

TC46 Series

VOLTAGE REGULATOR (LOW DROPOUT, LOW CURRENT)

FEATURES

- Extremely Low Quiescent Current 1.1 μA Typ
- Low Dropout Voltage 30 mV @ 1 mA Typ
- High Accuracy Output Voltage $\pm 2.5\%$
- Wide Choice of V_{OUT} 2.0V to 6.0V in 0.1V Steps
- Surface Mount or Through-Hole Packages

APPLICATIONS

- Low-loss power supply for battery-powered devices
- Post-regulator for boost converters in portable equipment
- Low Iq programmable reference

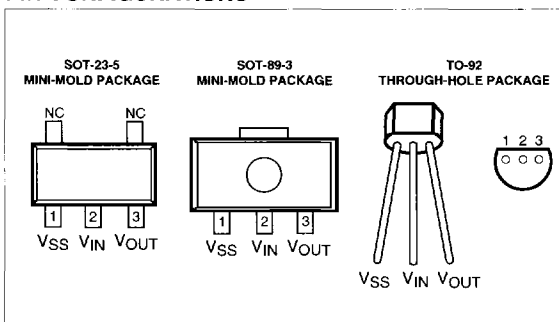
GENERAL DESCRIPTION

The TC46 Series are high accuracy 3-terminal CMOS voltage regulators. Output currents extend to 80mA, with quiescent currents around $1\mu\text{A}$. The design features very low dropout voltage and fast recovery from turn-on transients, both important features for battery-operated communications equipment. The device is also suitable as a micropower voltage reference.

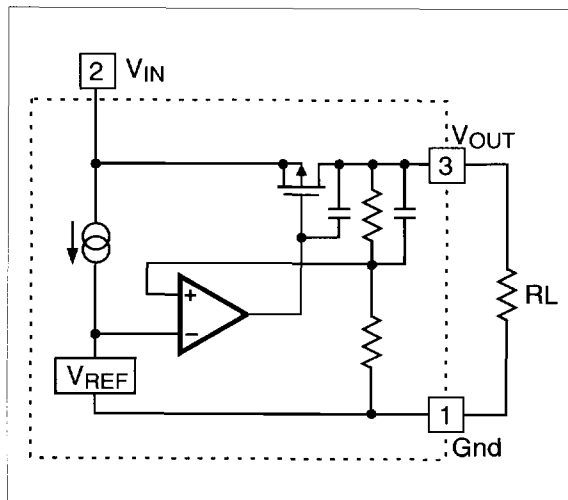
Available output voltages extend from 2.0V to 6.0V in 0.1V steps. They are available in SOT-23, SOT-89, and TO-92 packages.

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PIN CONFIGURATIONS



FUNCTIONAL BLOCK DIAGRAM



ORDERING INFORMATION

PART CODE TC46LR XX X X X XX XXX

Output Voltage:

Ex: 20 = 2.0V; 60 = 6.0V

Extra Feature Code: Fixed: 0

Tolerance:

3: $\pm 2.5\%$

Temperature: E: -40°C to $+85^{\circ}\text{C}$

Package Type and Pin Count:

CT: SOT-23-5

MB: SOT-89-3

ZB: TO-92-3

Taping Direction:

723: Left Taping

713: Right Taping

no suffix: TO-92 Bulk

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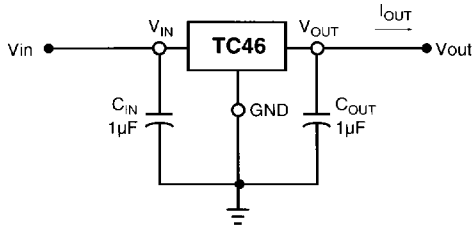
ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Limit	Unit
Input Voltage	V_{IN}	+12	V
Output Current	I_{OUT}	150	mA
Output Voltage	V_{OUT}	$(V_{SS} - 0.3)$ to $(V_{IN} + 0.3)$	V
Power Dissipation TO-92 and SOT-89-3	Pd1	300	mW
SOT-23-5	Pd2	150	
Operating Temperature Range	T_A	-40 to +85	°C
Storage Temperature Range	T_{stg}	-65 to +150	°C
Soldering Temperature	T_{solder}	260°C, 10 sec	

