

# NTMS4704N

## Power MOSFET

30 V, 12.3 A, Single N-Channel, SO-8

### Features

- Low  $R_{DS(on)}$
- Low Gate Charge
- Standard SO-8 Single Package
- Pb-Free Package is Available

### Applications

- Notebooks, Graphics Cards
- Synchronous Rectification
- High Side Switch
- DC-DC Converters

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise stated)

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage		$V_{DS}$	30	V
Gate-to-Source Voltage		$V_{GS}$	$\pm 20$	V
Continuous Drain Current (Note 1)	Steady State	$I_D$	10	A
	$T_A = 25^\circ\text{C}$		7.3	
	$t \leq 10\text{ s}$	$T_A = 25^\circ\text{C}$	12.3	
Power Dissipation (Note 1)	Steady State	$P_D$	1.6	W
	$t \leq 10\text{ s}$		2.3	
Continuous Drain Current (Note 2)	Steady State	$I_D$	7.6	A
	$T_A = 85^\circ\text{C}$		5.4	
Power Dissipation (Note 2)	$T_A = 25^\circ\text{C}$	$P_D$	0.86	W
Pulsed Drain Current	$t_p = 10\text{ }\mu\text{s}$	$I_{DM}$	37	A
Operating Junction and Storage Temperature		$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$
Source Current (Body Diode)		$I_S$	2.3	A
Single Pulse Drain-to-Source Avalanche Energy ( $V_{DD} = 25\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_L$ Peak = 7.5 A, $L = 10\text{ mH}$ , $R_G = 25\text{ }\Omega$ )		$E_{AS}$	200	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 secs)		$T_L$	260	$^\circ\text{C}$

### THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	80.5	$^\circ\text{C/W}$
Junction-to-Ambient – $t \leq 10\text{ s}$ (Note 1)	$R_{\theta JA}$	55	
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	145	

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. Surfaced mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
2. Surfaced mounted on FR4 board using the minimum recommended pad size.

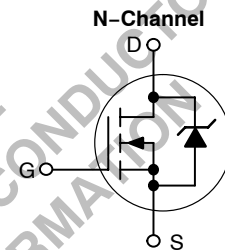


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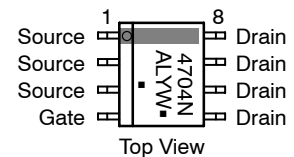
$V_{(BR)DSS}$	$R_{DS(ON)}$ TYP	$I_D$ MAX
30 V	7.5 m $\Omega$ @ 10 V	12.3 A
	10 m $\Omega$ @ 4.5 V	



### MARKING DIAGRAM/ PIN ASSIGNMENT



SO-8  
CASE 751  
STYLE 12



4704N = Device Code  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
WW = Work Week  
■ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

Device	Package	Shipping†
NTMS4704NR2	SO-8	2500/Tape & Reel
NTMS4704NR2G	SO-8 (Pb-Free)	2500/Tape & Reel

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

# NTMS4704N

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	30			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			28		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$	$T_J = 25^\circ\text{C}$		1.0	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		50	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA

### ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	1.0		2.5	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			5.0		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 12.3\text{ A}$		7.5	9.5	m $\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 10\text{ A}$		10	12.5	
Forward Transconductance	$g_{FS}$	$V_{DS} = 15\text{ V}, I_D = 10\text{ A}$		20		S

### CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 20\text{ V}$		1225		pF
Output Capacitance	$C_{oss}$			580		
Reverse Transfer Capacitance	$C_{rss}$			125		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 10\text{ A}$		12	17	nC
Threshold Gate Charge	$Q_{G(TH)}$			1.6		
Gate-to-Source Charge	$Q_{GS}$			3.25		
Gate-to-Drain Charge	$Q_{GD}$			5.25		
Gate Resistance	$R_G$			1.8		$\Omega$

### SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 10\text{ V}, V_{DD} = 15\text{ V}, I_D = 1.0\text{ A}, R_G = 3.0\text{ }\Omega$		8.2		ns
Rise Time	$t_r$			5.4		
Turn-Off Delay Time	$t_{d(off)}$			28.4		
Fall Time	$t_f$			10.5		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 2.3\text{ A}$	$T_J = 25^\circ\text{C}$		0.75	1.0	V
			$T_J = 125^\circ\text{C}$		0.56		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s}, I_S = 2.3\text{ A}$		35			ns
Charge Time	$t_a$			18			
Discharge Time	$t_b$			17			
Reverse Recovery Charge	$Q_{RR}$			33			nC

