

NPN General Purpose Transistor

UMT3904 / SST3904 / MMST3904 / 2N3904

●Features

- 1) $V_{CE0} > 40V$ ($I_C = 1mA$)
- 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	UMT3904, SST3904, MMST3904	0.2	W
	SST3904, MMST3904		
	2N3904	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)

UMT3904

ROHM : UMT3
EIAJ : SC-70

(1) Emitter
(2) Base
(3) Collector

SST3904

ROHM : SST3

(1) Emitter
(2) Base
(3) Collector

MMST3904

ROHM : SMT3
EIAJ : SC-59

(1) Emitter
(2) Base
(3) Collector

2N3904

ROHM : TO-92
EIAJ : SC-43

(1) Emitter
(2) Base
(3) Collector

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Collector-base breakdown voltage	V_{CBO}	60	—	—	V	$I_C = 10 \mu A$
Collector-emitter breakdown voltage	V_{CEO}	40	—	—	V	$I_C = 1mA$
Emitter-base breakdown voltage	V_{EBO}	6	—	—	V	$I_E = 10 \mu A$
Collector cutoff current	I_{CES}	—	—	50	nA	$V_{CE} = 30V$
Emitter cutoff current	I_{EBO}	—	—	50	nA	$V_{EE} = 3V$
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_r	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	$V_{CC} = 3V, I_C = 10mA, I_{B1} = -I_{B2} = 1mA$



● Electrical characteristic curves

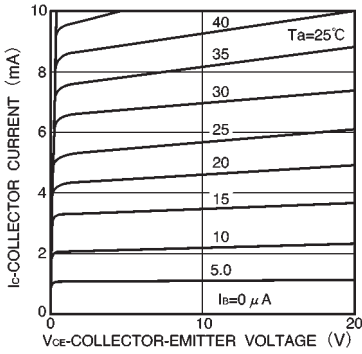


Fig.1 Grounded emitter output characteristics

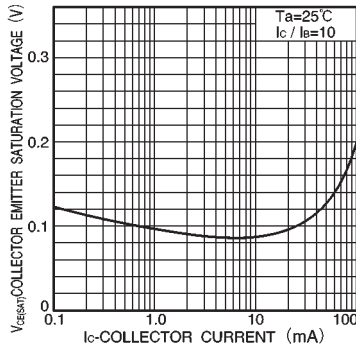


Fig.2 Collector-emitter saturation voltage vs. collector current

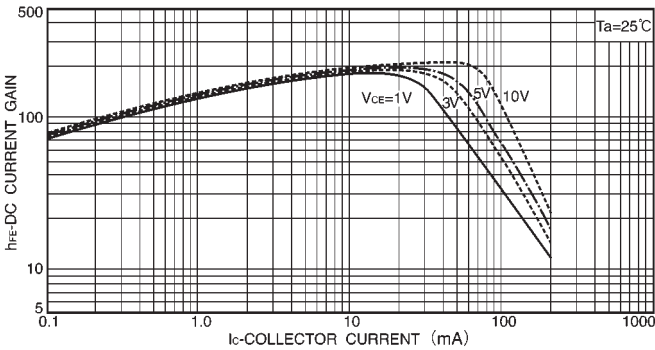


Fig.3 DC current gain vs. collector current (I)

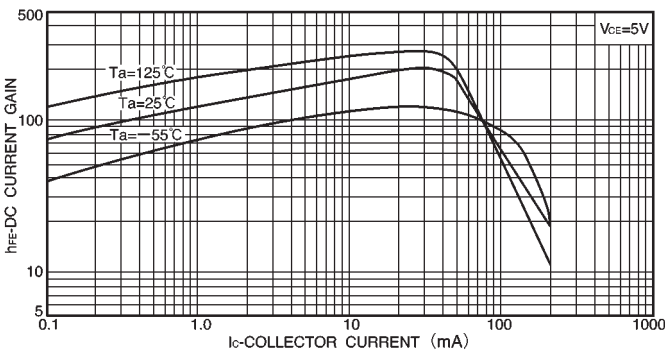


Fig.4 DC current gain vs. collector current (II)

