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Lovoltech™

Breakthrough Power JFET Technology

# PWRLITE LU1014D

## High Performance N-Channel *POWERJFET™* with PN Diode

### Features

- Superior gate charge x Rdson product (FOM)
- Trench Power JFET with low threshold voltage Vth.
- Device fully "ON" with Vgs = 0.7V
- Optimum for "Low Side" Buck Converters
- Excellent for high frequency dc/dc converters
- Optimized for Secondary Rectification in isolated DC-DC
- Low Rg and low Cds for high speed switching

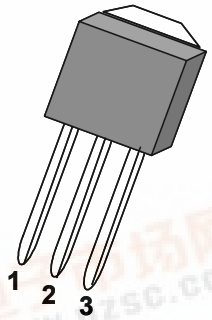
### Description

The Power JFET transistor from Lovoltech is a device that presents a Low Rdson allowing for improved efficiencies in DC-DC switching applications. The device is designed with a low threshold such that drivers can operate at 5V, which reduces the driver power dissipation and increases the overall efficiency. Lower threshold produces faster turn-on/turn-off, which minimizes the required dead time. A PN Diode is added for applications where a freewheeling diode is required.
This product has tin plated leads.

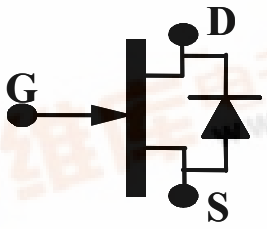
### Applications

- DC-DC Converters
- Synchronous Rectifiers
- PC Motherboard Converters
- Step-down power supplies
- VRM Modules

### IPAK Lead-free Pin Assignments




**Case TO251 (IPAK)**




**N – Channel PowerJFET with PN Diode**

### Pin Definitions

| Pin Number | Pin Name | Pin Function Description |
|---|---|---|
| 1 | Gate | **Gate.** Transistor Gate |
| 2, 4 | Drain | **Drain.** Transistor Drain |
| 3 | Source | **Source.** Transistor Source |

| Product Summary | | |
|---|---|---|
| $V_{DS}$ (V) | Rdson (Ω) | $I_D$ (A) |
| 24V | 0.0065 | 50[1] |
| | | |

### Absolute Maximum Ratings

| Parameter | Symbol | Ratings | Units |
|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | 24 | V |
| Gate-Source Voltage | $V_{GS}$ | -12 | V |
| Gate-Drain Voltage | $V_{GD}$ | -28 | V |
| Continuous Drain Current | $I_D$ | 50[1] | A |
| Pulsed Drain Current | $I_D$ | 100 | A |
| Single Pulse Drain-to-Source Avalanche Energy at 25°C ($V_{DD}$= 6$V_{DC}$, IL=60$A_{PK}$, L=0.3mH, $R_G$=100 Ω) | $E_{AS}$ | ***200*** | mJ |
| Junction Temperature | $T_J$ | -55 to 150°C | °C |
| Storage Temperature | $T_{STG}$ | -65 to 150°C | °C |
| Lead Soldering Temperature, 10 seconds | T | 260°C | °C |
| Power Dissipation (Derated at 25°C) | $P_D$ | 69 | W |

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## Thermal Resistance

| Symbol | Parameter | | DPAK Ratings | | Units |
|---|---|---|---|---|---|
| $R\Theta_{JA}$ | Thermal Resistance Junction-to-Ambient | | 90 | | °C/W |
| $R\Theta_{JC}$ | Thermal Resistance Junction-to-Case | | 1.8 | | °C/W |

## Electrical Specifications

($T_A$ = +25°C, unless otherwise noted.)

The ϕ denotes a specification which apply over the full operating temperature range.

