CE53L6XX - High PSRR Low Noise 300mA LDO

General Description

The CE53L6XX family are the 300mA LDO with auto discharge function. It uses an advanced CMOS process and a PMOSFET pass device to achieve high power supply rejection ratio (PSRR), low noise, low dropout, low ground current, fast start-up and excellent output accuracy.

The CE53L6XX family are stable with a 1.0μF ceramic output capacitor, uses a precision voltage reference and feedback loop to achieve excellent Regulation and transient response.

The CE53L6XX family offered in a small SOT23-5 and DFN4 package, which are ideal for small form factor portable equipment.

Features

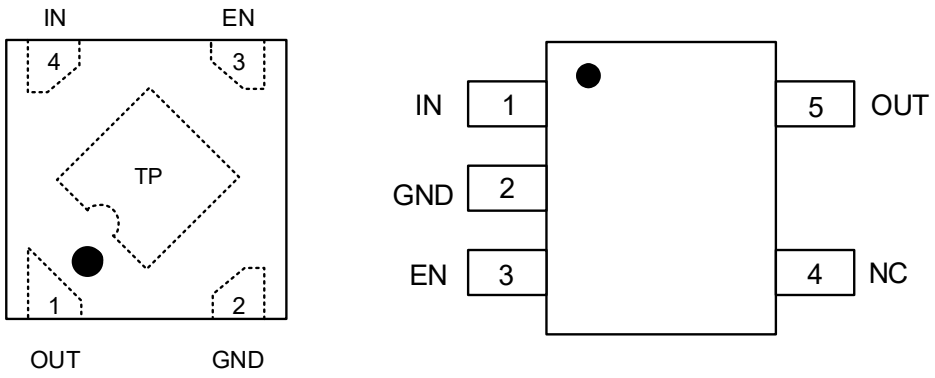
- Wide Input Voltage Range from 1.9V to 5.5V
- Up to 300mA Load Current
- Standard Fixed Output Voltage :1.05V, 1.1V, 1.2V, 1.5V, 1.8V, 2.4V, 2.5V, 2.8V, 3.0V 3.3V and etc.
- Very Low I_Q is 45μA typical
- Low Dropout is Typical 200mV@2.8V at 300mA Load
- Very High PSRR: 75dB at 1KHz
- Very Low Noise is 40uVrms at 1.2V output
- Excellent Load/Line Transient Response
- Excellent Load/Line Regulation
- With Auto Discharge Function
- Part No. and Package Information

Part No.	Package	Packing Option	MSL
CE53L6XXYB	DFN4 (1mm × 1mm)	Tape and Reel, 10K/Reel	1
CE53L6XX	SOT23-5 (1.6mm × 2.9mm)	Tape and Reel, 3K/Reel	3

Applications

- Smart Phones and Cellular Phones
- Digital Still Cameras
- Portable Instrument

Pin Configuration



DFN4(1mm × 1mm) SOT23-5

Figure1. Pin Configuration

Pin Function

Pin No.		Pin Name	Pin Function
DFN4	SOT23-5		
1	5	OUT	Output Pin. A 1μF low-ESR capacitor should be connected to this pin to ground.
2	2	GND	Ground
3	3	EN	Enable Control Input, active high. Do not leave EN floating
4	1	IN	Supply Input Pin. Must be closely decoupled to GND with a 1μF or greater ceramic capacitor
TP		Thermal Pad	Thermal Pad for DFN4(1×1) Package, Connect to GND or Leave Floating. Do not connect to any potential other than GND.
	4	NC	No Connection.

Block Diagram

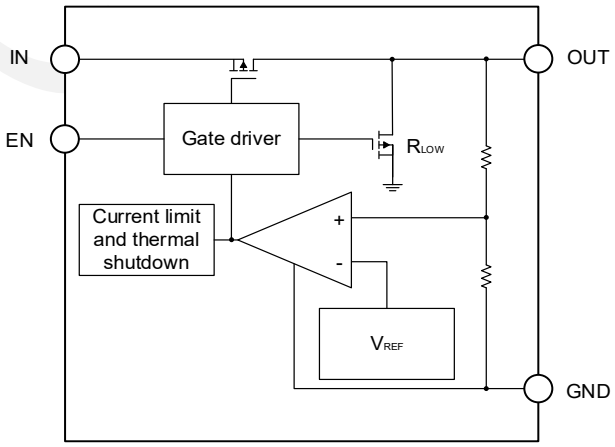


Figure2. Functional block diagram

Functional Description

Input Capacitor

A 1μF ceramic capacitor is recommended to connect between VIN and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both VIN and GND.

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is from 0.47μF to 4.7μF, Equivalent Series Resistance (ESR) is from 5mΩ to 100mΩ, and temperature characteristics is X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/overshoot. Place output capacitor as close as possible to OUT and GND pins.

ON/OFF Input Operation

The CE53L6XX is turned on by setting the EN pin high, and is turned off by pulling it low. If this feature is not used, the EN pin should be tied to IN pin to keep the regulator output on at all time.

Ultra-Fast Start-up

After enabled, the CE53L6XX is able to provide full power in as little as tens of microseconds, typically 80μs. This feature will help load circuitry move in and out of standby mode in real time, eventually extend battery life for mobile phones and other portable devices.

Current Limit Protection

When output current at the OUT pin is higher than current limit threshold or the OUT pin, the current limit protection will be triggered and clamp the output current to approximately 500mA to prevent over-current and to protect the regulator from damage due to overheating.

Thermal shutdown Protection

Thermal protection disables the output when the junction temperature rises to approximately 155°C, allowing the device to cool down. When the junction temperature reduces to approximately 130°C the output circuitry is enabled again. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits the heat dissipation of the regulator, protecting it from damage due to overheating.

Absolute Maximum Ratings

Symbol	Parameters (Items)		Value	Unit
V_{IN}	IN Voltage		-0.3 to 6.5	V
V_{EN}	Input Voltage (EN Pin)		-0.3 to V_{IN} + 0.3	V
V_{OUT}	Output Voltage		-0.3 to V_{IN} + 0.3	V
I_{MAX}	Maximum Load Current		500	mA
P_D	Maximum Power Consumption	DFN4	400	mW
		SOT23-5	400	
V_{ESD}	Human Body Model per JEDEC JS-001		±4000	V
	Charged Device Model per JEDEC JS-002		±1500	
$R_{\theta JA}$	Junction-to-Ambient Thermal Resistance		250	°C/W
T_J	Operating Junction Temperature		-40 to 150	°C
T_{STG}	Storage Temperature		-65 to 150	°C
T_{SLOD}	Lead Temperature (Soldering, 10 sec)		300	°C

Recommended Operating Conditions

Symbol	Parameters	Rating	Unit
V_{IN}	Input Voltage	1.9 to 5.5	V
I_{OUT}	Output Current	0 to 300	mA
T_A	Operating Ambient Temperature	-40 to 85	ºC
C_{IN}	Effective Input Ceramic Capacitor Value	0.47 to 4.7	μF
C_{OUT}	Effective Output Ceramic Capacitor Value	0.47 to 4.7	μF
ESR	Input and Output Capacitor Equivalent Series Resistance (ESR)	5 to 100	mΩ

Electrical Characteristics[1]

(V_{IN} = V_{OUT} + 1V, V_{EN} = 1.2V, I_{OUT} = 1mA, C_{IN}=1μF, C_{OUT} = 1μF, T_A = 25°C, unless otherwise noted)

