600V N-Channel Super Junction power MOSFET

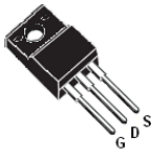
DESCRIPTION

SJ MOSFET is an advanced technology for high voltage power MOSFETs, designed according to the super junction principle by Xinyuan semiconductor. The offered devices provide all benefits of a fast switching and low on resistance, making it especially suitable for applications which require more efficient, more compact, LED Lighting, High Performance Adapter etc..

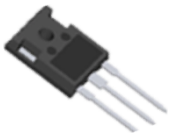
V_{DS}	600	V
$R_{DS(ON)}$	150	mΩ
I_D	24	A

TO-220

TO-220F



TO-247

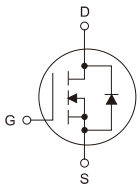


Features

- Extremely low losses due to very low R_{dson}*Q_g
- Superior Avalanche Rugged Technology
- Fast switching capability
- 100% Avalanche Tested
- Pb-free lead plating; ROHS compliant

APPLICATIONS

- Power factor correction（PFC）
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply（UPS）
- High Performance Adapter
- LED Lighting Power



ORDERING INFORMATION

Temperature Range	Package		Orderable Device	Package Qty.
-55°C ~ +125°C	TO-220	Pb-Free	CWS24N60AC	50 PCS/Tube
	TO-220F		CWS24N60AF	50 PCS/Tube
	TO-247		CWS24N60AZ	30 PCS/Tube

ABSOLUTE MAXIMUM RATINGS

（T_j=25°C, unless otherwise noted）

Parameter	Symbol	Value	Unit
Drain-Source Voltage (V_{GS}=0V)	V_{DSS}	600	V
Gate-Source Voltage (V_{DS}=0V, static)	V_{GS}	±30	V
Continuous Drain Current (T_C=25 °C)(Note 1)	$I_{D(DC)}$	24	A
Continuous Drain Current (T_C=100 °C) (Note 1)	$I_{D(DC)}$	18	A
Pulsed Drain Current (Note 2)	I_{DM}	89	A
MOSFET dv/dt ruggedness, V_{DS}≤480 V	dv/dt	50	V/nS
Single Pulsed Avalanche Energy (Note 3)	E_{AS}	720	mJ
Avalanche Energy, Repetitive(Note1)	E_{AR}	1.2	mJ
Avalanche Current, Single Pulsed (Note 3)	I_{AS}	12	A
Maximum Power Dissipation（T_C=25 °C）for TO-220, TO-220F, TO-247	P_D	TO-220：219 TO-220F：34 TO-247：219	W
Operating, Storage Temperature Range	T_J, T_{STG}	-55~150	°C

THERMAL CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Units
Thermal Resistance, Junction-to-Case	R_{thJC}	-	-	TO-220：0.57 TO-220F：3.65 TO-247：0.57	°C /W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	-	-	TO-220：62 TO-220F：80 TO-247：62	°C /W

ELECTRICAL CHARACTERISTICS

（T_j = 25°C, unless otherwise noted）

Parameter	Symbol	Test Conditions	Min.	TYP.	Max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_D=250μA	600	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=600V, V_{GS}=0V	-	-	1	μA
Gate-Source Leakage Current	I_{GSS}	V_{GS}=±30V, V_{DS}=0V	-	-	±100	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=250μA	2.5	3.0	3.5	V
Drain-Source On-state Resistance	$R_{DS(on)}$	V_{GS}=10V, I_D=12A	-	0.12	0.15	Ω
Gate Resistance	R_g	F=1MHZ, open drain	-	5.6	-	Ω

Dynamic Characteristics

（T_j = 25°C, unless otherwise noted）

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Input capacitance	C_{iss}	V_{DS}=100V, V_{GS}=0V, f=1MHz	-	2039	-	pF
Output capacitance	C_{oss}		-	127	-	
Reverse transfer capacitance	C_{rss}		-	2.5	-	
Turn-on delay Time	$t_{d(on)}$	V_{DD}=400V, I_D=15A R_G=3.3Ω, V_{GS}=10V	-	49	-	ns
Rise time	t_r		-	77		
Turn-off delay time	$t_{d(off)}$		-	182		
Fall time	t_f		-	61		

Gate charge characteristics

（T_j = 25°C, unless otherwise noted）

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Gate to Source Charge	Q_{gs}	V_{DD}=400V, I_D=15A V_{GS}=0 to 10V	-	12.6	-	nC
Gate to Drain Charge	Q_{gd}		-	16	-	
Gate Charge Total	Q_g		-	45.5	-	
Gate Plateau Voltage	$V_{plateau}$		-	6.4	-	V

