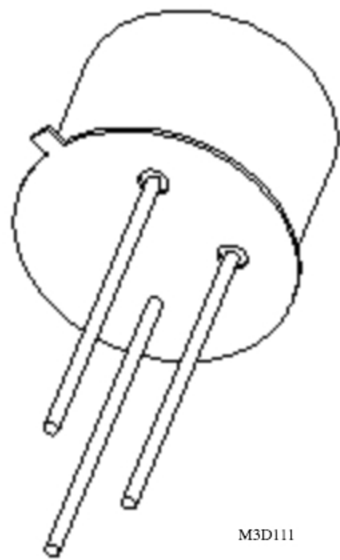

2N3019

NPN medium power transistor

Product specification
Supersedes data of September 1994
File under Discrete Semiconductors, SC04

1997 Jun 19

Philips
Semiconductors

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FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V).

APPLICATIONS

- Amplifier and switching circuits.

DESCRIPTION

NPN medium power transistor in a TO-39 metal package.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector, connected to case

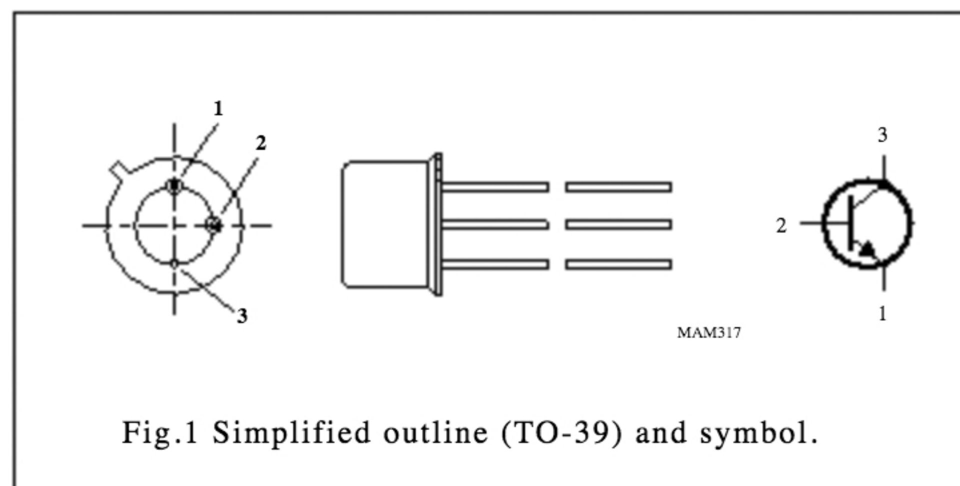


Fig.1 Simplified outline (TO-39) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	140	V
V_{CEO}	collector-emitter voltage	open base	–	80	V
I_C	collector current (DC)		–	1A	
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	800	mW
		$T_{case} \leq 25$ °C	–	5W	
h_{FE}	DC current gain	$I_C = 150$ mA; $V_{CE} = 10$ V	100	300	
f_T	transition frequency	$I_C = 50$ mA; $V_{CE} = 10$ V; f = 100 MHz	100	–	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	140	V
V_{CEO}	collector-emitter voltage	open base	–	80	V
V_{EBO}	emitter-base voltage	open collector	–	7V	
I_C	collector current (DC)		–	1A	
I_{CM}	peak collector current		–	1A	
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	800	mW
		$T_{case} \leq 25$ °C	–	5W	
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	200	°C
T_{amb}	operating ambient temperature		−65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j-a}$	thermal resistance from junction to ambient	in free air	218	K/W
$R_{th\ j-c}$	thermal resistance from junction to case		35	K/W

CHARACTERISTICS

T_{amb} =25 °C unless otherwise specified.

