MOTOROLA
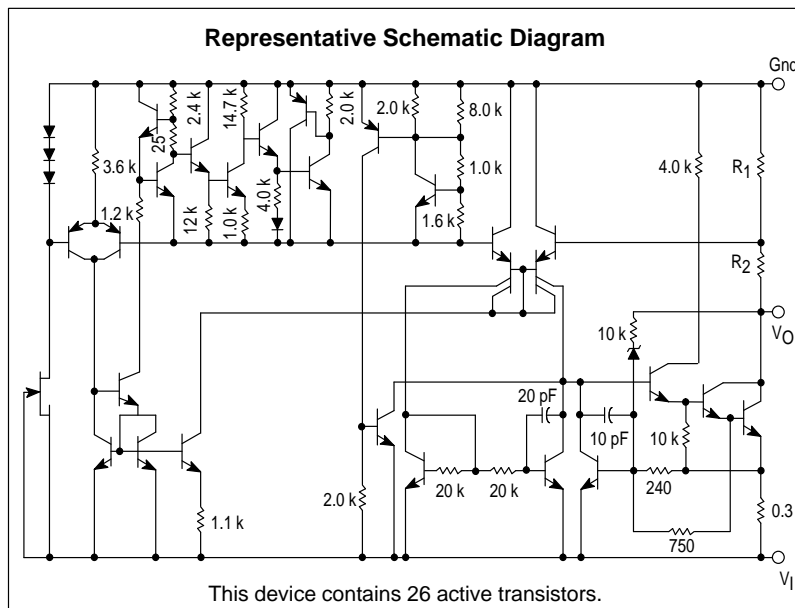
MC7900 Series

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)
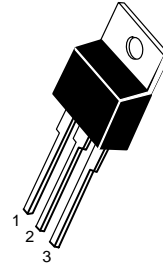
THREE–TERMINAL NEGATIVE FIXED VOLTAGE REGULATORS
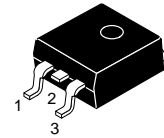
T SUFFIX
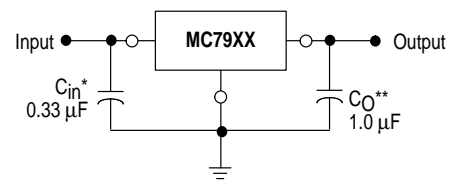PLASTIC PACKAGE
CASE 221A

Heatsink surface
connected to Pin 2.

Pin 1. Ground
    2. Input
    3. Output

D2T SUFFIX
PLASTIC PACKAGE
CASE 936
(D2PAK)

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

Representative Schematic Diagram

This device contains 26 active transistors.

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%		Surface Mount
MC79XXCD2T	4%	$T_J = 0°$ to $+125°C$	Surface Mount
MC79XXACT	2%		Insertion Mount
MC79XXCT	4%		Insertion Mount
MC79XXBD2T	4%	$T_J = −40°$ to $+125°C$	Surface Mount
MC79XXBT	4%		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	18V
MC7908	8.0 V	MC7924	24 V

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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 (D2PAK)
  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.

MC7900

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)
($T_J = +25°C$, $I_O = 100$ 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)	V_n	−	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.)

Characteristics	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)	V_n	−	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 $I_O = 5.0$ A, $0°C ≤ T_J ≤ +125°C$	$\Delta V_O/\Delta T$	−	−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.)

