ORIENTAL SEMICONDUCTOR

RoHS compliant

GreenMOS™

OSG65R1K4x_Datasheet

Enhancement Mode N-Channel Power MOSFET

Features

- Low $R_{DS(on)}$
- Low FOM
- Extremely low switching loss
- Good stability and uniformity
- Advanced GreenMOS™ technology

Applications

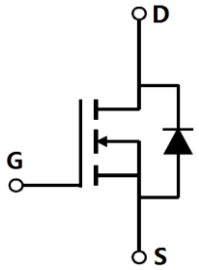
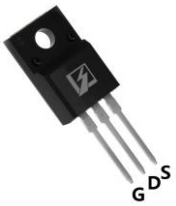
- Consumer electronics power supply
- LCD/LED/PDP
- Portable digital power management
- PFC
- Charger

■ General Description

OSG65R1K4x series 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.

- ◆ $V_{DS@Tjmax}$ 700V(min)
- ◆ I_D 4A
- ◆ $R_{DS(ON)}$@V_{GS}=10V 1.4Ω(max)

■ TO-251,TO-252,TO-220F Package Information

Schematic Diagram	Pin Assignment-Top View		
			
	TO-251 **OSG65R1K4A**	**TO-252** **OSG65R1K4D**	**TO-220F** **OSG65R1K4F**

■ Absolute Maximum Ratings (T_A=25℃ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	650	V
Gate-Source Voltage	V_{GS}	±30	V
Drain Current-Continuous(Note 1)	I_D	4	A
Drain Current- Pulsed(Note 2)	I_{DM}	12	A
Power Dissipation(Note 3) for TO-251,TO-252	P_D	28.4	W
Power Dissipation(Note 3) for TO-220F		24	
Single Pulsed-Avalanche Energy(Note 6)	E_{AS}	112	mJ
Operation and Storage Junction Temperature	T_{STG} , T_J	-55 to 150	℃

■ Thermal Characteristics

Parameter	Symbol	Value		Unit
		TO251/TO252	TO220F	
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	4.4	5.2	°C/W
Thermal Resistance, Junction-to-Ambient (Note 4)	$R_{\theta JA}$	62	62.5	°C/W

■ Electrical Characteristics (T_A=25℃ unless otherwise noted)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Drain-Source Breakdown Voltage	BV_{DSS}	650			V	V_{GS}=0V, I_D=250μA
		700	764			V_{GS}=0V,I_D=250μA, T_j=150℃
Gate Threshold Voltage	$V_{GS(th)}$	2.0		4.0	V	V_{DS}=V_{GS}, I_D=250μA
Drain-Source On-state Resistance	$R_{DS(ON)}$		1.2	1.4	Ω	V_{GS}=10V,I_D=2A
			2.9			V_{GS}=10V,I_D=2A, T_j=150℃
Gate-Source Leakage Current	I_{GSS}			100	nA	V_{GS}=30V
				-100		V_{GS}=-30V
Drain-to-Source leakage current	I_{DSS}			1	μA	V_{DS}=650V,V_{GS}=0V

■ Dynamic Characteristics

Input Capacitance	C_{iss}		259.9		pF	V_{GS} = 0V, V_{DS} = 50V, f = 1MHZ
Output Capacitance	C_{oss}		21.1		pF	
Reverse Transfer Capacitance	C_{rss}		0.9		pF	
Turn-on Delay Time	$t_{d(on)}$		30.9		ns	V_{GS}=10V, V_{DS} =380V, R_G=25Ω I_D =4A
Turn-on Rise Time	t_r		20.7		ns	
Turn-Off Delay Time	$t_{d(off)}$		56.3		ns	
Turn-Off Fall Time	t_f		28.7		ns	

■ Gate Charge Characteristics

Total Gate Charge	Q_g		8.2		nC	I_D = 4A, V_{DS}= 480V, V_{GS} = 10V
Gate-Source Charge	Q_{gs}		2.2		nC	
Gate-Drain Charge	Q_{gd}		3.4		nC	

■ Body Diode Characteristics

Body-diode Forward Current(NOTE 2)	I_S			4	A	$V_{GS}<V_{th}$
Pulsed Source Current	I_{SP}			12		
Inverse Diode Forward Voltage	V_{SD}			1.3	V	I_S=4A, V_{GS}=0V
Reverse Recovery Time	t_{rr}		162		ns	I_S=4A, V_{GS}=0V di/dt = 100A/μs
Reverse Recovery Charge	Q_{rr}		1.2		μC	

