HPC65R180

180mΩ, 650V, Super Junction N-Channel Power MOSFET

General Description

The HPC65R180 is a high voltage power MOSFET, fabricated using advanced super junction technology. The resulting device has extremely low on resistance, low gate charge and fast switching time, making it especially suitable for applications which require superior power density and outstanding efficiency.

The HPC65R180 break down voltage is 650V and it has a high rugged avalanche characteristics. The HPC65R180 is available in TO-220F, TO-220C, TO-262 and TO-247 packages.

Features

- Ultra Low $R_{DS(ON)}$ = 180mΩ @ V_{GS} = 10V.
- Ultra Low Gate Charge, Qg=38nC typ.
- Fast switching capability
- Robust design with better EAS performance
- EMI Improved

Application

- UPS, Inverter, etc
- Solar
- TV Power
- High Power AC/DC Power Supply

Symbol

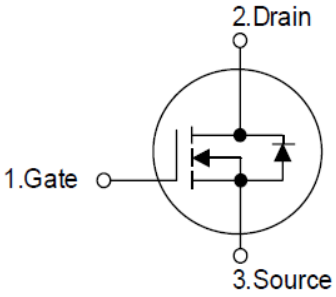


Figure 1 Symbol of HPC65R180

Package Type

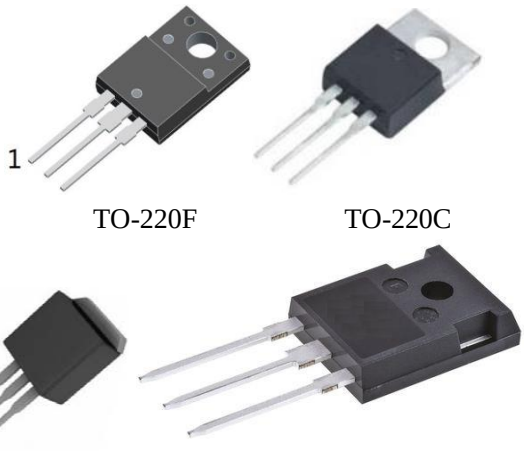


Figure 2 Package Types of HPC65R180

Ordering Information

HPC65R180□□–□

Circuit Type

Package
TF: TO-220F
TC: TO-220C
TS: TO-262
T: TO-247

E: Lead Free
G: Green

Blank: Tube
TR: Tape & Reel

Package	Part Number		Marking ID		Packing Type
	Lead Free	Green	Lead Free	Green	
TO-220F	HPC65R180TF-E	HPC65R180TF-G	HPC65R180TFE	HPC65R180TFG	Tube
TO-220C	HPC65R180TC-E	HPC65R180TC-G	HPC65R180TCE	HPC65R180TCG	Tube
TO-262	HPC65R180TS-E	HPC65R180TS-G	HPC65R180TSE	HPC65R180TSG	Tube

TO-247	HPC65R180T-E	HPC65R180T-G	HPC65R180TE	HPC65R180TG	Tube

Absolute Maximum Ratings

Parameter		Symbol	Rating	Unit
Drain-Source Voltage		V_{DSS}	650	V
Gate-Source Voltage		V_{GSS}	±30	V
Continuous Drain Current	T_C=25ºC	I_D	21.2	A
	T_C=125ºC		9.5	
Pulsed Drain Current (Note 2)		I_{DM}	64	A
Avalanche Energy, Single Pulse (Note 3)		E_{AS}	505	mJ
Avalanche Energy, Repetitive (Note 2)		E_{AR}	0.7	mJ
Avalanche Current, Repetitive (Note 2)		I_{AR}	3.6	A
Continuous Diode Forward Current		I_S	21.2	A
Diode Pulse Current		$I_{S.PULSE}$	64	A
MOSFET dv/dt Ruggedness, V_{DS}<=480V		dv/dt	50	V/ns
Reverse Diode dv/dt, V_{DS}<=480V, I_{SD}<=I_D		dv/dt	15	V/ns
Operating Junction Temperature		T_J	150	ºC
Storage Temperature		T_{STG}	-55 to 150	ºC
Lead Temperature (Soldering, 10 sec)		T_{LEAD}	260	ºC

Note:

1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Repetitive Rating: Pulse width limited by maximum junction temperature
3. I_{AS} = 3.6A, V_{DD} = 60V, R_G = 25Ω, Starting T_J = 25°C

Electrical Characteristics

T_J = 25 ºC, unless otherwise specified.

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0V, I_D=250uA	650			V
Zero Gate Voltage Drain Current		I_{DSS}	V_{DS}=650V, V_{GS}=0V			1	uA
Gate-Body Leakage Current	Forward	I_{GSSF}	V_{GS}=30V, V_{DS}=0V			100	nA
	Reverse	I_{GSSR}	V_{GS}=-30V, V_{DS}=0V			-1.0	uA
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS}=V_{GS}, I_D=250uA	2.4	3.4	4.4	V
Static Drain-Source On-Resistance		$R_{DS(ON)}$	V_{GS}=10V, I_D=10.0A		160	180	mΩ
Gate Resistance		R_G	f=1MHz, Open Drain		1.7		Ω
Dynamic Characteristics							
Input Capacitance		C_{ISS}	V_{DS}=50V, V_{GS}=0V, f=1MHz		1630		pF
Output Capacitance		C_{OSS}			110		
Reverse Transfer Capacitance		C_{RSS}			22		
Effective output capacitance, energy related NOTE5		$C_{O(er)}$	V_{GS}=0V, V_{DS}=0…480V		71		pF
Effective output capacitance, time related NOTE6		$C_{O(tr)}$			301		
Turn-on Delay Time		$t_{d(on)}$	V_{DD}=400V, I_D=10.0A R_G=3.4Ω, V_{GS}=10V		11		ns
Rise Time		t_r			10		
Turn-off Delay Time		$t_{d(off)}$			76		
Fall Time		t_f			8		
Gate Charge Characteristics							
Gate to Source Charge		Q_{gs}	V_{DD}=480V, I_D=10.0A V_{GS}=0 to 10V		10.6		nC
Gate to Drain Charge		Q_{gd}			12.2		
Gate Charge Total		Q_g			38		
Gate Plateau Voltage		$V_{plateau}$			5.5		V
Reverse Diode Characteristics							
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS}=0V, I_{SD}=10.0A		0.83	1.1	V
Reverse Recovery Time		t_{rr}	V_R=400V, I_F=10.0A dI$_F$/dt=100.0A/us		330		ns
Reverse Recovery Charge		Q_{rr}			4.5		uC
Peak Reverse Recovery Current		I_{rrm}			27		A

