



MOTOROLA

QUAD DUAL-IN-LINE SILICON ANNULAR[†] COMPLEMENTARY PAIR TRANSISTORS

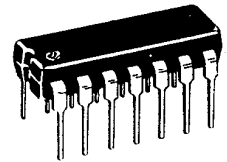
... designed for high-speed switching circuits, DC to VHF amplifier applications and complementary circuitry.

- Maximum Power Dissipation @ $T_A = 25^\circ\text{C}$
 $P_D = 1.25$ Watts — MPQ6001, MPQ6002, MPQ6501, MPQ6502
 $= 0.9$ Watts — MPQ6001N, MPQ6002N, MPQ6501N, MPQ6502N
- DC Current Gain Specified — 1.0 to 300 mAdc
- High Current-Gain-Bandwidth Product —
 $f_T = 400$ MHz (Typ) @ $I_C = 50$ mAdc
- NPN Transistor Similar to 2N2218 or 2N2219
- PNP Transistor Similar to 2N2904 or 2N2905
- Compact Size Compatible with IC Automatic Insertion Equipment

MPQ6001,N MPQ6002,N MPQ6501,N MPQ6502,N

QUAD DUAL-IN-LINE SILICON COMPLEMENTARY PAIR TRANSISTORS

CASE 646
PLASTIC PACKAGE



MAXIMUM RATINGS

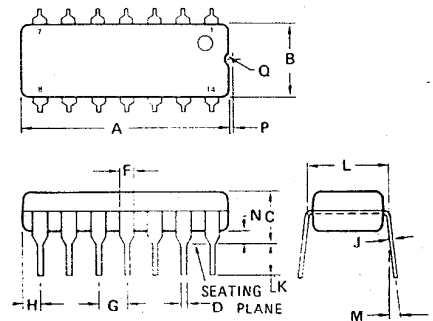
Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	30	Vdc
Collector-Base Voltage	V_{CB}	60	Vdc
Emitter-Base Voltage	V_{EB}	5.0	Vdc
Collector Current — Continuous	I_C	500	mAdc
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ (1) MPQ6001, MPQ6002, MPQ6501, MPQ6502 MPQ6001N, MPQ6002N, MPQ6501N, MPQ6502N Derate above 25°C		P_D	Watts
MPQ6001, MPQ6002, MPQ6501, MPQ6502		0.65	1.25
MPQ6001N, MPQ6002N, MPQ6501N, MPQ6502N		0.5	0.9
MPQ6001, MPQ6002, MPQ6501, MPQ6502		5.18	10
MPQ6001N, MPQ6002N, MPQ6501N, MPQ6502N		4.0	7.2
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ MPQ6001, MPQ6002, MPQ6501, MPQ6502 MPQ6001N, MPQ6002N, MPQ6501N, MPQ6502N Derate above 25°C		P_D	Watts
MPQ6001, MPQ6002, MPQ6501, MPQ6502		1.0	3.0
MPQ6001N, MPQ6002N, MPQ6501N, MPQ6502N		0.825	2.4
MPQ6001, MPQ6002, MPQ6501, MPQ6502		8.0	24
MPQ6001N, MPQ6002N, MPQ6501N, MPQ6502N		6.7	19.2
Operating and Storage Junction Temperature Range		T_J, T_{stg}	-55 to $+150$ $^\circ\text{C}$

(1) Second Breakdown occurs at power levels greater than 3 times the power dissipation rating.

THERMAL CHARACTERISTICS

Characteristic	Junction to Case	Junction to Ambient	Unit
Thermal Resistance			
Each Die			$^\circ\text{C/W}$
MPQ6001, MPQ6002, MPQ6501, MPQ6502	125	193	
MPQ6001N, MPQ6002N, MPQ6501N, MPQ6502N	151	250	
Effective, 4 Die			
MPQ6001, MPQ6002, MPQ6501, MPQ6502	41.6	100	
MPQ6001N, MPQ6002N, MPQ6501N, MPQ6502N	52	134	
Coupling Factors			
Q1-Q4 or Q2-Q3	30	60	%
Q1-Q2 or Q3-Q4	34	70	
	2.0	24	
	2.0	26	

[†] Annular Semiconductors Patented by Motorola Inc.