3. Pulse Test: pulse width = 300  $\mu\text{s}$ , duty cycle  $\leq 2\%$ .

4. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

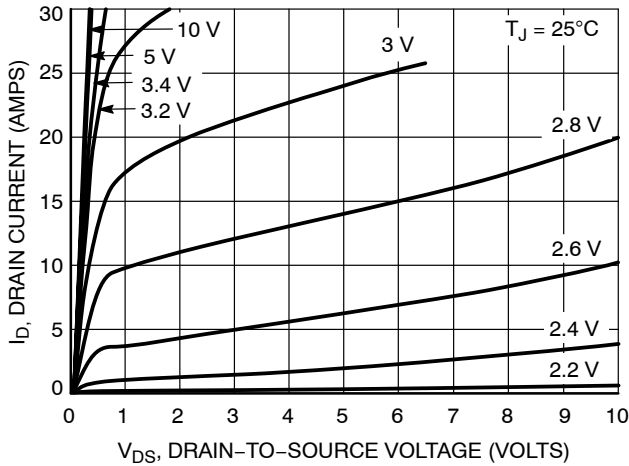


Figure 1. On-Region Characteristics

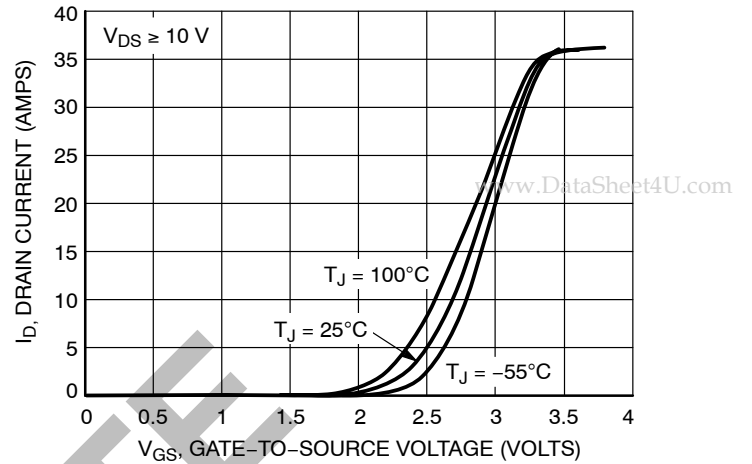


Figure 2. Transfer Characteristics

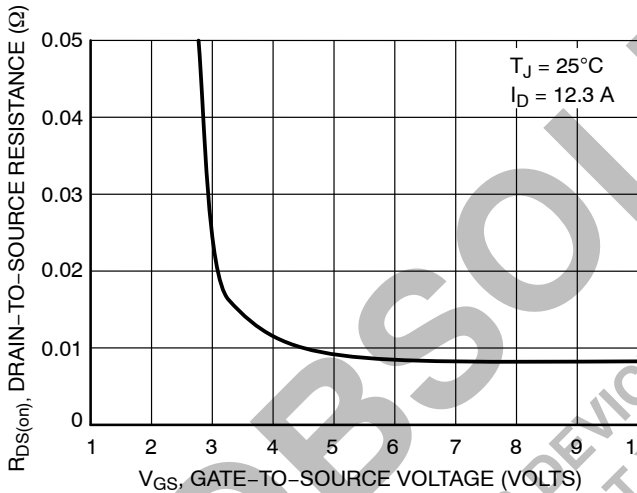


Figure 3. On-Resistance vs. Gate-to-Source Voltage

