

700V N-Channel Super Junction Power MOSFET

Description:

This series of power MOSFET use N channel Multi-EPI Super-Junction technology and design to provide better characteristics, such as fast switching time, low Ciss and Crss, low on resistance and excellent avalanche characteristics, making it especially suitable for applications which require superior power density and outstanding efficiency.

Features:

- Low on-resistance
- Ultra low gate charge and input capacitance
- 100% avalanche tested
- Rohs compliant

Mechanical Data

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

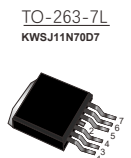
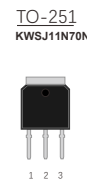
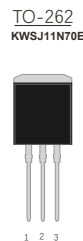
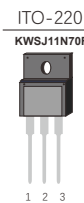
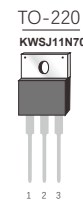
Application

- Switching applications

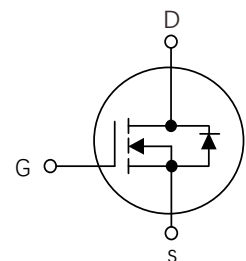
Ordering Information

Part No.	Package Type	Package	Quality(box)
KWSJ11N70	TO-220	Tube	1000
KWSJ11N70F	ITO-220	Tube	1000
KWSJ11N70D	TO-263	Tape & Reel	800
KWSJ11N70E	TO-262	Tube	1000
KWSJ11N70N	TO-251	Tube	1000
KWSJ11N70M	TO-252	Tape & Reel	3000
KWSJ11N70D7	TO-263-7L	Tape & Reel	800

Product Summary			
V _{DS}	R _{DS(on)} (Q) Typ	I _D (A)	Q _g (Typ)
700V	0.4 @ 10V, 5.5A	11	32nc



Block Diagram



Pin Definition:

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

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

Parameters		Symbol	KWSJ11N70 KWSJ11N70D KWSJ11N70E	KWSJ11N70M KWSJ11N70N KWSJ11N70D7	KWSJ11N70F	Unit
Drain-Source Voltage		V _{DS}	700			V
Gate-Source Voltage		V _{GS}	±30			V
Contionous Drain Current	T _C =25°C	I _D	11		5.5	A
	T _C =100°C		7		3.8	
Pulsed Drain Current (Note 1)		I _{DM}	42			A
Single Pulse Avalanche Energy(Note 2)		EAS	260			mJ
Avalanche Current(Note 1)		I _{AR}	2.0			A
Repetitive Avalanche Energy(Note 1)		EAR	1.0			mJ
Reverse Diode Recovery dv/dt(Note 3)		dv/dt	15			V/ns
Drain Source Voltage Slope (V _{DS} =480V)		dv/dt	50			V/ns
Power Dissipation T _C =25°C		P _D	104		36	W
Operating Junction and Storage Temperature		T _J /T _{STG}	-55 ~ +150			°C

Table 2. Thermal Characteristics

Parameters	Symbol	KWSJ11N70 KWSJ11N70D KWSJ11N70E	KWSJ11N70M KWSJ11N70N KWSJ11N70D7	KWSJ11N70F	Unit
Thermal resistance Junction to Ambient	$R_{\theta JA}$	62		82	$^{\circ}\text{C}/\text{W}$
Thermal resistance Junction to Case	$R_{\theta JC}$	1.0		3.5	$^{\circ}\text{C}/\text{W}$

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

Parameters		Symbol	Test Conditions	Min	Typ	Max	Unit
Off Characteristics							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V,I _D =250μA	700			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =700V,V _{GS} =0V			1	μA
Gate- Source Leakage Current	Forward	I _{GSS}	V _{GS} =30V,V _{DS} =0V			100	nA
	Reverse		V _{GS} = -30V,V _{DS} =0V			-100	nA
On Characteristics(Note 4)							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} =V _{GS} ,I _D =250μA	2.5		4.5	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} =10V,I _D =5.5A		0.40	0.45	Ω
Dynamic Characteristics(Note 5)							
Input Capacitance		C _{ISS}	V _{DS} =25V,V _{GS} =0V,f=1MHz		720		pF
Output Capacitance		C _{OSS}			20		pF
Reverse Transfer Capacitance		C _{RSS}			1.5		pF
Switching Characteristics (Note 5)							
Turn-On Delay Time		td(on)	V _{DD} =400V,I _D =5.5A, V _{GS} =10V,R _G =20Ω		15		ns
Turn-On Rise Time		tr			10		ns
Turn-Off Delay Time		td(off)			110		ns
Turn-Off Fall Time		tf			9		ns
Total Gate Charge		Q _G	V _{DS} =400V,I _D =5.5A, V _{GS} =10V		32		nC
Gate-Source Charge		Q _{GS}			4.0		nC
Gate-Drain Charge		Q _{GD}			16		nC
Drain-Source Diode Characteristics and Maximum Ratings							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =0V,I _S =5.5A		0.9	1.5	V
Maximum Continuous Drain-Source Diode Forward Current(Note 4)		I _S				9.2	A
Reverse Recovery Time		trr	V _R =400V,I _S =5.5A dI _R /dt=100A/μs(Note 4)		280		ns
Reverse Recovery Charge		Q _{RR}			3.3		μC

