

K3 Pack Module with Gen.7 Trench/Fieldstop IGBT and Emitter Controlled diode and NTC**Features**

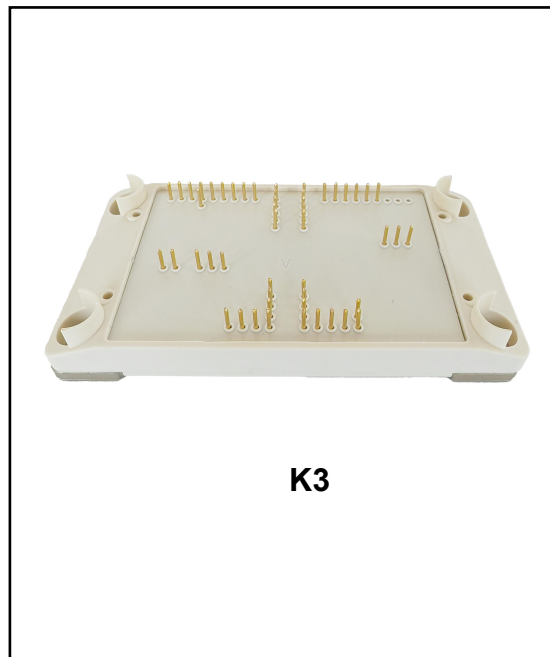
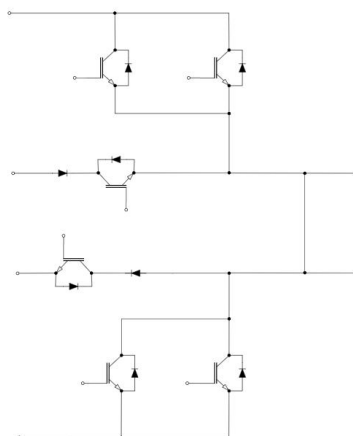
- Neutral Point Clamped Three-Level Inverter Module
- Low Inductive Layout
- Solderable Pins

Benefits

- Higher System Efficiency
- Reduced Cooling Requirements
- Low Conduction Losses Over Temperature

Typical Applications

- Solar Inverters
- 3-level-applications Converters
- 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
Creepage distance	d _{creep}	terminal to heatsink	> 12	mm
Clearance	d _{clear}	terminal to heatsink	> 11	mm
Comparative tracking index (electrical)	CTI		≥ 500	

Package Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Stray Inductance	L _{CE}			-	15	-	nH
Mounting torque for module mounting	M	-Mounting according to valid application note	M5, Screw	3		5	Nm
Storage Temperature Range	T _{STG}			-40		125	°C
Flatness of base plate						0.3	mm

IGBT(Q1,Q4)

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

Symbol	Description	Value	Unit
V _{CES}	Collector-Emitter Voltage	1200	V
V _{GES}	Gate-Emitter Voltage	± 20	V
I _C	Continuous Collector Current @ T _J = 150°C	550	A
I _{CP}	Pulsed Collector Current @ T _J = 150°C	1100	A

