

# NTD5407N, STD5407N, NVD5407N

## MOSFET – Power, Single, N-Channel, DPAK 40 V, 38 A

### Features

- Low  $R_{DS(on)}$
- High Current Capability
- Low Gate Charge
- STD Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable\*
- These Devices are Pb-Free and are RoHS Compliant

### Applications

- Electronic Brake Systems
- Electronic Power Steering
- Bridge Circuits

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

| Parameter                                                                                                                                                 |                        |                        | Symbol                               | Value         | Unit |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------------|--------------------------------------|---------------|------|
| Drain-to-Source Voltage                                                                                                                                   |                        |                        | V <sub>DSS</sub>                     | 40            | V    |
| Gate-to-Source Voltage                                                                                                                                    |                        |                        | V <sub>GS</sub>                      | ±20           | V    |
| Continuous Drain Current – R <sub>θJC</sub>                                                                                                               | Steady State           | T <sub>C</sub> = 25°C  | I <sub>D</sub>                       | 38            | A    |
|                                                                                                                                                           |                        | T <sub>C</sub> = 100°C |                                      | 27            |      |
| Power Dissipation – R <sub>θJC</sub>                                                                                                                      | Steady State           | T <sub>C</sub> = 25°C  | P <sub>D</sub>                       | 75            | W    |
| Continuous Drain Current R <sub>θJA</sub> (Note 1)                                                                                                        | Steady State           | T <sub>A</sub> = 25°C  | I <sub>D</sub>                       | 7.6           | A    |
|                                                                                                                                                           |                        | T <sub>A</sub> = 100°C |                                      | 5.3           |      |
| Power Dissipation – R <sub>θJA</sub> (Note 1)                                                                                                             | Steady State           | T <sub>A</sub> = 25°C  | P <sub>D</sub>                       | 2.9           | W    |
| Pulsed Drain Current                                                                                                                                      | t <sub>p</sub> = 10 μs |                        | I <sub>DM</sub>                      | 75            | A    |
| Operating Junction and Storage Temperature                                                                                                                |                        |                        | T <sub>J</sub> ,<br>T <sub>STG</sub> | –55 to<br>175 | °C   |
| Source Current (Body Diode)                                                                                                                               |                        |                        | I <sub>S</sub>                       | 36            | A    |
| Single Pulse Drain-to Source Avalanche Energy – (V <sub>DD</sub> = 50 V, V <sub>GS</sub> = 10 V, I <sub>PK</sub> = 17 A, L = 1 mH, R <sub>G</sub> = 25 Ω) |                        |                        | EAS                                  | 150           | mJ   |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s)                                                                                         |                        |                        | T <sub>L</sub>                       | 260           | °C   |

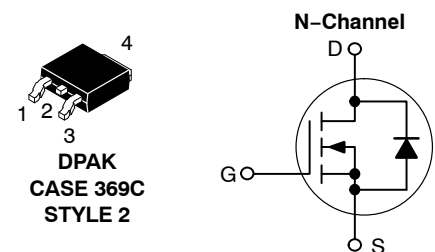
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



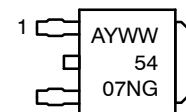
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| $V_{(BR)DSS}$ | $R_{DS(ON)}$ TYP     | $I_D$ MAX (Note 1) |
|---------------|----------------------|--------------------|
| 40 V          | 21 m $\Omega$ @ 10 V | 38 A               |



### MARKING DIAGRAM



A = Assembly Location\*  
Y = Year  
WW = Work Week  
5407N = Specific Device Code  
G = Pb-Free Device

\* The Assembly Location code (A) is front side optional. In cases where the Assembly Location is stamped in the package, the front side assembly code may be blank.

### ORDERING INFORMATION

| Device       | Package        | Shipping†          |
|--------------|----------------|--------------------|
| NTD5407NT4G  | DPAK (Pb-Free) | 2500 / Tape & Reel |
| STD5407NT4G* | DPAK (Pb-Free) | 2500 / Tape & Reel |
| NVD5407NT4G* | 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.

