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MD918, A, B (SILICON)

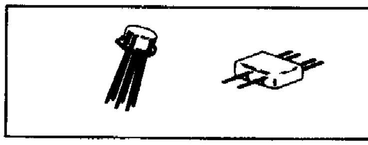
MD918F, AF, BF

MULTIPLE SILICON ANNULAR TRANSISTORS

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

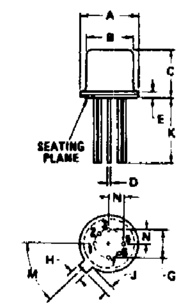
- Low Collector-Emitter Saturation Voltage – $V_{CE(sat)}$ = 0.2 Vdc (Max) @ I_C = 10 mAdc
- DC Current Gain – 50 (Min) @ I_C = 3.0 mAdc
- High Current-Gain – Bandwidth Product – f_T = 600 MHz @ I_C = 4.0 mAdc

NPN SILICON MULTIPLE TRANSISTORS



MD918
MD918A
MD918B

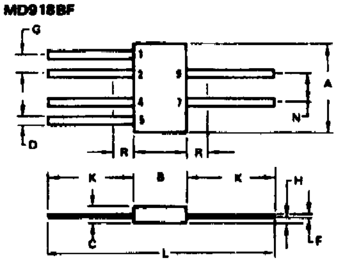
STYLE 1:
PIN 1. COLLECTOR
2. BASE
3. EMITTER
4. OMITTED
5. EMITTER
6. BASE
7. COLLECTOR
8. OMITTED



DIM	MILLIMETERS 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

MD918F
MD918AF
MD918BF



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

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	6.10	7.36	0.240	0.290
B	2.92	4.06	0.115	0.160
C	0.76	2.03	0.030	0.080
D	0.36	0.48	0.014	0.019
F	0.08	0.15	0.003	0.006
G	1.27 BSC		0.050 BSC	
H	–	0.89	–	0.035
K	3.81	–	0.150	–
M	2.54 BSC		0.100 BSC	
R	–	1.27	–	0.050

CASE 610A-03

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°C	P_D			
MD918,A,B		550	600	mW
MD918F,AF,BF		350	400	
Derate Above 25°C				
MD918,A,B		3.14	3.42	mW/°C
MD918F,AF,BF		2.0	2.28	
Total Power Dissipation @ T_C = 25°C	P_D			
MD918,A,B		1.4	2.0	Watts
MD918F,AF,BF		0.7	1.4	
Derate Above 25°C				
MD918,A,B		8.0	11.4	mW/°C
MD918F,AF,BF		4.0	8.0	
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 Ambient	$R_{\theta JA}$(1)			°C/W
MD918,A,B		319	292	
MD918F,AF,BF		500	438	
Thermal Resistance, Junction to Case	$R_{\theta JC}$			°C/W
MD918,A,B		125	87.5	
MD918F,AF,BF		250	125	
		Junction to Ambient	Junction to Case	
Coupling Factors				%
MD918,A,B		83	40	
MD918F,AF,BF		75	0	

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

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.

Quality Semi-Conductors

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

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector-Emitter Breakdown Voltage(1) (I_C = 3.0 mAdc, I_B = 0)		BV_{CEO}	15	–	–	Vdc
Collector-Base Breakdown Voltage (I_C = 1.0 μAdc, I_E = 0)		BV_{CBO}	30	–	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)		BV_{EBO}	3.0	–	–	Vdc
Collector Cutoff Current		I_{CBO}				
(V_{CB} = 15 Vdc, I_E = 0)			–	–	10	nAdc
(V_{CB} = 15 Vdc, I_E = 0, T_A = 150°C)			–	–	1.0	μAdc
ON CHARACTERISTICS						
DC Current Gain (I_C = 3.0 mAdc, V_{CE} = 5.0 Vdc)		h_{FE}	50	165	–	–
Collector-Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 Adc)		$V_{CE(sat)}$	–	0.09	0.2	Vdc
Base-Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc)		$V_{BE(sat)}$	–	0.86	0.9	Vdc
DYNAMIC CHARACTERISTICS						
Current-Gain – Bandwidth Product (I_C = 4.0 mAdc, V_{CE} = 10 Vdc, f = 100 MHz)*		f_T	600	1150	–	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 100 kHz)		C_{ob}	–	1.1	1.7	pF
Input Capacitance (V_{BE} = 0.5 Vdc, I_C = 0, f = 100 kHz)		C_{ib}	–	1.15	2.0	pF
Noise Figure (I_C = 1.0 mAdc, V_{CE} = 6.0 Vdc, R_S = 400 Ω, f = 60 MHz)		NF	–	–	6.0	dB
MATCHING CHARACTERISTICS						
DC Current-Gain Ratio(2)		h_{FE1}/h_{FE2}				–
(I_C = 1.0 mAdc, V_{CE} = 5.0 Vdc)	MD918B,BF		0.8	–	1.0	
	MD918A,AF		0.9	–	1.0	
Base-Emitter Voltage Differential		$\lvert V_{BE1}-V_{BE2}\rvert$				mVdc
(I_C = 1.0 mAdc, V_{CE} = 5.0 Vdc)	MD918B,BF		–	–	10	
	MD918A,AF		–	–	5.0	
Base-Emitter Voltage Differential Gradient		$\frac{\Delta\lvert V_{BE1}-V_{BE2}\rvert}{\Delta T_A}$				
(I_C = 1.0 mAdc, V_{CE} = 5.0 Vdc,	MD918B,AF,BF		–	–	20	μV/dc
T_A = -55 to +125°C)	MD918A		–	–	10	°C

(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.