WR0343

Ultra-Low quiescent current, 300mA, CMOS LDO

1. General Descriptions

The WR0343 is a high accuracy, ultra-low quiescent current, low dropout, CMOS Linear regulator. The WR0343 can source 300 mA of output current with an input voltage range of 1.8 V to 8.0 V and an output range of 1.2 V to 5.0 V, making the device can be used for a wide variety of applications. Low dropout voltage and ultra-low quiescent current make this series of devices ideal for a wide selection of battery-operated handheld equipment.

The WR0343 offer a new level of cost-effective performance in cellular phones, laptop and notebook computers, and other portable devices.

The WR0343 regulators are available in standard SOT23-5 package and DFN1x1-4 Package. Standard products are Pb-free and Halogen-free.

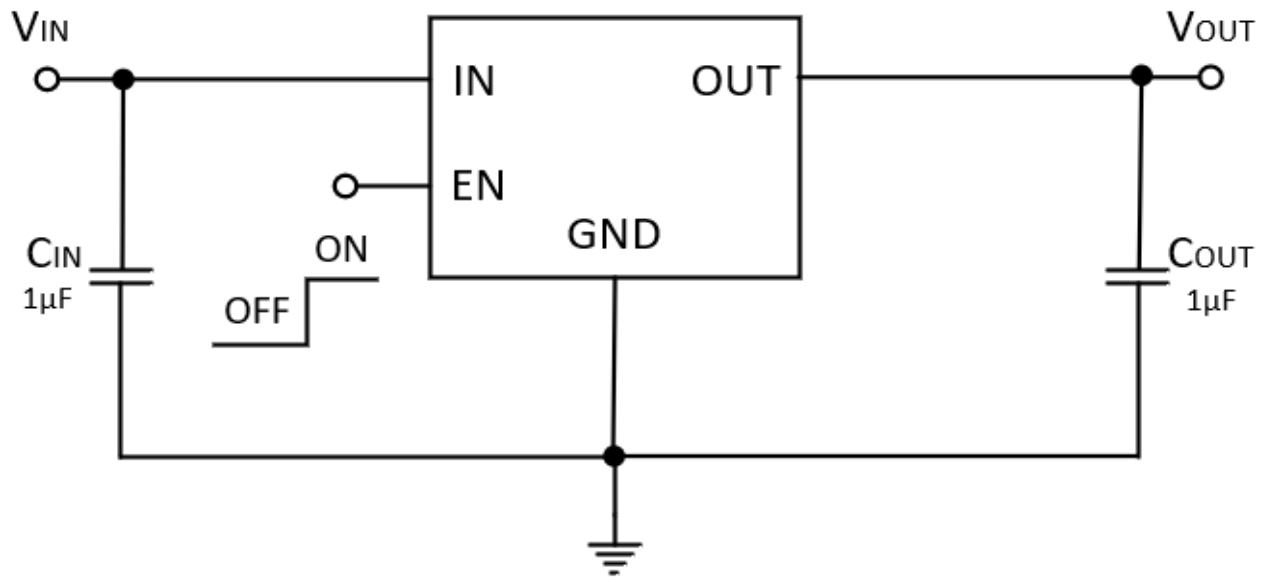
2. Features

- High Output Accuracy: ±1%
- Output Current: 300mA
- Input Voltage: 1.8V~8.0V
- Output Voltage: 1.2V~5.0V
- Low Dropout Voltage: 330mV @ I_{OUT} = 300mA
- Ultra-low Quiescent Current: 0.80μA (Typical)
- Power Supply Rejection Ration: 50dB@1kHz
- Excellent Load/Line Transient Response
- Over-current Protection
- Shut-down Current: < 0.1μA
- Recommend Capacitor: 1μF

3. Applications

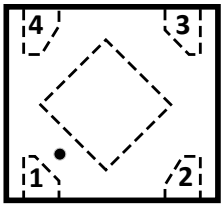
- Laptop, Palmtops and PDAs
- Portable Consumer Equipment
- Radio Control System

4. Typical Application

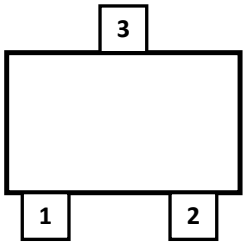


5. Pin Configuration

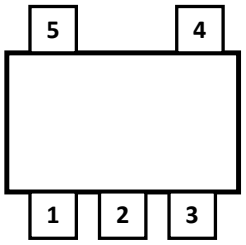
(Top View)



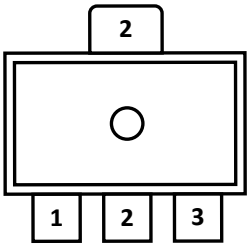
DFN-4



SOT23-3



SOT23-5



SOT89-3

6. Pin Description

PIN NUMBER								PIN NAME	I/O	PIN FUNCTION
SOT23-3	SOT23-31	SOT23-32	SOT89-3	SOT89-31	SOT89-32	SOT23-5	DFN-4			
3	1	2	3	2	1	1	4	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.
1	3	3	2	1	2	2	2	GND	-	Common ground.
						3	3	EN	I	Enable input. Active High.
						4	-	NC	-	No Connection.
2	2	1	1	3	3	5	1	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 180-Ω (typical) pull-down resistor prevents a charge from remaining on V_{OUT} when the regulator shutdowns.
						-	-	EPAD	-	Exposed pad .It should be connected directly to the GND pin as short as possible or leave floating. Connect the EPAD to a large-area ground plane for best thermal performance. Do not connect to any potential other than GND.

