MSCC60VRM99CT3AG

Vienna Rectifier MOSFET Power Module

Super junction MOSFET:
V_{DSS} = 600V ; R_{DSon} = 99mΩ Max @ Tj = 25°C
I_D = 28A @ Tc = 25°C

Application

- Power supply

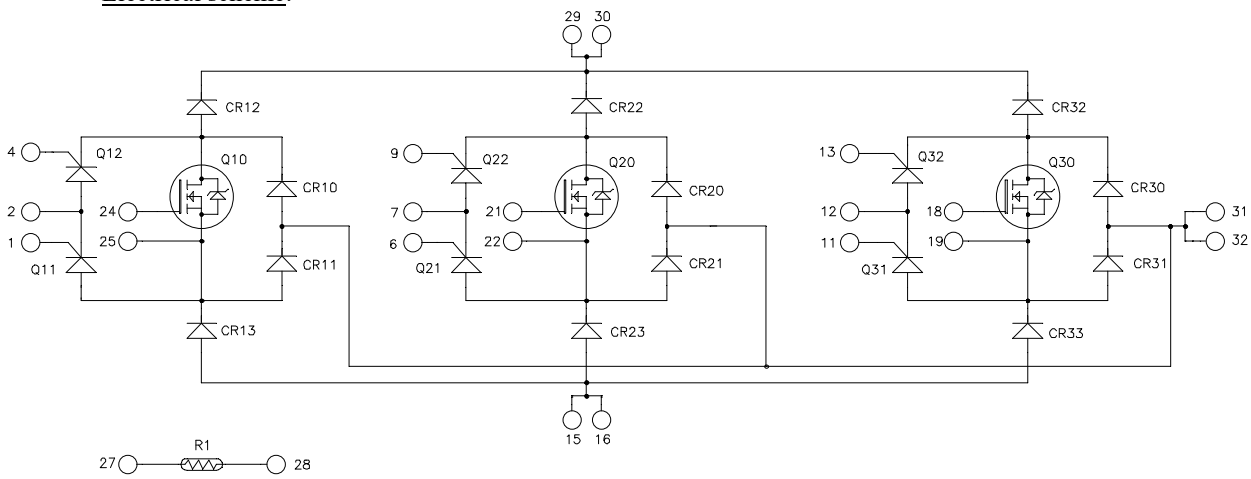
Features

- ***Super junction MOSFET***
  - Ultra low R_{DSon}
  - Low Miller capacitance
  - Ultra low gate charge
  - Avalanche energy rated
  - Very rugged
- ***SiC Schottky diode***
  - Zero reverse recovery
  - Zero forward recovery
  - Temp. Independent switching behavior
  - Positive temperature coefficient on VF
- AlN substrate for improved thermal performance
- Internal thermistor for temperature monitoring
- Kelvin emitter for easy drive
- Very low stray inductance
- High level of integration

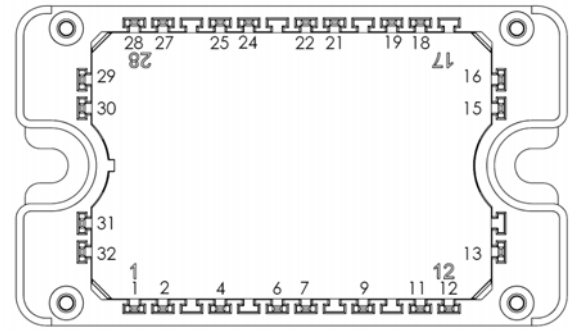
Benefits

- 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
- Low profile
- RoHS Compliant

Electrical scheme:



Pin out Location:



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

1. Absolute maximum ratings

Thyristor (per thyristor) Absolute maximum ratings

Symbol	*Parameter*			*Max ratings*	*Unit*
V_{DRM}	Repetitive Peak Reverse Voltage			1200	V
I_{DRM}	Repetitive Peak Reverse Current			1	mA
I_{TRMS}	RMS on – state current		T_J = 80°C	40	A
I_{TSM}	Surge on – state current	t = 10ms	T_C = 45°C	300	A
V_{RGM}	Peak Reverse Gate Voltage			10	V
P_D	Power Dissipation		T_C = 25°C	186	W

