MOTOROLA

MC7900 Series

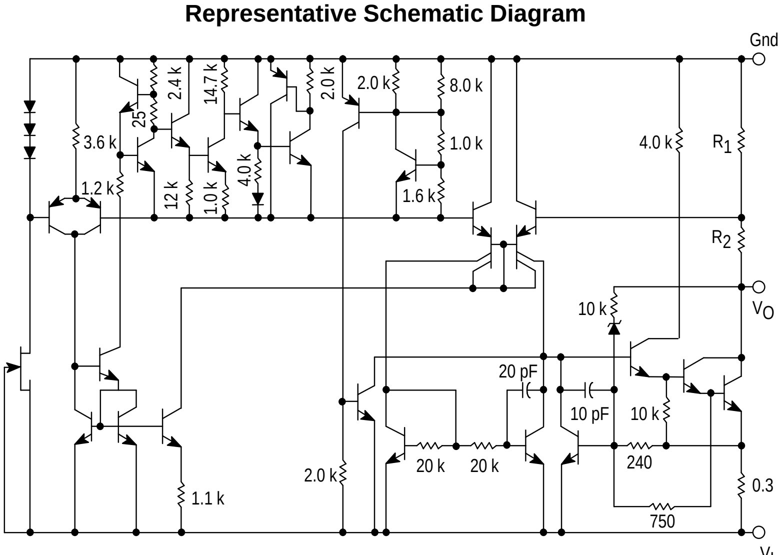
Three-Terminal Negative Voltage Regulators

The MC7900 series of fixed output negative voltage regulators are intended as complements to the popular MC7800 series devices. These negative regulators are available in the same seven–voltage options as the MC7800 devices. In addition, one extra voltage option commonly employed in MECL systems is also available in the negative MC7900 series.

Available in fixed output voltage options from −5.0 V to −24 V, these regulators employ current limiting, thermal shutdown, and safe–area compensation – making them remarkably rugged under most operating conditions. With adequate heatsinking they can deliver output currents in excess of 1.0 A.

- No External Components Required
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limiting
- Output Transistor Safe–Area Compensation
- Available in 2% Voltage Tolerance (See Ordering Information)

Representative Schematic Diagram

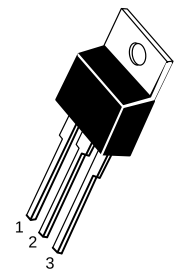


This device contains 26 active transistors.

THREE–TERMINAL NEGATIVE FIXED VOLTAGE REGULATORS

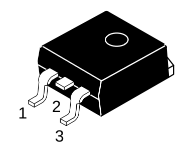
T SUFFIX
PLASTIC PACKAGE
CASE 221A

Heatsink surface connected to Pin 2.



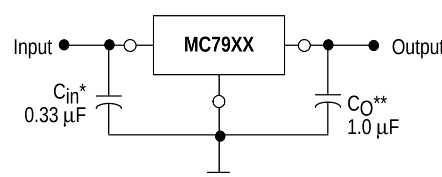
Pin 1. Ground
2. Input
3. Output

D2T SUFFIX
PLASTIC PACKAGE
CASE 936
(D^2PAK)



Heatsink surface (shown as terminal 4 in case outline drawing) is connected to Pin 2.

STANDARD APPLICATION



A common ground is required between the input and the output voltages. The input voltage must remain typically 2.0 V above more negative even during the high point of the input ripple voltage.

XX, These two digits of the type number indicate nominal voltage.
* C_{in} is required if regulator is located an appreciable distance from power supply filter.
** C_O improve stability and transient response.

ORDERING INFORMATION

Device	Output Voltage Tolerance	Operating Temperature Range	Package
MC79XXACD2T	2%	T_J = 0° to +125°C	Surface Mount
MC79XXCD2T	4%		
MC79XXACT	2%		Insertion Mount
MC79XXCT	4%		
MC79XXBD2T	4%	T_J = –40° to +125°C	Surface Mount
MC79XXBT			Insertion Mount

XX indicates nominal voltage.

DEVICE TYPE/NOMINAL OUTPUT VOLTAGE

MC7905	5.0 V	MC7912	12 V
MC7905.2	5.2 V	MC7915	15 V
MC7906	6.0 V	MC7918	28 V
MC7908	8.0 V	MC7924	24 V

MAXIMUM RATINGS (T_A = +25°C, unless otherwise noted.)

Rating	Symbol	Value	Unit
Input Voltage (–5.0 V ≥ V_O ≥ –18 V) (24 V)	V_I	–35 –40	Vdc
Power Dissipation Case 221A T_A = +25°C Thermal Resistance, Junction–to–Ambient Thermal Resistance, Junction–to–Case Case 936 (D^2PAK) T_A = +25°C Thermal Resistance, Junction–to–Ambient Thermal Resistance, Junction–to–Case	 P_D θ_{JA} θ_{JC} P_D θ_{JA} θ_{JC}	 Internally Limited 65 5.0 Internally Limited 70 5.0	 W °C/W °C/W W °C/W °C/W
Storage Junction Temperature Range	T_{stg}	–65 to +150	°C
Junction Temperature	T_J	+150	°C

THERMAL CHARACTERISTICS

Characteristics	Symbol	Max	Unit
Thermal Resistance, Junction–to–Ambient	$R_{\theta JA}$	65	°C/W
Thermal Resistance, Junction–to–Case	$R_{\theta JC}$	5.0	°C/W

