

General Description

The Sanrise SRT10N047H 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 SRT10N047H break down voltage is 100V and it has a high rugged avalanche characteristics. The SRT10N047H is available in PDFN5*6 and TO-220C and TO-263-2 and TO-247 and TOLL packages.

Features

- Ultra Low
 - $R_{DS(ON_TYP)} = 4.2m\Omega$,PDFN5*6 @ $V_{GS} = 10V$.
 - $R_{DS(ON_TYP)} = 4.7m\Omega$,TO-220C @ $V_{GS} = 10V$.
 - $R_{DS(ON_TYP)} = 4.7m\Omega$,TO-220F @ $V_{GS} = 10V$.
 - $R_{DS(ON_TYP)} = 4.5m\Omega$,TO-263-2 @ $V_{GS} = 10V$.
 - $R_{DS(ON_TYP)} = 4.9m\Omega$,TO-247 @ $V_{GS} = 10V$.
 - $R_{DS(ON_TYP)} = 4.4m\Omega$,PDFN5*6 @ $V_{GS} = 10V$.
- Ultra Low Qgd, Qg=80nC typ.
- Fast switching capability
- Robust design with better EAS performance
- EMI Improved
- Non-automotive Qualified

Application

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

Symbol

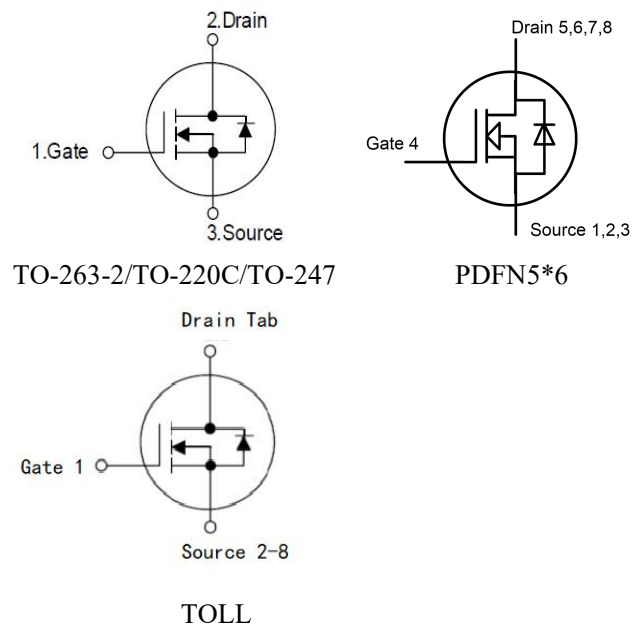


Figure 1 Symbol of SRT10N047H

Package Type

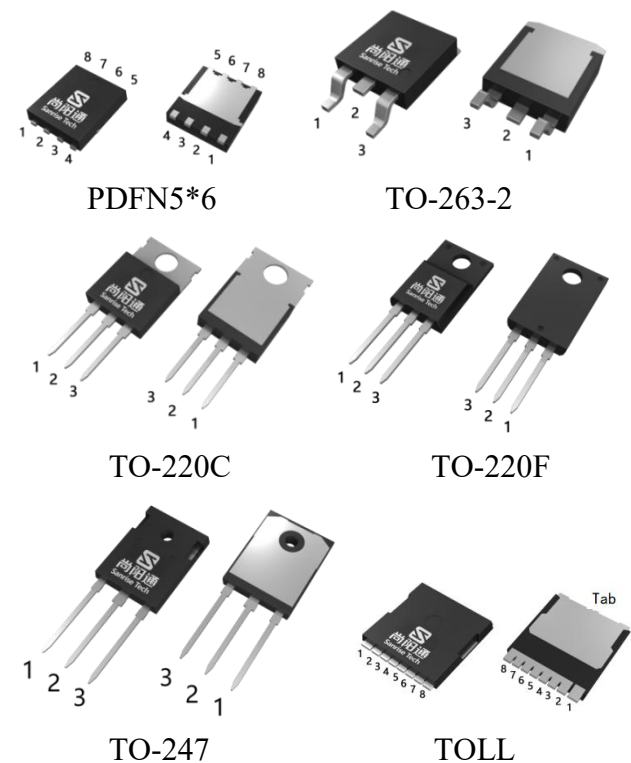
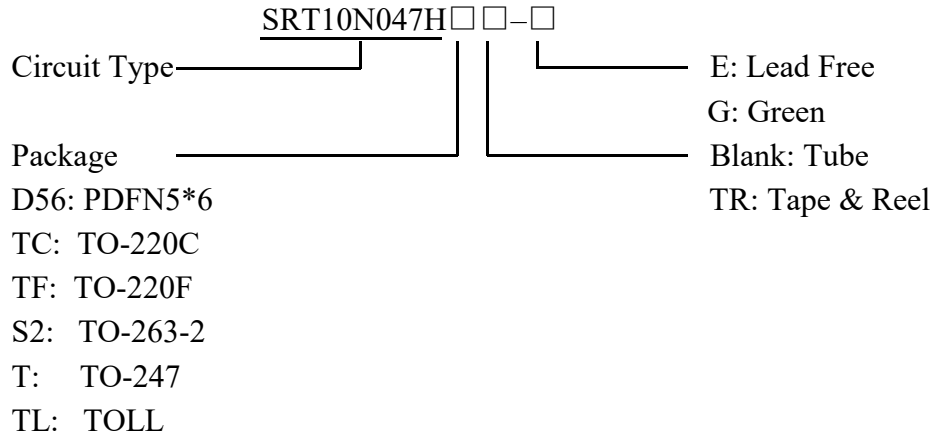


Figure 2 Package Type of SRT10N047H

Ordering Information


Package	Part Number		Marking ID		Packing Type
	Lead Free	Green	Lead Free	Green	
PDFN5*6	SRT10N047HD56TR-E	SRT10N047HD56TR-G	SRT10N047HD56E	SRT10N047HD56G	Tape & Reel
TO-220C	SRT10N047HTC-E	SRT10N047HTC-G	SRT10N047HTCE	SRT10N047HTCG	Tube
TO-220F	SRT10N047HTF-E	SRT10N047HTF-G	SRT10N047HTFE	SRT10N047HTFG	Tube
TO-263-2	SRT10N047HS2TR-E	SRT10N047HS2TR-G	SRT10N047HS2E	SRT10N047HS2G	Tape & Reel
TO-247	SRT10N047HT-E	SRT10N047HT-G	SRT10N047HTE	SRT10N047HTG	Tube
TOLL	SRT10N047HTLTR-E	SRT10N047HTLTR-G	SRT10N047HTLE	SRT10N047HTLG	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, Package Limited	$T_C=25^{\circ}\text{C}$	I_D	PDFN5*6	100	A
			TO-220C	120	
			TO-220F	120	
			TO-263-2	120	
			TO-247	120	
			TOLL	140	
	$T_C=100^{\circ}\text{C}$		PDFN5*6	87	
			TO-220C	85	
			TO-220F	85	
			TO-263-2	85	
			TO-247	85	
			TOLL	90	
Continuous Drain Current, Silicon	$T_C=25^{\circ}\text{C}$	PDFN5*6	120		
		TO-220C	135		
		TO-220F	135		
		TO-263-2	135		
		TO-247	135		
		TOLL	140		
Pulsed Drain Current (Note 2)		I_{DM}	PDFN5*6	400	A
			TO-220C	480	
			TO-220F	480	
			TO-263-2	480	
			TO-247	480	
			TOLL	560	
Max Power Dissipation		P_D	104	W	
Avalanche Destructive Energy, Single Pulse (Note 4)		E_{AS_Limit}	625	mJ	
Avalanche Energy, Single Pulse (Note 3)		E_{AS}	100	mJ	
Avalanche Energy, Repetitive (Note 2)		E_{AR}	0.2	mJ	
Avalanche Current, Repetitive (Note 2)		I_{AR}	50.0	A	
Continuous Diode Forward Current		I_S	100	A	
Diode Pulse Current		I_{S_PULSE}	400	A	
Operating Junction Temperature		T_J	150	$^{\circ}\text{C}$	
Storage Temperature		T_{STG}	-55 to 150	$^{\circ}\text{C}$	
Lead Temperature (Soldering, 10 sec)		T_{LEAD}	260	$^{\circ}\text{C}$	

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.

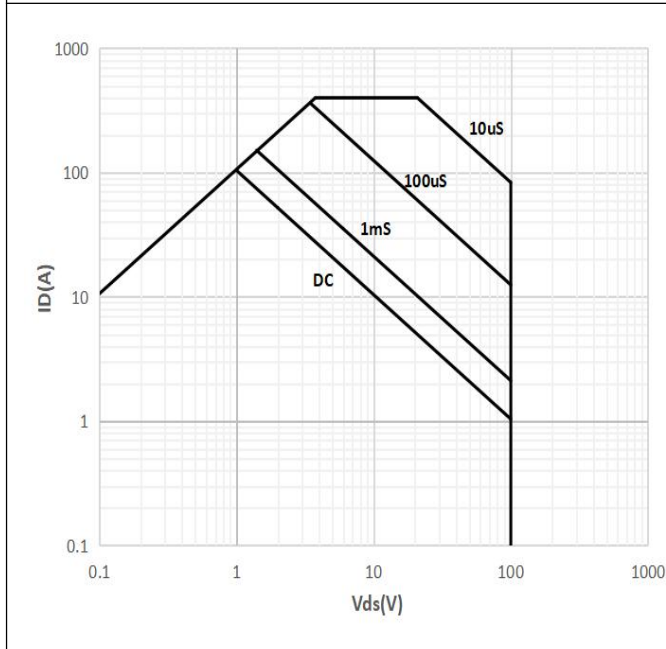
2. Repetitive Rating: Pulse width limited by maximum junction temperature
3. $I_{AS} = 20.0A$, $V_{DD} = 50V$, $R_G = 25\Omega$, Starting $T_J = 25^\circ C$
4. $I_{AS_Limit} = 50A$, $V_{DD} = 50V$, $R_G = 25\Omega$, Starting $T_J = 25^\circ C$

Thermal Resistance

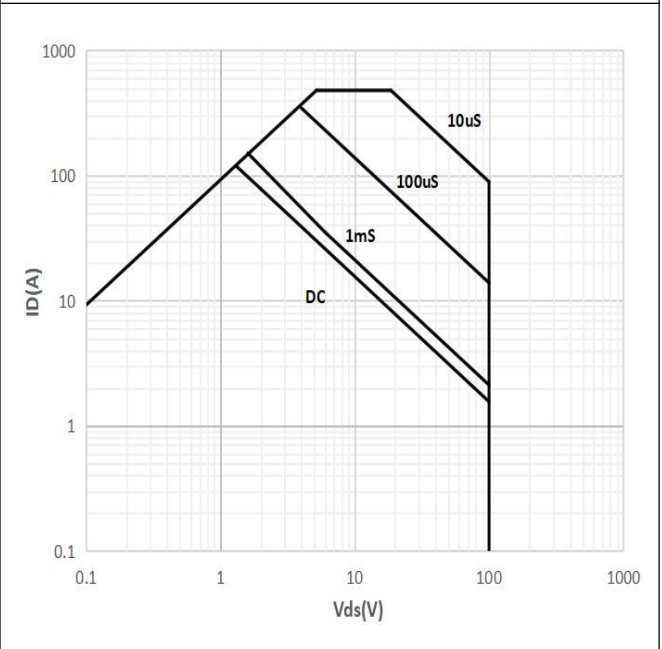
Parameter		Symbol	Min	Typ	Max	Unit
Thermal Resistance, Junction-to-Case	PDFN5*6	R_{thJC}			1.2	°C/W
	TO-220C				0.8	
	TO-220F				0.8	
	TO-263-2				0.8	
	TO-247				0.8	
	TOLL				0.75	
Thermal Resistance, Junction-to-Ambient	PDFN5*6	R_{thJA}			50	
	TO-220C				62	
	TO-220F				62	
	TO-263-2				40	
	TO-247				40	
	TOLL				40	

Electrical Characteristics
 $T_J = 25^\circ\text{C}$, unless otherwise specified.

