


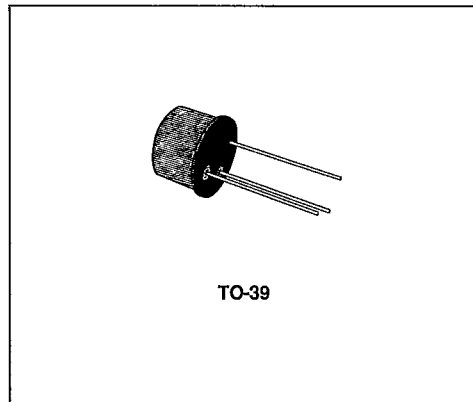
## SWITCHES AND UNIVERSAL AMPLIFIERS

### DESCRIPTION

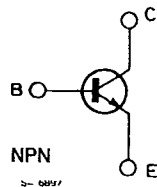
The 2N1613 and 2N1711 are silicon planar epitaxial NPN transistors in Jedec TO-39 metal case. They are designed for use in high-performance amplifier, oscillator and switching circuits.

The 2N1711 is also used to advantage in amplifiers where low noise is an important factor.

 Products approved to CECC 50002-104 available on request.



### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CBO}$	Collector-base Voltage ( $I_E = 0$ )	75	V
$V_{CER}$	Collector-emitter Voltage ( $R_{BE} \leq 10 \Omega$ )	50	V
$V_{EBO}$	Emitter-base Voltage ( $I_C = 0$ )	7	V
$I_C$	Collector Current	500	mA
$P_{tot}$	Total Power Dissipation at $T_{amb} \leq 25^\circ\text{C}$	0.8	W
	at $T_{case} \leq 25^\circ\text{C}$	3	W
	at $T_{case} \leq 100^\circ\text{C}$	1.7	W
$T_{stg}, T_J$	Storage and Junction Temperature	- 65 to 200	$^\circ\text{C}$

## THERMAL DATA

$R_{th\ j-case}$	Thermal Resistance Junction-case	Max	58	°C/W
$R_{th\ j-amb}$	Thermal Resistance Junction-ambient	Max	219	°C/W

ELECTRICAL CHARACTERISTICS ( $T_{amb} = 25\text{ °C}$  unless otherwise specified)

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
$I_{CBO}$	Collector Cutoff Current ( $I_E = 0$ )	$V_{CB} = 60\text{ V}$				10	nA
		$V_{CB} = 60\text{ V}$	$T_{amb} = 150\text{ °C}$			10	$\mu\text{A}$
$I_{EBO}$	Emitter Cutoff Current ( $I_C = 0$ )	$V_{EB} = 5\text{ V}$	for 2N1613 for 2N1711			10 5	nA nA
$V_{(BR)\ CBO}$	Collector-base Breakdown Voltage	$I_C = 0.1\text{ mA}$		75			V
$V_{(BR)\ CER}^*$	Collector-emitter Breakdown Voltage ( $R_{BE} \leq 10\ \Omega$ )	$I_C = 10\text{ mA}$		50			V
$V_{(BR)\ EBO}$	Emitter-base Breakdown Voltage ( $I_C = 0$ )	$I_E = 0.1\text{ mA}$		7			V
$V_{CE\ (sat)}^*$	Collector-emitter Saturation Voltage	$I_C = 150\text{ mA}$	$I_B = 15\text{ mA}$		0.5	1.5	V
$V_{BE\ (sat)}^*$	Base-emitter Saturation Voltage	$I_C = 150\text{ mA}$	$I_B = 15\text{ mA}$		0.95	1.3	V
$h_{FE}^*$	DC Current Gain	for 2N1613					
		$I_C = 0.01\text{ mA}$	$V_{CE} = 10\text{ V}$		35		
		$I_C = 0.1\text{ mA}$	$V_{CE} = 10\text{ V}$	20	50		
		$I_C = 10\text{ mA}$	$V_{CE} = 10\text{ V}$	35	80		
		$I_C = 150\text{ mA}$	$V_{CE} = 10\text{ V}$	40	80	120	
		$I_C = 500\text{ mA}$	$V_{CE} = 10\text{ V}$	20	55		
		$I_C = 10\text{ mA}$	$V_{CE} = 10\text{ V}$				
		$T_{amb} = -55\text{ °C}$		20	35		
$h_{FE}^*$	DC Current Gain	for 2N1711					
		$I_C = 0.01\text{ mA}$	$V_{CE} = 10\text{ V}$		60		
		$I_C = 0.1\text{ mA}$	$V_{CE} = 10\text{ V}$	20	80		
		$I_C = 10\text{ mA}$	$V_{CE} = 10\text{ V}$	35	130		
		$I_C = 150\text{ mA}$	$V_{CE} = 10\text{ V}$		130	300	
		$I_C = 500\text{ mA}$	$V_{CE} = 10\text{ V}$		75		
		$I_C = 10\text{ mA}$	$V_{CE} = 10\text{ V}$				
		$T_{amb} = 55\text{ °C}$			65		
$h_{fe}$	Small Signal Current Gain	for 2N1613					
		$I_C = 1\text{ mA}$	$V_{CE} = 10\text{ V}$				
		$f = 1\text{ kHz}$		30	70	150	
		for 2N1711					
		$I_C = 1\text{ mA}$	$V_{CE} = 10\text{ V}$				
		$f = 1\text{ kHz}$		70	135	300	
$f_t$	Transition Frequency	$I_C = 50\text{ mA}$	$V_{CE} = 10\text{ V}$				
		$f = 20\text{ MHz}$	for 2N1613 for 2N1711	60	80		MHz
				70	100		MHz
$C_{EBO}$	Emitter-base Capacitance	$I_C = 0$	$V_{EB} = 0.5\text{ V}$		50	80	pF
		$f = 1\text{ MHz}$					
$C_{CBO}$	Collector-base Capacitance	$I_E = 0$	$V_{CB} = 10\text{ V}$		18	25	pF
		$f = 1\text{ MHz}$					

\* Pulsed : pulse duration = 300  $\mu\text{s}$ , duty cycle = 1 %.

## ELECTRICAL CHARACTERISTICS (continued)

T-35-19

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
NF	Noise Figure	$I_C = 0.3 \text{ mA}$ $R_g = 510 \Omega$	$V_{CE} = 10 \text{ V}$ $f = 1 \text{ kHz}$ for <b>2N1613</b> for <b>2N1711</b>		6 3.5	12 8	dB dB
$h_{ie}$	Input Impedance	$I_C = 1 \text{ mA}$ $f = 1 \text{ kHz}$	$V_{CE} = 5 \text{ V}$ for <b>2N1613</b> for <b>2N1711</b>		2.2 4.4		k $\Omega$ k $\Omega$
$h_{re}$	Reverse Voltage Ratio	$I_C = 1 \text{ mA}$ $f = 1 \text{ kHz}$	$V_{CE} = 5 \text{ V}$ for <b>2N1613</b> for <b>2N1711</b>		$3.6 \times 10^{-4}$ $7.3 \times 10^{-4}$		
$h_{oe}$	Output Admittance	$I_C = 1 \text{ mA}$ $f = 1 \text{ kHz}$	$V_{CE} = 5 \text{ V}$ for <b>2N1613</b> for <b>2N1711</b>		12.5 23.8		$\mu\text{S}$ $\mu\text{S}$

\* Pulsed : pulse duration = 300  $\mu\text{s}$ , duty cycle = 1 %.