

STARPOWER

SEMICONDUCTOR

IGBT

GD15PJT60L1S

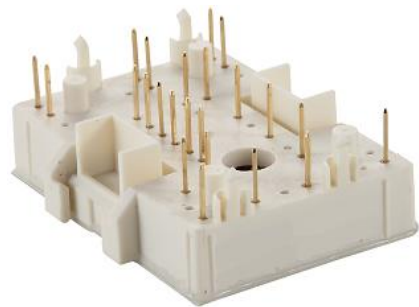
Molding Type Module**600V/15A PIM in one-package**

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
- 5 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Fast & soft reverse recovery anti-parallel FWD



Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Power supply

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

Symbol	Description	GD15PJT60L1S	Unit
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 @ $T_C=25^{\circ}\text{C}$ @ $T_C=100^{\circ}\text{C}$	25 15	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	30	A
P_{tot}	Total Power Dissipation @ $T_j=175^{\circ}\text{C}$	96	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	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.	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=350\mu\text{A}, V_{CE}=V_{GE},$ $T_j=25^{\circ}\text{C}$	4.0	5.5	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
		$I_C=15\text{A}, V_{GE}=15\text{V},$ $T_j=125^{\circ}\text{C}$		2.05		
		$I_C=15\text{A}, V_{GE}=15\text{V},$ $T_j=150^{\circ}\text{C}$		2.10		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300V, I_C=15A,$ $R_G=15\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		50		ns
t_r	Rise Time			35		ns
$t_{d(off)}$	Turn-Off Delay Time			78		ns
t_f	Fall Time			105		ns
E_{on}	Turn-On Switching Loss			0.55		mJ
E_{off}	Turn-Off Switching Loss			0.10		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300V, I_C=15A,$ $R_G=15\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		58		ns
t_r	Rise Time			38		ns
$t_{d(off)}$	Turn-Off Delay Time			80		ns
t_f	Fall Time			125		ns
E_{on}	Turn-On Switching Loss			0.65		mJ
E_{off}	Turn-Off Switching Loss			0.14		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300V, I_C=15A,$ $R_G=15\Omega, V_{GE}=\pm 15V,$ $T_j=150^\circ C$		60		ns
t_r	Rise Time			39		ns
$t_{d(off)}$	Turn-Off Delay Time			82		ns
t_f	Fall Time			130		ns
E_{on}	Turn-On Switching Loss			0.69		mJ
E_{off}	Turn-Off Switching Loss			0.16		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		0.77		nF
C_{oes}	Output Capacitance			0.05		nF
C_{res}	Reverse Transfer Capacitance			0.02		nF
Q_G	Gate Charge	$V_{CC}=400V, I_C=15A,$ $V_{GE}=15V$		31		nC
R_{Gint}	Internal Gate Resister			/		Ω
I_{SC}	SC Data	$t_p \leq 5\mu s, V_{GE}=15V,$ $T_j=150^\circ C, V_{CC}=400V,$ $V_{CEM} \leq 600V$		108		A

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

Symbol	Description	GD15PJT60L1S	Unit
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^{\circ}\text{C}$	600	V
I_F	DC Forward Current	15	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	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°C		1.20	1.65	V
			T _J =125°C		1.15		
			T _J =150°C		1.15		
Q _r	Recovered Charge	I _F =15A, V _R =300V, -di/dt=1100A/μs, V _{GE} =-15V	T _J =25°C		1.1		μC
			T _J =125°C		1.6		
			T _J =150°C		1.8		
I _{RM}	Peak Reverse Recovery Current		T _J =25°C		18		A
			T _J =125°C		21		
			T _J =150°C		21		
E _{rec}	Reverse Recovery Energy		T _J =25°C		0.27		mJ
			T _J =125°C		0.36		
			T _J =150°C		0.42		

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

Symbol	Description	GD15PJT60L1S	Unit
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^{\circ}\text{C}$	1600	V
I_O	Average Output Current	15	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.	Unit
V_F	Diode Forward Voltage	$I_F=15\text{A}$	$T_j=150^{\circ}\text{C}$		0.96		V
I_R	Reverse Current	$T_j=150^{\circ}\text{C}, V_R=1600\text{V}$				1.0	mA