Super junction MOSFET (per MOSFET) Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{DSS}	Drain - Source Breakdown Voltage		600	V
I_D	Continuous Drain Current	T_c = 25°C	28	A
		T_c = 80°C	22	
I_{DM}	Pulsed Drain current		75	
V_{GS}	Gate - Source Voltage		±20	V
R_{DSon}	Drain - Source ON Resistance		99	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	155	W
I_{AR}	Avalanche current (repetitive and non repetitive)		11	A
E_{AR}	Repetitive Avalanche Energy		1.2	mJ
E_{AS}	Single Pulse Avalanche Energy		800	

SiC Diode ***(CR12/13, CR22/23, CR32/33)*** (per diode) Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_R	DC reverse Voltage		600	V
V_{RRM}	Peak Repetitive Reverse Voltage			
I_F	DC Forward Current	T_C = 125°C	10	A
I_{FRM}	Repetitive Peak Forward Current	tp = 10ms	50	
P_D	Power Dissipation	T_C = 25°C	68	W

FRED diode ***(CR10/11, CR20/21, CR30/31)*** (per diode) Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_R	DC reverse Voltage		600	V
V_{RRM}	Peak Repetitive Reverse Voltage			
I_F	DC Forward Current	T_C = 100°C	30	A
I_{FRM}	Repetitive Peak Forward Current	tp = 1ms	60	
P_D	Power Dissipation	T_C = 25°C	107	W

2. Electrical Characteristics

Thyristor (per thyristor) Electrical Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
V_T	On – state Voltage	I_T = 20A	T_J = 25°C		1.55		V
V_{TO}	Direct On state threshold Voltage		T_J = 125°C		0.90		
r_T	On – state Slope resistance				18		mΩ
V_{GT}	Gate Trigger Voltage	V_D = 6V	T_J = 25°C		1.5		V
I_{GT}	Gate Trigger Current				130		mA
R_{thJC}	Junction to Case Thermal Resistance					0.67	°C/W

Super junction MOSFET (per MOSFET) Electrical Characteristics

Symbol	*Characteristic*	*Test Conditions*	*Min*	*Typ*	*Max*	*Unit*
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0V ; V_{DS} = 600V			50	µA
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 18A			99	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 1.2mA	2.5	3	3.5	V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = ±20 V, V_{DS} = 0V			140	nA
C_{iss}	Input Capacitance	V_{GS} = 0V ; V_{DS} = 100V		2800		pF
C_{oss}	Output Capacitance	f = 1MHz		130		
Q_g	Total gate Charge	V_{GS} = 10V		60		nC
Q_{gs}	Gate – Source Charge	V_{Bus} = 400V		14		
Q_{gd}	Gate – Drain Charge	I_D = 18A		20		
$T_{d(on)}$	Turn-on Delay Time	V_{GS} = 10V		10		ns
T_r	Rise Time	V_{Bus} = 400V		5		
$T_{d(off)}$	Turn-off Delay Time	I_D = 18A		60		
T_f	Fall Time	R_G = 3.3Ω		5		
R_{thJC}	Junction to Case Thermal Resistance				0.805	°C/W

SiC Diode ***(CR12/13, CR22/23, CR32/33)*** (per SiC diode) Electrical Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
I_{RM}	Reverse Leakage Current	V_R = 600V	T_j = 25°C		10	60	µA
			T_j = 175°C		20	300	
V_F	Diode Forward Voltage	I_F = 10A	T_j = 25°C		1.6	1.8	V
			T_j = 175°C		2	2.4	
Q_C	Total Capacitive Charge	I_F = 10A, V_R = 600V di/dt =500A/µs			28		nC
C	Total Capacitance	f = 1MHz, V_R = 200V			65		pF
		f = 1MHz, V_R = 400V			50		
R_{thJC}	Junction to Case Thermal Resistance					2.2	°C/W

FRED Diodes ***(CR10/11, CR20/21, CR30/31)*** (per diode) Electrical Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
V_{RRM}	Peak Repetitive Reverse Voltage			600			V
I_{RM}	Reverse Leakage Current	V_R=600V				50	µA
V_F	Diode Forward Voltage	I_F = 30A V_{GE} = 0V	T_j = 25°C		1.45		V
			T_j = 125°C		1.35		
t_{rr}	Reverse Recovery Time	I_F = 30A V_R = 300V di/dt =3000A/µs	T_j = 25°C		80		ns
			T_j = 125°C		105		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		1.7		µC
			T_j = 125°C		2.5		
E_r	Reverse Recovery Energy		T_j = 25°C		0.55		mJ
			T_j = 125°C		0.8		
R_{thJC}	Junction to Case Thermal Resistance					1.4	°C/W

