High Voltage Low Power Consumption LDO — MD84XX Series

CMOS Voltage Regulator With ON/OFF Switch — 300mA

MD84XX is a high voltage (up to 40V) low power low dropout voltage regulator (LDO) manufactured in CMOS processes. It can deliver up to 300mA of current while consuming only 1.5uA 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: 1.5uA
- Maximum Input Voltage: 40V
- Output Voltage Highly Accurate: ±2％
- Maximum Output Current: 300mA
- Dropout Voltage: 4mV@I_{OUT}=1mA
- Temperature Stability: ±50ppm/℃
- ON/OFF Logic = Enable High
- Protections Circuits: Current Limiter, Short Circuit, Foldback, Thermal shutdown
- Output Capacitor: Low ESR Ceramic Capacitor Compatible

■ APPLICATIONS

- Smart wearer
- Long-life battery-powered devices
- Portable mobile devices, such as mobile phones, cameras, and so on
- Wireless communication equipment

■ Product Selections

Type	Output Voltage （note 1*）	Current Limit	Accuracy	Package （note 2*）	MARKING (note 3*）
MD8425	2.5V	550mA	±2%	SOT23-5\SOT23-3	8425
MD8428	2.8V	550mA	±2%	SOT23-5\SOT23-3	8428
MD8430	3.0V	550mA	±2%	SOT23-5\SOT23-3	8430
MD8433	3.3V	550mA	±2%	SOT23-5\SOT23-3	8433 8433S
MD8436	3.6V	550mA	±2%	SOT23-5\SOT23-3	8436
MD8440	4.0V	550mA	±2%	SOT23-5\SOT23-3	8440
MD8450	5.0V	550mA	±2%	SOT23-5\SOT23-3	8450
MD8465	6.5V	550mA	±2%	SOT23-3	8465
MD8410	10V	550mA	±2%	SOT23-5	8410
MD8412	12V	550mA	±2%	SOT23-5	8412

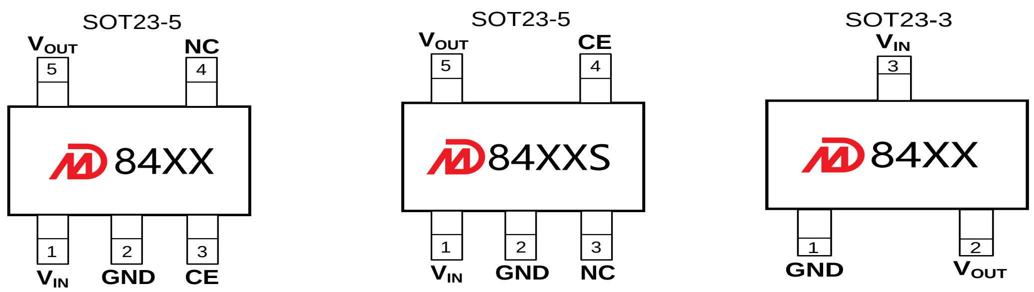
Notes:

1* Customer can request to customize the output voltage ranged from 1.2V to 15V 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.

■ PIN CONFIGURATION (TOP VIEW)



■ Absolute Maximum Ratings (Unless otherwise indicated: T_a=25℃)

PARAMETER	SYMBOL	RATINGS		UNITS
Input Voltage	V_{IN}	-0.3 ~ 45		V
Output Voltage	V_{OUT}	Vss-0.3 ~ VIN+0.3V		
Power Dissipation	P_D	SOT 23-5 250 SOT 23-3 250		mW
Thermal Resistance	$R_{\theta JA}$	SOT23-5	150 (mount on PCB)(1) 400 (free air)	℃/W
		SOT23-3	200 (mount on PCB)(1) 400 (free air)	
Operating Ambient Temperature	T_{opr}	-40 ~ +85		℃
Storage Temperature	T_{stg}	-40 ~ +125		
ESD Protection	ESD HBM	2000		V

