



TX4N65FA9R

Silicon N-Channel Power MOSFET

General Description

TX4N65FA9R, the silicon N-channel Enhanced VDMOSFET, is obtained by the self-aligned planar Technology which reduce the conduction loss, improve switching performance and enhance the avalanche energy. The transistor can be used in various power switching circuit for system miniaturization and higher efficiency. The package form is TO-220F, which accords with the RoHS standard.

Features

- Fast Switching
- ESD Improved Capability
- Low ON Resistance(Typical Data:1.9Ω)
- Low Gate Charge (Typical Data:14.5nC)
- Low Reverse transfer capacitances(Typical:8.5pF)
- 100% Single Pulse avalanche energy Test

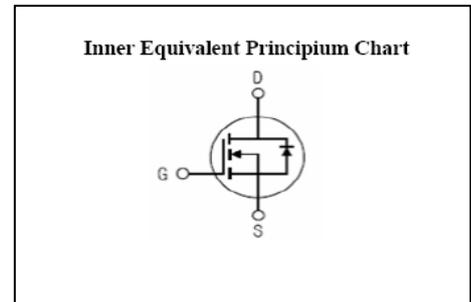
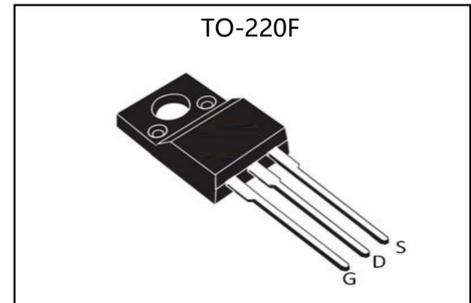
Applications

- Power switch circuit of adaptor and charger

Absolute (Tc= 25°C unless otherwise specified)

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	650	V
I_D	Continuous Drain Current	4	A
	Continuous Drain Current $T_C = 100\text{ }^\circ\text{C}$	3.2	A
I_{DM}^{a1}	Pulsed Drain Current	16	A
V_{GS}	Gate-to-Source Voltage	± 30	V
E_{AS}^{a2}	Single Pulse Avalanche Energy	280	mJ
dv/dt^{a3}	Peak Diode Recovery dv/dt	5.0	V/ns
P_D	Power Dissipation	30	W
	Derating Factor above 25°C	0.24	W/°C
T_J, T_{stg}	Operating Junction and Storage Temperature Range	150, -55 to 150	°C
T_L	Maximum Temperature for Soldering	300	°C

$V_{DSS}(T_C=150^\circ\text{C})$	650	V
I_D	4	A
$P_D(T_C=25^\circ\text{C})$	30	W
$R_{DS(ON)typ}$	1.9	Ω





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Electrical Characteristics (Tc= 25°C unless otherwise specified)

OFF Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
V _{DSS}	Drain to Source Breakdown Voltage	V _{GS} =0V, I _D =250μA	650	--	--	V
ΔBV _{DSS} /ΔT _J	Bvdss Temperature Coefficient	I _D =250uA, Reference 25°C	--	0.67	--	V/°C
I _{DSS}	Drain to Source Leakage Current	V _{DS} =650V, V _{GS} =0V, T _a =25°C	--	--	1	μA
		V _{DS} =520V, V _{GS} =0V, T _a =125°C	--	--	100	
I _{GSS(F)}	Gate to Source Forward Leakage	V _{GS} = +30V	--	--	1	μA
I _{GSS(R)}	Gate to Source Reverse Leakage	V _{GS} = -30V	--	--	-1	μA

ON Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
R _{DS(ON)}	Drain-to-Source On-Resistance	V _{GS} =10V, I _D =2.0A	--	1.9	2.4	Ω
V _{GS(TH)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	2.0	--	4.0	V
Pulse width tp ≤ 300μs, δ ≤ 2%						

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
g _{fs}	Forward Transconductance	V _{DS} =15V, I _D =2.0A	--	3.5	--	S
C _{iss}	Input Capacitance	V _{GS} =0V V _{DS} =25V f=1.0MHz	--	544	--	pF
C _{oss}	Output Capacitance		--	55	--	
C _{rss}	Reverse Transfer Capacitance		--	8.5	--	

Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
t _{d(ON)}	Turn-on Delay Time	I _D =4.0A, V _{DD} =325V R _g =4.7Ω	--	10	--	ns
t _r	Rise Time		--	11	--	
t _{d(OFF)}	Turn-Off Delay Time		--	31	--	
t _f	Fall Time		--	14	--	
Q _g	Total Gate Charge	I _D =4.0A, V _{DD} =325V V _{GS} =10V	--	13	--	nC
Q _{gs}	Gate to Source Charge		--	3.4	--	
Q _{gd}	Gate to Drain ("Miller") Charge		--	2.7	--	



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Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)		--	--	4	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	16	A
V_{SD}	Diode Forward Voltage	$I_S=4.0A, V_{GS}=0V$	--	--	1.5	V
t_{rr}	Reverse Recovery Time	$I_S=4.0A, T_J=25^\circ C$	--	430	--	ns
Q_{rr}	Reverse Recovery Charge	$di_F/dt=100A/us, V_{GS}=0V$	--	1270	--	μC
Pulse width $t_p \leq 380\mu s, \delta \leq 2\%$						

Thermal Characteristics

Symbol	Parameter	Typ.	Units
$R_{\theta JC}$	Junction-to-Case	4.17	$^\circ C/W$
$R_{\theta JA}$	Junction-to-Ambient	100	$^\circ C/W$

^{a1}: Repetitive rating; pulse width limited by maximum junction temperature

^{a2}: $L=10.0mH, I_D=7.6A, Start T_J=25^\circ C$

^{a3}: $I_{SD}=4A, di/dt \leq 100A/us, V_{DD} \leq BV_{DS}, Start T_J=25^\circ C$



