

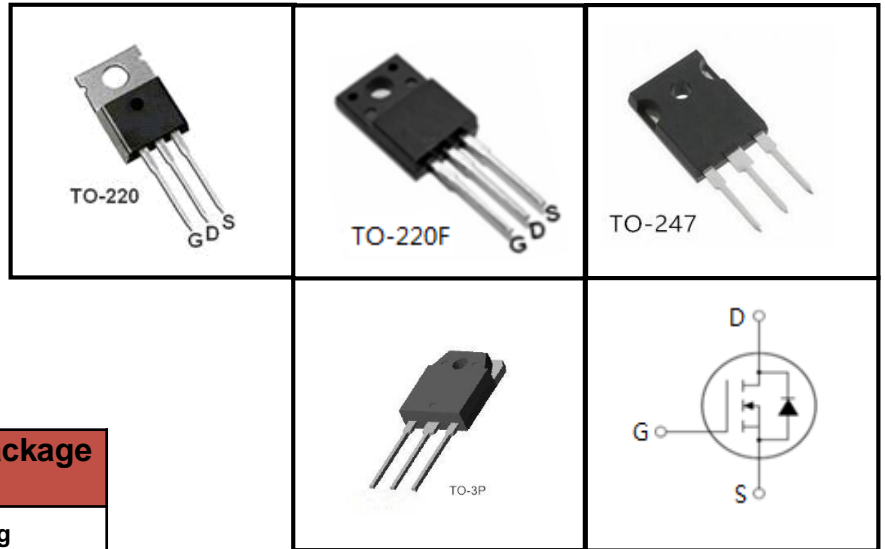
650V N-Channel MOSFET

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
CS20N65F	TO-220F	CS20N65F
CS20N65W	TO-247	CS20N65W
CS20N65V	TO-3P	CS20N65V
CS20N65P	TO-220	CS20N65P

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Value				Unit
		TO-220F	TO-220	TO-247	TO-3P	
Drain-Source Voltage ($V_{GS} = 0V$)	V_{DSS}	650				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}	363				mJ
Power Dissipation ($T_C = 25^\circ\text{C}$)	P_D	120				W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55~+150				$^\circ\text{C}$

