20V/500mA、0.7uA
超低功耗、高精度线性稳压器

1 简介

CN8501 是一款以 CMOS 工艺制造的超低静态功耗、低压差线性稳压器。稳压器消耗电流约 0.7uA，使能关断后功耗为 0.01uA（典型）。内置使能控制，输出放电，短路保护，热关断功能，提供 SOT89-3、SOT23-5、SOT23-3 封装。

2 特征

- 超低静态电流：0.7μA
- 关断电流：0.01uA
- 输入范围：2.8V-20V
- 输出范围：1.8V-5V（间隔 0.1V）
- 高精度：±2%
- 最大输出电流：500mA
- 使能控制
- 输出放电
- 输出短路保护
- 过热保护

3 应用领域

- 手机
- 电池供电设备
- 无线电话，无线通讯设备
- 摄像机录像机
- 便携式视听设备
- 掌上电脑

4 订购信息

产品编号	封装	数量/编带
CN8501MXXXOGR	SOT89-3	1000/盘
CN8501MXXXAOGR	SOT89-3	1000/盘
CN8501MXXXTCR	SOT23-5	3000/盘
CN8501MXXXTGR	SOT23-3	3000/盘
CN8501MXXXTCRA	SOT23-5	3000/盘

5 丝印

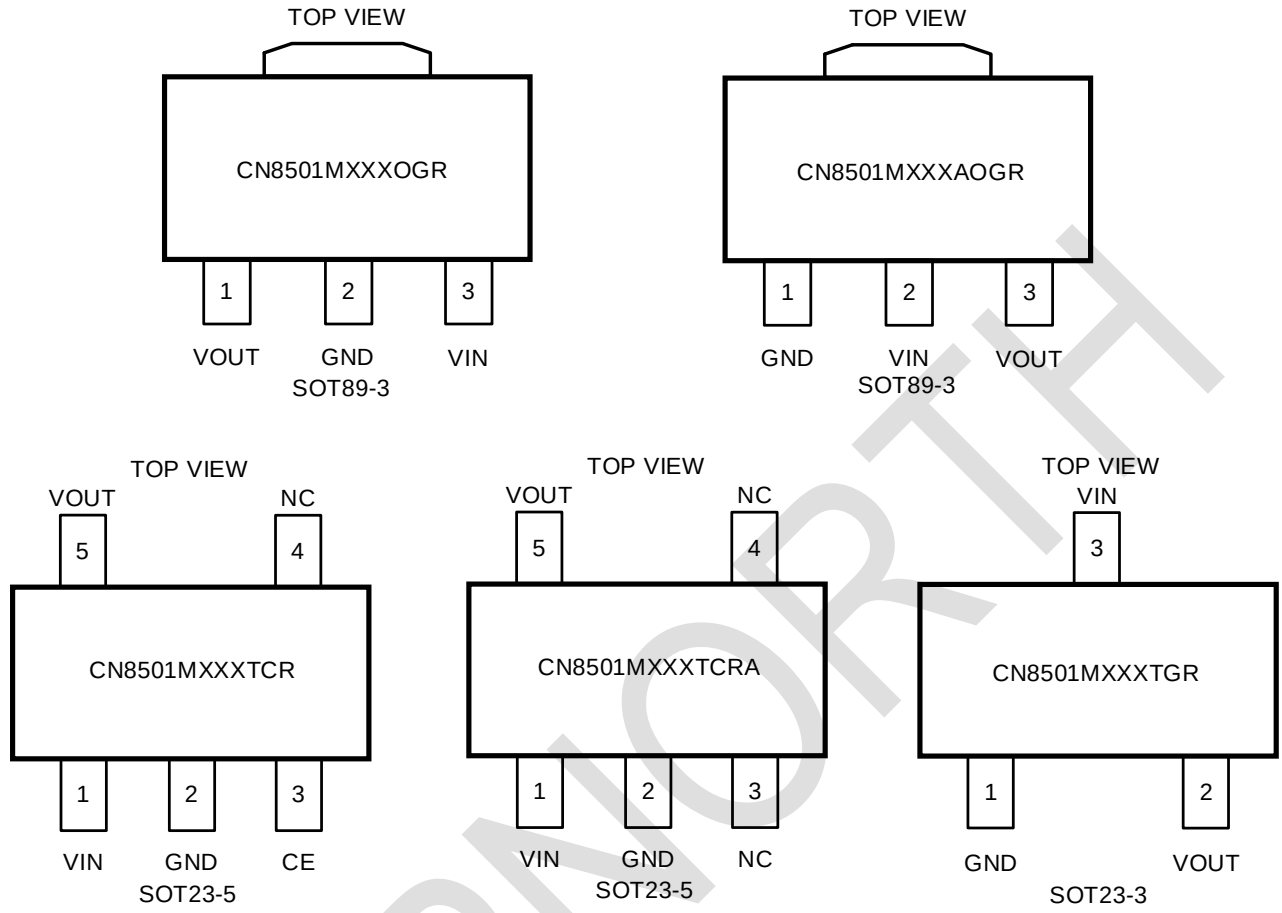
产品编号	丝印*
CN8501MXXXAOGR	01MXXXA YYWW
CN8501MXXXOGR	01MXXX YYWW
CN8501MXXXTCR	MXXX YYWW
CN8501MXXXTGR	MXXX YYWW
CN8501MXXXTCRA	MXXXA YYWW

注*：YY/Y=Year；WW/W=Week；8501MXXX=Product Name，XXX= Output Voltage

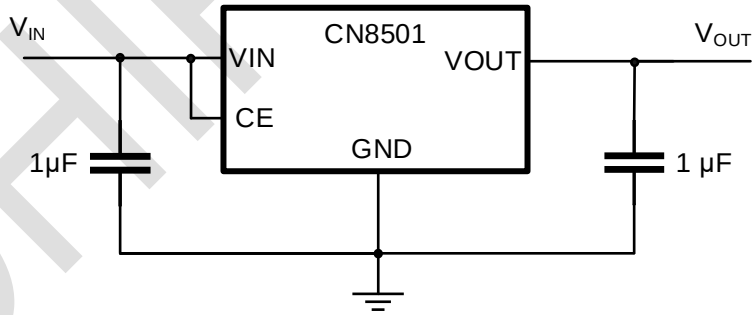
绿色(ROHS&HF)：芯北科技将“绿色”定义为无铅(符合 ROHS 标准)且不含卤素物质。如果您有其他意见或问题，请直接联系您的芯北代表。

