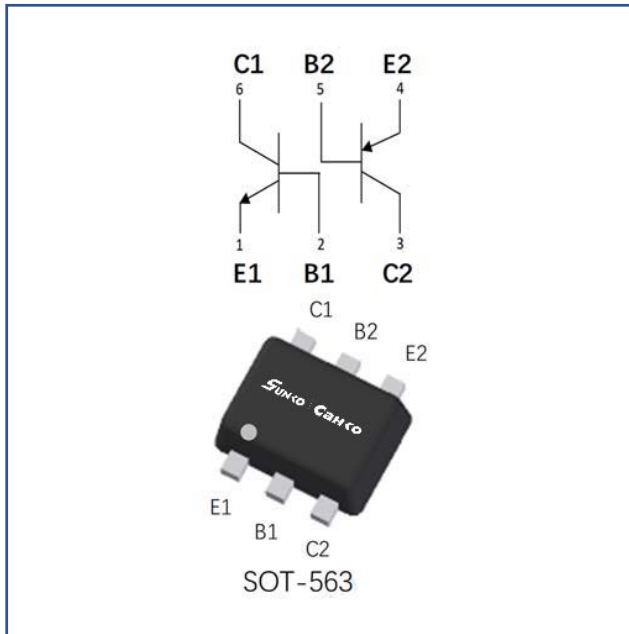


MMDT3946V

Dual NPN+PNP Small Signal Transistor



Features

- Moisture sensitivity level 1
- Halogen free and
- Surface mount package ideally suited for automatic Insertion

Application

- Signal amplification
- Switching circuit

Mechanical data

- **Package:** SOT-563
- **Terminals:** Tin plated leads, solderable per J-STD-002 and JESD22-B102

■ **Maximum Ratings** ($T_a=25^\circ\text{C}$ Unless otherwise specified)

TR1-NPN

Item	Symbol	Unit	Conditions	Value
Device marking code				K46
Collector-base voltage	V_{CBO}	V	$I_C=10\mu\text{A}, I_E=0$	60
Collector-emitter voltage	V_{CEO}	V	$I_C=1\text{mA}, I_B=0$	40
Emitter-base voltage	V_{EBO}	V	$I_E=10\mu\text{A}, I_C=0$	6
Collector current	I_C	mA		200
Power dissipation	P_D	mW		150
Junction temperature	T_J	$^\circ\text{C}$		-55 to +150
Storage temperature	T_{STG}	$^\circ\text{C}$		-55 to +150

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TR2-PNP

Item	Symbol	Unit	Conditions	Value
Collector-base voltage	V_{CBO}	V	$I_C = -10\mu A, I_E = 0$	-40
Collector-emitter voltage	V_{CEO}	V	$I_C = -1mA, I_B = 0$	-40
Emitter-base voltage	V_{EBO}	V	$I_E = -10\mu A, I_C = 0$	-5
Collector current	I_C	mA		-200
Power dissipation	P_D	mW		150
Junction temperature	T_J	°C		-55 to +150
Storage temperature	T_{STG}	°C		-55 to +150

■ Electrical Characteristics ($T_A = 25^\circ C$ Unless otherwise specified)

