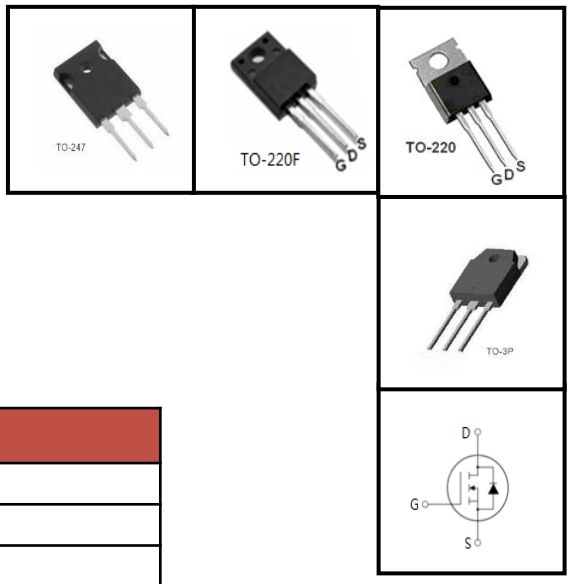
600V N-Channel MOSFET

FEATURES

- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)

Device Marking and Package Information

Device	Package	Marking
CS20N60F	TO-220F	CS20N60F
CS20N60P	TO-220	CS20N60P
CS20N60W	TO-247	CS20N60W
CS20N60V	TO-3P	CS20N60V

Absolute Maximum Ratings T_C = 25ºC, unless otherwise noted

Parameter	Symbol	Value				Unit
		TO-220F	TO-220	TO-247	TO-3P	
Drain-Source Voltage (V_{GS} = 0V)	V_{DSS}	600				V
Continuous Drain Current	I_D	20				A
Pulsed Drain Current (note1)	I_{DM}	80				A
Gate-Source Voltage	V_{GSS}	±30				V
Single Pulse Avalanche Energy (note2)	E_{AS}	605				mJ
Avalanche Current (note1)	I_{AS}	11				A
Repetitive Avalanche Energy (note1)	E_{AR}	302.5				mJ
Power Dissipation (T_C = 25ºC)	P_D	65.7	104			W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55~+150				ºC

Thermal Resistance

Parameter	Symbol	Value				Unit
		TO-220F	TO-220	TO247	TO-3P	
Thermal Resistance, Junction-to-Case	R_{thJC}	1.9	1.2			ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62.5	60			

Specifications T_J = 25ºC, unless otherwise noted						
Parameter	**Symbol**	**Test Conditions**	**Value**			**Unit**
			Min.	**Typ.**	**Max.**	
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D = 250μA	600	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 600V, V_{GS} = 0V, T_J = 25ºC	--	--	1	μA
Gate-Source Leakage	I_{GSS}	V_{GS} = ±30V	--	--	±100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250μA	3.0	--	4.0	V
Drain-Source On-Resistance (Note3)	$R_{DS(on)}$	V_{GS} = 10V, I_D = 10A	--	0.32	0.40	Ω
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 25V, f = 1.0MHz	--	2521	--	pF
Output Capacitance	C_{oss}		--	264	--	
Reverse Transfer Capacitance	C_{rss}		--	35	--	
Total Gate Charge	Q_g	V_{DD} = 480V, I_D = 20A, V_{GS} = 10V	--	76	--	nC
Gate-Source Charge	Q_{gs}		--	13	--	
Gate-Drain Charge	Q_{gd}		--	32	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 300V, I_D = 20A, R_G = 25 Ω	--	53	--	ns
Turn-on Rise Time	t_r		--	44	--	
Turn-off Delay Time	$t_{d(off)}$		--	321	--	
Turn-off Fall Time	t_f		--	80	--	
Drain-Source Body Diode Characteristics						
Continuous Body Diode Current	I_S	T_C = 25 ºC	--	--	20	A
Pulsed Diode Forward Current	I_{SM}		--	--	80	
Body Diode Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 10A, V_{GS} = 0V	--	--	1.4	V
Reverse Recovery Time	t_{rr}	V_{GS} = 0V,I_S = 20A, di_F/dt =100A /μs	--	733	--	ns
Reverse Recovery Charge	Q_{rr}		--	6.5	--	μC

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L=10mH, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25 ºC
3. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 1%

Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 1. Output Characteristics (T_J = 25ºC)

