PMI

MAT-02/883

LOW-NOISE, MATCHED DUAL MONOLITHIC TRANSISTOR

Precision Monolithics Inc.

1.0 SCOPE

This specification covers the detail requirements for a dual matched transistor.

It is highly recommended that this data sheet be used as a baseline for new military or aerospace spec control drawings.

1.2 Part Number. The complete part numbers per Table I of this specification follow:

Device	Part Number	Package
A	MAT-02AH/883	H
B	MAT-02BH/883	H
B	MAT-02BRC/883	RC

1.2.3 Case Outline.

Letter	Case Outline (Lead finish per MIL-M-38510)
H	6-lead metal can (TO-78)
RC	20-contact hermetic leadless chip carrier (LCC)

1.3 Absolute Maximum Ratings. (T_A = 25°C, unless otherwise noted)

Collector-Base Voltage (BV_{CBO}) 40V
Collector-Emitter Voltage (BV_{CEO}) 40V
Collector-Collector Voltage (BV_{CC}) 40V
Emitter-Emitter Voltage (BV_{EE}) 40V
Collector Current (I_C) 20mA
Emitter Current (I_E) 20mA
Total Power Dissipation
Case Temperature ≤40°C (Note 1) 1.8W
Ambient Temperature ≤70°C (Note 2) 500mW
Operating Ambient Temperature Range ..... -55°C to +125°C
Operating Junction Temperature Range ..... -55°C to +125°C
Storage Temperature Range ..... -65°C to +150°C
Lead Temperature (Soldering, 60 sec) ..... +300°C
DICE Junction Temperature Range (T_J) ..... -65°C to +150°C

NOTES:
1. Rating applies to applications using heat sinking to control case temperature. Derate linearly at 16.4mW/°C for case temperatures above 40°C.
2. Rating applies to applications not using heat sinking; device in free air only. Derate linearly at 6.3mW/°C for ambient temperatures above 70°C.

January 1988

1.5 Thermal Characteristics:

Thermal Resistance, TO-78 (H) package:

Junction-to-Case (Θ_{JC}) = 45°C/W MAX

Junction-to-Ambient (Θ_{JA}) = 150°C/W MAX

Thermal Resistance, LCC (RC) package:

Junction-to-Case (Θ_{JC}) = 35°C/W MAX

Junction-to-Ambient (Θ_{JA}) = 110°C/W MAX

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Spec. #D0171-01E
Rev. B

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TABLE 1

V_{CB} = 15V; I_C = 10μA; T_A = 25°C unless otherwise specified.

Characteristics	Symbol	Special Conditions	MAT-02/883 LIMITS A Min	LIMITS A Max	LIMITS B Min	LIMITS B Max	Units
		I_C = 1mA; V_{CB} = 0V, 40V	500	–	400	–	
		I_C = 100μA; V_{CB} = 0V, 40V	500	–	400	–	
		I_C = 10μA; V_{CB} = 0V, 40V	400	–	300	–	
		I_C = 1μA; V_{CB} = 0V, 40V	300	–	200	–	
Current Gain	h_{FE}	I_C = 1mA; V_{CB} = 0V, 40V -55°C ≤ T_A ≤ +125°C	275	–	250	–	
		I_C = 100μA, V_{CB} = 15V -55°C ≤ T_A ≤ +125°C	225	–	200	–	
		I_C = 10μA, V_{CB} = 15V -55°C ≤ T_A ≤ +125°C	175	–	150	–	
		I_C = 1μA, V_{CB} = 15V -55°C ≤ T_A ≤ +125°C	150	–	100	–	
Current Gain Match (Note 1)	Δh_{FE}	I_C = 10μA, 100μA, 1mA V_{CB} = 0V	–	2	–	4	%
Offset Voltage	V_{OS}	V_{CB} = 0V	–	50	–	150	μV
		V_{CB} = 0V -55°C ≤ T_A ≤ +125°C	–	80	–	250	μV
Offset Voltage Change vs. V_{CB} (Note 2)	$\Delta V_{OS}/\Delta V_{CB}$	V_{CB} = 0V, 40V	–	25	–	50	μV
Offset Voltage Change vs. Collector Current (Note 3)	$\Delta V_{OS}/\Delta I_C$	V_{CB} = 0V I_C = 10μA, 1mA	–	25	–	50	μV
Input Offset Current	I_{OS}	V_{CB} = 0V, 40V	–	0.6	–	1.3	nA
		V_{CB} = 0V, 40V -55°C ≤ T_A ≤ +125°C	–	9.0	–	15.0	nA
Offset Current Change vs. V_{CB}	$\Delta I_{OS}/\Delta V_{CB}$	V_{CB} = 0V, 40V	–	70	–	70	pA/V

