6V, 1.2A Current Mode Synchronous Step-Down DC/DC Converter

Description

ME3100 is a current mode synchronous step-down DC/DC converter with an input voltage range of 2.5V to 6V. And its output voltage is from 0.6V to the input voltage.

It works at PFM/PWM mode, it operates in nearly constant switching frequency 1.5MHz (TYP) over the heavy load and works in PFM mode that maintains high efficiency during light load operation.

ME3100 integrated a few protect circuits to make the system works in safety stations. It contains input Under-Voltage Lockout, V_{IN} Over-Voltage protection, over-current protection and short-circuit protection and over temperature protection.

Feature

- Output current：1.2A(TYP)
- Efficiency：94% (@I_{OUT}=500mA, V_{OUT}=3.3V)
- Input Voltage：2.5V~6V
- Feedback Voltage：0.6V (±2.0%) Allows Low V_{OUT}
- Frequency: 1.5MHz (TYP) at PWM model
- PFM/PWM control mode
- Low Dropout Operation: 100% Duty Cycle
- Input Voltage UVLO& OVP
- Internally Soft-Start Function
- Over-current protection and short-circuit protection
- Over Temperature protection

Applications

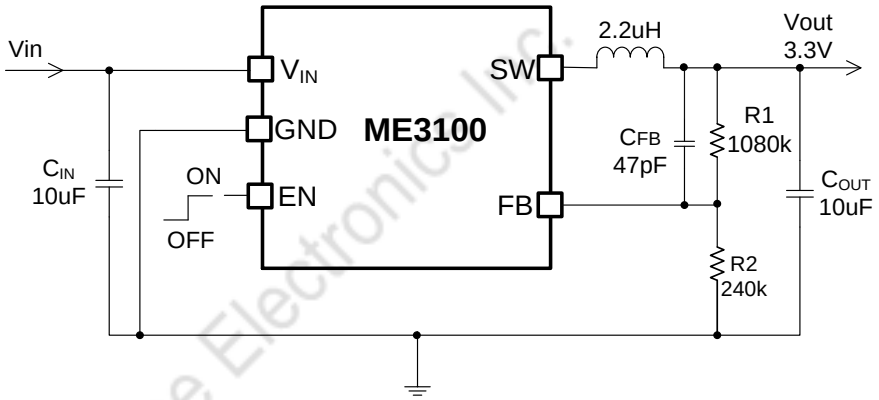
- Bluetooth, Cable Modem
- LCD TV Power Supply& Metering Platforms
- General Purpose Point-of-Load(POL)
- Mobile devices

