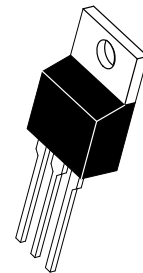
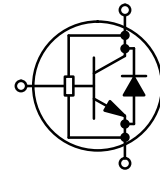


MJE18604D2

POWER TRANSISTORS
3 AMPERES
1600 VOLTS
100 WATTS



CASE 221A-06
TO-220AB

Advance Information

High Speed, High Gain Bipolar NPN Power Transistor with Integrated Collector-Emitter Diode and Built-in Efficient Antisaturation Network for 1600 V Applications

The MJE18604D2 is state-of-art High Speed High gain BIPolar transistor (H2BIP). Tight dynamic characteristics and lot to lot low spread (± 150 ns on storage time) make it ideally suitable for light ballast applications. Therefore, there is no more a need to guarantee an h_{fe} window.

Main features:

- Low Base Drive Requirement
- High DC Current Gain (30 Typical) @ $I_C = 400$ mA
- Extremely Low Storage Time Min/Max Guarantees Due to the Internal Active Antisaturation (H2BIP) Structure which Minimizes the Spread
- Integrated Collector-Emitter Free Wheeling Diode Matched with the Power Transistor
- Fully Characterized and Guaranteed Dynamic $V_{CE(sat)}$
- "6 Sigma" Process Providing Tight and Reproducible Parameter Spreads

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Breakdown Voltage	V_{CEO}	800	Vdc
Collector-Emitter Sustaining Voltage @ $R = 200 \Omega$	V_{CER}	800	Vdc
Collector-Base Breakdown Voltage	V_{CBO}	1600	Vdc
Collector-Emitter Breakdown Voltage	V_{CES}	1600	Vdc
Emitter-Base Voltage	V_{EBO}	12	Vdc
Collector Current — Continuous — Peak (1)	I_C I_{CM}	3 8	Adc
Base Current — Continuous — Peak (1)	I_B I_{BM}	2 4	Adc
*Total Device Dissipation @ $T_C = 25^\circ\text{C}$ *Derate above 25°C	P_D	100 0.8	Watt W/ $^\circ\text{C}$
Operating and Storage Temperature	T_J, T_{stg}	-65 to 150	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Thermal Resistance — Junction to Case — Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	1.25 62.5	$^\circ\text{C/W}$
Maximum Lead Temperature for Soldering Purposes: 1/8" from case for 5 seconds	T_L	260	$^\circ\text{C}$

(1) Pulse Test: Pulse Width = 5 ms, Duty Cycle $\leq 10\%$.

This document contains information on a new product. Specifications and information herein are subject to change without notice.

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ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector–Emitter Sustaining Voltage ($I_C = 100\text{ mA}$, $L = 25\text{ mH}$, $R_{BE} = 200\ \Omega$)	$V_{CER(sus)}$	800			Vdc
Collector–Base Breakdown Voltage ($I_{CBO} = 1\text{ mA}$)	V_{CBO}	1600			Vdc
Emitter–Base Breakdown Voltage ($I_{EBO} = 1\text{ mA}$)	V_{EBO}	12	14		Vdc
Collector Cutoff Current ($V_{CBO} = \text{Rated } V_{CBO}$, $I_B = 0$)	I_{CBO}			100	μAdc
Collector Cutoff Current ($V_{CE} = \text{Rated } V_{CES}$, $V_{EB} = 0$) ($V_{CE} = 1300\text{ V}$, $V_{EB} = 0$)	I_{CES}			100 1000 100	μAdc
Emitter–Cutoff Current ($V_{EB} = 11\text{ Vdc}$, $I_C = 0$)	I_{EBO}			500	μAdc

