High-precision, Low Power Linear Regulator with Current Foldback Function

1 Description

CN87MXXX is a high-precision, low-power, low-dropout voltage linear regulator with current foldback function. It can provide up to 500mA of output current with only 0.6μA quiescent current and foldback current limit protection. The LDO is available in SOT89-3, SOT23-3, SOT23-5, and DFNWB-4L package forms.

2 Features

- Ultra-low quiescent current：600nA
- Standby current：≤10nA
- High precision：±2%
- Low dropout voltage：60mV @ IOUT = 100mA @ VOUT = 3.3V
- Maximum output current：500mA
- Input voltage range：Max 6.0V
- Enable control
- Foldback current limit protection

3 Applications

- Smart wearables
- Long-life battery-powered devices
- Portable mobile devices such as mobile phones, cameras, etc
- Wireless communication equipment

4 Ordering information

Product Number	Package	Quantity/Tape
CN87MXXXAOGR	SOT89-3	1000/Tape
CN87MXXXOGR	SOT89-3	1000/Tape
CN87MXXXTGR	SOT23-3	3000/Tape
CN87MXXXTBR	SOT23-5	3000/Tape
CN87MXXXDQR	DFNWB-4L	10000/Tape

Product Number	Output voltage
CN87M012	VOUT=1.2V
CN87M018	VOUT=1.8V
CN87M025	VOUT=2.5V
CN87M028	VOUT=2.8V
CN87M030	VOUT=3.0V
CN87M033	VOUT=3.3V
CN87M036	VOUT=3.6V
CN87M040	VOUT=4.0V
CN87M050	VOUT=5.0V

5 Marking

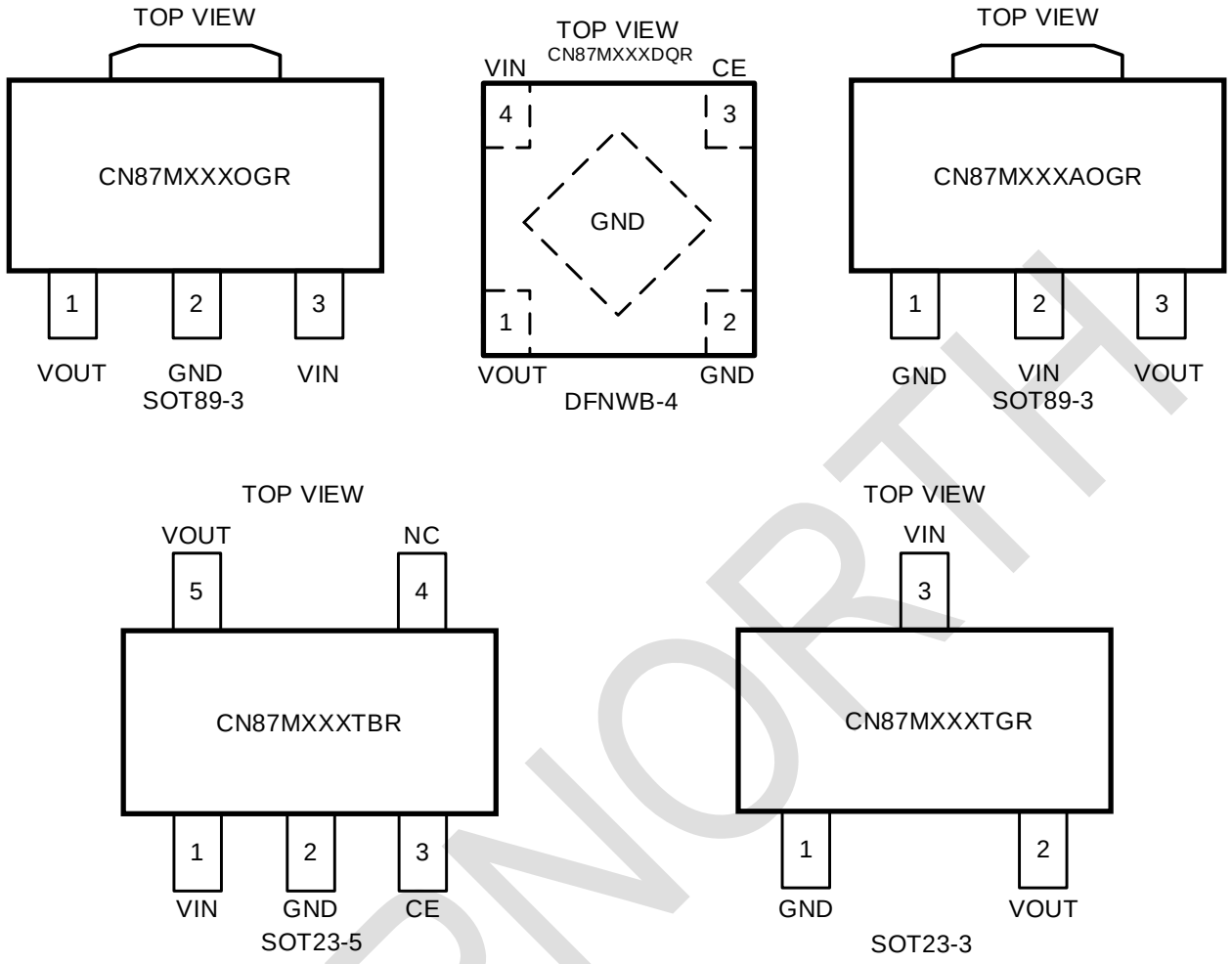
Product Number	Marking
CN87MXXXAOGR	CN87MXXXA YYWW
CN87MXXXOGR	CN87MXXX YYWW
CN87MXXXTGR	87XXXT YYWW
CN87MXXXTBR	87MXXX YYWW
CN87MXXXDQR	XX YW

