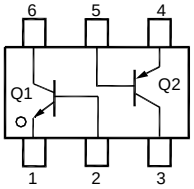
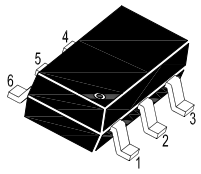
MMDT4413

NPN / PNP Silicon Epitaxial Planar Transistors





1. Emitter 2. Base 3. Collector
4. Emitter 5. Base 6. Collector

■ **Simplified outline(SOT-363)**

■ Features

- Complementary Pair
- One 4401-Type NPN
  One 4403-Type PNP
- Epitaxial Planar Die Construction
- Ideal for Low Power Amplification and Switching

■ Maximum Ratings Ta = 25℃ **NPN 4401 Section**

Symbol	Parameter	Value	Units
V_{CBO}	Collector-Base Voltage	60	V
V_{CEO}	Collector-Emitter Voltage	40	V
V_{EBO}	Emitter-Base Voltage	6	V
I_C	Collector Current -Continuous	0.6	A
P_C	Collector Power Dissipation	0.2	W
$R_{\theta JA}$	Thermal Resistance from Junction to Ambient	625	℃/W
T_J,T_{stg}	Operation Junction and Storage Temperature Range	-55 ~ +150	℃

■ Electrical Characteristics Ta = 25℃ **NPN 4401 Section**

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

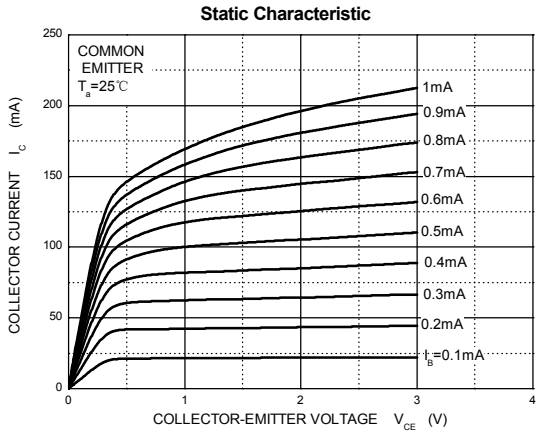
■ Maximum Ratings Ta = 25℃ **PNP 4403 Section**

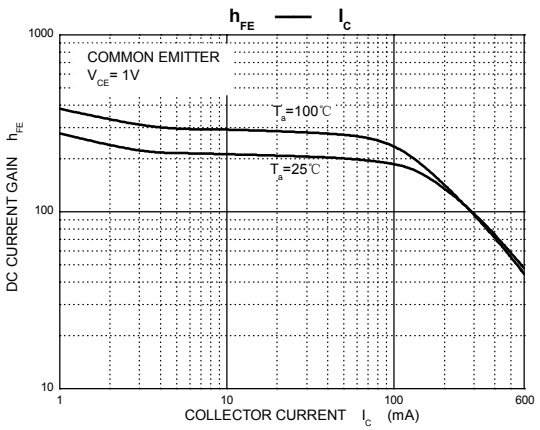
Symbol	Parameter	Value	Units
V_{CBO}	Collector-Base Voltage	-40	V
V_{CEO}	Collector-Emitter Voltage	-40	V
V_{EBO}	Emitter-Base Voltage	-5	V
I_C	Collector Current -Continuous	-0.6	A
P_C	Collector Power Dissipation	0.2	W
$R_{\theta}JA$	Thermal Resistance from Junction to Ambient	625	℃/W
T_J, T_{stg}	Operation Junction and Storage Temperature Range	-55 ~ +150	℃

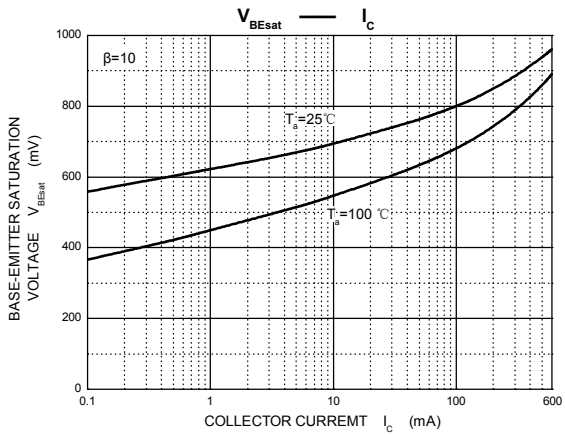
■ Electrical Characteristics Ta = 25℃ **PNP 4403 Section**

