ML62 Series Positive Voltage Regulator

❖ *Application*

- *Battery Powered Equipment*
- *Palmtops*
- *Portable Cameras and Video Recorders*
- *Reference Voltage Sources*

❖ *Features*

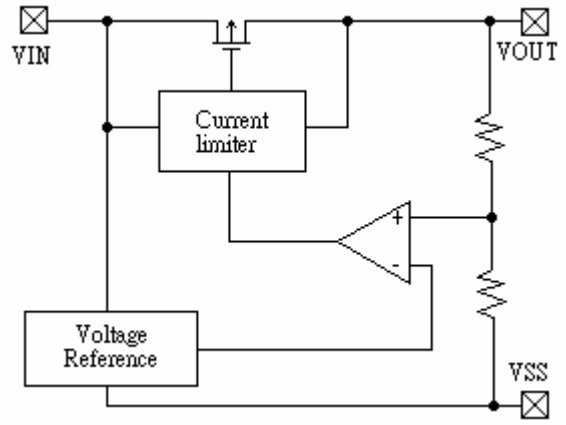
- CMOS Low Power Consumption :
  Typical 3.3uA at Vout=5.0V
- Output Voltage Range : 1.1V to 6.0V in 0.1V increments
- Highly Accurate:
  Output Voltage ± 3% for 1.1V to 1.9V
  Output Voltage ± 2% for 2.0V to 6.0V
- Maximum Output Current: 250mA
  (within the maximum power dissipation, Vout=5.0V)
- Small Input-Output Voltage Differential:
  0.12V at 100mA and 0.38V at 200mA
- Input stability: Typ. 0.2%/V
- Package Available:
  SOT-23 (150mW), SOT-89 (500mW) &
  TO-92 (300mW)

❖ *General Description*

The ML62 is a group of positive voltage output, three-pin regulator which provides high output current even when the input/output voltage differential is small.

The ML62 consists of a high-precision voltage reference, an error correction circuit, and a current limited output driver.

❖ *Block Diagram*

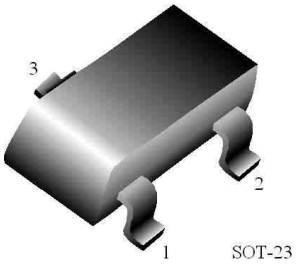


❖ *Absolute Maximum Ratings*

Parameter		Symbol	Ratings	Units
Input Voltage		V_{IN}	10	V
Output Current		I_{OUT}	500	mA
Output Voltage		V_{OUT}	V_{SS}-0.3 ~V_{IN}+0.3	V
Continuous Total Power Dissipation	SOT-23	P_d	150	mW
	SOT-89		500	
	TO-92		300	
Operating Ambient Temperature		T_{opr}	-40 ~ +70	°C
Storage Temperature		T_{stg}	-40 ~ +70	°C

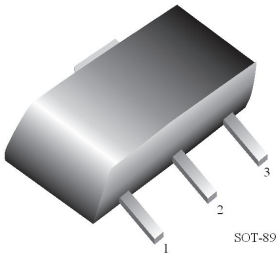
❖ *Pin Configuration*

SOT-23



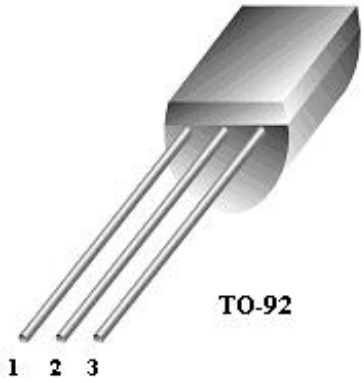
Pin Number	*Pin Name*	*Description*
1	*VSS*	*Ground*
2	*VOUT*	*Supply Voltage Output*
3	*VIN*	*Supply Voltage Input*

SOT-89



Pin Number	*Pin Name*	*Description*
1	*VSS*	*Ground*
2	*VIN*	*Supply Voltage Input*
3	*VOUT*	*Supply Voltage Output*

TO-92



Pin Number	*Pin Name*	*Description*
1	*VSS*	*Ground*
2	*VIN*	*Supply Voltage Input*
3	*VOUT*	*Supply Voltage Output*

❖ *Standard Circuit*

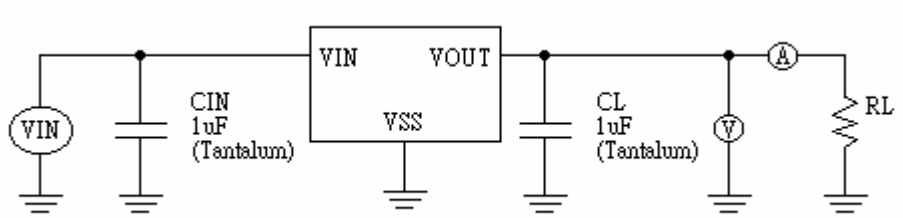
Note on Use

1. Oscillation may occur as a result of the impedance present between the power supply and the IC's input. Please use a capacitor (CIN) of at least 1uF, when the impedance is 10 ohm or more.
   With a large output current, Voltage output can be stabilised by increasing capacitor (CIN) size. If CIN is small and capacitor (CL) size is increased, oscillation may occur. In such cases, Voltage output can be stabilised by either increasing the size of CIN or decreasing the size of CL.

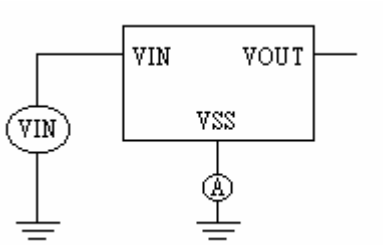
2. Please ensure that output current (IOUT) is less than Pd / (VIN-VOUT) and does not exceed the stipulated Continuous Total Power Dissipation value (Pd).