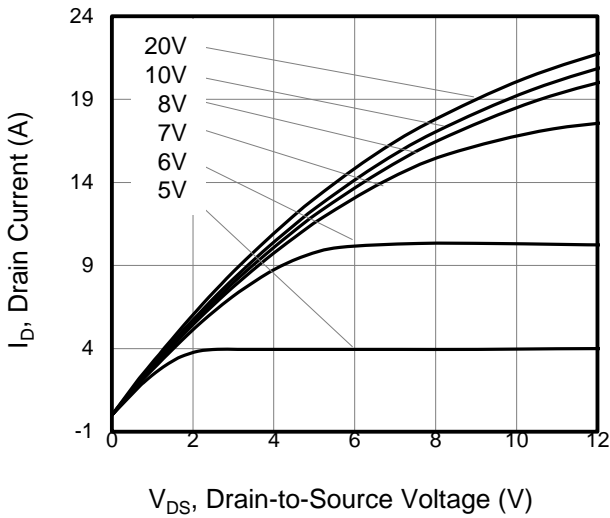
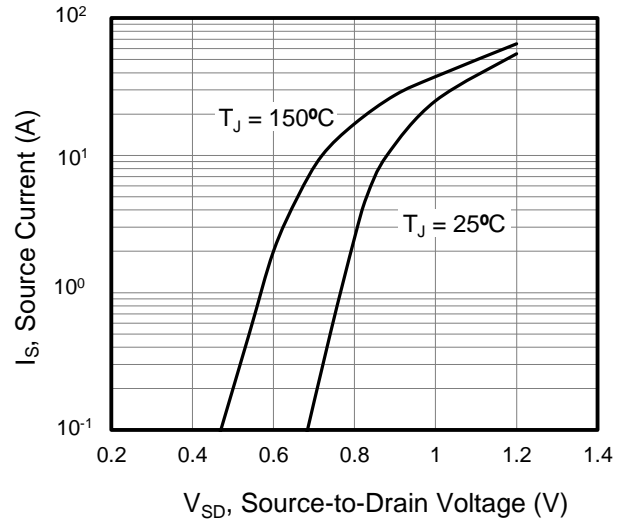
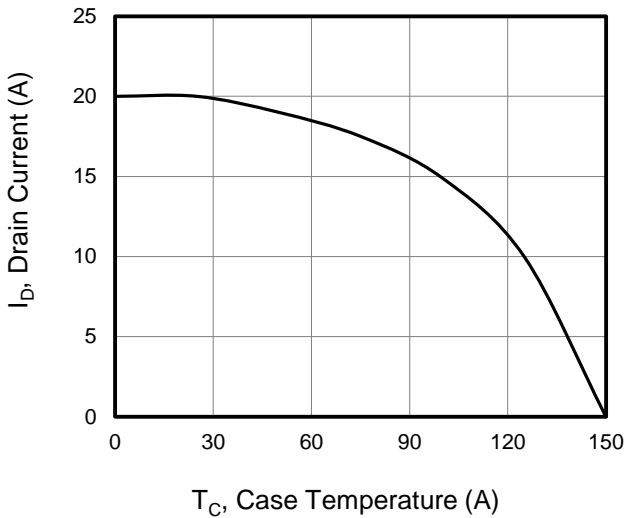
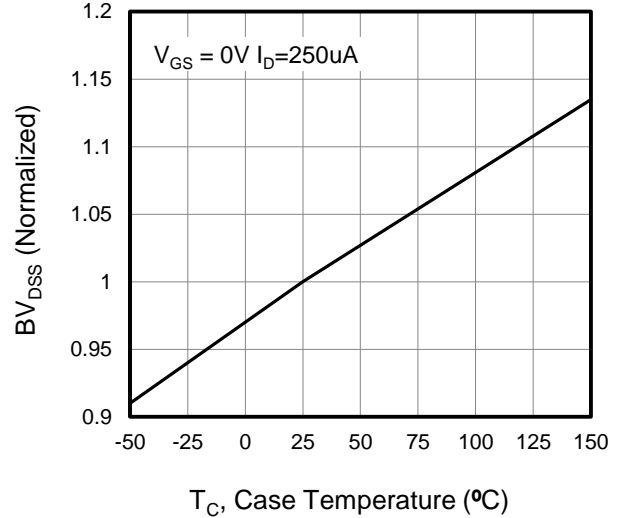
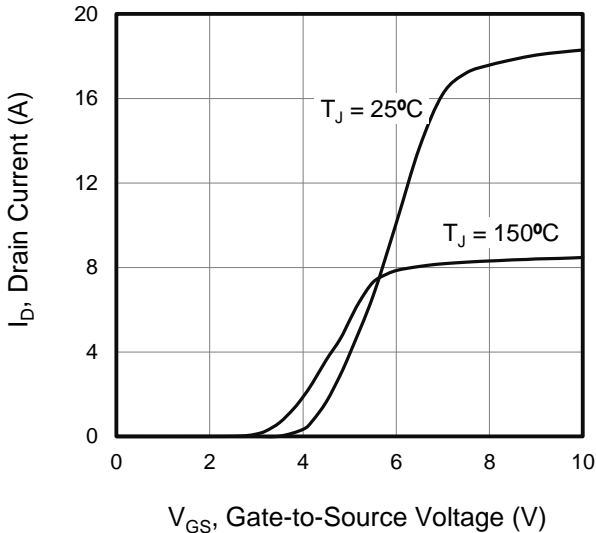
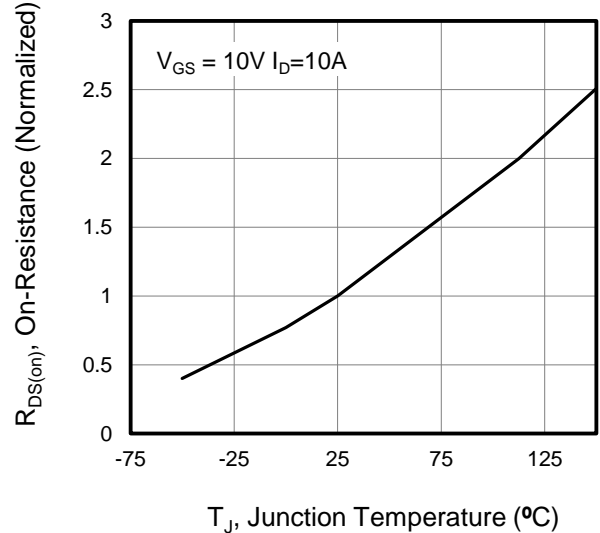
Thermal Resistance						
Parameter	Symbol	Value				Unit
		TO-220F	TO-220	TO-247	TO-3P	
Thermal Resistance, Junction-to-Case	R_{thJC}	1.04				$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62.5		50		