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

Symbol	Description	GD15PJT60L1S	Unit
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 @ $T_C=25^{\circ}\text{C}$ @ $T_C=100^{\circ}\text{C}$	25 15	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	30	A
P_{tot}	Total Power Dissipation @ $T_j=175^{\circ}\text{C}$	96	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	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.	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=350\mu\text{A}, V_{CE}=V_{GE},$ $T_j=25^{\circ}\text{C}$	4.0	5.5	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
		$I_C=15\text{A}, V_{GE}=15\text{V},$ $T_j=125^{\circ}\text{C}$		2.05		
		$I_C=15\text{A}, V_{GE}=15\text{V},$ $T_j=150^{\circ}\text{C}$		2.10		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300V, I_C=15A,$ $R_G=15\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		50		ns
t_r	Rise Time			35		ns
$t_{d(off)}$	Turn-Off Delay Time			78		ns
t_f	Fall Time			105		ns
E_{on}	Turn-On Switching Loss			0.55		mJ
E_{off}	Turn-Off Switching Loss			0.10		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300V, I_C=15A,$ $R_G=15\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		58		ns
t_r	Rise Time			38		ns
$t_{d(off)}$	Turn-Off Delay Time			80		ns
t_f	Fall Time			125		ns
E_{on}	Turn-On Switching Loss			0.65		mJ
E_{off}	Turn-Off Switching Loss			0.14		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300V, I_C=15A,$ $R_G=15\Omega, V_{GE}=\pm 15V,$ $T_j=150^\circ C$		60		ns
t_r	Rise Time			39		ns
$t_{d(off)}$	Turn-Off Delay Time			82		ns
t_f	Fall Time			130		ns
E_{on}	Turn-On Switching Loss			0.69		mJ
E_{off}	Turn-Off Switching Loss			0.16		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		0.77		nF
C_{oes}	Output Capacitance			0.05		nF
C_{res}	Reverse Transfer Capacitance			0.02		nF
Q_G	Gate Charge	$V_{CC}=400V, I_C=15A,$ $V_{GE}=15V$		31		nC
R_{Gint}	Internal Gate Resister			/		Ω
I_{SC}	SC Data	$t_p \leq 5\mu s, V_{GE}=15V,$ $T_j=150^\circ C, V_{CC}=400V,$ $V_{CEM} \leq 600V$		108		A

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

Symbol	Description	GD15PJT60L1S	Unit
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.	Unit
V _F	Diode Forward Voltage	I _F =10A, V _{GE} =0V	T _J =25°C		1.20	1.65	V
			T _J =125°C		1.10		
			T _J =150°C		1.10		
Q _r	Recovered Charge	I _F =10A, V _R =300V, -di/dt=700A/μs, V _{GE} =-15V	T _J =25°C		0.5		μC
			T _J =125°C		0.8		
			T _J =150°C		0.9		
I _{RM}	Peak Reverse Recovery Current		T _J =25°C		16		A
			T _J =125°C		17		
			T _J =150°C		19		
E _{rec}	Reverse Recovery Energy		T _J =25°C		0.10		mJ
			T _J =125°C		0.19		
			T _J =150°C		0.24		

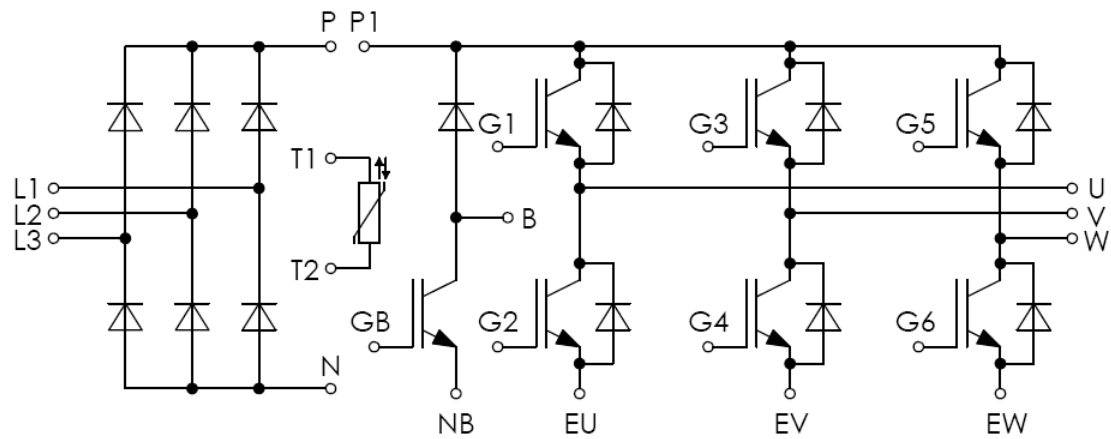
Electrical Characteristics of NTC $T_C=25^{\circ}\text{C}$ unless otherwise noted