## NTD5407N, STD5407N, NVD5407N

### THERMAL RESISTANCE RATINGS (Note 1)

| Parameter                    | Symbol          | Max | Unit |
|------------------------------|-----------------|-----|------|
| Junction-to-Case (Drain)     | $R_{\theta JC}$ | 2.0 | °C/W |
| Junction-to-Ambient (Note 1) | $R_{\theta JA}$ | 52  | °C/W |

1. Surface mounted on FR4 board using 1 sq in pad size, (Cu Area 1.127 sq in [2 oz] including traces).

# NTD5407N, STD5407N, NVD5407N

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

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|-----------|--------|----------------|-----|-----|-----|------|
|-----------|--------|----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|                                                           |                                      |                                                  |                        |    |      |       |
|-----------------------------------------------------------|--------------------------------------|--------------------------------------------------|------------------------|----|------|-------|
| 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> |                                                  |                        | 39 |      | mV/°C |
| Zero Gate Voltage Drain Current                           | I <sub>DSS</sub>                     | V <sub>GS</sub> = 0 V,<br>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> |                                                             |     | -6.0 |     | mV/°C |
| Drain-to-Source On Resistance          | R <sub>DS(on)</sub>                 | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A               |     | 21   | 26  | mΩ    |
|                                        |                                     | V <sub>GS</sub> = 5.0 V, I <sub>D</sub> = 10 A              |     | 32   | 40  |       |
| Forward Transconductance               | g <sub>FS</sub>                     | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 18 A               |     | 15   |     | S     |

### CHARGES AND CAPACITANCES

|                              |                     |                                                                          |  |      |      |    |
|------------------------------|---------------------|--------------------------------------------------------------------------|--|------|------|----|
| Input Capacitance            | C <sub>ISS</sub>    | V <sub>GS</sub> = 0 V, f = 1.0 MHz,<br>V <sub>DS</sub> = 32 V            |  | 615  | 1000 | pF |
| Output Capacitance           | C <sub>OSS</sub>    |                                                                          |  | 173  |      |    |
| Reverse Transfer Capacitance | C <sub>RSS</sub>    |                                                                          |  | 80   |      |    |
| Total Gate Charge            | Q <sub>G(TOT)</sub> | V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 32 V,<br>I <sub>D</sub> = 38 A |  | 20   |      | nC |
| Gate-to-Source Charge        | Q <sub>GS</sub>     |                                                                          |  | 2.25 |      |    |
| Gate-to-Drain Charge         | Q <sub>GD</sub>     |                                                                          |  | 10.5 |      |    |

### 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,<br>I <sub>D</sub> = 38 A, R <sub>G</sub> = 2.5 Ω |  | 6.8 |  | ns |
| Rise Time           | t <sub>r</sub>      |                                                                                                  |  | 17  |  |    |
| Turn-Off Delay Time | t <sub>d(OFF)</sub> |                                                                                                  |  | 66  |  |    |
| Fall Time           | t <sub>f</sub>      |                                                                                                  |  | 51  |  |    |

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

|                     |                     |                                                                                                 |  |     |  |    |
|---------------------|---------------------|-------------------------------------------------------------------------------------------------|--|-----|--|----|
| Turn-On Delay Time  | t <sub>d(ON)</sub>  | V <sub>GS</sub> = 5 V, V <sub>DD</sub> = 20 V,<br>I <sub>D</sub> = 20 A, R <sub>G</sub> = 2.5 Ω |  | 10  |  | ns |
| Rise Time           | t <sub>r</sub>      |                                                                                                 |  | 175 |  |    |
| Turn-Off Delay Time | t <sub>d(OFF)</sub> |                                                                                                 |  | 13  |  |    |
| Fall Time           | t <sub>f</sub>      |                                                                                                 |  | 23  |  |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS (Note 2)

