NTMS4404N

Power MOSFET

30 V, 12 A, Single N−Channel, SO−8

Features

- High Density Power MOSFET with Ultra Low $R_{DS(on)}$ for Higher Efficiency
- Miniature SO−8 Surface Mount Package Saving Board Space
- I_{DSS} Specified at Elevated Temperature
- Diode Exhibits High Speed, Soft Recovery

Applications

- Power Management for Battery Power Products
- Portable Products
- Computers, Printers, PCMCIA Cards
- Cell Phones, Cordless Telephones

MAXIMUM RATINGS (T_J = 25°C unless otherwise stated)

Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	30	V
Gate−to−Source Voltage			V_{GS}	±20	V
Continuous Drain Current (Note 1)	Steady State	T_A = 25°C	I_D	9.6	A
		T_A = 70°C		7.6	
	tp ≤ 10 s	T_A = 25°C		12	
Power Dissipation (Note 1)	Steady State		P_D	1.56	W
	tp ≤ 10 s			2.5	
Continuous Drain Current (Note 2)	Steady State	T_A = 25°C	I_D	7.0	A
		T_A = 70°C		5.6	
Power Dissipation (Note 2)		T_A = 25°C	P_D	0.83	W
Pulsed Drain Current	tp = 10 μs, DC = 2 %		I_{DM}	50	A
Operating Junction and Storage Temperature			T_J, T_{STG}	−55 to 150	°C
Source Current (Body Diode)			I_S	6.0	A
Single Pulse Drain−to−Source Avalanche Energy (V_{DD} = 20 V, V_{GS} = 5 V, I_{PK} = 7.25 A, L = 19 mH, R_G = 25 Ω)			E_{AS}	500	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T_L	260	°C

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction−to−Ambient – Steady State (Note 1)	$R_{\theta JA}$	80	°C/W
Junction−to−Ambient – t = 1 0 s (Note 1)	$R_{\theta JA}$	50	
Junction−to−Ambient – Steady State (Note 2)	$R_{\theta JA}$	150	

1. Surface−mounted on FR4 board using 1 in sq. pad size (Cu area = 1.127 in sq. [1 oz] including traces)
2. Surface−mounted on FR4 board using the minimum recommended pad size (Cu area = 0.412 in sq.)

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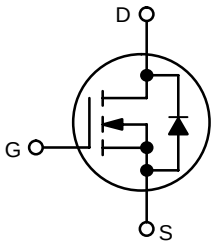
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
30 V	9.7 mΩ @ 10 V	12 A
	15.5 mΩ @ 4.5 V	

N−Channel



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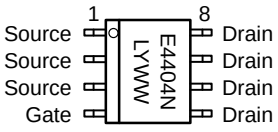
SO−8
CASE 751
STYLE 12

MARKING DIAGRAM/ PIN ASSIGNMENT



Top View

E4404N = Device Code
L = Assembly Location
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping†
NTMS4404NR2	SO−8	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.

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise specified)

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
OFF CHARACTERISTICS							
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 250 μA		30			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$				25		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 30 V	T_J = 25°C			1.0	μA
			T_J = 100°C			5.0	
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±20 V				±100	nA
ON CHARACTERISTICS (Note 3)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 250 μA		1.0	2.2	3.0	V
Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				−5.0		mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 12 A			9.7	11.5	mΩ
		V_{GS} = 4.5 V, I_D = 6.0 A			15.5	17.5	
Forward Transconductance	g_{FS}	V_{DS} = 15 V, I_D = 12 A			17.5		S
CHARGES AND CAPACITANCES							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1 MHz, V_{DS} = 24 V			1975	2500	pF
Output Capacitance	C_{OSS}				575	750	
Reverse Transfer Capacitance	C_{RSS}				180	300	
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 10 V, V_{DS} = 24 V, I_D = 12 A			50	70	nC
Threshold Gate Charge	$Q_{G(TH)}$				2.4		
Gate−to−Source Charge	Q_{GS}				7.5		
Gate−to−Drain Charge	Q_{GD}				16		
SWITCHING CHARACTERISTICS, V_{GS} = 10 V (Note 4)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = 10 V, V_{DS} = 24 V, I_D = 12 A, R_G = 2.5 Ω			15	25	ns
Rise Time	tr				25	50	
Turn−Off Delay Time	$t_{d(OFF)}$				35	55	
Fall Time	t_f				15	30	
SWITCHING CHARACTERISTICS, V_{GS} = 4.5 V (Note 4)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = 4.5 V, V_{DS} = 24 V, I_D = 6.0 A, R_G = 2.5 Ω			20		ns
Rise Time	tr				80		
Turn−Off Delay Time	$t_{d(OFF)}$				25		
Fall Time	t_f				15		
DRAIN−SOURCE DIODE CHARACTERISTICS (Note 4)							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = 6.0 A	T_J = 25°C		0.80	1.1	V
			T_J = 125°C		0.65		
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, d_{ISD}/d_t = 100 A/μs, I_S = 6.0 A			40	55	ns
Charge Time	t_a				23		
Discharge Time	tb				17		
Reverse Recovery Charge	Q_{RR}				0.05		μC