Package

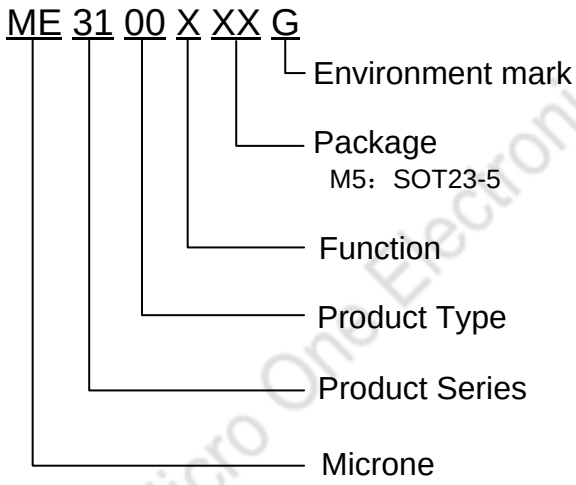
- 5-pin SOT23-5

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Typical Application Circuit



Selection Guide

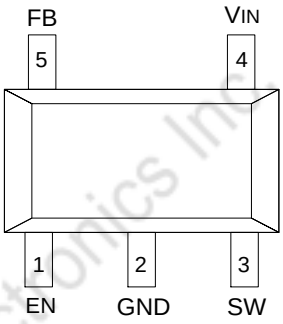


product serise	product description
ME3100AM5G	Package:SOT23-5

NOTE: If you need other voltage and package, please contact our sales staff。

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Pin Configuration

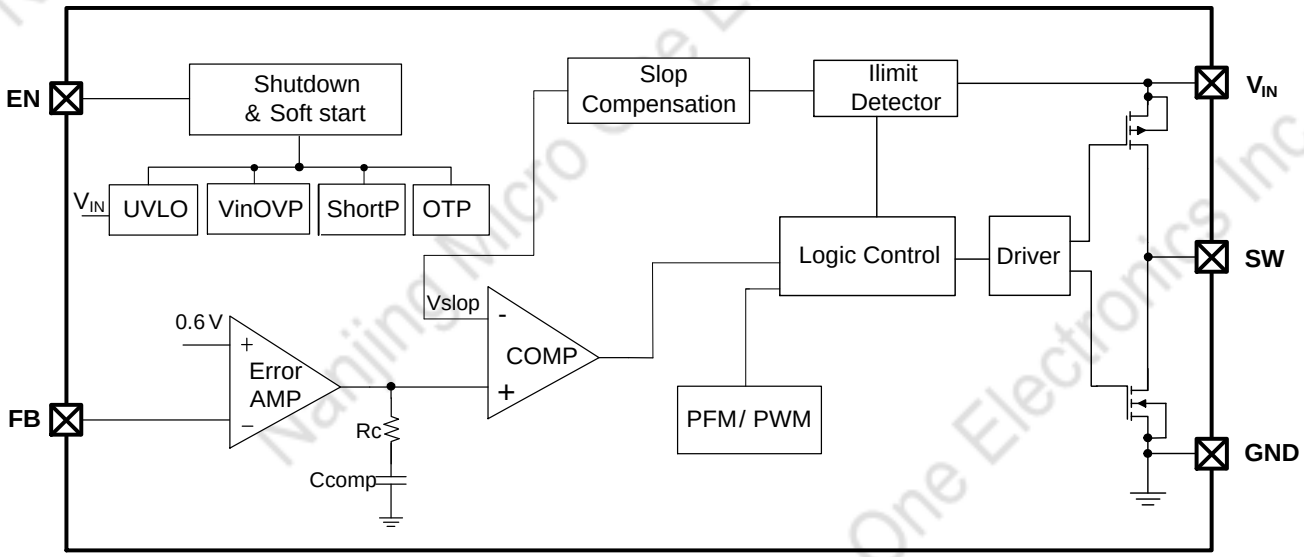


SOT23-5

Pin Assignment

PIN Number	symbol	Function
1	EN	Enable
2	GND	Ground
3	SW	Switch
4	V_{IN}	Input
5	FB	Feedback

Block Diagram



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Absolute Maximum Ratings

Parameter	Symbol	Ratings	Units
Input Voltage	V_{IN}	-0.3~7.0	V
SW Pin Voltage	V_{SW}	-0.3~7.5	V
EN Pin Voltage	V_{EN}	-0.3~6.0	V
FB Pin Voltage	V_{FB}	-0.3~6.0	V
Internal Power Dissipation (SOT23-5)	Pd	600	mW
Thermal resistance (Junction to air) (SOT23-5)	θ_{JA}	210	℃/W
Operating Temperature Range	T_{Opr}	-40~+85	℃
Storage Temperature Range	T_{stg}	-55~+150	℃
Maximum junction temperature	T_J	-40~+150	℃

Notes:

1) Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product.

2) The maximum allowable power dissipation is a function of the maximum junction temperature $T_{J\,(MAX)}$, the junction-to- ambient thermal resistance θ_{JA}, and the ambient temperature T_A. The maximum allowable continuous power dissipation at any ambient temperature is calculated by $P_{D(MAX)}=(T_{J(MAX)}-T_A)/\theta_{JA}$.

3）The θ_{JA} values given in this table are for comparison with other packages only and cannot be used for design purposes. They do not represent the performance achieved in real-world applications.

Electrical Characteristic

ME3100 test conditions：V_{IN}=5V, V_{EN}=5V, Topt=25℃ unless otherwise noted.

