145A 60V N-Channel Enhancement Mode Power MOSFET

Genaral 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 reverse transfer capacitances
- Low gate charge and Low on-resistance
- 100% avalanche tested

Mechanical Data

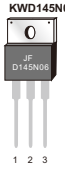
- Case:TO-220,ITO-220,TO-263,TO-263-7L, TO-262,TO-251, TO-252 Package

Application

- Power switching applications
- Inverter management system
- Electric tools

Product Summary			
V_{DS}	$R_{DS(on)}$ (mΩ) Typ	I_D (A)	Qg (Typ)
60V	4.5 @ 10V 30A	145	80nc

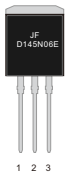
TO-220 KWD145N06



ITO-220 KWD145N06F

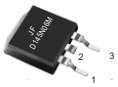
TO-263 KWD145N06D

TO-262 KWD145N06E

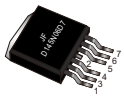


TO-251 KWD145N06N

TO-252 KWD145N06M



TO-263-7L KWD145N06D7



Ordering Information

Part No.	Package Type	Package	Quality(box)
KWD145N06	TO-220	Tube	1000
KWD145N06F	ITO-220	Tube	1000
KWD145N06D	TO-263	Tape & Reel	800
KWD145N06E	TO-262	Tube	1000
KWD145N06N	TO-251	Tube	1000
KWD145N06M	TO-252	Tape & Reel	2500
KWD145N06D7	TO-263-7L	Tape & Reel	800

Pin Definition:

1. Gate
2. Drain

3/4/5/6/7. Source

Block Diagram

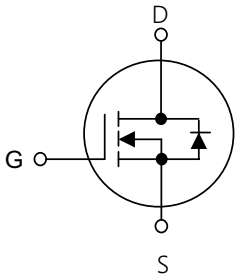


Table1 Absolute Maximum Ratings (Tc=25°C, unless otherwise specified)

Parameter		Symbol	KWD145N06/KWD145N06D/KWD145N06E KWD145N06M/KWD145N06N KWD145N06D7	KWD145N06F	Unit
Drain-Source Voltage		V_{DS}	60		V
Gate-Source Voltage		V_{GS}	±20		V
Continuous Drain Current	Tc=25°C	I_D	145	145※	A
	Tc=100°C		101	101※	
Pulsed Drain Current (Note 1)		I_{DM}	580		A
Single Pulse Avalanche Energy(Note 2)		E_{AS}	702		mJ
Avalanche Current(Note 2)		I_{AR}	53		A
Power Dissipation	Tc=25°C	P_D	214	80	W
Operating Junction and Storage Temperature		T_J/T_{STG}	-55~+175		°C

※ limited by maximum junction temperature

Table 2.Thermal Characteristics

Parameter	Symbol	D145N06/D145N06D/ D145N06M/D145N06N D145N06E/D145N06D7	D145N06F	Unit
Thermal resistance Junction to Ambient	$R_{\theta JA}$	75	75	°C/W
Thermal resistance Junction to Case	$R_{\theta JC}$	0.7	1.88	°C/W

Table 3. Electrical Characteristics (T_C=25°C, unless otherwise specified)

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Off Characteristics							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0V,I_D=250μA	60	-	-	V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=60V,V_{GS}=0V	-	-	1	μA
Gate- Source Leakage Current	Forward	I_{GSS}	V_{GS}=20V,V_{DS}=0V	-	-	100	nA
	Reverse		V_{GS}=-20V,V_{DS}=0V	-	-	-100	nA
On Characteristics(Note 3)							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS}=V_{GS},I_D=250μA	2.0	3.0	4.0	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	V_{GS}=10V,I_D=30A	-	4.5	5.3	mΩ
Dynamic Characteristics(Note 4)							
Input Capacitance		C_{ISS}	V_{DS}=30V,V_{GS}=0V,f=1MHz	-	4800	-	pF
Output Capacitance		C_{OSS}		-	365	-	pF
Reverse Transfer Capacitance		C_{RSS}		-	270	-	pF
Switching Characteristics (Note 4)							
Turn-On Delay Time		td(on)	V_{DD}=30V,I_D=30A V_{GS}=10V,R_{GEN}=25Ω,	-	67	-	ns
Turn-On Rise Time		t_R		-	136	-	ns
Turn-Off Delay Time		td(off)		-	190	-	ns
Turn-Off Fall Time		tf		-	140	-	ns
Total Gate Charge		Q_G	V_{DD}=30V,I_D=30A, V_{GS}=10V	-	80	-	nC
Gate-Source Charge		Q_{GS}		-	27	-	nC
Gate-Drain Charge		Q_{GD}		-	21	-	nC
Drain-Source Diode Characteristics and Maximum Ratings							
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS}=0V,I_S=30A	-	-	1.3	V
Maximum Continuous Drain-Source Diode Forward Current		I_S		-	-	130	A
Reverse Recovery Time		trr	V_{GS}=0V,I_F=60A dI$_F$/dt=100A/μs(Note 1)	-	23	-	ns
Reverse Recovery Charge		Q_{RR}		-	18	-	nC

