

# MOSFET – Dual, P-Channel (-1.5 V), Specified, POWERTRENCH® -20 V, -0.83 A, 0.5 Ω FDY1002PZ

## General Description

These P-Channel Logic Level MOSFETs are produced using onsemi's advanced POWERTRENCH process that has been especially tailored to minimize the on-state resistance and yet maintain low gate charge for superior switching performance. These devices are well suited for all applications where small size is desirable but especially low cost DC/DC conversion in battery powered systems.

This Dual P-Channel MOSFET has been designed using onsemi's advanced Power Trench process to optimize the  $r_{DS(on)}$  @  $V_{GS} = -1.5$  V.

## Features

- Max  $r_{DS(on)} = 0.5 \Omega$  at  $V_{GS} = -4.5$  V,  $I_D = -0.83$  A
- Max  $r_{DS(on)} = 0.7 \Omega$  at  $V_{GS} = -2.5$  V,  $I_D = -0.70$  A
- Max  $r_{DS(on)} = 1.2 \Omega$  at  $V_{GS} = -1.8$  V,  $I_D = -0.43$  A
- Max  $r_{DS(on)} = 1.8 \Omega$  at  $V_{GS} = -1.5$  V,  $I_D = -0.36$  A
- HBM ESD Protection Level = 1400 V (Note 1)
- This Device is Pb-Free and is RoHS Compliant

## Application

- Li-Ion Battery Pack

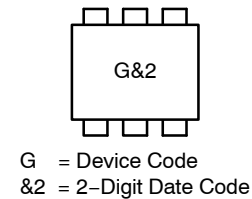
## NOTE:

1. The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

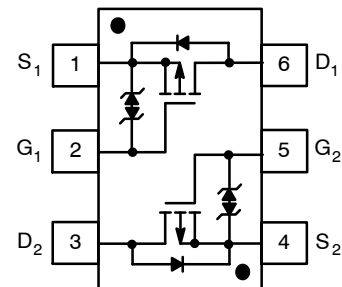
| $V_{DS}$ | $r_{DS(on)}$ MAX | $I_D$ MAX |
|----------|------------------|-----------|
| -20 V    | 0.5 Ω @ -4.5 V   | -0.83 A   |
|          | 0.7 Ω @ -2.5 V   |           |
|          | 1.2 Ω @ -1.8 V   |           |
|          | 1.8 Ω @ -1.5 V   |           |



## MARKING DIAGRAM



## PIN ASSIGNMENT



## ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

# FDY1002PZ

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

| Symbol         | Parameter                               |                        | Ratings     | Unit             |
|----------------|---|------------------------|-------------|------------------|
| $V_{DS}$       | Drain to Source Voltage                 |                        | -20         | V                |
| $V_{GS}$       | Gate to Source Voltage                  |                        | $\pm 8$     | V                |
| $I_D$          | Drain Current                           | - Continuous (Note 2a) | -0.83       | A                |
|                |   | - Pulsed               | -1.0        |                  |
| $P_D$          | Power Dissipation                       | (Note 2a)              | 0.625       | W                |
|                |   | (Note 2b)              | 0.446       |                  |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range |                        | -55 to +150 | $^\circ\text{C}$ |

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 CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| Symbol          | Parameter   | Ratings | Unit               |
|-----------------|---|---------|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 2a) | 200     | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case (Note 2b)    | 280     | $^\circ\text{C/W}$ |

2.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta JA}$  is determined by the user's board design.



a. 200°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



b. 280°C/W when mounted on a minimum pad of 2 oz copper.

# FDY1002PZ

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

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

### OFF CHARACTERISTICS

|                                      |   |   |     |     |     |       |
|--------------------------------------|---|---|-----|-----|-----|-------|
| BV <sub>DSS</sub>                    | Drain to Source Breakdown Voltage         | I <sub>D</sub> = -250 μA, V <sub>GS</sub> = 0 V | -20 | -   | -   | V     |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | I <sub>D</sub> = -250 μA, referenced to 25°C    | -   | -11 | -   | mV/°C |
| I <sub>DSS</sub>                     | Zero Gate Voltage Drain Current           | V <sub>DS</sub> = -16 V, V <sub>GS</sub> = 0 V  | -   | -   | -1  | μA    |
| I <sub>GSS</sub>                     | Gate to Source Leakage Current            | V <sub>GS</sub> = ±8 V, V <sub>DS</sub> = 0 V   | -   | -   | ±10 | μA    |

