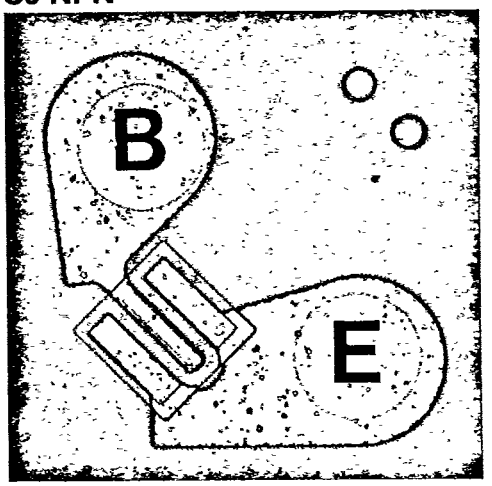
Raytheon

Ultra High Speed Switches

CJ NPN



Description

High speed gold doped silicon epitaxial transistor useful for high speed switching applications at collector currents of up to 100mA. The PNP compliment is GJ or GR.

Dimensions

Die Size: 16 x 16 mils
Bonding Pad Size:
Base — 4.5 mil diameter
Emitter — 4.5 mil diameter

Popular Types

2N2369A/JAN
2N4137
2N706A
2N2368

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Electrical Characteristics (+25° C ambient temperature unless otherwise stated)

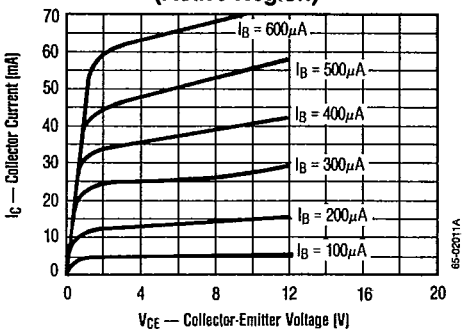
Parameter	Conditions	2N2369AJAN			2N4137			Units
		Min	Typ	Max	Min	Typ	Max	
BV_{CEO}	I_C = 10mA, I_B = 0	15	18		20	22		V
BV_{CBO}	I_C = 10μA, I_E = 0	40	60		40	65		V
BV_{CES}	I_E = 10μA, V_{BE} = 0	40	60		40	65		V
BV_{EBO}	I_E = 10μA, I_C = 0	4.5	5.6		4.5	5.6		V
I_{CBO}	I_E = 0, V_{CB} = 20V, T_A = 150° C		3.5	30		3.5	30	μA
I_{CES}	V_{EB} = 0, V_{CE} = 20V		2	400		2	400	nA
I_{CEX}	V_{CE} = 10V, V_{EB} = 0.25V		2	300				nA
I_{CEX}	V_{CE} = 10V, V_{EB} = 0.25V, T_A = 125° C		0.06	30				μA
I_{EBO}	I_C = 0, V_{EB} = 4V		40	250				nA
H_{FE}	I_C = 10mA, V_{CE} = 1V	40	80	120		60	120	
H_{FE}	I_C = 10mA, V_{CE} = 0.35V, T_A = -55° C	20	35		20	25		
H_{FE}	I_C = 10mA, V_{CE} = 0.35V	40	75	120	40	50		
H_{FE}	I_C = 30mA, V_{CE} = 0.4V	30	65	120	30	45		
H_{FE}	I_C = 100mA, V_{CE} = 1V	20	35	100	20	30		
$V_{CE(SAT)}$	I_C = 10mA, I_B = 1mA		0.15	0.20		0.15	0.20	V
$V_{CE(SAT)}$	I_C = 10mA, I_B = 1mA, T_A = 125° C		0.19	0.30		0.19	0.30	V
$V_{CE(SAT)}$	I_C = 10mA, I_B = 3.3mA						0.18	V
$V_{CE(SAT)}$	I_C = 30mA, I_B = 3mA		0.18	0.25		0.18	0.25	V
$V_{CE(SAT)}$	I_C = 100mA, I_B = 10mA		0.30	0.50		0.31	0.50	V
$V_{BE(SAT)}$	I_C = 10mA, I_B = 1mA	0.7	0.78	0.85	0.72	0.78	0.85	V
$V_{BE(SAT)}$	I_C = 10mA, I_B = 1mA, T_A = 125° C	0.59	0.92		0.59	0.92		V
$V_{BE(SAT)}$	I_C = 10mA, I_B = 1mA, T_A = -55° C		0.65	1.02		0.65	1.02	V
$V_{BE(SAT)}$	I_C = 30mA, I_B = 3mA		0.85	1.15		0.85	1.15	V
$V_{BE(SAT)}$	I_C = 100mA, I_B = 10mA		1	1.6		1	1.6	V
h_{fe}	I_C = 10mA, V_{CE} = 10V, f = 100MHz	5	6.5		5	6.5		
C_{ob}	V_{CB} = 5V, I_E = 0		2	4		2	4	pF
C_{ib}	V_{EB} = 0.5V, I_C = 0		3.7	5		3.7	5	pF
t_{on}	I_C = 10mA, I_{B1} = I_{B2} = 1mA (see Fig. 1)		9	12		9	12	nS
t_{off}	I_C = 10mA, I_{B1} = 3mA, I_{B2} = 1.5mA (see Fig. 1)		15	18		15	18	nS

