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# NPN - MPS6601; PNP - MPS6651, MPS6652

MPS6652 is a Preferred Device

## Amplifier Transistors

### Features

- Voltage and Current are Negative for PNP Transistors
- Pb-Free Packages are Available\*

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage MPS6601/6651 MPS6652	$V_{CEO}$	25 40	Vdc
Collector-Base Voltage MPS6601/6651 MPS6652	$V_{CBO}$	25 30	Vdc
Emitter-Base Voltage	$V_{EBO}$	4.0	Vdc
Collector Current - Continuous	$I_C$	1000	mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	625 5.0	W mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.5 12	W mW/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction-to-Ambient (Note 1)	$R_{\theta JA}$	200	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	83.3	$^\circ\text{C}/\text{W}$

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.

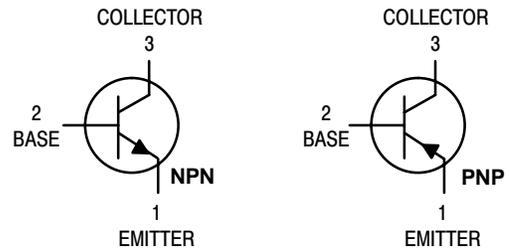
1.  $R_{\theta JA}$  is measured with the device soldered into a typical printed circuit board.

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

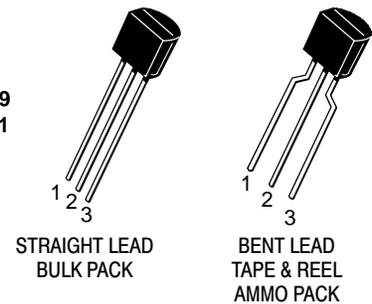


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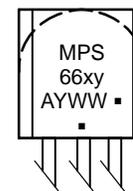
<http://onsemi.com>



TO-92  
CASE 29  
STYLE 1



### MARKING DIAGRAM



MPS66xy = Device Code

x = 0 or 5

y = 1 or 2

A = Assembly Location

Y = Year

WW = Work Week

▪ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

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

Preferred devices are recommended choices for future use and best overall value.

# NPN – MPS6601; PNP – MPS6651, MPS6652

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Breakdown Voltage (I <sub>C</sub> = 1.0 mA <sub>dc</sub> , I <sub>B</sub> = 0)	MPS6601/6651 MPS6652	V <sub>(BR)CEO</sub>	25 40	– –	V <sub>dc</sub>
Collector–Base Breakdown Voltage (I <sub>C</sub> = 100 μA <sub>dc</sub> , I <sub>E</sub> = 0)	MPS6601/6651 MPS6652	V <sub>(BR)CBO</sub>	25 40	– –	V <sub>dc</sub>
Emitter–Base Breakdown Voltage (I <sub>E</sub> = 10 μA <sub>dc</sub> , I <sub>C</sub> = 0)		V <sub>(BR)EBO</sub>	4.0	–	V <sub>dc</sub>
Collector Cutoff Current (V <sub>CE</sub> = 25 V <sub>dc</sub> , I <sub>B</sub> = 0) (V <sub>CE</sub> = 30 V <sub>dc</sub> , I <sub>B</sub> = 0)	MPS6601/6651 MPS6652	I <sub>CES</sub>	– –	0.1 0.1	μA <sub>dc</sub>
Collector Cutoff Current (V <sub>CB</sub> = 25 V <sub>dc</sub> , I <sub>E</sub> = 0) (V <sub>CB</sub> = 30 V <sub>dc</sub> , I <sub>E</sub> = 0)	MPS6601/6651 MPS6652	I <sub>CBO</sub>	– –	0.1 0.1	μA <sub>dc</sub>

