

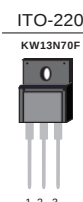
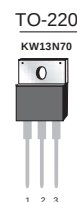
700V 13A Power MOSFET

Features:

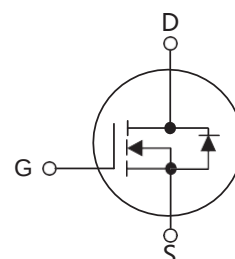
- $R_{DS(ON)} < 0.38\Omega @ V_{GS}=10V$
- 100% avalanche tested
- RoHS compliant

Mechanical Data:

- Case: TO-220, ITO-220, TO-251, TO-252, TO-263 package



Block Diagram



Pin Definition:

1. Gate
2. Drain
3. Source

Product Summary

V_{DS}	$R_{DS(on)}$ (Ω) Typ	I_D (A)	Q_g (Typ)
700V	0.36 @ 10V	13	34nc

Ordering Information

Part No.	Package Type	Package	Quality(box)
KW13N70	TO-220	Tube	1000
KW13N70F	ITO-220	Tube	1000
KW13N70E	TO-263	Tape & Reel	800
KW13N70M	TO-252	Tape & Reel	3000
KW13N70N	TO-251	Tube	1000

Table1 Absolute Maximum Ratings ($T_C=25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	TO-220/TO-263 TO-251/TO-252	ITO-220	Unit
Drain-Source Voltage	V_{DS}	700		V
Gate-Source Voltage	V_{GS}	± 30		V
Continuous Drain Current	I_D	13		A
		9		
Pulsed Drain Current (Note 1)	I_{DM}	46		A
Single Pulse Avalanche Energy (Note 2)	E_{AS}	280		mJ
Avalanche Current (Note 1)	I_{AR}	2.3		A
Repetitive Avalanche Energy (Note 1)	E_{AR}	1.2		mJ
Peak Diode Recovery dv/dt (Note 3)	dv/dt	15		V/ns
Drain Source voltage slope ($V_{DS}=480V$)	d V_{DS} /dt	50		V/ns
Power Dissipation $T_C=25^\circ\text{C}$	P_D	37	26	W
Operating Junction and Storage Temperature	T_J/T_{STG}	-55 ~ +150		$^\circ\text{C}$
Maximum Temperature for soldering	T_L	300		$^\circ\text{C}$

Table 2. Thermal Characteristics

Parameter	Symbol	TO-220/TO-263	ITO-220	Unit
Thermal resistance Junction to Ambient	$R_{\theta JA}$	62	62	$^{\circ}\text{C/W}$
Thermal resistance Junction to Case	$R_{\theta JC}$	0.82	3.57	$^{\circ}\text{C/W}$

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 _{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 =6.5A	--	0.36	0.38	Ω
Dynamic Characteristics(Note 5)							
Input Capacitance		C _{ISS}	V _{DS} =25V,V _{GS} =0V,f=1MHz	--	780	--	pF
Output Capacitance		C _{OSS}		--	23	--	pF
Reverse Transfer Capacitance		C _{RSS}		--	1.9	--	pF
Switching Characteristics (Note 5)							
Turn-On Delay Time		t _{d (on)}	V _{DD} =400V,I _D =6.5A, R _G =20Ω	--	17	--	ns
Turn-On Rise Time		t _r		--	12	--	ns
Turn-Off Delay Time		t _{d (off)}		--	130	--	ns
Turn-Off Fall Time		t _f		--	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 =6. 5A	--	0.9	1.5	V
Maximum Continuous Drain-Source Diode Forward Current		I _S		--	--	10	A
Reverse Recovery Time		t _{rr}	V _{GS} =0V, I _F =6. 5A	--	300	--	ns
Reverse Recovery Charge		Q _{RR}	dI _F /dt=100A/μs (Note 1)	--	3500	--	nC

Notes : 1 Repetitive Rating:Pulse width limited by maximum junction temperature 2