Specifications $T_J = 25^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	650	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 650V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	1	μA
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 30V$	--	--	± 100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	3.0	--	4.0	V
Drain-Source On-Resistance (Note3)	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 10A$	--	0.35	0.4	Ω
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0V,$ $V_{DS} = 25V,$ $f = 1.0\text{MHz}$	--	2701	--	pF
Output Capacitance	C_{oss}		--	249.5	--	
Reverse Transfer Capacitance	C_{rss}		--	24.8	--	
Total Gate Charge	Q_g	$V_{DD} = 520V, I_D = 20A,$ $V_{GS} = 10V$	--	80	--	nC
Gate-Source Charge	Q_{gs}		--	12	--	
Gate-Drain Charge	Q_{gd}		--	34	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 325V, I_D = 20A,$ $R_G = 25\Omega$	--	54	--	ns
Turn-on Rise Time	t_r		--	48.4	--	
Turn-off Delay Time	$t_{d(off)}$		--	301	--	
Turn-off Fall Time	t_f		--	85	--	
Drain-Source Body Diode Characteristics						
Continuous Body Diode Current	I_S	$T_C = 25^\circ\text{C}$	--	--	20	A
Pulsed Diode Forward Current	I_{SM}		--	--	80	
Body Diode Voltage	V_{SD}	$T_J = 25^\circ\text{C}, I_{SD} = 10A, V_{GS} = 0V$	--	--	1.4	V
Reverse Recovery Time	t_{rr}	$V_{GS} = 0V, I_S = 20A,$ $di_F/dt = 100A/\mu s$	--	741	--	ns
Reverse Recovery Charge	Q_{rr}		--	4.71	--	μC

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $L=10\text{mH}, V_{DD} = 50V, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. Pulse Test: Pulse width $\leq 300\mu s$, Duty Cycle $\leq 1\%$

Typical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted

Figure 1. Output Characteristics ($T_J = 25^\circ\text{C}$)

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 $T_J = 25^\circ\text{C}$, unless otherwise noted