湿敏等级(MSL)：3

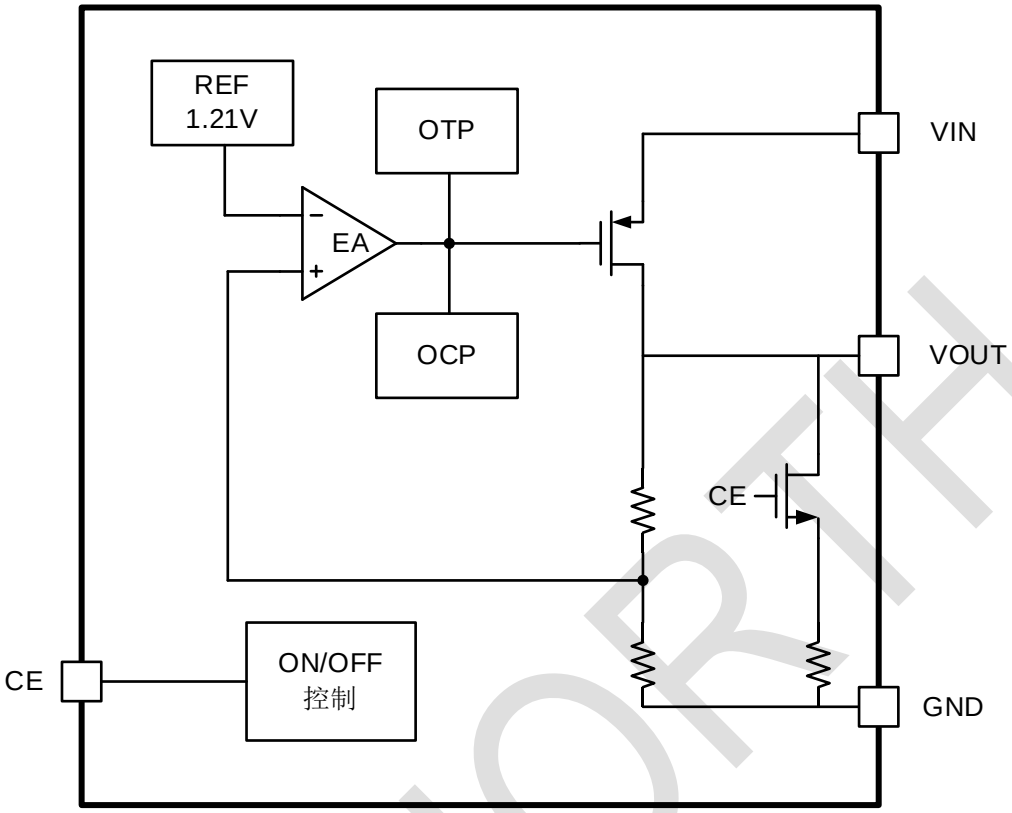
6 引脚排列



7 典型应用



8 功能框图



9 引脚描述

CN8501M XXXOGR	CN8501M XXXAOGR	CN8501M XXXTCR	CN8501M XXXTCRA	CN8501M XXXTGR	引脚名称	引脚描述
SOT89-3	SOT89-3	SOT23-5	SOT23-5	SOT23-3		
无	无	3	无	无	CE	使能引脚
2	1	2	2	1	GND	地
无	无	4	3、4	无	NC	无连接
3	2	1	1	3	VIN	电压输入端
1	3	5	5	2	VOUT	电压输出端

10 规格

10.1 绝对最大额定值

参数	符号	值	单位
VIN 引脚最大电压	V_{IN}	28	V
VOUT 引脚最大电压	V_{OUT}	-0.3 ~ 7	V
CE 引脚	V_{CE}	-0.3 ~ 28	V
工作结温(T_J)	T_{OPR}	-40 ~ 150	°C
焊接温度	T_{LEAD}	260(soldering，10s)	°C
存储温度范围	T_{STG}	-55 ~ 150	°C

备注：超出绝对最大额定值运行可能会对器件造成损坏。绝对最大额定值并不表示器件在这些条件下或在建议运行条件以外的任何其他条件下能够正常运行。如果超出建议运行条件但在绝对最大额定值范围内使用，器件可能不会完全正常运行，这可能影响器件的可靠性、功能和性能并缩短器件寿命。

10.2 静电放电等级

放电模式	规范	值	单位
HBM	ESDA/JEDEC JS-001-2017	±4000	V
CDM	ESDA/JEDEC JS-002-2018	±2000	V

10.3 推荐工作条件

参数	符号	最小值	最大值	单位
输入电压范围	V_{IN}	V_{OUT}+1	20	V
输出电压范围	V_{OUT}	1.8	5.0	V
工作温度环境	T_A	-40	85	°C
输出电流	I_{OUT}	0	500	mA
输入电容	C_{IN}	1		μF
输出电容	C_{OUT}	1		μF

10.4 热阻

热指标		CN8501					单位
		OGR [SOT89-3]	AOGR [SOT89-3]	TCR [SOT23-5]	TCRA [SOT23-5]	TGR [SOT23-3]	
$R_{\theta JA}$	结至环境热阻	72.5	131.7	195.7	195.7	297.3	°C/W
$R_{\theta JC(top)}$	结至外壳(顶部)热阻	121.4	65.8	88.2	88.2	128.5	°C/W
$R_{\theta JB}$	结至电路板热阻	37.3	32.4	40.7	40.7	91.7	°C/W

10.5 电性参数

CN8501M050

测试条件：V_{IN}=V_{OUT}+1V，C_{IN}=1μF，C_{OUT}=1μF，T_A=25°C，除非另有规定。

参数	符号	条件	最小	典型	最大	单位
输出电压	V_{OUT}	I_{OUT}=30mA	4.9	5	5.1	V
最大输出电流	I_{OUTMAX}	V_{IN}=V_{OUT}+1V	500			mA
负载特性 (Load regulation)	ΔV_{OUT}	1mA ≤ I_{OUT} ≤ 500mA		15	23	mV
压差	V_{DIF1}	I_{OUT} =100mA		100	203	mV
静态电流	I_{SS}	V_{IN}=V_{OUT}+1V		0.5		μA
关断电流	I_{SD}	V_{CE}=0V		0.01		μA
电源电压调整率 (Line regulation)	$\frac{\Delta V_{OUT}}{\Delta V_{IN} * V_{OUT}}$	I_{OUT}=10mA ΔV_{OUT}+1V ≤ ΔV_{IN} ≤ 18V		0.003	0.36	%/V
CE 高电平	V_{CEH}	开启，输出电压稳定	1.3			V
CE 低电平	V_{CEL}	关断，输出电压为 0			0.4	V
短路电流	I_{SHORT}	V_{IN}=V_{OUT}+1V，V_{CE}＝V_{IN} V_{OUT}＝0V		50		mA
限流保护	I_{limit}	V_{OUT}=$V_{OUT(E)}$ X 0.95 V_{IN}=V_{OUT} +2V	500	800		mA
负载电容放电电阻	R_{DCHG}	V_{CE}=V_{SS}，V_{OUT}=V_{OUT}		500		Ω
热保护阈值	OTP			160		°C
热保护迟滞	OTP_HYS			30		°C

CN8501M033

测试条件：V_{IN}=V_{OUT}+1V，C_{IN}=1μF，C_{OUT}=1μF，T_A=25°C，除非另有规定。

参数	符号	条件	最小	典型	最大	单位
输出电压	V_{OUT}	I_{OUT}=30mA	3.234	3.3	3.366	V
最大输出电流	I_{OUTMAX}	V_{IN}=V_{OUT}+1V	500			mA
负载特性 (Load regulation)	ΔV_{OUT}	1mA≤I_{OUT}≤500mA		10	23	mV
压差	V_{DIF1}	I_{OUT} =100mA		120	203	mV
静态电流	I_{SS}	V_{IN}=V_{OUT}+1V		0.5		μA
关断电流	I_{SD}	V_{CE}=0V		0.01		μA
电源电压调整率 (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 高电平	V_{CEH}	开启，输出电压稳定	1.3			V
CE 低电平	V_{CEL}	关断，输出电压为 0			0.4	V
短路电流	I_{SHORT}	V_{IN}=V_{OUT}+1V，V_{CE}＝V_{IN} V_{OUT}＝0V		50		mA
限流保护	I_{limit}	V_{OUT}=$V_{OUT(E)}$ X 0.95 V_{IN}=V_{OUT} +2V	500	800		mA
负载电容放电电阻	R_{DCHG}	V_{CE}=V_{SS}，V_{OUT}=V_{OUT}		500		Ω
热保护阈值	OTP			160		°C
热保护迟滞	OTP_HYS			30		°C

