STARPOWER

SEMICONDUCTOR **IGBT**

GD400TLT120E5S

1200V/400A 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.

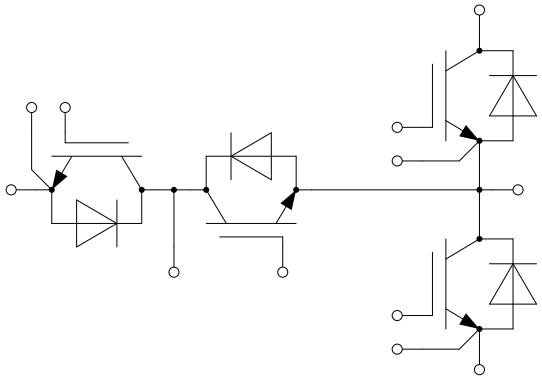
Features

- 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°C unless otherwise noted

T1,T2 IGBT

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	±30	V
I_C	Collector Current @ T_C=25°C @ T_C=100°C	655 400	A
I_{CM}	Pulsed Collector Current t_p=1ms	800	A
P_D	Maximum Power Dissipation @ T_j=175°C	2205	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=1ms	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°C @ T_C=70°C	515 400	A
I_{CM}	Pulsed Collector Current t_p=1ms	800	A
P_D	Maximum Power Dissipation @ T_j=175°C	1304	W

D3,D4 Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	400	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	800	A

Module

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

T1,T2 IGBT Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=400A,V_{GE}=15V, T_j=25°C		1.70	2.15	V
		I_C=400A,V_{GE}=15V, T_j=125°C		1.95		
		I_C=400A,V_{GE}=15V, T_j=150°C		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=16.0mA,V_{CE}=V_{GE}, T_j=25°C	5.0	5.7	6.5	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25°C			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25°C			400	nA
R_{Gint}	Internal Gate Resistance			0.6		Ω
C_{ies}	Input Capacitance	V_{CE}=30V,f=1MHz, V_{GE}=0V		40.5		nF
C_{res}	Reverse Transfer Capacitance			1.14		nF
Q_G	Gate Charge	V_{GE}=15V		2.22		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=400A, R_G=2.0Ω,V_{GE}=±15V, T_j=25°C		408		ns
t_r	Rise Time			119		ns
$t_{d(off)}$	Turn-Off Delay Time			573		ns
t_f	Fall Time			135		ns
E_{on}	Turn-On Switching Loss			10.5		mJ
E_{off}	Turn-Off Switching Loss			36.2		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=400A, R_G=2.0Ω,V_{GE}=±15V, T_j=125°C		409		ns
t_r	Rise Time			120		ns
$t_{d(off)}$	Turn-Off Delay Time			632		ns
t_f	Fall Time			188		ns
E_{on}	Turn-On Switching Loss			13.2		mJ
E_{off}	Turn-Off Switching Loss			53.6		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=400A, R_G=2.0Ω,V_{GE}=±15V, T_j=150°C		410		ns
t_r	Rise Time			123		ns
$t_{d(off)}$	Turn-Off Delay Time			638		ns
t_f	Fall Time			198		ns
E_{on}	Turn-On Switching Loss			14.4		mJ
E_{off}	Turn-Off Switching Loss			56.1		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=900V, V_{CEM}≤1200V		1600		A

D1,D2 Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=300A,V_{GE}=0V,T_i=25°C		1.65	2.10	V
		I_F=300A,V_{GE}=0V,T_j=125°C		1.65		
		I_F=300A,V_{GE}=0V,T_i=150°C		1.65		
Q_r	Recovered Charge	V_R=600V,I_F=300A, -di/dt=5200A/μs,V_{GE}=-15V T_j=25°C		34.0		μC
I_{RM}	Peak Reverse Recovery Current			280		A
E_{rec}	Reverse Recovery Energy			19.5		mJ
Q_r	Recovered Charge	V_R=600V,I_F=300A, -di/dt=5200A/μs,V_{GE}=-15V T_j=125°C		55.6		μC
I_{RM}	Peak Reverse Recovery Current			350		A
E_{rec}	Reverse Recovery Energy			29.8		mJ
Q_r	Recovered Charge	V_R=600V,I_F=300A, -di/dt=5200A/μs,V_{GE}=-15V T_j=150°C		63.6		μC
I_{RM}	Peak Reverse Recovery Current			368		A
E_{rec}	Reverse Recovery Energy			34.0		mJ

