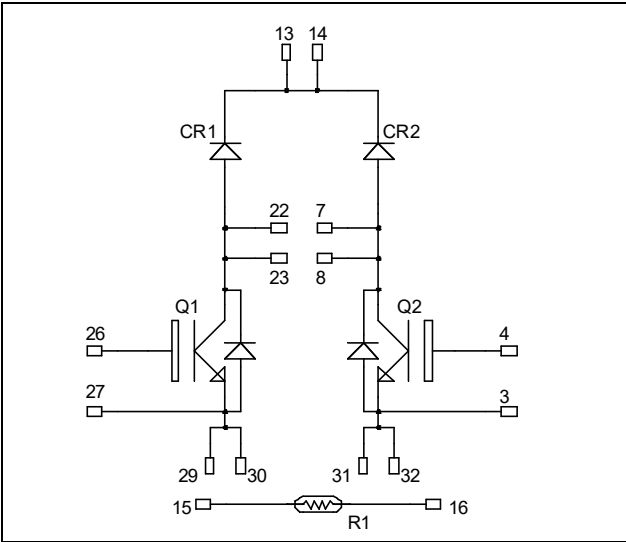


Dual Boost chopper
High speed Trench + Field Stop IGBT4
Power Module

V_{CES} = 1200V
I_C = 40A @ T_c = 80°C

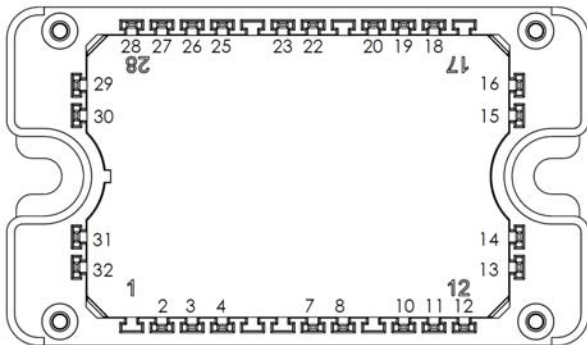


Application

- AC and DC motor control
- Switched Mode Power Supplies
- Power Factor Correction

Features

- **High speed Trench + Field Stop IGBT 4**
 - Low voltage drop
 - Low leakage current
 - Low switching losses
- **Chopper SiC Schottky Diode (CR1, CR2)**
 - Zero reverse recovery
 - Zero forward recovery
 - Temperature Independent switching behavior
 - Positive temperature coefficient on VF
- Kelvin emitter for easy drive
- Very low stray inductance
- Internal thermistor for temperature monitoring



Benefits

- Stable temperature behavior
- Very rugged
- Solderable terminals for easy PCB mounting
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Easy paralleling due to positive TC of V_{CEsat}
- Low profile
- RoHS Compliant

All multiple inputs and outputs must be shorted together
 Example: 13/14 ; 29/30 ; 22/23 ...

All ratings @ T_j = 25°C unless otherwise specified

Q1, Q2 Absolute maximum ratings (per IGBT)

Symbol	Parameter	Max ratings	Unit
V _{CES}	Collector - Emitter Voltage	1200	V
I _C	Continuous Collector Current	T _C = 25°C	75
		T _C = 80°C	40
I _{CM}	Pulsed Collector Current	T _C = 25°C	160
V _{GE}	Gate - Emitter Voltage	±20	V
P _D	Power Dissipation	250	W

These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

 CAUTION:

Q1, Q2 Electrical Characteristics (per IGBT)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I _{CES}	Zero Gate Voltage Collector Current	V _{GE} = 0V, V _{CE} = 1200V			100	μA
V _{CE(sat)}	Collector Emitter Saturation Voltage	V _{GE} = 15V I _C = 40A	T _j = 25°C 1.7	2.05	2.4	V
			T _j = 150°C	2.6		
V _{GE(th)}	Gate Threshold Voltage	V _{GE} = V _{CE} , I _C = 1 mA	5.0	5.8	6.5	V
I _{GES}	Gate – Emitter Leakage Current	V _{GE} = 20V, V _{CE} = 0V			120	nA

