

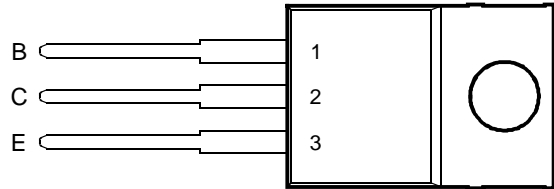
# BUT11 NPN SILICON POWER TRANSISTOR

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MAY 1989 - REVISED MARCH 1997

- Rugged Triple-Diffused Planar Construction
- 100 W at 25°C Case Temperature
- 5 A Continuous Collector Current

TO-220 PACKAGE  
(TOP VIEW)



Pin 2 is in electrical contact with the mounting base.

MDTRACA

### absolute maximum ratings at 25°C case temperature (unless otherwise noted)

RATING	SYMBOL	VALUE	UNIT
Collector-base voltage ( $I_E = 0$ )	$V_{CB0}$	850	V
Collector-emitter voltage ( $V_{BE} = 0$ )	$V_{CES}$	850	V
Collector-emitter voltage ( $I_B = 0$ )	$V_{CEO}$	400	V
Emitter-base voltage	$V_{EBO}$	10	V
Continuous collector current	$I_C$	5	A
Peak collector current (see Note 1)	$I_{CM}$	10	A
Continuous device dissipation at (or below) 25°C case temperature	$P_{tot}$	100	W
Operating junction temperature range	$T_j$	-65 to +150	°C
Storage temperature range	$T_{stg}$	-65 to +150	°C

NOTE 1: This value applies for  $t_p \leq 10$  ms, duty cycle  $\leq 2\%$ .

## PRODUCT INFORMATION

Information is current as of publication date. Products conform to specifications in accordance with the terms of Power Innovations standard warranty. Production processing does not necessarily include testing of all parameters.



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### electrical characteristics at 25°C case temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{CEO(sus)}$ Collector-emitter sustaining voltage	$I_C = 0.1\text{ A}$ $L = 25\text{ mH}$ (see Note 2)	400			V
$I_{CES}$ Collector-emitter cut-off current	$V_{CE} = 850\text{ V}$ $V_{BE} = 0$ $V_{CE} = 850\text{ V}$ $V_{BE} = 0$ $T_C = 125^\circ\text{C}$			50 500	$\mu\text{A}$
$I_{EBO}$ Emitter cut-off current	$V_{EB} = 10\text{ V}$ $I_C = 0$			1	mA
$h_{FE}$ Forward current transfer ratio	$V_{CE} = 5\text{ V}$ $I_C = 0.5\text{ A}$ (see Notes 3 and 4)	20		60	
$V_{CE(sat)}$ Collector-emitter saturation voltage	$I_B = 0.6\text{ A}$ $I_C = 3\text{ A}$ (see Notes 3 and 4)			1.5	V
$V_{BE(sat)}$ Base-emitter saturation voltage	$I_B = 0.6\text{ A}$ $I_C = 3\text{ A}$ (see Notes 3 and 4)			1.3	V
$f_t$ Current gain bandwidth product	$V_{CE} = 10\text{ V}$ $I_C = 0.5\text{ A}$ $f = 1\text{ MHz}$		12		MHz
$C_{ob}$ Output capacitance	$V_{CB} = 20\text{ V}$ $I_E = 0$ $f = 0.1\text{ MHz}$		110		pF

NOTES: 2. Inductive loop switching measurement.

