

COMPLEMENTARY NPN / PNP SMALL SIGNAL SURFACE MOUNT TRANSISTOR

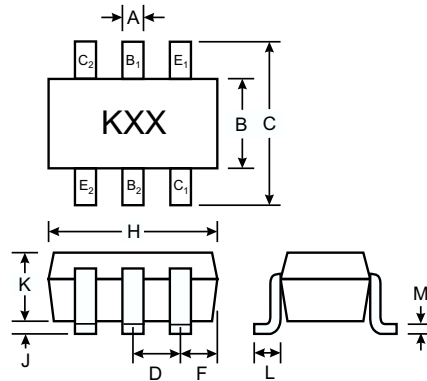
NEW PRODUCT

Features

- Complementary Pair
- One 4401-Type NPN, One 4403-Type PNP
- Epitaxial Planar Die Construction
- Ideal for Low Power Amplification and Switching
- Ultra-Small Surface Mount Package

Mechanical Data

- Case: SOT-363, Molded Plastic
- Terminals: Solderable per MIL-STD-202, Method 208
- Terminal Connections: See Diagram
- Marking: K13
- Weight: 0.006 grams (approx.)



SOT-363		
Dim	Min	Max
A	0.10	0.30
B	1.15	1.35
C	2.00	2.20
D	0.65 Nominal	
F	0.30	0.40
H	1.80	2.20
J	—	0.10
K	0.90	1.00
L	0.25	0.40
M	0.10	0.25
All Dimensions in mm		

Note: E1, B1, and C1 = PNP 4403 Section,
E2, B2, and C2 = NPN 4401 Section.
Type marking indicates orientation.

Maximum Ratings, NPN 4401 Section @ T_A = 25°C unless otherwise specified

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V _{CB0}	60	V
Collector-Emitter Voltage	V _{CE0}	40	V
Emitter-Base Voltage	V _{EBO}	6.0	V
Collector Current - Continuous (Note 1)	I _C	600	mA
Power Dissipation (Note 1, 2)	P _d	200	mW
Thermal Resistance, Junction to Ambient (Note 1)	R _{θJA}	625	K/W
Operating and Storage and Temperature Range	T _J , T _{STG}	-55 to +150	°C

Maximum Ratings, PNP 4403 Section @ T_A = 25°C unless otherwise specified

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V _{CB0}	-40	V
Collector-Emitter Voltage	V _{CE0}	-40	V
Emitter-Base Voltage	V _{EBO}	-5.0	V
Collector Current - Continuous (Note 1)	I _C	-600	mA
Power Dissipation (Note 1, 2)	P _d	200	mW
Thermal Resistance, Junction to Ambient (Note 1)	R _{θJA}	625	K/W
Operating and Storage and Temperature Range	T _J , T _{STG}	-55 to +150	°C

- Notes:
1. Valid provided that terminals are kept at ambient temperature.
 2. Maximum combined dissipation.

Electrical Characteristics, NPN 4401 Section

@ $T_A = 25^\circ\text{C}$ unless otherwise specified

Characteristic	Symbol	Min	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 3)					
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	60	—	V	$I_C = 100\mu\text{A}, I_E = 0$
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	40	—	V	$I_C = 1.0\text{mA}, I_B = 0$
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	6.0	—	V	$I_E = 100\mu\text{A}, I_C = 0$
Collector Cutoff Current	I_{CEX}	—	100	nA	$V_{CE} = 35\text{V}, V_{EB(OFF)} = 0.4\text{V}$
Base Cutoff Current	I_{BL}	—	100	nA	$V_{CE} = 35\text{V}, V_{EB(OFF)} = 0.4\text{V}$
ON CHARACTERISTICS (Note 3)					
DC Current Gain	h_{FE}	20 40 80 100 40	— — — 300 —	—	$I_C = 100\mu\text{A}, V_{CE} = 1.0\text{V}$ $I_C = 1.0\text{mA}, V_{CE} = 1.0\text{V}$ $I_C = 10\text{mA}, V_{CE} = 1.0\text{V}$ $I_C = 150\text{mA}, V_{CE} = 1.0\text{V}$ $I_C = 500\text{mA}, V_{CE} = 2.0\text{V}$
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	—	0.40 0.75	V	$I_C = 150\text{mA}, I_B = 15\text{mA}$ $I_C = 500\text{mA}, I_B = 50\text{mA}$
Base-Emitter Saturation Voltage	$V_{BE(SAT)}$	0.75 —	0.95 1.2	V	$I_C = 150\text{mA}, I_B = 15\text{mA}$ $I_C = 500\text{mA}, I_B = 50\text{mA}$
SMALL SIGNAL CHARACTERISTICS					
Output Capacitance	C_{cb}	—	6.5	pF	$V_{CB} = 5.0\text{V}, f = 1.0\text{MHz}, I_E = 0$
Input Capacitance	C_{eb}	—	30	pF	$V_{EB} = 0.5\text{V}, f = 1.0\text{MHz}, I_C = 0$
Input Impedance	h_{ie}	1.0	15	k Ω	$V_{CE} = 10\text{V}, I_C = 1.0\text{mA},$ $f = 1.0\text{kHz}$
Voltage Feedback Ratio	h_{re}	0.1	8.0	$\times 10^{-4}$	
Small Signal Current Gain	h_{fe}	40	500	—	
Output Admittance	h_{oe}	1.0	30	μS	
Current Gain-Bandwidth Product	f_T	250	—	MHz	$V_{CE} = 10\text{V}, I_C = 20\text{mA},$ $f = 100\text{MHz}$
SWITCHING CHARACTERISTICS					
Delay Time	t_d	—	15	ns	$V_{CC} = 30\text{V}, I_C = 150\text{mA},$ $V_{BE(off)} = 2.0\text{V}, I_{B1} = 15\text{mA}$
Rise Time	t_r	—	20	ns	
Storage Time	t_s	—	225	ns	$V_{CC} = 30\text{V}, I_C = 150\text{mA},$ $I_{B1} = I_{B2} = 15\text{mA}$
Fall Time	t_f	—	30	ns	

