

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

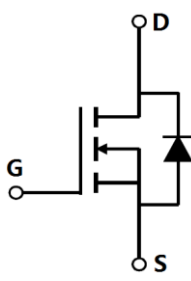

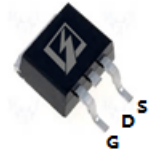
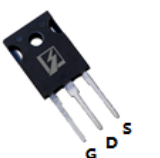
- ◆ Consumer electronic power supply
- ◆ Motor control
- ◆ Synchronous-rectification
- ◆ Isolated DC/DC convertor
- ◆ Invertors

■ General Description

SFG180N10xF use advanced SFGMOST™ 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
◆ $I_{D, pulse}$	540 A
◆ $R_{DS(ON), max @ V_{GS}=10 V}$	3 mΩ
◆ Q_g	158.8 nC

■ Schematic and Package Information

SCHEMATIC DIAGRAM	PIN ASSIGNMENT TOP VIEW		
	 <p>TO220 SFG180N10PF</p>	 <p>TO263 SFG180N10KF</p>	 <p>TO247 SFG180N10HF</p>

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

Parameter	Symbol	Value	Unit
Drain source voltage	V_{DS}	100	V
Gate source voltage	V_{GS}	±20	V
Continuous drain current ¹⁾	I_D	180	A
Pulsed drain current ²⁾	$I_{D, pulse}$	540	A
Power dissipation ³⁾	P_D	375	W
Single pulsed avalanche energy ⁵⁾	E_{AS}	1000	mJ
Operation and storage temperature	T_{stg}, T_j	-55 to 150	°C

■ Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal resistance, junction-case	$R_{\theta JC}$	0.33	$^{\circ}\text{C}/\text{W}$
Thermal resistance, junction-ambient ⁴⁾	$R_{\theta JA}$	62.5	$^{\circ}\text{C}/\text{W}$

■ Electrical Characteristics at $T_j=25^{\circ}\text{C}$ unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Drain-source breakdown voltage	BV_{DSS}	100			V	$V_{GS}=0\text{ V}, I_D=250\ \mu\text{A}$
Gate threshold voltage	$V_{GS(th)}$	2.0		4.0	V	$V_{DS}=V_{GS}, I_D=250\ \mu\text{A}$
Drain-source on-state resistance	$R_{DS(on)}$		2.5	3.0	m Ω	$V_{GS}=10\text{ V}, I_D=20\text{ A}$
Gate-source leakage current	I_{GSS}			100	nA	$V_{GS}=20\text{ V}$
				-100		$V_{GS}=-20\text{ V}$
Drain-source leakage current	I_{DSS}			1	μA	$V_{DS}=100\text{ V}, V_{GS}=0\text{ V}$

■ Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Input capacitance	C_{iss}		10952.7		pF	$V_{GS}=0\text{ V},$ $V_{DS}=50\text{ V},$ $f=100\text{ kHz}$
Output capacitance	C_{oss}		1402.2		pF	
Reverse transfer capacitance	C_{rss}		33.3		pF	
Turn-on delay time	$t_{d(on)}$		40.7		ns	$V_{GS}=10\text{ V},$ $V_{DS}=50\text{ V},$ $R_G=2.2\ \Omega,$ $I_D=25\text{ A}$
Rise time	t_r		31.4		ns	
Turn-off delay time	$t_{d(off)}$		75.4		ns	
Fall time	t_f		16.2		ns	

■ Gate Charge Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Total gate charge	Q_g		158.8		nC	$I_D=25\text{ A}$, $V_{DS}=50\text{ V}$, $V_{GS}=10\text{ V}$
Gate-source charge	Q_{gs}		38.4		nC	
Gate-drain charge	Q_{gd}		41.6		nC	
Gate plateau voltage	V_{plateau}		4.6		V	

■ Body Diode Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Diode forward current	I_S			180	A	$V_{GS} < V_{th}$
Pulsed source current	I_{SP}			540		
Diode forward voltage	V_{SD}			1.3	V	$I_S=20\text{ A}$, $V_{GS}=0\text{ V}$
Reverse recovery time	t_{rr}		99.2		ns	$I_S=25\text{ A}$, $di/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	Q_{rr}		401.9		nC	
Peak reverse recovery current	I_{rrm}		6.7		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) $V_{DD}=50\text{ V}$, $R_G=25\text{ }\Omega$, $L=0.3\text{ mH}$, starting $T_j=25\text{ }^\circ\text{C}$.

