SMALL-SIGNAL AMPLIFIERS (LOW CURRENT) — All devices in Case 29 (1)

Type NPN / PNP *	MAXIMUM RATINGS V_{CEO} Volts	V_{CB} Volts	V_{EB} Volts	ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) I_{CBO} μA(Max)	h_{FE} @ I_C (mA) 0.1 Min	0.1 Max	1.0 Min	1.0 Max	2.0 Min	2.0 Max	$V_{CE(sat)}$ @ I_C Volts(Max)	mA	f_T @ I_C MHz(Min)	mA	C_{ob} pF(Max)
2N5086*	50	50	3.0	0.01	150	500	150	-	-	-	0.3	10	40	0.5	4.0
2N5087*	50	50	3.0	0.01	250	800	250	-	-	-	0.3	10	40	0.5	4.0
2N5088	30	35	4.5	0.05	300	900	350	-	-	-	0.5	10	50/175**	0.5	4.0†
2N5089	25	30	4.5	0.05	400	1200	450	-	-	-	0.5	10	50/175**	0.5	4.0†
MPS918	15	30	3.0	0.01	-	-	-	-	20	-	0.4	10	600	4.0	1.7
MPS3707	30	30	6.0	0.1	100	400	-	-	-	-	1.0	10	-	-	-
MPS3708	30	30	6.0	0.1	-	-	45	660	-	-	1.0	10	-	-	-
MPS3709	30	30	6.0	0.1	-	-	45	165	-	-	1.0	10	-	-	-
MPS3710	30	30	6.0	0.1	-	-	90	330	-	-	1.0	10	-	-	-
MPS3711	30	30	6.0	0.1	-	-	180	660	-	-	1.0	10	-	-	-
MPS6520	25	40	4.0	0.05	100	-	-	-	200	400	0.5	50	390** -	2.0 -	3.5
MPS6521	25	40	4.0	0.05	150	-	-	-	300	600	0.5	50	390** -	2.0 -	3.5
MPS6522*	25	25	4.0	0.05	100	-	-	-	200	400	0.5	50	340** -	2.0 -	4.0
MPS6523*	25	25	4.0	0.05	150	-	-	-	300	600	0.5	50	340** -	2.0 -	4.0

** Typical † C_{cb}

SMALL-SIGNAL AMPLIFIERS (MEDIUM CURRENT) — All devices in Case 29 (1)

