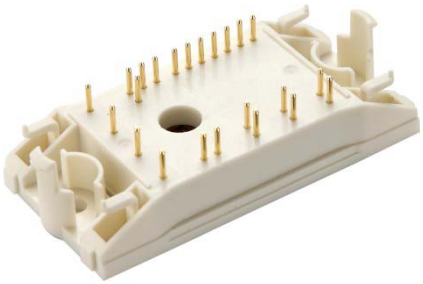
STARPOWER

SEMICONDUCTOR **IGBT**

GD15PJT60F1S

Molding Type Module

600V/15A 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
- Low switching loss
- 5μs short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175℃
- 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℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD15PJT60F1S	Unit
V_{CES}	Collector-Emitter Voltage @ T_j=25℃	600	V
V_{GES}	Gate-Emitter Voltage @ T_j=25℃	±20	V
I_C	Collector Current @ T_C=25℃ @ T_C=100℃	23 15	A
I_{CM}	Pulsed Collector Current t_p=1ms	30	A
P_{tot}	Total Power Dissipation @ T_j=175℃	79	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	T_j=25℃	600			V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25℃			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25℃			400	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=350μA,V_{CE}=V_{GE}, T_j=25℃	4.0	5.5	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=15A,V_{GE}=15V, T_j=25℃		1.70	2.15	V
		I_C=15A,V_{GE}=15V, T_j=125℃		2.05		
		I_C=15A,V_{GE}=15V, T_j=150℃		2.10		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=15A, R_G=22Ω,V_{GE}=±15V, T_j=25℃		29		ns
t_r	Rise Time			16		ns
$t_{d(off)}$	Turn-Off Delay Time			78		ns
t_f	Fall Time			23		ns
E_{on}	Turn-On Switching Loss			0.07		mJ
E_{off}	Turn-Off Switching Loss			0.21		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=15A, R_G=22Ω,V_{GE}=±15V, T_j=125℃		30		ns
t_r	Rise Time			17		ns
$t_{d(off)}$	Turn-Off Delay Time			90		ns
t_f	Fall Time			35		ns
E_{on}	Turn-On Switching Loss			0.13		mJ
E_{off}	Turn-Off Switching Loss			0.29		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=15A, R_G=22Ω,V_{GE}=±15V, T_j=150℃		32		ns
t_r	Rise Time			17		ns
$t_{d(off)}$	Turn-Off Delay Time			95		ns
t_f	Fall Time			37		ns
E_{on}	Turn-On Switching Loss			0.15		mJ
E_{off}	Turn-Off Switching Loss			0.31		mJ
C_{ies}	Input Capacitance	V_{CE}=30V,f=1Mhz, V_{GE}=0V		765		pF
C_{oes}	Output Capacitance			52		pF
C_{res}	Reverse Transfer Capacitance			23		pF
Q_G	Gate Charge	V_{CC}=300V,I_C=15A, V_{GE}=15V		31		nC
R_{Gint}	Internal Gate Resister			/		Ω
I_{SC}	SC Data	t_P≤5μs,V_{GE}=15V, T_j=150℃,V_{CC}=400V, V_{CEM}≤600V		108		A

Diode-inverter T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD15PJT60F1S	Unit
V_{RRM}	Repetitive Peak Reverse Voltage @ T_j=25℃	600	V
I_F	DC Forward Current	15	A
I_{FRM}	Repetitive Peak Forward Current t_p=1ms	30	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=15A,V_{GE}=0V	T_j=25℃		1.20	1.65	V
			T_j=125℃		1.10		
			T_j=150℃		1.10		
Q_r	Recovered Charge	I_F=15A, V_R=300V, -di/dt=680A/μs, V_{GE}=-15V	T_j=25℃		1.1		μC
			T_j=125℃		1.5		
			T_j=150℃		1.8		
I_{RM}	Peak Reverse Recovery Current		T_j=25℃		20		A
			T_j=125℃		22		
			T_j=150℃		24		
E_{rec}	Reverse Recovery Energy		T_j=25℃		0.18		mJ
			T_j=125℃		0.26		
			T_j=150℃		0.30		

Diode-rectifier T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD20PJT60L2S	Unit
V_{RRM}	Repetitive Peak Reverse Voltage @ T_j=25℃	1600	V
I_O	Average Output Current @ T_C=100℃	15	A
I_{FSM}	Surge Forward Current V_R=0V,t_p=10ms,T_j=45℃	270	A
I^2t	I^2t-value,V_R=0V,t_p=10ms,T_j=45℃	360	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=15A	T_j=150℃		0.95		V
I_R	Reverse Current	T_j=150℃,V_R=1600V				1.0	mA