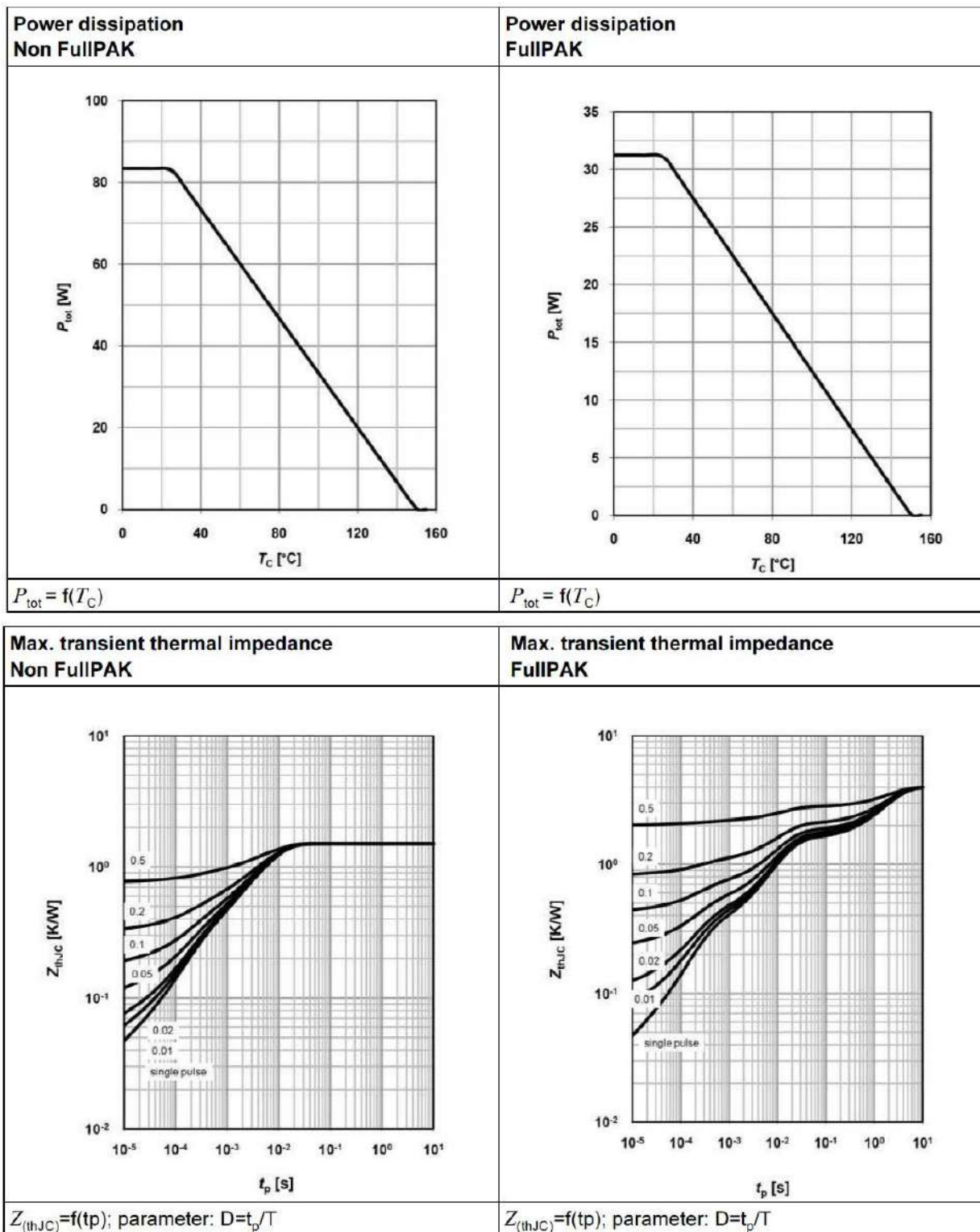
$I_{AS}=3A, V_{DD}=150V$, Starting $T_J=25^{\circ}\text{C}$

3 $I_{SD} \leq I_D, di/dt \leq 200A/\mu s, V_{DD} \leq BV_{DSS}$, Starting $T_J=25^{\circ}\text{C}$

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

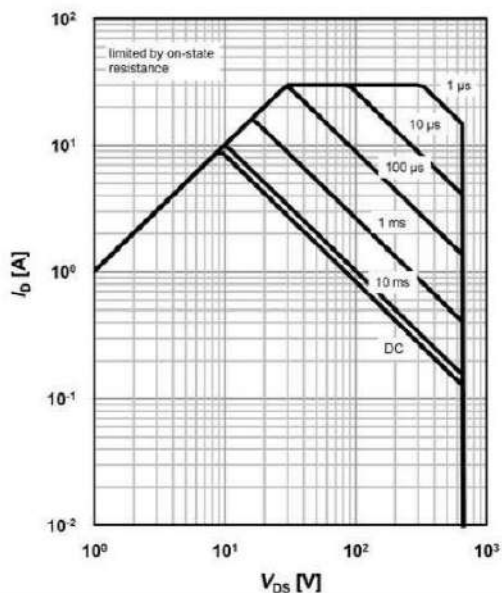
5 Guaranteed by design, not subject to production

