

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

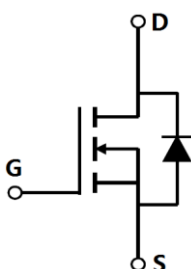
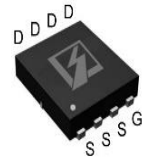

- ◆ Consumer electronic power supply
- ◆ Motor control
- ◆ Synchronous rectification
- ◆ Isolated DC/DC convertor
- ◆ Invertors

■ General Description

SFG12R12xF 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 synchronous rectification applications.

◆ $V_{DS, min}$	120 V
◆ $I_{D, pulse}$	150 A
◆ $R_{DS(ON), max @ V_{GS}=10 V}$	12 mΩ
◆ Q_g	33.1 nC

■ Schematic and Package Information

Schematic Diagram 	Pin Assignment Top View  PDFN5*6 SFG12R12GF	 TO252 SFG12R12DF
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■ Absolute Maximum Ratings at $T_j=25^{\circ}\text{C}$ 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⁾ , $T_C=25^{\circ}\text{C}$	I_D	50	A
Pulsed drain current ²⁾ , $T_C=25^{\circ}\text{C}$	$I_{D, pulse}$	150	A
Power dissipation ³⁾ , $T_C=25^{\circ}\text{C}$	P_D	140	W
Single pulsed avalanche energy ⁴⁾	E_{AS}	53.8	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	$R_{\theta JC}$	0.89	$^{\circ}\text{C}/\text{W}$
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}	120		200	V	$V_{GS}=0\text{ V}, I_D=250\ \mu\text{A}$
Gate threshold voltage	$V_{GS(th)}$	1.5		2.5	V	$V_{DS}=V_{GS}, I_D=250\ \mu\text{A}$
Drain-source on-state resistance	$R_{DS(on)}$		10.0	12.0	$\text{m}\Omega$	$V_{GS}=10\text{ V}, I_D=30\text{ A}$
Drain-source on-state resistance	$R_{DS(on)}$		13.0	15.0	$\text{m}\Omega$	$V_{GS}=4.5\text{ V}, I_D=20\text{ A}$
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	$V_{DS}=120\text{ V}, V_{GS}=0\text{ V}$

■ Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Input capacitance	C_{iss}		2640.1		pF	$V_{GS}=0\text{ V},$ $V_{DS}=50\text{ V},$ $f=100\text{ kHz}$
Output capacitance	C_{oss}		330.1		pF	
Reverse transfer capacitance	C_{rss}		11.2		pF	
Turn-on delay time	$t_{d(on)}$		22.3		ns	$V_{GS}=10\text{ V},$ $V_{DS}=50\text{ V},$ $R_G=2\ \Omega,$ $I_D=25\text{ A}$
Rise time	t_r		9.7		ns	
Turn-off delay time	$t_{d(off)}$		85		ns	
Fall time	t_f		112.3		ns	

■ Gate Charge Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Total gate charge	Q_g		33.1		nC	$I_D=25\text{ A}$, $V_{DS}=50\text{ V}$, $V_{GS}=10\text{ V}$
Gate-source charge	Q_{gs}		5.6		nC	
Gate-drain charge	Q_{gd}		7.2		nC	
Gate plateau voltage	V_{plateau}		3.1		V	

■ Body Diode Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Diode forward current	I_S			50	A	$V_{GS}<V_{th}$
Pulsed source current	I_{SP}			150		
Diode forward voltage	V_{SD}			1.3	V	$I_S=12\text{ A}$, $V_{GS}=0\text{ V}$
Reverse recovery time	t_{rr}		62.3		ns	$I_S=25\text{ A}$, $di/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	Q_{rr}		135.3		nC	
Peak reverse recovery current	I_{rrm}		3.5		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**

