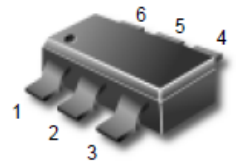
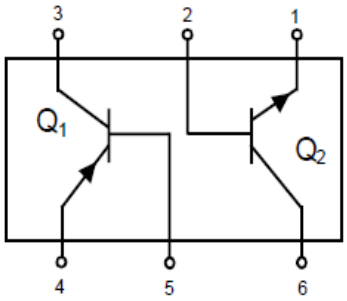
Dual General Purpose Transistors
NPN/PNP Silicon

LMBT3946DW1T1G
S-LMBT3946DW1T1G

The LMBT3946DW1T1G device is a spin–off of our popular SOT–23/SOT–323 three–leaded device. It is designed for general purpose amplifier applications and is housed in the SOT–363 six–leaded surface mount package. By putting two discrete devices in one package , this device is ideal for low–power surface mount applications where board space is at a premium.



SC-88



Q1:PNP Q2:NPN

●FEATURES

1)Low VCE(sat), ≤ 0.4 V
2)Simplifies Circuit Design
3)Reduces Board Space
4)Reduces Component Count
5)Available in 8 mm, 7–inch/3,000 Unit Tape and Reel
6)hFE, 100–300
7)We declare that the material of product compliance with RoHS requirements.
8)S- Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

●DEVICE MARKING AND ORDERING INFORMATION

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

●MAXIMUM RATINGS(Ta = 25℃)(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

●MAXIMUM RATINGS(Ta = 25℃)(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

●THERMAL CHARACTERISTICS

Total Device Dissipation, FR−5 Board (Note 1) @ T_A = 25°C	P_D	150	mW
Thermal Resistance, Junction–to–Ambient(Note 1)	$R_{\Theta JA}$	833	℃/W
Junction and Storage temperature	T_J,Tstg	−55～+150	℃

1. Device mounted on FR4 glass epoxy printed circuit board using the minimum recommended footprint.

LMBT3946DW1T1G,S-LMBT3946DW1T1G

●ELECTRICAL CHARACTERISTICS (Ta= 25℃)(NPN)

OFF CHARACTERISTICS

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Collector–Emitter Breakdown Voltage (I_C = 1.0 mAdc, I_B = 0)	$V_{BR(CEO)}$	40	–	–	V
Collector–Base Breakdown Voltage (I_C = 10 μAdc, I_E = 0)	$V_{BR(CBO)}$	60	–	–	V
Emitter–Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)	$V_{BR(EBO)}$	6	–	–	V
Collector Cutoff Current (V_{CE} = 30 Vdc, V_{EB} = 3.0Vdc)	I_{CEX}	–	–	50	nA
Base Cutoff Current (V_{CE} = 30 Vdc, V_{EB} = 3.0 Vdc)	I_{BL}	–	–	50	nA

ON CHARACTERISTICS (Note 2.)

DC Current Gain	h_{FE}				
(I_C = 0.1 mAdc, V_{CE} = 1.0 Vdc)		40	–	–	
(I_C = 1.0 mAdc, V_{CE} = 1.0 Vdc)		70	–	–	
(I_C = 10 mAdc, V_{CE} = 1.0 Vdc)		100	–	300	
(I_C = 50 mAdc, V_{CE} = 1.0 Vdc)		60	–	–	
(I_C = 100 mAdc, V_{CE} = 1.0 Vdc)		30	–	–	
Collector–Emitter Saturation Voltage	$V_{CE(sat)}$				V
(I_C = 10 mAdc, I_B = 1.0 mAdc)		–	–	0.2	
(I_C = 50mAdc, I_B = 5.0 mAdc)		–	–	0.3	
Base–Emitter Saturation Voltage	$V_{BE(sat)}$				V
(I_C = 10 mAdc, I_B = 1.0 mAdc)		0.65		0.85	
(I_C = 50mAdc, I_B = 5.0 mAdc)		–	–	0.95	