Characteristics	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)	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) −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)	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) ($T_J = +25°C$, $I_O = 100$ mA) -21 Vdc $\geq V_I \geq -33$ Vdc -24 Vdc $\geq V_I \geq -30$ Vdc ($T_J = +25°C$, $I_O = 500$ mA) -21 Vdc $\geq V_I \geq -33$ Vdc -24 Vdc $\geq V_I \geq -30$ Vdc	Reg_{line}	 − − − −	 25 10 90 50	 180 90 360 180	mV
Load Regulation, $T_J = +25°C$ (Note 1) 5.0 mA $\leq I_O \leq$ 1.5 A 250 mA $\leq I_O \leq$ 750 mA	Reg_{load}	 − −	 110 55	 360 180	mV
Output Voltage -21 Vdc $\geq V_I \geq -33$ Vdc, 5.0 mA $\leq I_O \leq$ 1.0 A, P $\leq$ 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 $\geq V_I \geq -33$ Vdc 5.0 mA $\leq I_O \leq$ 1.5 A	ΔI_{IB}	 − −	 − −	 1.0 0.5	mA
Output Noise Voltage ($T_A = +25°C$, 10 Hz $\leq$ f $\leq$ 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, $0°C \leq T_J \leq +125°C$	$\Delta V_O/\Delta T$	−	−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) ($T_J = +25°C$, $I_O = 100$ mA) -27 Vdc $\geq V_I \geq -38$ Vdc -30 Vdc $\geq V_I \geq -36$ Vdc ($T_J = +25°C$, $I_O = 500$ mA) -27 Vdc $\geq V_I \geq -38$ Vdc -30 Vdc $\geq V_I \geq -36$ Vdc	Reg_{line}	 − − − −	 31 14 118 70	 240 120 470 240	mV
Load Regulation, $T_J = +25°C$ (Note 1) 5.0 mA $\leq I_O \leq$ 1.5 A 250 mA $\leq I_O \leq$ 750 mA	Reg_{load}	 − −	 150 85	 480 240	mV
Output Voltage -27 Vdc $\geq V_I \geq -38$ Vdc, 5.0 mA $\leq I_O \leq$ 1.0 A, P $\leq$ 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 $\geq V_I \geq -38$ Vdc 5.0 mA $\leq I_O \leq$ 1.5 A	ΔI_{IB}	 − −	 − −	 1.0 0.5	mA
Output Noise Voltage ($T_A = +25°C$, 10 Hz $\leq$ f $\leq$ 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, $0°C \leq T_J \leq +125°C$	$\Delta V_O/\Delta T$	−	−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.
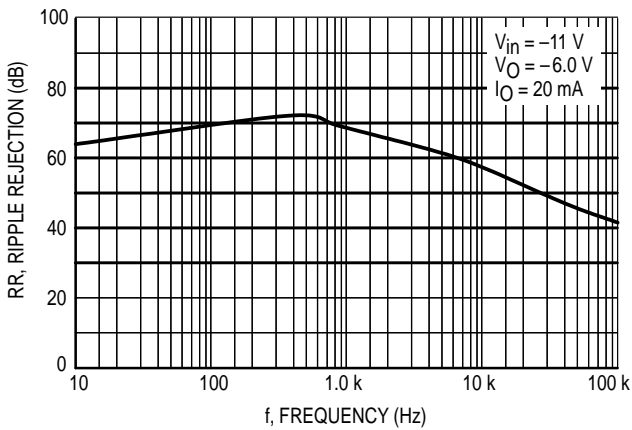
MC7900

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

P_D, POWER DISSIPATION (W) vs T_A, AMBIENT TEMPERATURE (°C)

Infinite Heatsink

$\theta_{HS} = 5°C/W$

$\theta_{HS} = 15°C/W$

No Heatsink

$\theta_{JC} = 5° C/W$
$\theta_{JA} = 65° C/W$
$P_D(max) = 15W$
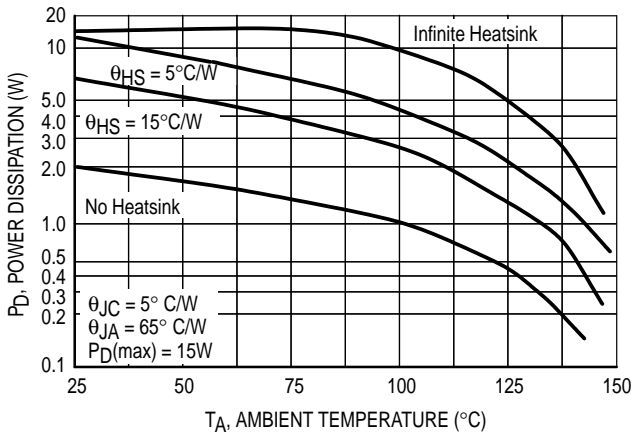
Figure 2. Peak Output Current as a Function of Input–Output Differential Voltage

