4.3mΩ, 100V, N-Channel Power MOSFET SRT10N043H

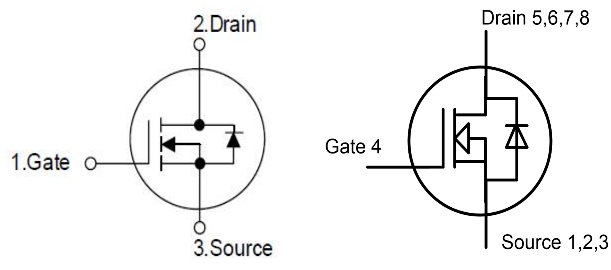
General Description

The Sanrise SRT10N043H is a low voltage power MOSFET, fabricated using advanced split gate trench 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 synchronous rectification.

The SRT10N043H break down voltage is 100V and it has a high rugged avalanche characteristics.

The SRT10N043H is available in PDFN5*6 and TO-220C and TO-263-2 packages.

Symbol



TO-220C,TO-263-2 PDFN5*6

Figure 1 Symbol of SRT10N043H

Package Type

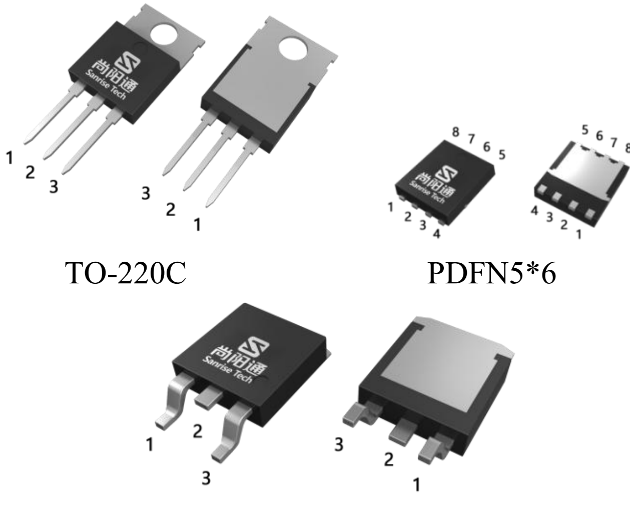


Figure 2 Package Type of SRT10N043H

Features

- Ultra Low

$R_{DS(ON)_TYP}$ = 3.7mΩ ,PDFN5*6 @V_{GS} = 10V.

$R_{DS(ON)_TYP}$ = 4.1mΩ ,TO-220C @V_{GS} = 10V.

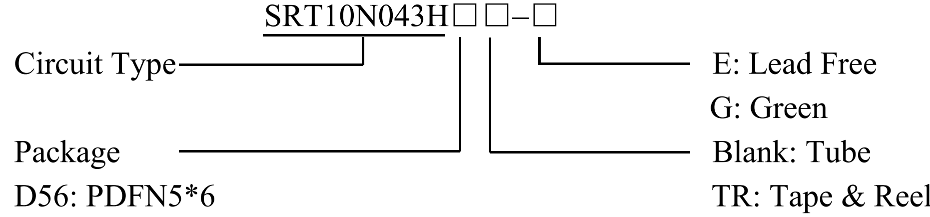
$R_{DS(ON)_TYP}$ = 3.9mΩ ,TO-263-2 @V_{GS} = 10V.

- Ultra Low Gate Charge, Qg=57nC typ.
- Fast switching capability
- Robust design with better EAS performance

Application

- Server/Telecom
- High Power Supply
- E-Tools
- BMS

Ordering Information



D56: PDFN5*6
TC: TO-220C
S2: TO-263-2

Package	Part Number	Marking ID	Packing Type
PDFN5*6	SRT10N043HD56TR-G	SRT10N043HD56G	Tape & Reel
TO-220C	SRT10N043HTC-E	SRT10N043HTCE	Tube
TO-263-2	SRT10N043HS2TR-E	SRT10N043HS2E	Tape & Reel

Absolute Maximum Ratings

Parameter		Symbol	Rating		Unit
Drain-Source Voltage		V_{DSS}	100		V
Gate-Source Voltage		V_{GSS}	±20		V
Continuous Drain Current	T_C=25℃	I_D	PDFN5*6	125	A
			TO-220C	125	
			TO-263-2	125	
	T_C=100℃		PDFN5*6	77	
			TO-220C	79	
			TO-263-2	81	
Pulsed Drain Current (Note 2)		I_{DM}	PDFN5*6	500	A
			TO-220C	500	
			TO-263-2	500	
Max Power Dissipation		P_D	119		W
Avalanche Destructive Energy, Single Pulse (Note 4)		E_{AS_Limit}	625		mJ
Avalanche Energy, Single Pulse (Note 3)		E_{AS}	110		mJ
Avalanche Energy, Repetitive (Note 2)		E_{AR}	0.2		mJ
Avalanche Current, Repetitive (Note 2)		I_{AR}	40.0		A
Continuous Diode Forward Current		I_S	100		A
Diode Pulse Current		$I_{S.PULSE}$	300		A
Operating Junction Temperature		T_J	150		℃
Storage Temperature		T_{STG}	-55 to 150		℃
Lead Temperature (Soldering, 10 sec)		T_{LEAD}	260		℃

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}= 21.0A, V_{DD}= 50V, R_G= 25Ω, Starting T_J= 25°C
4. I_{AS_Limit}= 50A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C

Thermal Resistance

Parameter		Symbol	Min	Typ	Max	Unit
Thermal Resistance，Junction-to-Case	PDFN5*6	R_{thJC}			1.05	℃/W
	TO-220C				0.94	
	TO-263-2				0.94	
Thermal Resistance，Junction-to-Ambient	PDFN5*6	R_{thJA}			50	
	TO-220C				60	
	TO-263-2				60	

Electrical Characteristics

T_J = 25℃, unless otherwise specified.

<table>
<tr><th colspan="2">Parameter</th><th>Symbol</th><th>Test Conditions</th><th>Min</th><th>Typ</th><th>Max</th><th>Unit</th></tr>
<tr><td colspan="8">Statistic Characteristics</td></tr>
<tr><td colspan="2">Drain-Source Breakdown Voltage</td><td>BV_{DSS}</td><td>V_{GS}=0V, I_D=250uA</td><td>100</td><td></td><td></td><td>V</td></tr>
<tr><td colspan="2">Zero Gate Voltage Drain Current</td><td>I_{DSS}</td><td>V_{DS}=100V, V_{GS}=0V</td><td></td><td></td><td>1</td><td>uA</td></tr>
<tr><td rowspan="2">Gate-Body Leakage Current</td><td>Forward</td><td>I_{GSSF}</td><td>V_{GS}=20V, V_{DS}=0V</td><td></td><td></td><td>100</td><td rowspan="2">nA</td></tr>
<tr><td>Reverse</td><td>I_{GSSR}</td><td>V_{GS}=-20V, V_{DS}=0V</td><td></td><td></td><td>-100</td></tr>
<tr><td colspan="2">Gate Threshold Voltage</td><td>$V_{GS(TH)}$</td><td>V_{DS}=V_{GS},
I_D=0.25mA</td><td>2.0</td><td>3.0</td><td>4.0</td><td>V</td></tr>
<tr><td rowspan="3">Static Drain-Source On-Resistance</td><td>PDFN5*6</td><td rowspan="3">$R_{DS(ON)}$</td><td rowspan="3">V_{GS}=10V, I_D=20A</td><td></td><td>3.7</td><td>4.3</td><td rowspan="3">mΩ</td></tr>
<tr><td>TO-220C</td><td></td><td>4.1</td><td>4.5</td></tr>
<tr><td>TO-263-2</td><td></td><td>3.9</td><td>4.3</td></tr>
<tr><td colspan="2">Gate Resistance</td><td>R_G</td><td>f=1MHz, Open Drain</td><td></td><td>1.0</td><td></td><td>Ω</td></tr>
<tr><td colspan="8">Dynamic Characteristics</td></tr>
<tr><td colspan="2">Input Capacitance</td><td>C_{ISS}</td><td rowspan="3">V_{DS}=50V, V_{GS}=0V,
f=1MHz</td><td></td><td>3.9</td><td></td><td>nF</td></tr>
<tr><td colspan="2">Output Capacitance</td><td>C_{OSS}</td><td></td><td>1.3</td><td></td><td>nF</td></tr>
<tr><td colspan="2">Reverse Transfer Capacitance</td><td>C_{RSS}</td><td></td><td>24</td><td></td><td>pF</td></tr>
<tr><td colspan="2">Effective output capacitance, energy related NOTE5</td><td>$C_{O(er)}$</td><td rowspan="2">V_{GS}=0V,
V_{DS}=0…60V</td><td></td><td>1.7</td><td></td><td rowspan="2">nF</td></tr>
<tr><td colspan="2">Effective output capacitance, time related NOTE6</td><td>$C_{O(tr)}$</td><td></td><td>2.1</td><td></td></tr>
<tr><td colspan="2">Turn-on Delay Time</td><td>$t_{d(on)}$</td><td rowspan="4">V_{DD}=50V, I_D=20A
R_G=3.0Ω, V_{GS}=10V</td><td></td><td>14</td><td></td><td rowspan="4">nS</td></tr>
<tr><td colspan="2">Rise Time</td><td>t_r</td><td></td><td>7</td><td></td></tr>
<tr><td colspan="2">Turn-off Delay Time</td><td>$t_{d(off)}$</td><td></td><td>32</td><td></td></tr>
<tr><td colspan="2">Fall Time</td><td>t_f</td><td></td><td>11</td><td></td></tr>
<tr><td colspan="8">Gate Charge Characteristics</td></tr>
<tr><td colspan="2">Gate to Source Charge</td><td>Q_{gs}</td><td rowspan="4">V_{DD}=50V, I_D=20A
V_{GS}=0 to 10V</td><td></td><td>16</td><td></td><td rowspan="3">nC</td></tr>
<tr><td colspan="2">Gate to Drain Charge</td><td>Q_{gd}</td><td></td><td>11</td><td></td></tr>
<tr><td colspan="2">Gate Charge Total</td><td>Q_g</td><td></td><td>57</td><td></td></tr>
<tr><td colspan="2">Gate Plateau Voltage</td><td>$V_{plateau}$</td><td></td><td>4.2</td><td></td><td>V</td></tr>
<tr><td colspan="2">Gate Charge Total, sync FET</td><td>Q_g</td><td>V_{DD}=0.1V, V_{GS}=0 to 10V</td><td></td><td>49</td><td></td><td>nC</td></tr>
<tr><td colspan="8">Reverse Diode Characteristics</td></tr>
<tr><td colspan="2">Drain-Source Diode Forward Voltage</td><td>V_{SD}</td><td>V_{GS}=0V, I_{SD}=20A</td><td></td><td>0.81</td><td>1.0</td><td>V</td></tr>
<tr><td colspan="2">Reverse Recovery Time</td><td>t_{rr}</td><td rowspan="3">V_R=50V, I_F=20A
dI_F/dt=100A/us</td><td></td><td>50</td><td></td><td>nS</td></tr>
<tr><td colspan="2">Reverse Recovery Charge</td><td>Q_{rr}</td><td></td><td>75</td><td></td><td>nC</td></tr>
<tr><td colspan="2">Peak Reverse Recovery Current</td><td>I_{rrm}</td><td></td><td>3</td><td></td><td>A</td></tr>
</table>