### ON CHARACTERISTICS (Note 3)

|  |  |  |      |      |      |       |
|--|--|--|------|------|------|-------|
| V <sub>GS(th)</sub>                    | Gate to Source Threshold Voltage                         | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = -250 μA               | -0.4 | -0.7 | -1.0 | V     |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | I <sub>D</sub> = -250 μA, referenced to 25°C                               | -    | 3    | -    | mV/°C |
| r <sub>DS(on)</sub>                    | Static Drain to Source On-Resistance                     | V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -0.83 A                         | -    | 0.28 | 0.5  | Ω     |
|  |  | V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -0.70 A                         | -    | 0.36 | 0.7  |       |
|  |  | V <sub>GS</sub> = -1.8 V, I <sub>D</sub> = -0.43 A                         | -    | 0.47 | 1.2  |       |
|  |  | V <sub>GS</sub> = -1.5 V, I <sub>D</sub> = -0.36 A                         | -    | 0.62 | 1.8  |       |
|  |  | V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -0.83 A, T <sub>J</sub> = 125°C | -    | 0.39 | 0.85 |       |
| g <sub>FS</sub>                        | Forward Transconductance                                 | V <sub>DD</sub> = -5 V, I <sub>D</sub> = -0.83 A                           | -    | 2    | -    | S     |

### DYNAMIC CHARACTERISTICS

|                  |                              |   |   |     |     |    |
|------------------|------------------------------|---|---|-----|-----|----|
| C <sub>iss</sub> | Input Capacitance            | V <sub>DS</sub> = -10 V, V <sub>GS</sub> = 0 V, f = 1 MHz | - | 100 | 135 | pF |
| C <sub>oss</sub> | Output Capacitance           |   | - | 23  | 35  | pF |
| C <sub>rss</sub> | Reverse Transfer Capacitance |   | - | 18  | 30  | pF |

### SWITCHING CHARACTERISTICS (Note 3)

|                     |                               |   |   |     |     |    |
|---------------------|-------------------------------|---|---|-----|-----|----|
| t <sub>d(on)</sub>  | Turn-On Delay Time            | V <sub>DD</sub> = -10 V, I <sub>D</sub> = -0.83 A, V <sub>GS</sub> = -4.5 V, R <sub>GEN</sub> = 6 Ω | - | 3.5 | 10  | ns |
| t <sub>r</sub>      | Rise Time                     |   | - | 2.9 | 10  | ns |
| t <sub>d(off)</sub> | Turn-Off Delay Time           |   | - | 23  | 37  | ns |
| t <sub>f</sub>      | Fall Time                     |   | - | 13  | 23  | ns |
| Q <sub>g</sub>      | Total Gate Charge             | V <sub>DD</sub> = -10 V, I <sub>D</sub> = -0.83 A, V <sub>GS</sub> = -4.5 V                         | - | 2.2 | 3.1 | nC |
| Q <sub>gs</sub>     | Gate to Source Charge         |   | - | 0.3 | -   | nC |
| Q <sub>gd</sub>     | Gate to Drain "Miller" Charge |   | - | 0.6 | -   | nC |

### DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATING

|                 |   |  |   |      |       |    |
|-----------------|---|--|---|------|-------|----|
| I <sub>S</sub>  | Maximum Continuous Drain–Source Diode Forward Current |  | – | –    | –0.52 | A  |
| V <sub>SD</sub> | Source to Drain Diode Forward Voltage                 | V <sub>GS</sub> = 0 V, I <sub>S</sub> = –0.52 A (Note 3) | – | –1.0 | –1.2  | V  |
| t <sub>rr</sub> | Reverse Recovery Time                                 | I <sub>F</sub> = –0.83 A, dI <sub>F</sub> /dt = 100 A/μs | – | 18   | 31    | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge                               |  | – | 3.8  | 10    | 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.

3. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%.

