

NTB5412NT4G Datasheet

www.digi-electronics.com



<https://www.DiGi-Electronics.com>

| | |
|------------------------------|--------------------------------------------------------|
| DiGi Electronics Part Number | NTB5412NT4G-DG |
| Manufacturer | onsemi |
| Manufacturer Product Number | NTB5412NT4G |
| Description | MOSFET N-CH 60V 60A D2PAK |
| Detailed Description | N-Channel 60 V 60A (Tc) 125W (Tc) Surface Mount D 2PAK |



Tel: +00 852-30501935

RFQ Email: Info@DiGi-Electronics.com

DiGi is a global authorized distributor of electronic components.

Purchase and inquiry

Manufacturer Product Number:

NTB5412NT4G

Series:

-

FET Type:

N-Channel

Drain to Source Voltage (Vdss):

60 V

Drive Voltage (Max Rds On, Min Rds On):

10V

Vgs(th) (Max) @ Id:

4V @ 250 μ A

Vgs (Max):

\pm 20V

FET Feature:

-

Operating Temperature:

-55°C ~ 175°C (Tj)

Supplier Device Package:

D2PAK

Base Product Number:

NTB54

Manufacturer:

onsemi

Product Status:

Obsolete

Technology:

MOSFET (Metal Oxide)

Current - Continuous Drain (Id) @ 25°C:

60A (Tc)

Rds On (Max) @ Id, Vgs:

14mOhm @ 30A, 10V

Gate Charge (Qg) (Max) @ Vgs:

85 nC @ 0 V

Input Capacitance (Ciss) (Max) @ Vds:

3220 pF @ 25 V

Power Dissipation (Max):

125W (Tc)

Mounting Type:

Surface Mount

Package / Case:

TO-263-3, D2PAK (2 Leads + Tab), TO-263AB

Environmental & Export classification

Moisture Sensitivity Level (MSL):

1 (Unlimited)

ECCN:

EAR99

REACH Status:

REACH Unaffected

HTSUS:

8541.29.0095

ON Semiconductor

Is Now

The logo for onsemi, featuring the word "onsemi" in a dark teal, lowercase, sans-serif font. The letter "i" is stylized with a white dot and a teal vertical bar. A small orange triangle is positioned above the top right of the "i". A trademark symbol (TM) is located to the right of the logo.

To learn more about onsemi™, please visit our website at
www.onsemi.com

onsemi and onsemi and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries. onsemi owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of onsemi product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. onsemi reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and onsemi makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using onsemi products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by onsemi. "Typical" parameters which may be provided in onsemi data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. onsemi does not convey any license under any of its intellectual property rights nor the rights of others. onsemi products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use onsemi products for any such unintended or unauthorized application, Buyer shall indemnify and hold onsemi and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that onsemi was negligent regarding the design or manufacture of the part. onsemi is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.

NTB5412N, NTP5412N

Power MOSFET 60 Amps, 60 Volts N-Channel D²PAK, TO-220

Features

- Low $R_{DS(on)}$
- High Current Capability
- Avalanche Energy Specified
- These are Pb-Free Devices

Applications

- LED Lighting and LED Backlight Drivers
- DC-DC Converters
- DC Motor Drivers
- Power Supplies Secondary Side Synchronous Rectification

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ Unless otherwise specified)