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Characteristics Curves

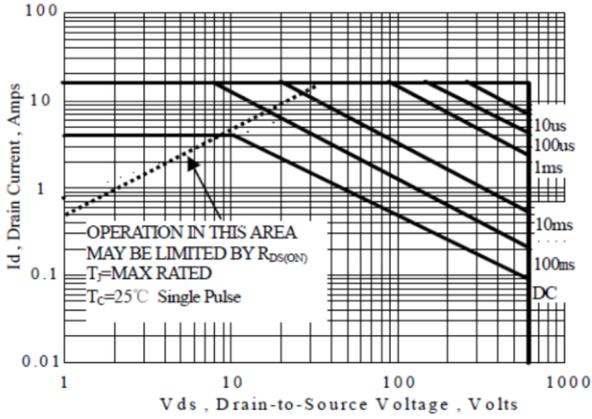


Figure 1 Maximum Forward Bias Safe Operating Area

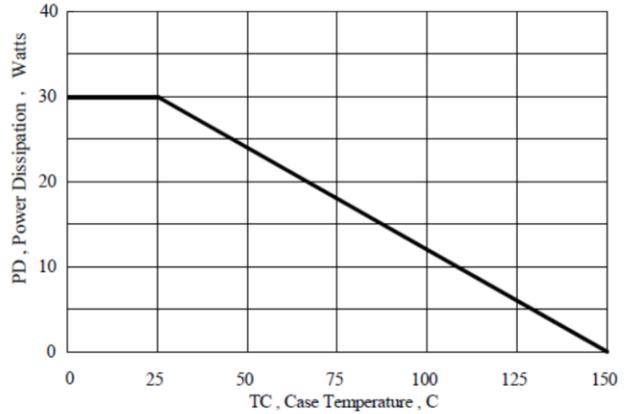


Figure 2 Maximum Power Dissipation vs Case Temperature

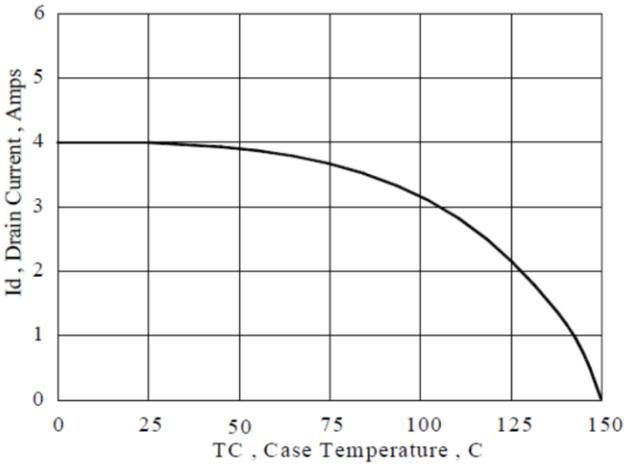