7. Absolute Maximum Ratings[1]

PARAMETER		RATING	UNIT
Input voltage range		-0.3 to 9.0	V
EN Input voltage range		-0.3 to V_{IN}	
Output voltage range		-0.3 to V_{IN}+0.3	
Junction Temperature		-40 to 125	ºC
Lead Temperature Range		260	
Storage Temperature Range		-40 to 125	
ESD Susceptibility	Human Body Model	±2000	V
	Machine Model	±200	

NOTE1: Greater than these given values, the device will be damaged.

8. Recommended Operating Conditions

PARAMETER	RATING	UNIT
Input voltage range	1.8 to 8.0	V
EN Input voltage range	1.8 to V_{IN}	
Nominal output voltage range	1.2 to 5.0	
Output current	0 to 300	mA
Input capacitor	1	µF
Output capacitor	1	
Operating temperature range	-40 to 85	ºC

9. Electrical Characteristics (V_{IN}=$V_{OUT(NOMINAL)}$+1V, C_{IN}=C_{OUT}=1μF, Full= -40℃ to 85℃, unless otherwise noted)

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{IN}	Input Voltage Range	Full	1.8		8	V
V_{OUT}	Output Voltage Range	Full	1.2		5	V
	DC Output Accuracy	I_{OUT}=1mA, Full	-1		1	%
V_{DO}	Dropout Voltage[1]	V_{OUT}=3.3V, I_{OUT}=300mA, Full		330	450	mV
I_{LIM}	Output current limit	V_{OUT}=0.5 x $V_{OUT-NOM}$, V_{IN}=5V, Full		650		mA
I_{OUT}	Maximum output current in the accuracy range	V_{EN}=V_{IN}, Full	300			mA
I_{SHORT}	Short Circuit Current	V_{EN}=V_{IN}, V_{OUT} Short to GND, measure GND current, Full		20		mA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	V_{IN}= V_{OUT}+1V ~ 8V, I_{OUT}=10mA, Full		0.05	0.3	%/V
ΔV_{OUT}	Load Regulation	V_{IN}=V_{OUT}+1V, I_{OUT}=1 ~ 100mA, Full		10		mV
		V_{IN}=V_{OUT}+1V, I_{OUT}=1 ~ 300mA, Full		20		
I_Q	Quiescent Current	V_{OUT}=3.3V, I_{OUT}=0mA, Full		0.8		μA
I_{SHDN}	Shut-down Current	V_{EN} = 0V, Full			0.1	μA
PSRR	Power Supply Rejection Ratio	V_{IN}=(V_{OUT}+1V) $_{DC}$+0.5 x V_{P-P} f=100Hz, I_{OUT}=50mA,T_A=25℃		70		dB
		V_{IN}=(V_{OUT}+1V) $_{DC}$+0.5 x V_{P-P} f=1kHz, I_{OUT}=50mA, T_A=25℃		50		
		V_{IN}=(V_{OUT}+1V) $_{DC}$+0.5 x V_{P-P} f=10kHz, I_{OUT}=50Ma,T_A=25℃		40		
V_{ON}	Output Noise Voltage	BW=10Hz ~ 100kHz,T_A=25℃		27 x V_{OUT}		μV_{RMS}
V_{ENH}	EN high voltage (enabled)	EN Input Voltage “H”, Full	1.5		V_{IN}	V
V_{ENL}	EN low voltage (disabled)	EN Input Voltage “L”, Full			0.3	V
I_{EN}	Enable Input Current	V_{IN}=V_{OUT}+1V, V_{EN}=V_{IN}, measure EN current, Full		0.01		μA

Electrical Characteristics ($V_{IN}=V_{OUT(NOMINAL)}+1V$, $C_{IN}=C_{OUT}=1uF$, Full= -40℃ to 85℃, unless otherwise noted)

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
R_{DIS}	Output Discharge resistance	V_{IN}=4.0V, V_{EN}=0V, $V_{OUT}=V_{OUT-NOM}$, Full		180		Ω
$\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$	Output Voltage Ambient Temperature Coefficient	T_A=-40 ºC ~ 85ºC, I_{OUT}=10mA		45		Ppm/ ºC

NOTE1: The dropout voltage is defined as (V_{IN}-V_{OUT}) when V_{OUT} is $V_{OUT(NOM)}$ x 99%.

