

# Enhancement Mode N-Channel Power MOSFET

## Features

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

## Applications

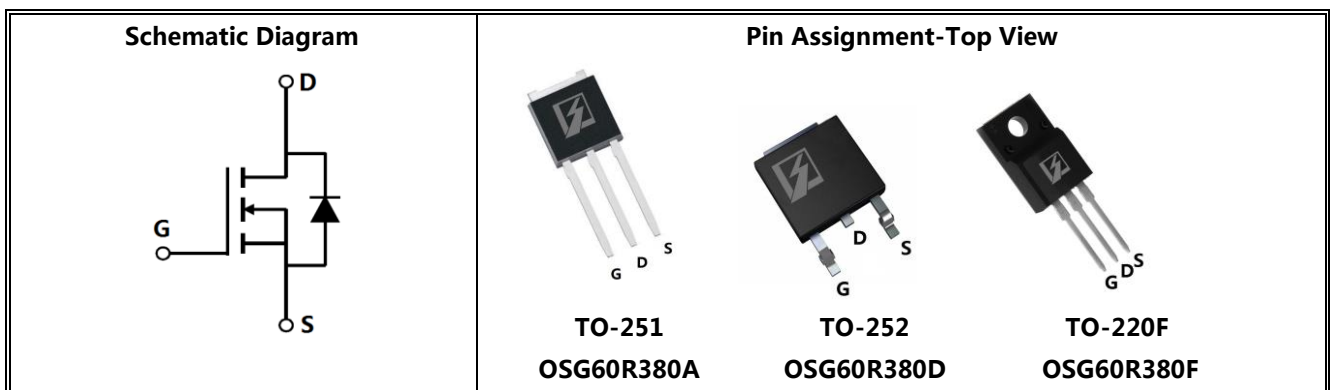
- ◆ Lighting
- ◆ Hard switching PWM
- ◆ Server power supply
- ◆ Adapter
- ◆ Telecom

## ■ General Description

OSG60R380x 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.

◆ $V_{DS@T_{jmax}}$	650V(min)
◆ $I_D$	11A
◆ $R_{DS(ON),@V_{GS}=10V}$	0.38Ω(max)

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



## ■ Absolute Maximum Ratings ( $T_A=25^{\circ}C$ unless otherwise noted )

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DS}$	600	V
Gate-Source Voltage	$V_{GS}$	±30	V
Drain Current-Continuous <sup>(Note 1)</sup>	$I_D$	11	A
Drain Current- Pulsed <sup>(Note 2)</sup>	$I_{DM}$	33	A
Power Dissipation <sup>(Note 3)</sup> for TO-251,TO-252	$P_D$	83	W
Power Dissipation <sup>(Note 3)</sup> for TO-220F		31	
Single Pulsed-Avalanche Energy <sup>(Note 6)</sup>	$E_{AS}$	272	mJ
Operation and Storage Junction Temperature	$T_{STG}, T_J$	-55 to 150	°C

## ■ Thermal Characteristics

Parameter	Symbol	Value		Unit
		TO251/TO252	TO220F	
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.5	4	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient (Note 4)	$R_{\theta JA}$	62	62.5	$^{\circ}\text{C}/\text{W}$

## ■ Electrical Characteristics ( $T_A=25^{\circ}\text{C}$ unless otherwise noted )

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Drain-Source Breakdown Voltage	$BV_{DSS}$	600			V	$V_{GS}=0\text{V}, I_D=250\mu\text{A}$
		650	746			$V_{GS}=0\text{V}, I_D=250\mu\text{A}, T_j=150^{\circ}\text{C}$
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	$R_{DS(on)}$		0.31	0.38	$\Omega$	$V_{GS}=10\text{V}, I_D=5.5\text{A}$
			0.83			$V_{GS}=10\text{V}, I_D=5.5\text{A}, T_j=150^{\circ}\text{C}$
Gate-Source Leakage Current	$I_{GSS}$			100	nA	$V_{GS}=30\text{V}$
				-100		$V_{GS}=-30\text{V}$
Drain-to-Source leakage current	$I_{DSS}$			1	$\mu\text{A}$	$V_{DS}=600\text{V}, V_{GS}=0\text{V}$

