High Voltage Low Power Consumption LDO   MD73XXH

CMOS Voltage Regulator   300mA

MD73XXH is a high voltage low power low dropout voltage regulator (LDO) manufactured in CMOS processes. It can deliver up to 300mA of current while consuming only 2.4uA of quiescent current，at the same time with high input voltage capacity it can be up to 40V, suitable for applications which requires higher voltage circuit.

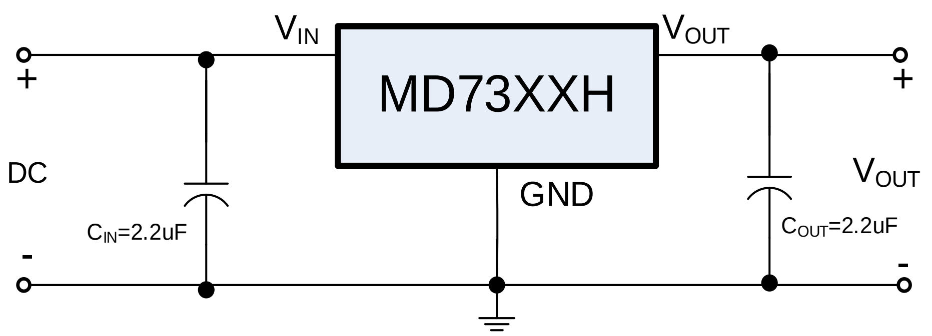
■ FEATURES:

- Output Voltage Highly Accurate: ±2%
- Dropout Voltage:3mV@I_{OUT}=1mA
- Low Quiescent Current:2.4uA
- Temperature Stability:±30ppm /℃
- Maximum Input Voltage:40V
- Current Limit Protection

■ APPLICATIONS:

- Automotive electronics
- Intelligent meters and instruments
- Industrial control
- And so on

■ TYPICAL APPLICATIONS:



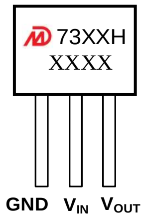
■ Notes on Use

1.Input Capacitor (C_{IN}): 2.2μF above.

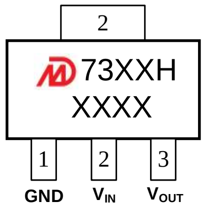
2.Output Capacitor (C_{OUT}): 2.2μF above.

■ Pin Configuration and Functions

TO-92
Top View



SOT89-3
Top View



■ Product Selections

Product Name	V_{OUT} (V)	Package	Ordering Name	Marking	Package Information
MD7330H	3.0	SOT89-3L	MD73HA30PA1	7330H XXXX	Tape and Reel, 1000pcs
MD7333H	3.3	SOT89-3L	MD73HA33PA1	7333H XXXX	
MD7336H	3.6	SOT89-3L	MD73HA36PA1	7336H XXXX	
MD7340H	4.0	SOT89-3L	MD73HA40PA1	7340H XXXX	
MD7350H	5.0	SOT89-3L	MD73HA50PA1	7350H XXXX	
MD7330H	3.0	TO-92	MD73HA30OA1	7330H XXXX	Bag, 1000pcs
MD7333H	3.3	TO-92	MD73HA33OA1	7333H XXXX	
MD7336H	3.6	TO-92	MD73HA36OA1	7336H XXXX	
MD7340H	4.0	TO-92	MD73HA40OA1	7340H XXXX	
MD7350H	5.0	TO-92	MD73HA50OA1	7350H XXXX	

Notes:

1* Customer can request to customize the output voltage ranged from 2.5V to 13V if desired voltage is not found in the selections.

2* Customer can request customization of package choice.

3* The characters "XXXX" in the second line of the Marking represents the internal lot number of MD.

