

# Bipolar Transistor

–50 V, –20 A, Low  $V_{CE(sat)}$ ,  
NPN TO–220F–3SG

## 2SA2210

### Features

- Adoption of MBIT Process
- Low Collector–to–Emitter Saturation Voltage
- Large Current Capacitance
- High–Speed Switching
- This is a Pb–Free Device

### Applications

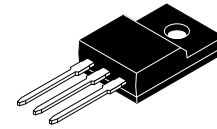
- Relay Drivers, Lamp Drivers, Motor Drivers

### Specifications

#### ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

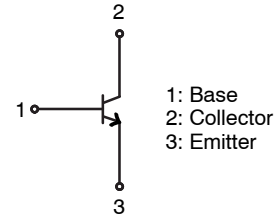
| Parameter                    | Symbol    | Condition                | Value       | Unit |
|------------------------------|-----------|--------------------------|-------------|------|
| Collector–to–Base Voltage    | $V_{CBO}$ |                          | –50         | V    |
| Collector–to–Emitter Voltage | $V_{CEO}$ |                          | –50         | V    |
| Emitter–to–Base Voltage      | $V_{EBO}$ |                          | –6          | V    |
| Collector Current            | $I_C$     |                          | –20         | A    |
| Collector Current (Pulse)    | $I_{CP}$  |                          | –25         | A    |
| Base Current                 | $I_B$     |                          | –3          | A    |
| Collector Dissipation        | $P_C$     |                          | 2           | W    |
|                              |           | $T_C = 25^\circ\text{C}$ | 30          | W    |
| Junction Temperature         | $T_J$     |                          | 150         | °C   |
| Storage Temperature          | $T_{stg}$ |                          | –55 to +150 | °C   |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



TO–220 Fullpack, 3–Lead /  
TO–220F–3SG  
CASE 221AT

### ELECTRICAL CONNECTION



### MARKING DIAGRAM



A2210 = Device Code  
YWW = Date Code (Year & Week)  
ZZ = Assembly Lot

### ORDERING INFORMATION

| Device     | Package              | Shipping  |
|------------|----------------------|-----------|
| 2SA2210–1E | TO–220F<br>(Pb–Free) | 50 / Tube |

## 2SA2210

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

| Parameter                               | Symbol        | Conditions                                        | Min | Typ  | Max  | Unit          |
|-----------------------------------------|---------------|---------------------------------------------------|-----|------|------|---------------|
| Collector Cutoff Current                | $I_{CBO}$     | $V_{CB} = -40\text{ V}, I_E = 0\text{ A}$         | –   | –    | –10  | $\mu\text{A}$ |
| Emitter Cutoff Current                  | $I_{EBO}$     | $V_{EB} = -4\text{ V}, I_C = 0\text{ A}$          | –   | –    | –10  | $\mu\text{A}$ |
| DC Current Gain                         | $h_{FE}$      | $V_{CE} = -2\text{ V}, I_C = -1\text{ A}$         | 150 | –    | 450  |               |
| Gain–Bandwidth Product                  | $f_T$         | $V_{CE} = -10\text{ V}, I_C = -1\text{ A}$        | –   | 140  | –    | MHz           |
| Output Capacitance                      | $C_{ob}$      | $V_{CB} = -10\text{ V}, f = 1\text{ MHz}$         | –   | 215  | –    | pF            |
| Collector–to–Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C = -7\text{ A}, I_B = -350\text{ mA}$         | –   | –200 | –500 | mV            |
| Base–to–Emitter Saturation Voltage      | $V_{BE(sat)}$ | $I_C = -7\text{ A}, I_B = -350\text{ mA}$         | –   | –    | –1.2 | V             |
| Collector–to–Base Breakdown Voltage     | $V_{(BR)CBO}$ | $I_C = -100\text{ }\mu\text{A}, I_E = 0\text{ A}$ | –50 | –    | –    | V             |
| Collector–to–Emitter Breakdown Voltage  | $V_{(BR)CEO}$ | $I_C = -1\text{ mA}, R_{BE} = \infty$             | –50 | –    | –    | V             |
| Emitter–to–Base Breakdown Voltage       | $V_{(BR)EBO}$ | $I_E = -100\text{ }\mu\text{A}, I_C = 0\text{ A}$ | –6  | –    | –    | V             |
| Turn–On Time                            | $t_{on}$      | See specified Test Circuit                        |     | 60   | –    | ns            |
| Storage Time                            | $t_{stg}$     |                                                   |     | 270  | –    | ns            |
| Fall Time                               | $t_f$         |                                                   |     | 20   | –    | ns            |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

