

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

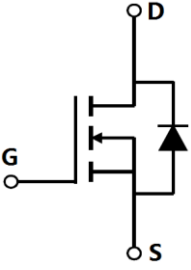
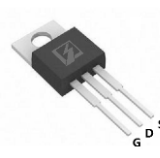
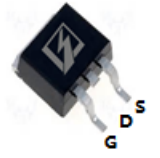
- ◆ Consumer electronic power supply
- ◆ Motor control
- ◆ Synchronous-rectification
- ◆ Isolated DC/DC convertor
- ◆ Invertors

■ General Description

SFG170N10xF 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
◆ $I_{D, pulse}$	510 A
◆ $R_{DS(ON), max @ V_{GS}=10 V}$	3 mΩ
◆ Q_g	114.5 nC

■ Schematic and Package Information

SCHEMATIC DIAGRAM	PIN ASSIGNMENT TOP VIEW	
	 TO220 SFG170N10PF	 TO263 SFG170N10KF

■ 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}	± 20	V
Continuous drain current ¹⁾	I_D	170	A
Pulsed drain current ²⁾	$I_{D, pulse}$	510	A
Power dissipation ³⁾	P_D	340	W
Single pulsed avalanche energy ⁴⁾	E_{AS}	540	mJ
Operation and storage temperature	T_{stg}, T_j	-55 to 150	$^{\circ}\text{C}$

■ Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal resistance, junction-case	$R_{\theta JC}$	0.37	$^{\circ}\text{C}/\text{W}$
Thermal resistance, junction-ambient ⁵⁾	$R_{\theta JA}$	62	$^{\circ}\text{C}/\text{W}$

■ 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	$R_{DS(on)}$		2.8	3.0	m Ω	$V_{GS}=10\text{ V}, I_D=30\text{ A}$
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}		9644.2		pF	$V_{GS}=0\text{ V},$ $V_{DS}=50\text{ V},$ $f=100\text{ kHz}$
Output capacitance	C_{oss}		1300.4		pF	
Reverse transfer capacitance	C_{rss}		24.6		pF	
Turn-on delay time	$t_{d(on)}$		43.7		ns	$V_{GS}=10\text{ V},$ $V_{DS}=50\text{ V},$ $R_G=2\ \Omega,$ $I_D=20\text{ A}$
Rise time	t_r		19.7		ns	
Turn-off delay time	$t_{d(off)}$		102.3		ns	
Fall time	t_f		22.5		ns	

■ Gate Charge Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Total gate charge	Q_g		114.5		nC	$I_D=20\text{ A}$, $V_{DS}=50\text{ V}$, $V_{GS}=10\text{ V}$
Gate-source charge	Q_{gs}		34.8		nC	
Gate-drain charge	Q_{gd}		23.2		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			170	A	$V_{GS} < V_{th}$
Pulsed source current	I_{SP}			510		
Diode forward voltage	V_{SD}			1.3	V	$I_S=30\text{ A}$, $V_{GS}=0\text{ V}$
Reverse recovery time	t_{rr}		105		ns	$I_S=20\text{ A}$, $di/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	Q_{rr}		414.7		nC	
Peak reverse recovery current	I_{rrm}		6.6		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) $V_{DD}=50\text{ V}$, $R_G=50\ \Omega$, $L=0.3\text{ mH}$, starting $T_j=25\text{ }^\circ\text{C}$.
- 5) 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 $T_a=25\text{ }^\circ\text{C}$.