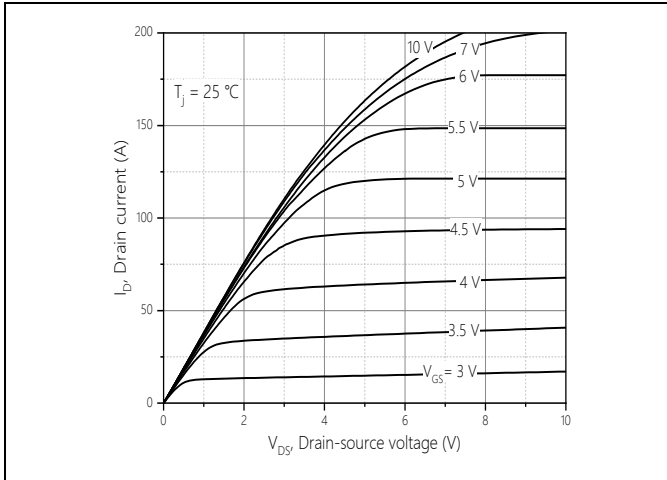


Figure 1, Typ. output characteristics

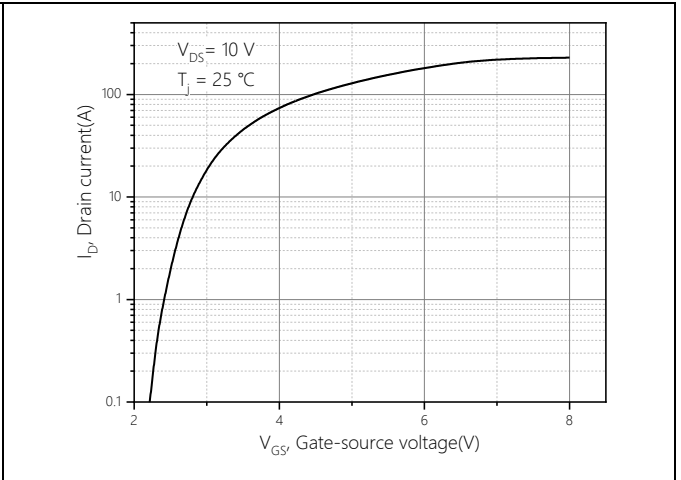


Figure 2, Typ. transfer characteristics

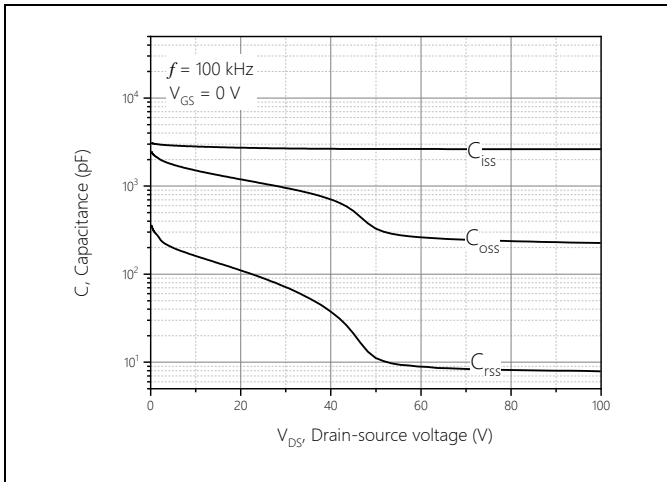


Figure 3, Typ. capacitances

