

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.

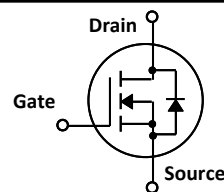
PFU4N65FG / PFD4N65FG

650V N-Channel MOSFET

$$BV_{DSS} = 650 V$$

$$R_{DS(on)} = 2.2 \Omega$$

$$I_D = 3.0 A$$

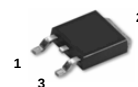


I-PAK(TO-251)



1.Gate 2. Drain 3. Source

D-PAK(TO-252)



1.Gate 2. Drain 3. Source

Absolute Maximum Ratings

$T_C=25^\circ C$ unless otherwise specified

Symbol	Parameter	Value	Units
V_{DSS}	Drain-Source Voltage	650	V
I_D	Drain Current – Continuous ($T_C = 25^\circ C$)	3.0	A
	Drain Current – Continuous ($T_C = 100^\circ C$)	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 ($T_C = 25^\circ C$) - Derate above $25^\circ C$	50	W
		0.4	W/ $^\circ C$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ C$
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ C$

Thermal Resistance Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	2.5	$^\circ C/W$
$R_{\theta JA}$	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 $T_C=25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
On Characteristics						
V_{GS}	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.5	--	4.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 2.0\text{ A}$	--	2.2	2.75	Ω

Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	650	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C	--	0.56	--	$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	μA
		$V_{DS} = 520\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	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	$V_{DS} = 325\text{ V}, I_D = 4.0\text{ A}$ $R_G = 25\text{ }\Omega, R_L = 80\text{ }\Omega$ (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	$V_{DS} = 520\text{ V}, I_D = 4.0\text{ A}$ $V_{GS} = 10\text{ V}$ (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	$I_S = 4.0\text{ A}, V_{GS} = 0\text{ V}$	--	--	1.4	V
t_{rr}	Reverse Recovery Time	$I_S = 4.0\text{ A}, V_{GS} = 0\text{ V}$ $di_F/dt = 100\text{ A}/\mu\text{s}$ (Note 4)	--	255	--	ns
Q_{rr}	Reverse Recovery Charge		--	1.5	--	μC

Notes ;

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $L=26\text{mH}, I_{AS}=4.0\text{A}, V_{OD}=50\text{V}, R_G=25\Omega$, Starting $T_J=25^\circ\text{C}$
3. $I_{SD}\leq 4.0\text{A}, di/dt\leq 300\text{A}/\mu\text{s}, V_{DD}\leq BV_{DSS}$, Starting $T_J=25^\circ\text{C}$
4. Pulse Test : Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$
5. Essentially Independent of Operating Temperature

