

# BIPOLAR ANALOG INTEGRATED CIRCUIT

## $\mu$ PC7900A Series

### THREE TERMINAL NEGATIVE VOLTAGE REGULATOR

#### DESCRIPTION

$\mu$ PC7900A series are monolithic three terminal negative regulators which employ internally current limiting, thermal shut down, output transistor safe operating area protection make them essentially indestructible.

They are intended as fixed voltage regulators in a wide range of application including local on card regulation for elimination of distribution problems associated wide single point regulation.

#### FEATURES

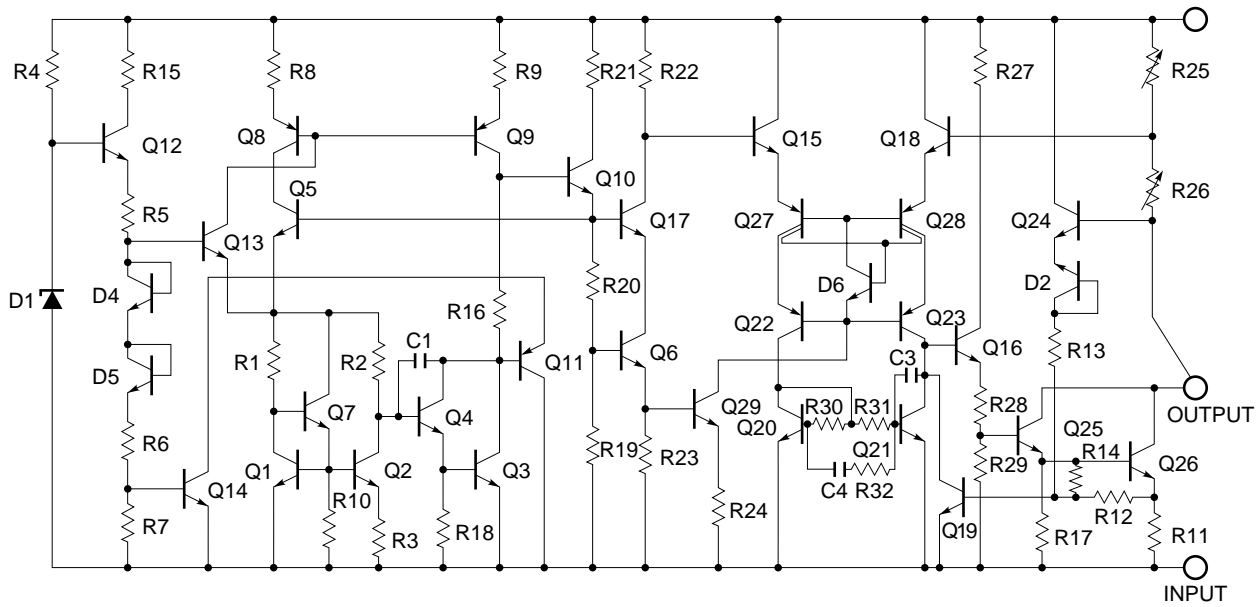
- Wide operation temperature range.  
T<sub>A</sub>: -30 °C to +85 °C
- Good load regulation.  
7 mV TYP. (250 mA ≤ I<sub>o</sub> ≤ 750 mA):  $\mu$ PC7905AHF
- Low noise.

#### ORDERING INFORMATION

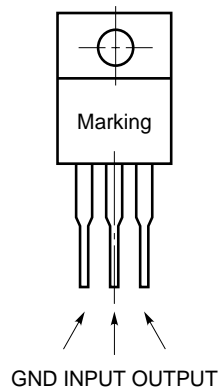
Part Number	Output Voltage	Package
$\mu$ PC7905AHF	-5 V	MP-45G (ISOLATED TO-220)
$\mu$ PC7908AHF	-8 V	MP-45G (ISOLATED TO-220)
$\mu$ PC7912AHF	-12 V	MP-45G (ISOLATED TO-220)
$\mu$ PC7915AHF	-15 V	MP-45G (ISOLATED TO-220)
$\mu$ PC7918AHF	-18 V	MP-45G (ISOLATED TO-220)
$\mu$ PC7924AHF	-24 V	MP-45G (ISOLATED TO-220)

The information in this document is subject to change without notice.

