



Power Semiconductors

Commercial & High-Rel • Discretes & Modules



Microsemi.



Microsemi Power Semiconductors

Commercial

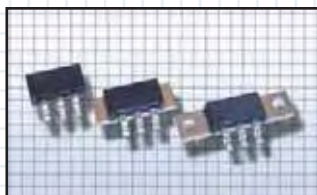
Power Surface Mounts	3
Discrete Modules	4
Power Modules	4-5
High Voltage Assemblies	5
Bridge Rectifiers and Quick Connects	6
Single Phase Bridges	7
Three Phase Bridges	8
Rectifier Doublers and Center Tap Assemblies	8
Commercial Packages and Dimensions	18

High-Rel Modules

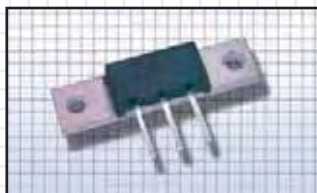
CoolPack™	10
ThinKey™	11
Slugger™	12
HPM Design Concepts	13
HPM Construction Techniques	14-15
HPM Configurations	16-17

Power Surface Mount

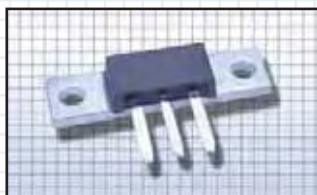
Mini-Mod



Small Pin Mini-Mod



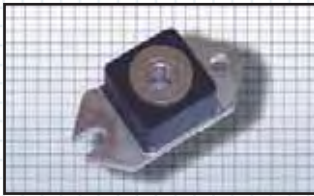
Mini-Mod



Schottky	Ultrafast (FRED)	Rectifiers
80A: FST8035SM to 150SM FST8135SM to 45SM FST8230SM	70A: UFT7010SM to 20SM UFT7120SM to 50SM UFT7250SM to 80SM	Consult Factory
60A: FST6130 to 45 FST6210 to 30 FST6380 to 100 FST6435 to 50	Consult Factory	Consult Factory
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

Half Pack



SDM



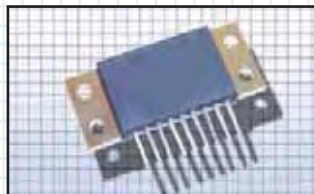
Schottky	Ultrafast (FRED)	Rectifiers
120A: HS12035 to 45 HS12135 to 45 HS12230 HS12380 to 100 HS12510 to 15 HS126150 180A: HS18035 to 45 HS18135 to 45 HS18230 HS18380 to 100 HS18515 240A: HS24035 to 45 HS24135 to 45 HS24230 HS24380 to 100 HS24510 to 15 HS24515	100A: HU10005 to 20 HU10120 to 50 HU10260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

Power Modules

T0249



9 PIN T0249



Non-isolated T0249



Schottky	Ultrafast (FRED)	Rectifiers
100A: FST10030 to 45 160A: FST16035 to 100 FST16135 to 45 FST16230 200A: FST190035 to 50 FST19235 to 45	100A: UFT14010 to 20 UFT14130 to 50 UFT14250 to 80 200A: UFT21010 to 20 UFT21130 to 50 UFT21260 to 80 300A: SSUM300120	Consult Factory
60A: FST6035 to 100 100A: FST10130 to 45 150A: FST15035 to 45 FST15135 to 50 FST15230 FST15515 FST15380 to 100 300A: FST19330 to 45	100A: UFT10010 to 20 UFT10130 to 50 UFT10260 to 80	Consult Factory
170A: FST17140 to 50	Consult Factory	Consult Factory

Power Modules

TO244AB



Twin Tower



SOT227(Isoblock)

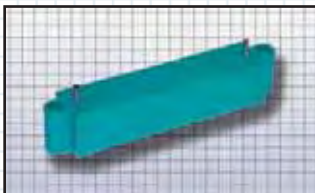


Schottky	Ultrafast (FRED)	Rectifiers
200A: 1N6459 to 60 FST20035 to 50 300A: FST30035 to 50	Consult Factory	Consult Factory
120A: CPT12035 to 50 200A: CPT20010 to 100 CPT20130 to 45 CPT20230 300A: CPT30035 to 100 CPT30135 to 45 CPT30230 400A: CPT40035 to 100 CPT40135 to 45 500A: CPT50035 to 100 CPT50235 to 45 600A: CPT60035 to 150 CPT60135 to 45	120A: UFT12505 to 20 UFT12620 to 50 UFT12760 to 80 200A: UFT20005 to 20 UFT20120 to 50 UFT20260 to 80 400A: UFT40010 to 20 UFT40130 to 50 UFT40260 to 80	300A: TDM15002 to 16 600A: TDM30002 to 16
200A: SPB10015 to 100 200A: SSPB100120* 320A: SPB16015 to 100	240A: UFPB6050	Consult Factory

