

4 Amps, 650 Volt N-CHANNEL POWER MOSFET

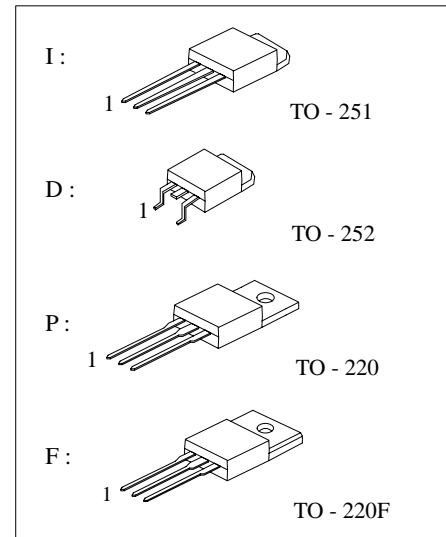
Power MOSFET

■ DESCRIPTION

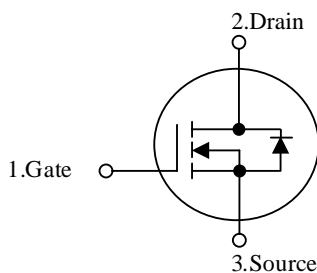
The FTK4N65 is a high voltage MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

■ FEATURES

- * $R_{DS(ON)} = 2.7\Omega @ V_{GS} = 10V$
- * Ultra low gate charge (typical 12 nC)
- * Low reverse transfer Capacitance ($C_{RSS} =$ typical 6.5 pF)
- * Fast switching capability
- * Avalanche energy Specified
- * Improved dv/dt capability, high ruggedness



■ SYMBOL



■ ORDERING INFORMATION

Ordering Number	Package	Pin Assignment			Packing
		1	2	3	
FTK4N65P	TO-220	G	D	S	Tube
FTK4N65F	TO-220F	G	D	S	Tube
FTK4N65I	TO-251	G	D	S	Tube
FTK4N65D	TO-252	G	D	S	Tape Reel

Note: Pin Assignment: G: Gate D: Drain S: Source



FTK4N65P/F/D/I

■ ABSOLUTE MAXIMUM RATINGS (T_C = 25°C, unless otherwise specified)

PARAMET		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V _{DSS}	650	V
Gate-Source Voltage		V _{GSS}	±30	V
Avalanche Current (Note 1)		I _{AR}	4.4	A
Continuous Drain Current	T _C = 25°C	I _D	3.6	A
	T _C = 100°C		2.3	
Pulsed Drain Current (Note 1)		I _{DM}	16	A
Avalanche Energy	Single Pulse(Note 2)	E _{AS}	150	mJ
	Repetitive Limited by T _{J(MAX)}	E _{AR}	7.0	mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5	V/ns
Total Power Dissipation (TO-251/252/TO-220F/220)	T _C =25°C	P _D	45/45/31/62.5	W
		Derate above 25°C	0.36/0.36/0.25/0.5	W
Junction Temperature		T _J	+150	°C
Operating Temperature		T _{OPR}	-55 ~ +150	°C
Storage Temperature		T _{STG}	-55 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.
Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ ELECTRICAL CHARACTERISTICS (T_C = 25°C, unless Otherwise specified.)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
OFF CHARACTERISTICS								
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} = 0V, I _D = 250μA	650			V	
Drain-Source Leakage Current		I _{DSS}	V _{DS} = 600V, V _{GS} = 0V			1	μA	
			V _{DS} = 480V, T _C = 125°C			10	μA	
Gate-Source Leakage Current	Forward	I _{GSS}	V _{GS} = 30V, V _{DS} = 0V			100	nA	
	Reverse		V _{GS} = -30V, V _{DS} = 0V			-100	nA	
Breakdown Voltage Temperature Coefficient		ΔBV _{DSS} / ΔT _J	I _D = 250μA, Referenced to 25°C		0.7		V / °C	
ON CHARACTERISTICS								
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} = V _{GS} , I _D = 250μA	2.0		4.0	V	
Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} = 10V, I _D = 2.0A			2.7	Ω	
Forward Transconductance		g _{FS}	V _{DS} = 50V, I _D = 2.0A (Note 4)		1.9		S	
DYNAMIC CHARACTERISTICS								
Input Capacitance		C _{ISS}	V _{DS} = 25V, V _{GS} = 0V, f = 1.0MHz		510		pF	
Output Capacitance		C _{OSS}				60		pF
Reverse Transfer Capacitance		C _{RSS}				6.5		pF
SWITCHING CHARACTERISTICS								
Turn-On Delay Time		t _{D(ON)}	V _{DD} = 325V, I _D = 3.6A, R _G = 25Ω (Note 4,5)		20		ns	
Turn-On Rise Time		t _r				15		ns
Turn-Off Delay Time		t _{D(OFF)}				45		ns
Turn-Off Fall Time		t _f				15		ns
Total Gate Charge		Q _G	V _{DS} = 520V, I _D = 3.6A, V _{GS} = 10V (Note 4,5)		12		nC	
Gate-Source Charge		Q _{GS}				2.5		nC
Gate-Drain Charge		Q _{GD}				5.0		nC



