

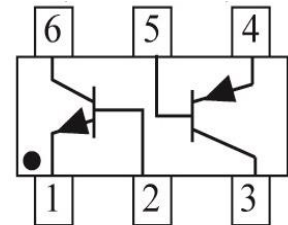
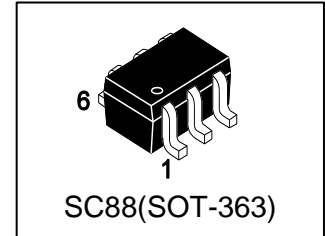
# LMBT3946DW1T1G

## S-LMBT3946DW1T1G

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  $V_{CE(sat)}$ ,  $\leq 0.4$  V
- Simplifies circuit design
- Reduces board space
- Reduces component count
- $h_{FE}$ , 100–300



### 2. DEVICE MARKING AND ORDERING INFORMATION

Device	Marking	Shipping
LMBT3946DW1T1G	46	3000/Tape&Reel
LMBT3946DW1T3G	46	10000/Tape&Reel

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

#### PNP:

Parameter	Symbol	Limits	Unit
Collector–Emitter Voltage	$V_{CEO}$	-40	Vdc
Collector–Base Voltage	$V_{CBO}$	-40	Vdc
Emitter–Base Voltage	$V_{EBO}$	-5	Vdc
Collector Current — Continuous	$I_C$	-200	mAdc

#### NPN:

Parameter	Symbol	Limits	Unit
Collector–Emitter Voltage	$V_{CEO}$	40	Vdc
Collector–Base Voltage	$V_{CBO}$	60	Vdc
Emitter–Base Voltage	$V_{EBO}$	6	Vdc
Collector Current — Continuous	$I_C$	200	mAdc

### 4. THERMAL CHARACTERISTICS

Parameter	Symbol	Limits	Unit
Total Device Dissipation, FR-5 Board (Note 1) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	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 mAdc, IB = 0)	VBR(CEO)	-40	-	-	V
Collector–Base Breakdown Voltage (IC = -10 µAdc, IE = 0)	VBR(CBO)	-40	-	-	V
Emitter–Base Breakdown Voltage (IE = -10 µAdc, IC = 0)	VBR(EBO)	-5	-	-	V
Collector Cutoff Current ( VCE = -30 Vdc, VEB = -3.0Vdc)	ICEX	-	-	-50	nA
Base Cutoff Current (VCE = -30 Vdc, VEB = -3.0Vdc)	IBL	-	-	-50	nA

**ON CHARACTERISTICS (Note 2.)**

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

**SMALL–SIGNAL CHARACTERISTICS**

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

**SWITCHING CHARACTERISTICS**

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

 2.Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

**NPN:**
**OFF CHARACTERISTICS**

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Collector–Emitter Breakdown Voltage ( $I_C = 1.0 \text{ mA}$ , $I_B = 0$ )	VBR(CEO)	40	-	-	V
Collector–Base Breakdown Voltage ( $I_C = 10 \mu\text{A}$ , $I_E = 0$ )	VBR(CBO)	60	-	-	V
Emitter–Base Breakdown Voltage ( $I_E = 10 \mu\text{A}$ , $I_C = 0$ )	VBR(EBO)	6	-	-	V
Collector Cutoff Current ( $V_{CE} = 30 \text{ Vdc}$ , $V_{EB} = 3.0 \text{ Vdc}$ )	ICEX	-	-	50	nA
Base Cutoff Current ( $V_{CE} = 30 \text{ Vdc}$ , $V_{EB} = 3.0 \text{ Vdc}$ )	IBL	-	-	50	nA

