

RoHS Compliant Product
A suffix of "-C" specifies halogen & lead-free

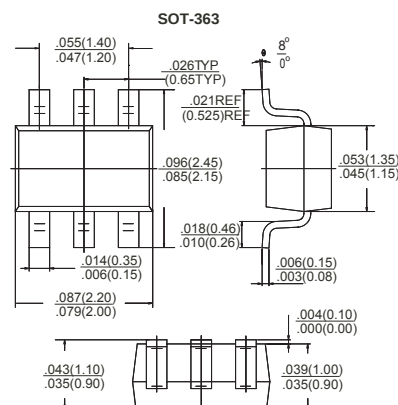
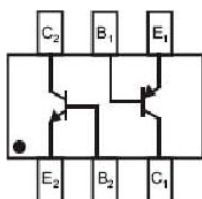
FEATURES

- Complementary Pair
- Epitaxial Planar Die Construction
- Ideal for Low Power Amplification and Switching

MARKING

K13

EQUIVALENT CIRCUIT



ABSOLUTE MAXIMUM RATINGS at Ta = 25°C

Parameter	Symbol	NPN Ratings	PNP Ratings	Unit
Collector-Base Voltage	V_{CBO}	60	-40	V
Collector-Emitter Voltage	V_{CEO}	40	-40	V
Emitter-Base Voltage	V_{EBO}	6	-5	V
Collector Current -Continuous	I_C	0.6	-0.6	A
Collector Power Dissipation	P_C	0.2	0.2	W
Thermal Resistance. Junction to	$R_{\theta JA}$	625	625	°C/W
Junction & Storage temperature	T_J, T_{STG}	150, -55~150		°C

NPN ELECTRICAL CHARACTERISTICS at Ta = 25°C

Parameter	Symbol	Min.	Max.	Unit	Test Conditions
Collector-base breakdown voltage	$V_{(BR)CBO}$	60	-	V	$I_C = 100 \mu A, I_E = 0$
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	40	-	V	$I_C = 1 \text{ mA}, I_B = 0$
Emitter-base breakdown voltage	$V_{(BR)EBO}$	6	-	V	$I_E = 100 \mu A, I_C = 0$
Collector cut-off current	I_{CBO}	-	0.1	μA	$V_{CB} = 50 \text{ V}, I_E = 0$
Collector cut-off current	I_{CEO}	-	0.5	μA	$V_{CE} = 35 \text{ V}, I_B = 0$
Emitter cut-off current	I_{EBO}	-	0.1	μA	$V_{EB} = 5 \text{ V}, I_C = 0$
DC current gain	$h_{FE(1)}$	20	-		$V_{CE} = 1 \text{ V}, I_C = 0.1 \text{ mA}$
	$h_{FE(2)}$	40	-		$V_{CE} = 1 \text{ V}, I_C = 1 \text{ mA}$
	$h_{FE(3)}$	80	-		$V_{CE} = 1 \text{ V}, I_C = 10 \text{ mA}$
	$h_{FE(4)}$	100	300		$V_{CE} = 1 \text{ V}, I_C = 150 \text{ mA}$
	$h_{FE(5)}$	40	-		$V_{CE} = 2 \text{ V}, I_C = 500 \text{ mA}$
Collector-emitter saturation voltage	$V_{CE(sat)1}$	-	0.4	V	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$
	$V_{CE(sat)2}$	-	0.75	V	$I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$
Base-emitter saturation voltage	$V_{BE(sat)1}$	0.75	0.95	V	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$
	$V_{BE(sat)2}$	-	1.2	V	$I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$
Transition frequency	f_T	250	-	MHz	$V_{CE} = 10 \text{ V}, I_C = 20 \text{ mA}, f = 100 \text{ MHz}$
Output Capacitance	C_{OB}	-	6.5	pF	$V_{CB} = 5 \text{ V}, I_E = 0, f = 1 \text{ MHz}$
Delay time	t_d	-	15	nS	$V_{CC} = 30 \text{ V}, V_{BE} = 2.0 \text{ V}, I_C = 150 \text{ mA}, I_{B1} = 15 \text{ mA}$
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	

