

## MOSFET Silicon N-Channel MOS



### 1. Applications

Soft Switching Boost PFC switch, Half bridge or Asymmetric half bridge or Series resonance half bridge and full bridge topologies.  
 phase-shift-bridge(ZVS),LLC Application-Server Power, Telecom Power, EV Charging, Solar inverter.



### 2. Features

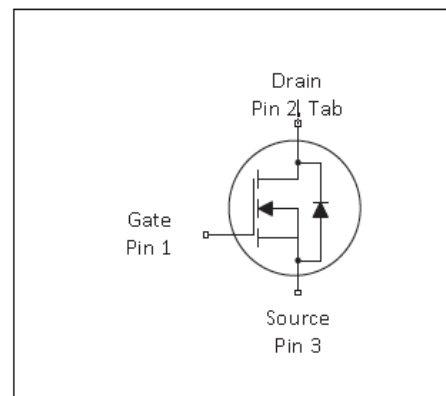
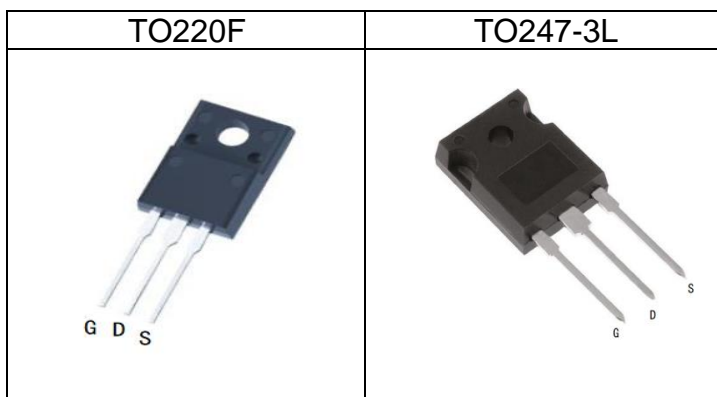
Low drain-source on-resistance:  $R_{DS(ON)} = 0.080\Omega$  (typ.)  
 Easy to control Gate switching  
 Enhancement mode:  $V_{th} = 3$  to 5V

**Table 1 Key Performance Parameters**

Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	650	V
$R_{DS(on),max}$	90	m $\Omega$
$Q_{g,typ}$	65.32	nC
$I_{D,pulse}$	141	A
Body diode dv/dt	50	V/ns

### 3. Packaging and Internal Circuit

Part Name	Package	Marking
ASA60R090EFDA	TO220F	ASA60R090EFDA
ASW60R090EFDA	TO247-3L	ASW60R090EFDA



**1 Maximum ratings**  
at  $T_j = 25^\circ\text{C}$ , unless otherwise specified

**Table 2 Maximum ratings**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current <sup>1)</sup>	$I_D$		-	47	A	$T_C=25^\circ\text{C}$
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	-	-	141	A	$T_C=25^\circ\text{C}$
Avalanche energy, single pulse	$E_{AS}$	-	-	885	mJ	$T_C=25^\circ\text{C}$ , $V_{DD}=50\text{V}$ , $L=10\text{mH}$ , $R_G=25\Omega$
MOSFET dv/dt ruggedness	dv/dt	-	-	59	V/ns	$V_{DS}=0\dots400\text{V}$
Gate source voltage (static)	$V_{GS}$	-20	-	20	V	static;
Gate source voltage (dynamic)	$V_{GS}$	-30	-	30	V	AC ( $f>1\text{ Hz}$ )
Power dissipation	$P_{tot}$	-	-	191	W	$T_C=25^\circ\text{C}$
Storage temperature	$T_{stg}$	-55	-	150	$^\circ\text{C}$	
Operating junction temperature	$T_j$	-55	-	150	$^\circ\text{C}$	
Soldering Temperature Distance of 1.6mm from case for 10s	$T_L$			260	$^\circ\text{C}$	
Reverse diode dv/dt <sup>3)</sup>	dv/dt	-	-	50	V/ns	$V_{DS}=0\dots400\text{V}$ , $I_{SD}\leq 48\text{A}$ , $T_j=25^\circ\text{C}$ see table 8

<sup>1)</sup>Limited by  $T_{j,max}$ . Maximum Duty Cycle  $D = 0.50$

<sup>2)</sup>Pulse width  $t_p$  limited by  $T_{j,max}$

<sup>3)</sup>Identical low side and high side switch with identical  $R_G$

## 2 Thermal characteristics

**Table 3 Thermal characteristics (TO220F)**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	$R_{thJC}$	-	-	3.65	°C/W	-
Thermal resistance, junction - ambient	$R_{thJA}$	-	-	80	°C/W	device on PCB, minimal footprint

