ORIENTAL SEMICONDUCTOR

RoHS compliant

OSG60R150x_Datasheet

GreenMOS™

Enhancement Mode N-Channel Power MOSFET

Features

- Low $R_{DS(on)}$ & FOM
- Extremely low switching loss
- Excellent stability and uniformity
- Easy to drive

Applications

- Lighting
- Hard switching PWM
- Server power supply
- Charger

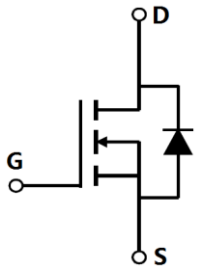
■ General Description

OSG60R150x use advanced GreenMOS™ technology to provide low $R_{DS(ON)}$, low gate charge, fast switching and excellent avalanche characteristics. This device is suitable for active power factor correction and switching mode power supply applications.

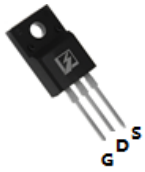
- ◆ $V_{DS,\ min@Tjmax}$ 650 V
- ◆ $I_{D,\ pulse}$ 69 A
- ◆ $R_{DS(ON),\ max\ @\ VGS=10\ V}$ 150 mΩ
- ◆ Q_g 23 nC

■ Schematic and Package Information

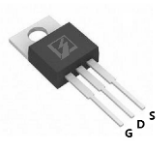
SCHEMATIC DIAGRAM



PIN ASSIGNMENT-TOP VIEW

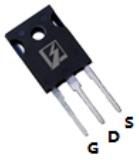


TO220F
OSG60R150F



TO220
OSG60R150P

TO263
OSG60R150K



TO247
OSG60R150H

■ Absolute Maximum Ratings at T_j=25℃ unless otherwise noted

Parameter	Symbol	Value	Unit
Drain source voltage	V_{DS}	600	V
Gate source voltage	V_{GS}	±30	V
Continuous drain current[1)]	I_D	23	A
Continuous drain current[1)] T_j=100 ℃		14.5	
Pulsed drain current[2)]	$I_{D,\ pulse}$	69	A
Power dissipation[3)] for TO220, TO263, TO247	P_D	151	W
Power dissipation[3)] for TO220F		34	
Single pulsed avalanche energy[5)]	E_{AS}	600	mJ
MOSFET dv/dt ruggedness, V_{DS}=0...480 V	dv/dt	50	V/ns
Reverse diode dv/dt, V_{DS}=0...480 V, I_{SD}≤I_D	dv/dt	15	V/ns
Operation and storage temperature	T_{stg} , T_j	-55 to 150	℃

■ Thermal Characteristics

Parameter	Symbol	Value		Unit
		TO220/TO263/TO247	TO220F	
Thermal resistance, junction-case	$R_{\theta JC}$	0.82	3.67	°C/W
Thermal resistance, junction-ambient[4)]	$R_{\theta JA}$	62	62.5	°C/W

■ Electrical Characteristics at T_j=25 ℃ unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Drain-source breakdown voltage	BV_{DSS}	600			V	V_{GS}=0 V, I_D=250 μA
		650	716			V_{GS}=0 V, I_D=250 μA T_j=150 ℃
Gate threshold voltage	$V_{GS(th)}$	2.0		4.0	V	V_{DS}=V_{GS}, I_D=250 μA
Drain-source on-state resistance	$R_{DS(ON)}$		0.12	0.15	Ω	V_{GS}=10 V, I_D=10 A
			0.29			V_{GS}=10 V, I_D=10 A, T_j=150 ℃
Gate-source leakage current	I_{GSS}			100	nA	V_{GS}=30 V
				-100		V_{GS}=-30 V
Drain-source leakage current	I_{DSS}			1	μA	V_{DS}=600 V, V_{GS}=0 V

■ Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Input capacitance	C_{iss}		1356		pF	V_{GS}=0 V, V_{DS}=50 V, f=1 MHz
Output capacitance	C_{oss}		155		pF	
Reverse transfer capacitance	C_{rss}		2		pF	
Turn-on delay time	$t_{d(on)}$		38.2		ns	V_{GS}=10 V, V_{DS}=400 V, R_G=25 Ω, I_D=10 A
Rise time	t_r		25.2		ns	
Turn-off delay time	$t_{d(off)}$		79.2		ns	
Fall time	t_f		31.5		ns	

