

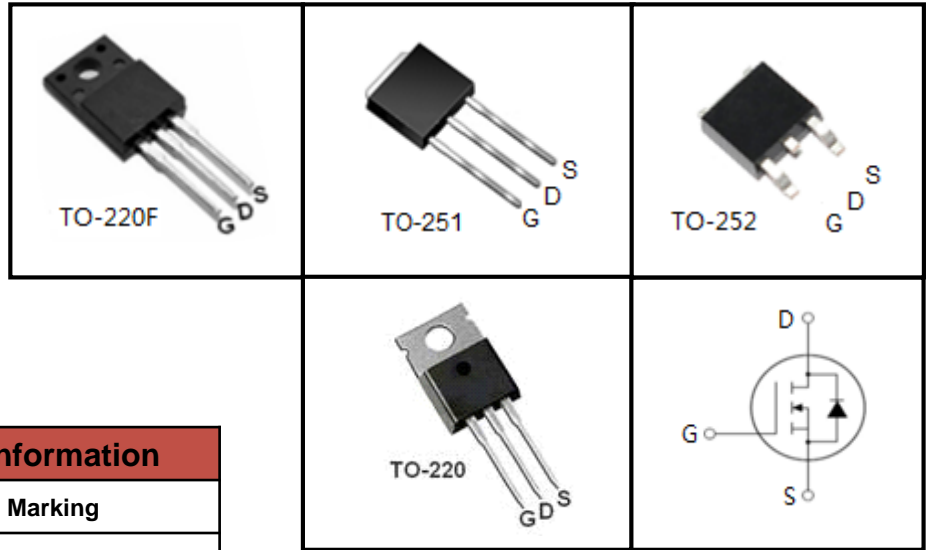
650V N-Channel MOSFET

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
CS5N65F	TO-220F	CS5N65F
CS5N65P	TO-220	CS5N65P
CS5N65U	TO-251	CS5N65U
CS5N65D	TO-252	CS5N65D

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$, unless otherwise noted

Parameter	Symbol	Value				Unit
		TO-220F	TO-252	TO-251	TO-220	
Drain-Source Voltage ($V_{GS} = 0V$)	V_{DSS}	650				V
Continuous Drain Current	I_D	5				A
Pulsed Drain Current (note1)	I_{DM}	20				A
Gate-Source Voltage	V_{GSS}	± 30				V
Single Pulse Avalanche Energy (note2)	E_{AS}	115				mJ
Avalanche Current (note1)	I_{AS}	4.8				A
Repetitive Avalanche Energy (note1)	E_{AR}	69				mJ
Power Dissipation ($T_C = 25^\circ\text{C}$)	P_D	83	54			W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55~+150				$^\circ\text{C}$