■ **Electrical Characteristics Diagrams**

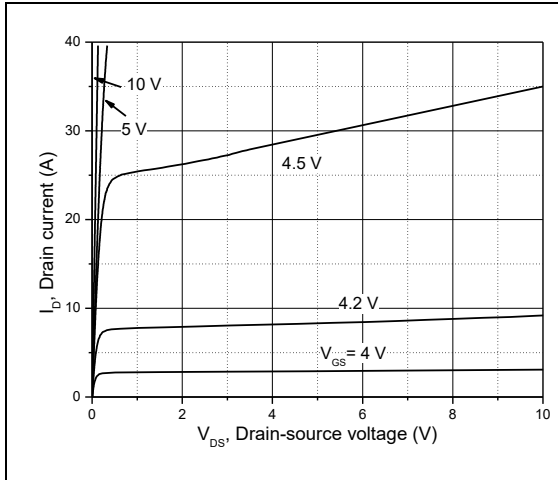


Figure 1, Typ. output characteristics

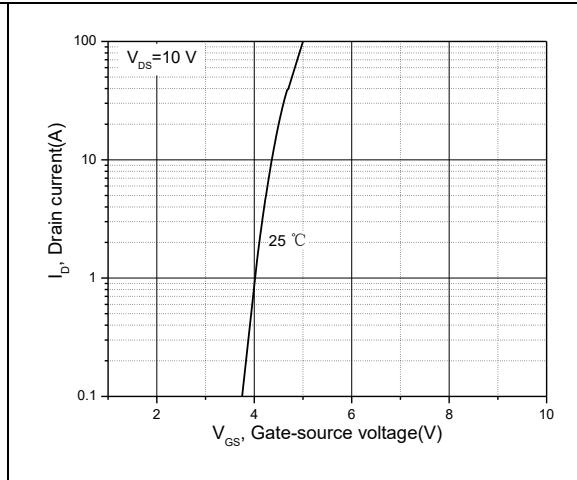


Figure 2, Typ. transfer characteristics

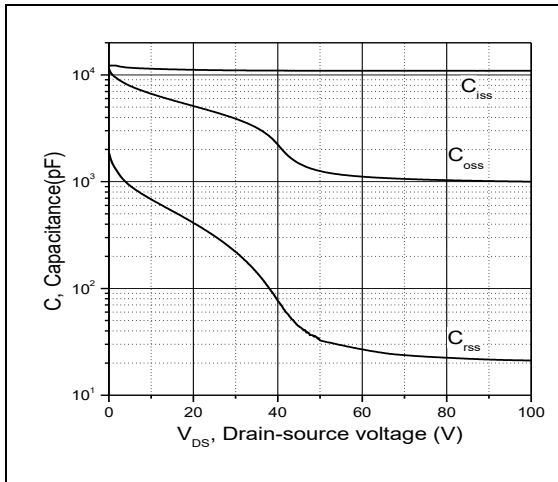


Figure 3, Typ. capacitances

