

STARPOWER

SEMICONDUCTOR™

IGBT

GD15PJK120L1S

Preliminary

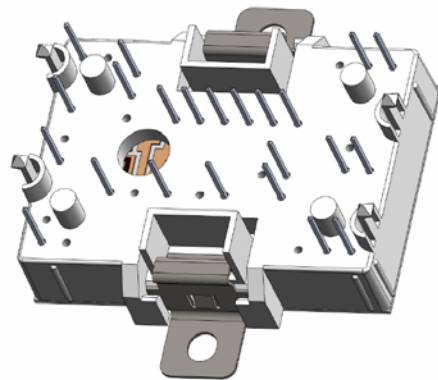
Molding Type Module**1200V/15A PIM in one-package**

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

- 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



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	GD15PJK120L1S	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 @ $T_C=25^\circ\text{C}$	30	A
	@ $T_C=80^\circ\text{C}$	15	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	30	A
P_{tot}	Total Power Dissipation @ $T_j=150^\circ\text{C}$	147	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	$I_C=250\mu\text{A}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	4.0	5.4	6.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=15\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		2.46		V
		$I_C=15\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		2.85		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
E_{on}	Turn-On Switching Loss	$V_{CC}=600\text{V}, I_C=15\text{A}, R_G=22\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		1.30		mJ
E_{off}	Turn-Off Switching Loss			0.90		mJ
E_{tot}	Total Switching Loss				2.20	
E_{on}	Turn-On Switching Loss	$V_{CC}=600\text{V}, I_C=15\text{A}, R_G=22\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		1.70		mJ
E_{off}	Turn-Off Switching Loss			1.25		mJ
E_{tot}	Total Switching Loss				2.95	

$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=15A,$ $R_G=22\Omega, V_{GE} = \pm 15V,$ $T_J=125^\circ C$	50		ns
t_r	Rise Time		50		ns
$t_{d(off)}$	Turn-Off Delay Time		300		ns
t_f	Fall Time		220		ns
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$	1285		pF
C_{oes}	Output Capacitance		280		pF
C_{res}	Reverse Transfer Capacitance		35		pF
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	GD15PJK120L1S	Units
V_{RRM}	Collector-Emitter Voltage @ $T_J=25^\circ C$	1200	V
I_F	DC Forward Current	15	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1ms$	30	A
I^2t	I^2t -value, $V_R=0V, t_p=10ms, T_J=125^\circ C$	50	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=15A, V_{GE}=0V$	$T_J=25^\circ C$	2.05		V
			$T_J=125^\circ C$	2.15		
Q_{rr}	Diode Reverse Recovery Charge	$I_F=15A,$ $V_R=600V,$ $di/dt=-900A/\mu s,$ $V_{GE}=-15V$	$T_J=25^\circ C$	1.6		μC
			$T_J=125^\circ C$	2.8		
I_{RM}	Diode Peak Reverse Recovery Current	$I_F=15A,$ $V_R=600V,$ $di/dt=-900A/\mu s,$ $V_{GE}=-15V$	$T_J=25^\circ C$	28		A
			$T_J=125^\circ C$	27		
E_{rec}	Reverse Recovery Energy	$I_F=15A,$ $V_R=600V,$ $di/dt=-900A/\mu s,$ $V_{GE}=-15V$	$T_J=25^\circ C$	0.5		mJ
			$T_J=125^\circ C$	1.0		

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

Symbol	Description	GD15PJK120L1S	Units
V_{RRM}	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	1600	V
I_{FRMSM}	Forward Current RMS Maximum Per Diode @ $T_C=80^\circ\text{C}$	25	A
I_{RMSM}	Maximum RMS Current at Rectifier output @ $T_C=80^\circ\text{C}$	25	A
I_{FSM}	Surge Forward Current $V_R=0\text{V}$, $t_p=10\text{ms}$, $T_j=45^\circ\text{C}$	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	$I_F=30\text{A}$	$T_j=25^\circ\text{C}$		1.29	V
			$T_j=125^\circ\text{C}$		1.31	
I_R	Reverse Current	$T_j=25^\circ\text{C}$, $V_R=1600\text{V}$			1	mA