ON CHARACTERISTICS

Base–Emitter Saturation Voltage ($I_C = 0.5\text{ Adc}$, $I_B = 0.1\text{ Adc}$) ($I_C = 1\text{ Adc}$, $I_B = 0.1\text{ Adc}$) ($I_C = 2\text{ Adc}$, $I_B = 0.4\text{ Adc}$)	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	$V_{BE(sat)}$		0.8 0.6 0.8 0.9 0.8	1.1 1 1 1.2 1.1	Vdc
Collector–Emitter Saturation Voltage ($I_C = 250\text{ mAdc}$, $I_B = 25\text{ mAdc}$) ($I_C = 0.5\text{ Adc}$, $I_B = 50\text{ mAdc}$) ($I_C = 0.8\text{ Adc}$, $I_B = 80\text{ mAdc}$)	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	$V_{CE(sat)}$		1 1.7 2.1 4 3.7 5	1.25 2.4 5	Vdc
DC Current Gain ($I_C = 0.4\text{ Adc}$, $V_{CE} = 3\text{ Vdc}$) ($I_C = 5\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$)	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	h_{FE}	20 6 20 20	10 35 55	40	—

DYNAMIC SATURATION VOLTAGE

Dynamic Saturation Voltage: Determined 1 μs and 3 μs respectively after rising I_{B1} reaches 90% of final I_{B1}	$I_C = 0.3\text{ Adc}$ $I_{B1} = 50\text{ mA}$ $V_{CC} = 300\text{ V}$	@ 1 μs	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	$V_{CE(dsat)}$	4.7 9.3		V
		@ 3 μs	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$		2.6 5.4		
	$I_C = 0.5\text{ Adc}$ $I_{B1} = 50\text{ mA}$ $V_{CC} = 300\text{ V}$	@ 1 μs	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$		9.7 18		
		@ 3 μs	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$		6.4 12.3		

DIODE CHARACTERISTICS

Forward Diode Voltage ($I_{EC} = 0.4\text{ Adc}$) ($I_{EC} = 1\text{ Adc}$)	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	V_{EC}		0.9 0.6 1.05 0.7	1.2 1.5	V
Forward Recovery Time ($I_F = 0.4\text{ Adc}$, $di/dt = 10\text{ A}/\mu\text{s}$) ($I_F = 1.0\text{ Adc}$, $di/dt = 10\text{ A}/\mu\text{s}$)	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_{fr}		0.9 1.5 1.15 1.6		μs

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
DYNAMIC CHARACTERISTICS					
Current Gain Bandwidth ($I_C = 0.5\text{ Adc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1\text{ MHz}$)	f_T		13		MHz
Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f = 1\text{ MHz}$)	C_{ob}		230	500	pF
Input Capacitance ($V_{CE} = 8\text{ Vdc}$)	C_{ib}		480	1000	pF

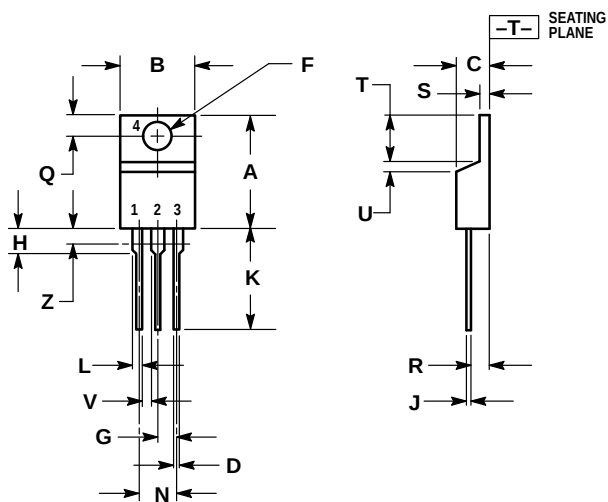
SWITCHING CHARACTERISTICS: Resistive Load (D.C. $\leq 10\%$, Pulse Width = $40\text{ }\mu\text{s}$)

