

Transistors

NPN General Purpose Transistor

UMT3904 / SST3904 / MMST3904 / 2N3904

●Features

- 1) $BV_{CEO} > 40V$ ($I_c = 1mA$)
- 2) Complements the UMT3906 / SST3906 / MMST3906 / 2N3906.

●Package, marking and packaging specifications

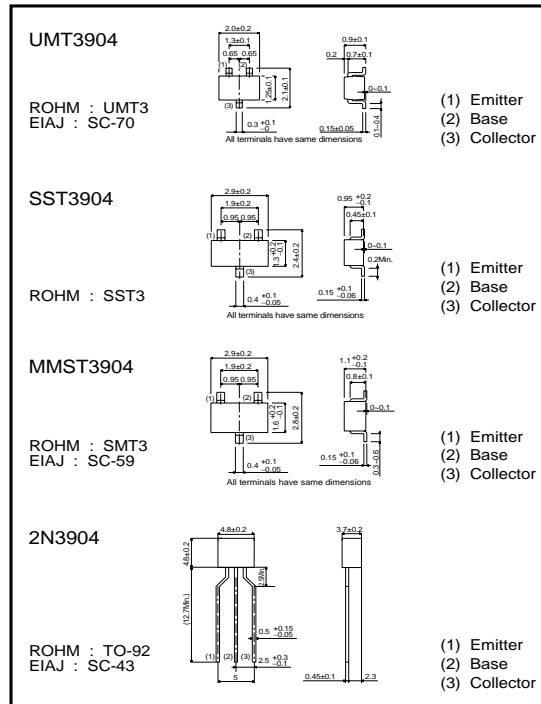
Part No.	UMT3904	SST3904	MMST3904	2N3904
Packaging type	UMT3	SST3	SMT3	TO-92
Marking	R1A	R1A	R1A	-
Code	T106	T116	T146	T93
Basic ordering unit (pieces)	3000	3000	3000	3000

●Absolute maximum ratings ($T_a = 25^\circ C$)

Parameter	Symbol	Limits	Unit
Collector-base voltage	V_{CBO}	60	V
Collector-emitter voltage	V_{CEO}	40	V
Emitter-base voltage	V_{EBO}	6	V
Collector current	I_c	0.2	A
Collector power dissipation	P_c	0.2	W
		0.35	W *
		0.625	W
		2N3904	
Junction temperature	T_j	150	$^\circ C$
Storage temperature	T_{stg}	-55~+150	$^\circ C$

* When mounted on a 7 x 5 x 0.6 mm ceramic board.

●External dimensions (Units : mm)



●Electrical characteristics ($T_a = 25^\circ C$)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Collector-base breakdown voltage	BV_{CBO}	60	-	-	V	$I_c = 10\mu A$
Collector-emitter breakdown voltage	BV_{CEO}	40	-	-	V	$I_c = 1mA$
Emitter-base breakdown voltage	BV_{EBO}	6	-	-	V	$I_e = 10\mu A$
Collector cutoff current	I_{CES}	-	-	50	nA	$V_{CB} = 30V$
Emitter cutoff current	I_{EBO}	-	-	50	nA	$V_{EB} = 3V$
Collector-emitter saturation voltage	$V_{CE(sat)}$	-	-	0.2	V	$I_c/I_b = 10mA/1mA$
		-	-	0.3	V	$I_c/I_b = 50mA/5mA$
Base-emitter saturation voltage	$V_{BE(sat)}$	0.65	-	0.85	V	$I_c/I_b = 10mA/1mA$
		-	-	0.95	V	$I_c/I_b = 50mA/5mA$
DC current transfer ratio	h_{FE}	40	-	-	-	$V_{CE} = 1V, I_c = 0.1mA$
		70	-	-	-	$V_{CE} = 1V, I_c = 1mA$
		100	-	300	-	$V_{CE} = 1V, I_c = 10mA$
		60	-	-	-	$V_{CE} = 1V, I_c = 50mA$
		30	-	-	-	$V_{CE} = 1V, I_c = 100mA$
Transition frequency	f_T	300	-	-	MHz	$V_{CE} = 20V, I_e = -10mA, f = 100MHz$
Collector output capacitance	C_{ob}	-	-	4	pF	$V_{CB} = 10V, f = 100kHz$
Emitter input capacitance	C_{ib}	-	-	8	pF	$V_{EB} = 0.5V, f = 100kHz$
Delay time	t_d	-	-	35	ns	$V_{CC} = 3V, V_{BE(OFF)} = 0.5V, I_c = 10mA, I_{B1} = 1mA$
Rise time	t_r	-	-	35	ns	$V_{CC} = 3V, V_{BE(OFF)} = 0.5V, I_c = 10mA, I_{B1} = 1mA$
Storage time	t_{stg}	-	-	200	ns	$V_{CC} = 3V, I_c = 10mA, I_{B1} = -I_{B2} = 1mA$
Fall time	t_f	-	-	50	ns	$V_{CC} = 3V, I_c = 10mA, I_{B1} = -I_{B2} = 1mA$