■ Typical Electrical and Thermal Characteristics

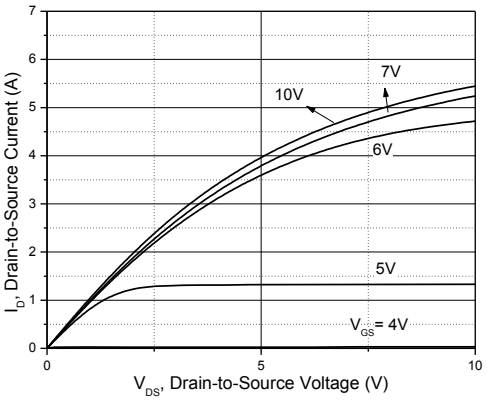


Figure 1. Typ. Output Characteristics

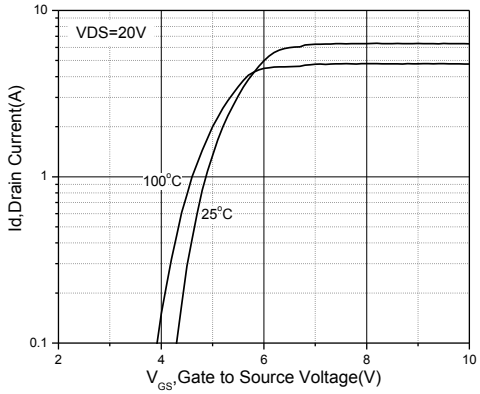


Figure 2. Transfer Characteristics

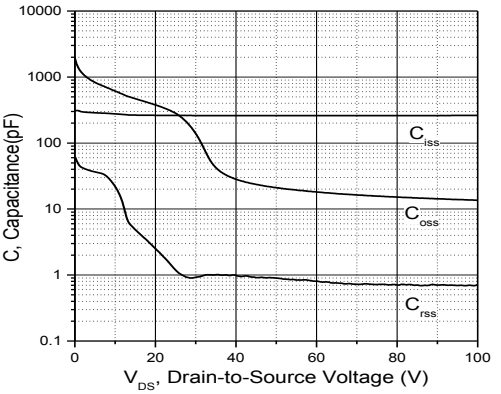


Figure 3. Typ. Capacitance

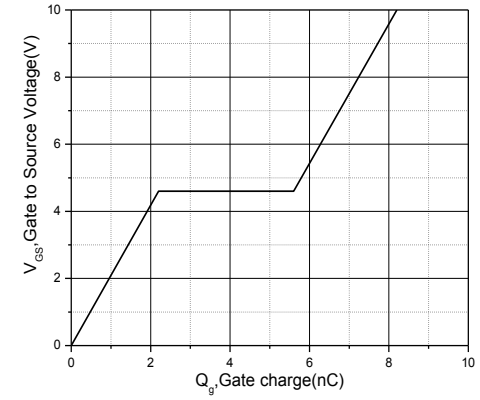


