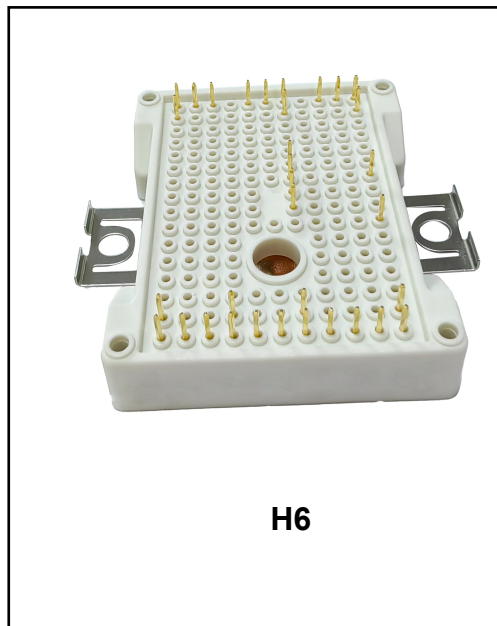


3-Level NPC Inverter Module with 650V Trench Stop IGBTs

Features

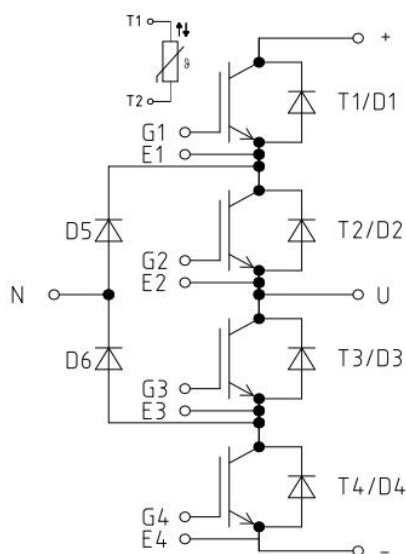
- Electrical features
 - 650V Trench Stop IGBTs
 - Low Inductive Design
 - Low Switching Losses
 - Low Inductive Layout
 - Thermistor
- Mechanical features
 - Compact Design
 - Pressfit contact technology
 - Al₂O₃ Substrate with Low Thermal Resistance



Typical Applications

- 3-Level-Applications
- Solar Applications
- UPS Systems
- Motor drivers

Description



Package Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, f=50Hz, t=60s	2.5	kV
Internal isolation		basic insulation(class 1, IEC 61140)	Al_2O_3	
Creepage distance	d_{creep}	terminal to heatsink	11.5	mm
Clearance	d_{clear}	terminal to heatsink	10	mm
Comparative tracking index (electrical)	CTI		>200	
RTI Elec.	RTI	housing	140	°C

Package Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Stray Inductance	LCE		--	20	--	nH
Module Lead Resistance, Terminal to Chip	RCC'+EE'		--	2	--	mΩ
Storage Temperature Range	T_{STG}		-40		125	°C
Mounting force per clamp	F		40	--	80	N
Weight	G		--	39	--	g

IGBT (T1、T2、T3、T4)
Absolute Maximum Ratings (T_C = 25°C unless otherwise noted)

Symbol	Description	Value	Unit
V _{CES}	Collector-Emitter Voltage	650	V
V _{GES}	Gate-Emitter Voltage	± 30	V
I _{CDC}	Continuous Collector Current @ T _C = 80°C (T _{JMAX} = 175°C)	200	A
I _{CM}	Pulsed Collector Current, t _p limited by T _{vj max}	400	A
T _{Jmax}	Maximum Junction Temperature	175	°C
P _D	Power Dissipation @ T _C = 25°C	456	W
	Power Dissipation @ T _C = 100 °C	227	W

Characteristics (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test Condition		Min	Typ	Max	Unit
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =100A, V _{GE} = 15V	T _{vj} = 25 °C	--	1.15	1.90	V
			T _{vj} = 175 °C	--	1.25	--	
		I _C =200A, V _{GE} = 15V	T _{vj} = 25 °C	--	1.45	2.20	
			T _{vj} = 175 °C	--	1.75	--	
V _{GE(TH)}	Gate-Emitter Threshold Voltage	I _C =3mA, V _{CE} =V _{GE}		4.0	--	5.5	V
I _{CES}	Collector-Emitter Cutoff Current	V _{GE} = 0 V, V _{CE} = 650 V		--	--	200	μA
I _{GES}	Gate-Emitter Leakage Current	V _{GE} = ±30 V, V _{CE} = 0 V, T _{vj} = 25°C		--	--	± 100	nA
R _{Gint}	Internal Gate Resistance	T _{vj} = 25 °C		--	0.8	--	Ω
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V, f=1MHz		--	12080	--	pF
C _{oes}	Output capacitance			--	424	--	pF
C _{res}	Reverse Transfer			--	52	--	pF
Q _G	Gate Charge	T _J = 25°C V _{CE} = 400 V, I _C = 200 A V _{GE} = -5 V to +15 V		--	0.381	--	μC
t _{d(on)}	Turn-On Delay Time	V _{CE} =400V, I _C =200A, V _{GE} = -5 V to +15 V, R _G =5Ω Inductive Load T _{vj} =25°C		--	124	--	ns
t _r	Rise Time			--	99	--	
t _{d(off)}	Turn-off Delay Time			--	288	--	
t _f	Fall Time			--	55	--	
E _{on}	Turn-On Switching Loss per Pulse			--	9.1	--	mJ
E _{off}	Turn Off Switching Loss per Pulse			--	5.3	--	
t _{d(on)}	Turn-On Delay Time	V _{CE} =400V, I _C =200A, V _{GE} = -5 V to +15 V, R _G =5Ω T _j =175°C		--	TBD	--	ns
t _r	Rise Time			--	TBD	--	
t _{d(off)}	Turn-off Delay Time			--	TBD	--	
t _f	Fall Time			--	TBD	--	
E _{on}	Turn-on Switching Loss per Pulse			--	13.0	--	mJ
E _{off}	Turn Off Switching Loss per Pulse			--	7.0	--	
R _{thJC}	Thermal resistance	Junction-to-Case (per IGBT)		--	0.294	--	K/W
T _{vj op}		Temperature under switching conditions		-40		175 ¹⁾	°C

¹⁾T_{vj op} > 150°C is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.

