
High Voltage Low Power Consumption LDO

MD82XX Series

CMOS Voltage Regulator

150mA



MD82XX is a high voltage (up to 40V) low power low dropout voltage regulator (LDO) manufactured in CMOS processes. It can deliver up to 150mA of current while consuming only 2.5 μ A of quiescent current. It consists of a reference voltage generator, an error amplifier, a current foldback circuit, and a phase compensation circuit plus a driver transistor.

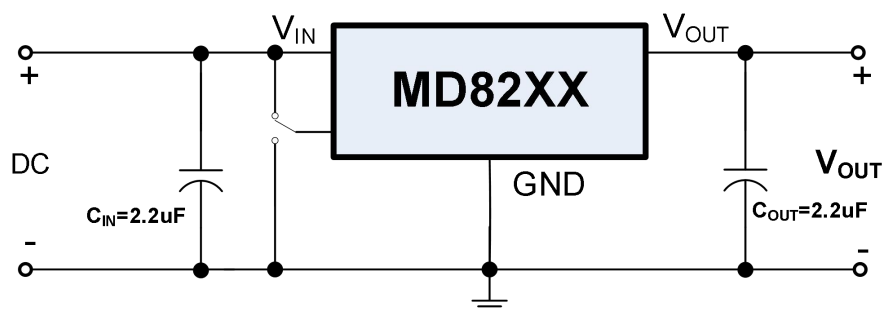
■ Features

- Ultra-low Quiescent Current: 2.5 μ A
- Maximum Input Voltage: 40V
- Output Voltage Highly Accurate: $\pm 2\%$
- Maximum Output Current: 150mA
- Dropout Voltage: 8mV@ $I_{OUT}=1mA$
- Temperature Stability: $\pm 50ppm/^{\circ}C$
- Protections Circuits: Current Limiter, Thermal shutdown
- Output Capacitor: Low ESR Ceramic Capacitor Compatible

■ Applications

- Automotive electronics
- Long-life battery-powered devices
- Portable mobile devices, such as mobile phones, cameras, and so on
- Wireless communication equipment
- Smart electric meter
- Industrial control

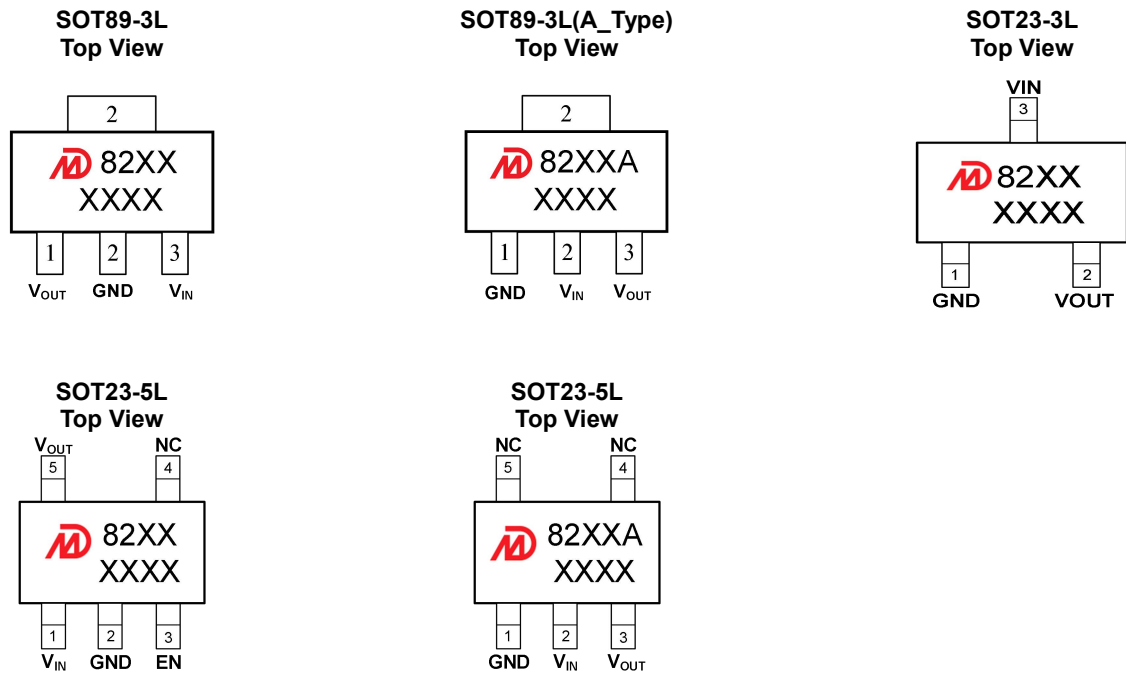
■ Typical Applications



■ Notes on Use

1. Input Capacitor (C_{IN}): 2.2 μ F above.
2. Output Capacitor (C_{OUT}): 2.2 μ F above.

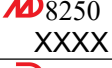
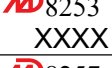
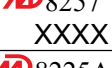
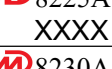
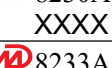
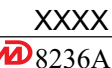
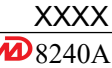
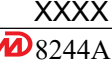
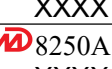
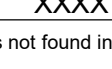
Pin Configuration and Functions



Product Selections

Product Name	V _{OUT} (V)	Package	Ordering Name	Marking	Package Information
MD8233	3.3	SOT23-5L	MD82E33QC3	8233 XXXX	Tape and Reel, 3000pcs
MD8250	5.0	SOT23-5L	MD82E50QC3	8250 XXXX	
MD8233A	3.3	SOT23-5L	MD82A33QC3	8233A XXXX	
MD8250A	5.0	SOT23-5L	MD82A50QC3	8250A XXXX	
MD8225	2.5	SOT23-3L	MD82E25QA3	8225 XXXX	
MD8230	3.0	SOT23-3L	MD82E30QA3	8230 XXXX	
MD8233	3.3	SOT23-3L	MD82E33QA3	8233 XXXX	
MD8244	4.4	SOT23-3L	MD82E44QA3	8244 XXXX	
MD8250	5.0	SOT23-3L	MD82E50QA3	8250 XXXX	
MD8255	5.5	SOT23-3L	MD82E55QA3	8255 XXXX	
MD8233	3.3	SOT89-3L	MD82E33PA1	8233 XXXX	
MD8236	3.6	SOT89-3L	MD82E36PA1	8236 XXXX	