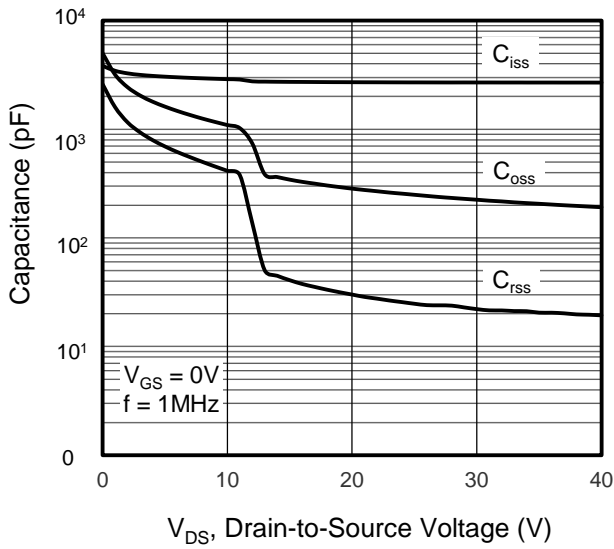
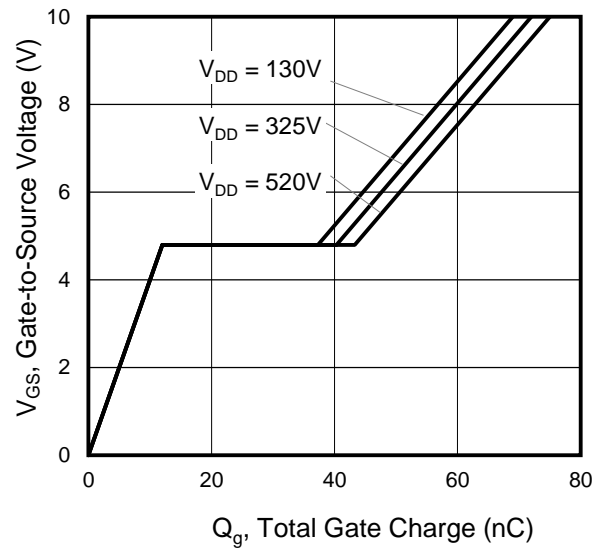
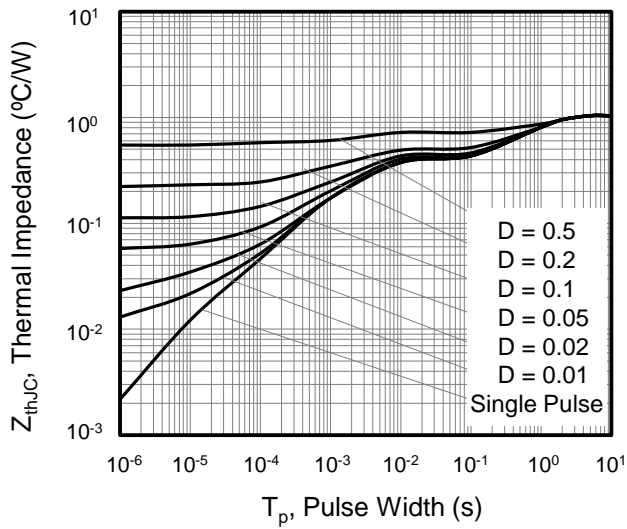
