# LOW NOISE, MATCHED, DUAL PNP TRANSISTOR

# MAT03

## 1.0 SCOPE

This specification documents the detail requirements for space qualified product manufactured on Analog Devices, Inc.'s QML certified line per MIL-PRF-38535 Level V except as modified herein.

The manufacturing flow described in the STANDARD SPACE LEVEL PRODUCTS PROGRAM brochure is to be considered a part of this specification. http://www.analog.com/aerospace

This data sheet specifically details the space grade version of this product. A more detailed operational description and a complete data sheet for commercial product grades can be found at www.analog.com/MAT03

## 2.0 Part Number. The complete part number(s) of this specification follow:

| Part Number | Description |
|---|---|
| MAT03-903L | Low noise, matched, dual PNP transistor |

### 2.1 Case Outline.

| Letter | Descriptive designator | Case Outline (Lead Finish per MIL-PRF-38535) |
|---|---|---|
| L | GDFP1-F10 | 10-Lead ceramic flatpack (cerpak) |

| Terminal Connections 1/ | |
|---|---|
| Terminal | 10 lead flatpack |
| 1 | C1 |
| 2 | nc |
| 3 | B1 |
| 4 | nc |
| 5 | E1 |
| 6 | E2 |
| 7 | nc |
| 8 | B2 |
| 9 | nc |
| 10 | C2 |

Figure 1 - Terminal connections.

1/ Substrate is normally connected to the most negative circuit potential, but can be floated.




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## 3.0 Absolute Maximum Ratings. ($T_A$ = 25°C, unless otherwise noted)

Collector to base voltage ($BV_{CBO}$) ..... 36V
Collector to emitter voltage ($BV_{CEO}$) ..... 36V
Collector to collector voltage ($BV_{CC}$) ..... 36V
Emitter to emitter voltage ($BV_{EE}$) ..... 36V
Collector current ($I_C$) ..... 20mA
Emitter current ($I_E$) ..... 20mA
Total power dissipation 1/ ..... 500mW
Operating ambient temperature range ..... -55 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 ..... +150°C

1/ Rating applies to applications not using heat sinking, device is free air only.

### 3.1 Thermal Characteristics:

Thermal Resistance, cerpac (L) Package
Junction-to-Case ($\Theta_{JC}$) = 80°C/W Max
Junction-to-Ambient ($\Theta_{JA}$) = 180°C/W Max
Derate linearly at 5.56 mW/°C for ambient temperatures above 70°C.

## 4.0 Electrical Table:

**Table I**

| Parameter<br>See notes at end of table | Symbol | Conditions 1/ | | Sub-group | Limit Min | Limit Max | Units |
|---|---|---|---|---|---|---|---|
| Current gain | $h_{FE}$ | $I_C$ = 1mA, $V_{CB}$ = 0V, -36V | | 1 | 100 | | |
| | | | | 2, 3 | 70 | | |
| | | $I_C$ = 100•A, $V_{CB}$ = 0V, -36V | | 1 | 90 | | |
| | | $I_C$ = 100•A, $V_{CB}$ =-36V | | 2, 3 | 60 | | |
| | | $I_C$ = 10•A, $V_{CB}$ = 0V, -36V | | 1 | 80 | | |
| | | $I_C$ = 10•A, $V_{CB}$ = -36V | | 2, 3 | 50 | | |
| Current gain match 2/ | $\Delta h_{FE}$ | $I_C$ = 100•A, $V_{CB}$ = 0V | | 1 | | 3 | % |
| Offset voltage | $V_{OS}$ | $V_{CB}$ = 0V | | 1 | | 100 | µV |
| | | | | 2,3 | | 150 | |
| Change in offset voltage vs temperature 3/ | $TCV_{OS}$ | $V_{CB}$ = 0V | | | | 0.5 | µV/°C |
| Offset voltage change vs $V_{CB}$ | $\Delta V_{OS}$ / $\Delta V_{CB}$ | VCB = 0V, -36V | | 1 | | 150 | µV |
| Offset voltage change vs collector current | $\Delta V_{OS}$/ $\Delta I_C$ | $I_C1$ = 10•A, $I_C2$ = 1mA, $V_{CB}$=0V | | 1 | | 50 | |
| Input offset current | $I_{OS}$ | $V_{CB}$ = 0V, $I_C$ = 100µA | | 1 | | 35 | nA |
| Bulk emitter resistance | $r_{BE}$ | | | 1 | | 0.75 | Ω |
| Collector base leakage current | $I_{CBO}$ | $V_{CB}$ = -36V | | 1 | | 200 | pA |
| Collector saturation voltage | $V_{CE}SAT$ | $I_C$ = 1mA, $I_B$ = 100µA | | 1 | | 0.1 | V |
| Breakdown voltage | $BV_{CEO}$ | | | 1 | 36 | | V |
| Noise voltage density | $e_N$ | IC = 1mA | $f_O$ = 10Hz | 7 | | 2 | $nV/\sqrt{Hz}$ |
| | | VCB = 0V | $f_O$ = 100Hz | | | 1 | |
| | | | $f_O$ = 1000Hz | | | 1 | |
| | | | $f_O$ = 10000Hz | | | 1 | |