**ON CHARACTERISTICS (Note 3.)**

DC Current Gain ( $I_C = 0.1 \text{ mA}$ , $V_{CE} = 10 \text{ Vdc}$ ) ( $I_C = 1.0 \text{ mA}$ , $V_{CE} = 1.0 \text{ Vdc}$ ) ( $I_C = 10 \text{ mA}$ , $V_{CE} = 1.0 \text{ Vdc}$ ) ( $I_C = 50 \text{ mA}$ , $V_{CE} = 1.0 \text{ Vdc}$ ) ( $I_C = 100 \text{ mA}$ , $V_{CE} = 1.0 \text{ Vdc}$ )	HFE	40 70 100 60 30	- - - - -	- - 300 - -	
Collector–Emitter Saturation Voltage ( $I_C = 10 \text{ mA}$ , $I_B = 1.0 \text{ mA}$ ) ( $I_C = 50 \text{ mA}$ , $I_B = 5.0 \text{ mA}$ )	VCE(sat)	- -	- -	0.2 0.3	V
Base–Emitter Saturation Voltage ( $I_C = 10 \text{ mA}$ , $I_B = 1.0 \text{ mA}$ ) ( $I_C = 50 \text{ mA}$ , $I_B = 5.0 \text{ mA}$ )	VBE(sat)	- -	- -	0.85 0.95	V