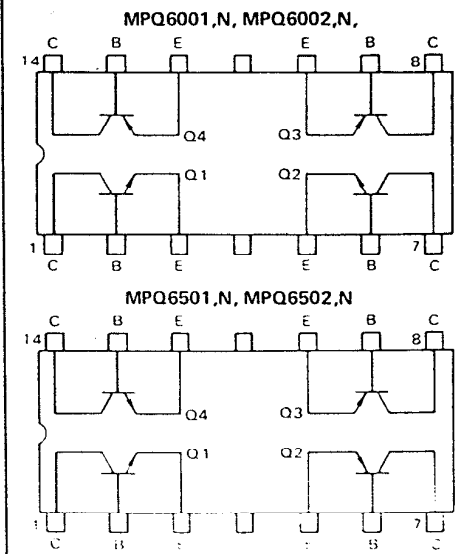


DIM	MIN	MAX	MIN	MAX
A	18.16	18.80	0.715	0.740
B	6.10	6.60	0.240	0.260
C	4.06	4.57	0.160	0.180
D	0.38	0.51	0.015	0.020
F	1.02	1.52	0.040	0.060
G	2.54	BSC	0.100	BSC
H	1.32	1.83	0.052	0.072
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.37	7.87	0.290	0.310
M	—	10 ⁰	—	10 ⁰
N	0.51	1.02	0.020	0.040
P	0.13	0.38	0.005	0.015
Q	0.51	0.76	0.020	0.030

NOTES:

- LEADS WITHIN 0.13 mm (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
- DIMENSION "L" TO CENTER OF LEADS WHEN FORMED PARALLEL

CONNECTION DIAGRAM



THERMAL COUPLING AND EFFECTIVE THERMAL RESISTANCE

In multiple chip devices, coupling of heat between die occurs. The junction temperature can be calculated as follows:

$$(1) \Delta T_{J1} = R_{\theta 1} P_{D1} + R_{\theta 2} K_{\theta 2} P_{D2} + R_{\theta 3} K_{\theta 3} P_{D3} + R_{\theta 4} K_{\theta 4} P_{D4}$$

Where ΔT_{J1} is the change in junction temperature of die 1
 $R_{\theta 1}$ thru 4 is the thermal resistance of die 1 through 4
 P_{D1} thru 4 is the power dissipated in die 1 through 4
 $K_{\theta 2}$ thru 4 is the thermal coupling between die 1 and die 2 through 4.

An effective package thermal resistance can be defined as follows:

$$(2) R_{\theta(EFF)} = \Delta T_{J1} / P_{DT}$$

where: P_{DT} is the total package power dissipation.

Assuming equal thermal resistance for each die, equation (1) simplifies to

$$(3) \Delta T_{J1} = R_{\theta 1} (P_{D1} + K_{\theta 2} P_{D2} + K_{\theta 3} P_{D3} + K_{\theta 4} P_{D4})$$

For the conditions where $P_{D1} = P_{D2} = P_{D3} = P_{D4}$, $P_{DT} = 4 P_D$, equation (3) can be further simplified and by substituting into equation (2) results in

$$(4) R_{\theta(EFF)} = R_{\theta 1} (1 + K_{\theta 2} + K_{\theta 3} + K_{\theta 4}) / 4$$

Values for the coupling factors when either the case or the ambient is used as a reference are given in the table on page 1. If significant power is to be dissipated in two die, die at the opposite ends of the package should be used so that lowest possible junction temperatures will result.

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (1) ($I_C = 10 \text{ mAdc}$, $I_B = 0$)	BV_{CEO}	30	—	—	Vdc
Collector-Base Breakdown Voltage ($I_C = 10 \mu\text{Adc}$, $I_E = 0$)	BV_{CBO}	60	—	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = 10 \mu\text{Adc}$, $I_C = 0$)	BV_{EBO}	5.0	—	—	Vdc
Collector Cutoff Current ($V_{CB} = 50 \text{ Vdc}$, $I_E = 0$)	I_{CBO}	—	—	30	nAdc
Emitter Cutoff Current ($V_{EB} = 3.0 \text{ Vdc}$, $I_C = 0$)	I_{EBO}	—	—	30	nAdc
ON CHARACTERISTICS					
DC Current Gain (1) ($I_C = 1.0 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$)	h_{FE}	25	—	—	—
		50	—	—	—
($I_C = 10 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$)		35	—	—	—
		75	—	—	—
($I_C = 150 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$)		40	—	—	—
		100	—	—	—
($I_C = 300 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$)		20	—	—	—
		30	—	—	—
Collector-Emitter Saturation Voltage (1) ($I_C = 150 \text{ mAdc}$, $I_B = 15 \text{ mAdc}$)	$V_{CE(sat)}$	—	—	0.4	Vdc
($I_C = 300 \text{ mAdc}$, $I_B = 30 \text{ mAdc}$)		—	—	1.4	Vdc
Base-Emitter Saturation Voltage (1) ($I_C = 150 \text{ mAdc}$, $I_B = 15 \text{ mAdc}$)	$V_{BE(sat)}$	—	—	1.3	Vdc
($I_C = 300 \text{ mAdc}$, $I_B = 30 \text{ mAdc}$)		—	—	2.0	Vdc
DYNAMIC CHARACTERISTICS					
Current-Gain-Bandwidth Product (1) ($I_C = 50 \text{ mAdc}$, $V_{CE} = 20 \text{ Vdc}$, $f = 100 \text{ MHz}$)	f_T	200	350	—	MHz
Output Capacitance ($V_{CB} = 10 \text{ Vdc}$, $I_E = 0$, $f = 100 \text{ kHz}$)	C_{ob}	—	6.0	8.0	pF
		—	4.5	8.0	pF
Input Capacitance ($V_{EB} = 2.0 \text{ Vdc}$, $I_C = 0$, $f = 100 \text{ kHz}$)	C_{ib}	—	20	30	pF
		—	17	30	pF
SWITCHING CHARACTERISTICS					
Turn-On Time ($V_{CC} = 30 \text{ Vdc}$, $V_{BE(on)} = 0.5 \text{ Vdc}$, $I_C = 150 \text{ mAdc}$, $I_{B1} = 15 \text{ mAdc}$, Figure 1)	t_{on}	—	30	—	ns
Turn-Off Time ($V_{CC} = 30 \text{ Vdc}$, $I_C = 150 \text{ mAdc}$, $I_{B1} = I_{B2} = 15 \text{ mAdc}$, Figure 2)	t_{off}	—	225	—	ns

