

6367254 MOTOROLA SC (XSTRS/R F)

96D 82448 D  
T-29-27

**MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V <sub>CEO</sub>	40	Vdc
Collector-Base Voltage	V <sub>CBO</sub>	50	Vdc
Emitter-Base Voltage	V <sub>EBO</sub>	5.0	Vdc
Collector Current — Continuous	I <sub>C</sub>	50	mAdc
		One Die	All Die Equal Power
Total Device Dissipation @ T <sub>A</sub> = 25°C MD3250,A, MD3251,A MD3250,AF, MD3251F,AF MQ3251	P <sub>D</sub>	575	625
		350	400
		400	600
Derate above 25°C MD3250,A, MD3251,A MD3250,AF, MD3251F,AF MQ3251	P <sub>D</sub>	3.29	3.57
		2.0	2.28
		2.28	3.42
Total Device Dissipation @ T <sub>C</sub> = 25°C MD3250,A, MD3251,A MD3250,AF, MD3251F,AF MQ3251	P <sub>D</sub>	1.8	2.5
		1.0	2.0
		0.9	3.6
Derate above 25°C MD3250,A, MD3251,A MD3250,AF, MD3251F,AF MQ3251	P <sub>D</sub>	10.3	14.3
		5.71	11.4
		5.13	20.5
Operating and Storage Junction Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-65 to +200	°C

**MD3250,A,AF**  
**MD3251,A,F,AF**  
**MQ3251**

MD3250,A  
MD3251,A  
CASE 654-07, STYLE 1



MD3250,AF  
MD3251F,AF  
CASE 610A-04, STYLE 1



MQ3251  
CASE 607-04, STYLE 1



**DUAL AMPLIFIER TRANSISTOR**  
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**THERMAL CHARACTERISTICS**

Characteristic	Symbol	One Die	All Die Equal Power	Unit
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	97	70	°C/W
		175	87.5	
		195	48.8	
Thermal Resistance, Junction to Ambient	R <sub>θJA</sub> (1)	304	280	°C/W
		500	438	
		438	292	
Coupling Factors		Junction to Ambient	Junction to Case	%
		84	44	
		75	0	
		57	0	
		55	0	

(1) R<sub>θJA</sub> is measured with the device soldered into a typical printed circuit board.

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted.)**

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector-Emitter Breakdown Voltage(2) (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	40	—	—	Vdc
Collector-Base Breakdown Voltage (I <sub>C</sub> = 10 μAdc, I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	50	—	—	Vdc
Emitter-Base Breakdown Voltage (I <sub>E</sub> = 10 μAdc, I <sub>C</sub> = 0)	V <sub>(BR)EBO</sub>	5.0	—	—	Vdc
Collector Cutoff Current (V <sub>CB</sub> = 40 Vdc, I <sub>E</sub> = 0) (V <sub>CB</sub> = 40 Vdc, I <sub>E</sub> = 0, T <sub>A</sub> = 150°C)	I <sub>CBO</sub>	—	—	10	nAdc
		—	—	10	μAdc
Emitter Cutoff Current (V <sub>BE</sub> = 3.0 Vdc, I <sub>C</sub> = 0)	I <sub>EBO</sub>	—	—	10	nAdc



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## MD3250,A,AF, MD3251,A,F,AF, MQ3251

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>ON CHARACTERISTICS(2)</b>					
DC Current Gain ( $I_C = 10 \mu\text{Adc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )	hFE MD3250,A,AF MD3251,A,F,AF	25 50	75 100	— —	—
( $I_C = 100 \mu\text{Adc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )	MD3250,A,AF MD3251,A,F,AF MQ3251	50 80 80	82 170 170	150 300 —	
( $I_C = 100 \mu\text{Adc}$ , $V_{CE} = 5.0 \text{ Vdc}$ , $T_A = -55^\circ\text{C}$ )	MD3250,A,AF MD3251,A,F,AF	25 50	35 75	— —	
( $I_C = 1.0 \text{ mAdc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )	MD3250,A,AF MD3251,A,F,AF MQ3251	50 100 100	87 180 180	150 300 —	
( $I_C = 10 \text{ mAdc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )	MD3250,A,AF MD3251,A,F,AF MQ3251	50 100 100	92 190 190	— — 300	
( $I_C = 50 \text{ mAdc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )	MD3250,A,AF MD3251,A,F,AF MQ3251	15 30 30	50 90 90	— — —	
Collector-Emitter Saturation Voltage ( $I_C = 10 \text{ mAdc}$ , $I_B = 1.0 \text{ mAdc}$ ) ( $I_C = 50 \text{ mAdc}$ , $I_B = 5.0 \text{ mAdc}$ )	$V_{CE(sat)}$	— —	0.11 0.18	0.25 0.5	Vdc
Base-Emitter Saturation Voltage ( $I_C = 10 \text{ mAdc}$ , $I_B = 1.0 \text{ mAdc}$ ) ( $I_C = 50 \text{ mAdc}$ , $I_B = 5.0 \text{ mAdc}$ )	$V_{BE(sat)}$	0.6 —	0.78 0.88	0.9 1.2	Vdc