Type NPN / PNP *	MAXIMUM RATINGS V_{CEO} Volts	V_{CB} Volts	V_{EB} Volts	ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) I_{CBO} μA (Max)	h_{FE} @ I_C (mA) 2.0 Min	2.0 Max	10 Min	10 Max	100 Min	100 Max	$V_{CE(sat)}$ @ I_C Volts (Max)	mA	f_T @ I_C MHz (Min)	mA	C_{ob} pF (Max)
MPS2711	18	18	5.0	0.5	30	90	-	-	-	-	-	-	-	-	4.0
MPS2712	18	18	5.0	0.5	75	225	-	-	-	-	-	-	-	-	4.0
MPS2715	18	18	5.0	0.5	30	90	-	-	-	-	-	-	-	-	3.5
MPS2716	18	18	5.0	0.5	75	225	-	-	-	-	-	-	-	-	3.5
MPS2923	25	25	5.0	0.5	90	180	-	-	-	-	-	-	-	-	12
MPS2924	25	25	5.0	0.5	150	300	-	-	-	-	-	-	-	-	12
MPS2925	25	25	5.0	0.5	235	470	-	-	-	-	-	-	-	-	12
MPS2926	18	18	5.0	0.5	35	470#	-	-	-	-	-	-	300*# -	4.0 -	3.5
MPS3392	25	25	5.0	0.1	150	300	-	-	-	-	-	-	-	-	3.5
MPS3393	25	25	5.0	0.1	90	180	-	-	-	-	-	-	-	2.0	3.5
MPS3394	25	25	5.0	0.1	55	110	-	-	-	-	-	-	-	-	3.5
MPS3395	25	25	5.0	0.1	150	500	-	-	-	-	-	-	-	-	3.5
MPS3396	25	25	5.0	0.1	90	500	-	-	-	-	-	-	-	-	3.5
MPS3397	25	25	5.0	0.1	55	500	-	-	-	-	-	-	-	-	3.5
MPS3398	25	25	5.0	0.1	55	800	-	-	-	-	-	-	-	-	3.5
MPS3563	12	30	2.0	0.05	-	-	20	200	-	-	-	-	600	8.0	1.7
MPS3693	45	45	4.0	0.05	-	-	40	160	-	-	-	-	200	10	3.5
MPS3694	45	45	4.0	0.05	-	-	100	400	-	-	-	-	200	10	3.5
MPS3721	18	18	5.0	0.5	60	660#	-	-	-	-	-	-	-	-	3.5
MPS3826	45	60	4.0	0.1	-	-	40	160	-	-	-	-	200	10	3.5
MPS3827	45	60	4.0	0.1	-	-	100	400	-	-	-	-	200	10	3.5
MPS6507	20	30	3.0	0.05	25	-	-	-	-	-	-	-	700	10	2.5
MPS6511	20	30	3.0	0.05	-	-	25	-	-	-	-	-	-	-	2.5
MPS6512	30	40	4.0	0.05	50	100	-	-	30	-	0.5	50	250** -	2.0 -	3.5
MPS6513	30	40	4.0	0.05	90	180	-	-	60	-	0.5	50	250** -	2.0 -	3.5
MPS6514	25	40	4.0	0.05	150	300	-	-	90	-	0.5	50	390** -	2.0 -	3.5
MPS6515	25	40	4.0	0.05	250	500	-	-	150	-	0.5	50	390** -	2.0 -	3.5
MPS6516*	40	40	4.0	0.05	50	100	-	-	30	-	0.5	50	200** -	2.0 -	4.0
MPS6517*	40	40	4.0	0.05	90	180	-	-	60	-	0.5	50	200** -	2.0 -	4.0
MPS6518*	40	40	4.0	0.05	150	300	-	-	90	-	0.5	50	340** -	2.0 -	4.0
MPS6519*	25	25	4.0	0.05	250	500	-	-	150	-	0.5	50	340** -	2.0 -	4.0

** Typical # h_{fe} @ 1.0 kHz

NIXIE DRIVERS All devices in Case 29 (1)

Type NPN	MAXIMUM RATINGS V_{CEO} Volts	V_{EB} Volts	ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) BV_{CEX} Volts (Min)	I_{CBO} @ V_{CB} μA(Max)	Volts	h_{FE} Min/Max @ I_C(mA) 1.0	10	$V_{CE(sat)}$ & $V_{BE(sat)}$ & $V_{BE(on)}$ @ I_C Volts (Max)			mA	f_T @ I_C MHz(Min/Max)	mA	C_{cb} @ V_{CB} pF(Max)	Volts
2N4409	50	5.0	80*	0.01	60	60/400	60/-	0.2	0.8	0.8	1.0	60/300	10	12	10
2N4410	80	5.0	120*	0.01	100	60/400	60/-	0.2	0.8	0.8	1.0	60/300	10	12	10

