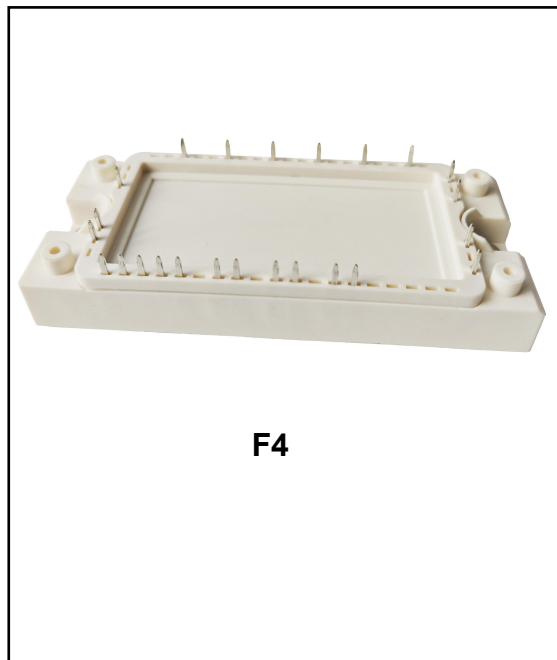


F4 PACK module with Trench/Fieldstop IGBT and Emitter Controlled diode and NTC

Features

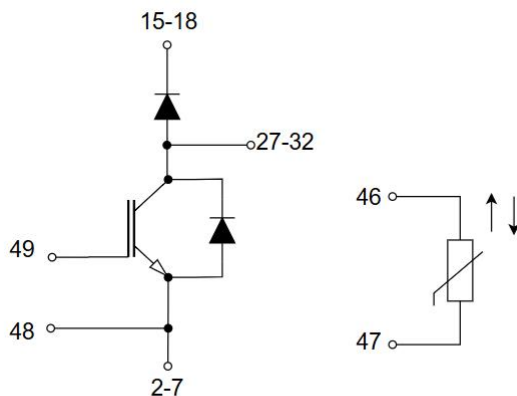
- Low $V_{CE(sat)}$ Trench IGBT technology
- 10 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- High power density
- Integrated temperature sensor available



Typical Applications

- AC motor drives
- Solar inverter
- Medical equipment
- Uninterruptible power supply
- Air-conditioning systems
- Welding equipment
- Switched-mode and resonant-mode power supplies
- Inductive heating, cookers
- Pumps, Fans

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 backside	12	mm
Creepage distance	d_{creep}	terminal to terminal	6	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		--	30	--	nH
Module Lead Resistance, Terminal to Chip	$R_{CC'+EE'}$		--	2.2	--	mΩ
Storage Temperature Range	T_{STG}		-40		125	°C
Mounting Torque, Screw M5	M		3		6	N.m
Weight	G		--	176	--	g

Boost IGBT

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

Symbol	Description	Value	Unit
V _{CES}	Collector-Emitter Voltage	1200V	V
V _{GES}	Gate-Emitter Voltage	±30	V
I _{CDC}	Continuous Collector Current @ T _c = 80°C (T _{JMAX} = 175°C)	400	A
I _{CM}	Pulsed Collector Current, t _p limited by T _{vj max}	800	A
T _{Jmax}	Maximum Junction Temperature	175	°C

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 = 400A, V _{GE} = 15 V	T _{vj} = 25 °C	--	1.45	V
			T _{vj} = 150 °C	--	1.70	
			T _{vj} = 175 °C	--	1.75	
V _{GE(TH)}	Gate-Emitter Threshold Voltage	V _{GE} = V _{CE} , I _C = 5 mA, T _{vj} = 25°C	5.0	5.8	6.5	V
I _{CES}	Collector-Emitter Cutoff Current	V _{GE} = 0 V, V _{CE} = 1200V, T _{vj} = 25°C	--	--	100	uA
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	--	0.67	--	Ω
C _{ies}	Input Capacitance	f = 100 kHz, T _{vj} = 25 °C, V _{CE} = 25 V, V _{GE} = 0 V	--	68	--	nF
C _{oes}	Out Capacitance		--	1.6	--	nF
C _{res}	Reverse Transfer		--	0.24	--	nF
Q _G	Gate Charge	V _{GE} = ±15 V, V _{CC} = 960 V	--	2.2	--	μC
t _{d(on)}	Turn-On Delay Time	I _C = 400A, V _{CC} = 600 V, V _{GE} = 15 /-5V, R _G = 1.0 Ω	T _{vj} = 25 °C	--	0.264	μS
			T _{vj} = 150 °C	--	0.299	
			T _{vj} = 175 °C	--	0.303	
t _r	Rise Time	I _C = 400A, V _{CC} = 600 V, V _{GE} = 15 /-5V, R _G = 1.0 Ω	T _{vj} = 25 °C	--	0.048	μS
			T _{vj} = 150 °C	--	0.057	
			T _{vj} = 175 °C	--	0.059	
t _{d(off)}	Turn-off Delay Time	I _C = 400A, V _{CC} = 600 V, V _{GE} = 15 /-5V, R _{Goff} = 1.0 Ω	T _{vj} = 25 °C	--	0.536	μS
			T _{vj} = 150 °C	--	0.611	
			T _{vj} = 175 °C	--	0.624	
t _f	Fall Time	I _C = 400A, V _{CC} = 600 V, V _{GE} = 15 /-5V, R _G = 1.0 Ω	T _{vj} = 25 °C	--	0.065	μS
			T _{vj} = 150 °C	--	0.146	
			T _{vj} = 175 °C	--	0.148	
E _{on}	Turn-On Switching Loss per Pulse	I _C = 400A, V _{CC} = 600 V, V _{GE} = 15 /-5V, R _G = 1.0 Ω (T _{vj max} = 175 °C)	T _{vj} = 25 °C	--	12.440	mJ
			T _{vj} = 150 °C	--	24.800	
			T _{vj} = 175 °C	--	27.600	
E _{off}	Turn Off Switching Loss per Pulse	I _C = 400A, V _{CC} = 600 V, V _{GE} = 15 /-5V, R _G = 1.0 Ω (T _{vj max} = 175 °C)	T _{vj} = 25 °C	--	54.060	mJ
			T _{vj} = 150 °C	--	72.000	
			T _{vj} = 175 °C	--	48.36	
I _{SC}	SC Data	V _{GE} ≤ 15 V, V _{CC} = 800 V, V _{CEmax} = V _{CES} - L _{sCE} · di/dt T _{vj} = 150 °C	t _p ≤ 10 μs, T _{vj} = 150 °C	--	2000	A

