

# 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

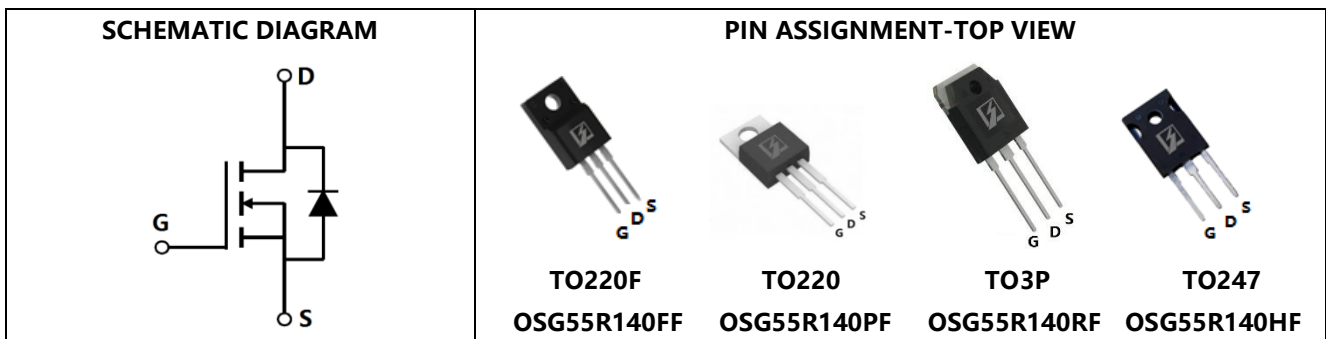


## General Description

OSG55R140xF 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.

◆ $V_{DS, min@T_{jmax}}$	600 V
◆ $I_{D, pulse}$	69 A
◆ $R_{DS(ON), max @ V_{GS}=10 V}$	140 mΩ
◆ $Q_g$	24.1 nC

## Schematic and Package Information



## Absolute Maximum Ratings at $T_j=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Value	Unit
Drain source voltage	$V_{DS}$	550	V
Gate source voltage	$V_{GS}$	$\pm 30$	V
Continuous drain current <sup>1)</sup> , $T_C=25^\circ\text{C}$	$I_D$	23	A
Continuous drain current <sup>1)</sup> , $T_C=100^\circ\text{C}$		14.5	
Pulsed drain current <sup>2)</sup> , $T_C=25^\circ\text{C}$	$I_{D, pulse}$	69	A
Power dissipation <sup>3)</sup> for TO220, TO3P, TO247, $T_C=25^\circ\text{C}$	$P_D$	151	W
Power dissipation <sup>3)</sup> for TO220F, $T_C=25^\circ\text{C}$		59.5	
Single pulsed avalanche energy <sup>4)</sup>	$E_{AS}$	330	mJ
MOSFET dv/dt ruggedness, $V_{DS}=0\text{...}400\text{ V}$	dv/dt	50	V/ns
Reverse diode dv/dt, $V_{DS}=0\text{...}400\text{ V}$ , $I_{SD}\leq I_D$	dv/dt	15	V/ns
Operation and storage temperature	$T_{stg}, T_j$	-55 to 150	$^\circ\text{C}$

## ■ Thermal Characteristics

Parameter	Symbol	Value		Unit
		TO220/TO3P/TO247	TO220F	
Thermal resistance, junction-case	$R_{\theta JC}$	0.82	2.1	$^{\circ}\text{C}/\text{W}$
Thermal resistance, junction-ambient	$R_{\theta JA}$	62	62.5	$^{\circ}\text{C}/\text{W}$

## ■ Electrical Characteristics at $T_j=25^{\circ}\text{C}$ unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Drain-source breakdown voltage	$BV_{DSS}$	550			V	$V_{GS}=0\text{ V}, I_D=250\ \mu\text{A}$
		600	670			$V_{GS}=0\text{ V}, I_D=250\ \mu\text{A}, T_j=150^{\circ}\text{C}$
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	$R_{DS(on)}$		0.11	0.14	$\Omega$	$V_{GS}=10\text{ V}, I_D=11.5\text{ A}$
			0.34			$V_{GS}=10\text{ V}, I_D=11.5\text{ A}, T_j=150^{\circ}\text{C}$
Gate-source leakage current	$I_{GSS}$			100	nA	$V_{GS}=30\text{ V}$
				-100		$V_{GS}=-30\text{ V}$
Drain-source leakage current	$I_{DSS}$			1	$\mu\text{A}$	$V_{DS}=550\text{ V}, V_{GS}=0\text{ V}$

## ■ Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Input capacitance	$C_{iss}$		1408.8		pF	$V_{GS}=0\text{ V}, V_{DS}=50\text{ V}, f=1\text{ MHz}$
Output capacitance	$C_{oss}$		151.2		pF	
Reverse transfer capacitance	$C_{rss}$		4.14		pF	
Turn-on delay time	$t_{d(on)}$		40.5		ns	$V_{GS}=10\text{ V}, V_{DS}=420\text{ V}, R_G=25\ \Omega, I_D=23\text{ A}$
Rise time	$t_r$		73.5		ns	
Turn-off delay time	$t_{d(off)}$		63.6		ns	
Fall time	$t_f$		73.5		ns	