### Switching Time Test Circuit

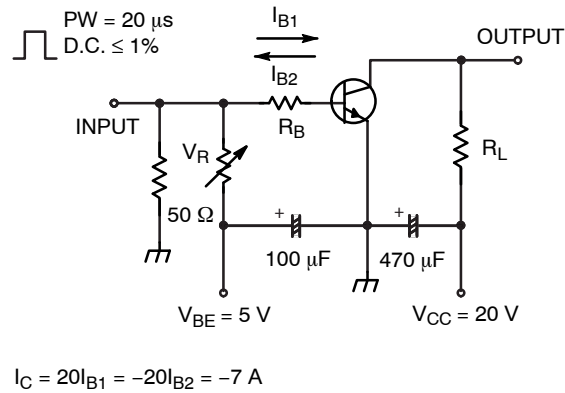
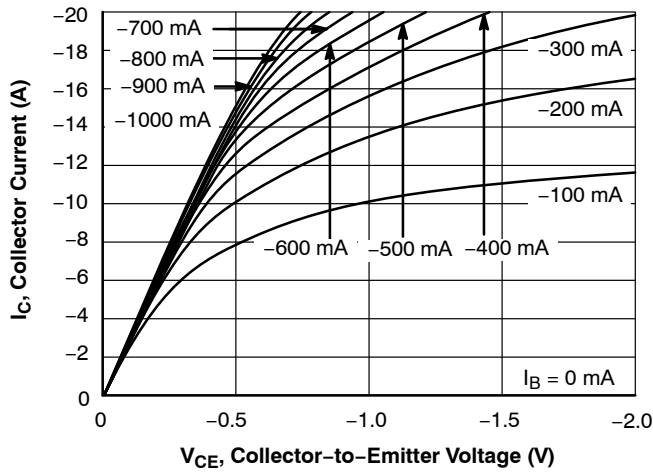
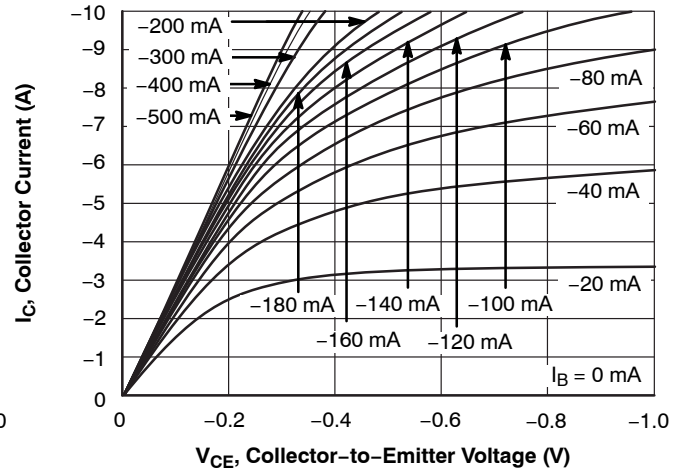
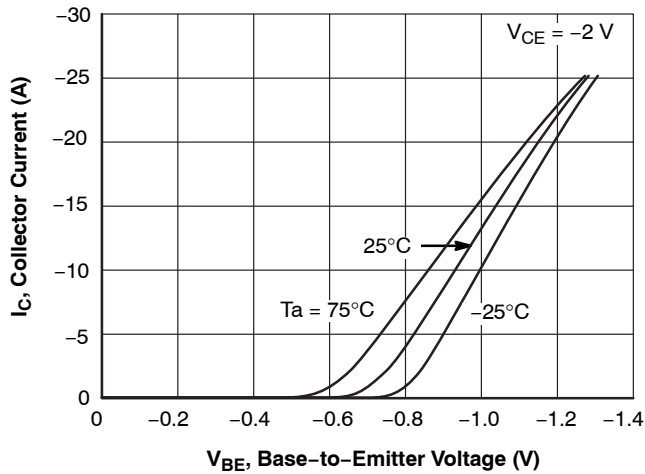
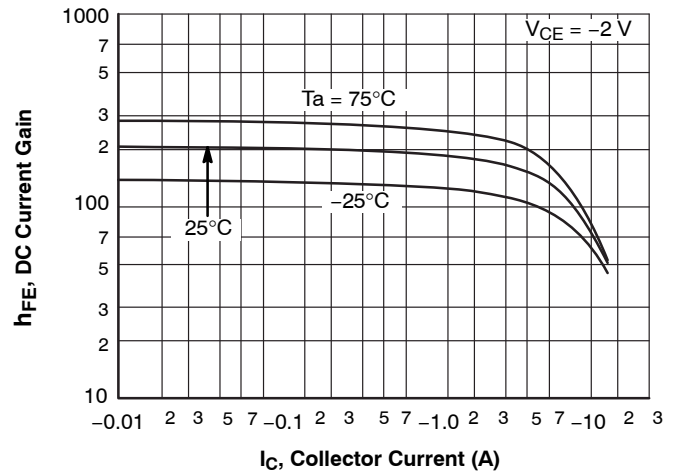
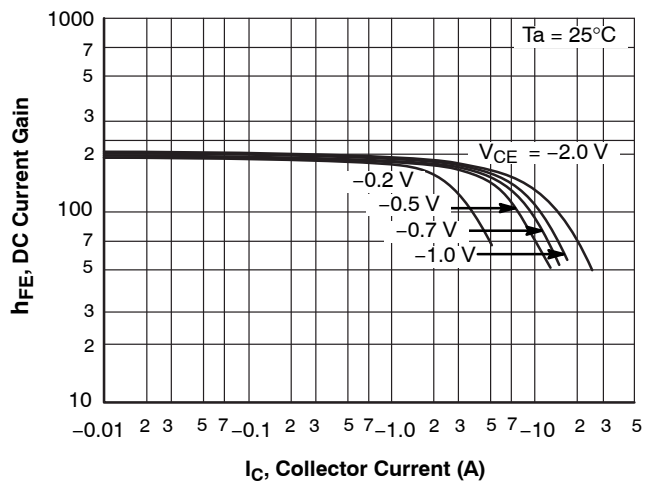