3. Temperature sensor NTC

Symbol	*Characteristic*	*Min*	*Typ*	*Max*	*Unit*
R_{25}	Resistance @ 25°C		22		kΩ
$\Delta R_{25}/R_{25}$	Resistance tolerance			5	%
$\Delta B/B$	Beta tolerance			3	
$B_{25/100}$	T_{25} = 298.16 K		3980		K

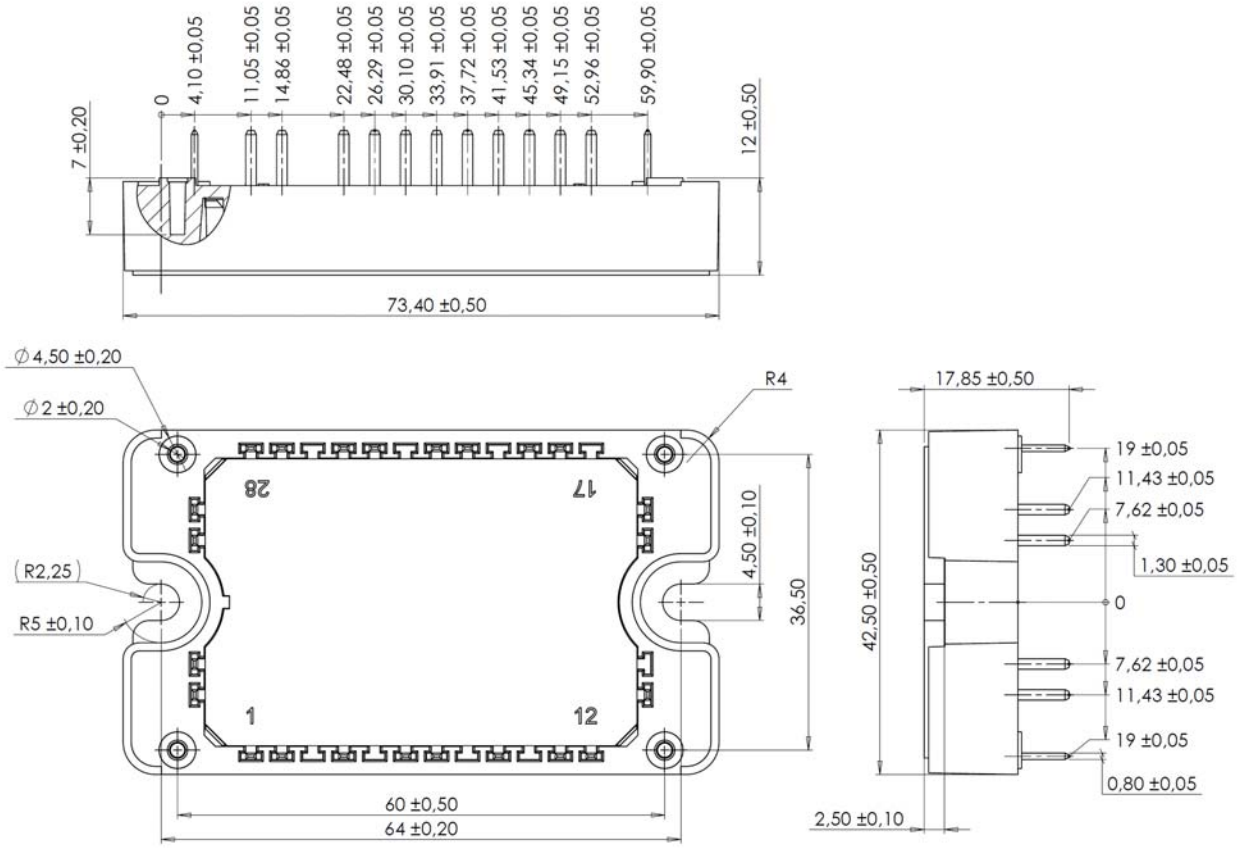
$$R_T = \frac{R_{25}}{\exp\left[B_{25/100}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