SMALL–SIGNAL CHARACTERISTICS

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Current–Gain — Bandwidth Product (I_C = 10mAdc, V_{CE}= 20Vdc, f = 100MHz)	f_T	300	–	–	MHz
Output Capacitance (V_{CB} = 5.0 Vdc, I_E = 0, f = 1.0 MHz)	C_{obo}	–	–	4	pF
Input Capacitance (V_{EB} = 0.5 Vdc, I_C = 0, f = 1.0 MHz)	C_{ibo}	–	–	8	pF
Input Impedance (V CE= 10 Vdc, I C = 1.0 mAdc, f = 1.0 kHz)	h_{ie}	1		10	kΩ
Voltage Feedback Ratio (V_{CE}= 10 Vdc, I_C = 1.0 mAdc, f = 1.0 kHz)	h_{re}	0.5	–	8	X 10^{-4}
Small–Signal Current Gain (V_{CE}= 10 Vdc, I_C = 1.0 mAdc, f = 1.0 kHz)	h_{fe}	100		400	
Output Admittance (V_{CE}= 10 Vdc, I_C = 1.0 mAdc, f = 1.0 kHz)	h_{oe}	1		40	μmhos
Noise Figure (V_{CE}=5V, I_C=100μA, R_S=1.0kΩ , f =1.0kHz)	NF			5	dB

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

LMBT3946DW1T1G,S-LMBT3946DW1T1G

●ELECTRICAL CHARACTERISTICS (Ta= 25℃)(NPN)

SWITCHING CHARACTERISTICS

Delay Time	(V_{CC} = 3.0 Vdc, V_{BE}= – 0.5 Vdc,I_C = 10 mAdc, I_{B1} = 1.0 mAdc)	t_d	–	–	35	ns
Rise Time		t_r	–	–	35	
Storage Time	(V_{CC} = 3.0 Vdc, I_C = 10 mAdc,I_{B1} = I_{B2} = 1.0 mAdc)	t_s	–	–	200	
Fall Time		t_f	–	–	50	

●ELECTRICAL CHARACTERISTICS (Ta= 25℃)(PNP)

OFF CHARACTERISTICS

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Collector–Emitter Breakdown Voltage (I_C = –1.0 mAdc, I_B = 0)	$V_{BR(CEO)}$	–40	–	–	V
Collector–Base Breakdown Voltage (I_C = –10 μAdc, I_E = 0)	$V_{BR(CBO)}$	–40	–	–	V
Emitter–Base Breakdown Voltage (I_E = –10 μAdc, I_C = 0)	$V_{BR(EBO)}$	–5	–	–	V
Collector Cutoff Current (V_{CE} = –30 Vdc, V_{EB} =– 3.0Vdc)	I_{CEX}	–	–	–50	nA
Base Cutoff Current (V_{CE} = –30 Vdc, V_{EB} = –3.0Vdc)	I_{BL}	–	–	–50	nA

ON CHARACTERISTICS (Note 2.)

DC Current Gain	h_{FE}				
(I_C = –0.1 mAdc, V_{CE} = –1.0 Vdc)		60	–	–	
(I_C = –1.0 mAdc, V_{CE} = –1.0 Vdc)		80	–	–	
(I_C = –10 mAdc, V_{CE} = –1.0 Vdc)		100	–	300	
(I_C = –50 mAdc, V_{CE} =– 1.0 Vdc)		60	–	–	
(I_C = –100 mAdc, V_{CE} =– 1.0 Vdc)		30	–	–	
Collector–Emitter Saturation Voltage	$V_{CE(sat)}$				V
(I_C = –10 mAdc, I_B = –1.0 mAdc)		–	–	–0.25	
(I_C = –50mAdc, I_B =– 5.0 mAdc)		–	–	–0.4	
Base–Emitter Saturation Voltage	$V_{BE(sat)}$				V
(I_C = –10 mAdc, I_B = –1.0 mAdc)		–0.65	–	–0.85	
(I_C = –50mAdc, I_B =– 5.0 mAdc)		–	–	–0.95	