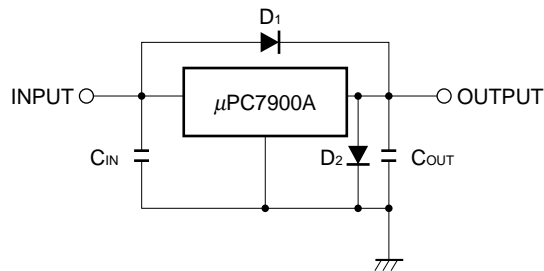
EQUIVALENT CIRCUIT



CONNECTION DIAGRAM



TYPICAL CONNECTION



- C<sub>IN</sub> : More than 2.2 μF
- C<sub>OUT</sub>: More than 0.33 μF
- D<sub>1</sub> : Needed for V<sub>IN</sub> > V<sub>O</sub>
- D<sub>2</sub> : Needed for V<sub>O</sub> > GND

**ABSOLUTE MAXIMUM REATINGS (T<sub>A</sub> = 25 °C)**

Parameter	Symbol	Rating	Unit
Input Voltage	V <sub>IN</sub>	-35/-40 <b>Note 1</b>	V
Internal Power Dissipation	P <sub>T</sub>	15 <b>Note 2</b>	W
Operating Ambient Temperature Range	T <sub>A</sub>	-30 to +85	°C
Operating Junction Temperature Range	T <sub>J</sub>	-30 to +150	°C
Storage Temperature Range	T <sub>stg</sub>	-55 to +150	°C
Thermal Resistance (junction to case)	R <sub>th(J-C)</sub>	5.0	°C/W
Thermal Resistance (junction to ambient)	R <sub>th(J-A)</sub>	65	°C/W

**Note 1.** μPC7905A, 08A, 12A, 15A, 18A: -35 V, μPC7924A: -40 V

**2.** Internally limited

**RECOMMENDED OPERATING CONDITIONS**

Parameter	Symbol	Part Number	MIN.	TYP.	MAX.	Unit
Input Voltage	V <sub>IN</sub>	μPC7905AHF	-7	-10	-25	V
		μPC7908AHF	-10.5	-14	-25	
		μPC7912AHF	-14.5	-19	-30	
		μPC7915AHF	-17.5	-23	-30	
		μPC7918AHF	-21	-27	-33	
		μPC7924AHF	-27	-33	-38	
Output Current	I <sub>o</sub>	All	0.005		1	A
Operating Ambient Temperature	T <sub>A</sub>	All	-30		+85	°C
Operating Junction Temperature Range	T <sub>J</sub>	All	-30		+125	°C