Notes: 1 Repetitive Rating:Pulse width limited by maximum junction temperature
2 L=0.5mH, I_D=53A,V_{DD}=50V,V_{GATE}=10V,Starting T_J=25°C
3 Pulse Test: Pulse width ≤300μS,Duty cycle≤2%
4 Guaranteed by design,not subject to production

Typical Characteristics Diagrams

Figure 1.Output Characteristics

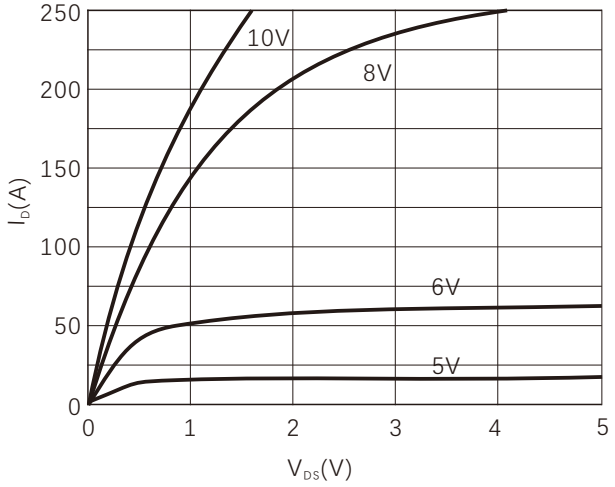


Figure 2. Transfer Characteristics

