

# 2N7000

Preferred Device

## Small Signal MOSFET 200 mAmps, 60 Volts N-Channel TO-92

### Features

- AEC Qualified
- PPAP Capable
- Pb-Free Packages are Available\*

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	60	Vdc
Drain-Gate Voltage ( $R_{GS} = 1.0 \text{ M}\Omega$ )	$V_{DGR}$	60	Vdc
Gate-Source Voltage - Continuous - Non-repetitive ( $t_p \leq 50 \mu\text{s}$ )	$V_{GS}$ $V_{GSM}$	$\pm 20$ $\pm 40$	Vdc Vpk
Drain Current - Continuous - Pulsed	$I_D$ $I_{DM}$	200 500	mAdc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	350 2.8	mW mW/ $^\circ\text{C}$
Operating and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	357	$^\circ\text{C}/\text{W}$
Maximum Lead Temperature for Soldering Purposes, 1/16" from case for 10 seconds	$T_L$	300	$^\circ\text{C}$

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.

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



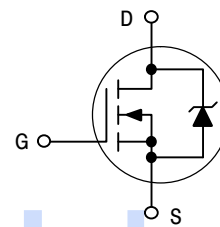
ON Semiconductor®

<http://onsemi.com>

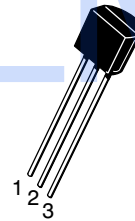
**200 mAmps  
60 Volts**

$R_{DS(on)} = 5 \Omega$

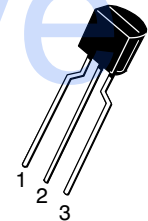
N-Channel



TO-92  
CASE 29  
STYLE 22

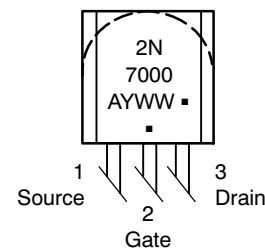


STRAIGHT LEAD  
BULK PACK



BENT LEAD  
TAPE & REEL  
AMMO PACK

### MARKING DIAGRAM AND PIN ASSIGNMENT



- 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.

## 2N7000

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

Characteristic	Symbol	Min	Max	Unit
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#### OFF CHARACTERISTICS

Drain-Source Breakdown Voltage	(V <sub>GS</sub> = 0, I <sub>D</sub> = 10 μAdc)	V <sub>(BR)DSS</sub>	60	-	Vdc
Zero Gate Voltage Drain Current	(V <sub>DS</sub> = 48 Vdc, V <sub>GS</sub> = 0) (V <sub>DS</sub> = 48 Vdc, V <sub>GS</sub> = 0, T <sub>J</sub> = 125°C)	I <sub>DSS</sub>	-	1.0	μAdc mAdc
Gate-Body Leakage Current, Forward	(V <sub>GSF</sub> = 15 Vdc, V <sub>DS</sub> = 0)	I <sub>GSSF</sub>	-	-10	nAdc

#### ON CHARACTERISTICS (Note 1)

Gate Threshold Voltage	(V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 1.0 mAdc)	V <sub>GS(th)</sub>	0.8	3.0	Vdc
Static Drain-Source On-Resistance	(V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 0.5 Adc) (V <sub>GS</sub> = 4.5 Vdc, I <sub>D</sub> = 75 mAdc)	r <sub>DS(on)</sub>	-	5.0 6.0	Ω
Drain-Source On-Voltage	(V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 0.5 Adc) (V <sub>GS</sub> = 4.5 Vdc, I <sub>D</sub> = 75 mAdc)	V <sub>DS(on)</sub>	-	2.5 0.45	Vdc
On-State Drain Current	(V <sub>GS</sub> = 4.5 Vdc, V <sub>DS</sub> = 10 Vdc)	I <sub>d(on)</sub>	75	-	mAdc
Forward Transconductance	(V <sub>DS</sub> = 10 Vdc, I <sub>D</sub> = 200 mAdc)	g <sub>fs</sub>	100	-	μmhos

#### DYNAMIC CHARACTERISTICS

Input Capacitance	(V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0, f = 1.0 MHz)	C <sub>iss</sub>	-	60	pF
Output Capacitance		C <sub>oss</sub>	-	25	
Reverse Transfer Capacitance		C <sub>rss</sub>	-	5.0	

#### SWITCHING CHARACTERISTICS (Note 1)

Turn-On Delay Time	(V <sub>DD</sub> = 15 V, I <sub>D</sub> = 500 mA, R <sub>G</sub> = 25 Ω, R <sub>L</sub> = 30 Ω, V <sub>gen</sub> = 10 V)	t <sub>on</sub>	-	10	ns
Turn-Off Delay Time		t <sub>off</sub>	-	10	

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

#### ORDERING INFORMATION

Device	Package	Shipping†
2N7000	TO-92	1000 Units / Bulk
2N7000G	TO-92 (Pb-Free)	1000 Units / Bulk
2N7000RLRA	TO-92	2000 Tape & Reel
2N7000RLRAG	TO-92 (Pb-Free)	2000 Tape & Reel
2N7000RLRMG	TO-92 (Pb-Free)	2000 Tape & Ammo Box
2N7000RLRPG	TO-92 (Pb-Free)	2000 Tape & Ammo Box

†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.

