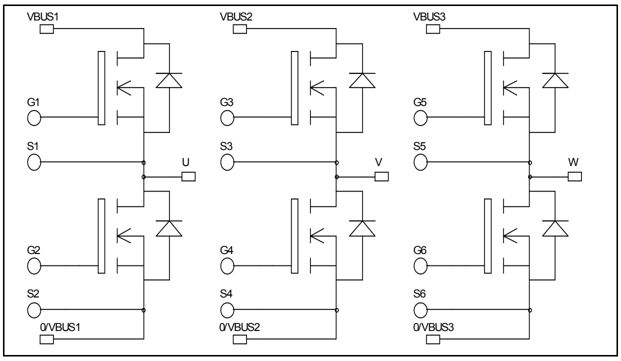
Microsemi POWER PRODUCTS GROUP

APTM08TAM04PG

Triple phase leg MOSFET Power Module

V_{DSS} = 75V
R_{DSon} = 4.2mΩ max @ Tj = 25°C
I_D = 120A @ Tc = 25°C

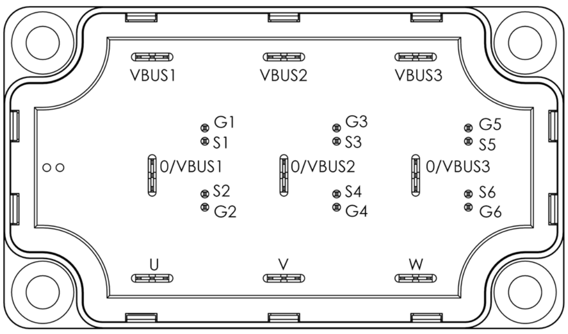


Application

- Welding converters
- Switched Mode Power Supplies
- Uninterruptible Power Supplies
- Motor control

Features

- Power MOSFETs
  - Low R_{DSon}
  - Low input and Miller capacitance
  - Low gate charge
  - Fast intrinsic diode
  - Avalanche energy rated
  - Very rugged
- Kelvin source for easy drive
- Very low stray inductance
  - Symmetrical design
  - Lead frames for power connections
- High level of integration



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
- Very low (12mm) profile
- Each leg can be easily paralleled to achieve a phase leg of three times the current capability
- Module can be configured as a three phase bridge
- Module can be configured as a boost followed by a full bridge
- RoHS Compliant

Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{DSS}	Drain - Source Breakdown Voltage		75	V
I_D	Continuous Drain Current	T_c = 25°C	120	A
		T_c = 80°C	90	
I_{DM}	Pulsed Drain current		250	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		4.5	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	138	W
I_{AR}	Avalanche current (repetitive and non repetitive)		75	A
E_{AR}	Repetitive Avalanche Energy		50	mJ
E_{AS}	Single Pulse Avalanche Energy		1500	

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed. See application note APT0502 on www.microsemi.com

All ratings @ $T_j = 25°C$ unless otherwise specified

Electrical Characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_{DSS}	Zero Gate Voltage Drain Current	$V_{GS} = 0V, V_{DS} = 75V$	$T_j = 25°C$			100	µA
		$V_{GS} = 0V, V_{DS} = 60V$	$T_j = 125°C$			250	
$R_{DS(on)}$	Drain – Source on Resistance	$V_{GS} = 10V, I_D = 60A$			4.2	4.5	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 1mA$		2		4	V
I_{GSS}	Gate – Source Leakage Current	$V_{GS} = \pm 30$ V, $V_{DS} = 0V$				±100	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{GS} = 0V$ $V_{DS} = 25V$ f = 1MHz		4530		pF
C_{oss}	Output Capacitance			1080		
C_{rss}	Reverse Transfer Capacitance			450		
Q_g	Total gate Charge	$V_{GS} = 10V$ $V_{Bus} = 60V$ I_D =120A		153		nC
Q_{gs}	Gate – Source Charge			25		
Q_{gd}	Gate – Drain Charge			82		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** $V_{GS} = 15V$ $V_{Bus} = 40V$ $I_D = 120A$ $R_G = 5Ω$		35		ns
T_r	Rise Time			60		
$T_{d(off)}$	Turn-off Delay Time			100		
T_f	Fall Time			65		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 25°C** $V_{GS} = 15V$, $V_{Bus} = 40V$ $I_D = 120A$, $R_G = 5Ω$		290		µJ
E_{off}	Turn-off Switching Energy			317		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** $V_{GS} = 15V$, $V_{Bus} = 40V$ $I_D = 120A$, $R_G = 5Ω$		319		µJ
E_{off}	Turn-off Switching Energy			336		