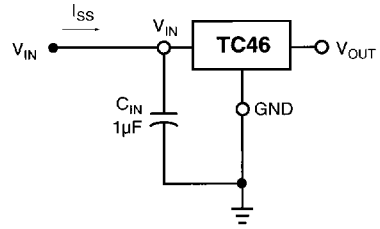
ELECTRICAL CHARACTERISTICS: ($T_A = 25^\circ\text{C}$)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{OUT}	Output Voltage	$10\mu\text{A} \leq I_{OUT} \leq 10\text{mA}$	$V_{OUT} \times 0.975$		$V_{OUT} \times 1.025$	V
I_{OUT}	Output Current	$V_{IN} = V_{OUT} + 2.0\text{V}$ $V_{OUT} = 2.0\text{V}$ $V_{OUT} = 3.0\text{V}$ $V_{OUT} = 4.0\text{V}$ $V_{OUT} = 5.0\text{V}, 6.0\text{V}$	25 35 45 55	35 50 65 80	mA	
ΔV_{OUT}	Load Regulation	$V_{IN} = V_{OUT} + 2.0\text{V}$ $V_{OUT} = 2.0\text{V}, 1\text{mA} \leq I_{OUT} \leq 35\text{mA}$ $V_{OUT} = 3.0\text{V}, 1\text{mA} \leq I_{OUT} \leq 50\text{mA}$ $V_{OUT} = 4.0\text{V}, 1\text{mA} \leq I_{OUT} \leq 65\text{mA}$ $V_{OUT} = 5.0\text{V}, 6.0\text{V}, 1\text{mA} \leq I_{OUT} \leq 80\text{mA}$		30 40 50 60	45 60 75 90	mV
Vdif	I/O Voltage Difference	$I_{OUT} = 1\text{mA}$ $V_{OUT} = 2.0\text{V}$ $V_{OUT} = 3.0\text{V}$ $V_{OUT} = 4.0\text{V}, 5.0\text{V}, 6.0\text{V}$		60 40 25	90 60 38	mV
I_{SS}	Quiescent Current	$V_{IN} = V_{OUT} + 2.0\text{V}$ $V_{OUT} = 2.0\text{V}$ $V_{OUT} = 3.0\text{V}$ $V_{OUT} = 4.0\text{V}$ $V_{OUT} = 5.0\text{V}, 6.0\text{V}$		1.0 1.1 1.2 1.3	3.0 3.3 3.6 3.9	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation	$I_{OUT} = 1\text{mA}$ $(V_{OUT} + 0.5\text{V}) \leq V_{IN} \leq 10\text{V}$		0.05	0.2	%/V
V_{IN}	Input Voltage				10	V
$\Delta V_{OUT}/\Delta T_A$	Temperature Coefficient	$I_{OUT} = 10\text{mA}$ $-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$		± 100		ppm/°C

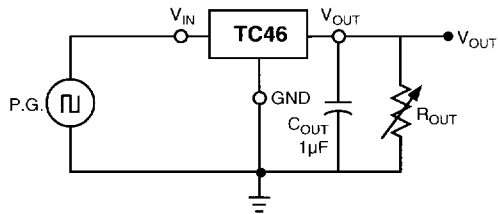
TEST CIRCUITS



STATIC CHARACTERISTICS
(Except QUIESCENT CURRENT)