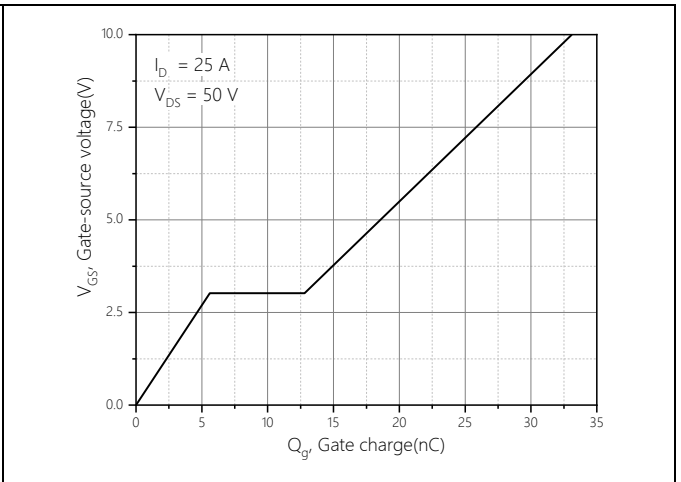


Figure 4, Typ. gate charge

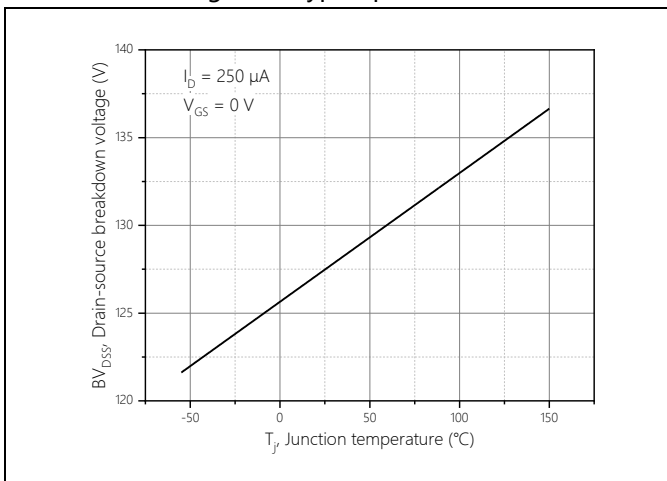


Figure 5, Drain-source breakdown voltage

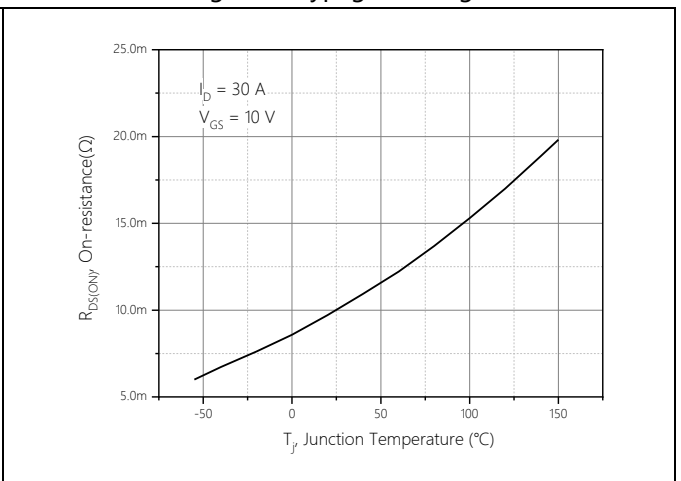


Figure 6, Drain-source on-state resistance

