

Precision Voltage Regulator

TDB 0723 -723
TDB 0723 A-723
TDC 0723 -723

The TDB 0723 is a monolithic voltage regulator and is intended for use with positive or negative supplies as a series, shunt, switching or floating regulator.

In addition to a low temperature drift, low standby current drain and high ripple rejection the voltage regulators feature:

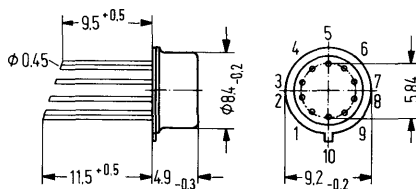
● Line regulation ($V_i = 12$ to 15 V)	.01% V_q
● Load regulation ($I_q = 1$ to 50 mA)	.03% V_q
● Ripple rejection	74 dB
● Average temperature coefficient of V_q	.002%/K
● Output noise voltage ($f = 100$ Hz to 1 kHz, $C_{ref} = 0$)	20 μV_{eff}
● Long time stability	.1%/1000 h
● Output voltage range	2 to 37 V
● Output current range	0 to 150 mA

Type	Ordering codes
TDB 0723	Q67000-A1068
TDB 0723 A	Q67000-A1069
TDC 0723	Q67000-A1070

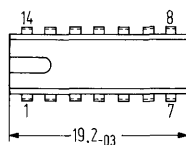
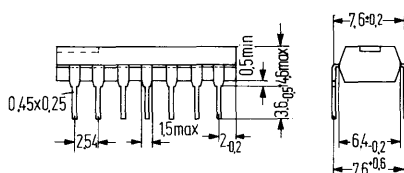
Package outlines

for TDB 0723 and TDC 0723

for TDB 0723 A



Package 5 J 10 DIN 41873
(similar TO-100)
Weight approx. 1.1 g



Plastic plug-in package, 14 pins,
20 A 14 DIN 41866 (TO-116),
Weight approx. 1.1 g

Dimensions in mm

Maximum ratings

Pulse voltage from + V_{CC} to $-V_{CC}$ (50 ms)
Continuous voltage from + V_{CC} to $-V_{CC}$
Input/output voltage differential
Differential input voltage
Voltage between non-inverting input and $-V_{CC}$
Current from V_Z
Current from V_{Ref}
Junction temperature
Storage temperature
Thermal resistances
System-case (TDB 0723, TDC 0723)
System-ambient air (TDB 0723, TDC 0723)
System-ambient air (TDB 0723 A)

	TDB 0723	TDB 0723 A	TDC 0723
V_{pp}	50		V
V_{CC}	40		V
V_i-V_q	40		V
V_{Di}	± 5		V
	8		V
	25		mA
	15		mA
T_j	150		°C
T_s	-65 to +150		°C
$R_{thScase}$	80		K/W
R_{thSamb}	190		K/W
R_{thSamb}	120		K/W

Range of operation

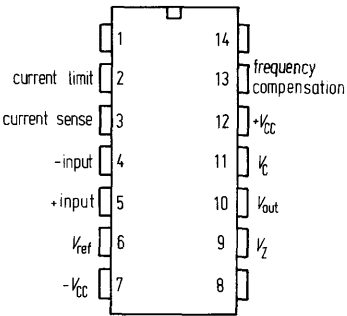
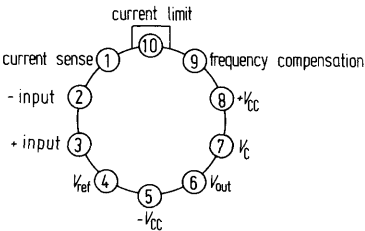
Ambient temperature in operation TDB 0723 A
TDC 0723