QUIESCENT CURRENT



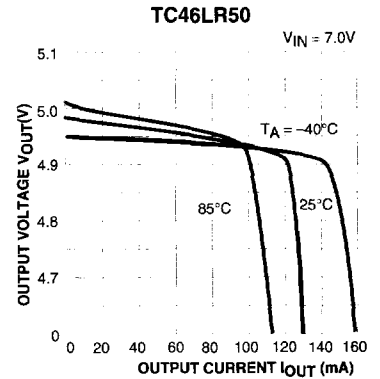
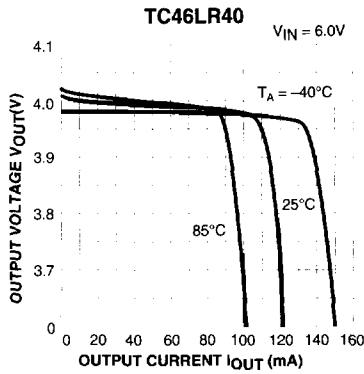
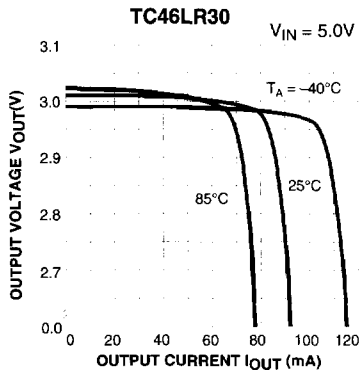
LINE TRANSIENT RESPONSE

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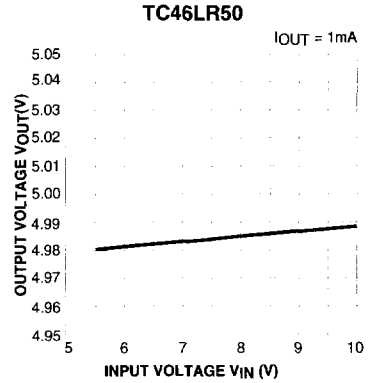
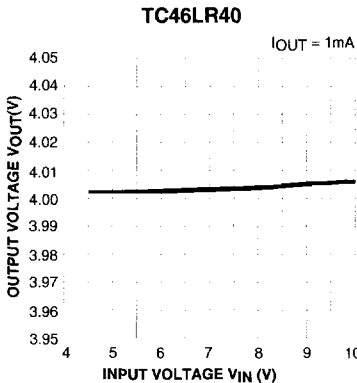
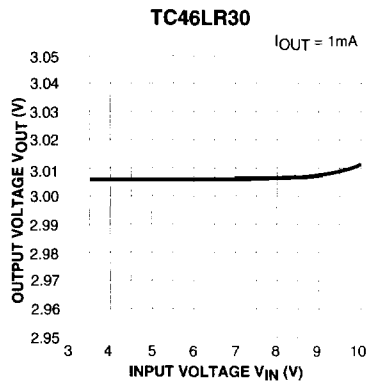
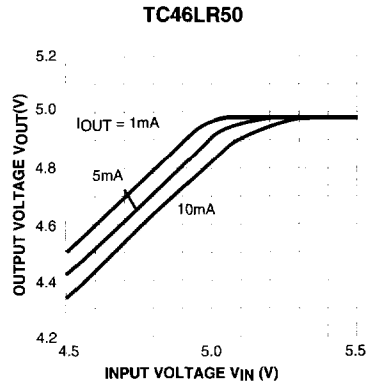
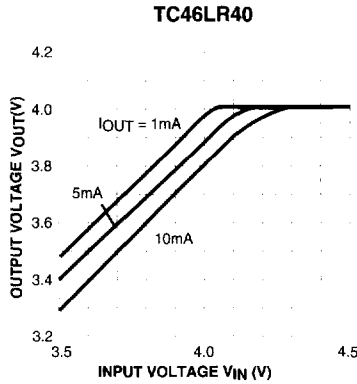
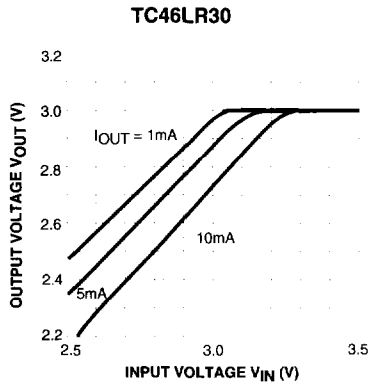
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TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current

