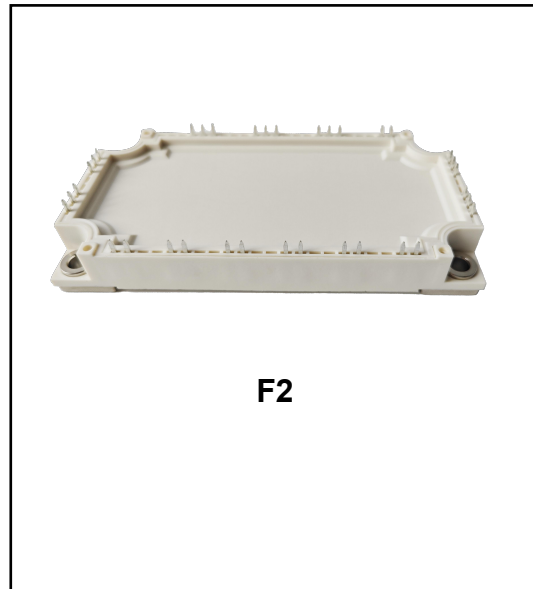


F2 PACK module with Gen.7 Trench/Fieldstop IGBT and Emitter Controlled diode and NTC

Features

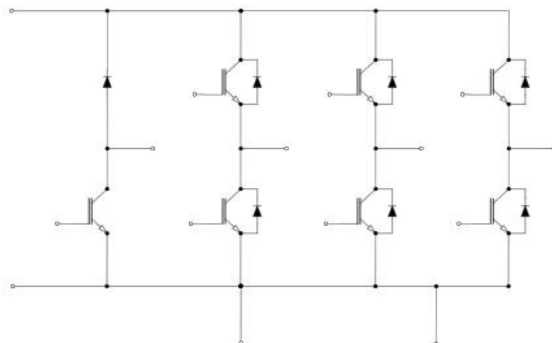
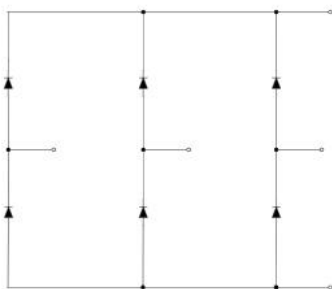
- Electrical features
 - $V_{CES} = 1200\text{ V}$
 - $I_C \text{ nom} = 150\text{ A} / I_{CRM} = 300\text{ A}$
 - Low V_{CEsat}
 - Overload operation up to 175°C
- Mechanical features
 - High power and thermal cycling capability
 - Integrated NTC temperature sensor
 - Copper base plate
 - Al_2O_3 substrate with low thermal resistance



Typical Applications

- Auxiliary inverters
- Motor drives
- Servo drives

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	10.0	mm
Clearance	d_{clear}	terminal to heatsink	7.5	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		--	25	--	nH
Module Lead Resistance, Terminal to Chip	$R_{AA'+CC'}$	$T_C=25^{\circ}C$, per switch	--	1.1	--	mΩ
Module Lead Resistance, Terminal to Chip	$R_{CC'+EE'}$	$T_C=25^{\circ}C$, per switch	--	1.6	--	mΩ
Storage Temperature Range	T_{STG}		-40		125	°C
Mounting Torque, Screw M5	M	M5, Screw	3		6	N.m
Weight	G		--	300	--	g

IGBT, Inverter

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	±30	V
I _C	Collector Current @ T _C =80°C	150	A
I _{CM}	Pulsed Collector Current, t _p =1S	300	A