MD82XX Series
High Voltage Low Power Consumption LDO

Product Name	V _{OUT} (V)	Package	Ordering Name	Marking	Package Information
MD8240	4.0	SOT89-3L	MD82E40PA1	 8240 XXXX	Tape and Reel, 1000pcs
MD8244	4.4	SOT89-3L	MD82E44PA1	 8244 XXXX	
MD8250	5.0	SOT89-3L	MD82E50PA1	 8250 XXXX	
MD8253	5.3	SOT89-3L	MD82E53PA1	 8253 XXXX	
MD8257	5.7	SOT89-3L	MD82E57PA1	 8257 XXXX	
MD8225A	2.5	SOT89-3L	MD82A25PA1	 8225A XXXX	
MD8230A	3.0	SOT89-3L	MD82A30PA1	 8230A XXXX	
MD8233A	3.3	SOT89-3L	MD82A33PA1	 8233A XXXX	
MD8236A	3.6	SOT89-3L	MD82A36PA1	 8236A XXXX	
MD8240A	4.0	SOT89-3L	MD82A40PA1	 8240A XXXX	
MD8244A	4.4	SOT89-3L	MD82A44PA1	 8244A XXXX	
MD8250A	5.0	SOT89-3L	MD82A50PA1	 8250A XXXX	

Notes: 1* Customer can request to customize the output voltage ranged from 2V to 5V if desired voltage is not found in the selections.

2* Customer can request customization of package choice.

3* Please pay attention to the MARKING of the product package type

■ **Absolute Maximum Ratings** (Unless otherwise indicated: $T_a=25^{\circ}\text{C}$)

PARAMETER	SYMBOL	RATINGS		UNITS
Input Voltage	V _{IN}	-0.3 ~ 45		V
Output Voltage	V _{OUT}	V _{SS} -0.3 ~ V _{IN} +0.3V		
Power Dissipation	P _D	SOT23-3L	250	mW
		SOT23-5L	250	
		SOT89-3L	1000	
Thermal Resistance	R _{θJA}	SOT23-3L	200	°C/W
		SOT23-5L	180	
		SOT89-3L	100	
Operating Ambient Temperature	T _{opr}	-40 ~ +85		°C
Storage Temperature	T _{stg}	-40 ~ +125		
ESD Protection	ESD HBM	4500		V
	ESD CDM	1000		

Note: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device.

■ Pin Configuration and Functions

MD82XX Series

(Unless otherwise indicated: $T_a=25^{\circ}\text{C}$)

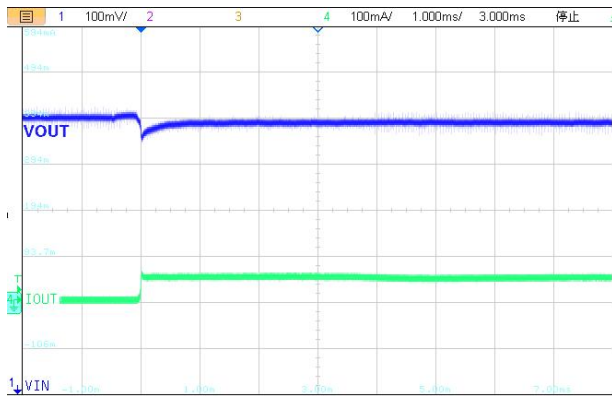
PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage	$V_{\text{OUT(S)}}^{*1}$	$V_{\text{IN}}=V_{\text{OUT(S)}}+2\text{V}$ $I_{\text{OUT}}=10\text{mA}$	$V_{\text{OUT(S)}}\times 0.98$	$V_{\text{OUT(S)}}$	$V_{\text{OUT(S)}}\times 1.02$	V
Dropout Voltage ^{*2}	V_{DROP}	$V_{\text{IN}}=V_{\text{OUT(S)}}+2\text{V}$ $I_{\text{OUT}}=1\text{mA}$		8		mV
		$V_{\text{IN}}=V_{\text{OUT(S)}}+2\text{V}$ $I_{\text{OUT}}=150\text{mA}$		1200	1800	
Line Regulation	$\frac{\Delta V_{\text{OUT}}}{\Delta V_{\text{IN}} \bullet V_{\text{OUT(S)}}}$	$V_{\text{OUT(S)}}+2\text{V} \leq V_{\text{IN}} \leq 40\text{V}$ $I_{\text{OUT}}=1\text{mA}$		0.01	0.1	%/V
Load Regulation	ΔV_{OUT2}	$V_{\text{EN}}=V_{\text{IN}}=V_{\text{OUT(S)}}+2\text{V}$ $1\text{mA} \leq I_{\text{OUT}} \leq 150\text{mA}$		40	80	mV
Temperature Stability	$\frac{\Delta V_{\text{OUT}}}{\Delta V_{\text{IN}} \bullet V_{\text{OUT(S)}}}$	$V_{\text{IN}}=V_{\text{OUT(S)}}+2\text{V}$ $I_{\text{OUT}}=1\text{mA}$ $-40^{\circ}\text{C} \leq T_a \leq 125^{\circ}\text{C}$		± 50		ppm/ $^{\circ}\text{C}$
GND Current	I_{GND}	no load		2.5	4	μA
Input Voltage	V_{IN}	---	2.2		40	V
Maximum Output Current	I_{OUTMAX}	$V_{\text{IN}}=V_{\text{OUT(S)}}+2.0\text{V}$	150			mA
Current Limit ^{*3}	I_{LIM}	$V_{\text{IN}}=V_{\text{OUT(S)}}+2.0\text{V}$ $V_{\text{OUT}} = 0.9 \times V_{\text{OUT(S)}}$		250		mA
Power Supply Rejection Ratio	PSRR	$f=100\text{Hz}$, $I_{\text{OUT}}=10\text{mA}$		70		dB
		$f=1\text{kHz}$, $I_{\text{OUT}}=10\text{mA}$		73		
		$f=10\text{kHz}$, $I_{\text{OUT}}=10\text{mA}$		77		
		$f=100\text{kHz}$, $I_{\text{OUT}}=10\text{mA}$		72		
EN"H"Level Voltage	V_{ENH}		1.5		40	V
EN"L"Level Voltage	V_{ENL}		0		0.3	
EN"H"Level Current	I_{ENH}	$V_{\text{IN}}=40.0$, $V_{\text{EN}} = V_{\text{IN}}$	-0.1		0.1	μA
EN"L"Level Current	I_{ENL}	$V_{\text{IN}}=40.0$, $V_{\text{EN}} = 0\text{V}$	-0.1		0.1	
Over Temperature Protection	OTP	$I_{\text{OUT}}=1\text{mA}$		170		$^{\circ}\text{C}$

Notes:

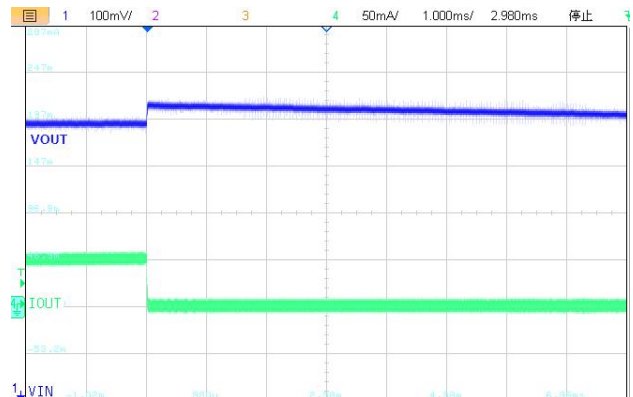
- $V_{\text{OUT(S)}}$: Output voltage when $V_{\text{IN}}=V_{\text{OUT}}+2\text{V}$, $I_{\text{OUT}}=1\text{mA}$.
- $V_{\text{DROP}}=V_{\text{IN1}} - (V_{\text{OUT(S)}} \times 0.98)$ where V_{IN1} is the input voltage when $V_{\text{OUT}} = V_{\text{OUT(S)}} \times 0.98$.
- I_{LIM} : Output current when $V_{\text{IN}}=V_{\text{OUT(S)}}+2\text{V}$ and $V_{\text{OUT}} = 0.95 \times V_{\text{OUT(S)}}$.

Typical Performance Characteristics

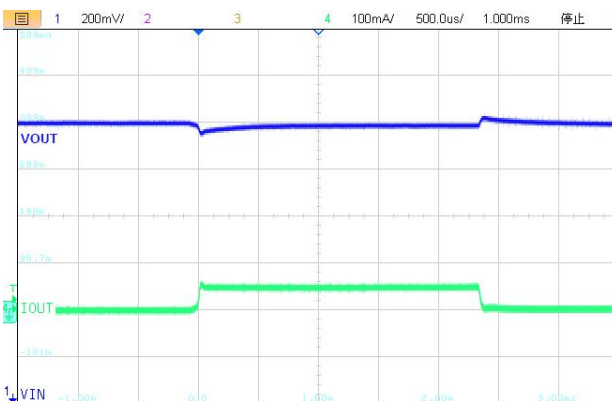
Test Conditions: $V_{IN}=V_{OUT}+2.0V$, $C_{IN}=2.2\mu F$, $C_{OUT}=2.2\mu F$, $T_a=25^\circ C$, unless otherwise indicated.



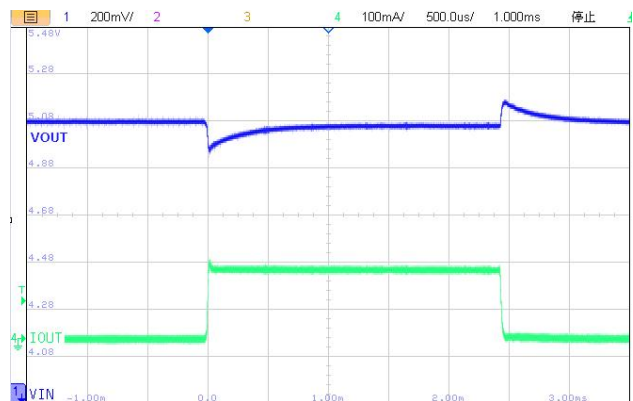
Load Transient at $V_{OUT}=5.0V$:
($I_{OUT}=0mA\sim 50mA$)



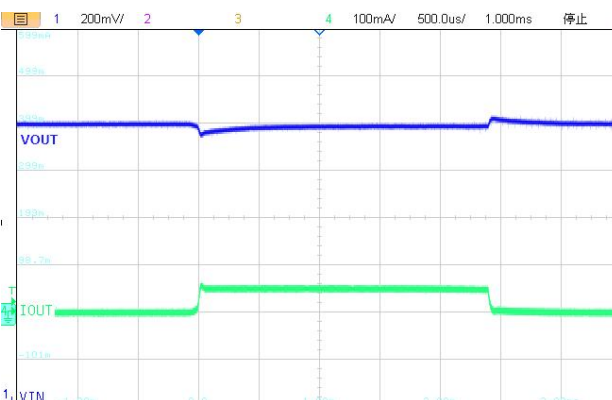
Load Transient at $V_{OUT}=5.0V$:
($I_{OUT}=50mA\sim 0mA$)



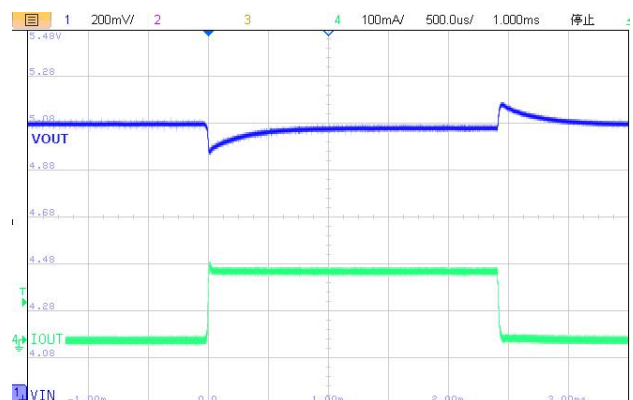
Load Transient at $V_{OUT}=5.0V$:
($I_{OUT}=1mA\sim 50mA\sim 1mA$)



Load Transient at $V_{OUT}=5.0V$:
($I_{OUT}=1mA\sim 150mA\sim 1mA$)



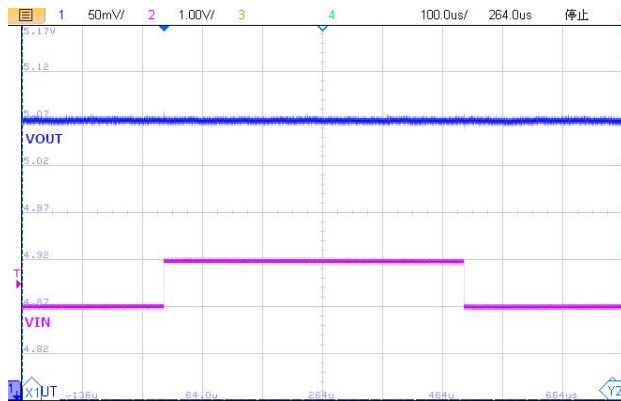
Load Transient at $V_{OUT}=5.0V$:
($I_{OUT}=0mA\sim 50mA\sim 0mA$)



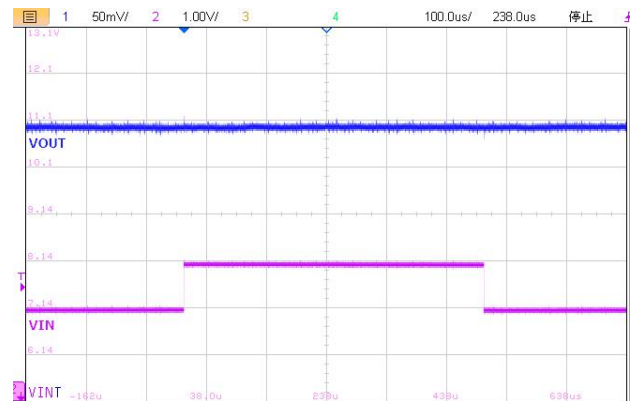
Load Transient at $V_{OUT}=5.0V$:
($I_{OUT}=0mA\sim 150mA\sim 0mA$)