Note:

5. $C_{O(er)}$ is a fixed capacitance that gives the same stored energy as C_{OSS} while V_{DS} is rising from 0 to 480V

6. $C_{O(tr)}$ is a fixed capacitance that gives the same charging time as C_{OSS} while V_{DS} is rising from 0 to 480 V

Typical Performance Characteristics

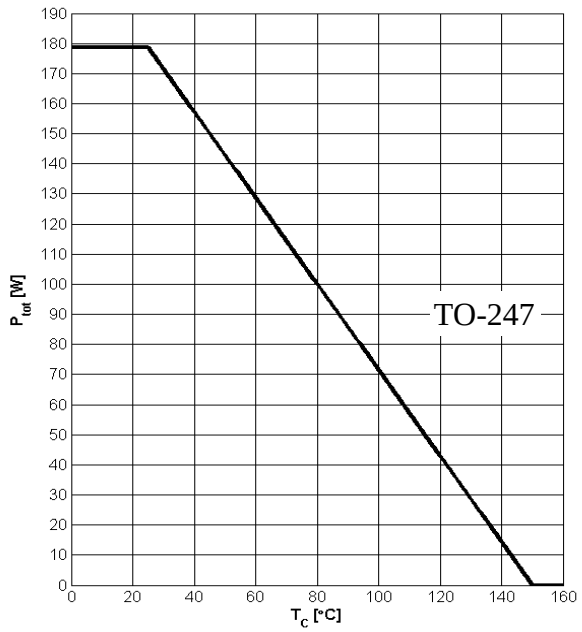
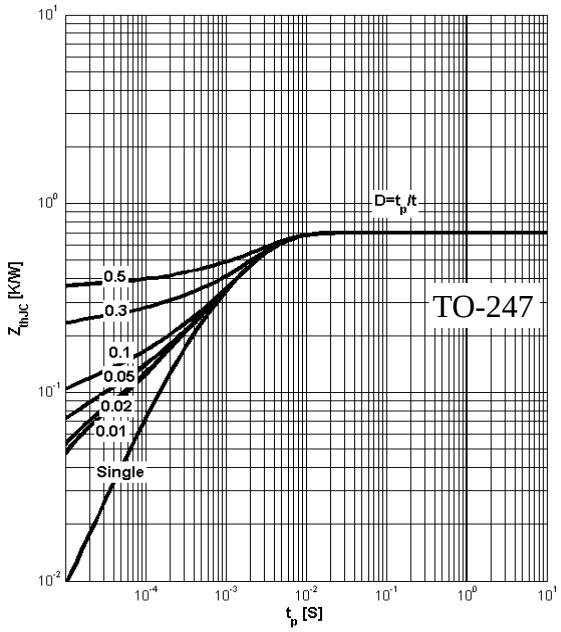
Figure 3: Power Dissipation	Figure 4: Max. Transient Thermal Impedance
	
$P_{tot} = f(T_c)$	$Z_{(thJC)} = f(t_p)$; parameter: $D = t_p/T$

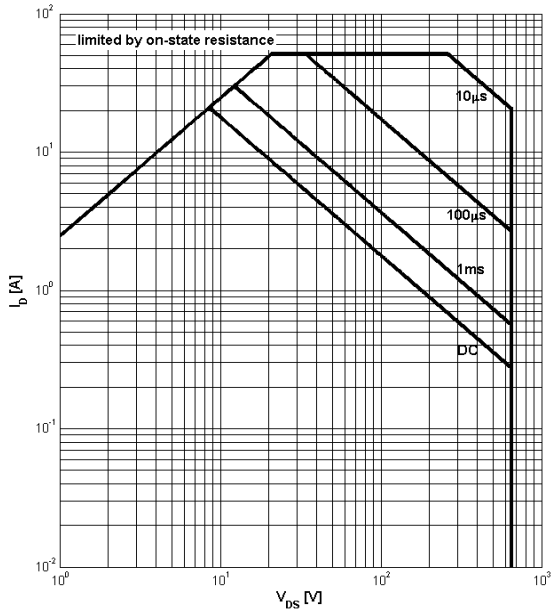
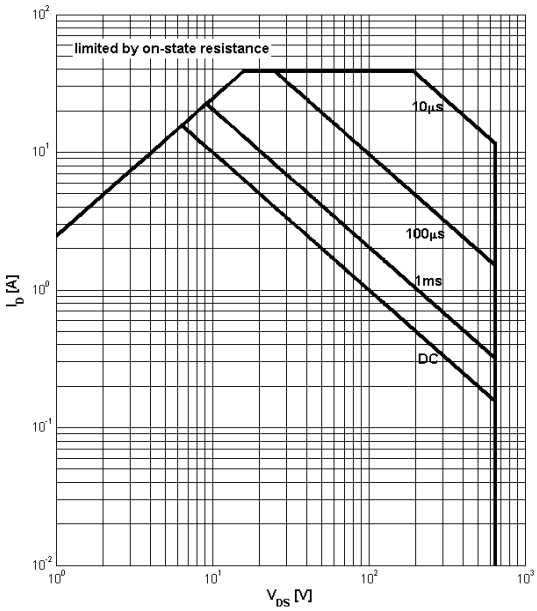
Figure 5: Safe Operating Area	Figure 6: Safe Operating Area
	
