

# NTD5406N

## Power MOSFET

40 V, 70 A, Single N-Channel, DPAK

### Features

- Low  $R_{DS(on)}$
- High Current Capability
- Low Gate Charge
- These are Pb-Free Devices

### Applications

- Electronic Brake Systems
- Electronic Power Steering
- Bridge Circuits

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

Parameter		Symbol	Value	Units	
Drain-to-Source Voltage		$V_{DSS}$	40	V	
Gate-to-Source Voltage		$V_{GS}$	$\pm 20$	V	
Continuous Drain Current - $R_{\theta JC}$ (Note 1)	Steady State	$T_C = 25^\circ\text{C}$	$I_D$	70	A
			$T_C = 100^\circ\text{C}$	50	
Power Dissipation - $R_{\theta JC}$ (Note 1)	Steady State	$T_C = 25^\circ\text{C}$	$P_D$	100	W
Pulsed Drain Current	$t_p = 10 \mu\text{s}$		$I_{DM}$	150	A
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-55 to 175	$^\circ\text{C}$	
Source Current (Body Diode) Pulsed		$I_S$	63.5	A	
Single Pulse Drain-to-Source Avalanche Energy - ( $V_{DD} = 50 \text{ V}, V_{GS} = 10 \text{ V}, I_{PK} = 30 \text{ A}, L = 1 \text{ mH}, R_G = 25 \Omega$ )		EAS	450	mJ	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	$^\circ\text{C}$	

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

### THERMAL RESISTANCE RATINGS (Note 1)

Parameter	Symbol	Max	Units
Junction-to-Case (Drain)	$R_{\theta JC}$	1.5	$^\circ\text{C/W}$

1. Surface mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).

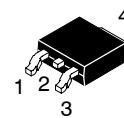
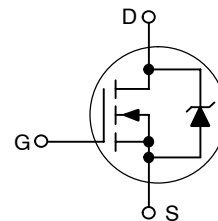


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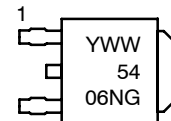
$V_{(BR)DSS}$	$R_{DS(ON)}$ TYP	$I_D$ MAX (Note 1)
40 V	8.7 m $\Omega$ @ 10 V	70 A

### N-Channel



DPAK  
CASE 369C  
STYLE 2

### MARKING DIAGRAM



Y = Year  
 WW = Work Week  
 5406N = Specific Device Code  
 G = Pb-Free Device

### ORDERING INFORMATION

Device	Package	Shipping†
NTD5406NG	DPAK (Pb-Free)	75 Units / Rail
NTD5406NT4G	DPAK (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 Specifications Brochure, BRD8011/D.

# NTD5406N

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> /T <sub>J</sub>			42		mV/°C
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 40 V	T <sub>J</sub> = 25°C		1.0	μA
			T <sub>J</sub> = 100°C		10	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±30 V			±100	nA

## ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	1.5		3.5	V
Gate Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>			-7.0		mV/°C
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 30 A		8.7	10	mΩ
		V <sub>GS</sub> = 5.0 V, I <sub>D</sub> = 10 A		13.2	17	
Forward Transconductance	g <sub>FS</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A		19		S

## CHARGES AND CAPACITANCES

Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1.0 MHz, V <sub>DS</sub> = 32 V		1375	2500	pF
Output Capacitance	C <sub>OSS</sub>			370	700	
Reverse Transfer Capacitance	C <sub>RSS</sub>			160	300	
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 32 V, I <sub>D</sub> = 30 A		45		nC
Threshold Gate Charge	Q <sub>G(TH)</sub>			2.0		
Gate-to-Source Charge	Q <sub>GS</sub>			5.4		
Gate-to-Drain Charge	Q <sub>GD</sub>			20		

## SWITCHING CHARACTERISTICS, V<sub>GS</sub> = 10 V (Note 3)

Turn-On Delay Time	t <sub>d(ON)</sub>	V <sub>GS</sub> = 10 V, V <sub>DD</sub> = 32 V, I <sub>D</sub> = 30 A, R <sub>G</sub> = 2.5 Ω		7.2		ns
Rise Time	t <sub>r</sub>			57		
Turn-Off Delay Time	t <sub>d(OFF)</sub>			30		
Fall Time	t <sub>f</sub>			67		

## SWITCHING CHARACTERISTICS, V<sub>GS</sub> = 5 V (Note 3)

Turn-On Delay Time	t <sub>d(ON)</sub>	V <sub>GS</sub> = 5.0 V, V <sub>DD</sub> = 20 V, I <sub>D</sub> = 30 A, R <sub>G</sub> = 2.5 Ω		15		ns
Rise Time	t <sub>r</sub>			147		
Turn-Off Delay Time	t <sub>d(OFF)</sub>			20		
Fall Time	t <sub>f</sub>			29		

## DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 10 A	T <sub>J</sub> = 25°C		0.82	1.1	V
			T <sub>J</sub> = 125°C		0.67		
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, dI <sub>SD</sub> /dt = 100 A/μs, I <sub>S</sub> = 10 A		46		ns	
Charge Time	t <sub>a</sub>			24			
Discharge Time	t <sub>b</sub>			22			
Reverse Recovery Charge	Q <sub>RR</sub>			65			nC

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

TYPICAL PERFORMANCE CURVES

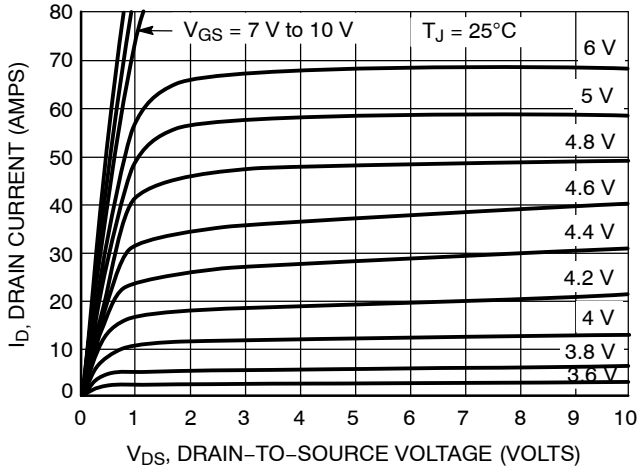


Figure 1. On-Region Characteristics

