

Applications for Standard & Custom Low Profile Power Modules



Minimum Size—Maximum Performance!

Renewable Energy



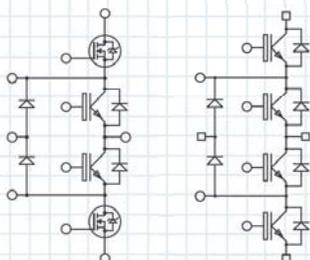
Typical Applications include Solar Inverters 1kW to 50kW, Wind Turbines and Fuel Cells

The Microsemi Advantage

Inverters for renewable energy demand the most efficient semiconductor and power modules to send power from solar panels and wind turbines to the grid.

Microsemi offers:

- Mix of silicon (Trench & CoolMos) for better performance
- SiC diodes for greater efficiency
- High performance base modules versus baseless modules
- New three level topology



Our Value Proposition:

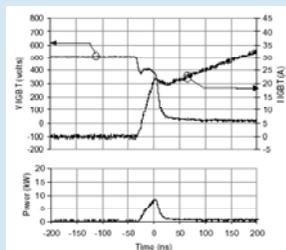
- Same height power module to realize the full inverter system
- SP1, SP3, SP6P offering same 12mm height as SOT-227
- Low stray inductance module for improved efficiency
- Standard configuration with SiC diodes integrated
- Temperature sensor built in
- New Multi Level Converter topology available (Neutral Point Clamped)

Why and When Choose Silicon Carbide?

- Real advantage in hard switching conditions
- Ultra low Qrr leads to reduced switching losses
- Temperature independent switching behavior
- Reduced system size and cost
- Improved system efficiency
- Improved cooling system

Applications:

- PFC
- Output rectifier,
- Freewheeling diode



Solutions for Solar Inverters 1kW to 50kW, Wind Turbines and Fuel Cells

Sample Part Numbers				
Input Rectifier	PFC	Resonant Converter	Output Rectifier	Inverter
APTDR40X1601G	APT50GF60JCU2	APTC60AM24T1G	APTDF100H601G	APTGT100H60T3G
APTDR90X1601G	APT50N60JCCU2	APTGF50A120T1G	APTDF100H1201G	APTGL90H120T3G

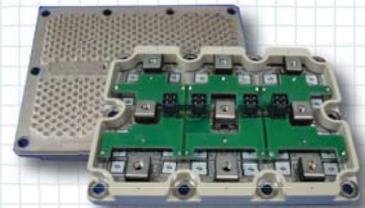
Hybrid and Electric Vehicles

Applications:

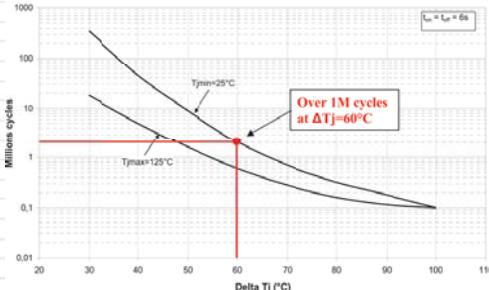
- Power Train up to 120kW
- DC-DC Converter
- Battery Charger

Microsemi offers:

- Greater flexibility in locating terminals
- Low stray inductance packages
- Baseplate models with optional incorporated fins
- Assembly material matched for thermal expansion
- High reliability (AEC Q101 qualification performed)
- Complete product line for low-cost solution
- Mass production manufacturing lines



Power cycling curve (short cycle)



Welding Equipment

Microsemi offers:

- Low RDSon MOSFET High Current Diode
- UltraFast IGBT
- Low Cost Products
- Standard and Custom Copper Baseplate for:
 - Improved Thermal Performance
 - High power Cycling Capabilities

Our Experience:

- 30% of Power Module Sales
- 10 year old Design still on market
- Up to 50K EAU per Reference
- Very high customer satisfaction
- Zero field return



Applications:

- MIG/MAG Welders
- Plasma Cutters
- TIG AC & DC Welders
- STUD Welding

Induction Heating

Applications:

- Induction heating from 10kW to 500kW

Microsemi advantages:

- Unique high voltage power MOSFET range:
 - 1000V and 1200V
- Easy paralleling of power modules
- Low profile package design dedicated to high frequency
- 500kHz operating frequency capability with MOSFET
- Various topologies available with series and parallel fast diodes
- Dedicated topologies for ZVS and ZCS mode application
- Fast IGBT combinations for resonant mode up to 100kHz



SP6

Aerospace / Military

Applications:

- Modules are used in aircraft for flight actuators, air conditioning, fuel pumps and cooling & chilling systems. They are also used in naval vessels, ground vehicles and back-up power systems.

Microsemi offers:

- Thermal expansion material matching for increased power and temperature cycling performance.
- Flexibility in design to develop any kind of shape and size power module.
- Withstands temperatures from -60°C to +200°C
- Hermetic sealed modules capabilities
- Light material for aerospace application
- Short development cycle
- Qualification test and Screening to customer specification
- No quantity limitation

Our Experience:

- 15 year old design still on market
- Thousands in the field, no returns
- Numerous developments for demonstrator
- Strong technical expertise and support



	Material	CTE (ppm/K)	Thermal conductivity (W/m.K)	Density (g/cc)
Base plate	CuW	6.5	190	17
	AlSiC	7	170	2.9
	Cu	17	390	8.9
Substrate	Al ₂ O ₃	7	25	-
	AlN	5	170	-
	Si ₃ N ₄	3	60	-
Die	Si	4	136	-
	SiC	2.6	270	-

	CTE (ppm/K)	Thermal conductivity (W/m.K)	Rthjc (K/W)
Silicon Die(120 mm ²)	4	136	
Cu/Al ₂ O ₃	17/7	390/25	0.35
AlSiC/Al ₂ O ₃	7/7	170/25	0.385
Cu/AlN	17/5	390/170	0.28
AlSiC/AlN	7/5	170/170	0.31
AlSiC/Si ₃ N ₄	7/3	170/60	0.31