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)**

**μPC7905A**

(V<sub>IN</sub> = -10 V, I<sub>o</sub> = 500 mA, 0 °C ≤ T<sub>J</sub> ≤ +125 °C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = 25 °C	-4.8	-5.0	-5.2	V
		-7 V ≤ V <sub>IN</sub> ≤ -20 V, 5 mA ≤ I <sub>o</sub> ≤ 1 A, P <sub>T</sub> ≤ 15 W	-4.75		-5.25	
		-30 °C ≤ T <sub>J</sub> ≤ +125 °C	-4.75		-5.25	
Line Regulation	REG <sub>IN</sub>	T <sub>J</sub> = 25 °C, -7 V ≤ V <sub>IN</sub> ≤ -25 V		25	100	mV
		T <sub>J</sub> = 25 °C, -8 V ≤ V <sub>IN</sub> ≤ -12 V		3	50	
Load Regulation	REG <sub>L</sub>	T <sub>J</sub> = 25 °C, 5 mA ≤ I <sub>o</sub> ≤ 1.5 A		30	100	mV
		T <sub>J</sub> = 25 °C, 250 mA ≤ I <sub>o</sub> ≤ 750 mA		7	50	
Quiescent Current	I <sub>BIAS</sub>	T <sub>J</sub> = 25 °C		3.6	6.0	mA
Quiescent Current Change	ΔI <sub>BIAS</sub>	-7 V ≤ V <sub>IN</sub> ≤ -25 V			1.3	mA
		5 mA ≤ I <sub>o</sub> ≤ 1 A			0.5	
Output Noise Voltage	V <sub>n</sub>	T <sub>J</sub> = 25 °C, 10 Hz ≤ f ≤ 100 kHz		77		μVr.m.s
Ripple Rejection	R•R	T <sub>J</sub> = 25 °C, f = 120 Hz, -8 V ≤ V <sub>IN</sub> ≤ -18 V, I <sub>o</sub> = 500 mA	56	63		dB
Dropout Voltage	V <sub>DIF</sub>	T <sub>J</sub> = 25 °C, I <sub>o</sub> = 1 A		1.2		V
Peak Output Current	I <sub>Opeak</sub>	T <sub>J</sub> = 25 °C	1.6	2.2	2.8	A
Temperature Coefficient of Output Voltage	ΔV <sub>O</sub> /ΔT	I <sub>o</sub> = 5 mA		0.36		mV/°C

**μPC7908A**

(V<sub>IN</sub> = -14 V, I<sub>o</sub> = 500 mA, 0 °C ≤ T<sub>J</sub> ≤ +125 °C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = 25 °C	-7.7	-8.0	-8.3	V
		-10.5 V ≤ V <sub>IN</sub> ≤ -23 V, 5 mA ≤ I <sub>o</sub> ≤ 1 A, P <sub>T</sub> ≤ 15 W	-7.6		-8.4	
		-30 °C ≤ T <sub>J</sub> ≤ +125 °C	-7.6		-8.4	
Line Regulation	REG <sub>IN</sub>	T <sub>J</sub> = 25 °C, -10.5 V ≤ V <sub>IN</sub> ≤ -25 V		33	150	mV
		T <sub>J</sub> = 25 °C, -11 V ≤ V <sub>IN</sub> ≤ -17 V		14	75	
Load Regulation	REG <sub>L</sub>	T <sub>J</sub> = 25 °C, 5 mA ≤ I <sub>o</sub> ≤ 1.5 A		40	160	mV
		T <sub>J</sub> = 25 °C, 250 mA ≤ I <sub>o</sub> ≤ 750 mA		14	80	
Quiescent Current	I <sub>BIAS</sub>	T <sub>J</sub> = 25 °C		3.9	6.0	mA
Quiescent Current Change	ΔI <sub>BIAS</sub>	-10.5 V ≤ V <sub>IN</sub> ≤ -25 V			1.0	mA
		5 mA ≤ I <sub>o</sub> ≤ 1 A			0.5	
Output Noise Voltage	V <sub>n</sub>	T <sub>J</sub> = 25 °C, 10 Hz ≤ f ≤ 100 kHz		130		μVr.m.s
Ripple Rejection	R•R	T <sub>J</sub> = 25 °C, -11.5 V ≤ V <sub>IN</sub> ≤ -21.5 V, f = 120 Hz, I <sub>o</sub> = 500 mA	52	58		dB
Dropout Voltage	V <sub>DIF</sub>	T <sub>J</sub> = 25 °C, I <sub>o</sub> = 1 A		1.2		V
Peak Output Current	I <sub>Opeak</sub>	T <sub>J</sub> = 25 °C	1.6	2.2	2.8	A
Temperature Coefficient of Output Voltage	ΔV <sub>O</sub> /ΔT	I <sub>o</sub> = 5 mA		0.32		mV/°C

μPC7912A

( $V_{IN} = -19\text{ V}$ ,  $I_o = 500\text{ mA}$ ,  $0\text{ }^\circ\text{C} \leq T_J \leq +125\text{ }^\circ\text{C}$ )