Typical Performance Characteristics (Continued)

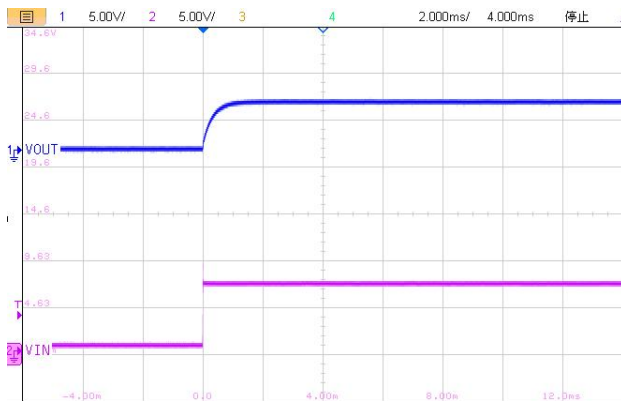
Test Conditions: $V_{IN}=V_{OUT}+2.0V$, $C_{IN}=2.2\mu F$, $C_{OUT}=2.2\mu F$, $T_a=25^\circ C$, unless otherwise indicated.



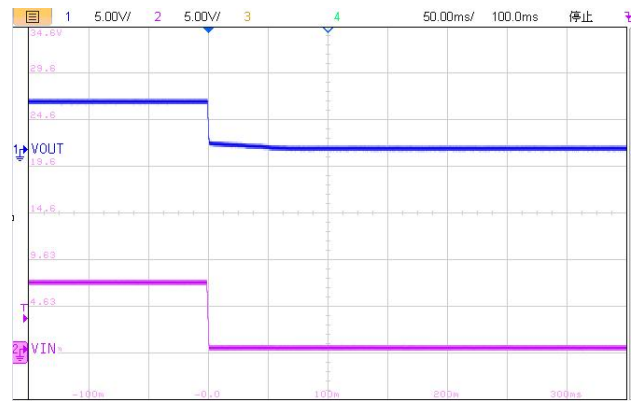
Line Transient at $V_{OUT}=5.0V$:
($I_{OUT}=1mA$)



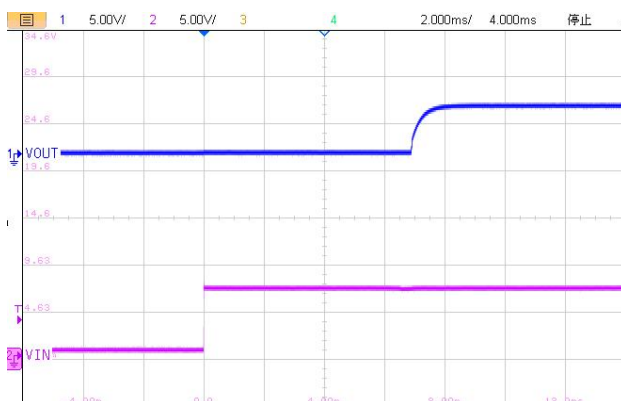
Line Transient at $V_{OUT}=5.0V$:
($I_{OUT}=10mA$)



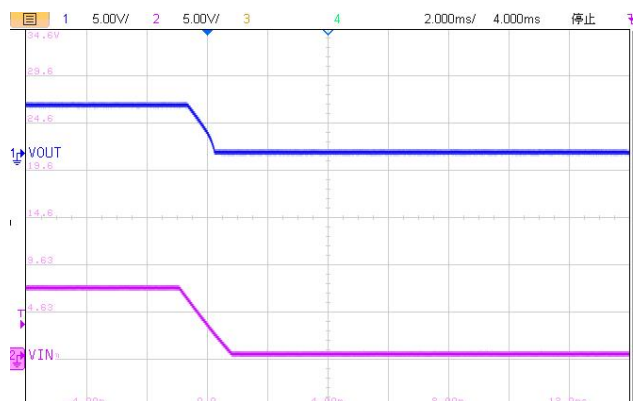
Power-Up at $V_{OUT}=5.0V$:
($I_{OUT}=1mA$)



Power-Down at $V_{OUT}=5.0V$:
($I_{OUT}=1mA$)



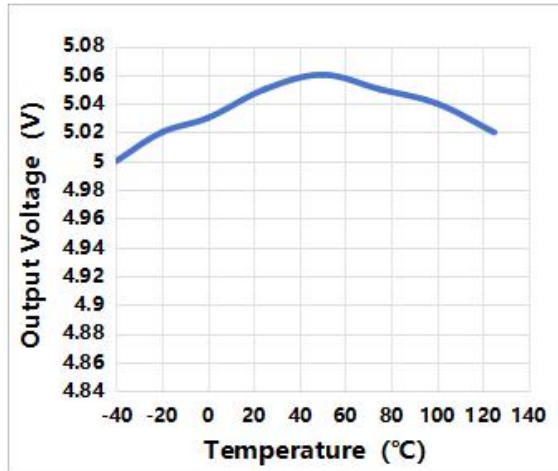
Power-Up at $V_{OUT}=5.0V$:
($I_{OUT}=150mA$)



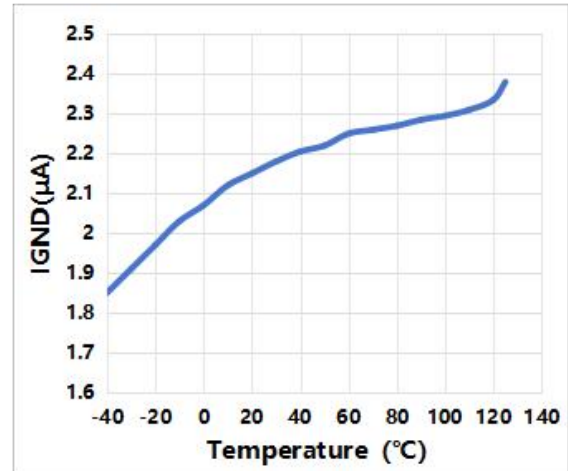
Power-Down at $V_{OUT}=5.0V$:
($I_{OUT}=150mA$)

■ Typical Performance Characteristics (Continued)

