20V/500mA, 0.8uA Ultra-Low Power High Precision Linear Regulator

1 Description

The CN8501 is an ultra-low quiescent power, low dropout linear regulator fabricated in CMOS process. The regulator consumes about 0.8uA and 0.01uA (typical) after enable/shutdown. Built-in enable control, output discharge, short circuit protection, and thermal shutdown are available in SOT89-3, SOT23-5, and SOT23-3 packages.

2 Features

- Ultra-low Quiescent Current: 0.8μA(VIN=12V)
- Shutdown Current: 0.01uA
- Input Range: 2.5V-20V
- Output Range: 1.8V-5V (0.1V interval)
- High Precision: ±2%
- Maximum Output Current: 500mA
- Enabling Control
- Output Discharge
- Output Short Circuit Protection
- Thermal Shutdown

3 Applications

- Cell Phone
- Battery powered equipment
- Wireless Telephones,
  Wireless Communication Equipment
- Camera Recorder
- Portable Audio-Visual Equipment
- PDA (Personal Digital Assistant)

4 Ordering Information

Product Number	Package	Quantity/Tape
CN8501MXXXOGR	SOT89-3	1000/Tape
CN8501MXXXAOGR	SOT89-3	1000/Tape
CN8501MXXXTCR	SOT23-5	3000/Tape
CN8501MXXXTGR	SOT23-3	3000/Tape
CN8501MXXXTCRA	SOT23-5	3000/Tape

5 Marking

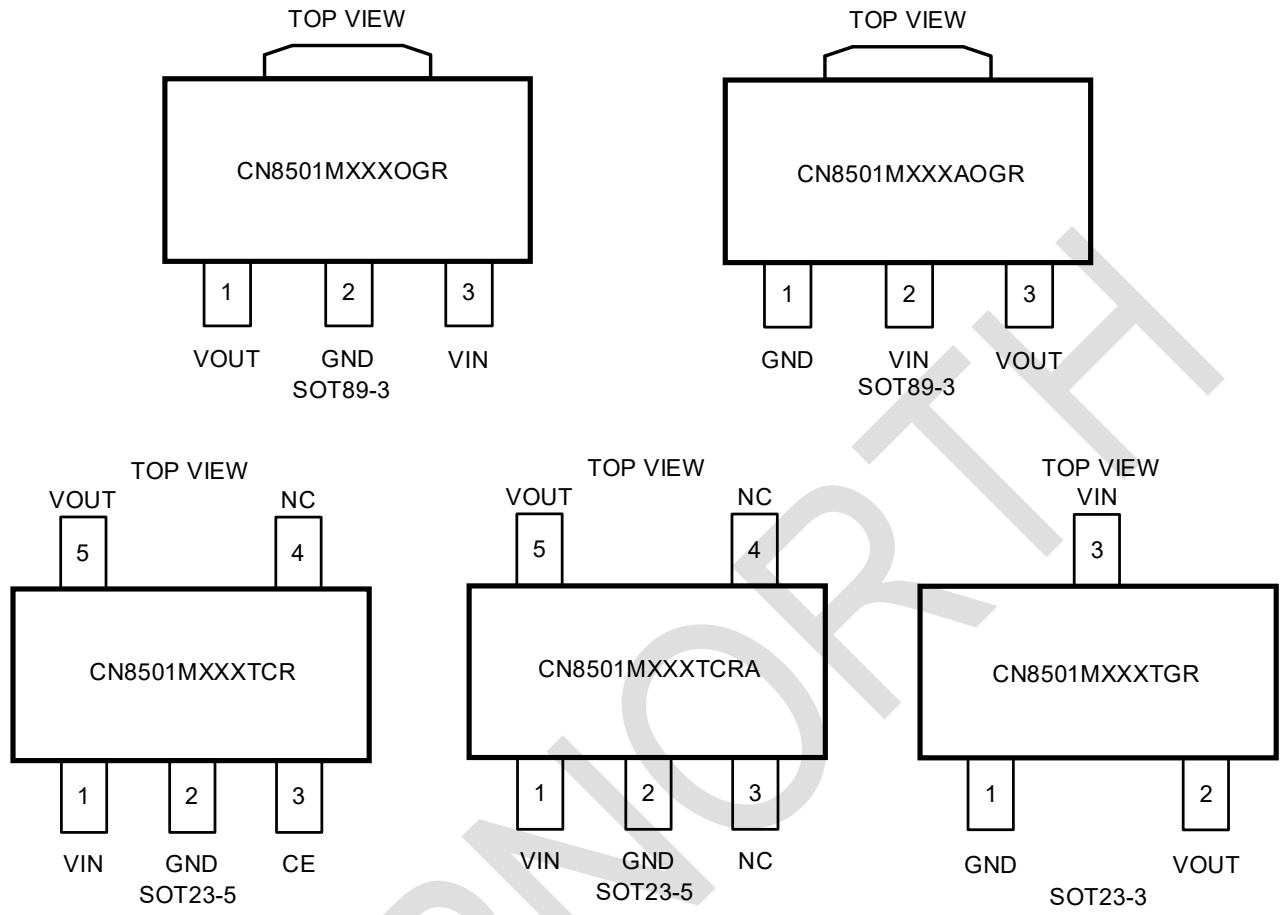
Product Number	Marking*
CN8501MXXXAOGR	01MXXXA YYWW
CN8501MXXXOGR	01MXXX YYWW
CN8501MXXXTCR	MXXX YYWW
CN8501MXXXTGR	MXXX YYWW
CN8501MXXXTCRA	MXXXA YYWW