3. These parameters must be measured using pulse techniques,  $t_p = 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

4. These parameters must be measured using voltage-sensing contacts, separate from the current carrying contacts.

### thermal characteristics

PARAMETER	MIN	TYP	MAX	UNIT
$R_{\theta JC}$ Junction to case thermal resistance			1.25	$^\circ\text{C/W}$

### inductive-load-switching characteristics at 25°C case temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS †	MIN	TYP	MAX	UNIT
$t_{sv}$ Voltage storage time	$I_C = 3\text{ A}$ $I_{B(on)} = 0.6\text{ A}$ $V_{BE(off)} = -5\text{ V}$			1.4	$\mu\text{s}$
$t_{fi}$ Current fall time	$V_{CC} = 50\text{ V}$ (see Figures 1 and 2)			150	ns
$t_{sv}$ Voltage storage time	$I_C = 3\text{ A}$ $I_{B(on)} = 0.6\text{ A}$ $V_{BE(off)} = -5\text{ V}$			1.5	$\mu\text{s}$
$t_{fi}$ Current fall time	$V_{CC} = 50\text{ V}$ $T_C = 100^\circ\text{C}$			300	ns

† Voltage and current values shown are nominal; exact values vary slightly with transistor parameters.

PARAMETER MEASUREMENT INFORMATION

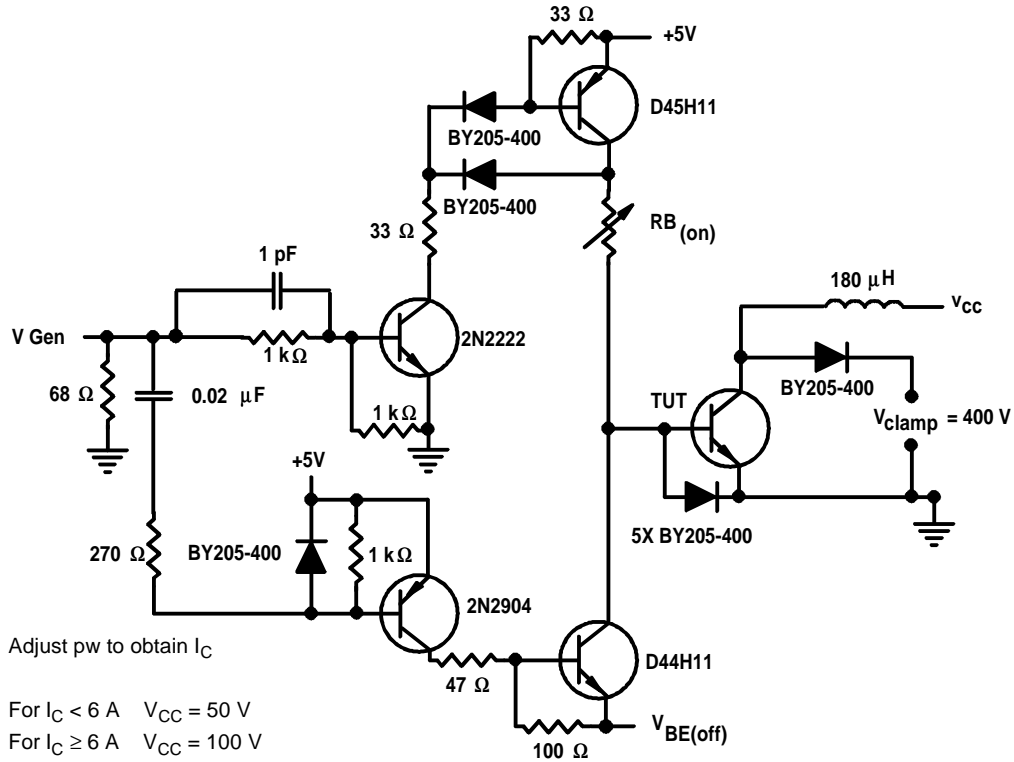
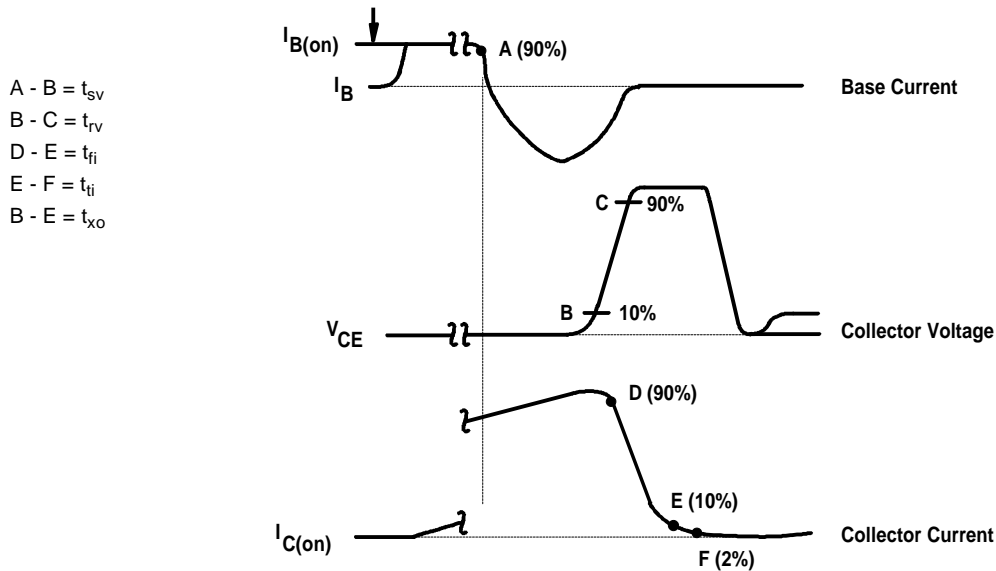


