Ordering number:EN4726

# FP302

TR:NPN Epitaxial Planar Silicon Transistor
SBD:Schottky Barrier Diode

## DC-DC Converter Applications

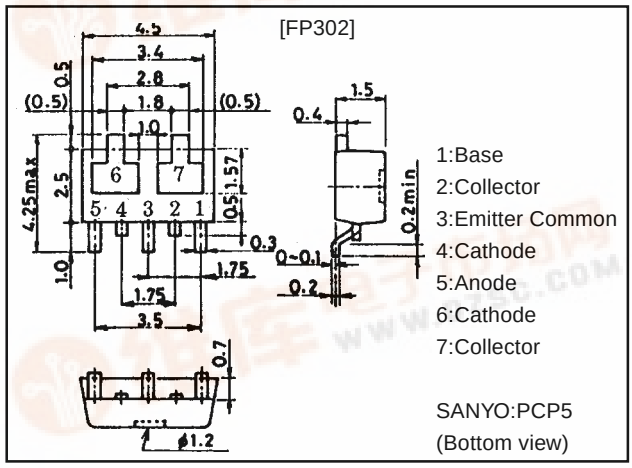
## Features

- Composite type with NPN transistor and Schottky barrier diode facilitating high-density mounting.
- The FP302 is composed of chips equivalent to the 2SC4520 and SB05-05CP, which are placed in one package.

## Package Dimensions

unit:mm

2099A



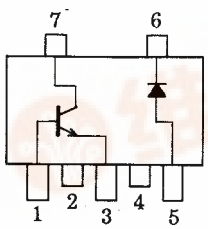

## Specifications

### Absolute Maximum Ratings at Ta = 25˚C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| [TR] | | | | |
| Collector-to-Base Voltage | $V_{CBO}$ | | 60 | V |
| Collector-to-Emitter Voltage | $V_{CEO}$ | | 45 | V |
| Emitter-to-Base Voltage | $V_{EBO}$ | | 5 | V |
| Collector Current | $I_C$ | | 1.5 | A |
| Collector Current (Pulse) | $I_{CP}$ | | 3 | A |
| Base Current | $I_B$ | | 300 | mA |
| Collector Dissipation | $P_C$ | Mounted on ceramic board (250mm²×0.8mm) | 0.8 | W |
| Junction Temperature | Tj | | 150 | ˚C |
| Storage Temperature | Tstg | | –55 to +150 | ˚C |
| [SBD] | | | | |
| Repetitive Peak Reverse Voltage | $V_{RRM}$ | | 50 | V |
| Non-repetitive Peak Reverse Surge Voltage | $V_{RSM}$ | | 55 | V |
| Average Rectified Current | $I_O$ | | 500 | mA |
| Surge Forward Current | $I_{FSM}$ | 50Hz sine wave, 1 cycle | 5 | A |
| Junction Temperature | Tj | | –55 to +125 | ˚C |
| Storage Temperature | Tstg | | –55 to +125 | ˚C |

Continued on next page.

### Electrical Connection




1:Base
2:Collector
3:Emitter Common
4:Cathode
5:Anode
6:Cathode
7:Collector

(Top view)

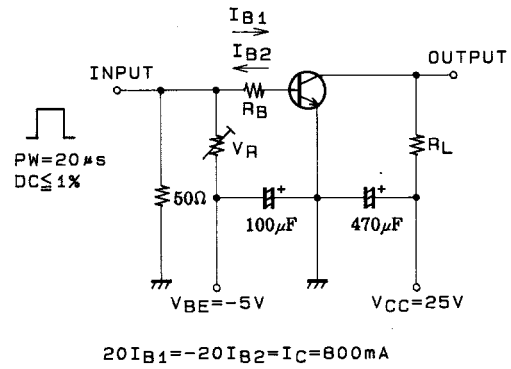
Continued from preceding page.