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

(1) Mounted on JEDEC standard 4layer (2s2p) PCB test board

■ ELECTRICAL CHARACTERISTICS

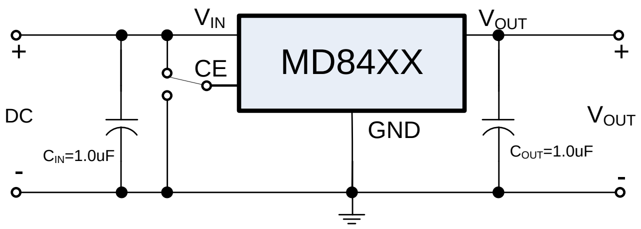
MD84XX Series (Unless otherwise indicated：T_a=25℃)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Voltage[*1]	$V_{OUT(S)}$	V_{IN}= $V_{OUT(S)}$+2V，I_{OUT}=10mA	$V_{OUT(S)}$× 0.98	$V_{OUT(S)}$	$V_{OUT(S)}$× 1.02	V
Dropout Voltage[*2]	V_{DROP}	V_{CE}=V_{IN}, $V_{OUT(S)}$=3.3V I_{OUT}=1mA		4	8	mV
		V_{CE}=V_{IN}, $V_{OUT(S)}$=3.3V I_{OUT}=300mA		1300	1950	
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \bullet V_{OUT(s)}}$	$V_{OUT(S)}$+2V≤V_{IN}≤40V I_{OUT} =1mA		0.01	0.02	%/V
Load Regulation	ΔV_{OUT2}	V_{IN} = $V_{OUT(S)}$+2V 1mA≤I_{OUT}≤300mA		20	40	mV
Temperature Stability	$\frac{\Delta V_{OUT}}{\Delta T_a \bullet V_{OUT(s)}}$	V_{IN} = $V_{OUT(S)}$+2V，I_{OUT}=10mA -40℃≤T_a≤85℃		±50		ppm/℃
GND Current (CE=V_{IN})	I_{GND}	no load, $V_{OUT(S)}$<3.0V	0.8	1.2	2	uA
		no load, 3.0≤$V_{OUT(S)}$≤5.3V	1	1.5	2.5	
		no load, $V_{OUT(S)}$>5.3V	1.5	2.3	3.5	
		I_{OUT}=100mA		460		
Shutdown Current (CE=0)	I_{SHUT}	V_{IN}=30.0V, V_{CE}=0		0.01	0.1	
Input Voltage	V_{IN}	---	2.2		40	V
Maximum Output Current	I_{OUTMAX}		300	350		mA
Current Limit[*3]	I_{LIM}	V_{IN}= $V_{OUT(S)}$+2V, V_{OUT} = 0.95 ×$V_{OUT(S)}$	350	550		
Short Circuit Current	I_{SHORT}	V_{IN}=V_{CE}=$V_{OUT(S)}$+2.0V V_{OUT}=0V		65		
Power Supply Rejection Ratio	PSRR	f=10Hz, $V_{OUT(S)}$=3.3V		74		dB
		f=100Hz, $V_{OUT(S)}$=3.3V		63		
		f=1kHz, $V_{OUT(S)}$=3.3V		42		
CE 'H' Level Voltage	V_{CEH}		1.5		40.0	V
CE 'L' Level Voltage	V_{CEL}		0		0.6	
CE 'H' Level Current	I_{CEH}	V_{IN}=40V, V_{CE}=V_{IN}	-0.1		0.1	uA
CE 'L' Level Voltage	I_{CEL}	V_{IN}=40V, V_{CE}=0	-0.1		0.1	
Over Temperature Protection	OTP	I_{OUT}=1mA		170		℃

Notes:

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

TYPICAL APPLICATIONS



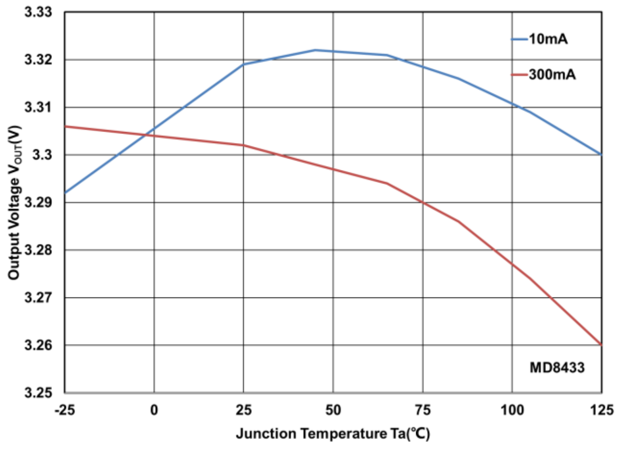
Notes on Use

Input Capacitor (C_{IN}): 1.0µF above

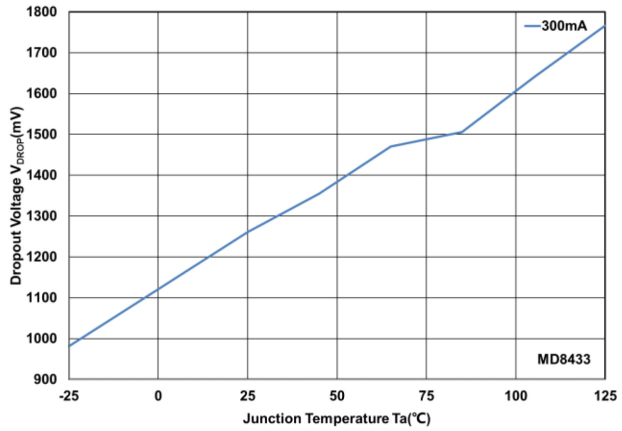
Output Capacitor (C_{OUT}): 1.0µF above

■ TYPICAL PERFORMANCE CHARACTERISTICS

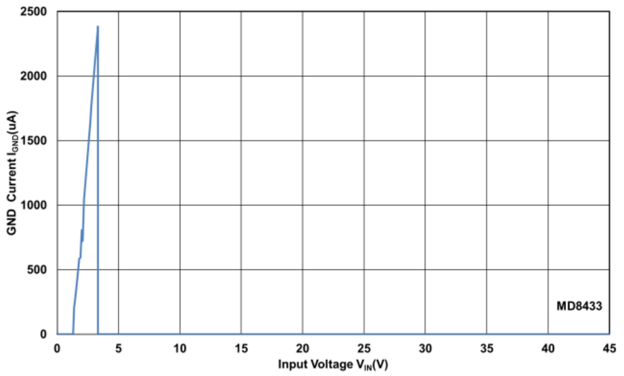
Test Conditions: $V_{IN}=V_{OUT}+2.0V$, $C_{IN}=1.0\mu F$, $C_{OUT}=1.0\mu F$, Ta=25℃, unless otherwise indicated.