Thermal Resistance

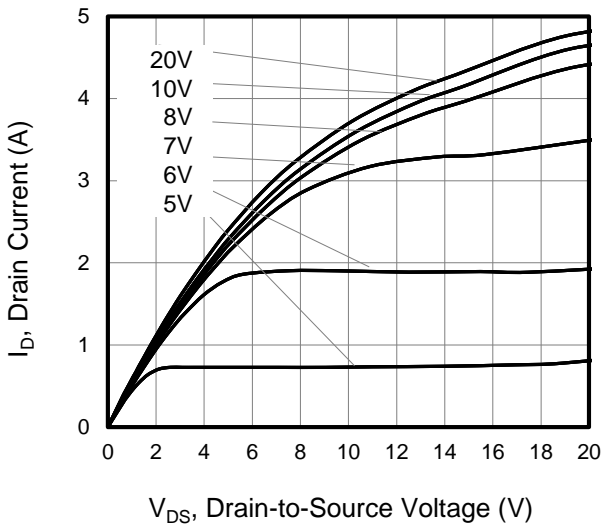
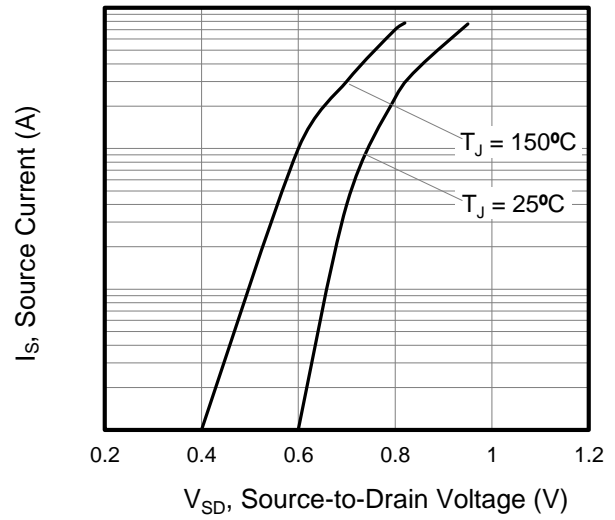
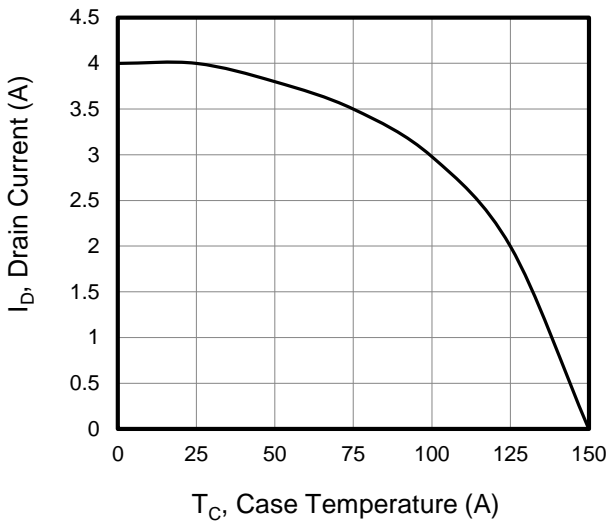
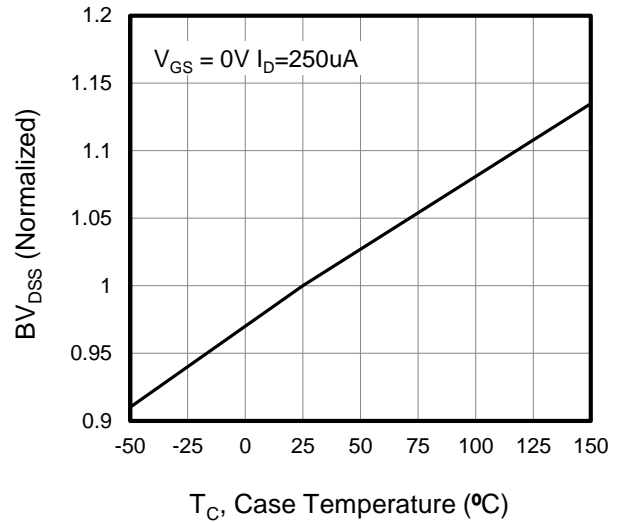
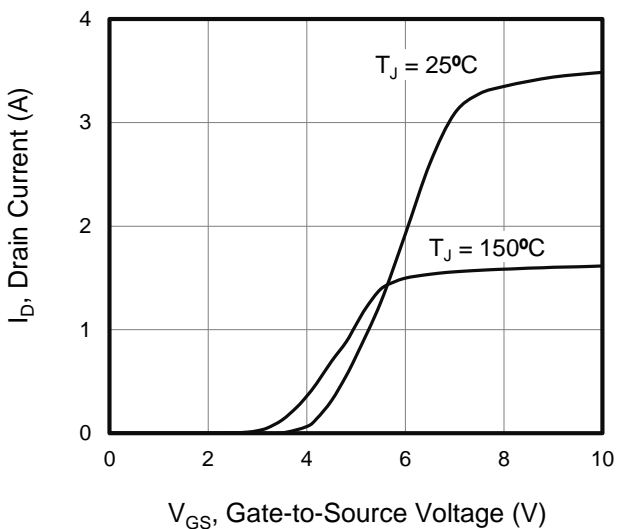
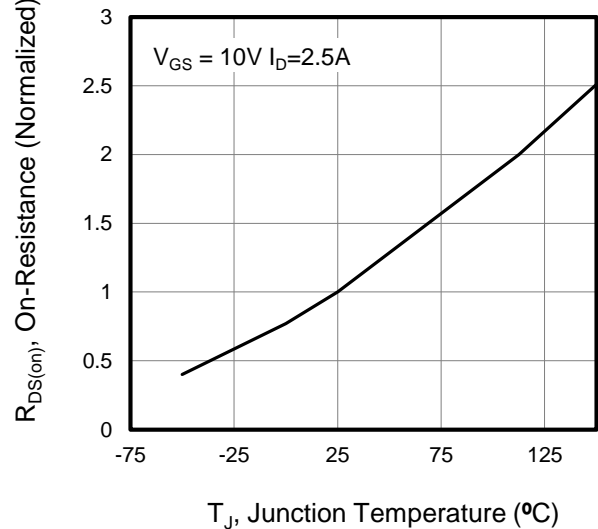
Parameter	Symbol	Value				Unit
		TO-220F	TO-252	TO-251	TO-220	
Thermal Resistance, Junction-to-Case	R_{thJC}	2.3	1.5			$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62.5	60			