TR1-NPN

Item	Symbol	Unit	Conditions	Min	Typ	Max
Collector-base breakdown voltage	$V_{(BR)CBO}$	V	$I_C = 10\mu A, I_E = 0$	60		
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	V	$I_C = 1mA, I_B = 0$	40		
Emitter-base breakdown voltage	$V_{(BR)EBO}$	V	$I_E = 10\mu A, I_C = 0$	6		
Collector cut-off current	I_{CBO}	nA	$V_{CB} = 30V, I_E = 0$			50
Collector cut-off current	I_{CEO}	nA	$V_{CE} = 30V, I_B = 0$			50
Collector cut-off current	I_{EBO}	nA	$V_{EB} = 5V, I_C = 0$			50
DC current gain	h_{FE1}		$V_{CE} = 1V, I_C = 0.1mA$	40		
	h_{FE2}		$V_{CE} = 1V, I_C = 1mA$	70		
	h_{FE3}		$V_{CE} = 1V, I_C = 10mA$	100		300
	h_{FE4}		$V_{CE} = 1V, I_C = 50mA$	60		
	h_{FE5}		$V_{CE} = 1V, I_C = 100mA$	30		
Collector-emitter saturation voltage	$V_{CE(sat)1}$	V	$I_C = 10mA, I_B = 1mA$			0.2
	$V_{CE(sat)2}$	V	$I_C = 50mA, I_B = 5mA$			0.3
Base-emitter saturation voltage	$V_{BE(sat)1}$	V	$I_C = 10mA, I_B = 1mA$	0.65		0.85
	$V_{BE(sat)2}$	V	$I_C = 50mA, I_B = 5mA$			0.95
Collector-base Output Capacitance	C_{ob}	pF	$V_{CB} = 5.0V, f = 1.0MHz, I_E = 0$			4

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Item	Symbol	Unit	Conditions	Min	Typ	Max
Transition frequency	f_T	MHz	$V_{CE}=20V, I_C=20mA, f=100MHz$	300		
Delay time	t_d	ns	$V_{CC}=3V, I_C=10mA, V_{BE}=0.5V,$ $I_{B1}=1mA$			35
Rise time	t_r	ns				35
Storage time	t_s	ns	$V_{CC}=3V, I_C=10mA, I_{B1}=-I_{B2}=1mA$			200
Fall time	t_f	ns				50

TR2-PNP

Item	Symbol	Unit	Conditions	Min	Typ	Max
Collector-base breakdown voltage	$V_{(BR)CBO}$	V	$I_C=-10\mu A, I_E=0$	-40		
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	V	$I_C=-1mA, I_B=0$	-40		
Emitter-base breakdown voltage	$V_{(BR)EBO}$	V	$I_E=-10\mu A, I_C=0$	-5		
Collector-base cut-off current	I_{CBO}	nA	$V_{CB}=-30V, I_E=0$			-50
Emitter-base cut-off current	I_{EBO}	nA	$V_{EB}=-5V, I_C=0$			-50
DC current gain	h_{FE1}		$V_{CE}=-1V, I_C=-0.1mA$	40		
	h_{FE2}		$V_{CE}=-1V, I_C=-1mA$	70		
	h_{FE3}		$V_{CE}=-1V, I_C=-10mA$	100		300
	h_{FE4}		$V_{CE}=-1V, I_C=-50mA$	60		
	h_{FE5}		$V_{CE}=-1V, I_C=-100mA$	30		
Collector-emitter saturation voltage	$V_{CE(sat)1}$	V	$I_C=-10mA, I_B=-1mA$			-0.25
	$V_{CE(sat)2}$	V	$I_C=-50mA, I_B=-5mA$			-0.4
Base-emitter saturation voltage	$V_{BE(sat)1}$	V	$I_C=-10mA, I_B=-1mA$	-0.65		-0.85
	$V_{BE(sat)2}$	V	$I_C=-50mA, I_B=-5mA$			-0.95
Collector-base Output Capacitance	C_{ob}	pF	$V_{CB}=-5.0Vdc, f=1.0MHz, I_E=0$			4.5
Transition frequency	f_T	MHz	$V_{CE}=-20V, I_C=-10mA, f=100MHz$	250		
Delay time	t_d	ns	$V_{CC}=-3V, I_C=-10mA,$ $V_{BE}=-0.5V, I_{B1}=-1mA$			35
Rise time	t_r	ns				35
Storage time	t_s	ns	$V_{CC}=-3V, I_C=-10mA,$ $I_{B1}=-I_{B2}=-1mA$			225
Fall time	t_f	ns				75

