



MOTOROLA

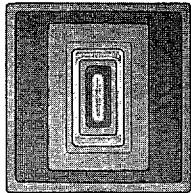
Semiconductors

BOX 955 • PHOENIX, ARIZONA 85001

MULTIPLE DEVICES

2N2913-2N2920

2N2972-2N2979

DUAL NPN SILICON ANNULAR^{*} TRANSISTORS

... especially designed for low-level, low-noise differential amplifier applications.

- High Breakdown Voltage
 $BV_{CEO} = 70$ Vdc typical
- Very High Beta Guaranteed from $10 \mu\text{Adc}$ to 1.0 mAdc
- Beta Match as tight as 0.9 to 1
- Base-Voltage Differential as low as
3 mW max at $I_C = 100 \mu\text{Adc}$
- Excellent Noise Characteristics
as low as 3.0 db max at $f = 1$ kc

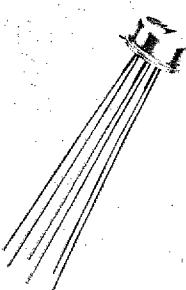
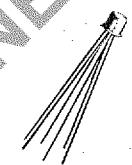
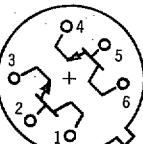
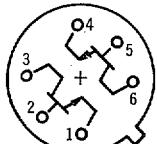
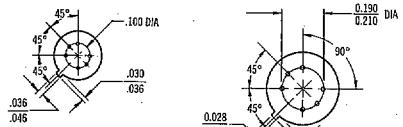
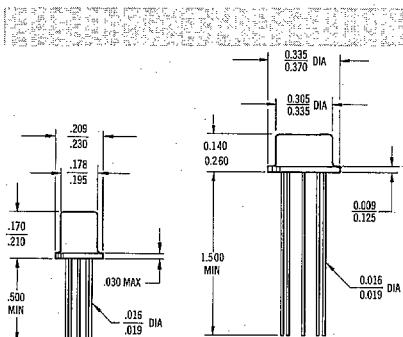
ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Characteristics	Symbol	Rating		Unit
		2N2913-18 2N2972-77	2N2919-20 2N2978-79	
Collector-Base Voltage	V_{CBO}	45	60	Vdc
Collector-Emitter Voltage	V_{CEO}	45	60	Vdc
Emitter-Base Voltage	V_{EBO}	6		Vdc
DC Collector Current	I_C	30		μAdc
Junction Temperature	T_J	+200		$^\circ\text{C}$
Storage Temperature Range	T_{stg}	-65 to +200		$^\circ\text{C}$
		ONE SIDE	BOTH SIDES	
Total Device Dissipation @ $T_A = 25^\circ\text{C}$	P_D			
TO-5 Case Derate above 25°C		300 1.7	600 3.4	mW $\text{mW}/^\circ\text{C}$
TO-18 Case Derate above 25°C		250 1.43	300 1.72	mW $\text{mW}/^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$	P_D			
TO-5 Case Derate above 25°C		750 4.3	1500 8.6	mW $\text{mW}/^\circ\text{C}$
TO-18 Case Derate above 25°C		500 2.85	750 4.3	mW $\text{mW}/^\circ\text{C}$

* Patents pending

NPN SILICON
DUAL TRANSISTORS

AUGUST 1965 — DS 4522

6-LEAD TO-18
2N2972
THRU
2N29796-LEAD TO-5
2N2913
THRU
2N2920Pin Connections, Bottom View
All Leads Electrically Isolated From CaseTO-18 TYPE
2N2972-79TO-5 TYPE
2N2913-20