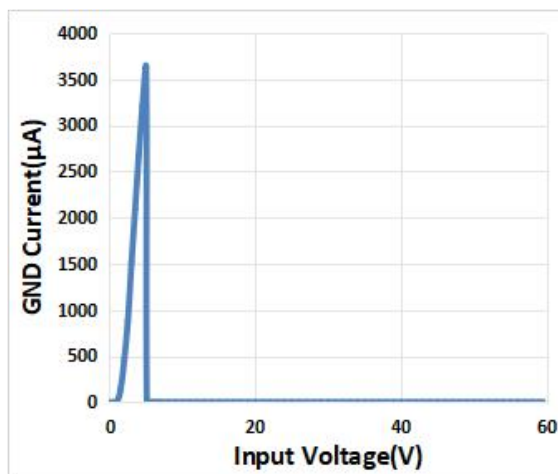
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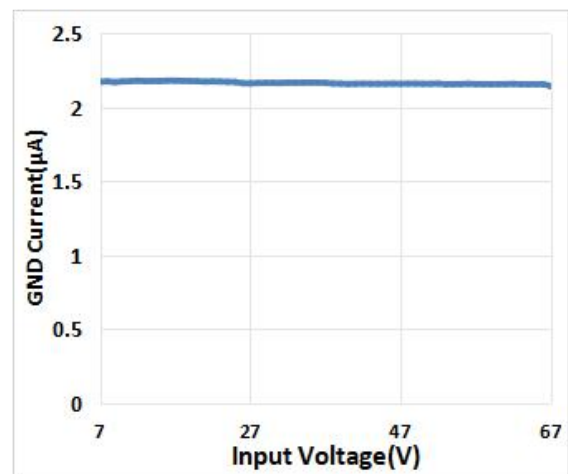
Output Voltage vs. Temperature at $V_{OUT}=5.0V$



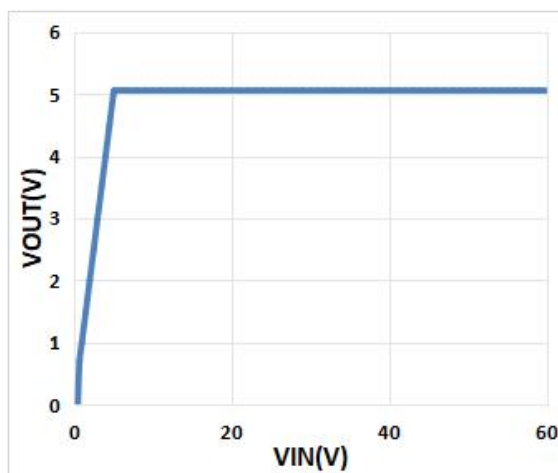
GND Current vs. Temperature at $V_{OUT}=5.0V$



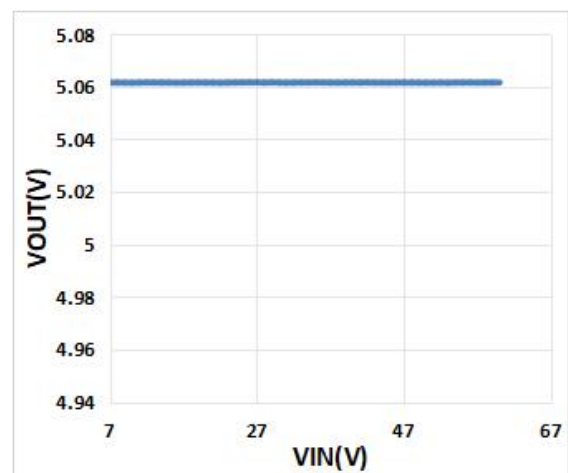
GND Current vs. Input Voltage at $V_{OUT}=5.0V$



GND Current vs. Input Voltage at $V_{OUT}=5.0V$



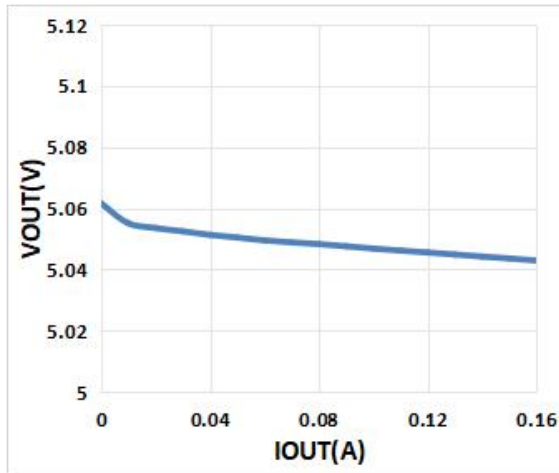
Output Voltage vs. Input Voltage at $V_{OUT}=5.0V$



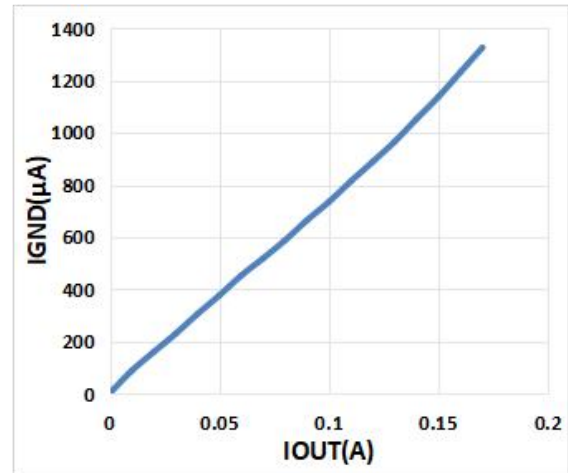
Output Voltage vs. Input Voltage at $V_{OUT}=5.0V$

■ Typical Performance Characteristics (Continued)

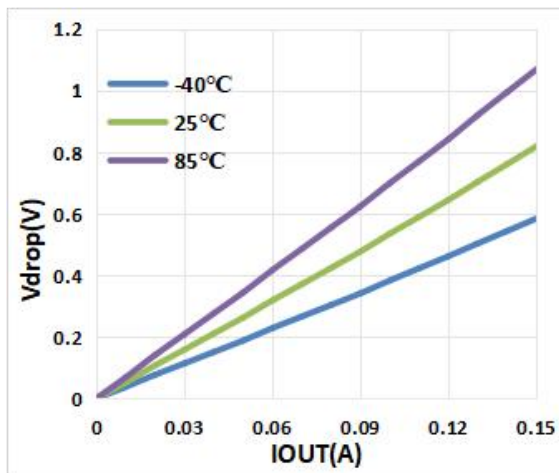
Test Conditions: $V_{IN}=V_{OUT}+2.0V$, $C_{IN}=2.2\mu F$, $C_{OUT}=2.2\mu F$, $T_A=25^\circ C$, unless otherwise indicated.