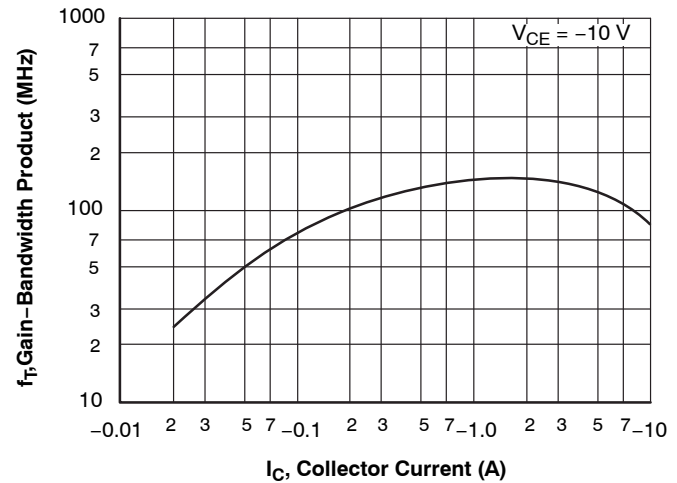


Figure 1. Switching Time Test Circuit

## TYPICAL CHARACTERISTICS

Figure 2.  $I_C - V_{CE}$ Figure 3.  $I_C - V_{CE}$ Figure 4.  $I_C - V_{BE}$ Figure 5.  $h_{FE} - I_C$ Figure 6.  $h_{FE} - I_C$ Figure 7.  $F_T - I_C$

TYPICAL CHARACTERISTICS (continued)

