

Enhancement Mode N-Channel Power MOSFET

Features

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

Applications

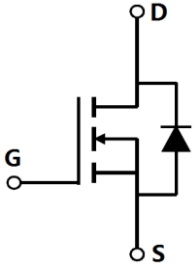
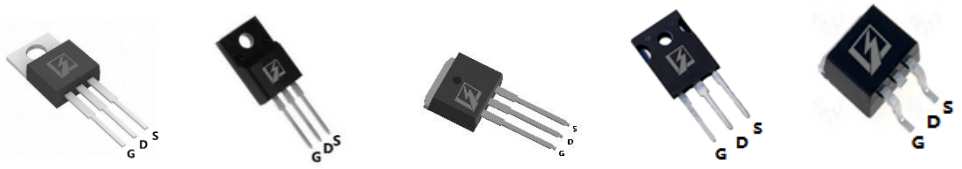
- ◆ Lighting
- ◆ Hard switching PWM
- ◆ Server power supply
- ◆ Charger

■ General Description

OSG60R180xSF use advanced GreenMOSTM 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.

◆ $V_{DS, min@T_{jmax}}$	650 V
◆ $I_{D, pulse}$	60 A
◆ $R_{DS(ON), max @ V_{GS}=10 V}$	180 mΩ
◆ Q_g	35.5 nC

■ Schematic and Package Information

Schematic Diagram 	Pin Assignment Top View 
	TO220 TO220F TO262 TO247 TO263 OSG60R180PSF OSG60R180FSF OSG60R180ISF OSG60R180HSF OSG60R180KSF

■ Absolute Maximum Ratings at $T_j=25^\circ\text{C}$ 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⁾ , $T_C=25^\circ\text{C}$	I_D	20	A
Continuous drain current ¹⁾ , $T_C=100^\circ\text{C}$		12.7	
Pulsed drain current ²⁾ , $T_C=25^\circ\text{C}$	$I_{D, pulse}$	60	A
Continuous diode forward current ¹⁾ , $T_C=25^\circ\text{C}$	I_S	20	A
Diode pulsed current ²⁾ , $T_C=25^\circ\text{C}$	$I_{S, pulse}$	60	A
Power dissipation ³⁾ for TO220, TO262, TO247, TO263, $T_C=25^\circ\text{C}$	P_D	163	W
Power dissipation ³⁾ for TO220F, $T_C=25^\circ\text{C}$		34	
Single pulsed avalanche energy ⁵⁾	E_{AS}	570	mJ
MOSFET dv/dt ruggedness, $V_{DS}=0\dots480\text{ V}$	dv/dt	50	V/ns
Reverse diode dv/dt, $V_{DS}=0\dots480\text{ V}$, $I_{SD}\leq I_D$	dv/dt	15	V/ns
Operation and storage temperature	T_{stg}, T_j	-55 to 150	°C

■ Thermal Characteristics

Parameter	Symbol	Value		Unit
		TO220/TO262/T247/TO263	TO220F	
Thermal resistance, junction-case	$R_{\theta JC}$	0.77	3.68	°C/W
Thermal resistance, junction-ambient ⁴⁾	$R_{\theta JA}$	62	62.5	°C/W

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Drain-source breakdown voltage	BV_{DSS}	600			V	$V_{GS}=0\text{ V}$, $I_D=250\text{ }\mu\text{A}$
		650				$V_{GS}=0\text{ V}$, $I_D=250\text{ }\mu\text{A}$, $T_j=150\text{ }^{\circ}\text{C}$
Gate threshold voltage	$V_{GS(th)}$	2.9		3.9	V	$V_{DS}=V_{GS}$, $I_D=250\text{ }\mu\text{A}$
Drain-source on-state resistance	$R_{DS(on)}$		0.14	0.18	Ω	$V_{GS}=10\text{ V}$, $I_D=10\text{ A}$
			0.34			$V_{GS}=10\text{ V}$, $I_D=10\text{ A}$, $T_j=150\text{ }^{\circ}\text{C}$
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	μA	$V_{DS}=600\text{ V}$, $V_{GS}=0\text{ V}$
Gate resistance	R_G		10.8		Ω	$f=1\text{ MHz}$, Open drain

■ Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Input capacitance	C_{iss}		1660.9		pF	$V_{GS}=0\text{ V}$, $V_{DS}=50\text{ V}$, $f=100\text{ kHz}$
Output capacitance	C_{oss}		120.2		pF	
Reverse transfer capacitance	C_{rss}		1.3		pF	
Turn-on delay time	$t_{d(on)}$		31		ns	$V_{GS}=10\text{ V}$, $V_{DS}=400\text{ V}$, $R_G=2\text{ }\Omega$, $I_D=10\text{ A}$
Rise time	t_r		20.1		ns	
Turn-off delay time	$t_{d(off)}$		84.4		ns	
Fall time	t_f		9.9		ns	

■ Gate Charge Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Total gate charge	Q_g		35.5		nC	$I_D=10\text{ A}$, $V_{DS}=400\text{ V}$, $V_{GS}=10\text{ V}$
Gate-source charge	Q_{gs}		10.3		nC	
Gate-drain charge	Q_{gd}		10		nC	
Gate plateau voltage	V_{plateau}		5.1		V	

■ Body Diode Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Diode forward voltage	V_{SD}			1.4	V	$I_S=20\text{ A}$, $V_{GS}=0\text{ V}$
Reverse recovery time	t_{rr}		364.1		ns	$V_R=400\text{ V}$, $I_S=10\text{ A}$, $di/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	Q_{rr}		4.3		μC	
Peak reverse recovery current	I_{rrm}		26.3		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) 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 $T_a=25\text{ }^\circ\text{C}$.
- 5) $V_{DD}=100\text{ V}$, $R_G=50\text{ }\Omega$, $L=79.9\text{ mH}$, starting $T_j=25\text{ }^\circ\text{C}$.

