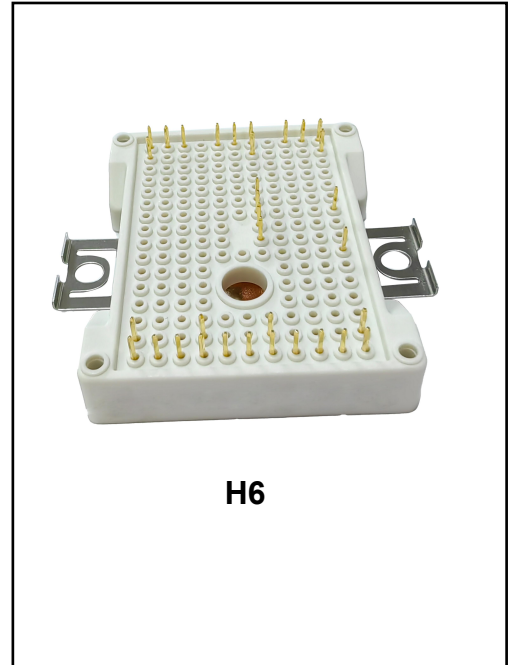


3-Level NPC Inverter Module with 650V Trench Stop IGBTs

Features

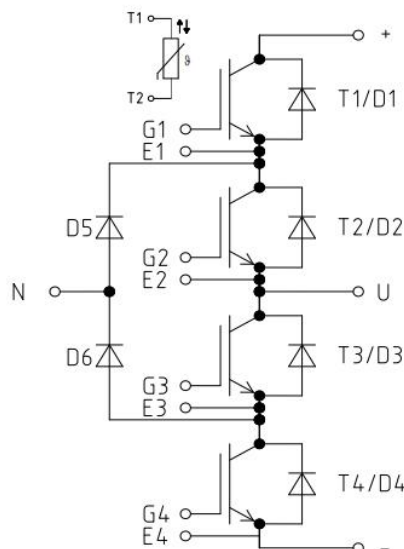
- Electrical features
 - 650V Trench Stop IGBTs
 - Low Inductive Design
 - Low Switching Losses
 - Low Inductive Layout
 - Thermistor
- Mechanical features
 - Compact Design
 - Solderable Pins
 - Al₂O₃ Substrate with Low Thermal Resistance



Typical Applications

- 3-Level-Applications
- Solar Applications
- UPS Systems

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 ₂ O 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		--	15	--	nH
Module Lead Resistance, Terminal to Chip	RCC'+EE'		--	2	--	mΩ
Storage Temperature Range	T _{STG}		-40	--	125	°C
Mounting torque for module mounting	M	-Mounting according to valid application note	40	--	80	N
Weight	G		--	39	--	g

IGBT (T1、T2、T3、T4)
Absolute Maximum Ratings ($T_C = 25^\circ\text{C}$ 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 @ $T_C = 80^\circ\text{C}$ ($T_{JMAX} = 175^\circ\text{C}$)	150	A
I_{CM}	Pulsed Collector Current, t_p limited by $T_{vj\ max}$	300	A
T_{jmax}	Maximum Junction Temperature	175	$^\circ\text{C}$
P_D	Power Dissipation @ $T_C = 25^\circ\text{C}$	379	W
	Power Dissipation @ $T_C = 100^\circ\text{C}$	151	W

