

50A 650V N-Channel Super Junction Power MOSFET

Features

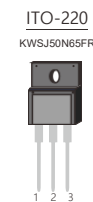
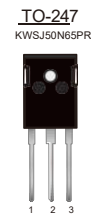
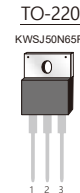
- Super_Junction technology
- Low gate charge
- Ultra high ruggedness
- Fast switching

Mechanical Data

- Case: TO-220 · ITO-220AB, TO-263 · TO-247 Package

Application

- LED/LCD/PDP TV and monitor Lighting
- Solar/Renewable/UPS-Micro Inverter System
- Charger
- Power Supply



Ordering Information

Part No.	Package Type	Package	Quantity(box)
KWSJ50N65R	TO-220	Tube	1000
KWSJ50N65FR	ITO-220	Tube	1000
KWSJ50N65DR	TO-263	Tape & Reel	800
KWSJ50N65PR	TO-247	Tube	360

Product Summary			
V _{DS}	R _{DS(on)} (mΩ) Typ	I _D (A)	Q _g (Typ)
650V	40@ 10V 25A	50	91nc

Block Diagram

Pin Definition:

1. Gate
2. Drain
3. Source

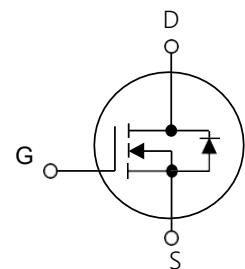


Table1 Absolute Maximum Ratings (T_C=25°C, unless otherwise specified)

Parameters	Symbol	KWSJ50N65R KWSJ50N65DR KWSJ50N65PR	KWSJ50N65FR	Unit
Drain-Source Voltage	V _{DS}	650		V
Gate-Source Voltage	V _{GS}	±30		V
Continuous Drain Current	T _C =25°C	50	50 [*]	A
	T _C =100°C	43	43 [*]	
Pulsed Drain Current (Note 1)	I _{DM}	73		A
Single Pulse Avalanche Energy (Note 2)	E _{AS}	77		mJ
Power Dissipation T _C =25°C	P _D	532	66	W
Operating Junction and Storage Temperature	T _J /T _{STG}	-55 ~ +150		°C

^{*} limited by maximum junction temperature

Table 2. Thermal Characteristics

Parameter	Symbol	KWSJ50N65R KWSJ50N65DR KWSJ50N65PR	KWSJ50N65FR	Unit
Thermal resistance Junction to Ambient. Max	$R_{\theta JA}$	65	82	$^{\circ}\text{C}/\text{W}$
Thermal resistance Junction to Case. Max	$R_{\theta JC}$	0.235	1.9	$^{\circ}\text{C}/\text{W}$

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	650	-	-	V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =650V,V _{GS} =0V	-	-	10	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 3)							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} =V _{GS} ,I _D =250μA	3.0	-	5.0	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} =10V,I _D =25A	-	40	50	mΩ
Dynamic Characteristics(Note 4)							
Input Capacitance		C _{ISS}	V _{DS} =25V,V _{GS} =0V,f=1MHz	-	4565	-	pF
Output Capacitance		C _{OSS}		-	330	-	pF
Reverse Transfer Capacitance		C _{RSS}		-	18	-	pF
Switching Characteristics (Note 4)							
Turn-On Delay Time		t _{d(on)}	V _{DS} =520V,I _D =35A V _{GS} =10V,R _G =20Ω,	-	318	-	ns
Turn-On Rise Time		t _r		-	43	-	ns
Turn-Off Delay Time		t _{d(off)}		-	97	-	ns
Turn-Off Fall Time		t _f		-	30	-	ns
Total Gate Charge		Q _G	V _{DS} =520V,I _D =35A, V _{GS} =10V	-	91	-	nC
Gate-Source Charge		Q _{GS}		-	15	-	nC
Gate-Drain Charge		Q _{GD}		-	58	-	nC
Drain-Source Diode Characteristics and Maximum Ratings							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =0V,I _S =35A	-	-	1.2	V
Body Diode Reverse Recovery Time		t _{rr}	I _F =35A,dI _F /dt=120A/μs V _{DS} =480V, R _G =255Ω	-	121	-	ns
Body Diode Reverse Recovery Charge		Q _R		-	0.8	-	μC
Body Diode Reverse Recovery Peak Current		I _{rrm}		-	11.5	-	A