■ **Electrical Characteristics Diagrams**

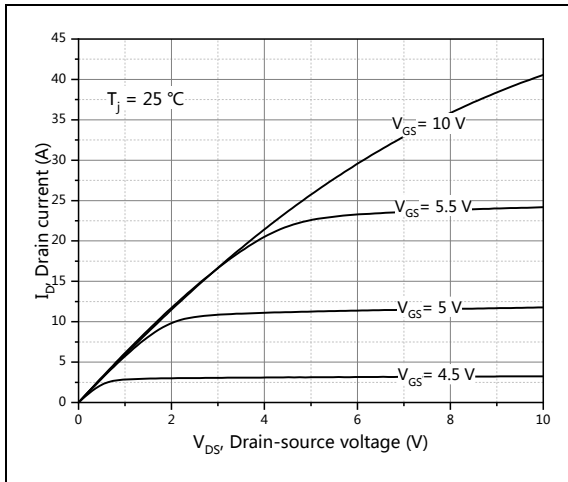


Figure 1, Typ. output characteristics

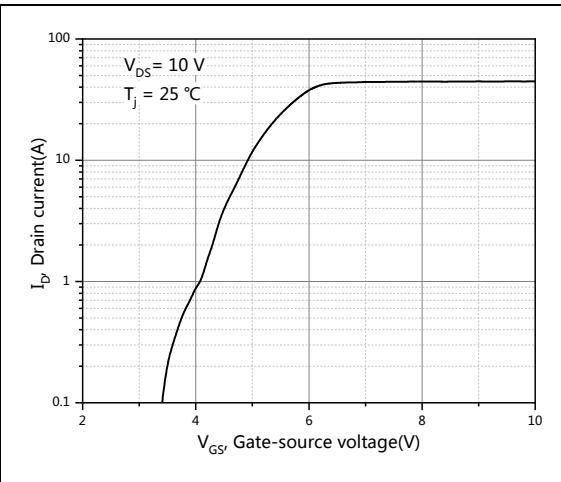


Figure 2, Typ. transfer characteristics

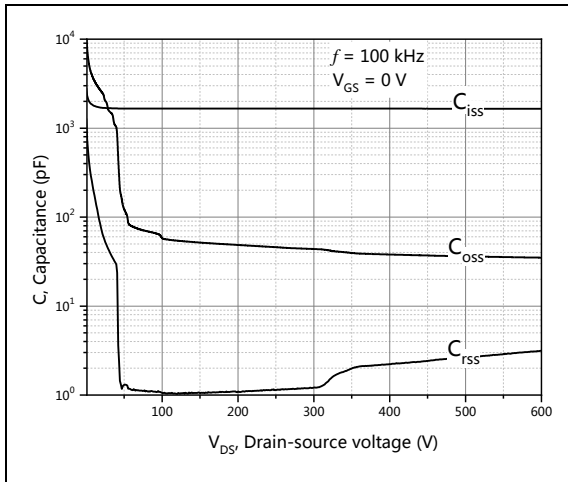


Figure 3, Typ. capacitances

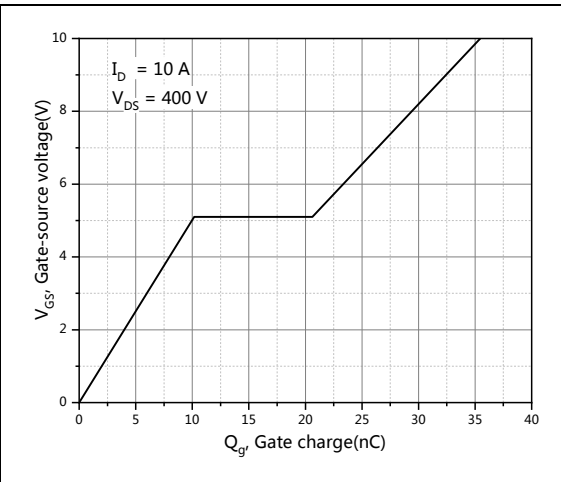


Figure 4, Typ. gate charge

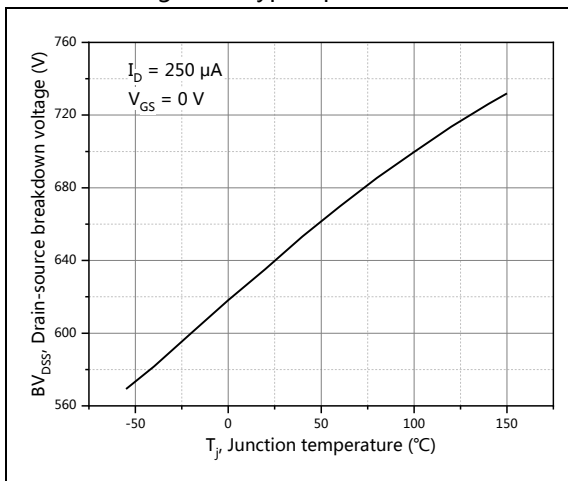


Figure 5, Drain-source breakdown voltage

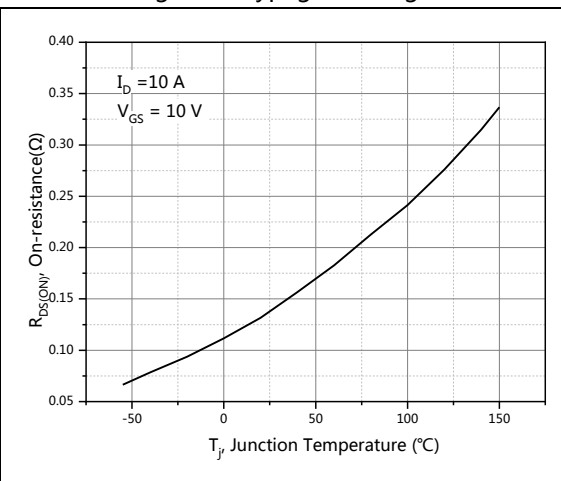