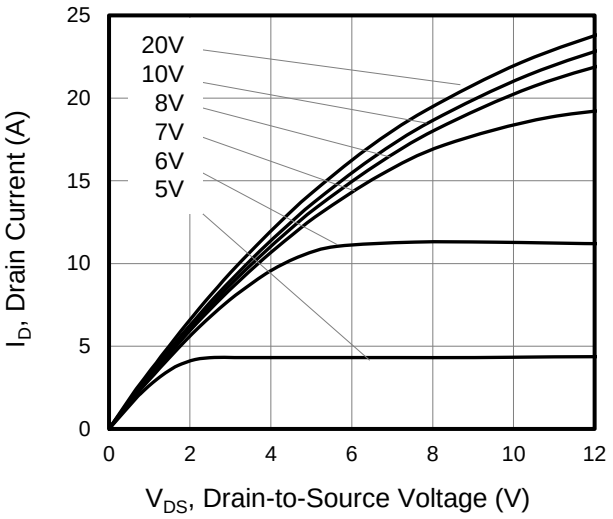


Figure 2. Body Diode Forward Voltage

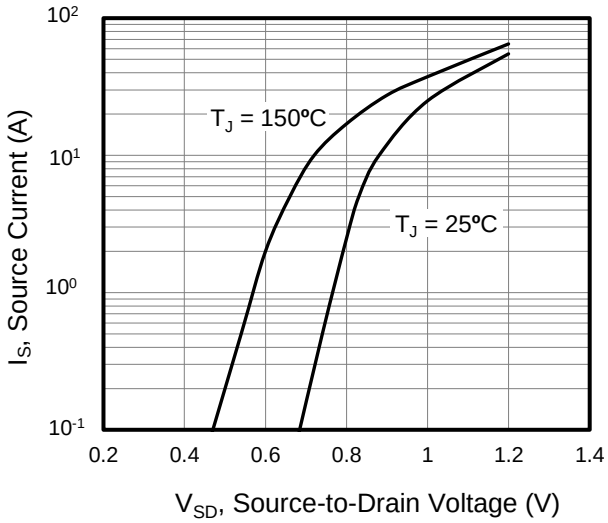


Figure 3. Drain Current vs. Temperature

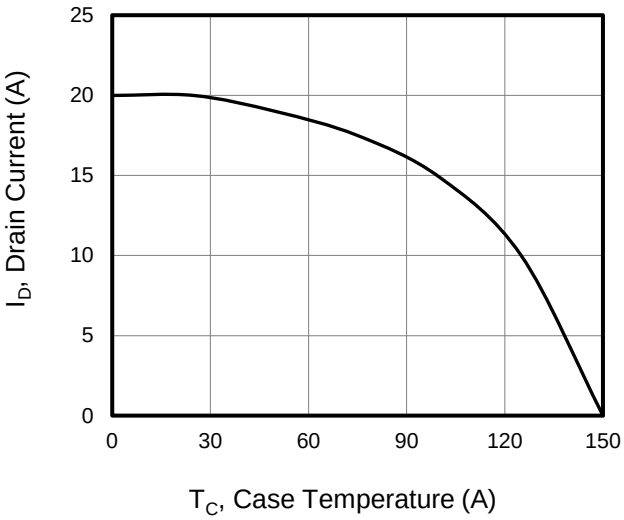


Figure 4. BV_{DSS} Variation vs. Temperature

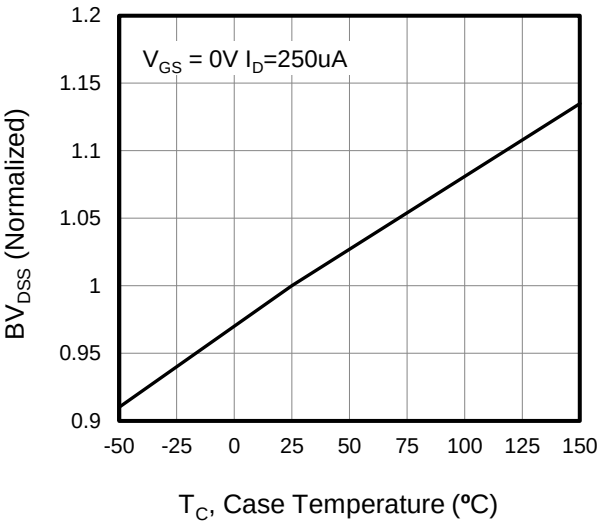


Figure 5. Transfer Characteristics

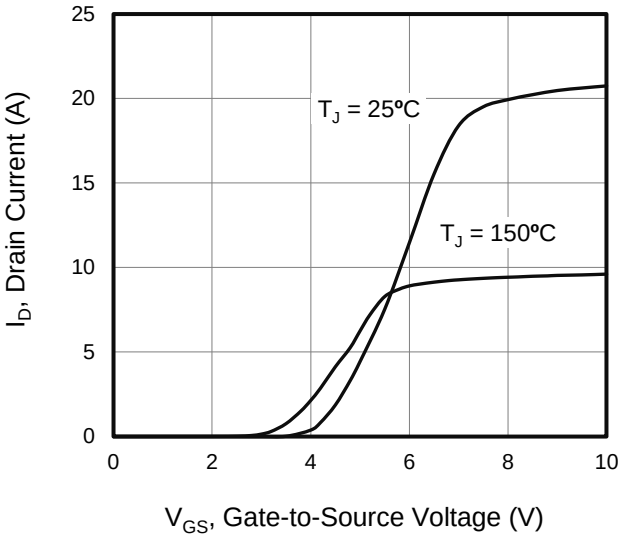
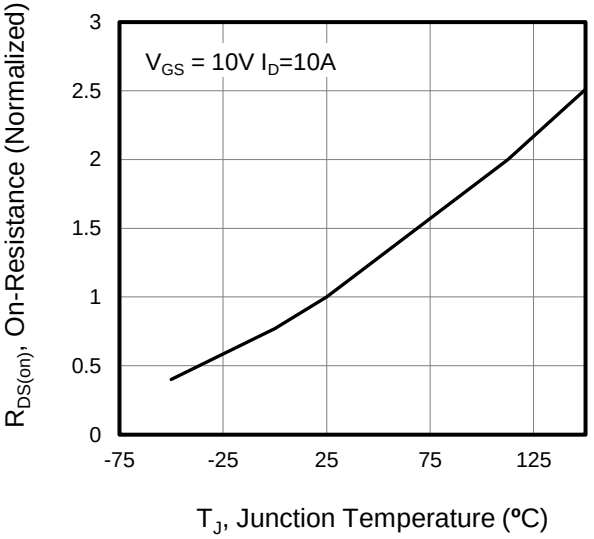