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■ Thermal Characteristics

Parameter	Symbol	Unit	Value
Thermal resistance, junction-to-ambient	$R_{\theta J-A}^{(1)}$	$^{\circ}\text{C/W}$	833
Thermal resistance, junction-to-case	$R_{\theta J-C}^{(1)}$	$^{\circ}\text{C/W}$	667

Note:

(1) Thermal resistance from junction to ambient and from junction to lead mounted on P.C.B. with 25.4mm*25.4mm copper pad areas

■ Characteristics

TR1-NPN

Fig 1: Static Characteristics

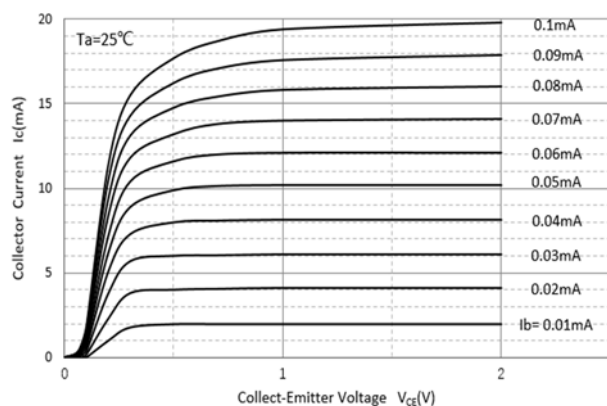


Fig 2: DC Current Gain

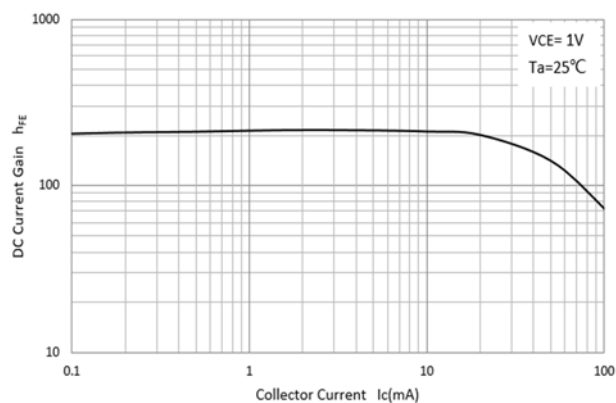


Fig 3: Collector-Emitter Saturation Voltage

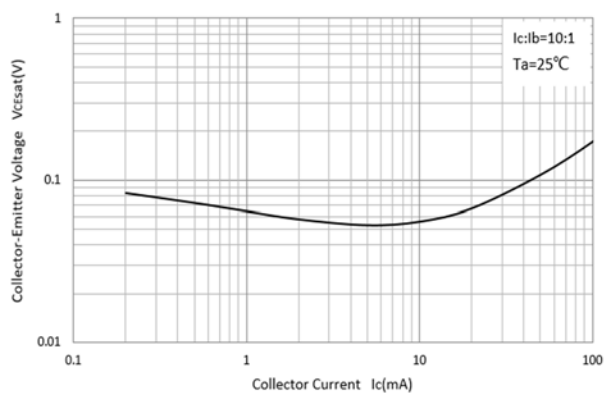
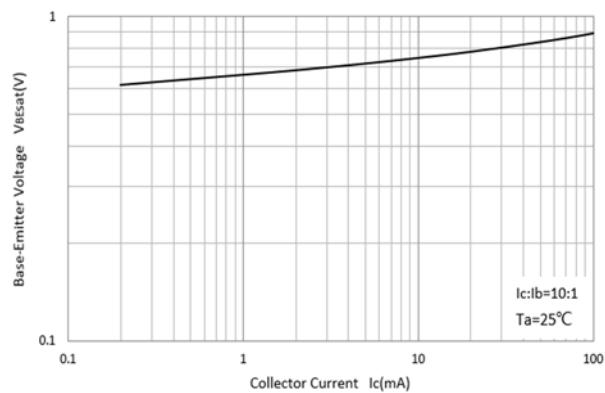


