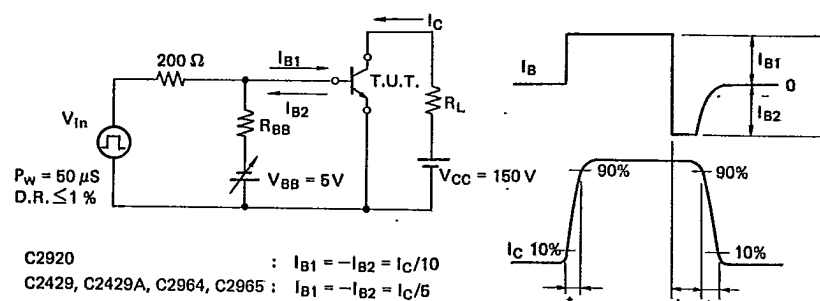
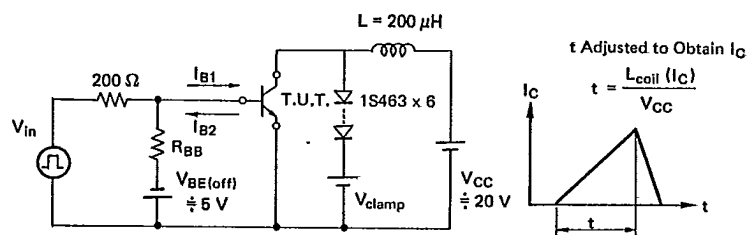


2SC2920, 2SC2429, 2SC2429A, 2SC2964, 2SC2965

• Test Circuit used for Measurement of Switching Time (Resistive)



• Test Circuit used for Measurement of $V_{CEX(SUS)}$ and Reverse Bias Safe Operating Area



(a) $V_{CEX(SUS)}$
 $I_C = 8\text{ A}$, $I_{B1} = 2\text{ A}$, $I_{B2} = -1\text{ A}$, $R_{BB} = 5\ \Omega$, $V_{clamp} = 450\text{ V}$

(b) Reverse Bias Safe Operating Area
 $I_{B1} \leq 4\text{ A}$, $I_{B2} = -1\text{ A}$, $R_{BB} = 5\ \Omega$

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T-33-13

PRODUCT PROFILE

2SC2920**Silicon High Speed Power Transistor**ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Rating	Symbol	2SC2920	Unit
Collector to Emitter Voltage	V_{CEO}	400	V
Collector to Base Voltage	V_{CBO}	450	V
Emitter to Base Voltage	V_{EBO}	7	V
Collector Current-Continuous	I_C	15	A
Collector Current-Pulsed ($P_w \leq 10 \text{ mS}$, D.R. $\leq 2\%$)	I_{CP}	20	A
Base Current-Continuous	I_B	5	A
Collector Power Dissipation ($T_C = 25^\circ\text{C}$)	P_C	150	W
Junction Temperature	T_J	175	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	$-65 \sim +175$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$)

Parameters	Symbols	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Collector to Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100 \mu\text{A}$, $I_E = 0$	450	—	—	V
Emitter to Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 1 \text{ mA}$, $I_C = 0$	7	—	—	V
Collector to Emitter Sustaining Voltage	$V_{CEO(SUS)}$	$I_C = 1 \text{ A}$, $R_{BE} = \infty \Omega$	400	—	—	V
Collector to Emitter Sustaining Voltage	$V_{CEX(SUS)}$	$I_C = 8 \text{ A}$, $I_{B2} = -1 \text{ A}$, $L = 200 \mu\text{H}$ ^{(*)1}	450	—	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 450 \text{ V}$, $I_E = 0$	—	—	100	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6 \text{ V}$, $I_C = 0$	—	—	100	μA
DC Current Gain	h_{FE}	$V_{CE} = 2 \text{ V}$, $I_C = 10 \text{ A}$ ^{(*)2}	10	13	30	—
Collector to Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10 \text{ A}$, $I_B = 1 \text{ A}$ ^{(*)2}	—	0.56	1.0	V
Base to Emitter Saturation Voltage	$V_{BE(sat)}$		—	1.2	1.5	V
Output Capacitance	C_{ob}	$V_{CB} = 10 \text{ V}$, $I_E = 0$, $f = 1 \text{ MHz}$	—	240	—	PF
Gain Bandwidth Product	f_T	$V_{CE} = 10 \text{ V}$, $I_C = 2 \text{ A}$	—	30	—	MHz
Rise Time	t_r	$V_{CC} = 150 \text{ V}$ ^{(*)1} $I_C = 10 \text{ A}$, $I_{B1} = -I_{B2} = 1 \text{ A}$	—	0.20	0.5	μs
Storage Time	t_{stg}		—	1.80	3.0	μs
Fall Time	t_f		—	0.18	0.3	μs

