2SC6011

Audio Amplification Transistor

Features and Benefits

- Small package (TO-3P)
- High power handling capacity, 160 W
- Improved sound output by reduced on-chip impedance
- For professional audio (PA) applications, V_{CEO} = 200 V versions available
- Complementary to 2SA2151
- Recommended output driver: 2SC4832

Package: 3-Lead TO-3P

Not to scale

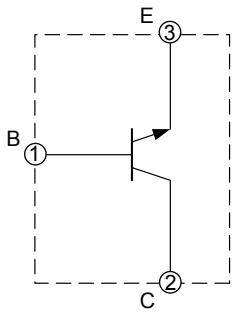
Description

By adapting the Sanken unique wafer-thinner technique, these NPN power transistors achieve power-up by decreasing thermal resistance, and provide higher voltage avalanche breakdown rating. The high power-handling capacity of the TO-3P package allows a smaller footprint on the circuit board design. This series of transistors is very well suited to not only multichannel applications for AV (audio-visual) amplifiers and receivers, but also parallel connection applications for PA (professional audio system) amplifiers.

Applications include the following:

- Single transistors for audio amplifiers
- Home audio amplifiers
- Professional audio amplifiers
- Automobile audio amplifiers
- Audio market
- Single transistors for general purpose

Equivalent Circuit



SANKEN ELECTRIC CO., LTD.
http://www.sanken-ele.co.jp/en/

SELECTION GUIDE

Part Number	Type	h_{FE} Rating	Packing
2SC6011*	NPN	Range O: 50 to 100	30 pieces per tube
		Range P: 70 tp 140	
		Range Y: 90 to 180	

*Specify h_{FE} range when ordering. If no h_{FE} range is specified, order will be fulfilled with either or both range O and range Y, depending upon availability.

ABSOLUTE MAXIMUM RATINGS at T_A = 25°C

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	200	V
Collector-Emitter Voltage	V_{CEO}	200	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	15	A
Base Current	I_B	4	A
Collector Power Dissipation	P_C	160	W
Junction Temperature	T_J	150	°C
Storage Temperature	T_{stg}	–55 to150	°C

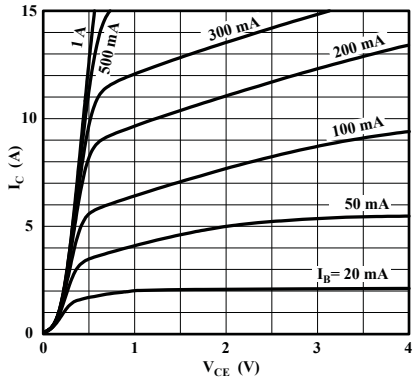
ELECTRICAL CHARACTERISTICS at T_A = 25°C

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Collector-Cutoff Current	I_{CBO}	V_{CB} = 200 V	–	–	10	µA
Emitter Cutoff Current	I_{EBO}	V_{EB} = 6 V	–	–	10	µA
Collector-Emitter Voltage	$V_{(BR)CEO}$	I_C = 50 mA	200	–	–	V
DC Current Transfer Ratio*	h_{FE}	V_{CE} = 4 V, I_C = 3 A	50	–	180	–
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 5 A, I_B = 0.5 A	–	–	0.5	V
Cutoff Frequency	f_T	V_{CE} = 12 V, I_E = –0.5 A	–	20	–	MHz
Output Capacitance	C_{OB}	V_{CB} = 10 V, I_E = 0 A, f = 1 MHz	–	270	–	pF

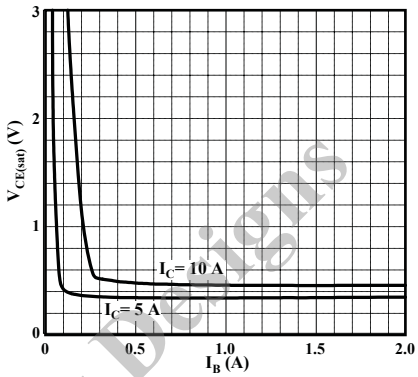
*h_{FE} rating: 50 to 100 (O brand on package), 70 to 140 (P), 90 to 180 (Y).

