

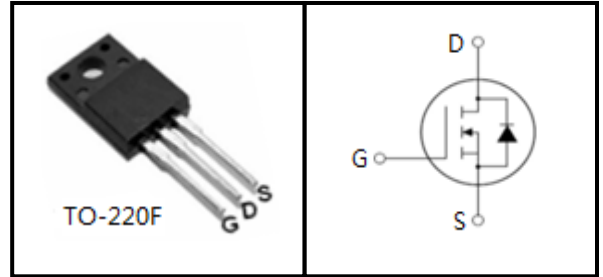
## 650V N-Channel MOSFET

### 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
CS12N65FF	TO-220F	CS12N65FF

Absolute Maximum Ratings $T_C = 25^{\circ}\text{C}$ , unless otherwise noted			
Parameter	Symbol	Value	Unit
		TO-220F	
Drain-Source Voltage ( $V_{GS} = 0\text{V}$ )	$V_{DSS}$	650	V
Continuous Drain Current	$I_D$	12	A
Pulsed Drain Current (note1)	$I_{DM}$	48	A
Gate-Source Voltage	$V_{GSS}$	$\pm 30$	V
Single Pulse Avalanche Energy (note2)	$E_{AS}$	352.8	mJ
Avalanche Current (note1)	$I_{AS}$	8.4	A
Repetitive Avalanche Energy (note1)	$E_{AR}$	211.68	mJ
Power Dissipation ( $T_C = 25^{\circ}\text{C}$ )	$P_D$	65	W
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55~+150	$^{\circ}\text{C}$

Thermal Resistance			
Parameter	Symbol	Value	Unit
		TO-220F	
Thermal Resistance, Junction-to-Case	$R_{thJC}$	1.92	$^{\circ}\text{C/W}$
Thermal Resistance, Junction-to-Ambient	$R_{thJA}$	62.5	

