MOTOROLA

T-58-11-13

MC7900 Series

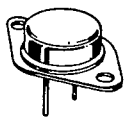
THREE-TERMINAL NEGATIVE VOLTAGE REGULATORS

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.

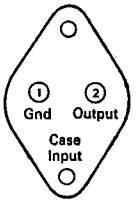
Available in fixed output voltage options from −5.0 to −24 volts, these regulators employ current limiting, thermal shutdown, and safe-area compensation — making them remarkably rugged under most operating conditions. With adequate heatsinking they can deliver output currents in excess of 1.0 ampere.

- 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)

THREE-TERMINAL NEGATIVE FIXED VOLTAGE REGULATORS



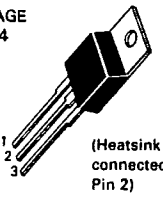
K SUFFIX
METAL PACKAGE
CASE 1-03



(Bottom View)

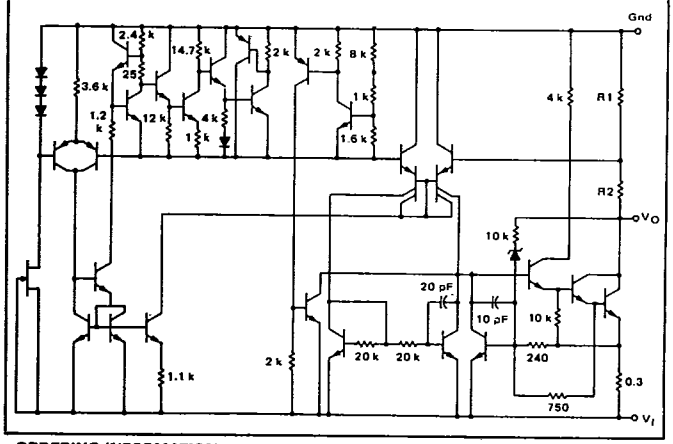
T SUFFIX
PLASTIC PACKAGE
CASE 221A-04

PIN 1. GROUND
2. INPUT
3. OUTPUT

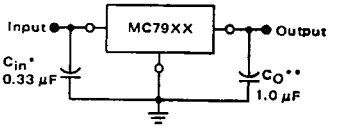


(Heatsink surface connected to Pin 2)

SCHEMATIC DIAGRAM



STANDARD APPLICATION



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

XX = these two digits of the type number indicate voltage.

* = C_{in} is required if regulator is located an appreciable distance from power supply filter.

** = C_O improves stability and transient response.

ORDERING INFORMATION

Device	Output Voltage Tolerance	Tested Operating Junction Temp. Range	Package
MC79XXCK MC79XXACK*	4% 2%	T_J = 0°C to +125°C	Metal Power**
MC79XXCT MC79XXACT*	4% 2%	T_J = 0°C to +125°C	Plastic Power
MC79XXBT#	4%	T_J = −40°C to +125°C	Plastic Power

XX indicates nominal voltage.
*2% output voltage tolerance available in 5, 12 and 15 volt devices.
**Metal power package available in 5, 12 and 15 volt devices.
#Automotive temperature range selections are available with special test conditions and additional tests in 5, 12 and 15 volt devices. Contact your local Motorola sales office for information.

DEVICE TYPE/NOMINAL OUTPUT VOLTAGE			
MC7905	5.0 Volts	MC7912	12 Volts
MC7905.2	5.2 Volts	MC7915	15 Volts
MC7906	6.0 Volts	MC7918	18 Volts
MC7908	8.0 Volts	MC7924	24 Volts

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 Plastic Package T_A = +25°C Derate above T_A = +25°C	P_D $1/R_{\theta JA}$	Internally Limited 15.4	Watts mW/°C
T_C = +25°C Derate above T_C = +95°C (See Figure 1)	P_D $1/R_{\theta JC}$	Internally Limited 200	Watts mW/°C
Metal Package T_A = +25°C Derate above T_A = +25°C	P_D $1/R_{\theta JA}$	Internally Limited 22.2	Watts mW/°C
T_C = +25°C Derate above T_C = +65°C	P_D $1/R_{\theta JC}$	Internally Limited 182	Watts mW/°C
Storage Junction Temperature Range	T_{stg}	-65 to +150	°C
Junction Temperature Range	T_J	0 to +150	°C

THERMAL CHARACTERISTICS

Characteristic		Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	— Plastic Package — Metal Package	$R_{\theta JA}$	65 45	°C/W
Thermal Resistance, Junction to Case	— Plastic Package — Metal Package	$R_{\theta JC}$	5.0 5.5	°C/W

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

Characteristic	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)	e_{on}	—	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.)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	-4.9	-5.0	-5.1	Vdc
Line Regulation (Note 1)	Reg_{line}				mV
-8.0 Vdc ≥ V_I ≥ -12 Vdc; I_O = 1.0 A, T_J = 25°C		—	2.0	25	
-8.0 Vdc ≥ V_I ≥ -12 Vdc; I_O = 1.0 A		—	7.0	50	
-7.5 Vdc ≥ V_I ≥ -25 Vdc; I_O = 500 mA		—	7.0	50	
-7.0 Vdc ≥ V_I ≥ -20 Vdc; I_O = 1.0 A, T_J = +25°C		—	6.0	50	
Load Regulation (Note 1)	Reg_{load}				mV
5.0 mA ≤ I_O ≤ 1.5 A, T_J = +25°C		—	11	.100	
250 mA ≤ I_O ≤ 750 mA		—	4.0	50	
5.0 mA ≤ I_O ≤ 1.0 A		—	9.0	100	
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	ΔI_{IB}				mA
-7.5 Vdc ≥ V_I ≥ -25 Vdc		—	—	1.3	
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)	e_{on}	—	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

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

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	-5.0	-5.2	-5.4	Vdc
Line Regulation (Note 1)	Reg_{line}				mV
(T_J = +25°C, I_O = 100 mA)					
-7.2 Vdc ≥ V_I ≥ -25 Vdc		—	8.0	52	
-8.0 Vdc ≥ V_I ≥ -12 Vdc		—	2.2	27	
(T_J = +25°C, I_O = 500 mA)					
-7.2 Vdc ≥ V_I ≥ -25 Vdc		—	37	105	
-8.0 Vdc ≥ V_I ≥ -12 Vdc		—	8.5	52	
Load Regulation (T_J = +25°C) (Note 1)	Reg_{load}				mV
5.0 mA ≤ I_O ≤ 1.5 A		—	12	105	
250 mA ≤ I_O ≤ 750 mA		—	4.5	52	
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	ΔI_{IB}				mA
-7.2 Vdc ≥ V_I ≥ -25 Vdc		—	—	1.3	
5.0 mA ≤ I_O ≤ 1.5 A		—	—	0.5	
Output Noise Voltage (T_A = +25°C. 10 Hz ≤ f ≤ 100 kHz)	e_{on}	—	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.)