IGBT-brake-chopper T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD15PJT60F1S	Unit
V_{CES}	Collector-Emitter Voltage @ T_j=25℃	600	V
V_{GES}	Gate-Emitter Voltage @ T_j=25℃	±20	V
I_C	Collector Current @ T_C=25℃ @ T_C=100℃	22 15	A
I_{CM}	Pulsed Collector Current t_p=1ms	30	A
P_{tot}	Total Power Dissipation @ T_j=175℃	75	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	T_j=25℃	600			V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25℃			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25℃			400	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=350μA,V_{CE}=V_{GE}, T_j=25℃	4.0	5.5	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=15A,V_{GE}=15V, T_j=25℃		1.70	2.15	V
		I_C=15A,V_{GE}=15V, T_j=125℃		2.05		
		I_C=15A,V_{GE}=15V, T_j=150℃		2.10		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=15A, R_G=22Ω,V_{GE}=±15V, T_j=25℃		29		ns
t_r	Rise Time			16		ns
$t_{d(off)}$	Turn-Off Delay Time			78		ns
t_f	Fall Time			23		ns
E_{on}	Turn-On Switching Loss			0.07		mJ
E_{off}	Turn-Off Switching Loss			0.21		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=15A, R_G=22Ω,V_{GE}=±15V, T_j=125℃		30		ns
t_r	Rise Time			17		ns
$t_{d(off)}$	Turn-Off Delay Time			90		ns
t_f	Fall Time			35		ns
E_{on}	Turn-On Switching Loss			0.13		mJ
E_{off}	Turn-Off Switching Loss			0.29		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=15A, R_G=22Ω,V_{GE}=±15V, T_j=150℃		32		ns
t_r	Rise Time			17		ns
$t_{d(off)}$	Turn-Off Delay Time			95		ns
t_f	Fall Time			37		ns
E_{on}	Turn-On Switching Loss			0.15		mJ
E_{off}	Turn-Off Switching Loss			0.31		mJ
C_{ies}	Input Capacitance	V_{CE}=30V,f=1Mhz, V_{GE}=0V		765		pF
C_{oes}	Output Capacitance			52		pF
C_{res}	Reverse Transfer Capacitance			23		pF
Q_G	Gate Charge	V_{CC}=300V,I_C=15A, V_{GE}=15V		31		nC
R_{Gint}	Internal Gate Resister			/		Ω
I_{SC}	SC Data	t_P≤5μs,V_{GE}=15V, T_j=150℃,V_{CC}=400V, V_{CEM}≤600V		108		A

Diode-brake-chopper T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD15PJT60F1S	Unit
V_{RRM}	Repetitive Peak Reverse Voltage @ T_j=25℃	600	V
I_F	DC Forward Current	10	A
I_{FRM}	Repetitive Peak Forward Current t_p=1ms	20	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=10A,V_{GE}=0V	T_j=25℃		1.20	1.65	V
			T_j=125℃		1.10		
			T_j=150℃		1.10		
Q_r	Recovered Charge	I_F=10A, V_R=300V, -di/dt=520A/μs, V_{GE}=-15V	T_j=25℃		0.5		μC
			T_j=125℃		0.8		
			T_j=150℃		1.0		
I_{RM}	Peak Reverse Recovery Current		T_j=25℃		11		A
			T_j=125℃		12		
			T_j=150℃		14		
E_{rec}	Reverse Recovery Energy		T_j=25℃		0.07		mJ
			T_j=125℃		0.14		
			T_j=150℃		0.15		