❖ *Test Circuit*

Test Circuit 1



Test Circuit 2



❖ *Electrical Characteristic*

ML62502 VOUT(T)=5.0V(Note 1)

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Circuit
Output Voltage	VOUT(E) (Note 2)	IOUT=40mA VIN=6.0V	4.900	5.000	5.100	V	1
Maximum Output Current	IOUT max	VIN=6.0V, VOUT(E) ≥ 4.5V	250			mA	1
Load Stability	ΔVOUT	VIN=6.0V, 1mA≤IOUT≤100mA		40	80	mV	1
Input –Output Voltage Differential (Note 3)	Vdif1	IOUT=100mA		120	400	mV	1
	Vdif2	IOUT=200mA		380	750	mV	1
Supply Current	ISS	VIN=6.0V		3.3	4.5	uA	2
Input Stability	$\frac{\Delta VOUT}{\Delta VIN * VOUT}$	IOUT=40mA 6.0V≤VIN≤10.0V		0.2	0.3	%V	1
Input Voltage	VIN				10	V	-

ML62402 VOUT(T)=4.0V(Note 1)

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Circuit
Output Voltage	VOUT(E) (Note 2)	IOUT=40mA VIN=5.0V	3.920	4.000	4.080	V	1
Maximum Output Current	IOUT max	VIN=5.0V, VOUT(E) ≥3.6V	200			mA	1
Load Stability	ΔVOUT	VIN=5.0V, 1mA≤IOUT≤100mA		45	90	mV	1
Input –Output Voltage Differential (Note 3)	Vdif1	IOUT=90mA		170	400	mV	1
	Vdif2	IOUT=180mA		400	750	mV	1
Supply Current	ISS	VIN=5.0V		3.0	4.5	uA	2
Input Stability	$\frac{\Delta VOUT}{\Delta VIN * VOUT}$	IOUT=40mA 5.0V≤VIN≤10.0V		0.2	0.3	%V	1
Input Voltage	VIN				10	V	-

ML62302 VOUT(T)=3.0V(Note 1)

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Circuit
Output Voltage	VOUT(E) (Note 2)	IOUT=40mA VIN=4.0V	2.940	3.000	3.060	V	1
Maximum Output Current	IOUT max	VIN=4.0V, VOUT(E) ≥2.7V	150			mA	1
Load Stability	ΔVOUT	VIN=4.0V, 1mA≤IOUT≤80mA		45	90	mV	1
Input –Output Voltage Differential (Note 3)	Vdif1	IOUT=80mA		180	450	mV	1
	Vdif2	IOUT=150mA		400	850	mV	1
Supply Current	ISS	VIN=4.0V		2.8	4.5	uA	2
Input Stability	$\frac{\Delta VOUT}{\Delta VIN * VOUT}$	IOUT=40mA 4.0V≤VIN≤10.0V		0.2	0.3	%V	1
Input Voltage	VIN				10	V	-

ML62202 VOUT(T)=2.0V(Note 1)

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Circuit
Output Voltage	VOUT(E) (Note 2)	IOUT=40mA VIN=3.0V	1.960	2.000	2.040	V	1
Maximum Output Current	IOUT max	VIN=3.0V, VOUT(E) ≥1.8V	100			mA	1
Load Stability	ΔVOUT	VIN=3.0V, 1mA≤IOUT≤60mA		45	90	mV	1
Input –Output Voltage Differential (Note 3)	Vdif1	IOUT=60mA		180	450	mV	1
	Vdif2	IOUT=100mA		400	850	mV	1
Supply Current	ISS	VIN=3.0V		2.5	4.5	uA	2
Input Stability	$\frac{\Delta VOUT}{\Delta VIN * VOUT}$	IOUT=40mA 3.0V≤VIN≤10.0V		0.2	0.3	%V	1
Input Voltage	VIN				10	V	-

Note : 1. VOUT(T) = Specified Output Voltage.

2. VOUT(E) = Effective Output Voltage (i.e. the output voltage when (VOUT(T)+1.0V) is provided at the VIN pin while maintaining a certain IOUT value).

3. Vdif = VIN1(Note 4) – VOUT(E)

4. VIN1 = The input voltage at the time 98% of VOUT (E) is output (input voltage has been gradually reduced).

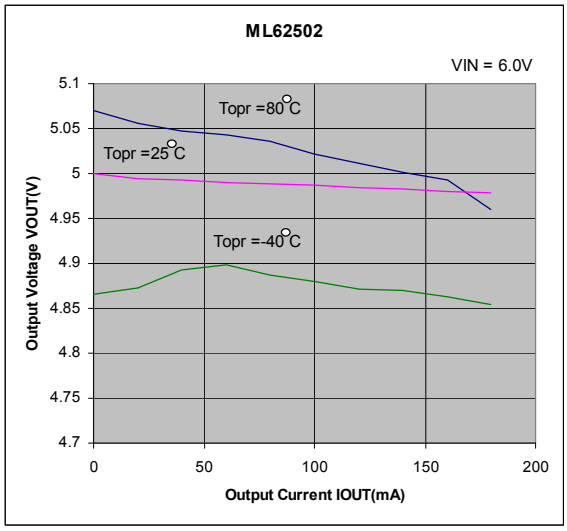
❖ *Electrical Characteristics by Output Voltage*