## ON CHARACTERISTICS

DC Current Gain (I <sub>C</sub> = 100 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> ) (I <sub>C</sub> = 500 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> ) (I <sub>C</sub> = 1000 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> )		h <sub>FE</sub>	50 50 30	– – –	–
Collector–Emitter Saturation Voltage (I <sub>C</sub> = 1000 mA <sub>dc</sub> , I <sub>B</sub> = 100 mA <sub>dc</sub> )		V <sub>CE(sat)</sub>	–	0.6	V <sub>dc</sub>
Base–Emitter On Voltage (I <sub>C</sub> = 500 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> )		V <sub>BE(on)</sub>	–	1.2	V <sub>dc</sub>

## SMALL–SIGNAL CHARACTERISTICS

Current–Gain — Bandwidth Product (I <sub>C</sub> = 50 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 100 MHz)		f <sub>T</sub>	100	–	MHz
Output Capacitance (V <sub>CB</sub> = 10 V <sub>dc</sub> , I <sub>E</sub> = 0, f = 1.0 MHz)		C <sub>obo</sub>	–	30	pF

## SWITCHING CHARACTERISTICS

Delay Time	(V <sub>CC</sub> = 40 V <sub>dc</sub> , I <sub>C</sub> = 500 mA <sub>dc</sub> , I <sub>B1</sub> = 50 mA <sub>dc</sub> , t <sub>p</sub> ≥ 300 ns Duty Cycle)	t <sub>d</sub>	–	25	ns
Rise Time		t <sub>r</sub>	–	30	ns
Storage Time		t <sub>s</sub>	–	250	ns
Fall Time		t <sub>f</sub>	–	50	ns

## ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
MPS6601RLRAG	TO–92 (TO–226) (Pb–Free)	2000 Units / Tape & Reel
MPS6651G	TO–92 (TO–226) (Pb–Free)	5000 Units / Bulk
MPS6652	TO–92 (TO–226)	
MPS6652G	TO–92 (TO–226) (Pb–Free)	
MPS6652RLRAG	TO–92 (TO–226) (Pb–Free)	2000 Units / Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# NPN – MPS6601; PNP – MPS6651, MPS6652

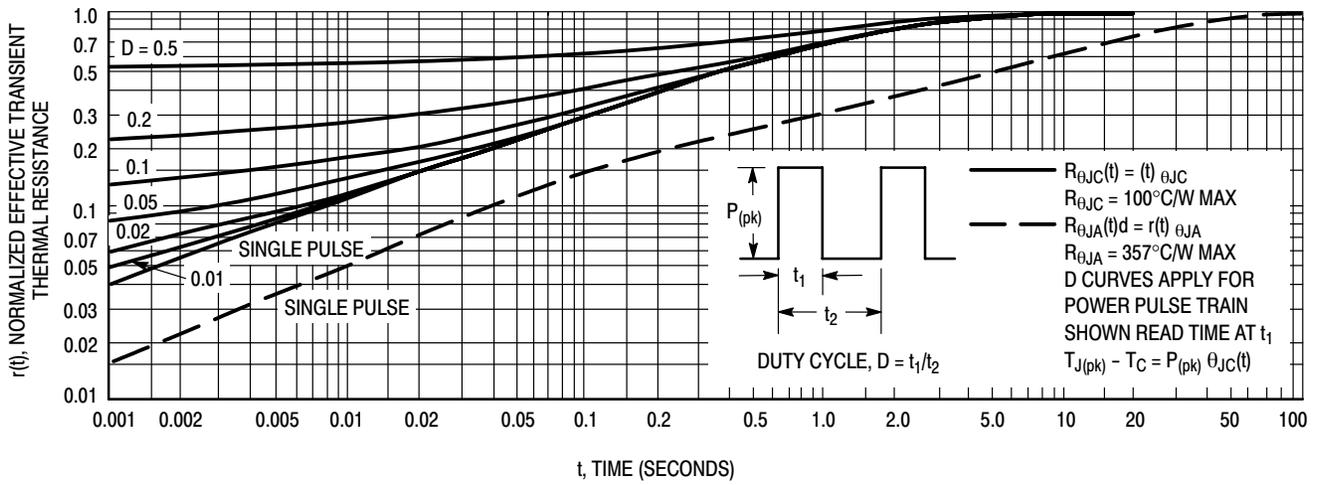
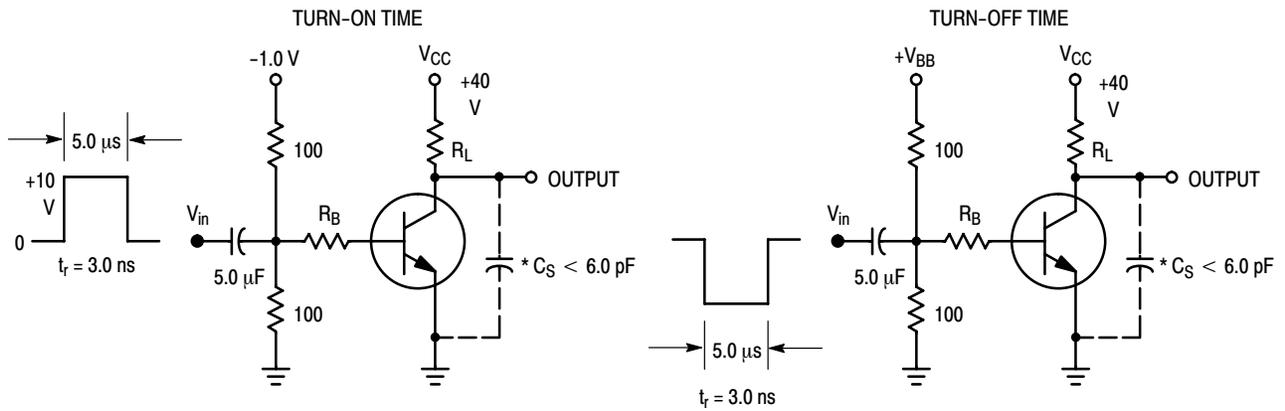


