



FQP12N65/FQPF12N65

650V, 12A N-Channel MOSFET

General Description

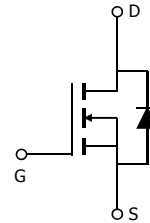
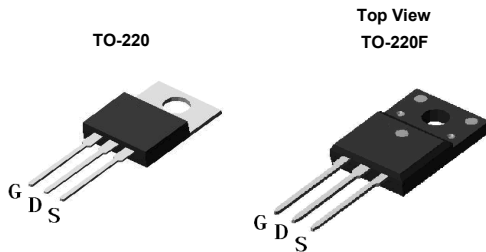
The FQP12N65 & FQPF12N65 have been fabricated using an advanced high voltage MOSFET process that is designed to deliver high levels of performance and robustness in popular AC-DC applications.

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}	750V@150°C
I_D (at $V_{GS}=10V$)	12A
$R_{DS(ON)}$ (at $V_{GS}=10V$)	< 0.72Ω

100% UIS Tested
100% R_g Tested



Orderable Part Number	Package Type	Form	Minimum Order Quantity
FQP12N65	TO-220 Pb Free	Tube	1000
FQPF12N65L	TO-220F	Tube	1000
FQB12N65L	TO-263 Green	Tape & Reel	800

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	FQP12N65	FQB12N65	FQPF12N65	Units	
Drain-Source Voltage	V_{DS}	650			V	
Gate-Source Voltage	V_{GS}	±30			V	
Continuous Drain Current	I_D	$T_C=25^\circ\text{C}$	12	12*	A	
		$T_C=100^\circ\text{C}$	7.7	7.7*		
Pulsed Drain Current ^C	I_{DM}	48			A	
Avalanche Current ^C	I_{AR}	5			A	
Repetitive avalanche energy ^C	E_{AR}	375			mJ	
Single pulsed avalanche energy ^G	E_{AS}	750			mJ	
MOSFET dv/dt ruggedness	dv/dt	30			V/ns	
Peak diode recovery dv/dt		5				
Power Dissipation ^B	P_D	$T_C=25^\circ\text{C}$	278	50	40	W
		Derate above 25°C	2.2	0.4	0.3	W/°C
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150			°C	
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds	T_L	300			°C	

Thermal Characteristics

Parameter	Symbol	FQP12N65	FQB12N65	FQPF12N65	Units
Maximum Junction-to-Ambient ^{A,D}	$R_{\theta JA}$	65	65	65	°C/W
Maximum Case-to-sink ^A	$R_{\theta CS}$	0.5	--	--	°C/W
Maximum Junction-to-Case	$R_{\theta JC}$	0.45	2.5	3.1	°C/W

* Drain current limited by maximum junction temperature.

Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV _{DSS}	Drain-Source Breakdown Voltage	I _D =250μA, V _{GS} =0V, T _J =25°C	650			V
		I _D =250μA, V _{GS} =0V, T _J =150°C		750		
BV _{DSS} /ΔT _J	Breakdown Voltage Temperature Coefficient	I _D =250μA, V _{GS} =0V		0.72		V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =650V, V _{GS} =0V			1	μA
		V _{DS} =520V, T _J =125°C			10	
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} =±30V			±100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =5V, I _D =250μA	3	3.9	4.5	V
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =6A		0.57	0.72	Ω
g _{FS}	Forward Transconductance	V _{DS} =40V, I _D =6A		17		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.71	1	V
I _S	Maximum Body-Diode Continuous Current				12	A
I _{SM}	Maximum Body-Diode Pulsed Current				48	A
DYNAMIC PARAMETERS						
C _{ISS}	Input Capacitance	V _{GS} =0V, V _{DS} =25V, f=1MHz	1430	1792	2150	pF
C _{OSS}	Output Capacitance		120	152	185	pF
C _{RSS}	Reverse Transfer Capacitance		9	11.5	18	pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz	1.7	3.5	5.3	Ω
SWITCHING PARAMETERS						
Q _g	Total Gate Charge	V _{GS} =10V, V _{DS} =520V, I _D =12A	32	39.8	48	nC
Q _{gs}	Gate Source Charge		7.5	9.2	11	nC
Q _{gd}	Gate Drain Charge		13.5	16.8	20	nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =325V, I _D =12A, R _G =25Ω		36		ns
t _r	Turn-On Rise Time			77		ns
t _{D(off)}	Turn-Off DelayTime			120		ns
t _f	Turn-Off Fall Time			63		ns
t _{rr}	Body Diode Reverse Recovery Time		I _F =12A, dI/dt=100A/μs, V _{DS} =100V	300	375	450
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =12A, dI/dt=100A/μs, V _{DS} =100V	6	7.5	9	μC

A. The value of R_{θJA} is measured with the device in a still air environment with T_A=25° C.

B. The power dissipation P_D is based on T_{J(MAX)}=150° C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Repetitive rating, pulse width limited by junction temperature T_{J(MAX)}=150° C, Ratings are based on low frequency and duty cycles to keep initial T_J=25° C.