Transistors

● Electrical characteristic curves

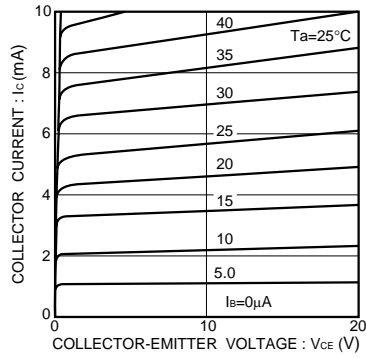


Fig.1 Grounded emitter output characteristics

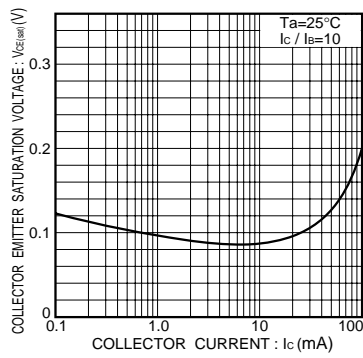


Fig.2 Collector-emitter saturation voltage vs. collector current

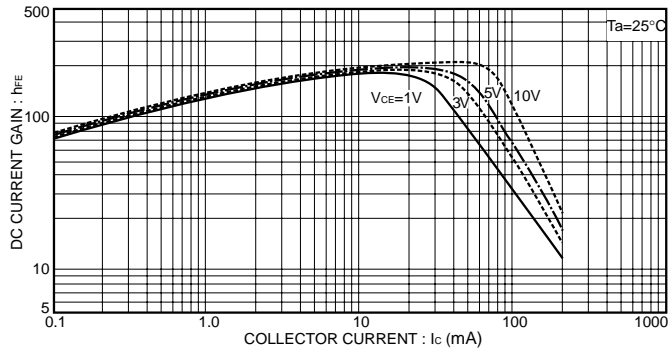


Fig.3 DC current gain vs. collector current (I)

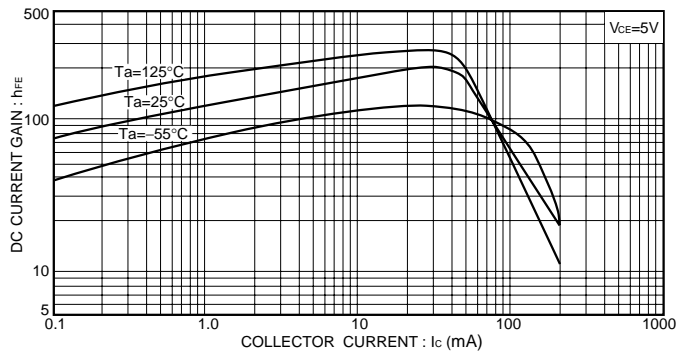


Fig.4 DC current gain vs. collector current (II)