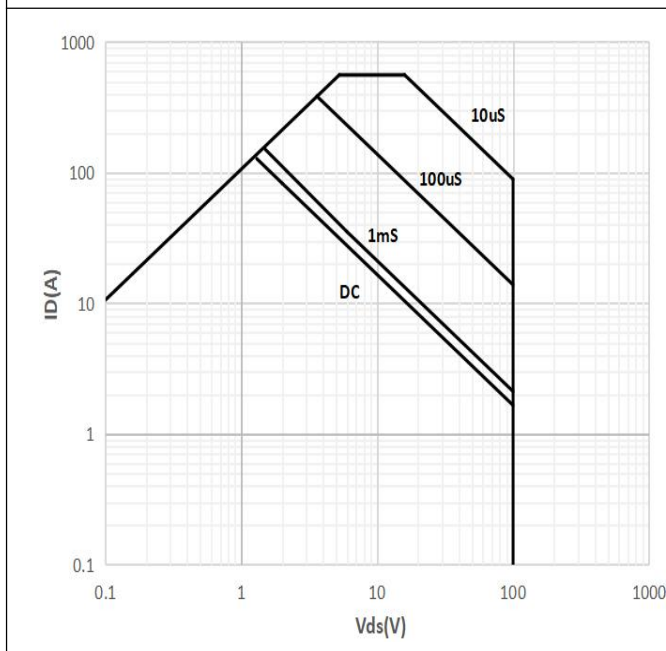
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Statistic Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	100			V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=100V, V_{GS}=0V$			1	μA
Gate-Body Leakage Current	Forward	$I_{GSSF}, V_{GS}=20V, V_{DS}=0V$			100	nA
	Reverse	$I_{GSSR}, V_{GS}=-20V, V_{DS}=0V$			-100	
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=150\mu A$	2.0	3.0	4.0	V
Static Drain-Source On-Resistance	PDFN5*6	$R_{DS(ON)}, V_{GS}=10V, I_D=50A$		4.2	4.7	mΩ
	TO-220C			4.7	5.4	
	TO-220F			4.7	5.4	
	TO-263-2			4.5	5.2	
	TO-247			4.9	5.4	
	TOLL			4.4	4.7	
Gate Resistance	R_G	$f=1MHz, \text{Open Drain}$		1.5		Ω
Dynamic Characteristics						
Input Capacitance	C_{ISS}	$V_{DS}=50V, V_{GS}=0V, f=1MHz$		4200		pF
Output Capacitance	C_{OSS}			640		pF
Reverse Transfer Capacitance	C_{RSS}			27		pF
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=50V, I_D=50A, R_G=1.6\Omega, V_{GS}=10V$		22		ns
Rise Time	t_r			9		
Turn-off Delay Time	$t_{d(off)}$			75		
Fall Time	t_f			12		
Gate Charge Characteristics						
Gate to Source Charge	Q_{gs}	$V_{DD}=50V, I_D=50A, V_{GS}=0 \text{ to } 10V$		20		nC
Gate to Drain Charge	Q_{gd}			16		
Gate Charge Total	Q_g			80		
Reverse Diode Characteristics						
Drain-Source Diode Forward Voltage	V_{SD}	$V_{GS}=0V, I_{SD}=50A$		0.8	1.0	V
Reverse Recovery Time	t_{rr}	$V_R=50V, I_F=50A, dI_F/dt=100A/\mu s$		60		ns
Reverse Recovery Charge	Q_{rr}			210		nC
Peak Reverse Recovery Current	I_{rrm}			9.6		A

Typical Performance Characteristics
Figure 1A: Max. Forward Safe Operating Area (PDFN5*6)


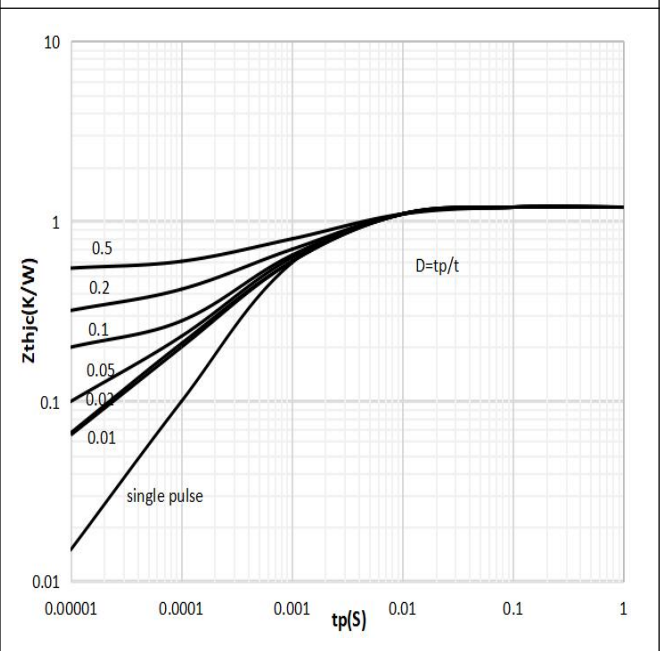
$$I_D = f(V_{DS}); T_c = 25^\circ\text{C}; V_{GS} > 7.0\text{V}; \text{parameter } t_p$$

Figure 1B: Max. Forward Safe Operating Area (TO-220C&TO-220F&TO-263-2&TO-247)


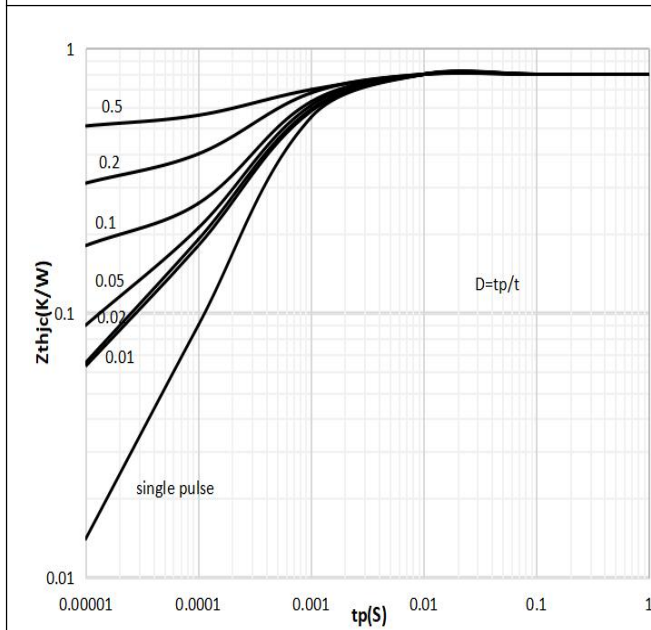
$$I_D = f(V_{DS}); T_c = 25^\circ\text{C}; V_{GS} > 7.0\text{V}; \text{parameter } t_p$$

Figure 1C: Max. Forward Safe Operating Area (TOLL)


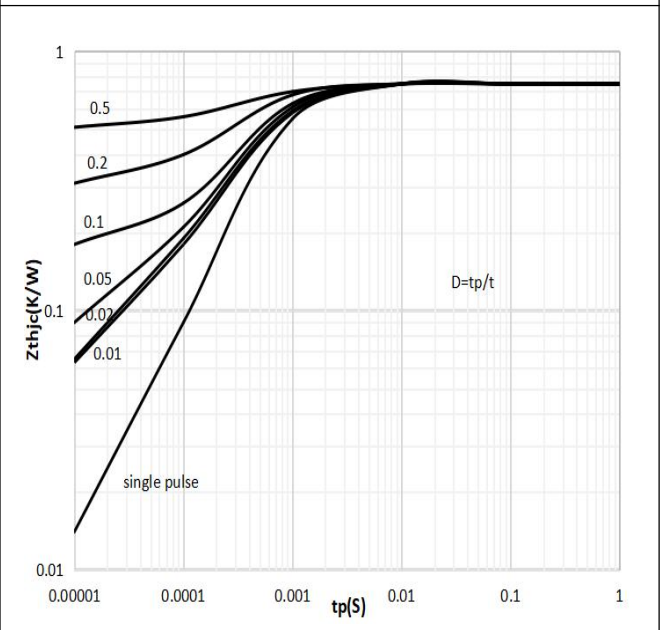
$$I_D = f(V_{DS}); T_c = 25^\circ\text{C}; V_{GS} > 7.0\text{V}; \text{parameter } t_p$$

Figure 2A: Max. Transient Thermal Impedance (PDFN5*6)


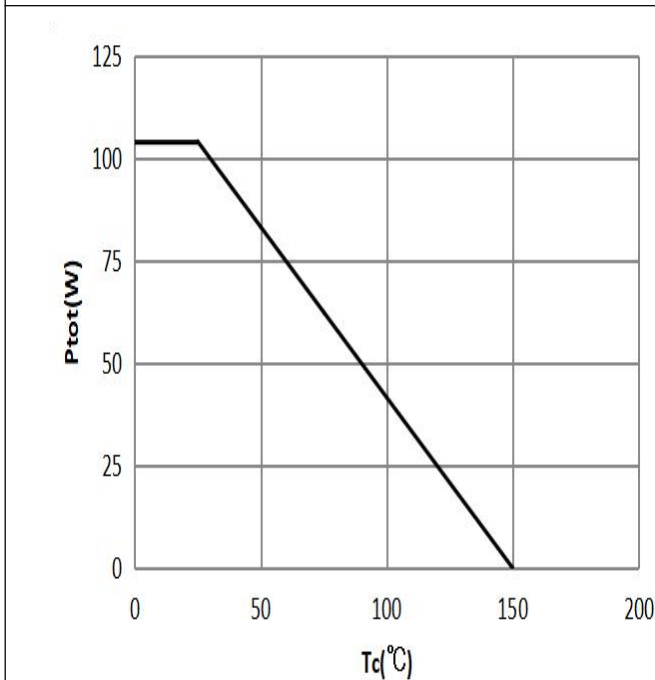
$$Z_{(th)C} = f(t_p); \text{parameter: } D = t_p/T$$

