1. General Description

The WR0340 series are CMOS-based low-dropout, low-quiescent current linear regulators, offering 300mA with low dropout voltage and high output accuracy. The WR0340 series consist of an accurate voltage-reference block, an error amplifier, a voltage-setting resistor net, a PMOSFET pass device, a thermal-shutdown circuit, and a current limit circuit with short protection.

The WR0340 series is designed with a capacitor-free architecture to ensure stability without an input or output capacitor. A low on-resistance PMOS pass device is equipped for lower dropout voltage. WR0340 also possess the EN function to save more energy and extend the battery life.

The WR0340 series provide an auto-discharging circuit to quickly discharge when disabled.

The WR0340 series are available in Green SOT23-5 package and DFN1×1-4 package.

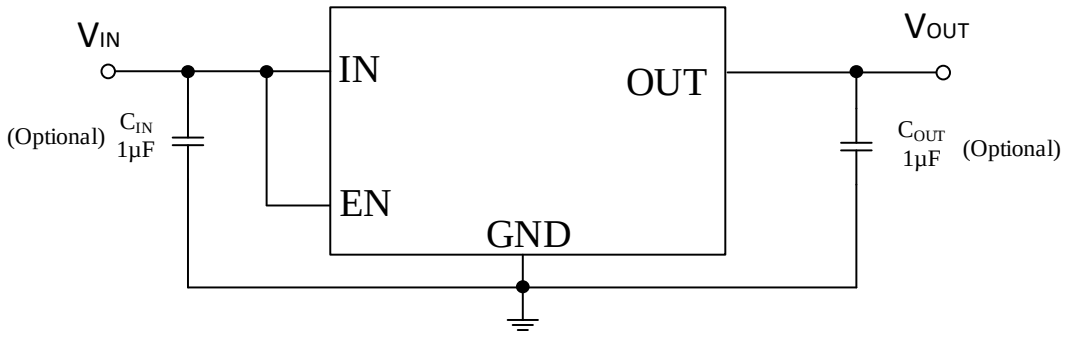
2. Features

- Wide Input Voltage Range: 1.4V to 5.5V
- Output Current: 300mA
- Output Voltage Range: 1.0V to 3.3V
- Accuracy: 1% typical
- Stable Operation with Capacitor or Not
- Low Dropout: 80mV at 300mA (V_{OUT}=3.3V)
- Ultra Low I_Q: 34μA
- Excellent Load/Line Transient Response
- Built-in Foldback Over Current Protection
- Built-in Auto-discharging Circuit

3. Applications

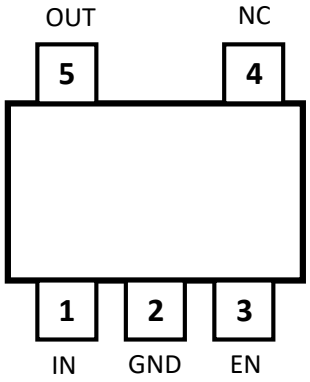
- Tablets
- Smartphones
- Notebook and Desktop Computers
- Portable Industrial and Consumer Products
- WLAN and Other PC Add-On Cards
- Camera Modules

4. Typical Application

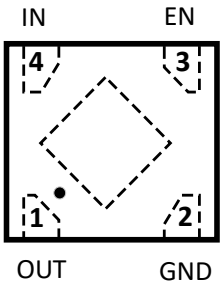


5. Pin Configuration

(Top View)



SOT23-5



DFN1×1-4

6. Pin Description

PIN NUMBER		PIN NAME	I/O	PIN FUNCTIONS
SOT23-5	DFN1×1-4			
1	4	IN	I	Input Voltage
2	2	GND	-	Ground
3	3	EN	I	Enable, Active High
4	-	NC	-	NC
5	1	OUT	O	Output Voltage
		EPAD	-	Exposed pad should be connected directly to the GND pin. Soldered to a large ground copper plane for improved thermal performance

7. Absolute Maximum Ratings [1]

SYMBOL	PARAMETER		RATING	UNIT
V_{IN}	Input voltage range		-0.3 to 6.0	V
V_{EN}	EN Input voltage range		-0.3 to 6.0	V
V_{OUT}	Output voltage range		-0.3 to 6.0	V
P_D	Power Dissipation @T_A = 25℃	SOT23-5	500	mW
		DFN1×1-4	500	mW
$R_{\theta JA}$	Thermal Resistance	SOT23-5	250	℃/W
		DFN1×1-4	250	℃/W
T_J	Junction Temperature		150	℃
T_{SDR}	Lead Temperature Range		260	℃
T_{STG}	Storage Temperature Range		-65 to 150	℃
ESD	HBM		±8000	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.

8. Recommended Operating Conditions

SYMBOL	PARAMETER	RATING	UNIT
V_{IN}	Input voltage range	1.4 to 5.5	V
V_{EN}	EN Input voltage range	0 to 5.5	V
V_{OUT}	Nominal output voltage range	1.0 to 3.3	V
I_{OUT}	Output current	0 to 300	mA
T_J	Operating Junction temperature	-40 to 125	℃

9. Electrical Characteristics

(V_{IN} = $V_{OUT\ (NOMINAL)}$ + 0.5 V or 2.0 V (whichever is greater), C_{IN} = C_{OUT} = 1μF, T_J=25℃, unless otherwise noted)

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{IN}	Input voltage			1.4		5.5	V
V_{OUT}	Output accuracy	T_J=25℃		0.99 V_{OUT}		1.01 V_{OUT}	V
		T_J=-40 ~ 125℃		0.986 V_{OUT}		1.014 V_{OUT}	V
UVLO	Undervoltage lockout	V_{IN} rising			1.3	1.4	V
		V_{IN} falling			1.25		
LNR	Line regulation	$\Delta V_{IN}=V_{IN(NOM)}$ to $V_{IN(NOM)}$ + 1			1		mV
LDR	Load regulation[1]	ΔI_{OUT}=1mA to 300 mA			5		mV
V_{DO}	Dropout Voltage[2]	V_{OUT} = 0.98 × $V_{OUT(NOM)}$, I_{OUT}=300mA	V_{OUT} = 1.2 V		250	330	mV
			V_{OUT} = 1.8 V		120	210	
			V_{OUT} = 2.5 V		100	200	
			V_{OUT} = 3.3 V		80	170	
I_{LIMIT}	Output current limit			360		700	mA
I_{OUT}	Maximum output current in the accuracy range[3]			300			mA
I_{SHORT}	Short current[4]	V_{OUT} shorted to GND	V_{OUT} = 1.2 V		180		mA
			V_{OUT} = 1.8 V		200		
			V_{OUT} = 3.3 V		280		
I_Q	Quiescent Current	I_{OUT} = 0 mA			34	60	μA
I_{SHDN}	Shut-down Current	V_{EN} = 0V			0.1	1.0	μA
PSRR	Power Supply Rejection Ratio	V_{OUT} = 2.5V, I_{OUT}=10mA	f=100Hz		68		dB
			f=1kHz		50		
			f=10kHz		40		

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{NO}	Output noise voltage	BW = 10 Hz to 100 kHz, V_{OUT} = 3.3 V, I_{OUT} = 10 mA, C_{OUT}=1μF			140		μV_{RMS}
V_{ENH}	EN high threshold voltage (enabled)			0.9			V
V_{ENL}	EN low threshold voltage (disabled)					0.4	V
I_{EN}	EN pin current	V_{EN}=5.5V			0.01		μA
R_{DIS}	Output Discharge Resistance	V_{IN}=2.3V，V_{EN}=0V			120		Ω
t_{STR}	Startup time	Time from EN assertion to 98%×$V_{OUT(NOM)}$, I_{OUT}= 0mA	V_{OUT} =1.8V		315		μS
			V_{OUT} =2.5V		420		
			V_{OUT} =3.3V		520		
T_C	Output Voltage Temperature Coefficient	I_{OUT}=1mA			50		ppm/℃
T_{SD}	Thermal shutdown	Shutdown, temperature increasing			160		℃
		Recover, temperature decreasing			135		℃

NOTE1: The Load regulation is measured by pulse test.

NOTE2: The dropout voltage is defined as (V_{IN}-V_{OUT}) when V_{OUT} is $V_{OUT(NOM)}$ ×98%.

NOTE3: Maximum output current is affected by the PCB layout, size of metal trace, the thermal conduction path between metal layers, ambient temperature and the other environment factors of system. Attention should be paid to the dropout voltage when V_{IN}< V_{OUT} + V_{DO}.

NOTE4: Short-circuit current limit is RMS value.

10. Typical Performance Characteristics

(V_{IN} = $V_{OUT\ (NOMINAL)}$ + 0.5 V or 2.0 V (whichever is greater), C_{IN} = C_{OUT} = 1μF, T_J=25℃， unless otherwise noted)

