ASA60R090EFD, ASW60R090EFD

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

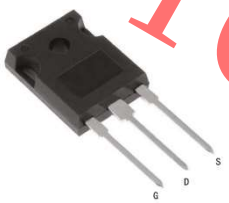
Low drain-source on-resistance: RDS(ON) = 0.080Ω (typ.)
Easy to control Gate switching
Enhancement mode: Vth = 3 to 5V

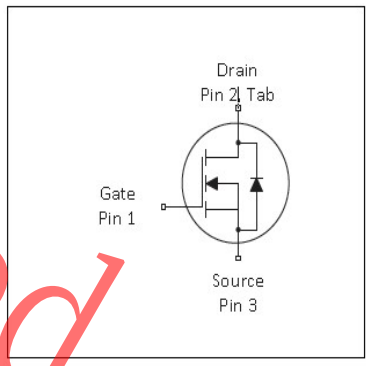
Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS} @ $T_{j,max}$	650	V
$R_{DS(on),max}$	90	mΩ
$Q_{g,typ}$	65	nC
$I_{D,pulse}$	141	A
Body diode dv/dt	50	V/ns

3. Packaging and Internal Circuit

Part Name	Package	Marking
ASW60R090EFD	TO247	ASW60R090EFD
ASA60R090EFD	TO220F	ASA60R090EFD

TO220F	TO247
	



1 Maximum ratings

at T_j = 25°C, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current[1]	I_D		-	47	A	T_C=25°C
Pulsed drain current[2]	$I_{D,pulse}$	-	-	141	A	T_C=25°C
Avalanche energy, single pulse	E_{AS}	-	-	5336	mJ	
MOSFET dv/dt ruggedness	dv/dt	-	-	59	V/ns	V_{DS}=0...400V
Gate source voltage (static)	V_{GS}	-20	-	20	V	static;
Gate source voltage (dynamic)	V_{GS}	-30	-	30	V	AC (f>1 Hz)
Power dissipation(TO220F)	P_{tot}	-	-	34	W	T_C=25°C
Power dissipation(TO247)	P_{tot}	-	-	391	W	T_C=25°C
Storage temperature	T_{stg}	-55	-	150	°C	
Operating junction temperature	T_j	-55	-	150	°C	
Reverse diode dv/dt[3]	dv/dt	-	-	50	V/ns	V_{DS}=0...400V, I_{SD}<=48A, T_j=25°C see table 8

[1] Limited by $T_{j,max}$. Maximum Duty Cycle D = 0.50
[2] Pulse width t_p limited by $T_{j,max}$
[3] 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}	-	-	0.32	°C/W	-
Thermal resistance, junction - ambient	R_{thJA}	-	-	62	°C/W	device on PCB, minimal footprint

3 Electrical characteristics

at T_j=25°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=10mA
Gate threshold voltage	$V_{(GS)th}$	3		5	V	V_{DS}=V_{GS}, I_D=250uA
Zero gate voltage drain current	I_{DSS}	-	-	5	uA	V_{DS}=600V, V_{GS}=0V, T_j=25°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	Ω	V_{GS}=10V, I_D=20A, T_j=25°C
Gate resistance (Intrinsic)	R_G	-	14	-	Ω	f=1MHz, open drain

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	4799	-	pF	V_{GS}=0V, V_{DS}=50V, f=10kHz
Output capacitance	C_{oss}	-	482	-	pF	V_{GS}=0V, V_{DS}=50V, f=10kHz
Reverse transfer capacitance	C_{rss}	-	4.6	-	pF	V_{GS}=0V, V_{DS}=50V, f=10kHz
Turn-on delay time	$t_{d(on)}$	-	38.8	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=25.8A R_G=1.7Ω; see table 9
Rise time	t_r	-	26.8	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=25.8A R_G=1.7Ω; see table 9
Turn-off delay time	$t_{d(off)}$	-	134.8	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=25.8A R_G=1.7Ω; see table 9
Fall time	t_f	-	20	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=25.8A R_G=1.7Ω; see table 9