Figure 6. On-Resistance vs. Temperature



Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 7. Capacitance

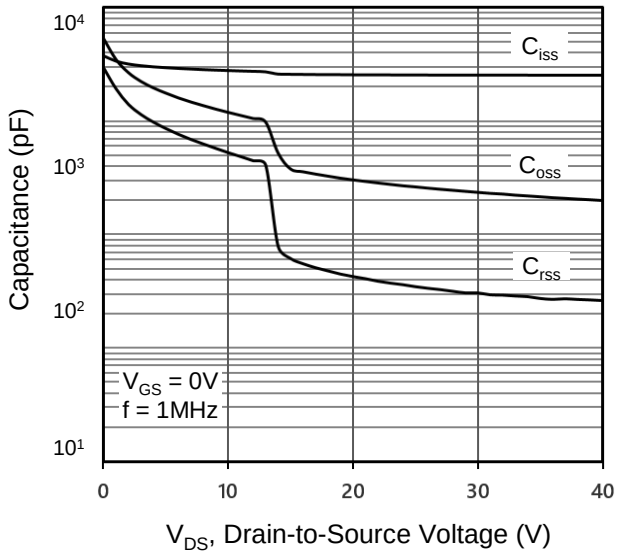


Figure 8. Gate Charge

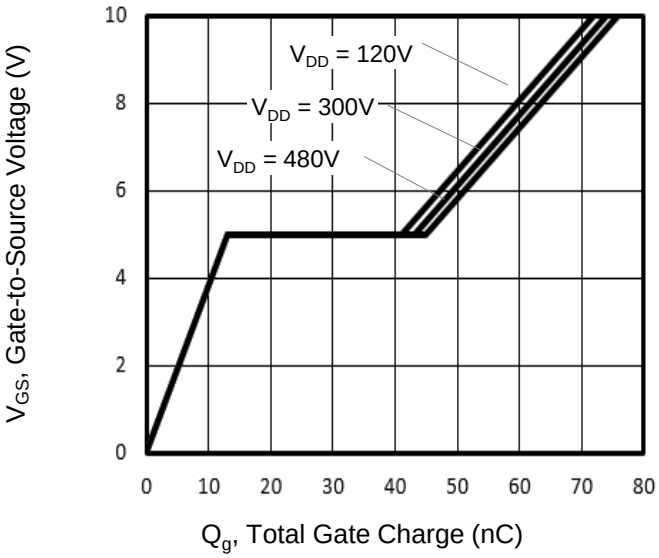


