WR0603

Ultra-low power consumption, CMOS LDO

1. General Description

The WR0603 series low-power, low-dropout, CMOS linear voltage regulators operate from a 2.0V to 5.5V input voltage and deliver up to 600mA output current. They are the perfect choice for low voltage, low power applications. A low ground current makes this part attractive for battery operated power systems. The WR0603 series also offer low dropout voltage to prolong battery life in portable electronics.

The WR0603 series include over current limit and thermal shutdown protection. The WR0603 has auto-discharge function to quickly discharge V_{OUT} when it's disabled.

The WR0603 series regulators are available in green SOT23-5, DFN2×2-6 packages.

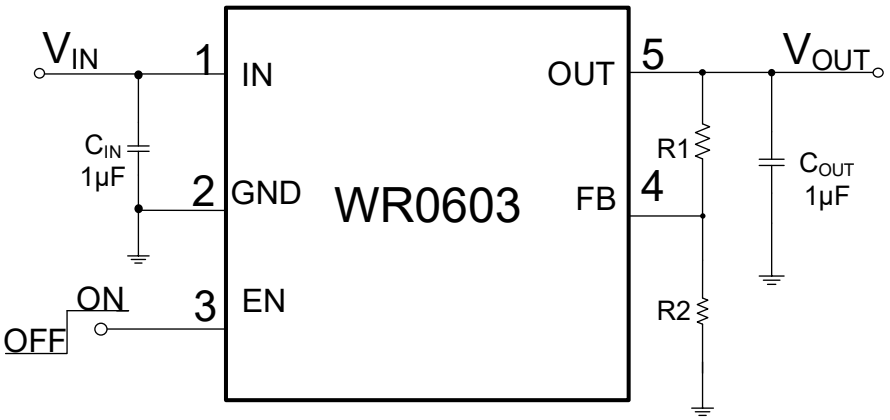
2. Features

- Low Dropout Voltage
- Thermal Shutdown Protection
- Fold Back Current Limit
- 2.0V to 5.5V Input Voltage Range
- Adjustable Output from 0.8V to 5.0V
- Output Discharge Function
- Operating Temperature: -40 to +85ºC
- Quiescent Current: 25μA Typ.
- Recommended Capacitor: 1μF

3. Applications

- MP3/MP4 Players
- Cellphones, radiophone, digital cameras
- Bluetooth, wireless handsets
- Others portable electronic device

4. Typical Application Circuit

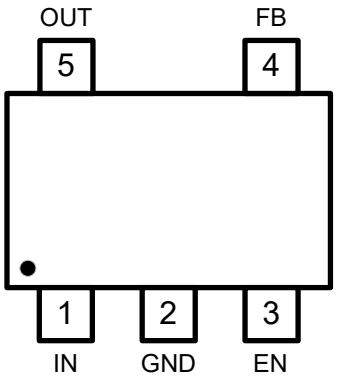


NOTE: Select R_2=160kΩ to maintain a 5μA minimum load.
Calculate the value of R_1 using the following equation:

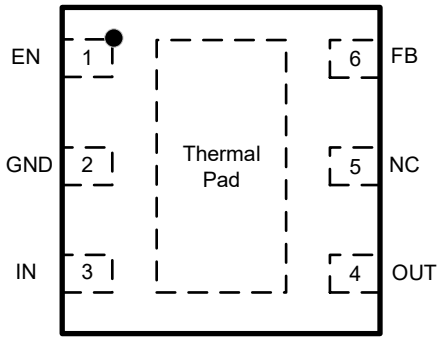
$$R_1 = R_2 \times \left(\frac{V_{OUT}}{0.8V} - 1\right)$$

5. Pin Configuration

(Top View)



SOT23-5



DFN2×2-6

6. Pin Description

PIN NUMBER		PIN NAME	I/O	PIN FUNCTION
SOT23-5	DFN2×2-6			
1	3	IN	I	Input voltage supply. Bypass with a typical 1μF capacitor to GND. Place the input capacitor as close to the IN and GND pins of the device as possible.
2	2	GND	-	Common ground.
3	1	EN	I	Enable input. Active High. EN is pulled down by a resistor of about 6.4MΩ.
4	6	FB	-	Feedback Pin
5	4	OUT	O	Regulated output voltage. A low equivalent series resistance (ESR) capacitor, typically 1μF, is required from OUT to ground for stability. Place the output capacitor as close to the OUT and GND pins of the device as possible. An internal 80Ω (typical) pull-down resistor can quickly discharge V_{OUT} when it's disabled.
-	5	NC	-	NC

7. Absolute Maximum Ratings[1]

SYMBOL	PARAMETER		RATING	UNIT
V_{IN}	Input Voltage Range		-0.3 to 6.0	V
V_{EN}, V_{FB}	EN, FB Input Voltage Range		-0.3 to V_{IN}	
V_{OUT}	Output Voltage Range		-0.3 to V_{IN}	
P_D[2]	Power Dissipation $P_{D(MAX)}$@T_A = 25ºC	SOT23-5	500	mW
		DFN2×2-6	1320	
$R_{\theta JA}$[3]	Thermal Resistance	SOT23-5	250	℃/W
		DFN2×2-6	94	
T_J	Junction Temperature		150	℃
T_{SDR}	Lead Temperature Range		260	
T_{STG}	Storage Temperature Range		-55 to 150	
ESD	HBM		±4000	V

NOTE1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE2: Power dissipation is calculated by $P_{D\,(MAX)} = (T_J - T_A) / R_{\theta JA}$.

NOTE3: Measured on 2cm x 2cm 2-layer FR4 PCB board, 1 oz copper, no via holes on GND copper.

8. Recommended Operating Conditions

SYMBOL	PARAMETER	RATING	UNIT
V_{IN}	Input Voltage Range	2.0 to 5.5	V
V_{EN}	EN Input Voltage Range	0 to 5.5	
V_{OUT}	Nominal Output Voltage Range	0.8 to 5.0	
I_{OUT}	Output Current Range	0 to 600	mA
C_{IN}	Input Capacitor	1	μF
C_{OUT}	Output Capacitor	1	
T_A	Ambient Temperature	-40 to 85	℃

9. Electrical Characteristics

(V_{IN} =V_{OUT}+0.5V or V_{IN}=2.0V (Whichever is greater), C_{IN}=C_{OUT}=1.0μF, T_A=25°C, unless otherwise noted)

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	TYP.	MAX	UNIT
V_{IN}	Input Voltage			2.0		5.5	V
V_{OUT}	Output Voltage	I_{OUT}=1mA		0.98 V_{OUT}	V_{OUT}	1.02 V_{OUT}	V
V_{FB}	Feedback Voltage	I_{OUT}=1mA		0.784	0.8	0.816	V
I_{OUT}	Maximum Output Current	0.8V ≤ V_{OUT} < 1.2V		300			mA
		V_{IN}=V_{OUT}+1.0V, 1.2V ≤ V_{OUT} < 5.0V		600			
I_{LIM}	Current Limit	V_{EN}=V_{IN}, V_{OUT}=$V_{OUT(NOM)}$ ×95%		700	750		mA
I_{SHORT}	Short Current	V_{EN}=V_{IN}, V_{OUT}=0V			350		mA
I_Q	Quiescent Current	V_{EN} = V_{IN} , I_{OUT}=0mA			25	40	μA
V_{DO}	Dropout Voltage[4]	I_{OUT} = 300mA	V_{OUT} = 0.8V		940	1200	mV
			V_{OUT} = 0.9V		840	1100	
			1.0V ≤ V_{OUT} < 1.1V		780	1000	
			1.1V ≤ V_{OUT} < 1.2V		680	900	
			1.2V ≤ V_{OUT} < 1.5V		590	800	
			1.5V ≤ V_{OUT} < 1.8V		420	550	
			1.8V ≤ V_{OUT} < 2.1V		320	420	
			2.1V ≤ V_{OUT} < 2.5V		260	340	
			2.5V ≤ V_{OUT} < 3.0V		215	280	
			3.0V ≤ V_{OUT} < 3.6V		190	250	
			3.6V ≤ V_{OUT} ≤ 5.0V		165	210	

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	TYP.	MAX	UNIT
V_{DO}	Dropout Voltage	I_{OUT}= 600mA	1.2V ≤ V_{OUT} < 1.5V		650	850	mV
			1.5V ≤ V_{OUT} < 1.8V		580	750	
			1.8V ≤ V_{OUT} < 2.1V		500	650	
			2.1V ≤ V_{OUT} < 2.5V		450	570	
			2.5V ≤ V_{OUT} < 3.0V		400	530	
			3.0V ≤ V_{OUT} < 3.6V		380	490	
			3.6V ≤ V_{OUT} ≤ 5.0V		330	420	
LNR	Line Regulation	V_{IN}=V_{OUT}+1.0V to 5.5V, I_{OUT}=1mA			0.01	0.2	%/V
LDR	Load Regulation[5]	I_{OUT}=1~600mA			10		mV
I_{SHDN}	Shut-down Current	V_{EN}=0V			0.01	1	μA
PSRR	Power Supply Rejection Ratio	V_{IN}=(V_{OUT}+1V) DC+0.5V_{P-P} f=100Hz, I_{OUT}=30mA			70		dB
		V_{IN}=(V_{OUT}+1V) DC+0.5V_{P-P} f=1kHz, I_{OUT}=30mA			50		
V_{NO}	Output noise voltage	BW=10Hz to 100kHz, V_{OUT}=1.8V, I_{OUT}=10mA			150		μV_{RMS}
V_{IH}	EN logic high voltage	V_{IN}=5.5V, I_{OUT}=1mA		1.2			V
V_{IL}	EN logic low voltage	V_{IN}=5.5V, I_{OUT}=1mA				0.4	V
I_{EN}	EN Input leakage	V_{EN}=0V or 5.5V		-1		1	μA
R_{DIS}	Output Discharge resistance	V_{IN}=4.0V, V_{EN}=0V			80		Ω
T_C	Output Voltage Temperature Coefficient	-40° C≤T_A≤85° C			100		ppm/°C
T_{SD}	Thermal shutdown threshold				155		°C
ΔT_{SD}	Thermal shutdown hysteresis				20		°C

NOTE4: The dropout voltage is defined as (V_{IN}-V_{OUT}) when V_{OUT} is $V_{OUT(NOM)}$ × 98%.