## ■ Dynamic Characteristics

Input Capacitance	$C_{iss}$		690		pF	$V_{GS}=0\text{V}, V_{DS}=50\text{V}, f=1\text{MHZ}$
Output Capacitance	$C_{oss}$		57		pF	
Reverse Transfer Capacitance	$C_{rss}$		2.47		pF	
Turn-on Delay Time	$t_{d(on)}$		26		ns	$V_{GS}=10\text{V}, V_{DS}=380\text{V}, R_G=25\Omega, I_D=11\text{A}$
Turn-on Rise Time	$t_r$		28.3		ns	
Turn-Off Delay Time	$t_{d(off)}$		34		ns	
Turn-Off Fall Time	$t_f$		33.2		ns	

## ■ Gate Charge Characteristics

Total Gate Charge	$Q_g$		13		nC	$I_D = 11A,$ $V_{DS} = 480V,$ $V_{GS} = 10V$
Gate-Source Charge	$Q_{gs}$		3.6		nC	
Gate-Drain Charge	$Q_{gd}$		5.6		nC	

## ■ Body Diode Characteristics

Body-diode Forward Current <sup>(NOTE 2)</sup>	$I_S$			11	A	$V_{GS} < V_{th}$
Pulsed Source Current	$I_{SP}$			33		
Inverse Diode Forward Voltage	$V_{SD}$			1.4	V	$I_S = 11A, V_{GS} = 0V$
Reverse Recovery Time	$t_{rr}$		266		ns	$I_S = 11A, V_{GS} = 0V$
Reverse Recovery Charge	$Q_{rr}$		2.8		$\mu C$	$di/dt = 100A/\mu s$

