

### General Description

These N-channel enhancement mode power mosfets used advanced trench technology design, provided excellent Rdson and low gate charge. Which accords with the RoHS standard.

### Features

- Fast switching
- Low on-resistance
- Low gate charge
- 100% avalanche tested

### Mechanical Data

- Case:TO-220,TO-263,TO-263-7L,TO-3P,TO-247 Package

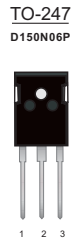
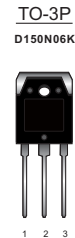
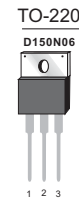
### Application

- Switching applications

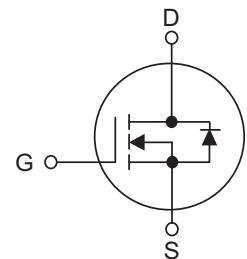
### Ordering Information

Part No.	Package Type	Package	Quality(box)
D150N06	TO-220	Tube	1000
D150N06D	TO-263	Tape & Reel	800
D150N06D7	TO-263-7L	Tape & Reel	800
D150N06P	TO-247	Tube	600
D150N06K	TO-3P	Tube	600

Product Summary			
V <sub>DS</sub>	R <sub>DS(on)</sub> (mΩ) Typ	I <sub>D</sub> (A)	Q <sub>g</sub> (Typ)
60V	4.5@ 10V	150	135nc



### Block Diagram



Pin Definition:

1. Gate
2. Drain
- 3/4/5/6/7. Source

Table1 Absolute Maximum Ratings (T<sub>C</sub>=25°C, unless otherwise specified)

Parameter	Symbol	TO-220/TO-263/ TO-263-7L TO-3P/TO-247	Unit
Drain-Source Voltage	V <sub>DS</sub>	60	V
Gate-Source Voltage	V <sub>GS</sub>	±25	V
Continuous Drain Current	I <sub>D</sub>	T <sub>C</sub> =25°C	A
		T <sub>C</sub> =100°C	
Pulsed Drain Current (Note 1)	I <sub>DM</sub>	600	A
Single Pulse Avalanche Energy(Note 2)	E <sub>AS</sub>	800	mJ
Avalanche Current(Note 1)	I <sub>AS</sub>	56.6	A
Power Dissipation T <sub>C</sub> =25°C	P <sub>D</sub>	220	W
Isolation Voltage	V <sub>ISO</sub>	/	V
Operating Junction and Storage Temperature	T <sub>J</sub> /T <sub>STG</sub>	-55 ~ +175	°C
Maximum Temperature for soldering	T <sub>L</sub>	300	°C

Table 2. Thermal Characteristics

Parameter	Symbol	TO-220/TO-263/ TO-3P/ TO-247/TO-263-7L	Unit
Thermal resistance Junction to Ambient	$R_{\theta JA}$	75	C/W
Thermal resistance Junction to Case	$R_{\theta JC}$	0.68	C/W

Table 3. Electrical Characteristics ( $T_J=25^{\circ}\text{C}$ , unless otherwise specified)

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Off Characteristics							
Drain-Source Breakdown Voltage		BV <sub>DSS</sub>	V <sub>GS</sub> =0V,I <sub>D</sub> =250μA	60	--	--	V
Drain-Source Leakage Current		I <sub>DSS</sub>	V <sub>DS</sub> =60V,V <sub>GS</sub> =0V	--	--	1	μA
Gate- Source Leakage Current	Forward	I <sub>GSS</sub>	V <sub>GS</sub> =25V,V <sub>DS</sub> =0V	--	--	100	nA
	Reverse		V <sub>GS</sub> =-25V,V <sub>DS</sub> =0V	--	--	-100	nA
On Characteristics(Note 4)							
Gate Threshold Voltage		V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA	2	3	4	V
Static Drain-Source On-State Resistance		R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V,I <sub>D</sub> =75A	--	4.5	5.5	mΩ
Dynamic Characteristics(Note 5)							
Input Capacitance		C <sub>ISS</sub>	V <sub>DS</sub> =25V,V <sub>GS</sub> =0V,f=1MHz	--	5800	--	pF
Output Capacitance		C <sub>OSS</sub>		--	1020	--	pF
Reverse Transfer Capacitance		C <sub>RSS</sub>		--	505	--	pF
Switching Characteristics (Note 5)							
Turn-On Delay Time		t <sub>d (on)</sub>	V <sub>DS</sub> =30V,I <sub>D</sub> =75A, V <sub>GS</sub> =10V,R <sub>GEN</sub> =25Ω	--	29	--	ns
Turn-On Rise Time		t <sub>R</sub>		--	19	--	ns
Turn-Off Delay Time		t <sub>d (off)</sub>		--	42	--	ns
Turn-Off Fall Time		t <sub>f</sub>		--	53	--	ns
Total Gate Charge		Q <sub>G</sub>	V <sub>DS</sub> =48V,I <sub>D</sub> =75A, V <sub>GS</sub> =10V	--	135	--	nC
Gate-Source Charge		Q <sub>GS</sub>		--	23	--	nC
Gate-Drain Charge		Q <sub>GD</sub>		--	48	--	nC
Drain-Source Diode Characteristics and Maximum Ratings							
Drain-Source Diode Forward Voltage		V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =75A	--	--	1.3	V
Maximum Continuous Drain-Source Diode Forward Current		I <sub>S</sub>		--	--	150	A
Reverse Recovery Time		t <sub>rr</sub>	V <sub>GS</sub> =0V, I <sub>F</sub> =75A	--	48	--	ns
Reverse Recovery Charge		Q <sub>RR</sub>	dI <sub>F</sub> /dt=100A/μs (Note 1)	--	72	--	nC

