2

MPS404
MPS404A

CASE 29-02, STYLE 1
TO-92 (TO-226AA)

CHOPPER TRANSISTOR

PNP SILICON

MAXIMUM RATINGS

Rating	Symbol	MPS404	MPS404A	Unit
Collector-Emitter Voltage	V_{CEO}	24	35	Vdc
Collector-Base Voltage	V_{CBO}	25	40	Vdc
Emitter-Base Voltage	V_{EBO}	12	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 Case	$R_{\theta JC}$	83.3	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$(1)	200	°C/W

(1) $R_{\theta JA}$ is measured with the device soldered into a typical printed circuit board.

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

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector-Emitter Breakdown Voltage(2) (I_C = 10 mAdc, I_B = 0)	MPS404 MPS404A	$V_{(BR)CEO}$	 24 35	 — —	 — —	Vdc
Collector-Base Breakdown Voltage (I_C = 10 μAdc, I_E = 0)	MPS404 MPS404A	$V_{(BR)CBO}$	 25 40	 — —	 — —	Vdc
Emitter-Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)	MPS404 MPS404A	$V_{(BR)EBO}$	 12 25	 50 50	 — —	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
ON CHARACTERISTICS						
DC Current Gain (I_C = 12 mAdc, V_{CE} = 0.15 Vdc)		h_{FE}	30	100	400	—
Collector-Emitter Saturation Voltage (I_C = 12 mAdc, I_B = 0.4 mAdc) (I_C = 24 mAdc, I_B = 1.0 mAdc)		$V_{CE(sat)}$	 — —	 0.1 0.12	 0.15 0.20	Vdc
Base-Emitter Saturation Voltage (I_C = 12 mAdc, I_B = 0.4 mAdc) (I_C = 24 mAdc, I_B = 1.0 mAdc)		$V_{BE(sat)}$	 — —	 0.7 0.74	 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}	—	6.8	20	pF

(2) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

FIGURE 1 – COLLECTOR-EMITTER VOLTAGE

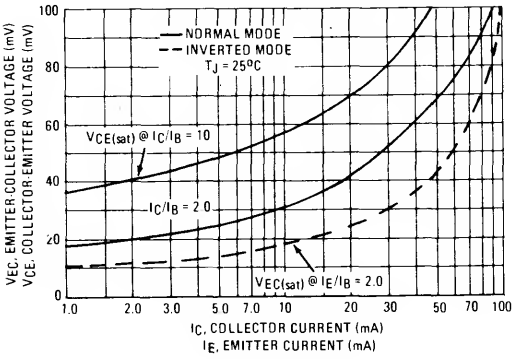
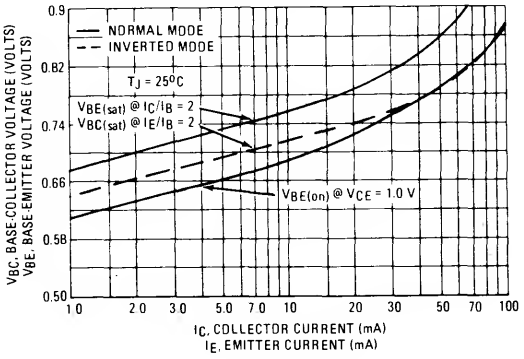


FIGURE 2 – BASE "ON" VOLTAGE



NORMAL MODE

FIGURE 3 – DC CURRENT GAIN @ V_{CE} = 0.15 Vdc

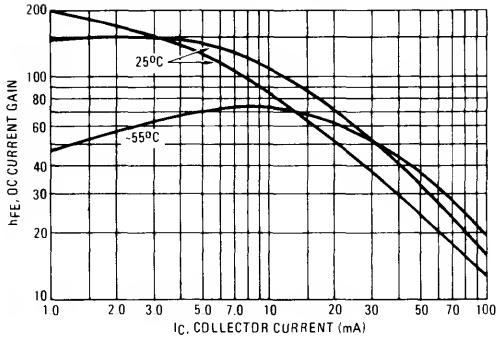
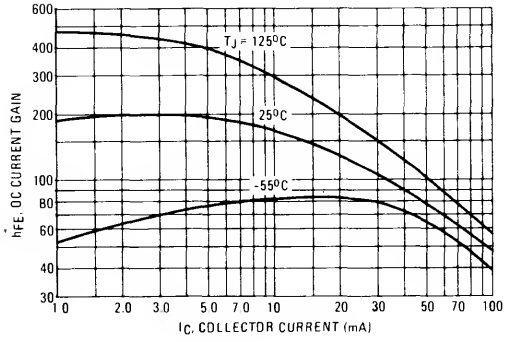


FIGURE 5 – DC CURRENT GAIN @ V_{CE} = 1.0 Vdc



INVERTED MODE

FIGURE 4 – DC CURRENT GAIN @ V_{EC} = 0.15 Vdc

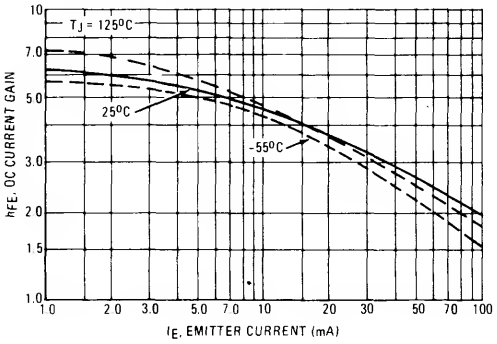
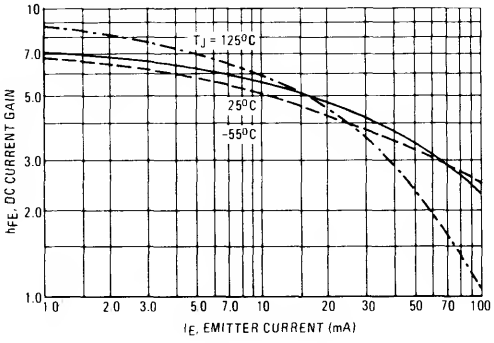