■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS						
Drain-Source Diode Forward Voltage	V_{SD}	$V_{GS} = 0 \text{ V}, I_S = 4.0 \text{ A}$			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	I_S				3.6	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}				14.4	A
Reverse Recovery Time	t_{RR}	$V_{GS} = 0 \text{ V}, I_S = 4.0 \text{ A},$		350		ns
Reverse Recovery Charge	Q_{RR}	$di_F/dt = 100 \text{ A}/\mu\text{s}$ (Note 4)		2.1		μC

Note:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $L = 15\text{mH}, I_{AS}=3.6\text{A}, V_{DD} = 50\text{V}, R_G = 25 \Omega,$ Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 7\text{A}, di/dt \leq 300\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS},$ 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

TEST CIRCUITS AND WAVEFORMS

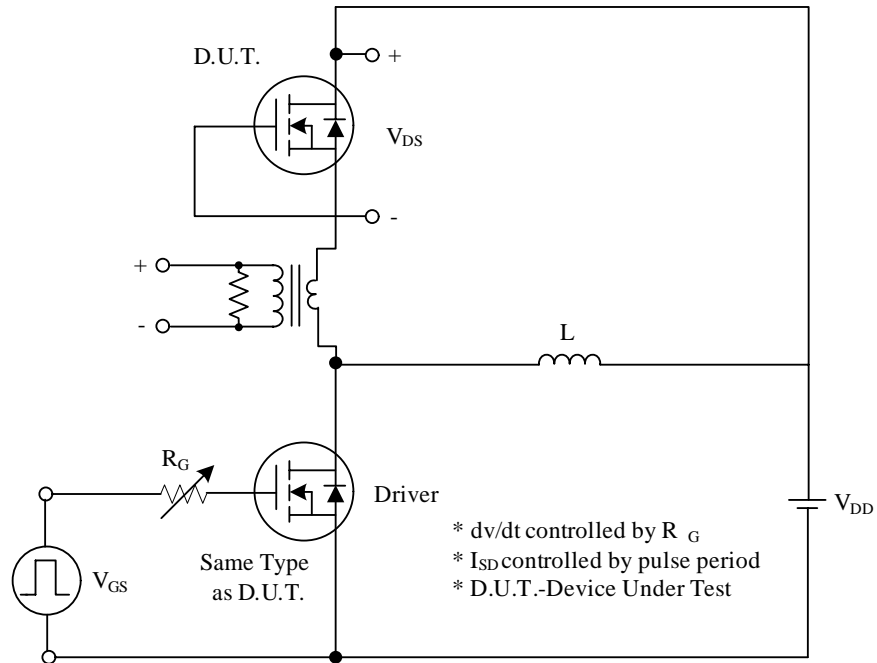


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

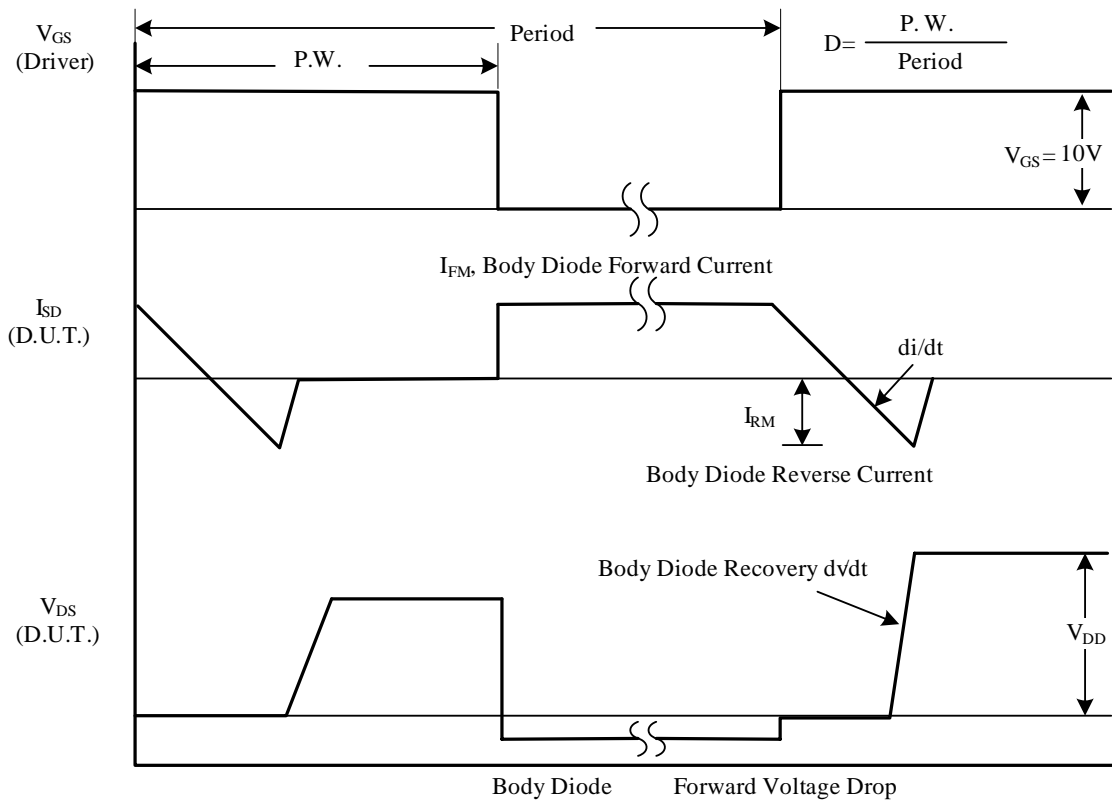


Fig. 1B Peak Diode Recovery dv/dt Waveforms

TEST CIRCUITS AND WAVEFORMS (Cont.)