Reverse diode characteristics

（T_j = 25°C, unless otherwise noted）

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Body Diode Forward Voltage	V_{SD}	V_{GS}=0V, I_{SD}=15A	-	0.9	-	V
Reverse Recovery Time	t_{rr}	V_R=400V, I_F=15A dI_F/dt=100A/μs	-	409	-	nS
Reverse Recovery Charge	Q_{rr}		-	8.5	-	μC
Peak Reverse Recovery Current	I_{rrm}		-	30	-	A

Notes：

1. Limited by maximum junction temperature;
2. Pulse width limited by maximum junction temperature;
3. I_{AS} = 12A, V_{DD} = 50 V, R_G = 25 Ω, Starting T_J = 25°C.

Electrical Characteristics Diagrams

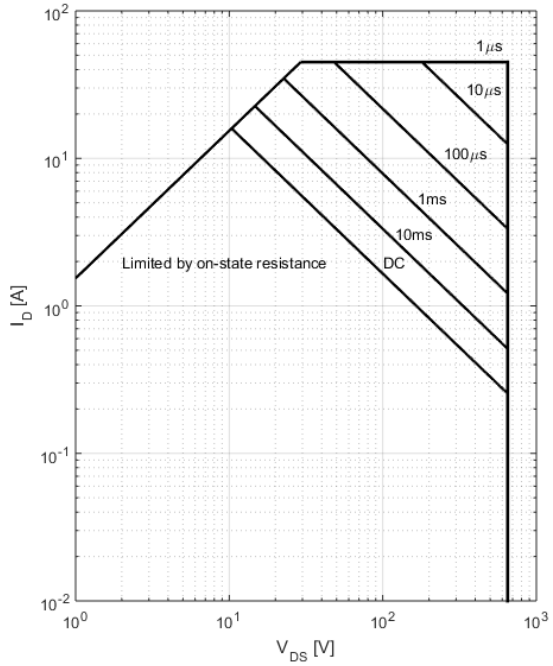
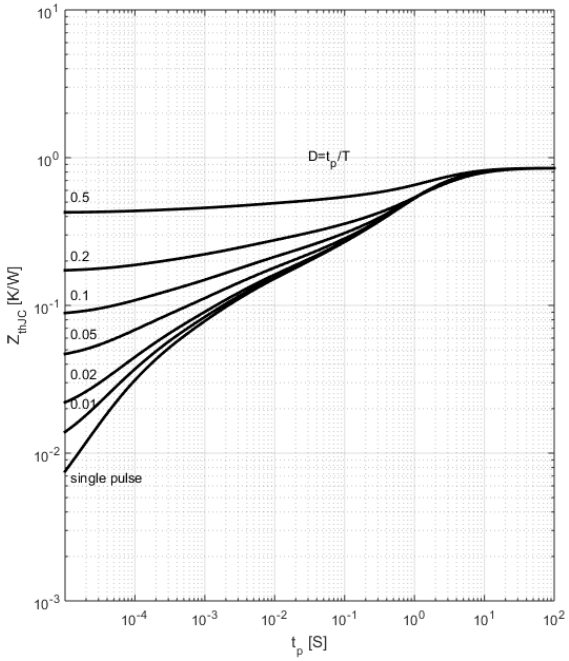
Figure 1. Safe operating area	Figure 2. Transient thermal impedance
	
$I_D=f(V_{DS})$; T_c=25 ºC; parameter t_p	$Z_{(thJC)}=f(t_p)$; parameter: $D=t_p/T$

