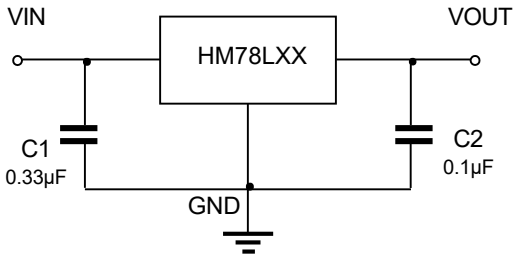
30V 100mA Low Dropout Linear Regulator

■ Description

The HM78LXX is a fixed voltage (3V/3.3V/5V) three-terminal integrated regulator that can be used in many applications. Its excellent internal current limit and thermal shutdown characteristics make it especially suitable for overload conditions. When used to replace the traditional Zener diode-resistor bank, its output impedance is effectively improved, but the bias current is greatly reduced.

With enough heat dissipation, HM78LXX can provide 100mA output current. A current limit is included to limit the peak output current to a safe value, and a safe area protection for the output transistor to limit internal power dissipation. A thermal shutdown circuit prevents the IC from overheating if the internal power dissipation is too high for the provided heat sink.

■ Typical Application Circuit



■ Features

- ±2% output voltage tolerance
- V_{IN} range up to 30V
- Maximum output current 100mA
- Output transistor safe area protection
- Built-in Thermal Protection
- Built-in Overcurrent Protection

■ Application

- New energy (photovoltaic inverter, charging pile, etc.)
- Security (walkie-talkies, alarms, etc.)
- Mobile terminals (notebooks, sound cards, etc.)
- Electric vehicles (wipers, windows, etc.)
- LED lighting
- High speed air duct, electric tools, induction cooker

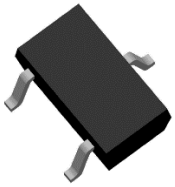
■ Package (RoHS Compliant)

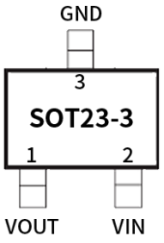
- SOT89-3
- SOT23-3
- DFN1X1-4L

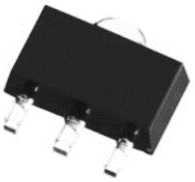
■ Ordering Information

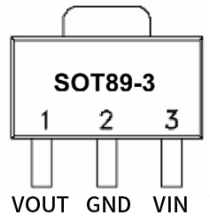
Order Code	V_{IN} (V)	V_{OUT} (V)	I_{OUT} max. (mA)	I_Q (uA)	Output Precision	PSRR (dB@1KHz)	Dropout Voltage (mV)	Enable
HM78L03	7~30	3.0	100	240	±2%	75	800@40mA	—
HM78L33		3.3						
HM78L05		5.0						