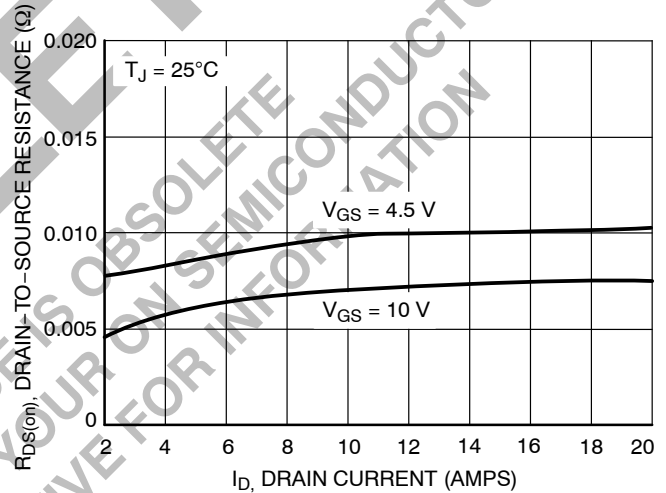


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

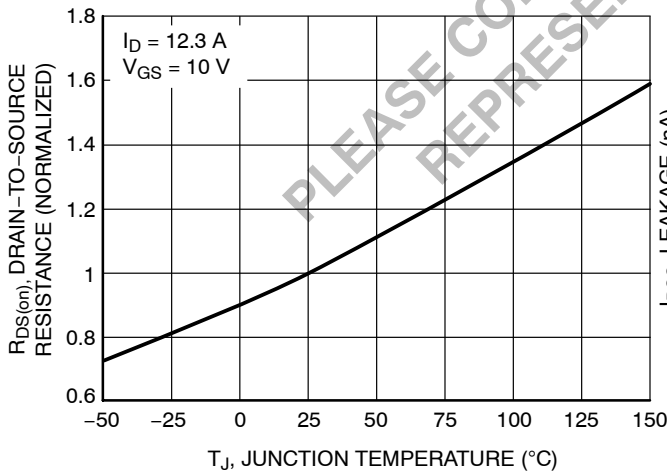


Figure 5. On-Resistance Variation with Temperature

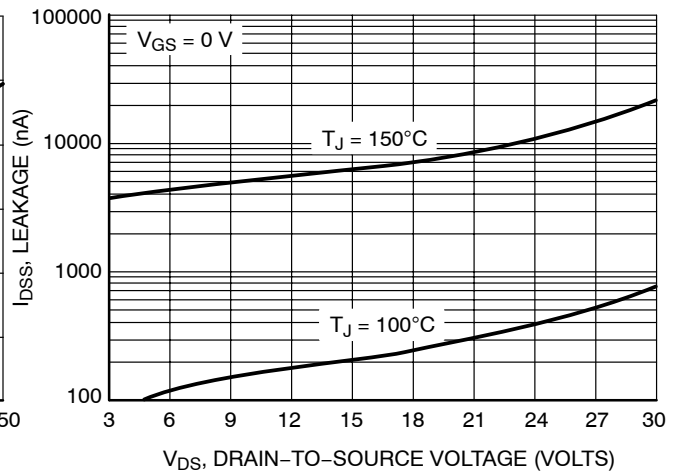
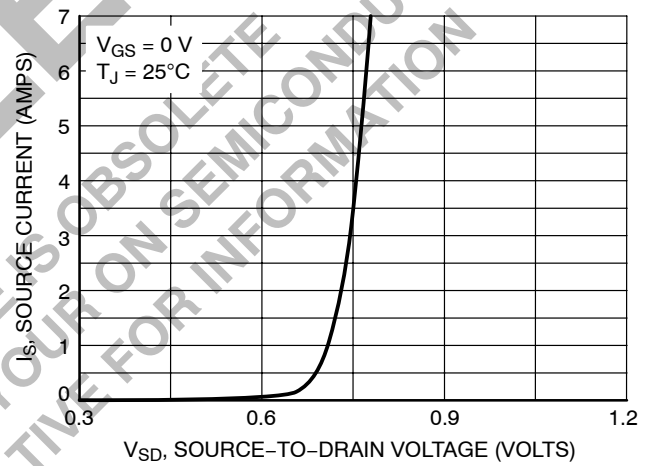
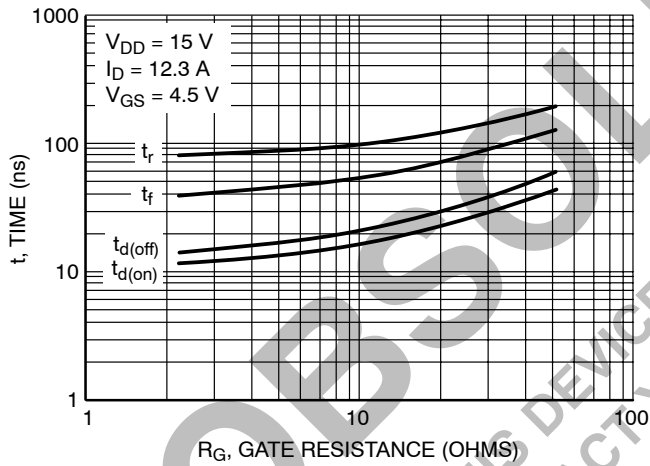
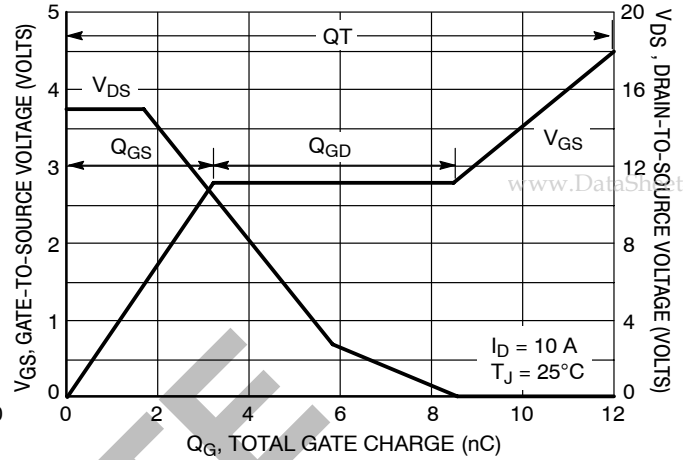
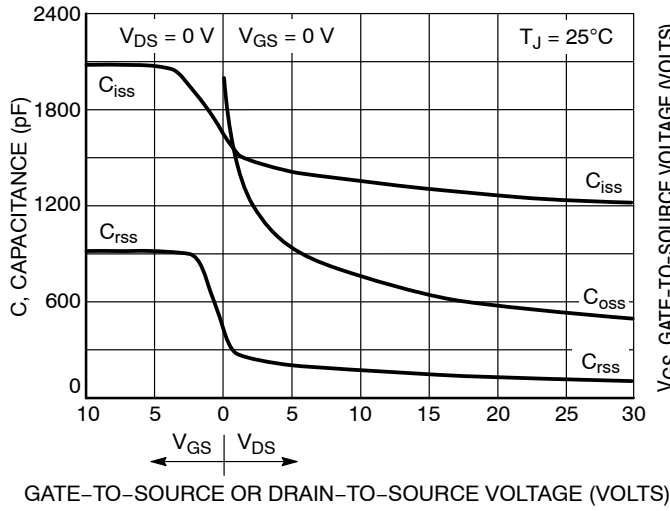