**SMALL–SIGNAL CHARACTERISTICS**

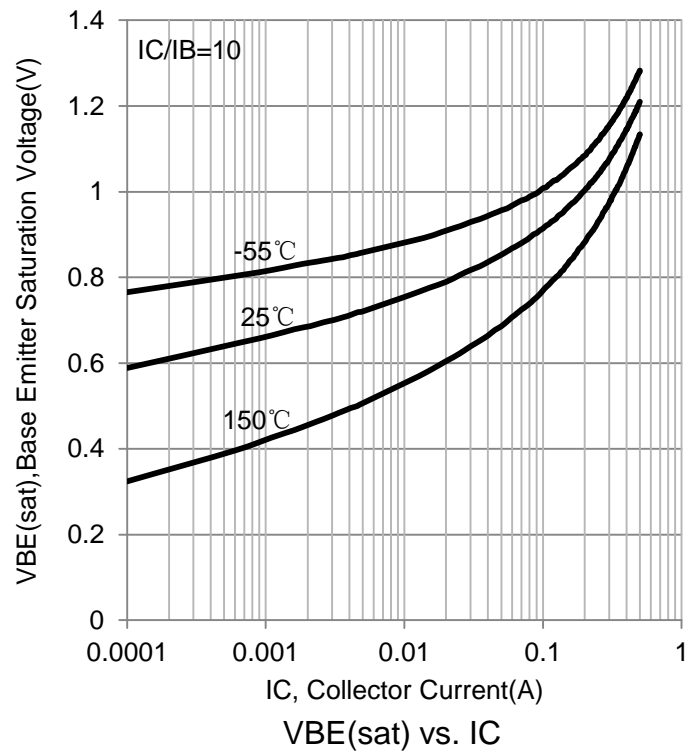
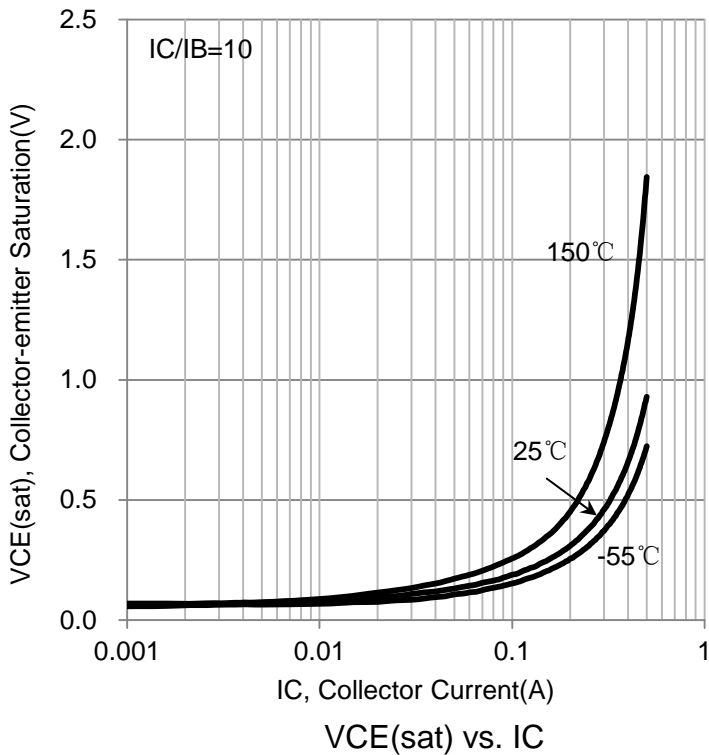
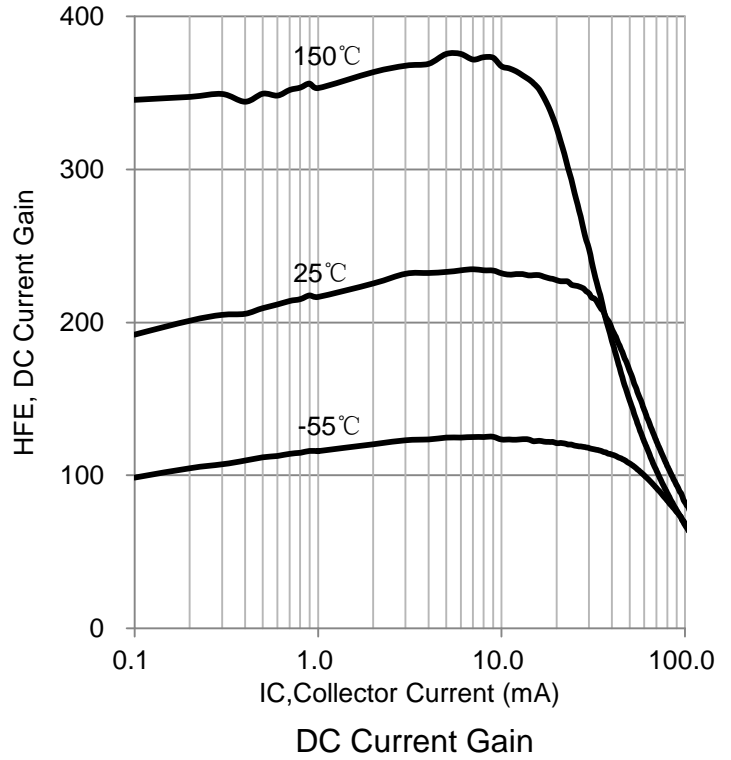
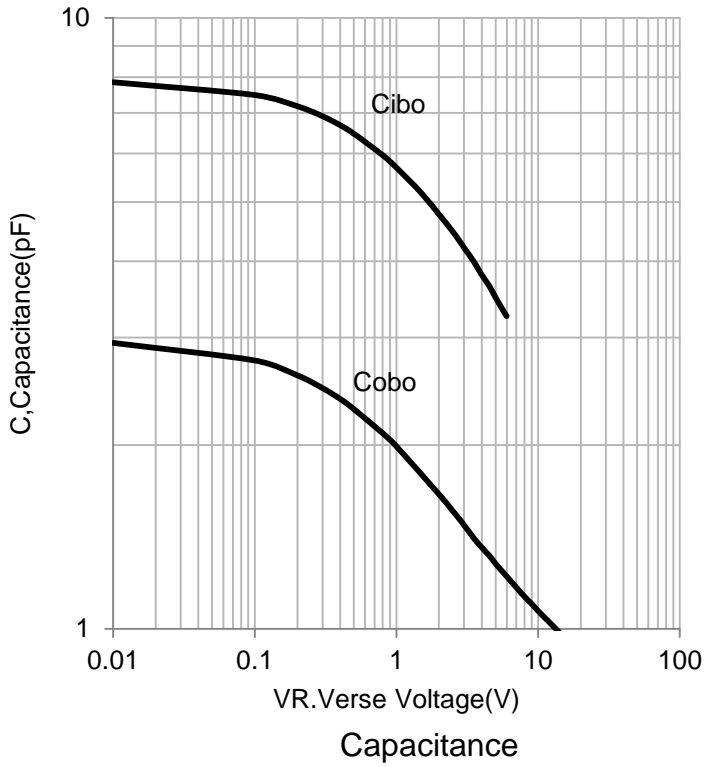
Current–Gain — Bandwidth Product ( $I_C = 10 \text{ mA}$ , $V_{CE} = 20 \text{ Vdc}$ , $f = 100 \text{ MHz}$ )	fT	300	-	-	MHz
Output Capacitance ( $V_{CB} = 5.0 \text{ Vdc}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$ )	Cobo	-	-	4	pF
Input Capacitance ( $V_{EB} = 0.5 \text{ Vdc}$ , $I_C = 0$ , $f = 1.0 \text{ MHz}$ )	Cibo	-	-	8	pF

