

MD2904,A,F,AF MD2905,A,F,AF MQ2904, MQ2905A

MD2904,A
MD2905,A
CASE 654-07, STYLE 1

MD2904F,AF
MD2905F,AF
CASE 610A-04, STYLE 1

MQ2904
MQ2905A
CASE 607-04, STYLE 1

DUAL
AMPLIFIER TRANSISTOR

PNP SILICON

MAXIMUM RATINGS

Rating	Symbol	MD2904,F MD2905,F MQ2904	MD2904A,AF MD2905A,AF MQ2905A	Unit
Collector-Emitter Voltage	V _{CEO}	40	60	V _{dc}
Collector-Base Voltage	V _{CBO}	60		V _{dc}
Emitter-Base Voltage	V _{EBO}	5.0		V _{dc}
Collector Current — Continuous	I _C	600		mAdc
		One Die	All Die Equal Power	
Total Device Dissipation @ T _A = 25°C MD2904,A, MD2905,A MD2904F,AF, MD2905F,AF MQ2904, MQ2905A Derate above 25°C MD2904,A, MD2905,A MD2904,F,AF, MD2905F,AF MQ2904, MQ2905A	P _D	575 350 400 3.29 2.0 2.28	625 400 600 3.57 2.28 3.42	mW mW/°C
Total Device Dissipation @ T _C = 25°C MD2904,A, MD2905,A MD2904F,AF, MD2905F,AF MQ2904, MQ2905A Derate above 25°C MD2904,A, MD2905,A MD2904F,AF, MD2905F,AF MQ2904, MQ2905A	P _D	1.8 1.0 0.9 10.3 5.71 5.13	2.5 2.0 3.6 14.3 11.4 20.5	Watts mW/°C
Operating and Storage Junction Temperature Range	T _J , T _{stg}	- 65 to + 200		°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	One Die	All Die Equal Power	Unit
Thermal Resistance, Junction to Case MD2904,A, MD2905,A MD2904F,AF, MD2905F,AF MQ2904, MQ2905A	R _{θJC}	97 175 195	70 87.5 48.8	°C/W
Thermal Resistance, Junction to Ambient MD2904,A, MD2905,A MD2904F,AF, MD2905F,AF MQ2904, MQ2905A	R _{θJA} (1)	304 500 438	280 438 292	°C/W
		Junction to Ambient	Junction to Case	
Coupling Factor MD2904,A, MD2905,A MD2904F,AF, MD2905F,AF MQ2904, MQ2905A (Q1-Q2) (Q1-Q3 or Q1-Q4)		84 75 57 55	44 0 0 0	%

(1) R_{θJA} 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 μAdc, I _B = 0)	V _{(BR)CEO}	40 60	— —	— —	V _{dc}
Collector-Base Breakdown Voltage (I _C = 10 μAdc, I _E = 0)	V _{(BR)CBO}	60	—	—	V _{dc}
Emitter-Base Breakdown Voltage (I _E = 10 μAdc, I _C = 0)	V _{(BR)EBO}	5.0	—	—	V _{dc}
Collector Cutoff Current (V _{CB} = 50 Vdc, I _E = 0) (V _{CB} = 50 Vdc, I _E = 0, T _A = 150°C)	I _{CBO}	— —	— —	0.020 30	μAdc

MD2904,A,F,AF, MD2905,A,F,AF, MQ2904, MQ2905A

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

Characteristic	Symbol	Min	Typ	Max	Unit
Emitter Cutoff Current ($V_{BE} = 3.0\text{ Vdc}$, $I_C = 0$)	I_{EBO}	—	—	30	nAdc

ON CHARACTERISTICS(2)

