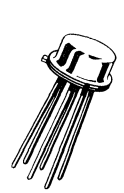
2N6441 (SILICON)
thru
2N6448

MULTIPLE SILICON ANNULAR MONOLITHIC TRANSISTORS

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

- Excellent Temperature Tracking – 2N6445 thru 2N6448
  $\Delta|V_{BE1} - V_{BE2}|$ = 0.8 mVdc (Max) @ -55 to +25°C
  = 1.0 mVdc (Max) @ +25 to +125°C
- Low Collector-Emitter Saturation Voltage –
  $V_{CE(sat)}$ = 0.1 Vdc (Typ) @ I_C = 1.0 mAdc
- DC Current Gain Specified – 10 μAdc to 1.0 mAdc
- High Current-Gain-Bandwidth Product–
  f_T = 500 MHz (Typ) @ I_C = 0.5 mAdc

NPN SILICON MONOLITHIC MULTIPLE TRANSISTORS



*MAXIMUM RATING

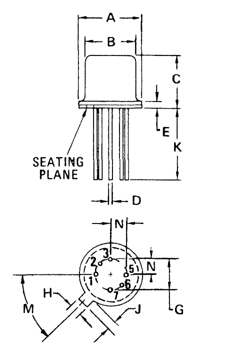
Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	45	Vdc
Collector-Base Voltage	V_{CB}	60	Vdc
Emitter-Base Voltage	V_{EB}	6.0	Vdc
Collector Current – Continuous	I_C	10	mAdc
Total Power Dissipation @ T_A = 25°C Derate above 25°C	P_D(1)	550 3.14	mW mW/°C
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D(1)	1.4 8.0	Watts mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200	°C

(1) One die or both die with equal power

THERMAL CHARACTERISTICS

Characteristic		Junction to Case	Junction to Ambient	Unit
Thermal Resistance	Each Die Effective, 2 Die	125	319	°C/W
Coupling Factors		100	100	%

*Indicates JEDEC Registered Data



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	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage (1) (I_C = 10 mAdc, I_B = 0)	BV_{CEO}	45	–	Vdc
Collector-Base Breakdown Voltage (I_C = 10 μAdc, I_E = 0)	BV_{CBO}	60	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)	BV_{EBO}	6.0	–	Vdc
Collector Cutoff Current (V_{CB} = 45 Vdc, I_E = 0)	I_{CBO}	–	5 0	nAdc
Emitter Cutoff Current (V_{BE} = 5.0 Vdc, I_C = 0)	I_{EBO}	–	5 0	nAdc
Collector Cutoff Current (V_{CE} = 5.0 Vdc, I_B = 0)	I_{CEO}	–	5 0	nAdc
Collector-Collector Leakage Current (V_{C1-C2} = 100 Vdc)	I_{C1-C2}	–	5.0	nAdc
ON CHARACTERISTICS (1)				
DC Current Gain	h_{FE}			–
(I_C = 10 μAdc, V_{CE} = 5.0 Vdc) 2N6441, 43, 45, 47		60	240	
2N6442, 44, 46, 48		120	600	
(I_C = 100 μAdc, V_{CE} = 5 0 Vdc) 2N6441, 43, 45, 47		100	–	
2N6442, 44, 46, 48		200	–	
(I_C = 100 μAdc, V_{CE} = 5.0 Vdc, T_A = -55°C)				
2N6441, 43, 45, 47		30	–	
2N6442, 44, 46, 48		60	–	
(I_C = 1.0 mAdc, V_{CE} = 5.0 Vdc) 2N6441, 43, 45, 47		125	–	
2N6442, 44, 46, 48		250	–	
Collector-Emitter Saturation Voltage (I_C = 1.0 mAdc, I_B = 0.1 mAdc)	$V_{CE(sat)}$	–	0.3	Vdc
Base-Emitter On Voltage (I_C = 100 μAdc, V_{CE} = 5.0 Vdc)	$V_{BE(on)}$	–	0 7	Vdc
DYNAMIC CHARACTERISTICS				
Current-Gain—Bandwidth Product (2) (I_C = 0.5 mAdc, V_{CE} = 5.0 Vdc, f = 20 MHz)	f_T	160	–	MHz
Collector-Base Capacitance (V_{CB} = 5.0 Vdc, I_E = 0, f = 140 kHz)	C_{cb}	–	1.5	pF
Collector-Collector Capacitance (V_{C1-C2} = 0)	C_{C1-C2}	–	1.5	pF
Emitter-Base Capacitance (V_{BE} = 0.5 Vdc, I_C = 0, f = 140 kHz)	C_{eb}	–	2 0	pF
Noise Figure	NF			dB
(I_C = 10 μAdc, V_{CE} = 5 0 Vdc, R_S = 10 k ohms, BW = 15.7 kHz)		–	4.0	
(I_C = 10 μAdc, V_{CE} = 5.0 Vdc, R_S = 10 k ohms, f = 10 kHz, BW = 20 Hz)		–	3.0	

*Indicates JEDEC Registered Data.
(1) Pulse Test: Pulse Width ≤300 μs, Duty Cycle ≤2.0%
(2) f_T is defined as the frequency at which $|h_{fe}|$ extrapolates to unity

ELECTRICAL CHARACTERISTICS (continued)