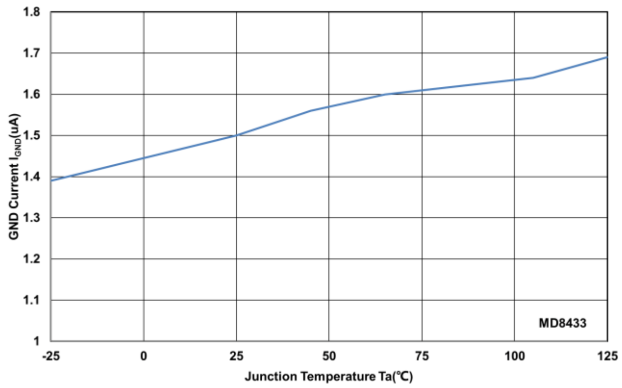
V_{OUT} vs Temperature



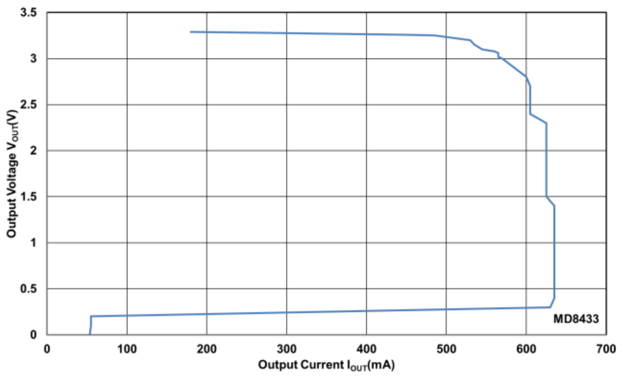
V_{DROP} vs Temperature



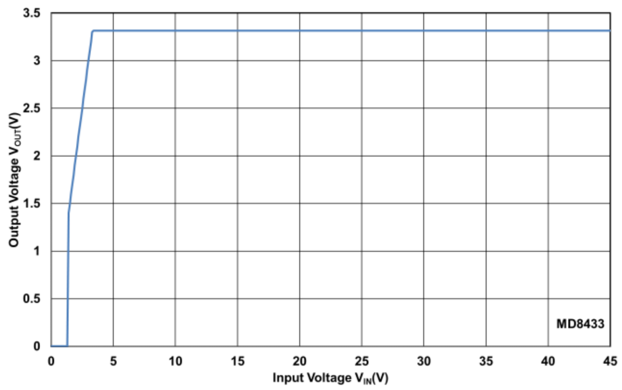
GND Current vs Input Voltage



GND Current vs Temperature



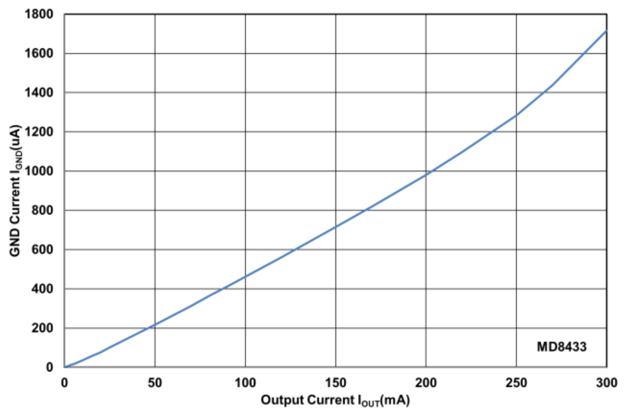
Output Current Fold-back



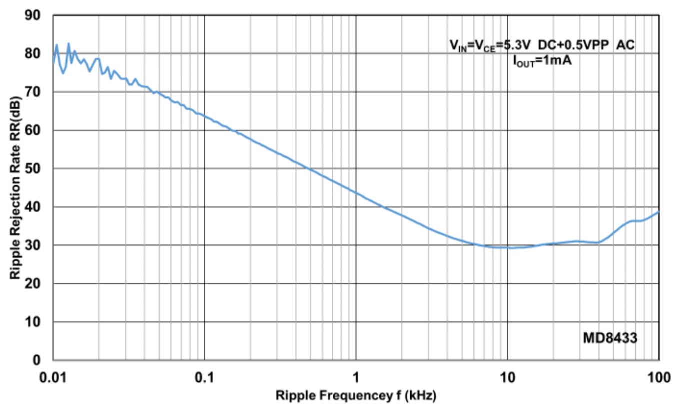
Output Voltage vs Input Voltage

■ TYPICAL PERFORMANCE CHARACTERISTICS(CONTINUTED)

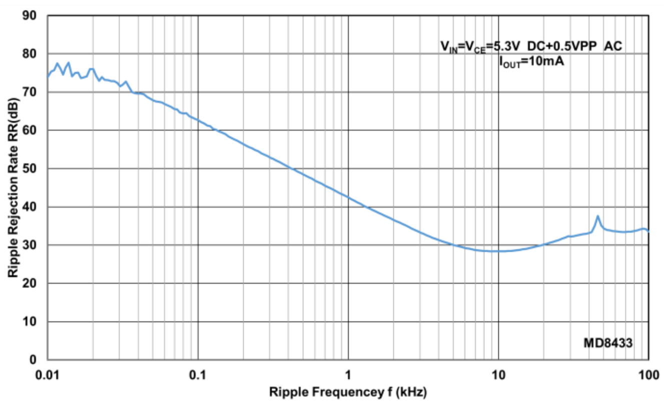
Test Conditions: $V_{IN}=V_{OUT}+2.0V$, $C_{IN}=1.0\mu F$, $C_{OUT}=1.0\mu F$, unless otherwise indicated.