Notes : 1 Repetitive Rating:Pulse width limited by maximum junction temperature

2  $L=0.5\text{mH}$ ,  $I_D=56.6A$ ,  $V_{DD}=50V$ ,  $V_{GATE}=60V$ , Starting  $T_J=25^{\circ}\text{C}$

4 Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$

5 Guaranteed by design, not subject to production

## Typical Test Circuit

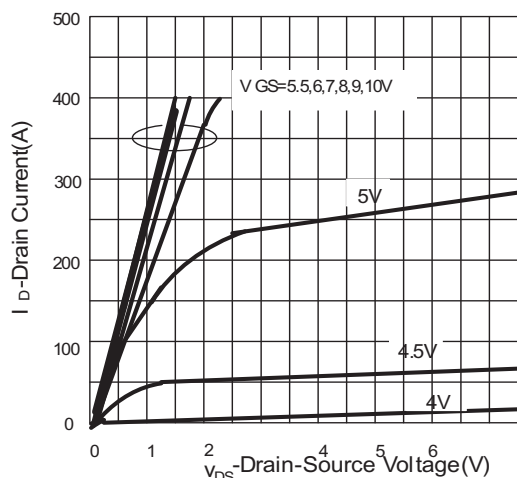


Figure.1 Output Characteristics

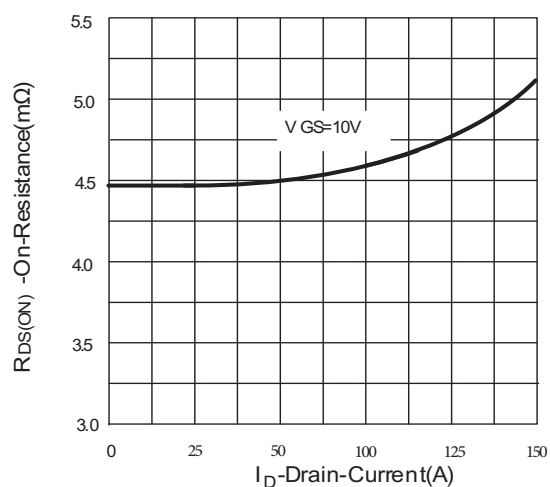