Symbol	Parameters	Conditions	Min	Typ	Max	Unit
V_{IN}	Input Voltage Range		1.9		5.5	V
V_{OUT}	Regulated Output Voltage	I_{OUT} = 1mA, -40°C ≤ T_A ≤ 85°C	-2		2	%
I_{Q_ON}	Input Quiescent Current	Active Mode: V_{EN} = V_{IN}		45	70	μA
I_{Q_OFF}	Input Shutdown Current	V_{EN} = 0V		0.01	1	μA
$Line_{REG}$	Line Regulation	V_{IN} = V_{OUT} + 1V to 5.5V, I_{OUT} = 10mA		0.03	0.2	%/V
$Load_{REG}$	Load Regulation	I_{OUT} from 0mA to 300mA		20	40	mV
V_{DROP}	Dropout Voltage	V_{OUT} = 1.2V, I_{OUT} = 300mA[2]		320	420	mV
		V_{OUT} = 1.5V, I_{OUT} = 300mA		240	340	mV
		V_{OUT} = 1.8V, I_{OUT} = 300mA		180	280	mV
		V_{OUT} = 2.5V, I_{OUT} = 300mA		160	260	mV
		V_{OUT} = 2.8V, I_{OUT} = 300mA		145	240	mV
		V_{OUT} = 3.0V, I_{OUT} = 300mA		140	230	mV
		V_{OUT} = 3.3V, I_{OUT} = 300mA		135	220	mV
I_{LIMIT}	Current Limit	R_{LOAD} = 1Ω	300			mA
I_{SHORT}	Short Current Limit	V_{OUT} = 0V		90		mA
PSRR	Power Supply Rejection Ratio[3]	f = 1kHz, C_{OUT} = 1μF, I_{OUT} = 20mA		75		dB
		f = 10kHz, C_{OUT} = 1μF, I_{OUT} = 30mA		65		dB
e_N	Output Noise[3]	10Hz to 100kHz, I_{OUT} = 200mA, V_{OUT} = 2.8V, C_{OUT} = 1μF		25		μV_{RMS}
		10Hz to 100kHz, I_{OUT} = 200mA, V_{OUT} = 1.2V, C_{OUT} = 1μF		20		
V_{IL}	EN Low Threshold	V_{IN} = 1.9V to 5.5V, V_{EN} Falling until the Output is Disabled			0.3	V
V_{IH}	EN High Threshold	V_{IN} = 1.9V to 5.5V, V_{EN} Rising until the Output is Enabled	1.2			V
I_{EN}	EN Pin Input Current	V_{EN} = 5.5V		0	0.1	μA
R_{PD}	EN Pull-Down Resistance		0.8	1	1.3	MΩ
R_{LOW}	Output Resistance of auto Discharge at off State	V_{EN} = 0V, V_{IN} = 4V		130		Ω

Electrical Characteristics(1)(Continued)

(V_{IN} = V_{OUT} + 1V, V_{EN} = 1.2V, I_{OUT} = 1mA, C_{IN} = 1μF, C_{OUT} = 1μF, T_A = 25°C, unless otherwise stated)

Symbol	Parameters	Conditions	Min	Typ	Max	Unit
t_{ON}	Output Turn-On Time	From V_{EN} > V_{IH} to V_{OUT} = 95% of $V_{OUT(NOM)}$		50		μs
T_{SD}	Over-Temperature Shutdown Threshold (3)	T_J Rising		150		°C
T_{HYS}	Over-Temperature Shutdown Hysteresis (3)	T_J Falling from Shutdown		20		°C

Note1: Production test at 25°C. Specifications over the temperature range are guaranteed by design and characterization.

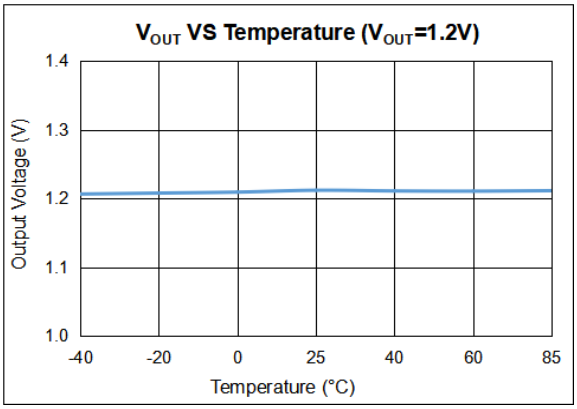
Note2: The minimum operating voltage is 1.9V. V_{DROP} = V_{IN}(min) - V_{OUT}.

Note3. Guaranteed by design and characterization. not a FT item.

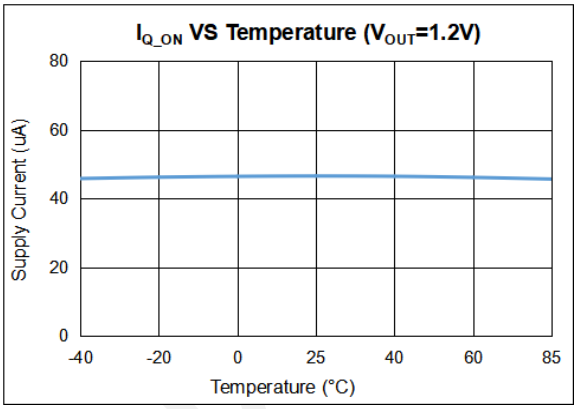
Typical Characteristics

(1) VOLTAGE VERSION 1.2V

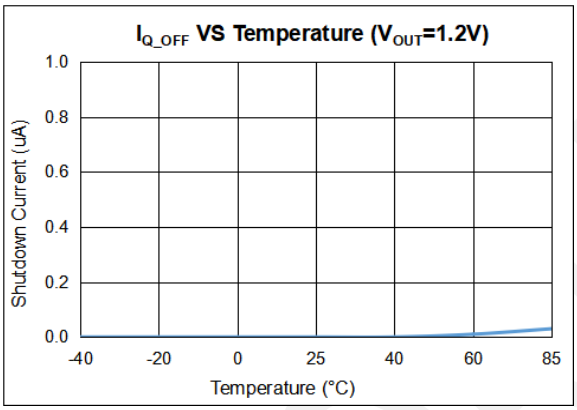
(V_{IN} = 2.2V; I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1μF, unless otherwise noted. Typical values are at T_A = 25°C.)



