3-Terminal 1 A Positive Voltage Regulator

Description

The LM78MxxA series of three-terminal positive regulators are available in the TO-252-2 package with several fixed output voltages making it useful in a wide range of applications.
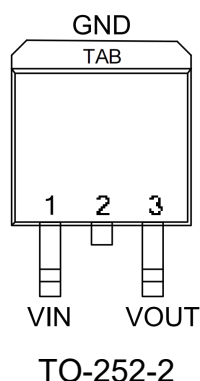
TO-252-2

Features

● Output Current up to 1A

● Output Voltages of 5, 6, 8, 9, 12, 15, 18, 24V

● Thermal Overload Protection

● Short Circuit Protection

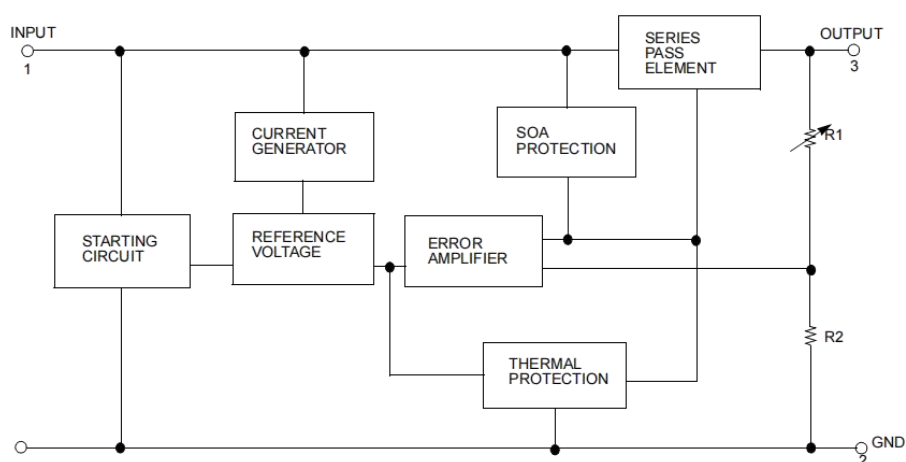● Output Transistor Safe Operating Area (SOA)Protection

Ordering Information

DEVICE	Package Type	MARKING	Packing	Packing Qty
LM78M05ADT/TR	TO-252-2	78M05A	REEL	2500pcs/reel
LM78M06ADT/TR	TO-252-2	78M06A	REEL	2500pcs/reel
LM78M08ADT/TR	TO-252-2	78M08A	REEL	2500pcs/reel
LM78M09ADT/TR	TO-252-2	78M09A	REEL	2500pcs/reel
LM78M12ADT/TR	TO-252-2	78M12A	REEL	2500pcs/reel
LM78M15ADT/TR	TO-252-2	78M15A	REEL	2500pcs/reel
LM78M18ADT/TR	TO-252-2	78M18A	REEL	2500pcs/reel
LM78M24ADT/TR	TO-252-2	78M24A	REEL	2500pcs/reel

Pin Configuration

GND
TAB

1 2 3

VIN   VOUT

TO-252-2

Internal Block Digram

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Input Voltage (for V_O = 5V to 18V)	V_I	35	V
(for V_O = 24V)	V_I	40	V
Thermal Resistance Junction-Case TO-252-2 (Tc = +25 ℃)	$R\theta JC$	2.5	℃/W
Thermal Resistance Junction-Air TO-252-2 (Ta = +25 ℃)	$R\theta JA$	92	℃/W
Operating Junction Temperature Range	TOPR	0 ~ +125	℃
Storage Temperature Range	TSTG	-65 ~ +150	℃
Lead Temperature (Soldering, 10 seconds)	T_L	260	℃

Note:Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not ensured.

