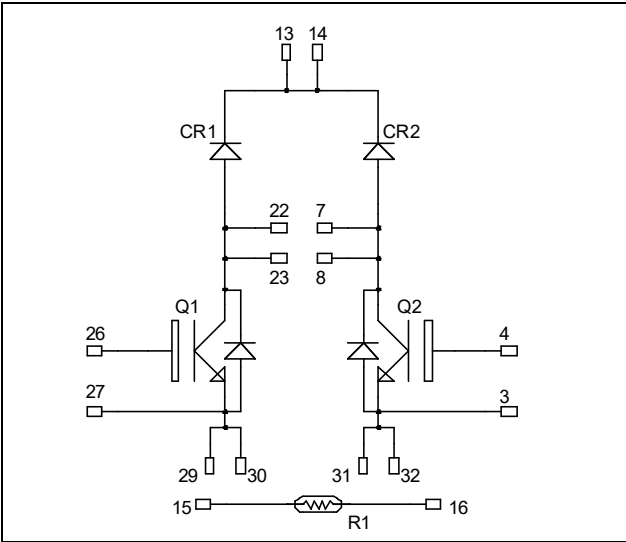


Dual Boost chopper
High speed Trench + Field Stop IGBT4
Power Module

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

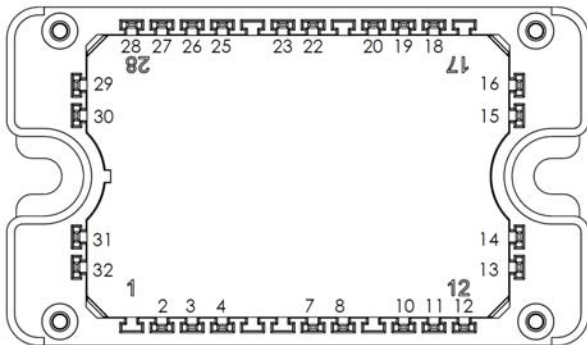


Application

- 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		%

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

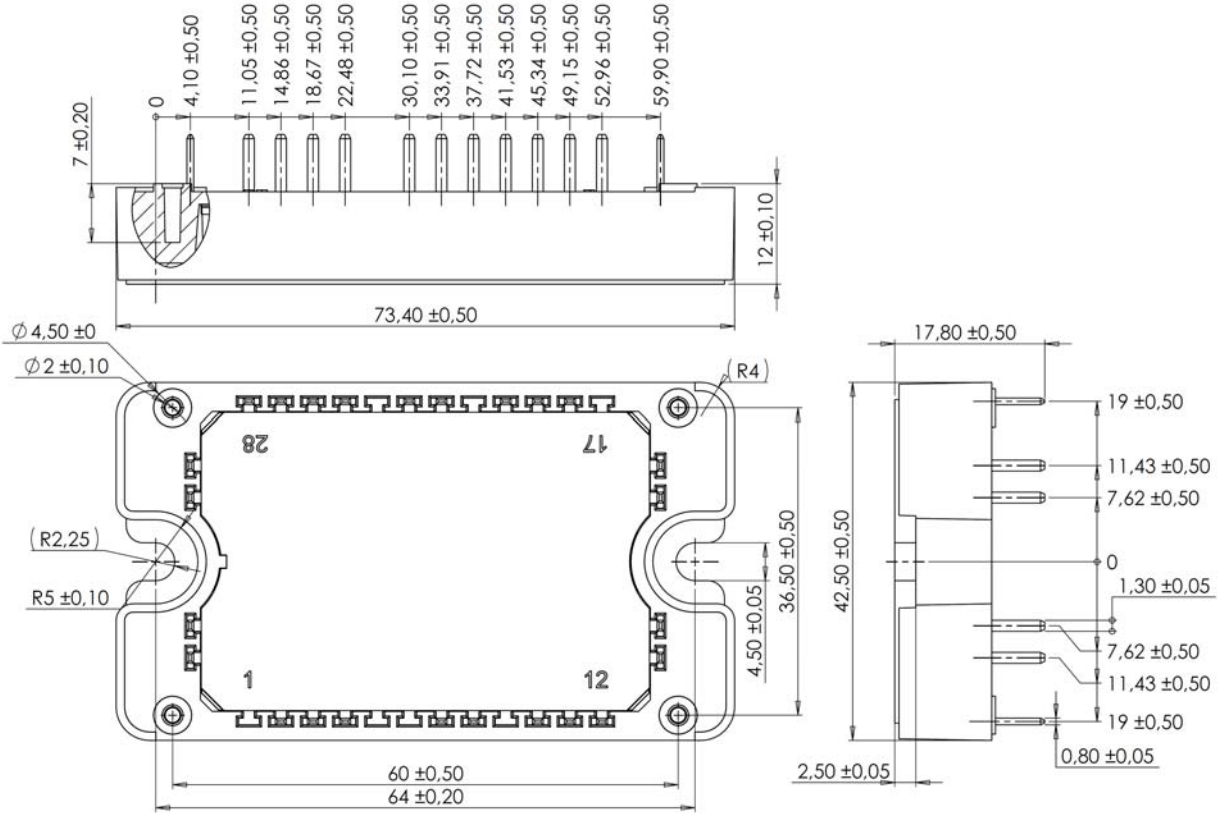
T: Thermistor temperature
R_T: Thermistor value at T