$I_D = f(V_{DS})$; T_c= 25ºC; V_{GS}>7V; parameter t_p	$I_D = f(V_{DS})$; T_c= 80ºC; V_{GS}>7V; parameter t_p

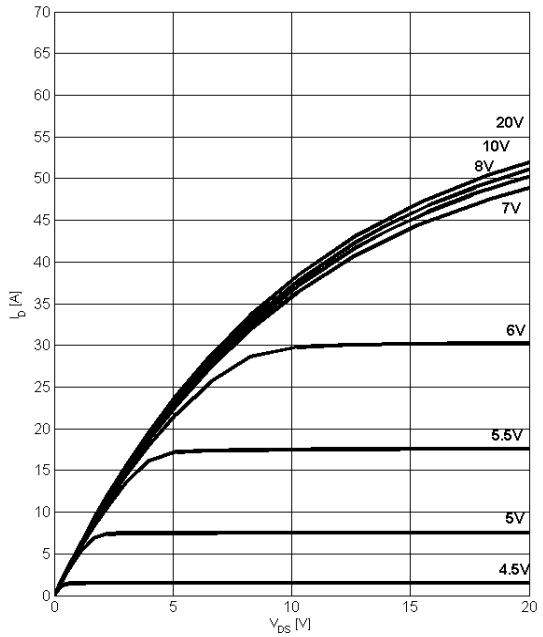
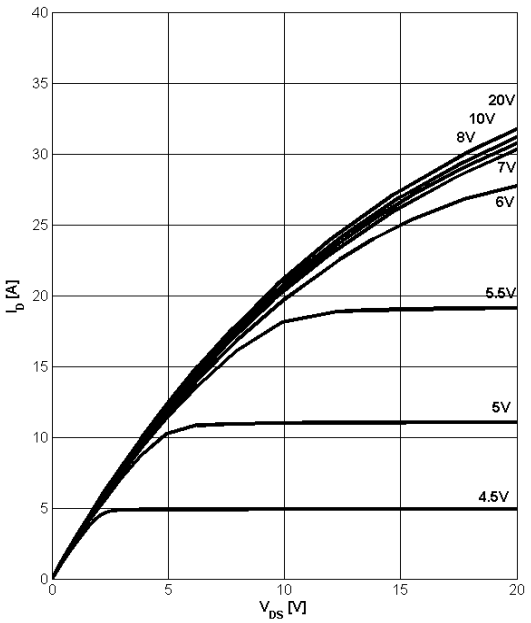
Figure 7: Typ. Output Characteristics	Figure 8: Typ. Output Characteristics
	
$I_D = f(V_{DS})$; Tj= 25ºC; parameter: V_{GS}	$I_D = f(V_{DS})$; T_j= 125ºC; parameter: V_{GS}

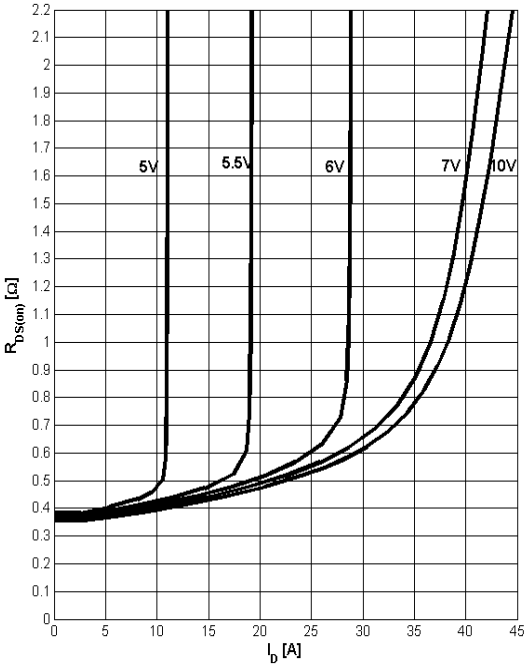
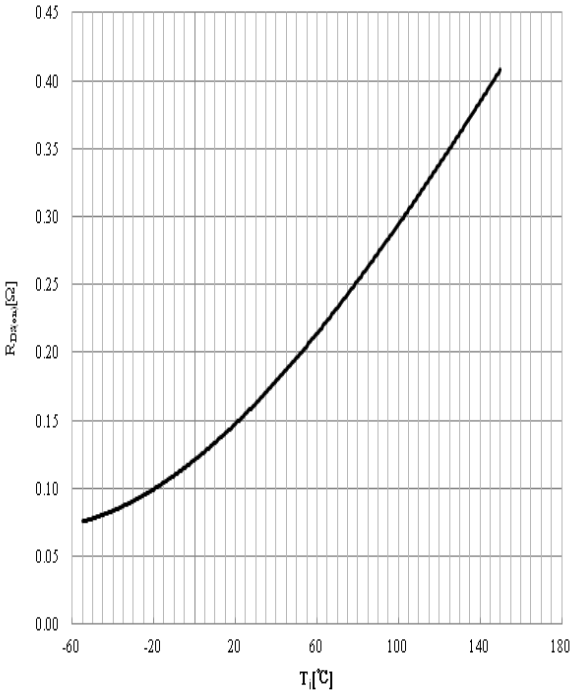
Figure 9: Typ. Drain-Source On-State Resistance	Figure 10: Typ. Drain-Source On-State Resistance
	
$R_{DS(ON)} = f(I_D)$; T_j=125ºC; parameter: V_{GS}	$R_{DS(ON)} = f(T_j)$; I_D=10A; V_{GS}=10V

