

GENERAL PURPOSE APPLICATION.  
SWITCHING APPLICATION.

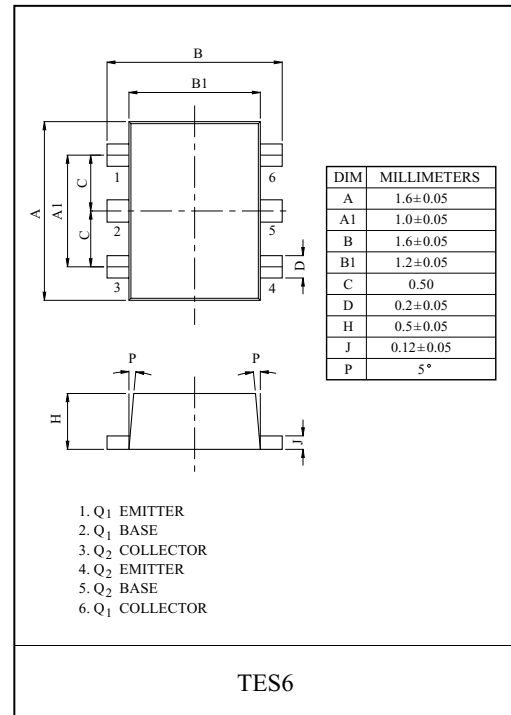
#### FEATURES

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

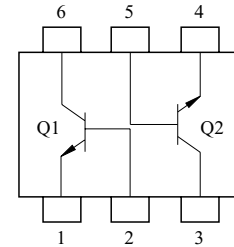
#### MAXIMUM RATING (Ta=25 °C)

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	$P_C^*$	200	mW
Junction Temperature	$T_j$	150	°C
Storage Temperature Range	$T_{stg}$	-55 ~ 150	°C

