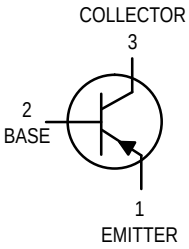
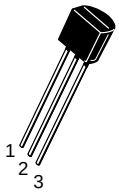
Chopper Transistor
PNP Silicon

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°C Derate above 25°C	P_D	625 5.0	mW mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	1.5 12	Watts mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–55 to +150	°C

THERMAL CHARACTERISTICS

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

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector–Emitter Breakdown Voltage(2) (I_C = –10 mAdc, I_B = 0)	$V_{(BR)CEO}$	–35	—	Vdc
Collector–Base Breakdown Voltage (I_C = –10 μAdc, I_E = 0)	$V_{(BR)CBO}$	–40	—	Vdc
Emitter–Base Breakdown Voltage (I_E = –10 μAdc, 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 μs, Duty Cycle ≤ 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

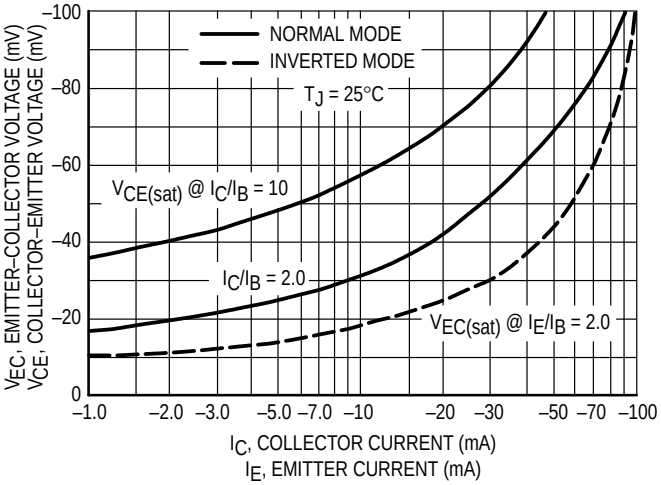


Figure 1. Collector–Emitter Voltage

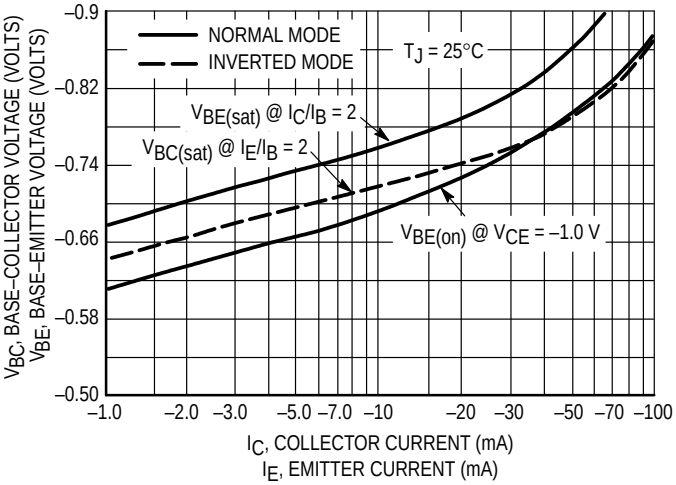


Figure 2. Base "On" Voltage

NORMAL MODE

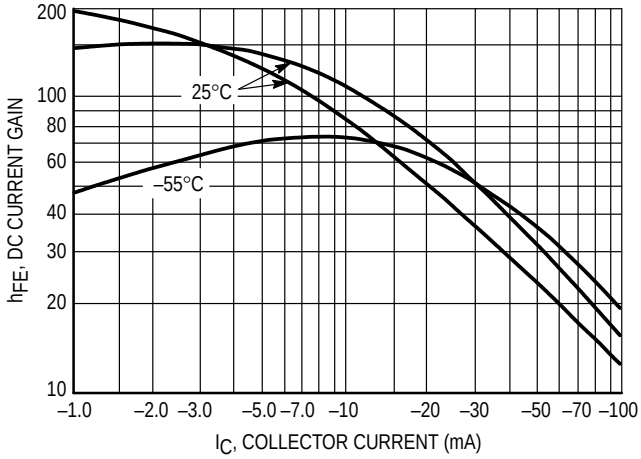


Figure 3. DC Current Gain @ V_{CE} = –0.15 Vdc

INVERTED MODE

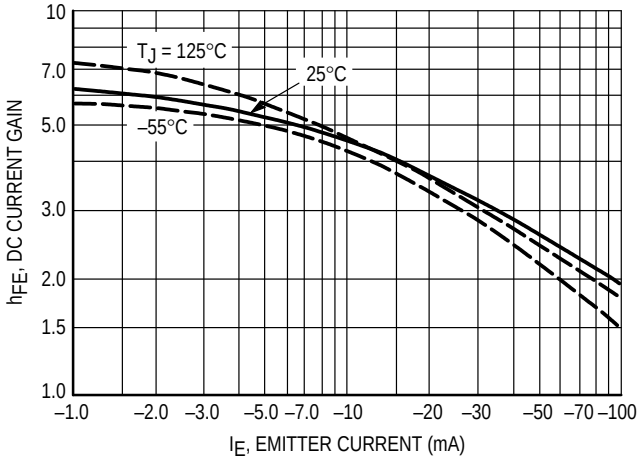


Figure 4. DC Current Gain @ V_{EC} = –0.15 Vdc

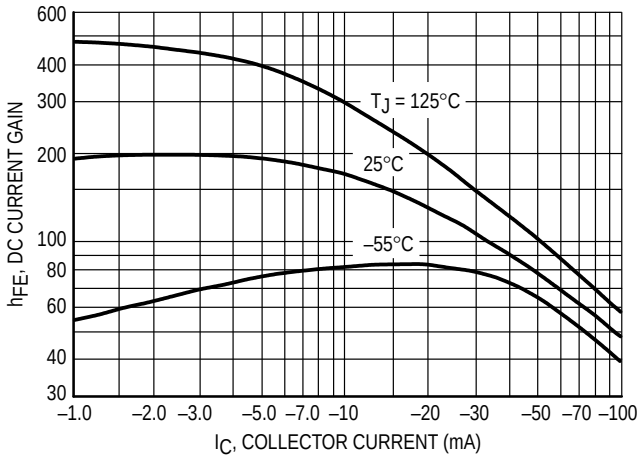


Figure 5. DC Current Gain @ V_{CE} = –1.0 Vdc

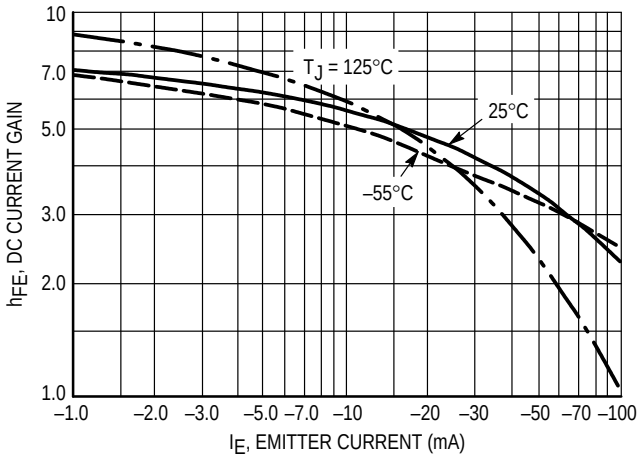


Figure 6. DC Current Gain @ V_{EC} = –1.0 Vdc