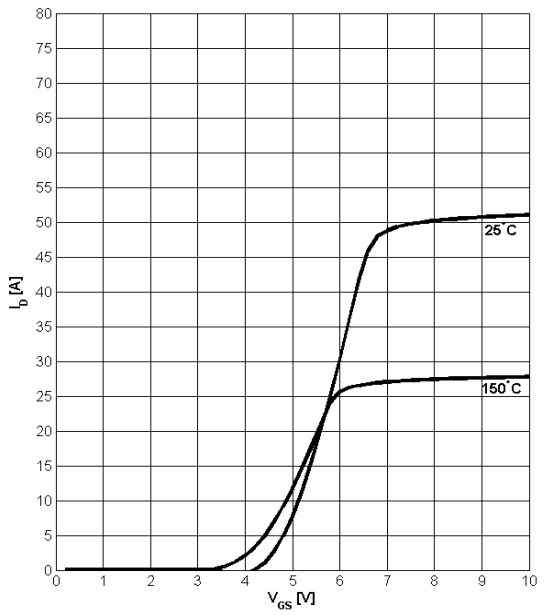
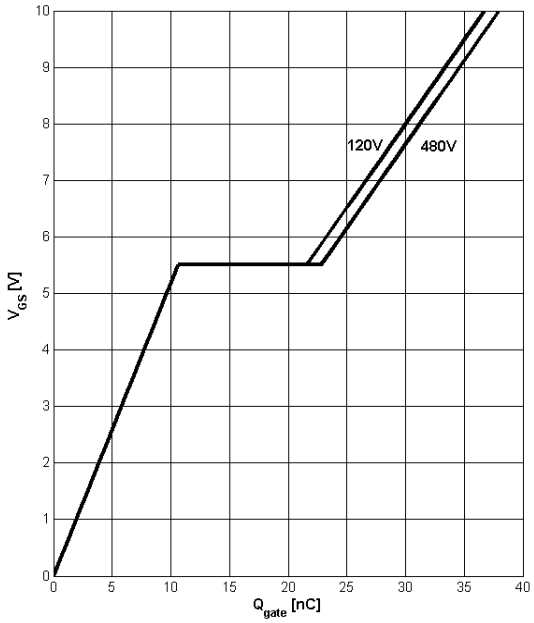
Figure 11: Typ. Transfer Characteristics	Figure 12: Typ. Gate Charge
	
$I_D = f(V_{GS})$; V_{DS} = 20V	V_{GS}= f(Q_{gate}), I_D= 10A pulsed

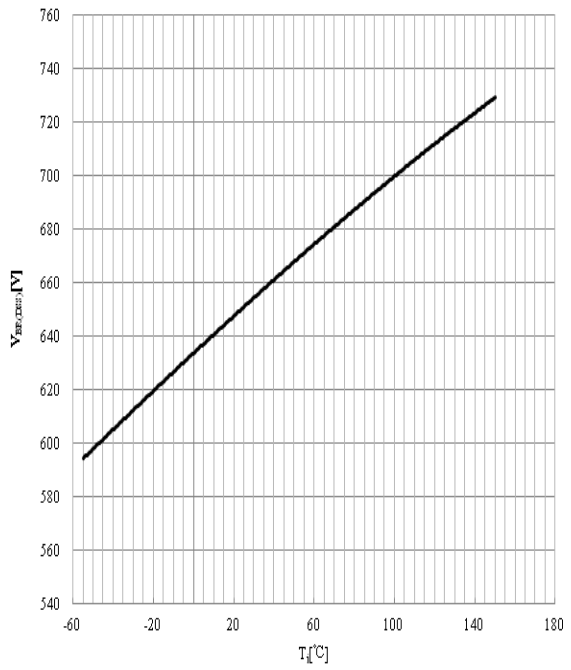
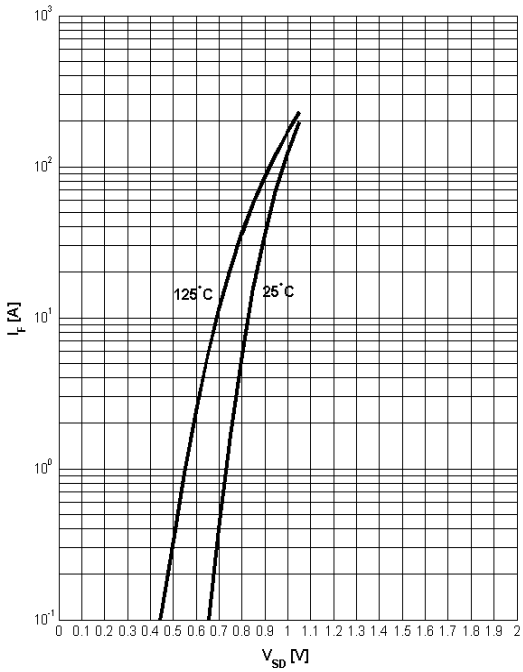
Figure 13: Drain-Source Breakdown Voltage	Figure 14: Forward Characteristics of Reverse Diode
	