Characteristic	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)	e_{on}	—	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 mA, 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.)

Characteristic	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)	e_{on}	—	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.

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

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	-14.4	-15	-15.6	Vdc
Line Regulation (Note 1) (T_J = +25°C, I_O = 100 mA) -17.5 Vdc ≥ V_I ≥ -30 Vdc -20 Vdc ≥ V_I ≥ -26 Vdc (T_J = +25°C, I_O = 500 mA) -17.5 Vdc ≥ V_I ≥ -30 Vdc -20 Vdc ≥ V_I ≥ -26 Vdc	Reg_{line}	 — — — —	 14 6.0 57 27	 150 75 300 150	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}	 — —	 68 25	 300 150	mV
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 -17.5 Vdc ≥ V_I ≥ -30 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)	e_{on}	—	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

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

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	-14.7	-15	-15.3	Vdc
Line Regulation (Note 1) -20 Vdc ≥ V_I ≥ -26 Vdc; I_O = 1.0 A, T_J = 25°C -20 Vdc ≥ V_I ≥ -26 Vdc; I_O = 1.0 A, -17.9 Vdc ≥ V_I ≥ -30 Vdc; I_O = 500 mA -17.5 Vdc ≥ V_I ≥ -30 Vdc; I_O = 1.0 A, T_J = 25°C	Reg_{line}	 — — — —	 27 57 57 57	 75 150 150 150	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}	 — — —	 68 25 40	 150 75 150	mV
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 -17.5 Vdc ≥ V_I ≥ -30 Vdc 5.0 mA ≤ I_O ≤ 1.0 A 5.0 mA ≤ I_O ≤ 1.5 A, T_J = 25°C	ΔI_{IB}	 — — —	 — — —	 0.8 0.5 0.5	mA
Output Noise Voltage (T_A = +25°C, 10 Hz ≤ f ≤ 100 kHz)	e_{on}	—	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.

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

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	-11.5	-12	-12.5	Vdc
Line Regulation (Note 1) (T_J = +25°C, I_O = 100 mA) -14.5 Vdc ≥ V_I ≥ -30 Vdc -16 Vdc ≥ V_I ≥ -22 Vdc (T_J = +25°C, I_O = 500 mA) -14.5 Vdc ≥ V_I ≥ -30 Vdc -16 Vdc ≥ V_I ≥ -22 Vdc	Reg_{line}	 — — — —	 13 6.0 55 24	 120 60 240 120	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}	 — —	 46 17	 240 120	mV
Output Voltage -14.5 Vdc ≥ V_I ≥ -27 Vdc, 5.0 mA ≤ I_O ≤ 1.0 A, P ≤ 15 W	V_O	-11.4	—	-12.6	Vdc
Input Bias Current (T_J = +25°C)	I_{IB}	—	4.4	8.0	mA
Input Bias Current Change -14.5 Vdc ≥ V_I ≥ -30 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)	e_{on}	—	75	—	μV
Ripple Rejection (I_O = 20 mA, f = 120 Hz)	RR	—	61	—	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

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

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	-11.75	-12	-12.25	Vdc
Line Regulation (Note 1) -16 Vdc ≥ V_I ≥ -22 Vdc; I_O = 1.0 A, T_J = 25°C -16 Vdc ≥ V_I ≥ -22 Vdc; I_O = 1.0 A, -14.8 Vdc ≥ V_I ≥ -30 Vdc; I_O = 500 mA -14.5 Vdc ≥ V_I ≥ -27 Vdc; I_O = 1.0 A, T_J = 25°C	Reg_{line}	 — — — —	 6.0 24 24 13	 60 120 120 120	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}	 — — —	 46 17 35	 150 75 150	mV
Output Voltage -14.8 Vdc ≥ V_I ≥ -27 Vdc, 5.0 mA ≤ I_O ≤ 1.0 A, P ≤ 15 W	V_O	-11.5	—	-12.5	Vdc
Input Bias Current	I_{IB}	—	4.4	8.0	mA
Input Bias Current Change -15 Vdc ≥ V_I ≥ -30 Vdc 5.0 mA ≤ I_O ≤ 1.0 A 5.0 mA ≤ I_O ≤ 1.5 A, T_J = 25°C	ΔI_{IB}	 — — —	 — — —	 0.8 0.5 0.5	mA
Output Noise Voltage (T_A = +25°C, 10 Hz ≤ f ≤ 100 kHz)	e_{on}	—	75	—	μV
Ripple Rejection (I_O = 20 mA, f = 120 Hz)	RR	—	61	—	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.)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	-17.3	-18	-18.7	Vdc
Line Regulation (Note 1) (T_J = +25°C, I_O = 100 mA) -21 Vdc ≥ V_I ≥ -33 Vdc -24 Vdc ≥ V_I ≥ -30 Vdc (T_J = +25°C, I_O = 500 mA) -21 Vdc ≥ V_I ≥ -33 Vdc -24 Vdc ≥ V_I ≥ -30 Vdc	Reg_{line}	 — — — —	 25 10 90 50	 180 90 360 180	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}	 — —	 110 55	 360 180	mV
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 -21 Vdc ≥ V_I ≥ -33 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)	e_{on}	—	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.)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	-23	-24	-25	Vdc
Line Regulation (Note 1) (T_J = +25°C, I_O = 100 mA) -27 Vdc ≥ V_I ≥ -38 Vdc -30 Vdc ≥ V_I ≥ -36 Vdc (T_J = +25°C, I_O = 500 mA) -27 Vdc ≥ V_I ≥ -38 Vdc -30 Vdc ≥ V_I ≥ -36 Vdc	Reg_{line}	 — — — —	 31 14 118 70	 240 120 480 240	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}	 — —	 150 85	 480 240	mV
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 -27 Vdc ≥ V_I ≥ -38 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)	e_{on}	—	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.

