General Description

SFGMOS® MOSFET is based on Oriental Semiconductor's unique device design to achieve low $R_{DS(ON)}$, low gate charge, fast switching and excellent avalanche characteristics. The low V_{th} series is specially optimized for synchronous rectification systems with low driving voltage.

Features

- Low $R_{DS(ON)}$ & FOM
- Extremely low switching loss
- Excellent reliability and uniformity
- Fast switching and soft recovery

RoHS compliant

Applications

- PD charger
- Motor driver
- Switching voltage regulator
- DC-DC convertor
- Switching mode power supply

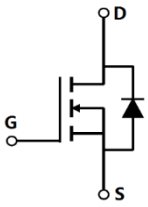
Key Performance Parameters

Parameter	Value	Unit
V_{DS}	120	V
$I_{D,\ pulse}$	180	A
$R_{DS(ON),\ max}$ @ V_{GS}=10V	13	mΩ
Q_g	37.4	nC

Marking Information

Product Name	Package	Marking
SFG60N12FF	TO220F	SFG60N12F

Package & Pin information



Absolute Maximum Ratings at T_j=25°C unless otherwise noted

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	120	V
Gate-source voltage	V_{GS}	±20	V
Continuous drain current[1], T_C=25 °C	I_D	60	A
Pulsed drain current[2], T_C=25 °C	$I_{D,\ pulse}$	180	A
Continuous diode forward current[1], T_C=25 °C	I_S	60	A
Diode pulsed current[2], T_C=25 °C	$I_{S,\ pulse}$	180	A
Power dissipation[3], T_C=25 °C	P_D	33	W
Single pulsed avalanche energy[5]	E_{AS}	109	mJ
Operation and storage temperature	T_{stg}, T_j	-55 to 150	°C

Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal resistance, junction-case	$R_{\theta JC}$	3.78	°C/W
Thermal resistance, junction-ambient[4]	$R_{\theta JA}$	62.5	°C/W

Electrical Characteristics at T_j=25°C unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Drain-source breakdown voltage	BV_{DSS}	120			V	V_{GS}=0 V, I_D=250 μA
Gate threshold voltage	$V_{GS(th)}$	1.5		2.5	V	V_{DS}=V_{GS}, I_D=250 μA
Drain-source on-state resistance	$R_{DS(ON)}$		8.8	13.0	mΩ	V_{GS}=10 V, I_D=30 A
Drain-source on-state resistance	$R_{DS(ON)}$		10.4	18.0	mΩ	V_{GS}=4.5 V, I_D=30 A
Gate-source leakage current	I_{GSS}			100	nA	V_{GS}=20 V
Drain-source leakage current	I_{DSS}			1	μA	V_{DS}=120 V, V_{GS}=0 V
Gate resistance	R_G		6		Ω	f=1 MHz, Open drain

Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Input capacitance	C_{iss}		2194		pF	V_{GS}=0 V, V_{DS}=25 V, f=100 kHz
Output capacitance	C_{oss}		1248		pF	
Reverse transfer capacitance	C_{rss}		102		pF	
Turn-on delay time	$t_{d(on)}$		7.8		ns	V_{GS}=10 V, V_{DS}=60 V, R_G=2 Ω, I_D=30 A
Rise time	t_r		38.9		ns	
Turn-off delay time	$t_{d(off)}$		39.2		ns	
Fall time	t_f		15.5		ns	

Gate Charge Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Total gate charge	Q_g		37.4		nC	V_{GS}=10 V, V_{DS}=60 V, I_D=30 A
Gate-source charge	Q_{gs}		6.3		nC	
Gate-drain charge	Q_{gd}		10.2		nC	
Gate plateau voltage	$V_{plateau}$		3.6		V	

Body Diode Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Diode forward voltage	V_{SD}			1.3	V	I_S=20 A, V_{GS}=0 V
Reverse recovery time	t_{rr}		54		ns	V_R=60V, I_S=30 A, di/dt=100 A/μs
Reverse recovery charge	Q_{rr}		79		nC	
Peak reverse recovery current	I_{rrm}		2.5		A	