| Parameter | | | Symbol | Value | Unit |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------------------|----------------|------------|------------------|
| Drain-to-Source Voltage | | | V_{DSS} | 60 | V |
| Gate-to-Source Voltage – Continuous | | | V_{GS} | ± 20 | V |
| Gate-to-Source Voltage – Nonrepetitive ($T_P < 10 \mu\text{s}$) | | | V_{GS} | ± 30 | V |
| Continuous Drain Current $R_{\theta JC}$ (Note 1) | Steady State | $T_C = 25^\circ\text{C}$ | I_D | 60 | A |
| | | $T_C = 100^\circ\text{C}$ | | 44 | |
| Power Dissipation $R_{\theta JC}$ (Note 1) | Steady State | $T_C = 25^\circ\text{C}$ | P_D | 125 | W |
| Pulsed Drain Current | $t_p = 10 \mu\text{s}$ | | I_{DM} | 155 | A |
| Operating and Storage Temperature Range | | | T_J, T_{stg} | -55 to 175 | $^\circ\text{C}$ |
| Source Current (Body Diode) | | | I_S | 60 | A |
| Single Pulse Drain-to-Source Avalanche Energy – Starting $T_J = 25^\circ\text{C}$ ($V_{DD} = 50 V_{dc}$, $V_{GS} = 10 V_{dc}$, $I_{L(pk)} = 60 \text{ A}$, $L = 0.1 \text{ mH}$, $R_G = 25 \Omega$) | | | E_{AS} | 180 | mJ |
| Lead Temperature for Soldering Purposes, 1/8" from Case for 10 Seconds | | | T_L | 260 | $^\circ\text{C}$ |

THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Max | Unit |
|------------------------------------------------|-----------------|------|---------------------------|
| Junction-to-Case (Drain) Steady State (Note 1) | $R_{\theta JC}$ | 1.2 | $^\circ\text{C}/\text{W}$ |
| | $R_{\theta JA}$ | 43.2 | |

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

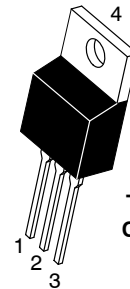
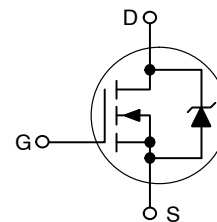


ON Semiconductor®

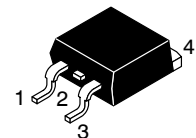
<http://onsemi.com>

| $V_{(BR)DSS}$ | $R_{DS(ON)} \text{ MAX}$ | $I_D \text{ MAX}$ (Note 1) |
|---------------|--------------------------|----------------------------|
| 60 V | 14 m Ω @ 10 V | 60 A |

N-Channel

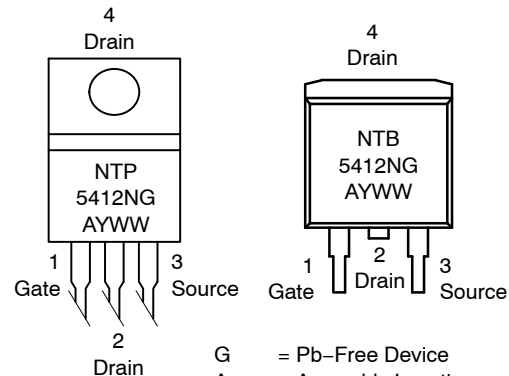


TO-220AB
CASE 221A
STYLE 5



D²PAK
CASE 418B
STYLE 2

MARKING DIAGRAM & PIN ASSIGNMENT



G = Pb-Free Device
A = Assembly Location
Y = Year
WW = Work Week

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

NTB5412N, NTP5412N**ELECTRICAL CHARACTERISTICS** ($T_J = 25^\circ\text{C}$ Unless otherwise specified)

| Characteristics | Symbol | Test Condition | Min | Typ | Max | Unit |
|-----------------------------------------------------------|-------------------|-------------------------------------------------|---------------------------|------|-----------|---------------|
| OFF CHARACTERISTICS | | | | | | |
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{DS} = 0\text{ V}, I_D = 250\ \mu\text{A}$ | 60 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | 54.6 | | mV/°C |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS} = 0\text{ V}$ $V_{DS} = 60\text{ V}$ | $T_J = 25^\circ\text{C}$ | | 1.0 | μA |
| | | | $T_J = 150^\circ\text{C}$ | | 100 | |
| Gate-Body Leakage Current | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$ | | | ± 100 | nA |