Source - Drain diode ratings and characteristics

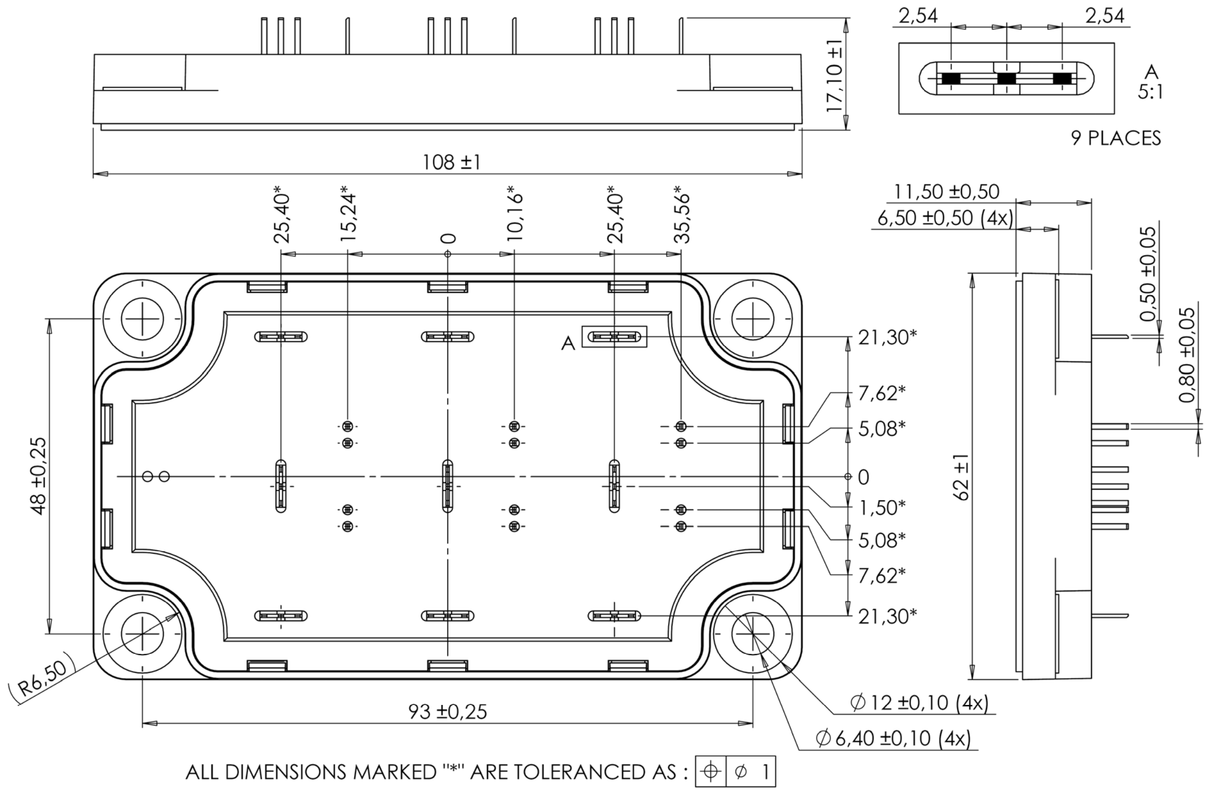
Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_S	Continuous Source current (Body diode)		Tc = 25°C			120	A
			Tc = 80°C			90	
V_{SD}	Diode Forward Voltage	$V_{GS} = 0V, I_S = -120A$				1.3	V
dv/dt	Peak Diode Recovery ❶					6	V/ns
t_{rr}	Reverse Recovery Time	$I_S = -120A$ $V_R = 40V$ $di_S/dt = 100A/µs$	$T_j = 25°C$		100	200	ns
Q_{rr}	Reverse Recovery Charge		$T_j = 25°C$		300		nC

❶ dv/dt numbers reflect the limitations of the circuit rather than the device itself.
$I_S \le -120A$ $di/dt \le 700A/µs$ $V_R \le V_{DSS}$ $T_j \le 150°C$