## TYPICAL ELECTRICAL CHARACTERISTICS

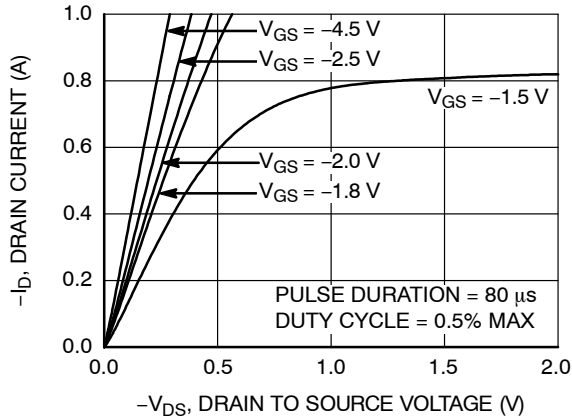
(T<sub>J</sub> = 25°C unless otherwise noted)

Figure 1. On Region Characteristics

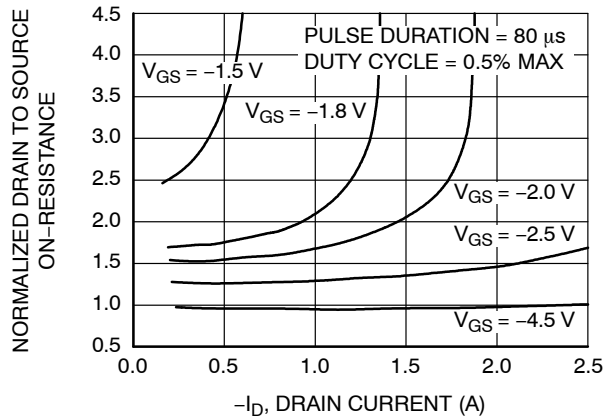


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

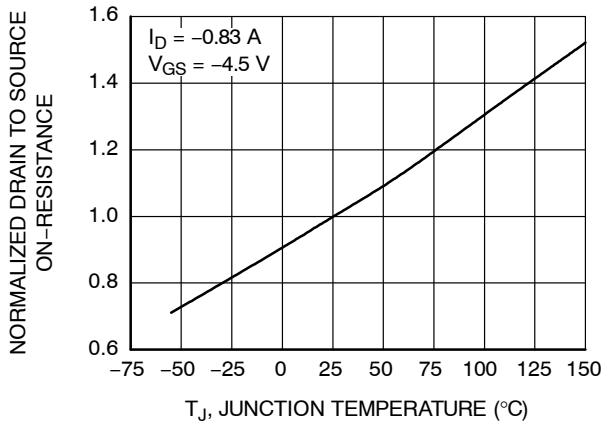


Figure 3. Normalized On Resistance vs. Junction Temperature

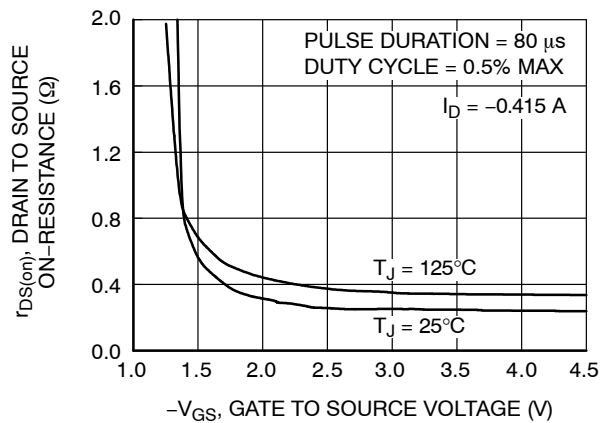


