

STARPOWER

SEMICONDUCTOR

IGBT

GD30PIK60C5S

Molding Type Module

600V/30A 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

- Low $V_{CE(sat)}$ NPT IGBT technology
- 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	GD30PIK60C5S	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 @ $T_C=25^\circ\text{C}$	48	A
	@ $T_C=80^\circ\text{C}$	30	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	60	A
P_{tot}	Total Power Dissipation @ $T_j=150^\circ\text{C}$	153	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	$I_C=250\mu\text{A}, V_{CE}=V_{GE},$ $T_j=25^\circ\text{C}$	3.5	4.5	5.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=30\text{A}, V_{GE}=15\text{V},$ $T_j=25^\circ\text{C}$		1.95	2.40	V
		$I_C=30\text{A}, V_{GE}=15\text{V},$ $T_j=125^\circ\text{C}$		2.35		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=30A,$ $R_G=10\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		47		ns	
t_r	Rise Time			30		ns	
$t_{d(off)}$	Turn-Off Delay Time			190		ns	
t_f	Fall Time			30		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	$V_{CC}=400V, I_C=30A,$ $R_G=10\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		49		ns	
t_r	Rise Time			30		ns	
$t_{d(off)}$	Turn-Off Delay Time			205		ns	
t_f	Fall Time			33		ns	
E_{on}	Turn-On Switching Loss				0.64		mJ
E_{off}	Turn-Off Switching Loss				1.15		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		1750		pF	
C_{oes}	Output Capacitance			160		pF	
C_{res}	Reverse Transfer Capacitance			60		pF	
Q_G	Gate Charge	$V_{CC}=400V, I_C=30A,$ $V_{GE}=15V$		102		nC	
I_{sc}	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=360V,$ $V_{CEM} \leq 600V$		270		A	

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

Symbol	Description	GD30PIK60C5S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	600	V
I_F	DC Forward Current @ $T_C=80^\circ\text{C}$	30	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	60	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=30\text{V}_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$		1.30	1.75	V
			$T_j=125^\circ\text{C}$		1.25		
Q_r	Recovered Charge	$I_F=30\text{A}$	$T_j=25^\circ\text{C}$		2.2		μC
			$T_j=125^\circ\text{C}$		4.6		
I_{RM}	Peak Reverse Recovery Current	$V_R=400\text{V},$ $R_G=10\Omega,$ $V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$		38		A
			$T_j=125^\circ\text{C}$		44		
E_{rec}	Reverse Recovery Energy		$T_j=25^\circ\text{C}$		0.41		mJ
			$T_j=125^\circ\text{C}$		0.92		

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

Symbol	Description	GD30PIK60C5S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	1600	V
$I_{F(AV)}$	Average On-state Current @ $T_C=100^\circ\text{C}$	31	A
I_{RMSM}	Maximum RMS Current At Rectifier Output @ $T_C=80^\circ\text{C}$	60	A
I_{FSM}	Surge Forward Current $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^\circ\text{C}$	320	A
I^2t	I^2t -value, $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^\circ\text{C}$	510	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=30\text{A}$	$T_j=150^\circ\text{C}$		1.05		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	GD30PIK60C5S	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 @ $T_C=25^\circ\text{C}$	48	A
	@ $T_C=80^\circ\text{C}$	30	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	60	A
P_{tot}	Total Power Dissipation @ $T_j=150^\circ\text{C}$	153	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	$I_C=250\mu\text{A}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	3.5	4.5	5.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=30\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.95	2.40	V
		$I_C=30\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		2.35		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=30A,$ $R_G=10\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		47		ns
t_r	Rise Time			30		ns
$t_{d(off)}$	Turn-Off Delay Time			190		ns
t_f	Fall Time			30		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	$V_{CC}=400V, I_C=30A,$ $R_G=10\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		49		ns
t_r	Rise Time			30		ns
$t_{d(off)}$	Turn-Off Delay Time			205		ns
t_f	Fall Time			33		ns
E_{on}	Turn-On Switching Loss			0.64		mJ
E_{off}	Turn-Off Switching Loss			1.15		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		1750		pF
C_{oes}	Output Capacitance			160		pF
C_{res}	Reverse Transfer Capacitance			60		pF
Q_G	Gate Charge	$V_{CC}=400V, I_C=30A,$ $V_{GE}=15V$		102		nC
I_{SC}	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=360V,$ $V_{CEM} \leq 600V$		270		A

