

# Dielectrically Isolated Monolithic Dual NPN General Purpose Amplifier

**2N4044 / 2N4045 / 2N4100 / 2N4878 / 2N4879 / 2N4880**

**FEATURES**

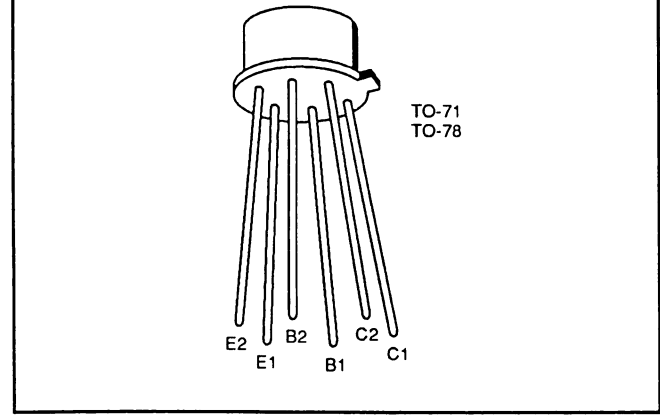
- High Gain at Low Current
- Low Output Capacitance
- Good  $h_{FE}$  Match
- Tight  $V_{BE}$  Tracking
- Dielectrically Isolated Matched Pairs for Differential Amplifiers

**ABSOLUTE MAXIMUM RATINGS**

( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Collector-Base or Collector-Emitter Voltage (Note 1)	
2N4044, 2N4878	60V
2N4100, 2N4879	55V
2N4045, 2N4880	45V
Collector-Collector Voltage	100V
Emitter Base Voltage (Note 2)	7V
Collector Current (Note 1)	10mA
Storage Temperature Range	$-65^\circ\text{C}$ to $+175^\circ\text{C}$
Operating Temperature Range	$-55^\circ\text{C}$ to $+175^\circ\text{C}$
Lead Temperature (Soldering, 10sec)	$+300^\circ\text{C}$

**PIN CONFIGURATION**



	TO-71		TO-78	
	One Side	Both Sides	One Side	Both Sides

Power Dissipation	200mW	400mW	250mW	500mW
Derate above $25^\circ\text{C}$ (mW/ $^\circ\text{C}$ )	1.3	2.7	1.7	3.3

**NOTE:** Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise specified)

SYMBOL	PARAMETER	2N4044 2N4878		2N4100 2N4879		2N4045 2N4880		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX		
$h_{FE}$	DC Current Gain	200	600	150	600	80	800	V	$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$
		225		175		100			$I_C = 1.0\text{mA}, V_{CE} = 5\text{V}$
		75		50		30			$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$ $T_A = -55^\circ\text{C}$
$V_{BE(on)}$	Emitter-Base On Voltage		0.7		0.7		0.7	V	$I_C = 1.0\text{mA}, I_B = 0.1\text{mA}$
$V_{CE(sat)}$	Collector Saturation Voltage		0.35		0.35		0.35		
$I_{CBO}$	Collector Cutoff Current		0.1		0.1		0.1	nA	$I_E = 0, V_{CB} = 45\text{V}, 30\text{V}$ $T_A = 150^\circ\text{C}$
			0.1		0.1		0.1	$\mu\text{A}$	
$I_{EBO}$	Emitter Cutoff Current		0.1		0.1		0.1	nA	$I_C = 0, V_{EB} = 5\text{V}$
$C_{obo}$	Output Capacitance (Note 4)		0.8		0.8		0.8	pF	$I_E = 0, V_{CB} = 5\text{V}, f = 1\text{MHz}$
$C_{ie}$	Emitter Transition Capacitance (Note 4)		1		1		1	pF	$I_C = 0, V_{EB} = 0.5\text{V}, f = 1\text{MHz}$
$C_{C1, C2}$	Collector to Collector Capacitance (Note 4)		0.8		0.8		0.8	pF	$V_{CC} = 0, f = 1\text{MHz}$
$I_{C1, C2}$	Collector to Collector Leakage Current		5		5		5	pA	$V_{CC} = \pm 100\text{V}$
$V_{CEO(sust)}$	Collector to Emitter Sustaining Voltage	60		55		45		V	$I_C = 10\text{mA}, I_B = 0$
$f_t$	Current Gain Bandwidth Product (Note 4)	200		150		150		MHz	$I_C = 10\text{mA}, V_{CE} = 10\text{V}$
$f_t$	Current Gain Bandwidth Product (Note 4)	20		15		15		MHz	$I_C = 10\mu\text{A}, V_{CE} = 10\text{V}$
NF	Narrow Band Noise Figure (Note 4)		2		3		3	dB	$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$ $R_G = 10\text{k}\Omega$ $f = 1\text{kHz}$ BW = 200Hz
$BV_{CBO}$	Collector Base Breakdown Voltage	60		55		45		V	$I_C = 10\mu\text{A}, I_E = 0$
$BV_{EBO}$	Emitter Base Breakdown Voltage (Note 2)	7		7		7		V	$I_E = 10\mu\text{A}, I_C = 0$