4.7mΩ, 100V, N-Channel Power MOSFET
SRT10N047H
**Figure 2B: Max. Transient Thermal Impedance
 ((TO-220C&TO-220F&TO-263-2&TO-247))**


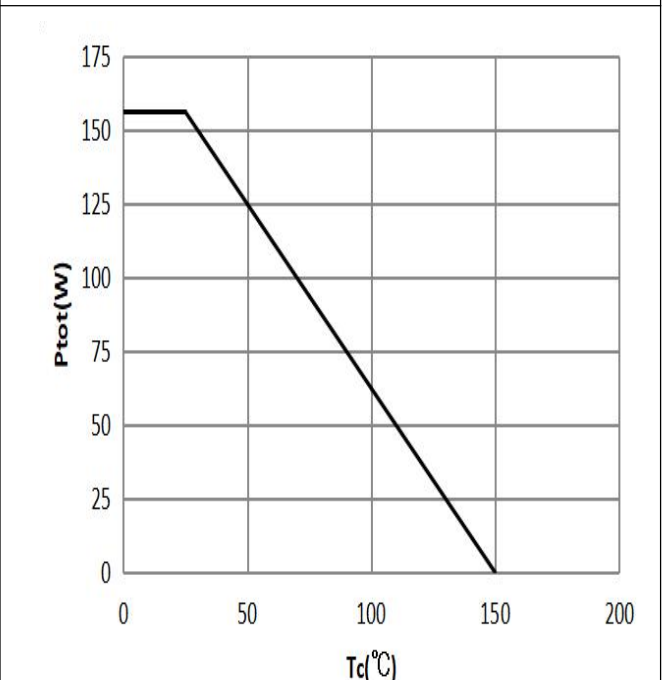
$$Z_{(th)JC} = f(t_p); \text{parameter: } D = t_p/T$$

**Figure 2C: Max. Transient Thermal Impedance
 (TOLL)**


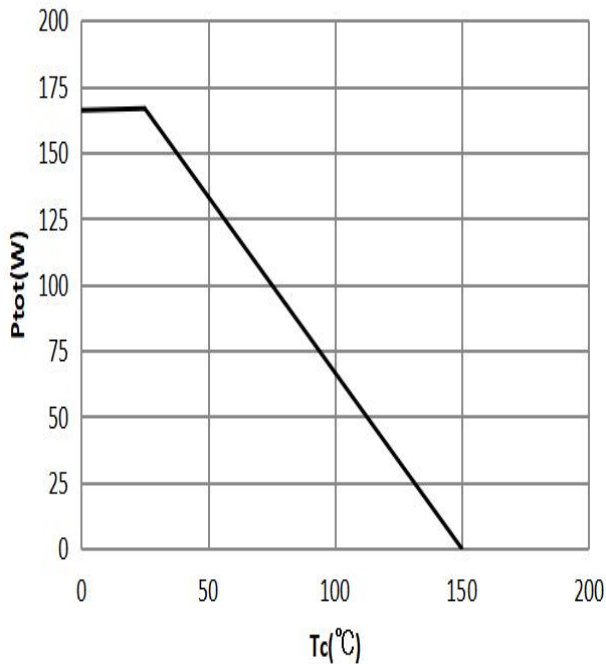
$$Z_{(th)JC} = f(t_p); \text{parameter: } D = t_p/T$$

**Figure 3A: Power Dissipation
 (PDFN5*6)**


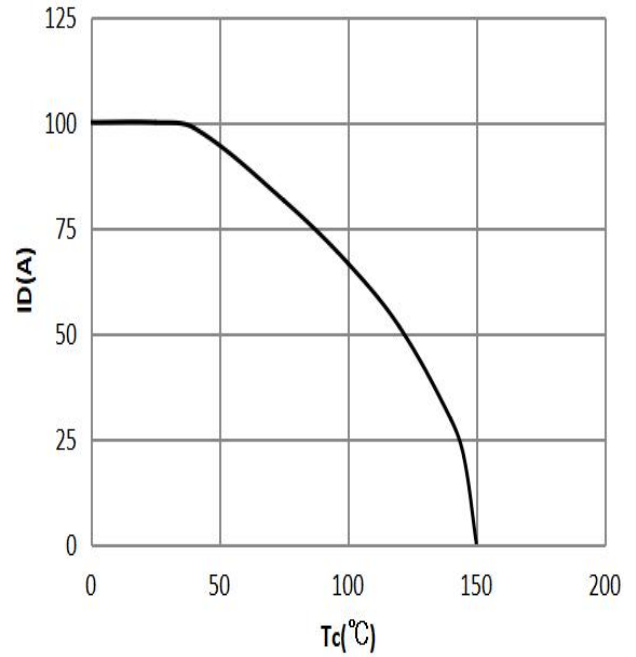
$$P_{tot} = f(T_c)$$

**Figure 3B: Power Dissipation
 (TO-220C&TO-220F&TO-263-2&TO-247)**


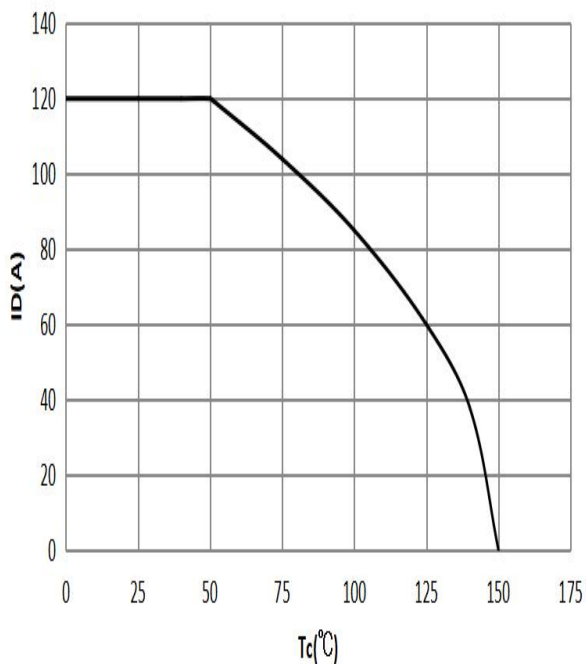
$$P_{tot} = f(T_c)$$

Figure 3C: Power Dissipation (TOLL)


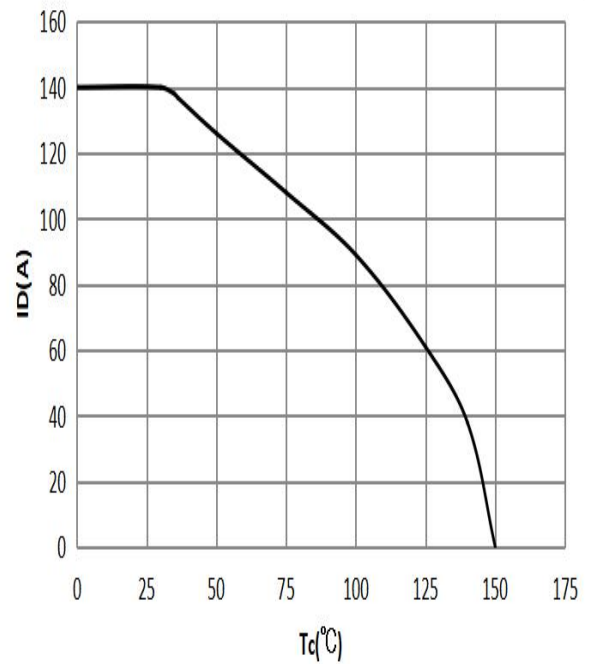
$$P_{tot} = f(T_c)$$

Figure 4A: Drain Current vs. Temperature (PDFN5*6)


$$I_D = f(T_J); V_{GS} \geq 10V$$

Figure 4B: Drain Current vs. Temperature (TO-220C&TO-263-2&TO-247)


$$I_D = f(T_J); V_{GS} \geq 10V$$

Figure 4C: Drain Current vs. Temperature (TOLL)