■ Typical Electrical and Thermal Characteristics

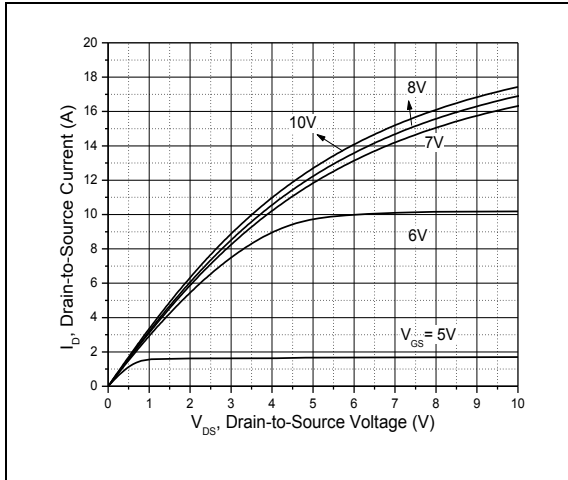


Figure 1. Typ. Output Characteristics

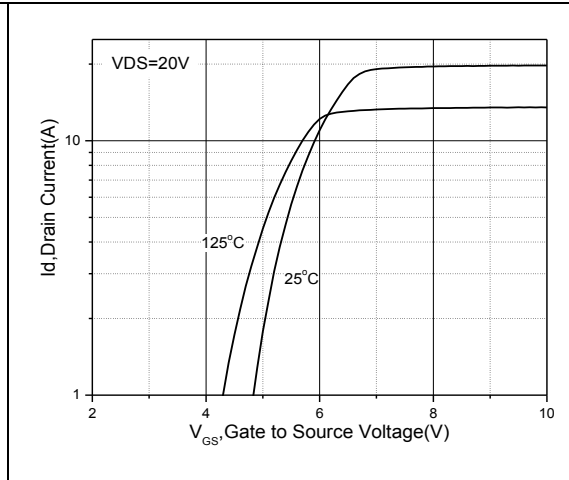


Figure 2. Transfer Characteristics

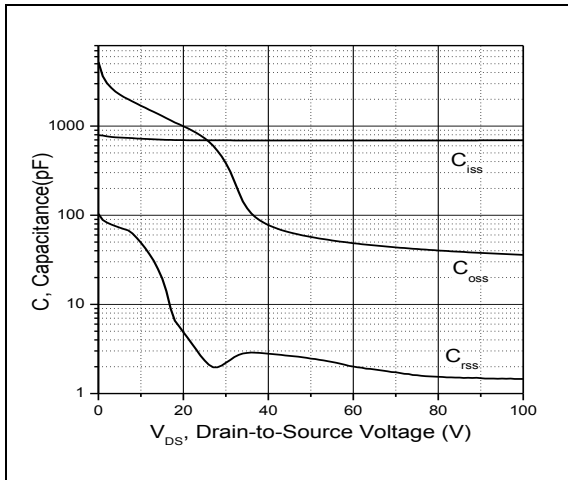


Figure 3. Typ. Capacitance

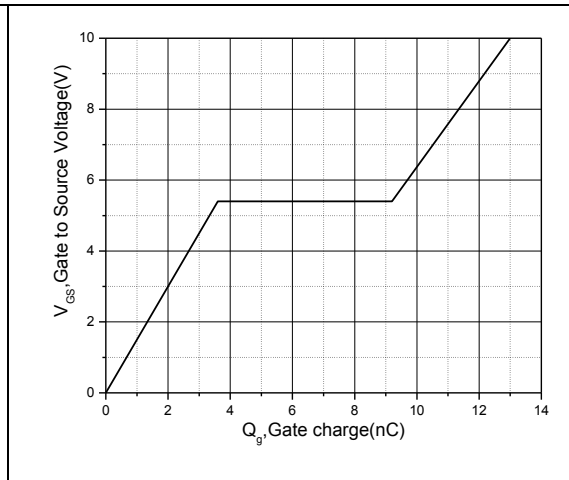