D. The R_{θJA} is the sum of the thermal impedance from junction to case R_{θJC} and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300 μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T_{J(MAX)}=150° C. The SOA curve provides a single pulse rating.

G. L=60mH, I_{AS}=5A, V_{DD}=150V, R_G=25Ω, Starting T_J=25° C

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

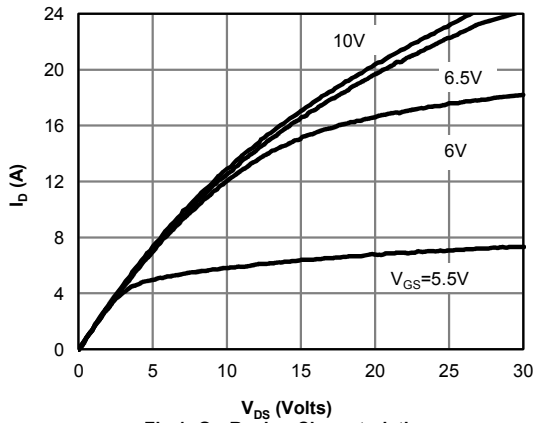


Fig 1: On-Region Characteristics

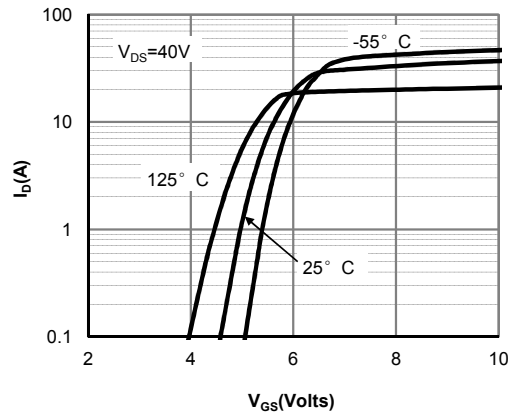


Figure 2: Transfer Characteristics

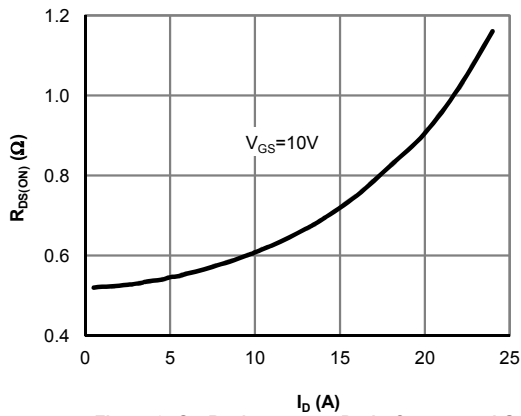


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

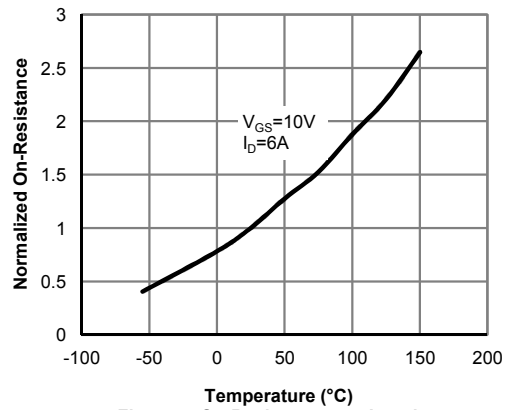