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

NPN SATURATED SWITCHING TIME TEST CIRCUITS

For PNP Switching Tests, reverse the diodes, voltage polarities, and input pulses.

FIGURE 1 — NPN TURN-ON TIME

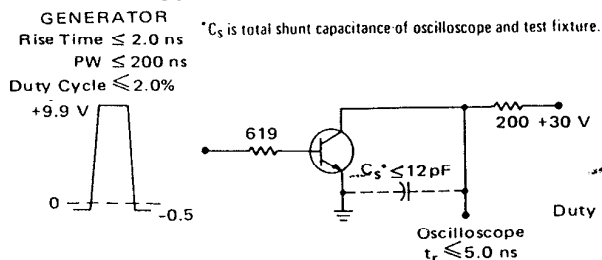
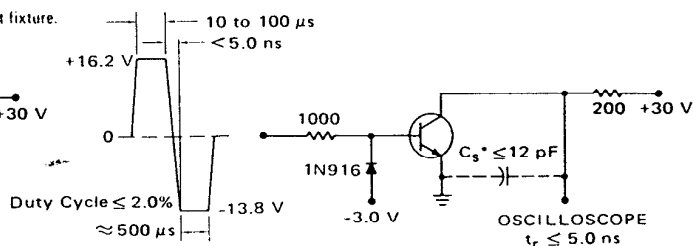