*1 Test Circuit

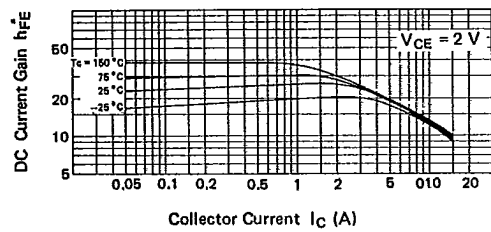
*2 Pulsed $P_w \leq 300 \mu\text{s}$, Duty Ratio $\leq 6\%$

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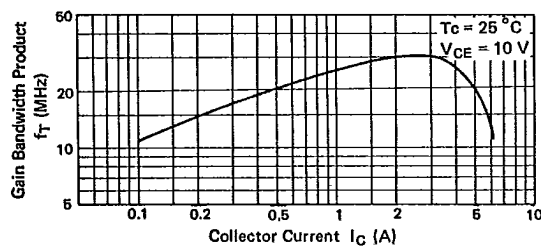
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2SC2920

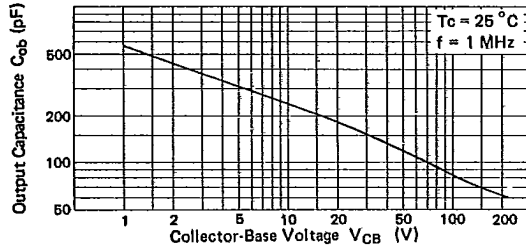
DC Current Gain



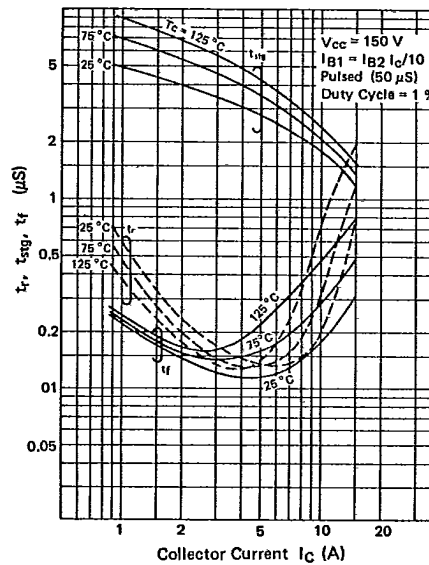
Gain Bandwidth Product



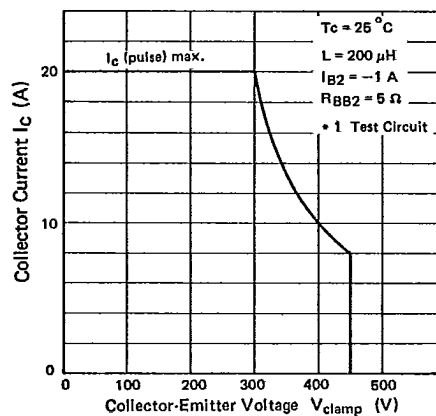
Output Capacitance



Switching Time



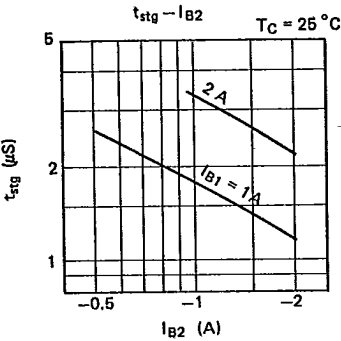
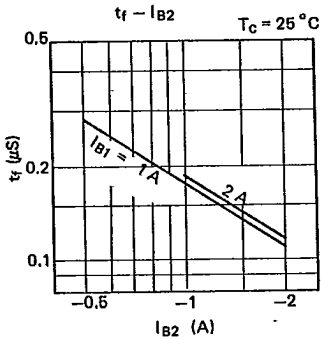
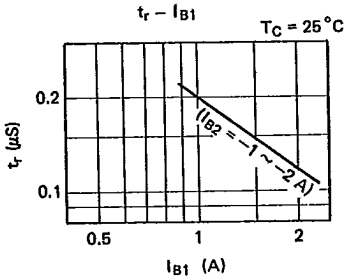
Reverse Bias Safe Operating Area