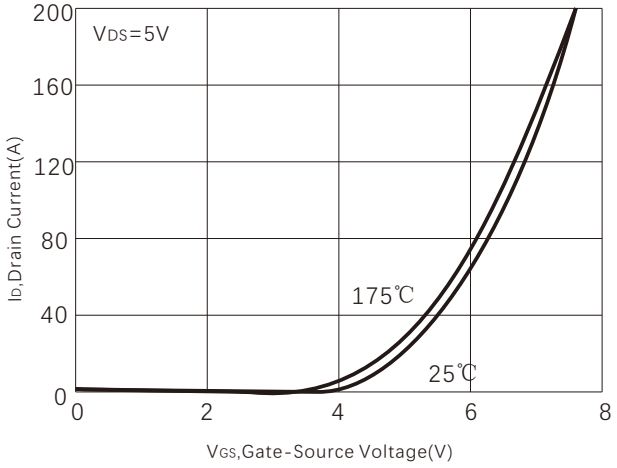


Figure 3. VSD_ Source vs Drain Diode forward

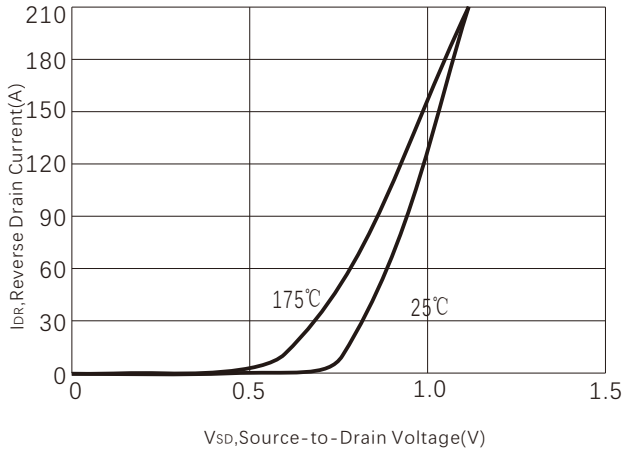


Figure 4. Capacitance

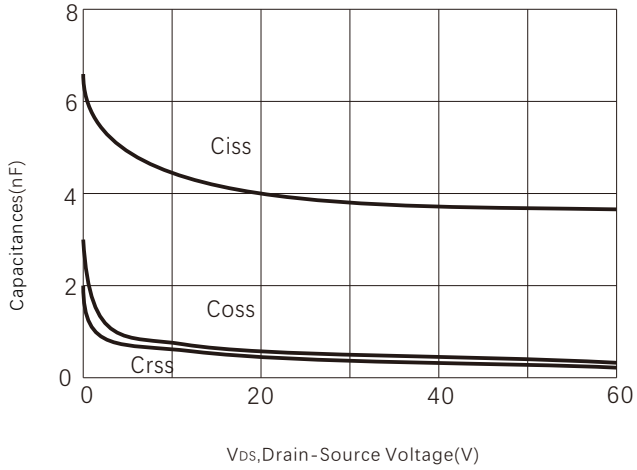


Figure 5.Gate charge

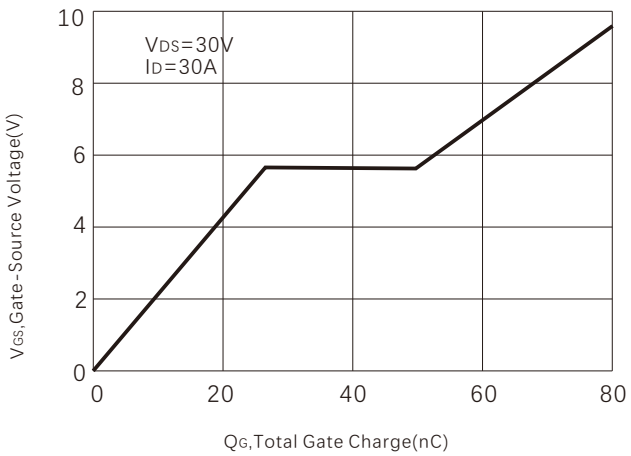


Figure 6. Drain Current

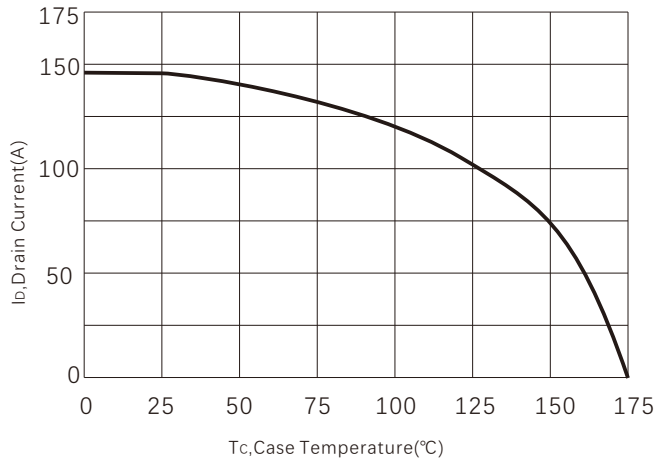


Figure7.$R_{DS(ON)}$ vs Junction Temperature

