650V 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.

Product Summary			
V_{DS}	$R_{DS(on)}$(Ω)Typ	I_D(A)	Qg(Typ)
650V	0.25 @ 10V,7.5A	15	34nc

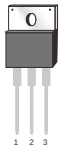
Features:

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

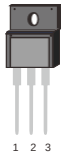
Mechanical Data:

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

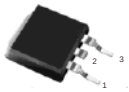
TO-220 KWSJ15N65



ITO-220 KWSJ15N65F



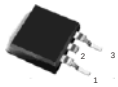
TO-263 KWSJ15N65D



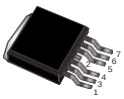
TO-262 KWSJ15N65E

TO-251 KWSJ15N65N

TO-252 KWSJ15N65M



TO-263-7L KWSJ15N65D7



Applications:

- Switching applications

Ordering Information

Part No.	Package Type	Package	Quality(box)
KWSJ15N65	TO-220	Tube	1000
KWSJ15N65F	ITO-220	Tube	1000
KWSJ15N65D	TO-263	Tape & Reel	800
KWSJ15N65E	TO-262	Tube	1000
KWSJ15N65N	TO-251	Tube	1000
KWSJ15N65M	TO-252	Tape & Reel	3000
KWSJ15N65D7	TO-263-7L	Tape & Reel	800

Pin Definition:

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

Block Diagram

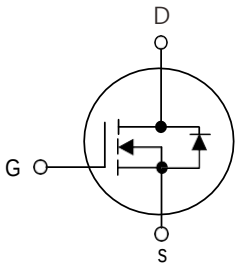


Table1 Absolute Maximum Ratings (T_C=25℃, unless otherwise specified)

Parameters		Symbol	KWSJ15N65 KWSJ15N65M KWSJ15N65D KWSJ15N65N KWSJ15N65E KWSJ15N65D7	KWSJ15N65F	Unit
Drain-Source Voltage		V_{DS}	650		V
Gate-Source Voltage		V_{GS}	±30		V
Contionous Drain Current	T_C=25°C	I_D	15		A
	T_C=100°C		12		
Pulsed Drain Current (Note 1)		I_{DM}	60		A
Single Pulse Avalanche Energy(Note 2)		EAS	280		mJ
Avalanche Current(Note 1)		I_{AR}	2.8		A
Repetitive Avalanche Energy(Note 1)		EAR	1.4		mJ
Reverse Diode Recovery dv/dt(Note 3)		dv/dt	15		V/ns
Drain Source Voltage Slope (V_{DS}=720V)		dv/dt	50		V/ns
Power Dissipation T_C=25°C		P_D	151	35	W
Operating Junction and Storage Temperature		T_J/T_{STG}	-55 ~ +150		℃

Table 2.Thermal Characteristics

Parameters	Symbol	KWSJ15N65 KWSJ15N65M KWSJ15N65D KWSJ15N65N KWSJ15N65E KWSJ15N65D7	KWSJ15N65F	Unit
Thermal resistance Junction to Ambient	$R_{\theta JA}$	62	82	℃/W
Thermal resistance Junction to Case	$R_{\theta JC}$	1.2	4.1	℃/W

Table 3. Electrical Chatacteristics (T_J=25℃, 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	650			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=650V,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=7.5A		0.25	0.28	Ω
Dynamic Characteristics(Note 5)							
Input Capacitance		C_{ISS}	V_{DS}=25V,V_{GS}=0V,f=1MHz		1050		pF
Output Capacitance		C_{OSS}			37		pF
Reverse Transfer Capacitance		C_{RSS}			2.5		pF
Switching Characteristics (Note 5)							
Turn-On Delay Time		td(on)	V_{DD}=400V,I_D=7.5A, V_{GS}=10V,R_G=20Ω		17		ns
Turn-On Rise Time		tr			12		ns
Turn-Off Delay Time		td(off)			85		ns
Turn-Off Fall Time		tf			10		ns
Total Gate Charge		Q_G	V_{DS}=400V,I_D=6.5A, V_{GS}=10V		34		nC
Gate-Source Charge		Q_{GS}			4.5		nC
Gate-Drain Charge		Q_{GD}			19		nC
Drain-Source Diode Characteristics and Maximum Ratings							
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS}=0V,I_S=7.5A		0.9	1.5	V
Maximum Continuous Drain-Source Diode Forward Current(Note 4)		I_S				15	A
Reverse Recovery Time		trr	V_R=400V,I_S=7.5A dI$_F$/dt=100A/μs(Note 4)		300		ns
Reverse Recovery Charge		Q_{RR}			3.5		μC

Notes：1 Repetitive Rating:Pulse width limited by maximum junction temperature 2
L=60mH,I_{AS}=3A,V_{DD}=150V,Starting T_J=25°C
3 I_{SD}≤4.5A,di/dt≤200A/μS,V_{DD}≤BV_{DSS},starting T_J=25℃
4 Pulse Test: Pulse width ≤300μS,Duty cycle≤2%5
Guaranteed by design,not subject to production

