MICRO POWER SYSTEMS

AD810 AD811 AD812 AD813 AD818

NPN DUAL MONOLITHIC SILICON NITROX® TRANSISTORS

MONOLITHIC MATCHED PAIRS FOR DIFFERENTIAL AMPLIFIERS

HIGH GAIN ..... $h_{FE} \geq 150$ @ 10μA - 1mA

LOG CONFORMANCE AD818 $\Delta re \leq 1\Omega$ from ideal TYP.

V_{BE} MATCHING .. $|V_{BE_1} - V_{BE_2}| = .4mV$ TYP.

HIGH f_T ..... 250 MHz TYP. @ 1mA

ABSOLUTE MAXIMUM RATINGS (Note 1)

@ 25°C (unless otherwise noted)

Maximum Temperatures

Storage Temperature	-65°	to	+200°C
Operating Junction Temperature			+150°C
Lead Temperature (Soldering, 10 second time limit)			+260°C

Maximum Power Dissipation	**ONE SIDE**	**BOTH SIDES**
Device Dissipation @ Free Air	250mW	500mW
Linear Derating Factor	2.3mW/°C	4.3mW/°C

Maximum Voltage and Current for Each Transistor	**AD810**	**AD811**	**AD813**	**AD812**	**AD818**
V_{CBO} Collector to Base Voltage	25V	45V	60V	45V	25V
V_{CEO} Collector to Emitter Voltage	25V	45V	60V	45V	25V
V_{EBO} Emitter to Base Voltage (note 2)	6.5V	6.5V	6.5V	6.5V	6.5V
V_{CCO} Collector to Collector Voltage	35V	40V	50V	50V	45V
I_C Collector Current	20mA	20mA	20mA	20mA	20mA

ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	AD810	AD811	AD813	AD812	AD818		UNITS	CONDITIONS
Δre	Log Conformance					1.0	MAX.	Ω	I_C = 10-100-1000μA,
						0.2	TYP.	Ω	V_{CE} = 5V
h_{FE}	DC Current Gain	100	200	200	400	150	MIN.		
			600	600	1000	600	MAX.		I_C = 10μA, V_{CE} = 5V
h_{FE}	DC Current Gain	100	200	200	400	150	MIN.		
						600	MAX.		I_C = 1mA, V_{CE} = 5V
h_{FE}	DC Current Gain	85	170	170	350	150	MIN.		I_C = 5mA, V_{CE} = 5V
h_{FE} (-55°C)	DC Current Gain	35	75	75	150	50	MIN.		I_C = 10μA, V_{CE} = 5V
V_{BE} (ON)	Emitter-Base "ON" Voltage	0.7	0.7	0.7	0.7	0.7	MAX.	V	I_C = 10μA, V_{CE} = 5V
	Collector Saturation Voltage	0.5		0.3	0.3			V	I_C = 1mA, I_B = 0.1mA
V_{CE} (SAT)	Collector Saturation Voltage	1.0	0.8	0.8	0.8		MAX.	V	I_C = 5mA, I_B = 0.5mA
I_{CBO}	Collector Cutoff Current	1.0	0.2	0.2	0.2	0.2	MAX.	nA	I_E = 0, V_{CB} = Note 3
I_{CBO} (+150°C)	Collector Cutoff Current	1.0	0.2	0.2	0.2	0.2	MAX.	μA	I_E = 0, V_{CB} = Note 3
I_{EBO}	Emitter Cutoff Current	0.3	0.2	0.2	0.2	0.2	MAX.	nA	I_C = 0, V_{EB} = 5V
C_{OBO}	Output Capacitance	2.5	2.5	2.5	2.5	2.5	MAX.	pF	I_E = 0, V_{CB} = 5V
C_{TE}	Emitter Transition Capacitance	3	3	3	3	2	MAX.	pF	I_C = 0, V_{EB} = 0.5V
$C_{C_1C_2}$	Collector to Collector Capacitance	3	3	3	3	2	MAX.	pF	V_{CC} = 0