Note: YY=Year WW=Week.

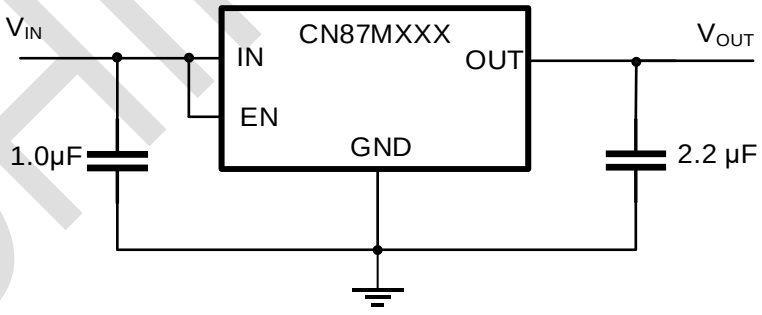
Green (RoHS & HF): CHIPNORTH defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your CHIPNORTH representative directly.

Moisture sensitivity level(MSL):3

6 Pinout

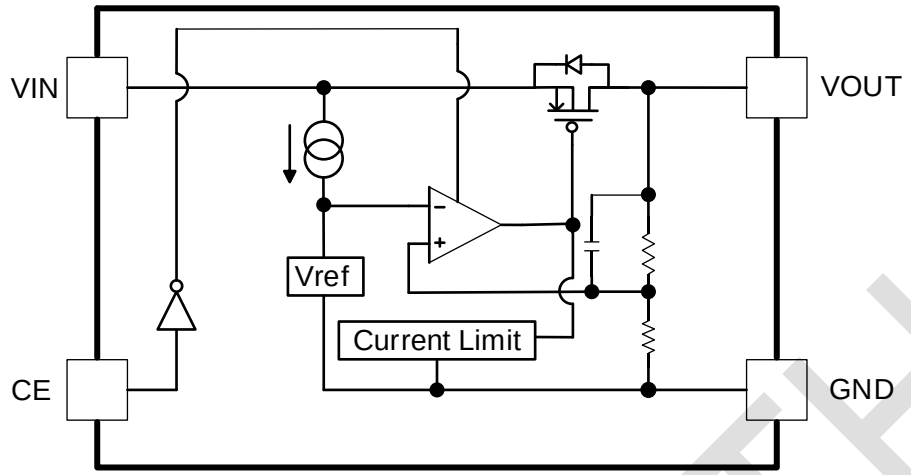


7 Typical Application



Note: All application circuits recommend an input capacitor (CIN ≥1.0μF) near the chip input and an output capacitor (COUT≥2.2μF) near the chip output.