NOTE5: The Load regulation is measured by pulse test.

10. Typical Performance Characteristics

(T_A=25°C, V_{IN}=V_{OUT}+0.5V, C_{IN}=C_{OUT}=1μF, unless otherwise noted)

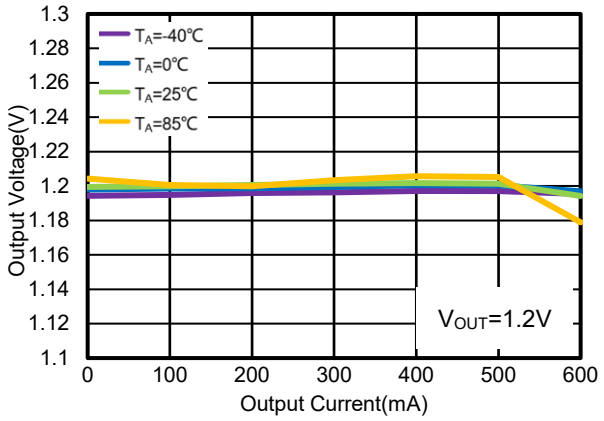


Figure 1. WR0603-ADA50R
Output Voltage vs. Output Current

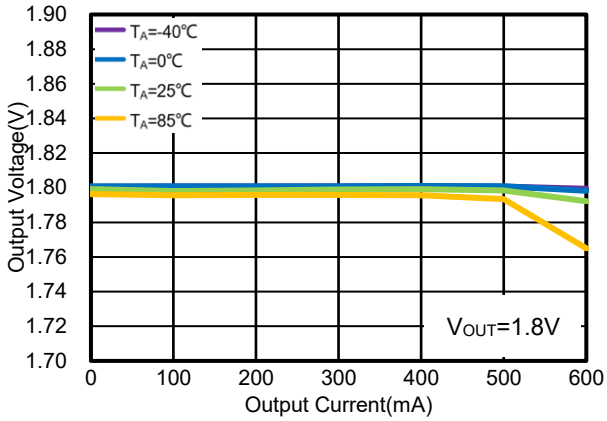


Figure 2. WR0603-ADA50R
Output Voltage vs. Output Current

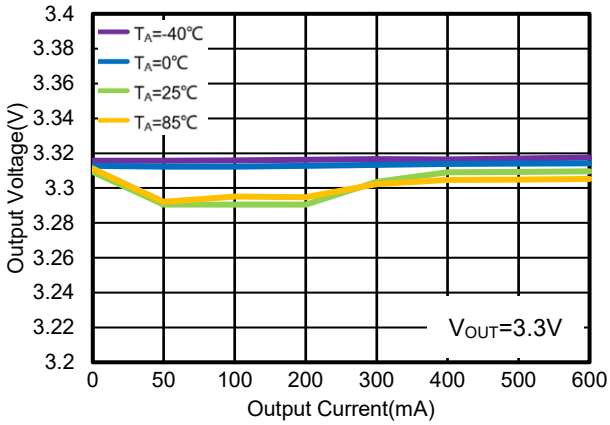


Figure 3. WR0603-ADA50R
Output Voltage vs. Output Current

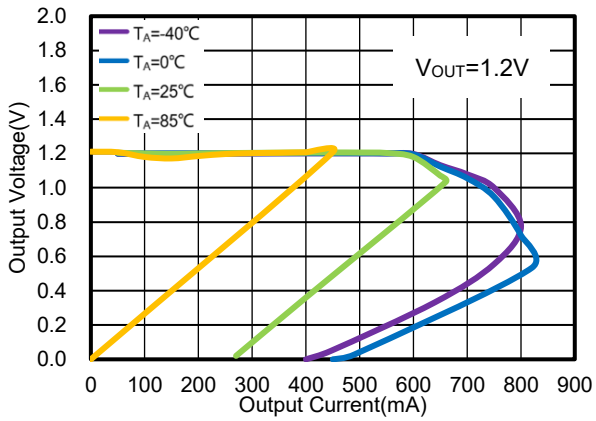


Figure 4. WR0603-ADA50R
Current Limit vs I_{OUT} & Ambient Temperature

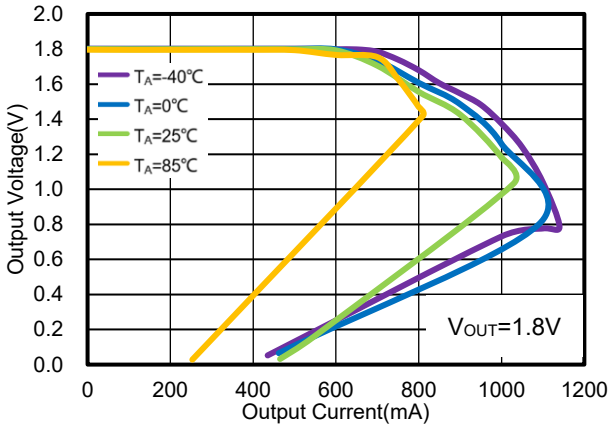


Figure 5. WR0603-ADA50R
Current Limit vs I_{OUT} & Ambient Temperature

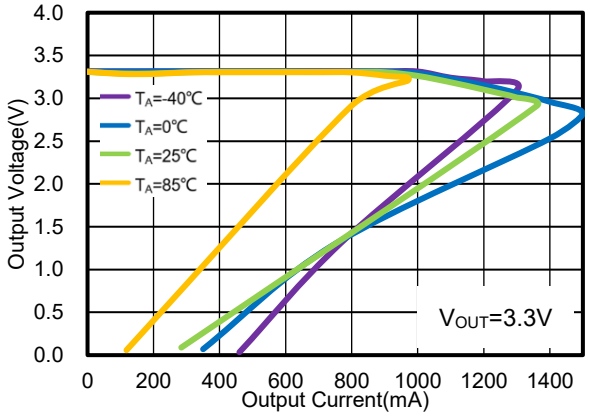


Figure 6. WR0603-ADA50R
Current Limit vs I_{OUT} & Ambient Temperature

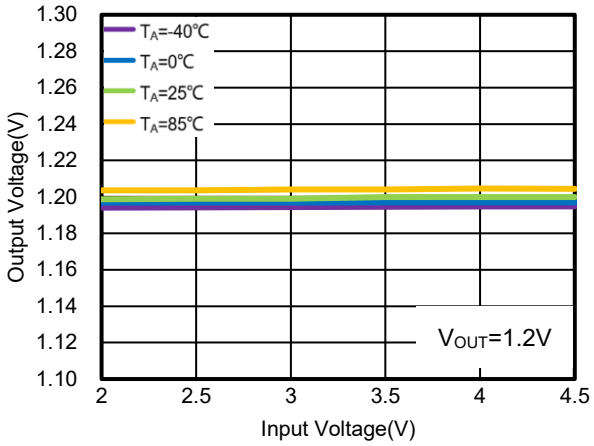


Figure 7. WR0603-ADA50R

Output Voltage vs V_{IN} & Ambient Temperature

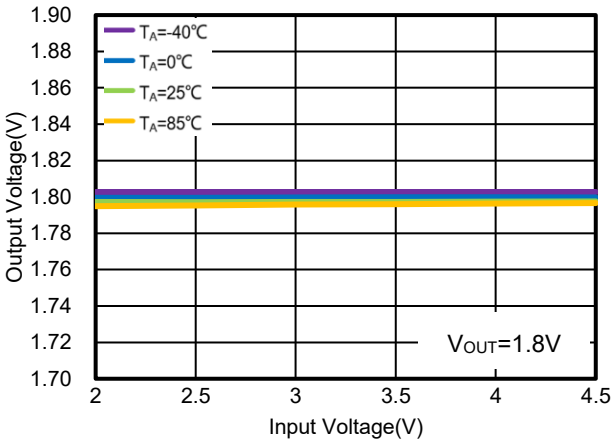


Figure 8. WR0603-ADA50R

Output Voltage vs V_{IN} & Ambient Temperature

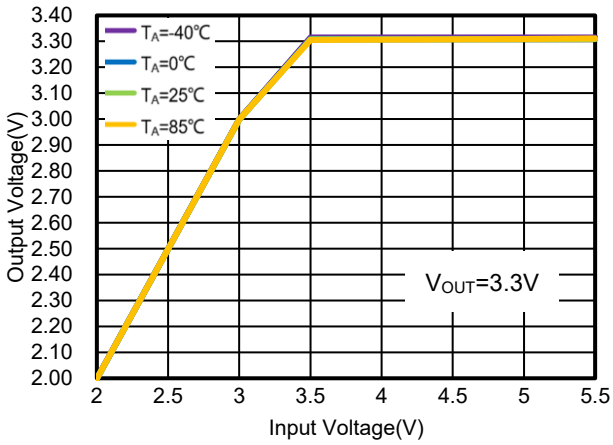


Figure 9. WR0603-ADA50R

Output Voltage vs V_{IN} & Ambient Temperature

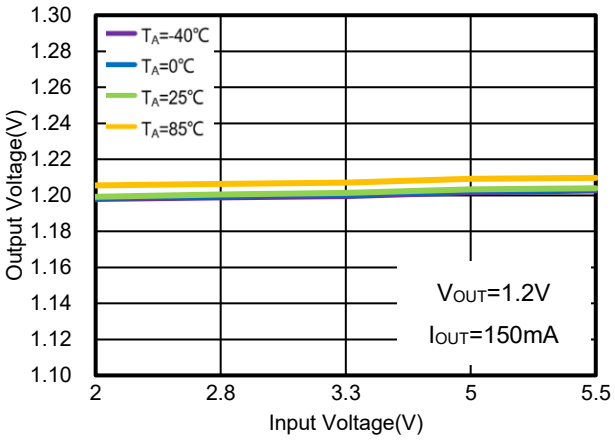


Figure 10. WR0603-ADA50R

Output Voltage vs V_{IN} & Ambient Temperature

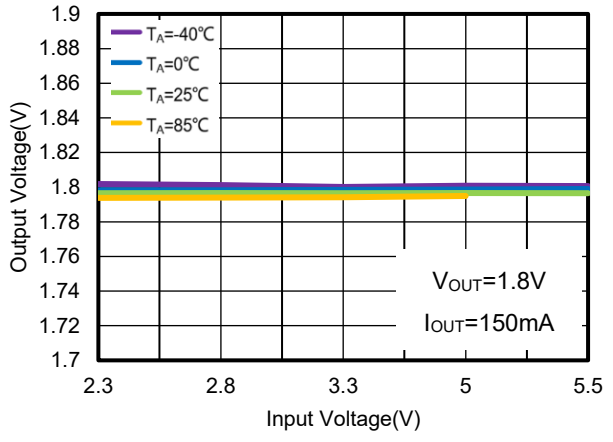


Figure 11. WR0603-ADA50R

Output Voltage vs V_{IN} & Ambient Temperature

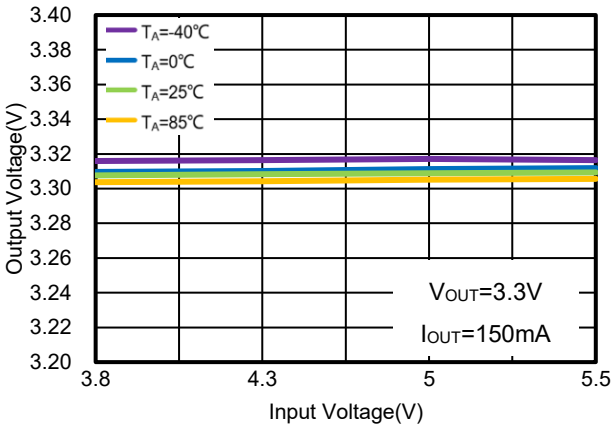


Figure 12. WR0603-ADA50R

Output Voltage vs V_{IN} & Ambient Temperature

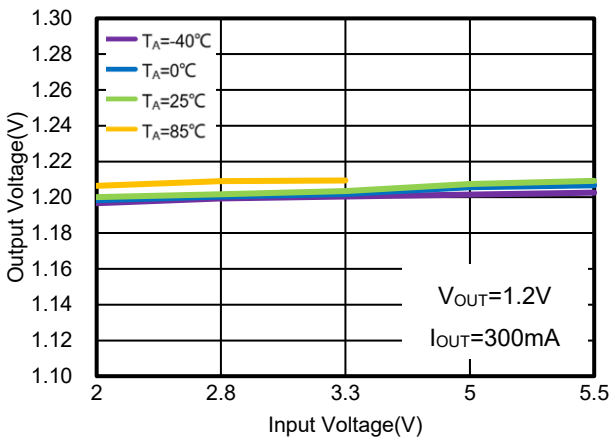


Figure 13. WR0603-ADA50R

Output Voltage vs V_{IN} & Ambient Temperature

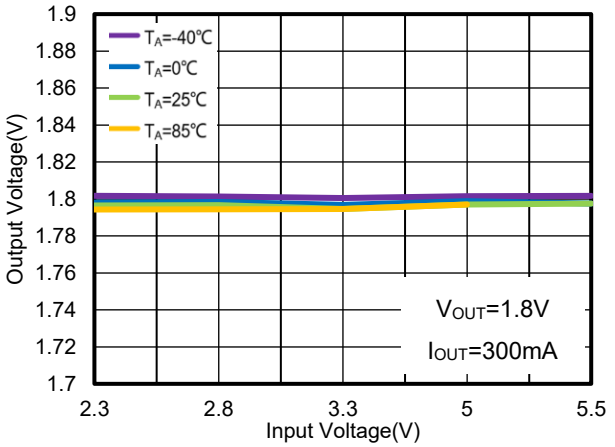


Figure 14. WR0603-ADA50R

Output Voltage vs V_{IN} & Ambient Temperature

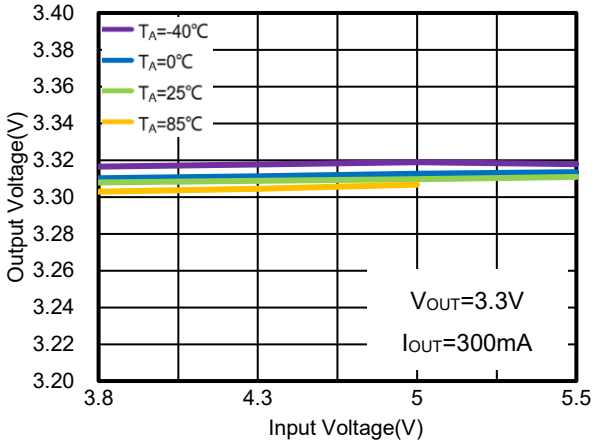


Figure 15. WR0603-ADA50R

Output Voltage vs V_{IN} & Ambient Temperature

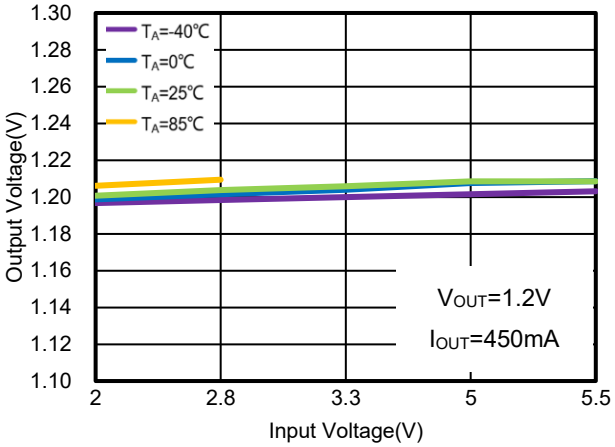


Figure 16. WR0603-ADA50R

