

## MOSFET Silicon N-Channel MOS



### 1. Applications

For half bridge or Asymmetric half bridge or Series resonance half bridge topologies  
Such as Server power, Telecom power, EV Charging.

### 2. Features

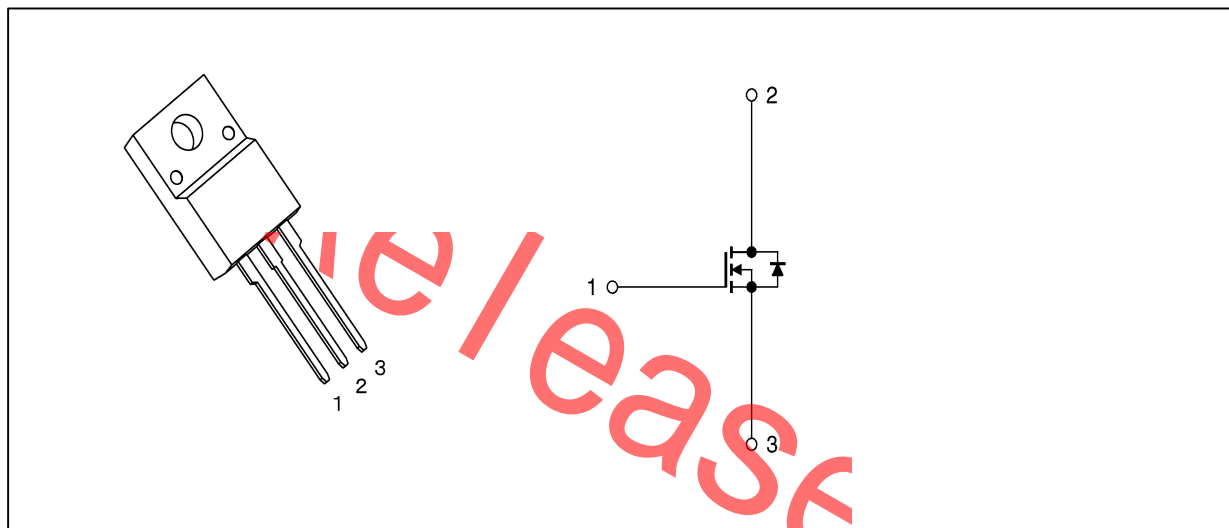
Low drain-source on-resistance:  $R_{DS(ON)} = 0.140\Omega$  (typ.)  
Easy to control Gate switching  
Enhancement mode:  $V_{th} = 3$  to  $5$  V



**Table 1 Key Performance Parameters**

Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	650	V
$R_{DS(on),max}$	180	m $\Omega$
$Q_{g,typ}$	47.59	nC
$I_{D,pulse}$	84	A
Body diode dv/dt	50	V/ns

### 3. Packaging and Internal Circuit



**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>	$I_D$		-	28	A	$T_C = 25^\circ\text{C}$
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	-	-	84	A	$T_C = 25^\circ\text{C}$
Avalanche energy, single pulse	$E_{AS}$	-	-	898	mJ	
MOSFET dv/dt ruggedness	dv/dt	-	-	130	V/ns	$V_{DS} = 0 \dots 400\text{V}$
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	$P_{tot}$	-	-	34	W	$T_C = 25^\circ\text{C}$
Storage temperature	$T_{stg}$	-55	-	150	$^\circ\text{C}$	
Operating junction temperature	$T_j$	-55	-	150	$^\circ\text{C}$	
Reverse diode dv/dt <sup>3)</sup>	dv/dt	-	-	50	V/ns	$V_{DS} = 0 \dots 400\text{V}$ , $I_{SD} \leq 48\text{A}$ , $T_j = 25^\circ\text{C}$ see table 8

