T-33-11

January 1990
Edition 1.1

FUJITSU

PRODUCT PROFILE

2SC3057

Silicon High Speed Power Transistor

DESCRIPTION

The 2SC3057 is a silicon NPN planar general purpose, high power switching transistor fabricated with Fujitsu's unique Ring Emitter Transistor (RET) technology. RET devices are constructed with multiple emitters connected through diffused ballast resistors which provide uniform current density. This structure permits the design of high power transistors with superior switching characteristics and frequency response in high current applications.

The 2SC3057 is especially well-suited for high speed/high voltage switching systems or other applications where large SOA is required.

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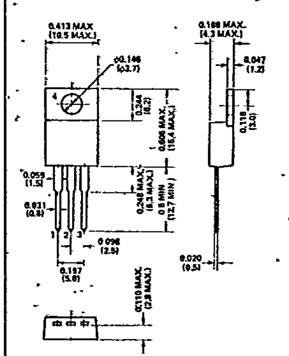
Features

* High voltage
* Ultra-fast switching
* Large safe operating area

Applications

* Switching regulators
* Motor controls
* Ultrasonic oscillators
* Class C and D amplifiers
* Deflection circuits

OUTLINE DIMENSION JEDEC TO-220



1: Base 2: Collector
3: Emitter 4: Fin (Collector)
Dimension in inches and (millimeters)

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	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	10	A
Collector Current-Pulsed $P_W \leq 10ms$, D.R. $\leq 2\%$	I_{CP}	15	A
Base Current-Continuous	I_B	5	A
Collector Power Dissipation ($T_C = 25°C$)	P_C	50	W
Junction Temperature	T_j	+150	°C
Storage Temperature Range	T_{stg}	−65 ~ +150	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Parameter	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Unit
Collector to Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 1mA$, $I_E = 0$	450	–	–	V
Emitter to Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 1mA$, $I_C = 0$	7	–	–	V
Collector to Emitter Sustaining Voltage	$V_{CEO(sus)}$	$I_C = 0.8A$, $R_{BE} = \infty \Omega$	400	–	–	V
Collector to Emitter Sustaining Voltage	$V_{CEX(sus)}$	$I_C = 2A$, $I_{B2} = -1A$, $L = 200 \mu H$ (*1)	450	–	–	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 450V$, $I_E = 0$	–	–	100	μA
Collector Cutoff Current	I_{CBO}	$V_{CB} = 400V$, $I_E = 0$, $T_C = 100°C$	–	–	1	mA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6V$, $I_C = 0$	–	–	100	μA
DC Current Gain	h_{FE}	$V_{CE} = 5V$, $I_C = 5A$ (*2)	10	16	40	–
Collector to Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 5A$, $I_B = 1A$ (*2)	–	0.46	1.0	V
Base to Emitter Saturation Voltage	$V_{BE(sat)}$		–	1.2	1.5	V
Output Capacitance	C_{ob}	$V_{CB} = 10V$, $I_E = 0$, $f = 1MHz$	–	100	–	pF
Gain Bandwidth Product	f_T	$V_{CE} = 10V$, $I_C = 1A$	–	32	–	MHz
Rise Time	t_r	$V_{CC} = 150V$ (*1) $I_C = 5A$, $I_{B1} = -I_{B2} = 1A$	–	0.09	0.5	μs
Storage Time	t_{stg}		–	1.90	2.5	μs
Fall Time	t_f		–	0.14	0.3	μs