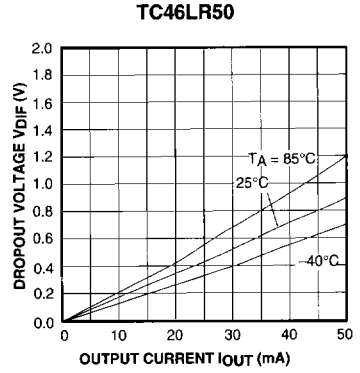
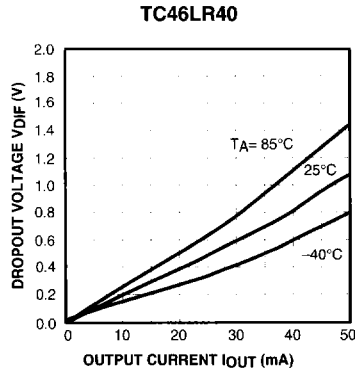
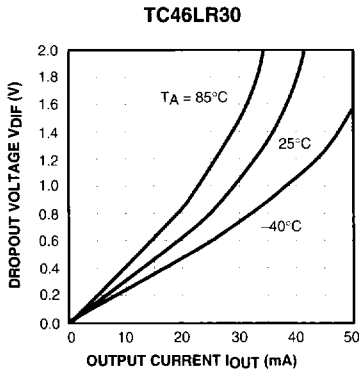


2) Output Voltage vs. Input Voltage (TA = 25°C)



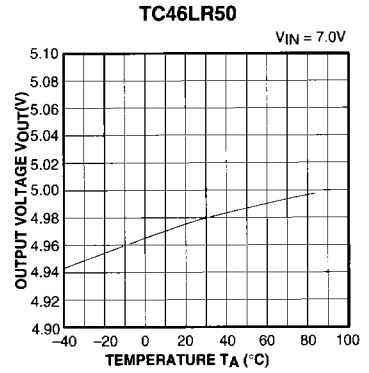
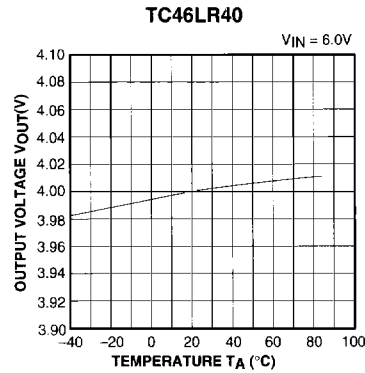
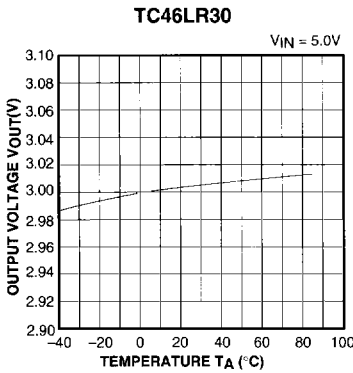
TYPICAL CHARACTERISTICS (CONT.)

