



# Microsemi Power Semiconductors

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## **Power Surface Mount**

	Schottky	Ultrafast (FRED)	Rectifiers
Mini-Mod	80A: FST8035SM to 150SM FST8135SM to 45SM FST8230SM	70A: UFT7010SM to 20SM UFT7120SM to 50SM UFT7250SM to 80SM	Consult Factory
Small Pin Mini-Mod	60A: FST6130 to 45 FST6210 to 30 FST6380 to 100 FST6435 to 50	Consult Factory	Consult Factory
Mini-Mod	80A: FST8035 to 150 FST8115 to 45 FST8230 FST8335 to 45 FST8515	70A: UFT7010 to 20 UFT7120 to 50 UFT7250 to 80	Consult Factory

## **Discrete Modules**

	Schottky	Ultrafast (FRED)	Rectifiers
Half Pack			
	120A: HS12035 to 45	100A: HU10005 to 20	Consult Factory
	HS12135 to 45	HU10120 to 50	
	HS12230	HU10260 to 80	
	HS12380 to 100	200A: HU20010 to 20	
	HS12510 to 15	HU20130 to 50	
	HS126150	HU20260 to 80	
	180A: HS18035 to 45		
	HS18135 to 45		
	HS18230		
	HS18380 to 100		
	HS18515		
	240A: HS24035 to 45		
	HS24135 to 45		
	HS24230		
	HS24380 to 100		
	HS24510 to 15		
	HS24515		
SDM			
	Consult Factory	Consult Factory	300A:SDM30002 to 160
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### **Power Modules**

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	Schottky	Ultrafast (FRED)	Rectifiers
T0249			
	100A: FST10030 to 45	100A: UFT14010 to 20	Consult Factory
	160A: FST16035 to 100	UFT14130 to 50	
	FST16135 to 45	UFT14250 to 80	
	FST16230	200A: UFT21010 to 20	
	200A: FST190035 to 50	UFT21130 to 50	
	FST19235 to 45	UFT21260 to 80	
200-		300A: SSUM300120	
9 PIN TO249			
	60A: FST6035 to 100	100A: UFT10010 to 20	Consult Factory
	100A: FST10130 to 45	UFT10130 to 50	
	150A: FST15035 to 45	UFT10260 to 80	
	FST15135 to 50		
- IIIII	FST15230		
	FST15515		
Cillino.	FST15380 to 100		
	300A: FST19330 to 45		
Non-isolated TO249			
	170A: FS117140 to 50	Consult Factory	Consult Factory

Consult Factory or our web site for competitor cross reference or specific customer requirements.

## **Power Modules**

	Schottky	Ultrafast (FRED)	Rectifiers
0244AB			
	200A: 1N6459 to 60	Consult Factory	Consult Factory
	FST20035 to 50		
	300A: FST30035 to 50		
U.S.			
win Tower			
	120A: CPT12035 to 50	120A: UFT12505 to 20	300A: TDM15002 to 16
	200A: CPT20010 to 100	UFT12620 to 50	600A: TDM30002 to 16
C C	CPT20130 to 45	UFT12760 to 80	
OB	CPT20230	200A: UFT20005 to 20	
	300A: CPT30035 to 100	UFT20120 to 50	
	CPT30135 to 45	UFT20260 to 80	
	CPT30230	400A: UFT40010 to 20	
	400A: CPT40035 to 100	UFT40130 to 50	
	CPT40135 to 45	UFT40260 to 80	
	500A: CP150035 to 100		
	CP150235 to 45		
	600A: CP160035 to 150		
	GP 160 135 (0 45		
)T227(Isoblock)			
	200A: SPB10015 to 100	240A: UFPB6050	Consult Factory
	200A: SSPB100120*		
	320A: SPB16015 to 100		
A STATE OF			
	* Supercoff		

## **High Voltage Assemblies**

	Rectifiers						
EF	1.25A: EFFH16 to H20   1.25A: EFLH16 to H20   1.25A: EFTH16 to H20   2.5A: EF30FH16 to 20   2.5A: EF30LH16 to 20   2.5A: EF30LT16 to 20						
		5					

