BOURNS®

- 40 W at 25°C Case Temperature
- 3 A Continuous Collector Current
- 5 A Peak Collector Current
- Customer-Specified Selections Available

(TOP VIEW)

3

Pin 2 is in electrical contact with the mounting base.

TO-220 PACKAGE

MDTRACA

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

RATING			VALUE	UNIT
	TIP31D		160	
Collector-base voltage ($I_E = 0$)	TIP31E	V _{CBO}	180	V
	TIP31F		200	
	TIP31D		120	
Collector-emitter voltage ($I_B = 0$)	TIP31E	V _{CEO}	140	V
	TIP31F		160	
Emitter-base voltage			5	V
Continuous collector current			3	Α
Peak collector current (see Note 1)			5	Α
Continuous base current			1	Α
Continuous device dissipation at (or below) 25°C case temperature (see Note 2)			40	W
Continuous device dissipation at (or below) 25°C free air temperature (see Note 3)			2	W
Unclamped inductive load energy (see Note 4)			32	mJ
Operating junction temperature range			-65 to +150	°C
Storage temperature range			-65 to +150	°C
Lead temperature 3.2 mm from case for 10 seconds			250	°C

NOTES: 1. This value applies for $t_p \le 0.3$ ms, duty cycle $\le 10\%$.

- 2. Derate linearly to 150°C case temperature at the rate of 0.32 W/°C.
- 3. Derate linearly to 150°C free air temperature at the rate of 16 mW/°C.
- 4. This rating is based on the capability of the transistor to operate safely in a circuit of: L = 20 mH, $I_{B(on)}$ = 0.4 A, R_{BE} = 100 Ω , $V_{BE(off)}$ = 0, R_S = 0.1 Ω , V_{CC} = 20 V.



electrical characteristics at 25°C case temperature

PARAMETER			TEST CONDITIONS			TYP	MAX	UNIT
V _{(BR)CEO}	Collector-emitter breakdown voltage	I _C = 30 mA (see Note 5)	I _B = 0	TIP31D TIP31E TIP31F	120 140 160			V
I _{CES}	Collector-emitter cut-off current	V _{CE} = 160 V V _{CE} = 180 V V _{CE} = 200 V	$V_{BE} = 0$ $V_{BE} = 0$ $V_{BE} = 0$	TIP31D TIP31E TIP31F			0.2 0.2 0.2	mA
I _{CEO}	Collector cut-off current	V _{CE} = 90 V	I _B = 0				0.3	mA
I _{EBO}	Emitter cut-off current	V _{EB} = 5 V	I _C = 0				1	mA
h _{FE}	Forward current transfer ratio	$V_{CE} = 4 V$ $V_{CE} = 4 V$	$I_C = 1 A$ $I_C = 3 A$	(see Notes 5 and 6)	25 5			
V _{CE(sat)}	Collector-emitter saturation voltage	I _B = 750 mA	I _C = 3 A	(see Notes 5 and 6)			2.5	٧
V _{BE}	Base-emitter voltage	V _{CE} = 4 V	I _C = 3 A	(see Notes 5 and 6)			1.8	٧
h _{fe}	Small signal forward current transfer ratio	V _{CE} = 10 V	I _C = 0.5 A	f = 1 kHz	20			
h _{fe}	Small signal forward current transfer ratio	V _{CE} = 10 V	I _C = 0.5 A	f = 1 MHz	3			

NOTES: 5. These parameters must be measured using pulse techniques, $t_0 = 300 \mu s$, duty cycle $\leq 2\%$.

thermal characteristics

	PARAMETER			MAX	UNIT
$R_{\theta JC}$	Junction to case thermal resistance			3.125	°C/W
$R_{\theta JA}$	Junction to free air thermal resistance			62.5	°C/W

resistive-load-switching characteristics at 25°C case temperature

	PARAMETER	TEST CONDITIONS †			MIN	TYP	MAX	UNIT
t _{on}	Turn-on time	I _C = 1 A	$I_{B(on)} = 0.1 A$	$I_{B(off)} = -0.1 A$		0.5		μs
t _{off}	Turn-off time	$V_{BE(off)} = -4.3 \text{ V}$	$R_L = 30 \Omega$	$t_p = 20 \ \mu s, \ dc \le 2\%$		2		μs

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

^{6.} These parameters must be measured using voltage-sensing contacts, separate from the current carrying contacts.

