μA7905/05.2/06/08/12/15/18/24-U,DA

DESCRIPTION

The μA7900 series of monolithic Three-Terminal Negative Voltage Regulators employs internal current limiting, thermal shut-down and safe-area compensation, making them essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. They are intended as fixed-voltage complements to the μA7800 positive regulators.

FEATURES

- **Output current in excess of 1 amp**
- **No external components**
- **Internal thermal overload protection**
- **Internal short circuit current limiting**
- **Output transistor safe-area compensation**
- **Available in the TO-220 and the TO-3 packages**
- **Output voltages of -5, -5.2, -6, -8, -12, -15, -18 and -24 volts**
- **Mil std 883A,B,C available**

ABSOLUTE MAXIMUM RATINGS

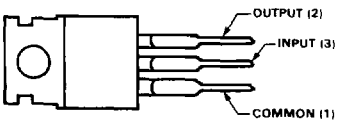
	PARAMETER	RATING	UNIT
V_{IN}	Input voltage		V
	-5V through -18V	-35	
	-24V	-40	
	Internal power dissipation[1]	Internally limited	
T_{stg}	Storage temperature range	-65 to +150	°C
T_J	Operating junction temperature range[2]		°C
	7900	-55 to +150	
	7900C	0 to +125	
	Lead temperature		°C
	TO-3 package (soldering, 60 second time limit)	300	
	TO-220 package (soldering, 10 second time limit)	230	

NOTES

1. Thermal resistance of the packages (without a heat sink)
   Junction to case: TO-3 Package 4°C/W; TO-220 Package 2°C/W
   Junction to ambient: TO-3 Package 35°C/W; TO-220 Package 50°C/W
2. Operating Ambient Temperature Range
   7900 -55°C to +125°C
   7900C 0°C to +85°C

PIN CONFIGURATION

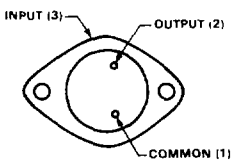
U PACKAGE (TO-220)



ORDER INFORMATION

Output voltage	Order part no.
-5V	7905CU
-5.2V	7905.2CU
-6V	7906CU
-8V	7908CU
-12V	7912CU
-15V	7915CU
-18V	7918CU
-24V	7924CU

DA PACKAGE (TO-3)



ORDER INFORMATION

Output voltage	Order part no.
-5V	7905DA
-5.2V	7905.2DA
-6V	7906DA
-8V	7908DA
-12V	7912DA
-15V	7915DA
-18V	7918DA
-24V	7924DA
-5V	7905CDA
-5.2V	7905.2CDA
-6V	7906CDA
-8V	7908CDA
-12V	7912CDA
-15V	7915CDA
-18V	7918CDA
-24V	7924CDA

μA7905/05.2/06/08/12/15/18/24-U,DA

DC ELECTRICAL CHARACTERISTICS

I_{OUT} = 500mA, -55°C ≤ T_J ≤ 150°C,[1]
C_{IN} = 2μF, C_{OUT} = 1μF unless otherwise specified.