### **Bridge Rectifiers and Quick Connects**



# **Single Phase Bridges**

		Kec	timers		rasi	
NA, NB						
	25A:	679-1	10A: 680-1	20A: 683-1	10A	: 684-1
D.	1	679-2	680-2	683-2		684-2
R O	ŧ	679-3	680-3	683-3		684-3
		679-4	680-4	683-4		684-4
		679-5	680-5	683-5		684-5
		679-6	680-6	683-6		684-6
					Ultrafas	st
MA, MB						
	Con	sult Factory	/	35A: 802-1	22.5A:	803-1
<u>.</u>				802-2		803-2
				802-3		803-3
				802-4		803-4
MD						
	10A:	JAN469-1	*	Consult Fa	ctory	
		JAN469-2	*			
e cons		JAN409-3	9-1*			
		JANTX46	9-2*			
		JANTX469	9-3*			
MB						
	25A:	JANSPA2	5^ 5*	Consult Fa	ctory	
		JANSPB2	ว 5*			
		JANSPD2	5*			
	* MIL C	Qualification F	Pending. MIL Equivaler	ts Available.		

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## **Three Phase Bridges**

	Rect	ifiers	Fa	st	Ultraf	ast
ИС	25A: 678-1 678-2 678-3 678-4 678-5 678-6	15A: 695-1 695-2 695-3 695-4 695-5 695-6	20A: 682-1 682-2 682-3 682-4 682-5 682-6	15A: 696-1 696-2 696-3 696-4 696-5 696-6	Consult Facto	pry
	J 75A: JANT) JANT) JANT)	X483-1* X483-2* X483-3*	Consult Fac	tory	40A: 800-1 2 800-2 800-3 800-4	25A:801-1 801-2 801-3 801-4

\* MIL Qualification Pending. MIL Equivalents Available.

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### **Rectifier Doublers and Center Tap**

	Rectifiers	Fast	
ND			
	15A: 681-1P, N, D	15A: 689-1P, N, D	
2	681-2P, N, D	689-2P, N, D	
	681-3P. N. D	689-3P. N. D	
	681-4P. N. D	689-4P. N. D	
	681-5P. N. D	689-5P. N. D	
A CONTRACTOR OF THE OWNER	681-6P N D	689-6P N D	
C.	001-01, 14, D		
WF			
	Consult Factory	20A: 804-1P. N. D	
		804-2P N D	
		804-3P N D	
		004-5F, N, D	

# Microsemi High-Rel Power Modules



Microsemi's patented hermetic surface mount devices - CoolPack<sup>™</sup>, ThinKey<sup>™</sup>, and Slugger<sup>™</sup> - provide light weight, low thermal resistance, extreme thermal cycling capability, rugged ceramic-tometal seals, and construction that allows for pre-cap inspection prior to seal, resulting in very high reliability. All three device types have over 5 years with multiple qualifications to both JANTX and JANS-Level equivalent (per Mil-PREF-19500) and are on multiple military and space programs.

A unique design feature of Microsemi's high power surface mount devices is that no soft solders (Pb/Sn) are used in the construction of the devices, including die attach and hermetic seal. Only high temperature eutectic hard solders (such as Au/Sn) are used. This eliminates the possibility of solder creep and re-crystallization during Intermittent Operational Life Testing, power cycling, multiple TVS surges, and high temperature storage. The die attach and seal will remain virtually the same throughout the entire operational life of the device.

Devices are available in commercial, JANTX, JANTXV, and JANS-Level equivalents per Mil-PREF-19500. Discretes are supplied in waffle pack or tape-and-reel. Lead free devices are readily available. Electrically matched discretes are also available.

#### **CoolPack<sup>™</sup> Surface Mount Packaging**

CoolPack is a chip-and-wire package designed for three-terminal devices including MOSFETs, IGBTs, SCRs and center tap diodes. It provides more rugged ceramic construction, lighter weight and cost savings compared to conventional through-hole devices such as TO-254 packaging. CoolPack devices are available in commercial, JANTXV and JANS equivalent screening.