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 60V

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 60 V

Typical Performance Characteristics

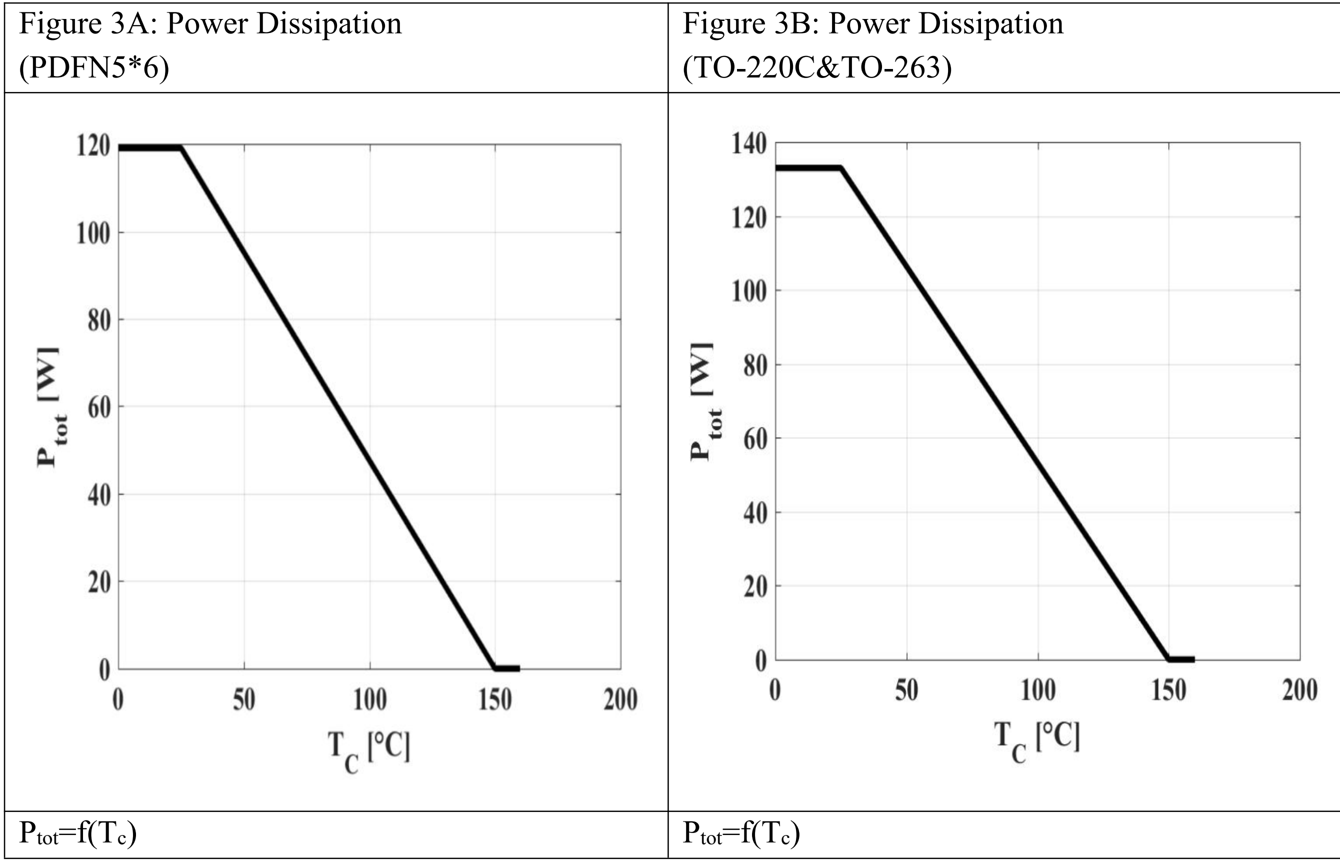


Figure 3A: Power Dissipation (PDFN5*6)	Figure 3B: Power Dissipation (TO-220C&TO-263)
$P_{tot}=f(T_c)$	$P_{tot}=f(T_c)$

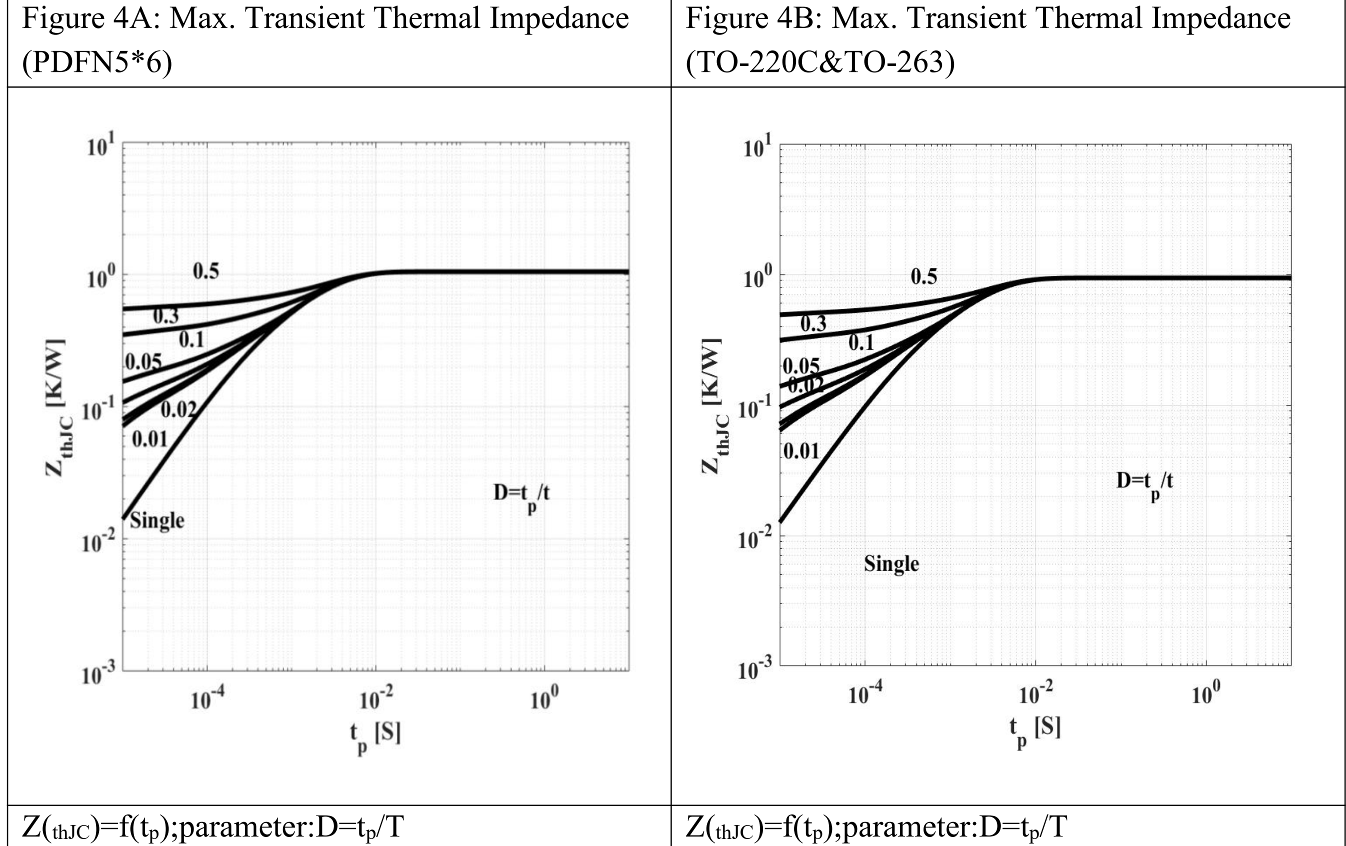


Figure 4A: Max. Transient Thermal Impedance (PDFN5*6)	Figure 4B: Max. Transient Thermal Impedance (TO-220C&TO-263)
$Z_{(thJC)}=f(t_p)$;parameter:$D=t_p/T$	$Z_{(thJC)}=f(t_p)$;parameter:$D=t_p/T$

