

650V N-Channel MOSFET

Features

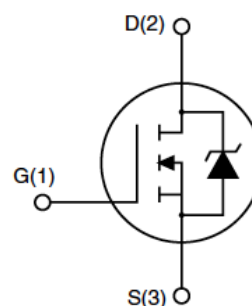
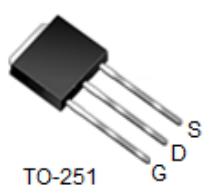
V _{DSS}	R _{DS ON} @ 10V (Typ)	I _D
650V	2Ω	4A

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

Application

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

Package



Ordering Information

Part Number	Marking	Case	Packaging
G4N65J	G4N65	TO-251	72pcs/Tube
G4N65F	G4N65	TO-220F	50pcs/Tube
G4N65K	G4N65	TO-252	2500pcs/Reel
G4N65T	G4N65	TO-220	50pcs/Tube

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

Parameter	Symbol	Value				Unit
		TO-220F	TO-220	TO-251	TO-252	
Drain-Source Voltage (V _{GS} = 0V)	V _{DSS}	650				V
Continuous Drain Current	I _D	4				A
Pulsed Drain Current (note1)	I _{DM}	16				A
Gate-Source Voltage	V _{GSS}	± 20				V
Single Pulse Avalanche Energy (note2)	E _{AS}	76				mJ
Avalanche Current (note1)	I _{AS}	4				A
Repetitive Avalanche Energy (note1)	E _{AR}	45				mJ
Power Dissipation (T _C = 25°C)	P _D	20	25			W
Operating Junction and Storage Temperature Range	T _J , T _{stg}	-55~+150				°C

Thermal Resistance

Parameter	Symbol	Value				Unit
		TO-220F	TO-251	TO-252	TO-220	
Thermal Resistance, Junction-to-Case	R _{thJC}	6.25	5			K/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 = 250μA	650	--	--	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 650V, V _{GS} = 0V, T _J = 25°C	--	--	1	μA
Gate-Source Leakage	I _{GSS}	V _{GS} = ±20V	--	--	±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 = 2A	--	2	2.4	Ω
Dynamic						
Input Capacitance	C _{iss}	V _{GS} = 0V, V _{DS} = 25V, f = 1.0MHz	--	545	--	pF
Output Capacitance	C _{oss}		--	53	--	
Reverse Transfer Capacitance	C _{rss}		--	4.5	--	
Total Gate Charge	Q _g	V _{DD} = 520V, I _D = 4A, V _{GS} = 10V	--	15	--	nC
Gate-Source Charge	Q _{gs}		--	3	--	
Gate-Drain Charge	Q _{gd}		--	7	--	
Turn-on Delay Time	t _{d(on)}	V _{DD} = 250V, I _D =4A, R _G = 25 Ω	--	36	--	ns
Turn-on Rise Time	t _r		--	13	--	
Turn-off Delay Time	t _{d(off)}		--	80	--	
Turn-off Fall Time	t _f		--	24	--	
Drain-Source Body Diode Characteristics						
Continuous Body Diode Current	I _S	T _C = 25 °C	--	--	4	A
Pulsed Diode Forward Current	I _{SM}		--	--	16	
Body Diode Voltage	V _{SD}	T _J = 25°C, I _{SD} = 2.0A, V _{GS} = 0V	--	--	1.4	V
Reverse Recovery Time	t _{rr}	V _{GS} = 0V, I _S = 4A, di _F /dt =100A /μs	--	550	--	ns
Reverse Recovery Charge	Q _{rr}		--	1.38	--	μC

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $L = 10.0\text{mH}$, $V_{DD} = 50V$, $R_G = 25\Omega$, 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 ($T_J = 25^\circ\text{C}$)