Figure 6, Drain-source on-state resistance

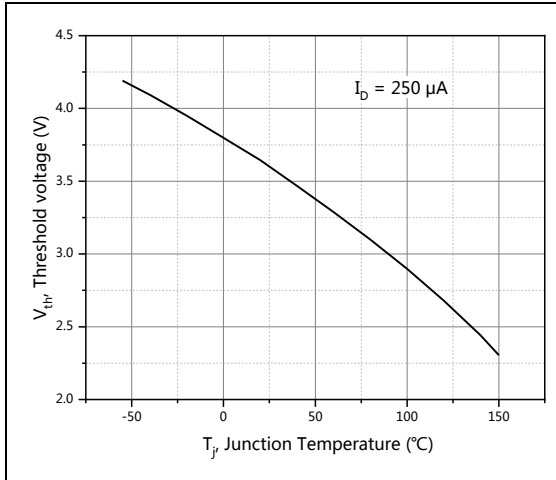


Figure 7, Threshold voltage

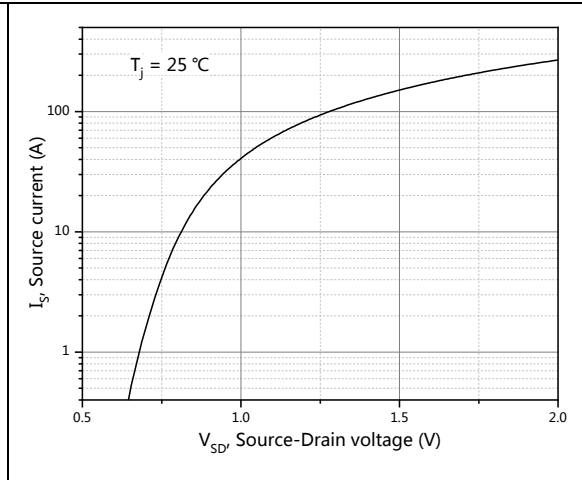


Figure 8, Forward characteristic of body diode

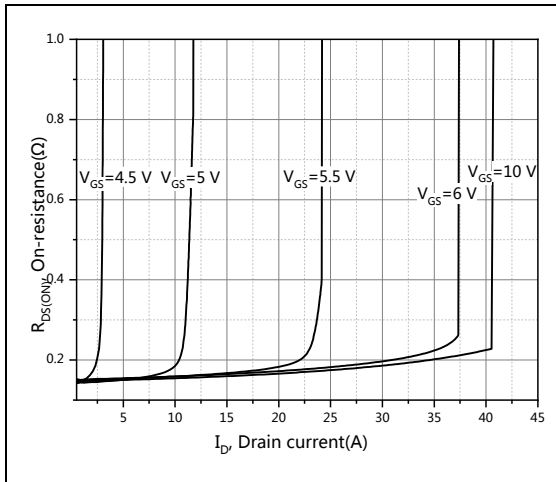


Figure 9, Drain-source on-state resistance

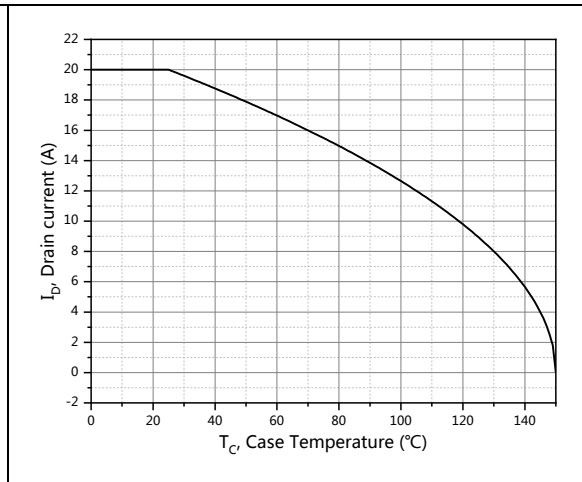


Figure 10, Drain current

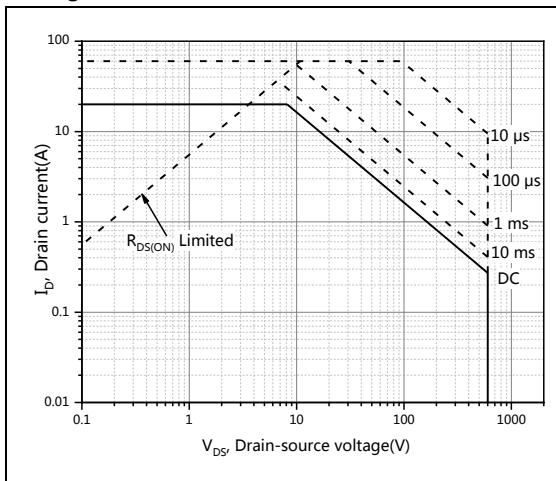


Figure 11, Safe operation area for TO220/TO262/TO247/TO263 $T_C=25\text{ }^\circ\text{C}$