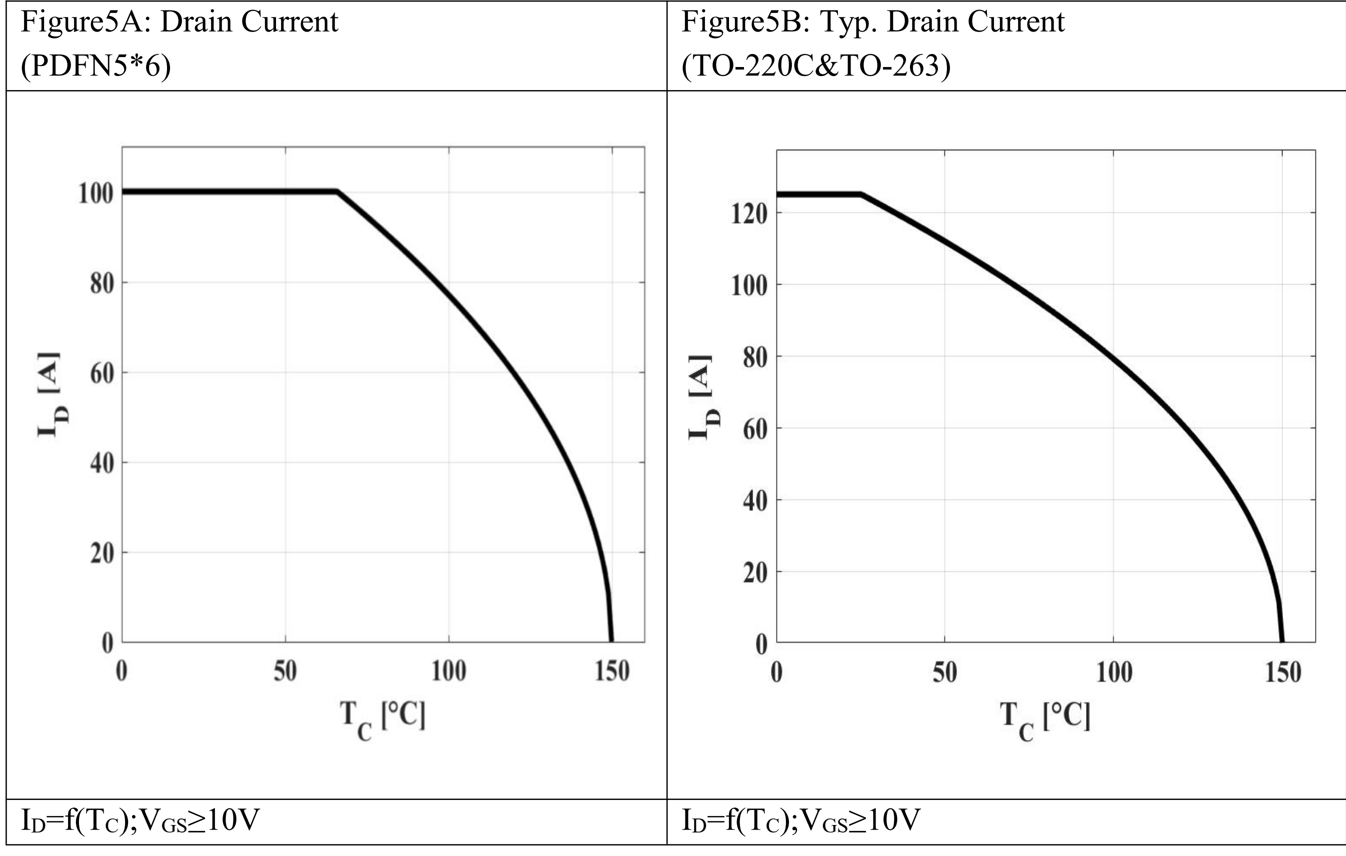


Figure5A: Drain Current
(PDFN5*6)
Figure5B: Typ. Drain Current
(TO-220C&TO-263)
I_D [A]
T_C [°C]
100
80
60
40
20
0
50
150
120
I_D=f(T_C);V_{GS}≥10V
I_D=f(T_C);V_{GS}≥10V

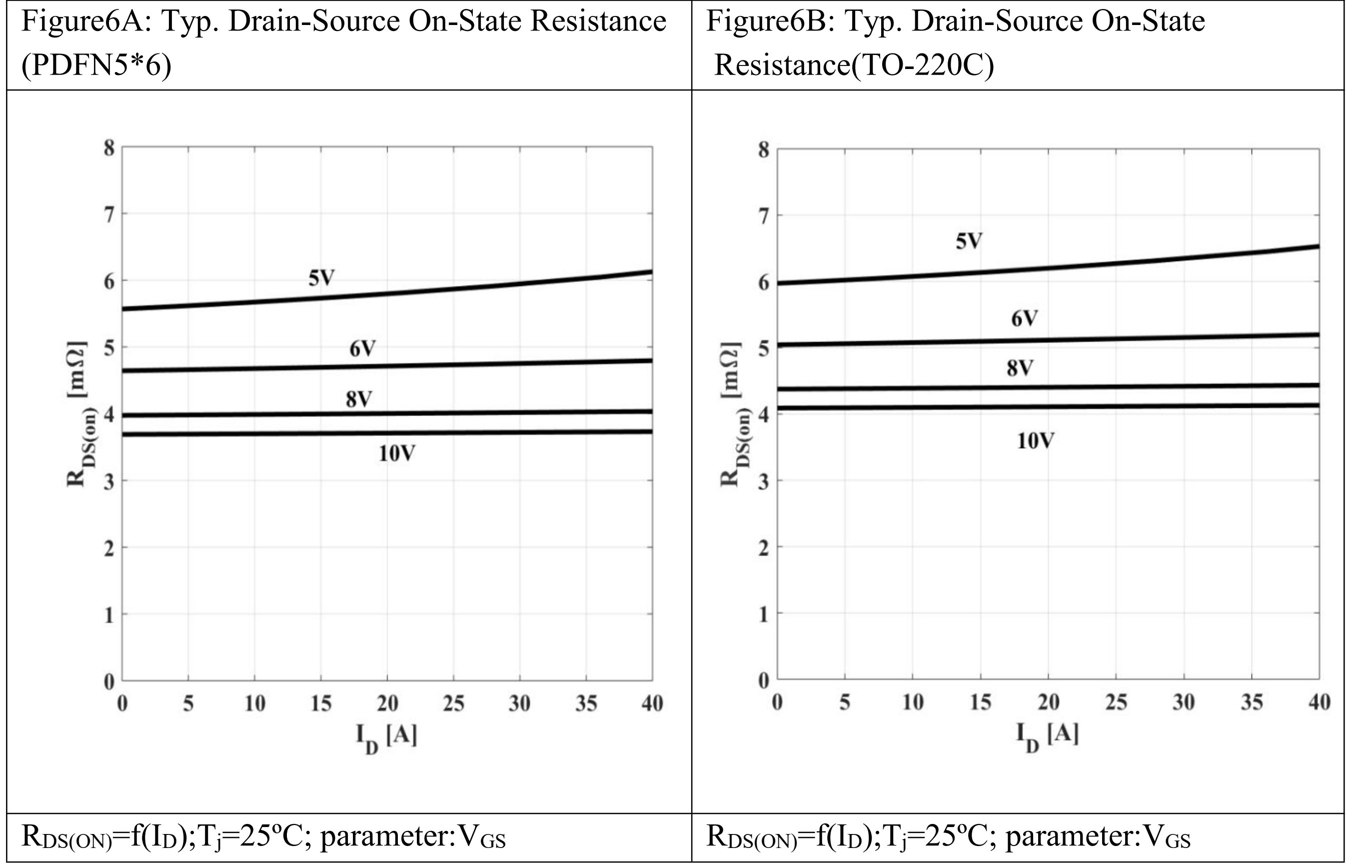


Figure6A: Typ. Drain-Source On-State Resistance
(PDFN5*6)
Figure6B: Typ. Drain-Source On-State
Resistance(TO-220C)
R_DS(on) [mΩ]
I_D [A]
5V
6V
8V
10V
0
5
10
15
20
25
30
35
40
1
2
3
4
6
7
8
$R_{DS(ON)}$=f(I_D);T_j=25°C; parameter:V_{GS}
$R_{DS(ON)}$=f(I_D);T_j=25°C; parameter:V_{GS}

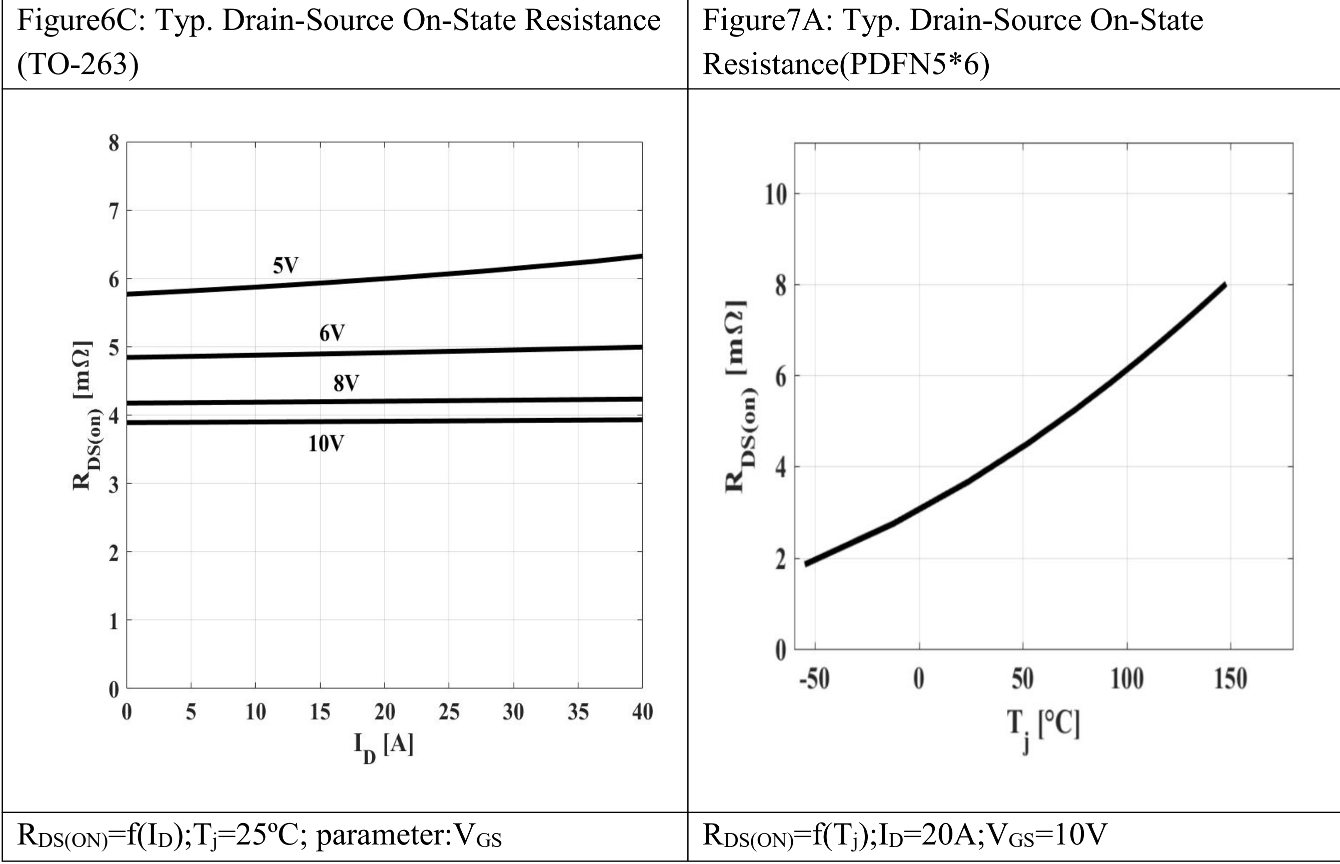


Figure6C: Typ. Drain-Source On-State Resistance (TO-263)	Figure7A: Typ. Drain-Source On-State Resistance(PDFN5*6)
$R_{DS(ON)}=f(I_D);T_j=25°C$; parameter:$V_{GS}$	$R_{DS(ON)}=f(T_j);I_D=20A;V_{GS}=10V$