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}		20	-	nC	V_{DD}=400V, I_D=25.8A, V_{GS}=0 to 10V
Gate to drain charge	Q_{gd}	-	24	-	nC	V_{DD}=400V, I_D=25.8A, V_{GS}=0 to 10V
Gate charge total	Q_g	-	65	-	nC	V_{DD}=400V, I_D=25.8A, V_{GS}=0 to 10V
Gate plateau voltage	$V_{plateau}$	-	7.4	-	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°C
Reverse recovery time	t_{rr}	-	120.8	-	ns	Vr=400v,IF=9.6A,di/dt=100A/us see table 8
Reverse recovery charge	Q_{rr}	-	0.7	-	uC	Vr=400v,IF=9.6A,di/dt=100A/us see table 8
Peak reverse recovery current	I_{rrm}	-	11.3	-	A	Vr=400v,IF=9.6A,di/dt=100A/us see table 8

4 Test Circuits

Table 8 Diode characteristics

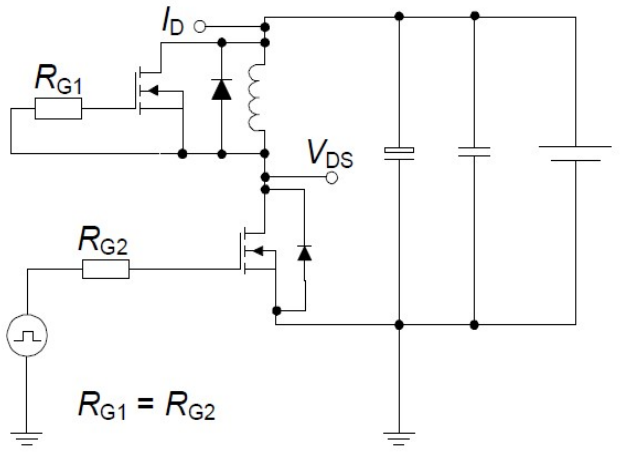
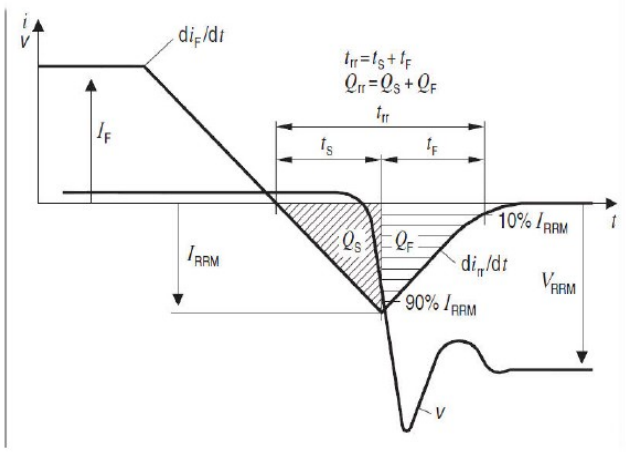
Test circuit for diode characteristics	Diode recovery waveform
	