3) Dropout Voltage vs. Output Current

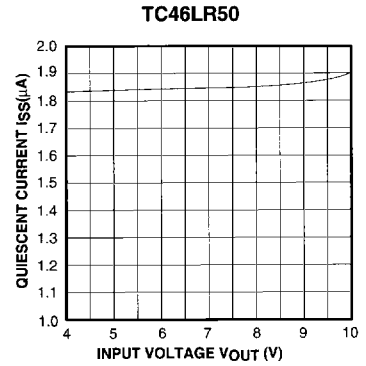
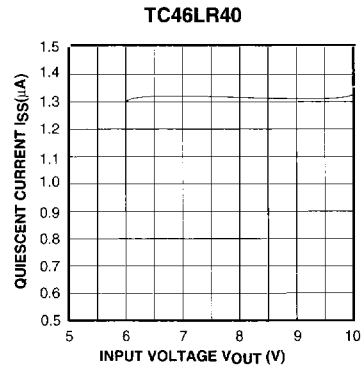
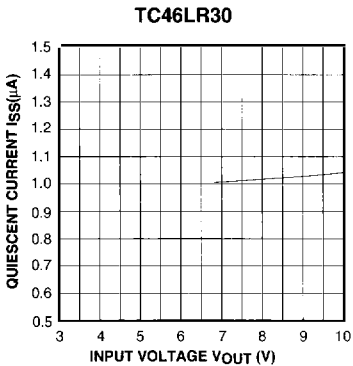


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4) Output Voltage vs. Temperature (IOUT = 10mA)



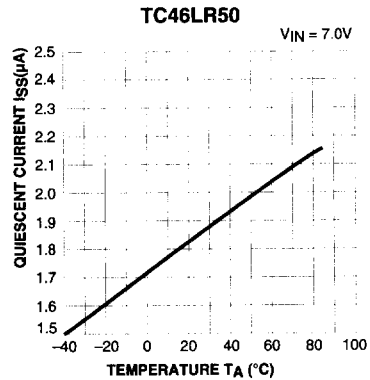
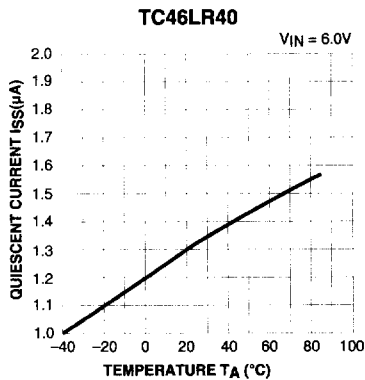
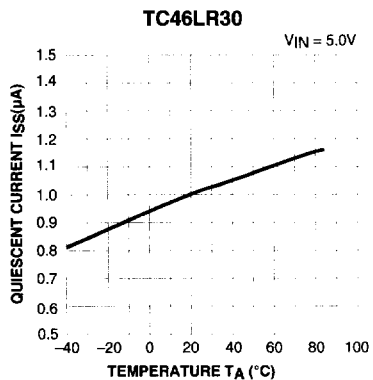
5) Quiescent Current vs. Input Voltage (TA = 25°C)



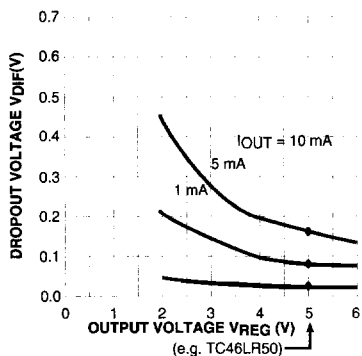
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TYPICAL CHARACTERISTICS (CONT.)

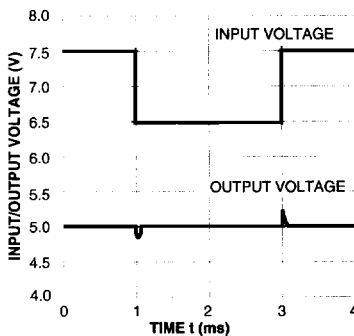
6) Quiescent Current vs. Temperature



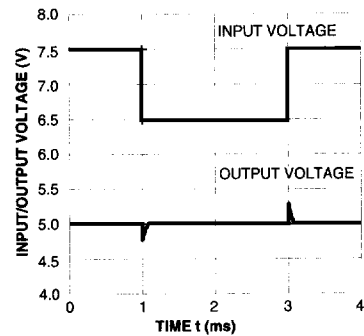
7) Dropout Voltage vs. Output Voltage (Set up Voltage)



8) Line Transient Response 1 (I_{OUT} = 1 mA)

