

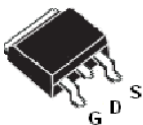
650V N-Channel Super Junction power MOSFET

DESCRIPTION

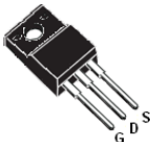
SJ MOSFET is an advanced technology for high voltage power MOSFETs, designed according to the super junction principle by Xinyuan semiconductor. The offered devices provide all benefits of a fast switching and low on resistance, making it especially suitable for applications which require more efficient,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

V_{DS}	650	V
$R_{DS(ON)}$	190	mΩ
I_D	20	A

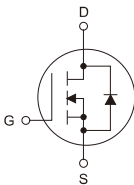
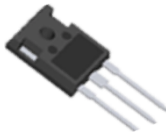
TO-252



TO-220F



TO-247



Features

- Extremely low losses due to very low $R_{dson} \cdot Q_g$
- 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-252	Pb-Free	CWS65R190BDR	2500 PCS/ R&T
	TO-220F		CWS65R190BF	50 PCS/Tube
	TO-247		CWS65R190BZ	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}	650	V
Gate-Source Voltage (V _{DS} =0V, static)	V _{GS}	±30	V
Continuous Drain Current (T _C =25 °C)(Note 1)	I _{D(DC)}	20	A
Continuous Drain Current (T _C =100 °C) (Note 1)	I _{D(DC)}	13	A
Pulsed Drain Current (Note 2)	I _{DM}	60	A
MOSFET dv/dt ruggedness, V _{DS} ≤480 V	dv/dt	50	V/nS
Single Pulsed Avalanche Energy (Note 3)	E _{AS}	590	mJ
Avalanche Energy, Repetitive (Note 1)	E _{AR}	1.3	mJ
Avalanche Current,(Note 1)	I _{AR}	7.7	A
Maximum Power Dissipation (T _C =25 °C)	P _D	33	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-252: 1.3 TO-220F: 3.75 TO-247: 0.96	°C /W
Thermal Resistance, Junction-to-Ambient	R _{thJA}	-	-	TO-252: 62 TO-220F: 80 TO-247: 57	°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	650	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =650V, V _{GS} =0V	-	-	10	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	2.0	3.0	4.0	V
Drain-Source On-state Resistance	R _{DS(on)}	V _{GS} =10V, I _D =10A	-	0.177	0.19	Ω
Gate Resistance	R _g	F=1MHZ, open drain	-	2.09	-	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	-	1673	-	pF
Output capacitance	C _{oss}		-	48.7	-	
Reverse transfer capacitance	C _{rss}		-	0.67	-	
Turn-on delay Time	t _{d(on)}	V _{DD} =480V, I _D =20A R _G =6.8Ω, V _{GS} =10V	-	40	-	ns
Rise time	t _r		-	173		
Turn-off delay time	t _{d(off)}		-	72		
Fall time	t _f		-	137		

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 =20A V _{GS} =0 to 10V	-	9.5	-	nC
Gate to Drain Charge	Q _{gd}		-	4.3	-	
Gate Charge Total	Q _g		-	25.9	-	
Gate Plateau Voltage	V _{plateau}		-	6.0	-	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} =20A	-	0.9	1.2	V
Reverse Recovery Time	t _{rr}	V _R =400V, I _F =20A dI _F /dt=100A/μs	-	121	-	nS
Reverse Recovery Charge	Q _{rr}		-	0.67	-	μC
Peak Reverse Recovery Current	I _{rrm}		-	10.6	-	A

Notes:

1. Limited by maximum junction temperature;
2. Pulse width limited by maximum junction temperature;
3. I_{AS} = 7.7 A, V_{DD} = 50 V, R_G = 25 Ω, Starting T_j = 25°C.



