UMW IRF4905STRL

-55V P-Channel MOSFET

1.Description

Features of this design are a 150°C junction operating temperature, fast switching speed and improved repetitive avalanche rating.

2.1Features

- $V_{DS\ (V)}$=-55V
- I_D=-70A
- $R_{DS(ON)}$<20mΩ(V_{GS}=-10V)

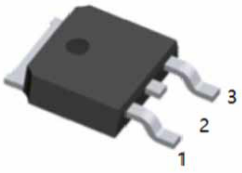
2.2Features

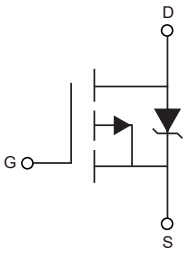
- Advanced Process Technology
- Ultra Low On-Resistance
- 50°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to T_{jmax}
- Some Parameters Are Differrent from IRF4905S

3.Pinning information

Pin	Symbol	Description
1	G	GATE
2	D	DRAIN
3	S	SOURCE

TO-252(DPAK) top view





4.Absolute Maximum Ratings

Parameter		Symbol	Rating	Units
Continuous Drain Current, V_{GS} @ 10V(Silicon Limited)	T_C=25°C	I_D	-70	A
Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)	T_C=100°C		-44	A
Continuous Drain Current, V_{GS} @ 10V (Wire Bond Limited)	T_C=25°C		-42	A
Pulsed Drain Current [1]		I_{DM}	-280	A
Power Dissipation	T_C=25°C	P_D	170	W
Linear Derating Factor			1.3	W/°C
Gate-to-Source Voltage		V_{GS}	±20	V
Single Pulse Avalanche Energy [2]		$E_{AS\ (Thermally\ limited)}$	140	mJ
Single Pulse Avalanche Energy Tested Value [6]		$E_{AS\ (Tested\ )}$	790	mJ

Avalanche Current [1]	I_{AR}	See Fig.16a,	A
Repetitive Avalanche Energy [5]	E_{AR}	16b, 15, 13	mJ
Storage Temperature Range	T_J,T_{STG}	-55 to 150	°C
Soldering Temperature, for 10 seconds (1.6mm from case)		300	°C
Mounting Torque, 6-32 or M3 screw [7]		10 lbf•in (1.1N•m)	

5.Thermal resistance rating

Parameter	Symbol	Typ	Max	Units
Junction-to-Case [8]	R_{thJC}		0.75	°C/W
Junction-to-Ambient (PCB Mount, steady state) [7.8]	R_{thJA}		40	°C/W

6.Electrical Characteristics @ T_J= 25°C (unless otherwise specified)

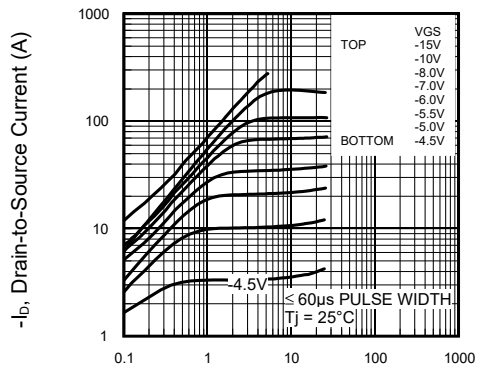
Parameter	Symbol	Conditions	Min	Typ	Max	Units
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	I_D=-250μA, V_{GS}=0V	-55			V
Breakdown Voltage Temp. Coefficient	$\Delta V_{(BR)DSS}/\Delta T_J$	Reference to 25°C,I_D=-1mA		-0.054		V/°C
Static Drain-to-Source On-Resistance	$R_{DS(ON)}$	V_{GS}=-10V, I_D=-42A [3]			20	mΩ
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=-250μA	-1.1	-1.8	-2.5	V
Forward Transconductance	g_{FS}	V_{DS}=-25V, I_D=-42A		19		S
Drain-to-Source Leakage Current	I_{DSS}	V_{DS}=-55V, V_{GS}=0V			-25	μA
		V_{DS}=-44V, V_{GS}=0V, T_J=125°C			-200	μA
Gate-to-Source Forward Leakage	I_{GSS}	V_{GS}=-20V			100	nA
Gate-to-Source Reverse Leakage		V_{GS}=20V			-100	nA
Total Gate Charge	Q_g	I_D=-42A, V_{DS}=-44, V_{GS}=-10V [3]		120	180	nC
Gate-to-Source Charge	Q_{gs}			32		nC
Gate-to-Drain ("Miller") Charge	Q_{gd}			53		nC
Tum-On Delay Time	$t_{D(on)}$	V_{DD}=-28V, I_D=-42A R_G=2.6Ω, V_{GS}=-10V [3]		20		ns
Rise Time	t_r			99		ns
Turn-Off Delay Time	$t_{D(off)}$			51		ns
Fall Time	t_f			64		ns
Internal Source Inductance	L_S	Between lead, and center of die contact		7.5		nH
Input Capacitance	C_{iss}	V_{GS}=0V, V_{DS}=-25V f=1MHz		3500		pF
Output Capacitance	C_{oss}			1250		pF
Reverse Transfer Capacitance	C_{rss}			450		pF
Output Capacitance	C_{oss}	V_{GS}=0V, V_{DS}=-1V, f=1MHz		4620		pF
Output Capacitance	C_{oss}	V_{GS}=0V, V_{DS}=-44V, f=1MHz		940		pF
Effective Output Capacitance	C_{oss}eff.	V_{GS}=0V, V_{DS}=0V to -44V [4]		1530		pF