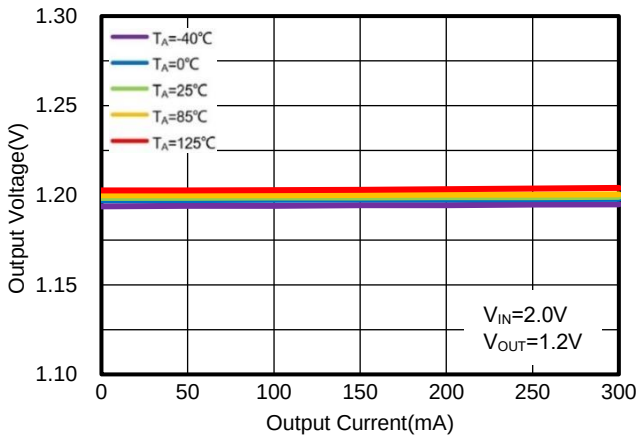


Figure 1. WR0340-12A50R

Load Regulation vs I_{OUT} & Ambient Temperature

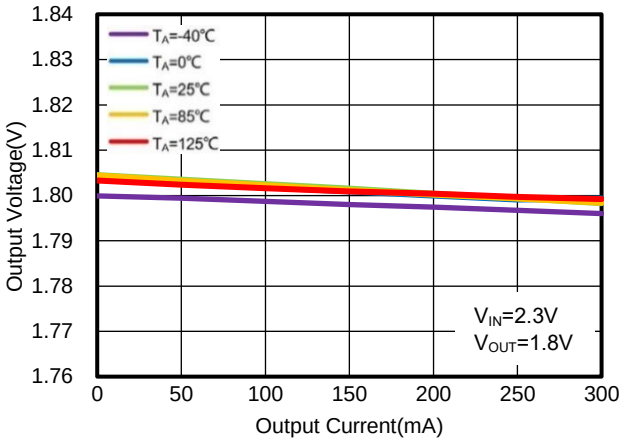


Figure 2. WR0340-18FF4R

Load Regulation vs I_{OUT} & Ambient Temperature

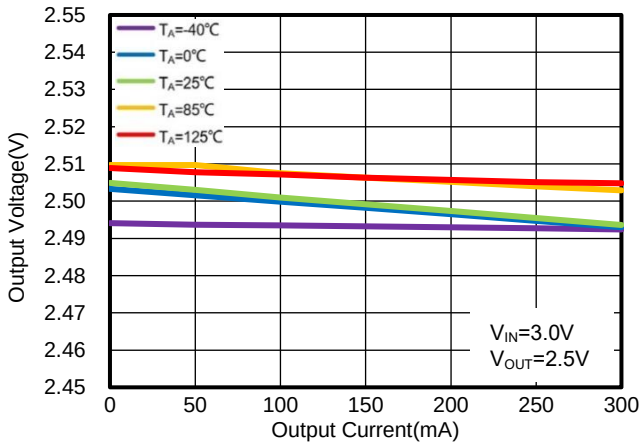


Figure 3. WR0340-25A50R

Load Regulation vs I_{OUT} & Ambient Temperature

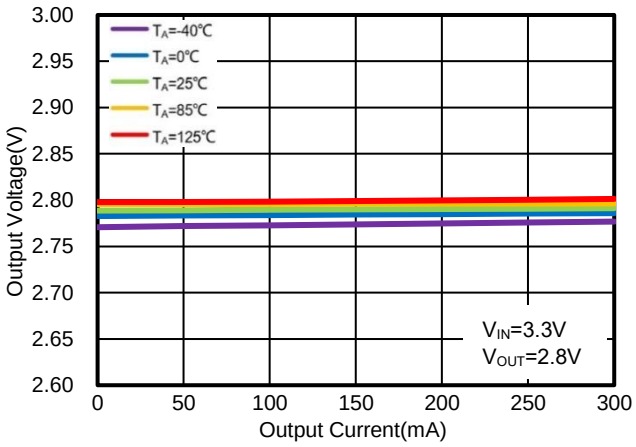


Figure 4. WR0340-28A50R

Load Regulation vs I_{OUT} & Ambient Temperature

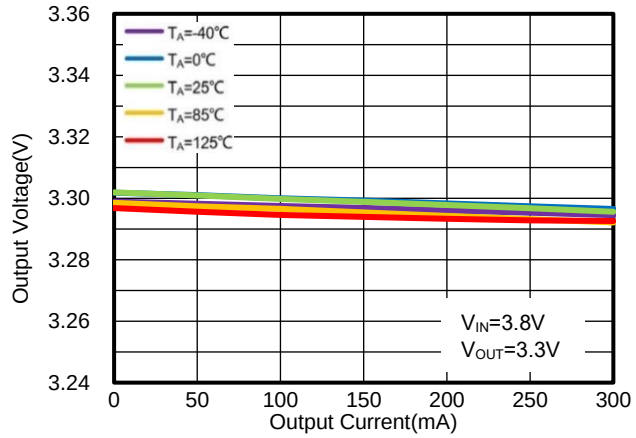


Figure 5. WR0340-33FF4R

Load Regulation vs I_{OUT} & Ambient Temperature

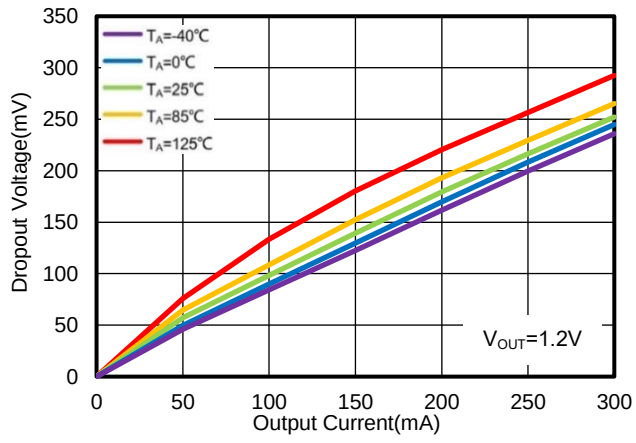


Figure 6. WR0340-12A50R

Dropout Voltage vs I_{OUT} & Ambient Temperature

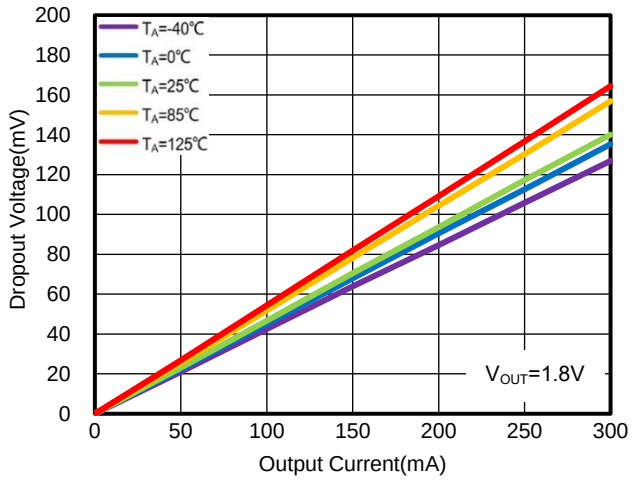


Figure 7. WR0340-18FF4R

Dropout Voltage vs I_{OUT} & Ambient Temperature

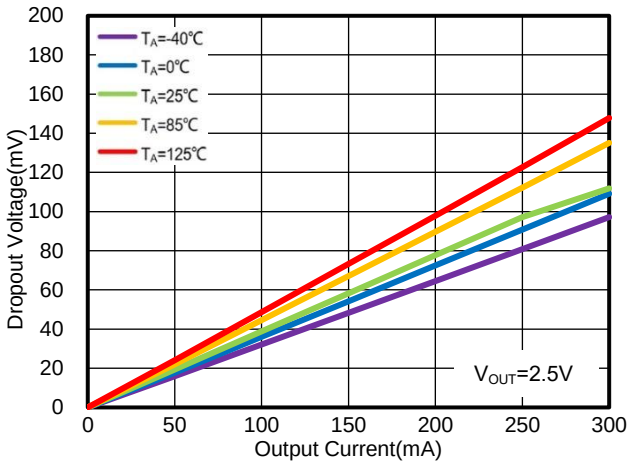


Figure 8. WR0340-25FF4R

Dropout Voltage vs I_{OUT} & Ambient Temperature

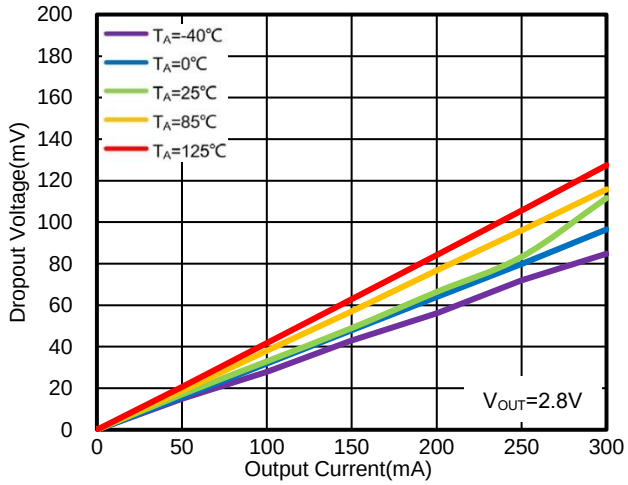


Figure 9. WR0340-28A50R

Dropout Voltage vs I_{OUT} & Ambient Temperature

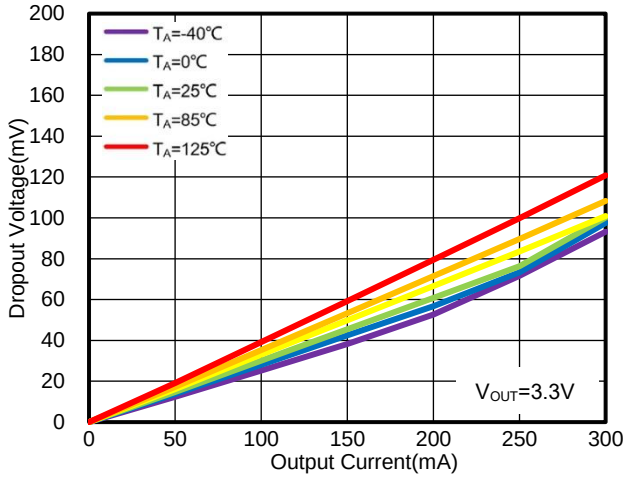


Figure 10. WR0340-33FF4R

Dropout Voltage vs I_{OUT} & Ambient Temperature

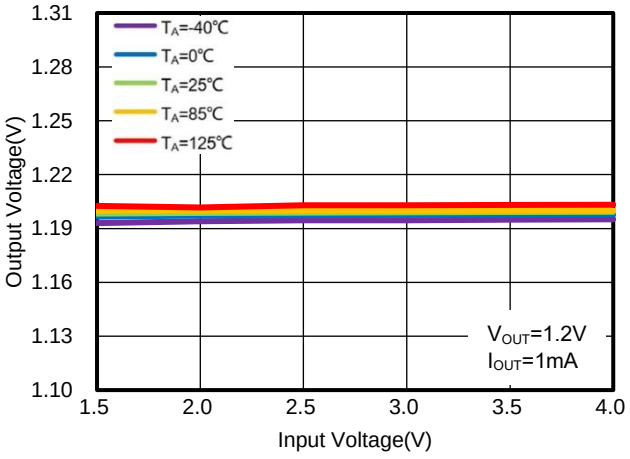


Figure 11. WR0340-12A50R

Regulation vs V_{IN} (Line Regulation) & Ambient Temperature

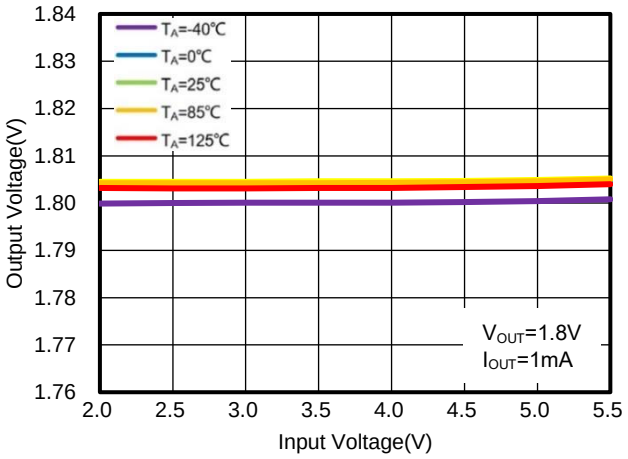


Figure 12. WR0340-18FF4R

Regulation vs V_{IN} (Line Regulation) & Ambient Temperature

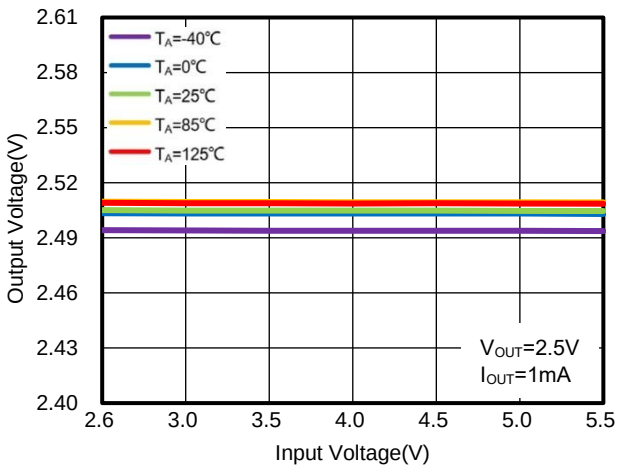


Figure 13. WR0340-25A50R

Regulation vs V_{IN} (Line Regulation) & Ambient Temperature

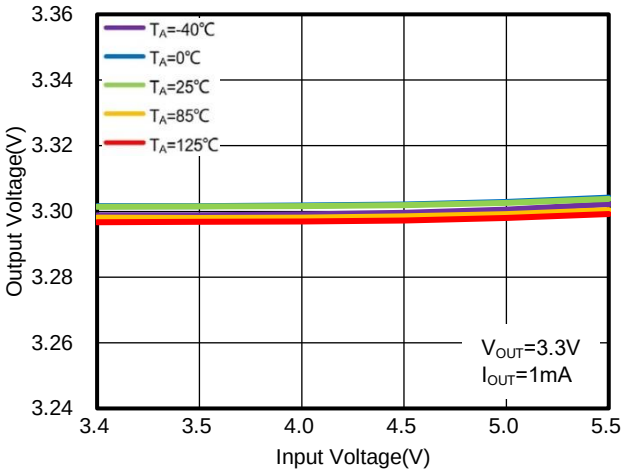