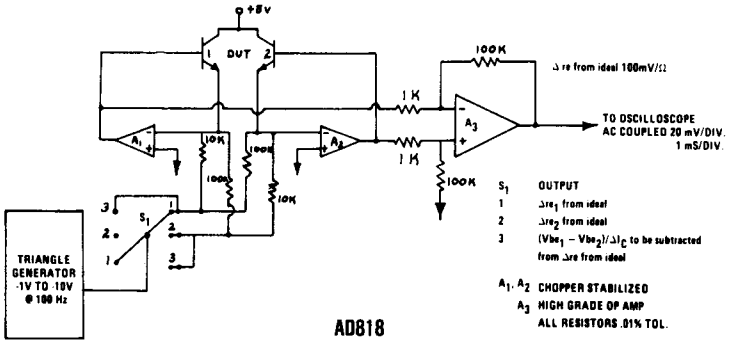
Notes and Additional Electrical Characteristics on next page.

ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	AD810	AD811	AD813	AD812	AD818			CONDITIONS
$I_{C_1C_2}$	Collector to Collector Leakage Current	1.0	0.5	0.5	0.5	0.5	MAX.	nA	V_{CE} = Note 4
f_T	Current Gain Bandwidth Product	100	100	100	100	100	MIN.	MHz	I_C = 200μA, V_{CE} = 5V
f_T	Current Gain Bandwidth Product	125	125	125	125	200	MIN.	MHz	I_C = 1mA, V_{CE} = 5V
Noise	Broad Band RMS Noise	1.0	1.0	1.0	1.0	1.0	MAX.	dB	I_C = 100μA, V_{CE} = 5V BW = 200 Hz, R_G = 10 Kohms
BV_{CBO}	Collector-Base Breakdown Voltage	35	45	45	35	25	MIN.	V	I_C = 10μA, I_E = 0
BV_{EBO}	Emitter-Base Breakdown Voltage	6.5	6.5	6.5	6.5	6.5	MIN.	V	I_E = 10μA, I_C = 0
V_{CEO} (SUST)	Collector-Emitter Sustaining Voltage	35	45	45	35	25	MIN.	V	I_B = 0, I_C = 100μA

MATCHING CHARACTERISTICS = 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	AD810	AD811	AD813	AD812	AD818			CONDITIONS
$\lvert V_{BE_1}\text{-}V_{BE_2}\rvert$	Base Emitter Voltage Differential	1.0	0.4	0.2	0.4	0.4	TYP.	mV	I_C = 10μA, V_{CE} = 5V
		3.0	1.5	0.5	1.0	1.0	MAX.	mV	
$\Delta\lvert(V_{BE_1}\text{-}V_{BE_2})\rvert$/°C	Base Emitter Voltage Differential	2.0	1	.5	1	1	TYP.	μV/°C	I_C = 10μA, V_{CE} = 5V
	Change with Temperature	15	7.5	2.5	5.0	5.0	MAX.	μV/°C	T_A = -55°C to +125°C
$\lvert I_{B_1}\text{-}I_{B_2}\rvert$	Base Current Differential	20	10	5	2.5	10	MAX.	nA	I_C = 10μA, V_{CE} = 5V
$\lvert\Delta(I_{B_1}\text{-}I_{B_2})\rvert$/°C	Base Current Differential Change With Temperature	0.6	0.3	0.3	0.5	0.5	MAX.	nA/°C	I_C = 10μA, V_{CE} = 5V T_A = -55°C to +125°C
h_{FE_1} / h_{FE_2}	DC Current Gain Differential	10	5	5	5	5	TYP.	%	I_C = 10μA, V_{CE} = 5V



AD818

LOG CONFORMANCE TEST CIRCUIT

NOTES:

1. These ratings are limiting values above which the serviceability of any semiconductor may be impaired.
2. The reverse base-to-emitter voltage must never exceed 7.0 volts and the reverse base-to-emitter current must never exceed 10μAmps.
3. For AD810 & AD818 V_{CB} = 20V; for AD811, AD812 & AD813 V_{CB} = 30V
4. For AD810, AD811, AD812 & AD818 V_{CE} = ±45V; for AD813 V_{CE} = ±100V