Note: YY=Year WW=Week; 8501MXXX=Product Name, XXX= Output Voltage

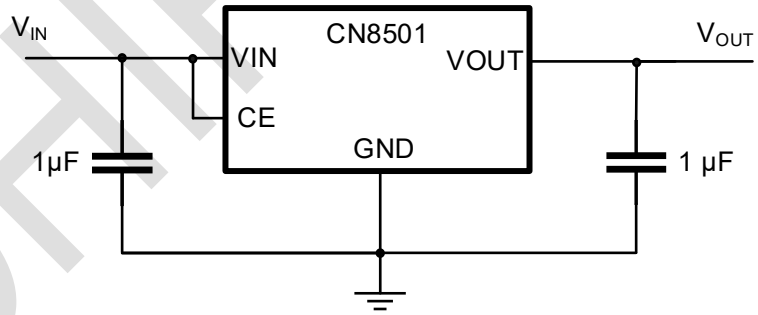
Green (RoHS & HF): CHIPNORTH defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your CHIPNORTH representative directly.

Moisture sensitivity level(MSL):3

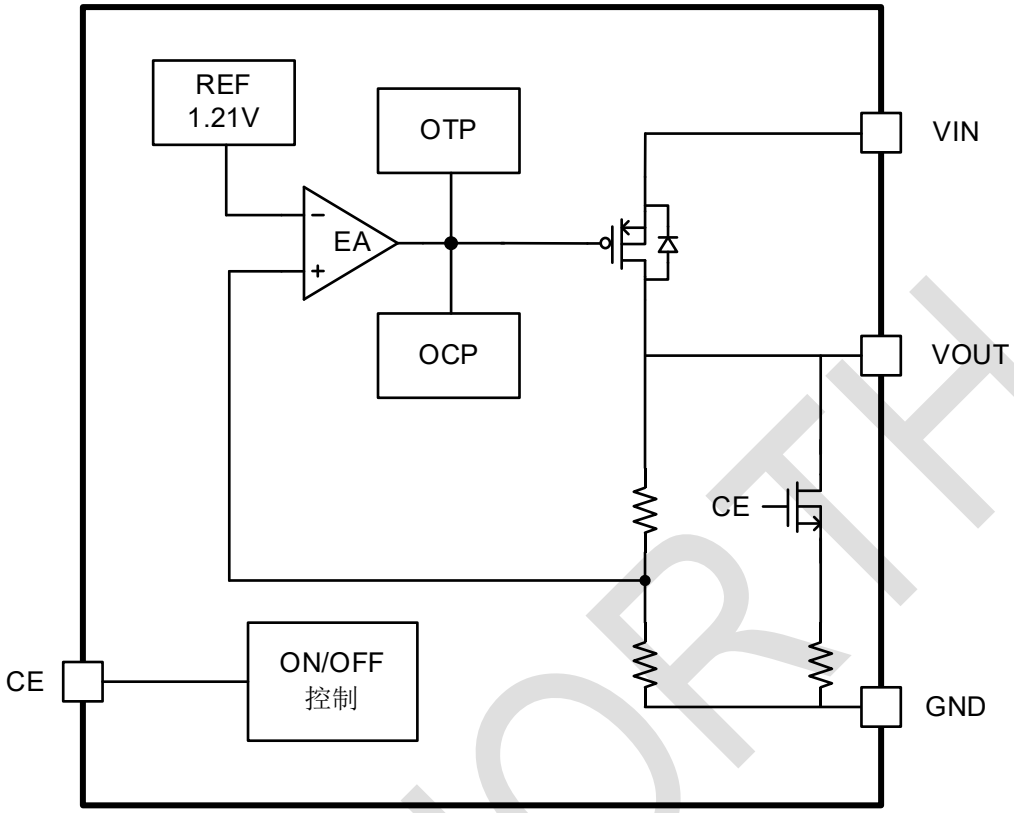
6 Pinout



7 Typical Application



8 Block Diagram



9 Pin Descriptions

CN8501M XXXOGR	CN8501M XXXAOGR	CN8501M XXXTCR	CN8501M XXXTCRA	CN8501M XXXTGR	Pin Name	Descriptions
SOT89-3	SOT89-3	SOT23-5	SOT23-5	SOT23-3		
/	/	3	/	/	CE	Enable pin
2	1	2	2	1	GND	Ground
		4	3、4		NC	No Connection
3	2	1	1	3	VIN	Power supply input
1	3	5	5	2	VOUT	Voltage output

10 Specifications

10.1 Absolute Maximum Ratings

Parameter	Symbol	Value	Units
Supply Input Voltage	V_{IN}	28	V
Output Voltage	V_{OUT}	-0.3 ~ 7	V
CE Voltage	V_{CE}	-0.3 ~ 28	V
Operating Junction Temperature Range	T_{OPR}	-40 ~ 150	°C
Soldering Temperature	T_{LEAD}	260(soldering,10s)	°C
Storage Temperature Range	T_{STG}	-55 ~ 150	°C

Note1: Stress exceeds these ratings listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Expose to absolute-maximum-rated conditions for extended periods may affect device reliability.