NOTES:
3. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
4. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

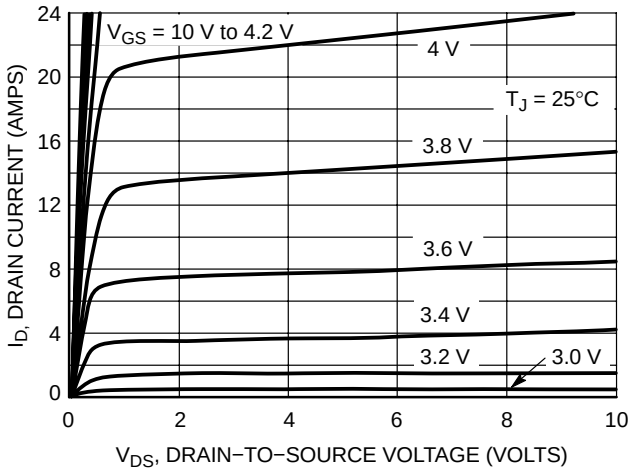


Figure 1. On−Region Characteristics

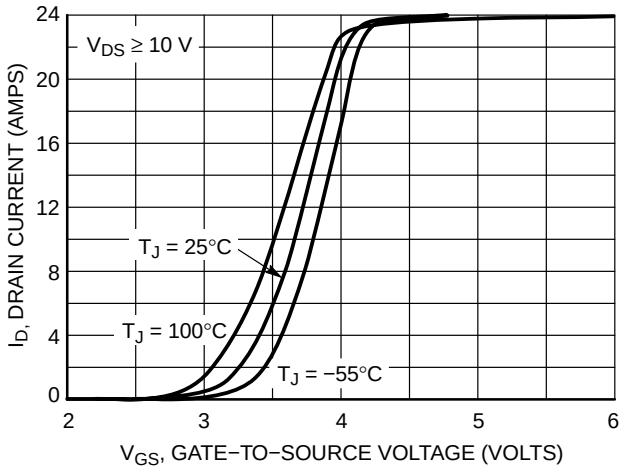


Figure 2. Transfer Characteristics

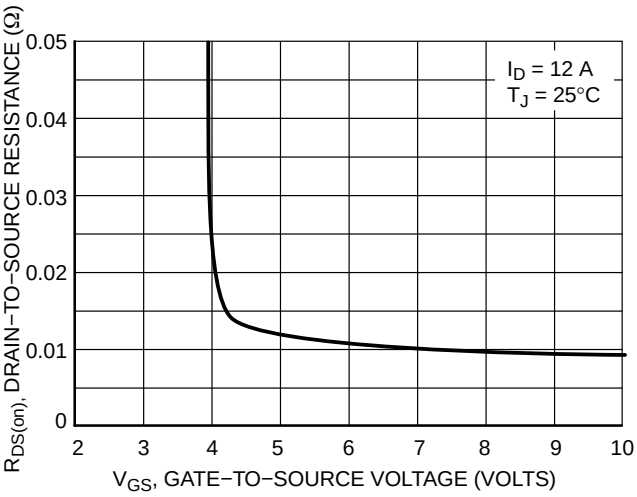


Figure 3. On−Resistance vs. Gate−to−Source Voltage

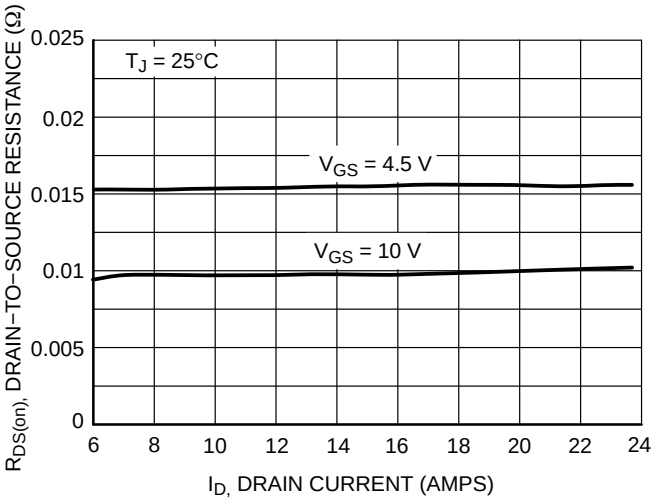


