Elektronische Bauelemente

MMDT4413

NPN - PNP

Plastic-Encapsulated Transistors

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

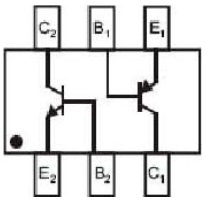
FEATURES

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

MARKING

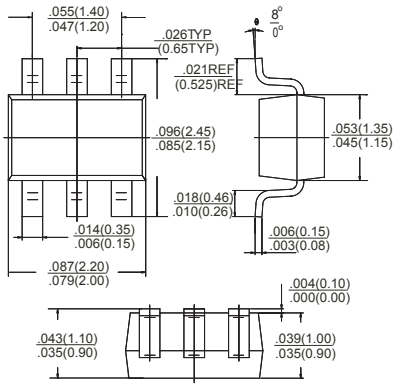
K13

EQUIVALENT CIRCUIT





SOT-363



Dimensions in inches and (millimeters)

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 μA, I_E=0
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	40	-	V	I_C= 1 mA, IB=0
Emitter-base breakdown voltage	$V_{(BR)EBO}$	6	-	V	I_E= 100 μA, I_C=0
Collector cut-off current	I_{CBO}	-	0.1	μA	V_{CB}= 50 V, I_E=0
Collector cut-off current	I_{CEO}	-	0.5	μA	V_{CE}= 35 V, I_B=0
Emitter cut-off current	I_{EBO}	-	0.1	μA	V_{EB}= 5V, I_C=0
DC current gain	$h_{FE(1)}$	20	-		V_{CE}= 1V, I_C= 0.1mA
	$h_{FE(2)}$	40	-		V_{CE}= 1V, I_C= 1mA
	$h_{FE(3)}$	80	-		V_{CE}= 1V, I_C= 10mA
	$h_{FE(4)}$	100	300		V_{CE}= 1V, I_C= 150mA
	$h_{FE(5)}$	40	-		V_{CE}= 2V, I_C= 500mA
Collector-emitter saturation voltage	$V_{CE(sat)1}$	-	0.4	V	I_C=150 mA, I_B= 15mA
	$V_{CE(sat)2}$	-	0.75	V	I_C=500 mA, I_B= 50mA
Base-emitter saturation voltage	$V_{BE(sat)1}$	0.75	0.95	V	I_C= 150 mA, I_B= 15mA
	$V_{BE(sat)2}$	-	1.2	V	I_C= 500 mA, I_B= 50mA
Transition frequency	f_T	250	-	MHz	V_{CE}= 10V, I_C= 20mA, f=100MHz
Output Capacitance	C_{OB}	-	6.5	pF	V_{CB}=5V, I_E= 0, f=1MHz
Delay time	t_d	-	15	nS	V_{CC}=30 V, V_{BE}=2.0 V, I_C=150 mA, I_{B1}=15 mA
Rise time	t_r	-	20	nS	
Storage time	t_s	-	225	nS	V_{CC}=30 V, I_C=150 mA, I_{B1} =-I_{B2} = 15 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 μA, I_E=0
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	-40	-	V	I_C= -1 mA, IB=0
Emitter-base breakdown voltage	$V_{(BR)EBO}$	5	-	V	I_E= -100 μA, I_C=0
Collector cut-off current	I_{CBO}	-	-0.1	μA	V_{CB}= -50 V, I_E=0
Collector cut-off current	I_{CEO}	-	-0.5	μA	V_{CE}= -35 V, I_B=0
Emitter cut-off current	I_{EBO}	-	-0.1	μA	V_{EB}= -5V, I_C=0
DC current gain	$h_{FE(1)}$	30	-		V_{CE}= -1V, I_C= -0.1mA
	$h_{FE(2)}$	60	-		V_{CE}= -1V, I_C= -1mA
	$h_{FE(3)}$	100	-		V_{CE}= -1V, I_C= -10mA
	$h_{FE(4)}$	100	300		V_{CE}= -2V, I_C= -150mA
	$h_{FE(5)}$	20	-		V_{CE}= -2V, I_C= -500mA
Collector-emitter saturation voltage	$V_{CE(sat)1}$	-	-0.4	V	I_C= -150 mA, I_B= -15mA
	$V_{CE(sat)2}$	-	-0.75	V	I_C= -500 mA, I_B= -50mA
Base-emitter saturation voltage	$V_{BE(sat)1}$	-0.75	-0.95	V	I_C= -150 mA, I_B= -15mA
	$V_{BE(sat)2}$	-	-1.3	V	I_C= -500 mA, I_B= -50mA
Transition frequency	f_T	200	-	MHz	V_{CE}= -10V, I_C= -20mA, f=100MHz
Output Capacitance	C_{OB}	-	8.5	pF	V_{CB}=-10V, I_E= 0, f=1MHz
Delay time	t_d	-	15	nS	V_{CC}=-30 V, V_{BE}=-2.0 V, I_C=-150 mA, I_{B1}=-15 mA
Rise time	t_r	-	20	nS	
Storage time	t_s	-	225	nS	V_{CC}=-30 V, I_C=-150 mA, I_{B1} =-I_{B2} = -15 mA
Fall time	t_f	-	30	nS	

