Ultra-low noise, high PSRR linear regulator without bypass capacitor

Description

GLD0501 is an ultra-low noise, high PSRR linear regulator that can provide 250mA output current. With 1μF input and 1μF output ceramic capacitors, it can provide excellent noise performance without noise bypass capacitors and save space. The device is not only suitable for noise-sensitive applications, such as high-performance analog circuits, but also suitable for various applications.

The output can be turned off by controlling the CE pin on the chip, which can achieve a power consumption of 0μA after shutdown, integrated soft start, temperature protection and current limit protection; adopts DFN1*1-4 and SOT23-5 small packages.

Feature

- High ripple rejection ratio：98dB@1KHz（IOUT=20mA）
- Ultra-low noise：10uV_{RMS}
- Operating voltage range：1.9V~5.5V
- Output voltage range：1.2V~5.0V
- Maximum output current：250mA（V_{IN}＝4.3V，V_{OUT}＝3.3V）
- Low dropout Voltage：124mV@I_{OUT}=250mA(V_{OUT}＝3.3V)
- High output accuracy：±1％
- Low quiescent current：18uA（TYP.）
- Shutdown current：0uA（TYP.）
- Built-in temperature protection and current limit protection

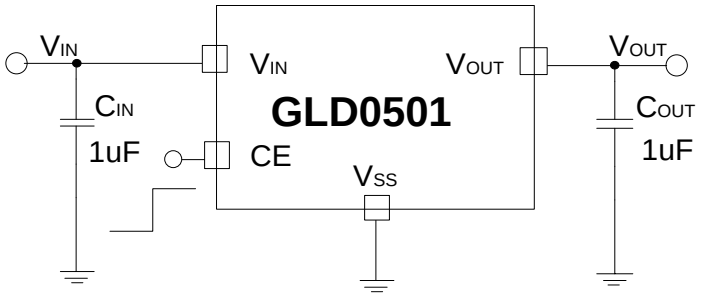
Applications

- A/D and D/A converter power supply
- Camera module
- Audio codec
- Precision analog circuit
- RF radio frequency products
- Battery-powered equipment

Package

- 4-pin　DFN1*1-4
- 5-pin　SOT23-5

Typical Application Circuit

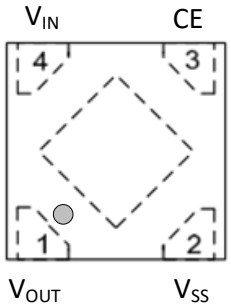


Selection Guide

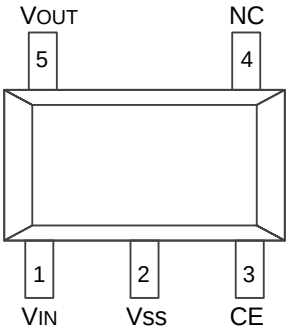
product series	product description
GLD050118D4	V_{OUT}=1.8V；Package：DFN1*1-4
GLD050128D4	V_{OUT}=2.8V；Package：DFN1*1-4
GLD050128S5	V_{OUT}=2.8V；Package：SOT23-5
GLD050133D4	V_{OUT}=3.3V；Package：DFN1*1-4
GLD050133S5	V_{OUT}=3.3V；Package：SOT23-5

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

Pin Configuration



DFN1*1-4

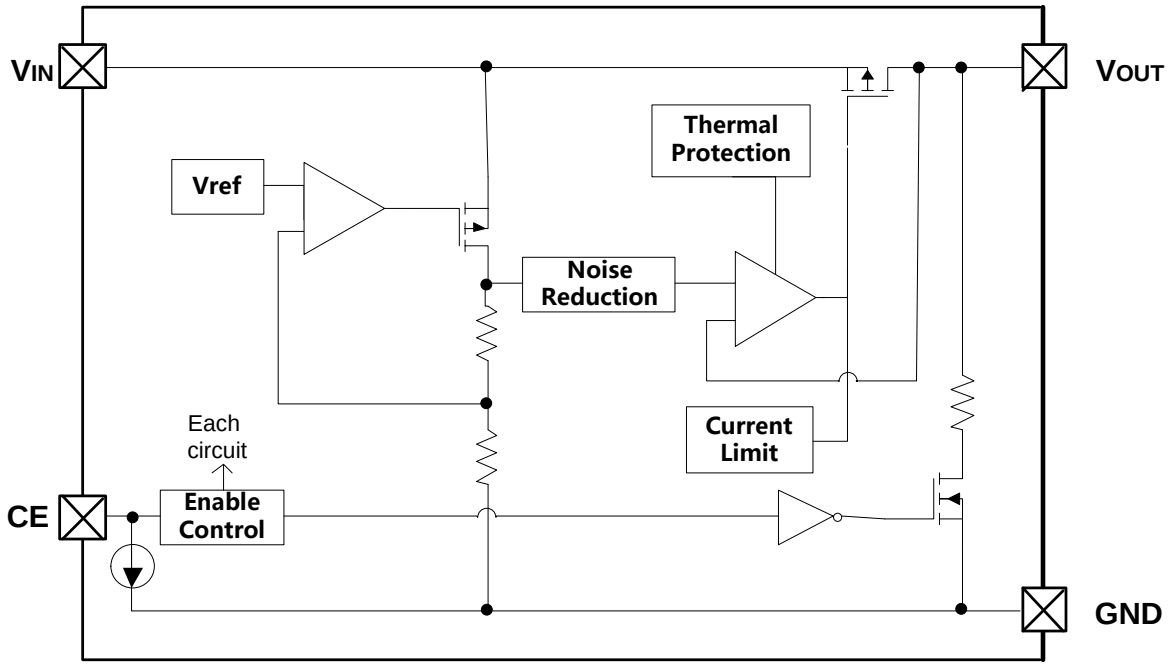


SOT23-5

Pin Assignment

Pin Number		Pin Name	Functions
SOT23-5	DFN1*1-4		
1	4	V_{IN}	Input voltage of the LDO
2	2	Vss	Common Ground
3	3	CE	ON/OFF Control
4	-	NC	NC
5	1	V_{OUT}	Output voltage of the LDO