10.2 ESD Ratings

Discharge mode	Standardize	Value	Units
HBM	ESDA/JEDEC JS-001-2017	±4000	V
CDM	ESDA/JEDEC JS-002-2018	±2000	V

10.3 Recommended Operating Range

Parameter	Symbol	Min.	Max.	Units
Input Voltage Range	V_{IN}	V_{OUT}+1	20	V
Output Voltage Range	V_{OUT}	1.8	5	V
Operating Ambient Temperature Range	T_A	-40	85	°C
Output Current	I_{OUT}	0	500	mA
Input Capacitor	C_{IN}	1		μF
Output Capacitor	C_{OUT}	1		μF

10.4 Thermal Information

Parameter		CN8501					Units
		OGR [SOT89-3]	AOGR [SOT89-3]	TCR [SOT23-5]	TCRA [SOT23-5]	TGR [SOT23-3]	
$R_{\theta JA}$	Junction to ambient	100	165	195.7	195.7	297.3	°C/W
$R_{\theta JC(top)}$	Junction to case(top)	121.4	65.8	88.2	88.2	128.5	°C/W
$R_{\theta JB}$	Junction to Board	37.3	32.4	40.7	40.7	91.7	°C/W

(1) Thermal resistance is not a fixed constant; its value is influenced by the following factors: PCB heat dissipation capacity, number and thickness of copper layers, ambient temperature, airflow velocity, etc.

(2) The thermal resistance values listed in the datasheet are provided solely for customers to compare the thermal performance of different packages. Since the heat dissipation conditions of the PCB in actual customer applications differ from those of our test boards, the actual measured thermal resistance values may vary from the nominal values in the datasheet. Customers should conduct verification on their own system boards to ensure that the thermal design meets the requirements of the product application.

10.5 Electrical Characteristics

CN8501M050

(VIN=VOUT+1V, CIN=1μF, COUT=1μF, TA=25°C, unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{OUT}	I_{OUT} = 30mA	4.9	5	5.1	V
Maximum Output Current	I_{OUTMAX}	V_{IN} =V_{OUT}+1V	500			mA
Load regulation	ΔV_{OUT}	1mA ≤ I_{OUT} ≤ 500mA		15	23	mV
Dropout voltage	V_{DIF1}	I_{OUT} = 100mA		100	203	mV
Input Quiescent Current	I_Q	V_{IN} = 6V		0.5	1	μA
Shutdown Current	I_{SD}	V_{CE} = 0V		0.01		μA
Line regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} * V_{OUT}}$	I_{OUT} = 0mA ΔV_{OUT}+1V ≤ ΔV_{IN} ≤ 18V		0.003	0.36	%/V
CE Rising Threshold	V_{CEH}	On, output voltage stabilized	1.3			V
CE Falling Threshold	V_{CEL}	Off, output voltage is 0			0.4	V
Short-Circuit Current	I_{SHORT}	V_{IN}=V_{OUT}+1V, V_{CE} = V_{IN} V_{OUT} = 0V		50		mA
Current Limiting	I_{limit}	V_{OUT}=$V_{OUT(E)}$ X 0.95 V_{IN} = V_{OUT} +2V	500	800		mA
Load Capacitor Discharge Resistance	R_{DCHG}	V_{CE} = V_{SS}, V_{OUT} = V_{OUT}		500		Ω
Thermal Shutdown Temperature	OTP			160		°C
Thermal Shutdown Hysteresis	OTP_HYS			30		°C

CN8501M040

(VIN=VOUT+1V, CIN=1μF, COUT=1μF, TA=25°C, unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{OUT}	I_{OUT} = 30mA	3.92	4	4.08	V
Maximum Output Current	I_{OUTMAX}	V_{IN} =V_{OUT}+1V	500			mA
Load regulation	ΔV_{OUT}	1mA ≤ I_{OUT} ≤ 500mA		10	23	mV
Dropout voltage	V_{DIF1}	I_{OUT} = 100mA		110	203	mV
Input Quiescent Current	I_Q	V_{IN}=5V		0.5	0.8	μA
		V_{IN} = 7.5V		0.7	1	μA
Shutdown Current	I_{SD}	V_{CE} = 0V		0.01		μA
Line regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} * V_{OUT}}$	I_{OUT} = 0mA ΔV_{OUT}+1V ≤ ΔV_{IN} ≤ 18V		0.01	0.55	%/V
CE Rising Threshold	V_{CEH}	On, output voltage stabilized	1.3			V
CE Falling Threshold	V_{CEL}	Off, output voltage is 0			0.4	V
Short-Circuit Current	I_{SHORT}	V_{IN}=V_{OUT}+1V, V_{CE} = V_{IN} V_{OUT} = 0V		50		mA
Current Limiting	I_{limit}	V_{OUT}=$V_{OUT(E)}$ X 0.95 V_{IN} = V_{OUT} +2V	500	800		mA
Load Capacitor Discharge Resistance	R_{DCHG}	V_{CE} = V_{SS}, V_{OUT} = V_{OUT}		500		Ω
Thermal Shutdown Temperature	OTP			160		°C
Thermal Shutdown Hysteresis	OTP_HYS			30		°C