Transistors

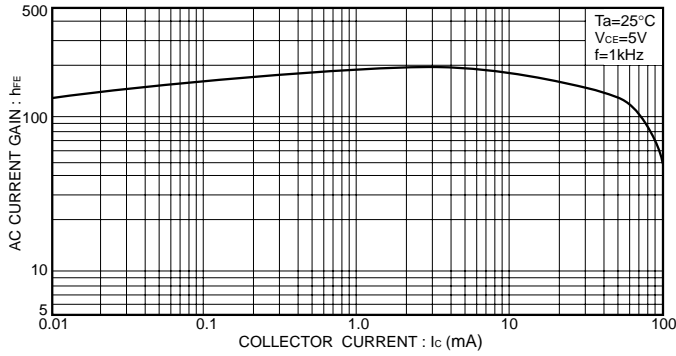


Fig.5 AC current gain vs. collector current

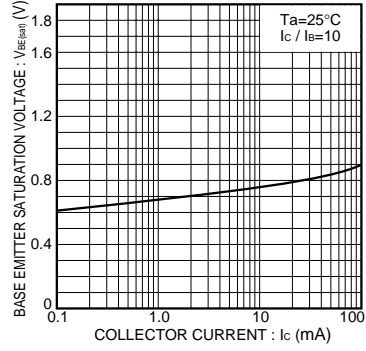


Fig.6 Base-emitter saturation voltage vs. collector current

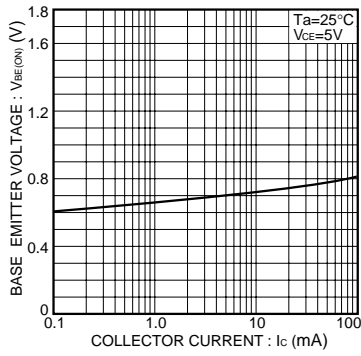


Fig.7 Grounded emitter propagation characteristics

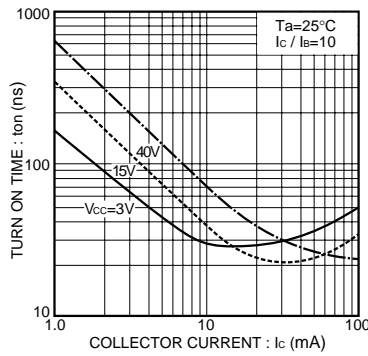


Fig.8 Turn-on time vs. collector current

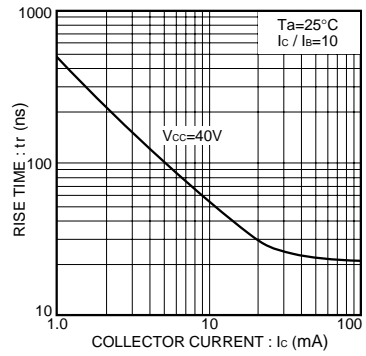


Fig.9 Rise time vs. collector current

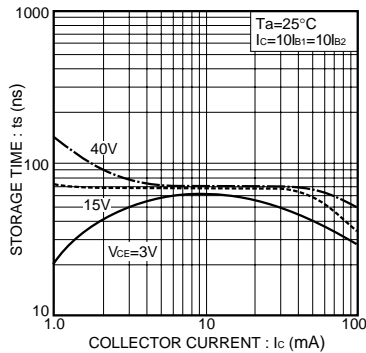


Fig.10 Storage time vs. collector current

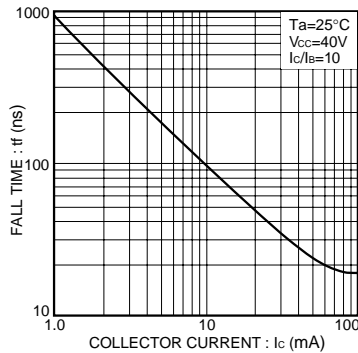


Fig.11 Fall time vs. collector current

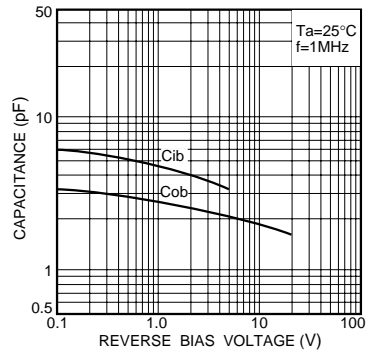