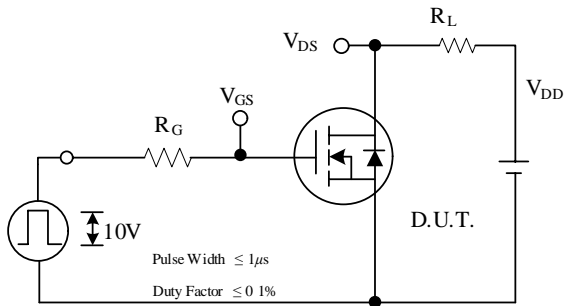


Fig. 2A Switching Test Circuit

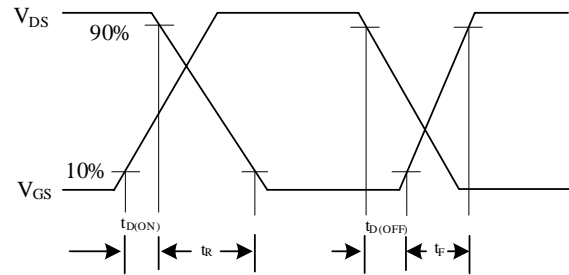


Fig. 2B Switching Waveforms

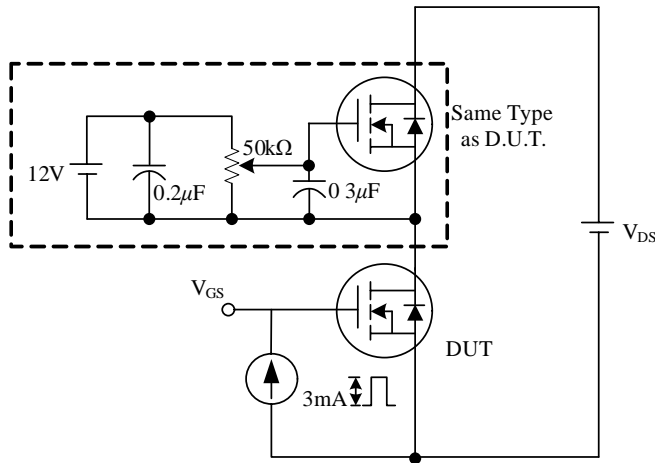


Fig. 3A Gate Charge Test Circuit

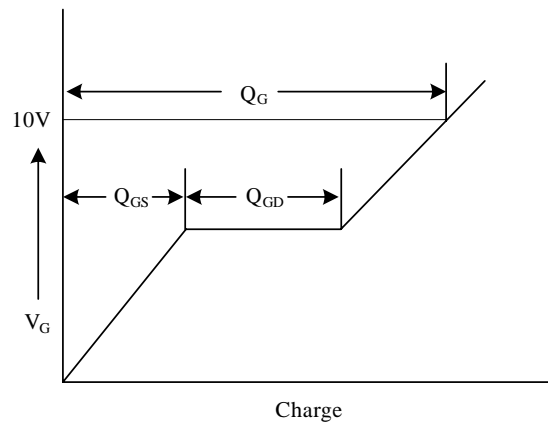


Fig. 3B Gate Charge Waveform

