

STARPOWER

SEMICONDUCTOR

IGBT

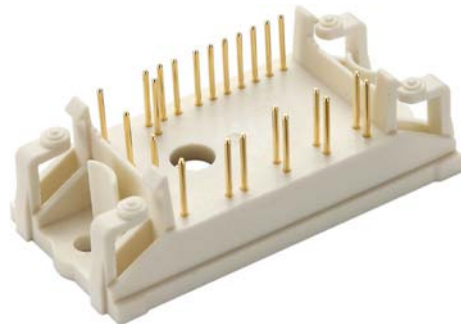
GD10PJK60F3S

Molding Type Module

600V/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

- Low $V_{CE(sat)}$ NPT IGBT technology
- 10 μ s short circuit capability
- Square RBSOA
- $V_{CE(sat)}$ with positive temperature coefficient
- Fast & soft reverse recovery anti-parallel FWD

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	GD10PJK60F3S	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 @ $T_C=25^\circ\text{C}$ @ $T_C=80^\circ\text{C}$	20 10	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	20	A
P_{tot}	Total Power Dissipation @ $T_j=150^\circ\text{C}$	79	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	$V_{CE}=V_{CES}, V_{GE}=0\text{V},$ $T_j=25^\circ\text{C}$			1.0	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	$I_C=10\text{A}, V_{GE}=15\text{V},$ $T_j=25^\circ\text{C}$		1.80	2.25	V
		$I_C=10\text{A}, V_{GE}=15\text{V},$ $T_j=150^\circ\text{C}$		2.20		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=10A,$ $R_G=47\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		30		ns	
t_r	Rise Time			20		ns	
$t_{d(off)}$	Turn-Off Delay Time			230		ns	
t_f	Fall Time			23		ns	
E_{on}	Turn-On Switching Loss				0.14		mJ
E_{off}	Turn-Off Switching Loss				0.25		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=10A,$ $R_G=47\Omega, V_{GE}=\pm 15V,$ $T_j=150^\circ C$		30		ns	
t_r	Rise Time			20		ns	
$t_{d(off)}$	Turn-Off Delay Time			250		ns	
t_f	Fall Time			26		ns	
E_{on}	Turn-On Switching Loss				0.23		mJ
E_{off}	Turn-Off Switching Loss				0.35		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		620		pF	
C_{res}	Reverse Transfer Capacitance			22		pF	
Q_G	Gate Charge	$V_{CC}=400V, I_C=10A,$ $V_{GE}=15V$		38		nC	
R_{Gint}	Internal Gate Resister			/		Ω	
I_{SC}	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=400V,$ $V_{CEM} \leq 600V$		90		A	

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

Symbol	Description	GD10PJK60F3S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	600	V
I_F	DC Forward Current	10	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	20	A

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=10\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.20	1.60	V
		$I_F=10\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.25		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=10\text{A}, R_G=47\Omega, V_{GE}=-15\text{V}, T_j=25^\circ\text{C}$		0.6		μC
I_{RM}	Peak Reverse Recovery Current			15		A
E_{rec}	Reverse Recovery Energy			0.14		mJ
Q_r	Recovered Charge			1.0		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=300\text{V}, I_F=10\text{A}, R_G=47\Omega, V_{GE}=-15\text{V}, T_j=125^\circ\text{C}$		19		A
			E_{rec}	Reverse Recovery Energy		0.25

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 @ $T_C=100^\circ\text{C}$	20	A
I_{RMSM}	Maximum RMS Current At Rectifier Output @ $T_C=80^\circ\text{C}$	40	A
I_{FSM}	Surge Forward Current $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^\circ\text{C}$	270	A
I^2t	I^2t -value, $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^\circ\text{C}$	360	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=10\text{A}, T_j=150^\circ\text{C}$		0.90		V
I_R	Reverse Current	$T_j=150^\circ\text{C}, V_R=1600\text{V}$			1.0	mA