Typical characteristics Diagrams



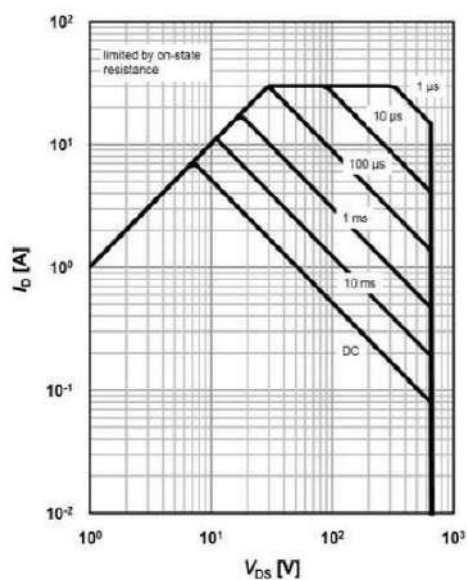
Typical characteristics Diagrams

**Safe operating area $T_C=25\text{ }^\circ\text{C}$
Non FullPAK**



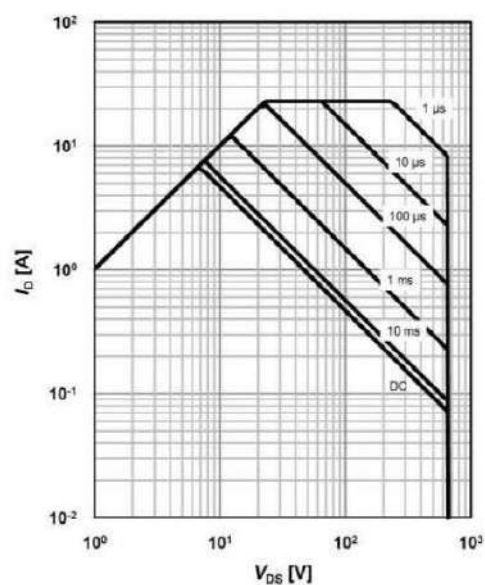
$I_D=f(V_{DS}); T_C=25\text{ }^\circ\text{C}; V_{GS} > 7\text{V}; D=0; \text{parameter } t_p$

**Safe operating area $T_C=25\text{ }^\circ\text{C}$
FullPAK**



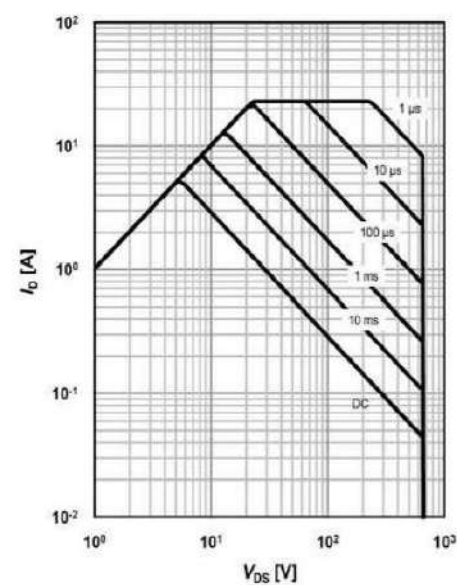
$I_D=f(V_{DS}); T_C=25\text{ }^\circ\text{C}; V_{GS} > 7\text{V}; D=0; \text{parameter } t_p$

**Safe operating area $T_C=80\text{ }^\circ\text{C}$
Non FullPAK**



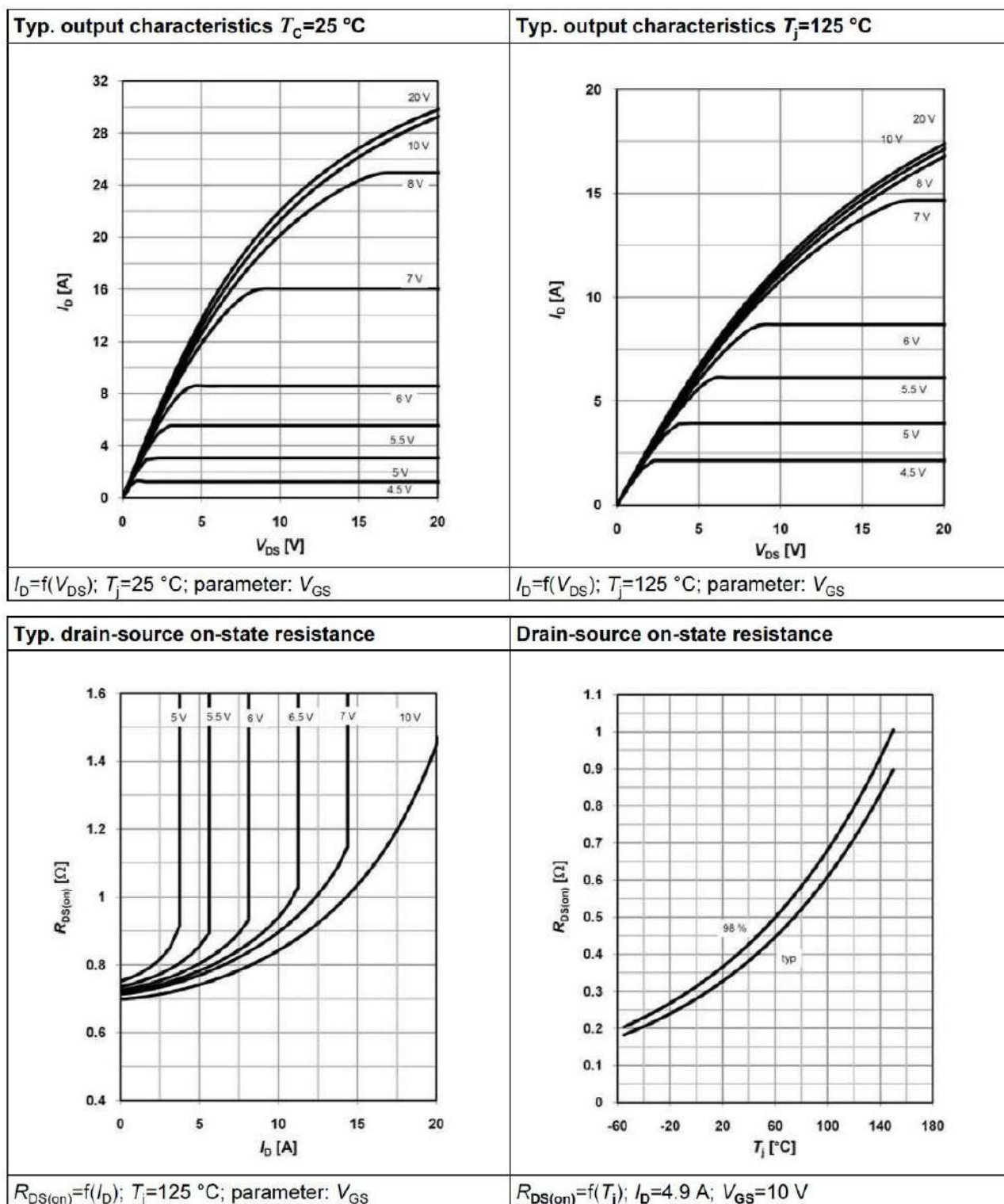
$I_D=f(V_{DS}); T_C=80\text{ }^\circ\text{C}; V_{GS} > 7\text{V}; D=0; \text{parameter } t_p$

