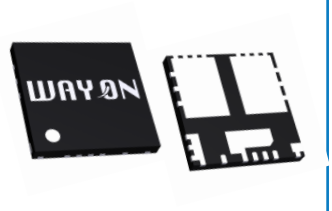
WPM4DT502QTA1

500V 4A half-bridge Integrated Power Modules

Description

WPM4DT502QTA1 is half-bridge Modules (IPM)designed for advanced appliance motor driveapplications such as energy efficient fans and pumps.These modules Integrated 2 MOSFET and 1 highvoltage gate driver in a familiar package.



QFN7X7-25L

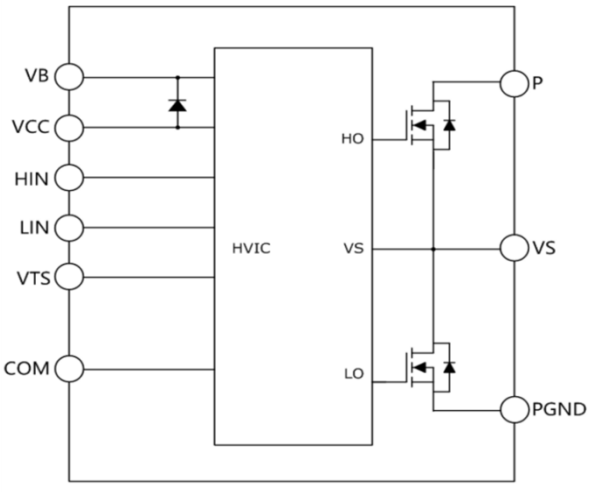
Features

- 500V half-bridge including high voltage gate drivers
- Works with 3.3V/5V MCU, Active-High interface
- Integrated bootstrap functionality
- HVIC for Under-voltage Protection
- HVIC Temperature-Sensing Built-In for temperature Monitoring

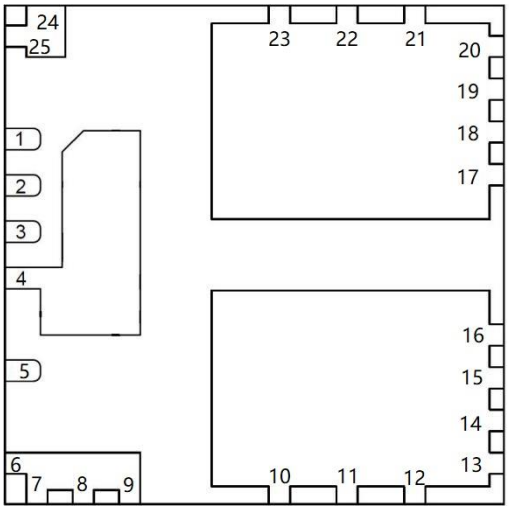
Applications

- Energy efficient fans
- Pumps
- High speed hair dryer

Internal Electrical Schematic



Module Pin-Out Description



Pin Number	Pin Name	Pin Description
1	VCC	Power Supply for Low Side
2	HIN	Logic Input for High Side Gate Driver
3	LIN	Logic Input for Low Side Gate Driver
4	COM	Logic Ground
5	VTS	Temperature-sensing Voltage Output
6,7,8,9	PGND	Source for low side MOSFET
10,11,12,13,14,15,16	VS	High Side Floating Offset Voltage
17,18,19,20,21,22,23	P	DC Bus Voltage Positive
24,25	VB	High Side Floating Supply Voltage

● Absolute Maximum Ratings（T_C=25℃ unless otherwise specified）

Inverter Part

Parameter	Symbol	Condition	Ratings	Unit
Drain-Source Voltage of Each MOSFET	V_{DSS}	-	500	V
Each MOSFET Current, Continuous	I_D	T_c=25℃ (Silicon limit)	4	A
Each MOSFET Current, Peak	I_{DP}	T_c=25℃ Pulse width less than 100us	9.1	A
Maximum Power Dissipation	P_D	T_c=25℃ For Each MOSFET	26	W

Control Part

Parameter	Symbol	Condition	Ratings	Unit
Control Supply Voltage	V_{CC}	Applied between V_{CC} - COM	20	V
High-side Bias Voltage	V_{BS}	T_c=25℃ (Silicon limit)	20	V
Input Signal Voltage	V_{IN}	T_c=25℃ Pulse width less than 100us	-0.3~V_{CC}+0.3	V

Bootstrap Diode Part

Parameter	Symbol	Condition	Ratings	Unit
Bootstrap Diode Reverse Voltage	V_{RRMB}	-	500	V

System

Parameter	Symbol	Condition	Ratings	Unit
Operating Junction Temperature	T_j	Note1	-20~+150	℃
Storage temperature	T_{STG}	-	-20~+125	℃
NOTE 1:The maximum junction temperature rating of built-in power chips is 150°C(@Tc≤100°C), however, to ensure safe operation of IPM, the average junction temperature should be limited to Tj (Ave)≤125°C (@Tc≤100°C).				