FIGURE 2 — NPN TURN-OFF TIME



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NPN DATA

FIGURE 3 – NORMALIZED DC CURRENT GAIN

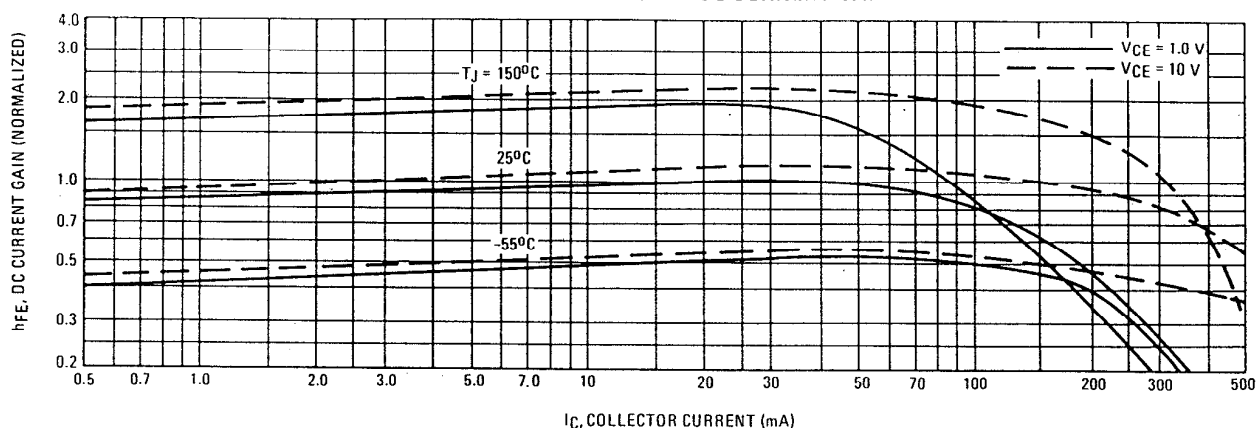


FIGURE 4 – "ON" VOLTAGES

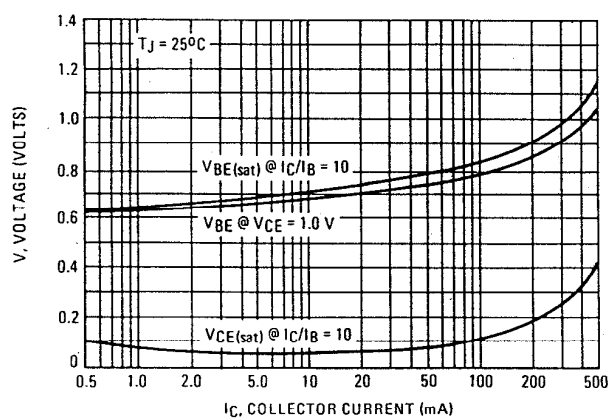
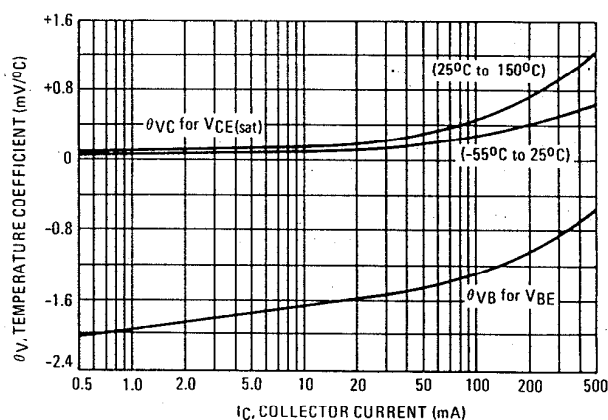


FIGURE 5 – TEMPERATURE COEFFICIENTS



NOISE FIGURE ($V_{CE} = 10 \text{ Vdc}$, $T_A = 25^\circ\text{C}$)

FIGURE 6 – FREQUENCY EFFECTS

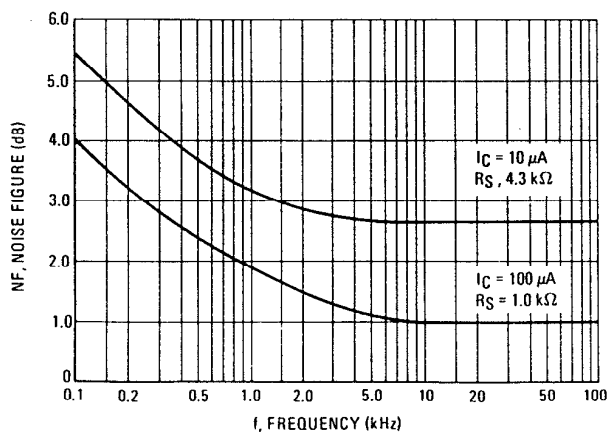
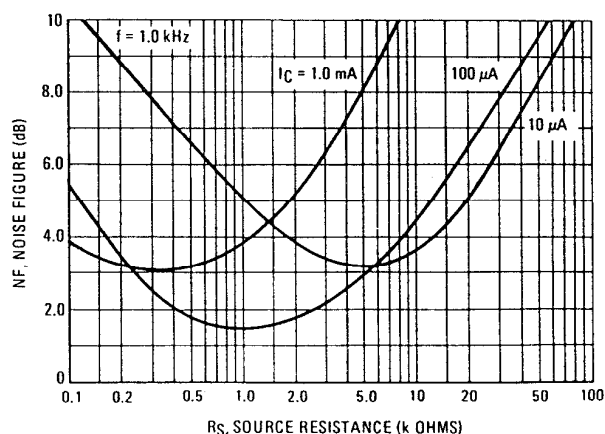


