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FQP20N50/FQPF20N50

500V, 20A N-Channel MOSFET

General Description

The FQP20N50 & FQPF20N50 have been fabricated using an advanced high voltage MOSFET process that is designed to deliver high levels of performance and robustness in popular AC-DC applications.

By providing low $R_{DS(on)}$, C_{iss} and C_{rss} along with guaranteed avalanche capability these parts can be adopted quickly into new and existing offline power supply designs.

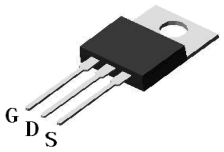
Product Summary

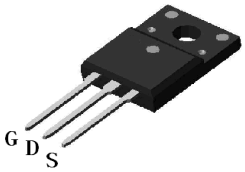
V_{DS}	500V@150℃
I_D (at V_{GS}=10V)	20A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 0.35Ω

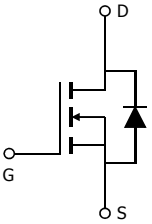
100% UIS Tested

100% R_g Tested

RoHS Compliant







Symbol	Parameter	Value	Units
V_{DSS}	Drain-Source Voltage	500	V
I_D	Drain Current - Continuous (T_C=25°C)	20	A
	- Continuous (T_C=100°C)	13*	A
I_{DM}	Drain Current - Pulsed (Note 1)	80*	A
V_{GSS}	Gate-Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	1150	mJ
I_{AR}	Avalanche Current (Note 1)	20	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	85	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5	V/ns
P_D	Power Dissipation (T_C=25°C)	36.5	W
	- Derate above 25°C	0.29	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

* Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	3.42	°C/W
$R_{\theta JS}$	Thermal Resistance, Case-to-Sink Typ.	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	44.2	°C/W

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Electrical Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0 V, I_D=250 μA	500			V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D=250 μA, Referenced to 25°C		0.47		V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=500 V, V_{GS}=0 V			1	μA
		V_{DS}=400 V, T_C=125°C			10	μA
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
On Characteristics						
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_D=250 uA	2.0		4.0	V
$R_{DS(On)}$	Drain-Source On-state Resistance	V_{GS}=10 V, I_D=10 A, T_J=25°C		0.25	0.35	Ω
g_{FS}	Forward Transconductance	V_{DS}=40 V, I_D=10 A (Note 4)		16.6		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS}=25 V, V_{GS}=0 V, f=1.0 MHz		3649		pF
C_{oss}	Output Capacitance			353		pF
C_{rss}	Reverse Transfer Capacitance			16.6		pF
Switching Characteristics						
$t_{d(on)}$	Turn On Delay Time	V_{DD}=250 V, I_D=20 A, R_G=25 Ω (Note 4, 5)		43		ns
t_r	Rising Time			64		ns
$t_{d(off)}$	Turn Off Delay Time			216		ns
t_f	Fall Time			71		ns
Q_g	Total Gate Charge	V_{DS}=400 V, I_D=20 A, V_{GS}=10 V (Note 4, 5)		84.6		nC
Q_{gs}	Gate-Source Charge			20.3		nC
Q_{gd}	Gate-Drain Charge			32.5		nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current				20	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current				80	A
V_{SD}	Diode Forward Voltage	V_{GS}=0 V, I_S=20 A			1.4	V
t_{rr}	Reverse Recovery Time	V_{GS}=0 V, I_S=20 A, dI_F / dt=100 A/μs Note 4)		425		ns
Q_{rr}	Reverse Recovery Charge			5.3		μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L=5.75 mH, I_{AS}=20A, V_{DD}=50V, R_G=25Ω, Starting T_J=25°C
3. I_{SD}≤20A, di/dt ≤200A/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