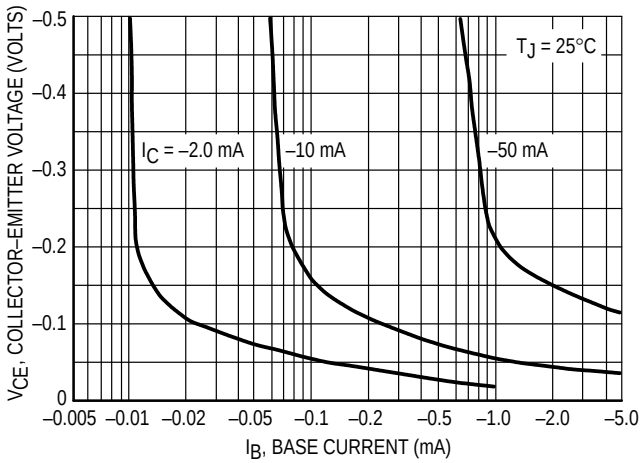


Figure 7. Collector Saturation Region

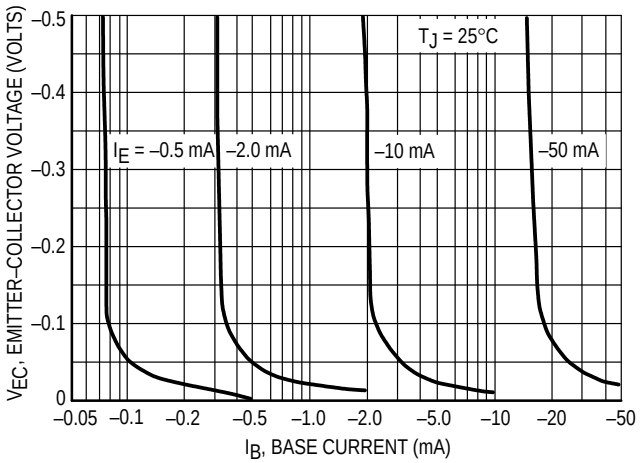


Figure 8. Emitter Saturation Region

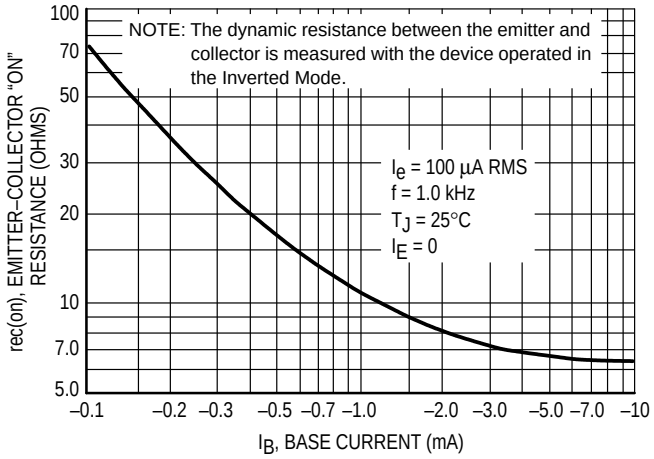


Figure 9. Emitter–Collector "On" Resistance

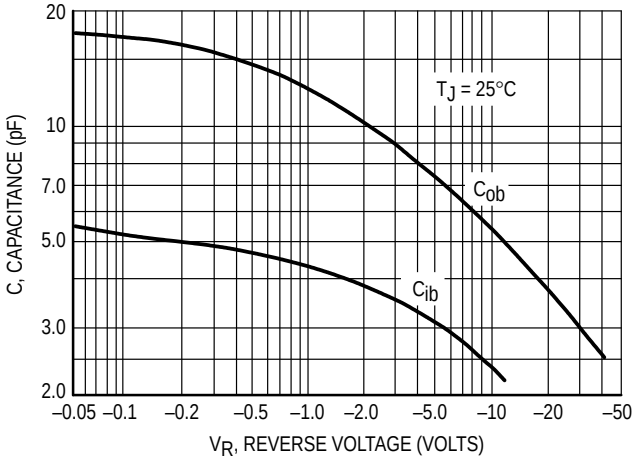


Figure 10. Capacitance

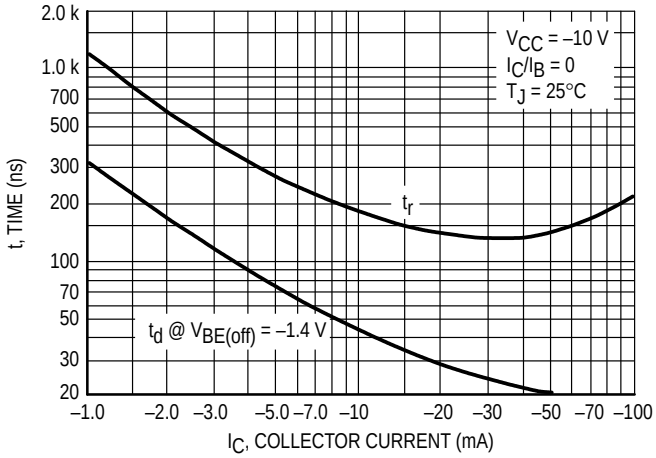


Figure 11. Turn–On Time

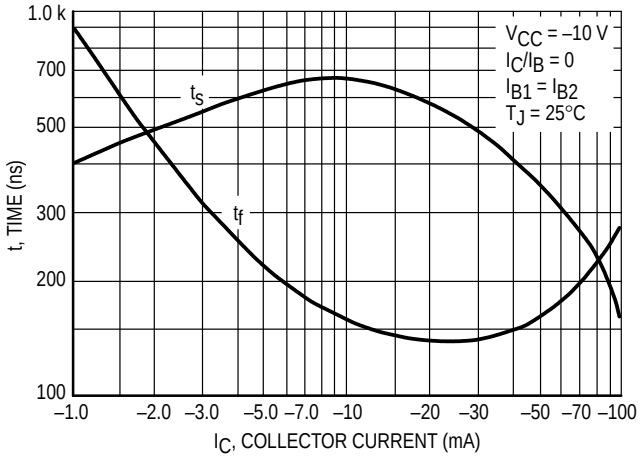
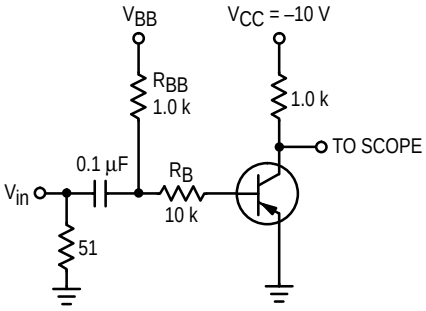


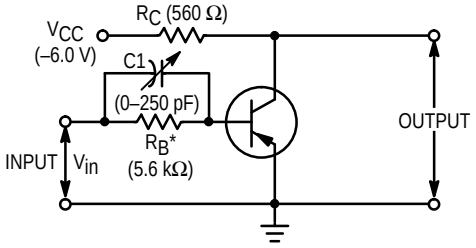
Figure 12. Turn–Off Time



	V_{in} (Volts)	V_{BB} (Volts)
t_{on}, t_d and t_r	–12	+1.4
t_{off}, t_s and t_f	+20.6	–11.6

Voltages and resistor values shown are for I_C = 10 mA. I_C/I_B = 10 and I_{B1} = I_{B2}. Resistor values changed to obtain curves in Figures 11 and 12.

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 μs, 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

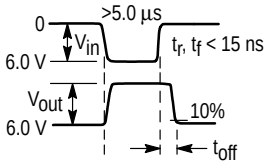
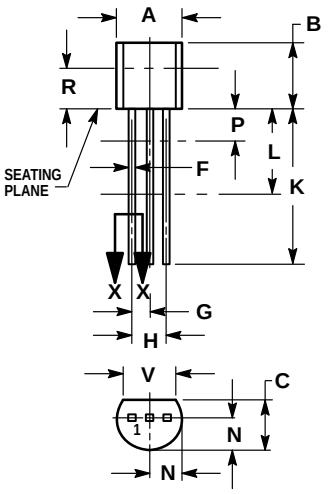
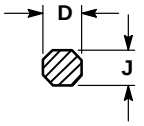


Figure 14. Stored Base Charge Test Circuit

PACKAGE DIMENSIONS





SECTION X–X

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.

	INCHES		MILLIMETERS	
DIM	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	—

CASE 029–04
(TO–226AA)
ISSUE AD

STYLE 1:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

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