Figure 6. Drain-to-Source Leakage Current vs. Voltage

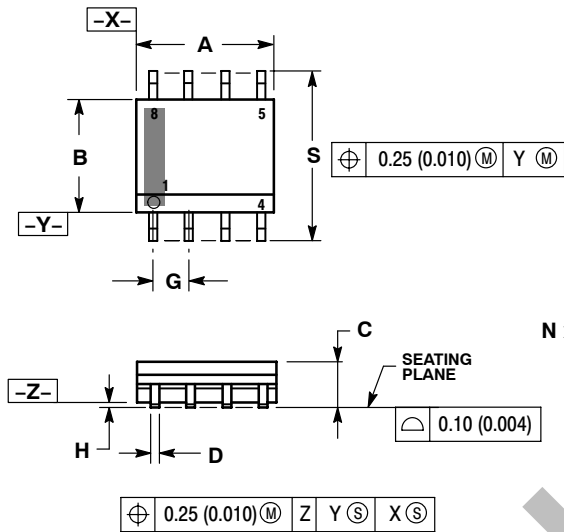
TYPICAL PERFORMANCE CURVES



# NTMS4704N

## PACKAGE DIMENSIONS

SOIC-8  
CASE 751-07  
ISSUE AG

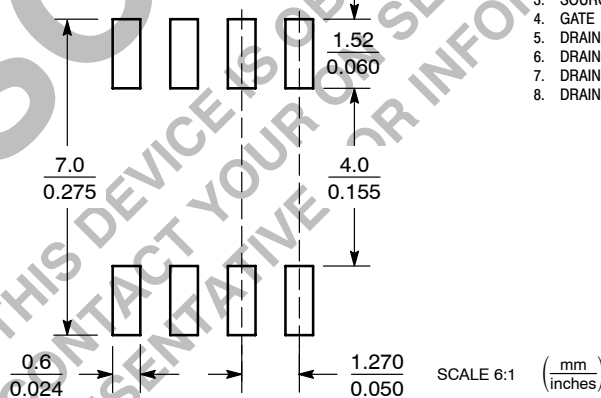


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0°	8°	0°	8°
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

### SOLDERING FOOTPRINT\*



### STYLE 12:

1. SOURCE
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN
7. DRAIN
8. DRAIN

\*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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