Figure 1. Thermal Response



\*Total Shunt Capacitance of Test Jig and Connectors  
For PNP Test Circuits, Reverse All Voltage Polarities

Figure 2. Switching Time Test Circuits

# NPN – MPS6601; PNP – MPS6651, MPS6652

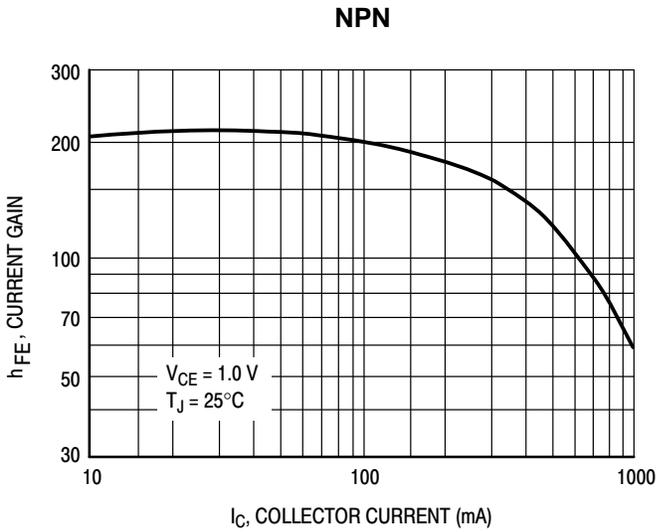


Figure 3. MPS6601/6602 DC Current Gain

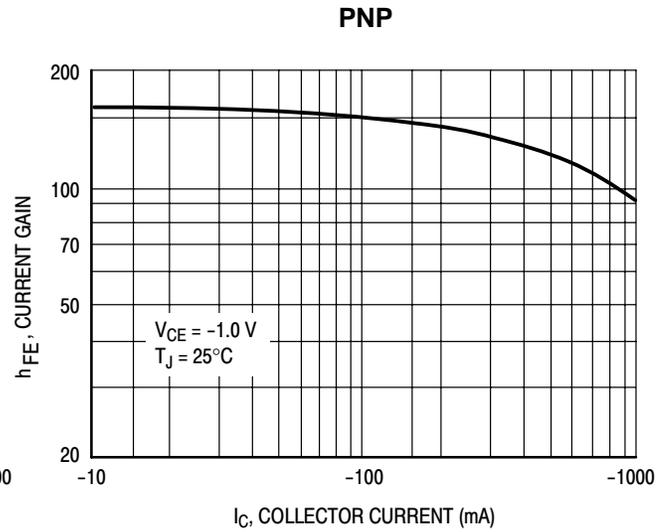