Figure 4. On−Resistance vs. Drain Current and Gate Voltage

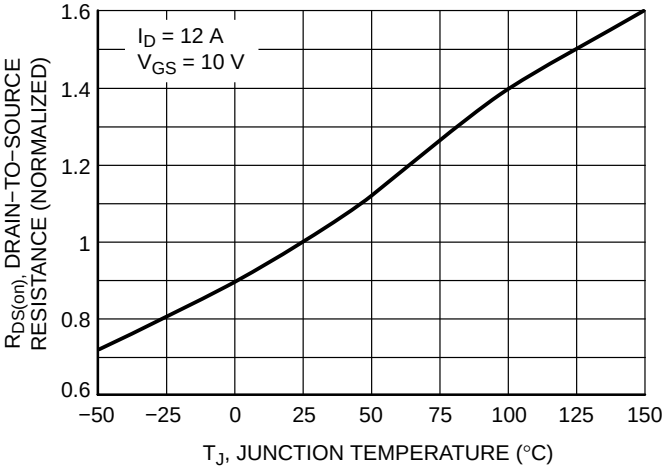


Figure 5. On−Resistance Variation with Temperature

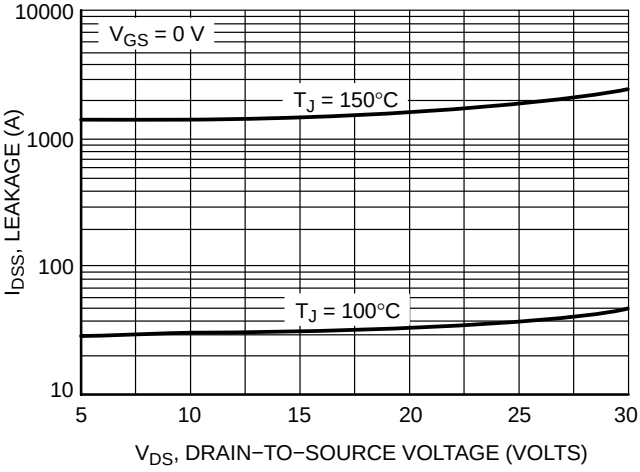


Figure 6. Drain−to−Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES

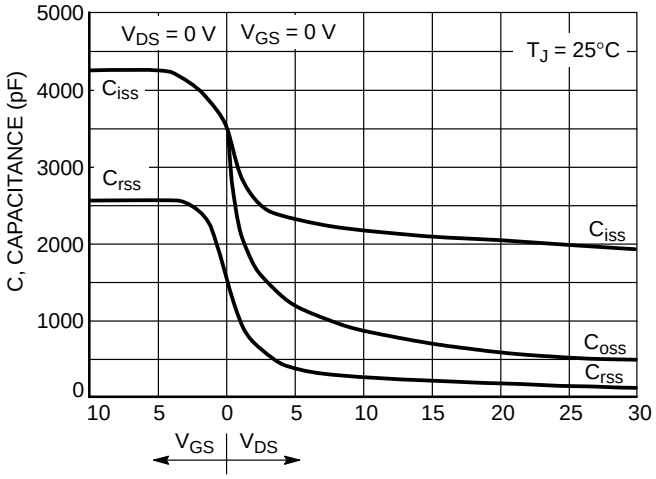


Figure 7. Capacitance Variation

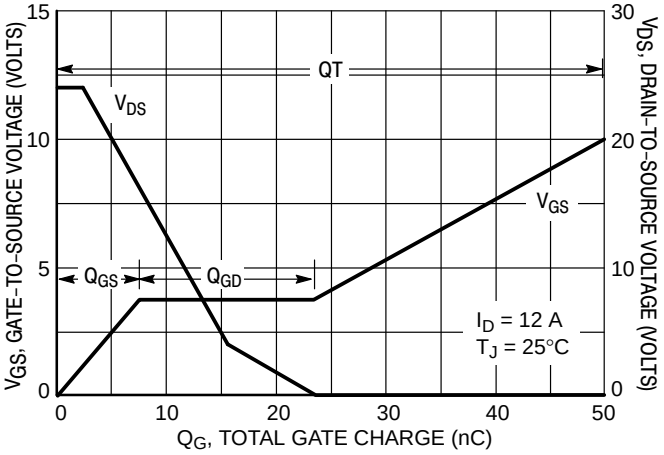


