

STARPOWER

SEMICONDUCTOR™

IGBT

GD50PIT60C5S

Molding Type Module**600V/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
- $V_{CE(sat)}$ 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	GD50PIT60C5S	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 @ $T_C=25^\circ\text{C}$ @ $T_C=80^\circ\text{C}$	75 50	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	100	A
P_{tot}	Total Power Dissipation @ $T_j=175^\circ\text{C}$	186	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	4.9	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
		$I_C=50\text{A}, V_{GE}=15\text{V},$ $T_j=175^\circ\text{C}$		2.05		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=50A,$ $R_G=10\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		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			0.63		mJ
E_{off}	Turn-Off Switching Loss			1.28		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=50A,$ $R_G=10\Omega, V_{GE}=\pm 15V,$ $T_j=175^\circ C$		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	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		3.03		nF
C_{oes}	Output Capacitance			0.25		nF
C_{res}	Reverse Transfer Capacitance			0.09		nF
Q_G	Gate Charge	$V_{CC}=400V, I_C=50A,$ $V_{GE}=15V$		96		nC

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

Symbol	Description	GD50PIT60C5S	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 Vd tage	$I_F=50A, V_{GE}=0V$	$T_j=25^\circ C$	1.35	1.80	V
			$T_j=125^\circ C$	1.37		
Q_r	Recovered Charge	$I_F=50A,$ $V_R=300V,$ $R_G=3.3\Omega,$ $V_{GE}=-15V$	$T_j=25^\circ C$	2.3		μC
			$T_j=125^\circ C$	4.3		
I_{RM}	Peak Reverse Recovery Current	$V_R=300V,$ $R_G=3.3\Omega,$ $V_{GE}=-15V$	$T_j=25^\circ C$	33		A
			$T_j=125^\circ C$	58		
E_{rec}	Reverse Recovery Energy	$V_R=300V,$ $R_G=3.3\Omega,$ $V_{GE}=-15V$	$T_j=25^\circ C$	0.56		mJ
			$T_j=125^\circ C$	1.11		

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

Symbol	Description	GD50PIT60C5S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	1600	V
$I_{F(AV)}$	Average On-state Current @ $T_C=80^\circ\text{C}$	50	A
I_{RMSM}	Maximum RMS Current At Rectifier Output @ $T_C=80^\circ\text{C}$	60	A
I_{FSM}	Surge Forward Current $V_R=0V, t_p=10\text{ms}, T_j=45^\circ\text{C}$	600	A
I^2t	I^2t -value, $V_R=0V, t_p=10\text{ms}, T_j=45^\circ\text{C}$	1800	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=50\text{A}$	$T_j=150^\circ\text{C}$		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	GD50PIT60C5S	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 @ $T_C=25^\circ\text{C}$ @ $T_C=80^\circ\text{C}$	50 30	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	60	A
P_{tot}	Total Power Dissipation @ $T_j=150^\circ\text{C}$	148	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	$V_{CE}=V_{CES}, V_{GE}=0V,$ $T_j=25^\circ\text{C}$			5.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0V,$ $T_j=25^\circ\text{C}$			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	4.5	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
		$I_C=30A, V_{GE}=15V, T_j=150^\circ C$		2.40		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=30A, R_G=10\Omega, V_{GE}=\pm 15V, T_j=25^\circ C$		46		ns
t_r	Rise Time			28		ns
$t_{d(off)}$	Turn-Off Delay Time			185		ns
t_f	Fall Time			31		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	$V_{CC}=400V, I_C=30A, R_G=10\Omega, V_{GE}=\pm 15V, T_j=150^\circ C$		46		ns
t_r	Rise Time			28		ns
$t_{d(off)}$	Turn-Off Delay Time			205		ns
t_f	Fall Time			32		ns
E_{on}	Turn-On Switching Loss			0.53		mJ
E_{off}	Turn-Off Switching Loss			0.95		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz, V_{GE}=0V$		1.75		nF
C_{oes}	Output Capacitance			0.16		nF
C_{res}	Reverse Transfer Capacitance			0.06		nF
Q_G	Gate Charge	$V_{CC}=400V, I_C=30A, V_{GE}=15V$		102		nC

