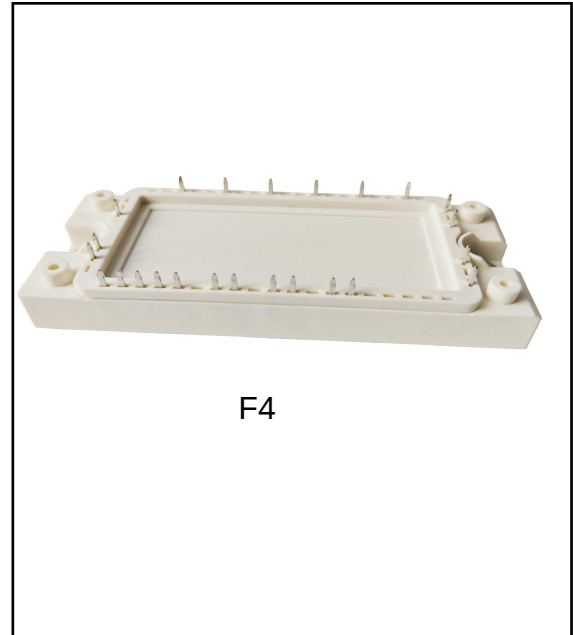


F4 PACK module with Gen.7 Trench/Fieldstop IGBT and Emitter Controlled diode and NTC

Features

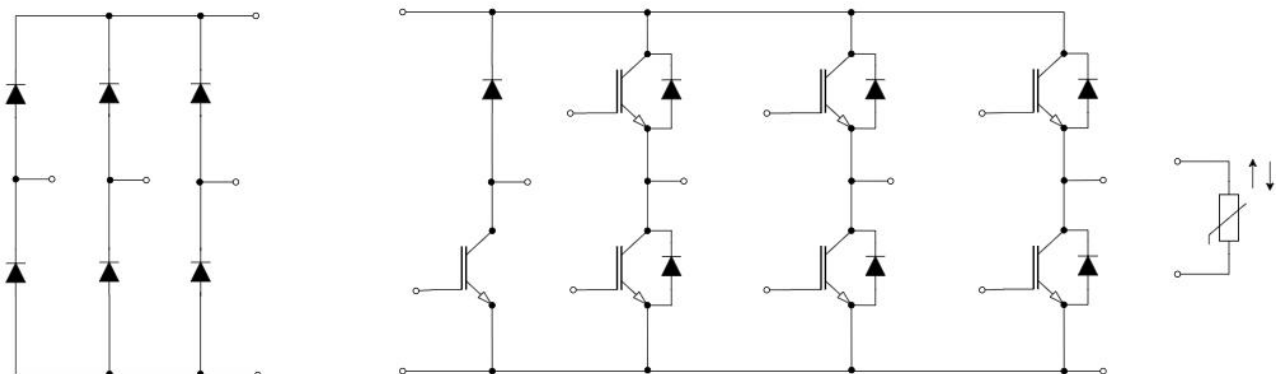
- Electrical features
 - $V_{CES} = 1200\text{ V}$
 - $I_C \text{ nom} = 50\text{ A} / I_{CRM} = 100\text{ A}$
 - Low V_{CEsat}
 - Overload operation up to 175°C
- Mechanical features
 - High power and thermal cycling capability
 - Integrated NTC temperature sensor
 - Copper base plate
 - Al_2O_3 substrate 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 ₂ O 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	L _{CE}		--	35	--	nH
Module Lead Resistance, Terminal to Chip	R _{AA'+CC'}	T _C =25°C, per switch	--	6.9	--	mΩ
Module Lead Resistance, Terminal to Chip	R _{CC'+EE'}	T _C =25°C, per switch	--	5.9	--	mΩ
Storage Temperature Range	T _{STG}		-40		125	°C
Mounting Torque, Screw M5	M	M5, Screw	3		6	N.m
Weight	G		--	180	--	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 =25°C	100	A
	Collector Current @ T _C =80°C	50	A
I _{CM}	Pulsed Collector Current, t _p =1S	150	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 = 50 A, T _{vj} = 25°C	--	1.80	2.20	V
		V _{GE} = 15 V, I _C = 50 A, T _{vj} = 125°C	--	1.95	--	
		V _{GE} = 15 V, I _C = 50 A, T _{vj} = 150°C	--	2.00	--	
V _{GE(TH)}	Gate-Emitter Threshold Voltage	V _{GE} = V _{CES} , I _C = 1 mA, T _{vj} = 25°C	5.0	6.0	7.0	V
I _{CES}	Collector-Emitter Cutoff Current	V _{GE} = 0 V, V _{CE} = V _{CES} , T _{vj} = 25°C	--	--	200	μA
I _{GES}	Gate-Emitter Leakage Current	V _{GE} = V _{GES} , V _{CE} = 0 V, T _{vj} = 25°C	--	--	200	nA
R _{Gint}	Internal Gate Resistance		--	1.27	--	Ω
C _{ies}	Input Capacitance	V _{CE} =25V, f=1MHz, V _{GE} =0V	--	5.07	--	nF
C _{res}	Reverse Transfer		--	0.13	--	nF
Q _G	Gate Charge	V _{GE} =15V, I _C =50A	--	0.19	--	μC
t _{d(on)}	Turn-On Delay Time	V _{CC} = 600 V, I _C = 50 A R _{Gon} = 10Ω, R _{Goff} = 25Ω , V _{GE} = ±15V Inductive Load T _{vj} = 25°C	--	110	--	ns
t _r	Rise Time		--	30	--	
t _{d(off)}	Turn-off Delay Time		--	180	--	
t _f	Fall Time		--	190	--	
E _{on}	Turn-On Switching Loss per Pulse		--	2.83	--	mJ
E _{off}	Turn Off Switching Loss per Pulse		--	4.42	--	
t _{d(on)}	Turn-On Delay Time	V _{CC} = 600 V, I _C = 50 A R _{Gon} = 10Ω, R _{Goff} = 25Ω , V _{GE} = ±15V Inductive Load T _{vj} = 125°C	--	120	--	ns
t _r	Rise Time		--	30	--	
t _{d(off)}	Turn-off Delay Time		--	230	--	
t _f	Fall Time		--	340	--	
E _{on}	Turn-on Switching Loss per Pulse		--	4.16	--	mJ
E _{off}	Turn Off Switching Loss per Pulse		--	5.24	--	
t _{d(on)}	Turn-On Delay Time	V _{CC} = 600 V, I _C = 50 A R _{Gon} = 10Ω, R _{Goff} = 25Ω , V _{GE} = ±15V Inductive Load T _{vj} = 150°C	--	110	--	ns
t _r	Rise Time		--	40	--	
t _{d(off)}	Turn-off Delay Time		--	240	--	
t _f	Fall Time		--	330	--	
E _{on}	Turn-on Switching Loss per Pulse		--	4.87	--	mJ
E _{off}	Turn Off Switching Loss per Pulse		--	5.49	--	
I _{SC}	SC Data	t _p ≤10μs, V _{GE} ≤15V, T _{vj} =150°C, V _{CC} =800V, V _{CEmax} =V _{CES} -L _{sCE} •di/dt	--	130	--	A
R _{thJC}	Thermal resistance	Junction-to-Case (per IGBT)	--	0.59	--	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	50	A
I _{FM}	Diode Maximum Forward Current t _p =1ms	150	A

