

# NTMYS2D9N04CL

## MOSFET – Power, Single, N-Channel

### 40 V, 2.8 mΩ, 110 A

#### Features

- Small Footprint (5x6 mm) for Compact Design
- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low  $Q_G$  and Capacitance to Minimize Driver Losses
- LFPACK Package, Industry Standard
- These Devices are Pb-Free and are RoHS Compliant

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

| Parameter                                                                  |                                                            |                             | Symbol            | Value       | Unit               |
|----------------------------------------------------------------------------|------------------------------------------------------------|-----------------------------|-------------------|-------------|--------------------|
| Drain-to-Source Voltage                                                    |                                                            |                             | $V_{DSS}$         | 40          | V                  |
| Gate-to-Source Voltage                                                     |                                                            |                             | $V_{GS}$          | $\pm 20$    | V                  |
| Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)                      | Steady State                                               | $T_C = 25^{\circ}\text{C}$  | $I_D$             | 110         | A                  |
|                                                                            |                                                            | $T_C = 100^{\circ}\text{C}$ |                   | 81          |                    |
| Power Dissipation $R_{\theta JC}$ (Note 1)                                 |                                                            | $T_C = 25^{\circ}\text{C}$  | $P_D$             | 68          | W                  |
|                                                                            |                                                            | $T_C = 100^{\circ}\text{C}$ |                   | 34          |                    |
| Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)                   | Steady State                                               | $T_A = 25^{\circ}\text{C}$  | $I_D$             | 27          | A                  |
|                                                                            |                                                            | $T_A = 100^{\circ}\text{C}$ |                   | 19          |                    |
| Power Dissipation $R_{\theta JA}$ (Notes 1, 2)                             |                                                            | $T_A = 25^{\circ}\text{C}$  | $P_D$             | 3.7         | W                  |
|                                                                            |                                                            | $T_A = 100^{\circ}\text{C}$ |                   | 1.6         |                    |
| Pulsed Drain Current                                                       | $T_A = 25^{\circ}\text{C}$ , $t_p = 10\text{ }\mu\text{s}$ |                             | $I_{DM}$          | 740         | A                  |
| Operating Junction and Storage Temperature Range                           |                                                            |                             | $T_J$ , $T_{stg}$ | -55 to +175 | $^{\circ}\text{C}$ |
| Source Current (Body Diode)                                                |                                                            |                             | $I_S$             | 76          | A                  |
| Single Pulse Drain-to-Source Avalanche Energy ( $I_{L(pk)} = 7\text{ A}$ ) |                                                            |                             | $E_{AS}$          | 215         | mJ                 |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s)          |                                                            |                             | $T_L$             | 260         | $^{\circ}\text{C}$ |

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.

#### THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter                                   | Symbol          | Value | Unit               |
|---------------------------------------------|-----------------|-------|--------------------|
| Junction-to-Case – Steady State             | $R_{\theta JC}$ | 2.2   | $^\circ\text{C/W}$ |
| Junction-to-Ambient – Steady State (Note 2) | $R_{\theta JA}$ | 39    |                    |

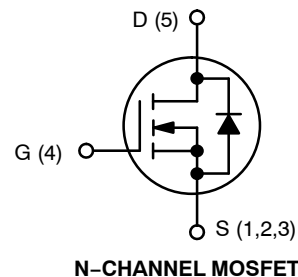
1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface-mounted on FR4 board using a 650 mm<sup>2</sup>, 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.



