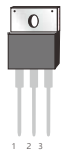
25A 650V N-Channel Super Junction Power MOSFETWith Fast Recovery Diode

Description:

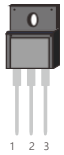
The 650 V 25A power MOSFET is a Low voltage N channel Multi-EPI Super-Junction power MOSFET sample with advanced technology to have better characteristics, such as fast switching time, low Ciss and Crss, low on resistance and excellent avalanche characteristics, making it especially suitable for applications which require superior power density and outstanding efficiency.

Product Summary			
V_{DS}	$R_{DS(on)}$ (Ω) Typ	I_D (A)	Qg (Typ)
650V	0.12 @ 10V	25	110nc

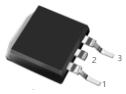
TO-220 KWSJ25N65R



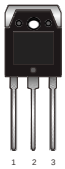
ITO-220 KWSJ25N65FR



TO-263 KWSJ25N65DR

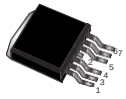


TO-3P KW2SJ5N65KR



TO-247 KW2SJ5N65PR

TO-263-7L KW2SJ5N65D7R



Features:

- Low gate charge and improved dv/dt capacitance
- 100% avalanche tested
- Fast switching

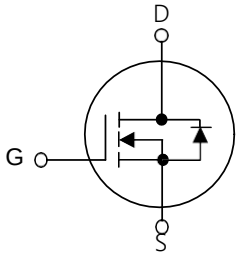
Mechanical Data:

- Case:TO-220,ITO-220, TO-263,TO-263-7, TO-247,TO-3P Packag

Application:

- Switching applications

Block Diagram



Pin Definition:

1. Gate
2. Drain

3/4/5/6/7. Source

Ordering Information

Part No.	Package Type	Package	Quality(box)
KWSJ25N65R	TO-220	Tube	1000
KWSJ25N65FR	ITO-220	Tube	1000
KWSJ25N65DR	TO-263	Tape & Reel	800
KWSJ25N65PR	TO-247	Tube	600
KWSJ25N65KR	TO-3P	Tube	600
KWSJ25N65D7R	TO-263-7	Tape & Reel	800

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

Parameter		Symbol	TO-220/TO-263/TO-247/TO-3P /TO-263-7	ITO-220	Unit
Drain-Source Voltage		V_{DS}	650		V
Gate-Source Voltage		V_{GS}	±30		V
Continuous Drain Current	T_C=25°C	I_D	25		A
	T_C=100°C		15		
Pulsed Drain Current (Note 1)		I_{DM}	53		A
Single Pulse Avalanche Energy(Note 2)		E_{AS}	500		mJ
Avalanche Current(Note 1)		I_{AR}	4		A
Repetitive Avalanche Energy(Note 1)		E_{AR}	1.2		mJ
Reverse Diode Recovery dv/dt(Note 3)		dv/dt	15		V/ns
Power Dissipation T_C=25°C		P_D	151	35	W
Operating Junction and Storage Temperature		T_J/T_{STG}	-55 ~ +150		°C

Table 2.Thermal Characteristics

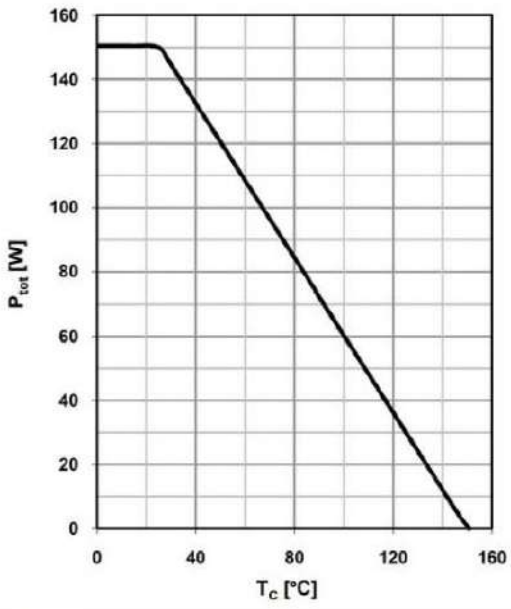
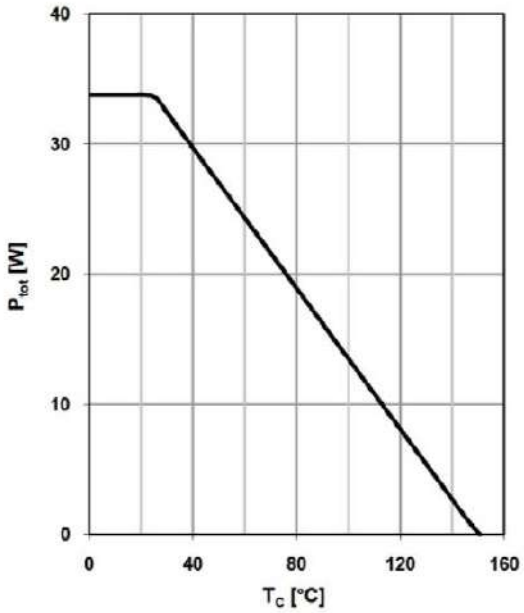
Parameter	Symbol	TO-220/TO-263 TO-247/TO-3P TO-263-7	ITO-220	Unit
Thermal resistance Junction to Ambient	$R_{\theta JA}$	62	82	°C/W
Thermal resistance Junction to Case	$R_{\theta JC}$	0.8	3.5	°C/W