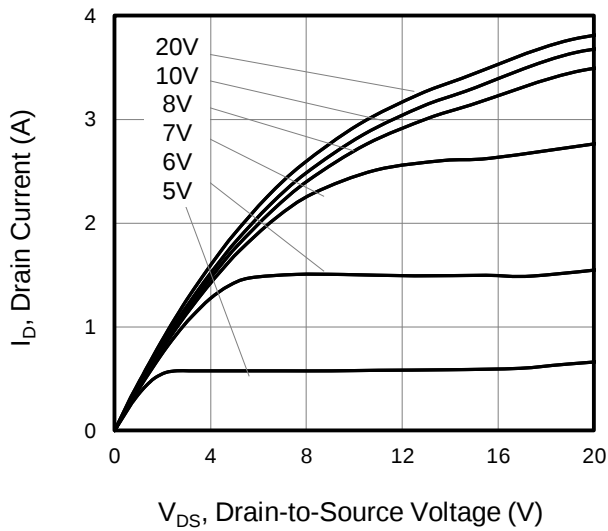


Figure 2. Body Diode Forward Voltage

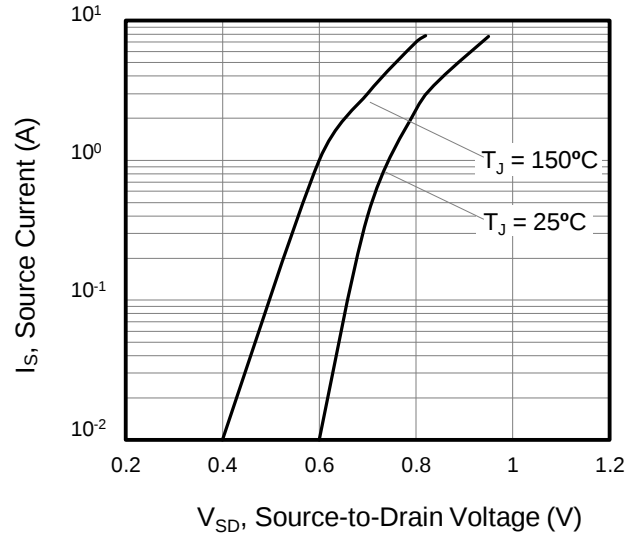


Figure 3. Drain Current vs. Temperature

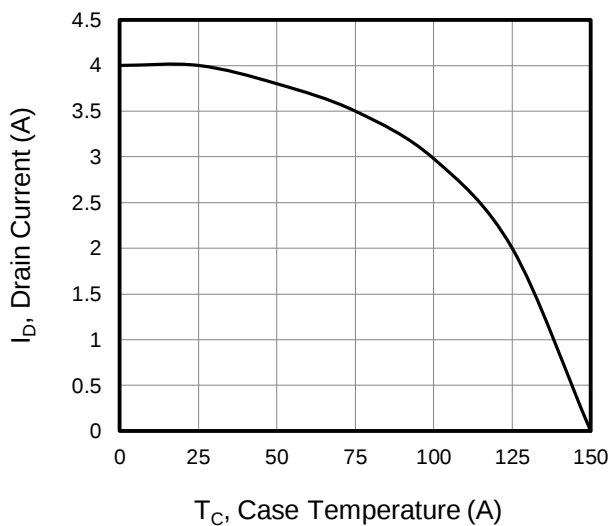


Figure 4. Power Dissipation vs. Temperature

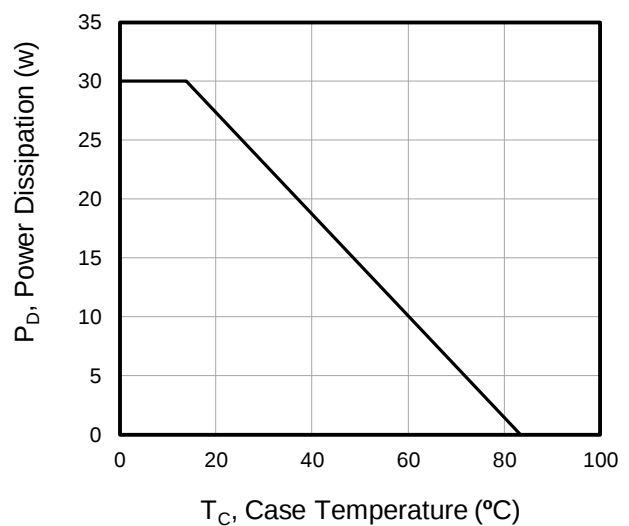


Figure 5. Transfer Characteristics

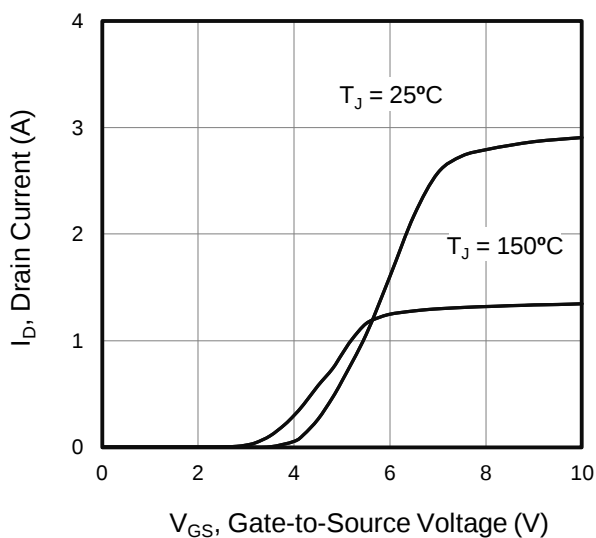
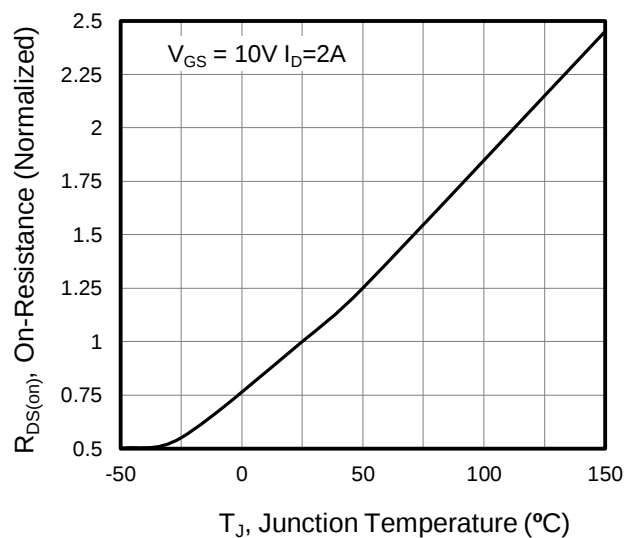