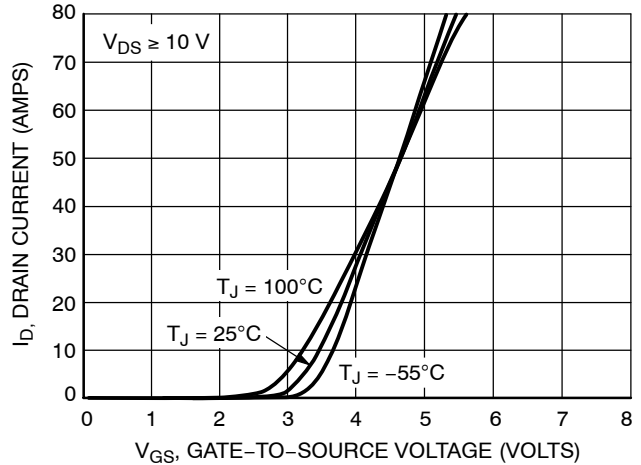


Figure 2. Transfer Characteristics

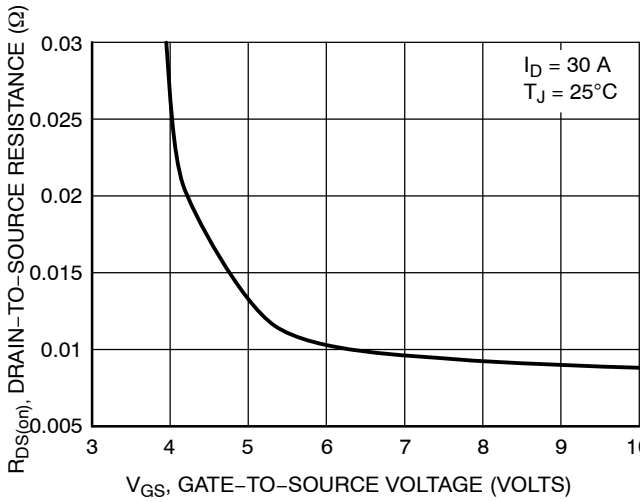


Figure 3. On-Resistance vs. Gate-to-Source Voltage

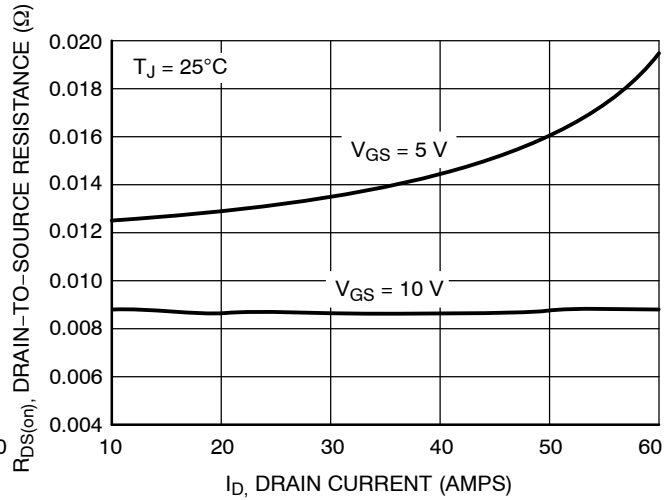


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

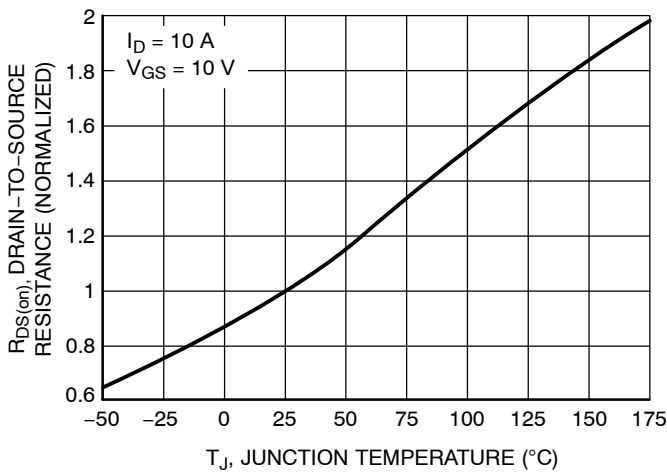


Figure 5. On-Resistance Variation with Temperature

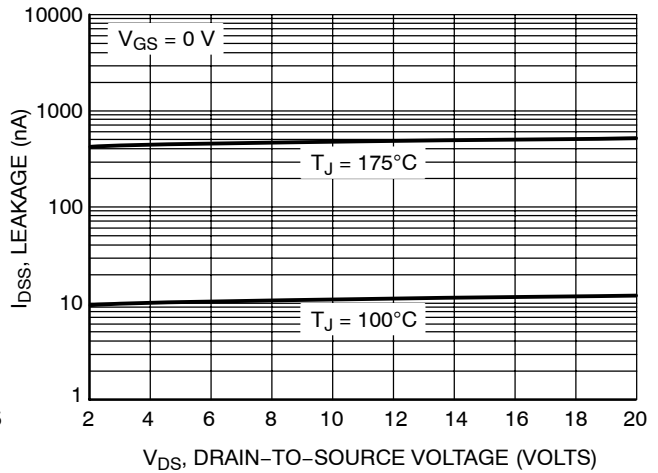
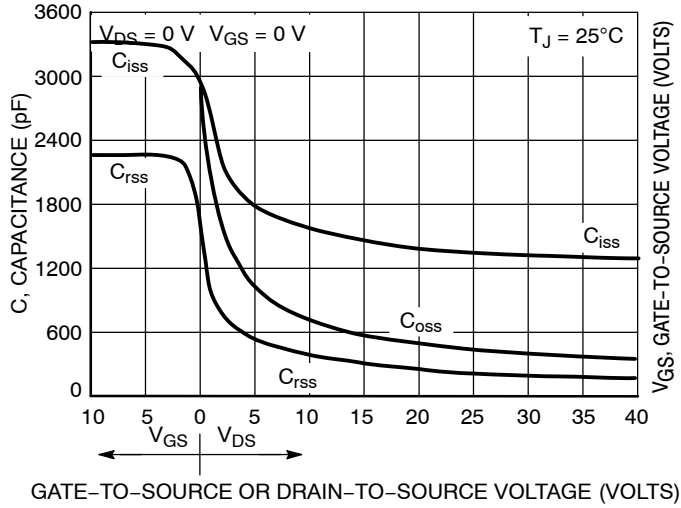


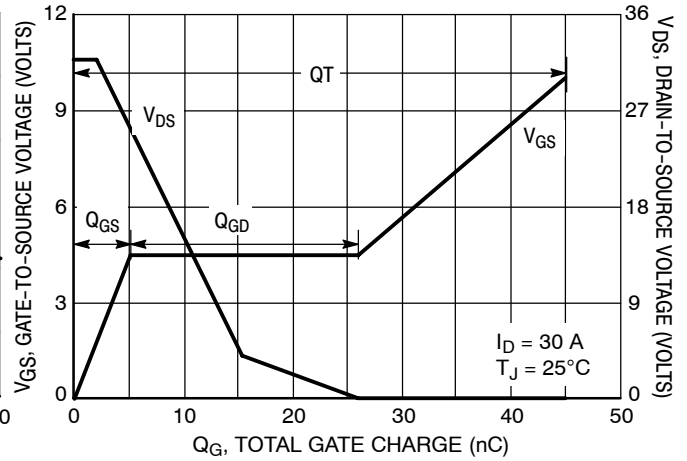
Figure 6. Drain-to-Source Leakage Current vs. Voltage