Notes: 1 Repetitive Rating:Pulse width limited by maximum junction temperature
2 $L=60\text{mH}, I_{AS}=3A, V_{DD}=150V$, Starting $T_J=25^{\circ}\text{C}$
3 $I_{SD}\leq 4.5A, di/dt\leq 200A/\mu s, V_{DD}\leq BV_{DSS}$, 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

Figure 7. Normalized $R_{DS(ON)}$ vs Junction Temperature

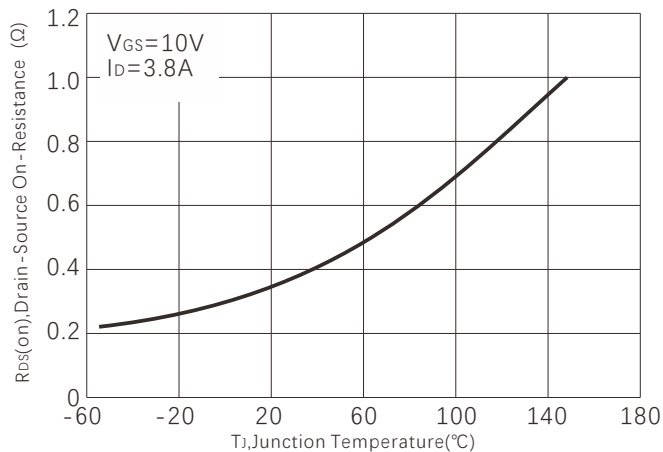


Figure 8. BV_{DSS} vs Junction Temperature

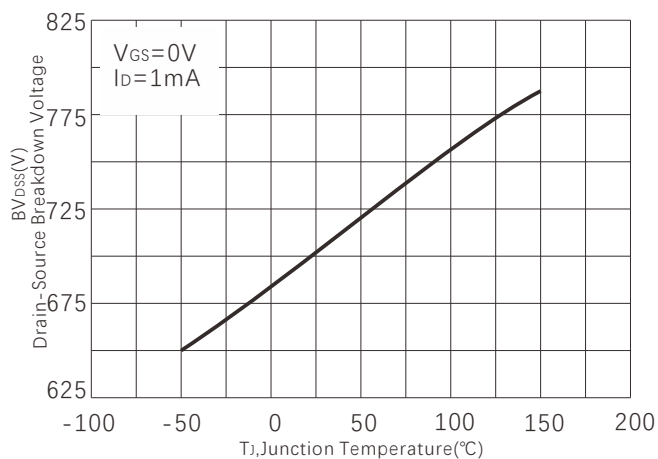


Figure 9. Safe operating area -Non ITO-220

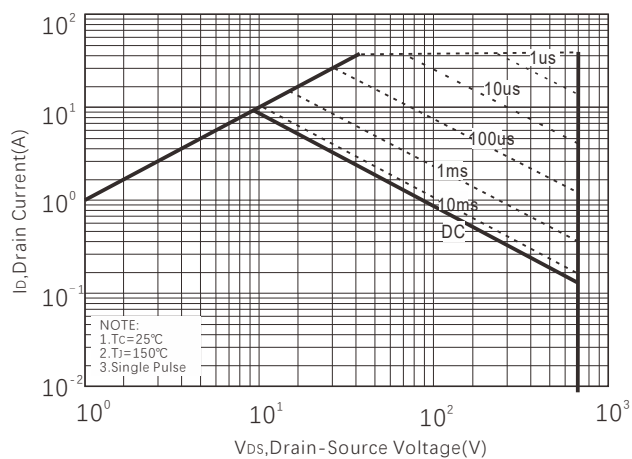


Figure 10. Safe operating area for ITO-220

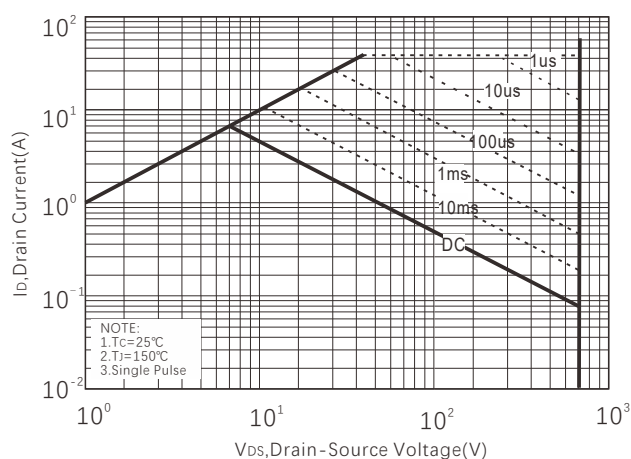


Figure 11. Maximum Transient Thermal Impedance -Non ITO-220

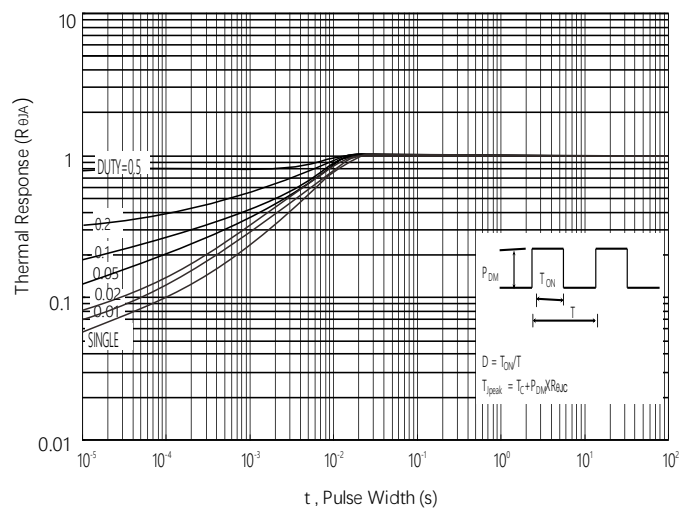
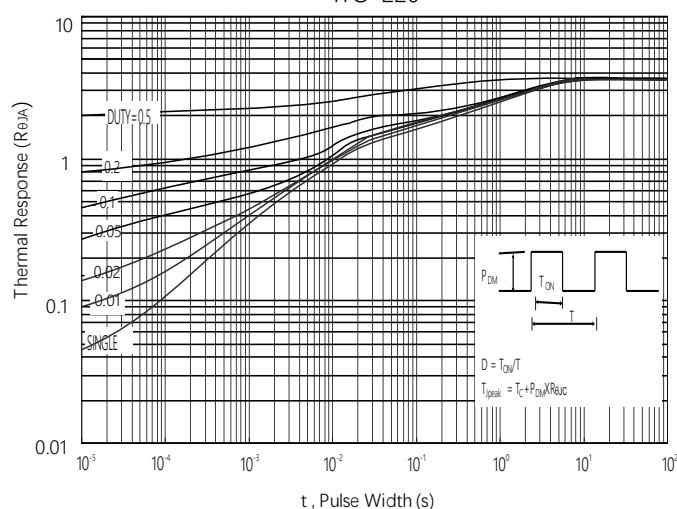