$$I_D = f(T_J); V_{GS} \geq 10V$$

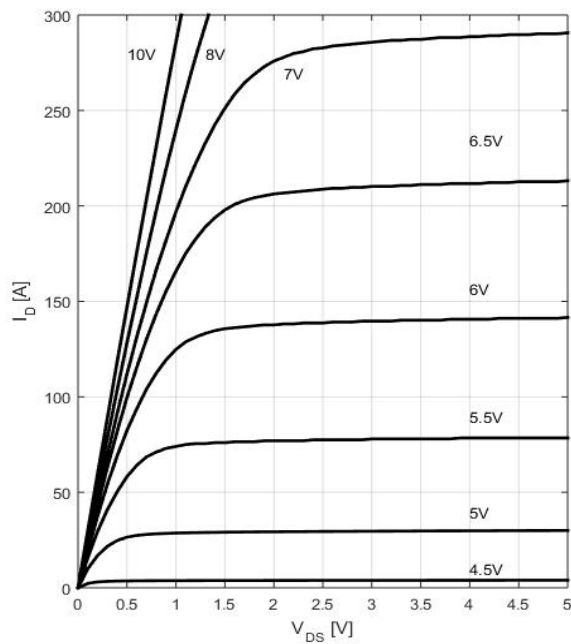
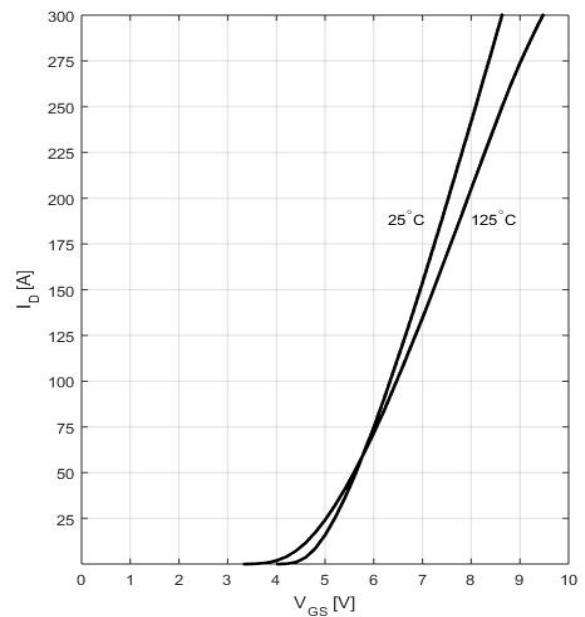
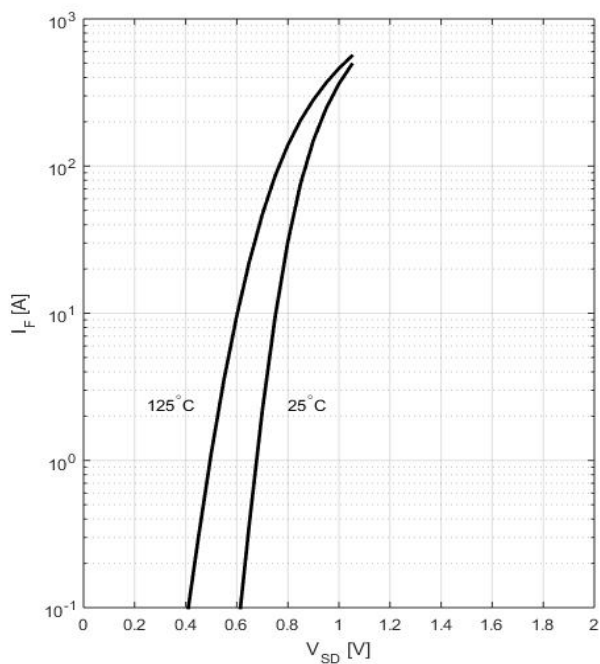
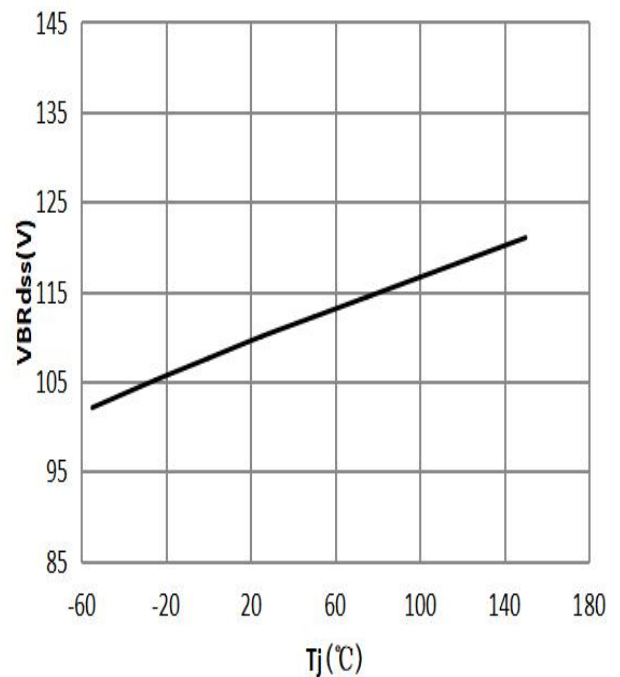
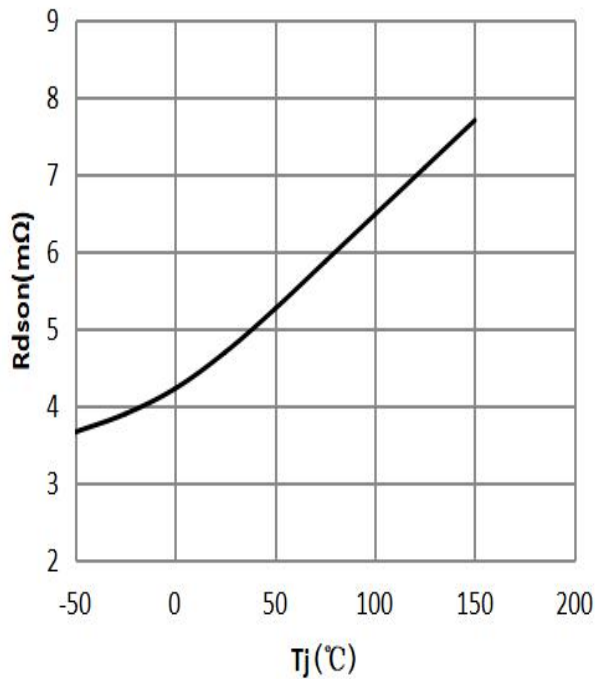
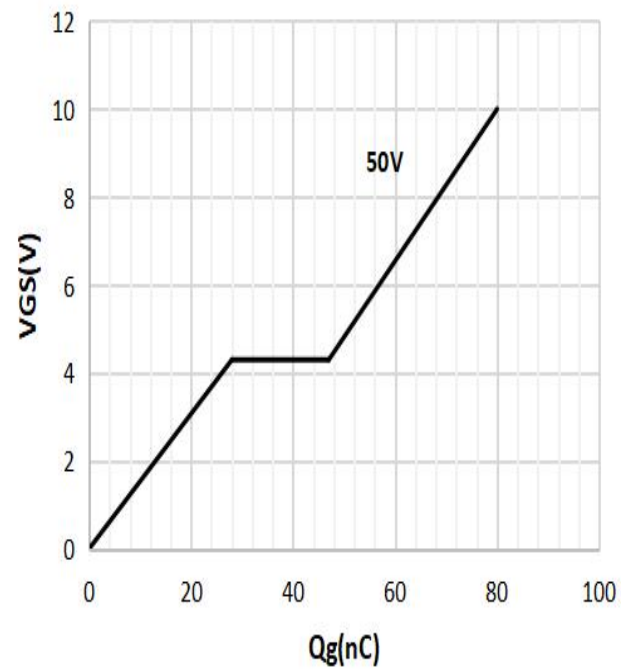
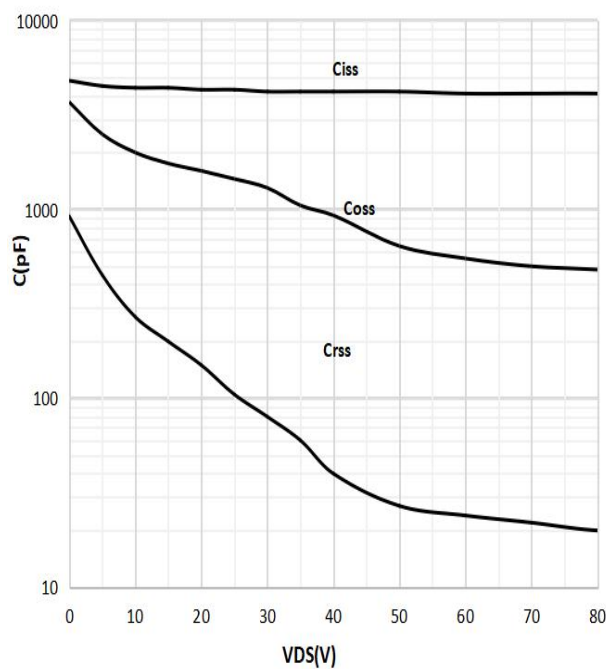
Figure 5: Typ. Output Characteristics

 $I_D = f(V_{DS}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$
Figure 6: Typ. Transfer Characteristics

 $I_D = f(V_{GS}); V_{DS} = 5\text{V}$
Figure 7: Forward Characteristics of Reverse Diode

 $I_F = f(V_{SD}); \text{parameter: } T_j$
Figure 8: Drain-Source Breakdown Voltage

 $V_{BR(DSS)} = f(T_j); I_D = 5\text{mA}$

Figure 9: Typ. Drain-Source On-State Resistance


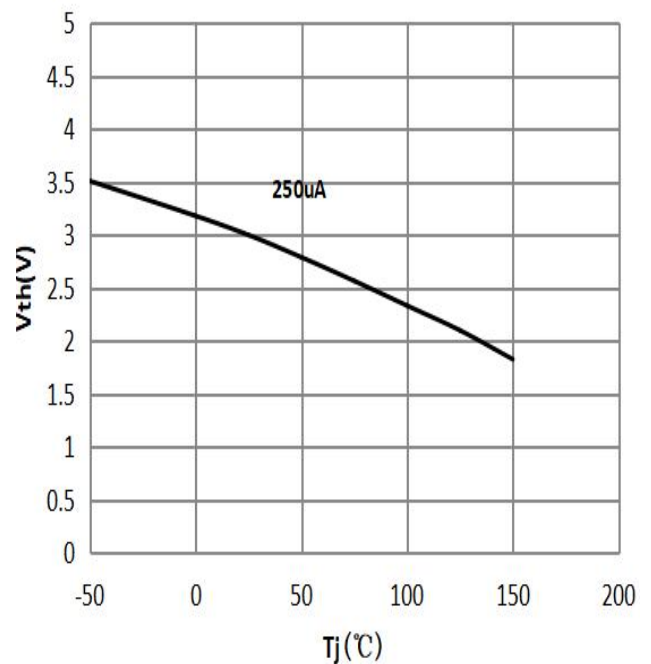
$$R_{DS(ON)} = f(T_j); I_D = 50A; V_{GS} = 10V$$

Figure 10: Typ. Gate Charge


$$V_{GS} = f(Q_{gate}), I_D = 50A \text{ pulsed}$$

Figure 11: Typ. Capacitances


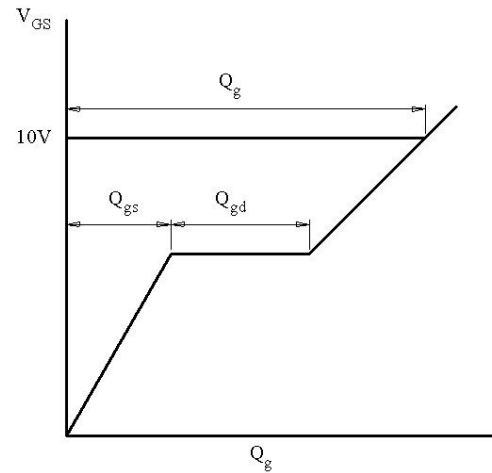
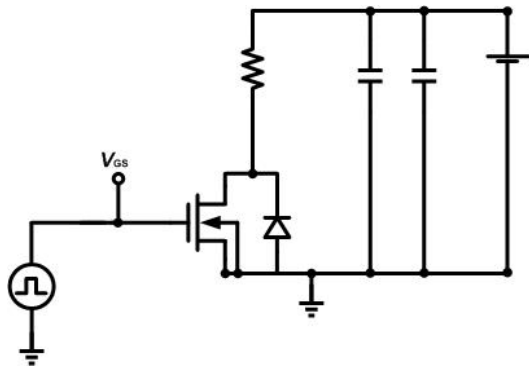
$$C = f(V_{DS}); V_{GS} = 0; f = 1MHz$$

Figure 12: Typ. Gate threshold voltage


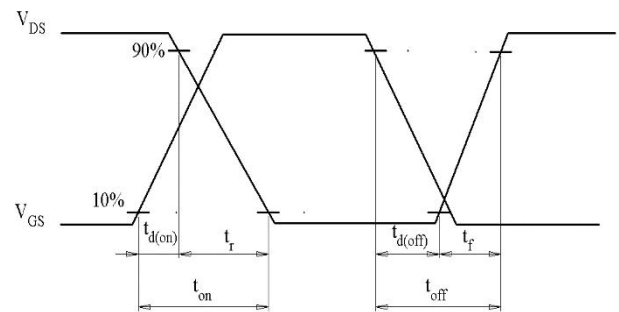
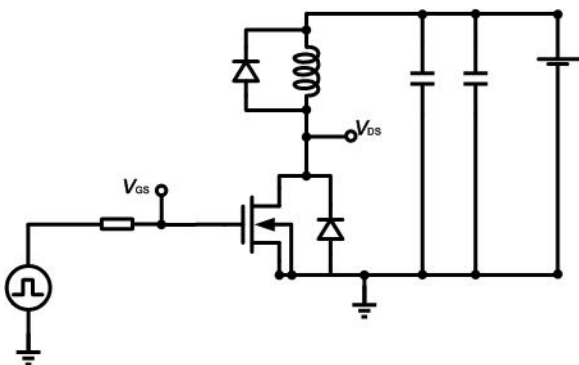
$$V_{GS} = f(T_j), V_{GS} = V_{DS}$$