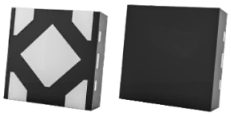
■ Pin Configuration

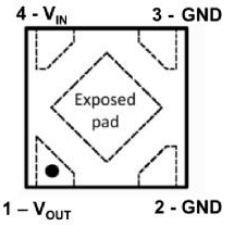






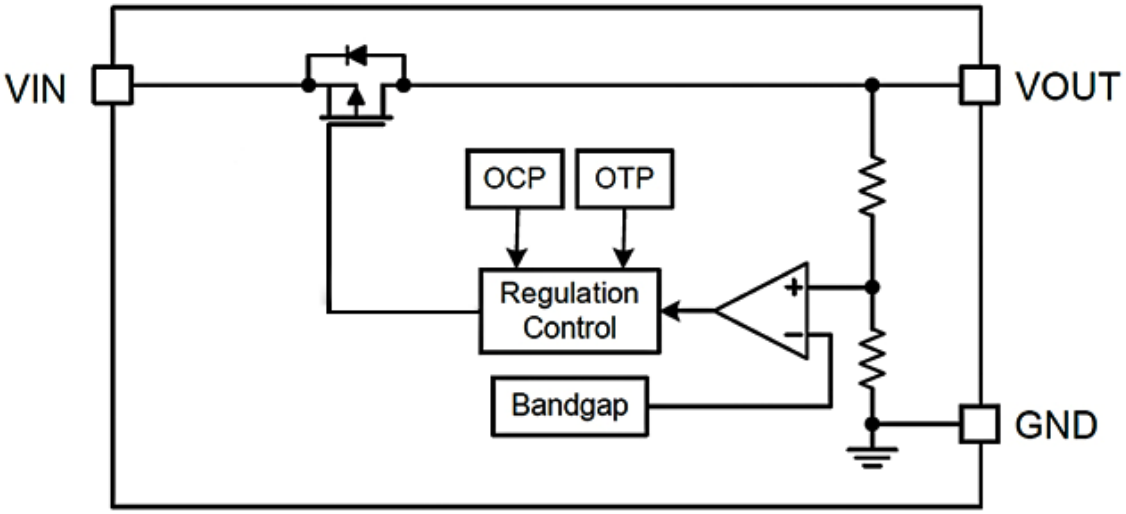






Pin Name	SOT23-3 Pin	SOT89-3 Pin	DFN1X1-4L Pin	Pin Function
VOUT	1	1	1	Output Voltage Pin
GND	3	2	2,3	Ground
VIN	2	3	4	Input Voltage Pin

■ Functional Block Diagram



■ Absolute Maximum Ratings

Project	Symbol	Value		Units
Input Voltage	V_{IN}	-0.3 ~ +35		V
Junction Temperature	T_J	150		℃
Power Dissipation	P_D	SOT89-3	0.5	W
		SOT23-3	0.29	
		DFN1X1	0.4	
Thermal Resistance	$R_{\theta JA}$	SOT89-3	200	ºC/W
		SOT23-3	350	
		DFN1X1	250	
Lead Temperature (Soldering, 10 sec.)	—	300		℃
Storage Temperature	Tstg	-65 ~ +150		℃

(1) Absolute maximum ratings indicate that exceeding these ratings may cause damage to the component. The operating rating is the specified operating conditions of the device.Running the rated value does not imply a validated performance limit. For performance limits and related testing conditions, please refer to the electrical characteristics table.

(2) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(3) $R_{\theta JA}$ is measured at T_A = 25°C on a high effective thermal conductivity four-layer test board per JEDEC 51-7.

■ Recommended Operating Conditions

Project	Symbol	Value	Units
Input voltage	V_{IN}	7~ 30	V
Operating temperature	T_A	-40 ~ +85	ºC
Junction Temperature	T_J	-40 ~ +125	℃

■ Electrical Characteristics

V_{IN}=10V, I_{OUT}=40mA, C_{IN}=0.33uF, C_{OUT}=0.1uF, T_J=25℃, unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{OUT}	Output Voltage （HM78L03）	T_J = 25℃	2.94	3	3.06	V
		V_{IN} = 7 ~20V, I_{OUT} = 1mA~40mA T_J = 0℃~125℃	2.91		3.09	
		I_{OUT} = 1mA~70mA T_J = 0℃~125℃	2.91		3.09	

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{OUT}	Output Voltage（HM78L33）	T_J = 25℃	3.234	3.3	3.366	V
		V_{IN} = 7 ~20V, I_{OUT} = 1mA~40mA T_J = 0℃~125℃	3.2		3.4	
		I_{OUT} = 1mA~70mA T_J = 0℃~125℃	3.2		3.4	
V_{OUT}	Output Voltage（HM78L05）	T_J = 25℃	4.9	5	5.1	V
		V_{IN} = 7 ~20V, I_{OUT} = 1mA~40mA T_J = 0℃~125℃	4.85		5.15	
		I_{OUT} = 1mA~70mA T_J = 0℃~125℃	4.85		5.15	
$\triangle V_{LINE}$	Line Regulation	V_{IN} = 7~20V		12	30	mV
		V_{IN} = 8~20V		10	25	
$\triangle V_{LOAD}$	Load Regulation	I_{OUT} = 1mA ~100mA		20	50	mV
		I_{OUT} = 1mA ~40mA		10	25	
I_Q	Quiescent Current	T_J = 25℃		240		uA
		T_J = 125℃			1000	
$\triangle I_Q$	Quiescent Current Change	V_{IN} = 8 ~20V T_J = 0℃~125℃			0.2	mA
		I_{OUT} = 1mA~40mA T_J = 0℃~125℃			0.1	
PSRR	Ripple Rejection	f = 1KHz,V_{IN} = 10V I_{OUT} = 10mA,T_J = 25°C		75		dB
V_N	Output Noise Voltage	f = 10Hz~100KHz		32		uV
V_{DROP}	Dropout Voltage	I_{OUT} = 40mA		0.8		V
		I_{OUT} = 100mA		2.3		V
$\triangle V_{OUT}/\triangle T$	V_{OUT} Temp. Coefficient	I_{OUT} = 5mA		0.4		mV/℃
I_{PK}	Peak Output Current			170		mA

