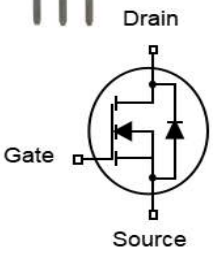
Features

- N-Channel
- Low $R_{DS(on)}$
- Low gate charge (typ. Q_g = 41.9 nC)
- 100% UIS tested
- RoHS compliant
- 100% EAS Tested

V_{DS}	650	V
$R_{DS(on),TYP}$@ V_{GS}=10 V	640	mΩ
I_D	12	A

TO-220F



Part ID	Package Type	Marking	Packing
ZT12N65F	TO-220F	ZT12N65F	1000pcs/Tape

Absolute Maximum Ratings T_A =25°C, unless otherwise specified

Symbol	Parameter		Rating	Unit
Common Ratings (T_C=25°C Unless Otherwise Noted)				
V_{GS}	Gate-Source Voltage		±30	V
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage		650	V
T_J	Maximum Junction Temperature		150	°C
T_{STG}	Storage Temperature Range		-55 to 150	°C
I_{DM}	Drain Current-Continuous@ Current-Pulsed (Note 1)	T_C =25°C	48	A
Mounted on Large Heat Sink				
I_D	Drain Current-Continuous	T_C =25°C	12	A
		T_C =100°C	7.5	A
P_D	Maximum Power Dissipation		42	W
	Derate above 25°C		0.34	W/°C
$R_{\theta JC}$	Thermal Resistance-Junction to Case		2.98	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient		110	°C/W
Drain-Source Avalanche Ratings				
EAS	Avalanche Energy, Single Pulsed (Note 2)		500	mJ
dv/dt	Reverse Diode dv/dt (Note 3)		5	V/ns

Electrical Characteristics (T_J=25℃ unless otherwise noted)

Symbol	Parameter	Condition	Min	Typ	Max	Unit
Static Electrical Characteristics @ T_j=25°C (unless otherwise stated)						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=250μA	650	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=650V,V_{GS}=0V	--	--	1	μA
I_{GSS}	Gate-Body Leakage Current	V_{GS}=±30V,V_{DS}=0V	--	--	±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS},I_D=250μA	2.0	--	4.0	V
$R_{DS(on)}$	Drain-Source On-State Resistance	V_{GS}=10V, I_D=6A	--	640	800	mΩ
Dynamic Electrical Characteristics @ T_j = 25°C (unless otherwise stated)						
Ciss	Input Capacitance	V_{DS}=25V,V_{GS}=0V, f=1MHz	--	1998	--	pF
Coss	OutputCapacitance		--	162	--	pF
Crss	ReverseTransferCapacitance		--	7.3	--	pF
Qg	Total Gate Charge	V_{DD}=520V,I_D=12A, V_{GS}=0to10V	--	41.9	--	nC
Qgs	Gate-SourceCharge		--	10.8	--	nC
Qgd	Gate-DrainCharge		--	15	--	nC
Vplateau	Gate plateau voltage		--	5	--	V
Switching Characteristics (Note 2)						
Td(on)	Turn-on Delay Time	V_{DD}=325V, I_D =12A, R_G=10Ω, V_{GS}=15V	--	14.5	--	ns
Tr	Turn-on Rise Time		--	37.6	--	ns
Td(off)	Turn-Off Delay Time		--	69	--	ns
Tf	Turn-Off Fall Time		--	16	--	ns
Source- Drain Diode Characteristics@ T_j = 25°C (unless otherwise stated)						
V_{SD}	Forward on voltage	I_F=12A,V_{GS}=0V	--	--	1.5	V
Trr	Reverse Recovery Time	T_j=25℃,I_F =12A, V_R =325V di/dt=100A/μs	--	450.4	--	ns
Qrr	Reverse Recovery Charge		--	4.75	--	nC
Irrm	Peak Reverse Recovery Current		--	21.1	--	A

Notes:

1. Pulse width limited by maximum junction temperature.
2. L=10mH, I_{AS} = 10A, Starting T_j= 25°C.
3. I_{SD} = 12A, di/dt≤100A/us, V_{DD}≤BV_{DS}, Starting T_j= 25°C.