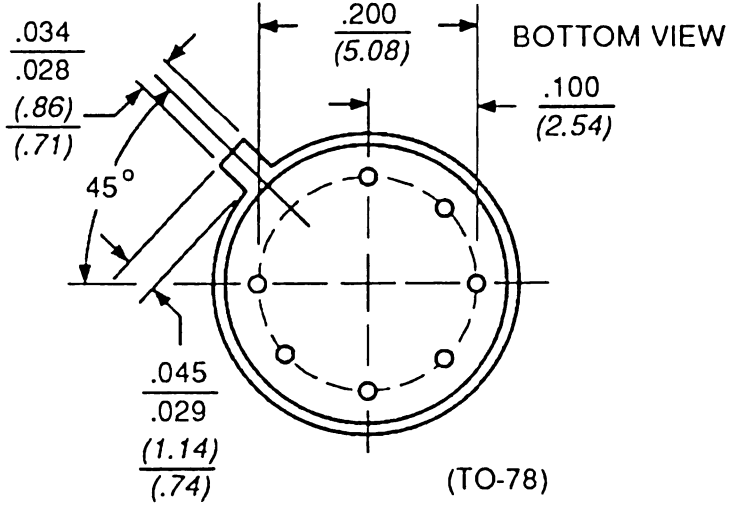
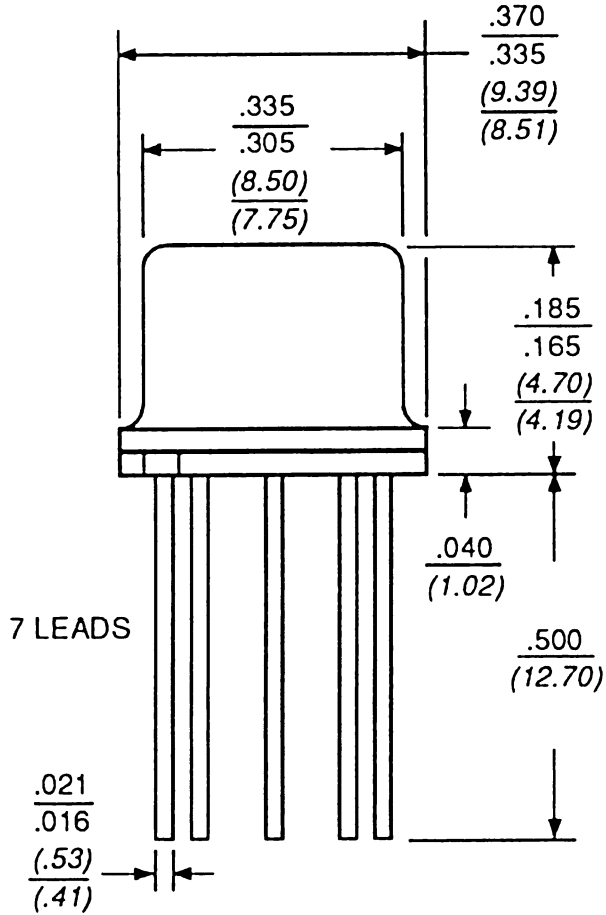
**MATCHING CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise specified)

$h_{FE1}/h_{FE2}$	DC Current Gain Ratio (Note 3)	0.9	1	0.85	1	0.8	1		$I_C = 10\mu\text{A}$ to 1mA, $V_{CE} = 5\text{V}$
$ V_{BE1} - V_{BE2} $	Base Emitter Voltage Differential		3		5		5	mV	$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$
$ I_{B1} - I_{B2} $	Base Current Differential		5		10		25	nA	$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$
$ \Delta(V_{BE1} - V_{BE2})/\Delta T $	Base Emitter Voltage Differential Change with Temperature		3		5		10	$\mu\text{V}/^\circ\text{C}$	$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$ $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$
$ \Delta(I_{B1} - I_{B2})/\Delta T $	Base Current Differential Change with Temperature		0.3		0.5		1	$\text{nA}/^\circ\text{C}$	