PARAMETER	TEST CONDITIONS	7905			7095C			7905.2			UNIT
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V_{OUT}	T_J = 25°C		V_{IN} = -10V			V_{IN} = -10V			V_{IN} = -10V		V
		-4.8	-5.0	-5.2	-4.8	-5.0	-5.2	-5.0	-5.2	-5.4	
	P ≤ 15W		-8V ≤ V_{IN} ≤ -20V			-7V ≤ V_{IN} ≤ -20V			-8V ≤ V_{IN} ≤ -20V		
	5mA ≤ I_{OUT} ≤ 1.0A	-4.7		-5.3	-4.75		-5.25	-5.0		-5.4	
Line regulation	T_J = 25°C		-7V ≤ V_{IN} ≤ -25V			-7V ≤ V_{IN} ≤ -25V			-7.2V ≤ V_{IN} ≤ -25V		mV
			3	50		3	100		3	52	
			-8V ≤ V_{IN} ≤ -12V			-8V - V_{IN} ≤ -12V			-8V ≤ V_{IN} ≤ -12V		
			1	25		1	50		1	27	
Load regulation	T_J = 25°C										mV
	5mA ≤ I_{OUT} ≤ 1.5A		15	50		15	100		15	52	
	250mA ≤ I_{OUT} ≤ 750mA		5	25		5	50		5	27	
I_{CC}	T_J = 25°C		1	2		1	2		1	2	mA
with line			-8V ≤ V_{IN} ≤ -25V			-7V ≤ V_{IN} ≤ -25V			-8V ≤ V_{IN} ≤ -25V		
				1.3			1.3			1.3	
with load	5mA ≤ I_{OUT} ≤ 1.0A		.1	0.5		.1	0.5		.1	0.5	
Output noise voltage	T_A = 25°C 10Hz ≤ f ≤ 100kHz		125			125			130		μV
Long term stability			20			20			22		mV
Ripple rejection	f = 120Hz		-8V ≤ V_{IN} ≤ -18V			-8V ≤ V_{IN} ≤ -18V			-8V ≤ V_{IN} ≤ -18V		dB
	I_{OUT} = 20mA	54	60		54	60		54	60		
Dropout voltage	T_J = 25°C I_{OUT} = 1.0A		1.1			1.1			1.1		V
Output resistance	f = 1kHz		17			17			17		mΩ
I_{OS}	T_J = 25°C		500			500			500		mA
Peak output current	T_J = 25°C		2.1			2.1			2.1		A
Average temperature coefficient of input voltage	I_{OUT} = 5mA		0°C ≤ T_J ≤ 150°C -.4			0°C ≤ T_J ≤ 125°C -.4			0°C ≤ T_J ≤ 150°C -.4		mV/°C

NOTE

1. 7900C - 0°C ≤ T_J ≤ 125°C

DC ELECTRICAL CHARACTERISTICS

(Cont'd) I_{OUT} = 500mA, -55°C ≤ T_J ≤ 150°C,[1] C_{IN} = 2μF, C_{OUT} = 1μF unless otherwise specified.

PARAMETER	TEST CONDITIONS	7905.2C			7906			7906C			UNIT
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V_{OUT}	T_J = 25°C		V_{IN} = -10V			V_{IN} = -11V			V_{IN} = -11V		V
		-5.0	-5.2	-5.4	-5.75	-6.0	-6.25	-5.75	-6.0	-6.25	
	P ≤ 15W		-7.2V ≤ V_{IN} ≤ -20V			-9V ≤ V_{IN} ≤ -21V			-8V ≤ V_{IN} ≤ -25V		
	5mA ≤ I_{OUT} ≤ 1.0A	-4.94		-5.46	-5.65		-6.35	-5.7		-6.3	
Line regulation	T_J = 25°C		-7.2V ≤ V_{IN} ≤ -25V			-8V ≤ V_{IN} ≤ -25V			-8V≤ V_{IN} ≤ -25V		mV
			3	105		5	60		5	120	
			-8V ≤ V_{IN} ≤ -12V			-9V ≤ V_{IN} ≤ -13V			-9V ≤ V_{IN} ≤ -13V		
			1	52		1.5	30		1.5	60	
Load regulation	T_J = 25°C										mV
	5mA ≤ I_{OUT} ≤ 1.5A		15	105		14	60		14	120	
	250mA ≤ I_{OUT} ≤ 750mA		5	52		4	30		4	60	
I_{CC}	T_J = 25°C		1	2		1	2		1	2	mA
with line			-7.2V ≤ V_{IN} ≤ -25V			-9V ≤ V_{IN} ≤ -25V			-8V ≤ V_{IN} ≤ -25V		
				1.3			1.3			1.3	
with load	5mA ≤ I_{OUT} ≤ 1.0A		0.1	0.5		0.1	0.5		0.1	0.5	
Output noise voltage	T_A = 25°C 10Hz ≤ f ≤ 100kHz		130			150			150		μV
Long term stability			22			24			24		mV
Ripple rejection	f = 120Hz		-8V ≤ V_{IN} ≤ -18V			-9V ≤ V_{IN} ≤ -19V			-9V ≤ V_{IN} ≤ -19V		dB
	I_{OUT} = 20mA	54	60		54	60		54	60		
Dropout voltage	T_J = 25°C I_{OUT} = 1.0A		1.1			1.1			1.1		V
Output resistance	f = 1kHz		17			19			19		mΩ
I_{OS}	T_J = 25°C		500			500			500		mA
Peak output current	T_J = 25°C		2.1			2.1			2.1		A
Average temperature coefficient of input voltage	I_{OUT} = 5mA		0°C ≤ T_J ≤ 125°C -0.4			0°C ≤ T_J ≤ 150°C -0.4			0°C ≤ T_J ≤ 125°C -0.4		mV/°C