Typical Characteristics

Fig.1 On Region Characteristics

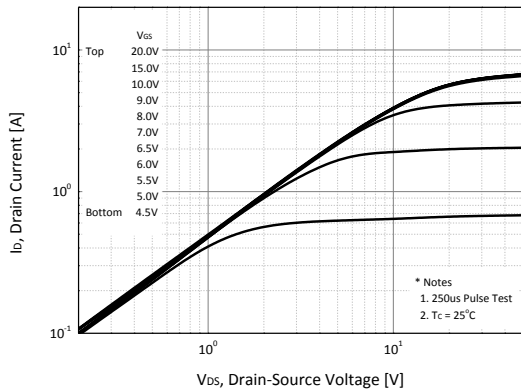


Fig.2 Transfer Characteristics

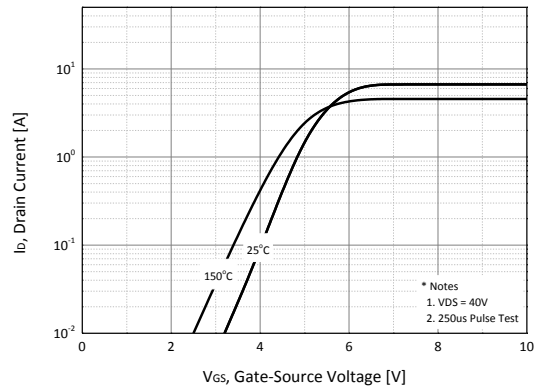


Fig.3 Static Drain-Source On Resistance

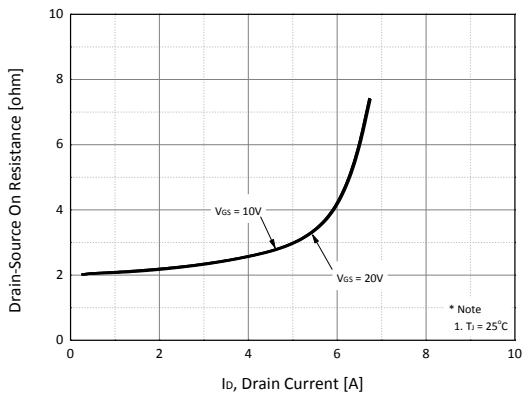


Fig.4 Body Diode Forward Voltage

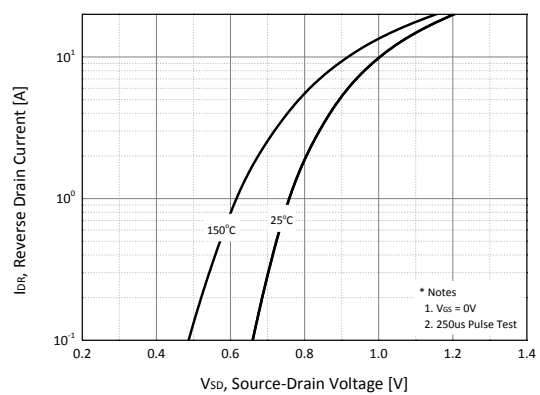


Fig.5 Capacitance Characteristics

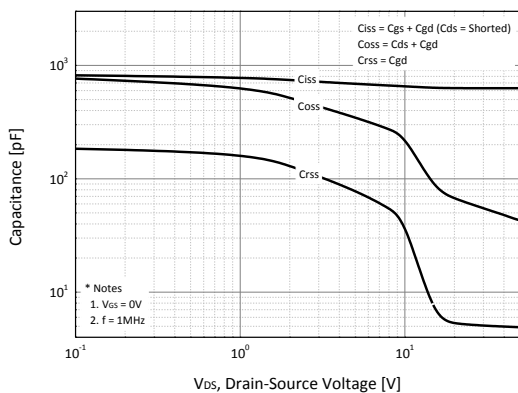
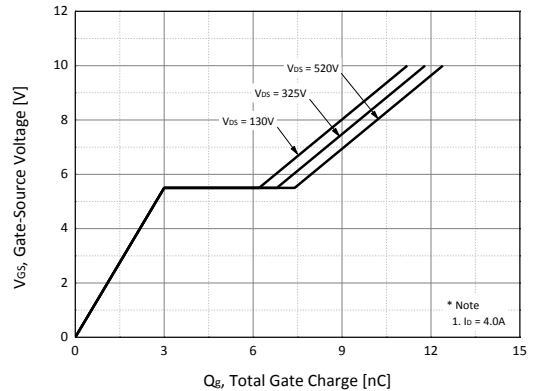