* Supersoft

High Voltage Assemblies

EF



Rectifiers
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

Bridge Rectifiers and Quick Connects

ER



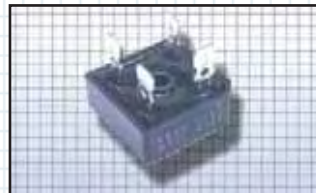
VJ



EH



KBPC



Power EH



KP Quick Connect



Rectifiers

4A: 1 phase: ERF2B1 to 16B1
1 phase: ERL2B1 to 16B1

10A: 1 phase: VJ247M to 847M
1 phase: VJ248M to 1048M
10A: 1 phase fast recovery: VJ248XM to 648XM

12A: 1 phase: EHF2B1 to 16B1
1 phase: EHS2B1 to 16B1
16A: 3 phase: EHF2Z1 to 16Z1
3 phase: EHS2Z1 to 16Z1

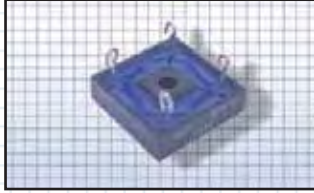
30A: 1 phase: KBPC3027 to 67
1 phase: VK227 to 267

60A: 1 phase: EH6002B to 12B
75A: 1 phase: EH7502B to 12B
80A: 3 phase: EH8002Z to 12Z1
100A: 3 phase: EH10002Z to 12Z1
150A: 3 phase: positive EH150Y2 to 14
3 phase: negative EHY150Q2 to 14

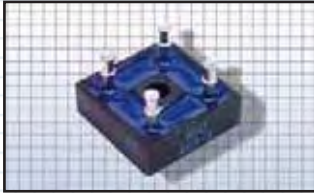
5A: KP247 to 647
KP248 to 1048

Single Phase Bridges

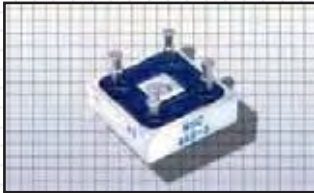
NA, NB



MA, MB



MD



MB



Rectifiers

25A: 679-1	10A: 680-1
679-2	680-2
679-3	680-3
679-4	680-4
679-5	680-5
679-6	680-6

Consult Factory

10A: JAN469-1*
JAN469-2*
JAN469-3*
JANTX469-1*
JANTX469-2*
JANTX469-3*

25A: JANSPA25*
JANSPB25*
JANSPC25*
JANSPD25*

Fast

20A: 683-1	10A: 684-1
683-2	684-2
683-3	684-3
683-4	684-4
683-5	684-5
683-6	684-6

Ultrafast

35A: 802-1	22.5A: 803-1
802-2	803-2
802-3	803-3
802-4	803-4

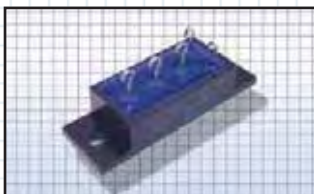
Consult Factory

Consult Factory

* MIL Qualification Pending. MIL Equivalents Available.

Three Phase Bridges

NC



ME



Rectifiers	Fast	Ultrafast
25A: 678-1 15A: 695-1 678-2 695-2 678-3 695-3 678-4 695-4 678-5 695-5 678-6 695-6	20A: 682-1 15A: 696-1 682-2 696-2 682-3 696-3 682-4 696-4 682-5 696-5 682-6 696-6	Consult Factory
75A: JANTX483-1* JANTX483-2* JANTX483-3*	Consult Factory	40A: 800-1 25A: 801-1 800-2 801-2 800-3 801-3 800-4 801-4

* MIL Qualification Pending. MIL Equivalents Available.