Typical Characteristics Diagrams

Figure 1.Output Characteristics

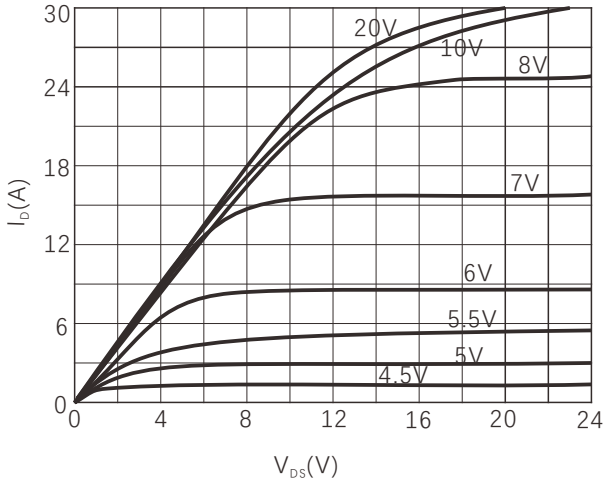


Figure 2. Transfer Characteristics

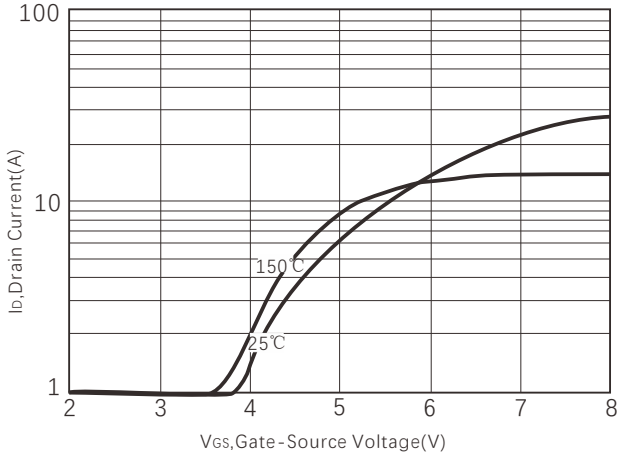


Figure 3.On-Resistance vs.Drain Current

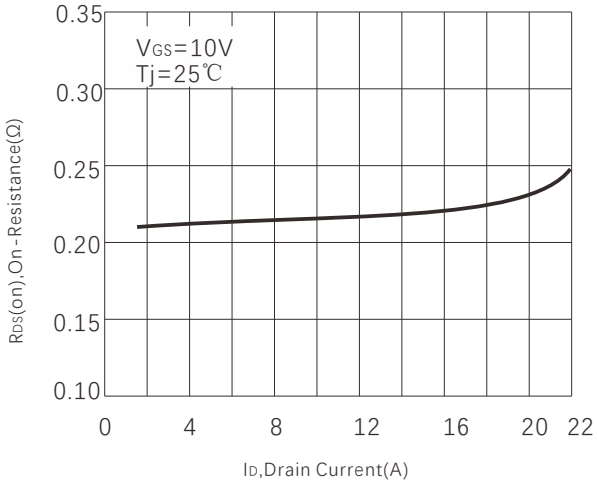


Figure 4. Capacitance

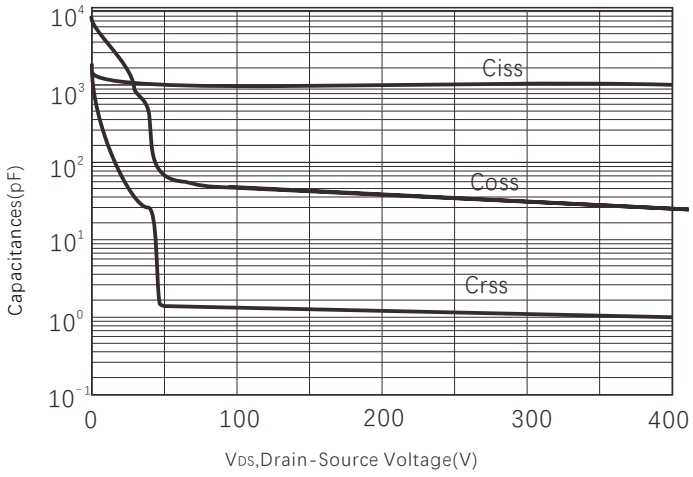


Figure 5.Gate charge

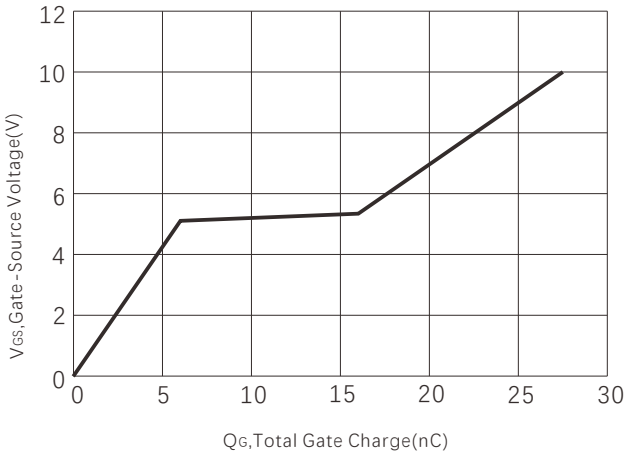


Figure 6.Source-Drain Diode Forward Voltage

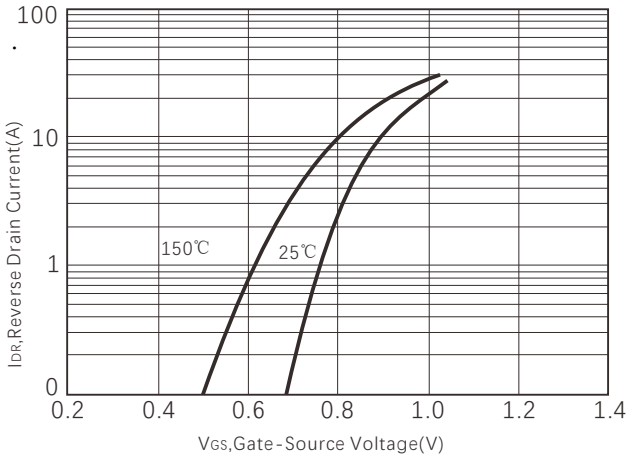