Figure 4. Gate Charge

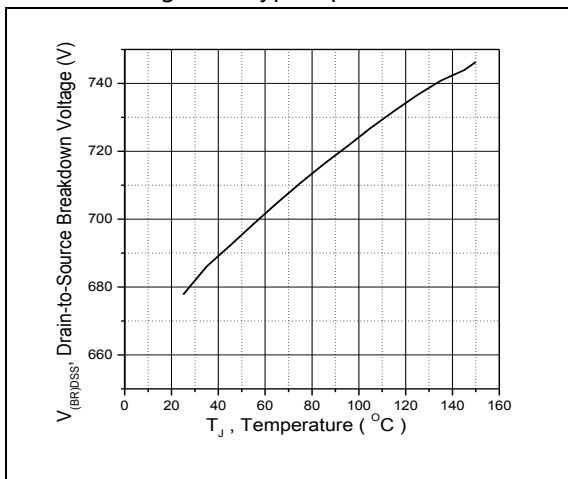


Figure 5. Drain-source breakdown voltage

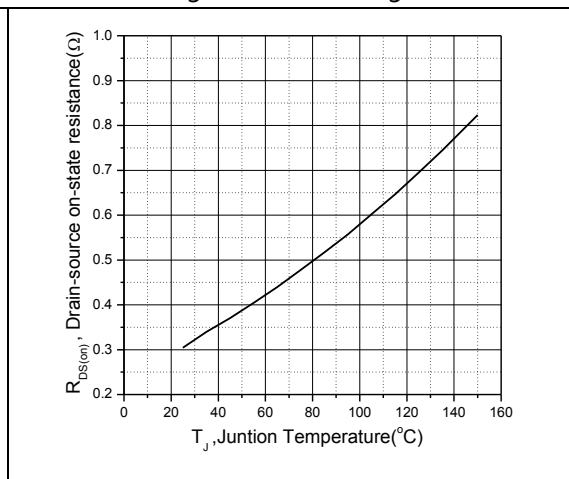


Figure 6. Drain-source on-resistance

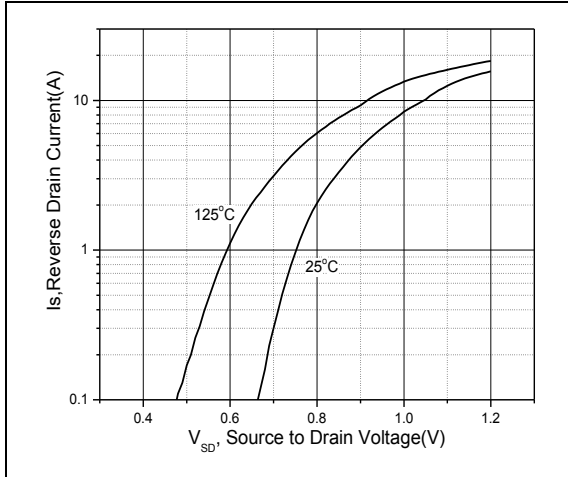


Figure 7.  $I_S$ - $V_{SD}$

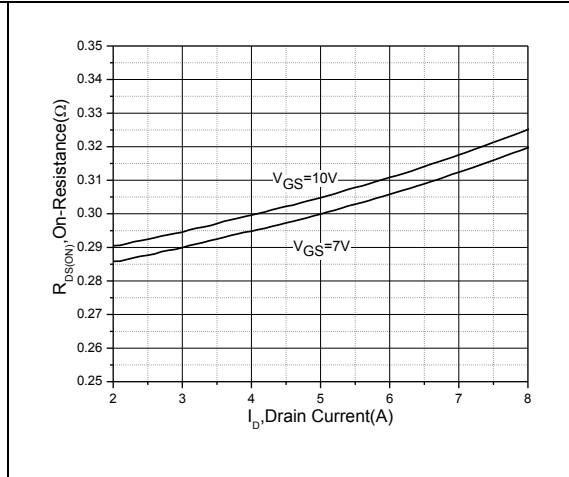