ON CHARACTERISTICS (Note 2)

| | | | | | | |
|--------------------------------------------|------------------|--------------------------------------------------------------|-----|------|-----|------------|
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$ | 2.0 | 3.3 | 4.0 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(th)}/T_J$ | | | 6.4 | | mV/°C |
| Drain-to-Source On Voltage | $V_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 60\text{ A}$ | | 0.7 | 1.2 | V |
| | | $V_{GS} = 10\text{ V}, I_D = 30\text{ A}, 150^\circ\text{C}$ | | 0.75 | | |
| Static Drain-to-Source On-Resistance | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 30\text{ A}$ | | 11.1 | 14 | m Ω |
| Forward Transconductance | g_{FS} | $V_{GS} = 15\text{ V}, I_D = 30\text{ A}$ | | 58 | | S |

CHARGES, CAPACITANCES & GATE RESISTANCE

| | | | | | | |
|-----------------------|--------------|---------------------------------------------------------------------|--|------|------|----|
| Input Capacitance | C_{iss} | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$ | | 2325 | 3220 | pF |
| Output Capacitance | C_{oss} | | | 440 | | |
| Transfer Capacitance | C_{rss} | | | 170 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = 0\text{ V}, V_{DS} = 48\text{ V},$ $I_D = 60\text{ A}$ | | 66 | 85 | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | 2.8 | | |
| Gate-to-Source Charge | Q_{GS} | | | 13.4 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 31 | | |

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

| | | | | | | |
|---------------------|--------------|-----------------------------------------------------------------------------------------|--|-----|--|----|
| Turn-On Delay Time | $t_{d(on)}$ | $V_{GS} = 10\text{ V}, V_{DD} = 48\text{ V},$ $I_D = 60\text{ A}, R_G = 2.5\ \Omega$ | | 14 | | ns |
| Rise Time | t_r | | | 115 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 41 | | |
| Fall Time | t_f | | | 89 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|--------------------------------|----------|---------------------------------------------------------------------------------------------|---------------------------|----|-----|-----|----------|
| Forward Diode Voltage | V_{SD} | $V_{GS} = 0\text{ V}$ $I_S = 60\text{ A}$ | $T_J = 25^\circ\text{C}$ | | 1.0 | 1.2 | V_{dc} |
| | | | $T_J = 125^\circ\text{C}$ | | 0.9 | | |
| Reverse Recovery Time | t_{rr} | $I_S = 60\text{ A}_{dc}, V_{GS} = 0\text{ V}_{dc},$ $di_S/dt = 100\text{ A}/\mu\text{s}$ | | 75 | | ns | |
| Charge Time | t_a | | | 54 | | | |
| Discharge Time | t_b | | | 21 | | | |
| Reverse Recovery Stored Charge | Q_{RR} | | | 96 | | | nC |

- Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.
- Switching characteristics are independent of operating junction temperatures.