|                         |                 |                                                                                 |                        |      |      |     |    |
|-------------------------|-----------------|---------------------------------------------------------------------------------|------------------------|------|------|-----|----|
| Forward Diode Voltage   | V <sub>SD</sub> | V <sub>GS</sub> = 0 V,<br>I <sub>S</sub> = 5.0 A                                | T <sub>J</sub> = 25°C  |      | 0.9  | 1.1 | V  |
|                         |                 |                                                                                 | T <sub>J</sub> = 125°C |      | 0.75 |     |    |
| Reverse Recovery Time   | t <sub>RR</sub> | V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs,<br>I <sub>S</sub> = 15 A |                        | 38   |      | ns  |    |
| Charge Time             | t <sub>a</sub>  |                                                                                 |                        | 20.5 |      |     |    |
| Discharge Time          | t <sub>b</sub>  |                                                                                 |                        | 17   |      |     |    |
| Reverse Recovery Charge | Q <sub>RR</sub> |                                                                                 |                        |      | 40   |     | nC |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

3. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

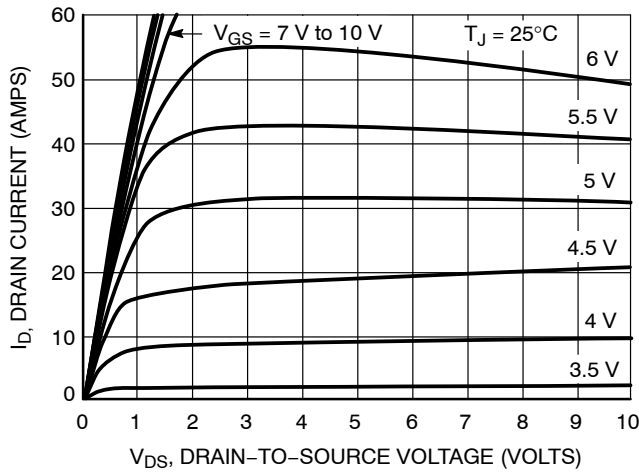


Figure 1. On-Region Characteristics

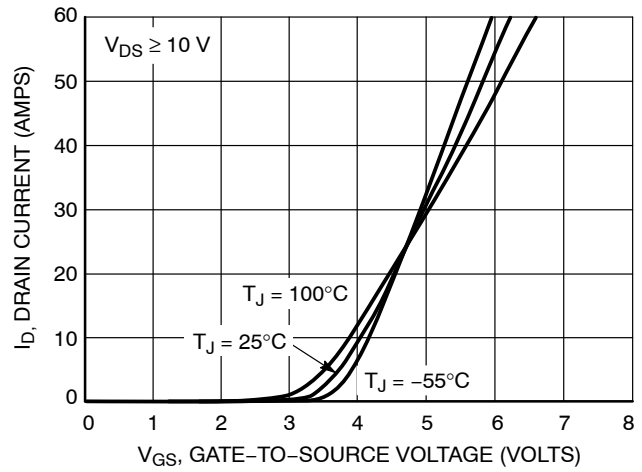


Figure 2. Transfer Characteristics

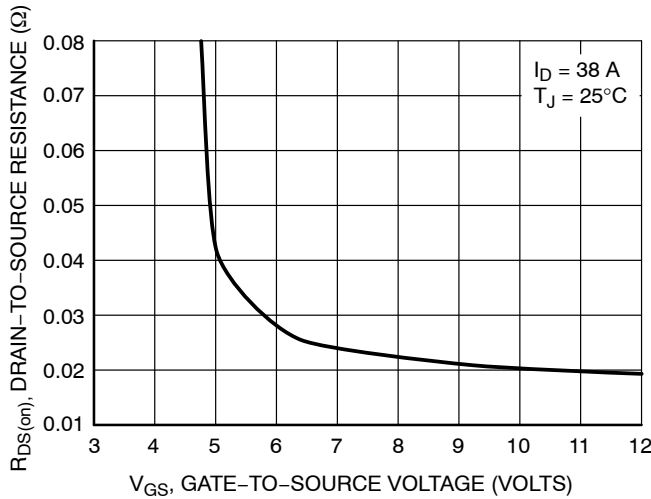


Figure 3. On-Resistance vs. Gate-to-Source Voltage

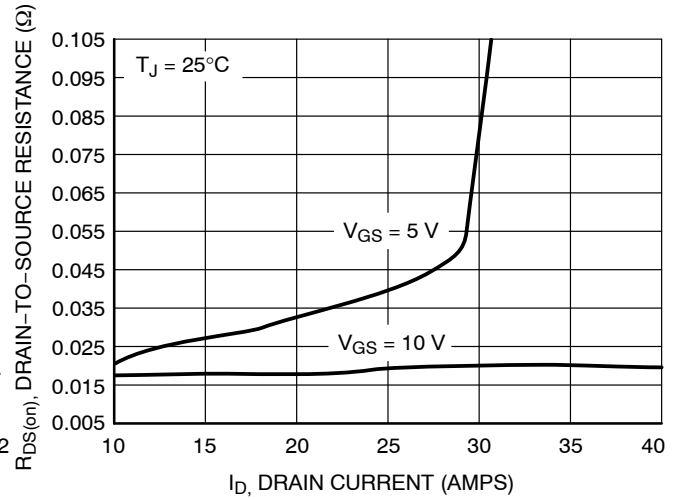


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

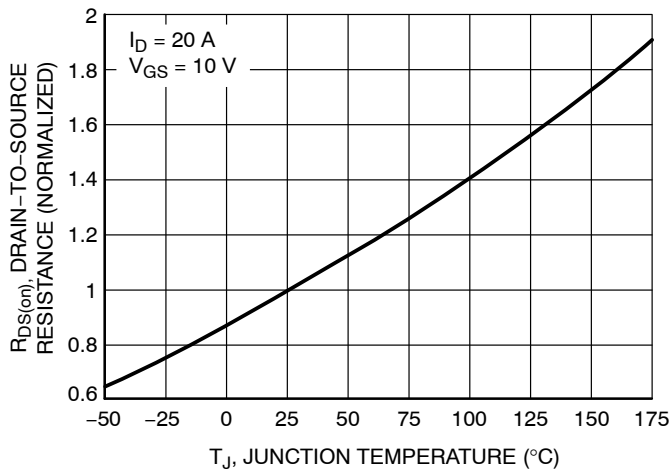


Figure 5. On-Resistance Variation with Temperature

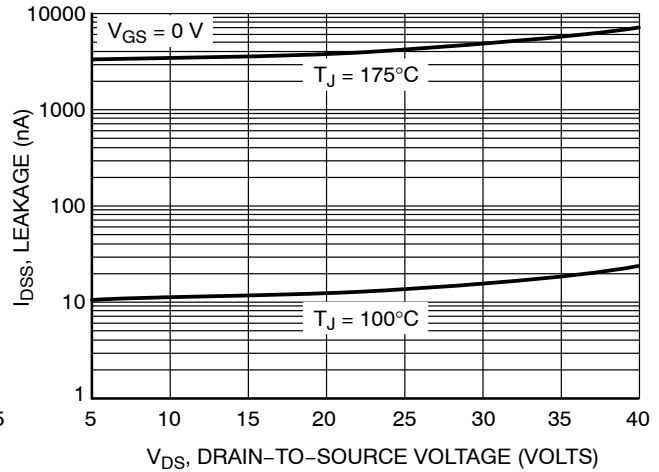
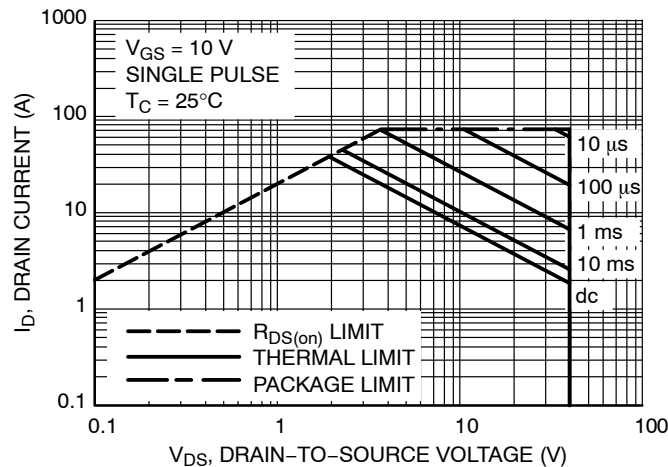
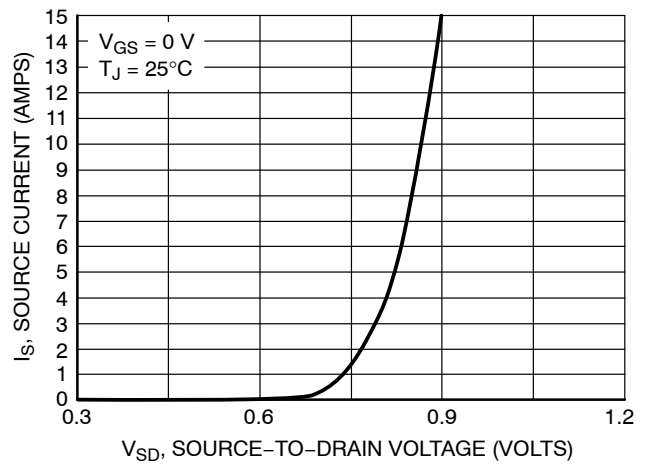
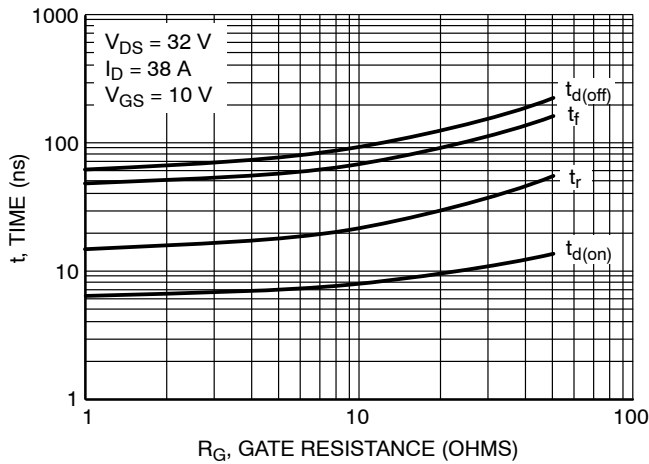
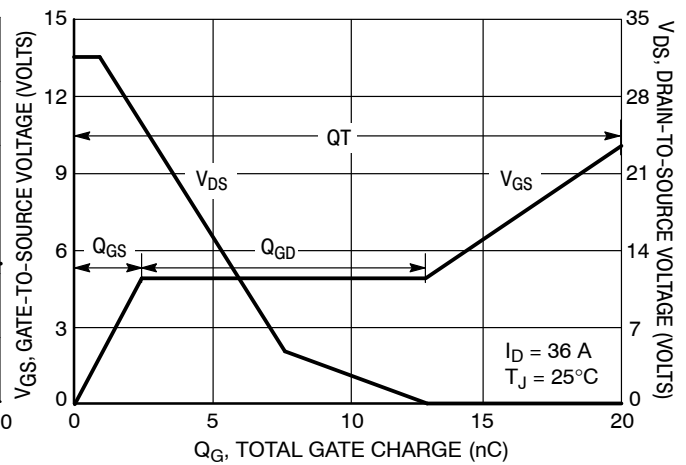
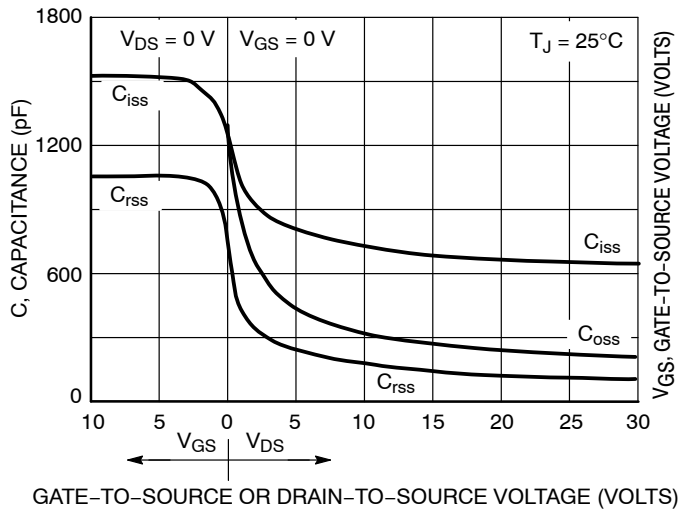