■ Gate Charge Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Total gate charge	Q_g		23		nC	I_D=10 A, V_{DS}=400 V, V_{GS}=10 V
Gate-source charge	Q_{gs}		6.0		nC	
Gate-drain charge	Q_{gd}		8.3		nC	
Gate plateau voltage	$V_{plateau}$		5.6		V	

■ Body Diode Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Diode forward current	I_S			23	A	V_{GS}<V_{th}
Pulsed source current	I_{SP}			69		
Diode forward voltage	V_{SD}			1.4	V	I_S=23 A, V_{GS}=0 V
Reverse recovery time	t_{rr}		258.1		ns	V_R=400 V, I_S=10 A, di/dt=100 A/μs
Reverse recovery charge	Q_{rr}		2.8		μC	
Peak reverse recovery current	I_{rrm}		19		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}=100 V, R_G=25 Ω, L=10.8 mH, starting T_j=25 °C.

■ Electrical Characteristics Diagrams

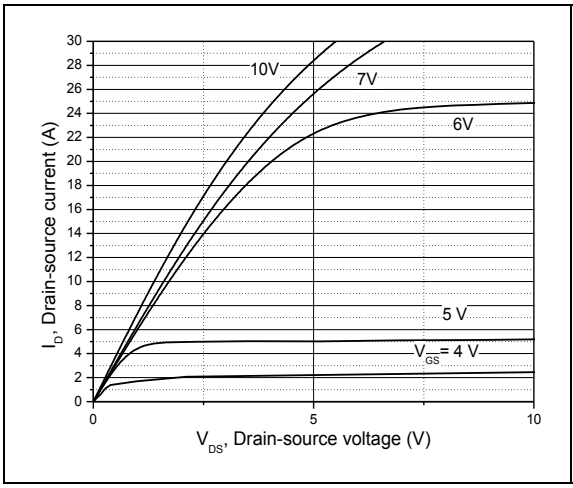


Figure 1, Typ. output characteristics