Figure 9. Transient Thermal Impedance

TO-220/ TO-247/ TO-3P

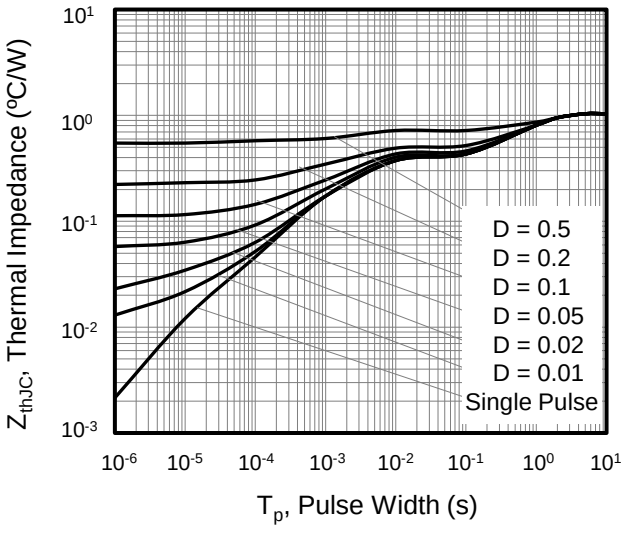


Figure 9. Transient Thermal Impedance

TO-220F

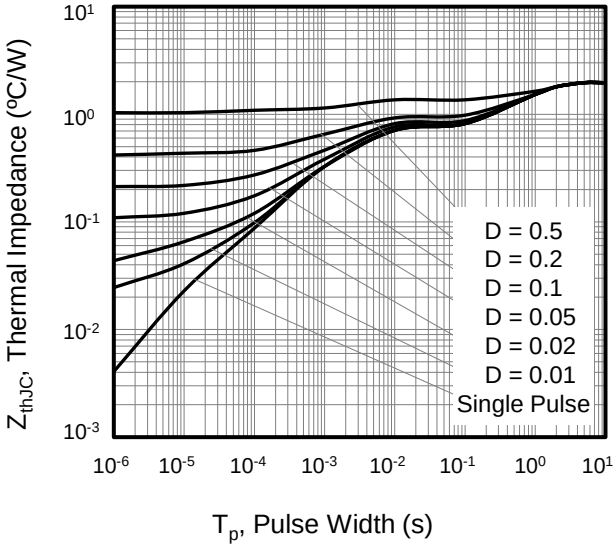


Figure A：Gate Charge Test Circuit and Waveform