Rectifier Doublers and Center Tap

ND



MF



Rectifiers	Fast
15A: 681-1P, N, D 681-2P, N, D 681-3P, N, D 681-4P, N, D 681-5P, N, D 681-6P, N, D	15A: 689-1P, N, D 689-2P, N, D 689-3P, N, D 689-4P, N, D 689-5P, N, D 689-6P, N, D
Consult Factory	20A: 804-1P, N, D 804-2P, N, D 804-3P, N, D 804-4P, N, D

Microsemi High-Rel Power Modules



Microsemi's patented hermetic surface mount devices - CoolPack™, ThinKey™, and Slugger™ - provide light weight, low thermal resistance, extreme thermal cycling capability, rugged ceramic-to-metal 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.

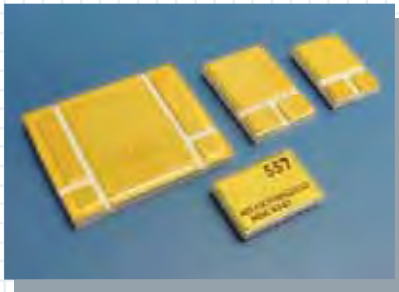
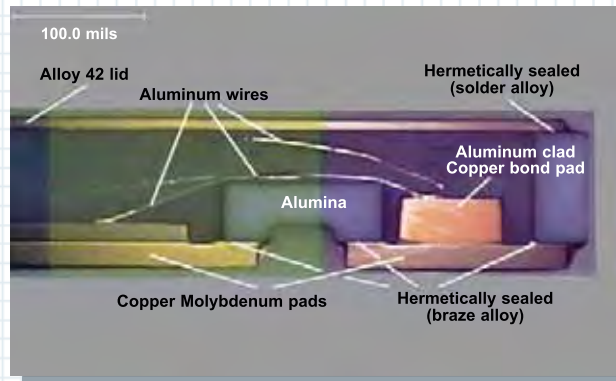
A unique design feature of Microsemi's high power surface mount devices is that no soft solders (Pb/Sn) are used in the construction of the devices, including die attach and hermetic seal.

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.

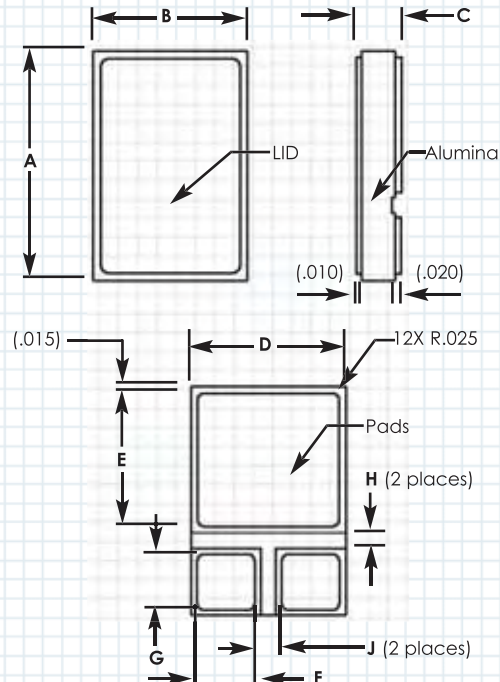
CoolPack™ Surface Mount Packaging

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.



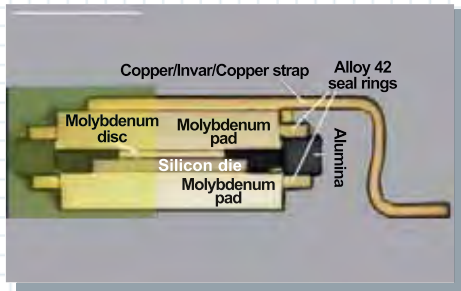
- Three CoolPack sizes available to hold up to a size #9 die
- All aluminum-to-aluminum mono-metallic wire bonds
- Rugged thick walled ceramic construction
- 0.040" min isolation for up to 1000V without added dielectric
- Low inductance: leads have no ferrous materials
- CoolPack1 is 6X lighter than 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

	CoolPack™ 1			CoolPack™ 2		
	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 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