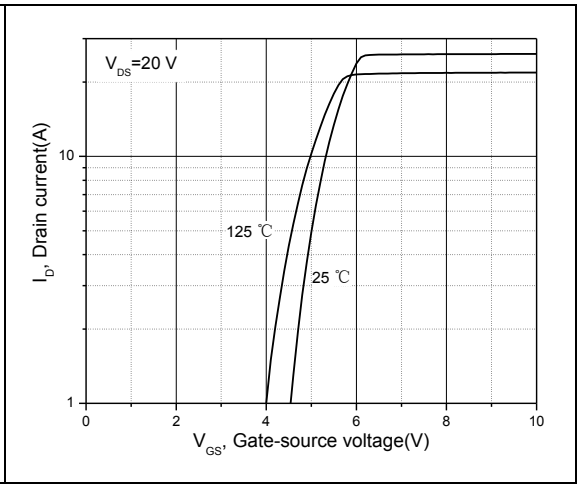


Figure 2, Typ. transfer characteristics

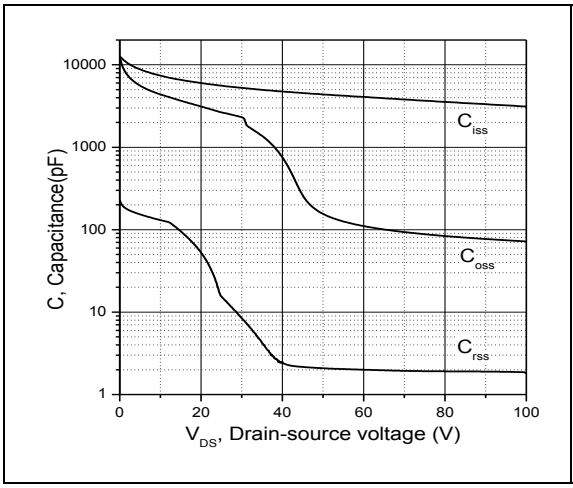


Figure 3, Typ. capacitances

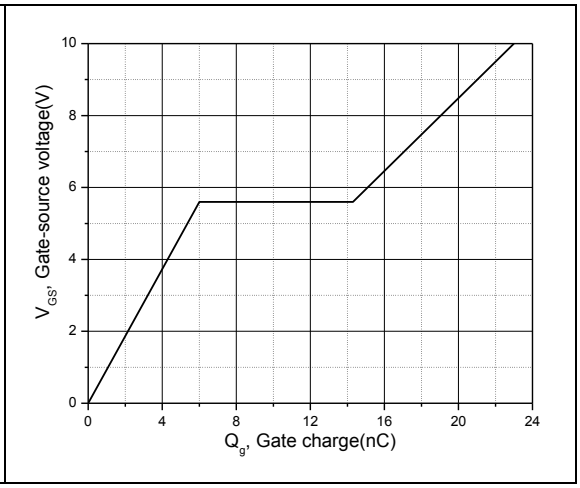


Figure 4, Typ. gate charge

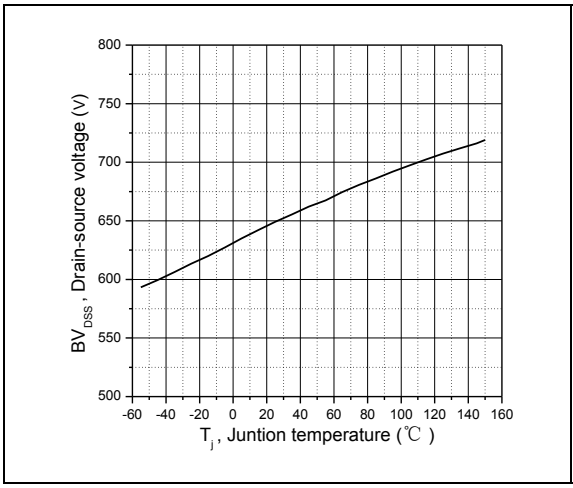


Figure 5, Drain-source breakdown voltage

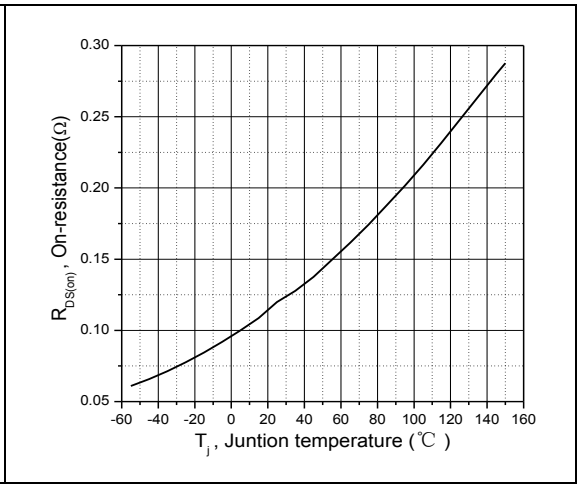


Figure 6, Drain-source on-state resistance

