

# MOSFET – P-Channel, POWER TRENCH®

**-40 V, -50 A, 12.3 mΩ**

## FDD4141

### General Description

This P-Channel MOSFET has been produced using onsemi's proprietary POWER TRENCH technology to deliver low  $R_{DS(on)}$  and optimized  $BV_{DSS}$  capability to offer superior performance benefit in the applications and optimized switching performance capability reducing power dissipation losses in converter/inverter applications.

### Features

- Max  $R_{DS(on)}$  = 12.3 mΩ at  $V_{GS} = -10$  V,  $I_D = -12.7$  A
- Max  $R_{DS(on)}$  = 18.0 mΩ at  $V_{GS} = -4.5$  V,  $I_D = -10.4$  A
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- This Device is Pb-Free and is RoHS Compliant

### Applications

- Inverter
- Power Supplies

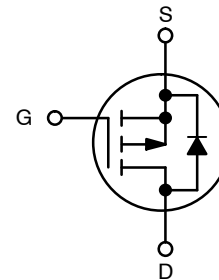
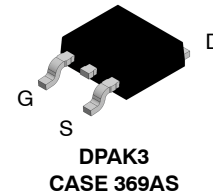
### MOSFET MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

| Symbol         | Parameter                                                                                                                                                                                      | Ratings                     | Unit             |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------|
| $V_{DS}$       | Drain to Source Voltage                                                                                                                                                                        | -40                         | V                |
| $V_{GS}$       | Gate to Source Voltage                                                                                                                                                                         | ±20                         | V                |
| $I_D$          | Drain Current<br>–Continuous (Package limited) $T_C = 25^\circ\text{C}$<br>–Continuous (Silicon limited) $T_C = 25^\circ\text{C}$<br>–Continuous $T_A = 25^\circ\text{C}$ (Note 1a)<br>–Pulsed | -50<br>-58<br>-10.8<br>-100 | A                |
| $E_{AS}$       | Single Pulse Avalanche Energy (Note 3)                                                                                                                                                         | 337                         | mJ               |
| $P_D$          | Power Dissipation<br>– $T_C = 25^\circ\text{C}$<br>– $T_A = 25^\circ\text{C}$ (Note 1a)                                                                                                        | 69<br>2.4                   | W                |
| $T_J, T_{STG}$ | Operating and Storage Junction 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.

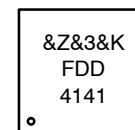
### THERMAL CHARACTERISTICS

| Symbol          | Parameter                                                 | Ratings | Unit                      |
|-----------------|-----------------------------------------------------------|---------|---------------------------|
| $R_{\theta JC}$ | Maximum Thermal Resistance, Junction to Case              | 1.8     | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Maximum Thermal Resistance, Junction to Ambient (Note 1a) | 52      |                           |



P-Channel MOSFET

### MARKING DIAGRAM



&Z = Assembly Plant Code  
&3 = Date Code (Year & Week)  
&K = 2 Digit Lot Run Traceability Code  
FDD4141 = Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

# FDD4141

## 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 | -40 | -   | -    | V     |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | I <sub>D</sub> = -250 μA, referenced to 25°C    | -   | -29 | -    | mV/°C |
| I <sub>DSS</sub>                     | Zero Gate Voltage Drain Current           | V <sub>DS</sub> = -32 V, V <sub>GS</sub> = 0 V  | -   | -   | -1   | μA    |
| I <sub>GSS</sub>                     | Gate to Source Leakage Current            | V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V  | -   | -   | ±100 | nA    |

### ON CHARACTERISTICS

|                                        |                                                          |                                                                           |    |      |      |       |
|----------------------------------------|----------------------------------------------------------|---------------------------------------------------------------------------|----|------|------|-------|
| V <sub>GS(th)</sub>                    | Gate to Source Threshold Voltage                         | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = -250 μA              | -1 | -1.8 | -3   | 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                              | -  | 5.8  | -    | mV/°C |
| R <sub>DS(on)</sub>                    | Static Drain to Source On Resistance                     | V <sub>GS</sub> = -10 V, I <sub>D</sub> = -12.7 A                         | -  | 10.1 | 12.3 | mΩ    |
|                                        |                                                          | V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -10.4 A                        | -  | 14.5 | 18.0 |       |
|                                        |                                                          | V <sub>GS</sub> = -10 V, I <sub>D</sub> = -12.7 A, T <sub>J</sub> = 125°C | -  | 15.3 | 18.7 |       |
| g <sub>FS</sub>                        | Forward Transconductance                                 | V <sub>DS</sub> = -5 V, I <sub>D</sub> = -12.7 A                          | -  | 38   | -    | S     |

