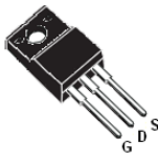
650V N-Channel Super Junction power MOSFET

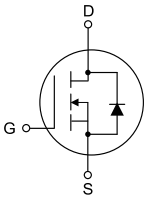
DESCRIPTION

SJ MOSFET is an advanced technology for high voltage power MOSFETs, designed according to the super junction principle by P&S. 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
$R_{DS(ON)}$	280	mΩ
I_D	15	A



TO-220F



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-220F	Pb-Free	CWS15N65AF	50 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)	$I_{D(DC)}$	15	A
Continuous Drain Current (T_C=100 °C) (Note 1)	$I_{D(DC)}$	10	A
Pulsed Drain Current (Note 2)	I_{DM}	45	A
MOSFET dv/dt ruggedness, V_{DS}≤480 V	dv/dt	50	V/nS
Single Pulsed Avalanche Energy (Note 3)	E_{AS}	400	mJ
Avalanche Energy, Repetitive (Note 1)	E_{AR}	0.7	mJ
Avalanche Current, Repetitive (Note 1)	I_{AR}	7.5	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}	-	-	3.8	°C /W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	-	-	80	°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	-	-	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=7.5A	-	0.25	0.28	Ω
Gate Resistance	R_g	F=1MHZ, open drain	-	10.3	-	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	-	1036	-	pF
Output capacitance	C_{oss}		-	44.2	-	
Reverse transfer capacitance	C_{rss}		-	2.16	-	
Turn-on delay Time	$t_{d(on)}$	V_{DD}=480V, I_D=15A R_G=6.8Ω, V_{GS}=10V	-	26	-	ns
Rise time	t_r		-	34		
Turn-off delay time	$t_{d(off)}$		-	109		
Fall time	t_f		-	36		

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}=480V, I_D=15A V_{GS}=0 to 10V	-	5.0	-	nC
Gate to Drain Charge	Q_{gd}		-	8.4	-	
Gate Charge Total	Q_g		-	24	-	
Gate Plateau Voltage	$V_{plateau}$		-	4.4	-	V

Reverse diode characteristics

（T_j = 25°C, unless otherwise noted）

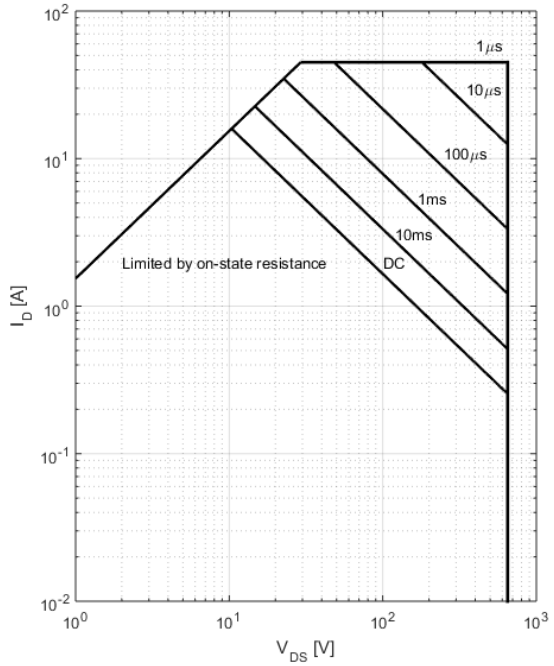
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Body Diode Forward Voltage	V_{SD}	V_{GS}=0V, I_{SD}=15A	-	0.9	-	V
Reverse Recovery Time	t_{rr}	V_R=480V, I_F=15A dI_F/dt=100A/μs	-	270	-	nS
Reverse Recovery Charge	Q_{rr}		-	4.1	-	μC
Peak Reverse Recovery Current	I_{rrm}		-	22.8	-	A

Notes：

1. Limited by maximum junction temperature;
2. Pulse width limited by maximum junction temperature;
3. I_{AS} = 9 A, V_{DD} = 50 V, R_G = 25 Ω, Starting T_J = 25°C.