Output Voltage vs V_{IN} & Ambient Temperature

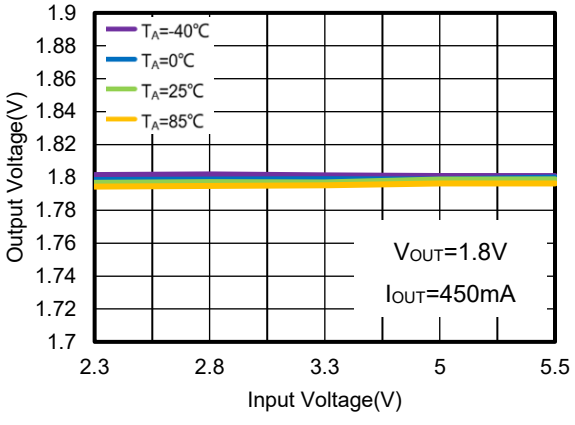


Figure17. WR0603-ADA50R

Output Voltage vs V_{IN} & Ambient Temperature

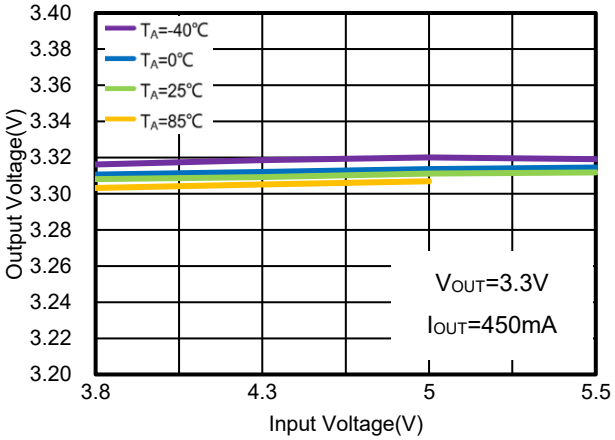


Figure18. WR0603-ADA50R

Output Voltage vs V_{IN} & Ambient Temperature

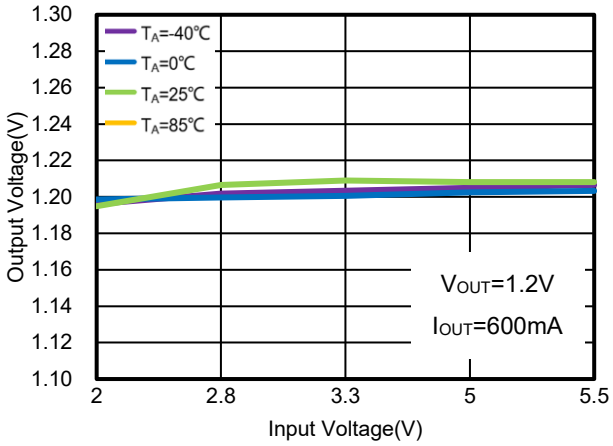


Figure19. WR0603-ADA50R

Output Voltage vs V_{IN} & Ambient Temperature

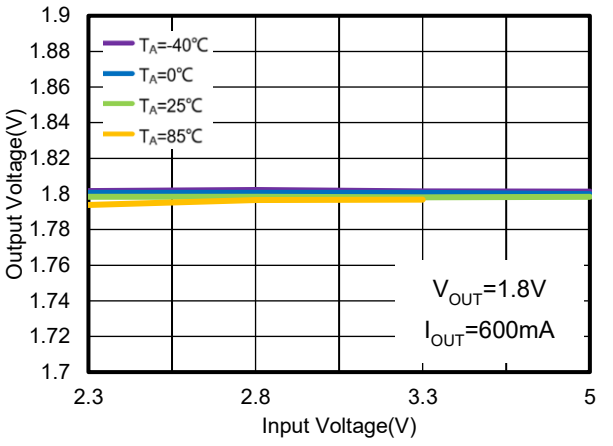


Figure20. WR0603-ADA50R

Output Voltage vs V_{IN} & Ambient Temperature

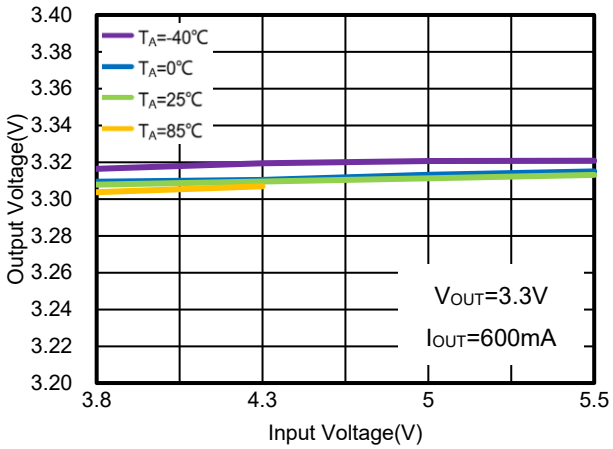


Figure21. WR0603-ADA50R

Output Voltage vs V_{IN} & Ambient Temperature

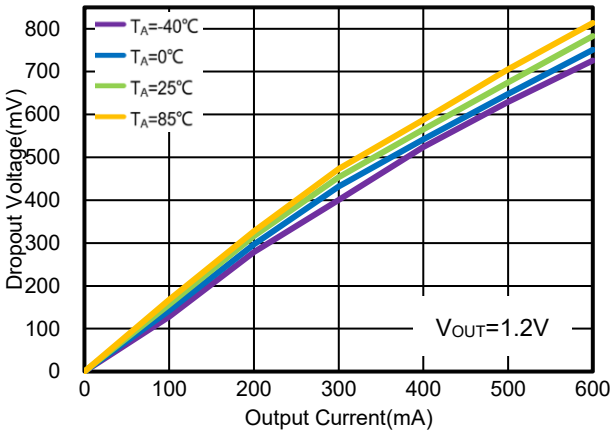


Figure22. WR0603-ADA50R

Dropout Voltage vs I_{OUT} & Ambient Temperature

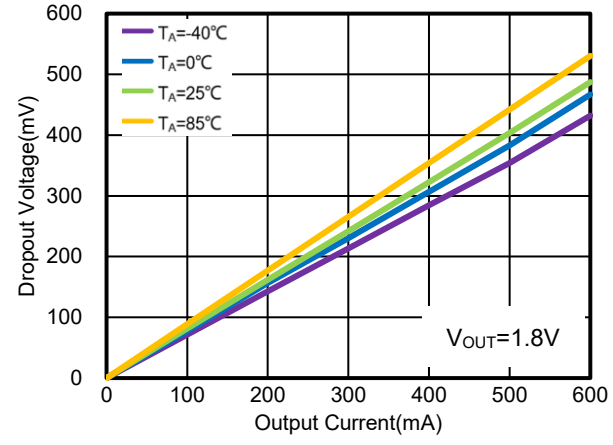


Figure23. WR0603-ADA50R

Dropout Voltage vs I_{OUT} & Ambient Temperature

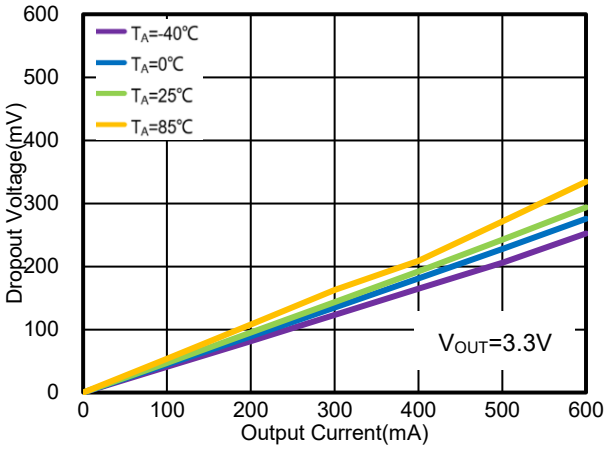


Figure24. WR0603-ADA50R

Dropout Voltage vs I_{OUT} &Ambient Temperature

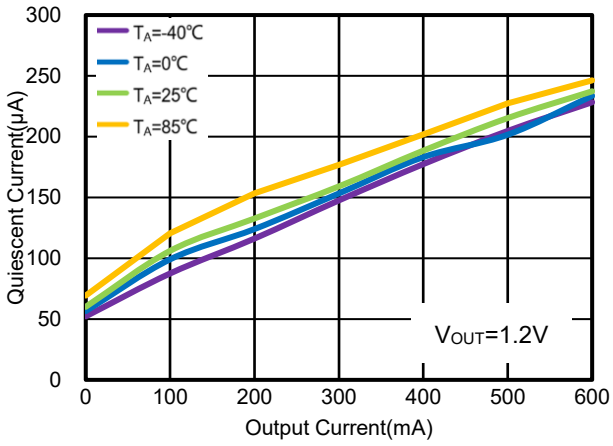


Figure 25. WR0603-ADA50R

Ground Pin Current vs. I_{OUT} & Ambient Temperature

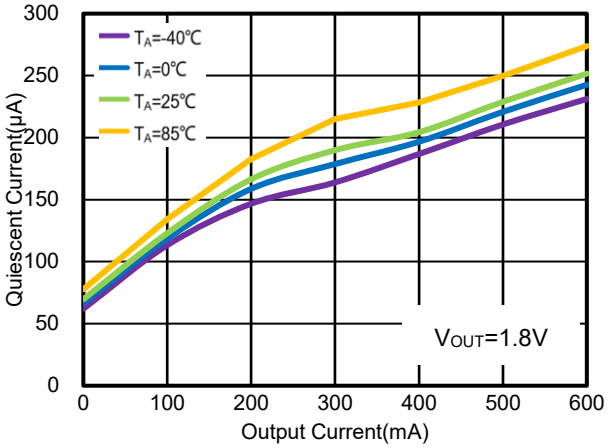


Figure 26.WR0603-ADA50R

Ground Pin Current vs. I_{OUT} & Ambient Temperature

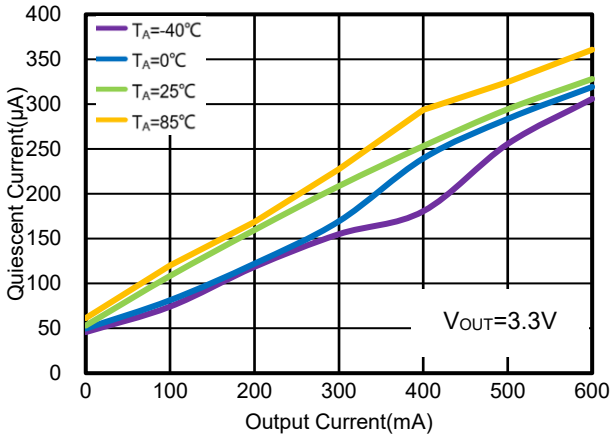


Figure 27. WR0603-ADA50R

Ground Pin Current vs. I_{OUT} & Ambient Temperature

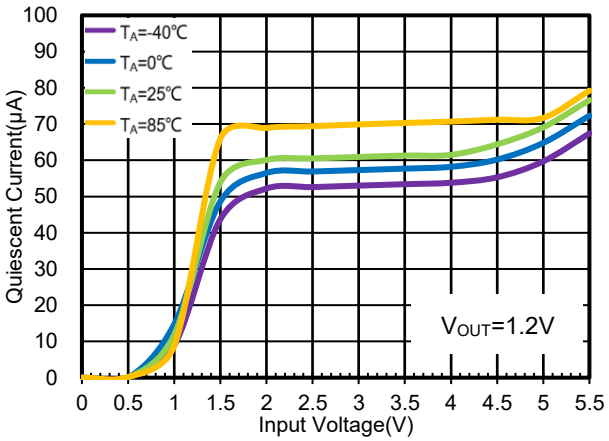


Figure 28. WR0603-ADA50R

Ground Pin Current vs. I_{OUT} & Ambient Temperature

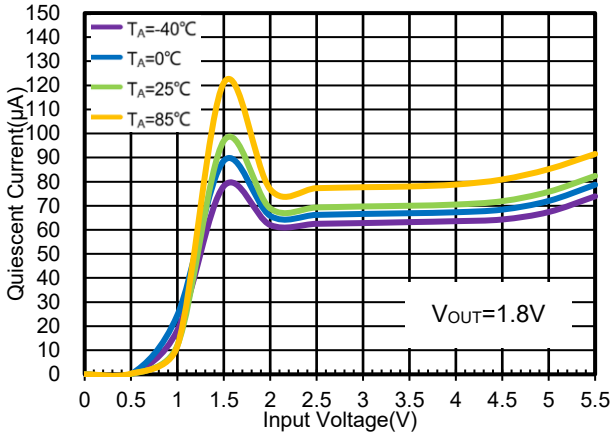


Figure 29. WR0603-ADA50R

Quiescent Current vs. V_{IN} & Ambient Temperature

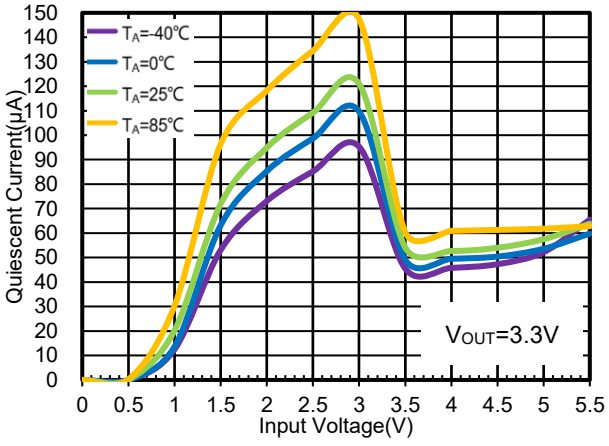


Figure 30. WR0603-ADA50R

Quiescent Current vs. V_{IN} & Ambient Temperature

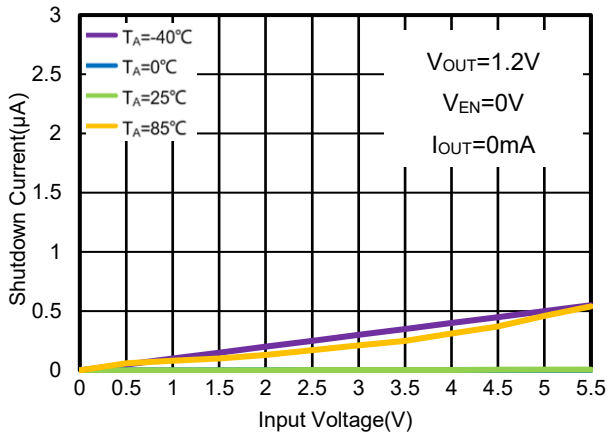


Figure 31. WR0603-ADA50R
Shutdown Current vs V_{IN} & Ambient Temperature

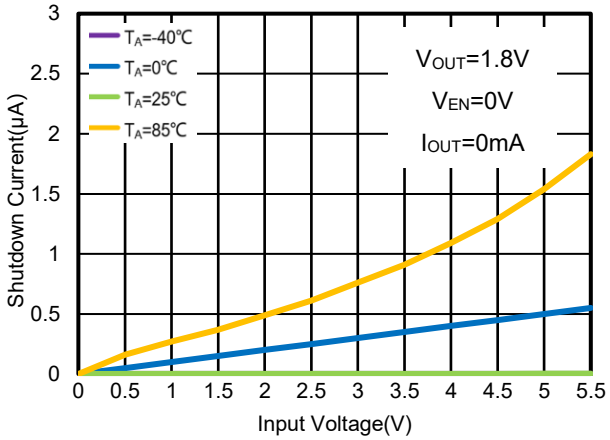


Figure 32. WR0603-ADA50R
Shutdown Current vs V_{IN} & Ambient Temperature