MC7905C
ELECTRICAL CHARACTERISTICS (V_I = –10 V, I_O = 500 mA, 0°C < T_J < +125°C, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	–4.8	–5.0	–5.2	Vdc
Line Regulation (Note 1) (T_J = +25°C, I_O = 100 mA) –7.0 Vdc ≥ V_I ≥ –25 Vdc –8.0 Vdc ≥ V_I ≥ –12 Vdc (T_J = +25°C, I_O = 500 mA) –7.0 Vdc ≥ V_I ≥ –25 Vdc –8.0 Vdc ≥ V_I ≥ –12 Vdc	Reg_{line}	 – – – –	 7.0 2.0 35 8.0	 50 25 100 50	mV
Load Regulation, T_J = +25°C (Note 1) 5.0 mA ≤ I_O ≤ 1.5 A 250 mA ≤ I_O ≤ 750 mA	Reg_{load}	 – –	 11 4.0	 100 50	mV
Output Voltage –7.0 Vdc ≥ V_I ≥ –20 Vdc, 5.0 mA ≤ I_O ≤ 1.0 A, P ≤ 15 W	V_O	 –4.75	 –	 –5.25	Vdc
Input Bias Current (T_J = +25°C)	I_{IB}	–	4.3	8.0	mA
Input Bias Current Change –7.0 Vdc ≥ V_I ≥ –25 Vdc 5.0 mA ≤ I_O ≤ 1.5 A	ΔI_{IB}	 – –	 – –	 1.3 0.5	mA
Output Noise Voltage (T_A = +25°C, 10 Hz ≤ f ≤ 100 kHz)	V_n	–	40	–	µV
Ripple Rejection (I_O = 20 mA, f = 120 Hz)	RR	–	70	–	dB
Dropout Voltage I_O = 1.0 A, T_J = +25°C	$V_I–V_O$	 –	 2.0	 –	Vdc
Average Temperature Coefficient of Output Voltage I_O = 5.0 mA, 0°C ≤ T_J ≤ +125°C	$\Delta V_O/\Delta T$	 –	 –1.0	 –	mV/°C

NOTE: 1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

MC7905AC
ELECTRICAL CHARACTERISTICS (V_I = –10 V, I_O = 500 mA, 0°C < T_J < +125°C, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	–4.9	–5.0	–5.1	Vdc
Line Regulation (Note 1) –8.0 Vdc ≥ V_I ≥ –12 Vdc; I_O = 1.0 A, T_J = +25°C –8.0 Vdc ≥ V_I ≥ –12 Vdc; I_O = 1.0 A –7.5 Vdc ≥ V_I ≥ –25 Vdc; I_O = 500 mA –7.0 Vdc ≥ V_I ≥ –20 Vdc; I_O = 1.0 A, T_J = +25°C	Reg_{line}	 – – – –	 2.0 7.0 7.0 6.0	 25 50 50 50	mV
Load Regulation (Note 1) 5.0 mA ≤ I_O ≤ 1.5 A, T_J = +25°C 250 mA ≤ I_O ≤ 750 mA 5.0 mA ≤ I_O ≤ 1.0 A	Reg_{load}	 – – –	 11 4.0 9.0	 100 50 100	mV
Output Voltage –7.5 Vdc ≥ V_I ≥ –20 Vdc, 5.0 mA ≤ I_O ≤ 1.0 A, P ≤ 15 W	V_O	 –4.80	 –	 –5.20	Vdc
Input Bias Current	I_{IB}	–	4.4	8.0	mA
Input Bias Current Change –7.5 Vdc ≥ V_I ≥ –25 Vdc 5.0 mA ≤ I_O ≤ 1.0 A 5.0 mA ≤ I_O ≤ 1.5 A, T_J = +25°C	ΔI_{IB}	 – – –	 – – –	 1.3 0.5 0.5	mA
Output Noise Voltage (T_A = +25°C, 10 Hz ≤ f ≤ 100 kHz)	V_n	–	40	–	µV
Ripple Rejection (I_O = mA, f = 120 Hz)	RR	–	70	–	dB
Dropout Voltage I_O = 1.0 A. T_J = +25°C	V_I–V_O	 –	 2.0	 –	Vdc
Average Temperature Coefficient of Output Voltage I_O = 5.0 A, 0°C ≤ T_J ≤ +125°C	$\Delta V_O/\Delta T$	 –	 –1.0	 –	mV/°C

MC7905.2C
ELECTRICAL CHARACTERISTICS (V_I = –10 V, I_O = 500 mA, 0°C < T_J < +125°C, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	–5.0	–5.2	–5.4	Vdc
Line Regulation (Note 1) (T_J = +25°C, I_O = 100 mA) –7.2 Vdc ≥ V_I ≥ –25 Vdc –8.0 Vdc ≥ V_I ≥ –12 Vdc (T_J = +25°C, I_O = 500 mA) –7.2 Vdc ≥ V_I ≥ –25 Vdc –8.0 Vdc ≥ V_I ≥ –12 Vdc	Reg_{line}	 – – – –	 8.0 2.2 37 8.5	 52 27 105 52	mV
Load Regulation, T_J = +25°C (Note 1) 5.0 mA ≤ I_O ≤ 1.5 A 250 mA ≤ I_O ≤ 750 mA	Reg_{load}	 – –	 12 4.5	 105 52	mV
Output Voltage –7.2 Vdc ≥ V_I ≥ –20 Vdc, 5.0 mA ≤ I_O ≤ 1.0 A, P ≤ 15 W	V_O	 –4.95	 –	 –5.45	Vdc
Input Bias Current (T_J = +25°C)	I_{IB}	–	4.3	8.0	mA
Input Bias Current Change –7.2 Vdc ≥ V_I ≥ –25 Vdc 5.0 mA ≤ I_O ≤ 1.5 A	ΔI_{IB}	 – –	 – –	 1.3 0.5	mA
Output Noise Voltage (T_A = +25°C, 10 Hz ≤ f ≤ 100 kHz)	V_n	–	42	–	µV
Ripple Rejection (I_O = 20 mA, f = 120 Hz)	RR	–	68	–	dB
Dropout Voltage I_O = 1.0 A, T_J = +25°C	V_I–V_O	 –	 2.0	 –	Vdc
Average Temperature Coefficient of Output Voltage I_O = 5.0 mA, 0°C ≤ T_J ≤ +125°C	$\Delta V_O/\Delta T$	 –	 –1.0	 –	mV/°C