NOTE

1. 7900 - 0°C ≤ T_J ≤ 125°C

DC ELECTRICAL CHARACTERISTICS

(Cont'd) I_{OUT} = 500mA, -55°C ≤ T_J ≤ 150°C,[1] C_{IN} = 2μF, C_{OUT} = 1μF unless otherwise specified.

PARAMETER	TEST CONDITIONS	7908			7908C			7912			UNIT
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V_{OUT}	T_J = 25°C	V_{IN} = - 14V			V_{IN} = -14V			V_{IN}= -19V			V
		-7.7	-8.0	-8.3	-7.7	-8.0	-8.3	-11.5	-12.0	-12.5	
	P ≤ 15W	-11.5V ≤ V_{IN} ≤ -23V			-10.5V ≤ V_{IN} ≤ -23V			-15.5V ≤ V_{IN} ≤ -27V			
	5mA ≤ I_{OUT} ≤ 1.0A	-7.6		-8.4	-7.6		-8.4	-11.4		-12.6	
Line regulation	T_J = 25°C	-10.5V ≤ V_{IN} ≤ -25V			-10.5V ≤ V_{IN} ≤ -25V			-14.5V ≤ V_{IN} ≤ -30V			mV
			6	80		6	160		10	120	
		-11V ≤ V_{IN} ≤ -17V			-11V ≤ V_{IN} ≤ -17V			-16V ≤ V_{IN} ≤ -22V			
			2	40		2	80		3	60	
Load regulation	T_J = 25°C										mV
	5mA ≤ I_{OUT} ≤ 1.5A		12	80		12	160		12	120	
	250mA ≤ I_{OUT} ≤ 750mA		4	40		4	80		4	60	
I_{CC}	T_J = 25°C		1	2		1	2		1.5	3.0	mA
with line		-11.5V ≤ V_{IN} ≤ -25V			-10.5V ≤ V_{IN} ≤ -25V			-15V ≤ V_{IN} ≤ -30V			
				1.0			1.0			1.0	
with load	5mA ≤ I_{OUT} ≤ 1.0A		.1	0.5		.1	0.5		.1	0.5	
Output noise voltage	T_A = 25°C 10Hz ≤ f ≤ 100kHz		200			200			300		μV
Long term stability			32			32			48		mV
Ripple rejection	f = 120Hz	-11.5V ≤ V_{IN} ≤ -21.5V			-11.5V ≤ V_{IN} ≤ -21.5V			-15V ≤ V_{IN} ≤ -25V			dB
	I_{OUT} = 20mA	54	60		54	60		54	60		
Dropout voltage	T_J = 25°C I_{OUT} = 1.0A		1.1			1.1			1.1		V
Output resistance	f = 1kHz		16			16			18		mΩ
I_{OS}	T_J = 25°C		500			500			500		mA
Peak output current	T_J = 25°C		2.1			2.1			2.1		A
Average temperature coefficient of input voltage	I_{OUT} = 5mA	0°C ≤ T_J ≤ 150°C			0°C ≤ T_J ≤ 125°C			0°C ≤ T_J ≤ 150°C			mV/°C
			-0.6			-0.6			-0.8		

NOTE

1 7900C - 0°C ≤ T_J ≤ 125°C

DC ELECTRICAL CHARACTERISTICS

(Cont'd) I_{OUT} = 500mA, -55°C ≤ T_J ≤ 150°C,[1] C_{IN} = 2μF, C_{OUT} = 1μF unless otherwise specified.