Thermal and package characteristics

Symbol	Characteristic			Min	Typ	Max	Unit
R_{thJC}	Junction to Case Thermal Resistance					0.9	°C/W
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000			V
T_J	Operating junction temperature range			-40		150	°C
T_{STG}	Storage Temperature Range			-40		125	°C
T_C	Operating Case Temperature			-40		100	°C
Torque	Mounting torque	To heatsink	M6	3		5	N.m
Wt	Package Weight					250	g

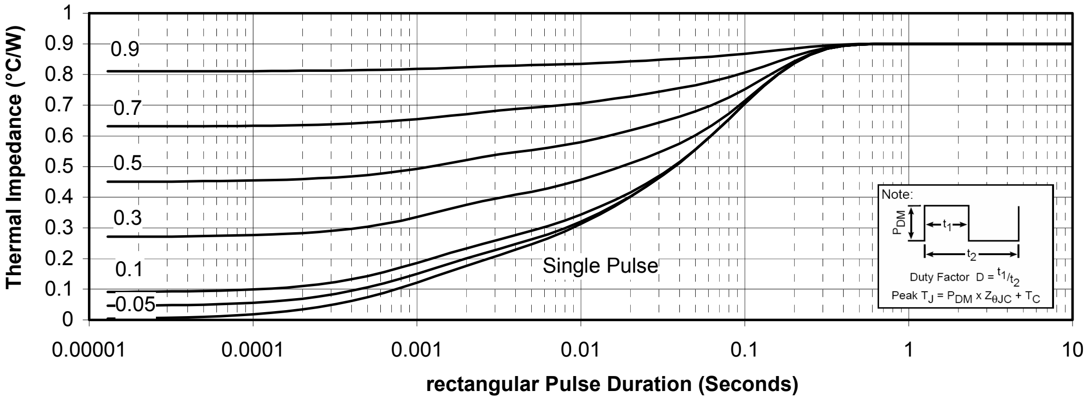
SP6-P Package outline (dimensions in mm)



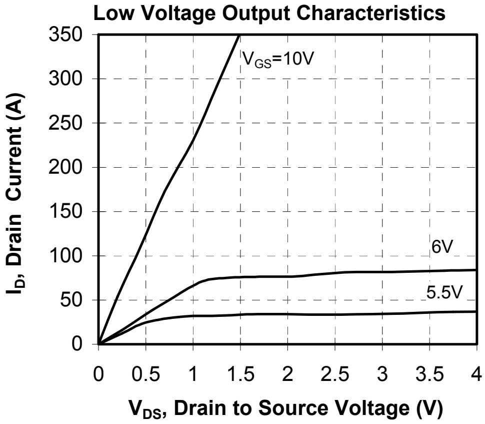
See application note 1902 - Mounting Instructions for SP6-P (12mm) Power Modules on www.microsemi.com

Typical Performance Curve

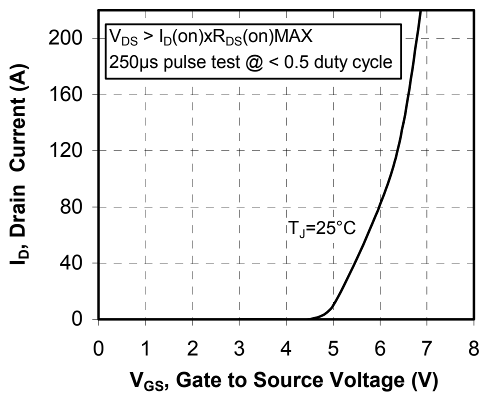
Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