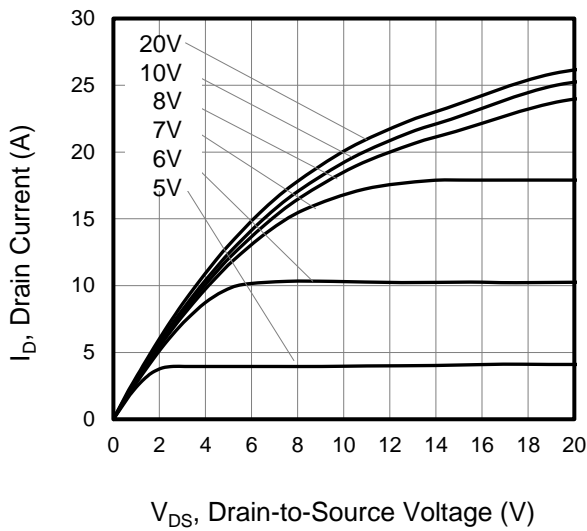
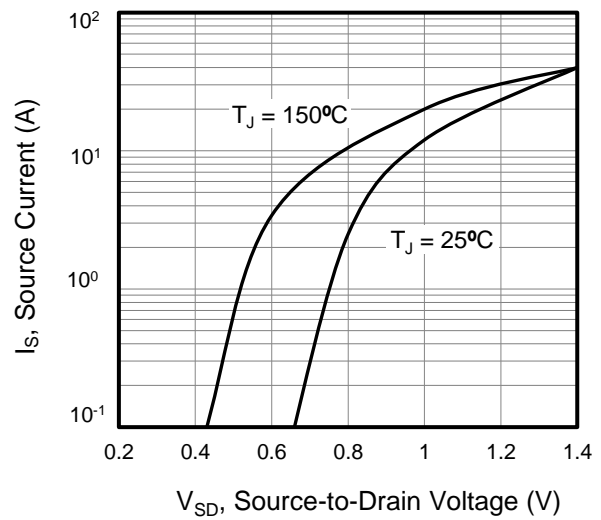
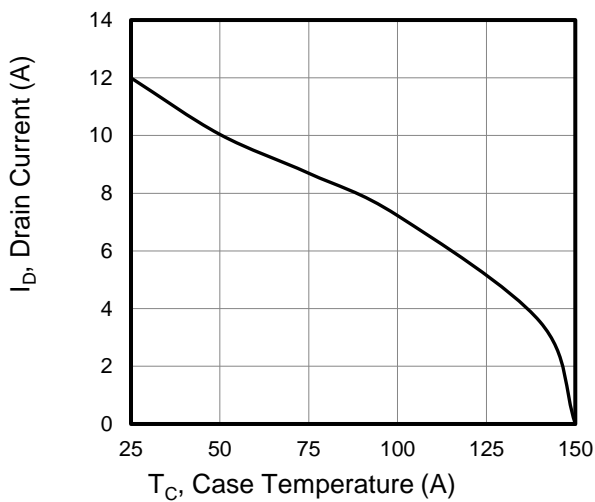
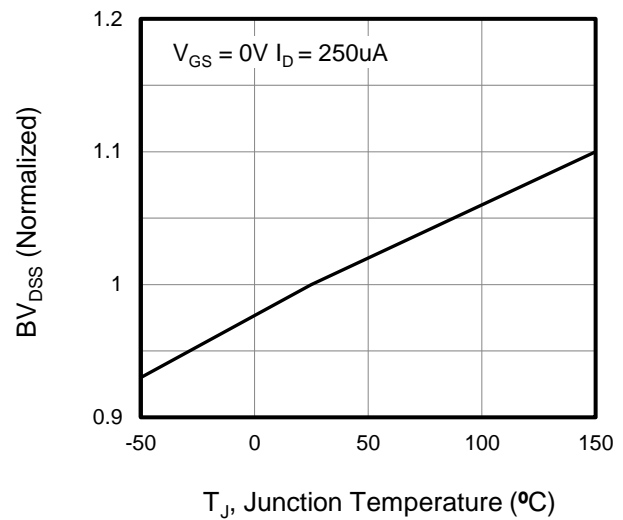
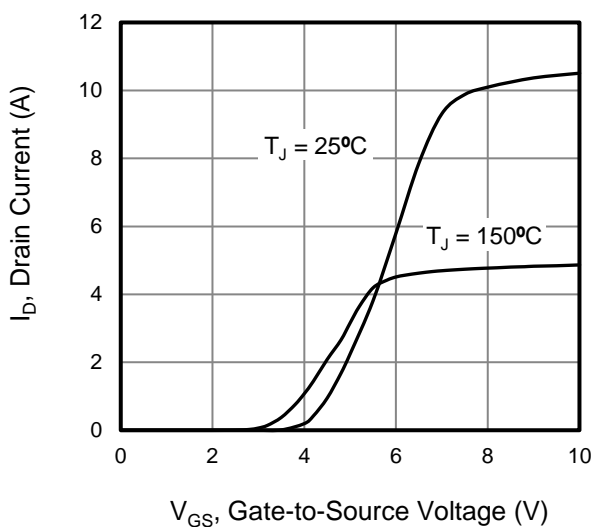
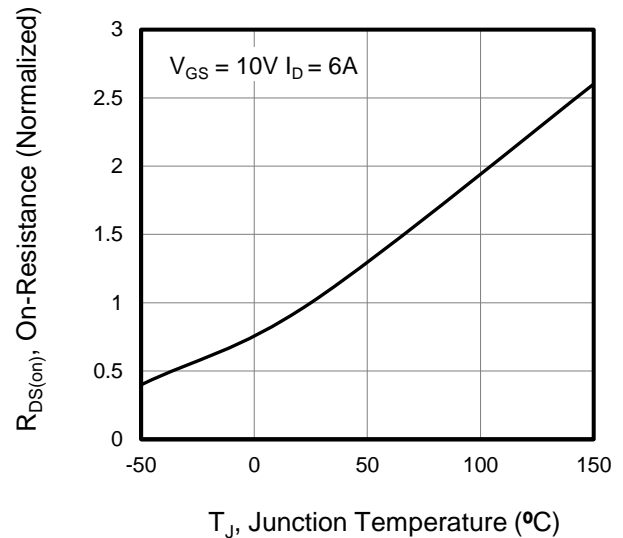
**Specifications**  $T_J = 25^{\circ}\text{C}$ , unless otherwise noted

Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Static						
Drain-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	650	--	--	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 650V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 25°C	--	--	1	μA
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>GS</sub> = ±30V	--	--	±100	nA
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	3.0	--	4.0	V
Drain-Source On-Resistance (Note3)	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 6.0A	--	0.55	0.68	Ω
Dynamic						
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V, f = 1.0MHz	--	1750	--	pF
Output Capacitance	C <sub>oss</sub>		--	157	--	
Reverse Transfer Capacitance	C <sub>rss</sub>		--	4.5	--	
Internal Gate Resistance	R <sub>g</sub>		--	1.1	--	Ω
Total Gate Charge	Q <sub>g</sub>	V <sub>DD</sub> = 520V, I <sub>D</sub> = 12A, V <sub>GS</sub> = 10V	--	32	--	nC
Gate-Source Charge	Q <sub>gs</sub>		--	8.78	--	
Gate-Drain Charge	Q <sub>gd</sub>		--	11.4	--	
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 325V, I <sub>D</sub> =12A, R <sub>G</sub> = 25 Ω	--	43	--	ns
Turn-on Rise Time	t <sub>r</sub>		--	20	--	
Turn-off Delay Time	t <sub>d(off)</sub>		--	122	--	
Turn-off Fall Time	t <sub>f</sub>		--	39	--	
Drain-Source Body Diode Characteristics						
Continuous Body Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	--	--	12	A
Pulsed Diode Forward Current	I <sub>SM</sub>		--	--	48	
Body Diode Voltage	V <sub>SD</sub>	T <sub>J</sub> = 25°C, I <sub>SD</sub> = 6A, V <sub>GS</sub> = 0V	--	--	1.4	V
Reverse Recovery Time	t <sub>rr</sub>	V <sub>GS</sub> = 0V, I <sub>S</sub> = 12A, di <sub>F</sub> /dt =100A /μs	--	348	--	ns
Reverse Recovery Charge	Q <sub>rr</sub>		--	4.5	--	μC

**Notes**

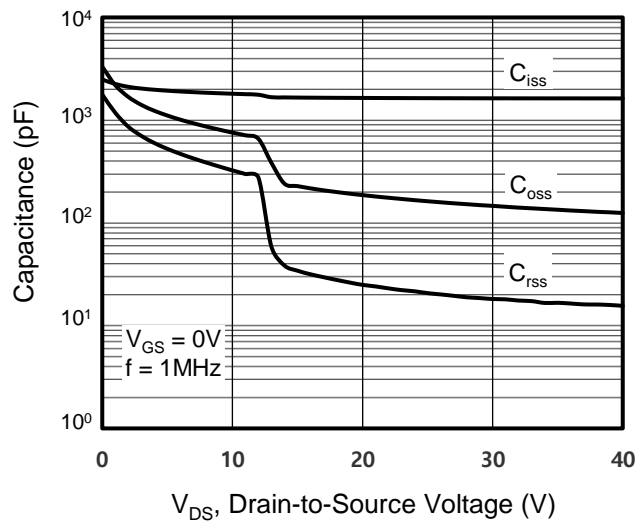
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $L = 10.0mH, V_{DD} = 50V, R_G = 25\Omega$ , Starting  $T_J = 25^{\circ}\text{C}$
3. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty Cycle  $\leq 1\%$