NOTE: 1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

MC7906C

ELECTRICAL CHARACTERISTICS (V_I = –11 V, I_O = 500 mA, 0°C < T_J < +125°C, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	–5.75	–6.0	–6.25	Vdc
Line Regulation (Note 1) (T_J = +25°C, I_O = 100 mA) –8.0 Vdc ≥ V_I ≥ –25 Vdc –9.0 Vdc ≥ V_I ≥ –13 Vdc (T_J = +25°C, I_O = 500 mA) –8.0 Vdc ≥ V_I ≥ –25 Vdc –9.0 Vdc ≥ V_I ≥ –13 Vdc	Reg_{line}	 – – – –	 9.0 3.0 43 10	 60 30 120 60	mV
Load Regulation, T_J = +25°C (Note 1) 5.0 mA ≤ I_O ≤ 1.5 A 250 mA ≤ I_O ≤ 750 mA	Reg_{load}	 – –	 13 5.0	 120 60	mV
Output Voltage –8.0 Vdc ≥ V_I ≥ –21 Vdc, 5.0 mA ≤ I_O ≤ 1.0 A, P ≤ 15 W	V_O	 –5.7	 –	 –6.3	Vdc
Input Bias Current (T_J = +25°C)	I_{IB}	–	4.3	8.0	mA
Input Bias Current Change –8.0 Vdc ≥ V_I ≥ –25 Vdc 5.0 mA ≤ I_O ≤ 1.5 A	ΔI_{IB}	 – –	 – –	 1.3 0.5	mA
Output Noise Voltage (T_A = +25°C, 10 Hz ≤ f ≤ 100 kHz)	V_n	–	45	–	µV
Ripple Rejection (I_O = 20 mA, f = 120 Hz)	RR	–	65	–	dB
Dropout Voltage I_O = 1.0 A, T_J = +25°C	V_I–V_O	 –	 2.0	 –	Vdc
Average Temperature Coefficient of Output Voltage I_O = 5.0 A, 0°C ≤ T_J ≤ +125°C	$\Delta V_O/\Delta T$	 –	 –1.0	 –	mV/°C

MC7908C

ELECTRICAL CHARACTERISTICS (V_I = –14 V, I_O = 500 mA, 0°C < T_J < +125°C, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	–7.7	–8.0	–8.3	Vdc
Line Regulation (Note 1) (T_J = +25°C, I_O = 100 mA) –10.5 Vdc ≥ V_I ≥ –25 Vdc –11 Vdc ≥ V_I ≥ –17 Vdc (T_J = +25°C, I_O = 500 mA) –10.5 Vdc ≥ V_I ≥ –25 Vdc –11 Vdc ≥ V_I ≥ –17 Vdc	Reg_{line}	 – – – –	 12 5.0 50 22	 80 40 160 80	mV
Load Regulation, T_J = +25°C (Note 1) 5.0 mA ≤ I_O ≤ 1.5 A 250 mA ≤ I_O ≤ 750 mA	Reg_{load}	 – –	 26 9.0	 160 80	mV
Output Voltage –10.5 Vdc ≥ V_I ≥ –23 Vdc, 5.0 mA ≤ I_O ≤ 1.0 A, P ≤ 15 W	V_O	 –7.6	 –	 –8.4	Vdc
Input Bias Current (T_J = +25°C)	I_{IB}	–	4.3	8.0	mA
Input Bias Current Change –10.5 Vdc ≥ V_I ≥ –25 Vdc 5.0 mA ≤ I_O ≤ 1.5 A	ΔI_{IB}	 – –	 – –	 1.0 0.5	mA
Output Noise Voltage (T_A = +25°C, 10 Hz ≤ f ≤ 100 kHz)	V_n	–	52	–	µV
Ripple Rejection (I_O = 20 mA, f = 120 Hz)	RR	–	62	–	dB
Dropout Voltage I_O = 1.0 A, T_J = +25°C	V_I–V_O	 –	 2.0	 –	Vdc
Average Temperature Coefficient of Output Voltage I_O = 5.0 mA, 0°C ≤ T_J ≤ +125°C	$\Delta V_O/\Delta T$	 –	 –1.0	 –	mV/°C

