

PWRLITE LU1004D

High Performance N-Ch Vertical *POWERJFET™* with PN Diode



Features

- ❖ Trench Power JFET with low threshold voltage V_{th} .
- ❖ Device fully "ON" with $V_{gs} = 0.7V$
- ❖ Optimum for "Low Side" Buck Converters
- ❖ Optimized for Secondary Rectification in isolated DC-DC
- ❖ Low R_g and low C_{ds} for high speed switching
- ❖ No "Body Diode"; extremely low C_{ds}
- ❖ Added Fast Recovery Schottky Diode in same package

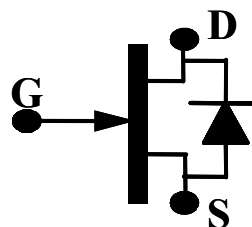
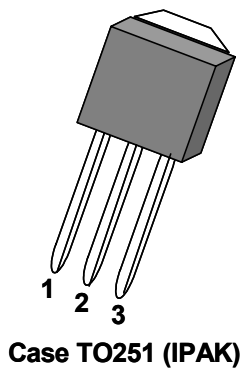
Applications

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

Description

The Power JFET transistor from Lovoltech is a device that presents a Low $R_{ds(on)}$ 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. The transistor "No Body Diode" provides a very low associated parasitic capacitance C_{ds} . A Schottky Diode is added for applications where a freewheeling diode is required. Ringing is also reduced so that a lower voltage device may be a better solution.

IPAK Pin Assignments



N – Channel PowerJFET
with PN Diode

Pin Definitions

Pin Number	Pin Name	Pin Function Description	Product Summary		
1	Gate	Gate. Transistor Gate	V_{DS} (V)	$R_{ds(on)}$ (Ω)	I_D (A)
2, 4	Drain	Drain. Transistor Drain	24V	0.0045	50
3	Source	Source. Transistor Source			

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Units
Drain-Source Voltage	V_{DS}	24	V
Gate-Source Voltage	V_{GS}	-10	V
Gate-Drain Voltage	V_{GD}	-28	V
Continuous Drain Current	I_D	50	A
Pulsed Drain Current	I_D	100	A
Single Pulse Drain-to-Source Avalanche Energy at 25°C ($V_{DD}=5V_{DC}$, $I_L=60A_{PK}$, $L=0.3mH$, $R_G=100\Omega$)	E_{AS}	220	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	80	W

Thermal Resistance

Symbol	Parameter		IPAK Ratings		Units
$R\Theta_{JA}$	Thermal Resistance Junction-to-Ambient		80		°C/W
$R\Theta_{JC}$	Thermal Resistance Junction-to-Case		1.6		°C/W

Electrical Specifications

($T_A = +25^\circ\text{C}$, 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 V _{GS} = -4 V		24			V
BV _{GDO}	Breakdown Voltage Gate to Drain	I _G = -50μA				-28	V
BV _{GSO}	Breakdown Voltage Gate to Source	I _G = -1 mA			-12	-10	V
R _{DS(ON)}	Static Drain to Source ¹ On Resistance (Current flows drain-to-source) See Fig. 1	I _G = 40 mA, I _D =10A I _G = 10 mA, I _D =10A I _G = 5 mA, I _D =10A			3.5 4.0 4.1	4.0 4.5	mΩ mΩ
V _{GS(TH)}	Gate Threshold Voltage	V _{DS} =0.1 V, I _D =250μA			-900		mV
	Dynamic						
Q _G	Total Gate Charge	ΔV _{Drive} =5V, I _D =10A, V _{DS} =15V			20		nC
Q _{GD}	Gate to Drain Charge				12		nC
Q _{GS}	Gate to Source Charge				1.5		nC
Q _{SW}	Switching Charge				13.5		nC
R _G	Gate Resistance				1		Ω
T _{D(ON)}	Turn-on Delay Time	V _{DD} =16V, I _D =15A V _{Drive} = 5 V Clamped Inductive Load			5		ns
T _R	Rise Time				12		
T _{D(OFF)}	Turn-off Delay				2		
T _F	Fall Time				10		
C _{ISS}	Input Capacitance	V _{DS} =10V, V _{GS} = -5 V, 1MHz.			3000		pF
C _{OSS}	Output Capacitance				900		
C _{GS}	Gate-Source Capacitance				2250		
C _{GD}	Gate-Drain Capacitance				750		
C _{DS}	Drain-Source Capacitance				150		
	PN Diode						
I _R	Reverse Leakage	V _R =20V, V _{gs} = -4V			0.25	0.3	mA
V _F	Forward Voltage	I _F = 1 A			700		mV
V _F	Forward Voltage	I _F = 10 A			900		mV
V _F	Forward Voltage	I _F = 20 A			1100		mV
Q _{rr}	Reverse Recovery Charge	I _s = 20 A di/dt = 100A/us.			20		nC