Performance Characteristics

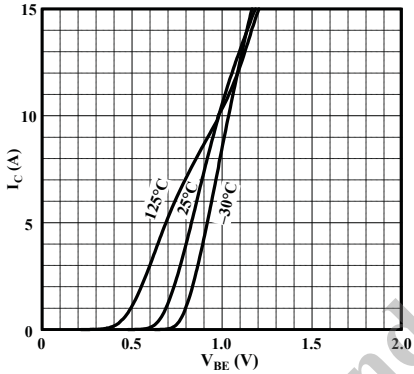
I_C vs. V_{CE}



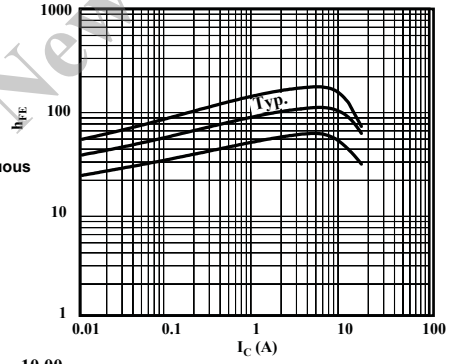
$V_{CE(sat)}$ vs. I_B



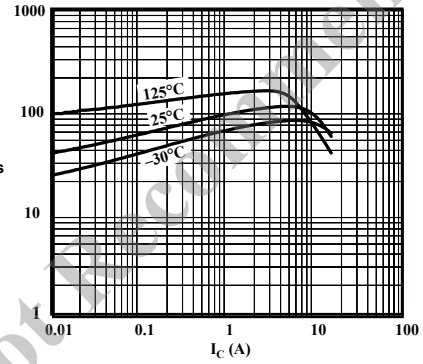
I_C vs. V_{BE}
V_{CE} = 4 V Continuous



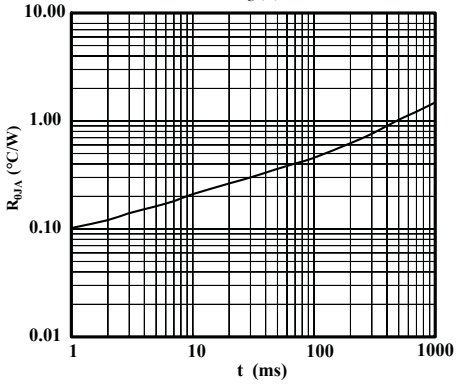
h_{FE} vs. I_C
V_{CE} = 4 V Continuous



h_{FE} vs. I_C
V_{CE} = 4 V Continuous



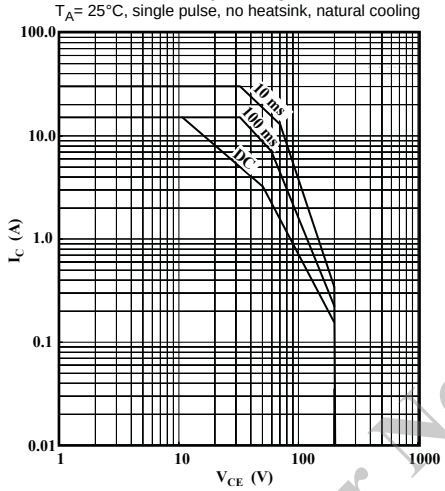
$R_{\theta JA}$ vs. t



Performance Characteristics, continued

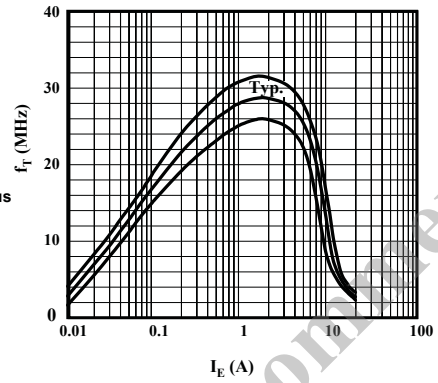
Safe Operating Area

T_A= 25°C, single pulse, no heatsink, natural cooling

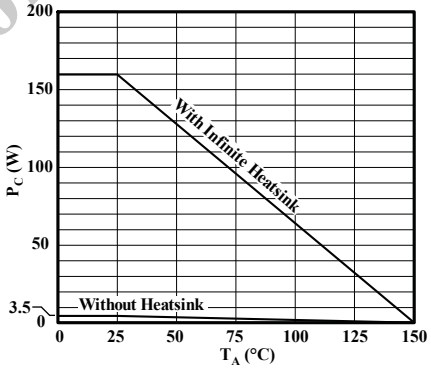


f_T vs. I_E

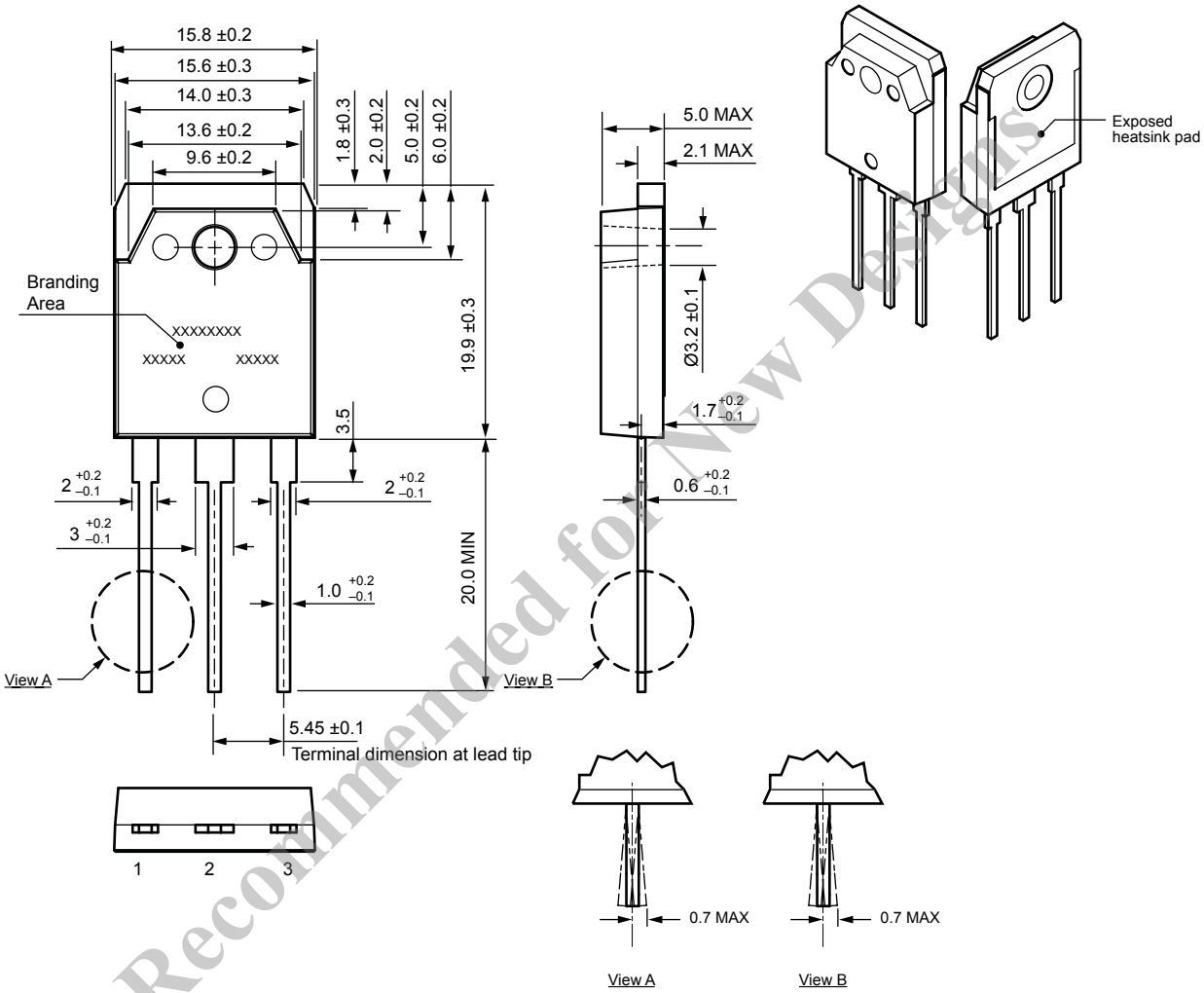
V_{CE} = 12 V Continuous



P_C vs. T_A



Package Outline Drawing, TO-3P



Gate burr: 0.3 mm (max.), mold flash may appear at opposite side
Terminal core material: Cu
Terminal treatment: Ni plating and Pb-free solder dip
Leadform: 100
Package: TO-3P (M100)
Approximate weight: 6 g

Dimensions in millimeters

Branding codes (exact appearance at manufacturer discretion):
1st line, type: C6011
2nd line left, lot: *YM*
Where: Y is the last digit of the year of manufacture
M is the month (*1* to *9, O, N, D*)
2nd line right, subtype: *H*
Where: H is the h_{FE} rating (*O, P,* or *Y*; for values see footnote, Electrical Characteristics table)

Leadframe plating Pb-free. Device composition includes high-temperature solder (Pb >85%), which is exempted from the RoHS directive.