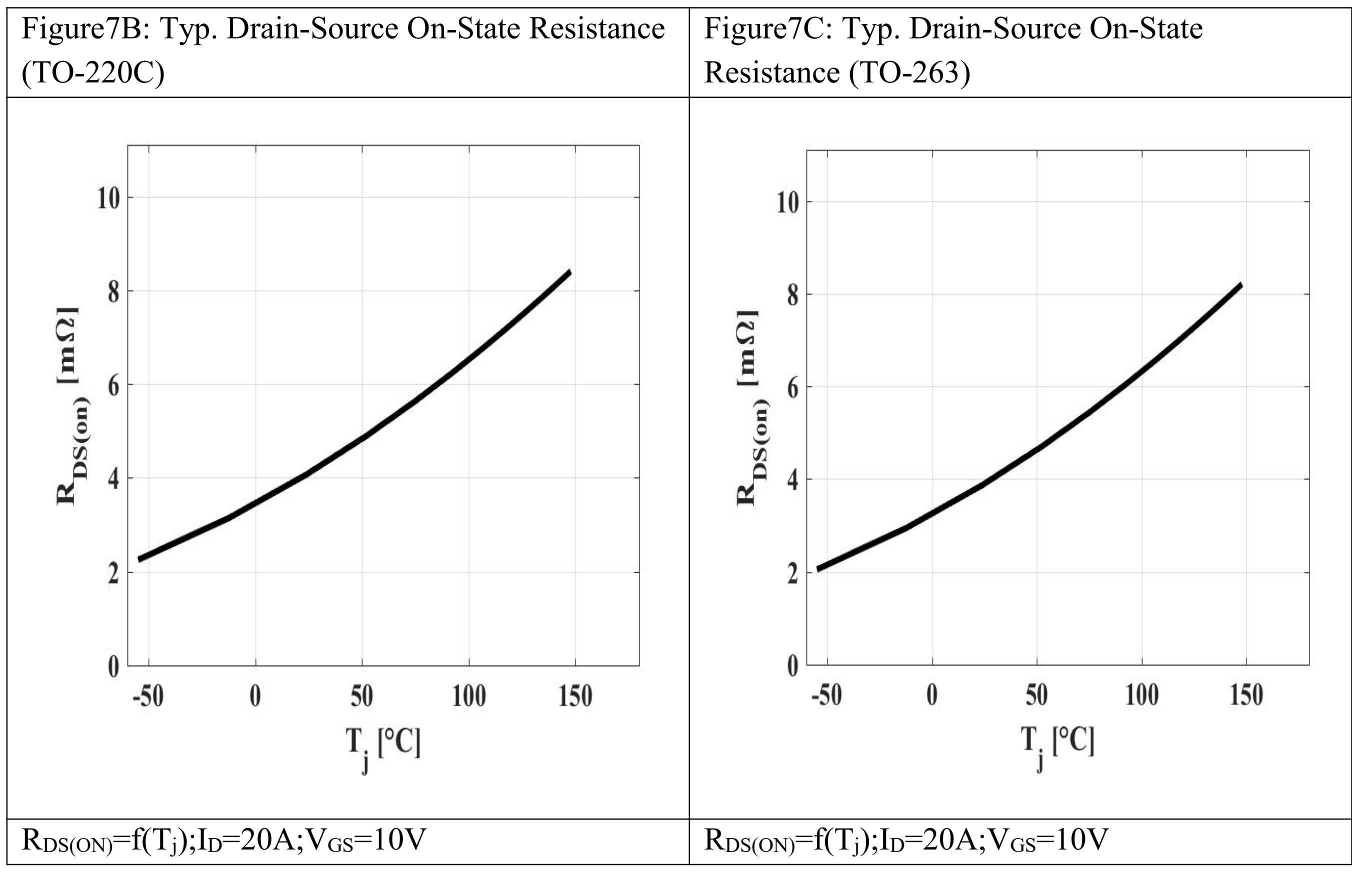


Figure7B: Typ. Drain-Source On-State Resistance (TO-220C)	Figure7C: Typ. Drain-Source On-State Resistance (TO-263)
$R_{DS(ON)}=f(T_j);I_D=20A;V_{GS}=10V$	$R_{DS(ON)}=f(T_j);I_D=20A;V_{GS}=10V$