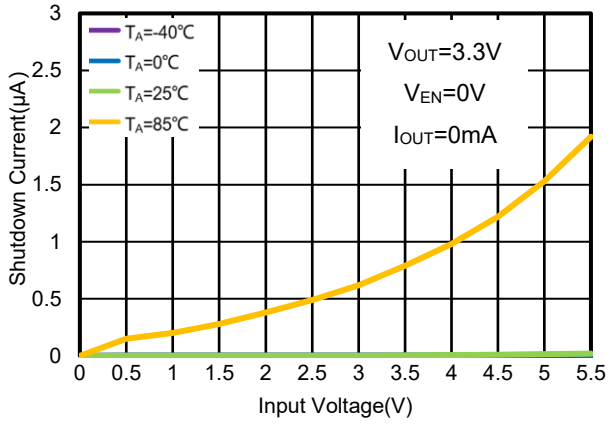


Figure 33. WR0603-ADA50R
Shutdown Current vs V_{IN} & Ambient Temperature

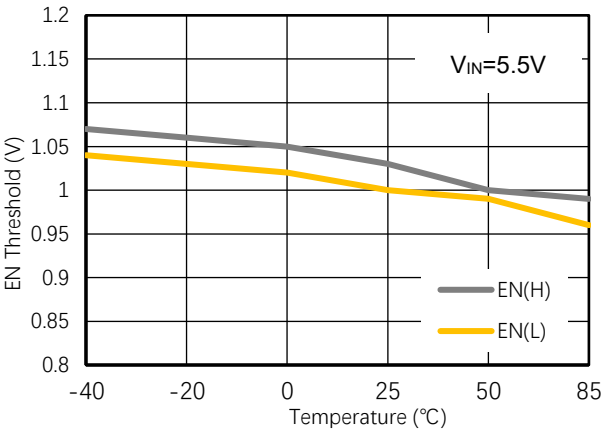


Figure 34. WR0603-ADA50R
Enable Threshold vs Ambient Temperature

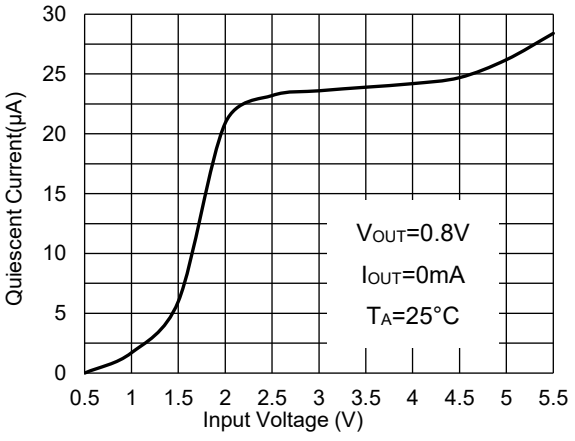


Figure 35.WR0603-ADA50R
Quiescent Current vs Supply Voltage

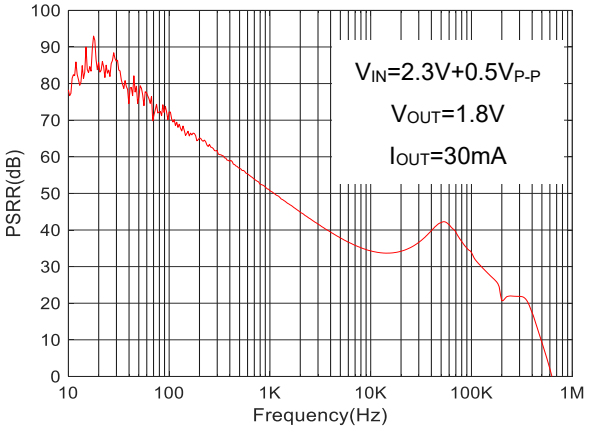


Figure 36.WR0603-ADA50R
PSRR vs.Frequency

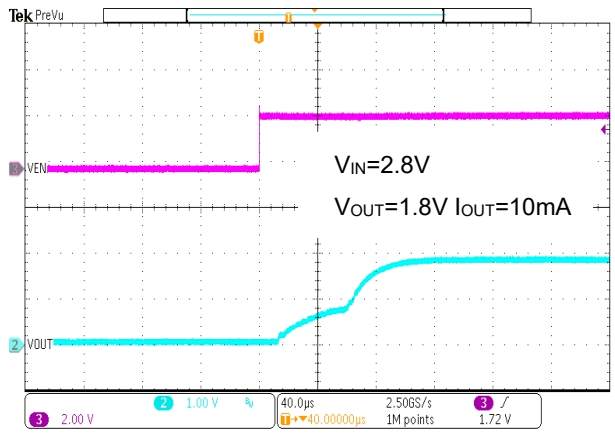


Figure 37. WR0603-ADA50R
Soft Start from EN

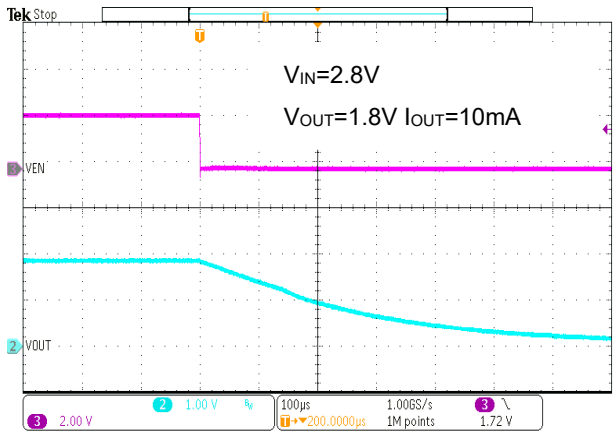


Figure 38. WR0603-ADA50R
EN Shutdown

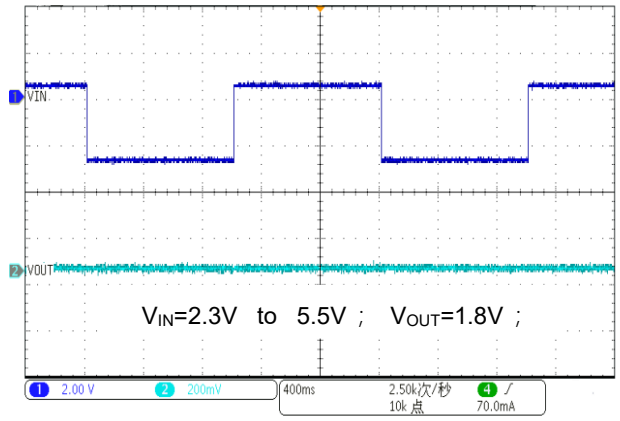


Figure 39. WR0603-ADA50R
Line Transient

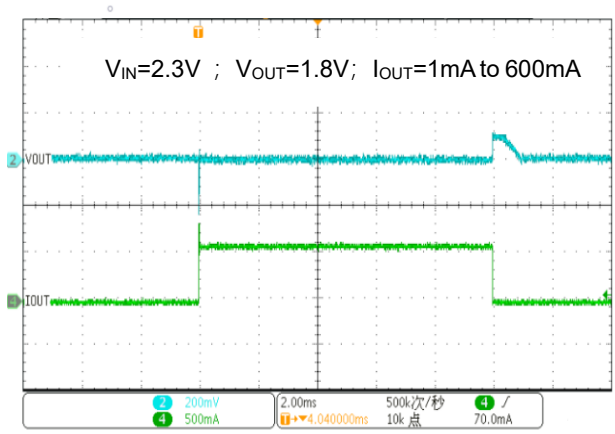


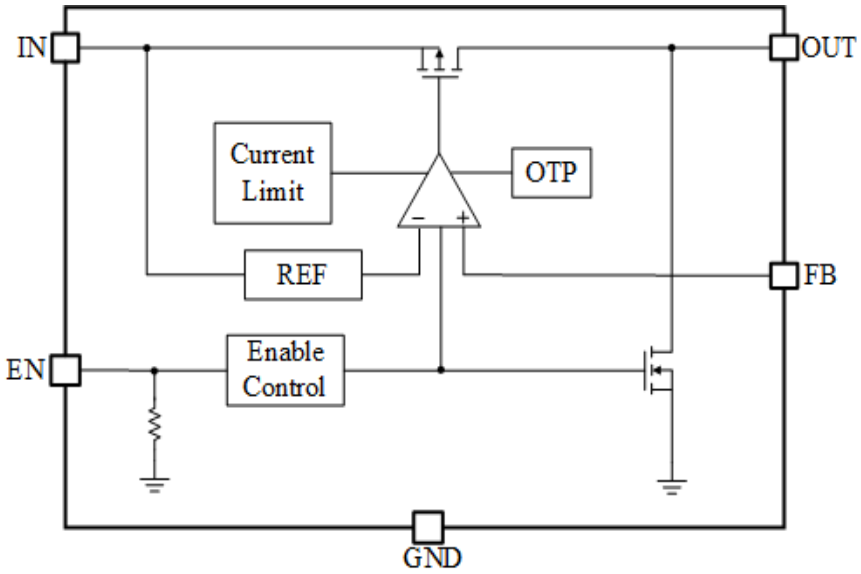
Figure 40. WR0603-ADA50R
Load Transient

11. Function Description

11.1 Overview

The WR0603 is high performance regulator capable of supplying 600 mA current and adjustable output voltage range from 0.8V to 5.0V. The device also offers low quiescent current, low-dropout voltage and very small packages suitable for space constrained application. The WR0603 is designed to be used in a variety of applications.

11.2 Block Diagram



11.3 Feature Description

11.3.1 Output Voltage Accuracy

Output voltage accuracy is defined as the maximum and minimum error in output voltage. The errors are introduced by internal reference, load regulation and line regulation differences over the full range of rated load and line operating conditions, considering differences between manufacturing lots. The output voltage accuracy of WR0603 is about 2% at T_A = 25℃ and maybe drift in full operating temperature.

11.3.2 Enable (EN)

The WR0603 EN pin is internally pulled down by a resistor of about 6.4MΩ. When the input voltage of the enable pin is higher than the high enable voltage threshold, the device outputs normally. When the input voltage of the enable pin is lower than the low input voltage threshold of the EN pin, the device shutdown. If you do not need to control the output voltage independently, connect the enable pin to the input of the device.