LM78MxxA

Electrical Characteristics (LM78M05A)

(Refer to the test circuits, -40< TJ < +85℃, IO=1A, VI=10V, unless otherwise specified, CI = 0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	T_J = +25℃		4.8	5	5.2	V
		IO=5mA to 1A VI=7V to 20V		4.75	5	5.25	
Line Regulation (Note3)	ΔV_O	I_O = 200mA	V_I = 7V to 25V	-	-	100	mV
		T_J =+25℃	V_I = 8V to 25V	-	-	50	
Load Regulation (Note3)	ΔV_O	I_O = 5mA to 0.5A, T_J =+25℃		-	-	100	mV
		I_O = 5mA to 200mA, T_J =+25℃		-	-	50	
Quiescent Current	IQ	T_J =+25℃		-	4.0	6.0	mA
Quiescent Current Change	ΔIQ	I_O = 5mA to 350mA		-	-	0.5	mA
		I_O = 200mA V_I = 8V to 25V		-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	I_O = 5mA T_J = -40 to +85℃		-	-0.5	-	mV/℃
Output Noise Voltage	VN	f = 10Hz to 100kHz		-	40	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 8V to 18V, T_J =+25℃		-	80	-	dB
Dropout Voltage	VD	T_J =+25℃, I_O = 500mA		-	2	-	V
Short Circuit Current	ISC	T_J =+25℃, V_I = 35V		-	300	-	mA
Peak Current	IPK	T_J =+25℃		-	700	-	mA

Note:

Load and line regulation are specified at constant junction temperature. Change in Vo due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Electrical Characteristics (LM78M06A) (Continued)

(Refer to the test circuits, -40 < TJ < +85 ℃, IO=1A, VI =11V, unless otherwise specified, CI=0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	T_J = +25℃		5.75	6	6.25	V
		I_O = 5mA to 1AV_I = 8V to 21V		5.7	6	6.3	
Line Regulation (Note1)	ΔV_O	I_O = 200mA	V_I = 8V to 25V	-	-	100	mV
		T_J = +25℃	V_I = 9V to 25V	-	-	50	
Load Regulation (Note1)	ΔV_O	I_O = 5mA to 0.5A, T_J = +25℃		-	-	120	mV
		I_O = 5mA to 200mA, T_J = +25℃		-	-	60	
Quiescent Current	IQ	T_J = +25℃		-	4.0	6.0	mA
Quiescent Current Change	ΔIQ	I_O = 5mA to 350mA		-	-	0.5	mA
		I_O = 200mA V_I = 9V to 25V		-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	I_O = 5mA T_J = -40 to +85℃		-	-0.5	-	mV/℃
Output Noise Voltage	VN	f = 10Hz to 100kHz		-	45	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 9V to 19V, T_J =+25℃		-	80	-	dB
Dropout Voltage	VD	T_J =+25℃, I_O = 500mA		-	2	-	V
Short Circuit Current	ISC	T_J = +25℃, V_I= 35V		-	300	-	mA
Peak Current	IPK	T_J =+25℃		-	700	-	mA

Note:

1. Load and line regulation are specified at constant junction temperature. Change in Vo due to heating effects must be taken into account separately. Pulse testing with low duty is used.

http://www.hgsemi.com.cn   3 / 11   2018 AUG

Electrical Characteristics (LM78M08A) (Continued)

(Refer to the test circuits, -40 < TJ < +85℃, IO=1A, VI=14V, unless otherwise specified, CI = 0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	VO	TJ =+25℃		7.7	8	8.3	V
		IO = 5mA to 1A VI = 10.5V to 23V		7.6	8	8.4	
Line Regulation (Note1)	ΔVO	IO = 200mA TJ =+25℃	VI = 10.5V to 25V	-	-	100	mV
			VI = 11V to 25V	-	-	50	
Load Regulation (Note1)	ΔVO	IO = 5mA to 0.5A, TJ =+25℃		-	-	160	mV
		IO = 5mA to 200mA, TJ =+25℃		-	-	80	
Quiescent Current	IQ	TJ = +25℃		-	4.0	6.0	mA
Quiescent Current Change	ΔIQ	IO = 5mA to 350mA		-	-	0.5	mA
		IO = 200mA VI = 10.5V to 25V		-	-	0.8	
Output Voltage Drift	RR	IO = 5mA TJ = -40 to +85℃		-	-0.5	-	mV/℃
Output Noise Voltage	VN	f = 10Hz to 100kHz		-	52	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, IO = 300mA VI = 11.5V to 21.5V, TJ =+25℃		-	80	-	dB
Dropout Voltage	VD	TJ = +25℃, IO = 500mA		-	2	-	V
Short Circuit Current	ISC	TJ = +25℃, VI = 35V		-	300	-	mA
Peak Current	IPK	TJ = +25℃		-	700	-	mA