Electrical Characteristics Diagrams

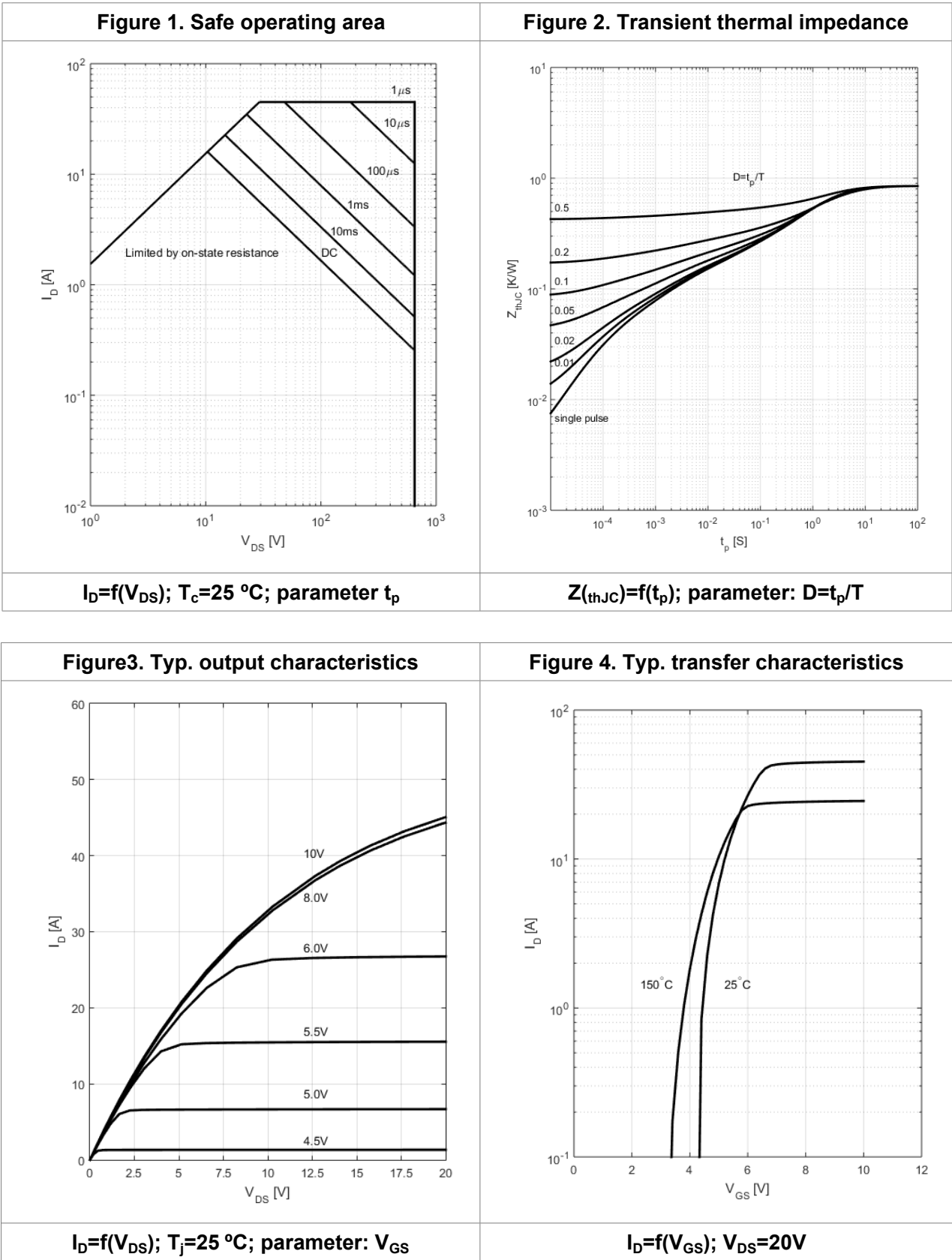
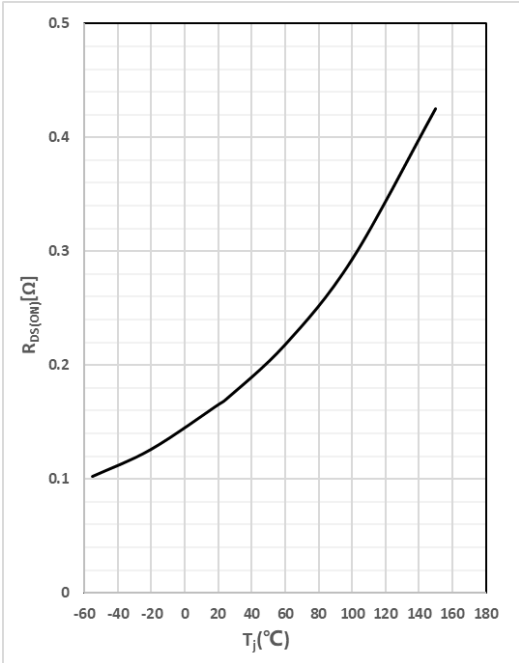
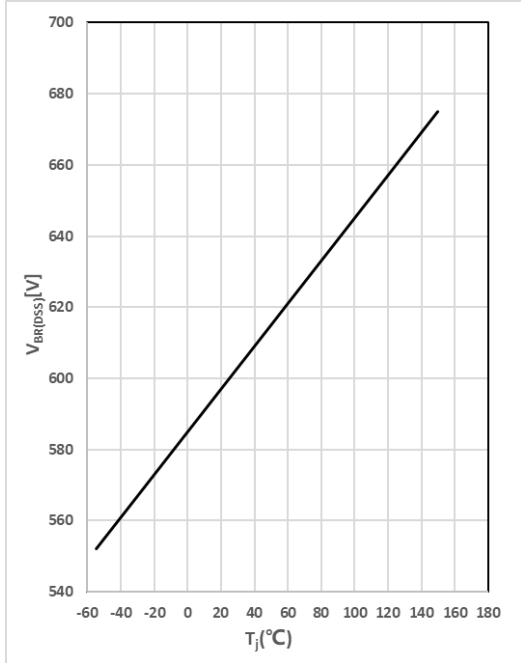