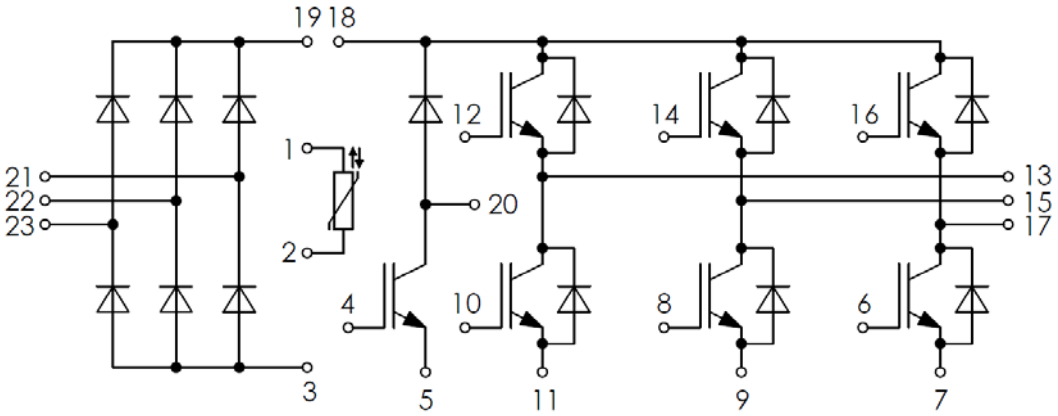
NTC T_C=25℃ unless otherwise noted

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

IGBT Module

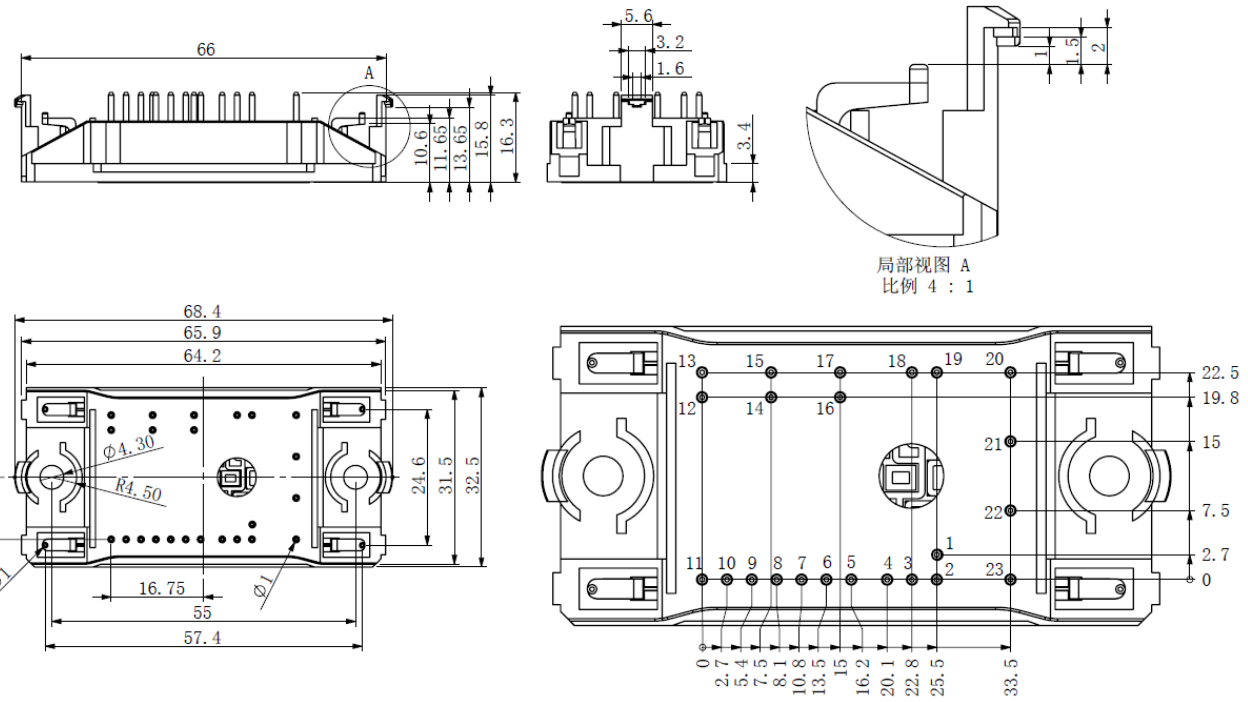
Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=1min	4000			V
$R_{\theta JC}$	Junction-to-Case (per IGBT-inverter) Junction-to-Case (per Diode-inverter) Junction-to-Case (per Diode-rectifier) Junction-to-Case (per IGBT-brake-chopper) Junction-to-Case (per Diode-brake-chopper)			1.893 2.636 1.623 2.009 3.399	K/W
$R_{\theta CS}$	Case-to-Sink (per IGBT-inverter) Case-to-Sink (per Diode-inverter) Case-to-Sink (per Diode-rectifier) Case-to-Sink (per IGBT-brake-chopper) Case-to-Sink (per Diode-brake-chopper)		0.658 0.917 0.564 0.699 1.182		K/W
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)		0.035		K/W
T_{jmax}	Maximum Junction Temperature			175	℃
T_{jop}	Operating Junction Temperature	-40		150	℃
T_{STG}	Storage Temperature Range	-40		125	℃

Equivalent Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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