11.3.3 Dropout Voltage (V_{DO})

WR0603 is a low dropout voltage LDO that can achieve nominal output voltage at lower input voltages. Dropout voltage is defined as the minimum of (V_{IN}-V_{OUT}) at the rated maximum output current where V_{OUT} is the minimum of $V_{OUT(NOM)}$. When the input voltage is below $V_{OUT(NOM)}$ plus V_{DO}, the output voltage varies with the input voltage.

For a CMOS regulator, the dropout voltage is determined by the drain-source on-state resistance ($R_{DS\ (ON)}$) of the pass transistor. Therefore, if the linear regulator operates at less than the rated current, the dropout voltage for that current scales accordingly. The $R_{DS\ (ON)}$ is calculated by following equation.

$$\mathbf{R_{DS\ (ON)} = V_{DO}/I_{OUT}}$$

11.3.4 Power Supply Rejection Ratio (PSRR)

PSRR, which stands for Power Supply Rejection Ratio, represents the ratio of the two voltage gains obtained when the input and output power supplies are considered as two independent sources.

The basic calculation formula is:

$$\mathbf{PSRR = 20lg(Ripple(in) / Ripple(out))}$$

The units are in decibels (dB) and the logarithmic ratio is used.

The above equation shows that the output signal is influenced by the power supply in general, in addition to the circuit itself. PSRR is a quantity used to describe how the output signal is affected by the power supply; the larger the PSRR, the less the output signal is affected by the power supply.

As the level of integration continues to increase, the magnitude of supply current required is also increasing. End users want to extend battery life, i.e. they need very efficient DC/DC conversion processes, using more efficient switching regulators. However, switching regulators generate more ripple in the power line than linear regulators.

