

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} | ± 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).

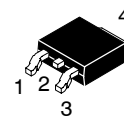
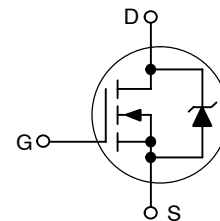


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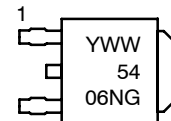
| $V_{(BR)DSS}$ | $R_{DS(ON)}$ TYP | I_D MAX (Note 1) |
|---------------|-----------------------|--------------------|
| 40 V | 8.7 m Ω @ 10 V | 70 A |

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_J = 25°C unless otherwise stated)

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

ON CHARACTERISTICS (Note 2)

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

CHARGES AND CAPACITANCES

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

SWITCHING CHARACTERISTICS, V_{GS} = 10 V (Note 3)

| | | | | | | |
|---------------------|---------------------|---|--|-----|--|----|
| Turn-On Delay Time | t _{d(ON)} | V _{GS} = 10 V, V _{DD} = 32 V, I _D = 30 A, R _G = 2.5 Ω | | 7.2 | | ns |
| Rise Time | t _r | | | 57 | | |
| Turn-Off Delay Time | t _{d(OFF)} | | | 30 | | |
| Fall Time | t _f | | | 67 | | |

SWITCHING CHARACTERISTICS, V_{GS} = 5 V (Note 3)

| | | | | | | |
|---------------------|---------------------|--|--|-----|--|----|
| Turn-On Delay Time | t _{d(ON)} | V _{GS} = 5.0 V, V _{DD} = 20 V, I _D = 30 A, R _G = 2.5 Ω | | 15 | | ns |
| Rise Time | t _r | | | 147 | | |
| Turn-Off Delay Time | t _{d(OFF)} | | | 20 | | |
| Fall Time | t _f | | | 29 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|-------------------------|-----------------|---|------------------------|----|------|-----|----|
| Forward Diode Voltage | V _{SD} | V _{GS} = 0 V, I _S = 10 A | T _J = 25°C | | 0.82 | 1.1 | V |
| | | | T _J = 125°C | | 0.67 | | |
| Reverse Recovery Time | t _{RR} | V _{GS} = 0 V, dI _{SD} /dt = 100 A/μs, I _S = 10 A | | 46 | | ns | |
| Charge Time | t _a | | | 24 | | | |
| Discharge Time | t _b | | | 22 | | | |
| Reverse Recovery Charge | Q _{RR} | | | 65 | | | nC |