PNP ELECTRICAL CHARACTERISTICS at Ta = 25°C

Parameter	Symbol	Min.	Max.	Unit	Test Conditions
Collector-base breakdown voltage	$V_{(BR)CBO}$	-40	-	V	$I_C = -100 \mu A, I_E = 0$
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	-40	-	V	$I_C = -1 \text{ mA}, I_B = 0$
Emitter-base breakdown voltage	$V_{(BR)EBO}$	5	-	V	$I_E = -100 \mu A, I_C = 0$
Collector cut-off current	I_{CBO}	-	-0.1	μA	$V_{CB} = -50 \text{ V}, I_E = 0$
Collector cut-off current	I_{CEO}	-	-0.5	μA	$V_{CE} = -35 \text{ V}, I_B = 0$
Emitter cut-off current	I_{EBO}	-	-0.1	μA	$V_{EB} = -5 \text{ V}, I_C = 0$
DC current gain	$h_{FE(1)}$	30	-		$V_{CE} = -1 \text{ V}, I_C = -0.1 \text{ mA}$
	$h_{FE(2)}$	60	-		$V_{CE} = -1 \text{ V}, I_C = -1 \text{ mA}$
	$h_{FE(3)}$	100	-		$V_{CE} = -1 \text{ V}, I_C = -10 \text{ mA}$
	$h_{FE(4)}$	100	300		$V_{CE} = -2 \text{ V}, I_C = -150 \text{ mA}$
	$h_{FE(5)}$	20	-		$V_{CE} = -2 \text{ V}, I_C = -500 \text{ mA}$
Collector-emitter saturation voltage	$V_{CE(sat)1}$	-	-0.4	V	$I_C = -150 \text{ mA}, I_B = -15 \text{ mA}$
	$V_{CE(sat)2}$	-	-0.75	V	$I_C = -500 \text{ mA}, I_B = -50 \text{ mA}$
Base-emitter saturation voltage	$V_{BE(sat)1}$	-0.75	-0.95	V	$I_C = -150 \text{ mA}, I_B = -15 \text{ mA}$
	$V_{BE(sat)2}$	-	-1.3	V	$I_C = -500 \text{ mA}, I_B = -50 \text{ mA}$
Transition frequency	f_T	200	-	MHz	$V_{CE} = -10 \text{ V}, I_C = -20 \text{ mA}, f = 100 \text{ MHz}$
Output Capacitance	C_{OB}	-	8.5	pF	$V_{CB} = -10 \text{ V}, I_E = 0, f = 1 \text{ MHz}$
Delay time	t_d	-	15	nS	$V_{CC} = -30 \text{ V}, V_{BE} = -2.0 \text{ V}, I_C = -150 \text{ mA}, I_{B1} = -15 \text{ mA}$
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	

CHARACTERISTIC CURVES

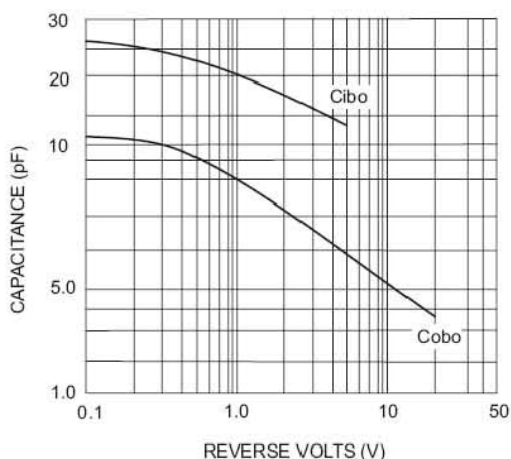


Fig. 1 Typical Capacitance (4401)