Electrical Characteristics Diagrams

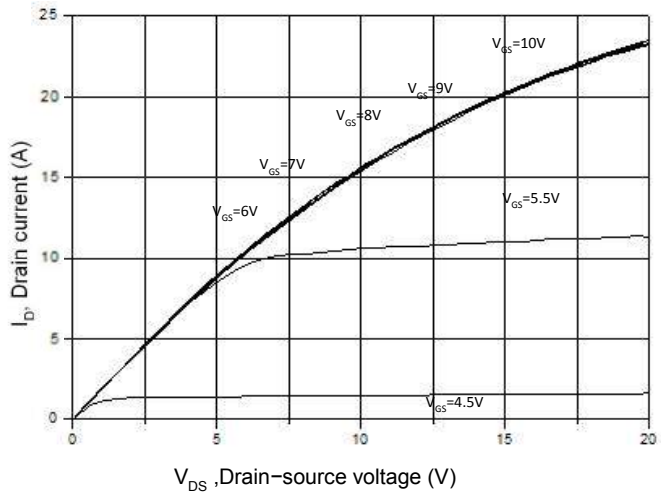


Figure 1. Typical Output Characteristics

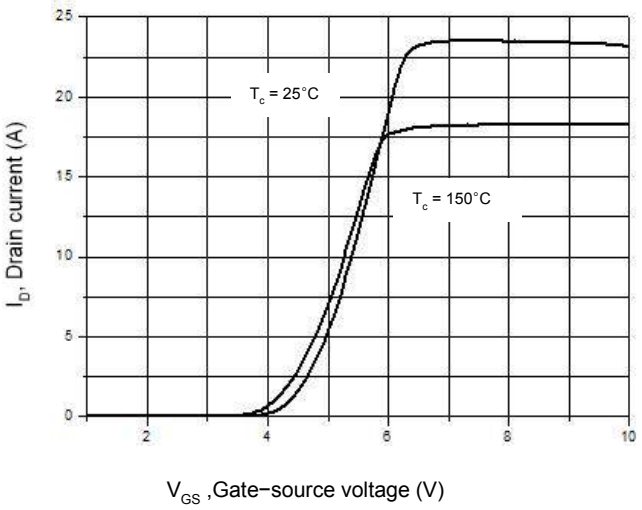


Figure 2. Transfer Characteristics

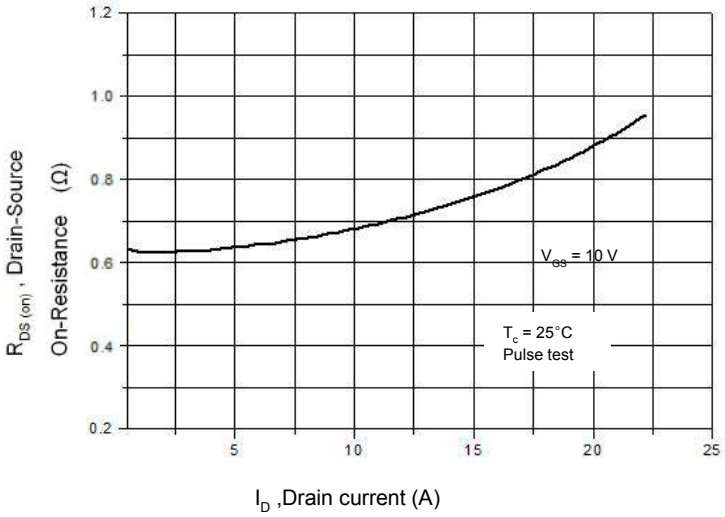


Figure 3. On-Resistance Variation vs. Drain Current

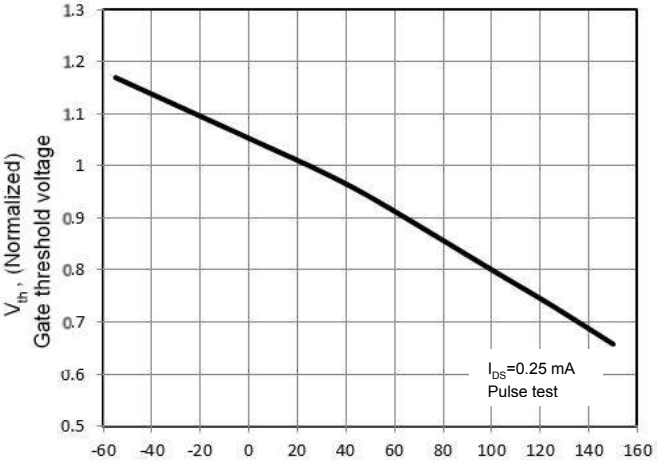