Block Diagram



Absolute Maximum Ratings

Parameter		Symbol	Ratings	Units
Input Voltage		V_{IN}	-0.3~6.5	V
CE Pin Voltage		V_{CE}	V_{IN} -0.3~ V_{IN}+0.3	V
V_{OUT} Voltage		V_{OUT}	V_{IN} -0.3~ V_{IN}+0.3	V
V_{OUT} Current		I_{OUT}	600	mA
Internal Power Dissipation	DFN1*1-4	Pd	0.5	W
	SOT23-5		0.6	
Thermal resistance	DFN1*1-4	θ_{JA}	250	℃/W
	SOT23-5		210	
Operating Ambient Temperature Range		T_{Opr}	-40~+85	℃
Storage Temperature Range		T_{stg}	-55~+150	℃
Maximum junction temperature		T_J	-40~+150	℃

Note: Use this IC within the stated maximum ratings. Operation beyond these limits may cause degrading or permanent damage to the device.

Electrical Characteristic

Test Conditions：V_{IN}=V_{OUT}(T)+1V，V_{CE} = V_{IN}，CIN=COUT=1uF，Ta=25℃，Unless otherwise specified。

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Operating Input Voltage	V_{IN}			1.9	-	5.5	V
Output Voltage	V_{OUT}	I_{OUT}=10mA,V_{IN}= V_{OUT}+1V		1.2	-	5.0	V
Maximum Output Current	I_{OUTMAX}	V_{IN}= V_{OUT}+1V		-	250	-	mA
Load Regulation	ΔV_{OUT}	V_{IN}= V_{OUT}+1V , 1mA≤I_{OUT}≤100mA		-	7	20	mV
Dropout Voltage (Note 3)	V_{DO}	IOUT=250mA V_{OUT}=3.3V		-	124	150	mV
		IOUT=250mA V_{OUT}=2.8V			136	164	mV
		IOUT=250mA V_{OUT}=1.8V			144	173	mV
Quiescent Current	I_Q	IOUT=0mA		-	18	20	μA
Shutdown current	I_{CEL}	V_{CE}＝0V		-	0	0.2	μA
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	I_{OUT} =30mA V_{OUT}+1V ≤VIN≤5.5V		-	0.035	-	%/V
Output Current Limit	I_{LIM}			-	650	-	mA
CE “High” Voltage	V_{CEH}	Start up		1.5	-	-	V
CE “Low” Voltage	V_{CEL}	Shut down		-	-	0.5	V
Active output discharge resistance	R_{DIS}	V_{CE}<0.5V		-	300	-	Ω
Ripple rejection ratio	PSRR	V_{IN}=(V_{OUT}+1)+0.2Vpp I_{OUT}=20mA	f=100Hz	-	90	-	dB
			f=1kHz	-	98	-	
			f=10kHz	-	85	-	
			f=100kHz	-	52	-	
Output noise	V_N	f = 10 Hz to 100 kHz	IOUT=1mA	-	14	-	uV_{RMS}
			IOUT=250mA	-	10	-	
Load Transient	Tran load	IOUT=1mA to 150mA in 10us		-40	-	-	mV
		IOUT=150mA to 1mA in 10us		-	-	40	
Thermal shutdown temperature	T_{SD}	Temperature rising，I_{OUT}=15mA		-	160	-	℃
Thermal shutdown hysteresis	ΔT_{SD}	Temperature falling，I_{OUT}=15mA		-	20	-	℃

NOTES：

1. V_{OUT} (T) ： Specified Output Voltage

2.V_{OUT} (E) ： Effective Output Voltage (Ie. The output voltage when “V_{OUT} (T)+1.0V”is provided at the Vin pin while maintaining a certain Iout value.)

3.V_{DIF}： V_{IN1} –V_{OUT} (E)’

V_{IN1}：Gradually reduce the input voltage, when the output voltage drops to the input voltage of VOUT (E)-100mV.

V_{OUT} (E)’= V_{OUT} (E)-100mV

Typical Performance Characteristics

GLD0501 （V_{CE} = V_{IN}= V_{OUT}+1V　CIN=1uF　COUT=1uF，Ta=25℃，unless otherwise noted。）