Figure 4: On-Resistance vs. Junction Temperature

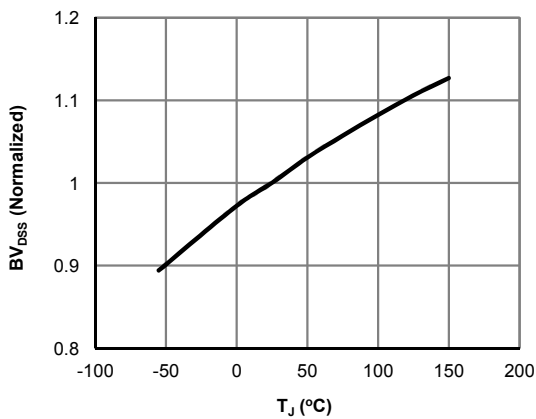


Figure 5: Break Down vs. Junction Temperature

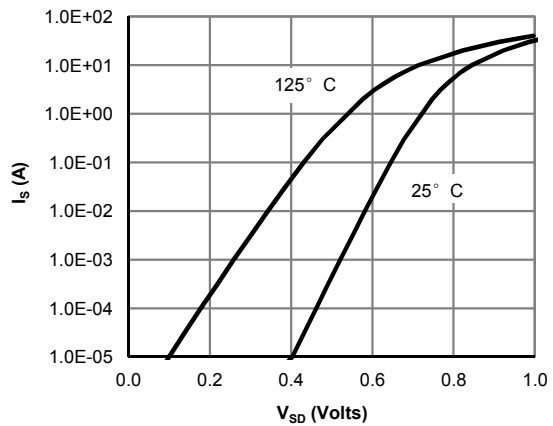


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

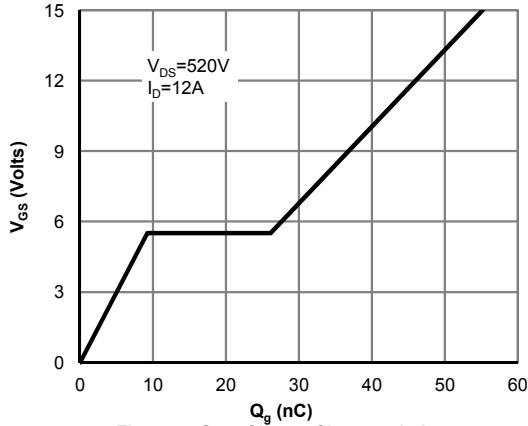


Figure 7: Gate-Charge Characteristics

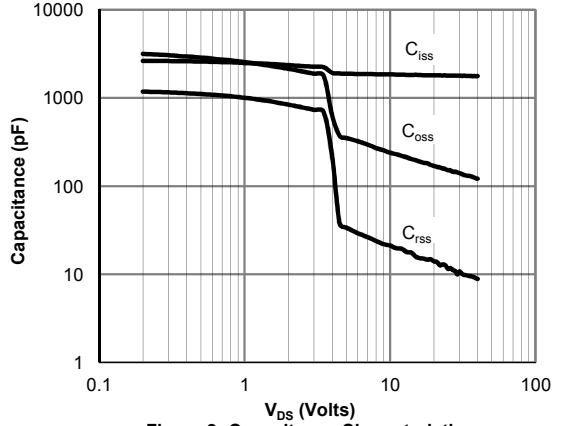


Figure 8: Capacitance Characteristics

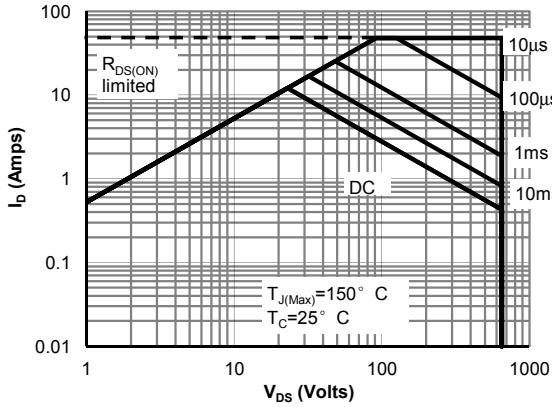


Figure 9: Maximum Forward Biased Safe Operating Area for AOT(B)12N65 (Note F)

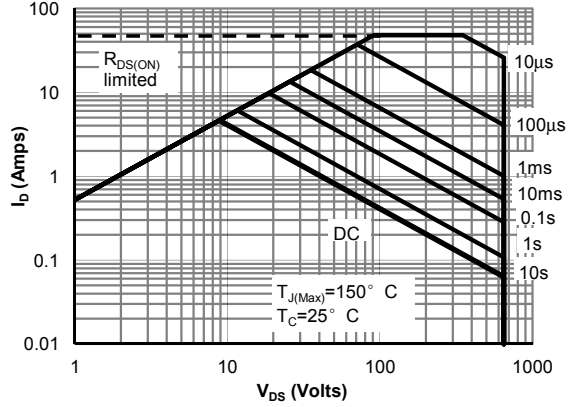


Figure 10: Maximum Forward Biased Safe Operating Area for AOTF12N65 (Note F)

