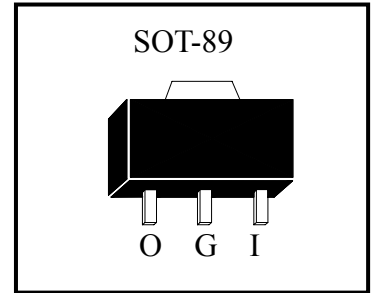


**Three Terminal Medium Current Positive Voltage Regulators**

# LM78MXXM3



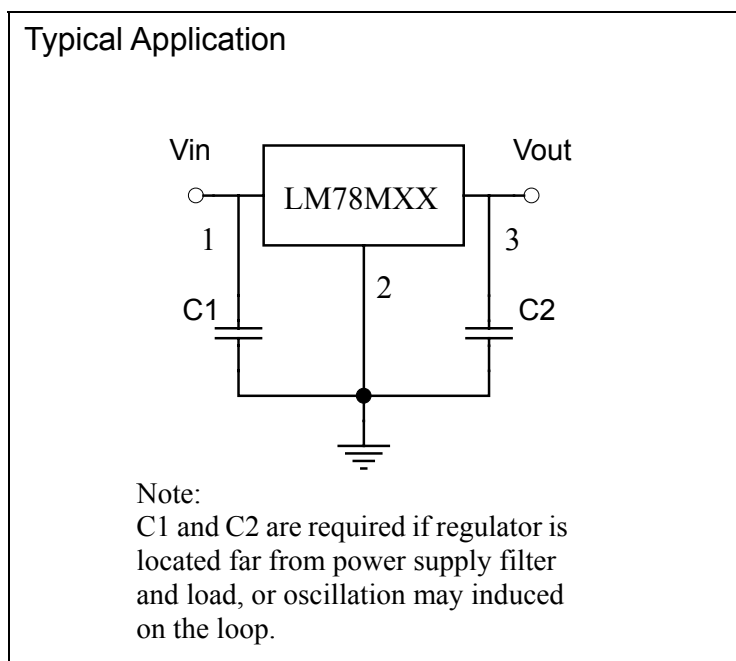
**Description**

The LM78MXXM3 series of three-terminal positive regulators are available in the SOT-89 package and with 5V, 6V, 8V, 9V, 12V, 15V, 18V and 24V fixed output voltages, making them useful in a wide range of applications. These regulators can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each type employs internal current-limiting, thermal shut-down and safe operating area protection, making them essentially indestructible. If adequate heat sinking is provided, they can deliver over 500mA output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

**Absolute Maximum Ratings (Ta=25°C)**

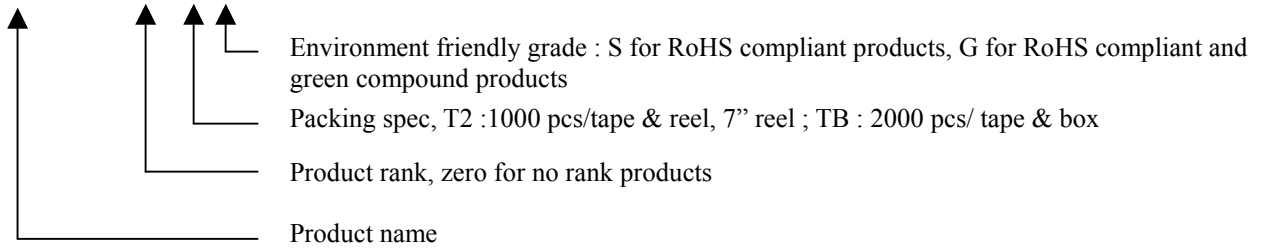
Parameter		Ratings	Unit
Input Voltage	LM7805~LM7818	35	V
	LM7824	40	
Operating Temperature Range		-40 ~ +125	°C
Output Current		500	mA
Storage Temperature Range		-65 ~ +150	°C
Total Power Dissipation		0.5	W

Note : When mounted on minimum pad size and tested in free air condition, without heat sinking.