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)	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 2.5A$	--	1.8	2.1	Ω
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0V,$ $V_{DS} = 25V,$ $f = 1.0\text{MHz}$	--	588	--	pF
Output Capacitance	C_{oss}		--	61	--	
Reverse Transfer Capacitance	C_{rss}		--	7	--	
Total Gate Charge	Q_g	$V_{DD} = 520V, I_D = 5A,$ $V_{GS} = 10V$	--	13	--	nC
Gate-Source Charge	Q_{gs}		--	2	--	
Gate-Drain Charge	Q_{gd}		--	7	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 325V, I_D = 5A,$ $R_G = 25\Omega$	--	36	--	ns
Turn-on Rise Time	t_r		--	16	--	
Turn-off Delay Time	$t_{d(off)}$		--	93	--	
Turn-off Fall Time	t_f		--	27	--	
Drain-Source Body Diode Characteristics						
Continuous Body Diode Current	I_S	$T_C = 25^\circ\text{C}$	--	--	5	A
Pulsed Diode Forward Current	I_{SM}		--	--	20	
Body Diode Voltage	V_{SD}	$T_J = 25^\circ\text{C}, I_{SD} = 2.5A, V_{GS} = 0V$	--	--	1.4	V
Reverse Recovery Time	t_{rr}	$V_{GS} = 0V, I_S = 5A,$ $di_F/dt = 100A/\mu s$	--	677	--	ns
Reverse Recovery Charge	Q_{rr}		--	1.9	--	μC

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $L=10\text{mH}, V_{DD} = 50V, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$
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