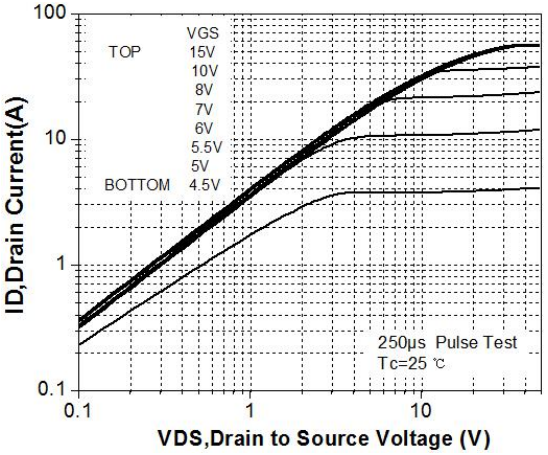


Figure 1. On-Region Characteristics

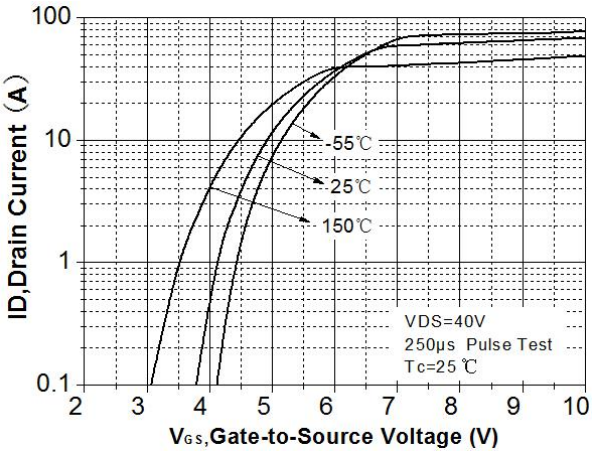


Figure 2. Transfer Characteristics

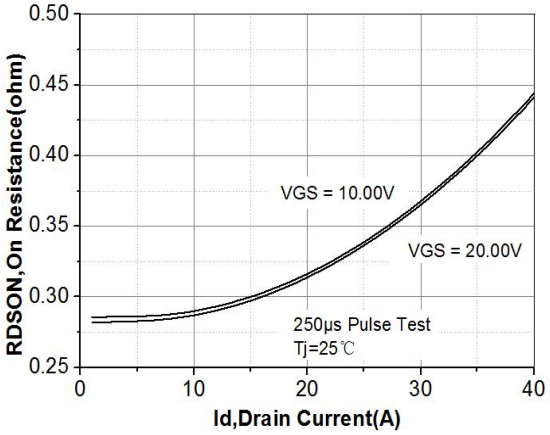


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

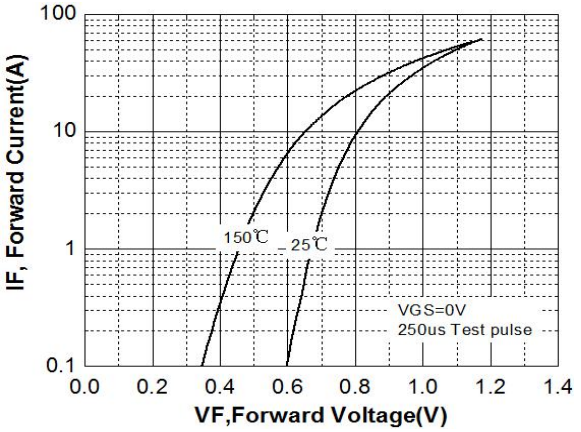


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