SMALL–SIGNAL CHARACTERISTICS

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Current–Gain — Bandwidth Product (I_C = –10mAdc, V_{CE}= –20Vdc, f = 100MHz)	f_T	250	–	–	MHz
Output Capacitance (V_{CB} = –5.0 Vdc, I_E = 0, f = 1.0 MHz)	Cobo	–	–	4.5	pF
Input Capacitance (V_{EB} = –0.5 Vdc, I_C = 0, f = 1.0 MHz)	Cibo	–	–	10	pF

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

●ELECTRICAL CHARACTERISTICS (Ta= 25℃)(PNP)

SMALL–SIGNAL CHARACTERISTICS

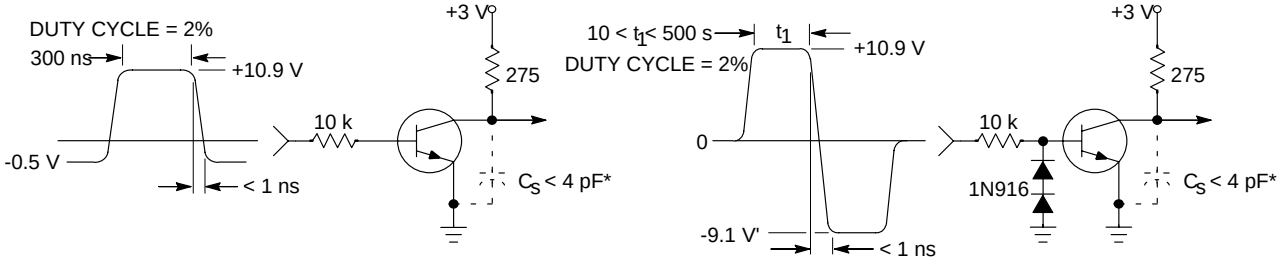
Input Impedance (V_{CE}=– 10 Vdc, I_C = –1.0 mAdc, f = 1.0 kHz)	h_{ie}	2		12	k Ω
Voltage Feedback Ratio (V_{CE}= –10 Vdc, I_C = –1.0 mAdc, f = 1.0 kHz)	h_{re}	0.1	–	10	X 10 –4
Small–Signal Current Gain (V_{CE}= –10 Vdc, I_C =– 1.0 mAdc, f = 1.0 kHz)	h_{fe}	100		400	
Output Admittance (V_{CE}= –10 Vdc, I_C =–1.0 mAdc, f = 1.0 kHz)	h_{oe}	3		60	μmhos
Noise Figure (V_{CE}=–5V, I_C=–100μA, R_S=1.0kΩ ,f =1.0kHz)	NF			4	dB

SWITCHING CHARACTERISTICS

Delay Time	(V_{CC} = –3.0 Vdc, V_{BE}= 0.5 Vdc,I_C = –10 mAdc, I_{B1} =– 1.0	t_d	–	–	35	ns
Rise Time		t_r	–	–	35	
Storage Time	(V_{CC} =– 3.0 Vdc, I_C = –10 mAdc,I_{B1} = I_{B2} = – 1.0 mAdc)	t_s	–	–	225	
Fall Time		t_f	–	–	75	

ELRCTRICAL CHARACTERISTICS CURVES

(NPN)



*Total shunt capacitance of test jig and connectors

Figure 1. Delay and Rise Time Equivalent Test Circuit

Figure 2. Storage and Fall Time Equivalent Test Circuit

LMBT3946DW1T1G,S-LMBT3946DW1T1G

ELRCTRICAL CHARACTERISTICS CURVES
(NPN)