NOTE: 1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

MC7912C
ELECTRICAL CHARACTERISTICS (V_I = –19 V, I_O = 500 mA, 0°C < T_J < +125°C, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	–11.5	–12	–12.5	Vdc
Line Regulation (Note 1)	Reg_{line}				mV
(T_J = +25°C, I_O = 100 mA)					
–14.5 Vdc ≥ V_I ≥ –30 Vdc		–	13	120	
–16 Vdc ≥ V_I ≥ –22 Vdc		–	6.0	60	
(T_J = +25°C, I_O = 500 mA)					
–14.5 Vdc ≥ V_I ≥ –30 Vdc		–	55	240	
–16 Vdc ≥ V_I ≥ –22 Vdc		–	24	120	
Load Regulation, T_J = +25°C (Note 1)	Reg_{load}				mV
5.0 mA ≤ I_O ≤ 1.5 A		–	46	240	
250 mA ≤ I_O ≤ 750 mA		–	17	120	
Output Voltage	V_O				Vdc
–14.5 Vdc ≥ V_I ≥ –27 Vdc, 5.0 mA ≤ I_O ≤ 1.0 A, P ≤ 15 W		–11.4	–	–12.6	
Input Bias Current (T_J = +25°C)	I_{IB}	–	4.4	8.0	mA
Input Bias Current Change	ΔI_{IB}				mA
–14.5 Vdc ≥ V_I ≥ –30 Vdc		–	–	1.0	
5.0 mA ≤ I_O ≤ 1.5 A		–	–	0.5	
Output Noise Voltage (T_A = +25°C, 10 Hz ≤ f ≤ 100 kHz)	V_n	–	75	–	µV
Ripple Rejection (I_O = 20 mA, f = 120 Hz)	RR	–	61	–	dB
Dropout Voltage	V_I–V_O				Vdc
I_O = 1.0 A, T_J = +25°C		–	2.0	–	
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$				mV/°C
I_O = 5.0 mA, 0°C ≤ T_J ≤ +125°C		–	–1.0	–	

MC7912AC
ELECTRICAL CHARACTERISTICS (V_I = –19 V, I_O = 500 mA, 0°C < T_J < +125°C, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	–11.75	–12	–12.25	Vdc
Line Regulation (Note 1)	Reg_{line}				mV
–16 Vdc ≥ V_I ≥ –22 Vdc; I_O = 1.0 A, T_J = +25°C		–	6.0	60	
–16 Vdc ≥ V_I ≥ –22 Vdc; I_O = 1.0 A		–	24	120	
–14.8 Vdc ≥ V_I ≥ –30 Vdc; I_O = 500 mA		–	24	120	
–14.5 Vdc ≥ V_I ≥ –27 Vdc; I_O = 1.0 A, T_J = +25°C		–	13	120	
Load Regulation (Note 1)	Reg_{load}				mV
5.0 mA ≤ I_O ≤ 1.5 A, T_J = +25°C		–	46	150	
250 mA ≤ I_O ≤ 750 mA		–	17	75	
5.0 mA ≤ I_O ≤ 1.0 A		–	35	150	
Output Voltage	V_O				Vdc
–14.8 Vdc ≥ V_I ≥ –27 Vdc, 5.0 mA ≤ I_O ≤ 1.0 A, P ≤ 15 W		–11.5	–	–12.5	
Input Bias Current	I_{IB}	–	4.4	8.0	mA
Input Bias Current Change	ΔI_{IB}				mA
–15 Vdc ≥ V_I ≥ –30 Vdc		–	–	0.8	
5.0 mA ≤ I_O ≤ 1.0 A		–	–	0.5	
5.0 mA ≤ I_O ≤ 1.5 A, T_J = +25°C		–	–	0.5	
Output Noise Voltage (T_A = +25°C, 10 Hz ≤ f ≤ 100 kHz)	V_n	–	75	–	µV
Ripple Rejection (I_O = 20 mA, f = 120 Hz)	RR	–	61	–	dB
Dropout Voltage	V_I–V_O				Vdc
I_O = 1.0 A, T_J = +25°C		–	2.0	–	
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$				mV/°C
I_O = 5.0 A, 0°C ≤ T_J ≤ +125°C		–	–1.0	–	

NOTE: 1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

MC7915C
ELECTRICAL CHARACTERISTICS (V_I = –23 V, I_O = 500 mA, 0°C < T_J < +125°C, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	–14.4	–15	–15.6	Vdc
Line Regulation (Note 1)	Reg_{line}				mV
(T_J = +25°C, I_O = 100 mA)					
–17.5 Vdc ≥ V_I ≥ –30 Vdc		–	14	150	
–20 Vdc ≥ V_I ≥ –26 Vdc		–	6.0	75	
(T_J = +25°C, I_O = 500 mA)					
–17.5 Vdc ≥ V_I ≥ –30 Vdc		–	57	300	
–20 Vdc ≥ V_I ≥ –26 Vdc		–	27	150	
Load Regulation, T_J = +25°C (Note 1)	Reg_{load}				mV
5.0 mA ≤ I_O ≤ 1.5 A		–	68	300	
250 mA ≤ I_O ≤ 750 mA		–	25	150	
Output Voltage –17.5 Vdc ≥ V_I ≥ –30 Vdc, 5.0 mA ≤ I_O ≤ 1.0 A, P ≤ 15 W	V_O	–14.25	–	–15.75	Vdc
Input Bias Current (T_J = +25°C)	I_{IB}	–	4.4	8.0	mA
Input Bias Current Change	ΔI_{IB}				mA
–17.5 Vdc ≥ V_I ≥ –30 Vdc		–	–	1.0	
5.0 mA ≤ I_O ≤ 1.5 A		–	–	0.5	
Output Noise Voltage (T_A = +25°C, 10 Hz ≤ f ≤ 100 kHz)	V_n	–	90	–	µV
Ripple Rejection (I_O = 20 mA, f = 120 Hz)	RR	–	60	–	dB
Dropout Voltage I_O = 1.0 A, T_J = +25°C	V_I–V_O	–	2.0	–	Vdc
Average Temperature Coefficient of Output Voltage I_O = 5.0 A, 0°C ≤ T_J ≤ +125°C	$\Delta V_O/\Delta T$	–	–1.0	–	mV/°C

