

NTP10N40, NTB10N40

Preferred Device

Advance Information

Power MOSFET 10 Amps, 400 Volts N-Channel TO-220 and D²PAK

Designed for high voltage, high speed switching applications in power supplies, converters, power motor controls and bridge circuits.

Features

- Higher Current Rating
- Lower $R_{DS(on)}$
- Lower Capacitances
- Lower Total Gate Charge
- Tighter V_{SD} Specifications
- Avalanche Energy Specified

Typical Applications

- Switch Mode Power Supplies
- PWM Motor Controls
- Converters
- Bridge Circuits

MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

| Rating | Symbol | Value | Unit |
|--|---|------------|---------------------------|
| Drain-Source Voltage | V_{DSS} | 400 | Vdc |
| Drain-Gate Voltage ($R_{GS} = 1.0\text{ M}\Omega$) | V_{DGR} | 400 | Vdc |
| Gate-Source Voltage | V_{GS} V_{GSM} | ± 20 | Vdc |
| – Continuous | | ± 40 | |
| – Non-Repetitive ($t_p \leq 10\text{ ms}$) | | | |
| Drain | I_D $I_{D@100^\circ\text{C}}$ I_{DM} | 10 | Adc |
| – Continuous | | 7.5 | |
| – Continuous @ 100°C | | 35 | |
| – Single Pulse ($t_p \leq 10\text{ }\mu\text{s}$) | | | |
| Total Power Dissipation | P_D | 142 | Watts |
| Derate above 25°C | | 1.14 | $\text{W}/^\circ\text{C}$ |
| Operating and Storage Temperature Range | T_J, T_{stg} | -55 to 150 | $^\circ\text{C}$ |
| Single Drain-to-Source Avalanche Energy – Starting $T_J = 25^\circ\text{C}$ ($V_{DD} = 100\text{ Vdc}$, $V_{GS} = 10\text{ Vdc}$, $I_L = 10\text{ A}$, $L = 10\text{ mH}$, $R_G = 25\text{ }\Omega$) | E_{AS} | 500 | mJ |
| Thermal Resistance | $R_{\theta JC}$ $R_{\theta JA}$ $R_{\theta JA}$ | 0.88 | $^\circ\text{C}/\text{W}$ |
| – Junction-to-Case | | 62.5 | |
| – Junction-to-Ambient | | 50 | |
| – Junction-to-Ambient (Note 1.) | | | |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds | T_L | 260 | $^\circ\text{C}$ |

1. When surface mounted to an FR4 board using the minimum recommended pad size.

This document contains information on a new product. Specifications and information herein are subject to change without notice.

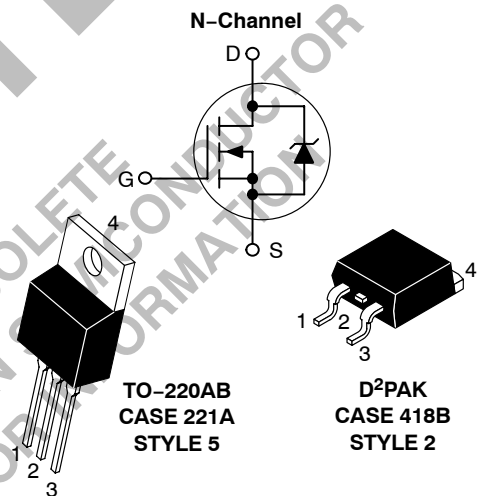


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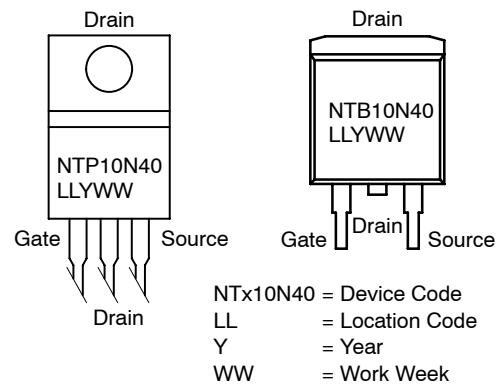
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**10 AMPERES
400 VOLTS**

$R_{DS(on)} = 500\text{ m}\Omega$



MARKING DIAGRAMS AND PIN ASSIGNMENTS



ORDERING INFORMATION

| Device | Package | Shipping |
|------------|--------------------|-----------------|
| NTP10N40 | TO-220AB | 50 Units/Rail |
| NTB10N40 | D ² PAK | 50 Units/Rail |
| NTB10N40T4 | D ² PAK | 800/Tape & Reel |

Preferred devices are recommended choices for future use and best overall value.