■ Typical Characteristics

V_{IN}=10V, I_{OUT}=40mA, C_{IN}=0.33uF, C_{OUT}=0.1uF, T_J=25℃, unless otherwise specified

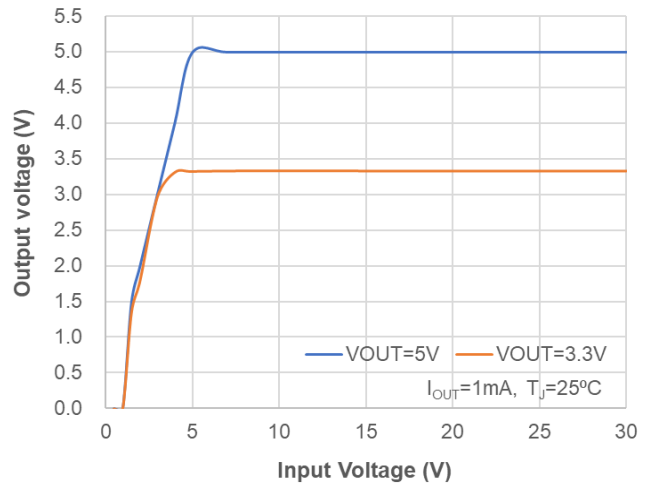


Fig 1. Output Voltage vs Input Voltage

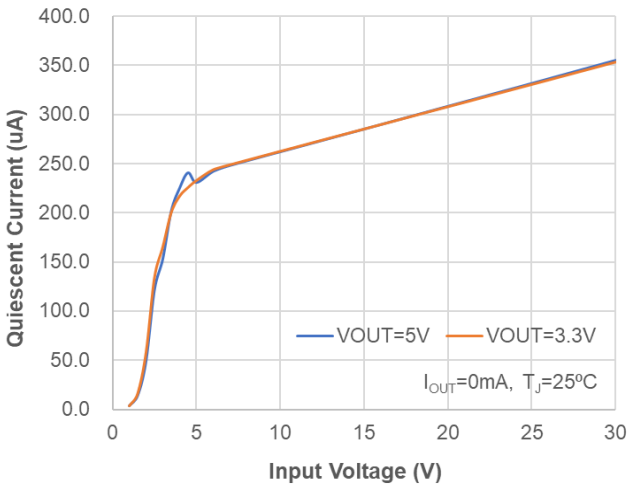


Fig 2. Quiescent Current vs Input Voltage