8 Block Diagram



9 Pin Descriptions

Pin Number						Descriptions
PinName	CN87M XXXAOGR	CN87M XXXOGR	CN87M XXXTGR	CN87M XXXDQR	CN87M XXXTBR	
GND	1	2	1	2	2	GND
VIN	2	3	3	4	1	Input
VOUT	3	1	2	1	5	Output
CE				3	3	Enable
NC					4	No Connect

10 Specifications

10.1 Absolute Maximum Ratings

Parameter	Value	Units
Pin input voltage	-0.3 ~ 7	V
Pin output voltage	-0.3 ~ V_{IN}-0.3	V
CE enable voltage	-0.3 ~ 7	V
Soldering Temperature	-55 ~ 150	°C
Storage Temperature Range	260（Soldering 10s）	°C

（1）Stresses in excess of those listed under the absolute maximum rating may cause permanent damage to the device. These listed values are stress levels only and do not indicate that the device will operate under these conditions and under any conditions other than those recommended for operation. Operating at maximum absolute rating for long periods of time can affect device reliability.

（2）All voltage values are based on the ground terminal.

10.2 ESD Ratings

Discharge mode	Norm	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	V_{IN}	V_{OUT}+1	6	V
Operating Temperature	T_A	-40	105	°C

10.4 Thermal Information

Parameter	Package	Value	Units
Junction to ambient thermal resistance ($R_{\theta JA}$)	SOT23-3	220	°C/W
	SOT23-5	188	°C/W
	DFNWB-4	208	°C/W
	SOT89-3（OGR）	100	°C/W
	SOT89-3（AOGR）	165	°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

Test conditions: V_{IN}=V_{OUT}+1V, C_{IN}=1.0μF, C_{OUT}=2.2μF, T_A=25°C, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input voltage range	V_{IN}				6	V
Output voltage range*1	V_{OUT}	V_{IN}=V_{OUT}+1V, I_{OUT}=5mA	$V_{OUT(s)}$ x0.98	$V_{OUT(s)}$	$V_{OUT(s)}$ x1.02	V
Dropout Voltage*2	V_{DROP}	V_{CE} = V_{IN}, V_{OUT} < 2V I_{OUT} = 100mA @ V_{OUT} = 1.8V	80	110	140	mV
		V_{CE} = V_{IN}, V_{OUT} ≥ 2V I_{OUT} = 100mA @ V_{OUT} = 3.3V	40	60	80	mV
Output voltage accuracy		V_{IN}=V_{OUT}+2V, I_{OUT}=10mA	-2		2	%
Linear regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \bullet V_{OUT}}$	V_{IN}=V_{SET}+1V~6V I_{OUT}=1mA@V_{OUT}=3.3V I_{OUT} =0~300mA		0.01		%/V
Load regulation	ΔV_{OUT}	V_{IN} = V_{CE} = V_{OUT} + 1.0V 0mA ≤ I_{OUT} ≤ 300mA @ V_{OUT} = 3.3V	10	31	50	mV
Supply Current (Standby)	I_{SD}	No connect，V_{CE} = V_{IN} =5V	0.1	0.6	1.5	μA
Ground current	I_{GND}	No connect，V_{CE} = V_{IN} =5V	0.1	0.6	1.5	μA
		I_{OUT} = 100mA，V_{CE} = V_{IN} = 5V	60	85	120	μA
Shutdown current	I_{SHUT}	V_{IN} = $V_{OUT(S)}$ + 1V，V_{CE} = 0V		0.01	0.1	μA
Maximum output current	I_{OUT_MAX}		500			mA
Current limit*3	I_{LIMIT}	V_{IN} = V_{CE} = V_{OUT} + 1.0V	500	630		mA
Short-circuit current	I_{SHORT}	V_{IN} = V_{CE} = V_{OUT} + 1.0V		220		mA
CE enablement threshold	V_{CEH}	---	1.5			V
CE shutdown threshold	V_{CEL}	---			0.4	
CE 'H' current	I_{CEH}	V_{IN} = 6.0V, V_{CE} = V_{IN}	-0.1		0.1	μA
CE 'L' current	I_{CEL}	V_{IN} = 6.0V, V_{CE} = 0	-0.1		0.1	μA
OUT discharge resistor		V_{CE} = 0, V_{OUT} = $V_{OUT(S)}$		300		Ω
OTP threshold		95%rated V_{OUT}			160	°C
OTP hysteresis				30		°C
Power supply rejection ratio	PSRR	f=10Hz, V_{OUT} = 2.5V		60		dB
		f=100Hz, V_{OUT} = 2.5V		45		
		f=1kHz, V_{OUT} = 2.5V		25		