T_{amb}	0 to +70	°C
T_{amb}	-55 to +125	°C

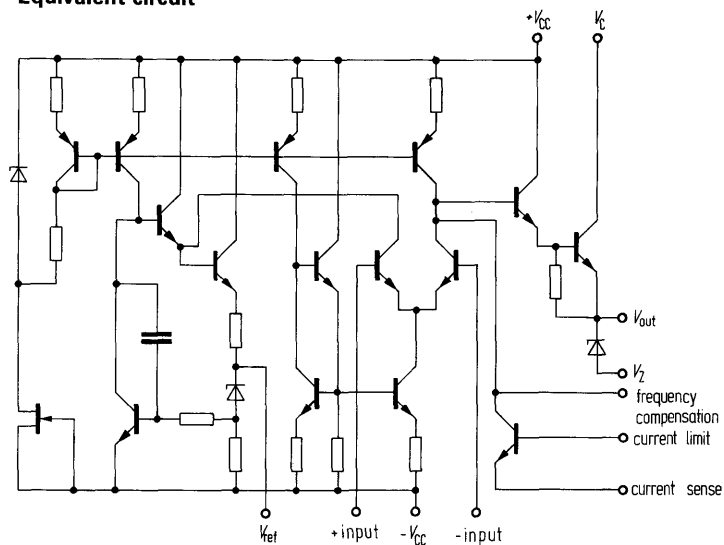
Pin connection

TDB 0723 and TDC 0723

TDB 0723 A



Equivalent circuit



Operating characteristics

($V_i = V_o = +V_{cc} = 12\text{V}$;
 $-V_{cc} = 0\text{V}$; $V_q = 5\text{mA}$
 $I_q = 1\text{mA}$) (see fig 1)

Line regulation

$V_i = 12\text{ to }15\text{V}$

$V_i = 12\text{ to }40\text{V}$

Load regulation

($I_q = 1\text{ to }50\text{mA}$)

Ripple rejection

$f = 50\text{ Hz to }10\text{ kHz}$

$f = 50\text{ Hz to }10\text{ kHz}$,

$C_{ref} = 5\text{ }\mu\text{F}$

Temperature

coefficient of V_q

Short circuit

current limit

$R_{sc} = 10\text{ }\Omega$, $V_q = 0$

Reference voltage

Output noise voltage

$f = 100\text{ Hz to }10\text{ kHz}$

$f = 100\text{ Hz to }10\text{ kHz}$,

$C_{ref} = 5\text{ }\mu\text{F}$

Long term stability

Standby current drain

($I_q = 0$, $V_i = 30\text{V}$)

Input voltage range

Output voltage range

Input/output voltage

differential

TDB 0723

TDB 0723 A

$T_{amb} = 25\text{ }^\circ\text{C}$

TDC 0723

$T_{amb} = 25\text{ }^\circ\text{C}$

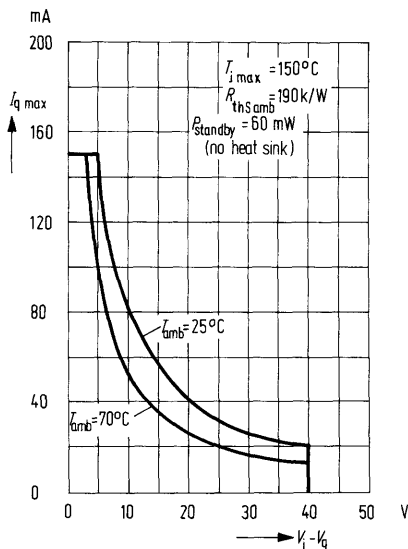
$T_{amb} = -55$

to $+125\text{ }^\circ\text{C}$

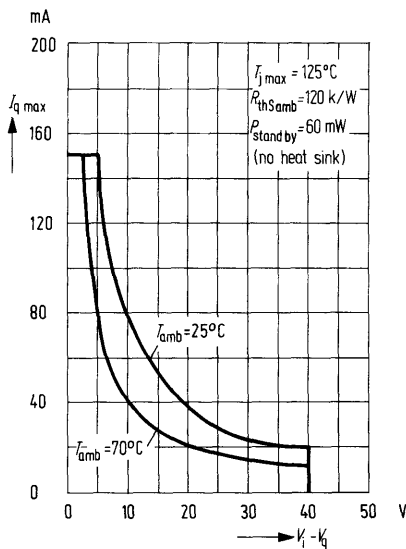
	TDB 0723 TDB 0723 A $T_{amb} = 25\text{ }^\circ\text{C}$			TDC 0723 $T_{amb} = 25\text{ }^\circ\text{C}$			$T_{amb} = -55$ to $+125\text{ }^\circ\text{C}$		
	min	typ	max	min	typ	max	min	max	
Line regulation		.01	.1		.01	.1		.3	% V_q
$V_i = 12\text{ to }15\text{V}$		.1	.5		.02	.2			% V_q
$V_i = 12\text{ to }40\text{V}$		.03	.2		.03	.15		.6	% V_q
Load regulation									
($I_q = 1\text{ to }50\text{mA}$)									
Ripple rejection		74			74				dB
$f = 50\text{ Hz to }10\text{ kHz}$		86			86				dB
$f = 50\text{ Hz to }10\text{ kHz}$,									
$C_{ref} = 5\text{ }\mu\text{F}$									
Temperature		.003	.015					.015	%/K
coefficient of V_q									
Short circuit		65			65				mA
current limit									
$R_{sc} = 10\text{ }\Omega$, $V_q = 0$									
Reference voltage	6.80	7.15	7.50	6.95	7.15	7.35			V
Output noise voltage		20			20				μV_{rms}
$f = 100\text{ Hz to }10\text{ kHz}$		2.5			2.5				μV_{rms}
$f = 100\text{ Hz to }10\text{ kHz}$,									
$C_{ref} = 5\text{ }\mu\text{F}$									
Long term stability		.1			.1				%/ 1000 h
Standby current drain		2.3	4.0		2.3	3.5			mA
($I_q = 0$, $V_i = 30\text{V}$)									
Input voltage range	V_i 9.5		40	9.5		40			V
Output voltage range	V_q 2.0		37	2.0		37			V
Input/output voltage		3.0	38	3.0		38			V
differential									

