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# FDB12N50F

## N-Channel UniFET™ FRFET® MOSFET

500 V, 11.5 A, 700 mΩ

### Features

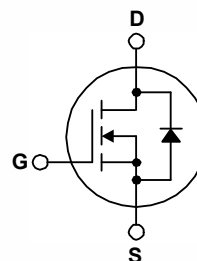
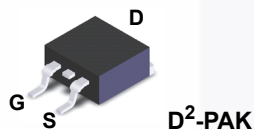
- $R_{DS(on)} = 590 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 6 \text{ A}$
- Low Gate Charge (Typ. 21 nC)
- Low  $C_{rss}$  (Typ. 11 pF)
- 100% Avalanche Tested
- Improve dv/dt Capability
- RoHS Compliant

### Applications

- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

### Description

UniFET™ MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. The body diode's reverse recovery performance of UniFET FRFET® MOSFET has been enhanced by lifetime control. Its  $t_{rr}$  is less than 100nsec and the reverse dv/dt immunity is 15V/ns while normal planar MOSFETs have over 200nsec and 4.5V/nsec respectively. Therefore, it can remove additional component and improve system reliability in certain applications in which the performance of MOSFET's body diode is significant. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.



### MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

| Symbol                            | Parameter                                                                    |                                       | FDB12N50FTM_WS | Unit |
|-----------------------------------|------------------------------------------------------------------------------|---------------------------------------|----------------|------|
| V <sub>DSS</sub>                  | Drain to Source Voltage                                                      |                                       | 500            | V    |
| V <sub>GSS</sub>                  | Gate to Source Voltage                                                       |                                       | ±30            | V    |
| I <sub>D</sub>                    | Drain Current                                                                | - Continuous (T <sub>C</sub> = 25°C)  | 11.5           | A    |
|                                   |                                                                              | - Continuous (T <sub>C</sub> = 100°C) | 6.9            |      |
| I <sub>DM</sub>                   | Drain Current                                                                | - Pulsed (Note 1)                     | 46             | A    |
| E <sub>AS</sub>                   | Single Pulsed Avalanche Energy (Note 2)                                      |                                       | 456            | mJ   |
| I <sub>AR</sub>                   | Avalanche Current (Note 1)                                                   |                                       | 11.5           | A    |
| E <sub>AR</sub>                   | Repetitive Avalanche Energy (Note 1)                                         |                                       | 16.5           | mJ   |
| dv/dt                             | Peak Diode Recovery dv/dt (Note 3)                                           |                                       | 20             | V/ns |
| P <sub>D</sub>                    | Power Dissipation                                                            | (T <sub>C</sub> = 25°C)               | 165            | W    |
|                                   |                                                                              | - Derate above 25°C                   | 1.33           | W/°C |
| T <sub>J</sub> , T <sub>STG</sub> | Operating and Storage Temperature Range                                      |                                       | -55 to +150    | °C   |
| T <sub>L</sub>                    | Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds |                                       | 300            | °C   |

### Thermal Characteristics

| Symbol          | Parameter                                                                            | FQB12N50FTM_WS | Unit               |
|-----------------|--------------------------------------------------------------------------------------|----------------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max                                            | 0.75           | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (minimum pad of 2 oz copper), Max.           | 62.5           |                    |
|                 | Thermal Resistance, Junction to Ambient (1 in <sup>2</sup> pad of 2 oz copper), Max. | 40             |                    |

## Package Marking and Ordering Information

| Device Marking | Device         | Package | Reel Size | Tape Width | Quantity  |
|----------------|----------------|---------|-----------|------------|-----------|
| FDB12N50F      | FDB12N50FTM_WS | D2-PAK  | 330mm     | 24mm       | 800 units |

## Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted.