T: Thermistor temperature
R_T: Thermistor value at T

4. 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	Q10, Q20, Q30, Q12, Q22, Q32		-40	150	°C
		CR12/13, CR22/23, CR32/33 CR10/11, CR20/21, CR30/31		-40	175	
T_{JOP}	Recommended junction temperature under switching conditions			-40	$T_J$max -25	
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

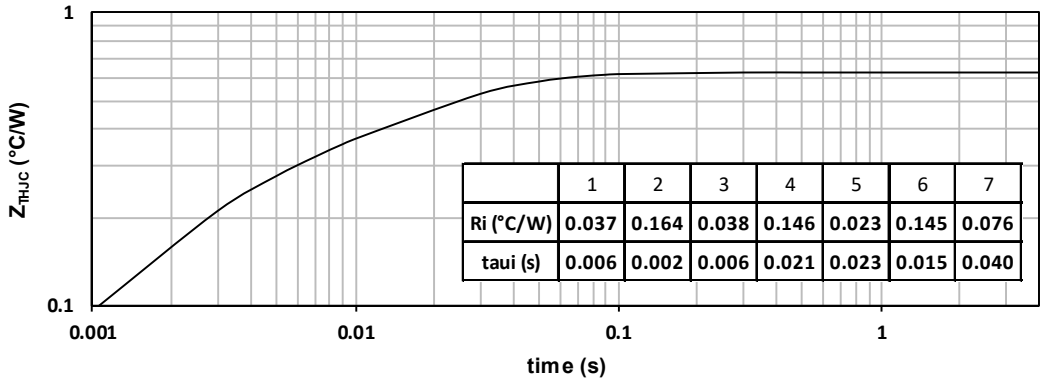
Package outline (dimensions in mm)



See application note 1906 - Mounting Instructions for SP3F Power Modules on www.microsemi.com

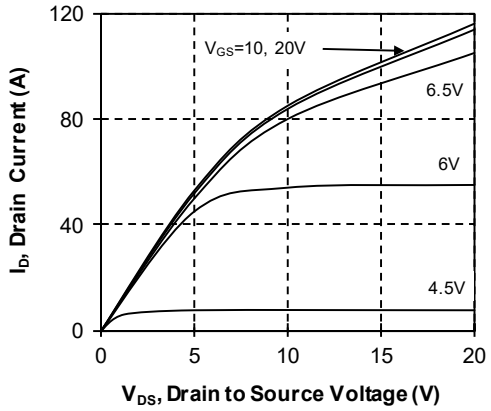
Typical Super junction MOSFET Performance Curve (Per MOSFET)

Maximum thermal impedance

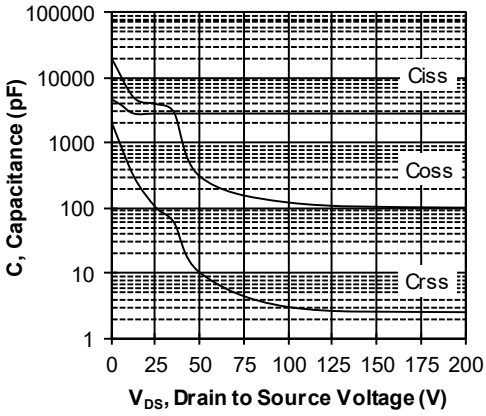


	1	2	3	4	5	6	7
Ri (°C/W)	0.037	0.164	0.038	0.146	0.023	0.145	0.076
taui (s)	0.006	0.002	0.006	0.021	0.023	0.015	0.040