TABLE 1 (Continued)

V_{CB} = 15V; I_C = 10μA; T_A = 25°C unless otherwise specified.

Characteristics	Symbol	Special Conditions	MAT-02/883 LIMITS A Min	LIMITS A Max	LIMITS B Min	LIMITS B Max	Units
Bulk Emitter Resistance	r_{BE}		–	0.5	–	0.5	Ω
Collector Base Leakage Current	I_{CBO}	V_{CB} = 40V	–	200	–	400	pA
Collector-Emitter Leakage Current (Note 4)	I_{CES}	V_{CE} = 40V, V_{BE} = 0V	–	200	–	400	pA
Collector-Collector Leakage Current (Note 4)	I_{CC}	V_{CC} = 40V	–	200	–	400	pA
Bias Current	I_B	V_{CB} = 0V, 40V V_{CB} = 0V, 40V -55°C ≤ T_A ≤ +125°C	– –	25 60	– –	34 70	nA nA
Collector Saturation Voltage	V_{CE}SAT	I_C = 1mA, I_B = 100μA	–	0.1	–	0.2	V
Breakdown Voltage	BV_{CEO}	I_C = 100μA	40	–	40	–	V
Change in Offset Voltage vs. Temperature (Note 5)	TCV_{OS}	V_{CB} = 0V	–	0.3	–	1.0	μV/°C

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TABLE 1 (Continued)

V_{CB} = 15V; I_C = 10μA; T_A = 25°C unless otherwise specified.

Characteristics	Symbol	Special Conditions	MAT-02/883 LIMITS A Min	LIMITS A Max	LIMITS B Min	LIMITS B Max	Units
		I_C = 1mA, V_{CB} = 0V					
Noise Voltage		f_O = 10Hz	–	2	–	3	nV/√Hz
Density	e_n	f_O = 100Hz	–	1	–	2	nV/√Hz
		f_O = 1kHz	–	1	–	2	nV/√Hz
		f_O = 10kHz	–	1	–	1	nV/√Hz

NOTES:

1. Current gain match (Δh_{FE}) is defined as: $\Delta h_{FE} = \frac{100(\Delta I_B)h_{FE}min}{I_C}$
2. Measured at I_C = 10μA and guaranteed by design over 10mA ≤ I_C ≤ 1mA.
3. This is the maximum change in V_{OS} measured at I_C = 10μA with V_{CB} = 0V.
4. I_{CC} and I_{CES} are verified by measurement of I_{CBO}.
5. Guaranteed by V_{OS} test ($TCV_{OS} \simeq \frac{V_{OS}}{T}$ for $V_{OS} << V_{BE}$) T = 298°k for T_A = +25°C.

TABLE 2

MAT-02/883

Electrical Test Requirements
For Class B Devices

MIL-STD-883 Test Requirements	Subgroups (see Table 3)
Interim Electrical Parameters (pre Burn-In)	1
Final Electrical Test Parameters	1*, 2, 3
Group A Test Requirements	1, 2, 3, 7

* PDA applies to Subgroup 1 only.
No other Subgroups are included in PDA.

TABLE 3

Group A Inspection

V_{CB} = 15V; I_C = 10μA unless otherwise specified.