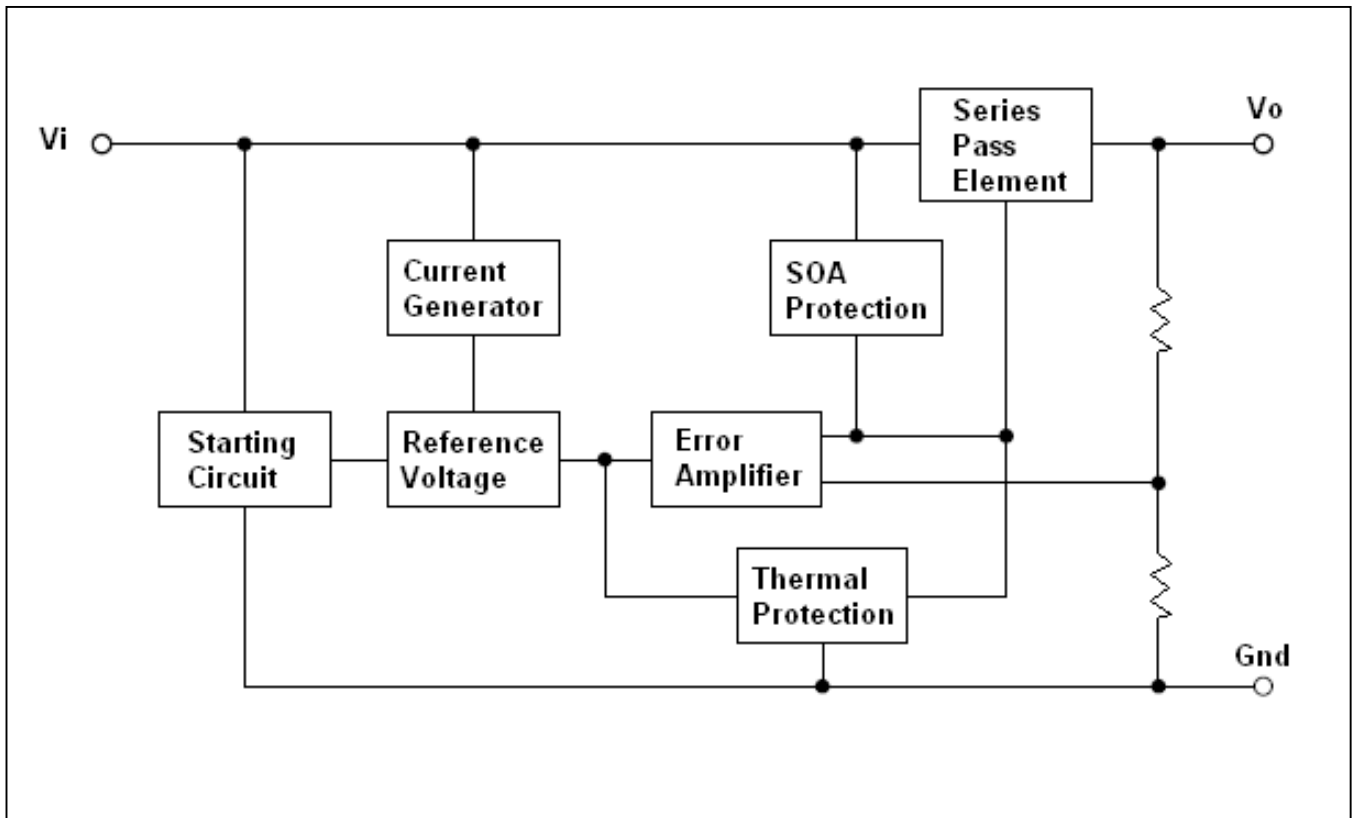


**Ordering Information**

Device	Output Voltage Tolerance	Package	Shipping
LM78MXXM3-A-T2-G	±3%	SOT-89	1000 pcs / Tape & Reel
LM78MXXM3-B-T2-G	±5%	(Pb-free lead plating and halogen-free package)	



**Block Diagram**





**Electrical Characteristics**

**LM78M05** (Ta=25°C, Vin=10V, Io=350mA, Cin=0.33uF, Cout=0.1uF, unless otherwise noted)

Symbol	Parameter	Conditions	LM78M05			Units
			Min	Typ	Max	
Vo	Output Voltage		4.80	5.0	5.20	V
		5mA≤Io≤350mA 7.5V≤Vin≤20V	4.75	-	5.25	
ΔVo	Line Regulation	Io=200mA, 7V≤Vin≤25V	-	3	100	mV
		Io=200mA, 8V≤Vin≤25V	-	1	50	
ΔVo	Load Regulation	5mA≤Io≤500mA	-	30	100	mV
		5mA≤Io≤200mA	-	12	50	
IQ	Quiescent Current		-	3	8	mA
ΔIQ	Quiescent Current Change	5mA≤Io≤350mA	-	-	0.5	mA
		8V≤Vin≤25V, Io=200mA	-	-	1.0	
Vn	Output Noise Voltage	10Hz≤f≤100KHz	-	40	-	μV
RR	Ripple Rejection	8V≤Vin≤18V, Io=100mA, f=120Hz, eIN=1Vrms	62	-	-	dB
VD	Dropout Voltage	Io=500mA	-	2	-	V
ISC	Output Short Circuit Current	Vin=25V		400		mA
IPK	Peak Output Current	Tj=25°C		700		mA
TCVo	Temperature Coefficient of Output Voltage	Io=5mA, 0≤Tj≤125°C		-1		mV/°C

