

STARPOWER

SEMICONDUCTOR™

IGBT

GD100PIT60C6S

Preliminary

Molding Type Module**600V/100A PIM in one-package**

General Description

STARPOWER IGBT Power Module provides ultra low conduction 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
- Low switching losses
- 5 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	GD100PIT60C6S	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 @ $T_C=25^\circ\text{C}$ @ $T_C=80^\circ\text{C}$	140	A
		100	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	200	A
P_{tot}	Total Power Dissipation @ $T_j=150^\circ\text{C}$	357	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	$I_C=1.0\text{mA}, V_{CE}=V_{GE},$ $T_j=25^\circ\text{C}$	4.0		6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=100\text{A}, V_{GE}=15\text{V},$ $T_j=25^\circ\text{C}$		1.65	2.10	V
		$I_C=100\text{A}, V_{GE}=15\text{V},$ $T_j=175^\circ\text{C}$		2.10		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400\text{V}, I_C=100\text{A},$ $R_G=4.7\Omega, V_{GE}=\pm 15\text{V},$ $T_j=25^\circ\text{C}$		32		ns	
t_r	Rise Time			58		ns	
$t_{d(off)}$	Turn-Off Delay Time				160		ns
t_f	Fall Time				70		ns
E_{on}	Turn-On Switching Loss				4.51		mJ
E_{off}	Turn-Off Switching Loss				2.98		mJ

$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=100A,$ $R_G=4.7\Omega, V_{GE}=\pm 15V,$ $T_j=175^\circ C$		36		ns
t_r	Rise Time			61		ns
$t_{d(off)}$	Turn-Off Delay Time			220		ns
t_f	Fall Time			85		ns
E_{on}	Turn-On Switching Loss			5.89		mJ
E_{off}	Turn-Off Switching Loss			4.12		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		7710		pF
C_{oes}	Output Capacitance			530		pF
C_{res}	Reverse Transfer Capacitance			230		pF
I_{SC}	SC Data	$T_P \leq 5\mu s, V_{GE}=15V,$ $T_j=150^\circ C, V_{CC}=360V,$ $V_{CEM} \leq 600V$		TBD		A

DIODE-inverter $T_C=25^\circ C$ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD100PIT60C6S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ C$	600	V
I_F	DC Forward Current @ $T_C=80^\circ C$	100	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1ms$	200	A

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=100A, V_{GE}=0V$	$T_j=25^\circ C$	1.40	1.80	V
			$T_j=125^\circ C$	1.45		
Q_{rr}	Recovered Charge	$I_F=100A,$	$T_j=25^\circ C$	4.2		μC
			$T_j=125^\circ C$	5.5		
I_{RM}	Peak Reverse Recovery Current	$V_R=300V,$ $di/dt=-1000A/\mu s,$	$T_j=25^\circ C$	65		A
			$T_j=125^\circ C$	70		
E_{rec}	Reverse Recovery Energy	$V_{GE}=-15V$	$T_j=25^\circ C$	1.0		mJ
			$T_j=125^\circ C$	1.3		

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

Symbol	Description	GD100PIT60C6S	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 @ $T_C=80^{\circ}\text{C}$	100	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	$I_F=150\text{A}$ $T_j=150^{\circ}\text{C}$			1.28	V
I_R	Reverse Current	$T_j=150^{\circ}\text{C}, V_R=1600\text{V}$			2.0	mA

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

Symbol	Description	GD100PIT60C6S	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 @ $T_C=25^{\circ}\text{C}$ @ $T_C=80^{\circ}\text{C}$	85 50	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	100	A
P_{tot}	Total Power Dissipation @ $T_j=150^{\circ}\text{C}$	216	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	$I_C=1.4mA, V_{CE}=V_{GE}, T_j=25^\circ C$	4.0		6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=50A, V_{GE}=15V, T_j=25^\circ C$		1.65	2.10	V
		$I_C=50A, V_{GE}=15V, T_j=125^\circ C$		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			150		ns	
t_f	Fall Time			40		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			170		ns	
t_f	Fall Time			50		ns	
E_{on}	Turn-On Switching Loss				1.63		mJ
E_{off}	Turn-Off Switching Loss				1.59		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz, V_{GE}=0V$		3025		pF	
C_{oes}	Output Capacitance			245		pF	
C_{res}	Reverse Transfer Capacitance				90		pF
I_{SC}	SC Data	$T_P \leq 5\mu s, V_{GE}=15V, T_j=150^\circ C, V_{CC}=360V, V_{CEM} \leq 600V$		TBD		A	

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

Symbol	Description	GD100PIT60C6S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	600	V
I_F	DC Forward Current @ $T_C=80^\circ\text{C}$	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	$I_F=50\text{A}, V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$	1.35	1.75	V
			$T_j=125^\circ\text{C}$	1.35		
Q_r	Recovered Charge	$I_F=50\text{A},$	$T_j=25^\circ\text{C}$	1.9		μC
			$T_j=125^\circ\text{C}$	3.1		
I_{RM}	Peak Reverse Recovery Current	$V_R=300\text{V},$ $di/dt=-2600\text{A}/\mu\text{s},$	$T_j=25^\circ\text{C}$	55		A
			$T_j=125^\circ\text{C}$	63		
E_{rec}	Reverse Recovery Energy	$V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	0.39		mJ
			$T_j=125^\circ\text{C}$	0.68		

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=1min	2500			V
L _{CE}	Stray Inductance		60		nH
R _{CC'+EE'}	Module Lead Resistance, Terminal to Chip @ T _C =25°C		4.00		mΩ
R _{θJC}	Junction-to-Case (per IGBT-inverter)			0.42	K/W
	Junction-to-Case (per DIODE-inverter)			0.84	
	Junction-to-Case (per DIODE-rectifier)			0.55	
	Junction-to-Case (per IGBT-brake-chopper)			0.58	
	Junction-to-Case (per DIODE-brake-chopper)			1.35	
R _{θCS}	Case-to-Sink (Conductive grease applied)		0.009		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		300		g

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