**Safe operating area $T_C=80\text{ }^\circ\text{C}$
FullPAK**

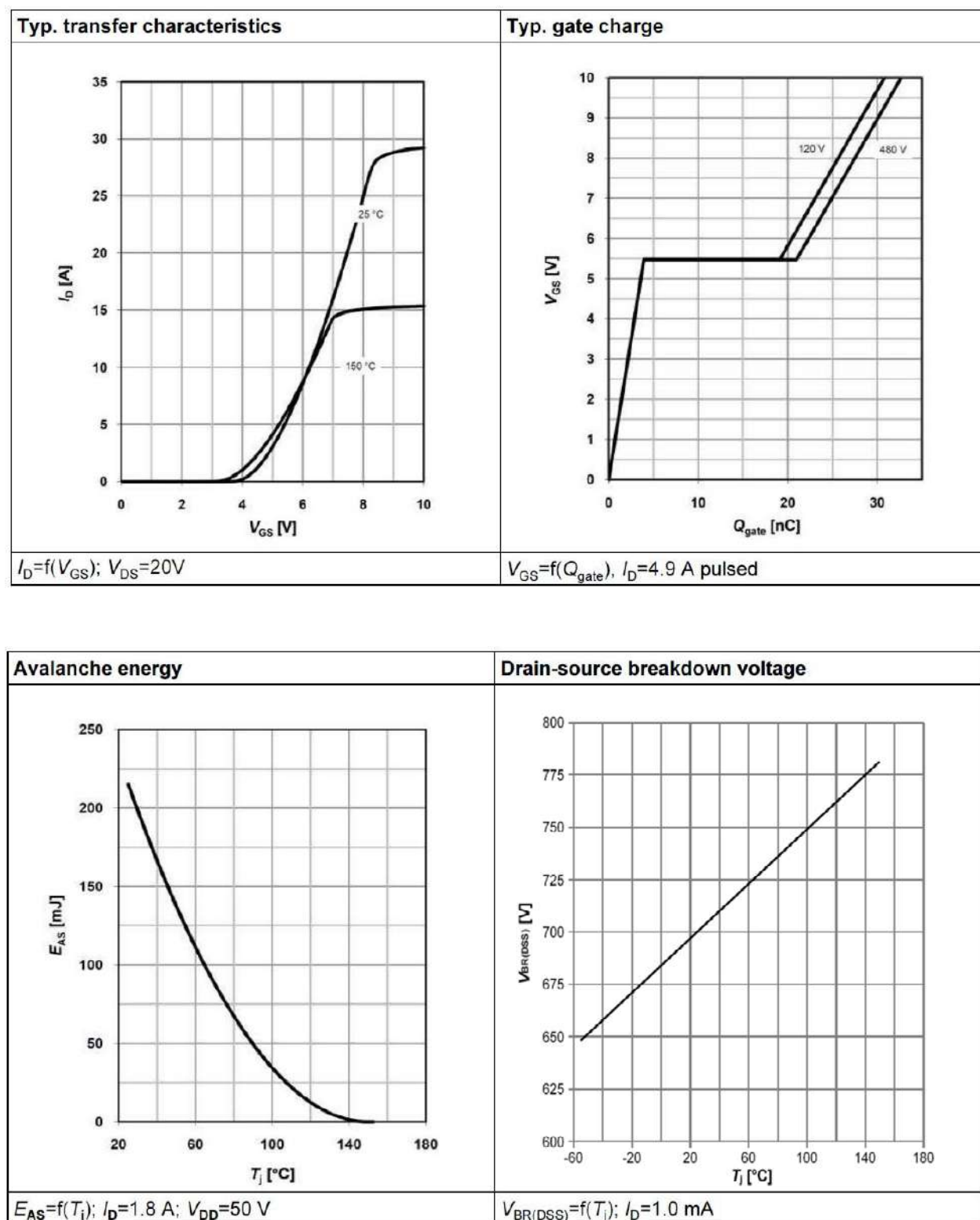


$I_D=f(V_{DS}); T_C=80\text{ }^\circ\text{C}; V_{GS} > 7\text{V}; D=0; \text{parameter } t_p$