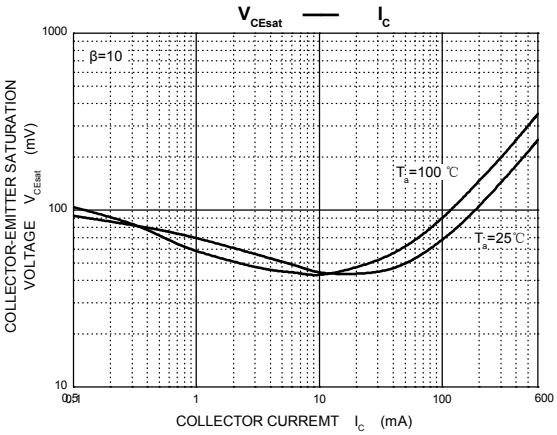
Parameter	Symbol	Test conditions	Min	Typ	Max	Unit
Collector-base breakdown voltage	$V_{(BR)CBO}$	I_C =-100μA , I_E=0	-40			V
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	I_C= -1mA , I_B=0	-40			V
Emitter-base breakdown voltage	$V_{(BR)EBO}$	I_E=-100μA, I_C=0	-5			V
Collector cut-off current	I_{CBO}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

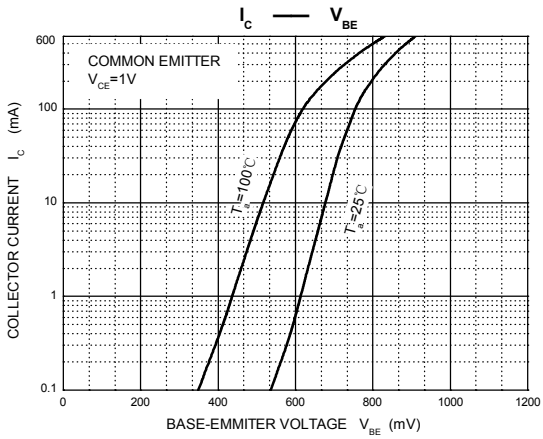
NPN Transistor

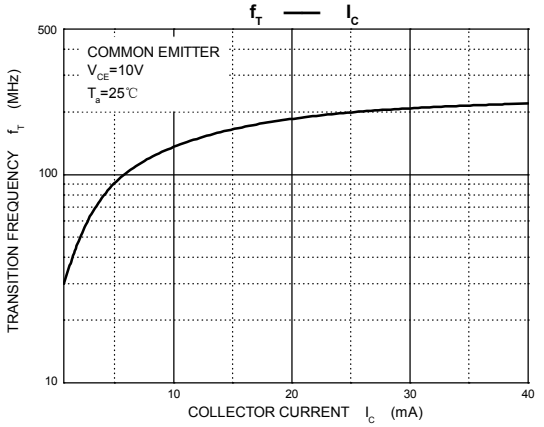


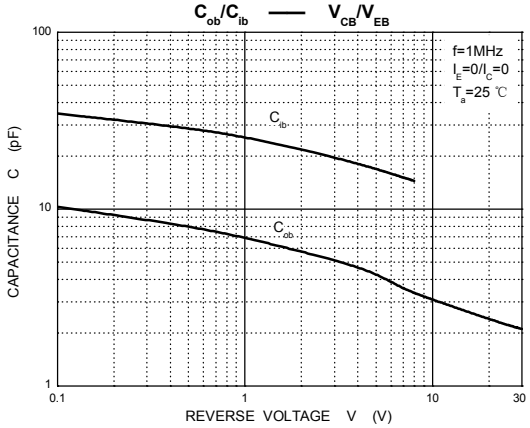






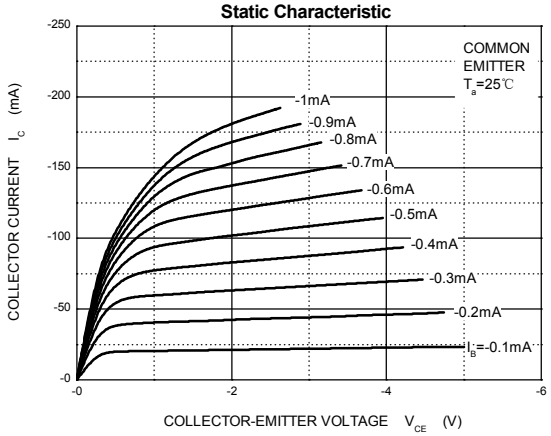




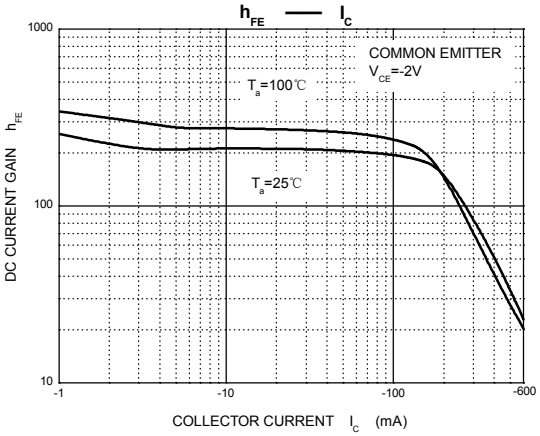


PNP Transistor

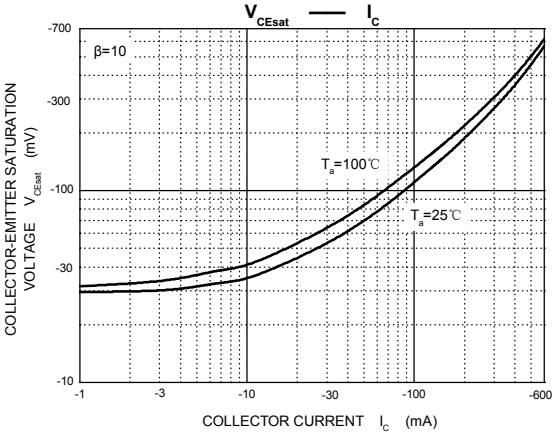
Static Characteristic



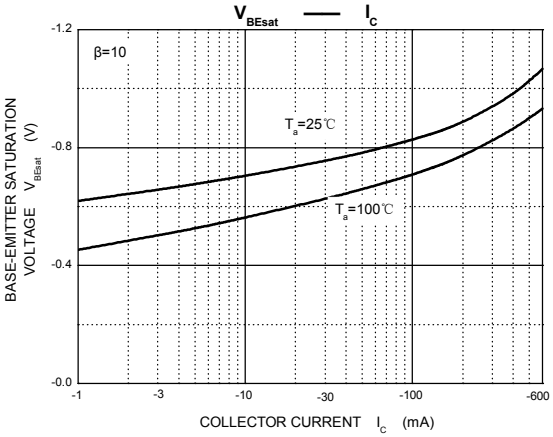
h_{FE} — I_C



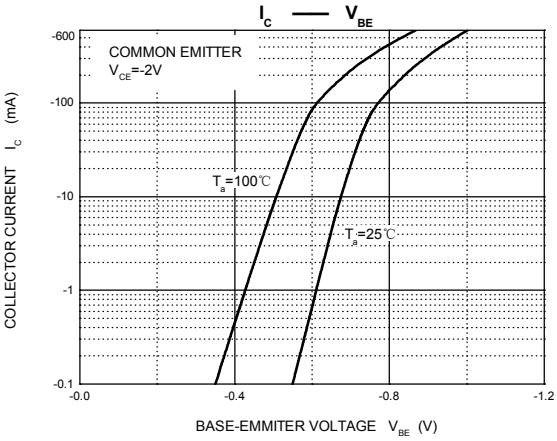
V_{CEsat} — I_C