注：

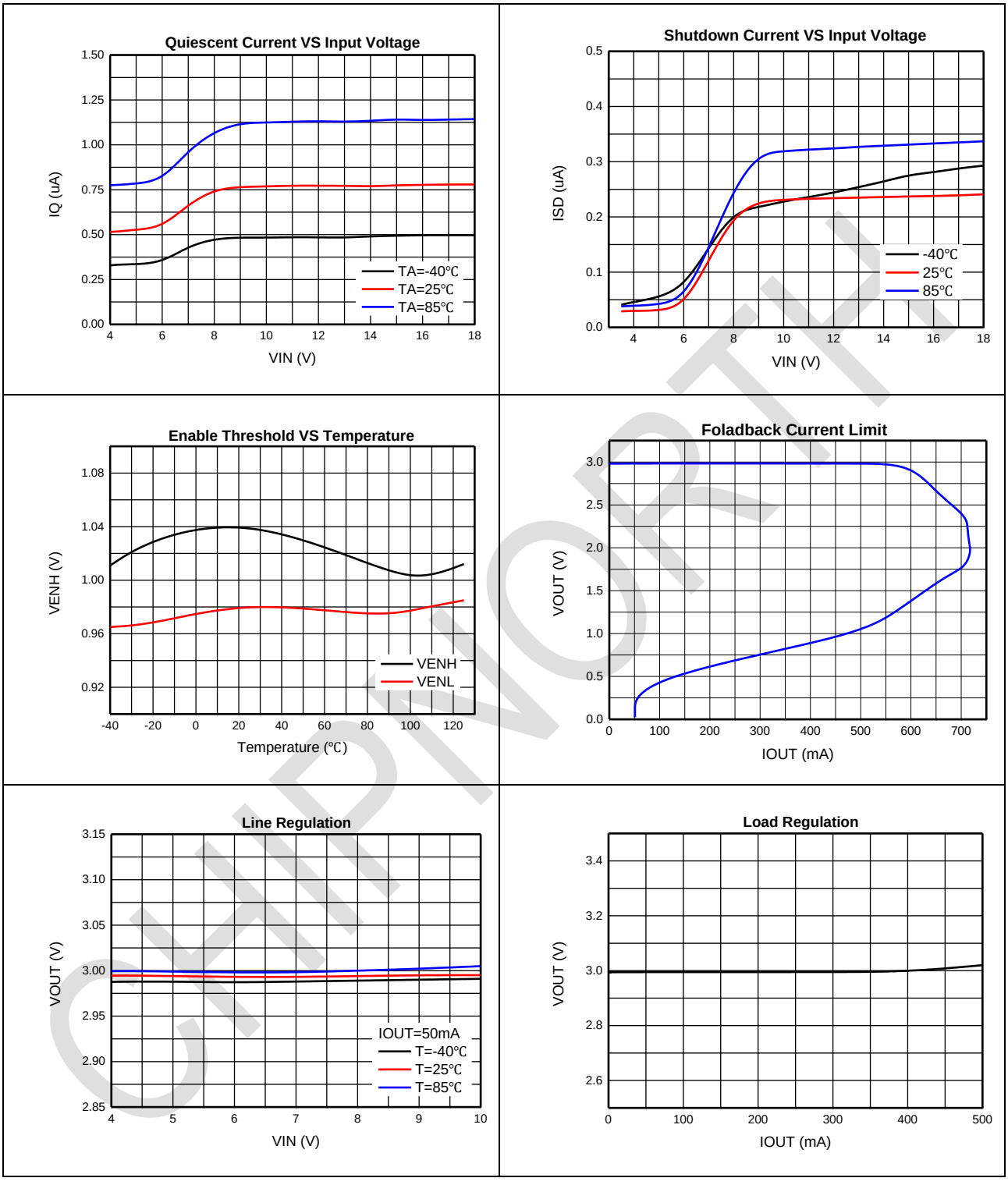
*1. $V_{OUT(E)}$: V_{IN} = V_{OUT} + 1V，I_{OUT} = 1mA 时的输出电压。

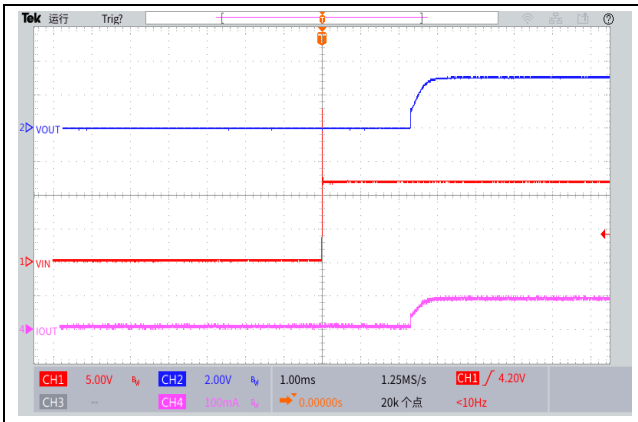
*2. V_{DROP}=V_{IN}-(V_{OUT_REG}*0.98)，V_{OUT_REG} 是当 V_{IN}=V_{OUT}+1.0V 和 I_{OUT}=100mA 时的输出电压。V_{IN} 是输入电压，当输入电压逐渐降低后，输出电压变为 V_{OUT_REG} 的 98%。