* R_{BE} = 8.2 k ohms, V_{BB} = 5.0 V

AUDIO PREAMPLIFIERS AND PREDRIVERS

Type NPN / PNP*	Case	MAXIMUM RATINGS V_{CEO} Volts	MAXIMUM RATINGS V_{EB} Volts	ELECTRICAL CHARACTERISTICS I_{CBO} @ V_{CB} nA (Max)	Volts	h_{FE} @ I_C Min/Max	mA	NF @ I_C & f dB Typ/Max	μA	Hz to kHz	$V_{BE(on)}$ @ I_C Volts (Max)	mA	C_{ob} @ V_{CB} = 10 V pF (Max)	f_T MHz Min/Max
MPS2711	29 (1)	18	5.0	500	18	30/ 90	2.0	-	-	-	-	-	4.0	-
MPS2712						75/225		-	-	-	-	-	4.0	-
MPS2715						30/ 90		-	-	-	-	-	3.5	-
MPS2716						75/225		-	-	-	-	-		-
MPS3392		25		100		150/300		-	-	-	-	-		-
MPS3393						90/180		-	-	-	-	-		-
MPS3394						55/110		-	-	-	-	-		-
MPS3395						150/500		-	-	-	-	-		-
MPS3396						90/500		-	-	-	-	-		-
MPS3397						55/500		-	-	-	-	-		-
MPS3398						55/800		-	-	-	-	-		-
MPS3702*					20	60/300	50	-	-	-	1.0	50	12	100/-
MPS3703*		30			20	30/150	50	-	-	-	1.0	50	12	100/-
MPS3826		45	4.0		30	40/160	10	-	-	-	-	-	3.5	200/800
MPS3827		45				100/400	10	-	-	-	-	-		200/800
MPS6512		30		50		50/100	2.0	-	-	-	-	-		250
MPS6513		30				90/180		-	-	-	-	-		250
MPS6514		25				150/300		-	-	-	-	-		390
MPS6515		25				250/500		-	-	-	-	-		390
MPS6516*		40				50/100		-	-	-	-	-	4.0	200 Typ
MPS6517*						90/180		-	-	-	-	-		200
MPS6518*						150/300		-	-	-	-	-		340
MPS6519*		25			20	250/500		-	-	-	-	-		340
MPS6552			6.0	100		100/300	10	-	-	-	0.8	10	12	30/180
MPS6553						100/300		/3.0	100	10 to 15.7**				
MPS6554						200/500		-	-	-				
MPS6555						200/500		/3.0	100	10 to 15.7**				
MPS6571		20	3.0	50	20	250/1000	0.1	-	-	-	-	-	4.5	50/-
MPS6573		35	4.0	100	35	100/-		-	-	-	0.8	10	12	-/200
MPS6574		35			35	100/-		-	-	-				
MPS6575		45			45	200/500	10	-	-	-				
MPS6576		45			45	200/500	10	-	-	-				
2N5086*		50	3.0	10	10	150/500	0.1	-/3.0	100	-1.0	0.85	1.0	4.0	40
2N5087*		50		10	10	250/800		-/2.0	100	-1.0	0.85	1.0	4.0	40
2N5088		30		50	20	300/900		-/3.0	100	10 to 15.7**	0.8	10	4.5	50/-
2N5089		25			15	400/1200		-/2.0	100		0.8	10	4.5	50/-

** Noise bandwidth

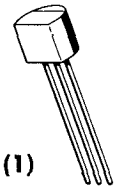
HIGH-SPEED SATURATED SWITCHES — All devices in Case 29 (1)