FIGURE 7 – SOURCE RESISTANCE EFFECTS



NPN DATA

FIGURE 8 — CURRENT-GAIN — BANDWIDTH PRODUCT

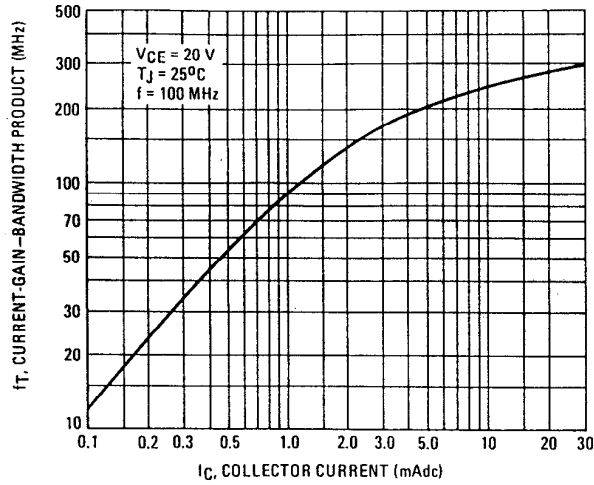
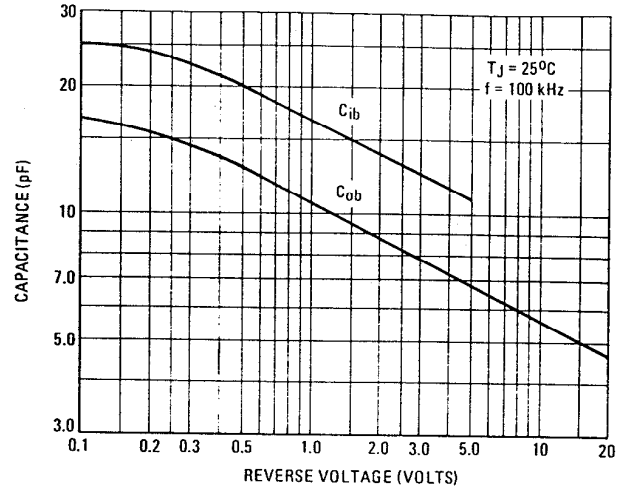


FIGURE 9 — CAPACITANCE



SWITCHING TIME CHARACTERISTICS

FIGURE 10 — TURN-ON TIME

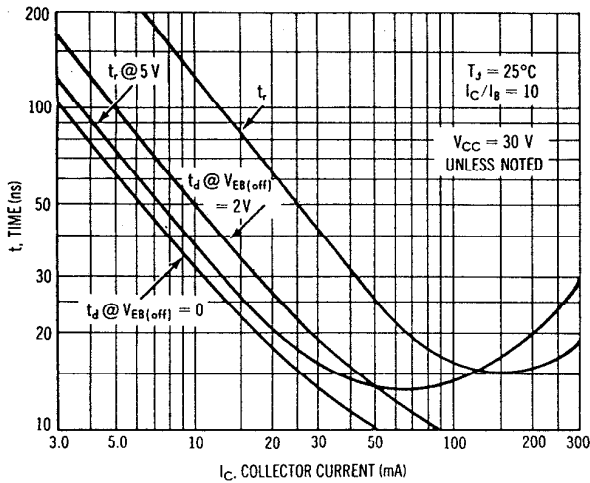


FIGURE 11 — CHARGE DATA

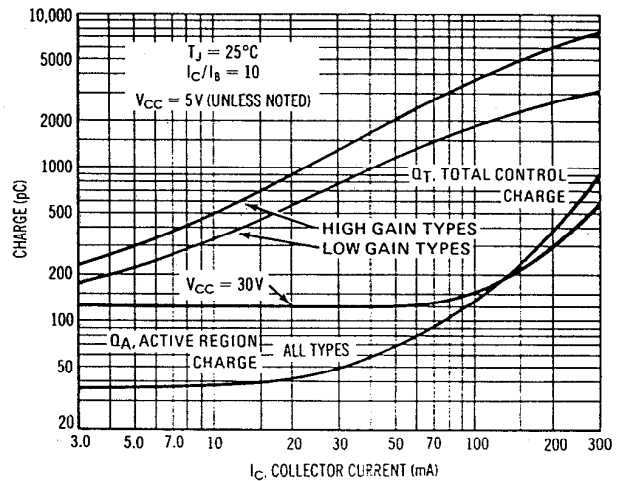
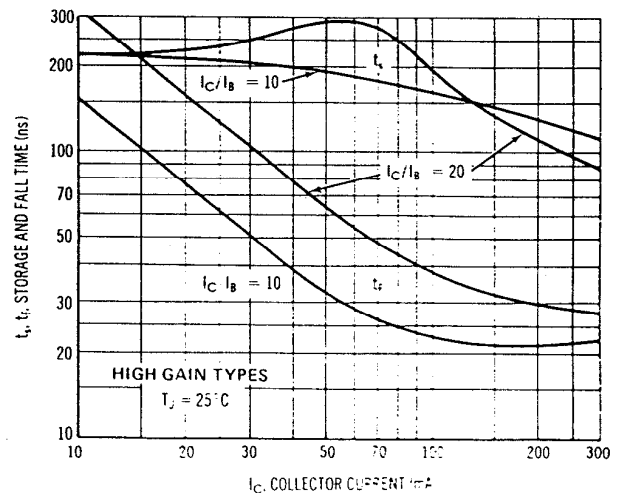
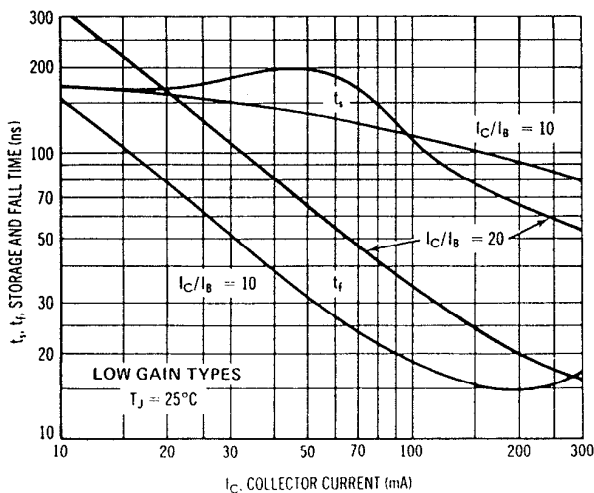