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

### Off Characteristics

|                                |                                           |                                                                          |     |     |           |                    |
|--------------------------------|-------------------------------------------|--------------------------------------------------------------------------|-----|-----|-----------|--------------------|
| $BV_{DSS}$                     | Drain to Source Breakdown Voltage         | $I_D = 250\mu\text{A}$ , $V_{GS} = 0\text{V}$ , $T_J = 25^\circ\text{C}$ | 500 | -   | -         | V                  |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$                | -   | 0.5 | -         | $V/^\circ\text{C}$ |
| $I_{DSS}$                      | Zero Gate Voltage Drain Current           | $V_{DS} = 500\text{V}$ , $V_{GS} = 0\text{V}$                            | -   | -   | 10        | $\mu\text{A}$      |
|                                |                                           | $V_{DS} = 400\text{V}$ , $T_C = 125^\circ\text{C}$                       | -   | -   | 100       |                    |
| $I_{GSS}$                      | Gate to Body Leakage Current              | $V_{GS} = \pm 30\text{V}$ , $V_{DS} = 0\text{V}$                         | -   | -   | $\pm 100$ | nA                 |

### On Characteristics

|              |                                      |                                            |     |      |     |          |
|--------------|--------------------------------------|--------------------------------------------|-----|------|-----|----------|
| $V_{GS(th)}$ | Gate Threshold Voltage               | $V_{GS} = V_{DS}$ , $I_D = 250\mu\text{A}$ | 3.0 | -    | 5.0 | V        |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10\text{V}$ , $I_D = 6\text{A}$  | -   | 0.59 | 0.7 | $\Omega$ |
| $g_{FS}$     | Forward Transconductance             | $V_{DS} = 40\text{V}$ , $I_D = 6\text{A}$  | -   | 12   | -   | S        |

### Dynamic Characteristics

|              |                               |                                                                                    |   |      |      |    |
|--------------|-------------------------------|------------------------------------------------------------------------------------|---|------|------|----|
| $C_{iss}$    | Input Capacitance             | $V_{DS} = 25\text{V}$ , $V_{GS} = 0\text{V}$<br>$f = 1\text{MHz}$                  | - | 1050 | 1395 | pF |
| $C_{oss}$    | Output Capacitance            |                                                                                    | - | 135  | 180  | pF |
| $C_{rss}$    | Reverse Transfer Capacitance  |                                                                                    | - | 11   | 17   | pF |
| $Q_{g(tot)}$ | Total Gate Charge at 10V      | $V_{DS} = 400\text{V}$ , $I_D = 11.5\text{A}$<br>$V_{GS} = 10\text{V}$<br>(Note 4) | - | 21   | 30   | nC |
| $Q_{gs}$     | Gate to Source Gate Charge    |                                                                                    | - | 6    | -    | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |                                                                                    | - | 9    | -    | nC |

### Switching Characteristics

|              |                     |                                                                               |   |    |     |    |
|--------------|---------------------|-------------------------------------------------------------------------------|---|----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = 250\text{V}$ , $I_D = 11.5\text{A}$<br>$R_G = 25\Omega$<br>(Note 4) | - | 21 | 50  | ns |
| $t_r$        | Turn-On Rise Time   |                                                                               | - | 45 | 100 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |                                                                               | - | 50 | 110 | ns |
| $t_f$        | Turn-Off Fall Time  |                                                                               | - | 35 | 80  | ns |

### Drain-Source Diode Characteristics

|                 |                                                          |                                               |   |      |     |    |
|-----------------|----------------------------------------------------------|-----------------------------------------------|---|------|-----|----|
| I <sub>S</sub>  | Maximum Continuous Drain to Source Diode Forward Current | -                                             | - | 11.5 | A   |    |
| I <sub>SM</sub> | Maximum Pulsed Drain to Source Diode Forward Current     | -                                             | - | 46   | A   |    |
| V <sub>SD</sub> | Drain to Source Diode Forward Voltage                    | V <sub>GS</sub> = 0V, I <sub>SD</sub> = 11.5A | - | -    | 1.5 | V  |
| t <sub>rr</sub> | Reverse Recovery Time                                    | V <sub>GS</sub> = 0V, I <sub>SD</sub> = 11.5A | - | 134  | -   | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge                                  | di <sub>F</sub> /dt = 100A/μs                 | - | 0.37 | -   | μC |

#### Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $L = 6.9\text{mH}$ ,  $I_{AS} = 11.5\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 11.5\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Characteristics