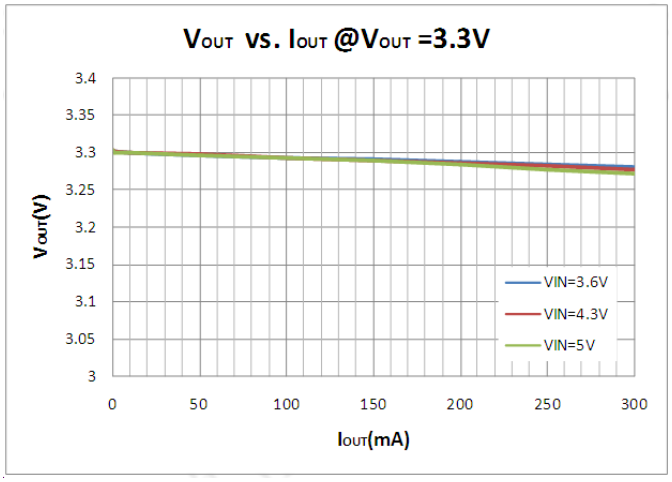


Figure 1. Output Voltage vs. Output Current

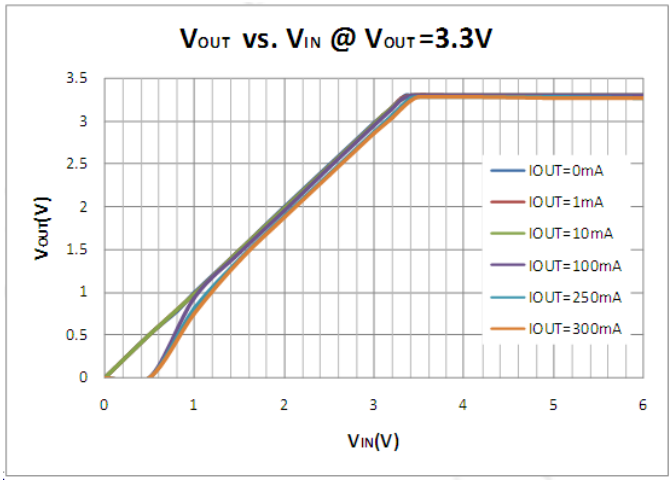


Figure 2. Output Voltage vs. Input Voltage

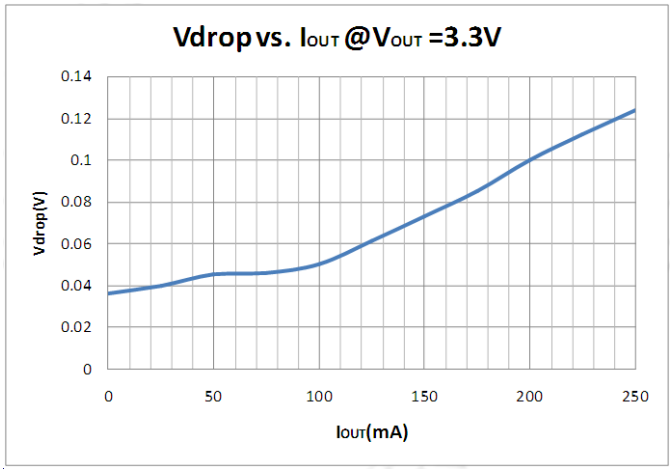


Figure 3. Dropout Voltage vs. Output Current

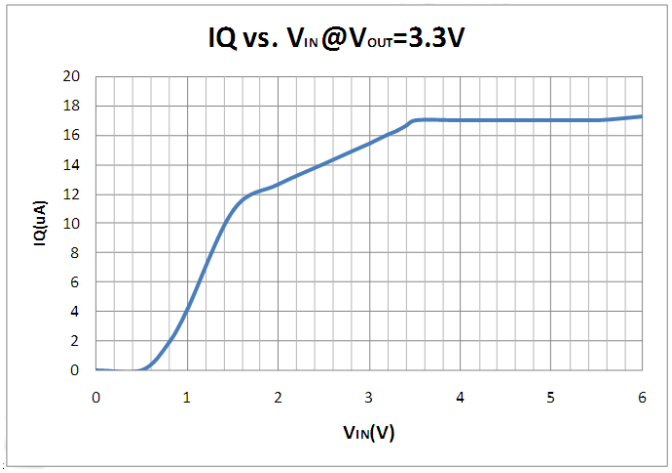


Figure 4.Quiescent Current vs. Input Voltage