Diode-brake-chopper $T_C=25^\circ C$ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD30PIK60C5S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ C$	600	V
I_F	DC Forward Current @ $T_C=80^\circ C$	10	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1ms$	20	A

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
V_F	Diode Forward Voltage	$I_F=10A, V_{GE}=0V$	$T_j=25^\circ C$		1.20	1.65	V
			$T_j=125^\circ C$		1.25		
Q_r	Recovered Charge	$I_F=10A,$	$T_j=25^\circ C$		0.55		μC
			$T_j=125^\circ C$		0.91		
I_{RM}	Peak Reverse Recovery Current	$V_R=400V,$ $R_G=47\Omega,$	$T_j=25^\circ C$		16		A
			$T_j=125^\circ C$		19		
E_{rec}	Reverse Recovery Energy	$V_{GE}=-15V$	$T_j=25^\circ C$		0.12		mJ
			$T_j=125^\circ C$		0.25		

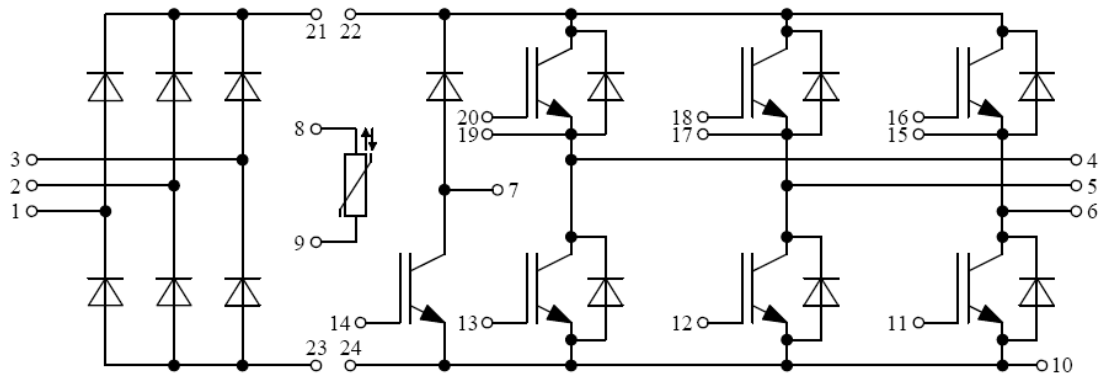
Electrical Characteristics of NTC $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
R_{25}	Rated Resistance			5.0		$k\Omega$
$\Delta R/R$	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	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		3375		K