Figure 1. On-Region Characteristics

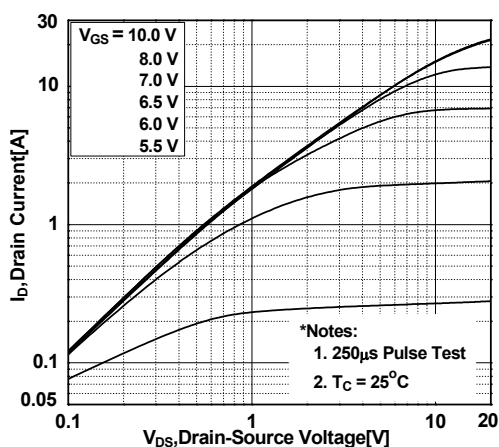


Figure 2. Transfer Characteristics

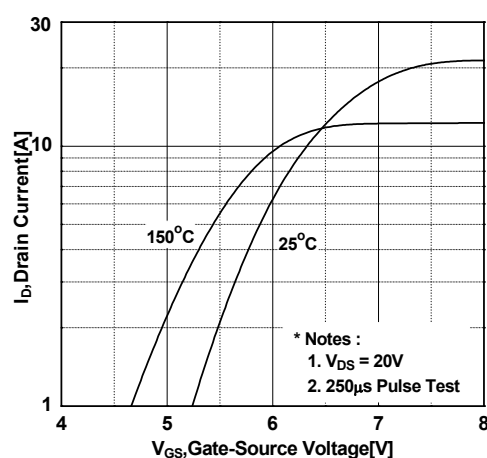


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

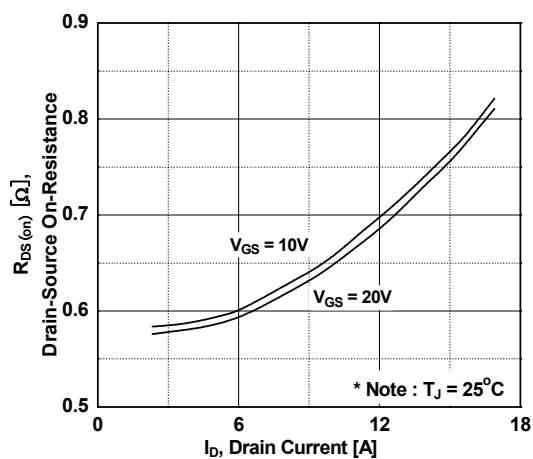


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

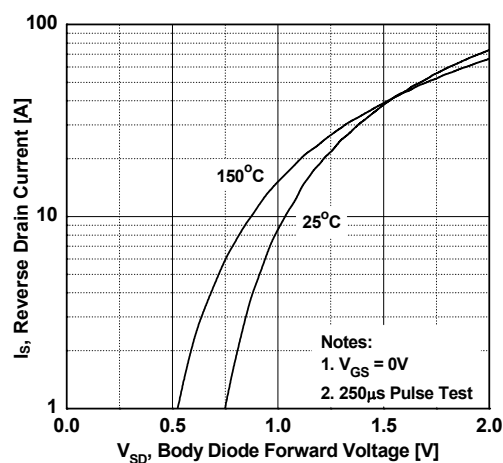


Figure 5. Capacitance Characteristics

