

1. Description

The 6N138 and 6N139 series combine an AlGaAs infrared emitting diode as the emitter which is optically coupled to a silicon high speed photo darlington transistor in a plastic DIP8 package with different lead forming options. A separate design between photodiode and darlington transistor reduces the base-collector capacitance of the input transistor which improves the speed by several orders of magnitude over conventional phototransistor optocouplers.

3. Applications

- Low current line receivers
- Current loop receivers
- Out interface to CMOS-LSTTL-TTL

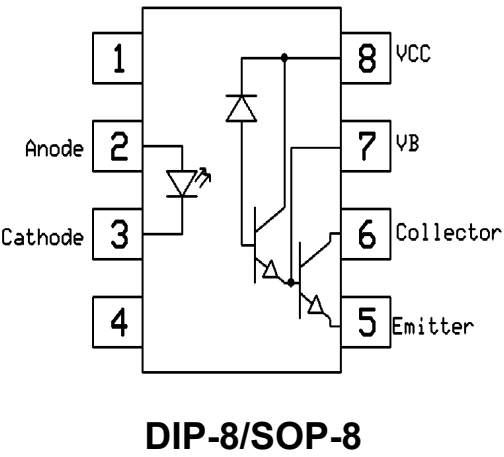
2. Features

- High isolation 5000 VRMS
- DC input with transistor output
- Operating temperature range
- 55 °C to 100 °C
- REACH compliance
- Halogen free (Optional)
- MSL class 1

- Pulse transformer replacement
- Computer-peripheral interface



4.Pinning Information



5.Truth Table (Positive Logic)

Input	Enable	Output
H	H	L
L	H	H
H	L	H
L	L	H
H	NC	L
L	NC	H



6. Absolute Maximum Ratings ($T_A=25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Symbol	Value	Units	Note
INPUT				
Forward Current	I_F	25	mA	
Peak Forward Current	I_{FP}	50	mA	1
Peak Transient Current	$I_{F(trans)}$	1	A	2
Reverse Voltage	V_R	5	V	
Input Power Dissipation	P_I	100	mW	
OUTPUT				
Supply Voltage	V_{CC}	-0.5 ~ 18	V	
Output Voltage	V_O	-0.5 ~ 18	V	
Output Current	I_O	60	mA	
Emitter-Base Reverse Voltage	V_{EBR}	0.5	V	
Output Power Dissipation	P_O	100	mW	
COMMON				
Total Power Dissipation	P_{tot}	200	mW	
Isolation Voltage	V_{iso}	5000	Vrms	3
Operating Temperature	T_{opr}	-55 ~ 100	$^{\circ}\text{C}$	
Storage Temperature	T_{stg}	-55 ~ 150	$^{\circ}\text{C}$	
Soldering Temperature	T_{sol}	260	$^{\circ}\text{C}$	4

Note 1. 50% duty, 1ms P.W

Note 2. $\leq 1\mu\text{s}$ P.W, 300pps

Note 3. AC For 1 Minute, R.H. = 40 ~ 60%

Note 4. For 10 seconds



7.1 Electrical Optical Characteristics

Parameter		Symbol	Conditions	Min	Typ	Max	Units
INPUT(at Ta=0 to 70°C , unless specified otherwise)							
Forward Voltage		V _F	I _F =1.6mA		1.28	1.7	V
Reverse Current		I _R	V _R =5V			10	μA
Input Capacitance		C _{in}	V=0, f=1MHz		60		pF
OUTPUT(at Ta=0 to 70°C , unless specified otherwise)							
High Level Supply Current		I _{CCH}	I _F =0mA, V _O =Open, V _{CC} =18V		0.05	10	μA
Low Level Supply Current		I _{CCL}	I _F =1.6mA, V _O =Open, V _{CC} =18V		0.6	1.5	mA
Logic High	UMW 6N138	I _{OH}	I _F =0mA, V _O =V _{CC} =18V		0.01	100	μA
Output Current	UMW 6N139					250	μA
TRANSFER CHARACTERISTICS(at Ta=0 to 70°C , unless specified otherwise)							
Current Transfer Ratio	UMW 6N139	CTR	I _F =0.5mA, V _O =0.4V, V _{CC} =4.5V	400	2500		%
			I _F =1.6mA, V _O =0.4V, V _{CC} =4.5V	500	2600		
	UMW 6N138			300	2600		
Logic Low Output Voltage	UMW 6N139	V _{OL}	I _F =0.5mA, I _O =2mA, V _{CC} =4.5V		0.04	0.4	V
			I _F =1.6mA, I _O =8mA, V _{CC} =4.5V		0.07	0.4	
			I _F =5mA, I _O =15mA, V _{CC} =4.5V		0.11	0.4	
			I _F =12mA, I _O =24mA, V _{CC} =4.5V		0.15	0.4	
	UMW 6N138		I _F =1.6mA, I _O =4.8mA, V _{CC} =4.5V		0.05	0.4	
Isolation Resistance		Riso	DC500V, 40 ~ 60% R.H.	10^12	10^14		Ω
Floating Capacitance		C _{IO}	V=0, f=1MHz		0.3	1	pF