NTB5412N, NTP5412N

TYPICAL PERFORMANCE CURVES

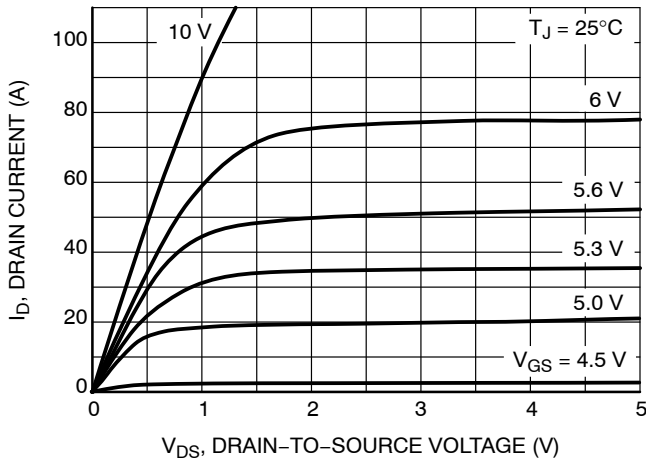


Figure 1. On-Region Characteristics

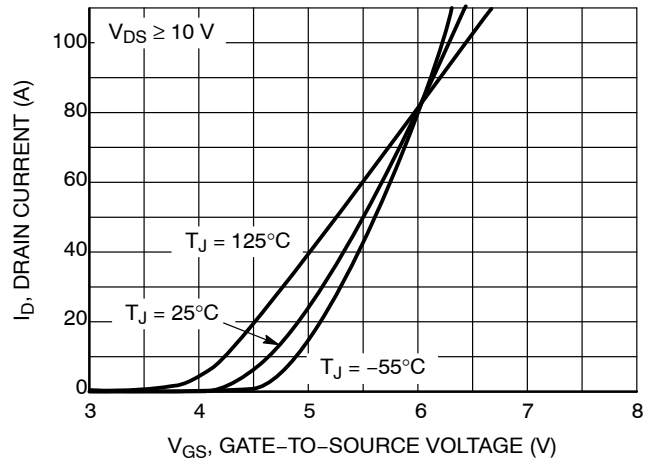


Figure 2. Transfer Characteristics

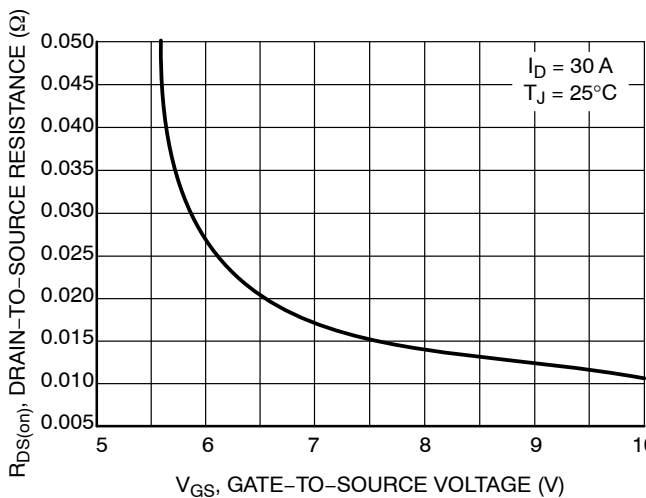


Figure 3. On-Resistance vs. Gate-to-Source Voltage

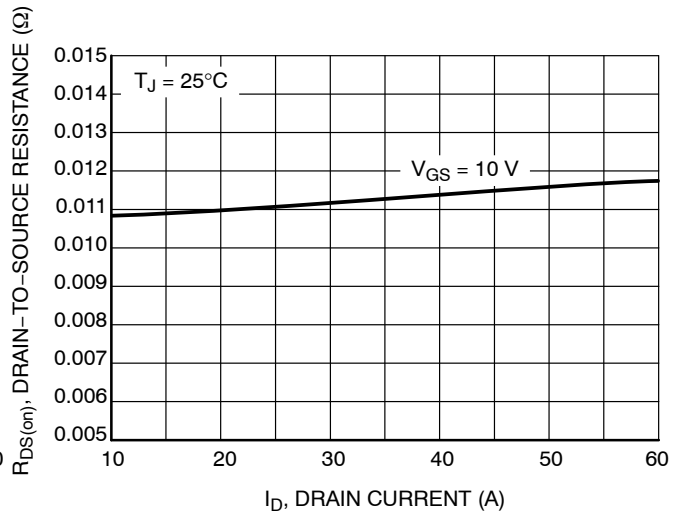


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