IGBT Module

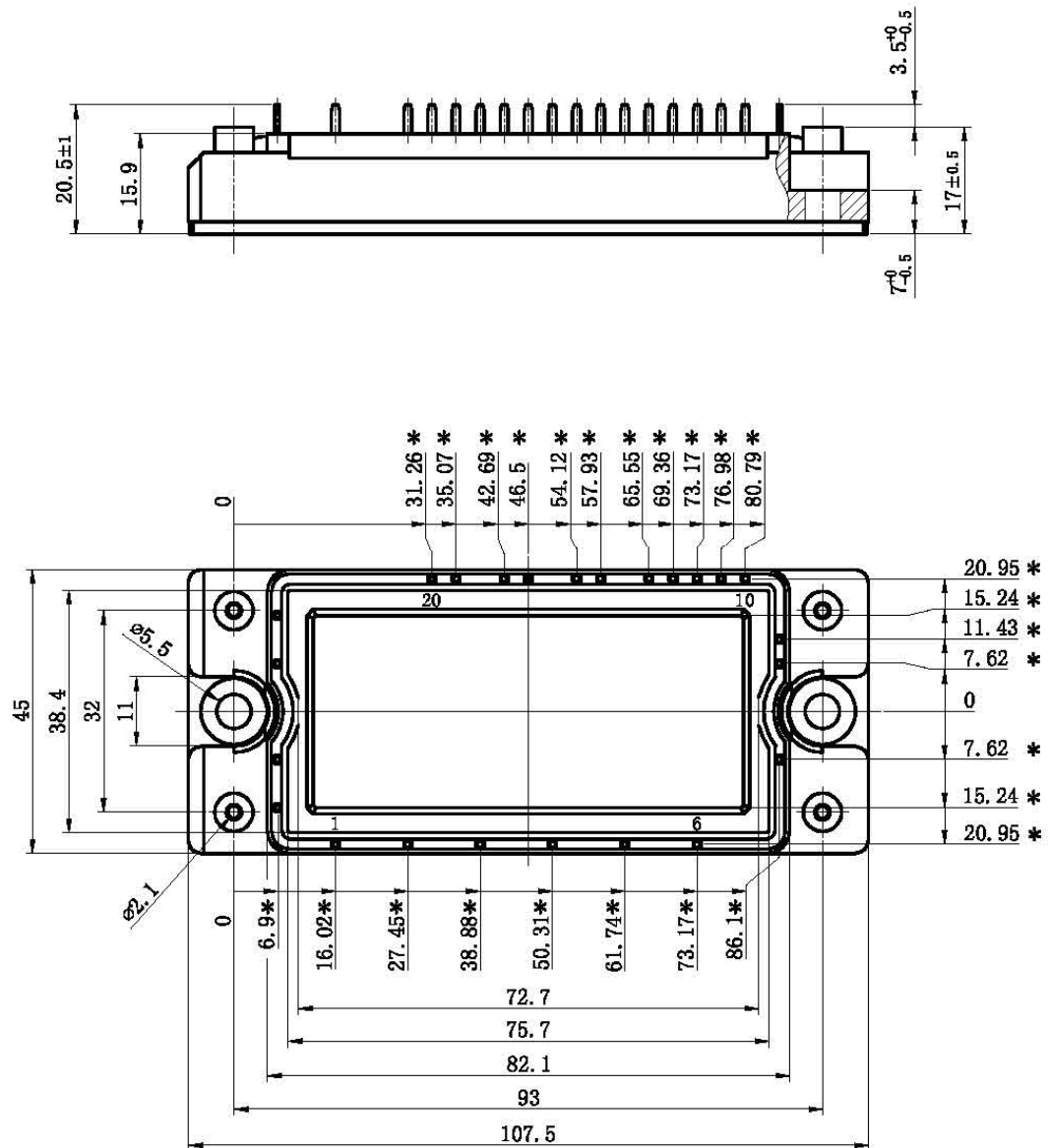
Symbol	Parameter	Min.	Typ.	Max.	Units
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}, t=1\text{min}$	2500			V
L_{CE}	Stray Inductance		60		nH
$R_{CC'+EE'}$ $R_{AA'+CC'}$	Module Lead Resistance, Terminal to Chip @ $T_C=25^\circ\text{C}$		4.00 2.00		$m\Omega$
$R_{\theta JC}$	Junction-to-Case (per IGBT-inverter) 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)			0.816 1.679 1.138 0.831 2.332	K/W
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)		0.02		K/W
T_j	Maximum Junction Temperature			150	$^\circ\text{C}$
T_{jop}	Operating Junction Temperature	-40		125	$^\circ\text{C}$
T_{STG}	Storage Temperature Range	-40		125	$^\circ\text{C}$
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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