Notes:

1. Pulse width $\leq 500\mu\text{s}$, duty cycle $\leq 2\%$

Typical Operating Characteristics

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

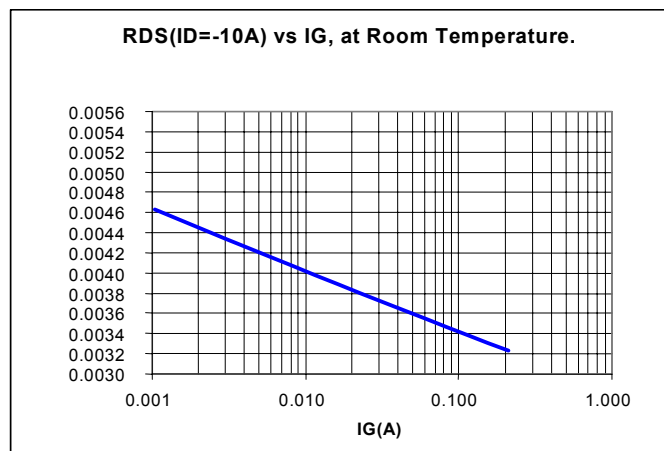


Figure 1 – $R_{DS(on)}$ vs Gate Current at $I_D = 10\text{A}$

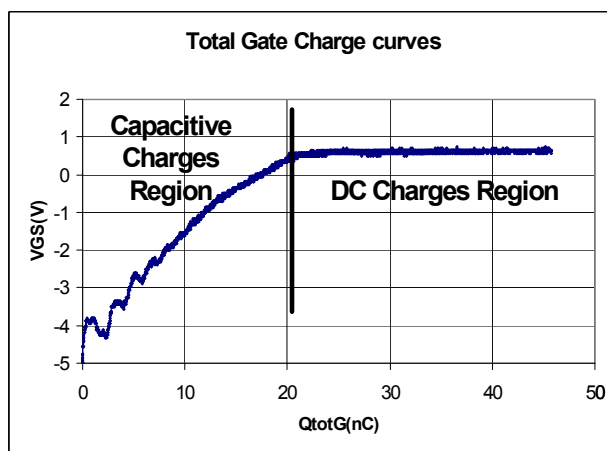


Figure 2 – Total Gate Charge

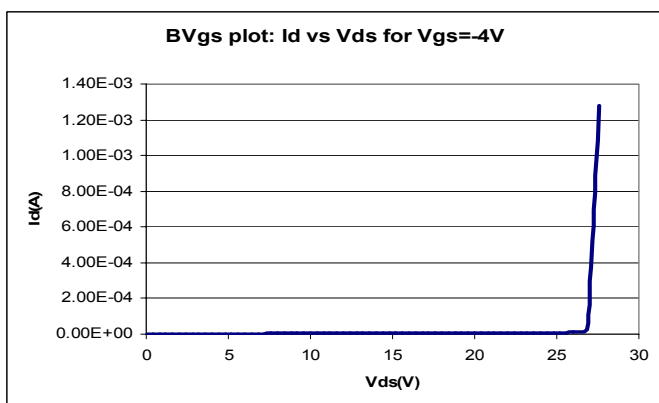


Figure 3 – Breakdown Voltage V_{ds} vs I_d

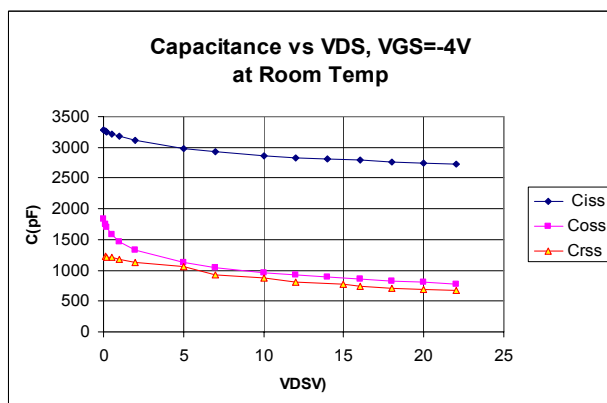


Figure 4 – Capacitance vs Drain Voltage V_{ds}