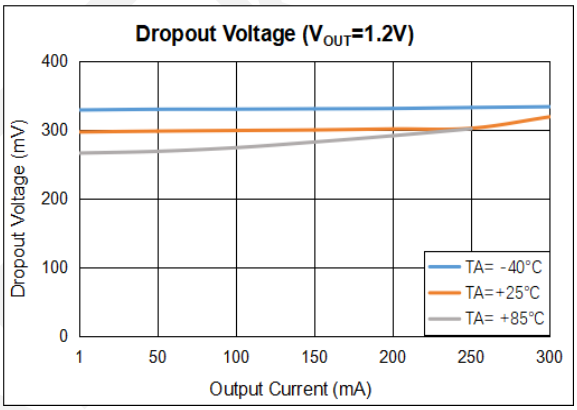
Output Voltage VS Temperature



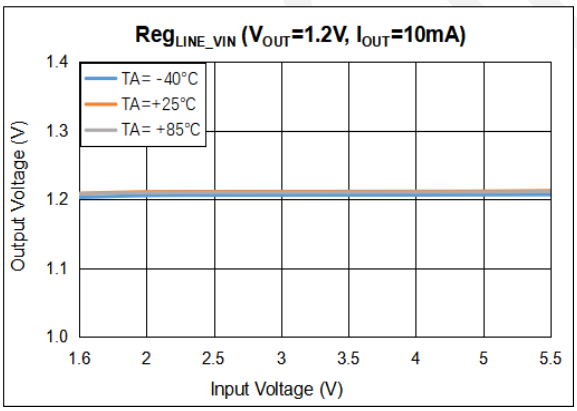
Supply Current VS Temperature



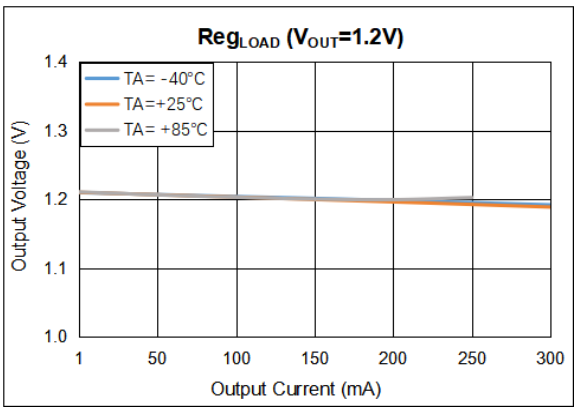
Shutdown Current VS Temperature



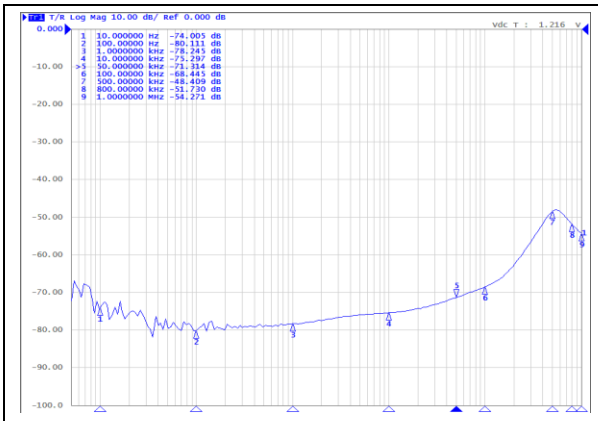
Dropout Voltage VS Output Current



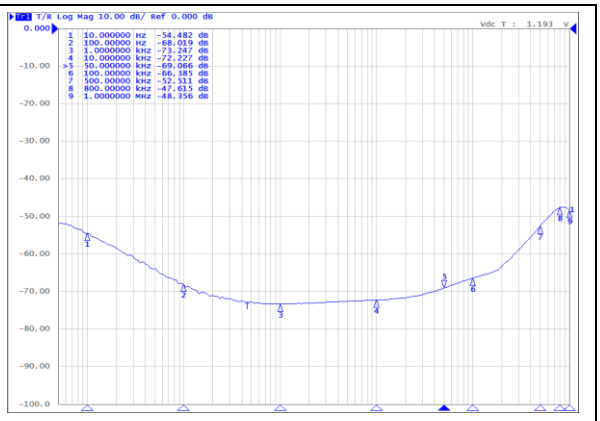
Output Voltage VS Input Voltage(I_{OUT} = 10mA)



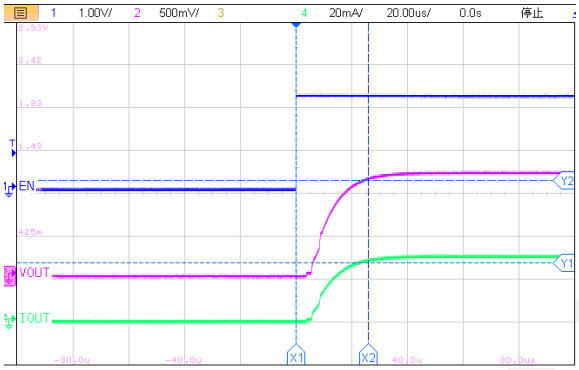
Output Voltage VS Output Current



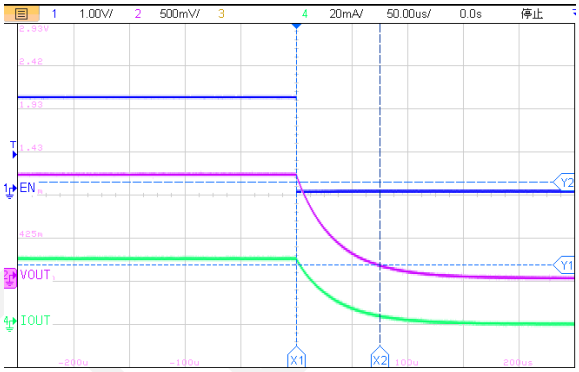
PSRR VS Output Current(I_{OUT} = 30mA)



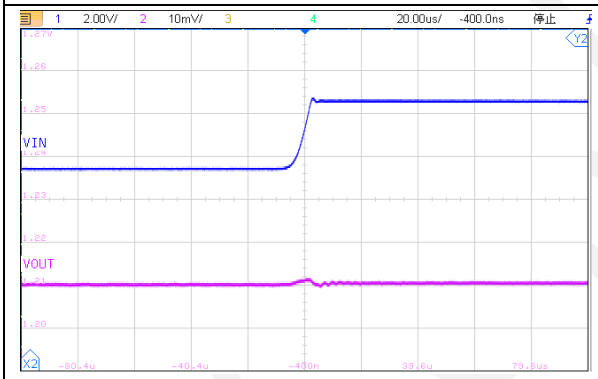
PSRR VS Output Current(I_{OUT} = 150mA)



Turn On Speed VS EN Voltage (I_{OUT} = 30mA)

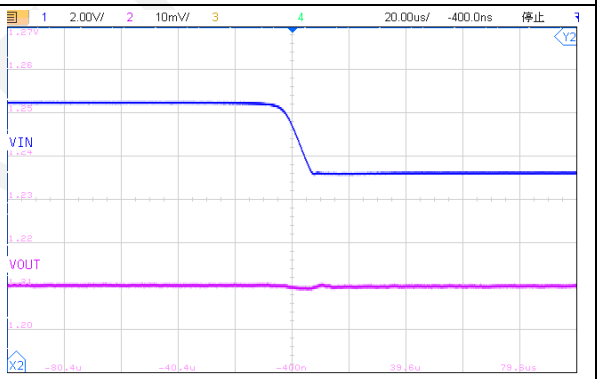


Turn Off Speed VS EN Voltage (I_{OUT} = 30mA)