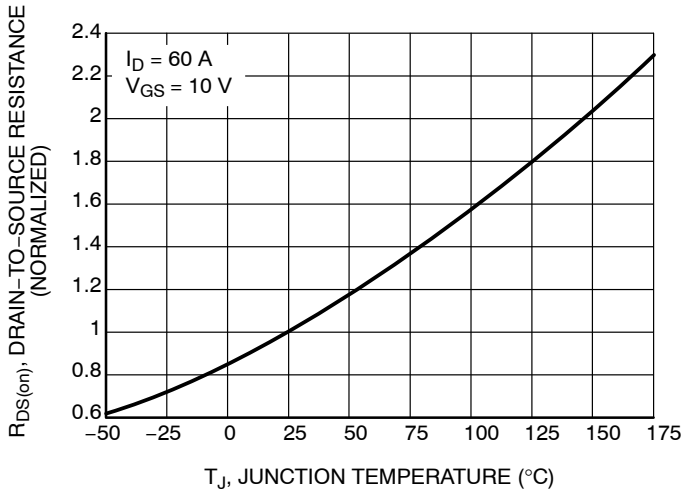


Figure 5. On-Resistance Variation with Temperature

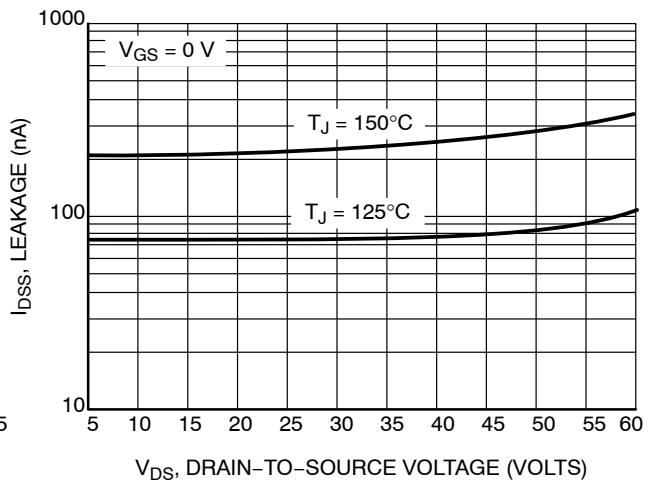


Figure 6. Drain-to-Source Leakage Current vs. Voltage

NTB5412N, NTP5412N

TYPICAL PERFORMANCE CURVES

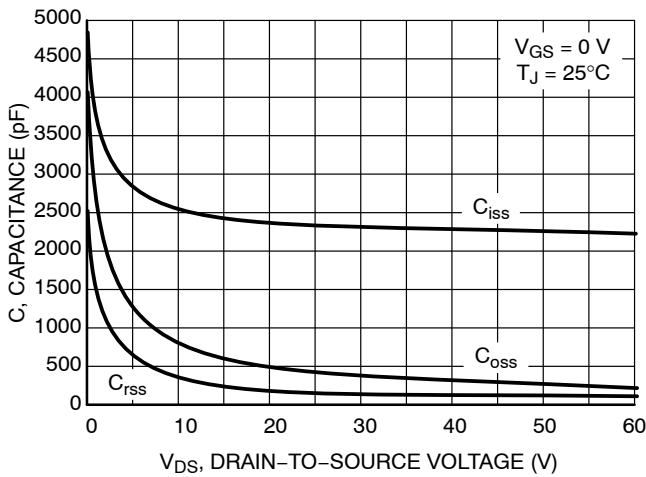


Figure 7. Capacitance Variation

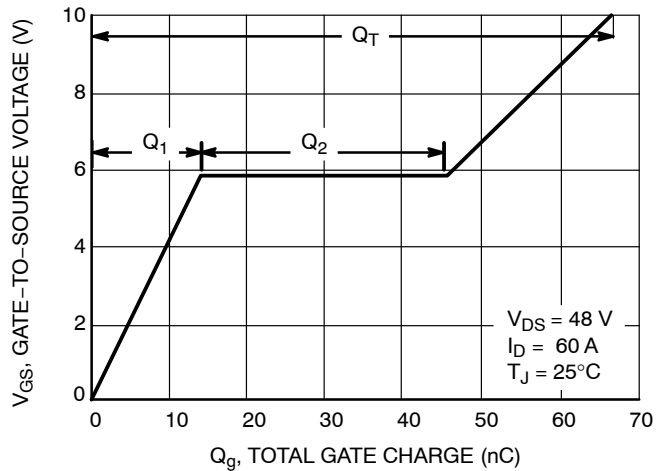


Figure 8. Gate-to-Source Voltage vs. Total Charge