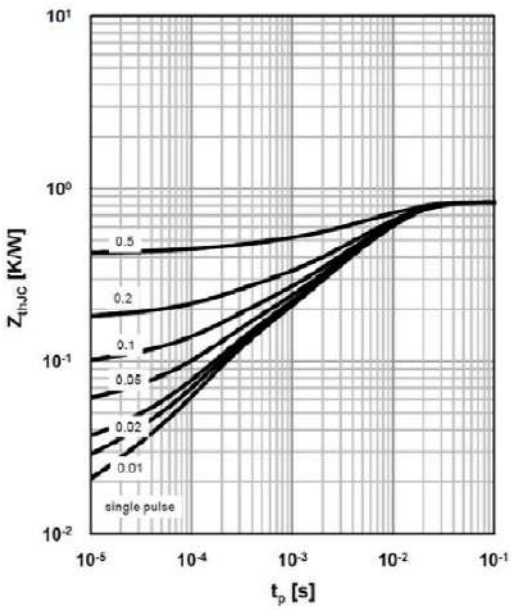
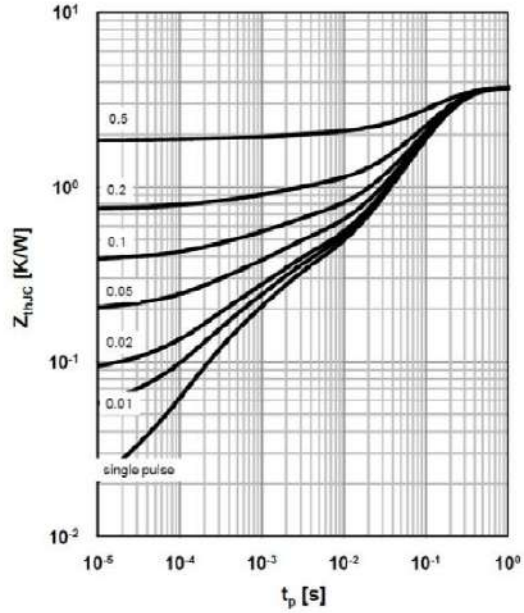
Table 3. Electrical Characteristics (T_J=25°C, unless otherwise specified)

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Off Characteristics							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0V,I_D=250μA	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	2.0		4.0	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	V_{GS}=10V,I_D=12A		0.12	0.14	Ω
Dynamic Characteristics(Note 5)							
Input Capacitance		C_{ISS}	V_{DS}=25V,V_{GS}=0V,f=1MHz		1650		pF
Output Capacitance		C_{OSS}			90		pF
Reverse Transfer Capacitance		C_{RSS}			9		pF
Switching Characteristics (Note 4)							
Turn-On Delay Time		td(on)	V_{DD}=520V		28		ns
Turn-On Rise Time		t_R			19		ns
Turn-Off Delay Time		td(off)			140		ns
Turn-Off Fall Time		tf			12		ns
Total Gate Charge		Q_G	V_{DS}=520V,I_D=12A, V_{GS}=10V		110		nC
Gate-Source Charge		Q_{GS}			9		nC
Gate-Drain Charge		Q_{GD}			15		nC
Drain-Source Diode Characteristics and Maximum Ratings							
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS}=0V, I_S=12A			1.5	V
Maximum Continuous Drain-Source Diode Forward Current		I_S				25	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				75	A
Reverse Recovery Time		trr	V_{GS}=0V, I_S=12A dI_F/dt=100A/μs (Note 1)		190		ns
Reverse Recovery Charge		Q_{RR}			6		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

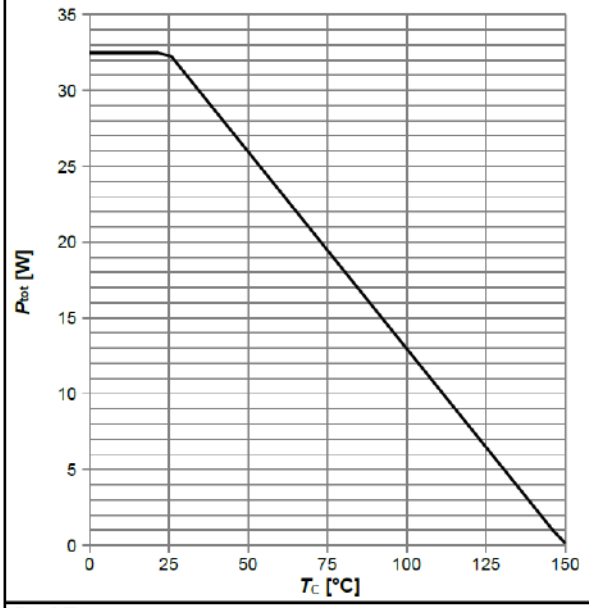
Typical Characteristics Diagrams

Power dissipation Non FullPAK	Power dissipation ITO-220
	
$P_{tot} = f(T_C)$	$P_{tot} = f(T_C)$

Max. transient thermal impedance Non FullPAK	Max. transient thermal impedance ITO-220
	
