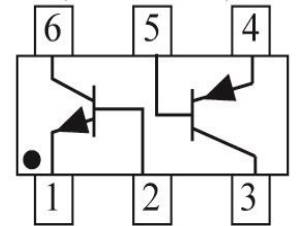
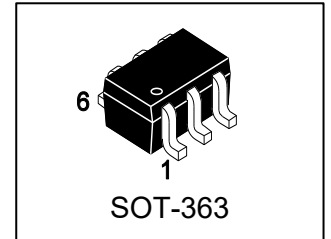


MBT3946D

S-MBT3946D

Dual General Purpose Transistors PNP/NPN Silicon



1. FEATURES

- We declare that the material of product compliance with RoHS requirements and Halogen Free.
- S- prefix for automotive and other applications requiring unique site and control change requirements; AEC-Q101 qualified and PPAP capable.
- Low $V_{CE(sat)}$, $\leq 0.4\text{ V}$
- Simplifies circuit design
- Reduces board space
- Reduces component count
- h_{FE} , 100–300

2. DEVICE MARKING AND ORDERING INFORMATION

Device	Marking	Shipping
MBT3946D	46	3000/Tape&Reel

3. MAXIMUM RATINGS($T_a = 25^\circ\text{C}$)

Parameter(PNP)	Symbol	Limits	Unit
Collector–Emitter Voltage	V_{CEO}	-40	V
Collector–Base Voltage	V_{CBO}	-40	V
Emitter–Base Voltage	V_{EBO}	-5	V
Collector Current — Continuous	IC	-200	mA

Parameter(NPN)	Symbol	Limits	Unit
Collector–Emitter Voltage	V_{CEO}	40	V
Collector–Base Voltage	V_{CBO}	60	V
Emitter–Base Voltage	V_{EBO}	6	V
Collector Current — Continuous	IC	200	mA

4. THERMAL CHARACTERISTICS

Parameter	Symbol	Limits	Unit
Total Device Dissipation, FR-5 Board (Note 1) @ $T_A = 25^\circ\text{C}$ Derate above 25°C	PD	150 1.2	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction–to–Ambient(Note 1)	$R_{\theta JA}$	833	$^\circ\text{C}/\text{W}$
Junction and Storage temperature	T_J, T_{stg}	-55~+150	$^\circ\text{C}$

1. FR-5 = 1.0×0.75×0.062 in.



5. ELECTRICAL CHARACTERISTICS (Ta= 25°C)

PNP

OFF CHARACTERISTICS

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Collector–Emitter Breakdown Voltage (IC = -1.0 mA, IB = 0)	VBR(CEO)	-40	-	-	V
Collector–Base Breakdown Voltage (IC = -10 μA, IE = 0)	VBR(CBO)	-40	-	-	V
Emitter–Base Breakdown Voltage (IE = -10 μA, IC = 0)	VBR(EBO)	-5	-	-	V
Collector Cutoff Current (VCE = -30 V, VEB = -3.0V)	ICEX	-	-	-50	nA
Base Cutoff Current (VCE = -30 V, VEB = -3.0V)	IBL	-	-	-50	nA
Collector Cutoff Current (VCB = -40 V, IE=0)	ICBO	-	-	-100	nA
Emitter-Base cut-off current (IC = 0, VEB=-6.0V)	IEBO	-	-	-100	nA
Collector-Emitter cutoff Current (VCE = -40V, IB=0)	ICEO	-	-	-10	μA

ON CHARACTERISTICS (Note 2.)

DC Current Gain (IC = -0.1 mA, VCE = -1.0 V)	HFE	60	-	-	
(IC = -1.0 mA, VCE = -1.0 V)		80	-	-	
(IC = -10 mA, VCE = -1.0 V)		100	-	300	
(IC = -50 mA, VCE = -1.0 V)		60	-	-	
(IC = -100 mA, VCE = -1.0 V)		30	-	-	
Collector–Emitter Saturation Voltage (IC = -10 mA, IB = -1.0 mA)	VCE(sat)	-	-	-0.25	V
(IC = -50 mA, IB = -5.0 mA)		-	-	-0.4	
Base–Emitter Saturation Voltage (IC = -10 mA, IB = -1.0 mA)	VBE(sat)	-0.65	-	-0.85	V
(IC = -50 mA, IB = -5.0 mA)		-	-	-0.95	