## SMALL-SIGNAL CHARACTERISTICS

Current-Gain — Bandwidth Product ( $I_C = 10 \text{ mAdc}$ , $V_{CE} = 20 \text{ Vdc}$ , $f = 100 \text{ MHz}$ )	$f_T$ MD3250,A,AF MD3251,A,F,AF MQ3251	200 250 300	600 600 600	— — —	MHz
Output Capacitance ( $V_{CB} = 5.0 \text{ Vdc}$ , $I_E = 0$ , $f = 100 \text{ kHz}$ )	$C_{obo}$	—	2.5	6.0	pF
Input Capacitance ( $V_{BE} = 1.0 \text{ Vdc}$ , $I_C = 0$ , $f = 100 \text{ kHz}$ )	$C_{ibo}$	—	6.0	8.0	pF

## MATCHING CHARACTERISTICS (MD3250,A,AF &amp; MD3251,A,F,AF ONLY)

DC Current Gain Ratio(3) ( $I_C = 100 \mu\text{Adc}$ , $V_{CE} = 5.0 \text{ Vdc}$ ) ( $I_C = 1.0 \text{ mAdc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )	$h_{FE1}/h_{FE2}$	0.9 0.9	— —	1.0 1.0	—
Base-Emitter Voltage Differential ( $I_C = 100 \mu\text{Adc}$ , $V_{CE} = 5.0 \text{ Vdc}$ ) ( $I_C = 10 \mu\text{Adc}$ , $V_{CE} = 5.0 \text{ Vdc}$ ) ( $I_C = 10 \text{ mAdc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )	$ V_{BE1}-V_{BE2} $	— — —	— — —	3.0 5.0 5.0	mVdc
Base-Emitter Voltage Differential Change Due to Temperature ( $I_C = 100 \mu\text{Adc}$ , $V_{CE} = 5.0 \text{ Vdc}$ , $T_A = -55$ to $+25^\circ\text{C}$ ) ( $I_C = 100 \mu\text{Adc}$ , $V_{CE} = 5.0 \text{ Vdc}$ , $T_A = +25$ to $+125^\circ\text{C}$ )	$\Delta V_{BE1}-V_{BE2} $	— —	— —	0.8 1.0	mVdc

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

(3) The lowest hFE reading is taken as hFE1 for this ratio.

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 MD3250,A,AF, MD3251,A,F,AF, MQ3251

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FIGURE 1 - CAPACITANCE

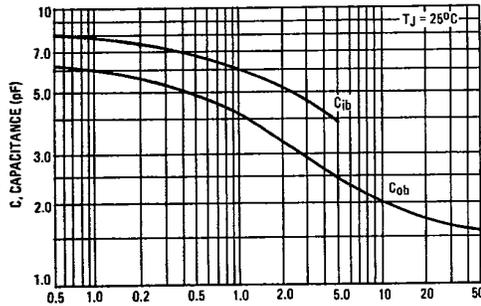
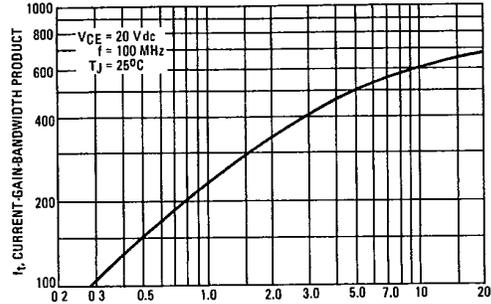


FIGURE 2 - CURRENT-GAIN BANDWIDTH PRODUCT



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NOISE FIGURE VARIATIONS  
 ( $V_{CE} = 6.0\text{ V}$ ,  $T_A = 25^\circ\text{C}$ )