TYPICAL CHARACTERISTICS
(T_A = +25°C unless otherwise noted.)

FIGURE 1 – WORST CASE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE

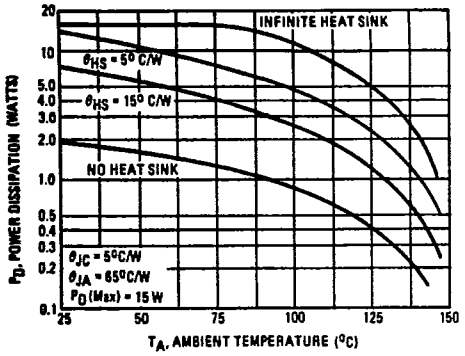


FIGURE 2 – WORST CASE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE

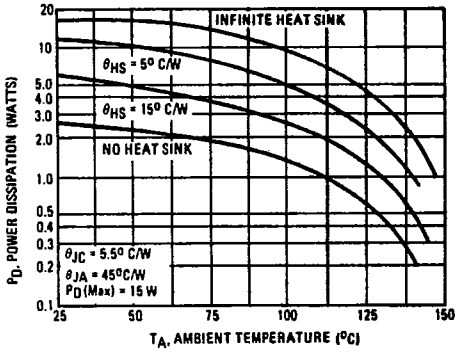


FIGURE 3 – PEAK OUTPUT CURRENT AS A FUNCTION OF INPUT-OUTPUT DIFFERENTIAL VOLTAGE

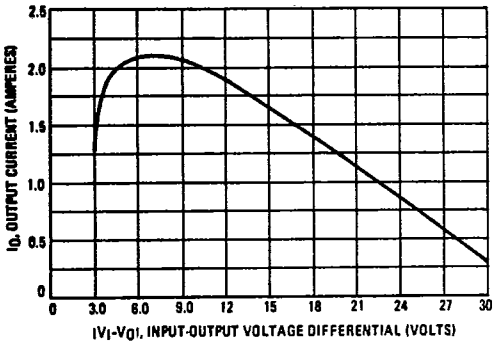


FIGURE 4 – RIPPLE REJECTION AS A FUNCTION OF FREQUENCY

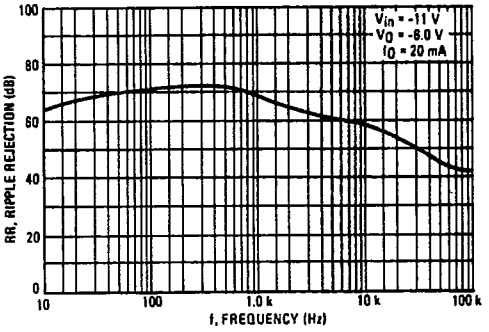


FIGURE 5 – RIPPLE REJECTION AS A FUNCTION OF OUTPUT VOLTAGES

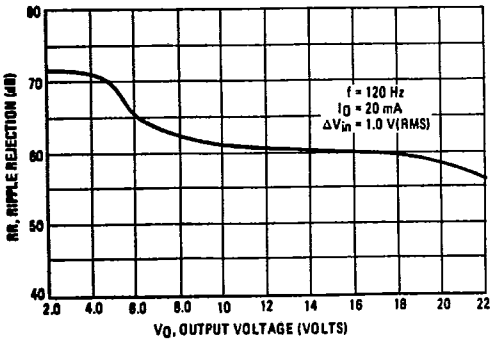
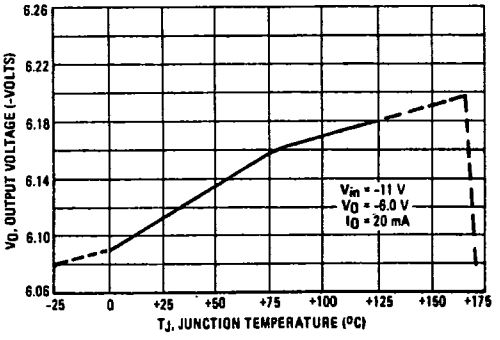
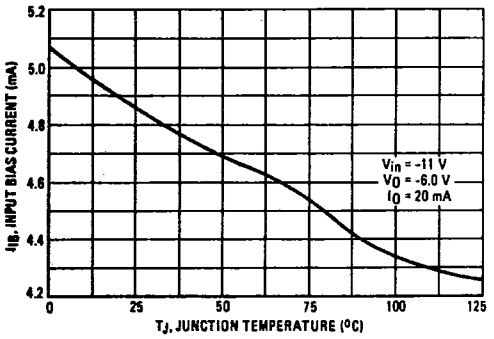


FIGURE 6 – OUTPUT VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE



TYPICAL CHARACTERISTICS (continued)

FIGURE 7 – QUIESCENT CURRENT AS A FUNCTION OF TEMPERATURE



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.

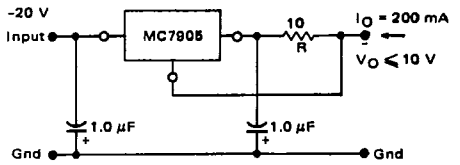
APPLICATIONS INFORMATION

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 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 8 – CURRENT REGULATOR

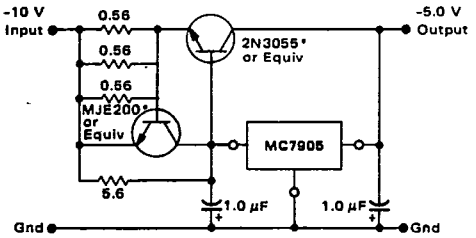


The MC7905,-5.0 V regulator can be used as a constant current source when connected as above. The output current is the sum of resistor R current and quiescent bias current as follows:

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

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

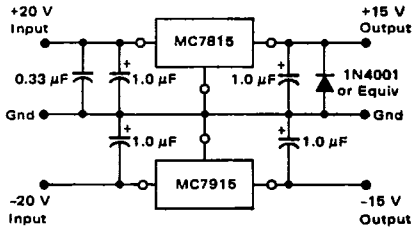
FIGURE 9 – CURRENT BOOST REGULATOR
(-5.0 V @ 4.0 A, with 5.0 A current limiting)



*Mounted on common heat sink, Motorola MS-10 or equivalent.

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 heat sink; otherwise thermal shutdown will occur when the additional load current is picked up by the regulator.

FIGURE 10 – OPERATIONAL AMPLIFIER SUPPLY
(±15 V @ 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.