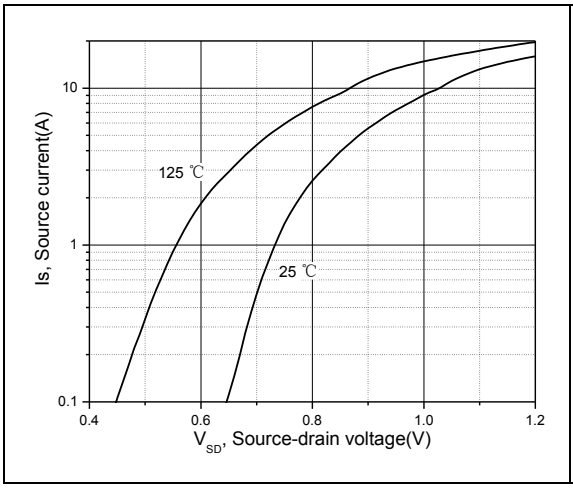


Figure 7, Forward characteristic of body diode

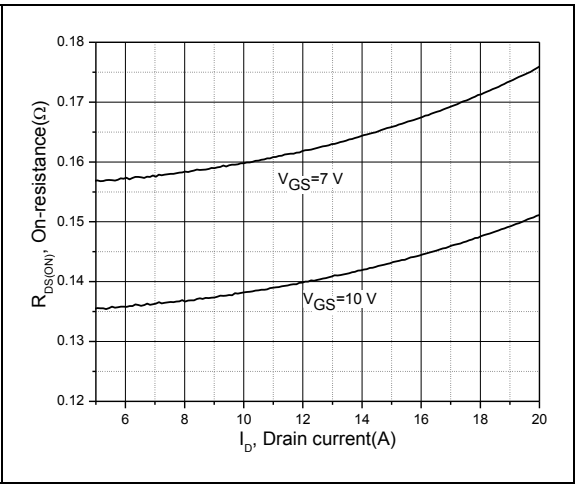


Figure 8, Drain-source on-state resistance

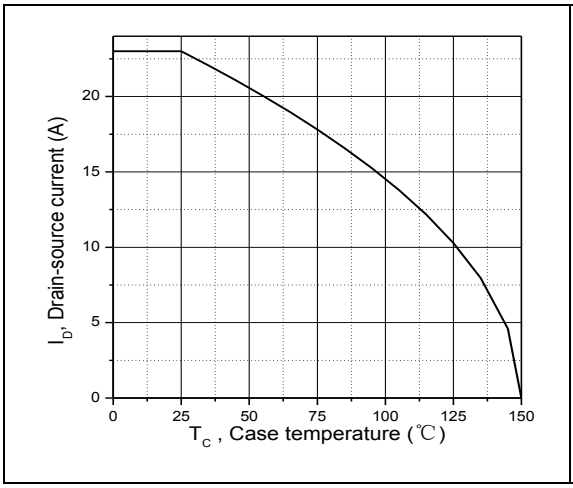


Figure 9, Drain current

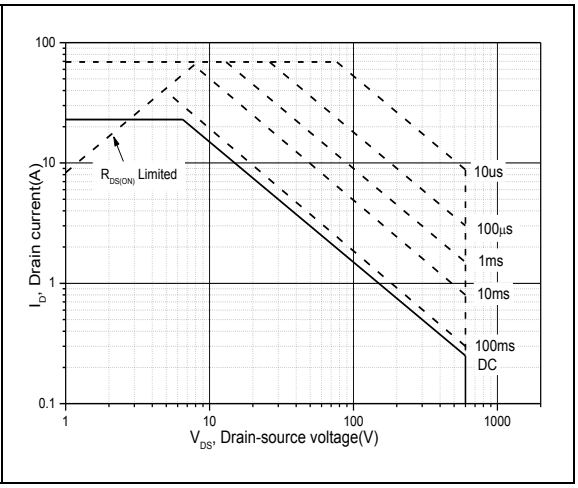


Figure 10, Safe operation area for TO220/TO263/TO247 T_C=25 ℃

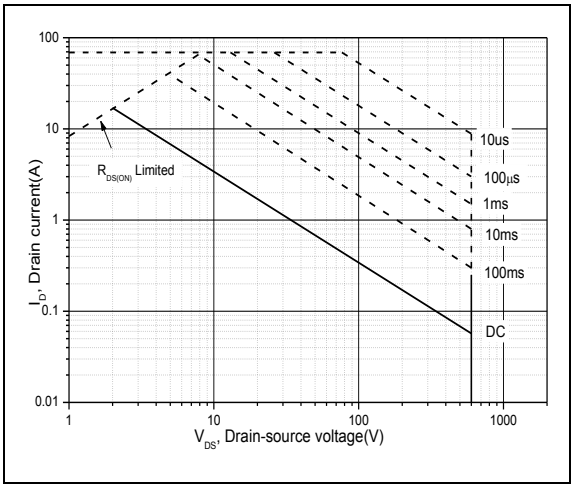


Figure 11, Safe operation area for TO220F T_C=25 ℃