CJ Single Transistors

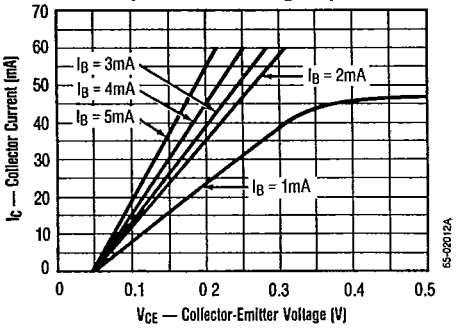
Product Type	Pkg.	Electrical Parameters @ +25°C Ambient Temperature										
		BV_{CBO} Min @ 10μA	BV_{CEO} Min @ 10mA	BV_{EBO} Min @ 10μA	H_{FE} @ I_C/V_{CE} Min/ Max	mA/ V_{CE}	$V_{CE(SAT)}$ @ I_C/I_B Volts Max	mA/mA	f_t MHz Min	C_{ob} pF Max	t_{ON} nS Max	t_{OFF} nS Max
2N706	TO-18	25	20*	3	20/—	10/1	0.6	10/1	200	6	40	75
2N706J	TO-18	25	15	5	30/120	10/1	0.5	10/1	200	6	40	75
2N706A	TO-18	25	15	5	20/60	10/1	0.6	10/1	200	5	40	75
2N706B	TO-18	25	15	5	20/60	10/1	0.4	10/1	200	5	40	75
2N706C	TO-18	30	15	5	20/60	10/1	0.4	10/1	200	5	40	75
2N708J, TX	TO-18	40	15	5	40/120	10/1	0.4	10/1	300	6	40	75
2N743	TO-18	20	12	5	20/60	10/.35	—	—	400	5	16	24
2N743A	TO-18	40	15	5	20/60	10/.35	—	—	500	4	12	15
2N744	TO-18	20	12	5	40/120	10/.35	—	—	400	5	16	24
2N744J	TO-18	20	12	5	40/120	10/.35	—	—	400	5	16	24
2N744A	TO-18	40	15	5	40/120	10/.35	—	—	500	4	12	15
2N783	TO-18	40	20*	5	20/80	10/1	0.25	10/1	200	3.5	18	30
2N784	TO-18	30	15	5	25/—	10/1	0.19	10/1	200	3.5	15	40
2N784A	TO-18	40	20*	5	25/150	10/1	0.19	10/1	200	3.5	20	40
2N834	TO-18	40	—	5	25/—	10/1	0.4	50/5	350	4	35	75
2N834A	TO-18	40	—	5	25/—	10/1	0.4	50/5	500	4	35	75
2N835	TO-18	25	20	3	20/—	10/1	0.3	10/1	300	4	20	35
2N2205	TO-18	25	12	3	20/—	10/1	0.35	50/5	200	6	40	75
2N2368	TO-18	40	15	4.5	20/60	10/1	0.25	10/1	400	4	12	15
2N2369	TO-18	40	15	4.5	40/120	10/1	0.25	10/1	500	4	12	18
2N2369A	TO-18	40	15	4.5	40/120	10/1	0.5	100/10	500	4	12	18
2N2369AJ,TX,V	TO-18	40	15	4.5	40/120	10/1	0.45	100/10	500	4	12	18
2N2481	TO-18	40	15	5	40/120	10/1	0.4	100/10	300	5	40	55
2N2481J,TX	TO-18	40	15	5	40/120	10/1	0.4	100/10	300	5	40	55
2N3011	TO-18	30	12	4	30/120	10/.35	0.5	100/10	400	4	15	20
2N3210	TO-18	40	15	5	30/120	10/1	0.75	200/20	400	4	15	20
2N3227	TO-18	40	20	6	70/250	10/.35	0.45	100/10	500	4	12	18
2N4137	TO-18	40	20	4.5	40/120	10/.35	0.5	100/10	500	5	12	12
2N4449	TO-46	40	15	4.5	40/120	10/.35	100/10	500	4	12	18	

