

# Enhancement Mode N-Channel Power MOSFET

## Features

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

## Applications

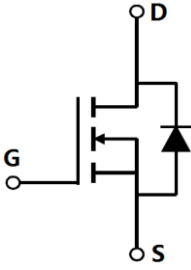
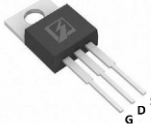
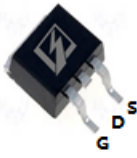

- ◆ Consumer electronic power supply
- ◆ Motor control
- ◆ Synchronous-rectification
- ◆ Isolated DC/DC convertor
- ◆ Invertors

## ■ General Description

SFG130N10xF use advanced SFGMOS™ technology to provide low  $R_{DS(ON)}$ , low gate charge, fast switching and excellent avalanche characteristics. This device is specially designed to get better ruggedness and suitable to use in motor control applications.

◆ $V_{DS, min}$	100 V
◆ $I_{D, pulse}$	390 A
◆ $R_{DS(ON), max @ V_{GS}=10 V}$	4.6 mΩ
◆ $Q_g$	101.6 nC

## ■ Schematic and Package Information

SCHEMATIC DIAGRAM	PIN ASSIGNMENT TOP VIEW		
	 <p><b>TO220</b> <b>SFG130N10PF</b></p>	 <p><b>TO263</b> <b>SFG130N10KF</b></p>	 <p><b>TO220F</b> <b>SFG130N10FF</b></p>

## ■ Absolute Maximum Ratings at $T_j=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Value	Unit
Drain source voltage	$V_{DS}$	100	V
Gate source voltage	$V_{GS}$	$\pm 20$	V
Continuous drain current <sup>1)</sup> , $T_C=25^\circ\text{C}$	$I_D$	130	A
Pulsed drain current <sup>2)</sup> , $T_C=25^\circ\text{C}$	$I_{D, pulse}$	390	A
Power dissipation <sup>3)</sup> for TO220, TO252 $T_C=25^\circ\text{C}$	$P_D$	192	W
Power dissipation <sup>3)</sup> for TO220F, $T_C=25^\circ\text{C}$		34	
Single pulsed avalanche energy <sup>5)</sup>	$E_{AS}$	400	mJ
Operation and storage temperature	$T_{stg}, T_j$	-55 to 150	$^\circ\text{C}$

## ■ Thermal Characteristics

Parameter	Symbol	Value		Unit
		TO252/TO220	TO220F	
Thermal resistance, junction-case	$R_{\theta JC}$	0.65	3.68	°C/W
Thermal resistance, junction-ambient <sup>4)</sup>	$R_{\theta JA}$	62	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	$BV_{DSS}$	100			V	$V_{GS}=0$ V, $I_D=250$ $\mu$ A
Gate threshold voltage	$V_{GS(th)}$	2.0		4.0	V	$V_{DS}=V_{GS}$ , $I_D=250$ $\mu$ A
Drain-source on-state resistance	$R_{DS(on)}$		4.0	4.6	m $\Omega$	$V_{GS}=10$ V, $I_D=60$ A
Gate-source leakage current	$I_{GSS}$			100	nA	$V_{GS}=20$ V
				-100		$V_{GS}=-20$ V
Drain-source leakage current	$I_{DSS}$			1	$\mu$ A	$V_{DS}=100$ V, $V_{GS}=0$ V

## ■ Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Input capacitance	$C_{iss}$		6124.6		pF	$V_{GS}=0$ V, $V_{DS}=50$ V, $f=1$ MHz
Output capacitance	$C_{oss}$		792.3		pF	
Reverse transfer capacitance	$C_{rss}$		15.1		pF	
Turn-on delay time	$t_{d(on)}$		28.2		ns	$V_{GS}=10$ V, $V_{DS}=50$ V, $R_G=2.2$ $\Omega$ , $I_D=22$ A
Rise time	$t_r$		7.5		ns	
Turn-off delay time	$t_{d(off)}$		81.9		ns	
Fall time	$t_f$		20.1		ns	

## ■ Gate Charge Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Total gate charge	$Q_g$		101.6		nC	$I_D=22\text{ A}$ , $V_{DS}=50\text{ V}$ , $V_{GS}=10\text{ V}$
Gate-source charge	$Q_{gs}$		20.6		nC	
Gate-drain charge	$Q_{gd}$		28.7		nC	
Gate plateau voltage	$V_{\text{plateau}}$		4.2		V	