Because reliability can be affected adversely by improper storage environments and handling methods, please observe the following cautions.

Cautions for Storage

- Ensure that storage conditions comply with the standard temperature (5°C to 35°C) and the standard relative humidity (around 40% to 75%); avoid storage locations that experience extreme changes in temperature or humidity.
- Avoid locations where dust or harmful gases are present and avoid direct sunlight.
- Reinspect for rust on leads and solderability of the products that have been stored for a long time.

Cautions for Testing and Handling

When tests are carried out during inspection testing and other standard test periods, protect the products from power surges from the testing device, shorts between the product pins, and wrong connections. Ensure all test parameters are within the ratings specified by Sanken for the products.

Remarks About Using Silicone Grease with a Heatsink

- When silicone grease is used in mounting the products on a heatsink, it shall be applied evenly and thinly. If more silicone grease than required is applied, it may produce excess stress.
- Volatile-type silicone greases may crack after long periods of time, resulting in reduced heat radiation effect. Silicone greases with low consistency (hard grease) may cause cracks in the mold resin when screwing the products to a heatsink.

  Our recommended silicone greases for heat radiation purposes, which will not cause any adverse effect on the product life, are indicated below:

Type	Suppliers
G746	Shin-Etsu Chemical Co., Ltd.
YG6260	Momentive Performance Materials Inc.
SC102	Dow Corning Toray Co., Ltd.

Cautions for Mounting to a Heatsink

- When the flatness around the screw hole is insufficient, such as when mounting the products to a heatsink that has an extruded (burred) screw hole, the products can be damaged, even with a lower than recommended screw torque. For mounting the products, the mounting surface flatness should be 0.05 mm or less.
- Please select suitable screws for the product shape. Do not use a flat-head machine screw because of the stress to the products. Self-tapping screws are not recommended. When using self-tapping screws, the screw may enter the hole diagonally, not vertically, depending on the conditions of hole before threading or the work situation. That may stress the products and may cause failures.
- Recommended screw torque: 0.686 to 0.882 N●m (7 to 9 kgf●cm).
- Diameter of Heatsink Hole: < 4 mm. The deflection of the press mold when making the hole may cause the case material to crack at the joint with the heatsink. Please pay special attention for this effect.
- For tightening screws, if a tightening tool (such as a driver) hits the products, the package may crack, and internal stress fractures may occur, which shorten the lifetime of the electrical elements and can cause catastrophic failure. Tightening with an air driver makes a substantial impact. In addition, a screw torque higher than the set torque can be applied and the package may be damaged. Therefore, an electric driver is recommended.

  When the package is tightened at two or more places, first pre-tighten with a lower torque at all places, then tighten with the specified torque. When using a power driver, torque control is mandatory.

Soldering

- When soldering the products, please be sure to minimize the working time, within the following limits:

  260±5°C 10±1 s (Flow, 2 times)

  350±5°C 3±0.5 s (Soldering iron, 1 time)
- Soldering should be at a distance of at least 1.5 mm from the body of the products.

Electrostatic Discharge

- When handling the products, the operator must be grounded. Grounded wrist straps worn should have at least 1 MΩ of resistance from the operator to ground to prevent shock hazard, and it should be placed near the operator.
- Workbenches where the products are handled should be grounded and be provided with conductive table and floor mats.
- When using measuring equipment such as a curve tracer, the equipment should be grounded.
- When soldering the products, the head of soldering irons or the solder bath must be grounded in order to prevent leak voltages generated by them from being applied to the products.
- The products should always be stored and transported in Sanken shipping containers or conductive containers, or be wrapped in aluminum foil.

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  In addition, it should be noted that since power devices or IC's including power devices have large self-heating value, the degree of derating of junction temperature affects the reliability significantly.
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