Figure.2 Drain Source On Resistance

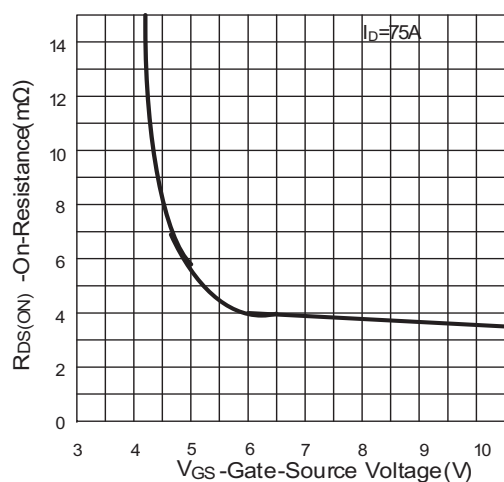


Figure.3 Gate-Source On Resistance

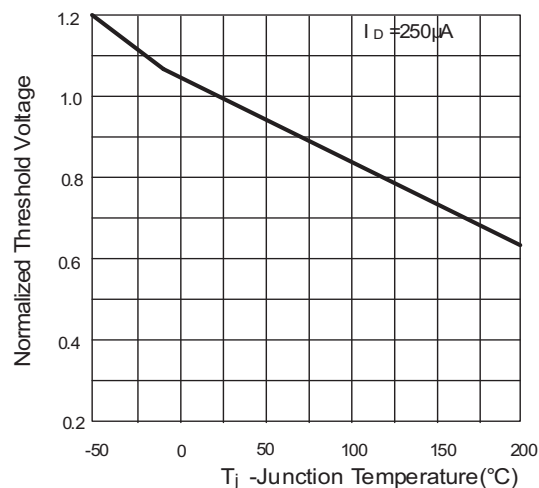


Figure.4 Gate Threshold Voltage

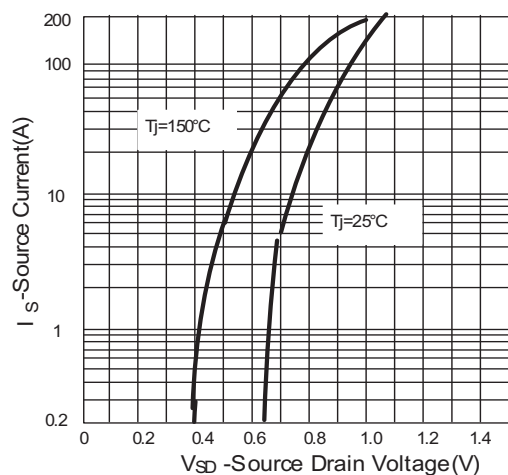


Figure.5 Source Drain Diode Forward

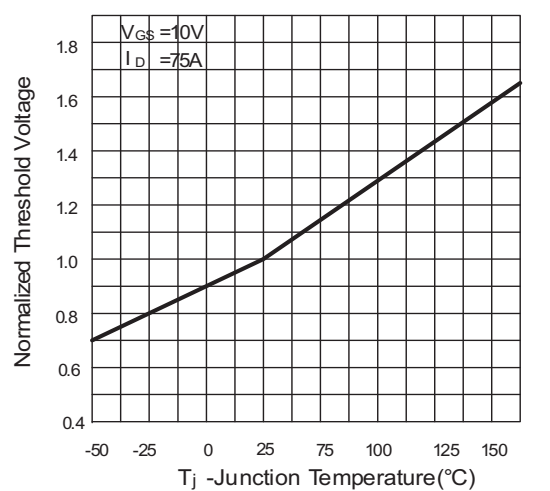


Figure.6 Drain-Source On Resistance

## Typical Test Circuit

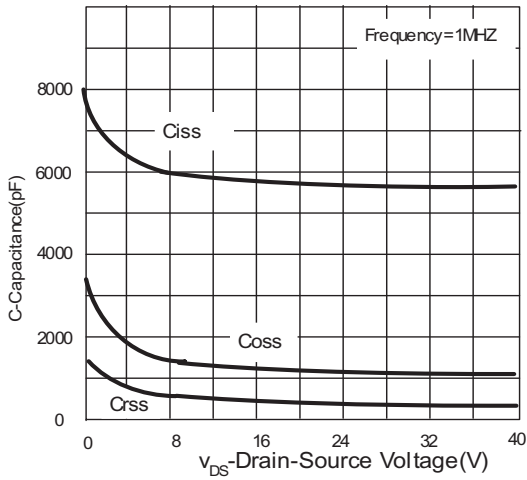