$Z_{(thJC)}$=f(tp); parameter: D=t_p/T	$Z_{(thJC)}$=f(tp); parameter: D=t_p/T

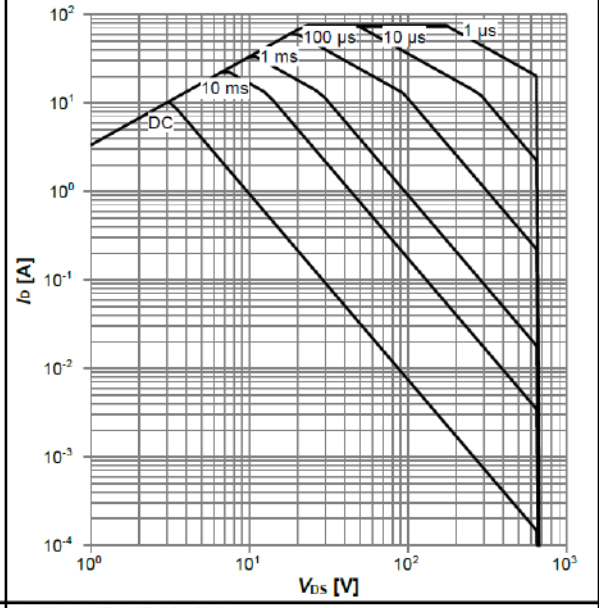
Typical Characteristics Diagrams

Diagram 1: Power dissipation



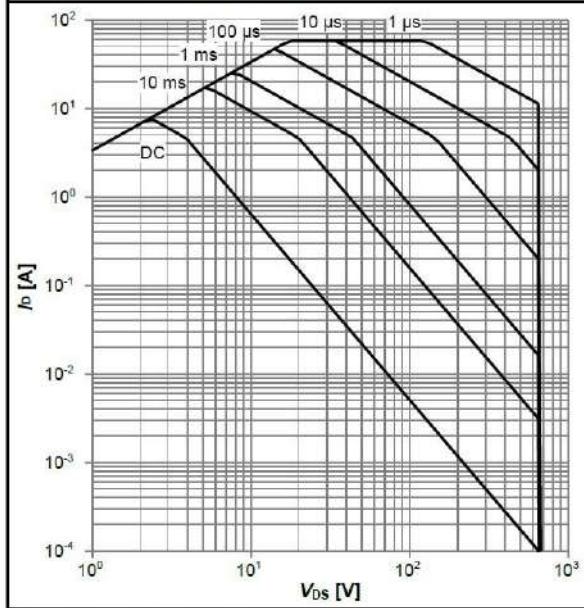
$P_{tot}=f(T_C)$

Diagram 2: Safe operating area



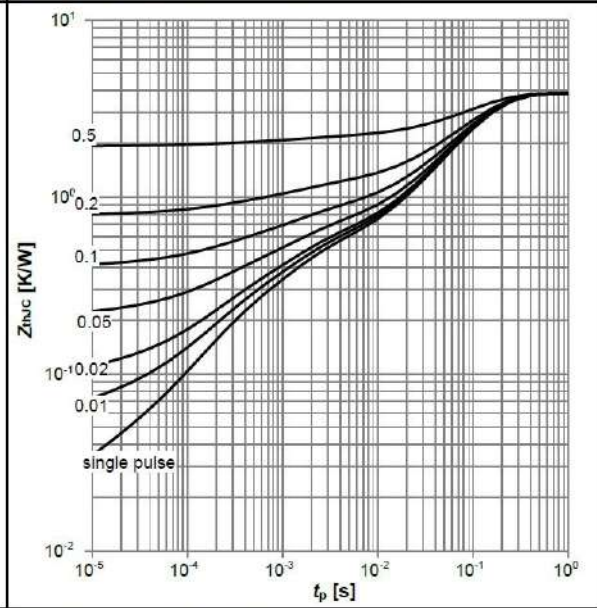
$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$; parameter: t_p

Diagram 3: Safe operating area



$I_D=f(V_{DS})$; $T_C=80$ °C; $D=0$; parameter: t_p

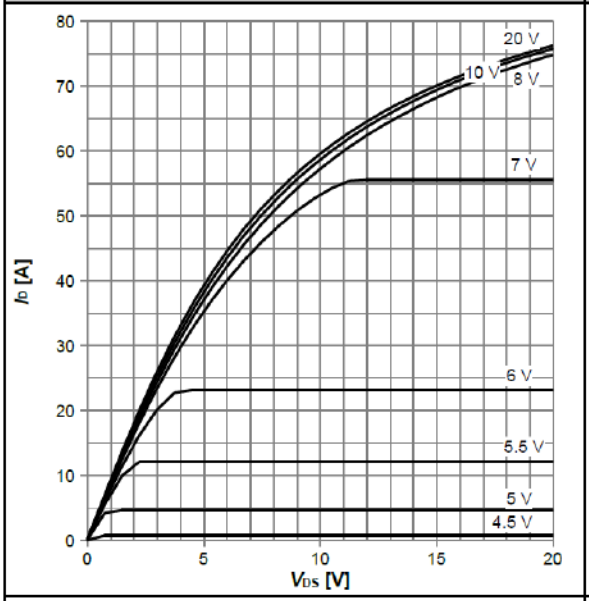
Diagram 4: Max. transient thermal impedance



$Z_{thJC}=f(t_p)$; parameter: $D=t_p/T$

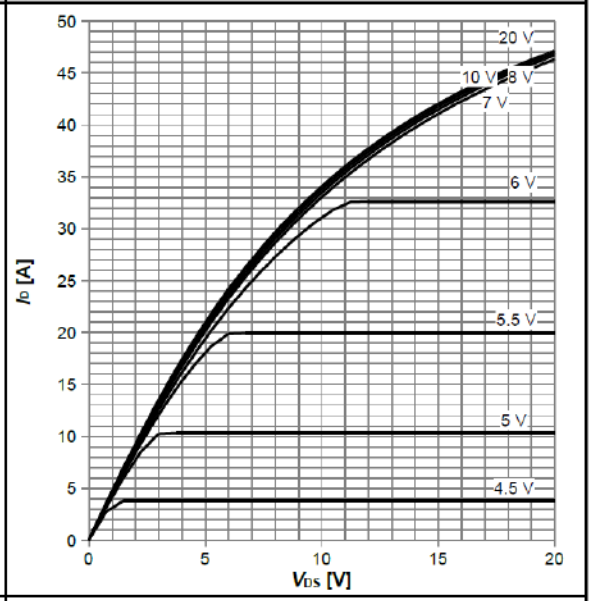
Typical Characteristics Diagrams

Diagram 5: Typ. output characteristics



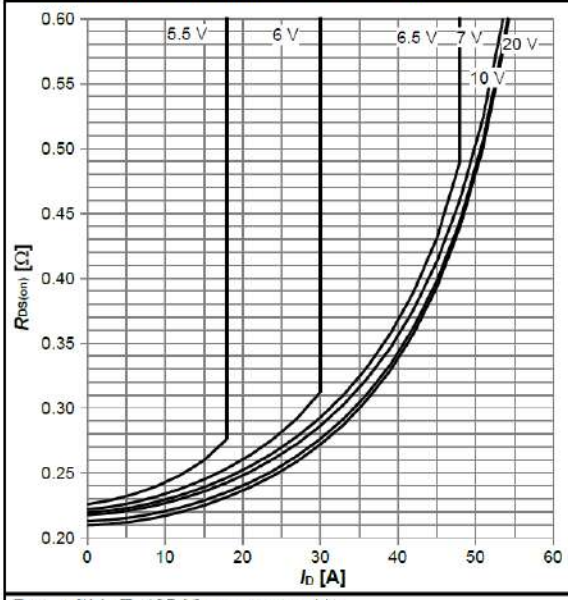
$I_D=f(V_{DS})$; $T_j=25$ °C; parameter: V_{GS}