Fig 4: Base-Emitter Saturation Voltage



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Fig 5: Base-Emitter On Voltage

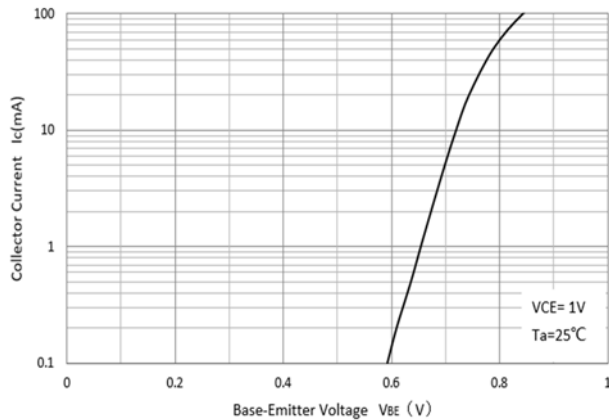


Fig 6: $C_{ob}/C_{ib}-V_{CB}/V_{EB}$

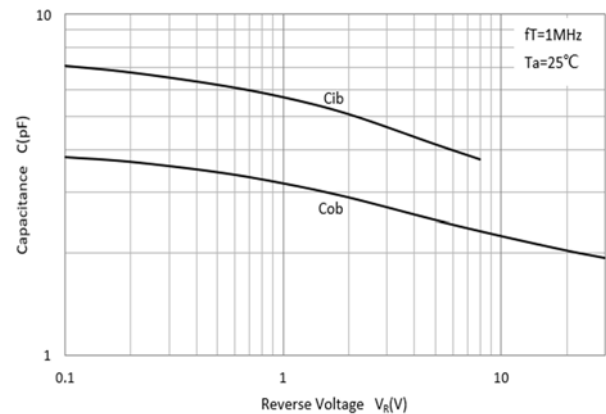
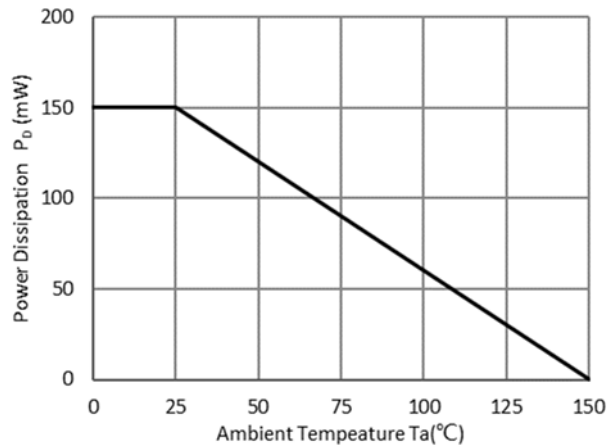


Fig 7: P_D - T_a Curve



TR2-PNP

Fig 1: Static Characteristics

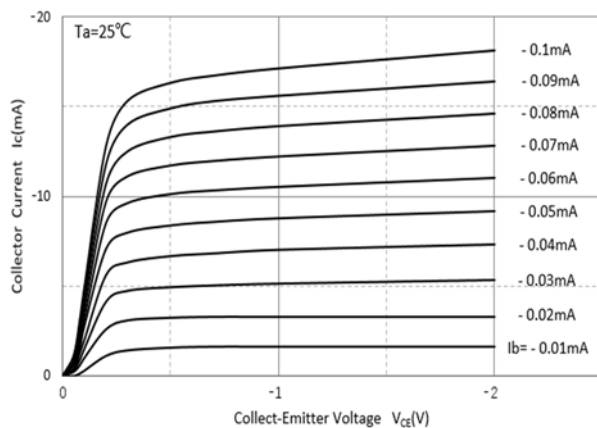
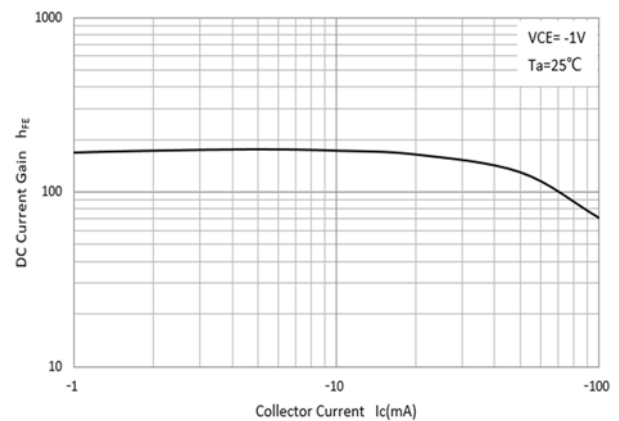