Delay Time	$I_C = 0.5\text{ Adc}$ $I_{B1} = 66\text{ mAdc}$ $I_{B2} = 390\text{ mAdc}$ $V_{CC} = 125\text{ V}$	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_d		95 110	150	ns
Rise Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_r		475 900	750	ns
Storage Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_s	400	910	700	ns
Fall Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_f		675 775	850	ns
Turn-on Time	$I_C = 0.3\text{ Adc}$ $I_{B1} = 50\text{ mAdc}$ $I_{B2} = 50\text{ mAdc}$ $V_{CC} = 125\text{ V}$	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_{on}		440 570		ns
Storage Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_s		4 5.9		μs
Fall Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_f		375 675		ns
Turn-off Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_{off}		4.5 6.6		μs
Turn-on Time	$I_C = 0.3\text{ Adc}$ $I_{B1} = 50\text{ mAdc}$ $I_{B2} = 150\text{ mAdc}$ $V_{CC} = 125\text{ V}$	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_{on}		465 550	600	ns
Storage Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_s	500	1800	800	ns
Fall Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_f		800 550	1000	ns
Turn-off Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_{off}		1.5 2.4	1.75	μs
Turn-on Time	$I_C = 0.5\text{ Adc}$ $I_{B1} = 50\text{ mAdc}$ $I_{B2} = 50\text{ mAdc}$ $V_{CC} = 125\text{ V}$	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_{on}		550 1300		ns
Storage Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_s		4.35 5		μs
Fall Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_f		500 2000		ns
Turn-off Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_{off}		4.8 7		μs
Delay Time	$I_C = 0.5\text{ Adc}$ $I_{B1} = 50\text{ mAdc}$ $I_{B2} = 250\text{ mAdc}$ $V_{CC} = 125\text{ V}$	@ $T_C = 25^\circ\text{C}$	t_d		100	300	ns
Rise Time		@ $T_C = 25^\circ\text{C}$	t_r		300	800	ns
Storage Time		@ $T_C = 25^\circ\text{C}$	t_s		1	1.2	μs
Fall Time		@ $T_C = 25^\circ\text{C}$	t_f		200	350	ns

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic			Symbol	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS: Inductive Load ($V_{CC} = 15\text{ V}$)							
Fall Time	$I_C = 300\text{ mAdc}$ $I_{B1} = 50\text{ mAdc}$ $I_{B2} = 50\text{ mAdc}$ $V_Z = 300\text{ V}$ $L_C = 200\text{ }\mu\text{H}$	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_f		170 210		ns
Storage Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_s		1.7 2.7		μs
Crossover Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_c		150 400		ns
Fall Time	$I_C = 300\text{ mAdc}$ $I_{B1} = 50\text{ mAdc}$ $I_{B2} = 150\text{ mAdc}$ $V_Z = 300\text{ V}$ $L_C = 200\text{ }\mu\text{H}$	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_f		160 150	250	ns
Storage Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_s	0.7	1.1	1	μs
Crossover Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_c		160 160	250	ns
Fall Time	$I_C = 500\text{ mAdc}$ $I_{B1} = 50\text{ mAdc}$ $I_{B2} = 50\text{ mAdc}$ $V_Z = 300\text{ V}$ $L_C = 200\text{ }\mu\text{H}$	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_f		165 700		ns
Storage Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_s		3 4.1		μs
Crossover Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_c		200 800		ns
Fall Time	$I_C = 500\text{ mAdc}$ $I_{B1} = 50\text{ mAdc}$ $I_{B2} = 250\text{ mAdc}$ $V_Z = 300\text{ V}$ $L_C = 200\text{ }\mu\text{H}$	@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_f		110 130	175	ns
Storage Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_s	0.7	1.8	1	μs
Crossover Time		@ $T_C = 25^\circ\text{C}$ @ $T_C = 125^\circ\text{C}$	t_c		130 250	200	ns

PACKAGE DIMENSIONS



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	—	1.15	—
Z	—	0.080	—	2.04

STYLE 1:

- PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

CASE 221A-06
TO-220AB
ISSUE Y

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