■ **Electrical Characteristics Diagrams**

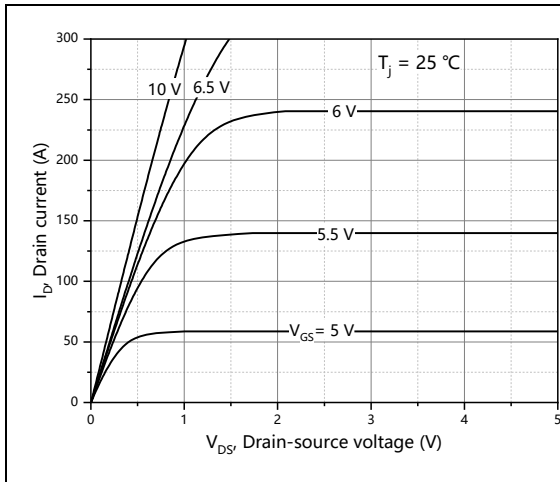


Figure 1, Typ. output characteristics

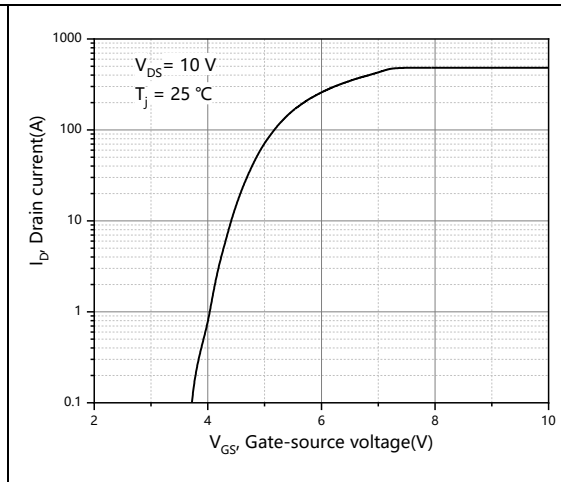


Figure 2, Typ. transfer characteristics

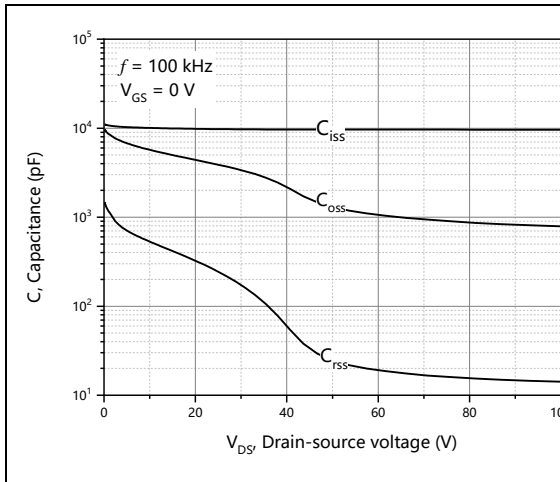


Figure 3, Typ. capacitances

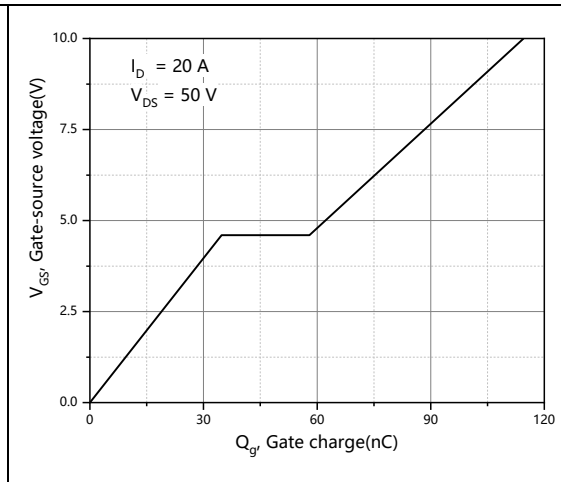