MC7915AC
ELECTRICAL CHARACTERISTICS (V_I = –23 V, I_O = 500 mA, 0°C < T_J < +125°C, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	–14.7	–15	–15.3	Vdc
Line Regulation (Note 1)	Reg_{line}				mV
–20 Vdc ≥ V_I ≥ –26 Vdc, I_O = 1.0 A, T_J = +25°C		–	27	75	
–20 Vdc ≥ V_I ≥ –26 Vdc, I_O = 1.0 A,		–	57	150	
–17.9 Vdc ≥ V_I ≥ –30 Vdc, I_O = 500 mA		–	57	150	
–17.5 Vdc ≥ V_I ≥ –30 Vdc, I_O = 1.0 A, T_J = +25°C		–	57	150	
Load Regulation (Note 1)	Reg_{load}				mV
5.0 mA ≤ I_O ≤ 1.5 A, T_J = +25°C		–	68	150	
250 mA ≤ I_O ≤ 750 mA		–	25	75	
5.0 mA ≤ I_O ≤ 1.0 A		–	40	150	
Output Voltage –17.9 Vdc ≥ V_I ≥ –30 Vdc, 5.0 mA ≤ I_O ≤ 1.0 A, P ≤ 15 W	V_O	–14.4	–	–15.6	Vdc
Input Bias Current	I_{IB}	–	4.4	8.0	mA
Input Bias Current Change	ΔI_{IB}				mA
–17.5 Vdc ≥ V_I ≥ –30 Vdc		–	–	0.8	
5.0 mA ≤ I_O ≤ 1.0 A		–	–	0.5	
5.0 mA ≤ I_O ≤ 1.5 A, T_J = +25°C		–	–	0.5	
Output Noise Voltage (T_A = +25°C, 10 Hz ≤ f ≤ 100 kHz)	V_n	–	90	–	µV
Ripple Rejection (I_O = 20 mA, f = 120 Hz)	RR	–	60	–	dB
Dropout Voltage I_O = 1.0 A, T_J = +25°C	V_I–V_O	–	2.0	–	Vdc
Average Temperature Coefficient of Output Voltage I_O = 5.0 mA, 0°C ≤ T_J ≤ +125°C	$\Delta V_O/\Delta T$	–	–1.0	–	mV/°C

NOTE: 1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

MC7918C

ELECTRICAL CHARACTERISTICS (V_I = –27 V, I_O = 500 mA, 0°C < T_J < +125°C, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	–17.3	–18	–18.7	Vdc
Line Regulation (Note 1)	Reg_{line}				mV
(T_J = +25°C, I_O = 100 mA)					
–21 Vdc ≥ V_I ≥ –33 Vdc		–	25	180	
–24 Vdc ≥ V_I ≥ –30 Vdc		–	10	90	
(T_J = +25°C, I_O = 500 mA)					
–21 Vdc ≥ V_I ≥ –33 Vdc		–	90	360	
–24 Vdc ≥ V_I ≥ –30 Vdc		–	50	180	
Load Regulation, T_J = +25°C (Note 1)	Reg_{load}				mV
5.0 mA ≤ I_O ≤ 1.5 A		–	110	360	
250 mA ≤ I_O ≤ 750 mA		–	55	180	
Output Voltage –21 Vdc ≥ V_I ≥ –33 Vdc, 5.0 mA ≤ I_O ≤ 1.0 A, P ≤ 15 W	V_O	–17.1	–	–18.9	Vdc
Input Bias Current (T_J = +25°C)	I_{IB}	–	4.5	8.0	mA
Input Bias Current Change	ΔI_{IB}				mA
–21 Vdc ≥ V_I ≥ –33 Vdc		–	–	1.0	
5.0 mA ≤ I_O ≤ 1.5 A		–	–	0.5	
Output Noise Voltage (T_A = +25°C, 10 Hz ≤ f ≤ 100 kHz)	V_n	–	110	–	µV
Ripple Rejection (I_O = 20 mA, f = 120 Hz)	RR	–	59	–	dB
Dropout Voltage I_O = 1.0 A, T_J = +25°C	$V_I–V_O$	–	2.0	–	Vdc
Average Temperature Coefficient of Output Voltage I_O = 5.0 mA, 0°C ≤ T_J ≤ +125°C	$\Delta V_O/\Delta T$	–	–1.0	–	mV/°C

MC7924C

ELECTRICAL CHARACTERISTICS (V_I = –33 V, I_O = 500 mA, 0°C < T_J < +125°C, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	–23	–24	–25	Vdc
Line Regulation (Note 1)	Reg_{line}				mV
(T_J = +25°C, I_O = 100 mA)					
–27 Vdc ≥ V_I ≥ –38 Vdc		–	31	240	
–30 Vdc ≥ V_I ≥ –36 Vdc		–	14	120	
(T_J = +25°C, I_O = 500 mA)					
–27 Vdc ≥ V_I ≥ –38 Vdc		–	118	470	
–30 Vdc ≥ V_I ≥ –36 Vdc		–	70	240	
Load Regulation, T_J = +25°C (Note 1)	Reg_{load}				mV
5.0 mA ≤ I_O ≤ 1.5 A		–	150	480	
250 mA ≤ I_O ≤ 750 mA		–	85	240	
Output Voltage –27 Vdc ≥ V_I ≥ –38 Vdc, 5.0 mA ≤ I_O ≤ 1.0 A, P ≤ 15 W	V_O	–22.8	–	–25.2	Vdc
Input Bias Current (T_J = +25°C)	I_{IB}	–	4.6	8.0	mA
Input Bias Current Change	ΔI_{IB}				mA
–27 Vdc ≥ V_I ≥ –38 Vdc		–	–	1.0	
5.0 mA ≤ I_O ≤ 1.5 A		–	–	0.5	
Output Noise Voltage (T_A = +25°C, 10 Hz ≤ f ≤ 100 kHz)	V_n	–	170	–	µV
Ripple Rejection (I_O = 20 mA, f = 120 Hz)	RR	–	56	–	dB
Dropout Voltage I_O = 1.0 A, T_J = +25°C	$V_I–V_O$	–	2.0	–	Vdc
Average Temperature Coefficient of Output Voltage I_O = 5.0 mA, 0°C ≤ T_J ≤ +125°C	$\Delta V_O/\Delta T$	–	–1.0	–	mV/°C