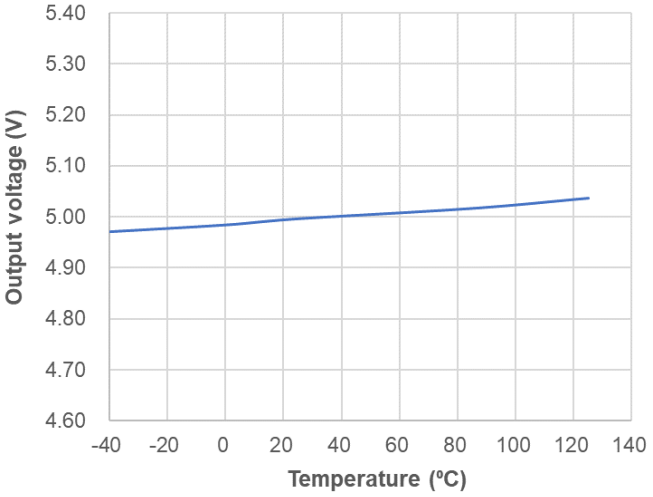


Fig 3. V_{OUT}=5V vs Temp

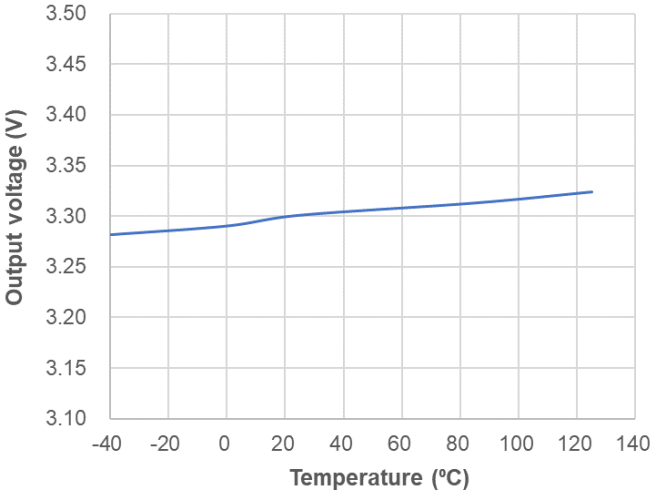


Fig 4. V_{OUT}=3.3V vs Temp

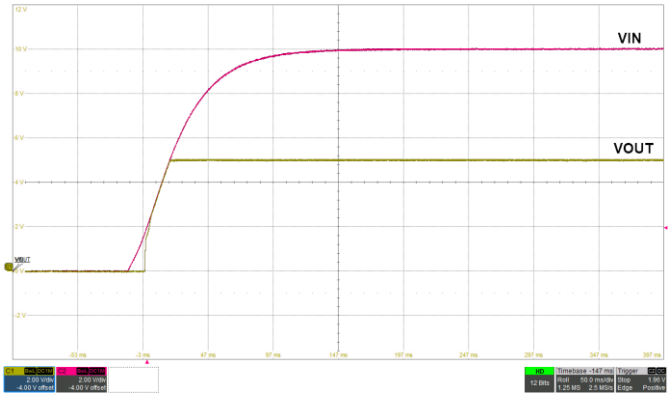


Fig 5. VIN power on (Rising time=100ms)

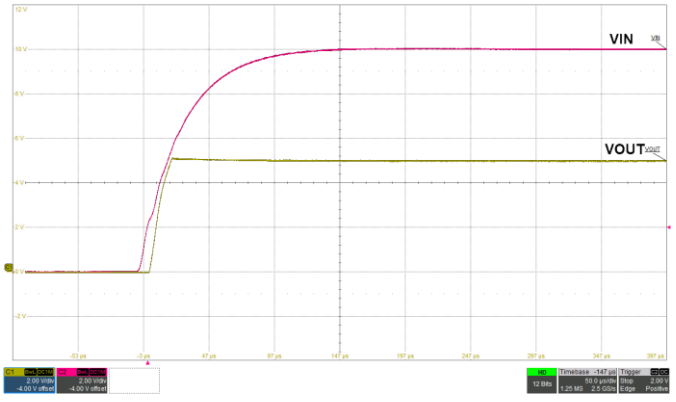


Fig 6. VIN power on (Rising time=100us)