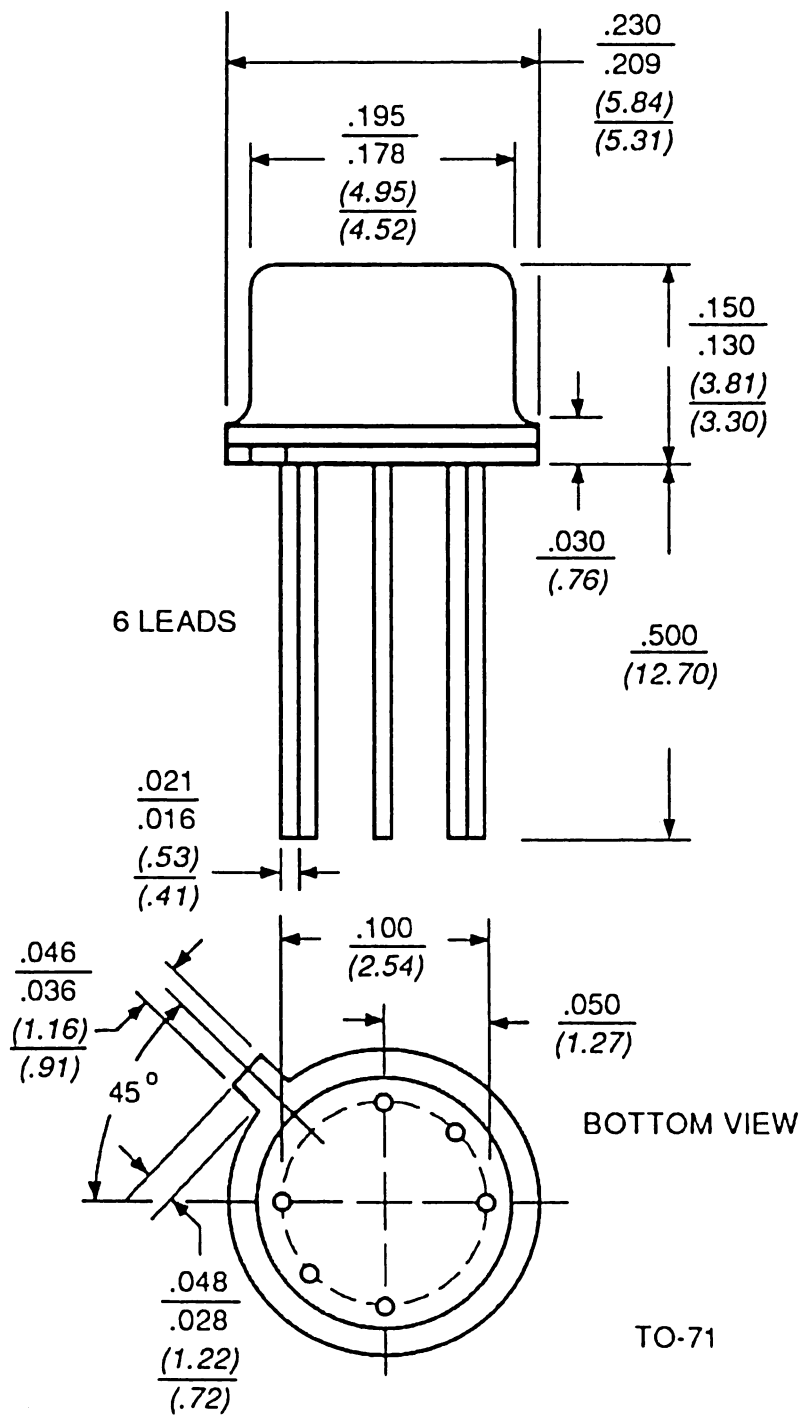
**SMALL SIGNAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise specified)

SYMBOL	PARAMETER	TYP. VALUE	UNITS	TEST CONDITIONS
$h_{ib}$	Input Resistance	28	$\Omega$	$I_C = 1\text{mA}, V_{CB} = 5\text{V}$ (Note 4)
$h_{rb}$	Voltage Feedback Ratio	43	$\times 10^{-3}$	
$h_{ie}$	Small Signal Current Gain	250		
$h_{ob}$	Output Conductance	60	$\mu\text{S}$	$I_C = 1\text{mA}, V_{CE} = 5\text{V}$ (Note 4)
$h_{ie}$	Input Resistance	9.6	$\text{k}\Omega$	
$h_{re}$	Voltage Feedback Ratio	42	$\times 10^{-3}$	
$h_{oe}$	Output Conductance	12	$\mu\text{S}$	

- NOTES:**
- Per transistor.
  - The reverse base-emitter voltage must never exceed 7.0 volts and the reverse base-emitter current must never exceed 10 $\mu\text{A}$ .
  - The lowest of two  $h_{FE}$  readings is taken as  $h_{FE1}$  for purposes of this ratio.
  - For design reference only, not 100% tested.



TO-78



TO-71