Figure 4. Threshold Voltage vs. Temperature

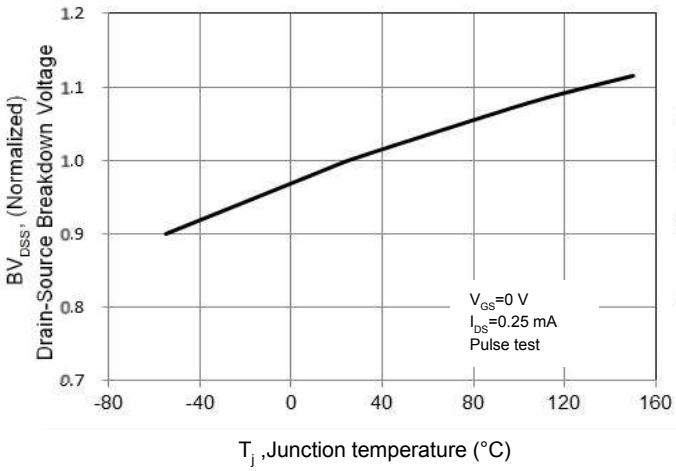


Figure 5. Breakdown Voltage vs. Temperature

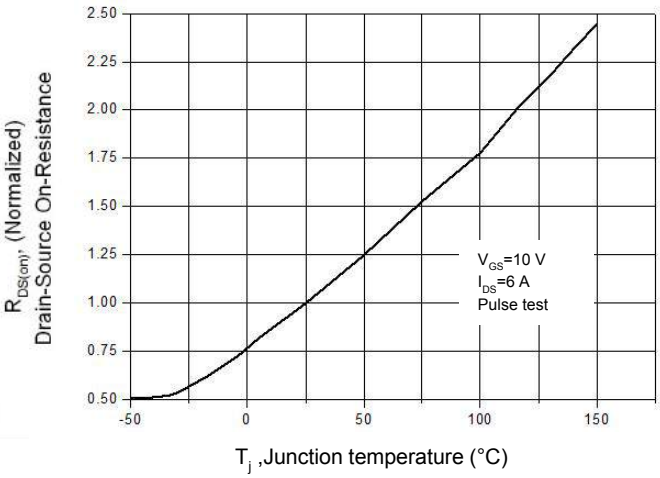


Figure 6. On-Resistance vs. Temperature

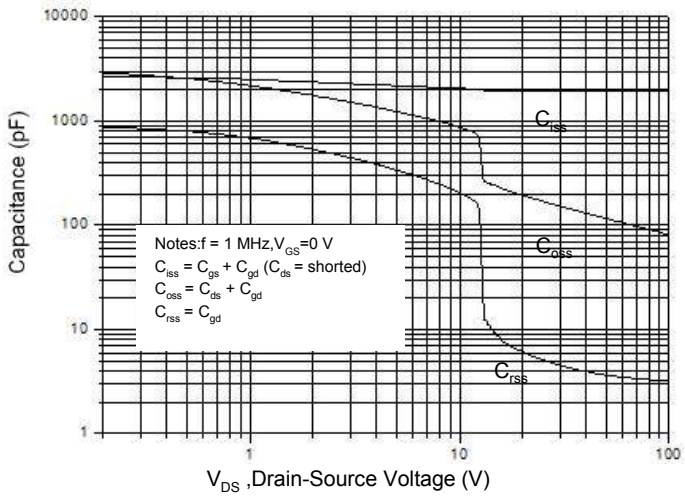


Figure 7. Capacitance Characteristics