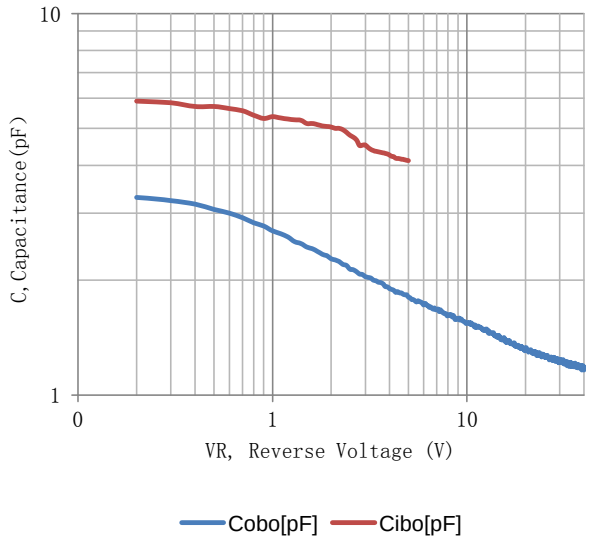


Figure 3. Capacitance

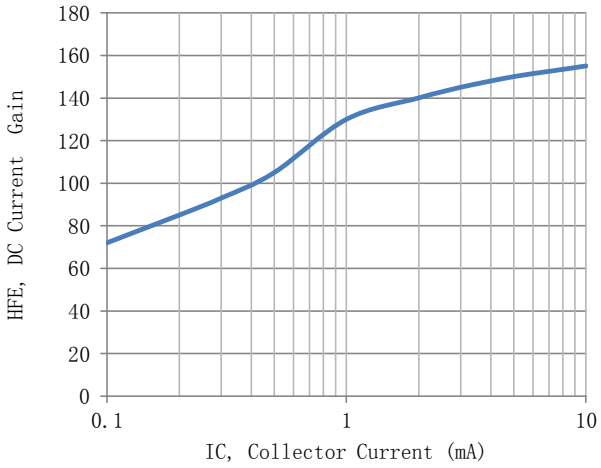


Figure 4. Current Gain

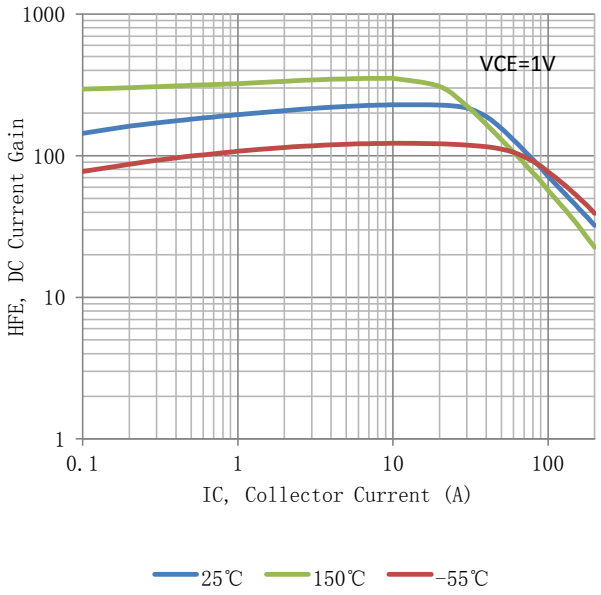


Figure 5. DC Current Gain

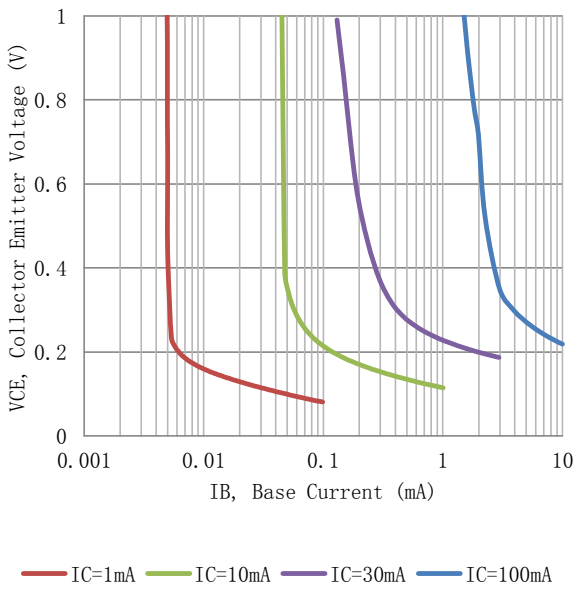


Figure 6. Collector Saturation Region

LMBT3946DW1T1G,S-LMBT3946DW1T1G

ELRCTRICAL CHARACTERISTICS CURVES
(NPN)