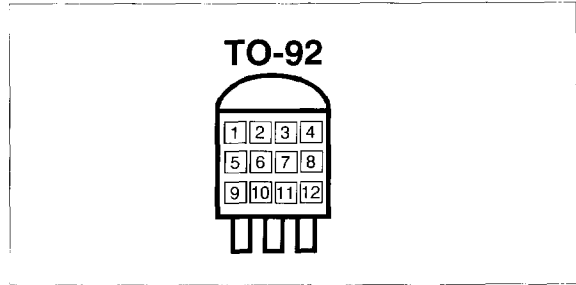
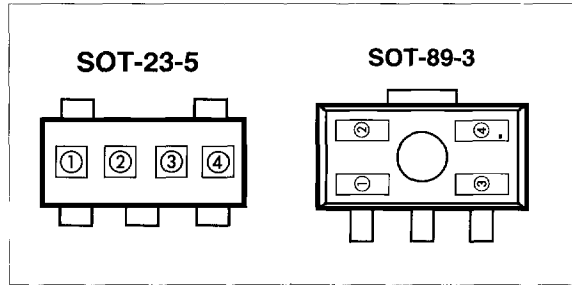


9) Line Transient Response 2 (I_{OUT} = 10 mA)



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MARKING



3

a represents first decimal place of voltage

Mark a	Volt	Mark a	Volt
0	b.0 (V)	5	b.5 (V)
1	b.1 (V)	6	b.6 (V)
2	b.2 (V)	7	b.7 (V)
3	b.3 (V)	8	b.8 (V)
4	b.4 (V)	9	b.9 (V)

b represents first digit of voltage

Mark b	Volt
B	2. a (V)
C	3. a (V)
D	4. a (V)
E	5. a (V)
F	6. a (V)

c and d represent assembly lot number

a, b, c & d represent 46LR: Fixed

e represents first digit of voltage

Mark e	Volt	Mark e	Volt
2	2.f (V)	5	5.f (V)
3	3.f (V)	6	6.f (V)
4	4.f (V)		

f represents first decimal place of voltage

Mark f	Volt	Mark f	Volt
0	e .0 (V)	5	e .5 (V)
1	e.1 (V)	6	e .6 (V)
2	e.2 (V)	7	e .7 (V)
3	e.3 (V)	8	e .8 (V)
4	e.4 (V)	9	e .9 (V)

g Extra Feature Code: Fixed: 0

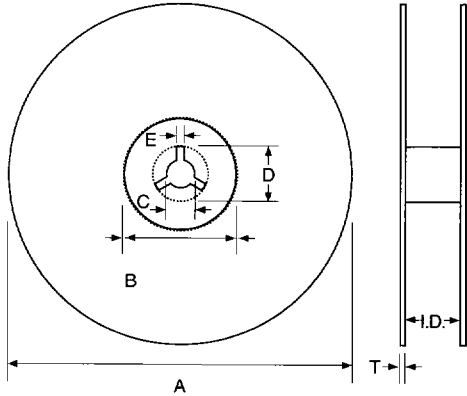
h represents regulation accuracy

Mark h	Regulation Accuracy
3	±2.5% (Standard)

i, j, k & l represent assembly lot number

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TAPING REEL



	SOT-23-5	SOT-89	TO-92
A	178 ±1.0	178 ±2.0	360
B	60 ±2.0	80 ±1.0	80
C	13 ±0.2	13 ±0.05	30
D	22 ±0.5	21 ±0.5	45
E	2 ±0.2	2 ±0.2	2
I.D.	8.5 ±1.5	14.0 +1/-1.5	43
T	1.5 ±0.3	2.0 ±0.5	5

(unit = mm)

Reel Materials: SOT-23-5/SOT-89: Plastic
 TO-92: Cardboard + Plastic Hub
 SOT-89: 1,000 pcs/Reel
 TO-92: 2,000 pcs/Reel
 SOT-23-5: 3,000 pcs/Reel

TAPING FORM