Diagram 6: Typ. output characteristics



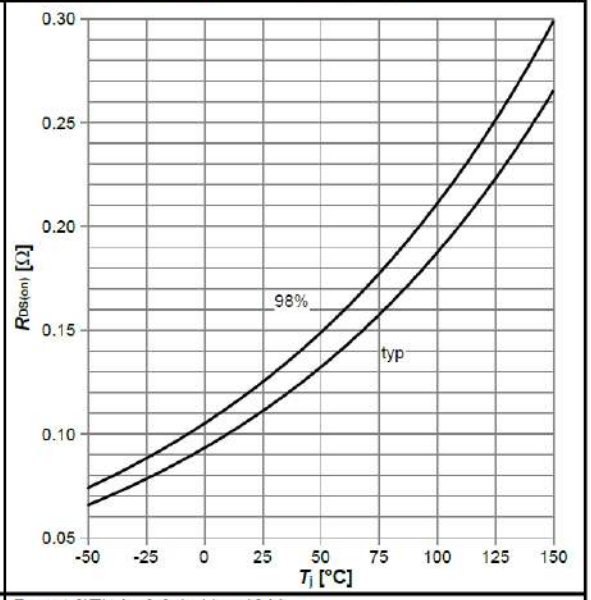
$I_D=f(V_{DS})$; $T_j=125$ °C; parameter: V_{GS}

Diagram 7: Typ. drain-source on-state resistance



$R_{DS(on)}=f(I_D)$; $T_j=125$ °C; parameter: V_{GS}

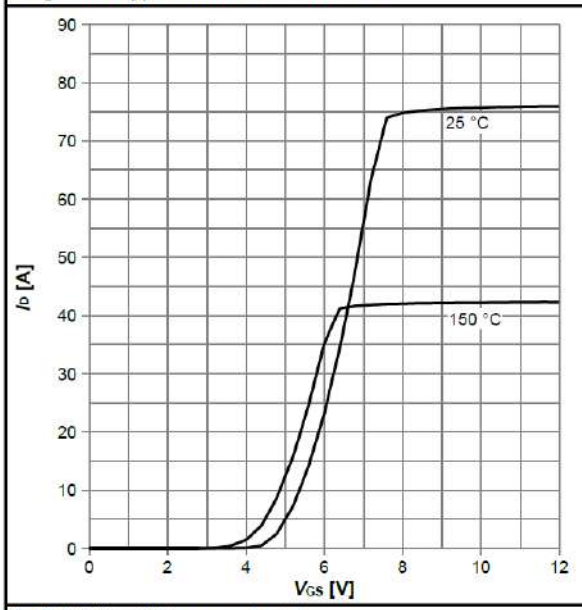
Diagram 8: Drain-source on-state resistance



$R_{DS(on)}=f(T_j)$; $I_D=8.9$ A; $V_{GS}=10$ V

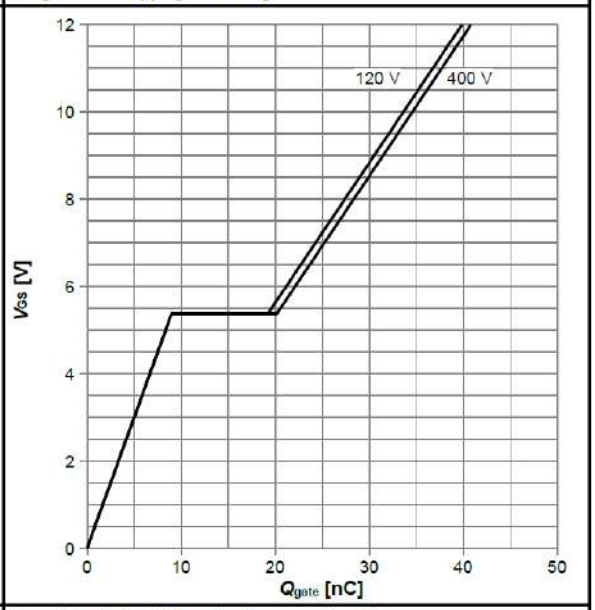
Typical Characteristics Diagrams

Diagram 9: Typ. transfer characteristics



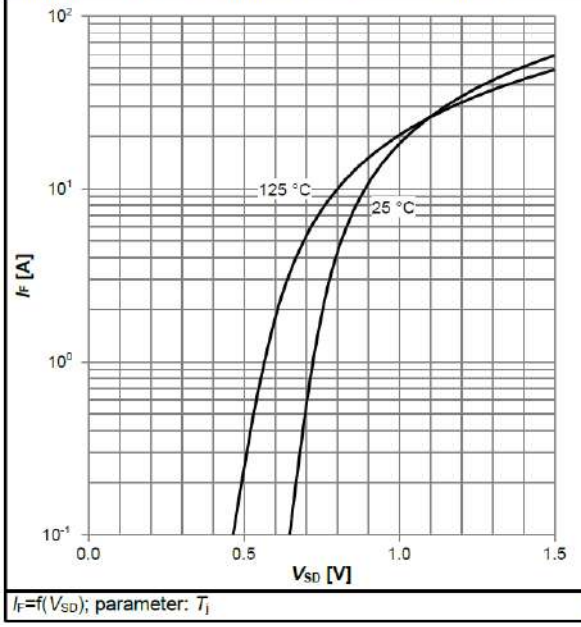
$I_D=f(V_{GS})$; V_{DS}=20V; parameter: T_j

Diagram 10: Typ. gate charge



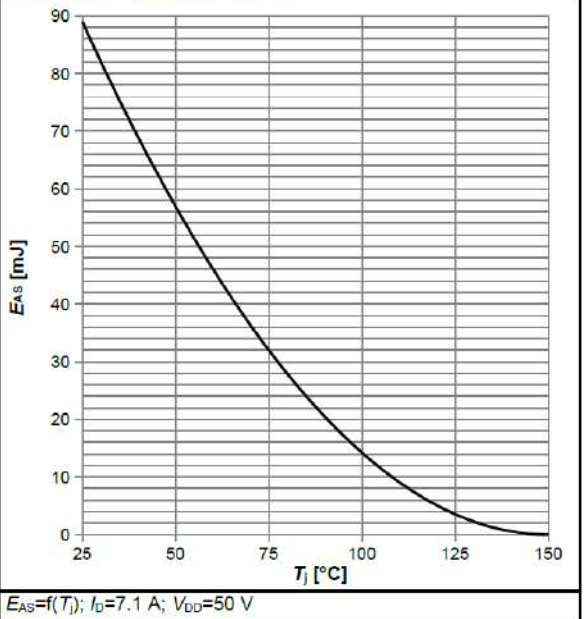
$V_{GS}=f(Q_{gate})$; I_D=8.9A pulsed; parameter: V_{DD}