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 =150A, V _{GE} =15V	T _{vj} =25°C	--	1.60	2.10	V		
			T _{vj} =125°C	--	1.75	--			
			T _{vj} = 175 °C	--	1.80	--			
V _{GE(th)}	Gate Threshold Voltage	I _C =5mA,V _{CE} =V _{GE}		5.00	6.00	7.00	V		
I _{CES}	Collector-Emitter Leakage Current	V _{GE} =0V,V _{CE} =1200V		--	--	500	uA		
I _{GES}	Gate-Emitter Leakage Current	V _{GE} =20V,V _{CE} =0V		--	--	100	nA		
R _{Gint}	Internal Gate Resistance	T _{vj} =25°C		--	2.0	--	Ω		
C _{ies}	Input Capacitance	V _{CE} =25V,V _{GE} =0V, f=100kHz		--	14.911	--	nF		
C _{oes}	Out Capacitance			--	0.369	--	nF		
C _{res}	Reverse Transfer			--	0.72	--	nF		
Q _G	Gate Charge	V _{CE} =600V,V _{GE} =15V			0.523		μC		
t _{d(on)}	Turn-On Delay Time	V _{CC} = 600 V, I _C =150 A, R _{Gon} = 25Ω,R _{Goff} = 25Ω V _{GE} =±15V Inductive Load T _{vj} = 25°C			142		ns		
t _r	Rise Time				97				
t _{d(off)}	Turn-off Delay Time				450				
t _f	Fall Time				73				
E _{on}	Turn-On Switching Loss per Pulse			V _{CC} = 600 V, I _C =150 A, R _{Gon} = 10Ω,R _{Goff} = 15Ω V _{GE} =±15V Inductive Load T _{vj} = 125°C			11.00		mJ
E _{off}	Turn Off Switching Loss per Pulse		7.62						
t _{d(on)}	Turn-On Delay Time	V _{CC} = 600 V, I _C =150 A, R _{Gon} = 10Ω,R _{Goff} = 15Ω V _{GE} =±15V Inductive Load T _{vj} = 125°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			V _{CC} = 600 V, I _C =150 A, R _{Gon} = 10Ω,R _{Goff} = 15Ω V _{GE} =±15V Inductive Load T _{vj} = 175°C			TBD		mJ
E _{off}	Turn Off Switching Loss per Pulse		TBD						
t _{d(on)}	Turn-On Delay Time	V _{CC} = 600 V, I _C =150 A, R _{Gon} = 10Ω,R _{Goff} = 15Ω V _{GE} =±15V Inductive Load T _{vj} = 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			V _{CC} = 600 V, I _C =150 A, R _{Gon} = 10Ω,R _{Goff} = 15Ω V _{GE} =±15V Inductive Load T _{vj} = 175°C			TBD		mJ
E _{off}	Turn Off Switching Loss per Pulse		TBD						
I _{sc}	SC Data	t _p ≤10μs,V _{GE} ≤15V, T _{vj} ≤150°C,V _{CC} =800V, V _{CEmax} =V _{CES} -L _s C _{ES} ·di/dt					800		A
R _{thJC}	Thermal resistance	Junction-to-Case (per IGBT)					0.26		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, Inverter

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

Symbol	Description	Value	Unit
V _{RRM}	Repetitive Peak Reverse Voltage	1200	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)

V _F	Diode Forward Voltage	I _F =150A	T _J =25°C	--	2.00	2.80	V
			T _J =125°C	--	1.90	--	
			T _J =175°C	--	1.80	--	
Q _r	Recovered Charge	V _R = 600 V I _F =150A, R _g =25Ω, T _J =25°C			4.91		μC
I _{RM}	Peak Reverse Recovery Current				41		A
T _{rr}	Reverse Recovery Time				249		ns
E _{rec}	Reverse Recovery Energy				1.937		mJ
Q _r	Recovered Charge	V _R = 600 V I _F =150A, R _g =25Ω, T _J =125°C			TBD		μC
I _{RM}	Peak Reverse Recovery Current				TBD		A
T _{rr}	Reverse Recovery Time				TBD		ns
E _{rec}	Reverse Recovery Energy				TBD		mJ
Q _r	Recovered Charge	V _R = 600 V I _F =150A, R _g =25Ω, T _J =175°C			TBD		μC
I _{RM}	Peak Reverse Recovery Current				TBD		A
T _{rr}	Reverse Recovery Time				TBD		ns
E _{rec}	Reverse Recovery Energy				TBD		mJ
R _{thJC}	Thermal resistance	Junction-to-Case (per diode)			0.43		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, Rectifier

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

Symbol	Description		Value	Unit
V _{RRM}	Repetitive Peak Reverse Voltage		1600	V
I _F	Diode Continuous Forward Current		150	A
I _{FM}	Diode Maximum Forward Current t _p =1ms		150	A
I _{FSM}	Surge Forward Current (t _p =10ms)	T _{Vj} =25 °C	1600	A
		T _{Vj} =150 °C	1400	A
I ² t - value	I ² t - value (t _p =10ms)	T _{Vj} =25 °C	12800	A ² s
		T _{Vj} =150 °C	9800	

Characteristics (T_c=25°C unless otherwise noted)

V _F	Diode Forward Voltage	I _F =150A, T _J = 150 °C		0.95		V
I _R	Reverse Current	T _J =175 °C, V _R =1600V		1		mA
R _{thJC}	Thermal resistance	Junction-to-Case (per diode)		0.23		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.

IGBT, Brake-Chopper

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	±30	V
I _C	Collector Current @ T _c =25°C	200	A
	Collector Current @ T _c =100°C	100	A
I _{Cpuls}	Pulsed Collector Current, t _p limited by T _{Jmax}	300	A