Figure 8.  $R_{DS(ON)}$ - $I_D$

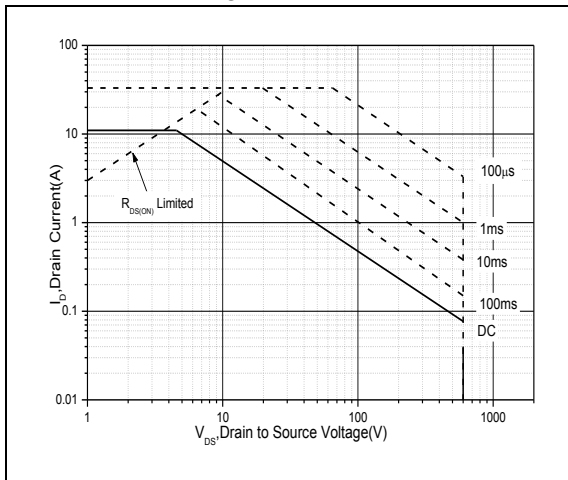


Figure 9. Safe Operation Area for TO251/TO252

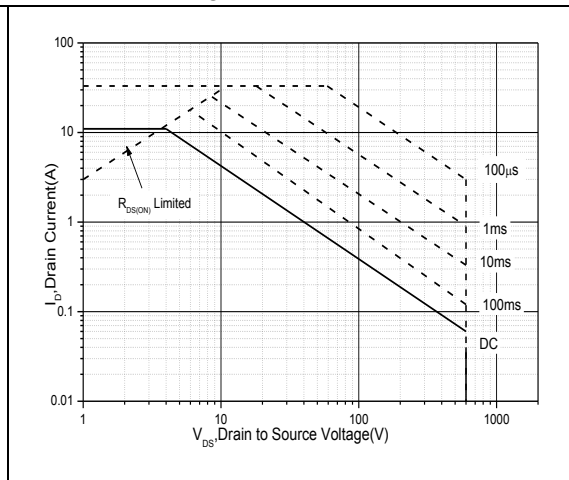


Figure 10. Safe Operation Area for TO220F

■ Test circuits and waveforms

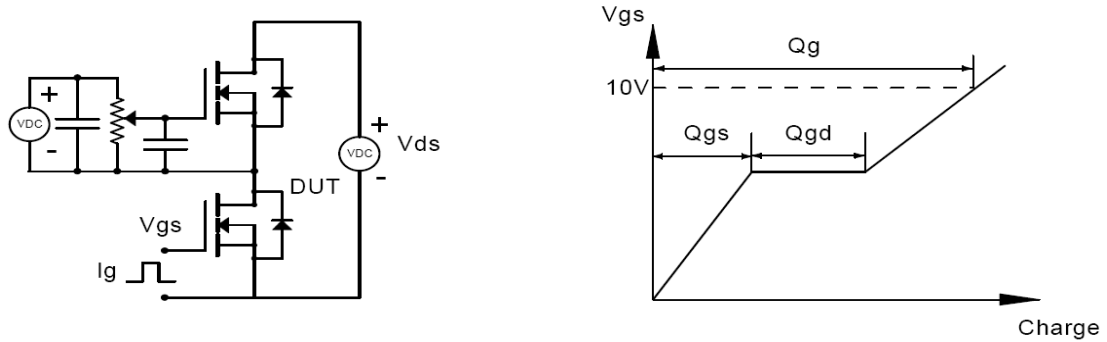


Figure 1: Gate Charge Test Circuit & Waveform