Typical Performance Characteristics

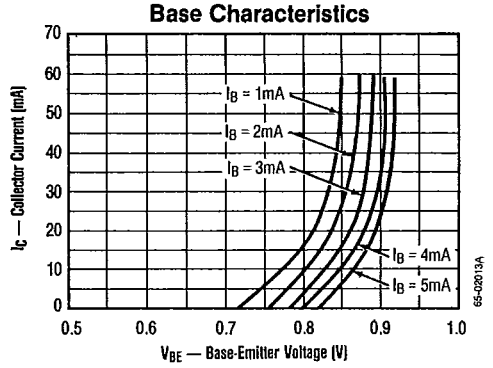
Collector Characteristics (Active Region)



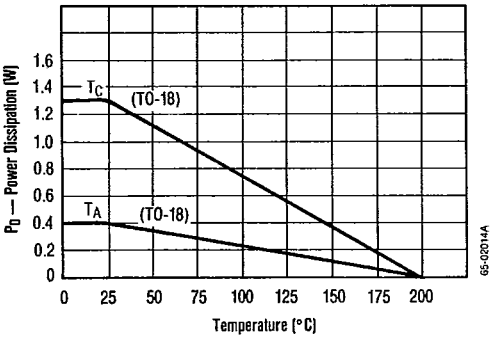
Collector Characteristics (Saturation Region)