**LM78M06** (Ta=25°C, Vin=11V, Io=350mA, Cin=0.33uF, Cout=0.1uF, unless otherwise noted)

Symbol	Parameter	Conditions	LM78M06			Units
			Min	Typ	Max	
Vo	Output Voltage		5.76	6.0	6.24	V
		5mA≤Io≤350mA 8.5V≤Vin≤21V	5.70	-	6.30	
ΔVo	Line Regulation	Io=200mA, 8V≤Vin≤25V	-	3	100	mV
		Io=200mA, 9V≤Vin≤25V	-	1	50	
ΔVo	Load Regulation	5mA≤Io≤500mA	-	30	120	mV
		5mA≤Io≤200mA	-	15	60	
IQ	Quiescent Current		-	3	8	mA
ΔIQ	Quiescent Current Change	5mA≤Io≤350mA	-	-	0.5	mA
		9V≤Vin≤25V, Io=200mA	-	-	1.0	
Vn	Output Noise Voltage	10Hz≤f≤100KHz	-	60	-	μV
RR	Ripple Rejection	9V≤Vin≤19V, Io=100mA, f=120Hz, eIN=1Vrms	60	-	-	dB
VD	Dropout Voltage	Io=500mA	-	2	-	V
ISC	Output Short Circuit Current	Vin=25V		400		mA
IPK	Peak Output Current	Tj=25°C		700		mA
TCVo	Temperature Coefficient of Output Voltage	Io=5mA, 0≤Tj≤125°C		-0.5		mV/°C



**LM78M08** ( $T_a=25^\circ\text{C}$ ,  $V_{in}=14\text{V}$ ,  $I_o=350\text{mA}$ ,  $C_{in}=0.33\mu\text{F}$ ,  $C_{out}=0.1\mu\text{F}$ , unless otherwise noted)

Symbol	Parameter	Conditions	LM78M08			Units
			Min	Typ	Max	
Vo	Output Voltage		7.68	8.0	8.32	V
		$5\text{mA} \leq I_o \leq 350\text{mA}$ $10.5\text{V} \leq V_{in} \leq 23\text{V}$	7.60	-	8.40	
$\Delta V_o$	Line Regulation	$I_o=200\text{mA}$ , $10.5\text{V} \leq V_{in} \leq 25\text{V}$	-	4	100	mV
		$I_o=200\text{mA}$ , $11\text{V} \leq V_{in} \leq 25\text{V}$	-	1	50	
$\Delta V_o$	Load Regulation	$5\text{mA} \leq I_o \leq 500\text{mA}$	-	30	160	mV
		$5\text{mA} \leq I_o \leq 200\text{mA}$	-	15	80	
IQ	Quiescent Current		-	3	8	mA
$\Delta IQ$	Quiescent Current Change	$5\text{mA} \leq I_o \leq 350\text{mA}$	-	-	0.5	mA
		$10.5\text{V} \leq V_{in} \leq 25\text{V}$ , $I_o=200\text{mA}$	-	-	1.0	
Vn	Output Noise Voltage	$10\text{Hz} \leq f \leq 100\text{KHz}$	-	80	-	$\mu\text{V}$
RR	Ripple Rejection	$11.5\text{V} \leq V_{in} \leq 21.5\text{V}$ , $I_o=100\text{mA}$ , $f=120\text{Hz}$ , $e_{IN}=1\text{Vrms}$	56	-	-	dB
VD	Dropout Voltage	$I_o=500\text{mA}$	-	2	-	V
ISC	Output Short Circuit Current	$V_{in}=25\text{V}$		400		mA
IPK	Peak Output Current	$T_j=25^\circ\text{C}$		700		mA
TCVo	Temperature Coefficient of Output Voltage	$I_o=5\text{mA}$ , $0 \leq T_j \leq 125^\circ\text{C}$		-0.5		$\text{mV}/^\circ\text{C}$

**LM78M09** ( $T_a=25^\circ\text{C}$ ,  $V_{in}=15\text{V}$ ,  $I_o=350\text{mA}$ ,  $C_{in}=0.33\mu\text{F}$ ,  $C_{out}=0.1\mu\text{F}$ , unless otherwise noted)

