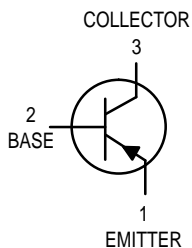


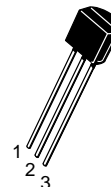
Chopper Transistor

PNP Silicon



MPS404A

Motorola Preferred Device



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

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	V_{CEO}	–35	Vdc
Collector–Base Voltage	V_{CBO}	–40	Vdc
Emitter–Base Voltage	V_{EBO}	–25	Vdc
Collector Current — Continuous	I_C	–150	mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	625 5.0	mW mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°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	Max	Unit
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OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage ⁽²⁾ ($I_C = -10$ mAdc, $I_E = 0$)	$V_{(BR)CEO}$	–35	—	Vdc
Collector–Base Breakdown Voltage ($I_C = -10$ μ Adc, $I_E = 0$)	$V_{(BR)CBO}$	–40	—	Vdc
Emitter–Base Breakdown Voltage ($I_E = -10$ μ Adc, $I_C = 0$)	$V_{(BR)EBO}$	–25	—	Vdc
Collector Cutoff Current ($V_{CB} = -10$ Vdc, $I_E = 0$)	I_{CBO}	—	–100	nAdc
Emitter Cutoff Current ($V_{BE} = -10$ Vdc, $I_C = 0$)	I_{EBO}	—	–100	nAdc

2. Pulse Test: Pulse Width ≤ 300 μ s, Duty Cycle $\leq 2.0\%$.

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

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (Continued)

Characteristic	Symbol	Min	Max	Unit
ON CHARACTERISTICS				
DC Current Gain (I _C = -12 mAdc, V _{CE} = -0.15 Vdc)	h _{FE}	30	400	—
Collector–Emitter Saturation Voltage (I _C = -12 mAdc, I _B = -0.4 mAdc) (I _C = -24 mAdc, I _B = -1.0 mAdc)	V _{CE(sat)}	— —	-0.15 -0.2	Vdc
Base–Emitter Saturation Voltage (I _C = -12 mAdc, I _B = -0.4 mAdc) (I _C = -24 mAdc, I _B = -1.0 mAdc)	V _{BE(sat)}	— —	-0.85 -1.0	Vdc
SMALL–SIGNAL CHARACTERISTICS				
Common–Base Cutoff Frequency (I _C = -1.0 mAdc, V _{CB} = 6.0 Vdc)	f _{ob}	4.0	—	MHz
Output Capacitance (V _{CB} = -6.0 Vdc, I _E = 0, f = 1.0 MHz)	C _{obo}	—	20	pF