MICRO POWER SYSTEMS

AD814 AD815 AD816

HIGH VOLTAGE SUPER-BETA DUAL NPN SILICON NITROX® TRANSISTORS

MONOLITHIC SUPER-BETA MATCHED PAIRS FOR DIFFERENTIAL AMPLIFIERS

VERY HIGH GAIN ..... $h_{FE} \geq 2000$ @ 1.0μA - 500μA TYP.
LOW OUTPUT CAPACITANCE ..... $C_{obo} \leq 0.8pF$
TIGHT V_{BE} MATCHING ..... $|V_{BE_1} - V_{BE_2}| = 0.2mV$ TYP.
HIGH f_T ..... 100 MHz

ABSOLUTE MAXIMUM RATINGS (Note 1)

@ 25°C (unless otherwise noted)

Maximum Temperatures

Storage Temperature	-65°	to	+200°C
Operating Junction Temperature			+150°C
Lead Temperature (Soldering, 10 second time limit)			+260°C

Maximum Power Dissipation	**ONE SIDE**	**BOTH SIDES**
Device Dissipation @ Free Air	250mW	500mW
Linear Derating Factor	2.3mW/°C	4.3mW/°C

Maximum Voltage and Current for Each Transistor

	AD814	AD815	AD816
V_{CBO} Collector to Base Voltage	35V	20V	10V
V_{CEO} Collector to Emitter Voltage	35V	20V	10V
V_{EBO} Emitter to Base Voltage (note 2)	7V	7V	7V
V_{CC} Collector to Collector Voltage	100V	100V	100V
I_C Collector Current	10mA	10mA	10mA

ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	AD814	AD815	AD816	LIMIT	UNITS	CONDITIONS
h_{FE}	DC Current Gain	1000	2000	2000	TYP.		$I_C = 1\mu A$, $V_{CE} = 5V$
h_{FE}	DC Current Gain	1000	2000	2000	MIN.		$I_C = 10\mu A$, $V_{CE} = 5V$
h_{FE}	DC Current Gain	1000	2000	2000	TYP.		$I_C = 500\mu A$, $V_{CE} = 5V$
h_{FE} (-55°C)	DC Current Gain	600	800	800	MIN.		$I_C = 100\mu A$, $V_{CE} = 5V$
V_{BE} (ON)	Emitter-Base "ON" Voltage	0.7	0.7	0.7	MAX.	V	$I_C = 10\mu A$, $V_{CE} = 5V$
V_{CE} (SAT)	Collector Saturation Voltage	0.5	0.5	0.5	MAX.	V	$I_C = 1mA$, $I_B = 0.1mA$
I_{CBO}	Collector Cutoff Current	10	10	10	MAX.	pA	$I_E = 0$, V_{CB} = Note 3
I_{CBO} (+150°C)	Collector Cutoff Current	10	10	10	MAX.	nA	$I_E = 0$, V_{CB} = Note 3
I_{EBO}	Emitter Cutoff Current	5	5	5	MAX.	pA	$I_C = 0$, $V_{EB} = 5V$
C_{OBO}	Output Capacitance	0.8	0.8	0.8	MAX.	pF	$I_E = 0$, $V_{CB} = 1V$
C_{TE}	Emitter Transition Capacitance	1.0	1.0	1.0	MAX.	pF	$I_C = 0$, $V_{EB} = 0.5V$
$C_{C_1C_2}$	Collector to Collector Capacitance	1.2	1.2	1.2	MAX.	pF	$V_{CC} = 0$

Notes and Additional Electrical Characteristics on next page.

ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	AD814	AD815	AD816	LIMIT	UNITS	CONDITIONS
$I_{C_1C_2}$	Collector to Collector Leakage Current	10	10	10	MAX.	nA	V_{CC} = Note 4
f_T	Current Gain Bandwidth Product	10	10	10	MIN.	MHz	I_C = 10μA, V_{CE} = 5V
f_T	Current Gain Bandwidth Product	100	100	100	MIN.	MHz	I_C = 200μA, V_{CE} = 5V
NF	Narrow Band Noise Figure	3	3	3	MAX.	dB	I_C = 10μA, V_{CE} = 3V, f = 1KHz, R_G = 10 Kohms, BW = 200 Hz
BV_{CBO}	Collector-Base Breakdown Voltage	35	20	10	MIN.	V	I_C = 100μA, I_E = 0
BV_{EBO}	Emitter-Base Breakdown Voltage	7	7	7	MIN.	V	I_E = 10μA, I_C = 0
V_{CEO} (SUST)	Collector-Emitter Sustaining Voltage	35	20	10	MIN.	V	I_C = 100μA, I_B = 0

