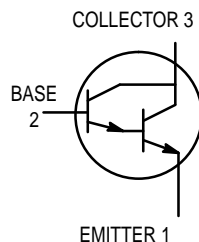


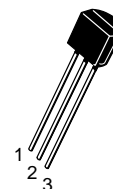
# Darlington Transistors

## NPN Silicon



**MPSA13**  
**MPSA14\***

\*Motorola Preferred Device



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

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	$V_{CES}$	30	Vdc
Collector–Base Voltage	$V_{CBO}$	30	Vdc
Emitter–Base Voltage	$V_{EBO}$	10	Vdc
Collector Current — Continuous	$I_C$	500	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	$R_{\theta JA}$	200	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	83.3	$^\circ\text{C}/\text{W}$

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

Characteristic	Symbol	Min	Max	Unit
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### OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage ( $I_C = 100 \mu\text{Adc}, I_B = 0$ )	$V_{(BR)CES}$	30	—	Vdc
Collector Cutoff Current ( $V_{CB} = 30 \text{ Vdc}, I_E = 0$ )	$I_{CBO}$	—	100	nAdc
Emitter Cutoff Current ( $V_{EB} = 10 \text{ Vdc}, I_C = 0$ )	$I_{EBO}$	—	100	nAdc

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

## MPSA13 MPSA14

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

Characteristic	Symbol	Min	Max	Unit
<b>ON CHARACTERISTICS(1)</b>				
DC Current Gain ( $I_C = 10 \text{ mA dc}$ , $V_{CE} = 5.0 \text{ V dc}$ )	$h_{FE}$	5,000	—	—
	MPSA13	10,000	—	—
	MPSA14	—	—	—
( $I_C = 100 \text{ mA dc}$ , $V_{CE} = 5.0 \text{ V dc}$ )	MPSA13	10,000	—	—
	MPSA14	20,000	—	—
Collector–Emitter Saturation Voltage ( $I_C = 100 \text{ mA dc}$ , $I_B = 0.1 \text{ mA dc}$ )	$V_{CE(sat)}$	—	1.5	Vdc
Base–Emitter On Voltage ( $I_C = 100 \text{ mA dc}$ , $V_{CE} = 5.0 \text{ V dc}$ )	$V_{BE(on)}$	—	2.0	Vdc
<b>SMALL–SIGNAL CHARACTERISTICS</b>				
Current–Gain – Bandwidth Product(2) ( $I_C = 10 \text{ mA dc}$ , $V_{CE} = 5.0 \text{ V dc}$ , $f = 100 \text{ MHz}$ )	$f_T$	125	—	MHz

1. Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ ; Duty Cycle  $\leq 2.0\%$ .
2.  $f_T = |h_{fe}| \cdot f_{\text{test}}$ .

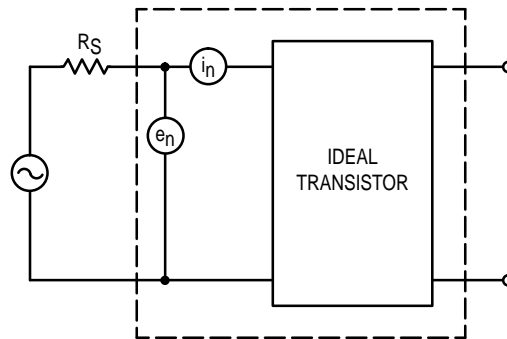
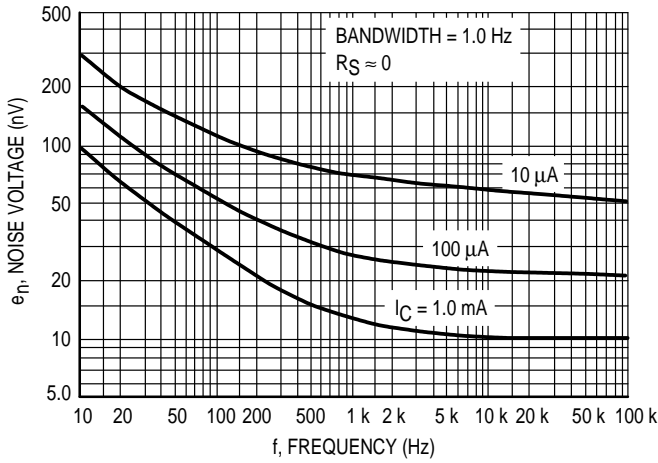