ON Semiconductor®

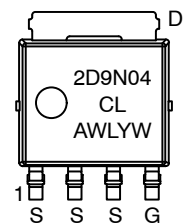
[www.onsemi.com](http://www.onsemi.com)

| $V_{(BR)DSS}$ | $R_{DS(ON)} \text{ MAX}$ | $I_D \text{ MAX}$ |
|---------------|--------------------------|-------------------|
| 40 V          | 2.8 mΩ @ 10 V            | 110 A             |
|               | 4.4 mΩ @ 4.5 V           |                   |



LFPACK4  
CASE 760AB

#### MARKING DIAGRAM



2D9N04CL = Specific Device Code  
A = Assembly Location  
WL = Wafer Lot  
Y = Year  
W = Work Week

#### ORDERING INFORMATION

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

# NTMYS2D9N04CL

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

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

### OFF CHARACTERISTICS

|                                                           |                   |                                                     |                                  |     |     |                      |
|-----------------------------------------------------------|-------------------|-----------------------------------------------------|----------------------------------|-----|-----|----------------------|
| Drain-to-Source Breakdown Voltage                         | $V_{(BR)DSS}$     | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 40                               |     |     | V                    |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ |                                                     |                                  | 1.6 |     | mV/ $^\circ\text{C}$ |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$         | $V_{GS} = 0\text{ V}, V_{DS} = 40\text{ V}$         | $T_J = 25\text{ }^\circ\text{C}$ |     | 10  | $\mu\text{A}$        |
|                                                           |                   |                                                     | $T_J = 125^\circ\text{C}$        |     | 250 |                      |
| Gate-to-Source Leakage Current                            | $I_{GSS}$         | $V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$         |                                  |     | 100 | nA                   |

### ON CHARACTERISTICS (Note 4)

|                                   |                  |                                                |     |      |     |                      |
|-----------------------------------|------------------|------------------------------------------------|-----|------|-----|----------------------|
| Gate Threshold Voltage            | $V_{GS(TH)}$     | $V_{GS} = V_{DS}, I_D = 60\text{ }\mu\text{A}$ | 1.2 |      | 2.0 | V                    |
| Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ |                                                |     | -5.3 |     | mV/ $^\circ\text{C}$ |
| Drain-to-Source On Resistance     | $R_{DS(on)}$     | $V_{GS} = 4.5\text{ V}, I_D = 40\text{ A}$     |     | 3.5  | 4.4 | $\text{m}\Omega$     |
|                                   |                  | $V_{GS} = 10\text{ V}, I_D = 40\text{ A}$      |     | 2.3  | 2.8 |                      |
| Forward Transconductance          | $g_{FS}$         | $V_{DS} = 15\text{ V}, I_D = 40\text{ A}$      |     | 120  |     | S                    |

### CHARGES, CAPACITANCES & GATE RESISTANCE

|                              |              |                                                                  |  |      |  |             |
|------------------------------|--------------|------------------------------------------------------------------|--|------|--|-------------|
| Input Capacitance            | $C_{ISS}$    | $V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 20\text{ V}$    |  | 2100 |  | $\text{pF}$ |
| Output Capacitance           | $C_{OSS}$    |                                                                  |  | 1000 |  |             |
| Reverse Transfer Capacitance | $C_{RSS}$    |                                                                  |  | 42   |  |             |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 20\text{ V}; I_D = 40\text{ A}$ |  | 16   |  | nC          |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 10\text{ V}, V_{DS} = 20\text{ V}; I_D = 40\text{ A}$  |  | 35   |  | $\text{nC}$ |
| Threshold Gate Charge        | $Q_{G(TH)}$  |                                                                  |  | 4.0  |  |             |
| Gate-to-Source Charge        | $Q_{GS}$     |                                                                  |  | 7.0  |  |             |
| Gate-to-Drain Charge         | $Q_{GD}$     |                                                                  |  | 5.0  |  |             |
| Plateau Voltage              | $V_{GP}$     |                                                                  |  | 3.2  |  | V           |

