

# MOSFET - Power, Single P-Channel, Small Signal

## -20 V, -127 mA

### NTNS2K1P021Z

#### Features

- Low Profile Ultra Small Package, XDFN3 (0.62 x 0.42 x 0.4 mm) for Extremely Space-Constrained Applications
- -1.5 V Gate Drive
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

#### Applications

- Small Signal Load Switch
- High Speed Interfacing
- Level Shift

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

| Parameter                                                         |                        |                            | Symbol         | Value      | Unit               |
|-------------------------------------------------------------------|------------------------|----------------------------|----------------|------------|--------------------|
| Drain-to-Source Voltage                                           |                        |                            | $V_{DSS}$      | 20         | V                  |
| Gate-to-Source Voltage                                            |                        |                            | $V_{GS}$       | $\pm 8$    | V                  |
| Continuous Drain Current (Note 1)                                 | Steady State           | $T_A = 25^{\circ}\text{C}$ | $I_D$          | -127       | mA                 |
|                                                                   |                        | $T_A = 85^{\circ}\text{C}$ |                | -91        |                    |
|                                                                   | $t \leq 5 \text{ s}$   | $T_A = 25^{\circ}\text{C}$ |                | -146       |                    |
| Power Dissipation (Note 1)                                        | Steady State           | $T_A = 25^{\circ}\text{C}$ | $P_D$          | 125        | mW                 |
|                                                                   |                        | $t \leq 5 \text{ s}$       |                | 166        |                    |
| Pulsed Drain Current                                              | $t_p = 10 \mu\text{s}$ |                            | $I_{DM}$       | -488       | mA                 |
| Operating Junction and Storage Temperature Range                  |                        |                            | $T_J, T_{STG}$ | -55 to 150 | $^{\circ}\text{C}$ |
| Source Current (Body Diode) (Note 2)                              |                        |                            | $I_S$          | 200        | mA                 |
| 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.

1. Surface-mounted on FR4 board using the minimum recommended pad size, or 2 mm<sup>2</sup>, 1 oz Cu.
2. Pulse Test: pulse width  $\leq 300 \mu\text{s}$ , duty cycle  $\leq 2\%$

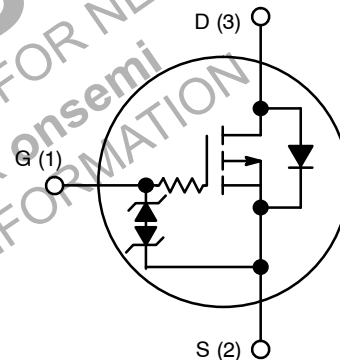


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| $V_{(BR)DS}$ | $R_{DS(on)}$ MAX      | $I_D$ Max |
|--------------|-----------------------|-----------|
| -20 V        | 5.0 $\Omega$ @ -4.5 V | -127 mA   |
|              | 7.0 $\Omega$ @ -1.8 V |           |
|              | 20 $\Omega$ @ -1.2 V  |           |

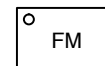
#### P-CHANNEL MOSFET



#### MARKING DIAGRAM



XDFN3  
CASE 711BH



1

F = Specific Device Code  
M = Date Code

#### ORDERING INFORMATION

| Device          | Package         | Shipping†          |
|-----------------|-----------------|--------------------|
| NTNS2K1P021ZTCG | XDFN3 (Pb-Free) | 8000 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

# NTNS2K1P021Z

## THERMAL RESISTANCE RATINGS

| Parameter                                   | Symbol          | Max | Unit |
|---------------------------------------------|-----------------|-----|------|
| Junction-to-Ambient – Steady State (Note 3) | $R_{\theta JA}$ | 998 | °C/W |
| Junction-to-Ambient – $t \leq 5$ s (Note 3) | $R_{\theta JA}$ | 751 |      |