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES



# NTD5407N, STD5407N, NVD5407N

## TYPICAL PERFORMANCE CURVES

$r(t)$ , EFFECTIVE TRANSIENT THERMAL RESISTANCE

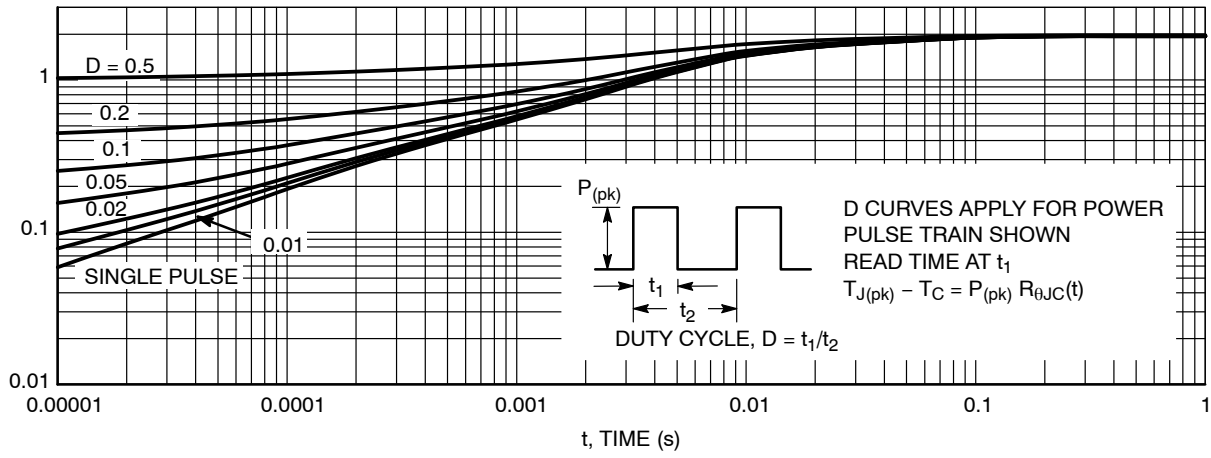
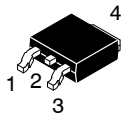


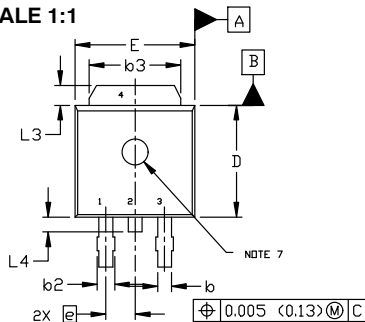
Figure 12. Thermal Response



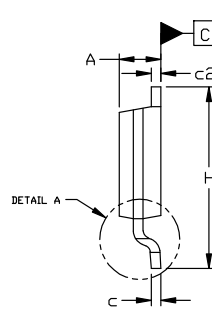
DPAK (SINGLE GAUGE)  
CASE 369C  
ISSUE G