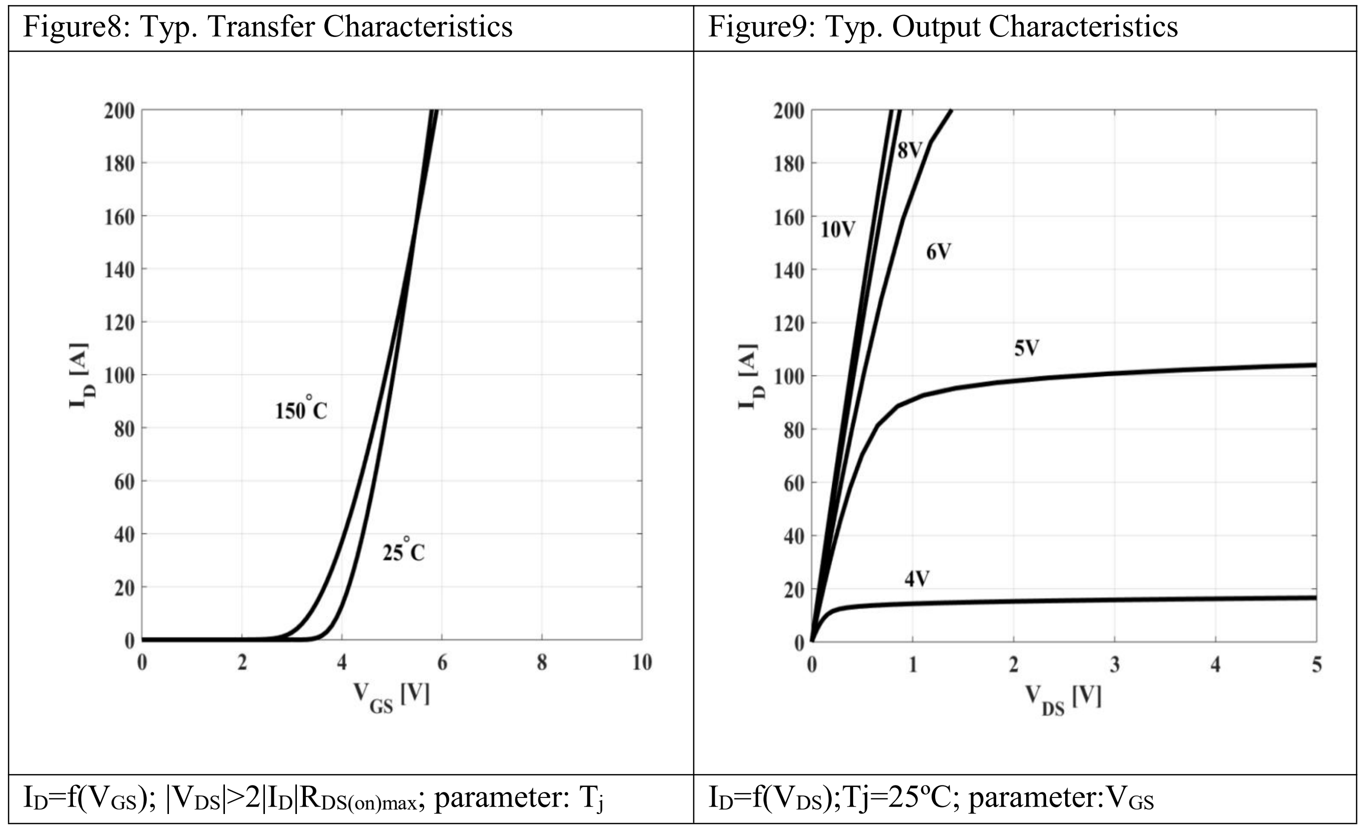


Figure8: Typ. Transfer Characteristics

I_D=f(V_{GS}); |V_{DS}|>2|I_D|$R_{DS(on)max}$; parameter: T_j

Figure9: Typ. Output Characteristics

I_D=f(V_{DS});Tj=25ºC; parameter:V_{GS}

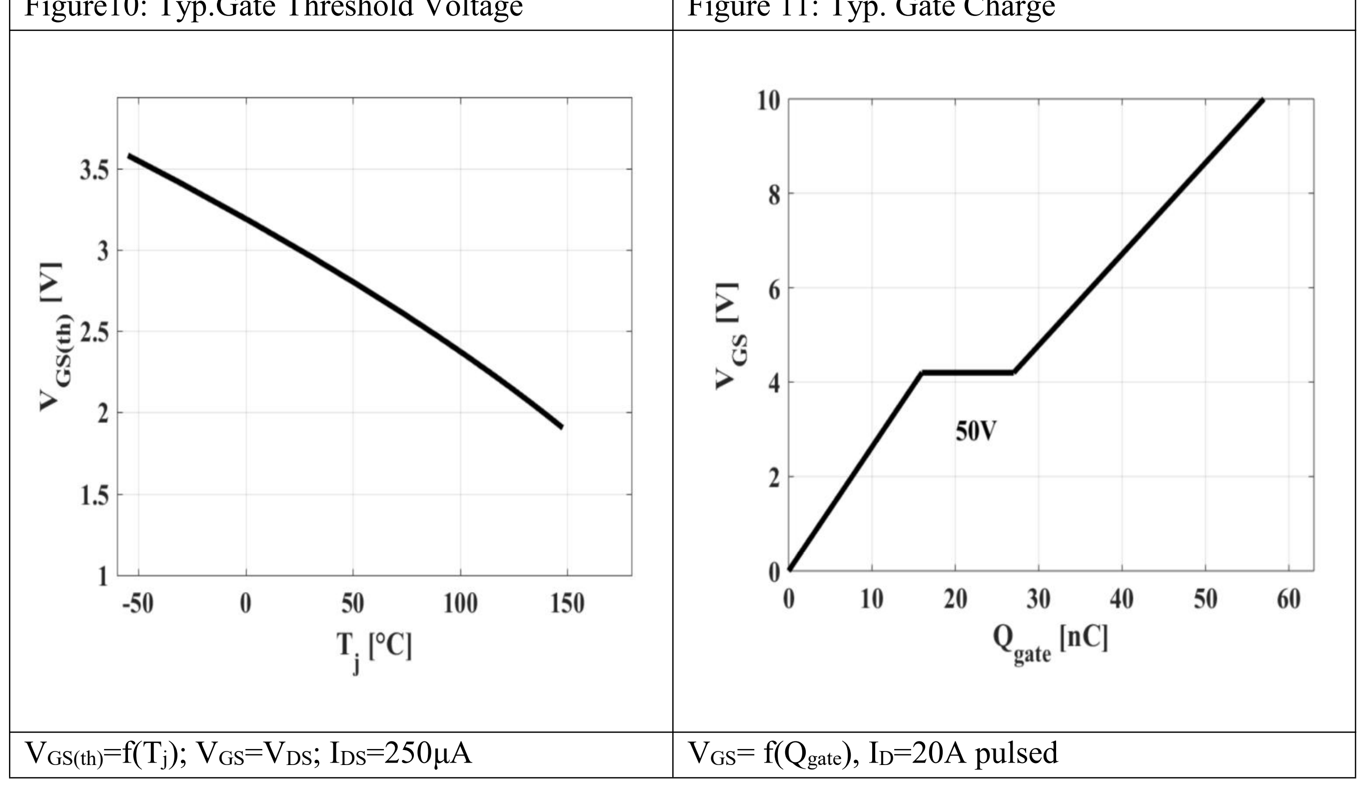


Figure10: Typ.Gate Threshold Voltage

$V_{GS(th)}$=f(T_j); V_{GS}=V_{DS}; I_{DS}=250μA

Figure 11: Typ. Gate Charge

V_{GS}= f(Q_{gate}), I_D=20A pulsed

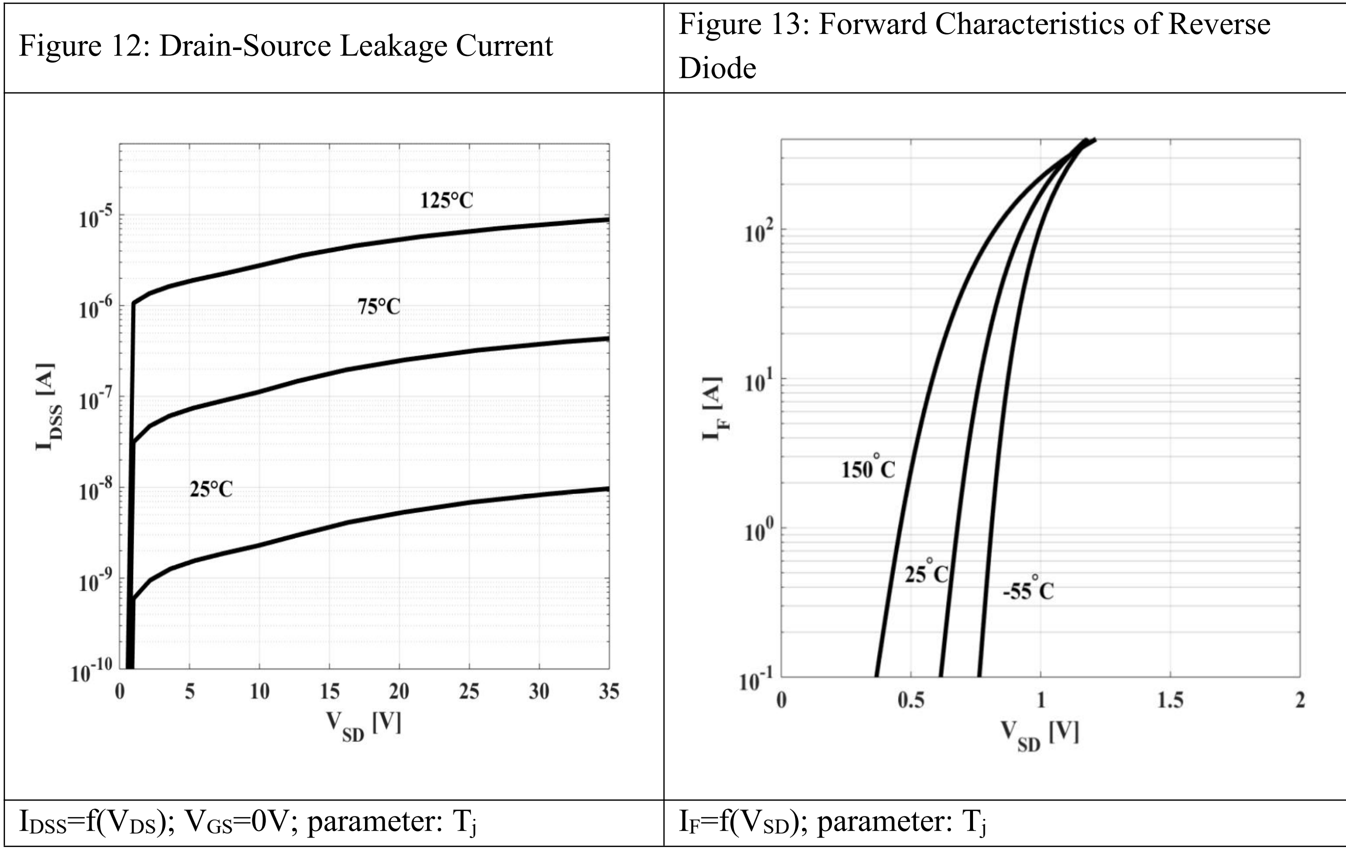


Figure 12: Drain-Source Leakage Current	Figure 13: Forward Characteristics of Reverse Diode
$I_{DSS}=f(V_{DS})$; $V_{GS}=0V$; parameter: T_j	$I_F=f(V_{SD})$; parameter: T_j

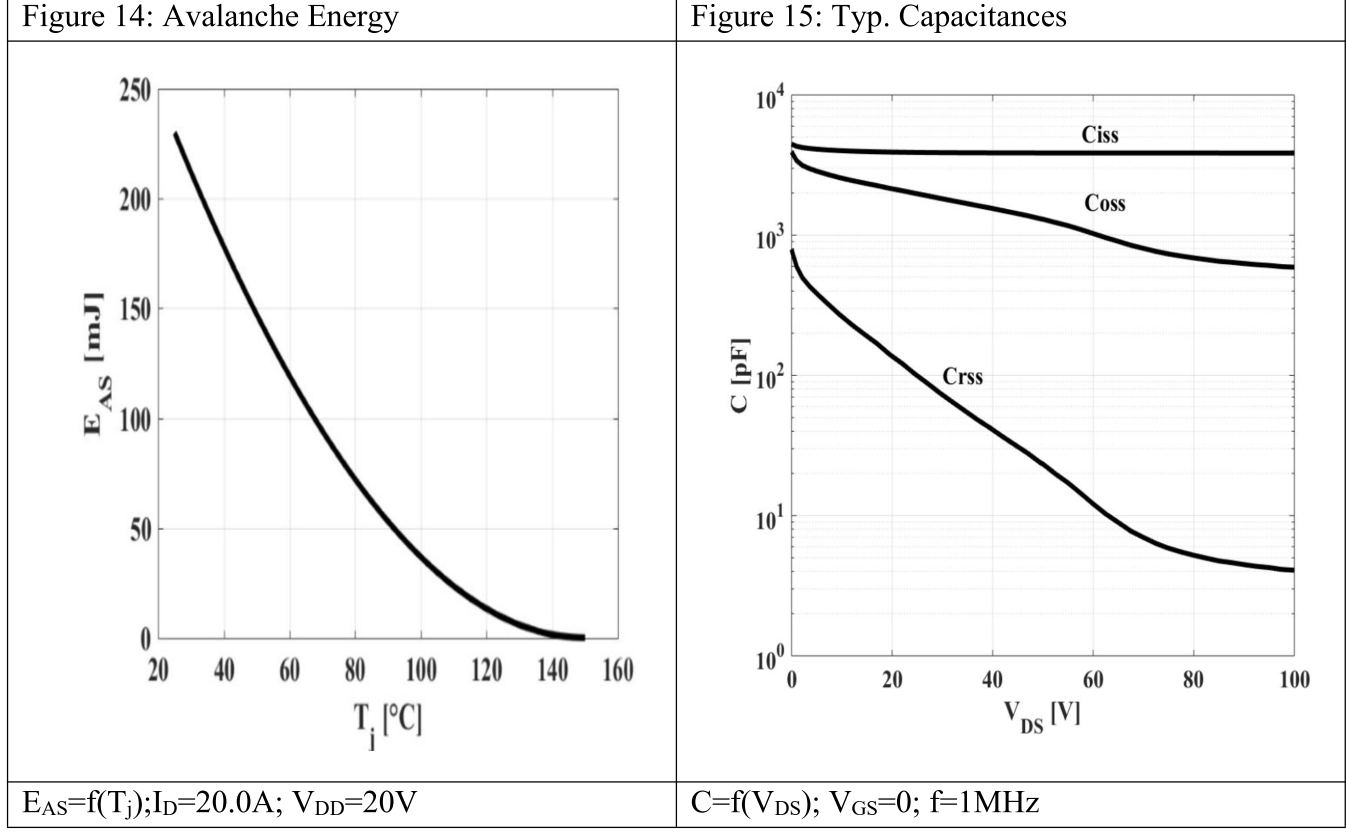


Figure 14: Avalanche Energy	Figure 15: Typ. Capacitances
$E_{AS}=f(T_j)$;$I_D=20.0A$; $V_{DD}=20V$	$C=f(V_{DS})$; $V_{GS}=0$; f=1MHz