Characteristics (T_c = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V _{CE(sat)}	Collector-Emitter Saturation Voltage	V _{GE} = 15 V, I _C = 550 A	T _J = 25°C	--	1.80	V
			T _J = 150°C	--	2.10	
V _{GE(TH)}	Gate-Emitter Threshold Voltage	V _{GE} = V _{CE} , I _C = 9 mA	--	5.25	--	V
I _{CES}	Collector-Emitter Cutoff Current	V _{GE} = 0 V, V _{CE} = 1200 V	--	--	150	μA
I _{GES}	Gate Leakage Current	V _{GE} = 20 V, V _{CE} = 0 V	--	--	100	nA
Q _g	Total Gate Charge	V _{CE} = 600 V, V _{GE} = ± 15 V	--	2.21	--	μC
C _{iss}	Input Capacitance	V _{CE} = 30 V, V _{GE} = 0 V, f = 100 kHz	--	64.2	--	nF
C _{rss}	Reverse Transfer Capacitance		--	0.32	--	nF
t _{d(on)}	Turn-On Delay Time (inductive load)	T _J = 25°C V _{CE} = 600V, I _C = 300A V _{GE} = -7 V to +15 V, R _{Gon} = 2Ω, R _{Goff} = 2Ω	--	97	--	ns
t _r	Rise Time (inductive load)		--	22	--	
t _{d(off)}	Turn-off Delay Time (inductive load)		--	135	--	
t _f	Fall Time (inductive load)		--	20	--	
E _{on}	Turn-On Switching Loss per Pulse		--	9.76	--	mJ
E _{off}	Turn Off Switching Loss per Pulse		--	13.17	--	
t _{d(on)}	Turn-On Delay Time	T _J = 25°C V _{CE} = 600V, I _C = 300A V _{GE} = -7 V to +15 V, R _{Gon} = 2Ω, R _{Goff} = 2Ω	--	107	--	ns
t _r	Rise Time		--	35	--	
t _{d(off)}	Turn-off Delay Time		--	165	--	
t _f	Fall Time		--	47	--	
E _{on}	Turn-on Switching Loss per Pulse		--	19.5	--	mJ
E _{off}	Turn Off Switching Loss per Pulse		--	21.3	--	
C _{iss}	Input Capacitance	V _{CE} = 30 V, V _{GE} = 0 V, f = 100 kHz	--	64.2	--	nF
C _{rss}	Reverse Transfer Capacitance		--	0.32	--	
R _{thJC}	Thermal Resistance – Chip-to-Case	Junction-to-Case (per diode)	--	0.053	--	°C/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, D4)

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

Symbol	Description	Value	Unit
V _{RRM}	Peak Repetitive Reverse Voltage	1200	V
I _F	Continuous Forward Current @T _J = 150°C	400	A
I _{FRM}	Repetitive Peak Forward Current @T _J = 150°C	800	A

Characteristics (T_c=25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V _F	Diode Forward Voltage	I _F = 400 A		T _J = 25°C	--	V
				T _J = 150°C	--	
Q _{rr}	Reverse Recovery Charge	T _J = 25°C V _{CE} = 600V, I _C = 300A V _{GE} = -7 V to +15 V, R _{Gon} = 2Ω, R _{Goff} = 2Ω	--	1.9	--	μC
I _{RRM}	Peak Reverse Recovery Current		--	24.775	--	A
E _{REC}	Reverse Recovery Energy		--	1.755	--	mJ
Q _{rr}	Reverse Recovery Charge	T _J = 150°C V _{CE} = 600V, I _C = 300A V _{GE} = -7 V to +15 V, R _{Gon} = 2Ω, R _{Goff} = 2Ω	--	5.91	--	μC
I _{RRM}	Peak Reverse Recovery Current		--	35.45	--	A
E _{REC}	Reverse Recovery Energy		--	4.345	--	mJ
R _{thJC}	Thermal Resistance – Chip-to-Case	Junction-to-Case (per diode)	--	0.083	--	°C/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.

IGBT(Q2,Q3)

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

Symbol	Description	Value	Unit
V _{CES}	Collector-Emitter Voltage	750	V
V _{GES}	Gate-Emitter Voltage	±20	V
I _C	Continuous Collector Current @ T _J = 150°C	400	A
I _{CP}	Pulsed Collector Current @ T _J = 150°C	800	A