Characteristics (T_C=25°C unless otherwise noted)

V _F	Diode Forward Voltage	I _F =50A	T _J =25°C		1.80	2.70	V
			T _J =175°C		1.75		
Q _r	Recovered Charge	I _F =50A, R _g =25Ω, T _J =25°C			1.06		μC
I _{RM}	Peak Reverse Recovery Current				39.5		A
T _{rr}	Reverse Recovery Time				126		ns
E _{rec}	Reverse Recovery Energy				0.44		mJ
Q _r	Recovered Charge	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)			0.84		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	50	A
I _{FM}	Diode Maximum Forward Current t _p =1ms	100	A

Characteristics (T_C=25°C unless otherwise noted)

V _F	Diode Forward Voltage	I _F = 50 A, T _J = 150 °C		1.0		V
I _R	Reverse Current	T _J =175 °C, V _R =1600V		3		mA
R _{thJC}	Thermal resistance	Junction-to-Case (per diode)		0.65		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, 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	100	A
	Collector Current @ T _c =80°C	35	A
I _{CM}	Pulsed Collector Current, t _p =1S	105	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 =35A, V _{GE} =15V	T _{vj} =25°C	1.50	2.10	V
			T _{vj} = 175 °C	1.75		
V _{GE(th)}	Gate Threshold Voltage	I _c =1mA, V _{CE} =V _{GE}	5.5	--	7.0	V
I _{CES}	Collector-Emitter Leakage Current	V _{GE} =0V, V _{CE} =1200V	--	--	10	uA
I _{GES}	Gate-Emitter Leakage Current	V _{GE} =30V, V _{CE} =0V	--	--	100	nA
R _{Gint}	Internal Gate Resistance	f=1MHz	--	0.6	--	Ω
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V, f=1MHz	3500	4203	4900	nF
C _{oes}	Out Capacitance		--	107	--	nF
C _{res}	Reverse Transfer		--	24	--	nF
Q _G	Gate Charge	V _{CE} =960V, I _c =35A, V _{GE} =15V	--	147	--	μC
t _{d(on)}	Turn-On Delay Time	V _{CE} =600V, I _c =35A, V _{GE} =0/15V, R _g =25Ω, Inductive Load		71		ns
t _r	Rise Time			53		
t _{d(off)}	Turn-off Delay Time			261		
t _f	Fall Time			66.3		
E _{on}	Turn-On Switching Loss per Pulse			2.34		mJ
E _{off}	Turn Off Switching Loss per Pulse			1.44		
t _{d(on)}	Turn-On Delay Time	V _{CE} =600V, I _c =35A, V _{GE} =0/15V, R _g =25Ω, Inductive Load, 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			3.64		mJ
E _{off}	Turn Off Switching Loss per Pulse			2.00		
I _{sc}	SC Data	V _{GE} =15V, V _{CC} ≤600V, t _{sc} ≤10us, T _j ≤150°C	--	175	--	A
R _{thJC}	Thermal resistance	Junction-to-Case (per IGBT)		0.67		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, Chopper

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

Symbol	Description	Value	Unit
V _{RRM}	Repetitive Peak Reverse Voltage	1200	V
I _F	Diode Continuous Forward Current	25	A
I _{FM}	Diode Maximum Forward Current t _p =1ms	50	A

Characteristics (Tc=25°C unless otherwise noted)

V _F	Diode Forward Voltage	I _F =25A	T _J =25°C		1.70	2.50	V
			T _J =175°C		1.65		
Q _r	Recovered Charge	I _F =25A, R _g =25Ω, T _J =25°C			0.47		μC
I _{RM}	Peak Reverse Recovery Current				18.2		A
T _{rr}	Reverse Recovery Time				58		ns
E _{rec}	Reverse Recovery Energy				0.19		mJ
Q _r	Recovered Charge	I _F =25A, 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)			0.95		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 (Tc = 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	Tc=100 °C, R100=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