I_O, OUTPUT CURRENT (A) vs $|V_I - V_O|$ INPUT–OUTPUT VOLTAGE DIFFERENTIAL (V)

$T_J = +25°C$
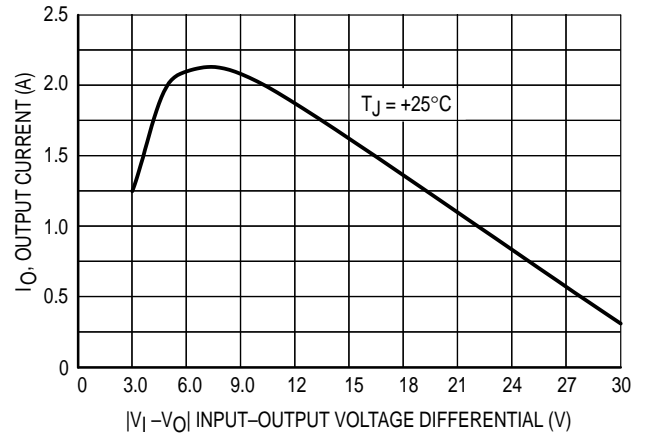
Figure 3. Ripple Rejection as a Function of Frequency

RR, RIPPLE REJECTION (dB) vs f, FREQUENCY (Hz)

$V_{in} = -11$ V
$V_O = -6.0$ V
$I_O = 20$ mA

Figure 4. Ripple Rejection as a Function of Output Voltage

RR, RIPPLE REJECTION (dB) vs V_O, OUTPUT VOLTAGE (V)

$f = 120$ Hz
$I_O = 20$ mA
$\Delta V_{in} = 1.0$ V(RMS)
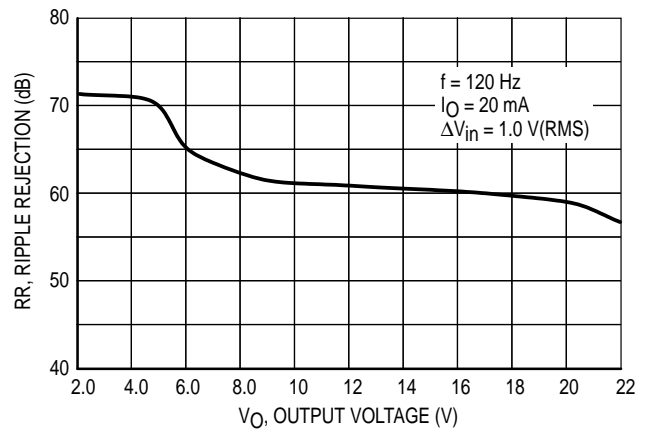
Figure 5. Output Voltage as a Function of Junction Temperature

V_O, OUTPUT VOLTAGE (–V) vs T_J, JUNCTION TEMPERATURE (°C)

$V_{in} = -11$ V
$V_D = -6.0$ V
$I_O = 20$ mA
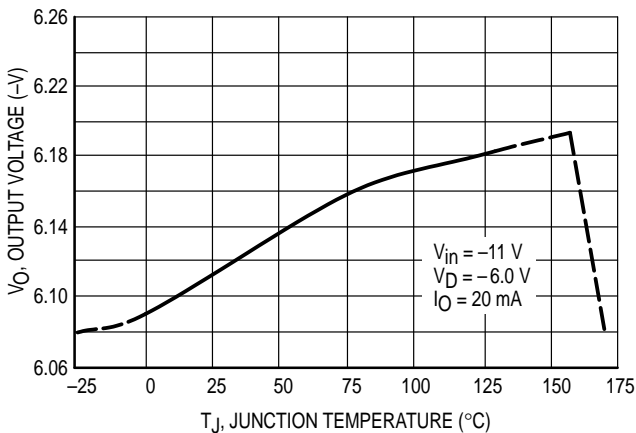
Figure 6. Quiescent Current as a Function of Temperature