Note

1) Calculated continuous current based on maximum allowable junction temperature.
2) Repetitive rating; pulse width limited by max. junction temperature.
3) Pd is based on max. junction temperature, using junction-case thermal resistance.
4) The value of $R_{\theta JA}$ is measured with the device mounted on 1 in^2 FR-4 board with 2oz. Copper, in a still air environment with T_a=25 °C.
5) V_{DD}=50 V,V_{GS}=10 V, L=0.3 mH, starting T_j=25 °C.

Electrical Characteristics Diagrams

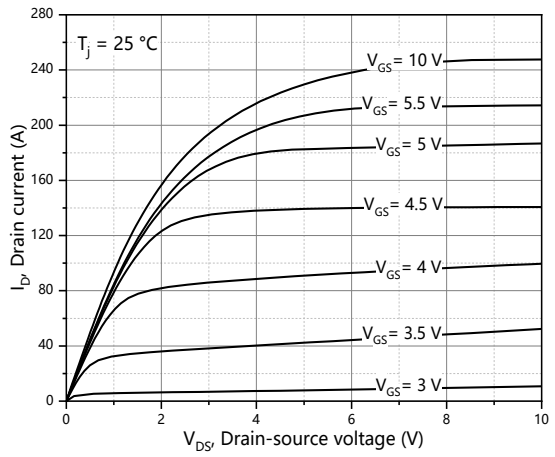


Figure 1. Typ. output characteristics

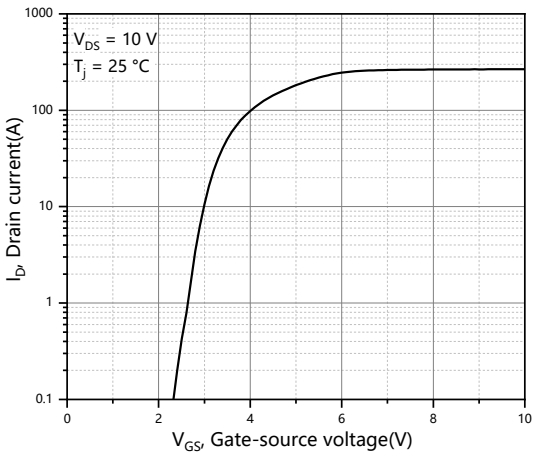


Figure 2. Typ. transfer characteristics

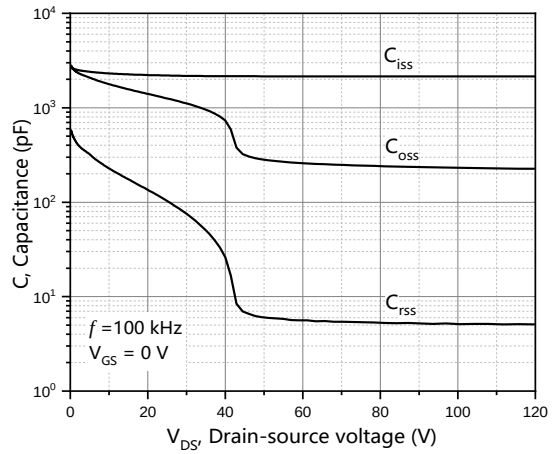


Figure 3. Typ. capacitances

