CE53L3XXQ - High PSRR Low Noise 300mA LDO

General Description

The CE53L3XXQ is the high performance 300mA LDO with auto discharge function. It uses an advanced CMOS process and a PMOSFET pass device to achieve very high-power supply rejection ratio (PSRR), very low noise, very low dropout, very low ground current, fast start-up and excellent output accuracy.

The CE53L3XXQ is stable with a 1.0μF ceramic input and output capacitor, uses a precision voltage reference and feedback loop to achieve high excellent Regulation and transient response.

CE53L3XXQ operates over an ambient temperature range of -40°C to 125°C.

Features

- Wide Input Voltage Range from 1.9V to 5.5V
- Up to 300mA Load Current
- Fixed Output Voltage :1.2V, 1.8V, 2.8V, 3.0V, 3.3V, etc.
- Very Low I_Q is 45μA Typical
- Low Dropout is 180mV at 300mA Load@3.3V
- Very High PSRR: 75dB at 1KHz
- Very Low Noise: 60uVrms@2.8V
- Excellent Load/Line Transient Response
- Auto Discharge Function
- Automotive AEC-Q100 Grade 1 Qualified
  -- Ambient Temperature Range of -40°C to 125°C
  -- ESD HBM 4KV PASS
  -- ESD CDM 1.5KV PASS
- Part No. and Package Information

Part No.	Package	Packing Option	MSL
CE53L3XXQ	SOT23-5 (1.6mm × 2.9mm)	Tape and Reel, 3K/Reel	1

Device information

CE 53L3 XX Q

XX Output Voltage		Q AEC-Q100 Qualified	
XX	X.XV Output Voltage For example, 33 is 3.3V output	Q	With AEC-Q100 Qualified

Applications

- Infotainment Power Supplies
- Automotive RF Supply
- Cameras
- Automotive POL in ADAS
- Automotive Wireless Communication

Pin Configuration

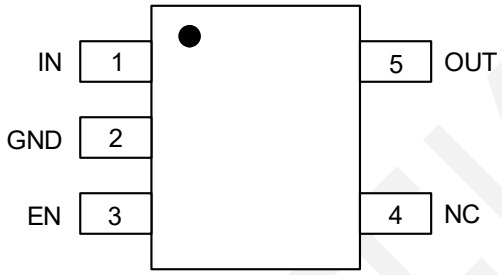


Figure1. Pin Configuration

Pin Function

Pin No.	Pin Name	Pin Function
1	IN	Supply Input Pin. Must be closely decoupled to GND with a 1μF or greater ceramic capacitor
2	GND	Ground
3	EN	Enable Control Input, active high. Do not leave EN floating
4	NC	No Connection.
5	OUT	Output Pin. A 1μF low-ESR capacitor should be connected to this pin to ground.

Block Diagram

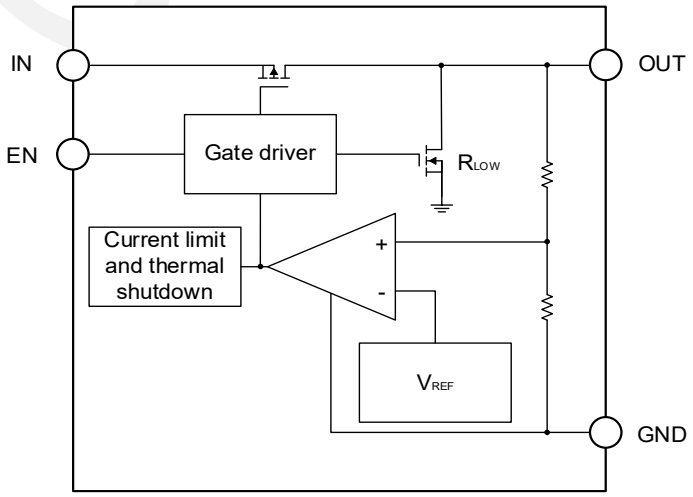


Figure2. Block Diagram

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 CE53L3XXQ 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 CE53L3XXQ 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.