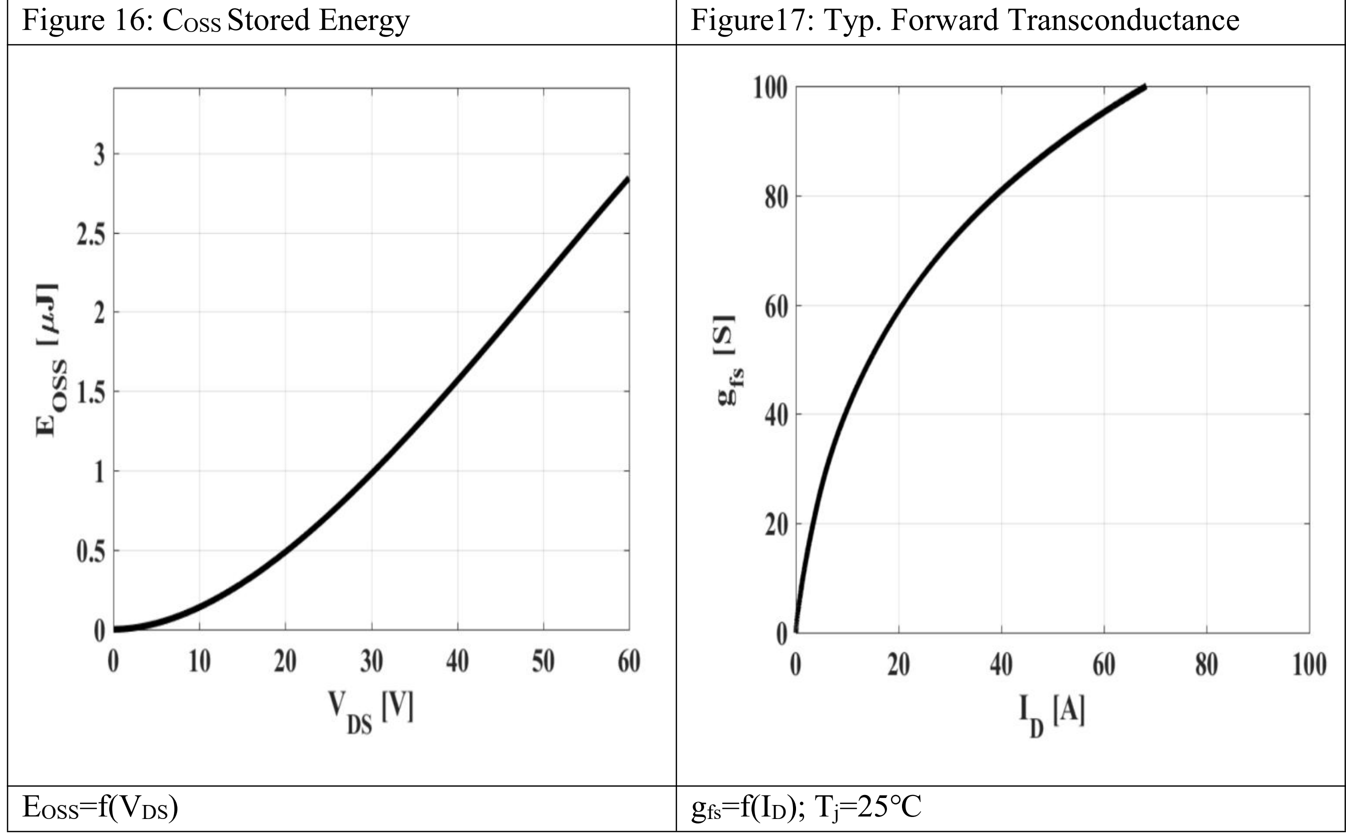


Figure 16: C_{OSS} Stored Energy

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

Figure17: Typ. Forward Transconductance

$g_{fs}=f(I_D)$; T_j=25°C

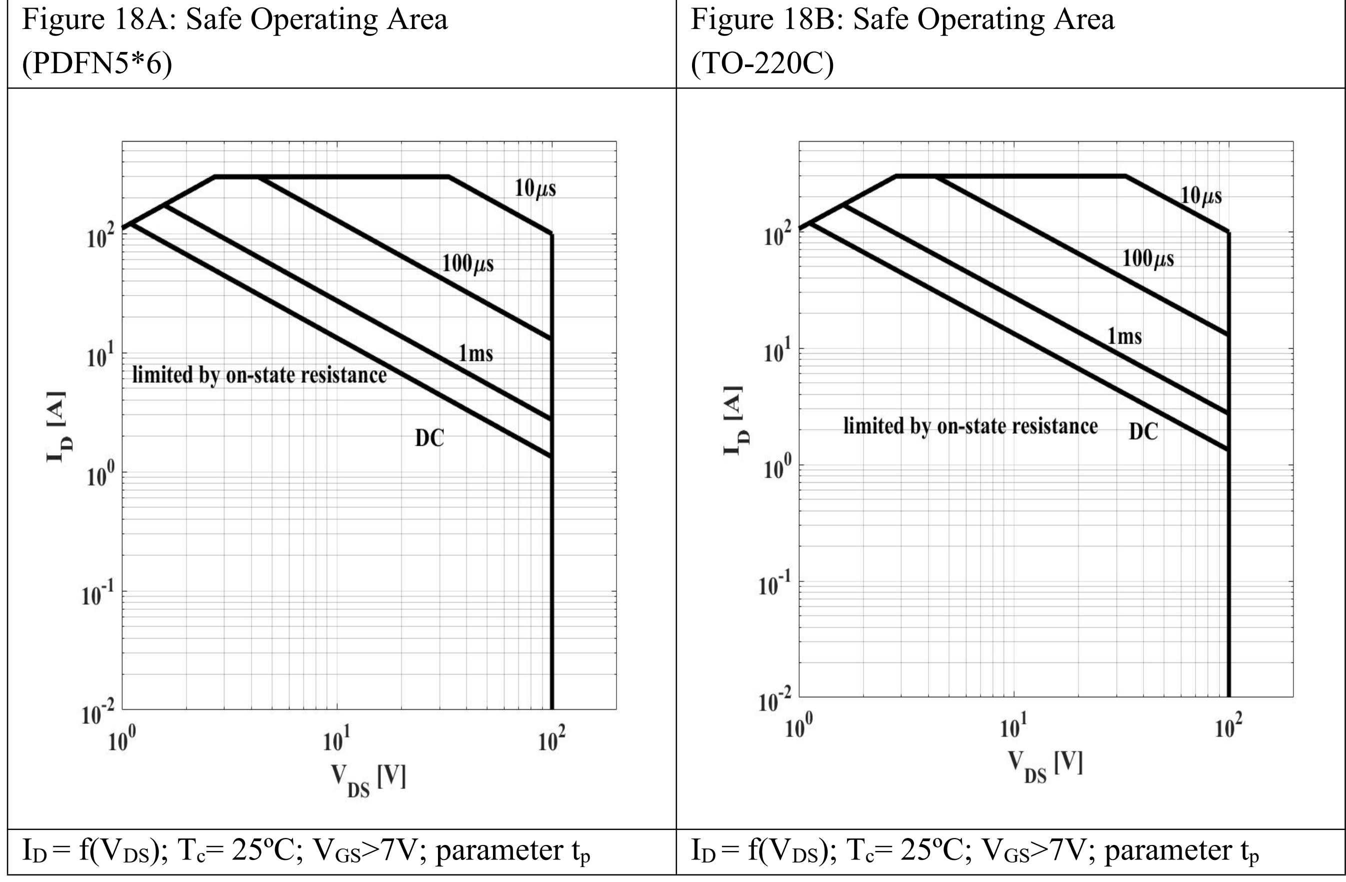


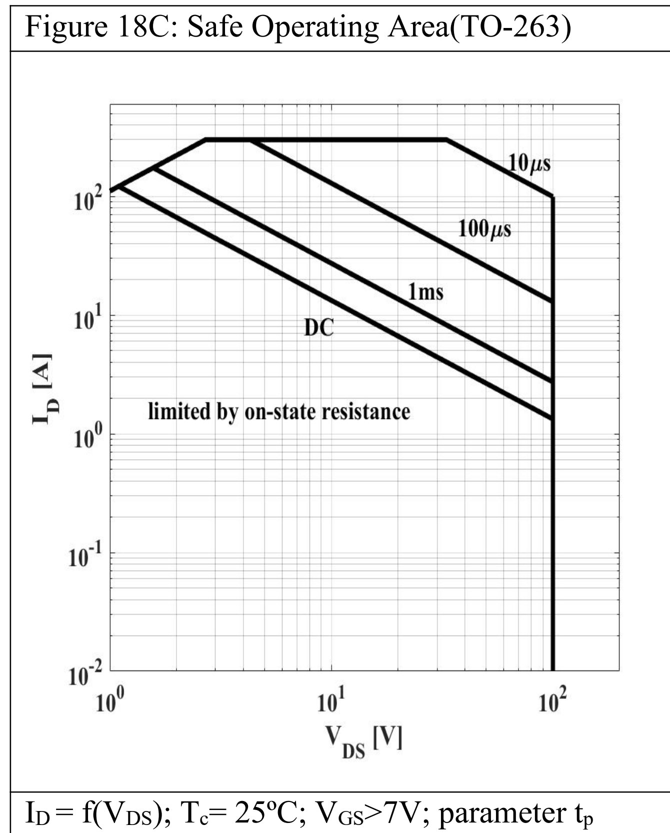
Figure 18A: Safe Operating Area (PDFN5*6)

$I_D = f(V_{DS})$; T_c= 25ºC; V_{GS}>7V; parameter t_p

Figure 18B: Safe Operating Area (TO-220C)

$I_D = f(V_{DS})$; T_c= 25ºC; V_{GS}>7V; parameter t_p

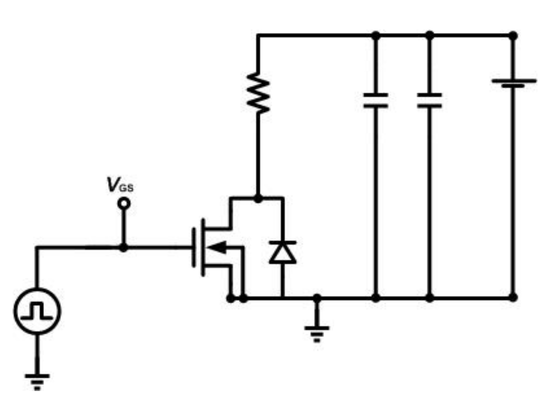
Figure 18C: Safe Operating Area(TO-263)