**SWITCHING CHARACTERISTICS**

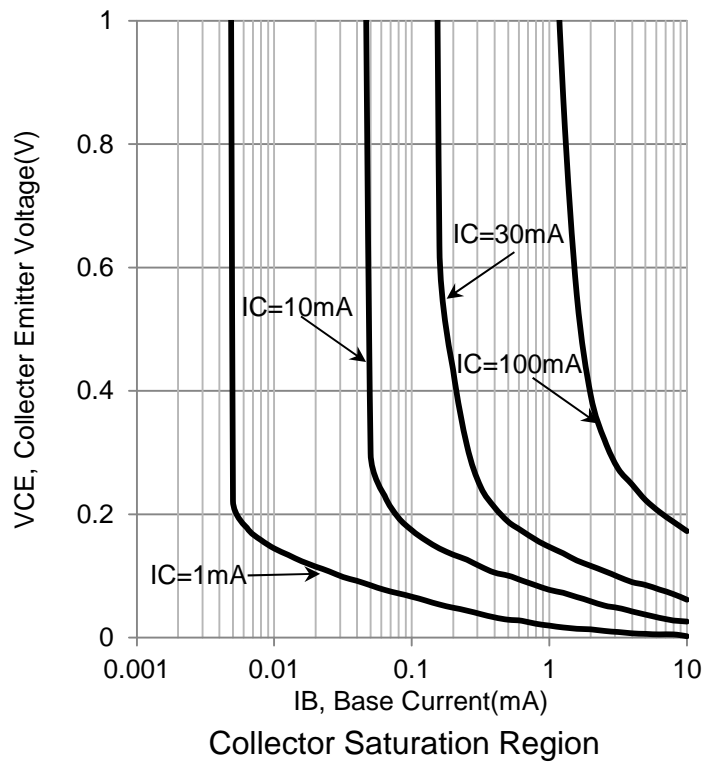
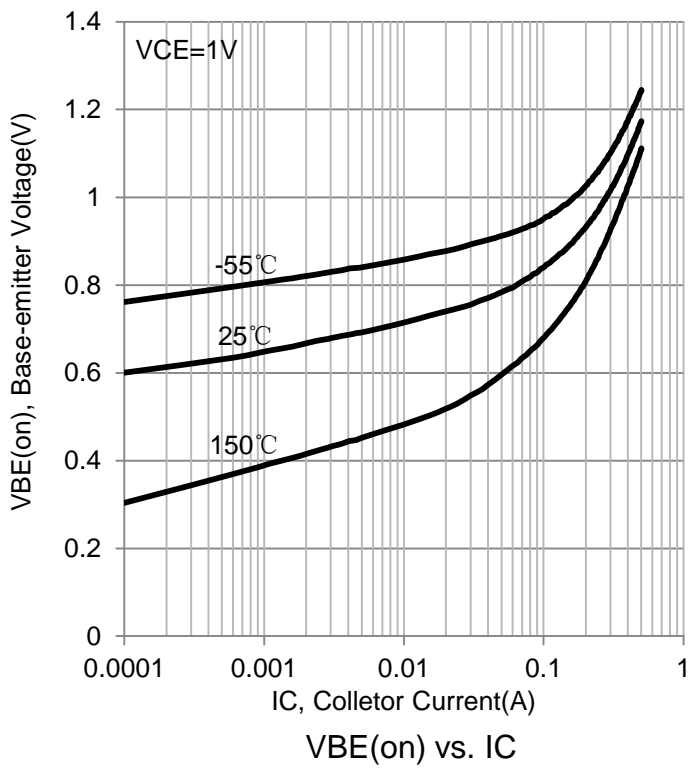
Delay Time	(VCC = 3.0 Vdc, VBE = -0.5Vdc, IC = 10mA, IB1 = 1.0 mA)	td	-	-	35	ns
Rise Time		tr	-	-	35	
Storage Time	(VCC = 3.0 Vdc, IC = 10 mA, IB1 = IB2 = 1.0 mA)	ts	-	-	200	
Fall Time		tf	-	-	50	