SECTION 19

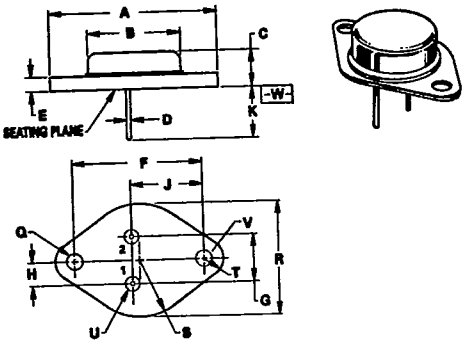
T-90-20

PACKAGE OUTLINE DIMENSIONS

K SUFFIX
METAL PACKAGE
CASE 1-03
$R_{\theta JA}$ = 45°C/W (TYP)
(TO-3)

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
B	—	22.23	—	0.875
C	8.35	11.43	0.250	0.450
D	0.97	1.09	0.038	0.043
E	—	3.43	—	0.135
F	30.15 BSC		1.187 BSC	
G	10.92 BSC		0.430 BSC	
H	5.46 BSC		0.215 BSC	
J	16.89 BSC		0.665 BSC	
K	7.92	—	0.312	—
Q	3.84	4.09	0.151	0.161
S	—	13.34	—	0.525
T	—	4.78	—	0.188
V	3.84	4.09	0.151	0.161

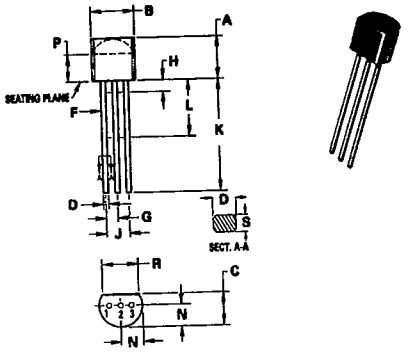
NOTES:
1. DIAMETER V AND SURFACE W ARE DATUMS.
2. POSITIONAL TOLERANCE FOR HOLE Q:
   ⌖ | ⌀0.25 (0.010) M | W | V M
3. POSITIONAL TOLERANCE FOR LEADS:
   ⌖ | ⌀0.30 (0.012) M | W | V M | Q M



LP, P, Z SUFFIX
PLASTIC PACKAGE
CASE 29-04
$R_{\theta JA}$ = 200°C/W (TYP)
(TO-226AA/TO-92)

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	4.32	5.33	0.170	0.210
B	4.45	5.20	0.175	0.205
C	3.18	4.19	0.125	0.165
D	0.41	0.55	0.016	0.022
F	0.41	0.48	0.016	0.019
G	1.15	1.39	0.045	0.055
H	—	2.54	—	0.100
J	2.42	2.66	0.095	0.105
K	12.70	—	0.500	—
L	6.35	—	0.250	—
N	2.04	2.68	0.080	0.105
P	2.93	—	0.115	—
R	3.43	—	0.135	—
S	0.39	0.50	0.015	0.020

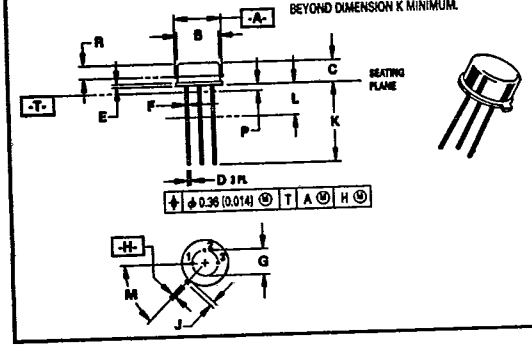
NOTES:
1. CONTOUR OF PACKAGE BEYOND ZONE "P" IS UNCONTROLLED.
2. DIM "F" APPLIES BETWEEN "H" AND "L". DIM "D" & "S" APPLIES BETWEEN "L" & 12.70mm (0.5") FROM SEATING PLANE. LEAD DIM IS UNCONTROLLED IN "H" & BEYOND 12.70mm (0.5") FROM SEATING PLANE.
3. CONTROLLING DIM: INCH.



G, H SUFFIX
METAL PACKAGE
CASE 79-05
$R_{\theta JA}$ = 185°C/W (TYP)
(TO-39)

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	9.02	9.29	0.355	0.366
B	8.01	8.50	0.315	0.335
C	4.20	4.57	0.165	0.180
D	0.44	0.53	0.017	0.021
E	0.44	0.86	0.017	0.035
F	0.41	0.48	0.016	0.019
G	5.08 BSC		0.200 BSC	
H	0.72	0.86	0.028	0.034
J	0.74	1.01	0.029	0.040
K	12.70	19.05	0.500	0.750
L	6.35	—	0.250	—
M	45° BSC		45° BSC	
P	—	1.27	—	0.050
R	2.54	—	0.100	—

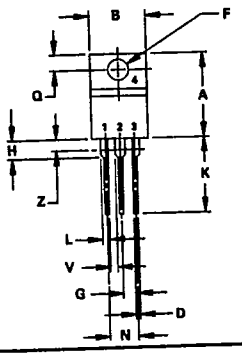
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION J MEASURED FROM DIMENSION A MAXIMUM.
4. DIMENSION B SHALL NOT VARY MORE THAN 0.25 (0.010) IN ZONE R. THIS ZONE CONTROLLED FOR AUTOMATIC HANDLING.
5. DIMENSION F APPLIES BETWEEN DIMENSION P AND L. DIMENSION D APPLIES BETWEEN DIMENSION L AND K MINIMUM. LEAD DIAMETER IS UNCONTROLLED IN DIMENSION P AND BEYOND DIMENSION K MINIMUM.

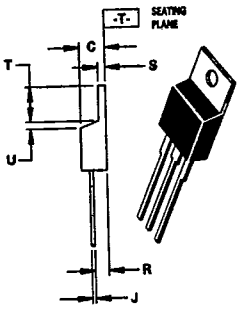


KC, T SUFFIX
PLASTIC PACKAGE
CASE 221A-04
$R_{\theta JA}$ = 65°C/W (TYP)
(TO-220AB)

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	14.48	15.75	0.570	0.620
B	9.66	10.28	0.380	0.405
C	4.07	4.82	0.160	0.190
D	0.64	0.88	0.025	0.035
F	3.61	3.73	0.142	0.147
G	2.42	2.66	0.095	0.105
H	2.80	3.93	0.110	0.155
J	0.36	0.55	0.014	0.022
K	12.70	14.27	0.500	0.562
L	1.15	1.39	0.045	0.055
N	4.83	5.33	0.190	0.210
Q	2.54	3.04	0.100	0.120
R	2.04	2.79	0.080	0.110
S	1.15	1.39	0.045	0.055
T	5.97	6.47	0.235	0.255
U	0.00	1.27	0.000	0.050
V	1.15	—	0.045	—
Z	—	2.04	—	0.080

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.