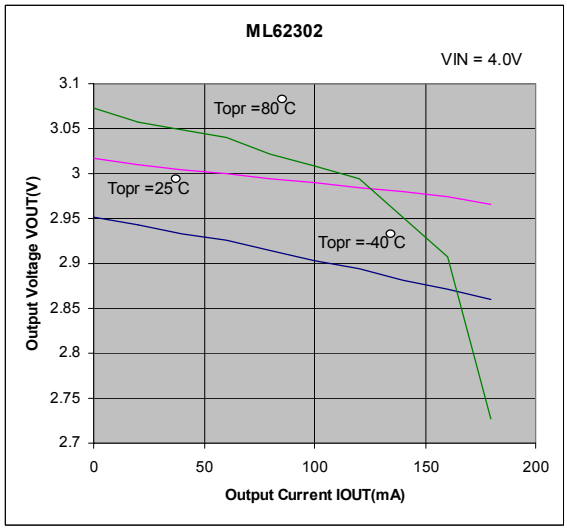
Part Number	Output voltage				Max Output Current		Load Stability			I-O Voltage Differential		
	V_{OUT}(V)				$I_{OUT\ max}$(mA)		Δ V_{OUT}(mV)			V_{difl}(mV)		
	Conditions	MIN.	TYP.	MAX.	Conditions	MIN.	Conditions	TYP.	MAX.	Conditions	TYP.	MAX.
ML62113	I_{OUT}=40mA V_{IN}=V_{OUT}(T)+1V	1.067	1.100	1.133	V_{IN}=V_{OUT}(T)+1V V_{OUT}(E)≥ V_{OUT}(T)*0.9	80	VIN=VOUT(T)+1V 1mA<IOUT<40mA	45	90	IOUT=20mA	250	450
ML62123		1.164	1.200	1.236								
ML62133		1.261	1.300	1.339						IOUT=30mA	250	450
ML62143		1.358	1.400	1.442								
ML62153		1.455	1.500	1.545								
ML62163		1.552	1.600	1.648								
ML62173		1.649	1.700	1.751						IOUT=40mA	250	450
ML62183		1.746	1.800	1.854								
ML62193		1.843	1.900	1.957								
ML62202		1.960	2.000	2.040		100	V_{IN}=V_{OUT}(T)+1V 1mA≤I_{OUT}≤60mA	45	90	I_{OUT}=60mA	180	450
ML62212		2.058	2.100	2.142								
ML62222		2.156	2.200	2.244								
ML62232		2.254	2.300	2.346								
ML62242		2.352	2.400	2.448								
ML62252		2.450	2.500	2.550								
ML62262		2.548	2.600	2.652								
ML62272		2.646	2.700	2.754								
ML62282		2.744	2.800	2.856								
ML62292		2.842	2.900	2.958								
ML62302		2.940	3.000	3.060		150	V_{IN}= V_{OUT}(T)+1V 1mA≤I_{OUT}≤80mA	45	90	I_{OUT}=80mA	180	450
ML62312		3.038	3.100	3.162								
ML62322		3.136	3.200	3.264								
ML62332		3.234	3.300	3.366								
ML62342		3.332	3.400	3.468								
ML62352		3.430	3.500	3.570								
ML62362		3.528	3.600	3.672								
ML62372		3.626	3.700	3.774								
ML62382		3.724	3.800	3.876								
ML62392		3.822	3.900	3.978								
ML62402		3.920	4.000	4.080		200	V_{IN}=V_{OUT}(T)+1V 1mA≤I_{OUT}≤100mA	45	90	I_{OUT}=90mA	170	400
ML62412		4.018	4.100	4.182								
ML62422		4.116	4.200	4.284								
ML62432		4.214	4.300	4.386								
ML62442		4.312	4.400	4.488								
ML62452		4.410	4.500	4.590								
ML62462		4.508	4.600	4.692								
ML62472		4.606	4.700	4.794								
ML62482		4.704	4.800	4.896								
ML62492		4.802	4.900	4.998								
ML62502		4.900	5.000	5.100		250	V_{IN}=V_{OUT}+1V 1mA≤I_{OUT}≤100mA	40	80	I_{OUT}=100mA	120	400
ML62512		4.998	5.100	5.202								
ML62522		5.096	5.200	5.304								
ML62532		5.194	5.300	5.406								
ML62542		5.292	5.400	5.508								
ML62552		5.390	5.500	5.610								
ML62562		5.488	5.600	5.712								
ML62572		5.586	5.700	5.814								
ML62582		5.684	5.800	5.916								
ML62592		5.782	5.900	6.018								
ML62602		5.880	6.000	6.120								

Part Number	I-O Voltage Differential			Supply Current			Input Stability			Input Voltage
	V_{dif2}(mV)			I_{SS}(uA)			$\Delta V_{OUT}/(\Delta V_{IN}*V_{OUT})$ (%V)			V_{IN}(V)
	Conditions	TYP.	MAX.	Conditions	TYP.	MAX.	Conditions	TYP.	MAX.	MAX.
ML62113	IOUT=40mA	450	850	$V_{IN}=V_{OUT}(T)+1V$	2.0	4.5	I_{OUT}=40mA $V_{OUT}(T)+1V \leq V_{IN} \leq 10V$	0.2	0.4	10
ML62123										
ML62133	IOUT=60mA	450	850							
ML62143										
ML62153										
ML62163										
ML62173	IOUT=80mA	450	850							
ML62183										
ML62193										
ML62202	I_{OUT}=100mA	400	850		2.5	4.5		0.2	0.3	
ML62212										
ML62222										
ML62232										
ML62242										
ML62252										
ML62262										
ML62272										
ML62282										
ML62292										
ML62302	I_{OUT}=150mA	400	850		2.8	4.5				
ML62312										
ML62322										
ML62332										
ML62342										
ML62352										
ML62362										
ML62372										
ML62382										
ML62392										
ML62402	I_{OUT}=180mA	400	750		3.0	4.5				
ML62412										
ML62422										
ML62432										
ML62442										
ML62452										
ML62462										
ML62472										
ML62482										
ML62492										
ML62502	I_{OUT}=200mA	380	750		3.3	4.5				
ML62512										
ML62522										
ML62532										
ML62542										
ML62552										
ML62562										
ML62572										
ML62582										
ML62592										
ML62602										