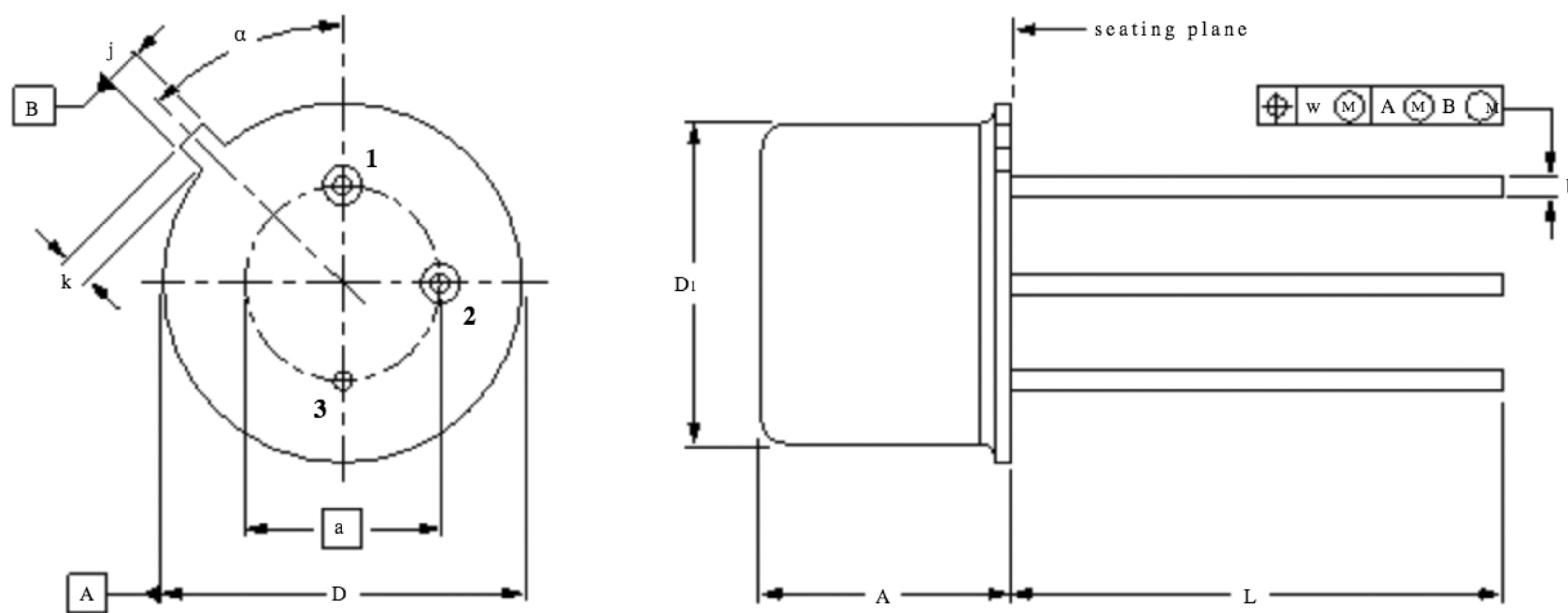
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} =90V	–	10	nA
		I_E = 0; V_{CB} =90V; T_{amb} = 150 °C	–	10	μA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} =5V	–	10	nA
h_{FE}	DC current gain	V_{CE} = 10 V; note 1			
		I_C = 0.1 mA	50	–	
		I_C =10mA	90	–	
		I_C = 150 mA	100	300	
		I_C = 150 mA; T_{case} = −55 °C40		–	
		I_C = 500 mA	50	–	
		I_C =1A	15	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B =15mA	–	200	mV
		I_C = 500 mA; I_B = 50 mA; note 1	–	500	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; note 1	–	1.1	V
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = 10 V; f = 1 MHz	–	12	pF
C_e	emitter capacitance	I_C = i_c = 0; V_{EB} = 500 mV; f = 1 MHz	–	60	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 20 MHz	100	–	MHz
F	noise figure	I_C = 0.1 mA; V_{CE} =5V; R_S =1kΩ; f = 1 kHz; B = 200 Hz	–	4 dB	

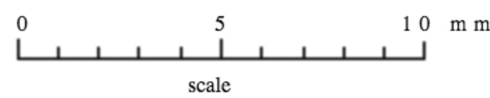
Note

1. Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.01$.