CHARACTERISTIC CURVES

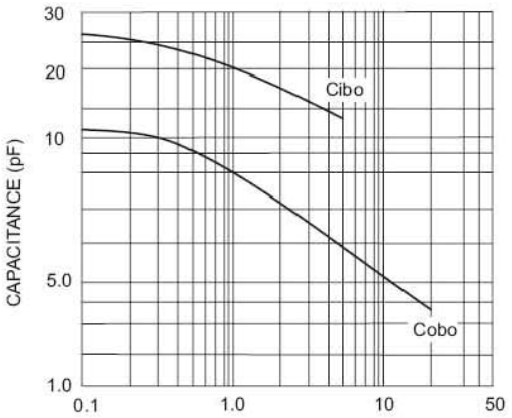


Fig. 1 Typical Capacitance (4401)

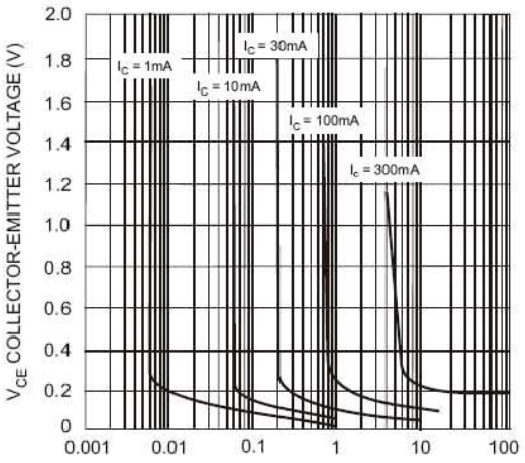


Fig. 2 Typical Collector Saturation Region (4401)

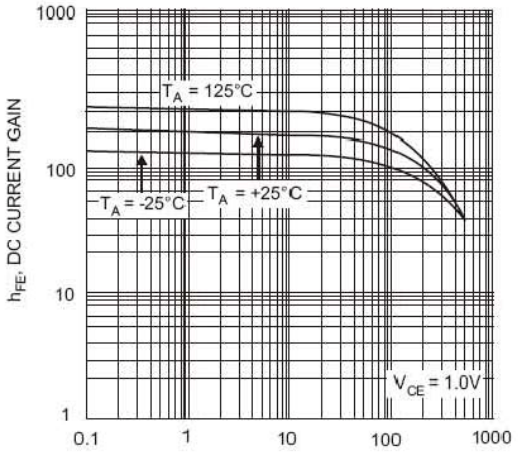


Fig. 3 Typical DC Current Gain vs Collector Current (4401)

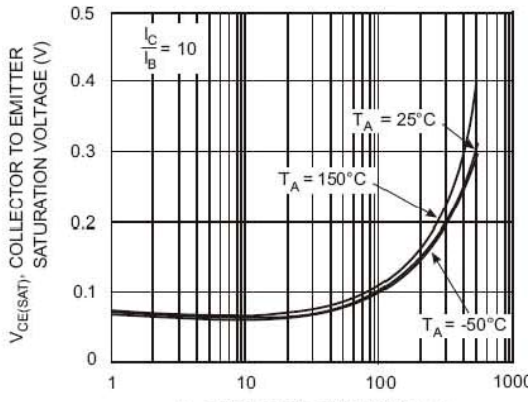


Fig. 4 Collector Emitter Saturation Voltage vs. Collector Current (4401)

