

# Silicon Dual NPN Transistor

## **MD708AF**

High Speed Transistor

40V / 200mA

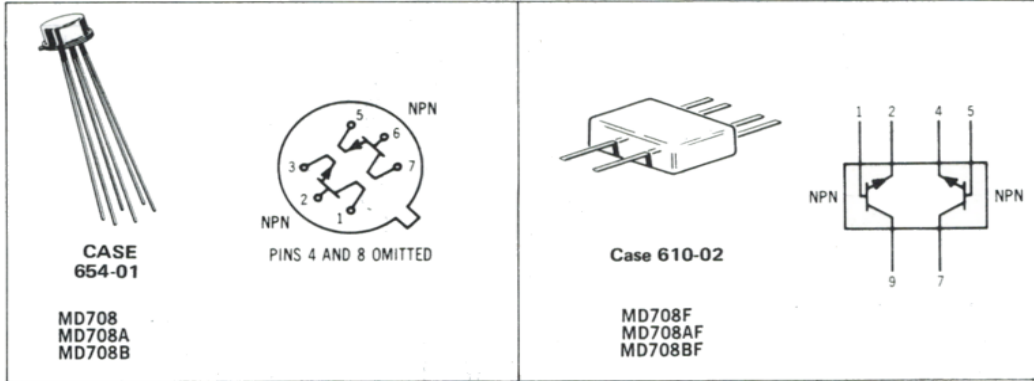
# DATASHEET

OEM –Motorola

Source: Motorola Databook 1972

# MD708, F (SILICON) MD708A, F MD708B, F

Dual NPN silicon annular transistors designed for high-speed, logic switching and space saving considerations. Matched pairs are available for differential amplifier applications.



Pin Connections, Bottom View  
All Leads Electrically Isolated from Case

## MAXIMUM RATINGS (each side) ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	15	Vdc
Collector-Base Voltage	$V_{CB}$	40	Vdc
Emitter-Base Voltage	$V_{EB}$	5.0	Vdc
Collector Current	$I_C$	200	mAdc
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +200	$^\circ\text{C}$
Total Device Dissipation @ $T_A = 25^\circ\text{C}$	$P_D$	One Side	mW mW/ $^\circ\text{C}$
		Both Sides	
Metal Can Derate above $25^\circ\text{C}$		300 1.7	400 2.3
Flat Package Derate above $25^\circ\text{C}$		250 1.5	350 2.0

FIGURE 1 — TURN-ON AND TURN-OFF TIME TEST CIRCUIT

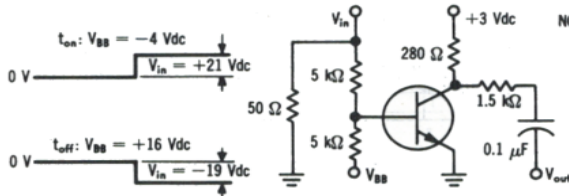
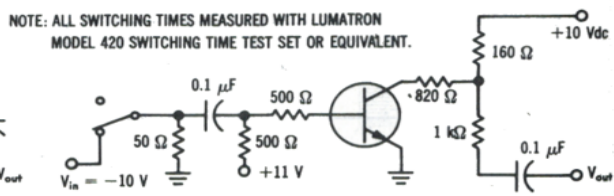


FIGURE 2 — CHARGE-STORAGE TIME CONSTANT TEST CIRCUIT



NOTE: ALL SWITCHING TIMES MEASURED WITH LUMATRON MODEL 420 SWITCHING TIME TEST SET OR EQUIVALENT.