SMALL–SIGNAL CHARACTERISTICS

Current–Gain — Bandwidth Product (IC = -10mA, VCE= -20V, f = 100MHz)	fT	250	-	-	MHz
Output Capacitance (VCB = -5.0 V, IE = 0, f = 1.0 MHz)	Cobo	-	-	4.5	pF
Input Capacitance (VEB = -0.5 V, IC = 0, f = 1.0 MHz)	Cibo	-	-	10	pF

SWITCHING CHARACTERISTICS

Delay Time	(VCC = -3.0 V, VBE=0.5V, IC = -10mA, IB1 = -1.0 mA)	td	-	-	35	ns
Rise Time		tr	-	-	35	
Storage Time	(VCC = -3.0 V, IC = -10 mA, IB1 = IB2 = -1.0 mA)	ts	-	-	225	
Fall Time		tf	-	-	75	

2.Pulse Test: Pulse Width ≤300 μs, Duty Cycle ≤2.0%.



5. ELECTRICAL CHARACTERISTICS (Ta= 25°C)

NPN

OFF CHARACTERISTICS

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Collector–Emitter Breakdown Voltage (IC = 1.0 mA, IB = 0)	VBR(CEO)	40	-	-	V
Collector–Base Breakdown Voltage (IC = 10 μA, IE = 0)	VBR(CBO)	60	-	-	V
Emitter–Base Breakdown Voltage (IE = 10 μA, IC = 0)	VBR(EBO)	6	-	-	V
Collector Cutoff Current (VCE = 30 V, VEB = 3.0V)	ICEX	-	-	50	nA
Base Cutoff Current (VCE = 30 V, VEB = 3.0V)	IBL	-	-	50	nA
Collector Cutoff Current (VCB = 60 V,IE=0)	ICBO	-	-	100	nA
Emitter-Base cut-off current (IC = 0, VEB=6.0V)	IEBO	-	-	100	nA
Collector-Emitter cutoff Current (VCE = 40V, IB=0)	ICEO	-	-	10	μA

ON CHARACTERISTICS (Note 3.)

DC Current Gain (IC = 0.1 mA, VCE = 10 V)	HFE	40	-	-	
(IC = 1.0 mA, VCE = 1.0 V)		70	-	-	
(IC = 10 mA, VCE = 1.0 V)		100	-	300	
(IC = 50 mA, VCE = 1.0 V)		60	-	-	
(IC = 100 mA, VCE = 1.0 V)		30	-	-	
Collector–Emitter Saturation Voltage (IC = 10 mA, IB = 1.0 mA)	VCE(sat)	-	-	0.2	V
(IC = 50 mA, IB = 5.0 mA)		-	-	0.3	
Base–Emitter Saturation Voltage (IC = 10 mA, IB = 1.0 mA)	VBE(sat)	-	-	0.85	V
(IC = 50 mA, IB = 5.0 mA)		-	-	0.95	

SMALL–SIGNAL CHARACTERISTICS

Current–Gain — Bandwidth Product (IC = 10mA, VCE= 20V, f = 100MHz)	fT	300	-	-	MHz
Output Capacitance (VCB = 5.0 V, IE = 0, f = 1.0 MHz)	Cobo	-	-	4	pF
Input Capacitance (VEB = 0.5 V, IC = 0, f = 1.0 MHz)	Cibo	-	-	8	pF