### Thermal characteristics (TO247)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	$R_{thJC}$	-	-	0.65	°C/W	-
Thermal resistance, junction - ambient	$R_{thJA}$	-	-	62	°C/W	device on PCB, minimal footprint

### 3 Electrical characteristics

at  $T_j=25^{\circ}\text{C}$ , unless otherwise specified

**Table 4 Static characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	605	-	-	V	$V_{GS}=0V, I_D=250\mu A$
Gate threshold voltage	$V_{(GS)th}$	3		5	V	$V_{DS}=V_{GS}, I_D=250\mu A$
Zero gate voltage drain current	$I_{DSS}$	-	-	5	$\mu A$	$V_{DS}=600V, V_{GS}=0V, T_j=25^{\circ}\text{C}$
Gate-source leakage current	$I_{GSS}$	-	-	100	nA	$V_{GS}=30V, V_{DS}=0V$
Drain-source on-state resistance	$R_{DS(on)}$	-	0.080	0.090	$\Omega$	$V_{GS}=10V, I_D=20A, T_j=25^{\circ}\text{C}$
Gate resistance (Intrinsic)	$R_G$	-	0.9	-	$\Omega$	$f=1\text{MHz}$ , open drain

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	$C_{iss}$	-	3291	-	pF	$V_{GS}=0V, V_{DS}=50V, f=10\text{kHz}$
Output capacitance	$C_{oss}$	-	298.1	-	pF	$V_{GS}=0V, V_{DS}=50V, f=10\text{kHz}$
Reverse transfer capacitance	$C_{rss}$	-	10.7	-	pF	$V_{GS}=0V, V_{DS}=50V, f=10\text{kHz}$
Turn-on delay time	$t_{d(on)}$	-	12.1	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=25.8A$ $R_G=1.7\Omega$ ; see table 9
Rise time	$t_r$	-	4.4	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=25.8A$ $R_G=1.7\Omega$ ; see table 9
Turn-off delay time	$t_{d(off)}$	-	39.1	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=25.8A$ $R_G=1.7\Omega$ ; see table 9
Fall time	$t_f$	-	4.3	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=25.8A$ $R_G=1.7\Omega$ ; see table 9

**Table 6 Gate charge characteristics**

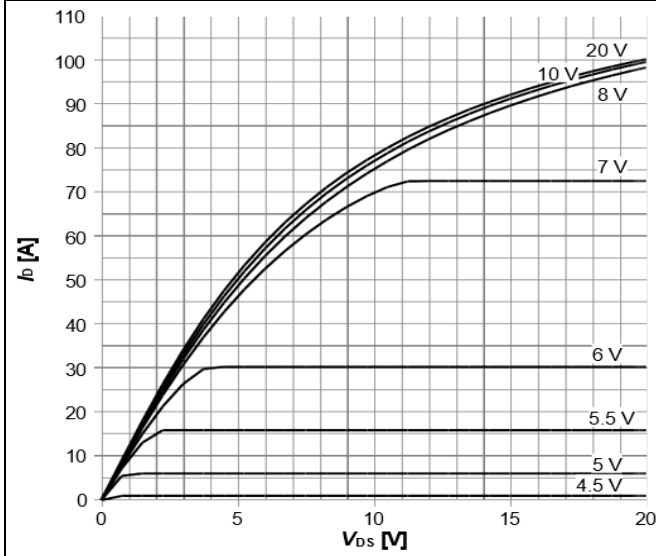
Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	18.16	-	nC	$V_{DD}=400V, I_D=25.8A, V_{GS}=0$ to 10V
Gate to drain charge	$Q_{gd}$	-	22.93	-	nC	$V_{DD}=400V, I_D=25.8A, V_{GS}=0$ to 10V
Gate charge total	$Q_g$	-	65.32	-	nC	$V_{DD}=400V, I_D=25.8A, V_{GS}=0$ to 10V
Gate plateau voltage	$V_{plateau}$	-	5.98	-	V	$V_{DD}=400V, I_D=25.8A, V_{GS}=0$ to 10V

**Table 7 Reverse diode characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	$V_{SD}$	-	0.66	-	V	$V_{GS}=0V, I_F=1A, T_J=25^{\circ}C$
Reverse recovery time	$t_{rr}$	-	147.8	-	ns	$V_r=400v, I_F=9.6A, di/dt=100A/us$ see table 8
Reverse recovery charge	$Q_{rr}$	-	0.96	-	$\mu C$	$V_r=400v, I_F=9.6A, di/dt=100A/us$ see table 8
Peak reverse recovery current	$I_{rrm}$	-	12.27	-	A	$V_r=400v, I_F=9.6A, di/dt=100A/us$ see table 8