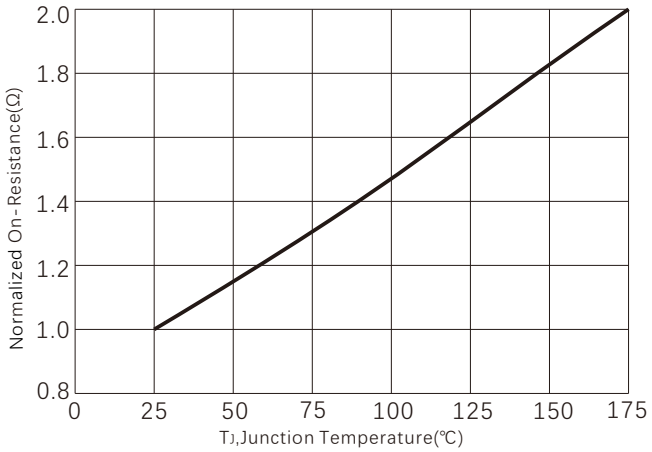


Figure 8. Power dissipation

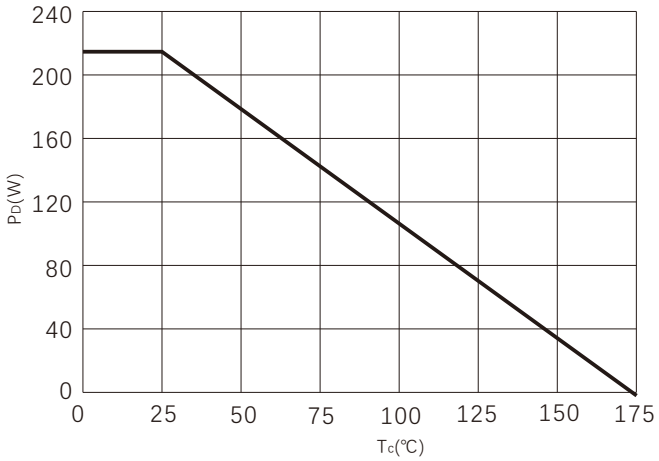


Figure 9. Safe operating area

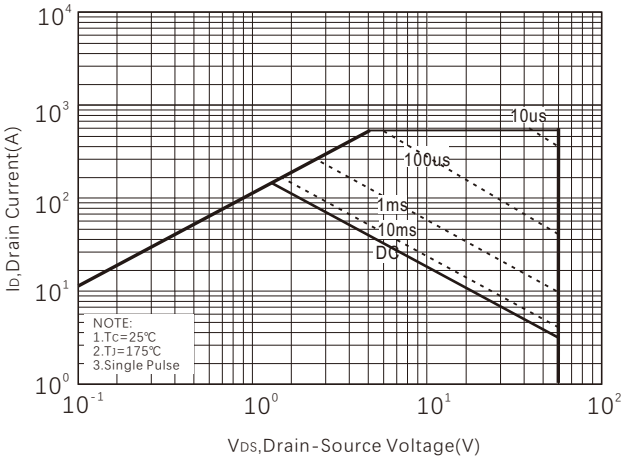
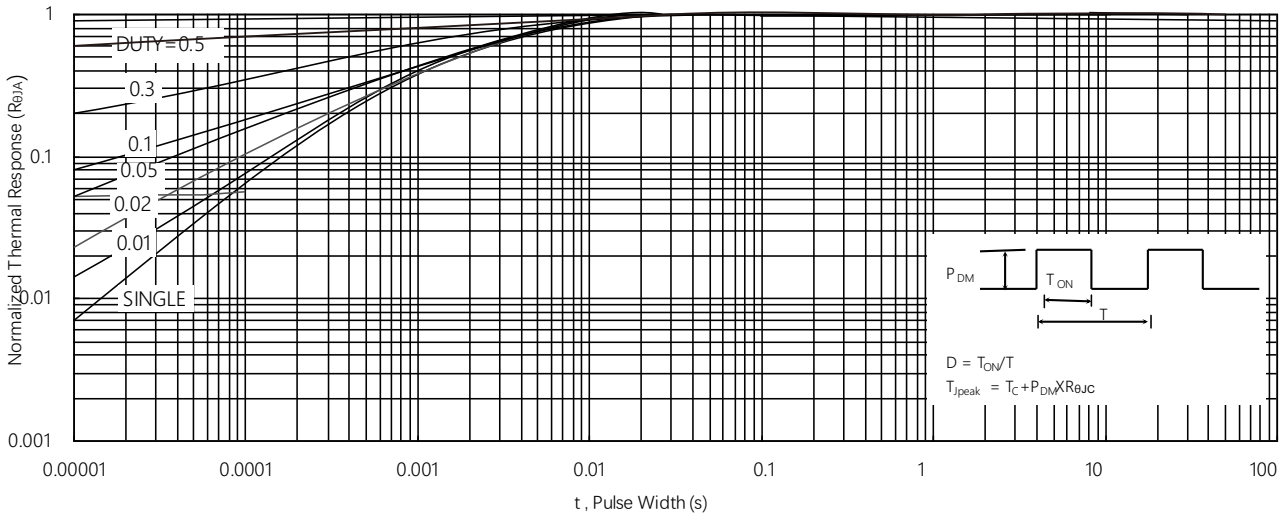
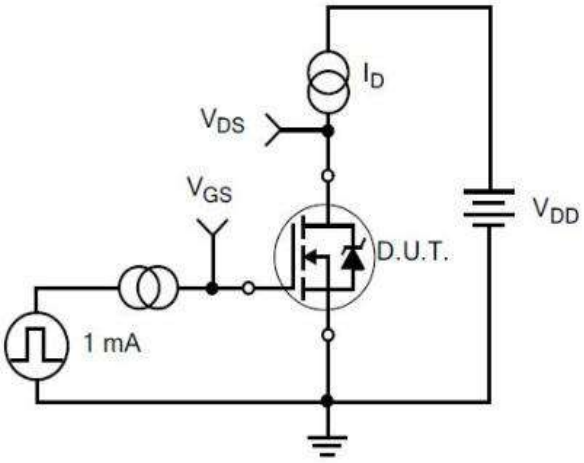


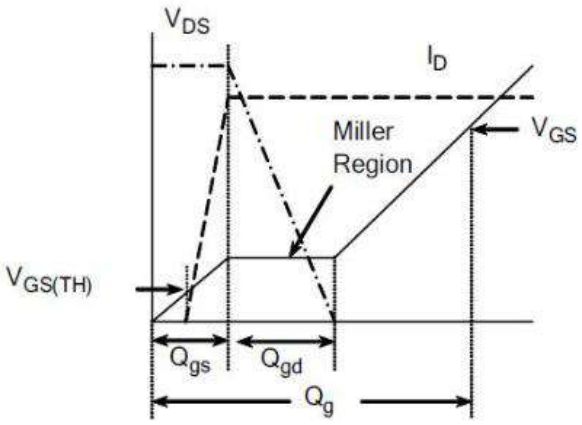
Figure 10.Normalized Maximum Transient Thermal Impedance