Test Circuits

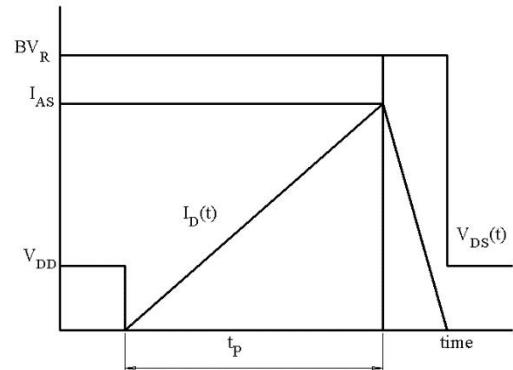
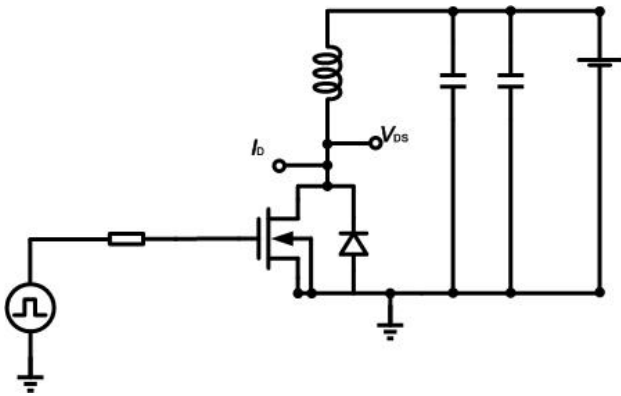
1. Gate Charge Test Circuit & Waveform



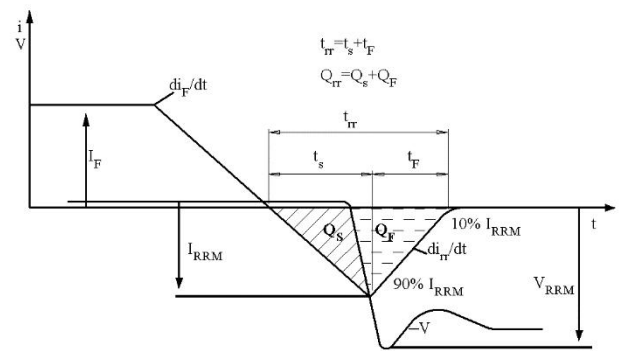
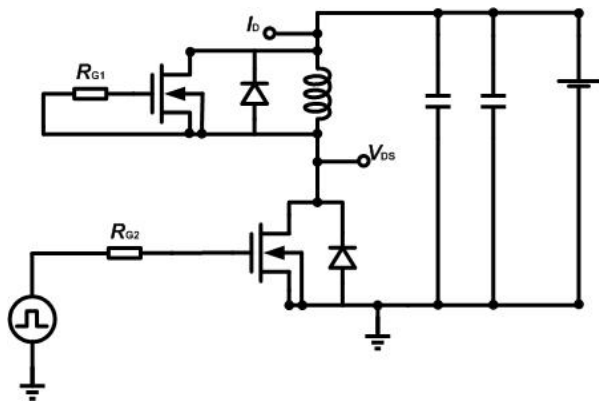
2. Switch Time Test Circuit