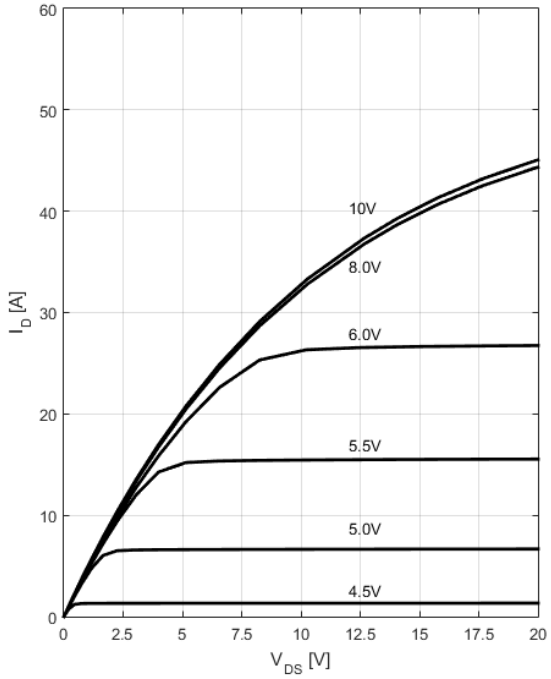
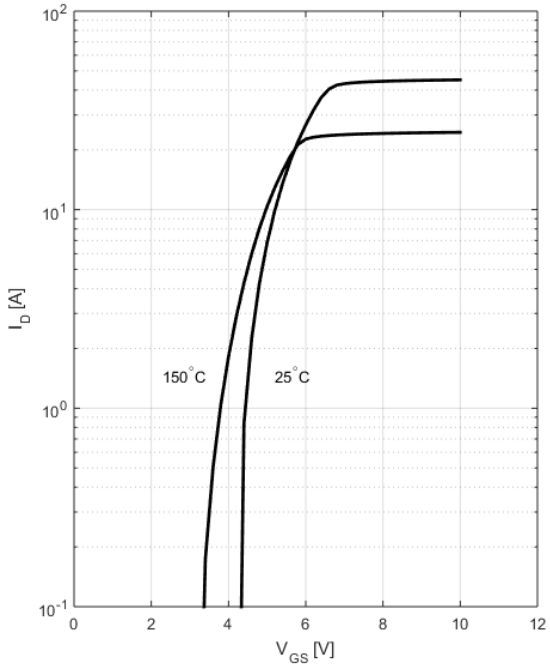
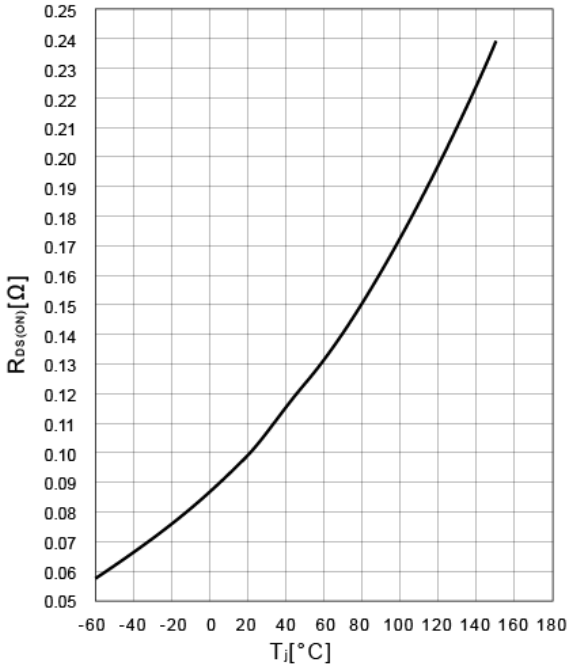
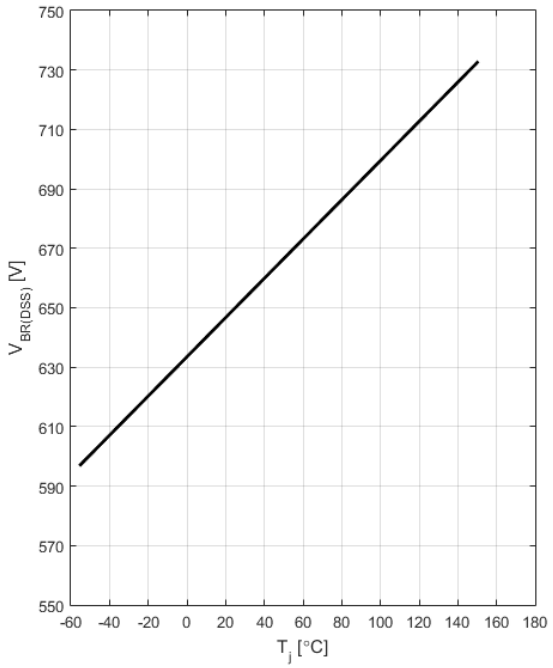
Figure3. Typ. output characteristics	Figure 4. Typ. transfer characteristics
	