Figure 4, Typ. gate charge

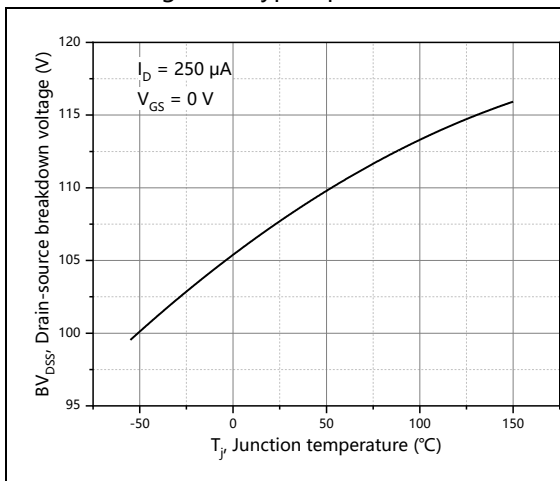


Figure 5, Drain-source breakdown voltage

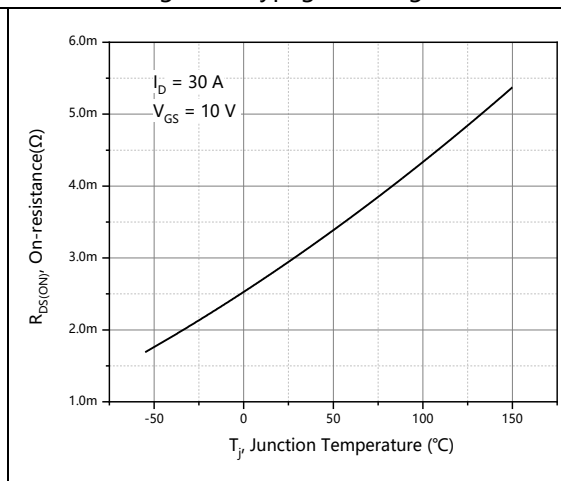


Figure 6, Drain-source on-state resistance

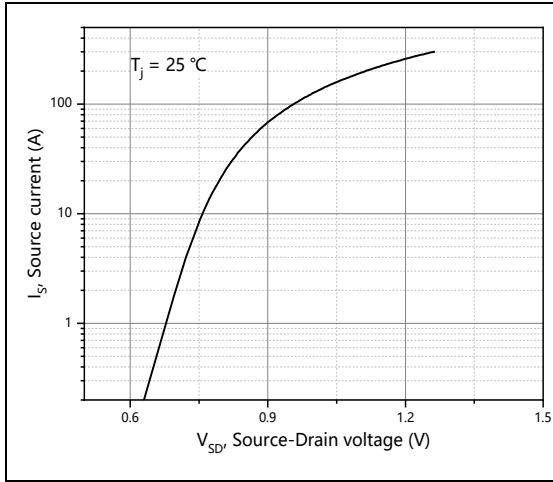


Figure 7, Forward characteristic of body diode

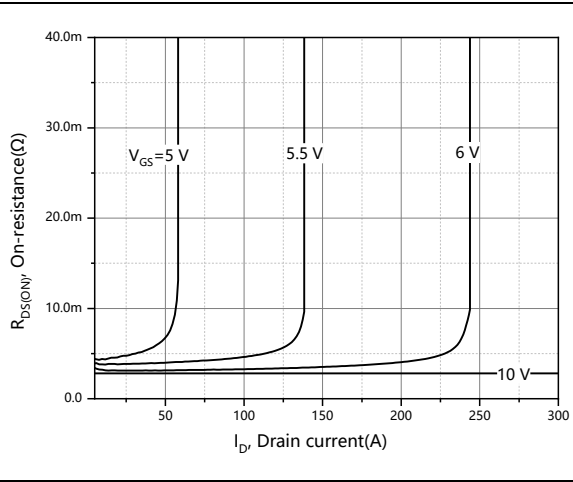