- Three CoolPack sizes available to hold up to a size #9 die
- All aluminum-to-aluminum mono-metallic wire bonds
- Rugged thick walled ceramic construction
- 0.040" min isolation for up to 1000V without added dielectric
- Low inductance: leads have no ferrous materials
- CoolPack1 is 6X lighter than conventional TO-254 packages
- Low thermal resistance, 0.3°C/W for size # 6 die
  - Available with protection diodes and gate resistors within the package

	Co	olPack	r™ <b>1</b>	Co	olPack	™ <b>2</b>
	AAtio	Non		AAlur	New	
	Min	Nom	Max	Min	Nom	max
A Inches	.640	.655	.670	.785	.800	.815
A Millimeters	16.26	16.64	17.02	19.94	20.32	20.70
B Inches	.435	.450	.465	.535	.550	.565
<b>B</b> Millimeters	11.05	11.43	11.81	13.59	13.97	14.35
C Inches	.110	.125	.140	.125	.140	.155
C Millimeters	2.79	3.18	3.56	3.18	3.56	3.94
D Inches	.415	.420	.425	.505	.510	.515
D Millimeters	10.54	10.67	10.80	12.83	12.95	13.08
E Inches	.385	.390	.395	.505	.510	.515
E Millimeters	9.78	9.91	10.03	12.83	12.95	13.08
F Inches	.170	.175	.180	.215	.220	.225
F Millimeters	4.32	4.45	4.57	5.46	5.59	5.72
G Inches	.180	.185	.190	.180	.185	.190
G Millimeters	4.57	4.70	4.83	4.57	4.70	4.83
H Inches	.040			.040		
H Millimeters	1.02			1.02		
J Inches	.060	.070	.080	.060	.070	.080
J Millimeters	1.52	1.78	2.03	1.52	1.78	2.03

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#### **ThinKey<sup>™</sup> Surface Mount Packaging**

Greater reliability, high surge capability, and weight reduction are hallmarks of Microsemi's patented ThinKey surface mount package. There are 4 ThinKey sizes, Thinkey 1, 2, 3, and 4, available ranging from 25 to 200A current carrying capability. ThinKeys are available as a Schottky (25-150A), rectifier (25-200A), and TVS (up to 30KW, 10/1000 us waveform).





- Double-plug construction, no wire bonds
- Low inductance
- High surge capability
- Surface mount with strap on anode or cathode
- Weight 9X lighter than conventional TO-254 packaging
- Low thermal resistance (0.2-0.85°C/W)
- Easy pre-cap inspection prior to seal
- JANTXV1N6872-6905 & 6910-6942,
- (MIL-PREF-19500/719-726)

	25A				75A			100A			150A			
	ThinKey™2			ThinKey™ 4			ThinKey™ 1			ThinKey™ 3				
	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max		
A Inches	.230	.240	.250	.320	.330	.340	.368	.378	.388	.420	.430	.440		
A Millimeters	5.84	6.10	6.35	8.13	8.38	8.64	9.35	9.60	9.86	10.67	10.92	11.18		
B Inches	.085	.100	.115	.135	.150	.165	.135	.150	.165	.185	.200	.215		
B Millimeters	2.16	2.54	2.92	3.43	3.81	4.19	3.43	3.81	4.19	4.70	5.08	5.46		
C Inches	.293	.313	.333	.378	.398	.418	.421	.441	.461	.469	.489	.509		
C Millimeters	7.44	7.95	8.46	9.60	10.11	10.62	10.69	11.20	11.71	11.91	12.42	12.93		
D Inches	.055	.065	.075	.055	.065	.075	.055	.065	.075	.055	.065	.075		
D Millimeters	1.40	1.65	1.91	1.40	1.65	1.91	1.40	1.65	1.91	1.40	1.65	1.91		
E Inches		.023			.032			.030			.038			
E Millimeters		0.58			0.81			0.76			0.97			
F Inches	0.171	0.176	0.181	.251	.256	.261	.289	.294	.299	.331	.336	.341		
F Millimeters	4.34	4.47	4.60	6.38	6.50	6.63	7.34	7.47	7.59	8.41	8.53	8.66		
G Inches		.040			.040			.040			.040			
G Millimeters		1.02			1.02			1.02			1.02			
H Inches			.125			.125			.125			.125		
H Millimeters			3.18			3.18			3.18			3.18		
J Inches	.005	.010	.015	.005	.010	.015	.005	.010	.015	.005	.010	.015		
J Millimeters	0.13	0.25	0.38	0.13	0.25	0.38	0.13	0.25	0.38	0.13	0.25	0.38		



### Slugger<sup>™</sup> Surface Mount Packaging

Slugger packaging provides advantages similar to those of ThinKey devices, but is constructed specifically for rectifier and TVS devices. It is designed with a doubleplug, metallurgical bond, like ThinKey, and eliminates all the problems encountered with wire bonds.