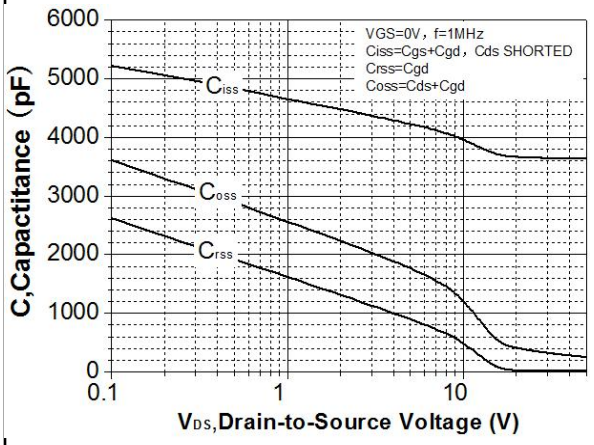


Figure 5. Capacitance Characteristics

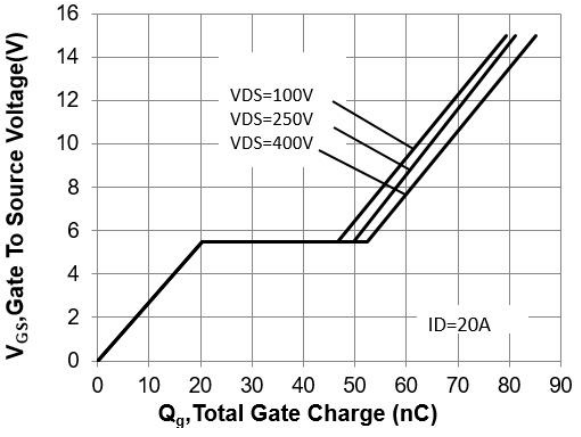


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

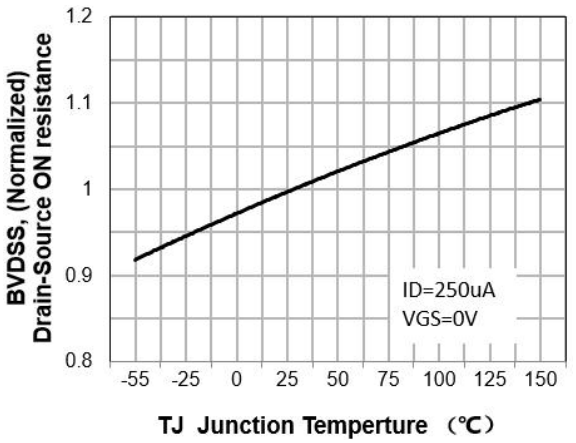


Figure 7. Breakdown Voltage Variation vs Temperature

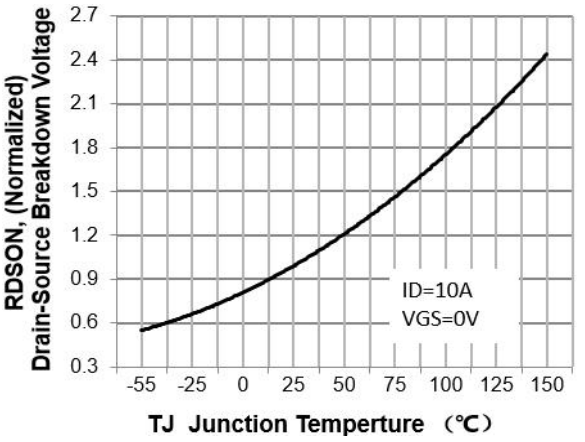


Figure 8. On-Resistance Variation vs Temperature