FIGURE 3 - EFFECTS OF FREQUENCY

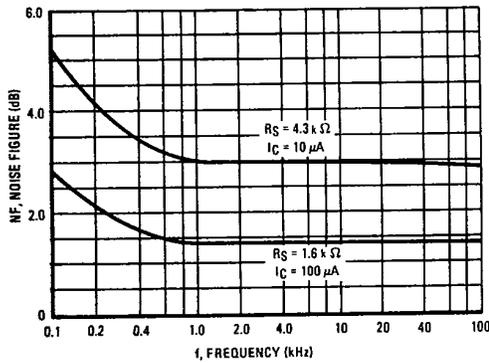


FIGURE 4 - EFFECTS OF SOURCE RESISTANCE

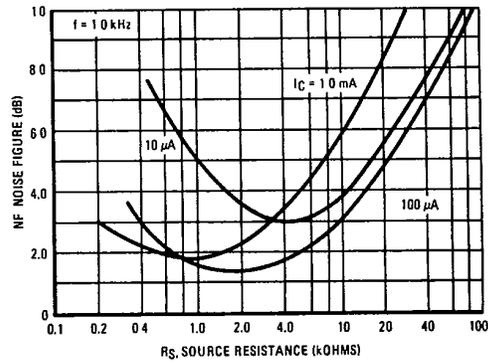
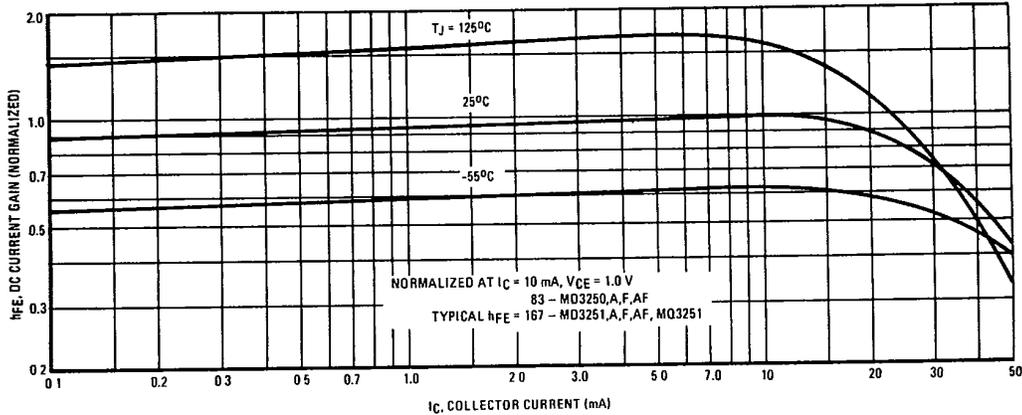


FIGURE 5 - DC CURRENT GAIN



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MAXIMUM RATINGS					
Rating	Symbol	Value		Unit	
Collector-Emitter Voltage	V <sub>CEO</sub>	40		Vdc	
Collector-Base Voltage	V <sub>CBO</sub>	50		Vdc	
Emitter-Base Voltage	V <sub>EBO</sub>	5.0		Vdc	
Collector Current — Continuous	I <sub>C</sub>	50		mAdc	
		One Die	All Die Equal Power		
Total Device Dissipation @ T <sub>A</sub> = 25°C MD7003,A,B MD7003,AF MQ7003 Derate above 25°C MD7003,A,B MD7003,AF MQ7003	P <sub>D</sub>			mW	
			550	600	
			350	400	
			400	600	
					mW/°C
Total Device Dissipation @ T <sub>C</sub> = 25°C MD7003,A,B MD7003,AF MQ7003 Derate above 25°C MD7003,A,B MD7003,AF MQ7003	P <sub>D</sub>			Watts	
			1.4	2.0	
			0.7	1.4	
			0.7	2.8	
					mW/°C
Operating and Storage Junction Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-65 to +200		°C	

**MD7003,A,B,AF**  
**MQ7003**

MD7003,A,B  
CASE 654-07, STYLE 1 

MD7003,AF  
CASE 610A-04, STYLE 1 

MQ7003  
CASE 607-04, STYLE 1 

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Refer to 2N3810 for curves.

