2N6338, 2N6341

High-Power NPN Silicon Transistors

. . . designed for use in industrial−military power amplifier and switching circuit applications.

- High Collector−Emitter Sustaining Voltage −

  $V_{CEO(sus)}$ = 100 Vdc (Min) − 2N6338

  = 150 Vdc (Min) − 2N6341

- High DC Current Gain −

  h_{FE} = 30 − 120 @ I_C = 10 Adc

  = 12 (Min) @ I_C = 25 Adc

- Low Collector−Emitter Saturation Voltage −

  $V_{CE(sat)}$ = 1.0 Vdc (Max) @ I_C = 10 Adc

- Fast Switching Times @ I_C = 10 Adc

  t_r = 0.3 ms (Max)

  t_s = 1.0 ms (Max)

  t_f = 0.25 ms (Max)

- Pb−Free Packages are Available

*MAXIMUM RATINGS

Rating	Symbol	2N6338	2N6341	Unit
Collector−Base Voltage	V_{CB}	120	180	Vdc
Collector−Emitter Voltage	V_{CEO}	100	150	Vdc
Emitter−Base Voltage	V_{EB}	6.0		Vdc
Collector Current Continuous Peak	I_C	25 50		Adc
Base Current	I_B	10		Adc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	200 1.14		W W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +200		°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	0.875	°C/W

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.
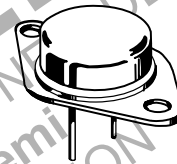*Indicates JEDEC Registered Data.

ON Semiconductor®

http://onsemi.com

25 AMPERE
POWER TRANSISTORS
NPN SILICON

TO−204AA
CASE 1−07

ORDERING INFORMATION

Device	Package	Shipping
2N6338	TO−204AA	100 Units / Tray
2N6338G	TO−204AA (Pb−Free)	100 Units / Tray
2N6341	TO−204AA	100 Units / Tray
2N6341G	TO−204AA (Pb−Free)	100 Units / Tray
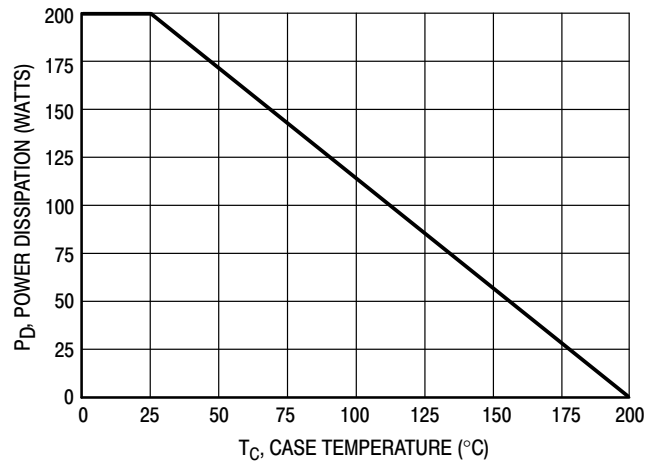
Figure 1. Power Derating

*ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector−Emitter Sustaining Voltage (1) (I_C = 50 mAdc, I_B = 0)	2N6338 2N6341	$V_{CEO(sus)}$	100 150	– –	Vdc
Collector Cutoff Current (V_{CE} = 50 Vdc, I_B = 0) (V_{CE} = 75 Vdc, I_B = 0)	2N6338 2N6341	I_{CEO}	– –	50 50	μAdc
Collector Cutoff Current (V_{CE} = Rated V_{CEO}, $V_{EB(off)}$ = 1.5 Vdc) (V_{CE} = Rated V_{CEO}, $V_{EB(off)}$ = 1.5 Vdc, T_C = 150°C)		I_{CEX}	– –	10 1.0	μAdc mAdc
Collector Cutoff Current (V_{CB} = Rated V_{CB}, I_E = 0)		I_{CBO}	–	10	μAdc
Emitter Cutoff Current (V_{BE} = 6.0 Vdc, I_C = 0)		I_{EBO}	–	100	μAdc
ON CHARACTERISTICS (1)					
DC Current Gain) (I_C = 0.5 Adc, V_{CE} = 2.0 Vdc) (I_C = 10 Adc, V_{CE} = 2.0 Vdc) (I_C = 25 Adc, V_{CE} = 2.0 Vdc)		h_{FE}	50 30 12	– 120 –	–
Collector Emitter Saturation Voltage (I_C = 10 Adc, I_B = 1.0 Adc) (I_C = 25 Adc, I_B = 2.5 Adc)		$V_{CE(sat)}$	– –	1.0 1.8	Vdc
Base−Emitter Saturation Voltage (I_C = 10 Adc, I_B = 1.0 Adc) (I_C = 25 Adc, I_B = 2.5 Adc)		$V_{BE(sat)}$	– –	1.8 2.5	Vdc
Base−Emitter On Voltage (I_C = 10 Adc, V_{CE} = 2.0 Vdc)		$V_{BE(on)}$	–	1.8	Vdc
DYNAMIC CHARACTERISTICS					
Current−Gain − Bandwidth Product (2) (I_C = 1.0 Adc, V_{CE} = 10 Vdc, f_{test} = 10 MHz)		f_T	40	–	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 0.1 MHz)		C_{ob}	–	300	pF
SWITCHING CHARACTERISTICS					
Rise Time (V_{CC} ≈ 80 Vdc, I_C = 10Adc, I_{B1} = 1.0 Adc, $V_{BE(off)}$ = 6.0 Vdc)		t_r	–	0.3	μs
Storage Time (V_{CC} ≈ 80 Vdc, I_C = 10 Adc, I_{B1} = I_{B2} = 1.0 Adc)		t_s	–	1.0	μs
Fall Time (V_{CC} ≈ 80 Vdc, I_C = 10 Adc, I_{B1} = I_{B2} = 1.0 Adc)		t_f	–	0.25	μs

*Indicates JEDEC Registered Data.
(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
(2) f_T = |h_{fe}| • f_{test}.