7.2 Electrical Optical Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Units	
SWITCHING CHARACTERISTICS(at Ta=0 to 70°C,Vcc=5V, unless specified otherwise)							
Propagation Delay Time to Logic Low (Fig.13)	UMW 6N139	TPHL	I _F =0.5mA, R _L =4.7kΩ, T _A =25°C		5	25	μs
			I _F =0.5mA, R _L =4.7kΩ			30	
			I _F =12mA, R _L =270Ω, T _A =25°C		0.2	1	
			I _F =12mA, R _L =270Ω			2	
	UMW 6N138		I _F =1.6mA, R _L =2.2kΩ, T _A =25°C		1.4	10	
			I _F =1.6mA, R _L =2.2kΩ			15	
Propagation Delay Time to Logic High (Fig.13)	UMW 6N139	TPLH	I _F =0.5mA, R _L =4.7kΩ, T _A =25°C		22	60	μs
			I _F =0.5mA, R _L =4.7kΩ			90	
			I _F =12mA, R _L =270Ω, T _A =25°C		2.1	7	
			I _F =12mA, R _L =270Ω			10	
	UMW 6N138		I _F =1.6mA, R _L =2.2kΩ, T _A =25°C		10.7	35	
			I _F =1.6mA, R _L =2.2kΩ			50	
Common Mode Transient Immunity at Logic High (Fig.15)	UMW 6N139	CM _H	I _F =0mA, V _{CM} =10V _{pp} R _L =2.2kΩ, T _A =25°C	1000			V/μs
	UMW 6N138			1000			
Common Mode Transient Immunity at Logic Low (Fig.15)	UMW 6N139	CM _L	I _F =1.6mA, V _{CM} =10V _{pp} R _L =2.2kΩ, T _A =25°C	1000			V/μs
	UMW 6N138			1000			