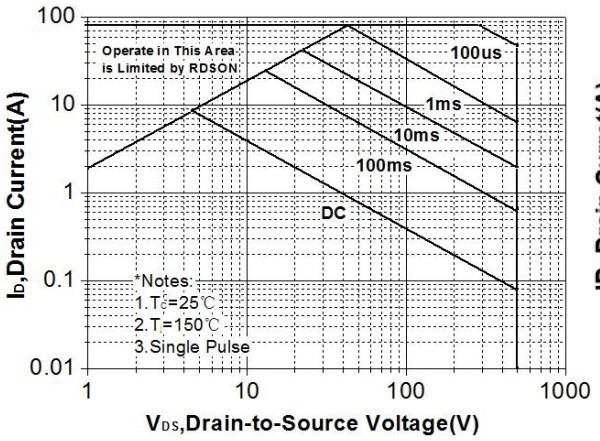


Figure 9. Maximum Safe Operating Area

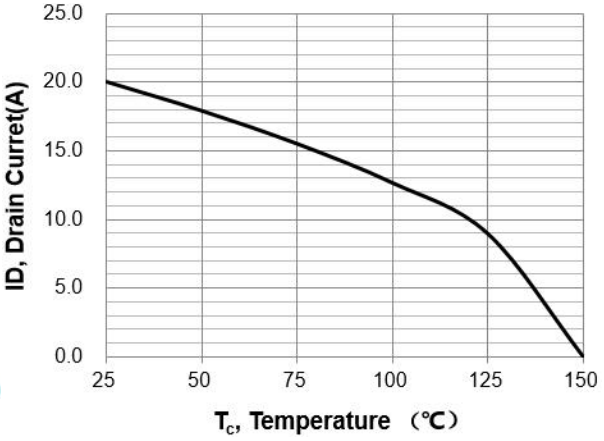


Figure 10. Maximum Drain Current vs Case Temperature

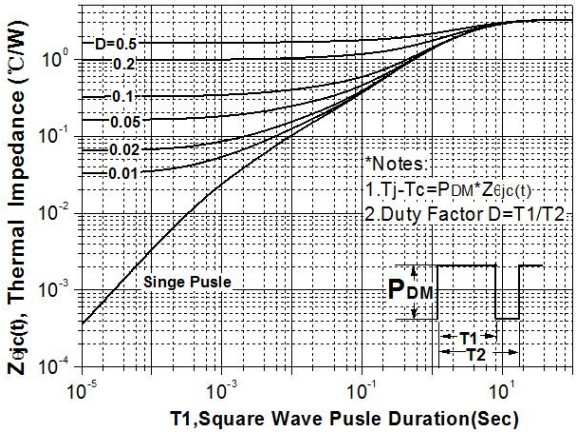
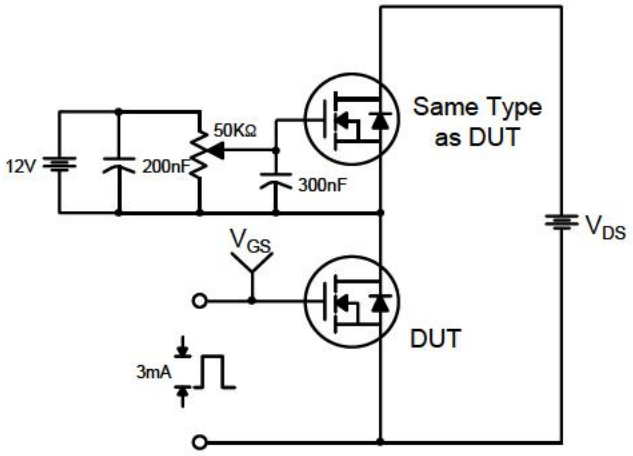
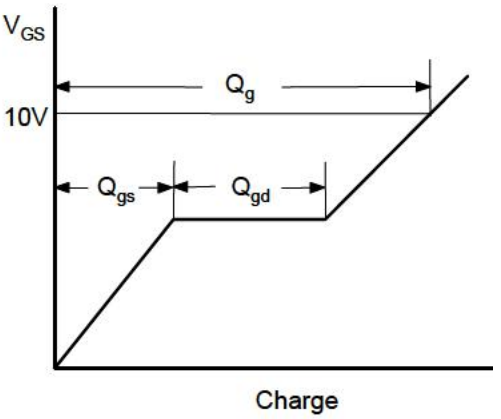


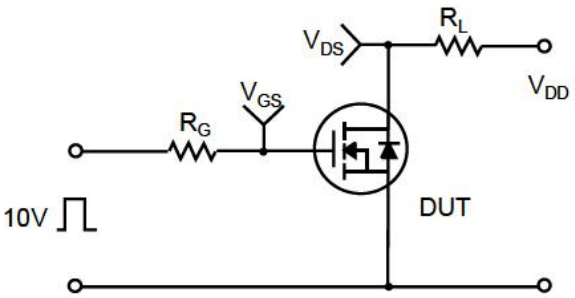
Figure 11. Transient Thermal Response Curve