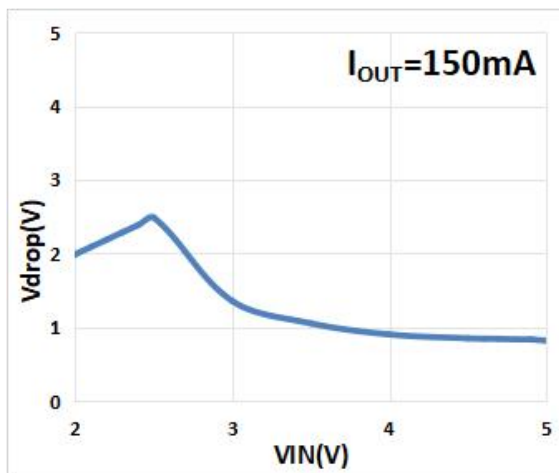
Output Voltage vs Output Current at $V_{OUT}=5.0V$



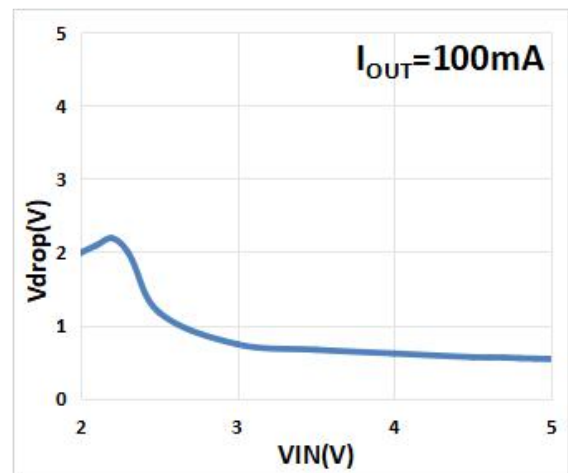
GND Current vs Output Current at $V_{OUT}=5.0V$



Dropout Voltage vs. Output Current at $V_{OUT}=5.0V$



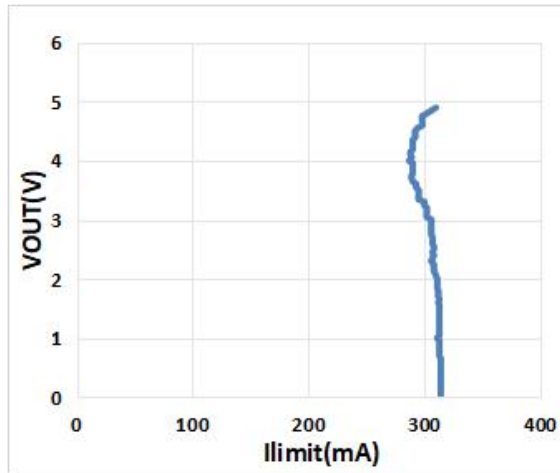
V_{drop} vs. Input Voltage at $V_{OUT}=5.0V$



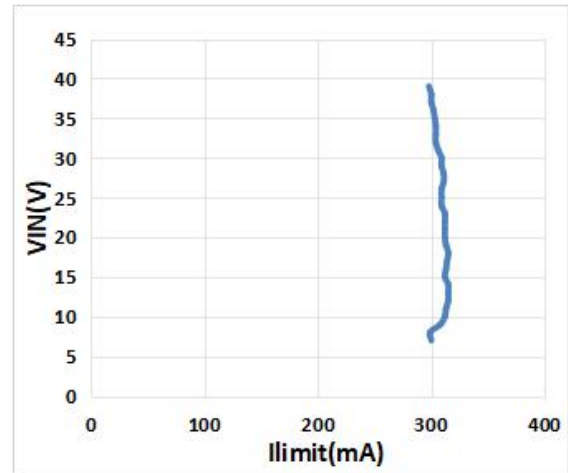
V_{drop} vs. Input Voltage at $V_{OUT}=5.0V$

■ Typical Performance Characteristics (Continued)

Test Conditions: $V_{IN}=V_{OUT}+2.0V$, $C_{IN}=2.2\mu F$, $C_{OUT}=2.2\mu F$, $T_A=25^\circ C$, unless otherwise indicated.



V_{OUT} vs. I_{limit} at $V_{OUT}=5.0V$

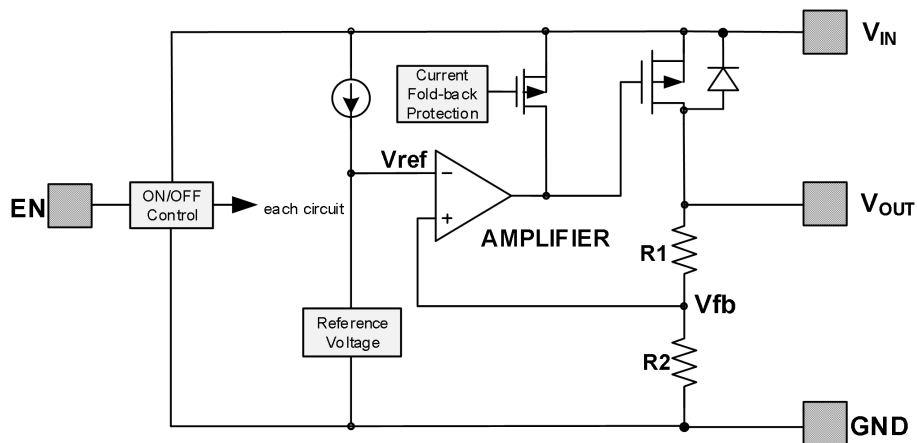


V_{IN} vs. I_{limit} at $V_{OUT}=5.0V$

■ Operational Explanation

1. Output voltage control

The voltage divided by resistors R1 and R2 is compared with the internal reference voltage by the error amplifier. The amplifier output then drives the P-channel MOSFET connected to the V_{OUT} pin. The output voltage at the V_{OUT} pin is regulated by this negative feedback system. The current limit circuit and short protect circuit operate in relation to output current level.



2. Pass transistor

The pass transistor with low turn-on resistance used in MD82XX is a P-channel MOSFET. If the potential on V_{OUT} pin is higher than V_{IN} , it is possible that IC will be destroyed due to reverse current which is caused by parasitic diodes between V_{IN} and V_{OUT} . Therefore, the V_{OUT} pin potential exceeds $V_{IN}+0.3V$ is not allowed.

3. Current Limiter, over temperature protection

The MD82XX series has the option of current limiting protection to protect the output transistors in the event of a short circuit between the V_{OUT} and GND terminals. The guard can inhibit the output current by about 300mA (typical), even in the case of a short circuit between the V_{OUT} and GND terminals. In this case, it is easy to make the chip temperature rise beyond the heat dissipation limit, and the overtemperature protection circuit triggers and turns off the output current until the chip temperature. The chip automatically restarts after the degree drops to a certain value.