$V_{BR(DSS)}$=f(T_j); I_D=1mA	I_F=f(V_{SD}); parameter: T_j

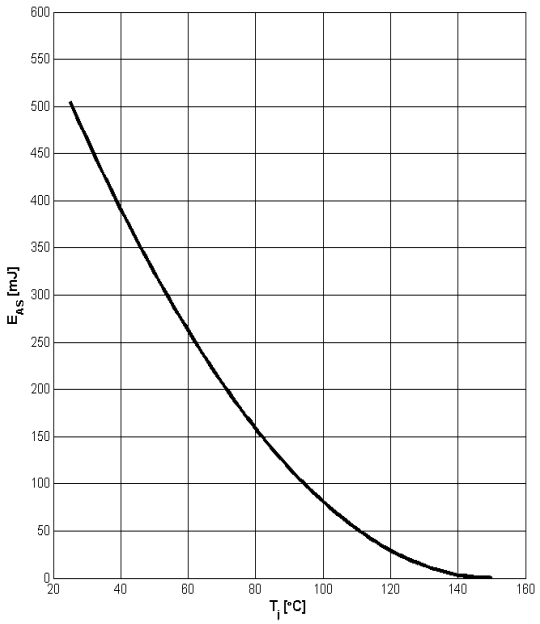
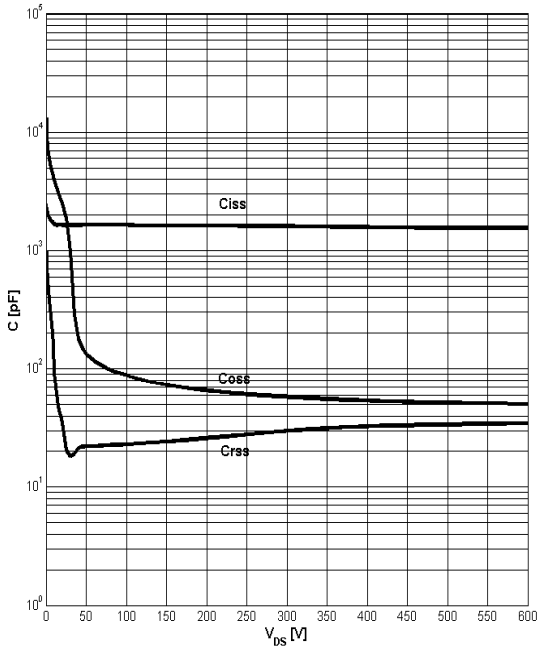
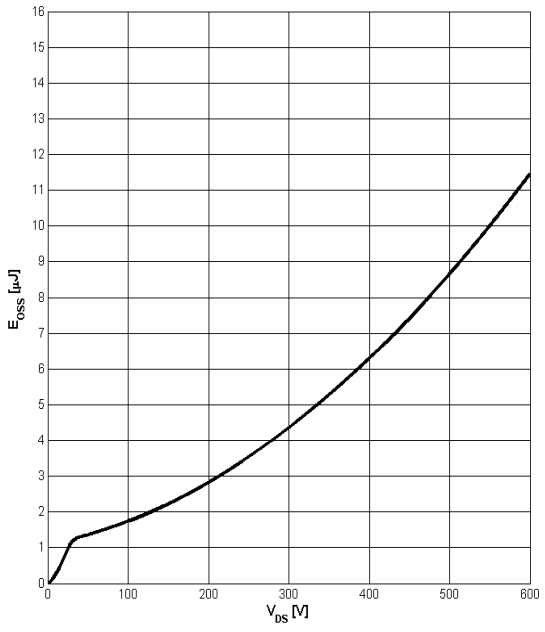
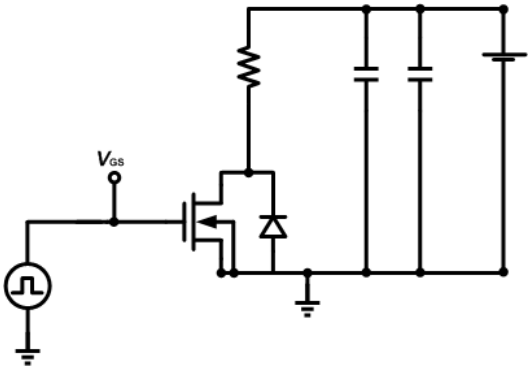
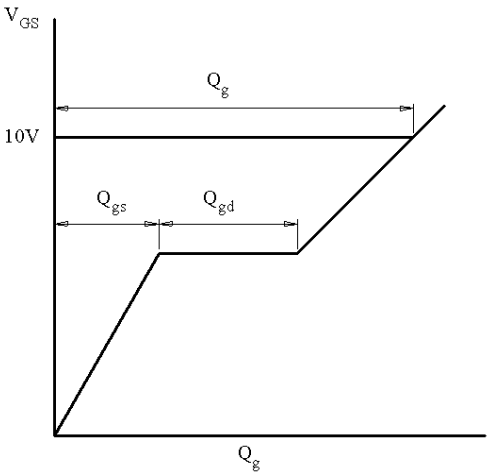
Figure 15: Avalanche Energy	Figure 16: Typ. Capacitances
	