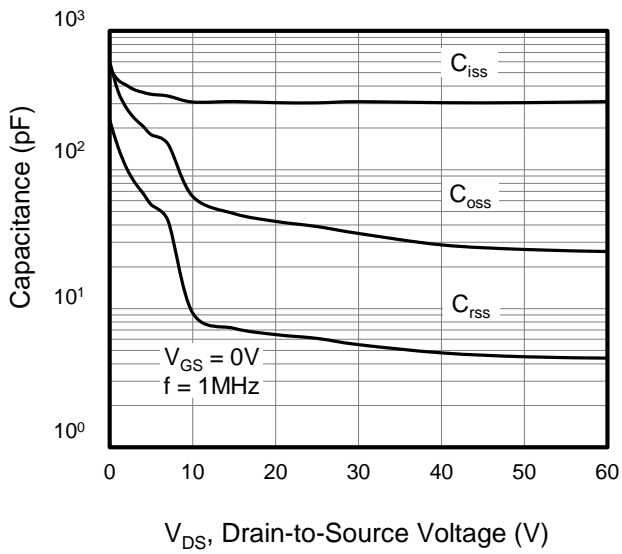


Figure 8. Gate Charge

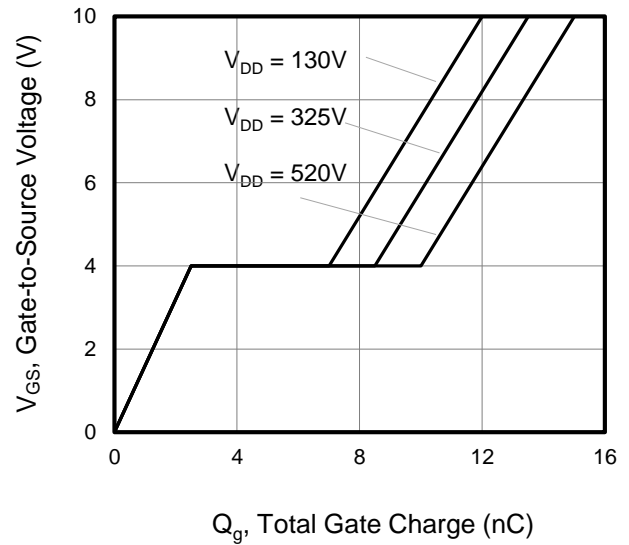


Figure 9. Transient Thermal Impedance

TO-220, TO-251, TO-252