Figure 6. On-Resistance vs. Temperature



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

Figure 7. Capacitance

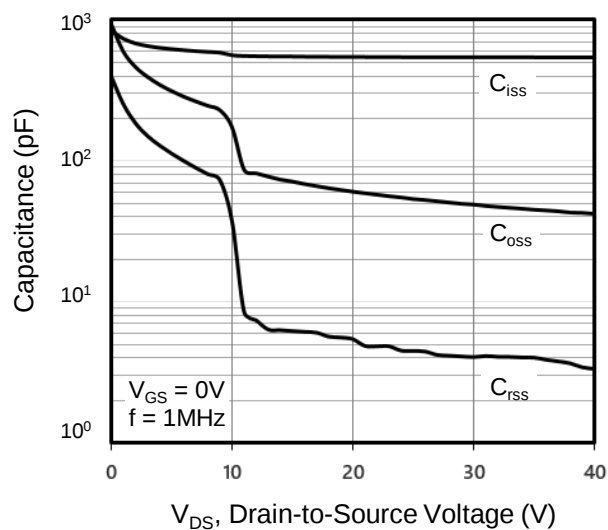


Figure 8. Gate Charge

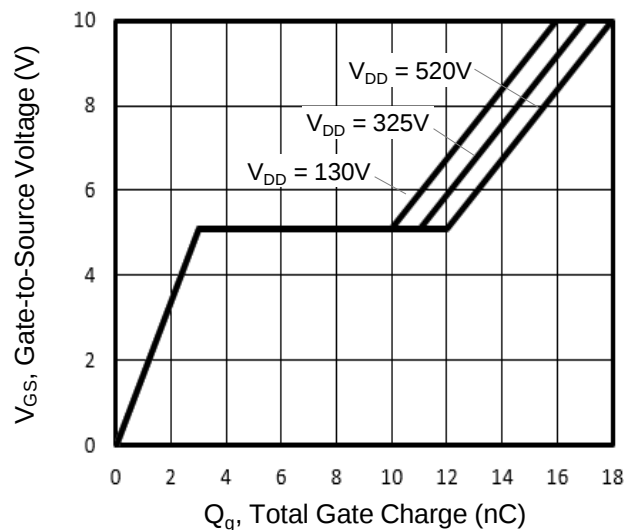