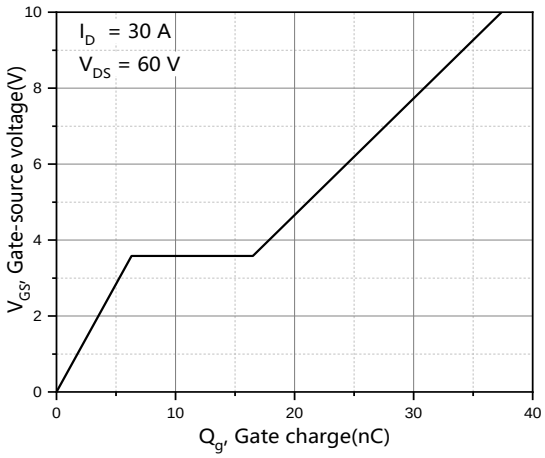


Figure 4. Typ. gate charge

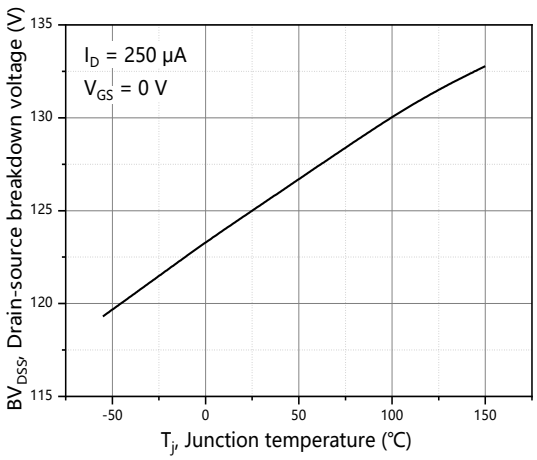


Figure 5. Drain-source breakdown voltage

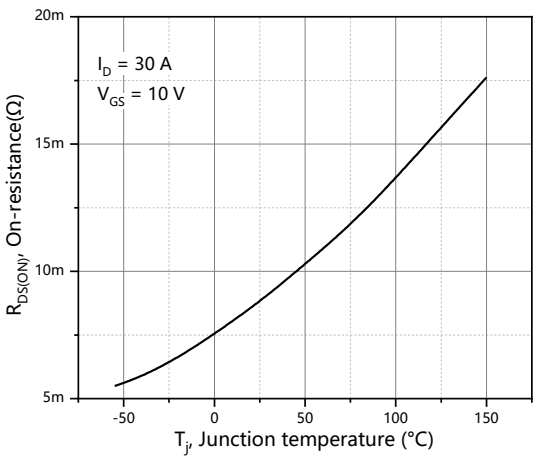


Figure 6. Drain-source on-state resistance

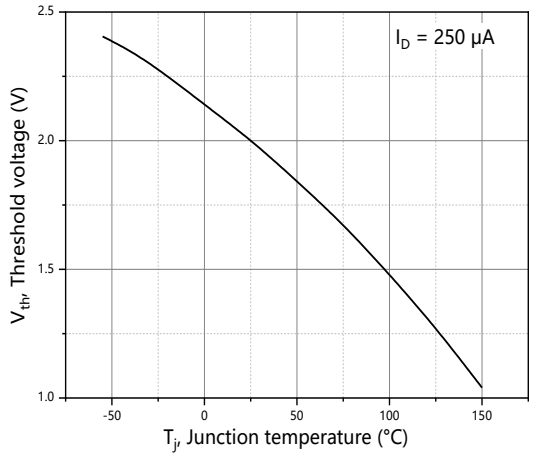


Figure 7. Threshold voltage

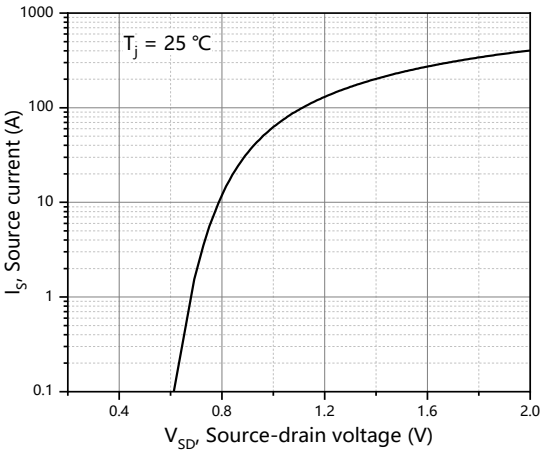


Figure 8. Forward characteristic of body diode