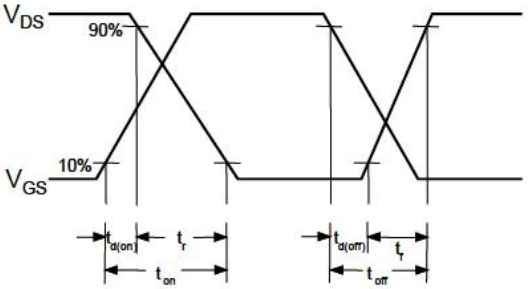
Gate Charge Test Circuit & Waveform



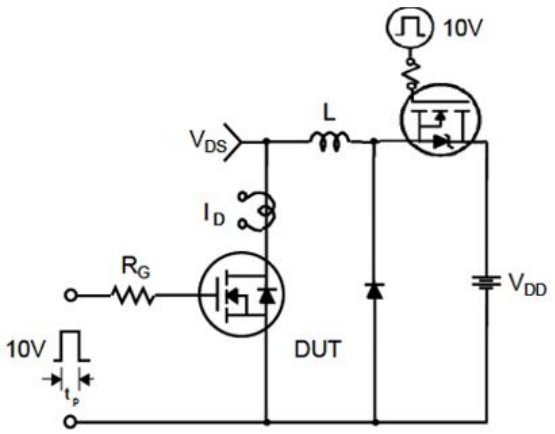


Resistive Switching Test Circuit & Waveforms

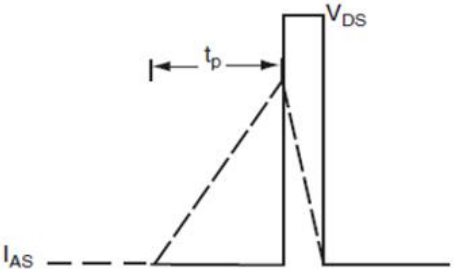




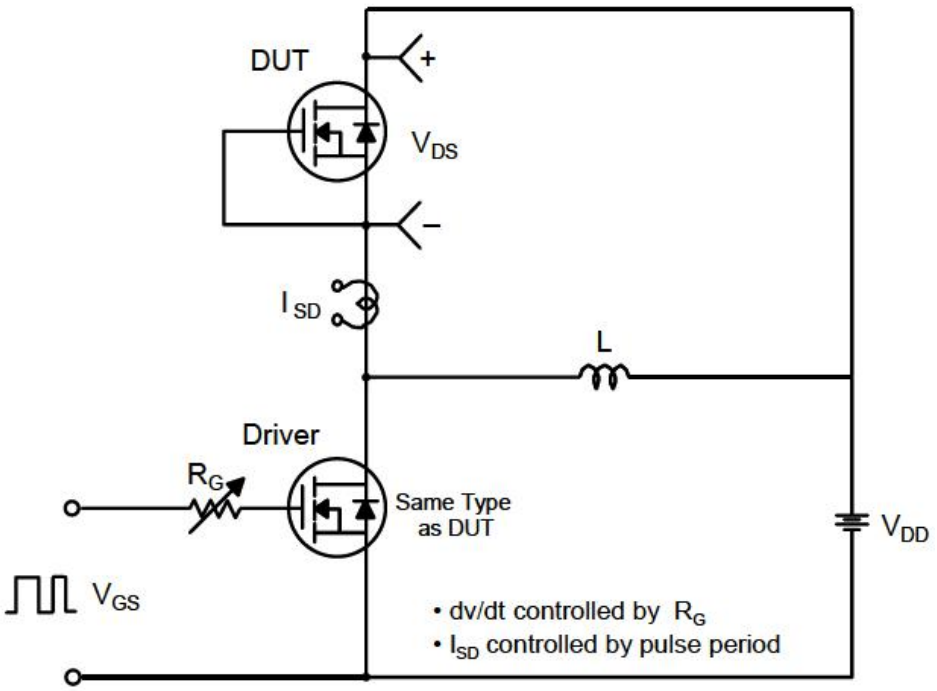
Unclamped Inductive Switching Test Circuit & Waveforms

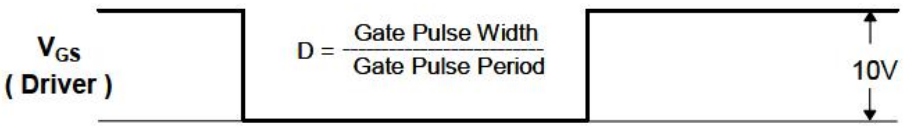


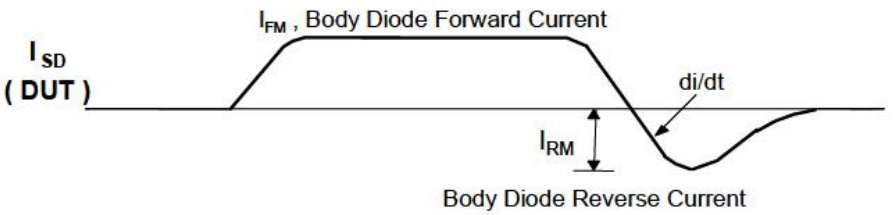
$$E_{AS} = \frac{1}{2} L I_{AS}^2$$

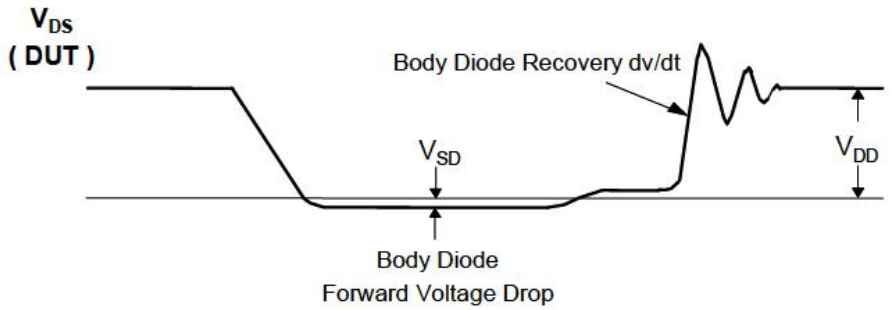


Peak Diode Recovery dv/dt Test Circuit & Waveforms









Package Dimensions

TO220F