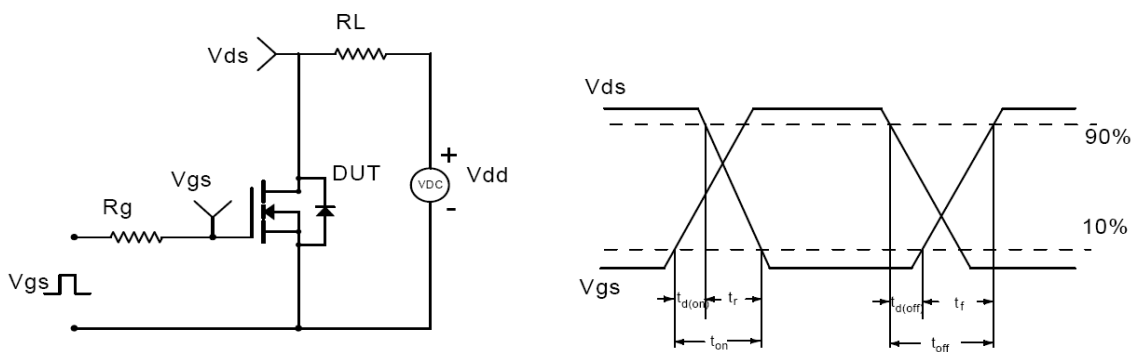


Figure 2: Resistive Switching Test Circuit & Waveforms

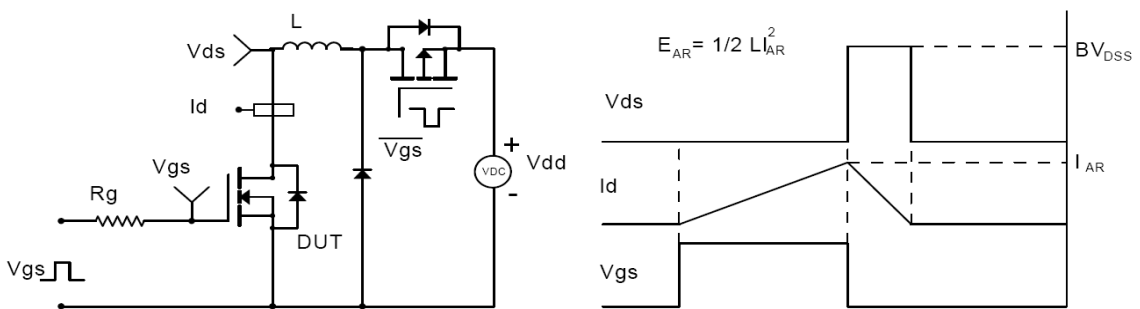


Figure 3: Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

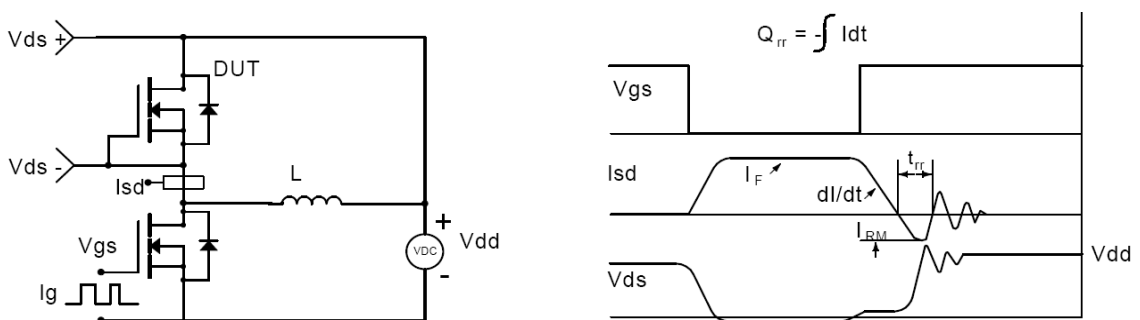
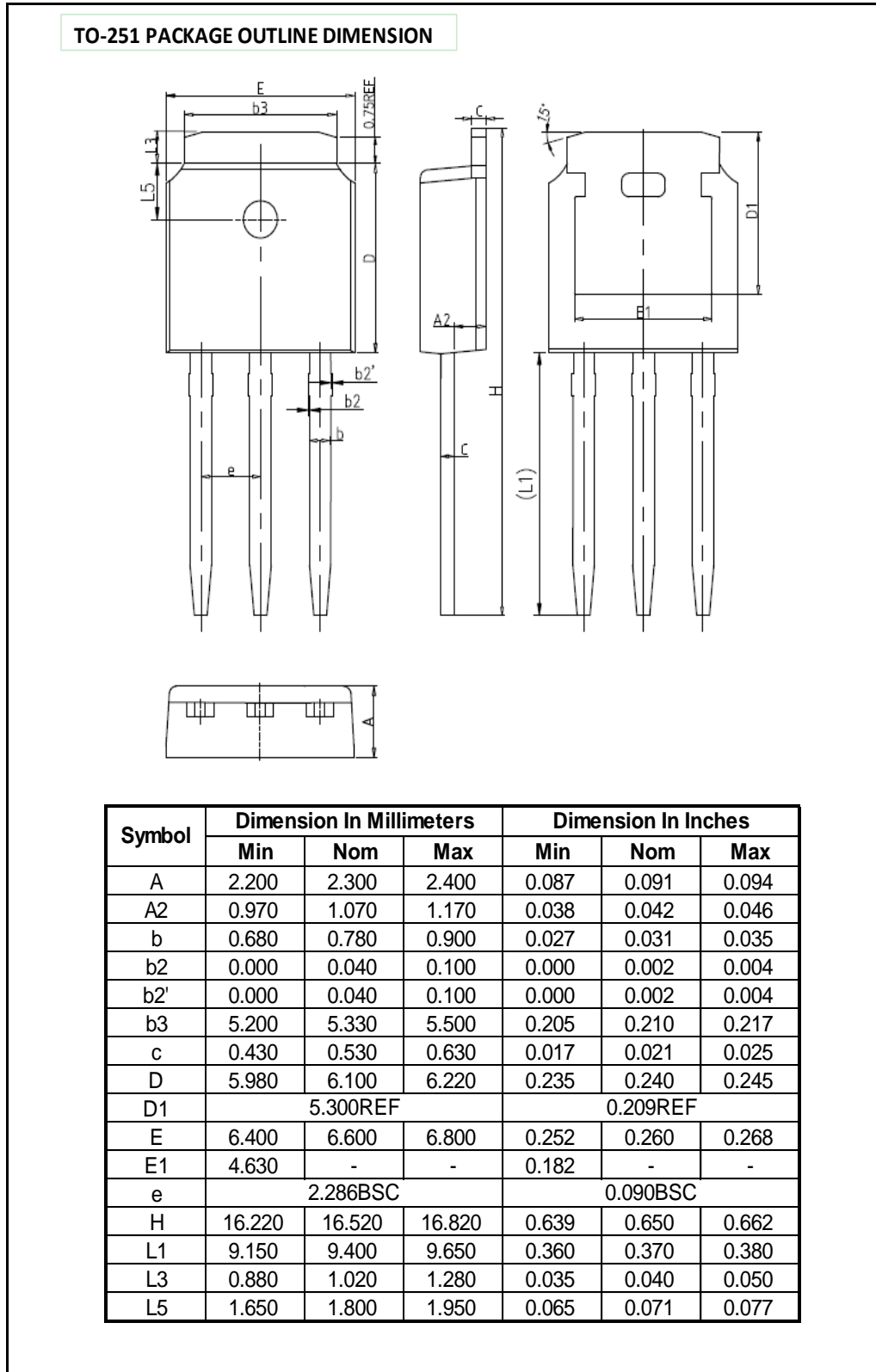