NOTE: 1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Figure 1. Worst Case Power Dissipation as a Function of Ambient Temperature

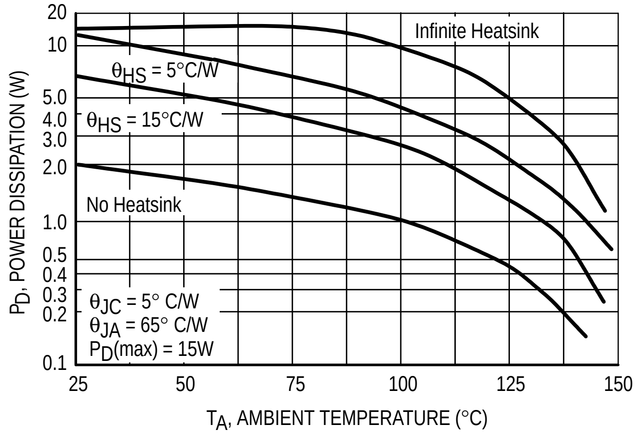


Figure 2. Peak Output Current as a Function of Input–Output Differential Voltage

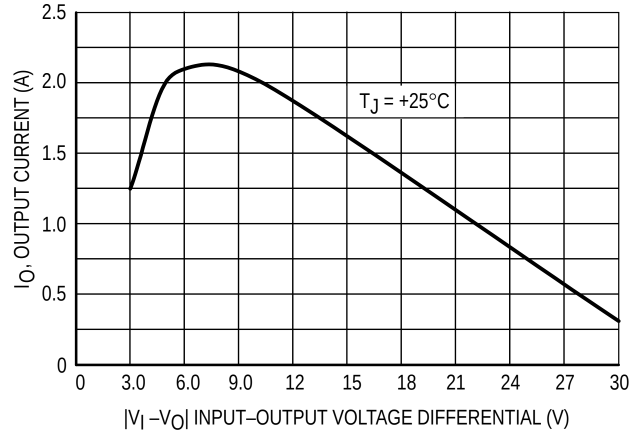


Figure 3. Ripple Rejection as a Function of Frequency

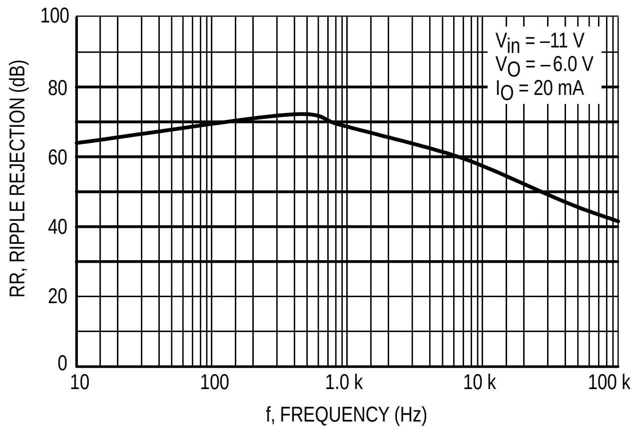


Figure 4. Ripple Rejection as a Function of Output Voltage

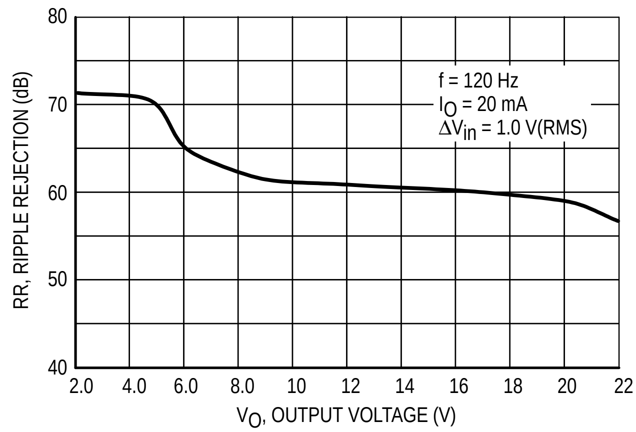


Figure 5. Output Voltage as a Function of Junction Temperature

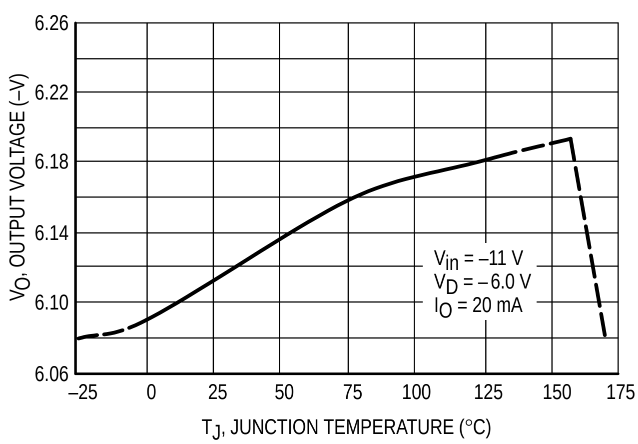
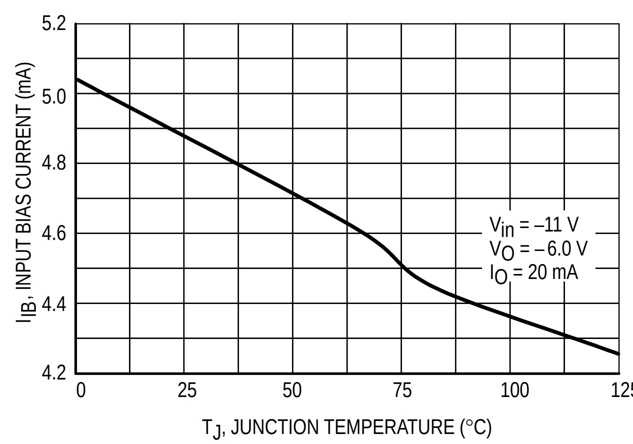