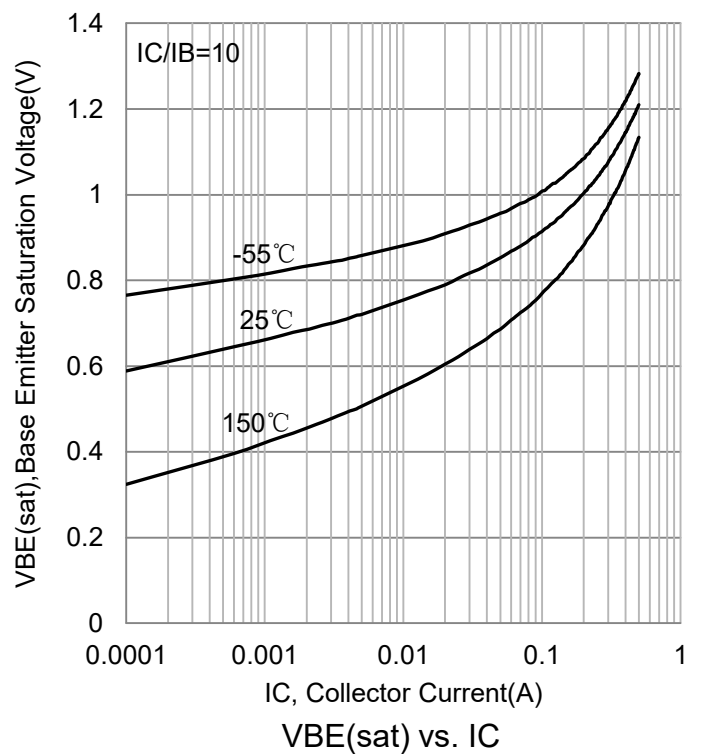
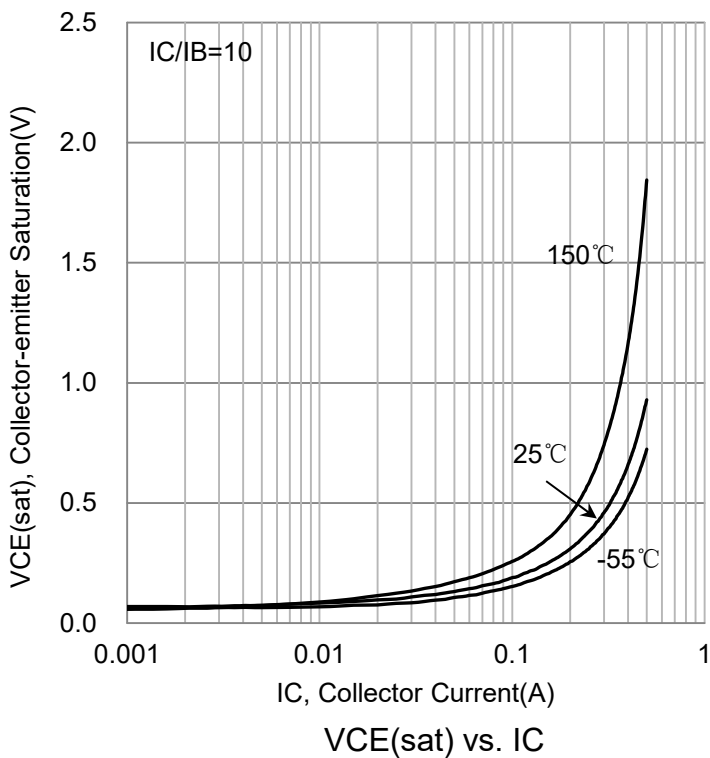