Figure 8, Drain-source on-state resistance

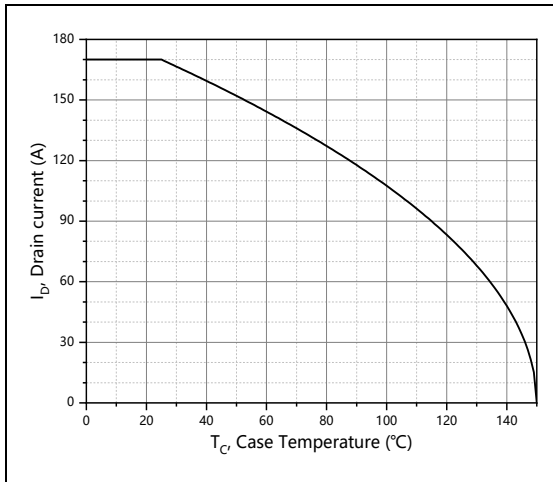


Figure 9, Drain current

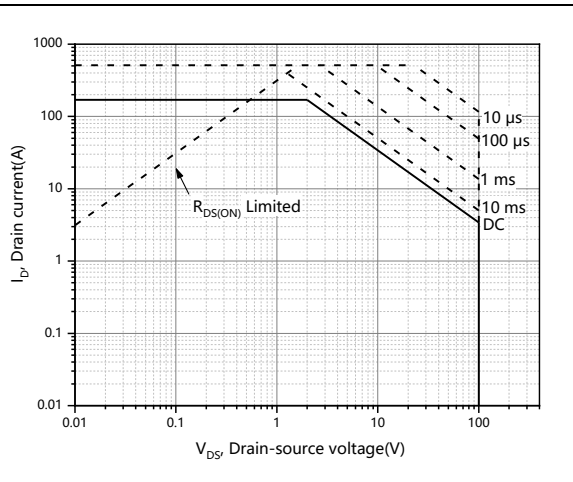


Figure 10, Safe operation area $T_C=25\text{ °C}$

■ Test circuits and waveforms

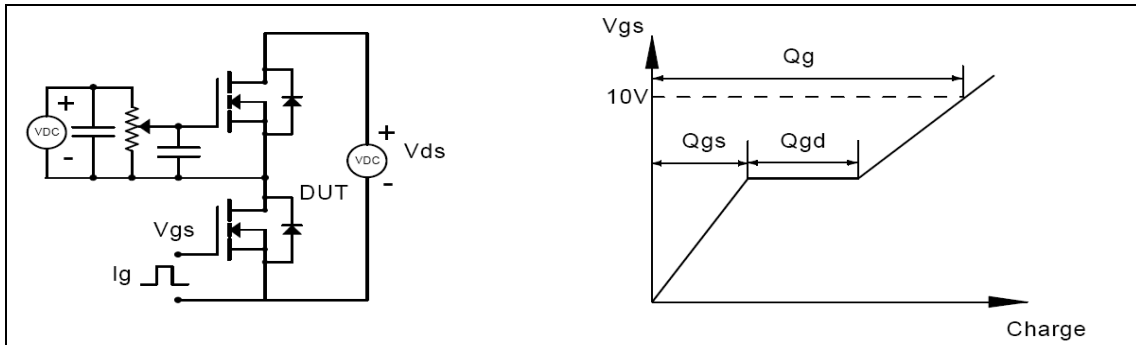