## Electrical Characteristics at Ta=25˚C

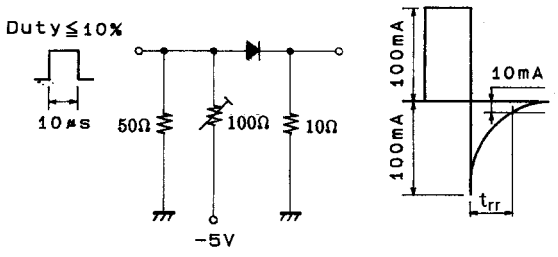
| Parameter | Symbol | Conditons | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| [TR] | | | | | | |
| Collector Cutoff Current | $I_{CBO}$ | $V_{CB}$=45V, $I_E$=0 | | | 1.0 | μA |
| Emitter Cutoff Current | $I_{EBO}$ | $V_{EB}$=3V, $I_C$=0 | | | 1.0 | μA |
| DC Current Gain | $h_{FE}1$ | $V_{CE}$=2V, $I_C$=100mA | 100 | | 400 | |
| | $h_{FE}2$ | $V_{CE}$=2V, $I_C$=1.5A | 40 | | | |
| Gain-Bandwidth Product | $f_T$ | $V_{CE}$=2V, $I_C$=100mA | | 300 | | MHz |
| Output Capacitance | Cob | $V_{CB}$=10V, f=1MHz | | 13 | | pF |
| C-E Saturation Voltage | $V_{CE(sat)}$ | $I_C$=800mA, $I_B$=40mA | | 0.25 | 0.7 | V |
| B-E Saturation Voltage | $V_{BE(sat)}$ | $I_C$=800mA, $I_B$=40mA | | 0.9 | 1.3 | V |
| C-B Breakdown Voltage | $V_{(BR)CBO}$ | $I_C$=10μA, $I_E$=0 | 60 | | | V |
| C-E Breakdown Voltage | $V_{(BR)CEO}$ | $I_C$=1mA, $R_{BE}$=∞ | 45 | | | V |
| E-B Breakdown Voltage | $V_{(BR)EBO}$ | $I_E$=10μA, $I_C$=0 | 5 | | | V |
| Turn-ON Time | $t_{on}$ | See specified Test Circuit | | 50 | | ns |
| Storage Time | $t_{stg}$ | See specified Test Circuit | | 150 | | ns |
| Turn-OFF Time | $t_{off}$ | See specified Test Circuit | | 180 | | ns |
| [SBD] | | | | | | |
| Reverse Voltage | $V_R$ | $I_R$=200μA | 50 | | | V |
| Forward Voltage | $V_F$ | $I_F$=500mA | | | 0.55 | V |
| Reverse Current | $I_R$ | $V_R$=25V | | | 50 | μA |
| Interterminal Capacitance | C | $V_R$=10V, f=1MHz cycle | | 22 | | pF |
| Reverse Recovery Time | $t_{rr}$ | $I_F$=$I_R$=100mA, See sepcified Test Circuit. | | | 10 | ns |
| Thermal Resistance | Rthj-a | Mounted on ceramic board (250mm²×0.8mm) | | 170 | | ˚C/W |

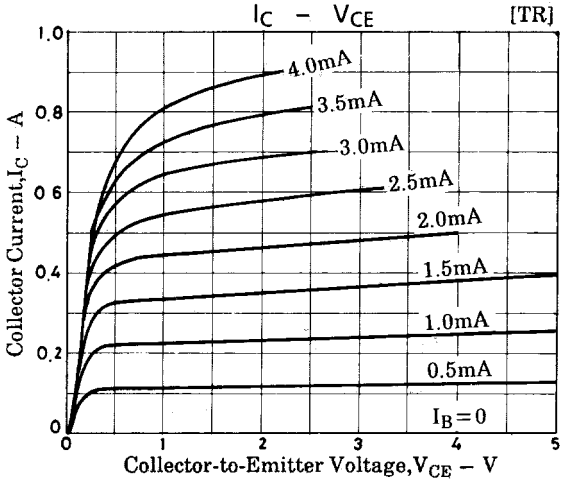
## Switching Time Test Circuit

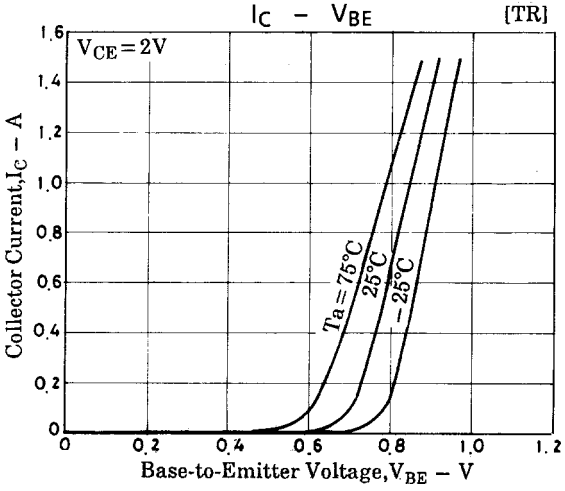
[TR]