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

PARAMETER	SYMBOL	RATINGS	UNITS
Input Voltage	VIN	-0.3 ~ 45	V
Output Voltage	VOUT	Vss-0.3 ~ VIN+0.3V	
Power Dissipation	P_D	SOT89-3 1000	mW
		TO-92 300	
Thermal Resistance	$R_{\theta JA}$	SOT89-3 100	℃/W
		TO-92 250	
Operating Ambient Temperature	Topr	-40 ~ +85	℃
Storage Temperature	Tstg	-40 ~ +125	
ESD Protection	ESD HBM	5500	V

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

■ ELECTRICAL CHARACTERISTICS

MD73XXH Series （Unless otherwise indicated: Ta=25℃）

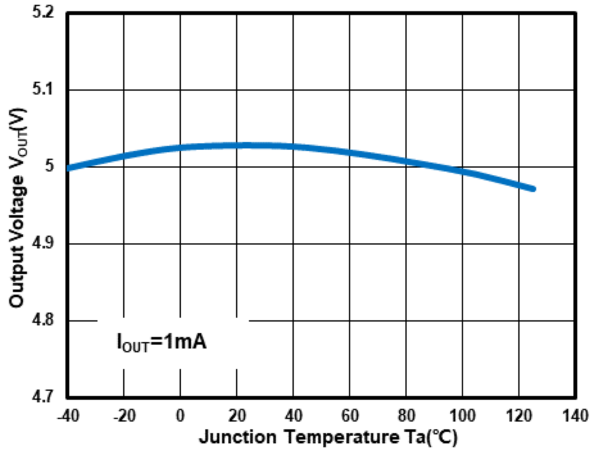
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage[*1]	$V_{OUT(S)}$	$V_{IN}=V_{OUT(S)}+2V$, $I_{OUT}=1mA$	$V_{OUT(S)}\times$ 0.98	$V_{OUT(S)}$	$V_{OUT(S)}\times$ 1.02	V
Output Current	I_{OUT}	$V_{IN} = V_{OUT(S)} +2V$	300			mA
Dropout Voltage[*2]	V_{drop}	$I_{OUT}=1mA$ $I_{OUT}=300mA$		3 1000	6 1600	mV
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \bullet V_{OUT(s)}}$	$V_{OUT(S)}+2V\le V_{IN}\le 40V$ $I_{OUT} =1mA$		0.01	0.15	%/V
Load Regulation	ΔV_{OUT2}	$V_{IN} = V_{OUT(S)}+2V$ $1mA\le I_{OUT}\le 300mA$		40	90	mV
Temperature Stability		$V_{IN} = V_{OUT(S)}+2V$, $I_{OUT}=10mA$ $-40℃\le T_a\le 85℃$		±30		ppm/℃
Quiescent Current	I_{SS}	V_{IN} =40V, no load		2.4	4	uA
Input Voltage	VIN_{max}	---			40	V
Current Limit[*3]	I_{LIM}	$V_{IN}= V_{OUT(S)}+3V$, $V_{OUT}= 0.9*V_{OUT(S)}$		630		mA
Power Supply Rejection Ratio	PSRR	f=100Hz, IOUT=10mA		73		dB
		f=1kHz, IOUT=10mA		83		
		f=10kHz, IOUT=10mA		80		
		f=100kHz, IOUT=10mA		60		

Notes：

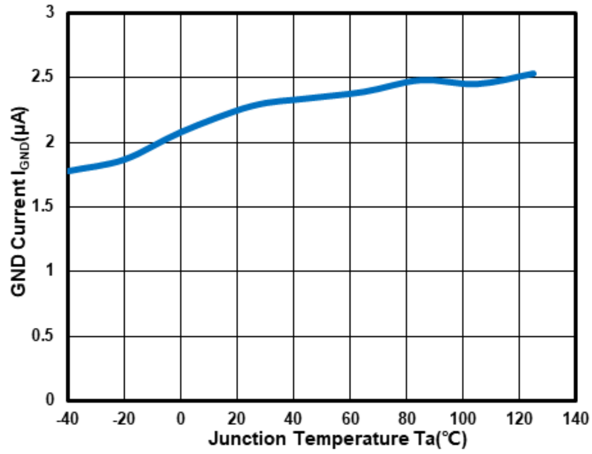
1. $V_{OUT(S)}$: Output voltage when $V_{IN}=V_{OUT}+2V$, $I_{OUT}=1$ mA.
2. $V_{DROP}=V_{IN1}$ -（$V_{OUT(S)}\times$ 0.98）where V_{IN1} is the input voltage when $V_{OUT} = V_{OUT(S)}\times$ 0.98.
3. I_{LIM}: Output current when $V_{IN}=V_{OUT(S)}+3V$ and $V_{OUT} = 0.9*V_{OUT(S)}$.