Figure 1, Gate charge test circuit & waveform

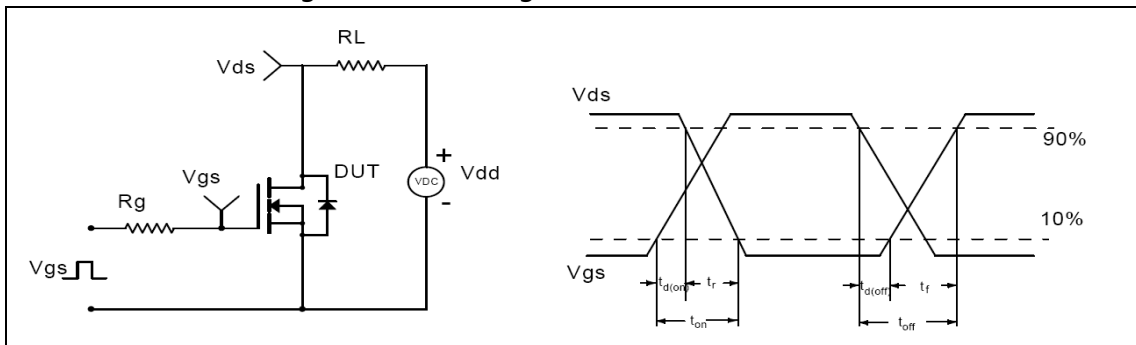


Figure 2, Switching time test circuit & waveforms

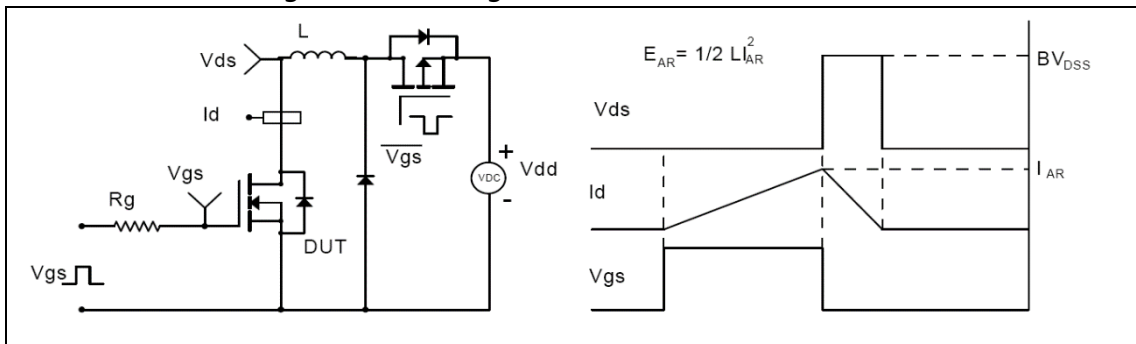


Figure 3, Unclamped inductive switching (UIS) test circuit & waveforms

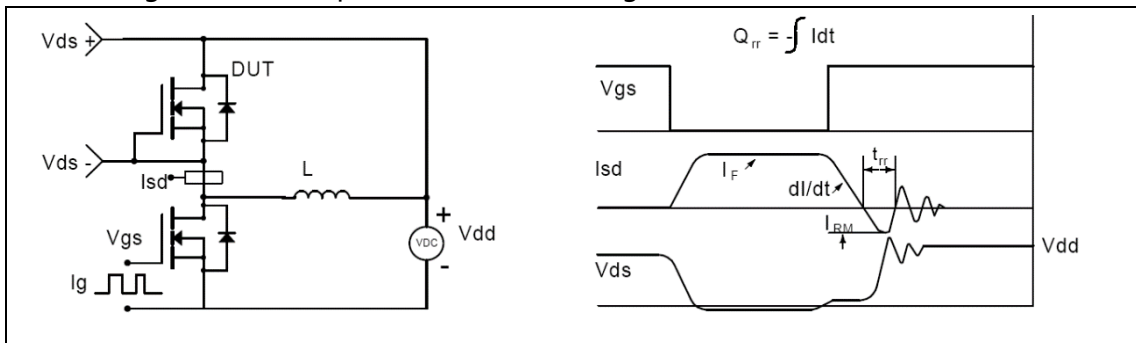
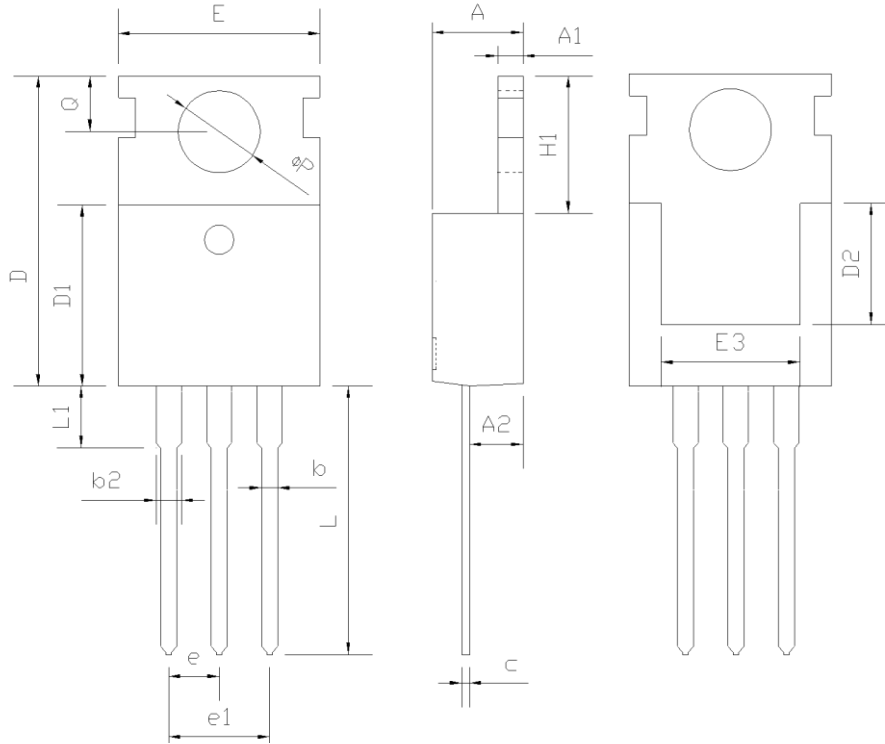