Table 9 Switching times

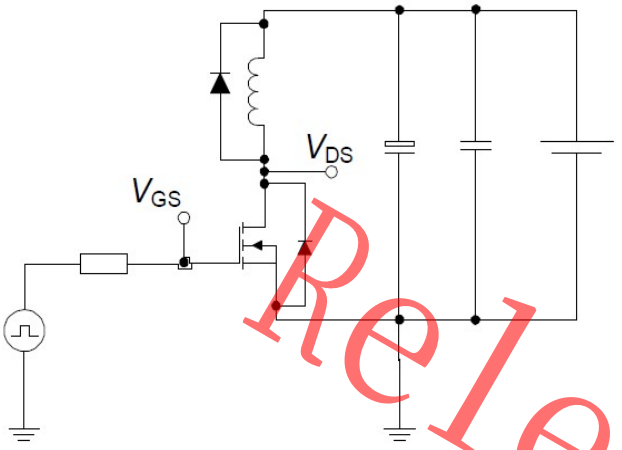
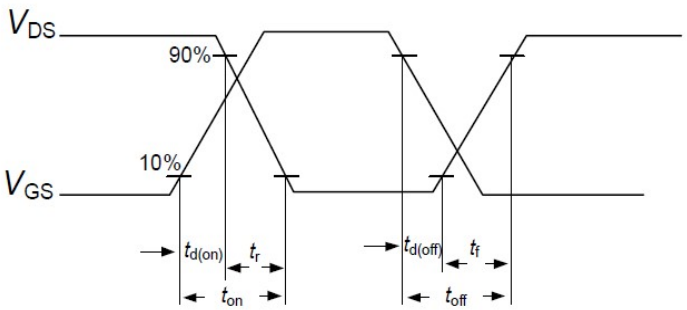
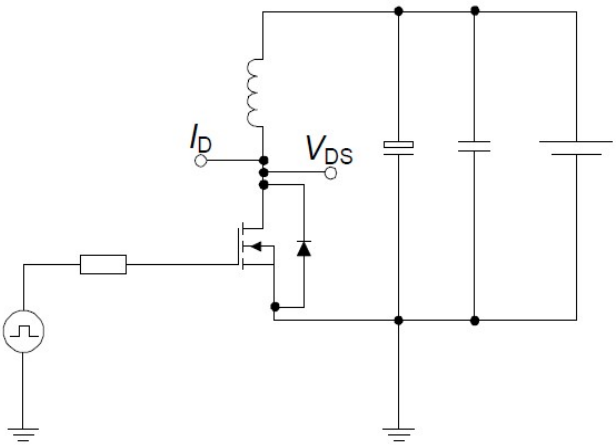