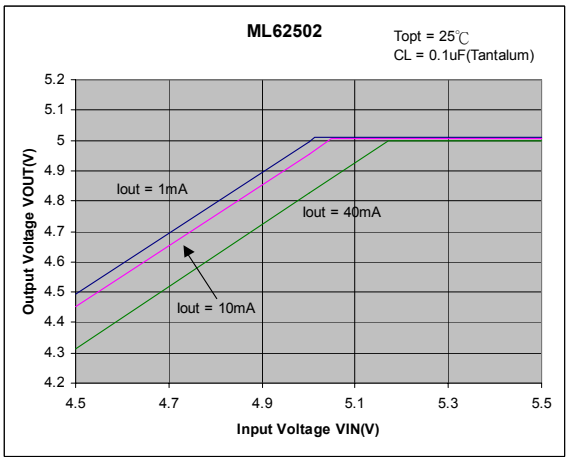
❖ *Typical Performance Characteristics*

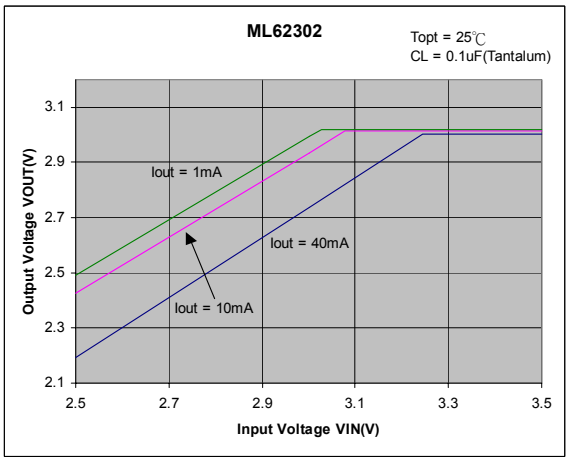
1) Output Voltage vs. Output Current



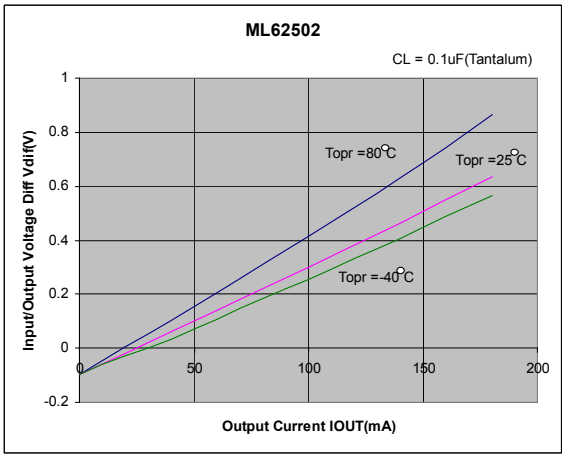


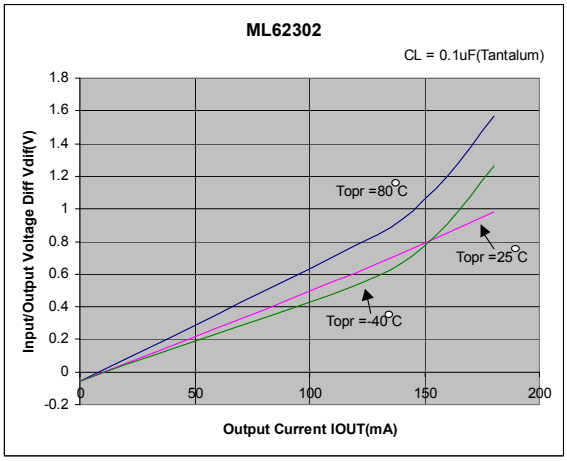
2) Output Voltage vs. Input Voltage



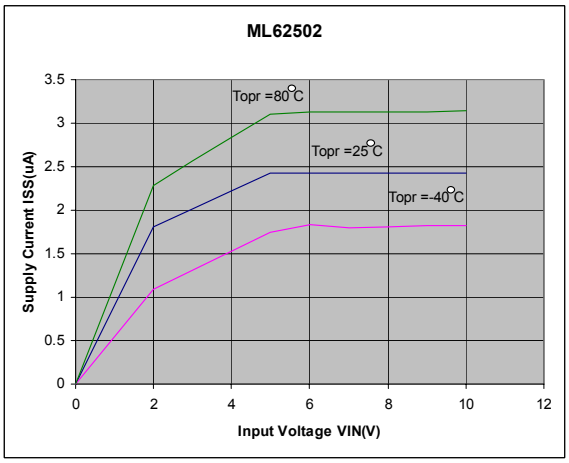


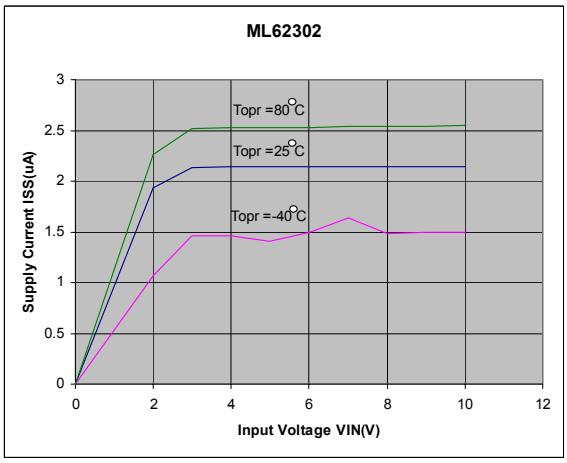
3) Input/Output Voltage Differential vs. Output Current