● Electrical characteristic curves

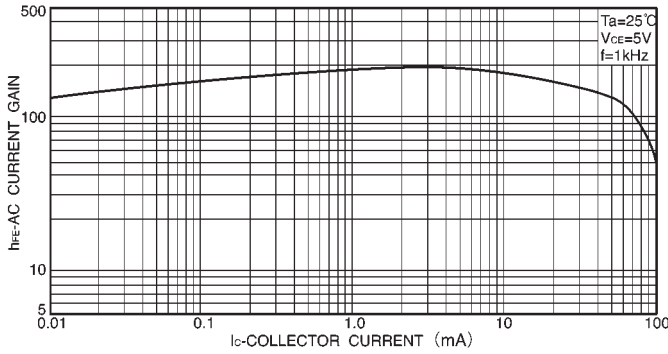


Fig.5 AC current gain vs. collector current

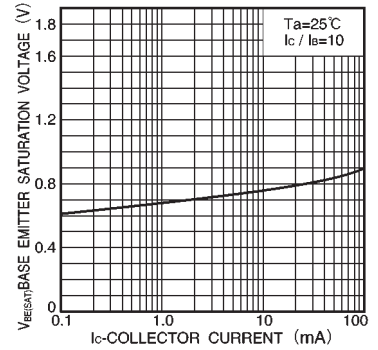


Fig.6 Base-emitter saturation voltage vs. collector current

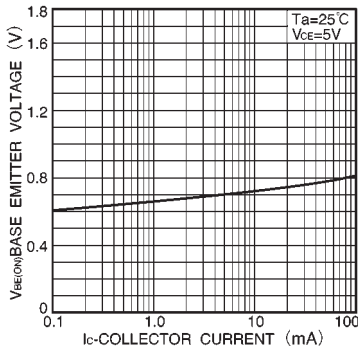


Fig.7 Grounded emitter propagation characteristics

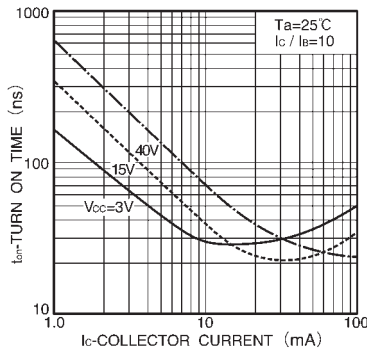


Fig.8 Turn-on time vs. collector current

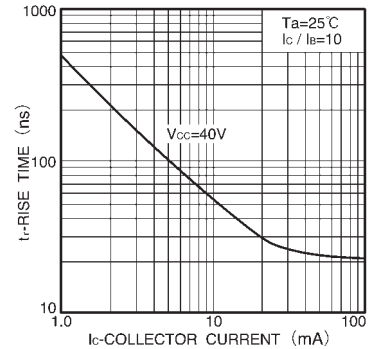


Fig.9 Rise time vs. collector current

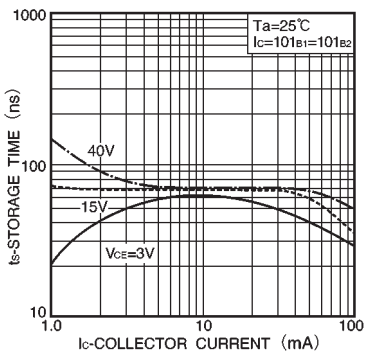


Fig.10 Storage time vs. collector current

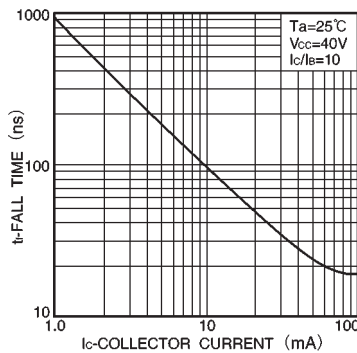


Fig.11 Fall time vs. collector current

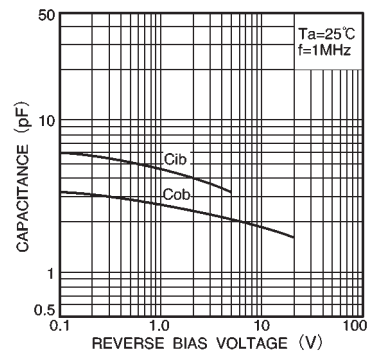


Fig.12 Input/output capacitance vs. voltage