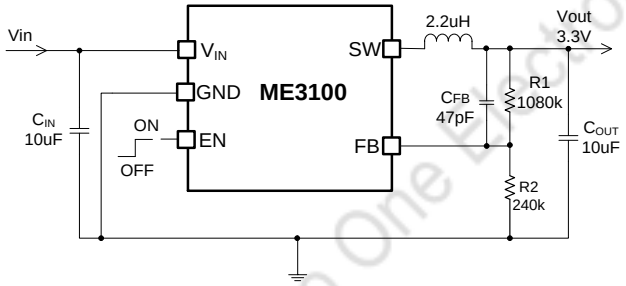
Parameter	Symbol	Condition	Min	Typ	Max	Unit	CIRCUIT
Input Voltage Range	V_{IN}		2.5	--	6	V	1
Feedback Voltage	V_{FB}		0.588	0.6	0.612	V	1
VIN Over-Voltage protection	V_{IN}OVP	V_{IN} rising	6.2	6.45	6.7	V	1
		Hysteresis	--	0.2	--	V	1
UVLO Voltage	V_{UVLO}	V_{IN} rising	2.15	2.35	2.50	V	1
		Hysteresis	--	0.15	--		1
VOUT Line Regulation	LNR	V_{IN}=2.5V to 6V I_{OUT}=10mA	--	--	0.6	%/V	1
VOUT Load Regulation	LDR	0mA<I_{OUT}<800mA	--	--	1	%/V	1
DC Bias Current	I_q	V_{FB}= 1V	--	50	65	μA	2
	I_{SBY}	V_{EN}=0V	--	0.0	1.0	μA	2
Switching Frequency	F_{OSC}	V_{IN}=5V,I_{OUT}=300mA	1.2	1.5	1.8	Mhz	1
Over-Temperature Threshold	T_{SD}	I_{OUT}=10mA	--	150	--	℃	1
	T_{SDHY}	I_{OUT}=10mA	--	25	--	℃	1
PMOS ON Resistance	R_{PMOS}		--	0.2	--	Ω	
NMOS ON Resistance	R_{NMOS}		--	0.15	--	Ω	
Peak Current Limit	I_{LIMH}		--	1.5	--	A	1
Enable Input Voltage	V_{ENH}	V_{FB}=0V, Applied voltage to V_{EN}, V_{SW} up to V_{IN}	1.3	--	6	V	2
	V_{ENL}	V_{FB}=0V, Applied voltage to	GND	--	0.5	V	2

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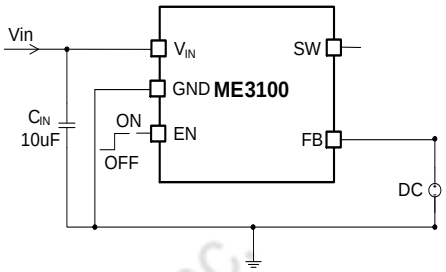
		V_{EN}, V_{SW} down to GND					
Soft-start Time	tss	When Lx pin oscillates until the V_{OUT} setup	0.1	0.3	0.5	mS	1
DISCHARG	$R_{DISCHARG}$	V_{EN}=0V， V_{IN}=5V	--	200	--	Ω	1

Test Circuits

Circuit No.1



Circuit No.2



Operation Principles

The ME3100 is a synchronous low voltage step-down DC/DC converter that can support the input voltage range of 2.5V to 6V and the output voltage could low to 0.6V.

The error amplifier EA adjusts COMP voltage by comparing the feedback signal (V_{FB}) from the output voltage with the internal reference. When the load current increases, it causes a drop in the feedback voltage relative to the reference, then the COMP voltage rises to allow higher inductor current to match the load current.

Soft start

An internal current source charges an internal capacitor to build the soft-start ramp voltage. The V_{FB} voltage will track the reference voltage during soft-start interval. The typical soft-start time is 0.3ms.

PFM/PWM Auto change

In PFM/PWM control mode, the ME3100 works in two states according to the load condition. It adopts PFM mode in light load, PWM mode in heavy load. So the ME3100 could acquire high efficiency in all over the loads.

Enable

A logic-high enables the converter; a logic-low forces the device into shutdown mode.

UVLO

If the V_{IN} lower than threshold voltage 2.1V (TYP), the UVLO comparator's output will go high and the switch controller will turn off the high side MOSFET. If the V_{IN} higher than 2.35V (typical value), the controller will resume the working state.

V_{IN}OVP

If the V_{IN} higher than threshold voltage 6.45V (TYP), the chip triggers overvoltage protection function and the switch controller will turn off the high side MOSFET. If the V_{IN} lower than 6.25V (typical value), the controller will

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resume the working state.

Over temperature protection (OTP)

The ME3100 implements an internal thermal shutdown function when the junction temperature exceeds 150℃ (TYP). The thermal shutdown forces the device to stop switching when the junction temperature exceeds the thermal shutdown threshold. Once the temperature decreases below the hysteresis of 25℃ (TYP), the device works again.

100% Duty Cycle Operation

When the input supply voltage decreases toward the output voltage, the duty cycle increases toward the maximum on-time. Further reduction of the supply voltage forces the main switch to remain on for more than one cycle, eventually reaching 100% duty cycle. The output voltage will then be determined by the input voltage minus the voltage drop across the internal P-MOSFET and the inductor.

Over Current Protection (OCP) & Short-circuit protection function

The ME3100 provides over current protection by detecting the high side MOSFET . When the peak current over 1.5A (TYP), the OCP will be triggered. When the OCP is triggered, the ME3100 will turn off the high side MOSFET immediately. And the output voltage will go down. The ME3100 has short-circuit protection function. When the output is shorted to ground or V_{FB} lower than 0.2V, the system works enter hiccup mode, to prevent current runaway from occurring. The soft start function will be triggered again every approximately 4.5mS. After the short circuit state is relieved, the system will automatically restart and return to normal working state.