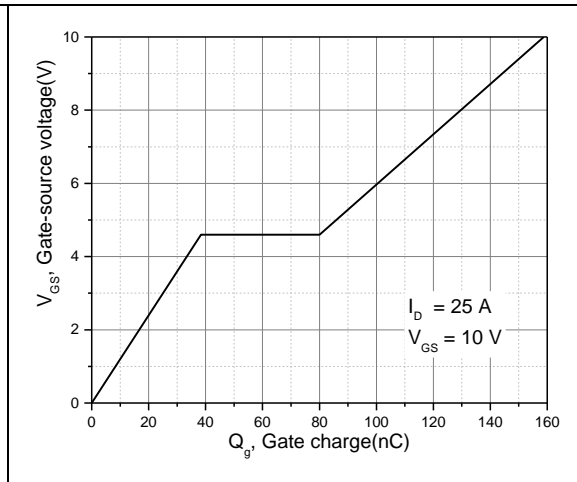


Figure 4, Typ. gate charge

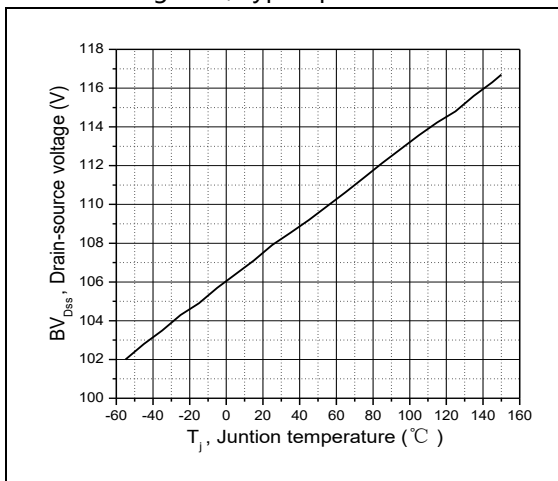


Figure 5, Drain-source breakdown voltage

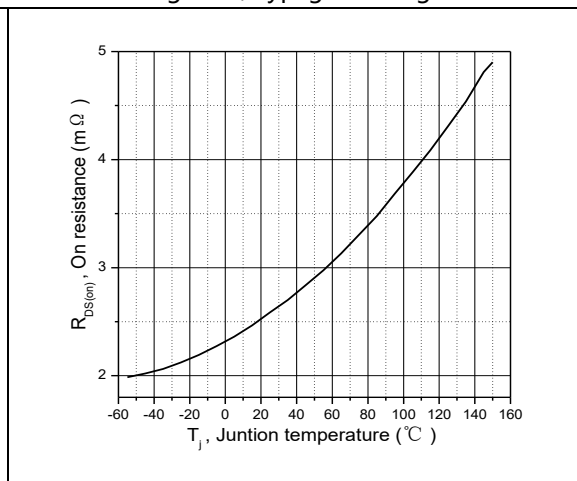


Figure 6, Drain-source on-state resistance

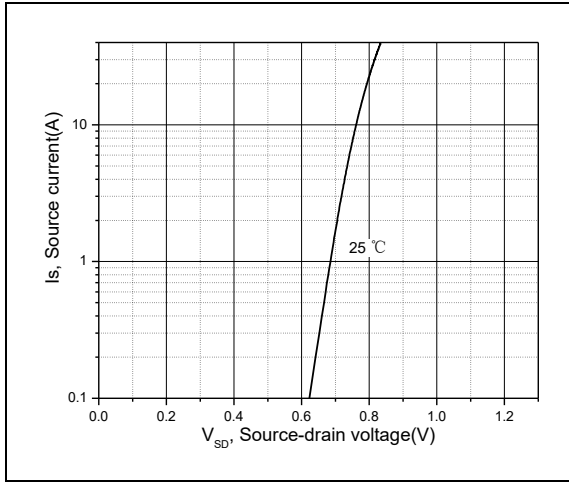


Figure 7, Forward characteristic of body diode