■ Typical Performance Characteristics:

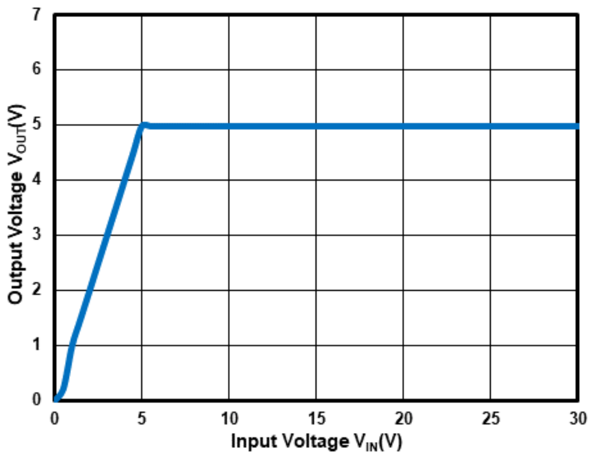
Test Conditions: $V_{IN}=V_{OUT}+2.0V$, $C_{IN}=2.2\mu F$, $C_{OUT}=2.2\mu F$, $T_a=25℃$, unless otherwise indicated.



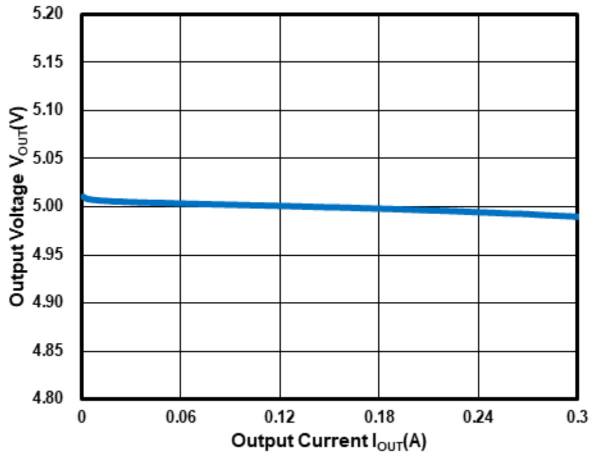
Output Voltage vs. Temperature at V_{OUT}=5V



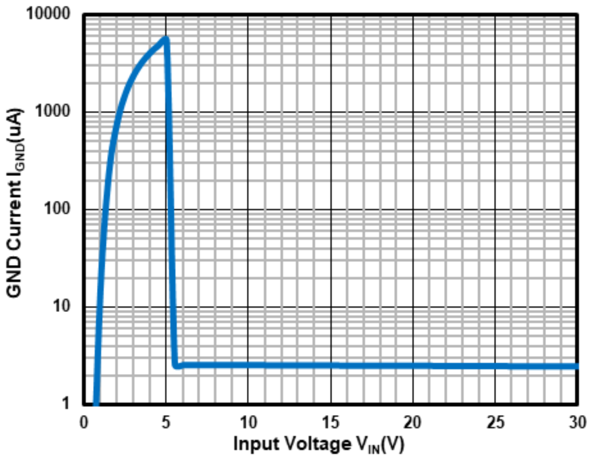
GND Current vs. Temperature at V_{OUT}=5V