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| | **Static** | | | | | | |
| $BV_{DSX}$ | Breakdown Voltage Drain to Source | $I_D$ = 0.5 mA<br>$V_{GS}$= -4 V | | 24 | 28 | | V |
| $BV_{GDO}$ | Breakdown Voltage Gate to Drain | $I_G$ = -50µA | | | -32 | -28 | V |
| $BV_{GSO}$ | Breakdown Voltage Gate to Source | $I_G$ = -50µA | | | -14 | -12 | V |
| $R_{DS(ON)}$) | Drain to Source On Resistance[2] | $I_G$ = 40 mA, $I_D$=10A<br>$I_G$ = 10 mA, $I_D$=10A<br>$I_G$ = 5 mA, $I_D$=10A | | | 4.6<br>4.8<br>4.9 | 6.5<br>7.0 | mΩ<br>mΩ |
| $V_{GS(TH)}$ | Gate Threshold Voltage | $V_{DS}$=0.1 V, $I_D$=250µA | | | -1 | | V |
| $TCV_{GSTH}$ | Temperature Coefficient of Gate Threshold Voltage | $V_{DS}$=0.1 V, $I_D$=250µA | | | -2.6 | | mV/°C |
| | **Dynamic** | | | | | | |
| $Q_{Gsync}$ | Total Gate Charge Sync JFET | $\Delta V_{Drive}$=5V,$V_{DS}$=0.1V (Fig. 2) | | | 9.8 | | nC |
| $Q_G$ | Total Gate Charge | $\Delta V_{Drive}$=5V, $I_D$=10A,$V_{DS}$=15V | | | 12.4 | | nC |
| $Q_{GD}$ | Gate to Drain Charge | $V_{DS}$=13.5V to $V_{DS}$=1.5V | | | 8.1 | | nC |
| $Q_{GS}$ | Gate to Source Charge | $V_{GS}$ =-4.5V to $V_{DS}$=13.5V | | | 4.3 | | nC |
| $Q_{SW}$ | Switching Charge | $V_{GS}$ =-2V to $V_{DS}$=1.5V | | | 9.1 | | nC |
| $R_G$ | Gate Resistance | | | | 0.7 | | Ω |
| $T_{D(ON)}$) | Turn-on Delay Time | $V_{DD}$=15V, $I_D$=10A<br>$V_{Drive}$ = 5 V<br>Resistive Load | | | 5.5 | | ns |
| $T_R$ | Rise Time | | | | 12.6 | | |
| $T_{D(OFF)}$ | Turn-off Delay | | | | 10.3 | | |
| $T_F$ | Fall Time | | | | 6.6 | | |
| $C_{ISS}$ | Input Capacitance | $V_{DS}$=10V, $V_{GS}$= -5 V, 1MHz. (see Fig. 4) | | | 1147 | | pF |
| $C_{OSS}$ | Output Capacitance | | | | 467 | | |
| $C_{GS}$ | Gate-Source Capacitance | | | | 784 | | |
| $C_{GD}$ | Gate-Drain Capacitance | | | | 363 | | |
| $C_{DS}$ | Drain-Source Capacitance | | | | 104 | | |
| | | | | | | | |
| | **PN Diode** | | | | | | |
| $I_R$ | Reverse Leakage | $V_R$=20V, Vgs = -4V | | | | 0.3 | mA |
| $V_F$ | Forward Voltage | $I_F$ = 1 A | | | 812 | | mV |
| $V_F$ | Forward Voltage | $I_F$ = 10 A | | | 932 | | mV |
| $V_F$ | Forward Voltage | $I_F$ = 20 A | | | 1010 | | mV |
| Qrr | Reverse Recovery Charge | $I_s$ = 10 A di/dt = 100A/us, | | | 7 | | nC |
| Trr | Reverse Recovery Time | $I_s$ = 10 A di/dt = 100A/us, | | | 13.3 | | ns |

**Notes:**

1. Current is limited by bondwire; with an Rthjc = 1.8 °C/W the chip is able to carry 80A.
2. Pulse width <= 500µs, duty cycle < = 2%


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## Typical Operating Characteristics

($T_A$ = +25°C, unless otherwise noted.)