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
V_{ESD}(1)	Human Body Model	±4000	V
	Charged Device Model	±1500	
P_D	Maximum Power Consumption	500	mW
$R_{\theta JA}$	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

Note1: This device series incorporates ESD protection and is tested by the following methods:

HBM tested per AEC-Q100-002(JEDEC JS-001);

CDM tested per AEC-Q100-011(JEDEC JS-002);

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 125	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[2]

(V_{IN} = V_{OUT} + 1V; I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1μF, T_A = -40°C~125°C unless otherwise noted. Typical values are at T_A = 25°C.)

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, T_A = -40~125°C	-2		2	%
I_{Q_ON}	Input Quiescent Current	I_{OUT} = 0mA, T_A = 25°C		45	70	μA
I_{Q_OFF}	Input Shutdown Current	V_{EN} = 0V, T_A = 25°C		0.01	1	μA
$Line_{REG}$	Line Regulation [5]	V_{IN} = V_{OUT} + 1V to 5.5V, I_{OUT} = 10mA		0.03	0.2	%/V
$Load_{REG}$	Load Regulation [5]	I_{OUT} from 0mA to 300mA		20	40	mV
V_{DROP}	Dropout Voltage I_{OUT}=300mA [5]	V_{OUT} = 1.2V, I_{OUT} = 300mA [3]		550	700	mV
		V_{OUT} = 1.8V, I_{OUT} = 300mA		290	550	mV
		V_{OUT} = 2.5V, I_{OUT} = 300mA		210	450	mV
		V_{OUT} = 2.8V, I_{OUT} = 300mA		190	400	mV
		V_{OUT} = 3.0V, I_{OUT} = 300mA		188	390	mV
		V_{OUT} = 3.3V, I_{OUT} = 300mA		180	380	mV
I_{LIMIT}	Current Limit	R_{LOAD} = 1Ω	300			mA
I_{SHORT}	Short Current Limit	V_{OUT} = 0V		70		mA
PSRR	Power Supply Rejection Ratio[4]	f = 1kHz, C_{OUT} = 1μF, I_{OUT} = 20mA		75		dB
		f = 10kHz, C_{OUT} = 1μF, I_{OUT} = 30mA		65		dB
e_N	Output Noise[4]	10Hz to 100kHz, I_{OUT} = 200mA, V_{OUT} = 2.8V, C_{OUT} = 1μF		60		μV_{RMS}
		10Hz to 100kHz, I_{OUT} = 200mA, V_{OUT} = 1.2V C_{OUT} = 1μF		40		
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} = 0V		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, I_{OUT} = 10mA		80		Ω

Electrical Characteristics (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 $V_{OUT(NOM)}$		70	150	us
T_{TSD}	Over-Temperature Shutdown Threshold(4)	T_J Rising		155		°C
T_{HYS}	Over-Temperature Shutdown Hysteresis(4)	T_J Falling from Shutdown		20		°C

Note2: Production test at 25°C. Specifications over the temperature range are guaranteed by design and characterization.

Note3: The minimum operating voltage is 1.9V. V_{DROP} = V_{IN}(min) - V_{OUT}.

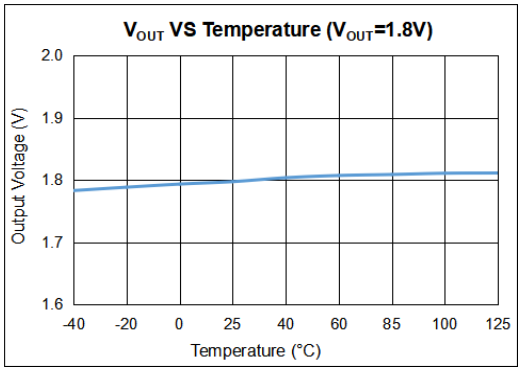
Note4: Guaranteed by design and characterization.

Note5: At high temperatures, the maximum load current can be calculated according to the following formula：

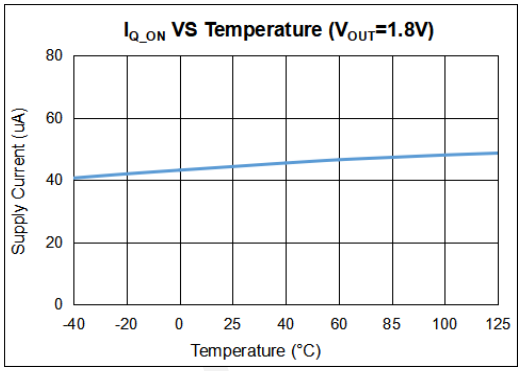
$$I_{OUT\_MAX} = (T_J - T_A) / R_{\theta JA} / (V_{IN} - V_{OUT})$$