Figure.7 Capacitance

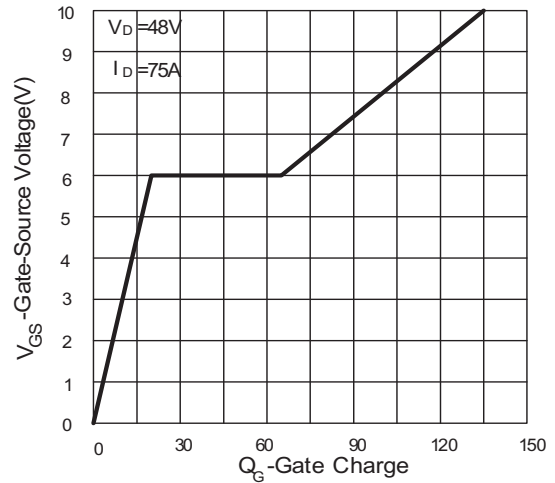


Figure.8 Gate Charge

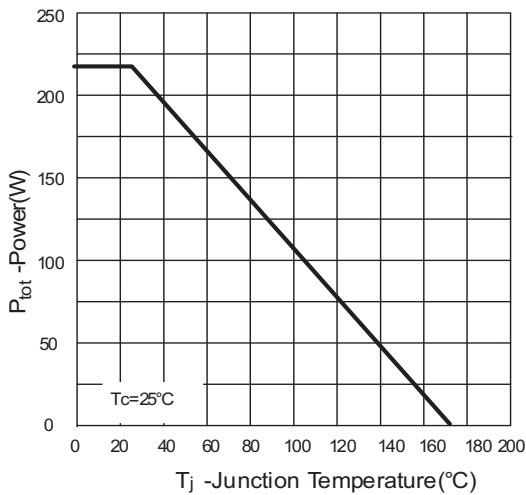


Figure.9 Power Dissipation

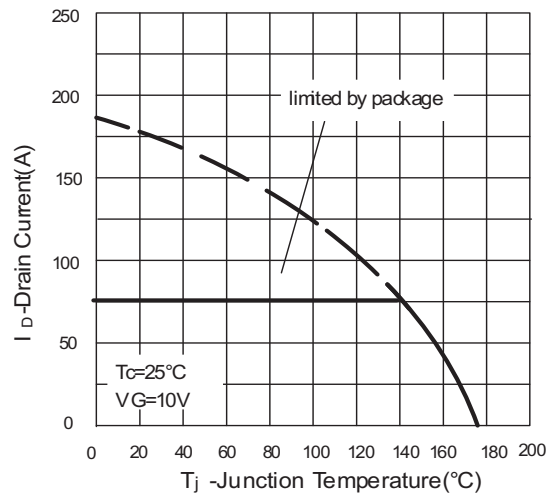


Figure.10 Drain Current

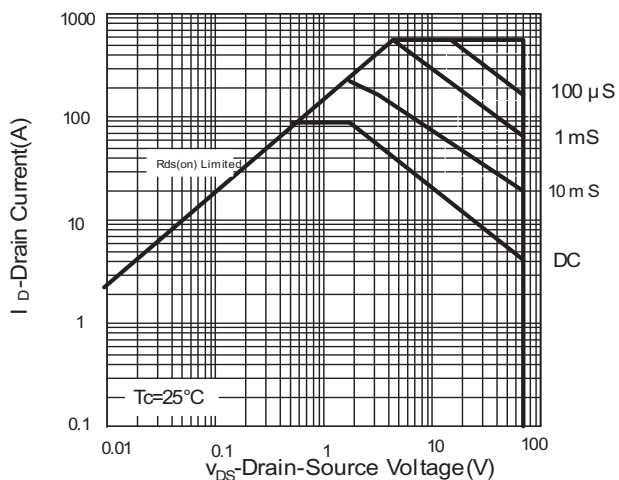


Figure.11 Safe Operation Area

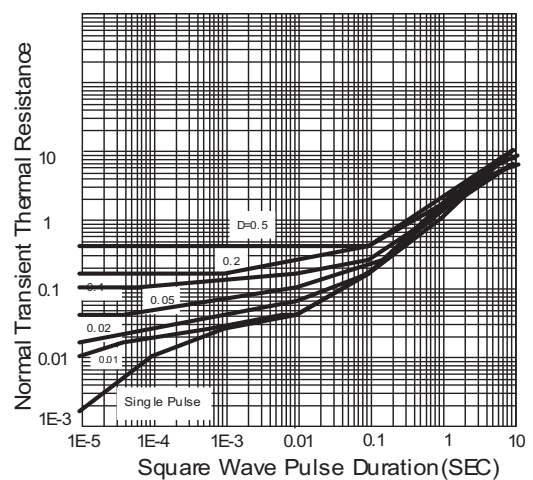
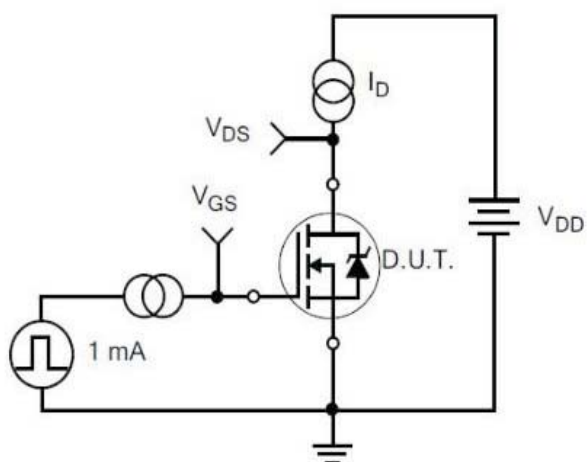
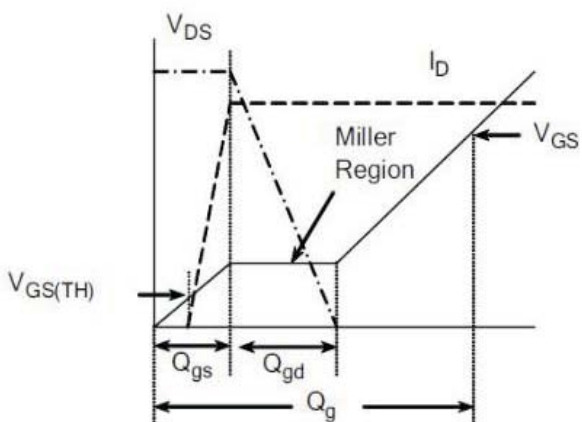