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

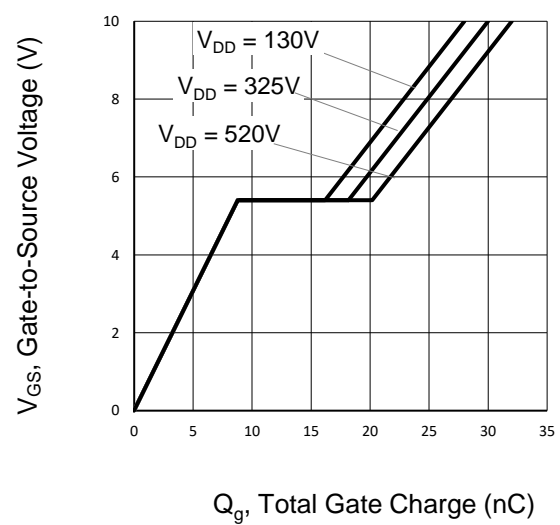
**Figure 1. Output Characteristics ( $T_J = 25^{\circ}\text{C}$ )**

**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**

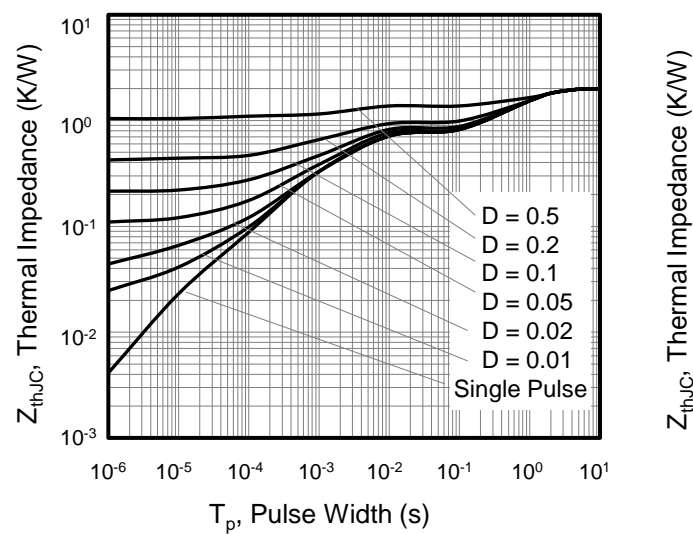


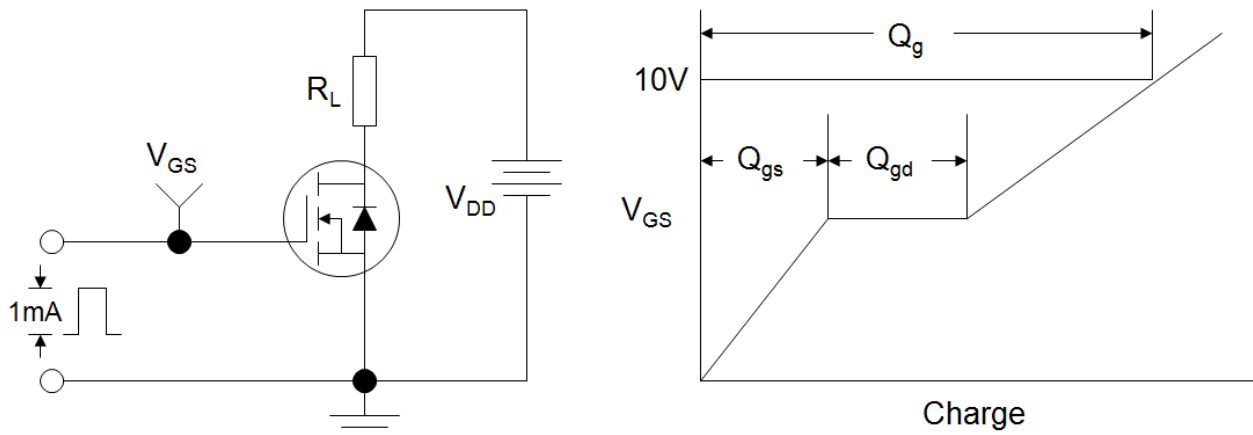
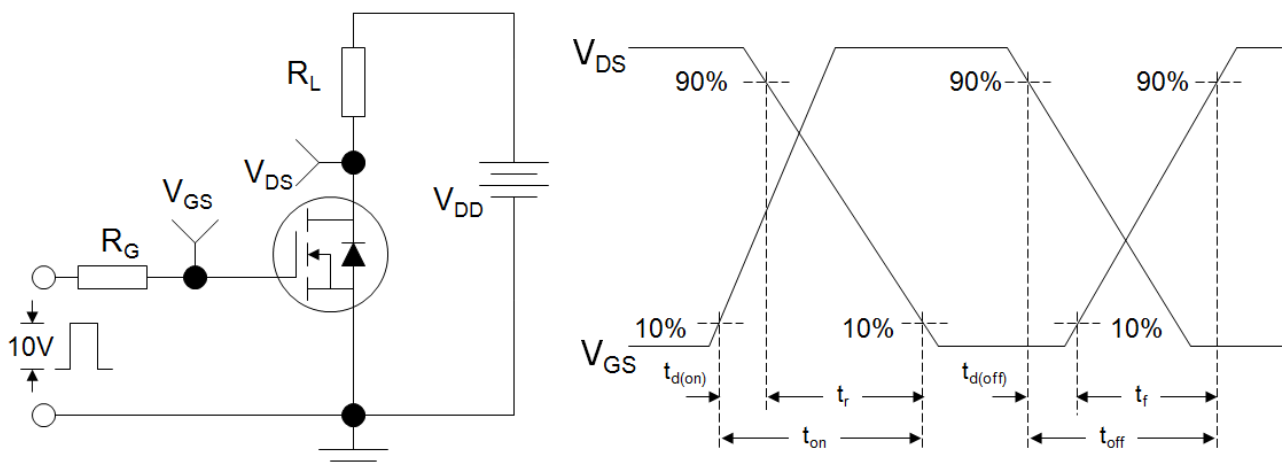
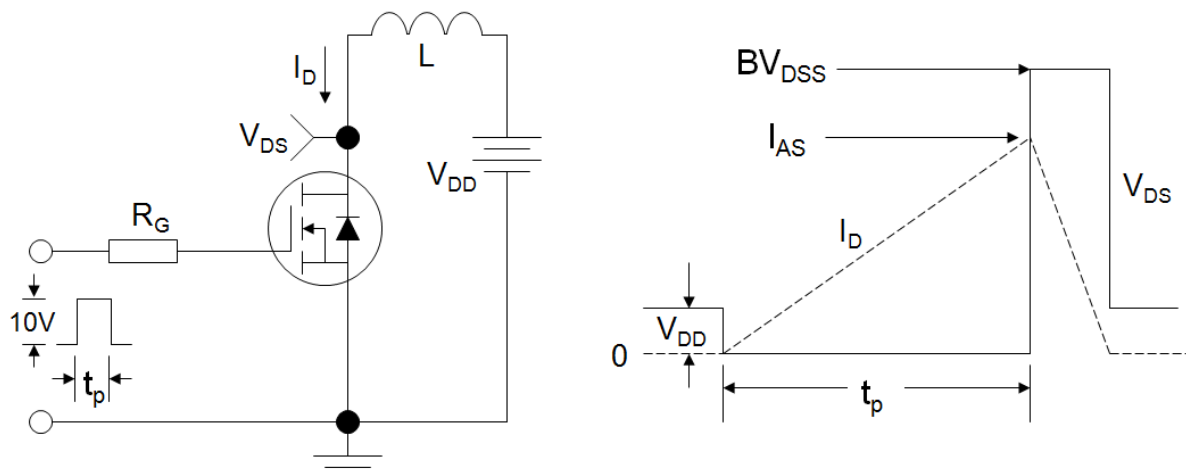
**Figure 8. Gate Charge**