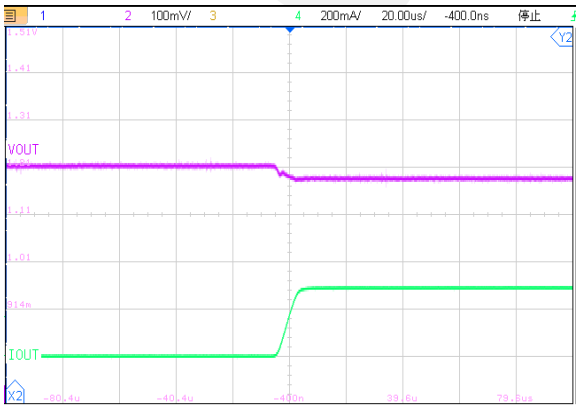
Line Transient Response

V_{IN} = 2.2V~5.5V, V_{OUT} = 1.2V, I_{OUT} = 1mA



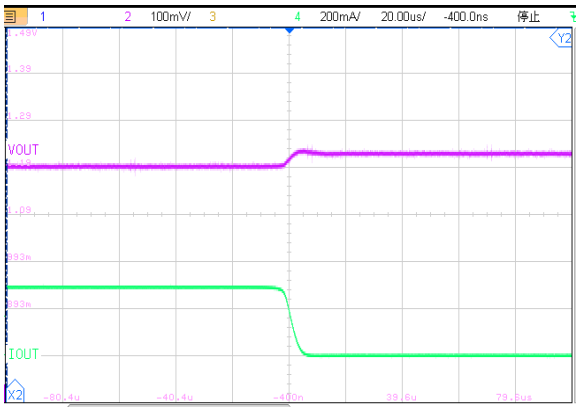
Line Transient Response

V_{IN} = 5.5V~2.2V, V_{OUT} = 1.2V, I_{OUT} = 1mA



Load Transient Response

V_{IN} = 2.2V, V_{OUT} = 1.2V, I_{OUT} = 1mA~300mA

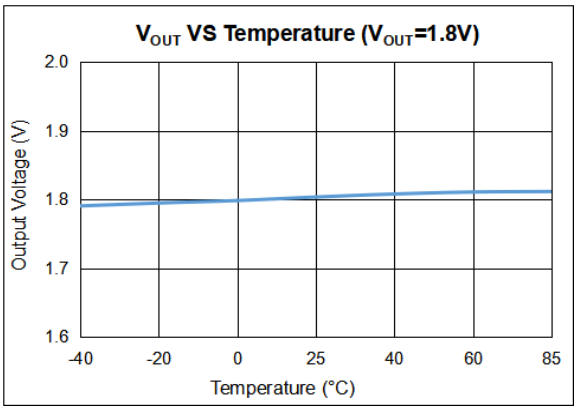


Load Transient Response

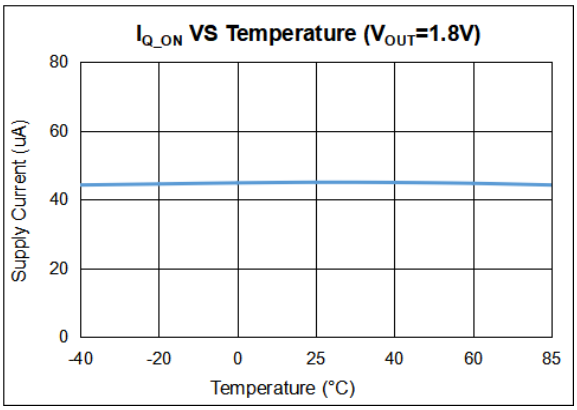
V_{IN} = 2.2V, V_{OUT} = 1.2V, I_{OUT} = 300mA~1mA

(2) VOLTAGE VERSION 1.8V

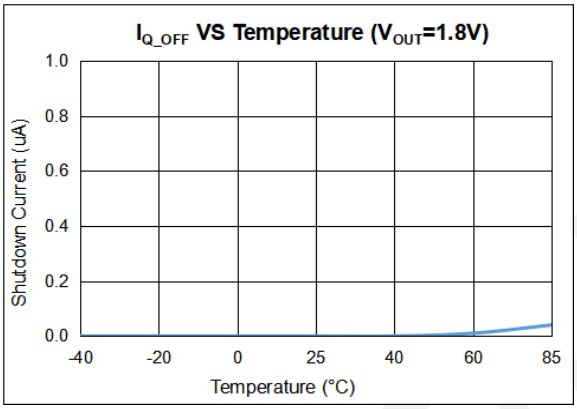
(V_{IN} = 2.8V; I_{OUT}= 1mA, C_{IN} = C_{OUT} = 1μF, unless otherwise noted. Typical values are at T_A = 25°C.)



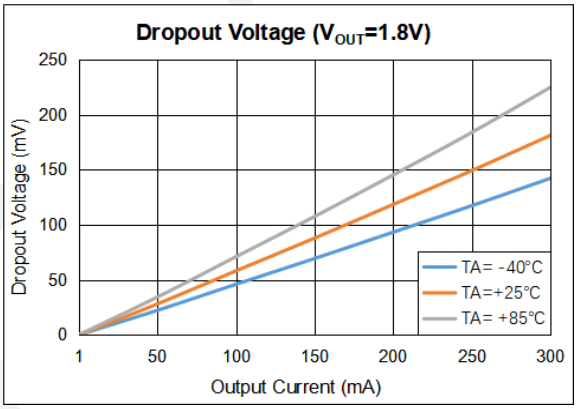
Output Voltage VS Temperature



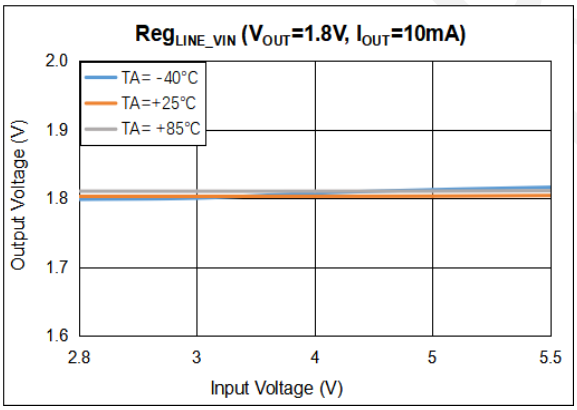
Supply Current VS Temperature



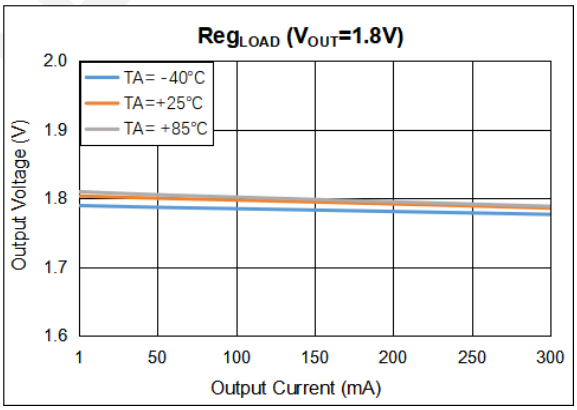
Shutdown Current VS Temperature



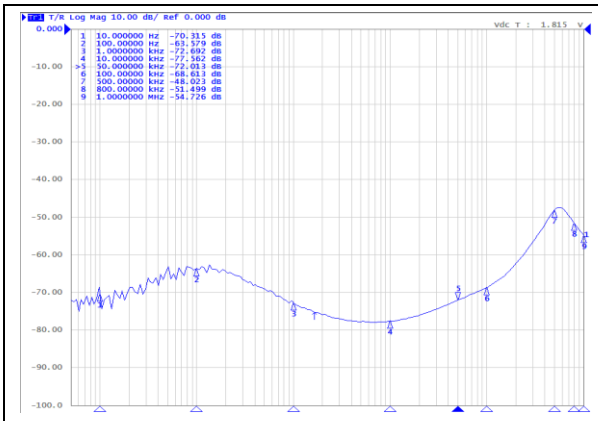
Dropout Voltage VS Output Current



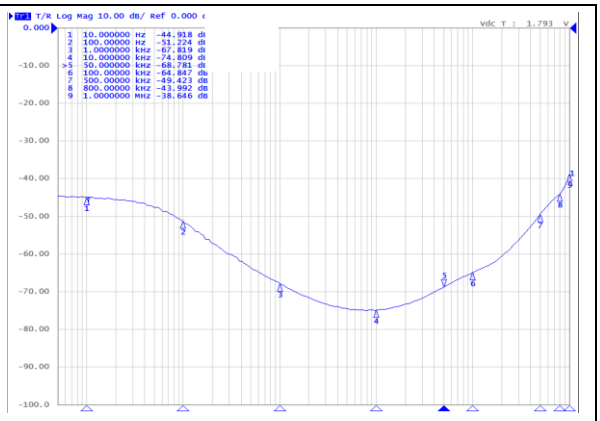
Output Voltage VS Input Voltage(I_{OUT} = 10mA)