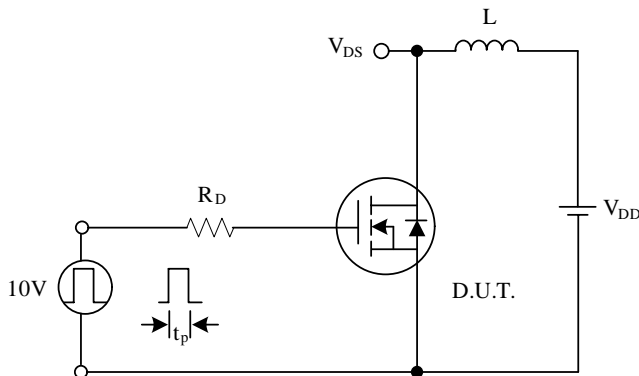


Fig. 4A Unclamped Inductive Switching Test Circuit

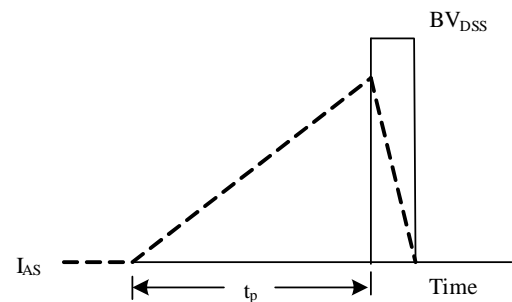


Fig. 4B Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS

Fig1. $I_D - V_{DS}$

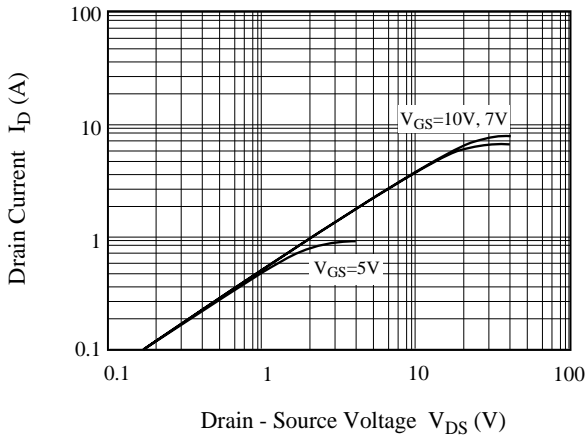


Fig2. $I_D - V_{GS}$

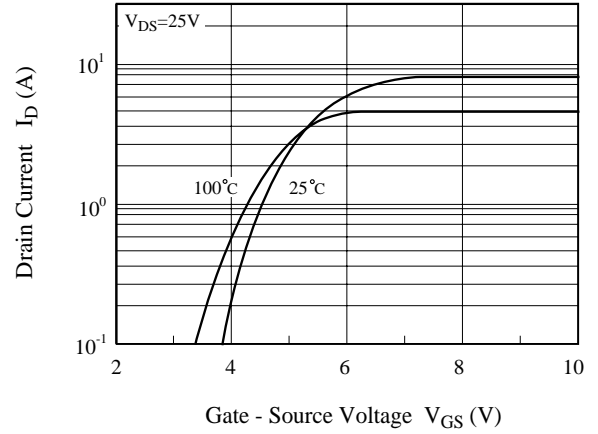