PACKAGE OUTLINE

Metal-can cylindrical single-ended package; 3 leads **SOT5/11**





DIMENSIONS (mm are the original dimensions)

UNIT	A	a	b	D	D1	jk		L	w	α
mm	6.60 6.35	5.08	0.48 0.41	9.39 9.08	8.33 8.18	0.85 0.75	0.95 0.75	14.2 12.7	0.2	45 °

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT5/11		TO-39				97-04-11

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

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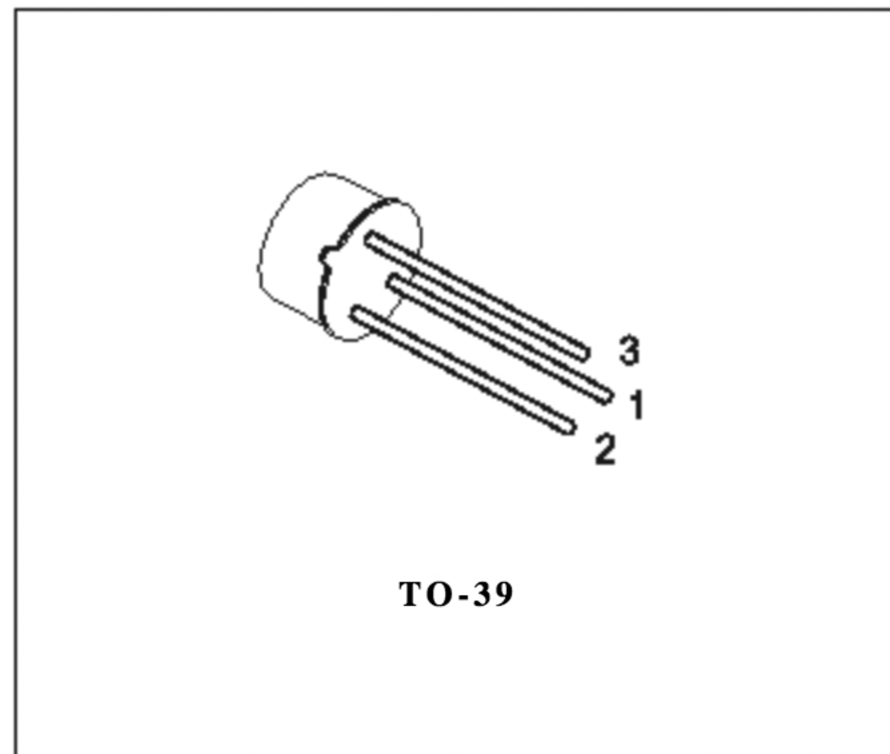
SGS-THOMSON MICROELECTRONICS