### DYNAMIC CHARACTERISTICS

|                  |                              |                                                           |   |      |      |    |
|------------------|------------------------------|-----------------------------------------------------------|---|------|------|----|
| C <sub>iss</sub> | Input Capacitance            | V <sub>DS</sub> = -20 V, V <sub>GS</sub> = 0 V, f = 1 MHz | - | 2085 | 2775 | pF |
| C <sub>oss</sub> | Output Capacitance           |                                                           | - | 360  | 480  | pF |
| C <sub>rss</sub> | Reverse Transfer Capacitance |                                                           | - | 210  | 310  | pF |
| R <sub>g</sub>   | Gate Resistance              | f = 1 MHz                                                 | - | 4.6  | -    | Ω  |

### SWITCHING CHARACTERISTICS

|                     |                               |                                                                                                    |   |    |    |    |
|---------------------|-------------------------------|----------------------------------------------------------------------------------------------------|---|----|----|----|
| t <sub>d(on)</sub>  | Turn-On Delay Time            | V <sub>DD</sub> = -20 V, I <sub>D</sub> = -12.7 A, V <sub>GS</sub> = -10 V, R <sub>GEN</sub> = 6 Ω | - | 10 | 19 | ns |
| t <sub>r</sub>      | Rise Time                     |                                                                                                    | - | 7  | 13 | ns |
| t <sub>d(off)</sub> | Turn-Off Delay Time           |                                                                                                    | - | 38 | 60 | ns |
| t <sub>f</sub>      | Fall Time                     |                                                                                                    | - | 15 | 27 | ns |
| Q <sub>g</sub>      | Total Gate Charge             | V <sub>GS</sub> = 0 V to -10 V<br>V <sub>DD</sub> = -20 V, I <sub>D</sub> = -12.7 A                | - | 36 | 50 | nC |
|                     |                               | V <sub>GS</sub> = 0 V to -5 V<br>V <sub>DD</sub> = -20 V, I <sub>D</sub> = -12.7 A                 | - | 19 | 27 | nC |
| Q <sub>gs</sub>     | Gate to Source Charge         | V <sub>DD</sub> = -20 V, I <sub>D</sub> = -12.7 A                                                  | - | 7  | -  | nC |
| Q <sub>gd</sub>     | Gate to Drain "Miller" Charge | V <sub>DD</sub> = -20 V, I <sub>D</sub> = -12.7 A                                                  | - | 8  | -  | nC |

### DRAIN-SOURCE DIODE CHARACTERISTICS

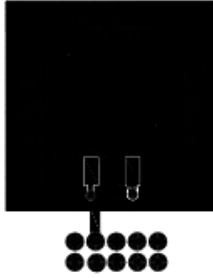
|                 |                                       |                                                          |   |      |      |    |
|-----------------|---------------------------------------|----------------------------------------------------------|---|------|------|----|
| V <sub>SD</sub> | Source to Drain Diode Forward Voltage | V <sub>GS</sub> = 0 V, I <sub>S</sub> = -12.7 A (Note 2) | - | -0.8 | -1.2 | V  |
| t <sub>rr</sub> | Reverse Recovery Time                 | I <sub>F</sub> = -12.7 A, di/dt = 100 A/μs               | - | 29   | 44   | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge               |                                                          | - | 26   | 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.

# FDD4141

## NOTES:

1.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta JA}$  is determined by the user's board design.



a) 52°C/W when mounted on a 1 in² pad of 2 oz copper.



b) 100°C/W when mounted on a minimum pad.

2. Pulse Test: Pulse Width < 300  $\mu$ s, Duty cycle < 2.0%.
3. Starting  $T_J$  = 25°C, L = 3 mH,  $I_{AS}$  = 15 A,  $V_{DD}$  = 40 V,  $V_{GS}$  = 10 V.

## PACKAGE MARKING AND ORDERING INFORMATION

| Device Marking | Device  | Package | Reel Size <sup>†</sup> | Tape Width | Quantity   |
|----------------|---------|---------|------------------------|------------|------------|
| FDD4141        | FDD4141 | DPAK3   | 13"                    | 16 mm      | 2500 Units |

<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.