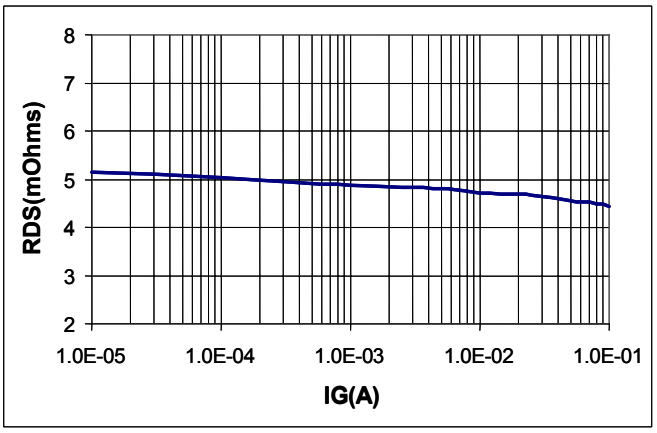


**Figure 1 – $R_{DSON}$ vs Gate Current at $I_D$ – 10A**

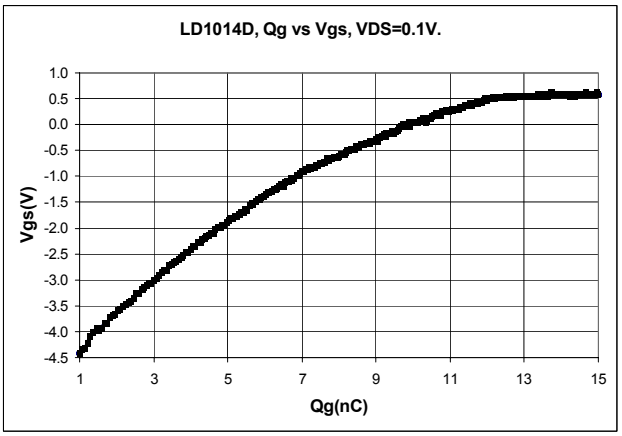


**Figure 2 – Gate Charge $Qg_{sync}$ for $V_{DS}$=0.1V**

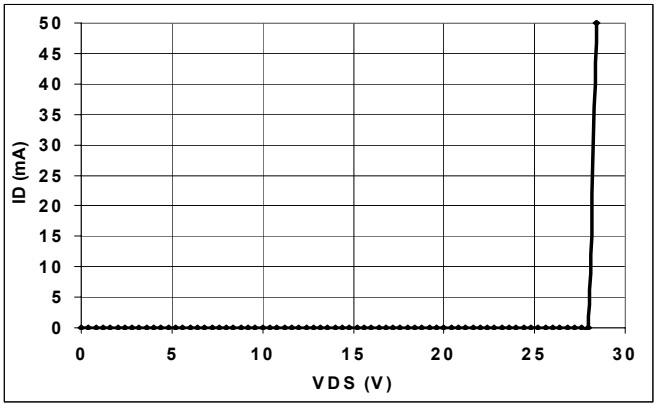


**Figure 3 – Breakdown Voltage Vds vs Id**

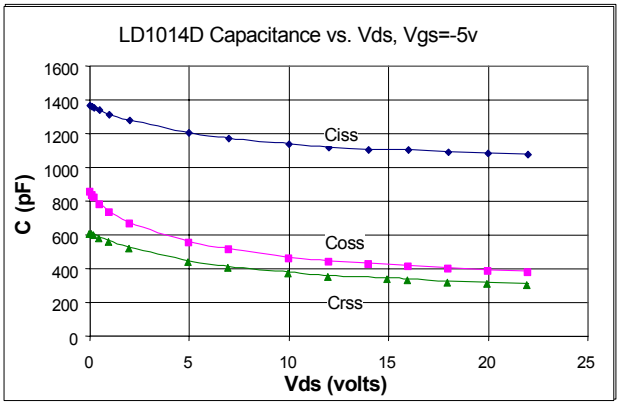


