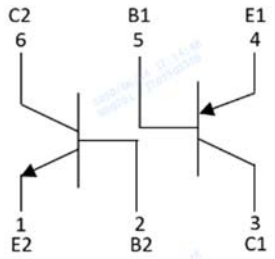
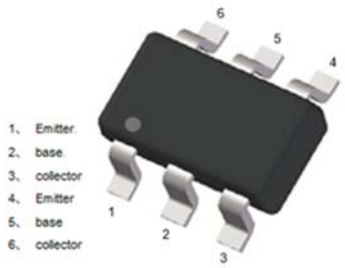
Dual NPN+PNP Small Signal Transistor





Features

- Moisture sensitivity level 1
- Halogen free and RoHS compliant
- Surface mount package ideally suited for automatic insertion

Application

- Signal amplification
- Switching circuit

Mechanical data

- **Package：** SOT-363S
- **Terminals：** Tin plated leads, solderable per J-STD-002 and JESD22-B102CC

■ **Maximum Ratings** (T_a=25℃ Unless otherwise specified)

TR1 NPN Pin1、2、6

Item	Symbol	Unit	Conditions	Value
Device marking code				K13
Collector-base voltage	V_{CBO}	V	I_C =100uA,I_E=0	60
Collector-emitter voltage	V_{CEO}	V	I_C =1mA,I_B=0	40
Emitter-base voltage	V_{EBO}	V	I_E=100uA,I_C=0	6
Collector current	I_C	mA		200
Power dissipation	P_D	mW		200
Operation junction temperature	T_J	℃		-55 to +150
Storage temperature	T_{STG}	℃		-55 to +150

TR2 PNP Pin3、4、5

Item	Symbol	Unit	Conditions	Value
Collector-base voltage	V_{CBO}	V	I_C =-100uA,I_E=0	-40
Collector-emitter voltage	V_{CEO}	V	I_C =-1mA,I_B=0	-40
Emitter-base voltage	V_{EBO}	V	I_E=-100uA,I_C=0	-5
Collector current	I_C	mA		-200
Power dissipation	P_D	mW		200
Operation junction temperature	T_J	℃		-55 to +150
Storage temperature	T_{STG}	℃		-55 to +150

■ Electrical Characteristics (Ta=25℃ Unless otherwise specified)

TR1 NPN Pin1、2、6

Item	Symbol	Unit	Conditions	Min	Typ	Max
Collector-base breakdown voltage	$V_{(BR)CBO}$	V	I_C=100μA,I_E=0	60		
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	V	I_C =1mA,I_B=0	40		
Emitter-base breakdown voltage	$V_{(BR)EBO}$	V	I_E=100μA,I_C=0	6		
Collector-base cut-off current	I_{CBO}	nA	V_{CE}=50V,I_E=0			100
Emitter-base cut-off current	I_{EBO}	nA	V_{BE}=5V,I_C=0			100
DC current gain	h_{FE1}		V_{CE}=1V,I_C=0.1mA	20		
	h_{FE2}		V_{CE}=1V,I_C=1mA	40		
	h_{FE3}		V_{CE}=1V,I_C=10mA	80		
	h_{FE4}		V_{CE}=1V,I_C=150mA	100		300
	h_{FE5}		V_{CE}=2V,I_C=500mA	40		
Collector-emitter saturation voltage	$V_{CE(sat)1}$	V	I_C=150mA,I_B=15mA			0.4
	$V_{CE(sat)2}$		I_C=500mA,I_B=50mA			0.75
Base-emitter saturation voltage	$V_{BE(sat)1}$	V	I_C=150mA,I_B=15mA			0.95
	$V_{BE(sat)2}$		I_C=500mA,I_B=50mA			1.2
Transition frequency	f_T	MHz	V_{CE}=10V,I_C=20mA,f=100MHz	250		
Delay time	td	ns	V_{CC}=30V, I_C=150mA, V_{BE}=2V, IB1=15mA			15
Rise time	tr	ns				20

Item	Symbol	Unit	Conditions	Min	Typ	Max
Storage time	ts	ns	V_{CC}=30V, I_C=150mA, I_{B1}=-I_{B2}=5mA			225
Fall time	tf	ns				30