Diode Characteristics						
Continuous Source Current (Body Diode)	I_S	MOSFET symbol showing the integral reverse p-n junction diode.			-42	A
Pulsed Source Current (Body Diode) [1]	I_{SM}				-280	A
Diode Forward Voltage	V_{SD}	T_J=25°C,I_S=-42A,V_{GS}=0V [3]			-1.3	V
Reverse Recovery Time	t_{rr}	T_J=25°C,I_F=-42A,V_{DD}=-28V		61	92	ns
Reverse Recovery Charge	Q_{rr}	di/dt=100A/μs [3]		150	220	nC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

Notes:

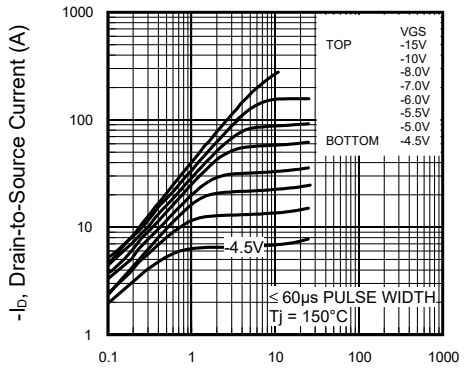
1. Repetitive rating; pulse width limited by max. junction temperature.
2. Limited by T_{Jmax}, starting T_J=25°C, L=0.16mH, R_G=25Ω, I_{AS}=-42A, V_{GS}=-10V. Part not recommended for use above this value.
3. Pulse width ≤ 1ms; duty cycle ≤ 2%.
4. C_{oss} eff. is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.
5. Limited by TJmax , see Fig.12a, 12b, 15, 16 for typical repetitive avalanche performance.
6. This value determined from sample failure population. 100% tested to this value in production.
7. This is applied to D ^{2}Pak, when mounted on 1" square PCB (FR-4 or G-10 Material).
8. R_θ is measured at T_J approximately 90°C.

7.1Typical Characterisitics



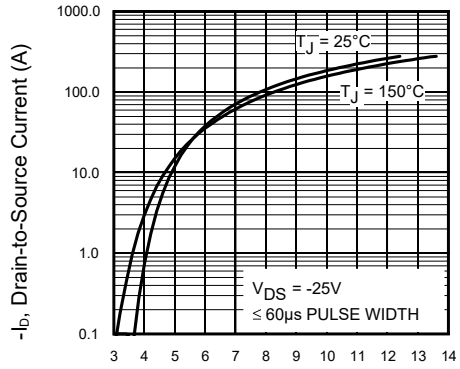
-V_{DS},Drain-to-Source Voltage (V)