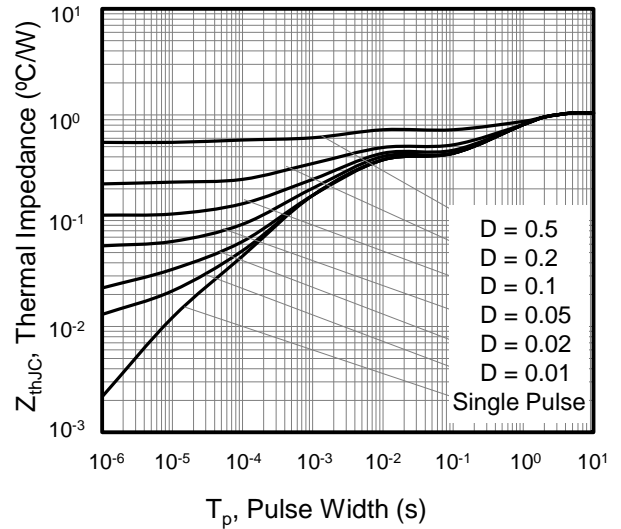
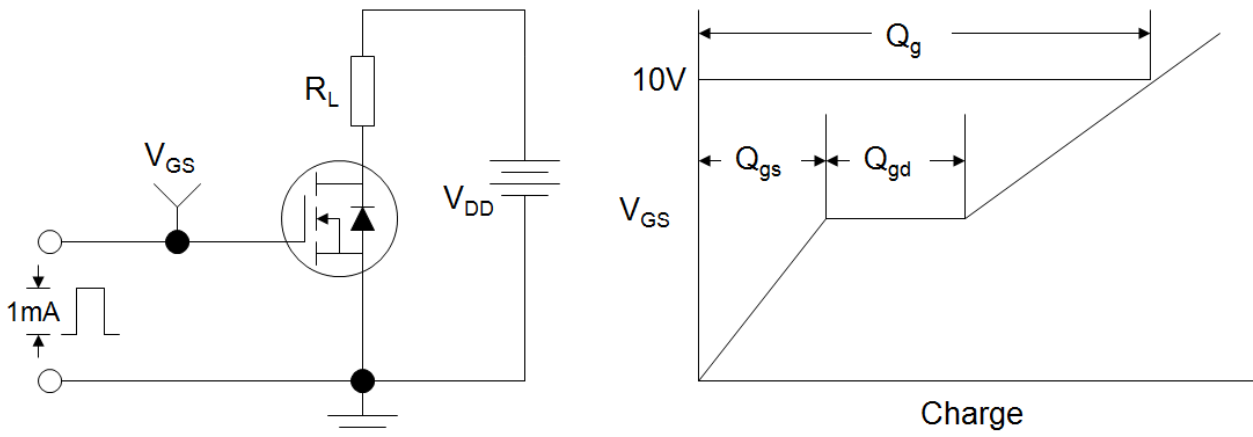