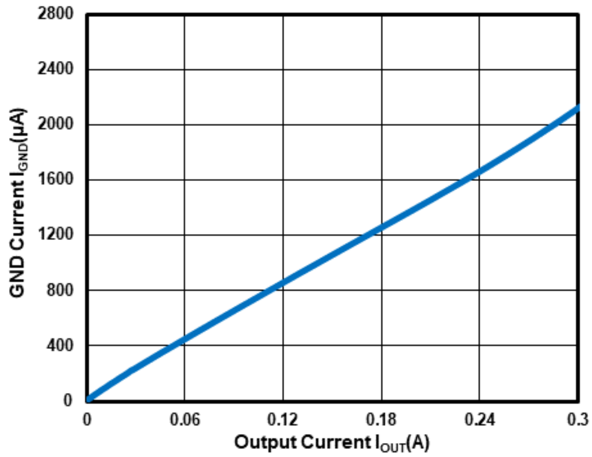
Output Voltage vs. Input Voltage at V_{OUT}=5V



Output Current vs. Output Voltage at V_{OUT}=5V



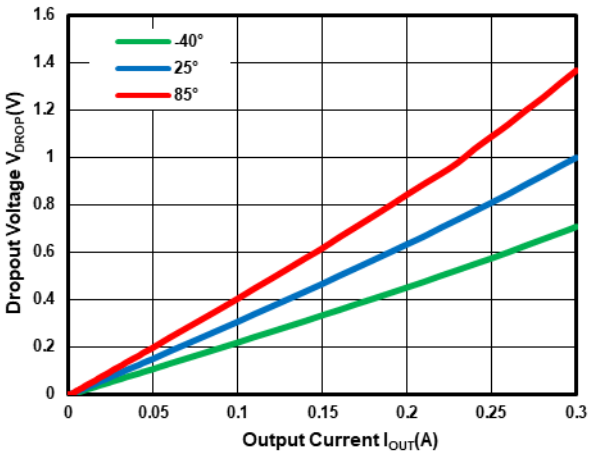
GND Current vs. Input Voltage at V_{OUT}=5V



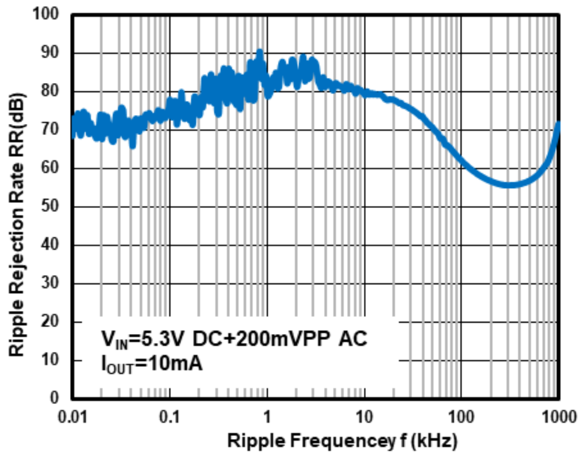
Output Current vs. GND Current at V_{OUT}=5V

■ **Typical Performance Characteristics:**

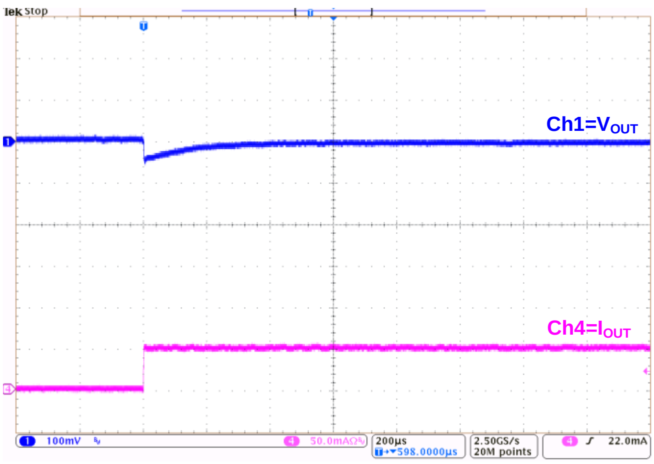
Test Conditions: $V_{IN}=V_{OUT}+2.0V$, $C_{IN}=2.2\mu F$, $C_{OUT}=2.2\mu F$, $T_a=25℃$, unless otherwise indicated.