Figure7.Normalized $R_{DS(ON)}$ vs Junction Temperature

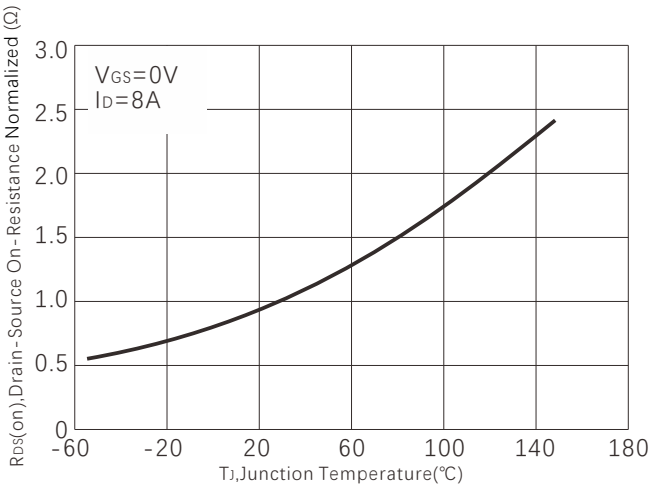


Figure 8.BV_{DSS} vs Junction Temperature

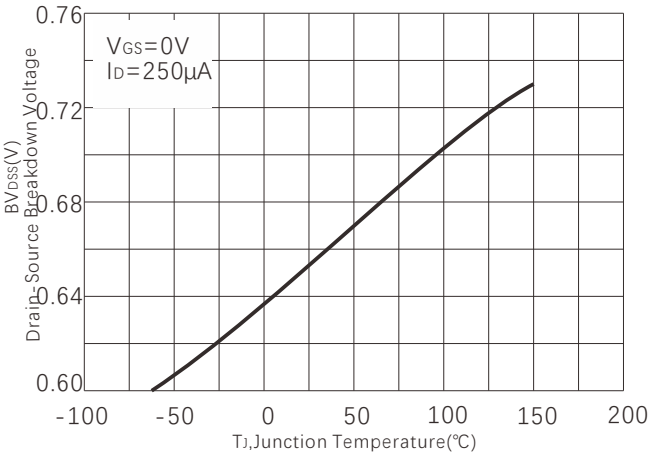


Figure 9. Safe operating area -Non ITO-220

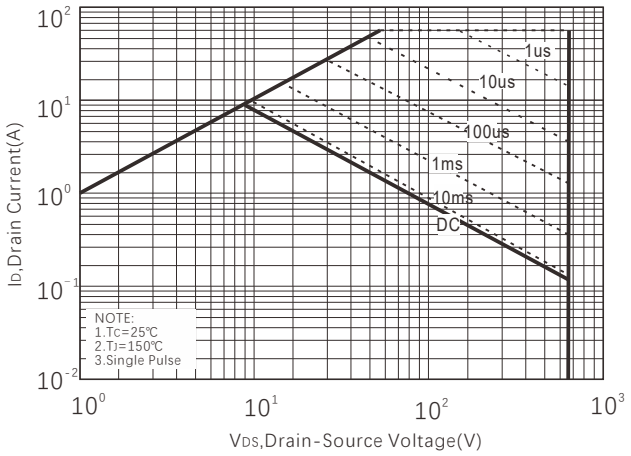


Figure 10. Safe operating area for ITO-220

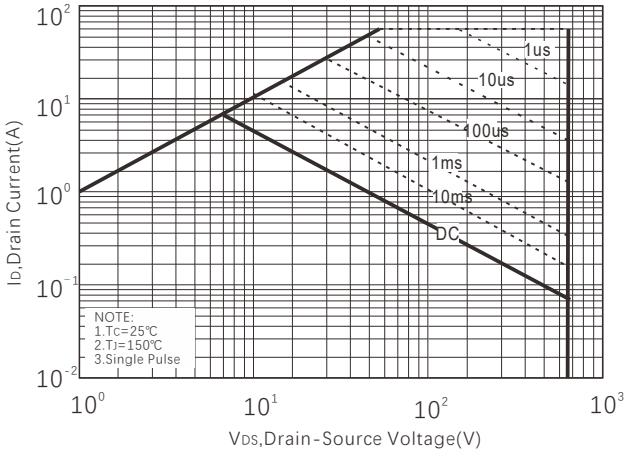


Figure 11. Maximum Transient Thermal Impedance -Non ITO-220

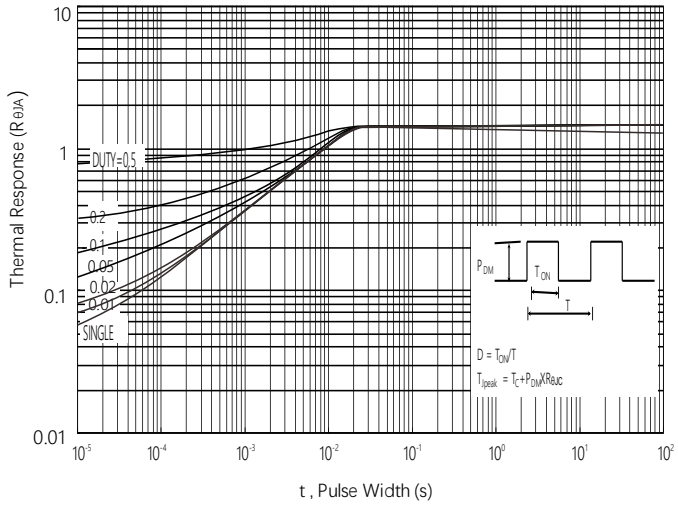
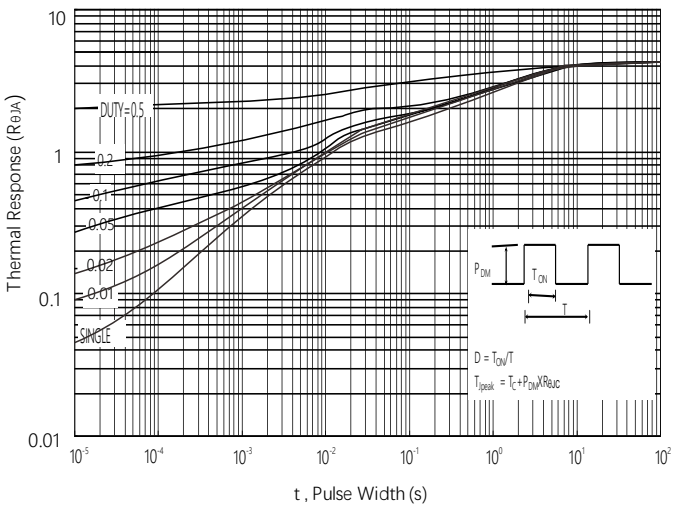
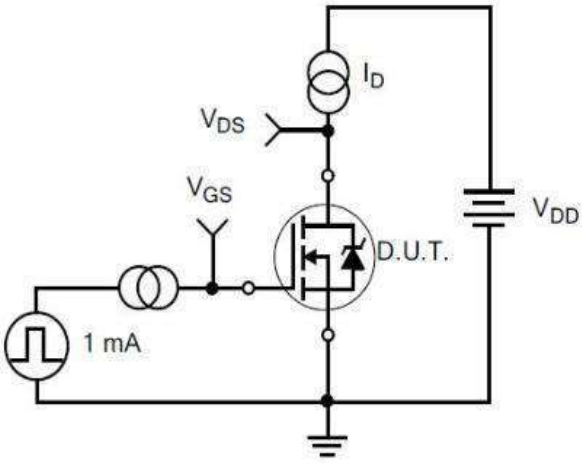