Symbol	Parameter	Conditions	LM78M09			Units
			Min	Typ	Max	
Vo	Output Voltage		8.64	9.0	9.36	V
		$5\text{mA} \leq I_o \leq 350\text{mA}$ $11.5\text{V} \leq V_{in} \leq 24\text{V}$	8.55	-	9.45	
$\Delta V_o$	Line Regulation	$I_o=200\text{mA}$ , $11.5\text{V} \leq V_{in} \leq 26\text{V}$	-	4	100	mV
		$I_o=200\text{mA}$ , $12\text{V} \leq V_{in} \leq 25\text{V}$	-	2	50	
$\Delta V_o$	Load Regulation	$5\text{mA} \leq I_o \leq 500\text{mA}$	-	30	180	mV
		$5\text{mA} \leq I_o \leq 200\text{mA}$	-	15	90	
IQ	Quiescent Current		-	3.5	8	mA
$\Delta IQ$	Quiescent Current Change	$5\text{mA} \leq I_o \leq 350\text{mA}$	-	-	0.5	mA
		$12\text{V} \leq V_{in} \leq 25\text{V}$ , $I_o=200\text{mA}$	-	-	1.0	
Vn	Output Noise Voltage	$10\text{Hz} \leq f \leq 100\text{KHz}$	-	90	-	$\mu\text{V}$
RR	Ripple Rejection	$13\text{V} \leq V_{in} \leq 23\text{V}$ , $I_o=100\text{mA}$ , $f=120\text{Hz}$ , $e_{IN}=1\text{Vrms}$	56	-	-	dB
VD	Dropout Voltage	$I_o=500\text{mA}$	-	2	-	V
ISC	Output Short Circuit Current	$V_{in}=30\text{V}$		170		mA
IPK	Peak Output Current	$T_j=25^\circ\text{C}$		700		mA
TCVo	Temperature Coefficient of Output Voltage	$I_o=5\text{mA}$ , $0 \leq T_j \leq 125^\circ\text{C}$		-0.5		$\text{mV}/^\circ\text{C}$



**LM78M12** ( $T_a=25^{\circ}\text{C}$ ,  $V_{in}=19\text{V}$ ,  $I_o=350\text{mA}$ ,  $C_{in}=0.33\mu\text{F}$ ,  $C_{out}=0.1\mu\text{F}$ , unless otherwise noted)

Symbol	Parameter	Conditions	LM78M12			Units
			Min	Typ	Max	
Vo	Output Voltage		11.52	12.0	12.48	V
		$5\text{mA} \leq I_o \leq 350\text{mA}$ $15\text{V} \leq V_{in} \leq 27\text{V}$	11.40	-	12.60	
$\Delta V_o$	Line Regulation	$I_o=200\text{mA}$ , $14.5\text{V} \leq V_{in} \leq 30\text{V}$	-	5	100	mV
		$I_o=200\text{mA}$ , $16\text{V} \leq V_{in} \leq 30\text{V}$	-	3	50	
$\Delta V_o$	Load Regulation	$5\text{mA} \leq I_o \leq 500\text{mA}$	-	30	240	mV
		$5\text{mA} \leq I_o \leq 200\text{mA}$	-	15	120	
IQ	Quiescent Current		-	3.5	8	mA
$\Delta IQ$	Quiescent Current Change	$5\text{mA} \leq I_o \leq 350\text{mA}$	-	-	0.5	mA
		$14.5\text{V} \leq V_{in} \leq 30\text{V}$ , $I_o=200\text{mA}$	-	-	1.0	
Vn	Output Noise Voltage	$10\text{Hz} \leq f \leq 100\text{KHz}$	-	110	-	$\mu\text{V}$
RR	Ripple Rejection	$15\text{V} \leq V_{in} \leq 25\text{V}$ , $I_o=100\text{mA}$ , $f=120\text{Hz}$ , $e_{IN}=1\text{V}_{rms}$	55	-	-	dB
VD	Dropout Voltage	$I_o=500\text{mA}$	-	2	-	V
ISC	Output Short Circuit Current	$V_{in}=30\text{V}$		170		mA
IPK	Peak Output Current	$T_j=25^{\circ}\text{C}$		700		mA
TCVo	Temperature Coefficient of Output Voltage	$I_o=5\text{mA}$ , $0 \leq T_j \leq 125^{\circ}\text{C}$		-0.5		$\text{mV}/^{\circ}\text{C}$

**LM78M15** ( $T_a=25^{\circ}\text{C}$ ,  $V_{in}=23\text{V}$ ,  $I_o=350\text{mA}$ ,  $C_{in}=0.33\mu\text{F}$ ,  $C_{out}=0.1\mu\text{F}$ , unless otherwise noted)

