

STARPOWER

SEMICONDUCTOR™

IGBT

GD10PIK120C5S

Preliminary

Molding Type Module**1200V/10A PIM in one-package**

General Description

STARPOWER IGBT Power Module provides ultra low conduction and switching loss as well as short circuit ruggedness. They are designed for the applications such as general inverters and UPS.

Features

- 10 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Square RBSOA
- 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	GD10PIK120C5S	Units
V_{CES}	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^\circ\text{C}$	25	A
	@ $T_C=80^\circ\text{C}$	10	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	20	A
P_{tot}	Total Power Dissipation @ $T_j=150^\circ\text{C}$	108	W
T_{SC}	Short Circuit Withstand Time @ $T_j=150^\circ\text{C}$	10	μs

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
BV_{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	$I_C=125\mu\text{A}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	4.4	5.0	6.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=10\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		2.45	2.70	V
		$I_C=10\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		2.75		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
E_{on}	Turn-On Switching Loss	$V_{CC}=600\text{V}, I_C=10\text{A}, R_G=22\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		0.96		mJ
E_{off}	Turn-Off Switching Loss			0.46		mJ
E_{tot}	Total Switching Loss			1.42		mJ
E_{on}	Turn-On Switching Loss	$V_{CC}=600\text{V}, I_C=10\text{A}, R_G=22\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		1.25		mJ
E_{off}	Turn-Off Switching Loss			0.69		mJ
E_{tot}	Total Switching Loss			1.94		mJ

$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=10A,$ $R_G=22\Omega, V_{GE} = \pm 15V,$ $T_J=125^\circ C$		86		ns
t_r	Rise Time			21		ns
$t_{d(off)}$	Turn-Off Delay Time			118		ns
t_f	Fall Time			274		ns
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		750		pF
C_{oes}	Output Capacitance			190		pF
C_{res}	Reverse Transfer Capacitance			20		pF
Q_G	Gate Charge	$V_{CC}=600V, I_C=10A,$ $V_{GE}=-15\dots+15V$		48		nC
R_{Gint}	Internal Gate Resistance			/		Ω
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	GD10PIK120C5S	Units
V_{RRM}	Collector-Emitter Voltage @ $T_J=25^\circ C$	1200	V
I_F	DC Forward Current @ $T_C=80^\circ C$	10	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1ms$	20	A
I^2t	I^2t -value, $V_R=0V, t_p=10ms, T_J=125^\circ C$	20	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
V_F	Diode Forward Voltage	$I_F=10A, V_{GE}=0V$	$T_J=25^\circ C$		1.85	2.20	V
			$T_J=125^\circ C$		2.00		
Q_{rr}	Recovered Charge	$I_F=10A,$	$T_J=25^\circ C$		0.82		ns
			$T_J=125^\circ C$		1.51		
I_{RM}	Peak Reverse Recovery Current	$V_R=600V,$ $di/dt=-400A/\mu s,$	$T_J=25^\circ C$		12		A
			$T_J=125^\circ C$		13		
E_{rec}	Reverse Recovery Energy	$V_{GE}=-15V$	$T_J=25^\circ C$		0.31		mJ
			$T_J=125^\circ C$		0.55		

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

Symbol	Description	GD10PIK120C5S	Units
V_{RRM}	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	1600	V
$I_{F(AV)}$	Average On-state Current @ $T_C=100^\circ\text{C}$	12	A
I_{RMSM}	Maximum RMS Current at Rectifier Output @ $T_C=80^\circ\text{C}$	25	A
I_{FSM}	Surge Forward Current $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^\circ\text{C}$	150	A
I^2t	I^2t -value, $V_R=0\text{V}, t_p=10\text{ms}, T_j=150^\circ\text{C}$	250	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=7\text{A}$	$T_j=25^\circ\text{C}$		1.11	V
			$T_j=150^\circ\text{C}$		1.01	
I_R	Reverse Current	$T_j=150^\circ\text{C}, V_R=1600\text{V}$			0.7	mA

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

Symbol	Description	GD10PIK120C5S	Units
V_{CES}	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^\circ\text{C}$	25	A
	@ $T_C=80^\circ\text{C}$	10	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	20	A
P_{tot}	Total Power Dissipation @ $T_j=150^\circ\text{C}$	108	W
T_{SC}	Short Circuit Withstand Time @ $T_j=150^\circ\text{C}$	10	μs