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	--	1.65	V
			T _{vj} =175 °C	--	1.95	
V _{GE(th)}	Gate Threshold Voltage	I _C =3 mA, V _{CE} =V _{GE}	5.0	6.0	7.0	V
I _{CES}	Collector-Emitter Leakage Current	V _{GE} =0V, V _{CE} =1200 V	--	--	40	uA
I _{GES}	Gate-Emitter Leakage Current	V _{GE} =30V, V _{CE} =0 V	--	--	100	nA
R _{Gint}	Internal Gate Resistance	f=1MHz	--	0.8	--	Ω
C _{ies}	Input Capacitance	V _{CE} =30V, V _{GE} =0 V, f=1MHz	9.7	11.4	13.2	nF
C _{oes}	Out Capacitance		--	0.28	--	nF
C _{res}	Reverse Transfer		--	0.06	--	nF
Q _G	Gate Charge	V _{CE} =600V, I _C =100A, V _{GE} =15V	--	0.403	--	μC
t _{d(on)}	Turn-On Delay Time	V _{CE} =600V, I _C =100A, V _{GE} =0/15V, R _g =25Ω, Inductive Load	--	100	--	ns
t _r	Rise Time		--	68	--	
t _{d(off)}	Turn-off Delay Time		--	316	--	
t _f	Fall Time		--	51	--	
E _{on}	Turn-On Switching Loss per Pulse		--	7.74	--	mJ
E _{off}	Turn Off Switching Loss per Pulse		--	5.36	--	
t _{d(on)}	Turn-On Delay Time	V _{CE} =600V, I _C =100A, V _{GE} =0/15V, R _g =25Ω, Inductive Load, T _{vj} =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		--	11.17	--	mJ
E _{off}	Turn Off Switching Loss per Pulse		--	7.39	--	
I _{SC}	SC Data	V _{GE} =15V, V _{CC} ≤600V, t _{SC} ≤10us, T _{vj} ≤150°C	--	500	--	A
R _{thJC}	Thermal resistance	Junction-to-Case (per IGBT)		0.32		K/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, Brake-Chopper

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

Symbol	Description	Value	Unit
V _{RRM}	Repetitive Peak Reverse Voltage	1200	V
I _F	Diode Continuous Forward Current	50	A
I _{FM}	Diode Maximum Forward Current t _p =1ms	100	A
I ² t - value	I ² t - value (t _p =10ms, V _R =0V)	T _{Vj} =25 °C	220
		T _{Vj} =150 °C	200
			A ² s

Characteristics (T_C=25°C unless otherwise noted)

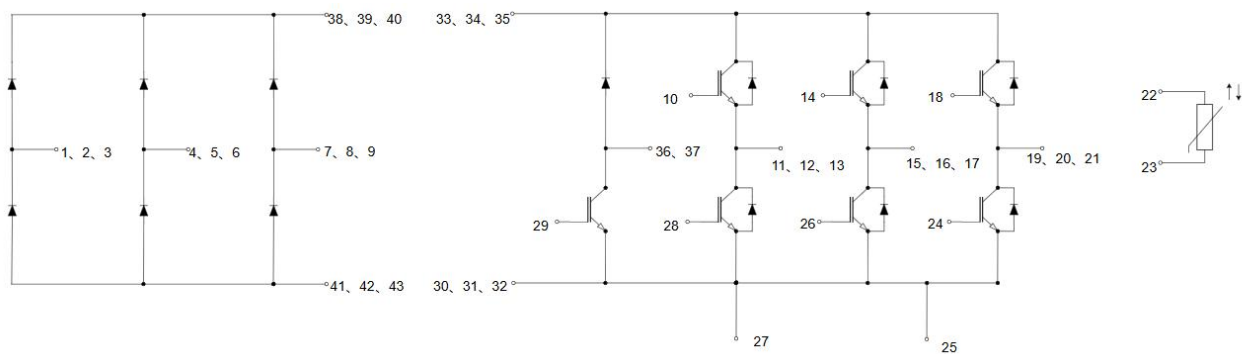
Characteristics (T _a =25 °C, unless otherwise noted)							
V _F	Diode Forward Voltage	I _F =50A	T _{Vj} =25 °C	--	1.70	2.70	V
			T _{Vj} =125 °C	--	1.60	--	
			T _{Vj} =175 °C	--	165	--	
Q _r	Recovered Charge	V _R = 600 V I _F =50A,R _g =25Ω, T _J =25°C		--	1.24	--	μC
I _{RM}	Peak Reverse Recovery Current			--	27	--	A
T _{rr}	Reverse Recovery Time			--	175	--	ns
E _{rec}	Reverse Recovery Energy			--	1.23	--	mJ
Q _r	Recovered Charge	V _R = 600 V I _F =50A,R _g =25Ω, T _J =125°C		--	TBD	--	μC
I _{RM}	Peak Reverse Recovery Current			--	TBD	--	A
T _{rr}	Reverse Recovery Time			--	TBD	--	ns
E _{rec}	Reverse Recovery Energy			--	TBD	--	mJ
Q _r	Recovered Charge	V _R = 600 V I _F =50A,R _g =25Ω, T _J =175°C		--	TBD	--	μC
I _{RM}	Peak Reverse Recovery Current			--	TBD	--	A
T _{rr}	Reverse Recovery Time			--	TBD	--	ns
E _{rec}	Reverse Recovery Energy			--	TBD	--	mJ
R _{thJC}	Thermal resistance	Junction-to-Case (per diode)			0.66		K/W
T _{vj op}		Temperature under switching conditions		-40		175 ⁵⁾	°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		--	5.0	--	kΩ
ΔR/R	Deviation of R100	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



PACKAGE DIMENSION