*3. I_{LIMIT}: 当 V_{IN} = V_{OUT} + 1V 和 V_{OUT} = 0.95 X $V_{OUT(E)}$时的输出电流。

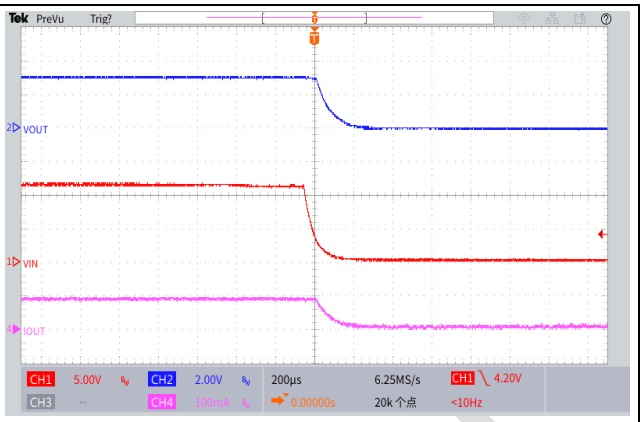
10.6 特性曲线（CN8501）

测试条件：V_{IN}=12V，C_{IN}=1uF，C_{OUT}= 1uF，T_A=25°C，除非另有规定

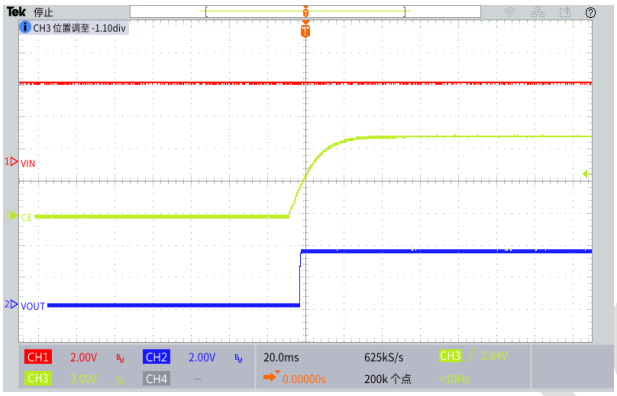




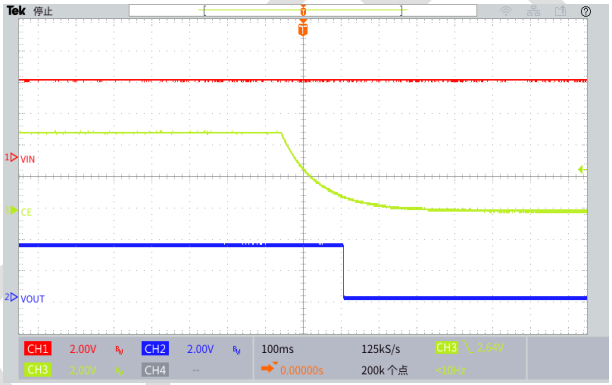
Power on



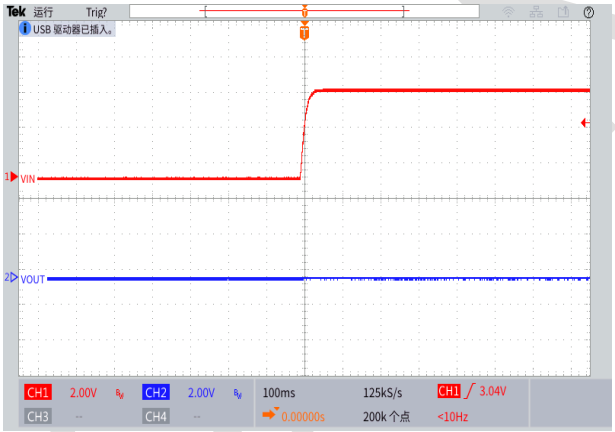
Power down



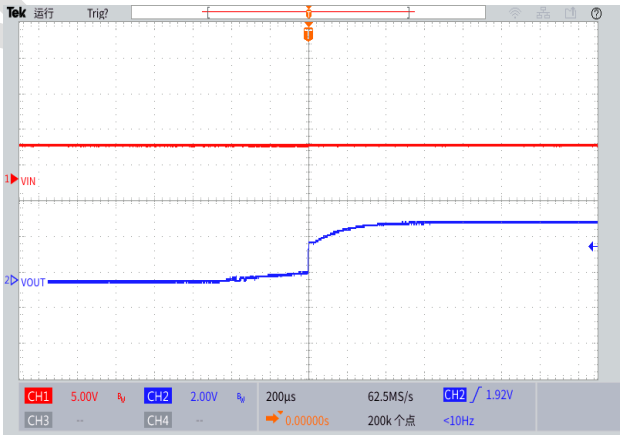
Enable on



Enable down



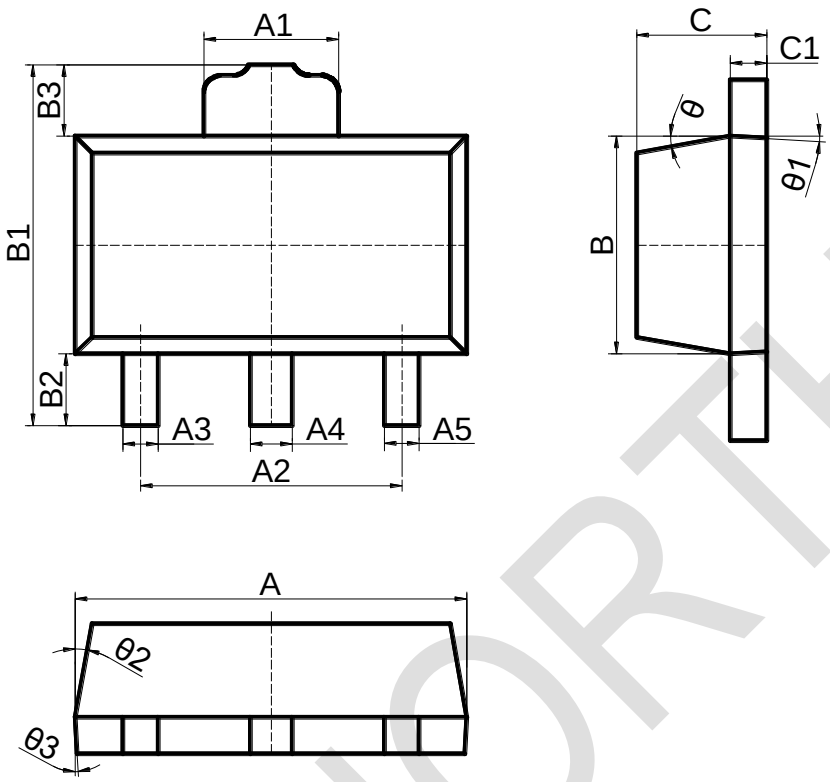
短路保护



短路恢复

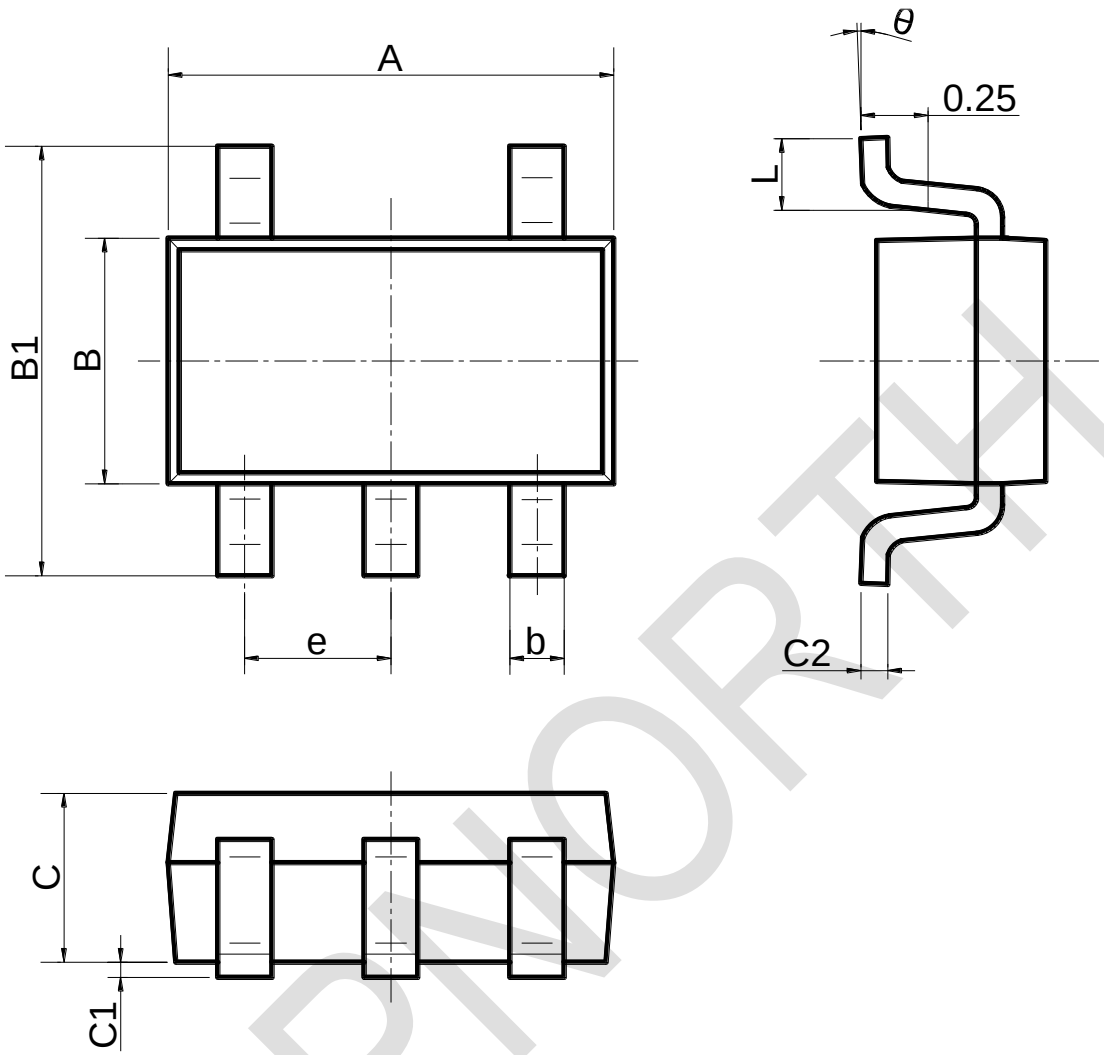
11 封装信息

SOT89-3



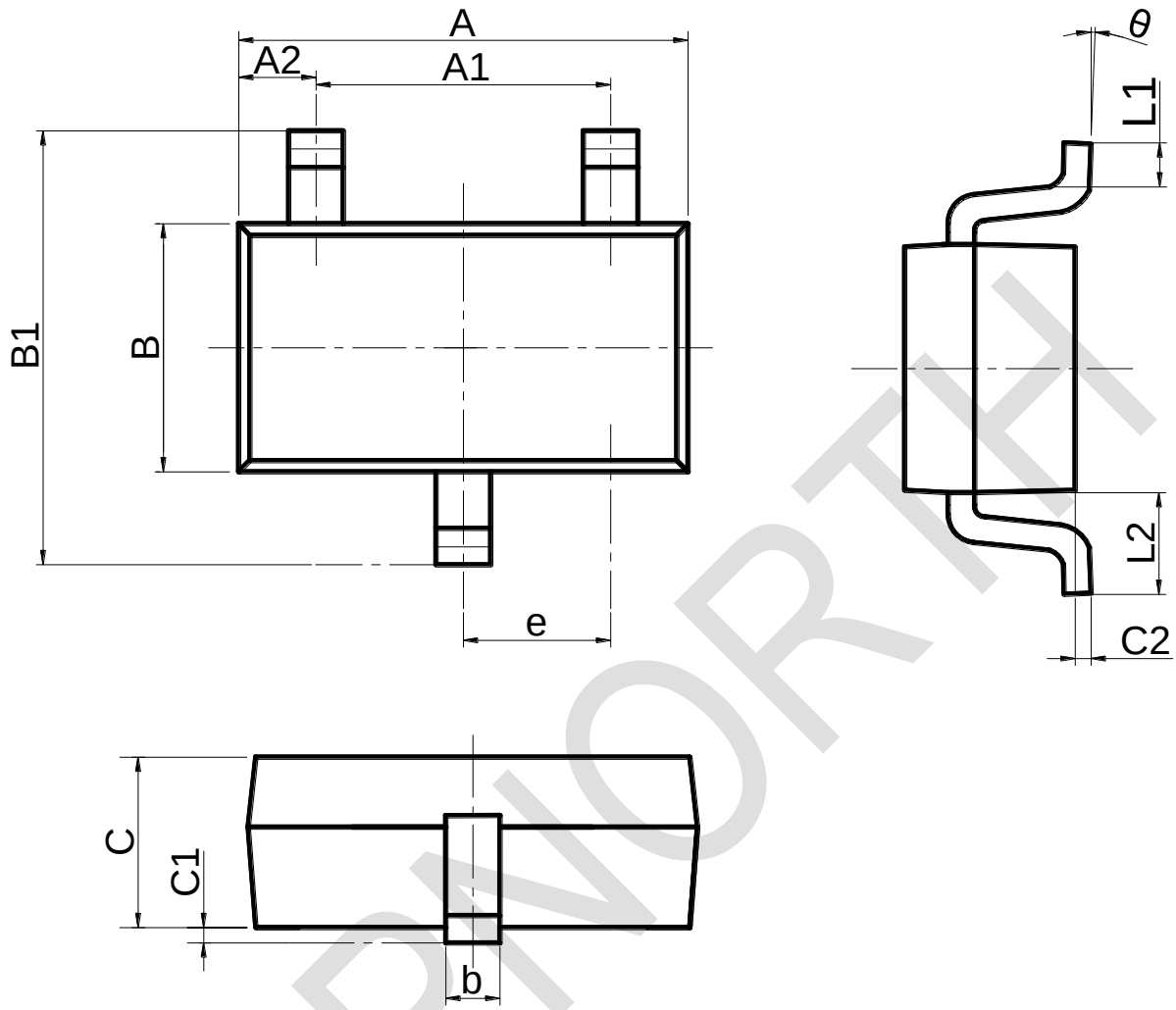
尺寸 / 标注	最小(mm)	最大(mm)
A	4.40	4.60
A1	1.65	1.75
A2	2.95	3.05
A3	0.35	0.45
A4	0.43	0.53
A5	0.35	0.45
B	2.40	2.60
B1	4.05	4.25
B2	0.82	0.83
B3	0.82	0.83
C	1.40	1.60
C1	0.35	0.45
θ	6°TYP4	
θ1	3°TYP4	
θ2	6°TYP4	
θ3	3°TYP4	

SOT23-5