Figure 6. Quiescent Current as a Function of Temperature



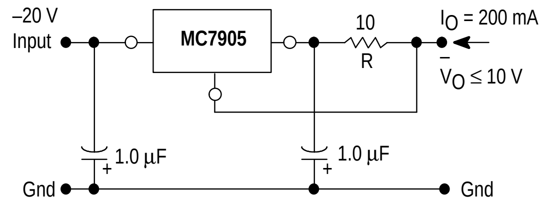
APPLICATIONS INFORMATION

Design Considerations

The MC7900 Series of fixed voltage regulators are designed with Thermal overload Protection that shuts down the circuit when subjected to an excessive power overload condition. Internal Short Circuit Protection that limits the maximum current the circuit will pass, and Output Transistor Safe–Area Compensation that reduces the output short circuit current as the voltage across the pass transistor is increased.

In many low current applications, compensation capacitors are not required. However, it is recommended that the regulator input be bypassed with a capacitor if the regulator is connected to the power supply filter with long wire lengths, or if the output load capacitance is large. An input bypass capacitor should be selected to provide good high–frequency characteristics to insure stable operation under all load conditions. A 0.33 µF or larger tantalum, mylar, or other capacitor having low internal impedance at high frequencies should be chosen. The capacitor chosen should have an equivalent series resistance of less than 0.7 Ω. The bypass capacitor should be mounted with the shortest possible leads directly across the regulators input terminals. Normally good construction techniques should be used to minimize ground loops and lead resistance drops since the regulator has no external sense lead. Bypassing the output is also recommended.

Figure 7. Current Regulator



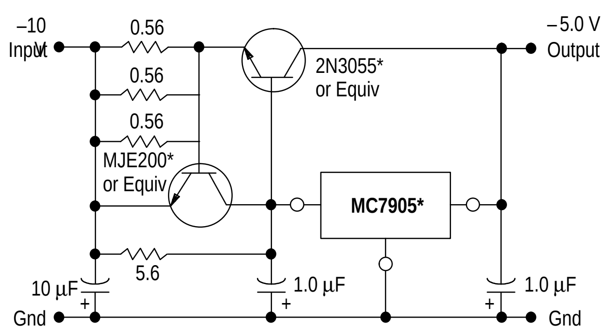
The MC7905, – 5.0 V regulator can be used as a constant current source when connected as above. The output current is the sum of resistor R current and quiescent bias current as follows.

$$I_O = \frac{5.0\ V}{R} + I_B$$

The quiescent current for this regulator is typically 4.3 mA. The 5.0 V regulator was chosen to minimize dissipation and to allow the output voltage to operate to within 6.0 V below the input voltage.

Figure 8. Current Boost Regulator

(– 5.0 V @ 4.0 A, with 5.0 A Current Limiting)

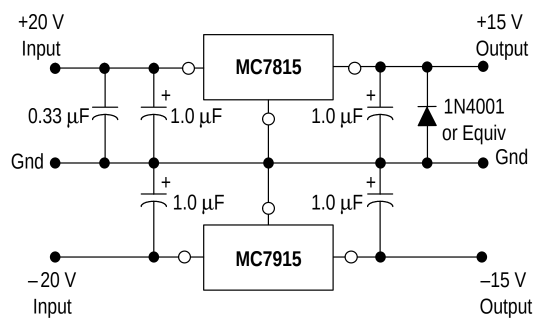


*Mounted on heatsink.

When a boost transistor is used, short circuit currents are equal to the sum of the series pass and regulator limits, which are measured at 3.2 A and 1.8 A respectively in this case. Series pass limiting is approximately equal to 0.6 V/R_{SC}. Operation beyond this point to the peak current capability of the MC7905C is possible if the regulator is mounted on a heatsink; otherwise thermal shutdown will occur when the additional load current is picked up by the regulator.

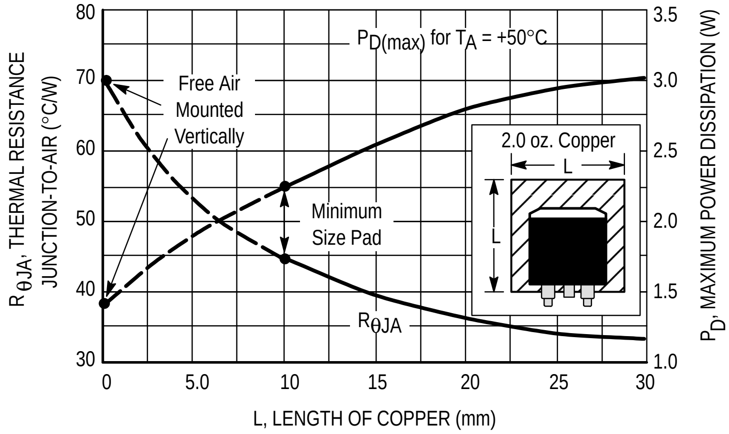
Figure 9. Operational Amplifier Supply

(±15 @ 1.0 A)



The MC7815 and MC7915 positive and negative regulators may be connected as shown to obtain a dual power supply for operational amplifiers. A clamp diode should be used at the output of the MC7815 to prevent potential latch–up problems whenever the output of the positive regulator (MC7815) is drawn below ground with an output current greater than 200 mA.