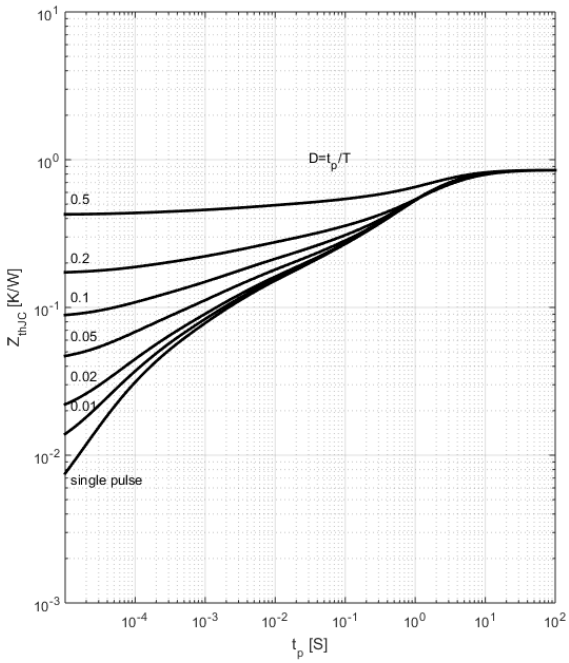
ELECTRICAL CHARACTERISTICS DIAGRAMS

Figure 1. Safe operating area



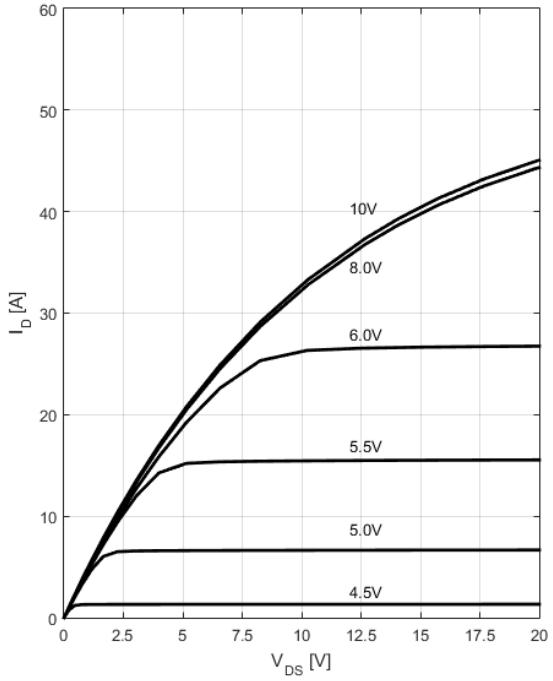
I_D=f(V_{DS}); T_c=25 ºC; parameter t_p

Figure 2. Transient thermal impedance



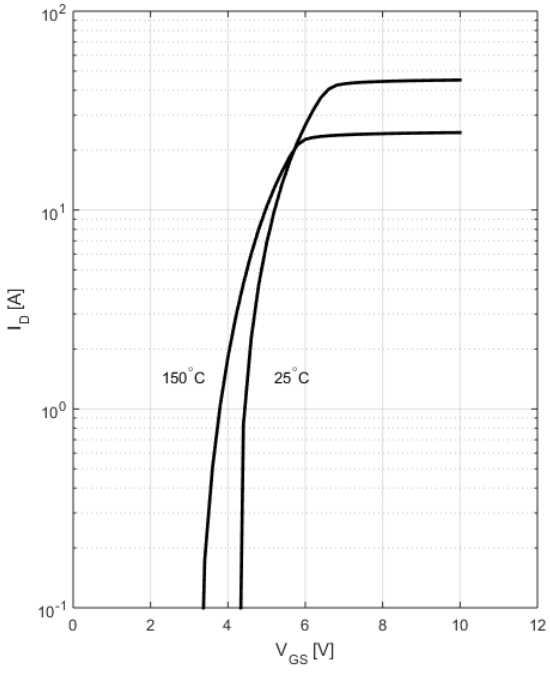
$Z_{(thJC)}$=f(t_p); parameter: D=t_p/T

Figure3. Typ. output characteristics