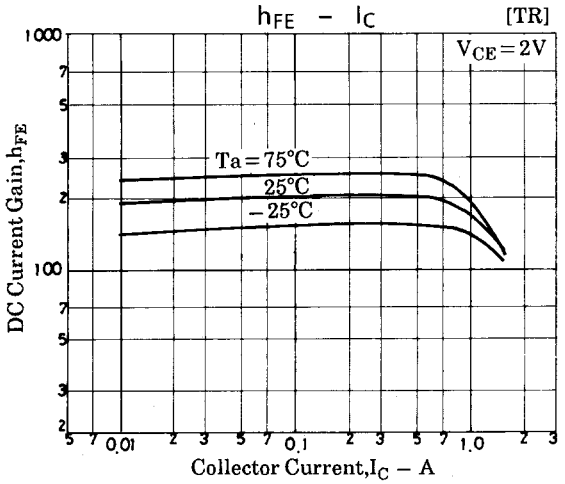


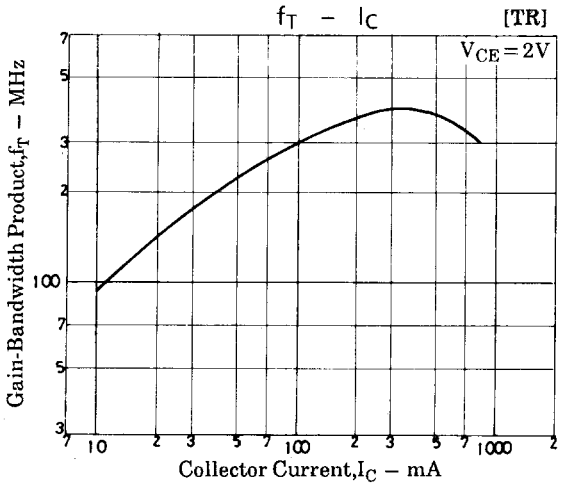

[SBD]