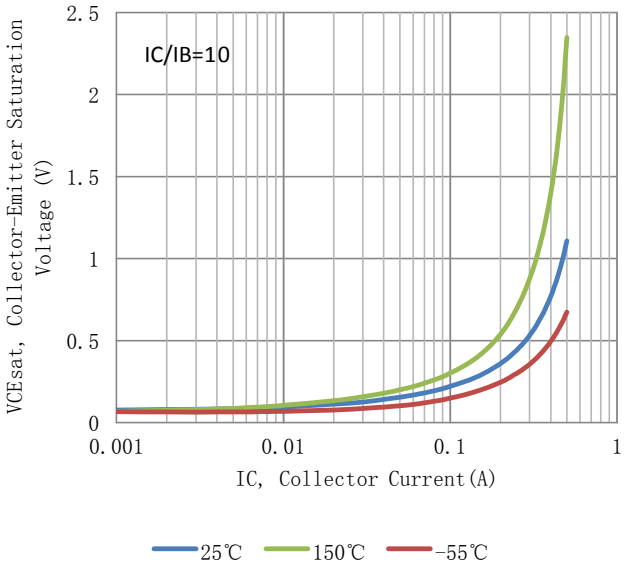


Figure 7. Collector Emitter Saturation Voltage vs. Collector Current

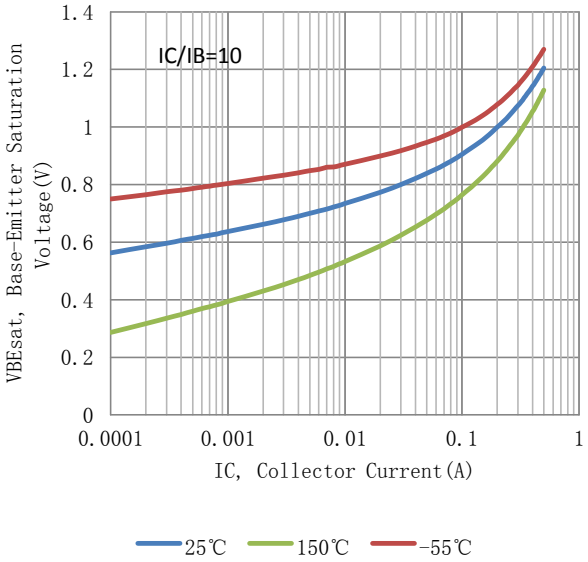


Figure 8. Base Emitter Saturation Voltage vs. Collector Current

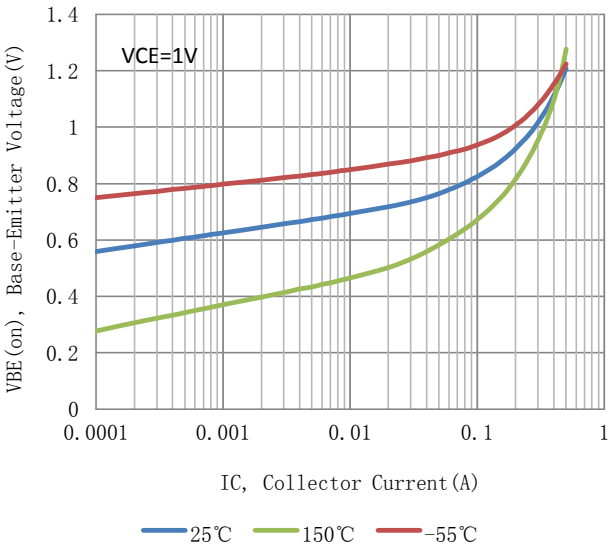


Figure 9. Base Emitter Voltage vs. Collector Current

LMBT3946DW1T1G,S-LMBT3946DW1T1G

ELRCTRICAL CHARACTERISTICS CURVES

(PNP)