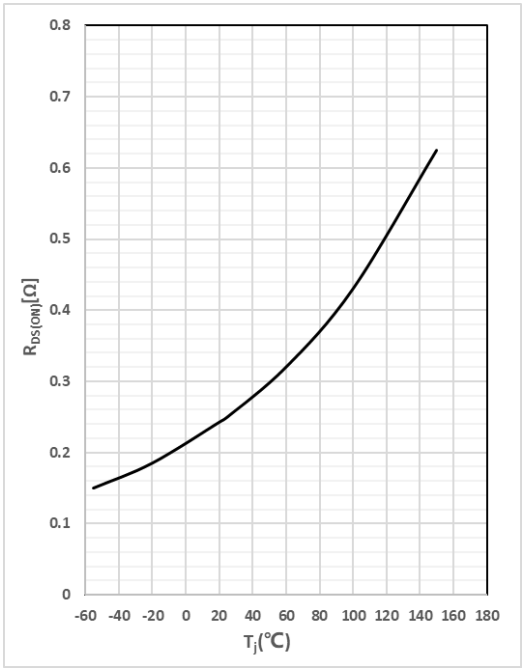
I_D=f(V_{DS}); T_j=25 ºC; parameter: V_{GS}

Figure 4. Typ. transfer characteristics



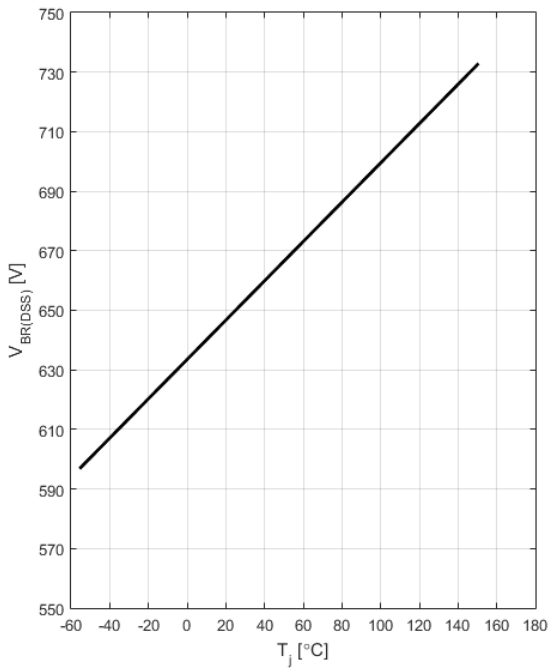
I_D=f(V_{GS}); V_{DS}=20V

Figure 5. Drain-source on-state resistance



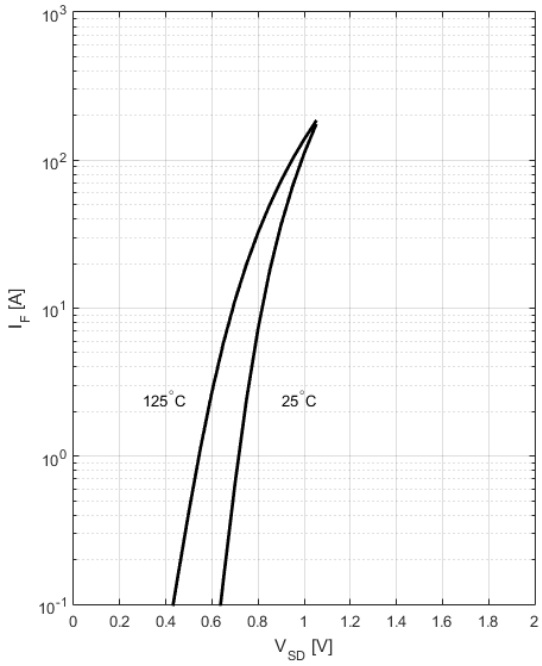
$R_{DS(ON)}=f(T_j)$; I_D=15A; V_{GS}=10V