2N3019

HIGH CURRENT, HIGH FREQUENCY AMPLIFIERS

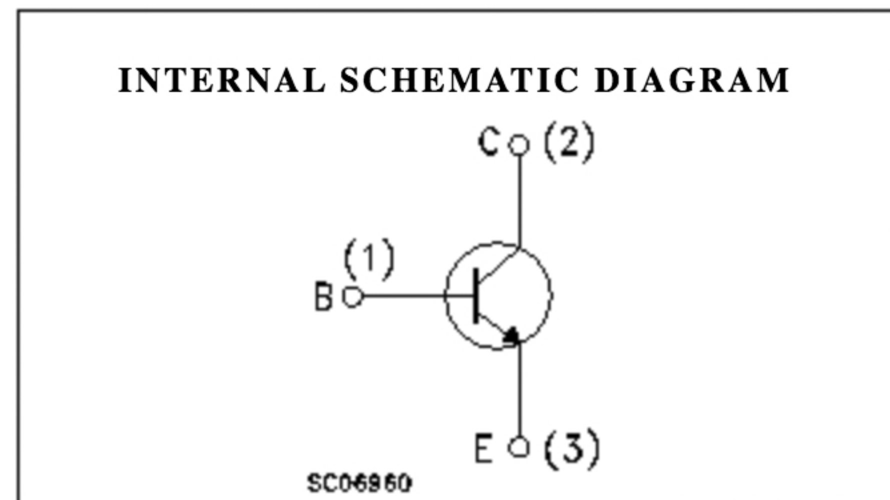
DESCRIPTION

The 2N3019 is a silicon planar epitaxial NPN transistors in Jedec TO-39 metal case, designed for high-current, high frequency amplifier application. It feature high gain and low saturation voltage.



TO-39

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CBO}	Collector-Base Voltage ($I_E = 0$)	140	V
V_{CEO}	Collector-Emitter Voltage ($I_B = 0$)	80	V
V_{EBO}	Emitter-Base Voltage ($I_C = 0$)	7	V
I_C	Collector Current	1	A
P_{tot}	Total Dissipation at $T_{amb} \leq 25$ ^oC at $T_{case} \leq 25$ ^oC	0.8 5	W W
T_{stg}	Storage Temperature	-65 to 200	^oC
T_j	Max. Operating Junction Temperature	200	^oC

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-Case	Max	35	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-Ambient	Max	219	°C/W