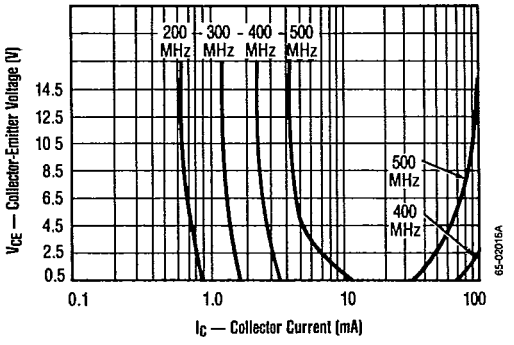
Base Characteristics



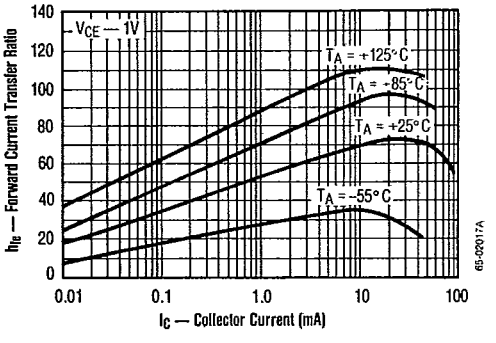
Power Derating Curves



f_f — Constant Gain Bandwidth Products Contours

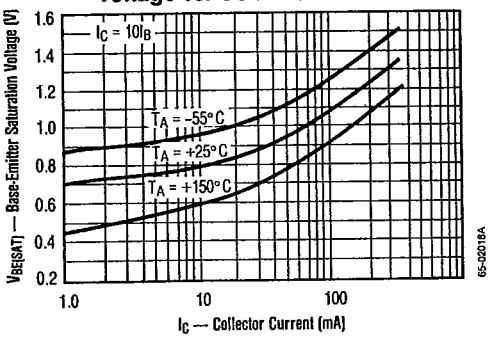


Forward Current Transfer Ratio vs. Collector Current

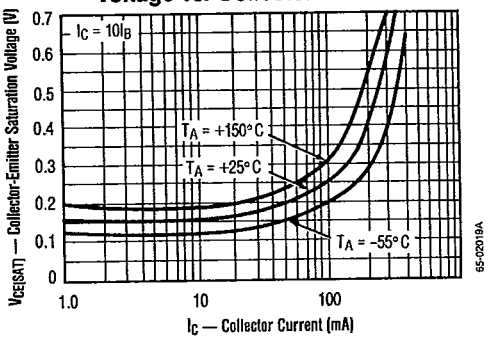


Typical Performance Characteristics (Continued)

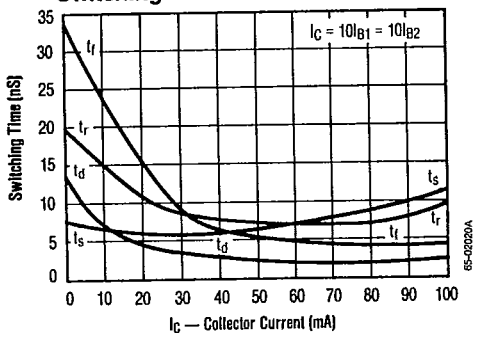
Base-to-Emitter Saturation Voltage vs. Collector Current



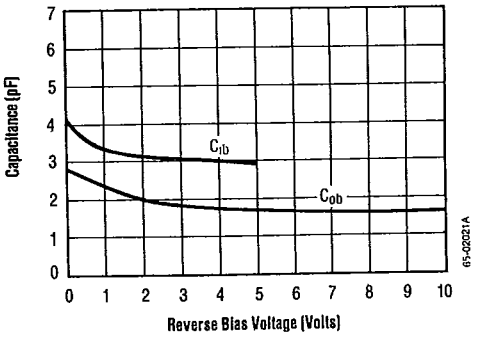
Collector-Emitter Saturation Voltage vs. Collector Current