CN8501M033

(VIN=VOUT+1V, CIN=1μF, COUT=1μF, TA=25°C, unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{OUT}	I_{OUT} = 30mA	3.234	3.3	3.366	V
Maximum Output Current	I_{OUTMAX}	V_{IN} = V_{OUT}+1V	500			mA
Load regulation	ΔV_{OUT}	1mA ≤ I_{OUT} ≤ 500mA		10	23	mV
Dropout voltage	V_{DIF1}	I_{OUT} = 100mA		120	203	mV
Input Quiescent Current	I_Q	V_{IN} = 5V		0.5	0.8	μA
Shutdown Current	I_{SD}	V_{CE} = 0V		0.01		μA
Line regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} * V_{OUT}}$	I_{OUT} = 10mA ΔV_{OUT}+1V ≤ ΔV_{IN} ≤ 18V		0.01	0.55	%/V
CE Rising Threshold	V_{CEH}	On, output voltage stabilized	1.3			V
CE Falling Threshold	V_{CEL}	Off, output voltage is 0			0.4	V
Short-Circuit Current	I_{SHORT}	V_{IN} = V_{OUT}+1V, V_{CE} = V_{IN} V_{OUT} = 0V		50		mA
Current Limiting	I_{limit}	V_{OUT} = $V_{OUT(E)}$ X 0.95 V_{IN} = V_{OUT} +2V	500	800		mA
Load Capacitor Discharge Resistance	R_{DCHG}	V_{CE} = V_{SS}, V_{OUT} = V_{OUT}		500		Ω
Thermal Shutdown Temperature	OTP			160		°C
Thermal Shutdown Hysteresis	OTP_HYS			30		°C

Notes:

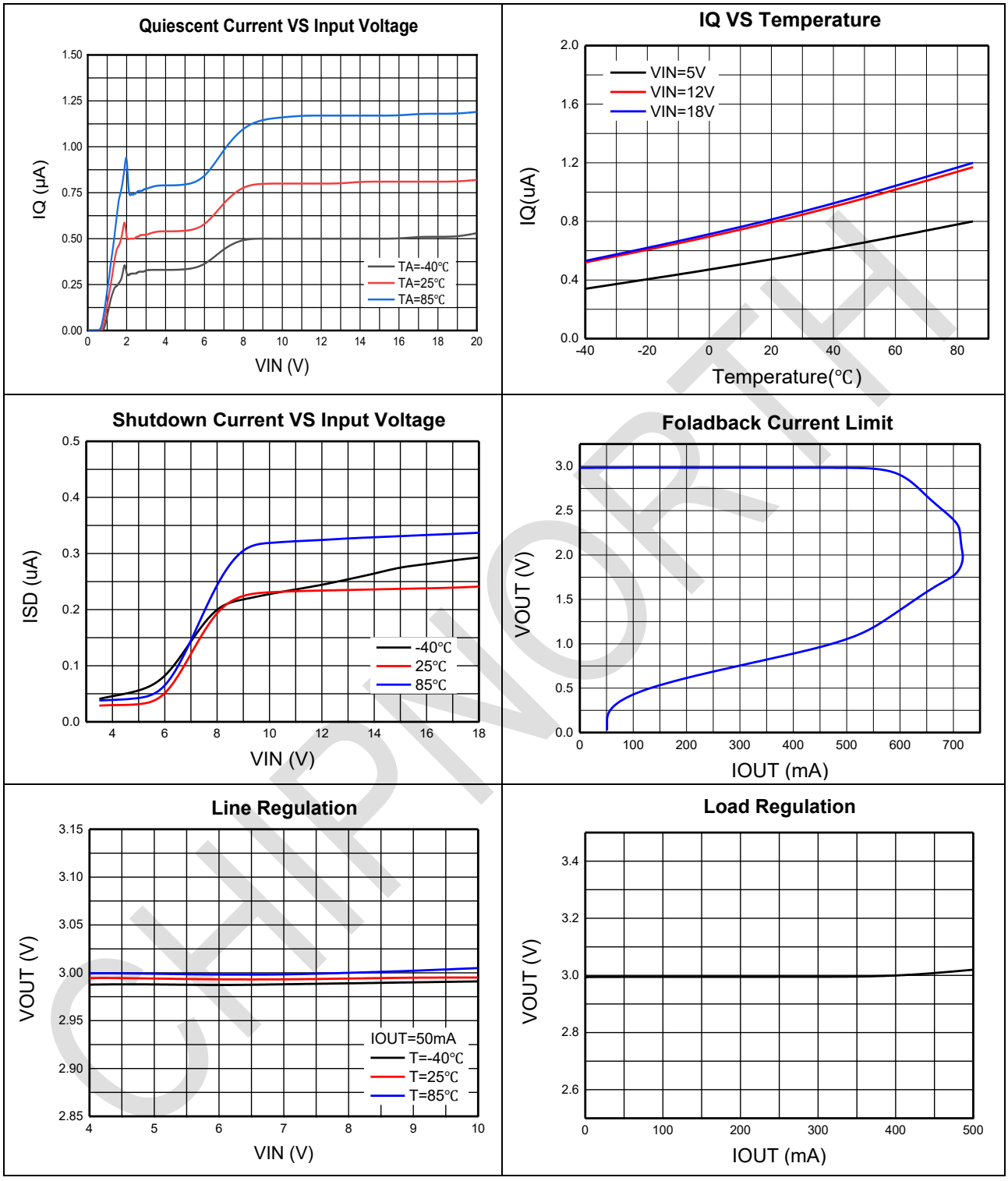
*1. VOUT(E): output voltage when VIN = VOUT + 1V, IOUT = 1mA.