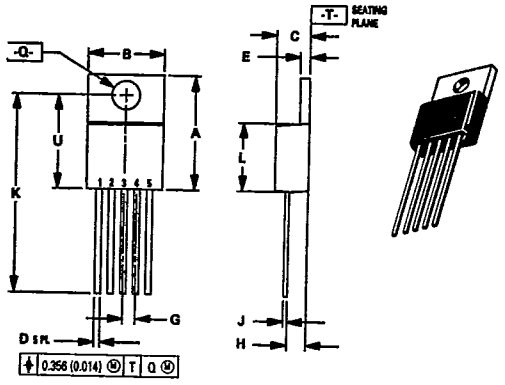


PACKAGE OUTLINE DIMENSIONS (continued)

T SUFFIX
PLASTIC PACKAGE
CASE 314D-02

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	14.529	15.570	0.572	0.613
B	9.906	10.541	0.390	0.415
C	4.318	4.572	0.170	0.180
D	0.635	0.965	0.025	0.038
E	1.169	1.397	0.046	0.055
G	1.702 BSC		0.067 BSC	
H	2.109	2.717	0.083	0.107
J	0.381	0.635	0.015	0.025
K	25.807	26.670	1.016	1.050
L	8.052	9.398	0.317	0.370
Q	3.556	3.937	0.140	0.155
U	11.889	12.827	0.468	0.505

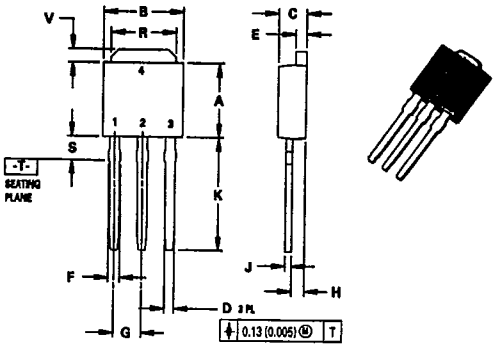
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.



DT-1 SUFFIX
PLASTIC PACKAGE
CASE 369-03

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	5.97	6.22	0.235	0.245
B	6.35	6.73	0.250	0.265
C	2.19	2.38	0.086	0.094
D	0.69	0.88	0.027	0.035
E	0.84	0.94	0.033	0.037
F	0.77	1.14	0.030	0.045
G	2.29 BSC		0.090 BSC	
H	0.97	1.06	0.038	0.042
J	0.46	0.58	0.018	0.023
K	8.89	9.65	0.350	0.380
R	5.21	5.46	0.205	0.215
S	1.91	2.28	0.075	0.090
V	0.89	1.27	0.035	0.050

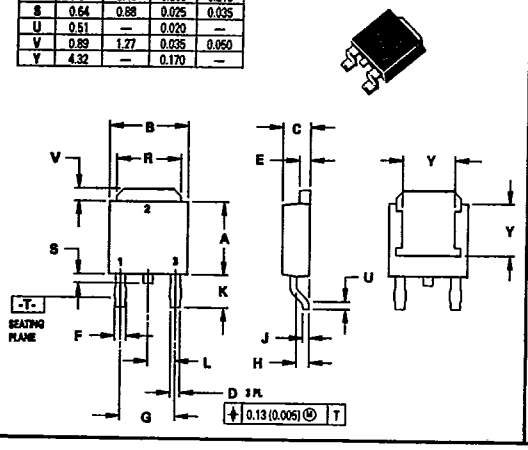
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.



DT SUFFIX
PLASTIC PACKAGE
CASE 369A-03
DPAK

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	5.97	6.22	0.235	0.245
B	6.35	6.73	0.250	0.265
C	2.19	2.38	0.086	0.094
D	0.69	0.88	0.027	0.035
E	0.84	0.94	0.033	0.037
F	0.77	1.14	0.030	0.045
G	4.58 BSC		0.180 BSC	
H	0.97	1.06	0.038	0.042
J	0.46	0.58	0.018	0.023
K	2.60	2.89	0.102	0.114
L	2.29 BSC		0.090 BSC	
R	5.21	5.46	0.205	0.215
S	0.64	0.88	0.025	0.035
U	0.51	—	0.020	—
V	0.89	1.27	0.035	0.050
Y	4.32	—	0.170	—

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

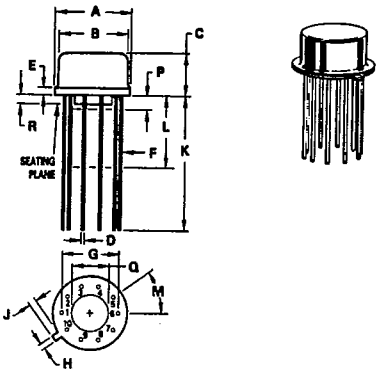


H, G SUFFIX
METAL PACKAGE
CASE 603-04
$R_{\theta JA}$ = 160°C/W
(TO-100)

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	8.51	9.39	0.335	0.370
B	7.75	8.51	0.305	0.335
C	4.19	4.70	0.165	0.185
D	0.407	0.533	0.016	0.021
E	—	1.02	—	0.040
F	0.406	0.483	0.016	0.019
G	5.84 BSC		0.230 BSC	
H	0.712	0.864	0.028	0.034
J	0.737	1.14	0.029	0.045
K	12.70	—	0.500	—
L	6.35	12.70	0.250	0.500
M	36° BSC		36° BSC	
P	—	1.27	—	0.050
Q	3.56	4.06	0.140	0.160
R	0.254	1.02	0.010	0.040

NOTE:
LEADS WITHIN 0.18 mm (0.007) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.

All JEDEC Dimensions and Notes Apply.