Note*:

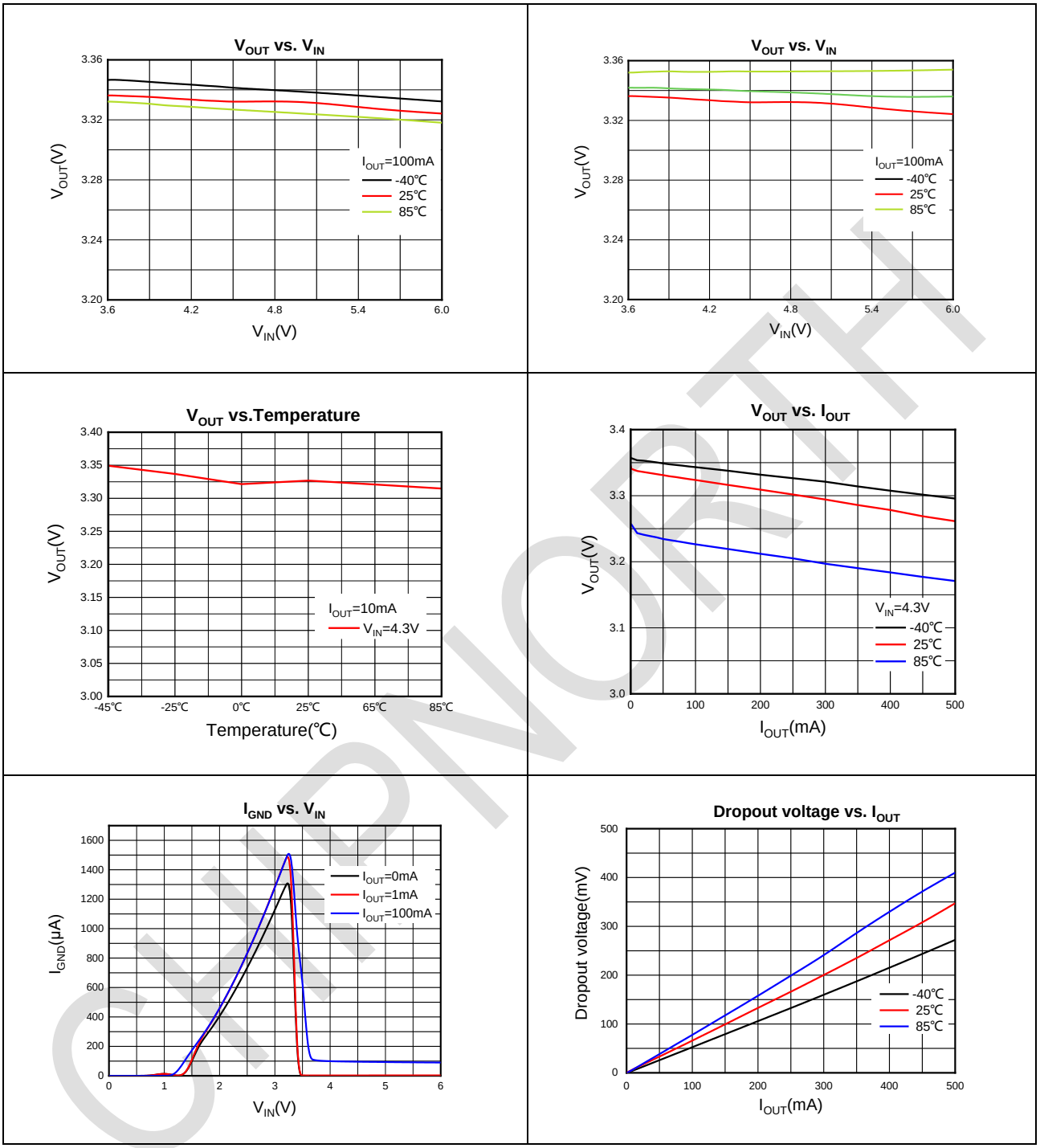
$V_{OUT(S)}$: Output voltage at V_{IN} = V_{OUT} + 1V, I_{OUT} = 5mA.