TYPICAL CHARACTERISTICS

TYPICAL DC CURRENT GAIN vs **COLLECTOR CURRENT** TCS631AA 1000 V_{CE} = 4 V # $T_{\rm C} = 25^{\circ} C$ $t_p = 300 \mu s$, duty cycle < 2%h_{FE} - DC Current Gain 100 10 0.001 0.01 0.1 1.0 10 I_c - Collector Current - A

COLLECTOR-EMITTER SATURATION VOLTAGE

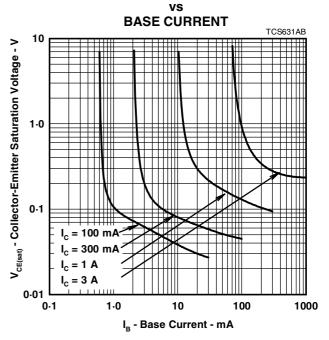


Figure 1. Figure 2.

BASE-EMITTER VOLTAGE

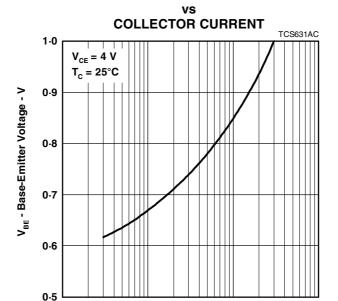


Figure 3.

I_c - Collector Current - A

1.0

10

0.01

MAXIMUM SAFE OPERATING REGIONS

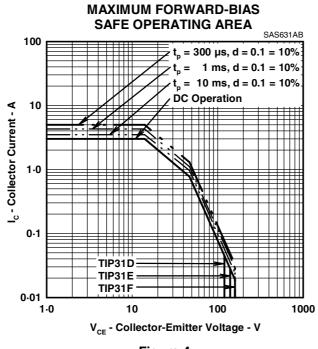


Figure 4.

THERMAL INFORMATION

MAXIMUM POWER DISSIPATION

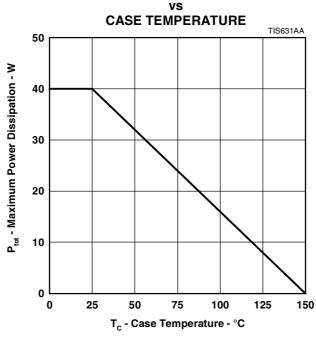


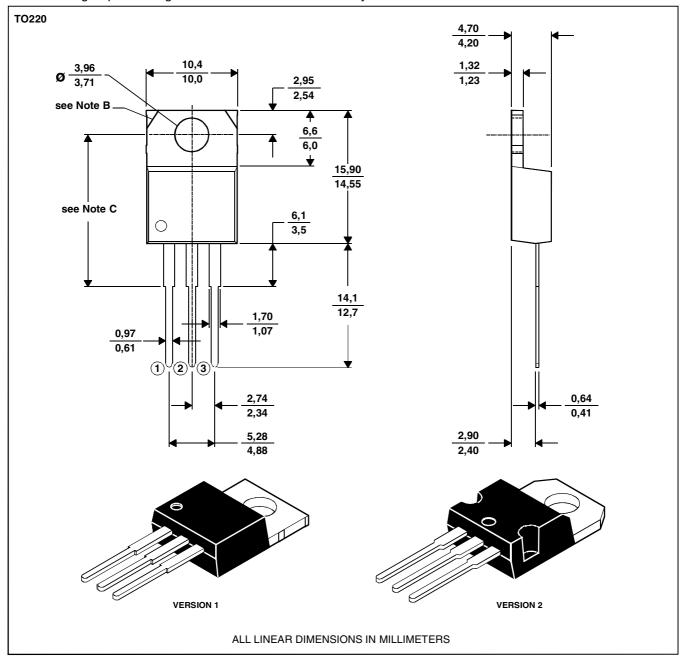
Figure 5.

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.

MDXXBE