2N5038

NPN Silicon Transistors

Fast switching speeds and high current capacity ideally suit these parts for use in switching regulators, inverters, wide-band amplifiers and power oscillators in industrial and commercial applications.

Features

- High Speed – t_f = 0.5 μs (Max)
- High Current – $I_{C(max)}$ = 30 Amps
- Low Saturation – $V_{CE(sat)}$ = 2.5 V (Max) @ I_C = 20 Amps
- Pb-Free Package is Available*

MAXIMUM RATINGS (Note 1)

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	90	Vdc
Collector-Base Voltage	V_{CBO}	150	Vdc
Collector-Emitter Voltage	V_{CEV}	150	Vdc
Emitter-Base Voltage	V_{EBO}	7	Vdc
Collector Current – Continuous Peak (Note 2)	I_C I_{CM}	20 30	Adc
Base Current – Continuous	I_B	5	Adc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	140 0.8	W W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +200	°C

THERMAL CHARACTERISTICS

Characteristics	Symbol	Max	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.25	°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.

1. Indicates JEDEC Registered Data.
2. Pulse Test: Pulse Width ≤ 10 ms, Duty Cycle ≤ 50%.

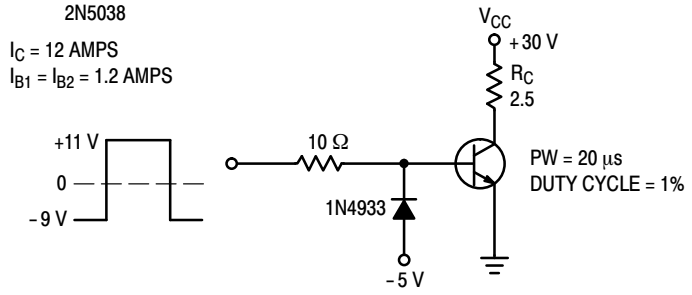

Figure 1. Switching Time Test Circuit

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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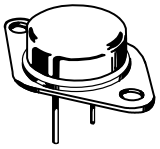
20 AMPERE
NPN SILICON
POWER TRANSISTORS
90 VOLTS – 140 WATTS



TO-204AA (TO-3)
CASE 1-07
STYLE 1

MARKING DIAGRAMS

G	=	Pb-Free Package
A	=	Assembly Location
YY	=	Year
WW	=	Work Week
MEX	=	Country of Origin

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted) (Note 3)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector−Emitter Sustaining Voltage (Note 4) (I_C = 200 mAdc, I_B = 0)	$V_{CEO(sus)}$	90	–	Vdc
Collector Cutoff Current (V_{CE} = 140 Vdc, $V_{BE(off)}$ = 1.5 V) (V_{CE} = 100 Vdc, $V_{BE(off)}$ = 1.5 Vdc, T_C = 150°C)	I_{CEX}	– –	50 10	mAdc
Emitter Cutoff Current (V_{EB} = 5 Vdc, I_C = 0) (V_{EB} = 7 Vdc, I_C = 0)	I_{EBO}	– –	5 50	mAdc
ON CHARACTERISTICS (Note 4)				
DC Current Gain (I_C = 12 Adc, V_{CE} = 5 Vdc)	h_{FE}	20	100	–
Collector−Emitter Saturation Voltage (I_C = 20 Adc, I_B = 5 Adc)	$V_{CE(sat)}$	–	2.5	Vdc
Base−Emitter Saturation Voltage (I_C = 20 Adc, I_B = 5 Adc)	$V_{BE(sat)}$	–	3.3	Vdc
DYNAMIC CHARACTERISTICS				
Magnitude of Common−Emitter Small−Signal Short−Circuit Forward Current Transfer Ratio (I_C = 2 Adc, V_{CE} = 10 Vdc, f = 5 MHz)	$\|h_{fe}\|$	12	–	–
SWITCHING CHARACTERISTICS				
RESISTIVE LOAD				
Rise Time (V_{CC} = 30 Vdc)	t_r	–	0.5	μs
Storage Time (I_C = 12 Adc, I_{B1} = I_{B2} = 1.2 Adc)	t_s	–	1.5	μs

3. Indicates JEDEC Registered Data.
4. Pulse Test: Pulse Width ≤ 300, μs, Duty Cycle ≤ 2%.

ORDERING INFORMATION

Device	Package	Shipping
2N5038	TO−204	100 Units / Tray
2N5038G	TO−204 (Pb−Free)	

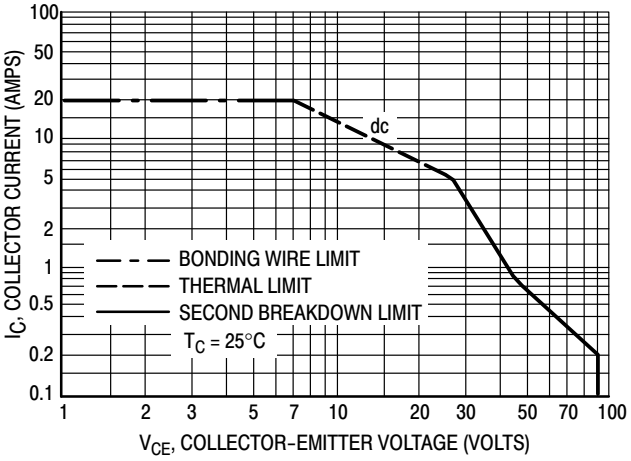
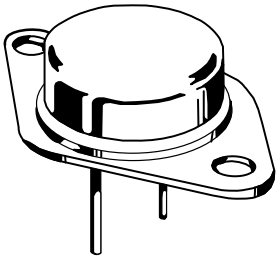


Figure 2. Forward Bias Safe Operating Area

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.

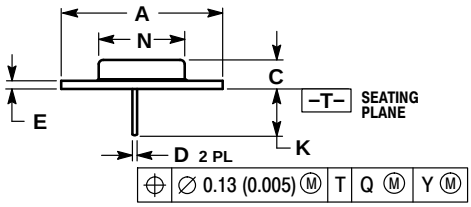
Second breakdown pulse limits are valid for duty cycles to 10%. At high case temperatures, thermal limitations may reduce the power that can be handled to values less than the limitations imposed by second breakdown.

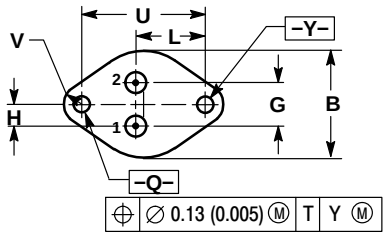


TO−204 (TO−3)
CASE 1−07
ISSUE Z

DATE 05/18/1988

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.

	INCHES		MILLIMETERS	
DIM	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

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