■ Test circuits and waveforms

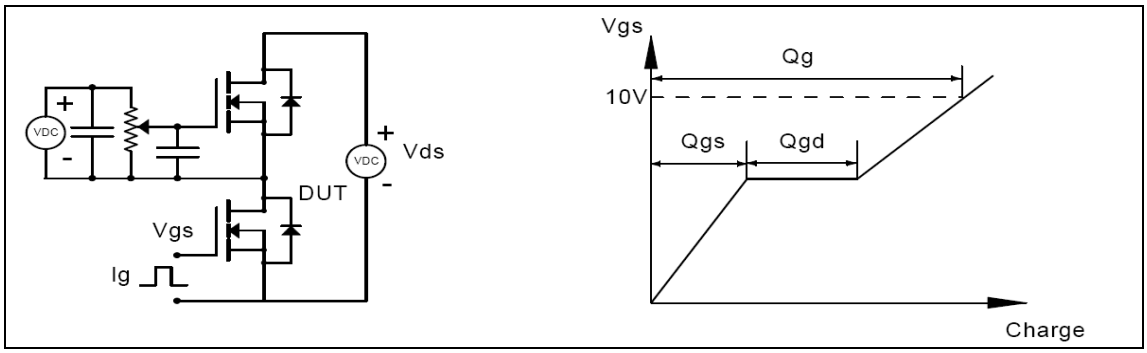


Figure 1, Gate charge test circuit & waveform

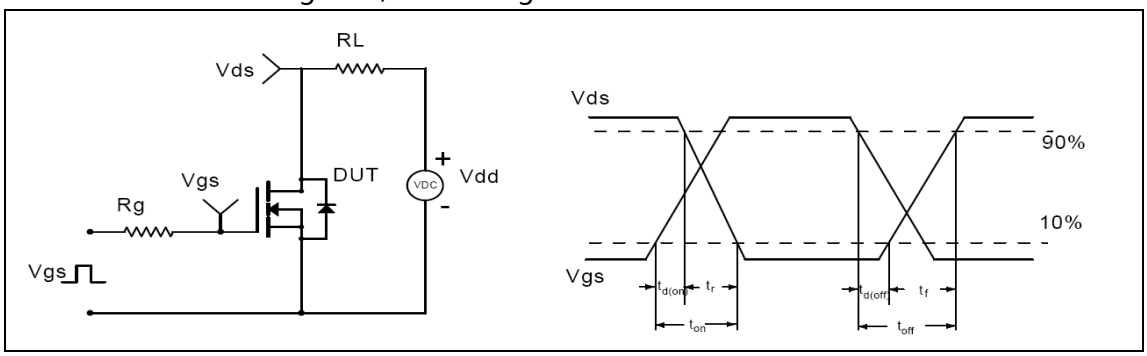


Figure 2, Switching time test circuit & waveforms

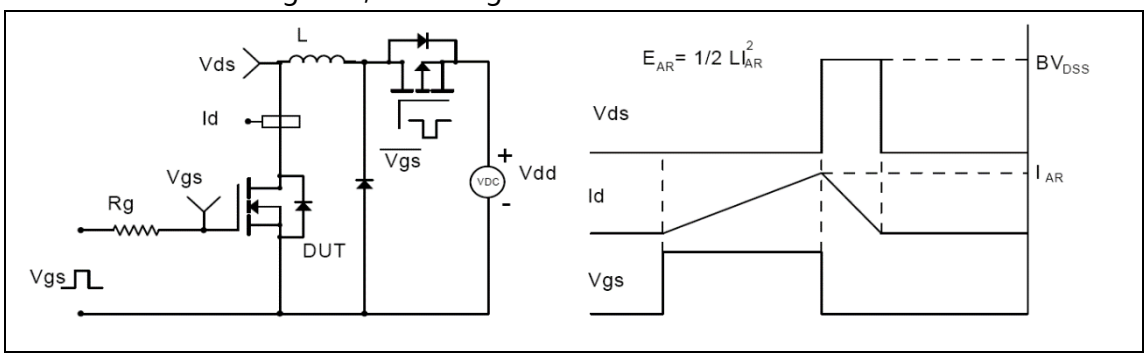


Figure 3, Unclamped inductive switching (UIS) test circuit & waveforms

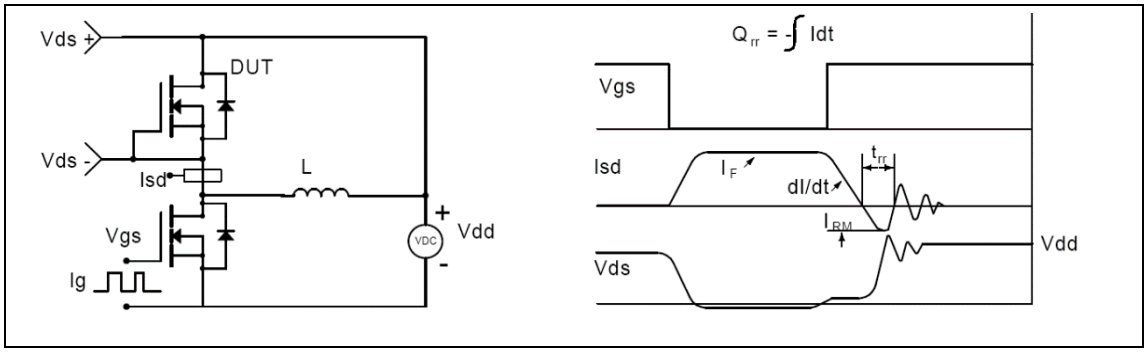
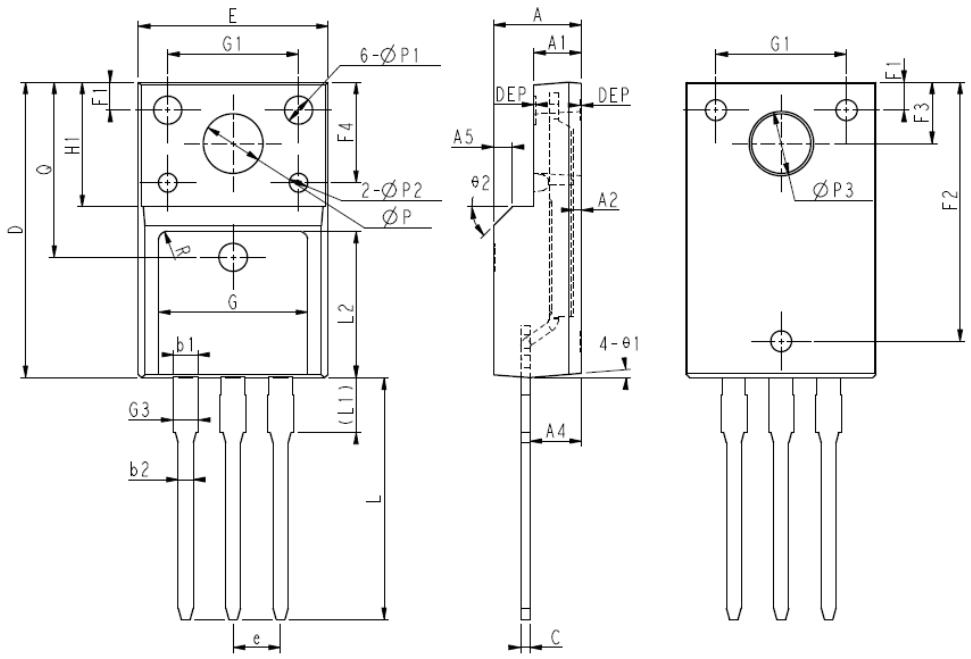