Symbol	Parameter	Conditions	LM78M15			Units
			Min	Typ	Max	
Vo	Output Voltage		14.40	15.0	15.60	V
		$5\text{mA} \leq I_o \leq 350\text{mA}$ $17.5\text{V} \leq V_{in} \leq 30\text{V}$	14.25	-	15.75	
$\Delta V_o$	Line Regulation	$I_o=200\text{mA}$ , $17.5\text{V} \leq V_{in} \leq 30\text{V}$	-	6	100	mV
		$I_o=200\text{mA}$ , $20\text{V} \leq V_{in} \leq 30\text{V}$	-	3	50	
$\Delta V_o$	Load Regulation	$5\text{mA} \leq I_o \leq 500\text{mA}$	-	30	300	mV
		$5\text{mA} \leq I_o \leq 200\text{mA}$	-	15	150	
IQ	Quiescent Current		-	4.5	8	mA
$\Delta IQ$	Quiescent Current Change	$5\text{mA} \leq I_o \leq 350\text{mA}$	-	-	0.5	mA
		$17.5\text{V} \leq V_{in} \leq 30\text{V}$ , $I_o=200\text{mA}$	-	-	1.0	
Vn	Output Noise Voltage	$10\text{Hz} \leq f \leq 100\text{KHz}$	-	130	-	$\mu\text{V}$
RR	Ripple Rejection	$18.5\text{V} \leq V_{in} \leq 28.5\text{V}$ , $I_o=100\text{mA}$ , $f=120\text{Hz}$ , $e_{IN}=1\text{V}_{rms}$	54	-	-	dB
VD	Dropout Voltage	$I_o=500\text{mA}$	-	2	-	V
ISC	Output Short Circuit Current	$V_{in}=30\text{V}$		170		mA
IPK	Peak Output Current	$T_j=25^{\circ}\text{C}$		700		mA
TCVo	Temperature Coefficient of Output Voltage	$I_o=5\text{mA}$ , $0 \leq T_j \leq 125^{\circ}\text{C}$		-0.6		$\text{mV}/^{\circ}\text{C}$



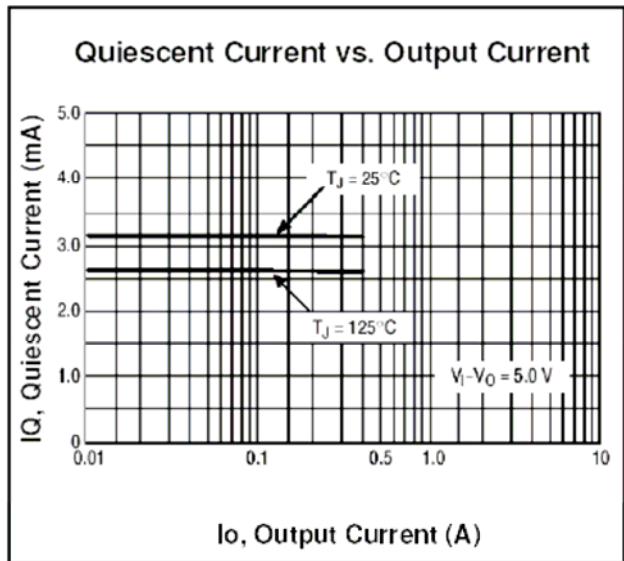
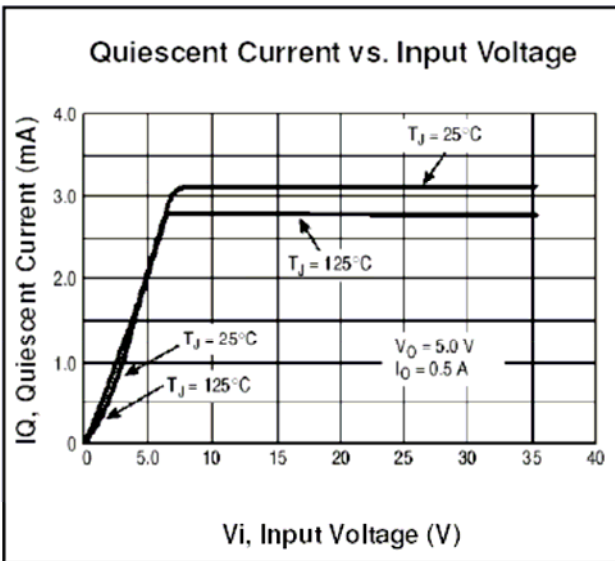
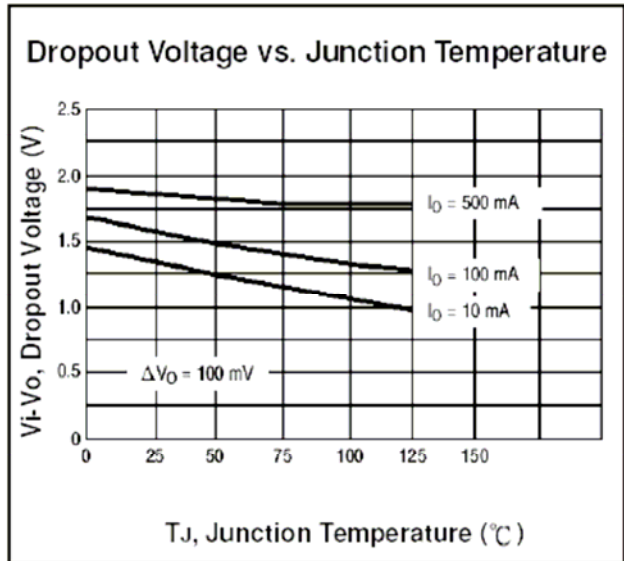
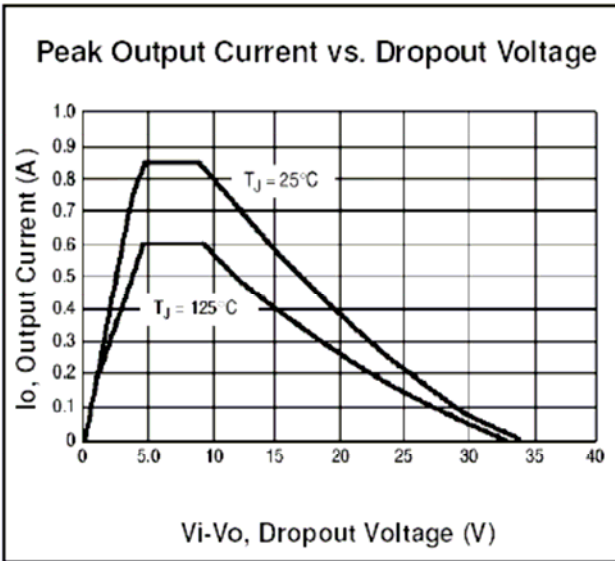
**LM78M18** ( $T_a=25^\circ\text{C}$ ,  $V_{in}=27\text{V}$ ,  $I_o=350\text{mA}$ ,  $C_{in}=0.33\mu\text{F}$ ,  $C_{out}=0.1\mu\text{F}$ , unless otherwise noted)