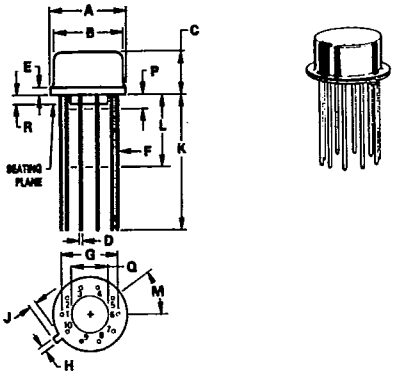


PACKAGE OUTLINE DIMENSIONS (continued)

G SUFFIX
METAL PACKAGE
CASE 603C-01
$R_{\theta JA}$ = 150°C/W (TYP)
(TO-100)

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	8.51	9.39	0.335	0.370
B	7.75	8.51	0.305	0.335
C	4.19	6.73	0.165	0.265
D	0.407	0.533	0.016	0.021
E	—	1.02	—	0.040
F	0.406	0.483	0.016	0.019
G	5.84 BSC		0.230 BSC	
H	0.712	0.864	0.028	0.034
J	0.737	1.14	0.029	0.045
K	12.70	—	0.500	—
L	6.35	12.70	0.250	0.500
M	36° BSC		36° BSC	
P	—	1.27	—	0.050
Q	3.56	4.06	0.140	0.160
R	0.254	1.02	0.010	0.040

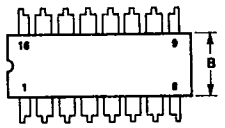
NOTES:
1. LEADS WITHIN 0.18 mm (0.007) RADIUS OF TRUE POSITION TO DIM. "A" & "H" AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
2. LEAD DIA UNCONTROLLED BEYOND DIM "K" MIN.

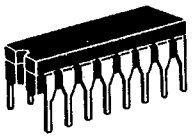


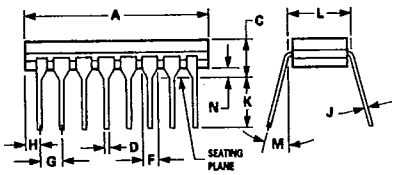
DP2, D, J, L, N SUFFIX
CERAMIC PACKAGE
CASE 620-10
$R_{\theta JA}$ = 100°C/W (TYP)

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	19.05	19.94	0.750	0.785
B	6.10	7.49	0.240	0.295
C	—	5.08	—	0.200
D	0.38	0.53	0.015	0.021
F	1.40	1.78	0.055	0.070
G	2.54 BSC		0.100 BSC	
H	0.51	1.14	0.020	0.045
J	0.20	0.30	0.008	0.012
K	3.18	4.32	0.125	0.170
L	7.62 BSC		0.300 BSC	
M	—	15°	—	15°
N	0.51	1.02	0.020	0.040

NOTES:
1. LEADS WITHIN 0.13 mm (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
2. PACKAGE INDEX: NOTCH IN LEAD NOTCH IN CERAMIC OR INK DOT.
3. DIM "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIM "A" AND "B" DO NOT INCLUDE GLASS RUN-OUT.
5. DIM "F" MAY NARROW TO 0.76 mm (0.030) WHERE THE LEAD ENTERS THE CERAMIC BODY.







N, P1 SUFFIX
PLASTIC PACKAGE
CASE 626-05
$R_{\theta JA}$ = 100°C/W (TYP)

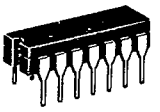
DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.52	0.040	0.060
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	—	10°	—	10°
N	0.76	1.01	0.030	0.040

NOTES:
1. LEAD POSITIONAL TOLERANCE: ⌖ 0.13 (0.005) Ⓜ | T | A Ⓜ | B Ⓜ
2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
3. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
4. DIMENSIONS A AND B ARE DATUMS.
5. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

L SUFFIX
CERAMIC PACKAGE
CASE 632-08
$R_{\theta JA}$ = 100°C/W (TYP)
(TO-116)

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	19.05	19.94	0.750	0.785
B	6.23	7.11	0.245	0.280
C	3.94	5.08	0.155	0.200
D	0.39	0.50	0.015	0.020
F	1.40	1.65	0.055	0.065
G	2.54 BSC		0.100 BSC	
J	0.21	0.38	0.008	0.015
K	3.18	4.31	0.125	0.170
L	7.62 BSC		0.300 BSC	
M	0°	15°	0°	15°
N	0.51	1.01	0.020	0.040

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIM F MAY NARROW TO 0.76 (0.030) WHERE THE LEAD ENTERS THE CERAMIC BODY.

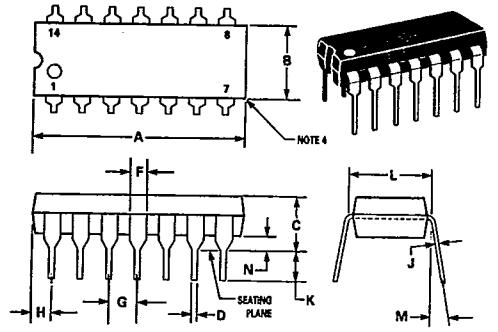


PACKAGE OUTLINE DIMENSIONS (continued)

N, P, N-14, P2 SUFFIX
PLASTIC PACKAGE
CASE 646-06
$R_{\theta JA}$ = 100°C/W (TYP)

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	18.16	19.56	0.715	0.770
B	6.10	6.60	0.240	0.260
C	3.69	4.69	0.145	0.185
D	0.38	0.53	0.015	0.021
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	1.32	2.41	0.052	0.095
J	0.20	0.38	0.008	0.015
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	0°	10°	0°	10°
N	0.39	1.01	0.015	0.039

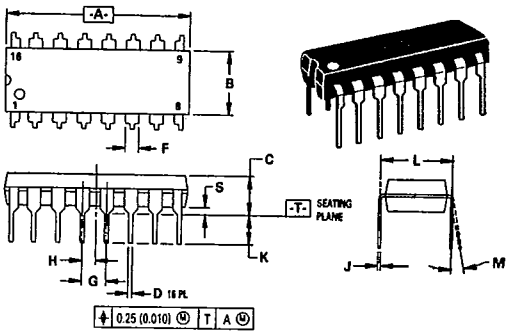
NOTES:
1. LEADS WITHIN 0.13 mm (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
2. DIMENSION "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.
3. DIMENSION "B" DOES NOT INCLUDE MOLD FLASH.
4. ROUNDED CORNERS OPTIONAL.