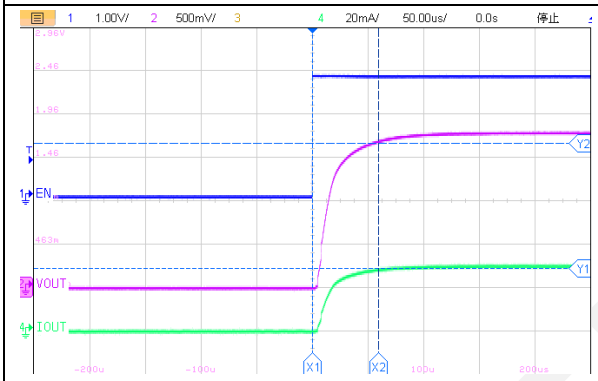
Output Voltage VS Output Current



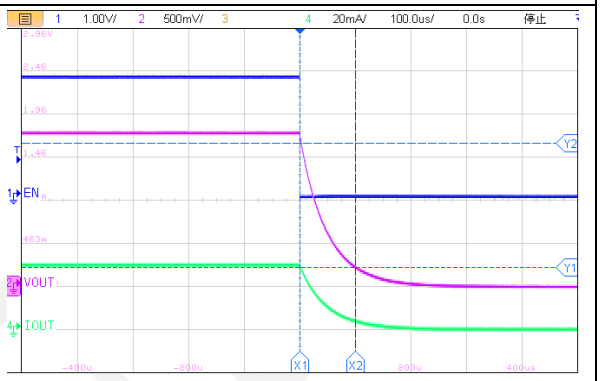
PSRR VS Output Current(I_{OUT} = 30mA)



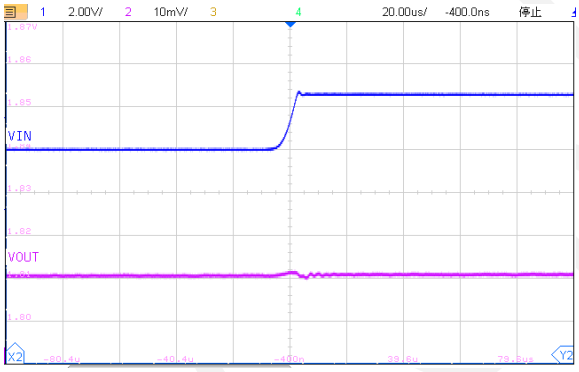
PSRR VS Output Current(I_{OUT} = 150mA)



Turn On Speed VS EN Voltage (I_{OUT} = 30mA)

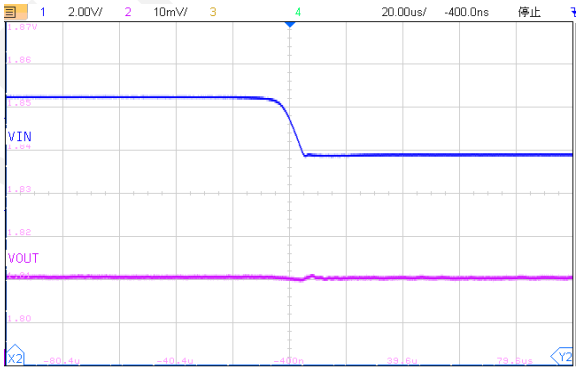


Turn Off Speed VS EN Voltage (I_{OUT} = 30mA)



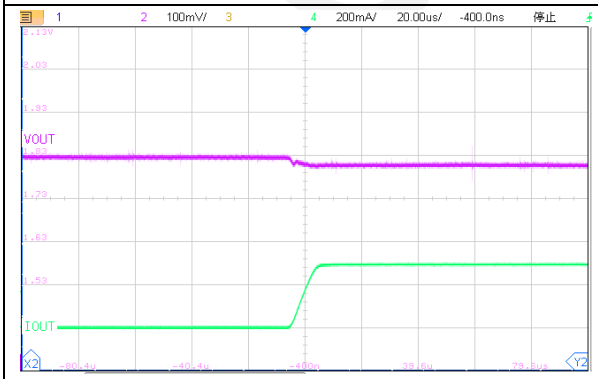
Line Transient Response

V_{IN} = 2.8V~5.5V, V_{OUT} = 1.8V, I_{OUT} = 1mA



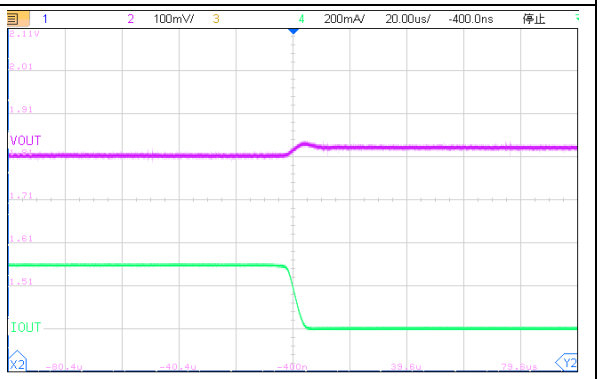
Line Transient Response

V_{IN} = 5.5V~2.8V, V_{OUT} = 1.8V, I_{OUT} = 1mA



Load Transient Response

V_{IN} = 2.8V, V_{OUT} = 1.8V, I_{OUT} = 1mA~300mA

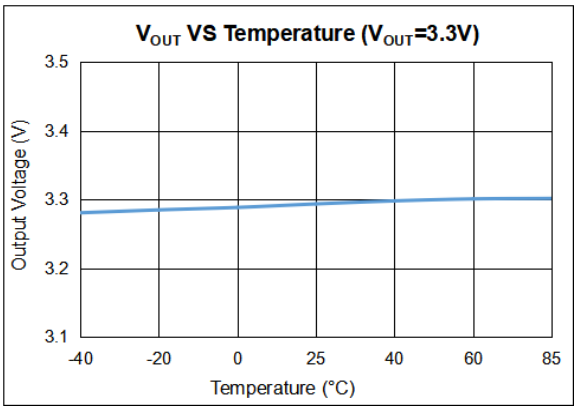


Load Transient Response

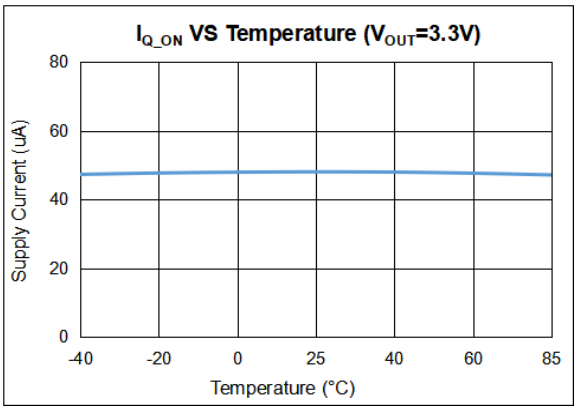
V_{IN} = 2.8V, V_{OUT} = 1.8V, I_{OUT} = 300mA~1mA

(3) VOLTAGE VERSION 3.3V

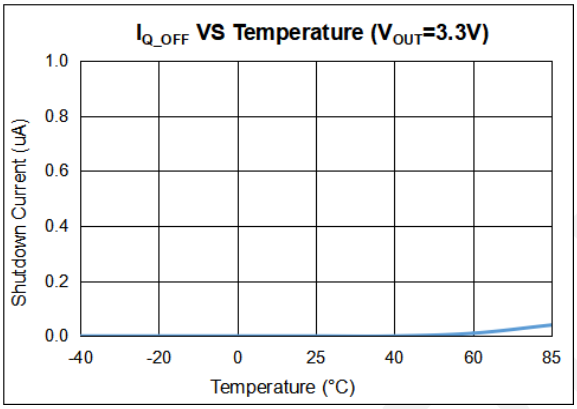
(V_{IN} = 4.3V; I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1μF, unless otherwise noted. Typical values are at T_A = 25°C.)