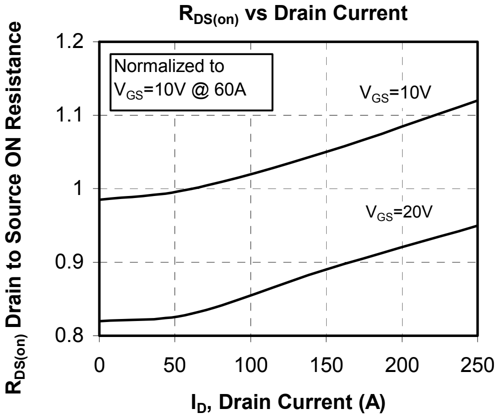
Low Voltage Output Characteristics



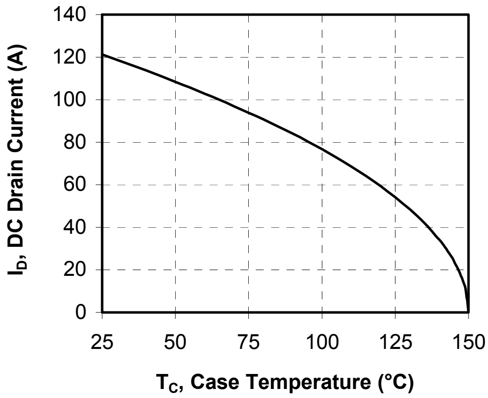
Transfert Characteristics

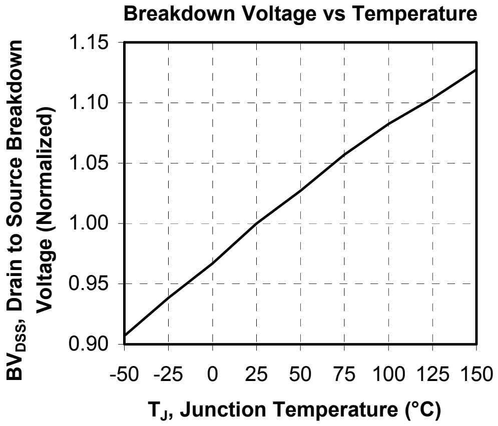


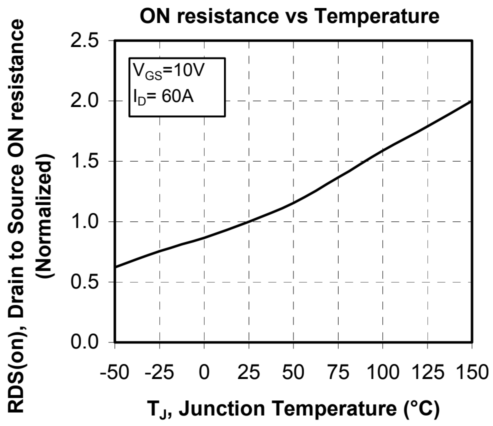
$R_{DS(on)}$ vs Drain Current

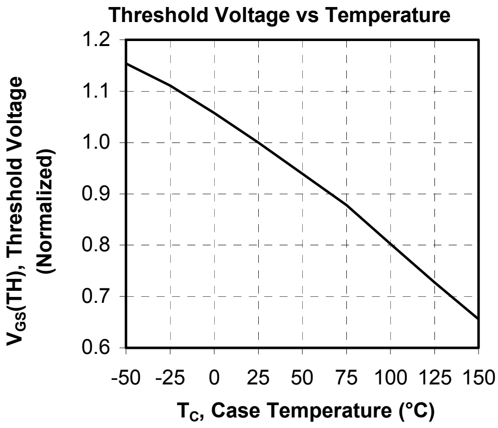


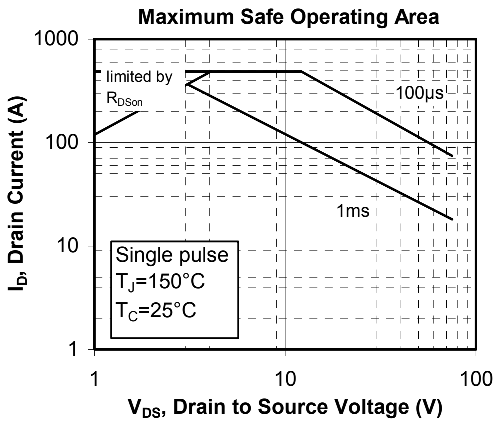
DC Drain Current vs Case Temperature

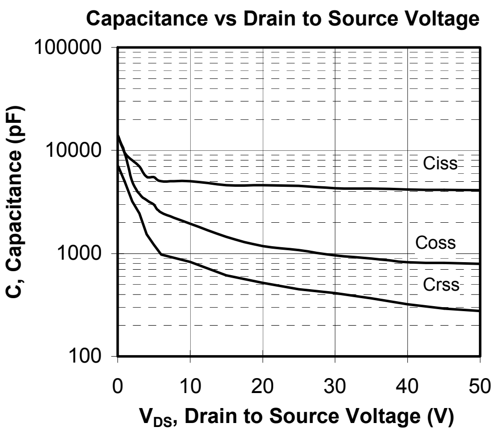


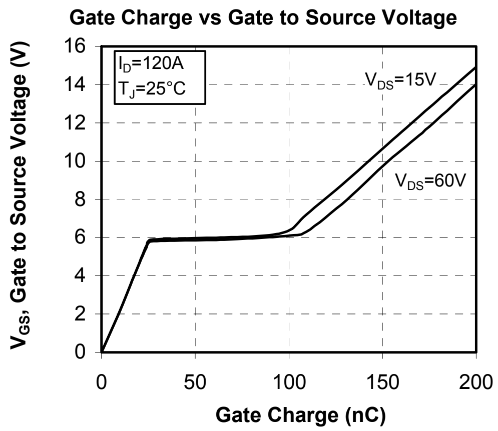

Breakdown Voltage vs Temperature
BVDSS, Drain to Source Breakdown Voltage (Normalized)
1.15
1.10
1.05
1.00
0.95
0.90
-50 -25 0 25 50 75 100 125 150
TJ, Junction Temperature (°C)


