POWER™

Green Package

PFU4N65FG / PFD4N65FG

650V N-Channel MOSFET

FEATURES

- ❑ Originative New Design
- ❑ 100% EAS Test
- ❑ Rugged Gate Oxide Technology
- ❑ Extremely Low Intrinsic Capacitances
- ❑ Remarkable Switching Characteristics
- ❑ Unequalled Gate Charge : 12.4 nC (Typ.)
- ❑ Extended Safe Operating Area
- ❑ Lower $R_{DS(ON)}$: 2.2 Ω (Typ.) @V_{GS}=10V
- ❑ Halogen Free

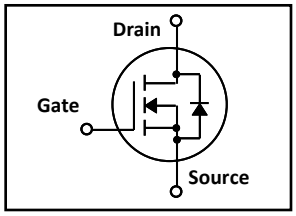
APPLICATION

- ❑ Low power battery chargers
- ❑ Switch mode power supply (SMPS)
- ❑ DC-AC converters.

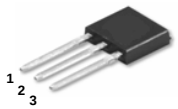
BV_{DSS} = 650 V

$R_{DS(on)}$ = 2.2 Ω

I_D = 3.0 A



I-PAK(TO-251)



1.Gate 2. Drain 3. Source

D-PAK(TO-252)

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Absolute Maximum Ratings

T_C=25°C unless otherwise specified

Symbol	Parameter	Value	Units
V_{DSS}	Drain-Source Voltage	650	V
I_D	Drain Current – Continuous (T_C = 25°C)	3.0	A
	Drain Current – Continuous (T_C = 100°C)	1.8	A
I_{DM}	Drain Current – Pulsed (Note 1)	11.5	A
V_{GS}	Gate-Source Voltage	±30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	240	mJ
I_{AR}	Avalanche Current (Note 1)	4.0	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	5.0	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P_D	Power Dissipation (T_C = 25°C)	50	W
	- Derate above 25°C	0.4	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	°C
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	°C

Thermal Resistance Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	2.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient*	--	50	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	110	

* When mounted on the minimum pad size recommended (PCB Mount)

Electrical Characteristics T_C=25 °C unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
On Characteristics						
V_{GS}	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 uA	2.5	--	4.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 2.0 A	--	2.2	2.75	Ω
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 uA	650	--	--	V
ΔBV_{DSS} /ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 uA, Referenced to25°C	--	0.56	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 650 V, V_{GS} = 0 V	--	--	1	uA
		V_{DS} = 520 V, T_C = 125°C	--	--	10	uA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30 V, V_{DS} = 0 V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30 V, V_{DS} = 0 V	--	--	-100	nA
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	630	820	pF
C_{oss}	Output Capacitance		--	60	80	pF
C_{rss}	Reverse Transfer Capacitance		--	5	6.5	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Time	V_{DS} = 325 V, I_D = 4.0 A, R_G = 25 Ω, R_L = 80 Ω (Note 4,5)	--	11	22	ns
t_r	Turn-On Rise Time		--	7	14	ns
$t_{d(off)}$	Turn-Off Delay Time		--	23	46	ns
t_f	Turn-Off Fall Time		--	13	26	ns
Q_g	Total Gate Charge	V_{DS} = 520 V, I_D = 4.0 A, V_{GS} = 10 V (Note 4,5)	--	12.4	18	nC
Q_{gs}	Gate-Source Charge		--	3	--	nC
Q_{gd}	Gate-Drain Charge		--	4.4	--	nC
Source-Drain Diode Maximum Ratings and Characteristics						
I_S	Continuous Source-Drain Diode Forward Current		--	--	4.0	A
I_{SM}	Pulsed Source-Drain Diode Forward Current		--	--	16	
V_{SD}	Source-Drain Diode Forward Voltage	I_S = 4.0 A, V_{GS} = 0 V	--	--	1.4	V
trr	Reverse Recovery Time	I_S = 4.0 A, V_{GS} = 0 V, di_F/dt = 100 A/us (Note 4)	--	255	--	ns
Qrr	Reverse Recovery Charge		--	1.5	--	uC

Notes ;