 3.Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

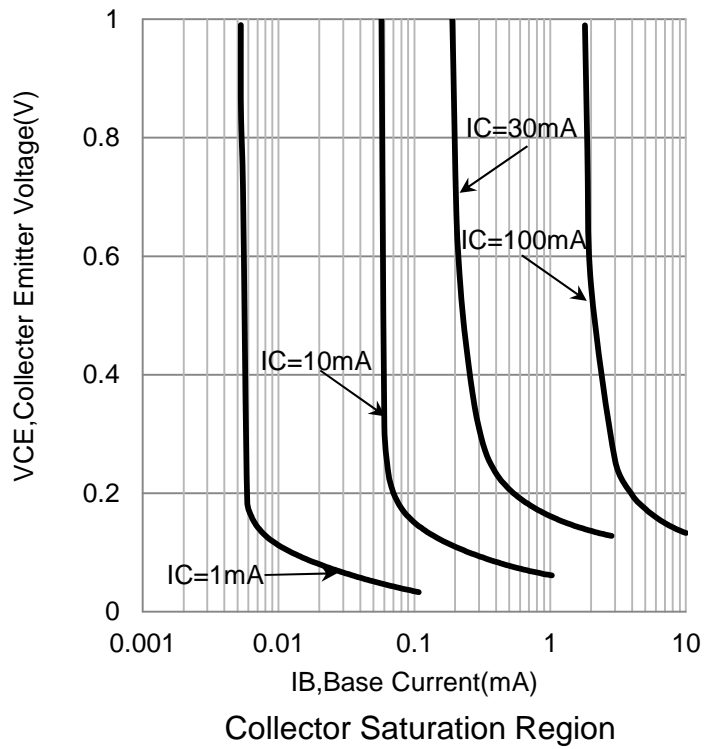
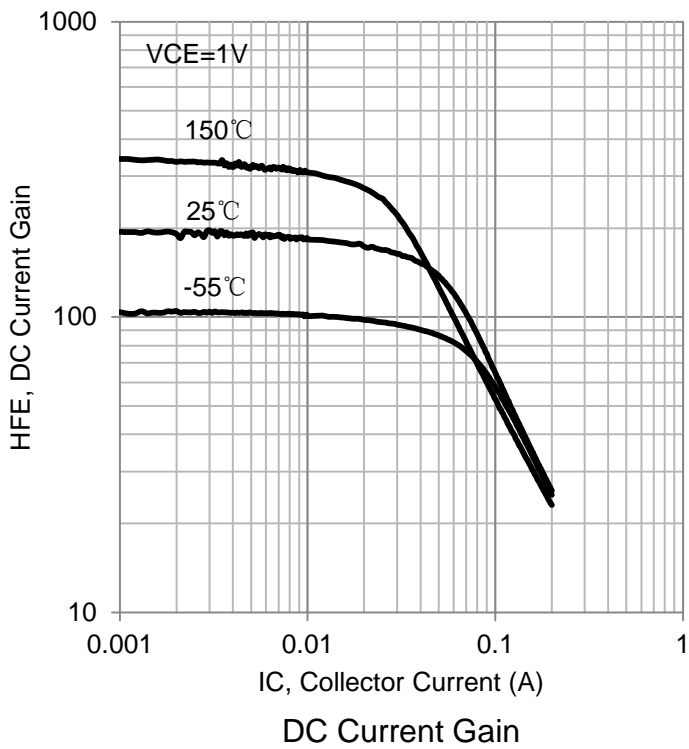
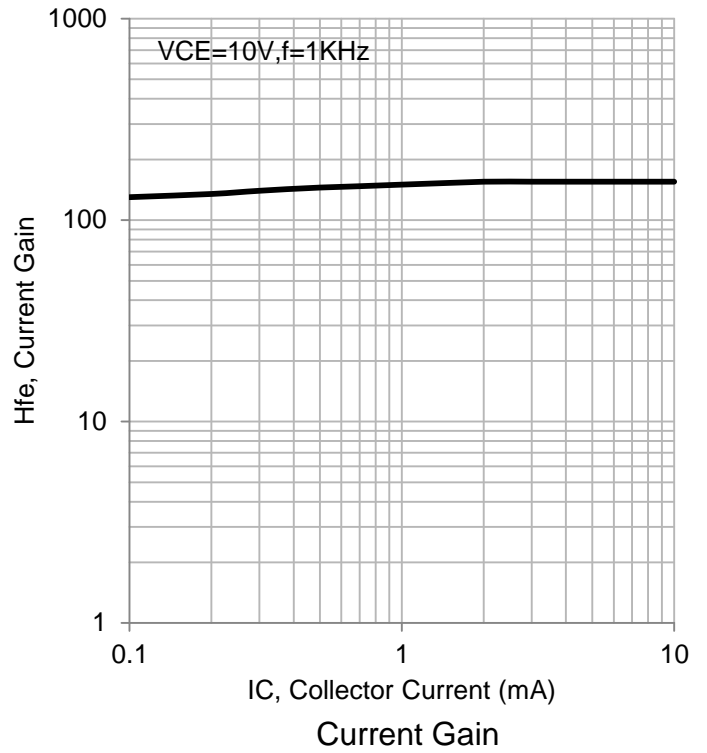
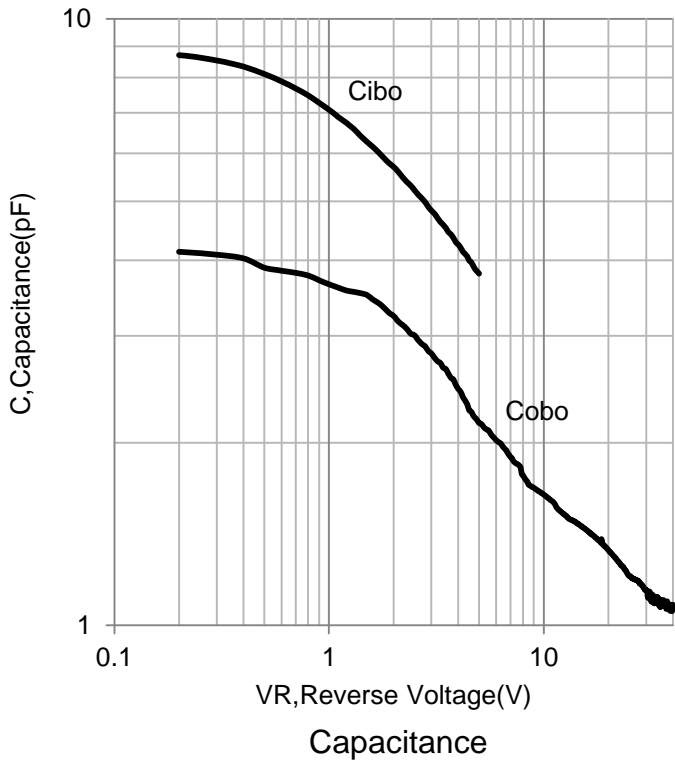
**6.ELECTRICAL CHARACTERISTICS CURVES(NPN)**