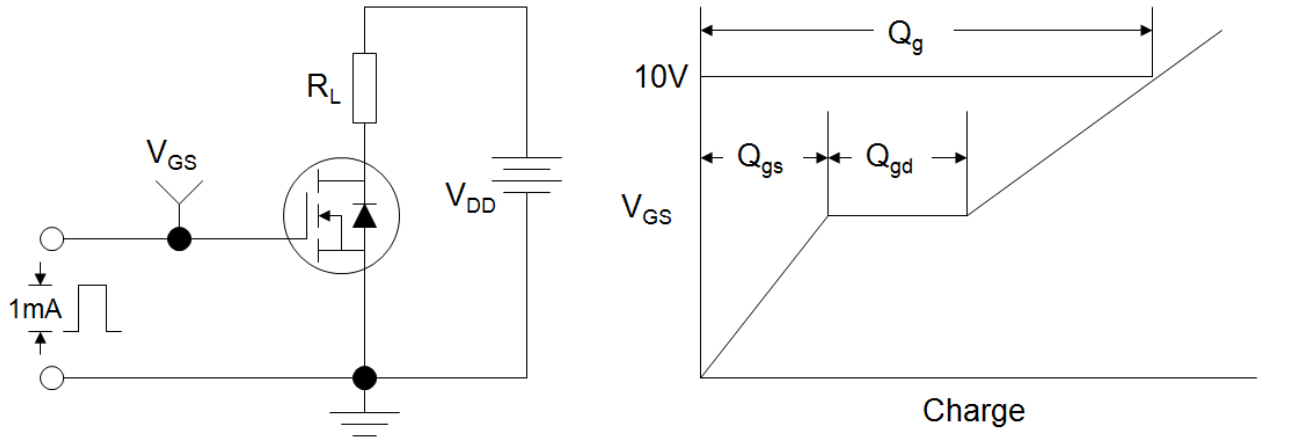


Figure B：Resistive Switching Test Circuit and Waveform

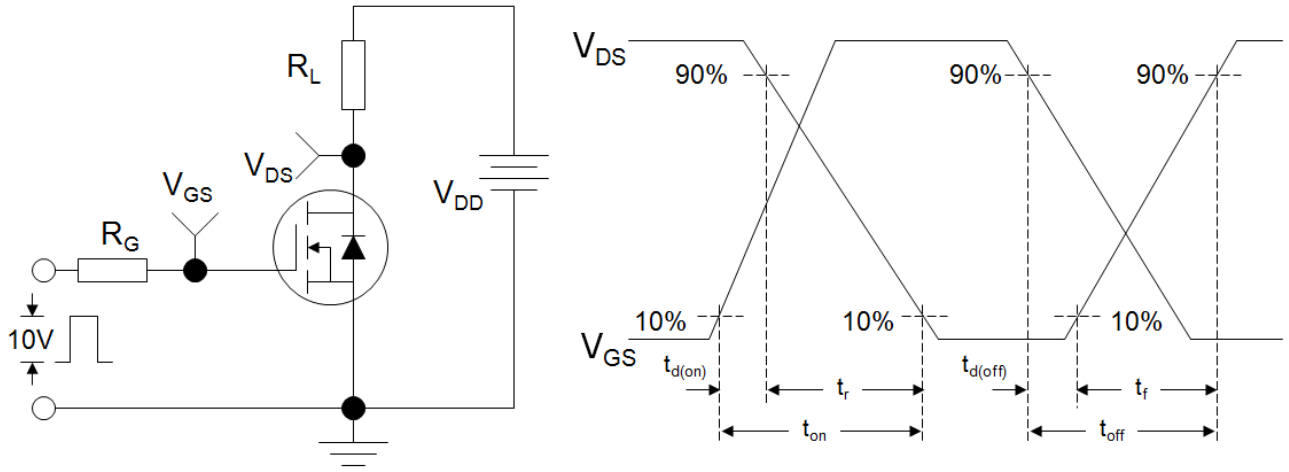
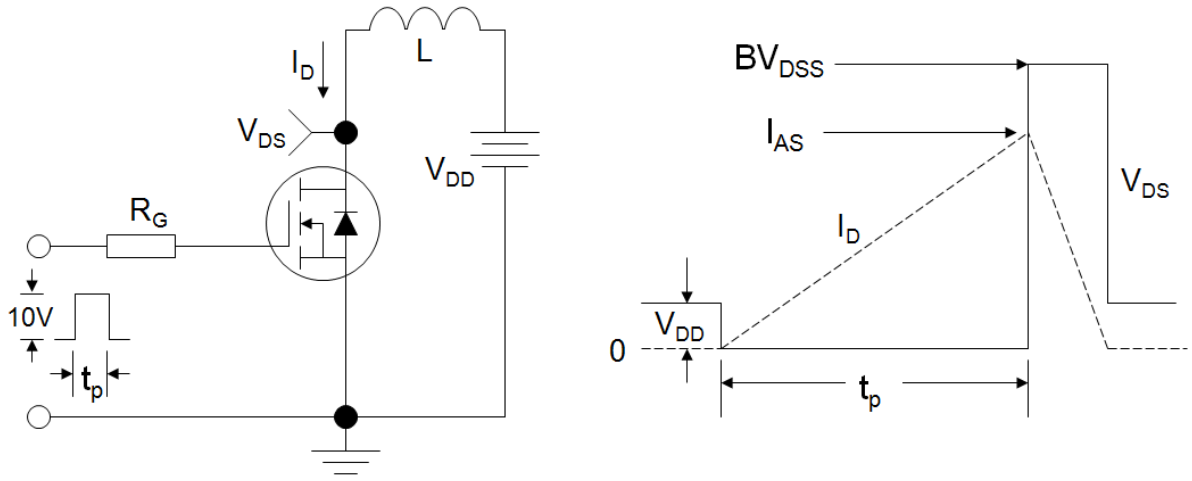
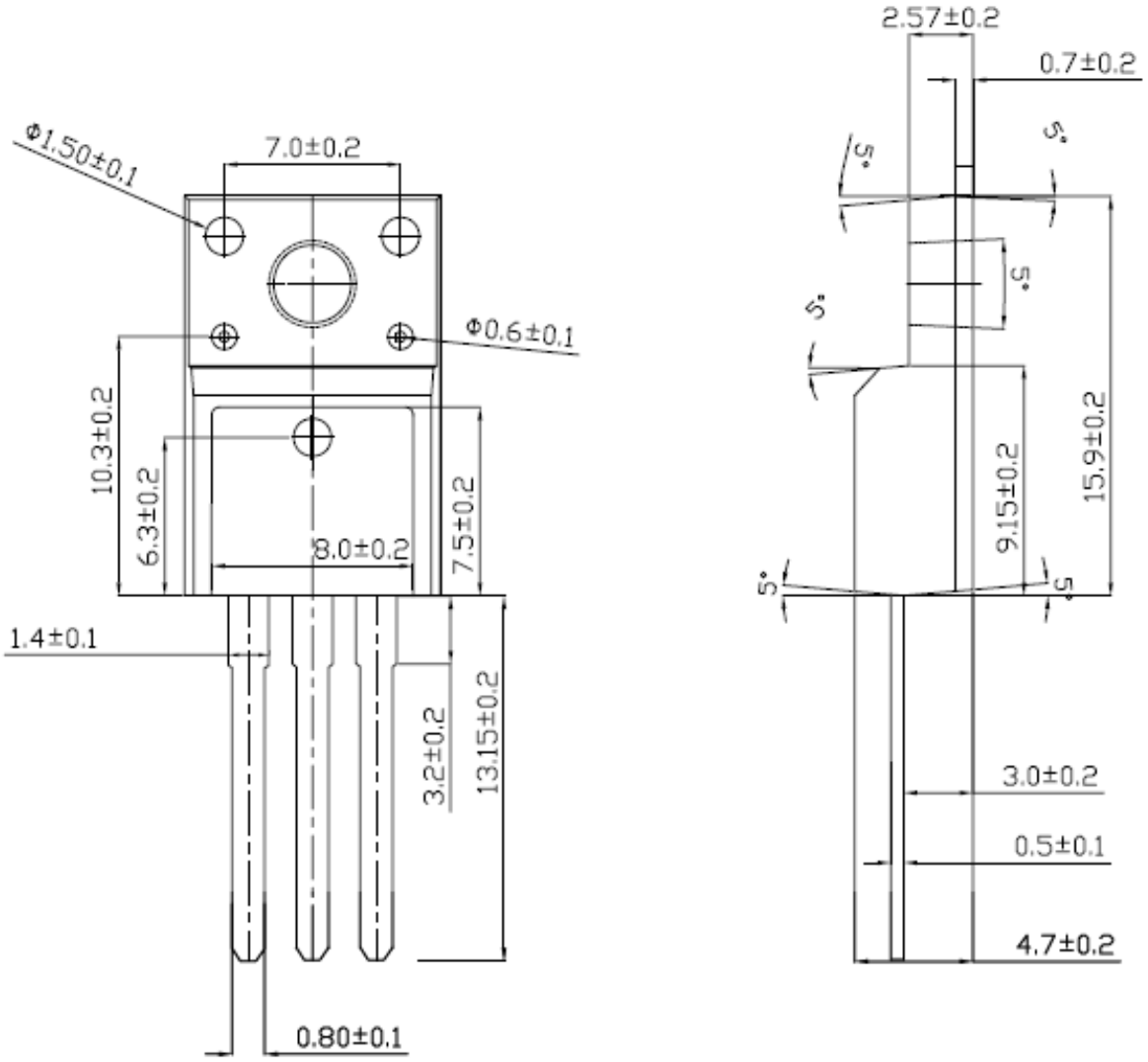