## ■ Body Diode Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Diode forward current	$I_S$			130	A	$V_{GS}<V_{th}$
Pulsed source current	$I_{SP}$			390		
Diode forward voltage	$V_{SD}$			1.3	V	$I_S=20\text{ A}$ , $V_{GS}=0\text{ V}$
Reverse recovery time	$t_{rr}$		82.1		ns	$I_S=10\text{ A}$ , $di/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	$Q_{rr}$		248.4		nC	
Peak reverse recovery current	$I_{rrm}$		4.9		A	

## ■ Note

- 1) Calculated continuous current based on maximum allowable junction temperature.
- 2) Repetitive rating; pulse width limited by max. junction temperature.
- 3)  $P_d$  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  $T_a=25\text{ }^\circ\text{C}$ .
- 5)  $V_{DD}=50\text{ V}$ ,  $R_G=25\text{ }\Omega$ ,  $L=0.5\text{ mH}$ , starting  $T_j=25\text{ }^\circ\text{C}$ .

■ **Electrical Characteristics Diagrams**

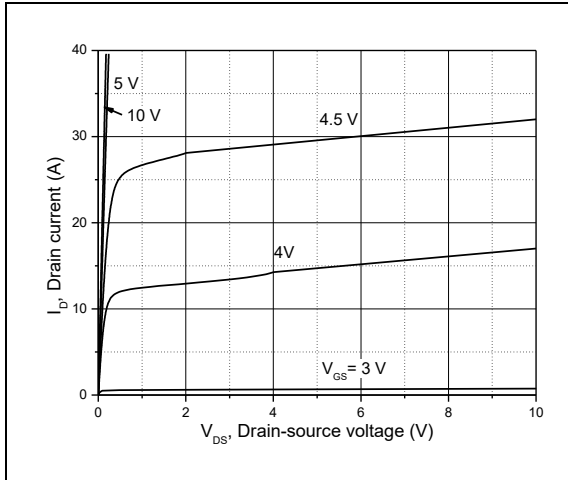