Figure 4, Diode reverse recovery test circuit & waveforms

■ Package Information

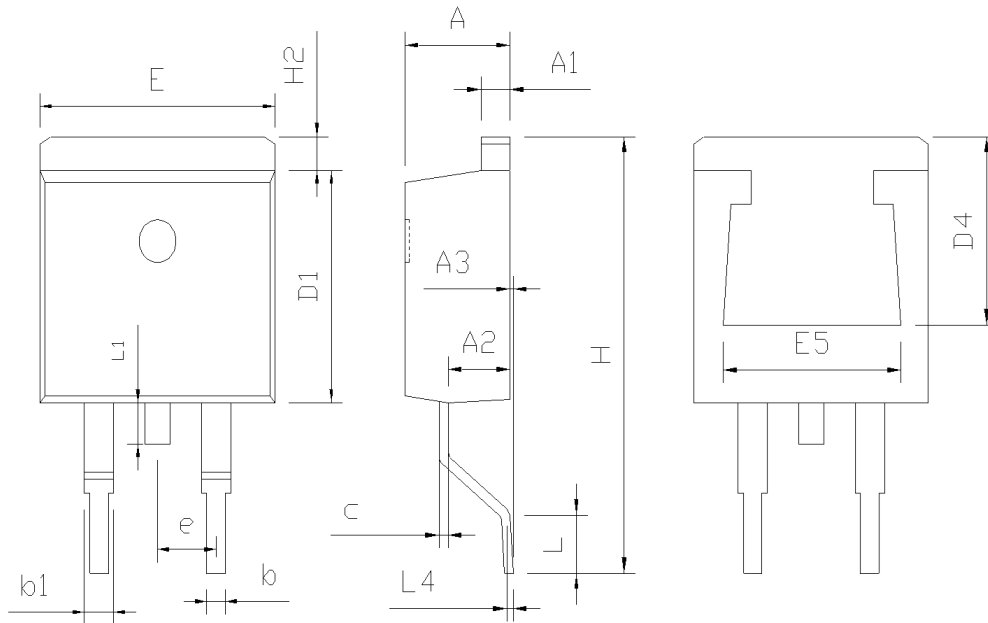
Figure1, TO220 package outline dimension



SYMBOL	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



SYMBOL	mm		
	MIN	NOM	MAX
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
A3	0.00	0.13	0.25
b	0.70	0.81	0.96
b1	1.17	1.27	1.47
c	0.30	0.38	0.53
D1	8.50	8.70	8.90
D4	6.60	-	-
E	9.86	10.16	10.36
E5	7.06	-	-
e	2.54 BSC		
H	14.70	15.10	15.50
H2	1.07	1.27	1.47
L	2.00	2.30	2.60
L1	1.40	1.55	1.70
L4	0.25 BSC		

■ Ordering Information

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

Package	Units/Reel	Reels/Inner Box	Units/Inner Box	Inner Box/Carton Box	Units/Carton Box
TO263	800	1	800	5	4000

■ Product Information

Product	Package	Pb Free	RoHS	Halogen Free
SGF170N10PF	TO220	yes	yes	yes
SGF170N10KF	TO263	yes	yes	yes