Diagram 11: Forward characteristics of reverse diode



$I_F=f(V_{SD})$; parameter: T_j

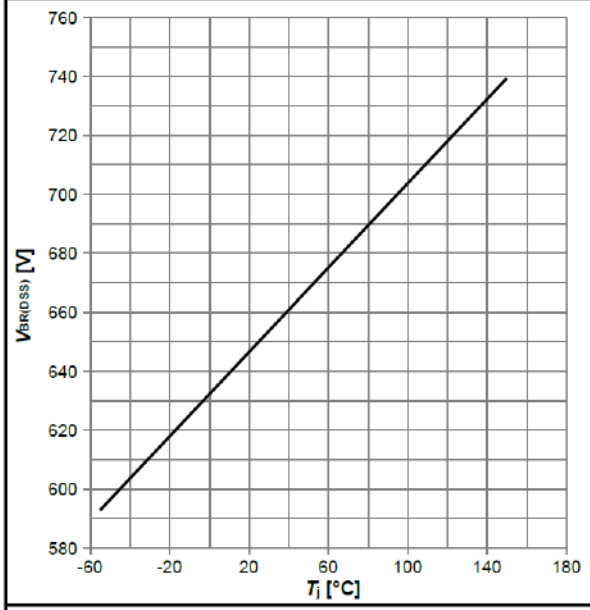
Diagram 12: Avalanche energy



$E_{AS}=f(T_j)$; I_D=7.1 A; V_{DD}=50 V

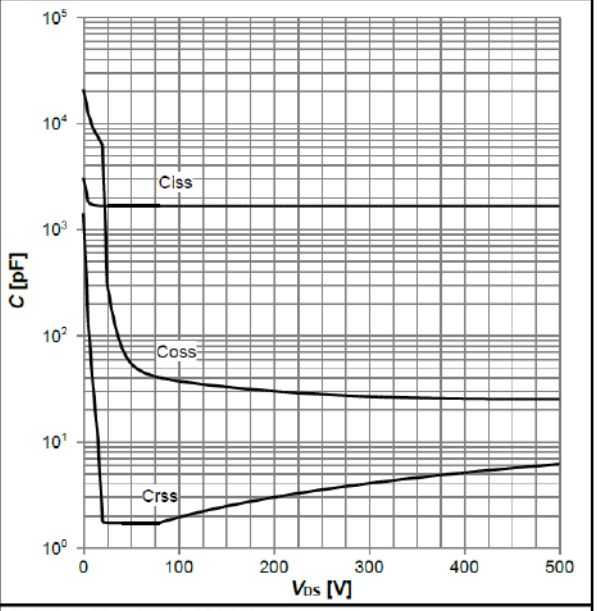
Typical Characteristics Diagrams

Diagram 13: Drain-source breakdown voltage



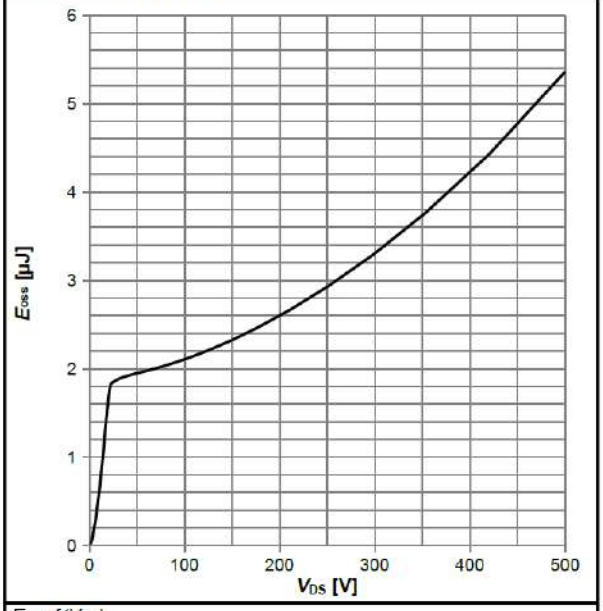
$V_{BR(DSS)}$=f(T_j); I_D=1 mA

Diagram 14: Typ. capacitances



C=f(V_{DS}); V_{GS}=0 V; f=250 kHz

Diagram 15: Typ. Coss stored energy



E_{oss}=f(V_{DS})

Typical Test Circuit

Table 20 Switching times test circuit and waveform for inductive load

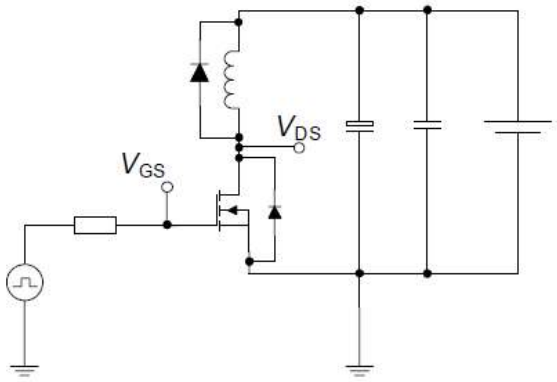
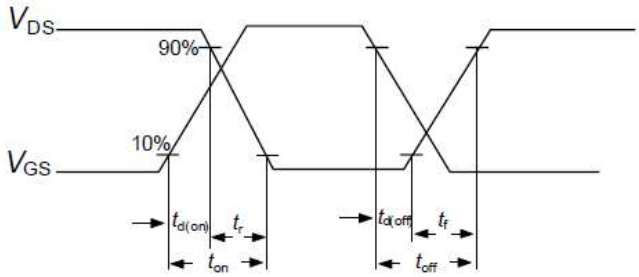
Switching times test circuit for inductive load	Switching time waveform
	