Figure 1, Typ. output characteristics

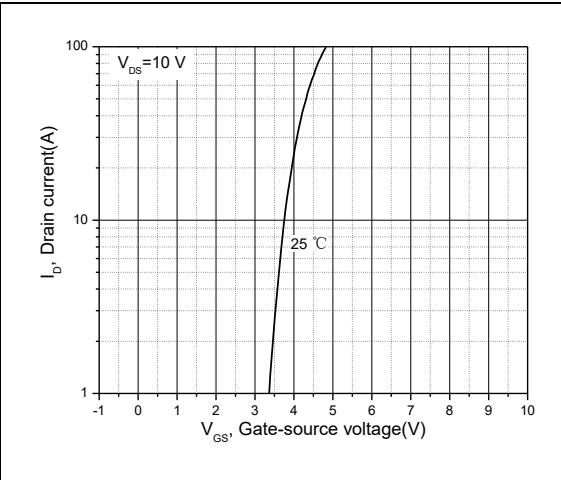


Figure 2, Typ. transfer characteristics

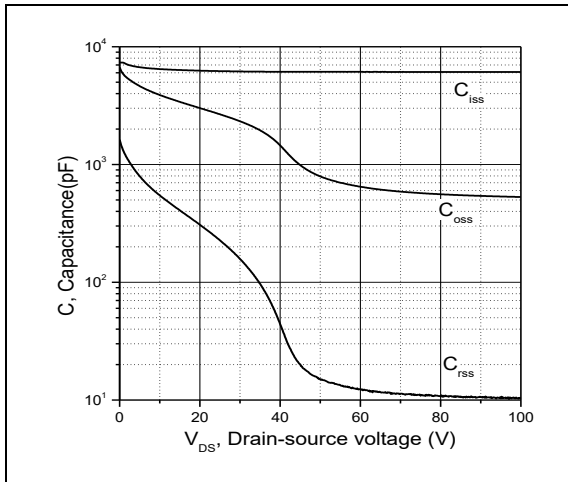


Figure 3, Typ. capacitances

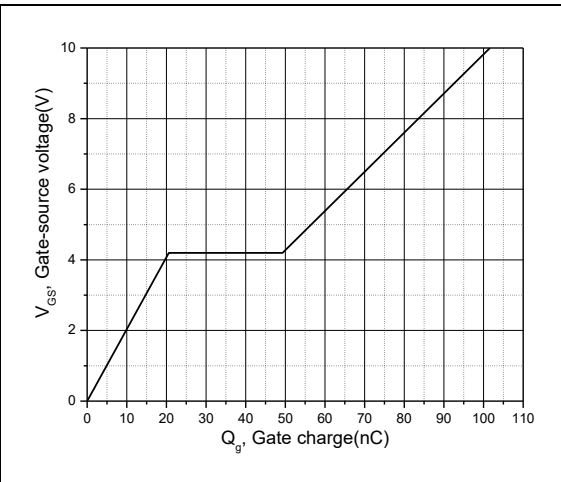


Figure 4, Typ. gate charge

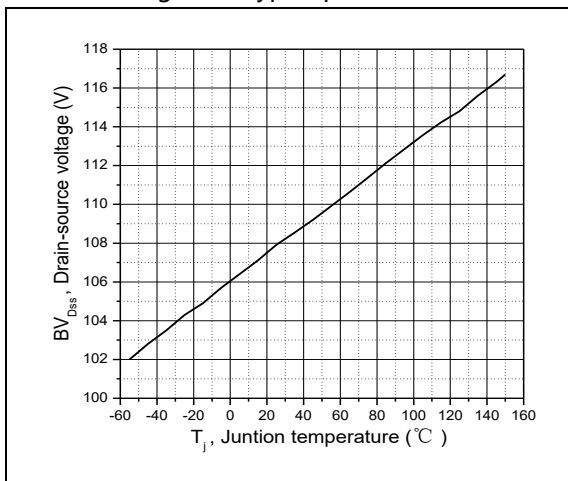


Figure 5, Drain-source breakdown voltage

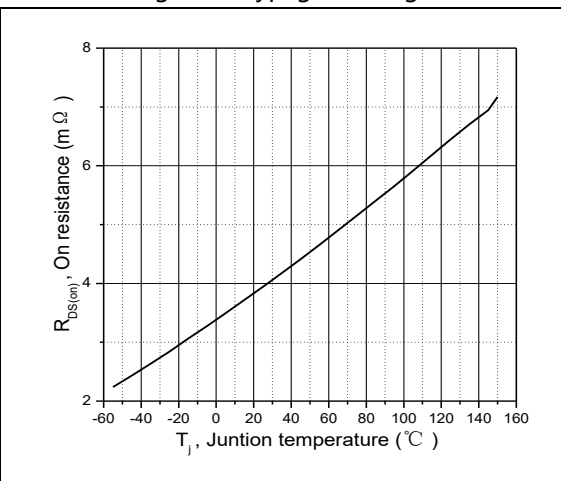


Figure 6, Drain-source on-state resistance

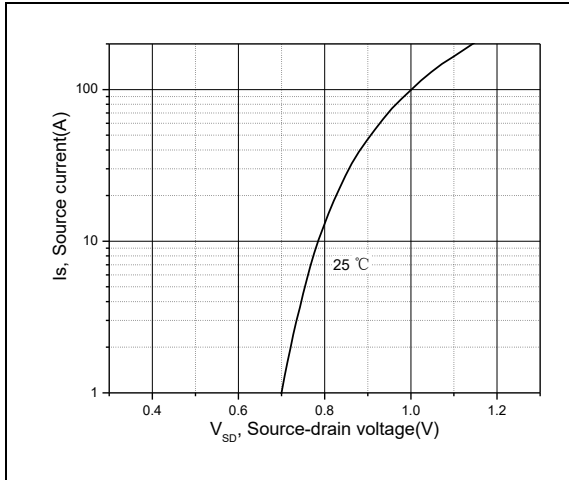


