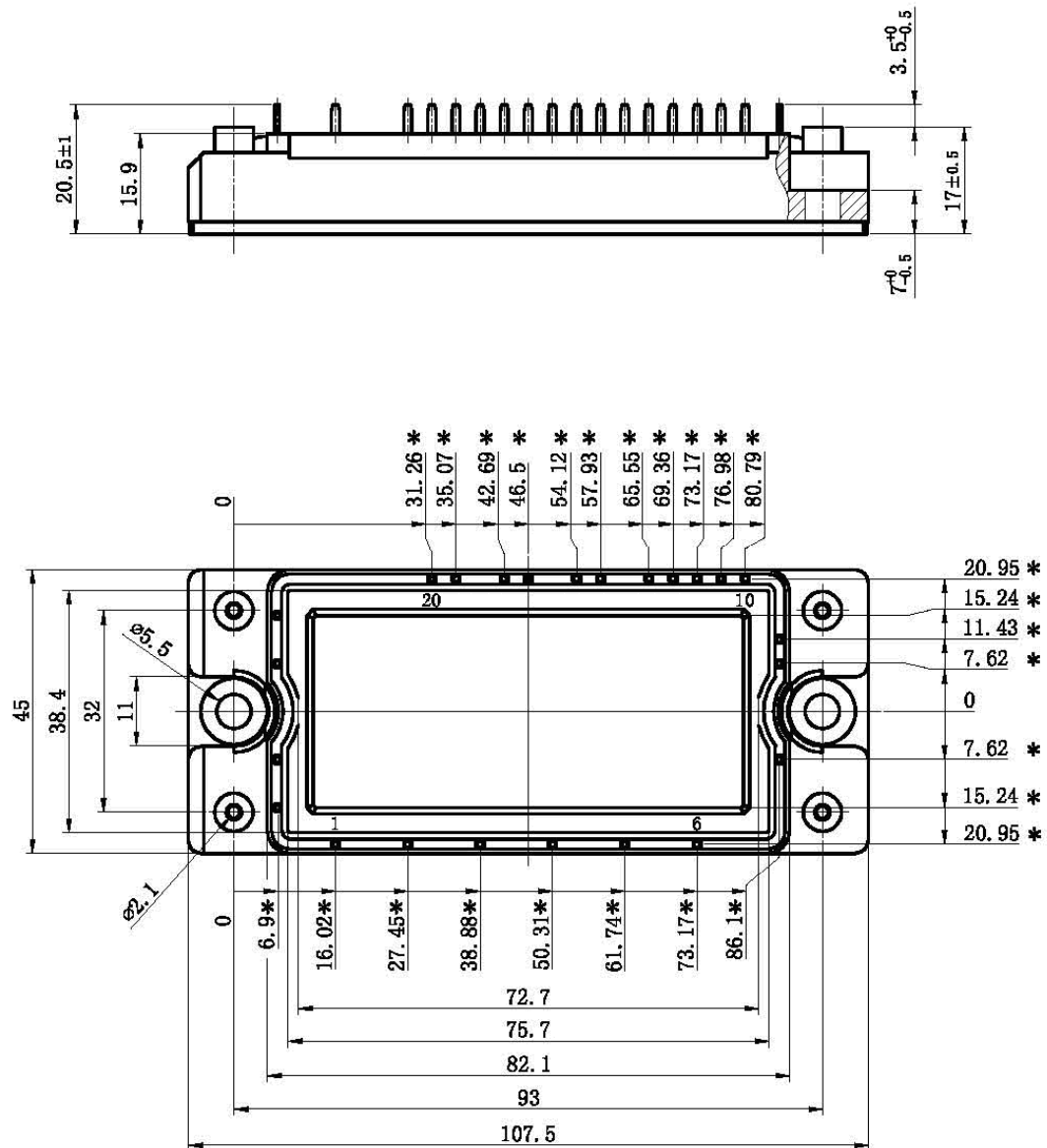
Symbol	Parameter	Min.	Typ.	Max.	Units
V _{ISO}	Isolation Voltage RMS, f=50Hz, t=1 min	2500			V
L _{CE}	Stray Inductance		60		nH
R _{CC'+EE'} R _{AA'+CC'}	Module Lead Resistance, Terminal to Chip @ T _C =25°C		4.00 2.00		mΩ
R _{θJC}	Junction-to-Case (per IGBT-inverter) Junction-to-Case (per Diode-inverter) Junction-to-Case (per Diode-rectifier) Junction-to-Case (per IGBT-brake-chopper) Junction-to-Case (per Diode-brake-chopper)			0.565 1.082 0.955 0.951 1.760	K/W
R _{θCS}	Case-to-Sink (per IGBT-inverter) Case-to-Sink (per Diode-inverter) Case-to-Sink (per Diode-rectifier) Case-to-Sink (per IGBT-brake-chopper) Case-to-Sink (per Diode-brake-chopper)		0.272 0.521 0.460 0.458 0.847		
R _{θCS}	Case-to-Sink (Conductive grease applied)		0.02		K/W
T _{jmax}	Maximum Junction Temperature (inverter, brake) Maximum Junction Temperature(rectifier)			175 150	°C
T _{jop}	Operating Junction Temperature (inverter, brake) Operating Junction Temperature(rectifier)	-40 -40		150 125	°C
T _{STG}	Storage Temperature Range	-40		125	°C
Mounting Torque	Mounting 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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