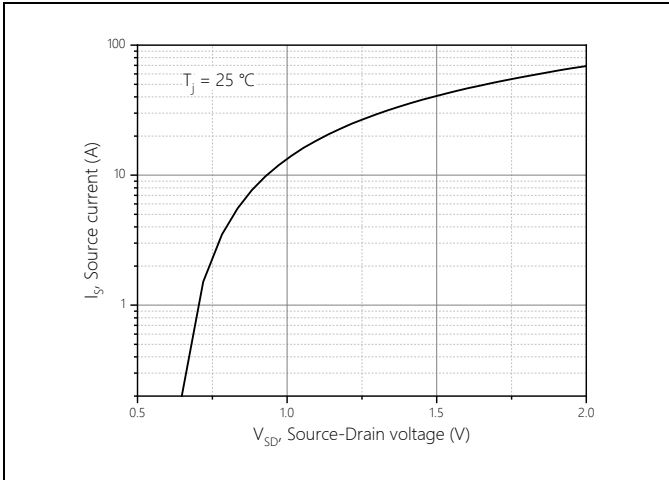


Figure 7, Forward characteristic of body diode

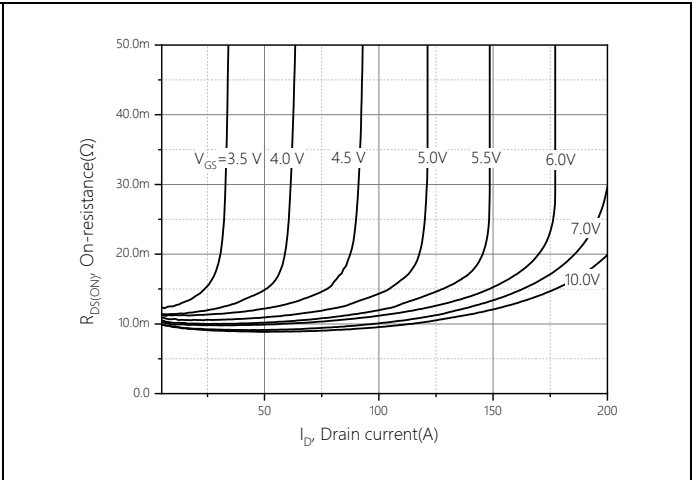


Figure 8, Drain-source on-state resistance

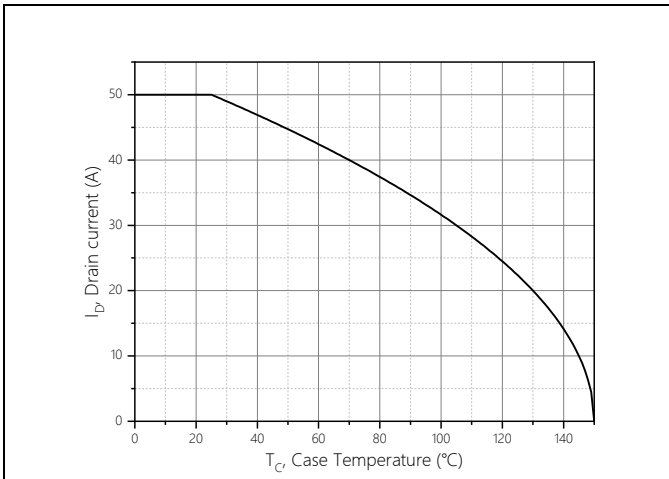