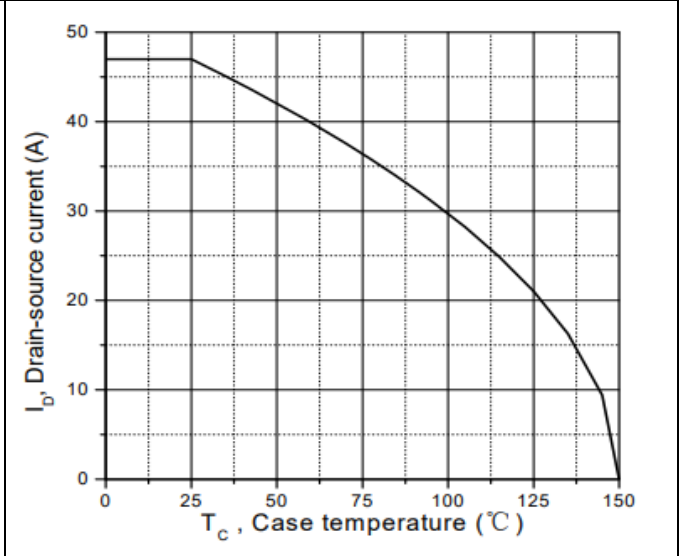
### 4 Electrical characteristics diagram

Diagram 1: Typ. Output characteristics



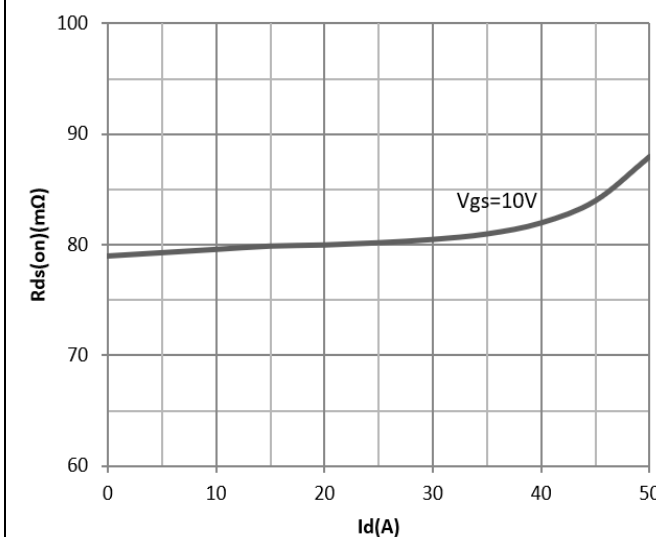
$I_D=f(V_{DS}); T_i=25\text{ }^\circ\text{C};$  parameter:  $V_{GS}$