Figure 14. WR0340-33FF4R

Regulation vs V_{IN} (Line Regulation) & Ambient Temperature

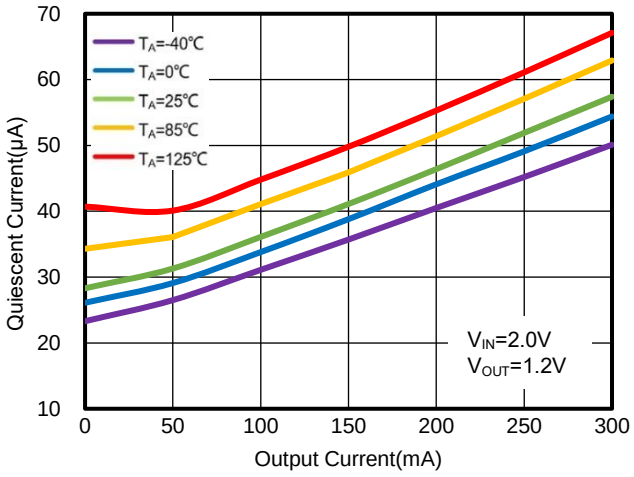


Figure 15. WR0340-12A50R

Quiescent Current vs I_{OUT} & Ambient Temperature

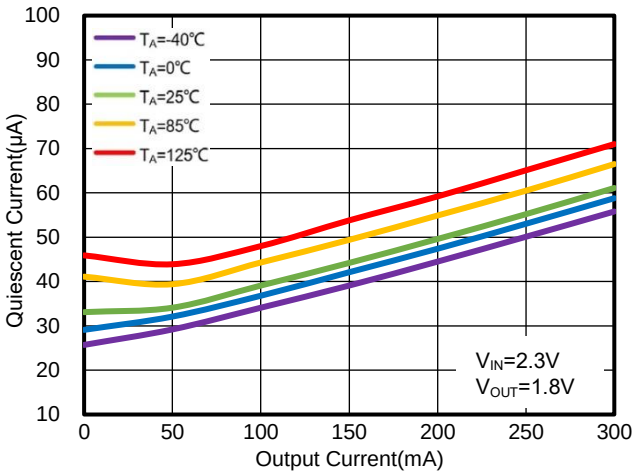


Figure 16. WR0340-18FF4R

Quiescent Current vs I_{OUT} & Ambient Temperature

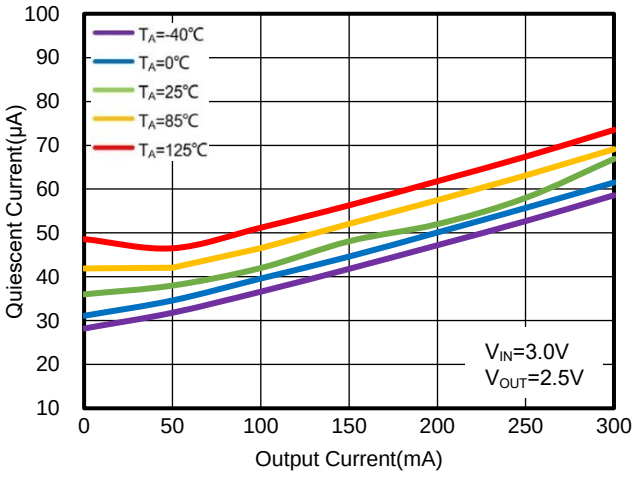


Figure 17. WR0340-25A50R

Quiescent Current vs I_{OUT} & Ambient Temperature

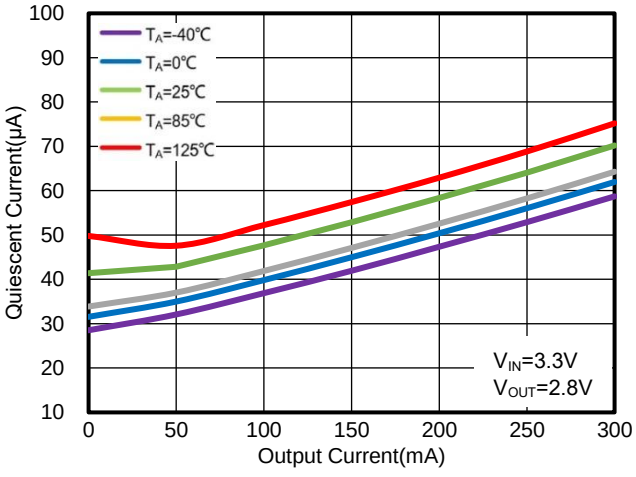


Figure 18. WR0340-28A50R

Quiescent Current vs I_{OUT} & Ambient Temperature

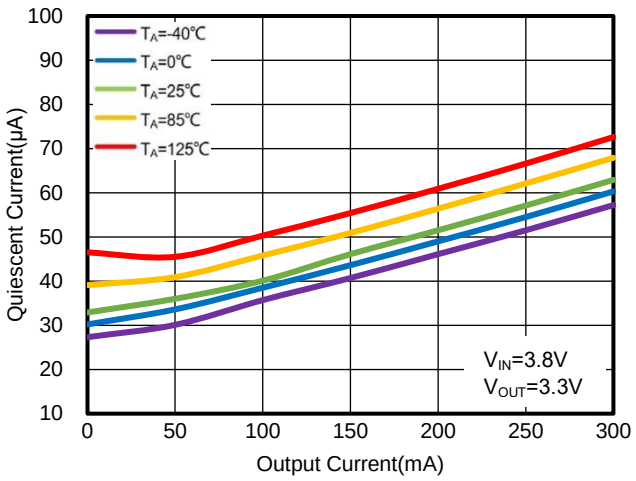


Figure 19. WR0340-33FF4R

Quiescent Current vs I_{OUT} & Ambient Temperature

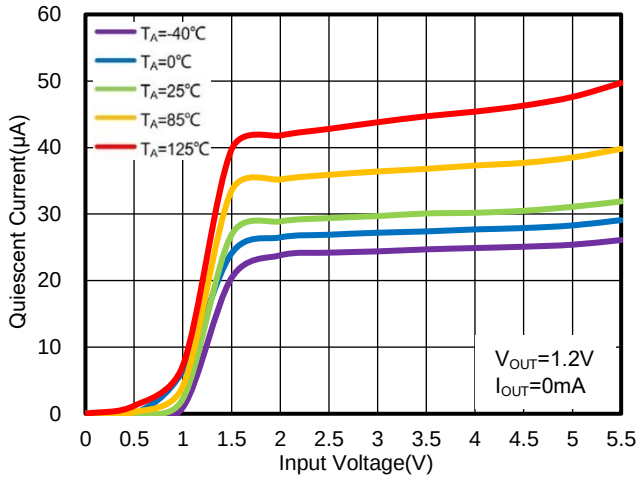


Figure 20. WR0340-12A50R

Quiescent Current vs V_{IN}

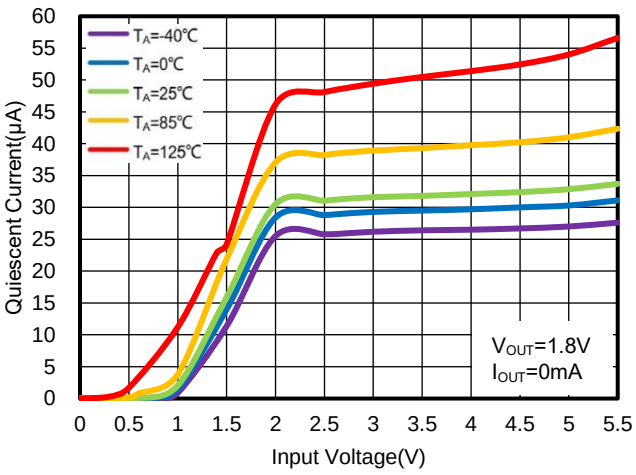


Figure 21. WR0340-18FF4R

Quiescent Current vs V_{IN}

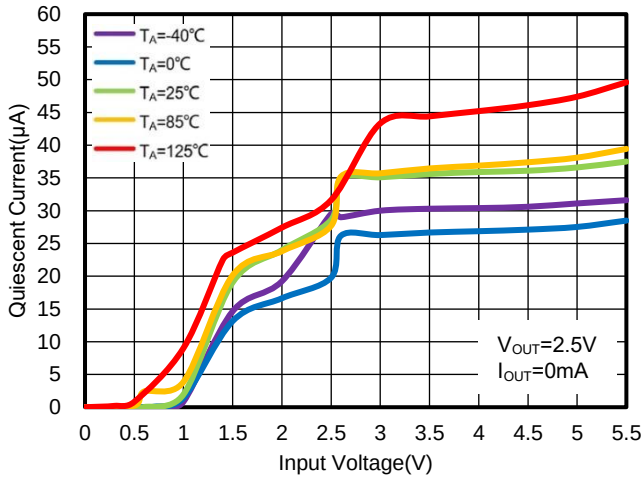


Figure 22. WR0340-25A50R

Quiescent Current vs V_{IN}

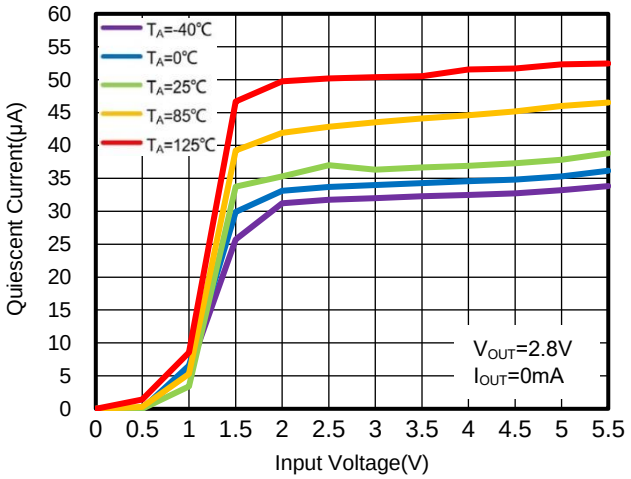


Figure 23. WR0340-28A50R

Quiescent Current vs V_{IN}

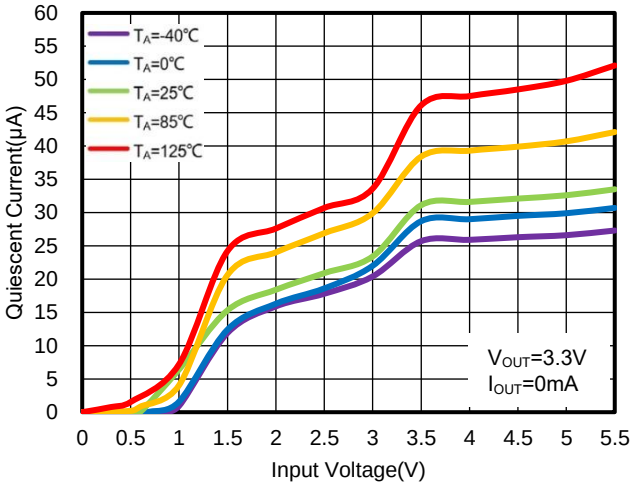


Figure 24. WR0340-33FF4R

Quiescent Current vs V_{IN}

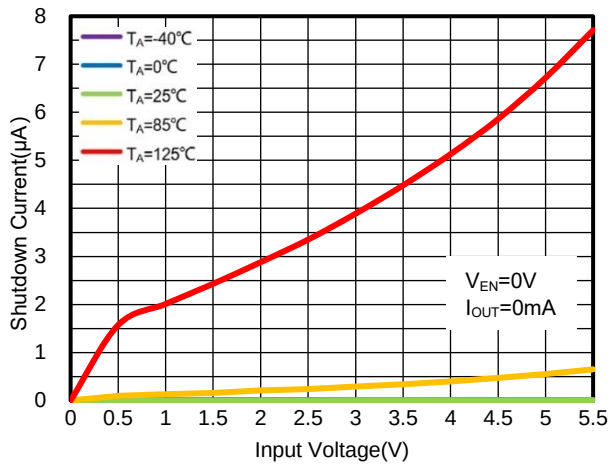


Figure 25. WR0340-12A50R
Shutdown Current vs V_{IN} & Ambient Temperature

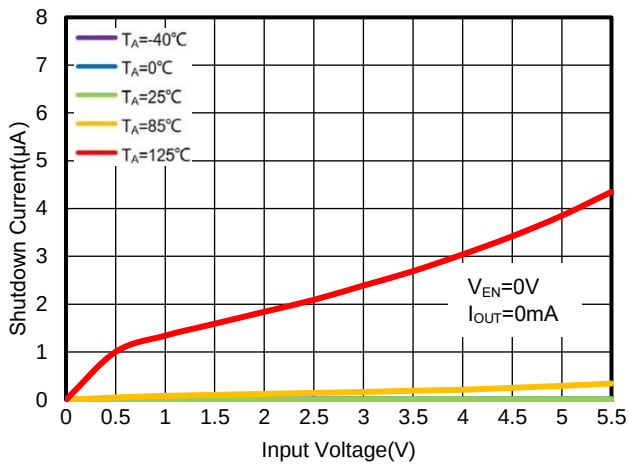


Figure 26. WR0340-18FF4R
Shutdown Current vs V_{IN} & Temperature

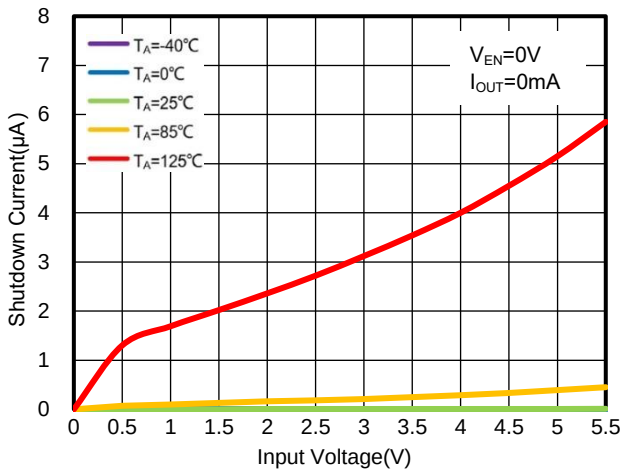


Figure 27. WR0340-25A50R
Shutdown Current vs V_{IN} & Ambient Temperature

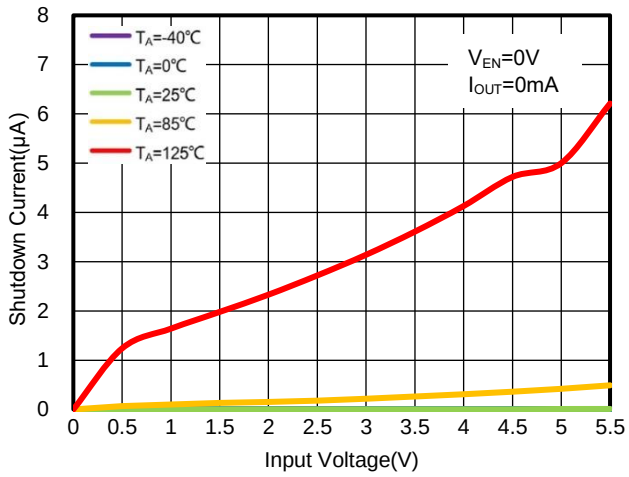


Figure 28. WR0340-33FF4R
Shutdown Current vs V_{IN} & Ambient Temperature