**Figure 4 – Capacitance vs Drain Voltage Vds**

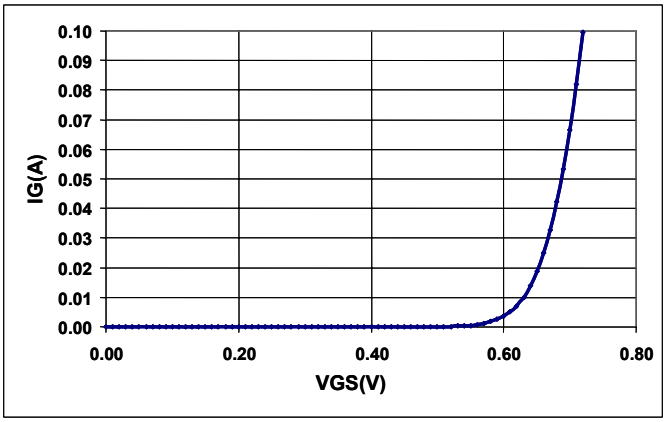


**Figure 5 – $I_G$ vs Gate Voltage $V_{GS}$**

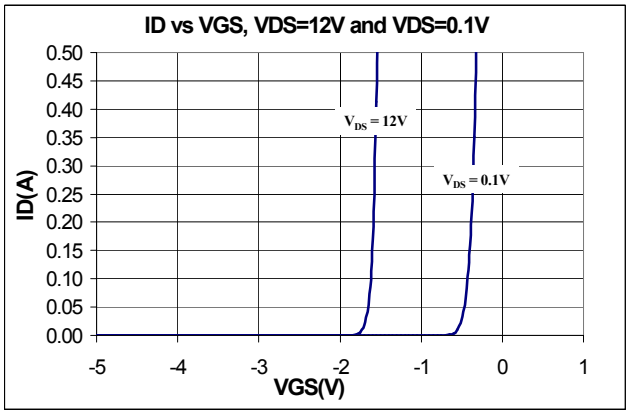


**Figure 6 – Transfer Characteristic**

## Typical Operating Characteristics

($T_A$ = +25°C, unless otherwise noted.)