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L=26mH, I_{AS}=4.0A, V_{DD}=50V, R_G=25Ω, Starting T_J =25°C
3. I_{SD}≤4.0A, di/dt≤300A/us, V_{DD}≤BV_{DSS} , Starting T_J =25 °C
4. Pulse Test : Pulse Width ≤ 300us, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature

Typical Characteristics

Fig.1 On Region Characteristics

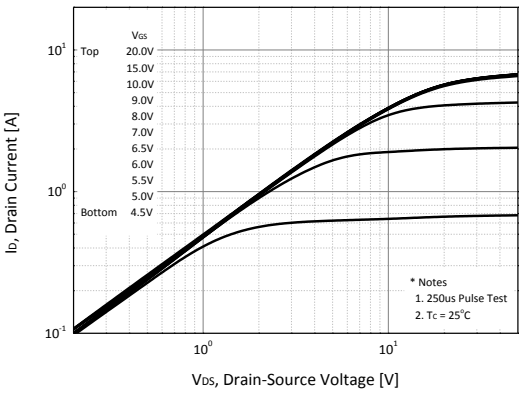


Fig.2 Transfer Characteristics

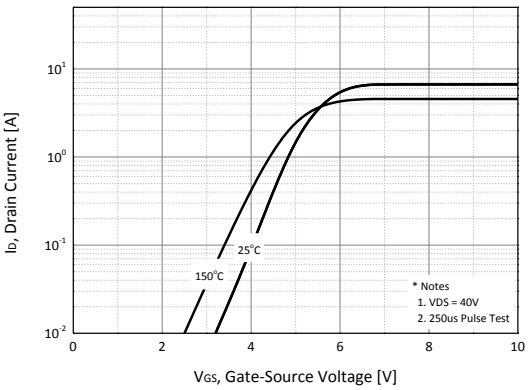


Fig.3 Static Drain-Source On Resistance

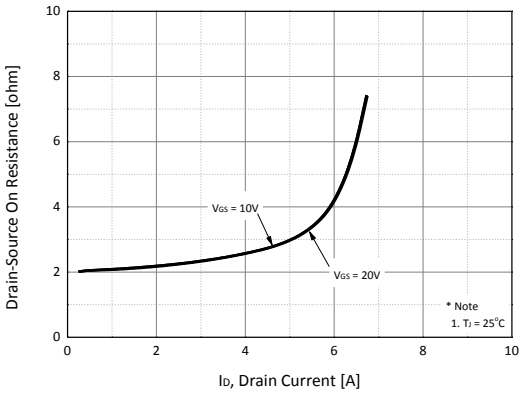


Fig.4 Body Diode Forward Voltage

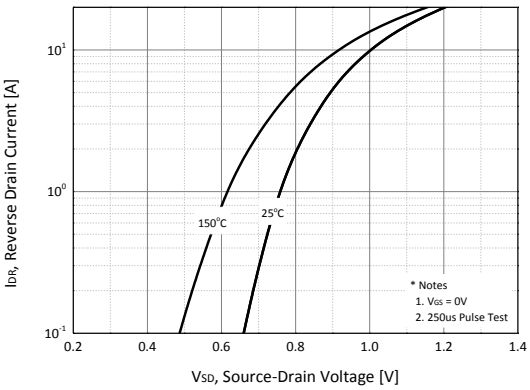


Fig.5 Capacitance Characteristics

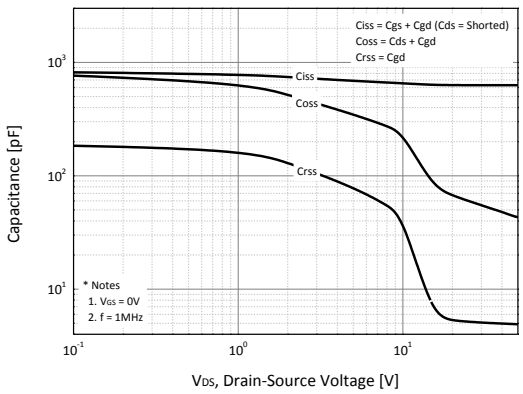
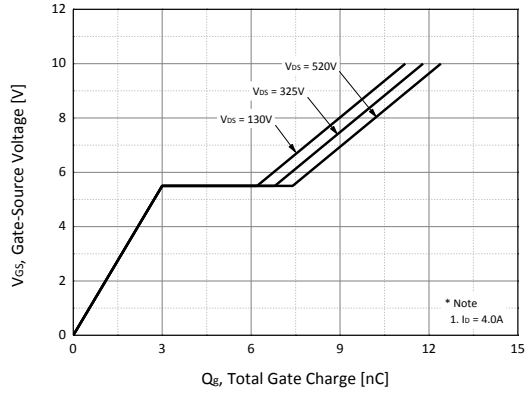