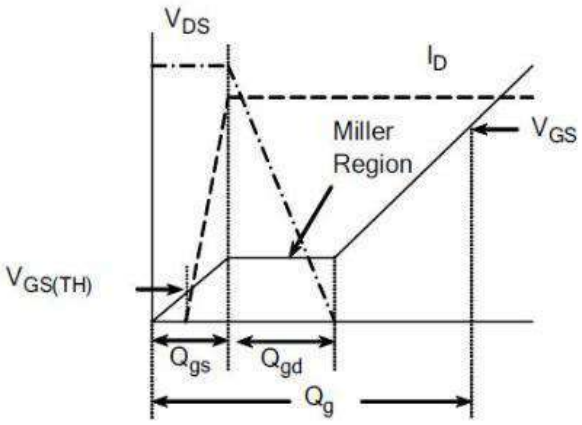
Figure 12. Maximum Transient Thermal Impedance - ITO-220



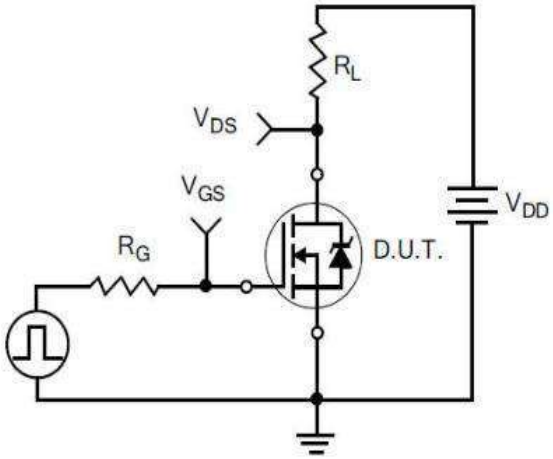
Typical Test Circuit



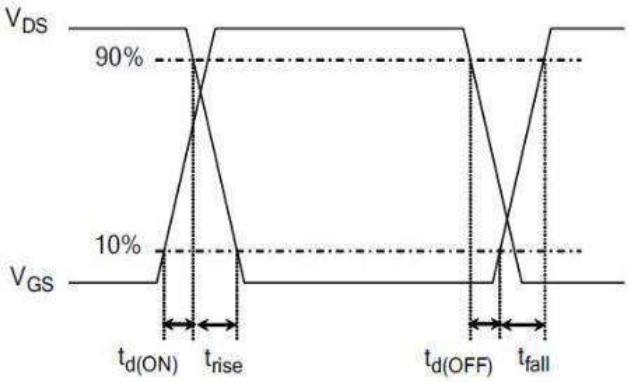
1) Gate Charge Test Circuit



2) . Gate Charge Waveform

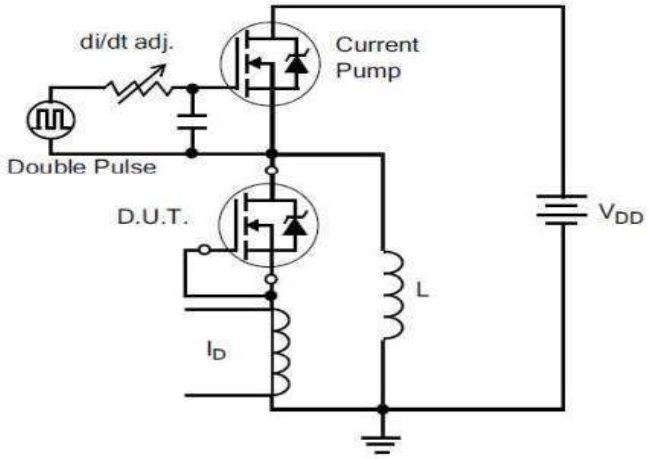


3) Resistive Switching Test Circuit

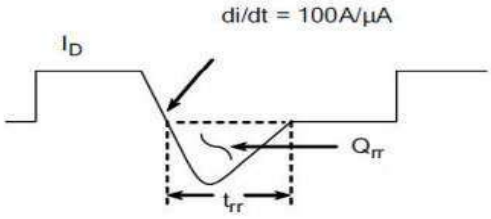