Thermal Resistance

Parameter	Symbol	Condition	Ratings	Unit
Junction to Case Thermal Resistance	Rth(j-c)	For Each MOSFET	4.8	K/W

● Recommended Operating Conditions（T_C=25℃）

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Power Supply Voltage	V_{PN}	Applied between P – N	-	300	400	V
Control Supply Voltage	V_{CC}	Applied between V_{CC} – COM	13.5	15.0	16.5	V
High side Supply Voltage	V_{BS}	Applied between V_B – V_S	13.5	15.0	16.5	V
Dead time	t_{dead}	For each input signal	1	-	-	μs
PWM input frequency	f_{PWM}	V_{CC} = V_{BS} = 13.5V~16.5V	-	20	-	KHz

● Electrical Characteristics （T_C=25℃）

Inverter Part

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	V_{IN} = 0V , I_D =250uA (NOTE 2)	500	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{IN} = 0V , V_{DS} = 500V	-	-	10	μA
Drain-Source Diode Forward Voltage	V_{SD}	V_{CC} = V_{BS}= 15V,V_{IN} = 0V,I_D = -4A	-	-	1.4	V
Drain-Source Turn-On Resistance	R_{DSON}	V_{CC} = V_{BS}= 15V,V_{IN} = 5V,I_D = 2A	-	2.1	-	Ω
Switching time	t_{on}	V_D = 300V, V_{CC} = V_{BS} = 15V , I_D =4A , V_{IN} = 0V—5V, Inductive Load (NOTE 3)	-	625	-	ns
	t_{off}		-	550	-	ns
	t_{rr}		-	80	-	ns
	E_{on}		-	128	-	μJ
	E_{off}		-	11	-	μJ

NOTE 2: BVDSS is the absolute maximum voltage rating between drain and source terminal of each MOSFET inside IPM. V_{PN} should be sufficiently less than this value considering the effect of the stray inductance so that V_{DS} should not exceed BV_{DSS} in any case.

NOTE 3: t_{ON} and t_{OFF} include the internal transmission delay time of the driver IC. Please refer to Figure 1 for details.

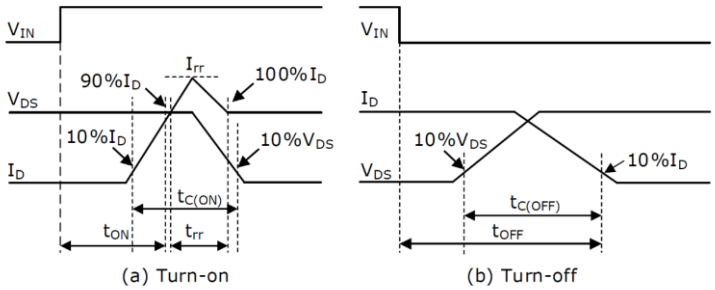


Figure 1: Switching Time Definition

Control Part

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
V_{CC} Quiescent Current	I_{QCC}	V_{CC} = 15V ,V_{IN} = 0V	-	270	400	μA
V_{BS} Quiescent Current	I_{QBS}	V_{BS} = 15V ,V_{IN} = 0V	-	75	160	μA
Input current	I_{IN}	V_{IN} = 5V	-	10	-	μA
Low-side under-voltage protection(UV)	UV_{CCD}	Detection level	8.0	8.8	9.6	V
	UV_{CCR}	Reset level	8.4	9.2	10.0	V
High-side under-voltage protection(UV)	UV_{BSD}	Detection level	8.0	8.8	9.6	V
	UV_{BSR}	Reset level	8.4	9.2	10.0	V
Turn on threshold voltage	V_{IH}	Applied between V_{IN} - COM	3.0	-	-	V
Turn off threshold voltage	V_{IL}		-	-	1.5	V
Temperature output	V_{TS}	T_{HVIC} = 25°C	0.64	0.89	1.14	V
		T_{HVIC} = 100°C	2.00	2.26	2.51	V