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<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**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	$R_{thJC}$	-	-	3.7	°C/W	-
Thermal resistance, junction - ambient	$R_{thJA}$	-	-	80	°C/W	device on PCB, minimal footprint

release

### 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	$V_{GS}=0\text{V}$ , $I_D=10\text{mA}$
Gate threshold voltage	$V_{(GS)th}$	3		5	V	$V_{DS}=V_{GS}$ , $I_D=250\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	-	5	$\mu\text{A}$	$V_{DS}=600\text{V}$ , $V_{GS}=0\text{V}$ , $T_j=25^{\circ}\text{C}$
Gate-source leakage current	$I_{GSS}$	-	-	100	nA	$V_{GS}=30\text{V}$ , $V_{DS}=0\text{V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	0.14	0.18	$\Omega$	$V_{GS}=10\text{V}$ , $I_D=10\text{A}$ , $T_j=25^{\circ}\text{C}$
Gate resistance (Intrinsic)	$R_G$	-	5.8	-	$\Omega$	$f=1\text{MHz}$ , open drain

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	$C_{iss}$	-	2389	-	pF	$V_{GS}=0\text{V}$ , $V_{DS}=50\text{V}$ , $f=10\text{kHz}$
Output capacitance	$C_{oss}$	-	218	-	pF	$V_{GS}=0\text{V}$ , $V_{DS}=50\text{V}$ , $f=10\text{kHz}$
Reverse transfer capacitance	$C_{rss}$	-	5.07	-	pF	$V_{GS}=0\text{V}$ , $V_{DS}=50\text{V}$ , $f=10\text{kHz}$
Turn-on delay time	$t_{d(on)}$	-	12.4	-	ns	$V_{DD}=400\text{V}$ , $V_{GS}=13\text{V}$ , $I_D=11.3\text{A}$ , $R_G=1.7\Omega$ ; see table 9
Rise time	$t_r$	-	21.6	-	ns	$V_{DD}=400\text{V}$ , $V_{GS}=13\text{V}$ , $I_D=11.3\text{A}$ , $R_G=1.7\Omega$ ; see table 9
Turn-off delay time	$t_{d(off)}$	-	50	-	ns	$V_{DD}=400\text{V}$ , $V_{GS}=13\text{V}$ , $I_D=11.3\text{A}$ , $R_G=1.7\Omega$ ; see table 9
Fall time	$t_f$	-	18.4	-	ns	$V_{DD}=400\text{V}$ , $V_{GS}=13\text{V}$ , $I_D=11.3\text{A}$ , $R_G=1.7\Omega$ ; see table 9

**Table 6 Gate charge characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	8.522	-	nC	$V_{DD}=400\text{V}$ , $I_D=11.3\text{A}$ , $V_{GS}=0$ to $10\text{V}$
Gate to drain charge	$Q_{gd}$	-	8.297	-	nC	$V_{DD}=400\text{V}$ , $I_D=11.3\text{A}$ , $V_{GS}=0$ to $10\text{V}$
Gate charge total	$Q_g$	-	47.59	-	nC	$V_{DD}=400\text{V}$ , $I_D=11.3\text{A}$ , $V_{GS}=0$ to $10\text{V}$
Gate plateau voltage	$V_{plateau}$	-	5.4	-	V	$V_{DD}=400\text{V}$ , $I_D=11.3\text{A}$ , $V_{GS}=0$ to $10\text{V}$