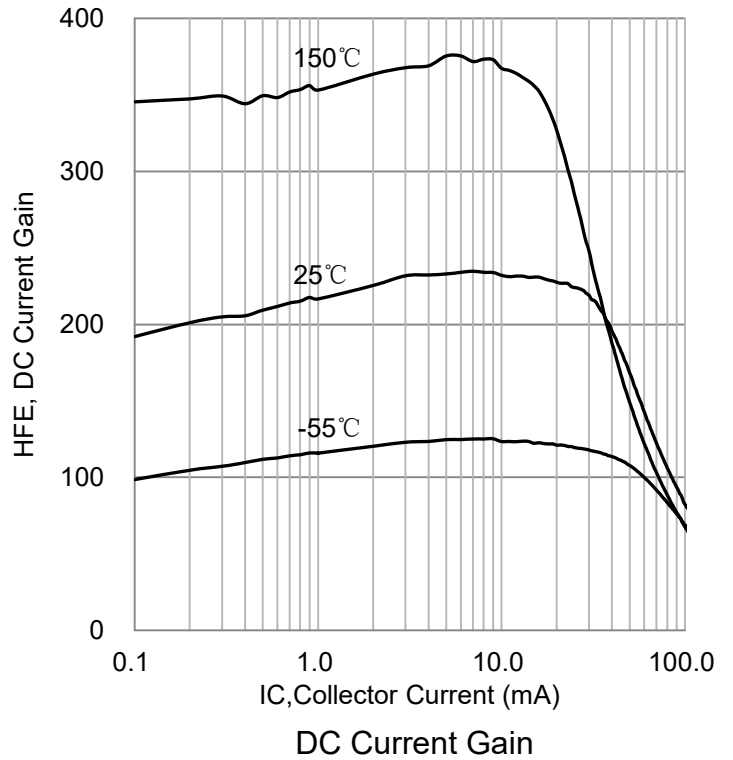
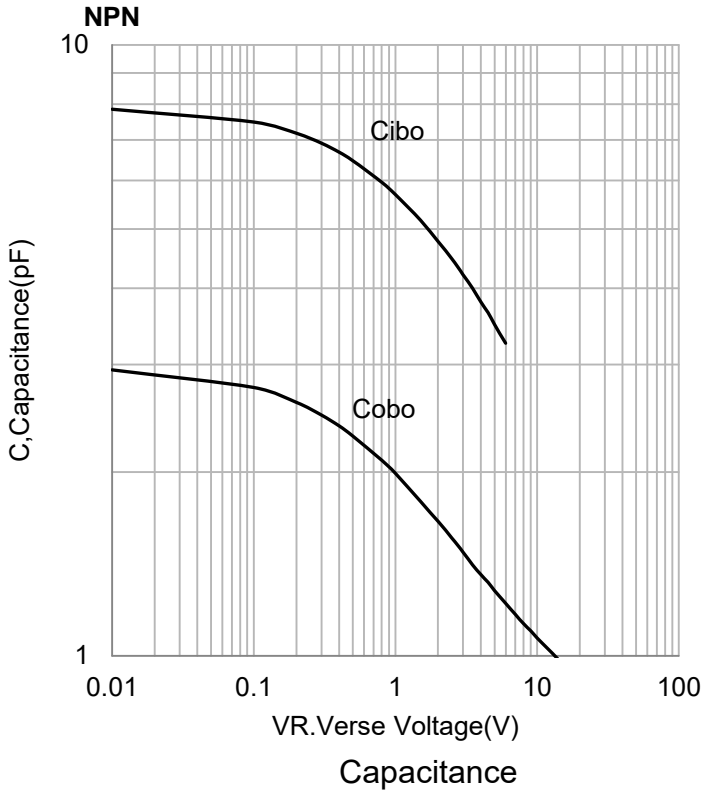
SWITCHING CHARACTERISTICS