Fig3. $BV_{DSS} - T_j$

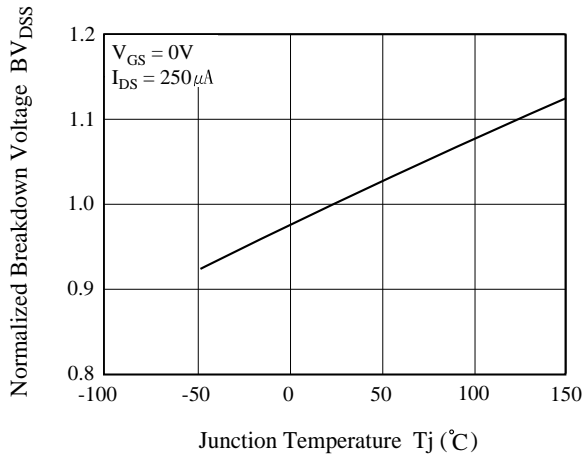


Fig4. $R_{DS(ON)} - I_D$

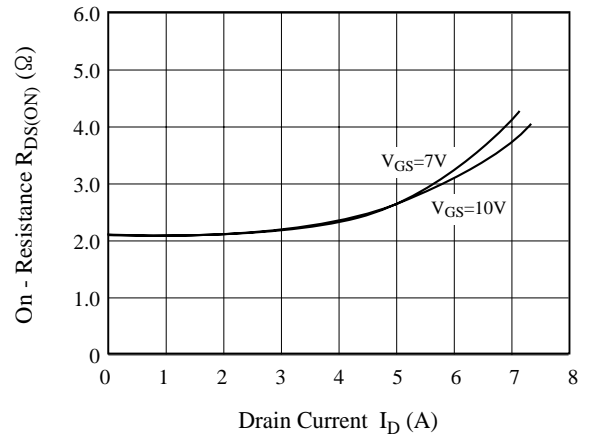


Fig5. $I_S - V_{SD}$

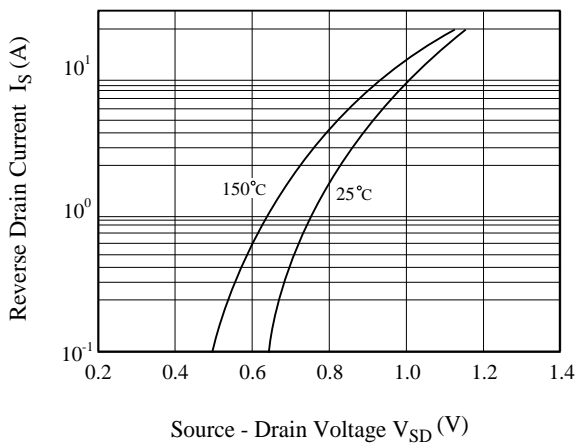
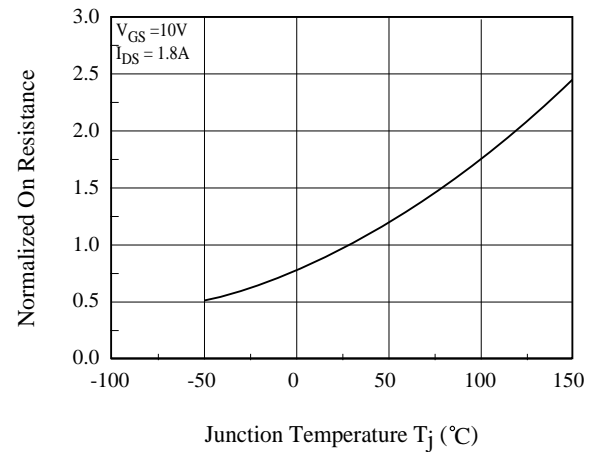


Fig6. $R_{DS(ON)} - T_j$



■ TYPICAL CHARACTERISTICS(Cont.)