FIGURE 6 – DC CURRENT GAIN @ V_{EC} = 1.0 Vdc



2

FIGURE 7 – COLLECTOR SATURATION REGION

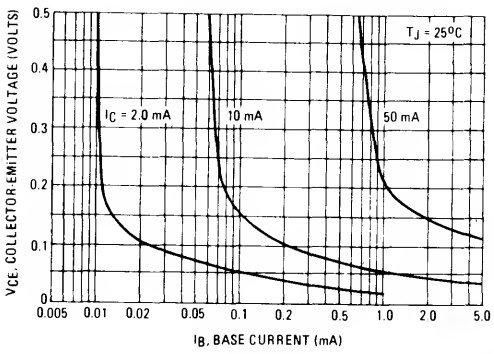


FIGURE 8 – EMITTER SATURATION REGION

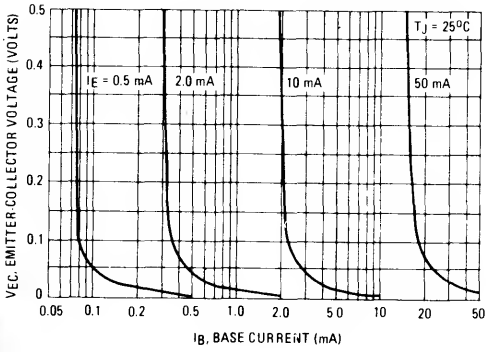


FIGURE 9 – EMITTER-COLLECTOR "ON" RESISTANCE

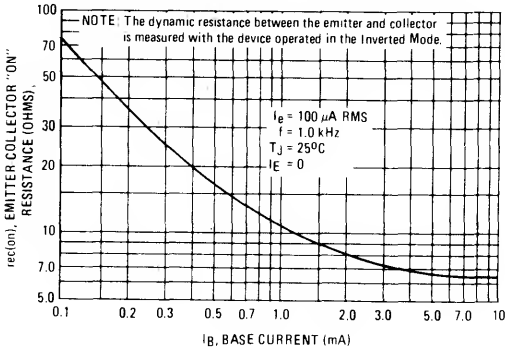


FIGURE 10 – CAPACITANCE

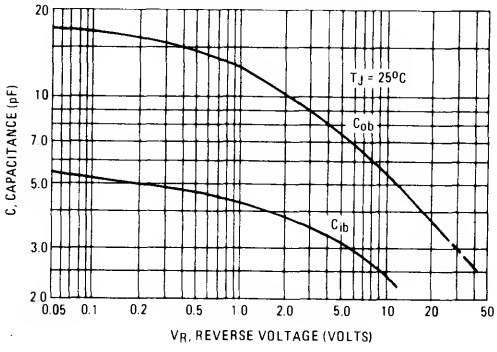


FIGURE 11 – TURN-ON TIME

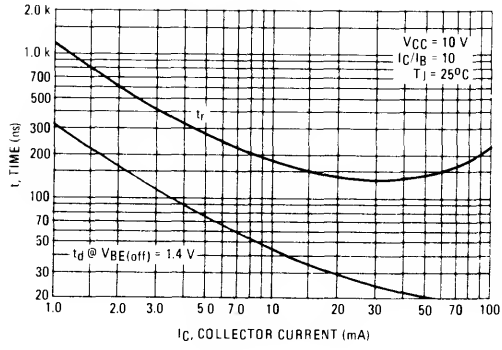


FIGURE 12 – TURN-OFF TIME

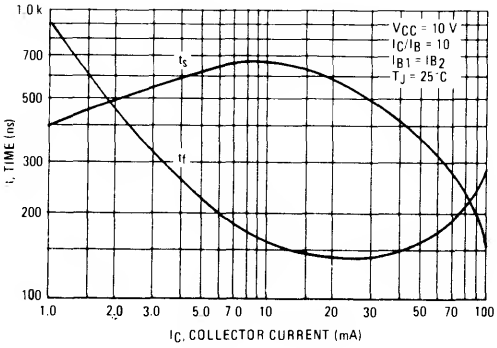
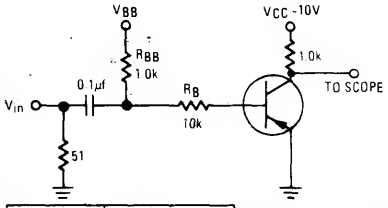


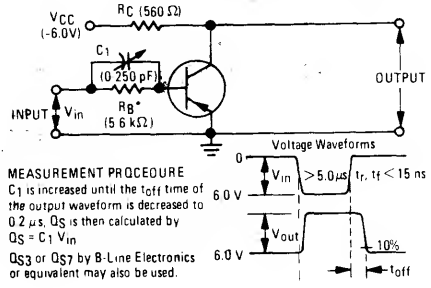
FIGURE 13 – SWITCHING TIME TEST CIRCUIT



	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 14 – STORED BASE CHARGE 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.