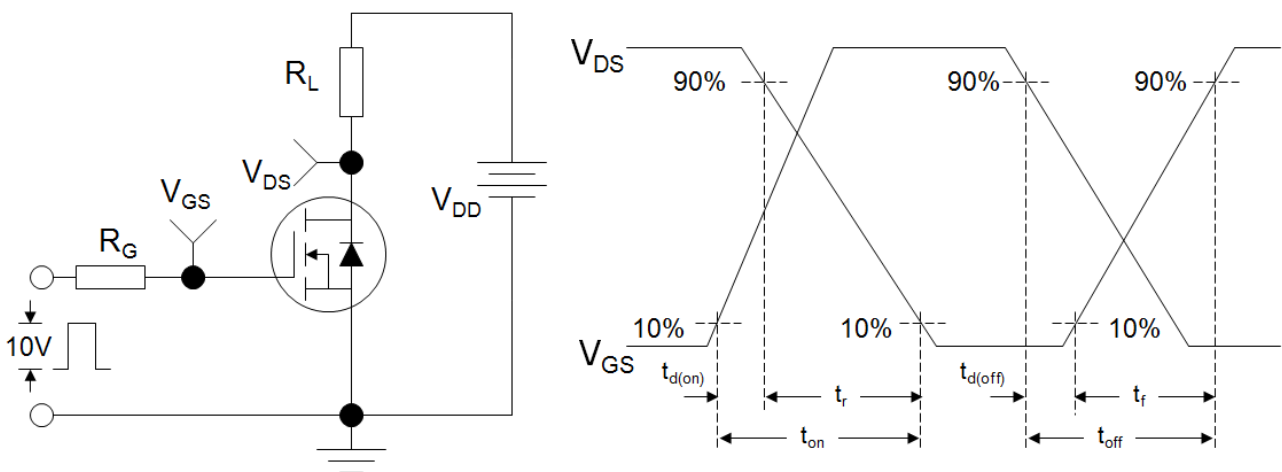
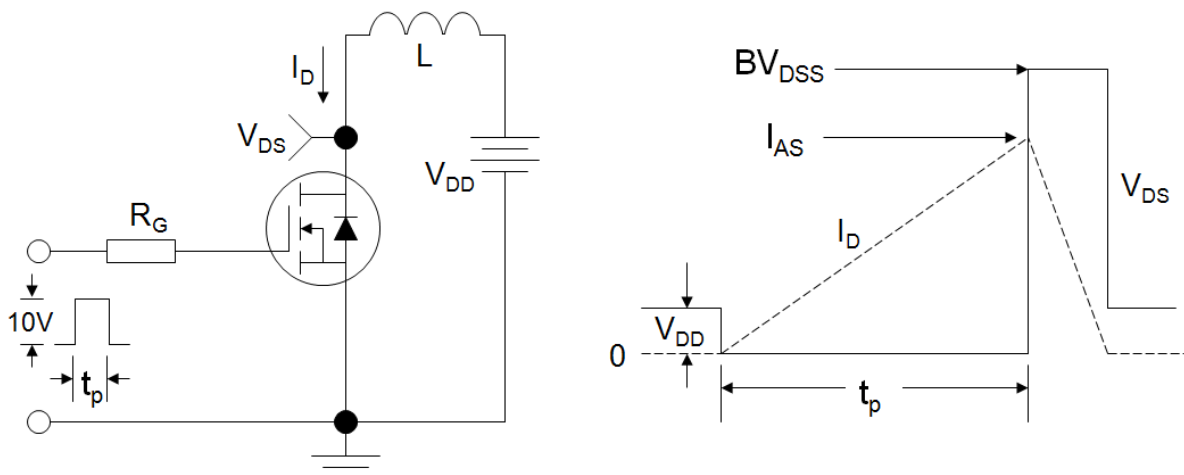
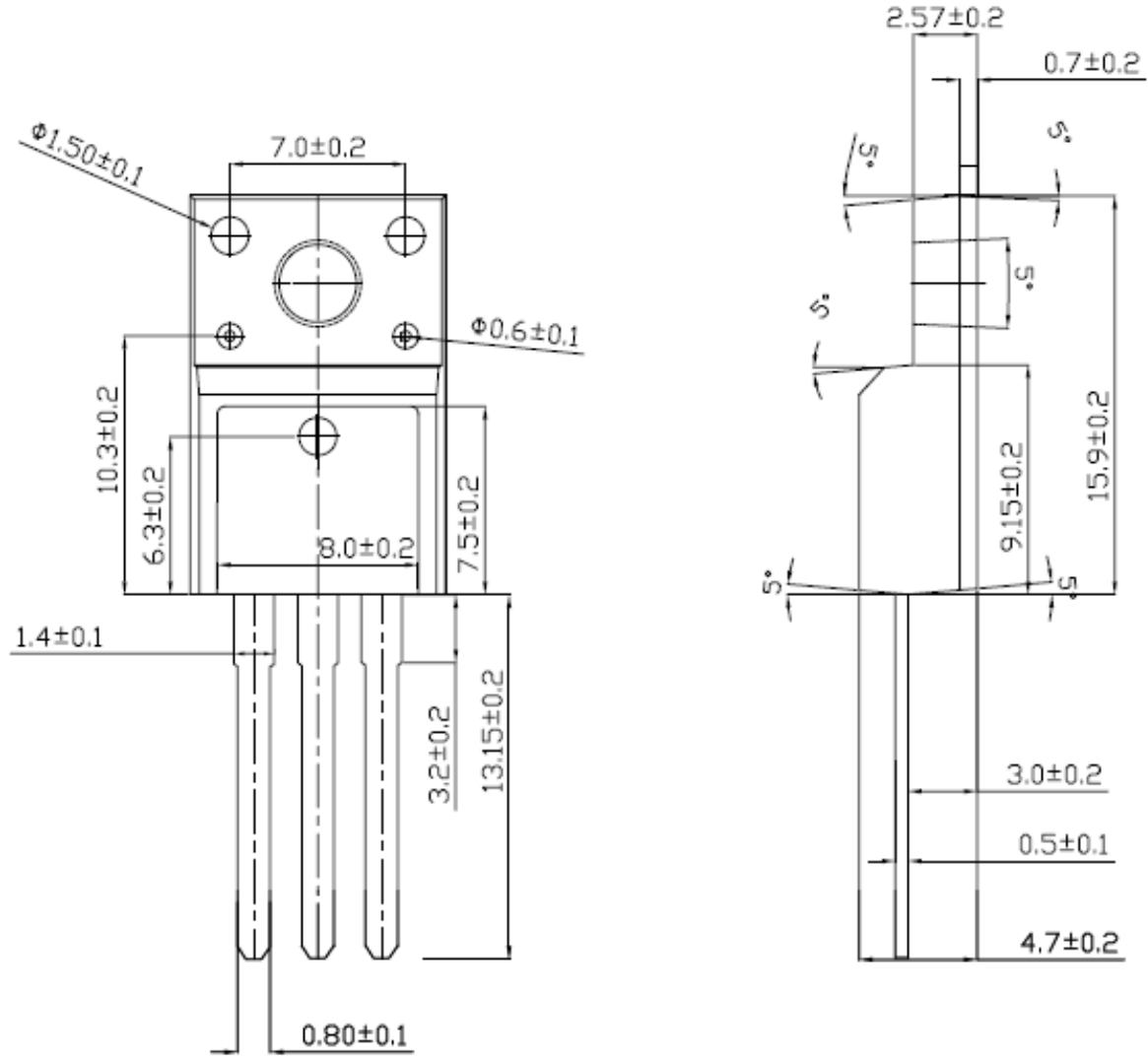