Table 21 Unclamped inductive load test circuit and waveform

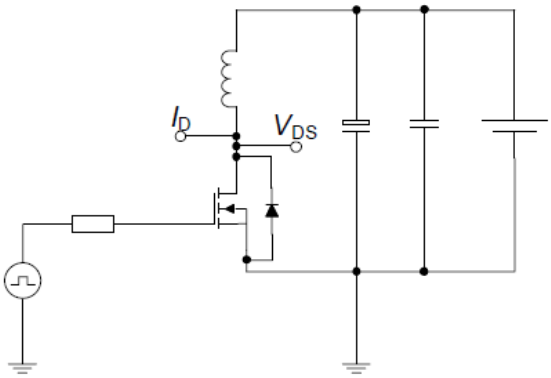
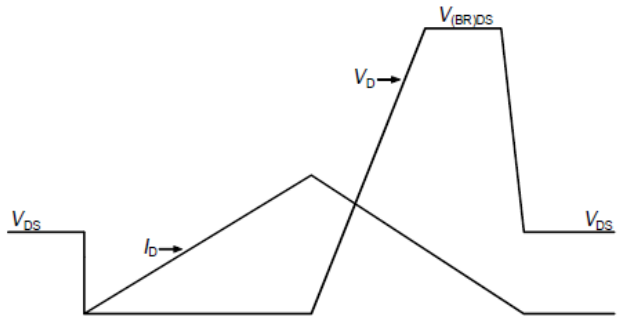
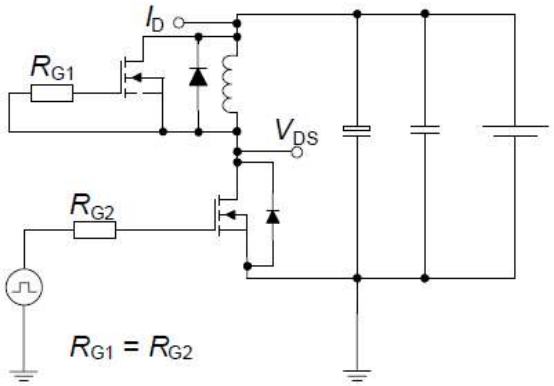
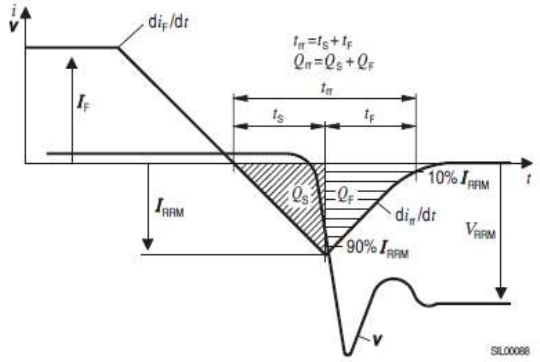
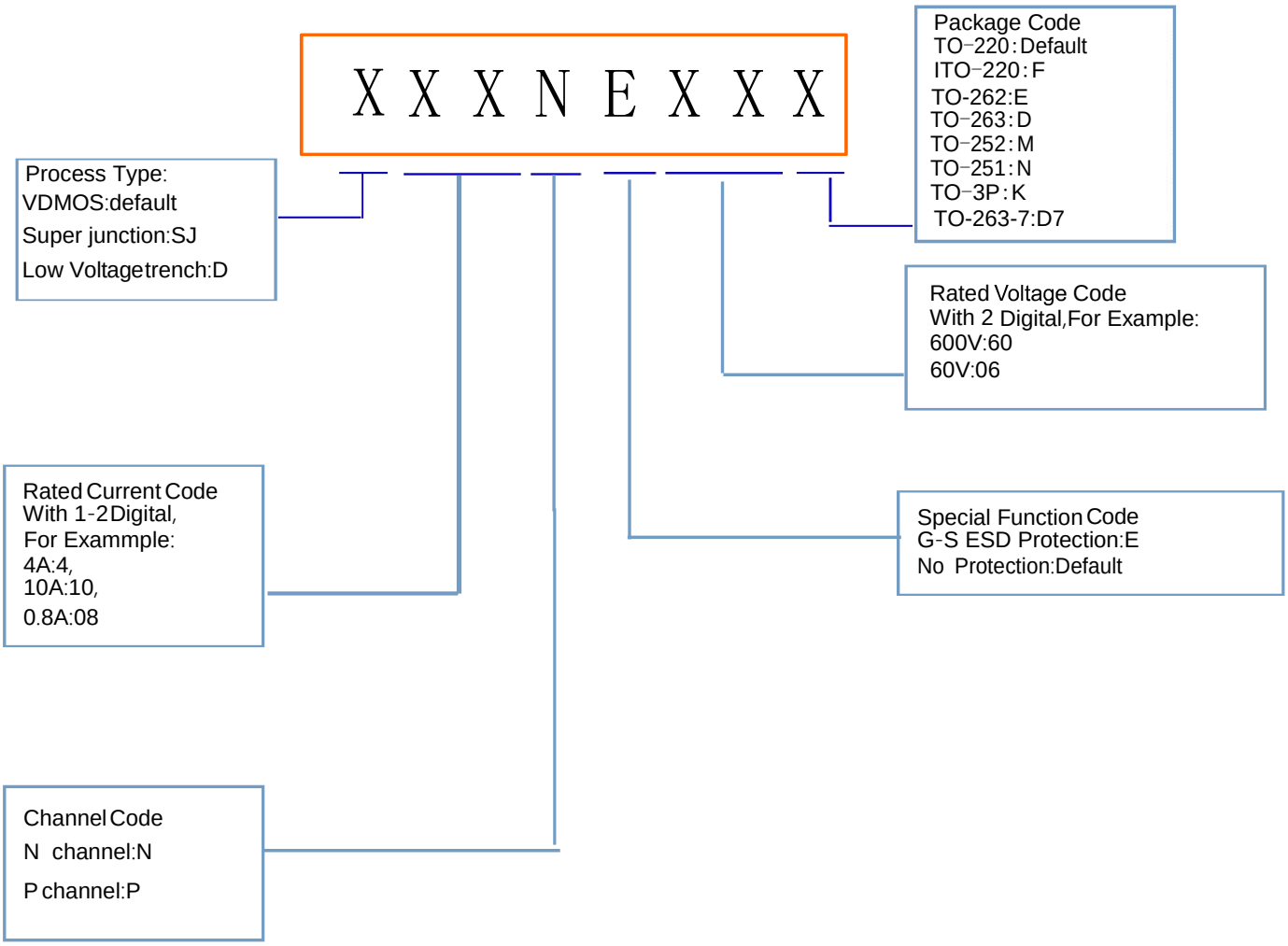
Unclamped inductive load test circuit	Unclamped inductive waveform
	