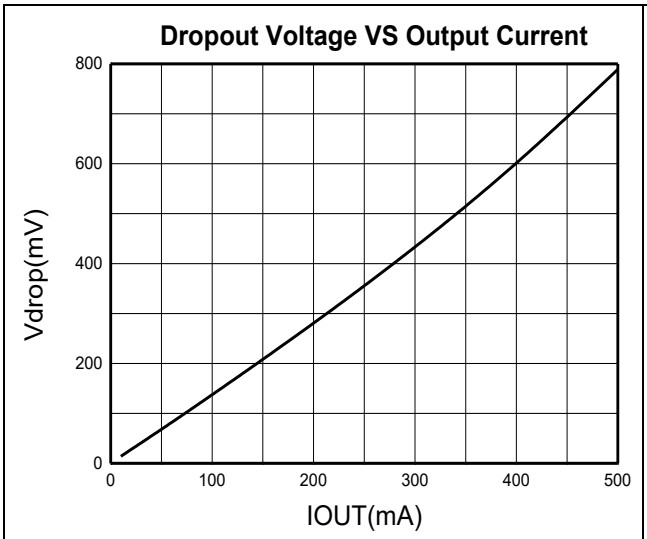
*2. VDROP=VIN-(VOUT_REG*0.98), VOUT_REG is the output voltage when VIN = VOUT + 1.0V and IOUT = 100mA. VIN is the input voltage, and when the input voltage is gradually reduced, the output voltage becomes 98% of VOUT_REG.

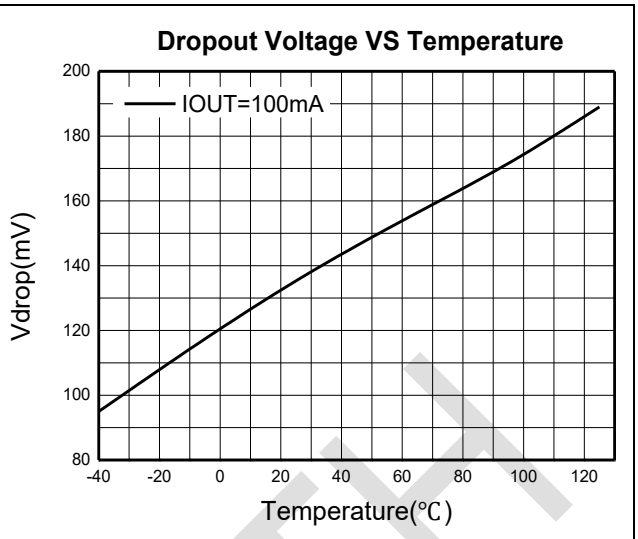
*3. ILIMIT: Output current when VIN = VOUT + 1V and VOUT = 0.95 X VOUT(E).

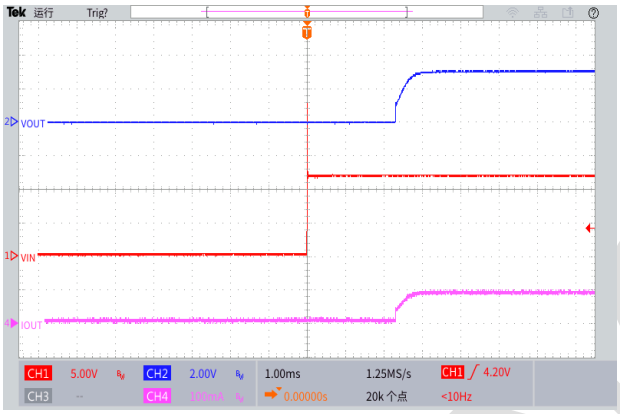
10.6 Characteristics Curve

(VIN=12V, CIN=1uF, COUT= 1uF, TA=25°C, unless otherwise specified.)