Delay Time	(VCC = 3.0 V, VBE=-0.5V, IC = 10mA, IB1 = 1.0 mA)	td	-	-	35	ns
Rise Time		tr	-	-	35	
Storage Time	(VCC = 3.0 V, IC = 10 mA,IB1 = IB2 = 1.0 mA)	ts	-	-	200	
Fall Time		tf	-	-	50	

3.Pulse Test: Pulse Width ≤300 μs, Duty Cycle ≤2.0%.

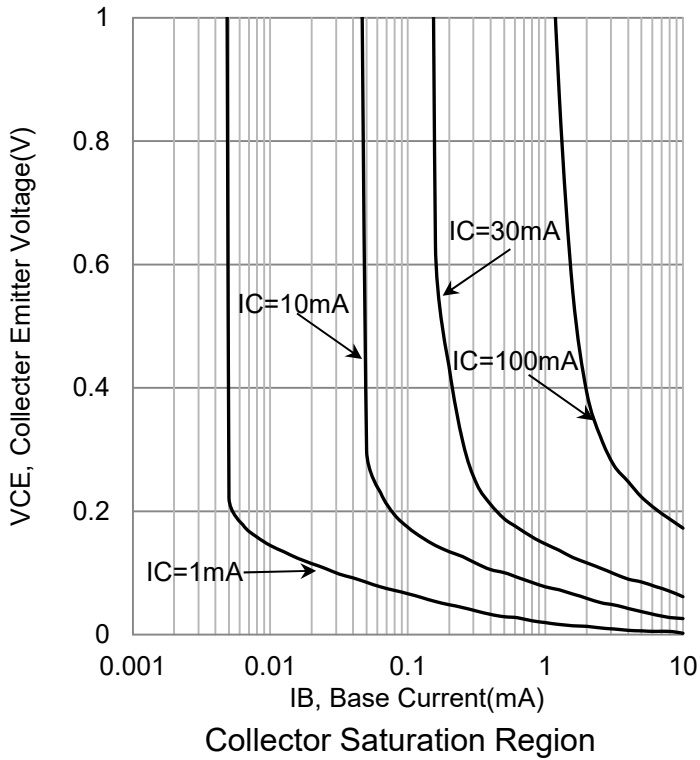
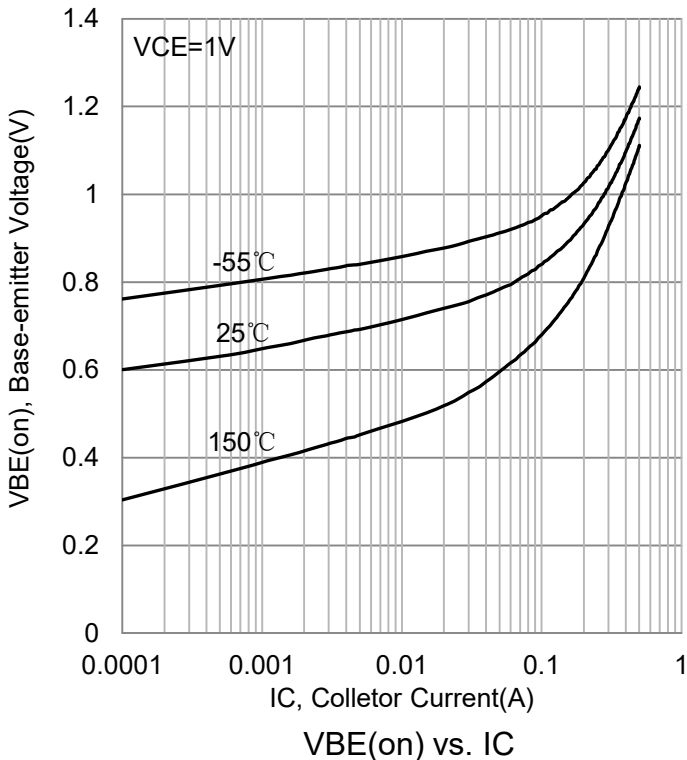


