3 Phase bridge IGBT4 Power Module
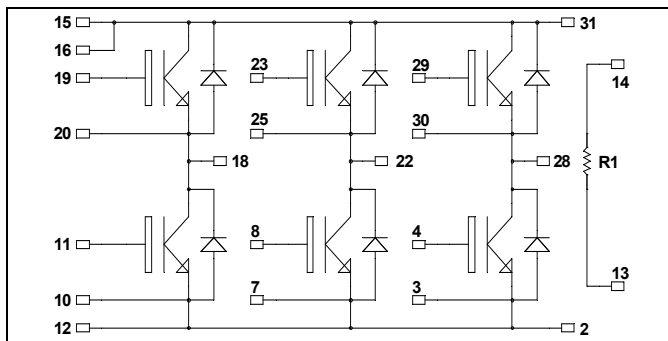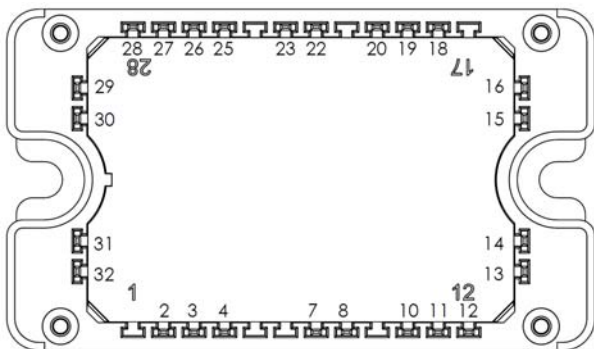
V_{CES} = 1200V
I_C = 40A @ Tc = 100°C

It is recommended to connect a decoupling capacitor between pins 31 & 2 to reduce switching overvoltages, if DC Power is connected between pins 15, 16 & 12.
Pins 15 & 16 must be shorted together.

Application
- Motor control

Features
- **IGBT 4**
  - Low voltage drop
  - Low leakage current
  - Low switching losses
  - Low tail current
- Kelvin emitter for easy drive
- Very low stray inductance
- Internal thermistor for temperature monitoring
- AlN substrate for improved thermal performance

Benefits
- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Solderable terminals both for power and signal for easy PCB mounting
- Low profile
- RoHS compliant

All ratings @ T_j = 25°C unless otherwise specified

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	80	A
		T_C = 100°C	40	
I_{CM}	Pulsed Collector Current	T_C = 25°C	90	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Power Dissipation	T_C = 25°C	312	W

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

Electrical Characteristics (per IGBT)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_{CES}	Zero Gate Voltage Collector Current	$V_{GE} = 0V$, $V_{CE} = 1200V$				250	µA
$V_{CE(sat)}$	Collector Emitter saturation Voltage	$V_{GE} = 15V$ $I_C = 35A$	$T_j = 25°C$		1.85	2.25	V
			$T_j = 150°C$		2.25		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}$, $I_C = 1.2mA$		5.0	5.8	6.5	V
I_{GES}	Gate – Emitter Leakage Current	$V_{GE} = 20V$, $V_{CE} = 0V$				400	nA

Dynamic Characteristics (per IGBT)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
C_{ies}	Input Capacitance	$V_{GE} = 0V$ $V_{CE} = 25V$ $f = 1MHz$			1950		pF
C_{oes}	Output Capacitance				155		
C_{res}	Reverse Transfer Capacitance				115		
Q_G	Gate charge	$V_{GE} = ±15V$; $V_{CE} = 600V$ $I_C = 35A$			0.27		µC
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) $V_{GE} = ±15V$ $V_{CE} = 600V$ $I_C = 35A$ $R_G = 12Ω$			130		ns
T_r	Rise Time				20		
$T_{d(off)}$	Turn-off Delay Time				300		
T_f	Fall Time				45		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (150°C) $V_{GE} = ±15V$ $V_{CE} = 600V$ $I_C = 35A$ $R_G = 12Ω$			150		ns
T_r	Rise Time				35		
$T_{d(off)}$	Turn-off Delay Time				350		
T_f	Fall Time				80		
E_{on}	Turn-on Switching Energy	$V_{GE} = ±15V$ $V_{CE} = 600V$ $I_C = 35A$ $R_G = 12Ω$	$T_J = 150°C$		4		mJ
E_{off}	Turn-off Switching Energy		$T_J = 150°C$		3		mJ
I_{sc}	Short Circuit data	$V_{GE} ≤15V$; $V_{Bus} = 900V$ $t_p ≤10µs$; $T_j = 150°C$			140		A
R_{thJC}	Junction to Case Thermal Resistance					0.48	°C/W