Figure 4. On-Resistance vs. Gate to Source Voltage

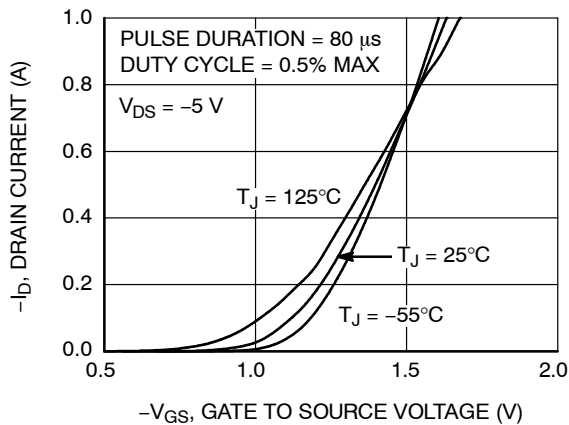


Figure 5. Transfer Characteristics

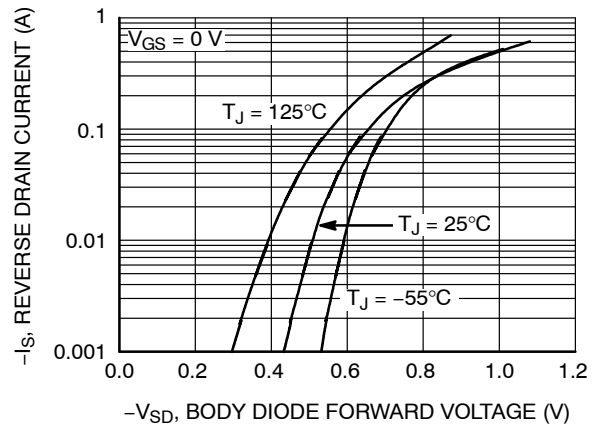


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

## TYPICAL ELECTRICAL CHARACTERISTICS

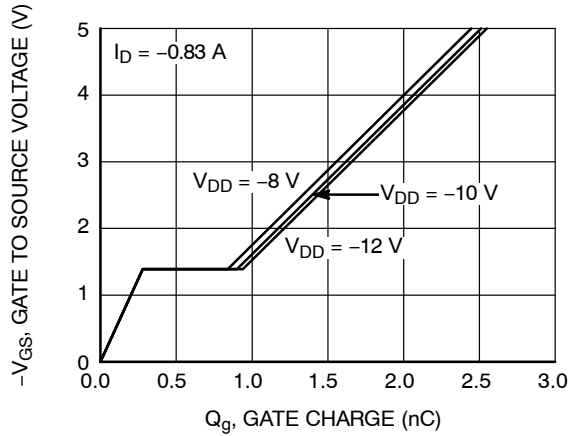
(T<sub>J</sub> = 25°C unless otherwise noted) (continued)