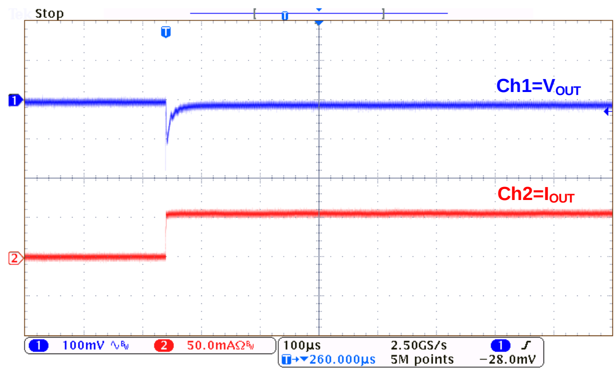
GND Current vs Output Current



Power Supply Rejection Ratio

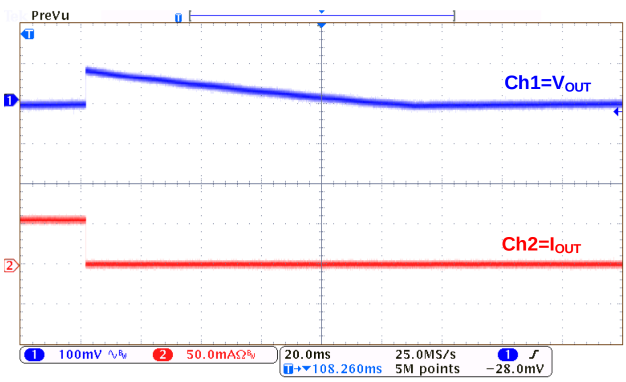


Power Supply Rejection Ratio



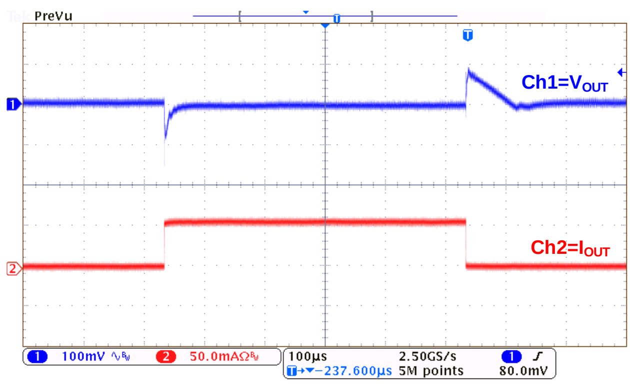
Load Transient:

MD8433(I_{OUT}=0mA~50mA)



Load Transient:

MD8433(I_{OUT}=50mA~0mA)

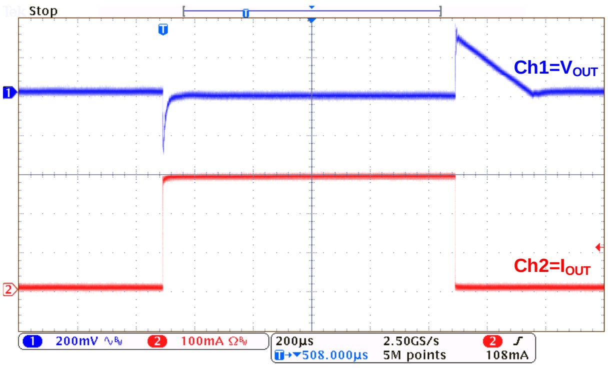


Load Transient:

MD8433(I_{OUT}=1mA~50mA~1mA)

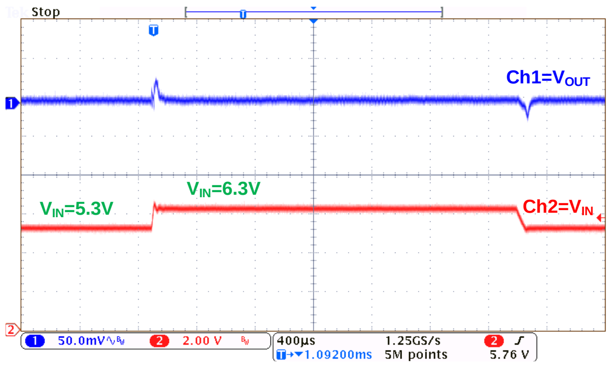
■ TYPICAL PERFORMANCE CHARACTERISTICS(CONTINUTED)

Test Conditions: $V_{IN}=V_{OUT}+2.0V$, $C_{IN}=1.0\mu F$, $C_{OUT}=1.0\mu F$, Ta=25℃, unless otherwise indicated.