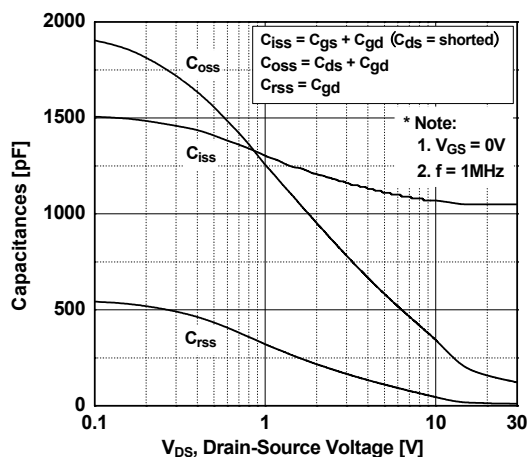
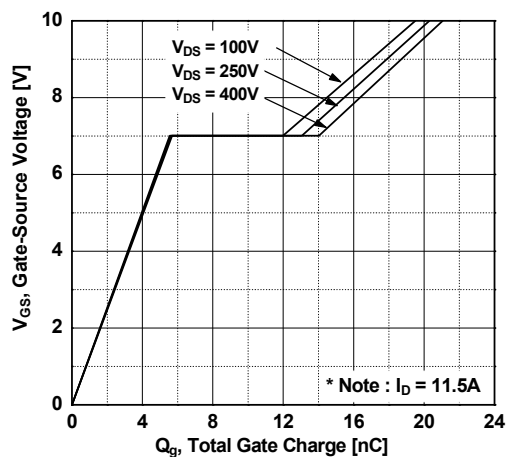
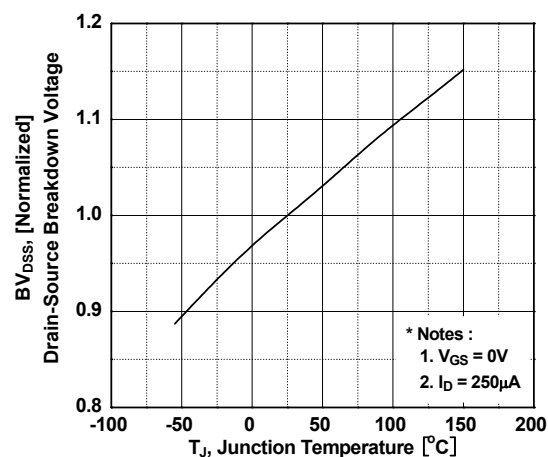


Figure 6. Gate Charge Characteristics

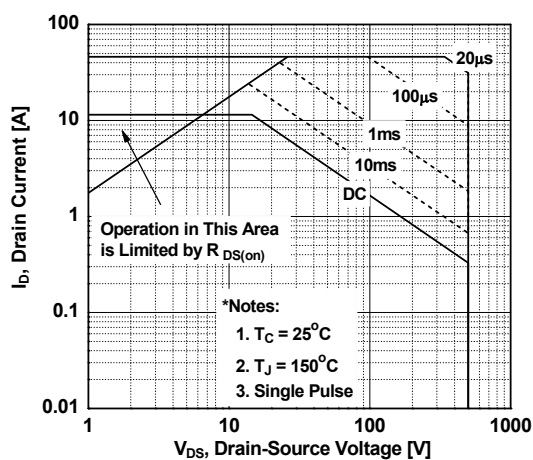


## Typical Characteristics (Continued)

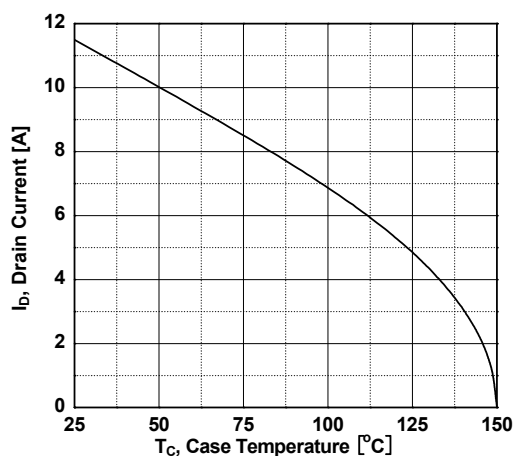
**Figure 7. Breakdown Voltage Variation vs. Temperature**



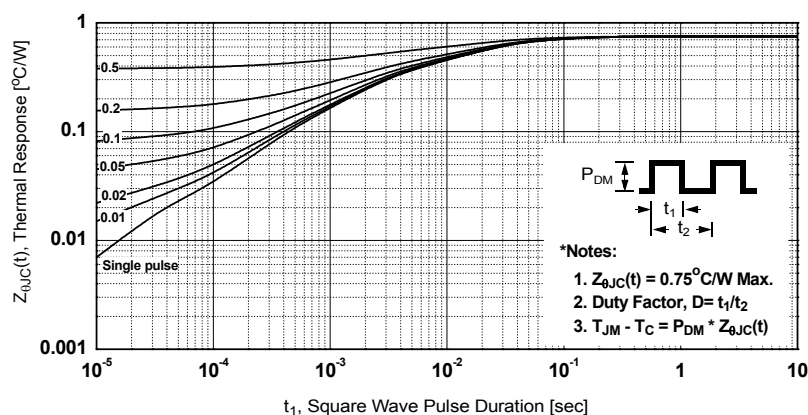
**Figure 8. Maximum Safe Operating Area**