8.1 Typical characteristic

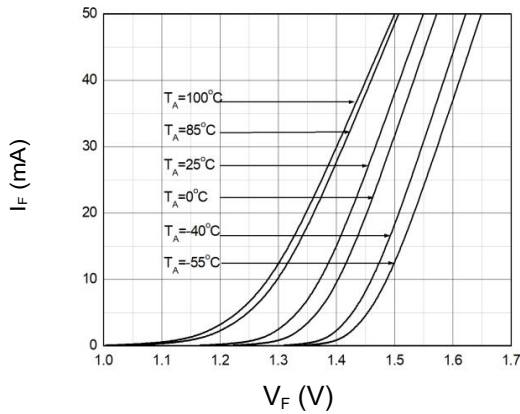


Figure 1: Forward Current vs. Forward Voltage

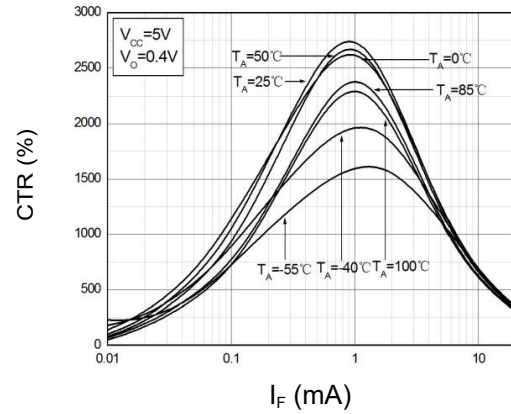


Figure 2: Current Transfer Ratio vs. Forward Current

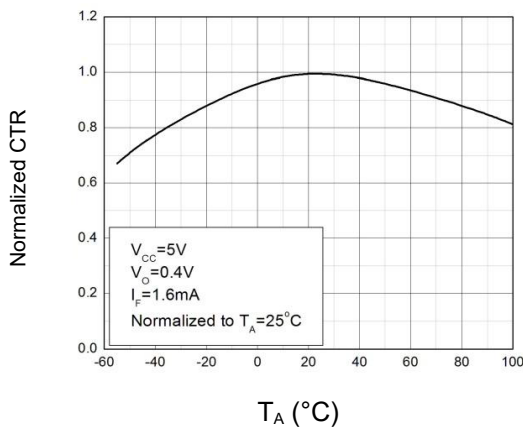


Figure 3: Normalized Current Transfer Ratio vs. Ambient Temperature

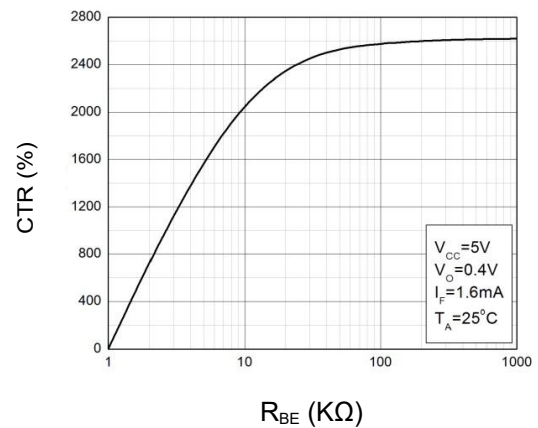


Figure 4: Capacitance

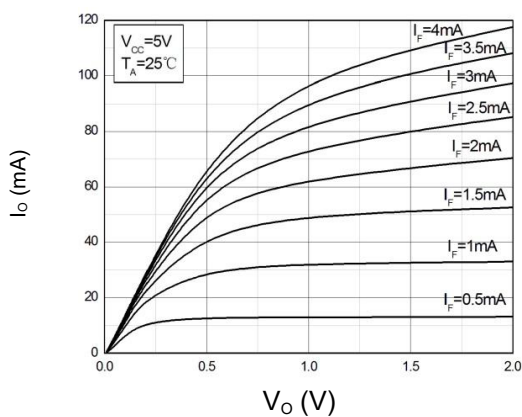


Figure 5: Low Level Output Current vs. Output Voltage

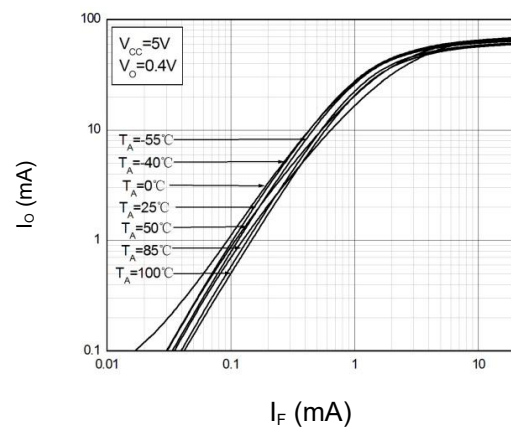


Figure 6: Low Level Output Current vs. Forward Current