Figure 12. Maximum Transient Thermal Impedance - ITO-220



Typical Characteristics Diagrams

Figure 1. Output Characteristics

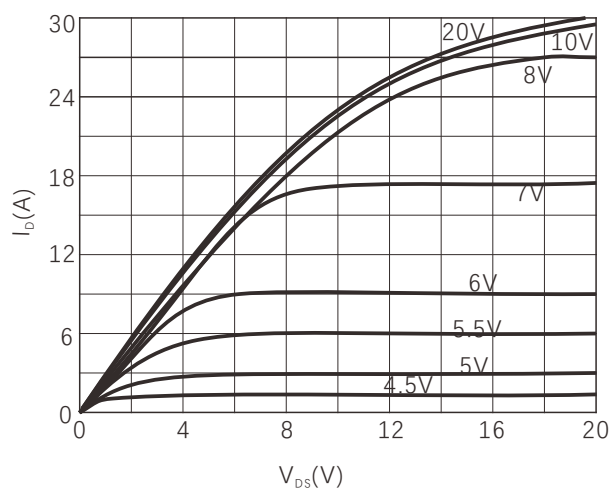


Figure 2. Transfer Characteristics

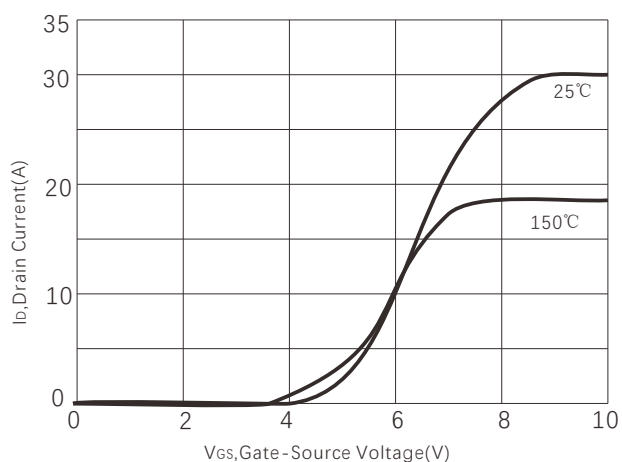


Figure 3. Power dissipation-ITO-220

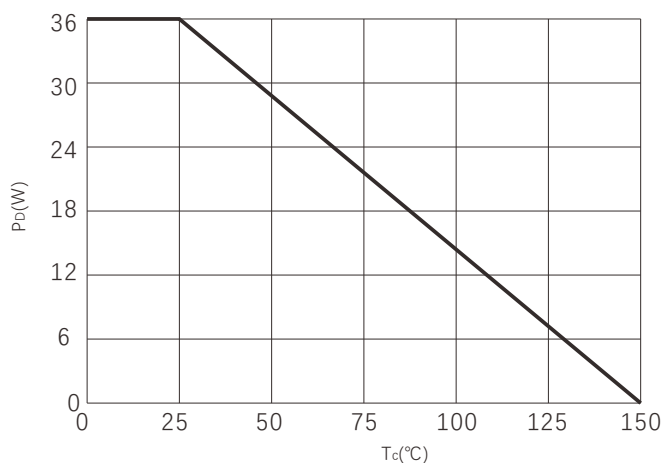