Figure 5. Drain-source on-state resistance



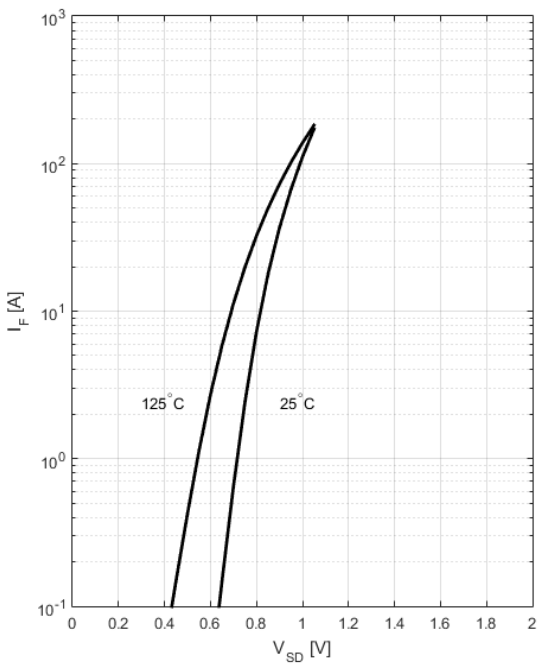
$R_{DS(ON)}=f(T_j)$; $I_D=20\text{A}$; $V_{GS}=10\text{V}$