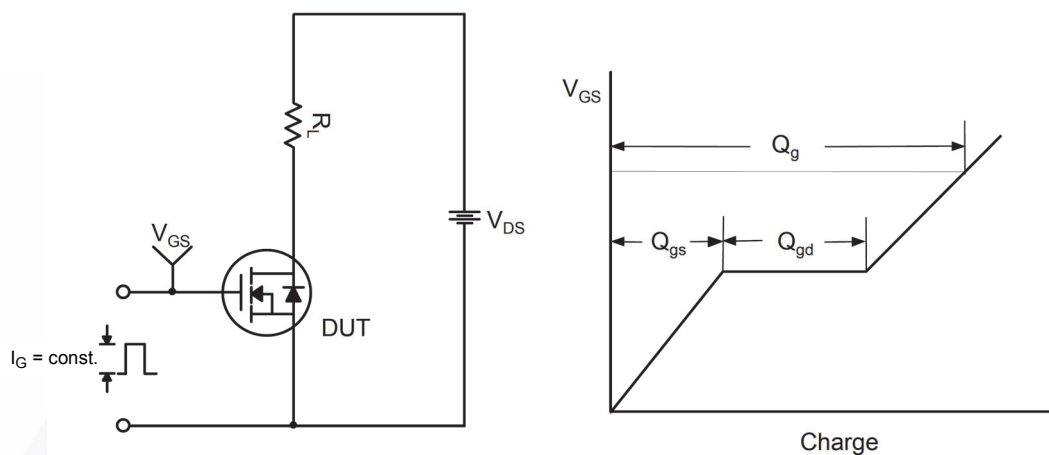
**Figure 9. Maximum Drain Current vs. Case Temperature**



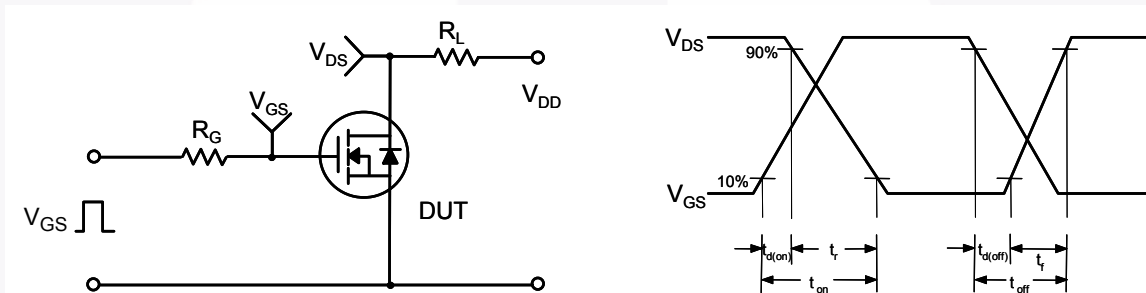
**Figure 10. Transient Thermal Response Curve**



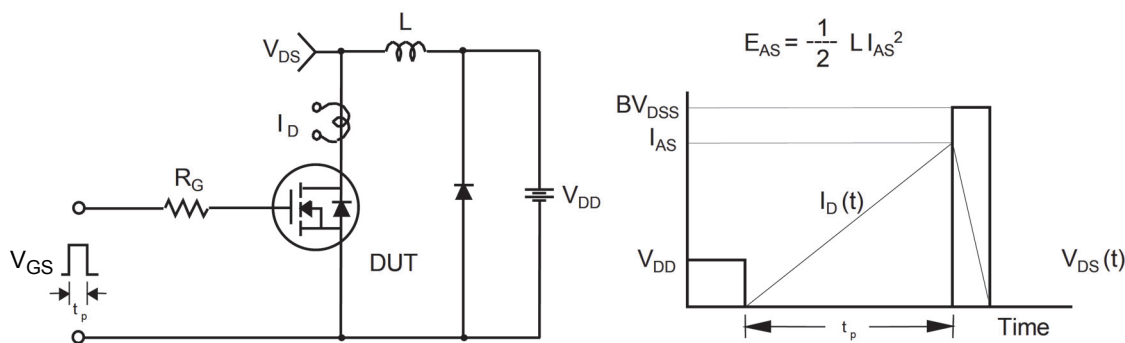
**Figure 11. Gate Charge Test Circuit & Waveform**