Figure6. Drain-source breakdown voltage



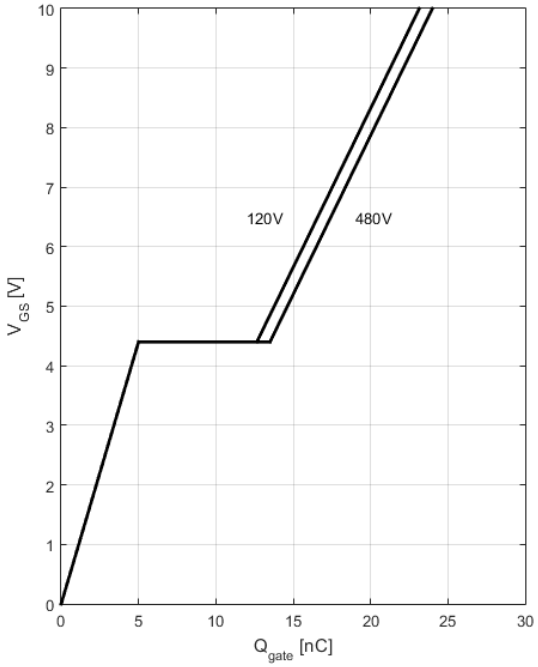
$V_{BR(DSS)}=f(T_j)$; I_D=10mA

Figure7. Forward characteristics of reverse diode

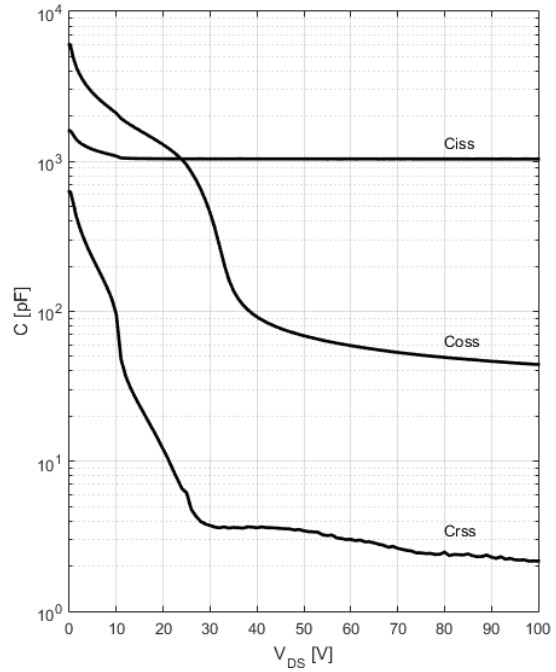
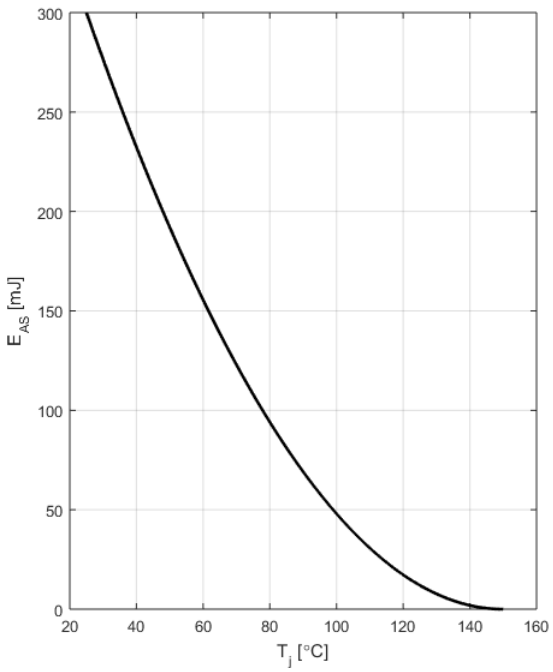