10. Typical Performance Characteristics (T_A= -40 to 125°C, V_{IN}=V_{OUT}+1V, C_{IN}=C_{OUT}=1μF, unless otherwise noted)

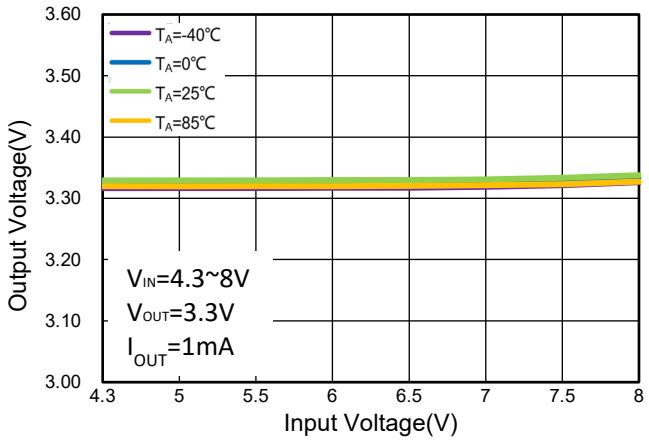


Figure 1. WR0343-33A50R
Regulation vs. V_{IN} (Line Regulation) & Ambient Temperature

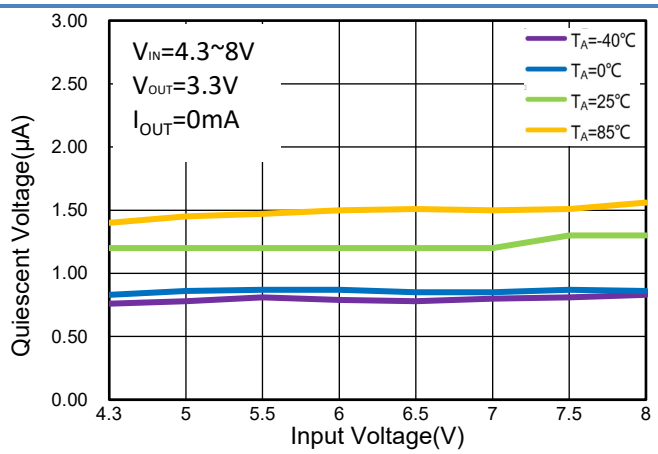


Figure 2. WR0343-33A50R
Quiescent Current vs. V_{IN} & Ambient Temperature

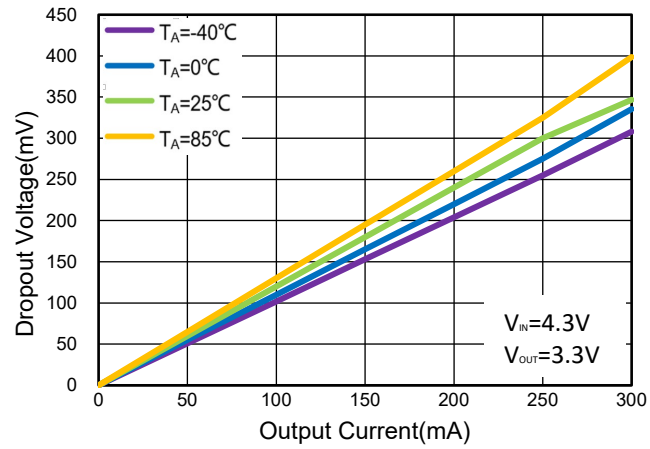


Figure 3. WR0343-33A50R
Load Regulation vs. I_{OUT} & Ambient Temperature

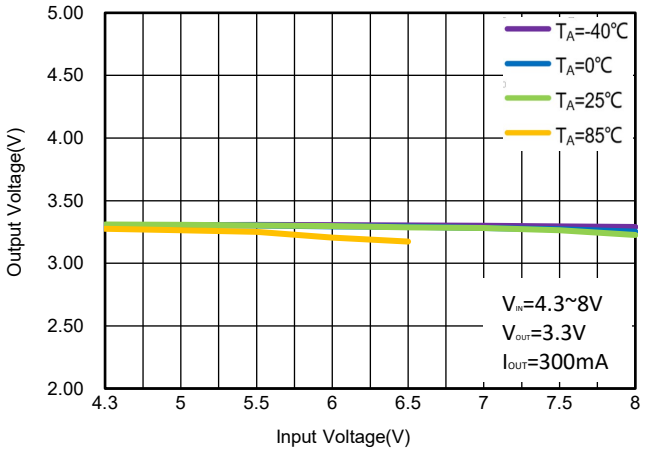


Figure4. WR0343-33A50R
Regulation vs. V_{IN} (Line Regulation) & Ambient Temperature