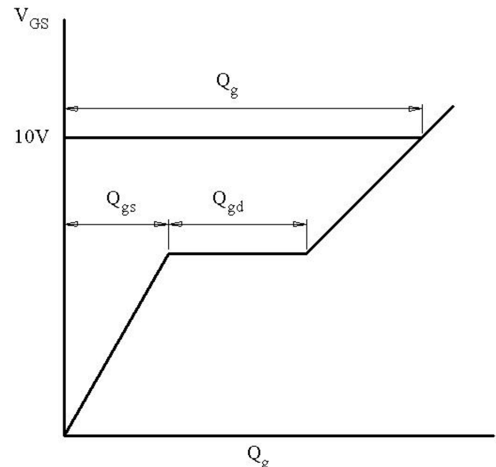


$I_D = f(V_{DS})$; $T_c = 25^oC$; $V_{GS} > 7V$; parameter t_p

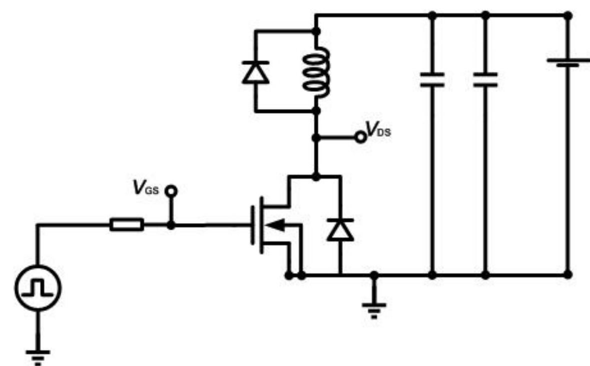
Test Circuits

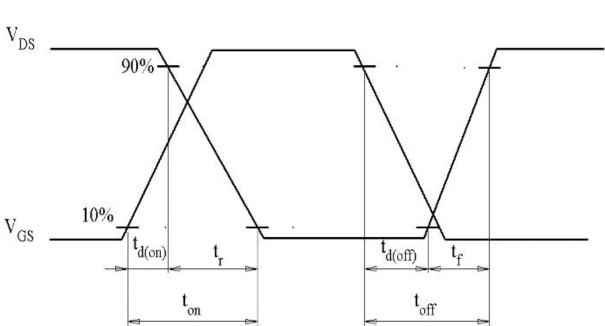
1. Gate Charge Test Circuit & Waveform



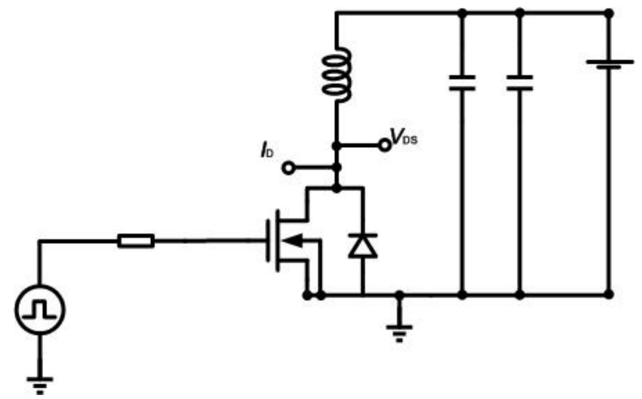


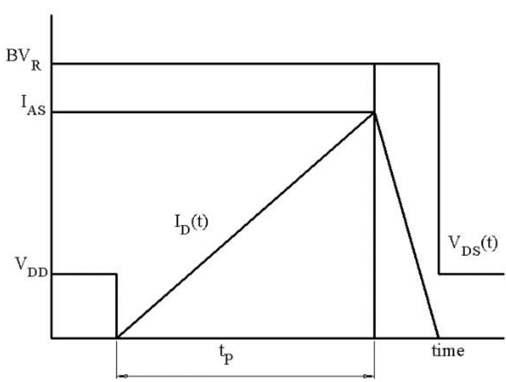
2. Switch Time Test Circuit



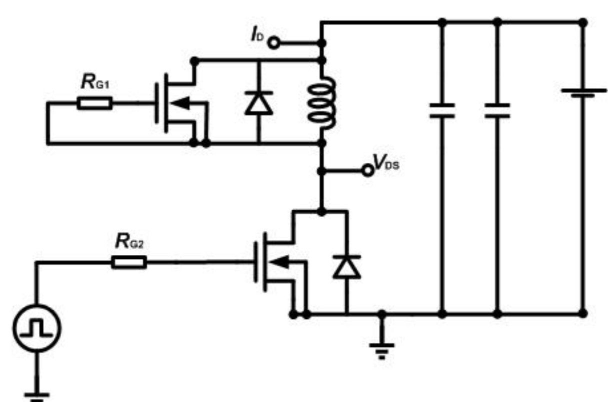


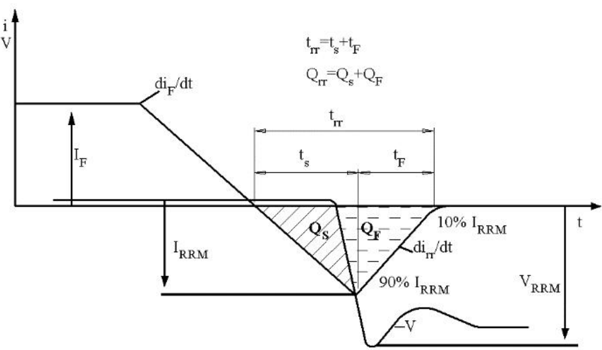
3. Unclamped Inductive Switching Test Circuit & Waveforms





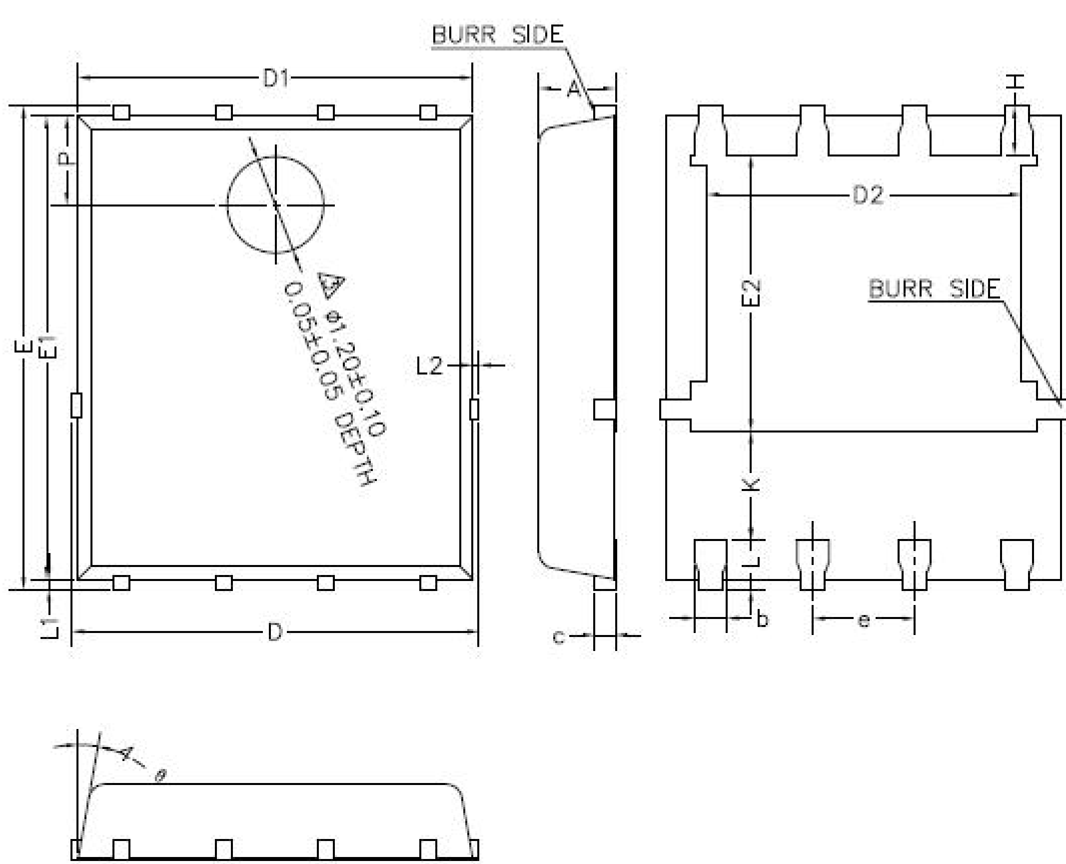
4. Test Circuit and Waveform for Diode Characteristics





Mechanical Dimensions

PDFN5*6 **Unit: mm**

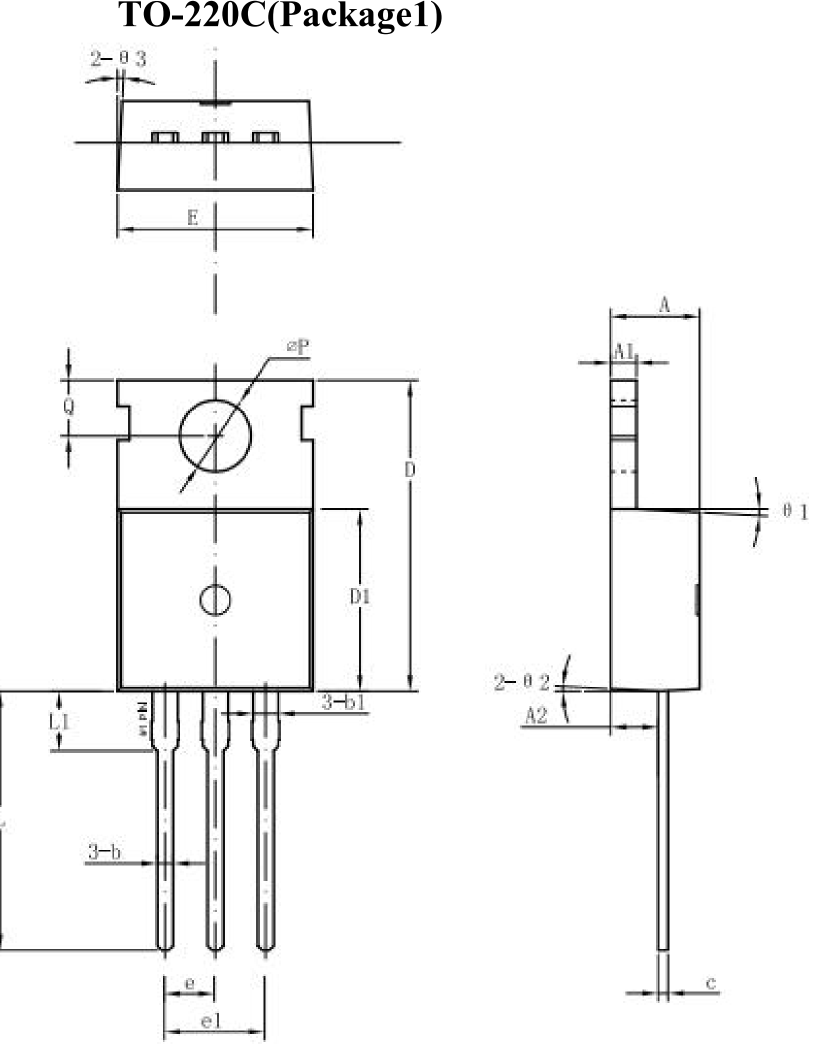


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	0.90	1.10	1.20
b	0.35	0.40	0.45
c	0.21	0.25	0.34
D			5.10
D1	4,80	4.90	5.00
D2	3.91	4.01	4.11
e	1.17	1.27	1.37
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.34	3.44	3.54
H	0.51	0.61	0.71
K	1.10		
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
L2			0.10
P	1.00	1.10	1.20
θ	8º	10º	12º

Mechanical Dimensions

TO-220C(Package1)