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

2 L = 1mH, $V_{GS}=10V$, $R_G=25\Omega$, $V_{DD}=50V$, Starting $T_J=25^{\circ}\text{C}$

3 Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$

4 Guaranteed by design, not subject to production

Typical Characteristics Diagrams

Figure 1. Output Characteristics

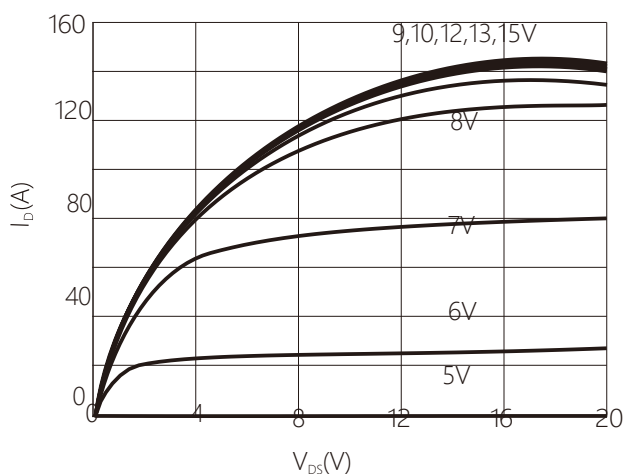


