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MD7002 (SILICON)
MD7002A
MD7002B

NPN SILICON ANNULAR MULTIPLE TRANSISTORS

. . . designed for use as differential amplifiers, dual general-purpose amplifiers, front end detectors and temperature compensation applications.

- Excellent Matching Characteristics @ I_C = 100 μAdc –
  h_{FE1}/h_{FE2} = 0.75 (Min) – MD7002A
  = 0.85 (Min) – MD7002B
- Low Collector-Emitter Saturation Voltage –
  $V_{CE(sat)}$ = 0.35 Vdc (Max) @ I_C = 10 mAdc
- DC Current Gain Specified @ 100 μAdc and 10 mAdc
- High Current-Gain–Bandwidth Product –
  f_T = 260 MHz (Typ) @ I_C = 5.0 mAdc

NPN SILICON MULTIPLE TRANSISTORS

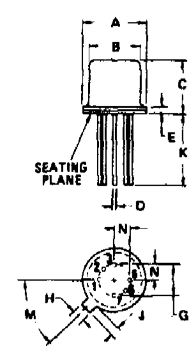
MAXIMUM RATINGS

Rating	Symbol	Value		Unit
Collector-Emitter Voltage	V_{CEO}	40		Vdc
Collector-Base Voltage	V_{CB}	50		Vdc
Emitter-Base Voltage	V_{EB}	5.0		Vdc
Collector-Current	I_C	30		mAdc
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200		°C
		One Die	Both Die Equal Power	
Total Power Dissipation @ T_A = 25°C Derate above 25°C	P_D	575 3.29	625 3.57	mW mW/°C
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	1.8 10.3	2.5 14.3	Watts mW/°C

THERMAL CHARACTERISTICS

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



STYLE 1:
PIN 1. COLLECTOR
2. BASE
3. EMITTER
4. OMITTED
5. EMITTER
6. BASE
7. COLLECTOR
8. OMITTED

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	8.51	9.40	0.335	0.370
B	7.75	8.51	0.305	0.335
C	3.81	4.70	0.150	0.185
D	0.41	0.53	0.016	0.021
G	5.08 BSC		0.200 BSC	
H	0.71	0.86	0.028	0.034
J	0.74	1.14	0.029	0.045
K	12.70	–	0.500	–
M	45° BSC		45° BSC	
N	2.54 BSC		0.100 BSC	

CASE 654-07

THERMAL COUPLING AND EFFECTIVE THERMAL RESISTANCE

In multiple chip devices, coupling of heat between die occurs. The junction temperature can be calculated as follows:

(1) $\Delta T_{J1} = R_{\theta 1} P_{D1} + R_{\theta 2} K_{\theta 2} P_{D2}$

Where ΔT_{J1} is the change in junction temperature of die 1
$R_{\theta 1}$ and $R_{\theta 2}$ is the thermal resistance of die 1 and die 2
P_{D1} and P_{D2} is the power dissipated in die 1 and die 2
$K_{\theta 2}$ is the thermal coupling between die 1 and die 2.

An effective package thermal resistance can be defined as follows:

(2) $R_{\theta(EFF)} = \Delta T_{J1}/P_{DT}$

Where P_{DT} is the total package power dissipation.

Assuming equal thermal resistance for each die, equation (1) simplifies to:

(3) $\Delta T_{J1} = R_{\theta 1} (P_{D1} + K_{\theta 2} P_{D2})$

For the conditions where $P_{D1} = P_{D2} = P_{DT} = 2 P_D$, equation (3) can be further simplified and by substituting into equation (2) results in:

(4) $R_{\theta(EFF)} = R_{\theta 1} (1 + K_{\theta 2})/2$

Values for the coupling factors when either the case or the ambient is used as a reference are given in the table on page 1

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (1) (I_C = 10 mAdc, I_B = 0)	BV_{CEO}	40	–	–	Vdc
Collector-Base Breakdown Voltage (I_C = 10 μAdc, I_E = 0)	BV_{CBO}	50	–	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)	BV_{EBO}	5.0	–	–	Vdc
Collector Cutoff Current (V_{CB} = 30 Vdc, I_E = 0)	I_{CBO}	–	–	100	nAdc
ON CHARACTERISTICS					
DC Current Gain (1)	h_{FE}				–
(I_C = 100 μAdc, V_{CE} = 10 Vdc)		40	130	–	
(I_C = 10 mAdc, V_{CE} = 10 Vdc)		50	170	–	
Collector-Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc)	$V_{CE(sat)}$	–	0.2	0.35	Vdc
Base-Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc)	$V_{BE(sat)}$	–	0.8	1.0	Vdc
DYNAMIC CHARACTERISTICS					
Current-Gain—Bandwidth Product (1) (I_C = 5.0 mAdc, V_{CE} = 20 Vdc, f = 100 MHz)	f_T	200	260	–	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 100 kHz)	C_{ob}	–	2.6	6.0	pF
Input Capacitance (V_{BE} = 2.0 Vdc, I_C = 0, f = 100 kHz)	C_{ib}	–	2.3	8.0	pF
MATCHING CHARACTERISTICS					
DC Current Gain Ratio (2)	h_{FE1}/h_{FE2}				–
(I_C = 100 μAdc, V_{CE} = 10 Vdc) MD7002A		0.75	–	1.0	
MD7002B		0.85	–	1.0	
Base Voltage Differential	$\lvert V_{BE1}-V_{BE2}\rvert$				mVdc
(I_C = 100 μAdc, V_{CE} = 10 Vdc) MD7002A		–	–	25	
MD7002B		–	–	15	

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