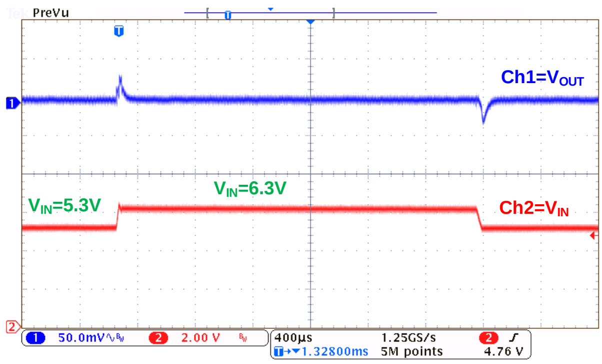
Load Transient:

MD8433(I_{OUT}=1mA~300mA~1mA)



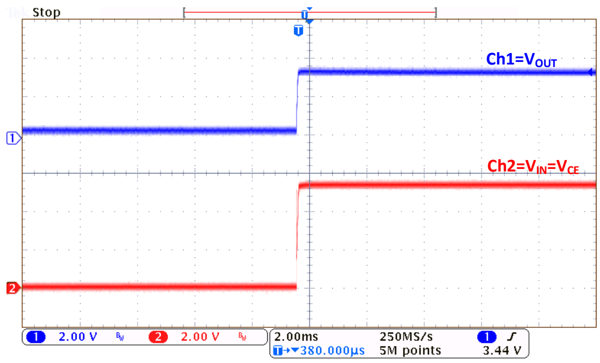
Line Transient:

MD8433(I_{OUT}=1mA)



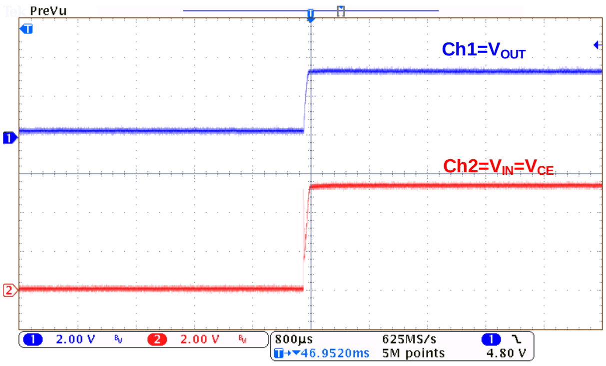
Line Transient:

MD8433(I_{OUT}=10mA)



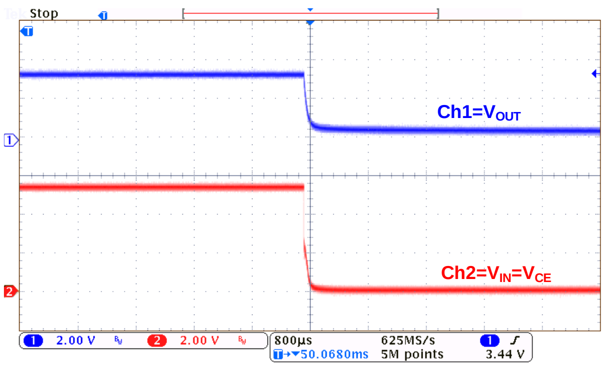
Power-Up:

MD8433(I_{OUT}=0mA)



Power-Up:

MD8433(I_{OUT}=300mA)