## TYPICAL CHARACTERISTICS

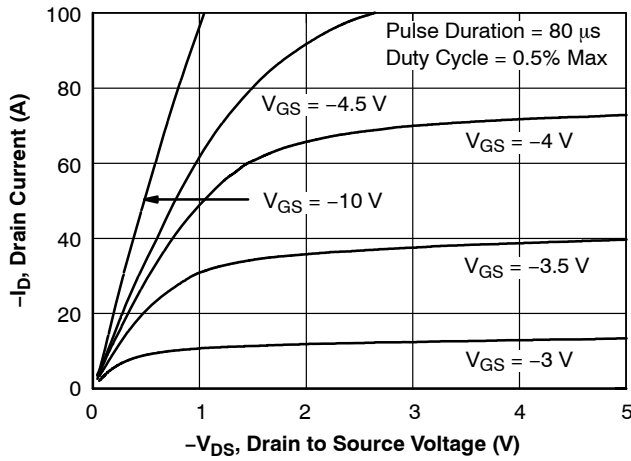
(T<sub>J</sub> = 25°C unless otherwise noted)

Figure 1. On-Region Characteristics

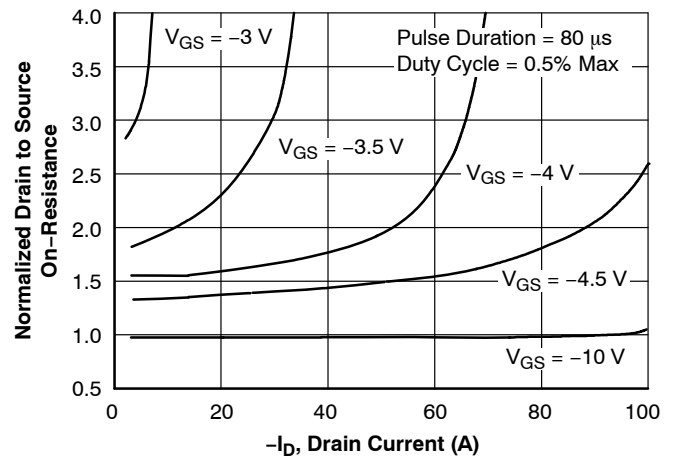


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

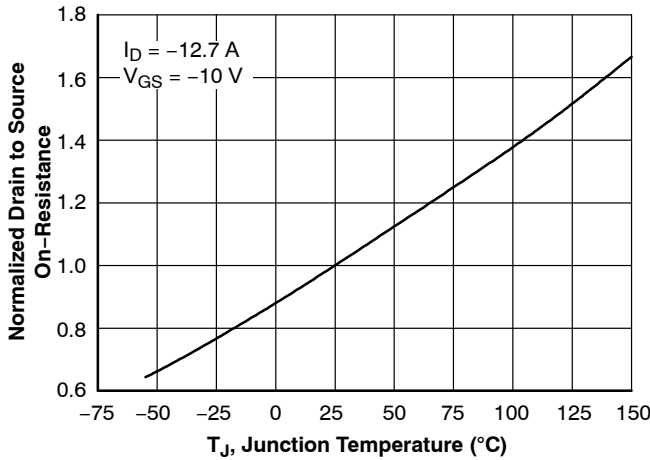


Figure 3. Normalized On-Resistance vs Junction Temperature

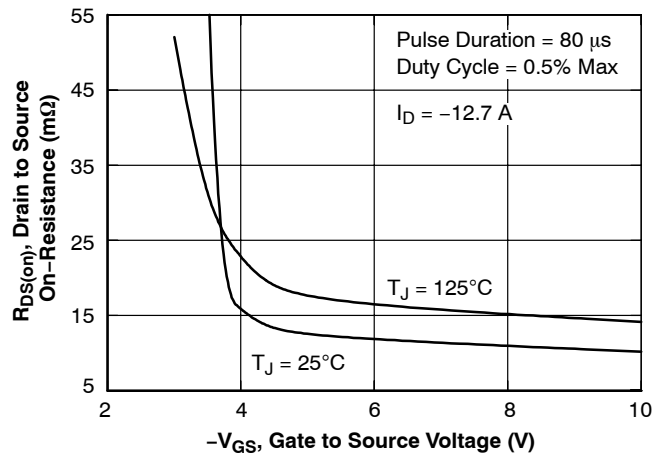


Figure 4. On-Resistance vs Gate to Source Voltage

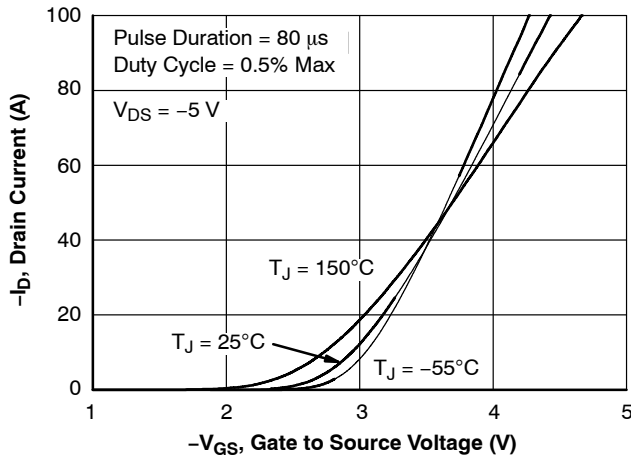


Figure 5. Transfer Characteristics

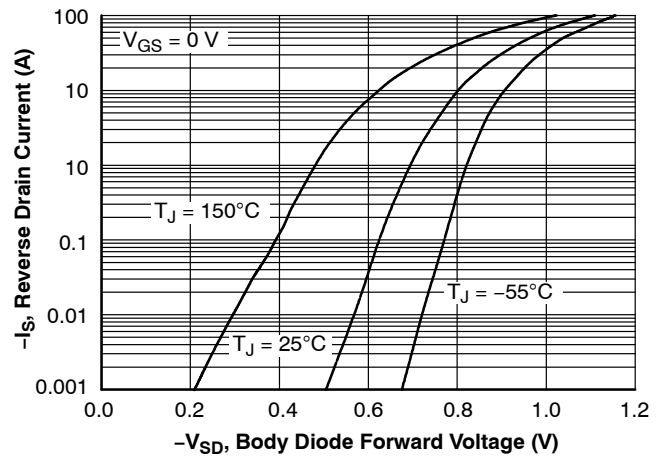


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

TYPICAL CHARACTERISTICS (continued)