尺寸 / 标注	最小(mm)	最大(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



尺寸 / 标注	最小(mm)	标准值(mm)	最大(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 重要声明

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20V/500mA, 0.7uA 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 0.7uA 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: 0.7μA
- Shutdown Current: 0.01uA
- Input Range: 2.8V-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

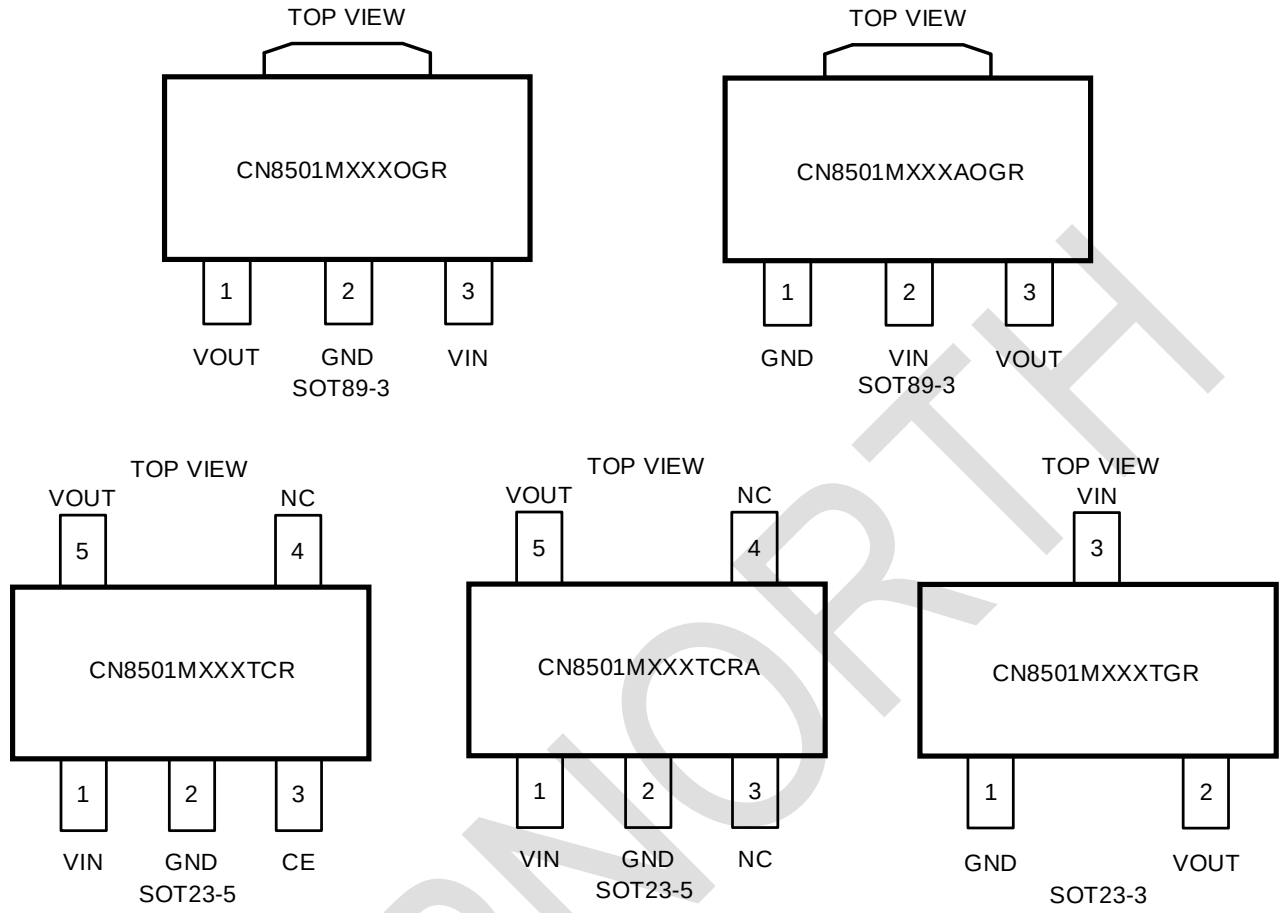
Product Number	Marking*
CN8501MXXXAOGR	01MXXXA YYWW
CN8501MXXXOGR	01MXXX YYWW
CN8501MXXXTCR	MXXX YYWW
CN8501MXXXTGR	MXXX YYWW
CN8501MXXXTCRA	MXXXA YYWW

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

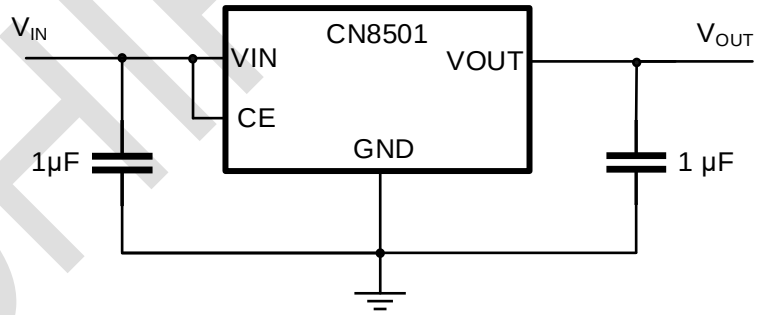
Green (RoHS & HF): CHIPNORTH defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your CHIPNORTH representative directly.