Figure 9. Transient Thermal Impedance
TO-251, TO-252

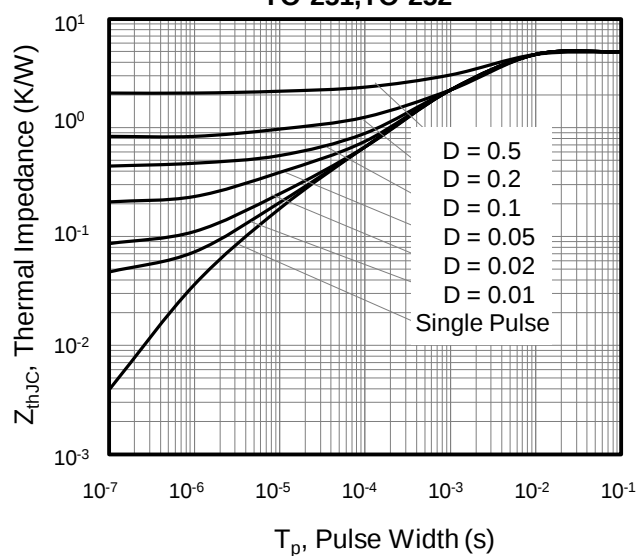


Figure 10. Transient Thermal Impedance
TO-220F

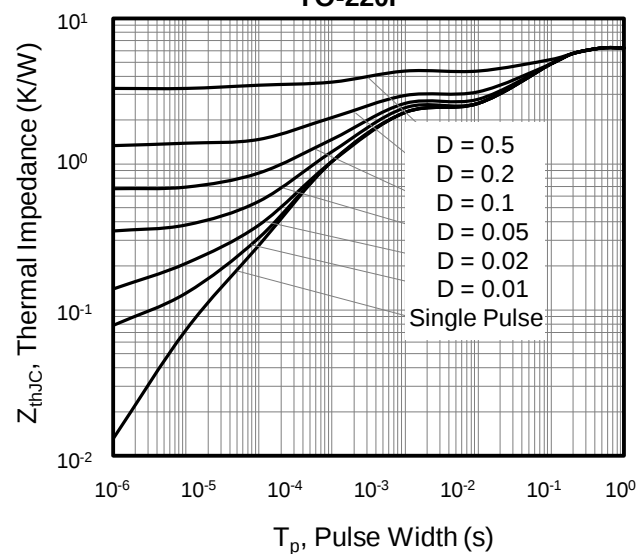


Figure A: Gate Charge Test Circuit and Waveform