Figure 10. D2PAK Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length



DEFINITIONS

Line Regulation – The change in output voltage for a change in the input voltage. The measurement is made under conditions of low dissipation or by using pulse techniques such that the average chip temperature is not significantly affected.

Load Regulation – The change in output voltage for a change in load current at constant chip temperature.

Maximum Power Dissipation – The maximum total device dissipation for which the regulator will operate within specifications.

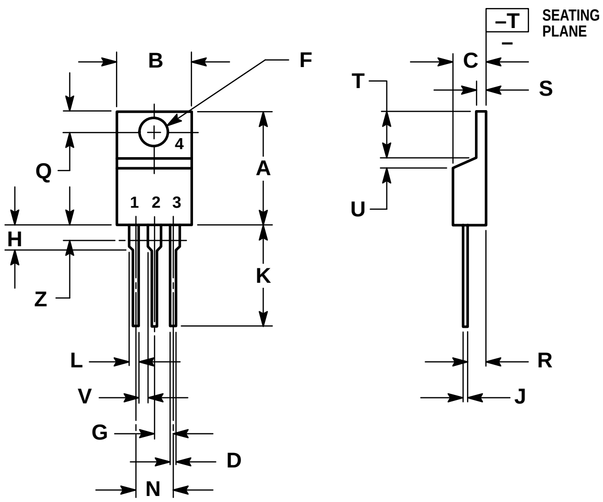
Input Bias Current – That part of the input current that is not delivered to the load.

Output Noise Voltage – The rms AC voltage at the output, with constant load and no input ripple, measured over a specified frequency range.

Long Term Stability – Output voltage stability under accelerated life test conditions with the maximum rated voltage listed in the devices' electrical characteristics and maximum power dissipation.

OUTLINE DIMENSIONS

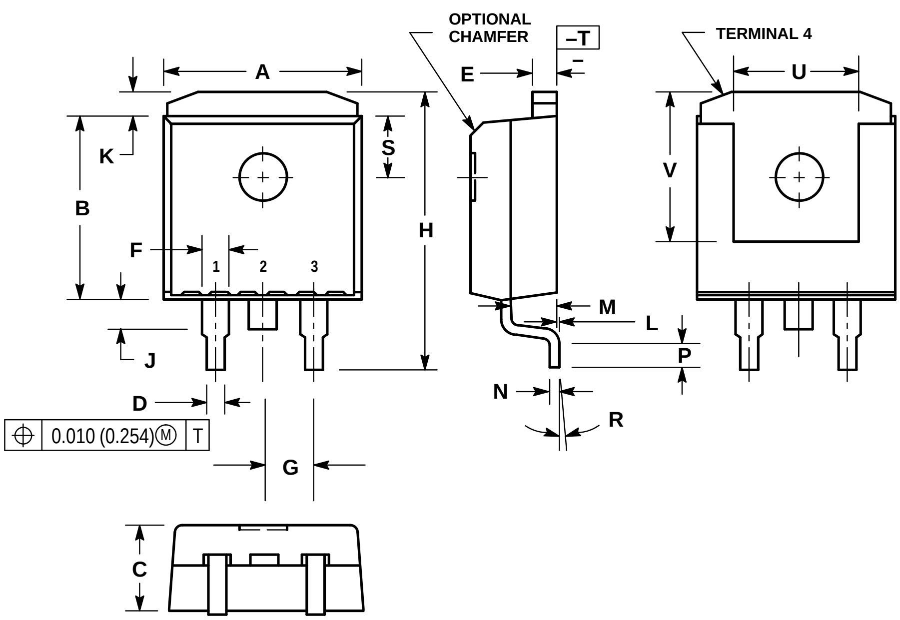
T SUFFIX
PLASTIC PACKAGE
CASE 221A–06
ISSUE Y



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIM Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	–	1.15	–
Z	–	0.080	–	2.04

D2T SUFFIX
PLASTIC PACKAGE
CASE 936–03
(D^2PAK)
ISSUE B



NOTES:
1 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2 CONTROLLING DIMENSION: INCH.
3 TAB CONTOUR OPTIONAL WITHIN DIMENSIONS A AND K.
4 DIMENSIONS U AND V ESTABLISH A MINIMUM MOUNTING SURFACE FOR TERMINAL 4.
5 DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH OR GATE PROTRUSIONS. MOLD FLASH AND GATE PROTRUSIONS NOT TO EXCEED 0.025 (0.635) MAXIMUM.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.386	0.403	9.804	10.236
B	0.356	0.368	9.042	9.347
C	0.170	0.180	4.318	4.572
D	0.026	0.036	0.660	0.914
E	0.045	0.055	1.143	1.397
F	0.051 REF		1.295 REF	
G	0.100 BSC		2.540 BSC	
H	0.539	0.579	13.691	14.707
J	0.125 MAX		3.175 MAX	
K	0.050 REF		1.270 REF	
L	0.000	0.010	0.000	0.254
M	0.088	0.102	2.235	2.591
N	0.018	0.026	0.457	0.660
P	0.058	0.078	1.473	1.981
R	5° REF		5° REF	
S	0.116 REF		2.946 REF	
U	0.200 MIN		5.080 MIN	
V	0.250 MIN		6.350 MIN	

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