Figure6. Drain-source breakdown voltage



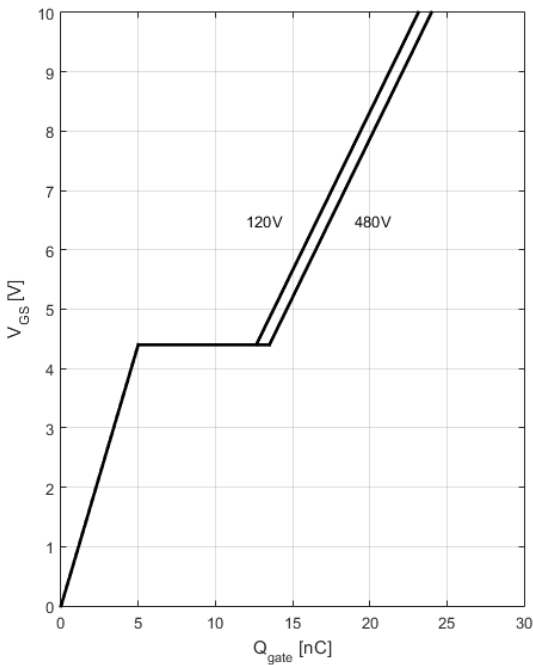
$V_{BR(DSS)}=f(T_j)$; $I_D=10\text{mA}$

Figure7. Forward characteristics of reverse diode



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

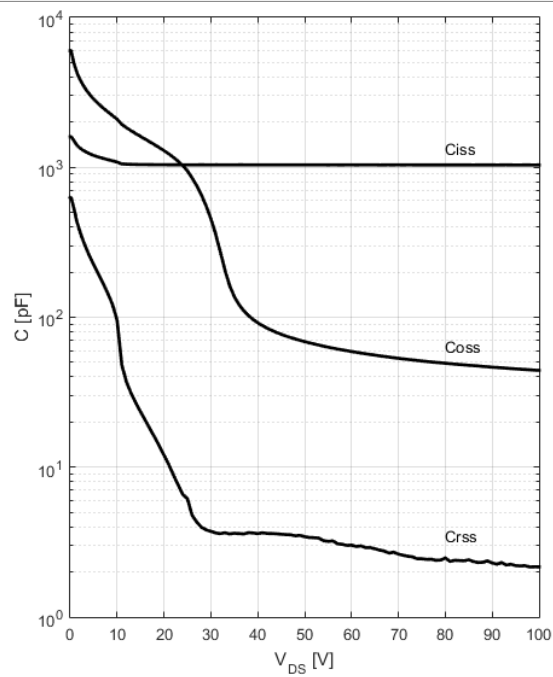
Figure 8. Typ. gate charge



$V_{GS}=f(Q_{gate})$, $I_D=20\text{A}$ pulsed

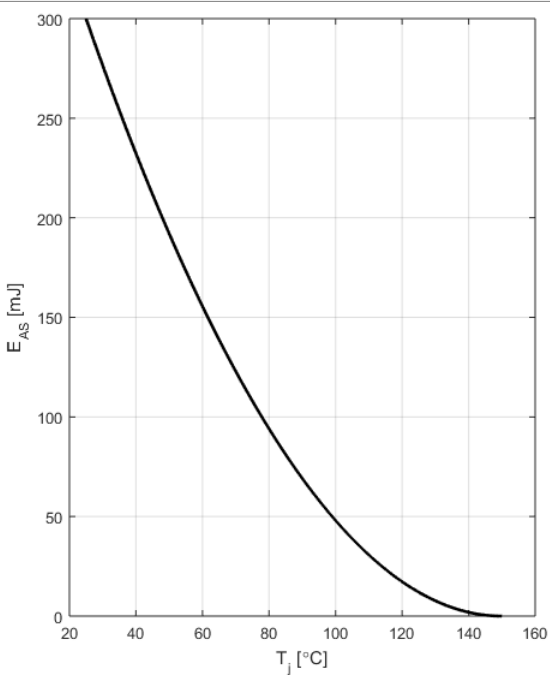


Figure 9: Typ. capacitances



$C=f(V_{DS}); V_{GS}=0; f=1\text{MHz}$

Figure 10: Avalanche energy

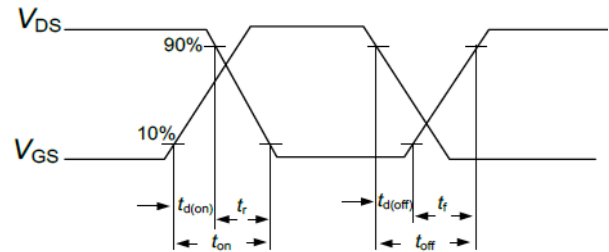
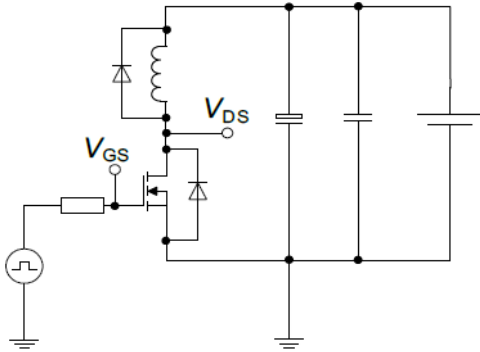