Fig.6 Gate Charge Characteristics



Typical Characteristics

Fig.7 BV_{DSS} Variation vs. Temperature

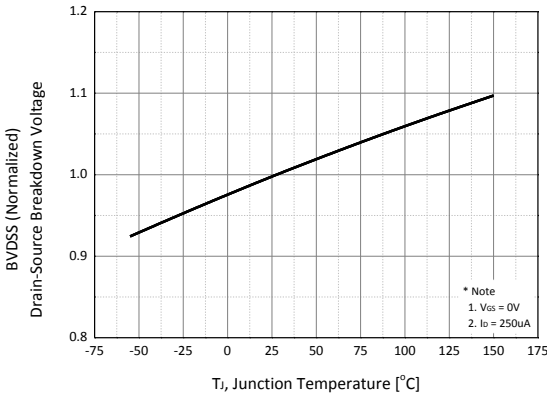


Fig.8 On-Resistance Variation vs. Temperature

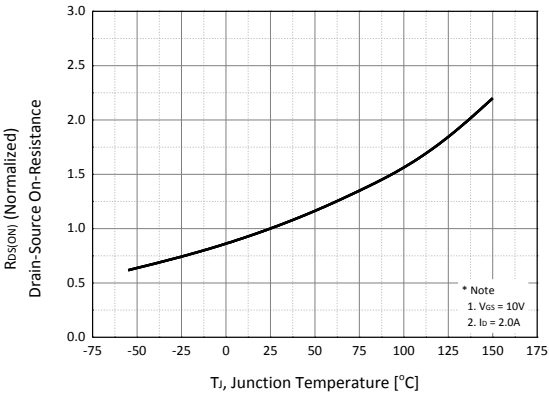


Fig.9 Safe Operation Area

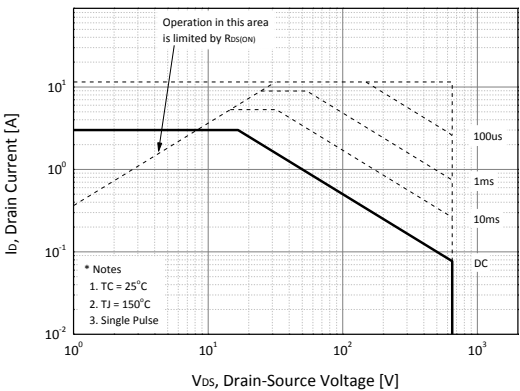


Fig.10 Maximum I_D vs. Case Temperature

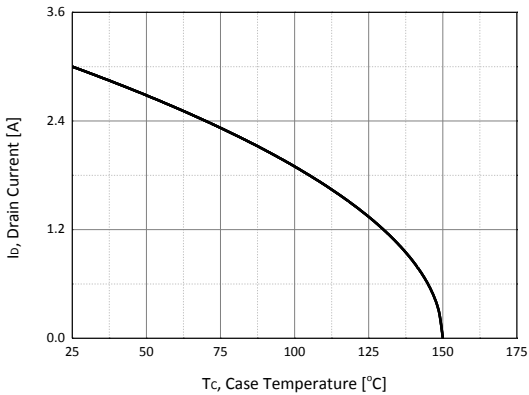
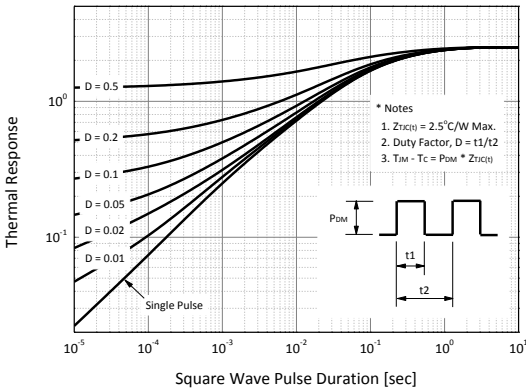
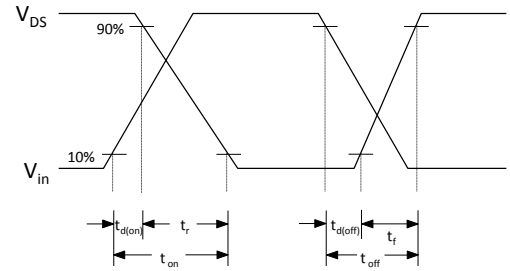
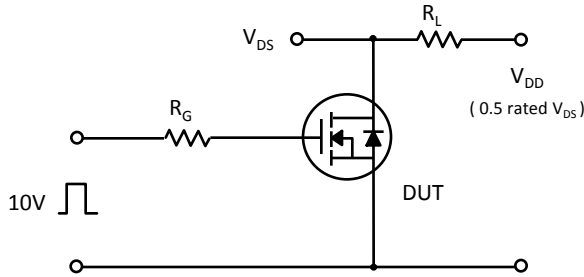


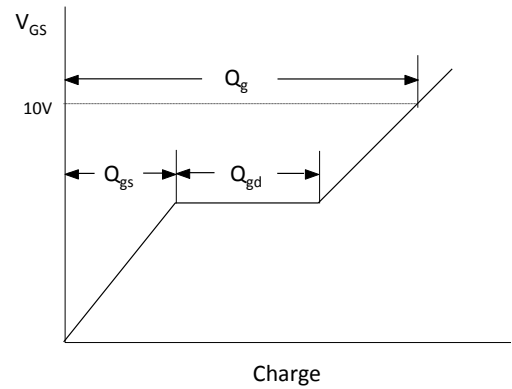
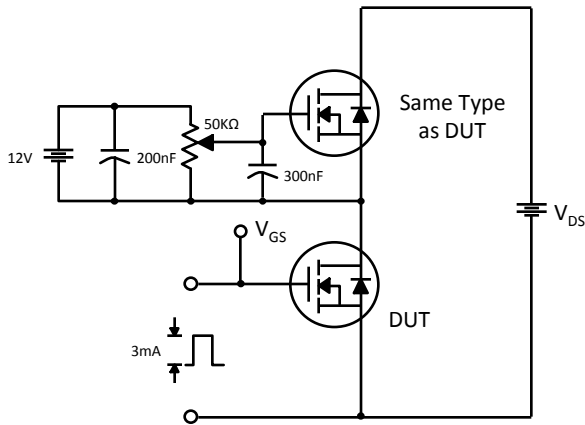
Fig.11 Transient Thermal Response Curve