NTP10N40, NTB10N40

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | |
|---|--|----------|----------|------------|--------------|
| Drain-to-Source Breakdown Voltage (V _{GS} = 0 Vdc, I _D = 0.25 mAdc) Temperature Coefficient (Positive) | V _{(BR)DSS} | 400 - | - 475 | - - | Vdc mV/°C |
| Zero Gate Voltage Collector Current (V _{DS} = 400 Vdc, V _{GS} = 0 Vdc) (V _{DS} = 400 Vdc, V _{GS} = 0 Vdc, T _J = 125°C) | I _{DSS} | - - | - - | 10 100 | μAdc |
| Gate-Body Leakage Current (V _{GS} = ±20 Vdc, V _{DS} = 0) | I _{GSS(f)} I _{GSS(r)} | - - | - - | 100 100 | nAdc |

ON CHARACTERISTICS (Note 1)

| | | | | | |
|---|---------------------|----------|------------|------------|--------------|
| Gate Threshold Voltage I _D = 0.25 mA, V _{DS} = V _{GS} Temperature Coefficient (Negative) | V _{GS(th)} | 2.0 - | 2.5 6.5 | 4.0 - | Vdc mV/°C |
| Static Drain-to-Source On-Resistance (V _{GS} = 10 Vdc, I _D = 5.0 Adc) | R _{DS(on)} | - | 350 | 500 | mOhm |
| Drain-to-Source On-Voltage (V _{GS} = 10 Vdc, I _D = 10 Adc) (V _{GS} = 10 Vdc, I _D = 5.0 Adc, T _J = 125°C) | V _{DS(on)} | - - | - - | 6.0 5.3 | Vdc |
| Forward Transconductance (V _{DS} = 15 Vdc, I _D = 5.0 Adc) | g _{FS} | 2.0 | 7.0 | - | Mhos |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|----------------------|---|------------------|---|------|------|----|
| Input Capacitance | (V _{DS} = 25 Vdc, V _{GS} = 0 Vdc, f = 1.0 MHz) | C _{ISS} | - | 1440 | 2020 | pF |
| Output Capacitance | | C _{OSS} | - | 360 | 500 | |
| Transfer Capacitance | | C _{FSS} | - | 15 | 30 | |

SWITCHING CHARACTERISTICS (Note 2)

| | | | | | | |
|---------------------|--|---------------------|---|-----|----|----|
| Turn-On Delay Time | (V _{DD} = 200 Vdc, I _D = 10 Adc, V _{GS} = 10 Vdc, R _G = 9.1 Ω) | t _{d(on)} | - | 10 | 20 | ns |
| Rise Time | | t _r | - | 20 | 40 | |
| Turn-Off Delay Time | | t _{d(off)} | - | 33 | 70 | |
| Fall Time | | t _f | - | 24 | 50 | |
| Gate Charge | (V _{DS} = 320 Vdc, I _D = 10 Adc, V _{GS} = 10 Vdc) | Q _T | - | 24 | 30 | nC |
| | | Q ₁ | - | 6.0 | - | |
| | | Q ₂ | - | 7.0 | - | |
| | | Q ₃ | - | 12 | - | |

SOURCE-DRAIN DIODE CHARACTERISTICS

| | | | | | | |
|--------------------------------|--|-----------------|--------|------------|----------|-----|
| Forward On-Voltage (Note 1) | (I _S = 10 Adc, V _{GS} = 0 Vdc) (I _S = 10 Adc, V _{GS} = 0 Vdc, T _J = 125°C) | V _{SD} | - - | 0.9 0.8 | 1.1 - | Vdc |
| Reverse Recovery Time | | t _{rr} | - | 305 | - | |
| | (I _S = 10 Adc, V _{GS} = 0 Vdc, dI _S /dt = 100 A/μs) | t _a | - | 155 | - | |
| | | t _b | - | 150 | - | |
| Reverse Recovery Stored Charge | | Q _{RR} | - | 2.5 | - | μC |