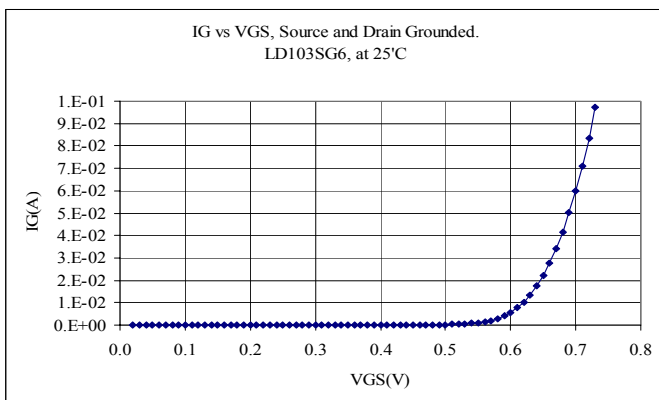


Figure 5 – I_G vs Gate Voltage V_{GS}

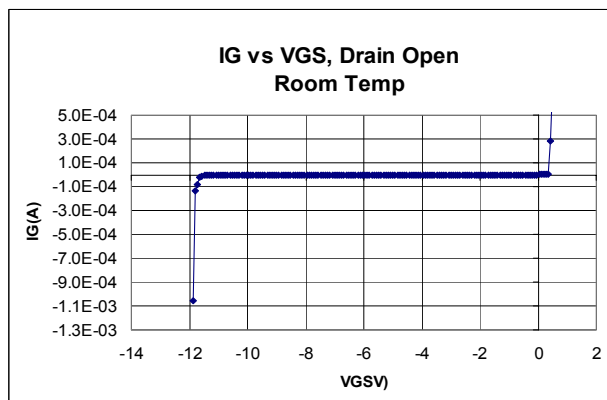


Figure 6 – Typical Gate Voltage Characteristic

Typical Operating Characteristics

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

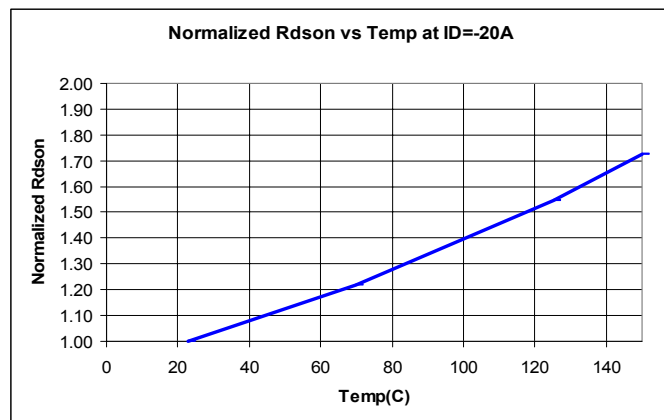


Figure 7 – $R_{DS(on)}$ Temperature Coefficient

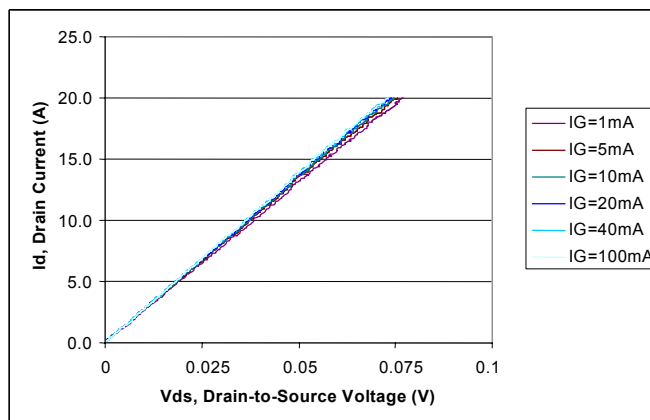


Figure 8 – On-Region Characteristics

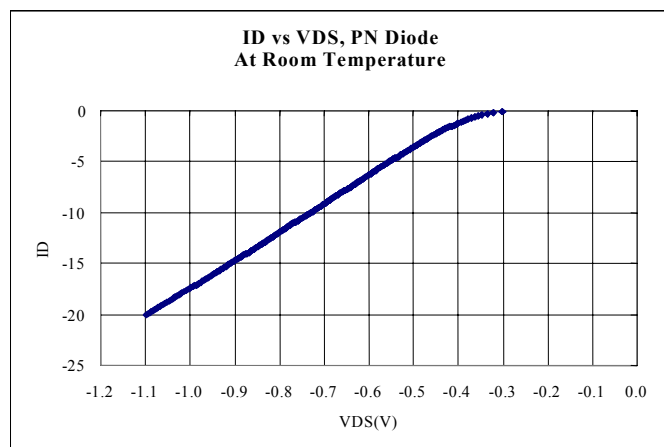


Figure 9 – Diode Voltage vs Current

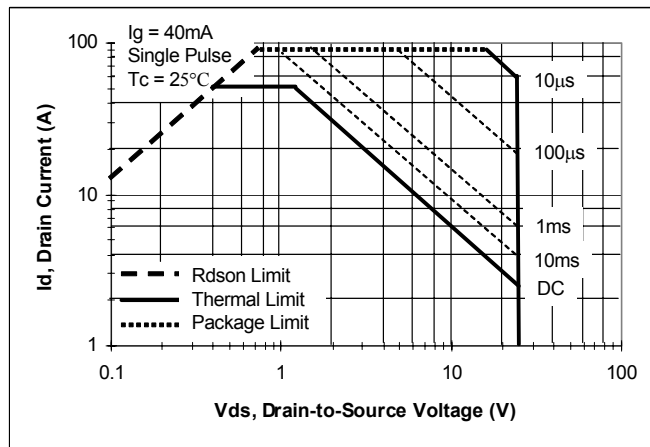