Typical Characteristics

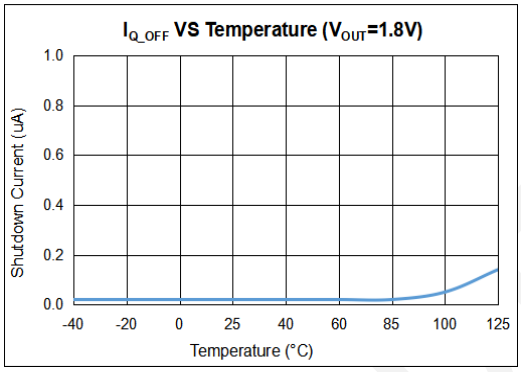
(V_{IN} = V_{OUT} + 1V; I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1μF, T_A = -40°C~125°C unless otherwise noted. Typical values are at T_A = 25°C.)



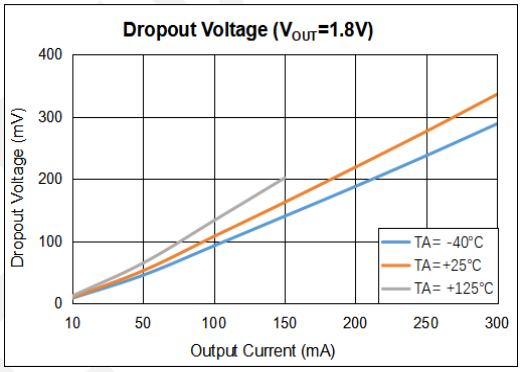
Output Voltage VS Temperature



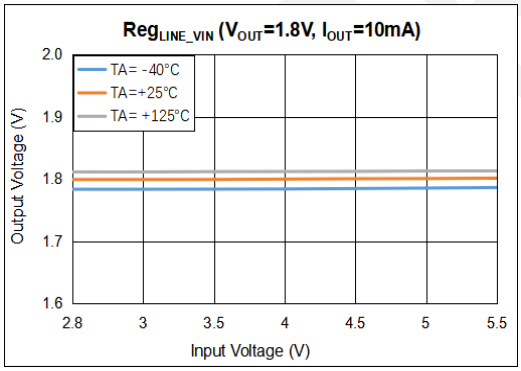
Supply Current VS Temperature



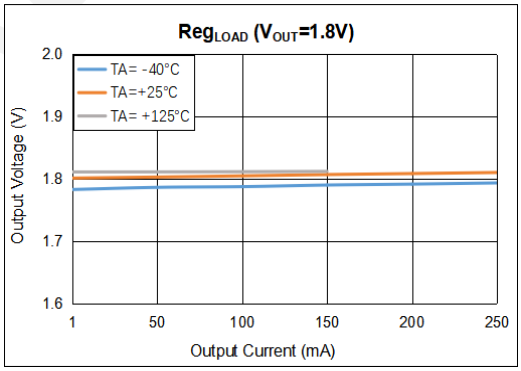
Shutdown Current VS Temperature



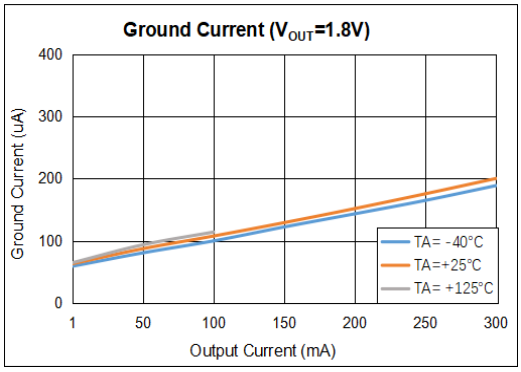
Dropout Voltage VS Output Current



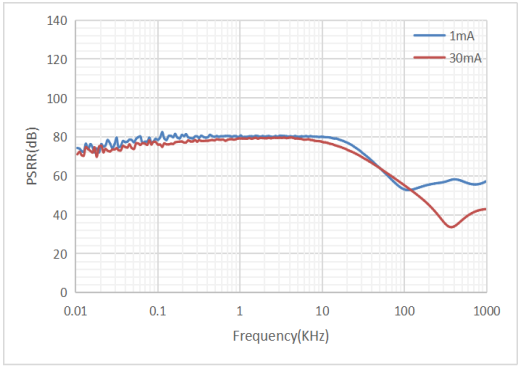