$E_{AS}=f(T_j)$; I_D=3.6A; V_{DD}=60V	C=f(V_{DS}); V_{GS}=0; f=1MHz

Figure 17: C_{OSS} Stored Energy

$E_{OSS}=f(V_{DS})$

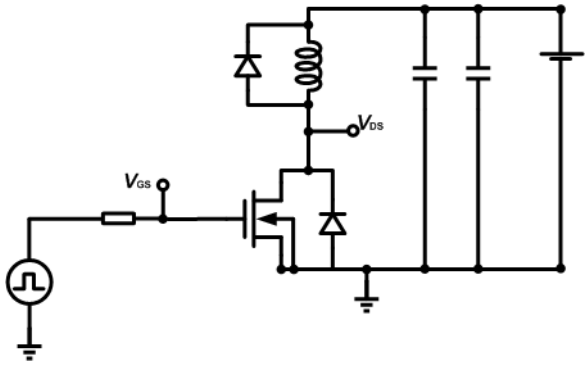
Test Circuits

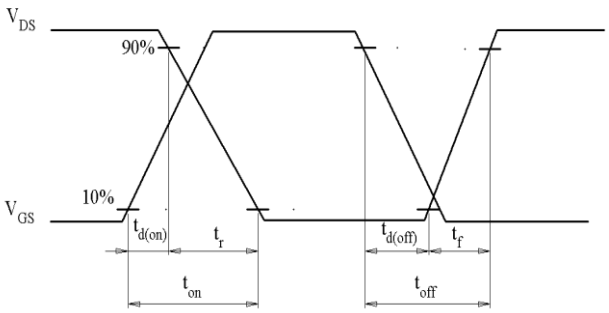
1. Gate Charge Test Circuit & Waveform



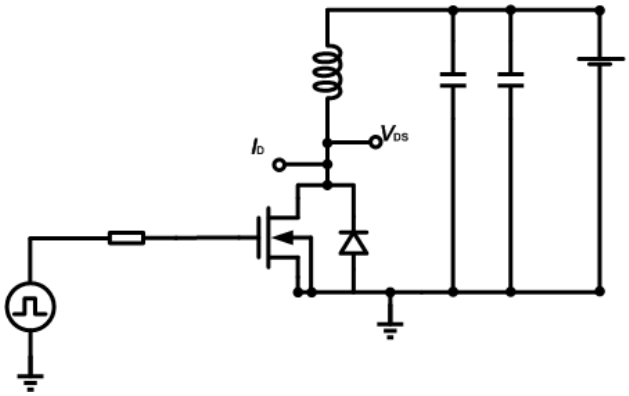


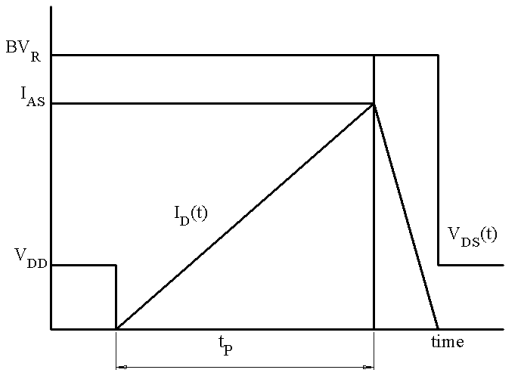
2. Switch Time Test Circuit



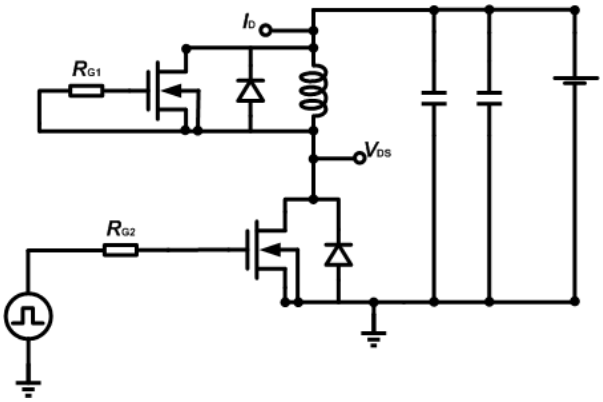


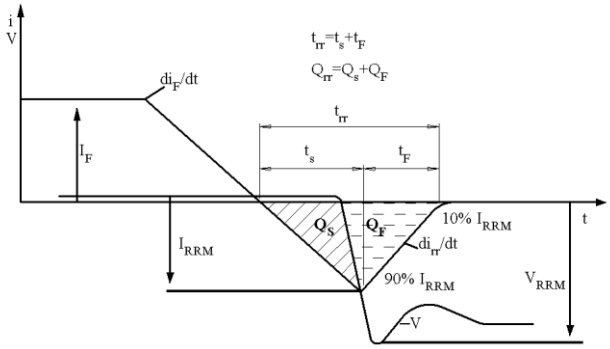
3. Unclaimed Inductive Switching Test Circuit & Waveforms





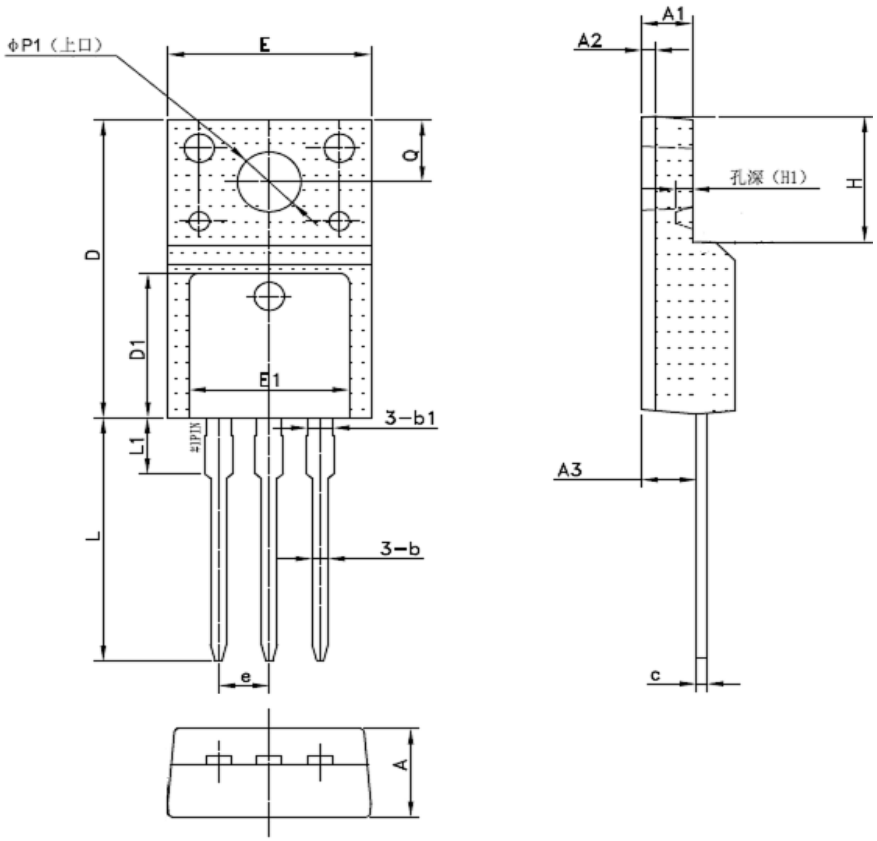
4. Test Circuit and Waveform for Diode Characteristics