Typical performance curves for TDB 0723/A

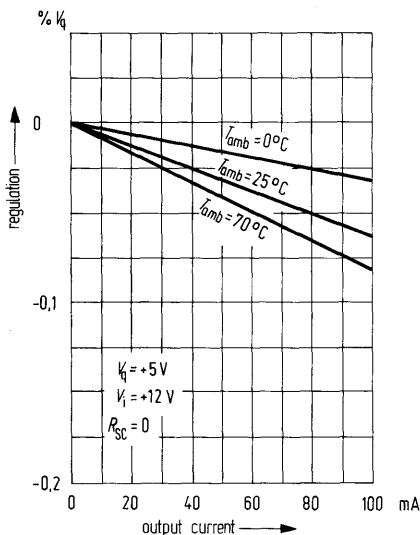
Maximum load current as a function of input/output voltage differential



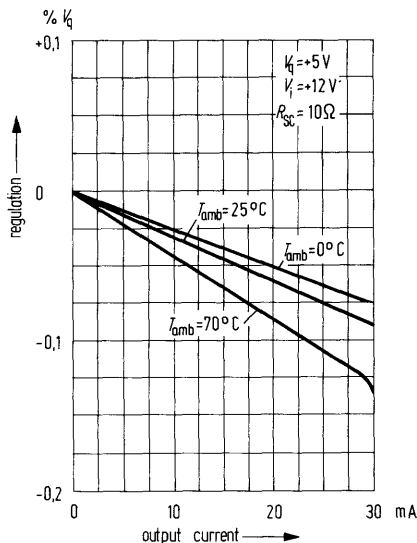
Maximum load current as a function of input/output voltage differential



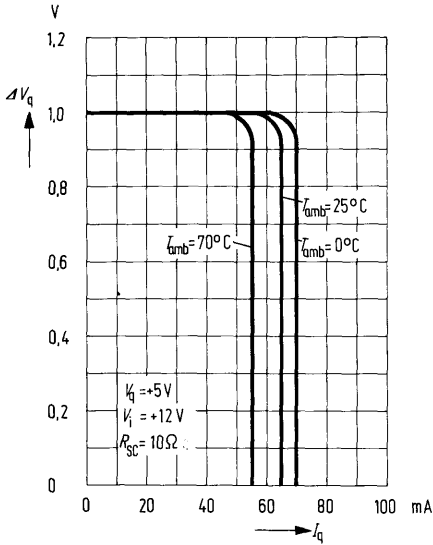
Load regulation characteristics without current limiting



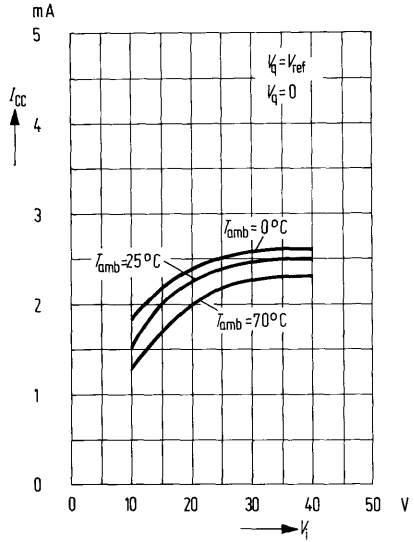
Load regulation characteristics with current limiting