Transistors

UMT3904/SST3904/MMST3904/2N3904

● Electrical characteristic curves

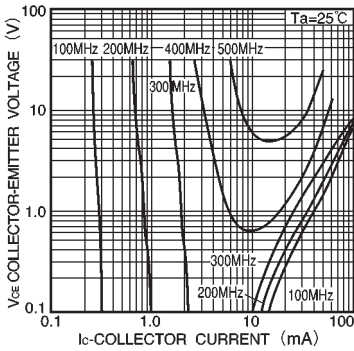


Fig.13 Gain bandwidth product

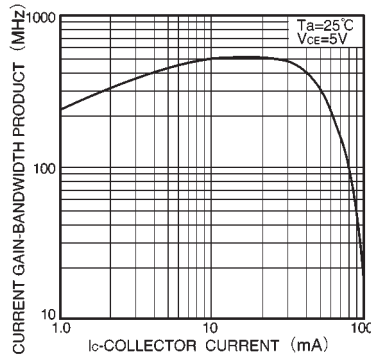


Fig.14 Gain bandwidth product vs. collector current

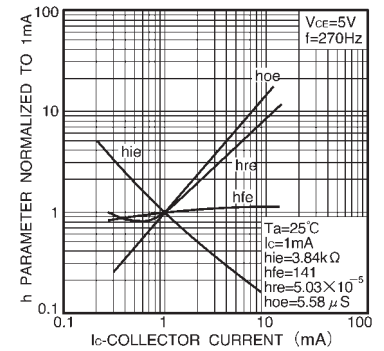


Fig.15 h parameter vs. collector current

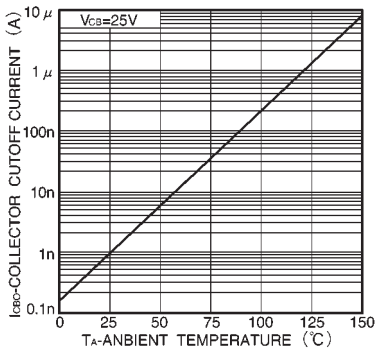


Fig.16 Noise characteristics (I)

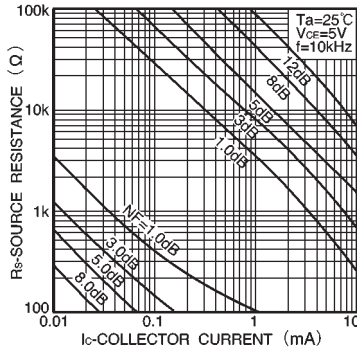


Fig.17 Noise characteristics (II)

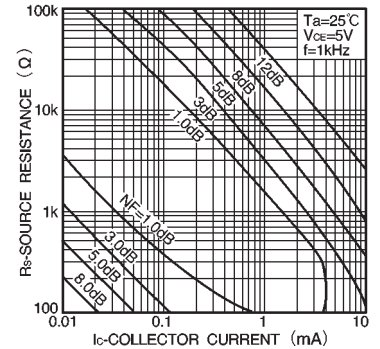


Fig.18 Noise characteristics (III)

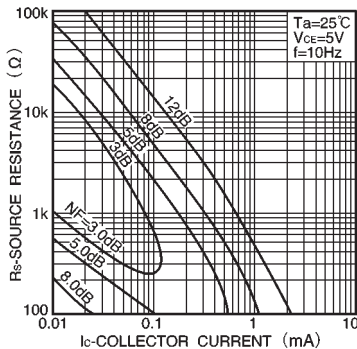


Fig.19 Noise characteristics (IV)

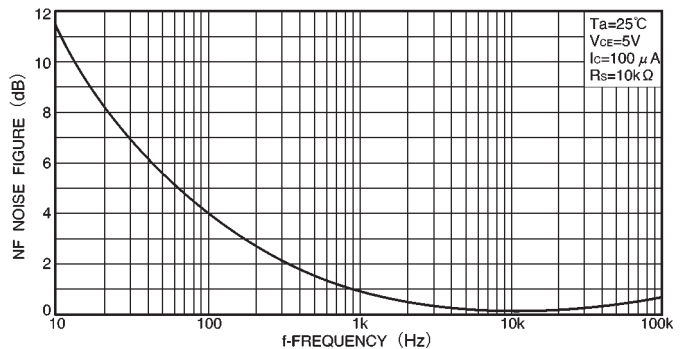


Fig.20 Noise vs. collector current