Characteristics (T_c = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V _{CE(sat)}	Collector-Emitter Saturation Voltage	V _{GE} = 15 V, I _C = 400 A	T _J = 25°C	--	1.55	V
			T _J = 150°C	--	1.85	
V _{GE(TH)}	Gate-Emitter Threshold Voltage	V _{GE} = V _{CE} , I _C = 5 mA	--	5.25	--	V
I _{CES}	Collector-Emitter Cutoff Current	V _{GE} = 0 V, V _{CE} = 750 V	--	--	100	μA
I _{GES}	Gate Leakage Current	V _{GE} = 20 V, V _{CE} = 0 V	--	--	100	nA
Q _g	Total Gate Charge	V _{CE} = 600 V, V _{GE} = ± 15 V	--	0.775	--	μC
C _{iss}	Input Capacitance	V _{CE} = 30 V, V _{GE} = 0 V, f = 100 kHz	--	23.65	--	nF
C _{oss}	Output Capacitance		--	0.785	--	
C _{rss}	Reverse Transfer Capacitance		--	0.145	--	
t _{d(on)}	Turn-On Delay Time	V _{CE} = 400V, I _C = 300A V _{GE} = -7 V to +15 V, R _{Gon} = 2Ω, R _{Goff} = 2Ω T _J = 25°C	--	62	--	ns
t _r	Rise Time		--	25	--	
t _{d(off)}	Turn-off Delay Time		--	250	--	
t _f	Fall Time		--	38	--	
E _{on}	Turn-On Switching Loss per Pulse		--	2.50	--	mJ
E _{off}	Turn Off Switching Loss per Pulse		--	1.12	--	
t _{d(on)}	Turn-On Delay Time	V _{CE} = 400V, I _C = 300A V _{GE} = -7 V to +15 V, R _{Gon} = 2Ω, R _{Goff} = 2Ω T _J = 150°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		--	3.37	--	mJ
E _{off}	Turn Off Switching Loss per Pulse		--	1.75	--	
R _{thJC}	Thermal Resistance – Chip-to-Case	Junction-to-Case (per diode)	--	0.099	--	°C/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.

Diode (D2, D3)

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

Symbol	Description	Value	Unit
V _{RRM}	Peak Repetitive Reverse Voltage	750	V
I _F	Continuous Forward Current @T _J = 150°C	100	A
I _{FRM}	Repetitive Peak Forward Current @T _J = 150°C	200	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	--	1.45	--	V
			T _J = 150°C	--	1.35	--	
R _{thJC}	Thermal Resistance – Chip-to-Case	Junction-to-Case (per diode)		--	0.357	--	°C/W
T _{vj op}	Temperature under switching conditions			-40	--	175 ⁴⁾	°C

⁴⁾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}	Peak Repetitive Reverse Voltage	750	V
I _F	Continuous Forward Current @ T _c = 75°C (T _J = 150°C)	500	A
I _{FRM}	Repetitive Peak Forward Current@ T _J = 150°C	1000	A

Characteristics (T_c=25°C unless otherwise noted)