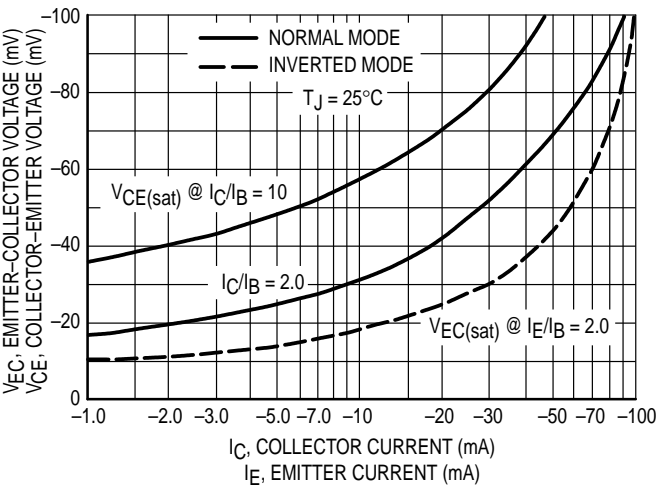


Figure 1. Collector–Emitter Voltage

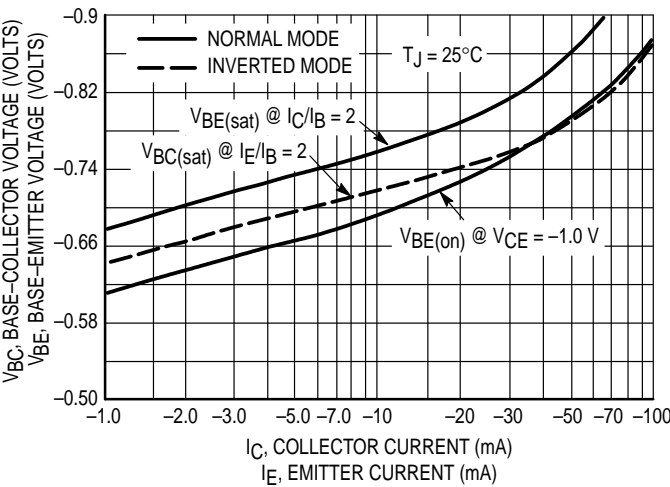


Figure 2. Base “On” Voltage

NORMAL MODE

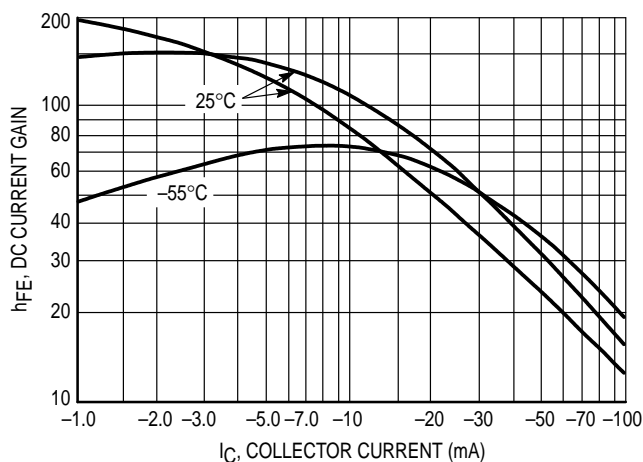
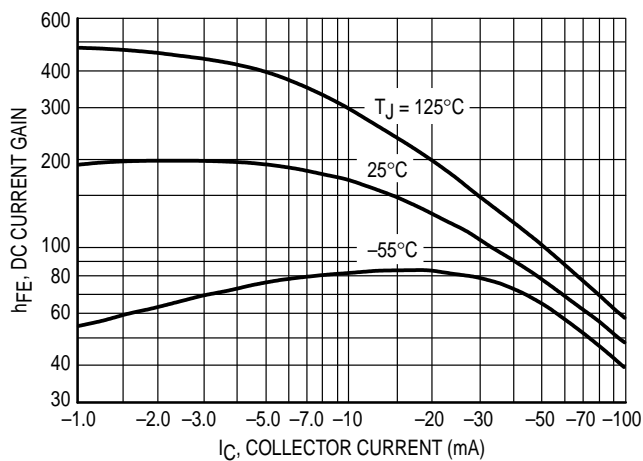
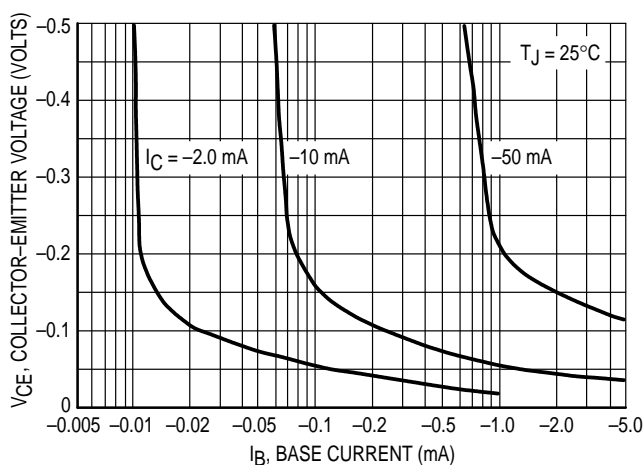
Figure 3. DC Current Gain @ $V_{CE} = -0.15$ VdcFigure 5. DC Current Gain @ $V_{CE} = -1.0$ Vdc