Special attention should be paid to that the product of the dropout voltage on the chip and the output current must be smaller than the heat dissipation. If power consumption on the chip is more than the heat dissipation, OTP will protect the chip from damaging due to over temperature.

4.Input capacitance(C_{IN})

Stable input voltage: Provide a stable input current for the converter to ensure that the input voltage (V_{IN}) remains constant when the load changes, avoiding voltage fluctuations caused by transient current surges.

Improve response speed: By quickly charging and discharging to respond to sudden load changes, shorten the adjustment time of the control loop, and enhance system stability.

Input Capacitor (C_{IN}): 2.2 μ F above.

5.Output capacitance(C_{OUT})

Suppress output ripple: Absorb the current fluctuations caused by high-frequency switching operations, and control the output voltage ripple within a safe range.

Support transient response: When the load switches from standby to full-speed operation, quickly release or store charges to compensate for the response delay of the control loop, preventing voltage drops or overshoots.

Output Capacitor (C_{OUT}): 2.2 μ F above.

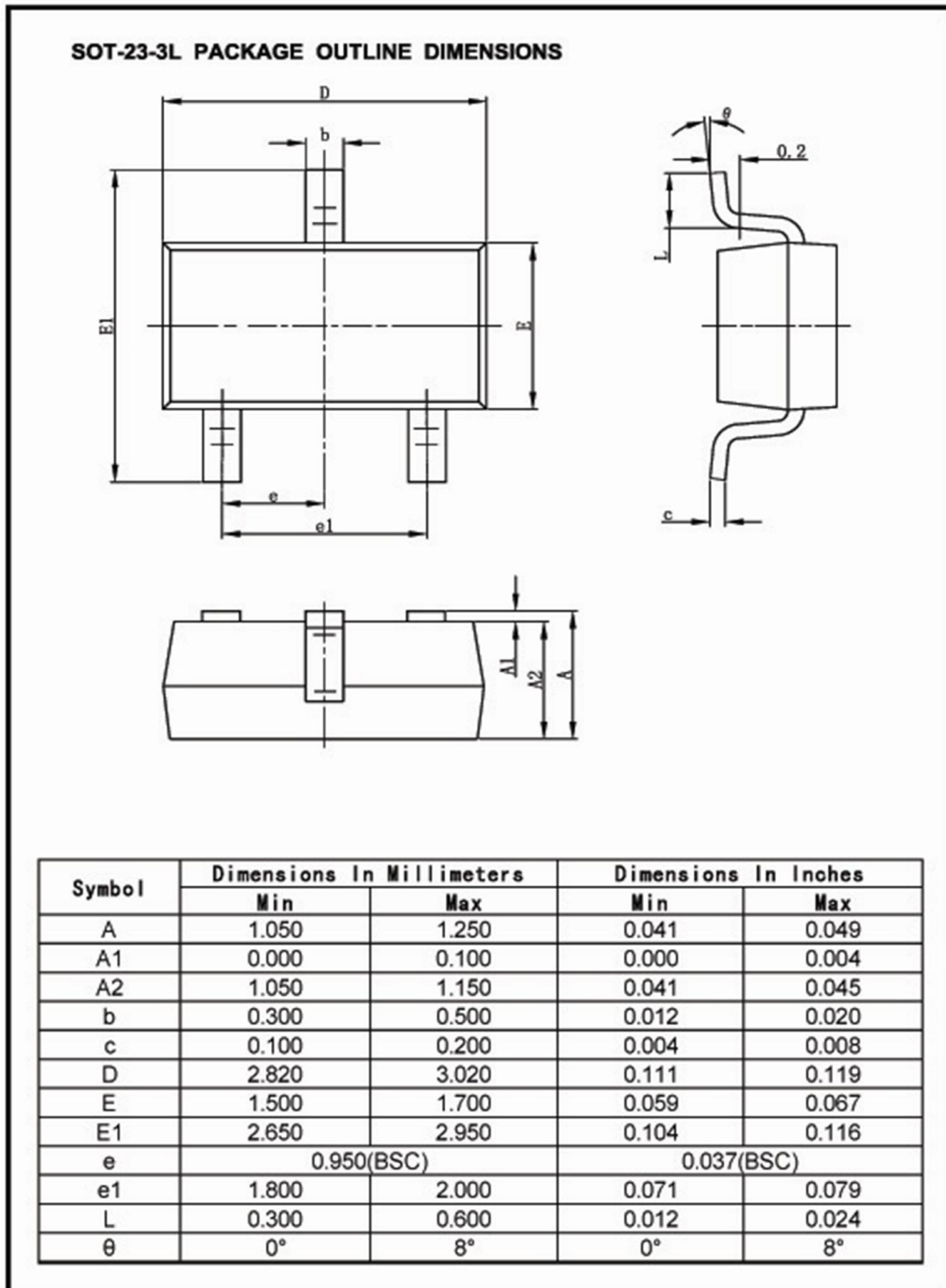
■ Notes:

1. The input and output capacitors should be placed as close as possible to the IC.
2. If the impedance of the power supply is high, which is caused by forgetting installing input capacitor or installing too small value capacitor, the oscillation may occur.
3. Pay attention to the operation conditions of input and output voltage and load current, such that the power consumption in the IC should not exceed the allowable power consumption of the package even though the chip has short circuit protection.
4. IC has a built-in anti-static protection (ESD) circuit, but please do not add excessive stress to the IC.