Figure 4, Diode reverse recovery test circuit & waveforms

■ Package Information

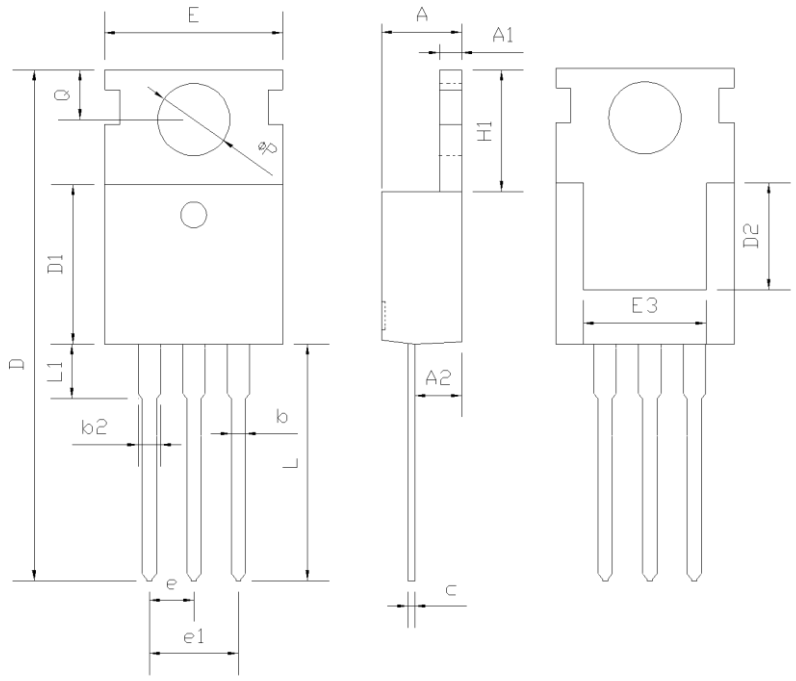
Figure1, TO220F package outline dimension



Symbol	Dimension In Millimeters			Dimension In Inches		
	Min	Nom	Max	Min	Nom	Max
E	10.000	10.160	10.320	0.394	0.400	0.406
E1	9.940	10.040	10.140	0.391	0.395	0.399
E2	9.360	9.460	9.560	0.369	0.372	0.376
A	4.500	4.700	4.900	0.177	0.185	0.193
A1	2.340	2.540	2.740	0.092	0.100	0.108
A2	0.430	-	0.480	0.017	-	0.019
A4	2.660	2.760	2.860	0.105	0.109	0.113
A5		1.00REF			0.039BSC	
c	0.450	0.525	0.600	0.018	0.021	0.024
D	15.670	15.870	16.070	0.617	0.625	0.633
Q		9.40REF			0.370REF	
H1		6.70REF			0.264REF	
e		2.54REF			0.100REF	
ΦP		3.18REF			0.125REF	
L	12.780	12.980	13.180	0.503	0.511	0.519
L1	2.830	2.930	3.030	0.111	0.115	0.119
L2	7.700	7.800	7.900	0.303	0.307	0.311
ΦP1	1.400	1.500	1.600	0.055	0.059	0.063
ΦP2	0.950	1.000	1.050	0.037	0.039	0.041
ΦP3	-	3.450	-	-	0.136	-
Θ1	3°	5°	7°	3°	5°	7°
Θ2	-	45°	-	-	45°	-
DEP	0.050	0.100	0.150	0.002	0.004	0.006
F1	1.000	1.500	2.000	0.039	0.059	0.079
F2	13.800	13.900	14.000	0.543	0.547	0.551
F3	3.200	3.300	3.400	0.126	0.130	0.134
F4	5.300	5.400	5.500	0.209	0.213	0.217
G	7.800	8.000	8.200	0.307	0.315	0.323
G1	6.900	7.000	7.100	0.272	0.276	0.280
G3	1.250	1.350	1.450	0.049	0.053	0.057
b1	1.230	1.280	1.380	0.048	0.050	0.054
b2	0.750	0.800	0.900	0.030	0.031	0.035
K1	0.650	0.700	0.750	0.026	0.028	0.030
R	-	0.5REF	-	-	0.020REF	-

