

MP350 MP351 MP352 MP358



PNP DUAL MONOLITHIC SILICON NITROX[®] TRANSISTORS

MONOLITHIC MATCHED PAIRS FOR DIFFERENTIAL AMPLIFIERS

LOG CONFORMANCE MP358 $\Delta r_e \leq 1.2\Omega$ from ideal TYP.
 HIGH GAIN $h_{FE} \geq 200$ @ 10 μ A - 1mA
 TIGHT V_{BE} MATCHING $|V_{BE1} - V_{BE2}| = .2mV$ 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

	MP350	MP351	MP352	MP358
V_{CBO} Collector to Base Voltage	25V	45V	60V	20V
V_{CEO} Collector to Emitter Voltage	25V	45V	60V	20V
V_{EBO} Emitter to Base Voltage (note 2)	6V	6V	6V	6V
V_{CCO} Collector to Collector Voltage	30V	60V	100V	45V
I_C Collector Current	20mA	20mA	20mA	20mA

ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	MP350	MP351	MP352	MP358		UNITS	CONDITIONS
Δr_e	Log Conformance				1.5		Ω	$I_C = 10 - 100 - 1000\mu A$
h_{FE}	DC Current Gain	100	150	200	100	MIN.		$V_{CE} = 5V$
			600	600	600	MAX.		$I_C = 10\mu A, V_{CE} = 5V$
h_{FE}	DC Current Gain	100	150	200	100	MIN.		$I_C = 100\mu A, V_{CE} = 5V$
			600	600	600	MAX.		
h_{FE}	DC Current Gain	100	150	200	100	MIN.		$I_C = 1mA, V_{CE} = 5V$
$h_{FE} (-55^\circ C)$	DC Current Gain	30	50	175	50	MIN.		$I_C = 10\mu A, V_{CE} = 5V$
$V_{BE} (ON)$	Emitter-Base "ON" Voltage	0.7	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	0.5	MAX.	V	$I_C = 1mA, I_B = 0.1mA$
I_{CBO}	Collector Cutoff Current	0.2	0.2	0.2	0.2	MAX.	nA	$I_E = 0, V_{CB} = \text{Note 3}$
$I_{CBO} (+150^\circ C)$	Collector Cutoff Current	0.2	0.2	0.2	0.2	MAX.	μA	$I_E = 0, V_{CB} = \text{Note 3}$
I_{EBO}	Emitter Cutoff Current	0.2	0.2	0.2	0.2	MAX.	nA	$I_C = 0, V_{EB} = \text{Note 4}$
C_{OBO}	Output Capacitance	2	2	2	2	MAX.	pF	$I_E = 0, V_{CB} = 5.0V$
C_{TE}	Emitter Transition Capacitance	2	2	2	2	MAX.	pF	$I_C = 0, V_{EB} = 0.5V$
C_{C1C2}	Collector to Collector Capacitance	2	2	2	2	MAX.	pF	$V_{CC} = 0$

Notes and Additional Electrical Characteristics on next page.

MP350 MP351 MP352 MP358

ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	MP350	MP351	MP352	MP358		UNITS	CONDITIONS
I_{C1C2}	Collector to Collector Leakage Current	0.5	0.5	0.5	0.5	MAX.	nA	$V_{CC} = \text{Note 5}$
f_T	Current Gain Bandwidth Product	100	100	100	100	MIN.	MHz	$I_C = 200\mu A, V_{CE} = 5V$
f_T	Current Gain Bandwidth Product	200	200	200	200	MIN.	MHz	$I_C = 1mA, V_{CE} = 5V$
NF	Narrow Band Noise Figure	3	3	2	3	MAX.	dB	$I_C = 100\mu A, V_{CE} = 5V$ $BW = 200\text{Hz}, R_G = 10K\Omega$ $f = 1\text{KHz}$
BV_{CBO}	Collector-Base Breakdown Voltage	25	45	60	20	MIN.	V	$I_C = 10\mu A, I_E = 0$
BV_{EBO}	Emitter-Base Breakdown Voltage	6	6.5	6.5	6.5	MIN.	V	$I_E = 10\mu A, I_C = 0$
$V_{CEO} \text{ (SUST)}$	Collector-Emitter Sustaining Voltage	25	45	60	20	MIN.	V	$I_B = 0, I_C = 100\mu A$

MATCHING CHARACTERISTICS = 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	MP350	MP351	MP352	MP358		UNITS	CONDITIONS
$ V_{BE1} - V_{BE2} $	Base Emitter Voltage Differential	1	0.4	0.2	0.4	TYP.	mV	$I_C = 10\mu A, V_{CE} = 5V$
		5	1.0	0.5	1.0	MAX.	mV	
$\Delta V_{BE1} - V_{BE2} / ^\circ C$	Base Emitter Voltage Differential Change with Temperature	2	1	0.5	1	TYP.	$\mu V / ^\circ C$	$I_C = 10\mu A, V_{CE} = 5V$
		20	10.0	2.0	10.0	MAX.	$\mu V / ^\circ C$	$T_A = -55^\circ C \text{ to } +125^\circ C$
$ I_{B1} - I_{B2} $	Base Current Differential		5	5	5	MAX.	nA	$I_C = 10\mu A, V_{CE} = 5V$
$ \Delta(I_{B1} - I_{B2}) / ^\circ C$	Base Current Differential Change with Temperature		0.5	0.3	0.5	MAX.	$nA / ^\circ C$	$I_C = 10\mu A, V_{CE} = 5V$ $T_A = -55^\circ \text{ to } +125^\circ C$
h_{FE1} / h_{FE2}	DC Current Gain Differential	10	5	5	5	TYP.	%	$I_C = 10\mu A, V_{CE} = 5V$