FIGURE 12 — TURN-OFF TIME



PNP DATA

FIGURE 13 – DC CURRENT GAIN

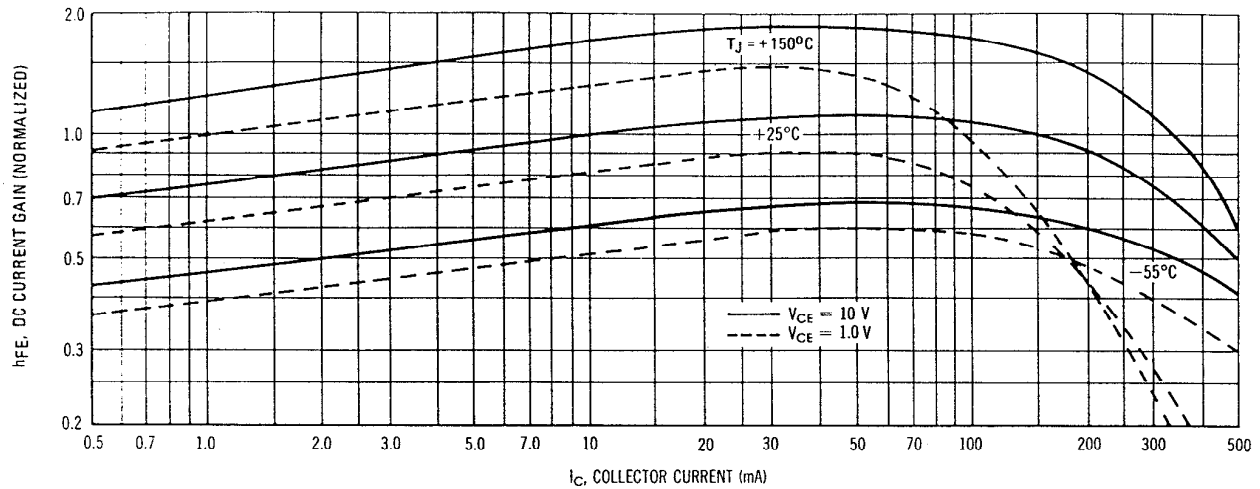


FIGURE 14 – "ON" VOLTAGES

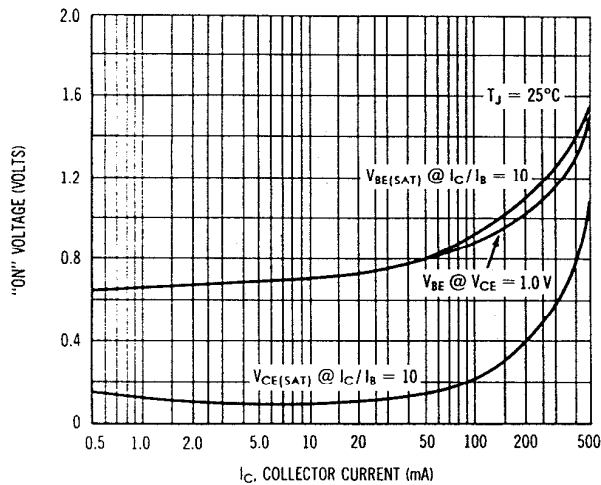
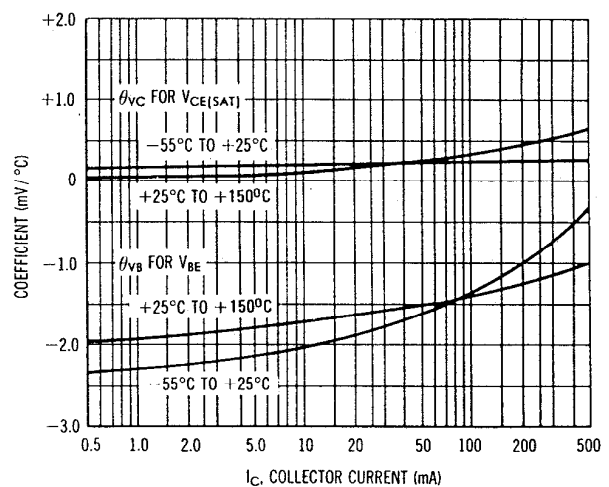


