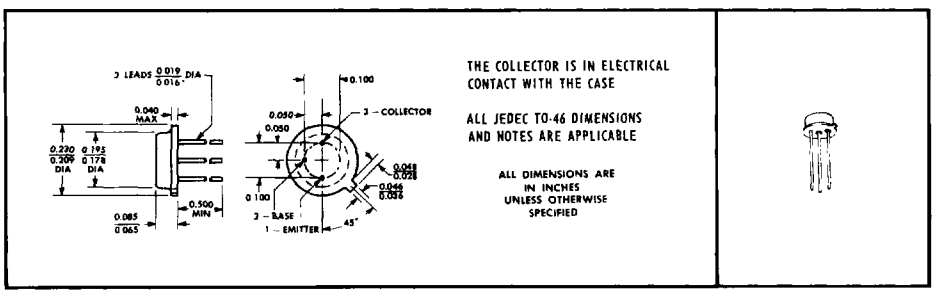
TYPES 2N2944, 2N2945, 2N2946, 2N2944A, 2N2945A, 2N2946A
P-N-P SILICON TRANSISTORS

BULLETIN NO. DL-S 679561, MARCH 1967

FOR LOW-LEVEL, HIGH-SPEED CHOPPER APPLICATIONS IN INVERTED CONNECTION

- **Low Guaranteed Offset Voltage**
- **High Emitter-Base Breakdown Voltage**
- **Greatly Improved $h_{FE(inv)}$ . . . 50 Min at I_B = 200 μA (2N2944A)**
- **Extremely Low $r_{ec(on)}$ . . . 4 Ω Max (2N2944A)**
- **Recommended For Complementary Use with 2N2432A**

***mechanical data**



†TI guaranteed minimum. The JEDEC registered minimum lead diameter for the TO-46 is 0.012.

***absolute maximum ratings at 25°C free-air temperature (unless otherwise noted)**

	2N2944 2N2944A	2N2945 2N2945A	2N2946 2N2946A
Collector-Base Voltage, V_{CB}	−15 V	−25 V	−40 V
Emitter-Collector Voltage, V_{ECO} (See Note 1)	−10 V	−20 V	−35 V
Emitter-Base Voltage, V_{EB}	−15 V	−25 V	−40 V
Continuous Collector Current	← −100 mA →		
Continuous Device Dissipation at (or below) 25°C Free-Air Temperature (See Note 2)	← 0.4 W →		
Storage Temperature Range	← −65°C to 200°C →		
Lead Temperature 1/16 Inch from Case for 10 Seconds	← 240°C →		

NOTES: 1. This value applies when the collector-base diode is open-circuited.

2. Derate linearly to 200°C free-air temperature at the rate of 2.3 mW/deg.

**Indicates JEDEC registered data*

USES CHIP P14

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electrical characteristics at 25°C free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS			2N2944 MIN	2N2944 MAX	2N2945 MIN	2N2945 MAX	2N2946 MIN	2N2946 MAX	UNIT
I_{CBO}	Collector Cutoff Current	V_{CB} = Rated V_{CB},	I_E = 0			–0.1*		–0.2*		–0.5*	nA
		V_{CB} = Rated V_{CB},	I_E = 0,	T_A = 100°C		–10		–20		–25	nA
I_{EBO}	Emitter Cutoff Current	V_{EB} = Rated V_{EB},	I_C = 0			–0.1*		–0.2*		–0.5*	nA
		V_{EB} = Rated V_{EB},	I_C = 0,	T_A = 100°C		–10		–15		–20	nA
h_{FE}	Static Forward Current Transfer Ratio	V_{CE} = –0.5 V,	I_C = –1 mA		80*		40*		30*		
$h_{FE(inv)}$	Static Forward Current Transfer Ratio (Inverted Connection)	V_{EC} = –0.5 V,	I_B = –200 μA		6		4		3		
$V_{EC(ofs)}$	Emitter-Collector Offset Voltage	I_B = –200 μA,	I_E = 0	See		–0.3		–0.5		–0.8	mV
		I_B = –1 mA,	I_E = 0	Figure		–0.6*		–1*		–2*	mV
		I_B = –2 mA,	I_E = 0	1		–1		–1.6		–2.5	mV
$r_{ec(on)}$	Small-Signal Emitter-Collector On-State Resistance	I_B = –1 mA,	I_E = 0,	I_o = 100 μA, f = 1 kHz, See Figure 2		20*		35*		45*	Ω
$\|h_{fe}\|$	Small-Signal Common-Emitter Forward Current Transfer Ratio	V_{CE} = –6 V,	I_C = –1 mA,	f = 1 MHz	10*		5*		3*		
C_{obo}	Common-Base Open-Circuit Output Capacitance	V_{CB} = –6 V,	I_E = 0,	f = 500 kHz		10*		10*		10*	pF
C_{ibo}	Common-Base Open-Circuit Input Capacitance	V_{EB} = –6 V,	I_C = 0,	f = 500 kHz		6*		6*		6*	pF