Figure 4. Capacitance

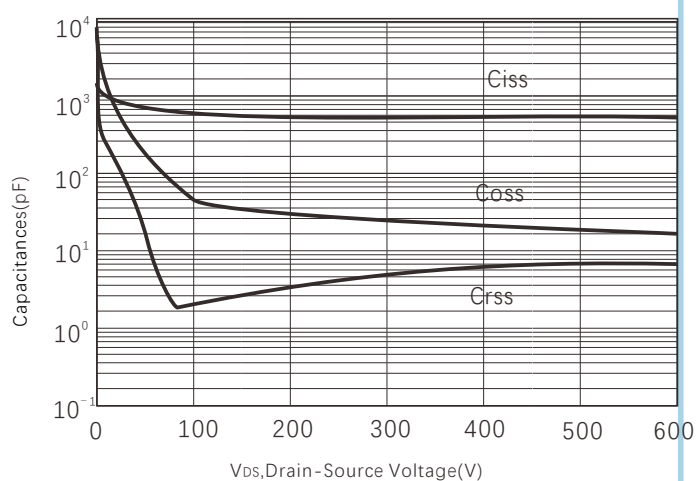


Figure 5. Gate charge

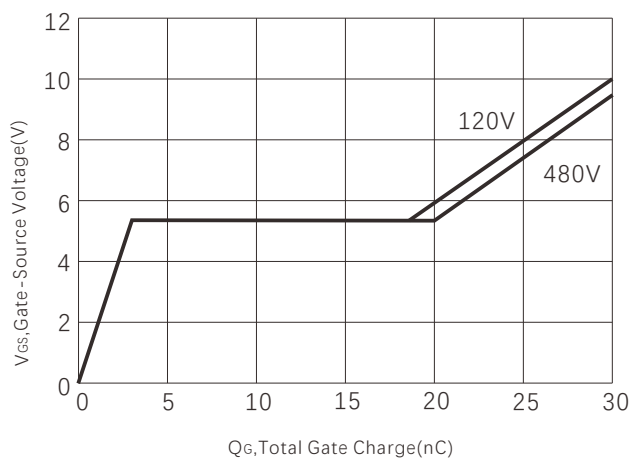
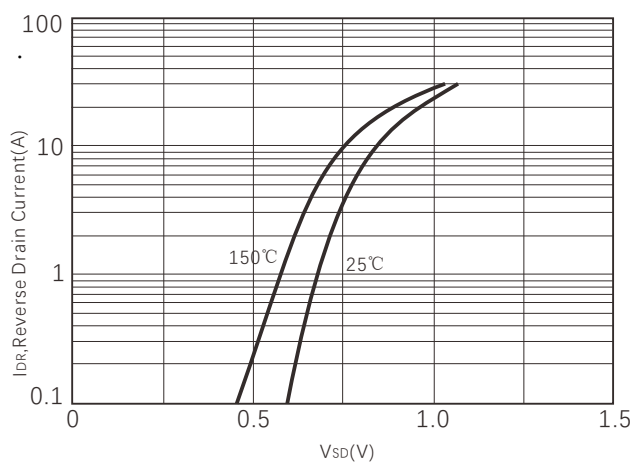
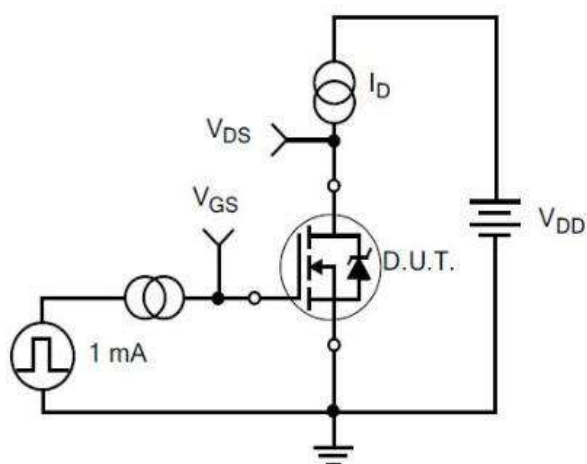


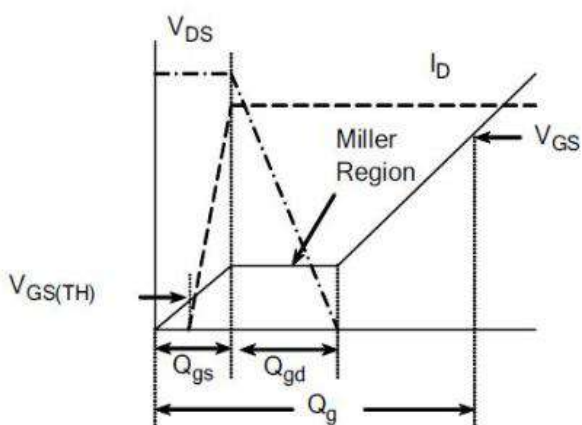
Figure 6. Source-Drain Diode Forward Voltage