Diagram 2: Typ. Drain Current De-rating



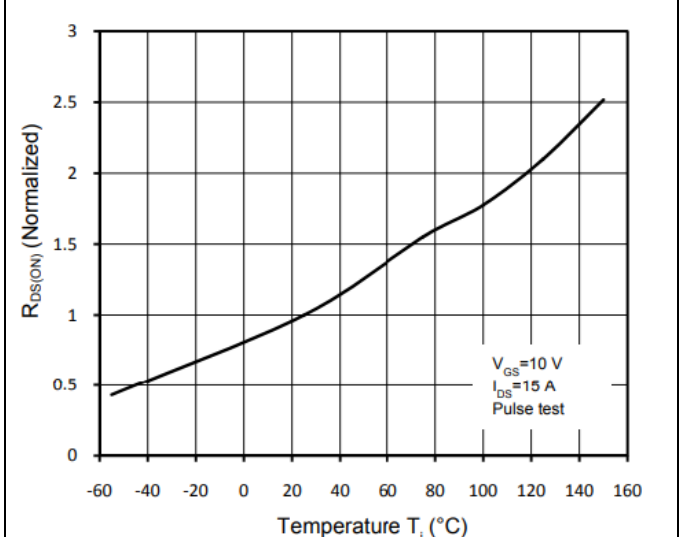
$I_D=f(T_C);$

Diagram 3: Typ. Rds(on) vs. Drain Current



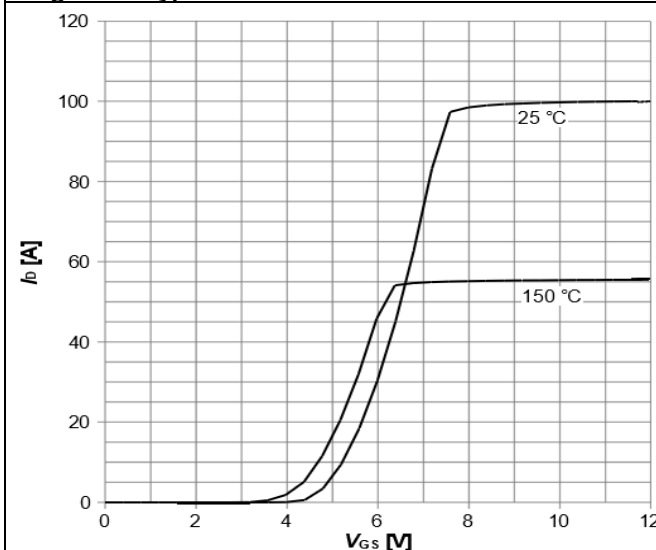
$R_{ds(on)}=f(I_D); V_{GS}=10V$

Diagram 4: Typ. Rds(on) – Junction Temperature



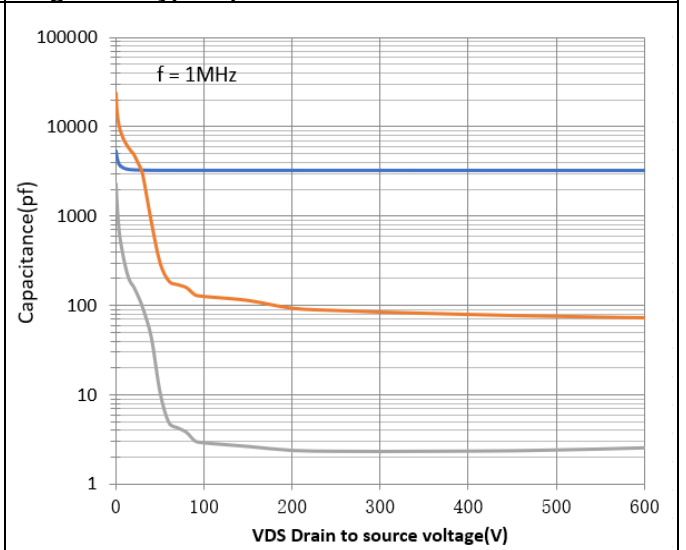
$R_{ds(on)}=f(T_J); V_{GS}=10V/I_D=15A$

Diagram 5: Typ. transfer characteristics



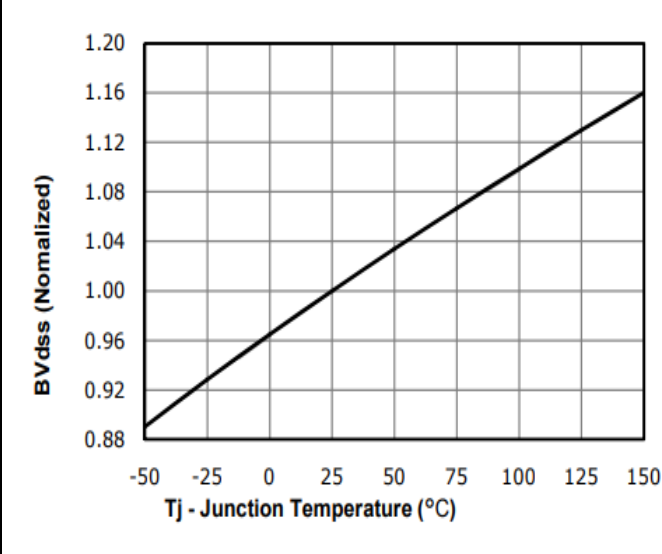
$I_D=f(V_{GS}); V_{DS}=20V;$  parameter:  $T_i$

Diagram 6: Typ. Capacitance vs. Vds



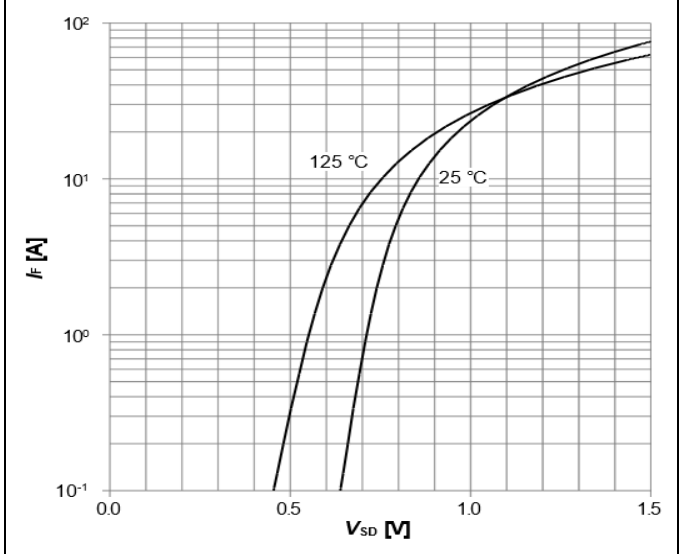
$C=f(V_{DS}); V_{GS}=0V; f=1\text{ MHz}$