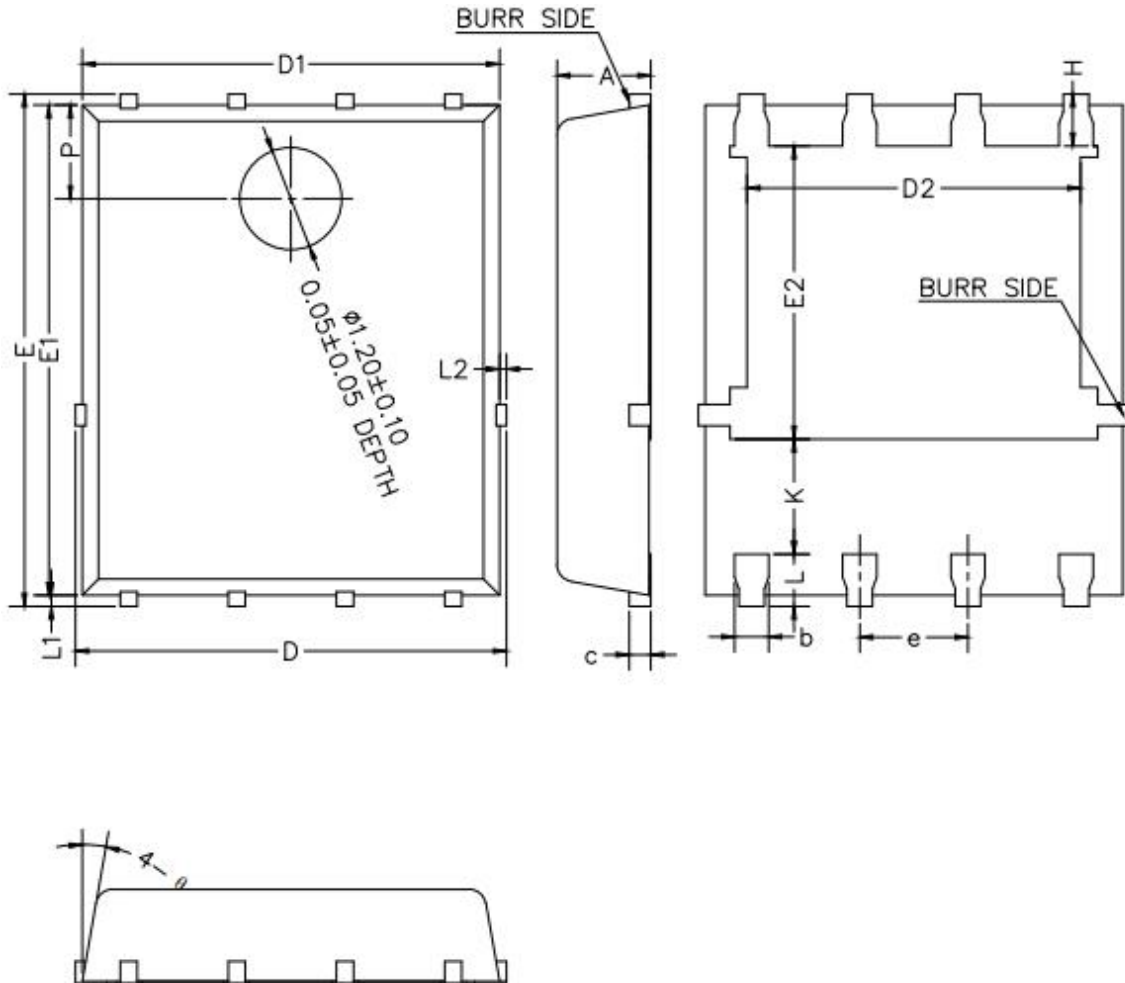


3. Unclamped Inductive Switching Test Circuit & Waveforms

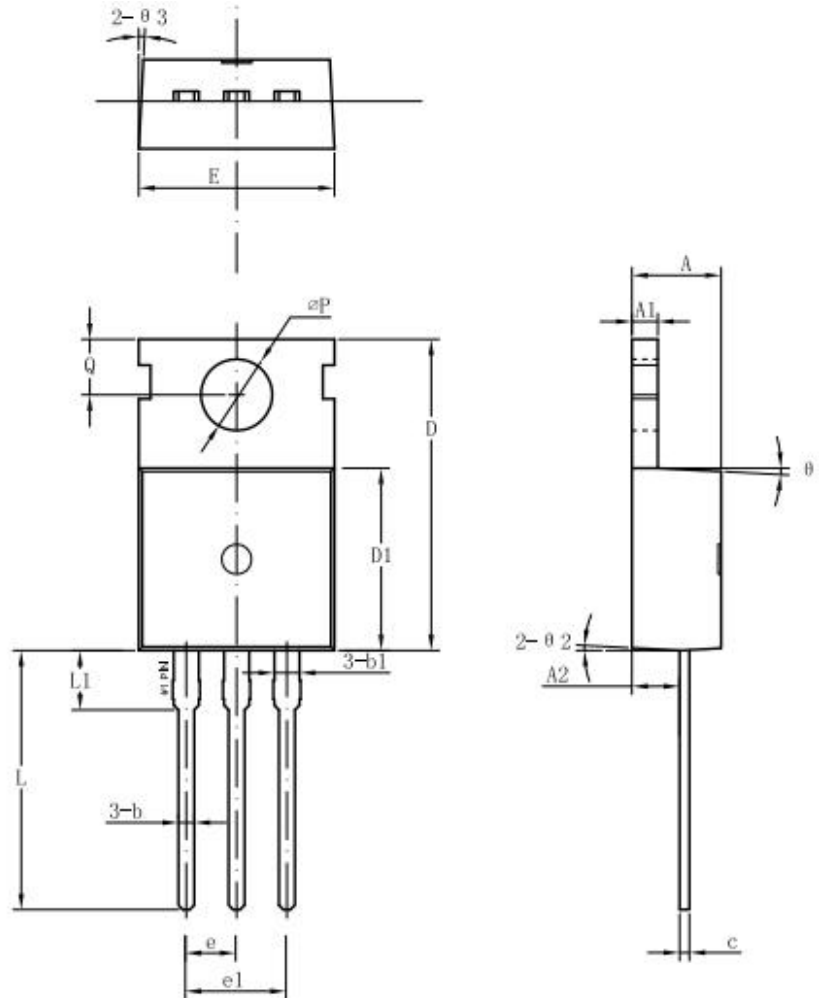


4. Test Circuit and Waveform for Diode Characteristics

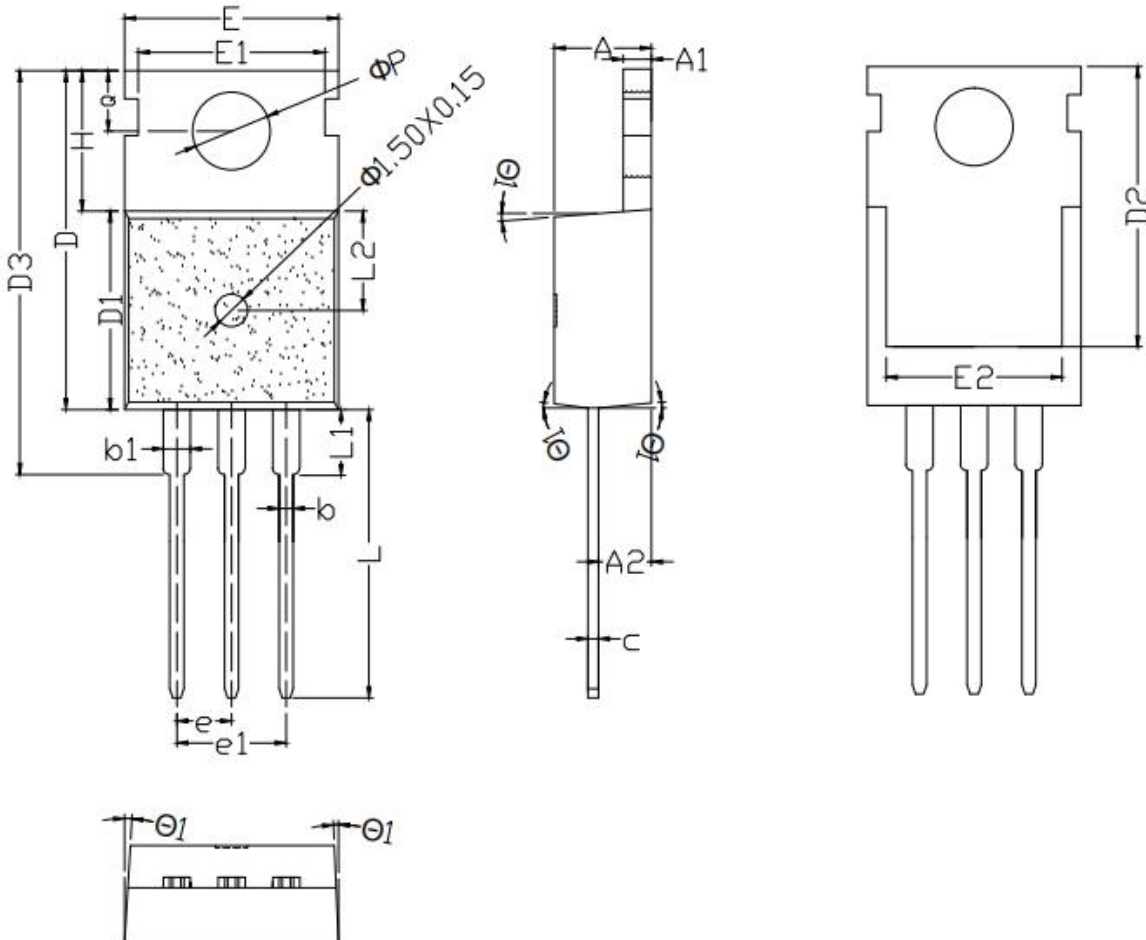


Mechanical Dimensions
DFN5*6-8 Unit: mm


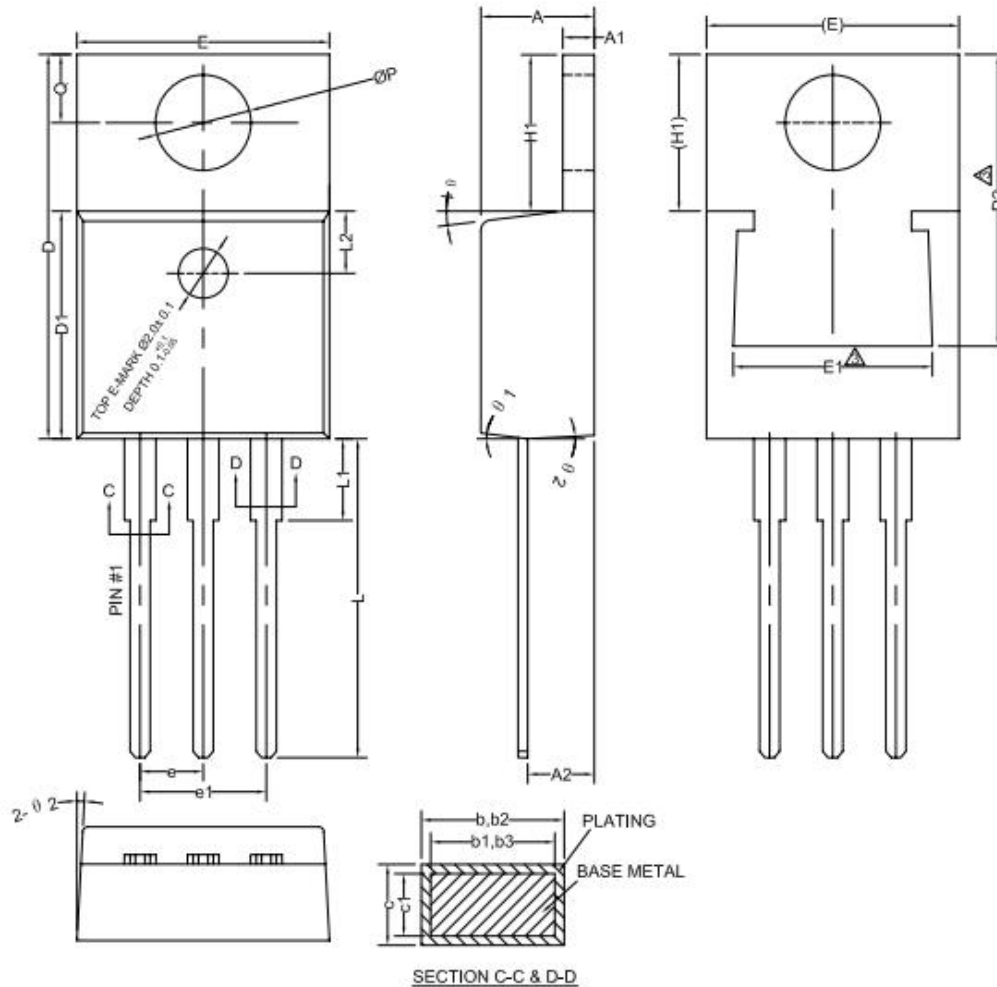
Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	0.90	1.10	1.20	E2	3.18	-	3.54
b	0.35	0.40	0.45	H	0.51	0.61	0.71
c	0.21	0.25	0.34	K	1.10	-	-
D	-	-	5.10	L	0.51	0.61	0.71
D1	4.80	4.90	5.00	L1	0.06	0.13	0.20
D2	3.82	-	4.11	L2	-	-	0.10
e	1.17	1.27	1.37	P	1.00	1.10	1.20
E	5.90	6.00	6.10	θ	8°	10°	12°
E1	5.70	5.75	5.80				

Mechanical Dimensions
TO-220C(SRT10N047HTC-G/E)
Unit: mm


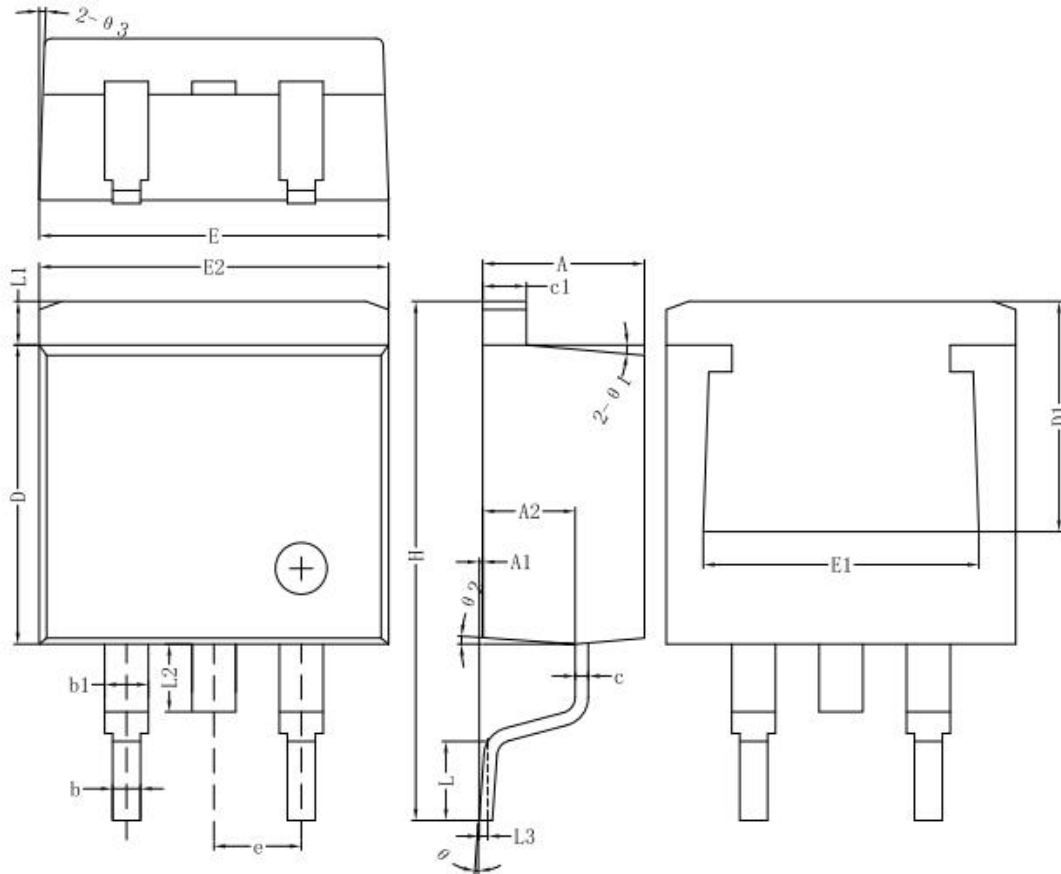
Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.30	4.50	4.70	e	-	2.54	-
A1	1.25	1.30	1.40	e1	-	5.08	-
A2	2.20	2.40	2.60	L	12.60	13.08	13.60
b	0.70	0.80	0.95	L1	-	3.00	-
b1	-	1.27	-	ΦP	3.50	3.60	3.80
c	0.40	0.50	0.65	Q	2.60	2.80	3.00
D	15.20	15.70	16.20	Ø1	-	3°	-
D1	9.00	9.20	9.40	Ø2	-	3°	-
E	9.70	10.00	10.10	Ø3	-	3°	-