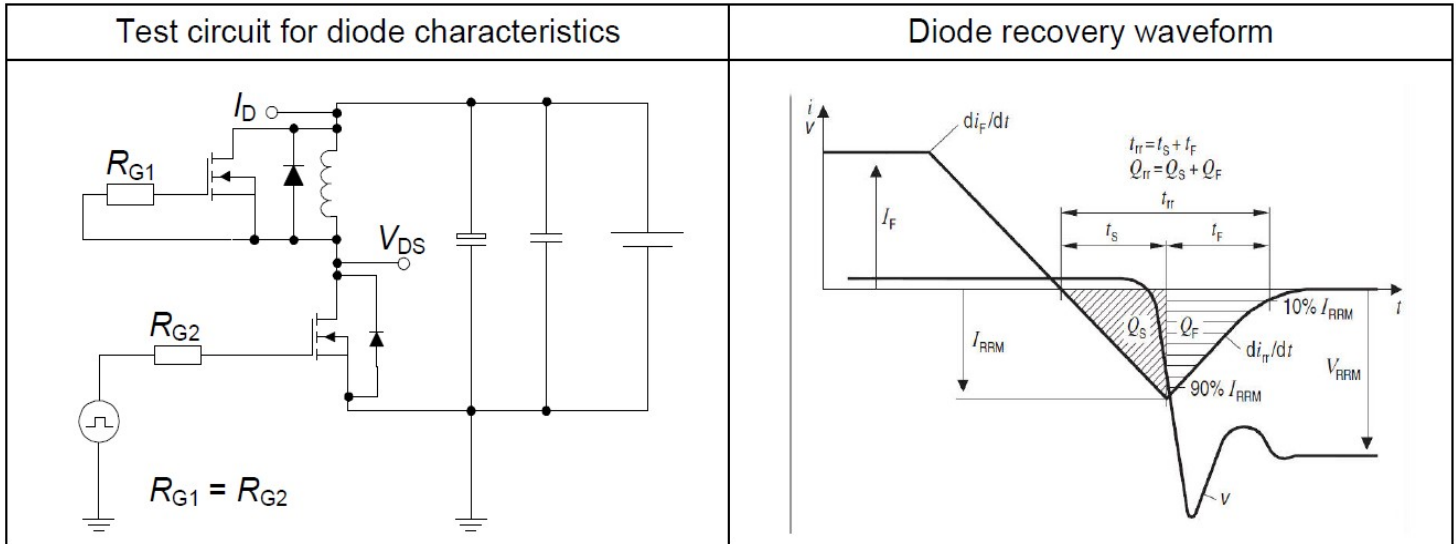
Table 7 Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	$V_{SD}$	-	0.69	-	V	$V_{GS}=0V, I_F=1A, T_j=25^{\circ}C$
Reverse recovery time	$t_{rr}$	-	115	-	ns	$V_r=400v, I_F=7A, di/dt=100A/us$ see table 8
Reverse recovery charge	$Q_{rr}$	-	0.623	-	uC	$V_r=400v, I_F=7A, di/dt=100A/us$ see table 8
Peak reverse recovery current	$I_{rrm}$	-	10.3	-	A	$V_r=400v, I_F=7A, di/dt=100A/us$ see table 8

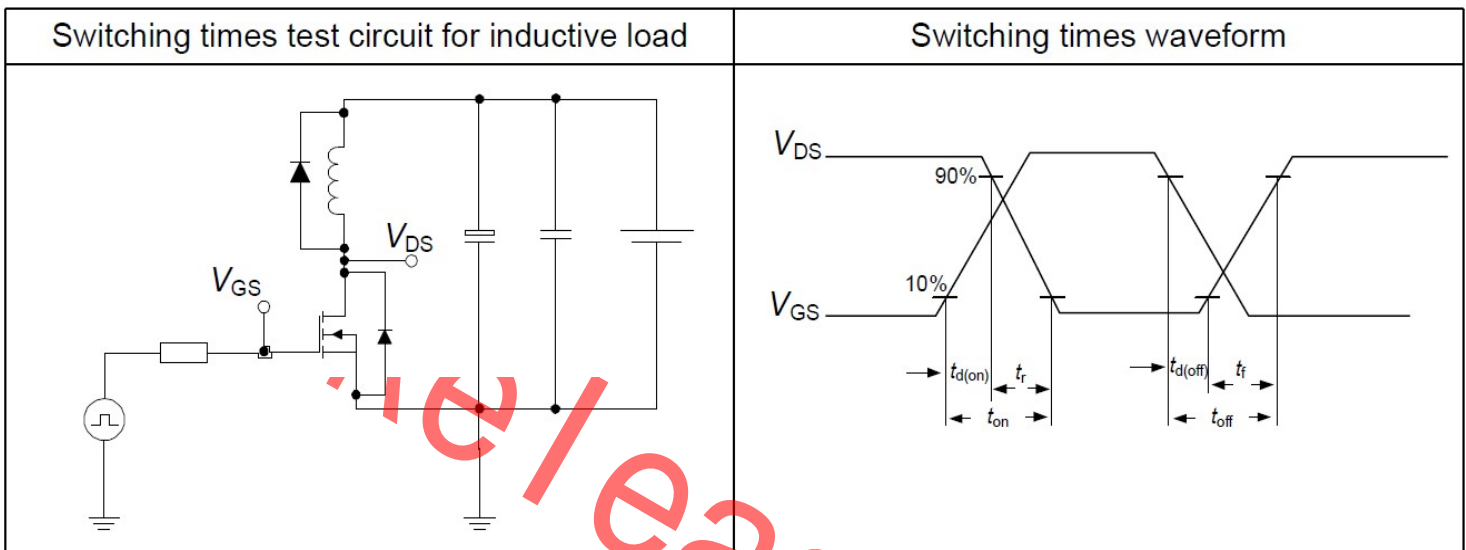
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### 4 Test Circuits