Figure 4. MPS6651/6652 DC Current Gain

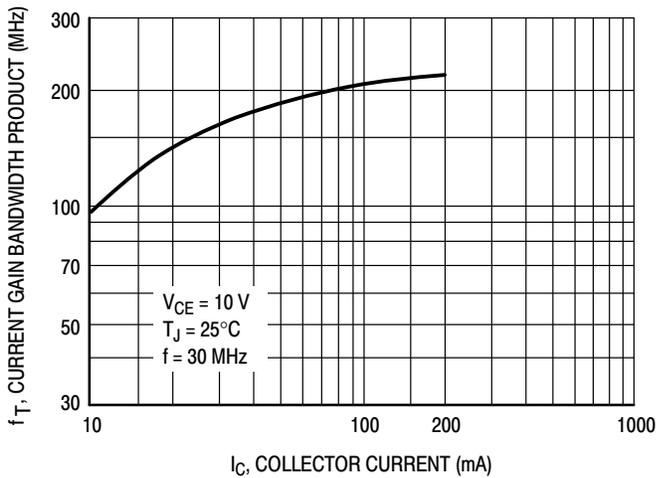


Figure 5. Current Gain Bandwidth Product

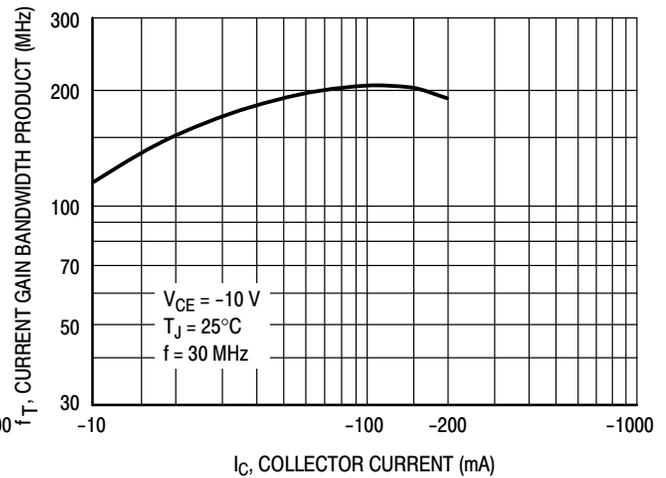


Figure 6. Current Gain Bandwidth Product

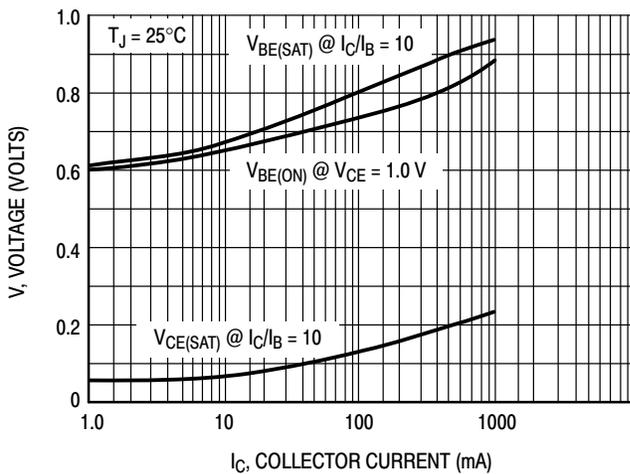


Figure 7. On Voltages

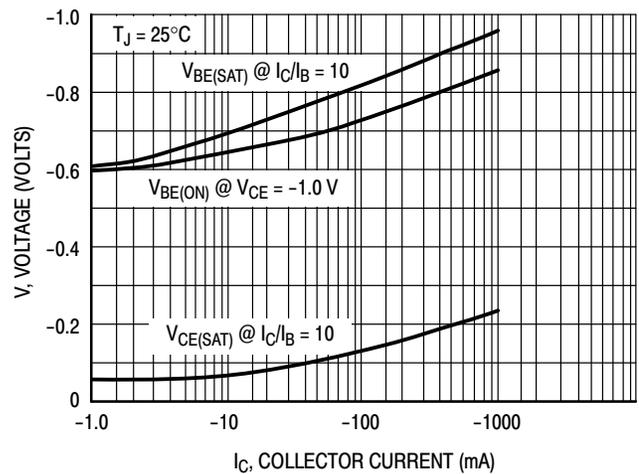
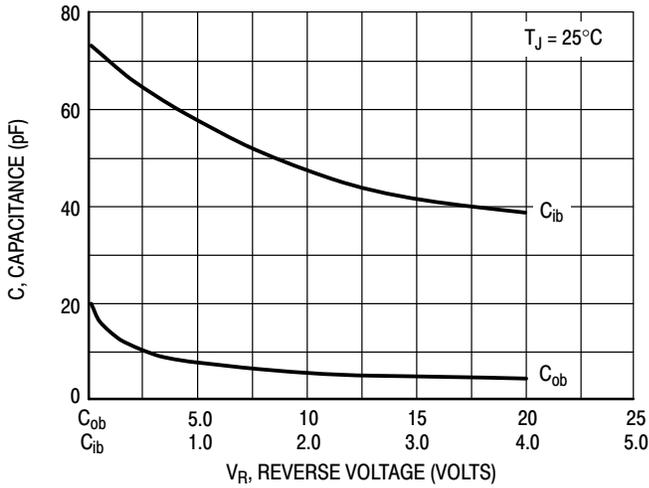