Characteristic		Symbol	Min	Max	Unit
***MATCHING CHARACTERISTICS**					
DC Current Gain Ratio (3)		h_{FE1}/h_{FE2}			–
(I_C = 100 μAdc, V_{CE} = 5.0 Vdc)	2N6441, 2N6442		0.6	1.0	
	2N6443, 2N6444		0.8	1.0	
	2N6445, 2N6446		0.9	1.0	
	2N6447, 2N6448		0.95	1.0	
Base-Emitter Voltage Differential		$\|V_{BE1}-V_{BE2}\|$			mVdc
(I_C = 10 μAdc, V_{CE} = 5.0 Vdc)	2N6441, 2N6442		–	10	
	2N6443, 2N6444		–	5.0	
	2N6445 thru 2N6448		–	3.0	
(I_C = 100 μAdc, V_{CE} = 5.0 Vdc)	2N6441, 2N6442		–	10	
	2N6443, 2N6444		–	5.0	
	2N6445 thru 2N6448		–	3.0	
Base-Emitter Voltage Differential Change Due to Temperature		$\Delta\|V_{BE1}-V_{BE2}\|$			mVdc
(I_C = 100 μAdc, V_{CE} = 5.0 Vdc, T_A = -55 to +25°C)	2N6441, 2N6442		–	3.2	
	2N6443, 2N6444		–	1.6	
	2N6445 thru 2N6448		–	0.8	
(I_C = 100 μAdc, V_{CE} = 5.0 Vdc, T_A = +25 to +125°C)	2N6441, 2N6442		–	4.0	
	2N6443, 2N6444		–	2.0	
	2N6445 thru 2N6448		–	1.0	

*Indicates JEDEC Registered Data

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

NOISE FIGURE
(V_{CE} = 5.0 Vdc, T_A = 25°C)

FIGURE 1 – FREQUENCY EFFECTS

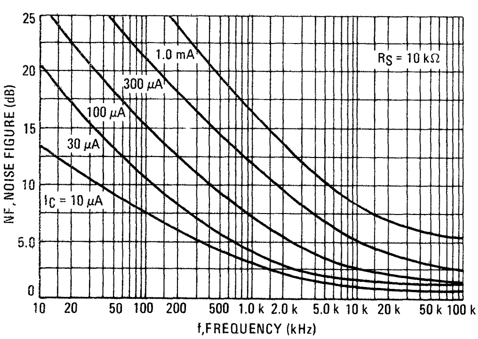


FIGURE 2 – SOURCE RESISTANCE EFFECTS

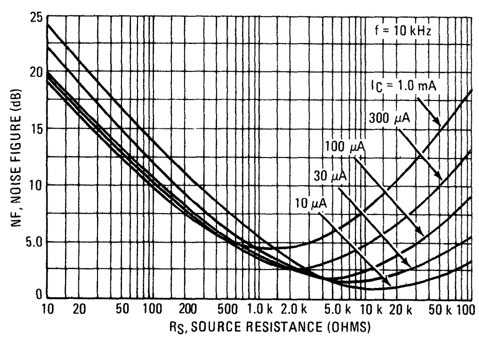


FIGURE 3 – DC CURRENT GAIN

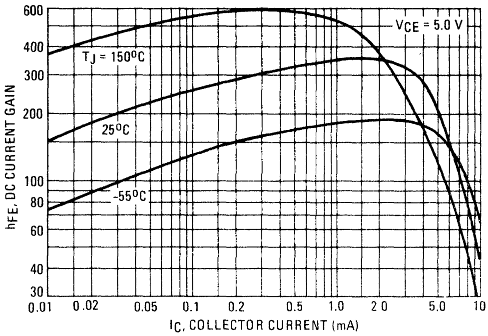


FIGURE 4 – "ON" VOLTAGES

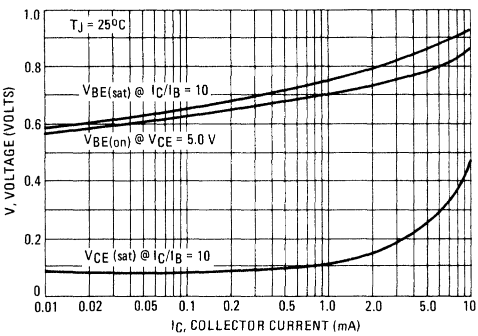


FIGURE 5 – TEMPERATURE COEFF CIENTS

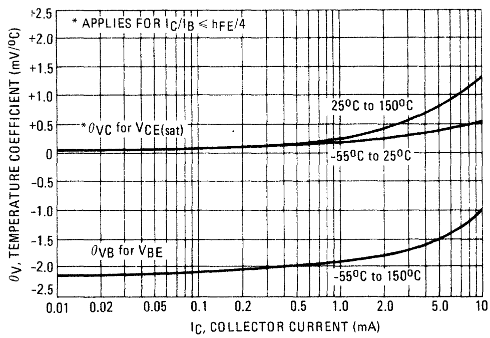


FIGURE 6 – CURRENT-GAIN–BANDWIDTH PRODUCT

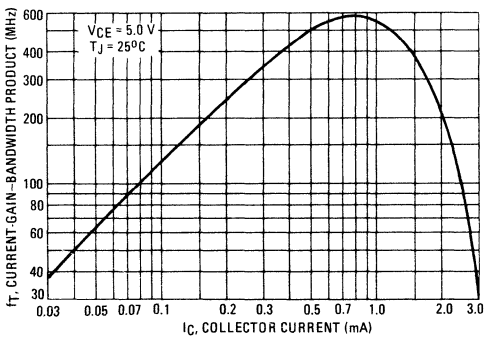


FIGURE 7 – CAPACITANCE