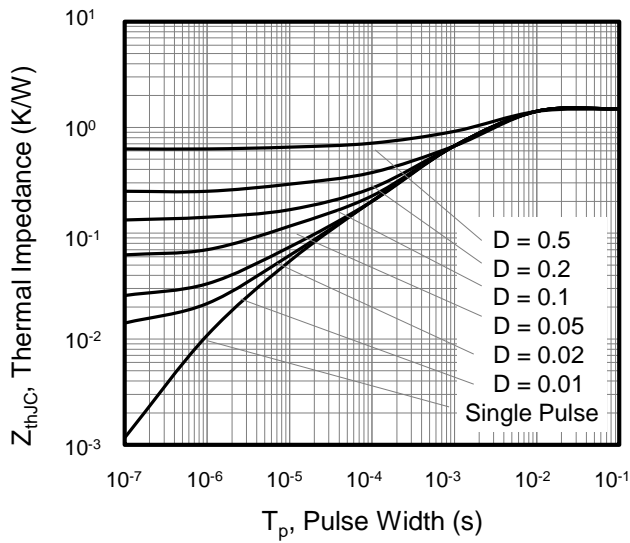


Figure 10. Transient Thermal Impedance

TO-220F

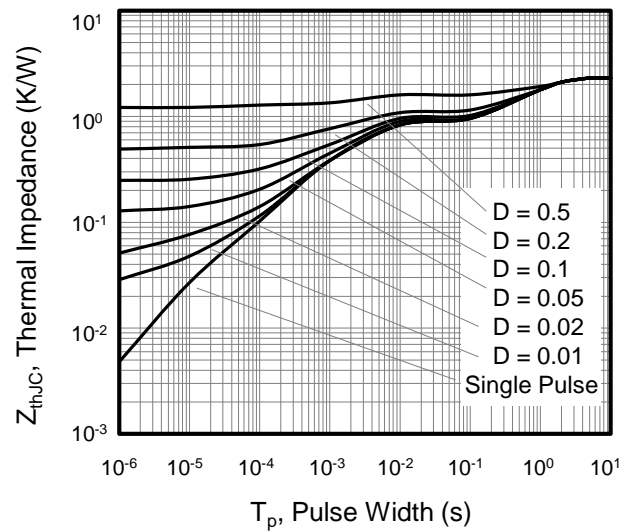
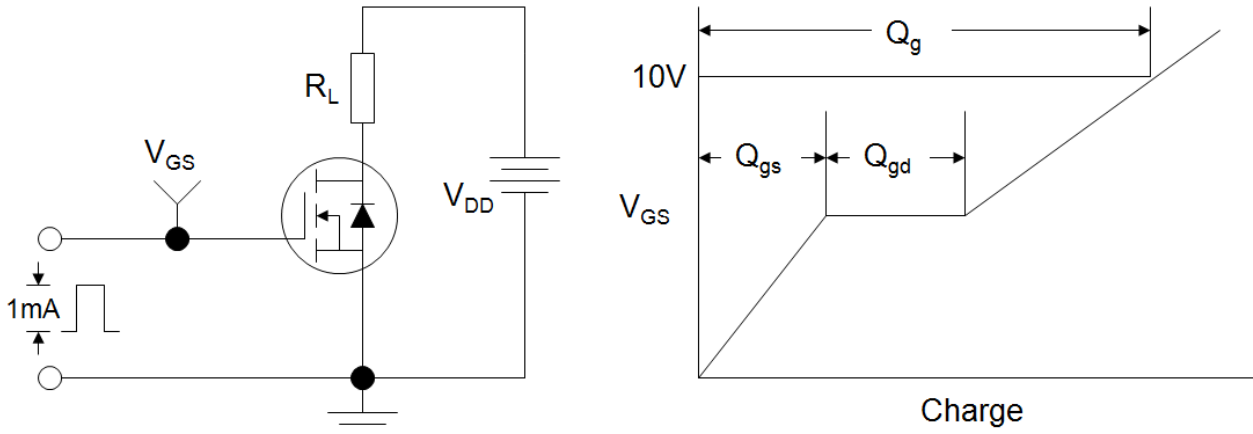