4) Resistive Switching Waveforms

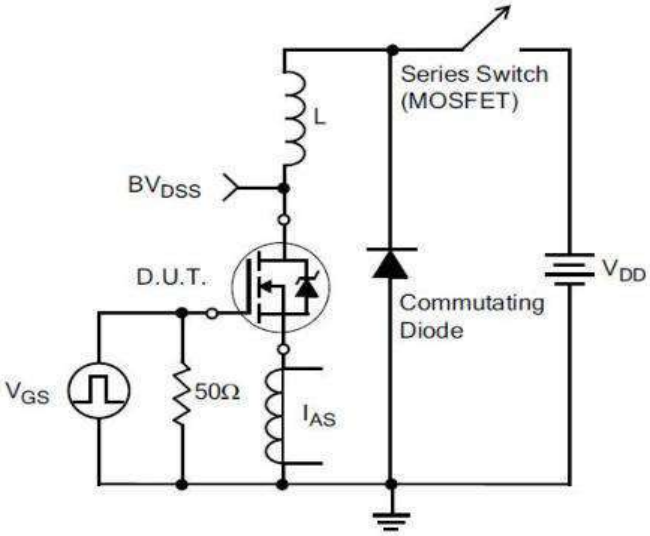
Typical Test Circuit



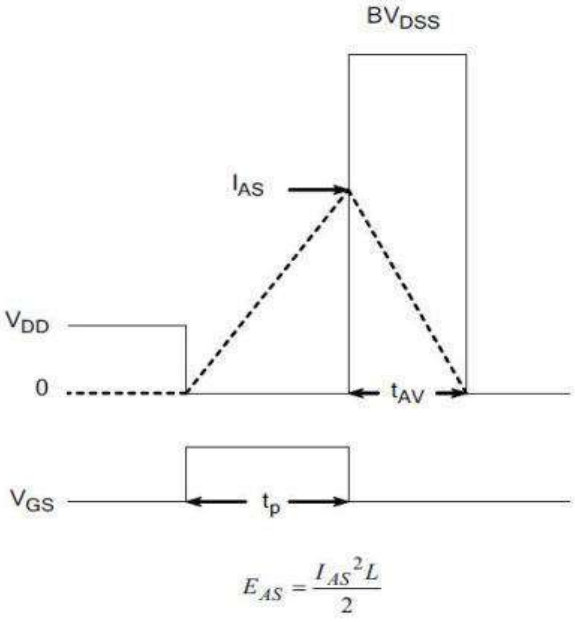
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform

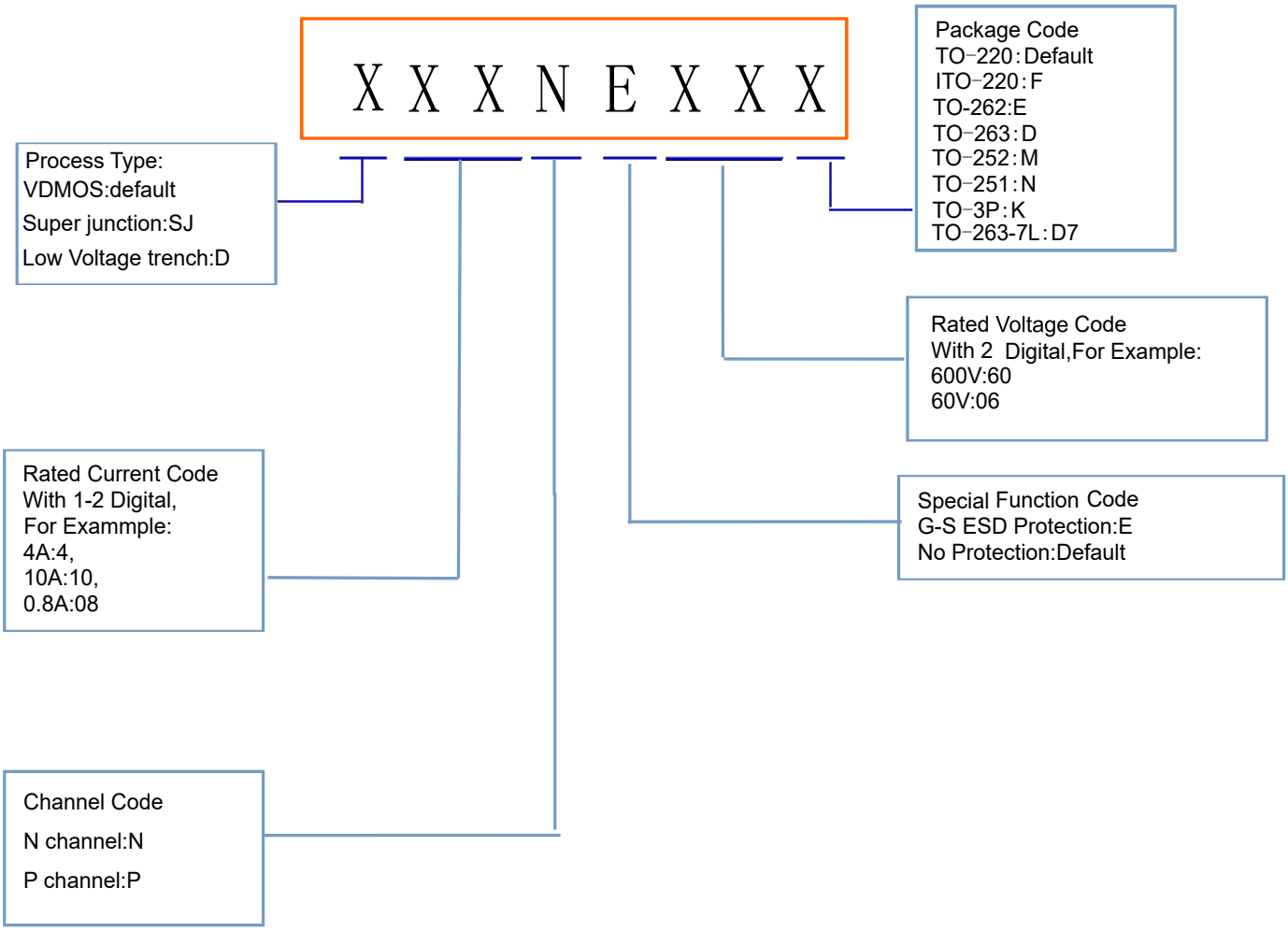


7) . Unclamped Inductive Switching Test Circuit



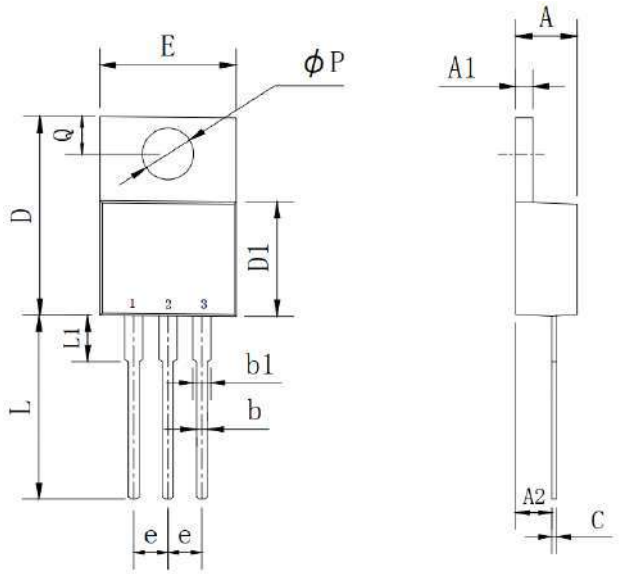
8) Unclamped Inductive Switching Waveforms