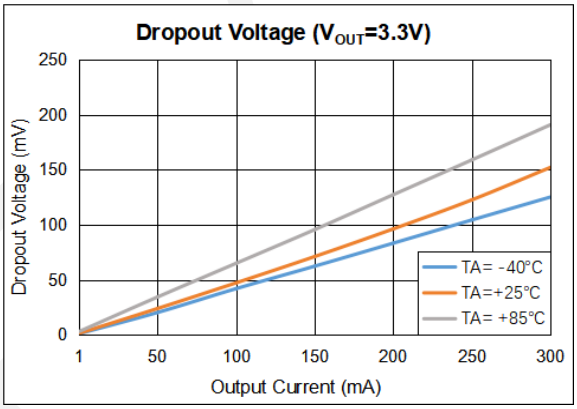
Output Voltage VS Temperature



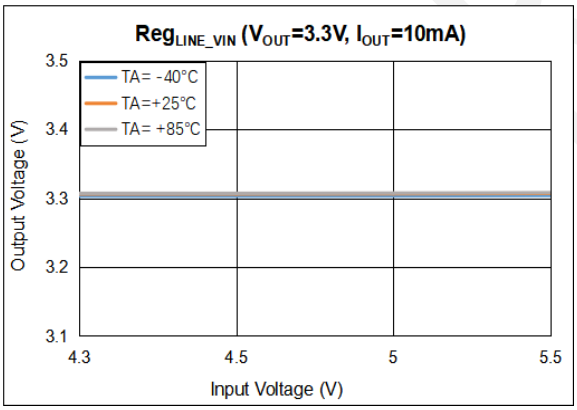
Supply Current VS Temperature



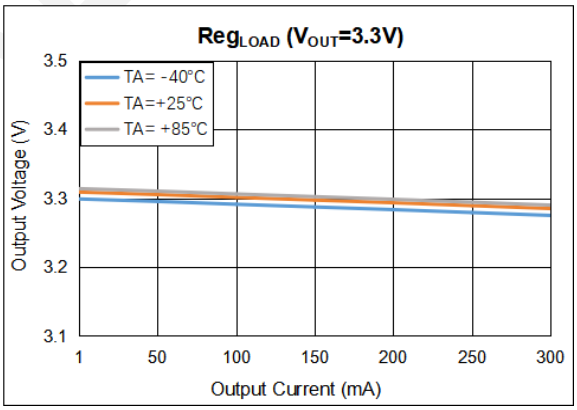
Shutdown Current VS Temperature



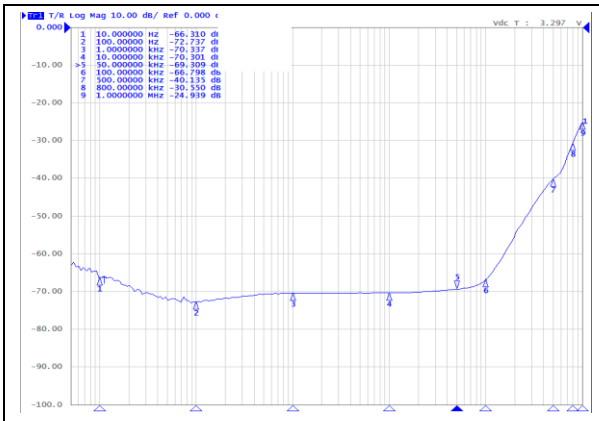
Dropout Voltage VS Output Current



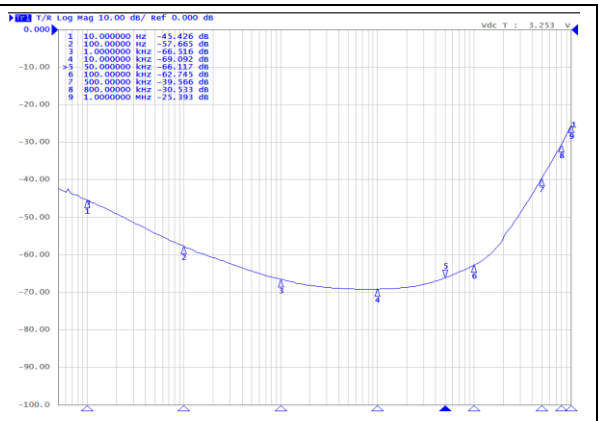
Output Voltage VS Input Voltage



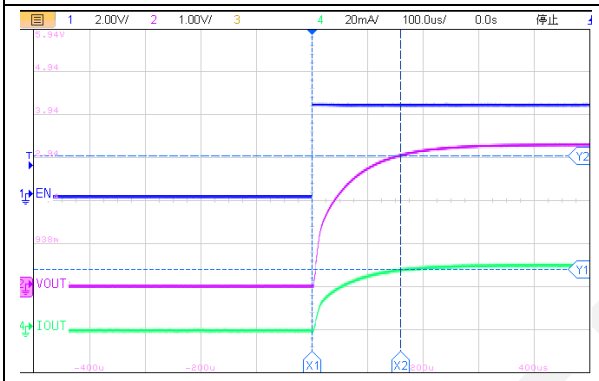
Output Voltage VS Output Current



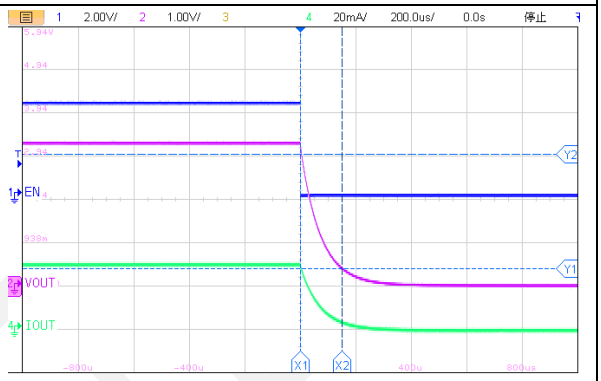
PSRR VS Output Current(I_{OUT} = 30mA)



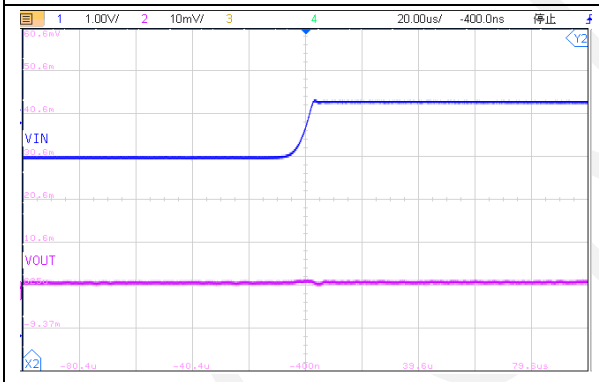
PSRR VS Output Current(I_{OUT} = 150mA)



Turn On Speed VS EN Voltage (I_{OUT} = 30mA)

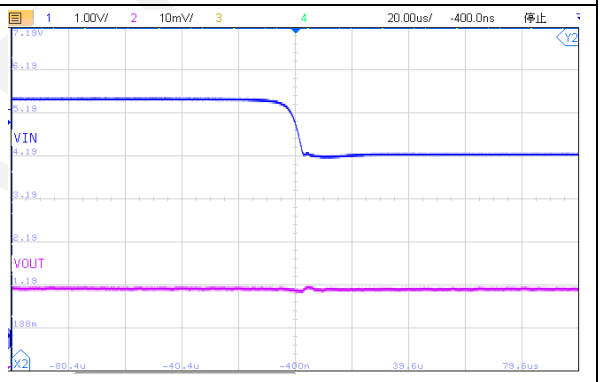


Turn Off Speed VS EN Voltage (I_{OUT} = 30mA)



