

# STARPOWER

SEMICONDUCTOR

**IGBT**

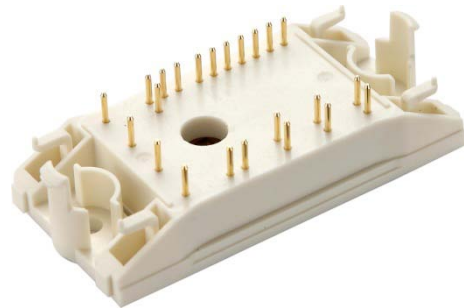
## GD15PJK60F1S

Molding Type Module

**600V/15A 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 $\mu$ 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	GD15PJK60F1S	Units
$V_{CES}$	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	600	V
$V_{GES}$	Gate-Emitter Voltage @ $T_j=25^\circ\text{C}$	$\pm 20$	V
$I_C$	Collector Current @ $T_C=25^\circ\text{C}$ @ $T_C=95^\circ\text{C}$	27 15	A
$I_{CM}$	Pulsed Collector Current $t_p=1\text{ms}$	30	A
$P_{tot}$	Total Power Dissipation @ $T_j=150^\circ\text{C}$	92	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	$I_C=15\text{A}, V_{GE}=15\text{V},$ $T_j=25^\circ\text{C}$		1.80	2.25	V
		$I_C=15\text{A}, V_{GE}=15\text{V},$ $T_j=125^\circ\text{C}$		2.10		

**Switching Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300V, I_C=15A,$ $R_G=22\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		34		ns
$t_r$	Rise Time			16		ns
$t_{d(off)}$	Turn-Off Delay Time			184		ns
$t_f$	Fall Time			20		ns
$E_{on}$	Turn-On Switching Loss			0.22		mJ
$E_{off}$	Turn-Off Switching Loss			0.34		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300V, I_C=15A,$ $R_G=22\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		34		ns
$t_r$	Rise Time			18		ns
$t_{d(off)}$	Turn-Off Delay Time			203		ns
$t_f$	Fall Time			28		ns
$E_{on}$	Turn-On Switching Loss			0.36		mJ
$E_{off}$	Turn-Off Switching Loss			0.49		mJ
$C_{ies}$	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		850		pF
$C_{oes}$	Output Capacitance			75		pF
$C_{res}$	Reverse Transfer Capacitance			35		pF
$Q_G$	Gate Charge	$V_{CC}=400V, I_C=15A,$ $V_{GE}=15V$		56		nC
$R_{Gint}$	Internal Gate Resister			/		$\Omega$
$I_{SC}$	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=400V,$ $V_{CEM} \leq 600V$		135		A

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

Symbol	Description	GD15PJK60F1S	Units
$V_{RRM}$	Repetitive Peak Reverse Voltage @ $T_j=25^\circ C$	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.	Units	
$V_F$	Diode Forward Voltage	$I_F=15A, V_{GE}=0V$	$T_j=25^\circ C$		1.20	1.60	V
			$T_j=125^\circ C$		1.15		
$Q_r$	Recovered Charge	$I_F=15A,$ $V_R=300V,$ $R_G=16\Omega,$ $V_{GE}=-15V$	$T_j=25^\circ C$		0.9		$\mu C$
			$T_j=125^\circ C$		1.4		
$I_{RM}$	Peak Reverse Recovery Current	$V_{GE}=-15V$	$T_j=25^\circ C$		27		A
			$T_j=125^\circ C$		31		
$E_{rec}$	Reverse Recovery Energy	$V_{GE}=-15V$	$T_j=25^\circ C$		0.23		mJ
			$T_j=125^\circ C$		0.36		

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

Symbol	Description	GD15PJK60F1S	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	$\text{A}^2\text{s}$

**Characteristics Values**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_F$	Diode Forward Voltage	$I_F=20\text{A}$ $T_j=150^\circ\text{C}$		1.11		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	GD15PJK60F1S	Units
$V_{CES}$	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	600	V
$V_{GES}$	Gate-Emitter Voltage @ $T_j=25^\circ\text{C}$	$\pm 20$	V
$I_C$	Collector Current @ $T_C=25^\circ\text{C}$ @ $T_C=95^\circ\text{C}$	22 15	A
$I_{CM}$	Pulsed Collector Current $t_p=1\text{ms}$	30	A
$P_{tot}$	Total Power Dissipation @ $T_j=175^\circ\text{C}$	75	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	$I_C=350\mu\text{A}, V_{CE}=V_{GE},$ $T_j=25^\circ\text{C}$	4.0	4.9	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=15\text{A}, V_{GE}=15\text{V},$ $T_j=25^\circ\text{C}$		1.70	2.15	V
		$I_C=15\text{A}, V_{GE}=15\text{V},$ $T_j=175^\circ\text{C}$		2.20		

### Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=15A,$ $R_G=22\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		39		ns
$t_r$	Rise Time			21		ns
$t_{d(off)}$	Turn-Off Delay Time			104		ns
$t_f$	Fall Time			30		ns
$E_{on}$	Turn-On Switching Loss			0.09		mJ
$E_{off}$	Turn-Off Switching Loss			0.28		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=15A,$ $R_G=22\Omega, V_{GE}=\pm 15V,$ $T_j=175^\circ C$		40		ns
$t_r$	Rise Time			23		ns
$t_{d(off)}$	Turn-Off Delay Time			128		ns
$t_f$	Fall Time			51		ns
$E_{on}$	Turn-On Switching Loss			0.23		mJ
$E_{off}$	Turn-Off Switching Loss			0.44		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	$V_{CC}=400V, I_C=15A,$ $V_{GE}=15V$		31		nC
$R_{Gint}$	Internal Gate Resister			/		$\Omega$
$I_{SC}$	SC Data	$t_p \leq 5\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=400V,$ $V_{CEM} \leq 600V$		135		A

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

### Maximum Rated Values

Symbol	Description	GD15PJK60F1S	Units
$V_{RRM}$	Repetitive Peak Reverse Voltage @ $T_j=25^\circ C$	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.	Units	
$V_F$	Diode Forward Voltage	$I_F=15A, V_{GE}=0V$	$T_j=25^\circ C$		1.20	1.60	V
			$T_j=125^\circ C$		1.15		
$Q_r$	Recovered Charge	$I_F=15A,$ $V_R=300V,$ $R_G=16\Omega,$ $V_{GE}=-15V$	$T_j=25^\circ C$		0.9		$\mu C$
			$T_j=125^\circ C$		1.4		
$I_{RM}$	Peak Reverse Recovery Current	$V_{GE}=-15V$	$T_j=25^\circ C$		27		A
			$T_j=125^\circ C$		31		
$E_{rec}$	Reverse Recovery Energy	$V_{GE}=-15V$	$T_j=25^\circ C$		0.23		mJ
			$T_j=125^\circ C$		0.36		

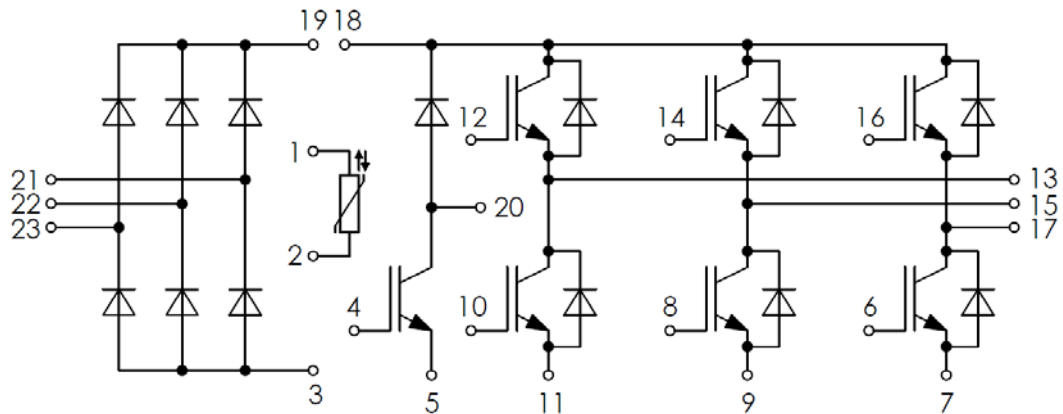
**NTC**  $T_C=25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$R_{25}$	Rated Resistance			22.0		$\text{k}\Omega$
$\Delta R/R$	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