The PSRR shows the ability of the LDO to suppress input voltage noise. For a clean, noise-free DC output voltage, use an LDO with a high PSRR.

Noise coupling from the input voltage to the internal reference voltage is the main cause of PSRR performance degradation. Using noise reduction capacitors at the input can effectively filter out noise and improve PSRR performance at low frequencies. The LDO can be used not only to regulate the voltage but also to provide an exceptionally clean DC supply for noise sensitive components.

11.3.5 Noise

LDO noise can be divided into two main categories: internal noise and external noise. Internal noise is the noise generated inside the electronics; external noise is the noise transmitted from outside the circuit to the circuit. The error amplifier determines the PSRR of the LDO and therefore its ability to suppress external noise at the input; internal noise is always present at the output of the LDO.

In practice, minimizing noise from the power supply is critical to system performance. In test and measurement systems, small fluctuations in power supply noise can alter the instantaneous measurement accuracy.

11.3.6 Current Limit (I_{LIM})

In LDO circuits, if an output short circuit or excessive load current occurs, the device may be burned out. Especially in the case of a short circuit, not only is there too much current flowing through the regulator, but the voltage across the source drain of the regulator is also at its maximum, which is likely to burn out the regulator and make the device inoperable. The current limiting circuit used in LDO is a constant current limiting circuit, where the maximum load current that the LDO can supply is limited to a set constant I_{LIM}, and when an overload or short circuit occurs, the output current will be maintained at I_{LIM}, and the output voltage will be reduced to $I_{LIM}R_{LOAD}$.