Figure 8. On Voltages

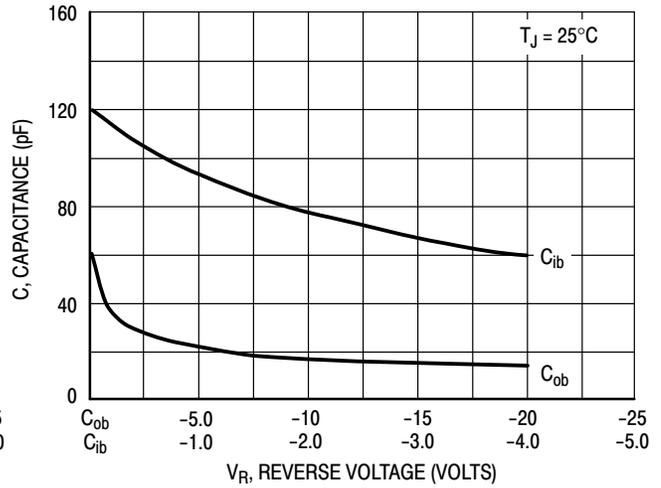
# NPN – MPS6601; PNP – MPS6651, MPS6652

**NPN**

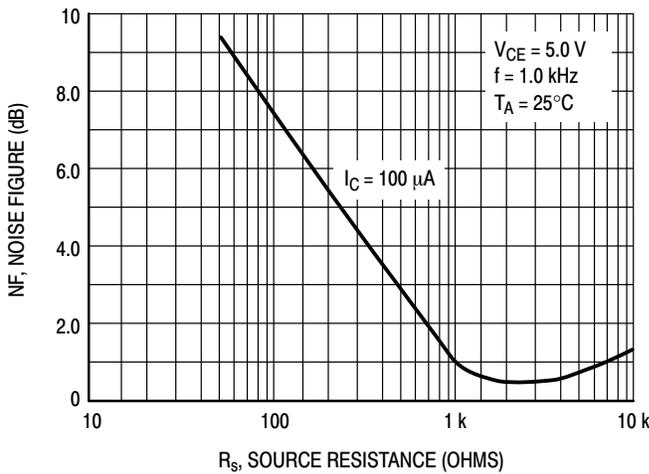


**Figure 9. Capacitance**

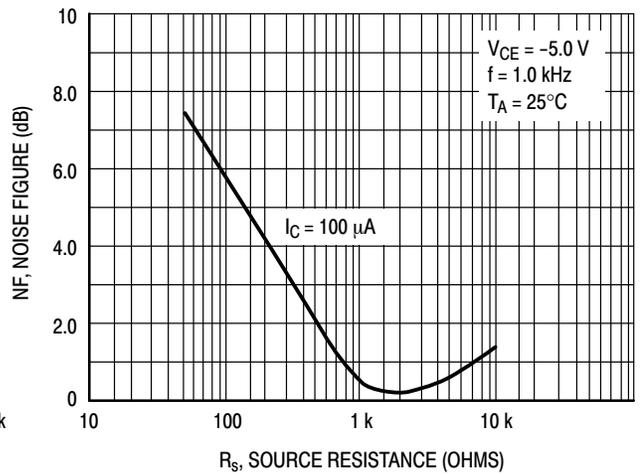
**PNP**



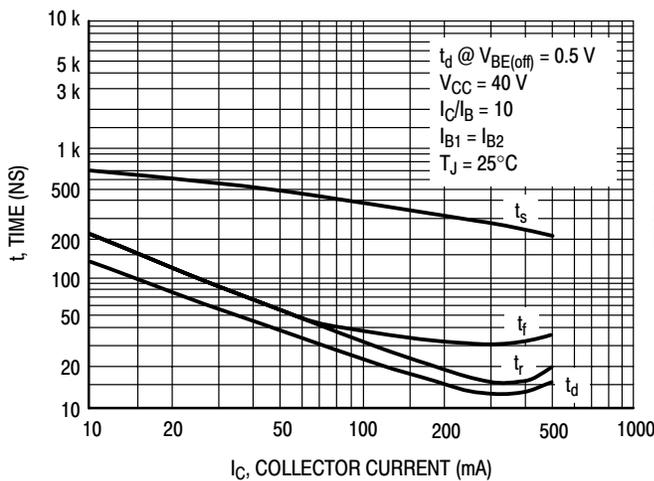
**Figure 10. Capacitance**



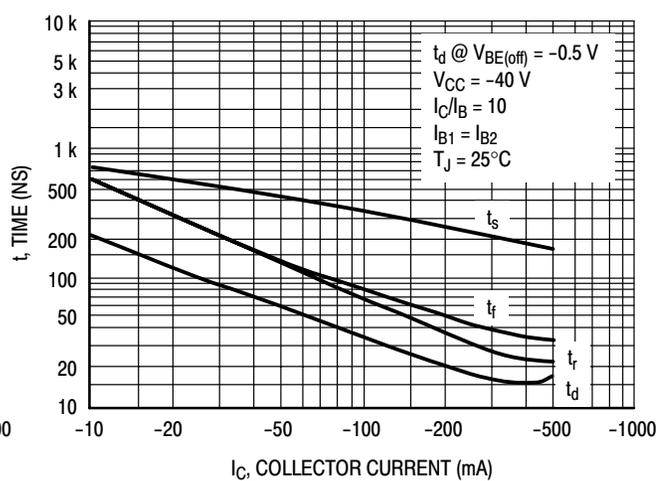
**Figure 11. MPS6601/6602 Noise Figure**