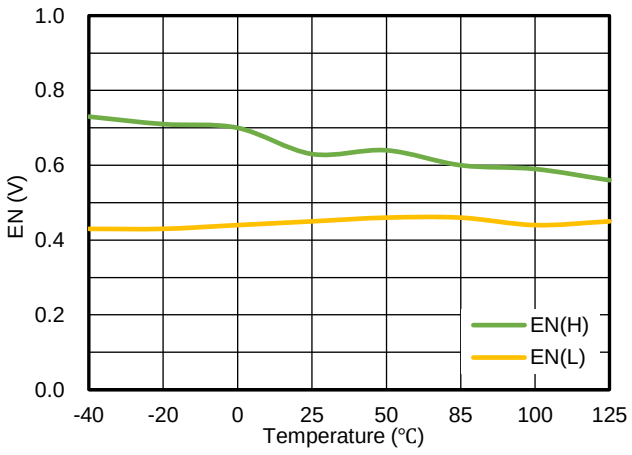


Figure 29. WR0340-12A50R
Enable Threshold vs Ambient Temperature

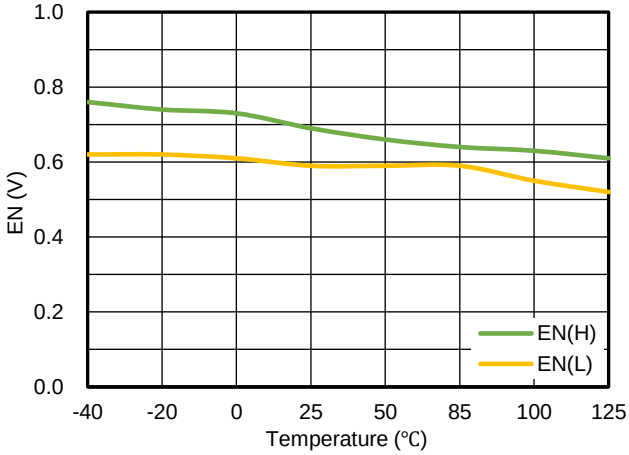


Figure 30. WR0340-18FF4R
Enable Threshold vs Ambient Temperature

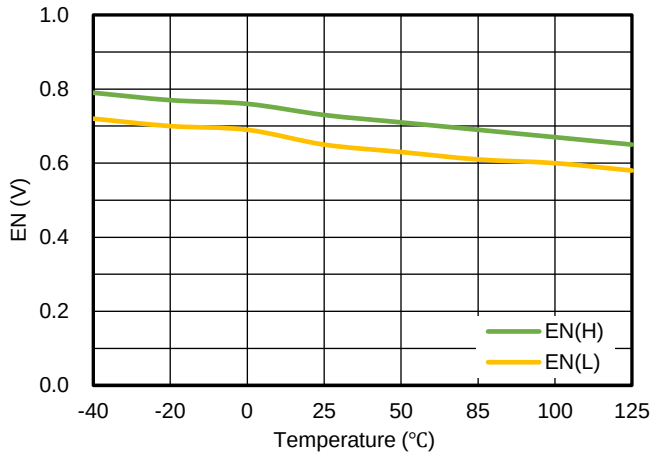


Figure 31. WR0340-25A50R
Enable Threshold vs Ambient Temperature

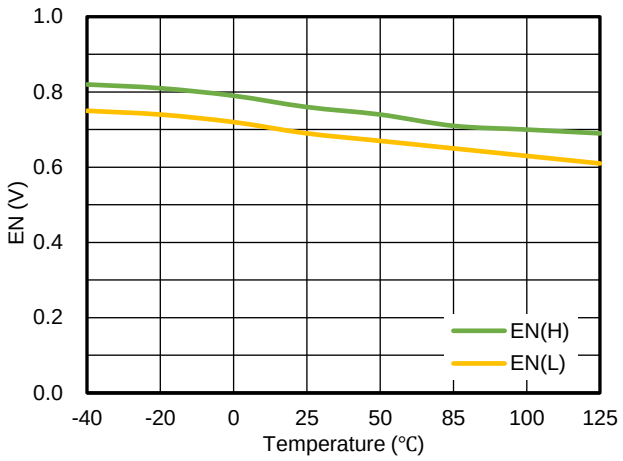


Figure 32. WR0340-33FF4R
Enable Threshold vs Ambient Temperature

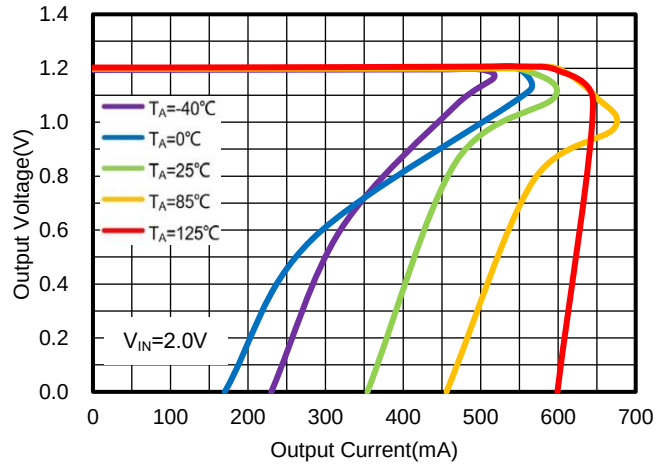


Figure 33. WR0340-12A50R
Foldback Current Limit vs I_{OUT} & Ambient Temperature

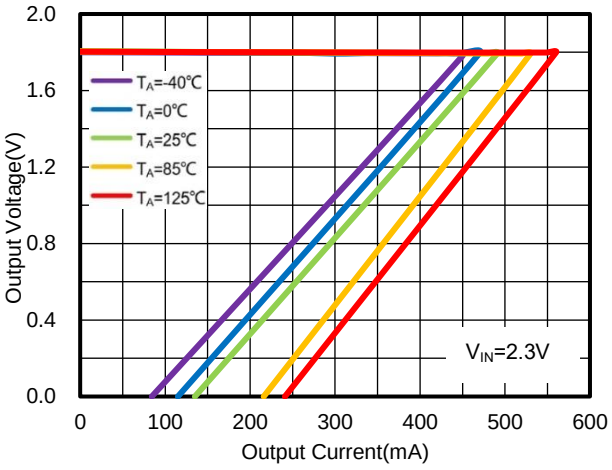


Figure 34. WR0340-18FF4R
Foldback Current Limit vs I_{OUT} & Ambient Temperature

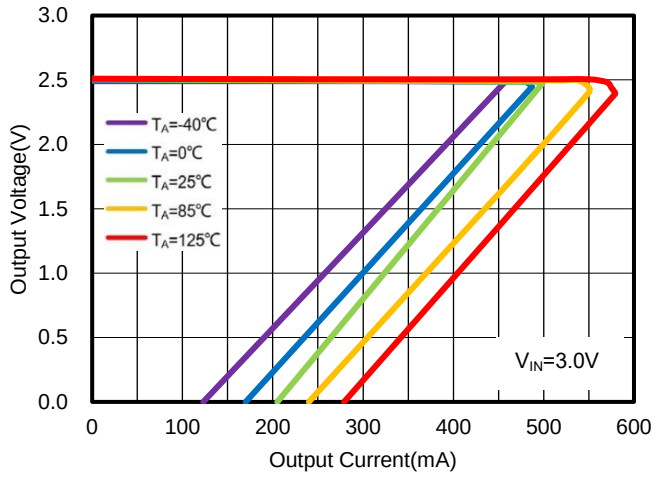


Figure 35. WR0340-25A50R
Foldback Current Limit vs I_{OUT} & Ambient Temperature

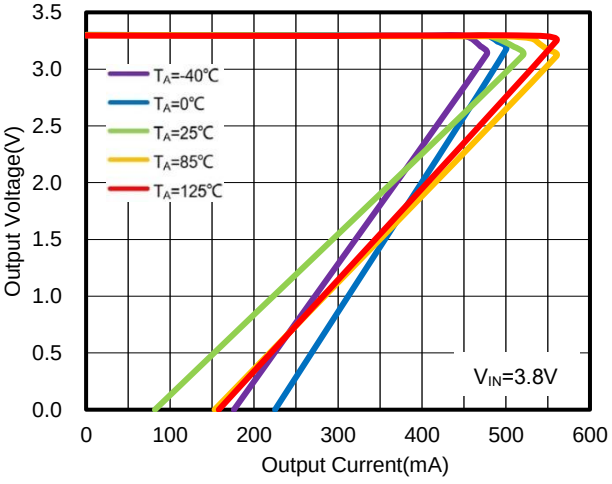


Figure 36. WR0340-33FF4R
Foldback Current Limit vs I_{OUT} & Ambient Temperature

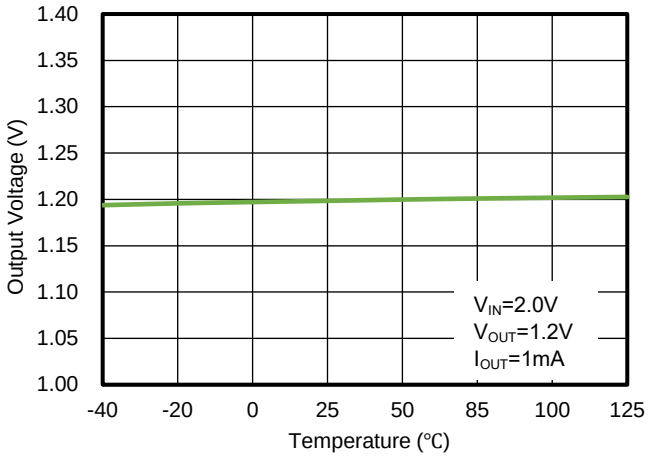


Figure 37. WR0340-12A50R
Output Voltage vs Ambient Temperature

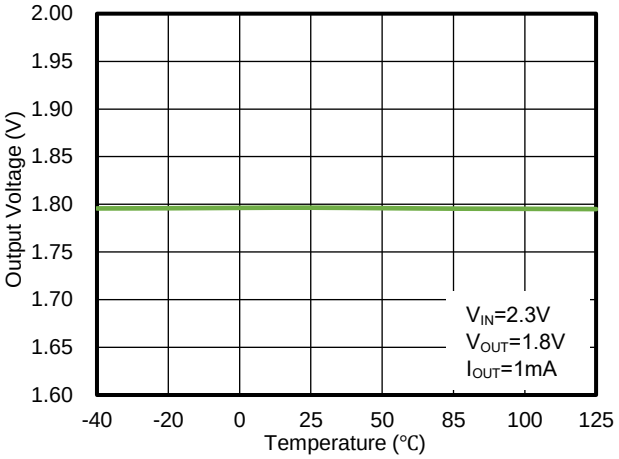


Figure 38. WR0340-18FF4R
Output Voltage vs Ambient Temperature

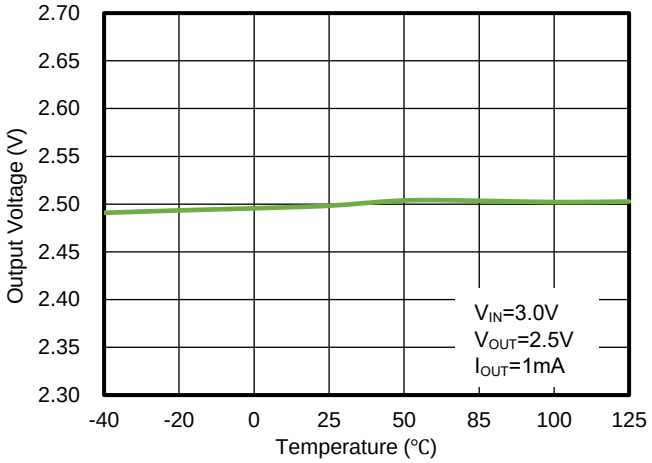


Figure 39. WR0340-25A50R
Output Voltage vs Ambient Temperature

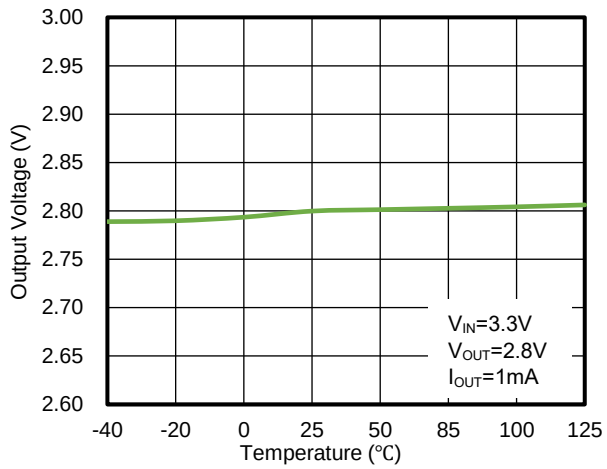


Figure 40. WR0340-28A50R
Output Voltage vs Ambient Temperature

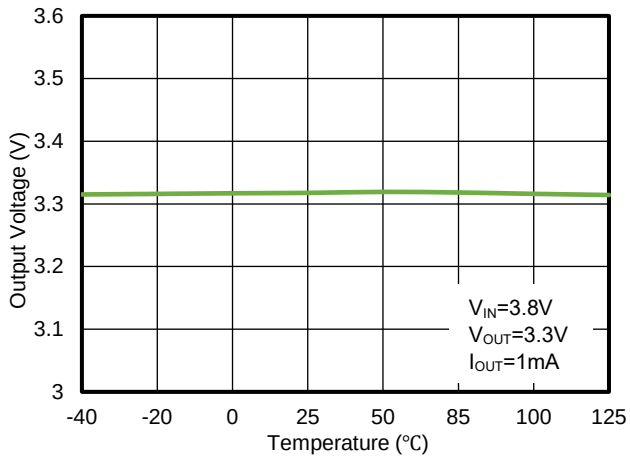


Figure 41. WR0340-33FF4R
Output Voltage vs Ambient Temperature

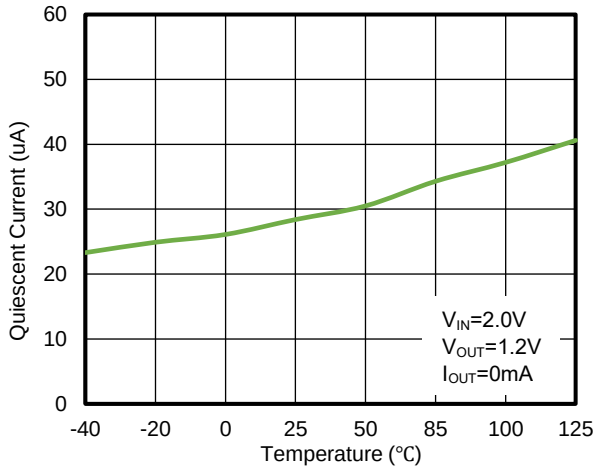


Figure 42. WR0340-12A50R
Quiescent Current vs Ambient Temperature

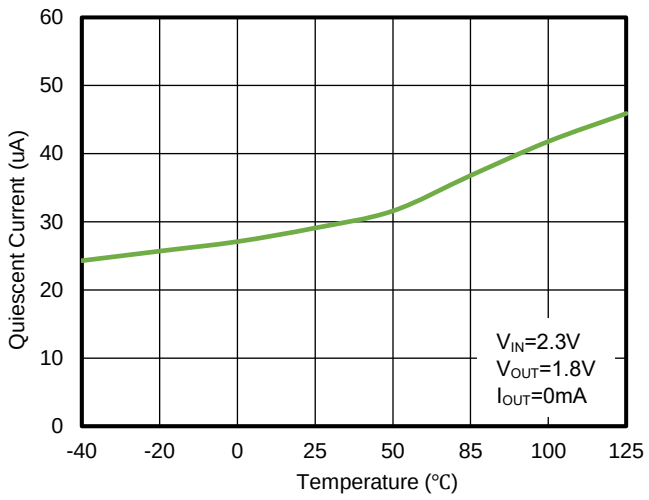