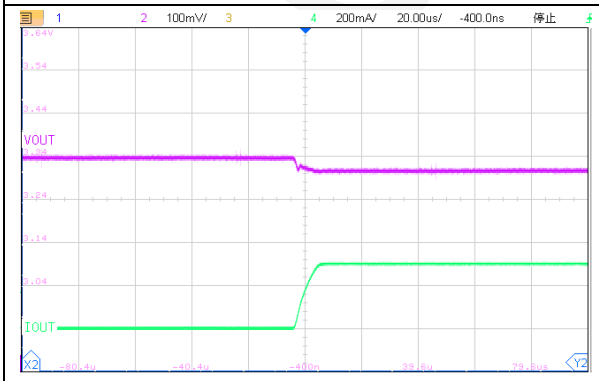
Line Transient Response

V_{IN} = 4.3V~5.5V, V_{OUT} = 3.3V, I_{OUT} = 1mA



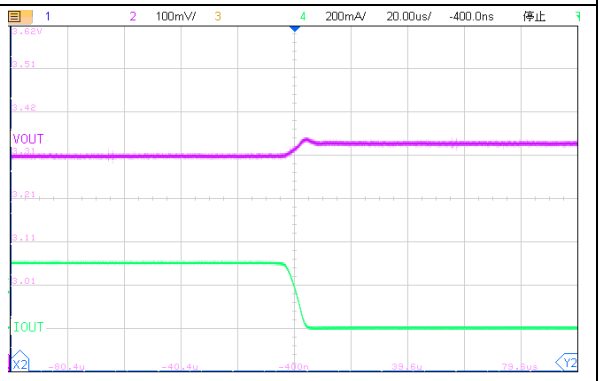
Line Transient Response

V_{IN} = 5.5V~4.3V, V_{OUT} = 3.3V, I_{OUT} = 1mA



Load Transient Response

V_{IN} = 4.3V, V_{OUT} = 3.3V, I_{OUT} = 1mA~300mA



Load Transient Response

V_{IN} = 4.3V, V_{OUT} = 3.3V, I_{OUT} = 300mA~1mA

Application Circuits

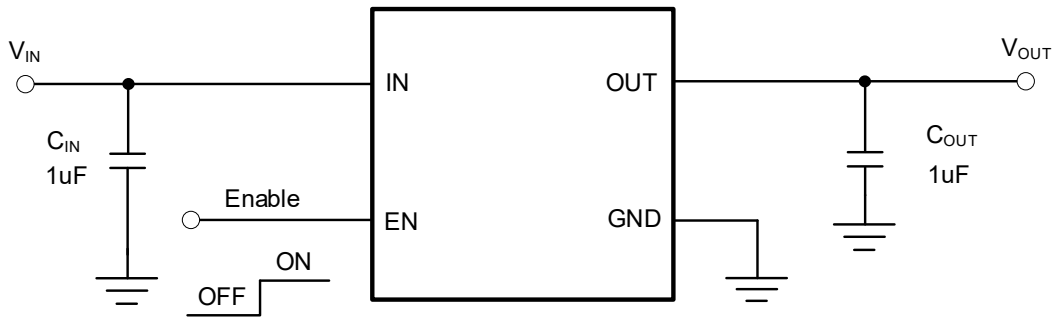


Figure3. Application Circuits

PCB Layout Guide

DFN4 (1mm × 1mm)

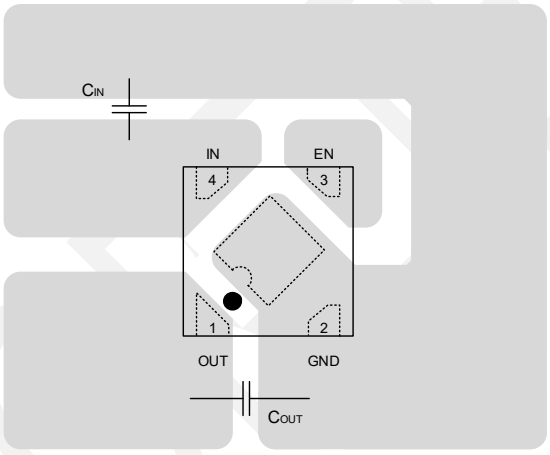


Figure4. PCB Layout Guide of DFN4

SOT23-5 (1.6mm × 2.9mm)

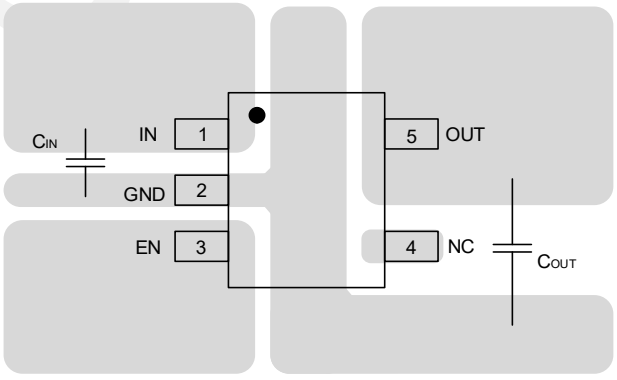
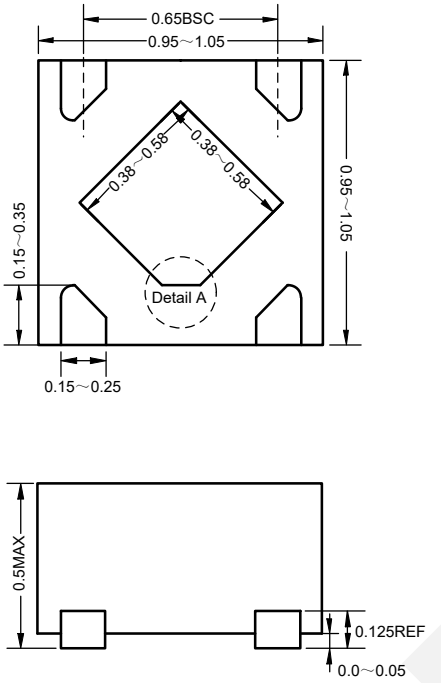
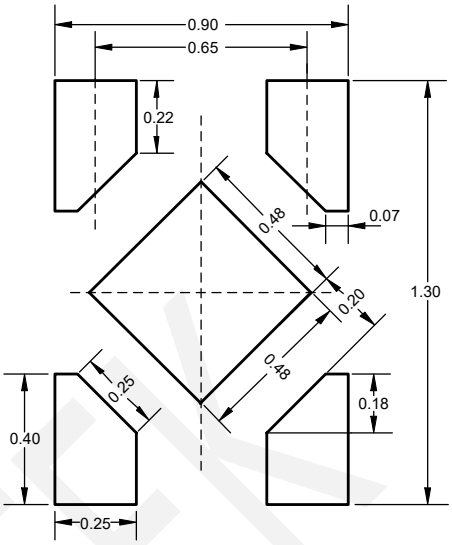


Figure5. PCB Layout Guide of SOT23-5

Package Dimension

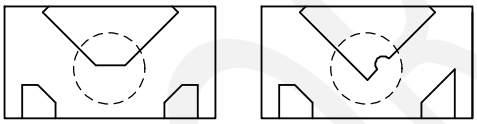
DFN4 (1mm × 1mm)





