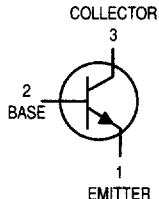


# Low Noise Transistor

## NPN Silicon

# MPSA18

Motorola Preferred Device



CASE 29-04, STYLE 1  
TO-92 (TO-226AA)

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	45	Vdc
Collector-Base Voltage	$V_{CBO}$	45	Vdc
Emitter-Base Voltage	$V_{EBO}$	6.5	Vdc
Collector Current — Continuous	$I_C$	200	mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	625 5.0	mW mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.5 12	Watts mW/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}^{(1)}$	200	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	83.3	$^\circ\text{C/W}$

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

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage <sup>(2)</sup> ( $I_C = 10 \text{ mAdc}, I_E = 0$ )	$V_{(BR)CEO}$	45	—	—	Vdc
Collector-Base Breakdown Voltage ( $I_C = 100 \mu\text{Adc}, I_E = 0$ )	$V_{(BR)CBO}$	45	—	—	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 10 \mu\text{Adc}, I_C = 0$ )	$V_{(BR)EBO}$	6.5	—	—	Vdc
Collector Cutoff Current ( $V_{CB} = 30 \text{ Vdc}, I_E = 0$ )	$I_{CBO}$	—	1.0	50	nAdc

- $R_{\theta JA}$  is measured with the device soldered into a typical printed circuit board.
- Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

Preferred devices are Motorola recommended choices for future use and best overall value.

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>ON CHARACTERISTICS(2)</b>					
DC Current Gain ( $I_C = 10\ \mu\text{A}$ , $V_{CE} = 5.0\ \text{Vdc}$ ) ( $I_C = 100\ \mu\text{A}$ , $V_{CE} = 5.0\ \text{Vdc}$ ) ( $I_C = 1.0\ \text{mA}$ , $V_{CE} = 5.0\ \text{Vdc}$ ) ( $I_C = 10\ \text{mA}$ , $V_{CE} = 5.0\ \text{Vdc}$ )	$h_{FE}$	400 500 500 500	580 850 1100 1150	— — — 1500	—
Collector–Emitter Saturation Voltage ( $I_C = 10\ \text{mA}$ , $I_B = 0.5\ \text{mA}$ ) ( $I_C = 50\ \text{mA}$ , $I_B = 5.0\ \text{mA}$ )	$V_{CE(\text{sat})}$	— —	— 0.08	0.2 0.3	Vdc
Base–Emitter On Voltage ( $I_C = 1.0\ \text{mA}$ , $V_{CE} = 5.0\ \text{Vdc}$ )	$V_{BE(\text{on})}$	—	0.6	0.7	Vdc

**SMALL–SIGNAL CHARACTERISTICS**

Current–Gain — Bandwidth Product ( $I_C = 1.0\ \text{mA}$ , $V_{CE} = 5.0\ \text{Vdc}$ , $f = 100\ \text{MHz}$ )	$f_T$	100	160	—	MHz
Collector–Base Capacitance ( $V_{CB} = 5.0\ \text{Vdc}$ , $I_E = 0$ , $f = 1.0\ \text{MHz}$ )	$C_{cb}$	—	1.7	3.0	pF
Emitter–Base Capacitance ( $V_{EB} = 0.5\ \text{Vdc}$ , $I_C = 0$ , $f = 1.0\ \text{MHz}$ )	$C_{eb}$	—	5.6	6.5	pF
Noise Figure ( $I_C = 100\ \mu\text{A}$ , $V_{CE} = 5.0\ \text{Vdc}$ , $R_S = 10\ \text{k}\Omega$ , $f = 1.0\ \text{kHz}$ ) ( $I_C = 100\ \mu\text{A}$ , $V_{CE} = 5.0\ \text{Vdc}$ , $R_S = 1.0\ \text{k}\Omega$ , $f = 100\ \text{Hz}$ )	NF	— —	0.5 4.0	1.5 —	dB
Equivalent Short Circuit Noise Voltage ( $I_C = 100\ \mu\text{A}$ , $V_{CE} = 5.0\ \text{Vdc}$ , $R_S = 1.0\ \text{k}\Omega$ , $f = 100\ \text{Hz}$ )	$V_T$	—	6.5	—	$\text{nV}/\sqrt{\text{Hz}}$

2. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

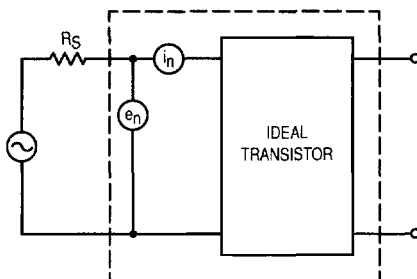
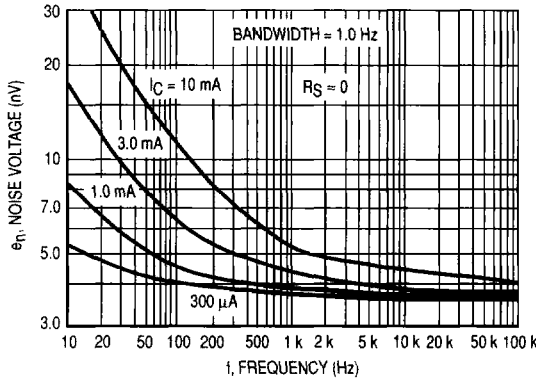


Figure 1. Transistor Noise Model

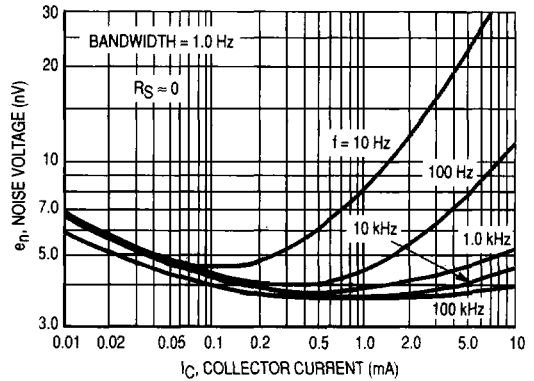
**NOISE CHARACTERISTICS**

( $V_{CE} = 5.0 \text{ Vdc}$ ,  $T_A = 25^\circ\text{C}$ )