Figure 3 Maximum Continuous Drain Current vs Case Temperature

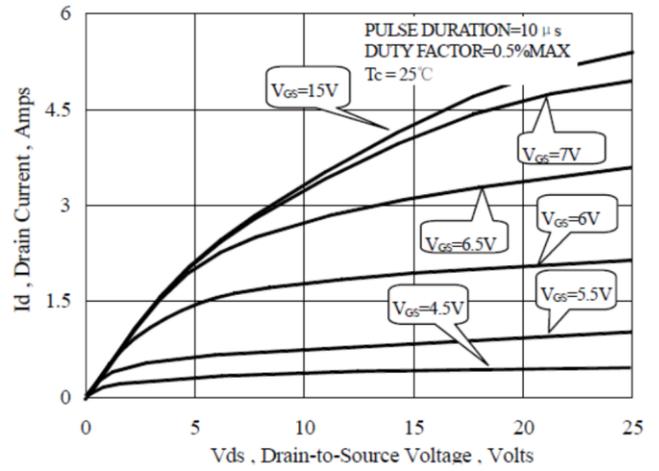


Figure 4 Typical Output Characteristics

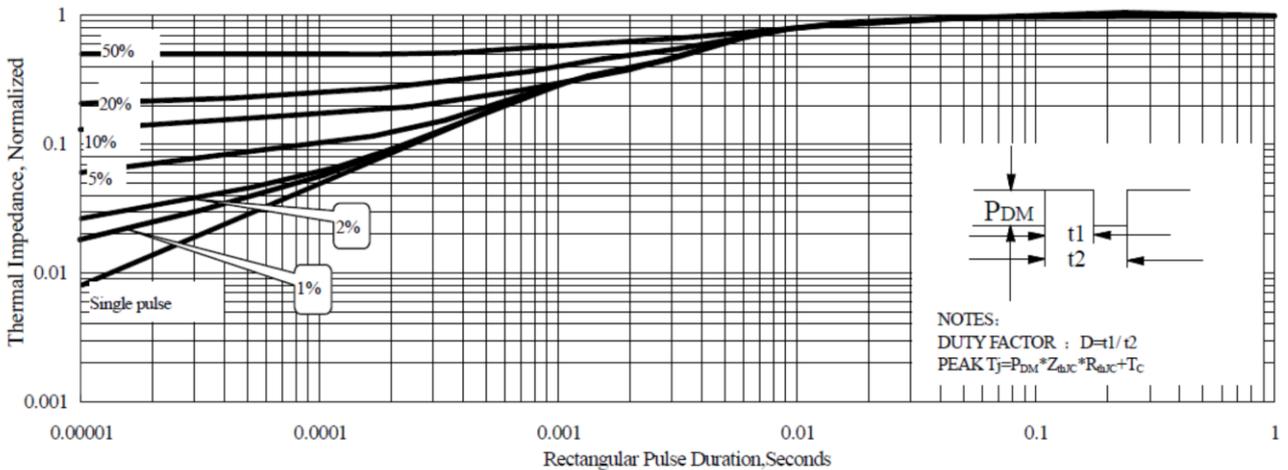


Figure 5 Maximum Effective Thermal Impedance, Junction to Case



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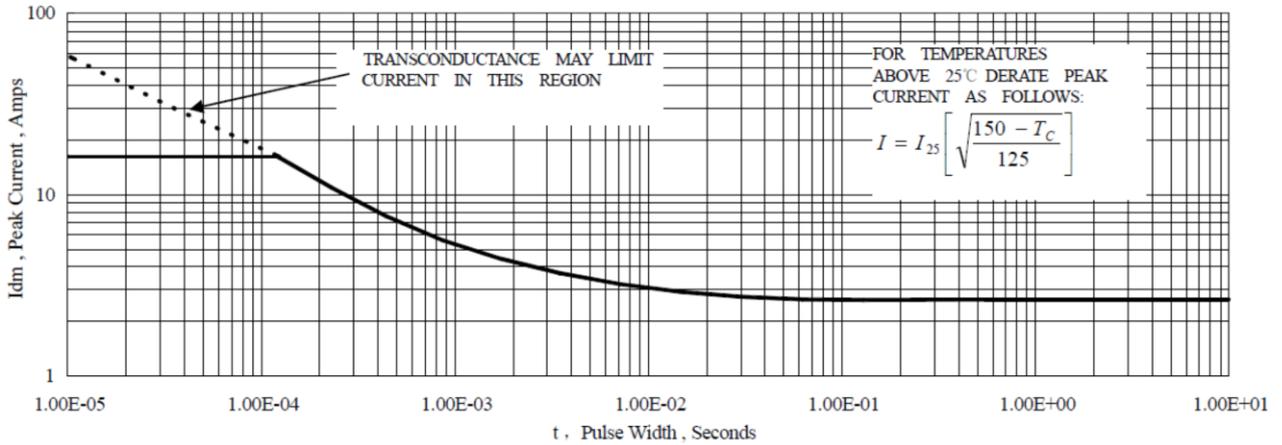