Figure 2. Normalized $R_{DS(ON)}$ vs Temperature

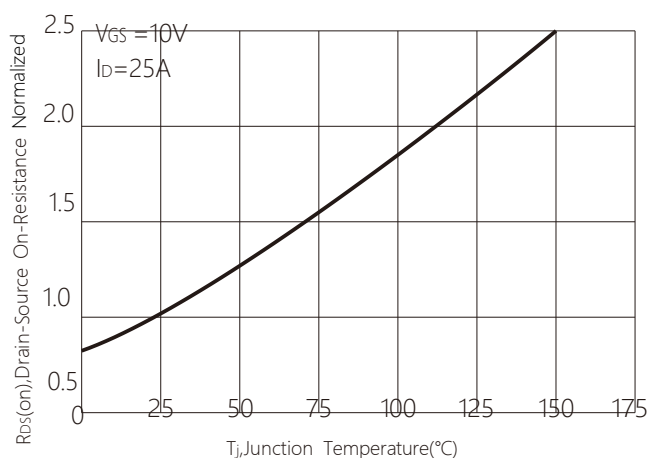


Figure 3. On-Resistance vs. Drain Current

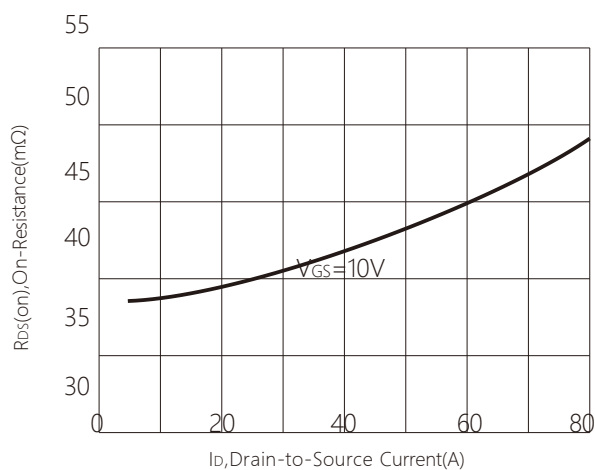


Figure 4. Capacitance

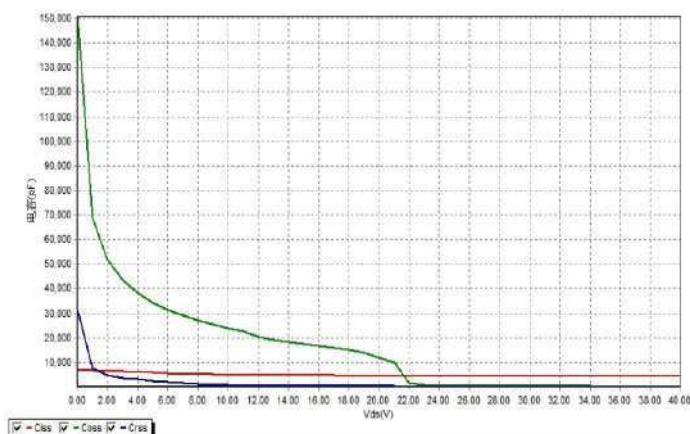


Figure 5. Gate charge

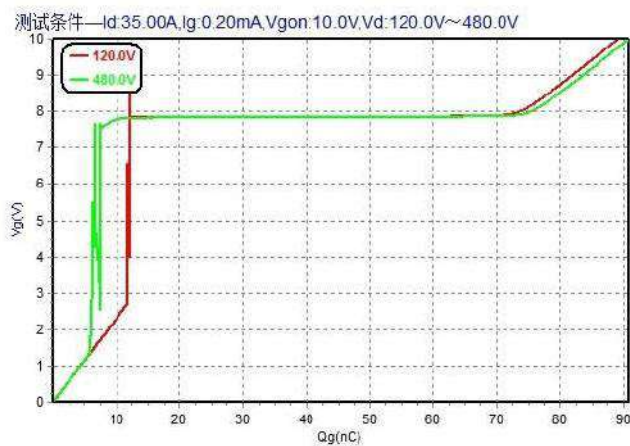


Figure 6. Source-Drain Diode Forward Voltage