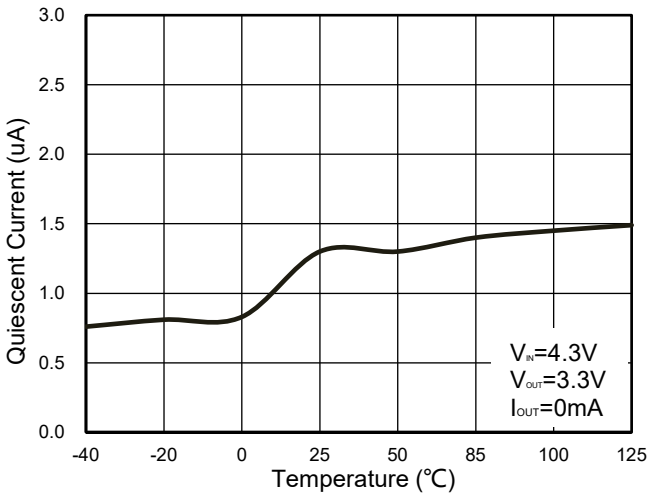


Figure 5. WR0343-33A50R
Quiescent Current vs. Ambient Temperature

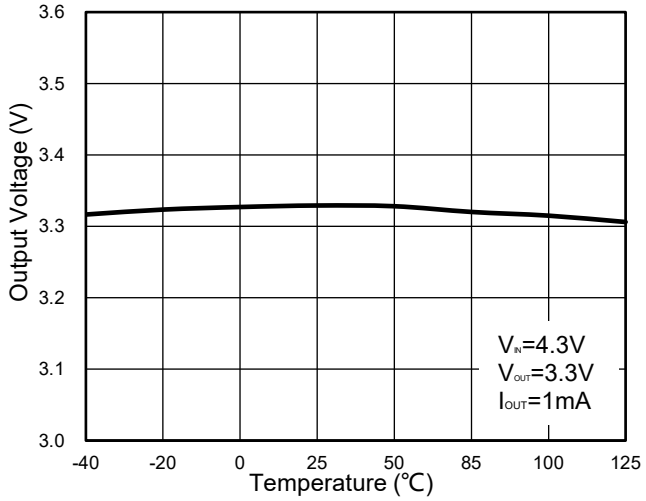


Figure 6. WR0343-33A50R
Output Voltage vs. Ambient Temperature

Typical Performance Characteristics (T_A= -40 to 125ºC, V_{IN}=V_{OUT}+1V, C_{IN}=C_{OUT}=1μF, unless otherwise noted)