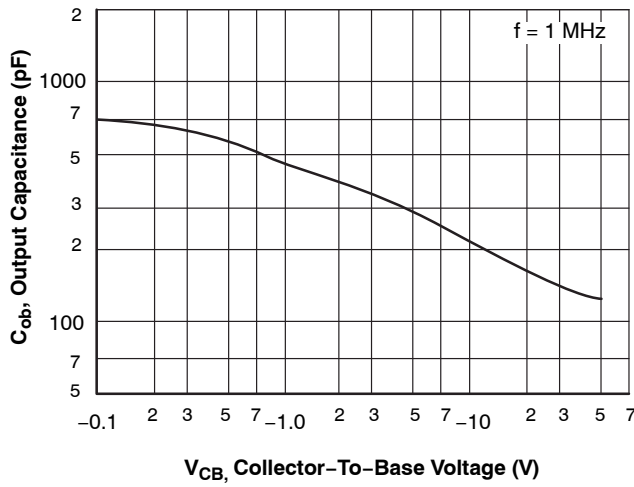


Figure 8.  $C_{ob} - V_{CB}$

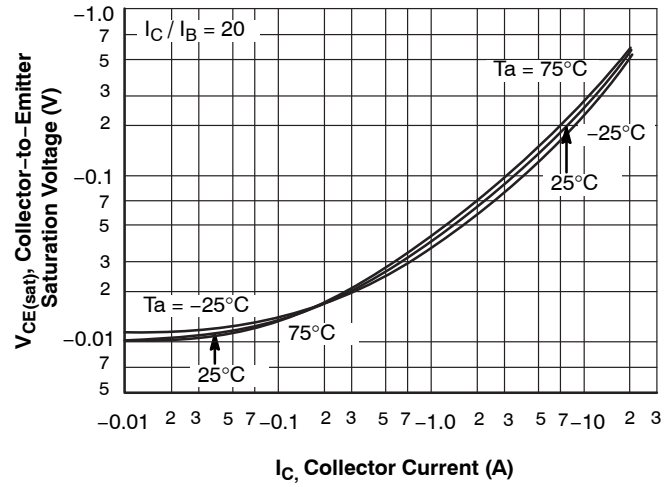


Figure 9.  $V_{CE(sat)} - I_C$

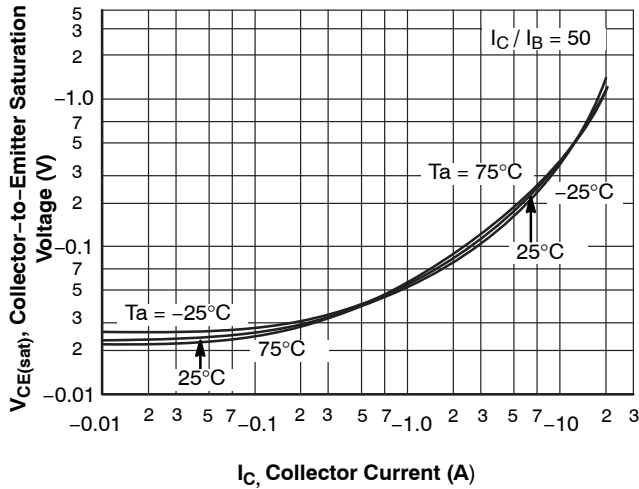


Figure 10.  $V_{CE(sat)} - I_C$

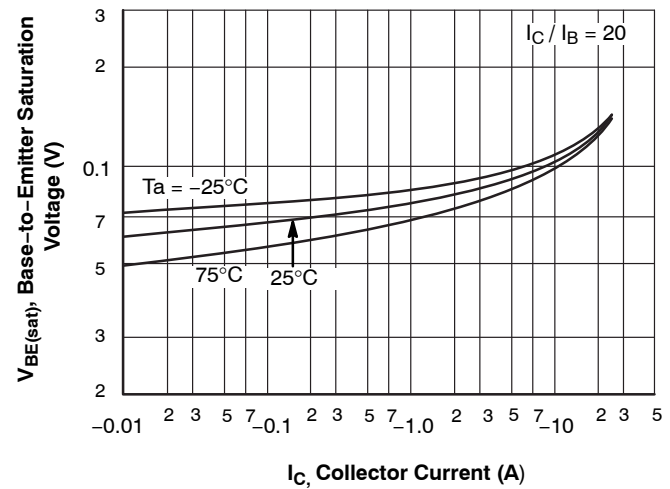