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

TYPICAL PERFORMANCE CURVES

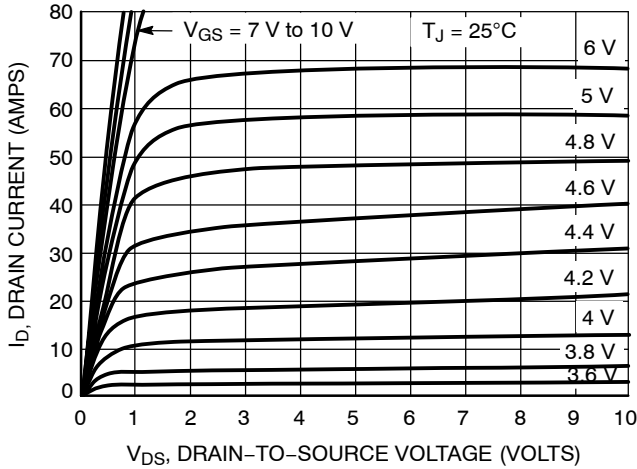


Figure 1. On-Region Characteristics

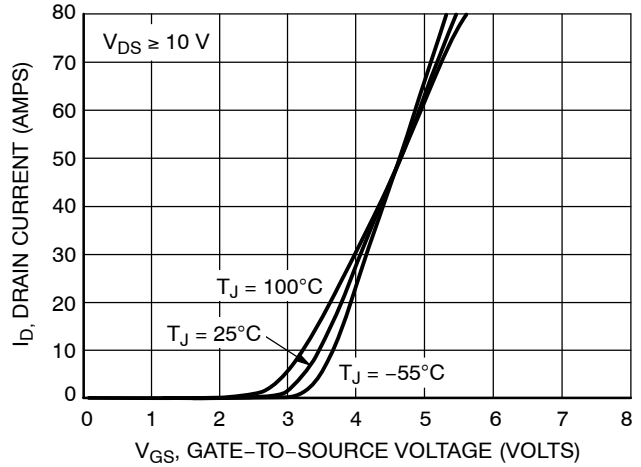


Figure 2. Transfer Characteristics

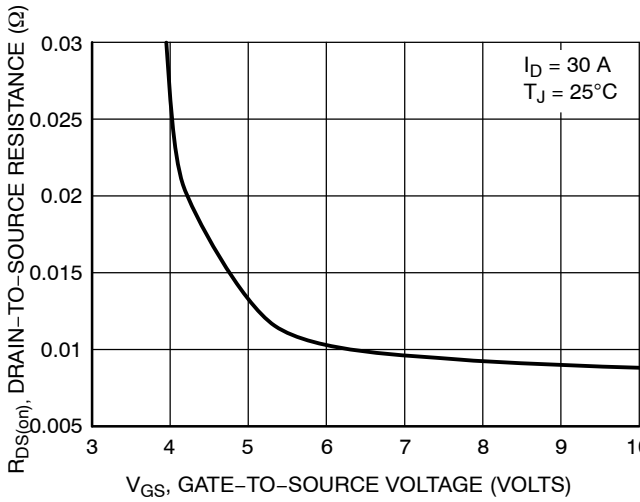


Figure 3. On-Resistance vs. Gate-to-Source Voltage

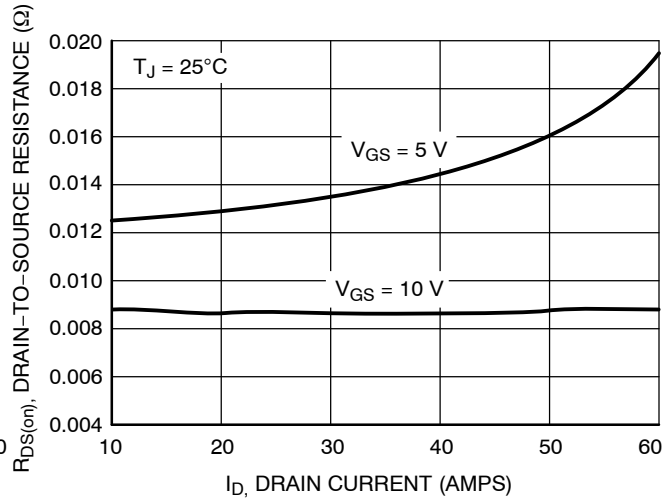


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

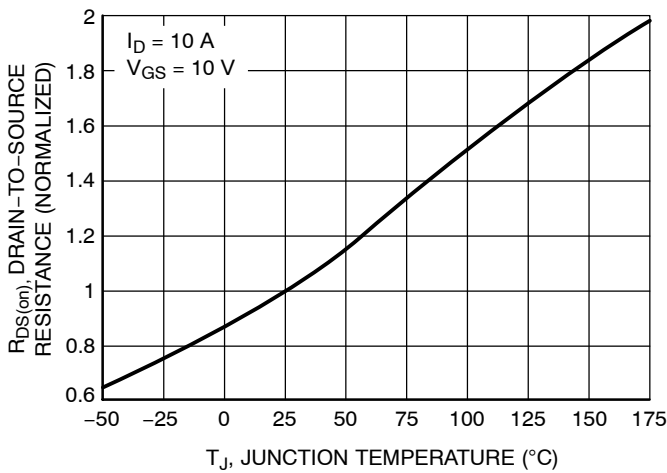


Figure 5. On-Resistance Variation with Temperature

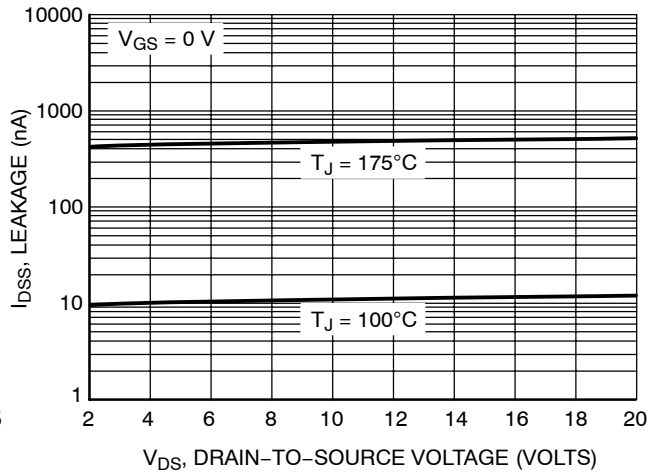


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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TYPICAL PERFORMANCE CURVES