Mechanical Dimensions

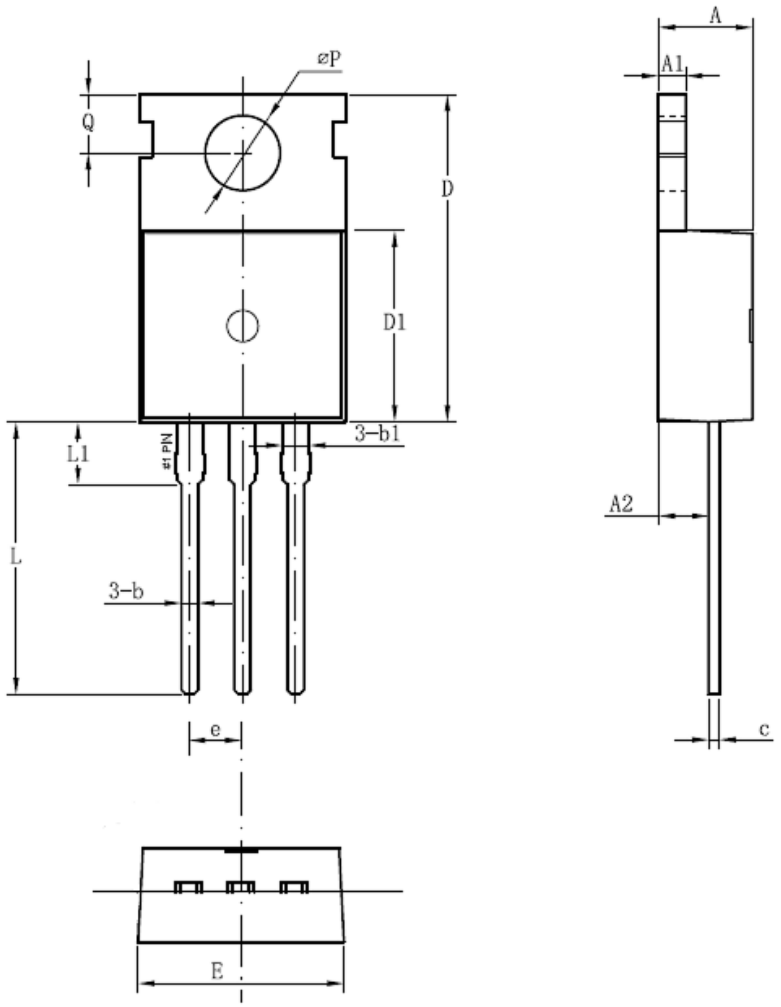
TO-220F **Unit: mm**



Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.30	4.70	4.90
A1	2.34	2.54	2.90
A2	-	0.70	-
A3	2.56	2.76	2.96
b	0.55	-	0.95
b1	-	1.28	-
c	0.42	0.50	0.70
D	14.70	-	16.07
D1	-	7.70	-
E	9.96	10.16	10.36
E1	-	8.00	-
e	2.54(BSC)		
H	-	6.70	-
(H1)	-	(0.81)	-
L	12.48	12.98	13.50
L1	-	2.93	-
ΦP1	-	3.18	-
Q	2.90	3.30	3.50

Mechanical Dimensions (Continued)