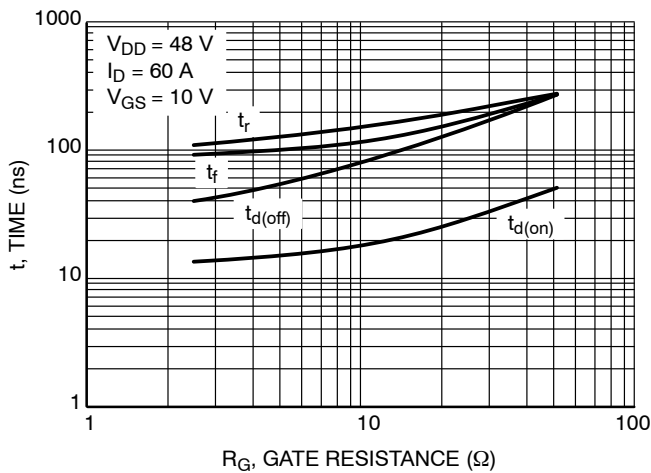


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

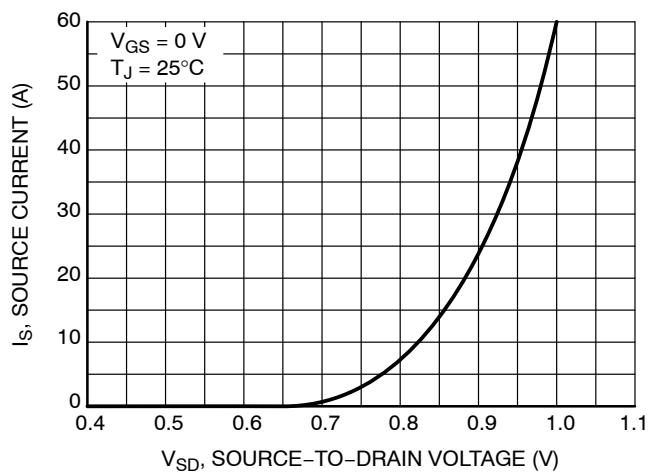


Figure 10. Diode Forward Voltage vs. Current

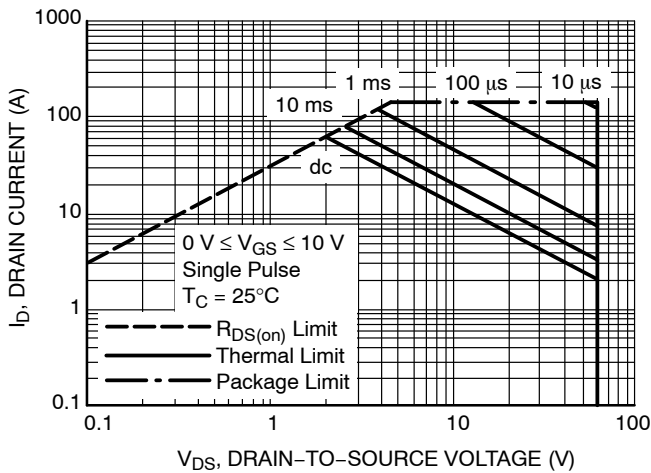


Figure 11. Maximum Rated Forward Biased Safe Operating Area

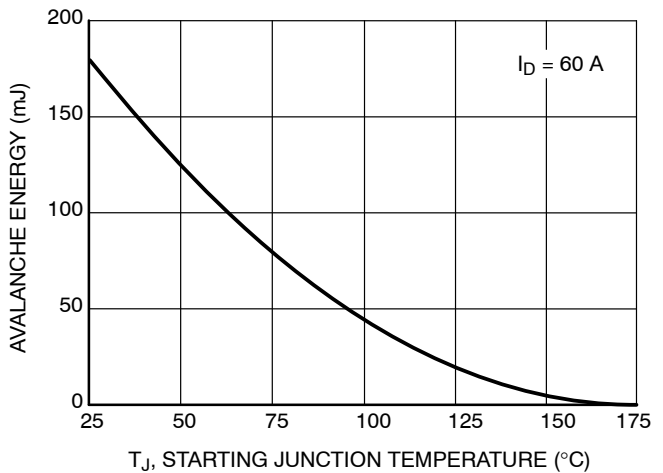


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

NTB5412N, NTP5412N

TYPICAL PERFORMANCE CURVES