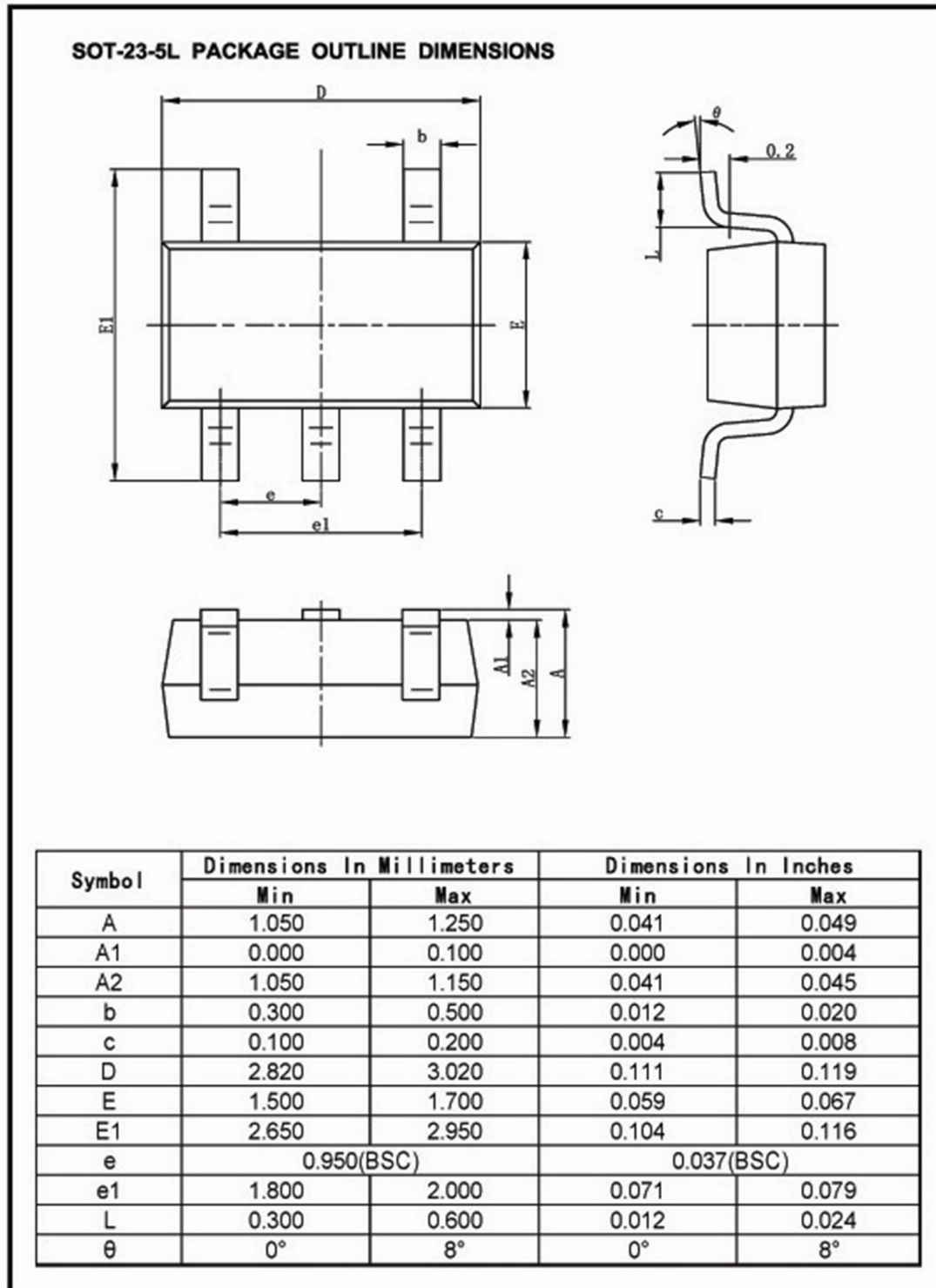
■ Revision History:

VERSION	Change Date	Change Item
Rev.1.0	2025/08/01	1.Update Marking
Rev.1.1	2025/09/17	1.Update the pin definition of SOT23-3

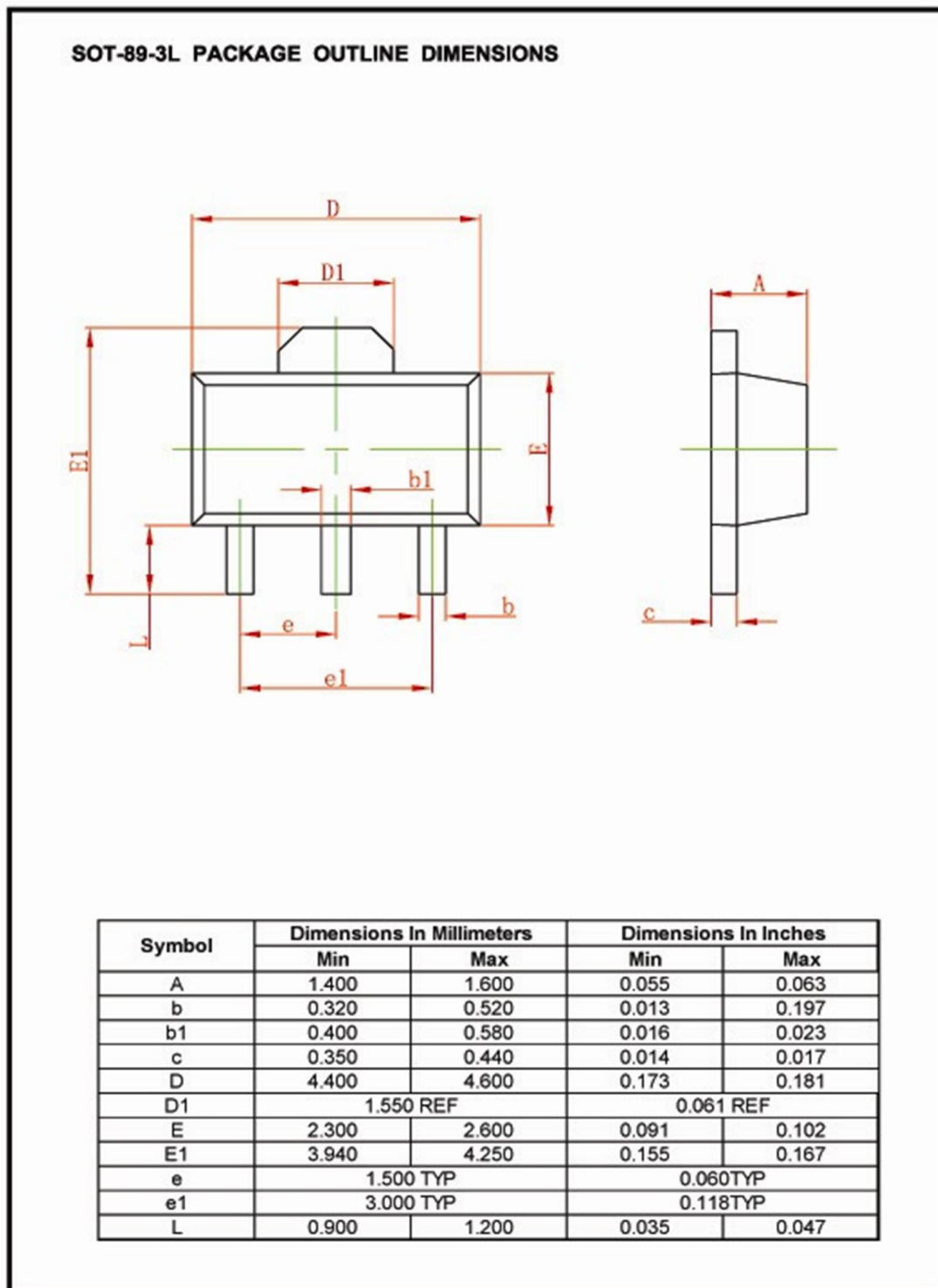
■ Packaging Information



■ Packaging Information (Continued)



■ Packaging Information (Continued)



For the newest datasheet, please see the website:

www.md-ic.com.cn

Version Rev.1.1 20250917