Subgroup	Symbol	Special Conditions	MAT-02/883 LIMITS A Min	LIMITS A Max	LIMITS B Min	LIMITS B Max	Units
Subgroup 1	h_{FE}	I_C = 1mA; V_{CB} = 0V, 40V	500	–	400	–	
		I_C = 100μA; V_{CB} = 0V, 40V	500	–	400	–	
T_A = +25°C		I_C = 10μA; V_{CB} = 0V, 40V	400	–	300	–	
		I_C = 1μA; V_{CB} = 0V, 40V	300	–	200	–	
	Δh_{FE}	I_C = 10μA, 100μA, 1mA V_{CB} = 0V (Note 1)	–	2	–	4	%
	V_{OS}	V_{CB} = 0V, I_C = 10μA	–	50	–	150	μV
	$\Delta V_{OS}/\Delta V_{CB}$	V_{CB} = 0V, 40V I_C = 10μA	–	25	–	50	μV
	$\Delta V_{OS}/\Delta I_C$	V_{CB} = 0V I_C = 10μA, 1mA	–	25	–	50	μV
	I_{OS}	V_{CB} = 0V, 40V	–	0.6	–	1.3	nA
	$\Delta I_{OS}/\Delta V_{CB}$	V_{CB} = 0V, 40V	–	70	–	70	pA/V
	r_{BE}		–	0.5	–	0.5	Ω
	I_{CBO}	V_{CB} = 40V	–	200	–	400	pA
	I_{CES}	V_{CE} = 40V, V_{BE} = 0V (Note 2)	–	200	–	400	pA
	I_{CC}	V_{CC} = 40V (Note 2)	–	200	–	400	pA
	I_B	V_{CB} = 0V, 40V	–	25	–	34	nA
	$V_{CE}SAT$	I_C = 1mA, I_B = 100μA	–	0.1	–	0.2	V
	BV_{CEO}	I_C = 100μA	40	–	40	–	V

TABLE 3

Group A Inspection (Continued)

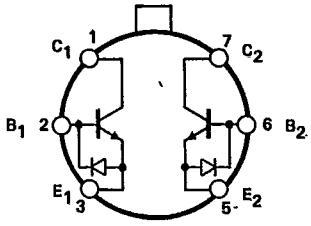
V_{CB} = 15V; I_C = 10μA unless otherwise specified.

Subgroup	Symbol	Special Conditions	MAT-02/883 LIMITS A Min	LIMITS A Max	LIMITS B Min	LIMITS B Max	Units
Subgroup 2		I_C = 1mA; V_{CB} = 0V, 40V	275	–	250	–	
		I_C = 100μA, V_{CB} = 15V	225	–	200	–	
T_A = +125°C	h_{FE}	I_C = 10μA, V_{CB} = 15V	175	–	150	–	
		I_C = 1μA, V_{CB} = 15V	150	–	100	–	
	V_{OS}	V_{CB} = 0V	–	80	–	250	μV
	I_{OS}	V_{CB} = 0V, 40V	–	9	–	15	nA
	I_B	V_{CB} = 0V, 40V	–	60	–	70	nA
Subgroup 3 T_A = -55°C	All Tests, Limits and Conditions are the same as for Subgroup 2.						
Subgroup 7		I_C = 1mA, V_{CB} = 0V					
		f_O = 10Hz	–	2	–	3	nV/√Hz
T_A = +25°C	e_n	f_O = 100Hz	–	1	–	2	nV/√Hz
		f_O = 1kHz	–	1	–	2	nV/√Hz
		f_O = 10kHz	–	1	–	2	nV/√Hz

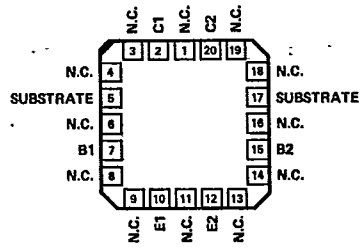
NOTES:

1. Current gain match (Δh_{FE}) is defined as: $\Delta h_{FE} = \frac{100(\Delta I_B)h_{FE}^{min}}{I_C}$
2. I_{CC} and I_{CES} are verified by measurement of I_{CBO}.

3.2.1 Pin Connections.



TO-78
(H-Suffix)



MAT-02BRC/883
20-LEAD LCC
(RC-Suffix)

NOTE: Substrate is connected to case on TO-78 package. Substrate is normally connected to the most negative circuit potential, but can be floated.

3.2.4 Microcircuit Group Assignment.

This microcircuit is covered by microcircuit group 49.

4.2 Life Test/Burn-In Circuit.