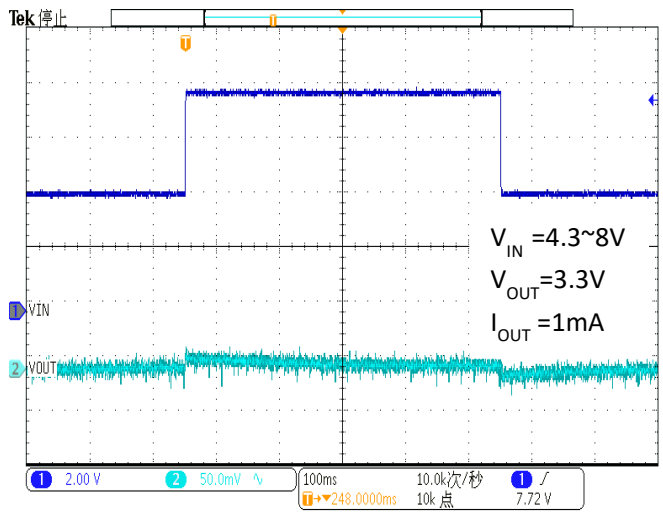


Figure 7. WR0343-33A50R
Line Transient

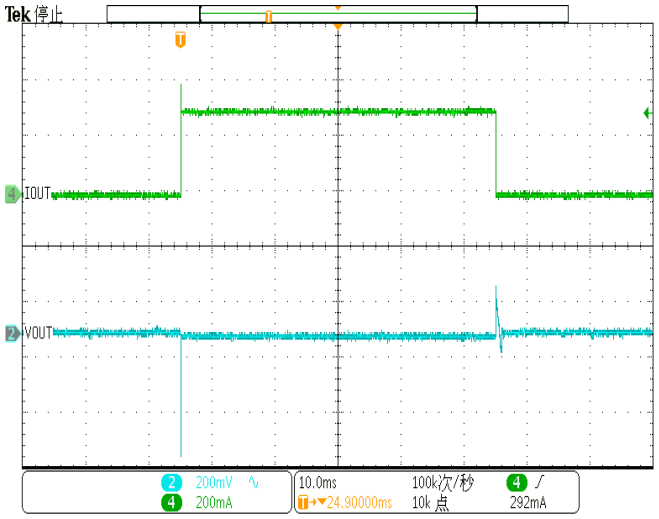


Figure 8. WR0343-33A50R
Load Transient

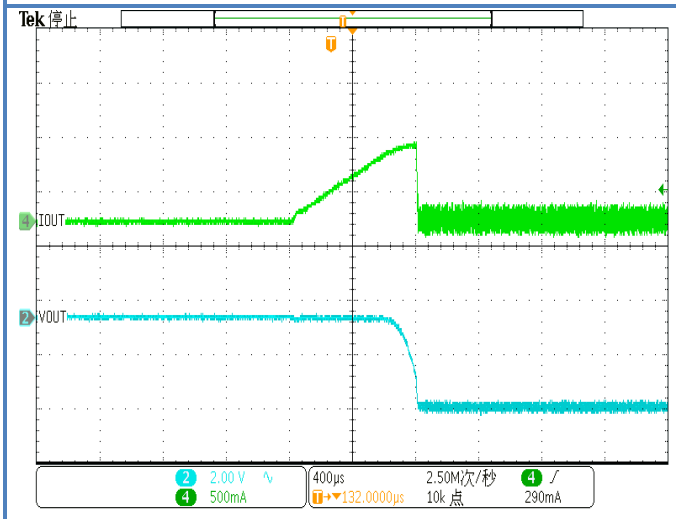


Figure 9. WR0343-33A50R
I_{LIMIT}

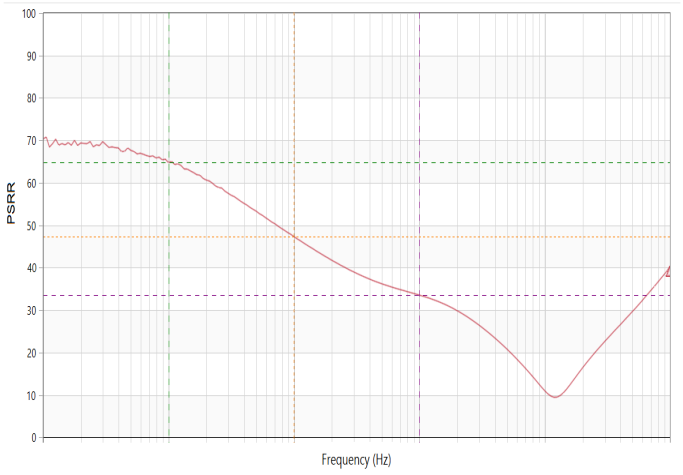


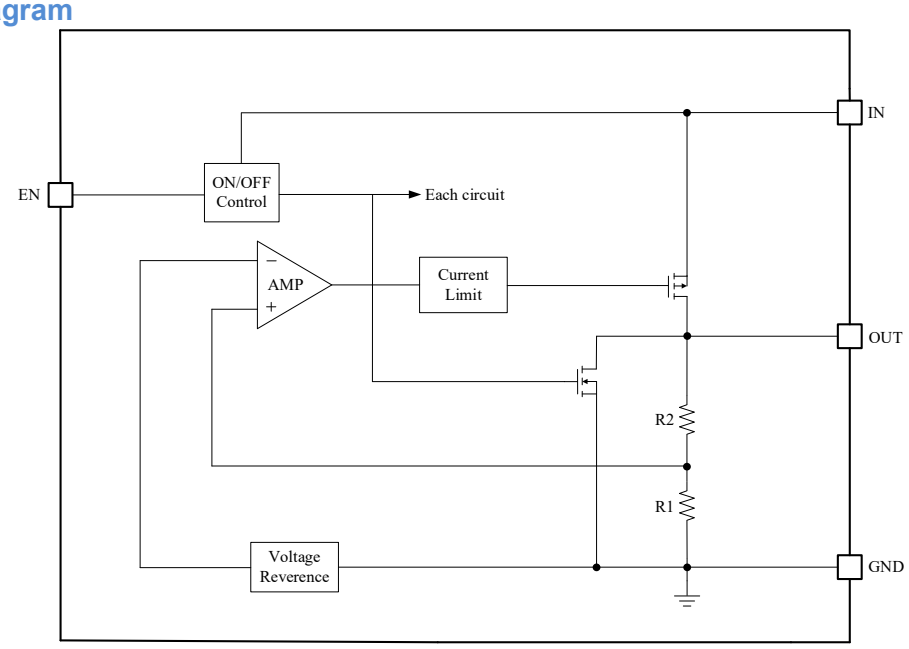
Figure 10. PSRR

11. Function Description

11.1 Overview

The WR0343 is a high accuracy, ultra-low quiescent current, low dropout, CMOS Linear regulator. The WR0343 can source 300 mA of output current with an input voltage range of 1.8 V to 8.0 V and an output range of 1.2 V to 5.0 V, making the device can be used for a wide variety of applications. Low dropout voltage and ultra-low quiescent current make this series of devices ideal for a wide selection of battery-operated handheld equipment.

11.2 Block Diagram



11.3 Feature Description

11.3.1 Output Voltage Accuracy

The WR0343 has an output voltage accuracy of 1%. 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 WR0343 enable pin contains a small pull-down current source, typically 10nA. 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 outputs 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})

WR0343 is a low dropout voltage LDO that can achieve nominal output voltage at lower input voltages. Dropout voltage is defined as the V_{IN}-V_{OUT} at the rated maximum output current. When the input voltage is

below the nominal output voltage, the output voltage varies with the input voltage. For CMOS regulators, the dropout voltage is determined by the $R_{DS\ (ON)}$ of the pass-FET. The $R_{DS\ (ON)}$ is calculated as follows:

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

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

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

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

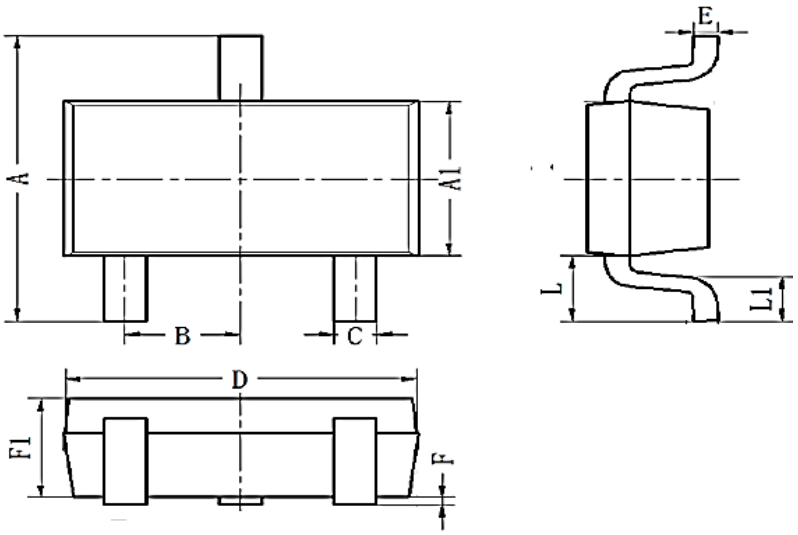
LDO noise can be divided into two main categories: internal noise and external noise. Internal noise is the noise generated inside the electronics; external noise is the noise transmitted from outside the circuit to the circuit. The error amplifier determines the PSRR of the LDO and therefore its ability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

12. 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.