Figure 9, Drain current

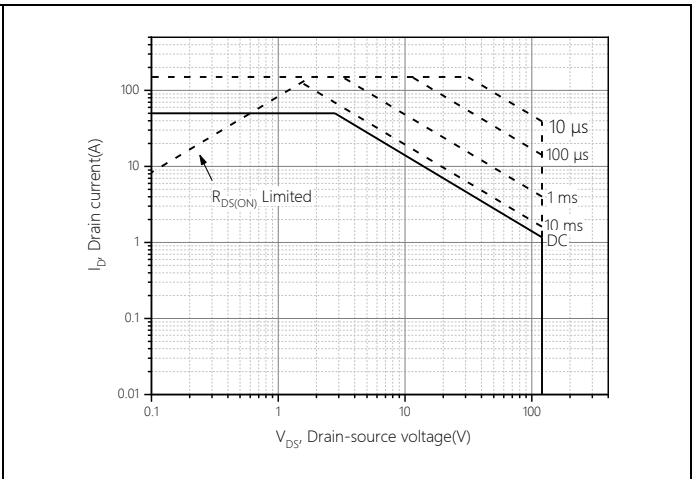
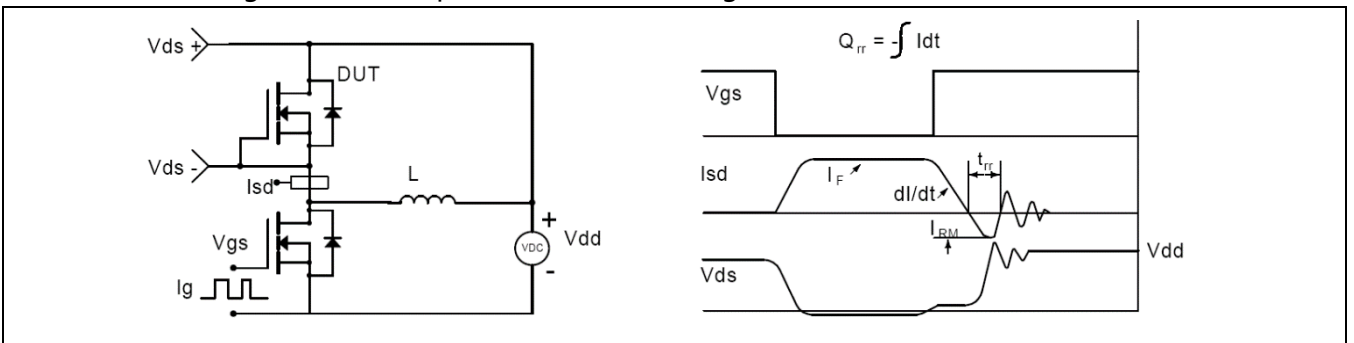
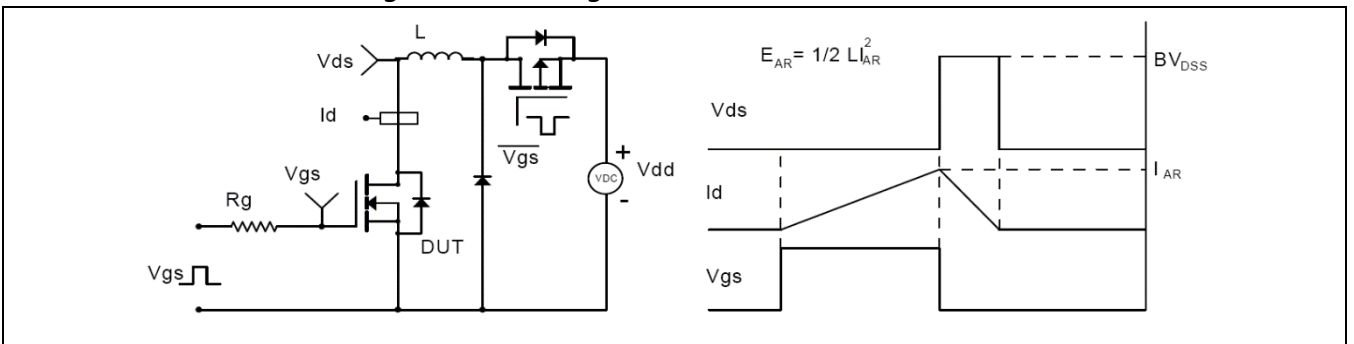
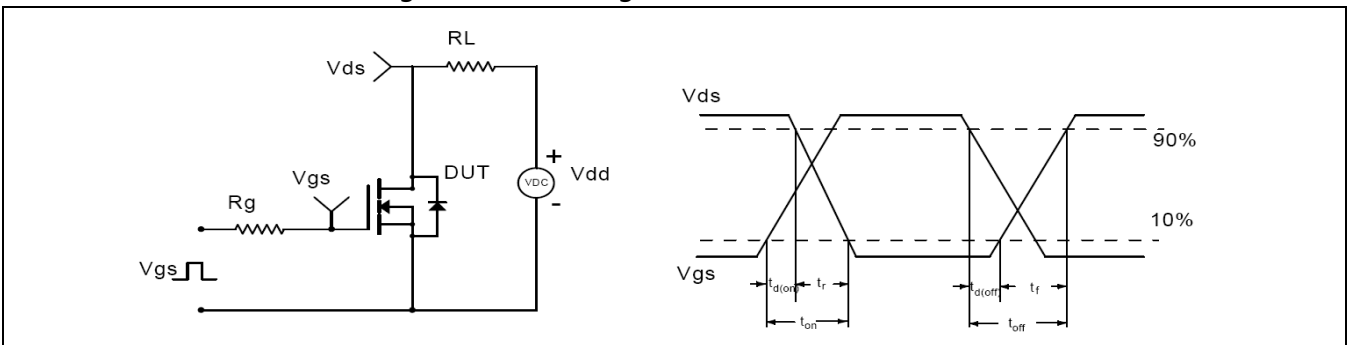
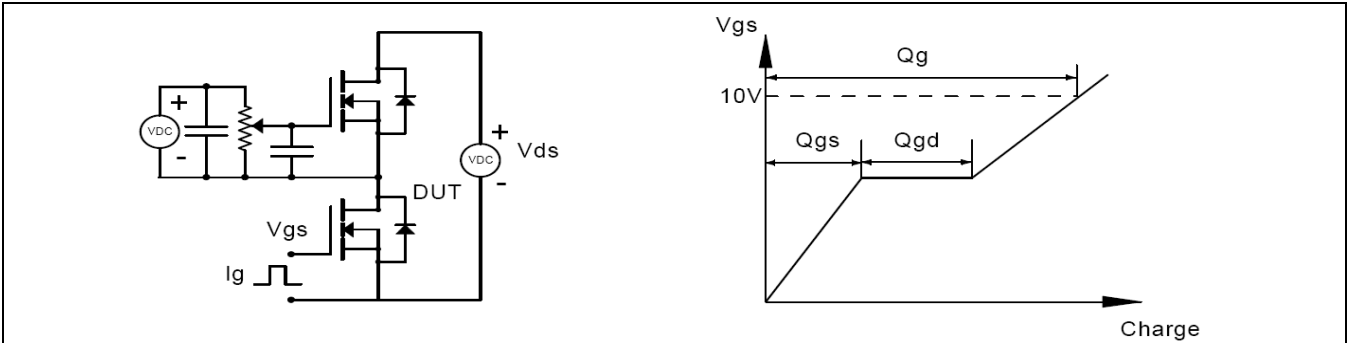