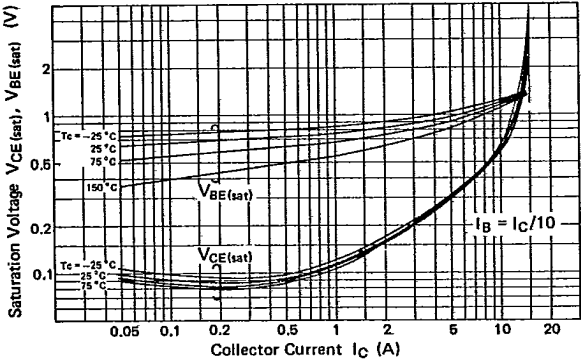
2SC2920

Switching Time

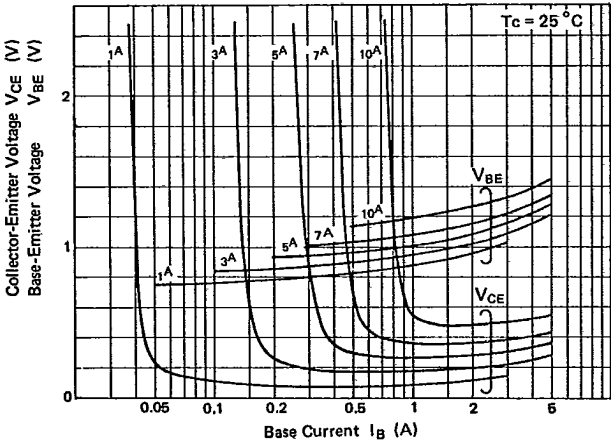
$V_{CC} = 150\text{ V}$
 $I_C = 10\text{ A}$
Pulsed ($50\text{ }\mu\text{S}$)
Duty Ratio = 1 %



Saturation Voltage

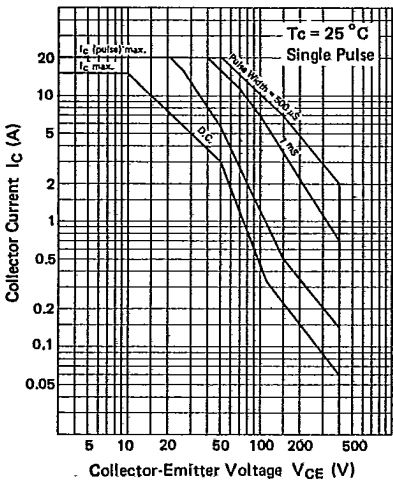


Collector Saturation Region

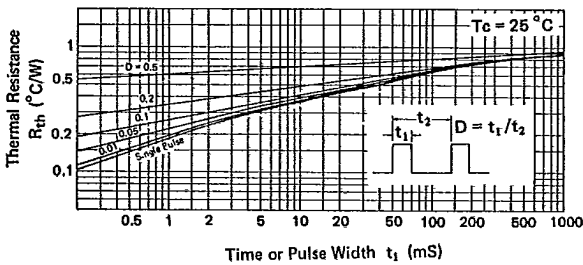


2SC2920

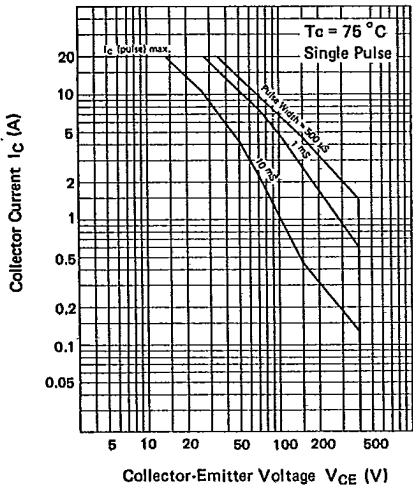
Forward Bias Safe Operating Area



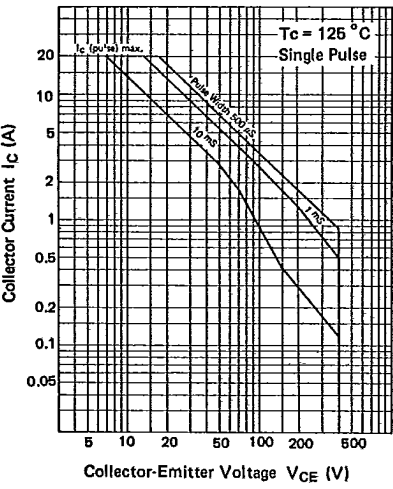
Thermal Response



Forward Bias Safe Operating Area



Forward Bias Safe Operating Area



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PRODUCT PROFILE

2SC2429, 2SC2429A

Silicon High Speed Power Transistor

ABSOLUTE MAXIMUM RATINGS (Ta = 25 °C)