Diagram 7: Typ. BVDSS voltage vs. Temperature



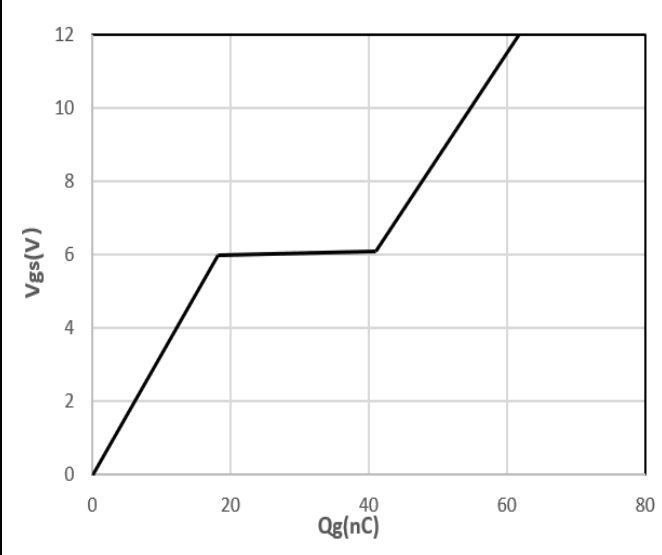
$V_{GS}=f(T_J); I_b=250\mu A$

Diagram 8: Typ. Source-Drain Diode Forward



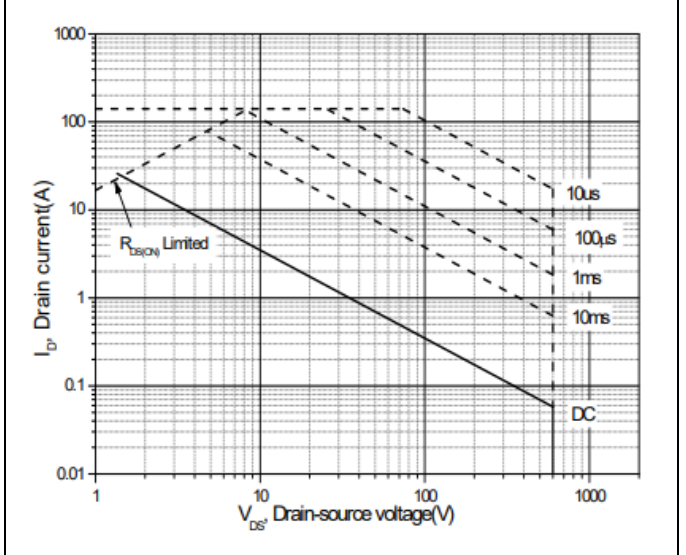
$I_{SD}=f(V_{DS}); T_C=25\text{ }^\circ\text{C};$

Diagram 9: Typ. Gate charge



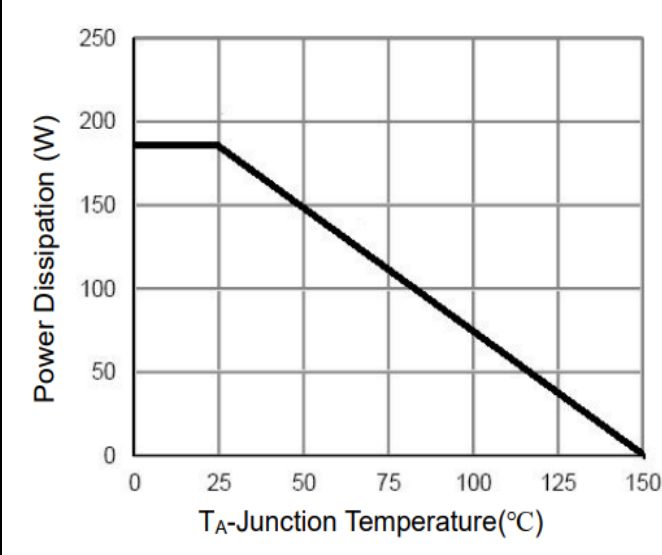
$V_{GS}=f(Q_{gate}); I_D=25.8\text{A pulsed}; \text{parameter: } V_{DD}$