PARAMETER	TEST CONDITIONS	7912C			7915			7915C			UNIT
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V_{OUT}	T_J = 25°C		V_{IN} = -19V			V_{IN} = -23V			V_{IN} = -23V		V
		-11.5	-12.0	-12.5	-14.4	-15.0	-15.6	-14.4	-15.0	-15.6	
	P ≤ 15W		-14.5V ≤ V_{IN} ≤ -27V			-18.5V ≤ V_{IN} ≤ -30V			-17.5V ≤ V_{IN} ≤ -30V		
	5mA ≤ I_{OUT} ≤ 1.0A	-11.4		-12.6	-14.25		-15.75	-14.25		-15.75	
Line regulation	T_J = 25°C		-14.5V ≤ V_{IN} ≤ -30V			-17.5V ≤ V_{IN} ≤ -30V			-17.5V ≤ V_{IN} -30V		mV
			10	240		11	150		11	300	
			-16V ≤ V_{IN} ≤ -22V			-20V ≤ V_{IN} ≤ -26V			-20V ≤ V_{IN}≤ -26V		
			3	120		3	75		3	150	
Load regulation	T_J = 25°C										mV
	5mA ≤ I_{OUT} ≤ 1.5A		12	240		12	150		12	300	
	250mA ≤ I_{OUT} ≤ 750mA		4	120		4	75		4	150	
I_{CC}	T_J = 25°C		1.5	3.0		1.5	3.0		1.5	3.0	mA
with line			-14.5V ≤ V_{IN} ≤ -30V			-18.5V ≤ V_{IN} ≤ -30V			-17.5V ≤ V_{IN} ≤ -30V		
				1.0			1.0			1.0	
with load	5mA ≤ I_{OUT} ≤ 1.0A		.1	0.5		.1	0.5		.1	0.5	
Output noise voltage	T_A = 25°C 10Hz ≤ f ≤ 100kHz		300			375			375		μV
Long term stability			48			60			60		mV
Ripple rejection	f = 120Hz		-15V ≤ V_{IN} ≤ -25V			18.5V ≤ V_{IN} ≤ -28.5V			-18.5V ≤ V_{IN} ≤ -28.5V		dB
	I_{OUT} = 20mA	54	60		54	60		54	60		
Dropout voltage	T_J = 25°C I_{OUT} = 1.0A		1.1			1.1			1.1		V
Output resistance	f = 1kHz		18			19			19		mΩ
I_{OS}	T_J = 25°C		500			500			500		mA
Peak output current	T_J = 25°C		2.1			2.1			2.1		A
Average temperature coefficient of input voltage	I_{OUT} = 5mA		0°C ≤ T_J ≤ 125°C -0.8			0°C ≤ T_J ≤ 150°C -1.0			0°C ≤ T_J ≤ 125°C -1.0		mV/°C

NOTE

1. 7900C - 0°C ≤ T_J ≤ 125°C

DC ELECTRICAL CHARACTERISTICS

(Cont'd) I_{OUT} = 500mA, -55°C ≤ T_J ≤ 150°C,[1] C_{IN} = 2μF, C_{OUT} = 1μF unless otherwise specified.