Two versions are available, Slugger 1 and 2. Slugger 1 is the low profile version and can be supplied as a 50A rectifier or 5KW TVS (10/1000 us waveform) and Slugger2 can be supplied as a 5-20 KW TVS (10/1000 us waveform).



Slugger <sup>™</sup> 1	MIN.	MAX.
a (inches)	.220	.230
a (mm)	5.59	5.84
B (INCHES) B (MM)	.010 .25	
C (INCHES) C (MM)		.090 2.28
d (inches)	.315	.335
d (mm)	8.00	8.50
e (inches)	.008	.012
e (mm)	.20	.30
F (INCHES)	.055	.075
F (MM)	1.40	1.91
G (INCHES)	.407	.447
G (MM)	10.34	11.35
h (inches)	.035	.055
h (mm)	.89	1.40
J (INCHES)	.072	.102
J (MM)	1.83	2.60
k (inches)	.140	.160
k (mm)	3.56	4.06

Slugger <sup>™</sup> 2	MIN.	MAX.
A (INCHES)	.220	.230
A (MM)	5.59	5.84
B (INCHES) B (MM)	.060 1.52	
C (INCHES) C (MM)		.150 3.81
d (Inches)	.315	.335
d (mm)	8.00	8.50
e (inches)	.008	.012
e (mm)	.20	.30
f (INCHES)	.055	.075
f (MM)	1.40	1.91
G (INCHES)	.407	.447
G (MM)	10.34	11.35
h (Inches)	.035	.055
h (mm)	.89	1.40
J (INCHES)	.072	.102
J (MM)	1.83	2.60
k (inches)	.140	.160





- Two models:
- Slugger1 for die < 500V</li>
- Slugger2 for up to 5 TVS die in series
- No wire bonds:
- Acceleration n/a
- High Surge Capability
- Low Inductance
- Compressive forces increase heat transfer for TVS die
- 10X lighter weight than conventional TO-254 packages
- Low thermal resistance (0.4°C/W)
- Easy pre-cap inspection prior to seal



#### **Hermetic Power Module Design Concepts**

CoolPack<sup>™</sup>, ThinKey<sup>™</sup> and Slugger<sup>™</sup> provide unique building blocks to create power modules having light weight, high thermal conductivity for heat dissipation/thermal management, thermal expansion matched materials and enormous flexibility throughout their design and manufacture for high reliability applications. We design these functional block modules using discrete semiconductors of our own manufacture, as well as readily-available high reliability passive and active devices of your choosing. Significant cost, weight and space savings are possible when we combine sections of your power circuits in an assembly created from our patented surface mount packages. Additional cost savings come from reduced assembly costs installing a completed HPM compared with installing and testing multiple discrete devices.

Custom prototypes can be created with faster turnaround for even the most demanding applications. The up front costs such as tooling and non-recurring engineering (NRE) charges are much less than a hybrid approach. In addition, since the HPM approach uses individual hermetic discrete devices, the HPM can be re-worked with relative ease and minimal costs. Microsemi has the ability to build prototype units and ship to our customer for in-circuit testing. If one or more of the discretes need to be changed due to electrical damage or a different electrical parameter is needed to optimize the circuit performance, the unit(s) can be sent back to Microsemi for new discrete devices to be installed and returned for additional testing.