Mechanical Dimensions
TO-220C(SRT10N047HTC-G)
Unit: mm


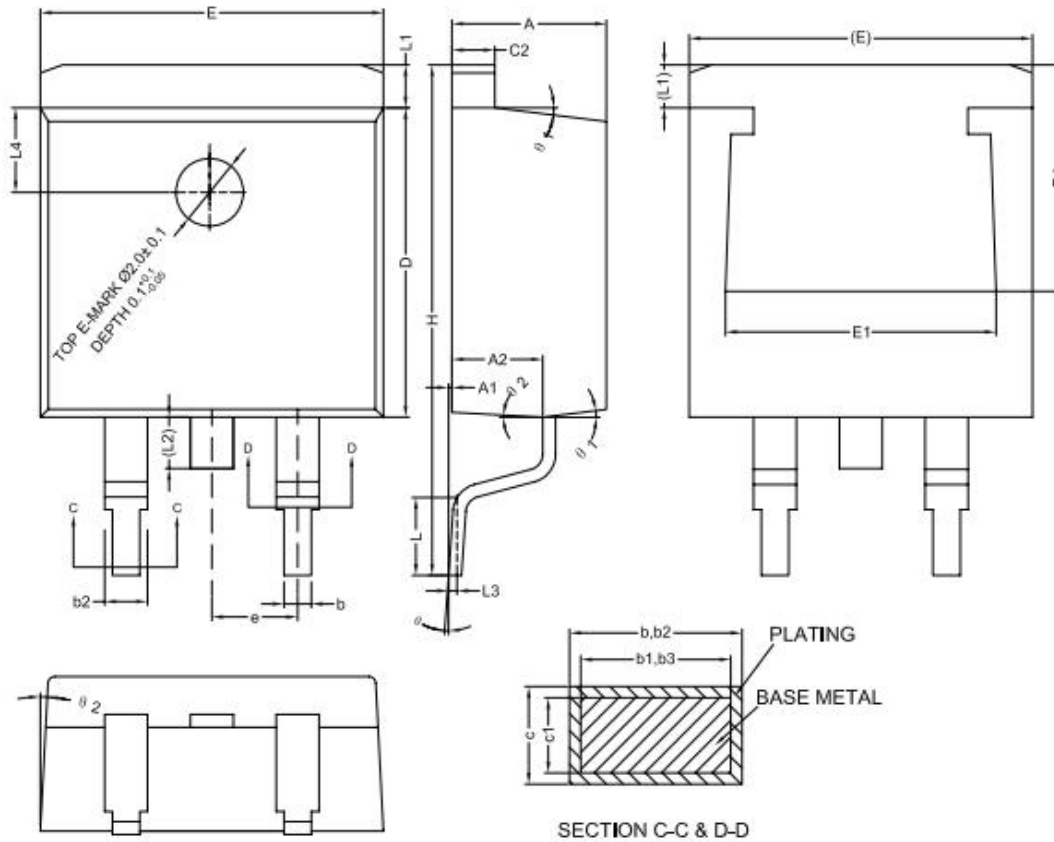
Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.40	4.50	4.60	E2	7.40	7.60	7.80
A1	1.25	1.30	1.35	e	-	2.54BSC	-
A2	2.30	2.40	2.50	e1	-	5.08BSC	-
b	0.70	0.80	0.90	H	6.40	6.50	6.60
b1	1.25	1.33	1.42	L	13.00	13.28	13.45
c	0.45	0.50	0.55	L1	-	-	3.40
D	15.50	15.75	16.00	L2	4.50	4.65	4.80
D1	9.10	9.20	9.30	L3	1.10	1.30	1.50
D2	12.90	13.10	13.30	ΦP	3.55	3.65	3.75
D3	15.45	15.80	16.15	Q	2.65	2.75	2.85
E	9.80	10.02	10.15	θ 1	2°	-	7°
E1	8.55	8.70	8.85				

Mechanical Dimensions
TO-220C(SRT10N047HTC-E)
Unit: mm


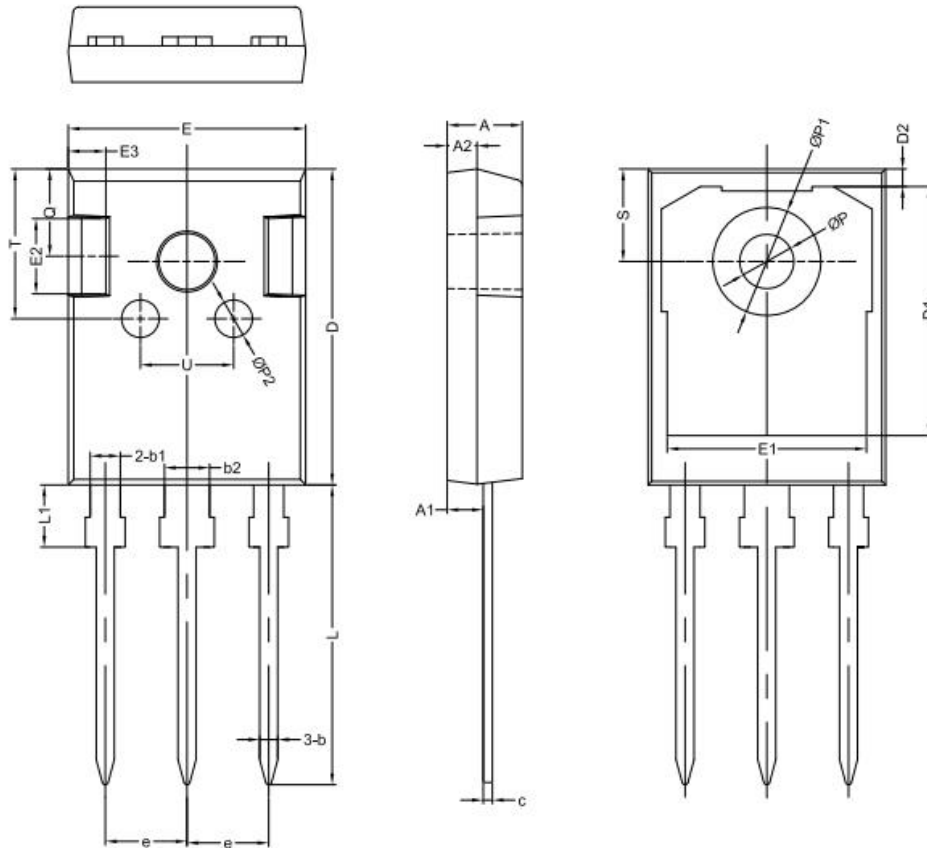
Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.40	4.57	4.70	E	9.96	10.16	10.36
A1	1.22	-	1.32	E1	6.86	-	8.89
A2	2.59	2.69	2.79	e	2.44	2.54	2.64
b	0.77	-	0.90	e1	4.98	5.08	5.18
b1	0.76	0.81	0.86	H1	6.10	6.30	6.50
b2	1.23	-	1.36	L	12.70	-	13.12
b3	1.22	1.27	1.32	L1	-	-	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	θ 1	5°	7°	9°
D2	11.40	-	12.88	θ 2	1°	3°	5°

Mechanical Dimensions
TO-263-2(Package1)
Unit: mm


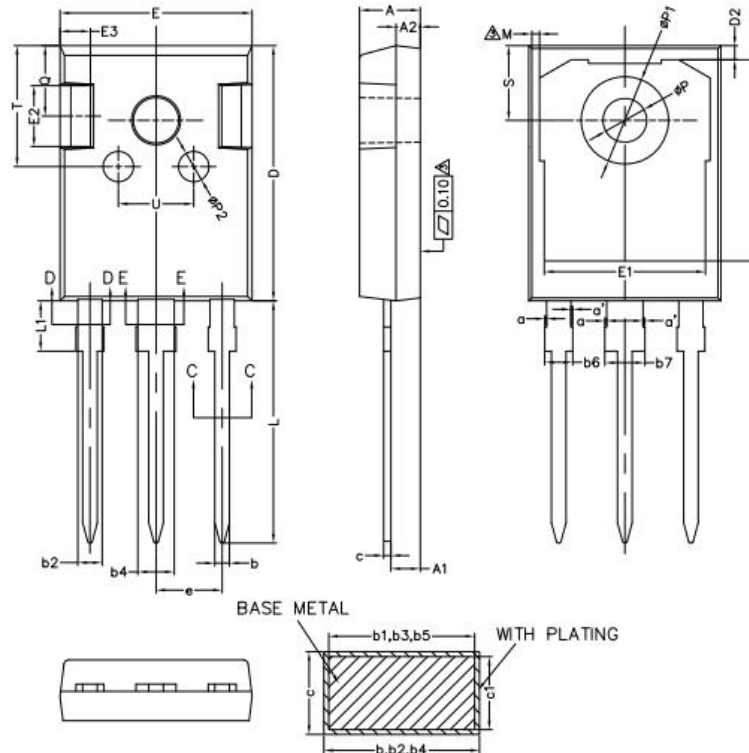
Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.55	4.70	4.85	E2	9.98	10.08	10.18
A1	0.00	0.10	0.25	e	-	2.54	-
A2	2.59	2.69	2.89	H	14.70	15.10	15.50
b	0.71	0.81	0.96	L	2.00	2.30	2.70
b1	-	1.27	-	L1	1.17	1.27	1.40
c	0.36	0.38	0.61	L2	-	-	2.20
c1	1.17	1.27	1.37	L3	-	0.25BSC	-
D	8.55	8.70	8.85	⊙	0°	-	8°
D1	-	7.20	-	⊙1	-	5°	-
E	10.01	10.16	10.31	⊙2	-	4°	-
E1	-	7.8	-	⊙3	-	4°	-

Mechanical Dimensions
TO-263-2(Package2)
Unit: mm


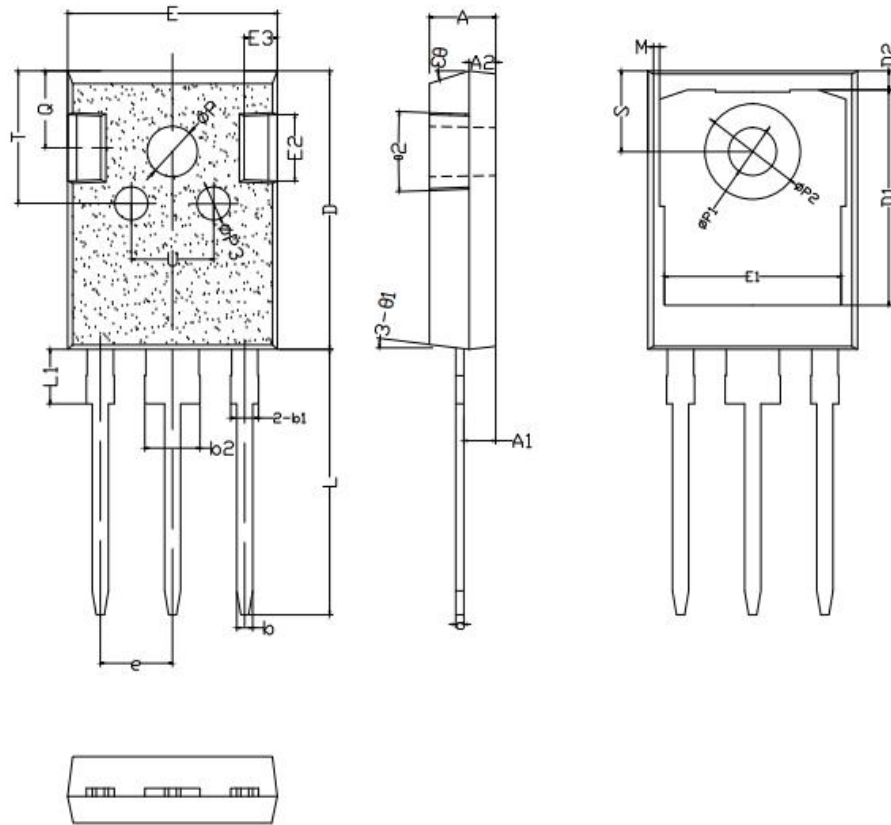
Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.40	4.57	4.70	E	10.06	10.16	10.26
A1	0.00	0.10	0.25	E1	7.80	-	8.20
A2	2.59	2.69	2.79	e	-	2.54BSC	-
b	0.77	-	0.90	H	14.70	15.10	15.50
b1	0.76	0.81	0.86	L	2.00	2.30	2.60
b2	1.23	-	1.36	L1	1.17	1.27	1.40
b3	1.22	1.27	1.32	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	$\theta 1$	5°	7°	9°
D1	6.60	-	-	$\theta 2$	1°	3°	5°