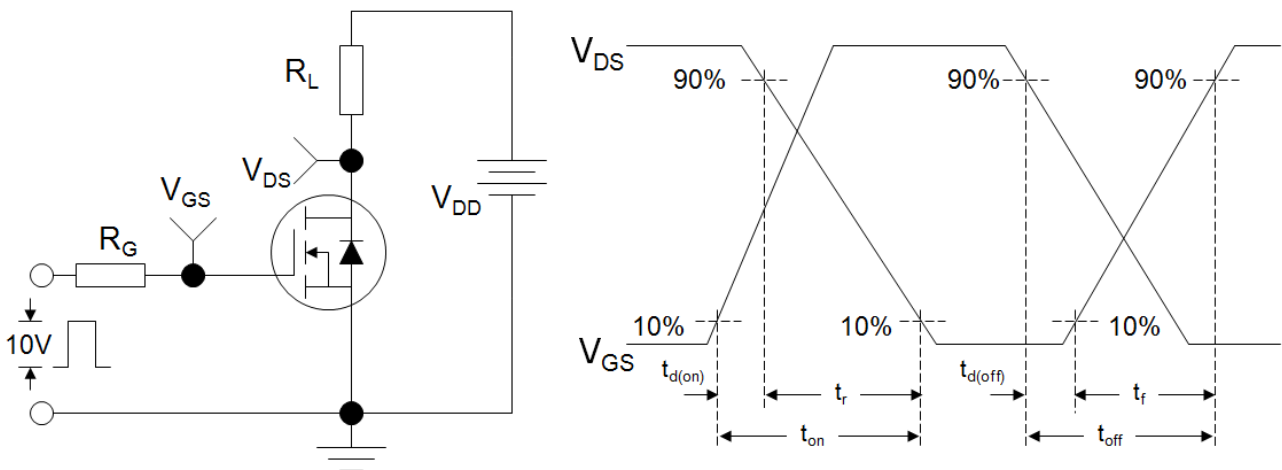
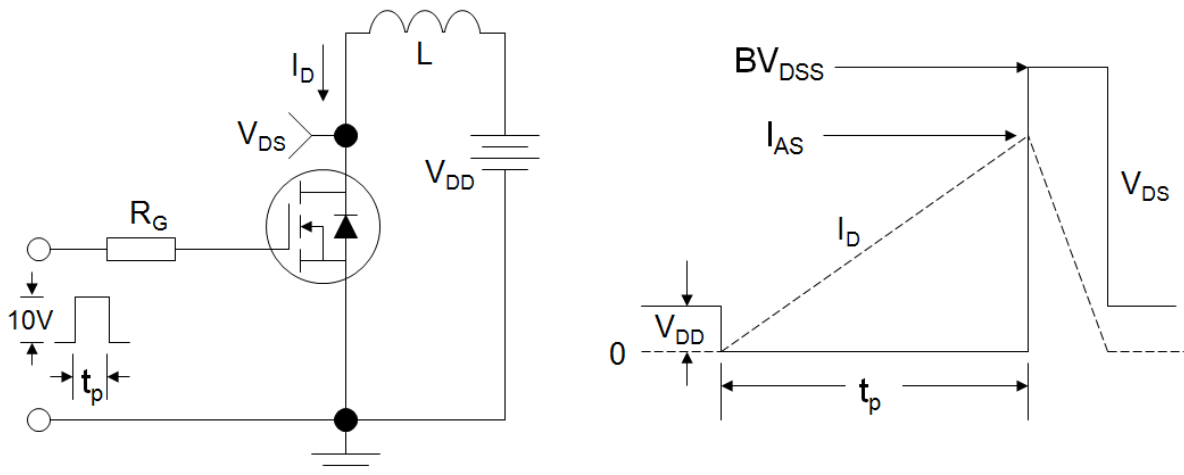
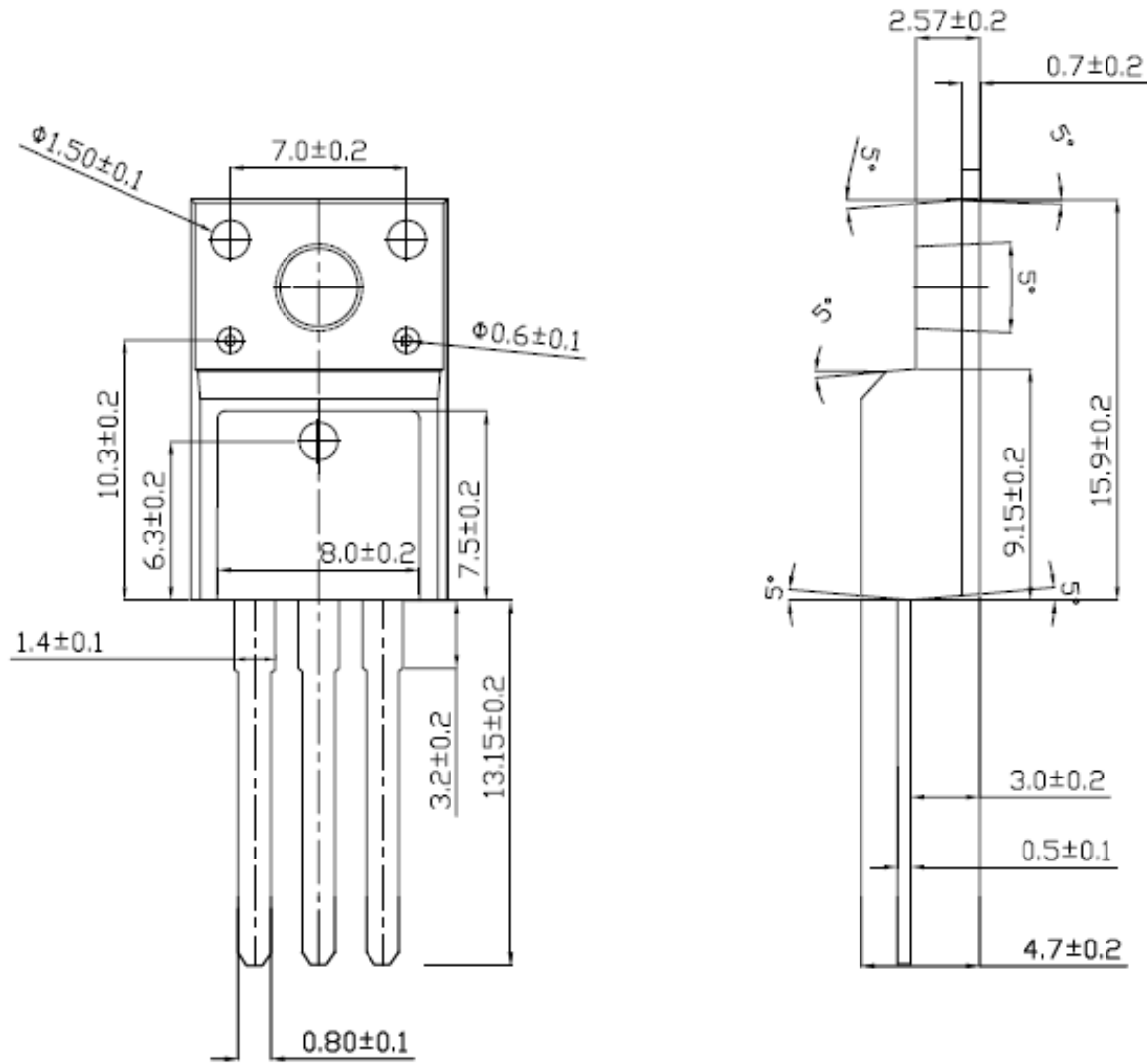
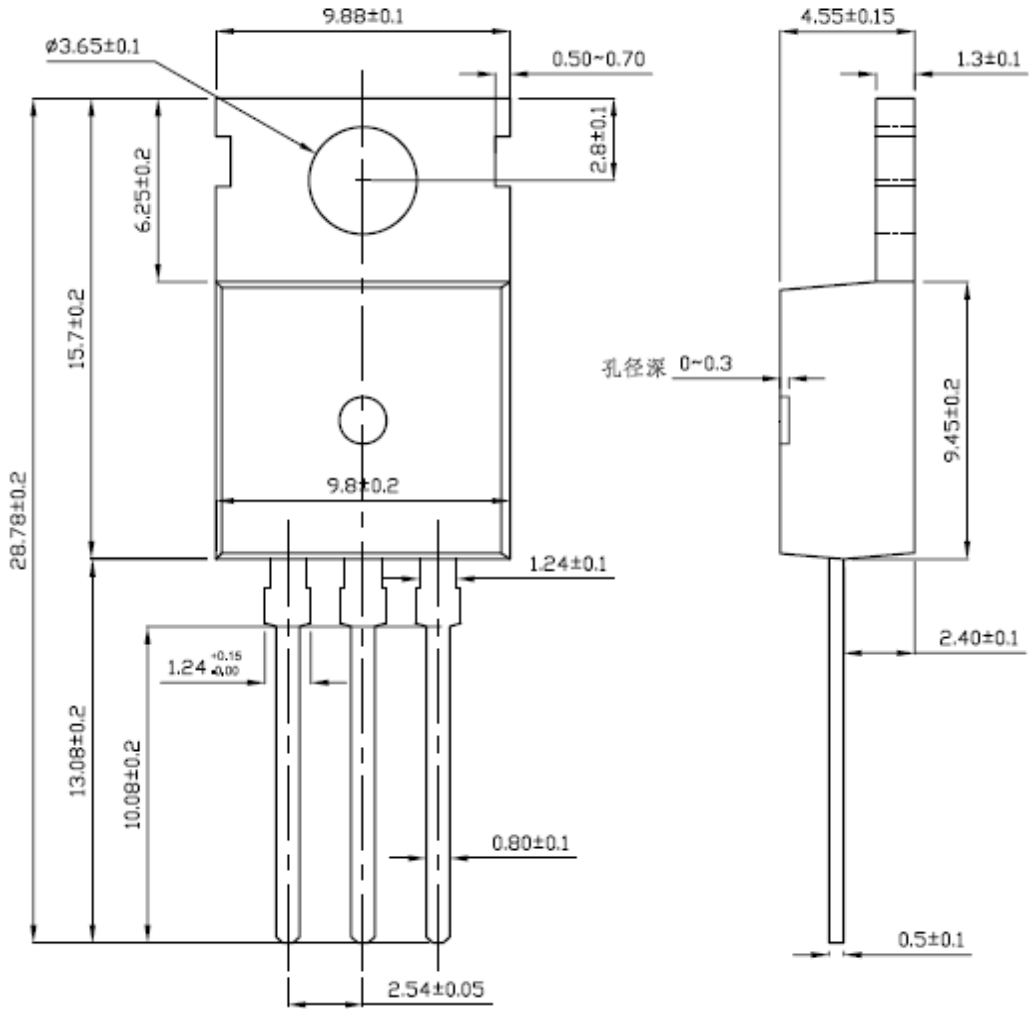