ON resistance vs Temperature
RDS(on), Drain to Source ON resistance (Normalized)
VGS=10V
ID= 60A
2.5
2.0
1.5
1.0
0.5
0.0
-50 -25 0 25 50 75 100 125 150
TJ, Junction Temperature (°C)

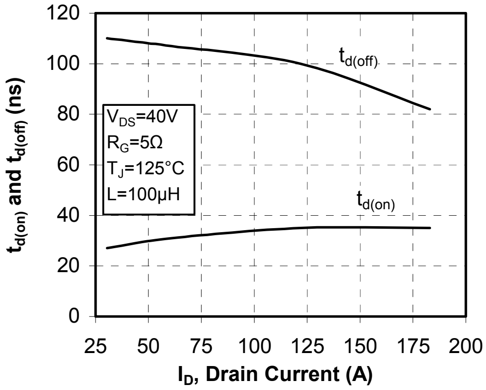

Threshold Voltage vs Temperature
VGS(TH), Threshold Voltage (Normalized)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
-50 -25 0 25 50 75 100 125 150
TC, Case Temperature (°C)


Maximum Safe Operating Area
ID, Drain Current (A)
1000
100
10
1
limited by RDSon
100µs
1ms
Single pulse
TJ=150°C
TC=25°C
1
10
100
VDS, Drain to Source Voltage (V)

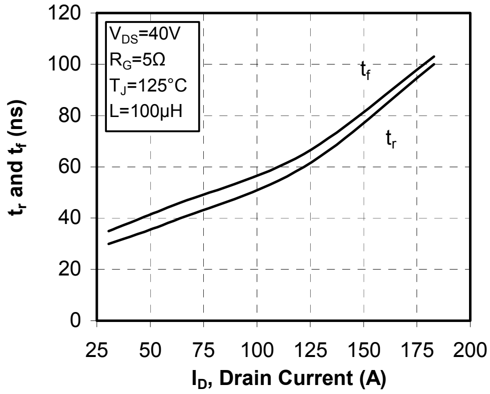

Capacitance vs Drain to Source Voltage
C, Capacitance (pF)
100000
10000
1000
100
Ciss
Coss
Crss
0 10 20 30 40 50
VDS, Drain to Source Voltage (V)


Gate Charge vs Gate to Source Voltage
VGS, Gate to Source Voltage (V)
ID=120A
TJ=25°C
VDS=15V
VDS=60V
16
14
12
10
8
6
4
2
0
0 50 100 150 200
Gate Charge (nC)