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

Symbol	Description	GD15PJK120L1S	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 @ $T_C=25^\circ\text{C}$ @ $T_C=80^\circ\text{C}$	30	A
		15	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	30	A
P_{tot}	Total Power Dissipation @ $T_j=150^\circ\text{C}$	156	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	$I_C=250\mu A, V_{CE}=V_{GE},$ $T_j=25^\circ C$	4.0	5.4	6.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=15A, V_{GE}=15V,$ $T_j=25^\circ C$		2.46		V
		$I_C=15A, V_{GE}=15V,$ $T_j=125^\circ C$		2.85		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
E_{on}	Turn-On Switching Loss	$V_{CC}=600V, I_C=15A,$ $R_G=22\Omega, V_{GE} = \pm 15V,$ $T_j=25^\circ C$		1.30		mJ
E_{off}	Turn-Off Switching Loss			0.90		mJ
E_{tot}	Total Switching Loss			2.20		mJ
E_{on}	Turn-On Switching Loss	$V_{CC}=600V, I_C=15A,$ $R_G=22\Omega, V_{GE} = \pm 15V,$ $T_j=125^\circ C$		1.70		mJ
E_{off}	Turn-Off Switching Loss			1.25		mJ
E_{tot}	Total Switching Loss			2.95		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=15A,$ $R_G=22\Omega, V_{GE} = \pm 15V,$ $T_j=125^\circ C$		50		ns
t_r	Rise Time			50		ns
$t_{d(off)}$	Turn-Off Delay Time			300		ns
t_f	Fall Time			220		ns
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		1285		pF
C_{oes}	Output Capacitance			280		pF
C_{res}	Reverse Transfer Capacitance			35		pF
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-brake-chopper $T_C=25^\circ\text{C}$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD15PJK120L1S	Units
V_{RRM}	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	1200	V
I_F	DC Forward Current	15	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	30	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	$I_F=15\text{A}$, $V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$	2.05		V
			$T_j=125^\circ\text{C}$		2.30	
Q_r	Diode Reverse Recovered charge	$I_F=15\text{A}$, $V_R=600\text{V}$, $di/dt=-300\text{A}/\mu\text{s}$, $V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	1.5		μC
			$T_j=125^\circ\text{C}$		2.9	
I_{RM}	Diode Peak Reverse Recovery Current	$I_F=15\text{A}$, $V_R=600\text{V}$, $di/dt=-300\text{A}/\mu\text{s}$, $V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	15		A
			$T_j=125^\circ\text{C}$		15	
E_{rec}	Reverse Recovery Energy	$I_F=15\text{A}$, $V_R=600\text{V}$, $di/dt=-300\text{A}/\mu\text{s}$, $V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$	0.5		mJ
			$T_j=125^\circ\text{C}$		1.1	

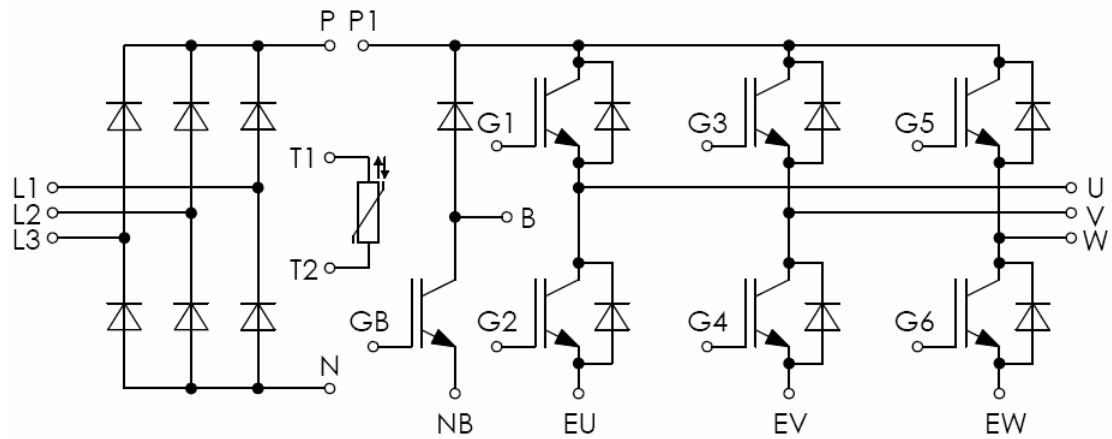
Electrical Characteristics of NTC $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
R_{25}	Rated resistance			5.0		$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$R_{100}=493.3\Omega$	-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