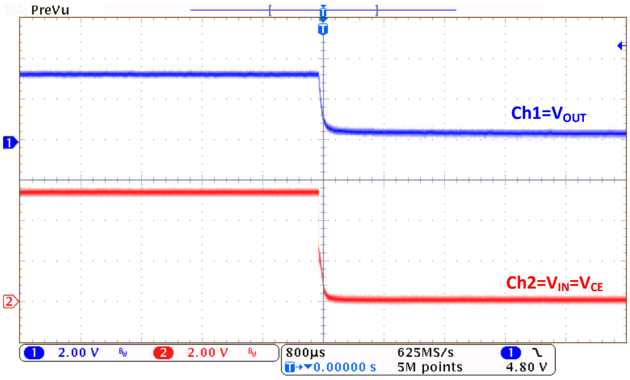


Power-Down:

MD8433(I_{OUT}=0mA)

■ TYPICAL PERFORMANCE CHARACTERISTICS(CONTINUTED)

Test Conditions: $V_{IN}=V_{OUT}+2.0V$, $C_{IN}=1.0\mu F$, $C_{OUT}=1.0\mu F$, Ta=25℃, unless otherwise indicated.



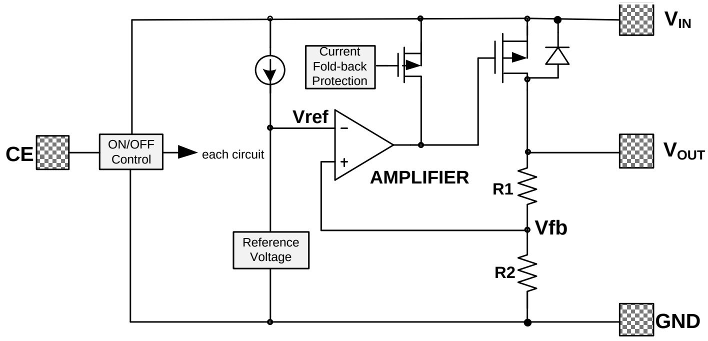
Power-Down:

MD8433(I_{OUT}=300mA)

■ 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. Further, the IC's internal circuitry can be in operation or shutdown modes controlled by the CE pin's signal.



2. Pass transistor

The pass transistor with low turn-on resistance used in MD84XX is a P-channel MOSFET. If the potential on V_{OUT} pin is higher than VIN, 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 foldback, short circuit protection and over temperature protection

The MD84XX series includes a combination of a fixed current limiter circuit and a foldback circuit, which aid the operations of the current limiter and circuit protection. When the load current reaches the current limit level, the fixed current limiter circuit operates and output voltage drops. As a result of this drop in output voltage, the foldback circuit operates, output voltage drops further and output current decreases. The short circuit current is about 65mA (typical value). This design can prevent the chip be damaged due to over temperature, moreover, the heat dissipation is limited by the package type.

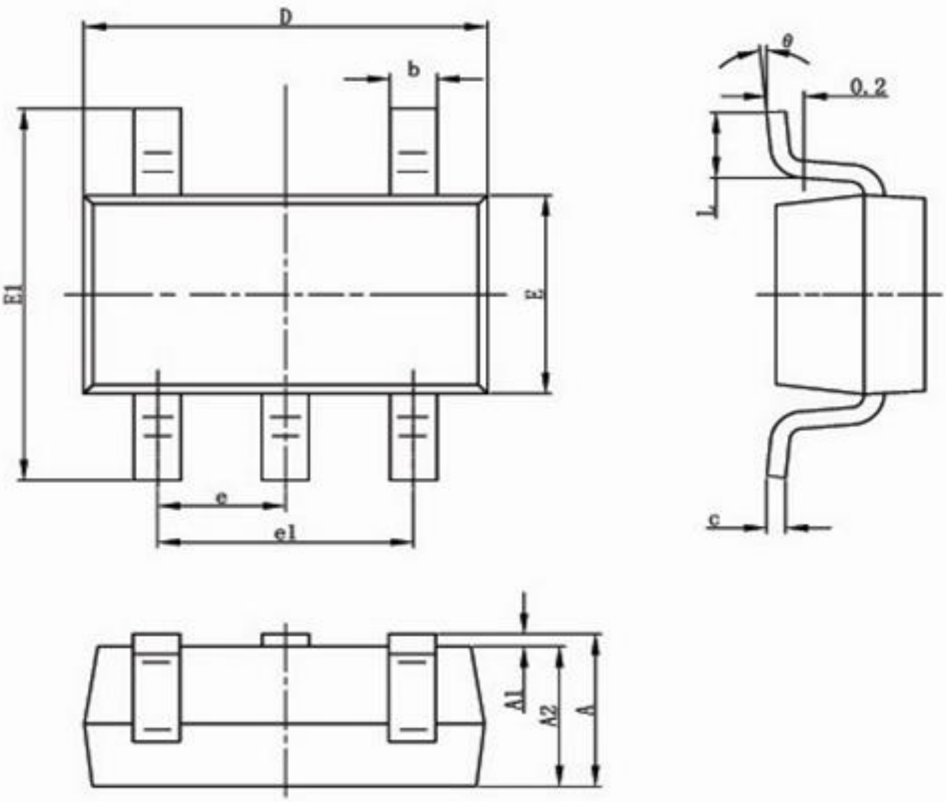
Special attention should be paid to that the product of the dropout voltage on the chip and the output current must be smaller than the heat dissipation. If power consumption on the chip is more than the heat dissipation, OTP will protect the chip from damaging due to over temperature.