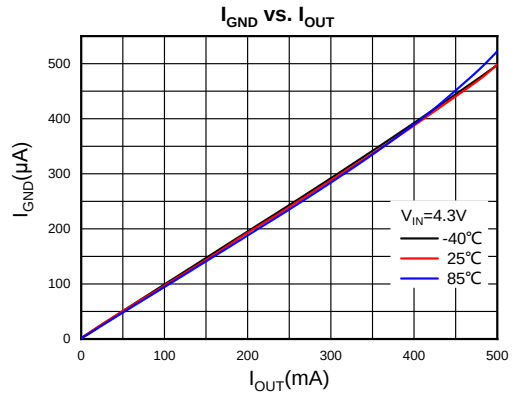
V_{DROP}=V_{IN}-(V_{OUT_REG}*0.98), V_{OUT_REG} is the output voltage when V_{IN}=V_{OUT}+1.0V and I_{OUT}=300mA. V_{IN} is the input voltage, and when the input voltage gradually decreases, the output voltage becomes 98% of the V_{OUT_REG}.

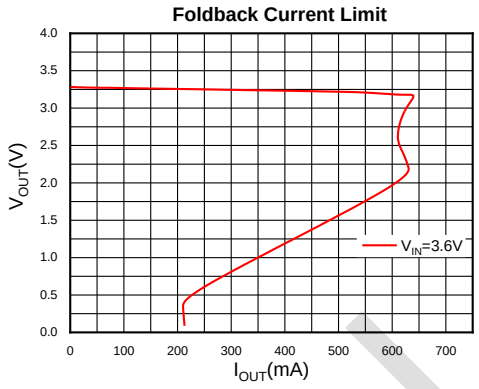
ILIMIT: Output current when V_{IN} = V_{OUT} + 1V and V_{OUT} = 0.95 x $V_{OUT(S)}$.

10.6 Characteristics Curve（CN87M033OGR）

Test conditions: V_{IN}=V_{OUT}+1V, C_{IN}=1.0μF, C_{OUT}=2.2μF, T_A=25°C, unless otherwise specified.







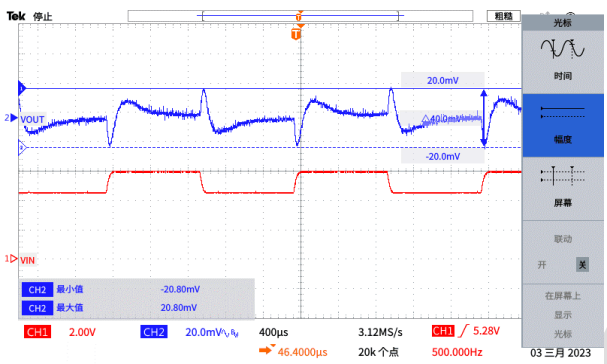


Figure1 Line Transient (V_{IN}=from V_{OUT}+1V to 6V to V_{OUT}+1V, I_{OUT}=50mA)

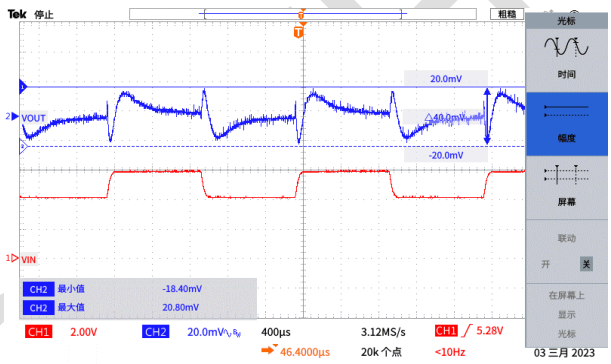


Figure2 Line Transient (V_{IN}=from V_{OUT}+1V to 7V to V_{OUT}+1V, I_{OUT}=500mA)