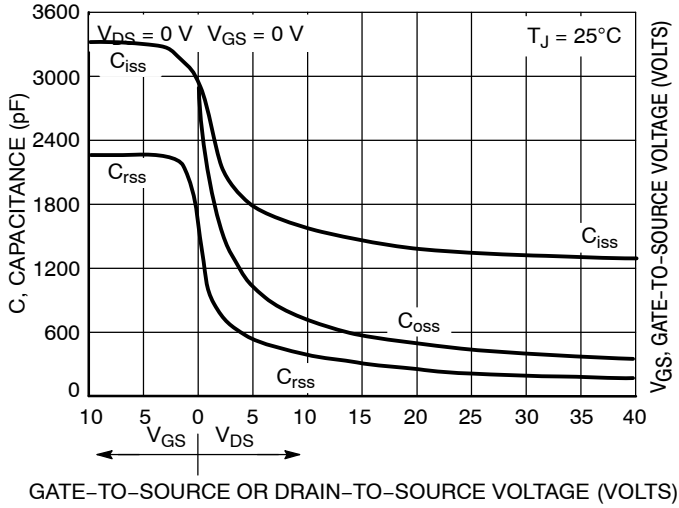


Figure 7. Capacitance Variation

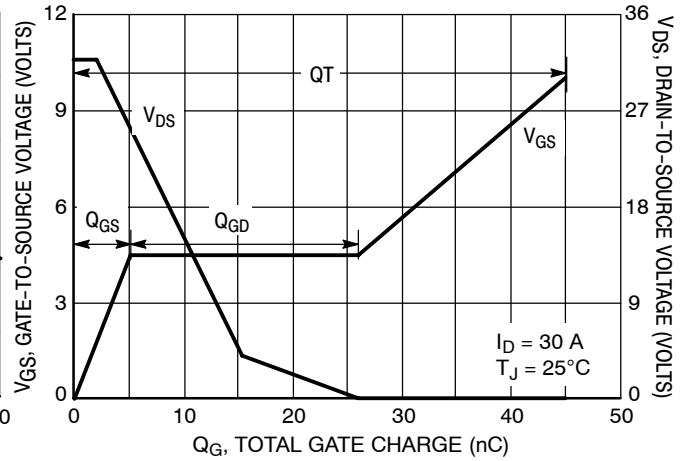


Figure 8. Gate-To-Source and Drain-To-Source Voltage vs. Total Charge

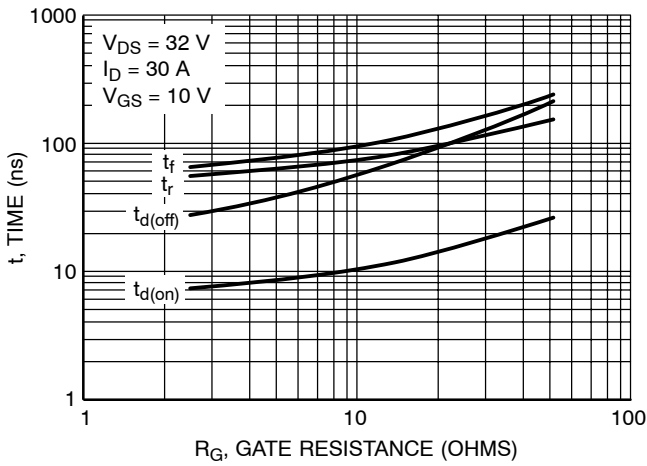


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

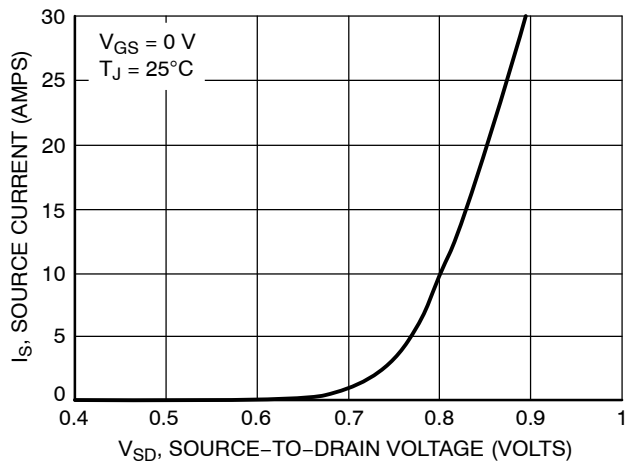
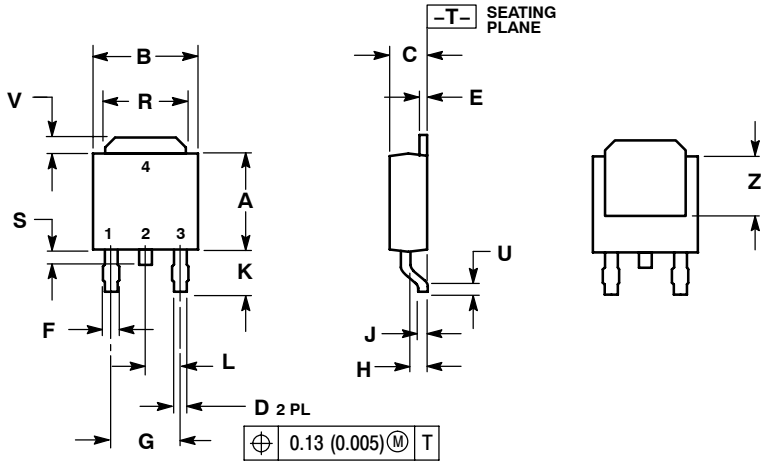


Figure 10. Diode Forward Voltage vs. Current

NTD5406N

PACKAGE DIMENSIONS

DPAK
CASE 369C-01
ISSUE O

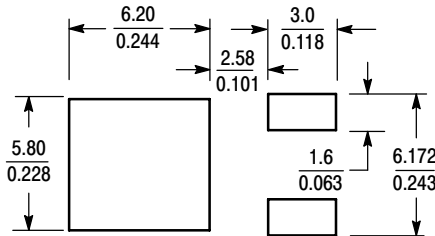


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| 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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