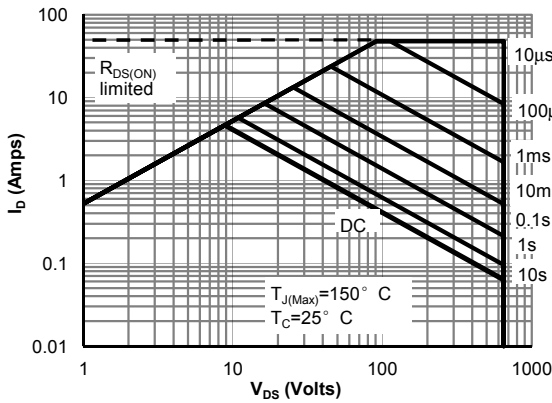


Figure 11: Maximum Forward Biased Safe Operating Area for AOTF12N65L (Note F)

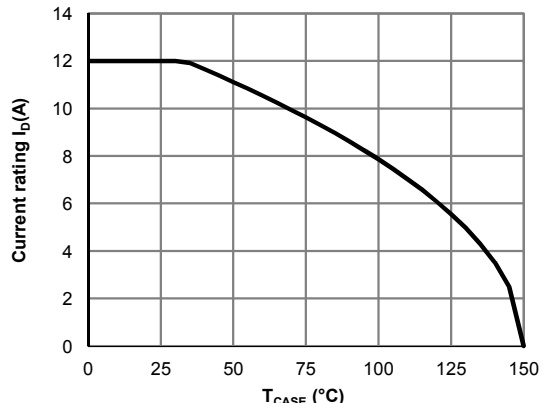


Figure 12: Current De-rating (Note B)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

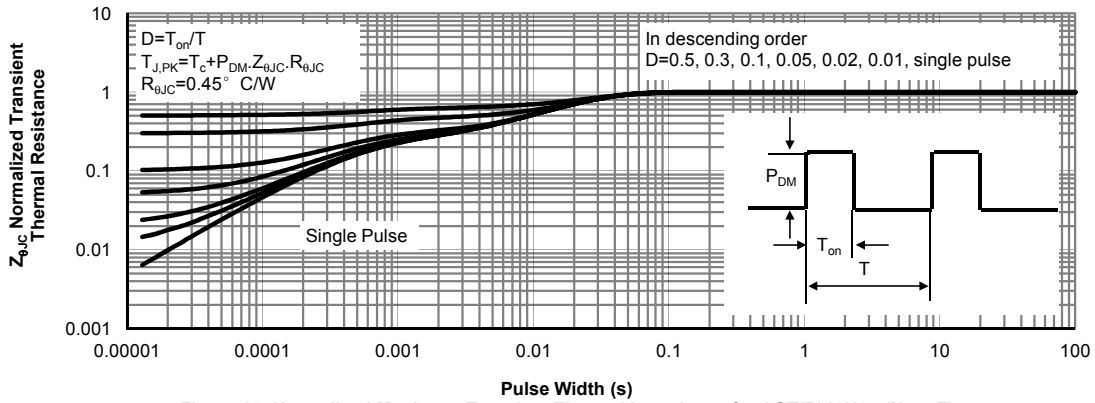


Figure 13: Normalized Maximum Transient Thermal Impedance for AOT(B)12N65 (Note F)

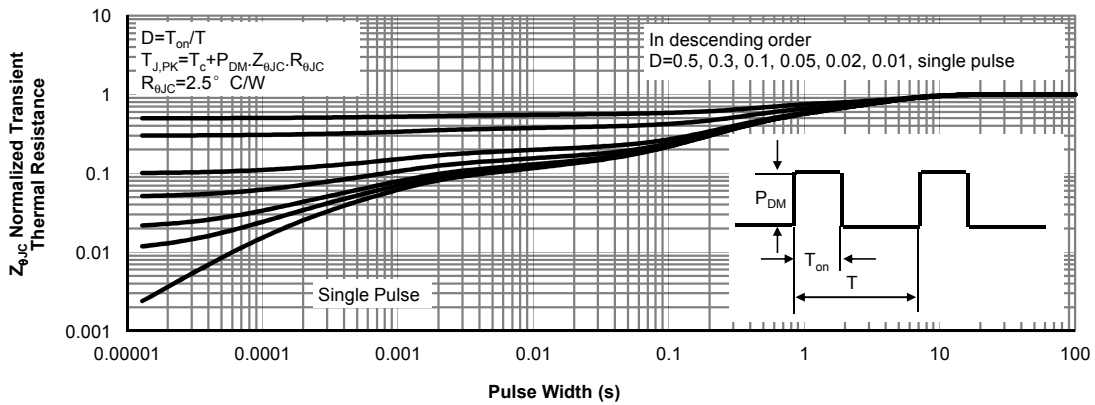


Figure 14: Normalized Maximum Transient Thermal Impedance for AOTF12N65 (Note F)