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

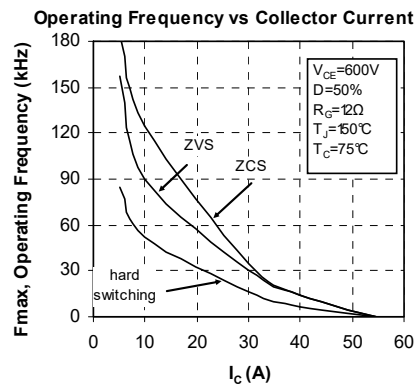
* T_J=150°C for the IGBT protection diode

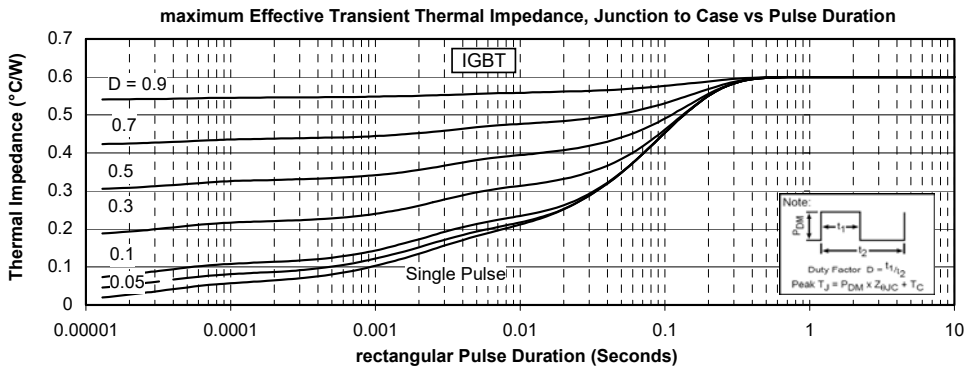
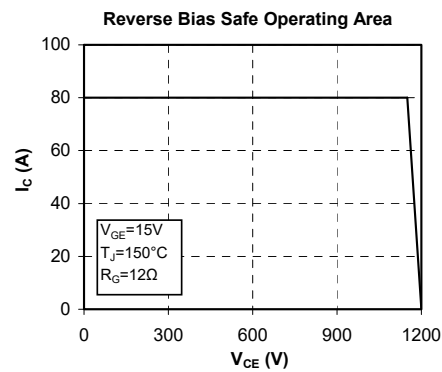
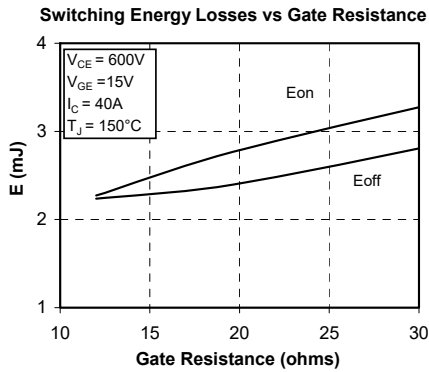
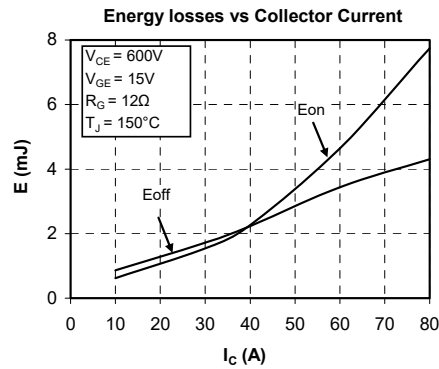
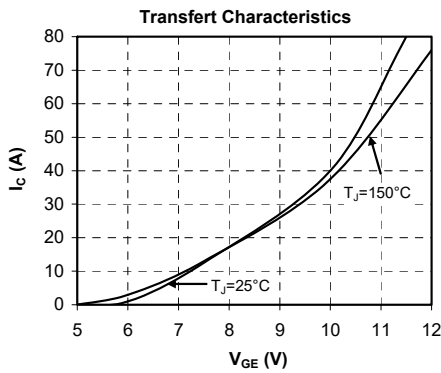
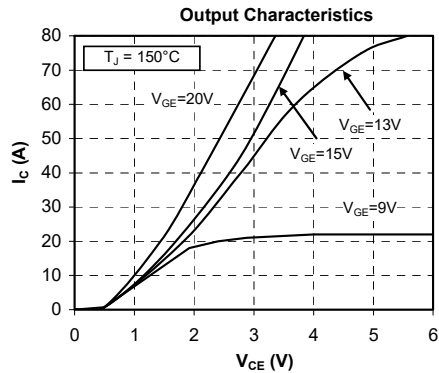
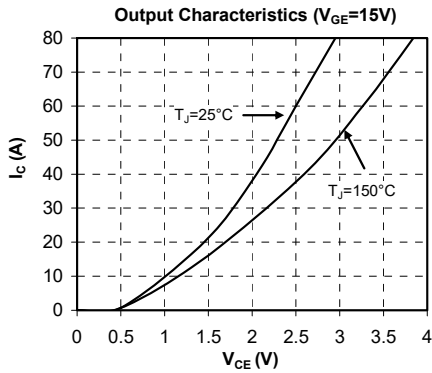
Package outline (dimensions in mm)