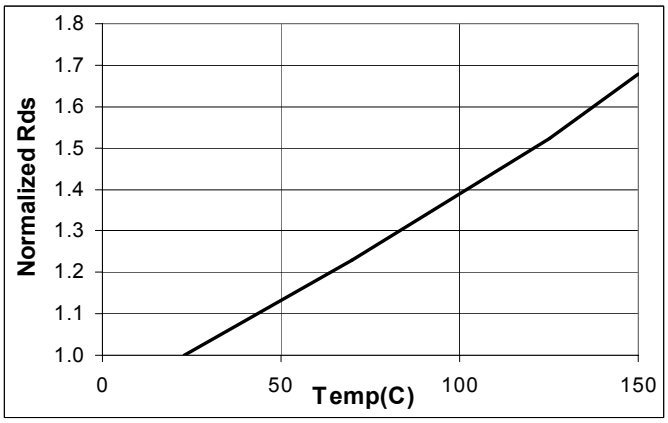


**Figure 7 – $R_{DSON}$ =f(T); $I_D$ = -10A; $I_G$ = 40mA**

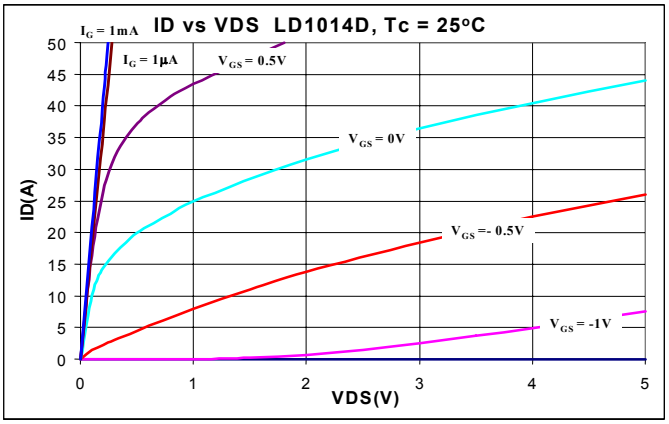


**Figure 8 – $I_D$ vs $V_{DS}$ Characteristics**

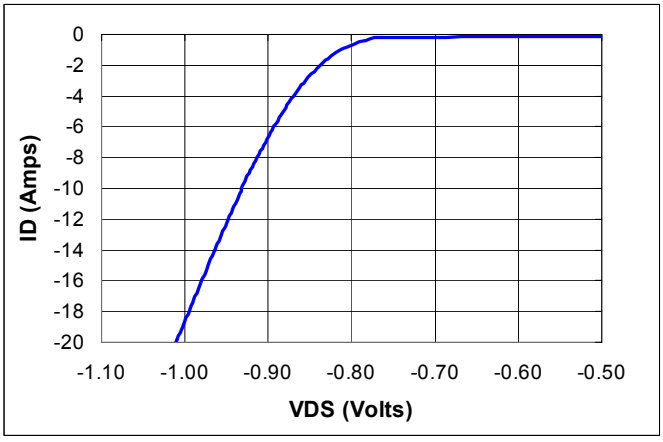


**Figure 9 – PN Diode Voltage vs Current**

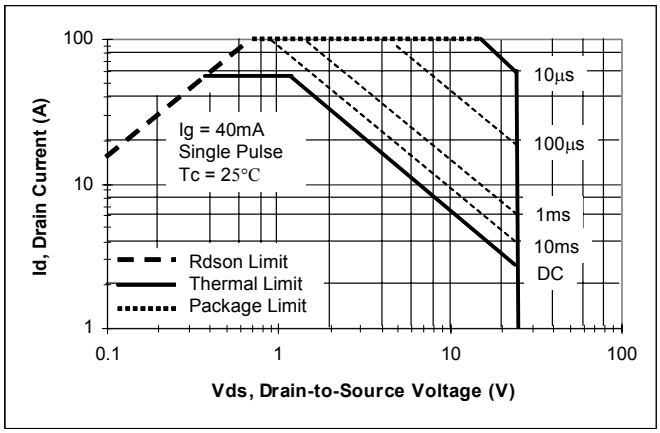


**Figure 10 – Safe Operating Area**

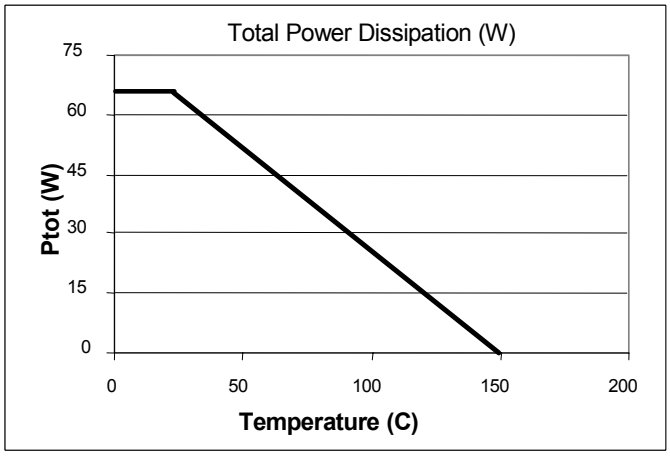


**Figure 11 – Total Power Dissipation**

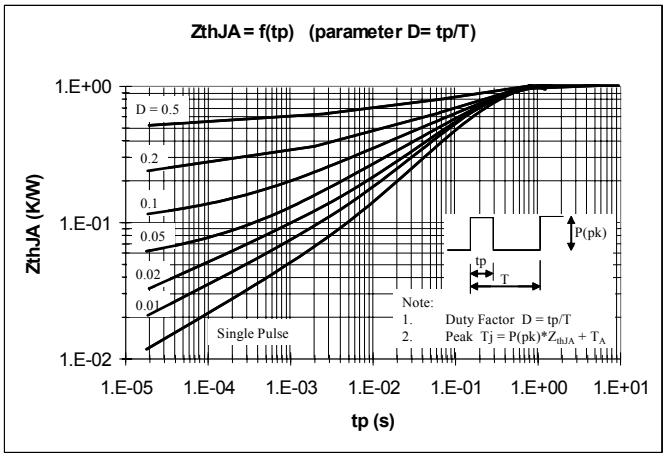


**Figure 12 – Normalized Thermal Response**


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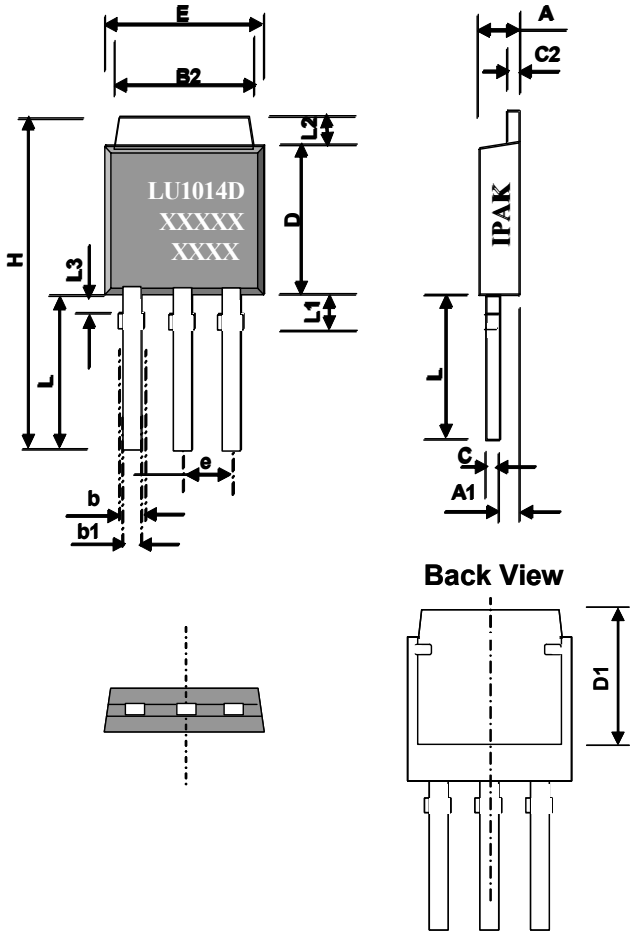
## Ordering Information

| Product Number | PN Marking | Package | Notes: |
|---|---|---|---|
| LU1014D | LU1014D | TO251 (IPAK) | This product is Pb-Free and has Tin Plated leads |

## Package and Marking Information

| DIMENSIONS | | | | | | |