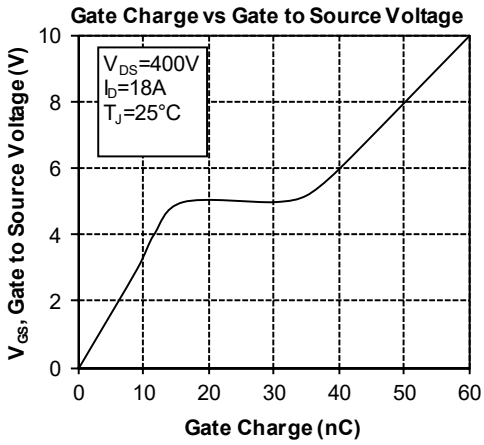
Low Voltage Output Characteristics



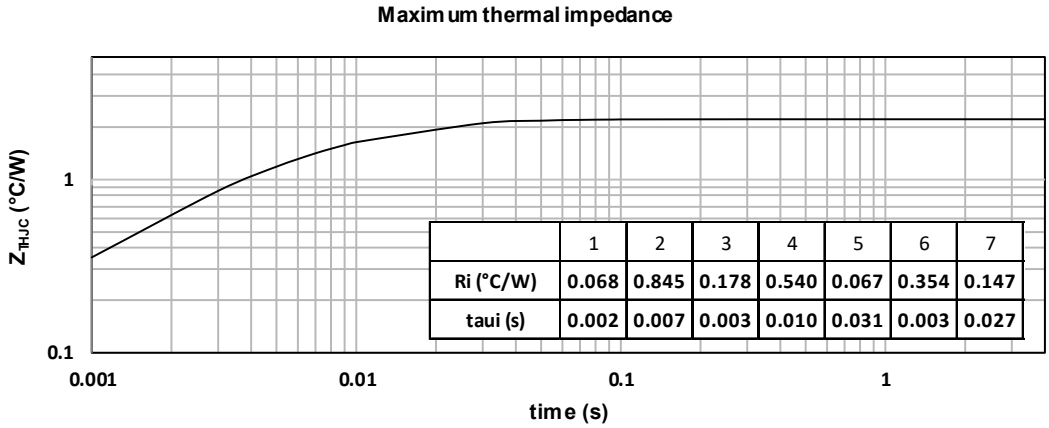
Capacitance vs Drain to Source Voltage



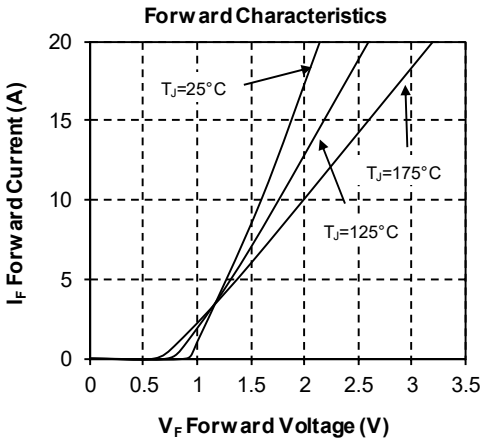
Gate Charge vs Gate to Source Voltage

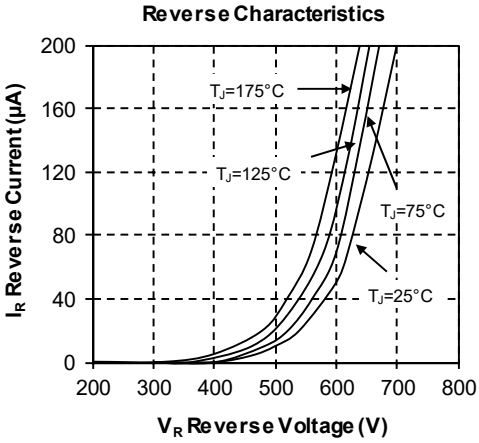


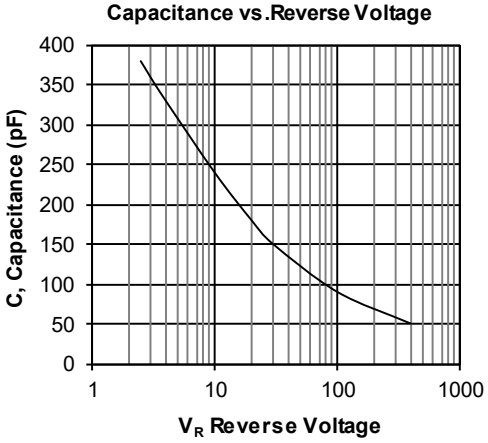
Typical SiC diode Performance Curve (Per SiC diode)



	1	2	3	4	5	6	7
Ri (°C/W)	0.068	0.845	0.178	0.540	0.067	0.354	0.147
taui (s)	0.002	0.007	0.003	0.010	0.031	0.003	0.027







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.