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 150\text{A}$, $V_{GE} = 15\text{V}$	$T_{vj} = 25^\circ\text{C}$	--	1.35	V
			$T_{vj} = 175^\circ\text{C}$	--	1.60	
$V_{GE(TH)}$	Gate-Emitter Threshold Voltage	$I_C = 3\text{mA}$, $V_{CE} = V_{GE}$	4.0	--	5.5	V
I_{CES}	Collector-Emitter Cutoff Current	$V_{GE} = 0\text{V}$, $V_{CE} = 650\text{V}$	--	--	200	μA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE} = \pm 30\text{V}$, $V_{CE} = 0\text{V}$, $T_{vj} = 25^\circ\text{C}$	--	--	± 100	nA
R_{Gint}	Internal Gate Resistance	$T_{vj} = 25^\circ\text{C}$	--	0.8	--	Ω
C_{ies}	Input Capacitance	$V_{CE} = 25\text{V}$, $V_{GE} = 0\text{V}$, $f = 1\text{MHz}$	--	12080	--	pF
C_{oes}	Output capacitance		--	424	--	pF
C_{res}	Reverse Transfer		--	52	--	pF
Q_G	Gate Charge	$V_{CE} = 400\text{V}$, $I_C = 150\text{A}$ $V_{GE} = -5\text{V to } +15\text{V}$ $T_{vj} = 25^\circ\text{C}$	--	0.381	--	μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CE} = 400\text{V}$, $I_C = 150\text{A}$, $V_{GE} = -5\text{V to } +15\text{V}$, $R_G = 5\Omega$ Inductive Load $T_{vj} = 25^\circ\text{C}$	--	81	--	ns
t_r	Rise Time		--	52	--	
$t_{d(off)}$	Turn-off Delay Time		--	224	--	
t_f	Fall Time		--	40	--	
E_{on}	Turn-On Switching Loss per Pulse		--	6.6	--	mJ
E_{off}	Turn Off Switching Loss per Pulse		--	3.5	--	
$t_{d(on)}$	Turn-On Delay Time	$V_{CE} = 400\text{V}$, $I_C = 150\text{A}$, $V_{GE} = -5\text{V to } +15\text{V}$, $R_G = 5\Omega$ $T_{vj} = 175^\circ\text{C}$	--	90	--	ns
t_r	Rise Time		--	63	--	
$t_{d(off)}$	Turn-off Delay Time		--	244	--	
t_f	Fall Time		--	47	--	
E_{on}	Turn-on Switching Loss per Pulse		--	8.3	--	mJ
E_{off}	Turn Off Switching Loss per Pulse		--	5.0	--	
R_{thJC}	Thermal resistance	Junction-to-Case (per IGBT)	--	0.294	--	K/W
$T_{vj\ op}$		Temperature under switching conditions	-40		175 ¹⁾	$^\circ\text{C}$

¹⁾ $T_{vj\ op} > 150^\circ\text{C}$ 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 ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	150	A
I_{FM}	Diode Maximum Forward Current $t_p = 1\text{ms}$	300	A

Characteristics (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V _F	Diode Forward Voltage	I _F = 150 A, T _{vj} = 25 °C	--	1.70	2.4	V
		I _F = 150 A, T _{vj} = 25 °C	--	1.60	--	
T _{rr}	Reverse Recovery Time	V _{CE} =400V, V _{GE} = -5 V to +15 V, I _F =150A,R _G =5Ω , T _{vj} = 25 °C	--	202	--	ns
I _{RM}	Peak Reverse Recovery Current		--	23.9	--	A
Q _{rr}	Recovered Charge		--	3.3	--	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 =150A,R _G =5Ω, T _{vj} = 175°C	--	273	--	ns
I _{RM}	Peak Reverse Recovery Current		--	45.3	--	A
Q _{rr}	Recovered Charge		--	8.1	--	μC
E _{rec}	Reverse Recovery Energy		--	0.8	--	mJ
R _{thJC}	Thermal resistance	Junction-to-Case (per diode)	--	0.319	--	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	150	A
I _{FM}	Diode Maximum Forward Current t _p =1ms	300	A