Reverse 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	$V_R = 1200V$				100	µA
I_F	DC Forward Current		$Tc = 100°C$		30		A
V_F	Diode Forward Voltage	$I_F = 30A$			2.6	3.5	V
		$I_F = 60A$			3.2		
		$I_F = 30A$	$T_j = 125°C$		1.8		
t_{rr}	Reverse Recovery Time	$I_F = 30A$ $V_R = 800V$ di/dt $=200A/µs$	$T_j = 25°C$		300		ns
			$T_j = 125°C$		380		
Q_{rr}	Reverse Recovery Charge		$T_j = 25°C$		360		nC
			$T_j = 125°C$		1700		
R_{thJC}	Junction to Case Thermal Resistance					0.84	°C/W

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

| Symbol	Characteristic		Min	Typ	Max	Unit
R_{25}	Resistance @ 25°C			50		kΩ
$\Delta R_{25}/R_{25}$				5		%
$B_{25/85}$	T_{25} = 298.15 K			3952		K
$\Delta B/B$		T_C=100°C		4		%

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

T: Thermistor temperature
R_T: Thermistor value at T
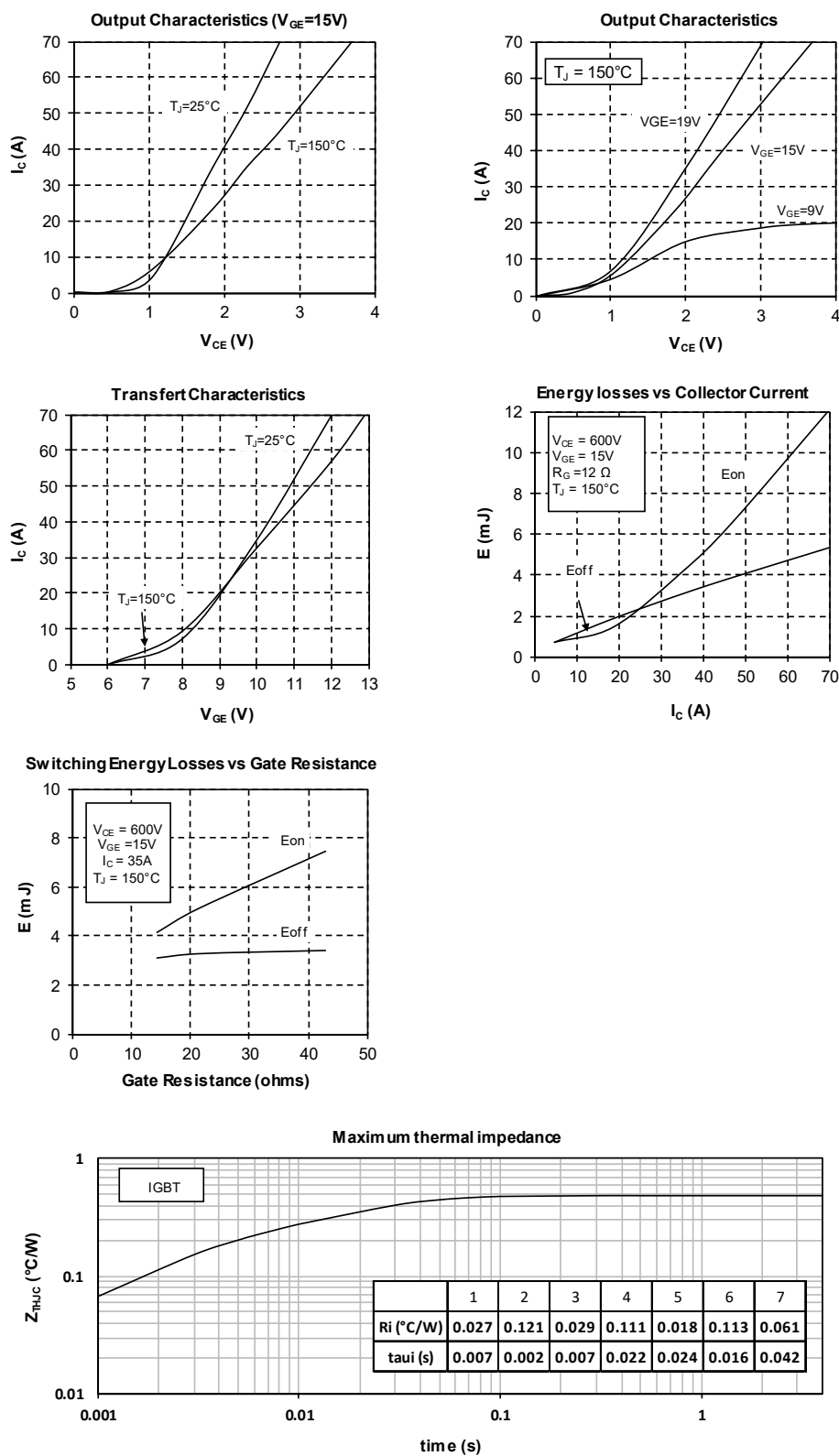
Thermal and package characteristics