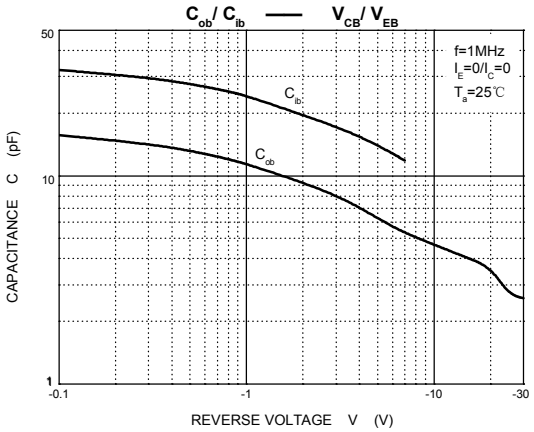
V_{BEsat} — I_C



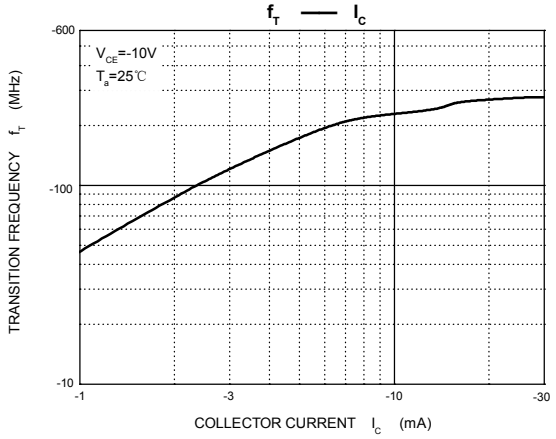
I_C — V_{BE}



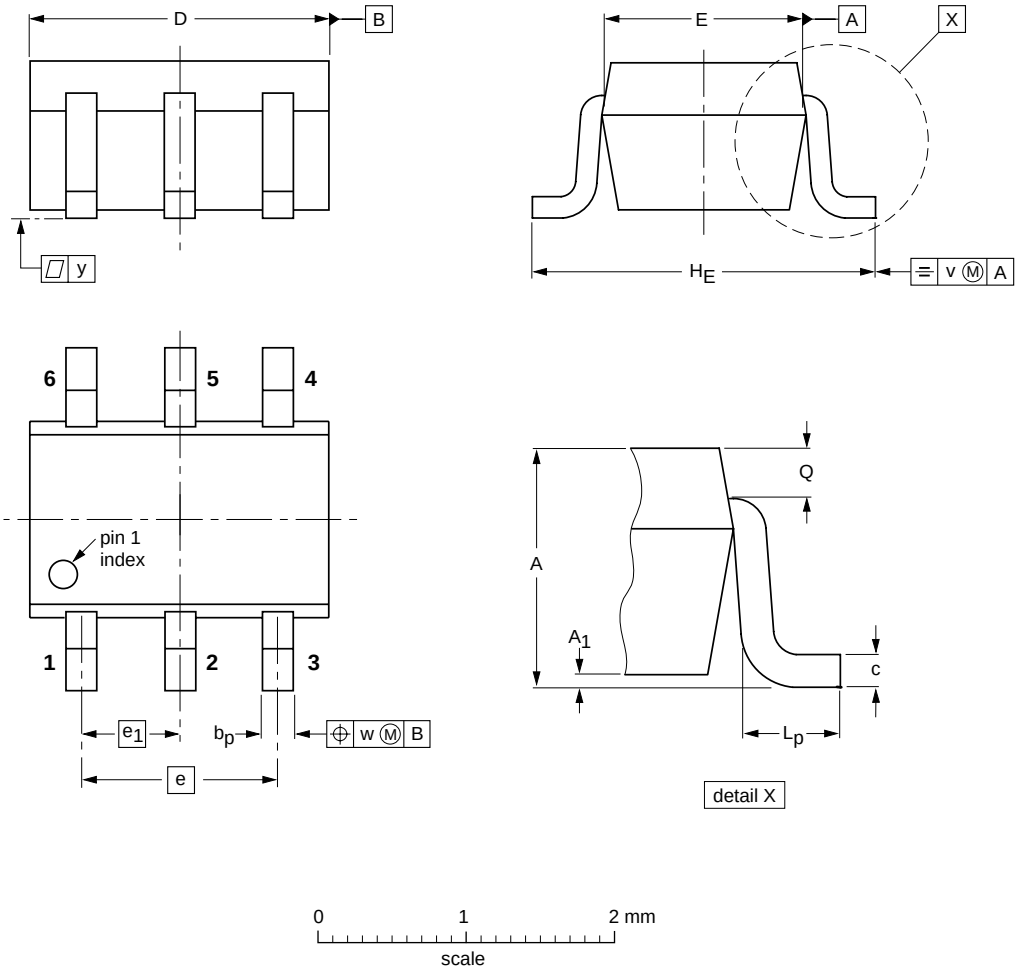
C_{ob} / C_{ib} — V_{CB} / V_{EB}



f_T — I_C



■ SOT-363



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max	b_p	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.1 0.8	0.1	0.30 0.20	0.25 0.10	2.2 1.8	1.35 1.15	1.3	0.65	2.2 2.0	0.45 0.15	0.25 0.15	0.2	0.2	0.1