			$t_p \leq 10 \mu s$, $T_{vj}=175^\circ C$	--	1880	--	
R_{thJC}	Thermal resistance	Junction-to-Case (per IGBT)		--	0.077		K/W
$T_{vj op}$		Temperature under switching conditions		-40		150 ¹⁾	$^\circ C$

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

Boost Diodes

Absolute Maximum Ratings ($T_c = 25^\circ C$ unless otherwise noted)

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current @ $T_c=80^\circ C$	400	A
I_{FRM}	Diode Maximum Forward Current $t_p=1ms$	800	A

Characteristics ($T_c=25^\circ C$ unless otherwise noted)

Symbol	Parameter	Note or Test Condition		Min	Typ	Max	Unit
V _F	Diode Forward Voltage	I _F = 400 A, V _{GE} = 0 V	T _{vj} = 25 °C	--	2.45	3.20	V
			T _{vj} = 125 °C	--	2.30	--	
			T _{vj} = 150 °C	--	2.25	--	
Q _r	Recovered Charge	V _{cc} = 600 V, I _F = 400 A, V _{GE} = 15 /-5V R _G = 1.0 Ω -di _F /dt = 3100 A/μs	T _{vj} = 25 °C	--	9.27	--	μC
			T _{vj} = 125 °C	--	19.41	--	
			T _{vj} = 150 °C	--	28.84	--	
I _{RM}	Peak Reverse Recovery Current	V _{cc} = 600 V, I _F = 400 A, V _{GE} = 15 /-5V R _G = 1.0 Ω -di _F /dt = 3100 A/μs	T _{vj} = 25 °C	--	120.9	--	A
			T _{vj} = 125 °C	--	166.1	--	
			T _{vj} = 150 °C	--	173.1	--	
E _{rec}	Reverse recovery energy	V _{cc} = 600 V, I _F = 400 A, V _{GE} = 15 /-5V R _G = 1.0 Ω -di _F /dt = 3100 A/μs (T _{vj max} = 175 °C)	T _{vj} = 25 °C	--	8.57	--	mJ
			T _{vj} = 125 °C	--	17.60	--	
			T _{vj} = 150 °C	--	21.21	--	
R _{thJC}	Thermal resistance, junction to case	per diode		--	0.11	--	K/W
T _{vj op}		Temperature under switching conditions		-40		150 ²⁾	°C

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

Free Wheeling Diodes

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

Symbol	Description	Value	Unit
V _{RRM}	Repetitive Peak Reverse Voltage	1200V	V
I _F	Diode Continuous Forward Current @ T _c =65°C	30	A
I _{FRM}	Diode Maximum Forward Current t _p =1ms	60	A

Characteristics (T_c=25°C unless otherwise noted)

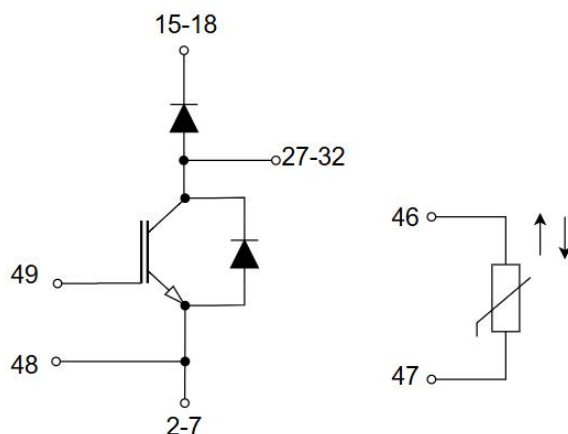
Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V _F	Diode Forward Voltage	I _F =20A	--	1.9	2.5	V
		I _F =40A		2.4	3.2	
		I _F =20A	--	1.8	--	
		I _F =40A		2.2	--	
P _{tot}	total power dissipation	T _c =25°C	--	--	125	W
R _{thJC}	Thermal resistance	Junction-to-Case (per diode)	--	0.89	--	K/W
T _{vj op}		Temperature under switching conditions	-40		150 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 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