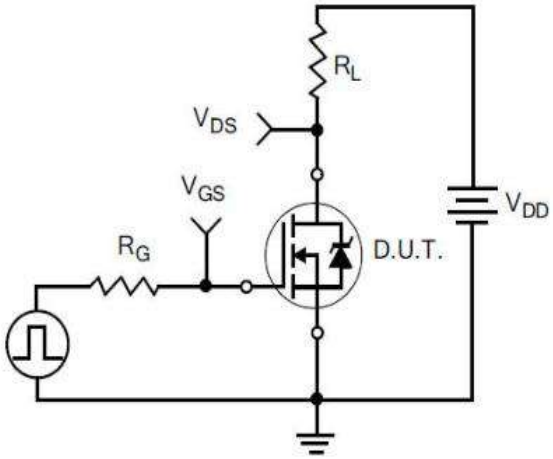
Typical Test Circuit



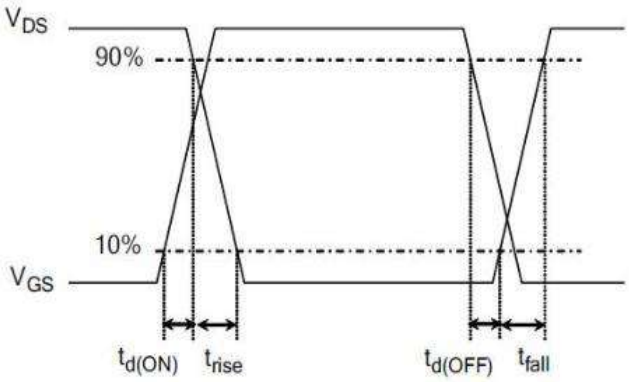
1) Gate Charge Test Circuit



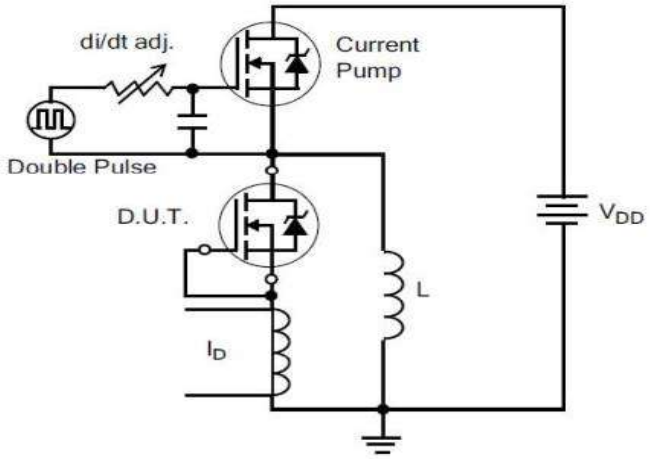
2) . Gate Charge Waveform



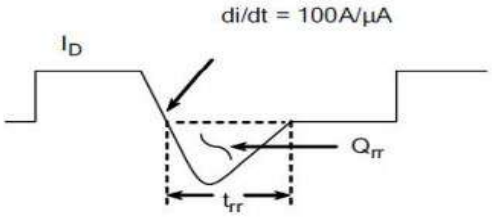
3) Resistive Switching Test Circuit



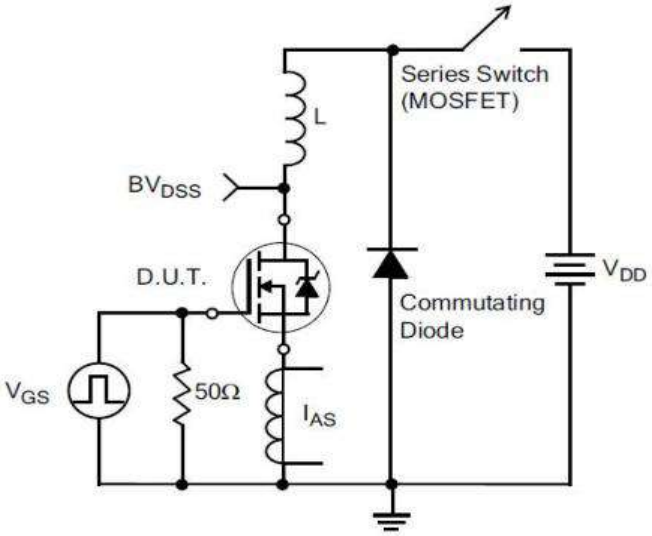
4) Resistive Switching Waveforms



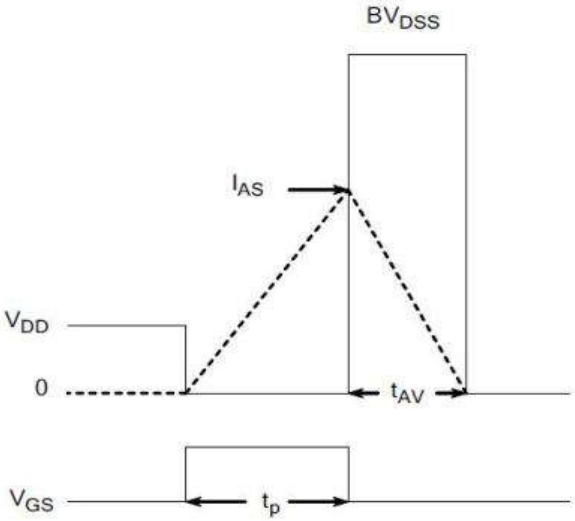
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform



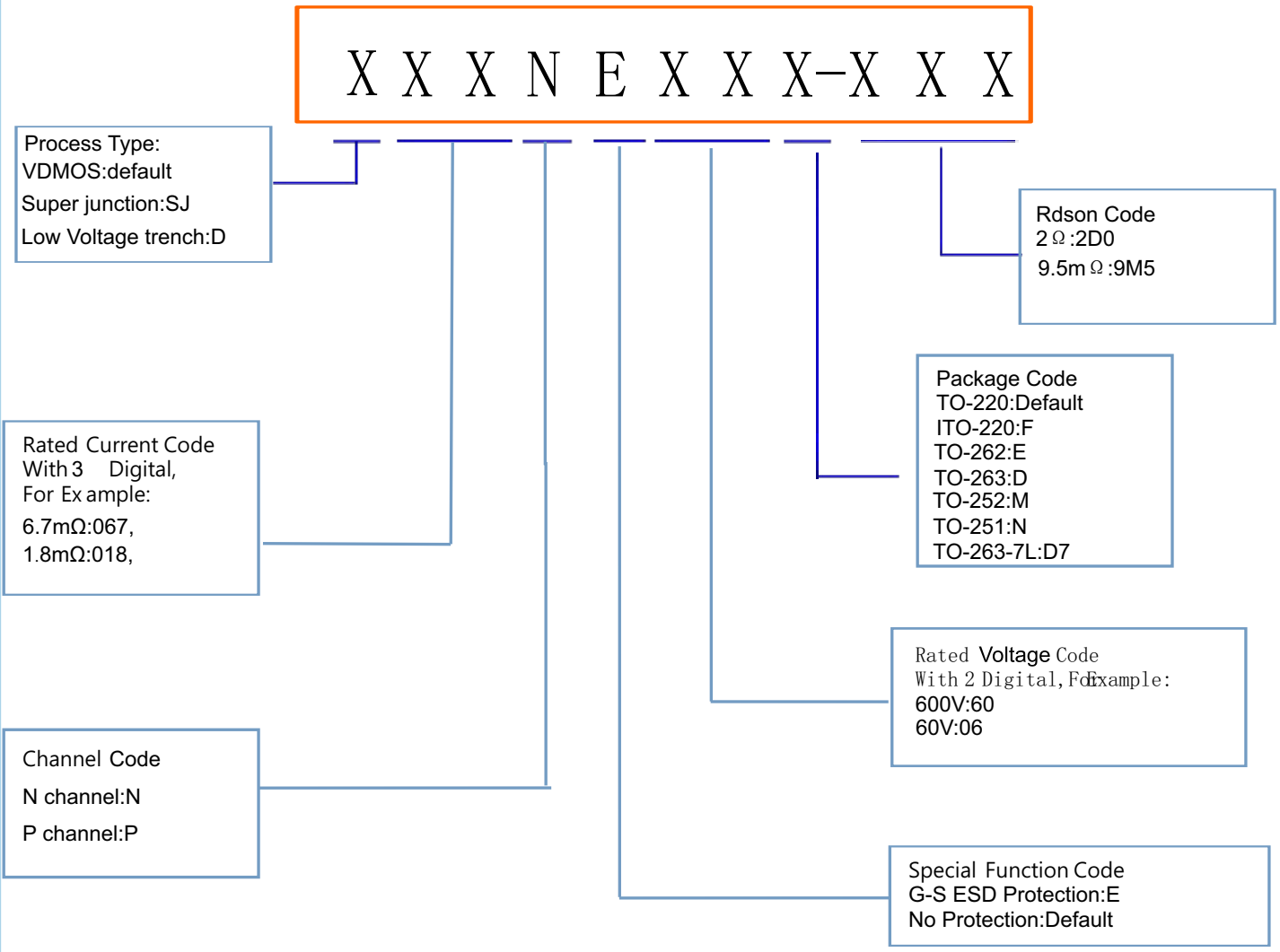
7) . Unclamped Inductive Switching Test Circuit



$$E_{AS} = \frac{I_{AS}^2 L}{2}$$

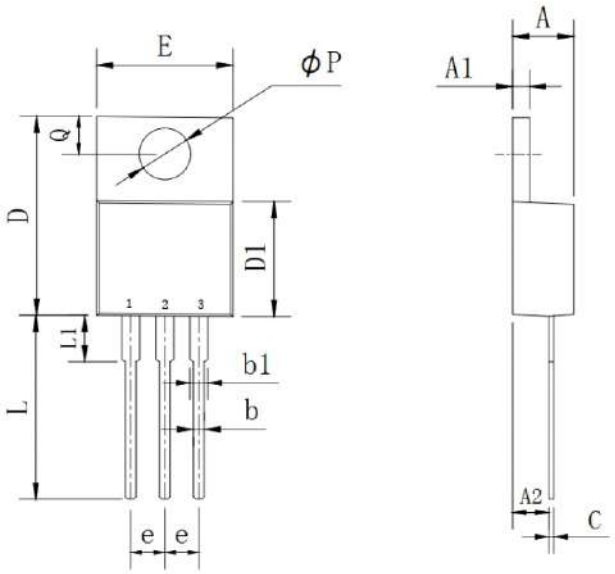
8) Unclamped Inductive Switching Waveforms