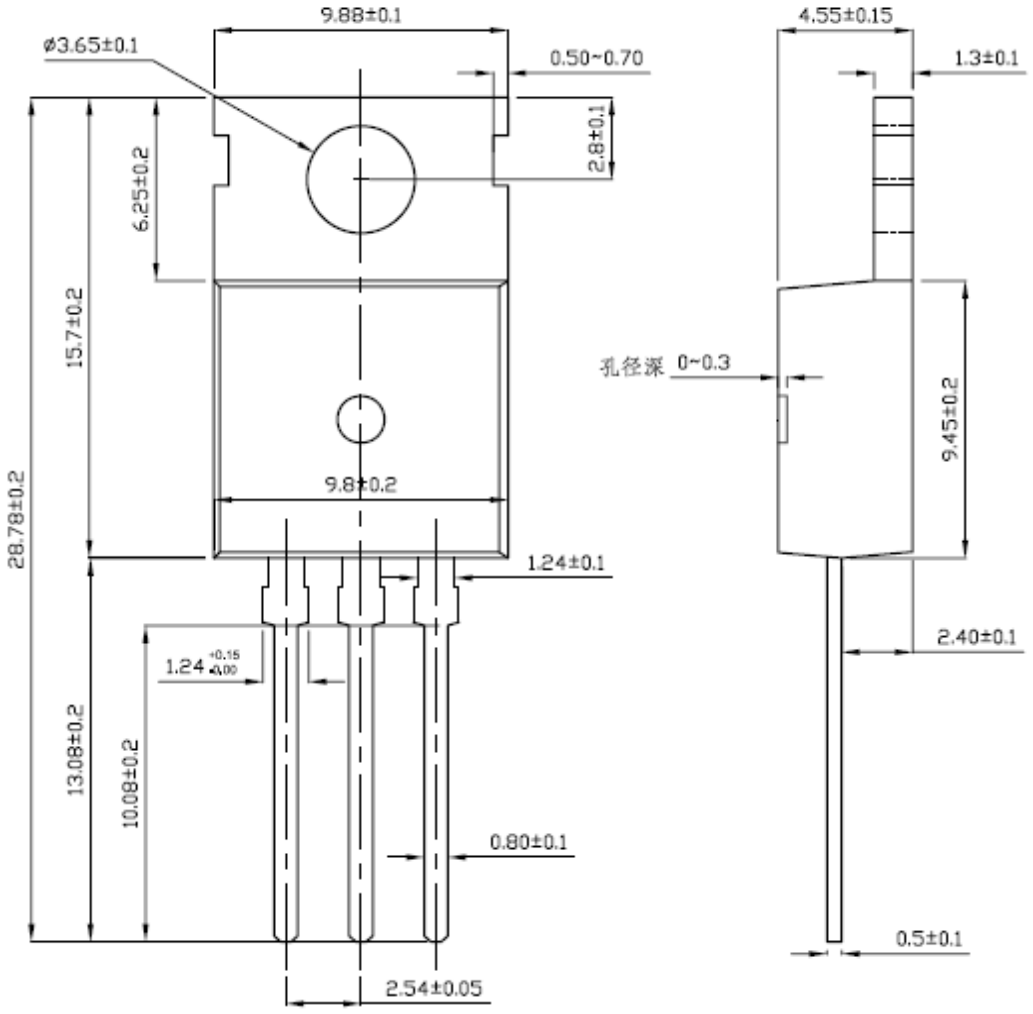
Figure C：Unclamped Inductive Switching Test Circuit and Waveform