Figure 4. Gate Charge

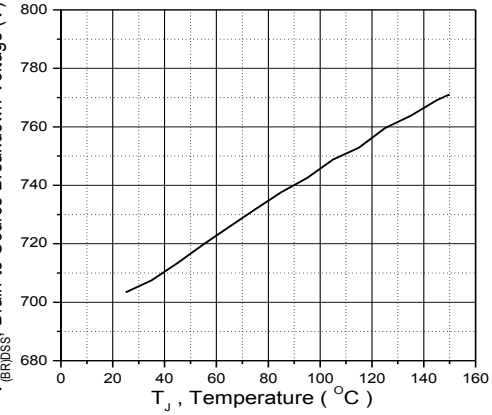


Figure 5. Drain-source breakdown voltage

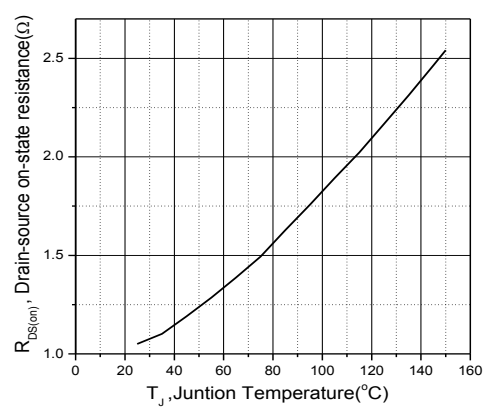


Figure 6. Drain-source on-resistance

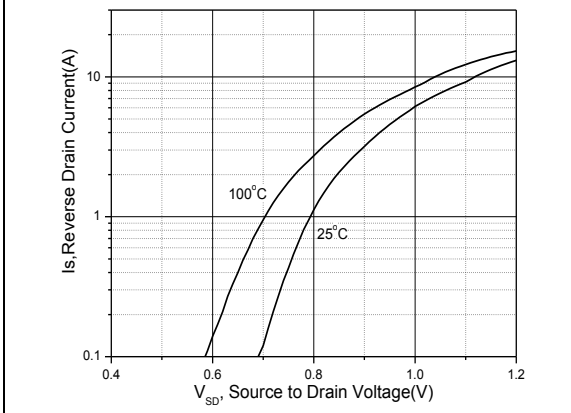


Figure 7. I_S-V_{SD}

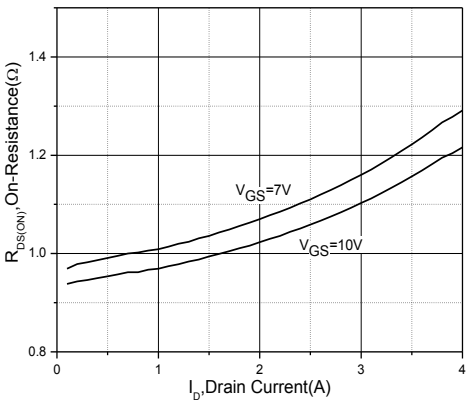