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	$V_o$	$T_J = 25\text{ }^\circ\text{C}$	-11.5	-12	-12.5	V
		$-14.5\text{ V} \leq V_{IN} \leq -27\text{ V}$ , $5\text{ mA} \leq I_o \leq 1\text{ A}$ , $P_T \leq 15\text{ W}$	-11.4		-12.6	
		$-30\text{ }^\circ\text{C} \leq T_J \leq +125\text{ }^\circ\text{C}$	-11.4		-12.6	
Line Regulation	$REG_{IN}$	$T_J = 25\text{ }^\circ\text{C}$ , $-14.5\text{ V} \leq V_{IN} \leq -30\text{ V}$		60	200	mV
		$T_J = 25\text{ }^\circ\text{C}$ , $-16\text{ V} \leq V_{IN} \leq -22\text{ V}$		25	100	
Load Regulation	$REG_L$	$T_J = 25\text{ }^\circ\text{C}$ , $5\text{ mA} \leq I_o \leq 1.5\text{ A}$		70	220	mV
		$T_J = 25\text{ }^\circ\text{C}$ , $250\text{ mA} \leq I_o \leq 750\text{ mA}$		20	110	
Quiescent Current	$I_{BIAS}$	$T_J = 25\text{ }^\circ\text{C}$		4.1	6.2	mA
Quiescent Current Change	$\Delta I_{BIAS}$	$-14.5\text{ V} \leq V_{IN} \leq -30\text{ V}$			1.0	mA
		$5\text{ mA} \leq I_o \leq 1\text{ A}$			0.5	
Output Noise Voltage	$V_n$	$T_J = 25\text{ }^\circ\text{C}$ , $10\text{ Hz} \leq f \leq 100\text{ kHz}$		140		μVr.m.s
Ripple Rejection	$R \cdot R$	$T_J = 25\text{ }^\circ\text{C}$ , $f = 120\text{ Hz}$ , $-15\text{ V} \leq V_{IN} \leq -25\text{ V}$ , $I_o = 500\text{ mA}$	49	56		dB
Dropout Voltage	$V_{DIF}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_o = 1\text{ A}$		1.2		V
Peak Output Current	$I_{Opeak}$	$T_J = 25\text{ }^\circ\text{C}$	1.6	2.2	2.8	A
Temperature Coefficient of Output Voltage	$ \Delta V_o/\Delta T $	$I_o = 5\text{ mA}$		0.04		mV/°C

μPC7915A

( $V_{IN} = -23\text{ V}$ ,  $I_o = 500\text{ mA}$ ,  $0\text{ }^\circ\text{C} \leq T_J \leq +125\text{ }^\circ\text{C}$ )

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	$V_o$	$T_J = 25\text{ }^\circ\text{C}$	-14.4	-15	-15.6	V
		$-17.5\text{ V} \leq V_{IN} \leq -30\text{ V}$ , $5\text{ mA} \leq I_o \leq 1\text{ A}$ , $P_T \leq 15\text{ W}$	-14.25		-15.75	
		$-30\text{ }^\circ\text{C} \leq T_J \leq +125\text{ }^\circ\text{C}$	-14.25		-15.75	
Line Regulation	$REG_{IN}$	$T_J = 25\text{ }^\circ\text{C}$ , $-17.5\text{ V} \leq V_{IN} \leq -30\text{ V}$		60	200	mV
		$T_J = 25\text{ }^\circ\text{C}$ , $-20\text{ V} \leq V_{IN} \leq -26\text{ V}$		30	100	
Load Regulation	$REG_L$	$T_J = 25\text{ }^\circ\text{C}$ , $5\text{ mA} \leq I_o \leq 1.5\text{ A}$		100	300	mV
		$T_J = 25\text{ }^\circ\text{C}$ , $250\text{ mA} \leq I_o \leq 750\text{ mA}$		30	150	
Quiescent Current	$I_{BIAS}$	$T_J = 25\text{ }^\circ\text{C}$		4.2	6.2	mA
Quiescent Current Change	$\Delta I_{BIAS}$	$-17.5\text{ V} \leq V_{IN} \leq -30\text{ V}$			1.0	mA
		$5\text{ mA} \leq I_o \leq 1\text{ A}$			0.5	
Output Noise Voltage	$V_n$	$T_J = 25\text{ }^\circ\text{C}$ , $10\text{ Hz} \leq f \leq 100\text{ kHz}$		240		μVr.m.s
Ripple Rejection	$R \cdot R$	$T_J = 25\text{ }^\circ\text{C}$ , $f = 120\text{ Hz}$ , $-18.5\text{ V} \leq V_{IN} \leq -28.5\text{ V}$ , $I_o = 500\text{ mA}$	47	54		dB
Dropout Voltage	$V_{DIF}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_o = 1\text{ A}$		1.2		V
Peak Output Current	$I_{Opeak}$	$T_J = 25\text{ }^\circ\text{C}$	1.6	2.2	2.8	A
Temperature Coefficient of Output Voltage	$ \Delta V_o/\Delta T $	$I_o = 5\text{ mA}$		1.2		mV/°C