## ■ Gate Charge Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Total gate charge	$Q_g$		24.1		nC	$I_D=23\text{ A}$ , $V_{DS}=420\text{ V}$ , $V_{GS}=10\text{ V}$
Gate-source charge	$Q_{gs}$		9		nC	
Gate-drain charge	$Q_{gd}$		7.4		nC	
Gate plateau voltage	$V_{\text{plateau}}$		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	$I_S=23\text{ A}$ , $V_{GS}=0\text{ V}$
Reverse recovery time	$t_{rr}$		372		ns	$I_S=23\text{ A}$ , $di/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	$Q_{rr}$		5.1		$\mu\text{C}$	
Peak reverse recovery current	$I_{rrm}$		25.6		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)  $V_{DD}=100\text{ V}$ ,  $R_G=25\ \Omega$ ,  $L=80\text{ mH}$ , starting  $T_J=25\text{ }^\circ\text{C}$ .



## ■ Electrical Characteristics Diagrams

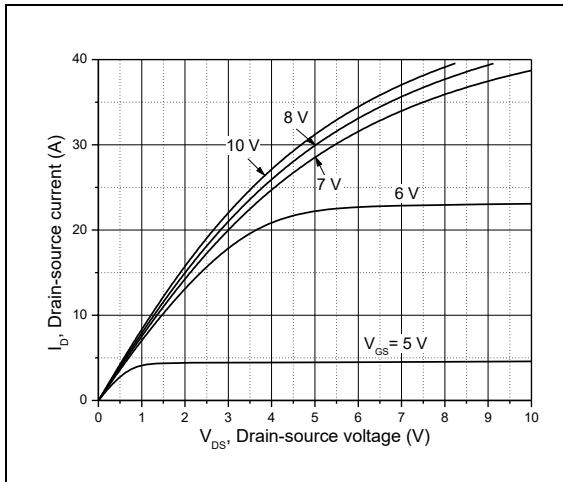