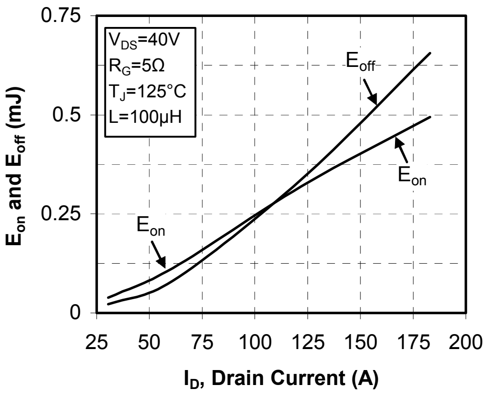
Delay Times vs Current



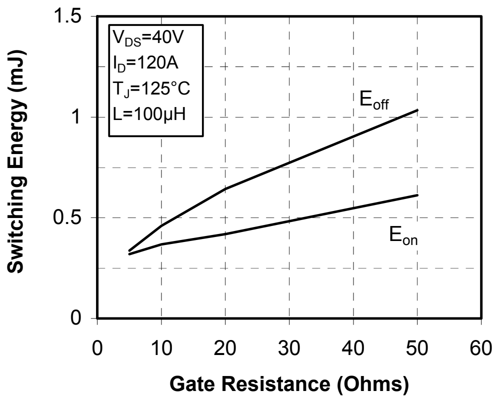
Rise and Fall times vs Current



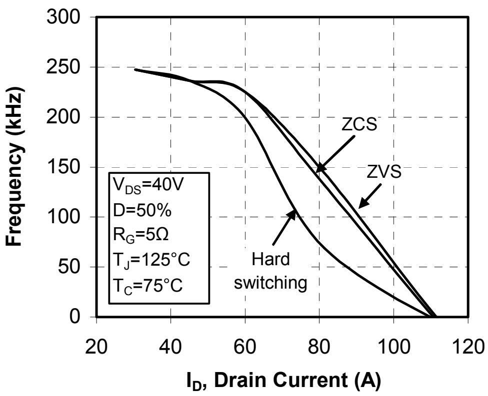
Switching Energy vs Current



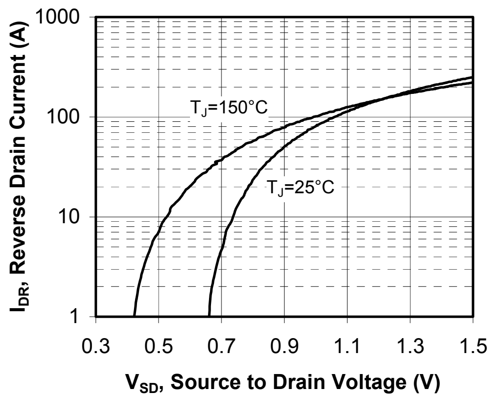
Switching Energy vs Gate Resistance



Operating Frequency vs Drain Current



Source to Drain Diode Forward Voltage



DISCLAIMER

The information contained in the document (unless it is publicly available on the Web without access restrictions) is PROPRIETARY AND CONFIDENTIAL information of Microsemi and cannot be copied, published, uploaded, posted, transmitted, distributed or disclosed or used without the express duly signed written consent of Microsemi. If the recipient of this document has entered into a disclosure agreement with Microsemi, then the terms of such Agreement will also apply. This document and the information contained herein may not be modified, by any person other than authorized personnel of Microsemi. No license under any patent, copyright, trade secret or other intellectual property right is granted to or conferred upon you by disclosure or delivery of the information, either expressly, by implication, inducement, estoppels or otherwise. Any license under such intellectual property rights must be approved by Microsemi in writing signed by an officer of Microsemi.

Microsemi reserves the right to change the configuration, functionality and performance of its products at anytime without any notice. This product has been subject to limited testing and should not be used in conjunction with life-support or other mission-critical equipment or applications. Microsemi assumes no liability whatsoever, and Microsemi disclaims any express or implied warranty, relating to sale and/or use of Microsemi products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright or other intellectual property right. Any performance specifications believed to be reliable but are not verified and customer or user must conduct and complete all performance and other testing of this product as well as any user or customers final application. User or customer shall not rely on any data and performance specifications or parameters provided by Microsemi. It is the customer's and user's responsibility to independently determine suitability of any Microsemi product and to test and verify the same. The information contained herein is provided "AS IS, WHERE IS" and with all faults, and the entire risk associated with such information is entirely with the User. Microsemi specifically disclaims any liability of any kind including for consequential, incidental and punitive damages as well as lost profit. The product is subject to other terms and conditions which can be located on the web at http://www.microsemi.com/legal/tnc.asp

Life Support Application

Seller's Products are not designed, intended, or authorized for use as components in systems intended for space, aviation, surgical implant into the body, in other applications intended to support or sustain life, or for any other application in which the failure of the Seller's Product could create a situation where personal injury, death or property damage or loss may occur (collectively "Life Support Applications").

Buyer agrees not to use Products in any Life Support Applications and to the extent it does it shall conduct extensive testing of the Product in such applications and further agrees to indemnify and hold Seller, and its officers, employees, subsidiaries, affiliates, agents, sales representatives and distributors harmless against all claims, costs, damages and expenses, and attorneys' fees and costs arising, directly or directly, out of any claims of personal injury, death, damage or otherwise associated with the use of the goods in Life Support Applications, even if such claim includes allegations that Seller was negligent regarding the design or manufacture of the goods.

Buyer must notify Seller in writing before using Seller's Products in Life Support Applications. Seller will study with Buyer alternative solutions to meet Buyer application specification based on Sellers sales conditions applicable for the new proposed specific part.