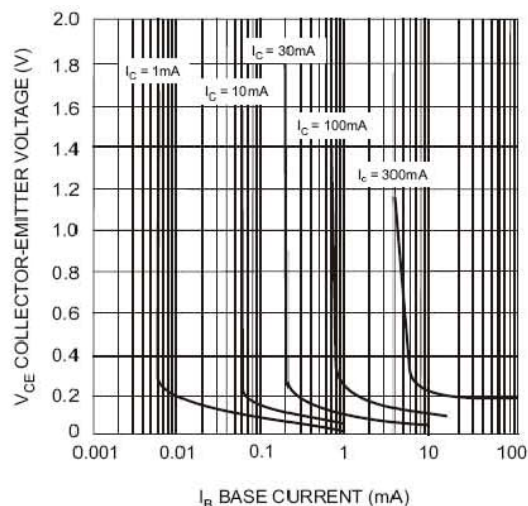


Fig. 2 Typical Collector Saturation Region (4401)

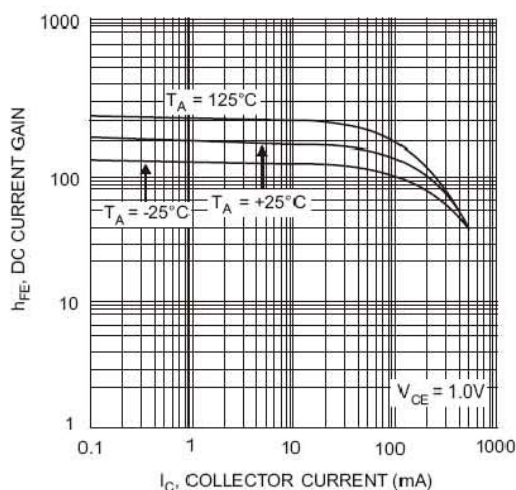


Fig. 3 Typical DC Current Gain vs Collector Current (4401)

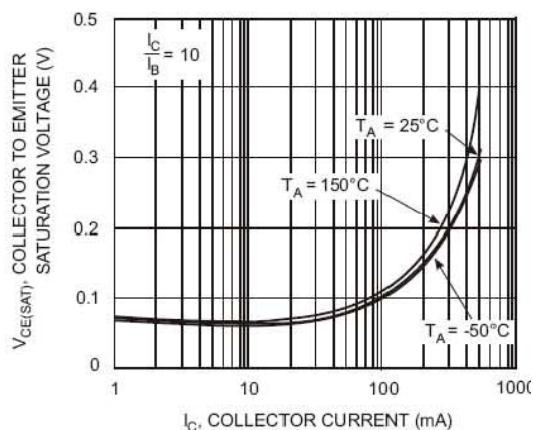


Fig. 4 Collector Emitter Saturation Voltage vs. Collector Current (4401)

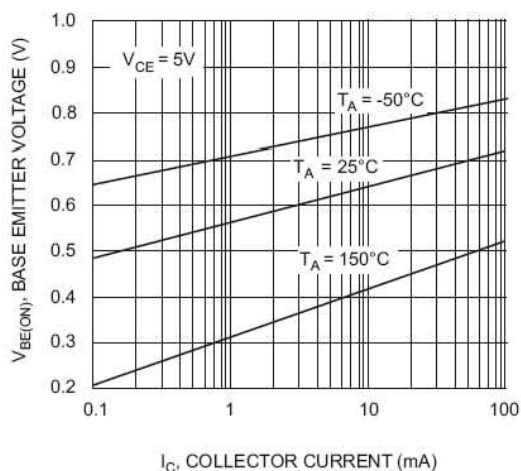


Fig. 5 Base Emitter Voltage vs. Collector Current (4401)