$I_D=f(V_{DS})$; T_j=25 ºC; parameter: V_{GS}	$I_D=f(V_{GS})$; V_{DS}=20V

Figure 5. Drain-source on-state resistance



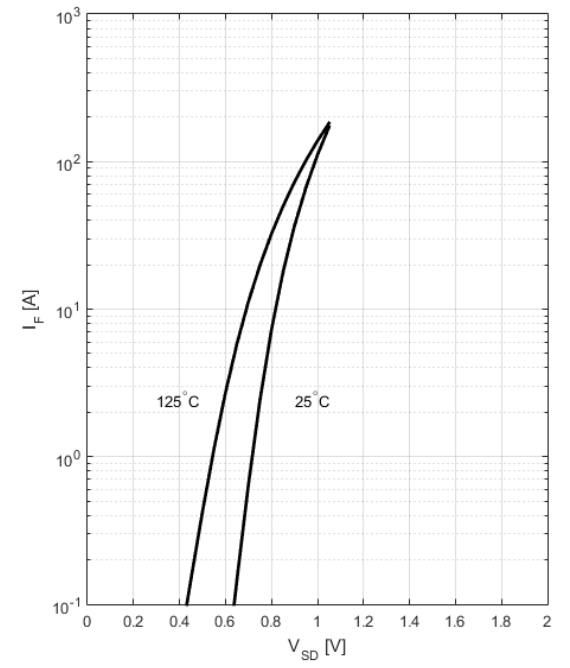
$R_{DS(ON)}=f(T_j)$; $I_D=30A$; $V_{GS}=10V$

Figure6. Drain-source breakdown voltage



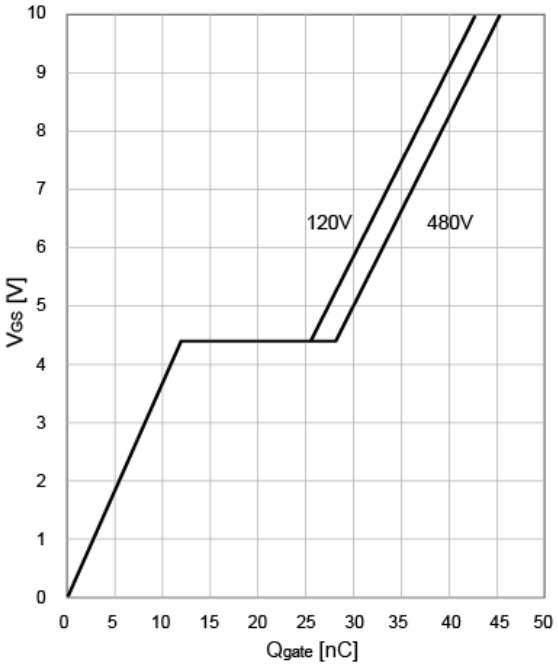
$V_{BR(DSS)}=f(T_j)$; $I_D=10mA$

Figure7. Forward characteristics of reverse diode

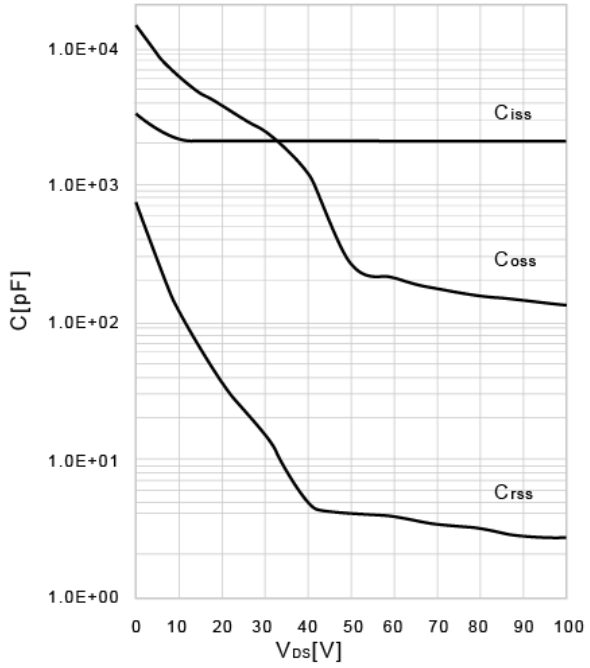
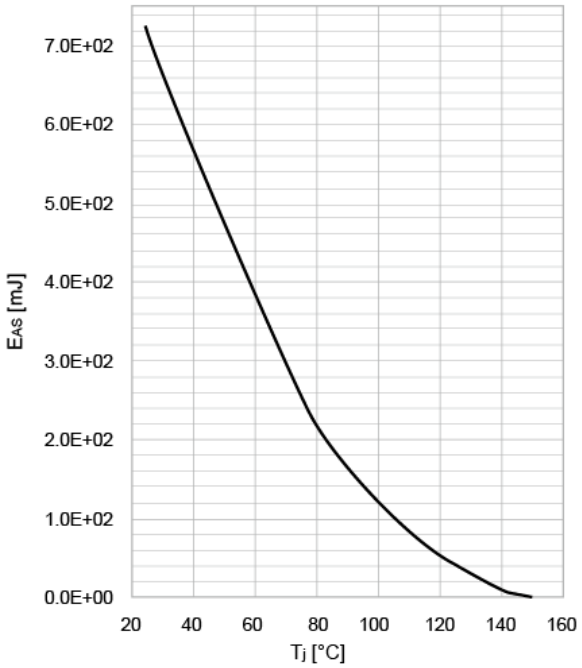