Figure 10 – Safe Operating Area

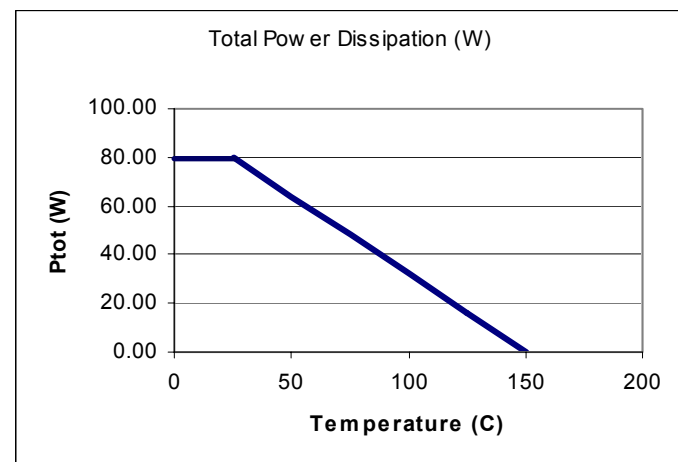


Figure 11 – Total Power Dissipation

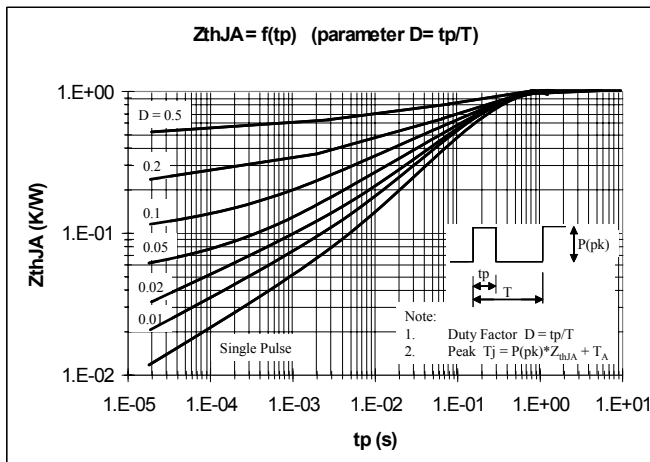


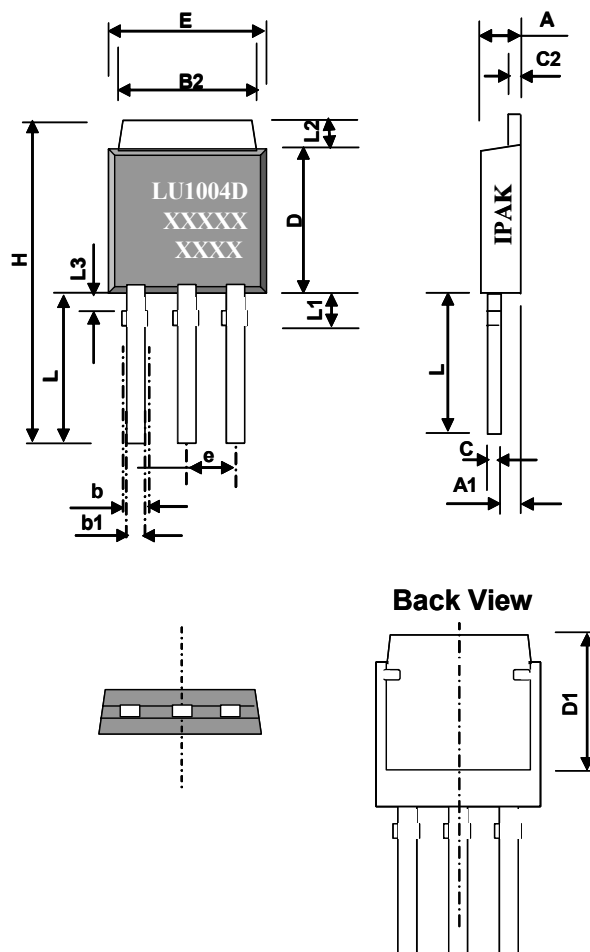
Figure 12 – Normalized Thermal Response

Ordering Information

Product Number	PN Marking	Package	Notes:
LU1004D	LU1004D	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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- A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

Datasheet Identification	Product Status	Definition
Advance Information	In definition or in Design	This datasheet contains the design specifications for product development. Specifications may change without notice.
Preliminary	Initial Production	This datasheet contains preliminary data; additional and application data will be published at a later date. Lovoltech, Inc. reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	In Production	This datasheet contains final specifications. Lovoltech reserves the right to make changes at any time without notice in order to improve the design.