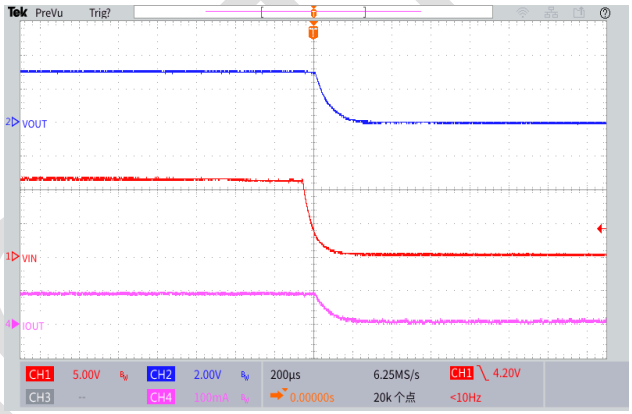




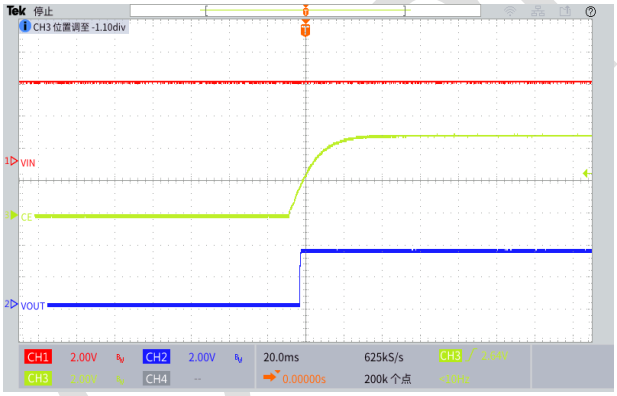




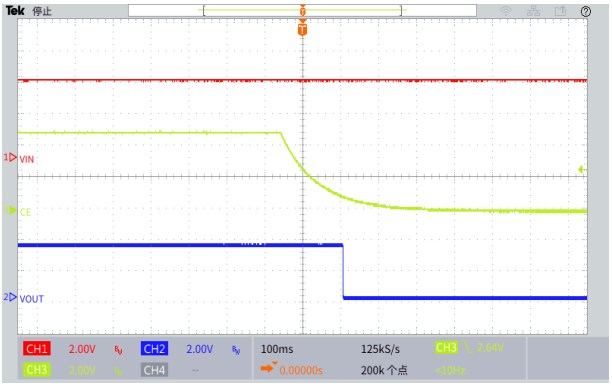
Power on



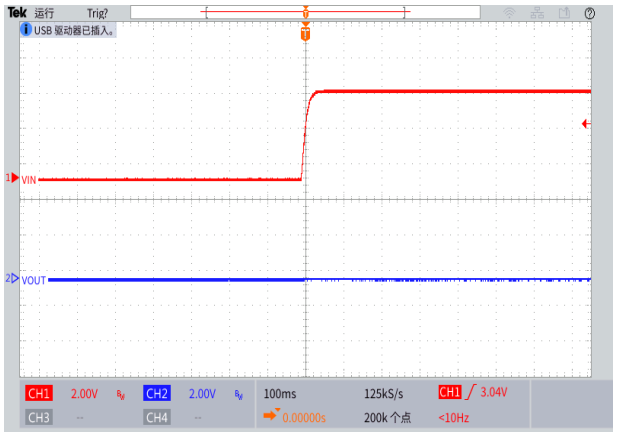
Power down



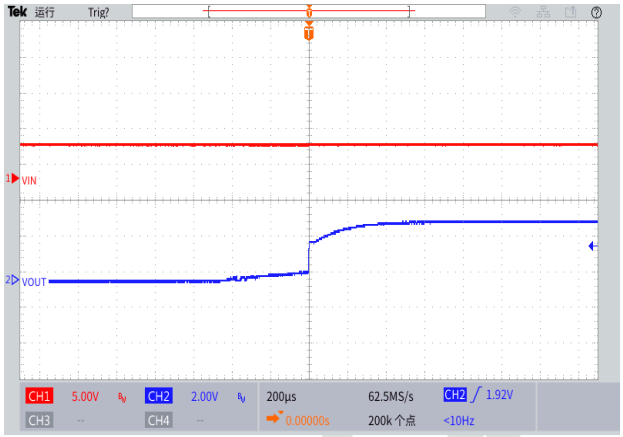
Enable on



Enable down



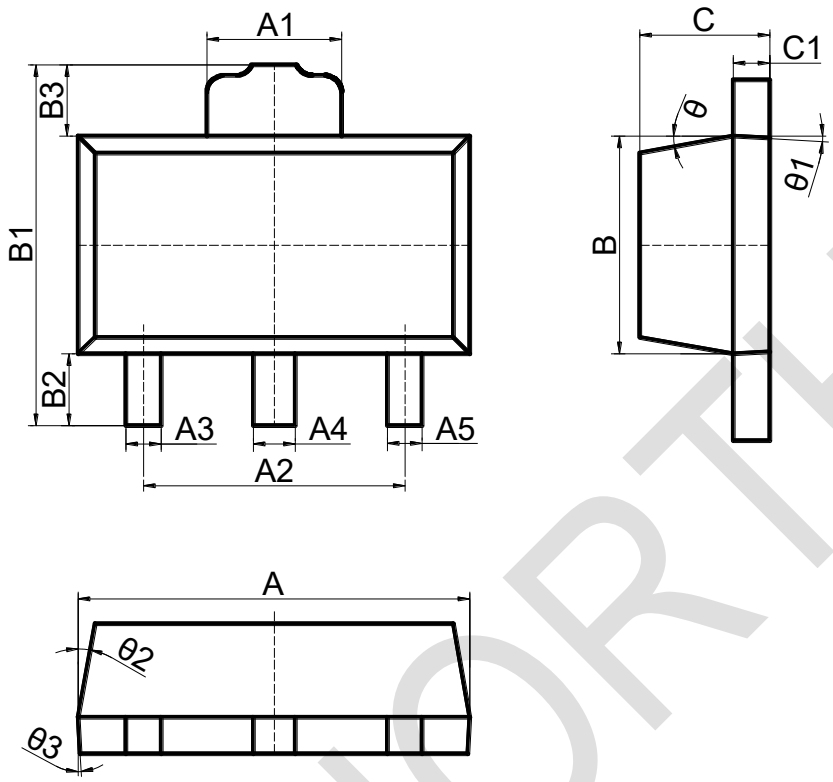
Short circuit protection



Short circuit recovery

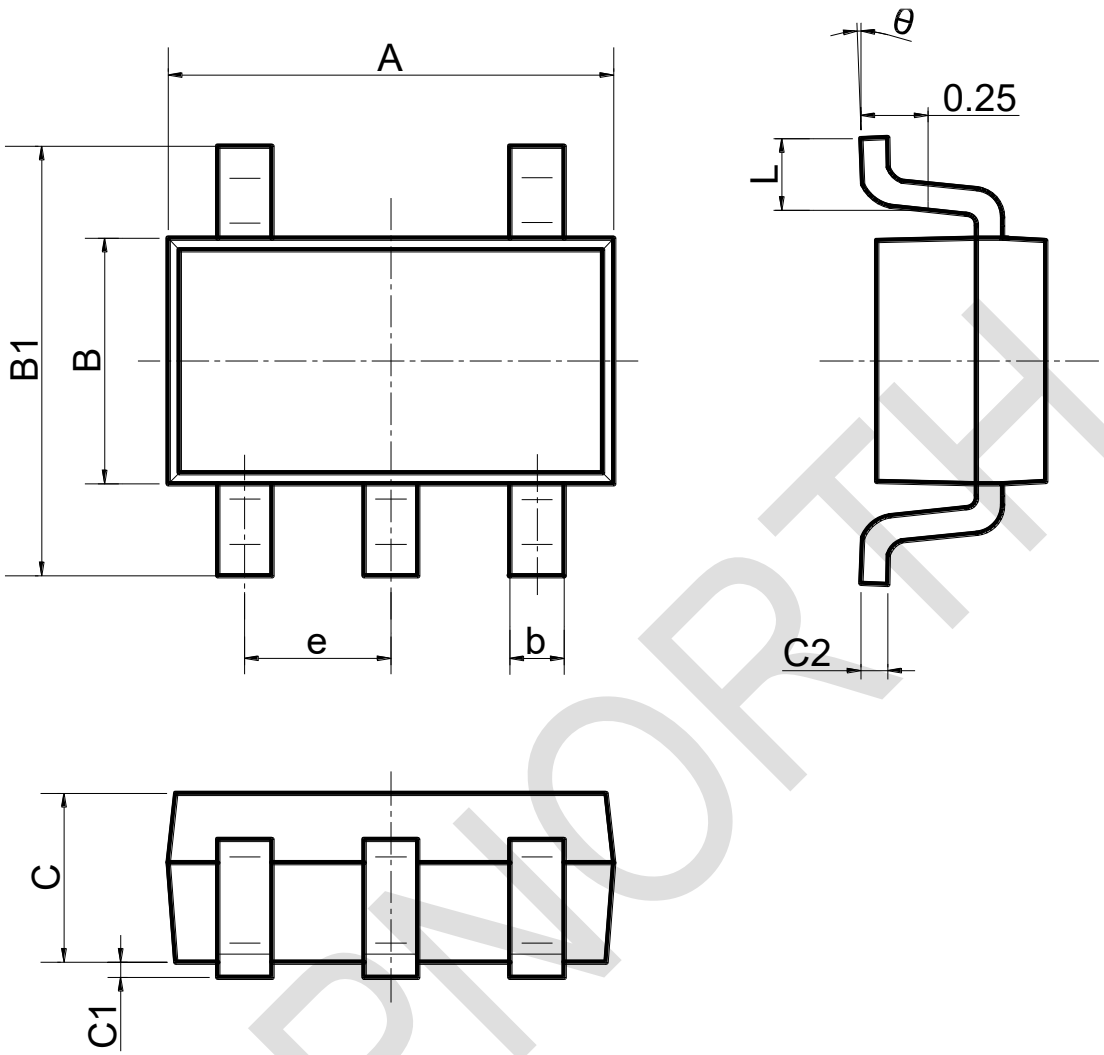