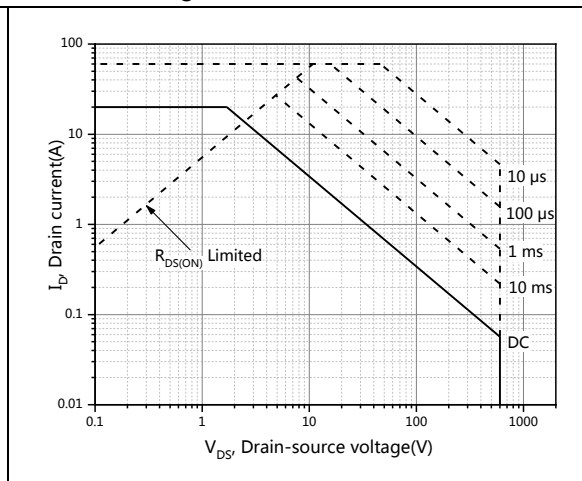


Figure 12, Safe operation area for TO220F $T_C=25\text{ }^\circ\text{C}$

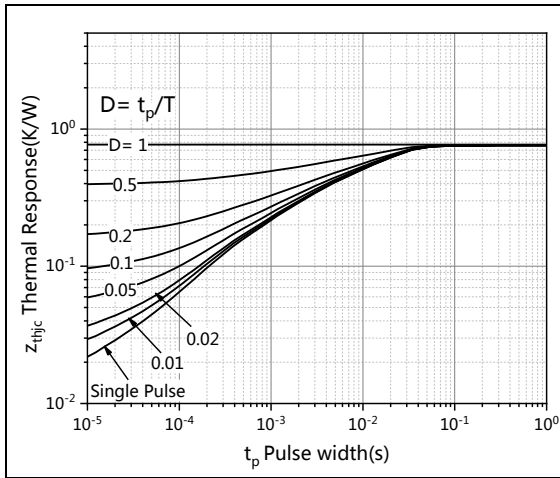


Figure 13, Max. transient thermal impedance for TO220/TO262/TO247/TO263

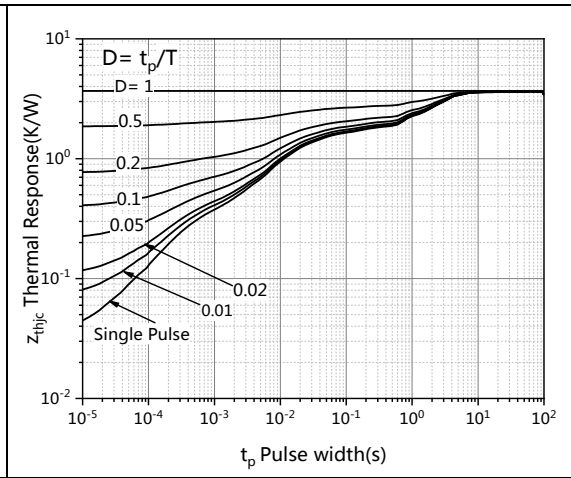


Figure 14, Max. transient thermal impedance for TO220F

■ Test circuits and waveforms