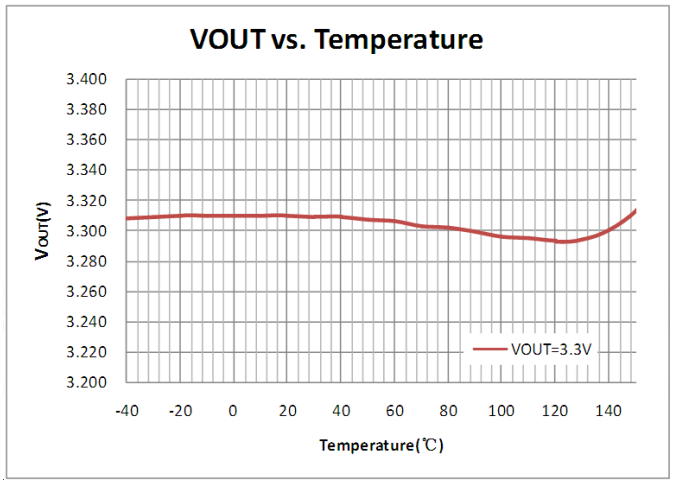


Figure 5. Output Voltage vs. Temperature

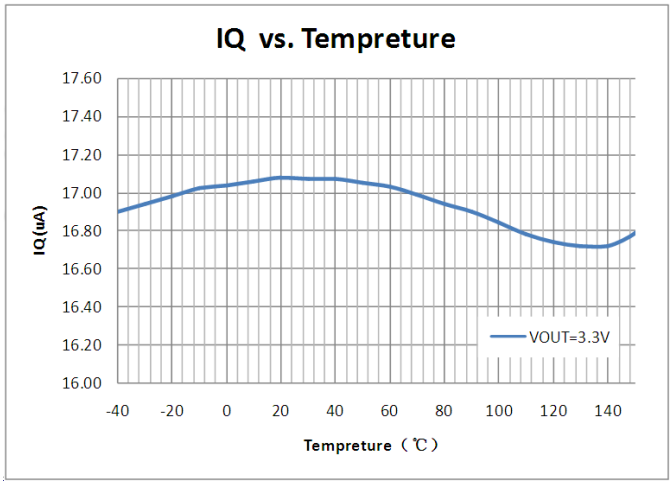


Figure 6. Quiescent Current vs. Temperature

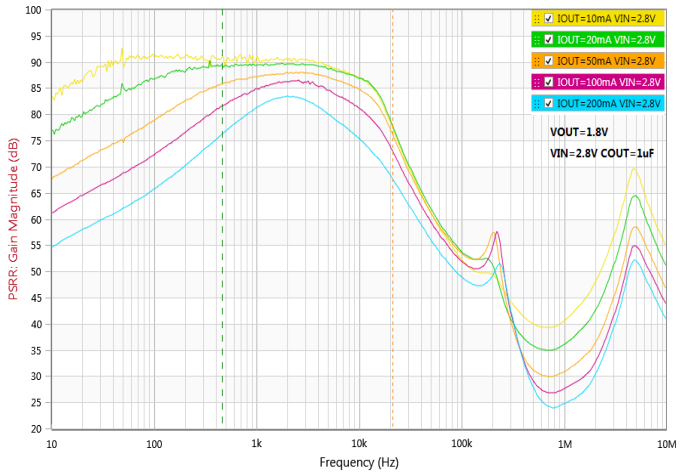


Figure 7. Ripple rejection ratio vs. frequency(VOUT=1.8V)

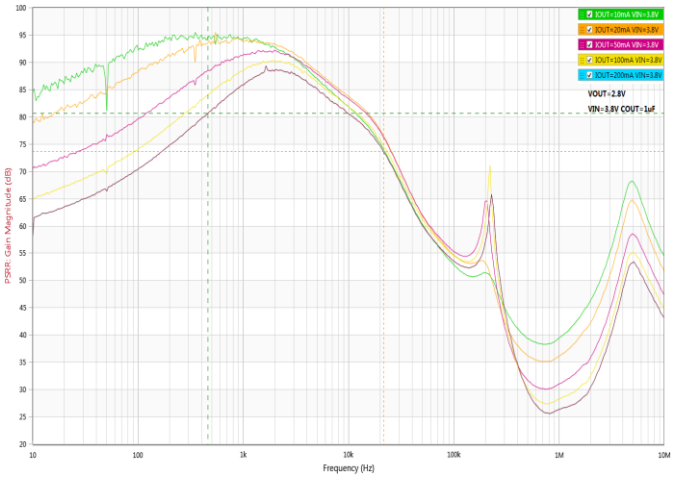


Figure 8. Ripple rejection ratio vs. frequency(VOUT=2.8)