Bootstrap Diode Part

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V_{FB}	I_F = 10mA , T_C = 25℃	-	3.0	-	V
Bootstrap emulator on resistance	R_{BSD}	V_{CC} = 15V, T_C = 25℃	-	240	-	Ω

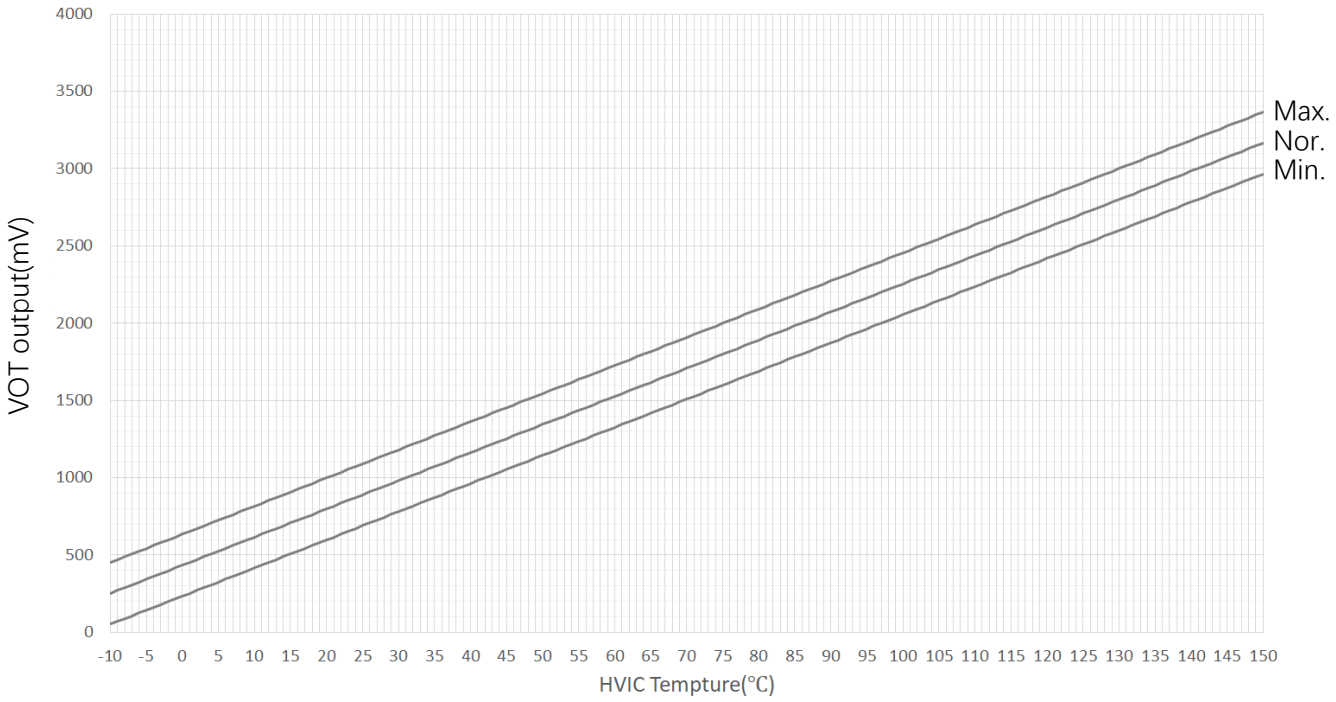
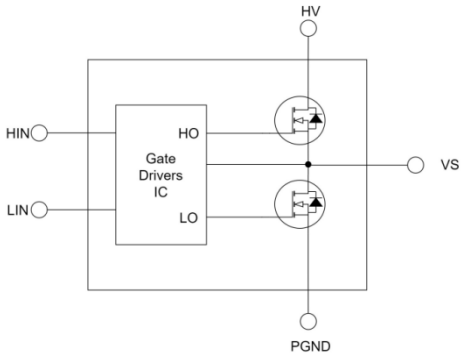


Figure 2: VTS output voltage curve

NOTE：The output voltage of VTS is calculated according to this formula：V_{VTS}(mV)=18.2xT_{HVIC}+435±250