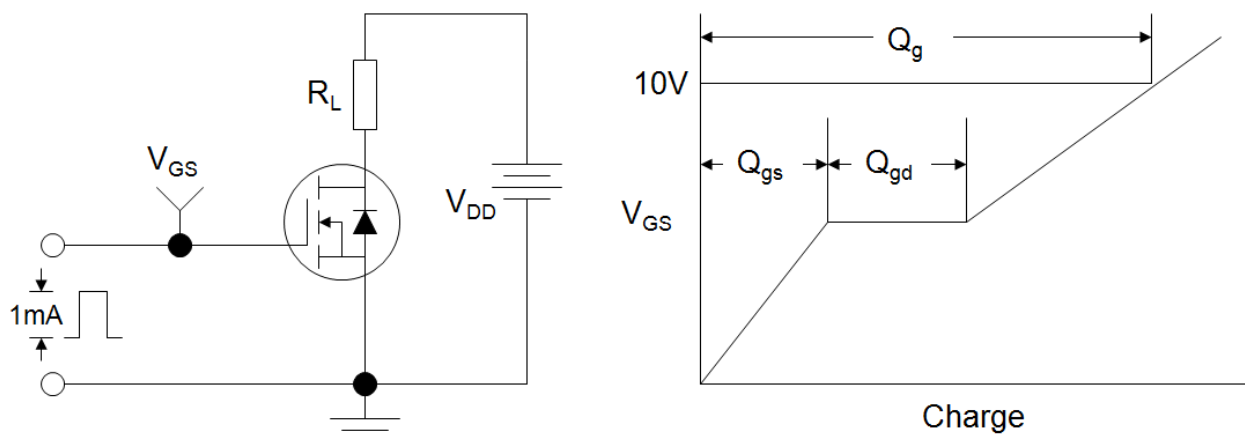


Figure B: Resistive Switching Test Circuit and Waveform

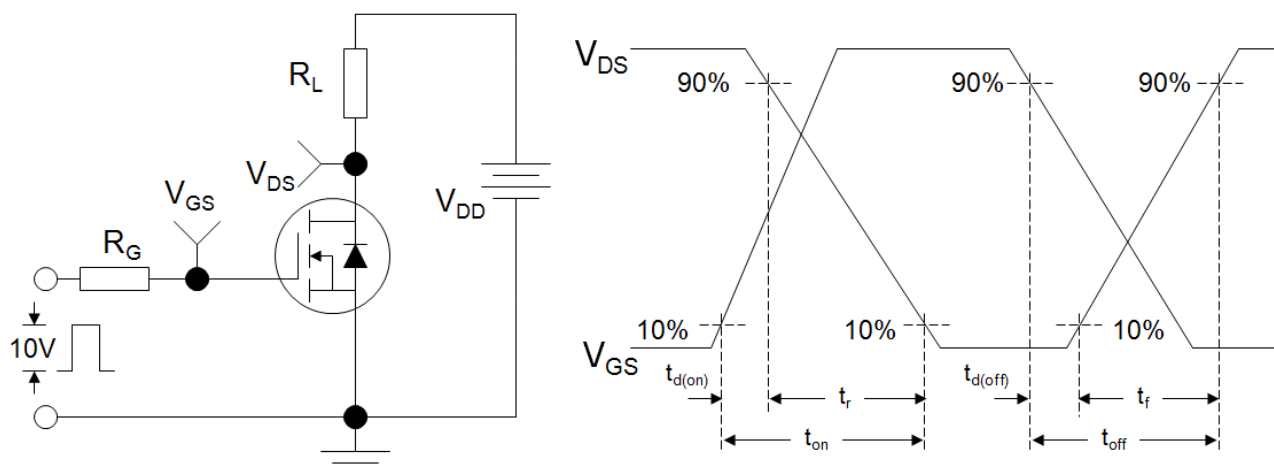
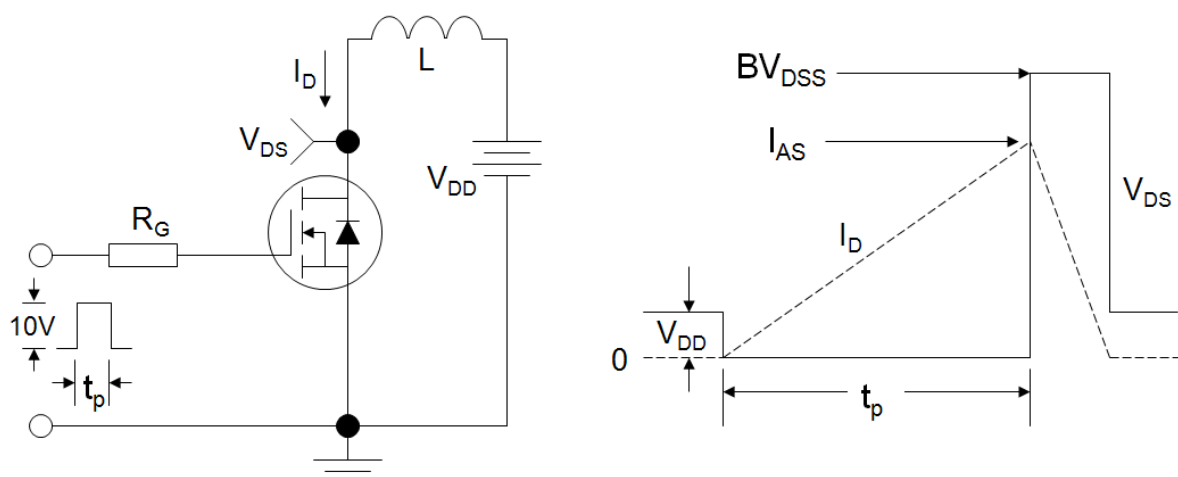
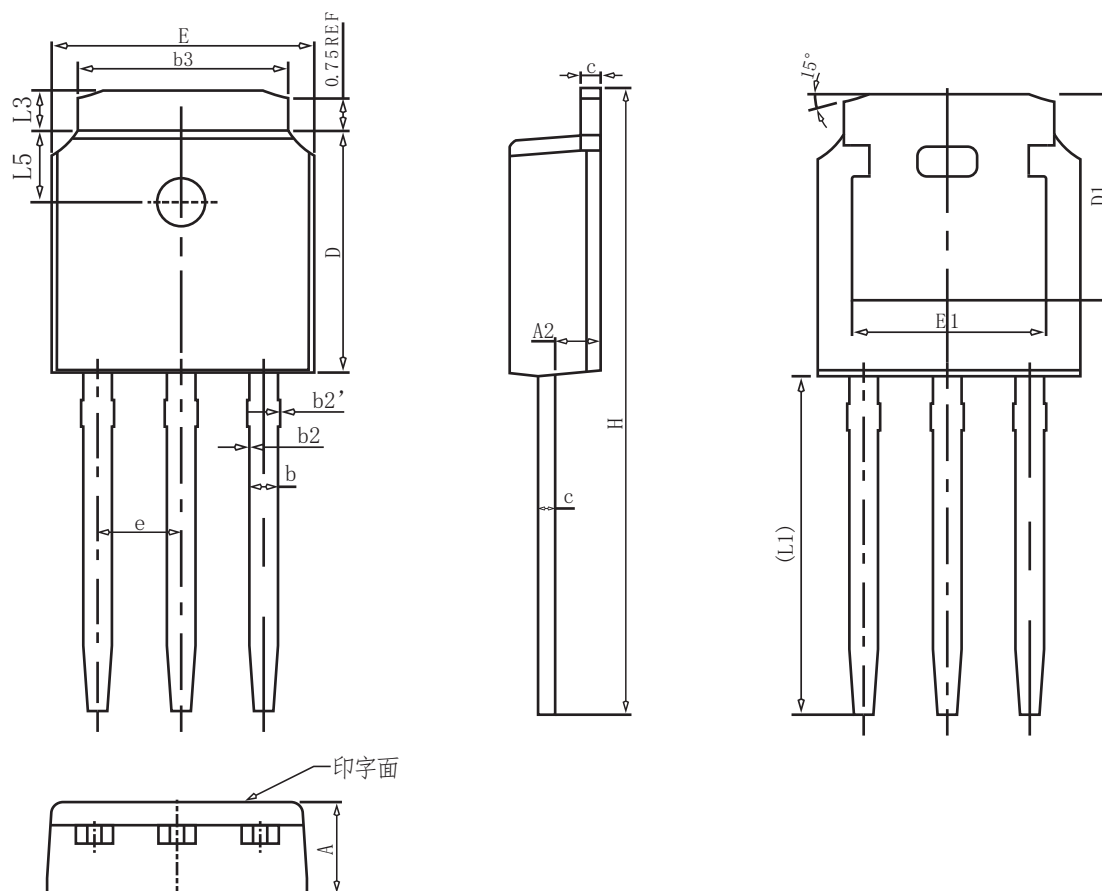