Figure 7, Forward characteristic of body diode

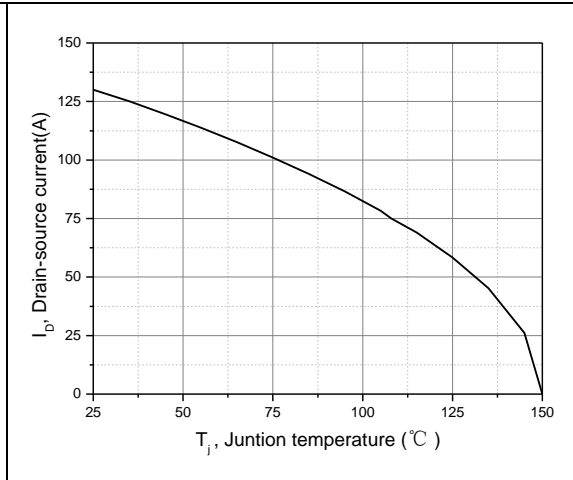


Figure 8, Drain current

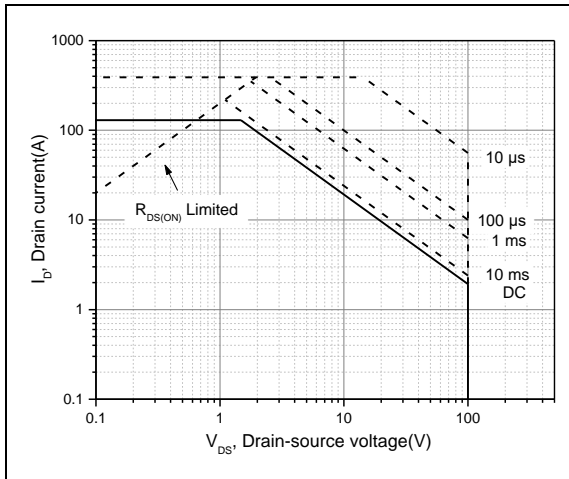


Figure 9, Safe operation area for TO220/TO263  
 $T_C=25\text{ }^\circ\text{C}$

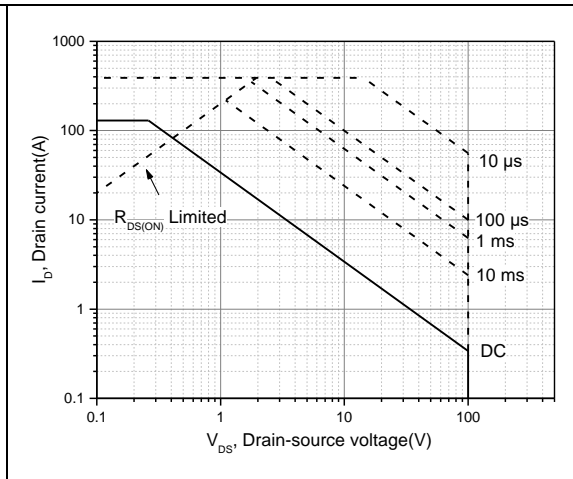
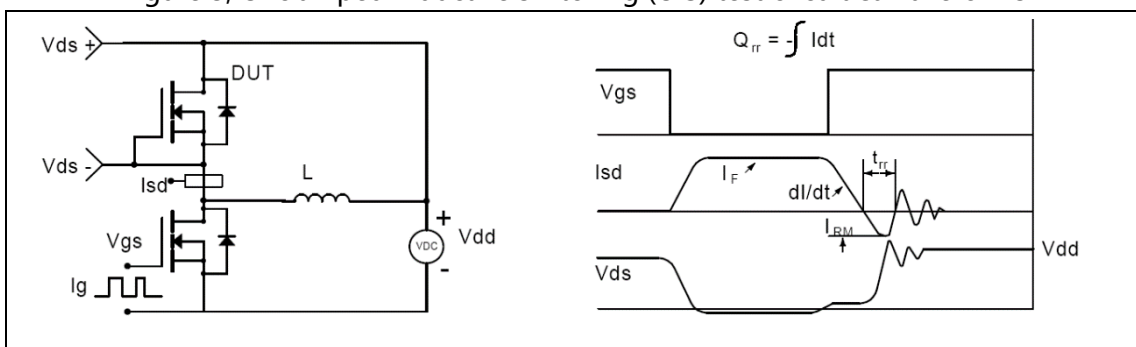
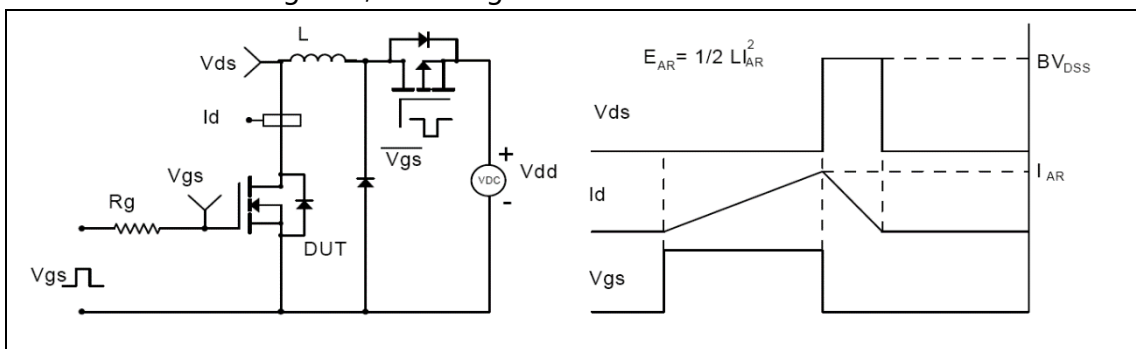
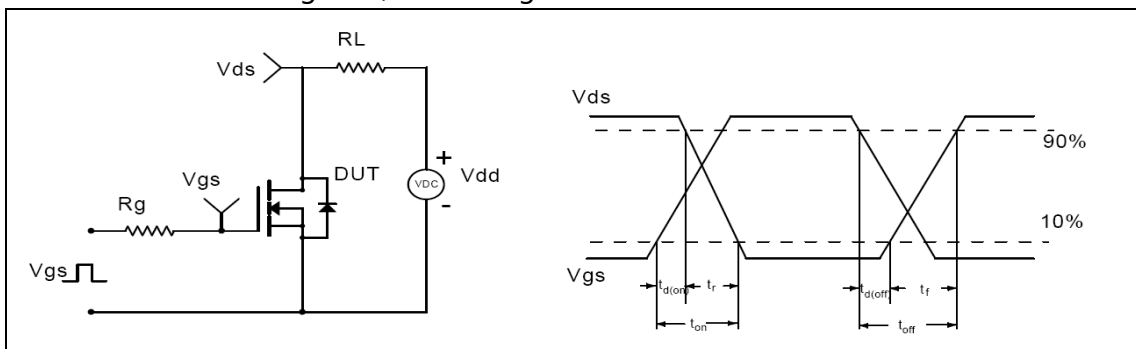
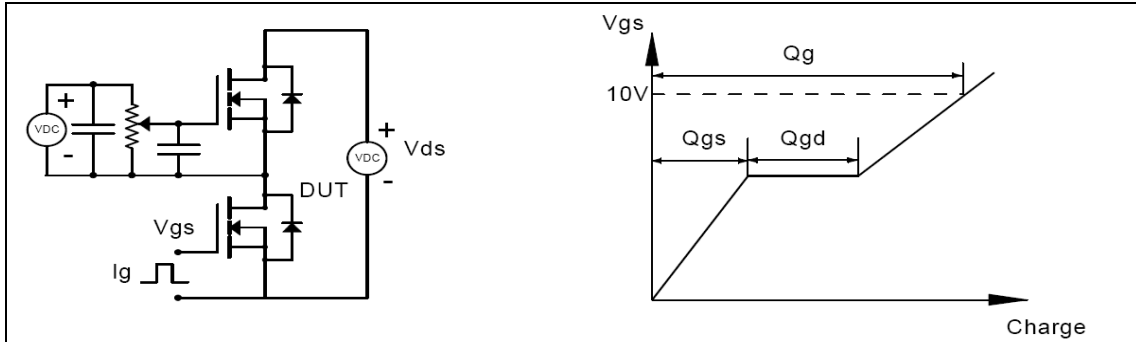