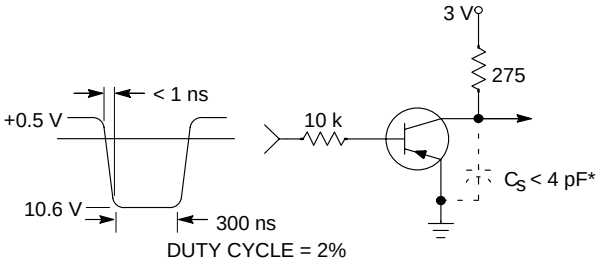


Figure 10. Delay and Rise Time Equivalent Test Circuit

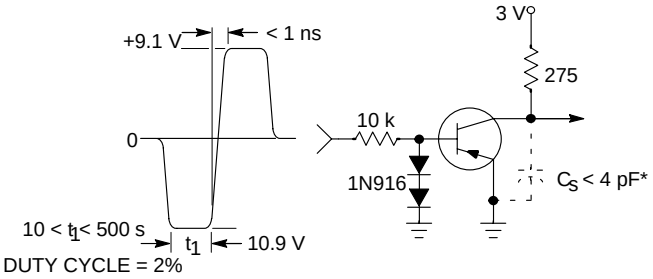


Figure 11. Storage and Fall Time Equivalent Test Circuit

*Total shunt capacitance of test jig and connectors

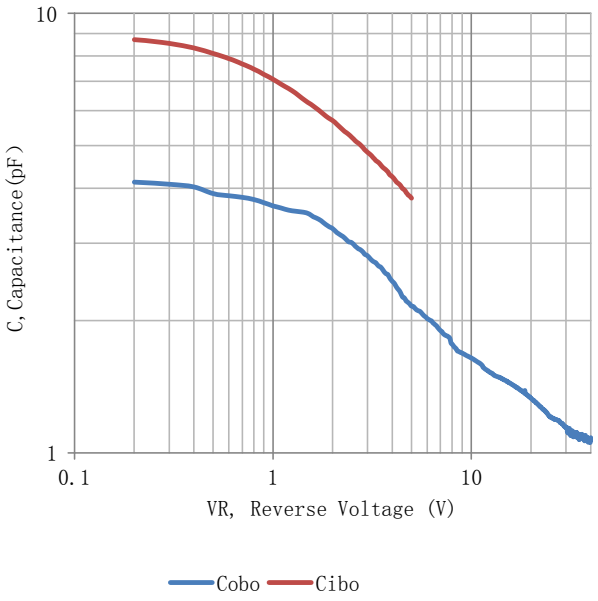


Figure 12. Capacitance

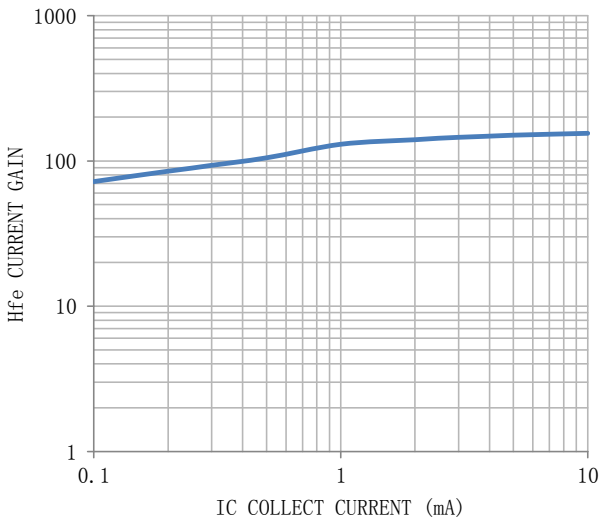


Figure 13. Current Gain

LMBT3946DW1T1G,S-LMBT3946DW1T1G

ELRCTRICAL CHARACTERISTICS CURVES

(PNP)