2N6338, 2N6341
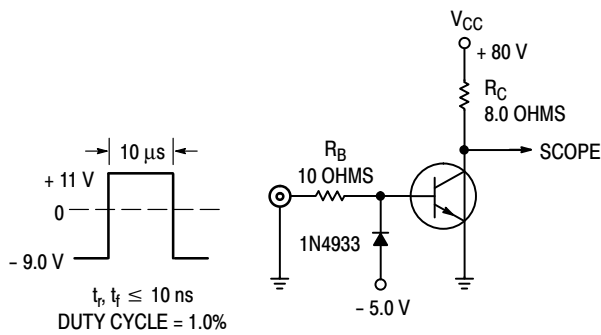
NOTE: For information on Figures 3 and 6, R_B and R_C were varied to obtain desired test conditions.
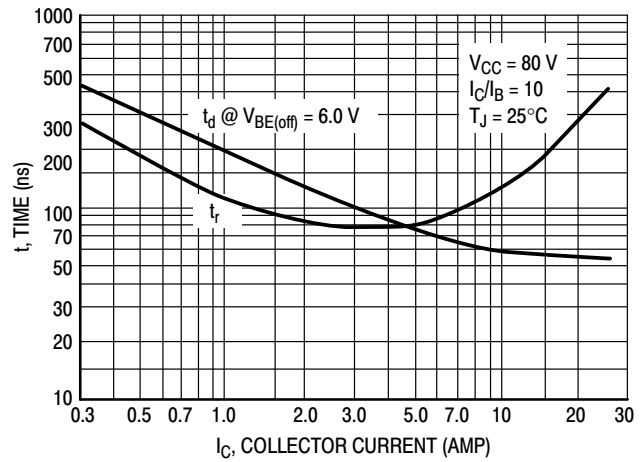
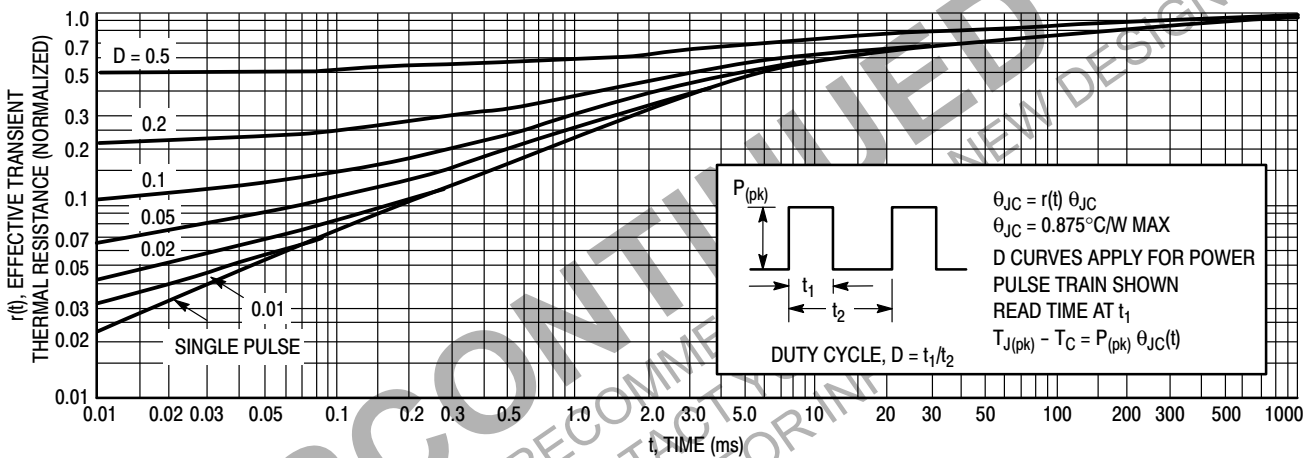**Figure 2. Switching Time Test Circuit**
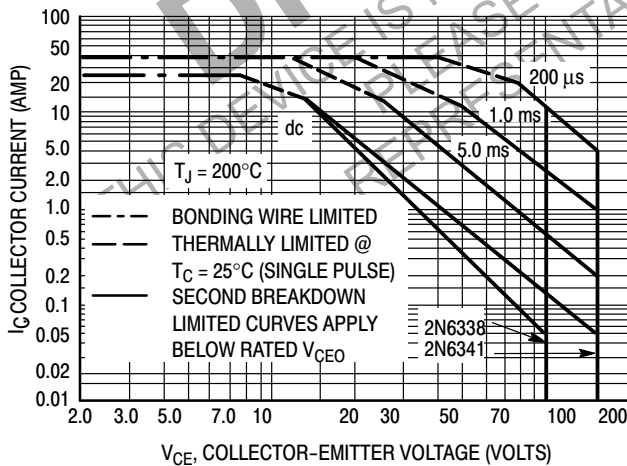

Figure 3. Turn−On Time

$\theta_{JC} = r(t)\ \theta_{JC}$
$\theta_{JC} = 0.875°C/W$ MAX
D CURVES APPLY FOR POWER
PULSE TRAIN SHOWN
READ TIME AT t_1
$T_{J(pk)} - T_C = P_{(pk)}\ \theta_{JC}(t)$

DUTY CYCLE, $D = t_1/t_2$

Figure 4. Thermal Response

Figure 5. Active Region Safe Operating Area

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate I_C−V_{CE} limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 5 is based on $T_{J(pk)} = 200°C$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 200°C$. $T_{J(pk)}$ may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

V_{CC} = 80 V
I_{B1} = I_{B2}
I_C/I_B = 10
T_J = 25°C
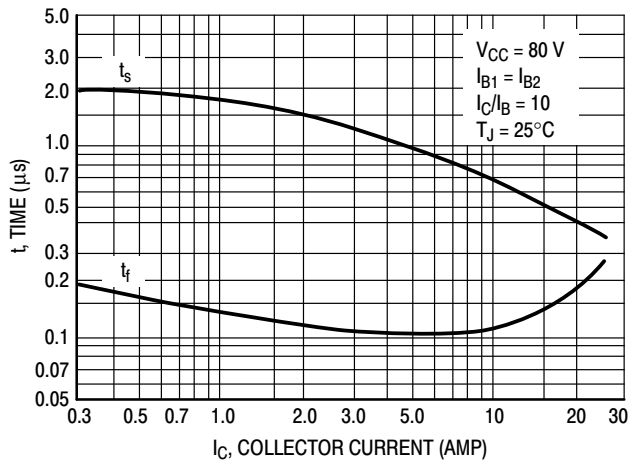
Figure 6. Turn−Off Time
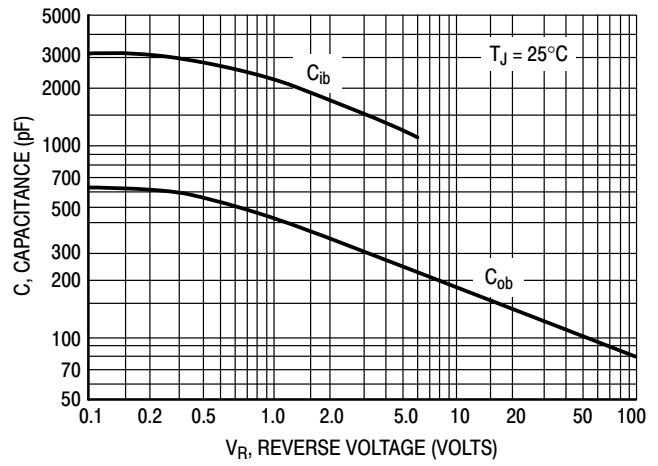
T_J = 25°C