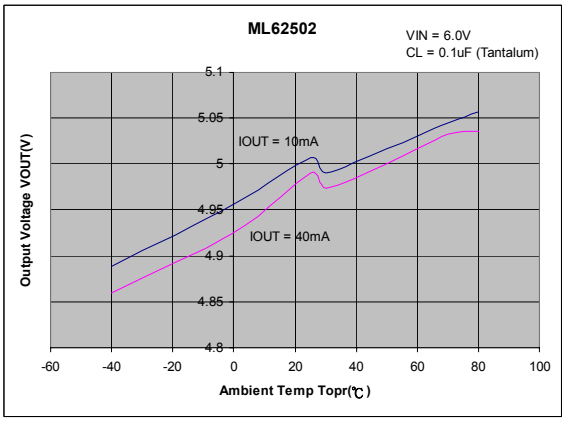


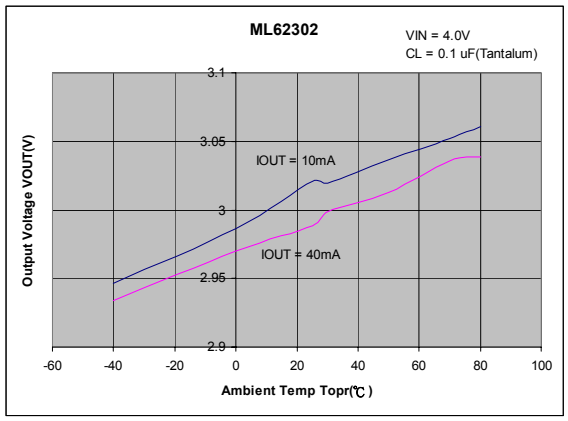
4) Supply Current vs. Input Voltage



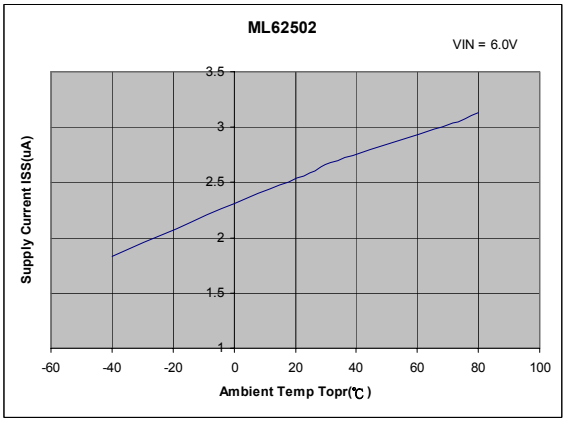


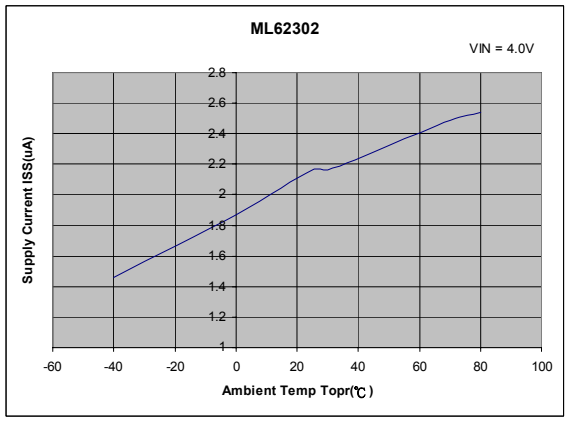
5) Output Voltage vs. Ambient Temperature





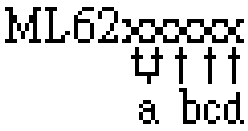
6) Supply Current vs. Ambient Temperature





❖ *Ordering Information*

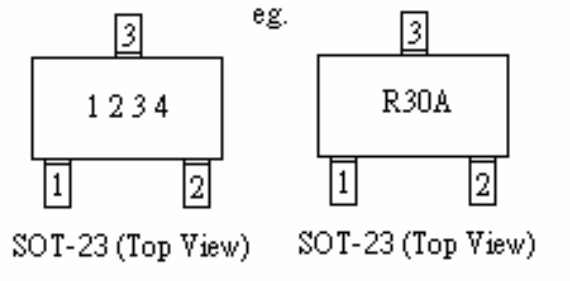
Designator	Description
a	**Output Voltage** eg. 30=3.0V 50=5.0V
b	**Output Voltage Accuracy** 2 = ± 2.0% 3 = ± 3.0%
c	**Package Type** M = SOT-23 P = SOT-89 T = TO-92
d	**Device Orientation** R = Embossed Tape (Orientation of Device : Right) L = Embossed Tape (Orientation of Device : Left) B = Bag (TO-92) H = Paper Tape (TO-92)



❖ *Marking*

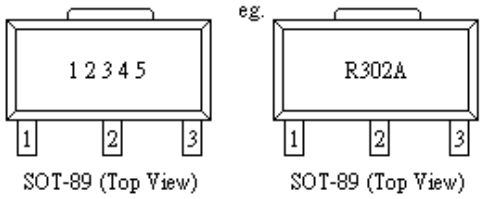
SOT-23 :

Designator	Description
1	**Type** R = Positive Voltage Regulator
2,3	**Output Voltage** eg. 30 = 3.0V
4	**Internal Code**



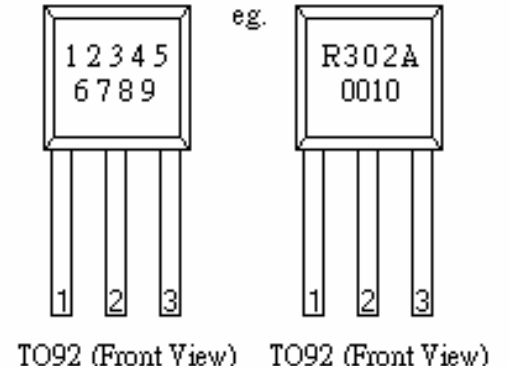
SOT-89 :

Designator	Description
1	**Type** R = Positive Voltage Regulator
2,3	**Output Voltage** eg. 30 = 3.0V
4	**Output Voltage Accuracy** 2 = ± 2.0% 3 = ± 3.0%
5	**Internal Code**



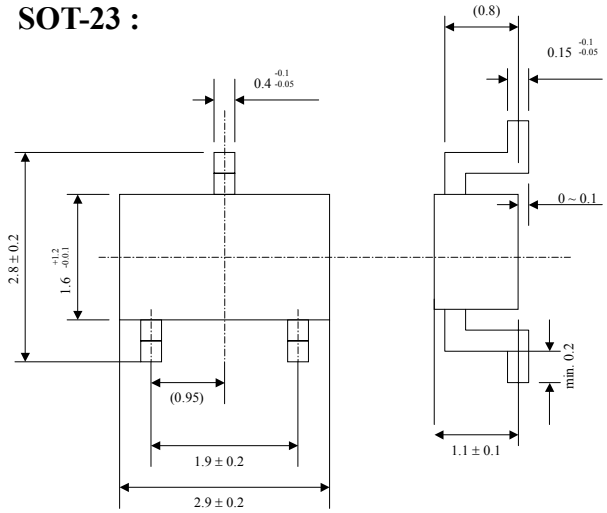
TO-92 :