Moisture sensitivity level(MSL):3

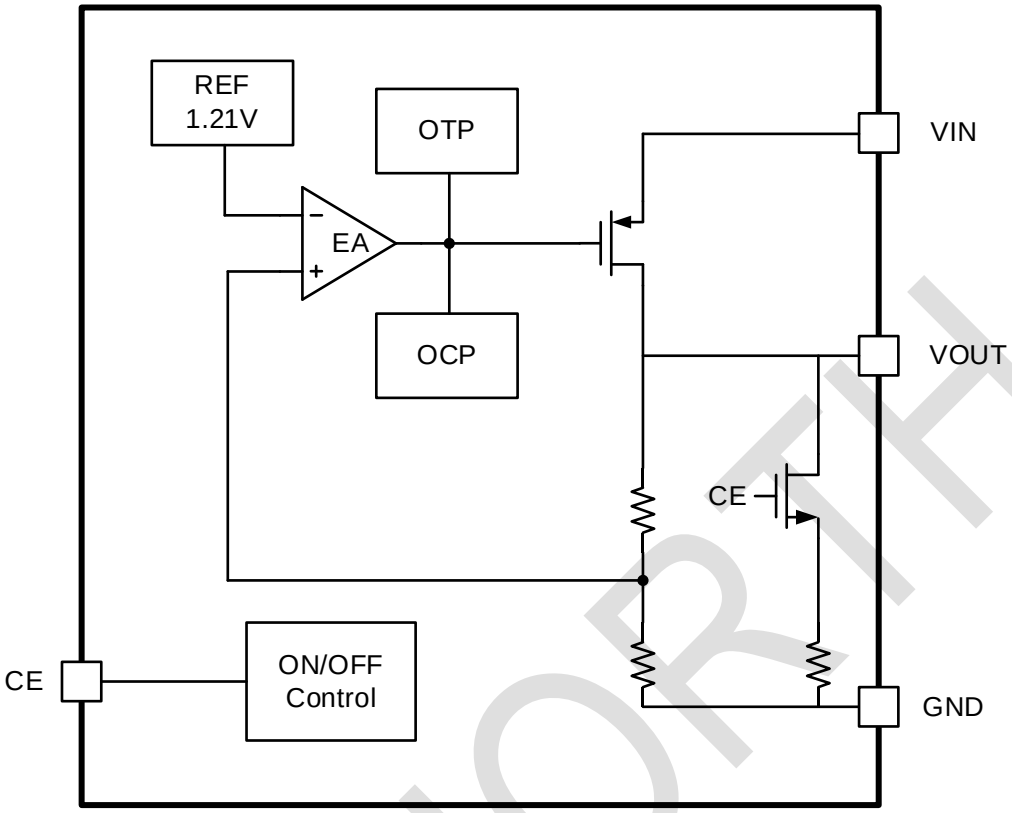
6 Pinout



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	72.5	131.7	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

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_{SS}	V_{IN} =V_{OUT}+1V		0.5		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

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_{SS}	V_{IN} = V_{OUT}+1V		0.5		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:

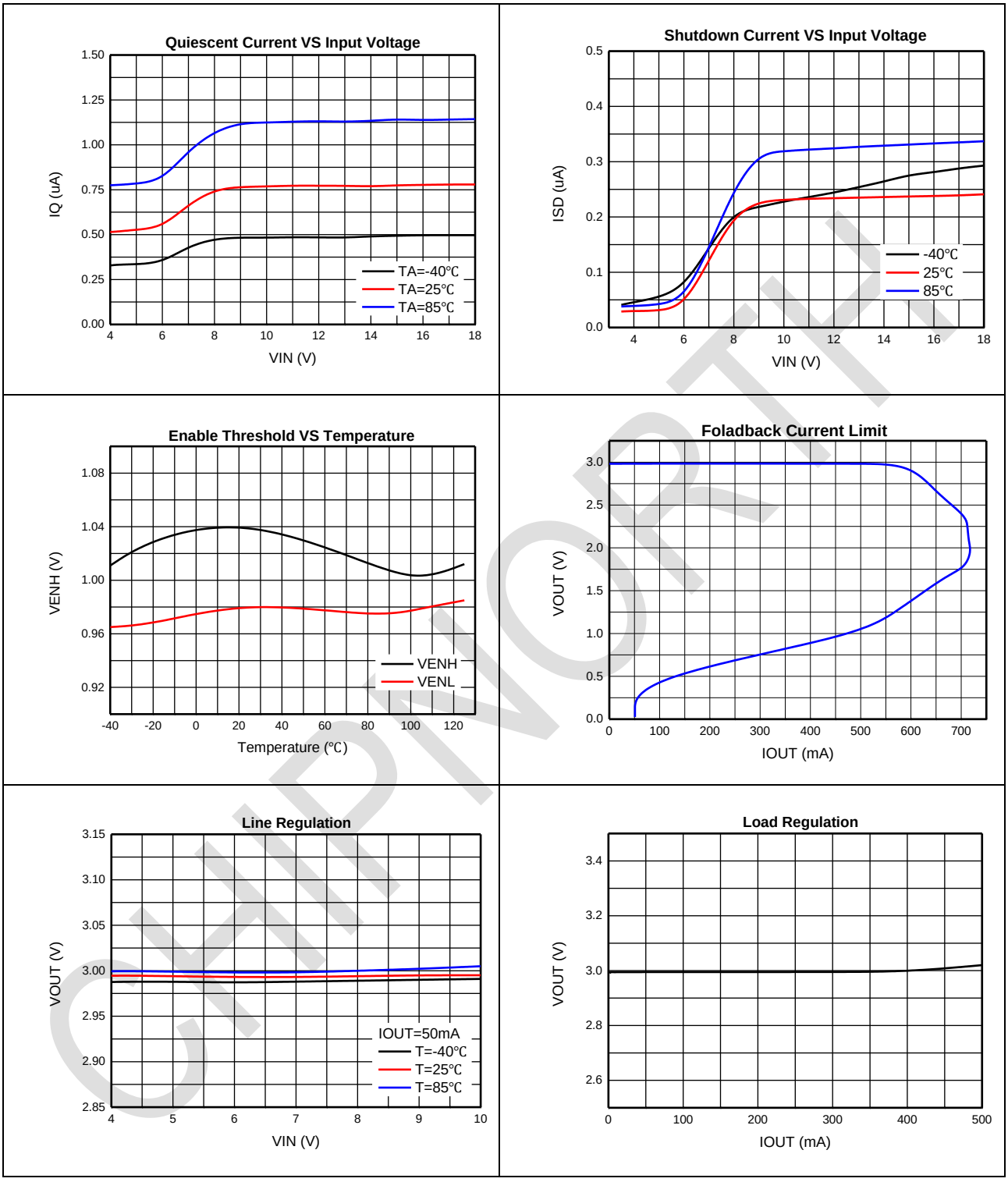
*1. VOUT(E): output voltage when VIN = VOUT + 1V, IOUT = 1mA.