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

Symbol	Description	GD10PJK60F3S	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 @ $T_C=25^\circ\text{C}$ @ $T_C=80^\circ\text{C}$	20 10	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	20	A
P_{tot}	Total Power Dissipation @ $T_j=175^\circ\text{C}$	79	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	$V_{CE}=V_{CES}, V_{GE}=0\text{V},$ $T_j=25^\circ\text{C}$			1.0	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	$I_C=10\text{A}, V_{GE}=15\text{V},$ $T_j=25^\circ\text{C}$		1.80	2.25	V
		$I_C=10\text{A}, V_{GE}=15\text{V},$ $T_j=150^\circ\text{C}$		2.20		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=10A,$ $R_G=47\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		30		ns
t_r	Rise Time			20		ns
$t_{d(off)}$	Turn-Off Delay Time			230		ns
t_f	Fall Time			23		ns
E_{on}	Turn-On Switching Loss			0.14		mJ
E_{off}	Turn-Off Switching Loss			0.25		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=10A,$ $R_G=47\Omega, V_{GE}=\pm 15V,$ $T_j=150^\circ C$		30		ns
t_r	Rise Time			20		ns
$t_{d(off)}$	Turn-Off Delay Time			250		ns
t_f	Fall Time			26		ns
E_{on}	Turn-On Switching Loss			0.23		mJ
E_{off}	Turn-Off Switching Loss			0.35		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		620		pF
C_{res}	Reverse Transfer Capacitance			22		pF
Q_G	Gate Charge	$V_{CC}=400V, I_C=10A,$ $V_{GE}=15V$		38		nC
R_{Gint}	Internal Gate Resister			/		Ω
I_{SC}	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=400V,$ $V_{CEM} \leq 600V$		90		A

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

Symbol	Description	GD10PJK60F3S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	600	V
I_F	DC Forward Current	10	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	20	A

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=10\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.20	1.60	V
		$I_F=10\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.25		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=10\text{A}, R_G=47\Omega, V_{GE}=-15\text{V}, T_j=25^\circ\text{C}$		0.6		μC
I_{RM}	Peak Reverse Recovery Current			15		A
E_{rec}	Reverse Recovery Energy			0.14		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=10\text{A}, R_G=47\Omega, V_{GE}=-15\text{V}, T_j=125^\circ\text{C}$		1.0		μC
			I_{RM}	Peak Reverse Recovery Current		19
E_{rec}	Reverse Recovery Energy			0.25		mJ

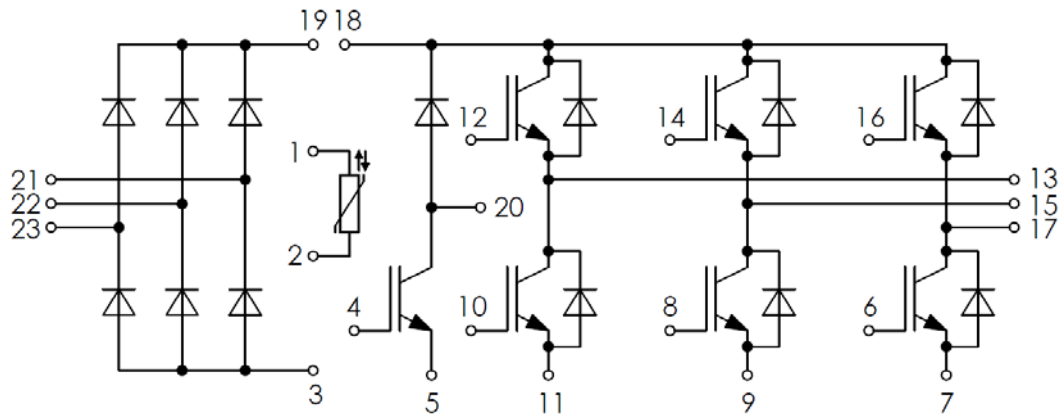
NTC $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
R_{25}	Rated Resistance			22.0		k Ω
$\Delta R/R$	Deviation of R_{100}	$T_C=100^\circ\text{C}, R_{100}=1486.1\Omega$	-5		5	%
P_{25}	Power Dissipation				200	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		4000		K