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
BV_{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	$I_C=125\mu A, V_{CE}=V_{GE},$ $T_J=25^\circ C$	4.4	5.0	6.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=10A, V_{GE}=15V,$ $T_J=25^\circ C$		2.45	2.70	V
		$I_C=10A, V_{GE}=15V,$ $T_J=125^\circ C$		2.75		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
E_{on}	Turn-On Switching Loss	$V_{CC}=600V, I_C=10A,$ $R_G=22\Omega, V_{GE} = \pm 15V,$ $T_J=25^\circ C$		0.96		mJ
E_{off}	Turn-Off Switching Loss			0.46		mJ
E_{tot}	Total Switching Loss				1.42	
E_{on}	Turn-On Switching Loss	$V_{CC}=600V, I_C=10A,$ $R_G=22\Omega, V_{GE} = \pm 15V,$ $T_J=125^\circ C$		1.25		mJ
E_{off}	Turn-Off Switching Loss			0.69		mJ
E_{tot}	Total Switching Loss				1.94	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=10A,$ $R_G=22\Omega, V_{GE} = \pm 15V,$ $T_J=125^\circ C$		86		ns
t_r	Rise Time			21		ns
$t_{d(off)}$	Turn-Off Delay Time			118		ns
t_f	Fall Time			274		ns
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		750		pF
C_{oes}	Output Capacitance			190		pF
C_{res}	Reverse Transfer Capacitance			20		pF
Q_G	Gate Charge	$V_{CC}=600V, I_C=10A,$ $V_{GE}=-15\dots+15V$		48		nC
R_{Gint}	Internal Gate Resistance			/		Ω
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 $T_C=25^\circ\text{C}$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD10PIK120C5S	Units
V_{RRM}	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	1200	V
I_F	DC Forward Current @ $T_C=80^\circ\text{C}$	10	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	20	A
I^2t	I^2t -value, $V_R=0\text{V}$, $t_p=10\text{ms}$, $T_j=125^\circ\text{C}$	20	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=10\text{A}$, $V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$	1.85	2.20	V
			$T_j=125^\circ\text{C}$		2.00	
Q_{rr}	Recovered Charge	$I_F=10\text{A}$,	$T_j=25^\circ\text{C}$	0.82		ns
			$T_j=125^\circ\text{C}$	1.51		
I_{RM}	Peak Reverse Recovery Current	$V_R=600\text{V}$, $di/dt=-400\text{A}/\mu\text{s}$,	$T_j=25^\circ\text{C}$	12		A
			$T_j=125^\circ\text{C}$	13		
E_{rec}	Reverse Recovery Energy	$V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	0.31		mJ
			$T_j=125^\circ\text{C}$	0.55		

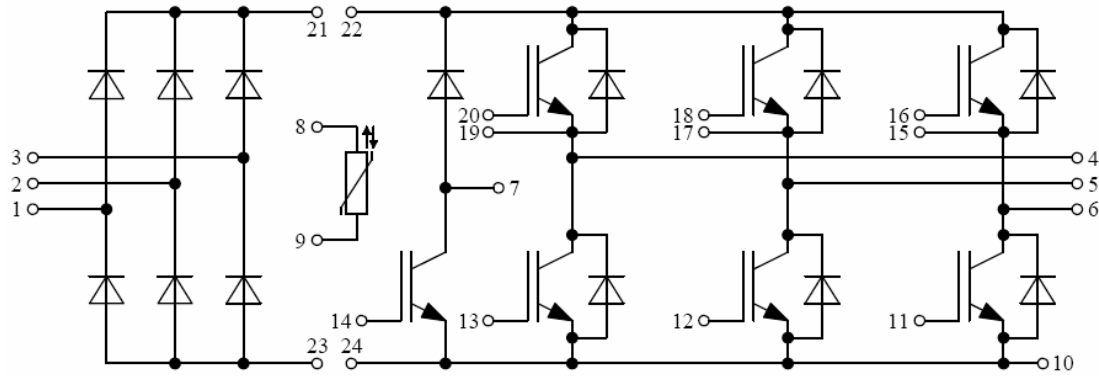
Electrical Characteristics of NTC $T_C=25^\circ\text{C}$ unless otherwise noted