PARAMETER	TEST CONDITIONS	7918			7918C			UNIT
		Min	Typ	Max	Min	Typ	Max	
V_{OUT}	T_J = 25°C		V_{IN} = -27V			V_{IN} = -27V		V
		-17.3	-18.0	-18.7	-17.3	-18.0	-18.7	
	P ≤ 15W		-22V ≤ V_{IN} ≤ -33V			-21V ≤ V_{IN} ≤ -33V		
	5mA ≤ I_{OUT} ≤ 1.0A	-17.1		-18.9	-17.1		-18.9	
Line regulation	T_J = 25°C		-21V ≤ V_{IN} ≤ -33V			-21V ≤ V_{IN} ≤ -33V		mV
			15	180		15	360	
			-24V ≤ V_{IN} ≤ -30V			-24V ≤ V_{IN} ≤ -30V		
			5	90		5	180	
Load regulation	T_J = 25°C							mV
	5mA ≤ I_{OUT} ≤ 1.5A		12	180		12	360	
	250mA ≤ I_{OUT} ≤ 750mA		4	90		4	180	
I_{CC}	T_J = 25°C		1.5	3.0		1.5	3.0	mA
with line			-22V ≤ V_{IN} ≤ -33V			-21V ≤ V_{IN} ≤ -33V		
				1.0			1.0	
with load	5mA ≤ I_{OUT} ≤ 1.0A		.1	0.5		.1	0.5	
Output noise voltage	T_A = 25°C 10Hz ≤ f ≤ 100kHz		450			450		μV
Long term stability			72			72		mV
Ripple rejection	f = 120Hz		-22V ≤ V_{IN} ≤ -32V			-22V ≤ V_{IN} ≤ -32V		dB
	I_{OUT} = 20mA	54	60		54	60		
Dropout voltage	T_J = 25°C I_{OUT} = 1.0A		1.1			1.1		V
Output resistance	f = 1kHz		22			22		mΩ
I_{OS}	T_J = 25°C		500			500		mA
Peak output current	T_J = 25°C		2.1			2.1		A
Average temperature coefficient of input voltage	I_{OUT} = 5mA		0°C ≤ T_J ≤ 150°C			0°C ≤ T_J ≤ 125°C		mV/°C
			-1.0			-1.0		

NOTE

1. 7900C - 0°C ≤ T_J ≤ 125°C

DC ELECTRICAL CHARACTERISTICS

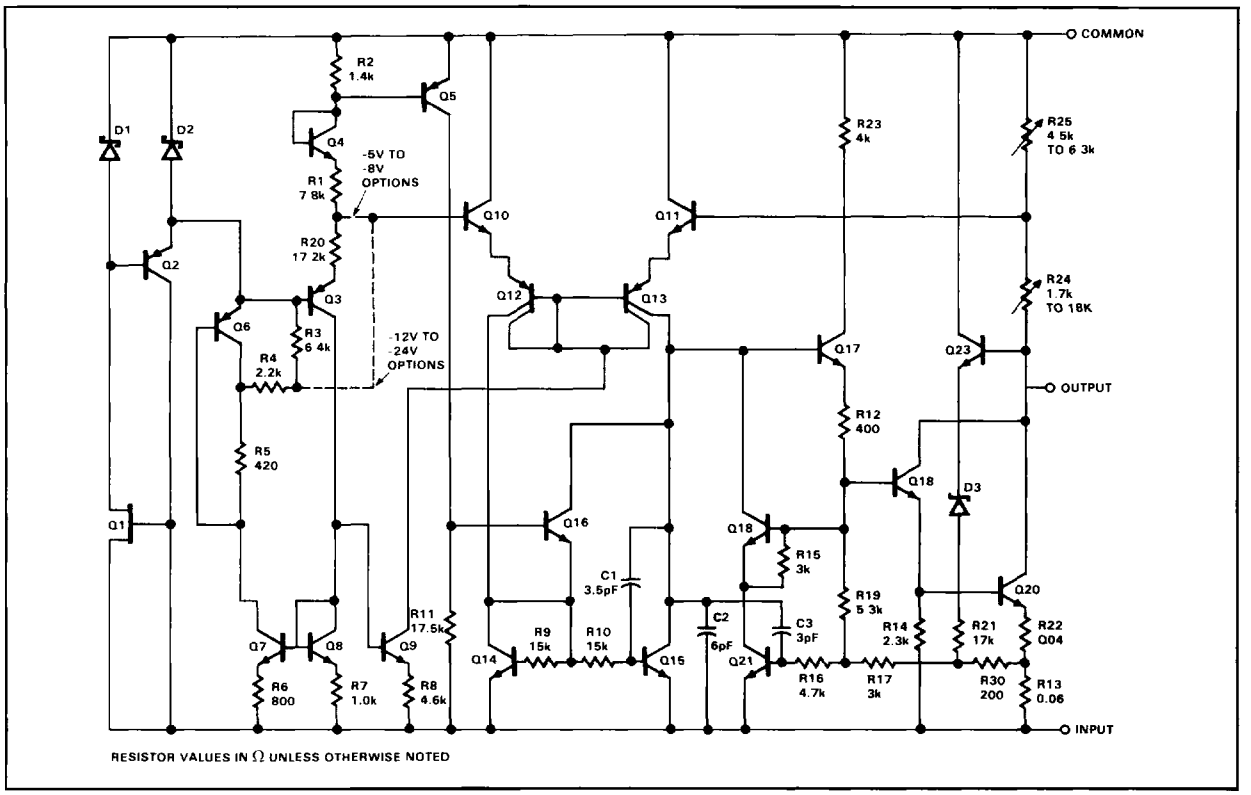
(Cont'd) I_{OUT} = 500mA, -55°C ≤ T_J ≤ 150°C,[1] C_{IN} = 2μF, C_{OUT} = 1μF unless otherwise specified.