Characteristics (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V _F	Diode Forward Voltage	I _F = 150 A, T _{vj} = 25 °C	--	1.40	2.20	V
		I _F = 150 A, T _{vj} = 175 °C	--	1.25	--	
T _{rr}	Reverse Recovery Time	V _{CE} =400V, V _{GE} = -5 V to +15 V I _F =150A,R _G =5Ω T _{vj} = 25 °C	--	186	--	ns
I _{RM}	Peak Reverse Recovery Current		--	44.5	--	A
Q _{rr}	Recovered Charge		--	6.16	--	μC
E _{rec}	Reverse Recovery Energy		--	0.60	--	mJ
T _{rr}	Reverse Recovery Time	V _{CE} =400V, V _{GE} = -5 V to +15 V I _F =150A,R _G =5Ω, T _{vj} = 175 °C	--	251	--	ns
I _{RM}	Peak Reverse Recovery Current		--	68.8	--	A
Q _{rr}	Recovered Charge		--	12.8	--	μC
E _{rec}	Reverse Recovery Energy		--	1.03	--	mJ
R _{thJC}	Thermal resistance	Junction-to-Case (per diode)	--	0.2	--	K/W
T _{vj op}		Temperature under switching conditions	-40		175 ³⁾	°C

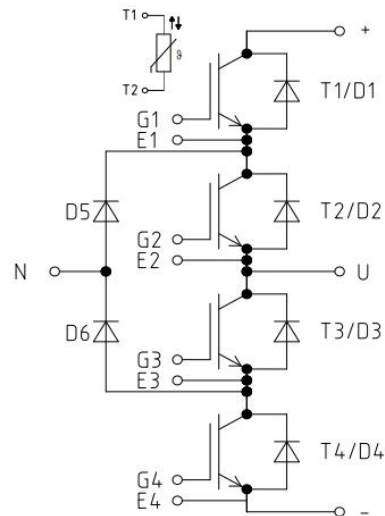
³⁾T_{vj op} > 150°C is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.

NTC Characteristics (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
R ₂₅	Rated Resistance		--	5.0	--	kΩ
ΔR/R	Deviation of R ₁₀₀	T _C =100 °C,R ₁₀₀ =493.3Ω	-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/(298.15K))]	--	3375	--	K
B _{25/80}	B-value	R ₂ =R ₂₅ exp[B _{25/80} (1/T ₂ - 1/(298.15K))]	--	3411	--	K
B _{25/100}	B-value	R ₂ =R ₂₅ exp[B _{25/100} (1/T ₂ - 1/(298.15K))]	--	3433	--	K

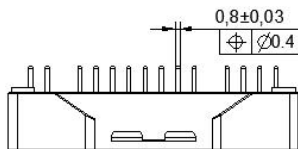
CIRCUIT DIAGRAM

Preliminary data

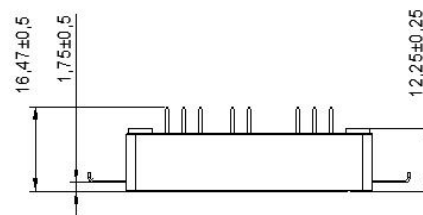


PACKAGE DIMENSION

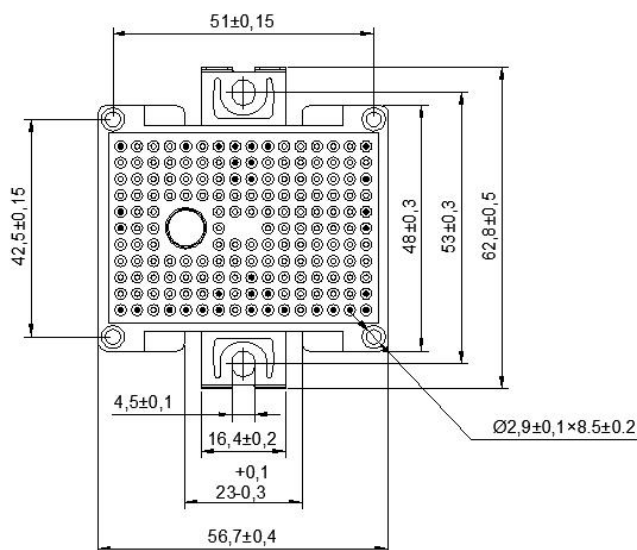
Dimensions in Millimeters



SIDE VIEW



SIDE VIEW



TOP VIEW