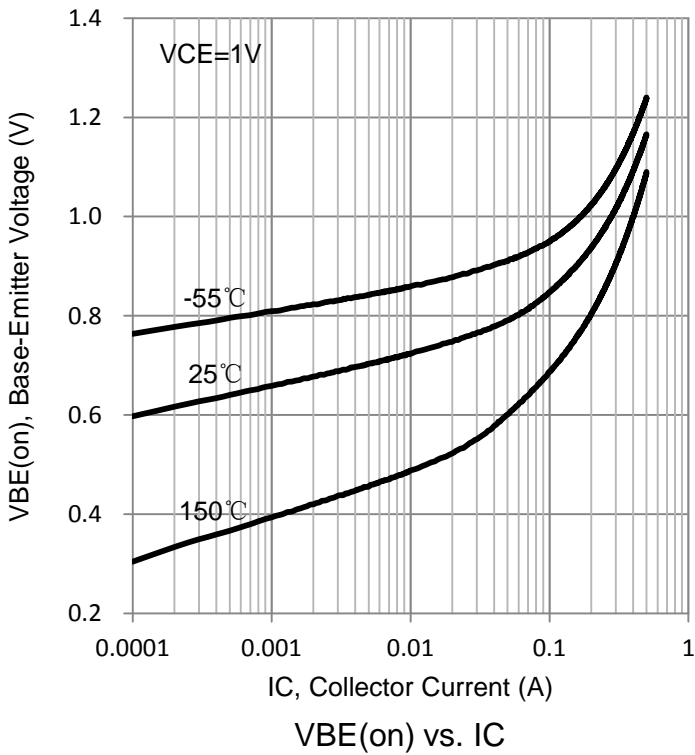
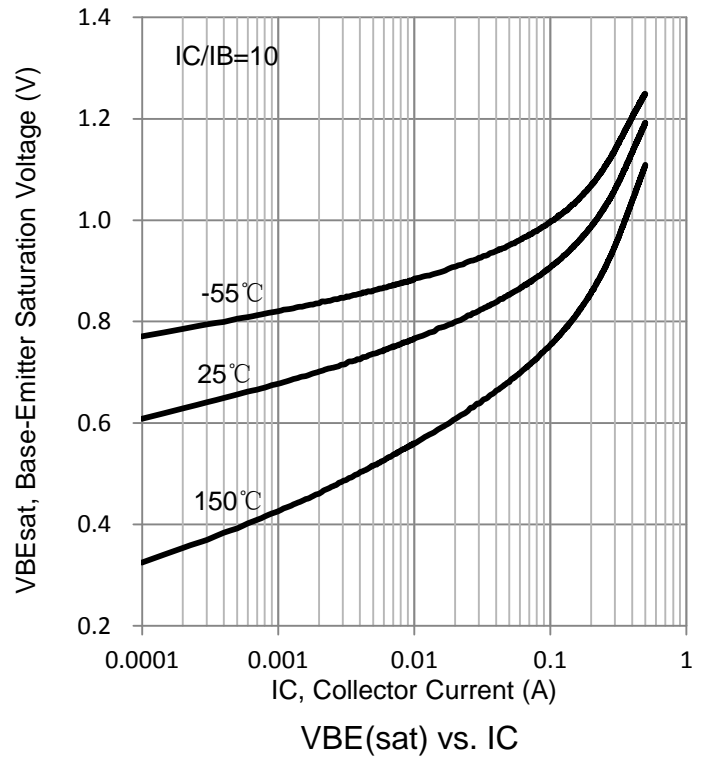
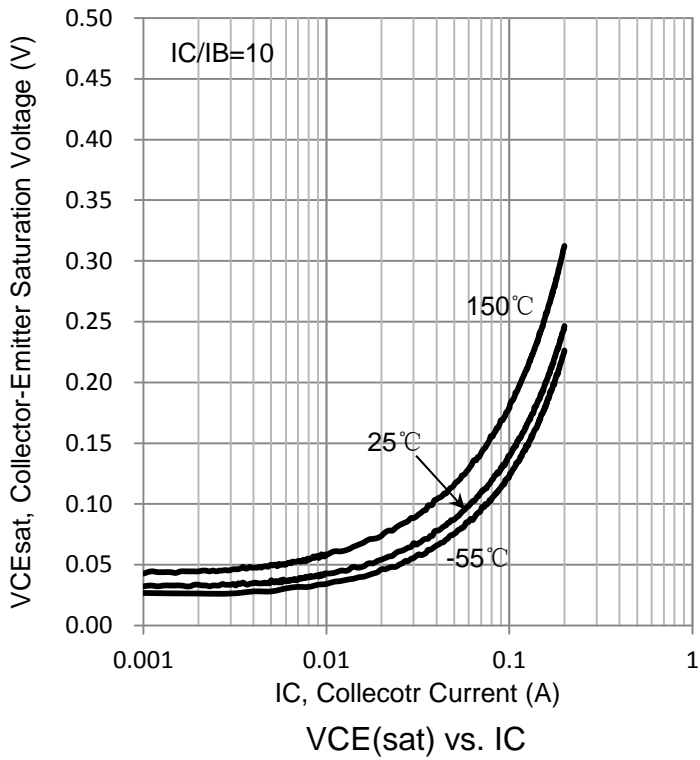
**6.ELECTRICAL CHARACTERISTICS CURVES(NPN)**