Symbol	Parameter	Conditions	LM78M18			Units
			Min	Typ	Max	
Vo	Output Voltage		17.28	18.0	18.72	V
		$5\text{mA} \leq I_o \leq 350\text{mA}$ $21\text{V} \leq V_{in} \leq 33\text{V}$	17.10	-	18.90	
$\Delta V_o$	Line Regulation	$I_o=200\text{mA}$ , $21\text{V} \leq V_{in} \leq 33\text{V}$	-	7	100	mV
		$I_o=200\text{mA}$ , $24\text{V} \leq V_{in} \leq 33\text{V}$	-	3	50	
$\Delta V_o$	Load Regulation	$5\text{mA} \leq I_o \leq 500\text{mA}$	-	30	360	mV
		$5\text{mA} \leq I_o \leq 200\text{mA}$	-	15	180	
IQ	Quiescent Current		-	4.5	8	mA
$\Delta IQ$	Quiescent Current Change	$5\text{mA} \leq I_o \leq 350\text{mA}$	-	-	0.5	mA
		$21\text{V} \leq V_{in} \leq 33\text{V}$ , $I_o=200\text{mA}$	-	-	1.0	
Vn	Output Noise Voltage	$10\text{Hz} \leq f \leq 100\text{KHz}$	-	140	-	$\mu\text{V}$
RR	Ripple Rejection	$22\text{V} \leq V_{in} \leq 32\text{V}$ , $I_o=100\text{mA}$ , $f=120\text{Hz}$ , $e_{IN}=1\text{V}_{rms}$	53	-	-	dB
VD	Dropout Voltage	$I_o=500\text{mA}$	-	2	-	V
ISC	Output Short Circuit Current	$V_{in}=30\text{V}$		170		mA
IPK	Peak Output Current	$T_j=25^\circ\text{C}$		700		mA
TCVo	Temperature Coefficient of Output Voltage	$I_o=5\text{mA}$ , $0 \leq T_j \leq 125^\circ\text{C}$		-0.6		$\text{mV}/^\circ\text{C}$

**LM78M24** ( $T_a=25^\circ\text{C}$ ,  $V_{in}=33\text{V}$ ,  $I_o=350\text{mA}$ ,  $C_{in}=0.33\mu\text{F}$ ,  $C_{out}=0.1\mu\text{F}$ , unless otherwise noted)