Output Voltage vs. Input Voltage at $V_{OUT}=5V$

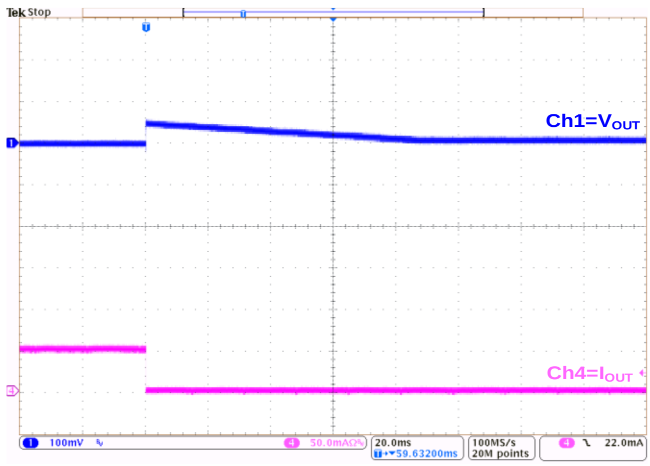


Power Supply Rejection Ratio at $V_{OUT}=5V$



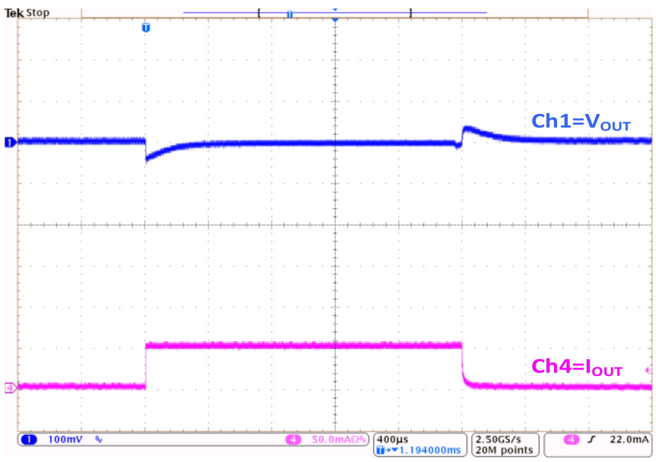
Load Transient at $V_{OUT}=5V$:

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



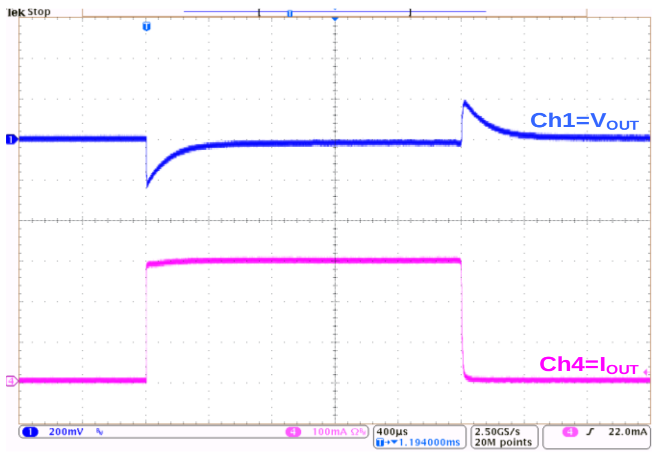
Load Transient at $V_{OUT}=5V$:

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



Load Transient at $V_{OUT}=5V$:

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

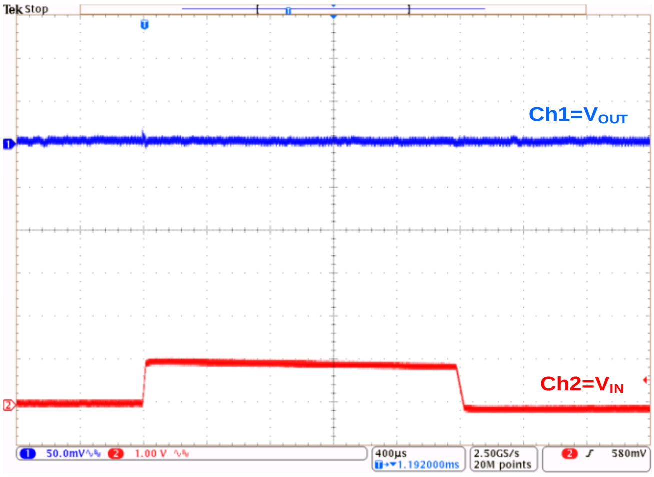


Load Transient at $V_{OUT}=5V$:

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

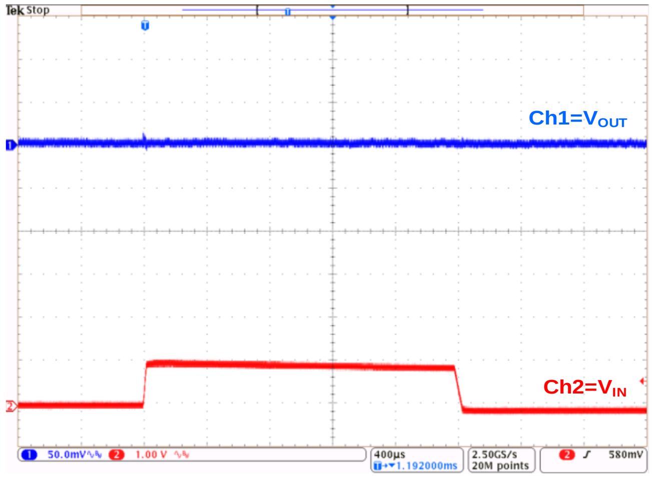
■ Typical Performance Characteristics:

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



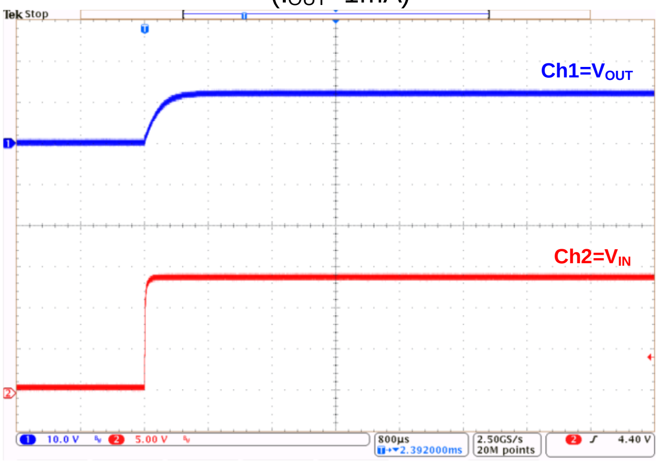
Line Transient at $V_{OUT}=5V$:

($I_{OUT}=1mA$)



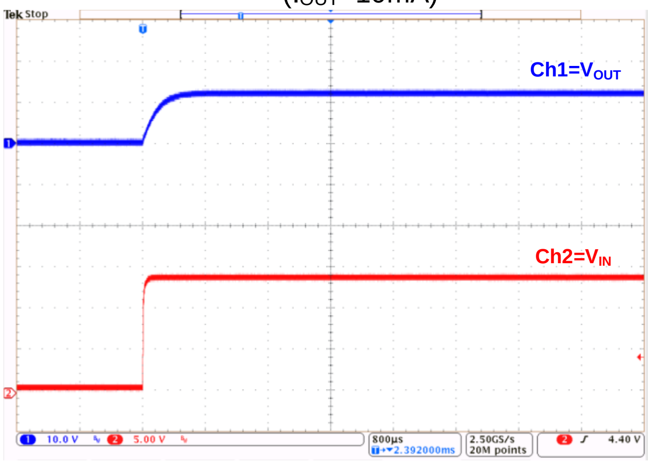
Line Transient at $V_{OUT}=5V$:

($I_{OUT}=10mA$)



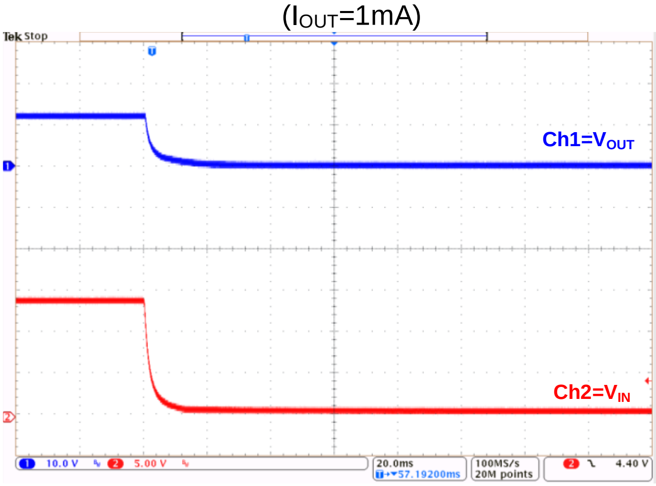
Power-Up at $V_{OUT}=5V$:

($I_{OUT}=1mA$)



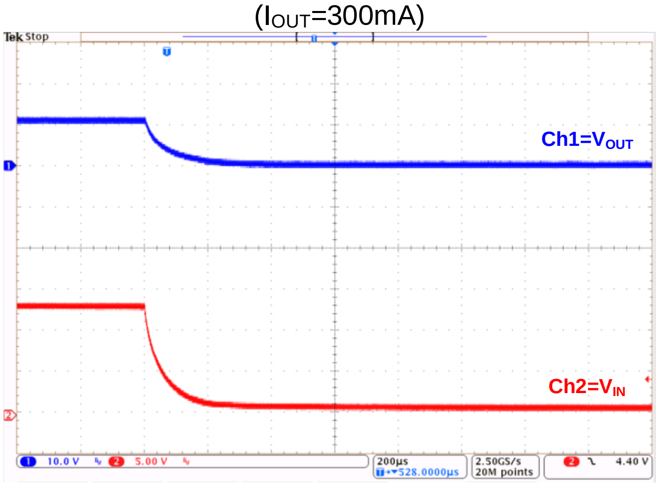
Power-Up at $V_{OUT}=5V$:

($I_{OUT}=300mA$)



Power-Down at $V_{OUT}=5V$:

($I_{OUT}=1mA$)



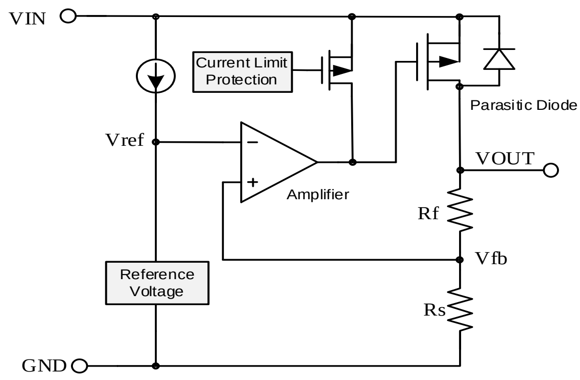
Power-Down at $V_{OUT}=5V$:

($I_{OUT}=300mA$)

■ OPERATIONAL EXPLANATION:

1.Output voltage control

The voltage divided by resistors Rf and Rs is compared with the internal reference voltage by the error amplifier. The amplifier output then drives the P-channel MOSFET connected to the VOUT pin. The output voltage at the VOUT pin is regulated by this negative feedback system. The current limit circuit operates in relation to output current level.