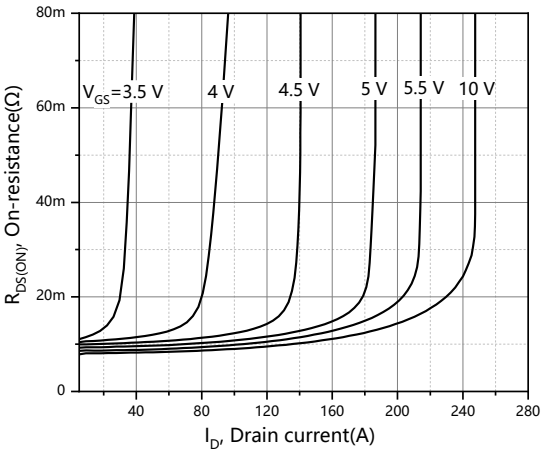


Figure 9. Drain-source on-state resistance

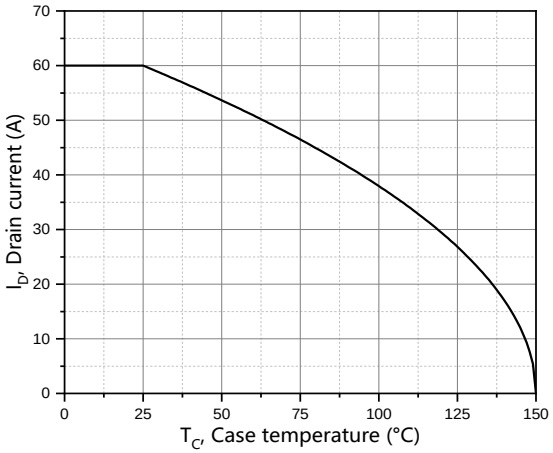


Figure 10. Drain current

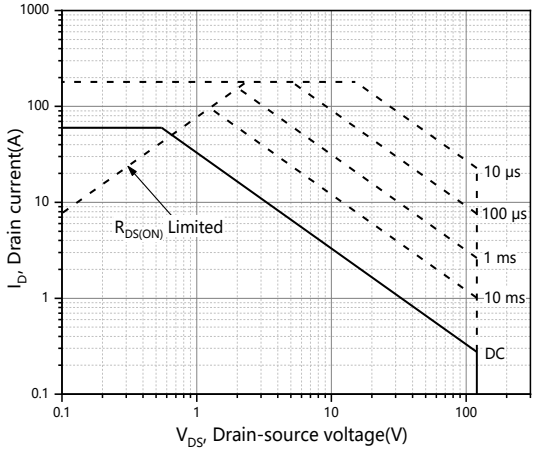


Figure 11. Safe operation area T_C=25 ℃

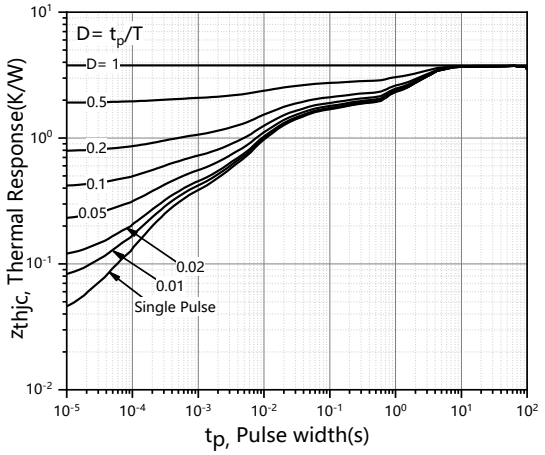


Figure 12. Max. transient thermal impedance

Test circuits and waveforms