Figure 8. Gate−To−Source and Drain−To−Source Voltage vs. Total Charge

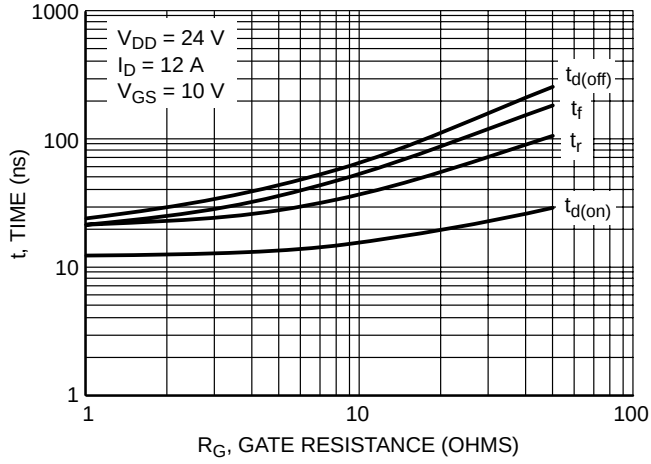


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

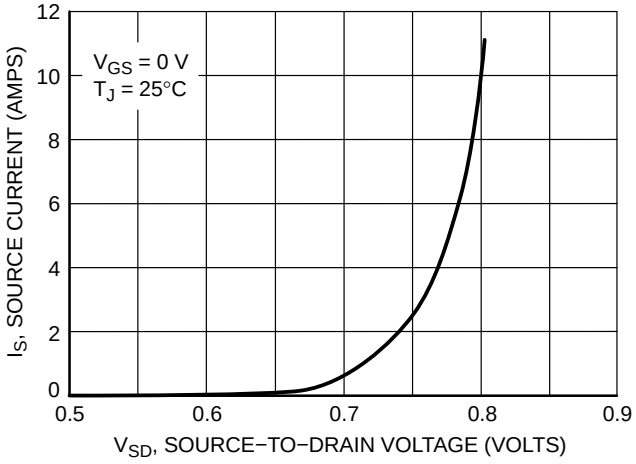


Figure 10. Diode Forward Voltage vs. Current

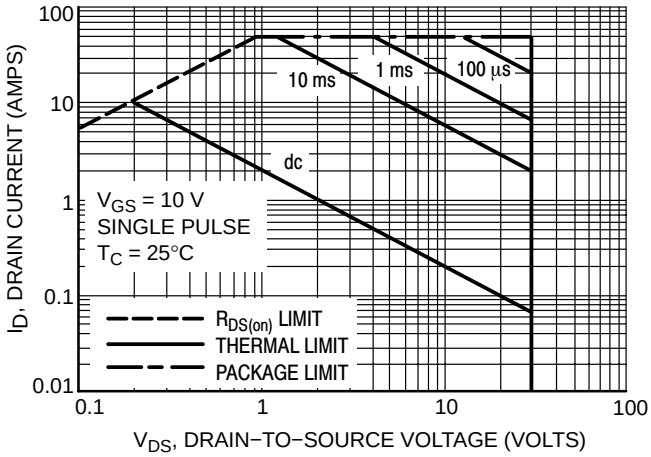


Figure 11. Maximum Rated Forward Biased Safe Operating Area

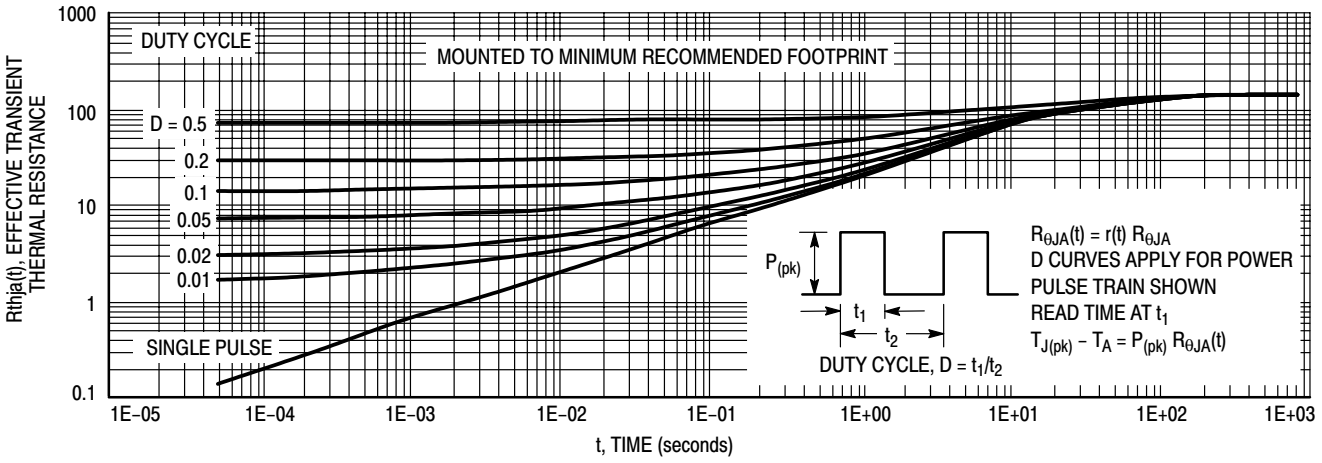
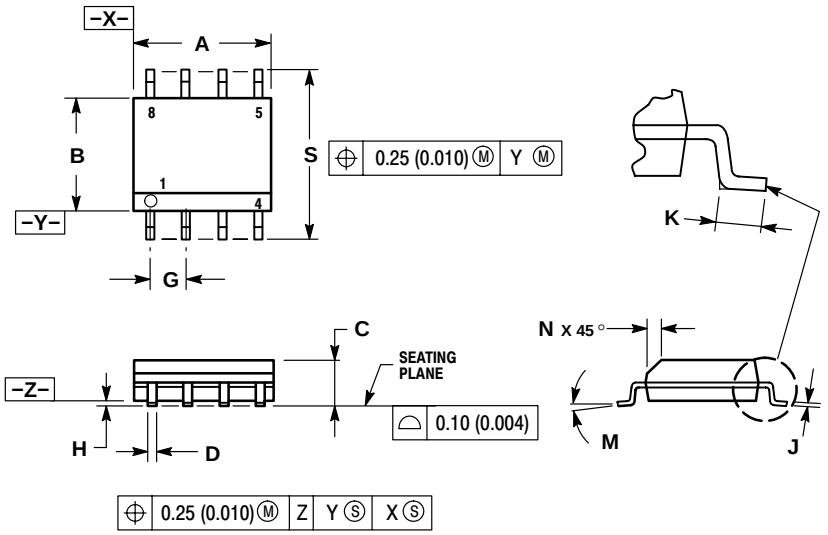


Figure 12. Thermal Response − Various Duty Cycles

PACKAGE DIMENSIONS

SOIC−8 NB
CASE 751−07
ISSUE AA



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.

	MILLIMETERS		INCHES	
DIM	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

STYLE 12:
PIN 1. SOURCE
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN
7. DRAIN
8. DRAIN

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