Figure 1, Typ. output characteristics

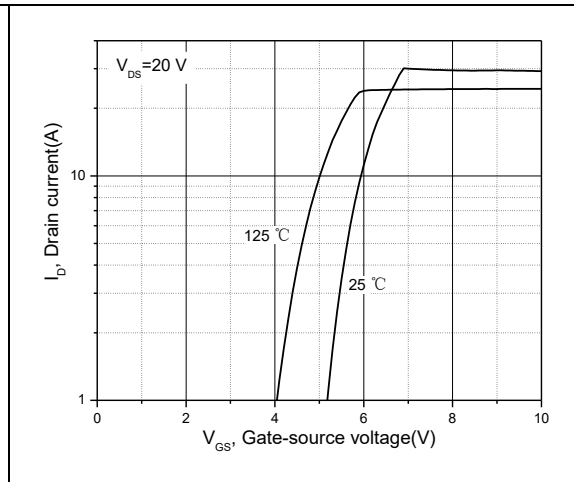


Figure 2, Typ. transfer characteristics

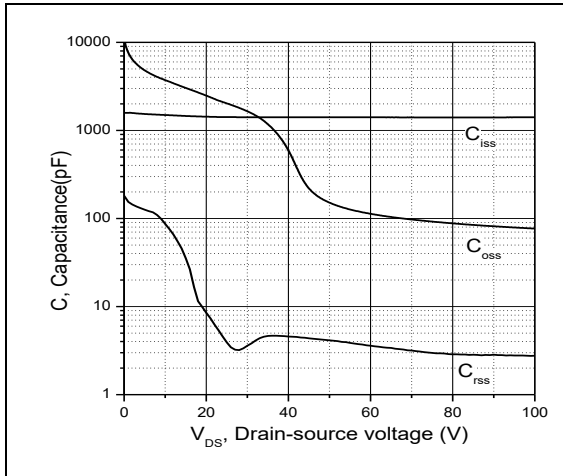


Figure 3, Typ. capacitances

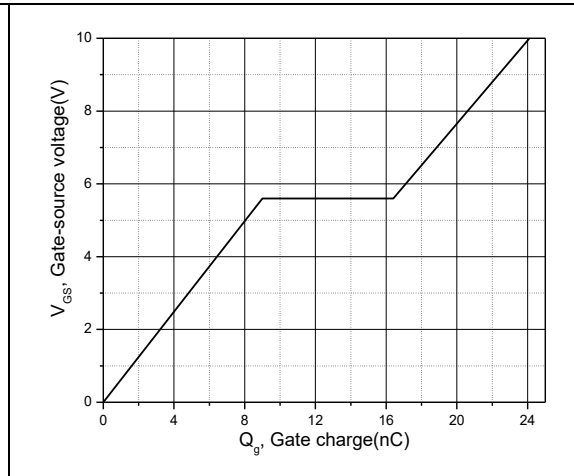


Figure 4, Typ. gate charge

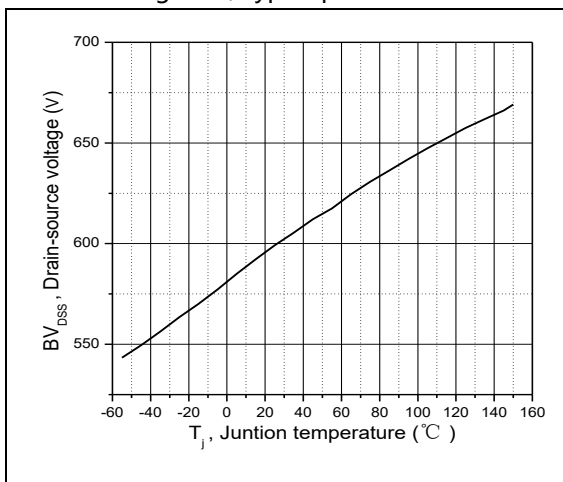


Figure 5, Drain-source breakdown voltage

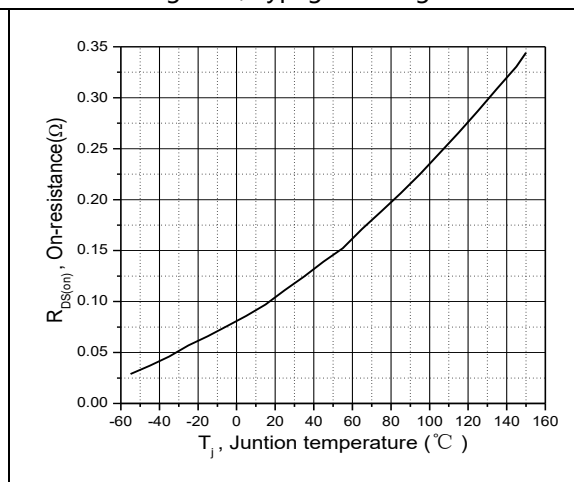


Figure 6, Drain-source on-state resistance

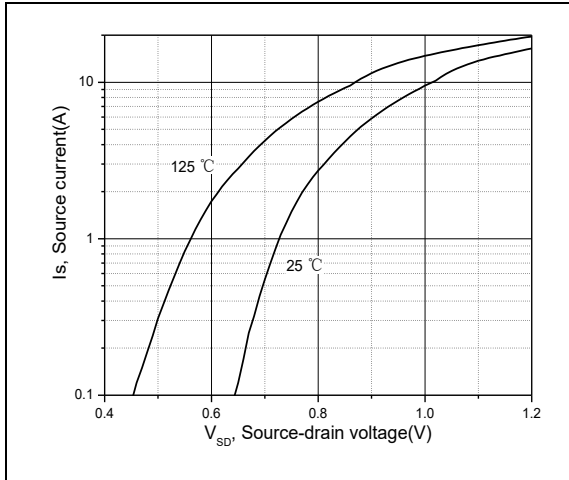


Figure 7, Forward characteristic of body diode

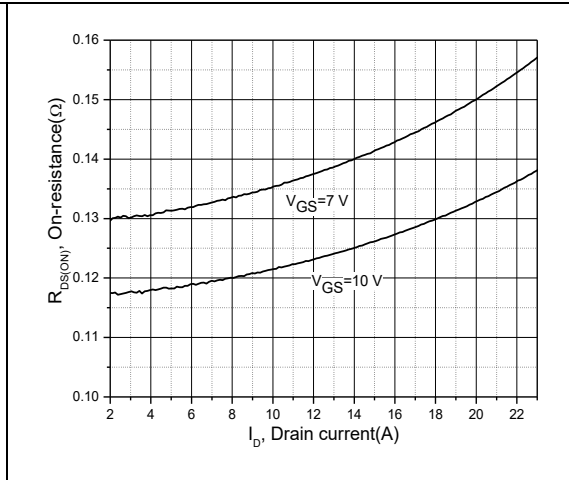


Figure 8, Drain-source on-state resistance

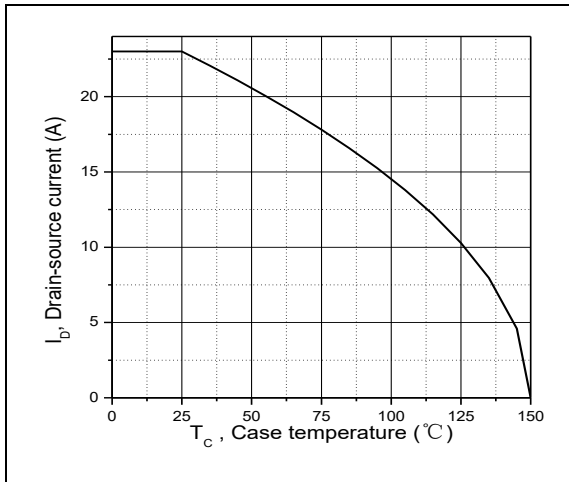


Figure 9, Drain current

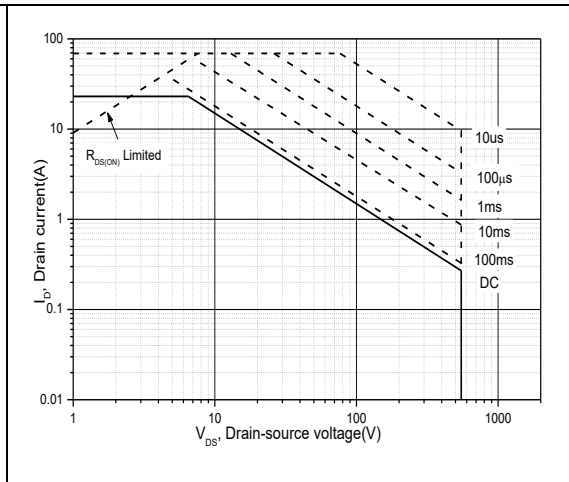


Figure 10, Safe operation area for TO220/TO3P/TO247  $T_C=25\text{ }^\circ\text{C}$