However, if the external overload or short circuit condition lasts for a long time, the continuous high current will increase the device temperature and increase the power consumption of the whole system. To improve this situation, a fold-back current limiting circuit can be used. In a fold-back current limiting circuit, both the output current and the output voltage are gradually reduced when the output current reaches the set maximum current I_{LIM}. The output current is reduced to the set current threshold I_{SHORT} and the output voltage is reduced to $I_{SHORT}R_{LOAD}$. The output current is clamped to a smaller value in the event of an overload or short circuit and the system power consumption is reduced and the device temperature does not rise significantly.

The fold-back current limiting circuit is essentially a constant current limiting circuit with an output voltage feedback loop, so that in the event of an overload or short circuit, the output current is gradually reduced due to the reduction in output voltage and eventually clamped at a smaller value.

The WR0603 uses a fold-back current limiting mode where the final current is clamped to around 350mA, thus providing good protection to the device.

11.3.7 Thermal Protection

The WR0603 contains a thermal shutdown protection circuit that implements the required switching gate circuit function through a thermal switch integrated inside the chip. The output current is turned off when the heat in the LDO is too high. Thermal shutdown occurs when the thermal junction temperature (T_J) of the energized crystal exceeds 155°C (typical). The thermal shutdown hysteresis ensures that the LDO resets (turns on) again when the temperature drops to 135°C (typical). The thermal time constant of the semiconductor chip is quite short, so when thermal shutdown is reached, the output turns on and off at a higher rate until the power dissipation is reduced.

The WR0603's internal protection circuitry is designed to prevent thermal overload conditions. This circuitry is not a substitute for a proper heat sink. Continuously putting the WR0603 into a thermal shutdown state will reduce the reliability of the device.

11.4 Functional Mode of the Device

The device has three modes: normal, dropout, and disabled modes of operation.

The operating conditions of each mode are listed in the table below.

Operating conditions of each mode

Functional Mode	Conditions			
	V_{IN}	V_{EN}	I_{OUT}	T_J
Normal	$5.5V > V_{IN} > V_{OUT(NOM)} + V_{DO}$	$V_{EN} > V_{ENH}$	$I_{OUT} < I_{LIM}$	$T_J < T_{SD}$
Dropout	$V_{IN} < V_{OUT(NOM)} + V_{DO}$	$V_{EN} > V_{ENH}$	$I_{OUT} < I_{LIM}$	$T_J < T_{SD}$
Disabled	—	$V_{EN} < V_{ENL}$	—	$T_J > T_{SD}$

11.4.1 Normal Mode

Normal operating mode requires that both of the following conditions are met.

1. The input voltage is greater than the rated output voltage plus the differential voltage ($V_{OUT(NOM)} + V_{DO}$) and is less than 5.5V.
2. The enable voltage has previously exceeded the enable rise threshold voltage and has not fallen below the enable fall threshold.
3. The output current is less than the current limit ($I_{OUT} < I_{LIM}$).
4. The device junction temperature is less than the thermal shutdown temperature ($T_J < T_{SD}$).

11.4.2 Dropout Mode

If the input voltage is below the rated output voltage plus a specified dropout voltage, the device operates in the dropout state and the output voltage tracks the input voltage.

11.4.3 Disabled

The WR0603 can be turned off by forcing the enable pin low, typically with an enable voltage below 0.4V, at which point the pass device is turned off, internal circuits are shutdown, and the output voltage is quickly discharged to ground through an internal resistor from output to ground.

12. Application Guide

Note: The information in the Applications section below is not part of WAY-ON's product specifications and WAY-ON does not guarantee its accuracy or completeness. The customer is responsible for determining the suitability of the component for its intended use and should verify and test its design implementation to confirm system functionality.

12.1 Application Information

The WR0603 is a linear voltage regulator with an input voltage of 2.0 V to 5.5 V and an output voltage of 0.8 V to 5.0V. The accuracy is 2% at ambient temperature 25℃ The maximum output current is 600 mA. The efficiency of a linear voltage regulator is determined by the ratio of the output voltage to the input voltage, so in order to achieve high efficiency, the differential voltage (V_{IN} - V_{OUT}) must be as small as possible. This section discusses how best to use this device in practical applications.

12.2 Automatic Discharge

The WR0603 has an internal pull-down MOSFET that connects a discharge resistor from V_{OUT} to ground to actively release the output voltage when the device is disabled.

12.3 Capacitor Recommendation

The WR0603 uses ceramic capacitors with low equivalent series resistance (ESR) at the V_{IN} and V_{OUT} pins to increase its stability. Multilayer ceramic capacitors are recommended. These capacitors also have limitations, and ceramic capacitors with X7R-, X5R-, and COG-rated dielectric materials have relatively good capacitance stability at different temperatures. WR0603 is designed to use ceramic capacitors of 1 μF or larger at the input and output. Place C_{IN} and C_{OUT} as close to the IN and OUT pins as possible to minimize trace inductance from the capacitor to the device.

12.4 Power Dissipation (P_D)

The reliability of the circuit requires reasonable consideration of the power dissipation of the device, the location of the circuit on the PCB, and the proper sizing of the thermal plane. The regulator should be surrounded by no other heat generating devices as much as possible. The power dissipation of the regulator depends on the input and output voltage difference and the load conditions.

P_D can be calculated using the following equation:

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT}$$

Using the proper input voltage minimizes the power dissipation, resulting in greater efficiency. To obtain the lowest power dissipation, use the minimum input voltage required for normal output voltage.

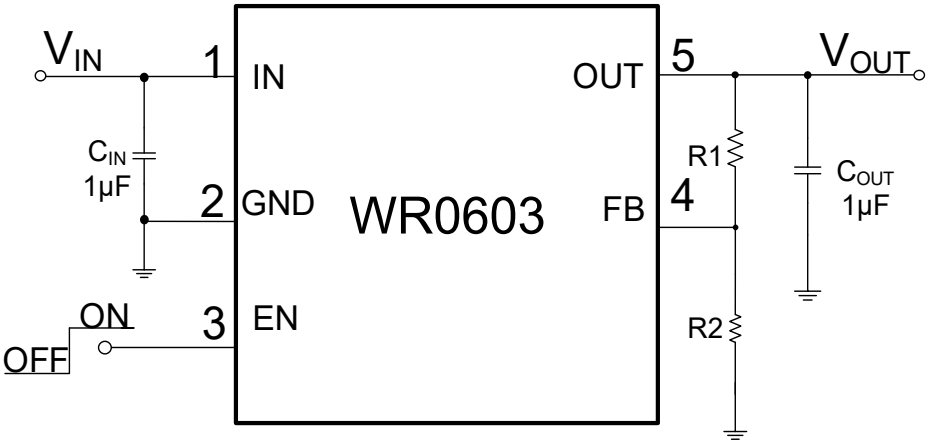
The maximum power dissipation determines the maximum allowable ambient temperature (T_A) of the device. Power dissipation and junction temperature are typically related to the junction-ambient thermal resistance ($R_{\theta JA}$) and ambient air temperature (T_A) of the PCB and package and are calculated as follows

$$T_J = T_A + (R_{\Theta JA} \times P_D)$$

The thermal resistance ($R_{\theta JA}$) depends primarily on the thermal dispersion capability of the PCB design. The total copper area, copper weight, and the location of the plane all affect the thermal dispersion capability, and the PCB and copper laydown area can only be used as a relative measure of the package's thermal performance.

12.5 Feedback Resistors For Adjustable Output Voltage

The device requires external feedback divider resistors to set the output voltage. The following figure shows how the output voltage of an adjustable device can be configured from 0.8 V to 5.0 V by using a resistor divider network.



Calculates the values of the R_1 and R_2 resistors to set the output voltage:

$$V_{OUT} = V_{FB} \times (1 + R_1 / R_2)$$

13. Power Supply Recommendations

The WR0603 has a V_{IN} range of between 2.0V and 5.5V and an input capacitance of 1μF. The input voltage should have some redundancy to ensure a stable output voltage when the load fluctuates. If the input supply is noisy, additional input capacitors can be used to improve the noise performance of the output.

14. Evaluation Modules

Evaluation Modules (EVMs) are available to help evaluate initial circuit performance. We have evaluation modules for different packages, you can contact us to get the evaluation module or schematic.

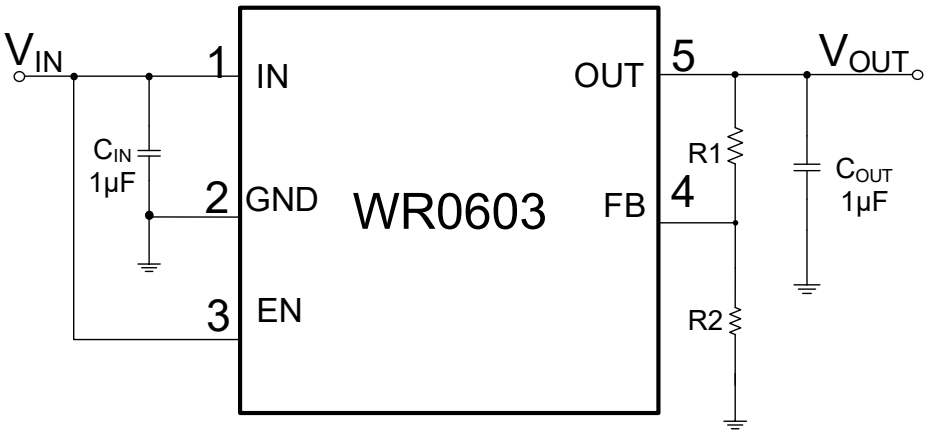
The module names are listed in the following table.

