INTERSIL

2N4044, 2N4045, 2N4100, 2N4878, 2N4879, 2N4880 Dual Monolithic Matched NPN Silicon Planar Transistors

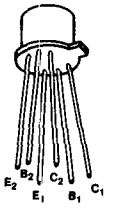
1

FEATURES

- High Gain At Low Current $h_{FE} \geq 200$ @ 10 μA
- Low Output Capacitance $C_{obo} \leq 0.8$ pF
- h_{FE} Match $h_{FE_1} / h_{FE_2} \leq 10\%$
- Tight V_{BE} Tracking
  $\Delta (V_{BE_1} - V_{BE_2}) \leq 3\ \mu V/^\circ C$ $-55^\circ C$ to $+125^\circ C$
- Dielectrically isolated matched pairs for differential amplifiers.

PIN CONFIGURATION

TO-71
TO-78



CHIP TOPOGRAPHY

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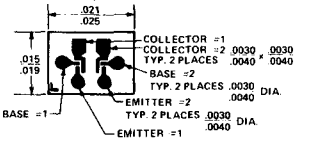

ABSOLUTE MAXIMUM RATINGS

@ 25°C (unless otherwise noted)

Maximum Temperatures

Storage Temperature	$-65^\circ C$ to $+200^\circ C$
Operating Junction Temperature	$+200^\circ C$

Maximum Power Dissipation

	TO-71		TO-78	
	ONE SIDE	BOTH SIDES	ONE SIDE	BOTH SIDES
Total Dissipation at 25°C Case Temperature	0.3 Watt	0.5 Watt	0.4 Watt	0.75 Watt
Derating Factor	1.7mW/°	2.9mW/°C	2.3mW/°C	4.3mW/°C

		2N4044 2N4878	2N4100 2N4879	2N4045 2N4880
V_{CBO}	Collector to Base Voltage	60 V	55 V	45 V
V_{CEO}	Collector to Emitter Voltage	60 V	55 V	45 V
V_{EBO}	Emitter to Base Voltage (Note 2)	7 V	7 V	7 V
V_{CCO}	Collector to Collector Voltage	100 V	100 V	100 V
I_C	Collector Current	10mA	10mA	10mA

ORDERING INFORMATION

TO-78	TO-71	WAFER	DICE
2N4044		2N4044/W	2N4044/D
2N4045		2N4045/W	2N4045/D
2N4100		2N4100/W	2N4100/D
	2N4878		
	2N4879		
	2N4880		

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N4044 2N4878		2N4100 2N4879		2N4045 2N4880		UNIT	TEST CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX		
h_{FE}	DC Current Gain	200	600	150	600	80	800		$I_C = 10\ \mu A$, $V_{CE} = 5V$
h_{FE}	DC Current Gain	225		175		100			$I_C = 1.0$ mA, $V_{CE} = 5$ V
$h_{FE}(-55^\circ C)$	DC Current Gain	75		50		30			$I_C = 10\ \mu A$, $V_{CE} = 5$ V
$V_{BE(on)}$	Emitter-Base On Voltage		0.7		0.7		0.7	V	$I_C = 10\ \mu A$, $V_{CE} = 5$ V
$V_{CE(sat)}$	Collector Saturation Voltage		0.35		0.35		0.35	V	$I_C = 1.0$ mA, $I_B = 0.1$ mA
I_{CBO}	Collector Cutoff Current		0.1		0.1		0.1	nA	$I_E = 0$, $V_{CB} = 45$ V, 30 V*
$I_{CBO}(+150^\circ C)$	Collector Cutoff Current		0.1		0.1		0.1	μA	$I_E = 0$, $V_{CB} = 45$ V, 30 V*
I_{EBO}	Emitter Cutoff Current		0.1		0.1		0.1	nA	$I_C = 0$, $V_{EB} = 5$ V
C_{obo}	Output Capacitance		0.8		0.8		0.8	pF	$I_E = 0$, $V_{CB} = 5$ V