N, P SUFFIX
PLASTIC PACKAGE
CASE 648-08
$R_{\theta JA}$ = 100°C/W (TYP)

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	18.80	19.55	0.740	0.770
B	6.35	6.85	0.250	0.270
C	3.69	4.44	0.145	0.175
D	0.39	0.53	0.015	0.021
F	1.02	1.77	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	1.27 BSC		0.050 BSC	
J	0.21	0.38	0.008	0.015
K	2.80	3.30	0.110	0.130
L	7.50	7.74	0.295	0.305
M	0°	10°	0°	10°
S	0.51	1.01	0.020	0.040

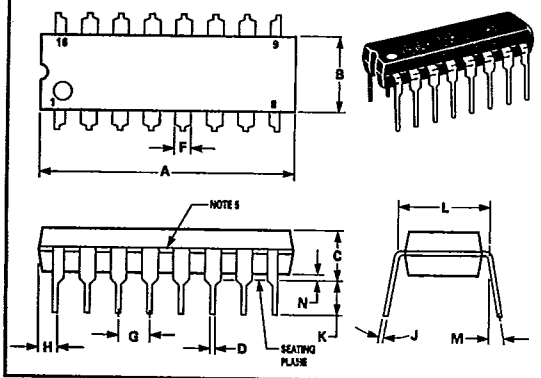
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION "B" DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.



P SUFFIX
PLASTIC PACKAGE
CASE 648C-02

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	18.80	21.34	0.740	0.840
B	6.10	6.60	0.240	0.260
C	3.69	4.69	0.145	0.185
D	0.38	0.53	0.015	0.021
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.38	2.41	0.015	0.095
J	0.20	0.38	0.008	0.015
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	0°	10°	0°	10°
N	0.39	1.01	0.015	0.040

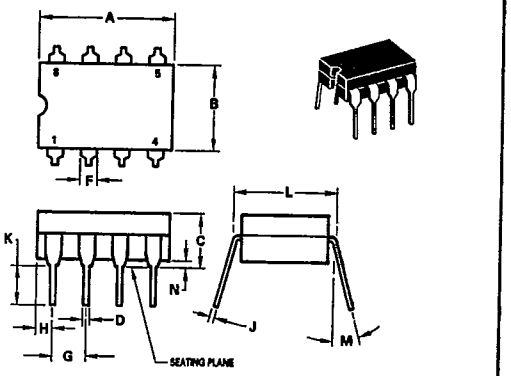
NOTES:
1. LEADS WITHIN 0.13 mm (0.005) RADIUS OF TRUE POSITON AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
2. DIMENSION "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.
3. DIMENSION "B" DOES NOT INCLUDE MOLD FLASH.
4. ROUNDED CORNERS OPTIONAL.
5. EXTERNAL LEAD CONNECTION, BETWEEN 4 AND 5, 12 AND 13 AS SHOWN.



J-8, J, JG, U, Z SUFFIX
CERAMIC PACKAGE
CASE 693-02
$R_{\theta JA}$ = 100°C/W (TYP)

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	9.91	10.92	0.390	0.430
B	6.22	6.99	0.245	0.275
C	4.32	5.08	0.170	0.200
D	0.41	0.51	0.016	0.020
F	1.40	1.65	0.055	0.065
G	2.54 BSC		0.100 BSC	
H	1.14	1.65	0.045	0.065
J	0.20	0.30	0.008	0.012
K	3.18	4.06	0.125	0.160
L	7.37	7.87	0.290	0.310
M	—	15°	—	15°
N	0.51	1.02	0.020	0.040

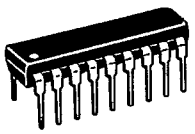
NOTES:
1. LEADS WITHIN 0.13 mm (0.005) RAD OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
2. DIMENSION "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.



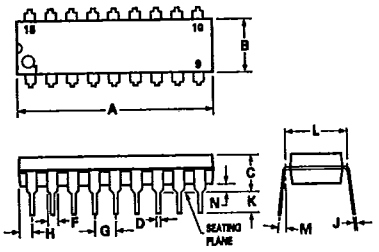
PACKAGE OUTLINE DIMENSIONS (continued)

A, B, N, P SUFFIX
PLASTIC PACKAGE
CASE 707-02
$R_{\theta JA}$ = 100°C/W (TYP)

DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	22.22	23.24	0.875	0.915
B	6.10	6.60	0.240	0.260
C	3.56	4.57	0.140	0.180
D	0.36	0.56	0.014	0.022
F	1.27	1.78	0.050	0.070
G	2.54 BSC		0.100 BSC	
H	1.02	1.52	0.040	0.060
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	0°	15°	0°	15°
N	0.51	1.02	0.020	0.040



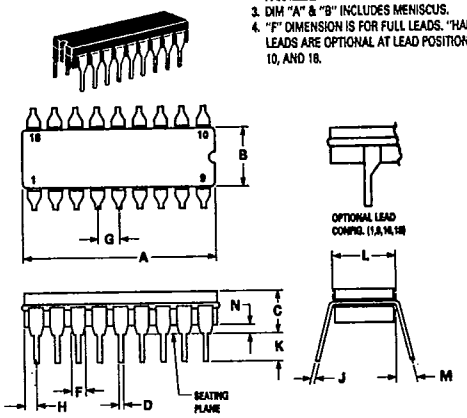
NOTES:
1. POSITIONAL TOLERANCE OF LEADS (D), SHALL BE WITHIN 0.25mm(0.010) AT MAXIMUM MATERIAL CONDITION, IN RELATION TO SEATING PLANE AND EACH OTHER.
2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
3. DIMENSION B DOES NOT INCLUDE MOLD FLASH.



