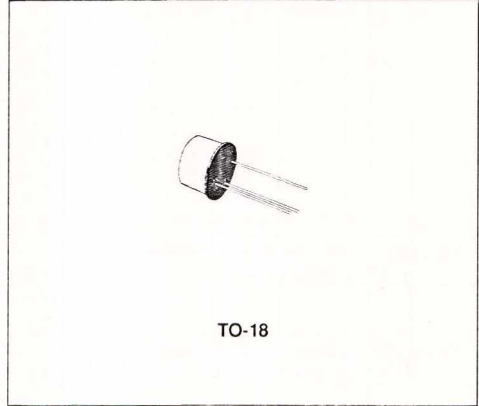


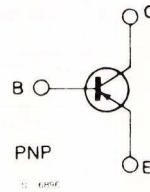
## LOW NOISE, LOW LEVEL AMPLIFIERS

### DESCRIPTION

The 2N3962, 2N3963, 2N3964 and 2N3965 are silicon planar epitaxial PNP transistors in Jedec TO-18 metal case particularly intended for use in low noise applications. They features are excellent current gain linearity from 1  $\mu$ A to 50 mA.



### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value			Unit
		2N3964	2N3962 2N3965	2N3963	
$V_{CB0}$	Collector-base Voltage ( $I_E = 0$ )	- 45	- 60	- 80	V
$V_{CE0}$	Collector-emitter Voltage ( $I_B = 0$ )	- 45	- 60	- 80	V
$V_{EB0}$	Emitter-base Voltage ( $I_C = 0$ )	- 6			V
$I_C$	Collector Current	- 200			mA
$P_{tot}$	Total Power Dissipation at $T_{amb} \leq 25^\circ\text{C}$ at $T_{case} \leq 25^\circ\text{C}$	0.36			W
		1.2			W
$T_{stg}, T_J$	Storage and Junction Temperature	- 65 to 200			$^\circ\text{C}$

**THERMAL DATA**

$R_{th\ j-case}$	Thermal Resistance Junction-case	Max	146	$^{\circ}C/W$
$R_{th\ j-amb}$	Thermal Resistance Junction-ambient	Max	487	$^{\circ}C/W$

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{CES}$	Collector Cutoff Current ( $V_{BE} = 0$ )	For <b>2N3964</b> $V_{CE} = -40\ V$ $V_{CE} = -40\ V$ $T_{amb} = 150^{\circ}C$ For <b>2N3962</b> and <b>2N3965</b> $V_{CE} = -50\ V$ $V_{CE} = -50\ V$ $T_{amb} = 150^{\circ}C$ For <b>2N3963</b> $V_{CE} = -70\ V$ $V_{CE} = -70\ V$ $T_{amb} = 150^{\circ}C$			-10 -10 -10 -10 -10 -10	nA $\mu A$ nA $\mu A$ nA $\mu A$
$I_{EBO}$	Emitter Cutoff Current ( $I_C = 0$ )	$V_{EB} = -4\ V$			-10	nA
$V_{(BR)CBO}$	Collector-base Breakdown Voltage ( $I_E = 0$ )	$I_C = -10\ \mu A$ For <b>2N3964</b> For <b>2N3962</b> and <b>2N3965</b> For <b>2N3963</b>	-45 -60 -80			V V V
$V_{(BR)CES}$	Collector-base Breakdown Voltage ( $V_{BE} = 0$ )	$I_C = -10\ \mu A$ For <b>2N3964</b> For <b>2N3962</b> and <b>2N3965</b> For <b>2N3963</b>	-45 -60 -80			V V V
$V_{(BR)CEO}^*$	Collector-emitter Breakdown Voltage ( $I_B = 0$ )	$I_C = -5\ mA$ For <b>2N3964</b> For <b>2N3962</b> and <b>2N3965</b> For <b>2N3963</b>	-45 -60 -80			V V V
$V_{(BR)EBO}$	Emitter-base Breakdown Voltage ( $I_C = 0$ )	$I_E = -10\ \mu A$	-6			V
$V_{CE(sat)}^*$	Collector-emitter Saturation Voltage	$I_C = -10\ mA$ $I_B = -0.5\ mA$ $I_C = -50\ mA$ $I_B = -5\ mA$			-0.25 -0.4	V V
$V_{BE(sat)}^*$	Base-emitter Saturation Voltage	$I_C = -10\ mA$ $I_B = -0.5\ mA$ $I_C = -50\ mA$ $I_B = -5\ mA$			-0.9 -0.95	V V
$h_{FE}^*$	DC Current Gain	For <b>2N3962</b> and <b>2N3963</b> $I_C = -1\ \mu A$ $V_{CE} = -5\ V$ $I_C = -10\ \mu A$ $V_{CE} = -5\ V$ $I_C = -100\ \mu A$ $V_{CE} = -5\ V$ $I_C = -1\ mA$ $V_{CE} = -5\ V$ $I_C = -10\ mA$ $V_{CE} = -5\ V$ $I_C = -50\ mA$ $V_{CE} = -5\ V$ $I_C = -10\ \mu A$ $V_{CE} = -5\ V$ $T_{amb} = -55^{\circ}C$	60 100 100 100 100 90 40		300 450	