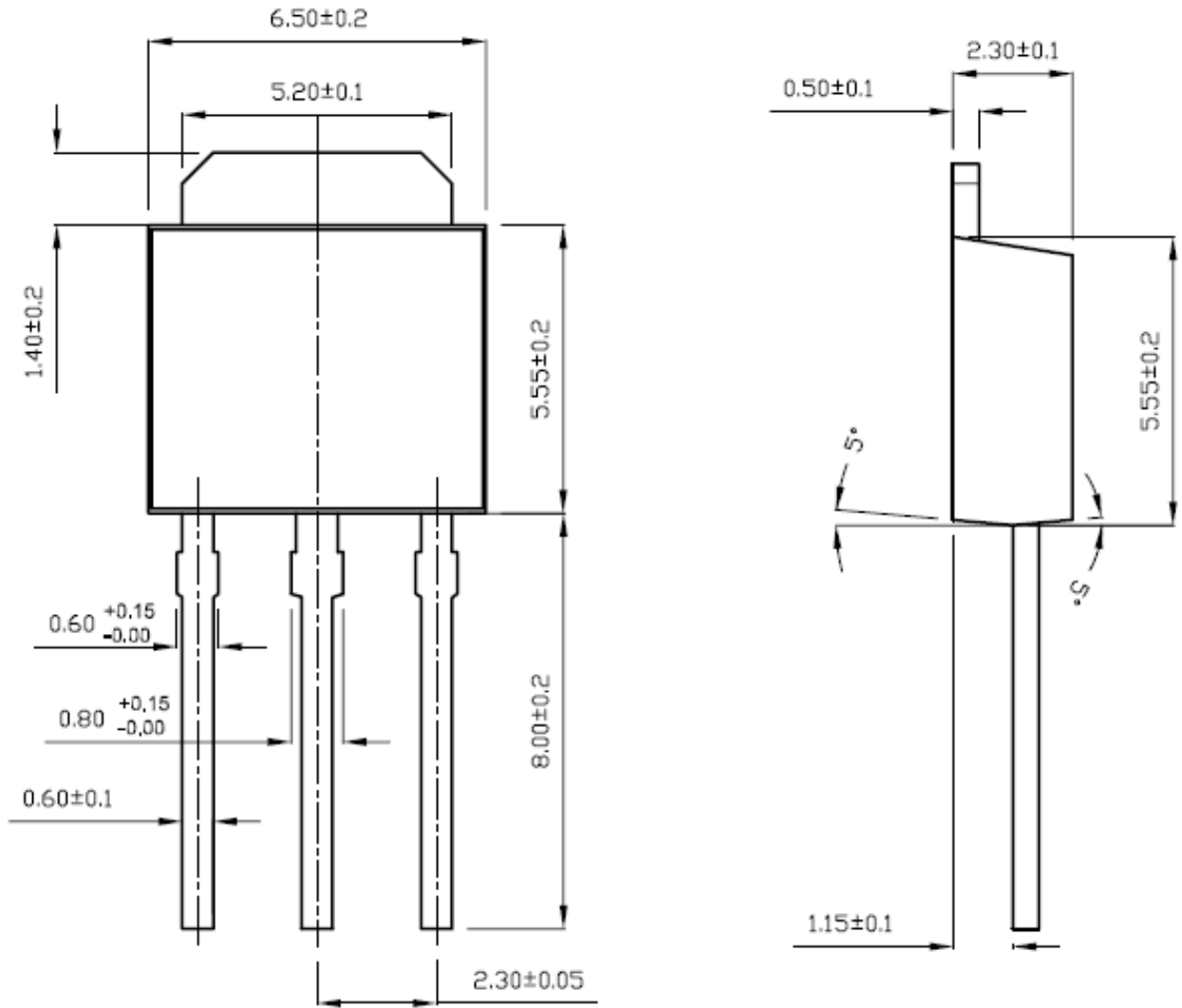
Figure A: Gate Charge Test Circuit and Waveform