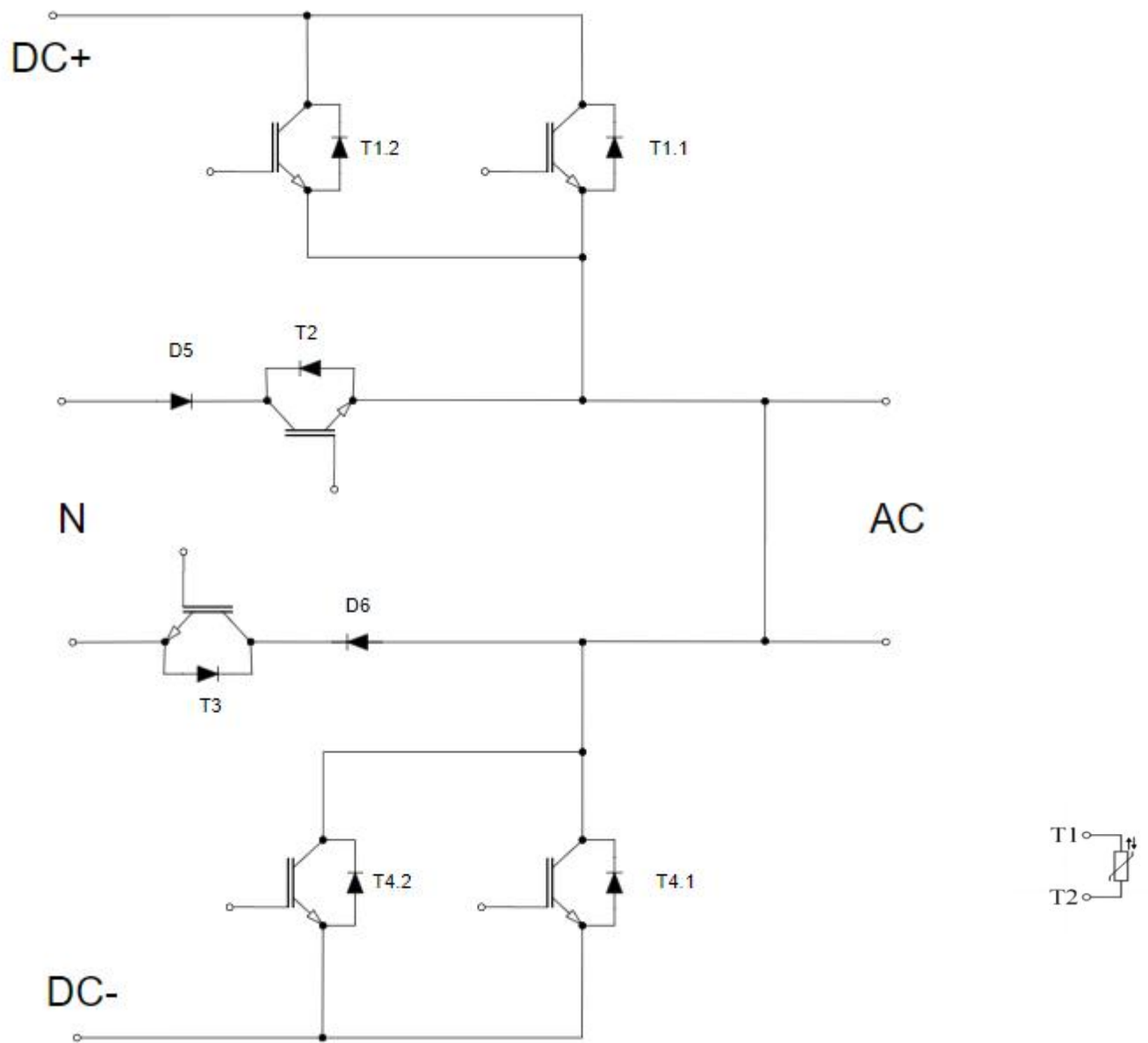
Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V _F	Diode Forward Voltage	I _F = 500 A, V _{GE} = 0 V	T _J = 25°C	--	1.50	V
			T _J = 150°C	--	1.40	
Q _{rr}	Reverse Recovery Charge	V _{CE} = 400 V, I _C = 300A V _{GE} = -7 V to +15 V, R _{Gon} = 2Ω, R _{Goff} = 0.5Ω, T _J = 25°C	--	6.07	--	μC
I _{RRM}	Peak Reverse Recovery Current		--	130	--	A
E _{REC}	Reverse Recovery Energy		--	1.62	--	mJ
Q _{rr}	Reverse Recovery Charge	V _{CE} = 400 V, I _C = 300A V _{GE} = -7 V to +15 V, R _{Gon} = 2Ω, R _{Goff} = 0.5Ω, T _J = 175°C	--	13.87	--	μC
I _{RRM}	Peak Reverse Recovery Current		--	169	--	A
E _{REC}	Reverse Recovery Energy		--	4.42	--	mJ
R _{thJC}	Thermal Resistance – Chip-to-Case	Junction-to-Case (per diode)	--	0.1	--	°C/W
T _{vj op}	Temperature under switching conditions		-40	--	175 ⁴⁾	°C