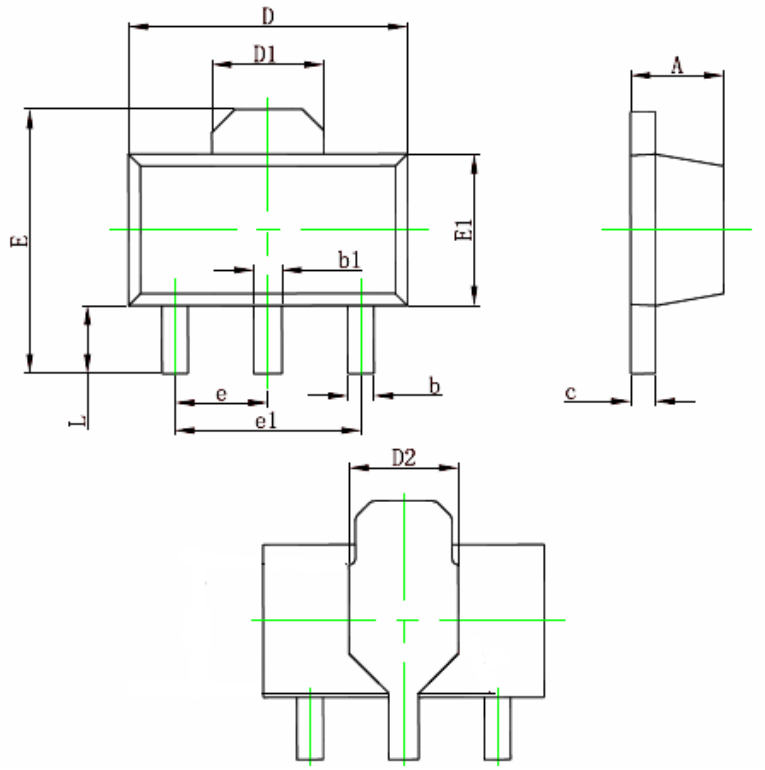
13. Package Information

SOT 23-3/L



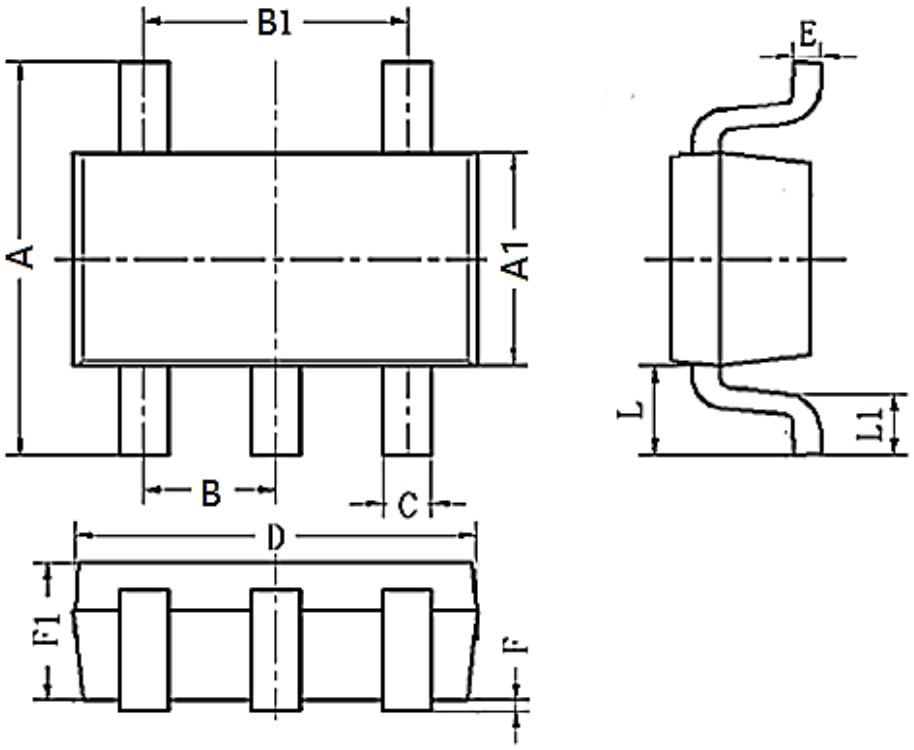
SYMBOL	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	2.60	2.80	3.00
A1	1.50	1.60	1.70
B		0.95BSC	
C	0.25	0.40	0.50
D	2.82	2.92	3.02
E	0.10	0.15	0.20
L		0.59REF	
L1	0.30	0.45	0.60
F1	0.90	1.10	1.30
F	0.00	0.08	0.15