Mechanical Dimensions
TO-247(Package1)
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	-
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	-	7.19	-
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	-

Mechanical Dimensions
TO-247(Package2)
Unit: mm


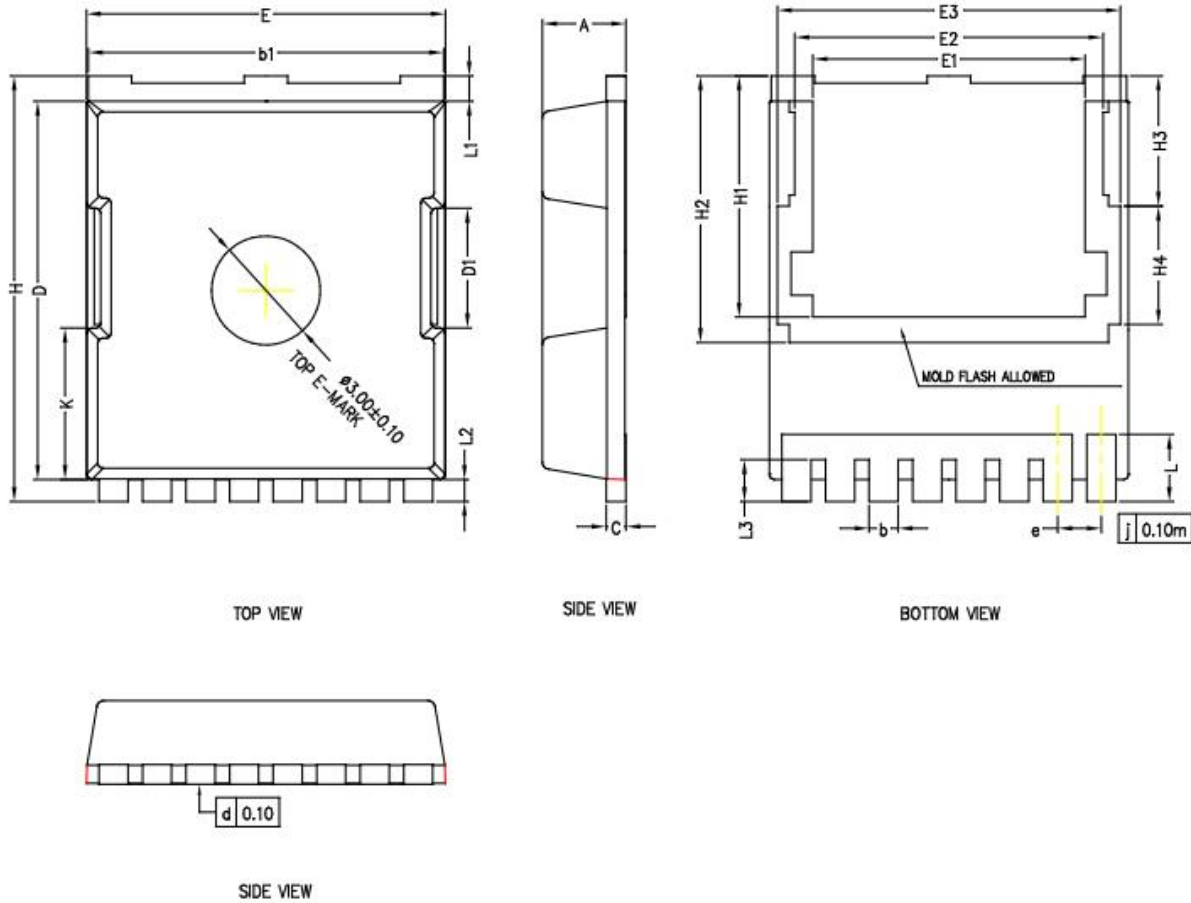
Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.90	5.00	5.10	D2	1.05	1.20	1.35
A1	2.31	2.41	2.51	E	15.70	15.80	15.90
A2	1.90	2.00	2.10	E1	13.10	13.30	13.50
a	0	-	0.15	E2	4.90	5.00	5.10
a'	0	-	0.15	E3	2.40	2.50	2.60
b	1.16	-	1.26	e	5.34	5.44	5.54
b1	1.15	1.20	1.22	L	19.80	19.92	20.10
b2	1.96	-	2.06	L1	3.95	4.13	4.30
b3	1.95	2.00	2.02	M	0.35	-	0.95
b4	2.96	-	3.06	P	3.50	3.60	3.70
b5	2.95	3.00	3.02	P1	7.00	-	7.40
b6	-	-	2.25	P2	2.40	2.50	2.60
b7	-	-	3.25	Q	5.60	-	6.00
c	0.59	-	0.66	S	6.05	6.15	6.25
c1	0.58	0.60	0.62	T	9.80	-	10.20
D	20.90	21.00	21.10	U	6.00	-	6.40
D1	16.25	16.55	16.85				

Mechanical Dimensions
TO-247(Package3)
Unit: mm


Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.90	5.00	5.10	e	5.40	5.44	5.48
A1	2.31	2.41	2.51	L	19.80	19.98	20.15
A2	1.90	2.00	2.10	L1	-	-	4.30
b	1.15	1.20	1.25	ΦP	3.60	3.70	3.80
b1	1.95	2.10	2.25	ΦP1	3.40	3.50	3.60
b2	2.95	3.10	3.25	ΦP2	6.90	7.10	7.30
c	0.55	0.60	0.65	ΦP3	2.40	2.50	2.60
D	20.90	21.00	21.10	Q	5.60	5.80	6.00
D1	16.35	16.55	16.75	S	6.05	6.15	6.25
D2	1.05	1.20	1.35	T	9.80	10.00	10.20
E	15.70	15.80	15.90	U	6.00	6.20	6.40
E1	13.10	13.25	13.40	⊙1	5°	7°	9°
E2	4.85	4.95	5.10	⊙2	1°	3°	5°
E3	2.40	2.50	2.60	⊙3	13°	15°	17°

Mechanical Dimensions
TOLL(Package1)

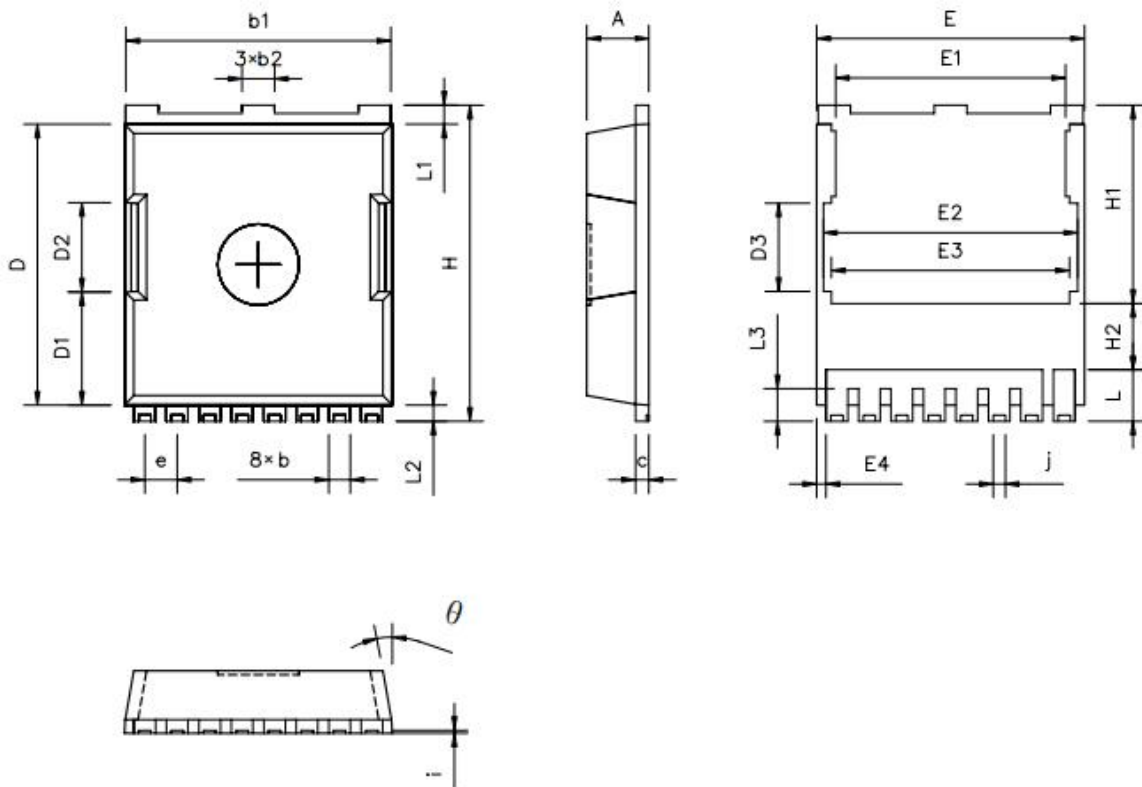
Unit: mm



Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	2.20	2.30	2.40	H	11.48	11.73	11.88
b	0.70	0.80	0.90	H1	6.55	6.65	6.75
b1	9.70	9.80	9.90	H2	7.20	7.35	7.50
c	0.40	0.50	0.60	H3	3.44	3.59	3.74
D	10.28	10.43	10.58	H4	3.11	3.26	3.41
D1	3.15	3.30	3.45	K	4.03	4.18	4.33
E	9.70	9.90	10.10	L	1.60	1.85	2.10
E1	7.35	7.50	7.65	L1	0.55	0.70	0.85
E2	8.35	8.50	8.65	L2	0.45	0.60	0.75
E3	9.31	9.46	9.61	L3	1.00	1.15	1.30
e	1.10	1.20	1.30				

Mechanical Dimensions
TOLL(Package2)

Unit: mm



Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	2.20	2.30	2.40	E4	0.25	0.35	0.45
b	0.70	0.80	0.90	e	-	1.20BSC	-
b1	9.70	9.80	9.90	H	11.58	11.68	11.78
b2	-	1.20REF	-	H1	7.23	7.33	7.43
c	0.40	0.50	0.60	H2	-	2.45REF	-
D	10.28	10.38	10.48	i	0.10	-	-
D1	4.08	4.18	4.28	j	-	0.45REF	-
D2	3.20	3.30	3.40	L	1.60	1.85	2.10
D3	3.16	3.26	3.36	L1	0.60	0.70	0.80
E	9.80	9.90	10.00	L2	0.50	0.60	0.70
E1	8.40	8.50	8.60	L3	1.05	-	1.30
E2	9.30	9.40	9.50	θ	-	10° REF	-
E3	-	8.8REF	-				



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