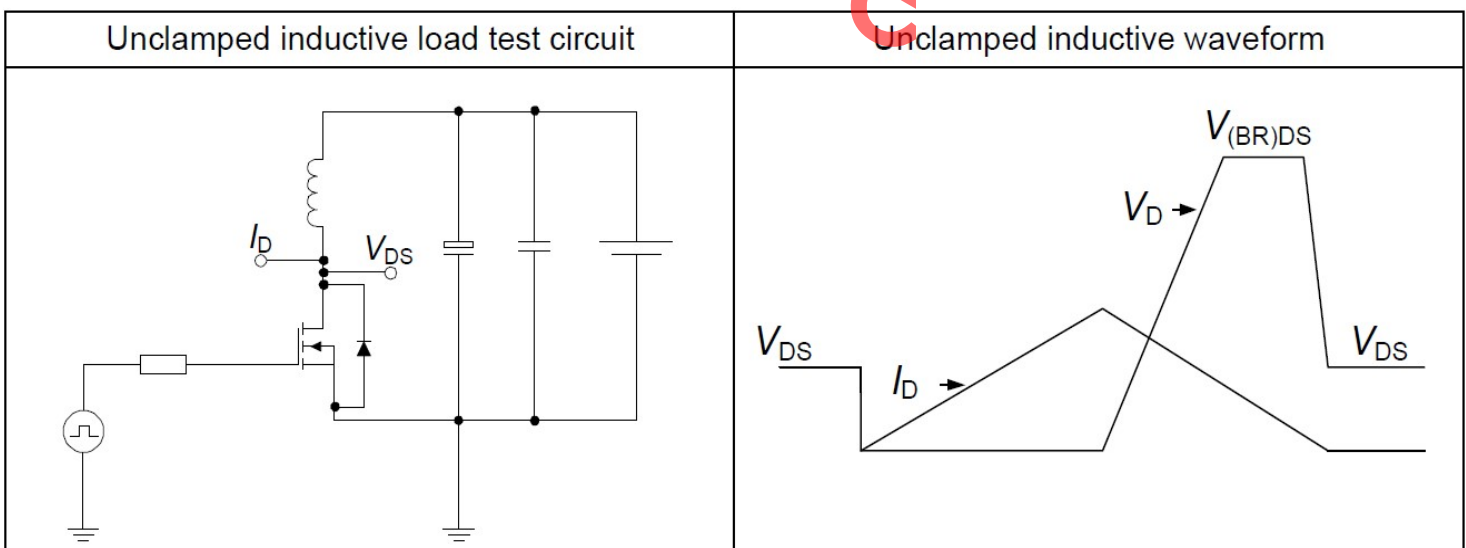
**Table 8 Diode characteristics**



**Table 9 Switching times**



**Table10 Unclamped inductive load**



5 Package Outlines

TO-220F

单位: mm

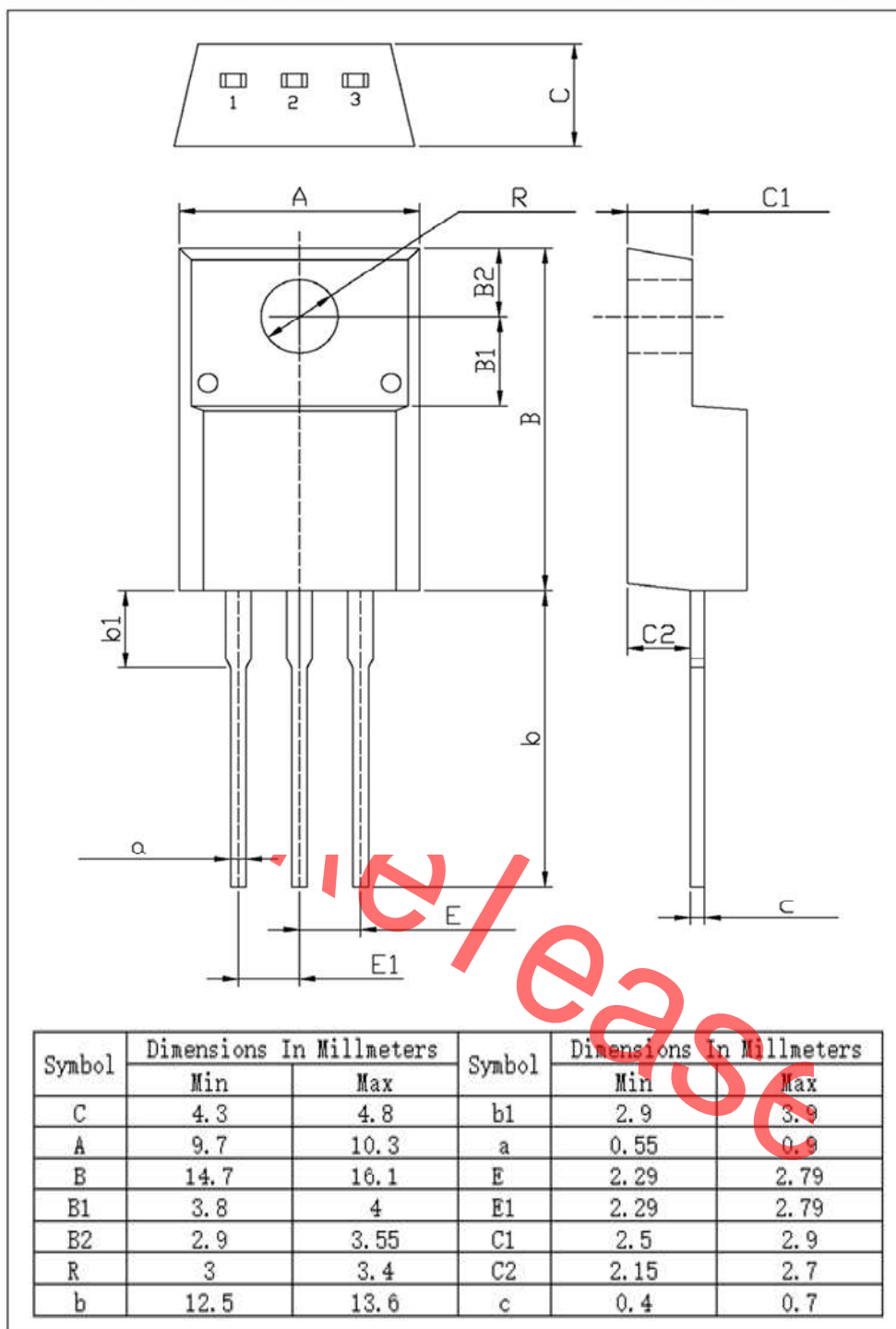


Figure1: Outline PG-TO220F

## Revision History

### ASA60R180EFD

Revision	Date	Subjects (major changes since last revision)
0.1	2019-05-21	Preliminary version
1.0	2019-11-07	Fine tune outline and add Crss test data.etc

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