Rating	Symbol	2SC2429	2SC2429A	Unit
Collector to Emitter Voltage	V _{CEO}	400	450	V
Collector to Base Voltage	V _{CBO}	450	600	V
Emitter to Base Voltage	V _{EBO}	7	7	V
Collector Current-Continuous	I _C	15	15	A
Collector Current-Pulsed ($P_w \leq 10 \text{ mS}$, $D.R. \leq 2 \%$)	I _{CP}	20	20	A
Base Current-Continuous	I _B	5	5	A
Collector Power Dissipation (T _C = 25°)	P _C	150	150	W
Junction Temperature	T _J	175	175	°C
Storage Temperature Range	T _{stg}	-65 ~ +175	-65 ~ +175	°C



ELECTRICAL CHARACTERISTICS (Ta = 25 °C)

Parameters	Symbols	Test Conditions	Limits			Unit	
			Min.	Typ.	Max.		
Collector to Base Breakdown Voltage	V _{(BR)CBO}	2SC2429: I _C = 100 μA, I _E = 0	450	—	—	V	
		2SC2429A: I _C = 1 mA, I _E = 0	600	—	—	V	
Emitter to Base Breakdown Voltage	V _{(BR)EBO}	I _E = 1 mA, I _C = 0	7	—	—	V	
Collector Emitter Sustaining Voltage	V _{CEO(SUS)}	2SC2429 I _C = 1 A, R _{BE} = ∞Ω	400	—	—	V	
		2SC2429A	450	—	—	V	
Collector to Emitter Sustaining Voltage	V _{CEX(SUS)}	I _C = 8 A, I _{B2} = -1 A, L = 200 μH (*1)	450	—	—	V	
Collector Cutoff Current	I _{CBO}	2SC2429: V _{CB} = 450 V, I _E = 0	—	—	100	μA	
		2SC2429A: V _{CB} = 500 V, I _E = 0	—	—	100	μA	
Emitter Cutoff Current	I _{EBO}	V _{EB} = 6 V, I _C = 0	—	—	100	μA	
DC Current Gain	h _{FE}	V _{CE} = 5 V, I _C = 10 A (*2)	10	15	40	—	
Collector to Emitter Saturation Voltage	V _{CE(sat)}	I _C = 10 A, I _B = 2 A (*2)	—	0.56	1.0	V	
Base to Emitter Saturation Voltage	V _{BE(sat)}		2SC2429	—	1.25	2.0	V
			2SC2429A	—	1.25	1.5	V
Output Capacitance	C _{ob}	V _{CB} = 10 V, I _E = 0, f = 1 MHz	—	240	—	PF	
Gain Bandwidth Product	f _T	V _{CE} = 10 V, I _C = 2 A	—	30	—	MHz	
Rise Time	t _r	V _{CC} = 150 V I _C = 10 A, I _{B1} = -I _{B2} = 2 A (*1)	—	0.13	0.5	μs	
Storage Time	t _{stg}		—	1.80	2.5	μs	
Fall Time	t _f		—	0.11	0.3	μs	

*1 Test Circuit

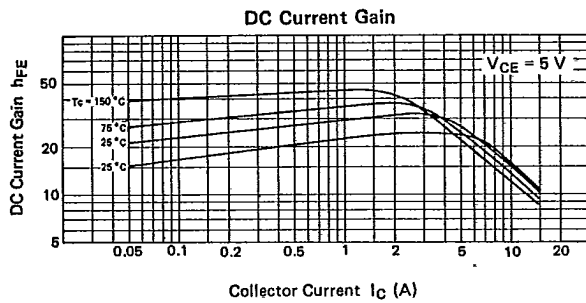
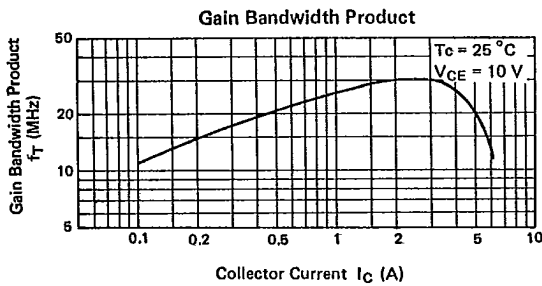
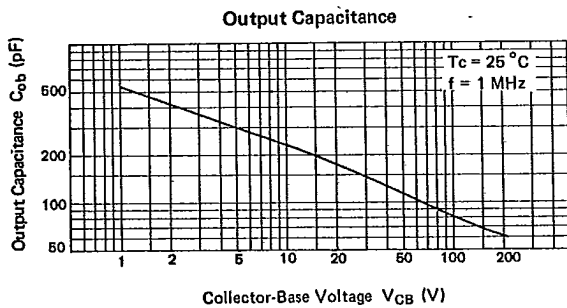
*2 Pulsed P_w ≤ 300 μs, Duty Ratio ≤ 6 %