Notes: 3. Pulse test: Pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.

Electrical Characteristics, PNP 4403 Section

@ $T_A = 25^\circ\text{C}$ unless otherwise specified

Characteristic	Symbol	Min	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 3)					
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	-40	—	V	$I_C = -100\mu\text{A}, I_E = 0$
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	-40	—	V	$I_C = -1.0\text{mA}, I_B = 0$
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	-5.0	—	V	$I_E = -100\mu\text{A}, I_C = 0$
Collector Cutoff Current	I_{CEX}	—	-100	nA	$V_{CE} = -35\text{V}, V_{EB(OFF)} = -0.4\text{V}$
Base Cutoff Current	I_{BL}	—	-100	nA	$V_{CE} = -35\text{V}, V_{EB(OFF)} = -0.4\text{V}$
ON CHARACTERISTICS (Note 3)					
DC Current Gain	h_{FE}	30 60 100 100 20	— — — 300 —	—	$I_C = -100\mu\text{A}, V_{CE} = -1.0\text{V}$ $I_C = -1.0\text{mA}, V_{CE} = -1.0\text{V}$ $I_C = -10\text{mA}, V_{CE} = -1.0\text{V}$ $I_C = -150\text{mA}, V_{CE} = -2.0\text{V}$ $I_C = -500\text{mA}, V_{CE} = -2.0\text{V}$
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	—	-0.40 -0.75	V	$I_C = -150\text{mA}, I_B = -15\text{mA}$ $I_C = -500\text{mA}, I_B = -50\text{mA}$
Base-Emitter Saturation Voltage	$V_{BE(SAT)}$	-0.75 —	-0.95 -1.30	V	$I_C = -150\text{mA}, I_B = -15\text{mA}$ $I_C = -500\text{mA}, I_B = -50\text{mA}$
SMALL SIGNAL CHARACTERISTICS					
Output Capacitance	C_{cb}	—	8.5	pF	$V_{CB} = -10\text{V}, f = 1.0\text{MHz}, I_E = 0$
Input Capacitance	C_{eb}	—	30	pF	$V_{EB} = -0.5\text{V}, f = 1.0\text{MHz}, I_C = 0$
Input Impedance	h_{ie}	1.5	15	k Ω	$V_{CE} = -10\text{V}, I_C = -1.0\text{mA},$ $f = 1.0\text{kHz}$
Voltage Feedback Ratio	h_{re}	0.1	8.0	$\times 10^{-4}$	
Small Signal Current Gain	h_{fe}	60	500	—	
Output Admittance	h_{oe}	1.0	100	μS	
Current Gain-Bandwidth Product	f_T	200	—	MHz	
SWITCHING CHARACTERISTICS					
Delay Time	t_d	—	15	ns	$V_{CC} = -30\text{V}, I_C = -150\text{mA},$ $V_{BE(off)} = -2.0\text{V}, I_{B1} = -15\text{mA}$
Rise Time	t_r	—	20	ns	
Storage Time	t_s	—	225	ns	$V_{CC} = -30\text{V}, I_C = -150\text{mA},$ $I_{B1} = I_{B2} = -15\text{mA}$
Fall Time	t_f	—	30	ns	

Notes: 3. Pulse test: Pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.