DATE 31 MAY 2023

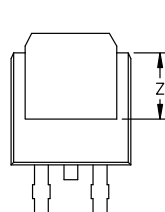
SCALE 1:1



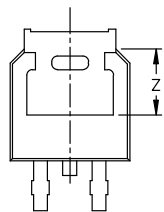
TOP VIEW



SIDE VIEW

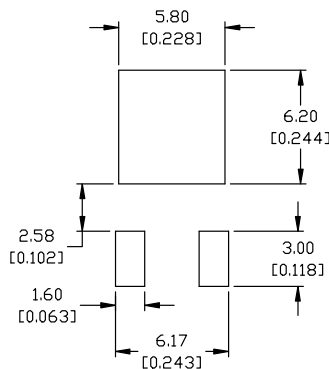


BOTTOM VIEW



BOTTOM VIEW

ALTERNATE  
CONSTRUCTIONS



RECOMMENDED MOUNTING 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.

STYLE 1:

PIN 1. BASE  
2. COLLECTOR  
3. EMITTER  
4. COLLECTOR

STYLE 2:

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

STYLE 3:

PIN 1. ANODE  
2. CATHODE  
3. ANODE  
4. CATHODE

STYLE 4:

PIN 1. CATHODE  
2. ANODE  
3. GATE  
4. ANODE

STYLE 5:

PIN 1. GATE  
2. ANODE  
3. CATHODE  
4. ANODE

STYLE 6:

PIN 1. MT1  
2. MT2  
3. GATE  
4. MT2

STYLE 7:

PIN 1. GATE  
2. COLLECTOR  
3. EMITTER  
4. COLLECTOR

STYLE 8:

PIN 1. N/C  
2. CATHODE  
3. ANODE  
4. CATHODE

STYLE 9:

PIN 1. ANODE  
2. CATHODE  
3. RESISTOR ADJUST  
4. CATHODE

STYLE 10:

PIN 1. CATHODE  
2. ANODE  
3. CATHODE  
4. ANODE

NOTES:

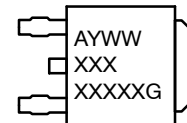
1. DIMENSIONING AND TOLERANCING ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3, AND Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.
7. OPTIONAL MOLD FEATURE.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN.   | MAX.  | MIN.        | MAX.  |
| A   | 0.086  | 0.094 | 2.18        | 2.38  |
| A1  | 0.000  | 0.005 | 0.00        | 0.13  |
| b   | 0.025  | 0.035 | 0.63        | 0.89  |
| b2  | 0.028  | 0.045 | 0.72        | 1.14  |
| b3  | 0.180  | 0.215 | 4.57        | 5.46  |
| c   | 0.018  | 0.024 | 0.46        | 0.61  |
| c2  | 0.018  | 0.024 | 0.46        | 0.61  |
| D   | 0.235  | 0.245 | 5.97        | 6.22  |
| E   | 0.250  | 0.265 | 6.35        | 6.73  |
| e   | 0.090  | BSC   | 2.29        | BSC   |
| H   | 0.370  | 0.410 | 9.40        | 10.41 |
| L   | 0.055  | 0.070 | 1.40        | 1.78  |
| L1  | 0.114  | REF   | 2.90        | REF   |
| L2  | 0.020  | BSC   | 0.51        | BSC   |
| L3  | 0.035  | 0.050 | 0.89        | 1.27  |
| L4  | ----   | 0.040 | ---         | 1.01  |
| Z   | 0.155  | ----  | 3.93        | ---   |

GENERIC  
MARKING DIAGRAM\*



IC



Discrete

XXXXXX = Device Code  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
WW = Work Week  
G = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

|                  |                     |                                                                                                                                                                                  |
|------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| DESCRIPTION:     | DPAK (SINGLE GAUGE) | PAGE 1 OF 1                                                                                                                                                                      |

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