$E_{AS}=f(T_j); I_D=10\text{A}; V_{DD}=50\text{V}$

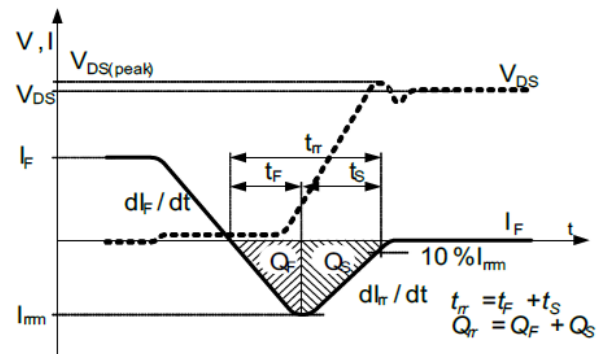
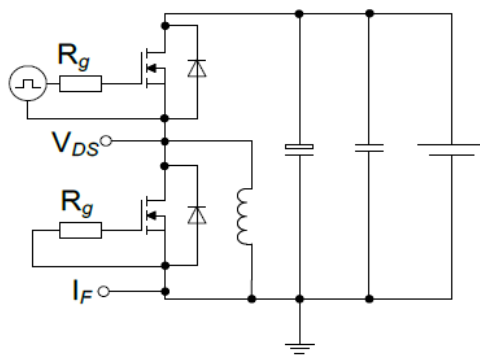


Test Circuits

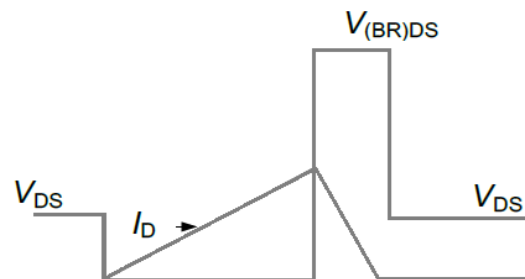
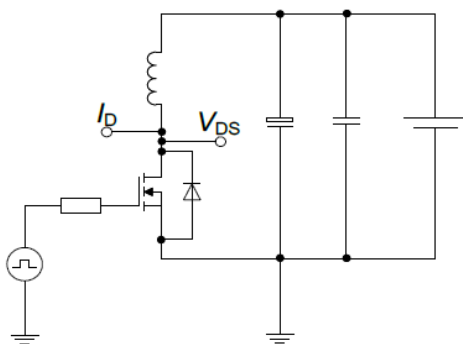
Switch time test circuit



