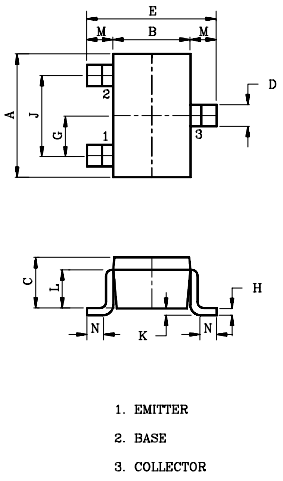
2N3904U

EPITAXIAL PLANAR NPN TRANSISTOR

GENERAL PURPOSE APPLICATION.
SWITCHING APPLICATION.

FEATURES

- Low Leakage Current
  : I_{CEX}=50nA(Max.), I_{BL}=50nA(Max.)
  @V_{CE}=30V, V_{EB}=3V.
- Excellent DC Current Gain Linearity.
- Low Saturation Voltage
  : $V_{CE(sat)}$=0.3V(Max.) @I_C=50mA, I_B=5mA.
- Low Collector Output Capacitance
  : C_{ob}=4pF(Max.) @V_{CB}=5V.
- Complementary to 2N3906U.



DIM	MILLIMETERS
A	2.00± 0.20
B	1.25± 0.15
C	0.90± 0.10
D	0.3+0.10/−0.05
E	2.10± 0.20
G	0.65
H	0.15+0.1/−0.06
J	1.30
K	0.00−0.10
L	0.70
M	0.42± 0.10
N	0.2 MIN

1. EMITTER
2. BASE
3. COLLECTOR

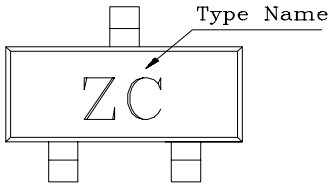
USM

MAXIMUM RATINGS (Ta=25℃)

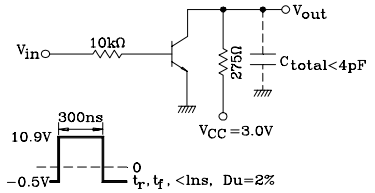
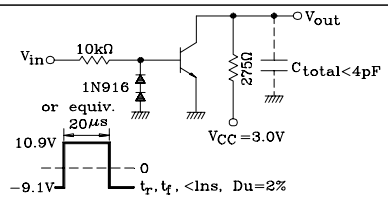
CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	200	mA
Base Current	I_B	50	mA
Collector Power Dissipation	P_C *	100	mW
Junction Temperature	T_j	150	℃
Storage Temperature Range	T_{stg}	-55~150	℃

* P_C : Package Mounted On 99.5% Alumina 10x8x0.6mm

Marking

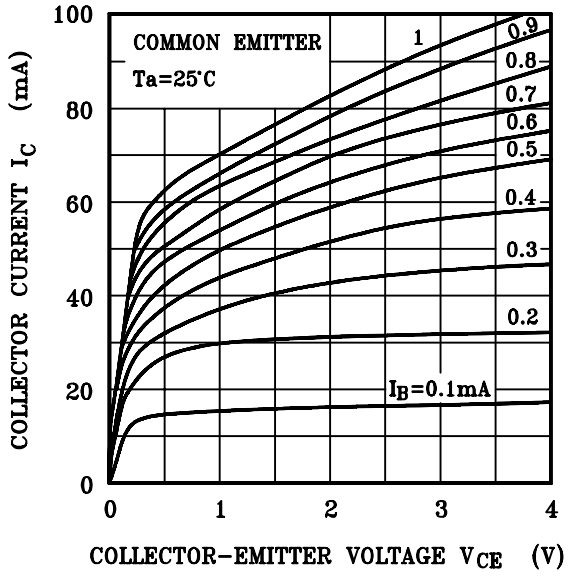


ELECTRICAL CHARACTERISTICS (Ta=25℃)