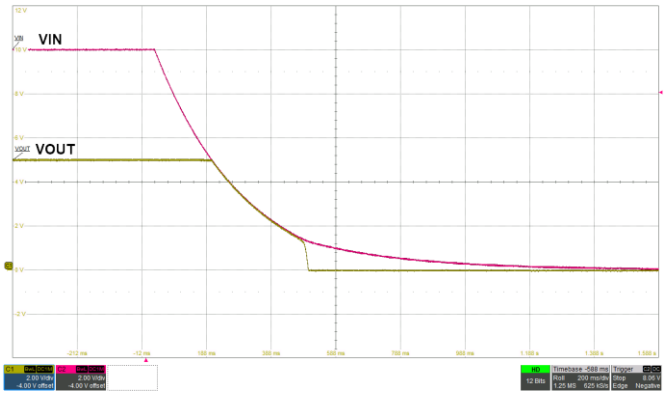


Fig 7. VIN power off

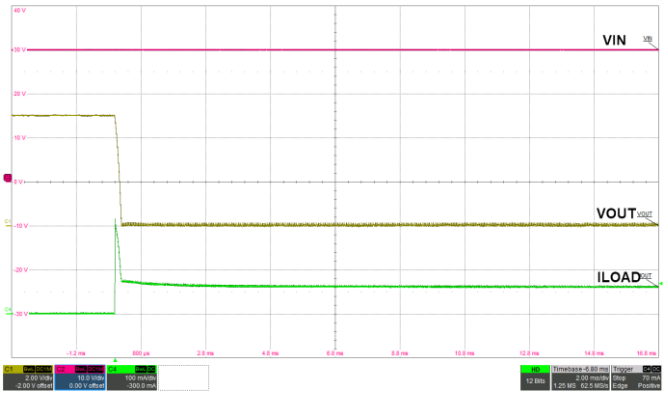


Fig 8. VOUT Short to GND

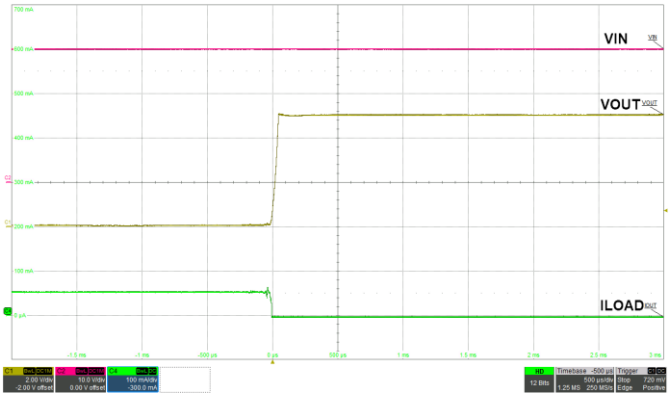


Fig 9. VOUT Short and Release

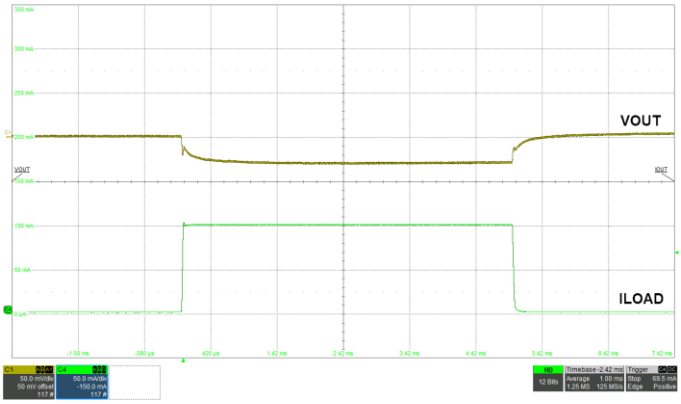


Fig 10. Load Transient(1mA to 100mA)

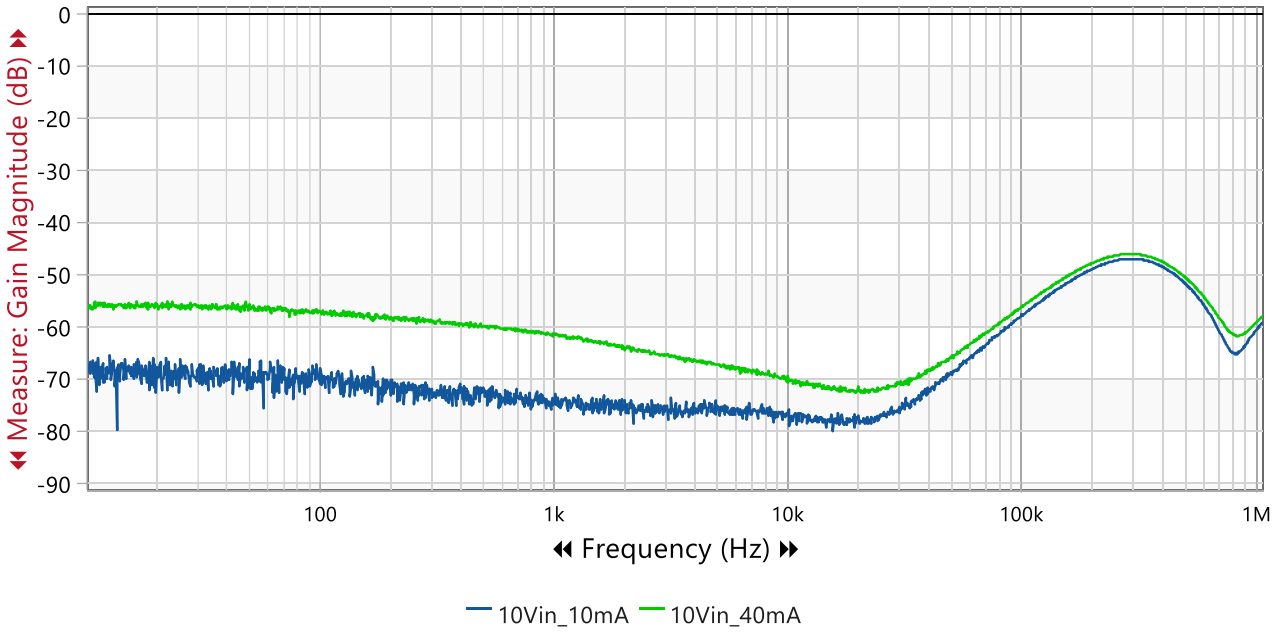


Fig 10. PSRR vs Frequency (V_{IN} = 10V, V_{OUT} = 5V)