Reverse diode characteristics test circuit and waveform

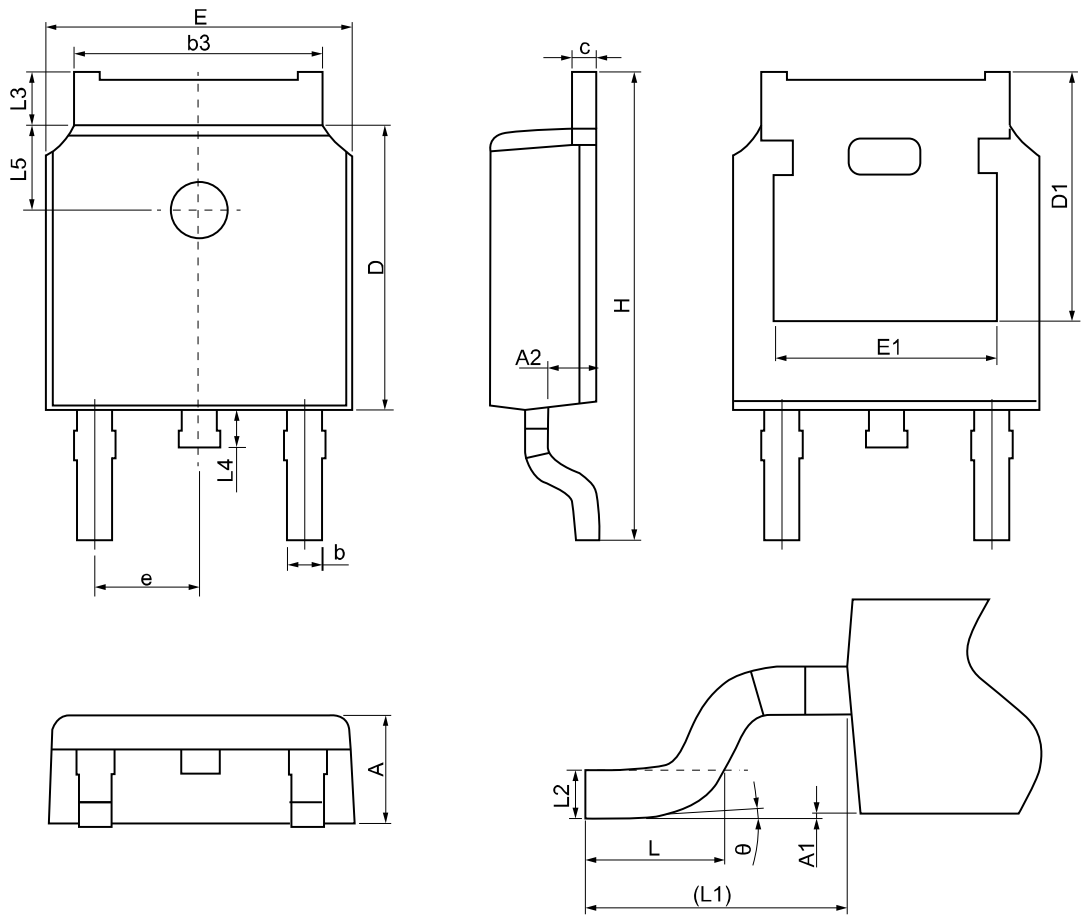


Unclamped inductive switching test circuit & waveform



PHYSICAL DIMENSIONS

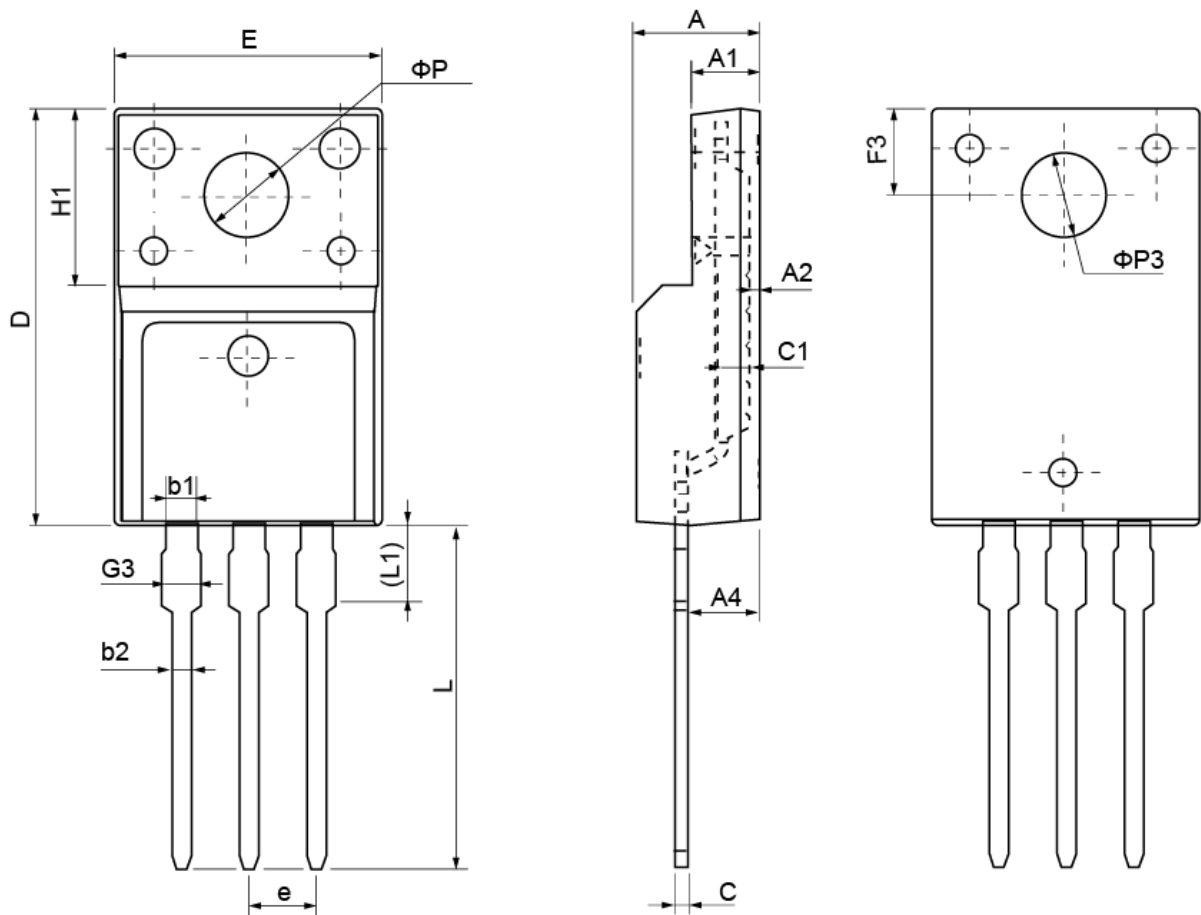
TO-252