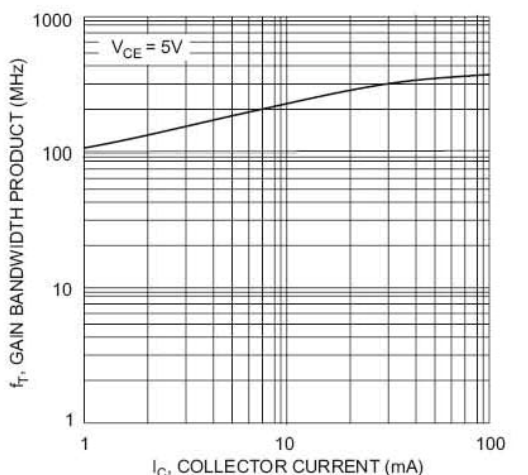


Fig. 6 Gain Bandwidth Product vs. Collector Current (4401)

CHARACTERISTIC CURVES

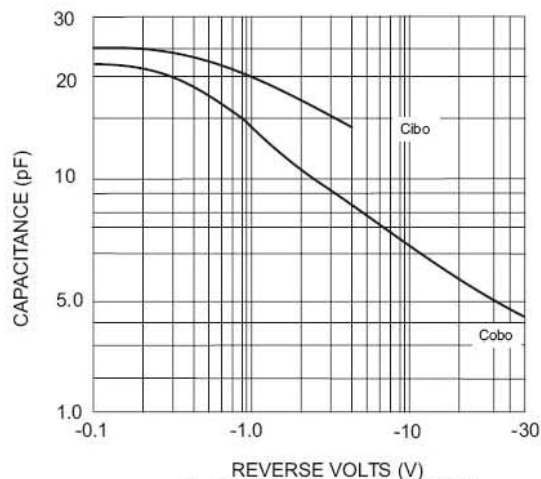


Fig. 7 Typical Capacitance (4403)

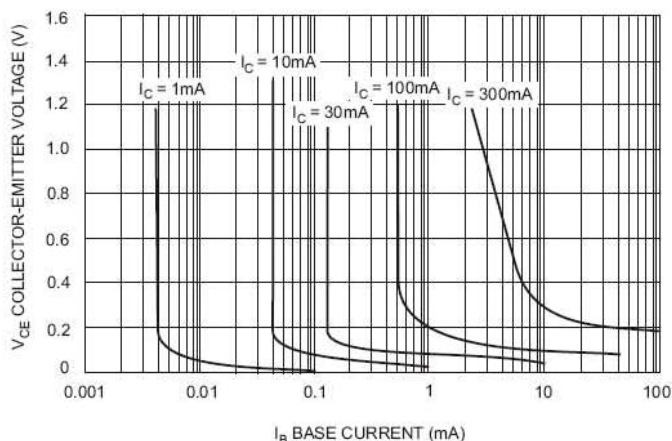


Fig. 8 Typical Collector Saturation Region (4403)

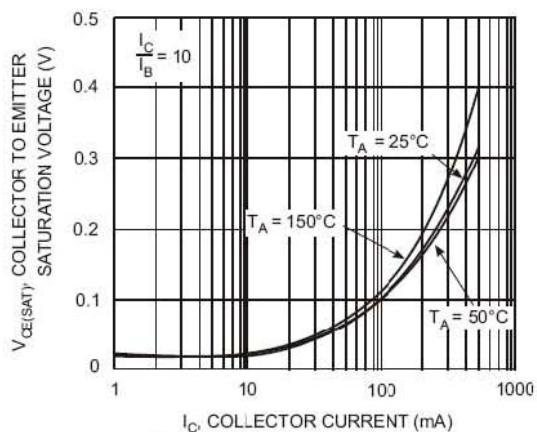


Fig. 9 Collector Emitter Saturation Voltage vs. Collector Current (4403)