Output Voltage VS Input Voltage



Output Voltage VS Output Current



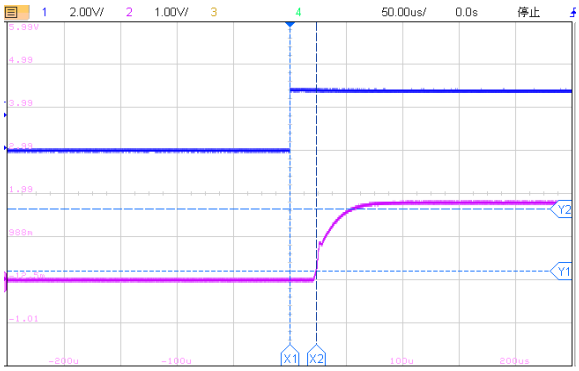
Ground Current VS Output Current



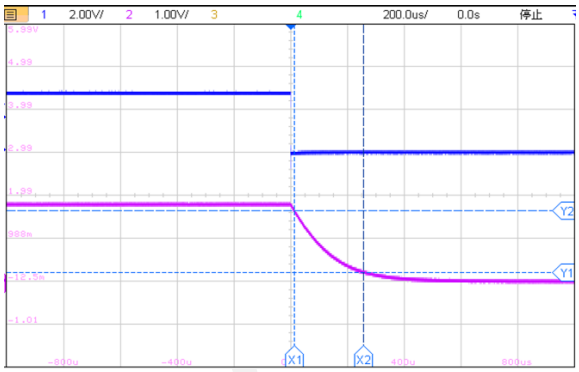
PSRR VS Output Current

Typical Characteristics (Continued)

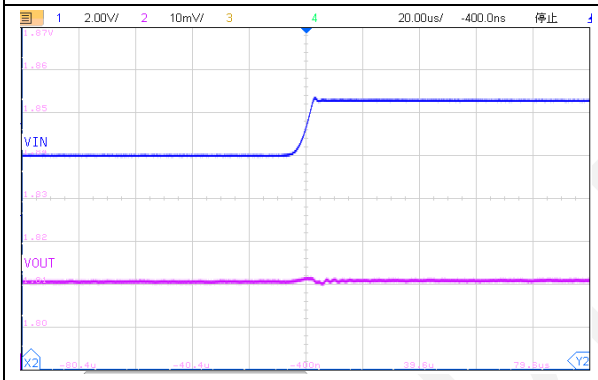
(V_{IN} = V_{OUT} + 1V; I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1μF, T_A = -40°C~125°C unless otherwise noted. Typical values are at T_A = 25°C.)



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

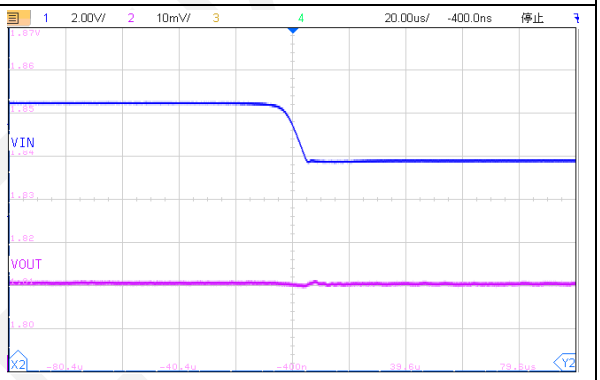


Turn Off Speed VS EN Voltage (I_{OUT} = 30mA)