Diagram 10: Typ. Maximum Safe Operating Area



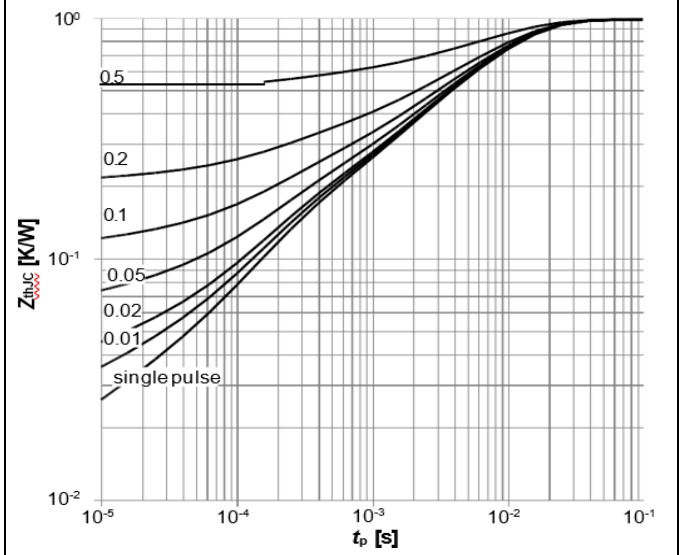
$I_D=f(V_{DS}); T_C=25\text{ }^\circ\text{C}; V_{GS}>7\text{V}; D=0; \text{parameter } t_p$

Diagram 11: Typ. Power Dissipation



$P_{tot}=f(T_C);$

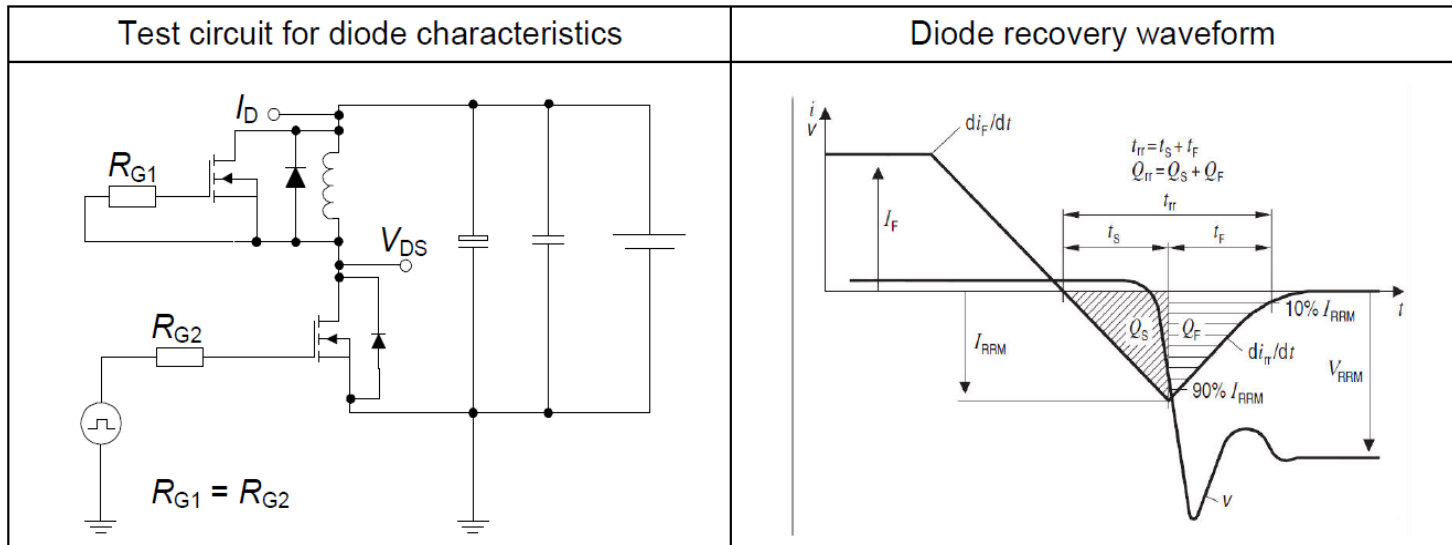
Diagram 12: Normalized Transient Impedance