Figure 4: Diode Recovery Test Circuit & Waveforms

**■ Package Information**

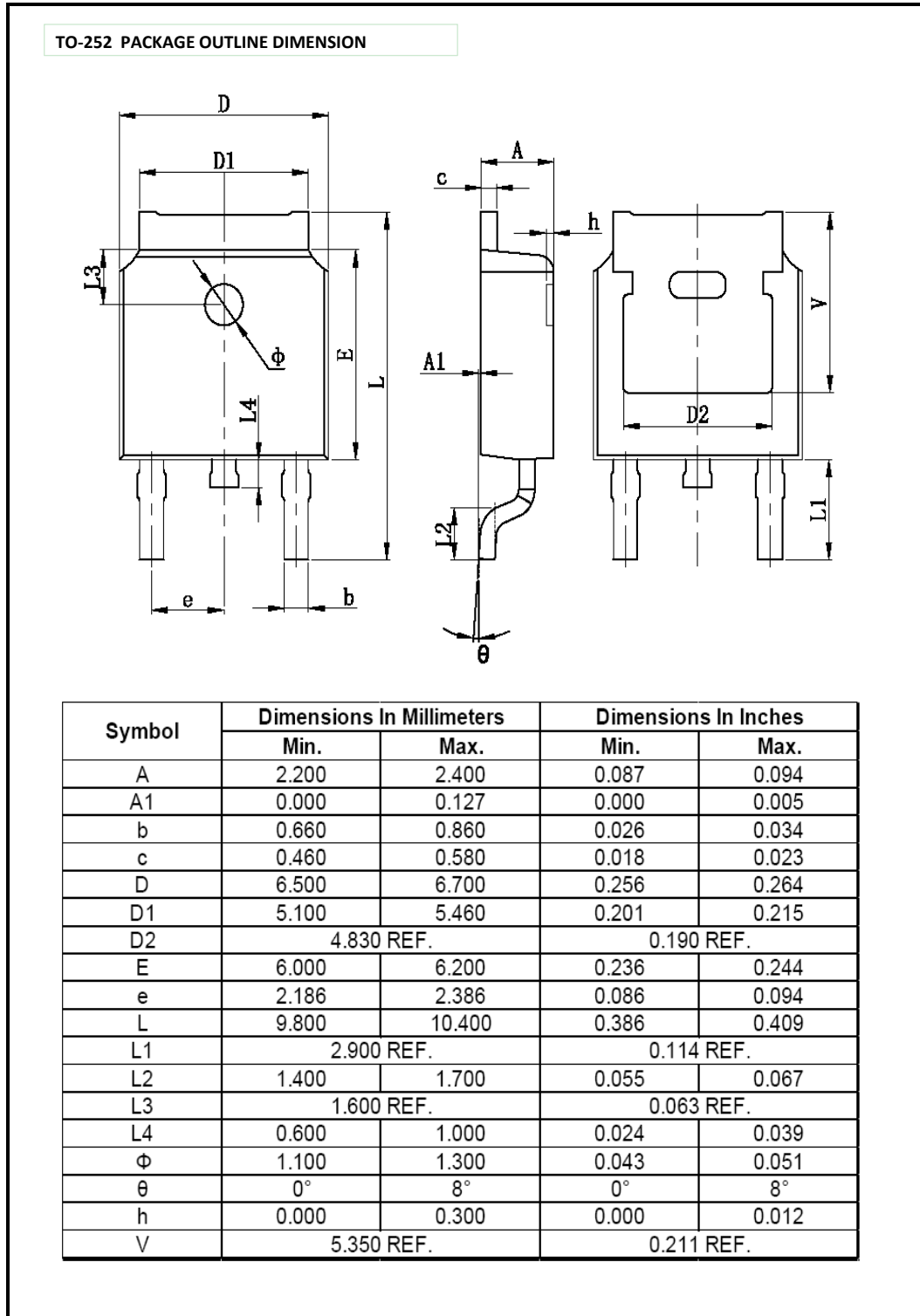
Figure1





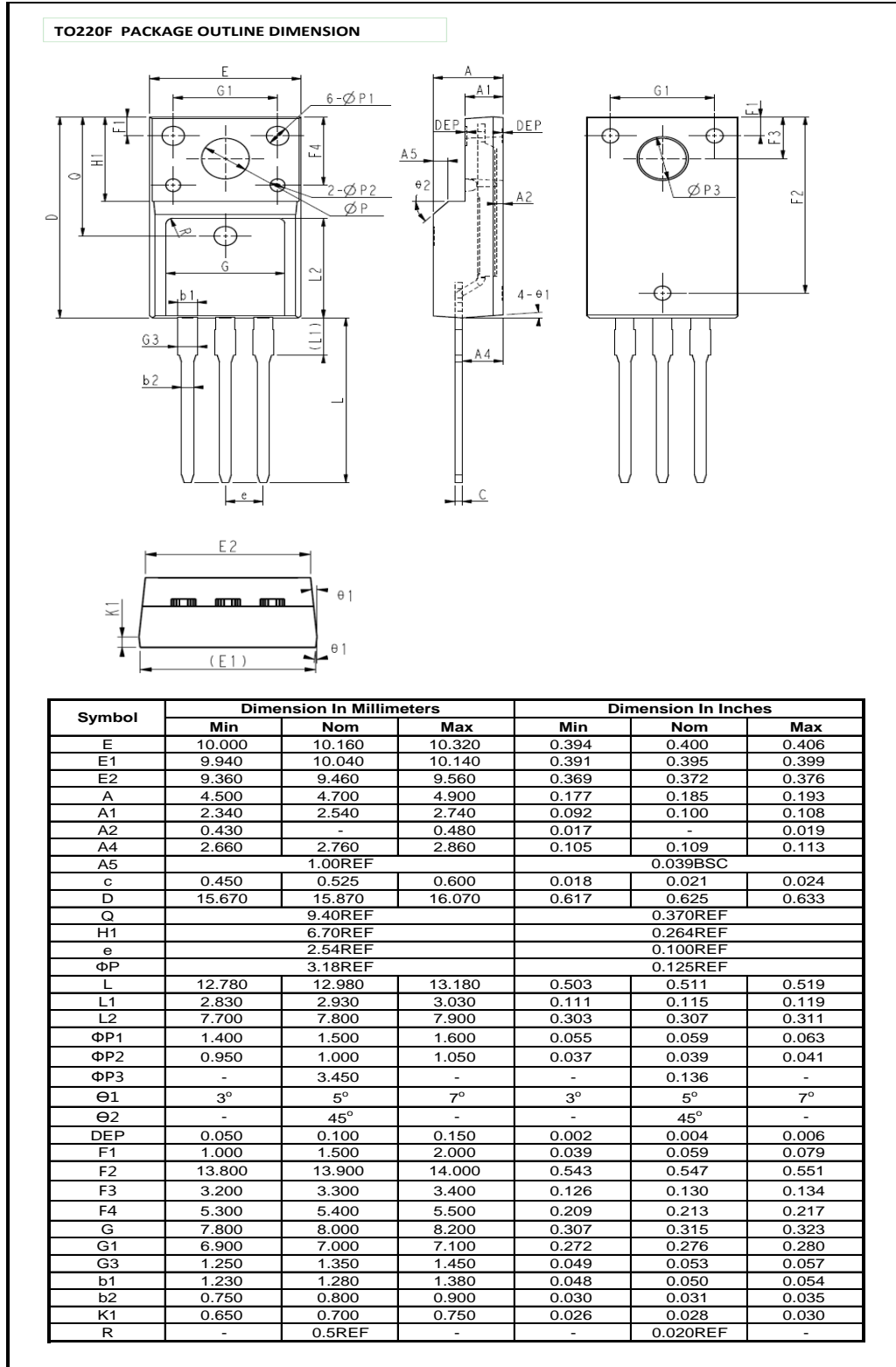
**■ Package Information**

Figure2



**■ Package Information**

Figure3



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## ■ Ordering Information

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

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## ■ Note

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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  $T_A = 25^\circ\text{C}$ .
5. Declared by design, not subject to production.
6.  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ ,  $L = 10.8\text{mH}$ , Starting  $T_J = 25^\circ\text{C}$ .