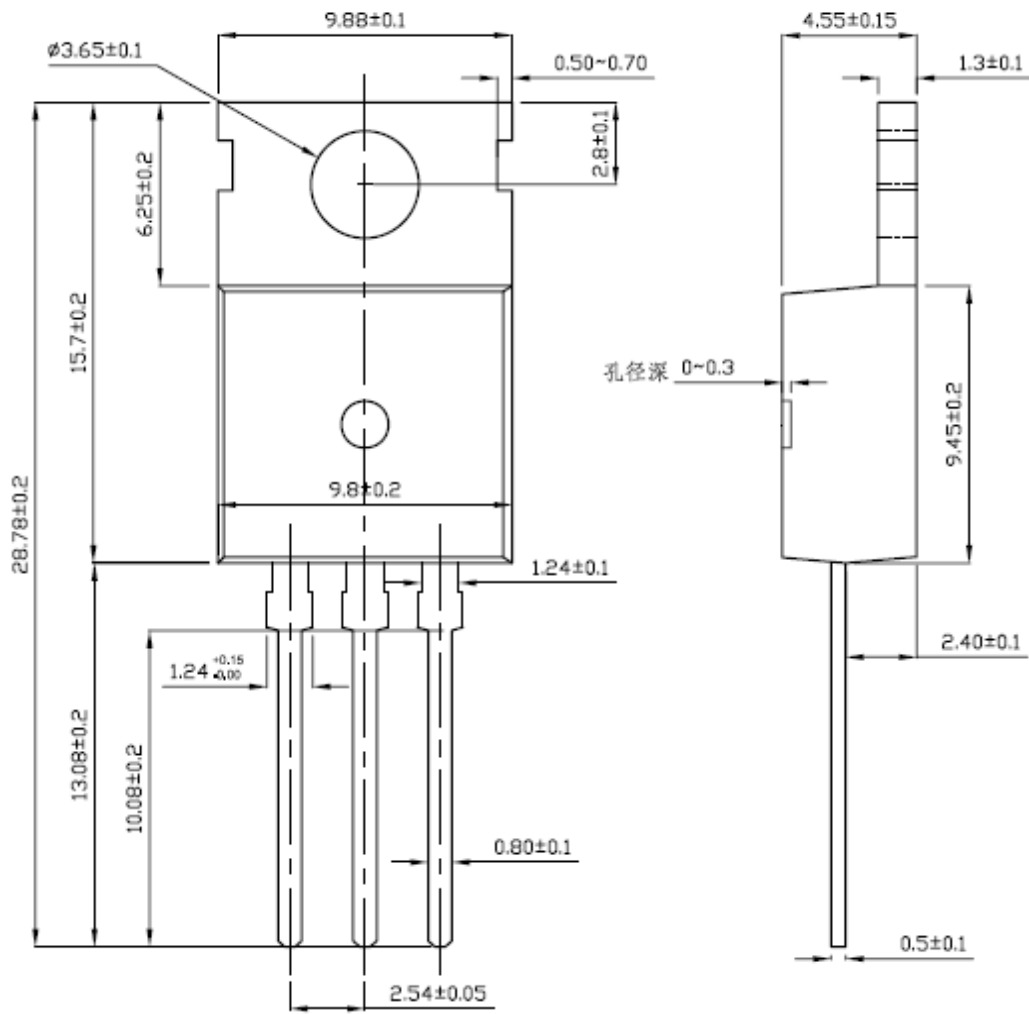
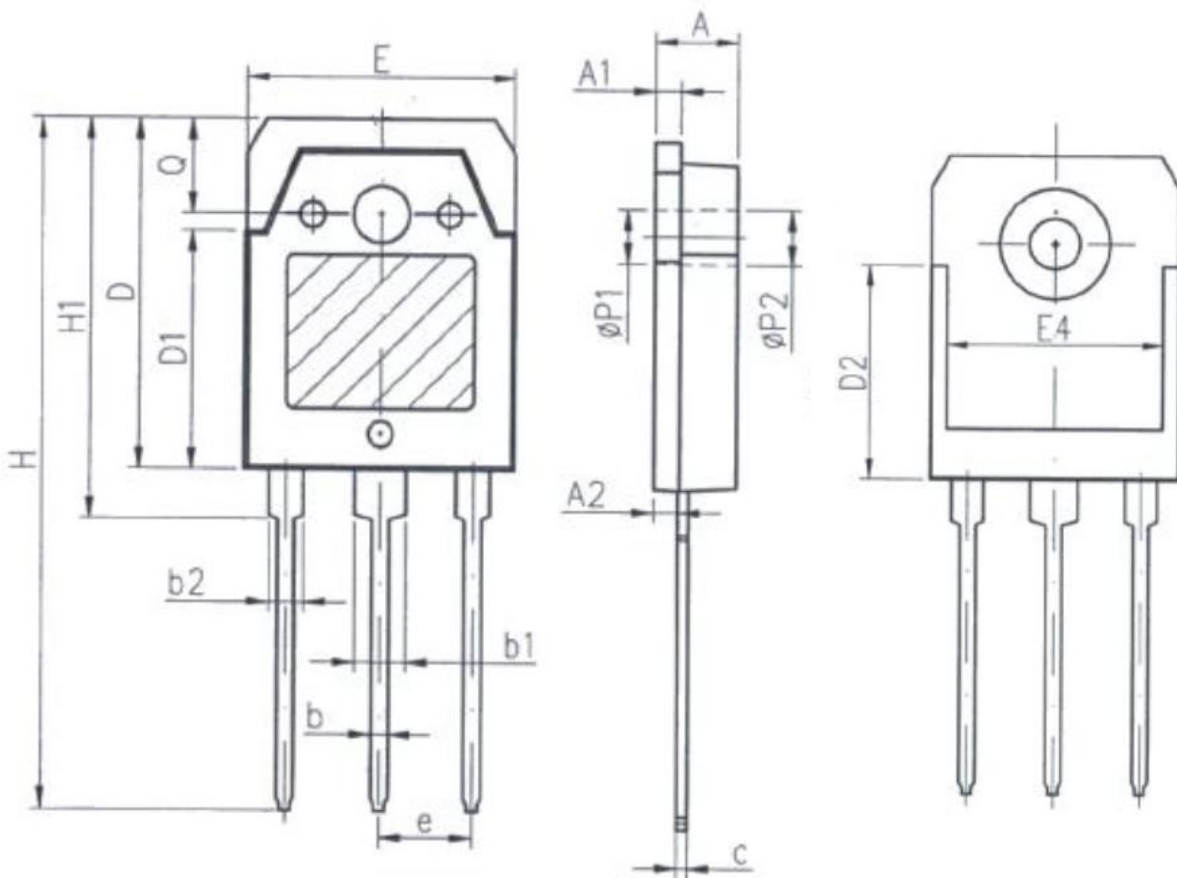
Figure 7. Capacitance