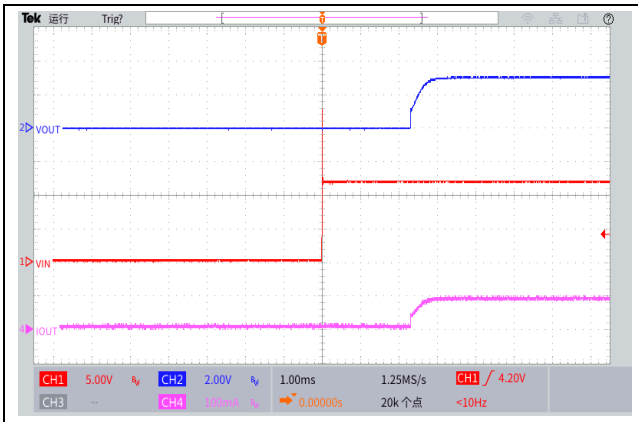
*2. VDROP=VIN-(VOUT_REG*0.98), VOUT_REG is the output voltage when VIN = VOUT + 1.0V and IOUT = 100mA. VIN is the input voltage, and when the input voltage is gradually reduced, the output voltage becomes 98% of VOUT_REG.

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

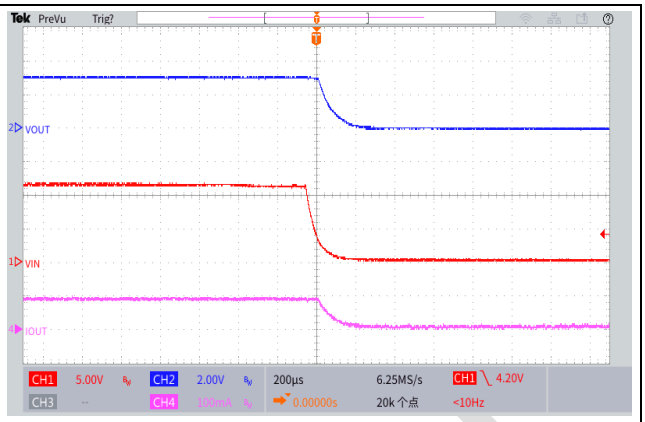
10.6 Characteristics Curve（CN8501）

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

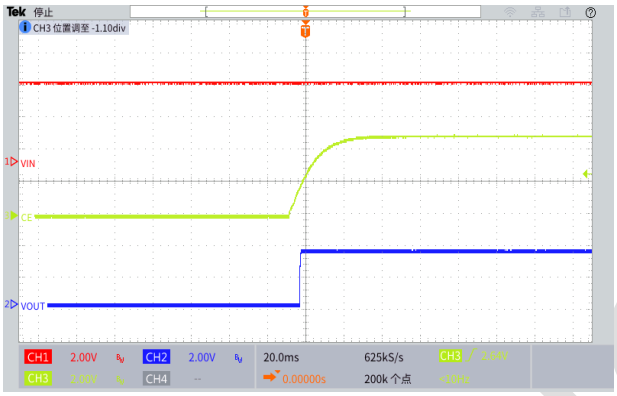




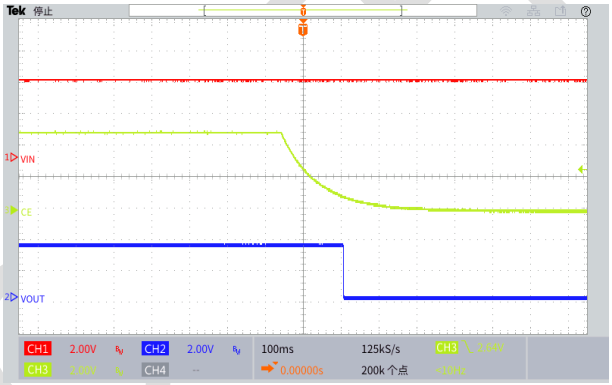
Power on



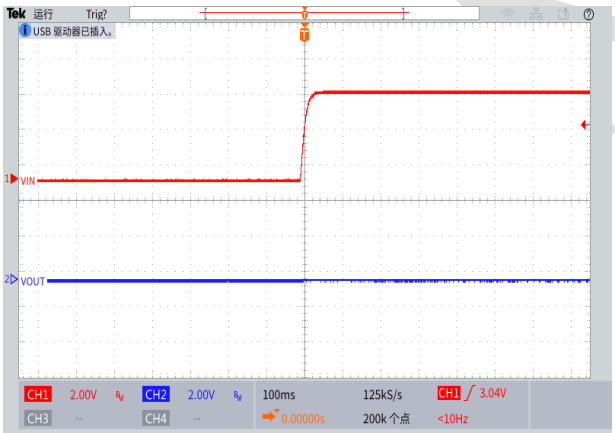
Power down