J, L SUFFIX
CERAMIC PACKAGE
CASE 726-04
$R_{\theta JA}$ = 100°C/W (TYP)

DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	22.35	23.11	0.880	0.910
B	6.10	7.49	0.240	0.295
C	—	5.08	—	0.200
D	0.38	0.53	0.015	0.021
F	1.40	1.78	0.055	0.070
G	2.54 BSC		0.100 BSC	
H	0.51	1.14	0.020	0.045
J	0.20	0.30	0.008	0.012
K	3.18	4.32	0.125	0.170
L	7.62 BSC		0.300 BSC	
M	0°	15°	0°	15°
N	0.51	1.02	0.020	0.040

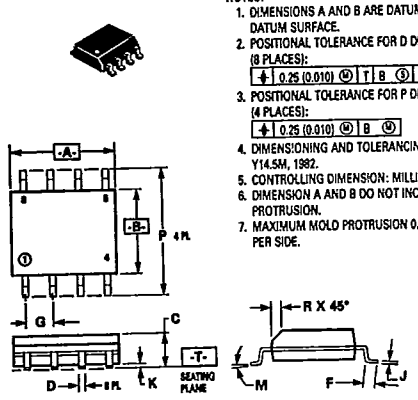
NOTES:
1. LEADS, TRUE POSITIONED WITHIN 0.25 mm (0.010) DIA. AT SEATING PLANE, AT MAXIMUM MATERIAL CONDITION.
2. DIM "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.
3. DIM "A" & "B" INCLUDES MENISCUS.
4. "F" DIMENSION IS FOR FULL LEADS. "HALF" LEADS ARE OPTIONAL AT LEAD POSITIONS 1, 9, 10, AND 18.



D SUFFIX
CASE 751-03
PLASTIC PACKAGE
SO-8, SOP-8
$R_{\theta JA}$ = 190°C/W (SO-8)
$R_{\theta JA}$ = 160°C/W (SOP-8)

DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	4.80	5.00	0.189	0.196
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

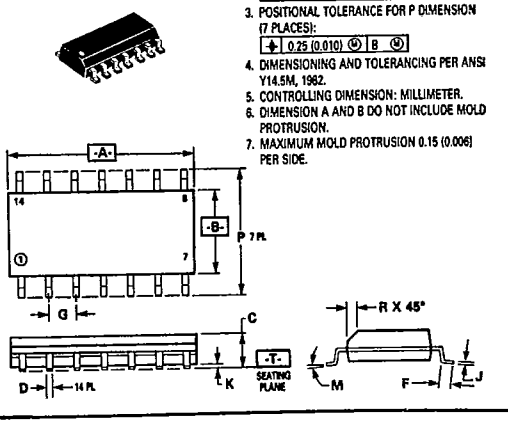
NOTES:
1. DIMENSIONS A AND B ARE DATUMS AND T IS A DATUM SURFACE.
2. POSITIONAL TOLERANCE FOR D DIMENSION (8 PLACES):
   ⌖ 0.25 (0.010) Ⓜ T B Ⓢ A Ⓢ
3. POSITIONAL TOLERANCE FOR P DIMENSION (4 PLACES):
   ⌖ 0.25 (0.010) Ⓜ B Ⓜ
4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
5. CONTROLLING DIMENSION: MILLIMETER.
6. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
7. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.



D SUFFIX
PLASTIC PACKAGE
CASE 751A-02
SO-14
$R_{\theta JA}$ = 145°C/W (TYP)

DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	8.55	8.75	0.337	0.344
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

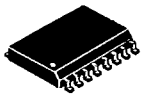
NOTES:
1. DIMENSIONS A AND B ARE DATUMS AND T IS A DATUM SURFACE.
2. POSITIONAL TOLERANCE FOR D DIMENSION (14 PLACES):
   ⌖ 0.25 (0.010) Ⓜ T B Ⓢ A Ⓢ
3. POSITIONAL TOLERANCE FOR P DIMENSION (7 PLACES):
   ⌖ 0.25 (0.010) Ⓜ B Ⓜ
4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
5. CONTROLLING DIMENSION: MILLIMETER.
6. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
7. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.

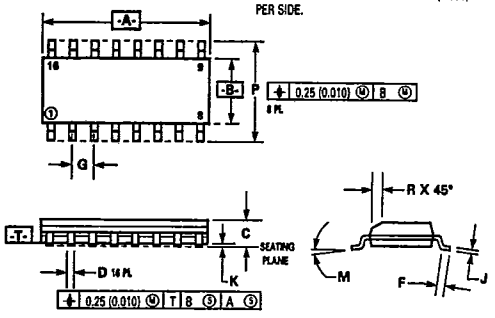


DW SUFFIX
PLASTIC PACKAGE
CASE 751G-01
SO-16L

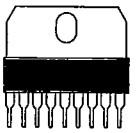
DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	10.15	10.45	0.400	0.411
B	7.40	7.60	0.292	0.299
C	2.35	2.65	0.093	0.104
D	0.35	0.49	0.014	0.019
F	0.50	0.90	0.020	0.035
G	1.27 BSC		0.050 BSC	
J	0.25	0.32	0.010	0.012
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	10.05	10.55	0.395	0.415
	0.25	0.75	0.010	0.029

NOTES:
1. DIMENSIONS A AND B ARE DATUMS AND T IS A DATUM SURFACE.
2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
3. CONTROLLING DIMENSION: MILLIMETER.
4. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
5. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.





CASE 762-01
PLASTIC MEDIUM POWER PACKAGE
SIP-9



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	22.40	23.00	0.873	0.897
B	6.40	6.60	0.252	0.260
C	3.45	3.85	0.135	1.143
D	0.40	0.55	0.015	0.021
E	9.35	9.60	0.368	0.377
F	1.40	1.60	0.055	0.062
G	2.54 BSC		0.100BSC	
H	1.51	1.71	0.059	0.067
J	0.360	0.400	0.014	0.015
K	3.95	4.20	0.155	0.165
M	30° BSC		30° BSC	
N	2.50	2.70	0.099	0.106
Q	3.15	3.45	0.124	0.135
R	13.80	13.90	0.535	0.547
S	1.65	1.95	0.064	0.076
U	22.00	22.20	0.866	0.874
V	0.55	0.75	0.021	0.029
W	2.89 BSC		0.113 BSC	
X	0.85	0.75	0.025	0.029
Y	2.70	2.90	0.106	0.110

NOTES:
1. DIMENSIONS A, AND C ARE DATUMS. AND -T- IS A DATUM PLANE.
2. POSITIONAL TOLERANCE FOR LEAD DIMENSION D: ⌖ ⌀0.25 (0.010) M -T- A M
3. POSITIONAL TOLERANCE FOR LEAD DIMENSION J: ⌖ ⌀0.25 (0.010) M -T- C M
4. POSITIONAL TOLERANCE FOR LEAD DIMENSION Q: ⌖ ⌀0.25 (0.010) M -T- A M
5. DIMENSIONING AND TOLERANCING PER ANSI Y14.5, 1982.
6. CONTROLLING DIMENSION: MILLIMETER.