**Figure 12. MPS6651/6652 Noise Figure**



**Figure 13. MPS6601/6602 Switching Times**



**Figure 14. MPS6651/6652 Switching Times**

# NPN – MPS6601; PNP – MPS6651, MPS6652

NPN

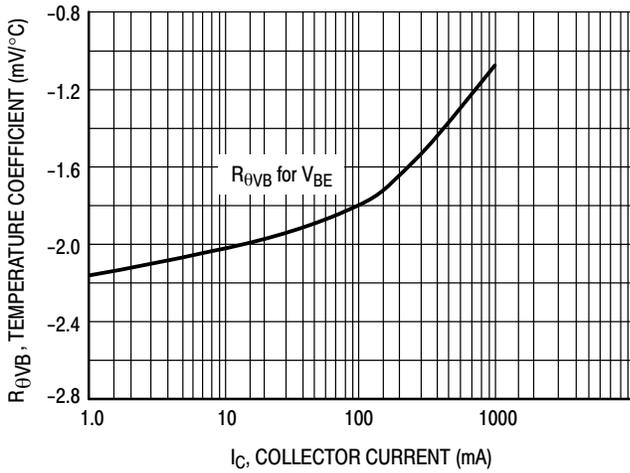


Figure 15. Base-Emitter Temperature Coefficient

PNP

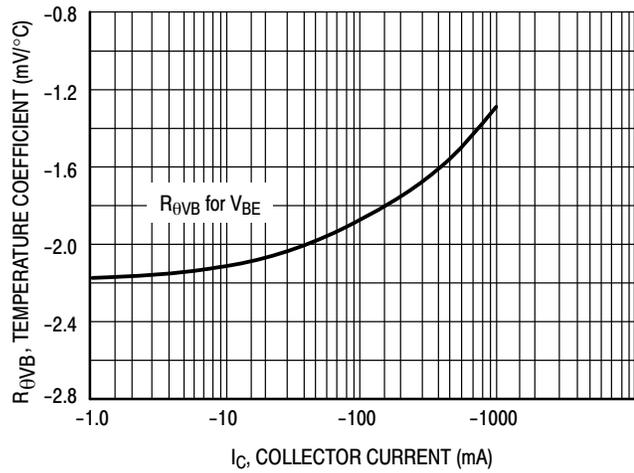


Figure 16. Base-Emitter Temperature Coefficient

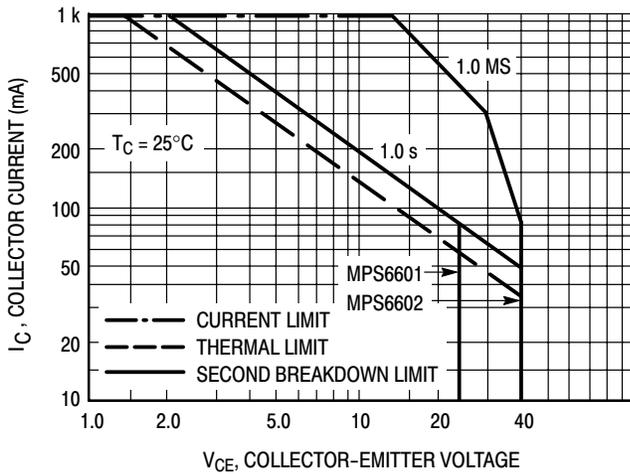


Figure 17. Safe Operating Area

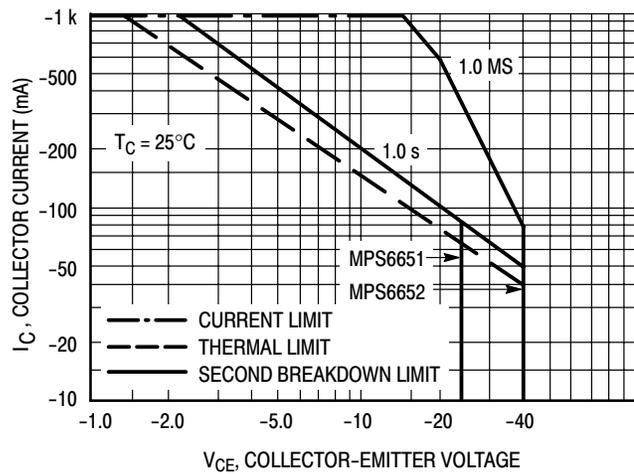


Figure 18. Safe Operating Area

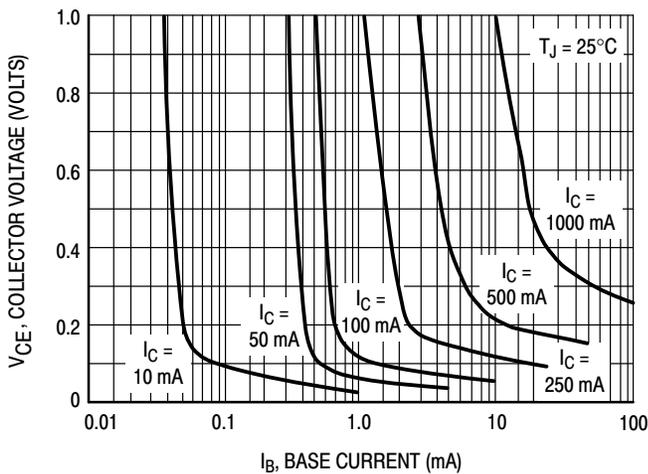


Figure 19. MPS6601/6602 Saturation Region

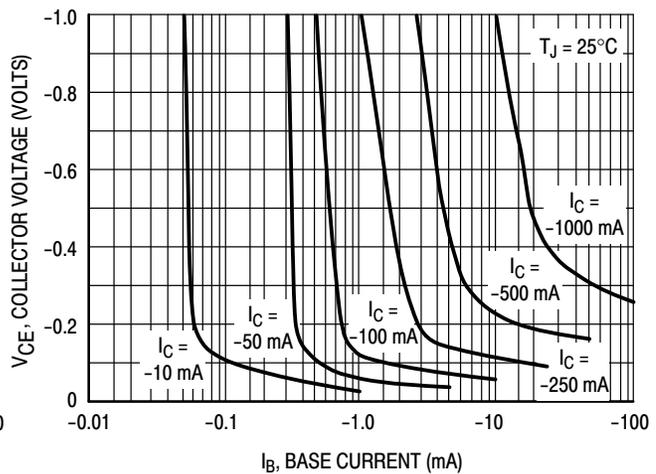
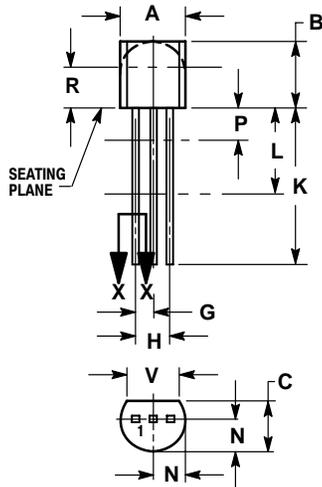


Figure 20. MPS6651/6652 Saturation Region

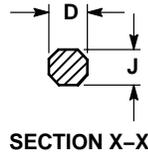