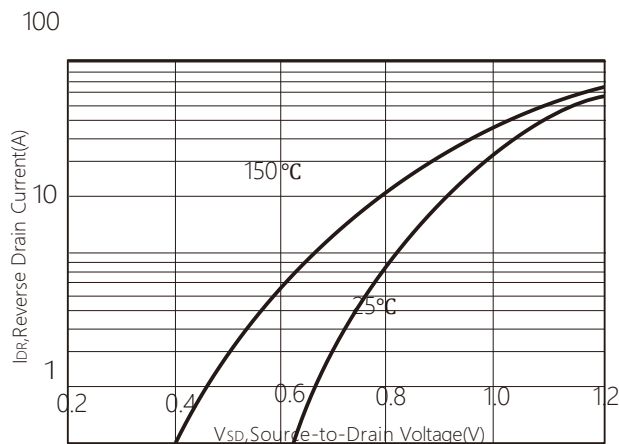


Figure 7. Transfer Characteristics

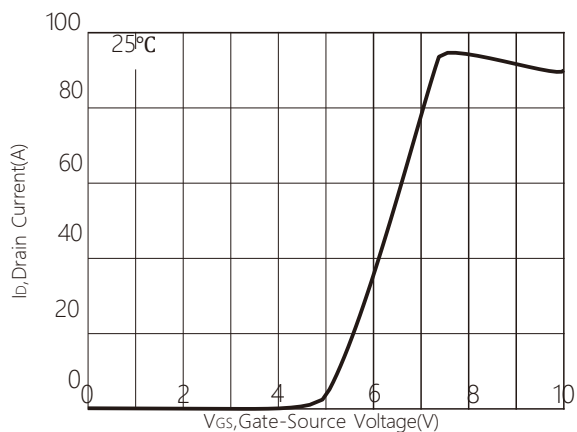


Figure 8. Power dissipation
TO-263, TO-220, TO-247

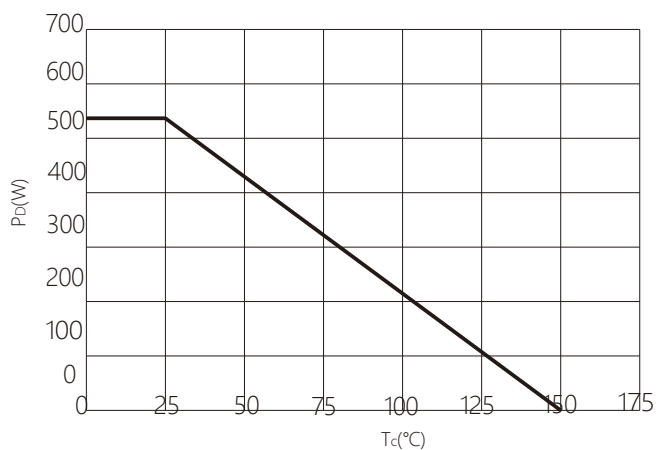


Figure 9. Safe operating area

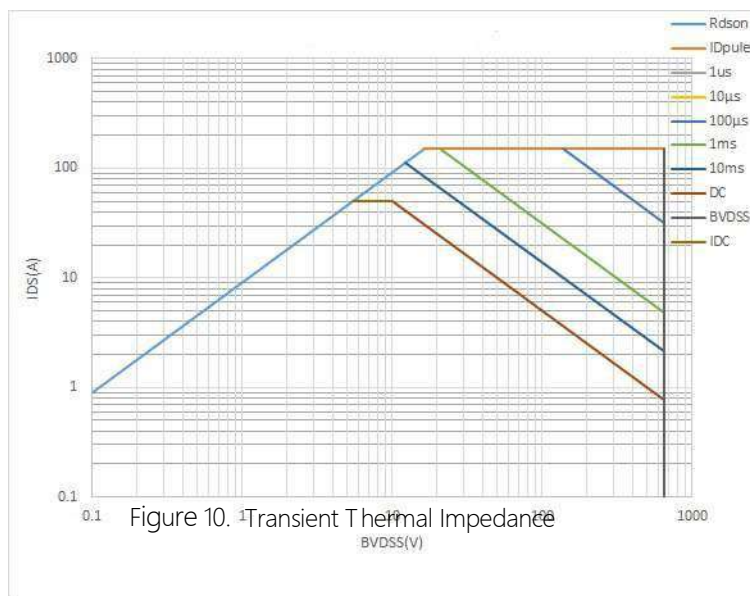
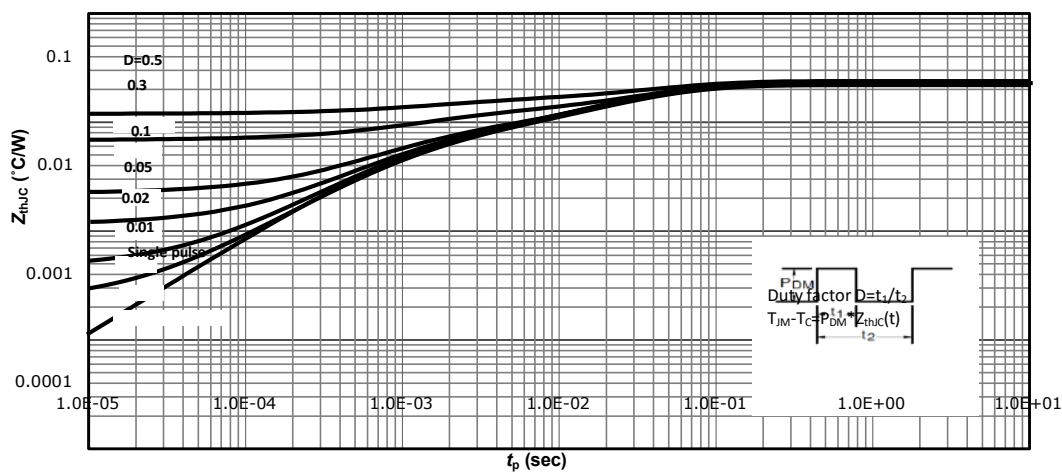
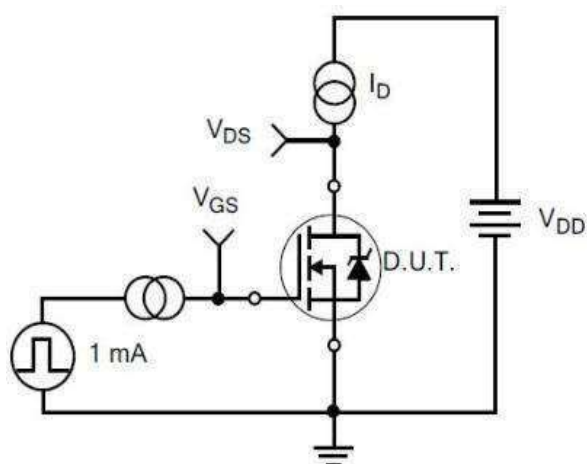