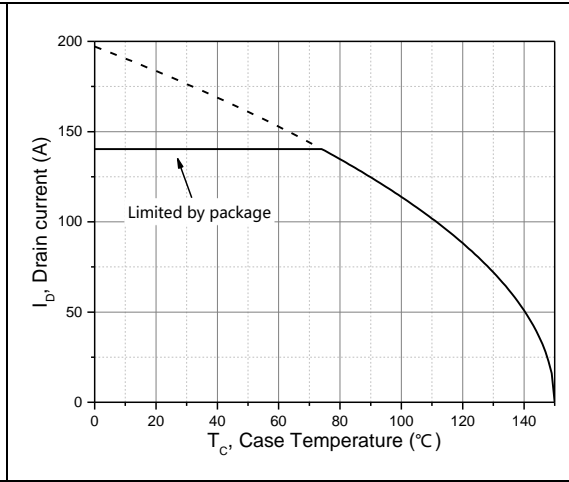


Figure 8, Drain current

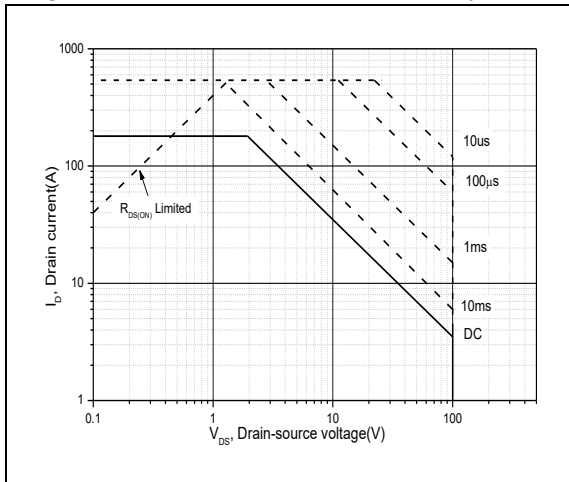


Figure 9, Safe operation area $T_C=25\text{ }^\circ\text{C}$

■ Test circuits and waveforms

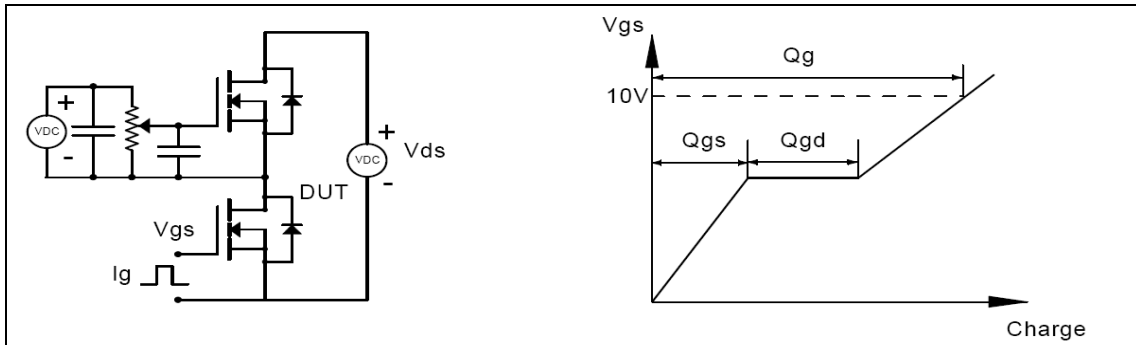


Figure 1, Gate charge test circuit & waveform