Figure 43. WR0340-18FF4R
Quiescent Current vs Ambient Temperature

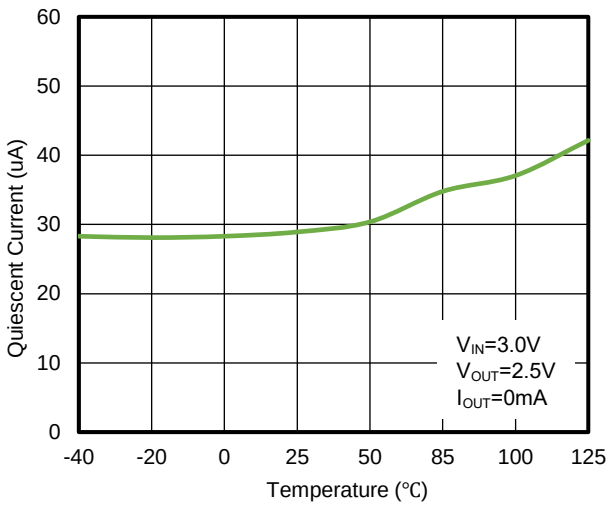


Figure 44. WR0340-25A50R
Quiescent Current vs Ambient Temperature

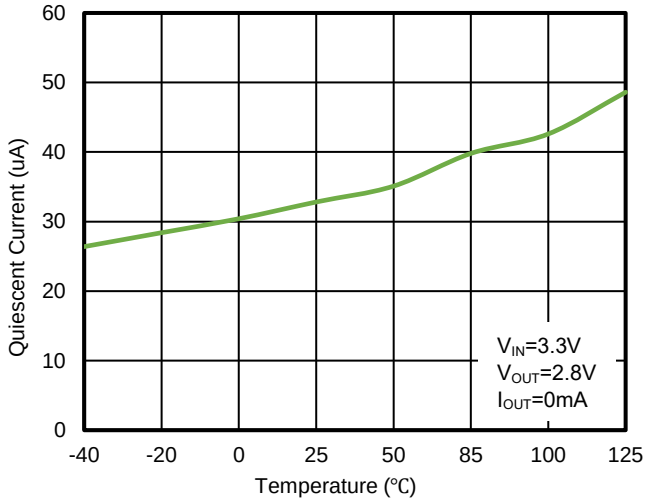


Figure 45. WR0340-28A50R
Quiescent Current vs Ambient Temperature

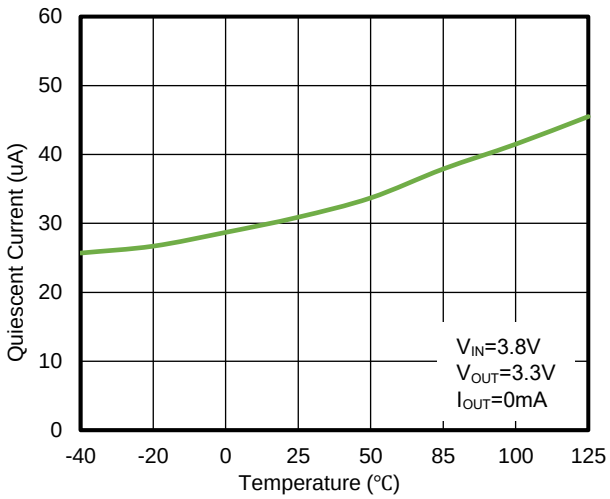


Figure 46. WR0340-33FF4R
Quiescent Current vs Ambient Temperature

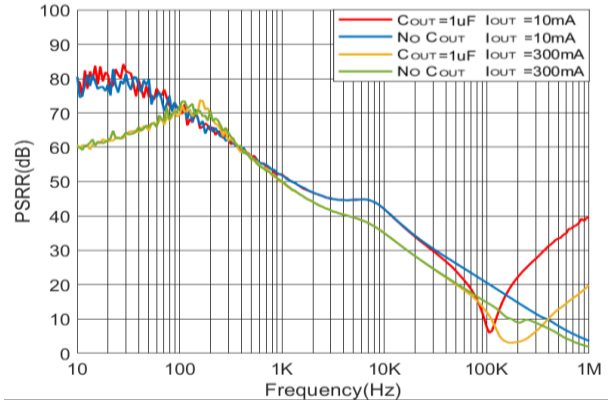


Figure 47. WR0340-18FF4R
Power-Supply Rejection Ratio vs Frequency

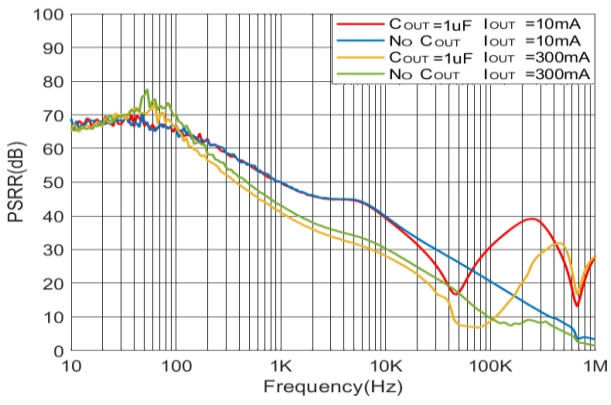


Figure 48. WR0340-25A50R
Power-Supply Rejection Ratio vs Frequency

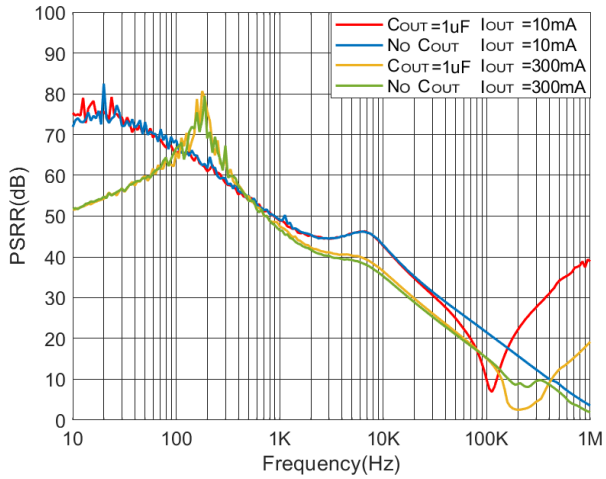


Figure 49. WR0340-33FF4R
Power-Supply Rejection Ratio vs Frequency

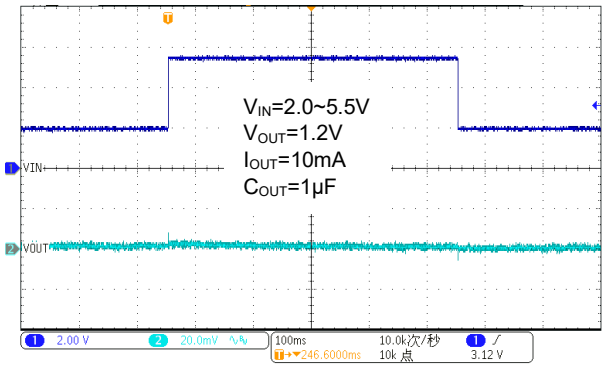


Figure 50. WR0340-12A50R
Line Transient

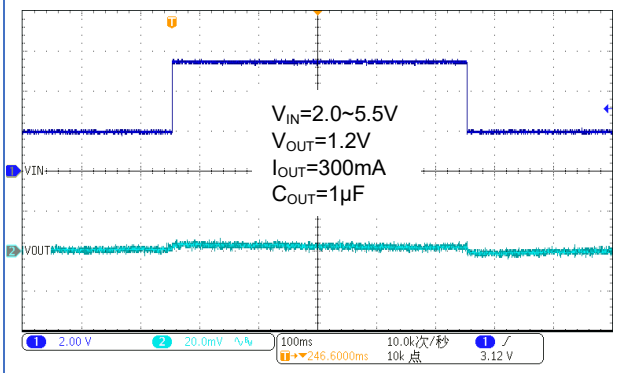


Figure 51. WR0340-12A50R
Line Transient

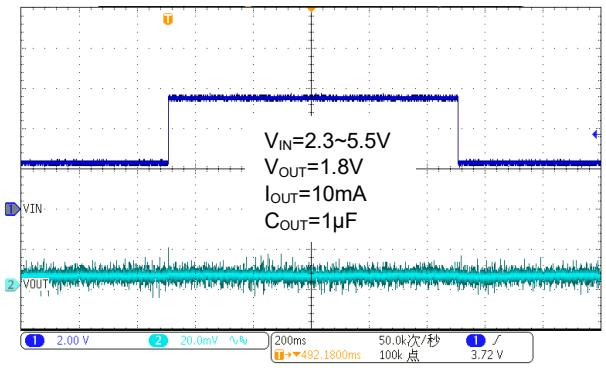


Figure 52. WR0340-18FF4R
Line Transient

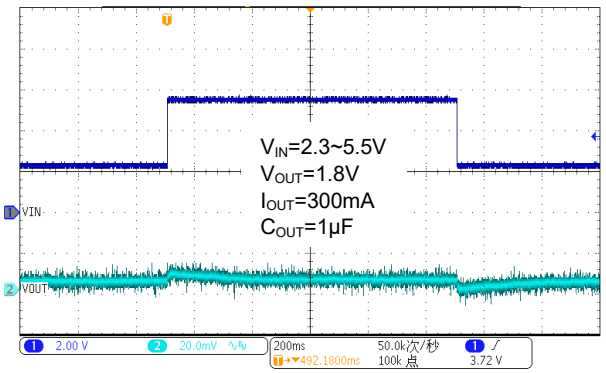


Figure 53. WR0340-18FF4R
Line Transient

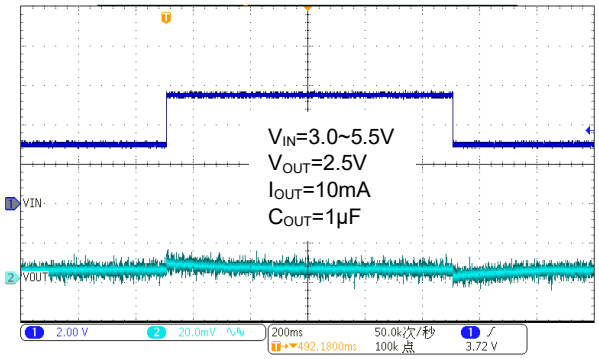


Figure 54. WR0340-25A50R
Line Transient

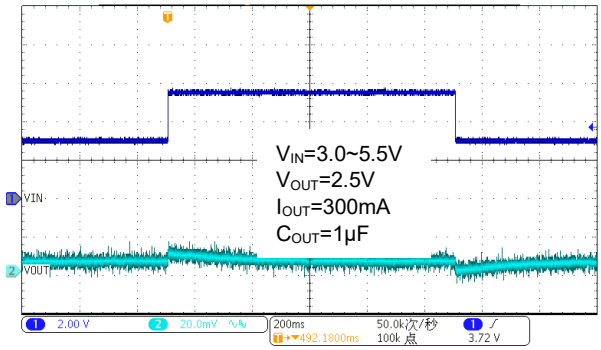


Figure 55. WR0340-25A50R
Line Transient

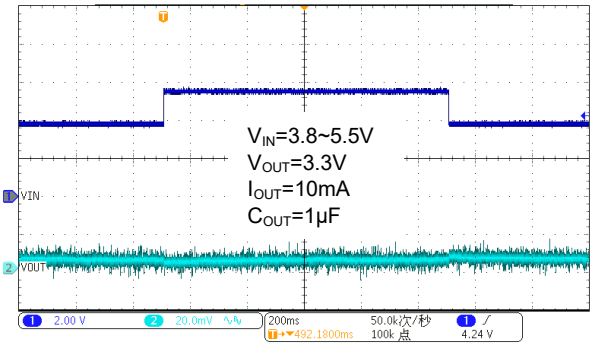


Figure 56. WR0340-33FF4R
Line Transient

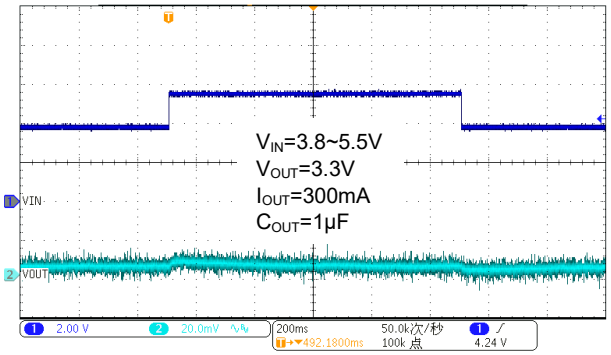


Figure 57. WR0340-33FF4R
Line Transient

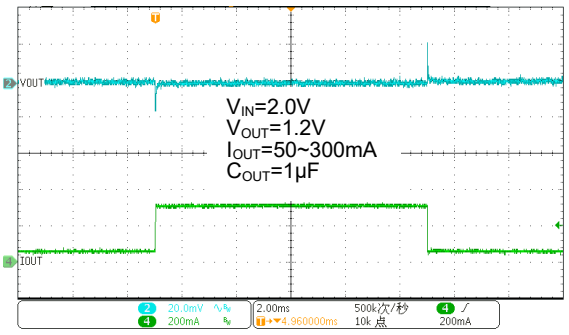


Figure 58. WR0340-12A50R
50mA to 300mA Load Transient

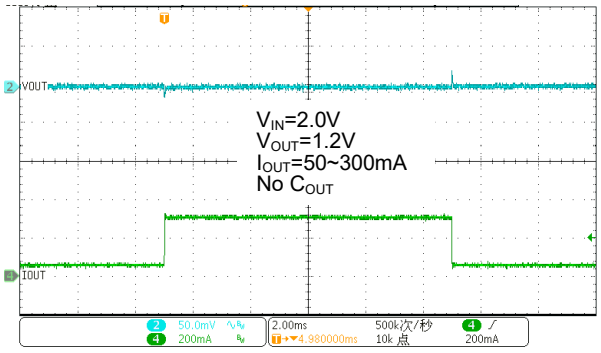


Figure 59. WR0340-12A50R
50mA to 300mA Load Transient