Fig 7. C - V_{DS}

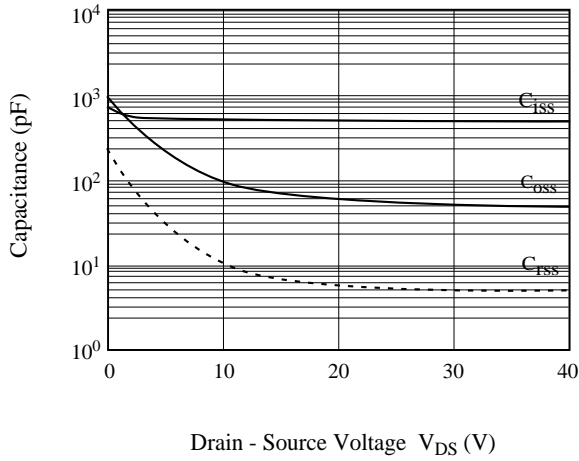


Fig8. Q_g - V_{GS}

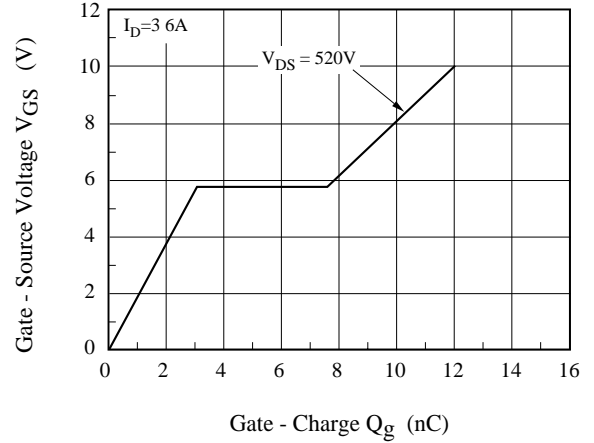


Fig9. Safe Operation Area

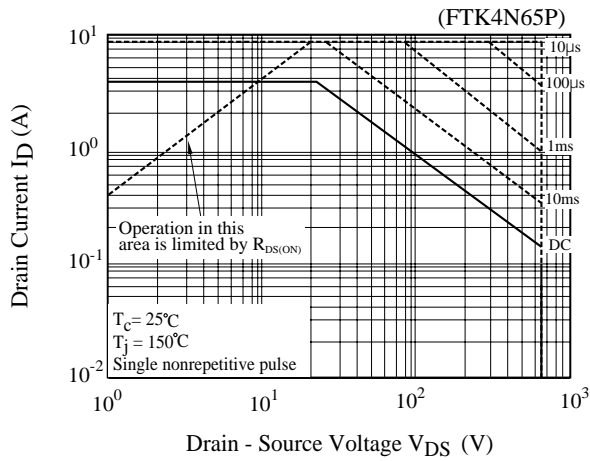


Fig10. Safe Operation Area

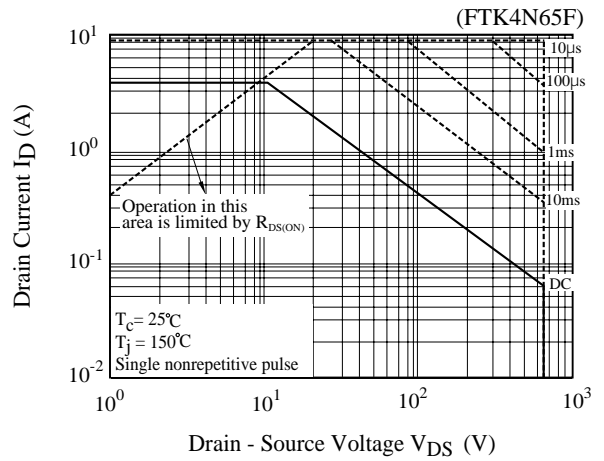


Fig11. I_D - T_j