Q1, Q2 Dynamic Characteristics (per IGBT)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C _{ies}	Input Capacitance	V _{GE} = 0V V _{CE} = 25V f = 1MHz		2300		pF
C _{oes}	Output Capacitance			150		
C _{res}	Reverse Transfer Capacitance			135		
Q _G	Gate charge	V _{GE} = 15V, I _C = 40A V _{CE} = 960V		185		nC
T _{d(on)}	Turn-on Delay Time	Inductive Switching (25°C) V _{GE} = ±15V V _{Bus} = 600V I _C = 40A R _G = 12Ω		30		ns
T _r	Rise Time			57		
T _{d(off)}	Turn-off Delay Time			290		
T _f	Fall Time			16		
T _{d(on)}	Turn-on Delay Time	Inductive Switching (150°C) V _{GE} = ±15V V _{Bus} = 600V I _C = 40A R _G = 12Ω		30		ns
T _r	Rise Time			49		
T _{d(off)}	Turn-off Delay Time			366		
T _f	Fall Time			48		
E _{on}	Turn on Energy	V _{GE} = ±15V V _{Bus} = 600V I _C = 40A	T _j = 25°C	1.9		mJ
			T _j = 150°C	2.25		
E _{off}	Turn off Energy	R _G = 12Ω	T _j = 25°C	1.2		
			T _j = 150°C	2.25		
I _{sc}	Short Circuit data	V _{GE} ≤ 15V ; V _{Bus} = 600V t _p ≤ 10μs ; T _j = 150°C		150		A
R _{thJC}	Junction to Case Thermal Resistance				0.6	°C/W

CR1, CR2 chopper SiC diode ratings and characteristics (per diode)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V _{RRM}	Peak Repetitive Reverse Voltage				1200	V
I _{RM}	Reverse Leakage Current	V _R = 1200V	T _j = 25°C	150	600	μA
			T _j = 175°C	300	3000	
I _F	DC Forward Current		T _c = 100°C	15		A
V _F	Diode Forward Voltage	I _F = 15A	T _j = 25°C	1.6	1.8	V
			T _j = 175°C	2.6	3	
Q _C	Total Capacitive Charge	I _F = 15A, V _R = 600V di/dt = 1000A/μs		42		nC
C	Total Capacitance	f = 1MHz, V _R = 200V		135		pF
		f = 1MHz, V _R = 400V		99		
R _{thJC}	Junction to Case Thermal Resistance				1	°C/W

IGBT protection diode ratings and characteristics (per diode)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V _{RRM}	Peak Repetitive Reverse Voltage					1200	V
I _{RM}	Reverse Leakage Current	V _R =1200V				250	μA
I _F	DC Forward Current		T _c = 80°C		25		A
V _F	Diode Forward Voltage	I _F = 25A			2.6	3.1	V
		I _F = 50A			3.2		
		I _F = 25A	T _j = 125°C		1.8		
t _{rr}	Reverse Recovery Time	I _F = 25A V _R = 667V di/dt = 200A/μs	T _j = 25°C		320		ns
	T _j = 125°C			360			
Q _{rr}	Reverse Recovery Charge		T _j = 25°C		480		nC
			T _j = 125°C		1800		
R _{thJC}	Junction to Case Thermal Resistance					1.4	°C/W

Temperature sensor NTC (see application note APT0406 on www.microsemi.com).

Symbol	Characteristic	Min	Typ	Max	Unit
R ₂₅	Resistance @ 25°C		50		kΩ
ΔR ₂₅ /R ₂₅			5		%
B _{25/85}	T ₂₅ = 298.15 K		3952		K
ΔB/B			4		%