DC Current Gain ($I_C = 0.1\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$)	MD2904	h_{FE}	20	50	—	—
	MD2904A		40	70	—	—
	MD2905		35	70	—	—
	MD2905A		75	150	—	—
($I_C = 1.0\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$)	MD2904	h_{FE}	25	75	—	—
	MD2904A		40	75	—	—
	MD2905		50	100	—	—
	MD2905A		100	175	—	—
($I_C = 10\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$)	MD2904	h_{FE}	35	90	—	—
	MD2904A		40	90	—	—
	MD2905		75	110	—	—
	MD2905A		100	200	—	—
($I_C = 150\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$)	MD2904,A, MD2905,A	h_{FE}	40	90	120	—
			100	200	300	—
($I_C = 500\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$)	MD2904	h_{FE}	20	60	—	—
	MD2904A		40	80	—	—
	MD2905		30	130	—	—
	MD2905A		50	150	—	—
Collector-Emitter Saturation Voltage ($I_C = 150\text{ mAdc}$, $I_B = 15\text{ mAdc}$)	$V_{CE(sat)}$		—	0.25	0.4	Vdc
($I_C = 500\text{ mAdc}$, $I_B = 50\text{ mAdc}$)			—	0.5	1.6	Vdc
Base-Emitter Saturation Voltage ($I_C = 150\text{ mAdc}$, $I_B = 15\text{ mAdc}$)	$V_{BE(sat)}$		—	0.88	1.3	Vdc
($I_C = 500\text{ mAdc}$, $I_B = 50\text{ mAdc}$)			—	1.0	2.6	Vdc

SMALL-SIGNAL CHARACTERISTICS

Current-Gain — Bandwidth Product(3) ($I_C = 50\text{ mAdc}$, $V_{CE} = 20\text{ Vdc}$, $f = 100\text{ MHz}$)	f_T	200	320	—	MHz
Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f = 100\text{ kHz}$)	C_{obo}	—	5.8	8.0	pF
Input Capacitance ($V_{BE} = 2.0\text{ Vdc}$, $I_C = 0$, $f = 100\text{ kHz}$)	C_{ibo}	—	16	30	pF

SWITCHING CHARACTERISTICS

Turn-On Time	$(V_{CC} = 30\text{ Vdc}$, $V_{BE} = 0.5\text{ Vdc}$, $I_C = 150\text{ mAdc}$, $I_{B1} = 15\text{ mAdc})$	t_{on}	—	—	45	ns
Delay Time		t_d	—	—	12	ns
Rise Time		t_r	—	—	35	ns
Turn-Off Time	$(V_{CC} = 30\text{ Vdc}$, $I_C = 150\text{ mAdc}$, $I_{B1} = I_{B2} = 15\text{ mAdc})$	t_{off}	—	—	130	ns
Storage Time		t_s	—	—	100	ns
Fall Time		t_f	—	—	40	ns

(2) Pulse Test: Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2.0\%$.