$I_F=f(V_{SD})$; parameter: T_j

Figure 8. Typ. gate charge

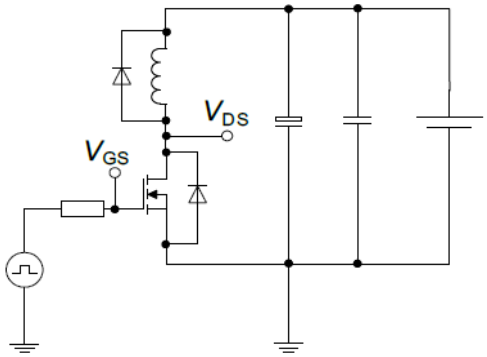


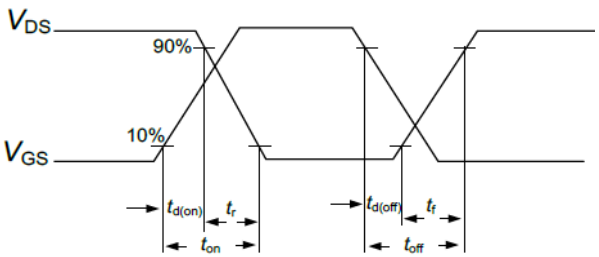
$V_{GS}=f(Q_{gate})$, I_D=15A pulsed

Figure 9: Typ. capacitances	Figure 10: Avalanche energy
	
$C=f(V_{DS})$; $V_{GS}=0$; f=1MHz	$E_{AS}=f(T_j)$; $I_D=7.5A$; $V_{DD}=50V$

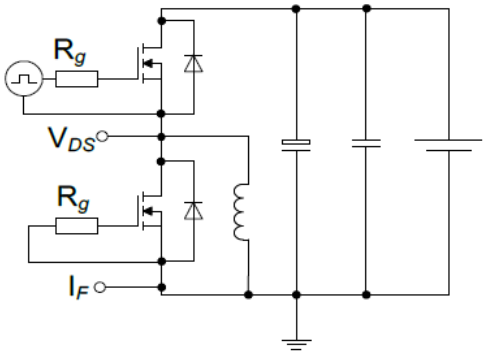
Test Circuits

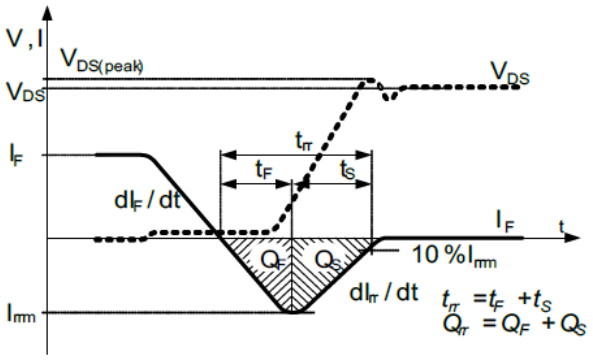
Switch time test circuit



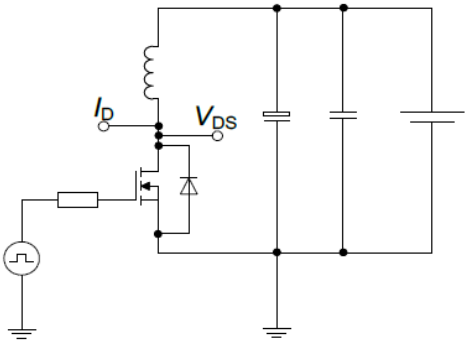


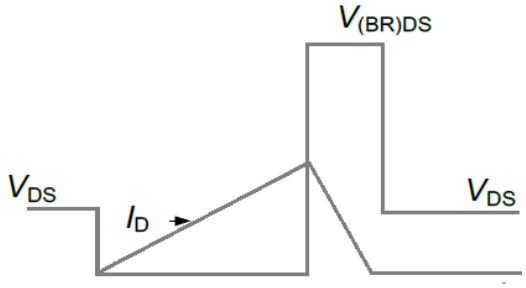
Reverse diode characteristics test circuit and waveform