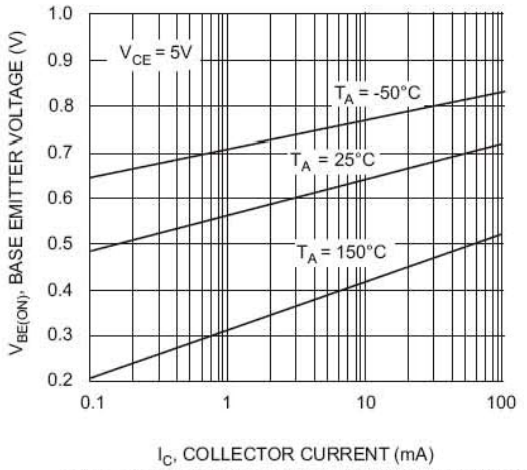


Fig. 5 Base Emitter Voltage vs. Collector Current (4401)

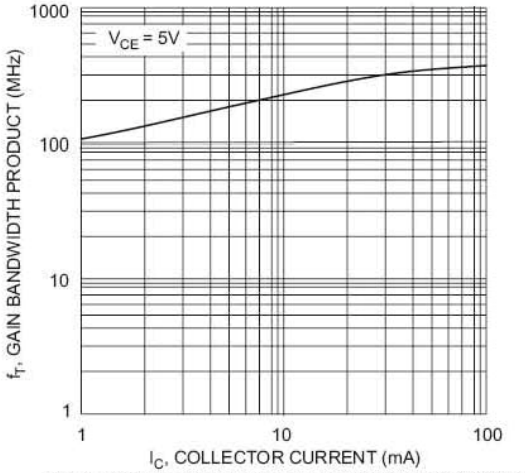


Fig. 6 Gain Bandwidth Product vs. Collector Current (4401)

CHARACTERISTIC CURVES

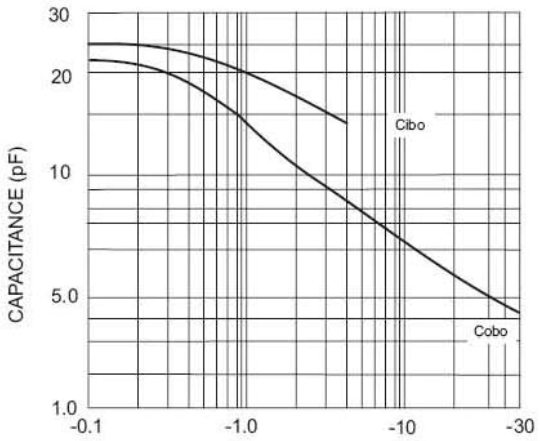


Fig. 7 Typical Capacitance (4403)

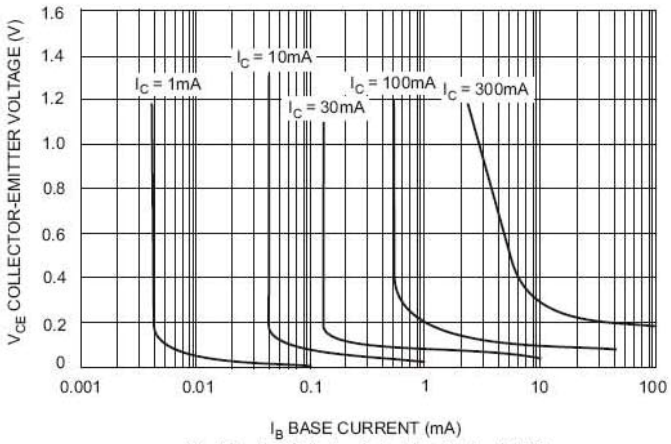


Fig. 8 Typical Collector Saturation Region (4403)