Note:

1. Load and line regulation are specified at constant junction temperature. Change in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Electrical Characteristics (LM78M09A) (Continued)

(Refer to the test circuits, -40 < TJ < +85℃, IO=1A, VI=15V, unless otherwise specified, CI = 0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	VO	TJ =+25℃		8.65	9	9.35	V
		IO = 5mA to 1A VI = 11.5V to 25V		8.55	9	9.45	
Line Regulation (Note1)	ΔVO	IO = 200mA TJ =+25℃	VI = 11.5V to 25V	-	-	100	mV
			VI = 12V to 25V	-	-	50	
Load Regulation (Note1)	ΔVO	IO = 5mA to 0.5A, TJ =+25℃		-	-	180	mV
		IO = 5mA to 200mA, TJ =+25℃		-	-	90	
Quiescent Current	IQ	TJ = +25℃		-	4.6	6.0	mA
Quiescent Current Change	ΔIQ	IO = 5mA to 350mA		-	-	0.5	mA
		IO = 200mA VI = 11.5V to 25V		-	-	0.8	
Output Voltage Drift	RR	IO = 5mA TJ = -40 to +85℃		-	-0.8	-	mV/℃
Output Noise Voltage	VN	f = 10Hz to 100kHz		-	60	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, IO = 300mA VI = 11.5V to 21.5V, TJ =+25℃		-	80	-	dB
Dropout Voltage	VD	TJ = +25℃, IO = 500mA		-	2	-	V
Short Circuit Current	ISC	TJ = +25℃, VI = 35V		-	300	-	mA
Peak Current	IPK	TJ = +25℃		-	700	-	mA

Note:

1. Load and line regulation are specified at constant junction temperature. Change in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Electrical Characteristics (LM78M12A) (Continued)

(Refer to the test circuits, -40 < TJ < +85℃, IO=1A, VI=19V, unless otherwise specified, CI =0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	T_J = +25℃		11.5	12	12.5	V
		I_O = 5mA to 1A V_I = 14.5V to 27V		11.4	12	12.6	
Line Regulation (Note1)	ΔV_O	I_O = 200mA T_J = +25℃	V_I = 14.5V to 30V	-	-	100	mV
			V_I = 16V to 30V	-	-	50	
Load Regulation (Note1)	ΔV_O	I_O = 5mA to 0.5A, T_J = +25℃		-	-	240	mV
		I_O = 5mA to 200mA, T_J = +25℃		-	-	120	
Quiescent Current	I_Q	T_J =+25℃		-	4.1	6.0	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 350mA		-	-	0.5	mA
		I_O = 200mA V_I = 14.5V to 30V		-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	I_O = 5mA T_J = -40 to +85℃		-	-0.5	-	mV/℃
Output Noise Voltage	V_N	f = 10Hz to 100kHz		-	75	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 15V to 25V, T_J =+25℃		-	80	-	dB
Dropout Voltage	V_D	T_J =+25℃, I_O = 500mA		-	2	-	V
Short Circuit Current	ISC	T_J = +25℃, V_I = 35V		-	300	-	mA
Peak Current	IPK	T_J = +25℃		-	700	-	mA

Note:

1. Load and line regulation are specified at constant junction temperature. Change in Vo due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Electrical Characteristics (LM78M15A) (Continued)