8.2 Typical characteristic

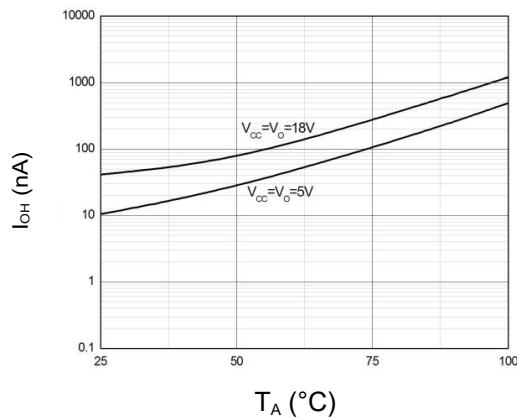


Figure 7: High Level Output Current vs. Ambient Temperature

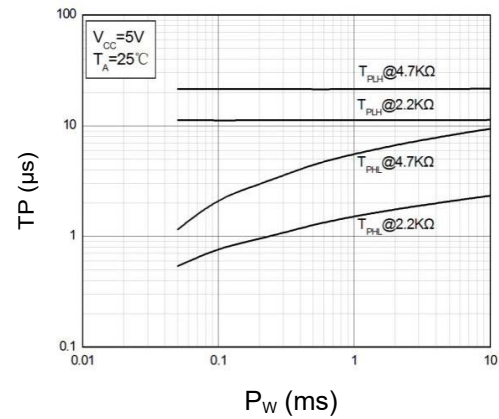


Figure 8: Propagation Delay vs. Pulse Width

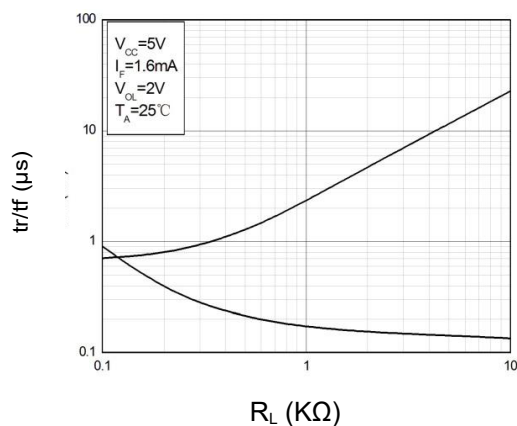


Figure 9: Rise and Fall Time vs. Load Resistance

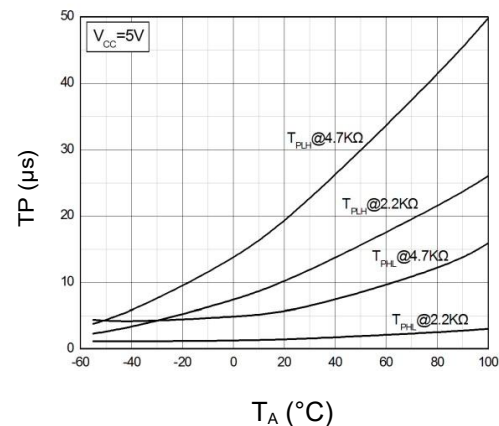


Figure 10: Propagation Delay vs. Ambient Temperature

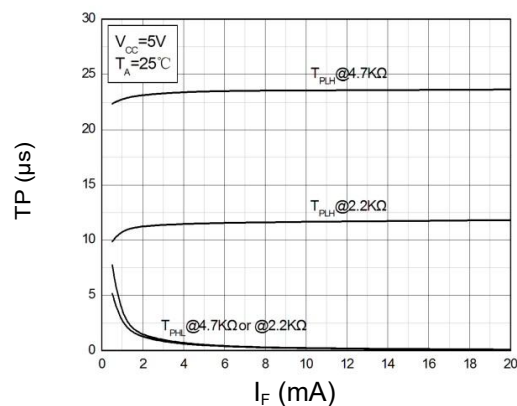


Figure 11: Propagation Delay vs. Forward Current

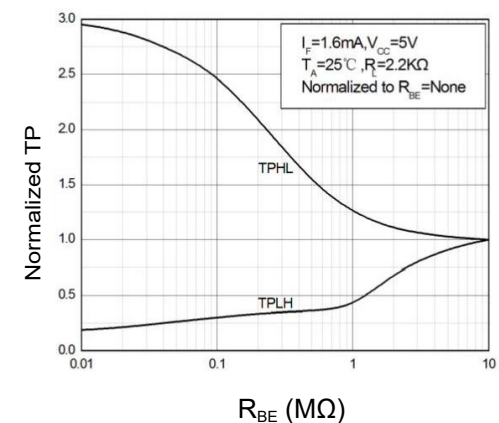


Figure 12: Propagation Delay vs. Base-Emitter Resistance