Product Names Rules



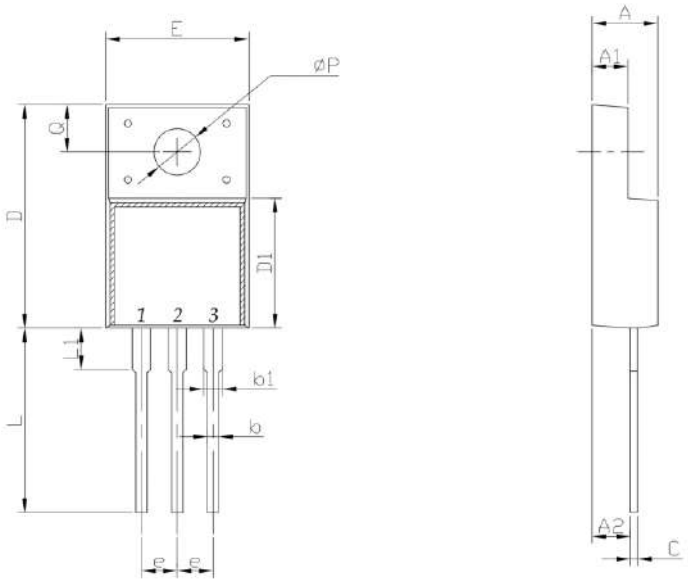
Dimensions

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

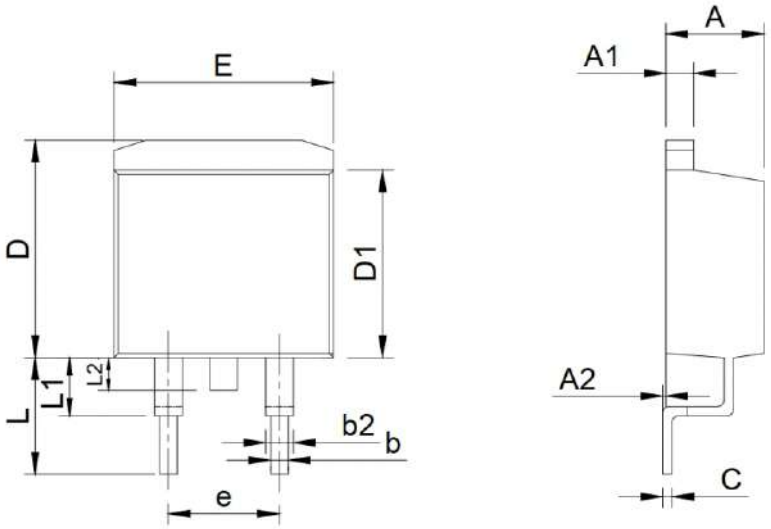
ITO-220 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	4.24	4.9	0.167	0.193
A1	2.3	2.92	0.091	0.115
A2	2.61	2.81	0.103	0.111
b	0.3	1	0.012	0.039
b1	0.9	1.55	0.035	0.061
C	0.3	0.7	0.012	0.028
D	14.5	16.36	0.571	0.644
D1	8.8	9.41	0.346	0.370
E	9.5	10.5	0.374	0.413
e	2.3	2.75	0.091	0.108
L	12.6	14	0.496	0.551
L1	2.45	4.3	0.096	0.169
P	2.9	3.8	0.114	0.150
Q	2.5	3.55	0.098	0.140