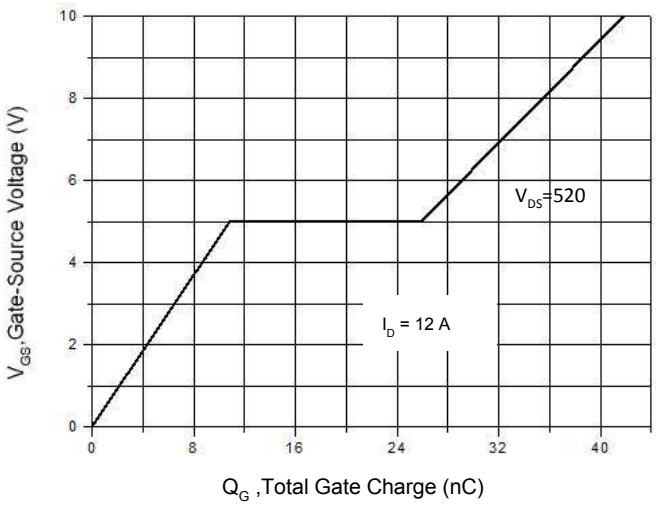


Figure 8. Gate Charge Characteristics

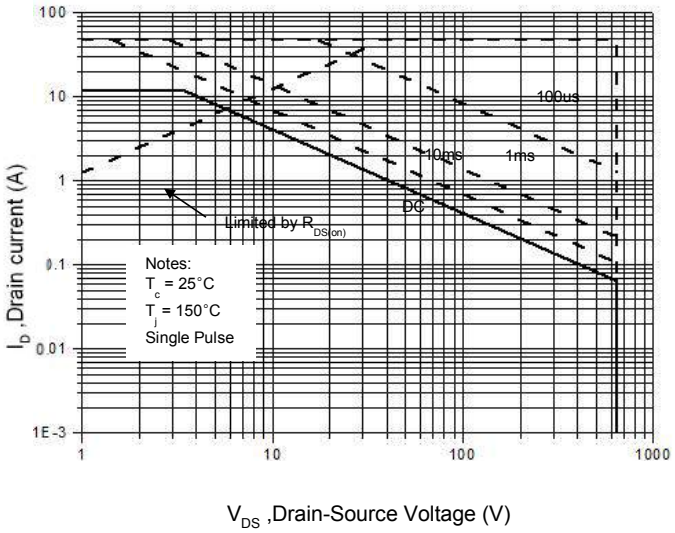


Figure 9. Maximum Safe Operating Area

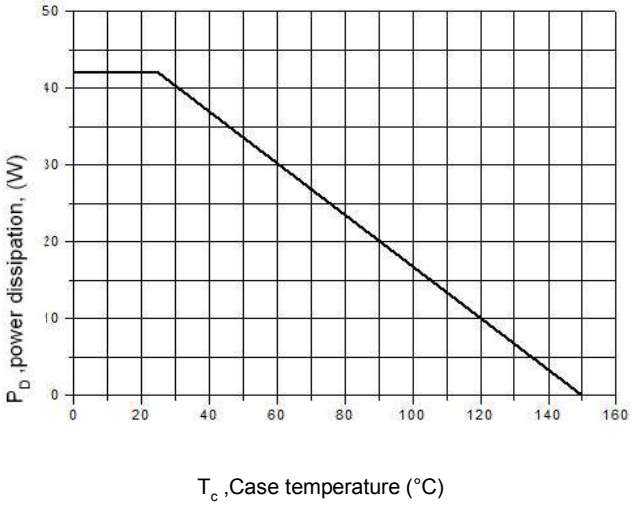


Figure 10. Power Dissipation vs. Temperature

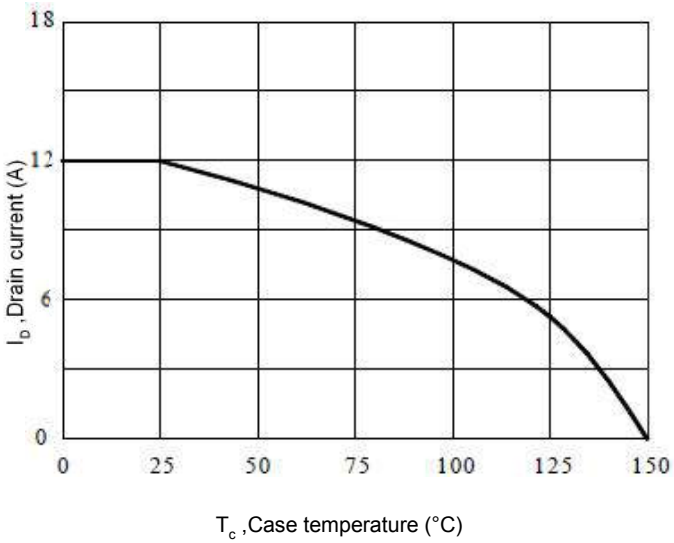


Figure 11. Continuous Drain Current vs. Temperature