Symbol	Parameter	Conditions	LM78M24			Units
			Min	Typ	Max	
Vo	Output Voltage		23.04	24.0	24.96	V
		$5\text{mA} \leq I_o \leq 350\text{mA}$ $27\text{V} \leq V_{in} \leq 33\text{V}$	22.80	-	25.20	
$\Delta V_o$	Line Regulation	$I_o=200\text{mA}$ , $27\text{V} \leq V_{in} \leq 33\text{V}$	-	10	100	mV
		$I_o=200\text{mA}$ , $28\text{V} \leq V_{in} \leq 33\text{V}$	-	5	50	
$\Delta V_o$	Load Regulation	$5\text{mA} \leq I_o \leq 500\text{mA}$	-	30	480	mV
		$5\text{mA} \leq I_o \leq 200\text{mA}$	-	15	240	
IQ	Quiescent Current		-	4.8	8	mA
$\Delta IQ$	Quiescent Current Change	$5\text{mA} \leq I_o \leq 350\text{mA}$	-	-	0.5	mA
		$27\text{V} \leq V_{in} \leq 33\text{V}$ , $I_o=200\text{mA}$	-	-	1.0	
Vn	Output Noise Voltage	$10\text{Hz} \leq f \leq 100\text{KHz}$	-	170	-	$\mu\text{V}$
RR	Ripple Rejection	$28\text{V} \leq V_{in} \leq 38\text{V}$ , $I_o=100\text{mA}$ , $f=120\text{Hz}$ , $e_{IN}=1\text{V}_{rms}$	50	-	-	dB
VD	Dropout Voltage	$I_o=500\text{mA}$	-	2	-	V
ISC	Output Short Circuit Current	$V_{in}=30\text{V}$		170		mA
IPK	Peak Output Current	$T_j=25^\circ\text{C}$		700		mA
TCVo	Temperature Coefficient of Output Voltage	$I_o=5\text{mA}$ , $0 \leq T_j \leq 125^\circ\text{C}$		-0.7		$\text{mV}/^\circ\text{C}$