Figure 1: Typical On-Resistance vs. Gate Voltage



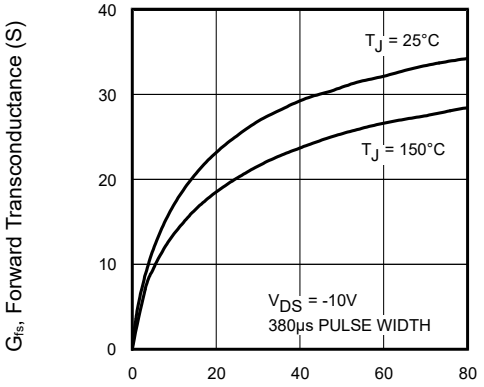
-V_{DS},Drain-to-Source Voltage (V)

Figure 2: Typical Output Characteristics



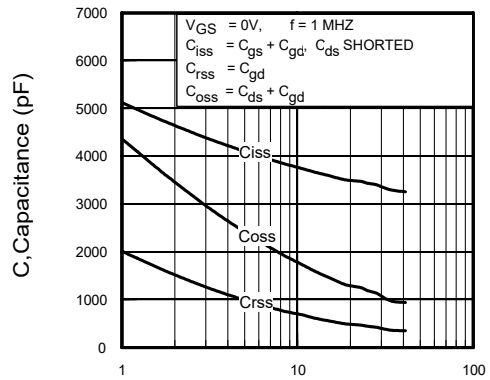
-V_{GS},Gate-to-Source Voltage (V)

Figure 3: Typical Output Characteristics



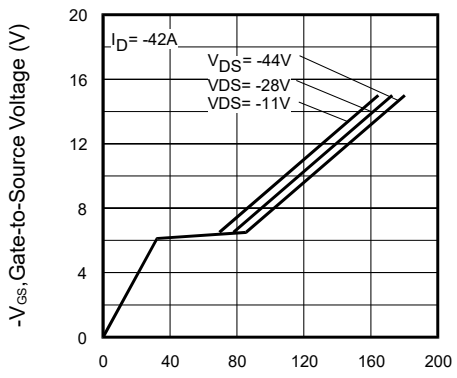
-I_D, Drain-to-Source Current (A)

Figure 4: Typical Forward Transconductance Vs. Drain Current



-V_{DS},Drain-to-Source Voltage (V)

Figure 5: Typical Capacitance vs. Drain-to-Source Voltage



Q_G, Total Gate Charge (nC)