SOT 89-3/L



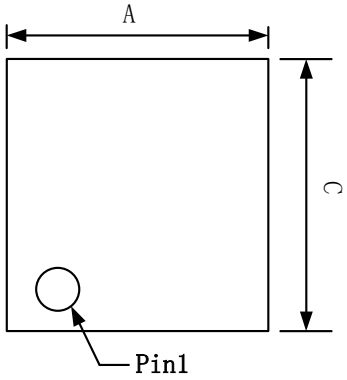
SYMBOL	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MIN
A	1.4	1.5	1.6
b	0.320	0.420	0.520
b1	0.380	0.480	0.580
c	0.350	0.405	0.460
D	4.400	4.500	4.600
D1		1.65REF	
D2	1.700	1.950	2.200
E	3.940	4.120	4.300
E1	2.300	2.450	2.600
e		1.5BSC	
e1		3.00BSC	
L	0.800	1.000	1.200

SOT 23-5

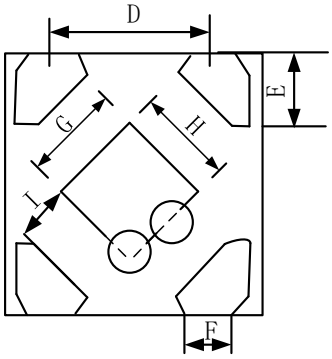


SYMBOL	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	2.60	2.80	3.00
A1	1.50	1.60	1.70
B	0.95BSC		
B1	1.90BSC		
C	0.25	0.40	0.50
D	2.82	2.92	3.02
E	0.10	0.15	0.20
F	0.00	0.08	0.15
L	0.59REF		
F1	0.90	1.10	1.30
L1	0.30	0.45	0.60

DFN-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	

14. Ordering Information

Part Number	Output Voltage	Package	Packing Quantity	Marking*
WR0343-12A20R	1.2V	SOT89-3	1k/Reel	WR0343 12 XXXX
WR0343-15A20R	1.5V	SOT89-3	1k/Reel	WR0343 15 XXXX
WR0343-18A20R	1.8V	SOT89-3	1k/Reel	WR0343 18 XXXX
WR0343-25A20R	2.5V	SOT89-3	1k/Reel	WR0343 25 XXXX
WR0343-28A20R	2.8V	SOT89-3	1k/Reel	WR0343 28 XXXX
WR0343-30A20R	3.0V	SOT89-3	1k/Reel	WR0343 30 XXXX
WR0343-33A20R	3.3V	SOT89-3	1k/Reel	WR0343 33 XXXX
WR0343-36A20R	3.6V	SOT89-3	1k/Reel	WR0343 36 XXXX
WR0343-45A20R	4.5V	SOT89-3	1k/Reel	WR0343 45 XXXX
WR0343-50A20R	5.0V	SOT89-3	1k/Reel	WR0343 50 XXXX
WR0343-12A21R	1.2V	SOT89-3	1k/Reel	WR0343 12 XXXX
WR0343-15A21R	1.5V	SOT89-3	1k/Reel	WR0343 15 XXXX
WR0343-18A21R	1.8V	SOT89-3	1k/Reel	WR0343 18 XXXX
WR0343-25A21R	2.5V	SOT89-3	1k/Reel	WR0343 25 XXXX
WR0343-28A21R	2.8V	SOT89-3	1k/Reel	WR0343 28 XXXX
WR0343-30A21R	3.0V	SOT89-3	1k/Reel	WR0343 30 XXXX
WR0343-33A21R	3.3V	SOT89-3	1k/Reel	WR0343 33 XXXX
WR0343-36A21R	3.6V	SOT89-3	1k/Reel	WR0343 36 XXXX
WR0343-45A21R	4.5V	SOT89-3	1k/Reel	WR0343 45 XXXX
WR0343-50A21R	5.0V	SOT89-3	1k/Reel	WR0343 50 XXXX
WR0343-12A22R	1.2V	SOT89-3	1k/Reel	WR0343 12 XXXX
WR0343-15A22R	1.5V	SOT89-3	1k/Reel	WR0343 15 XXXX
WR0343-18A22R	1.8V	SOT89-3	1k/Reel	WR0343 18 XXXX
WR0343-25A22R	2.5V	SOT89-3	1k/Reel	WR0343 25 XXXX
WR0343-28A22R	2.8V	SOT89-3	1k/Reel	WR0343 28 XXXX
WR0343-30A22R	3.0V	SOT89-3	1k/Reel	WR0343 30 XXXX
WR0343-33A22R	3.3V	SOT89-3	1k/Reel	WR0343 33 XXXX
WR0343-36A22R	3.6V	SOT89-3	1k/Reel	WR0343 36 XXXX
WR0343-45A22R	4.5V	SOT89-3	1k/Reel	WR0343 45 XXXX
WR0343-50A22R	5.0V	SOT89-3	1k/Reel	WR0343 50 XXXX