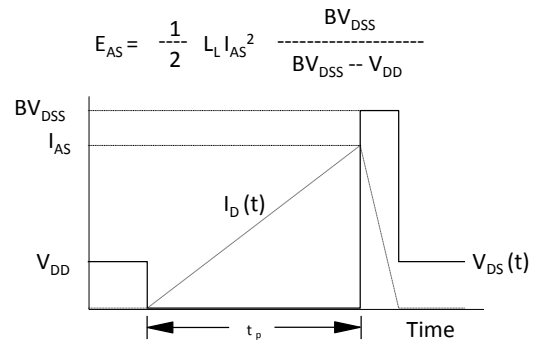
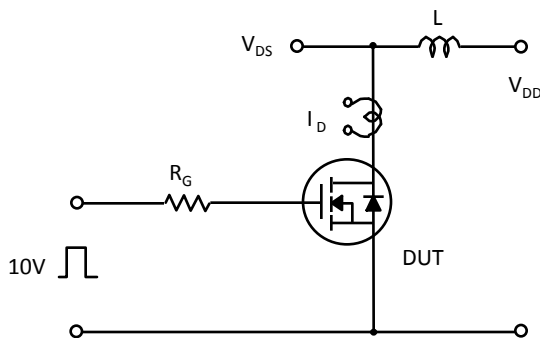
Characteristics Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms

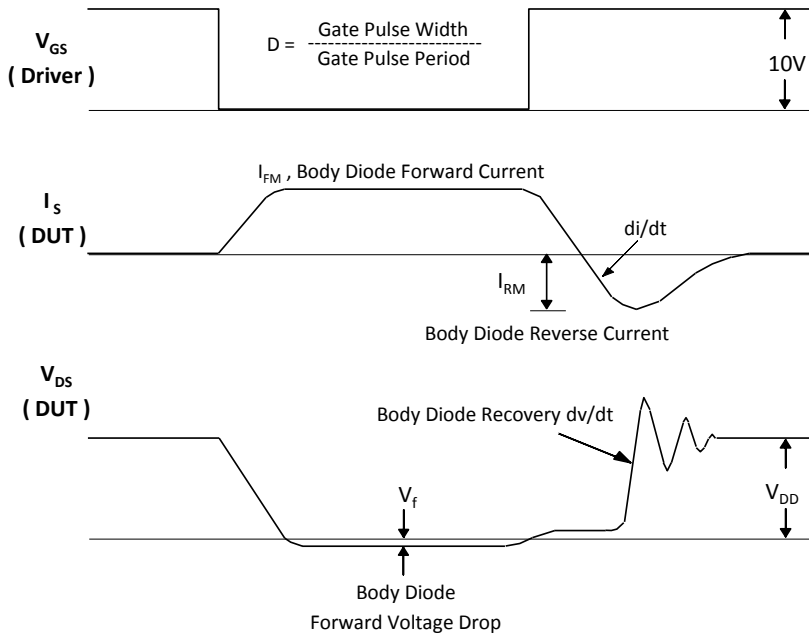
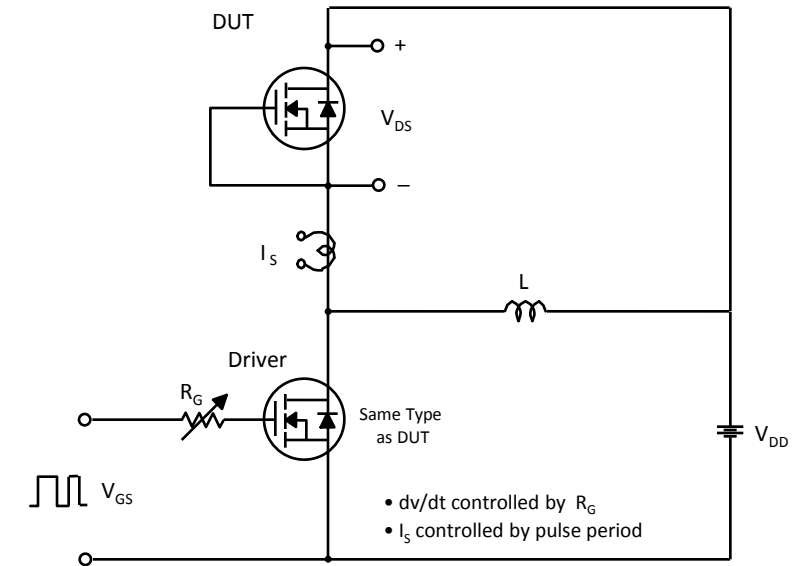


Gate Charge Test Circuit & Waveform



Unclamped Inductive Switching Test Circuit & Waveforms

Characteristics Test Circuit & Waveform (continued)



Peak Diode Recovery dv/dt Test Circuit & Waveforms