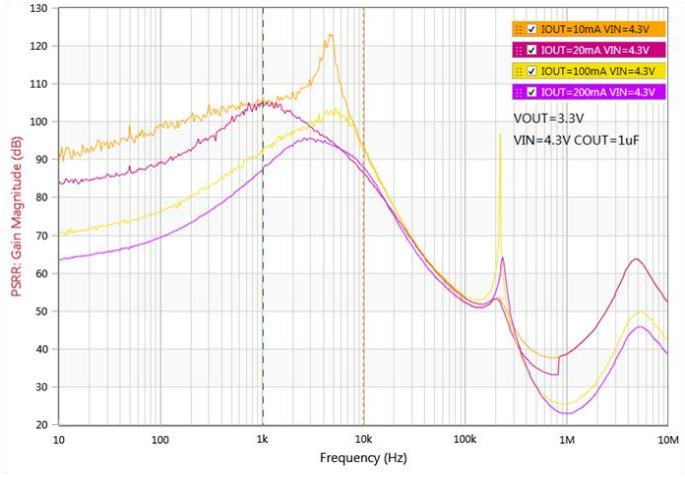


Figure 9. Ripple rejection ratio vs. frequency（VOUT=3.3V）

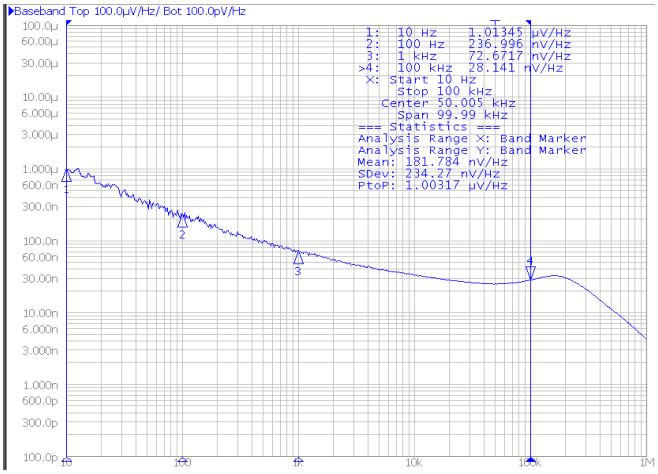


Figure 10. Noise vs. frequency（VOUT=3.3V ）

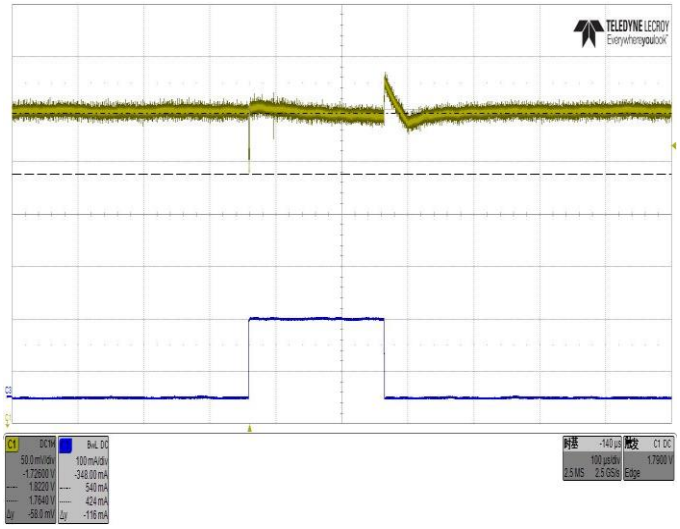


Figure 11. V_{OUT}=1.8V Load Transient Response（1mA to 150mA IN 0.5us）

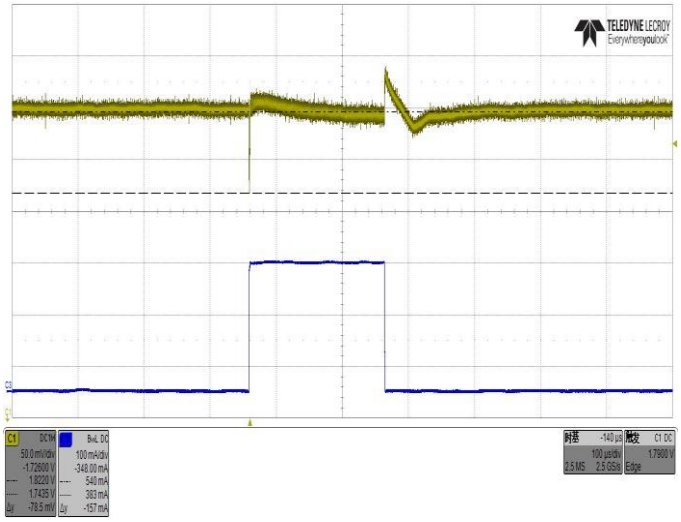


Figure 12. V_{OUT}=1.8V Load Transient Response（1mA to 250mA IN 0.5us）

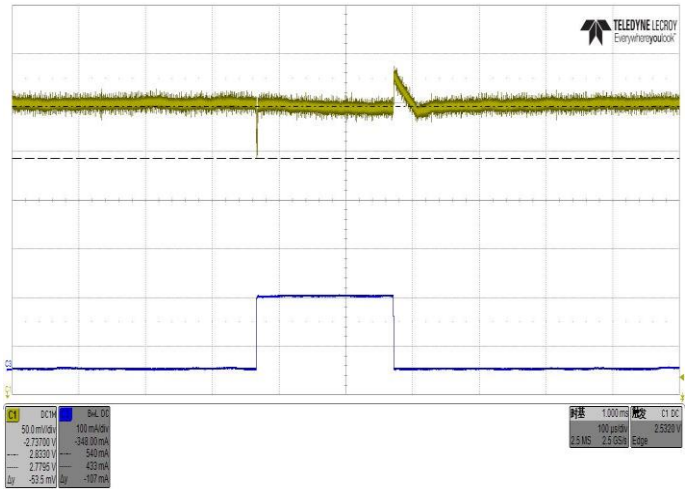


Figure 13. V_{OUT}=2.8V Load Transient Response （1mA to 150mA IN 0.5us）

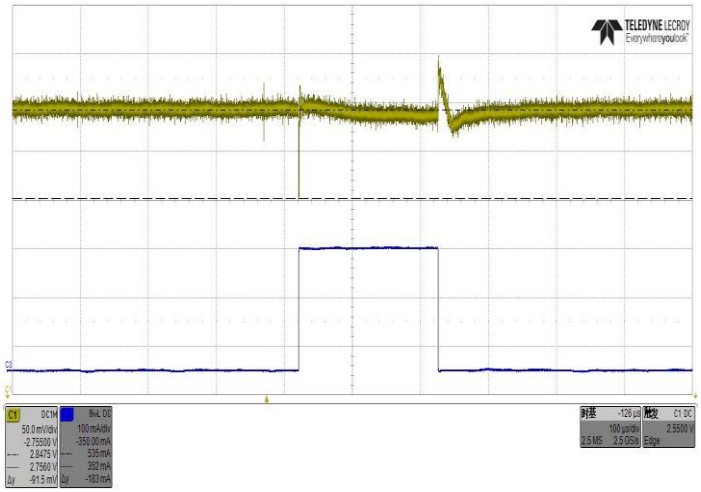