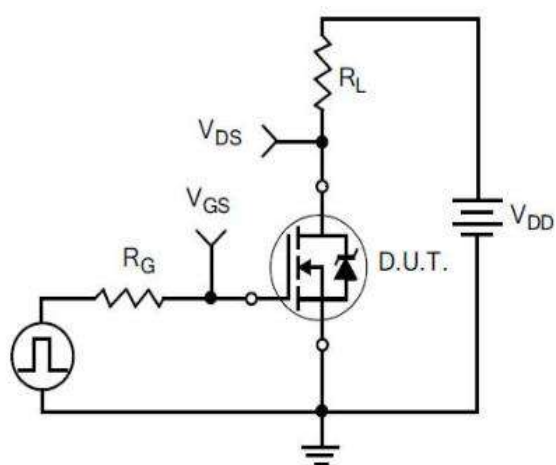
Typical Test Circuit



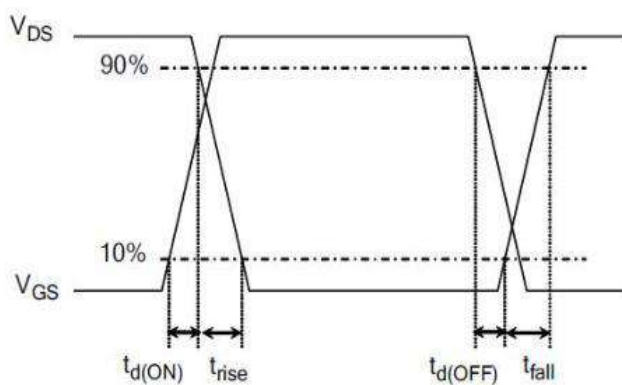
1) Gate Charge Test Circuit



2) Gate Charge Waveform

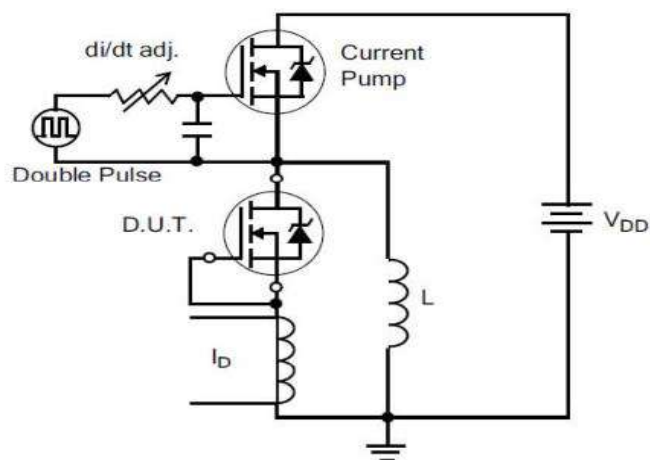


3) Resistive Switching Test Circuit

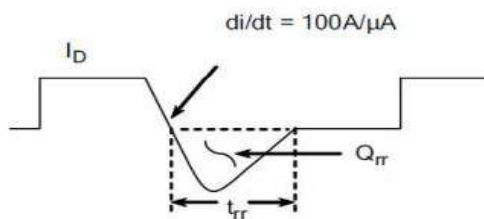


4) Resistive Switching Waveforms

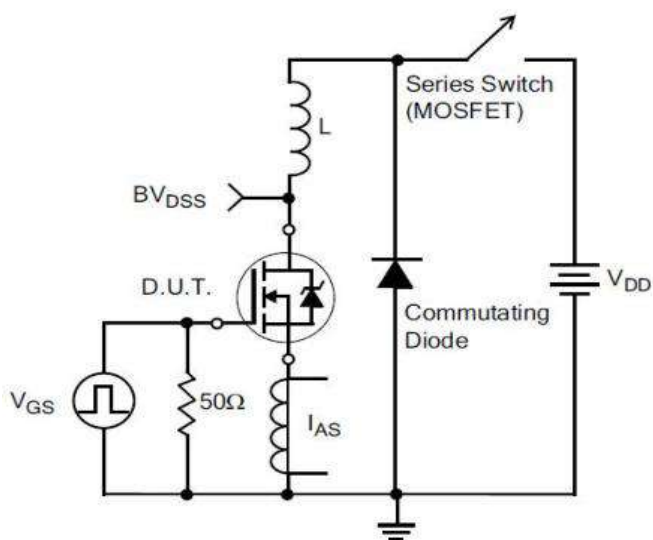
Typical Test Circuit



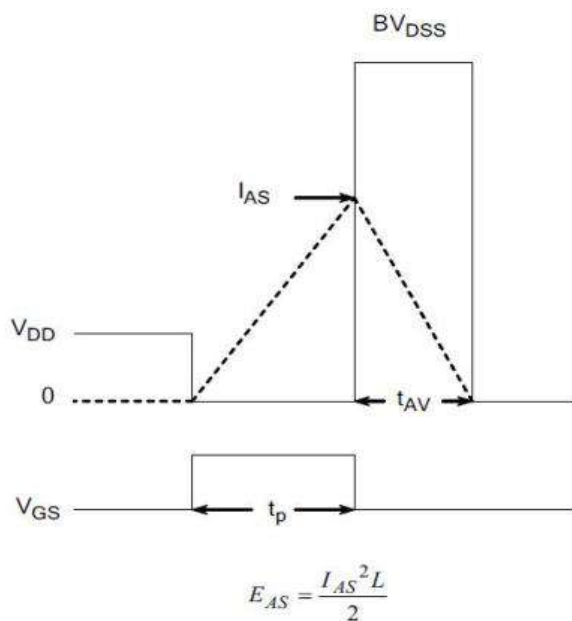
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform

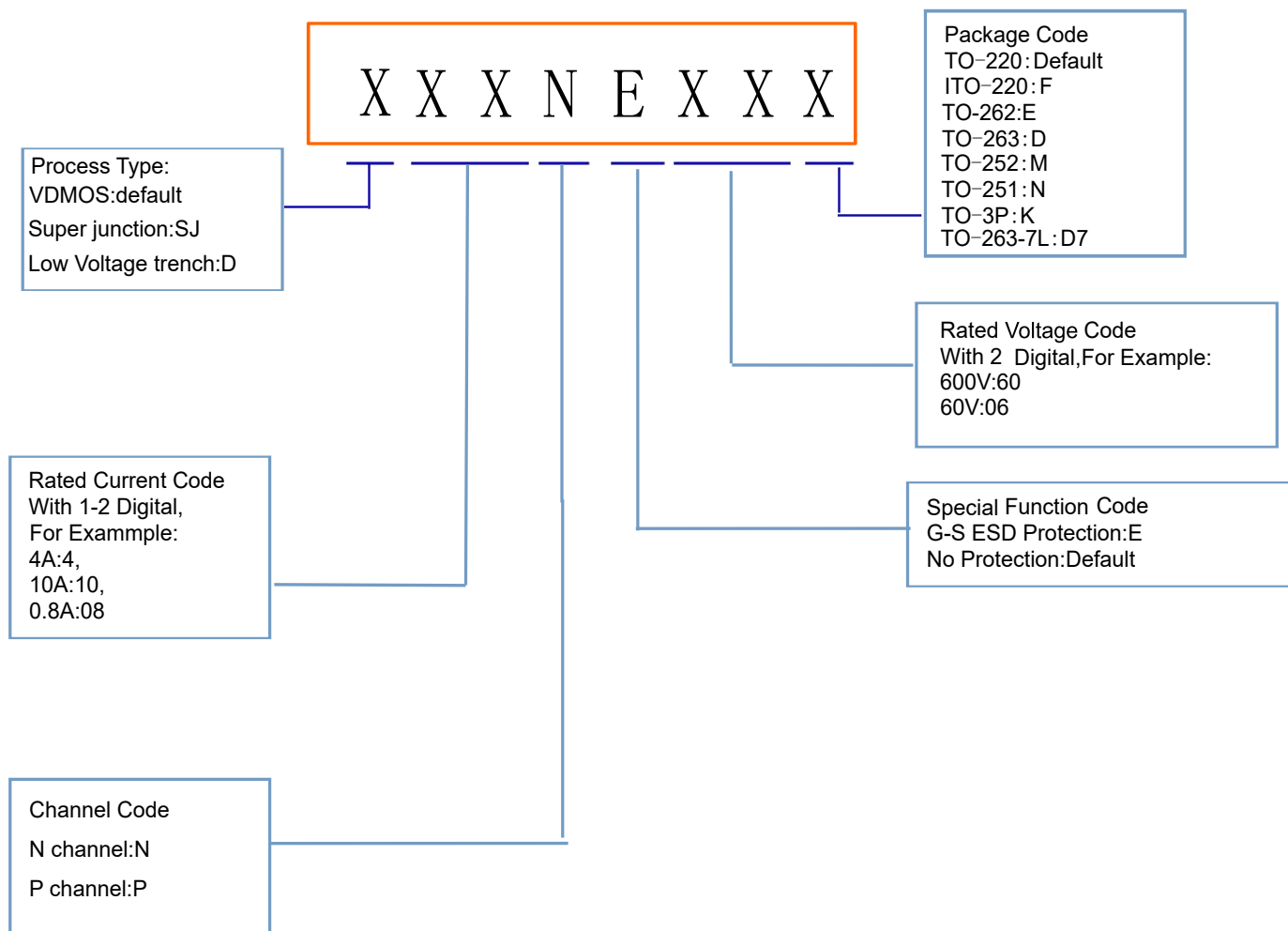


7) . Unclamped Inductive Switching Test Circuit

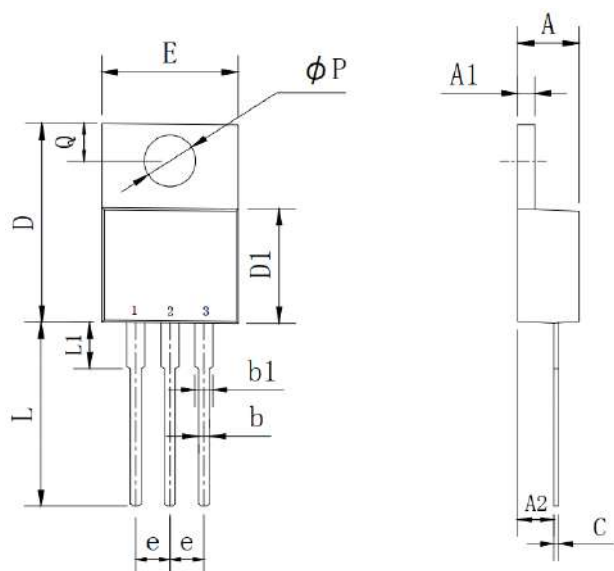


8) Unclamped Inductive Switching Waveforms

Product Names Rules

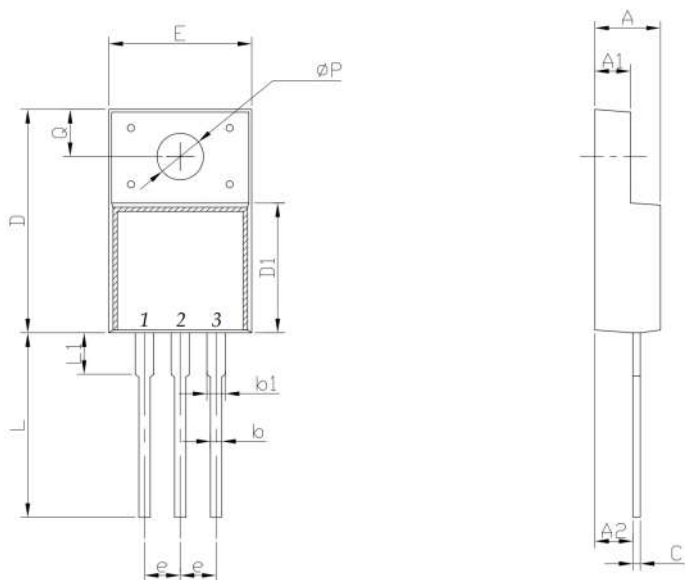


TO-220 PACKAGE OUTLINE DIMENSIONS



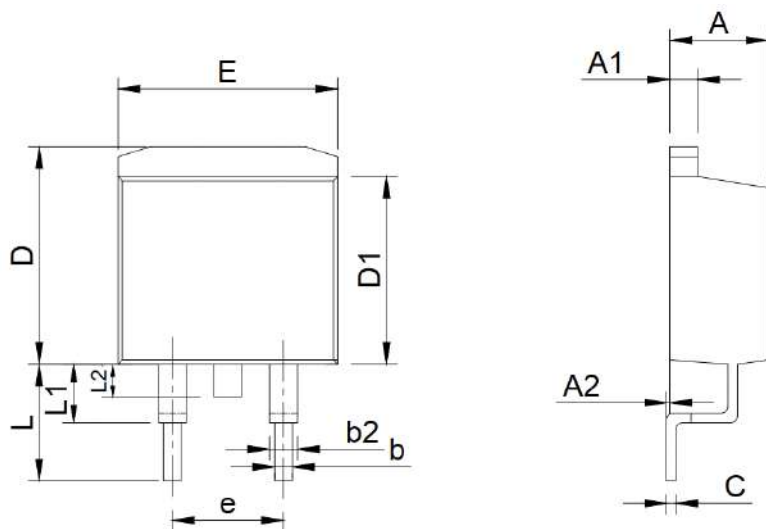
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	4.25	4.87	0.167	0.192
A1	1.07	1.47	0.042	0.058
A2	2.03	2.92	0.080	0.115
b	0.51	1.11	0.020	0.044
b1	0.97	1.6	0.038	0.063
C	0.3	0.7	0.012	0.028
