

MD918, A, B (SILICON)

MD918F, AF, BF

MULTIPLE SILICON ANNULAR TRANSISTORS

... designed for use as differential amplifiers, dual high frequency amplifiers, front end detectors and temperature compensation applications.

- Low Collector-Emitter Saturation Voltage –
 $V_{CE(sat)} = 0.2 \text{ Vdc (Max) @ } I_C = 10 \text{ mAdc}$
- DC Current Gain – 50 (Min) @ $I_C = 3.0 \text{ mAdc}$
- High Current-Gain – Bandwidth Product –
 $f_T = 600 \text{ MHz @ } I_C = 4.0 \text{ mAdc}$

MAXIMUM RATINGS

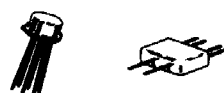
Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	15	Vdc
Collector-Base Voltage	V_{CB}	30	Vdc
Emitter-Base Voltage	V_{EB}	3.0	Vdc
Collector Current – Continuous	I_C	50	mAdc
One Die All Die			
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ MD918,A,B MD918F,AF,BF	P_D	550 350	mW
Derate Above 25°C MD918,A,B MD918F,AF,BF		3.14 2.0	mW/ $^\circ\text{C}$
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ MD918,A,B MD918F,AF,BF	P_D	1.4 0.7	Watts
Derate Above 25°C MD918,A,B MD918F,AF,BF		8.0 4.0	mW/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	One Die	All Die Equal Power	Unit
Thermal Resistance, Junction to Ambient MD918,A,B MD918F,AF,BF	$R_{\theta JA}(1)$	319 500	292 438	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case MD918,A,B MD918F,AF,BF	$R_{\theta JC}$	125 250	87.5 125	$^\circ\text{C/W}$
		Junction to Ambient	Junction to Case	
Coupling Factors MD918,A,B MD918F,AF,BF		83 75	40 0	%

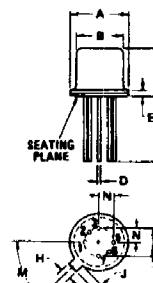
(1) $R_{\theta JA}$ is measured with the device soldered into a typical printed circuit board.

NPN SILICON MULTIPLE TRANSISTORS



MD918
MD918A
MD918B

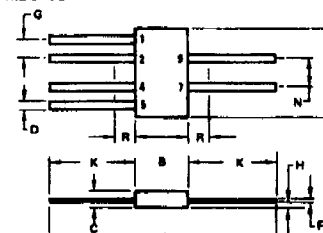
STYLE 1:
PIN 1. COLLECTOR
2. BASE
3. EMITTER
4. OMITTED
5. EMITTER
6. BASE
7. COLLECTOR
8. OMITTED



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.51	9.40	0.335	0.370
B	7.75	8.51	0.305	0.335
C	2.81	2.75	0.110	0.108
D	0.61	0.53	0.024	0.021
E	0.38 BSC		0.015 BSC	
H	0.71	0.38	0.028	0.015
J	0.74	1.14	0.029	0.045
K	12.75		0.500	
M	4.0 BSC		0.156 BSC	
N	2.54 BSC		0.100 BSC	

CASE 054-07

MD918F
MD918AF
MD918BF



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	6.10	7.36	0.240	0.290
B	2.82	4.06	0.110	0.160
C	0.76	2.03	0.030	0.080
D	0.28	0.48	0.011	0.019
E	0.08	0.10	0.003	0.004
F	1.27 BSC		0.050 BSC	
H	—	0.89	—	0.035
J	3.31	—	0.130	—
K	2.54 BSC		0.100 BSC	
N	—	1.27	—	0.050

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

CASE 610A-03

NJ Semi-Conductors reserves the right to change test conditions, parameter limits and package dimensions without notice. Information furnished by NJ Semi-Conductors is believed to be both accurate and reliable at the time of going to press. However, NJ Semi-Conductors assumes no responsibility for any errors or omissions discovered in its use. NJ Semi-Conductors encourages customers to verify that datasheets are current before placing orders.

MD918,A,B, MD918F,AF,BF (continued)

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 $P_{D1} = P_{D2}$, $P_{DT} = 2P_{D1}$, 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 ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage ⁽¹⁾ ($I_C = 3.0 \text{ mA}$, $I_B = 0$)	BV_{CEO}	15	—	—	Vdc
Collector-Base Breakdown Voltage ($I_C = 1.0 \mu\text{A}$, $I_E = 0$)	BV_{CBO}	30	—	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = 10 \mu\text{A}$, $I_C = 0$)	BV_{EBO}	3.0	—	—	Vdc
Collector Cutoff Current ($V_{CB} = 15 \text{ Vdc}$, $I_E = 0$) ($V_{CB} = 15 \text{ Vdc}$, $I_E = 0$, $T_A = 150^\circ\text{C}$)	I_{CBO}	—	—	10 1.0	nAdc μAdc
ON CHARACTERISTICS					
DC Current Gain ($I_C = 3.0 \text{ mA}$, $V_{CE} = 5.0 \text{ Vdc}$)	h_{FE}	50	165	—	—
Collector-Emitter Saturation Voltage ($I_C = 10 \text{ mA}$, $I_B = 1.0 \text{ A}$)	$V_{CE(sat)}$	—	0.09	0.2	Vdc
Base-Emitter Saturation Voltage ($I_C = 10 \text{ mA}$, $I_B = 1.0 \text{ mA}$)	$V_{BE(sat)}$	—	0.86	0.9	Vdc
DYNAMIC CHARACTERISTICS					
Current-Gain – Bandwidth Product ($I_C = 4.0 \text{ mA}$, $V_{CE} = 10 \text{ Vdc}$, $f = 100 \text{ MHz}$) ^a	f_T	600	1150	—	MHz
Output Capacitance ($V_{CB} = 10 \text{ Vdc}$, $I_E = 0$, $f = 100 \text{ kHz}$)	C_{ob}	—	1.1	1.7	pF
Input Capacitance ($V_{BE} = 0.5 \text{ Vdc}$, $I_C = 0$, $f = 100 \text{ kHz}$)	C_{ib}	—	1.15	2.0	pF
Noise Figure ($I_C = 1.0 \text{ mA}$, $V_{CE} = 6.0 \text{ Vdc}$, $R_S = 400 \Omega$, $f = 60 \text{ MHz}$)	NF	—	—	6.0	dB
MATCHING CHARACTERISTICS					
DC Current-Gain Ratio ⁽²⁾ ($I_C = 1.0 \text{ mA}$, $V_{CE} = 5.0 \text{ Vdc}$)	h_{FE1}/h_{FE2}	0.8 0.9	— —	1.0 1.0	—
Base-Emitter Voltage Differential ($I_C = 1.0 \text{ mA}$, $V_{CE} = 5.0 \text{ Vdc}$)	$ V_{BE1} - V_{BE2} $	— —	— —	10 5.0	mVdc
Base-Emitter Voltage Differential Gradient ($I_C = 1.0 \text{ mA}$, $V_{CE} = 5.0 \text{ Vdc}$, $T_A = -55 \text{ to } +125^\circ\text{C}$)	$\Delta(V_{BE1} - V_{BE2}) / \Delta T_A$	— —	— —	20 10	$\mu\text{V/dc}$ $^\circ\text{C}$

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

(2) The lowest h_{FE} reading is taken as h_{FE1} for this ratio.