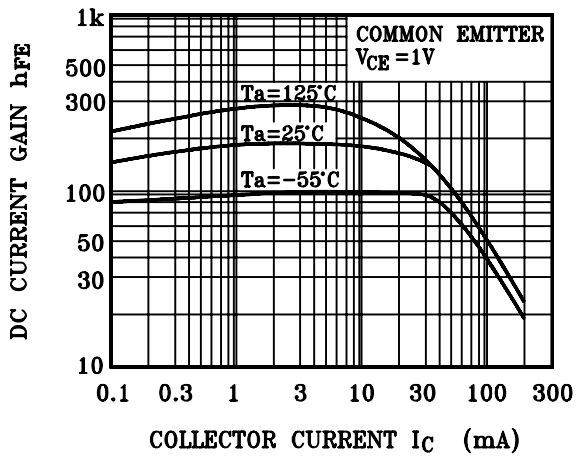
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current		I_{CEX}	V_{CE}=30V, V_{EB}=3V	-	-	50	nA
Base Cut-off Current		I_{BL}	V_{CE}=30V, V_{EB}=3V	-	-	50	nA
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=10μA, I_E=0	60	-	-	V
Collector-Emitter Breakdown Voltage *		$V_{(BR)CEO}$	I_C=1mA, I_B=0	40	-	-	V
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=10μA, I_C=0	6.0	-	-	V
DC Current Gain *		$h_{FE}(1)$	V_{CE}=1V, I_C=0.1mA	40	-	-	
		$h_{FE}(2)$	V_{CE}=1V, I_C=1mA	70	-	-	
		$h_{FE}(3)$	V_{CE}=1V, I_C=10mA	100	-	300	
		$h_{FE}(4)$	V_{CE}=1V, I_C=50mA	60	-	-	
		$h_{FE}(5)$	V_{CE}=1V, I_C=100mA	30	-	-	
Collector-Emitter Saturation Voltage *		$V_{CE(sat)}1$	I_C=10mA, I_B=1mA	-	-	0.2	V
		$V_{CE(sat)}2$	I_C=50mA, I_B=5mA	-	-	0.3	
Base-Emitter Saturation Voltage *		$V_{BE(sat)}1$	I_C=10mA, I_B=1mA	0.65	-	0.85	V
		$V_{BE(sat)}2$	I_C=50mA, I_B=5mA	-	-	0.95	
Transition Frequency		f_T	V_{CE}=20V, I_C=10mA, f=100MHz	300	-	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=5V, I_E=0, f=1MHz	-	-	4.0	pF
Input Capacitance		C_{ib}	V_{BE}=0.5V, I_C=0, f=1MHz	-	-	8.0	pF
Input Impedance		h_{ib}	V_{CE}=10V, I_C=1mA, f=1kHz	1.0	-	10	kΩ
Voltage Feedback Ratio		h_{re}		0.5	-	8.0	x10
Small-Signal Current Gain		h_{fe}		100	-	400	
Collector Output Admittance		h_{oe}		1.0	-	40	μ℧
Noise Figure		NF	V_{CE}=5V, I_C=0.1mA Rg=1kΩ, f=10Hz~15.7kHz	-	-	5.0	dB
Switching Time	Delay Time	t_d		-	-	35	nS
	Rise Time	t_r		-	-	35	
	Storage Time	t_{stg}		-	-	200	
	Fall Time	t_f		-	-	50	