Fig 2: DC Current Gain



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Fig 3: Collector-Emitter Saturation Voltage

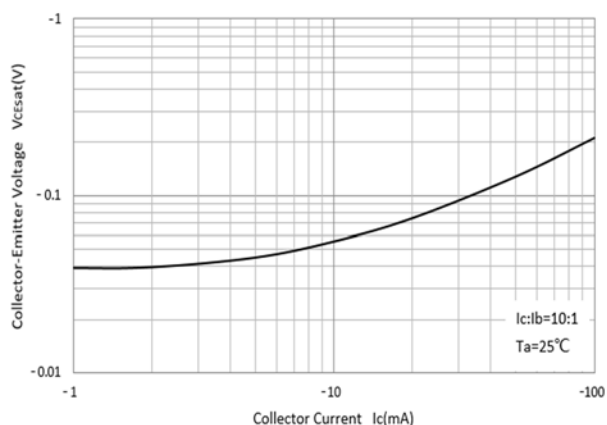


Fig 4: Base-Emitter Saturation Voltage

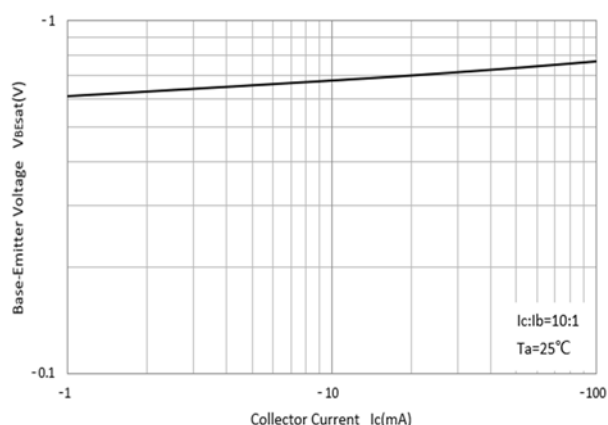


Fig 5: Base-Emitter Voltage

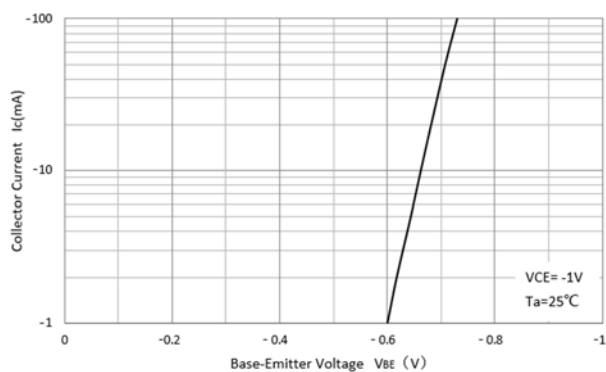


Fig 6: Cob/Cib- V_{CB}/V_{EB}

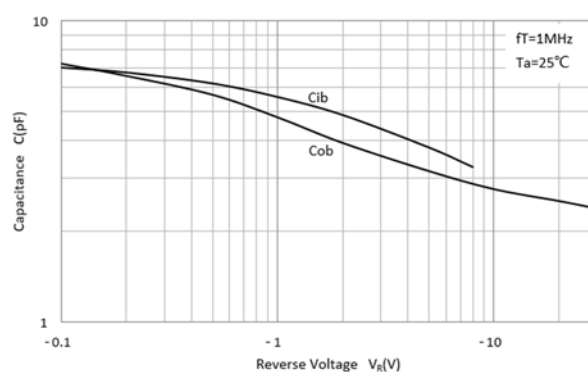
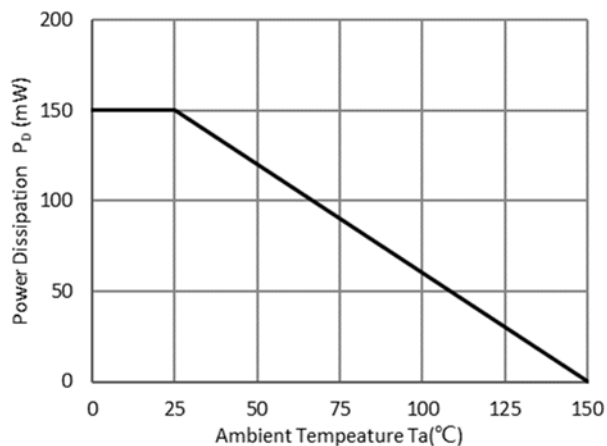


Fig 7: P_D - T_a Curve

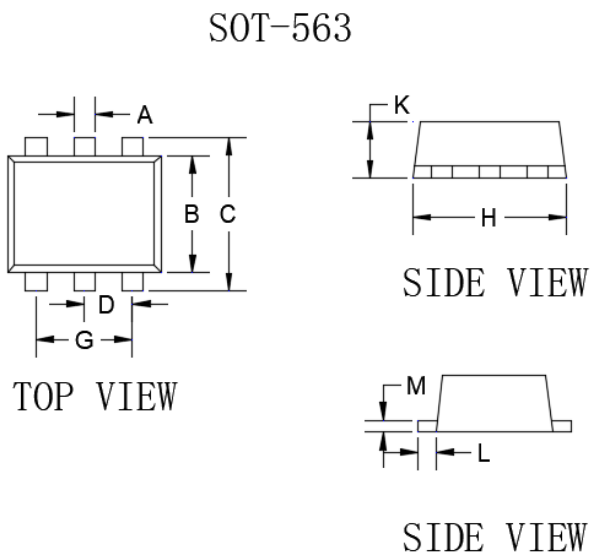


MMDT3946V

■ Ordering Information

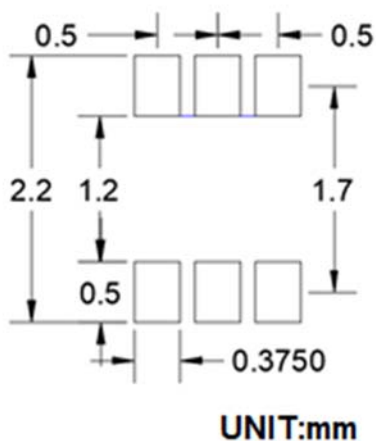
Preferred P/N	Packing code	Unit weight(g)	Minimum package(pcs)	Inner box quantity(pcs)	Outer carton quantity(pcs)	Delivery mode
MMDT3946V	F2	Approximate 0.0035	3000	30000	120000	7" reel

■ Outline Dimensions



DIM	DIMENSIONS			
	INCHES		MM	
	MIN	MAX	MM	MAX
A	0.006	0.011	0.150	0.300
B	0.043	0.051	1.100	1.300
C	0.059	0.067	1.500	1.700
D	0.016	0.024	0.400	0.600
G	0.035	0.043	0.900	1.100
H	0.059	0.067	1.500	1.700
K	0.021	0.026	0.550	0.650
L	0.004	0.011	0.100	0.300
M	0.004	0.007	0.100	0.180

■ Suggested Pad Layout



MMDT3946V

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