IGBT Module

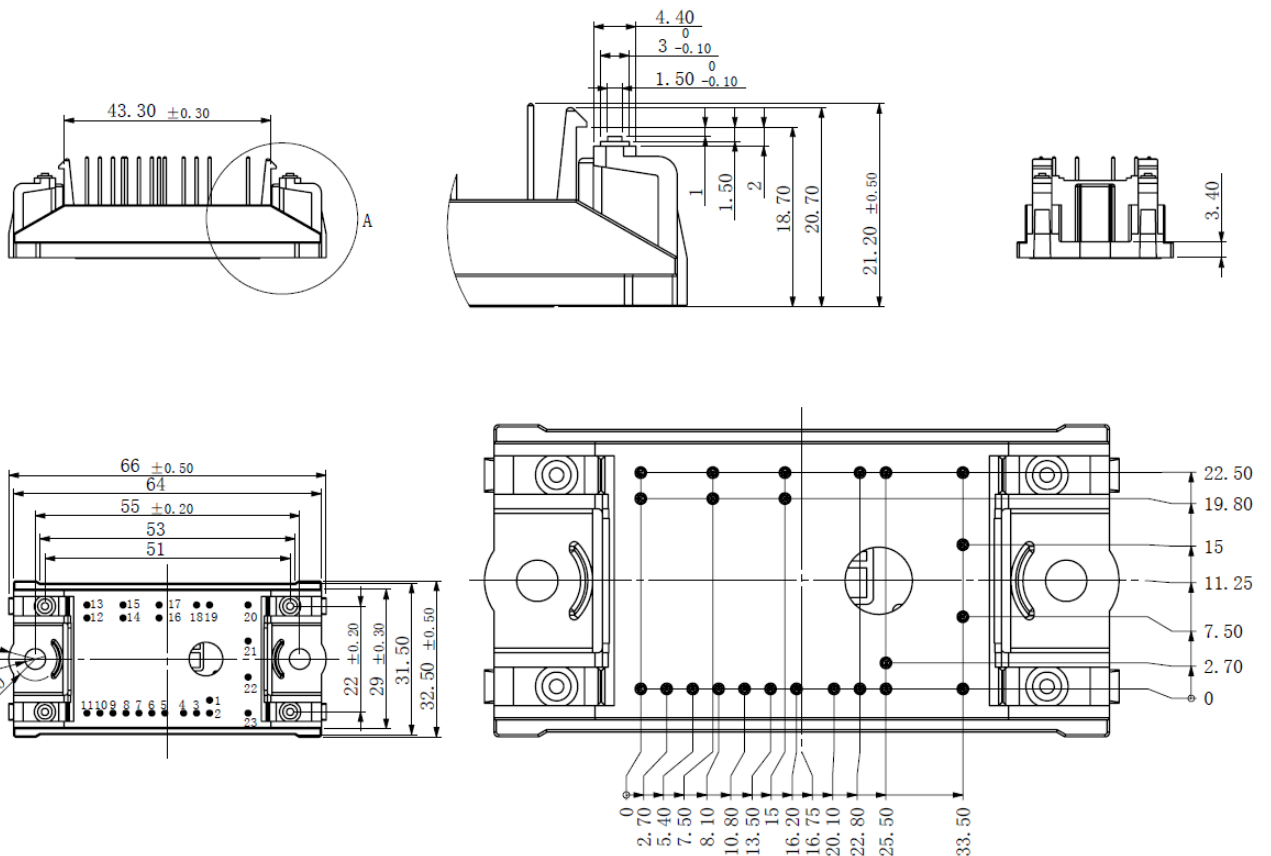
Symbol	Parameter	Min.	Typ.	Max.	Units
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}, t=1\text{min}$	4000			V
$R_{\theta JC}$	Junction-to-Case (per IGBT-inverter)			1.571	K/W
	Junction-to-Case (per Diode-inverter)			3.096	
	Junction-to-Case (per Diode-rectifier)			1.624	
	Junction-to-Case (per IGBT-brake-chopper)			1.768	
	Junction-to-Case (per Diode-brake-chopper)			3.394	
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)		0.036		K/W
T_{jmax}	Maximum Junction Temperature			150	$^\circ\text{C}$
T_{jop}	Operating Junction Temperature	-40		125	$^\circ\text{C}$
T_{STG}	Storage Temperature Range	-40		125	$^\circ\text{C}$

Equivalent Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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