**6.ELECTRICAL CHARACTERISTICS CURVES(PNP)**



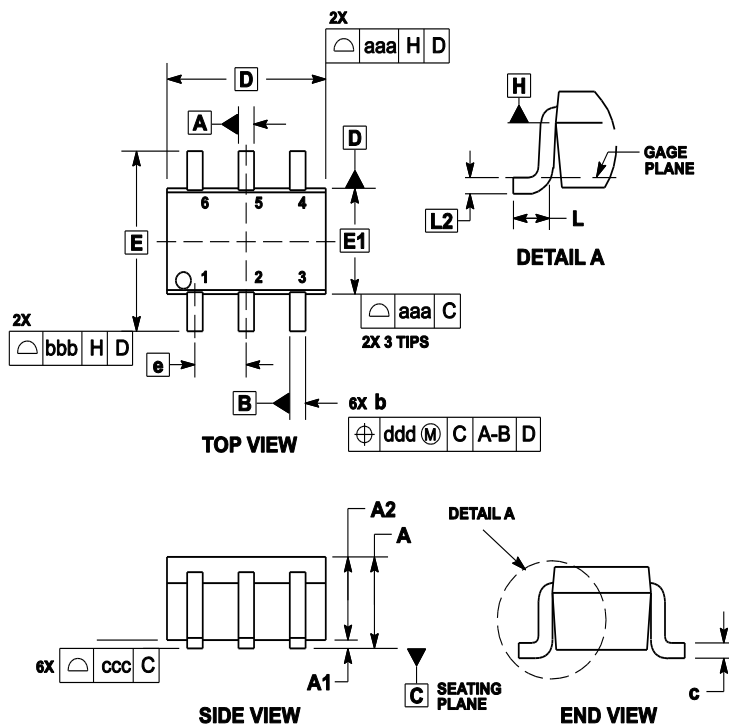
**6.ELECTRICAL CHARACTERISTICS CURVES(PNP)**



## 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