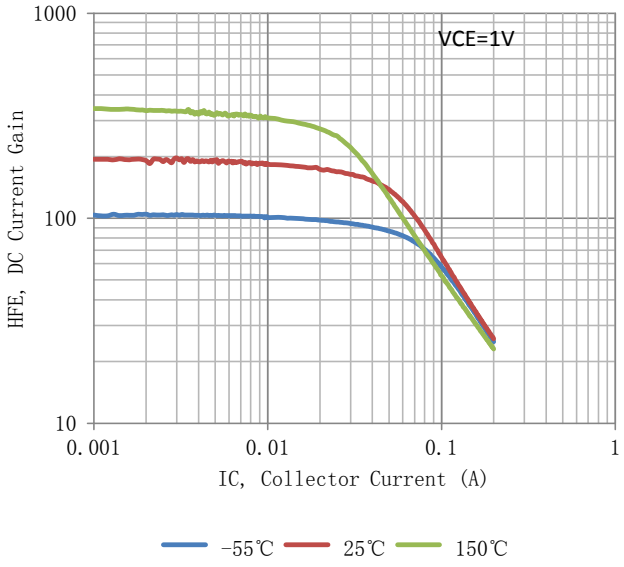


Figure 14. DC Current Gain

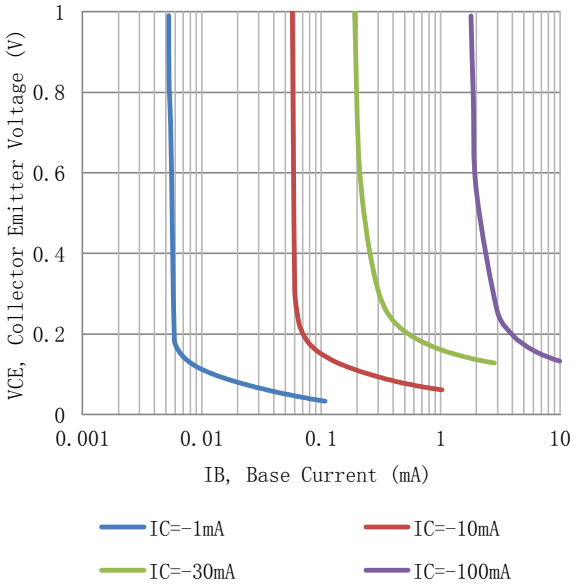


Figure 15. Collector Saturation Region

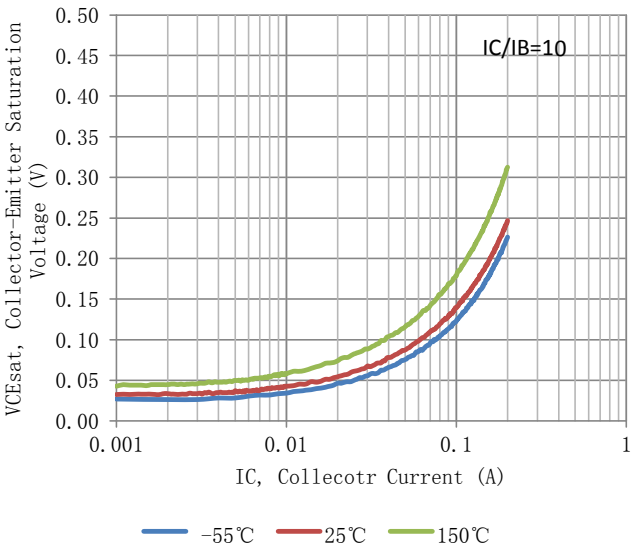


Figure 16. Collector Emitter Saturation Voltage vs. Collector Current

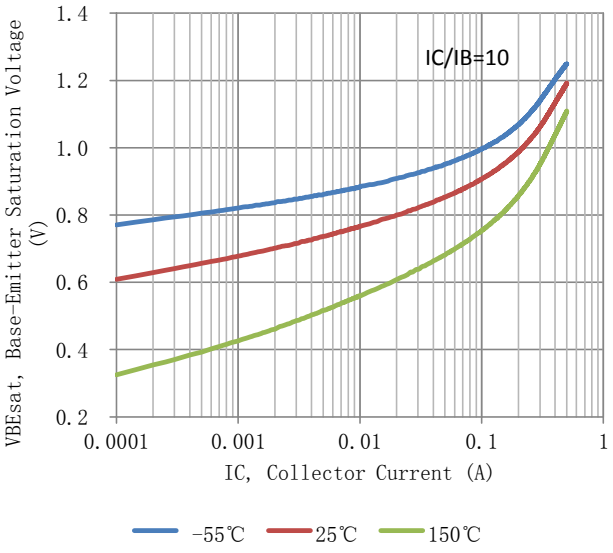


Figure 17. Base Emitter Saturation Voltage vs. Collector

LMBT3946DW1T1G,S-LMBT3946DW1T1G