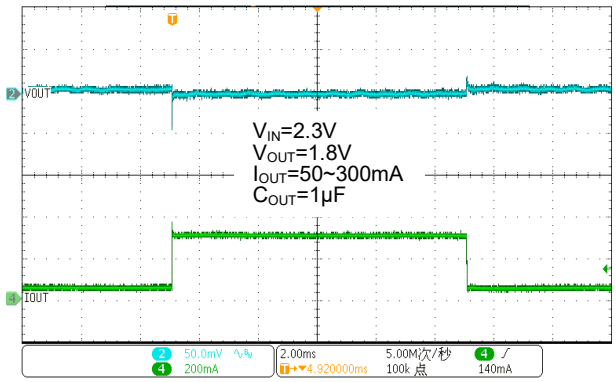


Figure 60. WR0340-18FF4R
50mA to 300mA Load Transient

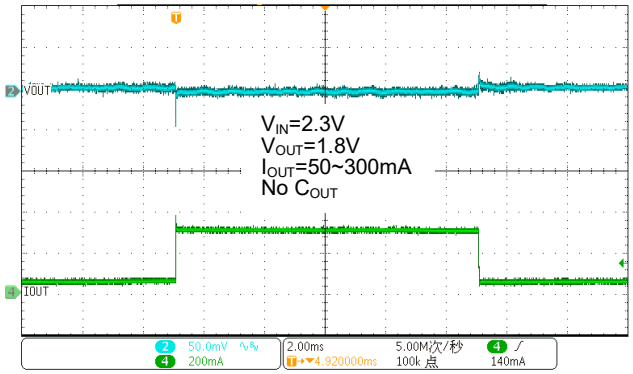


Figure 61. WR0340-18FF4R
50mA to 300mA Load Transient

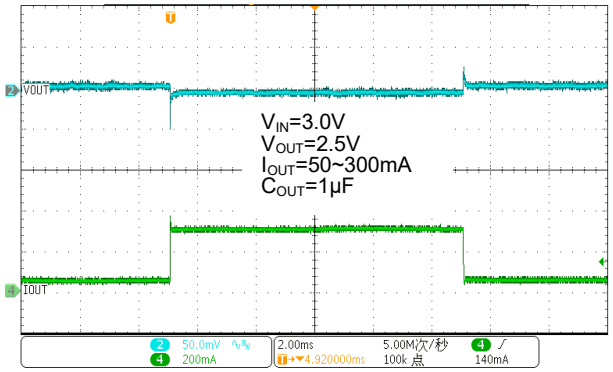


Figure 62. WR0340-25A50R
50mA to 300mA Load Transient

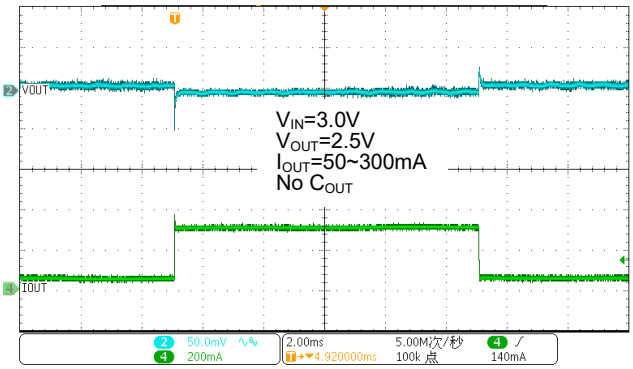


Figure 63. WR0340-25A50R
50mA to 300mA Load Transient

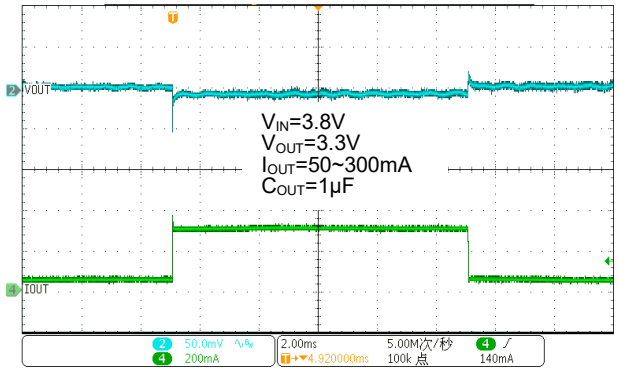


Figure 64. WR0340-33FF4R
50mA to 300mA Load Transient

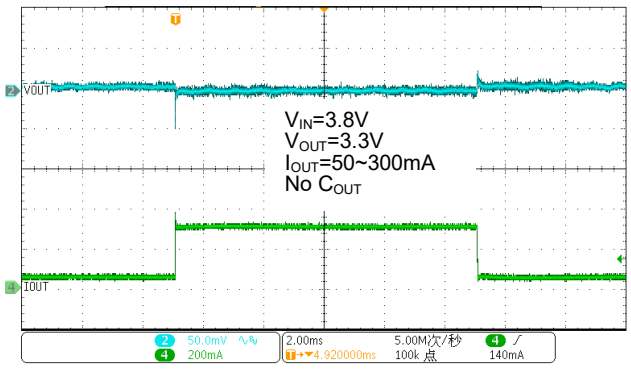


Figure 65. WR0340-33FF4R
50mA to 300mA Load Transient

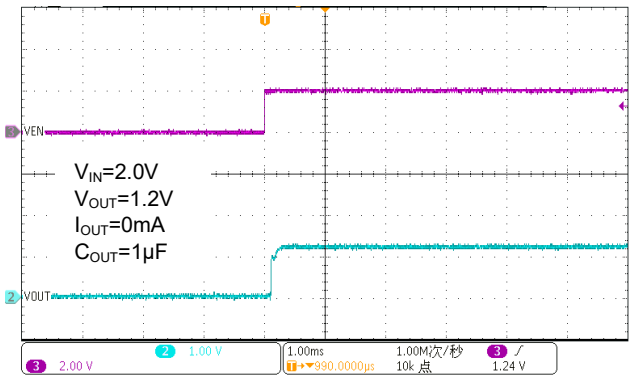


Figure 66. WR0340-12A50R
Startup with EN

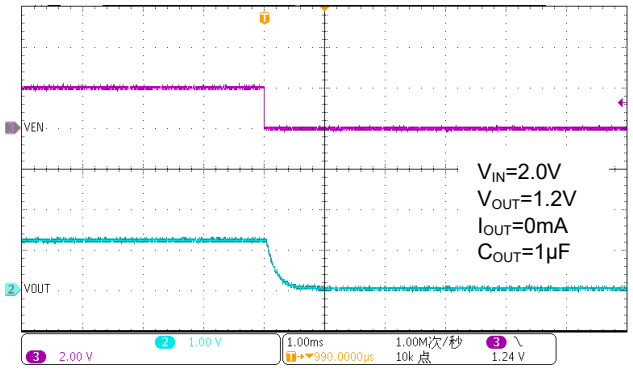


Figure 67. WR0340-12A50R
Shutdown Response with Enable

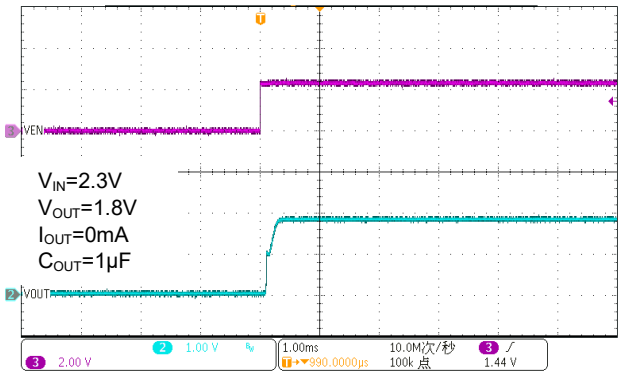


Figure 68. WR0340-18FF4R
Startup with EN

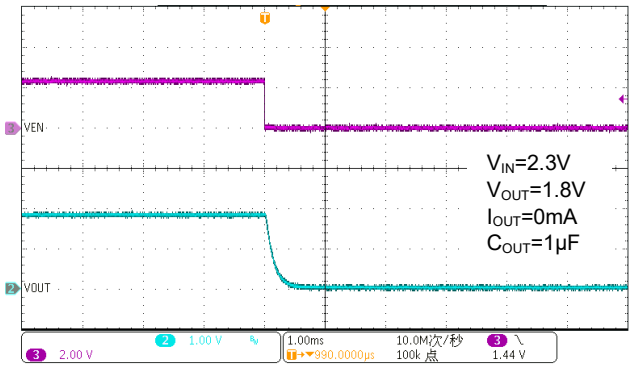


Figure 69. WR0340-18FF4R
Shutdown Response with Enable

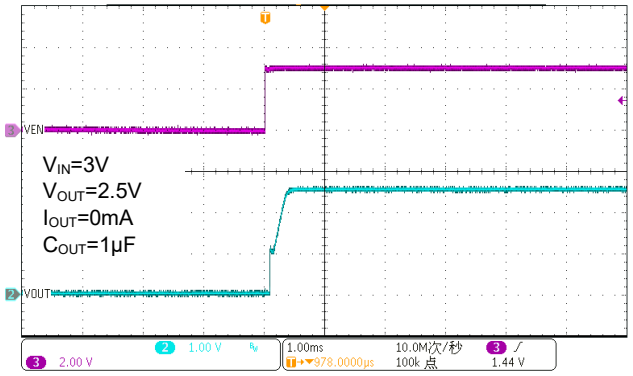


Figure 70. WR0340-25A50R
Startup with EN

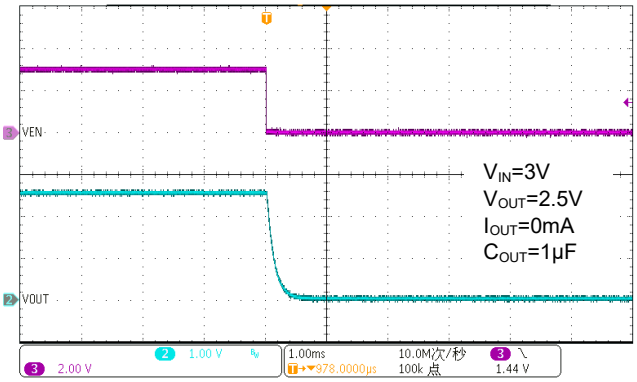


Figure 71. WR0340-25A50R
Shutdown Response with Enable

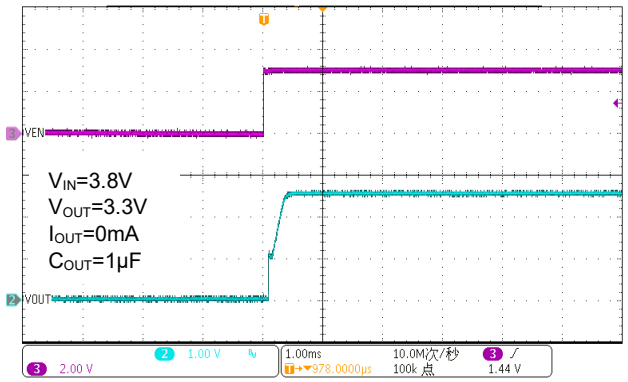


Figure 72. WR0340-33FF4R
Startup with EN

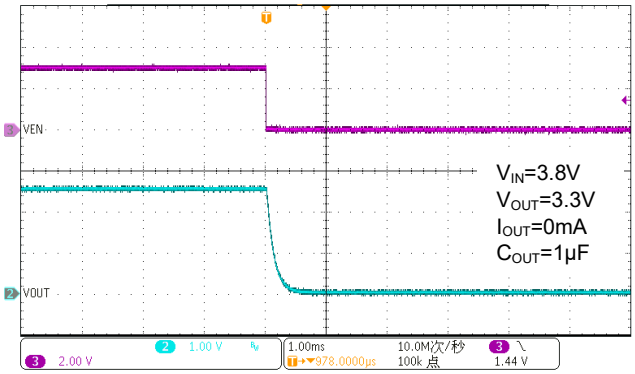


Figure 73. WR0340-33FF4R
Shutdown Response with Enable

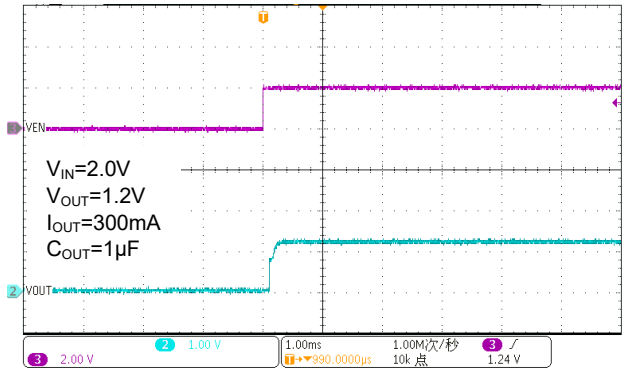


Figure 74. WR0340-12A50R
Startup with EN

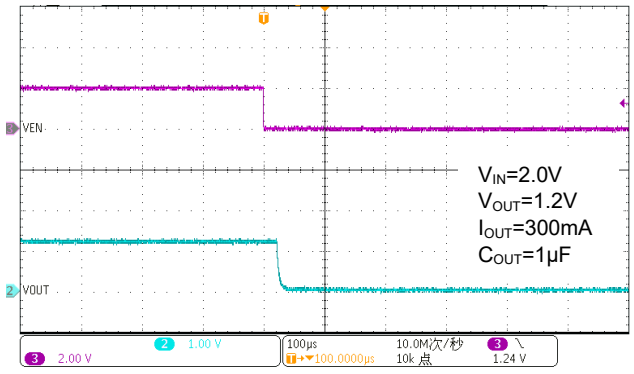


Figure 75. WR0340-12A50R
Shutdown Response with Enable

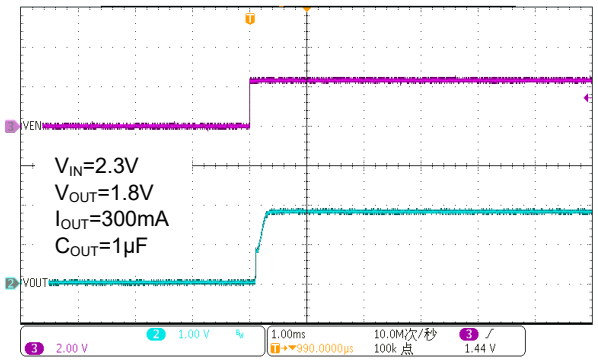


Figure 76. WR0340-18FF4R
Startup with EN

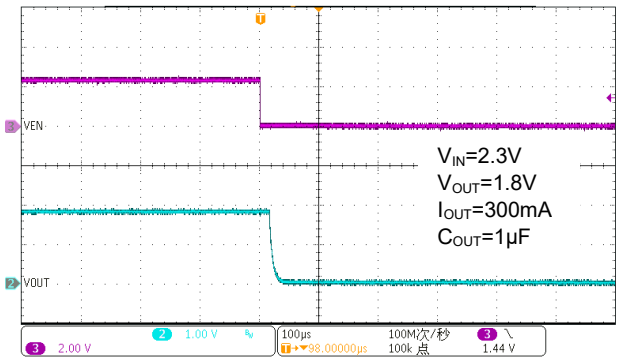