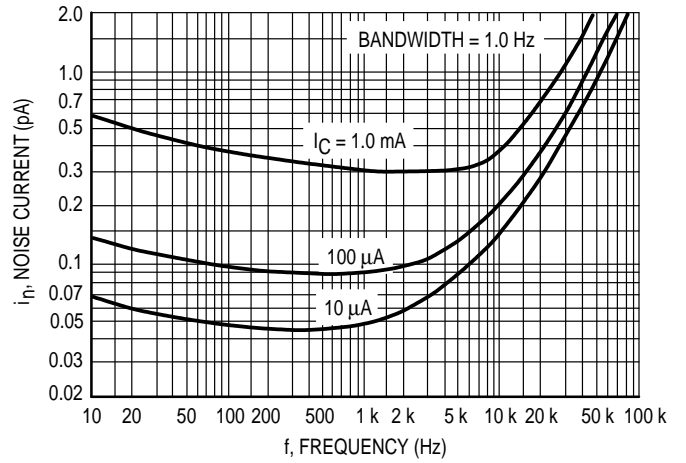
Figure 1. Transistor Noise Model

**NOISE CHARACTERISTICS**

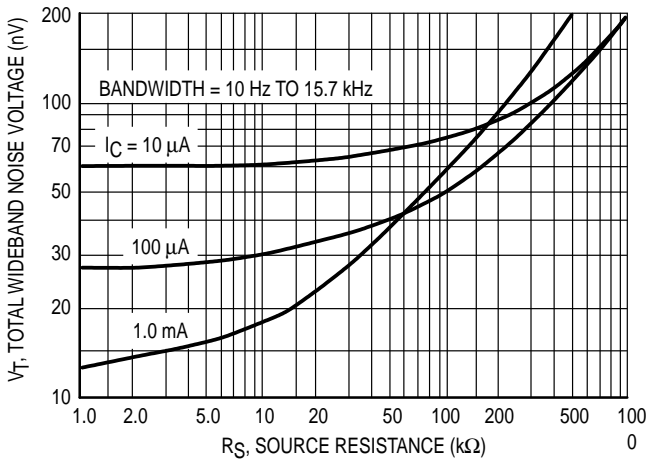
( $V_{CE} = 5.0 \text{ Vdc}$ ,  $T_A = 25^\circ\text{C}$ )