**Figure 12. Resistive Switching Test Circuit & Waveforms**



**Figure 13. Unclamped Inductive Switching Test Circuit & Waveforms**





## Mechanical Dimensions

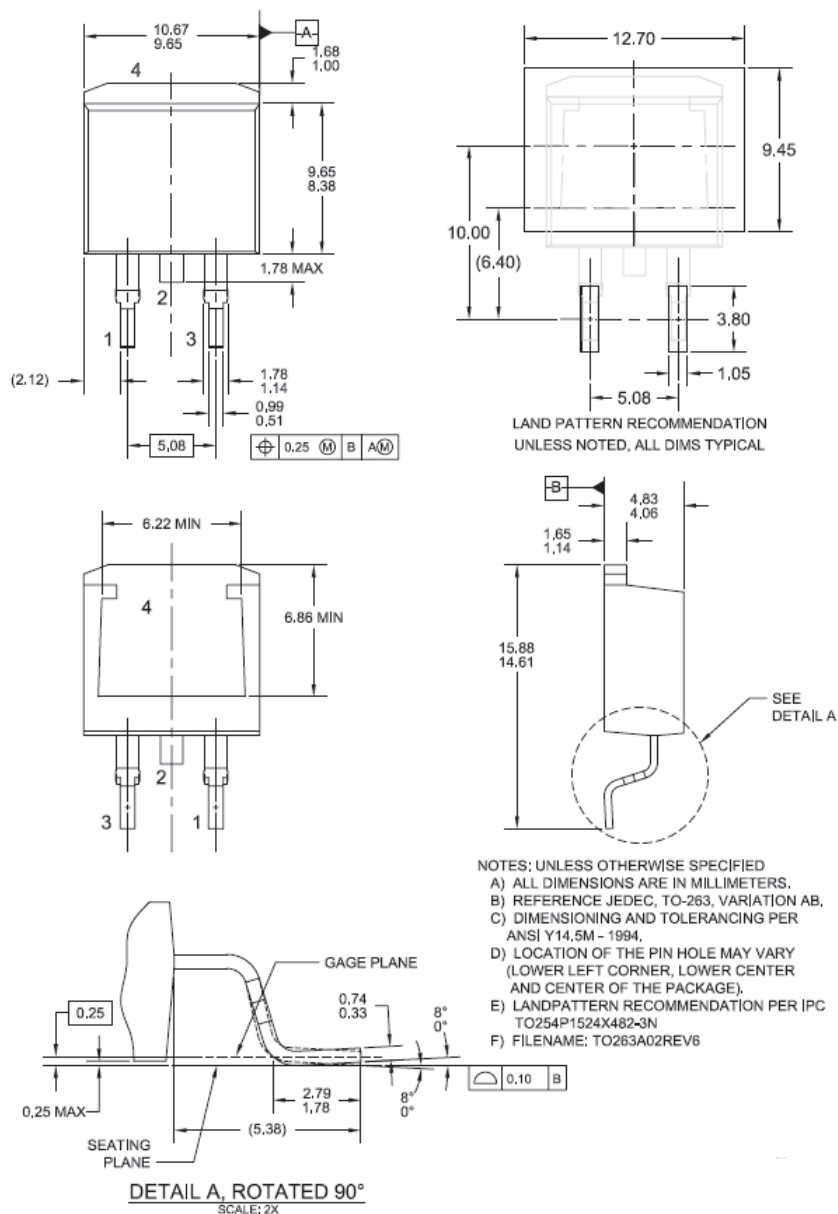
TO-263 2L (D<sup>2</sup>PAK)

Figure 15. 2LD, TO263, Surface Mount

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Dimension in Millimeters



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- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



## JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,  
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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