Output Voltage Setting

The output voltage is set by an external resistive divider according to the following equation:

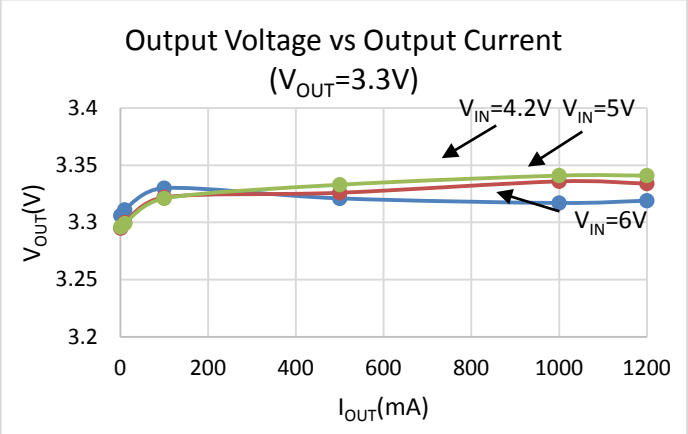
$$V_{OUT}=V_{REF} \times (1+R_1/R_2)$$

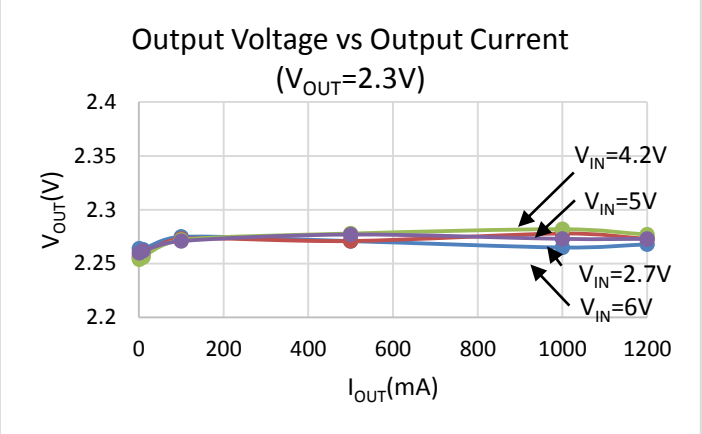
Output fast discharge resistor

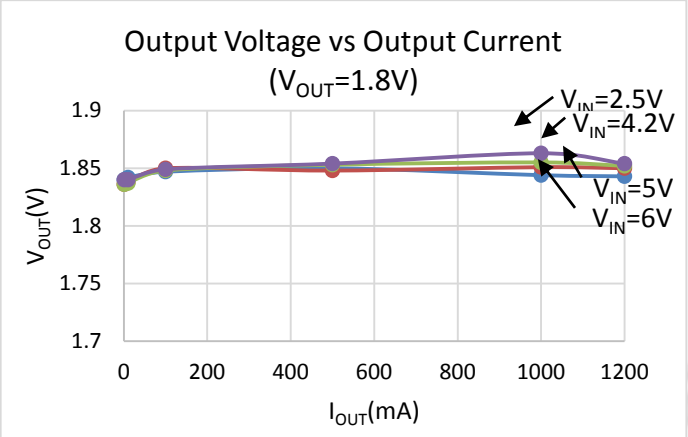
When V_{EN}=0V, the chip rapidly discharges to ground through SW internally. Discharge resistance value : $R_{DISCHANG}$=200 Ω (typical).