PARAMETER	TEST CONDITIONS	7924			7924C			UNIT
		Min	Typ	Max	Min	Typ	Max	
V_{OUT}	T_J = 25°C		V_{IN} = -33V			V_{IN} = -33V		V
		-23.0	-24.0	-25.0	-23.0	-24.0	-25.0	
	P ≤ 15W		-28V ≤ V_{IN} ≤ -38V			-27V ≤ V_{IN} ≤ -38V		
	5mA ≤ I_{OUT} ≤ 1.0A	-22.8		-25.2	-22.8		-25.2	
Line regulation	T_J = 25°C		-27V ≤ V_{IN} ≤ -38V			-27V ≤ V_{IN} ≤ -38V		mV
			18	240		18	480	
			-30V ≤ V_{IN} ≤ -36V			-30V ≤ V_{IN} ≤ -36V		
			6	120		6	240	
Load regulation	T_J = 25°C							mV
	5mA ≤ I_{OUT} ≤ 1.5A		12	240		120	480	
	250mA ≤ I_{OUT} ≤ 750mA		4	120		4	240	
I_{CC}	T_J = 25°C		1.5	3.0		1.5	3.0	mA
with line			-28V ≤ V_{IN} ≤ -38V			-27V ≤ V_{IN} ≤ -38V		
				1.0			1.0	
with load	5mA ≤ I_{OUT} ≤ 1.0A		0.1	0.5		0.1	0.5	
Output noise voltage	T_A = 25°C							μV
	10Hz ≤ f ≤ 100kHz		600			600		
Long term stability			96			96		mV
Ripple rejection	f = 120Hz		-28V ≤ V_{IN} ≤ -38V			-28V ≤ V_{IN} ≤ -38V		dB
	I_{OUT} = 20mA	54	60		54	60		
Dropout voltage	T_J = 25°C		1.1			1.1		V
	I_{OUT} = 1.0A							
Output resistance	f = 1kHz		28			28		mΩ
I_{OS}	T_J = 25°C		500			500		mA
Peak output current	T_J = 25°C		2.1			2.1		A
Average temperature coefficient of input voltage	I_{OUT} = 5mA		0°C ≤ T_J ≤ 150°C			0°C ≤ T_J ≤ 125°C		mV/°C
			-1.0			-1.0		