Figure 8. $R_{DS(ON)}$-I_D

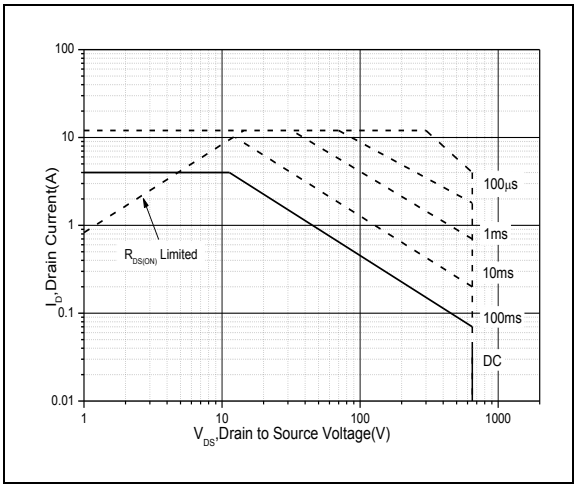


Figure 9. Safe Operation Area for TO251/TO252

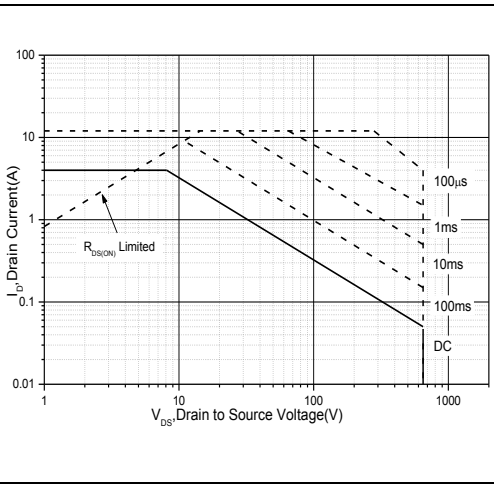


Figure 10. Safe Operation Area for TO220F

■ Test circuits and waveforms

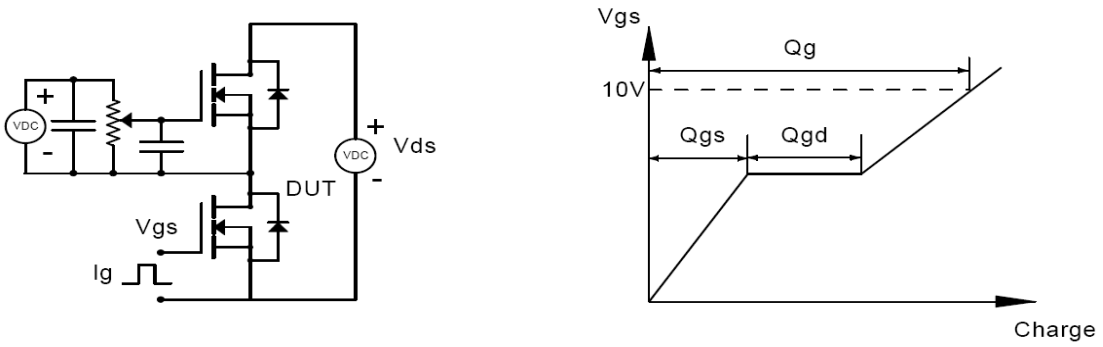


Figure 1: Gate Charge Test Circuit & Waveform