Figure 6 Maximum Peak Current Capability

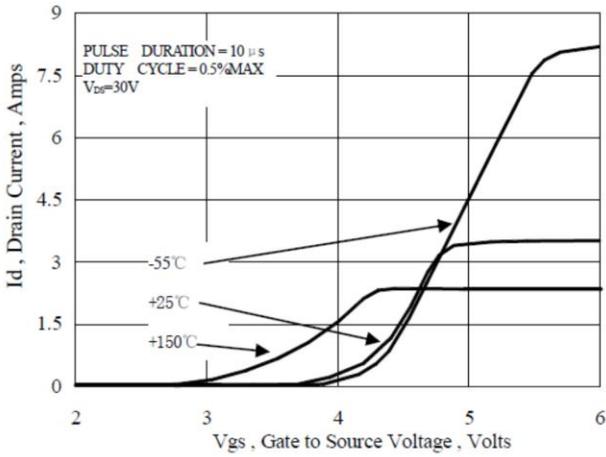


Figure 7 Typical Transfer Characteristics

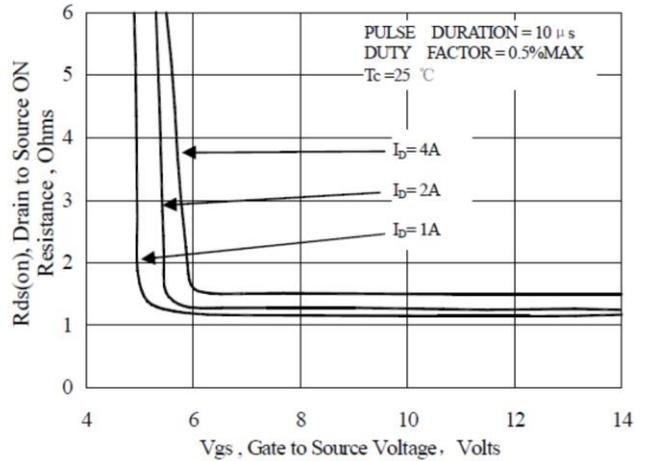


Figure 8 Typical Drain to Source ON Resistance vs Gate Voltage and Drain Current

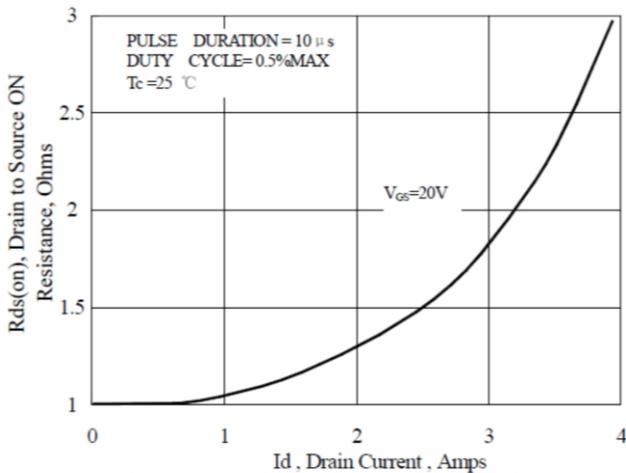


Figure 9 Typical Drain to Source ON Resistance vs Drain Current

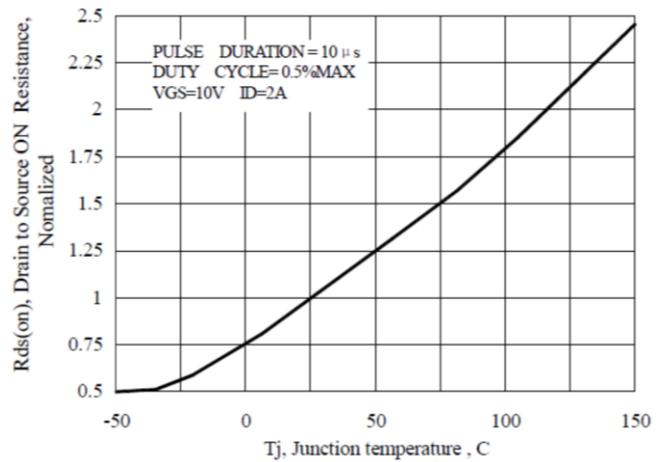


Figure 10 Typical Drain to Source on Resistance vs Junction Temperature



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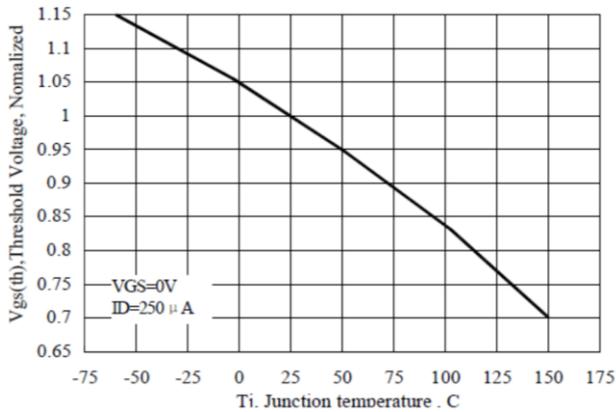