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

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

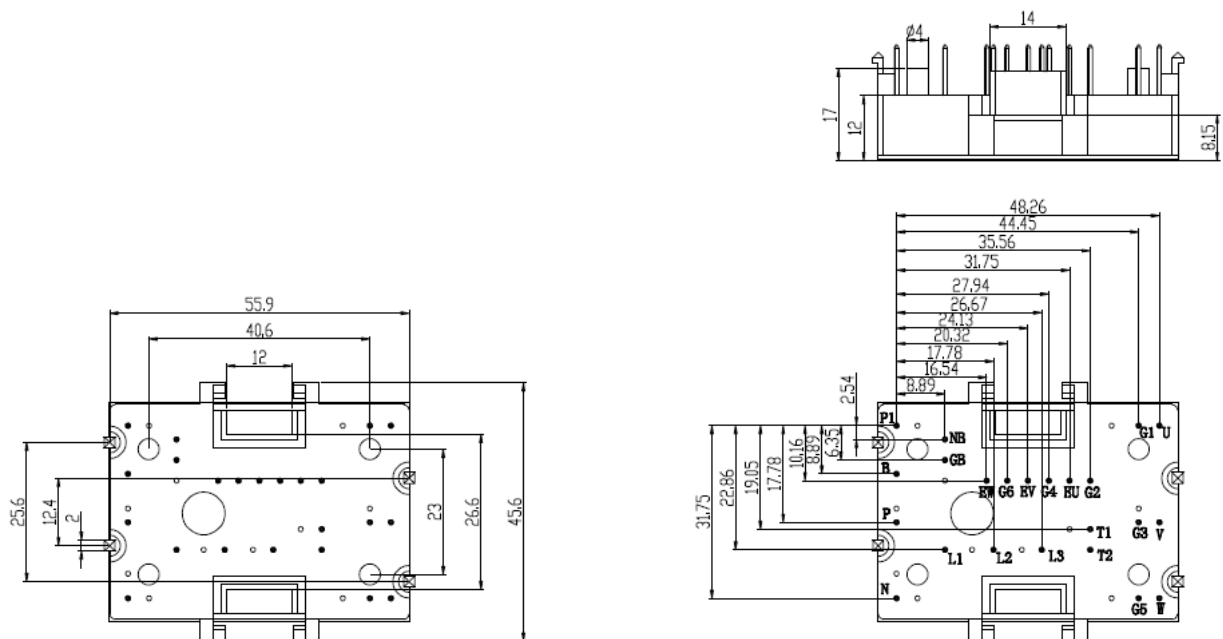
Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	2500			V
L_{CE}	Stray Inductance		40		nH
$R_{\text{CC}'+\text{EE}'}$ $R_{\text{AA}'+\text{CC}'}$	Module Lead Resistance, Terminal to Chip		10.0 7.00		m Ω
$R_{\theta\text{JC}}$	Junction-to-Case (per IGBT-inverter)		1.424	1.566	K/W
	Junction-to-Case (per Diode-inverter)		1.949	2.144	
	Junction-to-Case (per Diode-rectifier)		1.074	1.181	
	Junction-to-Case (per IGBT-brake)		1.424	1.566	
	Junction-to-Case (per Diode-brake)		2.471	2.718	
$R_{\theta\text{CS}}$	Case-to-Sink (per IGBT-inverter)		0.597		K/W
	Case-to-Sink (per Diode-inverter)		0.818		
	Case-to-Sink (per Diode-rectifier)		0.451		
	Case-to-Sink (per IGBT-brake)		0.597		
	Case-to-Sink (per Diode-brake)		1.037		
$R_{\theta\text{CS}}$	Case-to-Sink (Conductive grease applied)		0.030		K/W
T_{jmax}	Maximum Junction Temperature(inverter)			175	$^{\circ}\text{C}$
	Maximum Junction Temperature(rectifier)			150	
T_{jop}	Operating Junction Temperature	-40		150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40		125	$^{\circ}\text{C}$
F	Mounting Force Per Clamp	40		80	N
G	Weight of Module		36		g

Equivalent Circuit Schematic



Package Dimensions

Dimensions in Millimeters



Terms and Conditions of Usage

The data contained in this product datasheet is exclusively intended for technically trained staff. you and your technical departments will have to evaluate the suitability of the product for the intended application and the completeness of the product data with respect to such application.

This product data sheet is describing the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively pursuant the terms and conditions of the supply agreement. There will be no guarantee of any kind for the product and its characteristics.

Should you require product information in excess of the data given in this product data sheet or which concerns the specific application of our product, please contact the sales office, which is responsible for you (see www.powersemi.cc), For those that are specifically interested we may provide application notes.

Due to technical requirements our product may contain dangerous substances. For information on the types in question please contact the sales office, which is responsible for you.

Should you intend to use the Product in aviation applications, in health or live endangering or life support applications, please notify.

If and to the extent necessary, please forward equivalent notices to your customers.
Changes of this product data sheet are reserved.