MICRO POWER SYSTEMS

MP301 MP302 MP303

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	$C_{obo} \leq 0.8$pF
TIGHT V_{BE} MATCHING	$\lvert V_{BE_1} - V_{BE_2} \rvert = 0.2$mV 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

	MP301	MP302	MP303
V_{CBO} Collector to Base Voltage	18V	35V	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	MP301	MP302	MP303		UNITS	CONDITIONS
h_{FE}	DC Current Gain	2000	1000	2000	TYP.		$I_C = 1\mu A$, $V_{CE} = 5V$
h_{FE}	DC Current Gain	2000	1000	2000	MIN.		$I_C = 10\mu A$, $V_{CE} = 5V$
h_{FE}	DC Current Gain	2000	1000	2000	TYP.		$I_C = 500\mu A$, $V_{CE} = 5V$
h_{FE} (-55°C)	DC Current Gain	800	600	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	MP301	MP302	MP303		UNITS	CONDITIONS
$I_{C_1C_2}$	Collector to Collector Leakage Current	0.5	.5	.5	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	18	35	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

MATCHING CHARACTERISTICS = 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	MP301	MP302	MP303		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	I_C = 10μA, V_{CE} = 5V
$\Delta\lvert(V_{BE_1}\text{-}V_{BE_2})\rvert$/°C	Base Emitter Voltage Differential Change with Temperature	1.0	1.0	1.0	TYP.	μV/°C	I_C = 10μA, V_{CE} = 5V 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	1.0	.5	TYP.	nA	I_C = 10μA, V_{CE} = 1V
		1.0	5.0	1.5	MAX.	nA	I_C = 10μA, V_{CE} = 5V
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 10μ Amps.
3. For MP301 & 302 V_{CB} = 10V; for MP303, V_{CB} = 5V
4. For MP301 & MP302 V_{CC} = ±100V; for MP303 V_{CC} = ±20V

MICRO POWER SYSTEMS

MP310 MP311 MP312 MP313 MP318

NPN DUAL MONOLITHIC SILICON NITROX® TRANSISTORS

MONOLITHIC MATCHED PAIRS FOR DIFFERENTIAL AMPLIFIERS

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

LOG CONFORMANCE MP318 $\Delta re \leq 1\Omega$ 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

	MP310	MP311	MP312	MP313	MP318
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	7V	7V	7V	7V
V_{CCO} Collector to Collector Voltage	30V	100V	100V	100V	45V
I_C Collector Current	20mA	20mA	20mA	20mA	20mA

ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	MP310	MP311	MP312	MP313	MP318		UNITS	CONDITIONS
Δre	Log Conformance					1.5 0.2	MAX. TYP.	Ω Ω	I_C = 10-100-1000μA, V_{CE} = 5V
h_{FE}	DC Current Gain	150	150	200	400 1000	150 600	MIN. MAX.		I_C = 10μA, V_{CE} = 5V
h_{FE}	DC Current Gain	150	150	200	400	150 600	MIN. MAX.		I_C = 100μA, V_{CE} = 5V
h_{FE}	DC Current Gain	150	150	200	400	150	MIN.		I_C = 1mA, V_{CE} = 5V
h_{FE} (-55°C)	DC Current Gain	50	50	175	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
V_{CE} (SAT)	Collector Saturation Voltage	0.25	0.25	0.25	0.25	0.25	MAX.	V	I_C = 1mA, I_B = 0.1mA
I_{CBO}	Collector Cutoff Current	0.2	0.2	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	0.2	0.2	MAX.	μA	I_E = 0, V_{CB} = Note 3
I_{EBO}	Emitter Cutoff Current	0.2	0.2	0.2	0.2	0.2	MAX.	nA	I_C = 0, V_{EB} = 5V
C_{OBO}	Output Capacitance	2	2	2	2	2	MAX.	pF	I_E = 0, V_{CB} = 5V
C_{TE}	Emitter Transition Capacitance	2	2	2	2	2	MAX.	pF	I_C = 0, V_{EB} = 0.5V
$C_{C_1C_2}$	Collector to Collector Capacitance	2	2	2	2	2	MAX.	pF	V_{CC} = 0

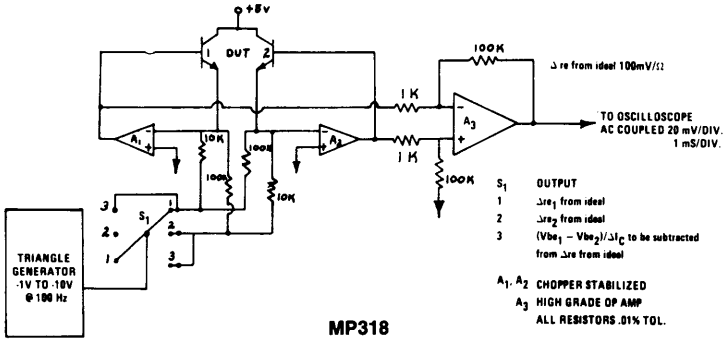
Notes and Additional Electrical Characteristics on next page.

ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	MP310	MP311	MP312	MP313	MP318			CONDITIONS
$I_{C_1C_2}$	Collector to Collector Leakage Current	0.5	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	200	200	200	200	200	MIN.	MHz	I_C = 1mA, V_{CE} = 5V
NF	Narrow Band Noise Figure	3	3	2	3	3	MAX.	dB	I_C = 100μA, V_{CE} = 5V BW = 200 Hz, R_G = 10 Kohms
BV_{CBO}	Collector-Base Breakdown Voltage	25	45	60	45	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	25	45	60	45	25	MIN.	V	I_B = 0, I_C = 100μA

MATCHING CHARACTERISTICS = 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	MP310	MP311	MP312	MP313	MP318			CONDITIONS
$\lvert V_{BE_1}\text{-}V_{BE_2}\rvert$	Base Emitter Voltage Differential	1.0	.4	0.2	.4	0.4	TYP.	mV	I_C = 10μA, V_{CE} = 5V
		3.0	1.0	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	15.0	5.0	2	5.0	5.0	MAX.		T_A = -55°C to +125°C
$\lvert I_{B_1}\text{-}I_{B_2}\rvert$	Base Current Differential				1.25		TYP.	nA	
			10	5	5	10	MAX.	nA	I_C = 10μA, V_{CE} = 5V
$\lvert\Delta(I_{B_1}\text{-}I_{B_2})\rvert$/°C	Base Current Differential		0.5	0.3	0.5	0.5	MAX.	nA/°C	I_C = 10μA, V_{CE} = 5V
	Change With Temperature								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



MP318

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 MP310 & 318 V_{CB} = 20V; for MP311, MP312 & MP313 V_{CB} = 30V
4. For MP310, MP311, MP313 & MP318 V_{CE} = ±45V; for MP312 V_{CE} = ±100V

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