D	14.6	15.9	0.575	0.626
D1	8.04	9.3	0.317	0.366
E	9.57	10.57	0.377	0.416
e	2.34	2.74	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



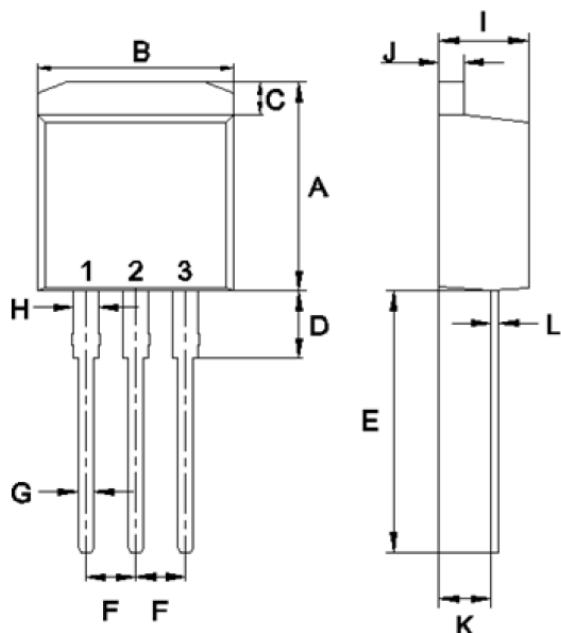
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	4.24	4.9	0.167	0.193
A1	2.3	2.92	0.091	0.115
A2	2.61	2.81	0.103	0.111
b	0.3	1	0.012	0.039
b1	0.9	1.55	0.035	0.061
C	0.3	0.7	0.012	0.028
D	14.5	16.36	0.571	0.644
D1	8.8	9.41	0.346	0.370
E	9.5	10.5	0.374	0.413
e	2.3	2.75	0.091	0.108
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