### SWITCHING CHARACTERISTICS (Note 5)

|                     |              |                                                                                         |  |     |  |    |
|---------------------|--------------|-----------------------------------------------------------------------------------------|--|-----|--|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = 4.5\text{ V}, V_{DS} = 20\text{ V}, I_D = 40\text{ A}, R_G = 1\text{ }\Omega$ |  | 11  |  | ns |
| Rise Time           | $t_r$        |                                                                                         |  | 110 |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |                                                                                         |  | 21  |  |    |
| Fall Time           | $t_f$        |                                                                                         |  | 5.0 |  |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                         |                 |                                                                                 |                        |  |      |     |    |
|-------------------------|-----------------|---------------------------------------------------------------------------------|------------------------|--|------|-----|----|
| Forward Diode Voltage   | V <sub>SD</sub> | V <sub>GS</sub> = 0 V,<br>I <sub>S</sub> = 40 A                                 | T <sub>J</sub> = 25°C  |  | 0.84 | 1.2 | V  |
|                         |                 |                                                                                 | T <sub>J</sub> = 125°C |  | 0.72 |     |    |
| 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> = 40 A |                        |  | 41   |     | ns |
| Charge Time             | t <sub>a</sub>  |                                                                                 |                        |  | 19   |     |    |
| Discharge Time          | t <sub>b</sub>  |                                                                                 |                        |  | 22   |     |    |
| Reverse Recovery Charge | Q <sub>RR</sub> |                                                                                 |                        |  | 31   |     | 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.