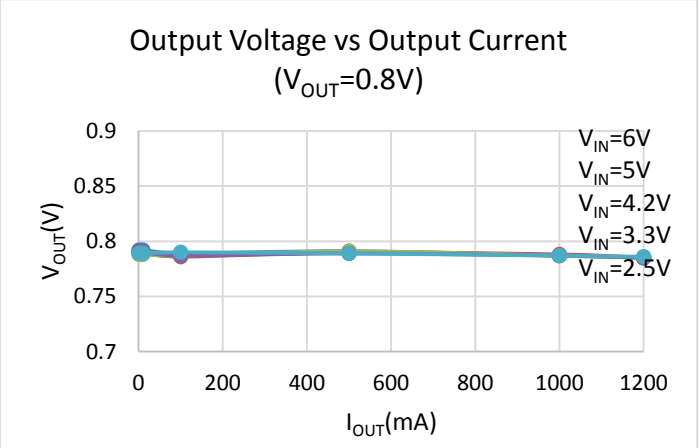
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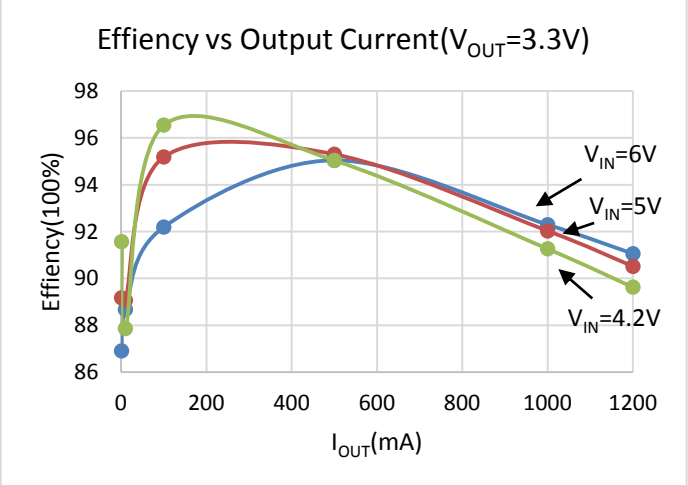
Typical Performance Characteristics