Current limiting characteristics

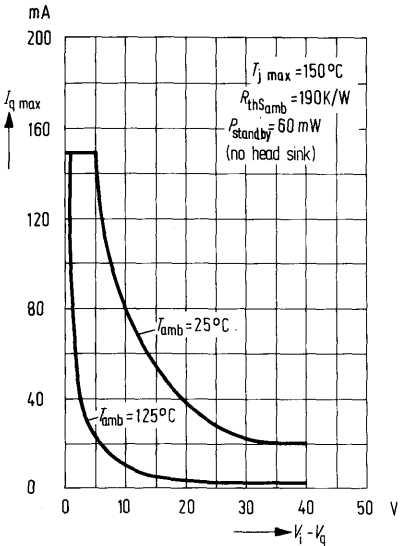


Standby current drain as a function of input voltage

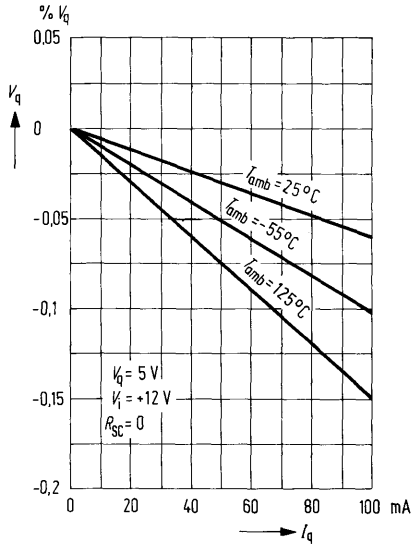


Typical performance curves for TDC 0723

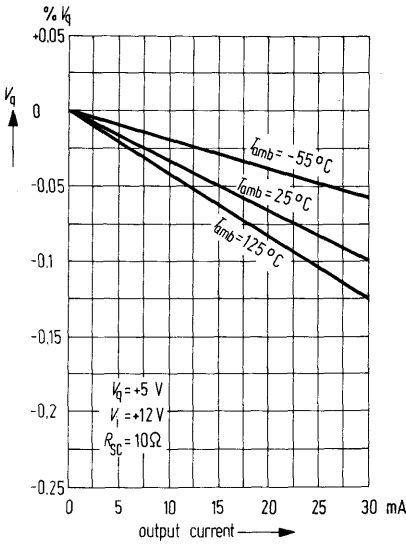
Maximum load current as a function of input/output voltage differential



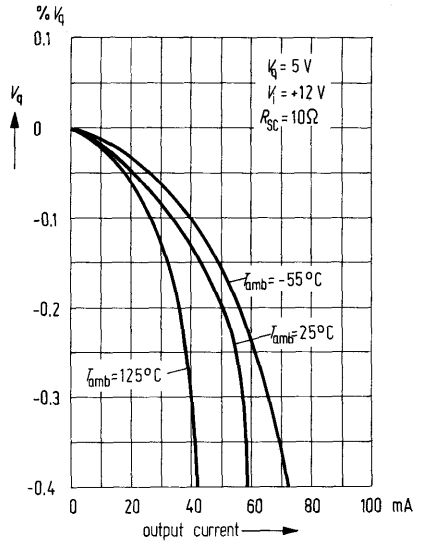
Load regulation characteristics without current limiting



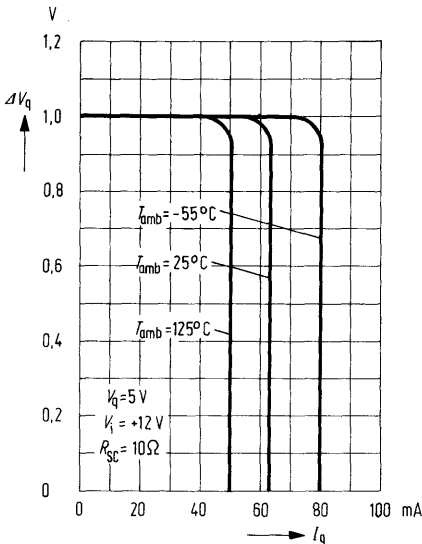
Load regulation characteristics with current limiting



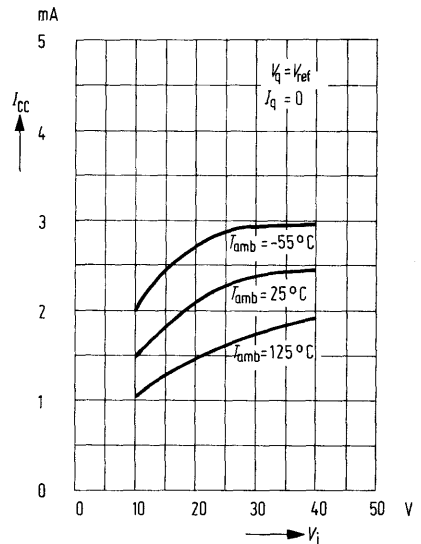
Load regulation characteristics with current limiting