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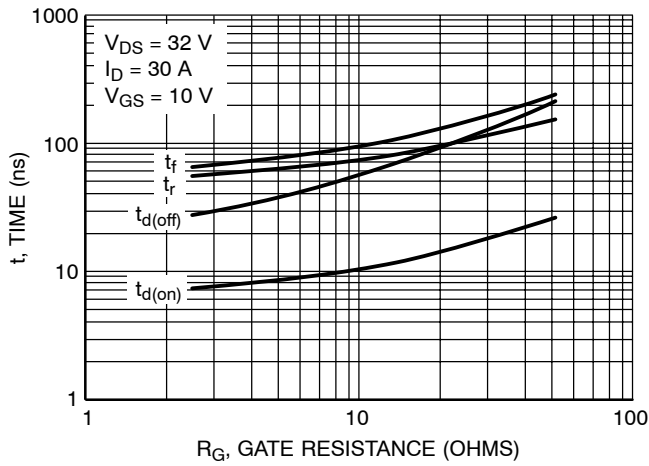
## TYPICAL PERFORMANCE CURVES



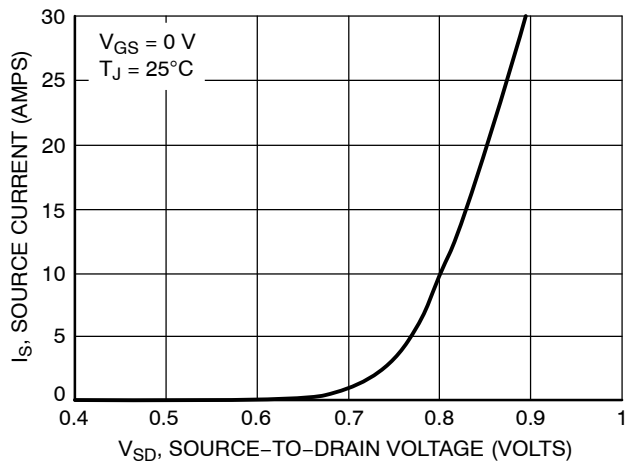
**Figure 7. Capacitance Variation**



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



**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**

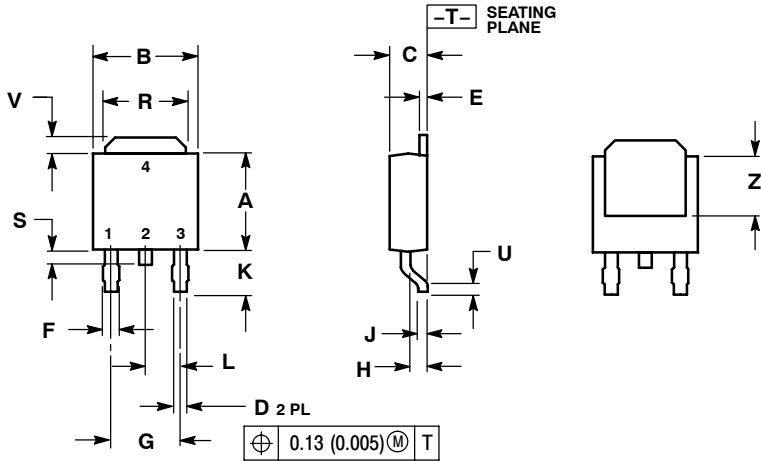


**Figure 10. Diode Forward Voltage vs. Current**

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## PACKAGE DIMENSIONS

### DPAK CASE 369C-01 ISSUE O

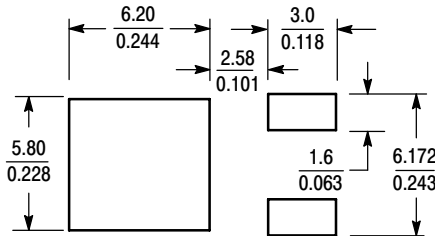


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.22
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.018	0.023	0.46	0.58
F	0.037	0.045	0.94	1.14
G	0.180 BSC		4.58 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.102	0.114	2.60	2.89
L	0.090 BSC		2.29 BSC	
R	0.180	0.215	4.57	5.45
S	0.025	0.040	0.63	1.01
U	0.020	---	0.51	---
V	0.035	0.050	0.89	1.27
Z	0.155	---	3.93	---

- STYLE 2:  
PIN 1. GATE  
2. DRAIN  
3. SOURCE  
4. DRAIN

### SOLDERING FOOTPRINT\*



SCALE 3:1  $\left(\frac{\text{mm}}{\text{inches}}\right)$

\*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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