$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

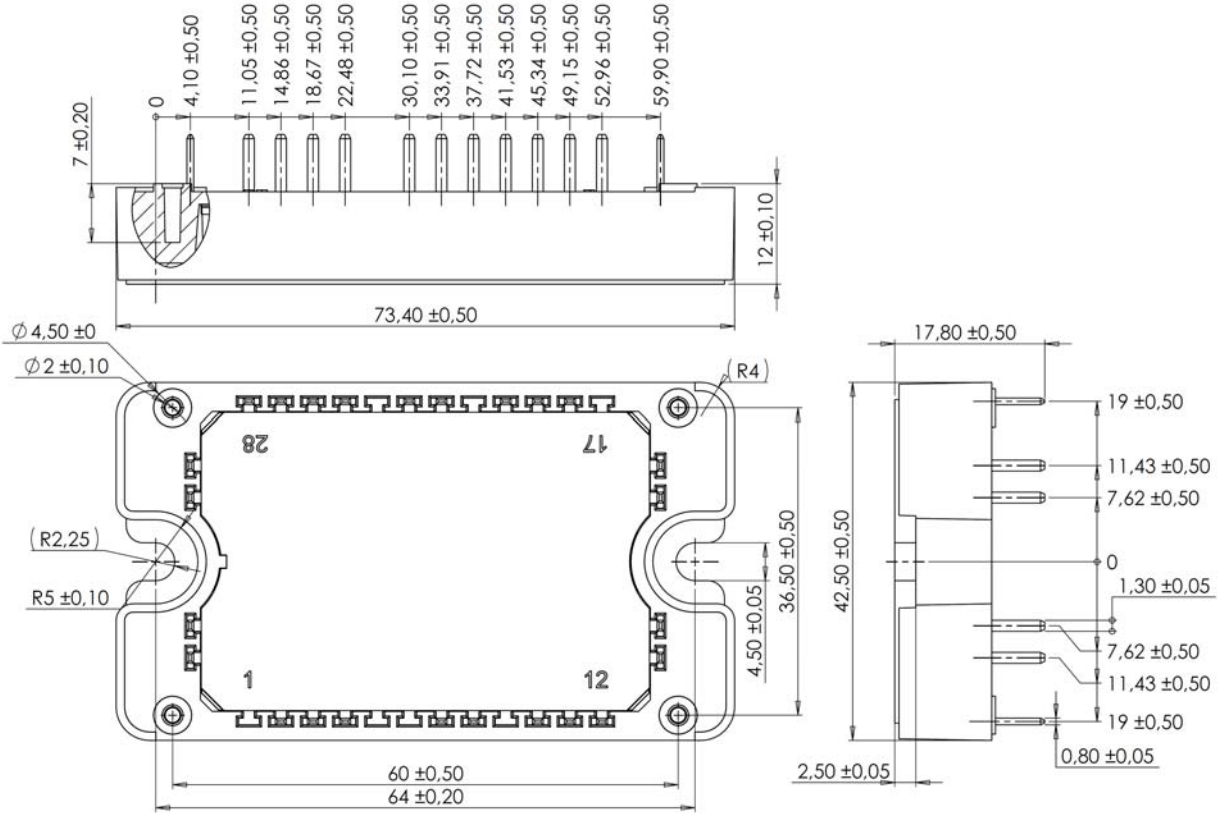
T: Thermistor temperature
R_T: Thermistor value at T

Thermal and package characteristics

Symbol	Characteristic	Min	Max	Unit		
V _{ISOL}	RMS Isolation Voltage, any terminal to case t=1 min, 50/60Hz	4000		V		
T _J	Operating junction temperature range	-40	175*	°C		
T _{JOP}	Recommended junction temperature under switching conditions	-40	T _{Jmax} -25			
T _{STG}	Storage Temperature Range	-40	125			
T _C	Operating Case Temperature	-40	125			
Torque	Mounting torque	To heatsink	M4	2	3	N.m
Wt	Package Weight				110	g

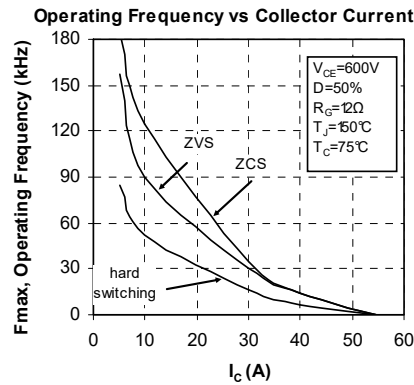
* T_J=150°C for the IGBT protection diode