**MD708,F/MD708A,F/MD708B,F** (continued)**ELECTRICAL CHARACTERISTICS** (each side) ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Emitter Sustaining Voltage (1) ( $I_C = 30 \text{ mAdc}$ , $I_B = 0$ )	$BV_{CEO(sus)}$	15	—	Vdc
Collector-Base Breakdown Voltage ( $I_C = 10 \mu\text{Adc}$ , $I_E = 0$ )	$BV_{CBO}$	40	—	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 10 \mu\text{Adc}$ , $I_C = 0$ )	$BV_{EBO}$	5.0	—	Vdc
Collector Cutoff Current ( $V_{CB} = 20 \text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 20 \text{ Vdc}$ , $I_E = 0$ , $T_A = +150^\circ\text{C}$ )	$I_{CBO}$	—	0.015 50	$\mu\text{Adc}$
<b>ON CHARACTERISTICS</b>				
DC Current Gain (1) ( $I_C = 0.5 \text{ mAdc}$ , $V_{CE} = 1.0 \text{ Vdc}$ ) ( $I_C = 10 \text{ mAdc}$ , $V_{CE} = 1.0 \text{ Vdc}$ ) ( $I_C = 100 \text{ mAdc}$ , $V_{CE} = 5.0 \text{ Vdc}$ ) ( $I_C = 150 \text{ mAdc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )	$h_{FE}$	40 40 35 30	— 200 — —	—
Collector-Emitter Saturation Voltage ( $I_C = 10 \text{ mAdc}$ , $I_B = 1 \text{ mAdc}$ ) ( $I_C = 50 \text{ mAdc}$ , $I_B = 5 \text{ mAdc}$ ) ( $I_C = 100 \text{ mAdc}$ , $I_B = 10 \text{ mAdc}$ )	$V_{CE(sat)}$	— — —	0.2 0.35 0.5	Vdc
Base-Emitter Saturation Voltage ( $I_C = 10 \text{ mAdc}$ , $I_B = 1 \text{ mAdc}$ ) ( $I_C = 50 \text{ mAdc}$ , $I_B = 5 \text{ mAdc}$ ) ( $I_C = 100 \text{ mAdc}$ , $I_B = 10 \text{ mAdc}$ )	$V_{BE(sat)}$	0.65 — —	0.85 0.95 1.1	Vdc
<b>DYNAMIC CHARACTERISTICS</b>				
Current-Gain-Bandwidth Product ( $I_C = 20 \text{ mAdc}$ , $V_{CE} = 10 \text{ Vdc}$ , $f = 100 \text{ MHz}$ )	$f_T$	300	—	MHz
Output Capacitance ( $V_{CB} = 10 \text{ Vdc}$ , $I_E = 0$ , $f = 100 \text{ kHz}$ )	$C_{ob}$	—	5.0	pF
Input Capacitance ( $V_{BE} = 0.5 \text{ Vdc}$ , $I_C = 0$ , $f = 100 \text{ kHz}$ )	$C_{ib}$	—	7.0	pF
Charge-Storage Time Constant (Figure 2) ( $I_C = 10 \text{ mAdc}$ , $I_{B1} = I_{B2} = 10 \text{ mAdc}$ )	$t_s$	—	25	ns
Turn-On Time (Figure 1) ( $I_C = 10 \text{ mAdc}$ , $I_{B1} = 3 \text{ mAdc}$ , $I_{B2} = 1 \text{ mAdc}$ )	$t_{on}$	—	35	ns
Turn-Off Time (Figure 1) ( $I_C = 10 \text{ mAdc}$ , $I_{B1} = 3 \text{ mAdc}$ , $I_{B2} = 1 \text{ mAdc}$ )	$t_{off}$	—	75	ns
<b>MATCHING CHARACTERISTICS</b>				
DC Current Gain Ratio** ( $I_C = 10 \text{ mAdc}$ , $V_{CE} = 1 \text{ Vdc}$ )	$h_{FE1}/h_{FE2}$ **	0.9 0.8	1.0 1.0	—
Base Voltage Differential ( $I_C = 10 \text{ mAdc}$ , $V_{CE} = 1 \text{ Vdc}$ )	$ V_{BE1} - V_{BE2} $	—	5.0 10	mVdc
Base Voltage Differential Gradient ( $I_C = 10 \text{ mAdc}$ , $V_{CE} = 1 \text{ Vdc}$ , $T_A = -55$ to $+125^\circ\text{C}$ )	$\frac{\Delta(V_{BE1} - V_{BE2})}{\Delta T_A}$	—	10 20	$\mu\text{V}/^\circ\text{C}$

(1) Pulse Test: Pulse Width = 300  $\mu\text{s}$ ; Duty Cycle = 2%\*\*The lowest  $h_{FE}$  reading is taken as  $h_{FE1}$  for this test.