**Characteristic Curves**



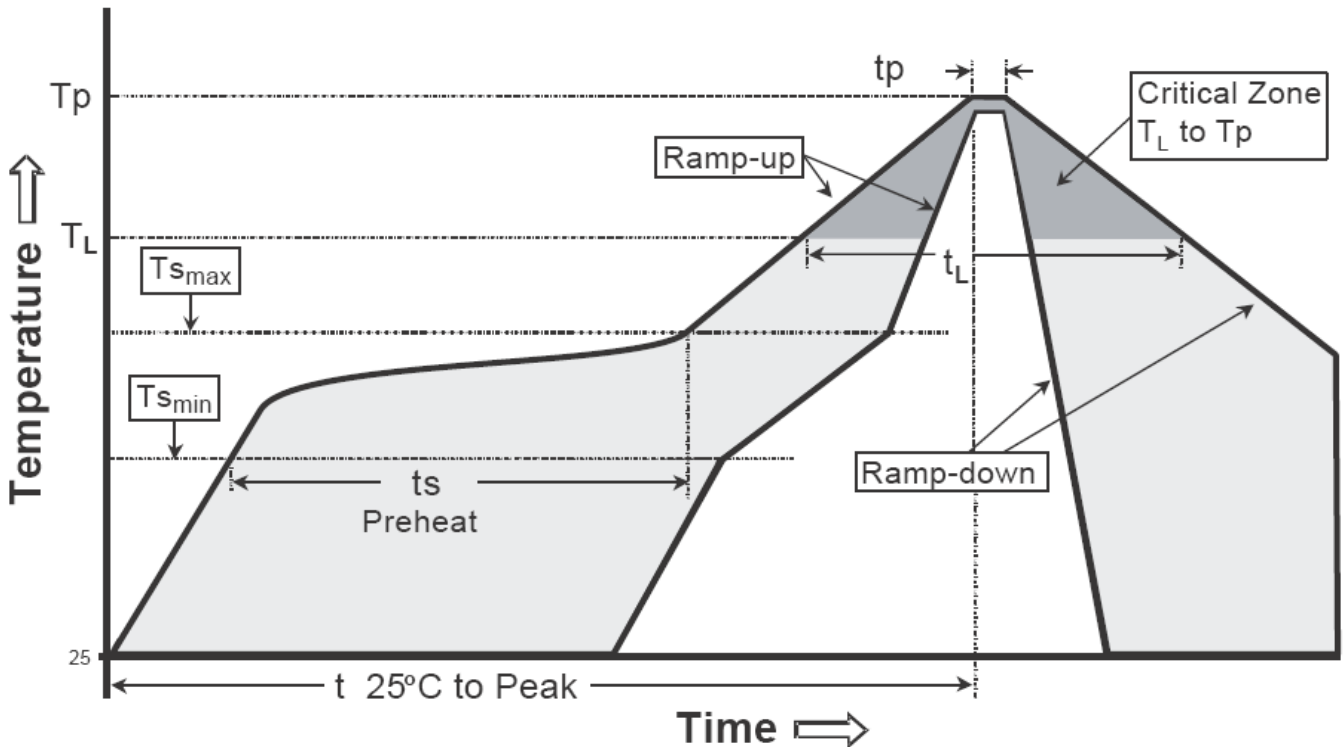




**Recommended wave soldering condition**

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

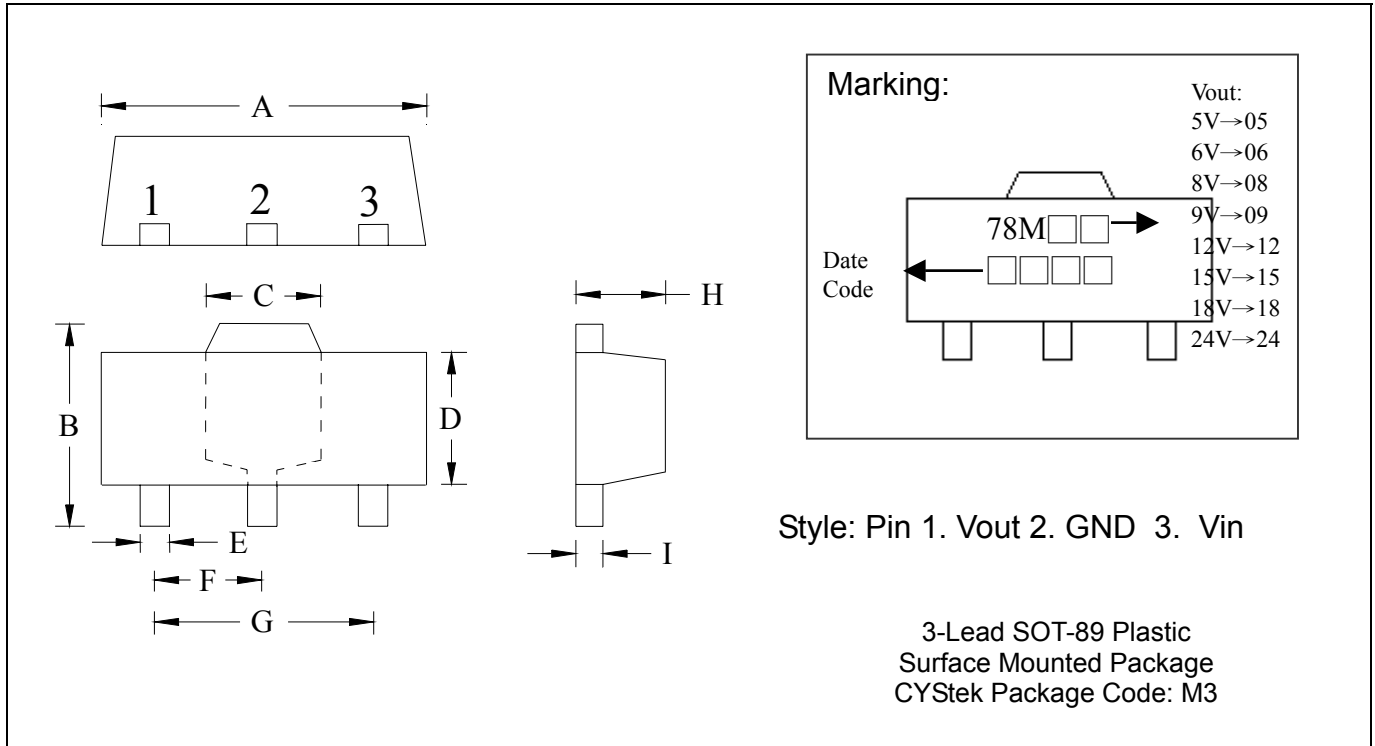
**Recommended temperature profile for IR reflow**



Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (T <sub>smax</sub> to T <sub>p</sub> )	3°C/second max.	3°C/second max.
Preheat		
-Temperature Min(T <sub>s min</sub> )	100°C	150°C
-Temperature Max(T <sub>s max</sub> )	150°C	200°C
-Time(t <sub>s min</sub> to t <sub>s max</sub> )	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (T <sub>L</sub> )	183°C	217°C
- Time (t <sub>L</sub> )	60-150 seconds	60-150 seconds
Peak Temperature(T <sub>P</sub> )	240 +0/-5 °C	260 +0/-5 °C
Time within 5°C of actual peak temperature(tp)	10-30 seconds	20-40 seconds
Ramp down rate	6°C/second max.	6°C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note : All temperatures refer to topside of the package, measured on the package body surface.

**SOT-89 Dimension**



\*: Typical

DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.1732	0.1811	4.40	4.60	F	0.0591	TYP	1.50	TYP
B	0.1551	0.1673	3.94	4.25	G	0.1181	TYP	3.00	TYP
C	0.0610	REF	1.55	REF	H	0.0551	0.0630	1.40	1.60
D	0.0906	0.1024	2.30	2.60	I	0.0138	0.0173	0.35	0.44
E	0.0126	0.0205	0.32	0.52					

**Notes:** 1.Controlling dimension: millimeters.  
 2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.  
 3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

**Material:**

- Lead: Pure tin plated.
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0.

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