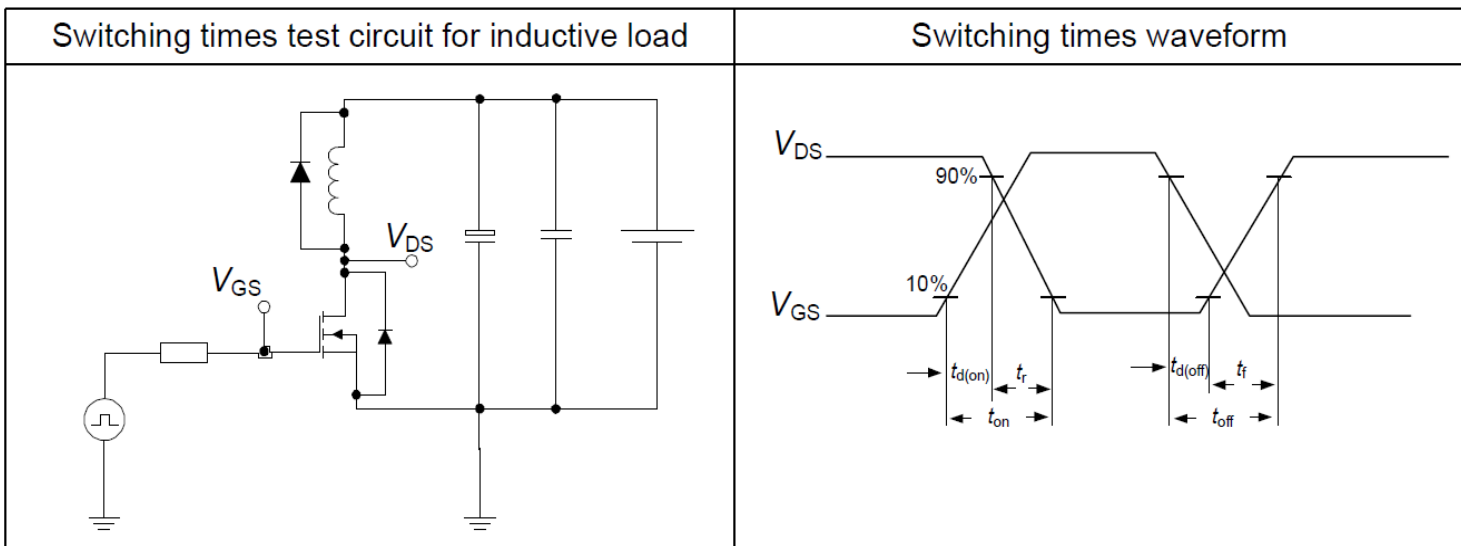
$Z_{thJC}=f(t_p); \text{parameter: } D=t_p/T$

