T-33-13
T-33-23

January 1990
Edition 1.1

FUJITSU

PRODUCT PROFILE

# 2SA1041, 2SA1042, 2SC2431, 2SC2432

## Silicon High Speed Power Transistor

## DESCRIPTION

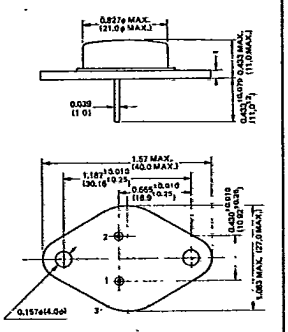
This series are silicon PNP/NPN planer general purpose, high power switching transistors fabricated with Fujitsu's unique Ring Emitter Transistor (RET) technology. RET devices are constructed with multiple emitters connected through diffused ballast resistors which provide uniform current density. This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

This series are especially well-suited for high speed/high voltage switching systems or other applications where large SOA is required.

**Features**

| | 2SA1041, 2SA1042 | 2SC2431, 2SC2432 |
|---|---|---|
| ★ $f_T$ : | 60MHz (typ.) | 80MHz (typ.) |
| ★ $t_r$ : | 0.15 μs (typ.) | 0.20 μs (typ.) |
| ★ $t_s$ : | 0.24 μs (typ.) | 0.70 μs (typ.) |
| ★ $t_f$ : | 0.08 μs (typ.) | 0.12 μs (typ.) |
| ★ Excellent Safe Operating Area : | 2SA1041–2SC2431 | |
| ★ Complements: | 2SA1042–2SC2432 | |

**OUTLINE DIMENSION**
**JEDEC TO-3**



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

## ABSOLUTE MAXIMUM RATINGS

| Rating | Symbol | Value | | Value | | Unit |
|---|---|---|---|---|---|---|
| | | 2SA1041 | 2SA1042 | 2SC2431 | 2SC2432 | |
| Collector to Base Voltage | $V_{CBO}$ | -120 | -70 | 120 | 70 | V |
| Emitter to Base Voltage | $V_{EBO}$ | -5 | -5 | 5 | 5 | V |
| Collector to Emitter Voltage | $V_{CEO}$ | -120 | -70 | 120 | 70 | V |
| Collector Current | $I_C$ | -15 | -15 | 15 | 15 | A |
| Base Current | $I_B$ | -5 | -5 | 5 | 5 | A |
| Collector Power Dissipation ($T_C$ = 25°C) | $P_C$ | 100 | 100 | 100 | 100 | W |
| Junction Temperature | $T_j$ | +175 | | +175 | | °C |
| Storage Temperature Range | $T_{stg}$ | -65 ~ +175 | | -65 ~ +175 | | °C |

## ELECTRICAL CHARACTERISTICS ($T_a$ = 25°C)

### 2SA1041, 2SA1042

| Parameter | Symbol | Test Conditions | Limits 2SA1041 Min. | 2SA1041 Typ. | 2SA1041 Max. | 2SA1042 Min. | 2SA1042 Typ. | 2SA1042 Max. | Unit |
|---|---|---|---|---|---|---|---|---|---|
| Collector Cutoff Current | $I_{CBO}$ | $V_{CB}$ = −120V, $I_E$ = 0 | – | −50 | – | – | – | – | μA |
| Collector Cutoff Current | $I_{CBO}$ | $V_{CB}$ = −70V, $I_E$ = 0 | – | – | – | – | – | −50 | μA |
| Emitter Cutoff Current | $I_{EBO}$ | $V_{EB}$ = −4V, $I_C$ = 0 | – | – | −50 | – | – | −50 | μA |
| Collector Cutoff Current | $I_{CEO}$ | $V_{CE}$ = −120V, $I_B$ = 0 | – | – | −1 | – | – | – | mA |
| Collector Cutoff Current | $I_{CEO}$ | $V_{CE}$ = −70V, $I_B$ = 0 | – | – | – | – | – | −1 | mA |
| Collector to Base Breakdown Voltage | $V_{(BR)CBO}$ | $I_C$ = −50μA, $I_E$ = 0 | −120 | – | – | −70 | – | – | V |
| Emitter to Base Breakdown Voltage | $V_{(BR)EBO}$ | $I_E$ = −1mA, $I_C$ = 0 | −5 | – | – | −5 | – | – | V |
| Collector to Emitter Breakdown Voltage | $V_{(BR)CEO}$ | $I_C$ = −10mA, $R_{BE}$ = ∞ | −120 | – | – | −70 | – | – | V |
| DC Current Gain | $h_{FE1}$ | $V_{CE}$ = −5V, $I_C$ = −1.5A * | 35 | – | 200 | 35 | – | 200 | – |
| DC Current Gain | $h_{FE2}$ | $V_{CE}$ = −5V, $I_C$ = −15A * | 7 | – | – | 10 | – | – | – |
| Collector to Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C$ = −7A, $I_B$ = −0.7A * | – | −0.6 | −1.5 | – | −0.6 | −1.5 | V |
| Base to Emitter Saturation Voltage | $V_{BE(sat)}$ | | – | −1.2 | −1.8 | – | −1.2 | −1.8 | V |
| Gain-Bandwidth Product | $f_T$ | $V_{CE}$ = −10V, $I_C$ = −1A | – | 60 | – | – | 60 | – | MHz |
| Output Capacitance | $C_{ob}$ | $V_{CB}$ = −10V, $I_E$ = 0, f = 1MHz | – | 350 | – | – | 350 | – | pF |
| Rise Time | $t_r$ | $I_C$ = −7.5A, $R_L$ = 4Ω, $I_{B1}$ = −$I_{B2}$ = −0.75A | – | 0.15 | 0.8 | – | 0.15 | 0.8 | μs |
| Storage Time | $t_{stg}$ | | – | 0.24 | 1.0 | – | 0.24 | 1.0 | μs |
| Fall Time | $t_f$ | | – | 0.08 | 0.8 | – | 0.08 | 0.8 | μs |