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

Symbol	Description	GD50PIT60C5S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ C$	600	V
I_F	DC Forward Current	30	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1ms$	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°C	1.30	1.75	V
			T _j =125°C	1.25		
Q _r	Recovered Charge	I _F =30A, V _R =600V, R _G =10Ω, V _{GE} =-15V	T _j =25°C	1.8		μC
			T _j =125°C	2.7		
I _{RM}	Peak Reverse Recovery Current	I _F =30A, V _R =600V, R _G =10Ω, V _{GE} =-15V	T _j =25°C	28		A
			T _j =125°C	36		
E _{rec}	Reverse Recovery Energy	I _F =30A, V _R =600V, R _G =10Ω, V _{GE} =-15V	T _j =25°C	0.38		mJ
			T _j =125°C	0.77		

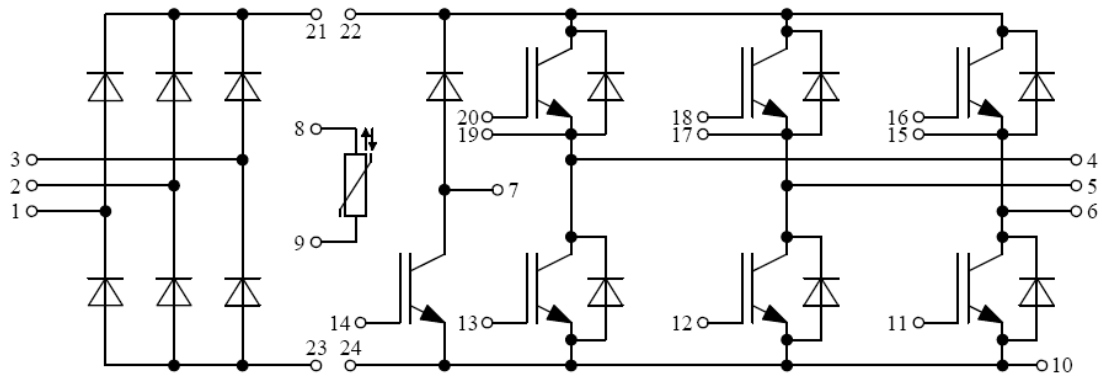
Electrical Characteristics of NTC T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
R ₂₅	Rated Resistance			5.0		kΩ
ΔR/R	Deviation of R ₁₀₀	T _C =100°C, R ₁₀₀ =493.3Ω	-5		5	%
P ₂₅	Power Dissipation				20.0	mW
B _{25/50}	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		3375		K