Figure 7. Gate Charge Characteristics

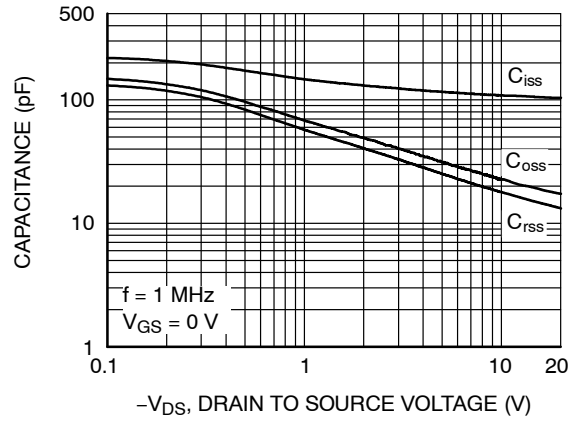


Figure 8. Capacitance vs. Drain to Source Voltage

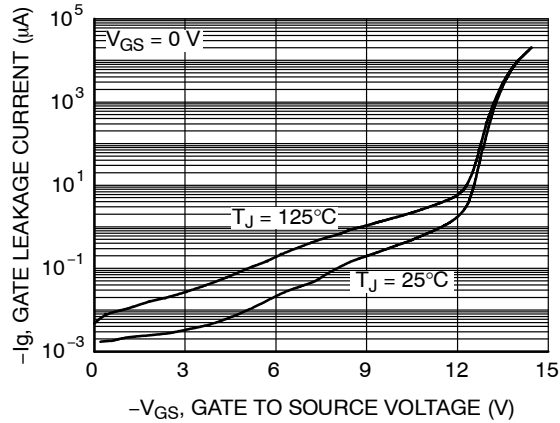


Figure 9. Gate Leakage Current vs. Gate to Source Voltage

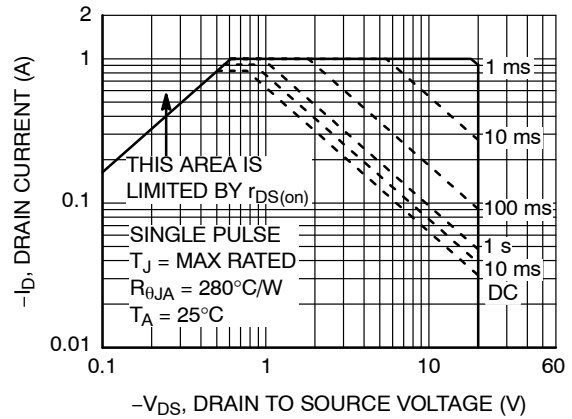


Figure 10. Forward Bias Safe Operating Area

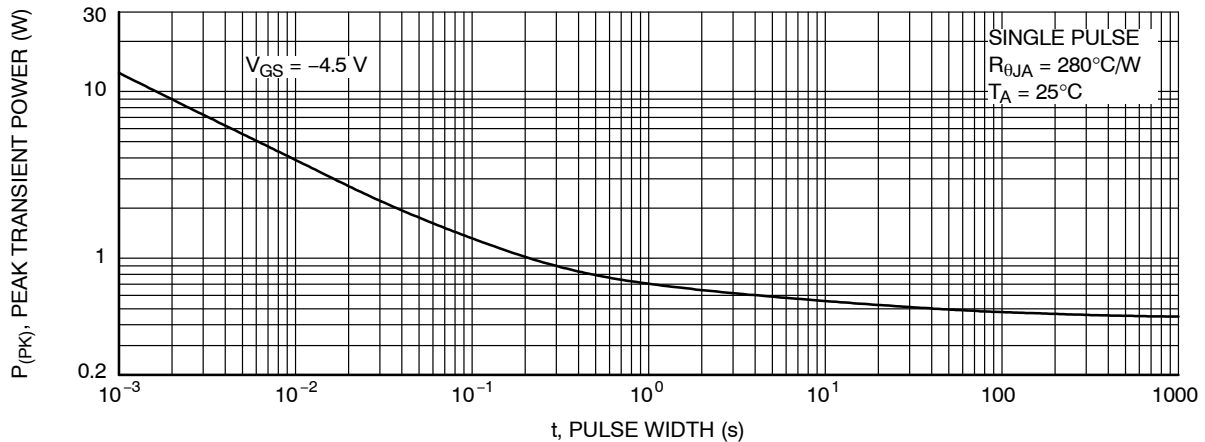


Figure 11. Single Pulse Maximum Power Dissipation

## TYPICAL ELECTRICAL CHARACTERISTICS

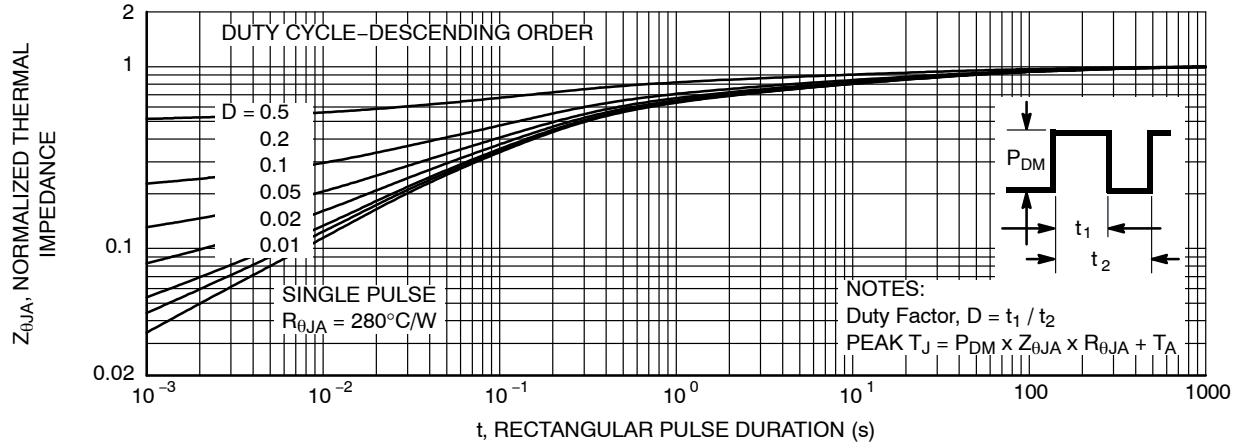
(T<sub>J</sub> = 25°C unless otherwise noted) (continued)

