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## TIP31E

### Silicon NPN Transistor

### General Purpose Amp, Switch

### TO-220 Type Package

**Features:**

- Collector-Emitter Sustaining Voltage:  $V_{CE(sus)} = 140V$  Min
- Current Gain Bandwidth Product:  $f_T = 3MHz$  Min @  $I_C = 1A$

**Absolute Maximum Ratings:**

Collector-Emitter Voltage, $V_{CEO}$ .....	140V
Collector-Base Voltage, $V_{CBO}$ .....	180V
Emitter-Base Voltage, $V_{EBO}$ .....	5V
Continuous Current, $I_C$	
Continuous .....	3A
Pulse .....	5A
Base Current, $I_B$ .....	1A
Power Dissipation ( $T_C = +25^\circ C$ ), $P_D$ .....	40W
Derate Above $+25^\circ C$ .....	$0.32W/^\circ C$
Operating Junction Temperature Range, $T_J$ .....	$-65^\circ$ to $+150^\circ C$
Storage Temperature Range, $T_{stg}$ .....	$-65^\circ$ to $+150^\circ C$
Thermal Resistance, Junction-to-Case, $R_{thJC}$ .....	$3.125^\circ C/W$

**Electrical Characteristics:** ( $T_C = +25^\circ C$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>OFF Characteristics</b>						
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 30mA, I_B = 0$ , Note 1	140	-	-	V
Collector Cutoff Current	$I_{CEO}$	$V_{CE} = 90V, I_B = 0$	-	-	0.3	mA
	$I_{CES}$	$V_{CE} = 180V, V_{BE} = 0$	-	-	0.2	mA
Emitter-Base Cutoff Current	$I_{EBO}$	$V_{EB} = 5V, I_C = 0$	-	-	1.0	mA
<b>ON Characteristics (Note 1)</b>						
DC Current Gain	$h_{FE}$	$V_{CE} = 4V, I_C = 1A$	25	-	-	
		$V_{CE} = 4V, I_C = 3A$	5	-	-	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 3A, I_B = 750mA$	-	-	2.5	V
Base-Emitter ON Voltage	$V_{BE(on)}$	$V_{CE} = 4V, I_C = 3A$	-	-	1.8	V

Note 1. Pulsed: Pulse Duration  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .

**Electrical Characteristics (Cont'd):** ( $T_C = +25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Dynamic Characteristics</b>						
Current Gain Bandwidth Product	$f_T$	$V_{CE} = 10\text{V}, I_C = 500\text{mA}, f = 1\text{MHz}$	3	-	-	MHz
Small Signal Current Gain	$h_{fe}$	$V_{CE} = 10\text{V}, I_C = 500\text{mA}, f = 1\text{kHz}$	20	-	-	
<b>Switching Characteristics</b>						
Turn On Time	$t_{on}$	$I_C = 1\text{A}, I_{B1} = -I_{B2} = 0.1\text{A},$ $V_{BE(off)} = -4.3\text{V}, R_L = 30\Omega$	-	-	0.6	$\mu\text{s}$
Turn Off Time	$t_{off}$		-	-	2.8	$\mu\text{s}$

Note 1. Pulsed: Pulse Duration  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

Note 2.  $f_T = |h_{fe}| \cdot f_{TEST}$