Current limiting characteristics

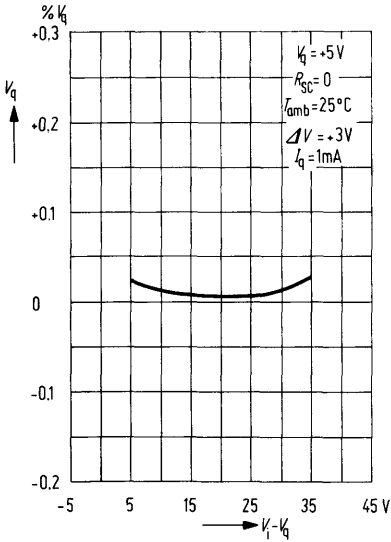


Standby current drain as a function of input voltage

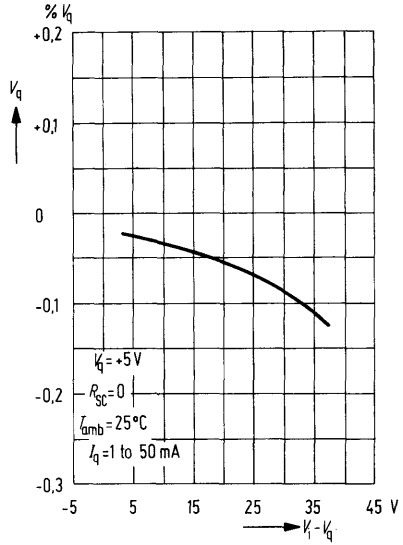


Typical performance curves for TDB 0723/A and TDC 0723

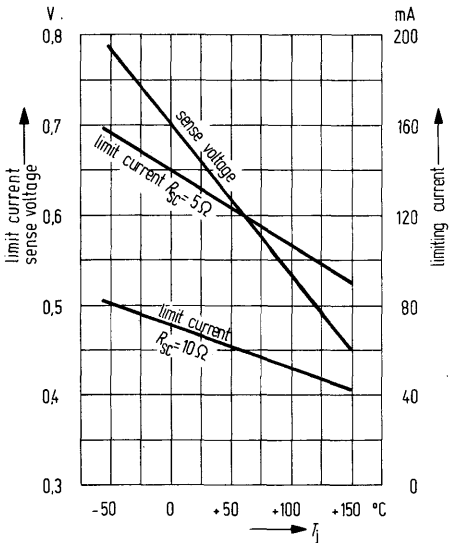
Line regulation as a function of input/output voltage differential



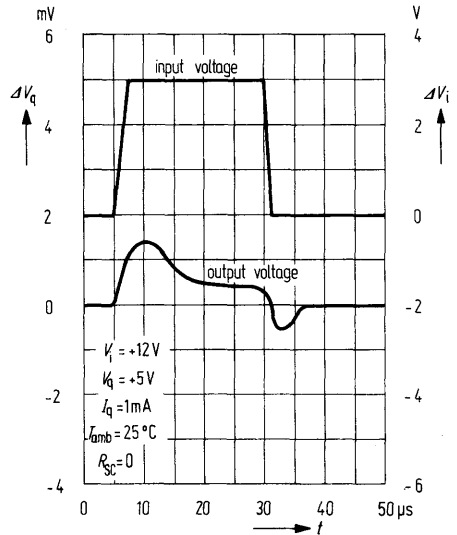
Load regulation as a function of input/output voltage differential



Current limiting characteristics as a function of junction temperature



Line transient response



Output impedance as a function of frequency

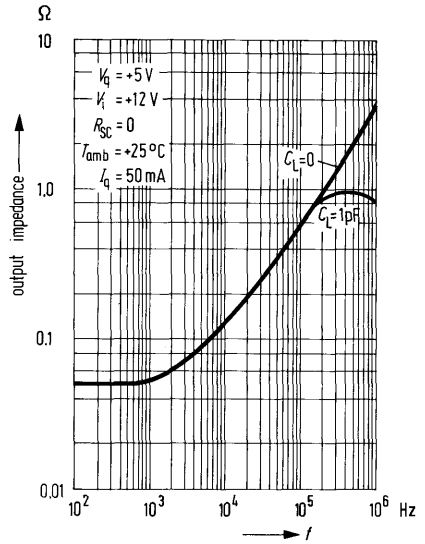


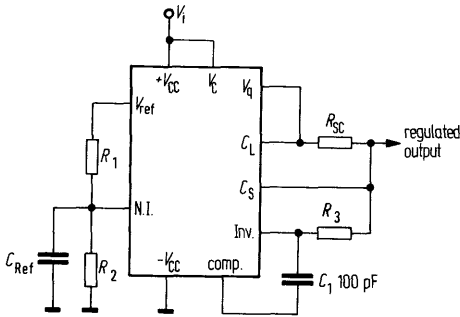
Table I
Resistor values (kΩ) for standard output voltages

