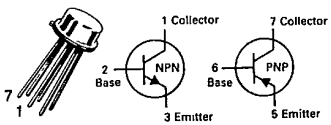
MD986

CASE 654-07, STYLE 5



COMPLEMENTARY DUAL GENERAL PURPOSE TRANSISTOR

NPN/PNP SILICON

MAXIMUM RATINGS

Rating	Symbol	Value		Unit
Collector-Emitter Voltage	V_{CEO}	15		Vdc
Collector-Base Voltage	V_{CBO}	40		Vdc
Emitter-Base Voltage	V_{EBO}	5.0		Vdc
Collector Current — Continuous	I_C	200		mAdc
		One Die	Both Die Equal Power	
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	550 3.14	600 3.42	mW mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	1.4 8.0	2.0 11.4	Watts mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +200		°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	One Die	Both Die Equal Power	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	125	87.5	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$(1)	319	292	°C/W
		Junction to Ambient	Junction to Case	
Coupling Factors		83	40	%

(1) $R_{\theta JA}$ is measured with the device soldered into a typical printed circuit board.

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage(2) (I_C = 10 mAdc, I_B = 0)	$V_{(BR)CEO}$	15	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 10 μAdc, I_E = 0)	$V_{(BR)CBO}$	40	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)	$V_{(BR)EBO}$	5.0	—	—	Vdc
Collector Cutoff Current (V_{CB} = 20 Vdc, I_E = 0) (V_{CB} = 20 Vdc, I_E = 0, T_A = 150°C)	I_{CBO}	— —	— —	25 30	nAdc μAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 10 mAdc, V_{CE} = 10 Vdc)	h_{FE}	25	—	—	—
Collector-Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc) (I_C = 50 mAdc, I_B = 10 mAdc)	$V_{CE(sat)}$	— —	— —	0.3 0.5	Vdc
Base-Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc)	$V_{BE(sat)}$	—	—	0.9	Vdc
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain — Bandwidth Product (I_C = 20 mAdc, V_{CE} = 20 Vdc, f = 100 MHz)	f_T	200	320	—	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 100 kHz)	C_{obo}	—	—	4.0	pF

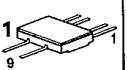
(2) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

T-29-21

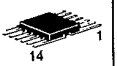
MD1120F
MD1121,F
MD1122,F
MQ1120

MD1121, MD1122
CASE 654-07, STYLE 1

MD1120F
CASE 610A-04, STYLE 1



MQ1120
CASE 607-04, STYLE 1



DUAL
AMPLIFIER TRANSISTOR

NPN SILICON

Refer to MD2218,A for graphs.

MAXIMUM RATINGS

Rating	Symbol	Value		Unit
Collector-Emitter Voltage	V_{CEO}	30		Vdc
Collector-Base Voltage	V_{CBO}	60		Vdc
Emitter-Base Voltage	V_{EBO}	5.0		Vdc
Collector Current — Continuous	I_C	500		mAdc
		One Die	All Die Equal Power	
Total Device Dissipation @ T_A = 25°C	P_D			
MD1121, MD1122		575	625	mW
MD1120F, MD1121F, MD1122F		350	400	
MQ1120		400	600	
Derate above 25°C				
MD1121, MD1122		3.29	3.57	mW/°C
MD1120F, MD1121F, MD1122F		2.0	2.28	
MQ1120		2.28	3.42	
Total Device Dissipation @ T_C = 25°C	P_D			
MD1120, MD1121, MD1122		1.8	2.5	Watts
MD1120F, MD1121F, MD1122F		1.0	2.0	
MQ1120		0.9	3.6	
Derate above 25°C				
MD1120, MD1121, MD1122		10.3	14.3	mW/°C
MD1120F, MD1121F, MD1122F		5.71	11.4	
MQ1120		5.13	20.5	
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +200		°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	One Die	All Die Equal Power	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$			°C/W
MD1121, MD1122		97	70	
MD1120F, MD1121F, MD1122F		175	87.5	
MQ1120		195	48.8	
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$(1)			°C/W
MD1121, MD1122		304	280	
MD1120F, MD1121F, MD1122F		500	438	
MQ1120		438	292	
		Junction to Ambient	Junction to Case	Unit
Coupling Factors				%
MD1121, MD1122		84	44	
MD1120F, MD1121F, MD1122F		75	0	
MQ1120 (Q1-Q2)		57	0	
(Q1-Q3 or Q1-Q4)		55	0	

(1) $R_{\theta JA}$ is measured with the device soldered into a typical printed circuit board.

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage(2) (I_C = 10 mAdc, I_B = 0)	$V_{(BR)CEO}$	30	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 10 μAdc, I_E = 0)	$V_{(BR)CBO}$	60	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)	$V_{(BR)EBO}$	5.0	—	—	Vdc
Collector Cutoff Current	I_{CBO}				
(V_{CB} = 50 Vdc, I_E = 0)		—	—	10	nAdc
(V_{CB} = 50 Vdc, I_E = 0, T_A = 150°C)		—	—	10	μAdc
Emitter Cutoff Current (V_{EB} = 3.0 Vdc, I_C = 0)	I_{EBO}	—	—	10	nAdc