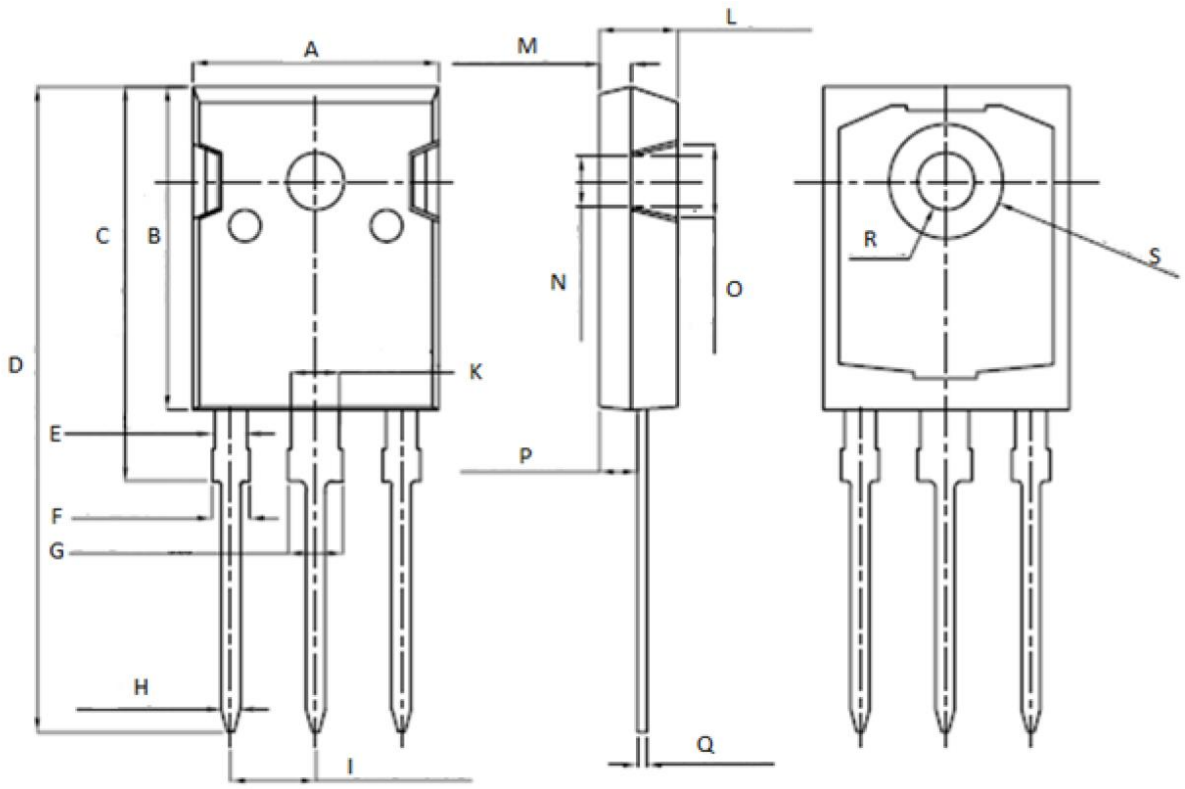
TO-220F


Φ1.50±0.1
7.0±0.2
Φ0.6±0.1
10.3±0.2
6.3±0.2
8.0±0.2
7.5±0.2
1.4±0.1
3.2±0.2
13.15±0.2
0.80±0.1
2.57±0.2
0.7±0.2
5°
5°
5°
5°
5°
5°
15.9±0.2
9.15±0.2
3.0±0.2
0.5±0.1
4.7±0.2

TO-220


9.88±0.1
ø3.65±0.1
0.50~0.70
2.8±0.1
6.25±0.2
15.7±0.2
28.78±0.2
9.8±0.2
1.24±0.1
1.24 +0.15 -0.00
13.08±0.2
10.08±0.2
0.80±0.1
2.54±0.05
4.55±0.15
1.3±0.1
孔径深 0~0.3
9.45±0.2
2.40±0.1
0.5±0.1