Module Number	Module Type	Screening Level	Program
MM006	Switching FET	TX	EFA
MM007	Rad Hard MOSFET	S	SBIRS
MM008	Rad Hard MOSFET	S	SBIRS
MM011	Diode	TX	EFA
MM023	Schottky	S	EOS
MM030	TVS	TX	NAVY
MM031	Diode	S	Various
MM032	MOSFET	TX	GLOBAL HAWK
MM037	Diode/Schottky	S	EOS
MM053	Rad Hard MOSFET	S	HELIOS 2
MM068	MOSFET	TX	Various
MM078	Diode/Schottky	S	Various
MM090	Diode	TX	EFA
MM099	Rad Hard MOSFET	S	HELIOS 2
MM100	Rad Hard MOSFET	S	HELIOS 2
MM101	Rad Hard MOSFET	S	HELIOS 2
MM117	Schottky	S	Titan
MM128	By-Pass (Diode)	S	Various
MM130	TVS	TX	EFA

### **Microsemi Hermetic Module Construction Technique**

The typical (standard) Hermetic Power Module (HPM) construction utilizes standard materials and processes that have been well established over the years. These standard materials and processes are used to create custom power circuits. The result is a high reliability application specific HPM circuit that can pass all Quality Conformance Inspection (QCI) tests. Commercial, TX, TXV and JANS equivalent screening levels are available. Our construction employs five process steps:

- Hermetic discrete devices are built and screened to the appropriate level (i.e. TX or S-level equivalent). Known good devices are used for module construction.
- 2. Terminals are brazed to the substrate at 800°C using Cu/Ag eutectic.
- Mounting base plate and substrate are attached in a vacuum to minimize voids.
- 4. Module is populated with discrete devices at 215°C.
- Module is tested and screened to the appropriate level (i.e. TX or S-level equivalent) including QCI samples. Discrete devices get re-screened as part of the module to insure quality.

### Microsemi builds hermetic power modules from four basic elements:

- 1. The active and passive devices pre-screened to the appropriate level, i.e. TX or S-level equivalent
- 2. The substrate, which provides the power circuit and isolation from the base, typically Alumina DBCu (8/25/8 mil).
- 3. Terminals/Interconnects made of steel or copper alloy.
- 4. The baseplate/heatsink typically made of Al composite, Al alloy, or Cu/Mo/Cu.

#### **Hermetic Power Module Configurations**

#### **Custom Data sheets**

Below is an example of a typical hermetic module configurations using Microsemi's patented surface mount technology. Significant flexibility exists to create ultimate shapes and contents that fit and function perfectly within an overall system design. Integrated drivers and passive components are available on modules.

Microsemi can assign a unique part number - with an accompanying data sheet and detailed manufacturing Process Specification - for customer CoolPack, ThinKey, Slugger, and Power Modules that require specific mechanical outlines, electrical test, electrical performance, and/or screening.

Many customers take advantage of this service to avoid having to write and maintain costly Source Control Drawings (SCD) for parts having special needs.

Once Microsemi receives customer approval, unique part numbers and data sheets are kept and maintained by Microsemi. This allows customers to place purchase orders using their special part numbers. All mechanical, electrical, and screening is guaranteed by the Microsemi Process Specification. If there is a customer SCD, Microsemi processes according to the SCD.

#### **Benefits of Unique Part Numbering**

- Eliminates need to write and maintain Source Control Drawings
- All Process Specifications are derived from MIL-PRF-19500
- MIL-PRF-19500 Equivalent devices provide
  - Traceability
  - 100% Screening
  - Quality Conformance Inspection (QCI)
  - Process Change Control
  - Data and Data Archiving
- Provides availability of devices not previously available, with appropriate screening
- Provides availability of hermetic devices with insufficient volume to justify QPL qualification



#### **Power Module Types**

- 3-Phase Bridge (Diode, MOSFET, IGBT)
- High Power TVS
- H-Bridge (MOSFET, IGBT)
- Battery By-Pass (Ni/H2, Li-ion)
- High Voltage
- Schottky
- Integrated Passive Components
- Many other custom designs
- Commercial, TX, TXV, and, JANS equivalent
- screening levels available per MSC PS11.50











#### **Power Semiconductors**

#### SALES

Microsemi Corporation 8700 East Thomas Road Scottsdale, AZ 85252 USA Phone: (480) 941-6300 Fax: (480) 947-1503

#### **EUROPEAN SALES**

Microsemi Corporation Gort Road Ennis, County Clare Ireland Phone: 353-65-68 40044 Fax: 353-65-68 22298

www.microsemi.com



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