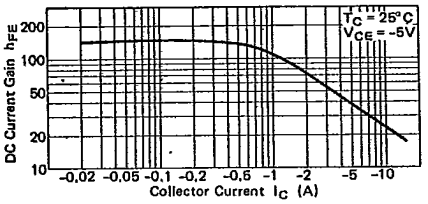
### 2SC2431, 2SC2432

| Parameter | Symbol | Test Conditions | Limits 2SC2431 Min. | 2SC2431 Typ. | 2SC2431 Max. | 2SC2432 Min. | 2SC2432 Typ. | 2SC2432 Max. | Unit |
|---|---|---|---|---|---|---|---|---|---|
| Collector Cutoff Current | $I_{CBO}$ | $V_{CB}$ = 120V, $I_E$ = 0 | – | – | 50 | – | – | – | μA |
| Collector Cutoff Current | $I_{CBO}$ | $V_{CB}$ = 70V, $I_E$ = 0 | – | – | – | – | – | 50 | μA |
| Emitter Cutoff Current | $I_{EBO}$ | $V_{EB}$ = 4V, $I_C$ = 0 | – | – | 50 | – | – | 50 | μA |
| Collector Cutoff Current | $I_{CEO}$ | $V_{CE}$ = 120V, $I_B$ = 0 | – | – | 1 | – | – | – | mA |
| Collector Cutoff Current | $I_{CEO}$ | $V_{CE}$ = 70A, $I_B$ = 0 | – | – | – | – | – | 1 | mA |
| Collector to Base Breakdown Voltage | $V_{(BR)CBO}$ | $I_C$ = 50 μA, $I_E$ = 0 | 120 | – | – | 70 | – | – | V |
| Emitter to Base Breakdown Voltage | $V_{(BR)EBO}$ | $I_E$ = 1mA, $I_C$ = 0 | 5 | – | – | 5 | – | – | V |
| Collector to Emitter Breakdown Voltage | $V_{(BR)CEO}$ | $I_C$ = 10mA, $R_{BE}$ = ∞ | 120 | – | – | 70 | – | – | V |
| DC Current Gain | $h_{FE1}$ | $V_{CE}$ = 5V, $I_C$ = 1.5A * | 35 | – | 200 | 35 | – | 200 | – |
| DC Current Gain | $h_{FE2}$ | $V_{CE}$ = 5V, $I_C$ = 15A * | 7 | – | – | 10 | – | – | – |
| Collector to Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C$ = 7A, $I_B$ = 0.7A * | – | 0.4 | 1.5 | – | 0.4 | 1.5 | V |
| Base to Emitter Saturation Voltage | $V_{BE(sat)}$ | | – | 1.2 | 1.8 | – | 1.2 | 1.8 | V |
| Gain-Bandwidth Product | $f_T$ | $V_{CE}$ = 10V, $I_C$ = 1A | – | 80 | – | – | 80 | – | MHz |
| Output Capacitance | $C_{ob}$ | $V_{CB}$ = 10V, $I_E$ = 0, f = 1MHz | – | 200 | – | – | 200 | – | pF |
| Rise Time | $t_r$ | $I_C$ = 7.5A, $R_L$ = 4Ω, $I_{B1}$ = −$I_{B2}$ = 0.75A | – | 0.20 | 0.8 | – | 0.20 | 0.8 | μs |
| Storage Time | $t_{stg}$ | | – | 0.70 | 1.0 | – | 0.70 | 1.0 | μs |
| Fall Time | $t_f$ | | – | 0.12 | 0.8 | – | 0.12 | 0.8 | μs |