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 MP350 $V_{CB} = 20V$; for MP351 & MP352 $V_{CB} = 30V$; for MP358 $V_{CB} = 15V$
4. For MP350 $V_{EB} = 4V$; for MP351, MP352 & MP358 $V_{EB} = 5V$
5. For MP351 & MP358 $V_{CC} = \pm 45V$; for MP352 $V_{CC} = \pm 100V$; for MP350 $V_{CC} = \pm 25V$

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MP360 MP361 MP362

PNP DUAL MONOLITHIC SILICON NITROX® TRANSISTORS

MONOLITHIC MATCHED PAIRS FOR DIFFERENTIAL AMPLIFIERS

HIGH GAIN $h_{FE} \geq 600$ @ $10\mu A - 1\mu A$
 TIGHT V_{BE} MATCHING $|V_{BE1} - V_{BE2}| = .2mV$ TYP.
 HIGH f_T 275 MHz TYP. @ 1mA
 LOW OUTPUT CAPACITANCE 1pF

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	MP360	MP361	MP362
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)	6V	6V	6V
V_{CC} Collector to Collector Voltage	30V	60V	100V
I_C Collector Current	20mA	20mA	20mA

ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	MP360	MP361	MP362		UNITS	CONDITIONS
h_{FE}	DC Current Gain	100	150	200	MIN.		$I_C = 10\mu A, V_{CE} = 5V$
			600	600	MAX.		
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.		$I_C = 1mA, V_{CE} = 5V$
$h_{FE} (-55^\circ C)$	DC Current Gain	30	50	175	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	$I_E = 0, V_{CB} = \text{Note 3}$
$I_{CBO} (+150^\circ C)$	Collector Cutoff Current	0.2	0.2	0.2	MAX.	μA	$I_E = 0, V_{CB} = \text{Note 3}$
I_{EBO}	Emitter Cutoff Current	0.2	0.2	0.2	MAX.	nA	$I_C = 0, V_{EB} = \text{Note 4}$
C_{OBO}	Output Capacitance	1	1	1	MAX.	pF	$I_E = 0, V_{CB} = 5V$
C_{TE}	Emitter Transition Capacitance	1	1	1	MAX.	pF	$I_C = 0, V_{EB} = 0.5V$
C_{C1C2}	Collector to Collector Capacitance	2	2	2	MAX.	pF	$V_{CC} = 0$

Notes and Additional Electrical Characteristics on next page.

MP360 MP361 MP362

ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	MP360	MP361	MP362		UNITS	CONDITIONS
I_{C1C2}	Collector to Collector Leakage Current	0.5	0.5	0.5	MAX.	nA	$V_{CC} = \text{Note 5}$
f_T	Current Gain Bandwidth Product	100	100	100	MIN.	MHz	$I_C = 200\mu A, V_{CE} = 5V$
f_T	Current Gain Bandwidth Product	200	200	200	MIN.	MHz	$I_C = 1mA, V_{CE} = 5V$
NF	Narrow Band Noise Figure	3	3	2	TYP.	dB	$I_C = 100\mu A, V_{CE} = 5V$ $BW = 200\text{Hz}, R_G = 10K\Omega$ $f = 1\text{KHz}$
BV_{CBO}	Collector-Base Breakdown Voltage	25	45	60	MIN.	V	$I_C = 10\mu A, I_E = 0$
BV_{EBO}	Emitter-Base Breakdown Voltage	6	6.5	6.5	MIN.	V	$I_E = 10\mu A, I_C = 0$
$V_{CEO}(\text{SUST})$	Collector-Emitter Sustaining Voltage	25	45	60	MIN.	V	$I_B = 0, I_C = 100\mu A$

MATCHING CHARACTERISTICS = 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	MP360	MP361	MP362		UNITS	CONDITIONS
$ V_{BE1} - V_{BE2} $	Base Emitter Voltage Differential	1	0.4	0.2	TYP.	mV	$I_C = 10\mu A, V_{CE} = 5V$
		5	1	0.5	MAX.	mV	
$\Delta(V_{BE1} - V_{BE2})/^\circ C$	Base Emitter Voltage Differential Change with Temperature	2	1.0	0.5	TYP.	$\mu V/^\circ C$	$I_C = 10\mu A, V_{CE} = 5V$
		20	5	2.0	MAX.	$\mu V/^\circ C$	$T_A = -55^\circ C \text{ to } +125^\circ C$
$ I_{B1} - I_{B2} $	Base Current Differential		10	5	MAX.	nA	
$ \Delta(I_{B1} - I_{B2})/^\circ C$	Base Current Differential Change With Temperature		0.5	0.3	MAX.	$nA/^\circ C$	$I_C = 10\mu A, V_{CE} = 5V$
							$I_C = 10\mu A, V_{CE} = 5V$
							$T_A = -55^\circ C \text{ to } +125^\circ C$
h_{FE1}/h_{FE2}	DC Current Gain Differential	10	5	5	TYP.	%	$I_C = 10\mu A, V_{CE} = 5V$

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 MP360 $V_{CB} = 20V$; for MP361 & MP362 $V_{CB} = 30V$
4. For MP360 $V_{EB} = 4V$; for MP361, & MP362 $V_{EB} = 5V$
5. For MP360 $V_{CC} = \pm 25V$; for MP361 $V_{CC} = \pm 45V$; for MP362 $V_{CC} = \pm 100V$

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