Figure C: Unclamped Inductive Switching Test Circuit and Waveform



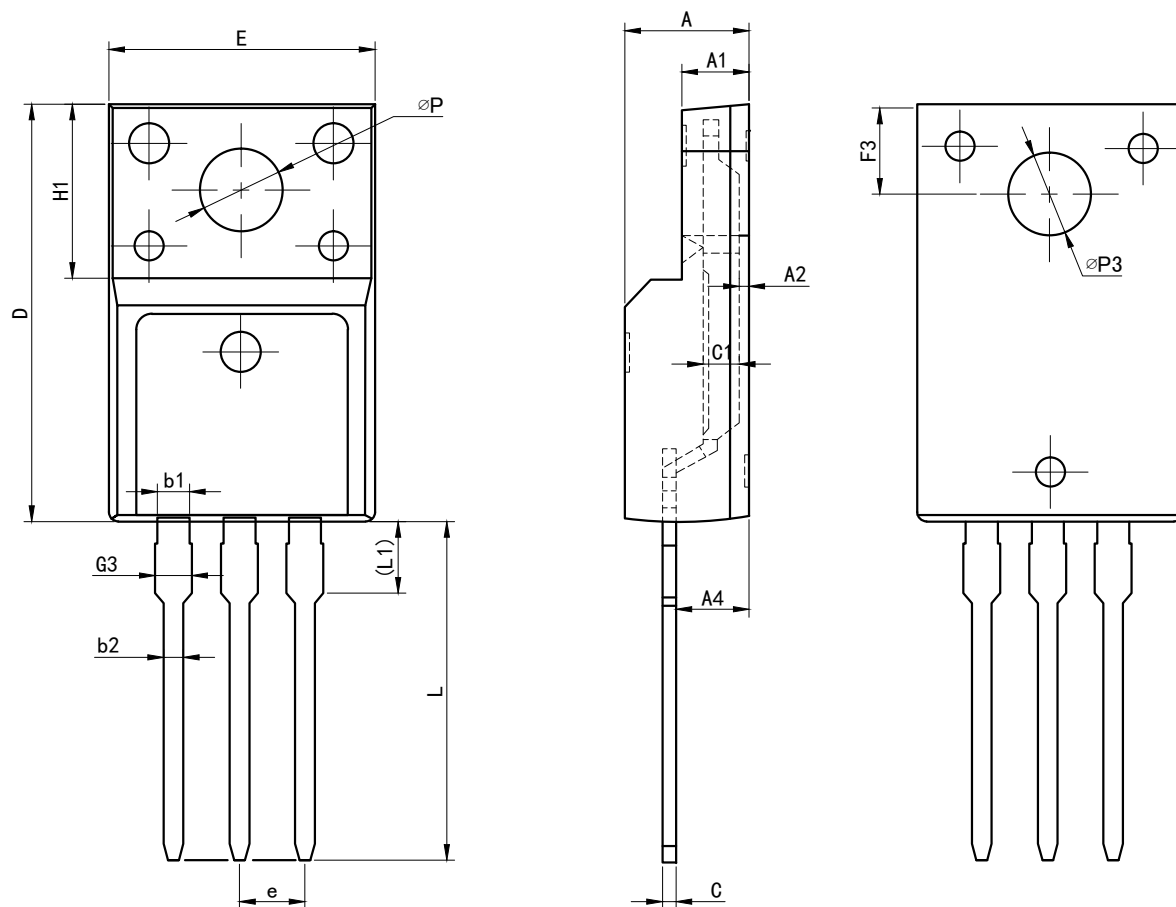
TO-251 Package information



COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	2.20	2.30	2.40
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b2	0.00	0.04	0.10
b2'	0.00	0.04	0.10
b3	5.20	5.33	5.50
c	0.43	0.53	0.63
D	5.98	6.10	6.22
D1	5.30 REF		
E	6.40	6.60	6.80
E1	4.63	—	—
e	2.286 BSC		
H	16.22	16.52	16.82
L1	9.15	9.40	9.65
L3	0.88	1.02	1.28
L5	1.65	1.80	1.95