TR2 PNP Pin3、4、5

Item	Symbol	Unit	Conditions	Min	Typ	Max
Collector-base breakdown voltage	$V_{(BR)CBO}$	V	I_C=-100μA,I_E=0	-40		
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	V	I_C =-1mA,I_B=0	-40		
Emitter-base breakdown voltage	$V_{(BR)EBO}$	V	I_E=-100μA,I_C=0	-5		
Collector-base cut-off current	I_{CBO}	nA	V_{CB}=-50V,I_E=0			-100
Emitter-base cut-off current	I_{EBO}	nA	V_{EB}=-5V,I_C=0			-100
DC current gain	h_{FE1}		V_{CE}=-1V,I_C=-0.1mA	30		
	h_{FE2}		V_{CE}=-1V,I_C=-1mA	60		
	h_{FE3}		V_{CE}=-1V,I_C=-10mA	100		
	h_{FE4}		V_{CE}=-2V,I_C=-150mA	100		300
	h_{FE5}		V_{CE}=-2V,I_C=-500mA	20		
Collector-emitter saturation voltage	$V_{CE(sat)}$	V	I_C=-150mA,I_B=-15mA			-0.4
		V	I_C=-500mA,I_B=-50mA			-0.75
Base-emitter saturation voltage	$V_{BE(sat)}$	V	I_C=-150mA,I_B=-15mA			-0.95
		V	I_C=-500mA,I_B=-50mA			-1.3
Transition frequency	f_T	MHz	V_{CE}=-10V,I_C=-20mA, f=100MHz	200		
Delay time	td	ns	V_{CC}=-30V, I_C=-150mA, V_{BE}=-2V, IB1=-15mA			15
Rise time	tr	ns				20
Storage time	ts	ns	V_{CC}=-30V, I_C=-150mA, I_{B1}=-I_{B2}=-15mA			225
Fall time	tf	ns				30

■ Thermal Characteristics

PARAMETER	Symbol	Unit	Value
Thermal resistance, junction-to-ambient	$R_{\theta J-A}$(1)	℃/W	625
Thermal resistance, junction-to-case	$R_{\theta J-C}$(1)	℃/W	500

Note:

（1）Device mounted on PCB, single-sided copper，with standard footprint

■Characteristics

TR1 NPN Pin1、2、6

Fig 1：Static Characteristics

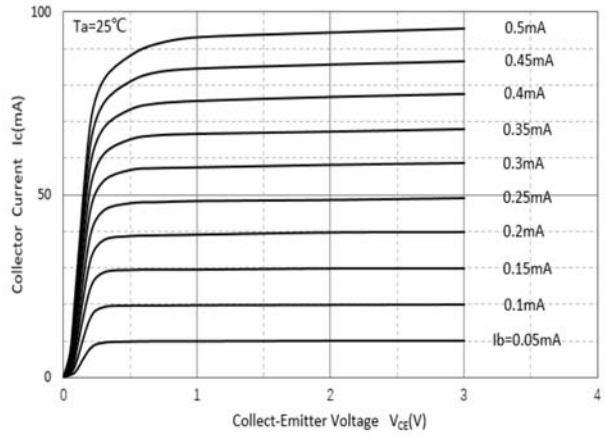


Fig 2：Dc Current Gain

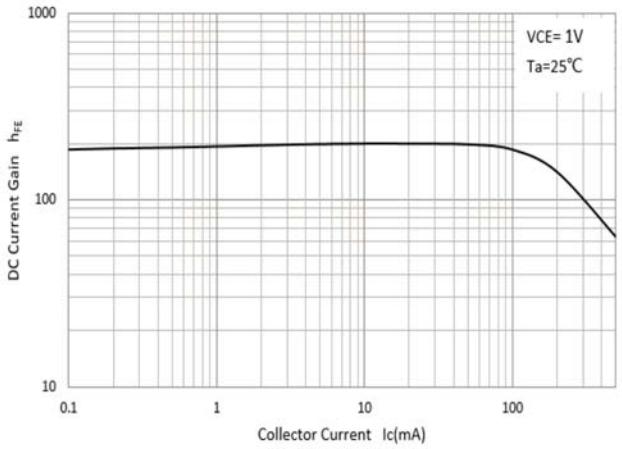


Fig 3：Collector-Emitter Saturation Voltage

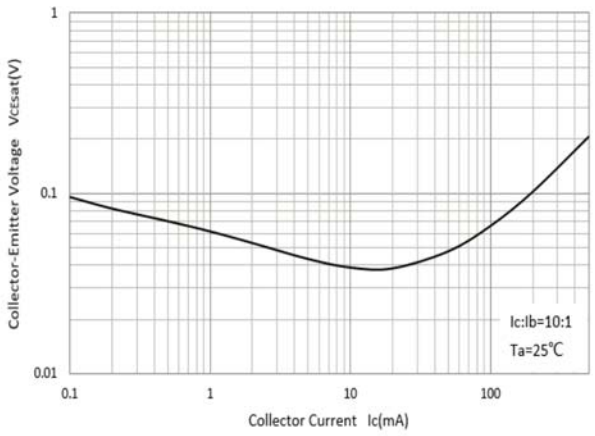


Fig 4：Base-Emitter Saturation Voltage

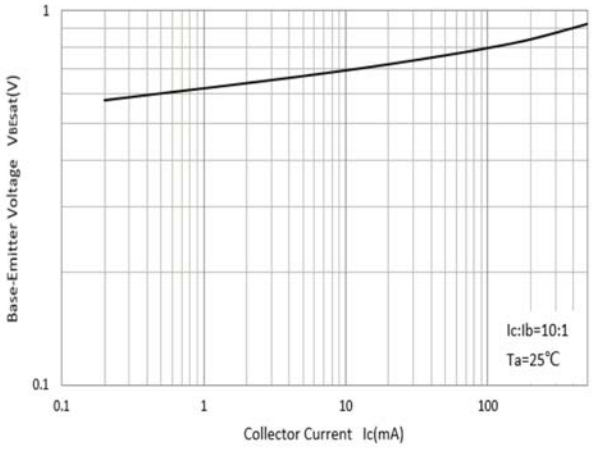


Fig 5：Base-Emitter Voltage

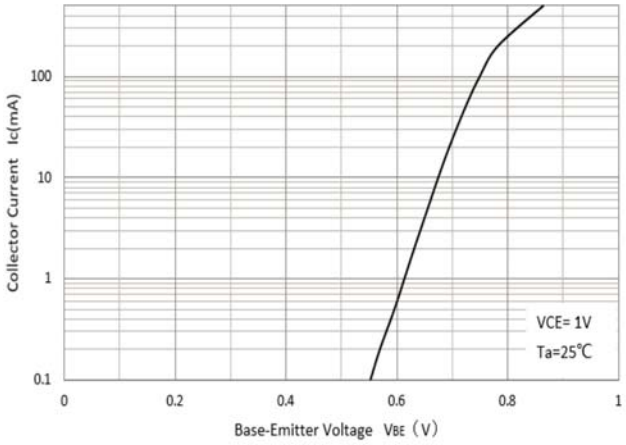


Fig 6：Cob/Cib-V_{CB}/V_{EB}

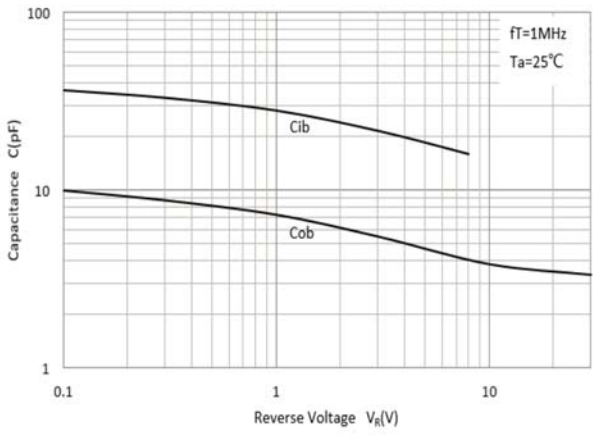
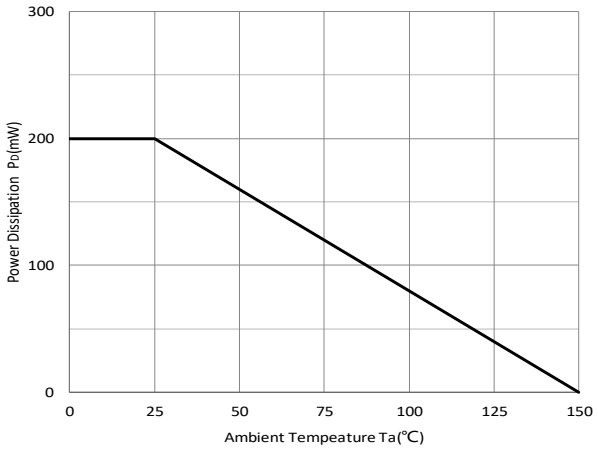