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electrical characteristics at 25°C free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS			2N2944A MIN	2N2944A MAX	2N2945A MIN	2N2945A MAX	2N2946A MIN	2N2946A MAX	UNIT
I_{CBO}	Collector Cutoff Current	V_{CB} = Rated V_{CB},	I_E = 0			–0.1*		–0.2*		–0.5*	nA
		V_{CB} = Rated V_{CB},	I_E = 0,	T_A = 100°C		–10*		–20*		–25*	nA
I_{EBO}	Emitter Cutoff Current	V_{EB} = Rated V_{EB},	I_C = 0			–0.1*		–0.2*		–0.5*	nA
		V_{EB} = Rated V_{EB},	I_C = 0,	T_A = 100°C		–10*		–15*		–20*	nA
h_{FE}	Static Forward Current Transfer Ratio	V_{CE} = –0.5 V,	I_C = –1 mA		100*		70*		50*		
$h_{FE(inv)}$	Static Forward Current Transfer Ratio (Inverted Connection)	V_{EC} = –0.5 V,	I_B = –200 μA		50*		30*		20*		
$V_{EC(ofs)}$	Emitter-Collector Offset Voltage	I_B = –200 μA,	I_E = 0	See		–0.3*		–0.5*		–0.8*	mV
		I_B = –1 mA,	I_E = 0	Figure		–0.6*		–1*		–2*	mV
		I_B = –2 mA,	I_E = 0	1		–1*		–1.6*		–2.5*	mV
$r_{ec(on)}$	Small-Signal Emitter-Collector On-State Resistance	I_B = –1 mA,	I_E = 0,	I_o = 100 μA, f = 1 kHz, See Figure 2		4*		6*		8*	Ω
$\|h_{fe}\|$	Small-Signal Common-Emitter Forward Current Transfer Ratio	V_{CE} = –6 V,	I_C = –1 mA,	f = 1 MHz	15*		10*		5*		
C_{obo}	Common-Base Open-Circuit Output Capacitance	V_{CB} = –6 V,	I_E = 0,	f = 0.1 MHz to 1 MHz		10*		10*		10*	pF
C_{ibo}	Common-Base Open-Circuit Input Capacitance	V_{EB} = –6 V,	I_C = 0,	f = 0.1 MHz to 1 MHz		6*		6*		6*	pF

PARAMETER MEASUREMENT INFORMATION

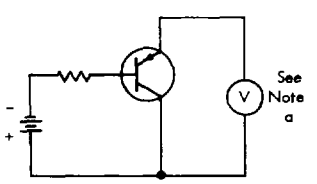

FIGURE 1

MEASUREMENT CIRCUIT FOR OFFSET VOLTAGE

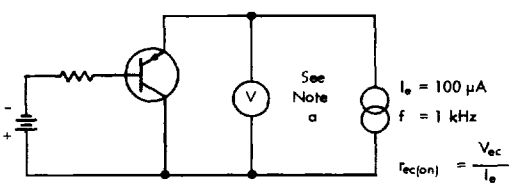

FIGURE 2

MEASUREMENT CIRCUIT FOR EMITTER-COLLECTOR ON-STATE RESISTANCE

NOTE a: The voltmeter must have high enough impedance that halving the value of the voltmeter impedance does not change the measured value.

*Indicates JEDEC registered data

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