Figure.12 Thermal Transient Impedance

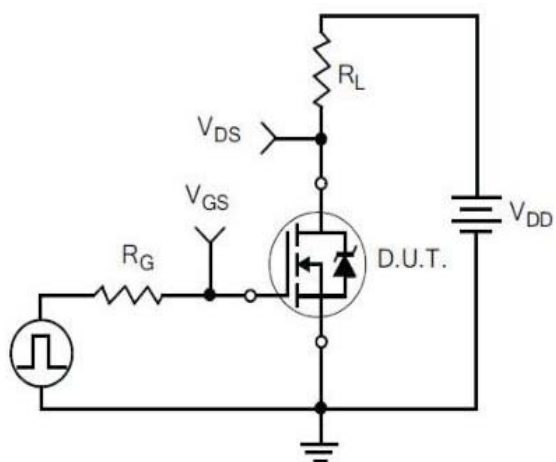
## Typical Test Circuit



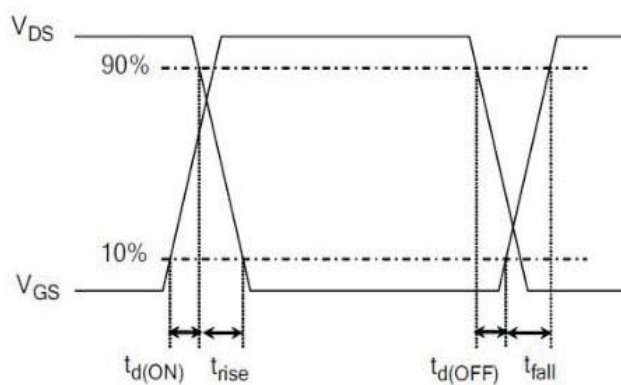
1) Gate Charge Test Circuit



2) . Gate Charge Waveform

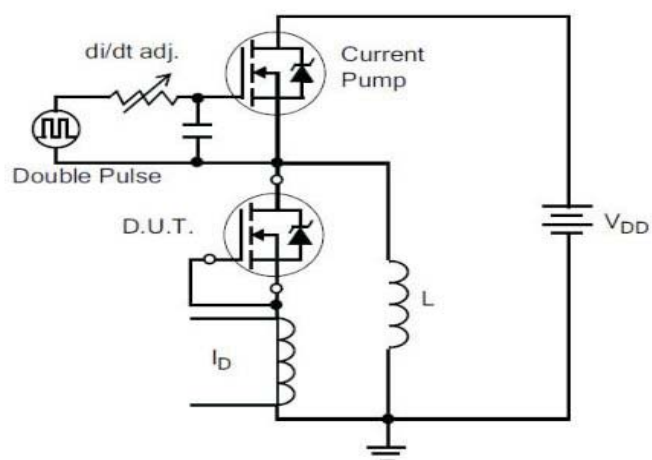


3) Resistive Switching Test Circuit

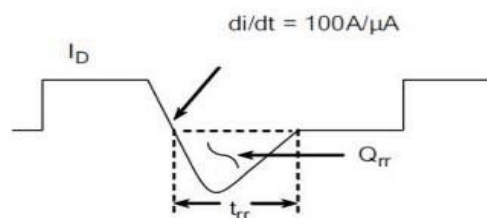


4) Resistive Switching Waveforms

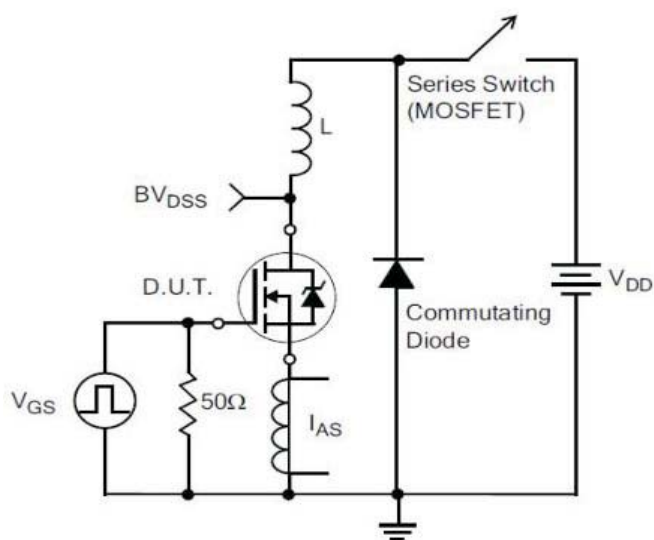
## Typical Test Circuit



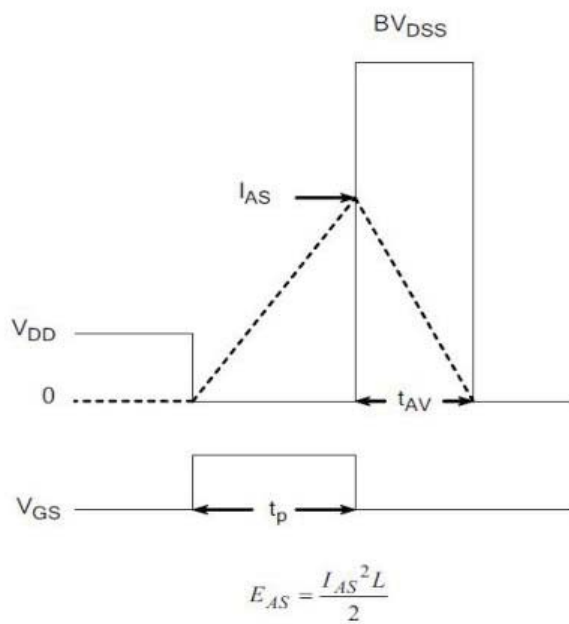
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform

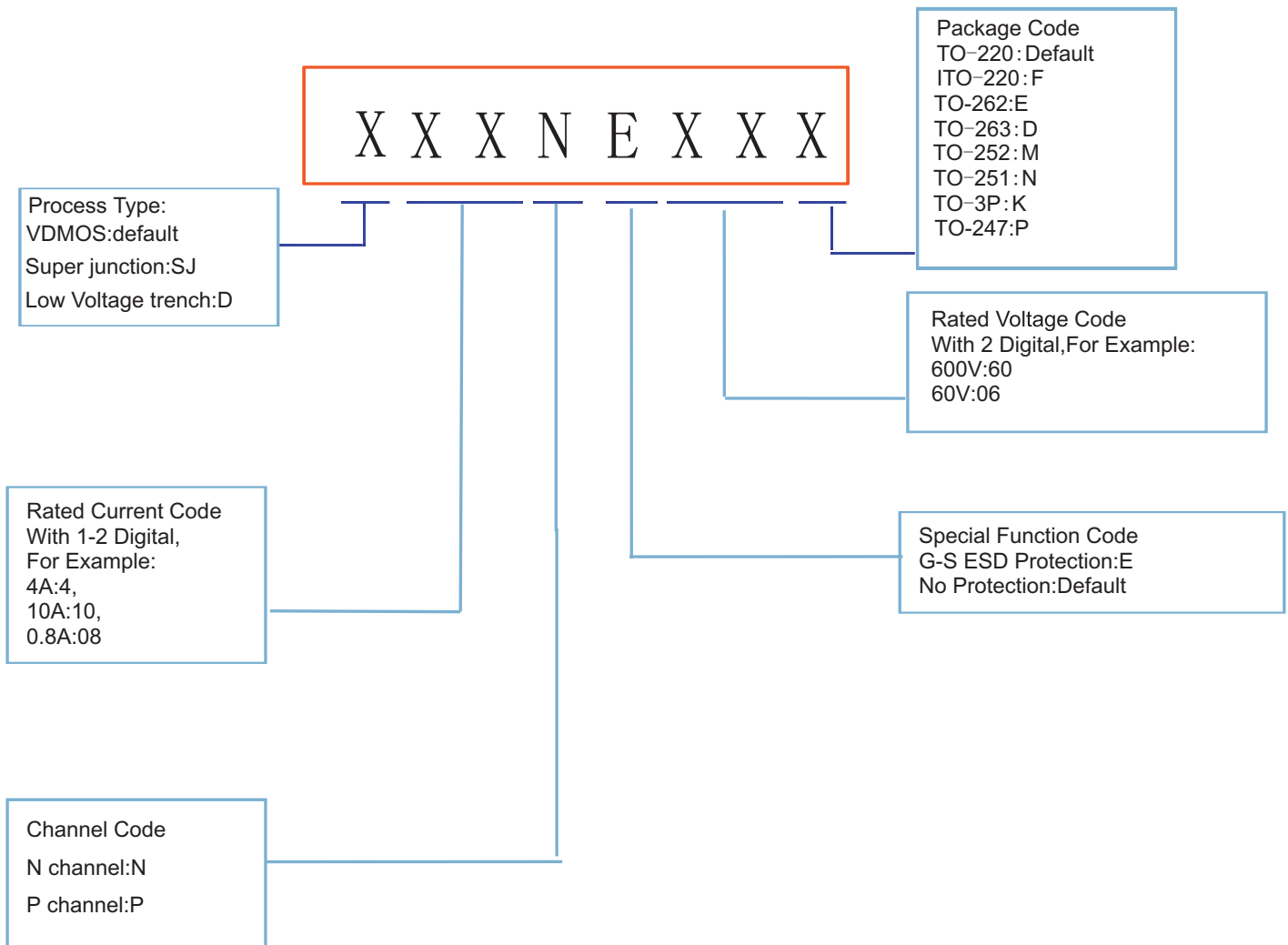


7) . Unclamped Inductive Switching Test Circuit



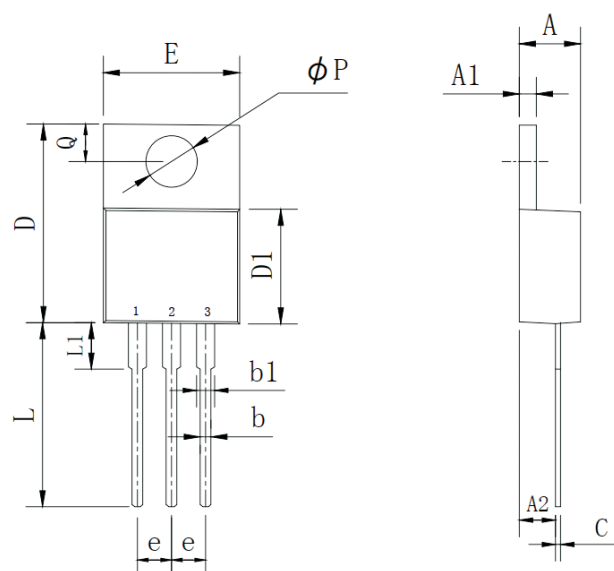
8) Unclamped Inductive Switching Waveforms

## Product Names Rules



## Dimensions

### TO-220 PACKAGE OUTLINE DIMENSIONS

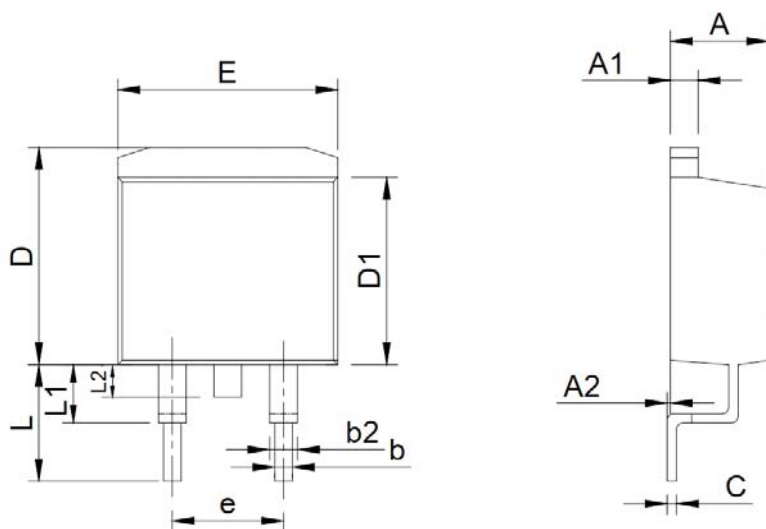


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	4.25	4.87	0.167	0.192
A1	1.07	1.47	0.042	0.058
A2	2.03	2.92	0.080	0.115
b	0.51	1.11	0.020	0.044
b1	0.97	1.6	0.038	0.063
C	0.3	0.7	0.012	0.028
D	14.6	15.9	0.575	0.626
D1	8.04	9.3	0.317	0.366
E	9.57	10.57	0.377	0.416