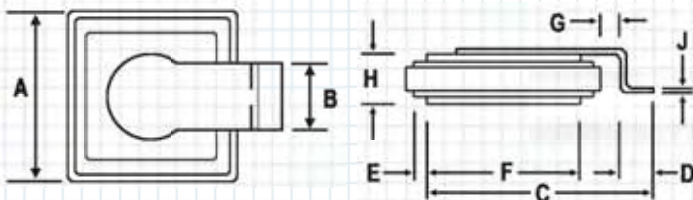
ThinKey™ Surface Mount Packaging

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)

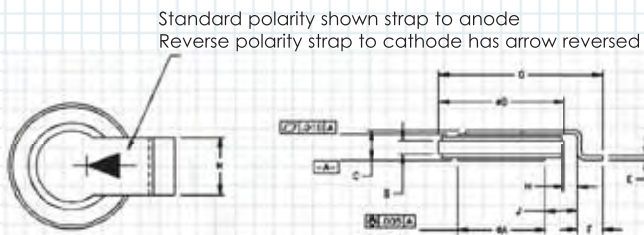
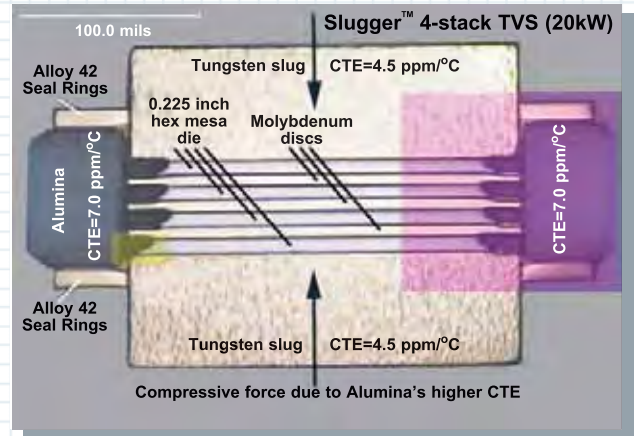
	25A			75A			100A			150A		
	ThinKey™ 2			ThinKey™ 4			ThinKey™ 1			ThinKey™ 3		
	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
A Inches	.230	.240	.250	.320	.330	.340	.368	.378	.388	.420	.430	.440
A Millimeters	5.84	6.10	6.35	8.13	8.38	8.64	9.35	9.60	9.86	10.67	10.92	11.18
B Inches	.085	.100	.115	.135	.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



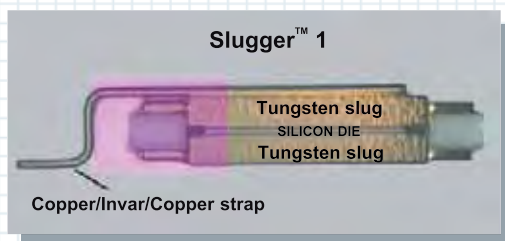
Slugger™ Surface Mount Packaging

Slugger packaging provides advantages similar to those of ThinKey devices, but is constructed specifically for rectifier and TVS devices. It is designed with a double-plug, 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™1	MIN.	MAX.	Slugger™2	MIN.	MAX.
A (INCHES)	.220	.230	A (INCHES)	.220	.230
A (MM)	5.59	5.84	A (MM)	5.59	5.84
B (INCHES)	.010		B (INCHES)	.060	
B (MM)	.25		B (MM)	1.52	
C (INCHES)		.090	C (INCHES)		.150
C (MM)		2.28	C (MM)		3.81
D (INCHES)	.315	.335	D (INCHES)	.315	.335
D (MM)	8.00	8.50	D (MM)	8.00	8.50
E (INCHES)	.008	.012	E (INCHES)	.008	.012
E (MM)	.20	.30	E (MM)	.20	.30
F (INCHES)	.055	.075	F (INCHES)	.055	.075
F (MM)	1.40	1.91	F (MM)	1.40	1.91
G (INCHES)	.407	.447	G (INCHES)	.407	.447
G (MM)	10.34	11.35	G (MM)	10.34	11.35
H (INCHES)	.035	.055	H (INCHES)	.035	.055
H (MM)	.89	1.40	H (MM)	.89	1.40
J (INCHES)	.072	.102	J (INCHES)	.072	.102
J (MM)	1.83	2.60	J (MM)	1.83	2.60
K (INCHES)	.140	.160	K (INCHES)	.140	.160
K (MM)	3.56	4.06	K (MM)	3.56	4.06



- Two models:
 - ♦ Slugger1 for die < 500V
 - ♦ 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™, ThinKey™ and Slugger™ 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.