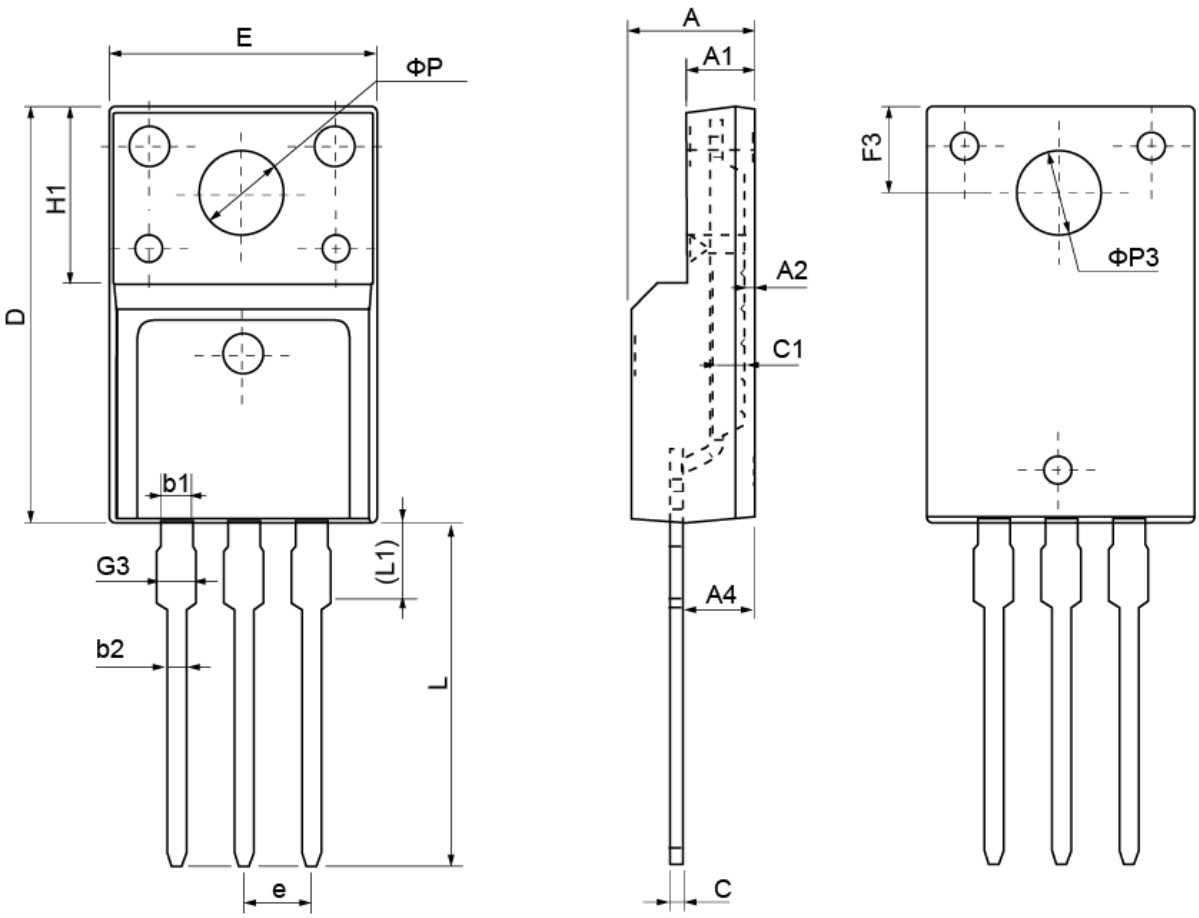
Unclaimed inductive switching test circuit & waveform





PHYSICAL DIMENSIONS

TO-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