NAME	PACKAGE	EVALUATION MODULE
WR0603	SOT23-5	WAYON LDO EVM V1.1 – SOT23-5
	DFN2×2-6	WAYON LDO EVM V1.1 – DFN2×2-6

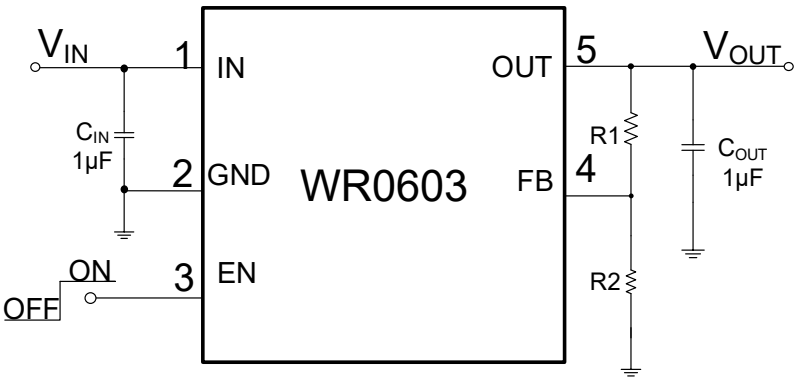
14.1 Typical Application Circuits

The following figures show the schematics of the application circuits.

Circuit schematic 1: EN is connected to IN.



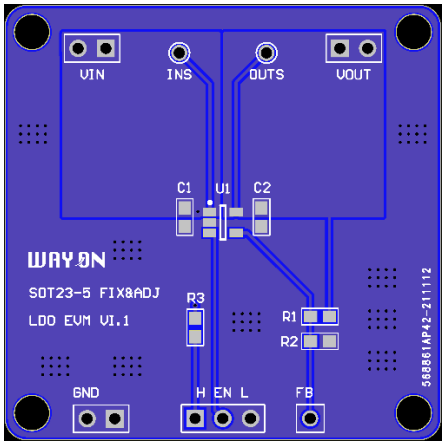
Circuit schematic 2: EN is controlled by external voltage.



14.2 Layout of Typical Application Circuits

Layout Guidelines

The principle of LDO design is to place all components on the same side of the board and connect them as close as possible to their respective LDO pins. A minimum 1.0μF input capacitor (C_{IN}) is recommended to IN to minimize the effect of resistance and inductance between the source and the LDO input. A minimum 1.0μF output capacitor (C_{OUT}) is recommended to OUT. Connect the ground sides of C_{IN} and C_{OUT} with LDO ground pins as close as possible through a wide copper surface. Through-holes and long wires may seriously affect system performance and is not recommended.



15. Naming Conventions

WR AA BB-CC DDD E

WR: WAYON Regulator

AA: 06 - Output Current, 600mA

BB: Serial number

CC: Output Voltage/AD-Output Voltage, Adjustable Voltage

DDD: A50-Package, SOT23-5

FF6- Package, DFN2×2-6

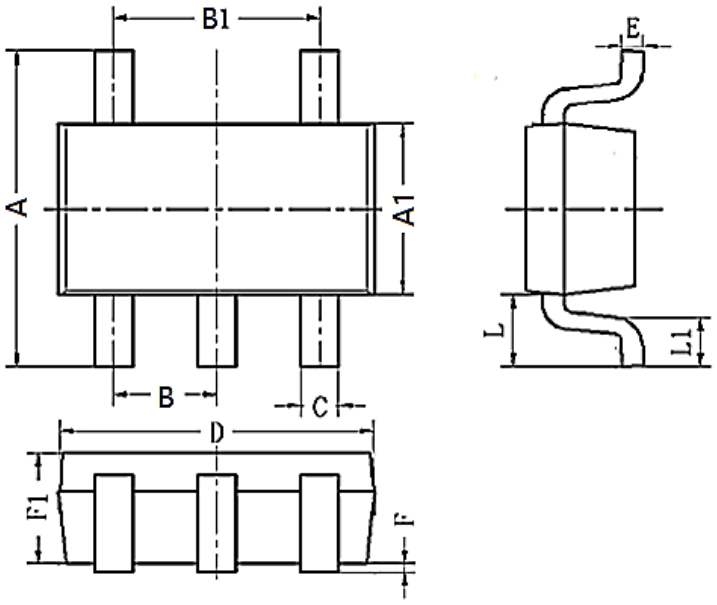
E: R-Reel & T-tube

16. Electrostatic Discharge Warning

ESD can cause irreversible damage to integrated circuits, ranging from minor performance degradation to device failure. Precision ICs are more susceptible to damage because very minor parameter changes can cause the device to be out of compliance with its published specifications. WAY-ON recommends that all ICs be handled with proper precautions. Failure to follow proper handling practices and installation procedures may damage the IC.

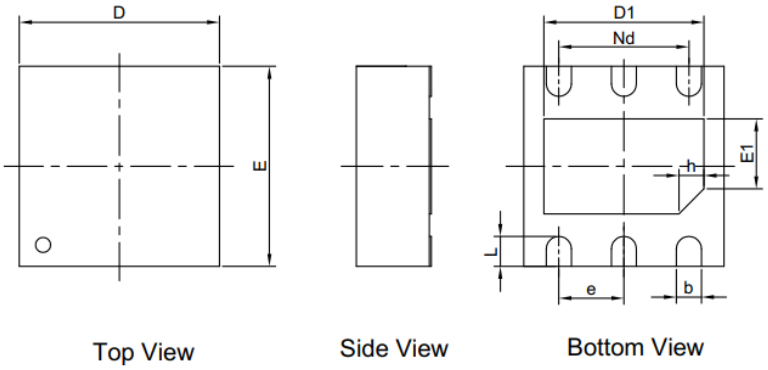
17. Package Information

SOT23-5

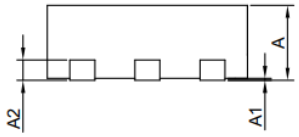


SYMBOL	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	2.60	2.80	3.00
A1	1.50	1.60	1.70
B	0.85	0.95	1.05
B1	1.80	1.90	2.00
C	0.25	0.37	0.50
D	2.79	2.90	3.02
E	0.10	0.15	0.20
F	0.00	0.10	0.20
L	0.60REF		
L1	0.30	0.45	0.60
F1	0.85	1.10	1.30

DFN2×2-6



Top View　　Side View　　Bottom View



Side View

SYMBOL	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A2		0.203REF	
b	0.25	0.30	0.35
D	1.90	2.00	2.10
D1	1.50	1.60	1.70
E	1.90	2.00	2.10
E1	0.85	0.95	1.10
e		0.65BSC	
Nd		1.30BSC	
L	0.25	0.30	0.35
h	0.20	0.25	0.30

18. Ordering Information

PART NUMBER	OUTPUT VOLTAGE	PACKAGE	PACKING QUANTITY	MARKING*
WR0603-ADA50R	adjustable	SOT23-5	3k/Reel	WR0603 AD XXXX
WR0603-ADFF6R	adjustable	DFN2×2-6	3k/Reel	0603 XXXX

* XXXX is variable.

Contact Information

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For additional information, please contact your local Sales Representative.
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Product Specification Statement

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.

3.WAYON strives to provide accurate and up-to-date information to the best of our ability. However, due to technical, human, or other reasons, WAYON cannot guarantee that the information provided in the product specification is entirely accurate and error-free. WAYON shall not be held responsible for any losses or damages resulting from the use or reliance on any information in these product specifications. WAYON reserves the right to revise or update the product specification and the products at any time without prior notice, and the user's continued use of the product specification is considered an acceptance of these revisions and updates. Prior to purchasing and using the product, users should verify the above information with WAYON to ensure that the product specification is the most current, effective, and complete. If users are particularly concerned about product parameters, please consult WAYON in detail or request relevant product test reports. Any data not explicitly mentioned in the product specification shall be subject to separate agreement.

4.Users are advised to pay attention to the parameter limit values specified in the product specification and maintain a certain margin in design or application to ensure that the product does not exceed the parameter limit values defined in the product specification. This precaution should be taken to avoid exceeding one or more of the limit values, which may result in permanent irreversible damage to the product, ultimately affecting the quality and reliability of the system or equipment.

5.The design of the product is intended to meet civilian needs and is not guaranteed for use in harsh environments or precision equipment. It is not recommended for use in systems or equipment such as medical devices, aircraft, nuclear power, and similar systems, where failures in these systems or equipment could reasonably be expected to result in personal injury. WAYON shall assume no responsibility for any consequences resulting from such usage.

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