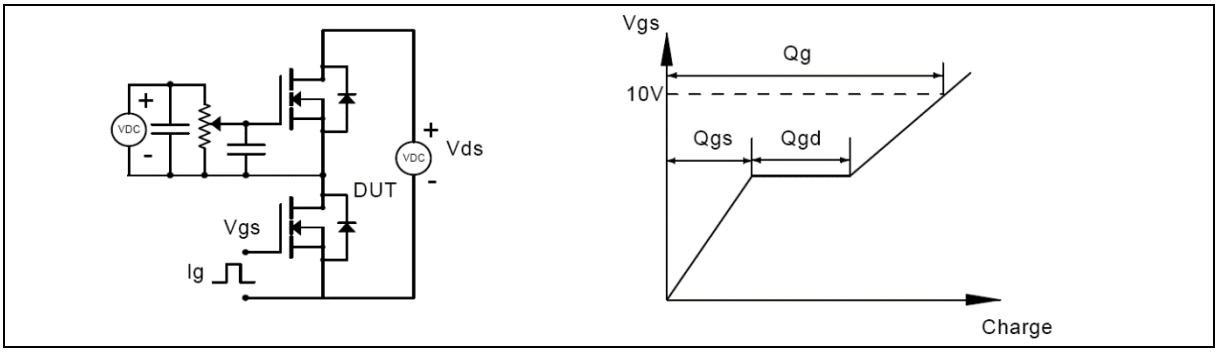


Figure 1. Gate charge test circuit & waveform

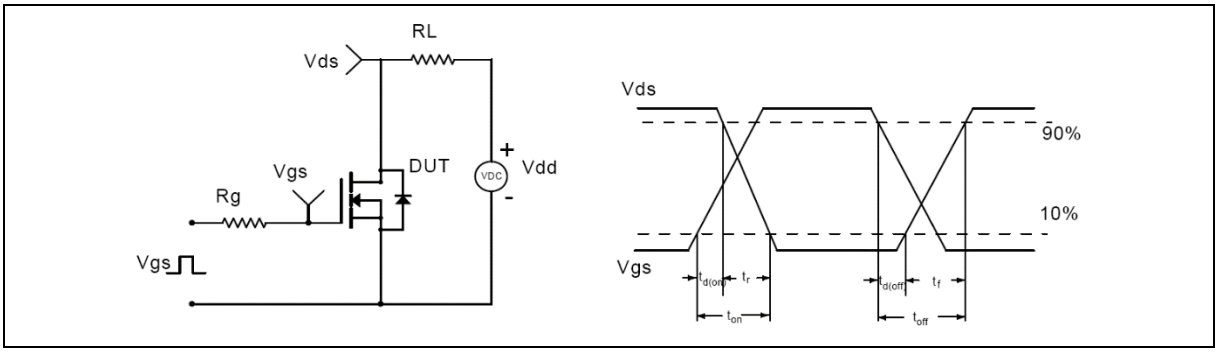


Figure 2. Switching time test circuit & waveforms

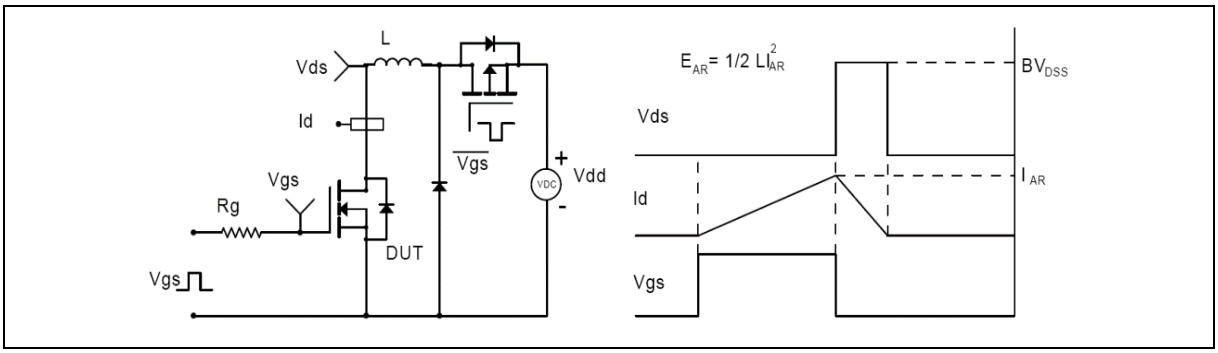


Figure 3. Unclamped inductive switching (UIS) test circuit & waveforms

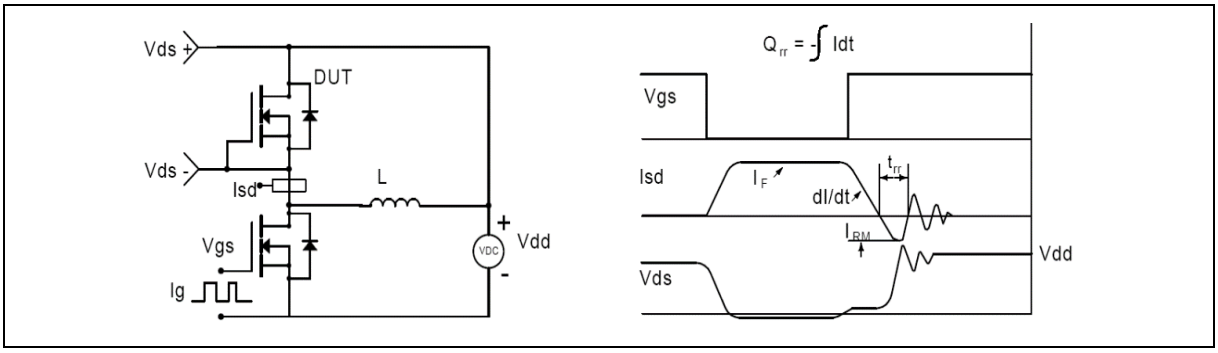
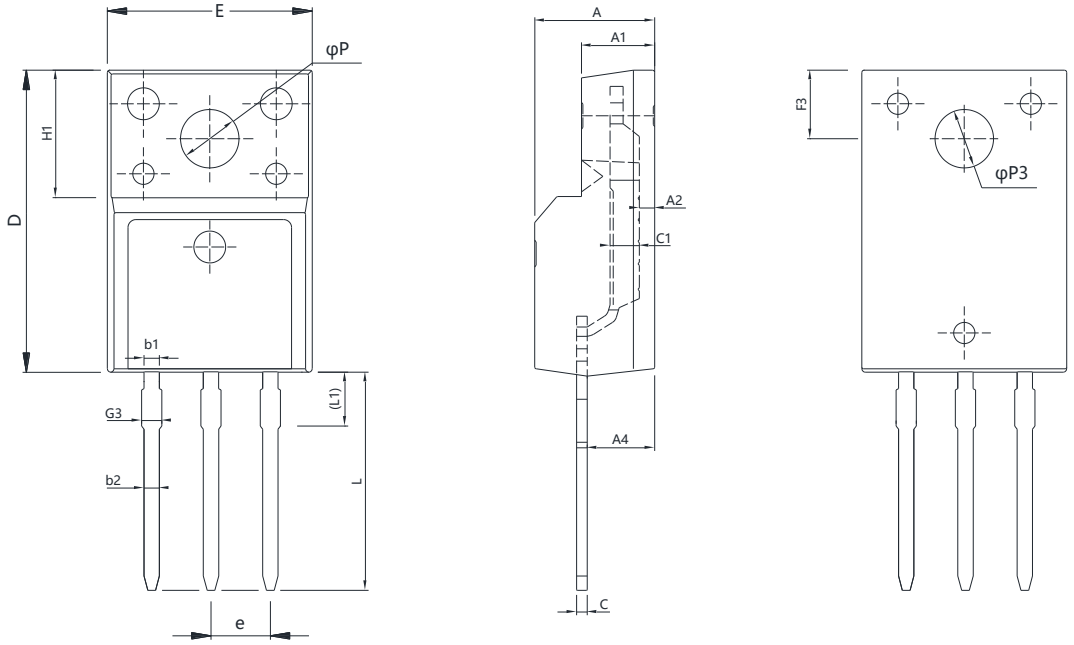