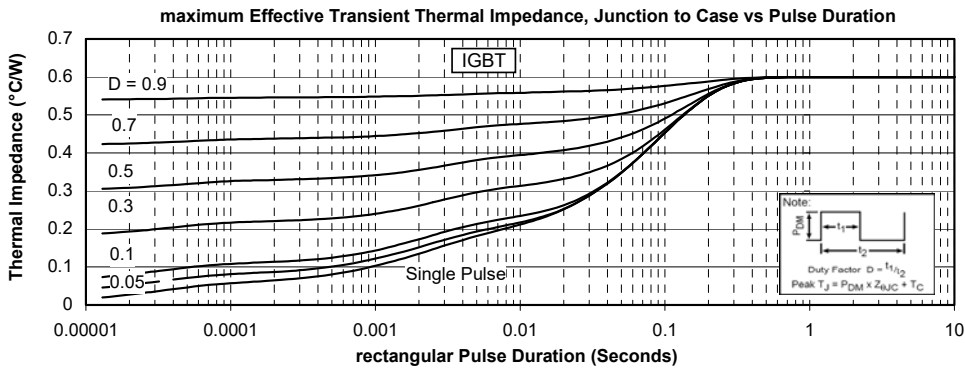
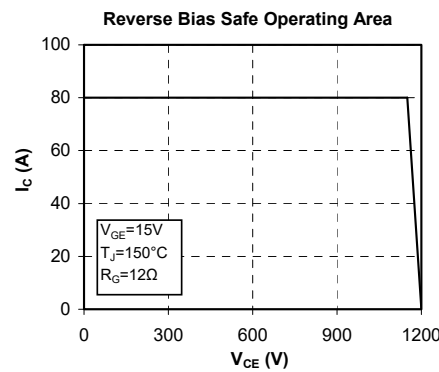
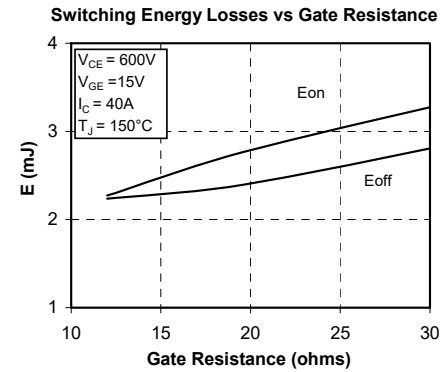
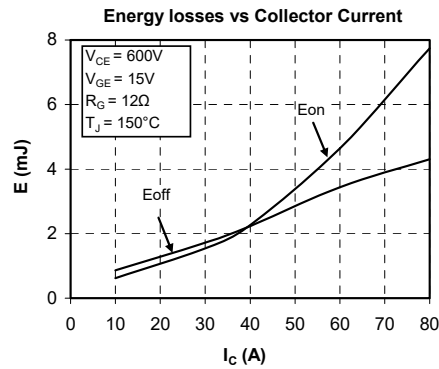
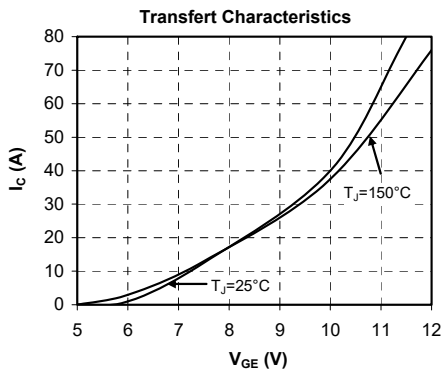
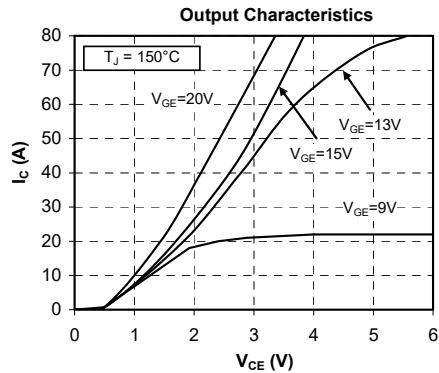
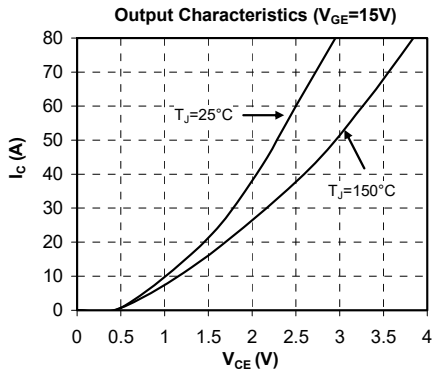
Package outline (dimensions in mm)