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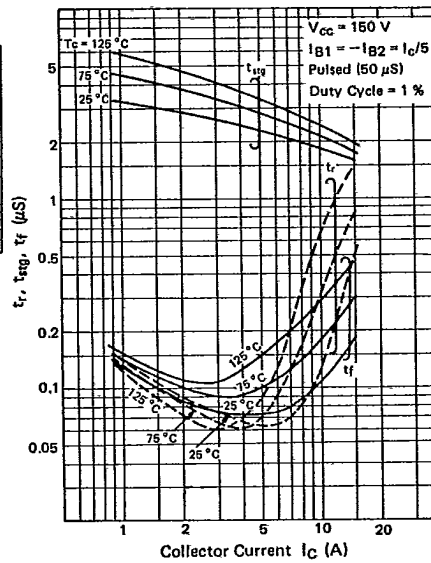
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1-37

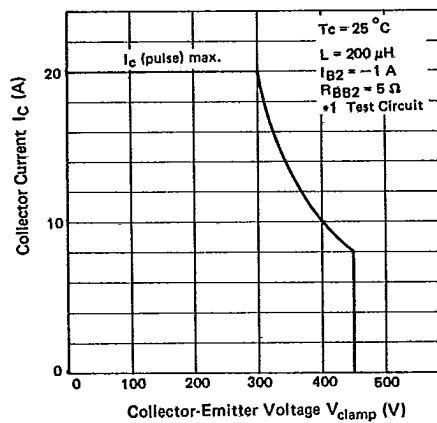
2SC2429, 2SC2429A



Switching Time



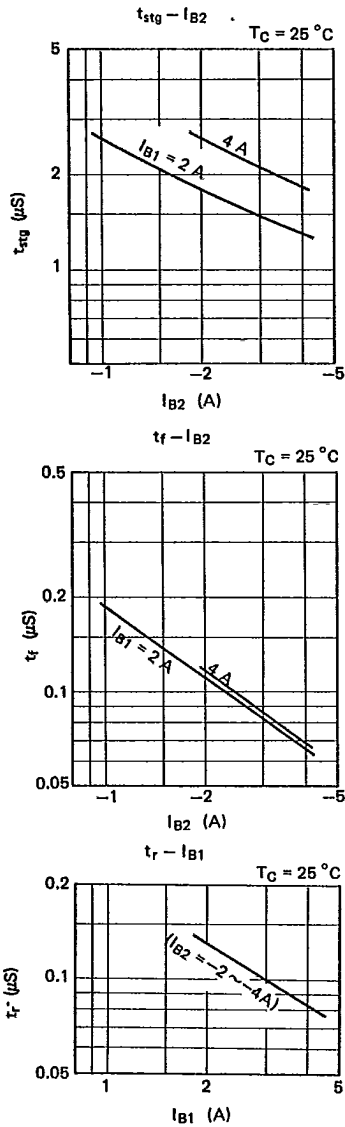
Reverse Bias Safe Operating Area



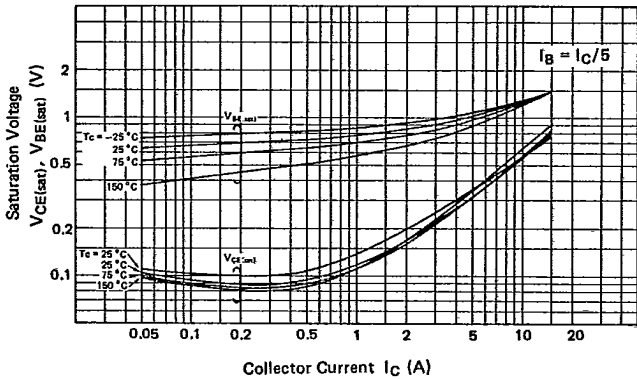
2SC2429, 2SC2429A

Switching Time

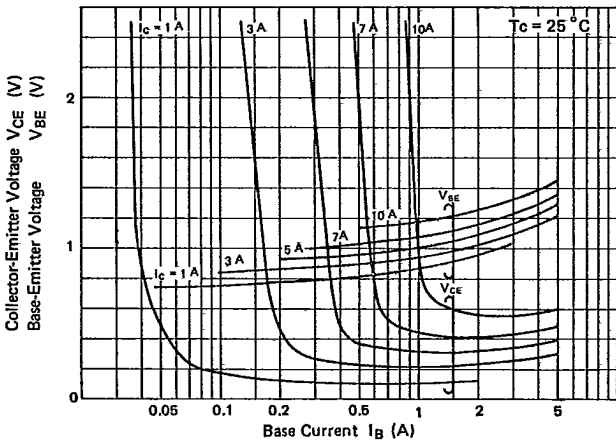
$V_{CC} = 150\text{ V}$
 $I_C = 10\text{ A}$
Pulsed (50 μs)
Duty Ratio = 1 %



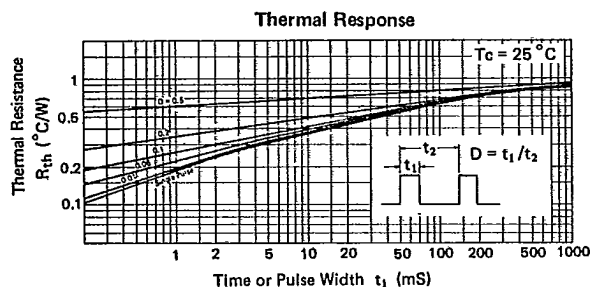
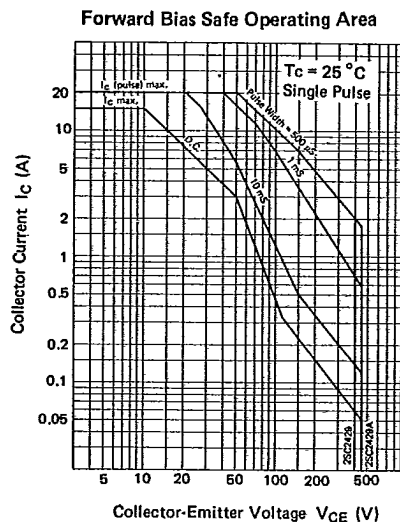
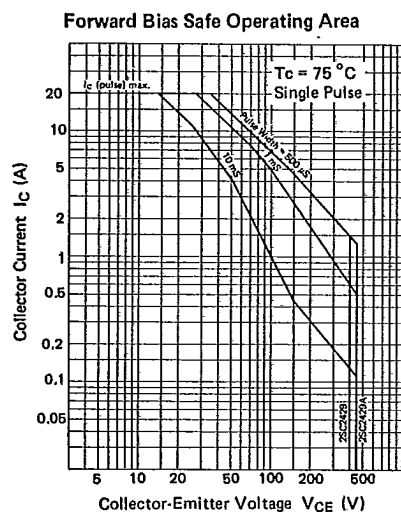
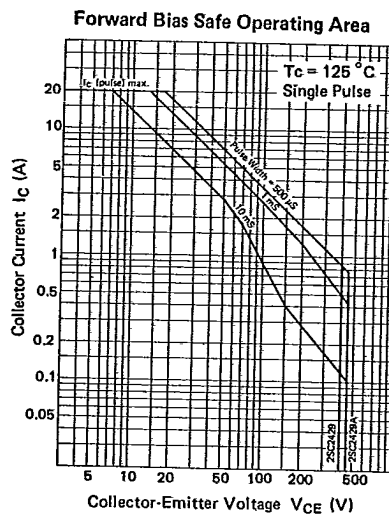
Saturation Voltage



Collector Saturation Region



2SC2429, 2SC2429A



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PRODUCT PROFILE

2SC2964, 2SC2965**Silicon High Speed Power Transistor**ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Rating	Symbol	2SC2964	2SC2965	Unit
Collector to Emitter Voltage	V_{CE0}	400	450	V
Collector Base Voltage	V_{CBO}	600	600	V
Emitter to Base Voltage	V_{EBO}	7	7	V
Collector Current-Continuous	I_C	15	15	A
Collector Current-Pulsed ($P_w \leq 10 \text{ mS}$, $D.R. \leq 2\%$)	I_{CP}	20	20	A
Base Current-Continuous	I_B	5	5	A
Collector Power Dissipation ($T_C = 25^\circ\text{C}$)	P_C	150	150	W
Junction Temperature	T_j	175	175	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	$-65 \sim +175$	$-65 \sim +175$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$)