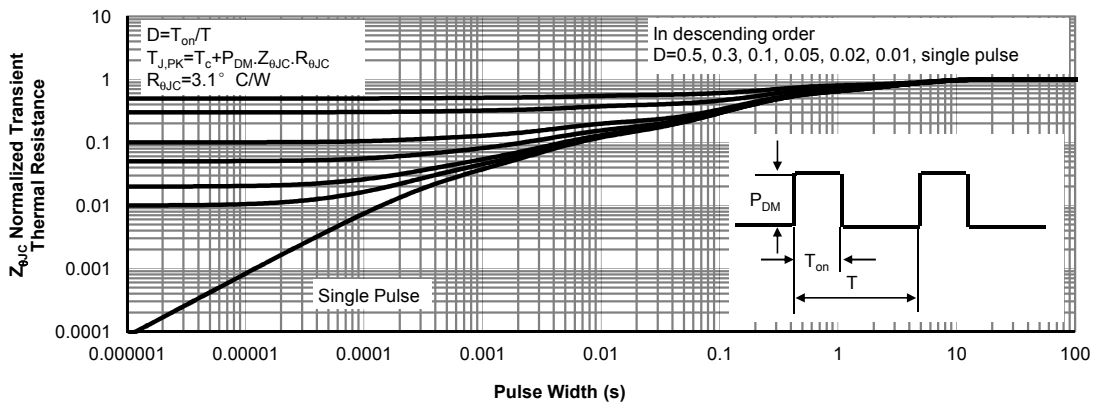
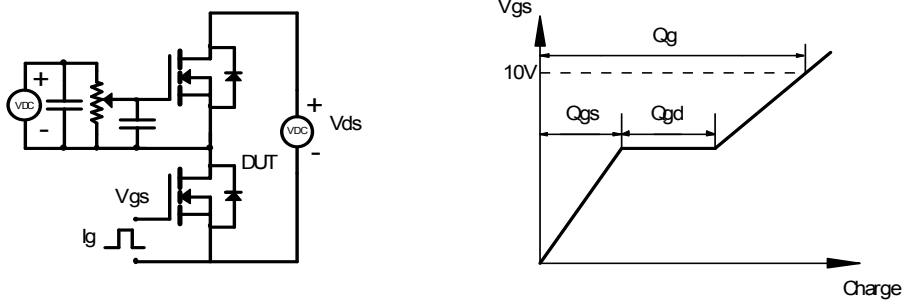
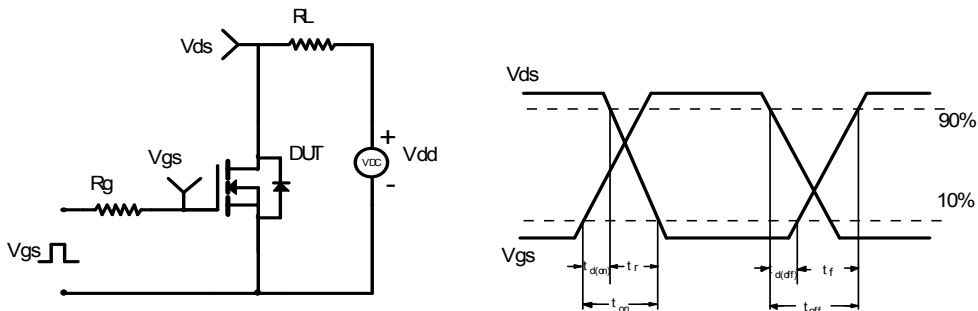


Figure 15: Normalized Maximum Transient Thermal Impedance for AOTF12N65L (Note F)

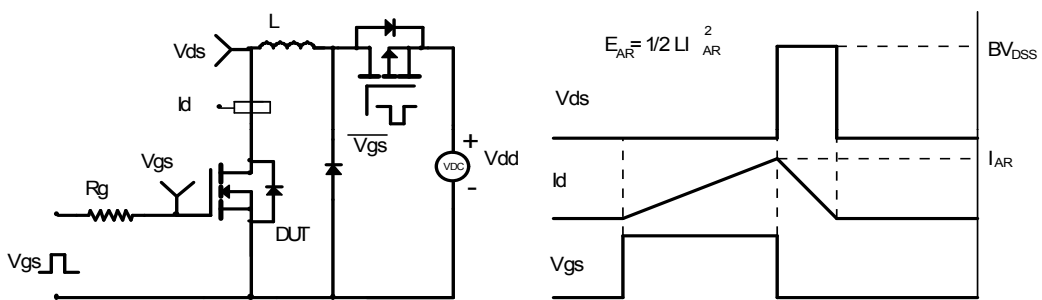
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