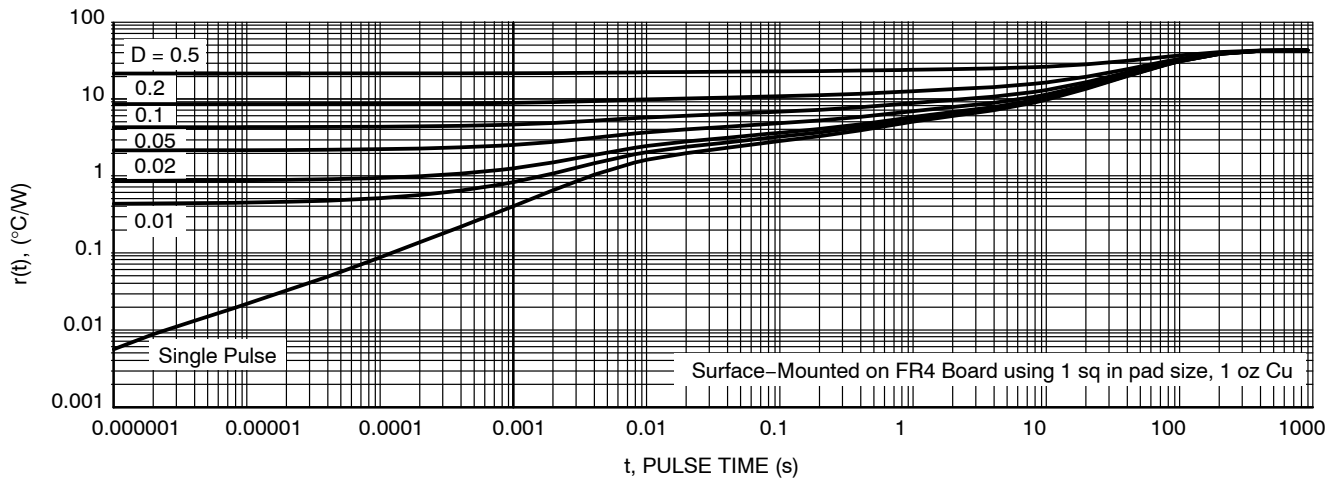


Figure 13. Thermal Response

ORDERING INFORMATION

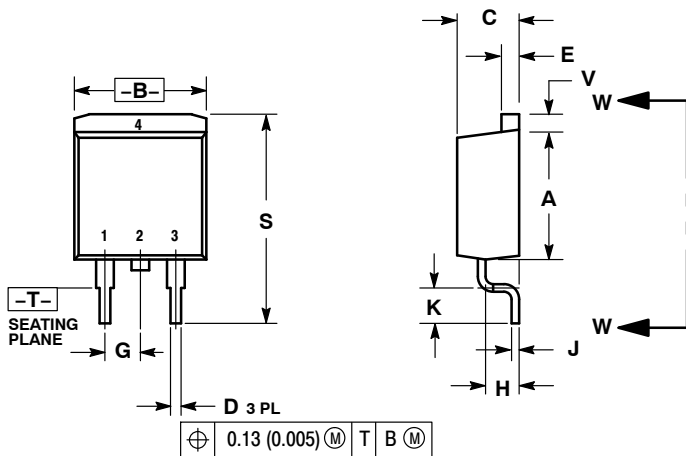
| Device | Package | Shipping [†] |
|-------------|---------------------------------|-----------------------|
| NTP5412NG | TO-220AB (Pb-Free) | 50 Units / Rail |
| NTB5412NT4G | D ² PAK (Pb-Free) | 800 / Tape & Reel |

[†]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.