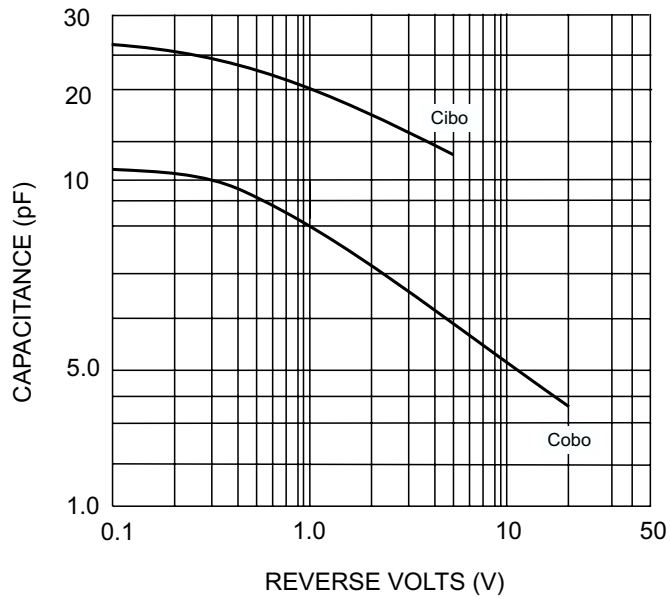


Fig. 1 (4401) Capacitances (Typical)

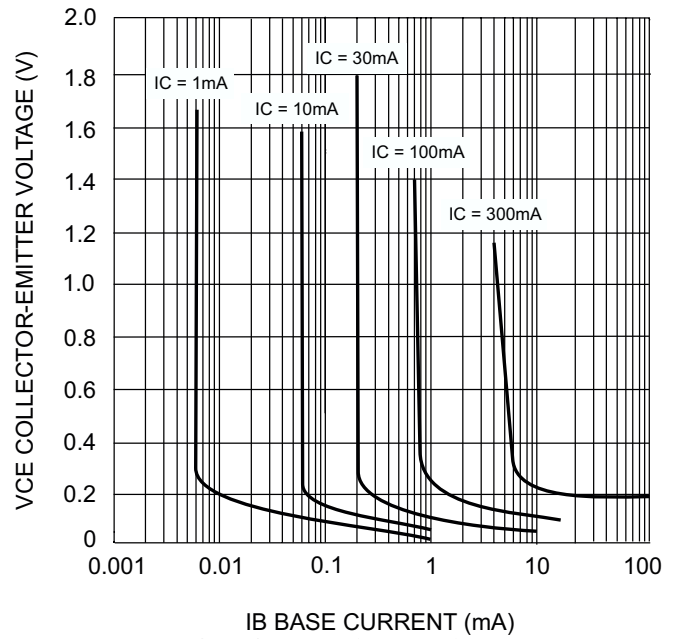


Fig. 2 (4401) Typical Collector Saturation Region

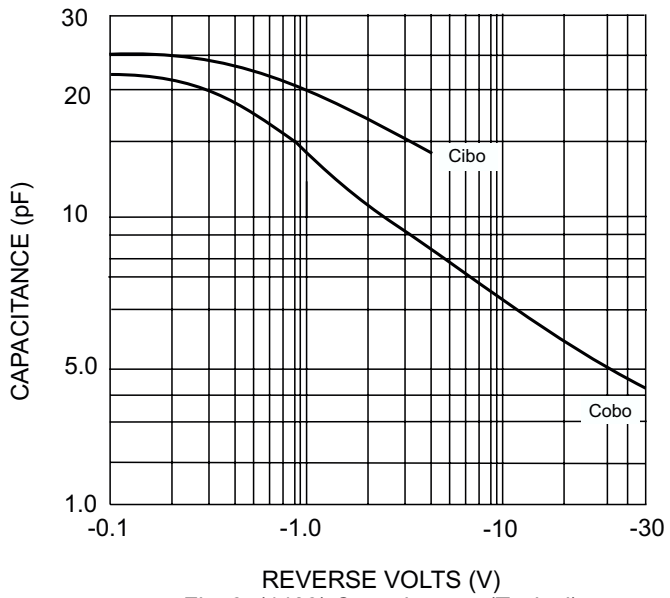


Fig. 3 (4403) Capacitances (Typical)

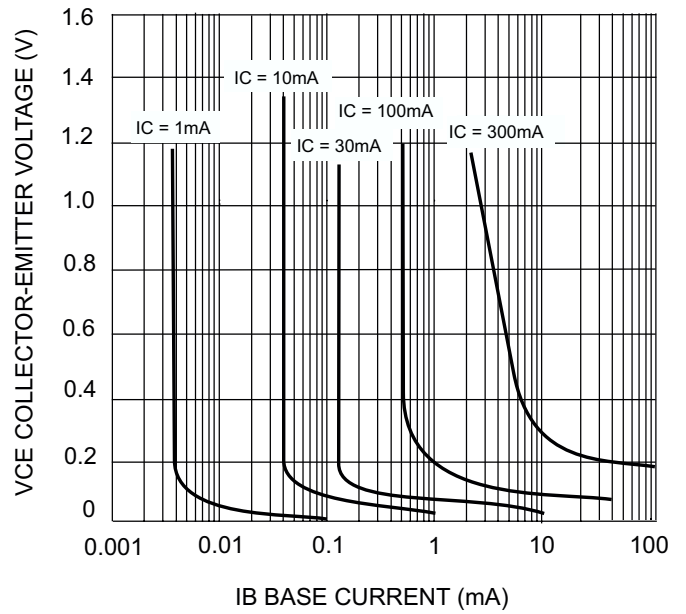


Fig. 4 (4403) Typical Collector Saturation Region