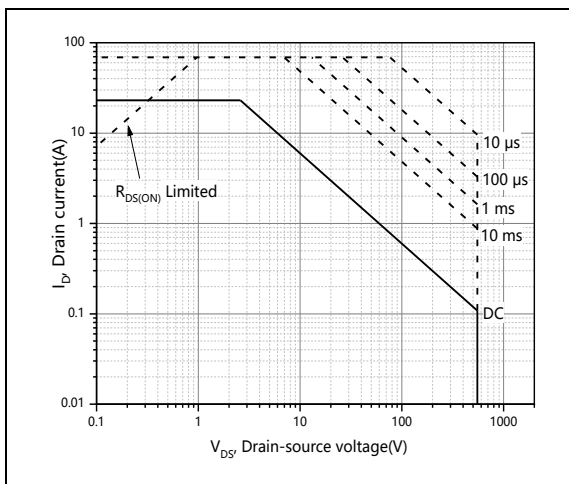


Figure 11, Safe operation area for TO220F  $T_C=25\text{ }^\circ\text{C}$



■ Test circuits and waveforms

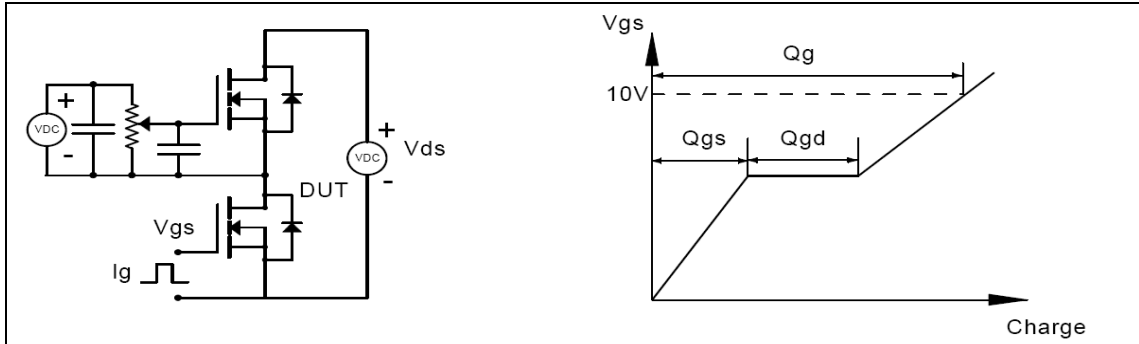


Figure 1, Gate charge test circuit & waveform

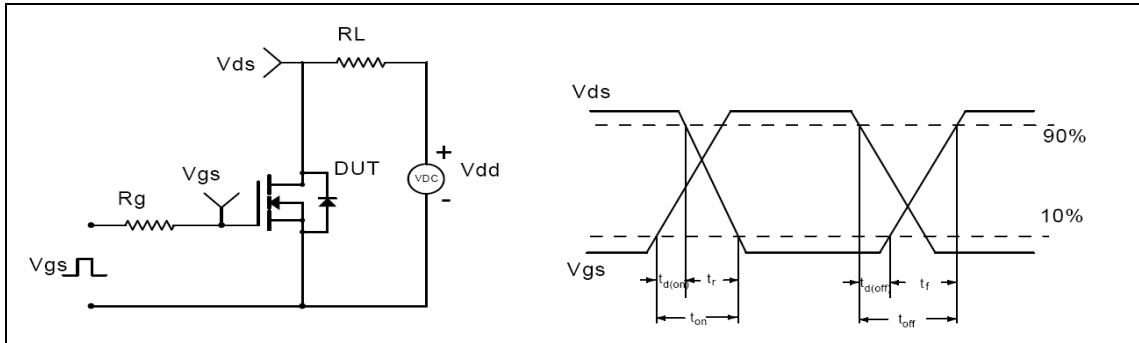