NOTE

1 7900C - 0°C ≤ T_J ≤ 125°C

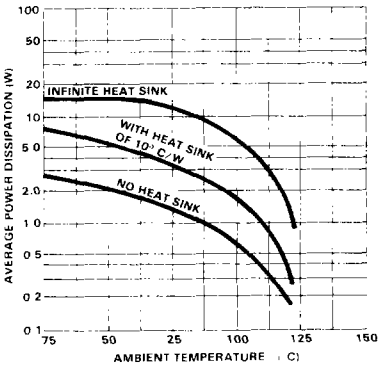
EQUIVALENT CIRCUIT



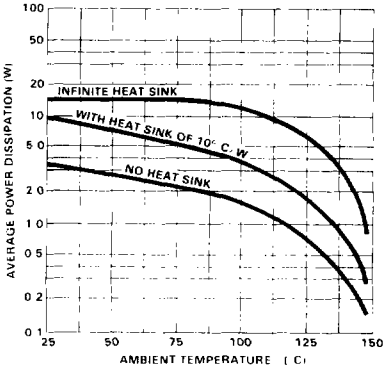
RESISTOR VALUES IN Ω UNLESS OTHERWISE NOTED

TYPICAL PERFORMANCE CURVES

MAXIMUM AVERAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE (TO-3, 7900C)

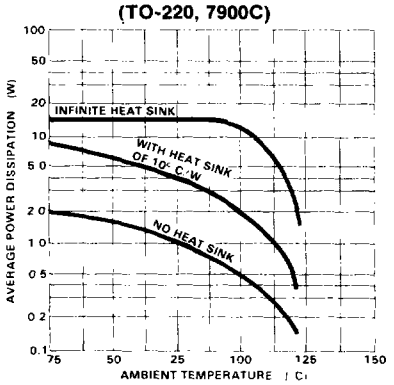


MAXIMUM AVERAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE (TO-3, 7900)

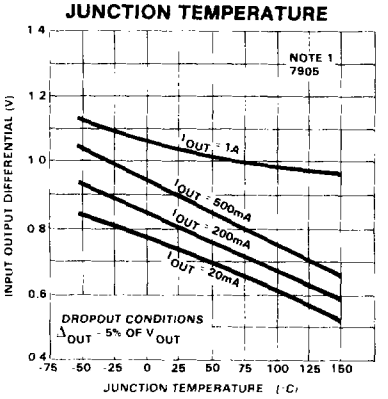


TYPICAL PERFORMANCE CURVES (Cont'd)

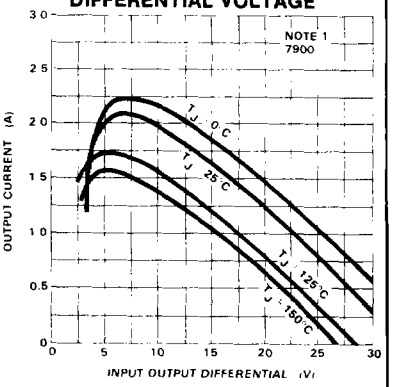
MAXIMUM AVERAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE (TO-220, 7900C)



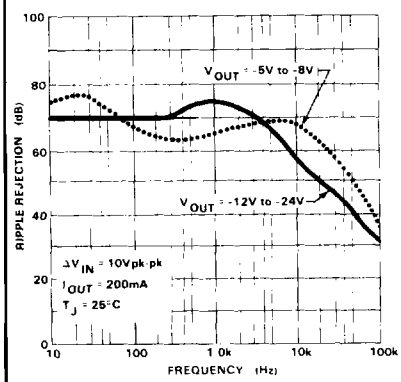
DROPOUT VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE



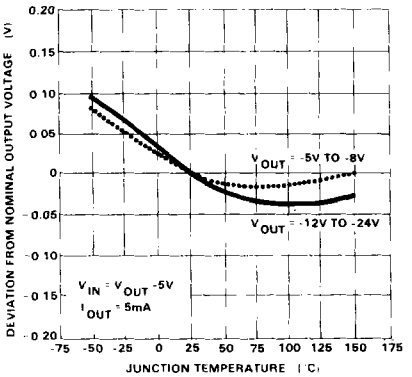
PEAK OUTPUT CURRENT AS A FUNCTION OF INPUT-OUTPUT DIFFERENTIAL VOLTAGE



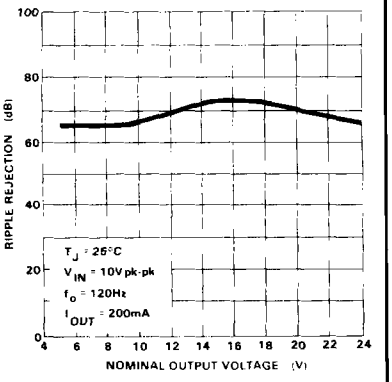
RIPPLE REJECTION AS A FUNCTION OF FREQUENCY



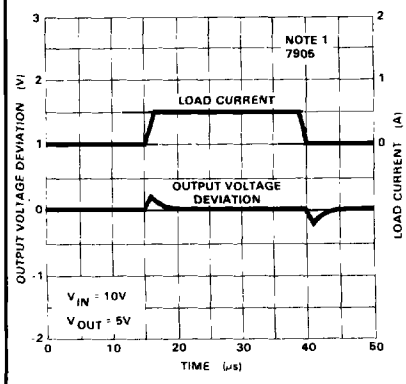
OUTPUT VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE



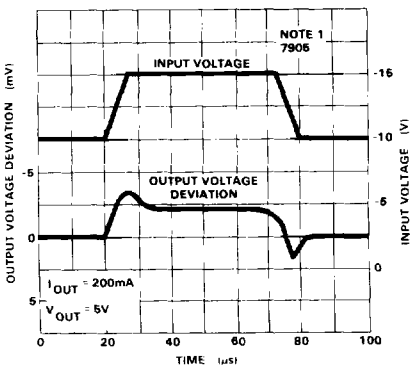
RIPPLE REJECTION AS A FUNCTION OF OUTPUT VOLTAGES



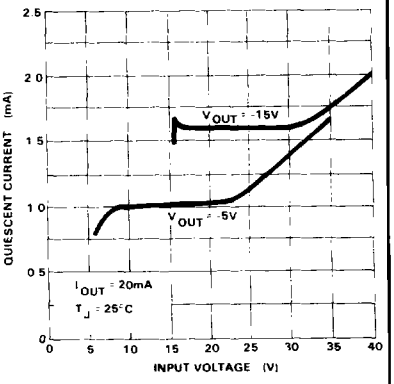
LOAD TRANSIENT RESPONSE



LINE TRANSIENT RESPONSE

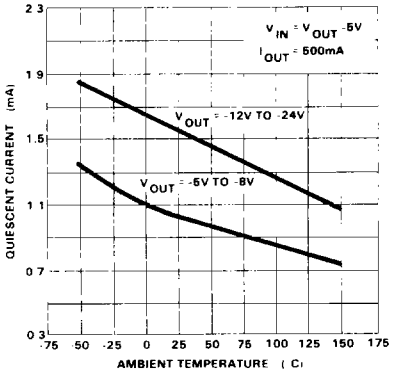


QUIESCENT CURRENT AS A FUNCTION OF INPUT VOLTAGE

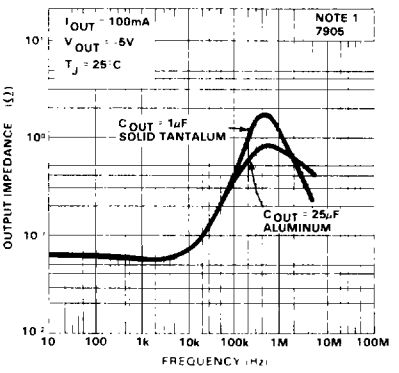


TYPICAL PERFORMANCE CURVES (Cont'd)

QUIESCENT CURRENT AS A FUNCTION OF TEMPERATURE



OUTPUT IMPEDANCE AS A FUNCTION OF FREQUENCY



NOTE
The other μA7900 series devices have similar performance curves.