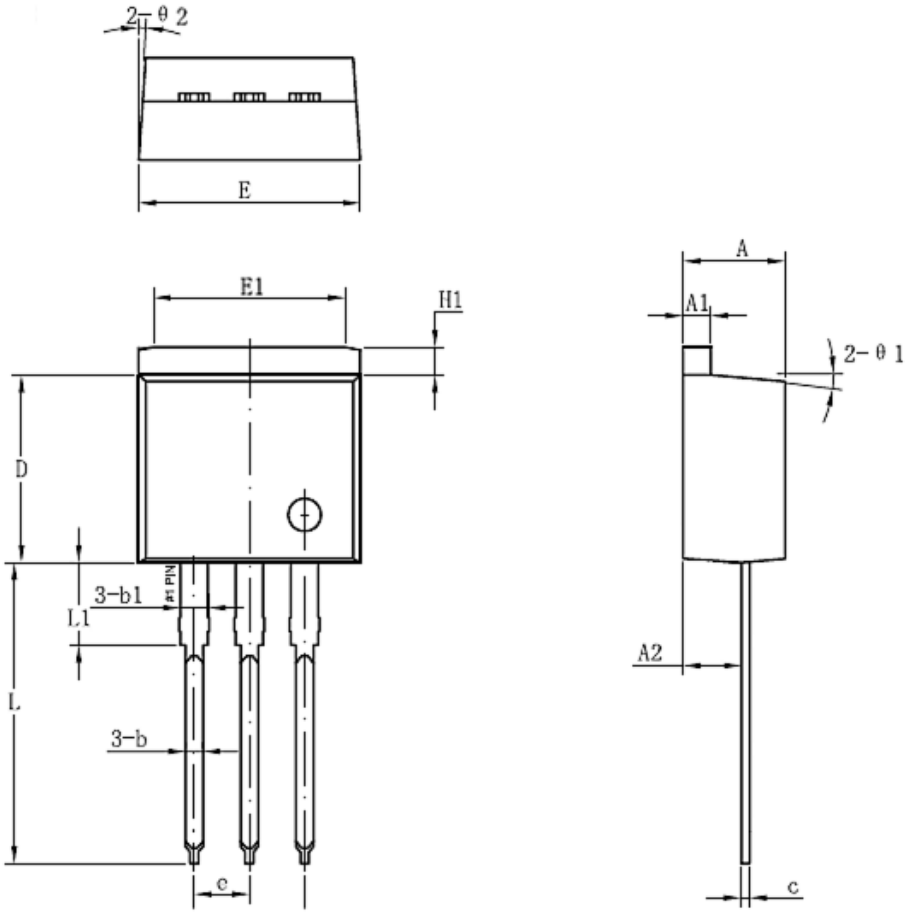
TO-220C **Unit: mm**



Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.30	4.50	4.70
A1	1.20	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b1	-	1.27	-
c	0.40	0.50	0.65
D	15.20	15.70	16.20
D1	9.00	9.20	9.40
E	9.70	10.00	10.20
e	2.54(BSC)		
L	12.60	13.08	13.60
L1	-	3.00	-
ΦP	3.50	3.60	3.80
Q	2.60	2.80	3.00

Mechanical Dimensions (Continued)

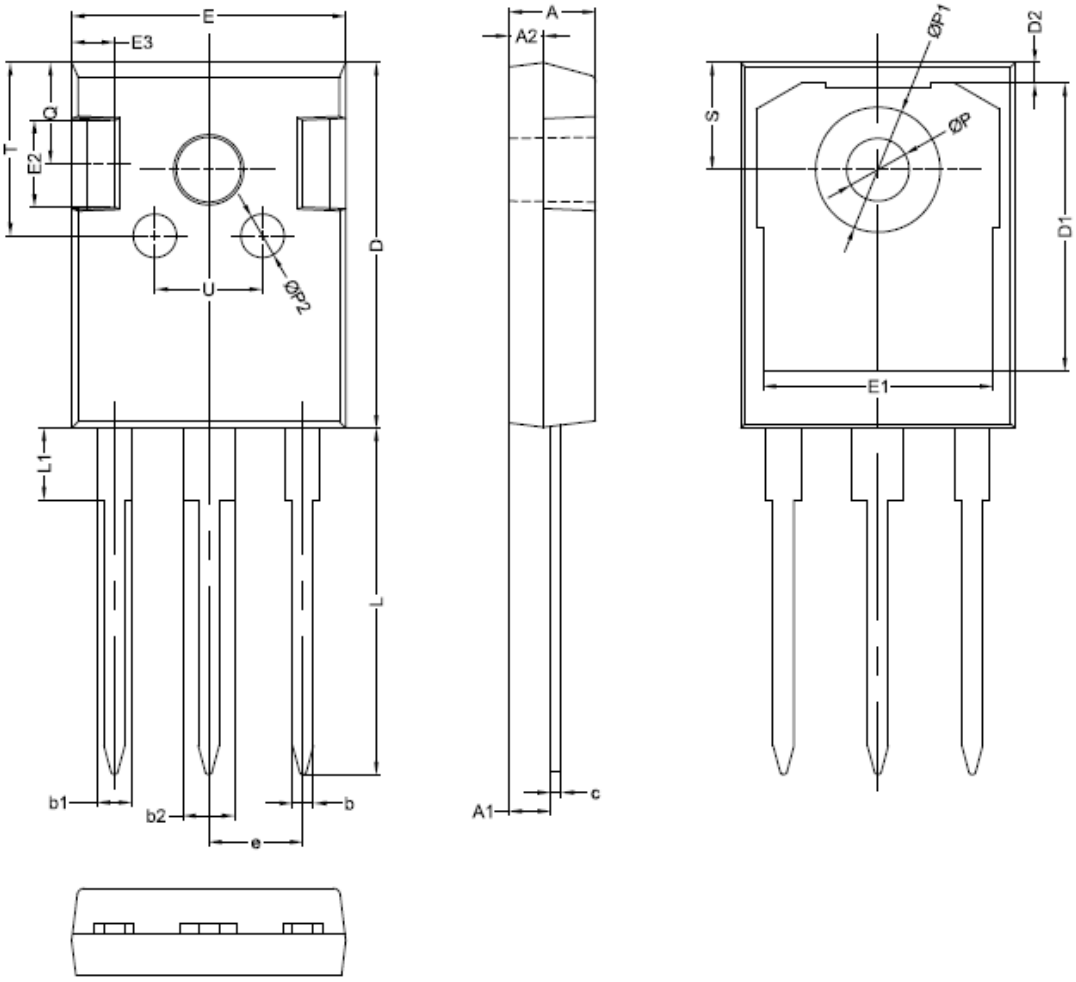
TO-262 **Unit: mm**



Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.30	4.65	4.85
A1	1.17	1.27	1.40
A2	2.20	-	2.89
b	0.70	0.81	0.96
b1	-	1.27	-
c	0.36	0.40	0.61
D	8.55	-	9.4
E	9.80	10.10	10.31
E1	-	8.80	-
e	2.54(BSC)		
H1	1.00	1.25	1.40
L	12.60	-	14.08
L1	-	3.8	-
θ1		5°	
θ2		4°	

Mechanical Dimensions (Continued)

TO-247 **Unit: mm**



Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.80	5.00	5.20	E2	-	5.00	-
A1	2.21	2.41	2.61	E3	-	2.50	-
A2	1.90	2.00	2.10	e	5.44(BSC)		
b	1.10	1.20	1.35	L	19.42	19.92	20.42
b1	-	2.00	-	L1	-	4.13	-
b2	-	3.00	-	P	3.50	3.60	3.70
c	0.55	0.60	0.75	P1	-	-	7.40
D	20.80	21.00	21.20	P2	-	2.50	-
D1	-	16.55	-	Q	-	5.80	-
D2	-	1.20	-	S	6.05	6.15	6.25
E	15.60	15.80	16.00	T	-	10.00	-
E1	-	13.30	-	U	-	6.20	-