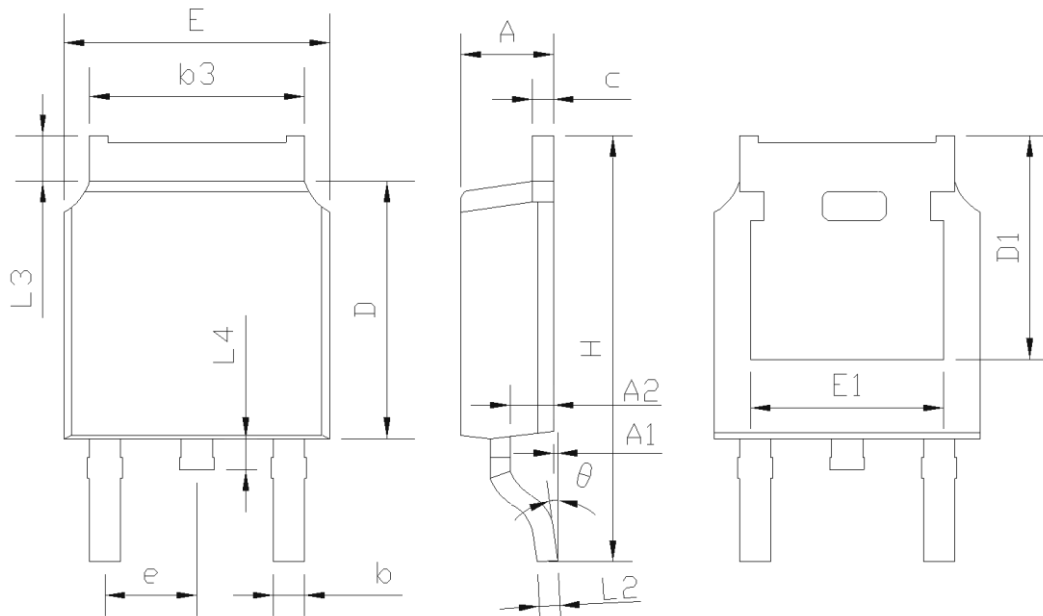
Figure 10, Safe operation area $T_C=25\text{ }^\circ\text{C}$