4. Pulse Test: pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

5. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

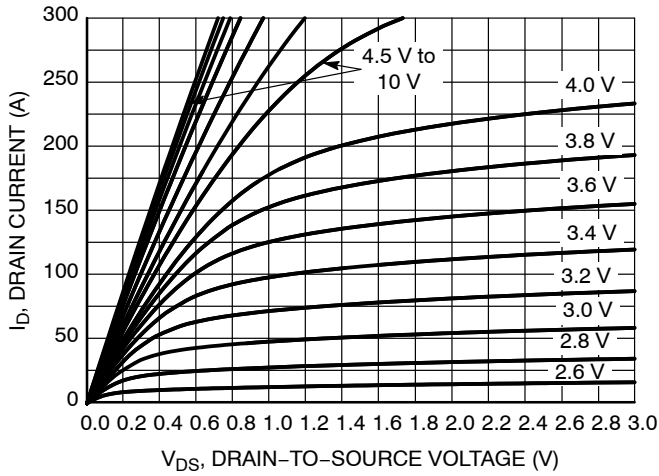


Figure 1. On-Region Characteristics

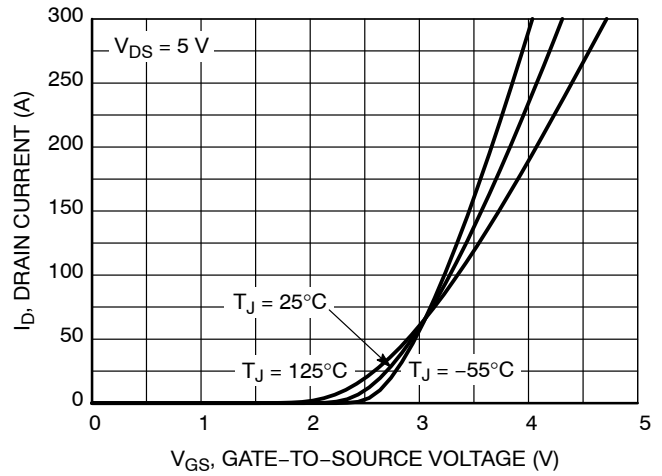


Figure 2. Transfer Characteristics