Figure 6: Typical Gate Charge Vs. Gate-to-Source Voltage

7.2Typical Characterisitics

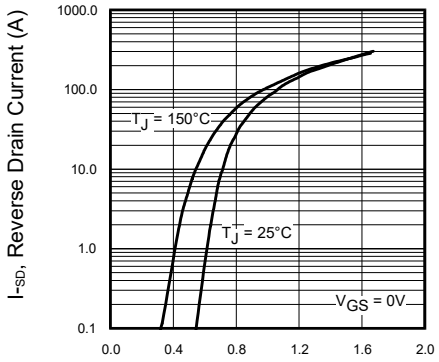


Figure 7: Typical Capacitance vs. Drain-to-Source Voltage

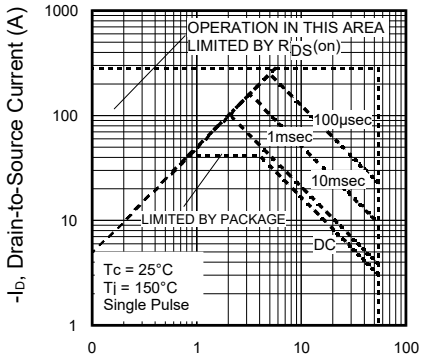


Figure 8: Maximum Safe Operating Area

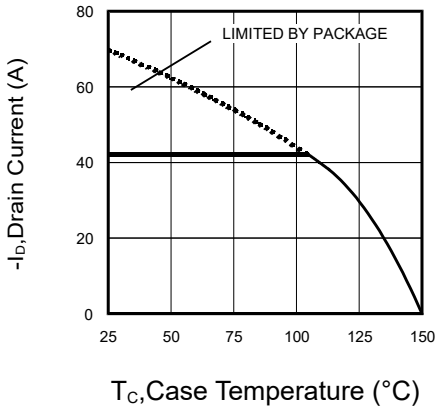


Figure 9: Maximum Drain Current Vs. Case Temperature

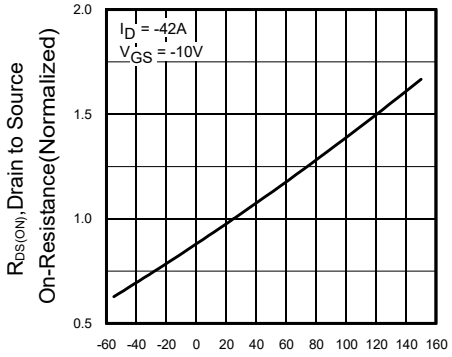


Figure 10: Normalized On-Resistance Vs. Temperature

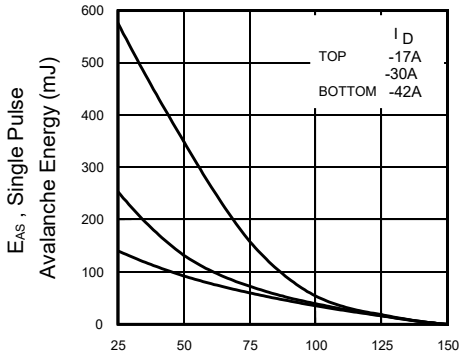


Figure 11: Typical On-Resistance vs. Drain Current

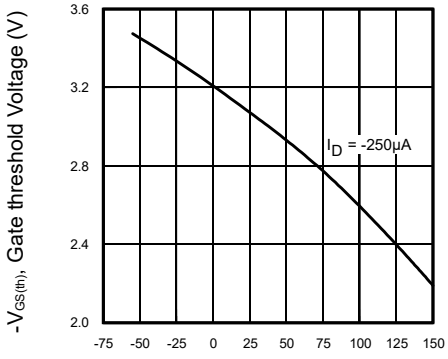
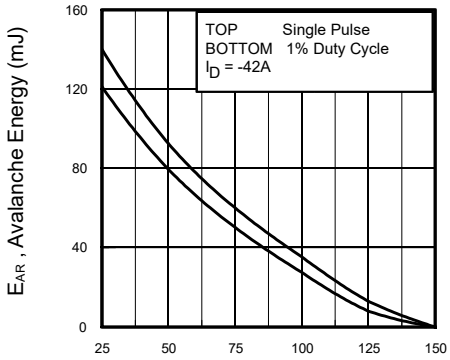