Figure 11 Typical Threshold Voltage vs Junction Temperature

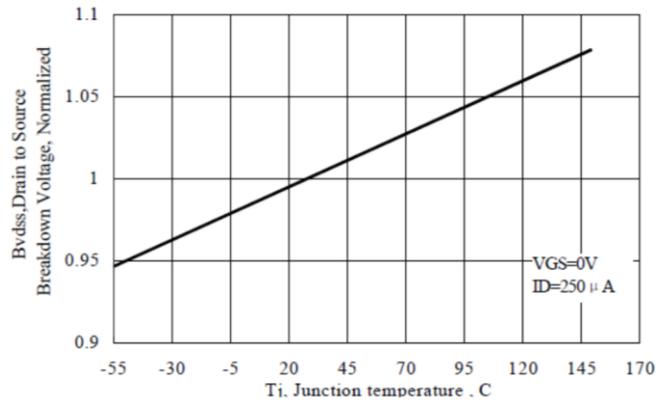


Figure 12 Typical Breakdown Voltage vs Junction Temperature

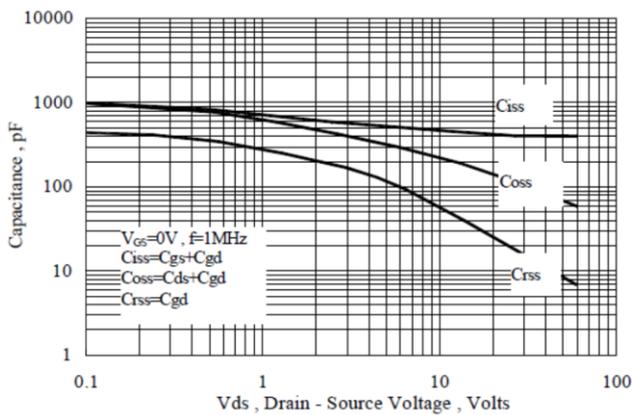


Figure 13 Typical Capacitance vs Drain to Source Voltage

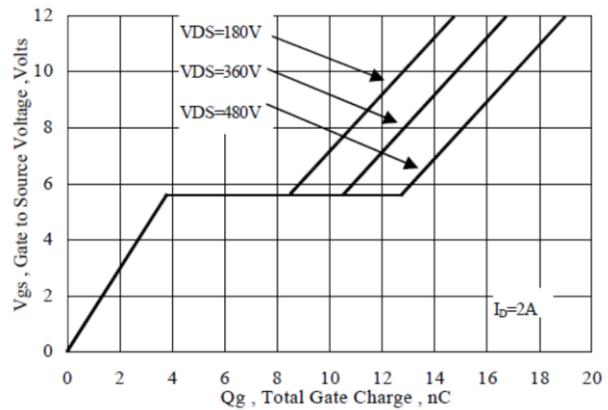


Figure 14 Typical Gate Charge vs Gate to Source Voltage

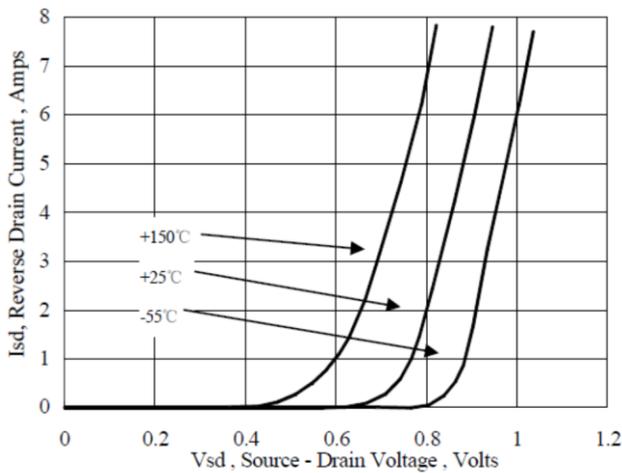


Figure 15 Typical Body Diode Transfer Characteristics

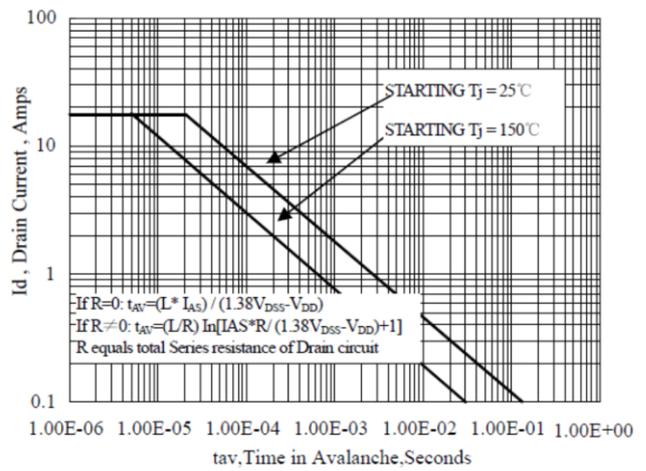


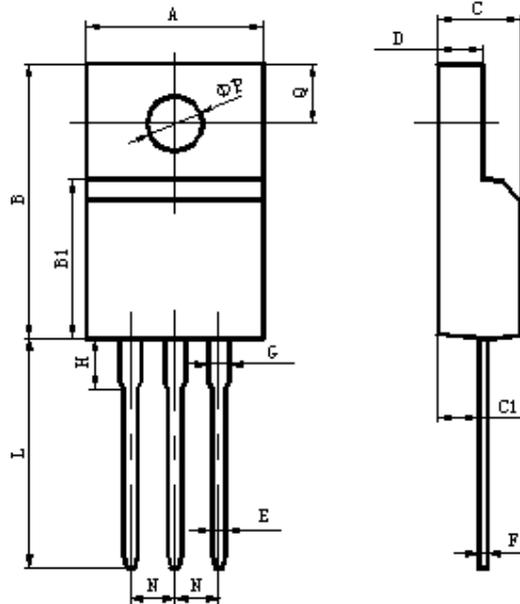
Figure 16 Unclamped Inductive Switching Capability



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Package Information



Items	Values(mm)	
	MIN	MAX
A	9.60	10.40
B	15.40	16.20
B1	8.90	9.50
C	4.30	4.90
C1	2.10	3.00
D	2.40	3.00
E	0.60	1.00
F	0.30	0.60
G	1.12	1.42
H	3.40	3.80
	2.00	2.40
L	12.00	14.00
	6.30	7.70
N	2.34	2.74
Q	3.15	3.55
ϕP	3.00	3.30

TO-220F Package