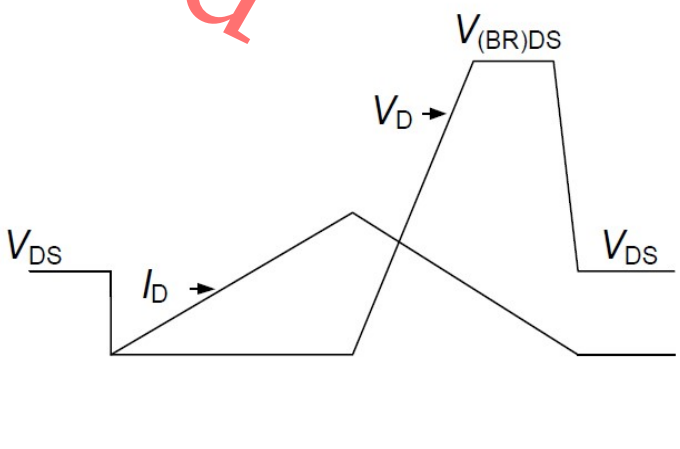
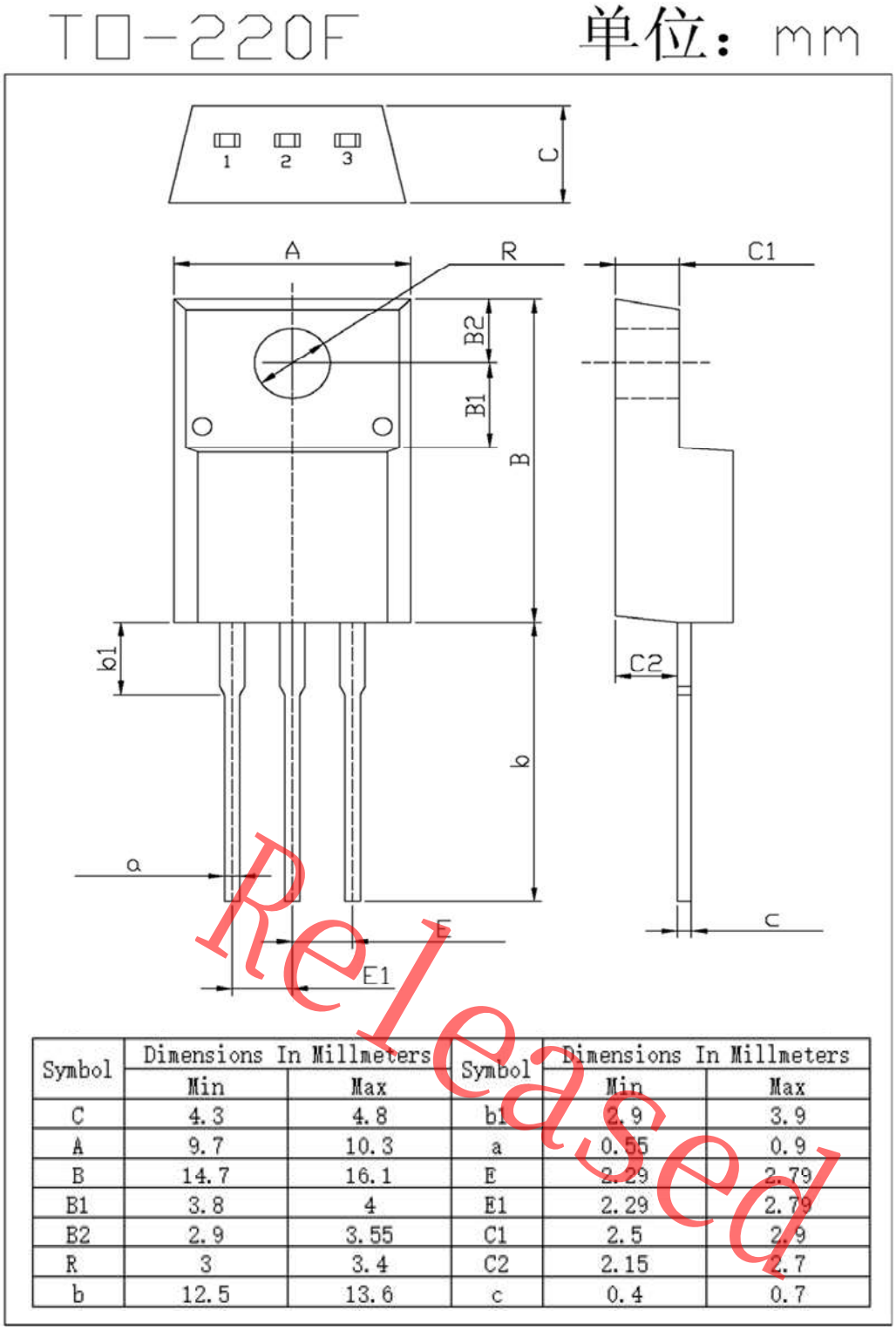
Switching times test circuit for inductive load	Switching times waveform
	