Table 22 Test circuit and waveform for diode characteristics

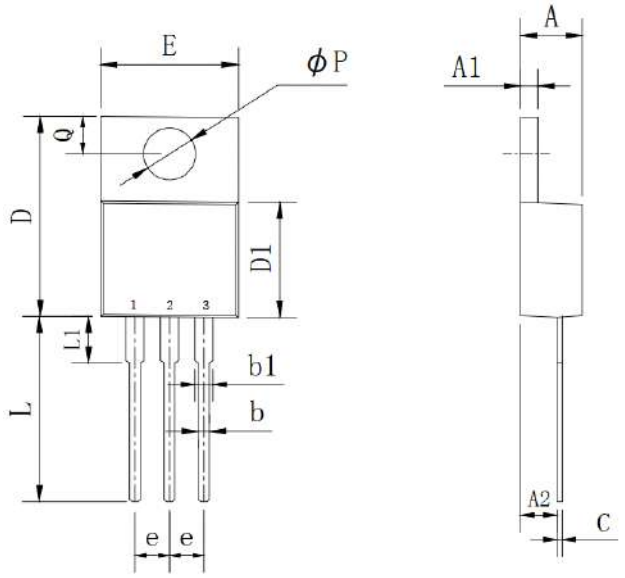
Test circuit for diode characteristics	Diode recovery waveform
	