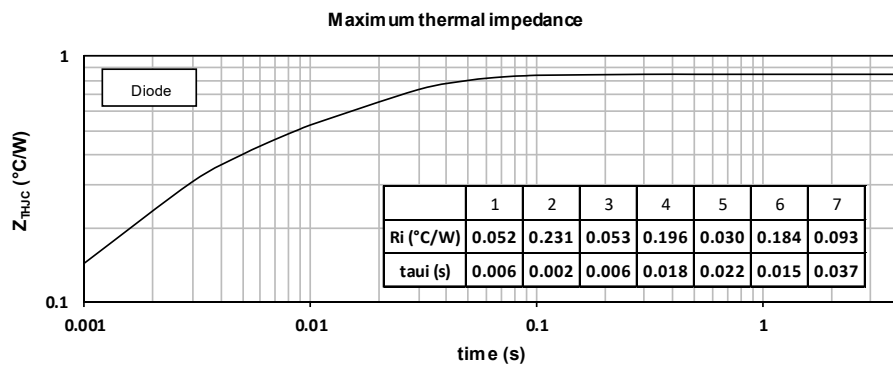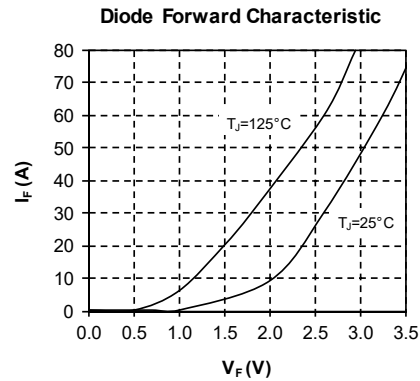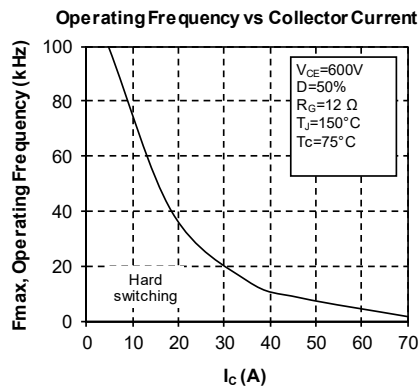| Symbol	Characteristic			Min	Max	Unit
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000		V
T_J	Operating junction temperature range			-40	175	
T_{JOP}	Recommended junction temperature under switching conditions			-40	$T_J$max -25	°C
T_{STG}	Storage Temperature Range			-40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