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

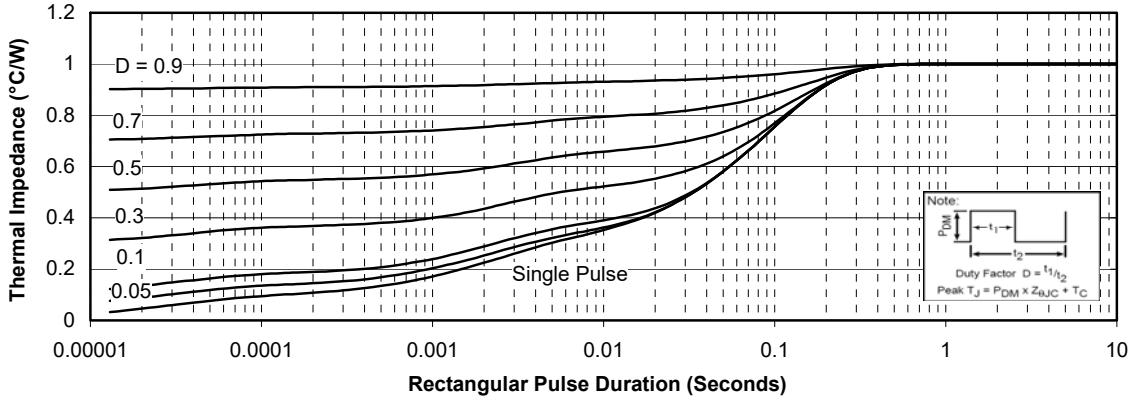
Typical Performance Curve
IGBT



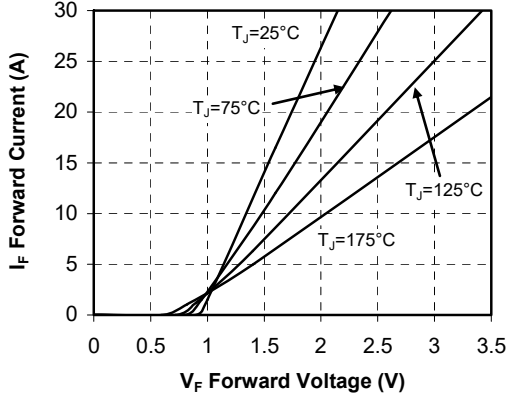


Chopper SiC diode

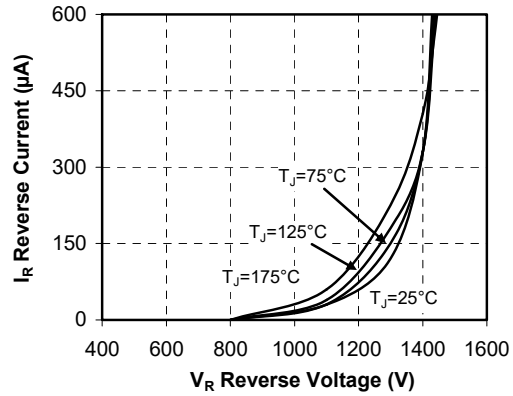
Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



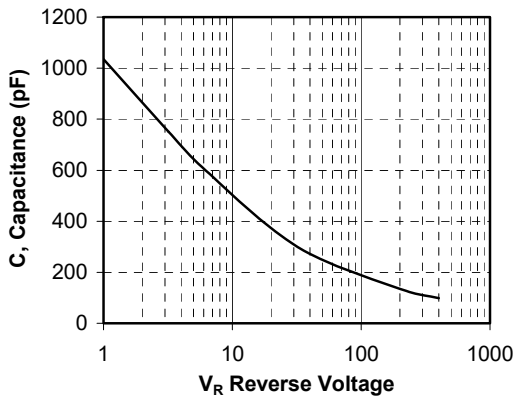
Forward Characteristics



Reverse Characteristics



Capacitance vs. Reverse Voltage



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