$I_F=f(V_{SD})$; parameter: T_j

Figure 8. Typ. gate charge

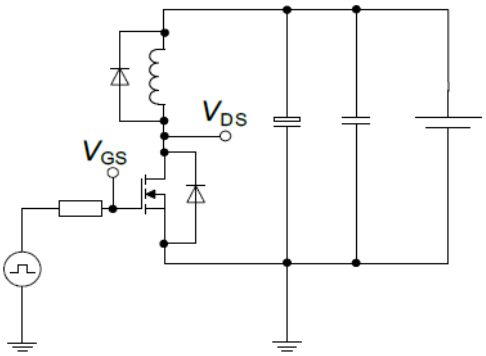


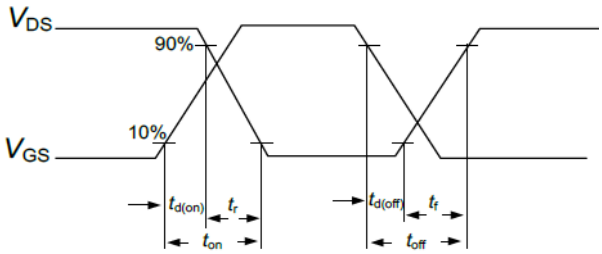
$V_{GS}=f(Q_{gate})$, $I_D=30A$ pulsed

Figure 9: Typ. capacitances	Figure 10: Avalanche energy
	
$C=f(V_{DS})$; $V_{GS}=0$; f=1MHz	$E_{AS}=f(T_j)$; $I_D=13A$; $V_{DD}=50V$

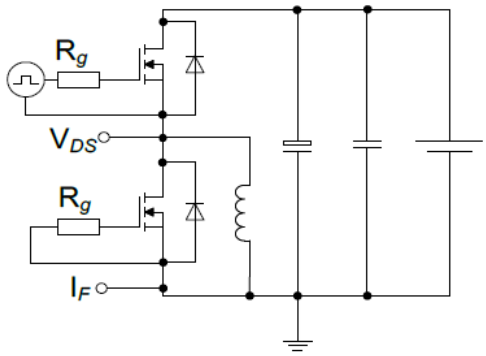
Test Circuits

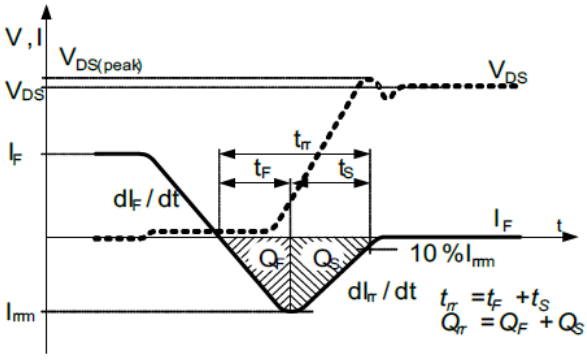
Switch time test circuit



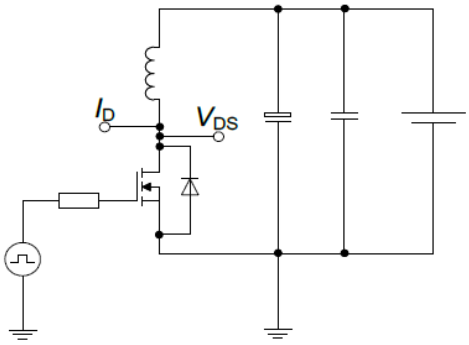


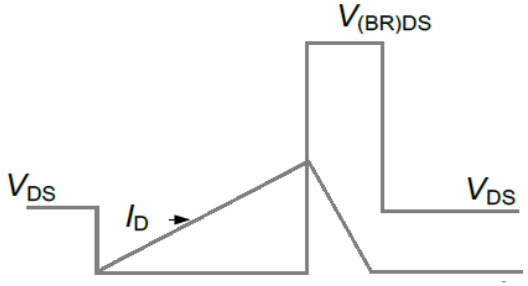
Reverse diode characteristics test circuit and waveform