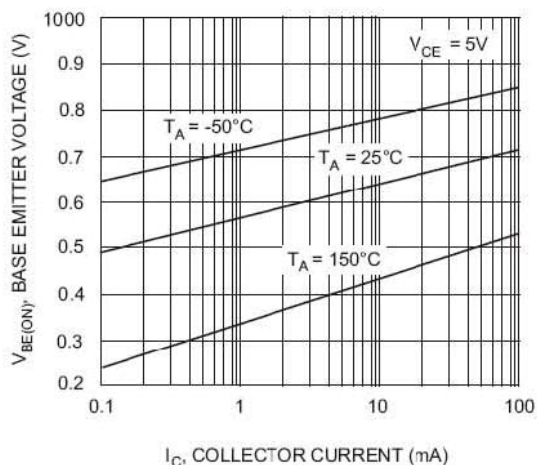


Fig. 10 Base-Emitter Voltage vs. Collector Current (4403)

CHARACTERISTIC CURVES

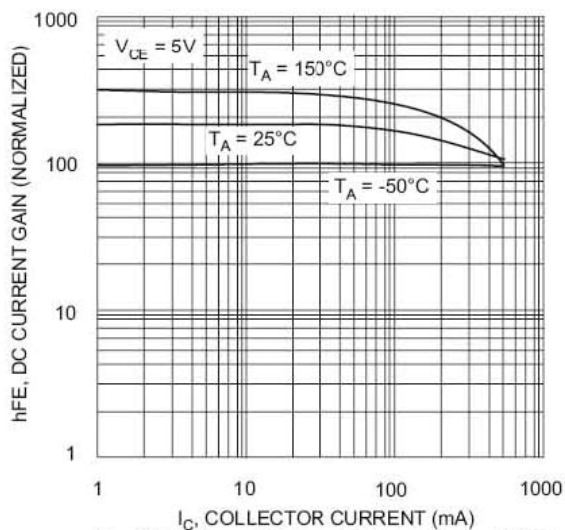


Fig. 11 DC Current Gain vs. Collector Current (4403)

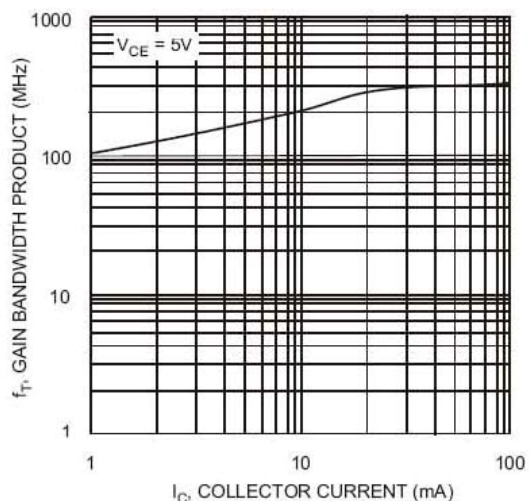


Fig. 12 Gain Bandwidth Product vs. Collector Current (4403)

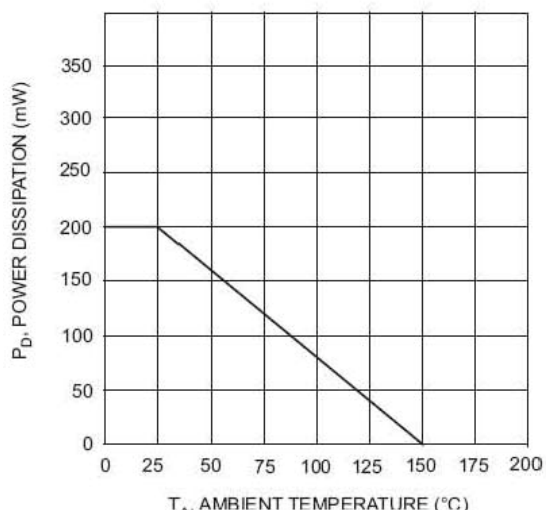


Fig. 13, Max Power Dissipation vs Ambient Temperature (4403)