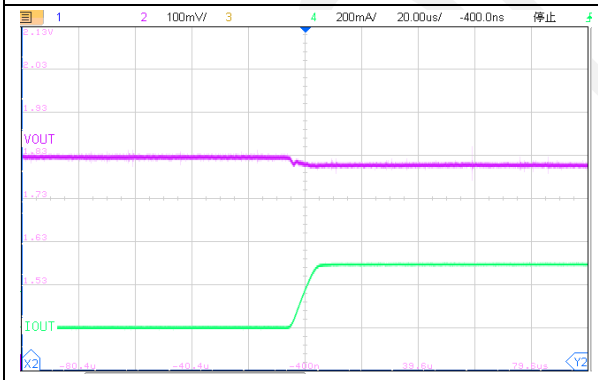
Line Transient Response

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



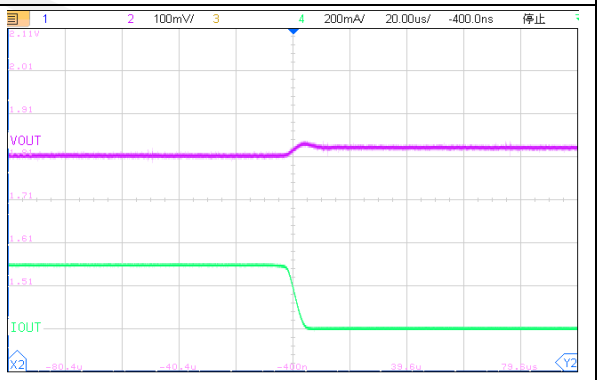
Line Transient Response

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

Application Circuits

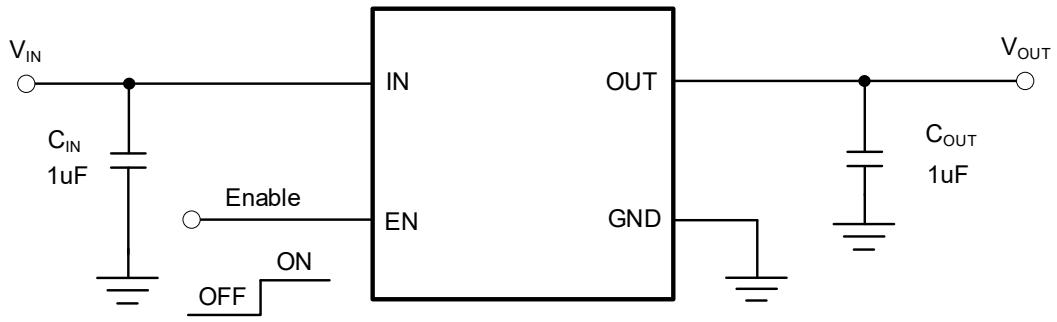


Figure3. Application Circuits

PCB Layout Guide

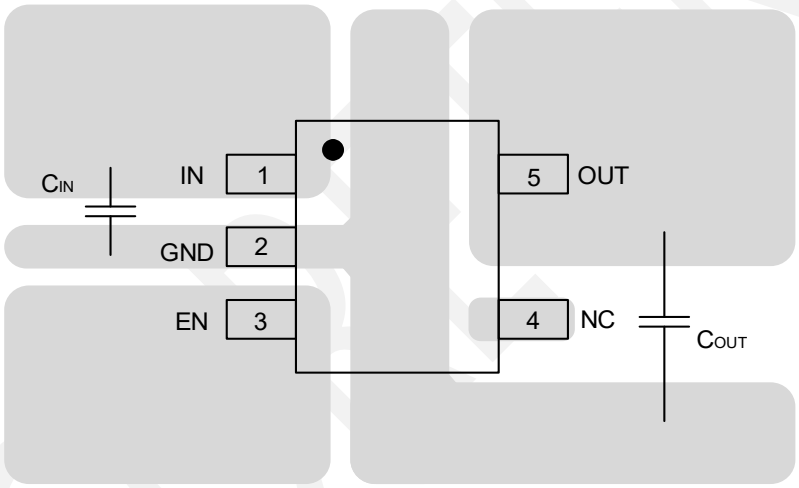
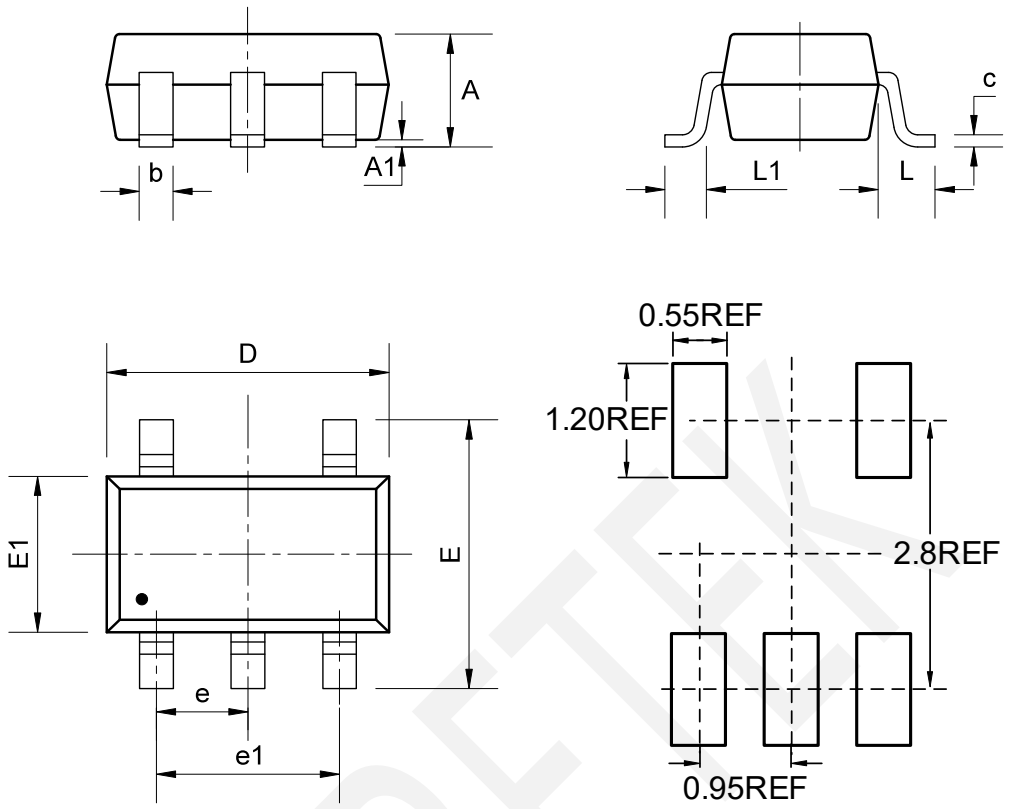