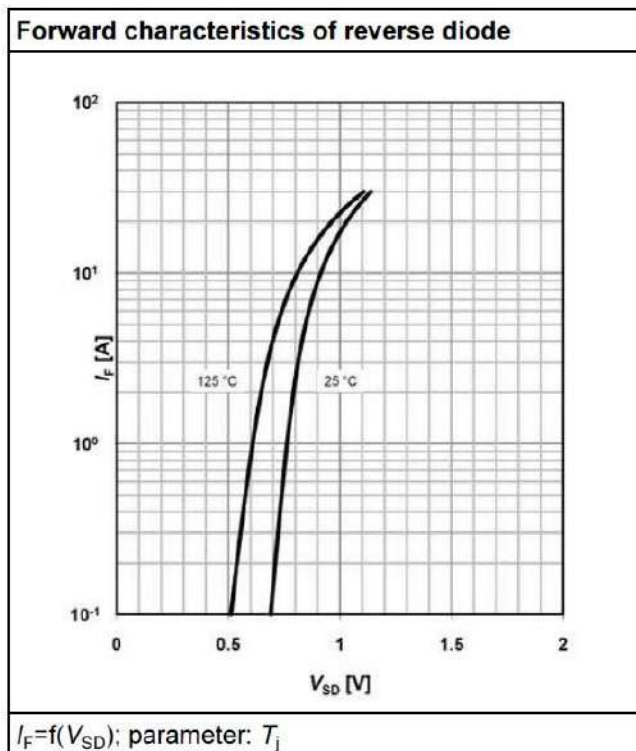
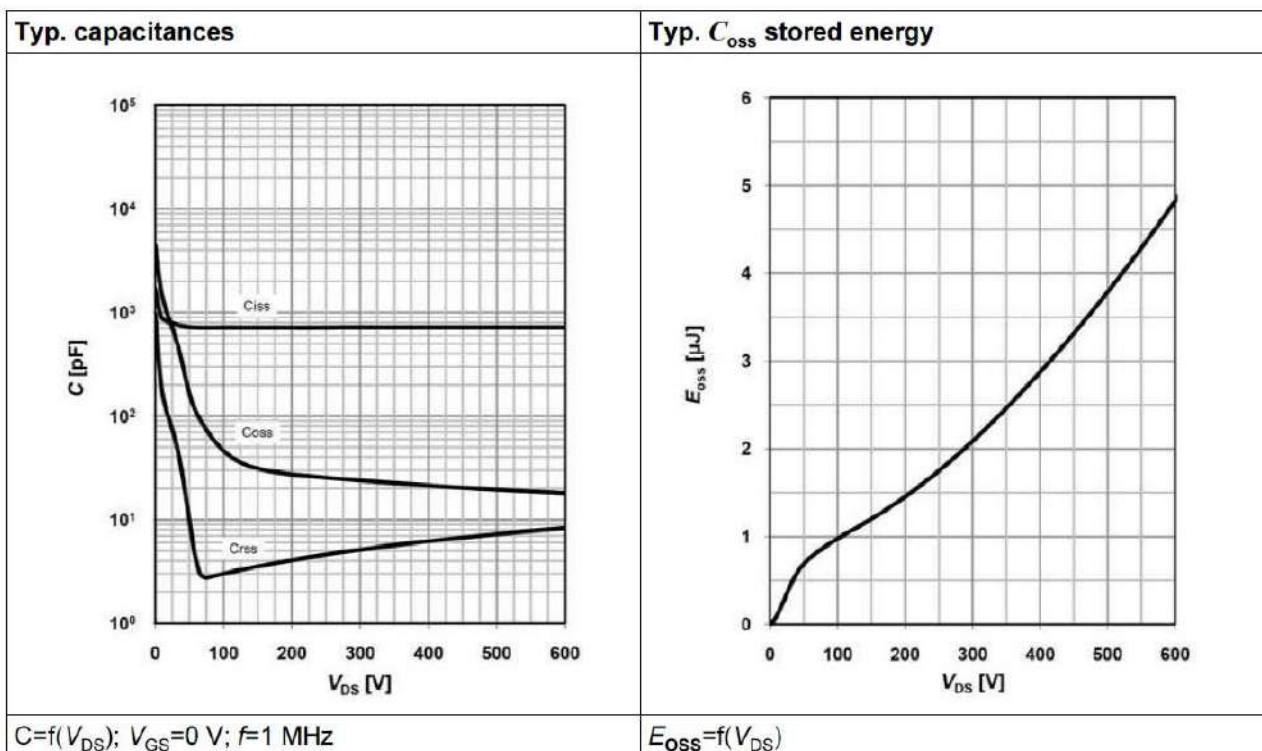
Typical characteristics Diagrams