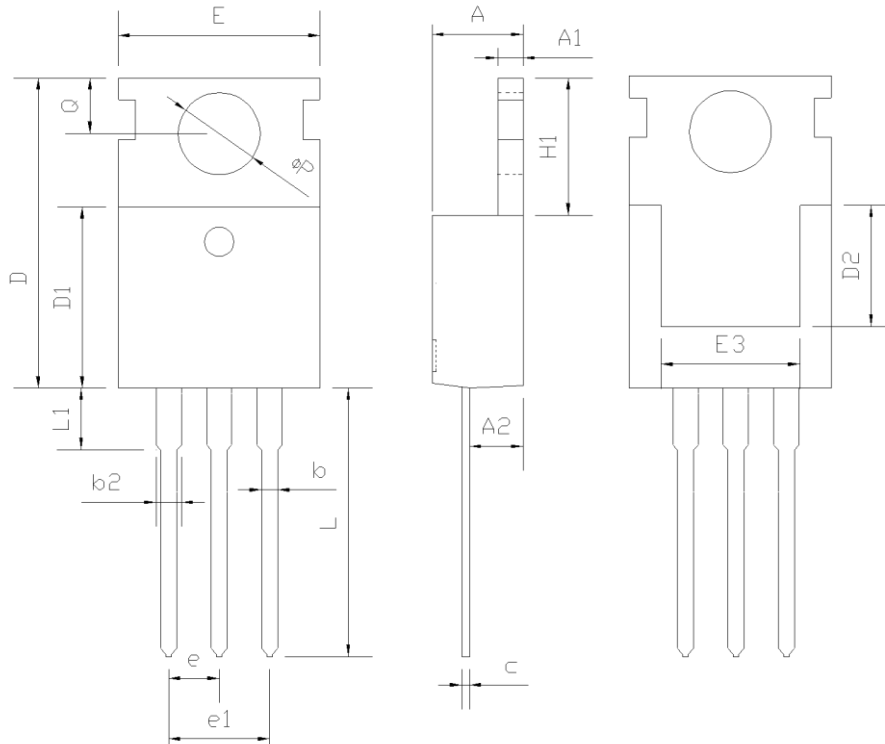
Figure 10, Safe operation area for TO220F  
 $T_C=25\text{ }^\circ\text{C}$