μPC7918A

( $V_{IN} = -27\text{ V}$ ,  $I_o = 500\text{ mA}$ ,  $0\text{ }^{\circ}\text{C} \leq T_J \leq +125\text{ }^{\circ}\text{C}$ )

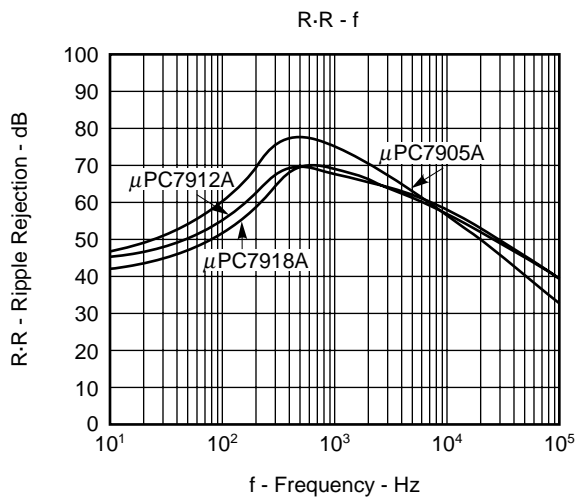
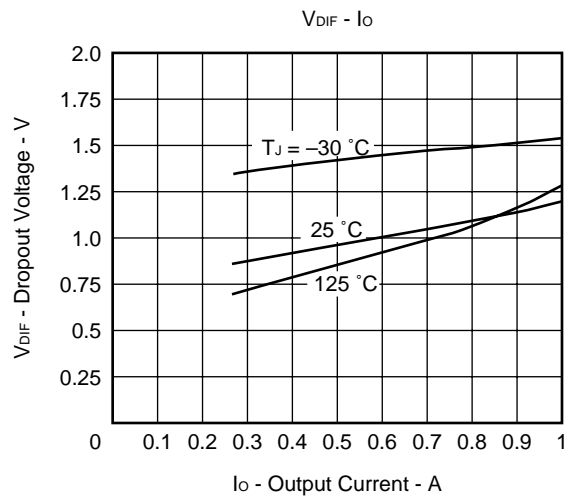
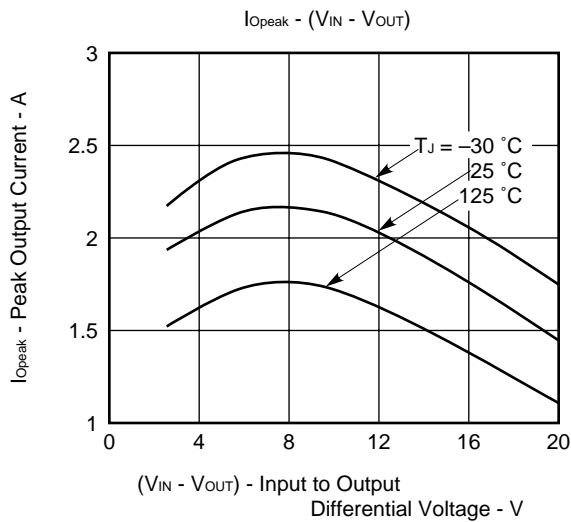
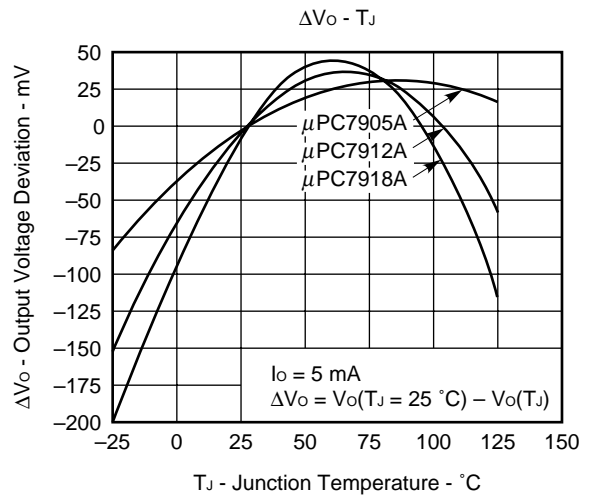
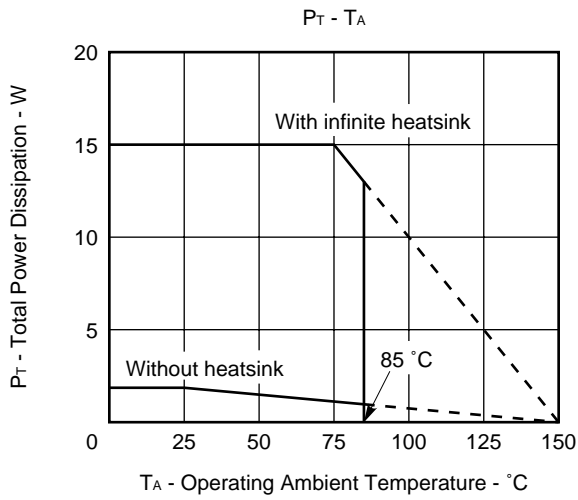
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	$V_o$	$T_J = 25\text{ }^{\circ}\text{C}$	-17.3	-18	-18.7	V
		$-21\text{ V} \leq V_{IN} \leq -33\text{ V}$ , $5\text{ mA} \leq I_o \leq 1\text{ A}$ , $P_T \leq 15\text{ W}$	-17.1		-18.9	
		$-30\text{ }^{\circ}\text{C} \leq T_J \leq +125\text{ }^{\circ}\text{C}$	-17.1		-18.9	
Line Regulation	$REG_{IN}$	$T_J = 25\text{ }^{\circ}\text{C}$ , $-21\text{ V} \leq V_{IN} \leq -33\text{ V}$		60	240	mV
		$T_J = 25\text{ }^{\circ}\text{C}$ , $-24\text{ V} \leq V_{IN} \leq -30\text{ V}$		30	120	