Type NPN / PNP*	MAXIMUM RATINGS V_{CEO} Volts	MAXIMUM RATINGS V_{EB} Volts	ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) I_{CBO} μA(Max)	h_{FE} Min/Max @ I_C(mA) 1.0	2.0	10	30	50	100	200	300	$V_{CE(sat)}$ & $V_{BE(sat)}$ @ I_C Volts(Max)		mA	f_T @ I_C MHz(Min)	mA	C_{ob} pF(Max)	Switching Times ns (Max) @ I_C/I_B t_d	t_r	t_s	t_f	mA
2N4264	15	6.0	0.10	25/-	-/-	40/160	40/-	-/-	30/-	20/-	-/-	0.22 0.35	0.80 0.95	10 100	300	10	4.0	8.0	15	20	15	100/10
2N4265	12	6.0	0.10	50/-	-/-	100/400	90/-	-/-	55/-	35/-	-/-	0.22 0.35	0.80 0.95	10 100	300	10	4.0	8.0	15	20	15	100/10
MPS706	15	3.0	0.5	-/-	-/-	20/-	-/-	-/-	-/-	-/-	-/-	0.60	0.90	10	200	10	6.0	t_{on} = 40, t_{off} = 75				10/-
MPS834	30	5.0	0.5	-/-	-/-	25/-	-/-	-/-	-/-	-/-	-/-	0.25	0.90	10	350	10	4.0	t_{on} = 16, t_{off} = 30				10/3
MPS2369	15	4.5	0.4	-/-	-/-	40/120	-/-	-/-	20/-	-/-	-/-	0.25	0.85	10	-	-	4.0	t_{on} = 12, t_{off} = 18				10/3
MPS2713	18	5.0	0.5	-/-	30/90	-/-	-/-	-/-	-/-	-/-	-/-	0.30	1.30	50	250**	10	2.5**	7.0	6.0	12	9	10/3
MPS2714	18	5.0	0.5	-/-	75/225	-/-	-/-	-/-	-/-	-/-	-/-	0.30	1.30	50	250**	10	2.5**	7.0	6.0	12	9	10/3
MPS3646	15	5.0	0.5	-/-	-/-	-/-	30/120	-/-	25/-	-/-	15/-	0.20 0.50	0.95 1.70	30 300	350	30	5.0	10	15	20	15	300/30
MPS3639*	6.0	4.0	-	-/-	-/-	30/120	-/-	20/-	-/-	-/-	-/-	0.16	1.00	10	500	10	3.5	10	30	20	12	50/5
MPS3640*	12	4.0	-	-/-	-/-	30/120	-/-	20/-	-/-	-/-	-/-	0.20	1.00	10	500	10	3.5	10	30	20	12	50/5.0

** Typical

MPS6512 thru MPS6515 (SILICON)
MPS6520
MPS6521

V_{CEO} = 25-30 V
I_C = 100 mA
P_D = 310 mW



CASE 29(1)
(TO-92)

NPN silicon transistors designed for use in general-purpose audio and low-frequency amplifier applications. Types MPS6520 and MPS6521 are particularly suited for low-noise applications.

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Rating	Symbol	MPS6512 MPS6513	MPS6514 MPS6515 MPS6520 MPS6521	Unit
Collector-Base Voltage	V_{CB}	40	40	Volts
Collector-Emitter Voltage	V_{CEO}	30	25	Volts
Emitter-Base Voltage	V_{EB}	4		Volts
Collector Current	I_C	100		mA
Total Device Dissipation @ T_A = 60°C @ T_A = 25°C	P_D	210 310		mW
Junction Temperature	T_J	135		°C

THERMAL RESISTANCE $\theta_{JA(air)}$ = 0.357°C/mW

MPS6512 thru MPS6515, MPS6520, MPS6521 (continued)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage (I_C = 0.5 mAdc, I_B = 0)	MPS6512, MPS6513	BV_{CEO}	30	—	—	Vdc
	MPS6514, MPS6515		25	—	—	
	MPS6520, MPS6521		25	—	—	
Emitter-Base Breakdown Voltage (I_B = 10 μAdc, I_C = 0)		BV_{EBO}	4	—	—	Vdc
Collector Cutoff Current (V_{CB} = 30 Vdc, I_E = 0)		I_{CBO}	—	—	0.05	μAdc
(V_{CB} = 30 Vdc, I_E = 0, T_A = 60°C)			—	—	1.0	
DC Current Gain (I_C = 100 μAdc, V_{CE} = 10 Vdc)	MPS6520	h_{FE}	100	—	—	—
	MPS6521		150	—	—	
(I_C = 2 mAdc, V_{CE} = 10 Vdc)	MPS6512		50	—	100	
	MPS6513		90	—	180	
	MPS6514		150	—	300	
	MPS6515		250	—	500	
	MPS6520		200	—	400	
	MPS6521		300	—	600	
(I_C = 100 mAdc, V_{CE} = 10 Vdc)*	MPS6512		30	—	—	
	MPS6513		60	—	—	
	MPS6514		90	—	—	
	MPS6515		150	—	—	
Collector-Emitter Saturation Voltage (I_C = 50 mAdc, I_B = 5 mAdc)		$V_{CE(sat)}$	—	—	0.5	Vdc
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 100 kHz)		C_{ob}	—	—	3.5	pF
Current Gain - Bandwidth Product (I_C = 2 mAdc, V_{CE} = 10 Vdc)	MPS6512, MPS6513	f_T	—	250	—	MHz
	MPS6514, MPS6515		—	390	—	
	MPS6520, MPS6521		—	390	—	
(I_C = 10 mAdc, V_{CE} = 10 Vdc)	MPS6512, MPS6513		—	330	—	
	MPS6514, MPS6515		—	480	—	
	MPS6520, MPS6521		—	480	—	
Wideband Noise Figure (V_{CE} = 5 Vdc, I_C = 10 μAdc, R_G = 10 k ohms, Power Bandwidth = 15.7 kHz, 3 dB points @ 10 Hz and 10kHz)	MPS6520, MPS6521	NF	—	1.8	3.0	dB