MATCHING CHARACTERISTICS = 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	AD814	AD815	AD816	LIMIT	UNITS	CONDITIONS
$\lvert V_{BE_1}\text{-}V_{BE_2}\rvert$	Base Emitter Voltage Differential	.2	.2	.2	TYP.	mV	I_C = 10μA, V_{CE} = 1V
		1	1	1	MAX.	mV	
$\Delta\lvert(V_{BE_1}\text{-}V_{BE_2})\rvert$ /°C	Base Emitter Voltage Differential Change with Temperature	1.0	1.0	1.0	TYP.	μV/°C	I_C = 10μA, V_{CE} = 1V T = -55°C to +125°C
		5.0	5.0	5.0	MAX.	μV/°C	
$\lvert I_{B_1}\text{-}I_{B_2}\rvert$	Base Current Differential	0.5	0.5	0.5	TYP.	nA	I_C = 10μA, V_{CE} = 1V
		1.0	1.0	1.0	MAX.		
h_{FE_1}/h_{FE_2}	DC Current Gain Differential	5	5	5	TYP.	%	I_C = 10μA, V_{CE} = 5V

NOTES:

1. These ratings are limiting values above which the serviceability of any semiconductor may be impaired.
2. The reverse base-to-emitter voltage must never exceed 7.0 volts and the reverse base-to-emitter current must never exceed 10μAmps.
3. For AD815 & AD814 V_{CB} = 10V; for AD816 V_{CB} = 5V
4. For AD815 & AD814 V_{CC} = ±100V; for AD816 V_{CB} = ±20V

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MICRO POWER SYSTEMS

AD820 AD821 AD822

PNP DUAL MONOLITHIC SILICON NITROX® TRANSISTORS

MATCHED PAIRS FOR DIFFERENTIAL AMPLIFIERS

HIGH GAIN ..... $h_{FE} \geq 200$ @ 10μA - 1mA
TIGHT V_{BE} MATCHING ..... $|V_{BE_1} - V_{BE_2}| = .2mV$ TYP.
HIGH f_T ..... 275 MHz TYP. @ 1mA

ABSOLUTE MAXIMUM RATINGS (Note 1)
@ 25°C (unless otherwise noted)

Maximum Temperatures

Storage Temperature	−65° to +200°C
Operating Junction Temperature	+150°C
Lead Temperature (Soldering, 10 second time limit)	+260°C

Maximum Power Dissipation	**ONE SIDE**	**BOTH SIDES**
Device Dissipation @ Free Air	250mW	500mW
Linear Derating Factor	2.3mW/°C	4.3mW/°C

Maximum Voltage and Current for Each Transistor	**AD820**	**AD821**	**AD822**
V_{CBO} Collector to Base Voltage	25V	45V	60V
V_{CEO} Collector to Emitter Voltage	25V	45V	60V
V_{EBO} Emitter to Base Voltage (note 2)	6.5V	6.5V	6.5V
V_{CCO} Collector to Collector Voltage	30V	60V	100V
I_C Collector Current	20mA	20mA	20mA

ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	AD820	AD821	AD822	LIMIT	UNITS	CONDITIONS
h_{FE}	DC Current Gain	100	150	200	MIN.		$I_C = 10\mu A$,
			600	600	MAX.		$V_{CE} = 5V$
h_{FE}	DC Current Gain	100	150	200	MIN.		$I_C = 100\mu A$, $V_{CE} = 5V$
			600	600	MAX.		
h_{FE}	DC Current Gain	100	150	200	MIN.		$I_C = 1mA$, $V_{CE} = 5V$
h_{FE} (-55°C)	DC Current Gain	30	50	75	MIN.		$I_C = 10\mu A$, $V_{CE} = 5V$
V_{BE} (ON)	Emitter-Base "ON" Voltage	0.7	0.7	0.7	MAX.	V	$I_C = 10\mu A$, $V_{CE} = 5V$
V_{CE} (SAT)	Collector Saturation Voltage	0.5	0.5	0.5	MAX.	V	$I_C = 1mA$, $I_B = 0.1mA$
I_{CBO}	Collector Cutoff Current	0.2	0.2	0.2	MAX.	nA	$I_E = 0$, V_{CB} = Note 3
I_{CBO} (+150°C)	Collector Cutoff Current	0.2	0.2	0.2	MAX.	μA	$I_E = 0$, V_{CB} = Note 3
I_{EBO}	Emitter Cutoff Current	0.2	0.2	0.2	MAX.	nA	$I_C = 0$, V_{EB} = Note 4
C_{OBO}	Output Capacitance	2	2	2	MAX.	pF	$I_E = 0$, $V_{CB} = 5.0V$
C_{TE}	Emitter Transition Capacitance	2	2	2	MAX.	pF	$I_C = 0$, $V_{EB} = 0.5V$
$C_{C_1C_2}$	Collector to Collector Capacitance	2	2	2	MAX.	pF	$V_{CC} = 0$

Notes and Additional Electrical Characteristics on next page.

ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	AD820	AD821	AD822		UNITS	CONDITIONS
$I_{C_1C_2}$	Collector to Collector Leakage Current	0.5	0.5	0.5	MAX.	nA	V_{CC} = Note 5
f_T	Current Gain Bandwidth Product		100	100	MIN.	MHz	I_C = 200μA, V_{CE}= 5V
f_T	Current Gain Bandwidth Product		200	200	MIN.	MHz	I_C = 1mA, V_{CE} = 5V
NF	Narrow Band Noise Figure		3	2	MAX.	dB	I_C = 100μA, V_{CE}= 5V BW = 200Hz, R_G = 10KΩ f = IKHz
BV_{CBO}	Collector-Base Breakdown Voltage	25	45	60	MIN.	V	I_C = 10μA, I_E = 0
BV_{EBO}	Emitter-Base Breakdown Voltage	6.5	6.5	6.5	MIN.	V	I_E = 10μA, I_C = 0
V_{CEO} (SUST)	Collector-Emitter Sustaining Voltage	25	45	60	MIN.	V	I_B = 0, I_C = 100μA

MATCHING CHARACTERISTICS = 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	AD820	AD821	AD822		UNITS	CONDITIONS
$\lvert V_{BE_1}-V_{BE_2}\rvert$	Base Emitter Voltage Differential	1	0.4	0.2	TYP.	mV	I_C = 10μA, V_{CE} = 5V
		5	1.0	0.5	MAX.	mV	
$\Delta\lvert(V_{BE_1}-V_{BE_2})\rvert$ /°C	Base Emitter Voltage Differential	2	1	0.5	TYP.	μV/°C	I_C = 10μA, V_{CE} = 5V
	Change with Temperature	20	5	2.5	MAX.	μV/°C	T_A = -55°C to +125°C
$\lvert I_{B_1}-I_{B_2}\rvert$	Base Current Differential		10	5	MAX.	nA	I_C = 10μA, V_{CE} = 5V
$\lvert\Delta(I_{B_1}-I_{B_2})\rvert$/°C	Base Current Differential Change with Temperature		0.5	0.3	MAX.	nA/°C	I_C = 10μA, V_{CE} = 5V T_A = -55° to +125°C
h_{FE_1}/h_{FE_2}	DC Current Gain Differential	10	5	5	TYP.	%	I_C = 10μA, V_{CE} = 5V

NOTES:

1. These ratings are limiting values above which the serviceability of any semiconductor may be impaired.
2. The reverse base-to-emitter voltage must never exceed 7.0 volts and the reverse base-to-emitter current must never exceed 10μAmps.
3. For AD820 V_{CB} = 20V; for AD821 & AD822 V_{CB} = 30V
4. For AD820 V_{EB} = 4V; for AD821 & AD822 V_{EB} = 5V
5. For AD821 V_{CC} = ±45V; for AD820 V_{CC} = ±25V; for AD822 V_{CC} = ±100V

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