Figure 4. Diode reverse recovery test circuit & waveforms

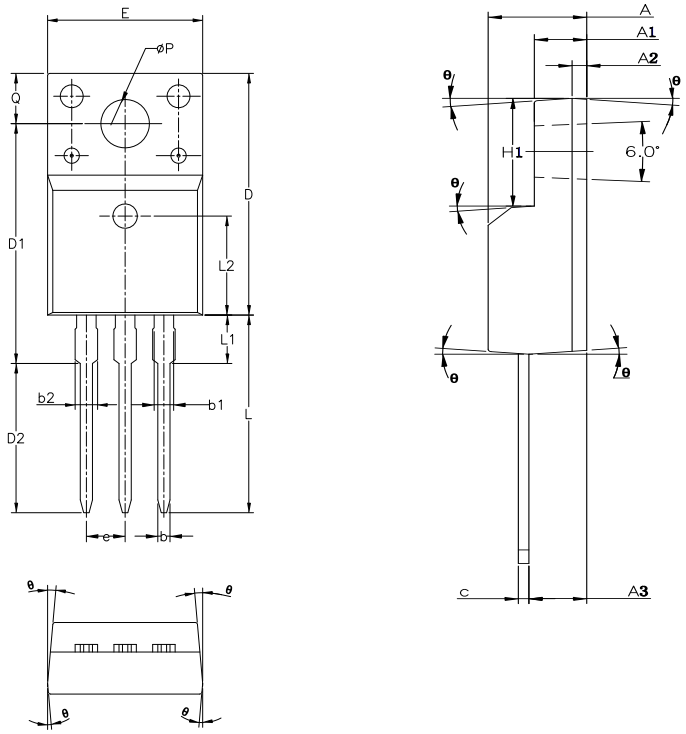
Package Information



Symbol	mm		
	Min	Nom	Max
E	9.96	10.16	10.36
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A4	2.56	2.76	2.96
c	0.40	0.50	0.65
D	15.57	15.87	16.17
H1	6.70 REF		
e	2.54 BSC		
L	12.68	12.98	13.28
L1	2.88	3.03	3.18
ΦP	3.03	3.18	3.38
ΦP3	3.15	3.45	3.65
F3	3.15	3.30	3.45
G3	1.25	1.35	1.55
b1	1.18	1.28	1.43
b2	0.70	0.80	0.95

Version 1: TO220F-P package outline dimension

Package Information



Symbol	mm		
	Min	Nom	Max
A	4.50	4.70	4.83
A1	2.34	2.54	2.74
A2		0.70 REF	
A3	2.56	2.76	2.93
b	0.70	-	0.90
b1	1.18	-	1.38
b2	-	-	1.47
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.55	15.75	15.95
D2	9.60	9.80	10.00
E	9.96	10.16	10.36
e		2.54 BSC	
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	-	-	3.50
L2		6.50 REF	
ΦP	3.08	3.18	3.28
Q	3.20	-	3.40
θ	1º	3º	5º

Version 2: TO220F-J package outline dimension

Ordering Information

Package Type	Units/ Tube	Tubes/ Inner Box	Units/ Inner Box	Inner Boxes/ Carton Box	Units/ Carton Box
TO220F-P	50	20	1000	6	6000
TO220F-J	50	20	1000	5	5000

Product Information

Product	Package	Pb Free	RoHS	Halogen Free
SFG60N12FF	TO220F	yes	yes	yes

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