IGBT Module

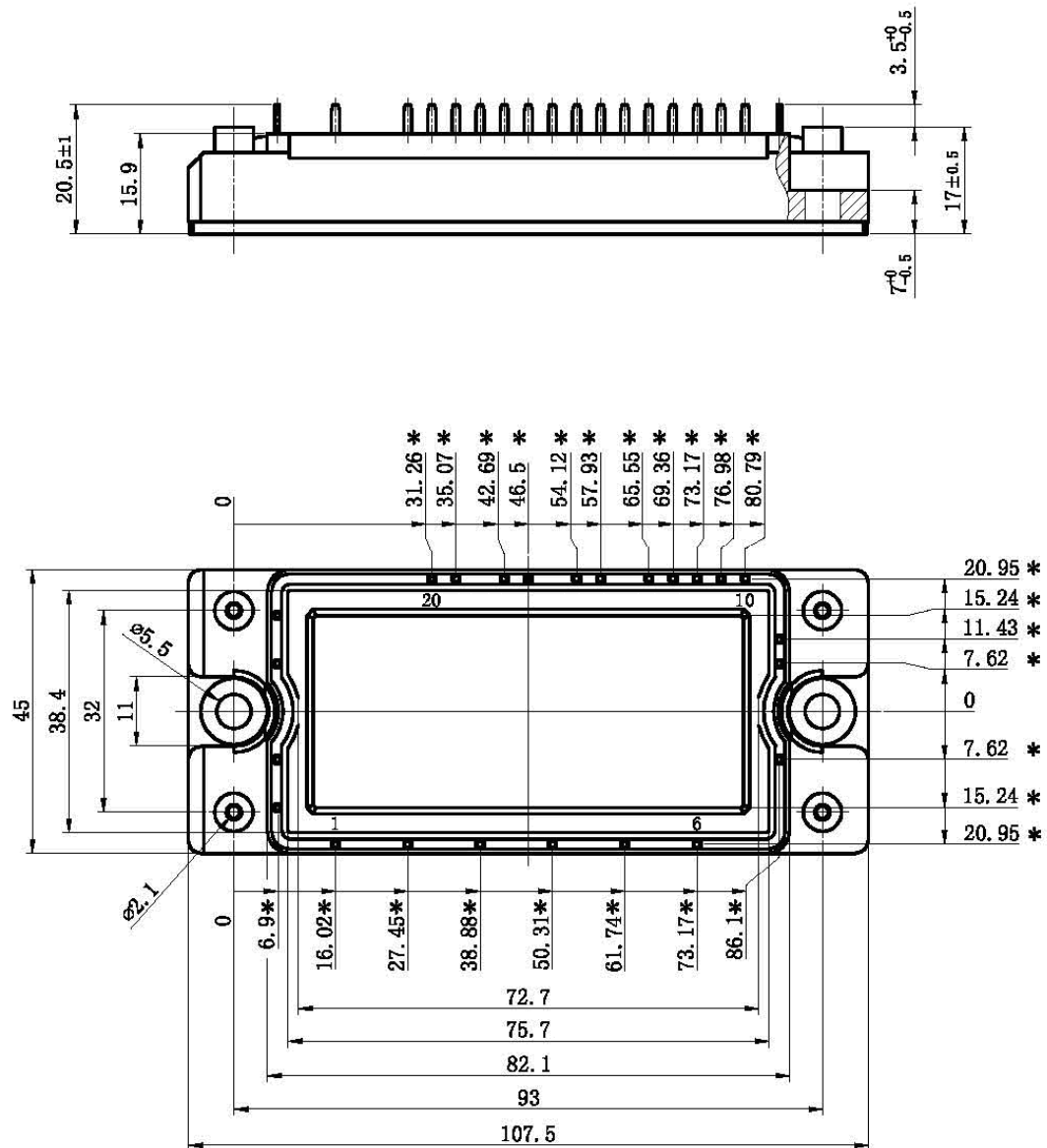
Symbol	Parameter	Min.	Typ.	Max.	Units
V _{ISO}	Isolation Voltage RMS, f=50Hz, t=1 min		2500		V
L _{CE}	Stray Inductance		60		nH
R _{CC'+EE'} R _{AA'+CC'}	Module Lead Resistance, Terminal to Chip @ T _C =25°C		4.00 2.00		mΩ
R _{θJC}	Junction-to-Case (per IGBT-inverter)			0.806	K/W
	Junction-to-Case (per DIODE-inverter)			1.165	
	Junction-to-Case (per DIODE-rectifier)			0.880	
	Junction-to-Case (per IGBT-brake-chopper)			0.845	
	Junction-to-Case (per DIODE-brake-chopper)			1.753	
R _{θCS}	Case-to-Sink (Conductive grease applied)		0.02		K/W
T _j	Maximum Junction Temperature			175	°C
T _{STG}	Storage Temperature Range	-40		125	°C
Mounting Torque	Mounting Screw:M5	3.0		6.0	N.m
G	Weight of Module		200		g

Equivalent Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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