Figure 8. Gate Charge

Figure 9. Transient Thermal Impedance
TO-220F, TO-220

Figure 10. Transient Thermal Impedance
TO-247, TO-3P


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


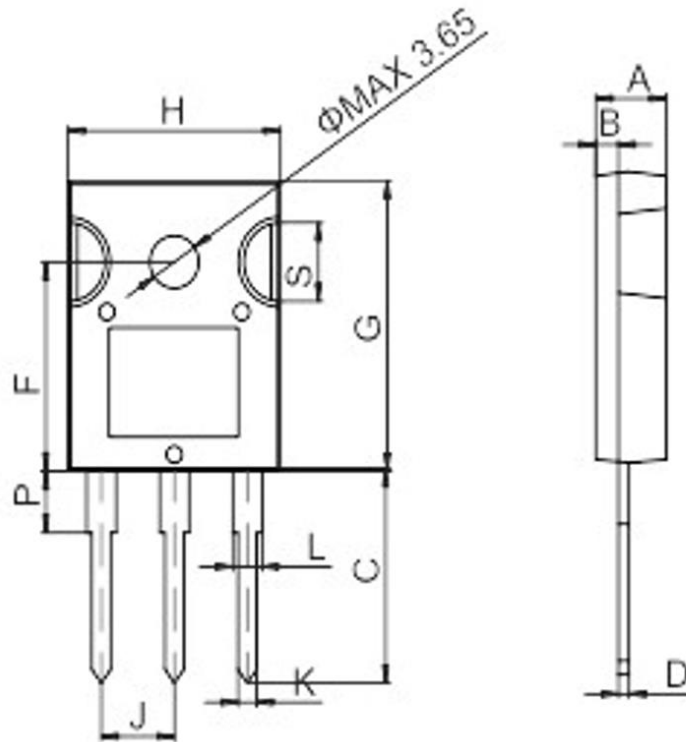
TO-220



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	

TO-247



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.9		5.4	0.193		0.213
B	1.6		2.0	0.063		0.079
C	14.35		15.4	0.565		0.606
D	0.5		0.8	0.020		0.031
F	14.4		15.1	0.567		0.594
G	19.7		20.6	0.775		0.811
H	15.4		16.2	0.606		0.638
J	5.3		5.6	0.209		0.220
K	1.3		1.5	0.051		0.059
L	2.8		3.3	0.110		0.130
P	3.7		4.2	0.146		0.165
S	5.35		5.65	0.211		0.222

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