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**THERMAL CHARACTERISTICS**

Characteristic	Symbol	One Die	All Die Equal Power	Unit	
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	MD7003,A,B	125	87.5	°C/W
		MD7003,AF	250	125	
		MQ7003	250	62.6	
Thermal Resistance, Junction to Ambient	R <sub>θJA</sub> (1)	MD7003,A,B	319	292	°C/W
		MD7003,AF	500	438	
		MQ7003	438	292	
Coupling Factor			Junction to Ambient	Junction to Case	%
		MD7003,A,B	83	40	
		MD7003,AF	75	0	
		MQ7003 (Q1-Q2)	57	0	
		MQ7003 (Q1-Q3 or Q1-Q4)	55	0	

(1) R<sub>θJA</sub> is measured with the device soldered into a typical printed circuit board.

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted.)**

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector-Emitter Breakdown Voltage(2) (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	40	—	—	Vdc
Collector-Base Breakdown Voltage (I <sub>C</sub> = 10 μAdc, I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	50	—	—	Vdc
Emitter-Base Breakdown Voltage (I <sub>E</sub> = 10 μAdc, I <sub>C</sub> = 0)	V <sub>(BR)EBO</sub>	5.0	—	—	Vdc
Collector Cutoff Current (V <sub>CB</sub> = 30 Vdc, I <sub>E</sub> = 0)	I <sub>CBO</sub>	—	—	100	nAdc
<b>ON CHARACTERISTICS</b>					
DC Current Gain(2) (I <sub>C</sub> = 100 μAdc, V <sub>CE</sub> = 10 Vdc) (I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 10 Vdc)	h <sub>FE</sub>	40 50	350 350	— —	—

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MD7003,A,B,AF, MQ7003

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

Characteristic	Symbol	Min	Typ	Max	Unit
Collector-Emitter Saturation Voltage ( $I_C = 10\text{ mAdc}$ , $I_B = 1.0\text{ mAdc}$ )	$V_{CE(sat)}$	—	0.25	0.35	Vdc
Base-Emitter Saturation Voltage ( $I_C = 10\text{ mAdc}$ , $I_B = 1.0\text{ mAdc}$ )	$V_{BE(sat)}$	—	0.6	1.0	Vdc

**SMALL-SIGNAL CHARACTERISTICS**

Current-Gain — Bandwidth Product ( $I_C = 5.0\text{ mAdc}$ , $V_{CE} = 20\text{ Vdc}$ , $f = 100\text{ MHz}$ )	$f_T$	200	300	—	MHz
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 100\text{ kHz}$ )	$C_{obo}$	—	3.0	6.0	pF
Input Capacitance ( $V_{BE} = 2.0\text{ Vdc}$ , $I_C = 0$ , $f = 100\text{ kHz}$ )	$C_{ibo}$	—	2.0	8.0	pF
Noise Figure ( $I_C = 100\text{ }\mu\text{A}$ , $V_{CE} = 10\text{ Vdc}$ , $R_S = 3.0\text{ kohms}$ , $f = 10\text{ Hz to }15.7\text{ kHz}$ )	NF	—	2.0	—	dB

**MATCHING CHARACTERISTICS**

DC Current Gain Ratio(3) ( $I_C = 100\text{ }\mu\text{A}$ , $V_{CE} = 10\text{ Vdc}$ )	MD7003A,AF MD7003B	$h_{FE1}/h_{FE2}$	0.75 0.85	— —	1.0 1.0	—
Base-Emitter Voltage Differential ( $I_C = 100\text{ }\mu\text{A}$ , $V_{CE} = 10\text{ Vdc}$ )	MD7003A,AF MD7003B	$ V_{BE1} - V_{BE2} $	— —	— —	25 15	mV

(2) Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .  
 (3) The lowest  $h_{FE}$  reading is taken as  $h_{FE1}$  for this ratio.

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**MAXIMUM RATINGS**

Rating	Symbol	Value	Unit		
Collector-Emitter Voltage	V <sub>CEO</sub>	40	Vdc		
Collector-Base Voltage	V <sub>CBO</sub>	50	Vdc		
Emitter-Base Voltage	V <sub>EBO</sub>	5.0	Vdc		
Collector Current — Continuous	I <sub>C</sub>	200	mAdc		
		One Die	All Die Equal Power		
Total Device Dissipation @ T <sub>A</sub> = 25°C	P <sub>D</sub>			mW	
		MD7007,A,B	575		625
		MD7007F,BF	350		400
		MQ7007	400		600
Derate above 25°C	P <sub>D</sub>			mW/°C	
		MD7007,A,B	3.29		3.57
		MD7007F,BF	2.0		2.28
		MQ7007	2.28		3.42
Total Device Dissipation @ T <sub>C</sub> = 25°C	P <sub>D</sub>			Watts	
		MD7007,A,B	1.8		2.5
		MD7007F,BF	1.0		2.0
		MQ7007	0.9		3.6
Derate above 25°C	P <sub>D</sub>			mW/°C	
		MD7007,A,B	10.3		14.3
		MD7007F,BF	5.71		11.4
		MQ7007	5.13		20.5
Operating and Storage Junction Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-65 to +200	°C		