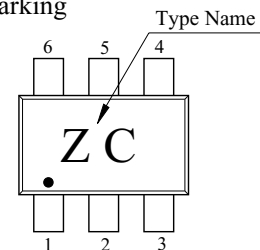
\* Total Rating



#### EQUIVALENT CIRCUIT (TOP VIEW)



#### Marking



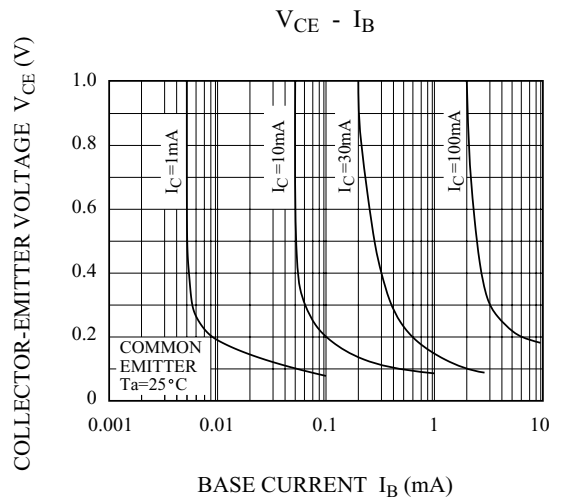
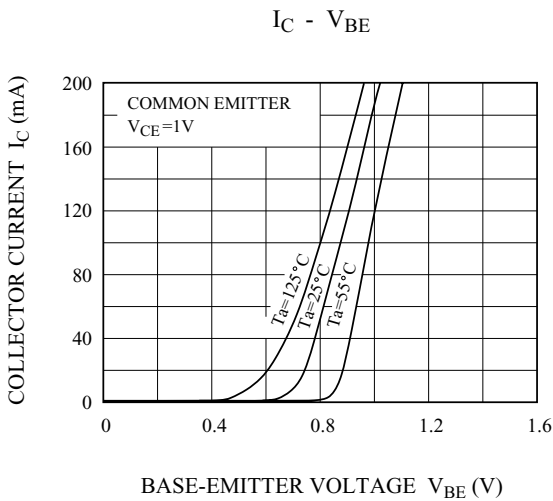
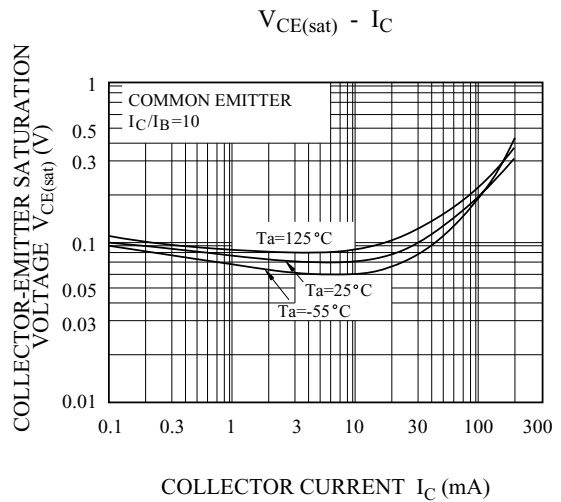
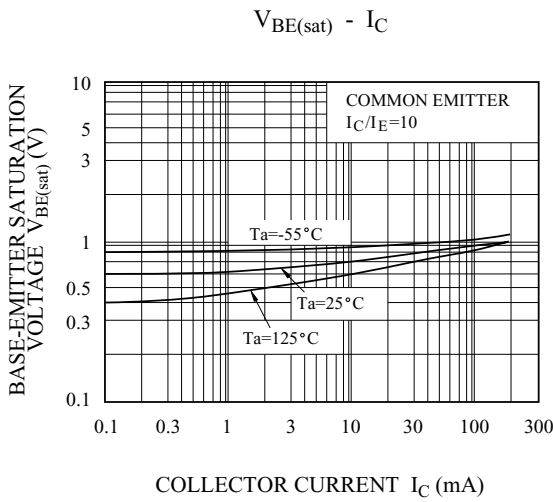
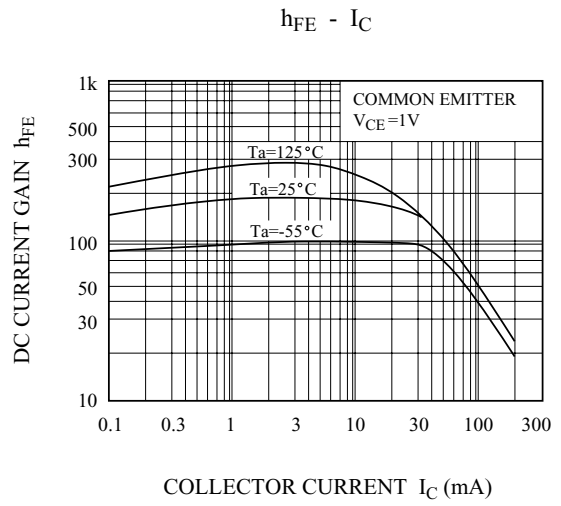
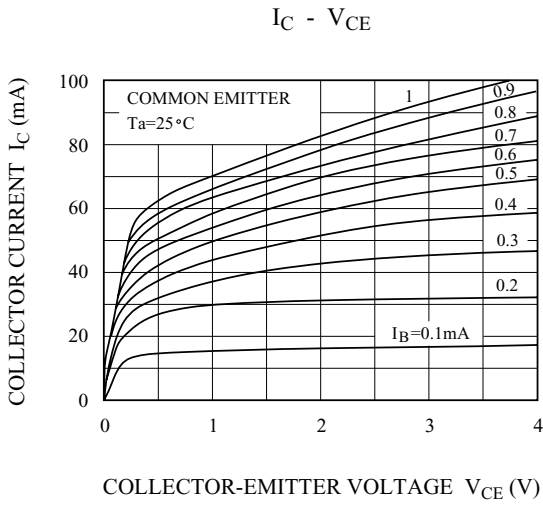
# 2N2904E

## ELECTRICAL CHARACTERISTICS (Ta=25 °C)

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		$V_{(BR)CBO}$	$I_C=10\mu A, I_E=0$	60	-	-	V
Collector-Emitter Breakdown Voltage *		$V_{(BR)CEO}$	$I_C=1mA, I_B=0$	40	-	-	V
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	$I_E=10\mu A, I_C=0$	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		$h_{ie}$	$V_{CE}=10V, I_C=1mA, f=1kHz$	1.0	-	10	k $\Omega$
Voltage Feedback Ratio		$h_{re}$		0.5	-	8.0	$\times 10^{-4}$
Small-Signal Current Gain		$h_{fe}$		100	-	400	
Collector Output Admittance		$h_{oe}$		1.0	-	40	$\mu \bar{o}$
Noise Figure		NF		$V_{CE}=5V, I_C=0.1mA, R_g=1k \Omega,$ $f=10Hz \sim 15.7kHz$	-	-	5.0
Switching Time	Delay Time	$t_d$		-	-	35	nS
	Rise Time	$t_r$		-	-	35	
	Storage Time	$t_{sig}$		-	-	200	
	Fall Time	$t_f$		-	-	50	

\* Pulse Test : Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .

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