Figure 14. V_{OUT}=2.8V Load Transient Response （1mA to 250mA IN 0.5us）

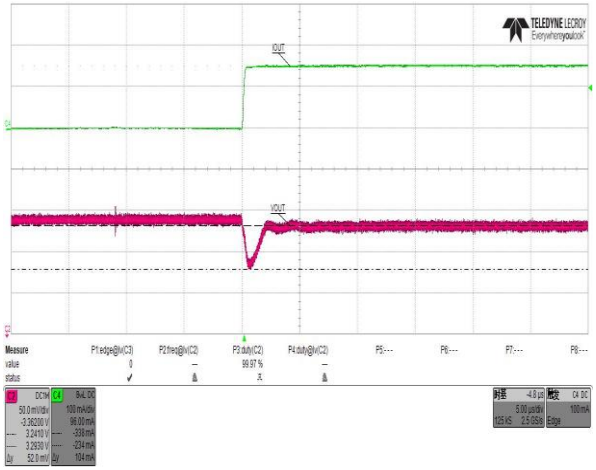


Figure 15. V_{OUT}=3.3V Load Transient Response （1mA to 150mA IN 0.5us）

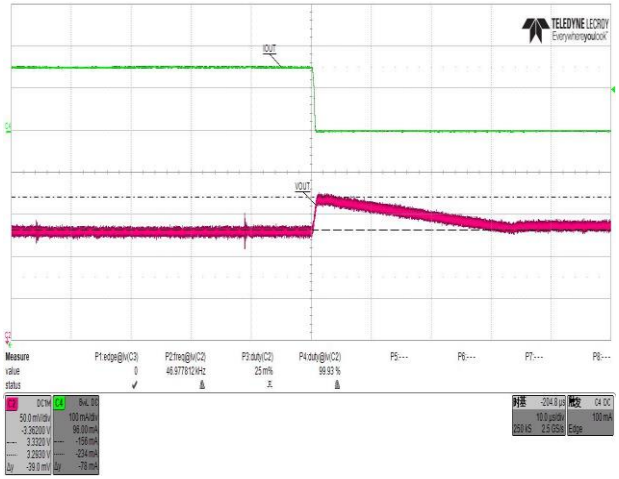
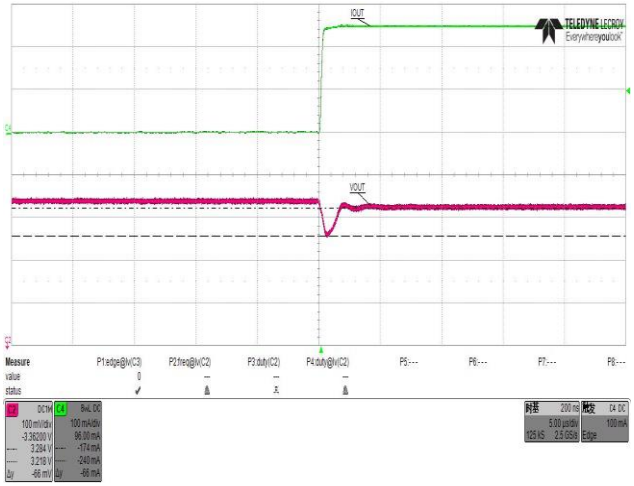


Figure 16. V_{OUT}=3.3V Load Transient Response （150mA to 1mA IN 0.5us）]



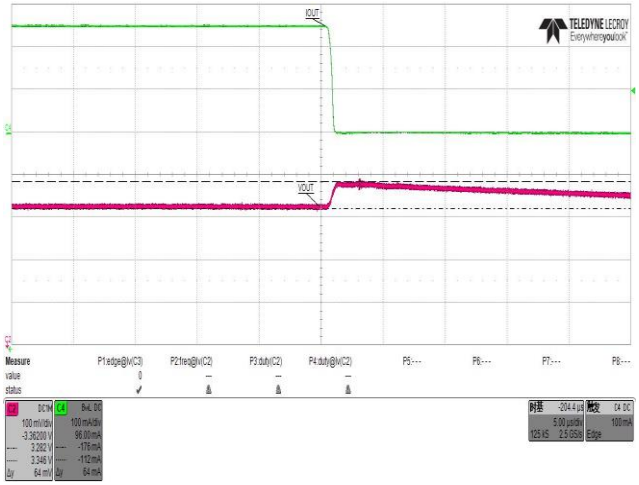


Figure 17. V_{OUT}=3.3V Load Transient Response （1mA to 250mA IN 0.5us）]

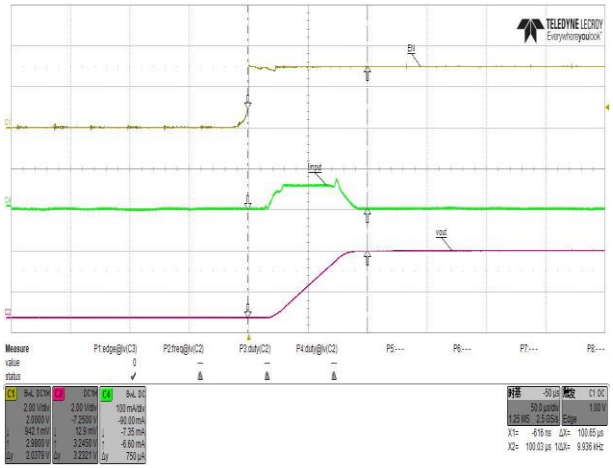


Figure 18. V_{OUT}=3.3V Load Transient Response （250mA to 1mA IN 0.5us）]