6.ELECTRICAL CHARACTERISTICS CURVES

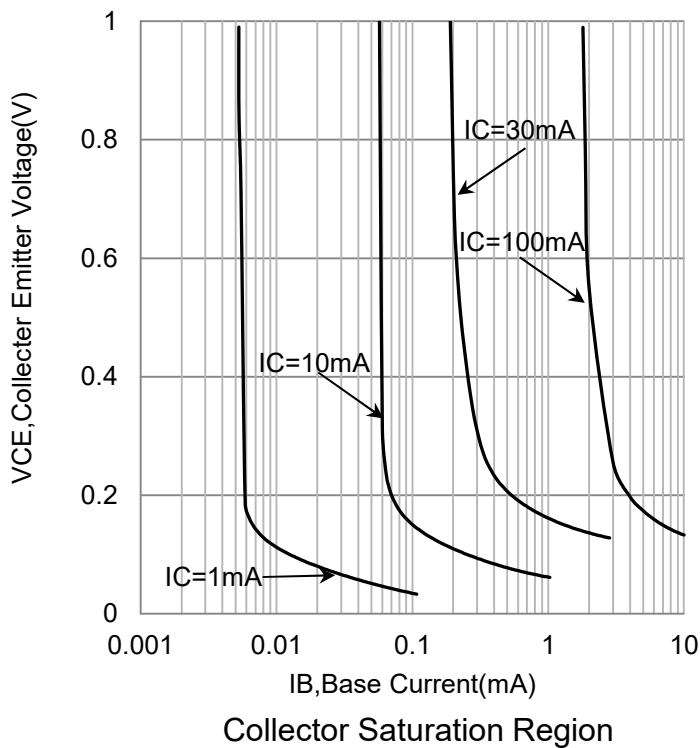
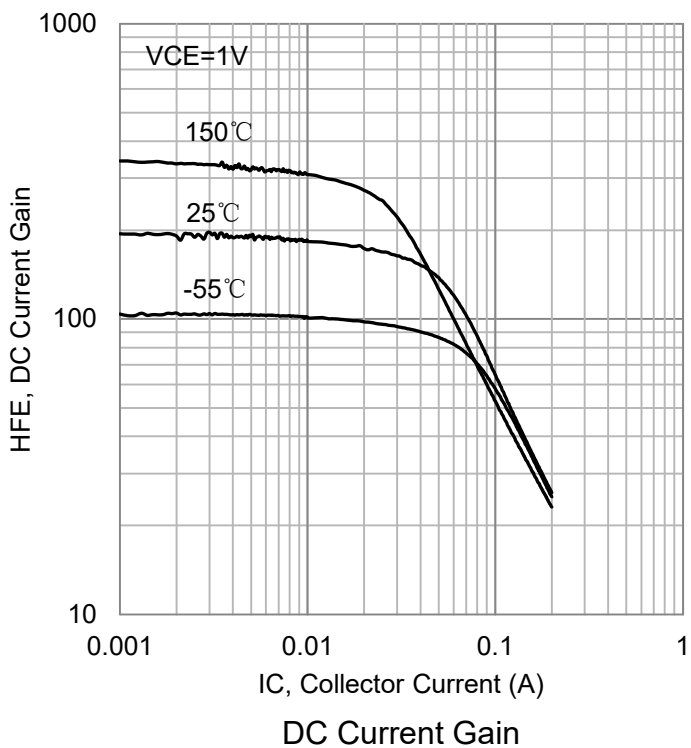
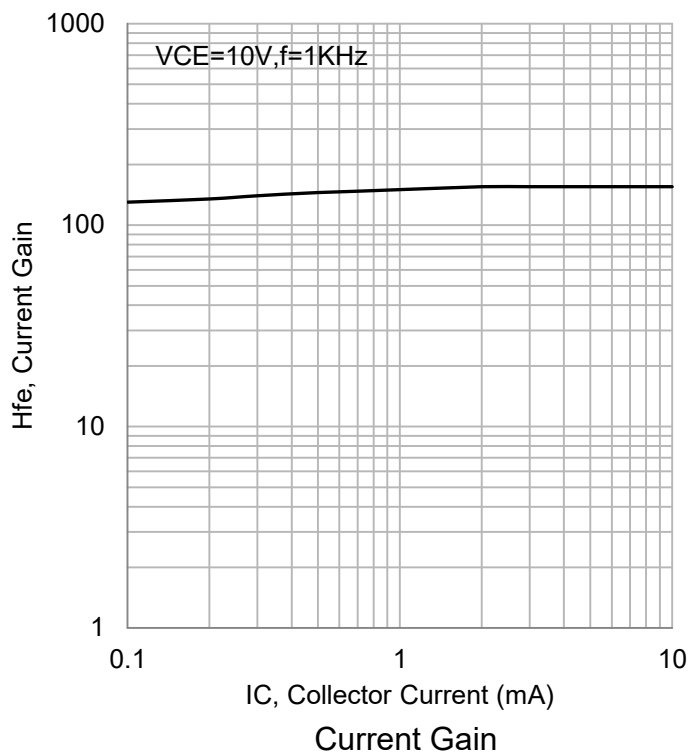
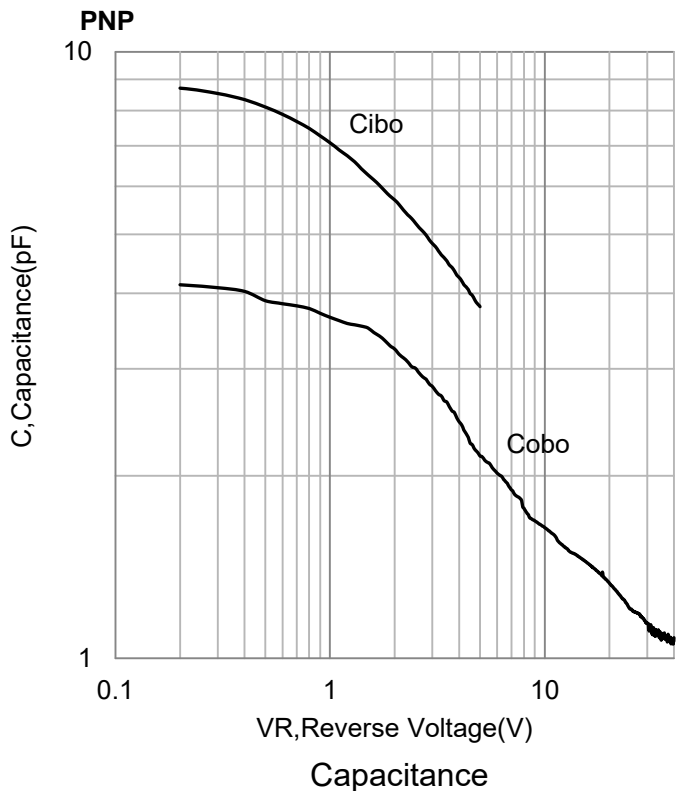