Load Regulation	$REG_L$	$T_J = 25\text{ }^{\circ}\text{C}$ , $5\text{ mA} \leq I_o \leq 1.5\text{ A}$		125	360	mV
		$T_J = 25\text{ }^{\circ}\text{C}$ , $250\text{ mA} \leq I_o \leq 750\text{ mA}$		47	180	
Quiescent Current	$I_{BIAS}$	$T_J = 25\text{ }^{\circ}\text{C}$		4.1	6.5	mA
Quiescent Current Change	$\Delta I_{BIAS}$	$-21\text{ V} \leq V_{IN} \leq -33\text{ V}$			1.0	mA
		$5\text{ mA} \leq I_o \leq 1\text{ A}$			0.5	
Output Noise Voltage	$V_n$	$T_J = 25\text{ }^{\circ}\text{C}$ , $10\text{ Hz} \leq f \leq 100\text{ kHz}$		190		μVr.m.s
Ripple Rejection	$R \cdot R$	$T_J = 25\text{ }^{\circ}\text{C}$ , $f = 120\text{ Hz}$ , $-22\text{ V} \leq V_{IN} \leq -32\text{ V}$ , $I_o = 500\text{ mA}$	45	53		dB
Dropout Voltage	$V_{DIF}$	$T_J = 25\text{ }^{\circ}\text{C}$ , $I_o = 1\text{ A}$		1.2		V
Peak Output Current	$I_{Opeak}$	$T_J = 25\text{ }^{\circ}\text{C}$	1.6	2.2	2.8	A
Temperature Coefficient of Output Voltage	$ \Delta V_o/\Delta T $	$I_o = 5\text{ mA}$		0.24		mV/°C