Figure 12: Threshold Voltage Vs. Temperature

7.3Typical Characterisitics



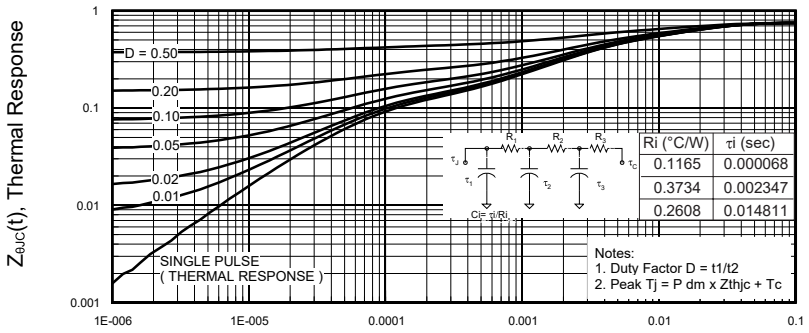


Figure 14: Maximum Effective Transient Thermal Impedance, Junction-to-Case

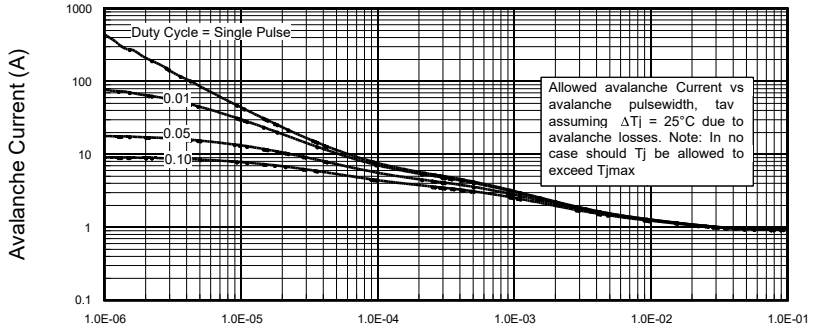


Figure 15: Typical Avalanche Current vs.Pulse width

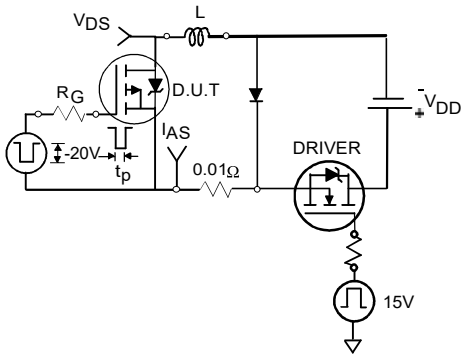


Figure 16a: Unclamped Inductive Test Circuit

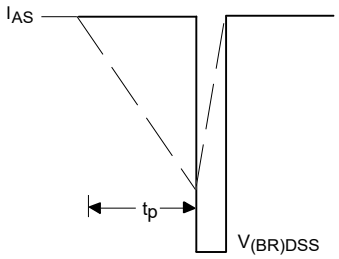


Figure 16b: Unclamped Inductive Waveforms

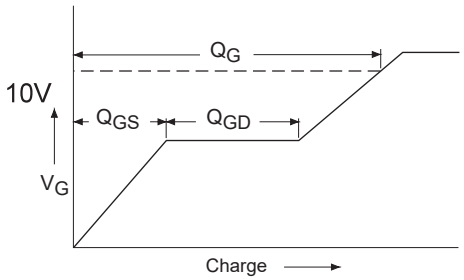


Figure 17a: Gate Charge Test Circuit

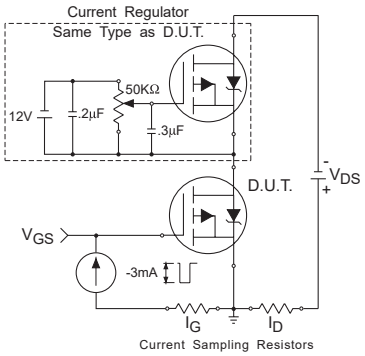


Figure 17b: Threshold Voltage Vs. Temperature

Notes on Repetitive Avalanche Curves , Figures 13, 15:

1.Avalanche failures assumption: Purely a thermal phenomenon and failure occurs at a temperature far in excess of T_{jmax}. This is validated for every part type.

2. Safe operation in Avalanche is allowed as long asT_{jmax} is not exceeded.

3. Equation below based on circuit and waveforms shown in Figures 16a, 16b.

4. $P_{D\ (ave)}$ = Average power dissipation per single avalanche pulse.

5. BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).

6. I_{av} = Allowable avalanche current.

7. ΔT = Allowable rise in junction temperature, not to exceed T_{jmax} (assumed as 25°C in Figure 15, 13).

t_{av} = Average time in avalanche.