Fig.12 Input/output capacitance vs. voltage

Transistors

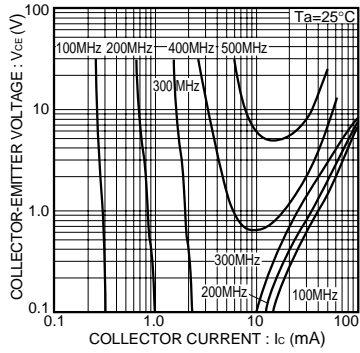


Fig.13 Gain bandwidth product

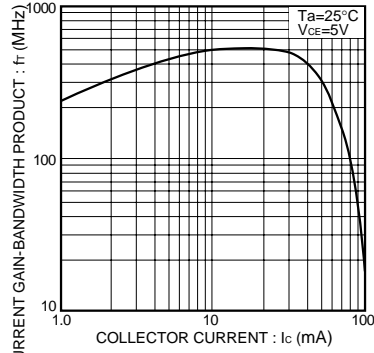


Fig.14 Gain bandwidth product vs. collector current

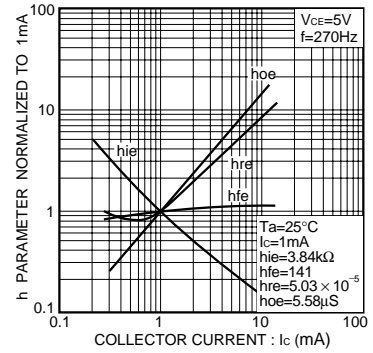


Fig.15 h parameter vs. collector current

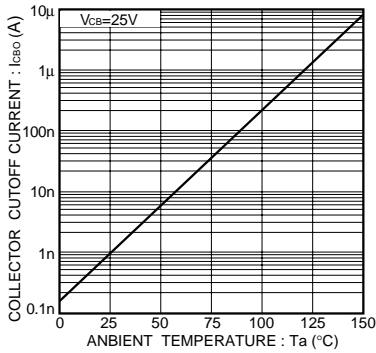


Fig.16 Noise characteristics (I)

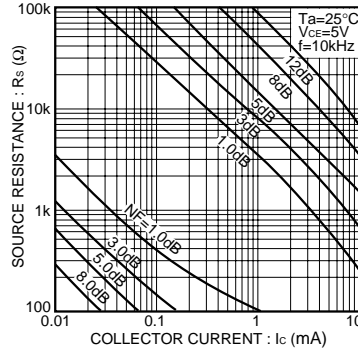


Fig.17 Noise characteristics (II)

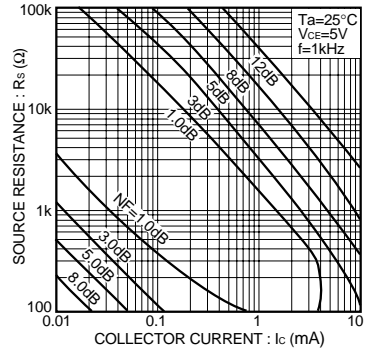


Fig.18 Noise characteristics (III)

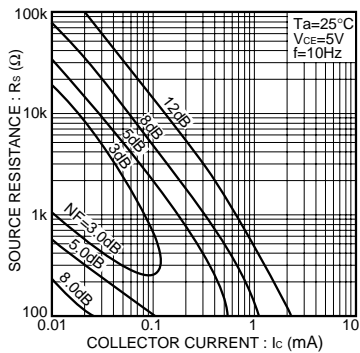


Fig.19 Noise characteristics (IV)

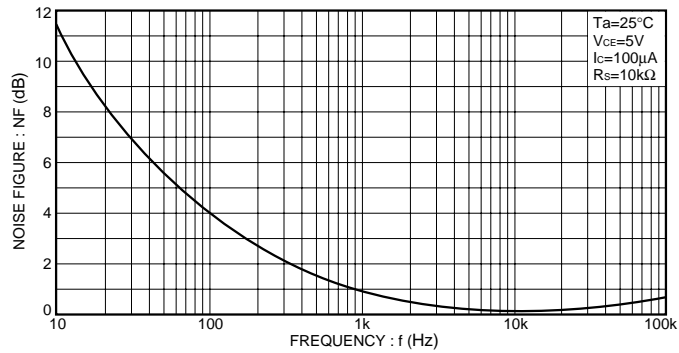


Fig.20 Noise vs. collector current