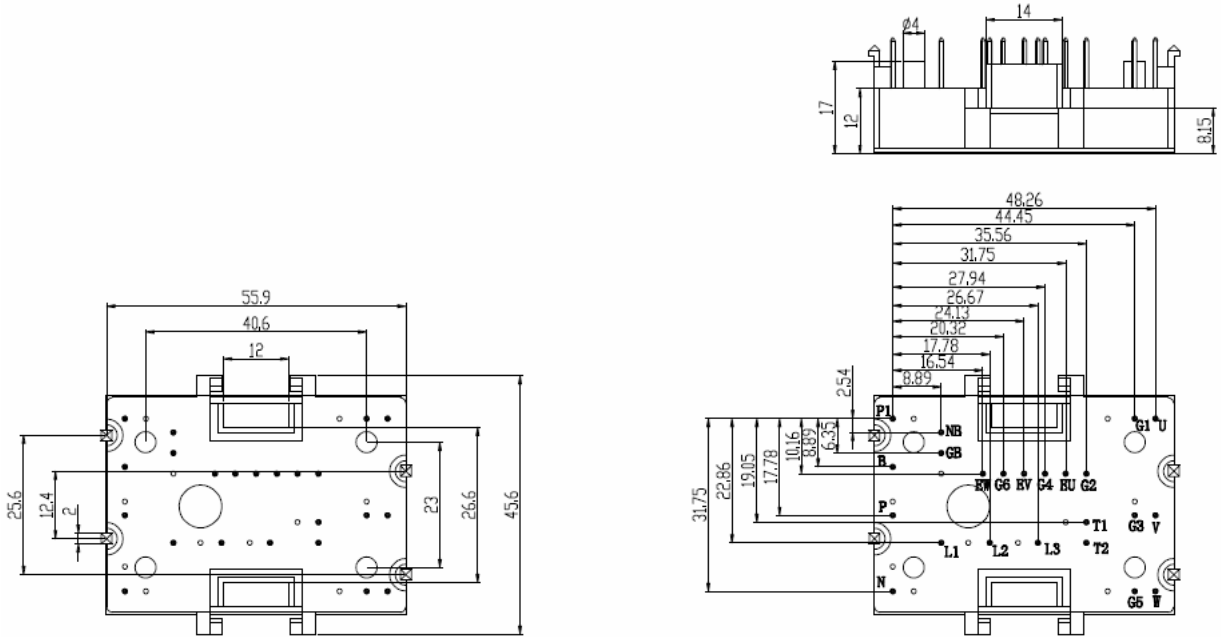
Symbol	Parameter	Min.	Typ.	Max.	Units
V _{ISO}	Isolation Voltage RMS, f=50Hz, t=1min		2500		V
L _{CE}	Stray Inductance		40		nH
R _{CC'+EE'}	Module Lead Resistance, Terminal to Chip @ T _C =25°C		10		mΩ
R _{θJC}	Junction-to-Case (per IGBT-inverter)			0.85	K/W
	Junction-to-Case (per DIODE-inverter)			1.61	
	Junction-to-Case (per DIODE-rectifier)			1.08	
	Junction-to-Case (per IGBT-brake-chopper)			0.80	
	Junction-to-Case (per DIODE-brake-chopper)			1.92	
R _{θCS}	Case-to-Sink (Conductive grease applied)		0.03		K/W
T _j	Maximum Junction Temperature			150	°C
T _{STG}	Storage Temperature Range	-40		125	°C
F	Mounting Force Per Clamp	40		80	N
G	Weight of Module		36		g

Equivalent Circuit Schematic



Package Dimension

Dimensions in Millimeters



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