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

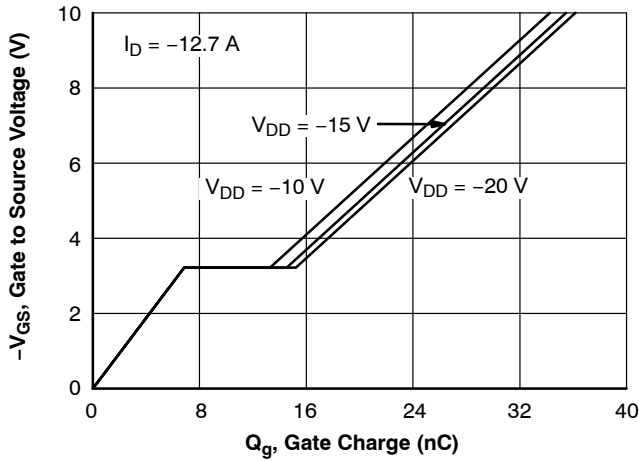


Figure 7. Gate Charge Characteristics

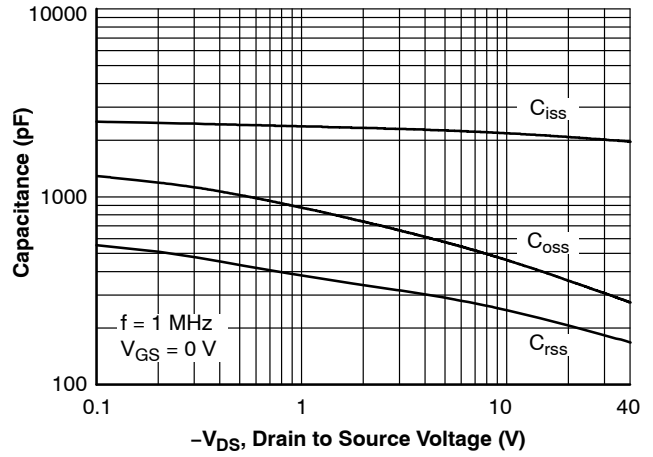


Figure 8. Capacitance vs Drain to Source Voltage

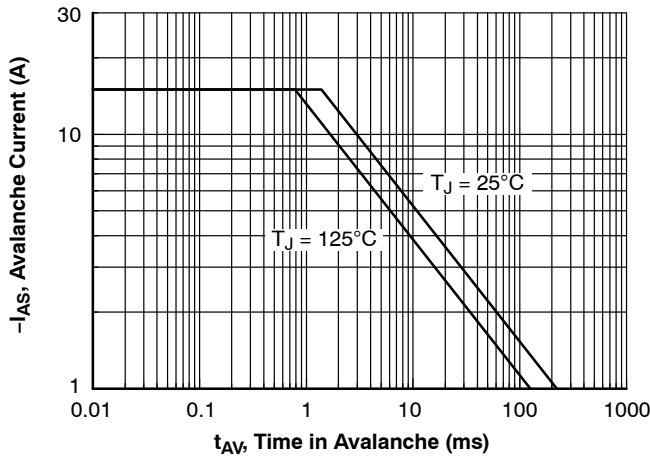


Figure 9. Unclamped Inductive Switching Capability

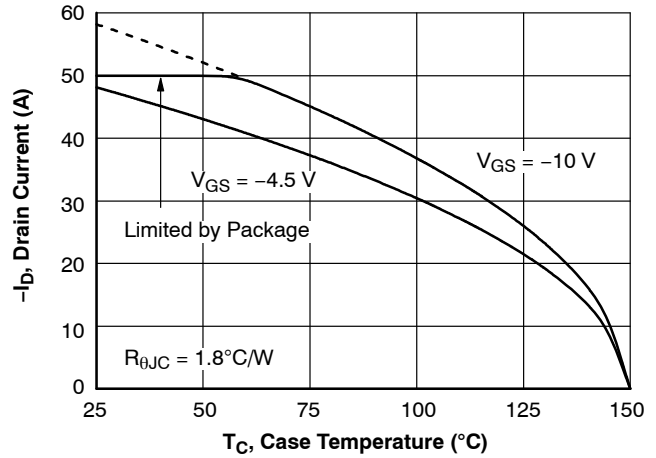


Figure 10. Maximum Continuous Drain Current vs Case Temperature

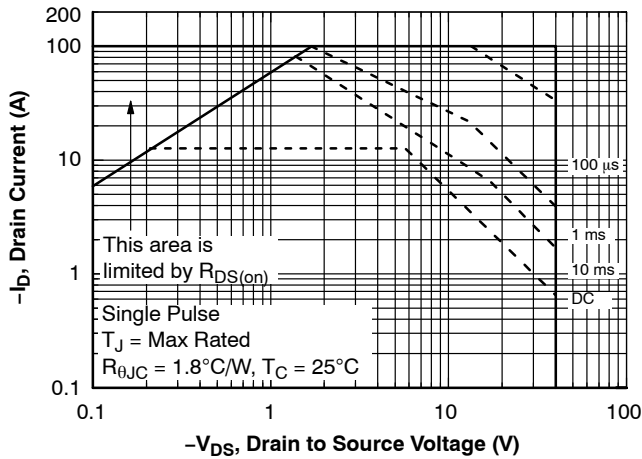


Figure 11. Forward Bias Safe Operating Area

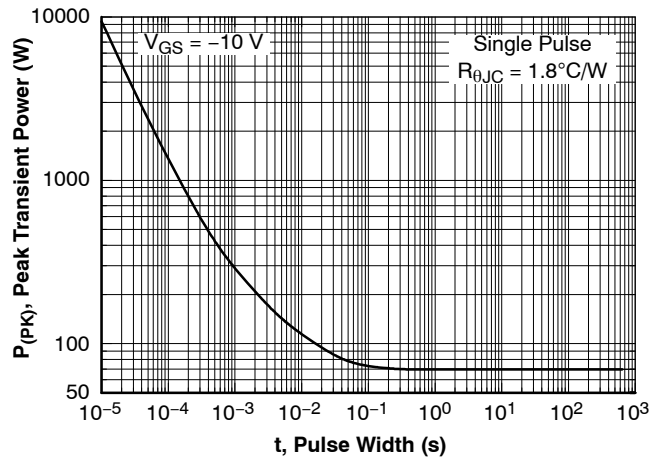


Figure 12. Single Pulse Maximum Power Dissipation

## TYPICAL CHARACTERISTICS

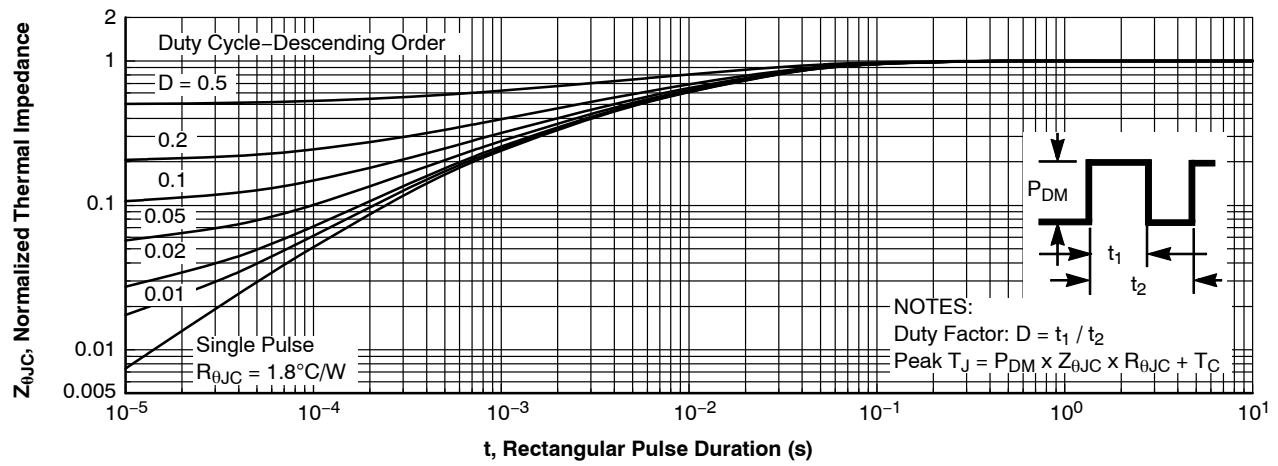
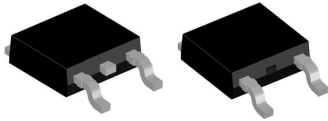
(T<sub>J</sub> = 25°C unless otherwise noted)

Figure 13. Transient Thermal Response Curve


**DPAK3 6.10x6.54x2.29, 4.57P**  
**CASE 369AS**  
**ISSUE B**

DATE 20 DEC 2023



NON-DIODE PRODUCTS VERSION



NON-DIODE PRODUCTS VERSION



NOTES: UNLESS OTHERWISE SPECIFIED

A) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE F, VARIATION AA.