Product Names Rules



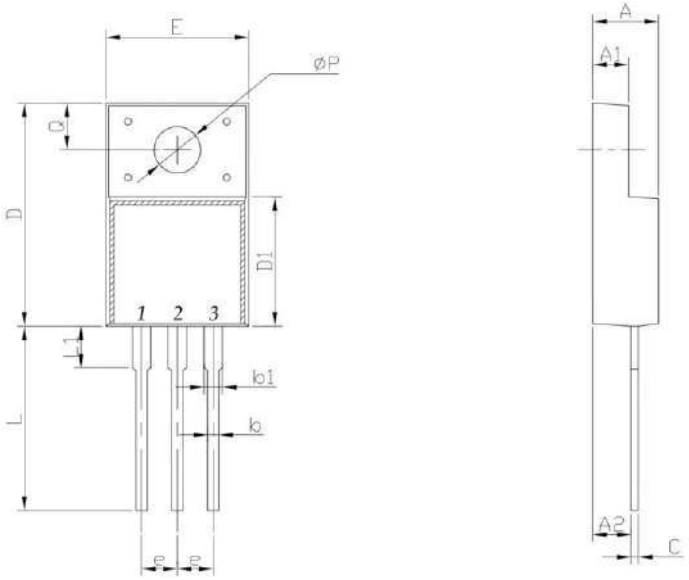
Dimensions

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

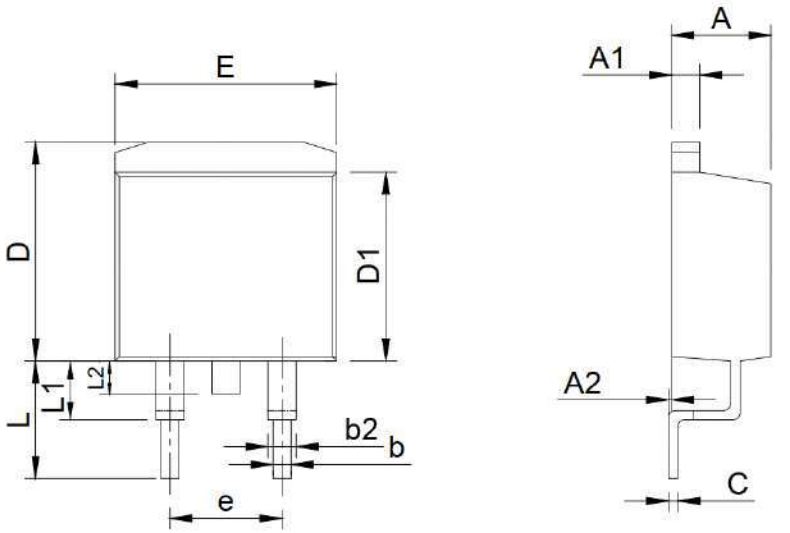
ITO-220 PACKAGE OUTLINE DIMENSIONS



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

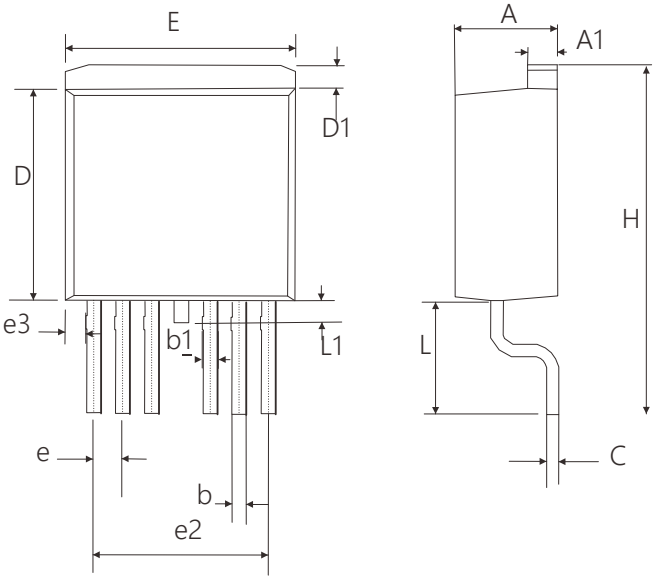
Dimensions

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

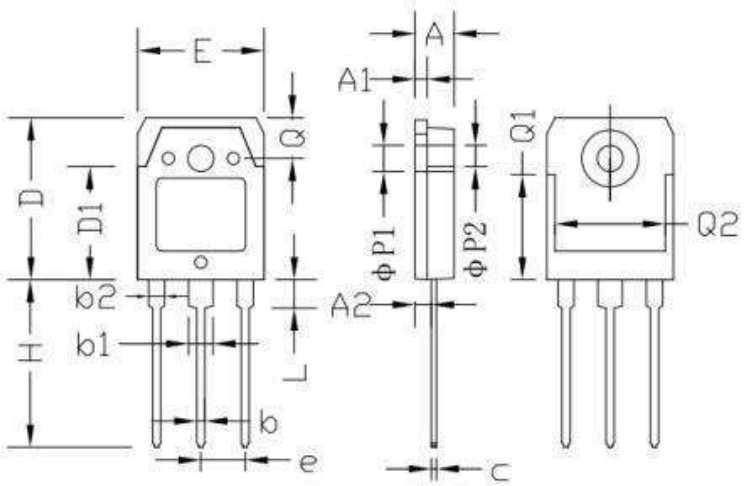
TO-263-7L PACKAGE OUTLINE DIMENSIONS



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

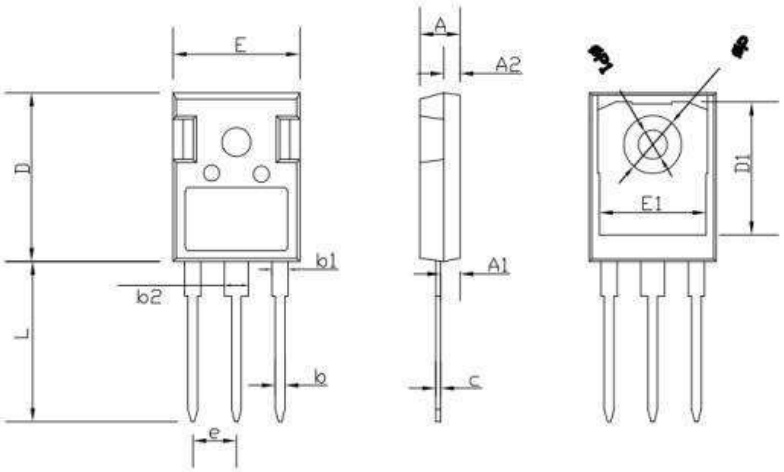
Dimensions

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	-

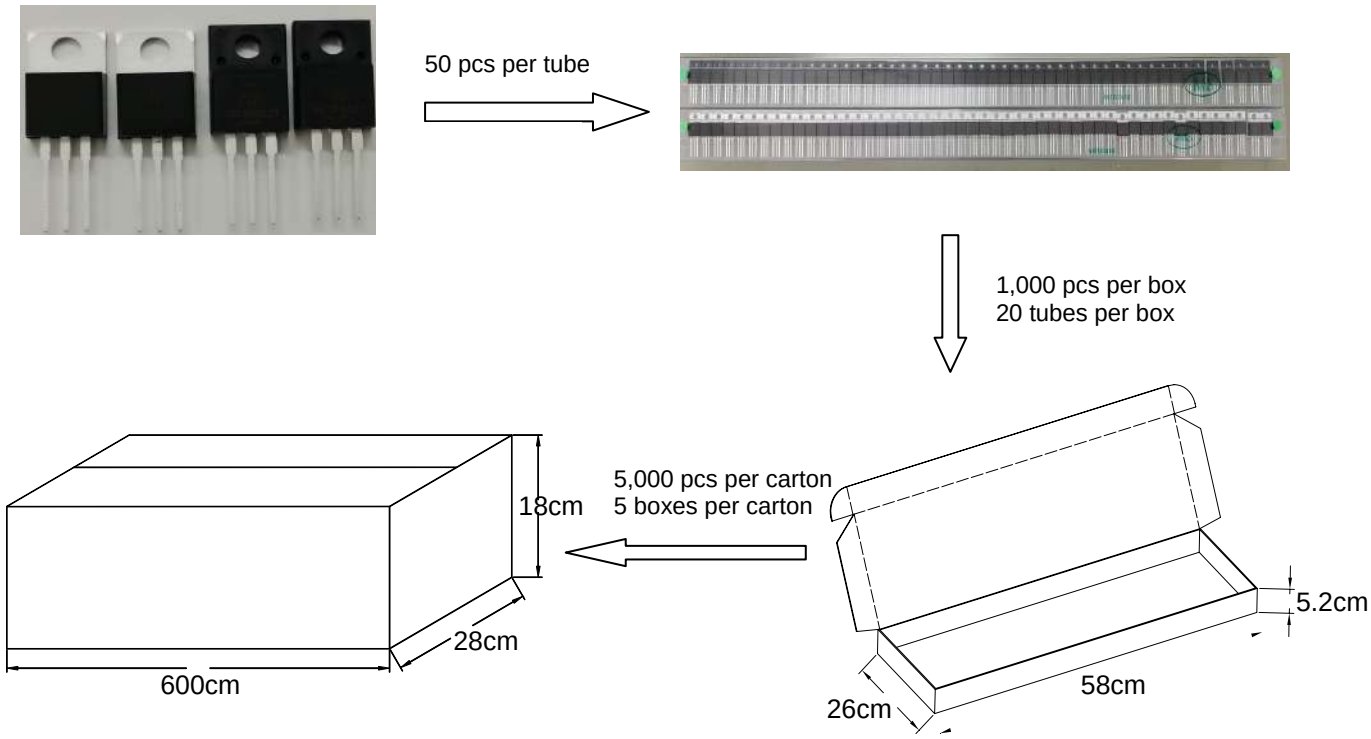
TO-247 PACKAGE OUTLINE DIMENSIONS



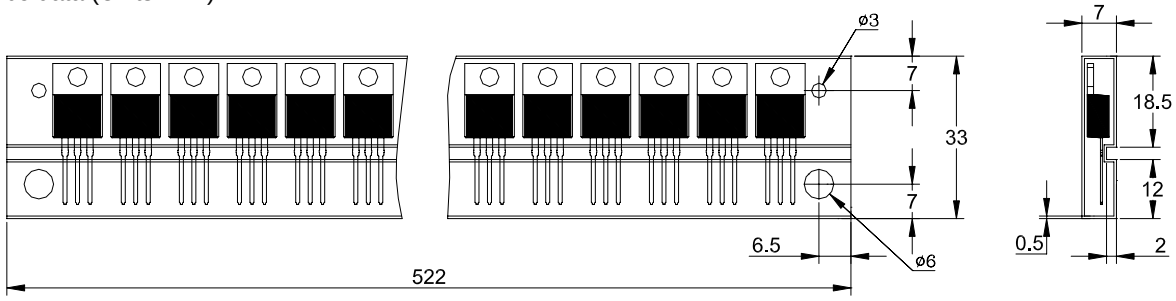
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	min.	max.	min.	max.
A	4.90	5.10	0.193	0.201
A1	2.31	2.51	0.091	0.099
A2	1.90	2.10	0.075	0.083
b	1.16	1.26	0.046	0.050
b1	1.96	2.06	0.0772	0.0812
b2	2.96	3.06	0.117	0.121
c	0.59	0.66	0.0232	0.0260
D	20.90	21.10	0.8235	0.8313
D1	16.25	16.85	0.6403	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

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.