Designator	Description
1	**Type** R = Positive Voltage Regulator
2,3	**Output Voltage** eg. 30 = 3.0V
4	**Output Voltage Accuracy** 2 = ± 2.0% 3 = ± 3.0%
5	**Internal code**
6, 7	**Year Code** eg. 00 = Year 2000
8, 9	**Week Code** eg. 10 = Week 10

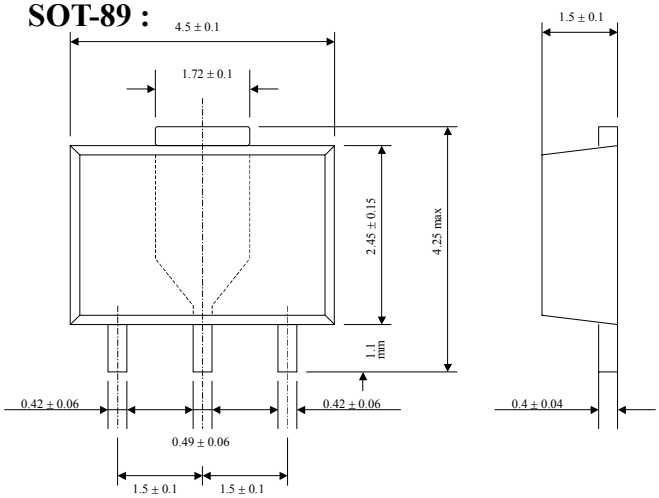


❖ *Packaging Information*

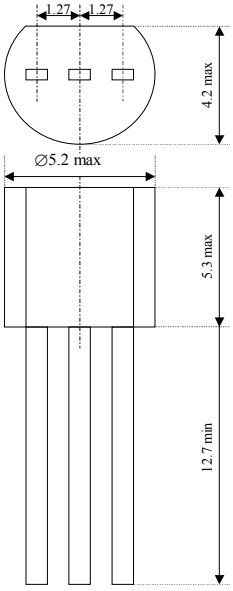
SOT-23 :



SOT-89 :



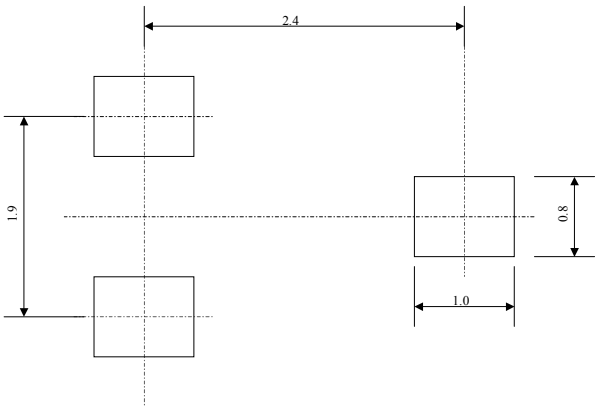
TO-92 :



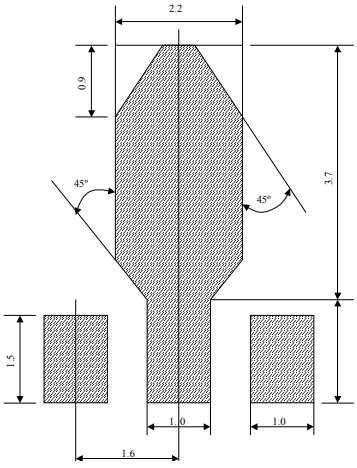
Units : mm

❖ *Recommended Pattern Layout*

SOT-23 :