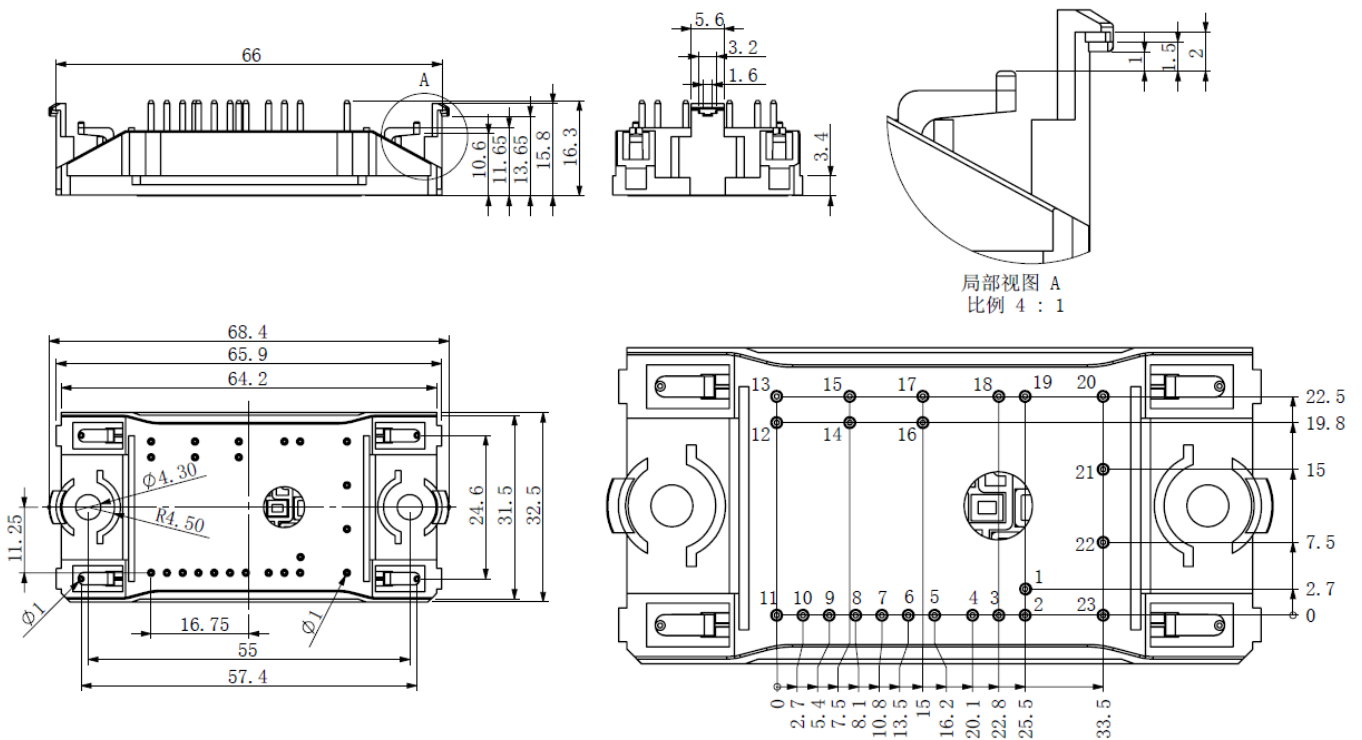
Symbol	Parameter	Min.	Typ.	Max.	Units
$V_{\text{ISO}}$	Isolation Voltage RMS, $f=50\text{Hz}, t=1\text{min}$	4000			V
$R_{\theta\text{JC}}$	Junction-to-Case (per IGBT-inverter)			1.362	K/W
	Junction-to-Case (per Diode-inverter)			2.642	
	Junction-to-Case (per Diode-rectifier)			1.623	
	Junction-to-Case (per IGBT-brake-chopper)			2.009	
	Junction-to-Case (per Diode-brake-chopper)			2.885	
$R_{\theta\text{CS}}$	Case-to-Sink (Conductive grease applied)		0.036		K/W
$T_{\text{jmax}}$	Maximum Junction Temperature			150	$^\circ\text{C}$
$T_{\text{jop}}$	Operating Junction Temperature	-40		125	$^\circ\text{C}$
$T_{\text{STG}}$	Storage Temperature Range	-40		125	$^\circ\text{C}$

### Equivalent Circuit Schematic



### Package Dimensions

Dimensions in Millimeters



局部视图 A  
比例 4 : 1

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