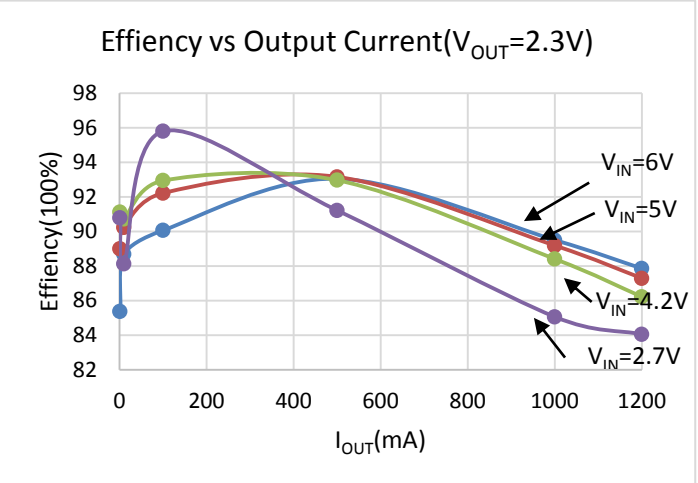


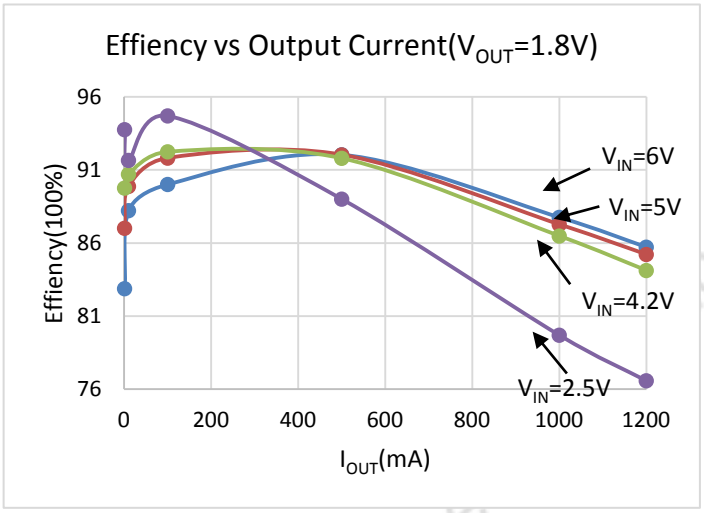


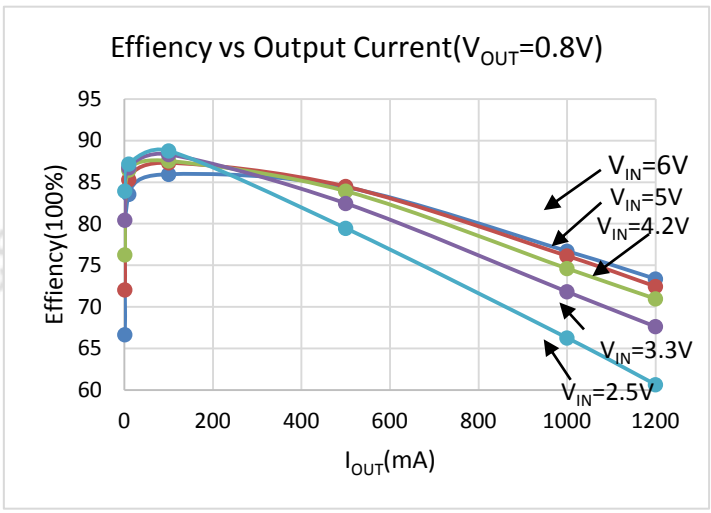


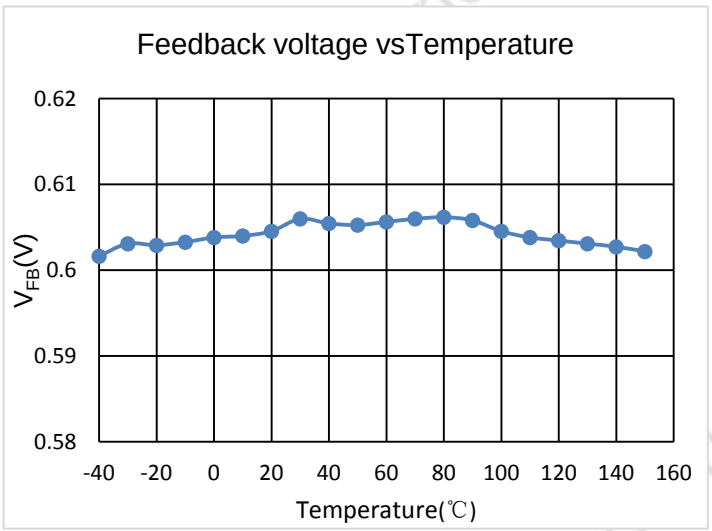


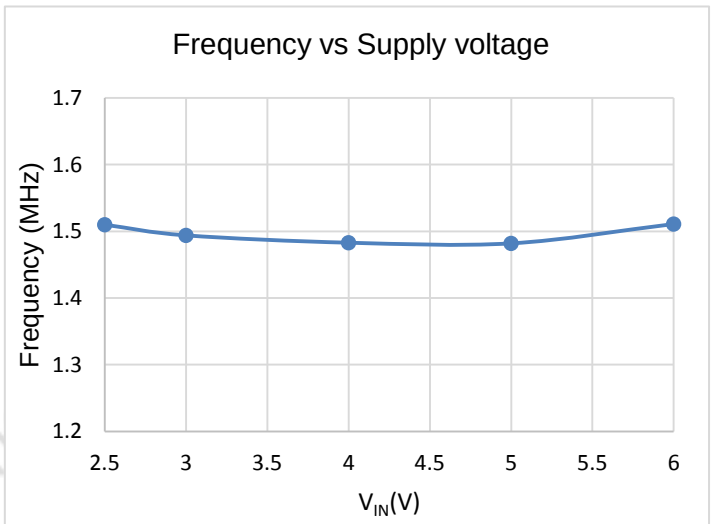