Figure4. PCB Layout Guide

Package Dimension

SOT23-5 (1.6mm × 2.9mm)



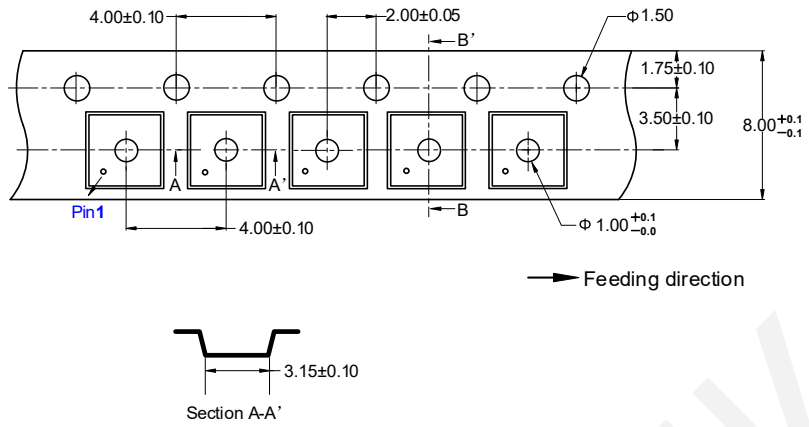
COMMON DIMENSIONS

(Unit: mm)

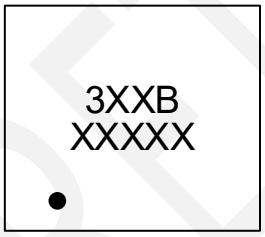
SYMBOL	MIN	NOM	MAX
A	-	-	1.45
A1	0.00	-	0.15
b	0.28	0.35	0.50
c	0.08	0.15	0.22
D	2.75	2.9	3.05
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
E	2.60	2.80	3.00
E1	1.45	1.6	1.75
L	0.60REF		
L1	0.30	0.45	0.60

Tape Information

SOT23-5 (1.6mm × 2.9mm)



Marking Information



3XXB = Output Version, e.g. 318B: 1.8V

XXXXX = Tracking Number

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2022-10-22	Original Version	Yang xiaoxu	Liu xiaomin	Yang xiaoxu
1.1	2025-05-08	Update some form	Yang xiaoxu	Liu xiaomin	Yang xiaoxu