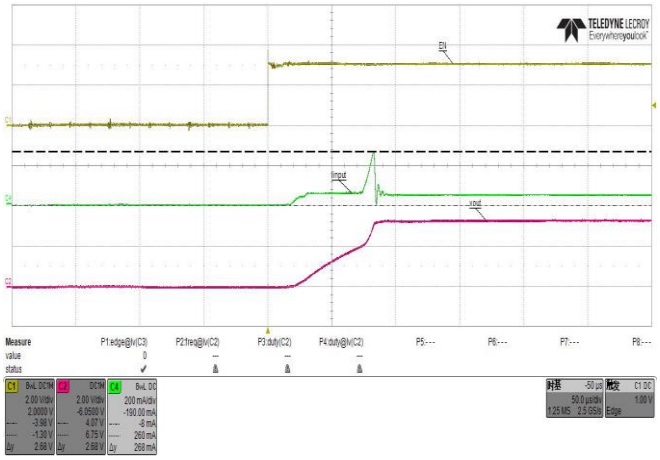


Figure 19. Start up COUT=1uF（V_{OUT}=3.3V I_{OUT}=0mA）

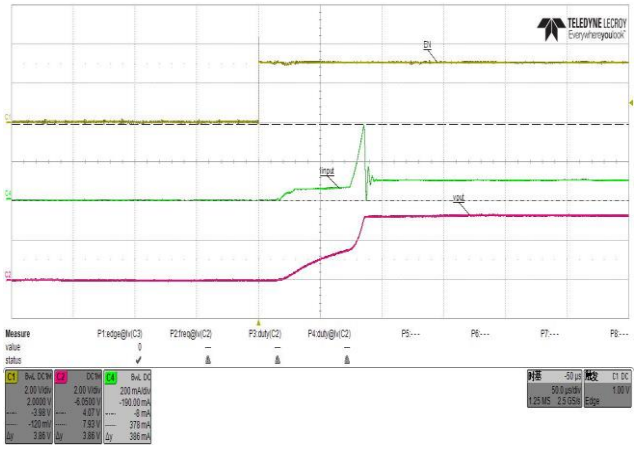


Figure 20.Start up COUT=1uF（V_{OUT}=3.3V I_{OUT}=50mA）

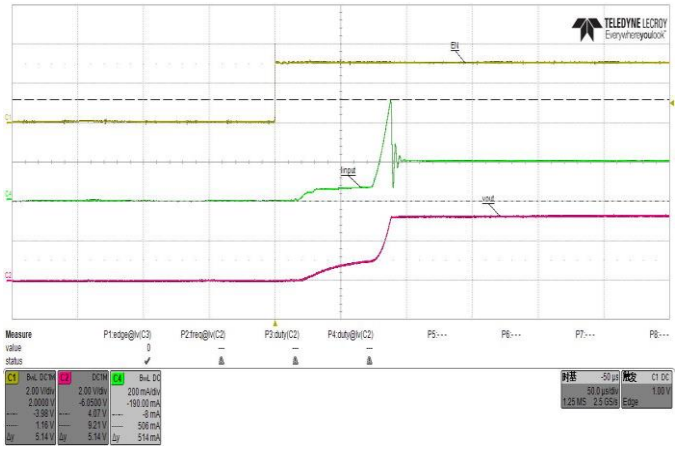


Figure 21.Start up COUT=1uF（V_{OUT}=3.3V I_{OUT}=50mA）

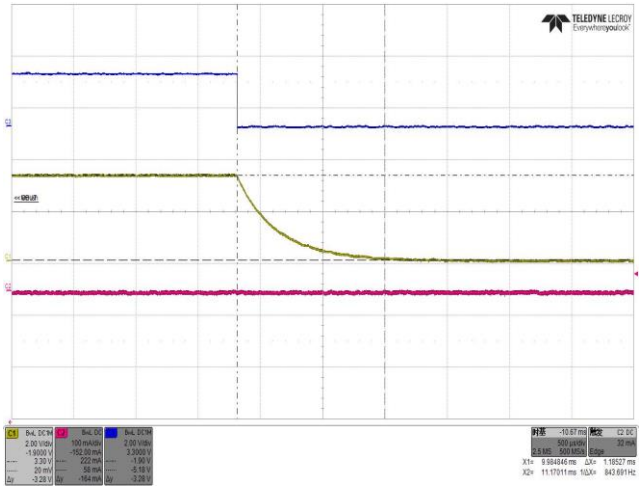


Figure 22.Start up COUT=1uF（V_{OUT}=3.3V I_{OUT}=200mA）

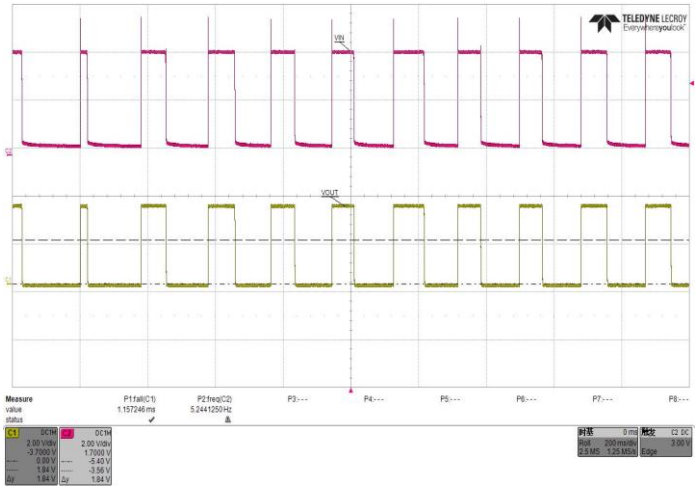
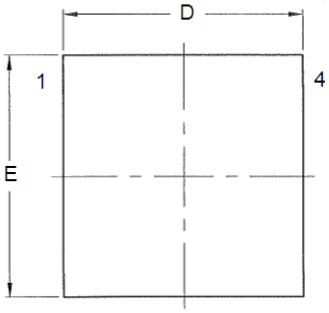