(Refer to the test circuits, -40 < TJ < +85℃, IO=1A, VI=23V, unless otherwise specified, CI =0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	T_J = +25℃		14.4	15	15.6	V
		I_O = 5mA to 1A V_I = 17.5V to 30V		14.25	15	15.75	
Line Regulation (Note1)	ΔV_O	I_O = 200mA T_J =+25℃	V_I = 17.5V to 30V	-	-	100	mV
			V_I = 20V to 30V	-	-	50	
Load Regulation (Note1)	ΔV_O	I_O = 5mA to 0.5A, T_J =+25℃		-	-	300	mV
		I_O = 5mA to 200mA, T_J =+25℃		-	-	150	
Quiescent Current	I_Q	T_J = +25℃		-	4.1	6.0	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 350mA		-	-	0.5	mA
		I_O = 200mA V_I = 17.5V to 30V		-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	I_O = 5mA T_J = -40 to +85℃		-	-1	-	mV/℃
Output Noise Voltage	V_N	f = 10Hz to 100kHz		-	100	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 18.5V to 28.5V, T_J =+25℃		-	70	-	dB
Dropout Voltage	V_D	T_J =+25℃, I_O = 500mA		-	2	-	V
Short Circuit Current	ISC	T_J = +25℃, V_I = 35V		-	300	-	mA
Peak Current	IPK	T_J = +25℃		-	700	-	mA

Note:

1. Load and line regulation are specified at constant junction temperature. Change in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Electrical Characteristics (LM78M18A) (Continued)

(Refer to the test circuits, -40 < TJ < +85 ℃, IO=1A, VI=26V, unless otherwise specified, CI =0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	TJ = +25℃		17.3	18	18.7	V
		IO = 5mA to 1A VI = 20.5V to 33V		17.1	18	18.9	
Line Regulation (Note1)	ΔV_O	IO = 200mA	VI = 21V to 33V	-	-	100	mV
		TJ = +25℃	VI = 24V to 33V	-	-	50	
Load Regulation (Note1)	ΔV_O	IO = 5mA to 0.5A, TJ = +25℃		-	-	360	mV
		IO = 5mA to 200mA, TJ = +25℃		-	-	180	
Quiescent Current	IQ	TJ = +25℃		-	4.2	6.0	mA
Quiescent Current Change	ΔIQ	IO = 5mA to 350mA		-	-	0.5	mA
		IO = 200mA VI = 21V to 33V		-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	IO = 5mA TJ = -40 to 85℃		-	-1.1	-	mV/℃
Output Noise Voltage	V_N	f = 10Hz to 100kHz		-	100	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, IO= 300mA , VI = 22V to 32V TJ =+25℃		-	70	-	dB
Dropout Voltage	VD	TJ = +25℃, IO = 500mA		-	2	-	V
Short Circuit Current	ISC	TJ = +25℃, VI = 35V		-	300	-	mA
Peak Current	IPK	TJ = +25℃		-	700	-	mA

Note:

1. Load and line regulation are specified at constant junction temperature. Change in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Electrical Characteristics (LM78M24A) (Continued)

(Refer to the test circuits, -40 < TJ < +85℃, IO=350mA, VI=33V, unless otherwise specified, CI =0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	TJ =+25℃		23	24	25	V
		IO = 5mA to 1A VI = 27V to 38V		22.8	24	25.2	
Line Regulation (Note1)	ΔV_O	IO = 200mA	VI = 27V to 38V	-	-	100	mV
		TJ =+25℃	VI = 28V to 38V	-	-	50	
Load Regulation (Note1)	ΔV_O	IO = 5mA to 0.5A, TJ =+25℃		-	-	480	mV
		IO = 5mA to 200mA, TJ =+25℃		-	-	240	
Quiescent Current	IQ	TJ = +25℃		-	4.2	6.0	mA
Quiescent Current Change	ΔIQ	IO = 5mA to 350mA		-	-	0.5	mA
		IO = 200mA VI = 27V to 38V		-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	IO = 5mA TJ = -40 to +85℃		-	-1.2	-	mV/℃
Output Noise Voltage	V_N	f = 10Hz to 100kHz		-	170	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, IO = 300mA VI = 28V to 38V, TJ =+25℃		-	70	-	dB
Dropout Voltage	VD	TJ = +25℃, IO = 500mA		-	2	-	V
Short Circuit Current	ISC	TJ = +25℃, VI = 35V		-	300	-	mA
Peak Current	IPK	TJ = +25℃		-	700	-	mA

Note:

1.Load and line regulation are specified at constant junction temperature. Change in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.
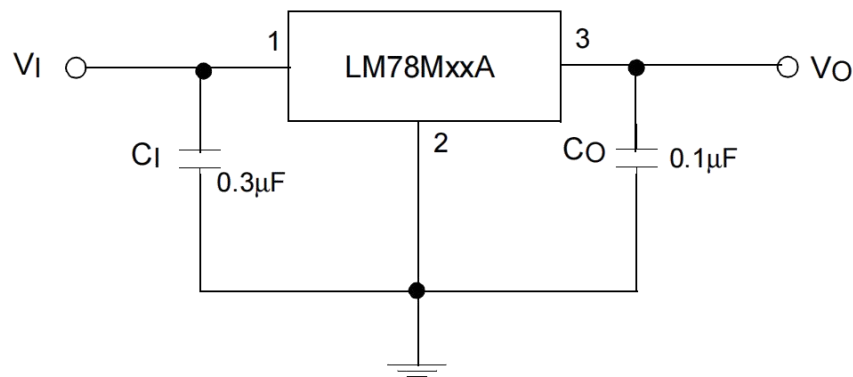
Typical Applications
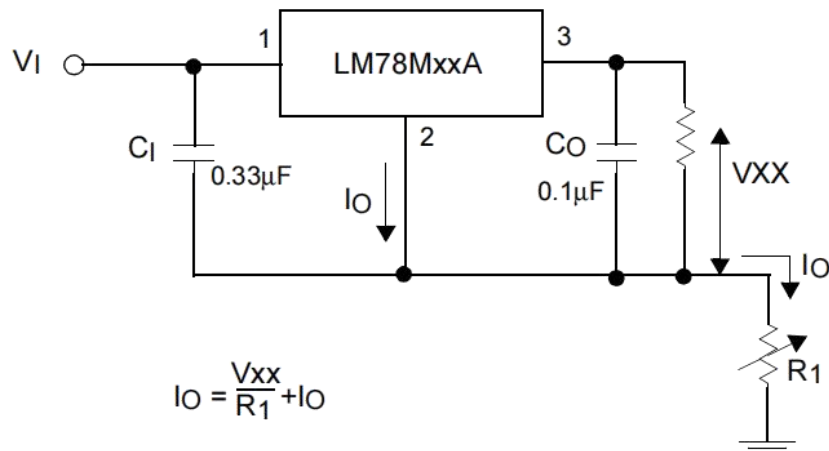

Figure 1. Fixed Output Regulator

$$I_O = \frac{V_{xx}}{R_1} + I_O$$

Figure 2. Constant Current Regulator

Notes:

1. To specify an output voltage, substitute voltage value for "XX"

2. Although no output capacitor is needed for stability, it does improve transient response.

3. CI is required if regulator is located an appreciable distance from power Supply filter
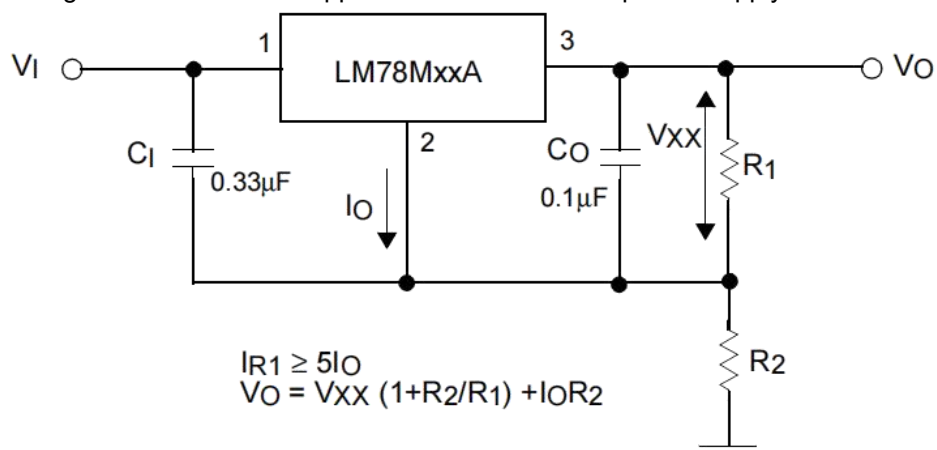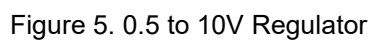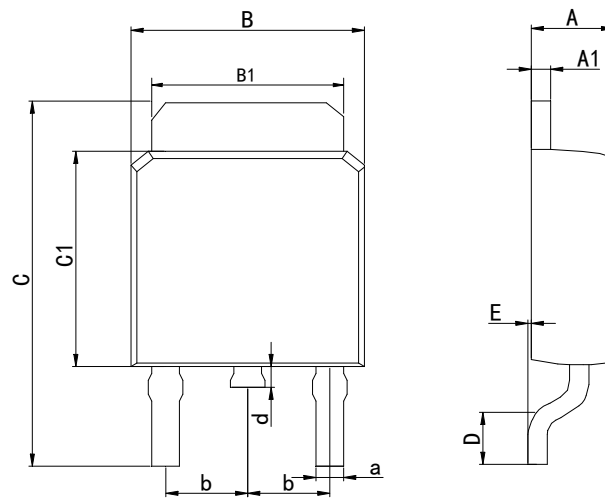