■ Test circuits and waveforms



■ Package Information

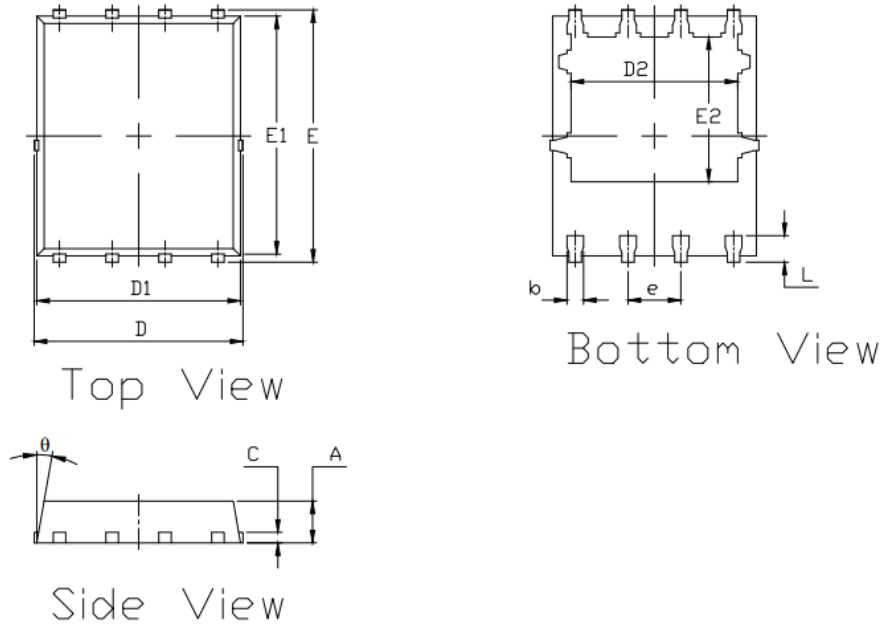
Figure1, TO252 package outline dimension



SYMBOL	mm		
	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0.00	-	0.20
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b3	5.20	5.33	5.46
c	0.43	0.53	0.61
D	5.98	6.10	6.22
D1	5.30REF		
E	6.40	6.60	6.73
E1	4.63	-	-
e	2.286BSC		
H	9.40	10.10	10.50
L2	0.51BSC		
L3	0.88	-	1.28
L4	0.50	-	1.00
θ	0°	-	8°

■ Package Information

Figure2, PDFN5*6 package outline dimension



Power56			
DIM.	MIN.	MAX.	TYP.
A	0.95	1.05	1.00
b	0.30	0.50	0.40
C	0.254		
D	5.02		
D1	4.80	5.00	4.90
D2	3.91	4.11	4.01
E	5.95	6.15	6.05
E1	5.60	5.90	5.75
E2	3.38	3.58	3.48
e	1.27REF		
L	0.45	0.65	0.55
θ	10°		

■ Ordering Information

Package	Units/Reel	Reels/Inner Box	Units/Inner Box	Inner Box/Carton Box	Units/Carton Box
TO252	2500	2	5000	5	25000
PDFN5*6	5000	2	10000	5	50000

■ Product Information

Product	Package	Pb Free	RoHS	Halogen Free
SFG12R12DF	TO252	yes	yes	yes
SFG12R12GF	PDFN5*6	yes	yes	yes