Figure 2, Switching time test circuit & waveforms

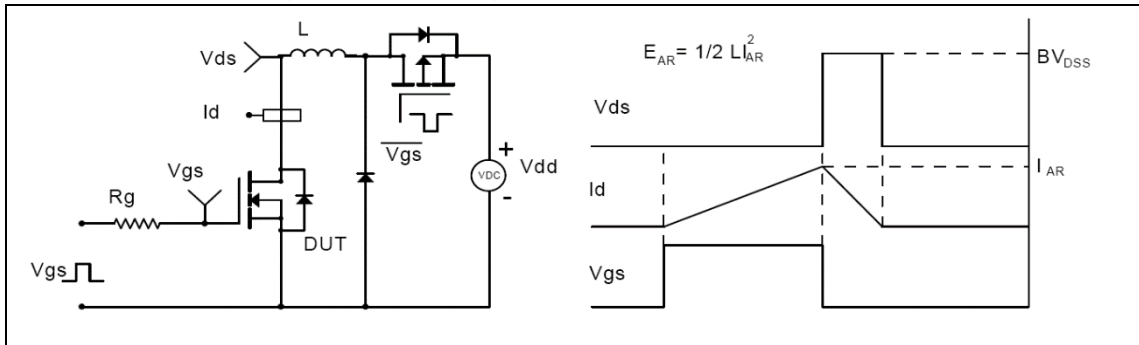


Figure 3, Unclamped inductive switching (UIS) test circuit & waveforms

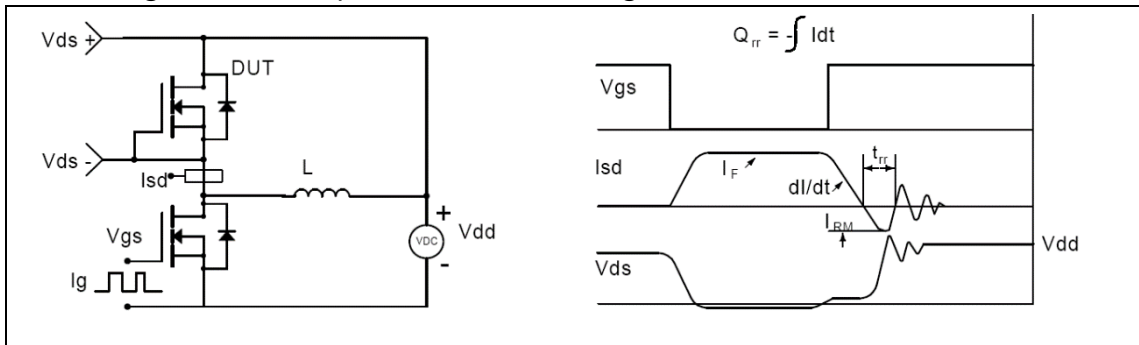
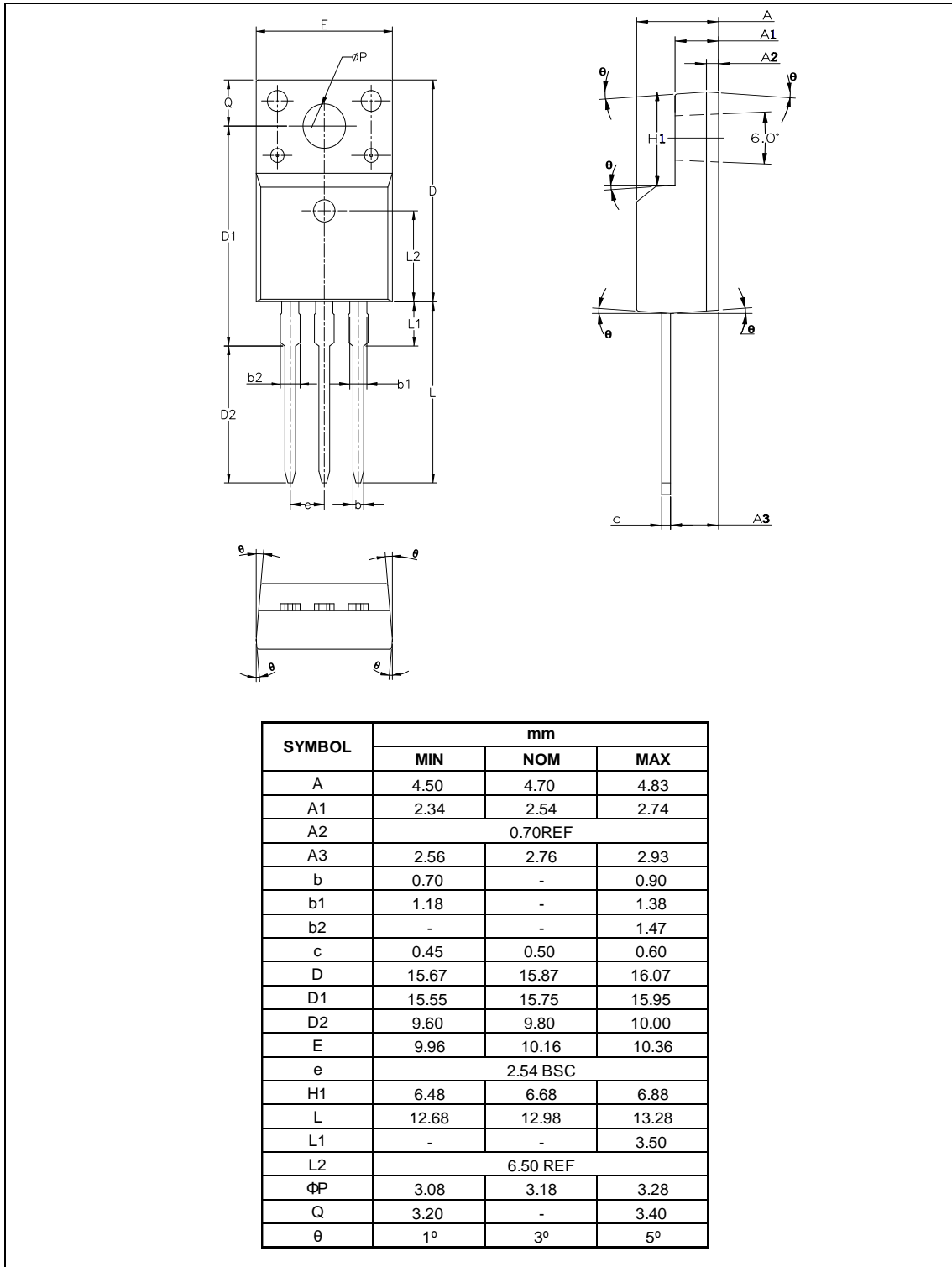