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



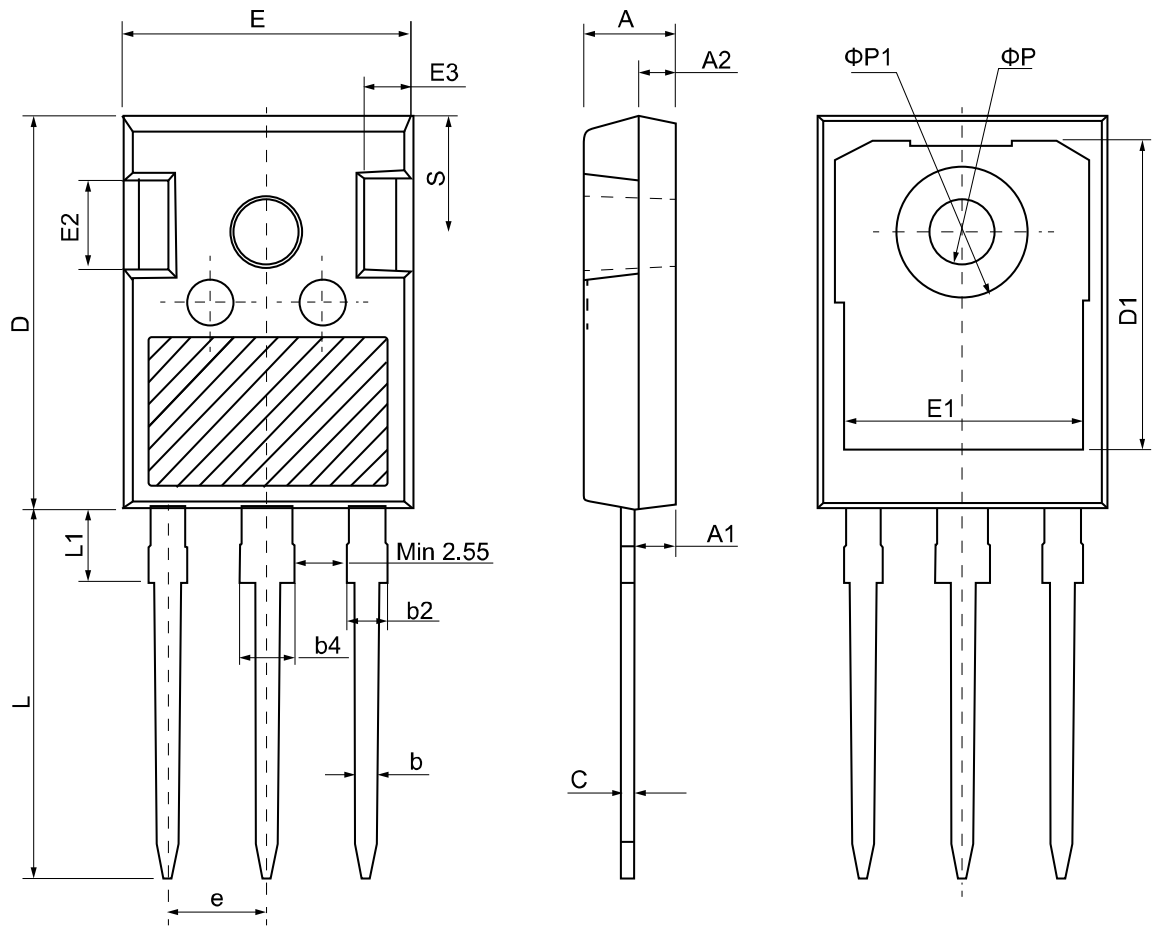
TO-220F



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	-	-	-	-

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