Figure 77. WR0340-18FF4R
Shutdown Response with Enable

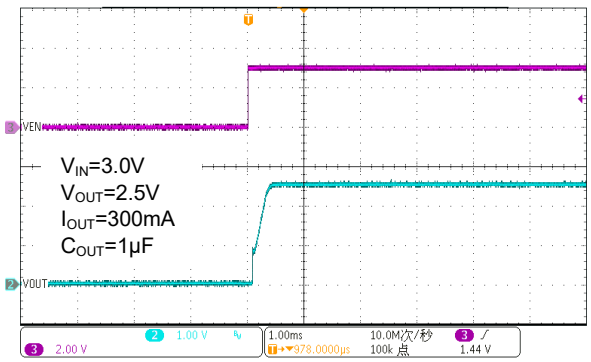


Figure 78. WR0340-25A50R
Startup with EN

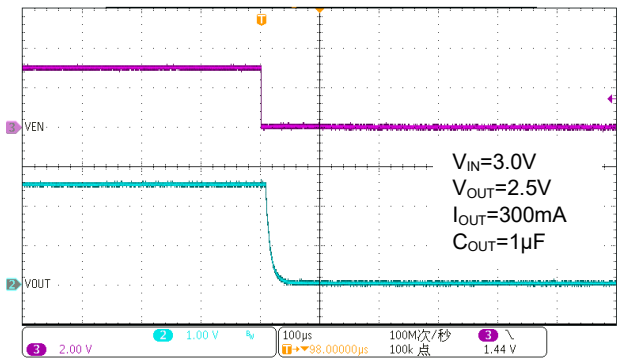


Figure 79. WR0340-25A50R
Shutdown Response with Enable

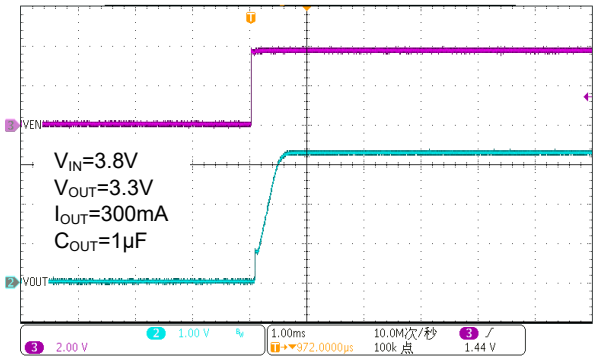


Figure 80. WR0340-33FF4R
Startup with EN

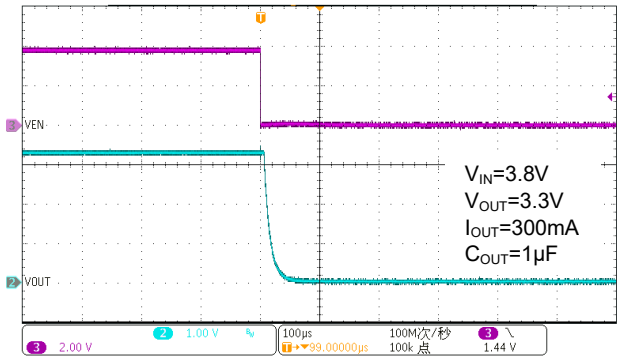


Figure 81. WR0340-33FF4R
Shutdown Response with Enable

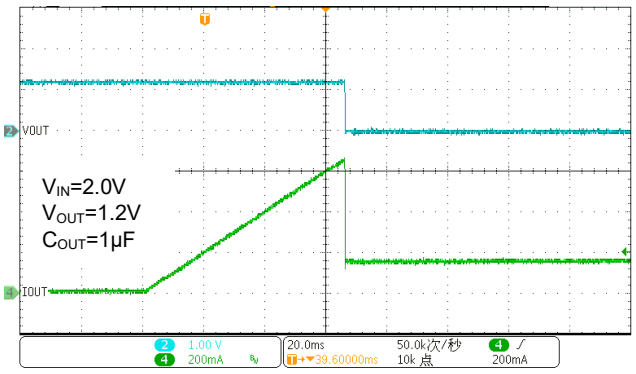


Figure 82. WR0340-12A50R
Foldback Current Limit Response

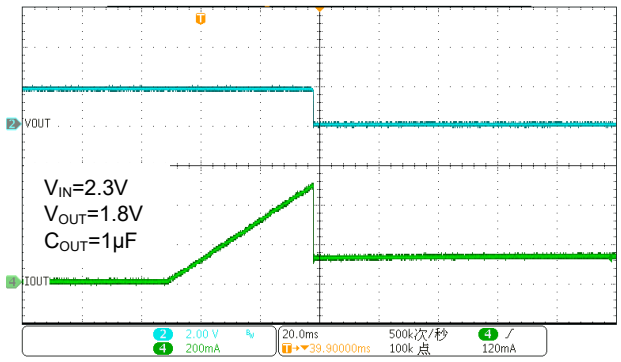


Figure 83. WR0340-18FF4R
Foldback Current Limit Response

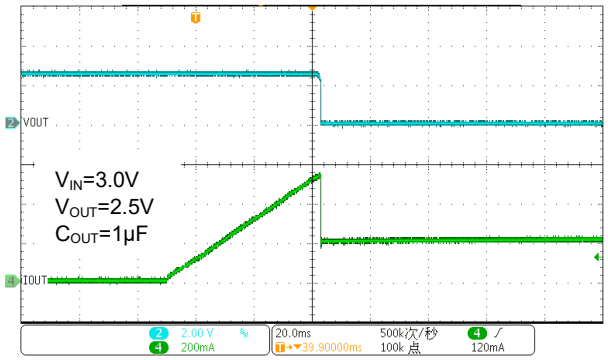


Figure 84. WR0340-25A50R
Foldback Current Limit Response

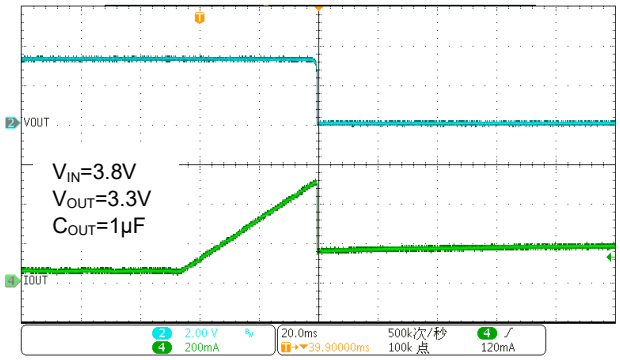


Figure 85. WR0340-33FF4R
Foldback Current Limit Response

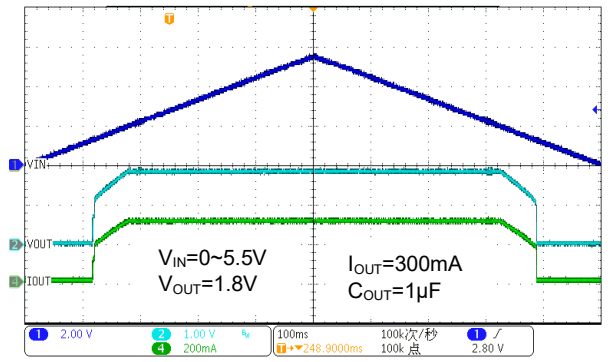


Figure 86. WR0340-18FF4R
V_{IN} Power-Up & Power-Down

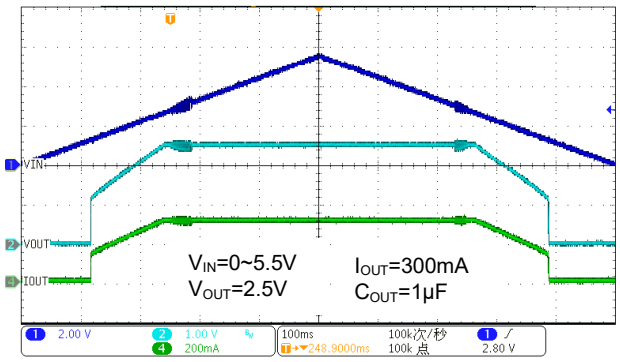


Figure 87. WR0340-25A50R
V_{IN} Power-Up & Power-Down

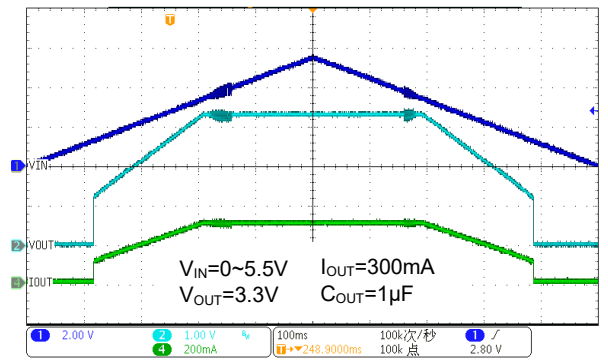


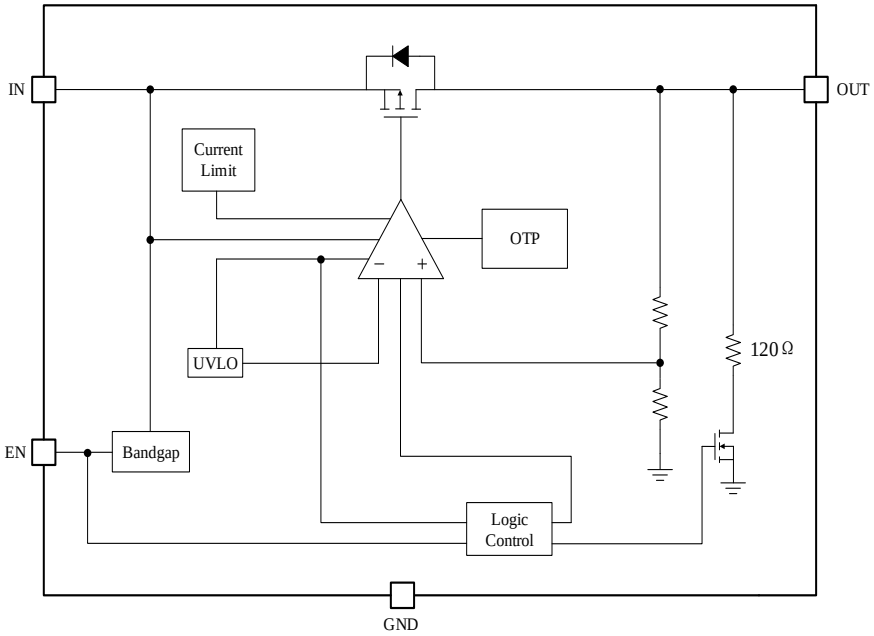
Figure 88. WR0340-33FF4R
V_{IN} Power-Up & Power-Down

11. Function Description

11.1 Overview

The WR0340 series are CMOS-based low-dropout, low-quiescent current linear regulators, offering 300mA with low dropout voltage and high output accuracy. The WR0340 series is designed with a capacitor-free architecture to ensure stability without an input or output capacitor. The device also offers low quiescent current, low-dropout voltage and very small packages suitable for space constrained application.