6.ELECTRICAL CHARACTERISTICS CURVES

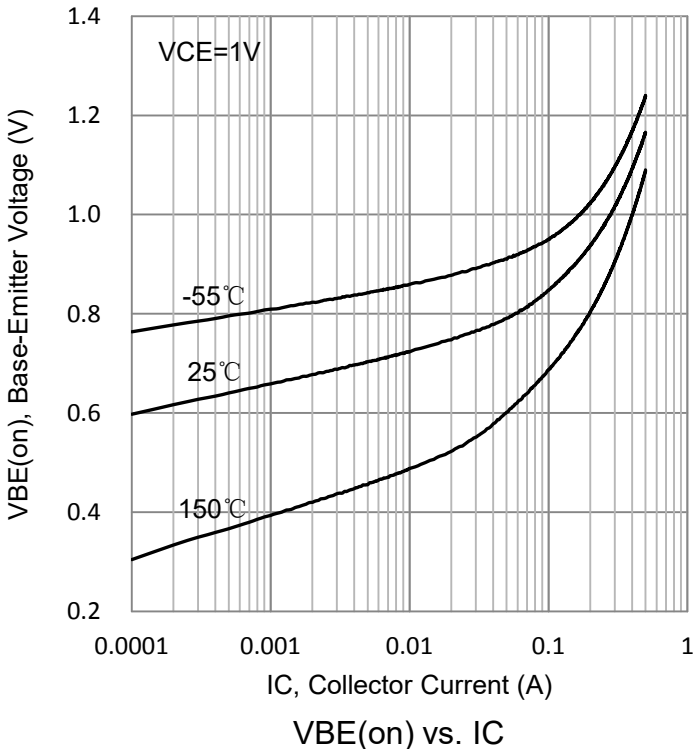
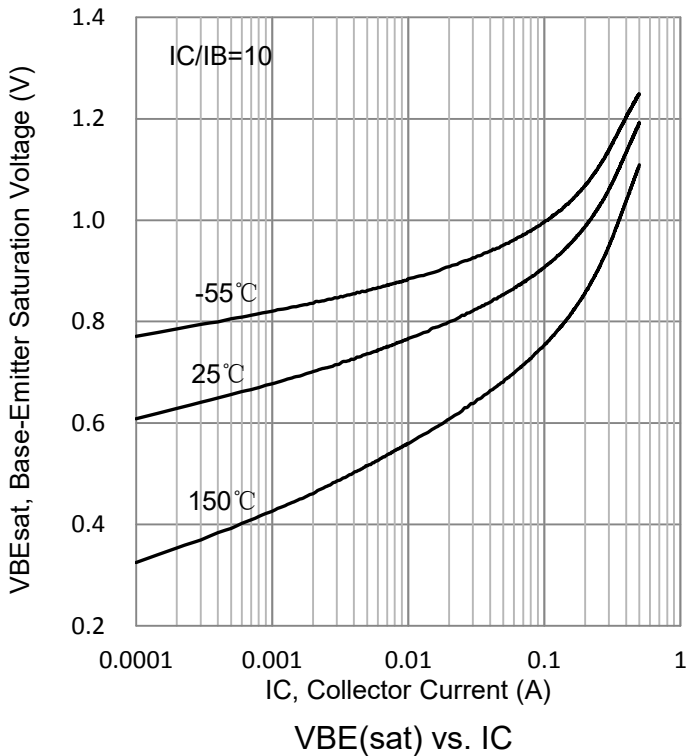
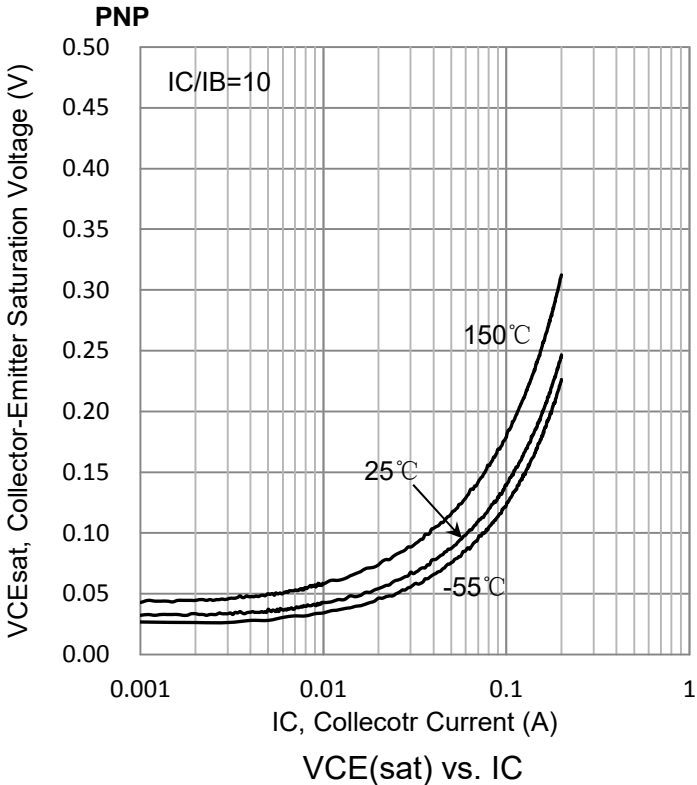
NPN