Positive output voltage	Applicable figures	Fixed output ±5%		Output adjustable ±10% (fig. 13)		
		R_1	R_2	R_1	P_1	R_2
+ 3.0	1, 5, 6, 9, 12	4.12	3.01	1.8	.5	1.2
+ 3.6	1, 5, 6, 9, 12	3.57	3.65	1.5	.5	1.5
+ 5.0	1, 5, 6, 9, 12	2.15	4.99	0.75	.5	2.2
+ 6.0	1, 5, 6, 9, 12	1.15	6.04	0.5	.5	2.7
+ 9.0	2, 4	1.87	7.15	0.75	1.0	2.7
+ 12	2, 4	4.87	7.15	2.0	1.0	3.0
+ 15	2, 4	7.87	7.15	3.3	1.0	3.0
+ 28	2, 4	21.0	7.15	5.6	1.0	2.0
+ 45	7	3.57	48.7	2.2	10	39
+ 75	7	3.57	78.7	2.2	10	68
+100	7	3.57	102	2.2	10	91
+250	7	3.57	255	2.2	10	240
- 6 (+ $V_{cc} \geq 3$)	3	3.57	2.43	1.2	.5	.75
- 9	3, 10	3.48	5.36	1.2	.5	2.0
- 12	3, 10	3.57	8.45	1.2	.5	3.3
- 15	3, 10	3.65	11.5	1.2	.5	4.3
- 28	3, 10	3.57	24.3	1.2	.5	10
- 45	8	3.57	41.2	2.2	10	33
-100	8	3.57	97.6	2.2	10	91
-250	8	3.57	249	2.2	10	240

Table II
Formulare for intermediate output voltages

Outputs from +2 to +7 volts [Figures 1, 5, 6, 9, 12] $V_q = V_{ref} \cdot \frac{R_2}{R_1 + R_2}$	Outputs from +4 to +250 volts (Figure 7) $V_q = \frac{V_{ref}}{2} \cdot \frac{R_2 - R_1}{R_1};$ $R_3 = R_4$	Current limiting $I_{limit} = \frac{V_{sense}}{R_{sc}}$
Outputs from +7 to +37 volts [Figures 2, 4] $V_q = V_{ref} \cdot \frac{R_1 + R_2}{R_2}$	Outputs from -6 to -250 volts (Figures 3, 8, 10) $V_q = \frac{V_{ref}}{2} \cdot \frac{R_1 + R_2}{R_1};$ $R_3 = R_4$	Foldback current limiting $I_{knee} = \frac{V_q \cdot R_3}{R_{sc} \cdot R_4} + \frac{V_{sense} (R_3 + R_4)}{R_{sc} R_4}$ $I_{short\ ckt} = \frac{V_{sense}}{R_{sc}} \cdot \frac{R_3 + R_4}{R_4}$

Fig. 1 Basic low voltage regulator ($V_q = 2$ to 7 V)

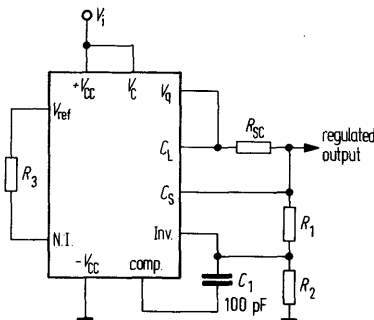


Typical performance

Regulated output voltage	5 V
Line regulation ($\Delta V_i = 3$ V)	.5 mV
Load regulation ($\Delta I_q = 50$ mA)	1.5 mV

Note: $R_3 = \frac{R_1 \cdot R_2}{R_1 + R_2}$ for minimum temperature drift.

Fig. 2 Basic high voltage regulator ($V_q = 7$ to 37 V)



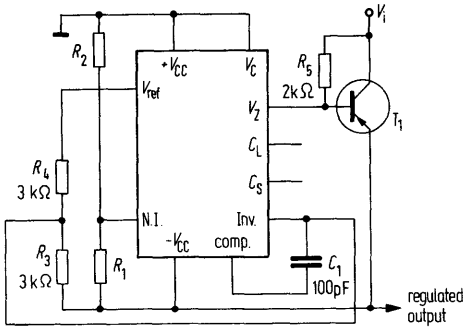
Typical performance

Regulated output voltage	15 V
Line regulation ($\Delta V_i = 3$ V)	1.5 mV
Load regulation ($\Delta I_q = 50$ mA)	4.5 mV

Note: $R_3 = \frac{R_1 \cdot R_2}{R_1 + R_2}$ for minimum temperature drift.