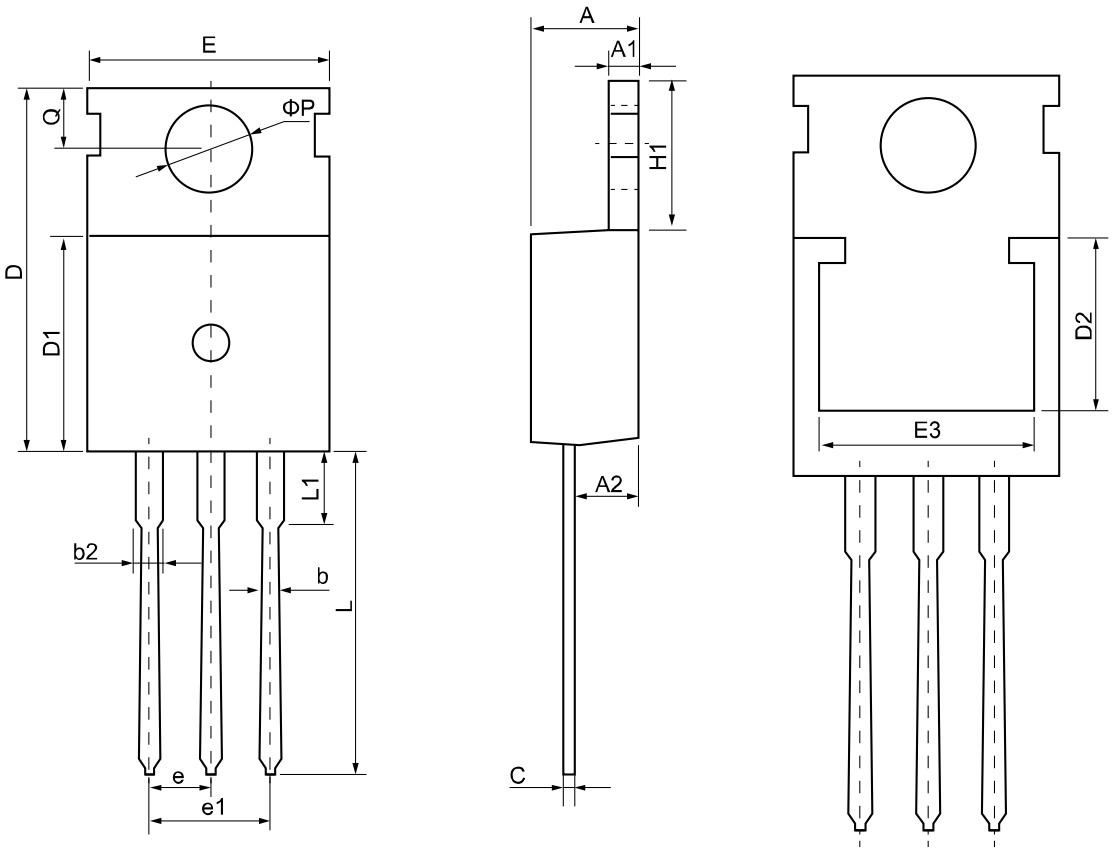
Unclaimed inductive switching test circuit & waveform