ELRCTRICAL CHARACTERISTICS CURVES

(PNP)

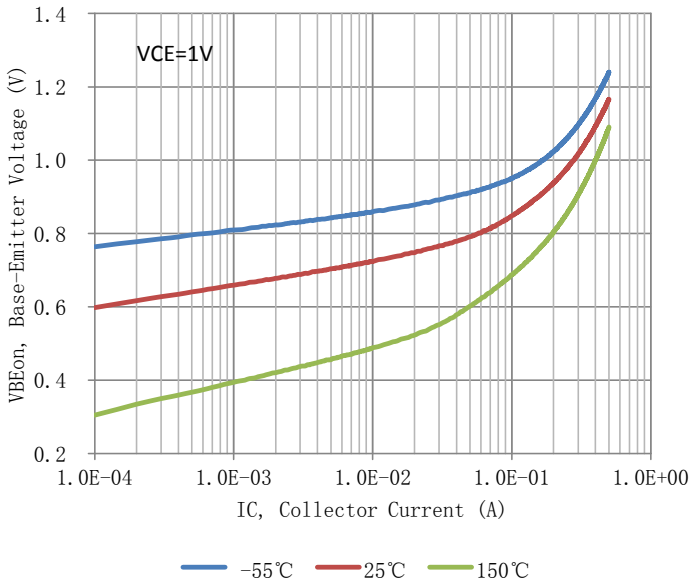
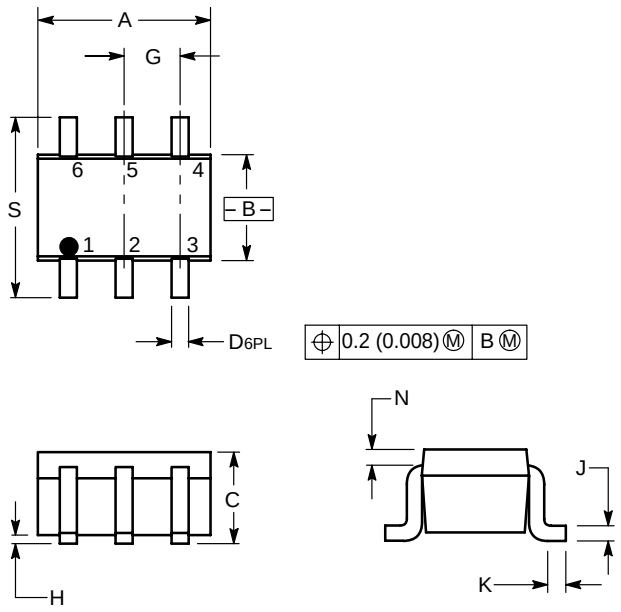


Figure 18. Base Emitter Voltage vs. Collector Current

LMBT3946DW1T1G,S-LMBT3946DW1T1G

SC-88



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	0.004	---	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20

PIN 1. EMITTER 2
2. BASE 2
3. COLLECTOR 1
4.EMITTER 1
5. BASE 1
6.COLLECTOR 2