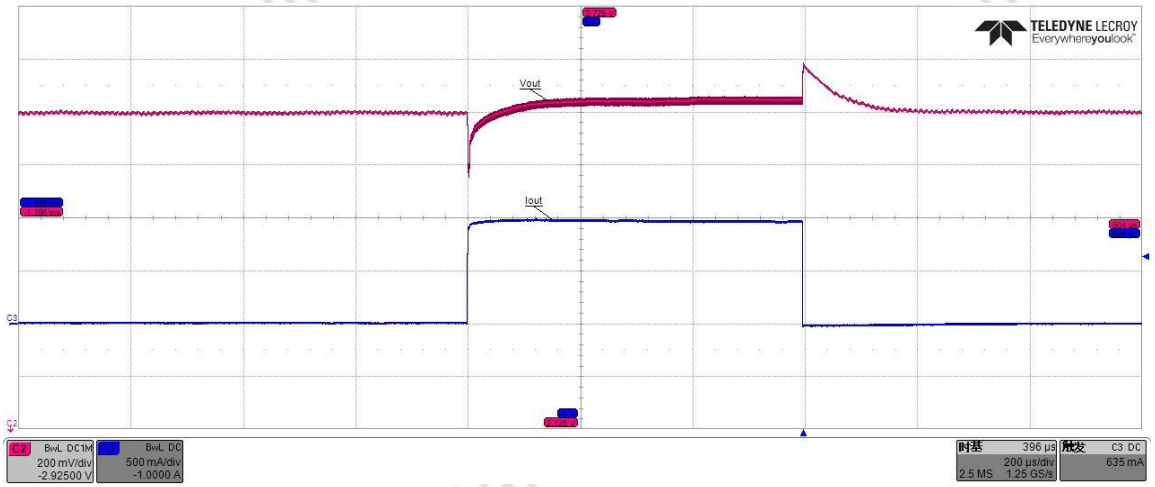




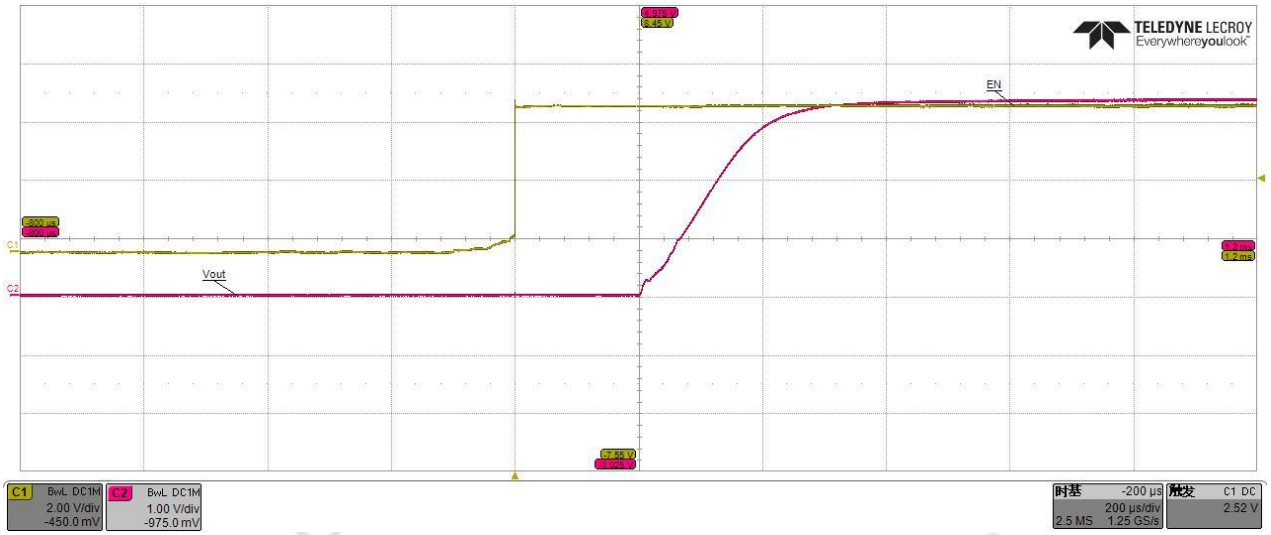




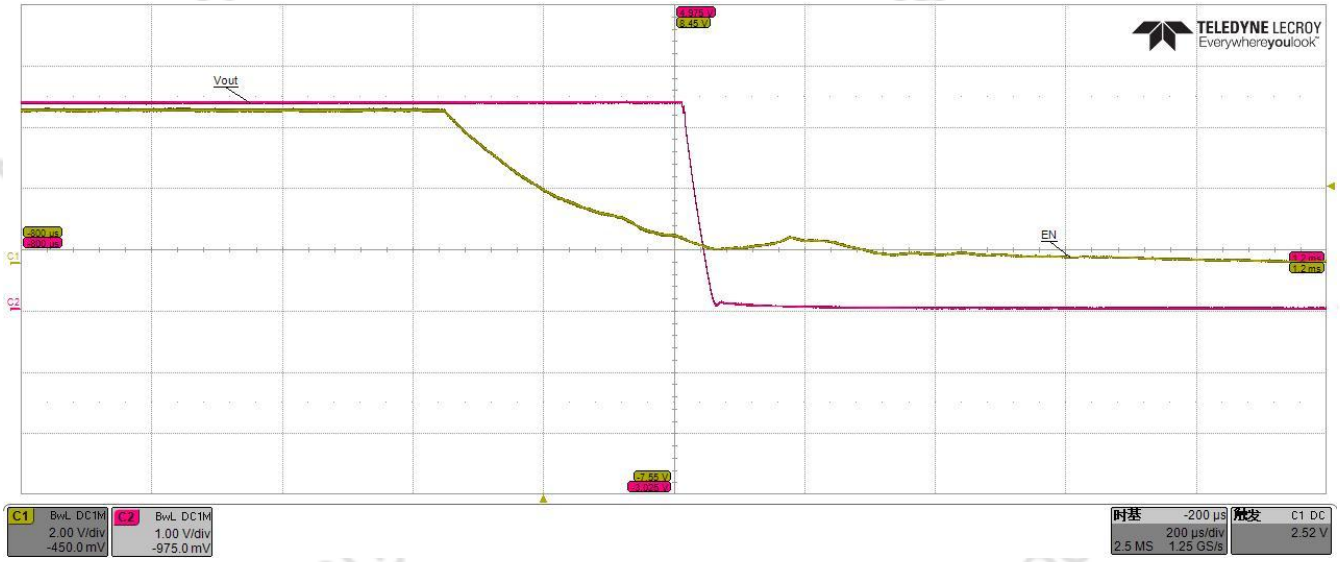
Transient response: I_{OUT}=10mA->1A->10mA，V_{IN}=5V，V_{OUT}=3.3V，L=2.2uH，C_{IN}=10uF，C_{OUT}=10uF，C_{FB}=47pF (ceramics)