$$I_{R1} \geq 5I_O$$
$$V_O = V_{xx}(1 + R_2/R_1) + I_O R_2$$

Figure 3. Circuit for Increasing Output Voltage

Figure 4. Adjustable Output Regulator (7 to 30V)

$$VO = Vxx \frac{R4}{R_1}$$

Figure 5. 0.5 to 10V Regulator

Physical Dimensions

TO-252-2

Dimensions In Millimeters(TO-252-2)											
Symbol：	A	A1	B	B1	C	C1	D	E	a	d	b
Min：	2.10	0.45	6.40	5.10	9.20	5.30	0.90	0	0.50	0.60	2.28
Max：	2.50	0.70	6.80	5.50	10.6	6.30	1.75	0.23	0.80	1.20	BSC

Revision History

DATE	REVISION	PAGE
2018-8-5	New	1-11
2023-9-13	Update encapsulation type、Add annotation for Maximum Ratings.	1、2
2024-10-31	Update Lead Temperature	2

IMPORTANT STATEMENT:

Huaguan Semiconductor reserves the right to change its products and services without notice. Before ordering, the customer shall obtain the latest relevant information and verify whether the information is up to date and complete. Huaguan Semiconductor does not assume any responsibility or obligation for the altered documents.

Customers are responsible for complying with safety standards and taking safety measures when using Huaguan Semiconductor products for system design and machine manufacturing. You will bear all the following responsibilities: Select the appropriate Huaguan Semiconductor products for your application; Design, validate and test your application; Ensure that your application meets the appropriate standards and any other safety,security or other requirements. To avoid the occurrence of potential risks that may lead to personal injury or property loss.

Huaguan Semiconductor products have not been approved for applications in life support, military, aerospace and other fields, and Huaguan Semiconductor will not bear the consequences caused by the application of products in these fields. All problems, responsibilities and losses arising from the user's use beyond the applicable area of the product shall be borne by the user and have nothing to do with Huaguan Semiconductor, and the user shall not claim any compensation liability against Huaguan Semiconductor by the terms of this Agreement.

The technical and reliability data (including data sheets), design resources (including reference designs), application or other design suggestions, network tools, safety information and other resources provided for the performance of semiconductor products produced by Huaguan Semiconductor are not guaranteed to be free from defects and no warranty, express or implied, is made. The use of testing and other quality control technologies is limited to the quality assurance scope of Huaguan Semiconductor. Not all parameters of each device need to be tested.

The documentation of Huaguan Semiconductor authorizes you to use these resources only for developing the application of the product described in this document. You have no right to use any other Huaguan Semiconductor intellectual property rights or any third party intellectual property rights. It is strictly forbidden to make other copies or displays of these resources. You should fully compensate Huaguan Semiconductor and its agents for any claims, damages, costs, losses and debts caused by the use of these resources. Huaguan Semiconductor accepts no liability for any loss or damage caused by infringement.