Typical characteristics Diagrams



Typical characteristics Diagrams



Typical characteristics Diagrams

Table 20 Switching times test circuit and waveform for inductive load

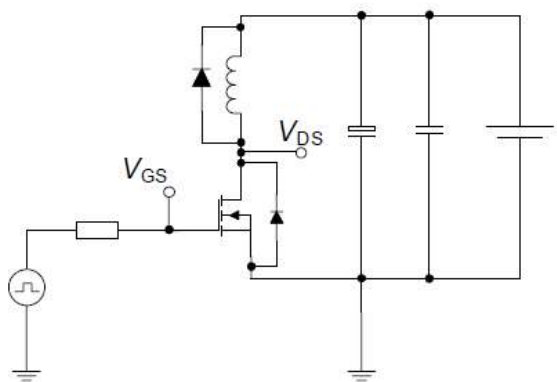
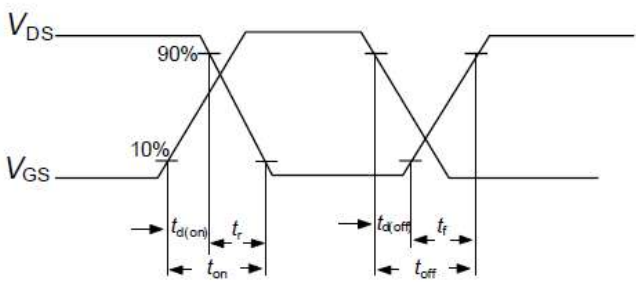
Switching times test circuit for inductive load	Switching time waveform
	