\* Pulsed : pulse duration = 300  $\mu s$ , duty cycle = 1 %.

## ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$h_{FE}^*$	DC Current Gain	For <b>2N3962</b> and <b>2N3963</b> $I_C = -50 \text{ mA}$ $V_{CE} = -5 \text{ V}$ $T_{amb} = -55 \text{ }^\circ\text{C}$ $I_C = -1 \text{ mA}$ $V_{CE} = -5 \text{ V}$ $T_{amb} = 100 \text{ }^\circ\text{C}$ For <b>2N3964</b> and <b>2N3965</b> $I_C = -1 \text{ } \mu\text{A}$ $V_{CE} = -5 \text{ V}$ $I_C = -10 \text{ } \mu\text{A}$ $V_{CE} = -5 \text{ V}$ $I_C = -100 \text{ } \mu\text{A}$ $V_{CE} = -5 \text{ V}$ $I_C = -1 \text{ mA}$ $V_{CE} = -5 \text{ V}$ $I_C = -10 \text{ mA}$ $V_{CE} = -5 \text{ V}$ $I_C = -50 \text{ mA}$ $V_{CE} = -5 \text{ V}$ $I_C = -10 \text{ } \mu\text{A}$ $V_{CE} = -5 \text{ V}$ $T_{amb} = -55 \text{ }^\circ\text{C}$ $I_C = -50 \text{ mA}$ $V_{CE} = -5 \text{ V}$ $T_{amb} = -55 \text{ }^\circ\text{C}$ $I_C = -1 \text{ mA}$ $V_{CE} = -5 \text{ V}$ $T_{amb} = 100 \text{ }^\circ\text{C}$	45		600	
$h_{fe}$	Small Signal Current Gain	$I_C = -1 \text{ mA}$ $V_{CE} = -5 \text{ V}$ $f = 1 \text{ kHz}$ For <b>2N3962</b> and <b>2N3963</b> For <b>2N3964</b> and <b>2N3965</b>	100 250		550 700	
$f_T$	Transition Frequency	$I_C = -0.5 \text{ mA}$ $V_{CE} = -5 \text{ V}$ $f = 20 \text{ MHz}$ For <b>2N3962</b> and <b>2N3963</b> For <b>2N3964</b> and <b>2N3965</b>	40 50		160 160	MHz MHz
$C_{EBO}$	Emitter-base Capacitance	$I_C = 0$ $V_{EB} = -0.5 \text{ V}$ $f = 1 \text{ MHz}$			15	pF
$C_{CBO}$	Collector-base Capacitance	$I_E = 0$ $V_{CB} = -5 \text{ V}$ $f = 1 \text{ MHz}$			6	pF
NF	Noise Figure	$I_C = -20 \text{ } \mu\text{A}$ $V_{CE} = -5 \text{ V}$ $R_G = 10 \text{ k}\Omega$ For <b>2N3962</b> and <b>2N3963</b> $f = 10 \text{ to } 10\,000 \text{ Hz}$ $f = 100 \text{ Hz}$ $B = 15 \text{ Hz}$ $f = 1 \text{ kHz}$ $B = 150 \text{ Hz}$ $f = 10 \text{ kHz}$ $B = 1.5 \text{ kHz}$ For <b>2N3964</b> and <b>2N3965</b> $f = 10 \text{ to } 10\,000 \text{ Hz}$ $f = 10 \text{ Hz}$ $B = 2 \text{ Hz}$ $f = 100 \text{ Hz}$ $B = 15 \text{ Hz}$ $f = 1 \text{ kHz}$ $B = 150 \text{ Hz}$ $f = 10 \text{ kHz}$ $B = 1.5 \text{ kHz}$			3 10 3 3	2 dB dB dB dB

\* Pulsed : pulse duration = 300  $\mu\text{s}$ , duty cycle = 1 %.