Part Number	Output Voltage	Package	Packing Quantity	Marking*
WR0343-12A50R	1.2V	SOT23-3	3k/Reel	WR0343 12 XXXX
WR0343-15A50R	1.5V	SOT23-3	3k/Reel	WR0343 15 XXXX
WR0343-18A50R	1.8V	SOT23-3	3k/Reel	WR0343 18 XXXX
WR0343-25A50R	2.5V	SOT23-3	3k/Reel	WR0343 25 XXXX
WR0343-28A50R	2.8V	SOT23-3	3k/Reel	WR0343 28 XXXX
WR0343-30A50R	3.0V	SOT23-3	3k/Reel	WR0343 30 XXXX
WR0343-33A50R	3.3V	SOT23-3	3k/Reel	WR0343 33 XXXX
WR0343-36A50R	3.6V	SOT23-3	3k/Reel	WR0343 36 XXXX
WR0343-45A50R	4.5V	SOT23-3	3k/Reel	WR0343 45 XXXX
WR0343-50A50R	5.0V	SOT23-3	3k/Reel	WR0343 50 XXXX
WR0343-12A31R	1.2V	SOT23-3	3k/Reel	WR0343 12 XXXX
WR0343-15A31R	1.5V	SOT23-3	3k/Reel	WR0343 15 XXXX
WR0343-18A31R	1.8V	SOT23-3	3k/Reel	WR0343 18 XXXX
WR0343-25A31R	2.5V	SOT23-3	3k/Reel	WR0343 25 XXXX
WR0343-28A31R	2.8V	SOT23-3	3k/Reel	WR0343 28 XXXX
WR0343-30A31R	3.0V	SOT23-3	3k/Reel	WR0343 30 XXXX
WR0343-33A31R	3.3V	SOT23-3	3k/Reel	WR0343 33 XXXX
WR0343-36A31R	3.6V	SOT23-3	3k/Reel	WR0343 36 XXXX
WR0343-45A31R	4.5V	SOT23-3	3k/Reel	WR0343 45 XXXX
WR0343-50A31R	5.0V	SOT23-3	3k/Reel	WR0343 50 XXXX
WR0343-12A32R	1.2V	SOT23-3	3k/Reel	WR0343 12 XXXX
WR0343-15A32R	1.5V	SOT23-3	3k/Reel	WR0343 15 XXXX
WR0343-18A32R	1.8V	SOT23-3	3k/Reel	WR0343 18 XXXX
WR0343-25A32R	2.5V	SOT23-3	3k/Reel	WR0343 25 XXXX
WR0343-28A32R	2.8V	SOT23-3	3k/Reel	WR0343 28 XXXX
WR0343-30A32R	3.0V	SOT23-3	3k/Reel	WR0343 30 XXXX
WR0343-33A32R	3.3V	SOT23-3	3k/Reel	WR0343 33 XXXX
WR0343-36A32R	3.6V	SOT23-3	3k/Reel	WR0343 36 XXXX
WR0343-45A32R	4.5V	SOT23-3	3k/Reel	WR0343 45 XXXX
WR0343-50A32R	5.0V	SOT23-3	3k/Reel	WR0343 50 XXXX

Part Number	Output Voltage	Package	Packing Quantity	Marking*
WR0343-12A30R	1.2V	SOT23-5	3k/Reel	WR0343 12 XXXX
WR0343-15A30R	1.5V	SOT23-5	3k/Reel	WR0343 15 XXXX
WR0343-18A30R	1.8V	SOT23-5	3k/Reel	WR0343 18 XXXX
WR0343-25A30R	2.5V	SOT23-5	3k/Reel	WR0343 25 XXXX
WR0343-28A30R	2.8V	SOT23-5	3k/Reel	WR0343 28 XXXX
WR0343-30A30R	3.0V	SOT23-5	3k/Reel	WR0343 30 XXXX
WR0343-33A30R	3.3V	SOT23-5	3k/Reel	WR0343 33 XXXX
WR0343-36A30R	3.6V	SOT23-5	3k/Reel	WR0343 36 XXXX
WR0343-45A30R	4.5V	SOT23-5	3k/Reel	WR0343 45 XXXX
WR0343-50A30R	5.0V	SOT23-5	3k/Reel	WR0343 50 XXXX
WR0343-12FF4R	1.2V	DFN-4	10k/Reel	WR0343 12 XXXX
WR0343-15FF4R	1.5V	DFN-4	10k/Reel	WR0343 15 XXXX
WR0343-18FF4R	1.8V	DFN-4	10k/Reel	WR0343 18 XXXX
WR0343-25FF4R	2.5V	DFN-4	10k/Reel	WR0343 25 XXXX
WR0343-28FF4R	2.8V	DFN-4	10k/Reel	WR0343 28 XXXX
WR0343-30FF4R	3.0V	DFN-4	10k/Reel	WR0343 30 XXXX
WR0343-33FF4R	3.3V	DFN-4	10k/Reel	WR0343 33 XXXX
WR0343-36FF4R	3.6V	DFN-4	10k/Reel	WR0343 36 XXXX
WR0343-45FF4R	4.5V	DFN-4	10k/Reel	WR0343 45 XXXX
WR0343-50FF4R	5.0V	DFN-4	10k/Reel	WR0343 50 XXXX

STATEMENTS

WAY-ON provides data sheets based on the actual performance of the device, and users should verify actual device performance in their specific applications. The device characteristics and parameters in this data sheet can and do vary from application to application, and actual device performance may change over time.This information is intended for developers designing with WAY-ON products. Users are responsible for selecting the appropriate WAY-ON product for their application and for designing and verifying the application to ensure that your application meets the appropriate standards or other requirements, and users are responsible for all consequences. Specifications are subject to change without notice.

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