D = Duty cycle in avalanche = $t_{av} \cdot f$

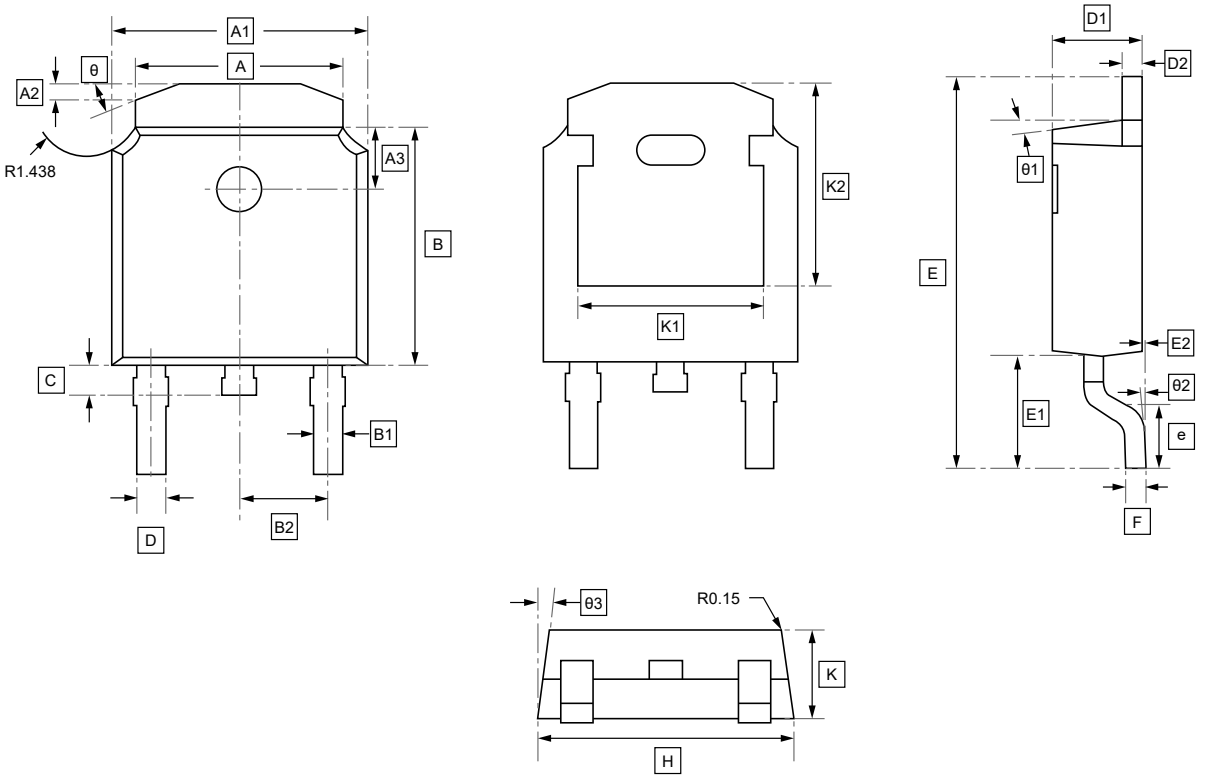
$Z_{thJC}(D, t_{av})$ = Transient thermal resistance.

P_D (ave) = 1/2 ($1.3 \cdot BV \cdot I_{av}$) = $\Delta T / Z_{thJC}$

$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Zth]$

$E_{AS\ (AR)} = P_D\ (ave) \cdot t_{av}$

8.TO-252 Package Outline Dimensions

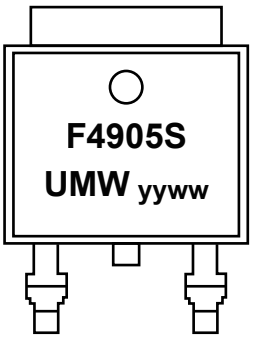


DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	A3	B	B1	B2	C	D	D1	D2	E
Min	5.20	6.50	0.40	1.40	6.00	0.740	2.286	0.60	0.74	2.15	0.50	9.80
Max	5.46	6.70	(typ)	1.80	6.20	0.940	(typ)	1.0	0.86	2.45	(typ)	10.40

Symbol	E1	E2	e	F	H	K	K1	K2	θ	θ1	θ2	θ3
Min	2.60	0.00	1.65	0.50	6.50	2.15	4.63	5.10	20°	7°	0°	7°
Max	3.20	0.127	(typ)	0.60	6.70	2.45	5.03	5.50	(typ)	(typ)	8°	(typ)

9.Ordering information



yy: Year Code
ww: Week Code

Order Code	Package	Base QTY	Delivery Mode
UMW IRF4905STRL	TO-252	2500	Tape and reel

10.Disclaimer

UMW reserves the right to make changes to all products, specifications. Customers should obtain the latest version of product documentation and verify the completeness and currency of the information before placing an order.

When applying our products, please do not exceed the maximum rated values, as this may affect the reliability of the entire system. Under certain conditions, any semiconductor product may experience faults or failures. Buyers are responsible for adhering to safety standards and implementing safety measures during system design, prototyping, and manufacturing when using our products to prevent potential failure risks that could lead to personal injury or property damage.

Unless explicitly stated in writing, UMW products are not intended for use in medical, life-saving, or life-sustaining applications, nor for any other applications where product failure could result in personal injury or death. If customers use or sell the product for such applications without explicit authorization, they assume all associated risks.

When reselling, applying, or exporting, please comply with export control laws and regulations of China, the United States, the United Kingdom, the European Union, and other relevant countries, regions, and international organizations.

This document and any actions by UMW do not grant any intellectual property rights, whether express or implied, by estoppel or otherwise. The product names and marks mentioned herein may be trademarks of their respective owners.