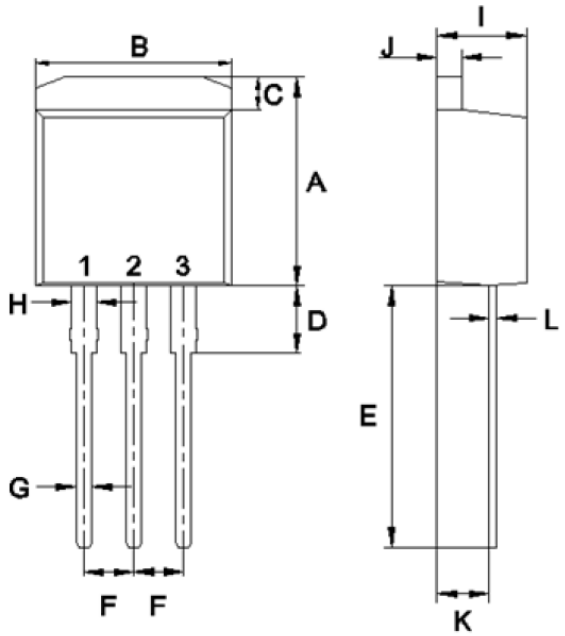
Dimensions

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

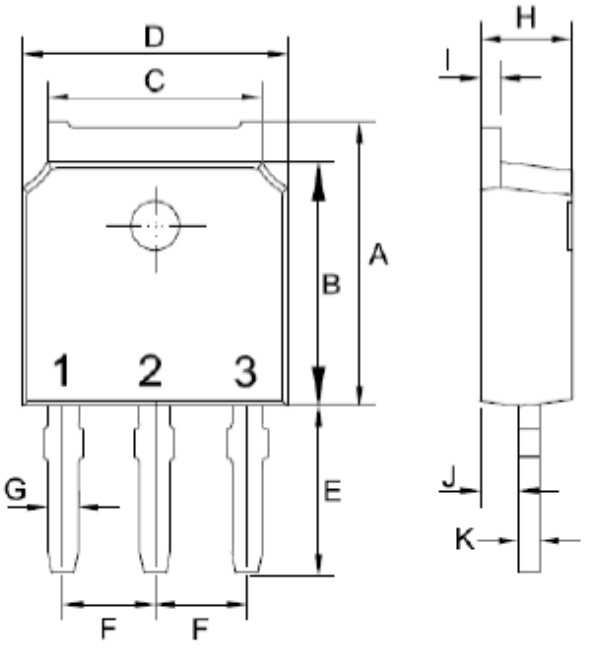
TO-262 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	10.14	11.14	0.399	0.439
B	9.57	10.57	0.377	0.416
C	1.15	1.84	0.045	0.072
D	2.95	3.95	0.116	0.156
E	12.25	13.75	0.482	0.541
F	2.34	2.74	0.092	0.108
G	0.51	1.11	0.020	0.044
H	0.97	1.57	0.038	0.062
I	4.25	4.87	0.167	0.192
J	1.07	1.47	0.042	0.058
K	2.03	2.92	0.080	0.115
L	0.3	0.6	0.012	0.024

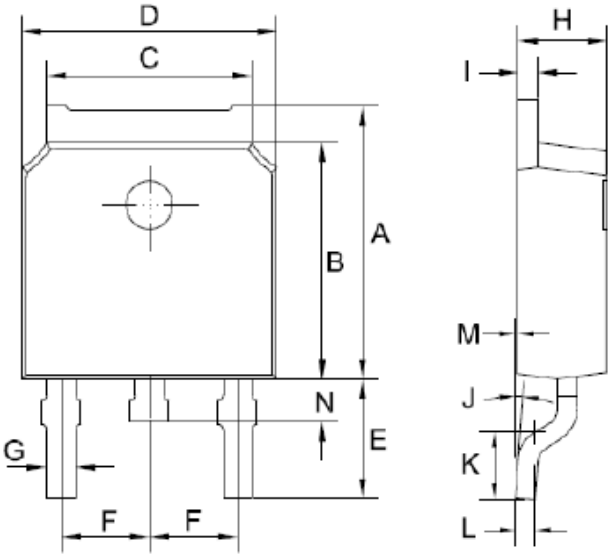
Dimensions

TO-251 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	6.85	7.25	0.270	0.285
B	5.8	6.3	0.228	0.248
C	5	5.53	0.197	0.218
D	6.3	6.8	0.248	0.268
E	3.5	4.35	0.138	0.171
F	2.19	2.39	0.086	0.094
G	0.45	0.85	0.018	0.033
H	2.2	2.4	0.087	0.094
I	0.41	0.61	0.016	0.024
J	0.71	1.31	0.028	0.052
K	0.41	0.61	0.016	0.024

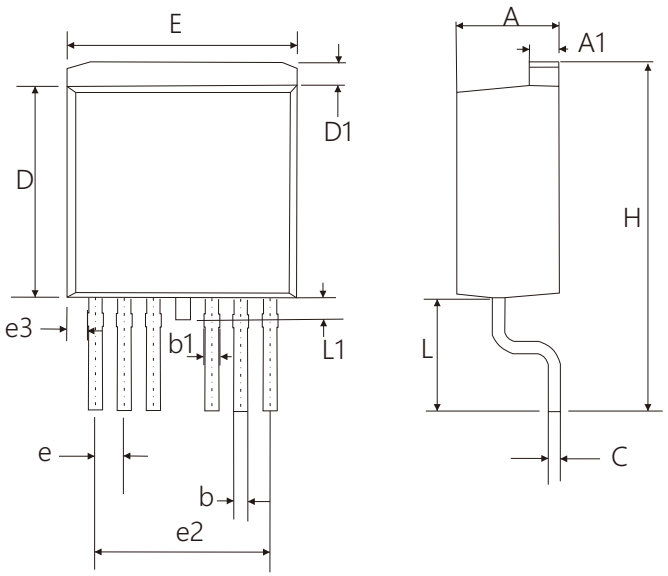
TO-252 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	6.85	7.25	0.270	0.285
B	5.8	6.3	0.228	0.248
C	5	5.53	0.197	0.218
D	6.3	6.8	0.248	0.268
E	2.6	3.3	0.102	0.130
F	2.19	2.39	0.086	0.094
G	0.45	0.85	0.018	0.033
H	2.2	2.4	0.087	0.094
I	0.41	0.61	0.016	0.024
J	0°	8°	0°	8°
K	1.45	1.85	0.057	0.073
L	0.41	0.61	0.016	0.024
M	0	0.12	0.000	0.005
P	0.6	1	0.024	0.039

Dimensions

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