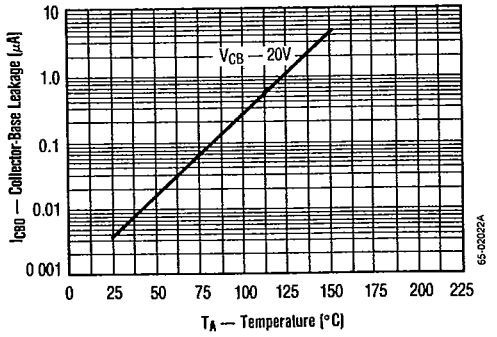
Switching Time vs. Collector Current



Output and Input Capacitance vs. Reverse Bias Voltage



Collector-Base Leakage Current vs. Temperature



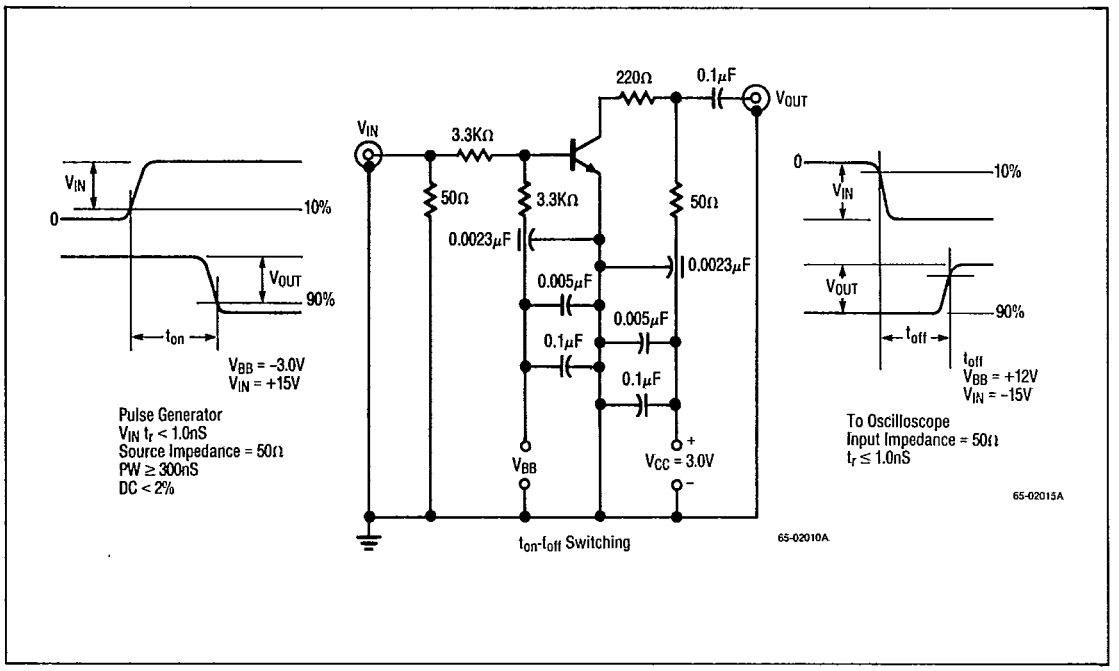
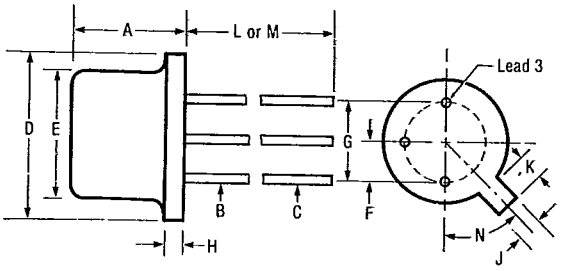


Figure 1. Switching Measurement Circuit

Packaging Information

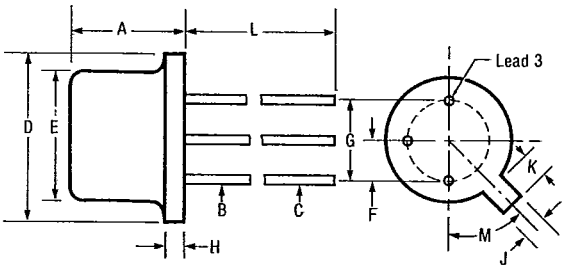
In Accordance With JEDEC (TO-18) Outline (8 mil Kovar Header)



Notes: Lead No. 3 internally connected to case.
Can material is nickel.

Dimension	Inches		Millimeters	
	Min.	Max.	Min.	Max.
A	.170	210	4 31	5 33
B	016	019	41	48
C	016	021	41	53
D	209	230	5 30	5 84
E	.178	195	4 52	4 95
F	.050BSC		1 27BSC	
G	.100BSC		2 54BSC	
H		030		.76
J	036	046	91	1.16
K	.028	048	71	1 21
L	.500		12 70	
M	1 500		38 10	
N	45° BSC		45° BSC	

In Accordance With JEDEC (TO-46) Outline (45 mil Kovar Header)



Notes: Lead No 3 internally connected to case
Can material is nickel

Dimension	Inches		Millimeters	
	Min.	Max.	Min.	Max.
A	.065	085	1.65	2.15
B	.012	.019	.30	.48
C	.012	.021	.30	53
D	.209	230	5.30	5.84
E	.178	.195	4.52	4.95
F	.050BSC		1.27BSC	
G	.100BSC		2.54BSC	
H		.040		1.02
J	.036	.046	.91	1.16
K	.028	.048	.71	1 21
L	.500		12.70	
M	45° BSC		45° BSC	