# 2N7000

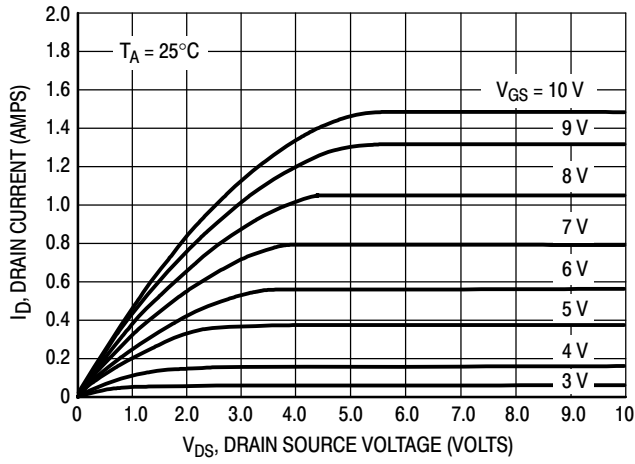


Figure 1. Ohmic Region

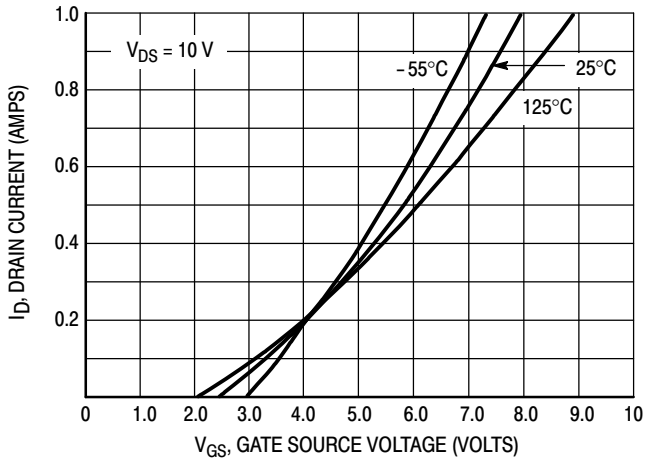


Figure 2. Transfer Characteristics

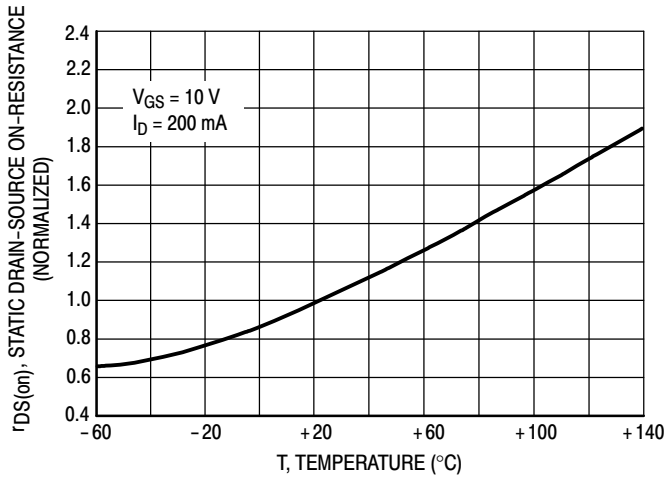


Figure 3. Temperature versus Static Drain-Source On-Resistance

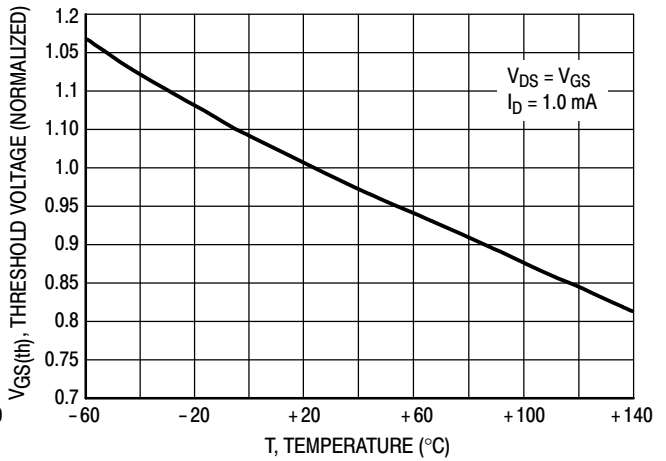
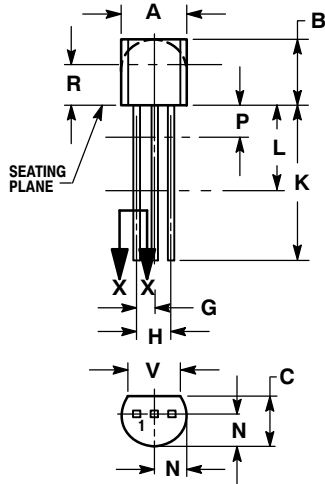


Figure 4. Temperature versus Gate Threshold Voltage

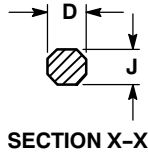
# 2N7000

## PACKAGE DIMENSIONS

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



STRAIGHT LEAD  
BULK PACK

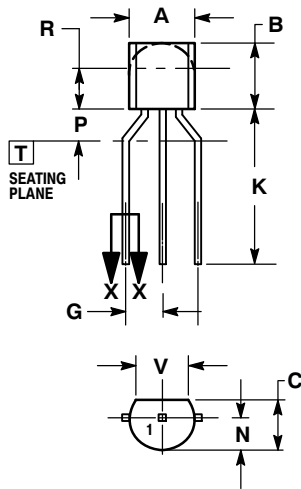


SECTION X-X

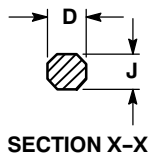
NOTES:

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



SECTION X-X

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 22:

1. SOURCE
2. GATE
3. DRAIN

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