

STARPOWER

SEMICONDUCTOR

IGBT

GD300TLT120E5S

1200V/300A 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 3-level-application.

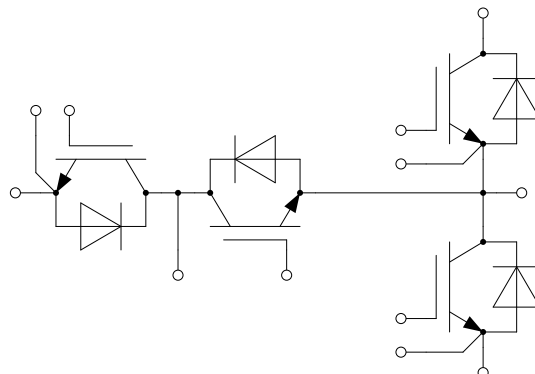
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low switching loss
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology

Typical Applications

- Inverter for motor drive
- Uninterruptible power supply
- Solar power

Equivalent Circuit Schematic



Absolute Maximum Ratings $T_C=25^{\circ}\text{C}$ unless otherwise noted**T1,T2 IGBT**

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	540	A
	@ $T_C=100^{\circ}\text{C}$	300	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	600	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	1948	W

D1,D2 Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	300	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	600	A

T3,T4 IGBT

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	650	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	415	A
	@ $T_C=80^{\circ}\text{C}$	300	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	600	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	1086	W

D3,D4 Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	300	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	600	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
T_{jop}	Operating Junction Temperature	-40 to +150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40 to +125	$^{\circ}\text{C}$
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	2500	V

T1,T2 IGBT Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.70	2.15	V	
		$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		2.00			
		$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.10			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=12.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.0	5.8	6.5	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	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^\circ\text{C}$			100	nA	
R_{Gint}	Internal Gate Resistance			2.5		Ω	
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		21.5		nF	
C_{res}	Reverse Transfer Capacitance			0.98		nF	
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		2.80		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=300\text{A}, R_G=2.4\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		250		ns	
t_r	Rise Time			90		ns	
$t_{d(off)}$	Turn-Off Delay Time			550		ns	
t_f	Fall Time			130		ns	
E_{on}	Turn-On Switching Loss			17.0		mJ	
E_{off}	Turn-Off Switching Loss			29.5		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=600\text{V}, I_C=300\text{A}, R_G=2.4\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		300		ns
t_r	Rise Time				100		ns
$t_{d(off)}$	Turn-Off Delay Time			650		ns	
t_f	Fall Time			180		ns	
E_{on}	Turn-On Switching Loss			25.0		mJ	
E_{off}	Turn-Off Switching Loss			44.0		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=300\text{A}, R_G=2.4\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$			320		ns
t_r	Rise Time				100		ns
$t_{d(off)}$	Turn-Off Delay Time			680		ns	
t_f	Fall Time			190		ns	
E_{on}	Turn-On Switching Loss			27.5		mJ	
E_{off}	Turn-Off Switching Loss			48.5		mJ	
I_{SC}	SC Data		$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$		1200		A

D1,D2 Diode Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.65	2.10	V
		$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.65		
		$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.65		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=300\text{A},$ $-di/dt=6000\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^\circ\text{C}$		30.0		μC
I_{RM}	Peak Reverse Recovery Current			210		A
E_{rec}	Reverse Recovery Energy			14.0		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=300\text{A},$ $-di/dt=6000\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^\circ\text{C}$		56.0		μC
I_{RM}	Peak Reverse Recovery Current			270		A
E_{rec}	Reverse Recovery Energy			26.0		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=300\text{A},$ $-di/dt=6000\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^\circ\text{C}$		62.0		μC
I_{RM}	Peak Reverse Recovery Current			290		A
E_{rec}	Reverse Recovery Energy			28.5		mJ

T3,T4 IGBT Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.45	1.90	V	
		$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		1.60			
		$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		1.70			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=4.8\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.1	5.8	6.4	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	
R_{Gint}	Internal Gate Resistance			1.0		Ω	
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		18.5		nF	
C_{res}	Reverse Transfer Capacitance			0.55		nF	
Q_G	Gate Charge	$V_{GE}=-15\text{V}\dots+15\text{V}$		3.22		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=300\text{A}, R_G=2.4\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		110		ns	
t_r	Rise Time			50		ns	
$t_{d(off)}$	Turn-Off Delay Time			490		ns	
t_f	Fall Time			50		ns	
E_{on}	Turn-On Switching Loss			2.13		mJ	
E_{off}	Turn-Off Switching Loss			9.83		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=300\text{V}, I_C=300\text{A}, R_G=2.4\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		120		ns
t_r	Rise Time				60		ns
$t_{d(off)}$	Turn-Off Delay Time			520		ns	
t_f	Fall Time			70		ns	
E_{on}	Turn-On Switching Loss			3.10		mJ	
E_{off}	Turn-Off Switching Loss			12.0		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=300\text{A}, R_G=2.4\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$			130		ns
t_r	Rise Time				60		ns
$t_{d(off)}$	Turn-Off Delay Time			530		ns	
t_f	Fall Time			70		ns	
E_{on}	Turn-On Switching Loss			3.30		mJ	
E_{off}	Turn-Off Switching Loss			12.5		mJ	
I_{SC}	SC Data		$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=360\text{V}, V_{CEM} \leq 650\text{V}$		1500		A