NTB5412N, NTP5412N

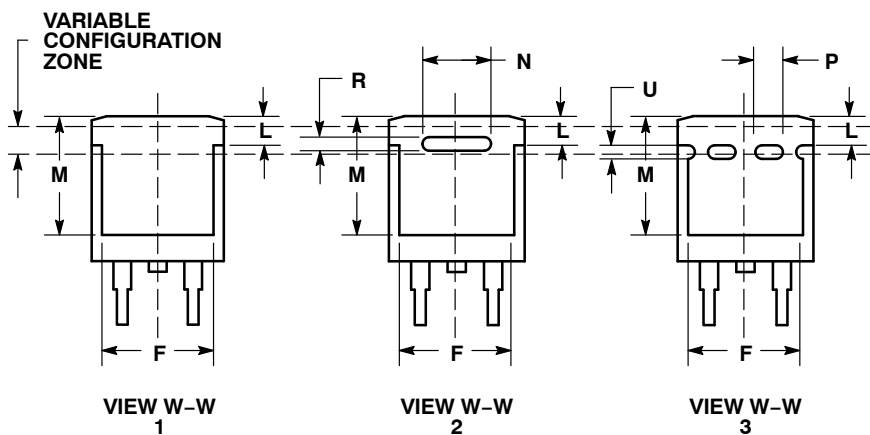
PACKAGE DIMENSIONS

D²PAK 3
CASE 418B-04
ISSUE K



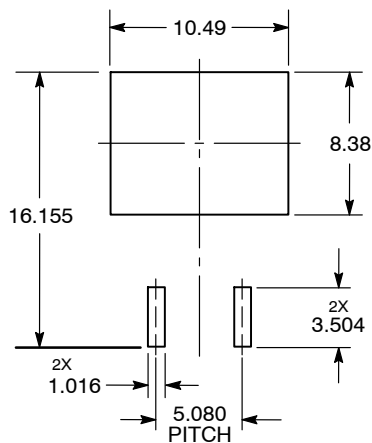
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. 418B-01 THRU 418B-03 OBSOLETE, NEW STANDARD 418B-04.

| 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 |
| F | 0.310 | 0.350 | 7.87 | 8.89 |
| 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 |
| L | 0.052 | 0.072 | 1.32 | 1.83 |
| M | 0.280 | 0.320 | 7.11 | 8.13 |
| N | 0.197 REF | | 5.00 REF | |
| P | 0.079 REF | | 2.00 REF | |
| R | 0.039 REF | | 0.99 REF | |
| S | 0.575 | 0.625 | 14.60 | 15.88 |
| V | 0.045 | 0.055 | 1.14 | 1.40 |

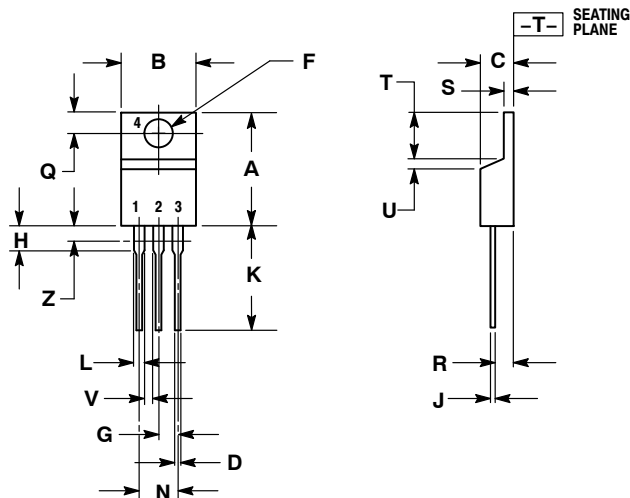


- STYLE 2:
- PIN 1. GATE
 2. DRAIN
 3. SOURCE
 4. DRAIN

SOLDERING FOOTPRINT*



*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NTB5412N, NTP5412N**PACKAGE DIMENSIONS****TO-220
CASE 221A-09
ISSUE AF**


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 | 0.161 | 3.61 | 4.09 |
| G | 0.095 | 0.105 | 2.42 | 2.66 |
| H | 0.110 | 0.155 | 2.80 | 3.93 |
| J | 0.014 | 0.025 | 0.36 | 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 | 4.83 | 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:

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

ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION**LITERATURE FULFILLMENT:**

Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5773-3850

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative

OUR CERTIFICATE

DiGi provide top-quality products and perfect service for customer worldwide through standardization, technological innovation and continuous improvement. DiGi through third-party certification, we stricly control the quality of products and services. Welcome your RFQ to

Email: Info@DiGi-Electronics.com



Tel: +00 852-30501935

RFQ Email: Info@DiGi-Electronics.com

DiGi is a global authorized distributor of electronic components.