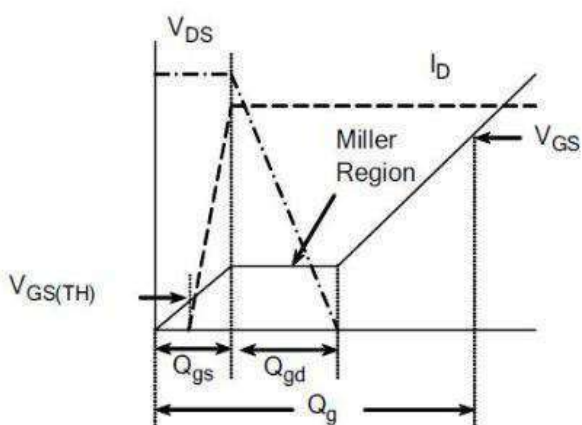
Figure 10. Transient Thermal Impedance



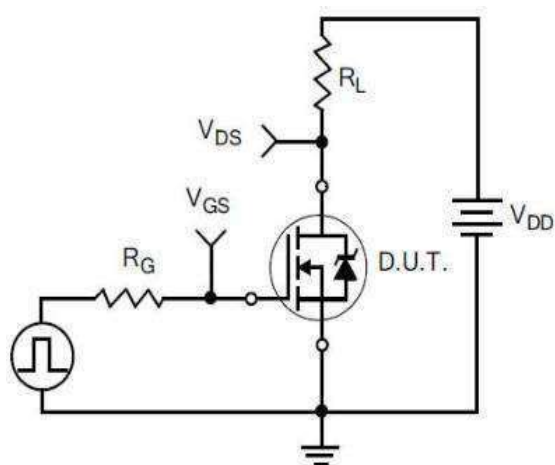
Typical Test Circuit



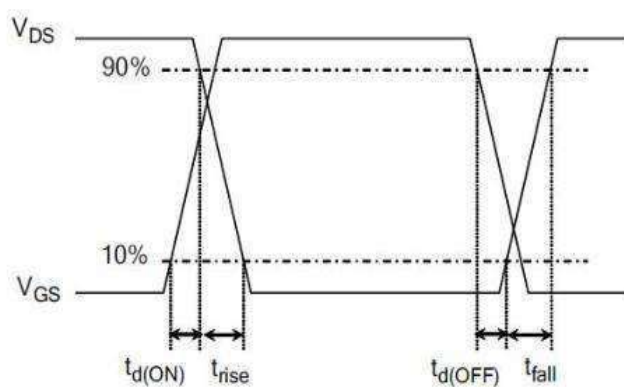
1) Gate Charge Test Circuit



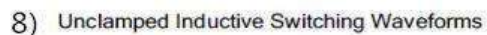
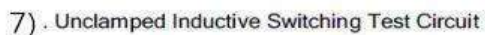
2) Gate Charge Waveform



3) Resistive Switching Test Circuit



4) Resistive Switching Waveforms



Product Names Rules

X X X N E X X X

Process Type:
 VDMOS:default
 Super junction:SJ
 Low Voltage trench:D
 Low Voltage SGT:DS

Rated Current Code
 With 1 - 3 Digital,
 For Ex ample:
 50A:50,
 0.8A:08,

Channel Code
 N channel:N
 P channel:P

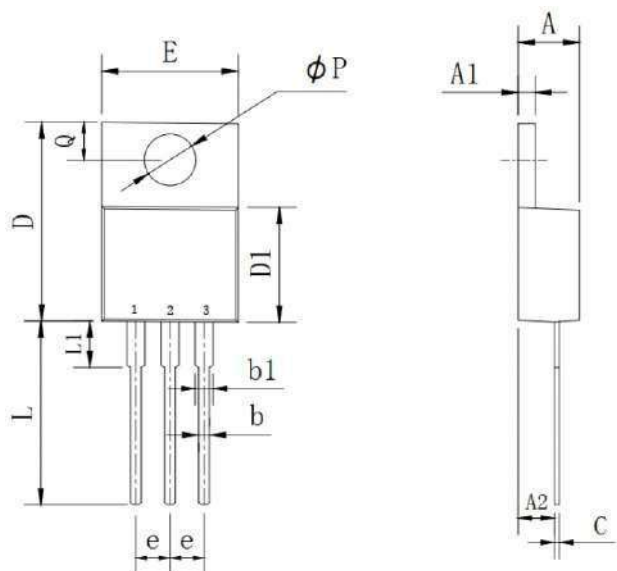
Package Code
 TO-220:Default
 ITO-220:F
 TO-262:E
 TO-263:D
 TO-252:M
 TO-251:N
 TO-263-7L:D7
 TOLL:T
 TOLT:TT