Figure 4, Diode reverse recovery test circuit & waveforms



■ Package Information

Figure1, TO220F package outline dimension

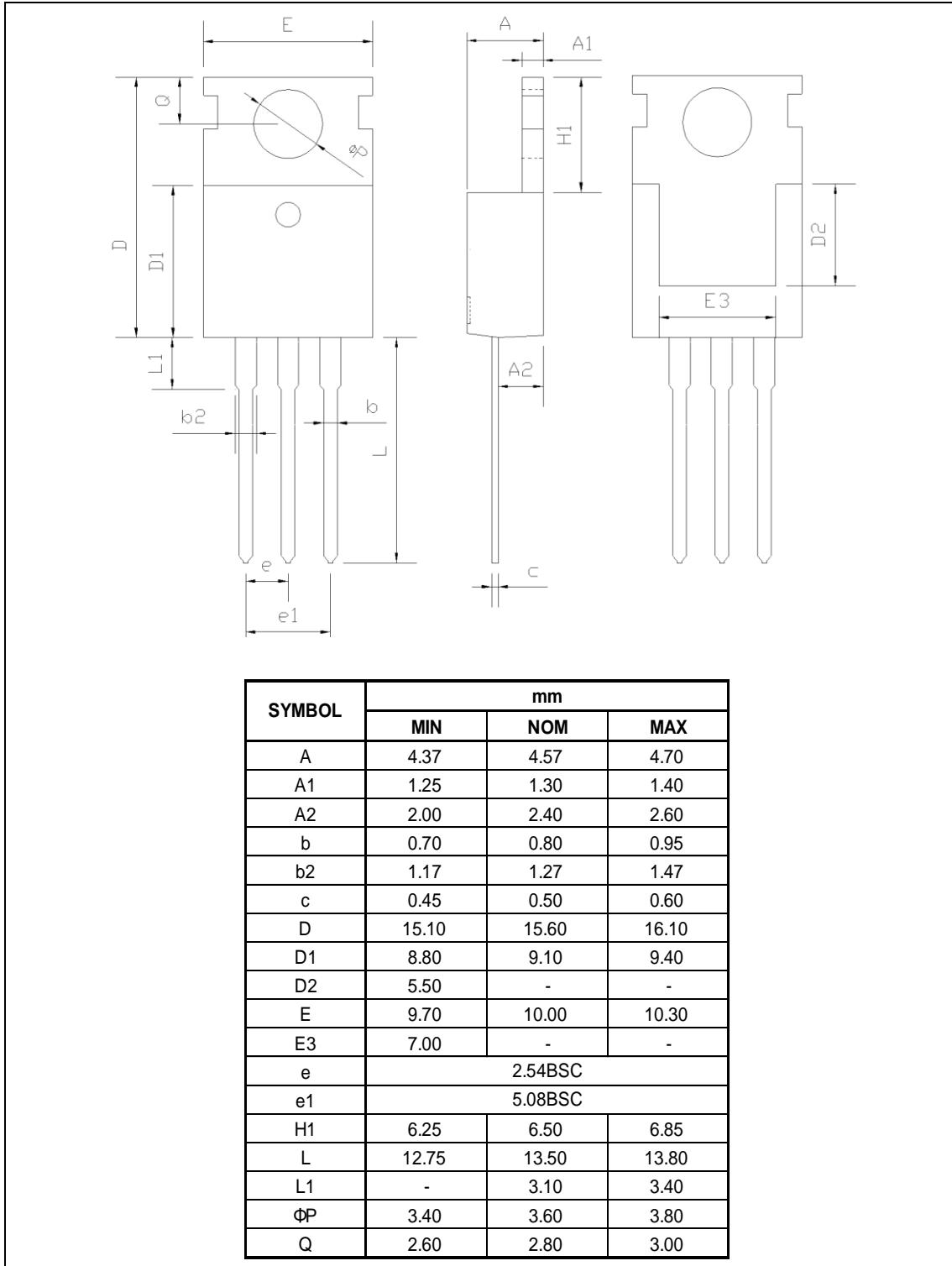






■ Package Information

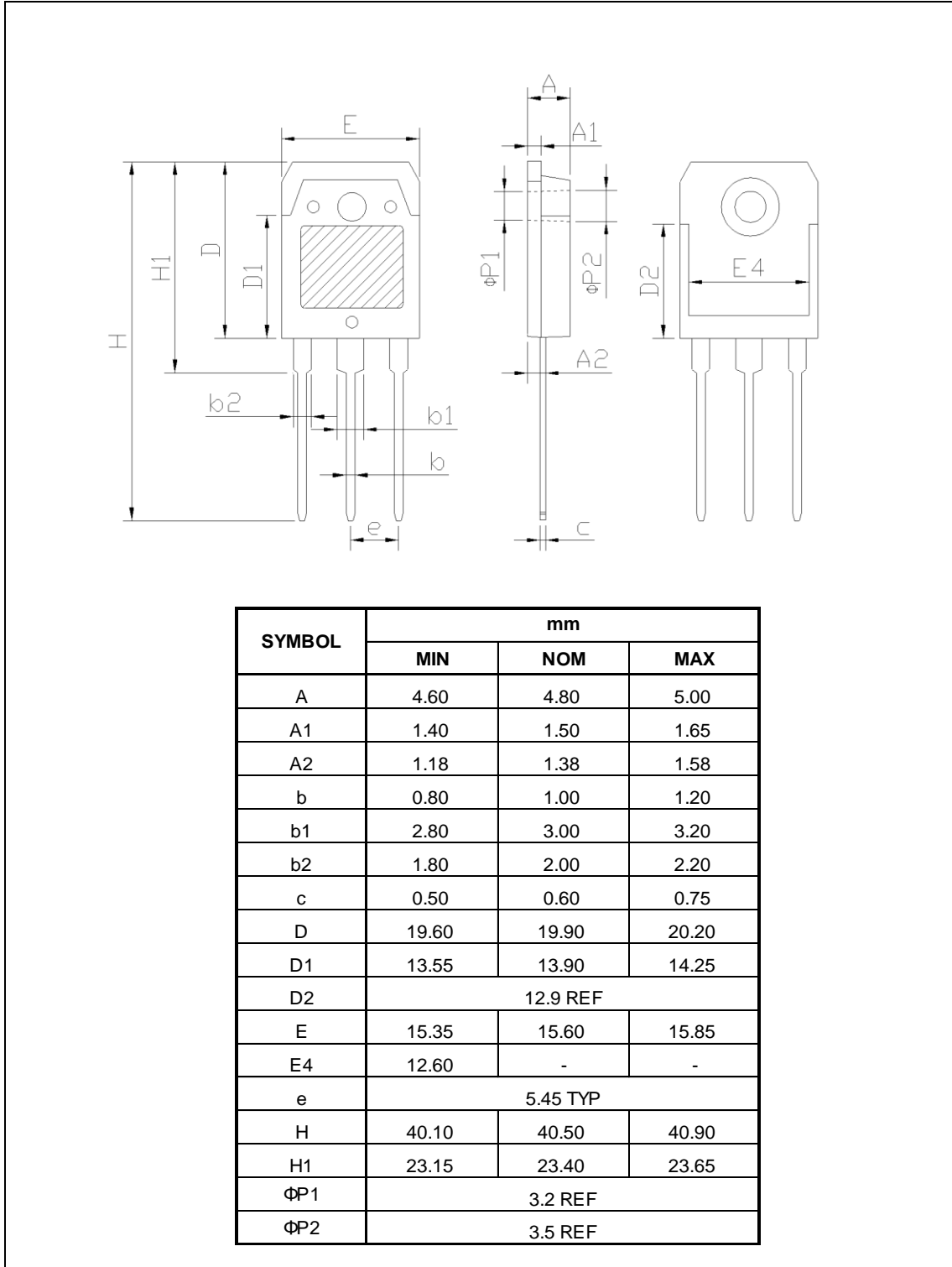
Figure2, TO220 package outline dimension