TO-263 PACKAGE OUTLINE DIMENSIONS



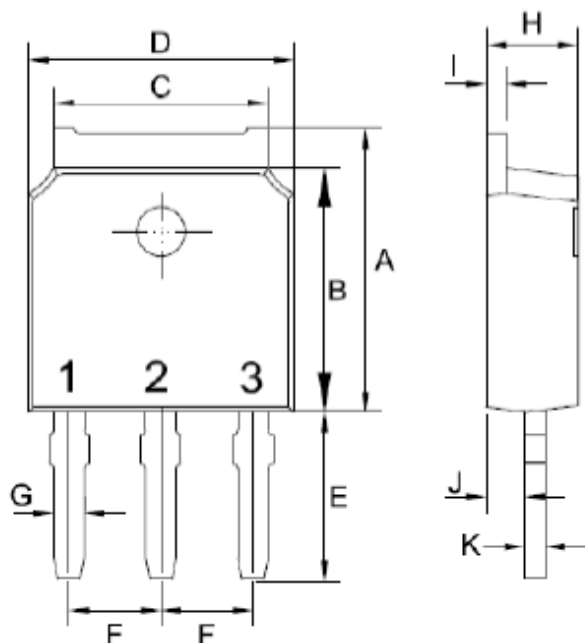
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	4.25	4.87	0.167	0.192
A1	1.07	1.47	0.042	0.058
A2	0	0.25	0.000	0.010
b	0.61	1.01	0.024	0.040
b1	1.2	1.34	0.047	0.053
C	0.3	0.6	0.012	0.024
D	9.48	10.84	0.373	0.427
D1	8.49	9.3	0.334	0.366
E	9.7	10.31	0.382	0.406
e	4.88	5.28	0.192	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



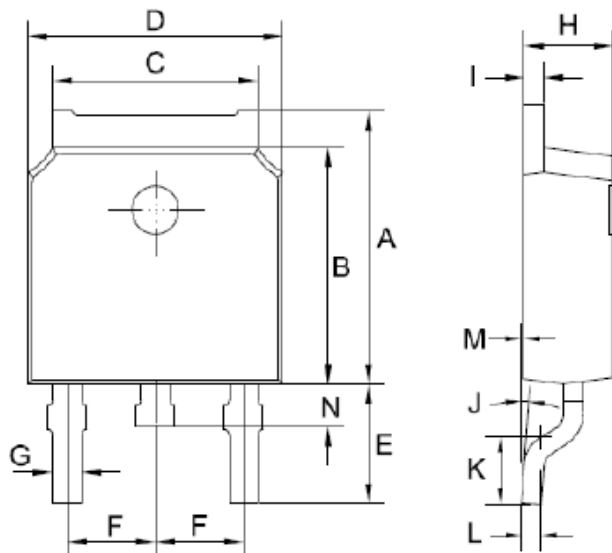
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	10.14	11.14	0.399	0.439
B	9.57	10.57	0.377	0.416
C	1.15	1.84	0.045	0.072
D	2.95	3.95	0.116	0.156
E	12.25	13.75	0.482	0.541
F	2.34	2.74	0.092	0.108
G	0.51	1.11	0.020	0.044
H	0.97	1.57	0.038	0.062
I	4.25	4.87	0.167	0.192
J	1.07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

TO-251 PACKAGE OUTLINE DIMENSIONS



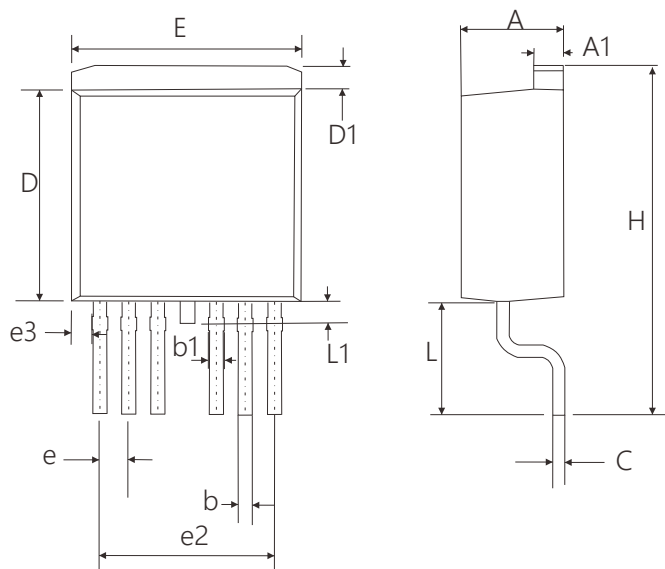
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	6.85	7.25	0.270	0.285
B	5.8	6.3	0.228	0.248
C	5	5.53	0.197	0.218
D	6.3	6.8	0.248	0.268
E	3.5	4.35	0.138	0.171
F	2.19	2.39	0.086	0.094
G	0.45	0.85	0.018	0.033
H	2.2	2.4	0.087	0.094
I	0.41	0.61	0.016	0.024
J	0.71	1.31	0.028	0.052
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	0.41	0.81	0.016	0.032
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

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