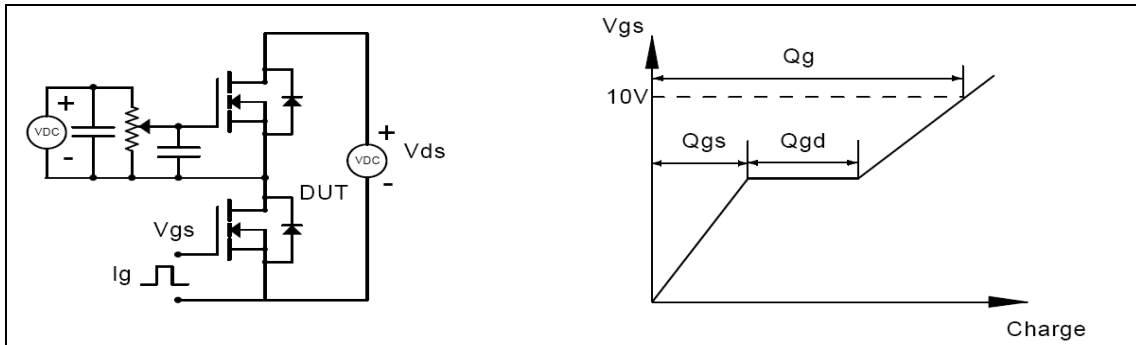


Figure 1, Gate charge test circuit & waveform

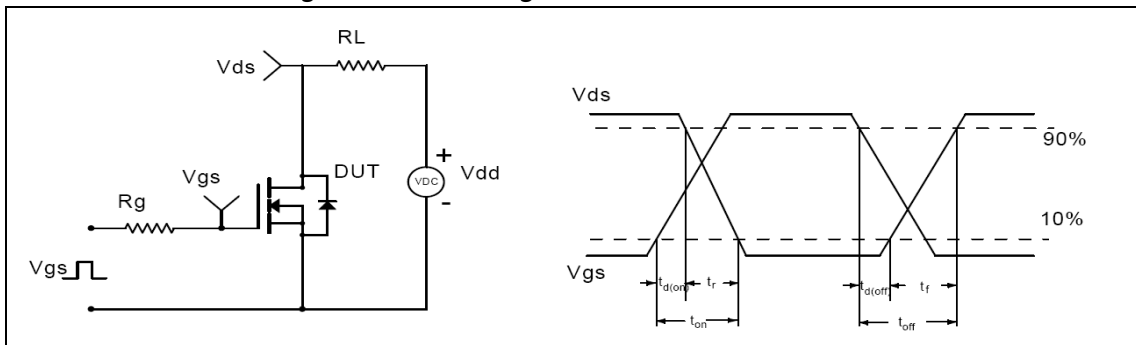


Figure 2, Switching time test circuit & waveforms

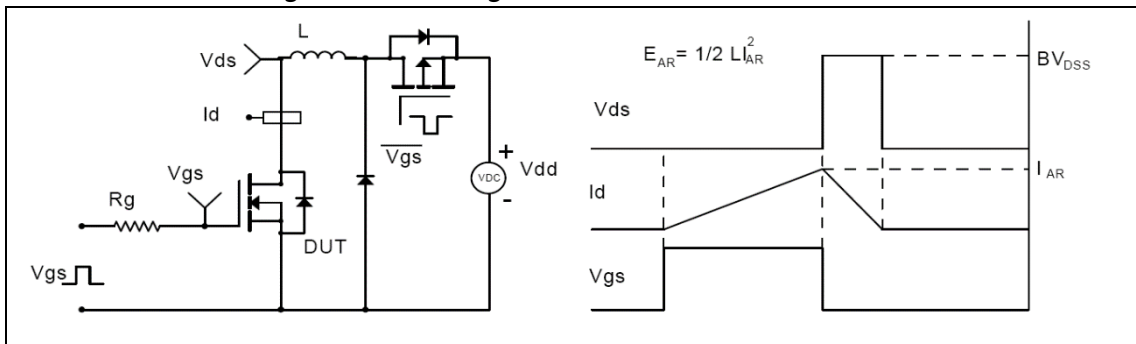


Figure 3, Unclamped inductive switching (UIS) test circuit & waveforms

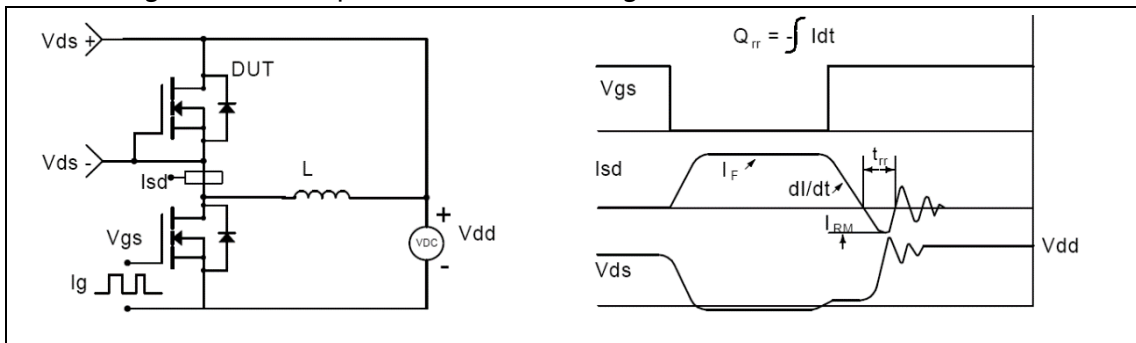
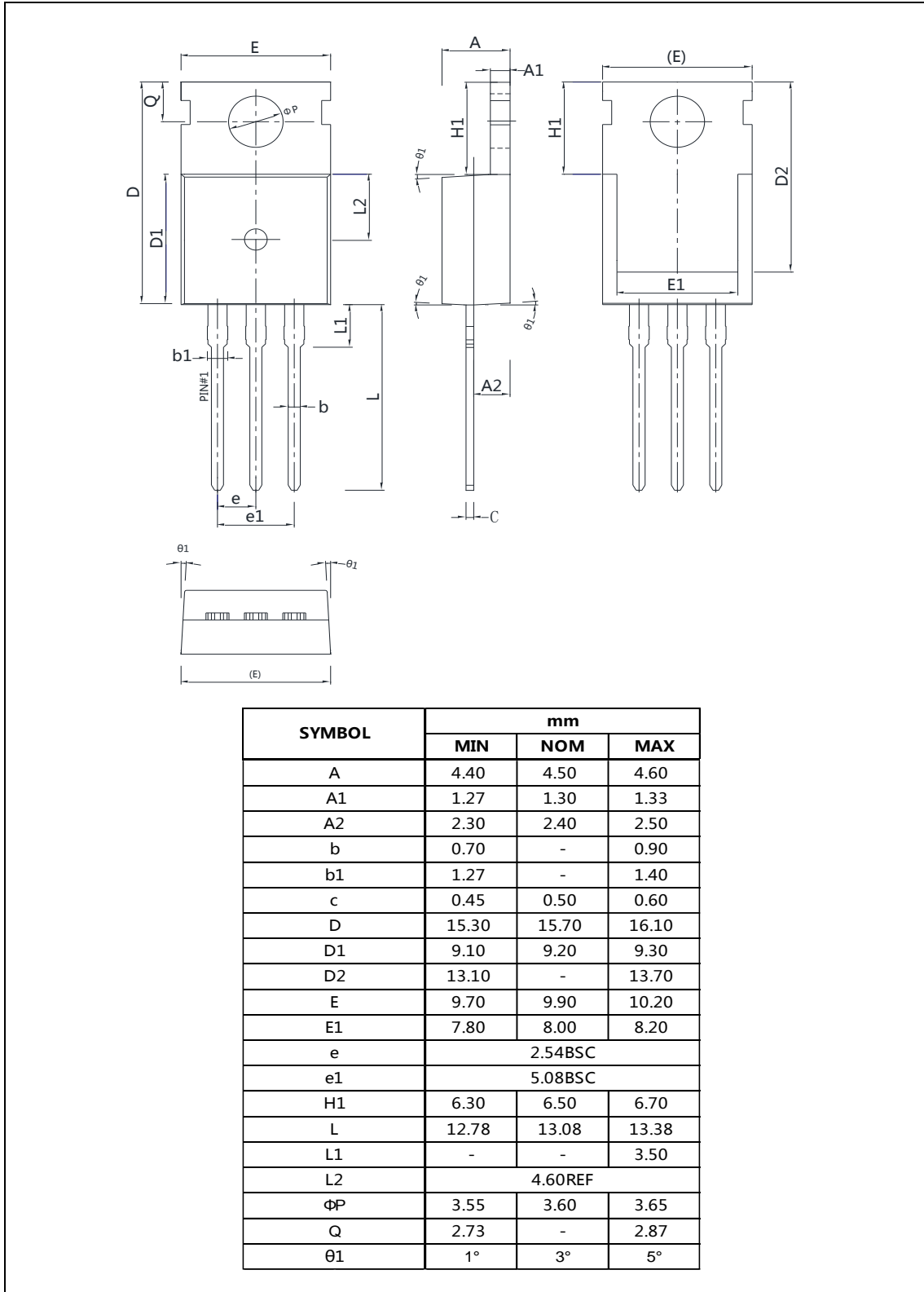