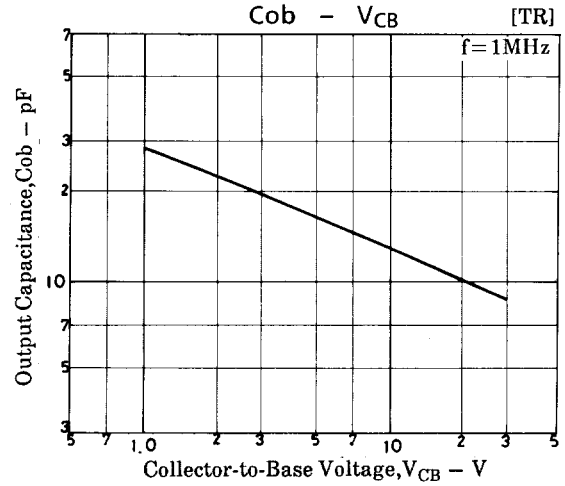


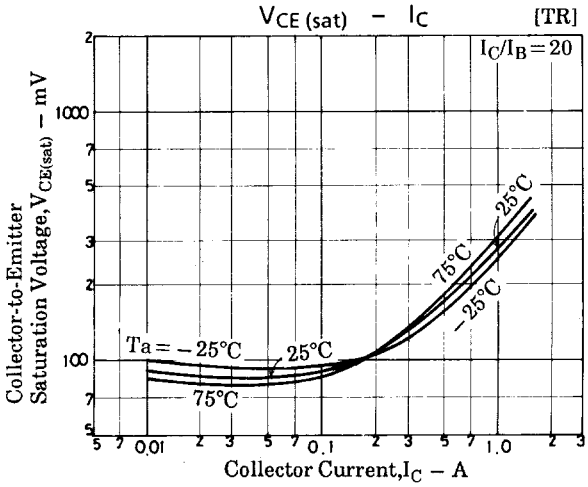



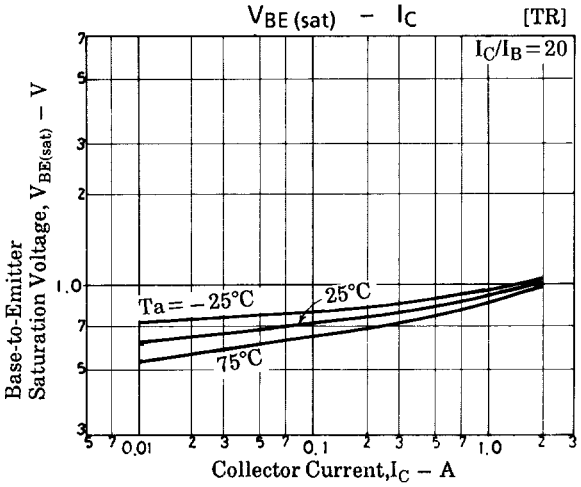



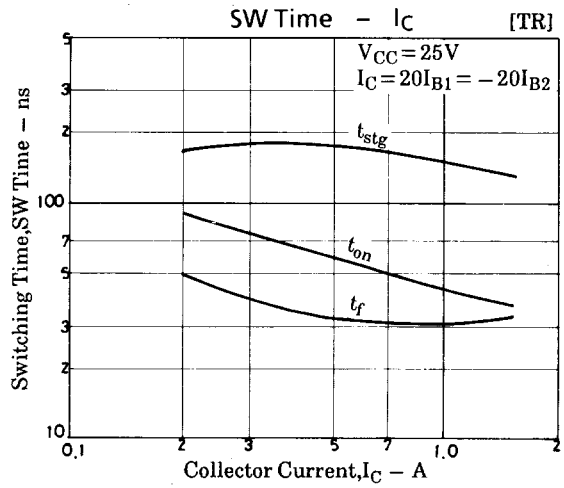

hFE – IC
[TR]
VCE = 2V
Ta = 75°C
25°C
– 25°C
DC Current Gain, hFE
Collector Current, IC – A

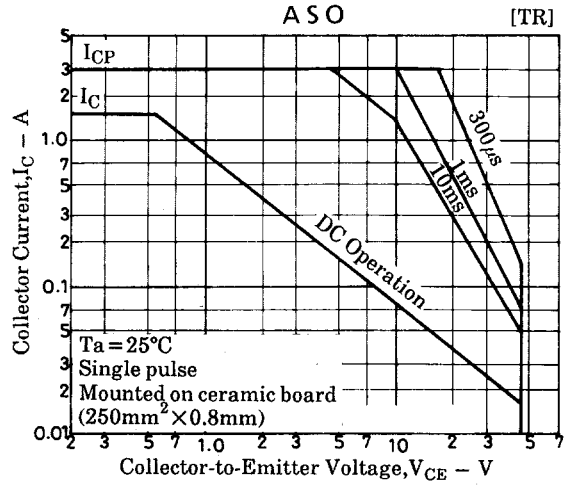

fT – IC
[TR]
VCE = 2V
Gain-Bandwidth Product, fT – MHz
Collector Current, IC – mA

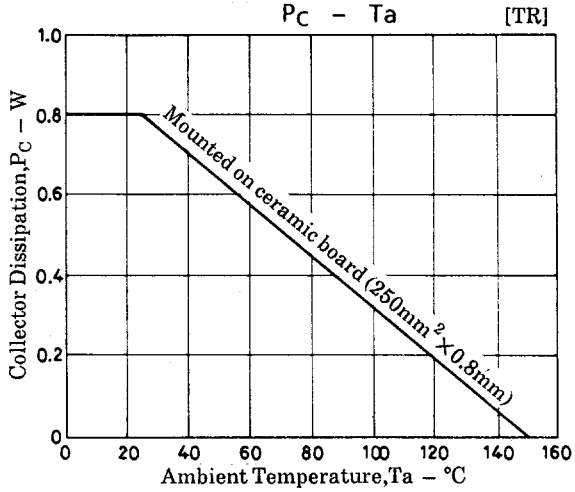

Cob – VCB
[TR]
f = 1MHz
Output Capacitance, Cob – pF
Collector-to-Base Voltage, VCB – V


VCE (sat) – IC
[TR]
IC/IB = 20
Collector-to-Emitter Saturation Voltage, VCE(sat) – mV
Ta = – 25°C
25°C
75°C
25°C
75°C
– 25°C
Collector Current, IC – A


VBE (sat) – IC
[TR]
IC/IB = 20
Base-to-Emitter Saturation Voltage, VBE(sat) – V
Ta = – 25°C
25°C
75°C
Collector Current, IC – A


SW Time – IC
[TR]
VCC = 25V
IC = 20IB1 = – 20IB2
tstg
ton
tf
Switching Time, SW Time – ns
Collector Current, IC – A


A S O
[TR]
ICP
IC
300μs
1ms
10ms
DC Operation
Ta = 25°C
Single pulse
Mounted on ceramic board
(250mm2×0.8mm)
Collector Current, IC – A
Collector-to-Emitter Voltage, VCE – V


PC – Ta
[TR]
Mounted on ceramic board (250mm2×0.8mm)
Collector Dissipation, PC – W
Ambient Temperature, Ta – °C