## ■ Package Information

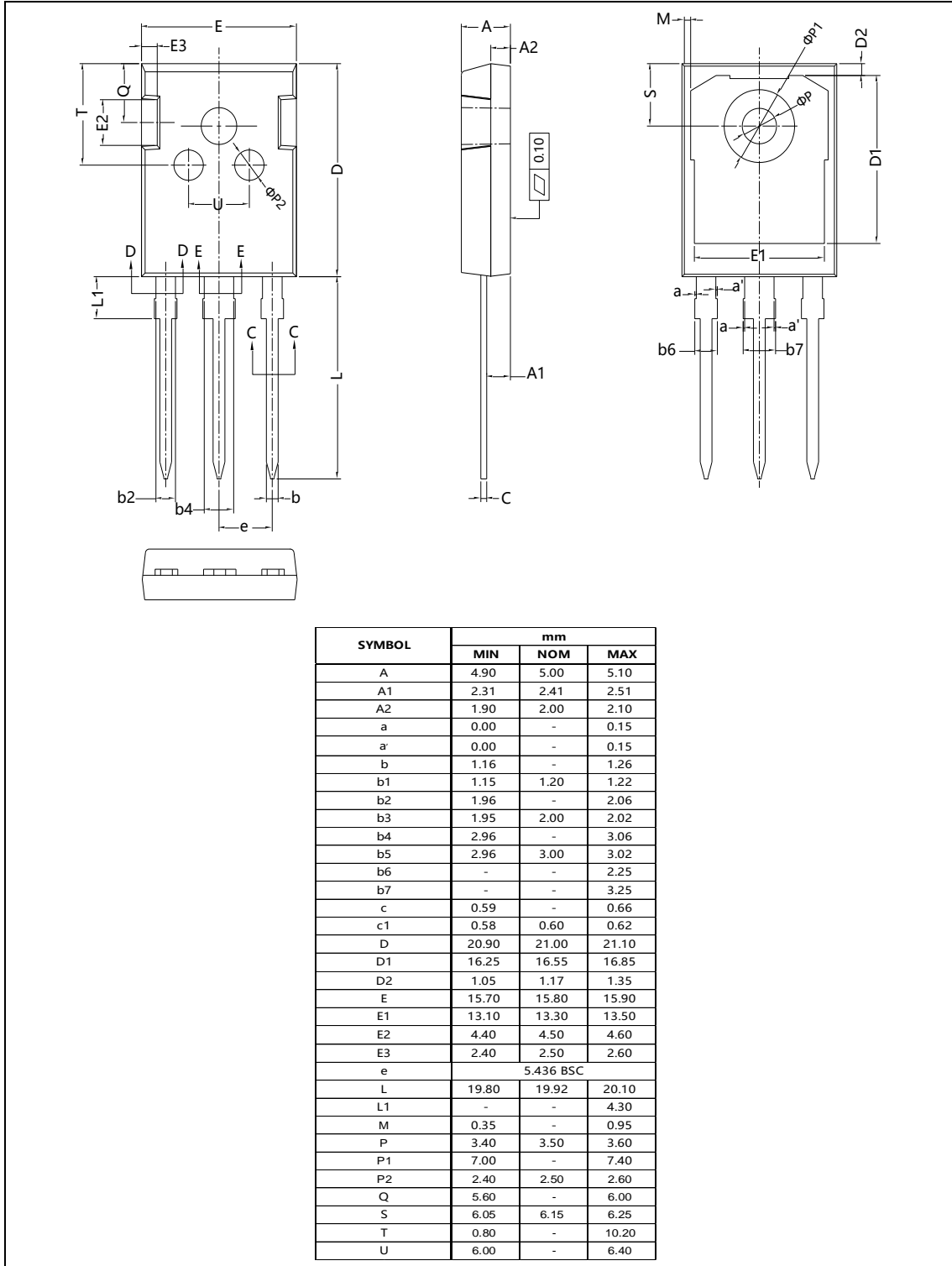
Figure3, TO3P package outline dimension





■ Package Information

Figure4, TO247 package outline dimension





## ■ Ordering Information

Package	Units/Tube	Tubes/Inner Box	Units/Inner Box	Inner Box/Carton Box	Units/Carton Box
TO220F	50	20	1000	5	5000
TO220	50	20	1000	6	6000
TO3P	30	11	330	6	1980
TO247	30	20	600	5	3000

## ■ Product Information

Product	Package	Pb Free	RoHS	Halogen Free
OSG55R140FF	TO220F	yes	yes	yes
OSG55R140PF	TO220	yes	yes	yes
OSG55R140RF	TO3P	yes	yes	yes
OSG55R140HF	TO247	yes	yes	yes