2N2913 thru 2N2920 / 2N2972 thru 2N2979

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

Characteristics		Symbol	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage ($I_C = 10 \mu\text{Adc}$, $I_E = 0$)	2N2913 thru 2N2918, 2N2972 thru 2N2977 2N2919, 2N2920, 2N2978, 2N2979	BV_{CBO}	45 60	— 90	—	Vdc
Collector-Emitter Sustaining Voltage ($I_C = 10 \text{ mA}$, $I_B = 0$)	2N2913, thru 2N2918, 2N2972 thru 2N2977 2N2919, 2N2920, 2N2978, 2N2979	$BV_{CEO(sus)}$	45 60	— 70	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = 10 \mu\text{Adc}$, $I_C = 0$)	All Types	BV_{EBO}	6	7	—	Vdc
Collector-Base Cutoff Current ($V_{CB} = 45 \text{ Vdc}$, $I_E = 0$) ($V_{CB} = 45 \text{ Vdc}$, $I_E = 0$, $T_A = 150^\circ\text{C}$)	2N2913 thru 18, 2N2972 thru 77 2N2919, 2N2920, 2N2978, 2N2979 All Types	I_{CBO}	— — —	— — —	0.010 0.002 10	μAdc
Collector-Emitter Cutoff Current ($V_{CE} = 5 \text{ Vdc}$, $I_B = 0$)	All Types	I_{CEO}	—	—	0.002	μAdc
Emitter-Base Cutoff Current ($V_{EB} = 5 \text{ Vdc}$, $I_C = 0$)	All Types	I_{EBO}	—	—	0.002	μAdc
Collector-Emitter Saturation Voltage ($I_C = 1 \text{ mA}$, $I_B = 0.1 \text{ mA}$)	All Types	$V_{CE(\text{sat})}$	—	—	0.35	Vdc
Base-Emitter "ON" Voltage ($I_C = 100 \mu\text{Adc}$, $V_{CE} = 5 \text{ Vdc}$)	All Types	$V_{BE(\text{ON})}$	—	—	0.7	Vdc
DC Current Gain*		h_{FE}	60 150	—	240 600	—
($I_C = 10 \mu\text{Adc}$, $V_{CE} = 5 \text{ Vdc}$)	2N2913, 15, 17, 19, 2N2972, 74, 76, 78 2N2914, 16, 18, 20, 2N2973, 75, 77, 79		15 30	—	—	—
($I_C = 10 \mu\text{Adc}$, $V_{CE} = 5 \text{ Vdc}$, $T_A = -55^\circ\text{C}$)	2N2913, 15, 17, 19, 2N2972, 74, 76, 78 2N2914, 16, 18, 20, 2N2973, 75, 77, 79		100 225	—	—	—
($I_C = 100 \mu\text{Adc}$, $V_{CE} = 5 \text{ Vdc}$)	2N2913, 15, 17, 19, 2N2972, 74, 76, 78 2N2914, 16, 18, 20, 2N2973, 75, 77, 79		150 300	—	—	—
($I_C = 1 \text{ mA}$, $V_{CE} = 5 \text{ Vdc}$)	2N2913, 15, 17, 19, 2N2972, 74, 76, 78 2N2914, 16, 18, 20, 2N2973, 75, 77, 79		—	—	—	—
Output Capacitance ($V_{CB} = 5 \text{ Vdc}$, $I_E = 0$, $f = 140 \text{ kc}$)	All Types	C_{obo}	—	4	6	pf
High Frequency Current Gain ($I_C = 500 \mu\text{A}$, $V_{CE} = 5 \text{ V}$, $f = 20 \text{ mc}$)	All Types	$ h_{fe} $	3.0	—	—	—
Input Impedance ($I_C = 1.0 \text{ mA}$, $V_{CB} = 5 \text{ V}$, $f = 1 \text{ kc}$)	All Types	h_{ib}	25	28	32	ohms
Output Admittance ($I_C = 1.0 \text{ mA}$, $V_{CB} = 5 \text{ V}$, $f = 1 \text{ kc}$)	All Types	h_{ob}	—	—	1.0	μmhos
Noise Figure ($I_C = 10 \mu\text{A}$, $V_{CE} = 5 \text{ V}$, $R_G = 10 \text{ kohms}$)		NF	—	—	—	db
	$f = 1 \text{ kc}$, $BW = 200 \text{ cps}$ 2N2914, 16, 18, 20, 73, 75, 77, 79 2N2913, 15, 17, 19, 72, 74, 76, 78		— — —	2 3 2	3 4 3	—
	$f = 10 \text{ cps}$ to 15.7 kc , $BW = 10 \text{ kc}$ 2N2914, 16, 18, 20, 73, 75, 77, 79 2N2913, 15, 17, 19, 72, 74, 76, 78		— —	3	4 3	—

MATCHING CHARACTERISTICS

DC Current Gain Ratio** ($I_C = 100 \mu\text{Adc}$, $V_{CE} = 5 \text{ Vdc}$)	2N2917, 18, 76, 77 2N2915, 16, 19, 20, 74, 75, 78, 79	h_{FE1}/h_{FE2}^{**}	0.8 0.9	—	1.0 1.0	—
Base Voltage Differential ($I_C = 10 \mu\text{A}$, to 1.0 mA , $V_{CE} = 5 \text{ Vdc}$)	2N2917, 18, 76, 77 2N2915, 16, 19, 20, 74, 75, 78, 79	$ V_{BE1}-V_{BE2} $	— — —	— — —	10 5 5	mVdc
($I_C = 100 \mu\text{Adc}$, $V_{CE} = 5 \text{ Vdc}$)	2N2917, 18, 76, 77 2N2915, 16, 19, 20, 74, 75, 78, 79		— — —	— — —	3	—
Base Voltage Differential Change ($I_C = 100 \mu\text{Adc}$, $V_{CE} = 5 \text{ Vdc}$, $T_A = -55$ to $+25^\circ\text{C}$)	2N2917, 18, 76, 77 2N2915, 16, 19, 20, 74, 75, 78, 79	$\Delta(V_{BE1}-V_{BE2})$	— — —	— — —	1.6 0.8 2.0	mVdc
($I_C = 100 \mu\text{Adc}$, $V_{CE} = 5 \text{ Vdc}$, $T_A = 25$ to 125°C)	2N2917, 18, 76, 77 2N2915, 16, 19, 20, 74, 75, 78, 79		— — —	— — —	1.0	—

* Pulse Test $\leq 300 \mu\text{sec}$, duty cycle $\leq 2\%$

**The lowest h_{FE} reading is taken as h_{FE1} for this ratio



MOTOROLA Semiconductor Products Inc.

BOX 955 • PHOENIX, ARIZONA 85001 • A SUBSIDIARY OF MOTOROLA INC.

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