Fig.6 Gate Charge Characteristics



Typical Characteristics

Fig.7 BV_{DSS} Variation vs. Temperature

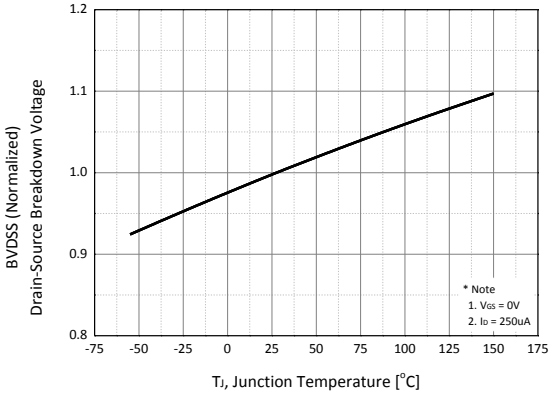


Fig.8 On-Resistance Variation vs. Temperature

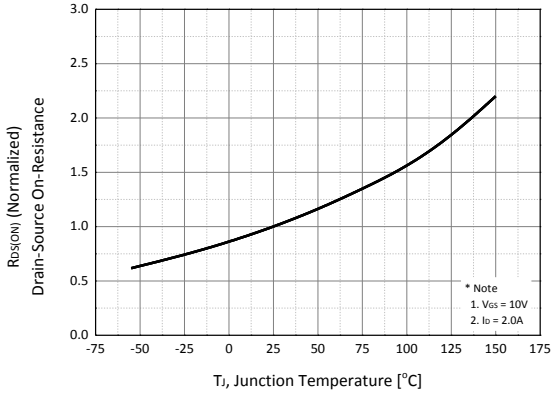


Fig.9 Safe Operation Area

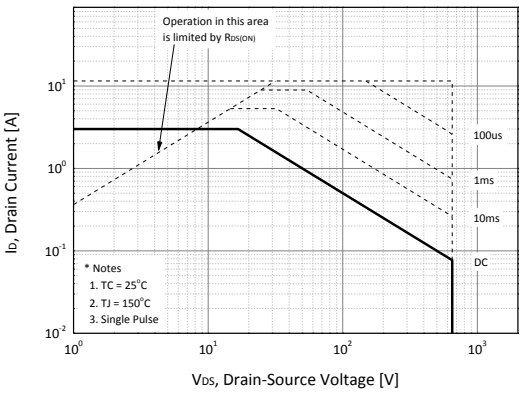


Fig.10 Maximum I_D vs. Case Temperature