T3,T4 IGBT Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=400A,V_{GE}=15V, T_j=25°C		1.45	1.90	V
		I_C=400A,V_{GE}=15V, T_j=125°C		1.60		
		I_C=400A,V_{GE}=15V, T_j=150°C		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=6.4mA,V_{CE}=V_{GE}, T_j=25°C	5.1	5.8	6.4	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25°C			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25°C			400	nA
R_{Gint}	Internal Gate Resistance			1.0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		12.7		nF
C_{res}	Reverse Transfer Capacitance			0.73		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		4.30		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=400A, R_G=1.8Ω,V_{GE}=±15V, T_j=25°C		102		ns
t_r	Rise Time			79		ns
$t_{d(off)}$	Turn-Off Delay Time			458		ns
t_f	Fall Time			49		ns
E_{on}	Turn-On Switching Loss			2.88		mJ
E_{off}	Turn-Off Switching Loss			12.9		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=400A, R_G=1.8Ω,V_{GE}=±15V, T_j=125°C		111		ns
t_r	Rise Time			80		ns
$t_{d(off)}$	Turn-Off Delay Time			505		ns
t_f	Fall Time			70		ns
E_{on}	Turn-On Switching Loss			4.20		mJ
E_{off}	Turn-Off Switching Loss			16.0		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=400A, R_G=1.8Ω,V_{GE}=±15V, T_j=150°C		120		ns
t_r	Rise Time			80		ns
$t_{d(off)}$	Turn-Off Delay Time			510		ns
t_f	Fall Time			80		ns
E_{on}	Turn-On Switching Loss			4.50		mJ
E_{off}	Turn-Off Switching Loss			17.0		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_j=150°C,V_{CC}=360V, V_{CEM}≤600V		2000		A

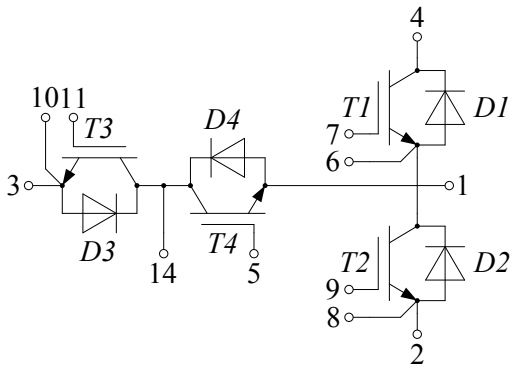
D5,D6 Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=400A,V_{GE}=0V,T_j=25°C		1.55	2.00	V
		I_F=400A,V_{GE}=0V,T_j=125°C		1.50		
		I_F=400A,V_{GE}=0V,T_j=150°C		1.45		
Q_r	Recovered Charge	V_R=300V,I_F=400A, -di/dt=5500A/μs,V_{GE}=-15V T_j=25°C		18.2		μC
I_{RM}	Peak Reverse Recovery Current			215		A
E_{rec}	Reverse Recovery Energy			3.58		mJ
Q_r	Recovered Charge	V_R=300V,I_F=400A, -di/dt=5500A/μs,V_{GE}=-15V T_j=125°C		29.8		μC
I_{RM}	Peak Reverse Recovery Current			280		A
E_{rec}	Reverse Recovery Energy			7.26		mJ
Q_r	Recovered Charge	V_R=300V,I_F=400A, -di/dt=5500A/μs,V_{GE}=-15V T_j=150°C		34.2		μC
I_{RM}	Peak Reverse Recovery Current			300		A
E_{rec}	Reverse Recovery Energy			8.30		mJ