Figure 1. Inductive-Load Switching Test Circuit



NOTES: A. Waveforms are monitored on an oscilloscope with the following characteristics:  $t_r < 15 \text{ ns}$ ,  $R_{in} > 10 \Omega$ ,  $C_{in} < 11.5 \text{ pF}$ .  
 B. Resistors must be noninductive types.

Figure 2. Inductive-Load Switching Waveforms

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## MAXIMUM SAFE OPERATING REGIONS

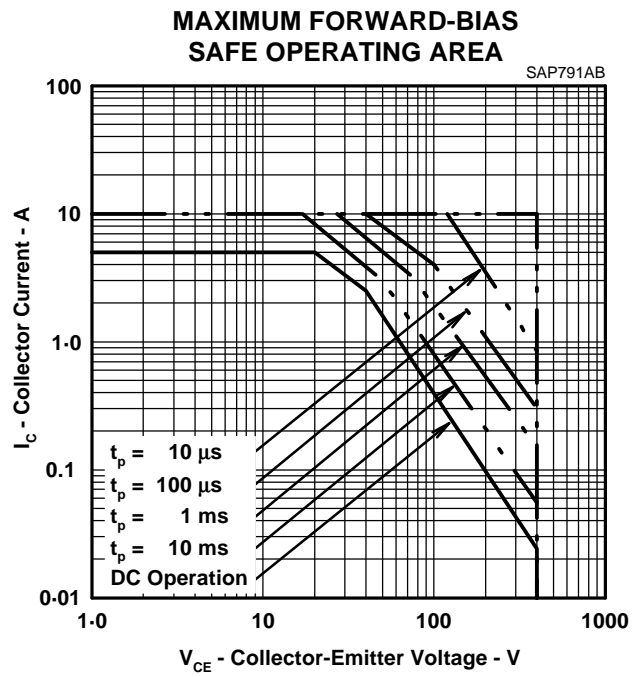


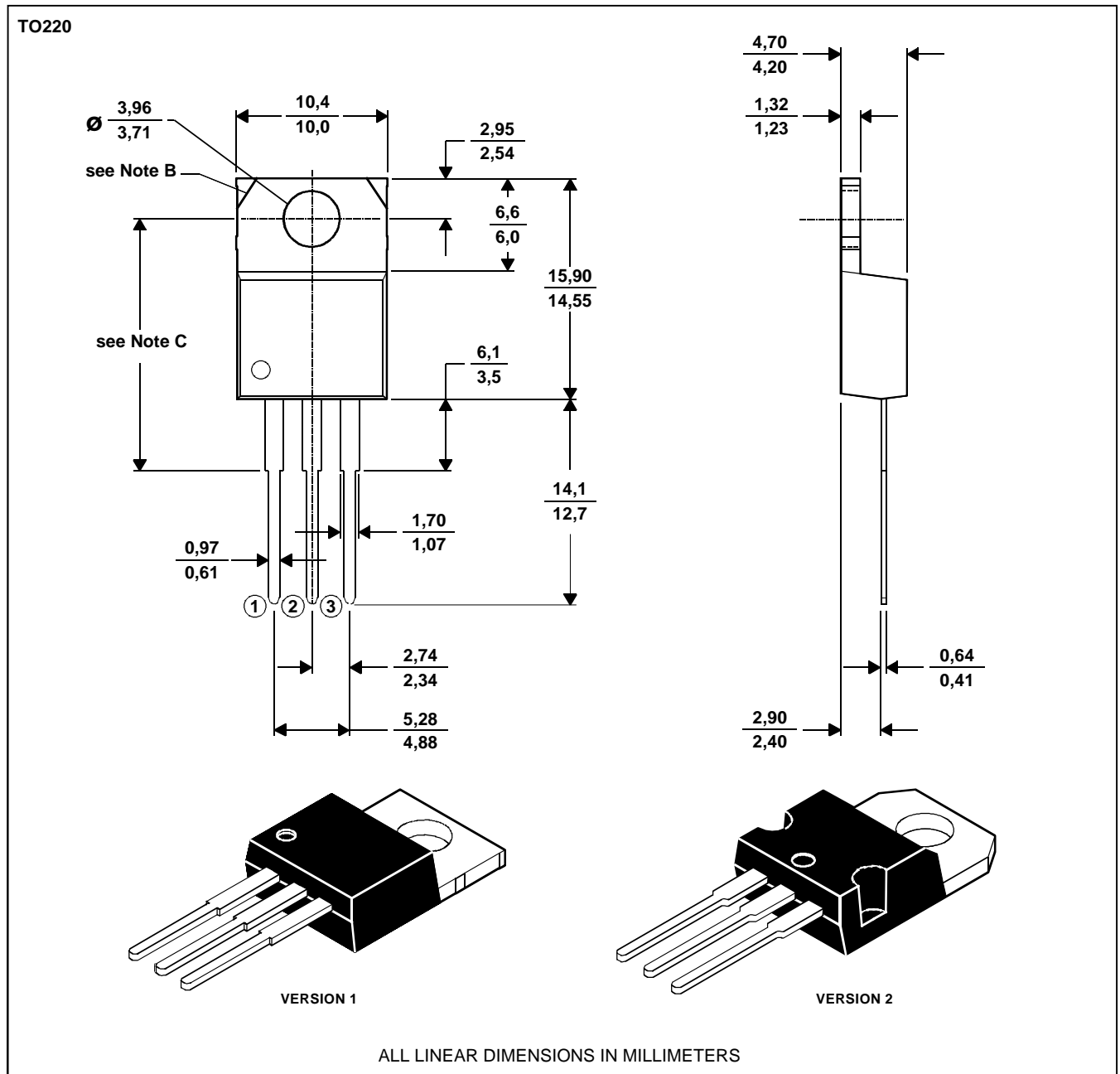
Figure 3.

MECHANICAL DATA

TO-220

3-pin plastic flange-mount package

This single-in-line package consists of a circuit mounted on a lead frame and encapsulated within a plastic compound. The compound will withstand soldering temperature with no deformation, and circuit performance characteristics will remain stable when operated in high humidity conditions. Leads require no additional cleaning or processing when used in soldered assembly.



- NOTES: A. The centre pin is in electrical contact with the mounting tab.  
 B. Mounting tab corner profile according to package version.  
 C. Typical fixing hole centre stand off height according to package version.  
 Version 1, 18.0 mm. Version 2, 17.6 mm.

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