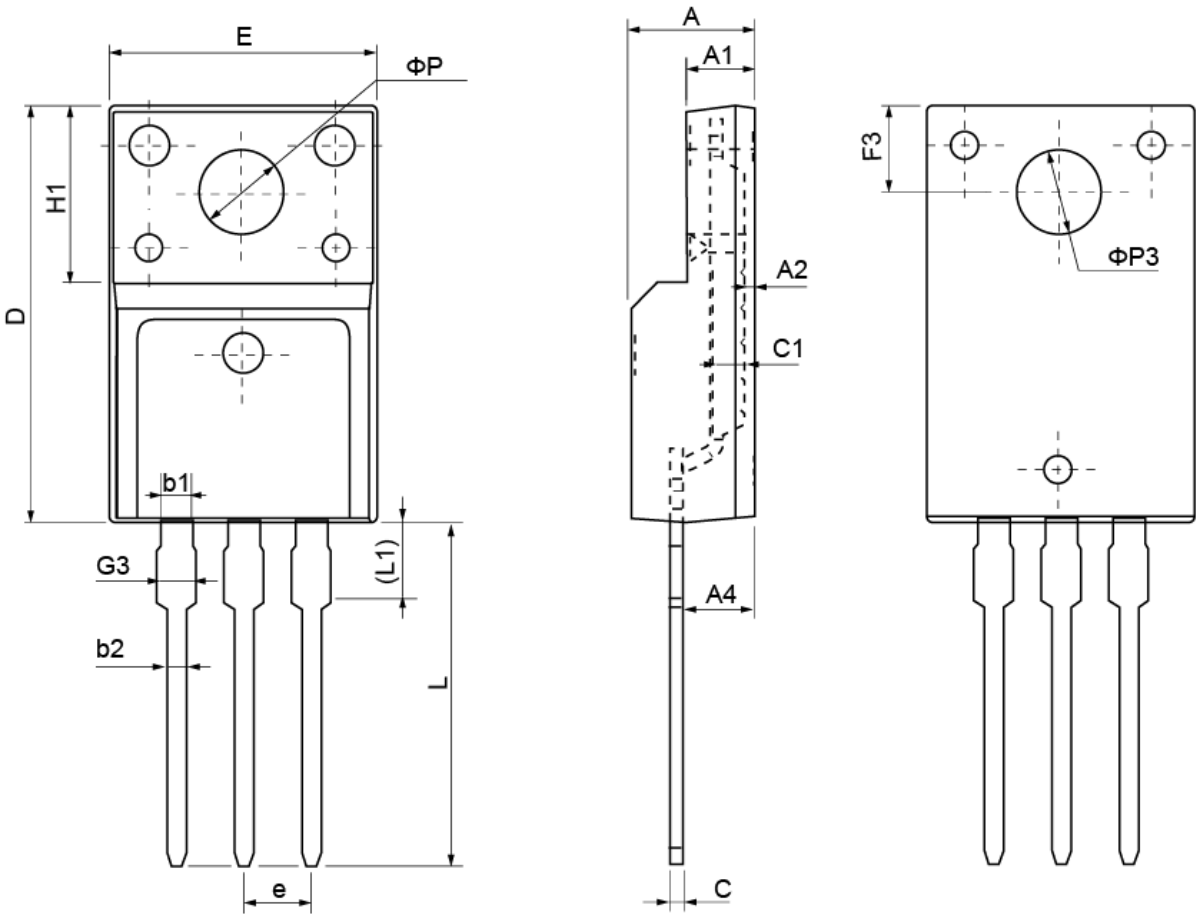
PHYSICAL DIMENSIONS

TO-220



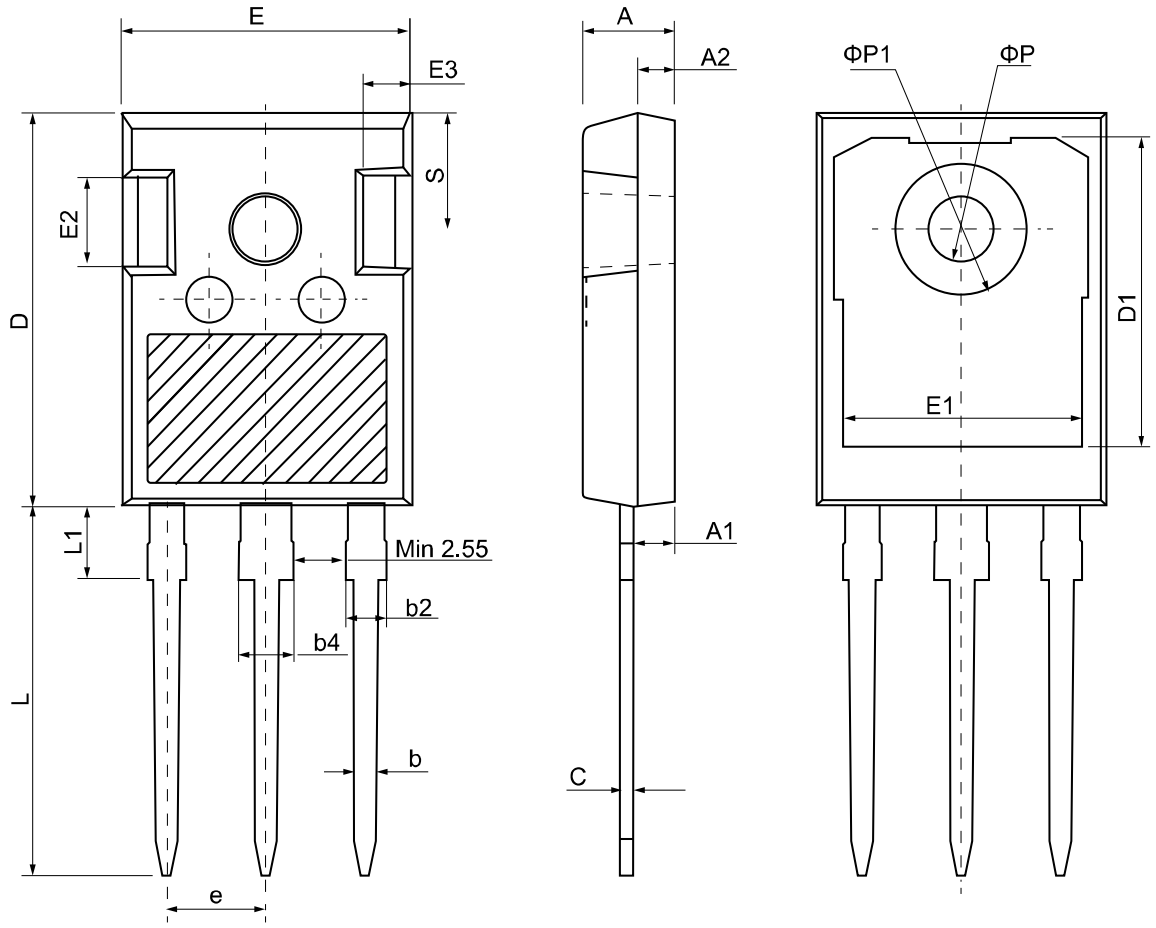
Symbol	Dimension（mm）			Symbol	Dimension（mm）		
	Min	Nom	Max		Min	Nom	Max
A	4.37	4.57	4.77	E	9.80	10.00	10.20
A1	1.25	1.30	1.45	E3	7.00	-	-
A2	2.20	2.40	2.60	e	2.54(BSC)		
b	0.70	0.80	0.95	e1	5.08(BSC)		
b2	1.17	1.27	1.47	H1	6.30	6.50	6.80
c	0.40	0.50	0.65	L	12.75	13.50	13.80
D	15.30	15.60	15.90	L1	-	3.10	3.40
D1	8.90	9.10	9.30	ΦP	3.40	3.60	3.80
D2	5.50	-	-	Q	2.60	2.80	3.00

TO-220F



Symbol	Dimension（mm）			Symbol	Dimension（mm）		
	Min	Nom	Max		Min	Nom	Max
E	9.96	10.16	10.36	e	2.54(BSC)		
A	4.50	4.70	4.90	L	12.68	12.98	13.28