9.1 Test Circuits

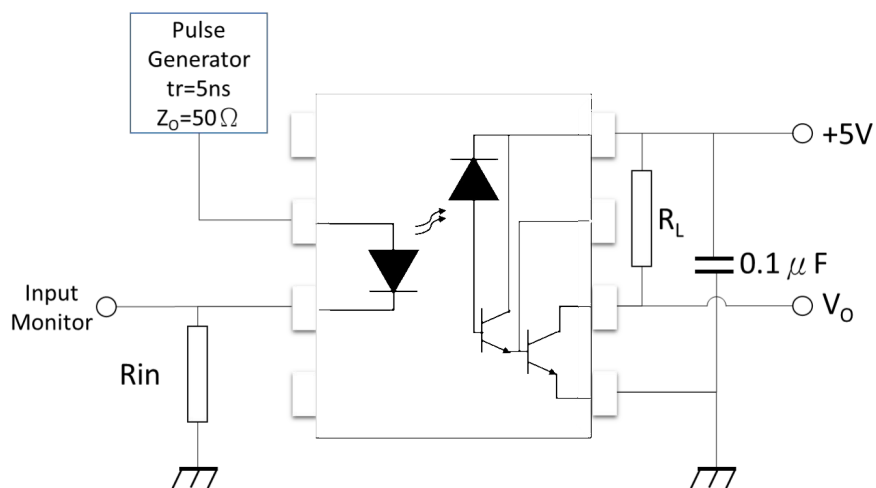


Fig.13 Test Circuits for TPHL, TPLH, tr, tf

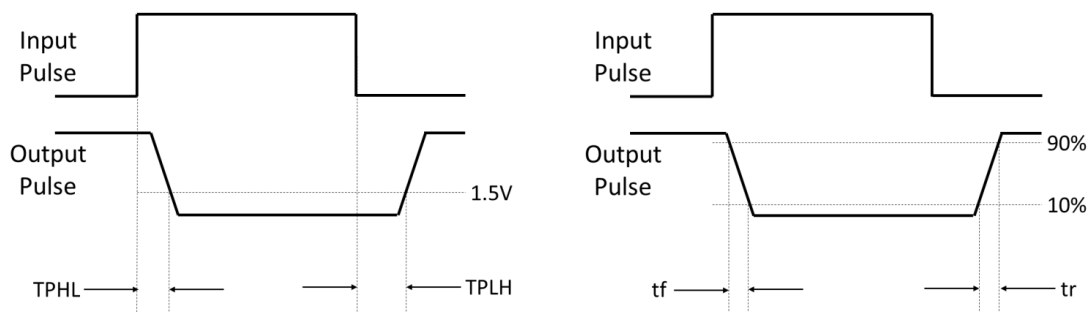


Fig.14 Waveforms of TPHL, TPLH, tr, tf



9.2 Test Circuits

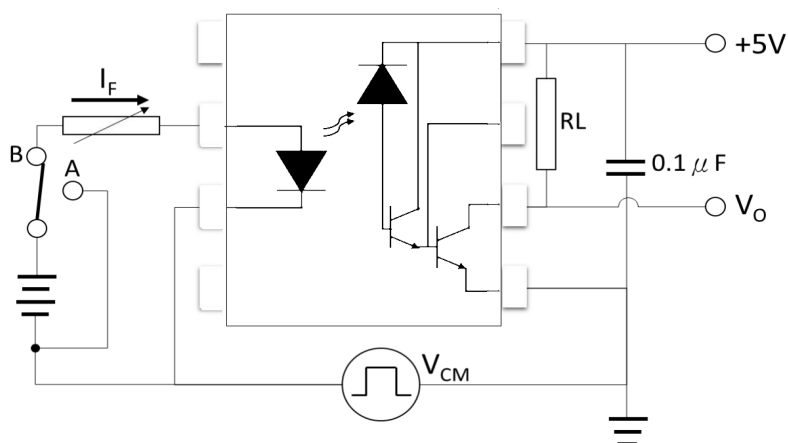


Fig.15 Test Circuits for Common Mode Transient Immunity

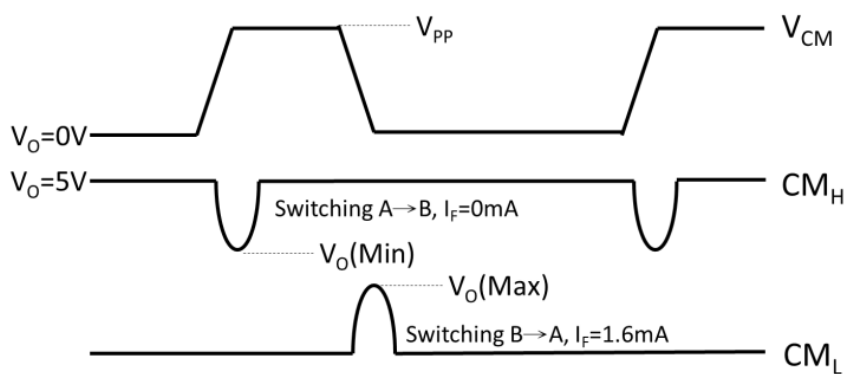
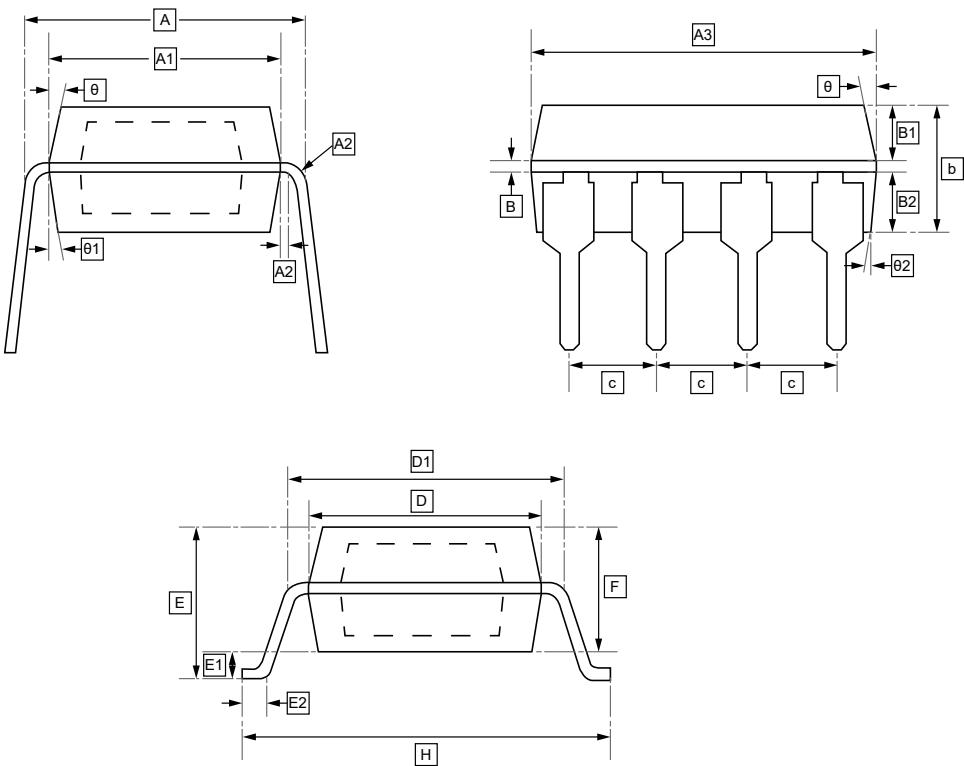


Fig.16 Waveforms of Common Mode Transient Immunity



10.DIP-8/SOP-8 Package Outline Dimensions



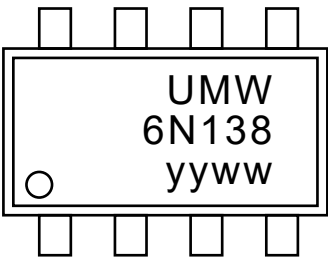
DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	A3	B	B1	B2	b	c	D	D1	E
Min	7.65	6.55	0.2	9.71	0.25	1.6	1.62	3.45	2.54	6.55	7.65	4.15
Max	7.95	6.65	(typ.)	9.78	(typ.)	(typ.)	1.68	3.55	(typ.)	6.65	7.95	4.35

Symbol	E1	E2	F	H	θ	θ1	θ2
Min	0.75	0.66	3.45	10.1	12°	9°	5°
Max	(typ.)	(typ.)	3.55	10.5	(typ.)	(typ.)	(typ.)



11.Ordering information



yy: Year Code
ww: Week Code

Order Code	Package	Base QTY	Delivery Mode
UMW 6N138M	DIP-8	2250	Tube and box
UMW 6N138S	SOP-8	1000	Tape and reel
UMW 6N139M	DIP-8	2250	Tube and box
UMW 6N139S	SOP-8	1000	Tape and reel



12.Disclaimer

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