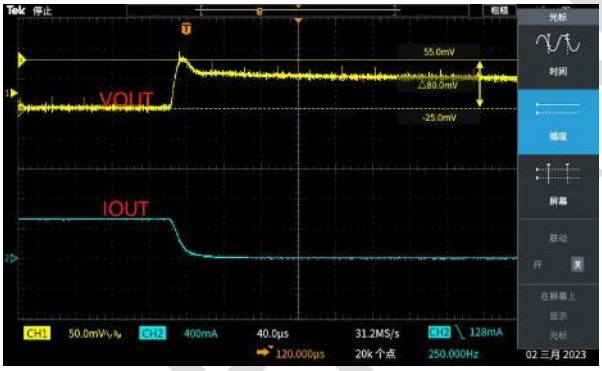


Figure 3 Load Transient (V_{IN}=V_{OUT}+1V, I_{OUT}=0mA-500mA)

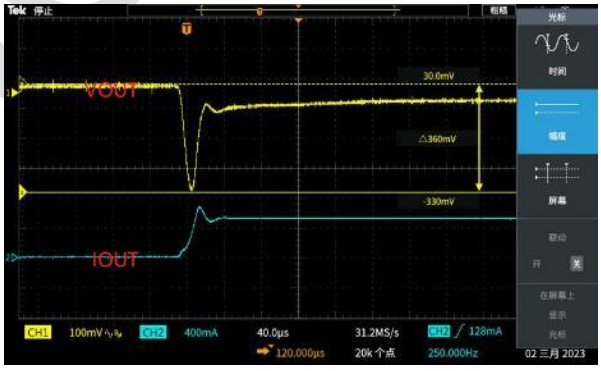


Figure 4 Load Transient (V_{IN}=V_{OUT}+1V, I_{OUT}=500mA-0mA)

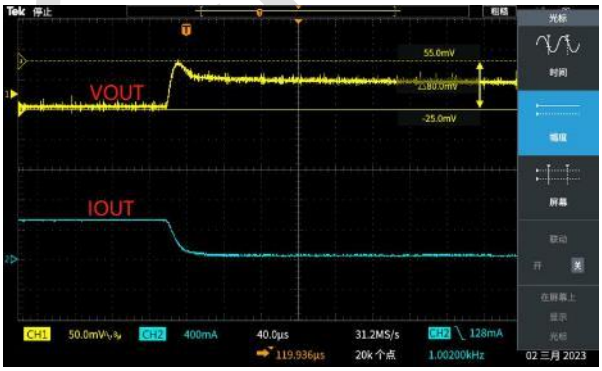


Figure 5 Load Transient (V_{IN}=V_{OUT}+1V, I_{OUT}=50mA-500mA)

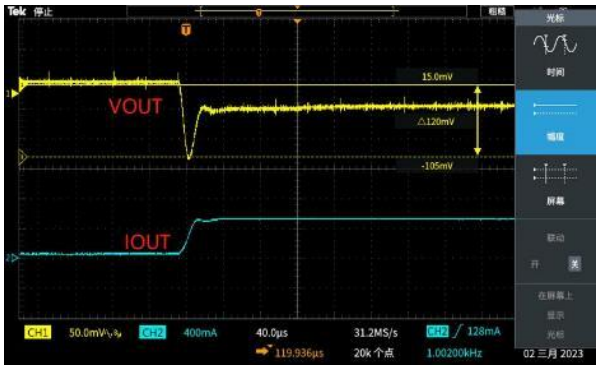
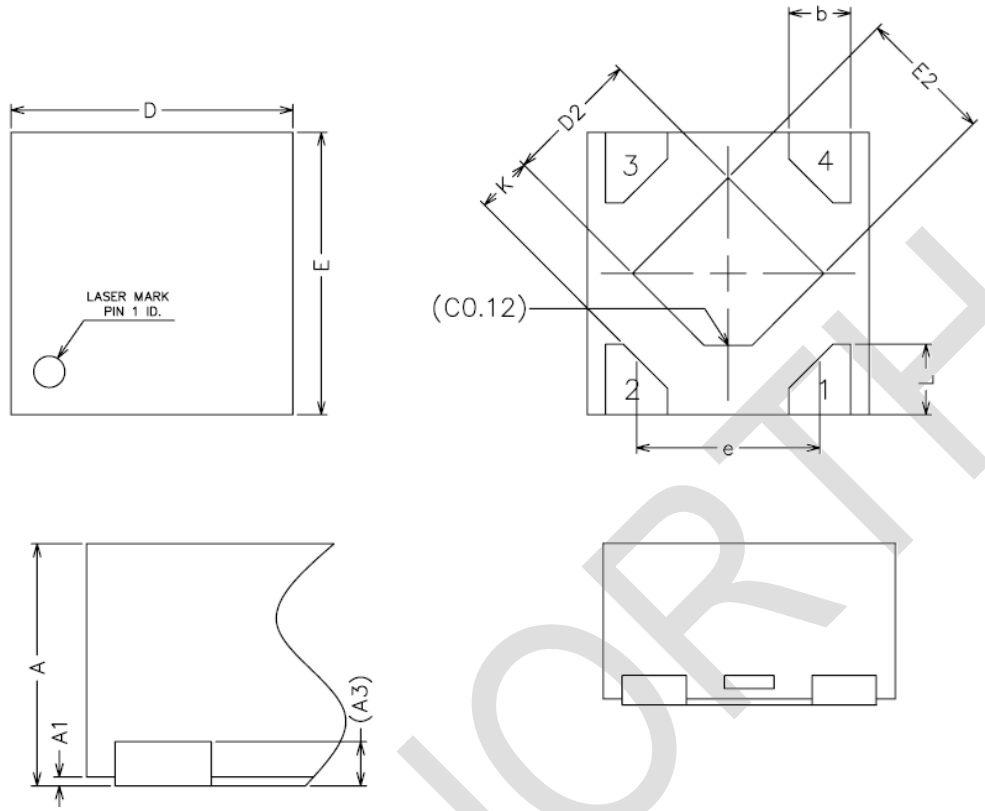