Figure B: Resistive Switching Test Circuit and Waveform

Figure C: Unclamped Inductive Switching Test Circuit and Waveform


TO-220F

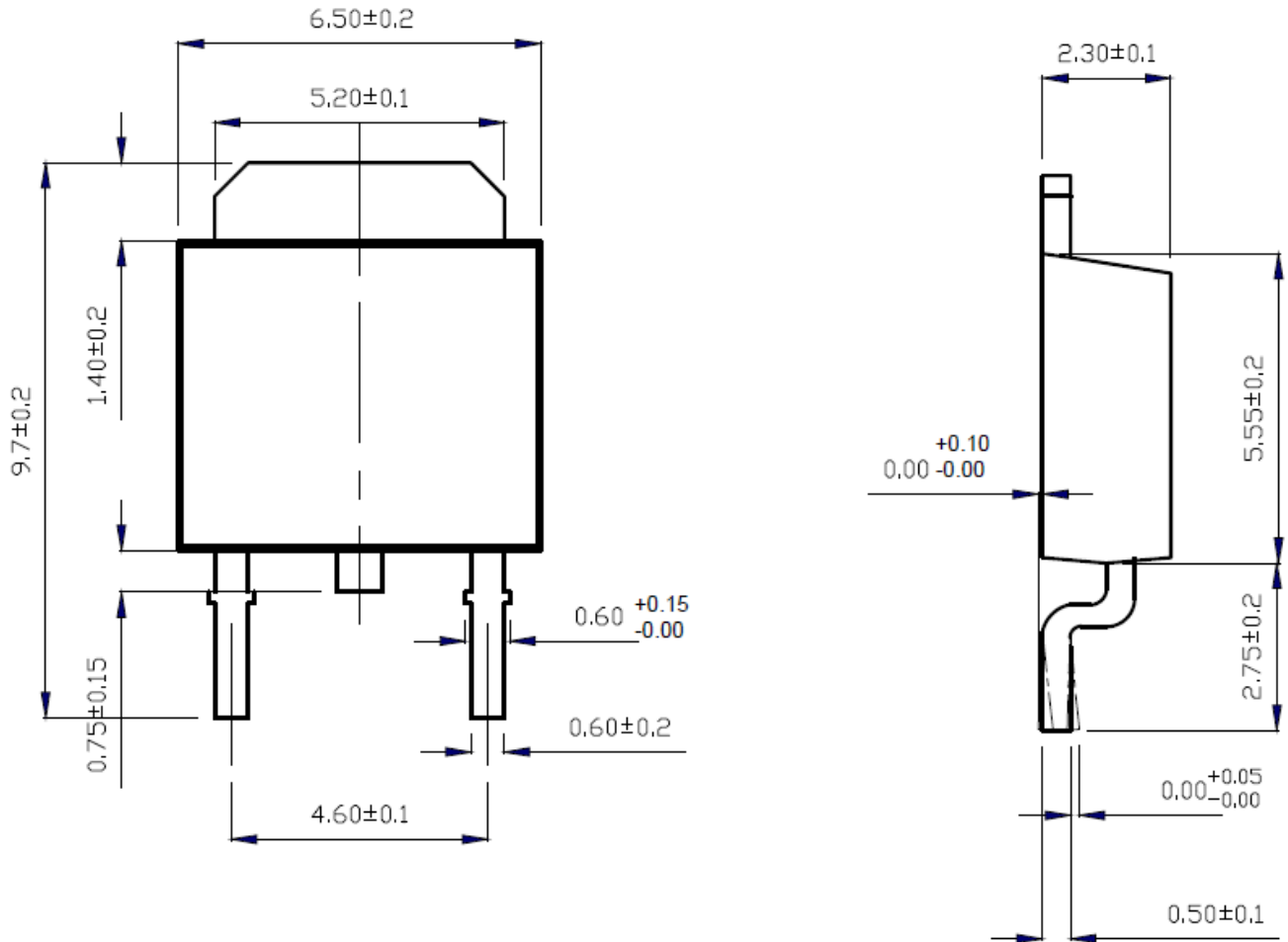


TO-220



TO-251


TO-252



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