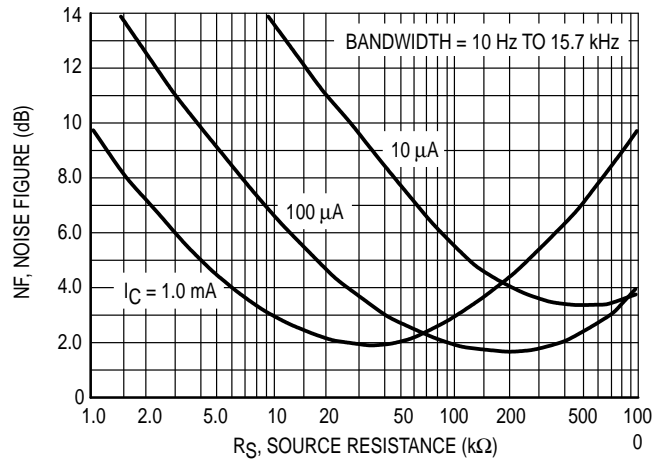
**Figure 2. Noise Voltage**



**Figure 3. Noise Current**



**Figure 4. Total Wideband Noise Voltage**



**Figure 5. Wideband Noise Figure**

SMALL-SIGNAL CHARACTERISTICS

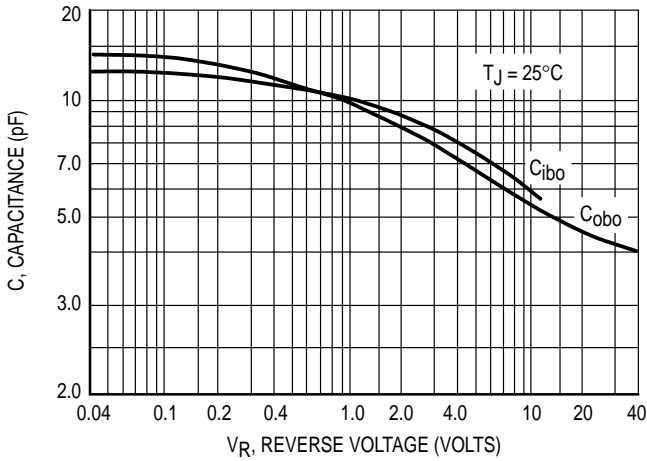


Figure 6. Capacitance

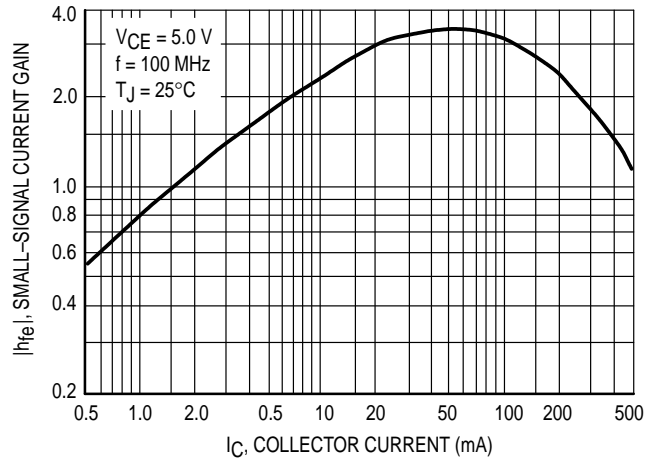


Figure 7. High Frequency Current Gain

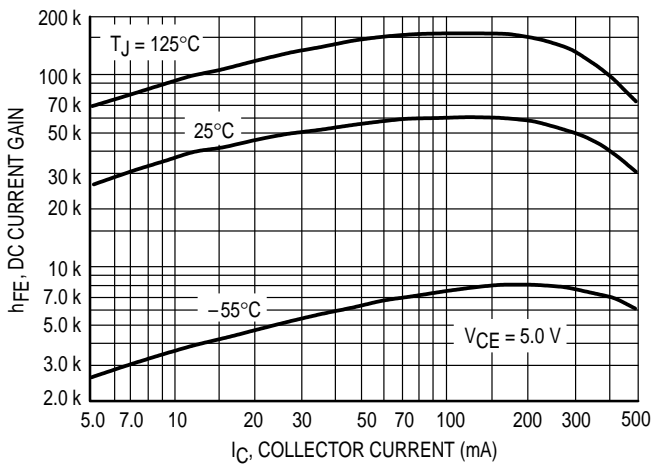


Figure 8. DC Current Gain

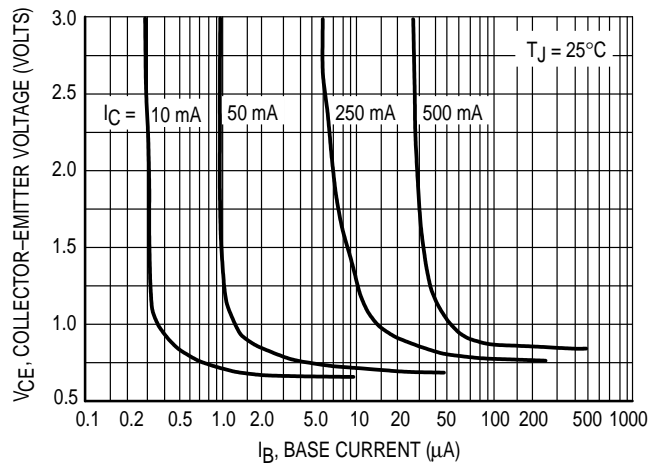


Figure 9. Collector Saturation Region

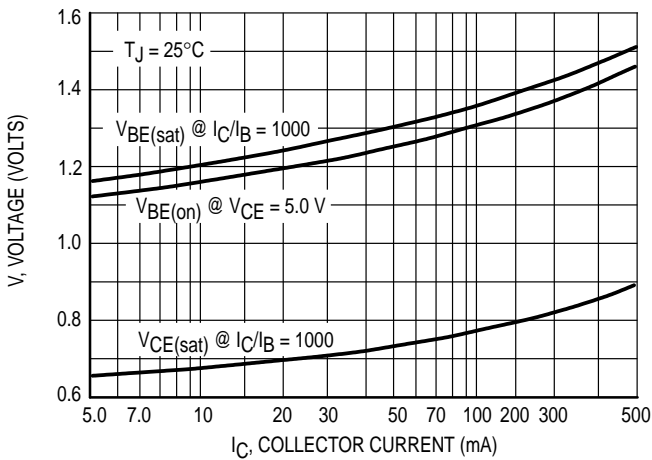


Figure 10. "On" Voltages

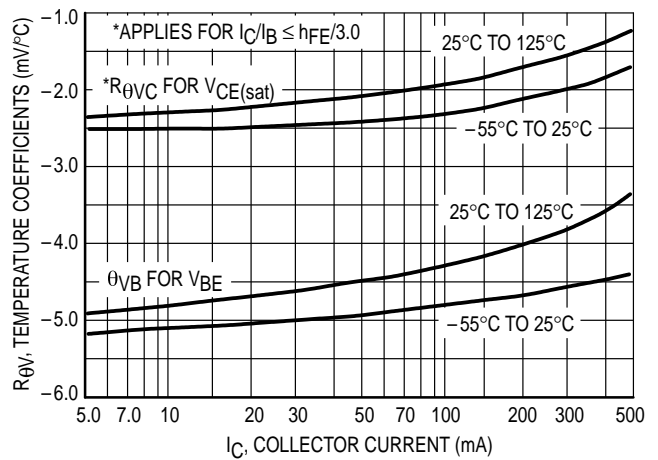


Figure 11. Temperature Coefficients

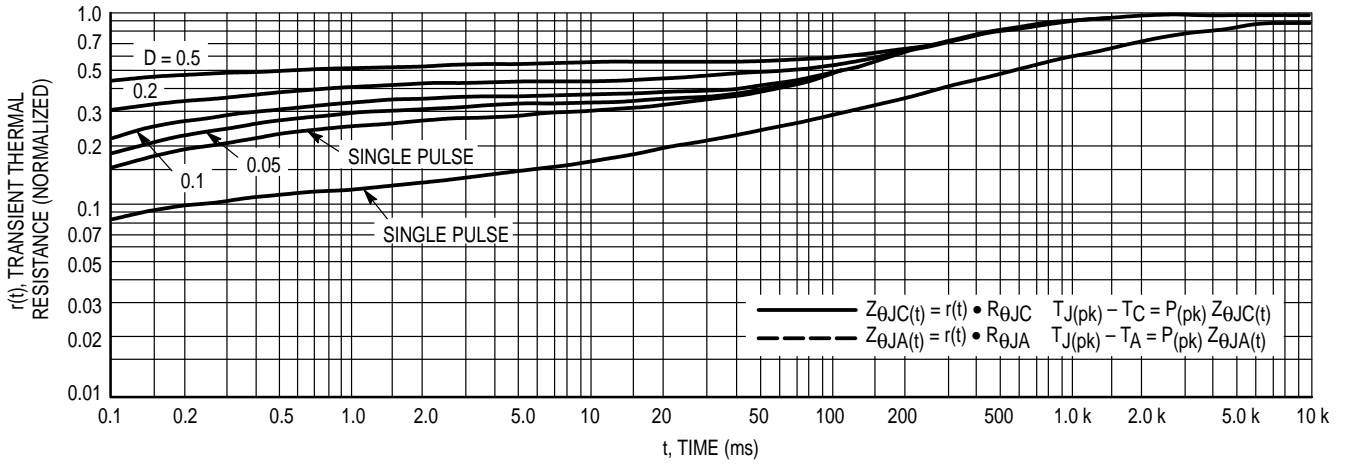


Figure 12. Thermal Response