Parameters	Symbols	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Collector to Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 1 \text{ mA}$, $I_E = 0$	600	—	—	V
Emitter to Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 1 \text{ mA}$, $I_C = 0$	7	—	—	V
Collector to Emitter Sustaining Voltage	$V_{CE0(SUS)}$	$I_C = 0.8 \text{ A}$, $R_{BE} = \infty \Omega$	2SC2964	400	—	V
			2SC2965	450	—	V
Collector to Emitter Sustaining Voltage	$V_{CEX(SUS)}$	$I_C = 8 \text{ A}$, $I_{B2} = -1 \text{ A}$, $L = 200 \mu\text{H}$ (*)	450	—	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 500 \text{ V}$, $I_E = 0$	—	—	100	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6 \text{ V}$, $I_C = 0$	—	—	100	μA
DC Current Gain	h_{FE}	$V_{CE} = 5 \text{ V}$, $I_C = 10 \text{ A}$ (*)	7	8.5	20	—
Collector to Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10 \text{ A}$, $I_B = 2 \text{ A}$ (*)	—	0.75	1.5	V
Base to Emitter Saturation Voltage	$V_{BE(sat)}$		—	1.25	1.5	V
Output Capacitance	C_{ob}	$V_{CB} = 10 \text{ V}$, $I_E = 0$, $f = 1 \text{ MHz}$	—	230	—	pF
Gain Bandwidth Product	f_T	$V_{CE} = 10 \text{ V}$, $I_C = 2 \text{ A}$	—	28	—	MHz
Rise Time	t_r	$V_{CC} = 150 \text{ V}$ $I_C = 10 \text{ A}$, $I_{B1} = -I_{B2} = 2 \text{ A}$ (*)	—	0.15	0.5	μs
Storage Time	t_{stg}		—	0.84	1.0	μs
Fall Time	t_f		—	0.10	0.3	μs

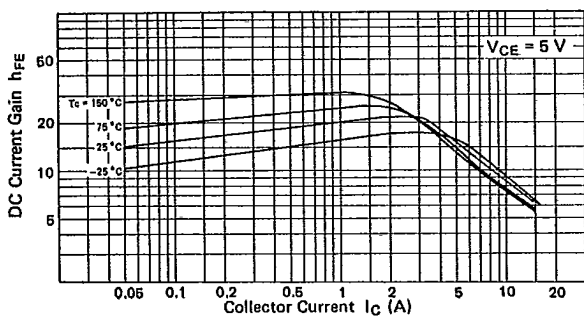
*1 Test Circuit

*2 Pulsed $P_w \leq 300 \mu\text{s}$, Duty Ratio $\leq 6\%$

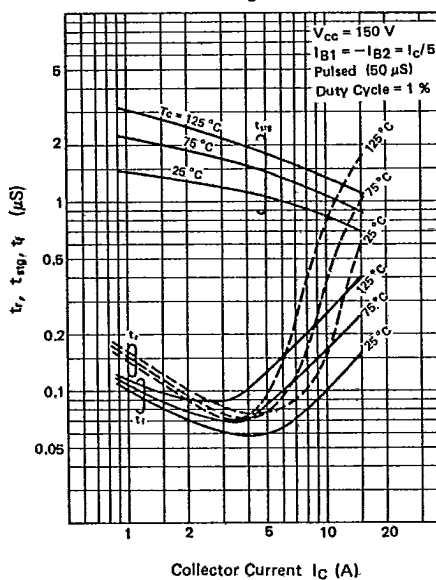
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2SC2964, 2SC2965