*Pulse Test : Pulse Width ≦300μS, Duty Cycle≦2%

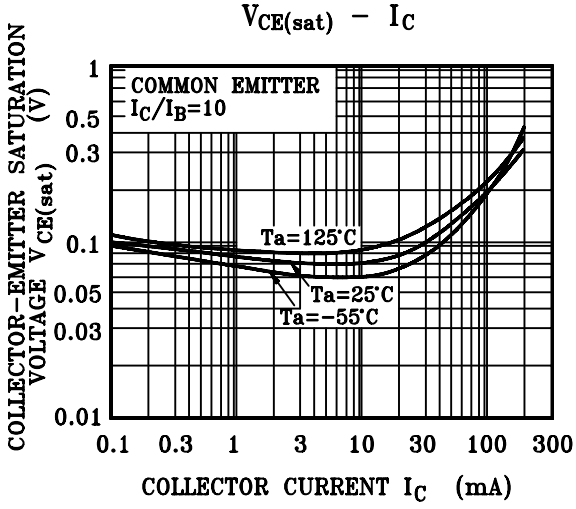
I_C – V_{CE}



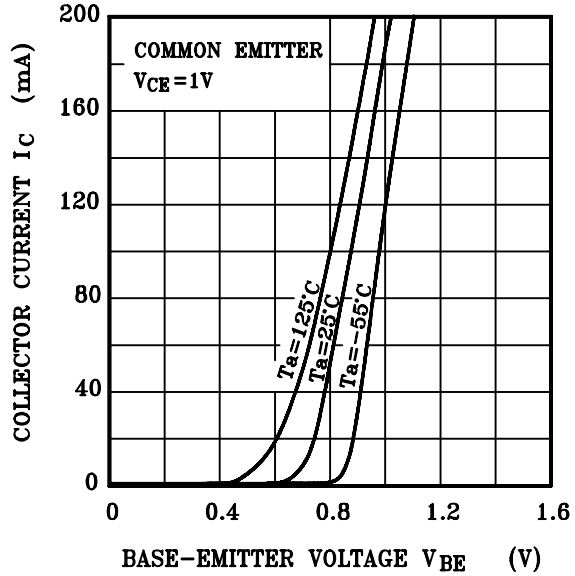
h_{FE} – I_C



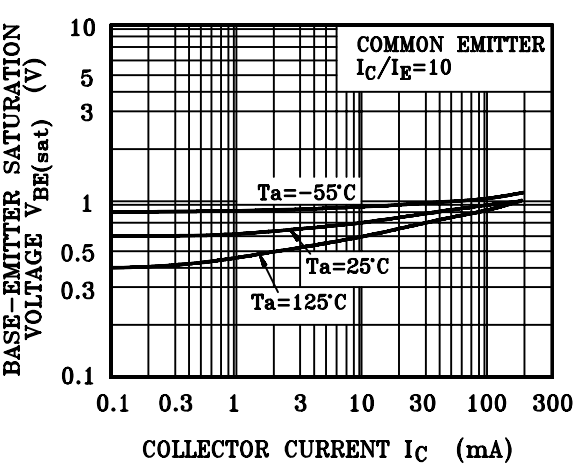
$V_{CE(sat)}$ – I_C

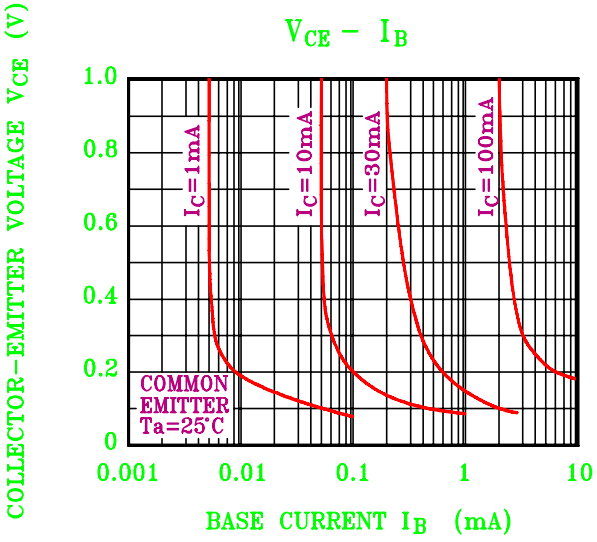


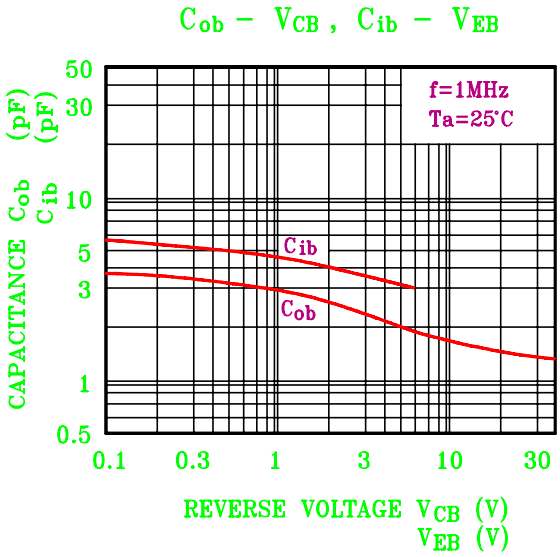
I_C – V_{BE}



$V_{BE(sat)}$ – I_C




V_{CE} - I_B
COLLECTOR-EMITTER VOLTAGE V_{CE} (V)
1.0
0.8
0.6
0.4
0.2
0
I_C=1mA
I_C=10mA
I_C=30mA
I_C=100mA
COMMON EMITTER
Ta=25°C
0.001
0.01
0.1
1
10
BASE CURRENT I_B (mA)


C_{ob} - V_{CB} , C_{ib} - V_{EB}
CAPACITANCE C_{ob} (pF) C_{ib} (pF)
50
30
10
5
3
1
0.5
f=1MHz
Ta=25°C
C_{ib}
C_{ob}
0.1
0.3
1
3
10
30
REVERSE VOLTAGE V_{CB} (V)
V_{EB} (V)