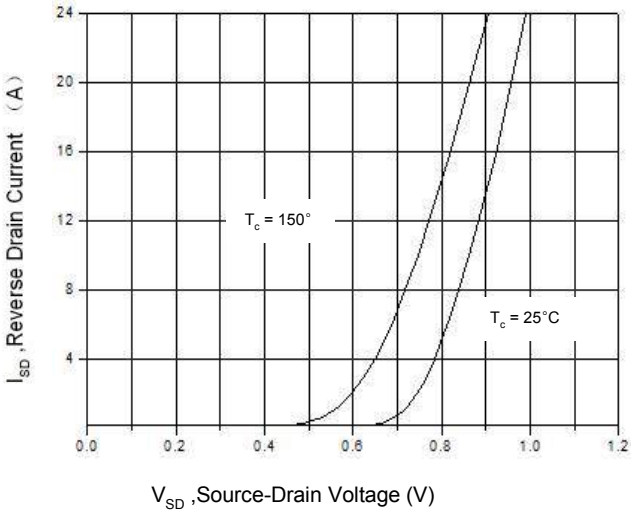


Figure 12. Body Diode Transfer Characteristics

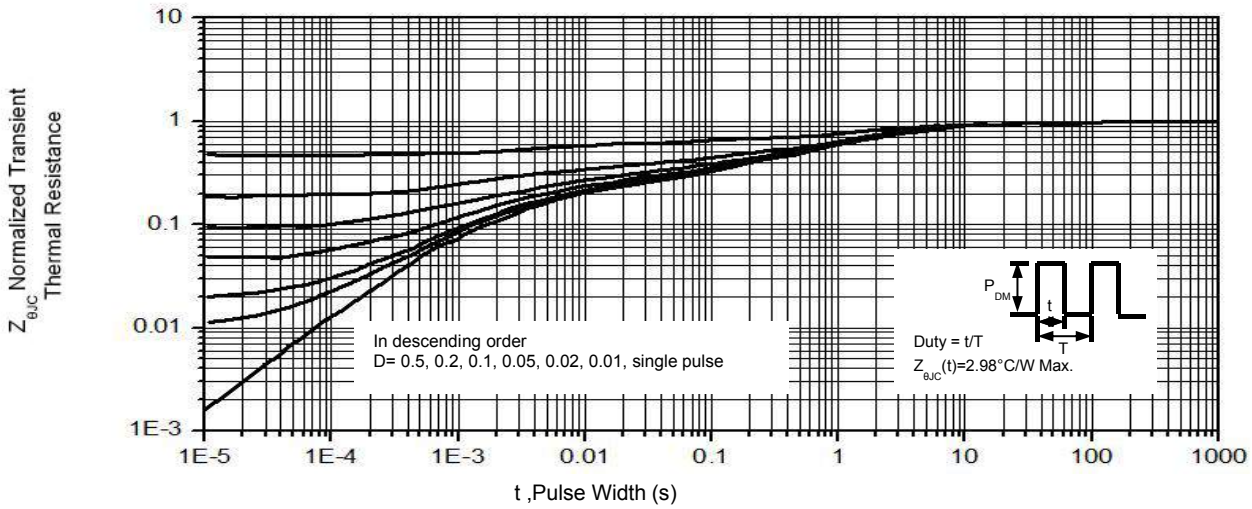
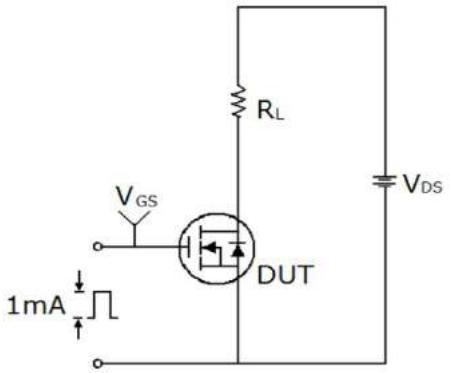
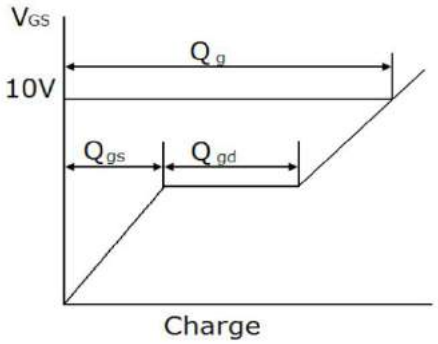


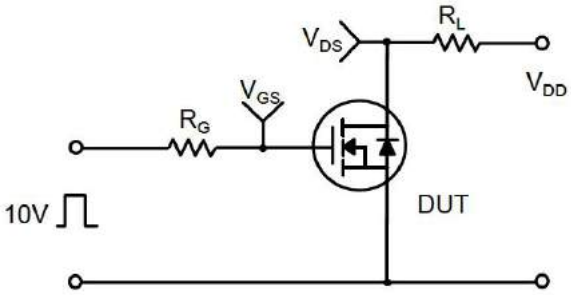
Figure 13 Transient Thermal Impedance, Junction to Case