I_{IB}, INPUT BIAS CURRENT (mA) vs T_J, JUNCTION TEMPERATURE (°C)

$V_{in} = -11$ V
$V_O = -6.0$ V
$I_O = 20$ mA
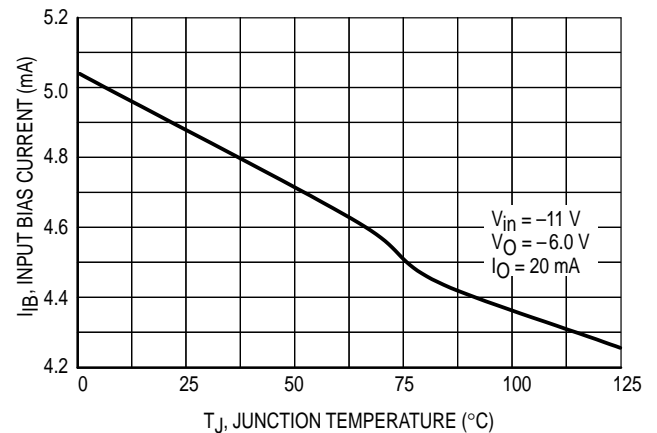
MC7900
APPLICATIONS INFORMATION

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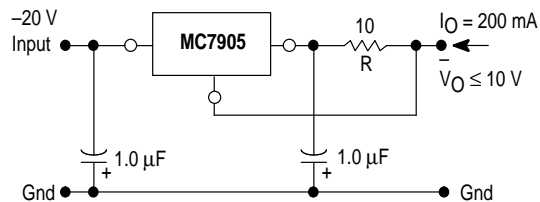
The MC7905, −5.0 V regulator can be used as a constant current source when connected as above. The output current is the sum of resistor R current and quiescent bias current as follows.

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

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)
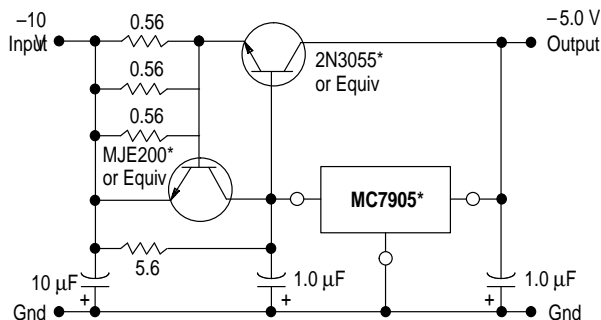
*Mounted on heatsink.

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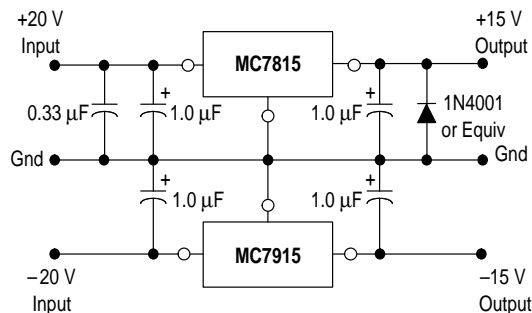
The MC7815 and MC7915 positive and negative regulators may be connected as shown to obtain a dual power supply for operational amplifiers. A clamp diode should be used at the output of the MC7815 to prevent potential latch–up problems whenever the output of the positive regulator (MC7815) is drawn below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