Figure 4, Diode reverse recovery test circuit & waveforms

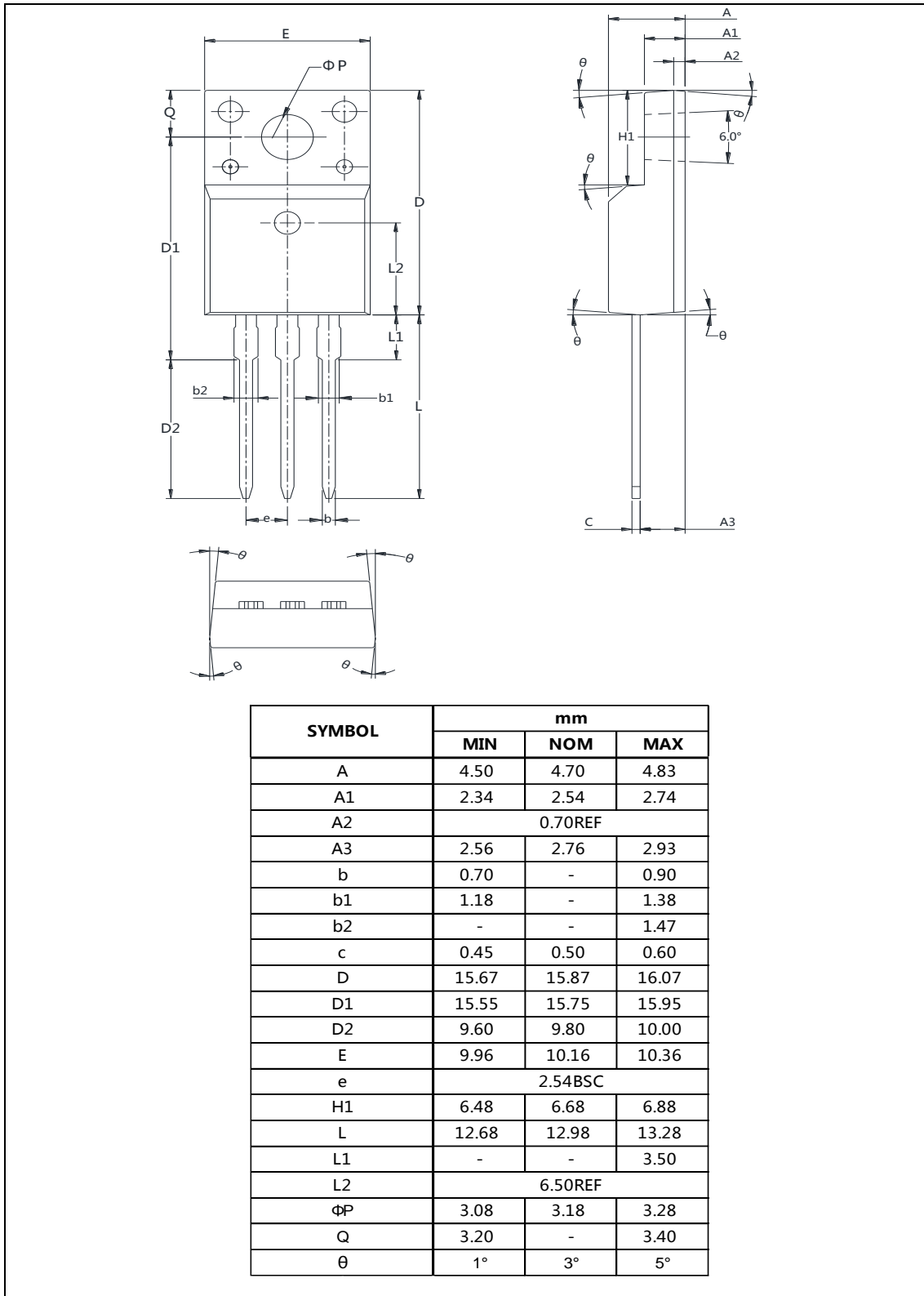
■ Package Information

Figure1, TO220 package outline dimension



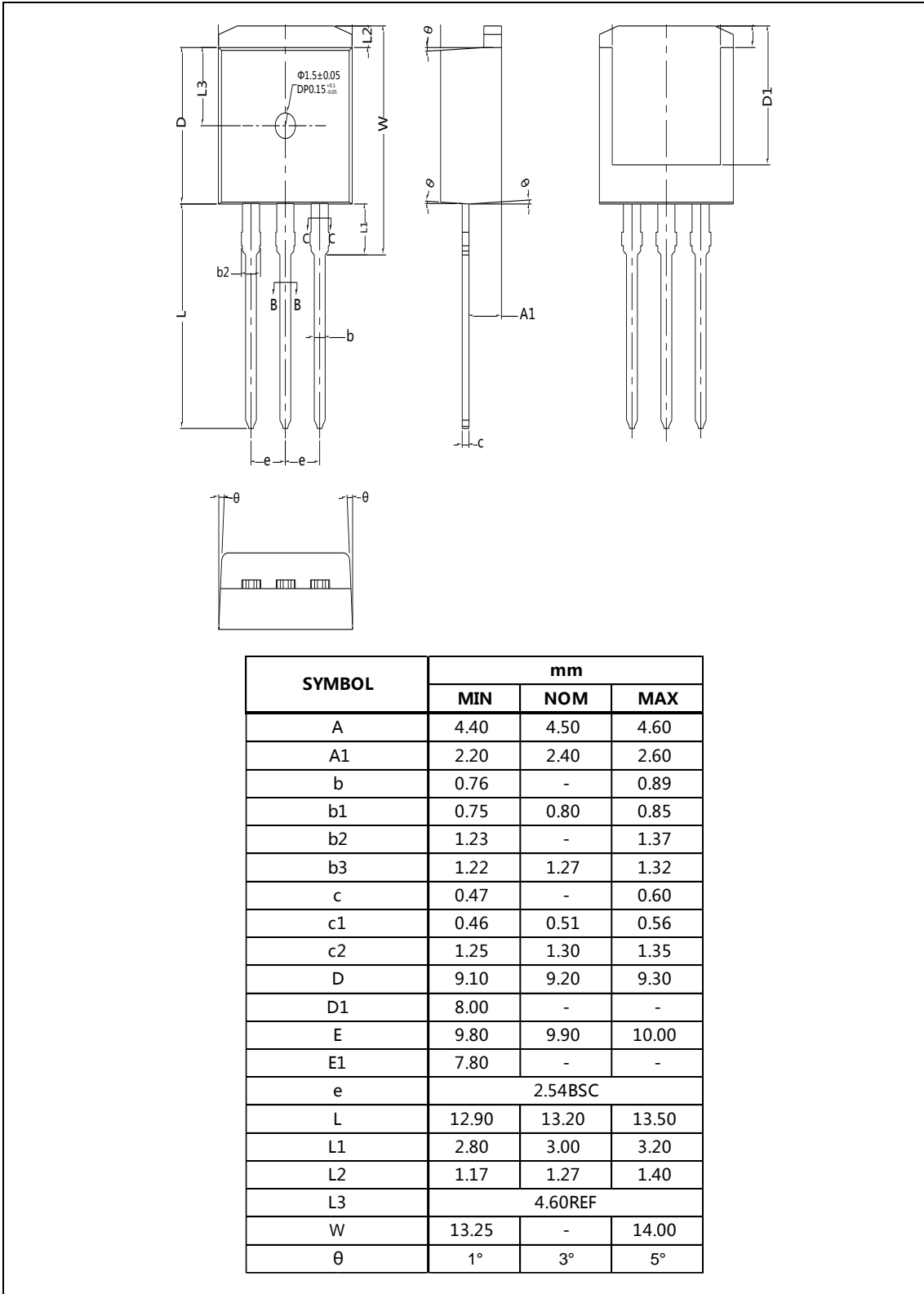
■ Package Information

Figure2, TO220F package outline dimension



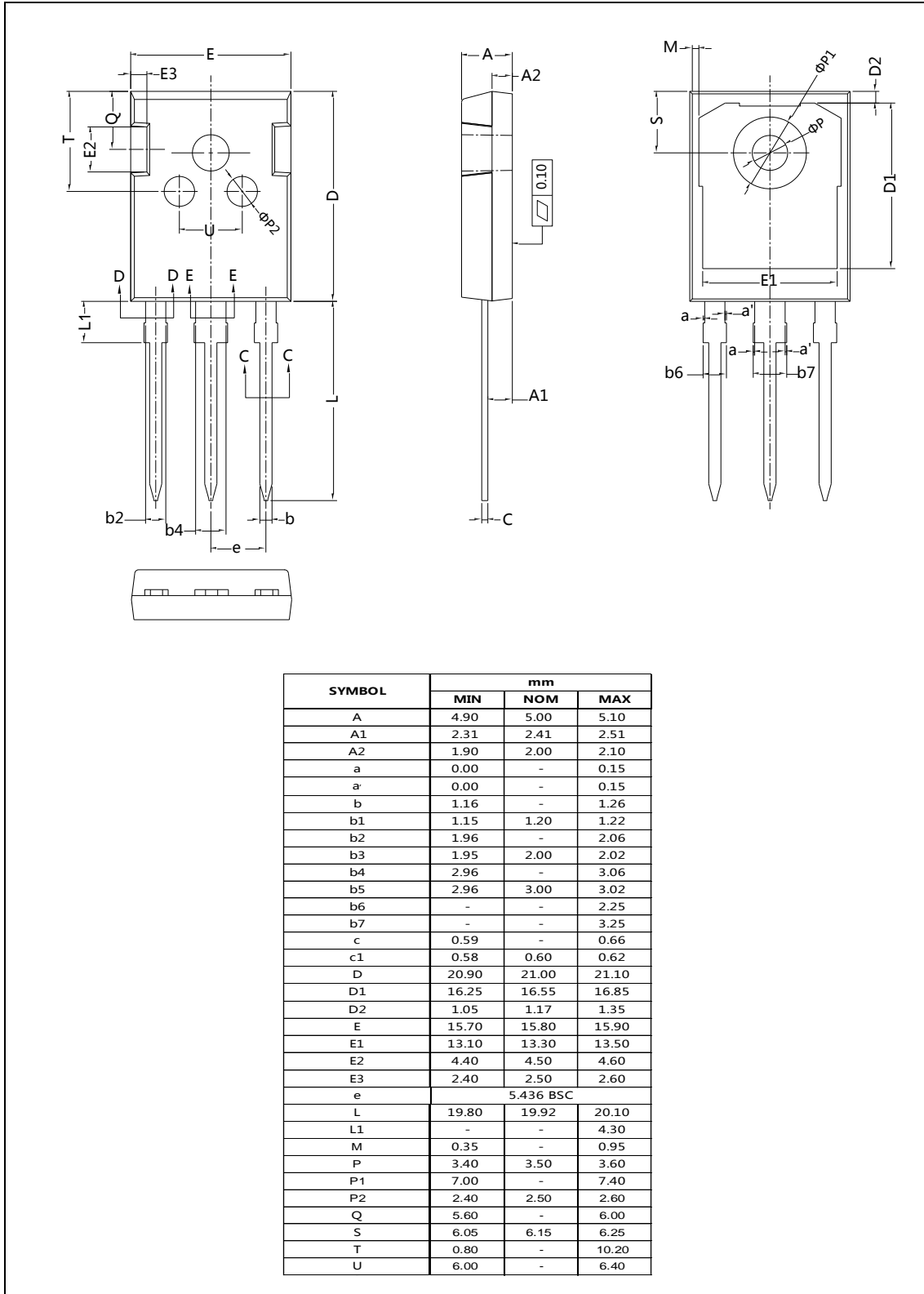
■ Package Information

Figure3, TO262 package outline dimension



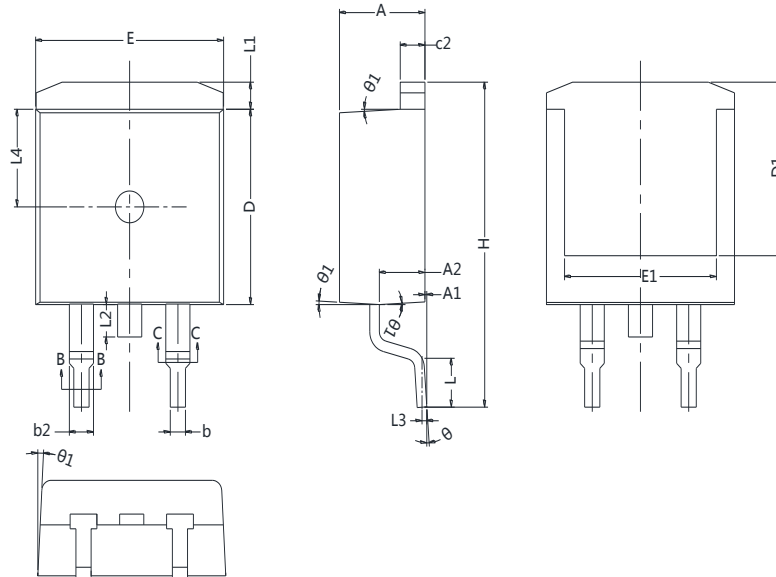
■ Package Information

Figure4, TO247 package outline dimension