3. Surface-mounted on FR4 board using the minimum recommended pad size, or 2 mm<sup>2</sup>, 1 oz Cu.

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

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

### OFF CHARACTERISTICS

|                                   |               |                                                                      |     |  |           |    |
|-----------------------------------|---------------|----------------------------------------------------------------------|-----|--|-----------|----|
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$                 | -20 |  |           | V  |
| Zero Gate Voltage Drain Current   | $I_{DSS}$     | $V_{GS} = 0\text{ V}, V_{DS} = -5\text{ V}, T_J = 25^\circ\text{C}$  |     |  | -50       | nA |
| Zero Gate Voltage Drain Current   | $I_{DSS}$     | $V_{GS} = 0\text{ V}, V_{DS} = -16\text{ V}, T_J = 25^\circ\text{C}$ |     |  | -100      | nA |
| Gate-to-Source Leakage Current    | $I_{GSS}$     | $V_{DS} = 0\text{ V}, V_{GS} = \pm 5\text{ V}$                       |     |  | $\pm 100$ | nA |

### ON CHARACTERISTICS (Note 4)

|                               |              |                                                  |      |      |      |          |
|-------------------------------|--------------|--------------------------------------------------|------|------|------|----------|
| Gate Threshold Voltage        | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = -250\text{ }\mu\text{A}$ | -0.4 |      | -1.0 | V        |
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS} = -4.5\text{ V}, I_D = -100\text{ mA}$   |      | 2.1  | 5.0  | $\Omega$ |
|                               |              | $V_{GS} = -1.8\text{ V}, I_D = -20\text{ mA}$    |      | 3.6  | 7.0  |          |
|                               |              | $V_{GS} = -1.2\text{ V}, I_D = -10\text{ mA}$    |      | 7.3  | 20   |          |
| Forward Transconductance      | $g_{FS}$     | $V_{DS} = -5\text{ V}, I_D = -125\text{ mA}$     |      | 0.35 |      | S        |
| Source-Drain Diode Voltage    | $V_{SD}$     | $V_{GS} = 0\text{ V}, I_S = -10\text{ mA}$       |      | -0.6 | -1.0 | V        |

### CHARGES & CAPACITANCES

|                              |           |                                                                          |  |      |  |    |
|------------------------------|-----------|--------------------------------------------------------------------------|--|------|--|----|
| Input Capacitance            | $C_{ISS}$ | $V_{GS} = 0\text{ V}, \text{freq} = 1\text{ MHz}, V_{DS} = -15\text{ V}$ |  | 12.8 |  | pF |
| Output Capacitance           | $C_{OSS}$ |                                                                          |  | 2.8  |  |    |
| Reverse Transfer Capacitance | $C_{RSS}$ |                                                                          |  | 2.0  |  |    |

### SWITCHING CHARACTERISTICS, $V_{GS} = 4.5\text{ V}$ (Note 4)

|                     |              |                                                                                             |  |     |  |    |
|---------------------|--------------|---------------------------------------------------------------------------------------------|--|-----|--|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = -4.5\text{ V}, V_{DD} = -15\text{ V}, I_D = 200\text{ mA}, R_G = 2\text{ }\Omega$ |  | 37  |  | ns |
| Rise Time           | $t_r$        |                                                                                             |  | 71  |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |                                                                                             |  | 280 |  |    |
| Fall Time           | $t_f$        |                                                                                             |  | 171 |  |    |

4. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

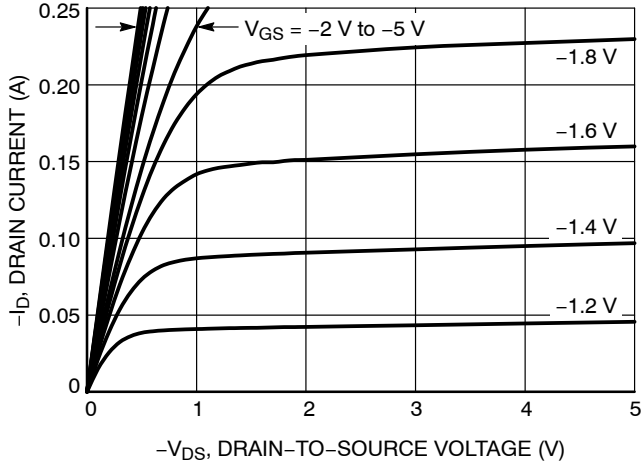


Figure 1. On-Region Characteristics

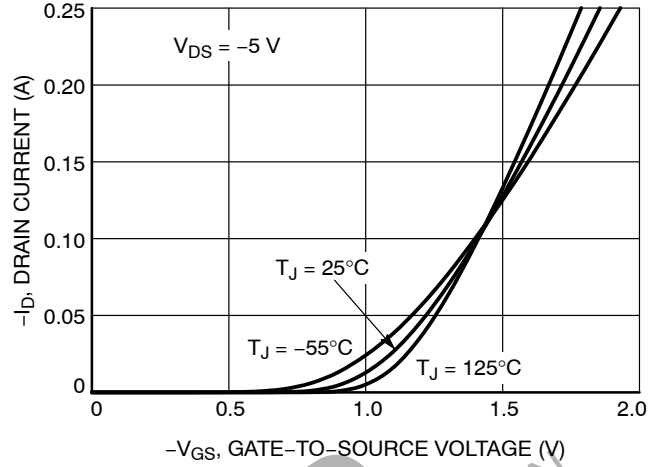


Figure 2. Transfer Characteristics

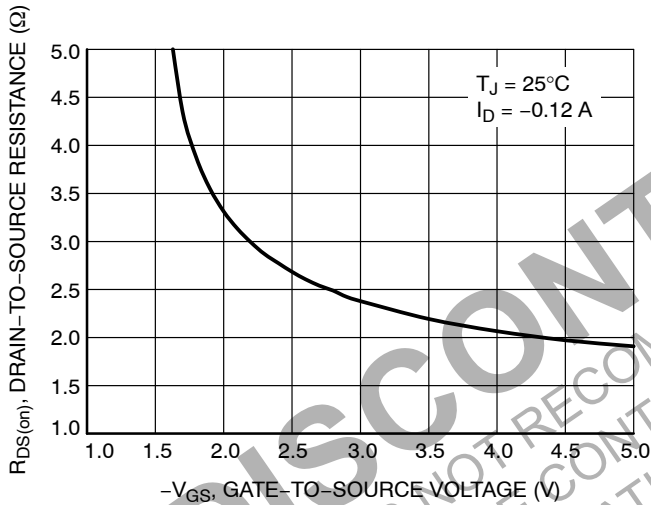


Figure 3. On-Resistance vs. Gate-to-Source Voltage

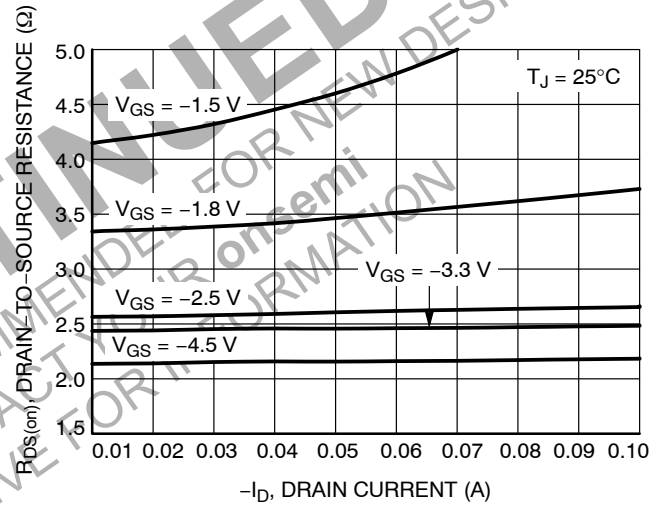


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

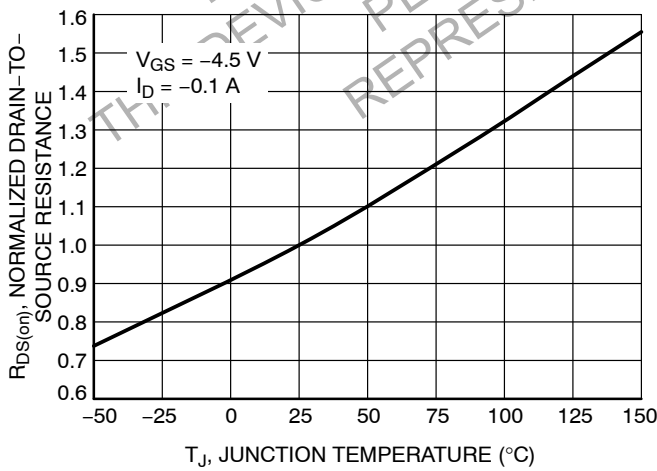


Figure 5. On-Resistance Variation with Temperature

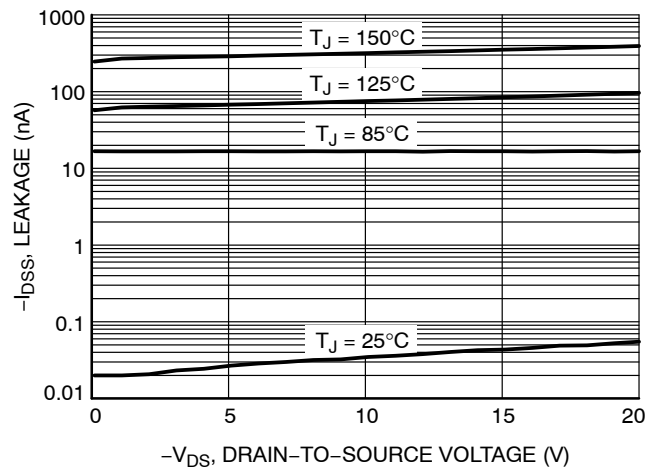


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

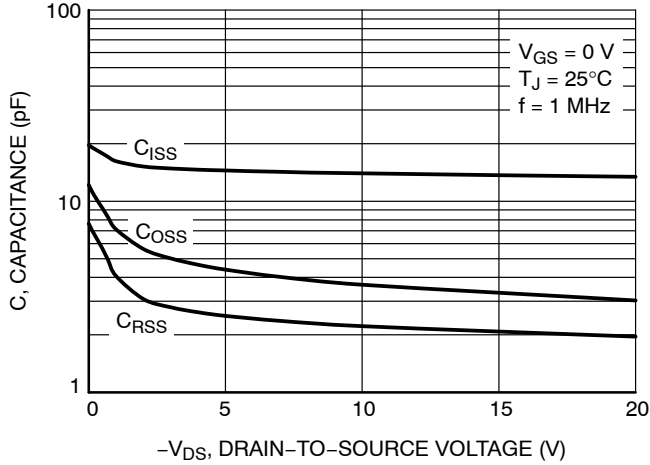


Figure 7. Capacitance Variation

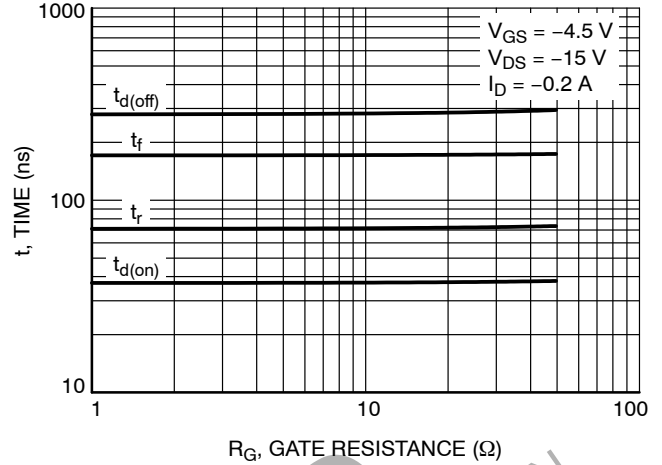


Figure 8. Resistive Switching Time Variation vs. Gate Resistance