Figure 7. Collector Saturation Region

INVERTED MODE

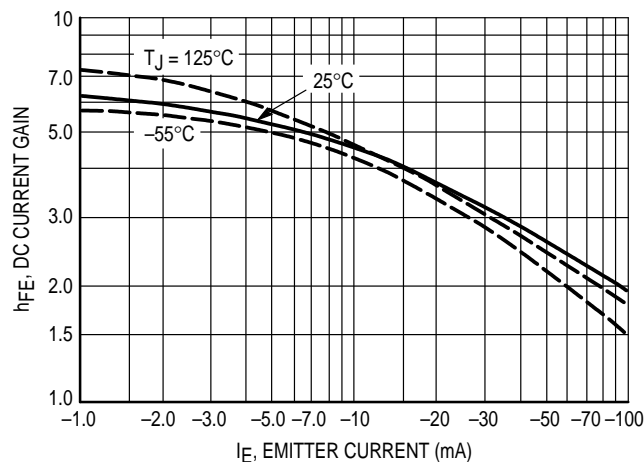
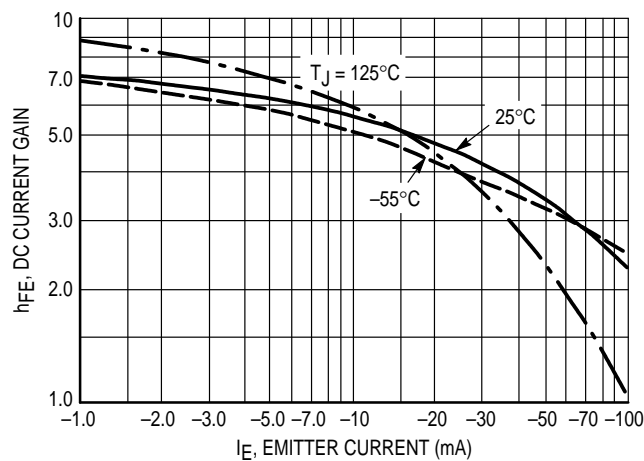
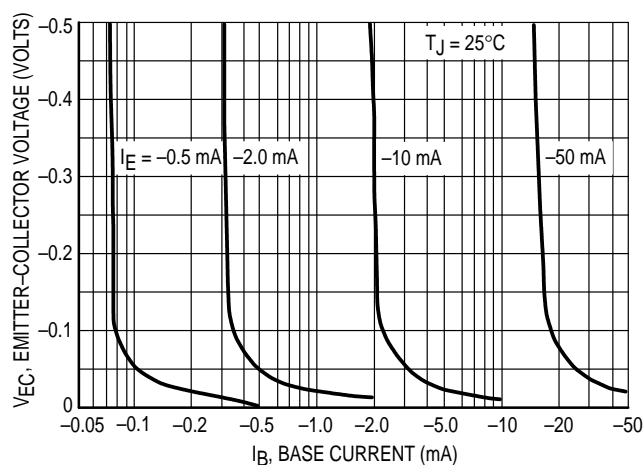
Figure 4. DC Current Gain @ $V_{EC} = -0.15$ VdcFigure 6. DC Current Gain @ $V_{EC} = -1.0$ Vdc