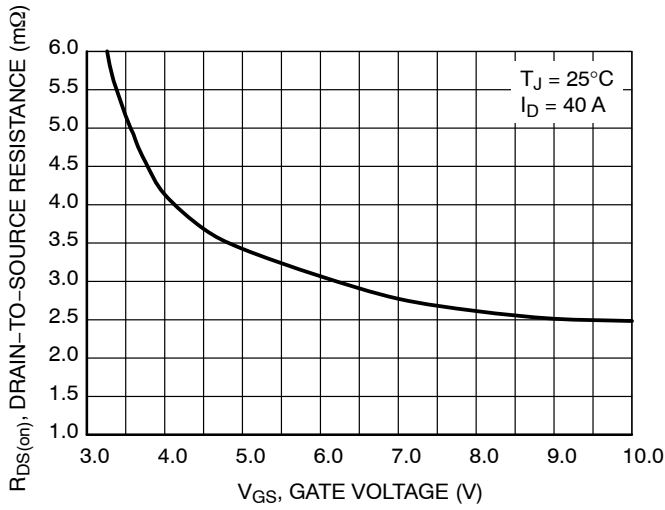


Figure 3. On-Resistance vs. Gate-to-Source Voltage

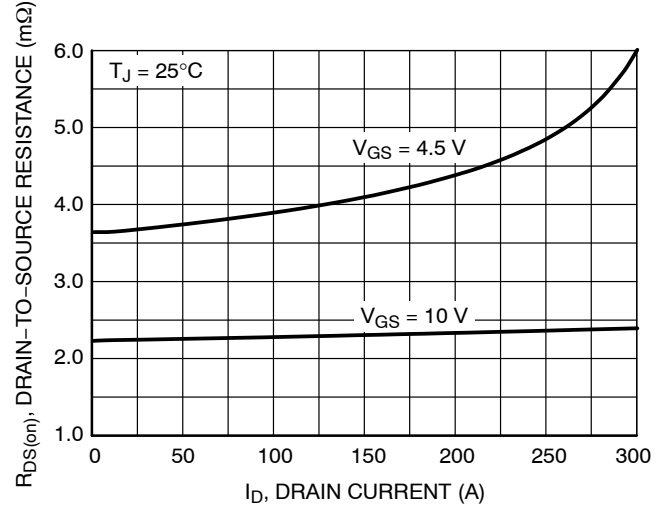


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

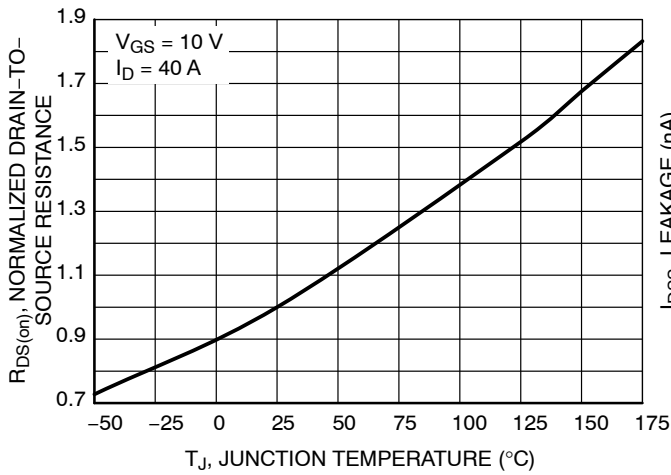


Figure 5. On-Resistance Variation with Temperature