Figure 7. Capacitance
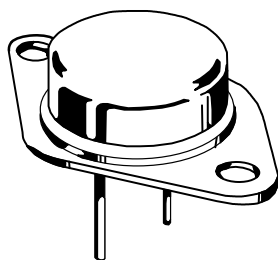
TO–204 (TO–3)
CASE 1–07
ISSUE Z

DATE 10 MAR 2000

SCALE 1:1
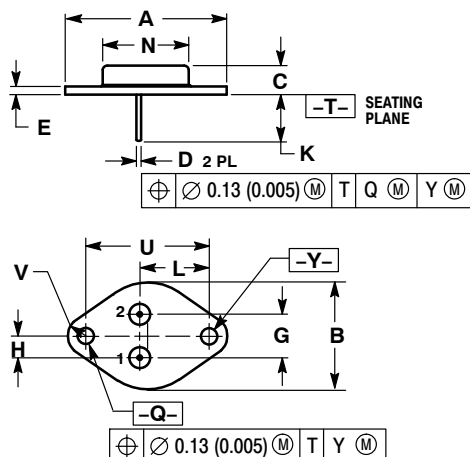
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO–204AA OUTLINE SHALL APPLY.

SEATING PLANE

$\oplus$ $\varnothing$ 0.13 (0.005) Ⓜ T Q Ⓜ Y Ⓜ

$\oplus$ $\varnothing$ 0.13 (0.005) Ⓜ T Y Ⓜ

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.550 REF		39.37 REF	
B	---	1.050	---	26.67
C	0.250	0.335	6.35	8.51
D	0.038	0.043	0.97	1.09
E	0.055	0.070	1.40	1.77
G	0.430 BSC		10.92 BSC	
H	0.215 BSC		5.46 BSC	
K	0.440	0.480	11.18	12.19
L	0.665 BSC		16.89 BSC	
N	---	0.830	---	21.08
Q	0.151	0.165	3.84	4.19
U	1.187 BSC		30.15 BSC	
V	0.131	0.188	3.33	4.77

STYLE 1:
PIN 1. BASE
     2. EMITTER
CASE: COLLECTOR

STYLE 2:
PIN 1. BASE
     2. COLLECTOR
CASE: EMITTER

STYLE 3:
PIN 1. GATE
     2. SOURCE
CASE: DRAIN

STYLE 4:
PIN 1. GROUND
     2. INPUT
CASE: OUTPUT

STYLE 5:
PIN 1. CATHODE
     2. EXTERNAL TRIP/DELAY
CASE: ANODE

STYLE 6:
PIN 1. GATE
     2. EMITTER
CASE: COLLECTOR

STYLE 7:
PIN 1. ANODE
     2. OPEN
CASE: CATHODE

STYLE 8:
PIN 1. CATHODE #1
     2. CATHODE #2
CASE: ANODE

STYLE 9:
PIN 1. ANODE #1
     2. ANODE #2
CASE: CATHODE

DOCUMENT NUMBER:	98ASB42001B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.	
DESCRIPTION:	TO–204 (TO–3)		PAGE 1 OF 1

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical–documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support
For additional information, please contact your local Sales Representative at
www.onsemi.com/support/sales

◊