FIGURE 15 – TEMPERATURE COEFFICIENTS



NOISE FIGURE ($V_{CE} = 10\text{ V}$, $T_A = 25^\circ\text{C}$)

FIGURE 16 – FREQUENCY EFFECTS

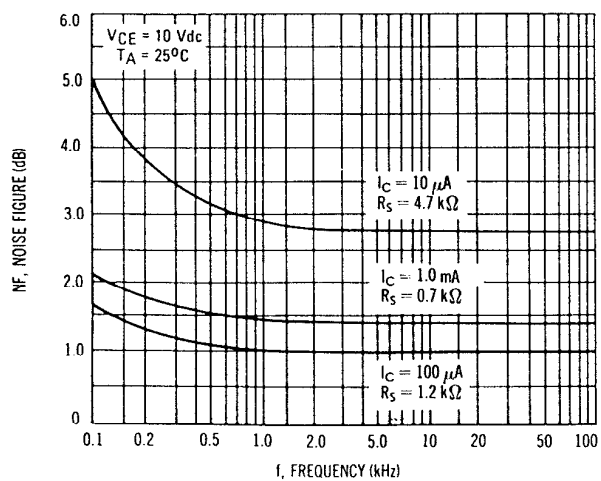
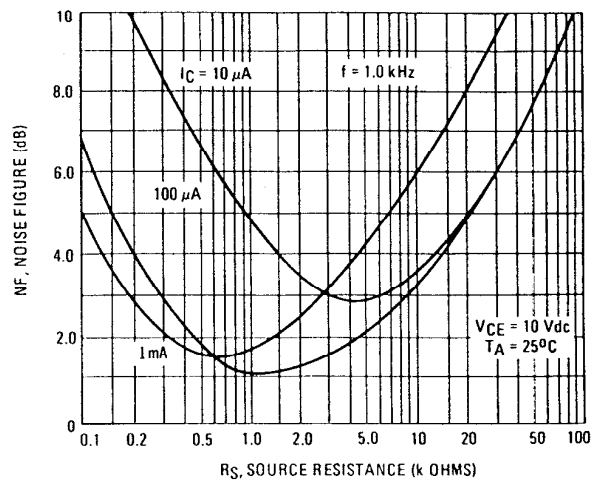