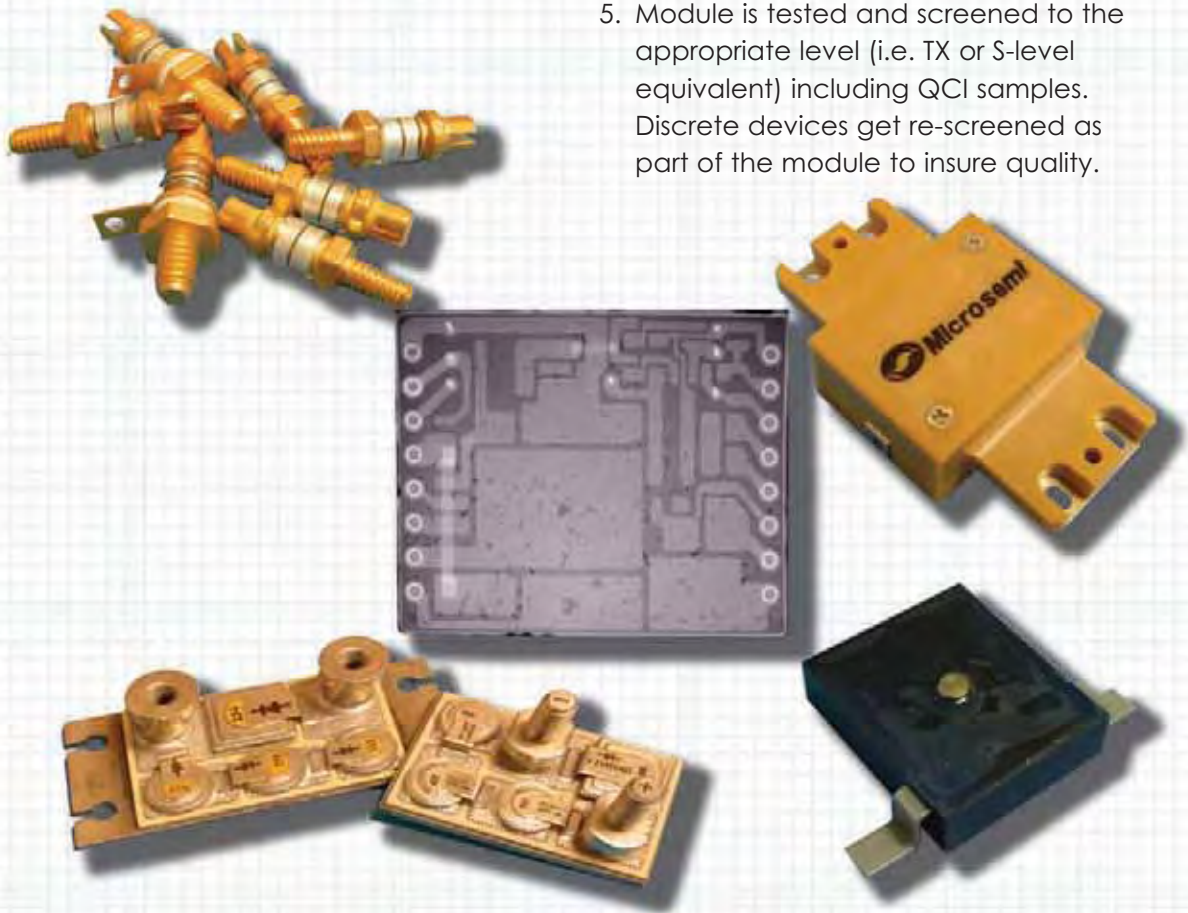
Module Number	Module Type	Screening Level	Program
MM006	Switching FET	TX	EFA
MM007	Rad Hard MOSFET	S	SBIRS
MM008	Rad Hard MOSFET	S	SBIRS
MM011	Diode	TX	EFA
MM023	Schottky	S	EOS
MM030	TVS	TX	NAVY
MM031	Diode	S	Various
MM032	MOSFET	TX	GLOBAL HAWK
MM037	Diode/Schottky	S	EOS
MM053	Rad Hard MOSFET	S	HELIOS 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:

1. 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.
3. Mounting base plate and substrate are attached in a vacuum to minimize voids.
4. Module is populated with discrete devices at 215°C.
5. 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.