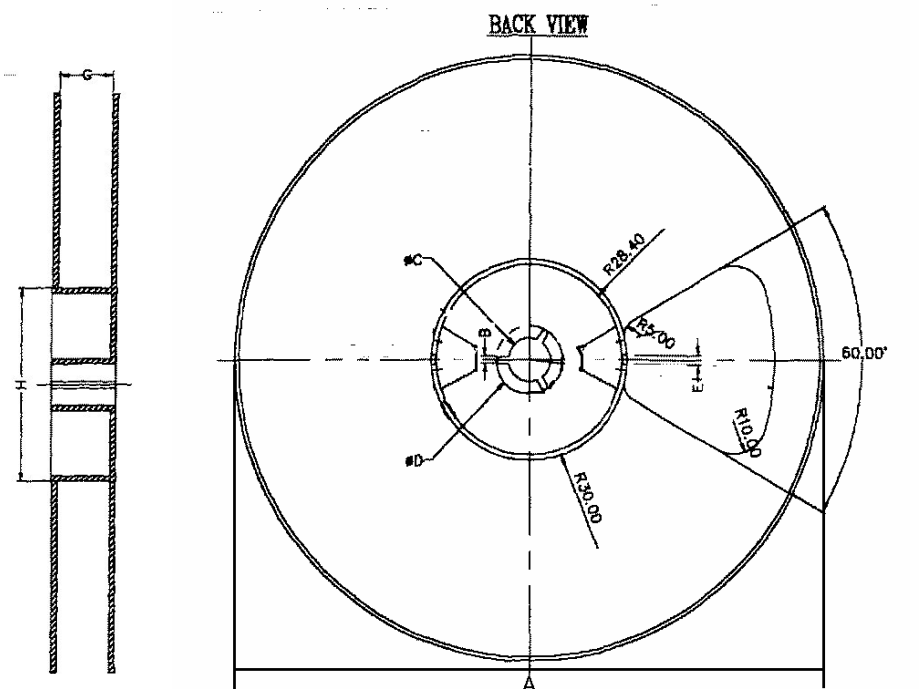


SOT-89



❖ *Tape and Reel Information*

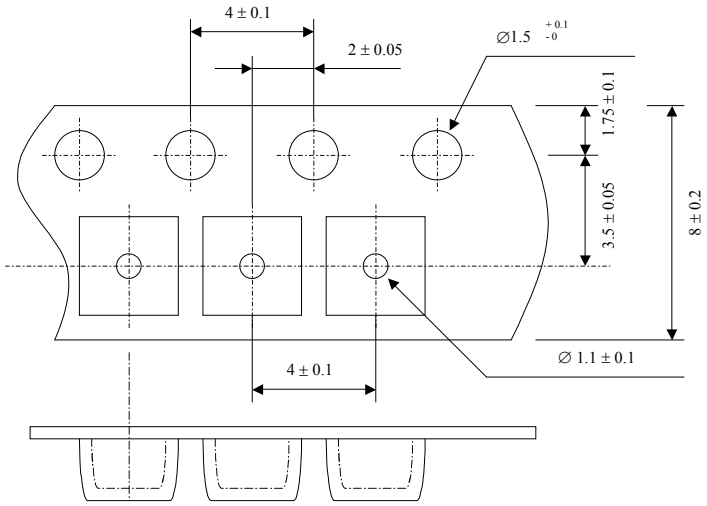
SOT-23 :

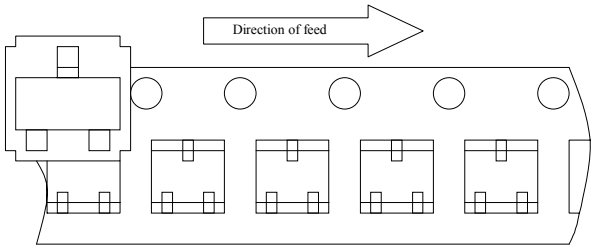


	SIZE (mm)
A	∅ 178 ± 0.8
B	2 ± 0.2
C	∅ 13 ± 0.2
D	∅ 21 ± 0.8
G	8 ± 0.5
H	∅ 60

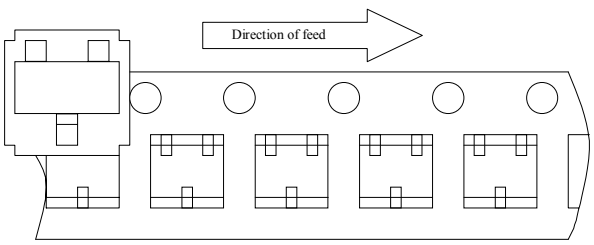
3,000 pcs / reel

SOT-23 Taping Specifications :



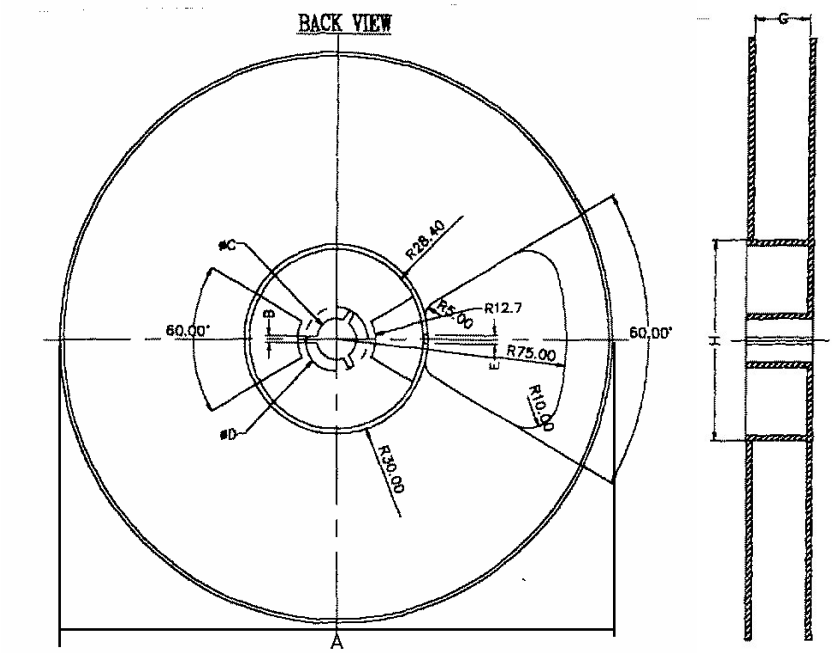


"R" type [Orientation of Device: Right]
Standard Type



"L" type [Orientation of Device: Left]
Reverse Type

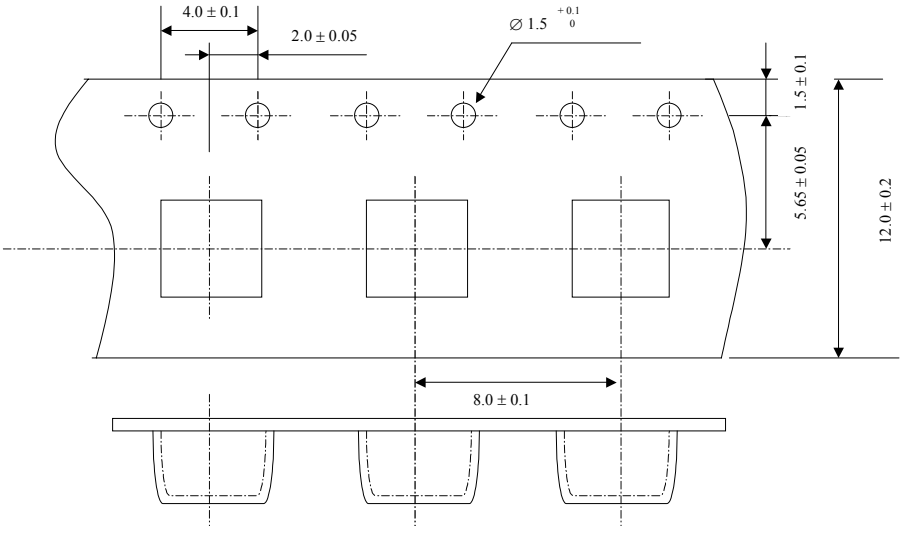
SOT-89 :