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FIGURE 1 - DC CURRENT GAIN

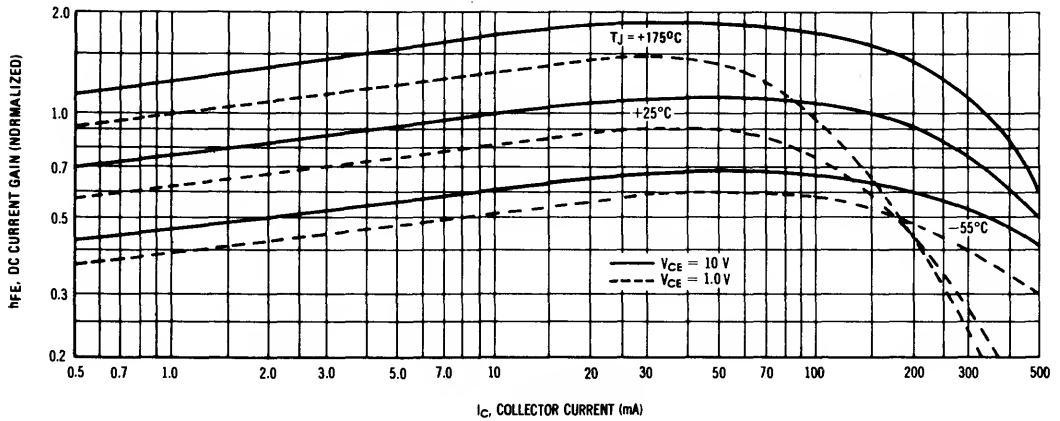


FIGURE 2 - "ON" VOLTAGES

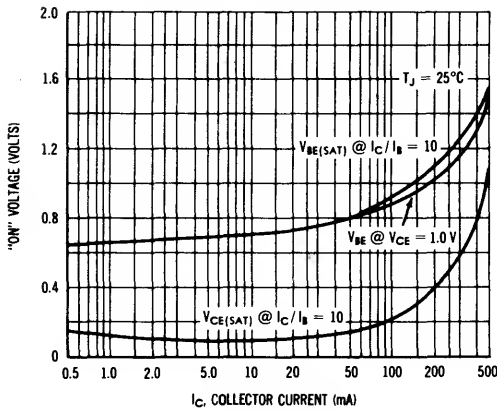
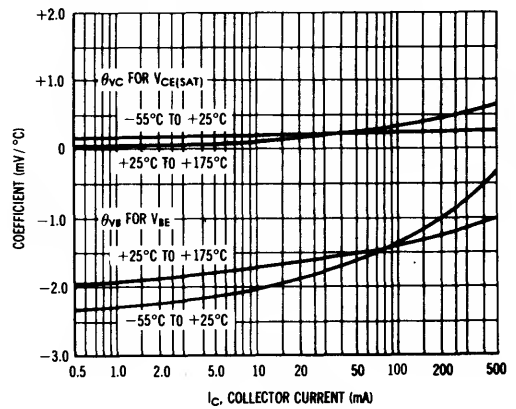


FIGURE 3 - TEMPERATURE COEFFICIENTS



NOISE FIGURE
VCE = 10 V, TA = 25°C

FIGURE 4 - FREQUENCY EFFECTS

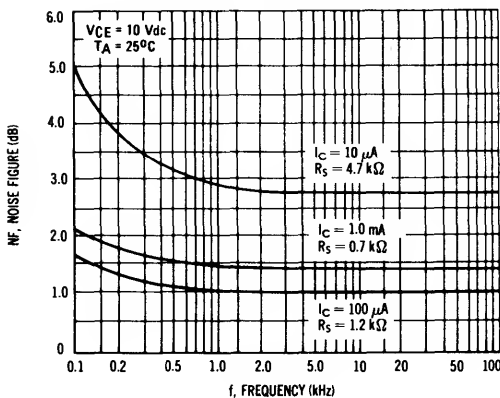
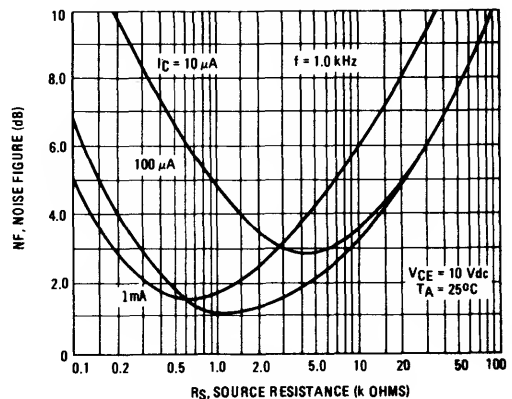