Product Names Rules



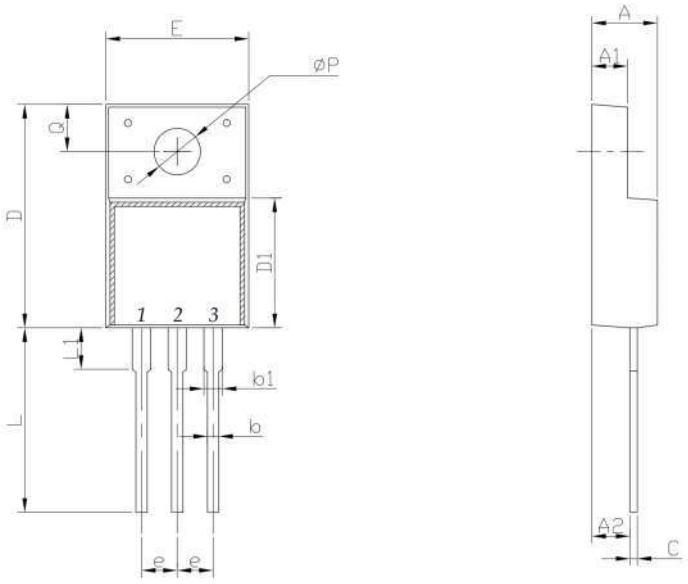
Dimensions

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

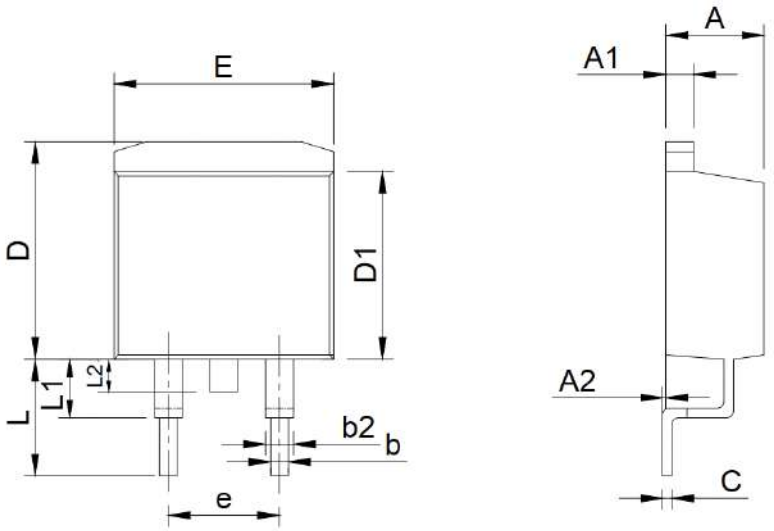
ITO-220 PACKAGE OUTLINE DIMENSIONS



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

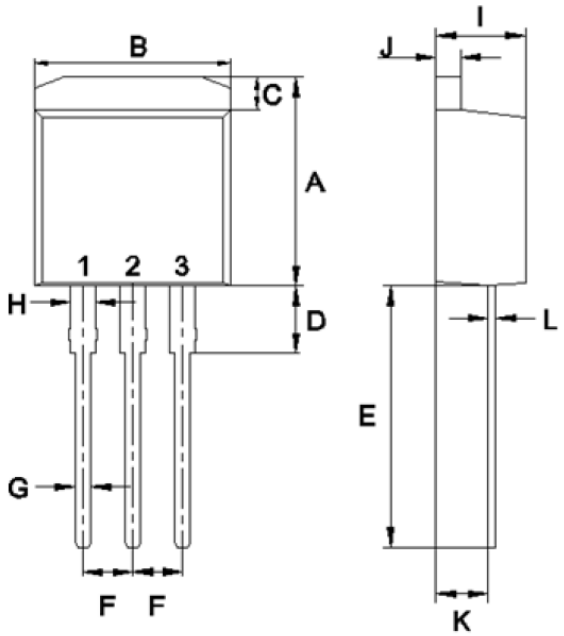
Dimensions

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

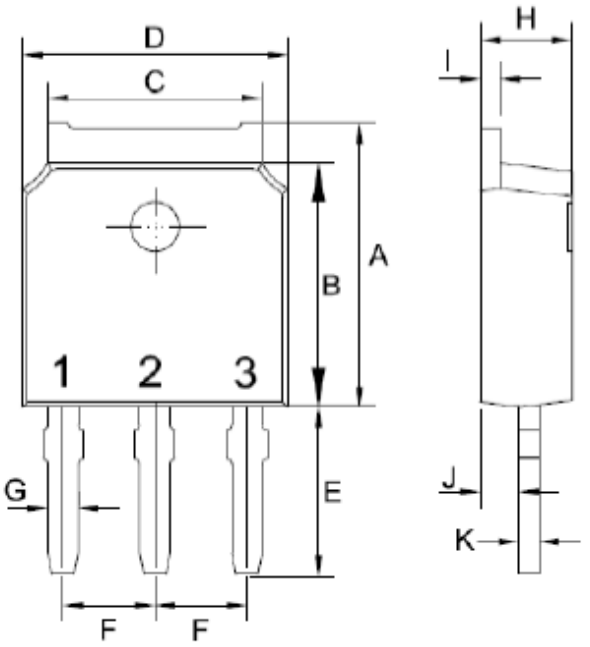
TO-262 PACKAGE OUTLINE DIMENSIONS



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

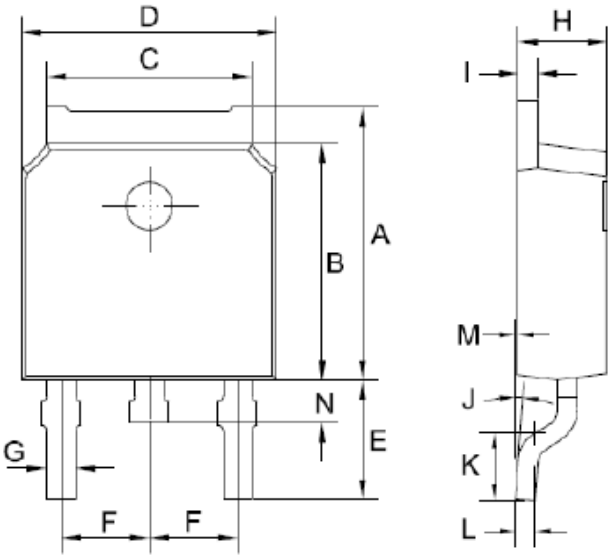
Dimensions

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

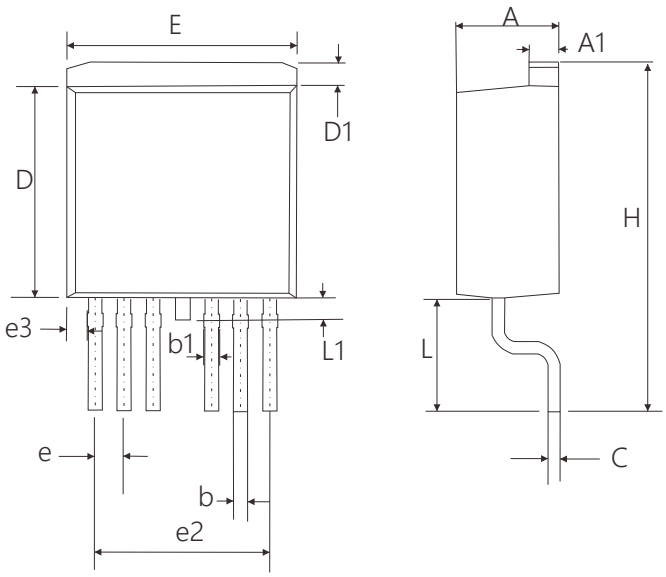
TO-252 PACKAGE OUTLINE DIMENSIONS



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	0ú	8ú	0ú	8ú
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