EN start up: V_{OUT}=3.3V V_{IN}=5V I_{OUT}=1A



EN shutdown: V_{OUT}=3.3V V_{IN}=5V I_{OUT}=1A

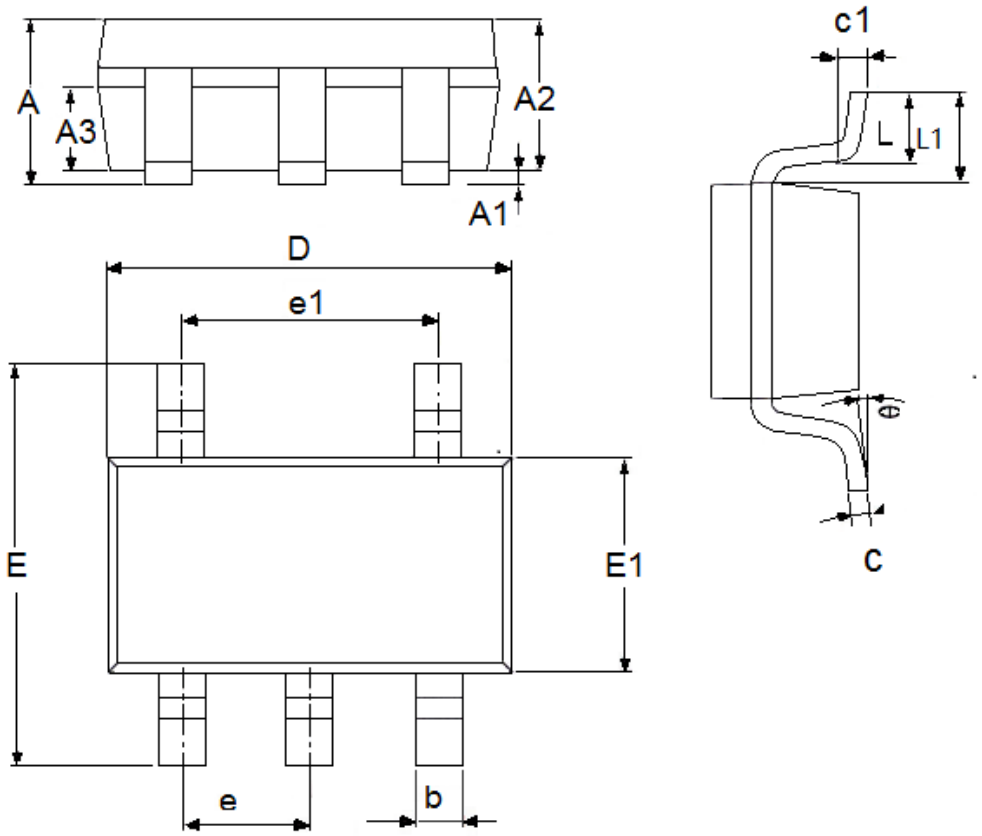


Package Quantity

Package Type	Minimum Packing QTY	UNITS	Small Box	Large BOX
SOT23-5	3000	Tape & Reel	30K	120K

Package Information

- **Package type: SOT23-5**



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	1.05	1.45	0.0413	0.0571
A1	0	0.15	0.0000	0.0059
A2	0.9	1.3	0.0354	0.0512
A3	0.6	0.7	0.0236	0.0276
b	0.25	0.5	0.0098	0.0197
c	0.1	0.23	0.0039	0.0091
D	2.82	3.05	0.1110	0.1201
e1	1.9(TYP)		0.0748(TYP)	
E	2.6	3.05	0.1024	0.1201
E1	1.5	1.75	0.0512	0.0689
e	0.95(TYP)		0.0374(TYP)	
L	0.3	0.6	0.0118	0.0236
L1	0.59(TYP)		0.0232(TYP)	
θ	0	8°	0.0000	8°
c1	0.2(TYP)		0.0079(TYP)	

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