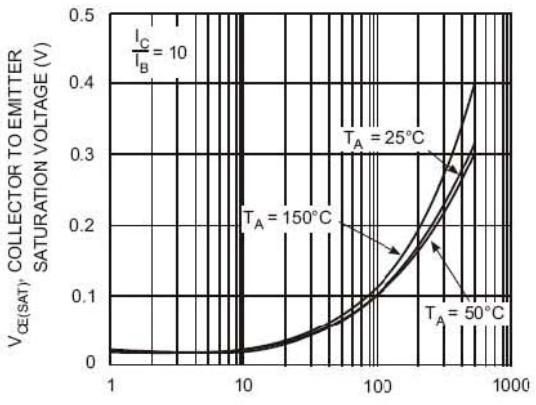


Fig. 9 Collector Emitter Saturation Voltage vs. Collector Current (4403)

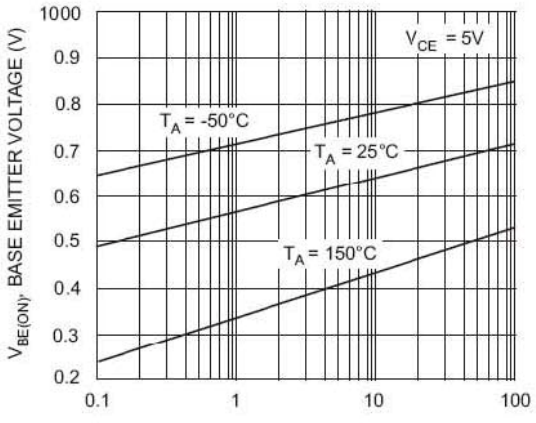


Fig. 10 Base-Emitter Voltage vs. Collector Current (4403)

CHARACTERISTIC CURVES

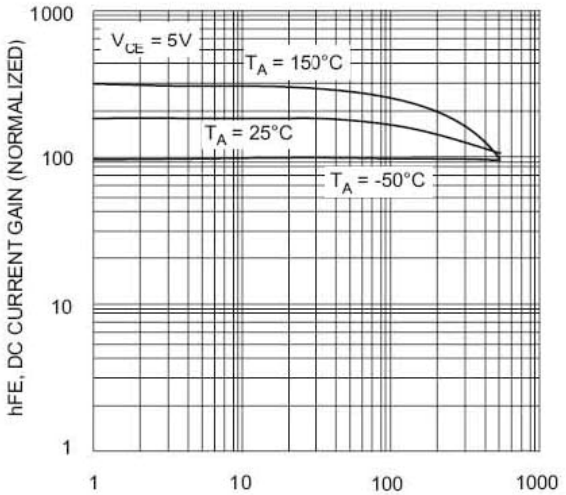


Fig. 11 DC Current Gain vs. Collector Current (4403)

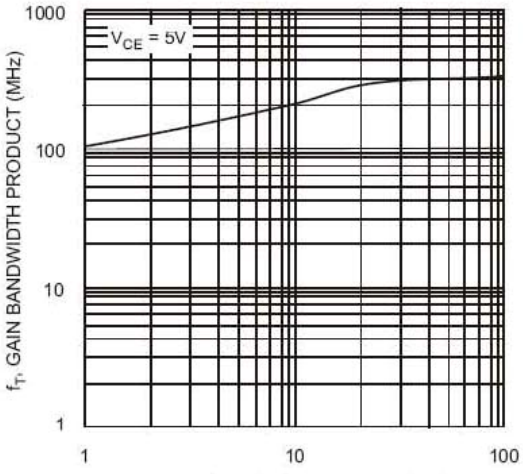


Fig. 12 Gain Bandwidth Product vs. Collector Current (4403)

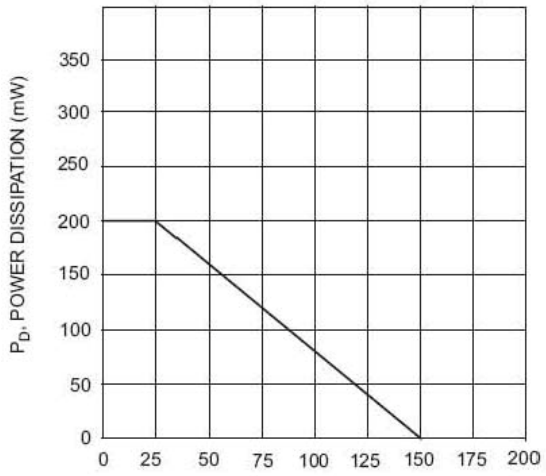


Fig. 13, Max Power Dissipation vs Ambient Temperature (4403)