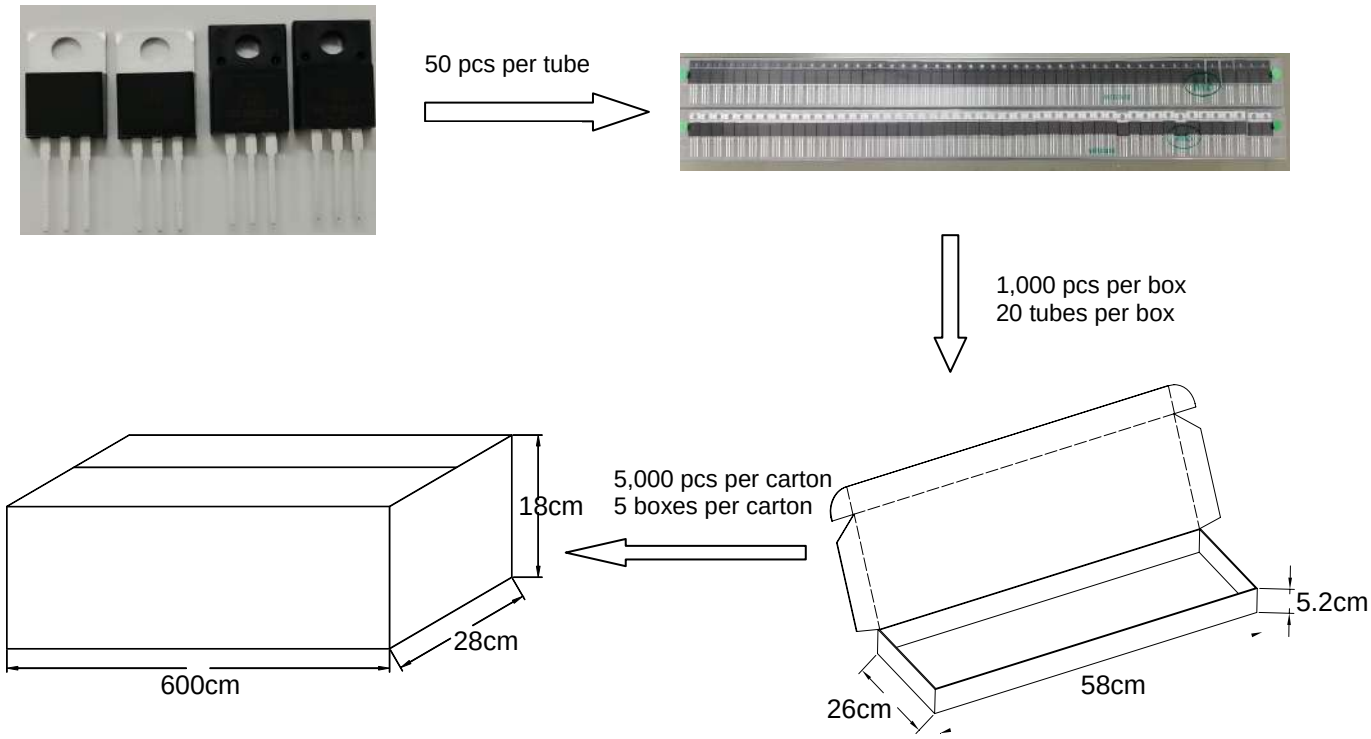
TO-263-7L PACKAGE OUTLINE DIMENSIONS



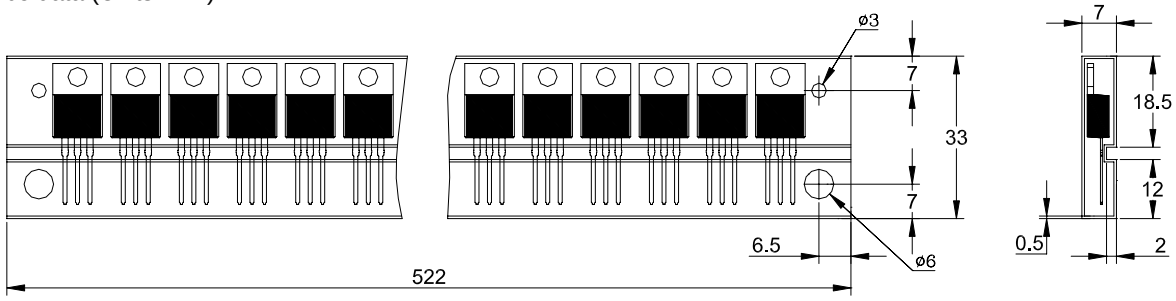
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	4.25	4.75	0.167	0.187
A1	1.2	1.4	0.047	0.055
b	0.5	0.7	0.020	0.028
b1	0.5	0.9	0.020	0.035
C	0.4	0.6	0.016	0.024
D	9.05	9.45	0.356	0.372
D1	0.7	1.3	0.028	0.051
E	9.8	10.2	0.386	0.402
e	1.07	1.47	0.042	0.058
e2	7.32	7.92	0.288	0.312
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

Packaging Specifications of Tube Pack for TO-220AB and ITO-220AB

1. The method of packaging and dimension are shown as below figure. (Dimension in mm)



2. Tube data (Units: mm)



Storage

1 It is recommended to store the products in the following conditions:

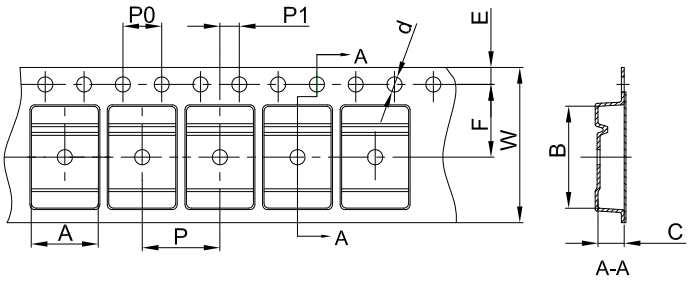
Humidity: 75% R.H. Max.

Temperature : 0℃~35℃(32℉~95℉)