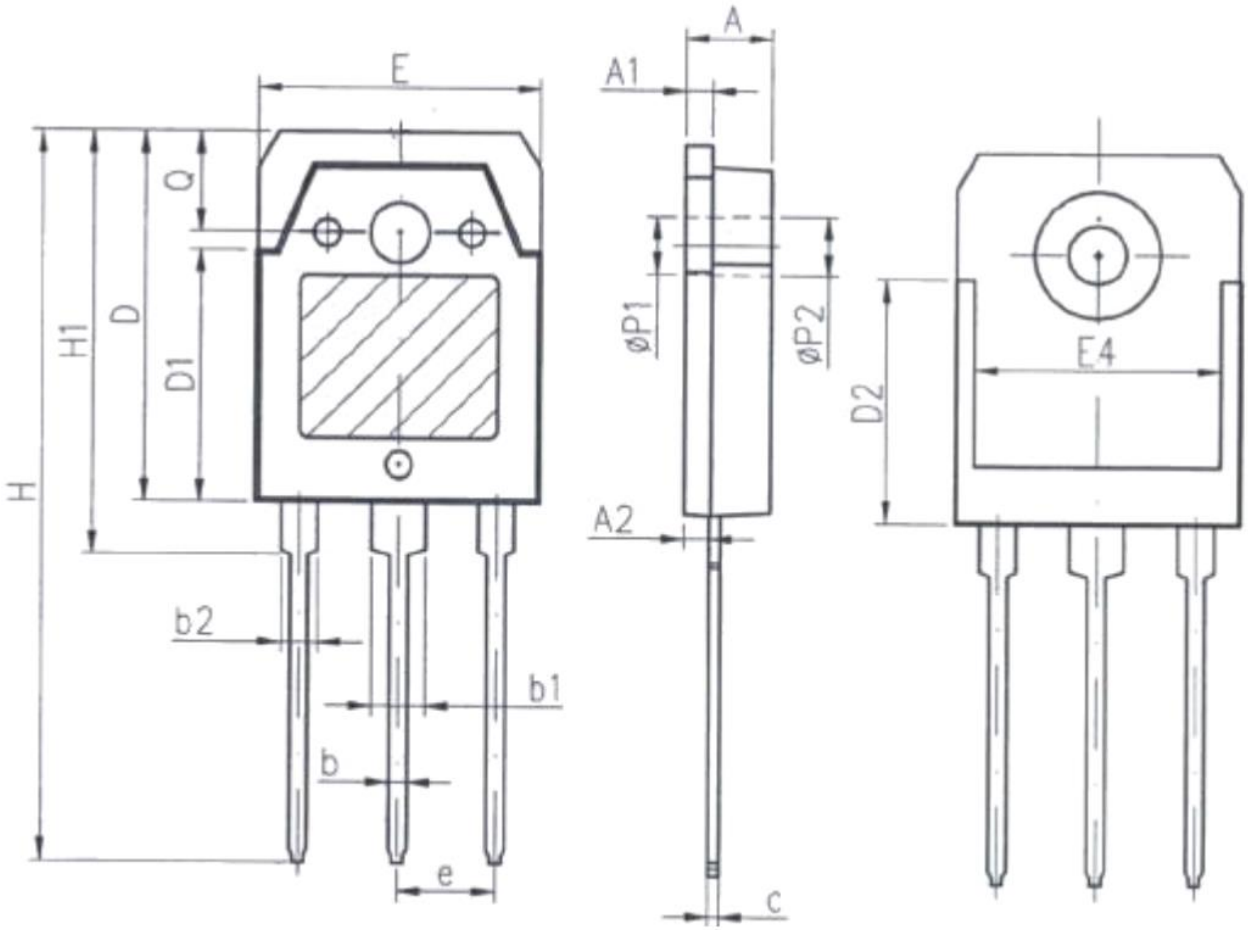
TO-247



Unit: mm		
Symbol	Min.	Max.
A	15.95	16.25
B	20.85	21.25
C	20.95	21.35
D	40.5	40.9
E	1.9	2.1
F	2.1	2.25
G	3.1	3.25
H	1.1	1.3
I	5.40	5.50

Unit: mm		
Symbol	Min.	Max.
K	2.90	3.10
L	4.90	5.30
M	1.90	2.10
N	4.50	4.70
O	5.40	5.60
P	2.29	2.49
Q	0.51	0.71
R	ϕ3.5	ϕ3.7
S	ϕ7.1	ϕ7.3

TO-3P



Unit:mm		
Symbol	Min.	Max.
A	4.6	5
A1	1.4	1.65
A2	1.18	1.58
b	0.8	1.2
b1	2.8	3.2
b2	1.8	2.2
c	0.5	0.75
D	19.6	20.2
D1	13.55	14.25
D2	12.9REF	
E	15.35	15.85
E4	12.6	-
e	5.45TYP	
H	40.1	40.9
H1	23.15	23.65
P1	3.2REF	
P2	3.5REF	

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