11 Package Information

SOT89-3



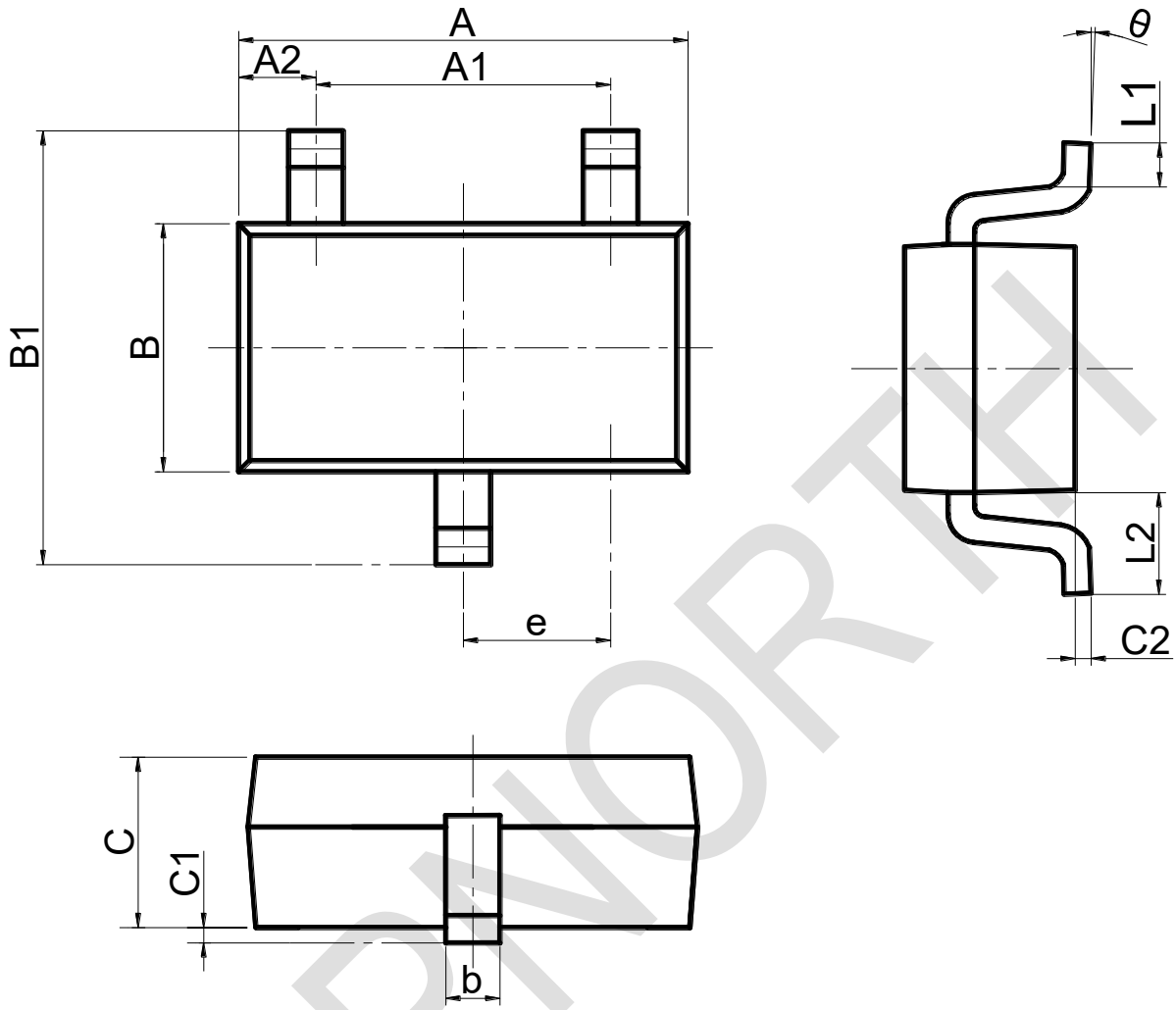
Symbol \ Size	Min(mm)	Max(mm)
A	4.40	4.60
A1	1.65	1.75
A2	2.95	3.05
A3	0.35	0.45
A4	0.43	0.53
A5	0.35	0.45
B	2.40	2.60
B1	4.05	4.25
B2	0.82	0.83
B3	0.82	0.83
C	1.40	1.60
C1	0.35	0.45
θ	6°TYP4	
θ1	3°TYP4	
θ2	6°TYP4	
θ3	3°TYP4	

SOT23-5



Symbol \ Size	Min(mm)	Max(mm)
A	2.82	3.02
e	0.95(BSC)	
b	0.27	0.35
B	1.50	1.70
B1	2.60	3.00
C	1.05	1.15
C1	0.03	0.15
C2	0.135	0.23
L	0.35	0.55
θ	0°	8°

SOT23-3



Size / Symbol	Min(mm)	Typ(mm)	Max(mm)
A	2.70	2.90	3.10
A1	1.70	1.90	2.10
A2			0.60
e	0.85	0.95	1.05
b	0.30	0.40	0.50
B	1.50	1.60	1.80
B1	2.60	2.80	3.00
C	1.00	1.10	1.20
C1			0.10
C2	0.02		0.08
L1	0.20		0.55
L2		0.60	
θ	0°		15°

12 Important Statement

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