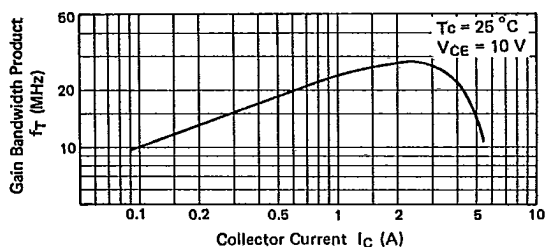
DC Current Gain



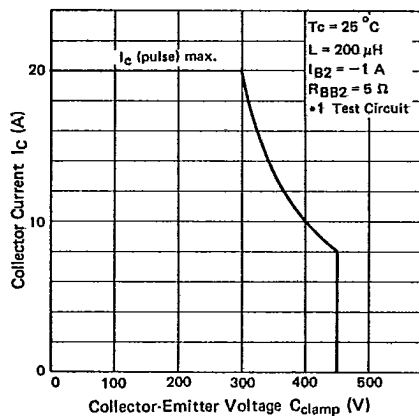
Switching Time



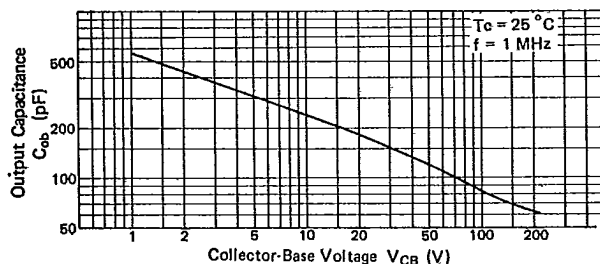
Gain Bandwidth Product



Reverse Bias Safe Operating Area



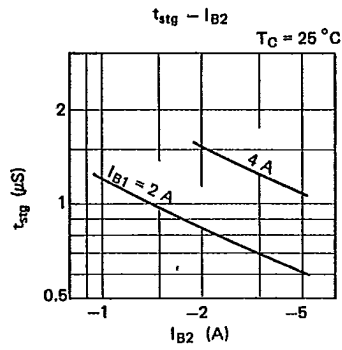
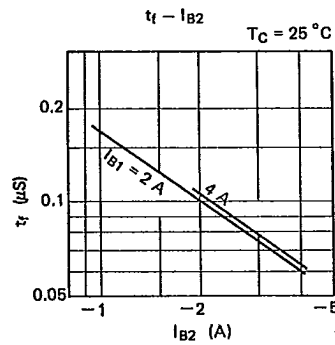
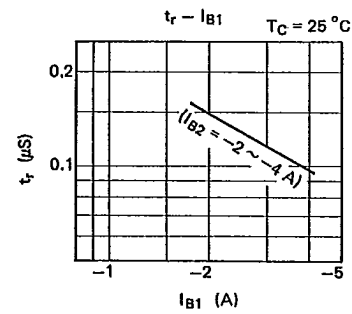
Output Capacitance



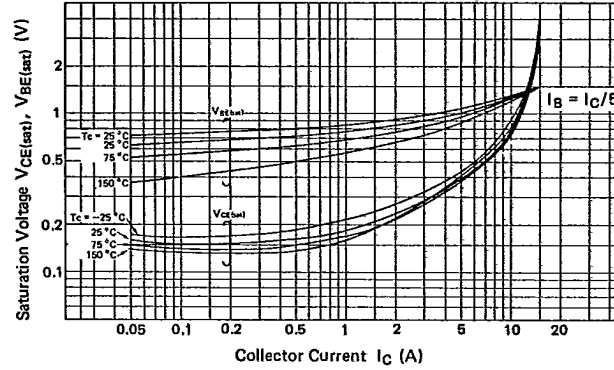
2SC2964, 2SC2965

Switching Time

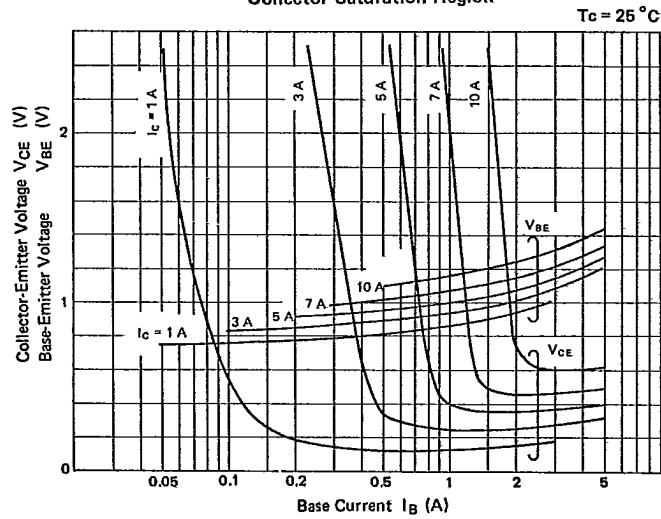
$V_{CC} = 150 \text{ V}$
 $I_C = 10 \text{ A}$
 Pulsed ($50 \mu\text{s}$)
 Duty Ratio = 1 %



Saturation Voltage



Collector Saturation Region



Thermal Response

$T_c = 25\text{ }^{\circ}\text{C}$

Thermal Resistance R_{th} ($^{\circ}\text{C/W}$)

Time or Pulse Width t_1 (mS)

$D = 0.5$
 0.2
 0.1
 0.05
 0.01
 Single Pulse

t_1
 t_2
 $D = t_1/t_2$