μPC7924A

( $V_{IN} = -33\text{ V}$ ,  $I_o = 500\text{ mA}$ ,  $0\text{ }^{\circ}\text{C} \leq T_J \leq +125\text{ }^{\circ}\text{C}$ )

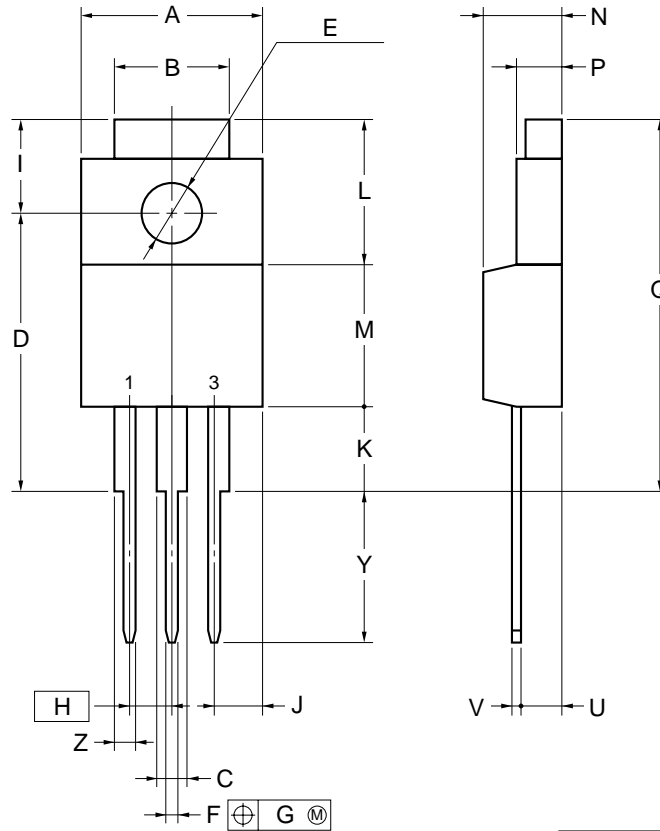
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	$V_o$	$T_J = 25\text{ }^{\circ}\text{C}$	-23.0	-24	-25.0	V
		$-27\text{ V} \leq V_{IN} \leq -38\text{ V}$ , $5\text{ mA} \leq I_o \leq 1\text{ A}$ , $P_T \leq 15\text{ W}$	-22.8		-25.2	
		$-30\text{ }^{\circ}\text{C} \leq T_J \leq +125\text{ }^{\circ}\text{C}$	-22.8		-25.2	
Line Regulation	$REG_{IN}$	$T_J = 25\text{ }^{\circ}\text{C}$ , $-27\text{ V} \leq V_{IN} \leq -38\text{ V}$		70	280	mV
		$T_J = 25\text{ }^{\circ}\text{C}$ , $-30\text{ V} \leq V_{IN} \leq -36\text{ V}$		37	140	
Load Regulation	$REG_L$	$T_J = 25\text{ }^{\circ}\text{C}$ , $5\text{ mA} \leq I_o \leq 1.5\text{ A}$		160	480	mV
		$T_J = 25\text{ }^{\circ}\text{C}$ , $250\text{ mA} \leq I_o \leq 750\text{ mA}$		60	240	
Quiescent Current	$I_{BIAS}$	$T_J = 25\text{ }^{\circ}\text{C}$		4.2	6.5	mA
Quiescent Current Change	$\Delta I_{BIAS}$	$-27\text{ V} \leq V_{IN} \leq -38\text{ V}$			1.0	mA
		$5\text{ mA} \leq I_o \leq 1\text{ A}$			0.5	
Output Noise Voltage	$V_n$	$T_J = 25\text{ }^{\circ}\text{C}$ , $10\text{ Hz} \leq f \leq 100\text{ kHz}$		240		μVr.m.s
Ripple Rejection	$R \cdot R$	$T_J = 25\text{ }^{\circ}\text{C}$ , $f = 120\text{ Hz}$ , $-28\text{ V} \leq V_{IN} \leq -38\text{ V}$ , $I_o = 500\text{ mA}$	43	49		dB
Dropout Voltage	$V_{DIF}$	$T_J = 25\text{ }^{\circ}\text{C}$ , $I_o = 1\text{ A}$		1.2		V
Peak Output Current	$I_{Opeak}$	$T_J = 25\text{ }^{\circ}\text{C}$	1.6	2.2	2.8	A
Temperature Coefficient of Output Voltage	$ \Delta V_o/\Delta T $	$I_o = 5\text{ mA}$		1.1		mV/°C