2 Shelf life : 12 month at ＜0℃~35℃(32℉~95℉) and ＜75% R.H.

TO-252-2L Tape and Reel

TO-252 Embossed Carrier Tape

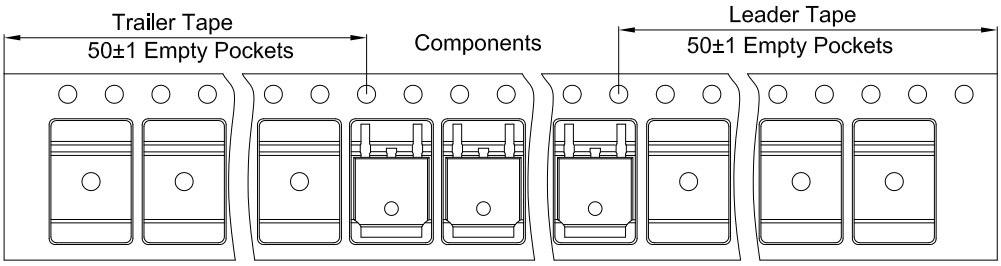


Packaging Description:

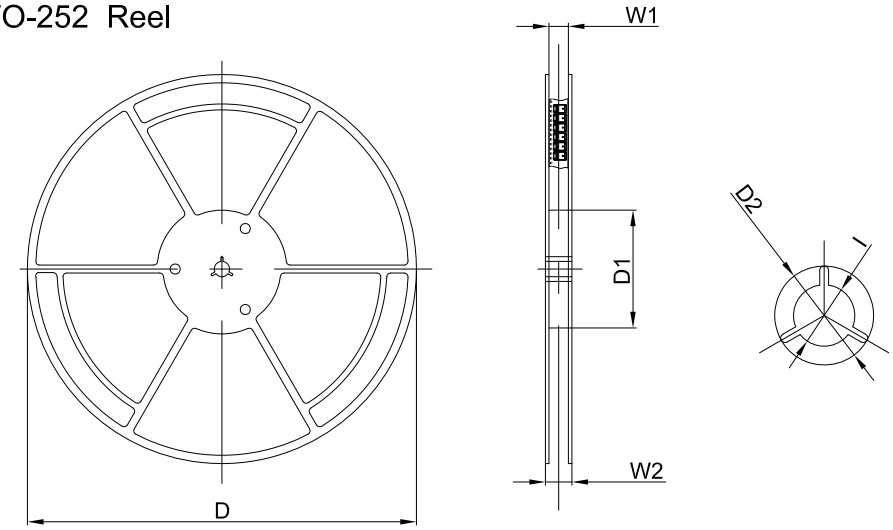
TO-252 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 25,00 units per 13" or 33.0 cm diameter reel. The reels are clear in color and is made of polystyrene plastic (anti-static coated).

Dimensions are in millimeter										
Pkg type	A	B	C	d	E	F	P0	P	P1	W
TO-252	6.90	10.50	2.70	Ø1.55	1.75	7.50	4.00	8.00	2.00	16.00

TO-252 Tape Leader and Trailer



TO-252 Reel



Dimensions are in millimeter						
Reel Option	D	D1	D2	W1	W2	I
13"Dia	330.00	100.00	Ø21.00	16.40	21.00	Ø13.00

REEL	Reel Size	Box	Box Size(mm)	Carton	Carton Size(mm)	G.W.(kg)
2,500 pcs	13inch	2,500 pcs	340×336×29	25,000 pcs	353×346×365	