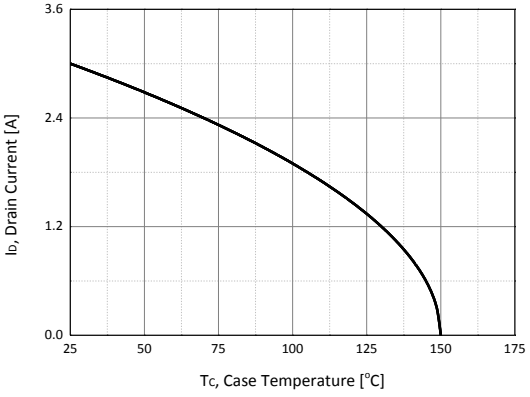
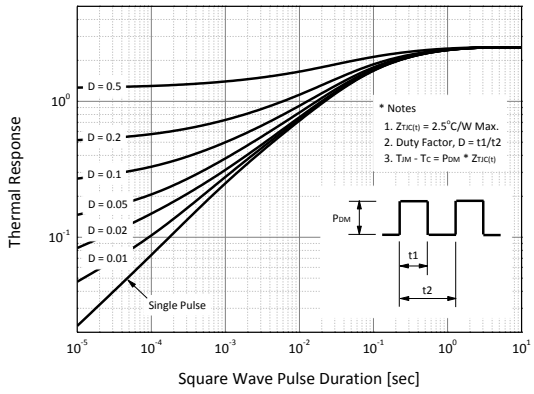
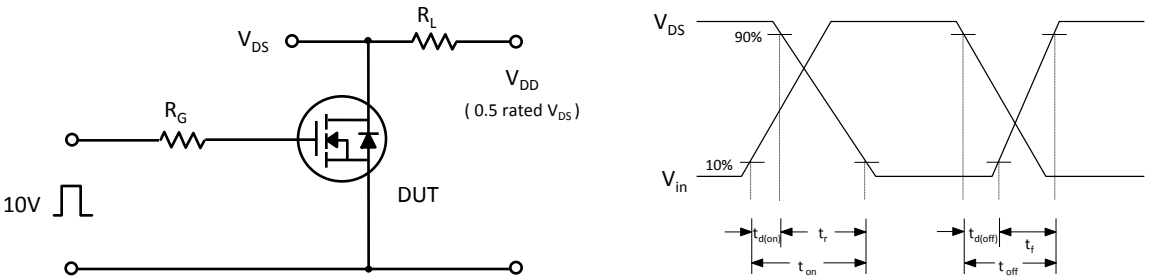


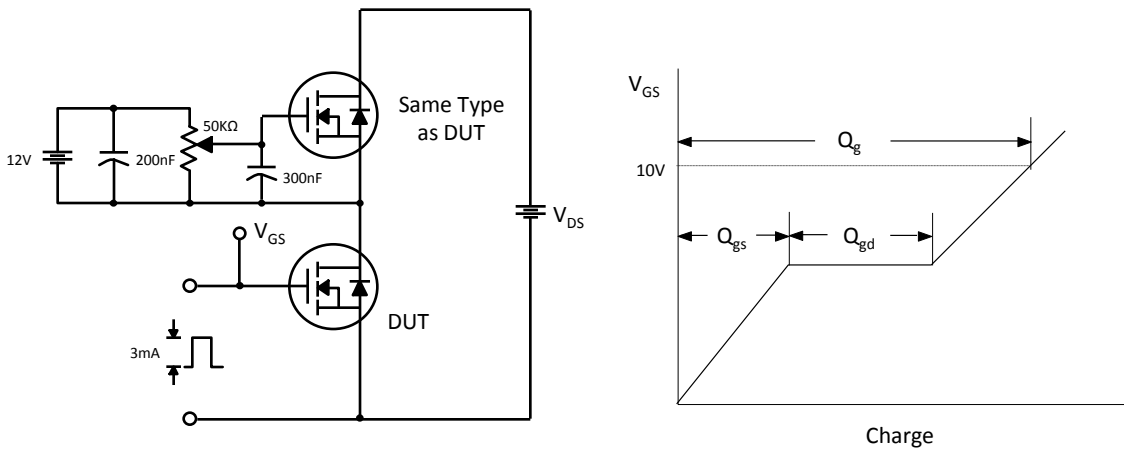
Fig.11 Transient Thermal Response Curve



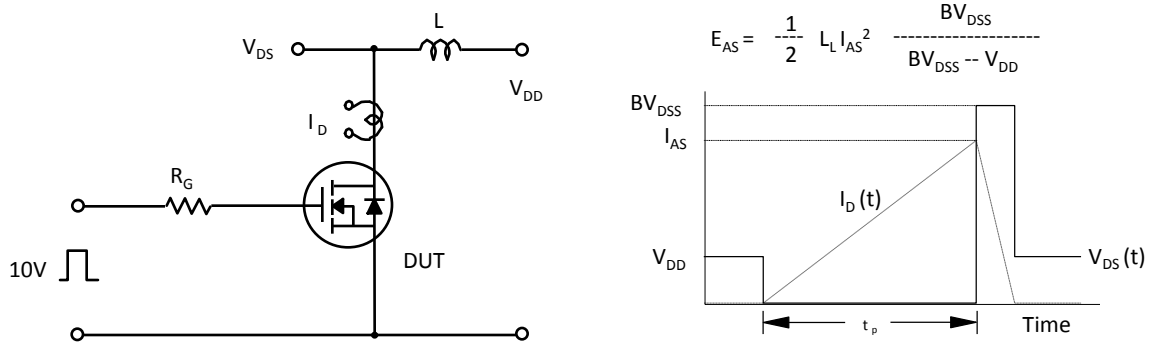
Characteristics Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms

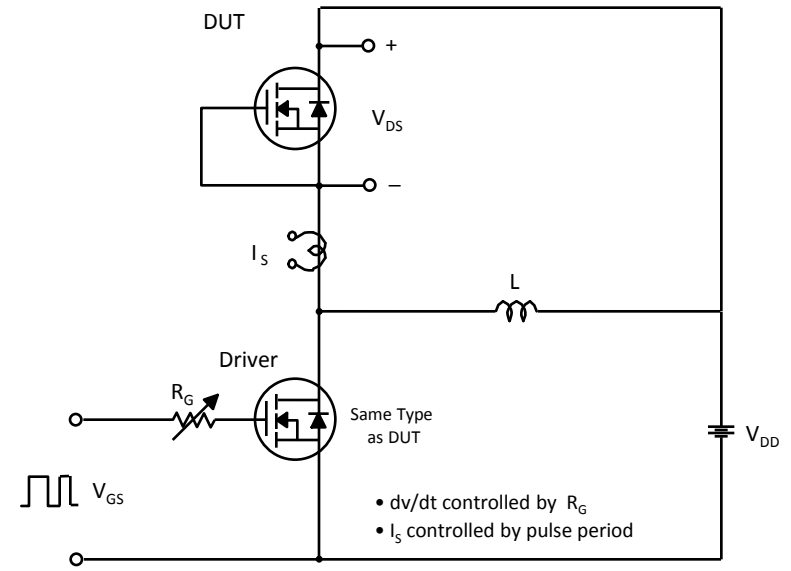


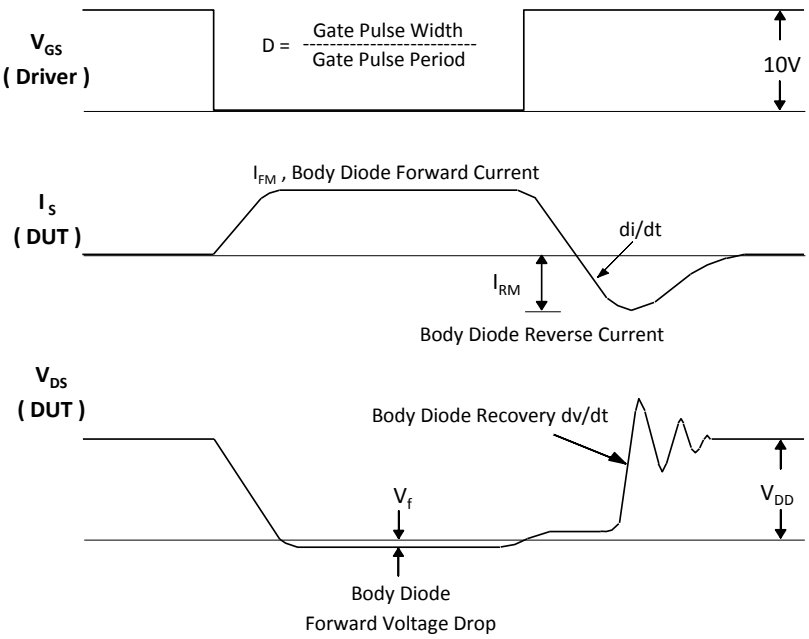
Gate Charge Test Circuit & Waveform



Unclamped Inductive Switching Test Circuit & Waveforms

Characteristics Test Circuit & Waveform (continued)





Peak Diode Recovery dv/dt Test Circuit & Waveforms