Table 21 Unclamped inductive load test circuit and waveform

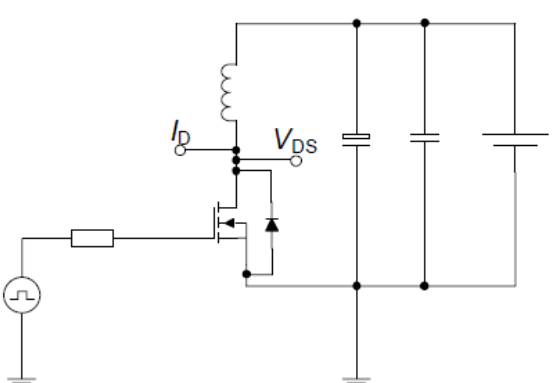
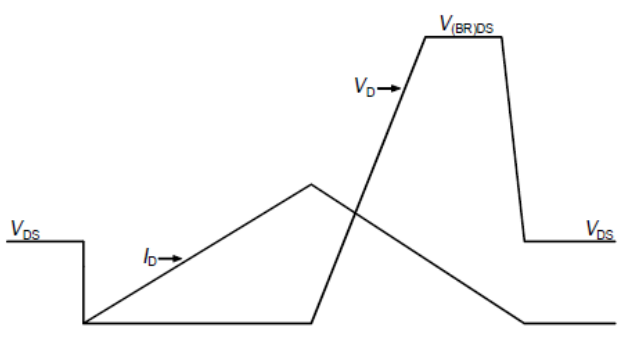
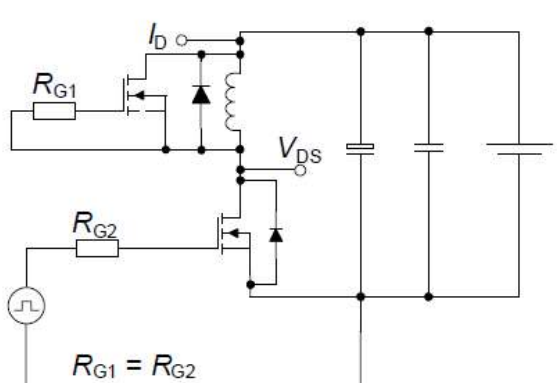
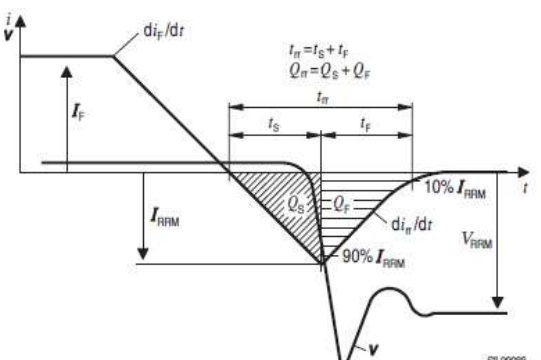
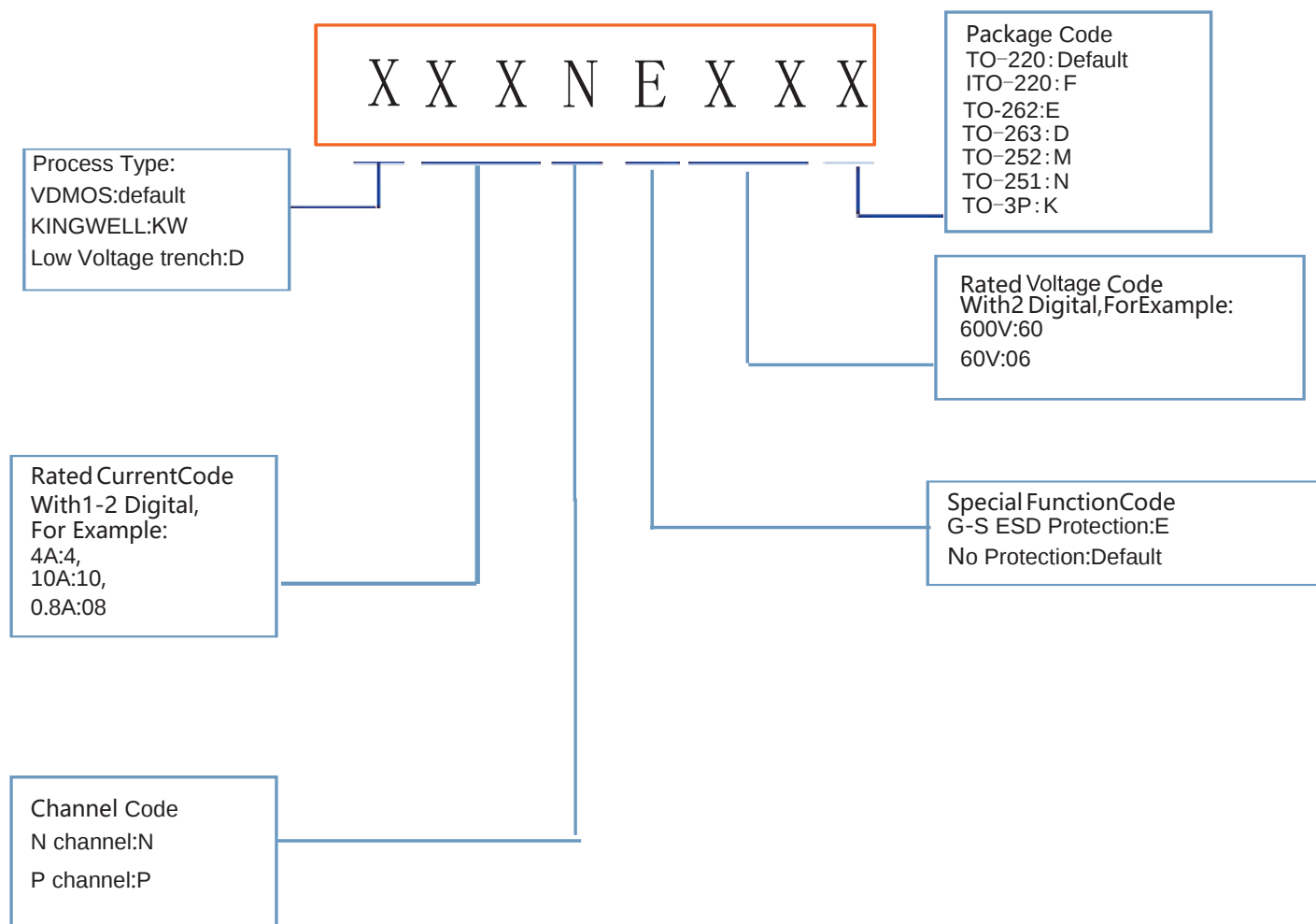
Unclamped inductive load test circuit	Unclamped inductive waveform
	

Table 22 Test circuit and waveform for diode characteristics

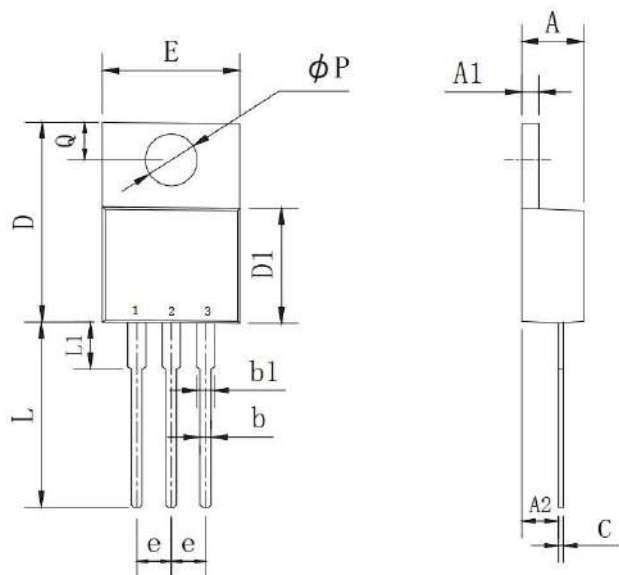
Test circuit for diode characteristics	Diode recovery waveform
	