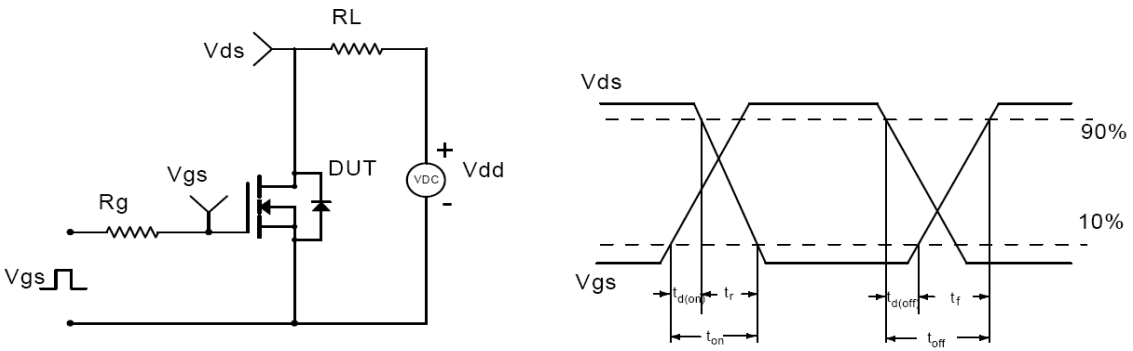


Figure 2: Resistive Switching Test Circuit & Waveforms

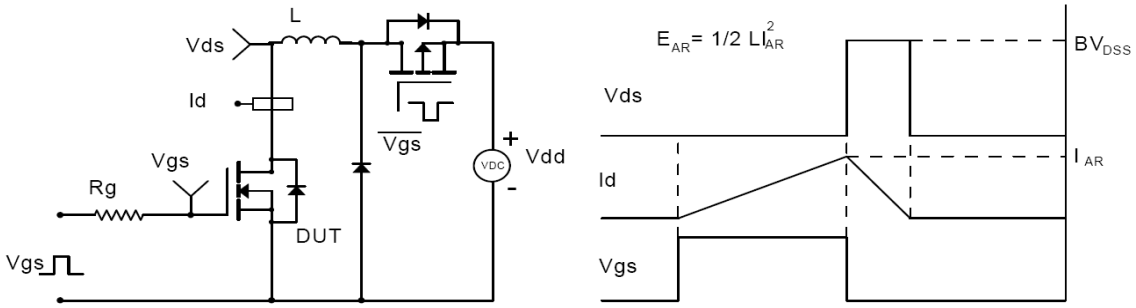


Figure 3: Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

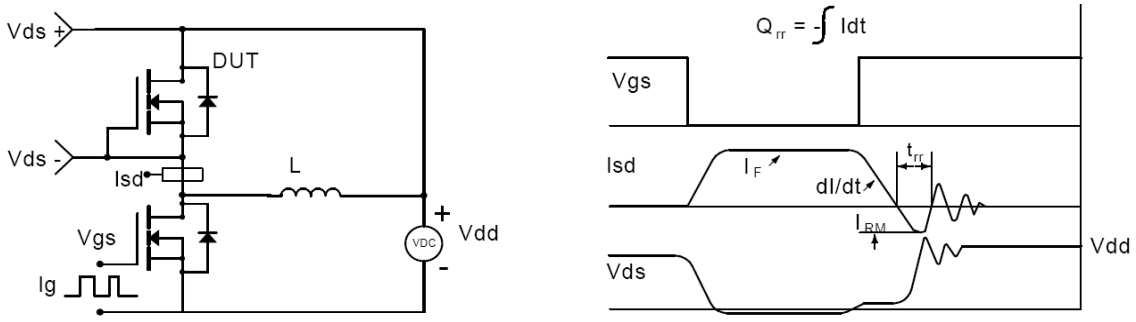
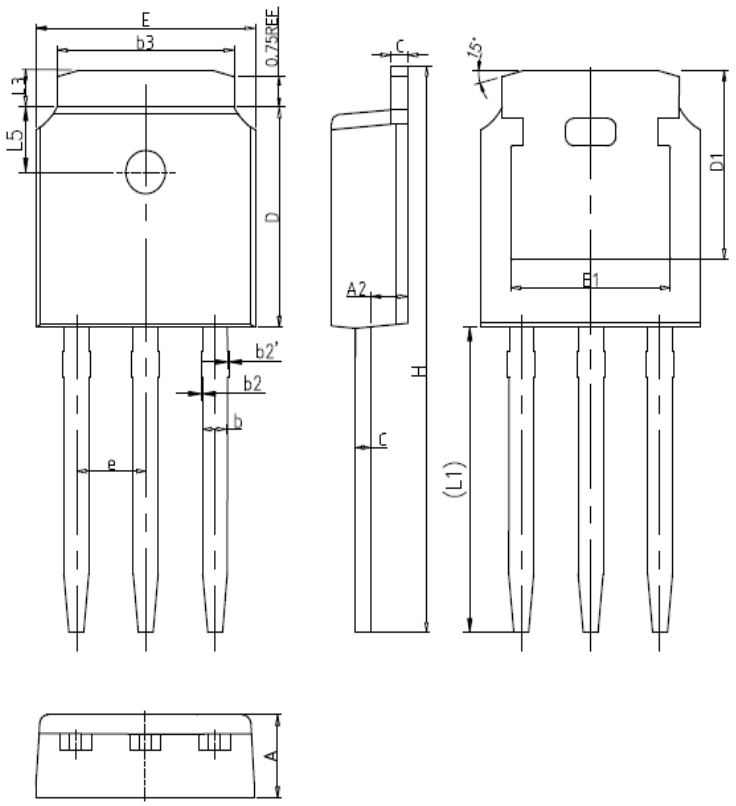