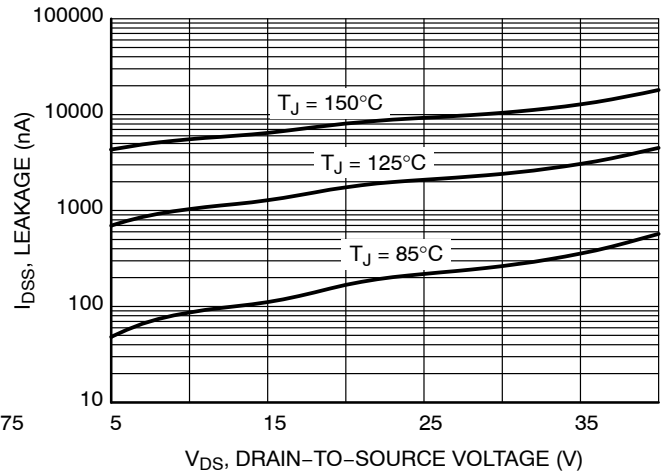
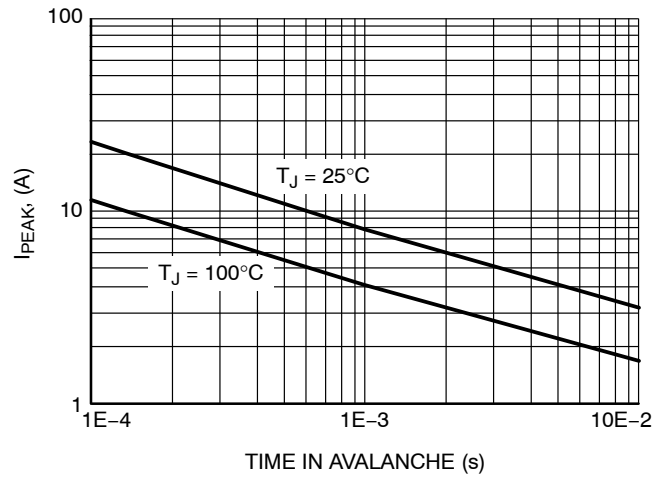
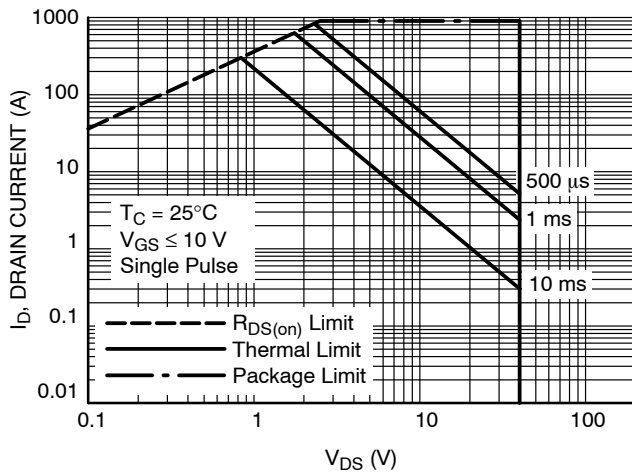
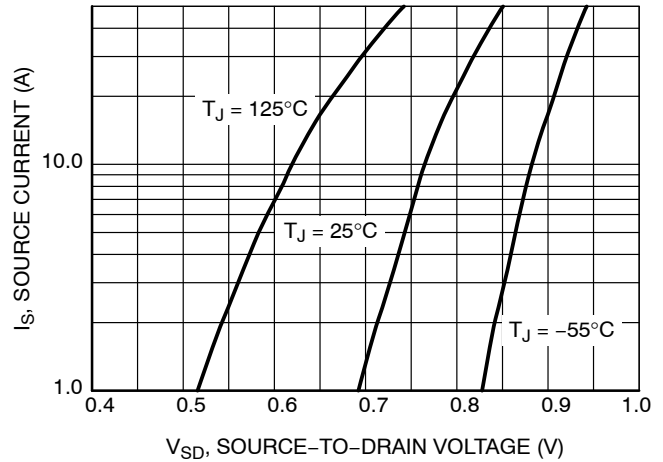
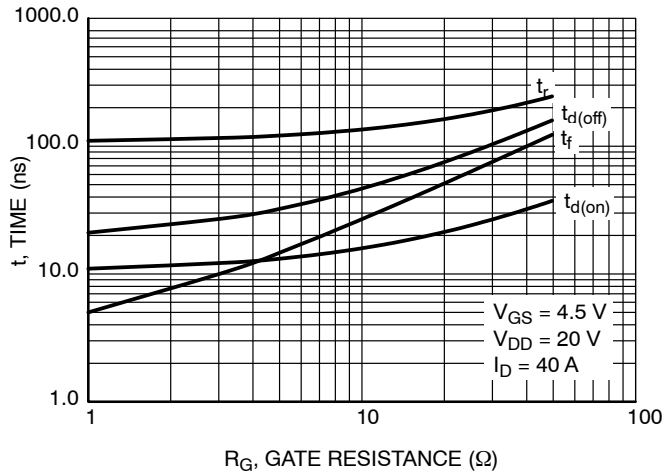
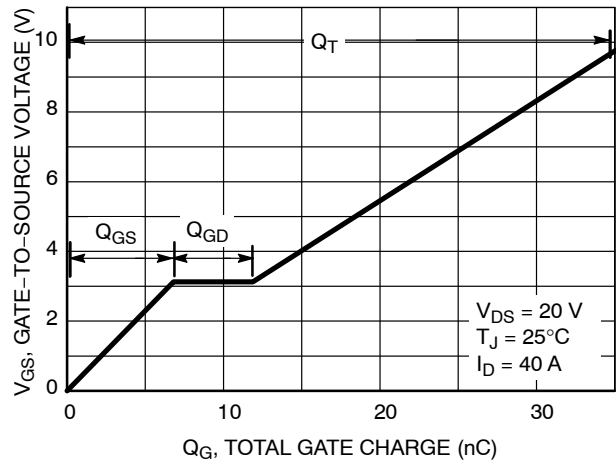
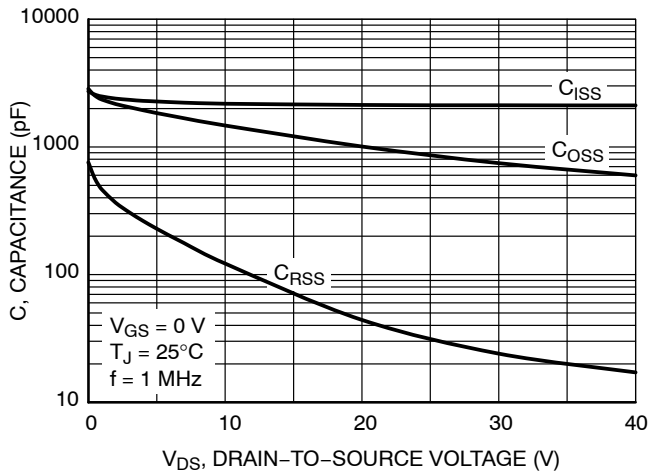