Table10 Unclamped inductive load

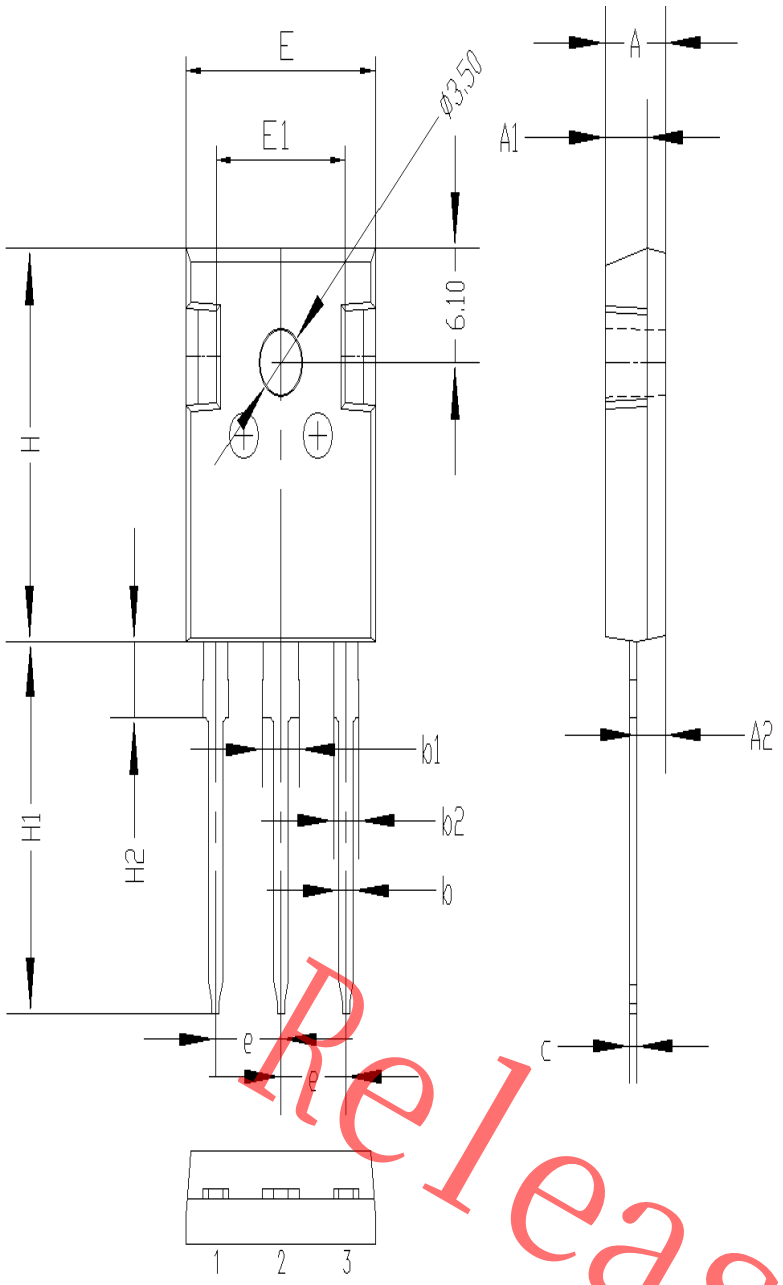
Unclamped inductive load test circuit	Unclamped inductive waveform
	

5 Package Outlines



Symbol	Dimensions In Millmeters		Symbol	Dimensions In Millmeters	
	Min	Max		Min	Max
C	4.3	4.8	b1	2.9	3.9
A	9.7	10.3	a	0.55	0.9
B	14.7	16.1	E	2.29	2.79
B1	3.8	4	E1	2.29	2.79
B2	2.9	3.55	C1	2.5	2.9
R	3	3.4	C2	2.15	2.7
b	12.5	13.6	c	0.4	0.7

Figure1：Outline PG-TO220F



	单位: mm		
	MIN	NOM	MAX
A	4.8	5	5.2
A1	3.3	3.5	3.7
A2	2.1	2.3	2.5
b	1	1.2	1.4
b1	2.9	3.1	3.3
b2	1.9	2.1	2.3
c	0.4	0.6	0.8
e	5.25	5.45	5.65
E	15.6	15.8	16
E1	10.6	10.8	11
H	20.8	21	21.2
H1	19.4	19.9	20.4
H2	3.9	4.1	4.3
G	5.9	6.1	6.3
ØP	3.3	3.5	3.7

Figure2：Outline PG-TO247

Revision History

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
1.1	2020-03-18	Change part name for revision history
1.2	2020-03-23	Add part name”ASA60R090EFD”

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