Product Names Rules



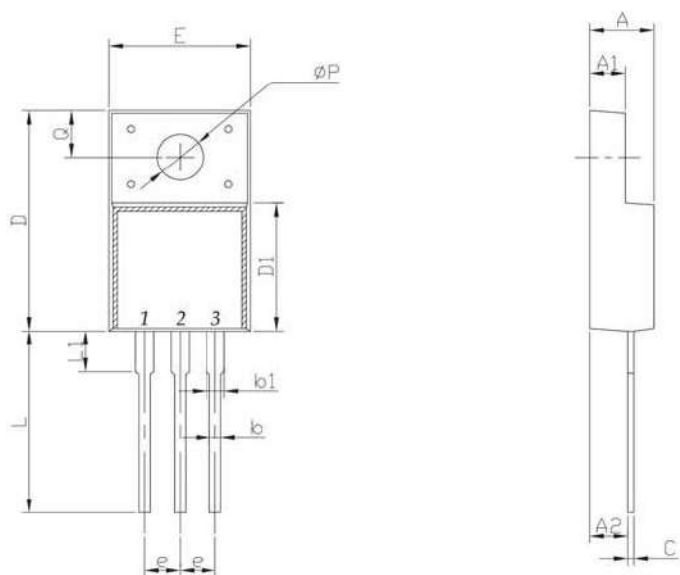
Dimensions

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

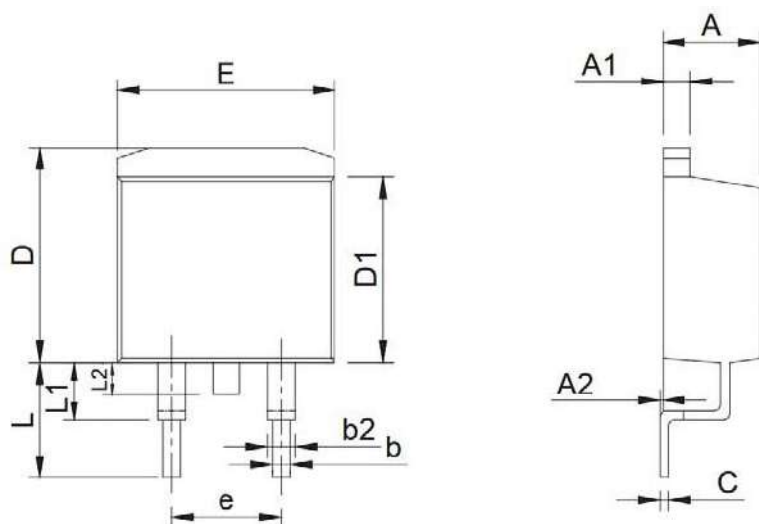
ITO-220 PACKAGE OUTLINE DIMENSIONS



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

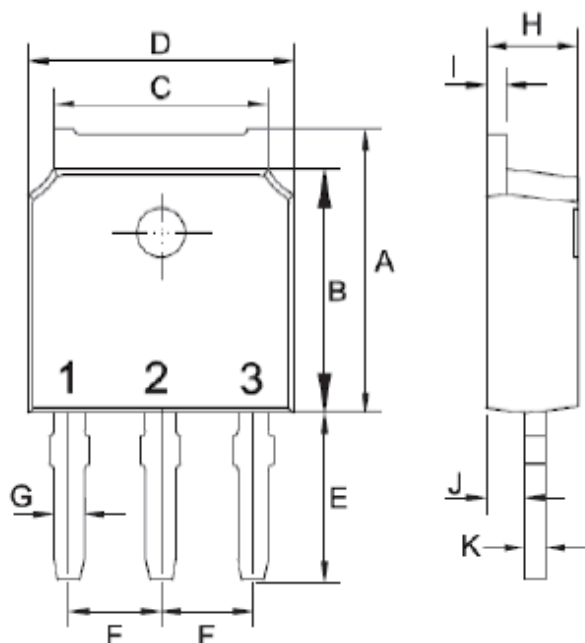
TO-263 PACKAGE OUTLINE DIMENSIONS



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

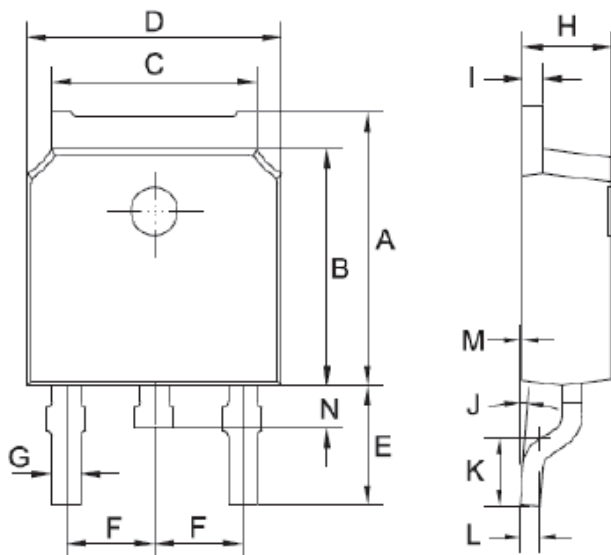
Dimensions

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
N	0.6	1	0.024	0.039