Figure 6 Load Transient (V_{IN}=V_{OUT}+1V, I_{OUT}=500mA-50mA)

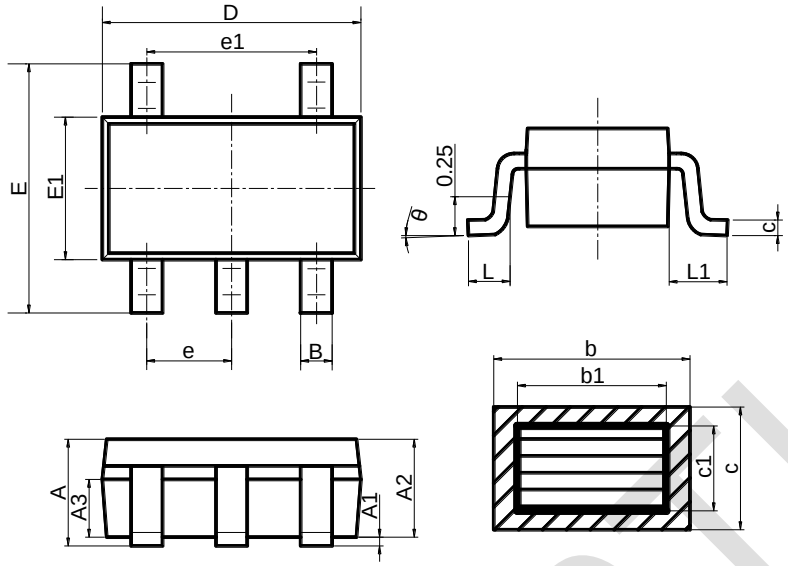
11 Package Information

DFNWB-4



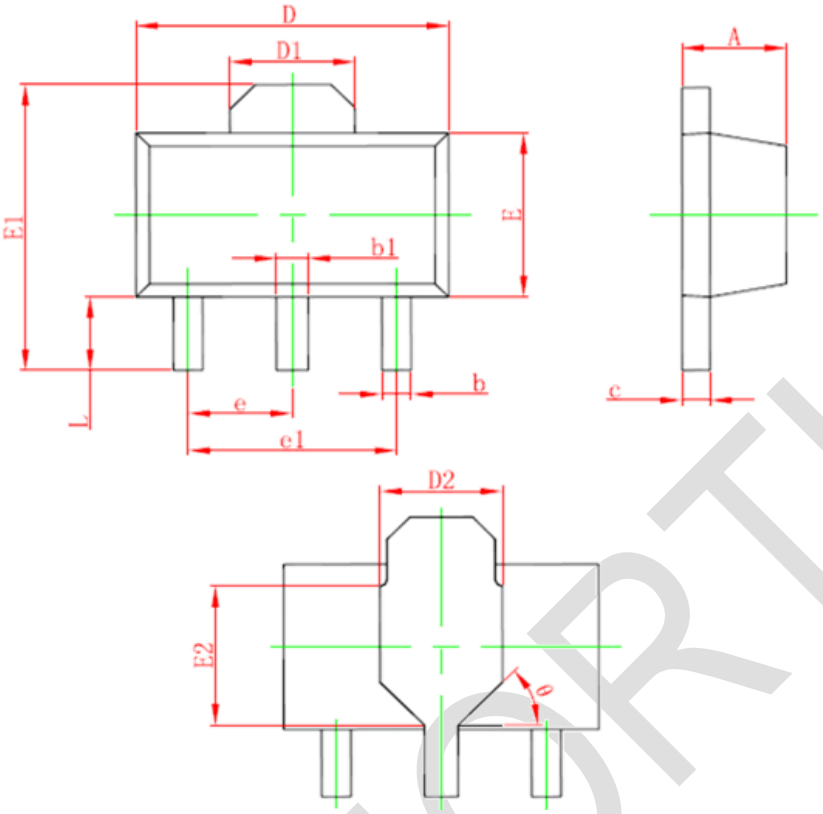
Dimension / Symbol	Min (mm)	Nom (mm)	Max (mm)
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
A3		0.100REF	
b	0.17	0.22	0.27
D	0.95	1.00	1.05
E	0.95	1.00	1.05
sD2	0.43	0.48	0.53
E2	0.43	0.48	0.53
L	0.20	0.25	0.30
e	0.60	0.65	0.70
K	0.15		

SOT23-5



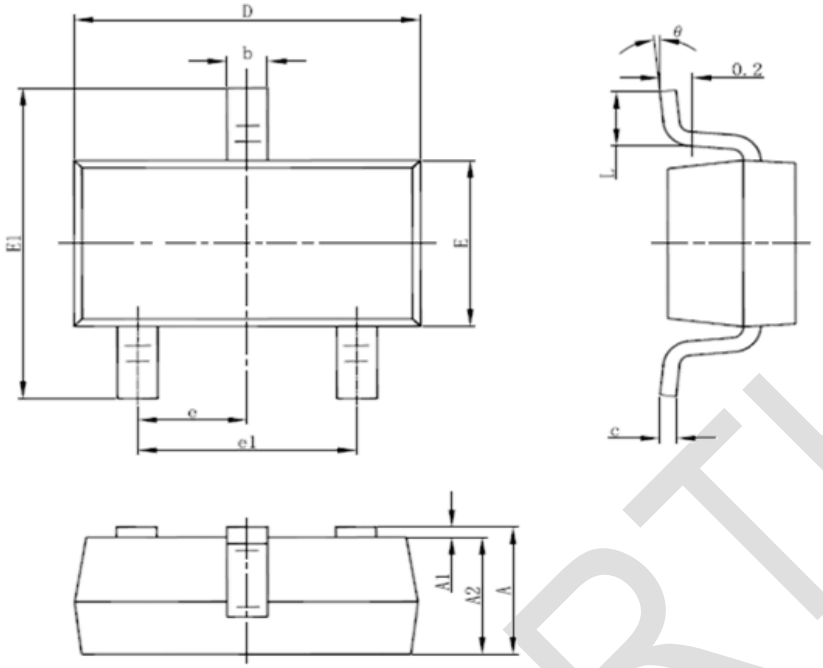
Dimension / Symbol	Min (mm)	Nom (mm)	Max (mm)
A			1.25
A1	0.04		0.10
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.33		0.41
b1	0.32	0.35	0.38
c	0.15		0.19
c1	0.14	0.15	0.16
D	2.82	2.92	3.02
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95BSC		
e1	1.90BSC		
L	0.30		0.60
L1	0.60REF		
θ	0		8°

SOT89-3L



Dimension / Symbol	Min (mm)	Max (mm)	Min(inch)	Max(inch)
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550REF		0.061REF	
D2	1.750REF		0.069REF	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
E2	1.900REF		0.075REF	
e	1.500TYP		0.060TYP	
e2	3.00TYP		0.118TYP	
L	0.900	1.200	0.035	0.047
θ	45°		45°	

SOT23-3



Dimension / Symbol	Min (mm)	Max (mm)	Min (inch)	Max (inch)
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

12 Important Statement

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