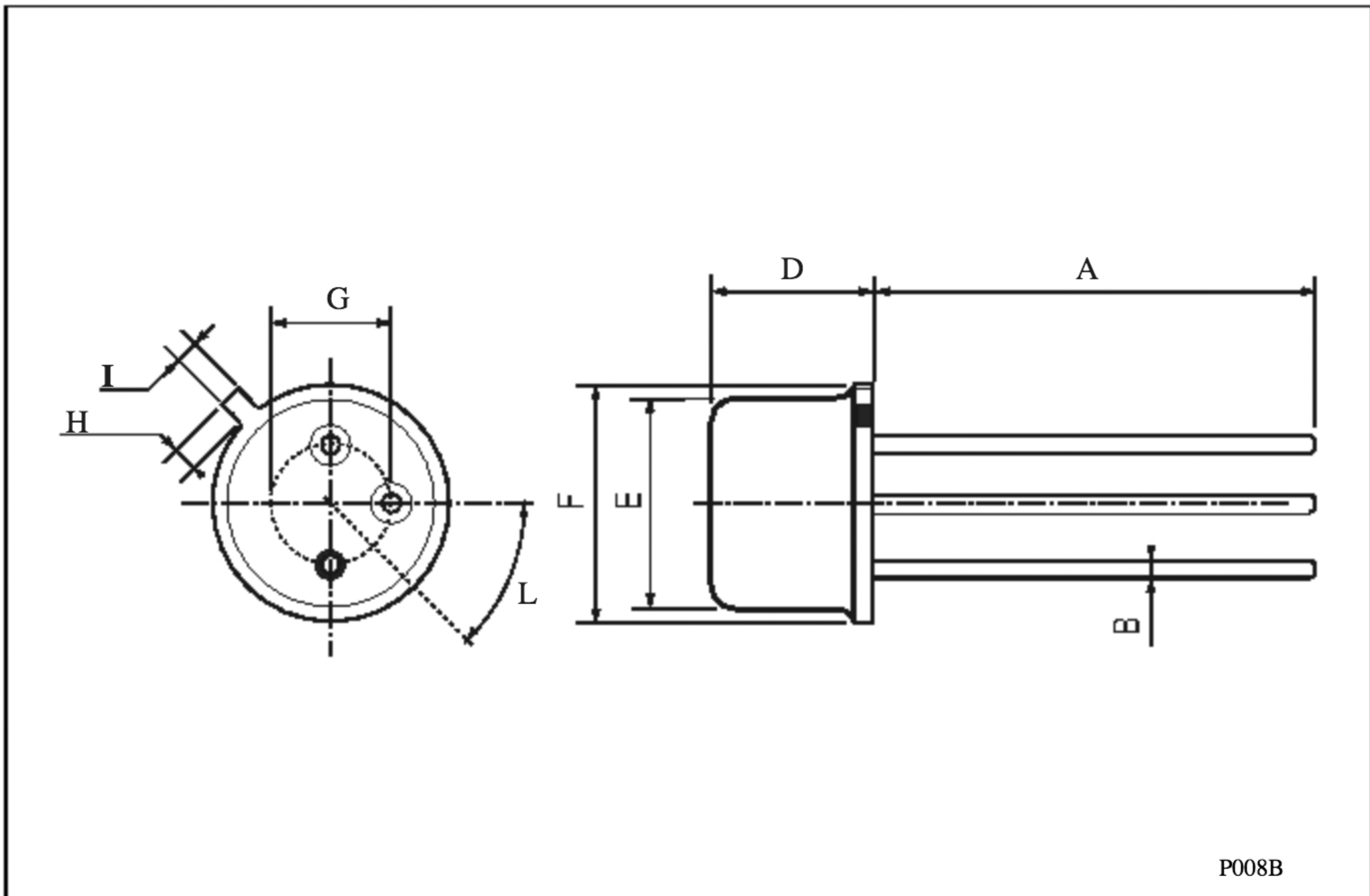
ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector Cut-off Current (I_E = 0)	V_{CB} = 90 V V_{CB} = 90 V T_{case} = 150 °C			10 10	nA μA
I_{EBO}	Emitter Cut-off Current (I_C = 0)	V_{EB} = 5 V			10	nA
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage (IE = 0)	I_C = 100 μA	140			V
$V_{(BR)CEO}$ *	Collector-Emitter Breakdown Voltage (I_B = 0)	I_C = 10 mA	80			V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage (I_C = 0)	I_E = 100 μA 7				V
$V_{CE(sat)}$ *	Collector-Emitter Saturation Voltage	I_C = 150 mA I_B = 15 mA I_C = 500 mA I_B = 50 mA			0.2 0.5	V V
$V_{BE(sat)}$ *	Base-Emitter Saturation Voltage	I_C = 150 mA I_B = 15 mA			1.1	V
h_{FE} *	DC Current Gain	I_C = 0.1 mA V_{CE} = 10 V I_C = 10 mA V_{CE} = 10 V I_C = 150 mA V_{CE} = 10 V I_C = 500 mA V_{CE} = 10 V I_C = 1A V_{CE} = 10 V I_C = 150 mA V_{CE} = 10 V T_{amb} = -55 °C	50 90 100 50 15 40		 300	
h_{fe} *	Small Signal Current Gain	I_C = 1 mA V_{CE} = 5 V f = 1KHz	80		400	
f_T	Transition Frequency	I_C = 50 mA V_{CE} = 10 V f = 20MHz	100			MHz
C_{CBO}	Collector Base Capacitance	I_E = 0 V_{CB} = 10 V f = 1MHz			12	pF
C_{EBO}	Emitter Base Capacitance	I_C = 0 V_{EB} = 0.5 V f = 1MHz			60	pF
NF	Noise Figure	I_C = 0.1 mA V_{CE} = 10 V f = 1KHz R_g = 1K Ω			4	dB
$r_{bb'}C_{b'c}$	Feedback Time Constant	I_C = 10 mA V_{CE} = 10 V f = 4MHz			400	ps

∗ Pulsed: Pulse duration = 300 μs, duty cycle ≤ 1 %

TO-39 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	12.7			0.500		
B 0 .	4 9					0.019
D 6	. 6					0.260
E 8	. 5					0.334
F 9	. 4					0.370
G	5.08			0.200		
H 1	. 2					0.047
I 0	. 9					0.035
L	4 5		o (typ.)			



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