Rated Voltage Code
 With 2 Digital,For Example:
 600V:60
 60V:06

Special Function Code
 G-S ESD Protection:E
 No Protection:Default

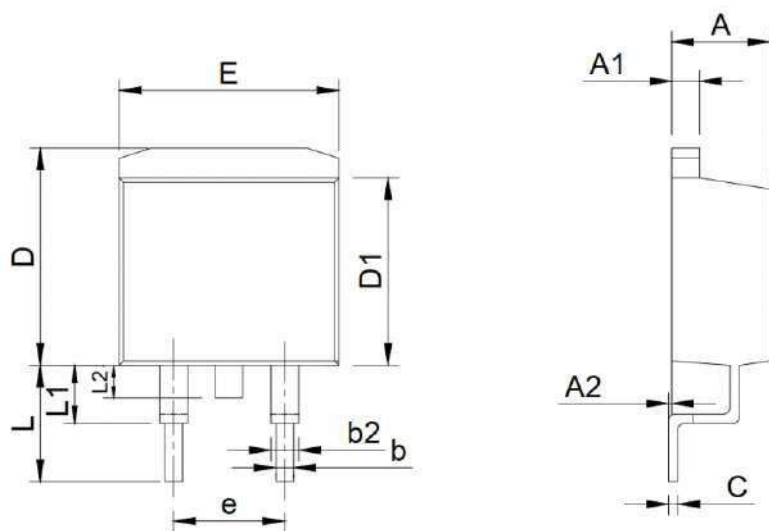
Dimensions

TO-220 PACKAGE OUTLINE DIMENSIONS



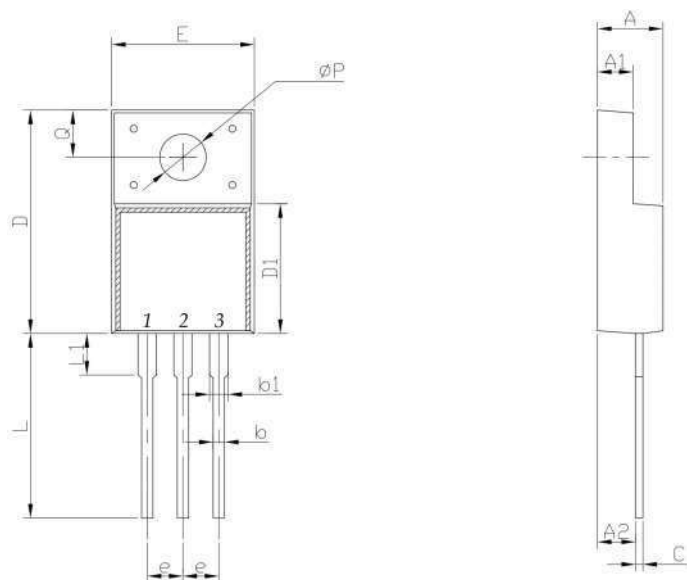
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	4.25	4.87	0.167	0.192
A1	1.07	1.47	0.042	0.058
A2	2.03	2.92	0.080	0.115
b	0.51	1.11	0.020	0.044
b1	0.97	1.6	0.038	0.063
C	0.3	0.7	0.012	0.028
D	14.6	15.9	0.575	0.626
D1	8.04	9.3	0.317	0.366
E	9.57	10.57	0.377	0.416
e	2.34	2.74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

TO-263 PACKAGE OUTLINE DIMENSIONS



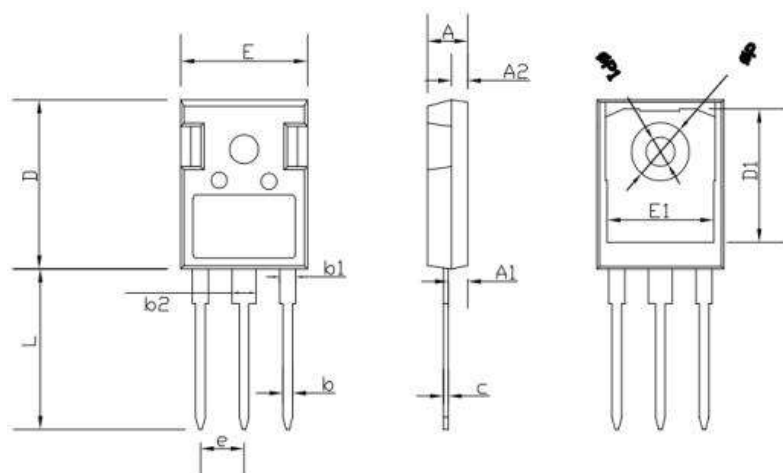
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	4.25	4.87	0.167	0.192
A1	1.07	1.47	0.042	0.058
A2	0	0.25	0.000	0.010
b	0.61	1.01	0.024	0.040
b1	1.2	1.34	0.047	0.053
C	0.3	0.6	0.012	0.024
D	9.48	10.84	0.373	0.427
D1	8.49	9.3	0.334	0.366
E	9.7	10.31	0.382	0.406
e	4.88	5.28	0.192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

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-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
ØP	3.50	3.70	0.1379	0.1458
ØP1	0	7.30	0	0.2876