Package outline (dimensions in mm)
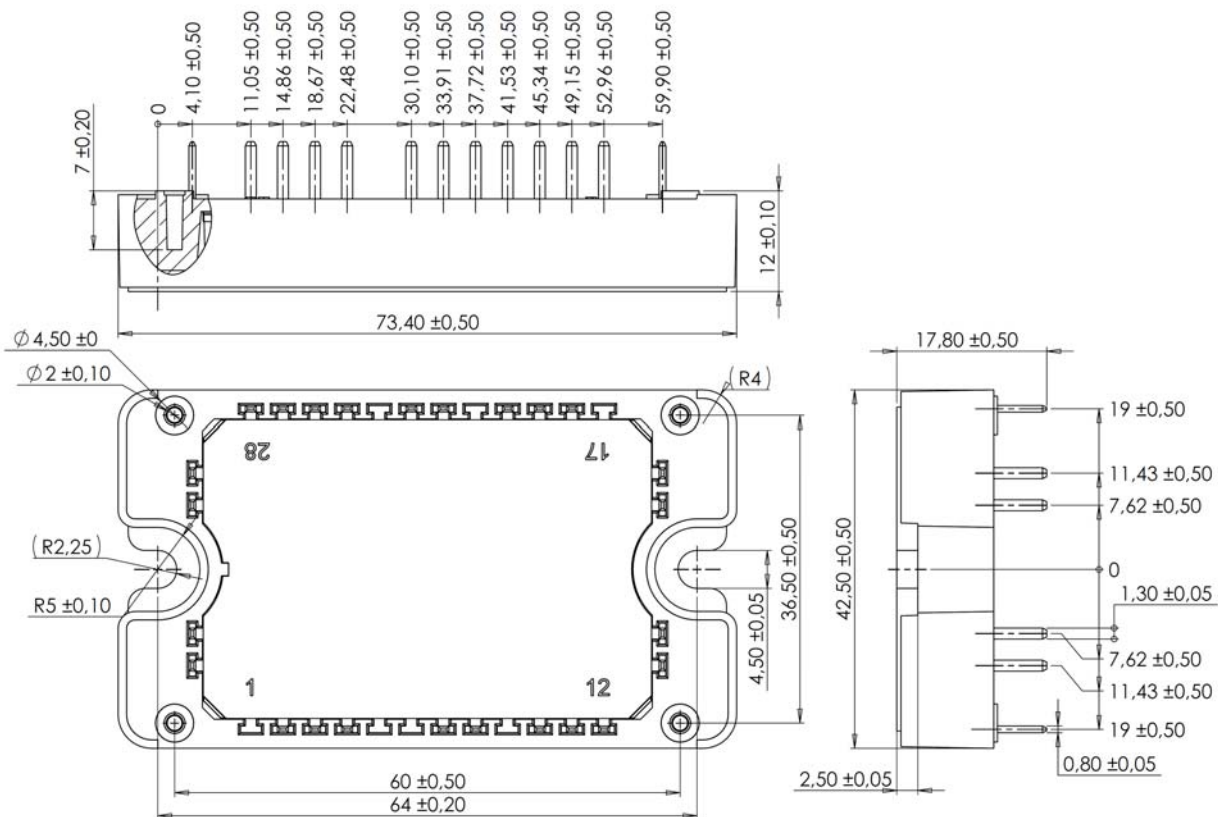
See application note 1906 - Mounting Instructions for SP3F Power Modules on www.microsemi.com

Typical Performance Curve

Output Characteristics (V_{GE}=15V)

I_C (A) vs V_{CE} (V); T_J=25°C, T_J=150°C

Output Characteristics

T_J = 150°C; I_C (A) vs V_{CE} (V); V_{GE}=19V, V_{GE}=15V, V_{GE}=9V

Transfert Characteristics

I_C (A) vs V_{GE} (V); T_J=25°C, T_J=150°C

Energy losses vs Collector Current

V_{CE} = 600V, V_{GE} = 15V, R_G =12 Ω, T_J = 150°C; E (mJ) vs I_C (A); Eon, Eoff

Switching Energy Losses vs Gate Resistance

V_{CE} = 600V, V_{GE} =15V, I_C = 35A, T_J = 150°C; E (mJ) vs Gate Resistance (ohms); Eon, Eoff

Maximum thermal impedance

IGBT; Z_{THJC} (°C/W) vs time (s)

	1	2	3	4	5	6	7
Ri (°C/W)	0.027	0.121	0.029	0.111	0.018	0.113	0.061
taui (s)	0.007	0.002	0.007	0.022	0.024	0.016	0.042

Operating Frequency vs Collector Current

V_{CE}=600V
D=50%
R_G=12 Ω
T_J=150°C
Tc=75°C

Hard switching

Fmax, Operating Frequency (kHz)

I_C (A)

Diode Forward Characteristic

T_J=125°C

T_J=25°C

I_F (A)

V_F (V)

Maximum thermal impedance

Diode

Z_{THJC} (°C/W)

time (s)

	1	2	3	4	5	6	7
Ri (°C/W)	0.052	0.231	0.053	0.196	0.030	0.184	0.093
taui (s)	0.006	0.002	0.006	0.018	0.022	0.015	0.037

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