R_3 may be eliminated for minimum component count.

Fig.3 Negative voltage regulator

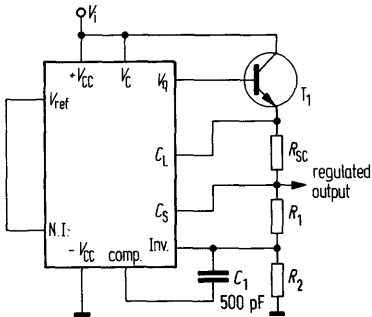


Typical performance

Regulated output voltage	-15 V
Line regulation ($\Delta V_i = 3$ V)	1 mV
Load regulation ($\Delta I_q = 100$ mA)	2 mV

For metal can applications where V_Z is required, an external 6.2 V zener diode should be connected in series with V_q .

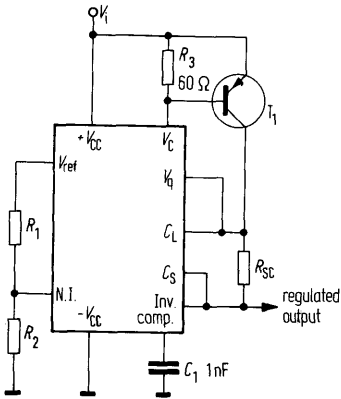
Fig.4 Positive voltage regulator (External NPN Pass Transistor)



Typical performance

Regulated output voltage	+15 V
Line regulation ($\Delta V_i = 3$ V)	1.5 mV
Load regulation ($\Delta I_q = 1$ A)	15 mV

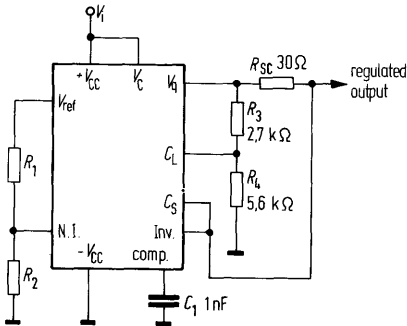
Fig. 5 Positive voltage regulator (External PNP Pass Transistor)



Typical performance

Regulated output voltage	+5 V
Line regulation ($\Delta V_i = 3$ V)	.5 mV
Load regulation ($\Delta I_q = 1$ A)	5 mV

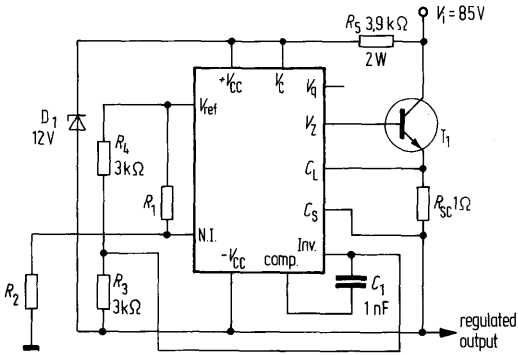
Fig. 6 Foldback current limiting



Typical performance

Regulated output voltage	+5 V
Line regulation ($\Delta V_i = 3$ V)	.5 mV
Load regulation ($\Delta I_q = 10$ mA)	1 mV
Short circuit current	20 mA

Fig. 7 Positive floating regulator

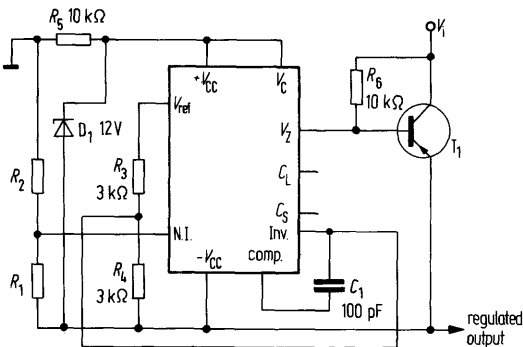


Typical performance

Regulated output voltage	+50 V
Line regulation ($\Delta V_i = 20$ V)	15 mV
Load regulation ($\Delta I_q = 50$ mA)	20 mV

For metal can applications, where V_Z is required, an external 6.2 V zener diode should be connected in series with V_q .