*1 Test Circuit *2 Pulsed $P_W \leq 300 \mu s$, Duty Ratio $\leq 6\%$

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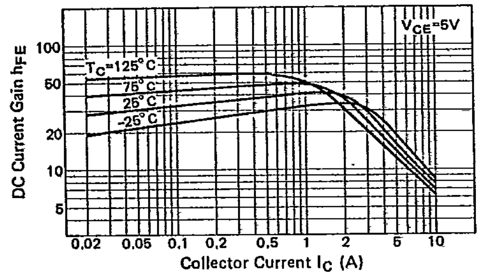
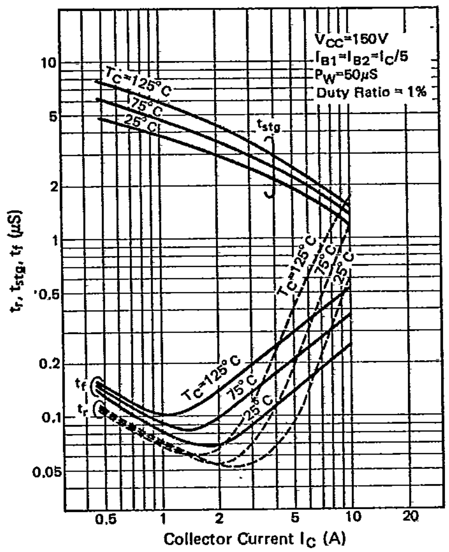
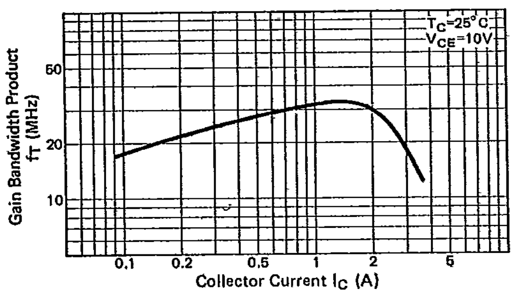
DC CURRENT GAIN