Figure 12. Junction-to-Ambient Transient Thermal Response Curve

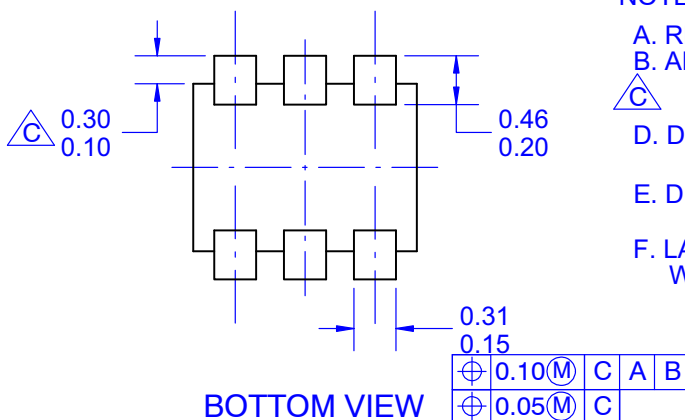
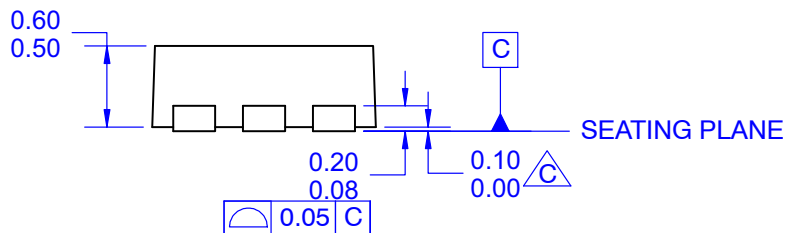
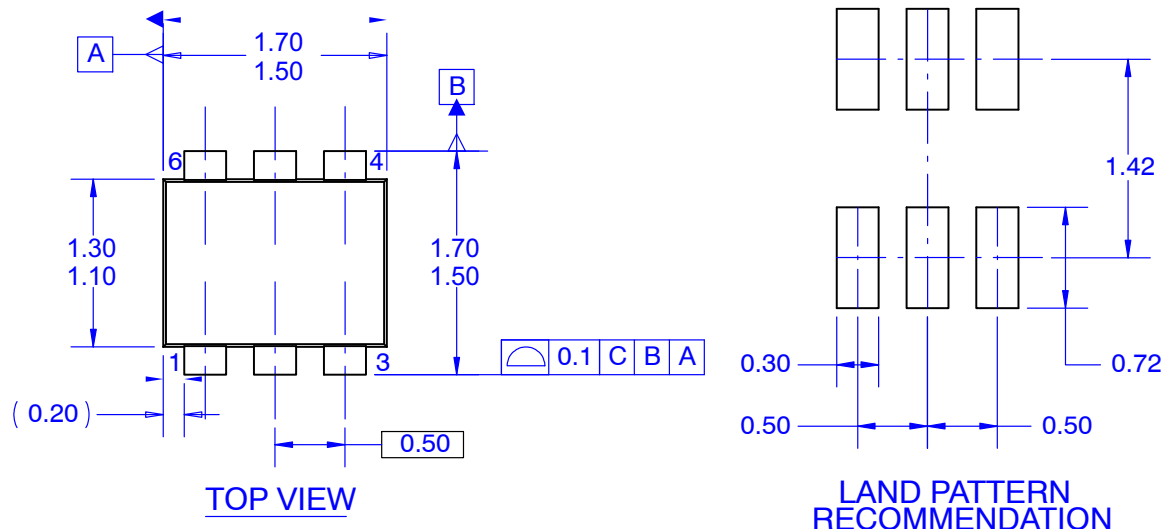
## PACKAGE MARKING AND ORDERING INFORMATION

| Device    | Device Marking | Package              | Reel Size | Tape Width | Shipping <sup>†</sup> |
|-----------|----------------|----------------------|-----------|------------|-----------------------|
| FDY1002PZ | G              | SOT-563<br>(Pb-Free) | 7"        | 8 mm       | 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.

**SOT-563**  
**CASE 419BH**  
**ISSUE O**

DATE 31 AUG 2016



NOTES: UNLESS OTHERWISE SPECIFIED.

A. REFERENCE TO JEDEC MO293.

B. ALL DIMENSIONS ARE IN MILLIMETERS.

△ DOES NOT COMPLY JEDEC STANDARD VALUE.

D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSION.

E. DIMENSION AND TOLERANCE AS PER ASME Y14.5-2009.

F. LAND PATTERN RECOMMENDATION GENERATED WITH IPC LANDPATTERN GENERATOR

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