* Pulsed $P_W \leq 300\,\mu$, Duty Ratio ≦ 6%

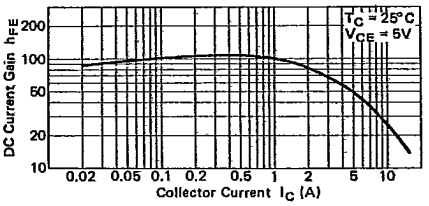
2SA1041, 2SA1042

DC CURRENT GAIN

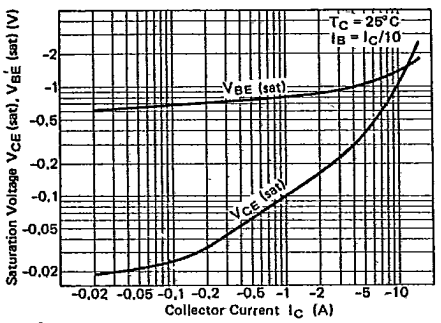



2SC2431, 2SC2432

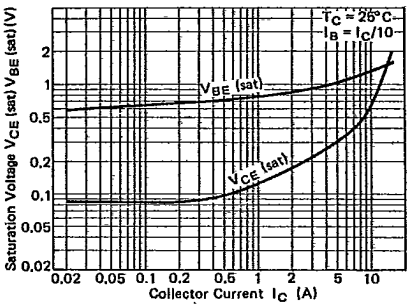
DC CURRENT GAIN



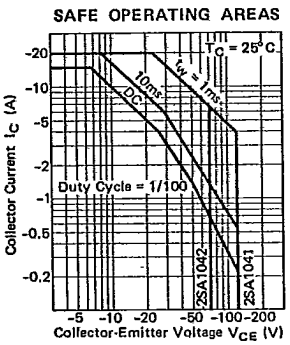

SATURATION VOLTAGE



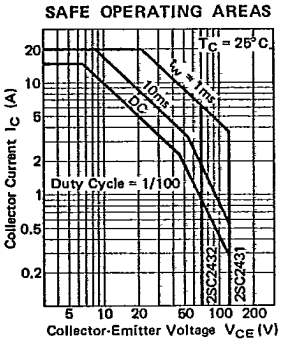

SATURATION VOLTAGE




SAFE OPERATING AREAS



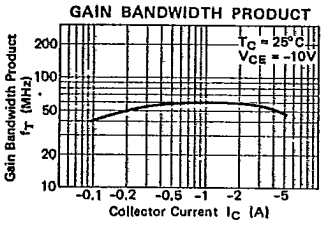

SAFE OPERATING AREAS



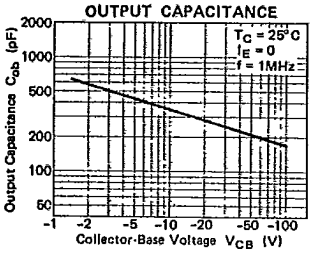
## 2SA1041, 2SA1042, 2SC2431, 2SC2432

2SA1041, 2SA1042

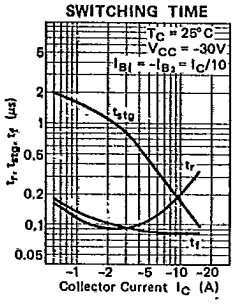
GAIN BANDWIDTH PRODUCT




OUTPUT CAPACITANCE

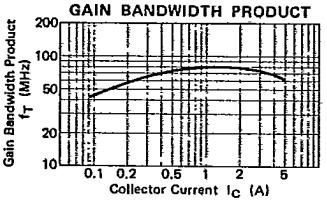



SWITCHING TIME

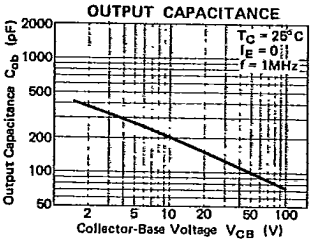



2SC2431, 2SC2432

GAIN BANDWIDTH PRODUCT




OUTPUT CAPACITANCE




SWITCHING TIME