■ Test circuits and waveforms



**■ Package Information**

Figure1, TO220 package outline dimension

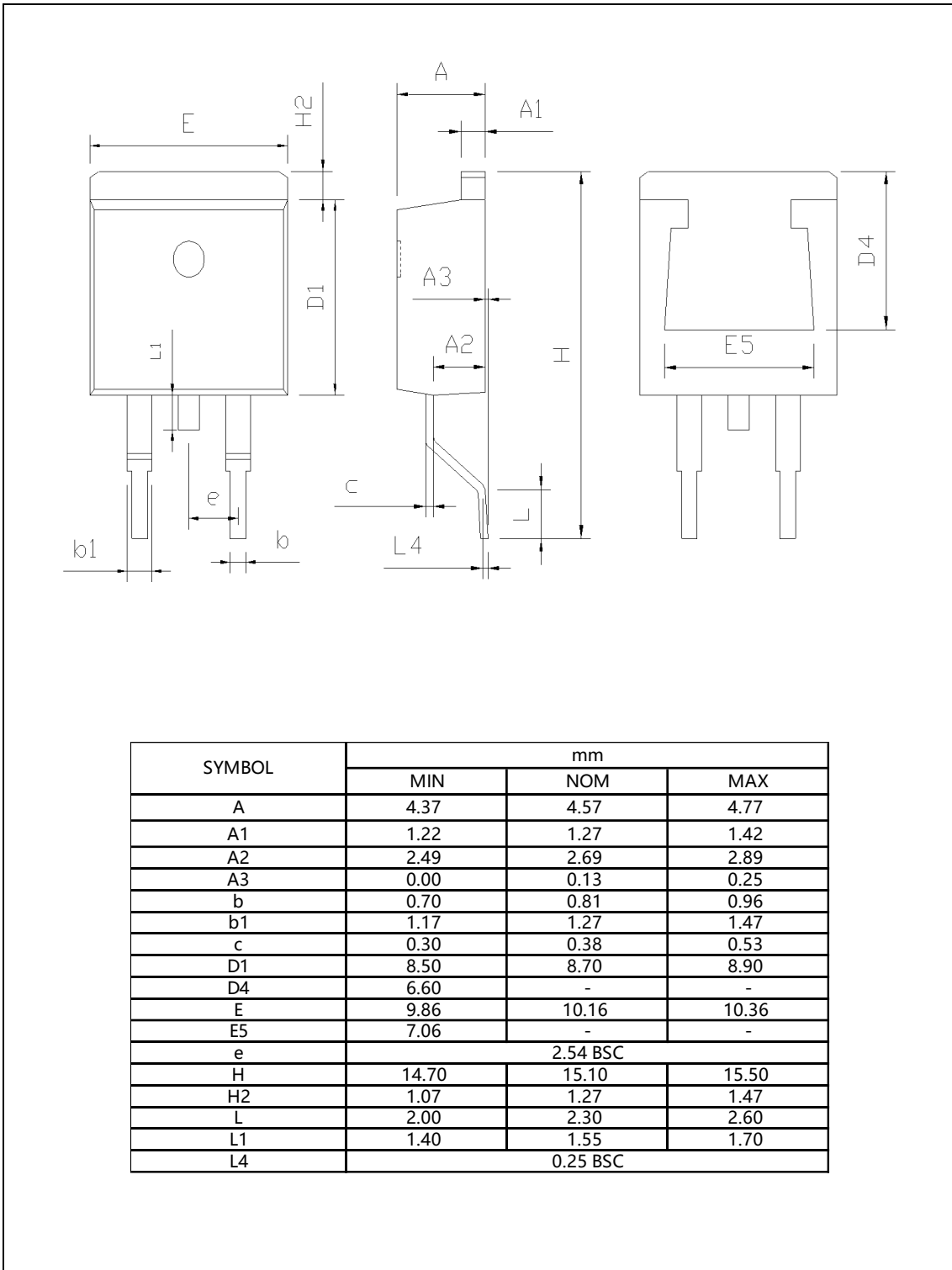


SYMBOL	mm		
	MIN	NOM	MAX
A	4.37	4.57	4.70
A1	1.25	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b2	1.17	1.27	1.47
c	0.45	0.50	0.60
D	15.10	15.60	16.10
D1	8.80	9.10	9.40
D2	5.50	-	-
E	9.70	10.00	10.30
E3	7.00	-	-
e	2.54 BSC		
e1	5.08 BSC		
H1	6.25	6.50	6.85
L	12.75	13.50	13.80
L1	-	3.10	3.40
ΦP	3.40	3.60	3.80
Q	2.60	2.80	3.00



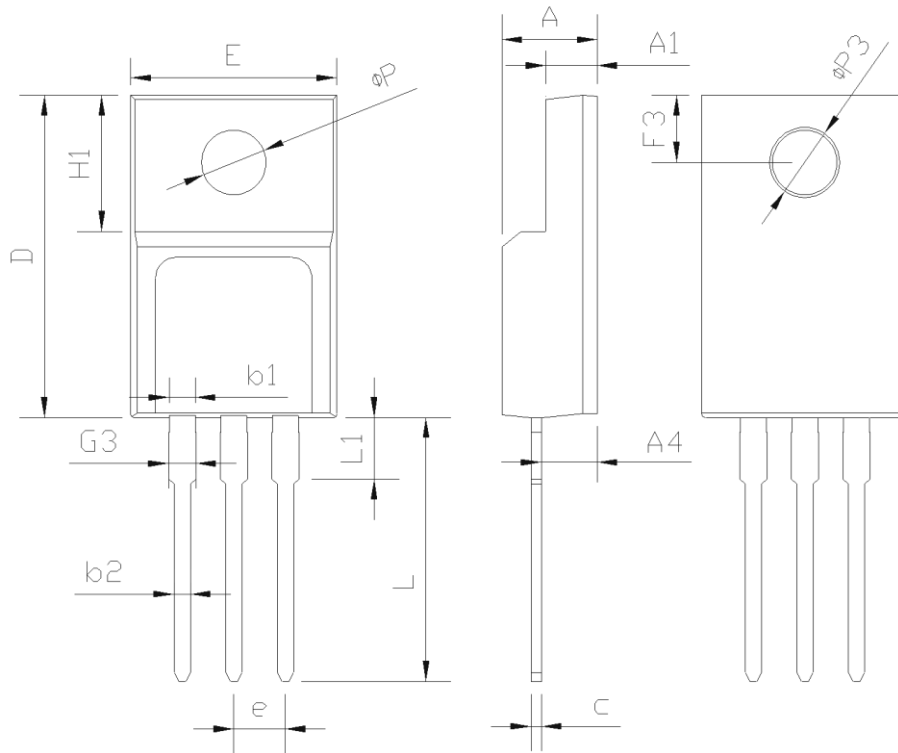
**■ Package Information**

Figure2, TO263 package outline dimension



**■ Package Information**

Figure3, TO220F package outline dimension



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	6.70REF		
e	2.54BSC		
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

## ■ Ordering Information

Package	Units/Tube	Tubes/Inner Box	Units/Inner Box	Inner Box/Carton Box	Units/Carton Box
TO220	50	20	1000	6	6000
TO263	50	20	1000	6	6000
TO220F	50	20	1000	6	6000

## ■ Product Information

Product	Package	Pb Free	RoHS	Halogen Free
SFG130N10PF	TO220	yes	yes	yes
SFG130N10KF	TO263	yes	yes	yes
SFG130N10FF	TO220F	yes	yes	yes