MOTOROLA ANALOG IC DEVICE DATA

**Figure 10. D^{2}PAK Thermal Resistance and Maximum
Power Dissipation versus P.C.B. Copper Length**
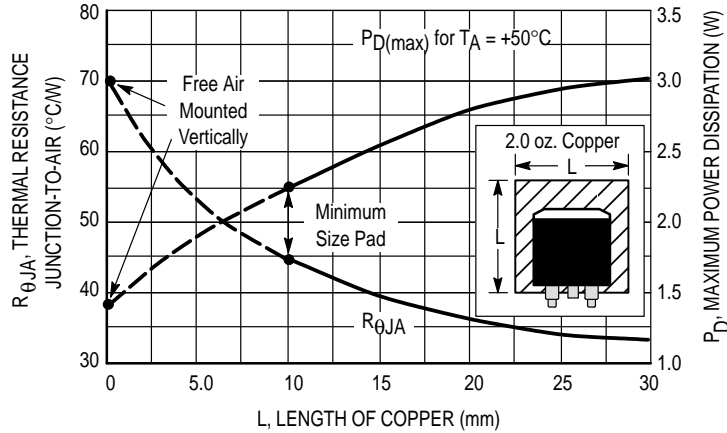
DEFINITIONS

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.

MC7900

OUTLINE DIMENSIONS

T SUFFIX
PLASTIC PACKAGE
CASE 221A–06
ISSUE Y
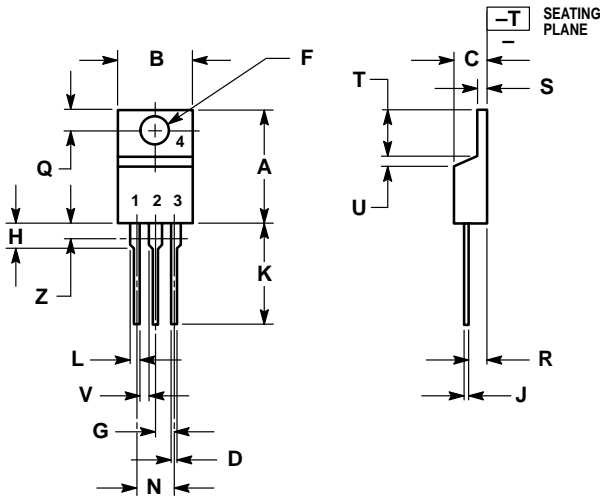
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIM Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

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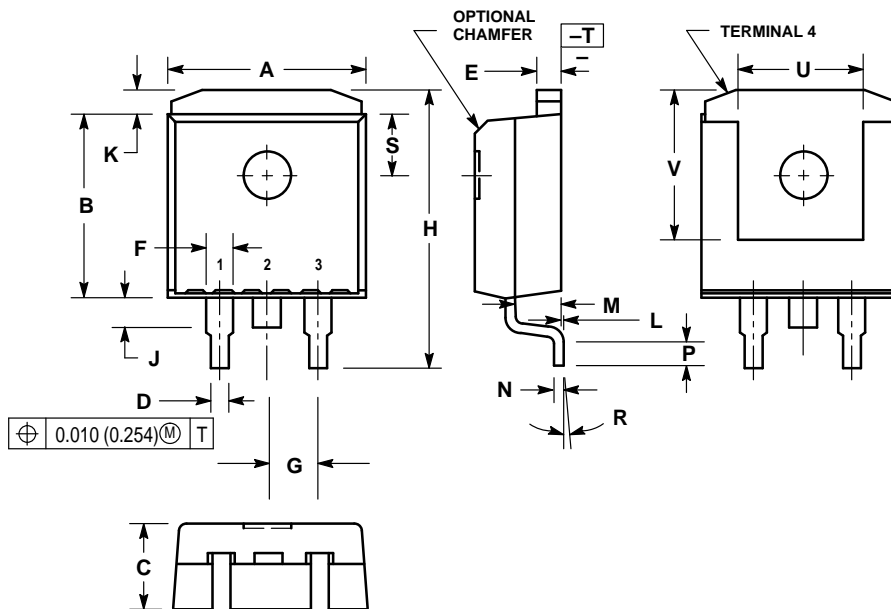
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. TAB CONTOUR OPTIONAL WITHIN DIMENSIONS A AND K.
4. DIMENSIONS U AND V ESTABLISH A MINIMUM MOUNTING SURFACE FOR TERMINAL 4.
5. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH OR GATE PROTRUSIONS. MOLD FLASH AND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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	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	

⊕ | 0.010 (0.254) Ⓜ | T

MOTOROLA

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