INTERNAL PACKAGE INDUCTANCE

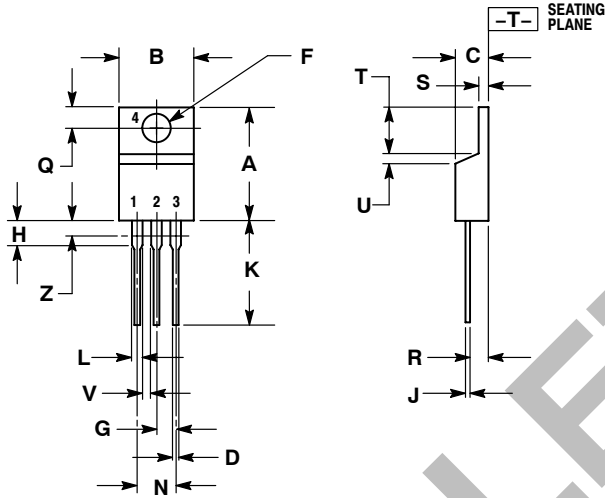
| | | | | | |
|--|----------------|--------|------------|--------|----|
| Internal Drain Inductance (Measured from contact screw on tab to center of die) (Measured from the drain lead 0.25" from package to center of die) | L _D | - - | 3.5 4.5 | - - | nH |
| Internal Source Inductance (Measured from the source lead 0.25" from package to source bond pad) | L _S | - | 7.5 | - | |

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
2. Switching characteristics are independent of operating junction temperature.

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PACKAGE DIMENSIONS

TO-220 THREE-LEAD
TO-220AB
CASE 221A-09
ISSUE AA



NOTES:

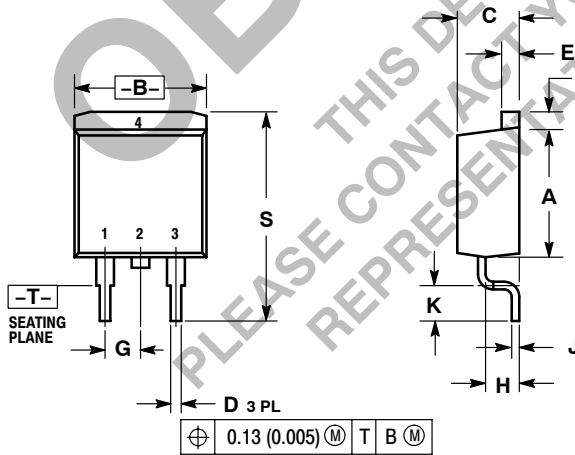
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

| DIM | INCHES | | MILLIMETERS | |
|-----|--------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.570 | 0.620 | 14.48 | 15.75 |
| B | 0.380 | 0.405 | 9.66 | 10.28 |
| C | 0.160 | 0.190 | 4.07 | 4.82 |
| D | 0.025 | 0.035 | 0.64 | 0.88 |
| F | 0.142 | 0.147 | 3.61 | 3.73 |
| G | 0.095 | 0.105 | 2.42 | 2.66 |
| H | 0.110 | 0.155 | 2.80 | 3.93 |
| J | 0.018 | 0.025 | 0.46 | 0.64 |
| K | 0.500 | 0.562 | 12.70 | 14.27 |
| L | 0.045 | 0.060 | 1.15 | 1.52 |
| N | 0.190 | 0.210 | 4.89 | 5.33 |
| Q | 0.100 | 0.120 | 2.54 | 3.04 |
| R | 0.080 | 0.110 | 2.04 | 2.79 |
| S | 0.045 | 0.055 | 1.15 | 1.39 |
| T | 0.235 | 0.255 | 5.97 | 6.47 |
| U | 0.000 | 0.050 | 0.00 | 1.27 |
| V | 0.045 | --- | 1.15 | --- |
| Z | --- | 0.080 | --- | 2.04 |

STYLE 5:

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

D²PAK
CASE 418B-03
ISSUE D



NOTES:


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

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.340 | 0.380 | 8.64 | 9.65 |
| B | 0.380 | 0.405 | 9.65 | 10.29 |
| C | 0.160 | 0.190 | 4.06 | 4.83 |
| D | 0.020 | 0.035 | 0.51 | 0.89 |
| E | 0.045 | 0.055 | 1.14 | 1.40 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.080 | 0.110 | 2.03 | 2.79 |
| J | 0.018 | 0.025 | 0.46 | 0.64 |
| K | 0.090 | 0.110 | 2.29 | 2.79 |
| S | 0.575 | 0.625 | 14.60 | 15.88 |
| V | 0.045 | 0.055 | 1.14 | 1.40 |

STYLE 2:

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

OBSOLETE
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