Diode (D1、D2、D3、D4)

Absolute Maximum Ratings (T_c = 25°C unless otherwise noted)

Symbol	Description	Value	Unit
V _{RRM}	Repetitive Peak Reverse Voltage	650	V
I _F	Diode Continuous Forward Current	200	A
I _{FM}	Diode Maximum Forward Current t _p =1ms	400	A

Characteristics (T_c=25°C unless otherwise noted)

Symbol	Parameter	Test Condition		Min	Typ	Max	Unit
V _F	Diode Forward Voltage	I _F = 100 A	T _J = 25°C	--	1.40	2.40	V
			T _J = 175°C	--	1.30	--	
		I _F = 200 A	T _J = 25°C	--	1.80	2.80	V
			T _J = 175°C	--	1.65	--	
T _{rr}	Reverse Recovery Time	V _{CE} =400V, V _{GE} = -5 V to +15 V, I _F =200A,R _G =5Ω, T _{vj} =25°C		--	265	--	ns
I _{RM}	Peak Reverse Recovery Current			--	58	--	A
Q _{rr}	Recovered Charge			--	7.69	--	μC
E _{rec}	Reverse Recovery Energy			--	0.83	--	mJ
T _{rr}	Reverse Recovery Time	V _{CE} =400V, V _{GE} = -5 V to +15 V I _F =200A,R _G =5Ω, T _{vj} =175°C		--	357	--	ns
I _{RM}	Peak Reverse Recovery Current			--	83	--	A
Q _{rr}	Recovered Charge			--	14.64	--	μC
E _{rec}	Reverse Recovery Energy			--	1.06	--	mJ
R _{thJC}	Thermal resistance	Junction-to-Case (per diode)		--	0.32	--	K/W
T _{vj op}		Temperature under switching conditions		-40		175 ²⁾	°C

²⁾T_{vj op} > 150°C is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.

Diode (D5、D6)

Absolute Maximum Ratings (T_c = 25°C unless otherwise noted)

Symbol	Description	Value	Unit
V _{RRM}	Repetitive Peak Reverse Voltage	650	V
I _F	Diode Continuous Forward Current	200	A
I _{FM}	Diode Maximum Forward Current t _p =1ms	400	A

Characteristics (T_c=25°C unless otherwise noted)

Symbol	Parameter	Test Condition		Min	Typ	Max	Unit
V _F	Diode Forward Voltage	I _F = 100 A	T _J = 25°C	--	0.85	1.70	V
			T _J = 175°C	--	0.75	--	
		I _F = 200 A	T _J = 25°C	--	1.10	1.90	V
			T _J = 175°C	--	1.0	--	
T _{rr}	Reverse Recovery Time	V _{CE} =400V, V _{GE} = -5 V to +15 V, I _F =200A,R _G =5Ω, T _{vj} =25°C		--	159	--	ns
I _{RM}	Peak Reverse Recovery Current			--	34.8	--	A
Q _{rr}	Recovered Charge			--	4.61	--	μC
E _{rec}	Reverse Recovery Energy			--	0.5	--	mJ
T _{rr}	Reverse Recovery Time	V _{CE} =400V, V _{GE} = -5 V to +15 V I _F =200A,R _G =5Ω, T _{vj} =175°C		--	214	--	ns
I _{RM}	Peak Reverse Recovery Current			--	49.8	--	A
Q _{rr}	Recovered Charge			--	8.78	--	μC

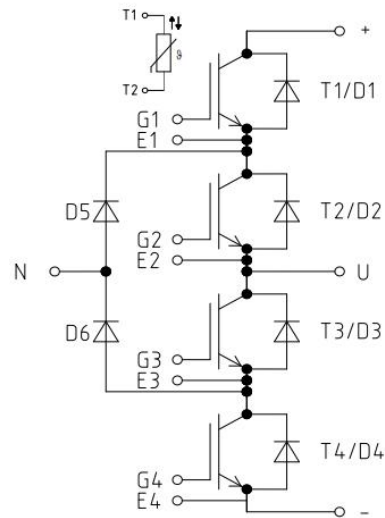
E_{rec}	Reverse Recovery Energy		--	0.64	--	mJ
R_{thJC}	Thermal resistance	Junction-to-Case (per diode)	--	0.31	--	K/W
$T_{vj\ op}$		Temperature under switching conditions	-40		175 ³⁾	°C

³⁾ $T_{vj\ op} > 150^{\circ}\text{C}$ is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
R_{25}	Rated Resistance		--	5.0	--	k Ω
$\Delta R/R$	Deviation of R100	$T_C = 100^{\circ}\text{C}, R_{100} = 493.3\Omega$	-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
$B_{25/80}$	B-value	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298.15\text{K}))]$	--	3411	--	K
$B_{25/100}$	B-value	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298.15\text{K}))]$	--	3433	--	K

CIRCUIT DIAGRAM



Preliminary data

PACKAGE DIMENSION

Dimensions in Millimeter