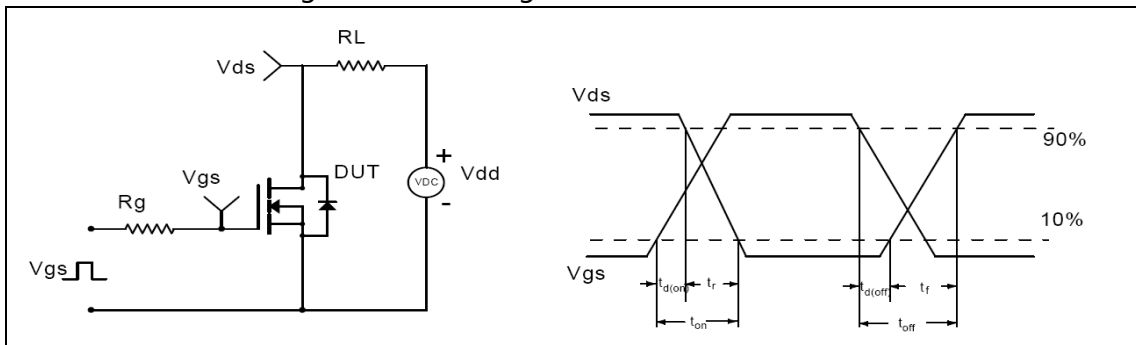


Figure 2, Switching time test circuit & waveforms

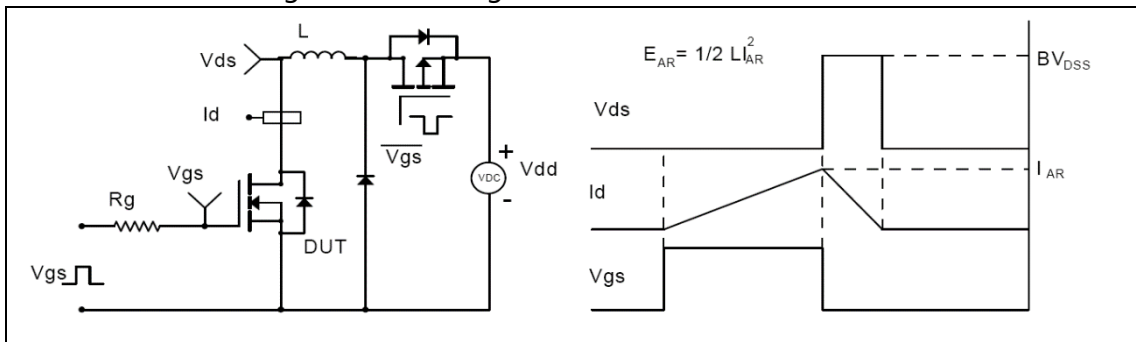


Figure 3, Unclamped inductive switching (UIS) test circuit & waveforms

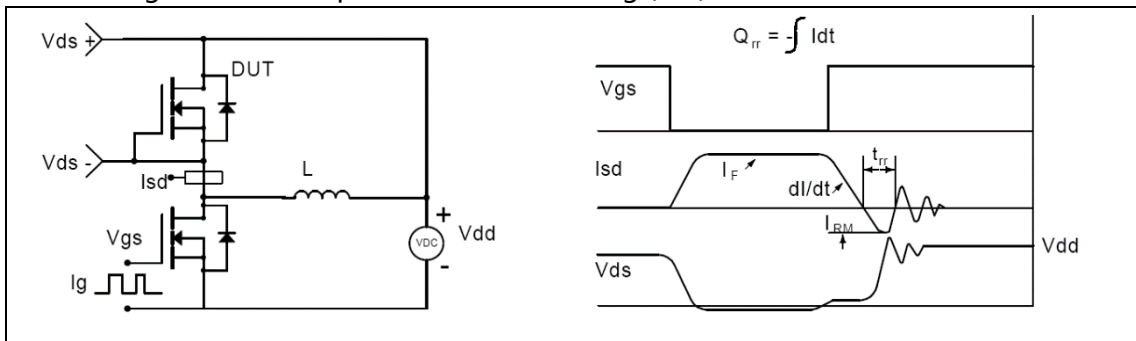
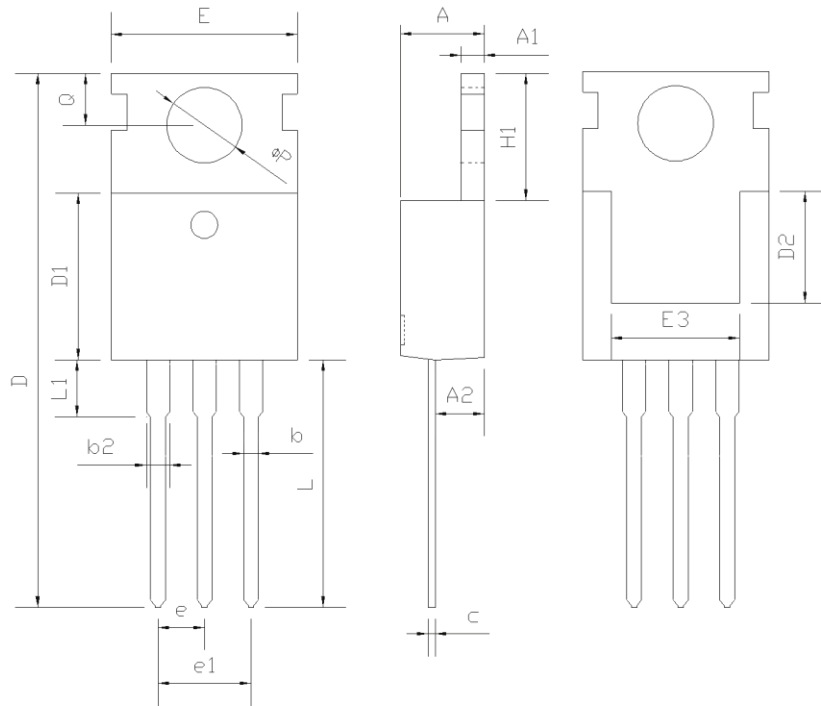