|---|---|---|---|---|---|---|
| DIM. | mm. | | | inch | | |
| | TYP. | MIN. | MAX. | TYP. | MIN. | MAX. |
| A | | 2.19 | 2.40 | | 0.086 | 0.094 |
| A1 | | 0.89 | 1.14 | | 0.035 | 0.045 |
| | | | | | | |
| b | | 0.76 | 1.14 | | 0.030 | 0.045 |
| b1 | | 0.64 | 0.90 | | 0.025 | 0.035 |
| B2 | | 5.20 | 5.46 | | 0.205 | 0.215 |
| C | | 0.45 | 0.60 | | 0.017 | 0.023 |
| C2 | | 0.45 | 0.60 | | 0.017 | 0.023 |
| D | | 5.97 | 6.22 | | 0.235 | 0.244 |
| D1 | 5.64 | | | 0.222 | | |
| E | | 6.35 | 6.73 | | 0.250 | 0.265 |
| e | 2.28 | | | 0.090 | | |
| H | 13.19 | 13.06 | 13.32 | | 0.514 | 0.525 |
| L | | 5.95 | 7.6 | | 0.234 | 0.300 |
| L1 | | 2.03 | 2.29 | | 0.079 | 0.090 |
| L3 | | 0.63 | 1.14 | | 0.025 | 0.045 |

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|---|---|---|
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