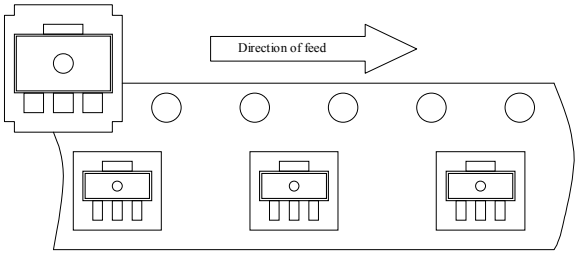


	SIZE (mm)
A	∅ 178 ± 0.8
B	2 ± 0.2
C	∅ 13 ± 0.2
D	∅ 21 ± 0.8
G	12 ± 0.5
H	∅ 60

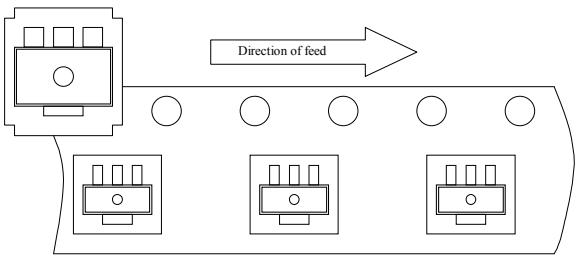
1,000 pcs / reel

SOT-89 Taping Specifications :



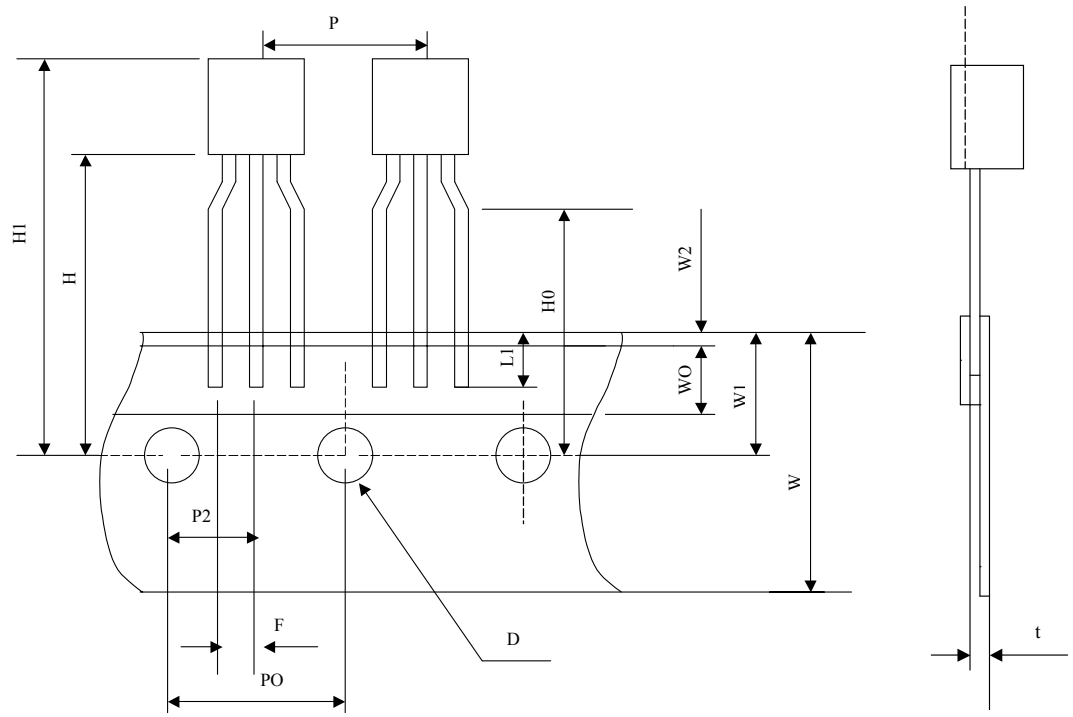


"R" type [Orientation of Device: Right]
Standard Type



"L" type [Orientation of Device: Left]
Reverse Type

TO-92 Taping Specifications :



	SIZE (mm)
P	12.7 ± 1.0
PO	12.7 ± 0.3
P2	6.35 ± 0.4
F	$2.5^{+0.45}_{-0.15}$
W	18.0 ± 1.0
WO	6.0 ± 0.3
W1	9.0 ± 0.5
W2	0.5 MAX
H	19.0 ± 0.5
H0	16.0 ± 0.5
H1	32.25 MAX
D	∅ 4.0 ± 0.2
t	0.6 ± 0.2
L1	3.5 MIN

2,000 pcs / box

❖ *History of Revision*

REV	DESCRIPTION	DATE
	First Official Specification	04/04/01
A	SOT-23, SOT-89 & TO-92 Package and packing description added. Operating and Storage Temperature modified.	23/10/01
B	Absolute Maximum Input Rating of Input Voltage increased from 10V to 12V.	02/08/02
C	1.1V to 1.9V Voltage Regulator Added. Typical Performance Characteristics added.	24/10/02
D	Modify 1.1V to 1.9V Voltage Regulator Electrical Characteristics.	08/11/02
E	Modify 1.1V & 1.2V Voltage Regulator I-O Voltage Differential Characteristics.	23/12/02
F	Modify 1.3V to 1.6V Voltage Regulator I-O Voltage Differential Characteristics.	24/1/03
G	Modify Operating and Storage Temperature Range, and the outlook of packages.	4/10/03
H	Absolute Maximum Input Rating of Input Voltage reduced from 12V to 10V.	3/9/04