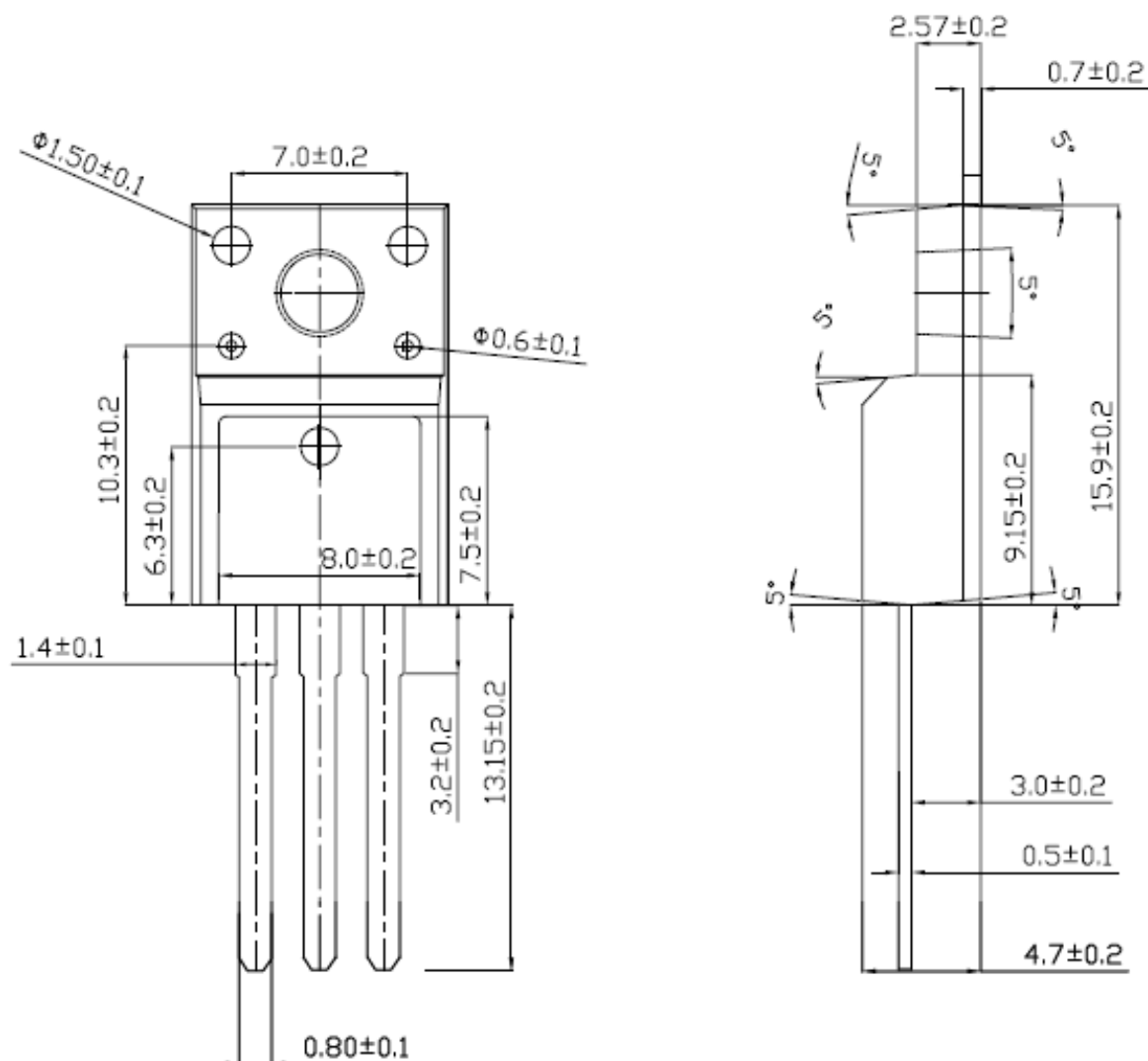
**Figure 9. Transient Thermal Impedance**

TO-220F



**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



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