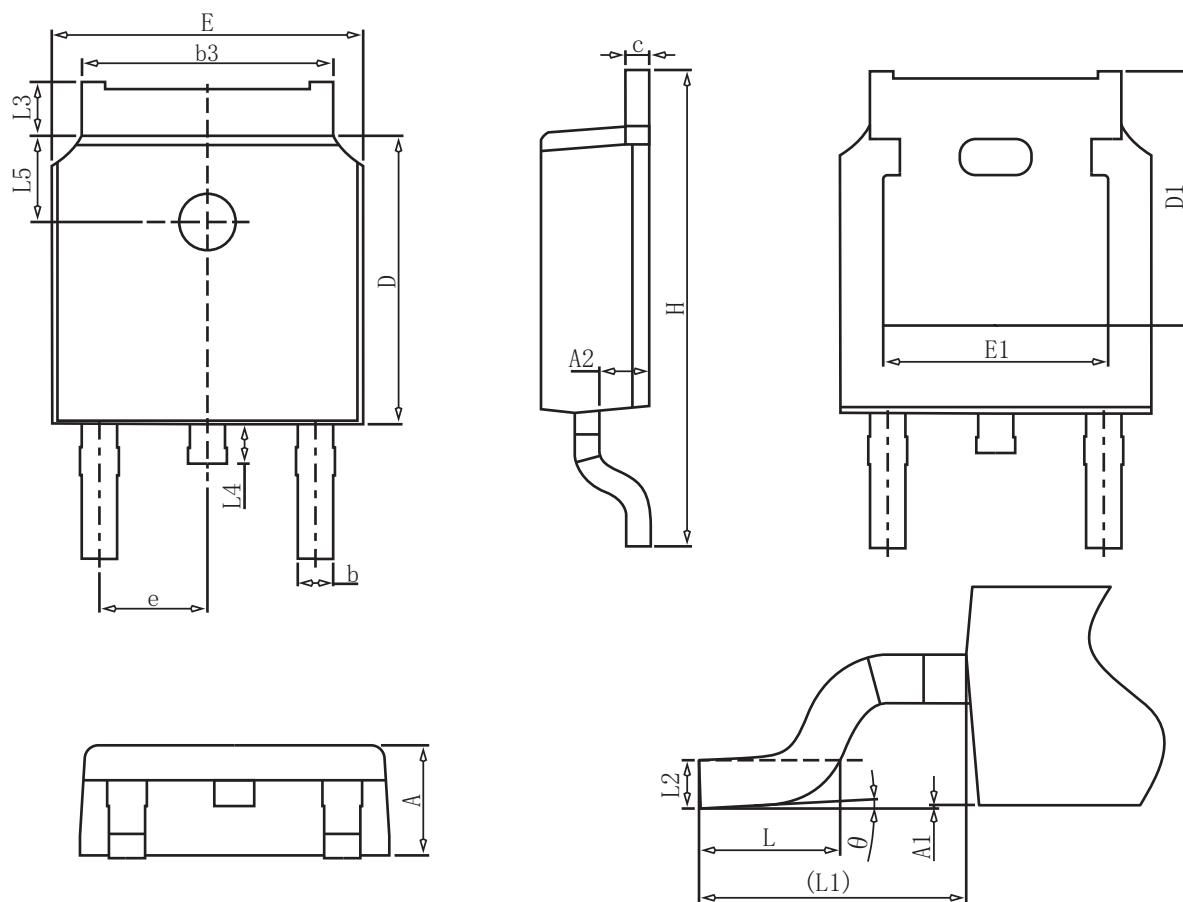
TO-220F Package information



COMMON DIMENSIONS

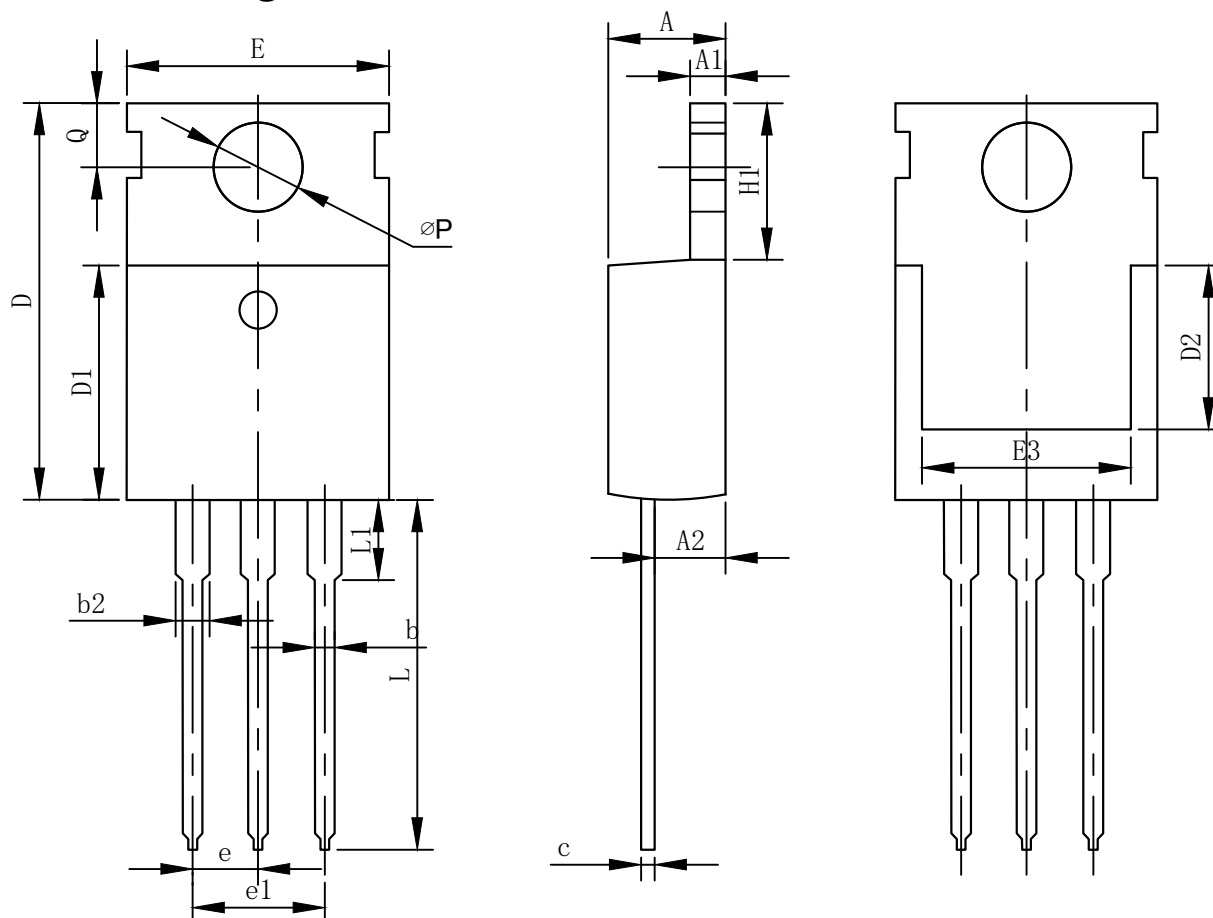
SYMBOL	mm		
	MIN	NOM	MAX
E	9.96	10.16	10.36
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	0.30	0.45	0.60
A4	2.56	2.76	2.96
c	0.40	0.50	0.65
c1	1.20	1.30	1.35
D	15.57	15.87	16.17
H1	6.70REF		
e	2.54BSC		
L	12.68	12.98	13.28
L1	2.93	3.03	3.13
ϕP	3.03	3.18	3.38
$\phi P3$	3.15	3.45	3.65
F3	3.15	3.30	3.45
G3	1.25	1.35	1.55
b1	1.18	1.28	1.43
b2	0.70	0.80	0.95

TO-252 Package information



COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	2.20	2.30	2.40
A1	0.00	—	0.20
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b3	5.20	5.33	5.50
c	0.43	0.53	0.63
D	5.98	6.10	6.22
D1	5.30REF		
E	6.40	6.60	6.80
E1	4.63	—	—
e	2.286BSC		
H	9.40	10.10	10.50
L	1.38	1.50	1.75
L1	2.90REF		
L2	0.51BSC		
L3	0.88	—	1.28
L4	0.50	—	1.00
L5	1.65	1.80	1.95
θ	0°	—	8°

TO-220 Package information


COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.37	4.57	4.70
A1	1.25	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b2	1.70	1.27	1.47
c	0.45	0.50	0.60
D	15.10	15.60	16.10
D1	8.80	9.10	9.40
D2	5.50	—	—
E	9.70	10.00	10.30
E3	7.00	—	—
e	2.54BSC		
e1	5.08BSC		
H1	6.25	6.50	6.85
L	12.75	13.50	13.80
L1	—	3.10	3.40
øP	3.40	3.60	3.80
Q	2.60	2.80	3.00