e	2.34	2.74	0.092	0.108
L	12.58	14.3	0.495	0.563
L1	2.8	4.2	0.110	0.165
P	3.4	4.14	0.134	0.163
Q	2.45	3	0.096	0.118



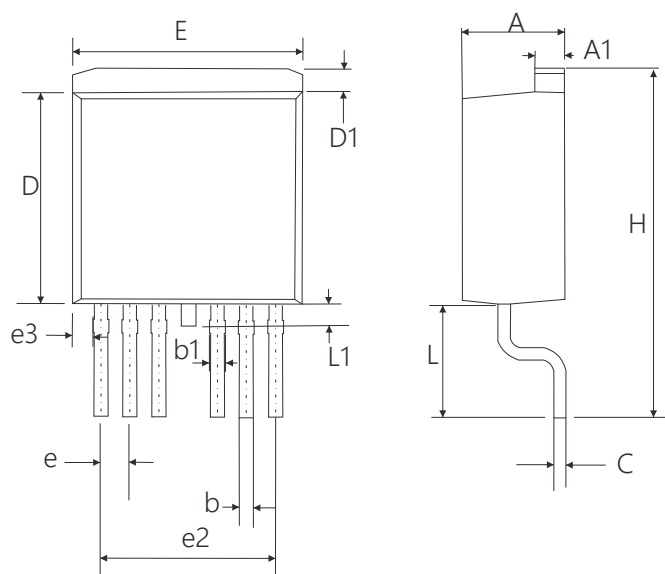
## Dimensions

### TO-263 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	4.25	4.87	0.167	0.192
A1	1.07	1.47	0.042	0.058
A2	0	0.25	0.000	0.010
b	0.61	1.01	0.024	0.040
b1	1.2	1.34	0.047	0.053
C	0.3	0.6	0.012	0.024
D	9.48	10.84	0.373	0.427
D1	8.49	9.3	0.334	0.366
E	9.7	10.31	0.382	0.406
e	4.88	5.28	0.192	0.208
L	4.46	5.85	0.176	0.230
L1	1.33	2.33	0.052	0.092
L2	0	2.2	0.000	0.087