11.2 Block Diagram



11.3 Feature Description

11.3.1 Output Voltage Accuracy

The WR0340 has an output voltage accuracy of 1% or 1.4%. Output voltage accuracy is defined as the maximum and minimum error in output voltage. This includes the errors introduced by internal reference, load regulation and line regulation differences over the full range of rated load and line operating conditions, taking into account differences between manufacturing lots.

11.3.2 Enable (EN)

The WR0340 uses the EN pin to enable /disable its device and to activate /deactivate the discharge function. If the EN pin voltage is pulled below 0.4V the device is guaranteed to be disable. When EN is disabled, the active discharge transistor is activated and the output voltage V_{OUT} is pulled to GND through an internal circuitry with effective resistance about 120ohms.

If the voltage of EN pin is higher than 0.9V, the device is guaranteed to be enabled. If the Enable function is not required, the EN pin should be connected directly to IN.

11.3.3 Undervoltage Lockout (UVLO)

When V_{IN} is less than the UVLO threshold, the WR0340 disables the output using an undervoltage lockout (UVLO) circuit, which ensures that the device does not exhibit any unpredictable behavior. During UVLO disable, the output is pulled to ground through a 120Ω pulldown resistor.

11.3.4 Dropout Voltage (V_{DO})

The WR0340 is an 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.

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

11.3.5 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

$$PSRR = 20lg(Ripple(in) / Ripple(out))$$

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.

The WR0340 is a high PSRR LDO that can be used not only for voltage regulation but also for noise cancellation in the power supply.

11.3.6 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.

The WR0340 has a low noise reference to ensure that output noise is reduced during normal operation.

11.3.7 Fold-back 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 WR0340 uses a fold-back current limiting mode, providing good protection to the device.

More information on current limiting can be found in Electrical Characteristics Figure 33 to Figure 36.

11.3.8 Thermal Protection

The WR0340 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 160℃ (typical). The thermal shutdown hysteresis ensures that the LDO resets (turns on) again when the temperature drops to 135℃ (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 WR0340'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 WR0340 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	$V_{UVLO}<V_{IN}<V_{OUT(NOM)}+V_{DO}$	$V_{EN}>V_{ENH}$	$I_{OUT}<I_{LIM}$	$T_J<T_{SD}$
Disabled	$V_{IN}<V_{UVLO}$	$V_{EN}<V_{ENL}$	—	$T_J>T_{SD}$

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 WR0340 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 discharged to ground through an internal resistor.

12. Application

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 WR0340 is a linear regulator with an input voltage of 1.4V to 5.5V, an output voltage of 1.0V to 3.3V, and an output voltage accuracy of 1% or 1.4%. The maximum output current is 300mA. The efficiency of a linear regulator is determined by the ratio of the output voltage to the input voltage, so to achieve high efficiency, the differential voltage (V_{IN}-V_{OUT}) must be as small as possible. This section discusses how to best use the device in practical applications.

12.2 Capacitor Recommendation

The WR0340 uses an advanced internal control loop to obtain stable operation both with and without the use of input or output capacitors. Dynamic performance is improved with the use of an output capacitor, and may be improved with an input capacitor. An output capacitance of 0.1 μF or larger generally provides good dynamic response. Use X5R- and X7R-type ceramic capacitors because these capacitors have minimal variation in value and equivalent series resistance (ESR) over temperature.

12.3 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.

13. Power supply recommendation

The WR0340 has a V_{IN} range of between 1.4V and 5.5V. 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.

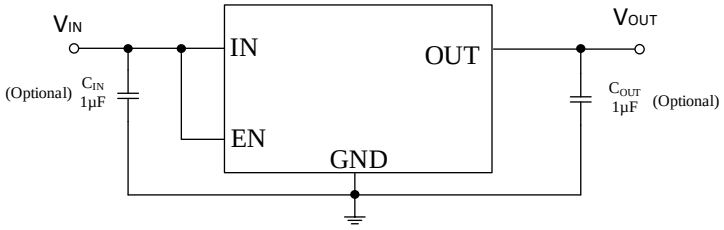
The modules are listed in the following table.

NAME	PACKAGE	EVALUATION MODULE
WR0340	SOT23-5	WAYON LDO EVM V1.1 -SOT23-5
	DFN1×1-4	WAYON LDO EVM V1.1 - DFN1×1-4

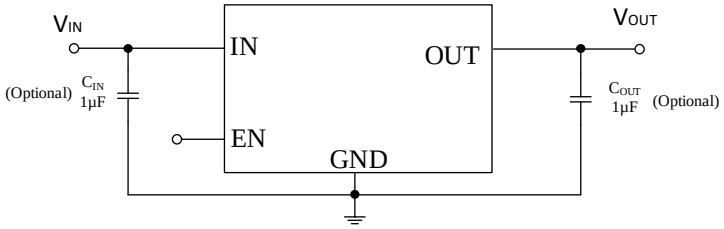
14.1 Typical Application Circuits

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.



Whether or not the WR0340 uses input or output capacitors, stabilization is achieved through the internal control loop. Some applications benefit from the removal of output capacitors. In addition to saving space and cost, the removal of the output capacitor reduces inrush current, in these cases, care should be taken to ensure that the load can withstand the additional output voltage deviation. Typically the slew rate increases, the peak voltage deviation increases significantly. For loads exhibiting fast currents with a slew rate higher than 0.1 A/μs, use an output capacitor. For best performance, the recommended input and output capacitors are 1μF, and the output capacitor cannot exceed a maximum of 100 μF.

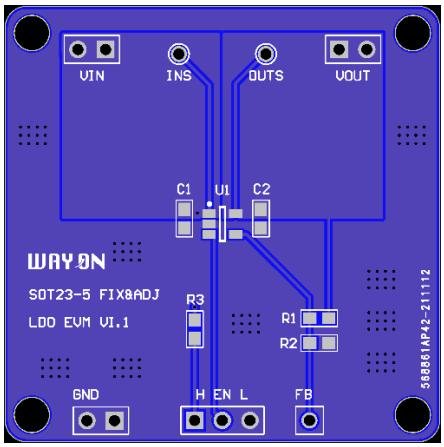
14.2 Layout of Typical Application Circuits

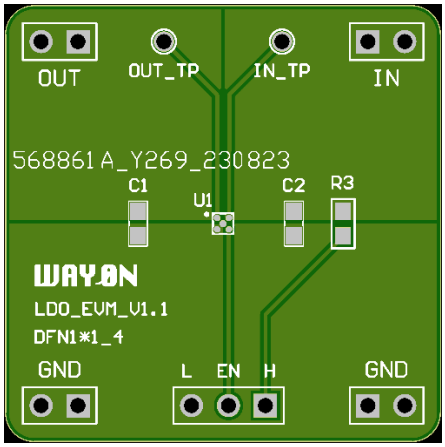
Layout Guidelines

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. Although WR0340 is capacitor-free LDO, input capacitor and output capacitor may be used to improve performance. A 0.1μF to 1μF input capacitor (C_{IN}) is recommended to IN to minimize the effect of resistance and inductance between the source and the LDO input. A 0.1μF or larger 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.

To improve thermal performance, an array of thermal vias is used to connect the thermal pad to the ground plane. A larger ground plane improves the thermal performance of the device and reduces the operating temperature of the device.

Layout Example





15. Naming Conventions

WR AA BB-CC DDD E

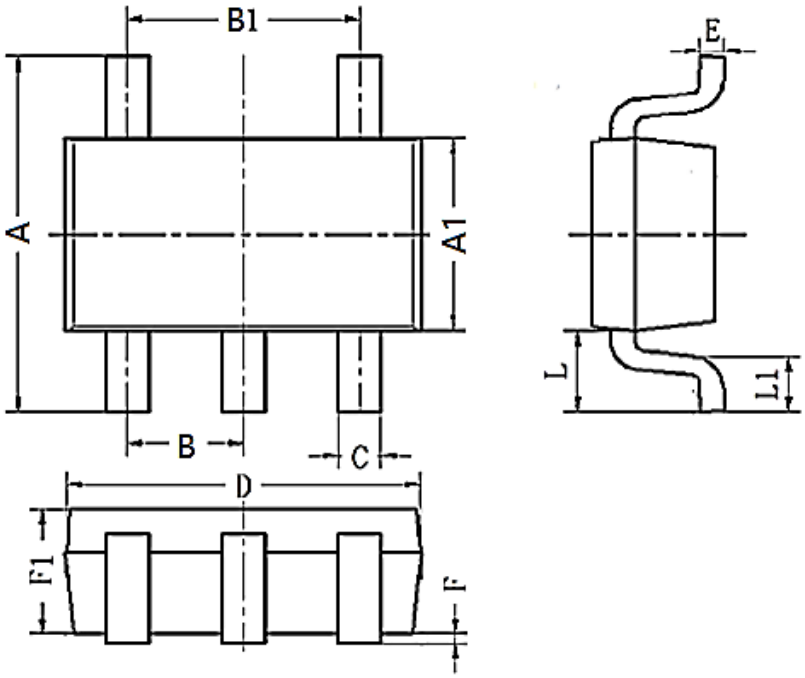
WR: WAYON Regulator
AA: 03 - Output Current, 300mA
BB: Serial number
CC: Output Voltage
DDD: A50-Package, SOT23-5
FF4- Package, DFN1×1-4
E: R-Reel & T-tube

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.

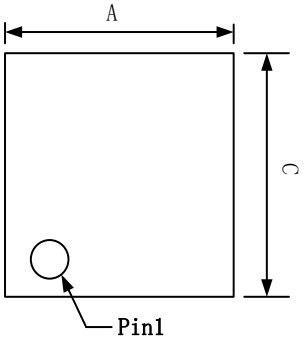
17. Package Information

SOT23-5

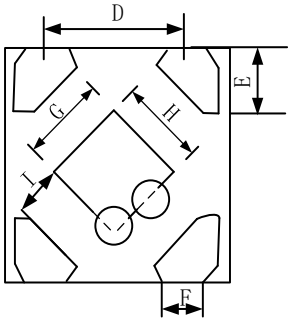


SYMBOL	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	2.60	2.80	3.00
A1	1.50	1.60	1.70
B	0.85	0.95	1.05
B1	1.80	1.90	2.00
C	0.25	0.37	0.50
D	2.79	2.90	3.02
E	0.10	0.15	0.20
F	0.00	0.10	0.20
L	0.60REF		
L1	0.30	0.45	0.60
F1	0.85	1.10	1.30

DFN1×1-4



Top View



Bottom View



DETAIL A

Pin 1 ID and Tie Bar Mark Options

Note: The configuration of the Pin 1 identifier is optional, but must be located within the zone indicated.



Side View

SYMBOL	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	0.950	1.000	1.050
B	0.320	0.370	0.420
C	0.950	1.000	1.050
D		0.650BSC	
E	0.170	0.270	0.370
F	0.130	0.235	0.300
G	0.430	0.485	0.540
H	0.430	0.485	0.540
I		0.200REF	

18. Ordering Information

Part Number	Output Voltage	Package	Packing Quantity	Marking*
WR0340-10A50R	1.0V	SOT23-5	3k/Reel	WR0340 10 XXXX
WR0340-11A50R	1.1V	SOT23-5	3k/Reel	WR0340 11 XXXX
WR0340-12A50R	1.2V	SOT23-5	3k/Reel	WR0340 12 XXXX
WR0340-15A50R	1.5V	SOT23-5	3k/Reel	WR0340 15 XXXX
WR0340-18A50R	1.8V	SOT23-5	3k/Reel	WR0340 18 XXXX
WR0340-25A50R	2.5V	SOT23-5	3k/Reel	WR0340 25 XXXX
WR0340-28A50R	2.8V	SOT23-5	3k/Reel	WR0340 28 XXXX
WR0340-30A50R	3.0V	SOT23-5	3k/Reel	WR0340 30 XXXX
WR0340-33A50R	3.3V	SOT23-5	3k/Reel	WR0340 33 XXXX
WR0340-10FF4R	1.0V	DFN1×1-4	10k/Reel	340 10
WR0340-11FF4R	1.1V	DFN1×1-4	10k/Reel	340 11
WR0340-12FF4R	1.2V	DFN1×1-4	10k/Reel	340 12
WR0340-15FF4R	1.5V	DFN1×1-4	10k/Reel	340 15
WR0340-18FF4R	1.8V	DFN1×1-4	10k/Reel	340 18
WR0340-25FF4R	2.5V	DFN1×1-4	10k/Reel	340 25
WR0340-28FF4R	2.8V	DFN1×1-4	10k/Reel	340 28
WR0340-30FF4R	3.0V	DFN1×1-4	10k/Reel	340 30
WR0340-33FF4R	3.3V	DFN1×1-4	10k/Reel	340 33

* XXXX is variable

Contact Information

No.1001, Shiwan(7) Road, Pudong District, Shanghai, P.R.China.201207
Tel: 86-21-50310888 Fax: 86-21-50757680 Email: market@way-on.com
WAYON website: http://www.way-on.com
For additional information, please contact your local Sales Representative.
WAYON® is registered trademark of Wayon Corporation.

Specifications are subject to change without notice.
The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time.
Users should verify actual device performance in their specific applications.

Product Specification Statement

- 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.
- 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.
- 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.
- 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.
- 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.
- Users should also comply with relevant laws, regulations, policies, and standards when using the product specification. Users are responsible for the risks and liabilities arising from the use of the product specification and must ensure that it is not used for illegal purposes. Additionally, users should respect the intellectual property rights related to the product specification and refrain from infringing upon any third-party legal rights. WAYON shall assume no responsibility for any disputes or controversies arising from the above-mentioned issues in any form.