## 5 Test Circuits

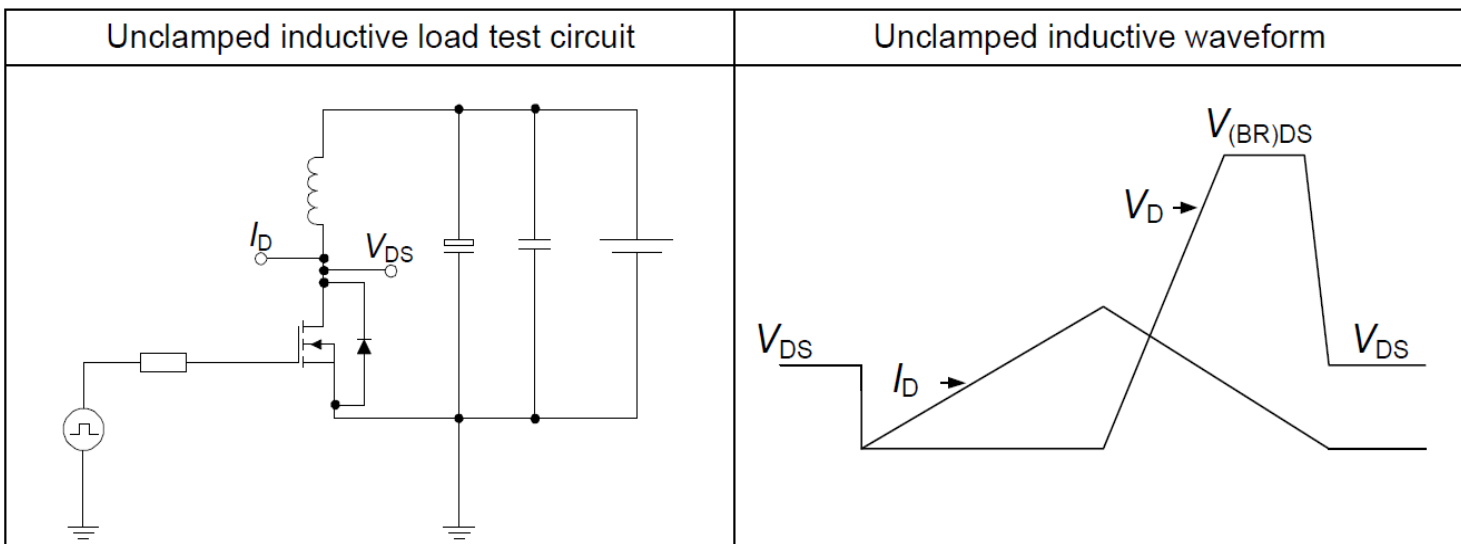
**Table 8 Diode characteristics**



**Table 9 Switching times**

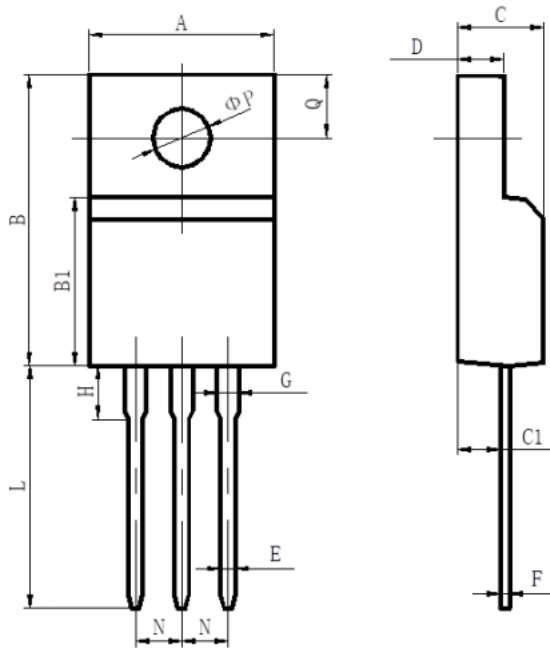


**Table 10 Unclamped inductive load**





## 6 Package Outlines



项目	规范(mm)	
	MIN	MAX
A	9.70	10.30
B	15.50	16.10
B1	8.99	9.39
C	4.40	4.80
C1	2.15	2.55
D	2.50	2.90
E	0.70	0.90
F	0.40	0.60
G	1.12	1.42
H	3.40	3.80
L	12.6	13.6
N	2.34	2.74
Q	3.15	3.55
$\phi P$	3.00	3.30

Figure1: Outline PG-T0220F(HT)

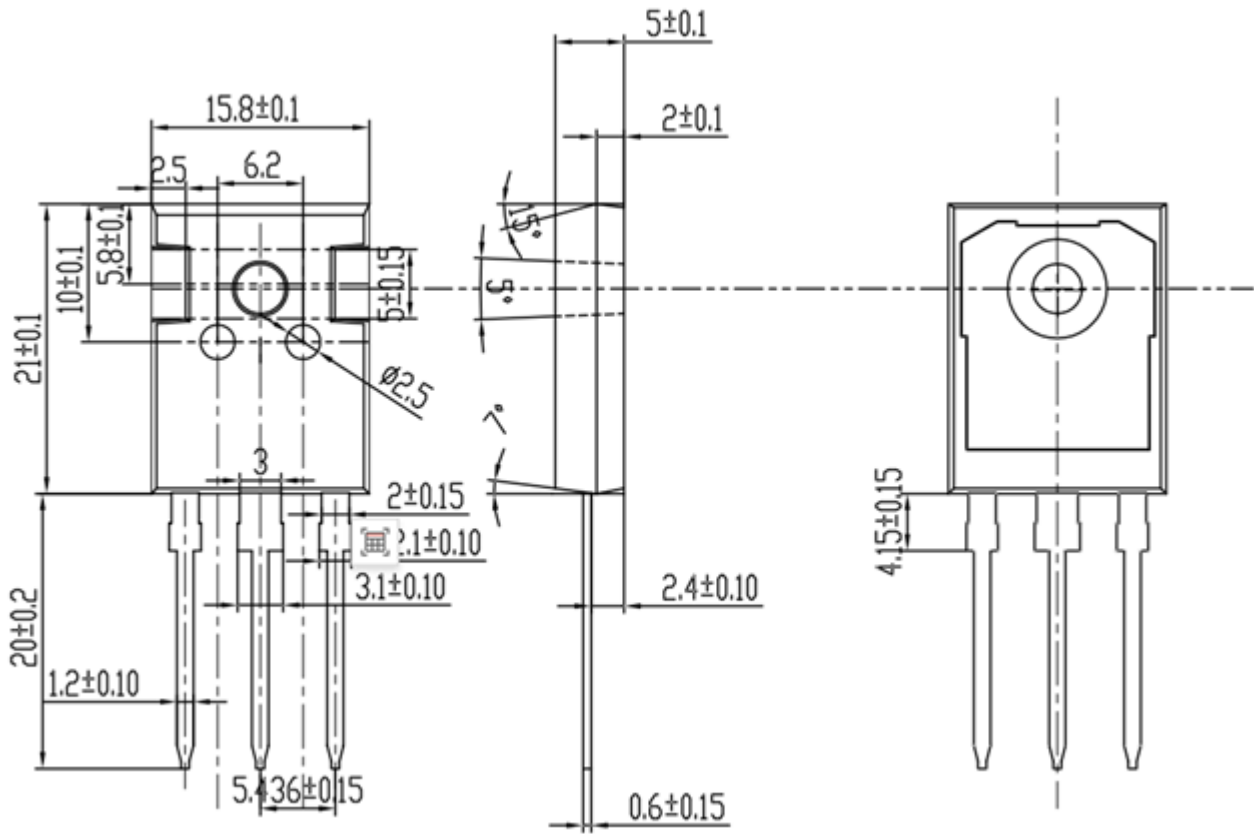


Figure2: Outline PG-T0247(HT)

## Revision History

Revision	Date	Subjects (major changes since last revision)
1.0	2023-07-28	Preliminary version

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