■ Package Information

Figure5, TO263 package outline dimension



SYMBOL	mm		
	MIN	NOM	MAX
A	4.40	4.50	4.60
A1	0.00	0.10	0.25
A2	2.20	2.40	2.60
b	0.76	-	0.89
b1	0.75	0.80	0.85
b2	1.23	-	1.37
b3	1.22	1.27	1.32
c	0.47	-	0.60
c1	0.46	0.51	0.56
c2	1.25	1.30	1.35
D	9.10	9.20	9.30
D1	8.00	-	-
E	9.80	9.90	10.00
E1	7.80	-	-
e	2.54BSC		
H	14.90	15.30	15.70
L	2.00	2.30	2.60
L1	1.17	1.27	1.40
L2	-	-	1.75
L3	0.25BSC		
L4	4.60REF		
θ	0°	-	8°
θ1	1°	3°	5°

■ Ordering Information

Package	Units/Tube	Tubes/Inner Box	Units/Inner Box	Inner Box/Carton Box	Units/Carton Box
TO220	50	40	2000	4	8000
TO220F	50	40	2000	4	8000
TO262	50	40	2000	4	8000
TO247	30	20	600	5	3000

Package	Units/Reel	Reels /Inner Box	Units/Inner Box	Inner Box/Carton Box	Units/Carton Box
TO263	800	1	800	10	8000

■ Product Information

Product	Package	Pb Free	RoHS	Halogen Free
OSG60R180PSF	TO220	yes	yes	yes
OSG60R180FSF	TO220F	yes	yes	yes
OSG60R180ISF	TO262	yes	yes	yes
OSG60R180HSF	TO247	yes	yes	yes
OSG60R180KSF	TO263	yes	yes	yes