Figure 4, Diode reverse recovery test circuit & waveforms

■ Package Information

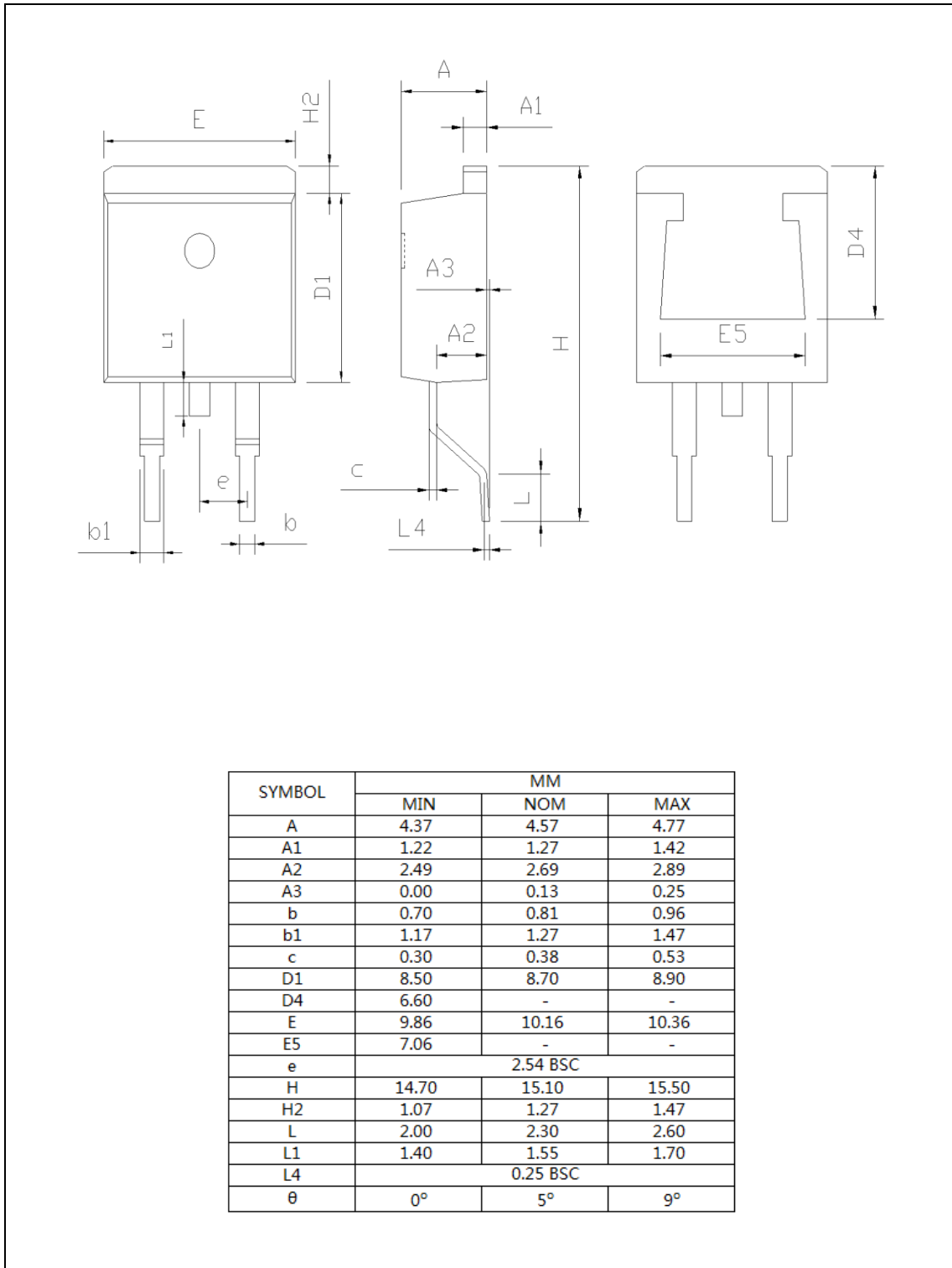
Figure1, TO220 package outline dimension