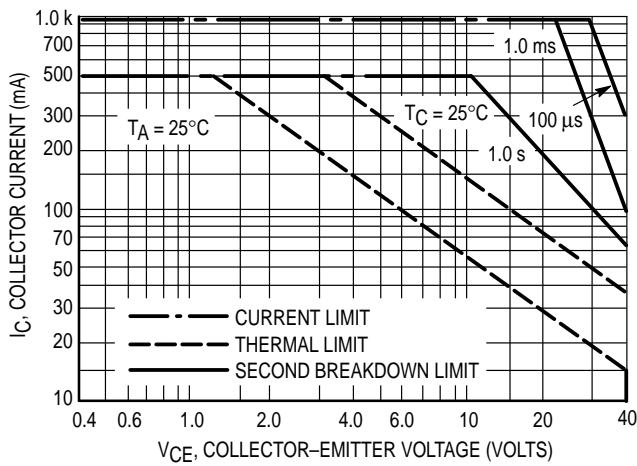
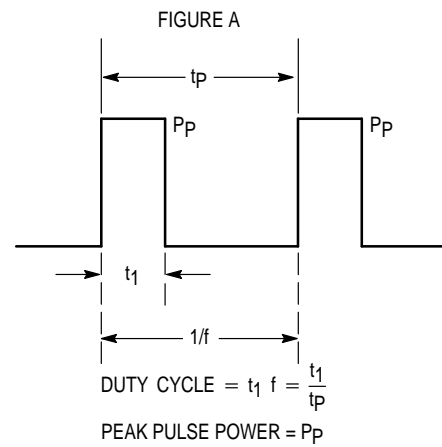


Figure 13. Active Region Safe Operating Area



Design Note: Use of Transient Thermal Resistance Data

PACKAGE DIMENSIONS



**CASE 029-04  
(TO-226AA)  
ISSUE AD**


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. DIMENSION F APPLIES BETWEEN P AND L. DIMENSION D AND J APPLY BETWEEN L AND K. MINIMUM LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.022	0.41	0.55
F	0.016	0.019	0.41	0.48
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	—	12.70	—
L	0.250	—	6.35	—
N	0.080	0.105	2.04	2.66
P	—	0.100	—	2.54
R	0.115	—	2.93	—
V	0.135	—	3.43	—

STYLE 1:

1. EMITTER
2. BASE
3. COLLECTOR

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