■ Package Information

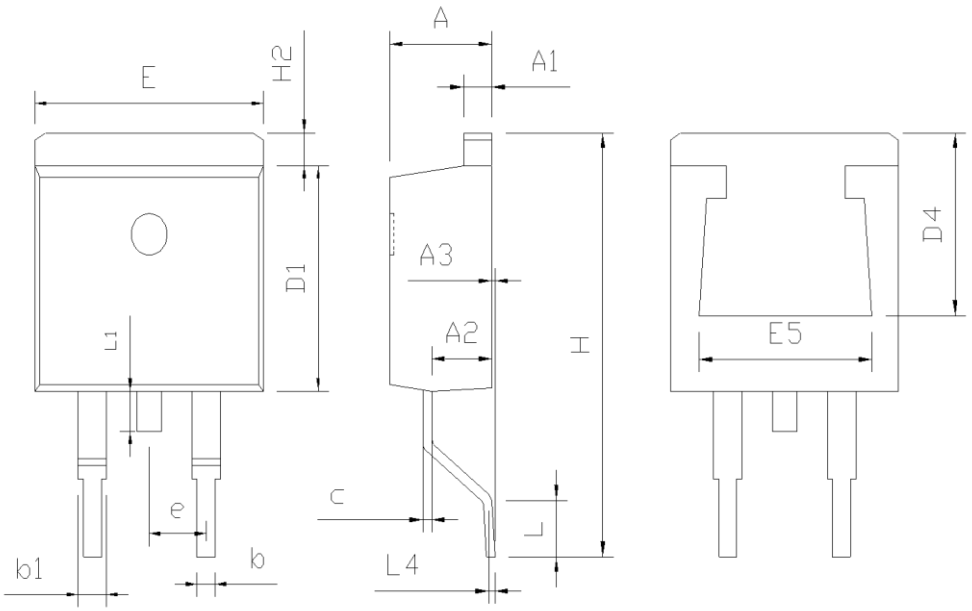
Figure2, TO220 package outline dimension



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

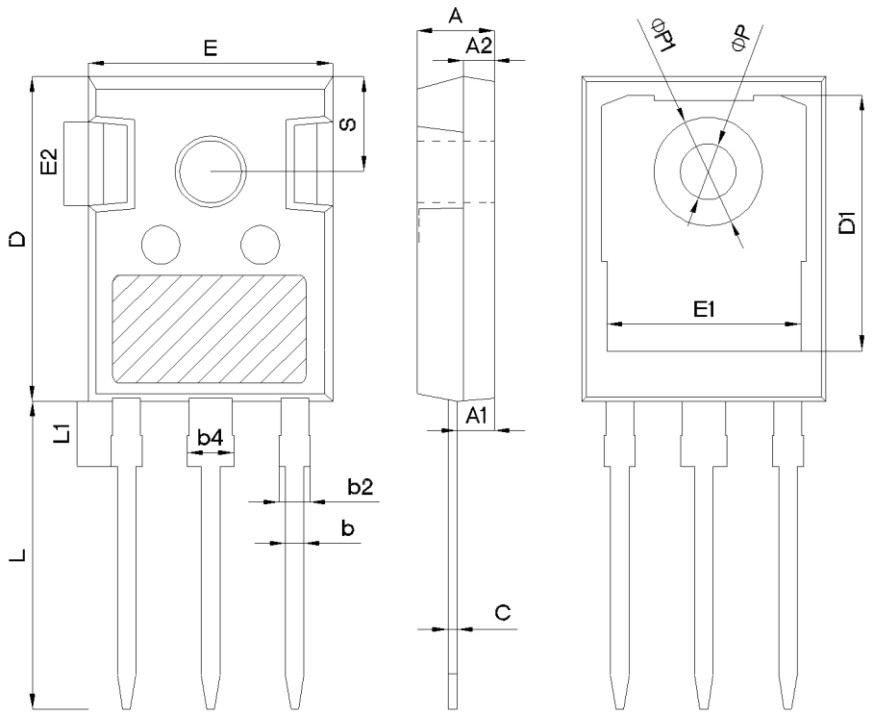
Figure3, TO263 package outline dimension



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		
θ	0°	5°	9°

■ Package Information

Figure4, 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
TO220F	50	20	1000	6	6000
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
OSG60R150F	TO220F	yes	yes	no
OSG60R150FF	TO220F	yes	yes	yes
OSG60R150P	TO220	yes	yes	no
OSG60R150PF	TO220	yes	yes	yes
OSG60R150K	TO263	yes	yes	no
OSG60R150KF	TO263	yes	yes	yes
OSG60R150H	TO247	yes	yes	no
OSG60R150HF	TO247	yes	yes	yes