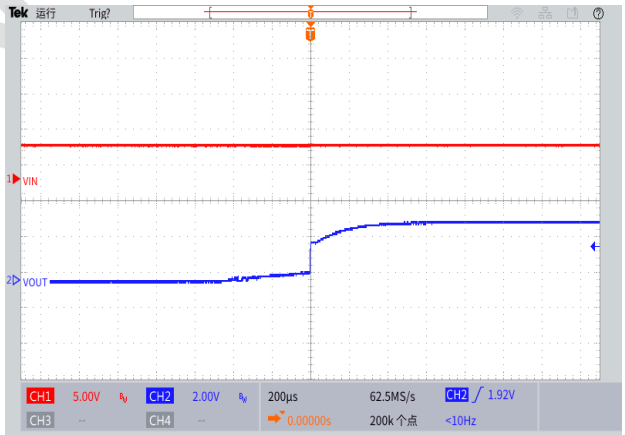
Enable on



Enable down



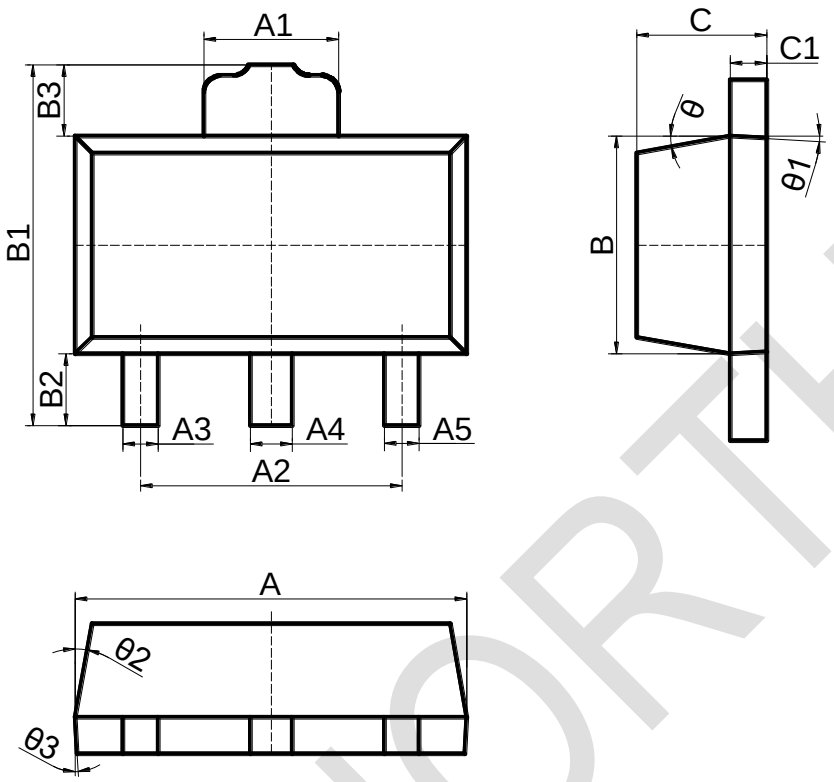
Short circuit protection



Short circuit recovery

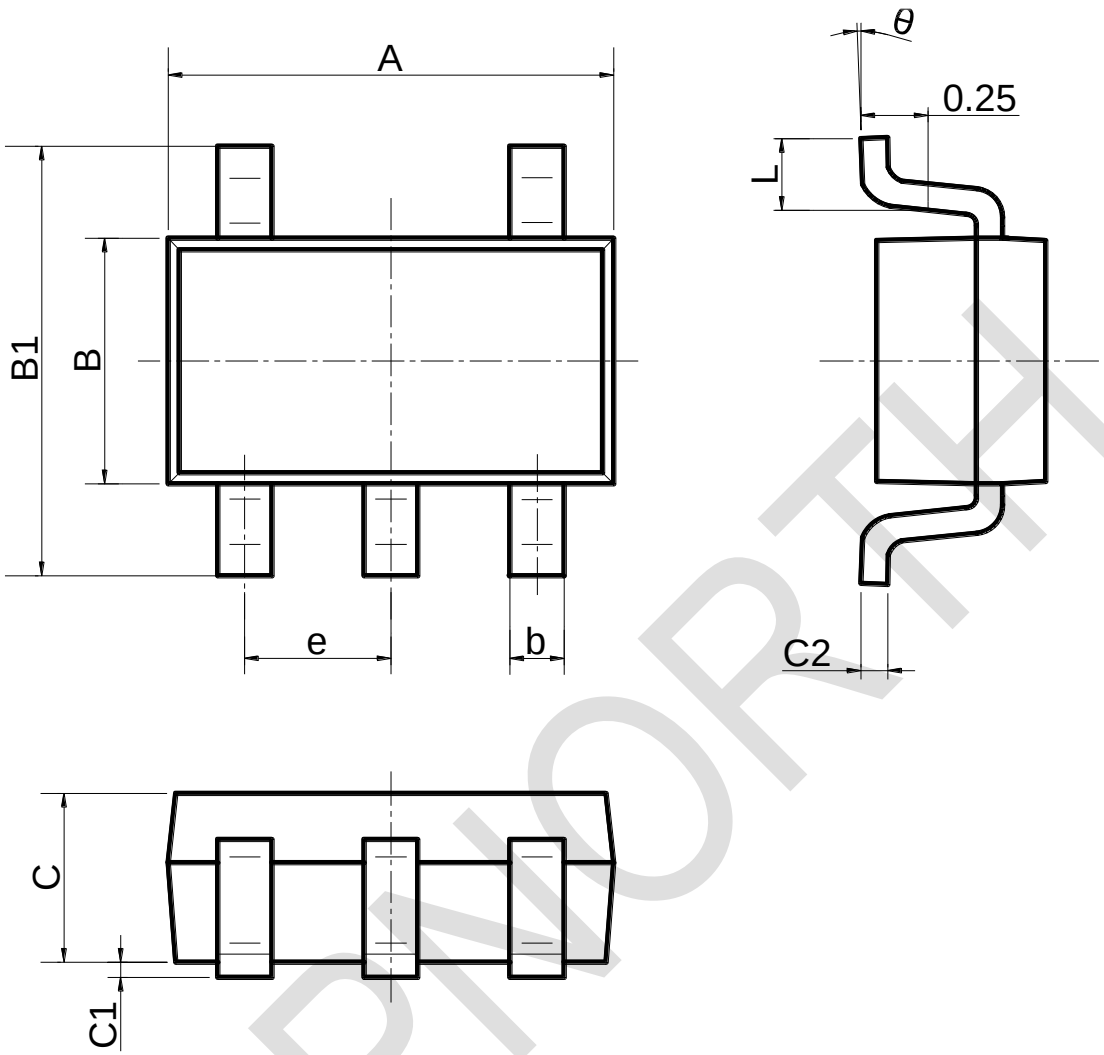
11 Package Information

SOT89-3



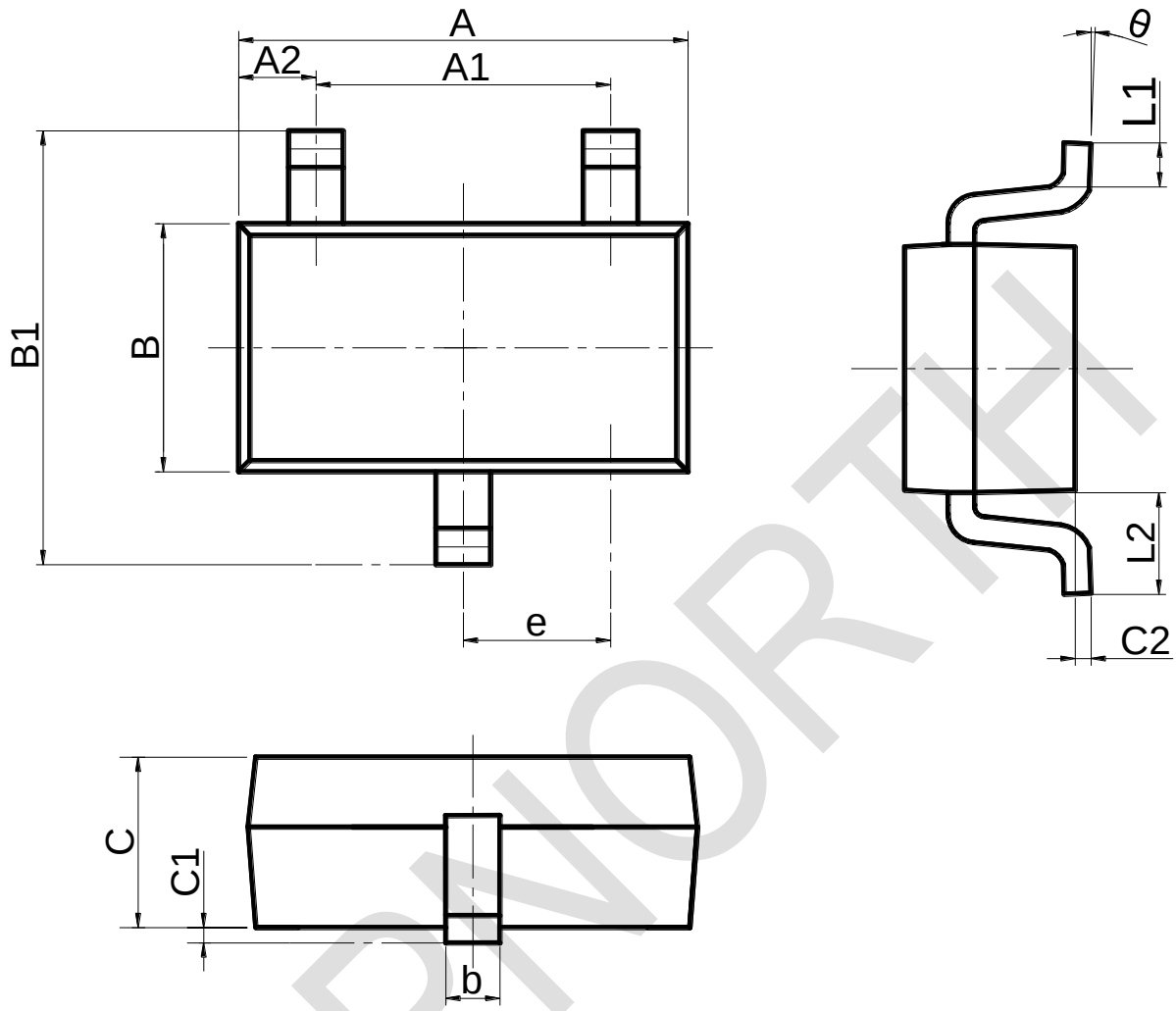
Symbol \ Size	Min(mm)	Max(mm)
A	4.40	4.60
A1	1.65	1.75
A2	2.95	3.05
A3	0.35	0.45
A4	0.43	0.53
A5	0.35	0.45
B	2.40	2.60
B1	4.05	4.25
B2	0.82	0.83
B3	0.82	0.83
C	1.40	1.60
C1	0.35	0.45
θ	6°TYP4	
θ1	3°TYP4	
θ2	6°TYP4	
θ3	3°TYP4	

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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