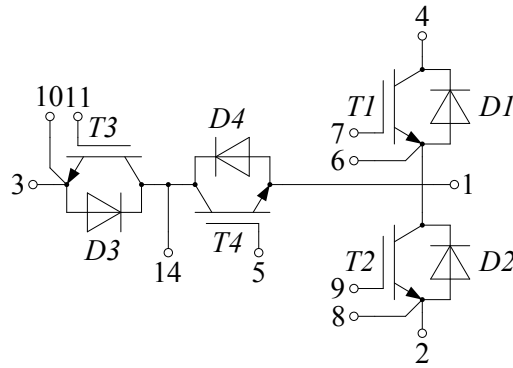
D5,D6 Diode Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.55	2.00	V
		$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.50		
		$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.45		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=300\text{A},$ $-di/dt=6500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^\circ\text{C}$		13.0		μC
I_{RM}	Peak Reverse Recovery Current			190		A
E_{rec}	Reverse Recovery Energy			3.40		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=300\text{A},$ $-di/dt=6500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^\circ\text{C}$		24.0		μC
I_{RM}	Peak Reverse Recovery Current			235		A
E_{rec}	Reverse Recovery Energy			6.20		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=300\text{A},$ $-di/dt=6500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^\circ\text{C}$		28.0		μC
I_{RM}	Peak Reverse Recovery Current			250		A
E_{rec}	Reverse Recovery Energy			7.00		mJ

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

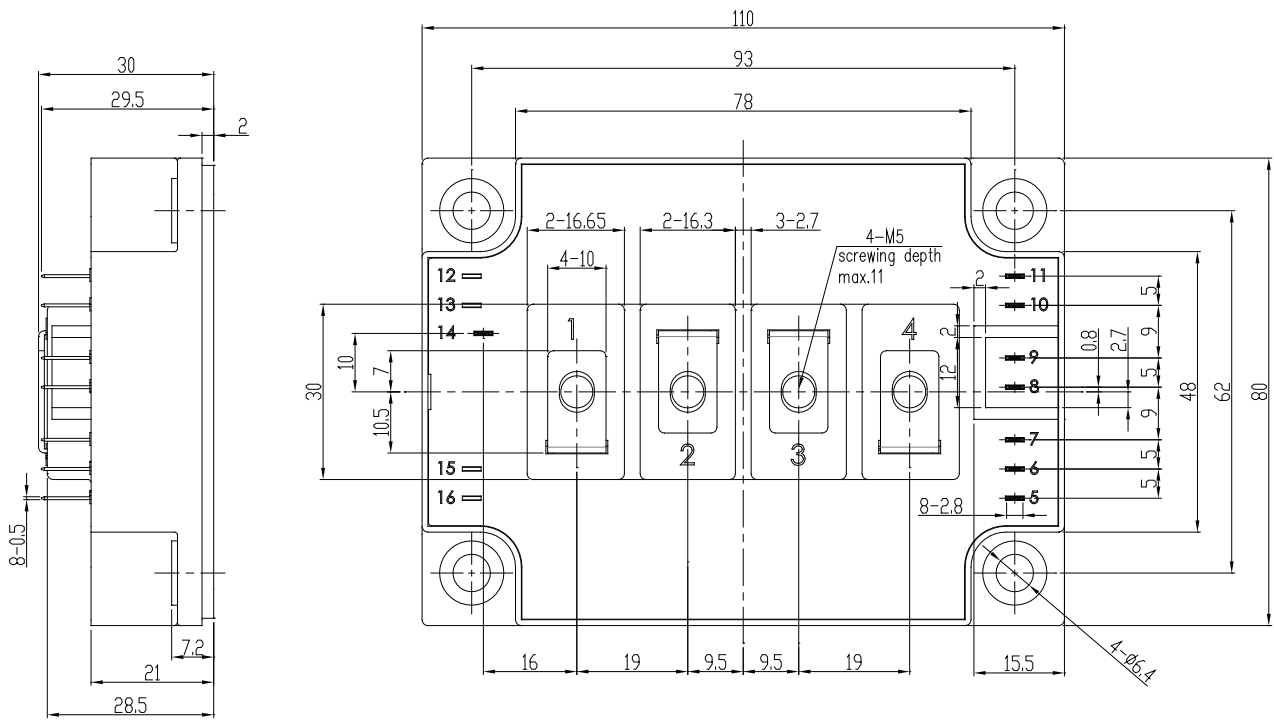
Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case (per T1,T2 IGBT)			0.077	K/W
	Junction-to-Case (per D1,D2 Diode)			0.141	
	Junction-to-Case (per T3,T4 IGBT)			0.138	
	Junction-to-Case (per D3,D4 Diode)			0.237	
R_{thCH}	Case-to-Heatsink (per T1,T2 IGBT)		0.136		K/W
	Case-to-Heatsink (per D1,D2 Diode)		0.249		
	Case-to-Heatsink (per T3,T4 IGBT)		0.244		
	Case-to-Heatsink (per D3,D4 Diode)		0.419		
	Case-to-Heatsink (per Module)		0.028		
M	Mounting Torque, Screw M6	3.0		6.0	N.m
	Terminal Connection Torque, Screw M5	2.5		5.0	

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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