Figure 11.  $V_{BE(sat)} - I_C$

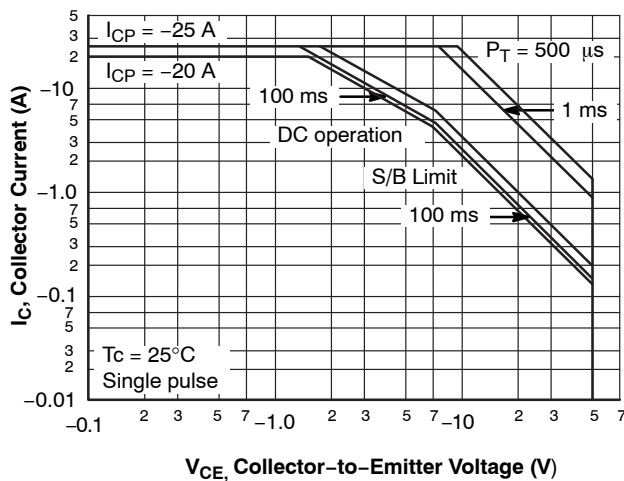


Figure 12. Forward Bias ASO

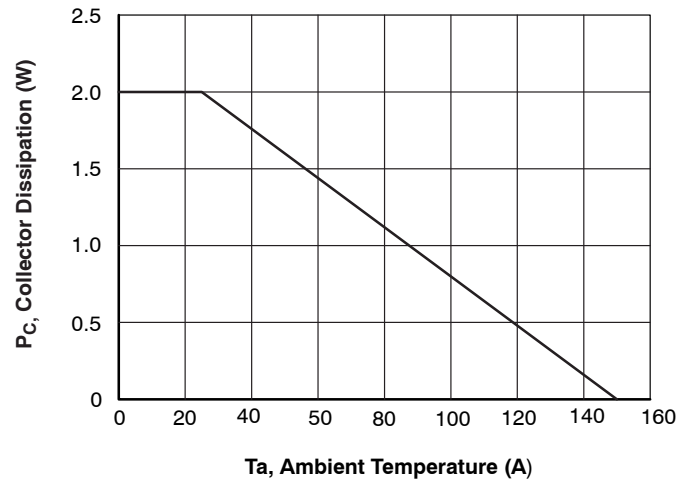


Figure 13.  $P_C - T_a$

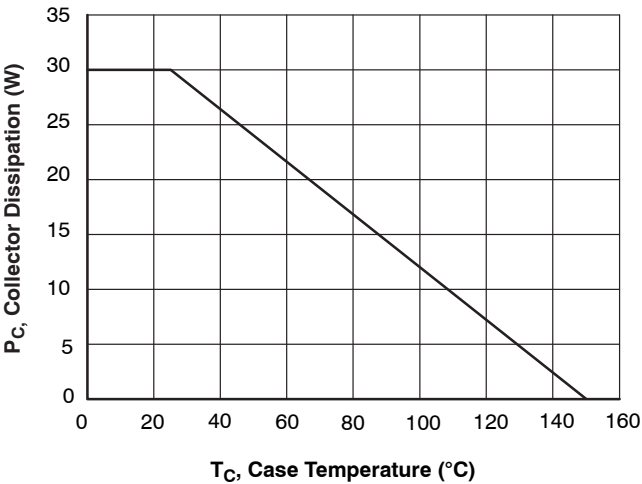
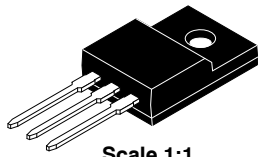