Figure 23.Turn off（VOUT=3.3V）

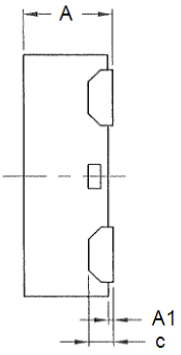
Figure 24. Continuous Hot plug and hot Un-plug(VOUT=3.3V)

Packaging Information

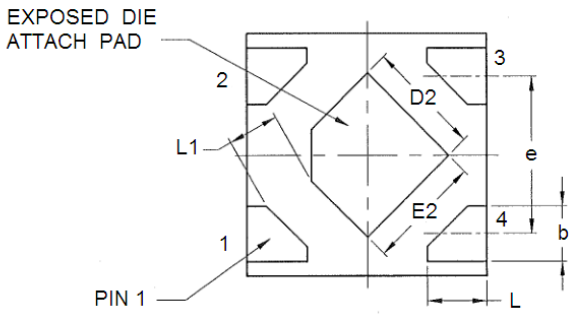
- **Packaging Type: DFN1*1-4**



TOP VIEW



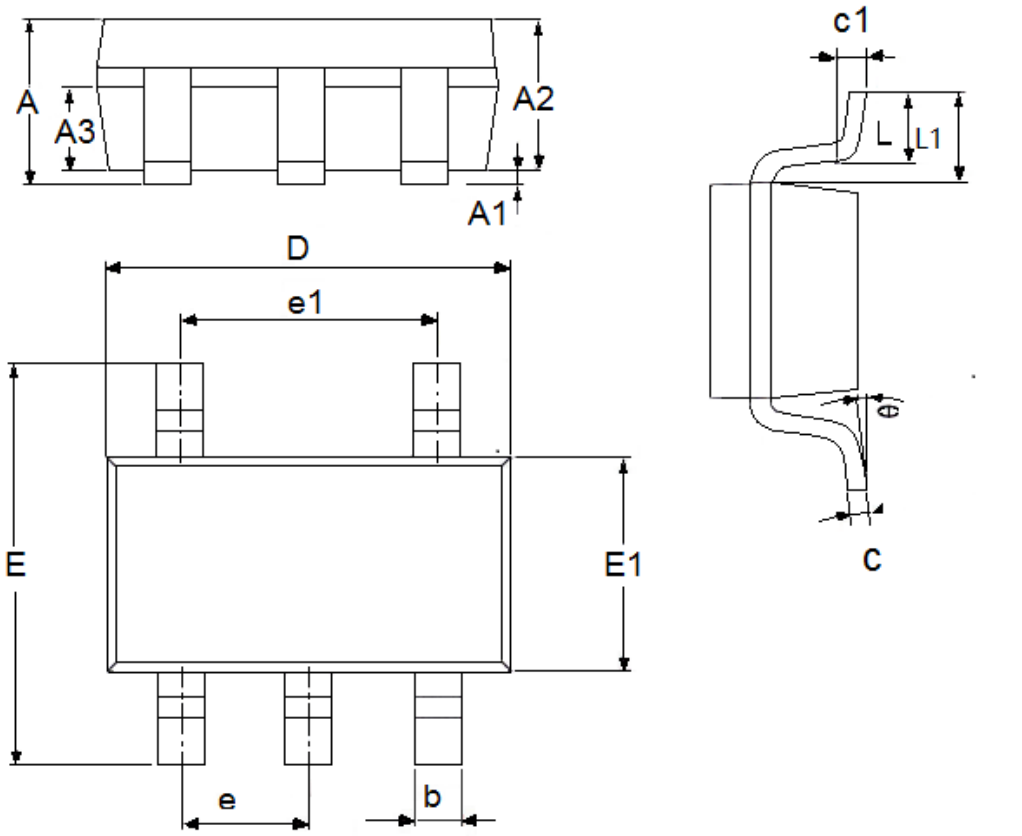
SIDE VIEW



BOTTOM VIEW

DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	0.32	0.4	0.0126	0.0157
A1	0	0.05	0	0.0020
b	0.18	0.28	0.0071	0.0110
c	0.102		0.0040	
D	0.95	1.05	0.0374	0.0413
D2	0.43	0.53	0.0169	0.0209
e	0.65 (TYP)		0.0256 (TYP)	
E	0.95	1.05	0.0374	0.0413
E2	0.43	0.53	0.0169	0.0209
L	0.2	0.3	0.0079	0.0118
L1	0.205 (TYP)		0.0081 (TYP)	

- **Packaging 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)	

- The contents of this document will be updated with the product's improvement without prior notice. Please consult our sales staff before using this document to ensure that you are using the latest version.
- The application circuit examples described in this document are only used to indicate the representative use of the product and do not guarantee the design of mass production.
- Please use this product within the limits stated in this document. We will not be responsible for any damage caused by improper use.
- The products described in this document are not allowed to be used in equipment or devices that affect the human body without the written permission of our company, including but not limited to: health equipment, medical equipment, disaster prevention equipment, fuel control equipment, automobile equipment, aviation equipment and vehicle equipment.
- Although our company has always been committed to improving product quality and reliability, semiconductor products have a certain probability of malfunction or wrong work. To prevent personal injury or property damage caused by such accidents, please pay full attention to safety design, for example: Alternate design, fire protection design, and prevention of wrong action design.
- When exporting this product or this document overseas, you should abide by applicable import and export control laws.
- Copying or reprinting part or all of this document in any form without the permission of our company is strictly prohibited.