B) ALL DIMENSIONS ARE IN MILLIMETERS.

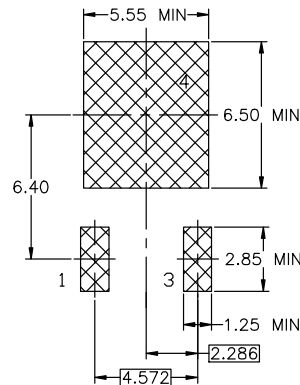
C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2018.

D) SUPPLIER DEPENDENT MOLD LOCKING HOLES OR CHAMFERED CORNERS OR EDGE PROTRUSION.

E) FOR DIODE PRODUCTS, L4 IS 0.25 MM MAX PLASTIC BODY STUB WITHOUT CENTER LEAD.

F) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.

G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TD228P991X239-3N.


**LAND PATTERN RECOMMENDATION**

\*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERM/D.

| DIM | MILLIMETERS |      |       |
|-----|-------------|------|-------|
|     | MIN.        | NDM. | MAX.  |
| A   | 2.18        | 2.29 | 2.39  |
| A1  | 0.00        | -    | 0.127 |
| b   | 0.64        | 0.77 | 0.89  |
| b2  | 0.76        | 0.95 | 1.14  |
| b3  | 5.21        | 5.34 | 5.46  |
| c   | 0.45        | 0.53 | 0.61  |
| c2  | 0.45        | 0.52 | 0.58  |
| D   | 5.97        | 6.10 | 6.22  |
| D1  | 5.21        | ---  | ---   |
| E   | 6.35        | 6.54 | 6.73  |
| E1  | 4.32        | ---  | ---   |
| e   | 2.286 BSC   |      |       |
| e1  | 4.572 BSC   |      |       |
| H   | 9.40        | 9.91 | 10.41 |
| L   | 1.40        | 1.59 | 1.78  |
| L1  | 2.90 REF    |      |       |
| L2  | 0.51 BSC    |      |       |
| L3  | 0.89        | 1.08 | 1.27  |
| L4  | ---         | ---  | 1.02  |
| θ   | 0°          | ---  | 10°   |

**GENERIC MARKING DIAGRAM\***

XXXXXX  
XXXXXX  
AYWWZZ  
•

\*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.

XXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
ZZ = Assembly Lot Code

|                         |                                    |                                                                                                                                                                                  |
|-------------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| <b>DESCRIPTION:</b>     | <b>DPAK3 6.10x6.54x2.29, 4.57P</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                               |

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