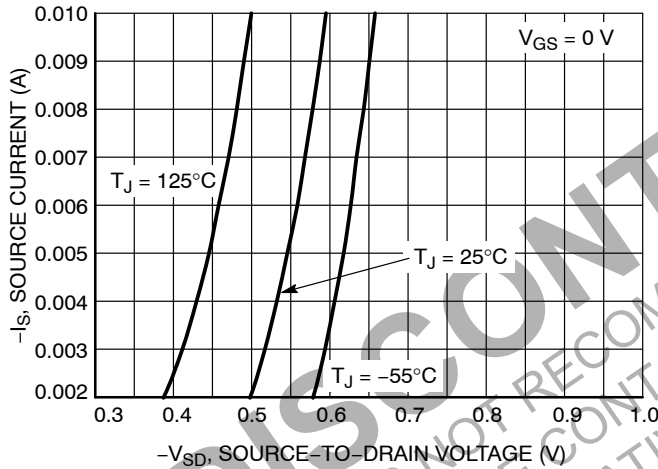


Figure 9. Diode Forward Voltage vs. Current

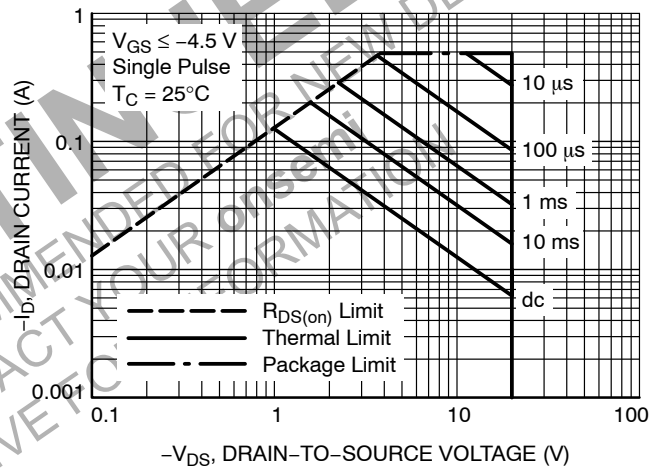


Figure 10. Maximum Rated Forward Biased Safe Operating Area

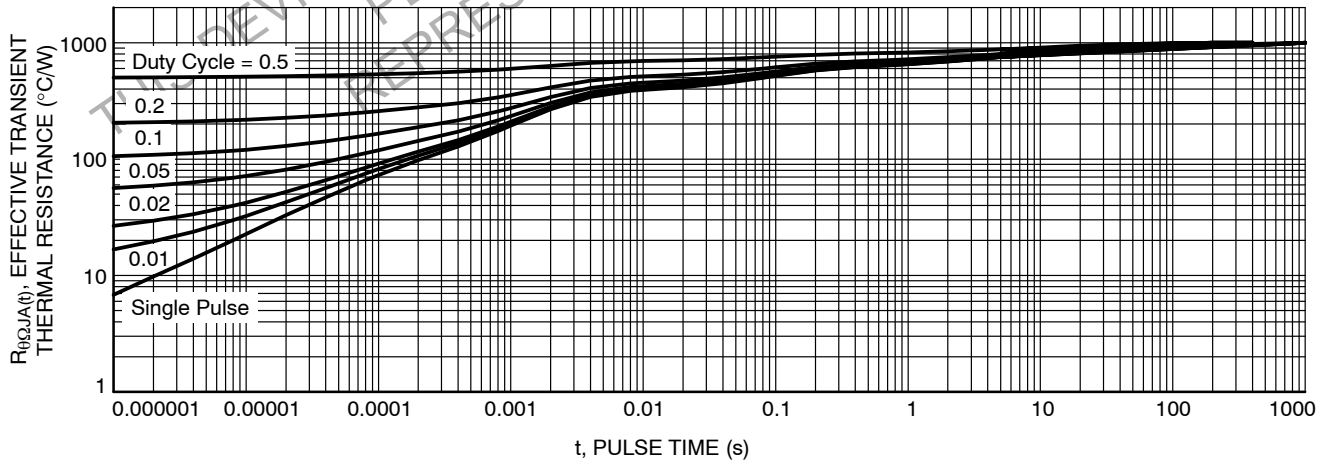


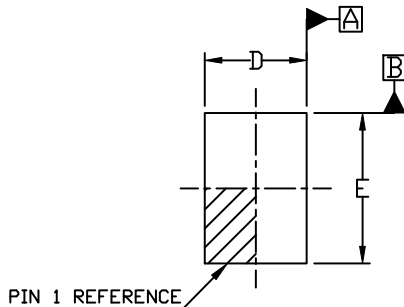
Figure 11. Thermal Response



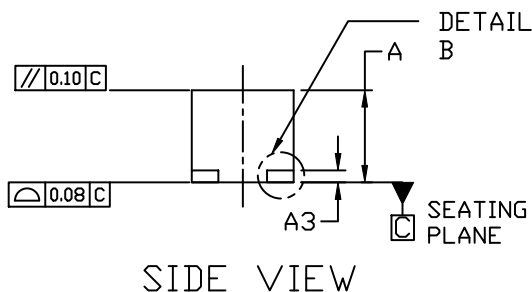
SCALE 8:1

**XDFN3 0.42x0.62, 0.3P**  
**CASE 711BH**  
**ISSUE A**

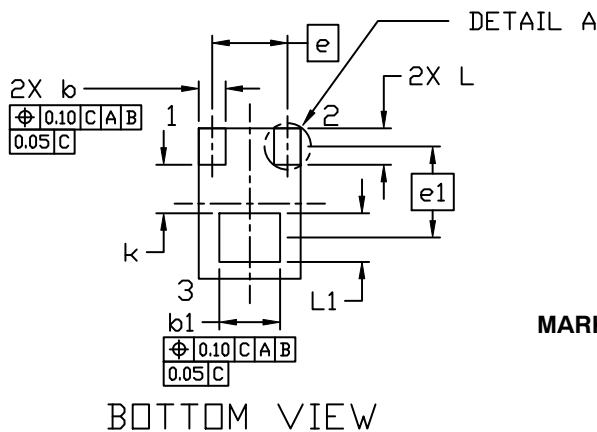
DATE 29 APR 2018



TOP VIEW

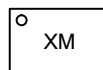


SIDE VIEW



BOTTOM VIEW

**GENERIC**  
**MARKING DIAGRAM\***

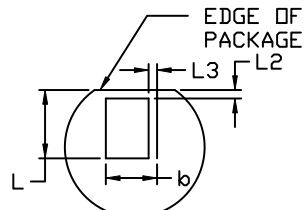


X = Specific Device Code  
M = Date Code

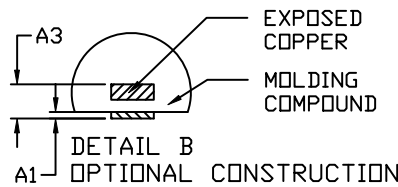