Table I Notes:

1/ $V_{CB}$ = -15V, $I_C$ = 10µA, unless otherwise specified.

2/ Current gain match ($\Delta h_{FE}$) is defined as: $\Delta h_{FE} = \frac{100\ (\Delta I_B) h_{FE\ min}}{I_C}$.

3/ Guaranteed by VOS test ($TC_{VOS} = V_{OS}/T$ for $V_{OS} << V_{BE}$) (T = 298°K for $T_A$ = +25°C).

### 4.1 Electrical Test Requirements:

| Table II | |
|---|---|
| **Test Requirements** | **Subgroups (in accordance with MIL-PRF-38535, Table III)** |
| Interim Electrical Parameters | 1 |
| Final Electrical Parameters | 1, 2, 3, 1/ 2/ |
| Group A Test Requirements | 1, 2, 3, 7 |
| Group C end-point electrical parameters | 1 2/ |
| Group D end-point electrical parameters | 1 |
| Group E end-point electrical parameters | 1 |

1/ PDA applies to Subgroup 1. Delta's excluded from PDA.
2/ See Table III for delta parameters. See table I for conditions.

### 4.2 Table III. Burn-in test delta limits.

| Table III | | | | |
|---|---|---|---|---|
| TEST TITLE | BURN-IN ENDPOINT | LIFETEST ENDPOINT | DELTA LIMIT | UNITS |
| $h_{FE}$ @ 1mA | 100 min | 60 min | ±40 | |
| $h_{FE}$ @ 100µA | 90 min | 54 min | ±36 | |
| $h_{FE}$ @ 10µA | 80 min | 48 min | ±32 | |
| IOS | 35 | 55 | ±20 | nA |

## 5.0 Life Test/Burn-In Circuit:

5.1 HTRB is not applicable for this drawing.
5.2 Burn-in is per MIL-STD-883 Method 1015 test condition B.
5.3 Steady state life test is per MIL-STD-883 Method 1005.

| Rev | Description of Change | Date |
|---|---|---|
| A | Initiate | 7/24/2000 |
| B | Page 1: Update web address; correct typo for dice junction temperature.<br>Page 2: change RC package theta JC from 18 to 35 °C<br>Page 3: delete text "note 1" under table I conditions; change delta hFE condition from mA to •A; delete subgroups for TCVOS; format note numbers for table I; change note 3 from " This is the maximum change in VOS measured at IC = 10mA with VCB = 0V" TO "Guaranteed by VOS test ($TC_{VOS} = V_{OS}/T$ for $V_{OS} << V_{BE}$) (T = 298°K for $T_A$ = +25°C)"<br>Page 4, Table II: delete subgroup 7 from final electricals<br>Page 5: add resistor values to burn-in figure. | 1/22/2002 |
| C | Change R3 of BI circuit from 2.5K to 10K ohm. | 4/17/2002 |
| D | Update web address. Delete burn-in circuit. | 6/20/2003 |
| E | Update package offering | 10/10/2007 |
| F | Update header/footer & add to 1.0 scope description | 2/25/2008 |
| G | Remove min. range in Dice Junction Temp | 3/28/2008 |
| H | Remove obsolete part number and update ASD to ADI standard | 11/10/11 |
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