Fig. 8 Negative floating regulator

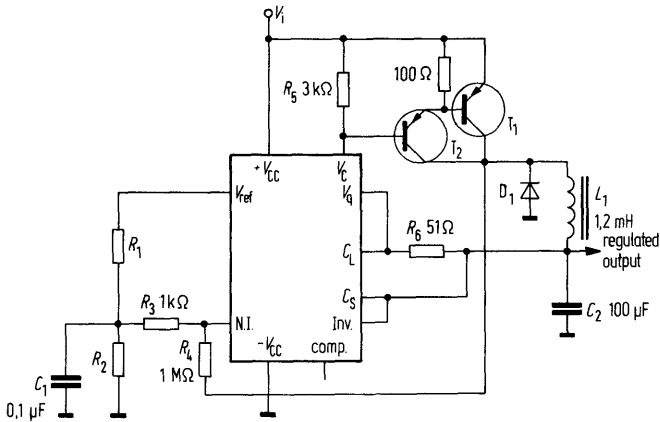


Typical performance

Regulated output voltage	-100 V
Line regulation ($\Delta V_i = 20$ V)	30 mV
Load regulation ($\Delta I_q = 100$ mA)	20 mV

For metal can applications, where V_Z is required, an external 6.2 V zener diode should be connected in series with V_q .

Fig.9 Positive switching regulator

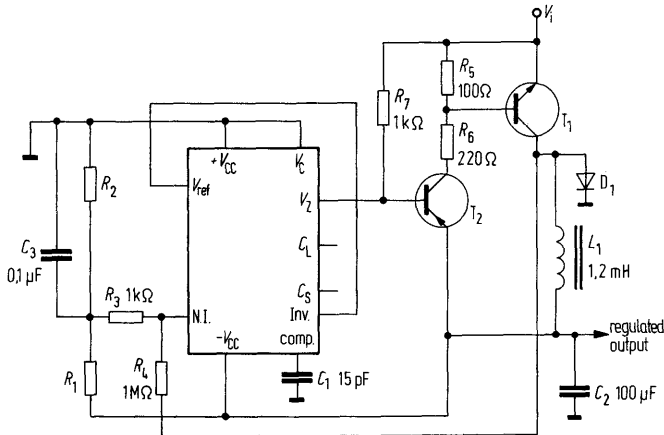


Typical performance

Regulated output voltage	+5 V
Line regulation ($\Delta V_i = 30$ V)	10 mV
Load regulation ($\Delta I_q = 2$ A)	80 mV

L_1 is 40 turns of No 20 enameled copper wire wound on pot core.

Fig.10 Negative switching regulator



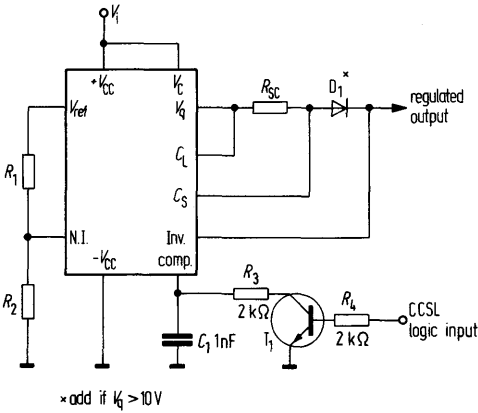
Typical performance

Regulated output voltage	-15 V
Line regulation ($\Delta V_i = 20$ V)	8 mV
Load regulation ($\Delta I_q = 2$ A)	6 mV

L_1 is 40 turns of No 20 enameled copper wire wound on pot core.

For metal can applications, where V_2 is required, an external 6.2 V zener diode should be connected in series with V_q .

Fig. 11 Remote shutdown regulator with current limiting



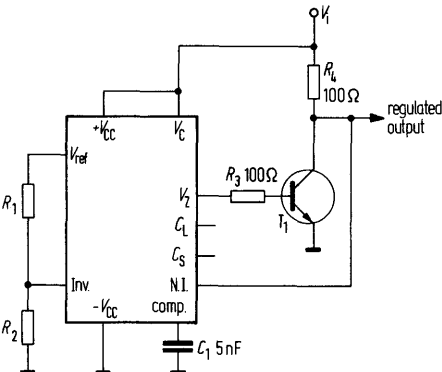
Typical performance

Regulated output voltage	+5 V
Line regulation ($\Delta V_i = 3\text{ V}$)	0.5 mV
Load regulation ($\Delta I_q = 50\text{ mA}$)	1.5 mV

Note 1: Current limit transistor may be used for shutdown if current limiting is not required.

Note 2: Add if $V_q > 10\text{ V}$

Fig. 12 Shunt regulator



Typical performance

Regulated output voltage	+5 V
Line regulation ($\Delta V_i = 10\text{ V}$)	0.5 mV
Load regulation ($\Delta I_q = 100\text{ mA}$)	1.5 mV

For metal can applications where V_z is required, an external 6.2 V zener diode should be connected in series with V_q .

Fig. 13 Output voltage adjust