Figure 8. Emitter Saturation Region

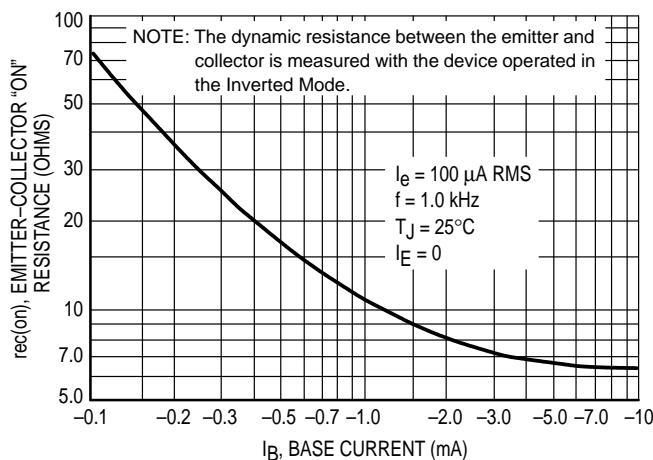


Figure 9. Emitter-Collector "On" Resistance

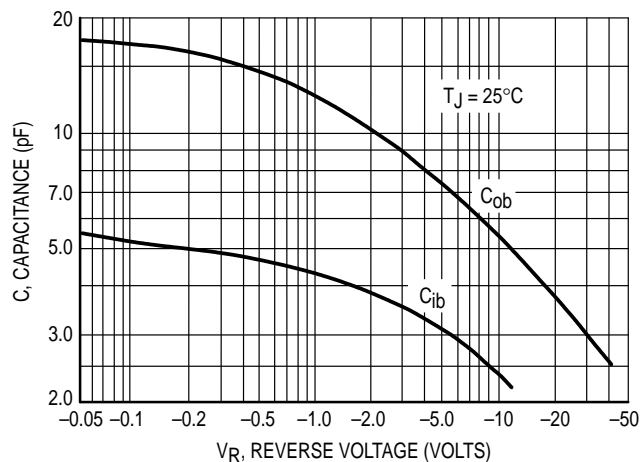


Figure 10. Capacitance

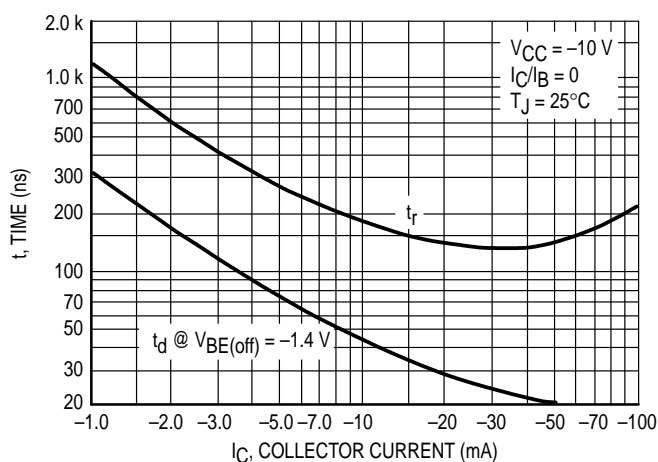


Figure 11. Turn-On Time

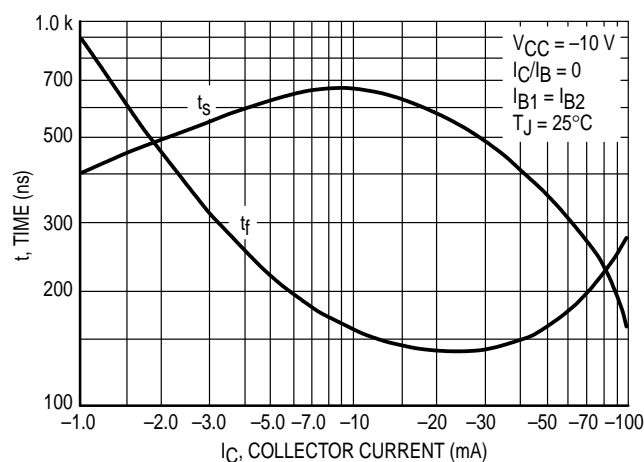


Figure 12. Turn-Off Time

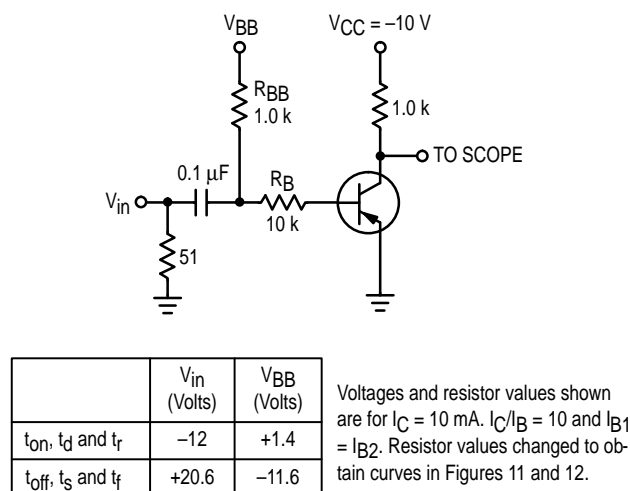
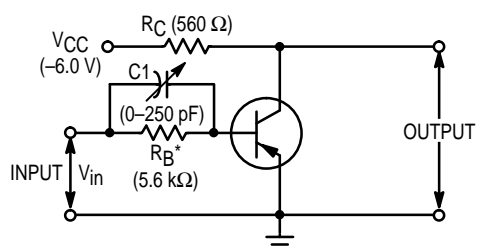


Figure 13. Switching Time Test Circuit



MEASUREMENT PROCEDURE

C_1 is increased until the t_{off} time of the output waveform is decreased to $0.2 \mu\text{s}$, Q_S is then calculated by $Q_S = C_1 V_{in}$. Q_{S3} or Q_{S7} by B-Line Electronics or equivalent may also be used.

VOLTAGE WAVEFORMS

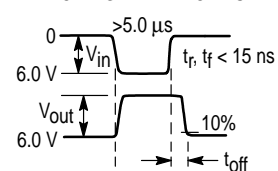
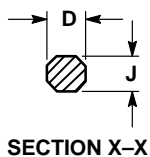
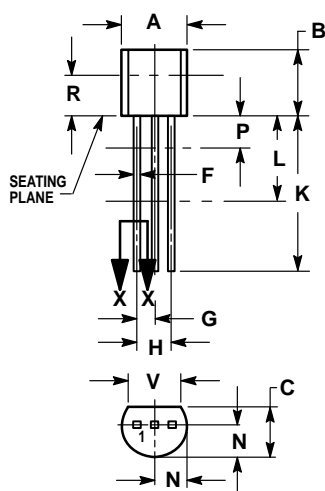


Figure 14. Stored Base Charge Test Circuit

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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