# NPN – MPS6601; PNP – MPS6651, MPS6652

## PACKAGE DIMENSIONS

TO-92 (TO-226)  
CASE 29-11  
ISSUE AM



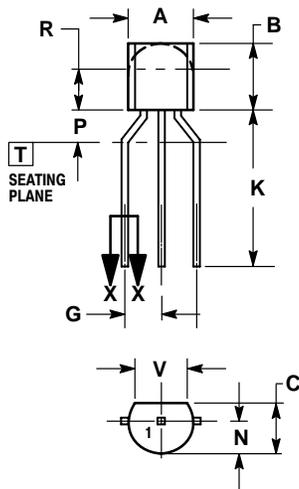
STRAIGHT LEAD  
BULK PACK



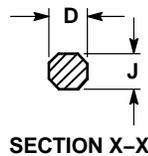
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.021	0.407	0.533
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	---	12.70	---
L	0.250	---	6.35	---
N	0.080	0.105	2.04	2.66
P	---	0.100	---	2.54
R	0.115	---	2.93	---
V	0.135	---	3.43	---



BENT LEAD  
TAPE & REEL  
AMMO PACK



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

DIM	MILLIMETERS	
	MIN	MAX
A	4.45	5.20
B	4.32	5.33
C	3.18	4.19
D	0.40	0.54
G	2.40	2.80
J	0.39	0.50
K	12.70	---
N	2.04	2.66
P	1.50	4.00
R	2.93	---
V	3.43	---

STYLE 1:

1. EMITTER
2. BASE
3. COLLECTOR

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