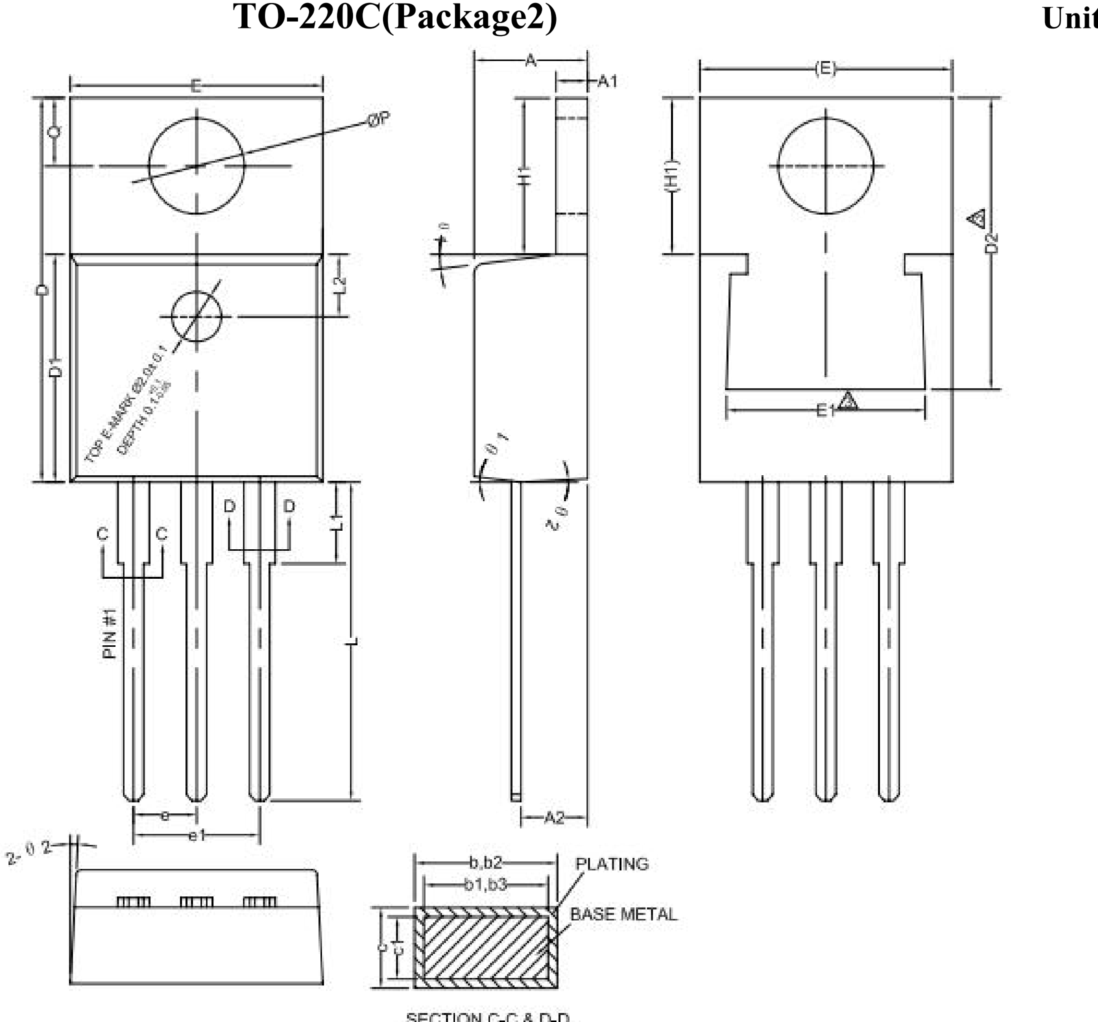
Unit: mm



Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.30	4.50	4.70	e	–	2.54	–
A1	1.25	1.30	1.40	e1	–	5.08	–
A2	2.20	2.40	2.60	L	12.60	13.08	13.60
b	0.70	0.80	0.95	L1	–	3.00	–
b1	–	1.27	–	ΦP	3.50	3.60	3.80
c	0.40	0.50	0.65	Q	2.60	2.80	3.00
D	15.20	15.70	16.20	Θ1	–	3°	–
D1	9.00	9.20	9.40	Θ2	–	3°	–
E	9.70	10.00	10.10	Θ3	–	3°	–

Mechanical Dimensions

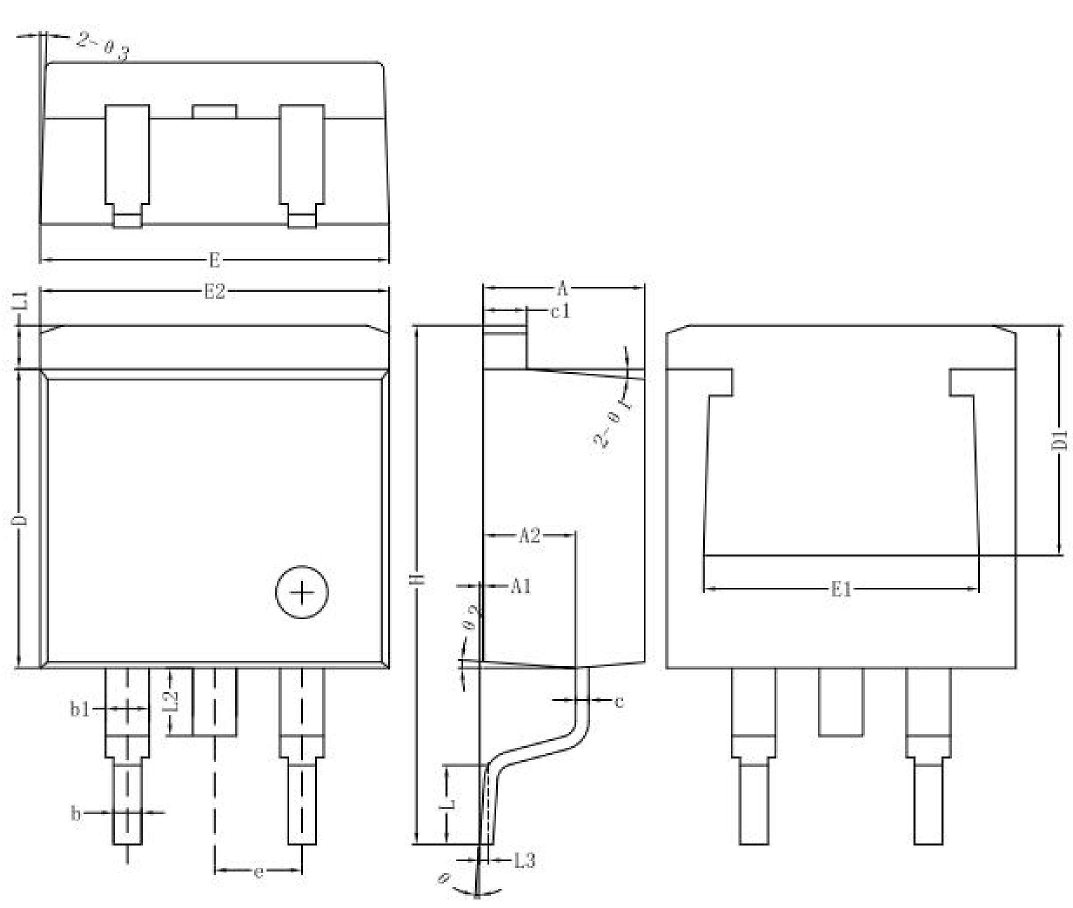
TO-220C(Package2) **Unit: mm**



Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.40	4.57	4.70	E	9.96	10.16	10.36
A1	1.22	–	1.32	E1	6.86	–	8.89
A2	2.59	2.69	2.79	e	2.44	2.54	2.64
b	0.77	–	0.90	e1	4.98	5.08	5.18
b1	0.76	0.81	0.86	H1	6.10	6.30	6.50
b2	1.23	–	1.36	L	12.70	–	13.12
b3	1.22	1.27	1.32	L1	–	–	3.90
c	0.34	–	0.47	L2	–	2.50REF	–
c1	0.33	0.38	0.43	ΦP	3.80	3.84	3.88
D	15.15	15.45	15.75	Q	2.60	–	2.90
D1	9.05	9.15	9.25	θ1	5°	7°	9°
D2	11.40	–	12.88	θ2	1°	3°	5°

Mechanical Dimensions (Continued)

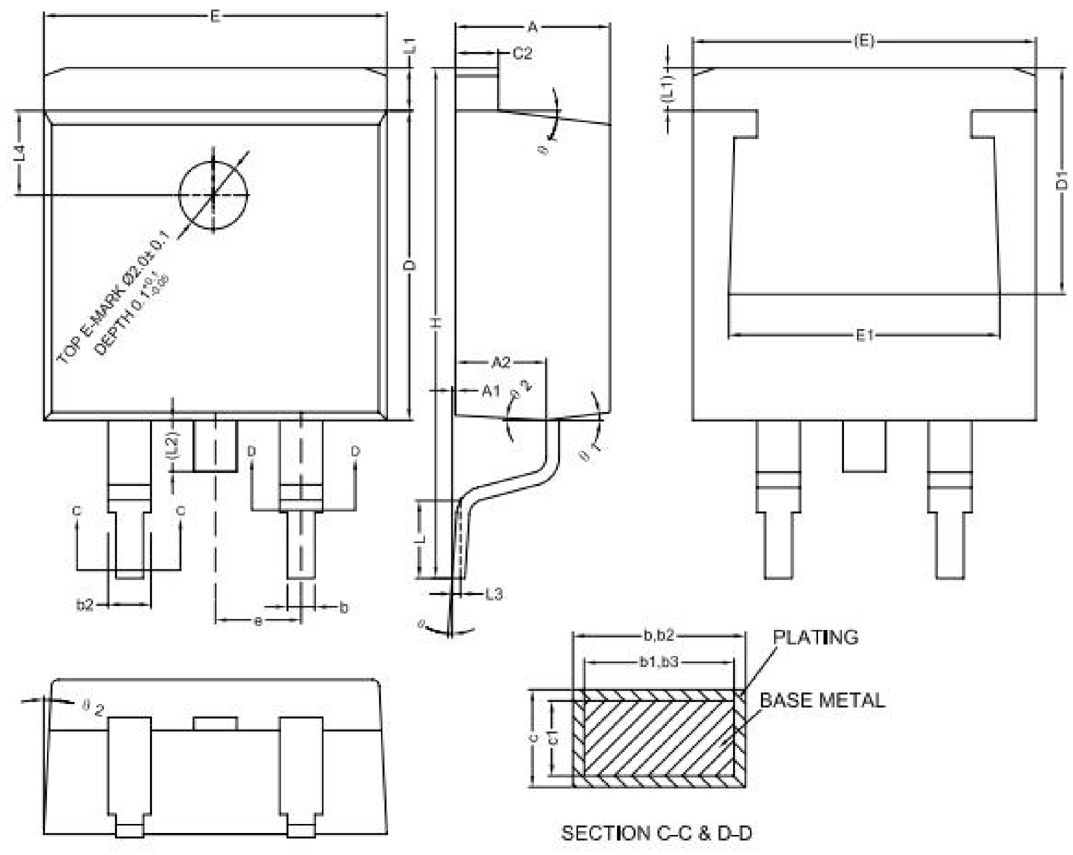
TO-263-2(Package1) **Unit: mm**



Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.55	4.70	4.85	E2	9.98	10.08	10.18
A1	0.00	0.10	0.25	e	–	2.54	–
A2	2.59	2.69	2.89	H	14.70	15.10	15.50
b	0.71	0.81	0.96	L	2.00	2.30	2.70
b1	–	1.27	–	L1	1.17	1.27	1.40
c	0.36	0.38	0.61	L2	–	–	2.20
c1	1.17	1.27	1.37	L3	–	0.25BSC	–
D	8.55	8.70	8.85	Θ	0°	–	8°
D1	–	7.20	–	Θ1	–	5°	–
E	10.01	10.16	10.31	Θ2	–	4°	–
E1	–	7.8	–	Θ3	–	4°	–

Mechanical Dimensions (Continued)

TO-263-2(Package2)



Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.40	4.57	4.70	E	10.06	10.16	10.26
A1	0.00	0.10	0.25	E1	7.80	–	8.20
A2	2.59	2.69	2.79	e	–	2.54BSC	–
b	0.77	–	0.90	H	14.70	15.10	15.50
b1	0.76	0.81	0.86	L	2.00	2.30	2.60
b2	1.23	–	1.36	L1	1.17	1.27	1.40
b3	1.22	1.27	1.32	L2	–	–	1.75
c	0.34	–	0.47	L3	–	0.25BSC	–
c1	0.33	0.38	0.43	L4	–	2.00REF	–
c2	1.22	–	1.32	Θ	0°	–	8°
D	9.05	9.15	9.25	Θ1	5°	7°	9°
D1	6.60	–	–	Θ2	1°	3°	5°

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