Module Characteristics T_C=25°C unless otherwise noted

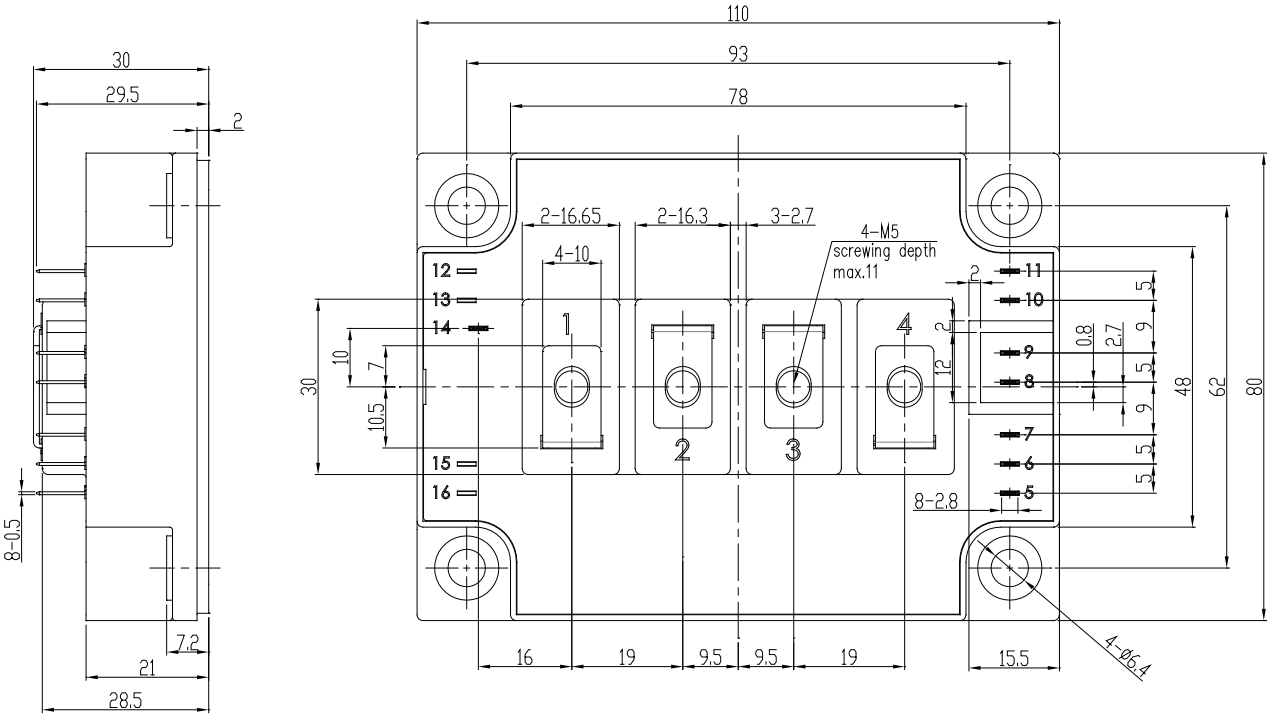
Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case (per T1,T2 IGBT) Junction-to-Case (per D1,D2 Diode) Junction-to-Case (per T3,T4 IGBT) Junction-to-Case (per D3,D4 Diode)			0.068 0.138 0.115 0.195	K/W
R_{thCH}	Case-to-Heatsink (per T1,T2 IGBT) Case-to-Heatsink (per D1,D2 Diode) Case-to-Heatsink (per T3,T4 IGBT) Case-to-Heatsink (per D3,D4 Diode) Case-to-Heatsink (per Module)		0.136 0.276 0.230 0.391 0.028		K/W
M	Mounting Torque, Screw M6 Terminal Connection Torque, Screw M5	3.0 2.5		6.0 5.0	N.m

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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