6.ELECTRICAL CHARACTERISTICS CURVES



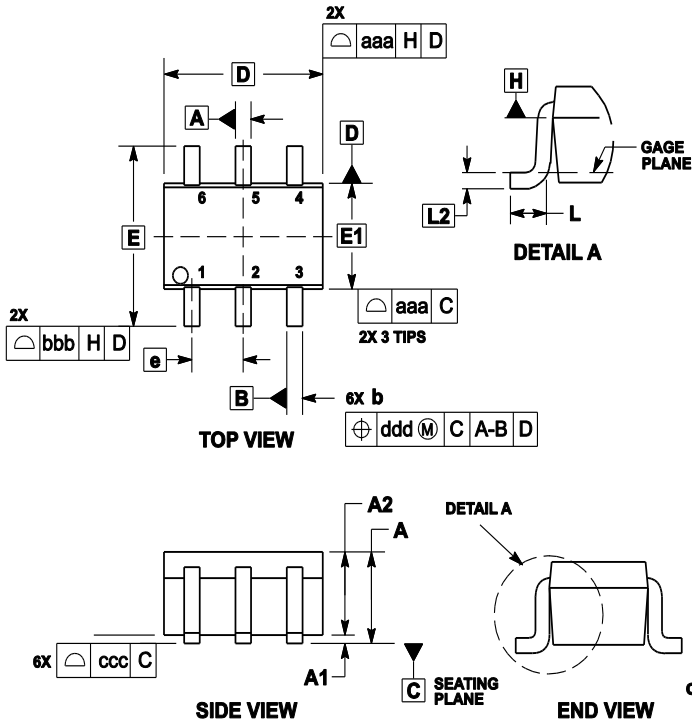
6.ELECTRICAL CHARACTERISTICS CURVES



7. OUTLINE AND DIMENSIONS

Notes:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.



DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	---	---	1.10	---	---	0.043
A1	0.00	---	0.10	0	---	0.004
A2	0.70	0.90	1.00	0.027	0.035	0.039
b	0.15	0.20	0.25	0.006	0.008	0.01
C	0.08	0.15	0.22	0.003	0.006	0.009
D	1.80	2.00	2.20	0.07	0.078	0.086
E	2.00	2.10	2.20	0.078	0.082	0.086
E1	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65 BSC			0.026 BSC		
L	0.26	0.36	0.46	0.010	0.014	0.018
L2	0.15 BSC			0.006 BSC		
aaa	0.15			0.01		
bbb	0.30			0.01		
ccc	0.10			0.00		
ddd	0.10			0.00		

8. SOLDERING FOOTPRINT