\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G", may or not be present. Some products may not follow the Generic Marking.

**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b AND b1 APPLIES TO THE PLATED TERMINALS AND IS MEASURED BETWEEN 0.20 AND 0.25 FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE PLATED TERMINALS.

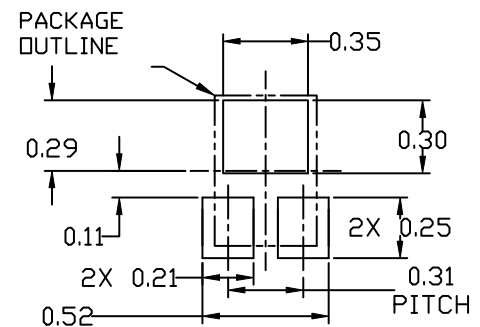


DETAIL A  
OPTIONAL  
CONSTRUCTION



DETAIL B  
OPTIONAL CONSTRUCTION

| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| A   | 0.33        | 0.38 | 0.43 |
| A1  | ---         | ---  | 0.07 |
| A3  | 0.13 REF    |      |      |
| b   | 0.05        | 0.11 | 0.17 |
| b1  | 0.20        | 0.25 | 0.30 |
| D   | 0.32        | 0.42 | 0.52 |
| E   | 0.52        | 0.62 | 0.72 |
| e   | 0.30 BSC    |      |      |
| e1  | 0.38 BSC    |      |      |
| L   | 0.09        | 0.15 | 0.21 |
| L1  | 0.15        | 0.20 | 0.25 |
| L2  | ---         | ---  | 0.03 |
| L3  | ---         | ---  | 0.03 |
| k   | 0.20 REF    |      |      |



RECOMMENDED  
MOUNTING FOOTPRINT

|                         |                              |                                                                                                                                                                                  |
|-------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| <b>DESCRIPTION:</b>     | <b>XDFN3 0.42x0.62, 0.3P</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                               |

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