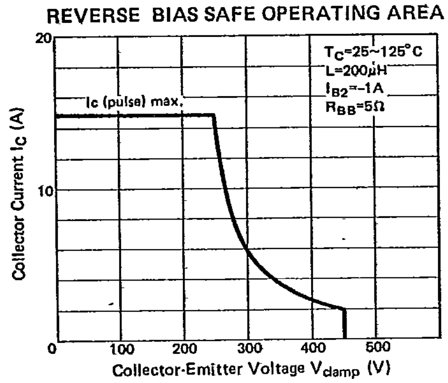
SWITCHING TIME



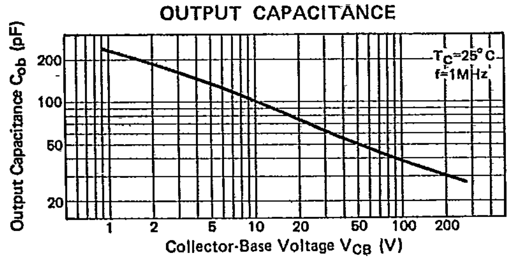
GAIN BANDWIDTH PRODUCT



REVERSE BIAS SAFE OPERATING AREA

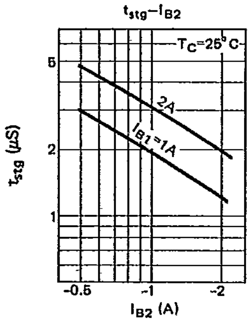


OUTPUT CAPACITANCE

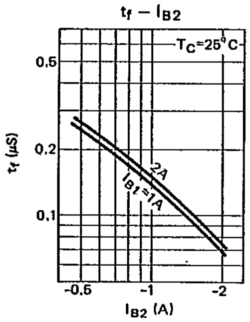


SWITCHING TIME

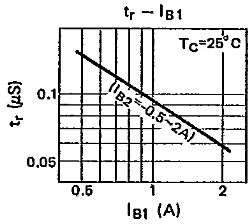
$t_{stg}-I_{B2}$



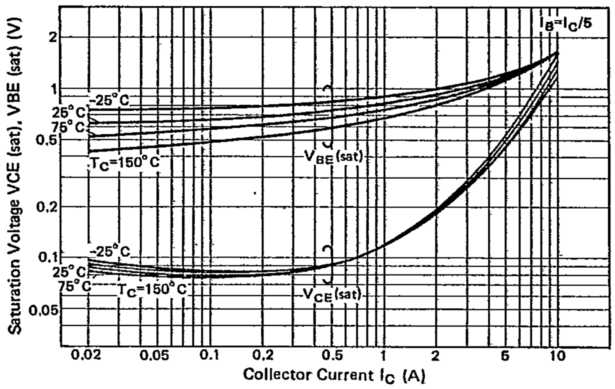
$t_f - I_{B2}$



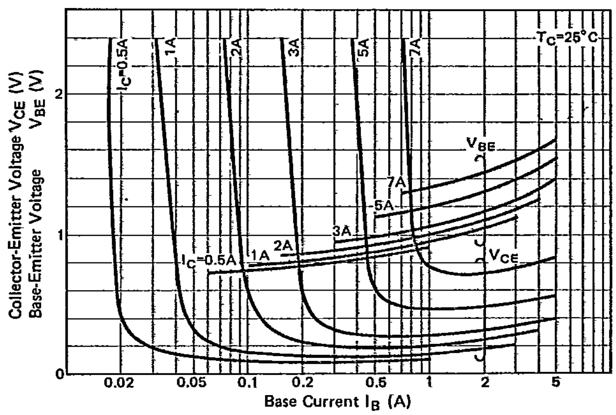
$t_r - I_{B1}$



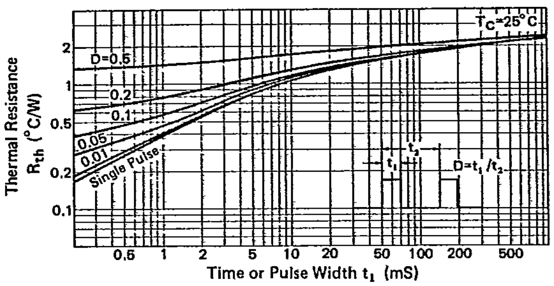
SATURATION VOLTAGE



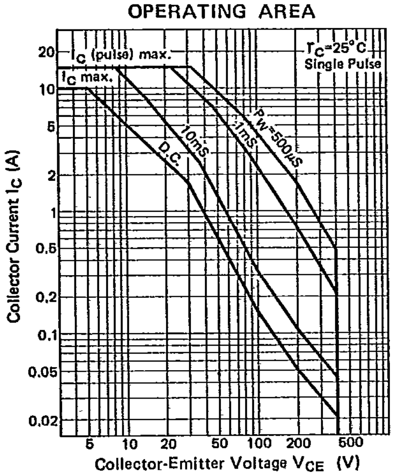
COLLECTOR SATURATION REGION



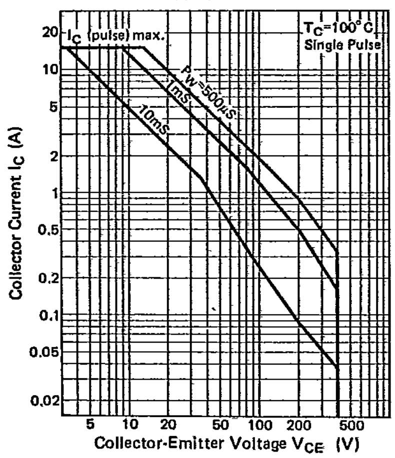
THERMAL RESPONSE



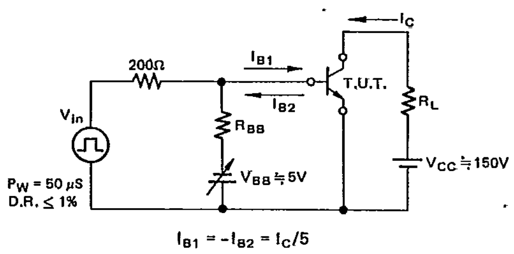
FORWARD BIAS SAFE OPERATING AREA

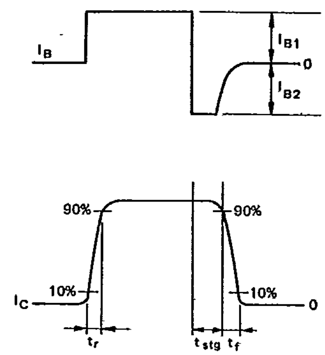


FORWARD BIAS SAFE OPEARTING AREA

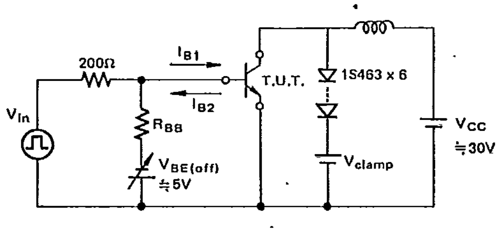


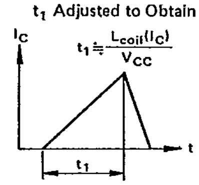
TEST CIRCUIT USED FOR MEASUREMENT OF SWITCHING TIME (RESISTIVE)





TEST CIRCUIT USED FOR MEASUREMENT OF $V_{CEX(SUS)}$ AND REVERSE BIAS SAFE OPERATING AREA





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

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