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

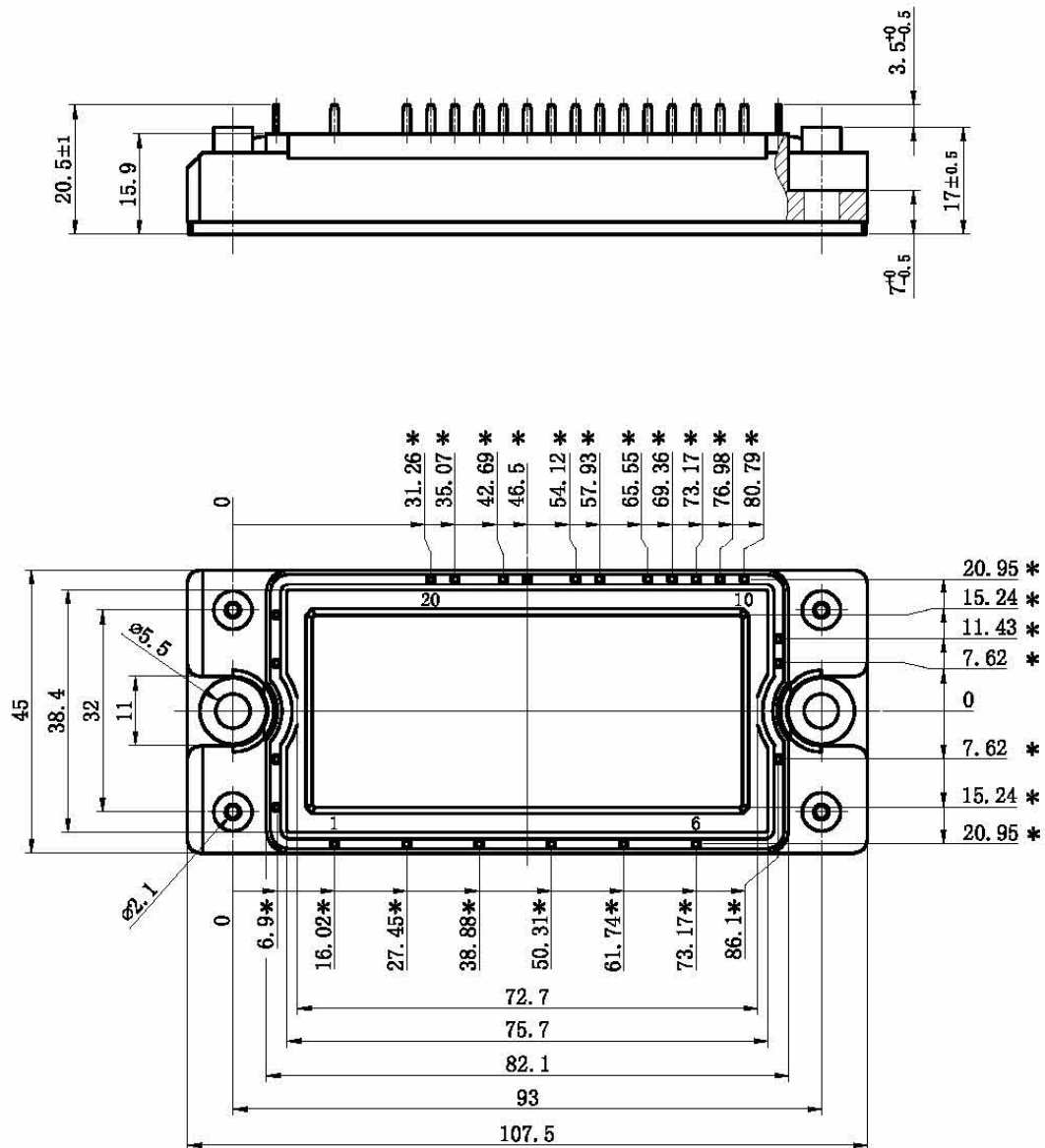
Symbol	Parameter	Min.	Typ.	Max.	Units
V _{ISO}	Isolation Voltage RMS, f=50Hz, t=1min		2500		V
L _{CE}	Stray Inductance		60		nH
R _{CC'+EE'}	Module Lead Resistance, Terminal to Chip @ T _C =25°C		4.00		mΩ
R _{θJC}	Junction-to-Case (per IGBT-inverter)			1.16	K/W
	Junction-to-Case (per DIODE-inverter)			1.84	
	Junction-to-Case (per DIODE-rectifier)			1.91	
	Junction-to-Case (per IGBT-brake-chopper)			1.16	
	Junction-to-Case (per DIODE-brake-chopper)			1.84	
R _{θCS}	Case-to-Sink (Conductive grease applied)		0.02		K/W
T _j	Maximum Junction Temperature			150	°C
T _{STG}	Storage Temperature Range	-40		125	°C
Mounting Torque	Mounting Screw:M5	3.0		6.0	N.m
G	Weight of Module		175		g

Equivalent Circuit Schematic



Package Dimension

Dimensions in Millimeters



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