Fig 7：P_D-Ta Curve



TR2 PNP Pin3、4、5

Fig 1：Static Characteristics

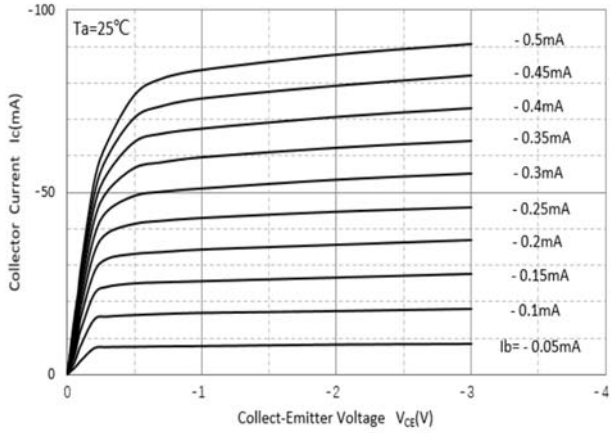


Fig 2：Dc Current Gain

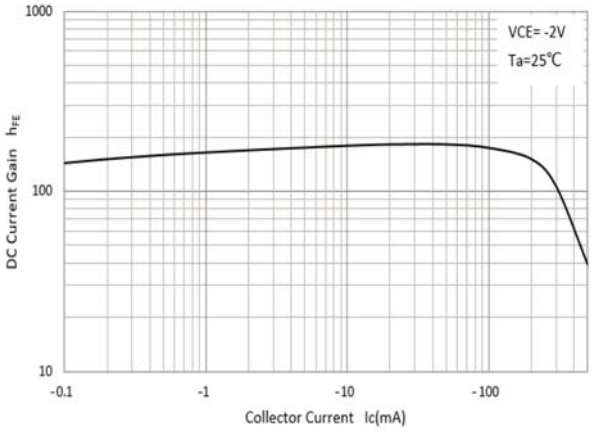


Fig 3：Collector-Emitter Saturation Voltage

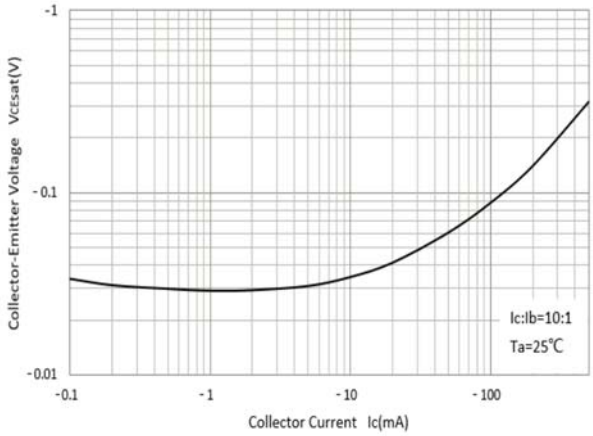


Fig 4：Base-Emitter Saturation Voltage

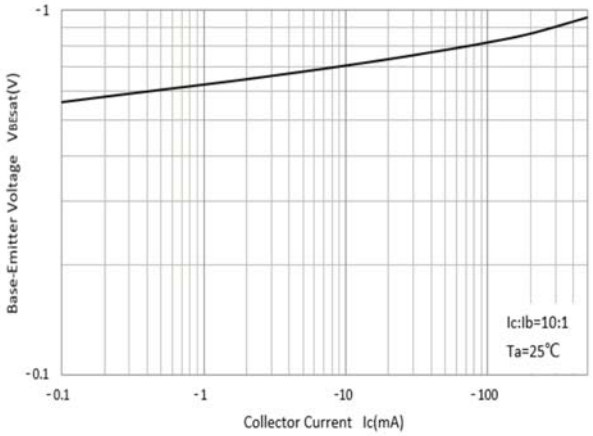


Fig 5：Base-Emitter Voltage

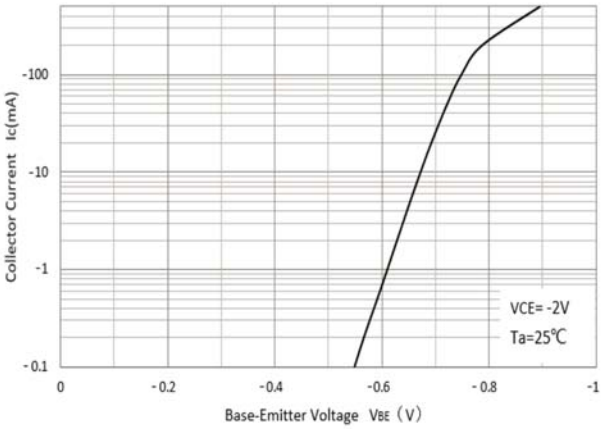
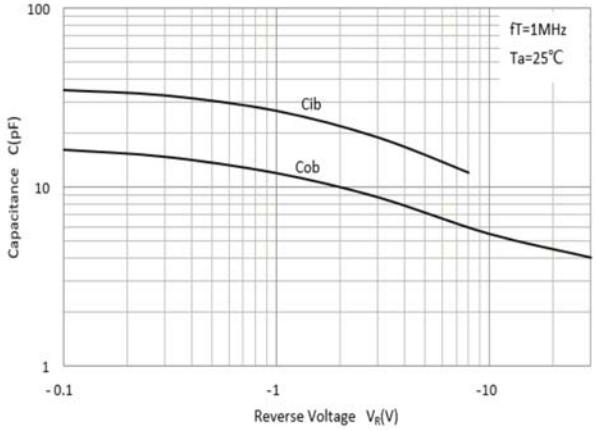


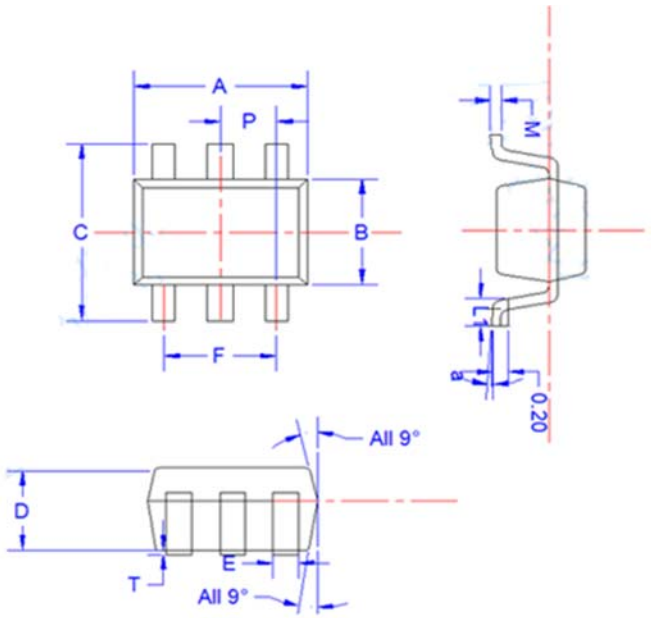
Fig 6：Cob/Cib-V_{CB}/V_{EB}



■Ordering Information

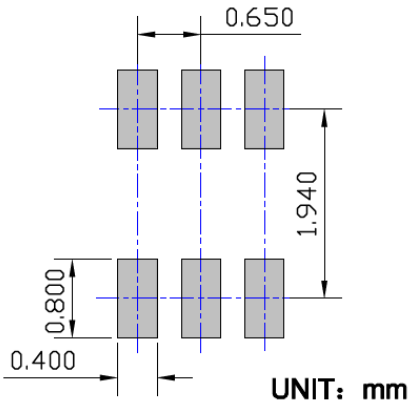
Preferred P/N	Packing code	Unit weight(g)	Minimum package(pcs)	Inner box quantity(pcs)	Outer carton quantity(pcs)	Delivery mode
MMDT4413S	F2	Approximate 0.009	3000	30000	120000	7” reel
MMDT4413S	F3	Approximate 0.009	10000	/	210000	7” reel

■ Outline Dimensions



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
E	0.15	0.25	0.35
B	1.15	1.25	1.35
C	2.00	2.10	2.20
P		0.650BSC	
A	1.80	2.00	2.20
T	0.00	0.05	0.100
D	0.90	0.95	1.00
L1	0.20	0.30	0.40
a		4°±4°	
M	0.10	0.15	0.25

■ Suggested Pad Layout



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