TYPICAL CHARACTERISTICS ( $T_A = 25\text{ }^\circ\text{C}$ )



μPC7900AHF Series

3PIN PLASTIC SIP (MP-45G)



NOTE

Each lead centerline is located within 0.25 mm (0.01 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	10.4 MAX.	0.410 MAX.
B	7.0	0.276
C	1.2 MIN.	0.047 MIN.
D	17.0±0.3	0.669 <sup>+0.013</sup> <sub>-0.012</sub>
E	φ3.3±0.2	φ0.130±0.008
F	0.75±0.10	0.030 <sup>+0.004</sup> <sub>-0.005</sub>
G	0.25	0.010
H	2.54 (T.P.)	0.100 (T.P.)
I	5.0±0.3	0.197±0.012
J	2.66 MAX.	0.105 MAX.
K	4.8 MIN.	0.188 MIN.
L	8.5	0.335
M	8.5	0.335
N	4.5±0.2	0.177±0.008
P	2.8±0.2	0.110 <sup>+0.009</sup> <sub>-0.008</sub>
Q	22.4 MAX.	0.882 MAX.
U	2.4±0.5	0.094 <sup>+0.021</sup> <sub>-0.020</sub>
V	0.65±0.10	0.026 <sup>+0.004</sup> <sub>-0.005</sub>
Y	8.9±0.7	0.350±0.028
Z	1.0 MIN.	0.039 MIN.

P3HF-254B-2



**RECOMMENDED SOLDERING CONDITIONS**

When soldering this product, it is highly recommended to observe the conditions as shown below. If other soldering processes are used, or if the soldering is performed under different conditions, please make sure to consult with our sales offices.

For more details, refer to our document “**SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL**” (C10535E).

**TYPES OF THROUGH HOLE MOUNT DEVICE**

μPC7900AHF Series

Soldering Process	Soldering Conditions	Symbol
Wave soldering	Solder temperature: 260 °C or below. Flow Time: 10 seconds or below.	

**REFERENCE**

Document Name	Document No.
NEC semiconductor device reliability/quality control system.	IEI-1212
Quality grade on NEC semiconductor devices.	C11531E
Semiconductor device mounting technology manual.	C10535E
IC package manual.	C10943X
Guide to quality assurance for semiconductor devices.	MEI-1202
Semiconductors selection guide.	X10679E

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NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.