Application Guide

Input/Output Function



HIN	LIN	HO	LO	Note
1	0	1	0	High Side MOS open,Low Side MOS close
0	1	0	1	High Side MOS close,Low Side MOS open
0	0	0	0	High Side MOS close,Low Side MOS close
1	1	0	0	High Side MOS close,Low Side MOS close

Timing diagram of protection function

[Under-Voltage Protection] Low-side

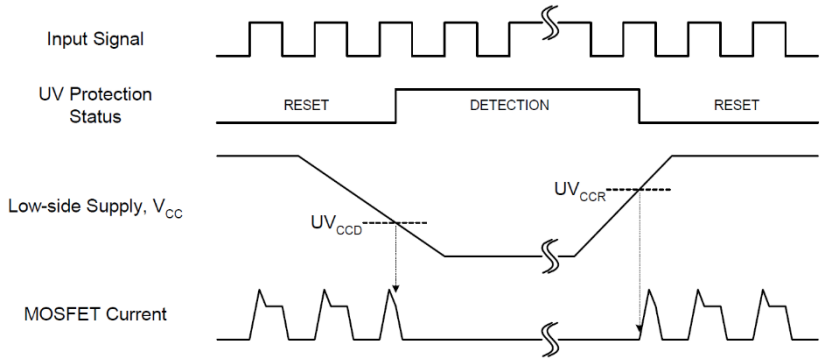


Figure 3: Timing diagram of under-voltage protection (Low-side)

[Under-Voltage Protection] High-side

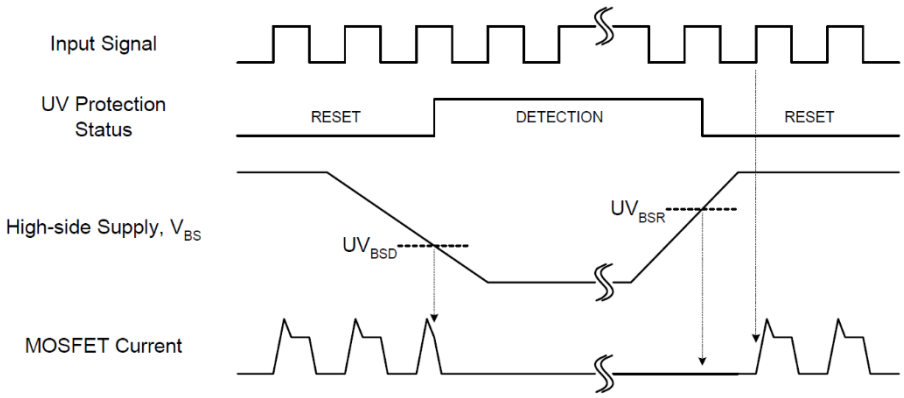


Figure 4: Timing diagram of under-voltage protection (High-side)