⁵⁾T_{vj op} > 150°C is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14

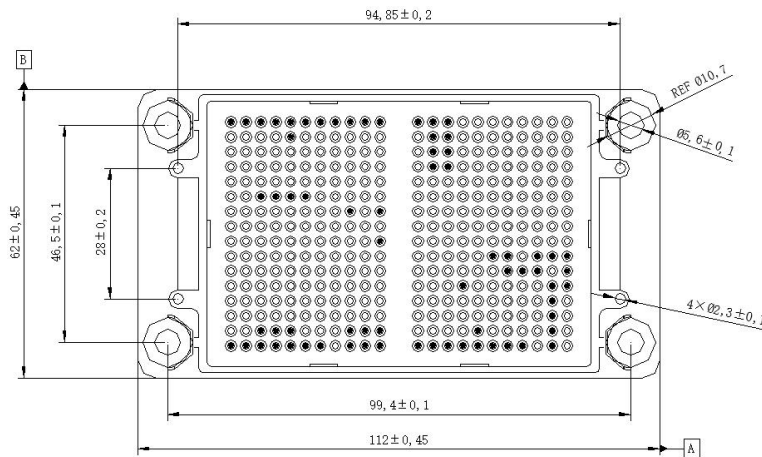
NTC Characteristics (T_c = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
R ₂₅	Rated Resistance	T _c = 25°C	--	5	--	kΩ
ΔR/R	Deviation of R100	T _c = 100 °C, R ₁₀₀ = 493Ω	-5	--	5	%
B _{25/50}	B-value	R ₂ = R ₂₅ exp[B _{25/50} (1/T ₂ - 1/(298.15K))]	--	3375	--	K
B _{25/100}	B-value	R ₂ = R ₂₅ exp[B _{25/100} (1/T ₂ - 1/(298.15K))]	--	3433	--	K

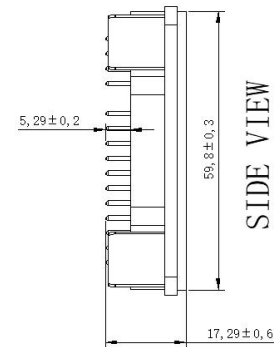
CIRCUIT DIAGRAM



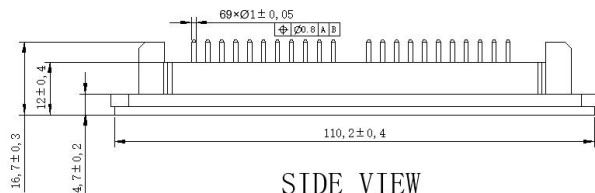
PACKAGE DIMENSIONS



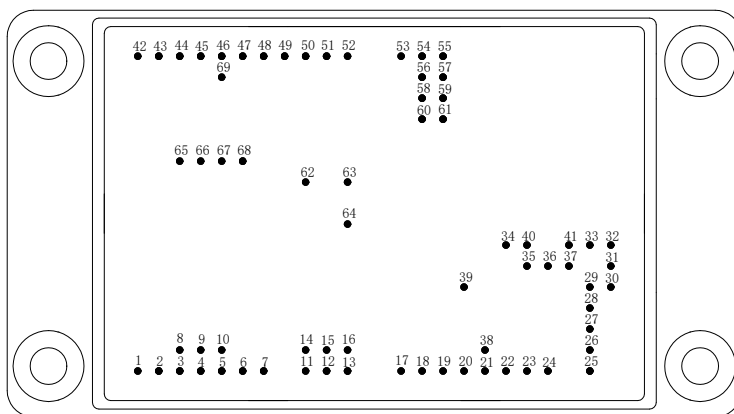
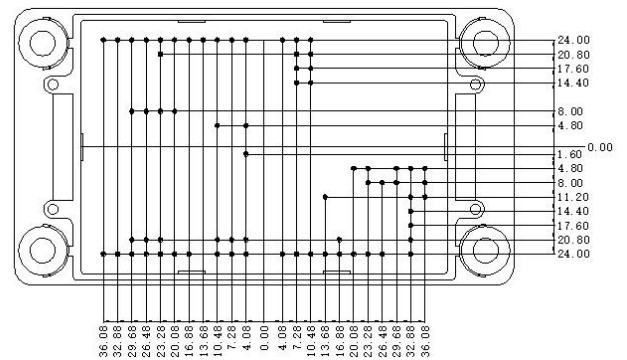
TOP VIEW



SIDE VIEW



SIDE VIEW



PIN	PIN Definition
1~10	DC+
11~24	N
25~37	DC-
38	G3
39	C3
40	G4.2
41	G4.1
42~61	AC
62	C2
63	T1
64	T2
65	E1.2
66	G1.2
67	G1.1
68	E1.1
69	G2