*Pulse Test: PW ≤ 30 μs, duty cycle ≤ 2%

WIDEBAND NOISE FIGURE versus SOURCE IMPEDANCE

FIGURE 1 — MPS6512 thru MPS6515

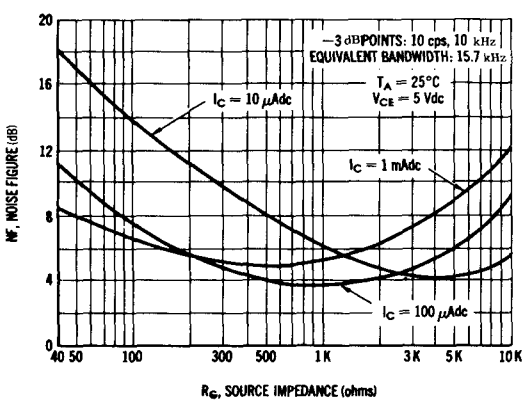
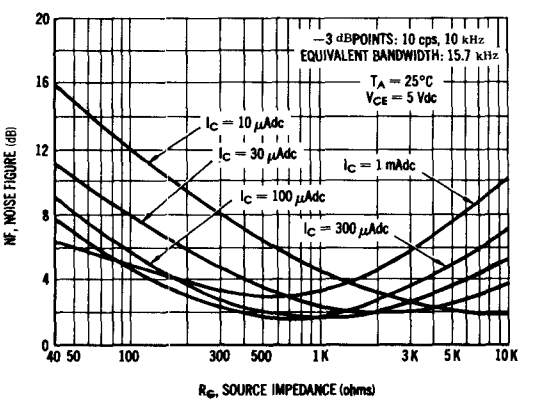


FIGURE 2 — MPS6520, MPS6521



MPS6512 thru MPS6515, MPS6520, MPS6521 (continued)