Symbol	Min	Nom	Max
A	4.37	4.57	4.77
A1	1.25	1.30	1.45
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b2	1.17	1.27	1.47
c	0.40	0.50	0.65
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

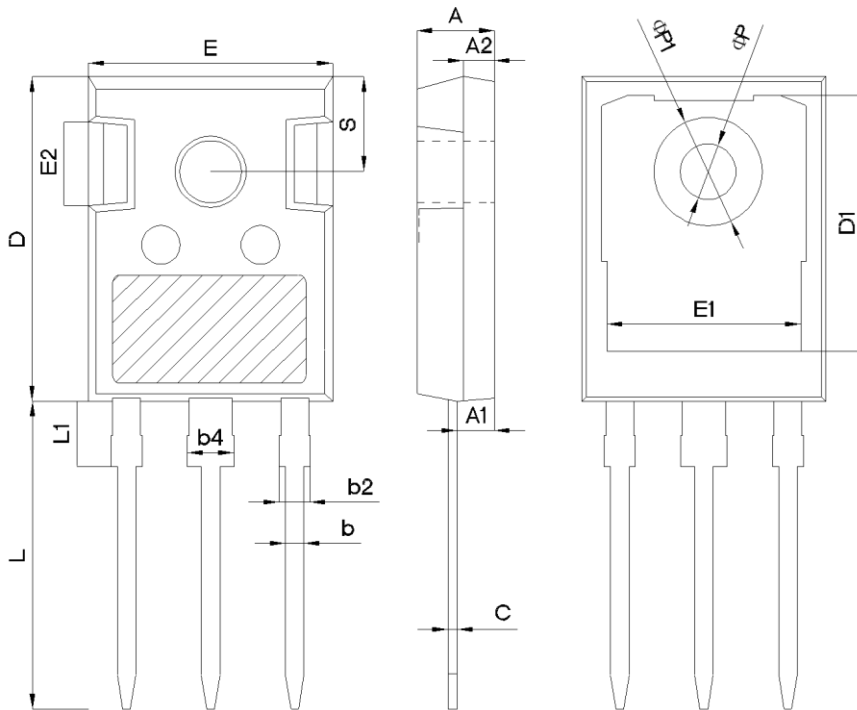
■ Package Information

Figure2, TO263 package outline dimension



■ Package Information

Figure3, TO247 package outline dimension



SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.70	21.00	21.30
D1	16.25	16.55	16.85
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
ΦP	3.40	3.60	3.80
ΦP1	-	-	7.30
S	6.15BSC		

■ **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
TO247	30	11	330	6	1980

■ **Product Information**

Product	Package	Pb Free	RoHS	Halogen Free
SGF180N10PF	TO220	yes	yes	yes
SGF180N10KF	TO263	yes	yes	yes
SGF180N10HF	TO247	yes	yes	yes