■ 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.

■ PACKAGING INFORMATION

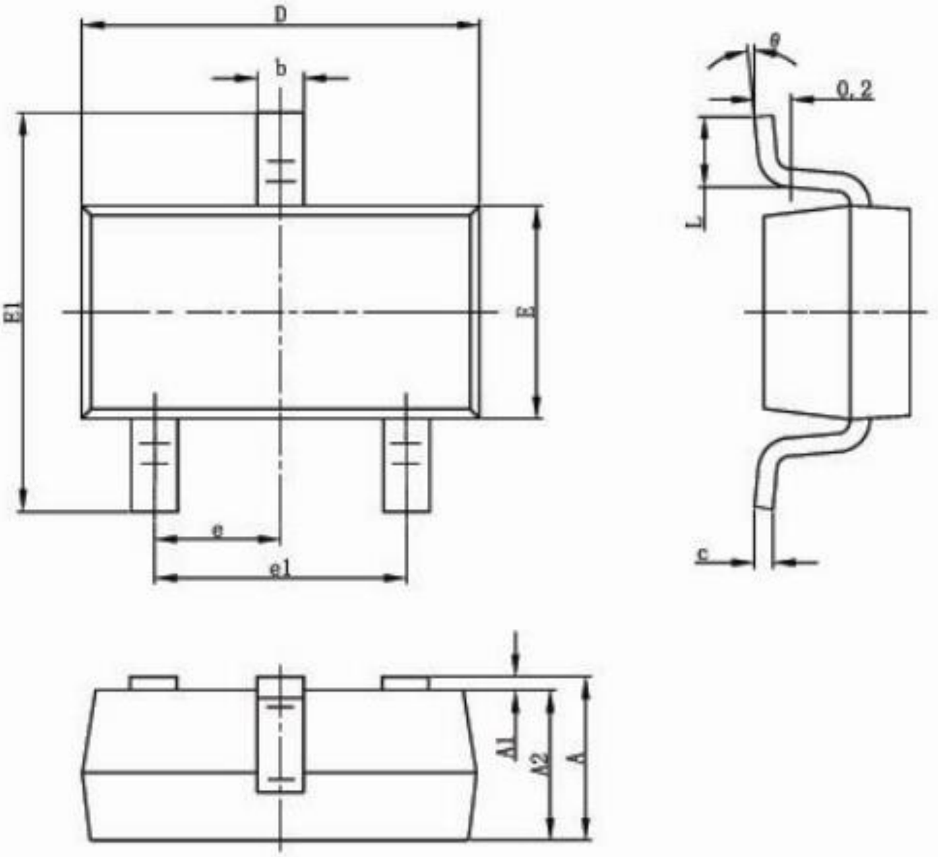
SOT-23-5L PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
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°

■ PACKAGING INFORMATION(Continued)

SOT-23-3L PACKAGE OUTLINE DIMENSIONS



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For the newest datasheet, please see the website: www.md-ic.com.cn

Version V1.4: 20191028

单击下面可查看定价，库存，交付和生命周期等信息

[>>MingDa(明达微)]