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS



# NTMYS2D9N04CL

## TYPICAL CHARACTERISTICS

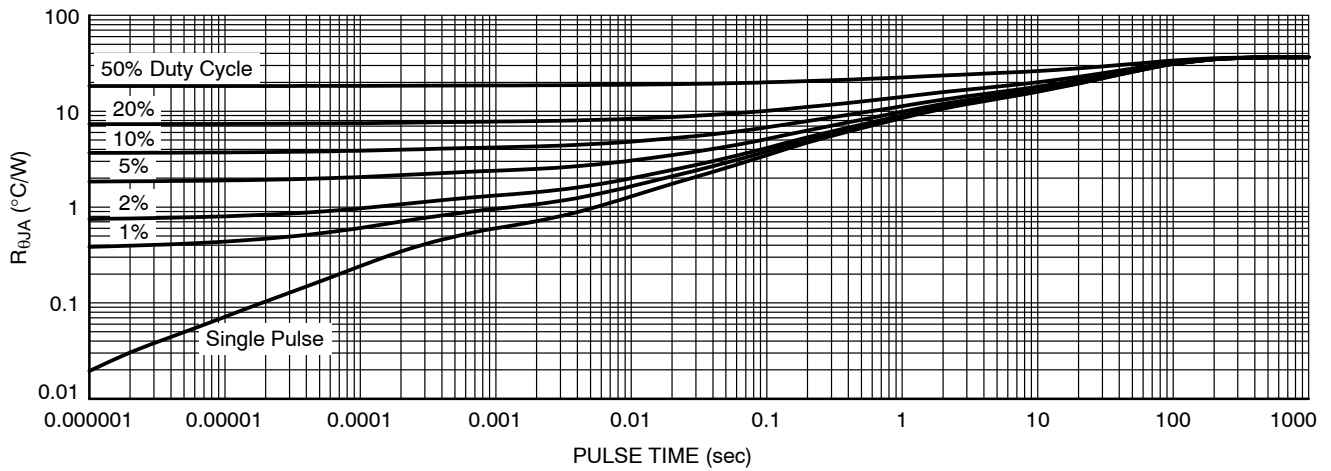


Figure 13. Thermal Characteristics

### DEVICE ORDERING INFORMATION

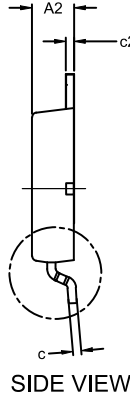
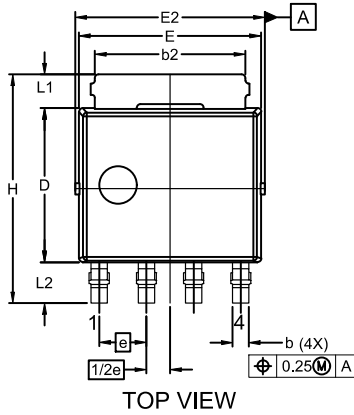
| Device           | Marking  | Package             | Shipping <sup>†</sup> |
|------------------|----------|---------------------|-----------------------|
| NTMYS2D9N04CLTWG | 2D9N04CL | LFP4K4<br>(Pb-Free) | 3000 / Tape & Reel    |

<sup>†</sup>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.

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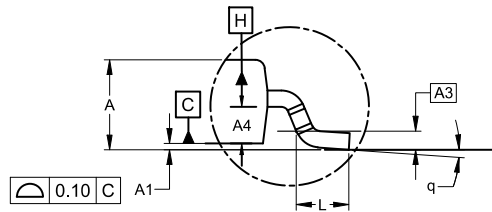
## PACKAGE DIMENSIONS

### LFPAK4 5x6 CASE 760AB ISSUE A

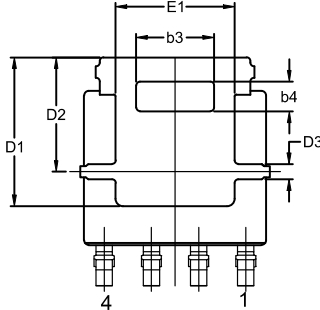


#### NOTES:

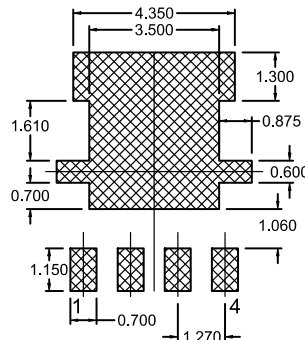
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.150mm PER SIDE.
4. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.



DETAIL 'A'  
SCALE: 2:1



BOTTOM VIEW



RECOMMENDED MOUNTING  
FOOTPRINT

| UNIT IN MILLIMETER |      |          |      |
|--------------------|------|----------|------|
| DIM                | MIN  | NOM      | MAX  |
| A                  | 1.10 | 1.20     | 1.30 |
| A1                 | 0.00 | 0.08     | 0.15 |
| A2                 | 1.10 | 1.15     | 1.20 |
| A3                 |      | 0.25     |      |
| A4                 | 0.45 | 0.50     | 0.55 |
| b                  | 0.40 | 0.45     | 0.50 |
| b2                 | 3.80 | 4.10     | 4.40 |
| b3                 | 2.00 | 2.10     | 2.20 |
| b4                 | 0.70 | 0.80     | 0.90 |
| c                  | 0.19 | 0.22     | 0.25 |
| c2                 | 0.19 | 0.22     | 0.25 |
| D                  | 4.05 | 4.15     | 4.25 |
| D1                 | -    | -        | 4.20 |
| D2                 | 3.0  | 3.10     | 3.20 |
| D3                 | 0.30 | 0.40     | 0.50 |
| E                  | 4.80 | 4.90     | 5.00 |
| E1                 | 3.10 | 3.20     | 3.30 |
| E2                 | 5.00 | 5.15     | 5.30 |
| e                  |      | 1.27 BSC |      |
| H                  | 6.00 | 6.15     | 6.30 |
| L                  | 0.40 | 0.65     | 0.85 |
| L1                 | 0.80 | 0.90     | 1.00 |
| L2                 | 0.80 | 1.05     | 1.30 |
| q                  | 0°   | 4°       | 8°   |

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