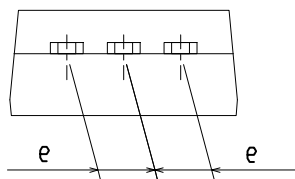
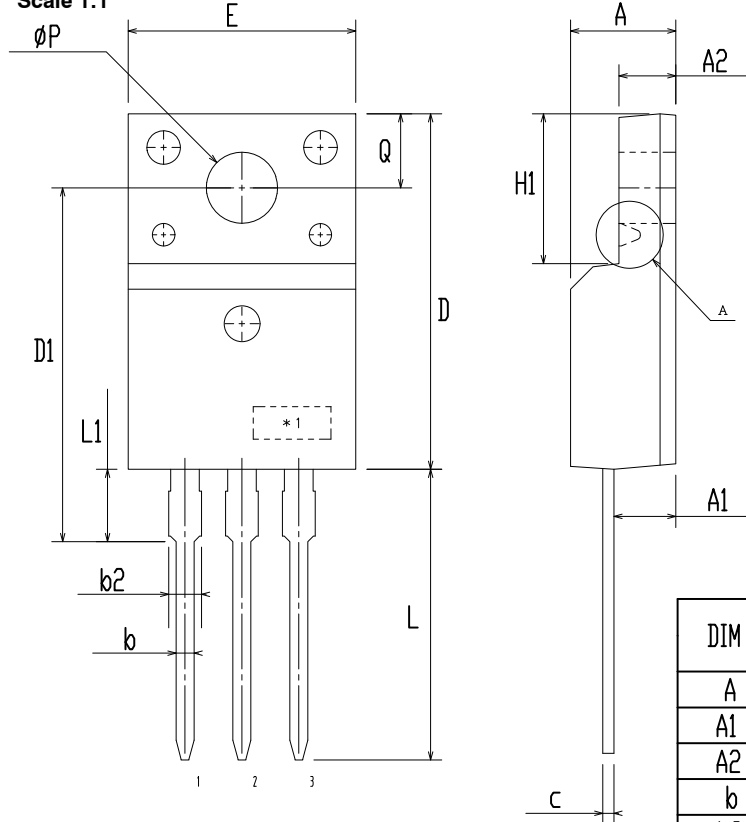
Figure 14.  $P_C - T_C$

**TO-220 Fullpack, 3-Lead / TO-220F-3SG**  
**CASE 221AT**  
**ISSUE B**

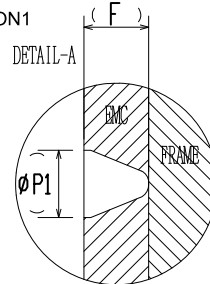
DATE 19 JAN 2021



Scale 1:1



OPTION1



| DIM  | MILLIMETERS |       |       |
|------|-------------|-------|-------|
|      | MIN         | NOM   | MAX   |
| A    | 4.50        | 4.70  | 4.90  |
| A1   | 2.56        | 2.76  | 2.96  |
| A2   | 2.34        | 2.54  | 2.74  |
| b    | 0.70        | 0.80  | 0.90  |
| b2   | ~           | ~     | 1.47  |
| c    | 0.45        | 0.50  | 0.60  |
| D    | 15.67       | 15.87 | 16.07 |
| D1   | 15.60       | 15.80 | 16.00 |
| E    | 9.96        | 10.16 | 10.36 |
| e    | 2.34        | 2.54  | 2.74  |
| F    | ~           | 0.84  | ~     |
| H1   | 6.48        | 6.68  | 6.88  |
| L    | 12.78       | 12.98 | 13.18 |
| L1   | 3.03        | 3.23  | 3.43  |
| Ø P  | 2.98        | 3.18  | 3.38  |
| Ø P1 | ~           | 1.00  | ~     |
| Q    | 3.20        | 3.30  | 3.40  |

**NOTES:**

A. DIMENSION AND TOLERANCE AS ASME Y14.5-2009

B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUCTIONS.

C. OPTION 1 - WITH SUPPORT PIN HOLE

OPTION 2 - NO SUPPORT PIN HOLE

|                         |                                              |                                                                                                                                                                                     |
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| <b>DESCRIPTION:</b>     | <b>TO-220 FULLPACK, 3-LEAD / TO-220F-3SG</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                                  |

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