**MD7007,A,B,F,BF**  
**MQ7007**

MD7007,A,B  
CASE 654-07, STYLE 1 

MD7007F,BF  
CASE 610A-04, STYLE 1 

MQ7007  
CASE 607-04, STYLE 1 

**DUAL**  
**AMPLIFIER TRANSISTOR**

PNP SILICON



**THERMAL CHARACTERISTICS**

Characteristic	Symbol	One Die	All Die Equal Power	Unit	
Thermal Resistance, Junction to Case	R <sub>θJC</sub>			°C/W	
		MD7007,A,B	97		70
		MD7007F,BF	175		87.5
		MQ7007	195		48.8
Thermal Resistance, Junction to Ambient	R <sub>θJA</sub> (1)			°C/W	
		MD7007,A,B	304		280
		MD7007F,BF	500		438
		MQ7007	438		292
Coupling Factors			Junction to Ambient	Junction to Case	%
		MD7007,A,B	84	44	
		MD7007F,BF	75	0	
		MQ7007 (Q1-Q2)	57	0	
	(Q1-Q2 or Q1-Q4)	55	0		

(1) R<sub>θJA</sub> is measured with the device soldered into a typical printed circuit board.

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted.)**

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector-Emitter Breakdown Voltage(2) (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	40	—	—	Vdc
Collector-Base Breakdown Voltage (I <sub>C</sub> = 10 μAdc, I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	50	—	—	Vdc
Emitter-Base Breakdown Voltage (I <sub>E</sub> = 10 μAdc, I <sub>C</sub> = 0)	V <sub>(BR)EBO</sub>	5.0	—	—	Vdc
Collector Cutoff Current (V <sub>CB</sub> = 30 Vdc, I <sub>E</sub> = 0)	I <sub>CBO</sub>	—	—	100	nAdc
<b>ON CHARACTERISTICS(2)</b>					
DC Current Gain (I <sub>C</sub> = 100 μAdc, V <sub>CE</sub> = 10 Vdc) (I <sub>C</sub> = 1.0 mAdc, V <sub>CE</sub> = 10 Vdc) (I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 10 Vdc) (I <sub>C</sub> = 50 mAdc, V <sub>CE</sub> = 10 Vdc)	h <sub>FE</sub>	30	110	—	—
		30	130	—	—
		30	75	—	—
		15	25	—	—
		—	—	—	—

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 MD7007,A,B,F,BF, MQ7007

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

Characteristic	Symbol	Min	Typ	Max	Unit
Collector-Emitter Saturation Voltage ( $I_C = 50\text{ mAdc}$ , $I_B = 5.0\text{ mAdc}$ )	$V_{CE(sat)}$	—	0.38	1.0	Vdc
Base-Emitter Saturation Voltage ( $I_C = 50\text{ mAdc}$ , $I_B = 5.0\text{ mAdc}$ )	$V_{BE(sat)}$	—	0.9	1.5	Vdc

**SMALL-SIGNAL CHARACTERISTICS**

Current-Gain — Bandwidth Product(2) ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 100\text{ MHz}$ )	$f_T$	300	600	—	MHz
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 100\text{ kHz}$ )	$C_{obo}$	—	4.0	8.0	pF
Input Capacitance ( $V_{BE} = 2.0\text{ Vdc}$ , $I_C = 0$ , $f = 100\text{ kHz}$ )	$C_{ibo}$	—	3.8	10	pF

**MATCHING CHARACTERISTICS**

DC Current Gain Ratio(3) ( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ )	MD7007A	$h_{FE1}/h_{FE2}$	0.75	—	1.0	—
	MD7007B		0.85	—	1.0	
Base-Emitter Voltage Differential ( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ )	MD7007A	$ V_{BE1} - V_{BE2} $	—	—	20	mVdc
	MD7007B		—	—	10	

(2) Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .  
 (3) The lowest  $h_{FE}$  reading is taken as  $h_{FE1}$  for this ratio.

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