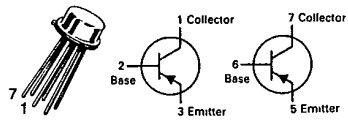
ELECTRICAL CHARACTERISTICS (continued) (T_A = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS					
DC Current Gain(2) (I_C = 10 μAdc, V_{CE} = 10 Vdc) (I_C = 100 μAdc, V_{CE} = 10 Vdc) (I_C = 1.0 mAdc, V_{CE} = 10 Vdc) (I_C = 10 mAdc, V_{CE} = 10 Vdc)	h_{FE}	 20 30 40 50	 40 50 60 65	 100 120 160 200	—
Collector-Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc)	$V_{CE(sat)}$	—	80	100	mVdc
Base-Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc)	$V_{BE(sat)}$	—	700	850	mVdc
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain — Bandwidth Product(2) (I_C = 20 mAdc, V_{CE} = 20 Vdc, f = 100 MHz)	f_T	200	250	—	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 100 kHz)	C_{obo}	—	3.5	8.0	pF
MATCHING CHARACTERISTICS					
DC Current Gain Ratio(3) (I_C = 100 μAdc, V_{CE} = 10 Vdc) All Devices (I_C = 1.0 mAdc, V_{CE} = 10 Vdc) MD1122, MD1122F	h_{FE1}/h_{FE2}	 0.8 0.9	 — —	 1.0 1.0	—
Base-Emitter Voltage Differential (I_C = 100 μAdc, V_{CE} = 10 Vdc) All Devices (I_C = 1.0 mAdc, V_{CE} = 10 Vdc) MD1122, MD1122F	$\lvert V_{BE1}-V_{BE2}\rvert$	 — —	 — —	 10 5.0	mVdc
Base-Emitter Voltage Differential Change Due to Temperature — MD1121, MD1122 (I_C = 100 μAdc, V_{CE} = 10 Vdc, T_A = −55 to +25°C) (I_C = 100 μAdc, V_{CE} = 10 Vdc, T_A = +25 to +125°C)	$\Delta(V_{BE1}-V_{BE2})$	 — —	 — —	 0.8 1.0	mVdc

(2) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
(3) The lowest h_{FE} reading is taken as h_{FE1} for this ratio.

MD1123
MD1130

CASE 654-07, STYLE 1



DUAL AMPLIFIER TRANSISTOR

PNP SILICON

MAXIMUM RATINGS

Rating	Symbol	Value		Unit
Collector-Emitter Voltage	V_{CEO}	40		Vdc
Collector-Base Voltage	V_{CBO}	60		Vdc
Emitter-Base Voltage	V_{EBO}	5.0		Vdc
Collector Current — Continuous	I_C	200		mAdc
		One Die	All Die	
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	575 3.29	625 3.57	mW mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	1.8 10.3	2.5 14.3	Watts mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +200		°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	One Die	All Die Equal Power	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	97	70	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$(1)	304	280	°C/W
		Junction to Ambient	Junction to Case	
Coupling Factors		84	44	%

(1) $R_{\theta JA}$ is measured with the device soldered into a typical printed circuit board.

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

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector-Emitter Breakdown Voltage(2) (I_C = 10 mAdc, I_B = 0)		$V_{(BR)CEO}$	40	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 10 μAdc, I_E = 0)		$V_{(BR)CBO}$	60	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)		$V_{(BR)EBO}$	5.0	—	—	Vdc
Collector Cutoff Current (V_{CB} = 50 Vdc, I_E = 0) (V_{CB} = 50 Vdc, I_E = 0, T_A = 150°C)		I_{CBO}	— —	— —	10 10	nAdc μAdc
Emitter Cutoff Current (V_{BE} = 3.0 Vdc, I_C = 0)		I_{EBO}	—	—	10	nAdc
ON CHARACTERISTICS						
DC Current Gain(2) (I_C = 10 μAdc, V_{CE} = 10 Vdc)	MD1130	h_{FE}	60	100	—	—
(I_C = 100 μAdc, V_{CE} = 10 Vdc)	MD1123		30	80	120	
(I_C = 1.0 mAdc, V_{CE} = 10 Vdc)	MD1130		100	180	—	
(I_C = 10 mAdc, V_{CE} = 10 Vdc)	MD1123 MD1130		50 100	75 150	200 —	

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

Characteristic		Symbol	Min	Typ	Max	Unit
Collector-Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 Adc)		$V_{CE(sat)}$	—	0.18	0.25	Vdc
Base-Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc)		$V_{BE(sat)}$	—	0.8	0.9	Vdc
SMALL-SIGNAL CHARACTERISTICS						
Current-Gain — Bandwidth Product (I_C = 20 mAdc, V_{CE} = 20 Vdc, f = 100 MHz)	MD1123 MD1130	f_T	 250 200	 600 550	 — —	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 100 kHz)		C_{obo}	—	3.6	4.0	pF
MATCHING CHARACTERISTICS						
DC Current Gain Ratio(3) (I_C = 100 μAdc, V_{CE} = 10 Vdc)	MD1123 MD1130	h_{FE1}/h_{FE2}	 0.8 0.9	 — —	 1.0 1.0	—
Base-Emitter Voltage Differential (I_C = 100 μAdc, V_{CE} = 10 Vdc) (I_C = 1.0 mAdc, V_{CE} = 10 Vdc)	MD1123 MD1130	$\lvert V_{BE1}-V_{BE2}\rvert$	 — —	 — —	 10 5.0	mVdc
Base-Emitter Voltage Differential Change Due to Temperature — MD1121, MD1122 (I_C = 100 μAdc, V_{CE} = 10 Vdc, T_A = +25 to +125°C)	MD1130	$\Delta\lvert V_{BE1}/V_{BE2}\rvert$	—	—	10	mVdc

(2) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
(3) The lowest h_{FE} reading is taken as h_{FE1} for this ratio.