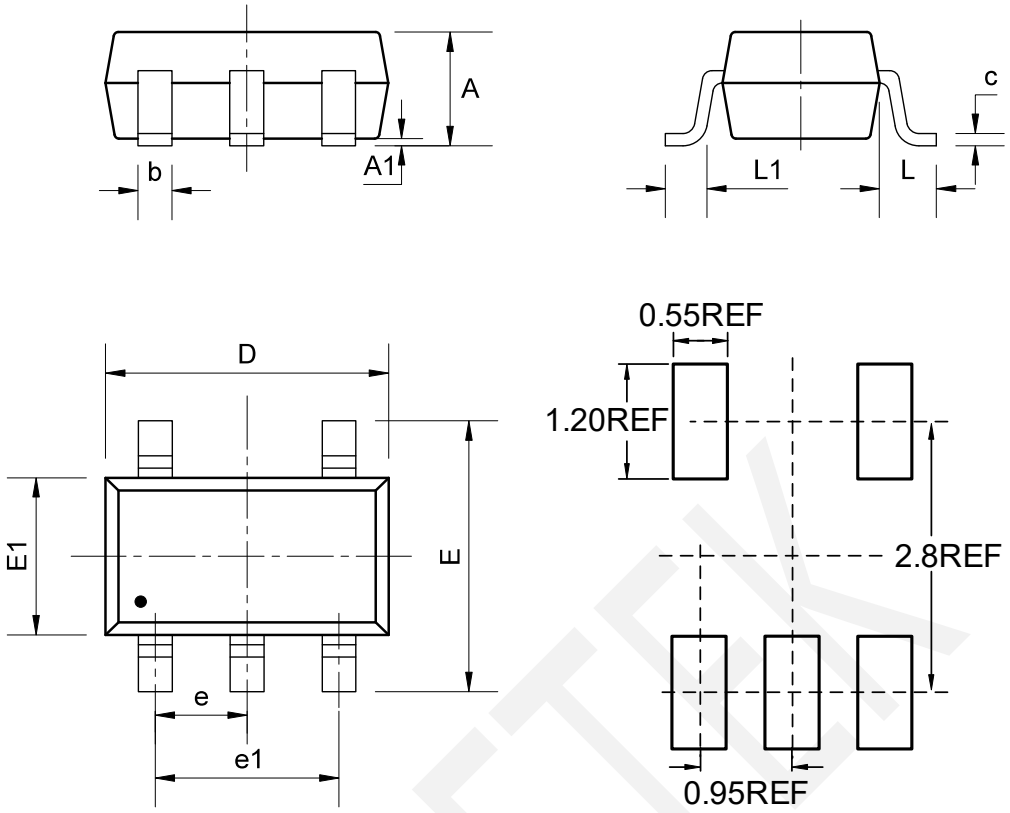
Recommended Land Pattern

Detail A: (PIN1 shape)



Unit: mm

SOT23-5 (1.6mm × 2.9mm)



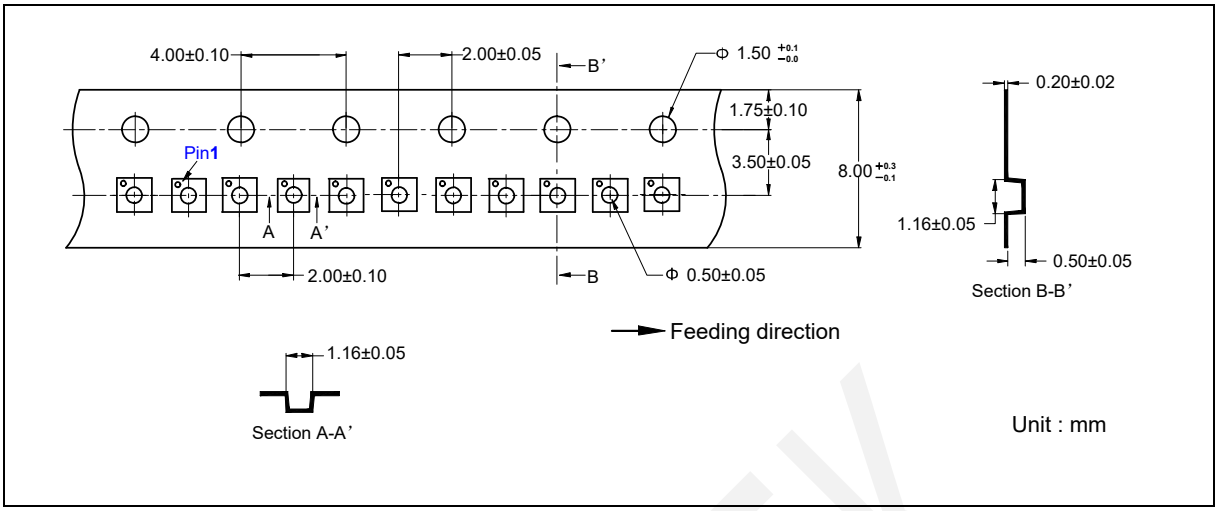
COMMON DIMENSIONS

(Unit: mm)

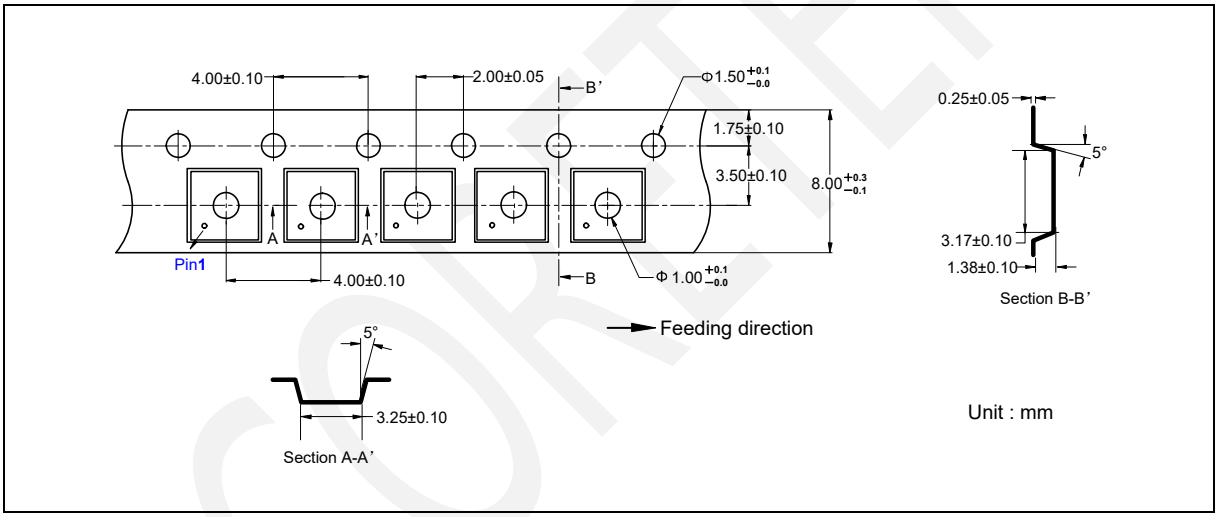
SYMBOL	MIN	NOM	MAX
A	-	-	1.45
A1	0.00	-	0.15
b	0.28	0.35	0.50
c	0.08	0.15	0.22
D	2.75	2.9	3.05
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
E	2.60	2.80	3.00
E1	1.45	1.6	1.75
L	0.60REF		
L1	0.30	0.45	0.60

Tape Information

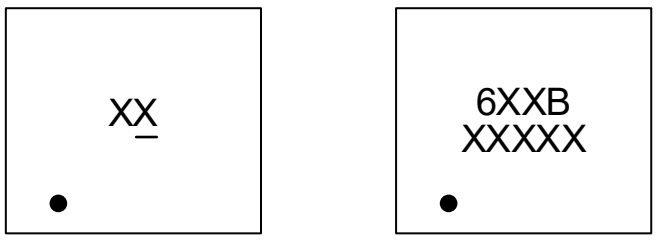
DFN4 (1mm × 1mm)



SOT23-5 (1.6mm × 2.9mm)



Marking Information



DFN4

X = Output Version

X= Tracking Number

SOT23-5

XX = Output Version

XXXXX = Tracking Number

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2020-07-08	Original Version	Liu xiaomin	Liu xiaomin	Zhu junli
1.1	2021-10-21	Add ESD and $R_{\theta JA}$ in AMR Table	Liu xiaomin	Liu xiaomin	Zhu junli
1.2	2022-09-23	Update Typeset Add Typical Characteristic	Li cheng	Liu xiaomin	Li cheng
1.3	2025-10-09	Add Tape Information	Shi bo	Liu xiaomin	Liu jiaying