Figure 4: Diode Recovery Test Circuit & Waveforms

■ Package Information

Figure1

TO-251 PACKAGE OUTLINE DIMENSION

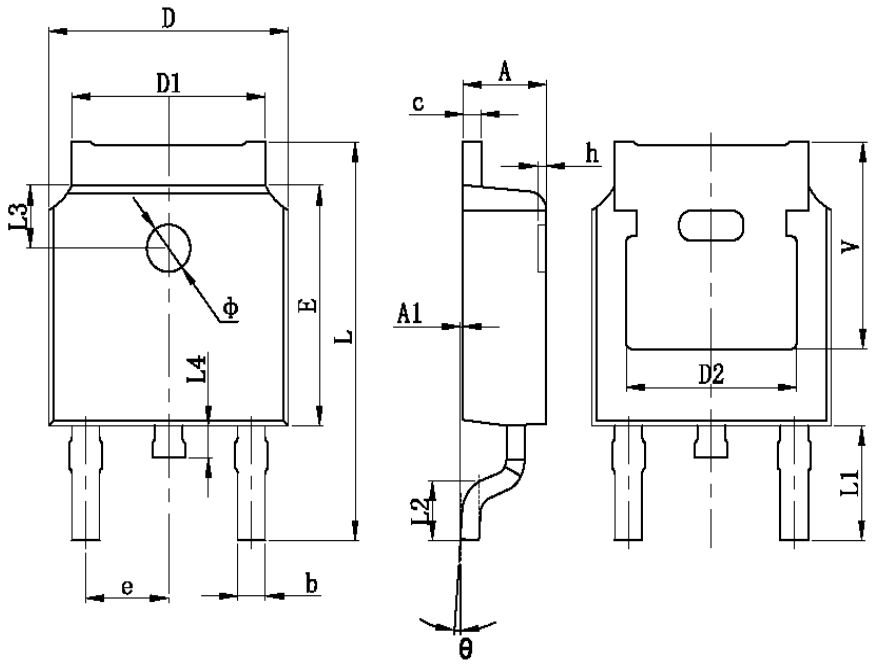


Symbol	Dimension In Millimeters			Dimension In Inches		
	Min	Nom	Max	Min	Nom	Max
A	2.200	2.300	2.400	0.087	0.091	0.094
A2	0.970	1.070	1.170	0.038	0.042	0.046
b	0.680	0.780	0.900	0.027	0.031	0.035
b2	0.000	0.040	0.100	0.000	0.002	0.004
b2'	0.000	0.040	0.100	0.000	0.002	0.004
b3	5.200	5.330	5.500	0.205	0.210	0.217
c	0.430	0.530	0.630	0.017	0.021	0.025
D	5.980	6.100	6.220	0.235	0.240	0.245
D1	5.300REF			0.209REF		
E	6.400	6.600	6.800	0.252	0.260	0.268
E1	4.630	-	-	0.182	-	-
e	2.286BSC			0.090BSC		
H	16.220	16.520	16.820	0.639	0.650	0.662
L1	9.150	9.400	9.650	0.360	0.370	0.380
L3	0.880	1.020	1.280	0.035	0.040	0.050
L5	1.650	1.800	1.950	0.065	0.071	0.077

■ Package Information

Figure2

TO-252 PACKAGE OUTLINE DIMENSION

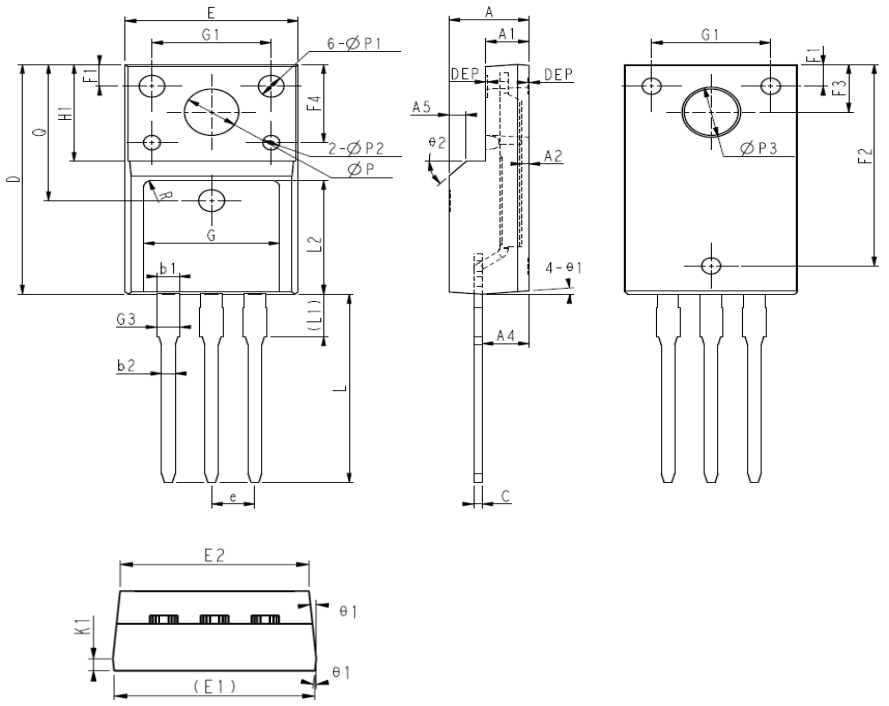


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 REF.		0.190 REF.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 REF.		0.114 REF.	
L2	1.400	1.700	0.055	0.067
L3	1.600 REF.		0.063 REF.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 REF.		0.211 REF.	

■ Package Information

Figure3

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	-

■ Ordering Information

Package	Units/Tape	Tapes/Inner Box	Units/Inner Box	Inner Box/Carton Box	Units/Carton Box
TO251	75	66	4950	6	29700
TO252 Option1	75	66	4950	6	29700
TO252 Option2	2500	2	5000	5	25000
TO220F	50	20	1000	6	6000

■ 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-to-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. Declared by design, not subject to production.
6. V_{DD}=50V, R_G=25Ω, L=20mH, Starting T_J=25°C.