● Example of Application Circuit

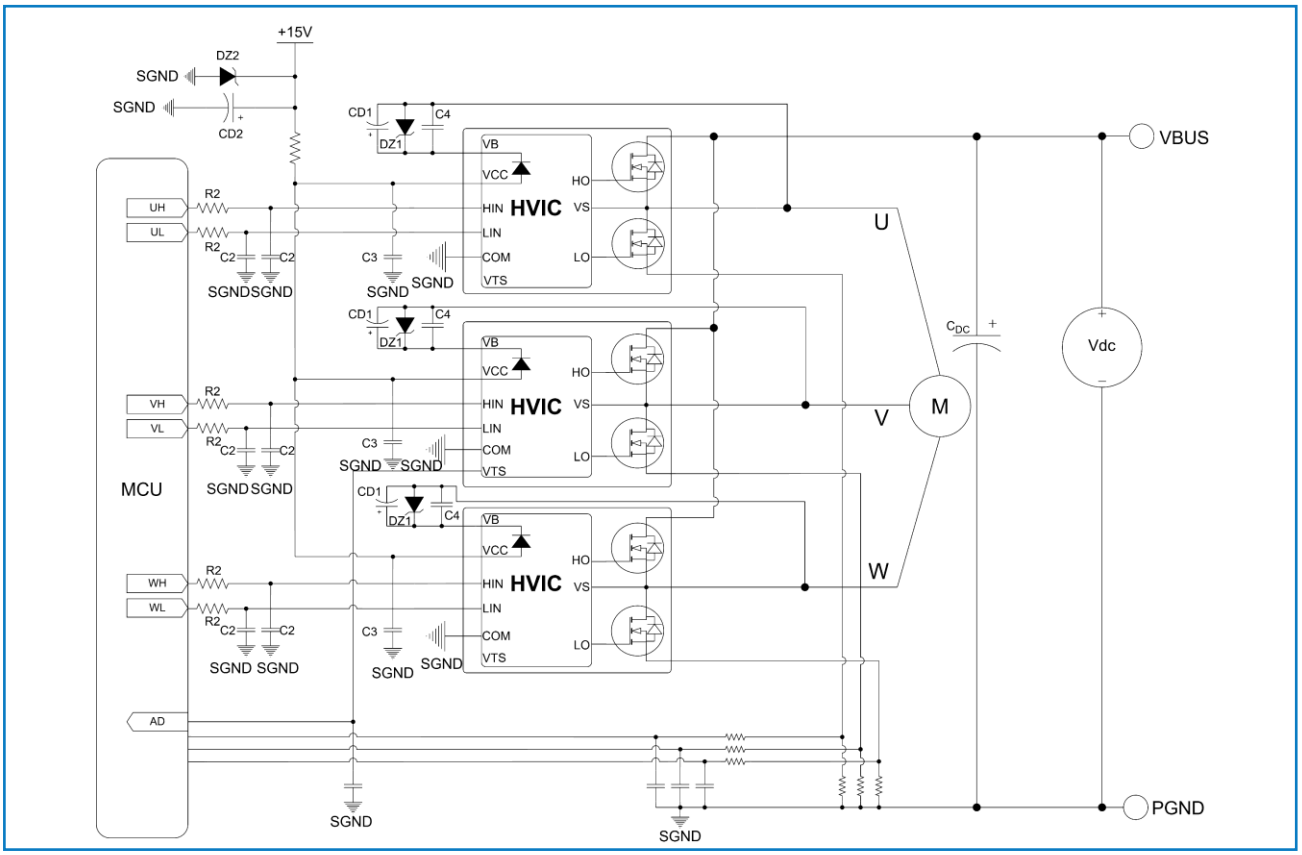


Figure 5: Application Circuit

Notes：

1、To avoid input signal oscillation, the wiring of each input should be as short as possible, and the use of RC filters (R2, C2) on each input signal is recommended. The filters should be with a time constant of about 100 ns and placed as close as possible to the IPM input pins.

2、The use of a bypass capacitor CD2 (aluminum or tantalum) can reduce the transient circuit demand on the power supply. The recommended value of CD2 is range of 10uf or more. Also, to reduce any high-frequency switching noise distributed on the power lines, a decoupling capacitor C3 (100 to 220nF, with low ESR and low ESL) should be placed as close as possible to the VCC pin and in parallel with the bypass capacitor.

3、The decoupling capacitor C4 (from 100 to 220nF, ceramic with low ESR and low ESL), in parallel with each CD1, filters high-frequency disturbance. The recommended value of CD1 is between 2.2uF and 47uF. CD1 and C4 should be placed as close as possible to the SW and BST pins. Bootstrap negative electrodes should be connected to SW terminals directly and separated from the main output wires.

4、To avoid overvoltage on the VCC pin, a Zener diode (DZ2) can be used. Similarly, on the BST pin, a Zener diode (DZ1) can be placed in parallel with each CD1.

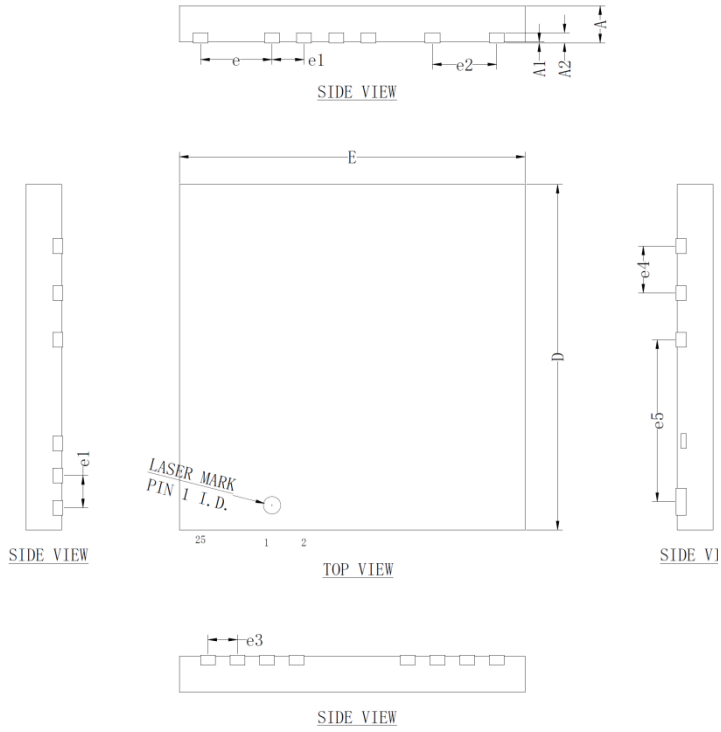
5、Low-inductance shunt resistors Rcs to be used for phase leg current sensing.