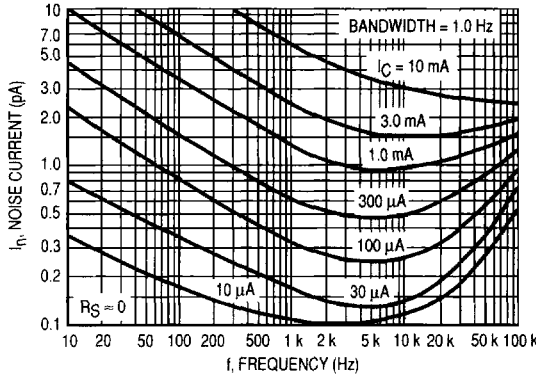
**NOISE VOLTAGE**



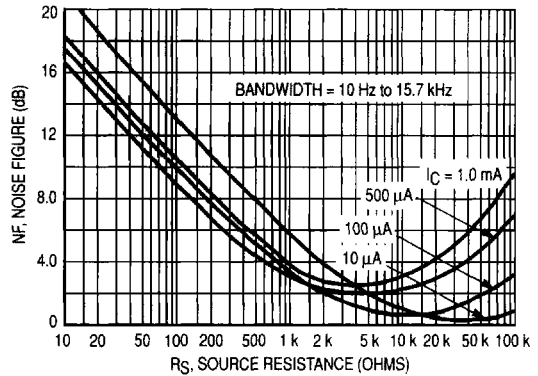
**Figure 2. Effects of Frequency**



**Figure 3. Effects of Collector Current**

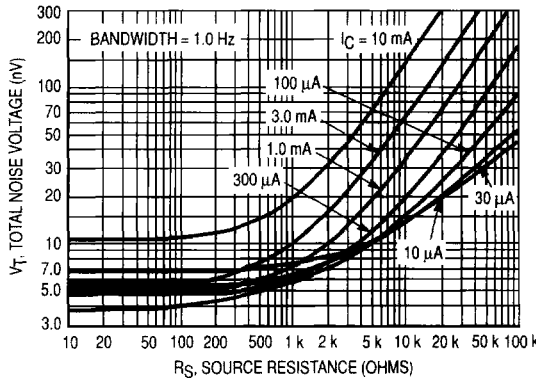


**Figure 4. Noise Current**

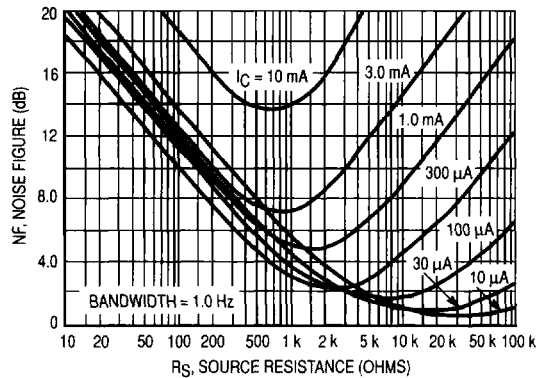


**Figure 5. Wideband Noise Figure**

**100 Hz NOISE DATA**



**Figure 6. Total Noise Voltage**



**Figure 7. Noise Figure**

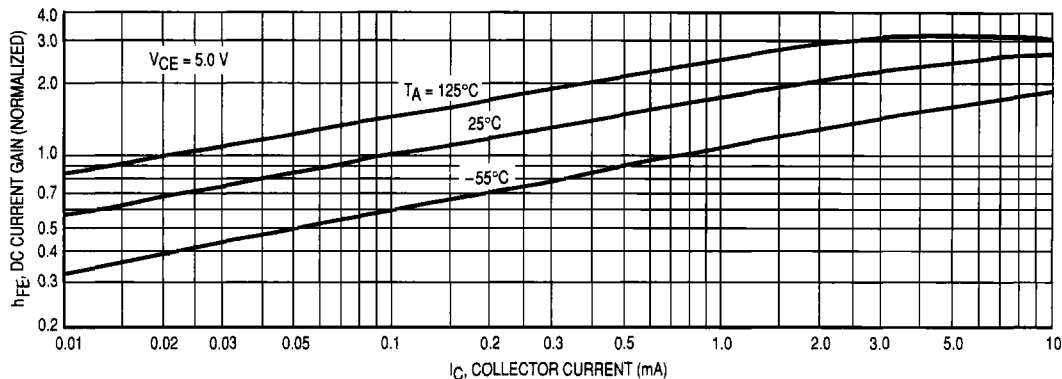


Figure 8. DC Current Gain

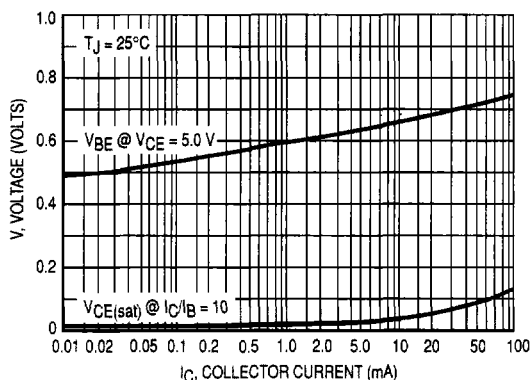


Figure 9. "On" Voltages

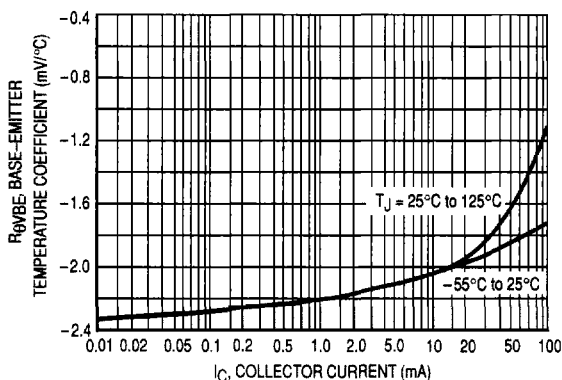


Figure 10. Temperature Coefficients

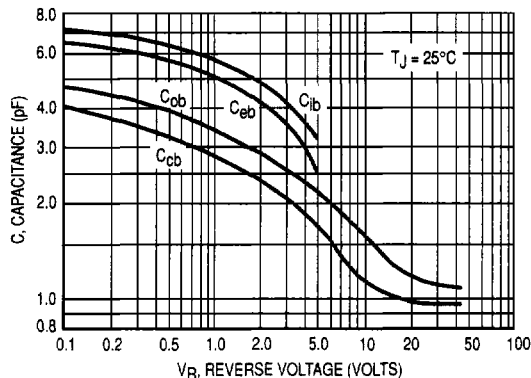


Figure 11. Capacitance

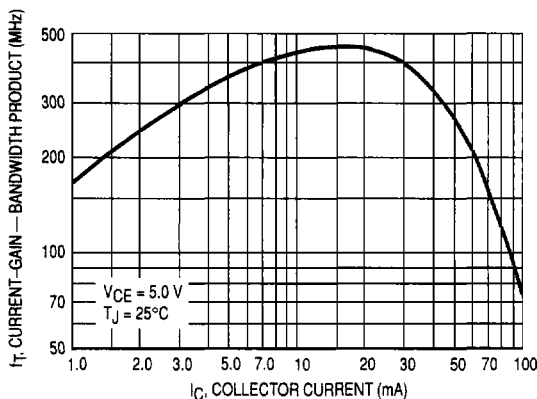


Figure 12. Current-Gain — Bandwidth Product