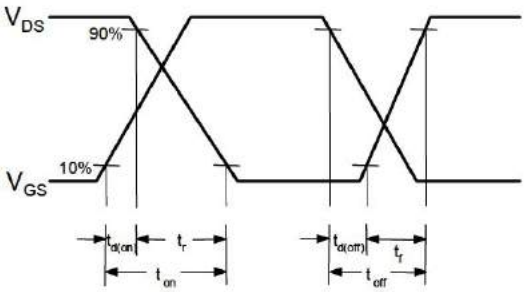
Gate Charge Test Circuit & Waveform



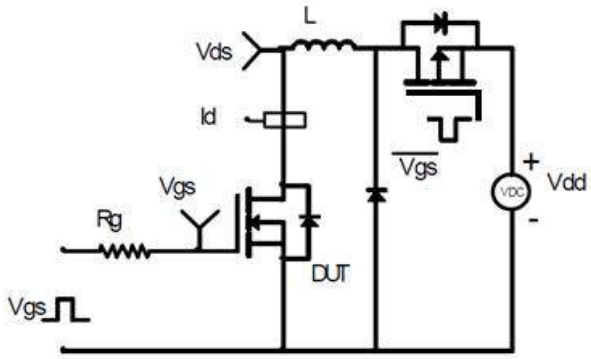


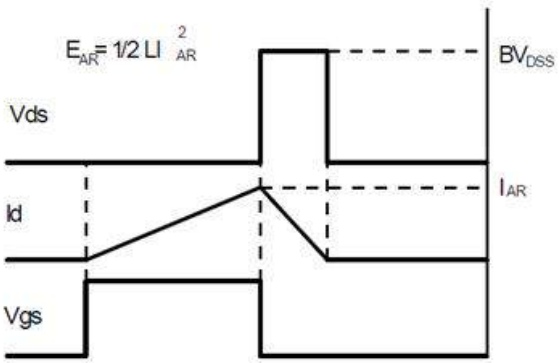
Switching Test Circuit & Waveforms



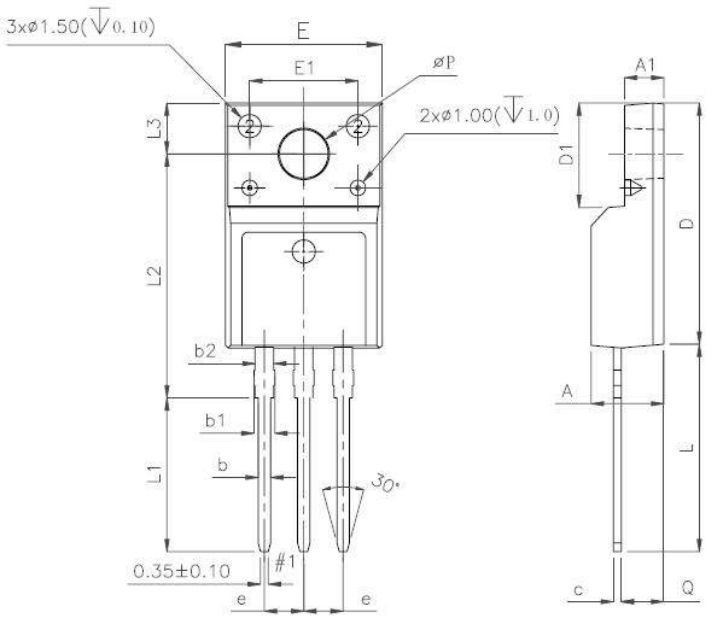


Unclamped Inductive Switching Test Circuit & Waveforms





Mechanical Dimensions for TO-220F



UNIT：mm

SYMBOL	MIN	NOM	MAX
A	4.5		4.9
A1	2.3		2.9
b	0.65		0.9
b1	1.1		1.7
b2	1.2		1.4
c	0.35		0.65
D	14.5		16.5
D1	6.1		6.9
E	9.6		10.3
E1	6.5	7	7.5
e	2.44	2.54	2.64
L	12.5		14.3
L1	9.45		10.05
L2	15		16
L3	3.2		4.4
ΦP	3		3.3
Q	2.5		2.9

Customer Service

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