FIGURE 17 – SOURCE RESISTANCE EFFECTS



PNP DATA

FIGURE 18 – CURRENT-GAIN BANDWIDTH PRODUCT

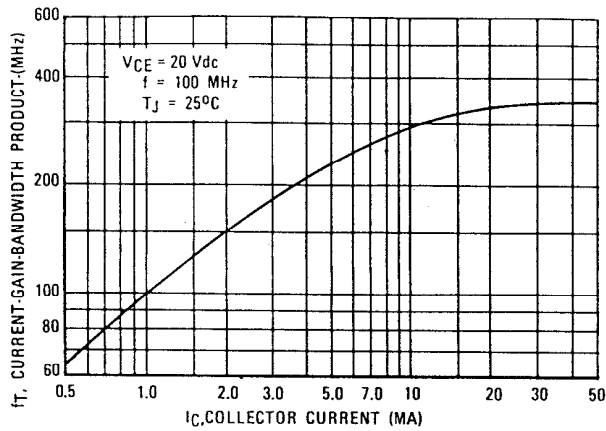


FIGURE 19 – CAPACITANCE

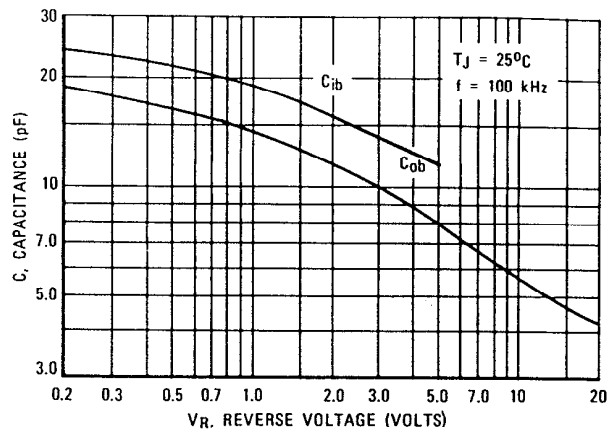


FIGURE 20 – TURN ON TIME

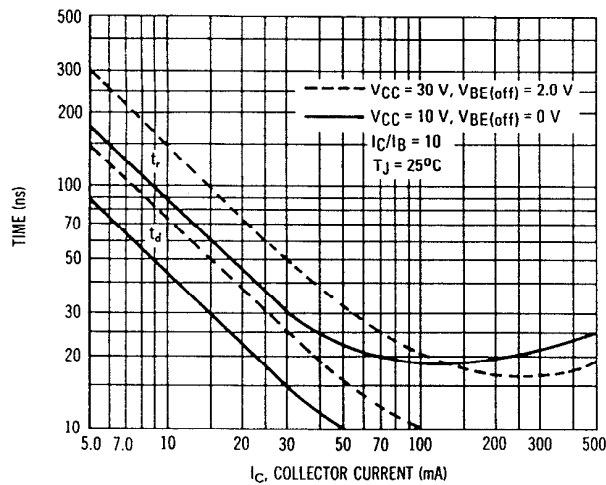


FIGURE 21 – CHARGE DATA

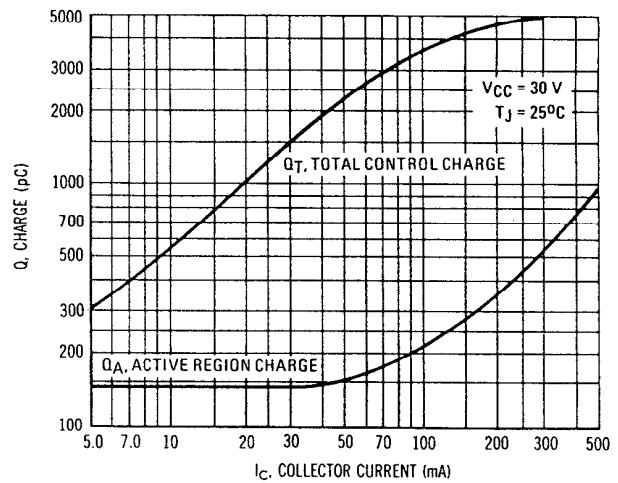


FIGURE 22 – STORAGE TIME

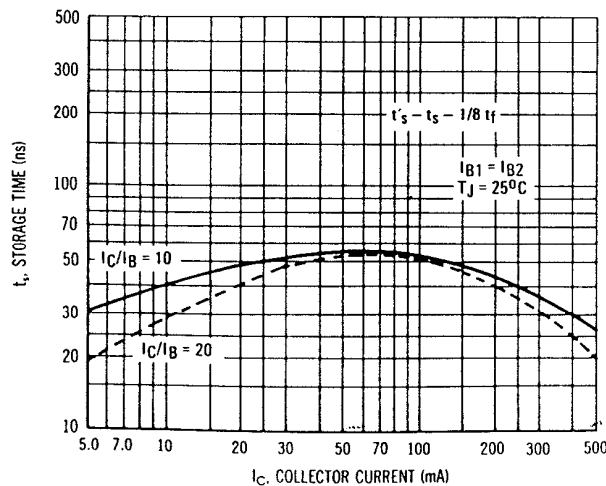
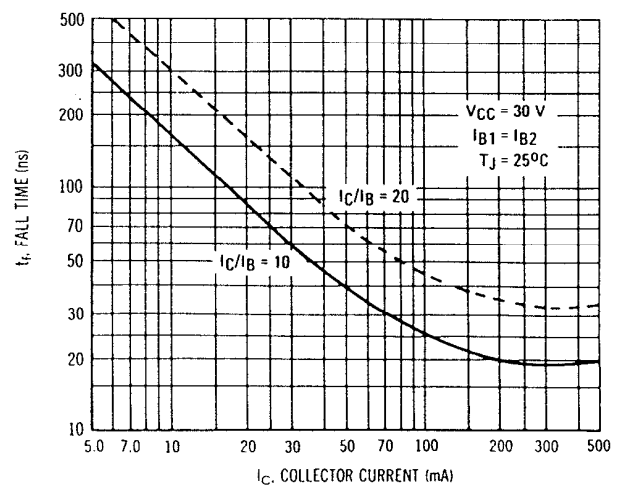


FIGURE 23 – FALL TIME


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Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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