COLLECTOR CHARACTERISTICS — COMMON EMITTER

FIGURE 3 — MPS6512

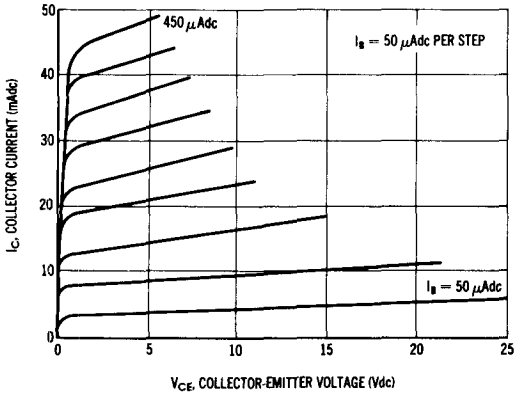


FIGURE 4 — MPS6513

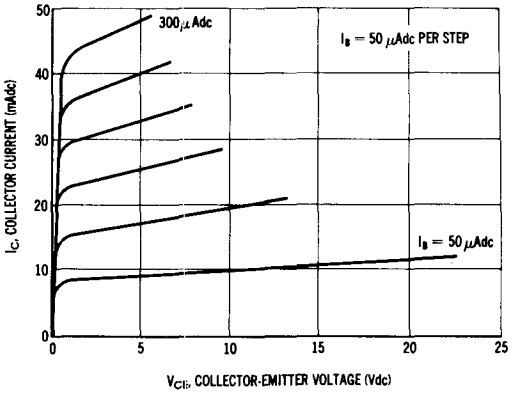


FIGURE 5 — MPS6514, MPS6520

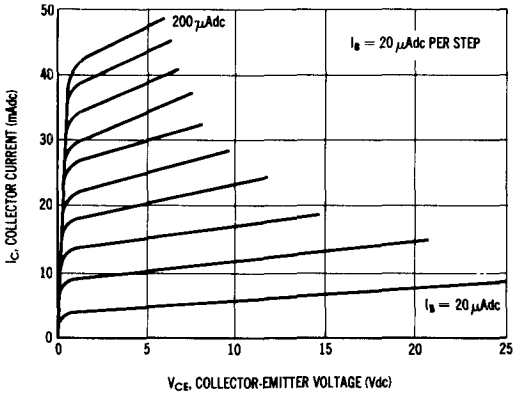


FIGURE 6 — MPS6515, MPS6521

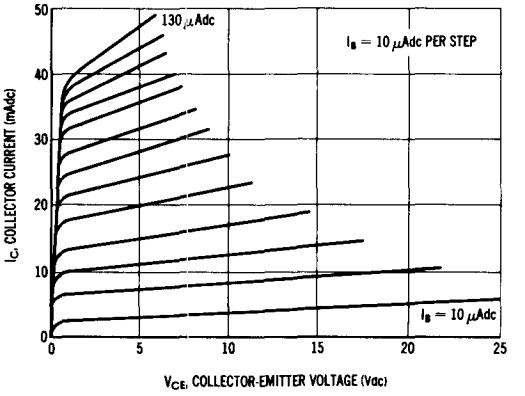


FIGURE 7 — SPOT NOISE FIGURE versus FREQUENCY

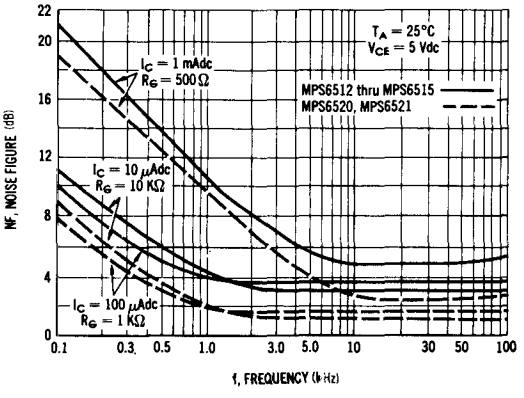
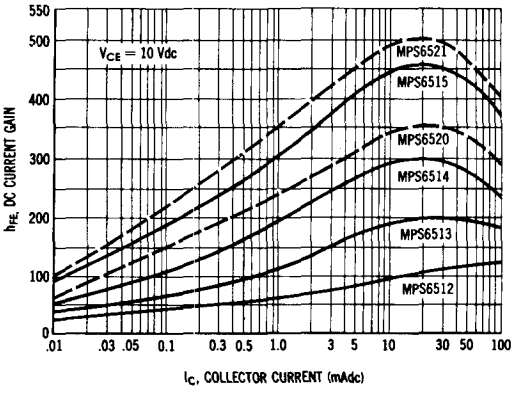


FIGURE 8 — DC CURRENT GAIN versus COLLECTOR CURRENT



MPS6512 thru MPS6515, MPS6520, MPS6521 (continued)

h PARAMETER VARIATIONS
(f = 1 MHz , T_A = 25°C)