A1	2.34	2.54	2.74	L1	2.93	3.03	3.13
A2	0.30	0.45	0.60	ΦP	3.03	3.18	3.38
A4	2.56	2.76	2.96	ΦP3	3.15	3.45	3.65
c	0.40	0.50	0.65	F3	3.15	3.30	3.45
c1	1.20	1.30	1.35	G3	1.25	1.35	1.55
D	15.57	15.87	16.17	b1	1.18	1.28	1.43
H1	6.70(REF)			b2	0.70	0.80	0.95

TO-247



Symbol	Dimension（mm）			Symbol	Dimension（mm）		
	Min	Nom	Max		Min	Nom	Max
A	4.80	5.00	5.20	E1	13.00	13.30	13.60
A1	2.21	2.41	2.59	E2	4.80	5.00	5.20
A2	1.85	2.00	2.15	E3	2.30	2.50	2.70
b	1.11	1.21	1.36	e	5.44(BSC)		
b2	1.91	2.01	2.21	L	19.82	19.92	20.22
b4	2.91	3.01	3.21	L1	-	-	4.30
c	0.51	0.61	0.75	ΦP	3.40	3.60	3.80
D	20.80	21.00	21.30	ΦP1	-	-	7.30
D1	16.25	16.55	16.85	S	6.15(BSC)		
E	15.50	15.80	16.10	-	-	-	-