FIGURE 5 - SOURCE RESISTANCE EFFECTS



MD2904,A,F,AF, MD2905,A,F,AF, MQ2904, MQ2905A

FIGURE 6 – CURRENT-GAIN BANDWIDTH PRODUCT

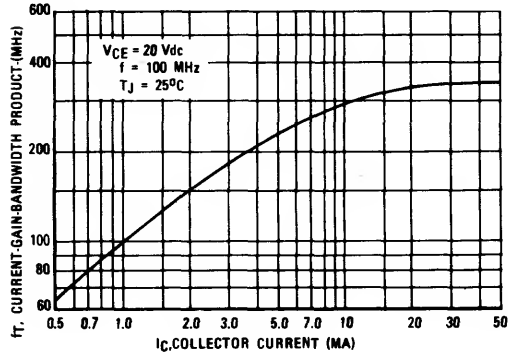


FIGURE 7 – CAPACITANCE

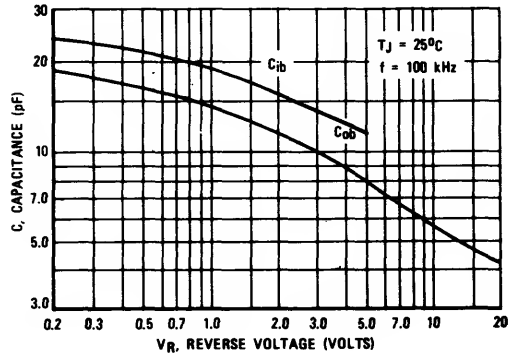


FIGURE 8 – TURN ON TIME

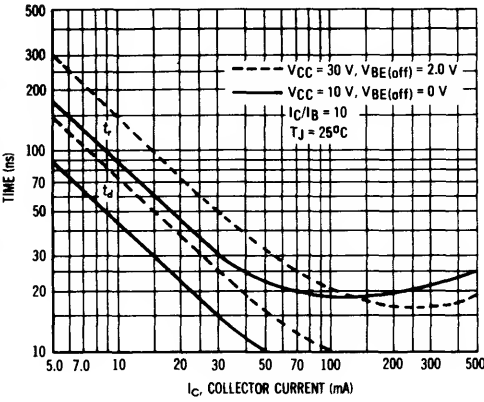


FIGURE 9 – CHARGE DATA

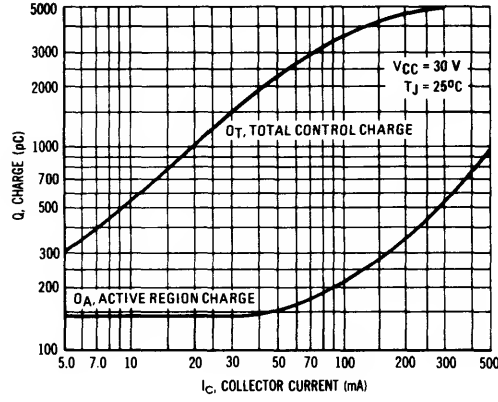


FIGURE 10 – STORAGE TIME

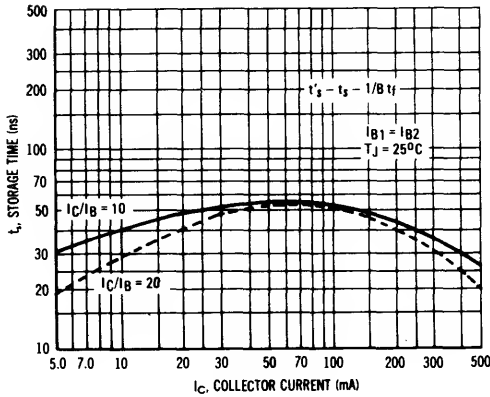
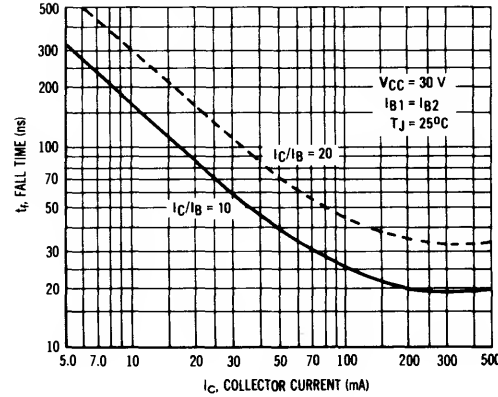


FIGURE 11 – FALL TIME



MD2904,A,F,AF, MD2905,A,F,AF, MQ2904, MQ2905A

FIGURE 12 – DELAY AND RISE
TIME TEST CIRCUIT

P.W. > 200 ns
 $t_r \leq 2.0$ ns
Duty Cycle $\leq 2.0\%$.

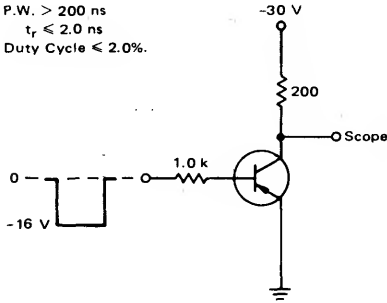


FIGURE 13 – STORAGE AND FALL
TIME TEST CIRCUIT

P.W. ≈ 1.0 μ s
 $t_r \leq 2.0$ ns
Duty Cycle $\leq 2.0\%$.