2.Pass transistor

The pass transistor with low turn-on resistance used in MD73HXX is a P-channel MOSFET. If the potential on VOUT pin is higher than VIN, it is possible that IC will be destroyed due to reverse current which is caused by parasitic diodes between VIN and VOUT. Therefore, the VOUT pin potential exceeds VIN+0.3V is not allowed.

3.Circuit limit protection

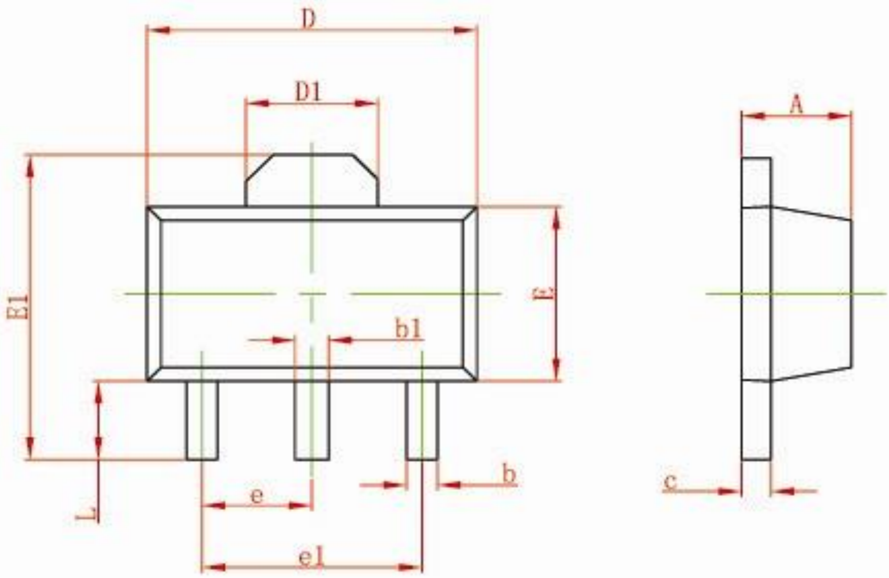
The MD73HXX includes current limit protection feature. If the output is overloaded or shorted to ground,it can inhibit the current of 630mA(typical value),therefore,the chip can avoid damage. Special attention should be paid to that the product of the dropout voltage on the chip and the output current must be smaller than the heat dissipation.

■ 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.

■ Packaging Information

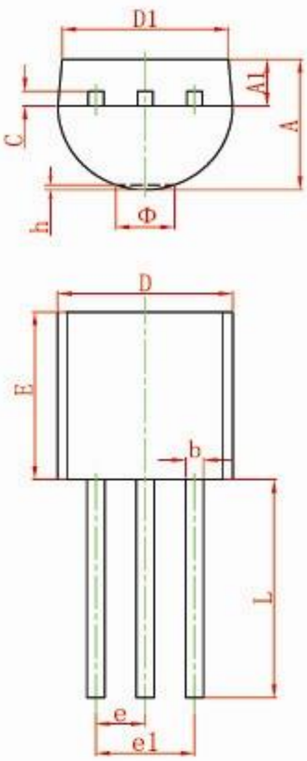
SOT-89-3L PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.197
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	1.550 REF		0.061 REF	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP		0.060TYP	
e1	3.000 TYP		0.118TYP	
L	0.900	1.200	0.035	0.047

■ Packaging Information (Continued)

TO-92 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.300	3.700	0.130	0.146
A1	1.100	1.400	0.043	0.055
b	0.380	0.550	0.015	0.022
c	0.360	0.510	0.014	0.020
D	4.400	4.700	0.173	0.185
D1	3.430		0.135	
E	4.300	4.700	0.169	0.185
e	1.270 TYP		0.050 TYP	
e1	2.440	2.640	0.096	0.104
L	14.100	14.500	0.555	0.571
Φ		1.600		0.063
h	0.000	0.380	0.000	0.015