FIGURE 9 — INPUT IMPEDANCE versus COLLECTOR CURRENT

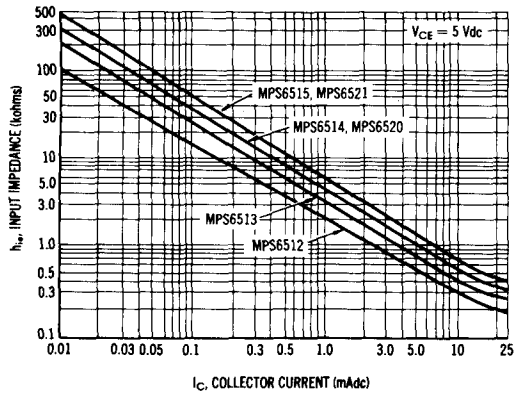


FIGURE 10 — REVERSE VOLTAGE TRANSFER RATIO versus COLLECTOR CURRENT

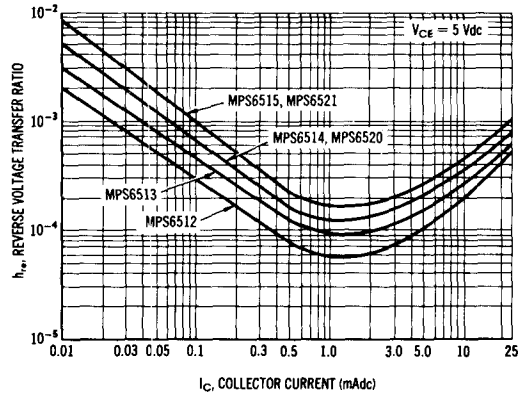


FIGURE 11 — SMALL SIGNAL CURRENT GAIN versus COLLECTOR CURRENT

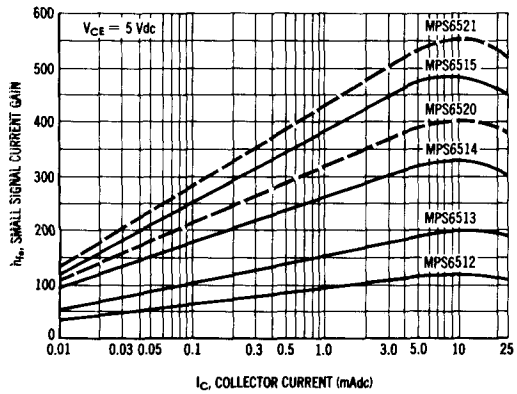


FIGURE 12 — OUTPUT ADMITTANCE versus COLLECTOR CURRENT

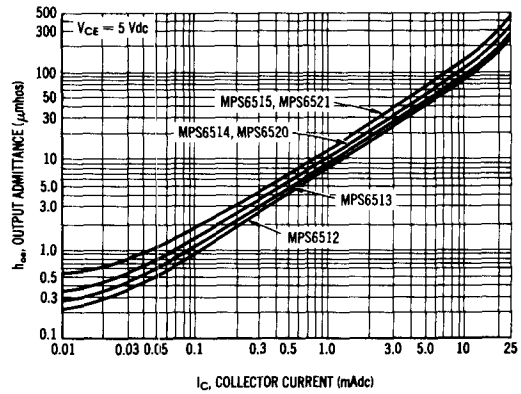


FIGURE 13 — GAIN — BANDWIDTH PRODUCT versus COLLECTOR CURRENT

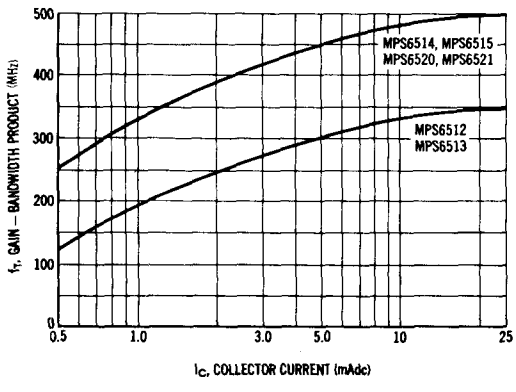


FIGURE 14 — COLLECTOR CURRENT versus BASE-EMITTER TURN-ON VOLTAGE