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N4044 2N4878		2N4100 2N4879		2N4045 2N4880		UNIT	TEST CONDITIONS	
		MIN	MAX	MIN	MAX	MIN	MAX			
C_{TE}	Emitter Transition Capacitance		1		1		1	pF	$I_C = 0, V_{EB} = 0.5V$	
C_{C_1, C_2}	Collector to Collector Capacitance		0.8		0.8		0.8	pF	$V_{CC} = 0$	
I_{C_1, C_2}	Collector to Collector Leakage Current		5		5		5	pA	$V_{CC} = \pm 100V$	
$V_{CEO(sust)}$	Collector to Emitter Sustaining Voltage	60		55		45		V	$I_C = 1mA, I_B = 0$	
f_T	Current Gain Bandwidth Product	200		150		150		MHz	$I_C = 1mA, V_{CE} = 10V$	
f_T	Current Gain Bandwidth Product	20		15		15		MHz	$I_C = 10\mu A, V_{CE} = 10V$	
NF	Narrow Band Noise Figure		2		3		3	dB	$I_C = 10\mu A, V_{CE} = 5V$ $R_G = 10$ kohms	f = 1kHz BW = 200 Hz
BV_{CBO}	Collector Base Breakdown Voltage	60		55		45		V	$I_C = 10\mu A, I_E = 0$	
BV_{EBO}	Emitter Base Breakdown Voltage	7		7		7		V	$I_E = 10\mu A, I_C = 0$	

MATCHING CHARACTERISTICS (25°C unless otherwise noted)

h_{FE_1}/h_{FE_2}	DC Current Gain Ratio (Note 3)	0.9	1	0.85		0.8	1		$I_C = 10\mu A$ to 1mA, $V_{CE} = 5V$	
$\|V_{BE_1}-V_{BE_2}\|$	Base Emitter Voltage Differential		3		5		5	mV	$I_C = 10\mu A, V_{CE} = 5V$	
$\|I_{B_1}-I_{B_2}\|$	Base Current Differential		5		10		25	nA	$I_C = 10\mu A, V_{CE} = 5V$	
$\|\Delta(V_{BE_1}-V_{BE_2})\|/°C$	Base Current Differential Voltage Differential Change with Temperature		3		5		10	$\mu V/°C$	$I_C = 10\mu A$, $V_{CE} = 5V$	$T_A = -55°C$ to $+125°C$
$\|\Delta(I_{B_1}-I_{B_2})\|/°C$	Base Current Differential Change with Temperature		0.3		0.5		1	nA/°C	$I_C = 10\mu A$, $V_{CE} = 5V$	$T_A = -55°C$ to $+125°C$

SMALL SIGNAL CHARACTERISTICS

PARAMETER		TYPICAL VALUE	UNIT	TEST CONDITIONS
h_{ib}	Input Resistance	28	ohms	$I_C = 1mA, V_{CB} = 5V$
h_{rb}	Voltage Feedback Ratio	4.3	$\times 10^{-4}$	$I_C = 1mA, V_{CB} = 5V$
h_{fe}	Small Signal Current Gain	250		$I_C = 1mA, V_{CB} = 5V$
h_{ob}	Output Conductance	0.6	$\times 10^{-7}$mhos	$I_C = 1mA, V_{CB} = 5V$
h_{ie}	Input Resistance	9.6	k ohms	$I_C = 1mA, V_{CB} = 5V$
h_{re}	Voltage Feedback Ratio	4.2	$\times 10^{-4}$	$I_C = 1mA, V_{CB} = 5V$
h_{oe}	Output Conductance	12	μmhos	$I_C = 1mA, V_{CB} = 5V$

NOTES:
1. These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.
2. The reverse base-to-enter voltage must never exceed 7.0 volts and the reverse base-to-emitter current must never exceed 10 μamps.
3. The lowest of two h_{FE} readings is taken as h_{FE_1} for purposes of this ratio.