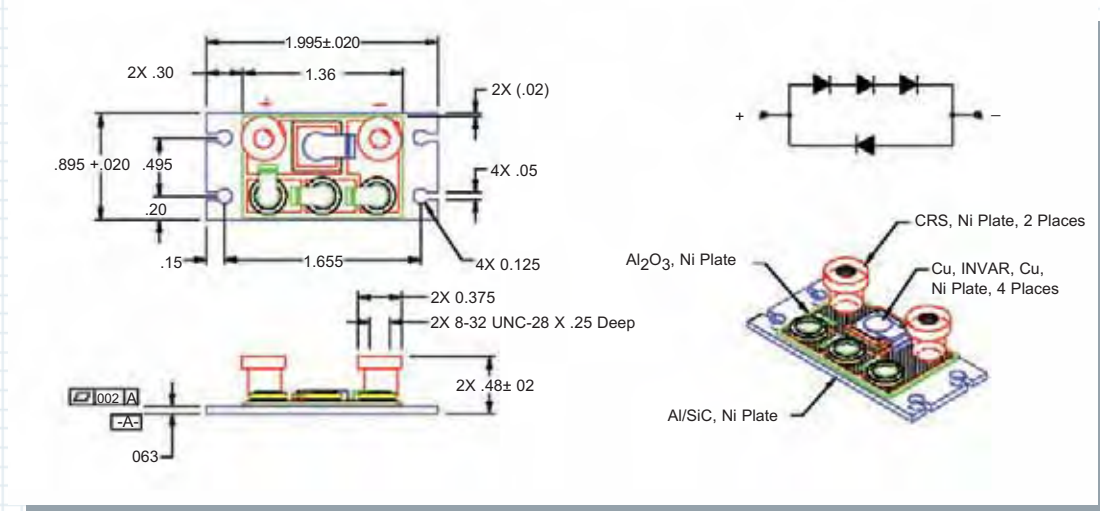
Many customers take advantage of this service to avoid having to write and maintain costly Source Control Drawings (SCD) for parts having special needs.

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.

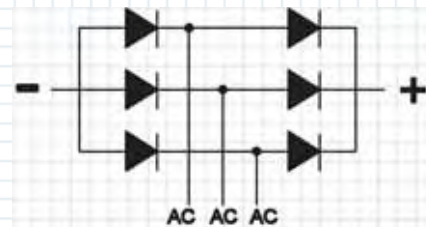
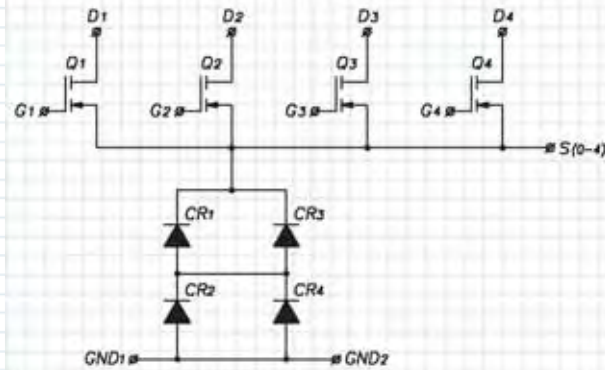
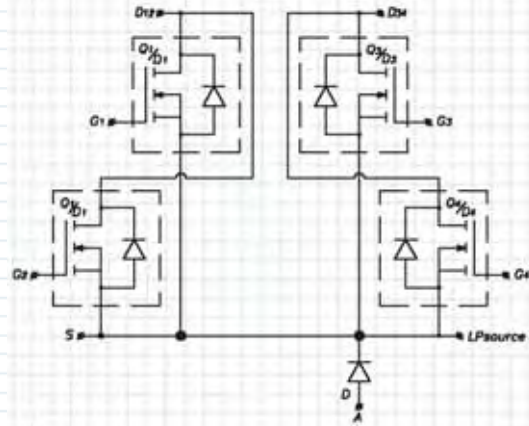
Benefits of Unique Part Numbering

- 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