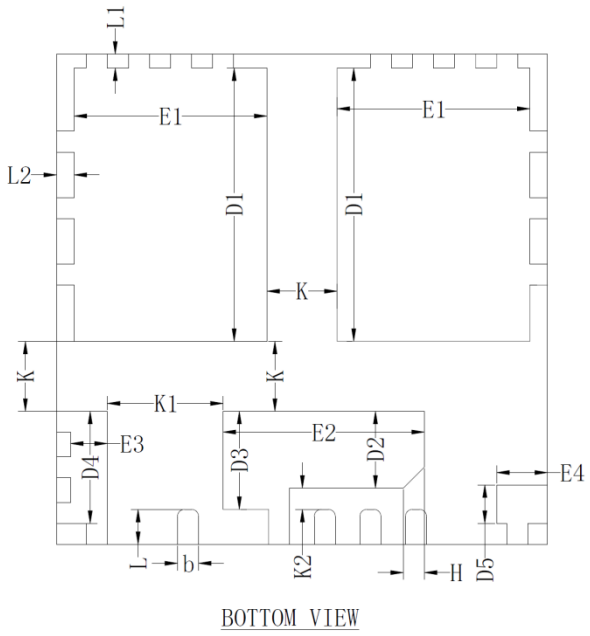
6、In order to avoid malfunctions, the wiring on vs pins, the shunt resistor and PGND should be as short as possible.

7、The connection of SGND to PGND on one point only (close to the shunt resistor terminal) can reduce the impact of power ground fluctuation.

Mechanical Dimensions for QFN7X7-25L

UNIT:mm





SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	--	0.02	0.05
A2		0.203REF	
b	0.25	0.30	0.35
D	6.90	7.00	7.10
E	6.90	7.00	7.10
D1	3.80	3.90	4.00
E1	2.65	2.75	2.85
D2	1.00	1.10	1.20
D3	1.30	1.40	1.50
E2	2.77	2.87	2.97
D4	1.50	1.60	1.70
E3	0.42	0.52	0.62
D5	0.45	0.55	0.65
E4	0.63	0.73	0.83
e		1.44BSC	
e1		0.65BSC	
e2		1.30BSC	
e3		0.60BSC	
e4		0.95BSC	
e5		3.27BSC	
H	0.25	0.30	0.35
K		1.00REF	
K1		1.65REF	
K2		0.30REF	
L	0.45	0.50	0.55
L1	0.15	0.20	0.25
L2	0.20	0.25	0.30

Ordering Information

Part	Package	Marking	QTY(PCS)	Packing method
WPM4DT502QTA1	QFN7X7-25L	WPM4DT502QTA1	3000	Tape and reel

Contact Information

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WAYON website: http://www.way-on.com
For additional information, please contact your local Sales Representative.
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1.The product specification aims to provide users with a reference regarding various product parameters, performance, and usage. It presents certain aspects of the product's performance in graphical form and is intended solely for users to select product and make product comparisons, enabling users to better understand and evaluate the characteristics and advantages of the product. It does not constitute any commitment, warranty, or guarantee.

2.The product parameters described in the product specification are numerical values, characteristics, and functions obtained through actual testing or theoretical calculations of the product in an independent or ideal state. Due to the complexity of product applications and variations in test conditions and equipment, there may be slight fluctuations in parameter test values. WAYON shall not guarantee that the actual performance of the product when installed in the customer's system or equipment will be entirely consistent with the product specification, especially concerning dynamic parameters. It is recommended that users consult with professionals for product selection and system design. Users should also thoroughly validate and assess whether the actual parameters and performance when installed in their respective systems or equipment meet their requirements or expectations. Additionally, users should exercise caution in verifying product compatibility issues, and WAYON assumes no responsibility for the application of the product.

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