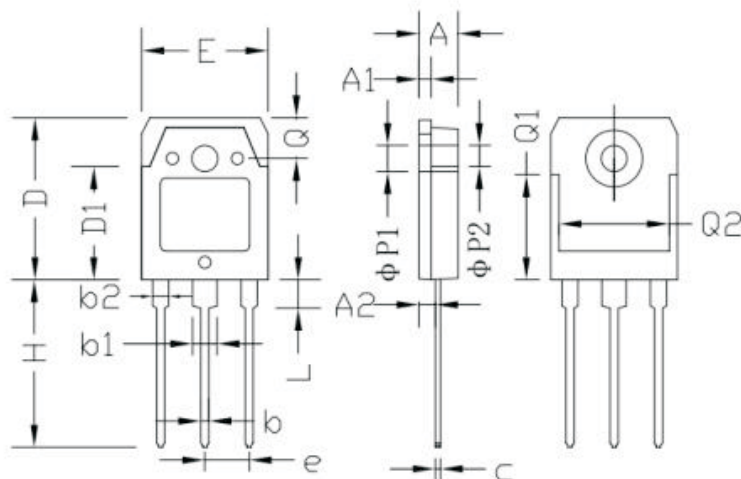
### TO-263-7L PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	4.25	4.75	0.167	0.187
A1	1.2	1.4	0.047	0.055
b	0.5	0.7	0.020	0.028
b1	0.5	0.9	0.020	0.035
C	0.4	0.6	0.016	0.024
D	9.05	9.45	0.356	0.372
D1	0.7	1.3	0.028	0.051
E	9.8	10.2	0.386	0.402
e	1.07	1.47	0.042	0.058
e2	7.32	7.92	0.288	0.312
e3	0.64	1.04	0.025	0.041
H	14.65	15.65	0.577	0.616
L	4.47	5.47	0.176	0.215
L1	0.90	1.50	0.035	0.059

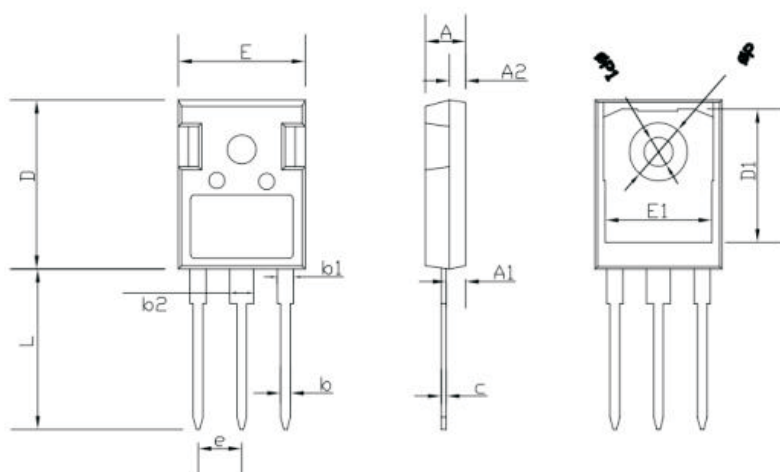
## Dimensions

### TO-3P PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	min.	max.	min.	max.
A	4.60	5.00	0.181	0.197
A1	1.45	1.65	0.057	0.065
A2	2.20	2.60	0.087	0.102
b	0.80	1.20	0.032	0.047
b1	2.80	3.20	0.110	0.126
b2	1.80	2.20	0.071	0.087
C	0.55	0.75	0.022	0.030
D	19.20	19.70	0.756	0.776
D1	13.10	14.70	0.516	0.578
E	15.40	15.80	0.607	0.623
e	5.45 TYP		0.215 TYP	
H	19.80	20.20	0.780	0.826
L	3.30	3.70	0.130	0.146
ΦP1	3.20 TYP		0.126 TYP	
ΦP2	3.50 TYP		0.138 TYP	
Q	5.00 TYP		0.197 TYP	
Q1	12.40 TYP		0.488 TYP	
Q2	12.6	-	0.496	-

### TO-247 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	min.	max.	min.	max.
A	4.90	5.10	0.193	0.201
A1	2.31	2.51	0.091	0.099
A2	1.90	2.10	0.075	0.083
b	1.16	1.26	0.046	0.050
b1	1.96	2.06	0.0772	0.0812
b2	2.96	3.06	0.117	0.121
c	0.59	0.66	0.0232	0.0260
D	20.90	21.10	0.8235	0.8313
D1	16.25	16.85	0.6403	0.6639
E	15.70	15.90	0.6186	0.6265
E1	13.10	13.50	0.5161	0.5319
e	5.44		0.2143	
L	19.80	20.10	0.7801	0.7919
ΦP	3.50	3.70	0.1379	0.1458
ΦP1	0	7.30	0	0.2876

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