See application note 1906 - Mounting Instructions for SP3F Power Modules on www.microsemi.com

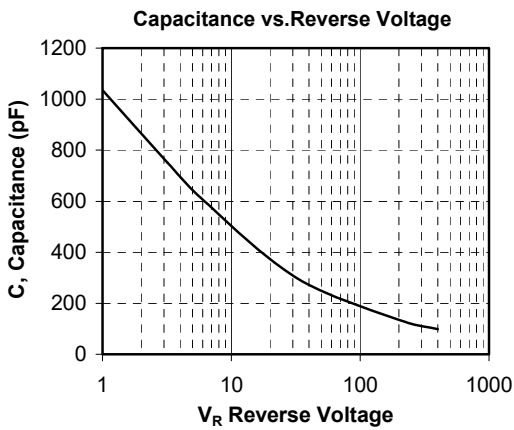
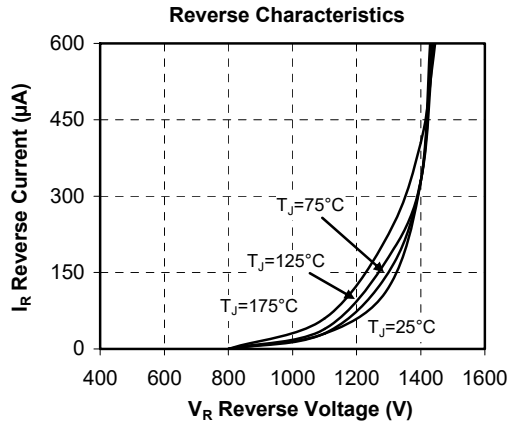
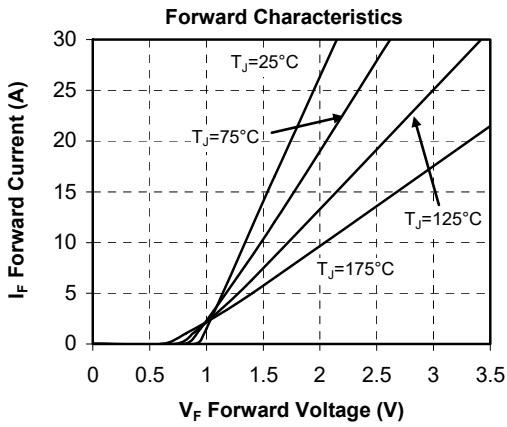
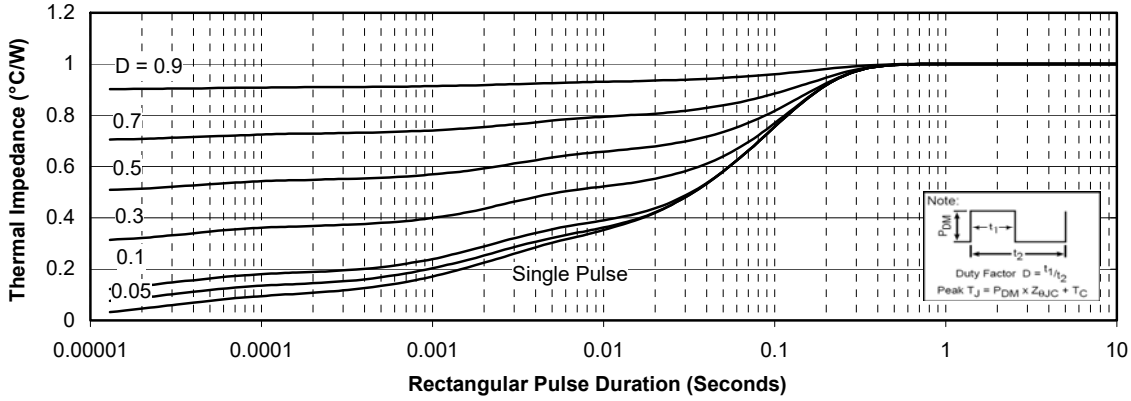
Typical Performance Curve
IGBT





Chopper SiC diode

Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



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