

600V SUPER-JUNCTION Power MOSFET

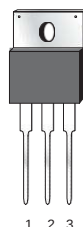
Features:

- $R_{DS(ON)} < 0.15\Omega @ V_{GS} = 10V$
- 100% avalanche tested
- RoHS compliant

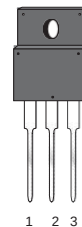
Mechanical Data :

- Case: TO-220, ITO-220, TO-247 Package

TO-220
KWSJ20N60



ITO-220
KWSJ20N60F



TO-247
KWSJ20N60K



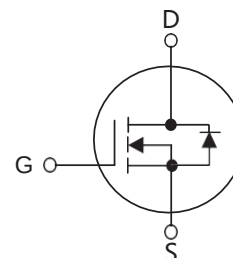
Ordering Information

Part No.	Package Type	Package	Quality(box)
KWSJ20N60-TU	TO-220	Tube	1000
KWSJ20N60F-TU	ITO-220	Tube	1000
KWSJ20N60K-TU	TO-247	Tube	360

Pin Definition:

1. Gate
2. Drain
3. Source

Block Diagram



PRODUCT SUMMARY

$V_{DS}(V)$	$R_{DS(ON)}(\Omega)$	$I_D(A)$
600	$0.15 @ V_{GS} = 10V$	20

ABSOLUTE MAXIMUM RATINGS ($T_c = 25^\circ C$, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Drain-Source Voltage	V_{DS}	600	V
Gate-Source Voltage	V_{GS}	± 30	V
Continuous Drain Current	I_D	20	A
Pulsed Drain Current (Note 1)	I_{DM}	60	A
Avalanche Energy(Note 2)	E_{AS}	480	mJ
Power Dissipation	TO-220/TO-247	P_D 151	W
	ITO-220	34	
Junction Temperature	T_J	+150	$^\circ C$
Storage Temperature	T_{STG}	-55 ~ +150	$^\circ C$

THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/TO-247	θ_{JA}	62	°C/W
	ITO-220		80	
Junction to Case	TO-220/TO-247	θ_{JC}	0.83	°C/W
	ITO-220		3.7	

ELECTRICAL CHARACTERISTICS ($T_C=25^{\circ}\text{C}$, 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	600			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =600V,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 3)							
Gate Threshold Voltage		V _{GS (TH)}	V _{DS} =V _{GS} ,I _D =250μA	2.5		4.0	V
DRAIN-SOURCE ON-RESISTANCE		R _{DS(ON)}	V _{GS} =10V,I _D =10A		0.13	0.15	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C _{ISS}	V _{DS} =50V,V _{GS} =0V,f=1MHz		2328		pF
Output Capacitance		C _{OSS}			116		pF
Reverse Transfer Capacitance		C _{RSS}			7		pF
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		t _{D(ON)}	V _{DD} =400V,I _D =20A, R _G =25Ω		43		ns
Turn-On Rise Time		t _R			14		ns
Turn-Off Delay Time		t _{D(OFF)}			150		ns
Turn-Off Fall Time		t _F			7		ns
Total Gate Charge		Q _G	V _{DS} =480V,I _D =20A, V _{GS} =10V		46		nC
Gate-Source Charge		Q _{GS}			11		nC
Gate-Drain Charge		Q _{GD}			13		nC
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =0V, I _S =20A		0.9	1.2	V
Maximum Continuous Drain-Source Diode Forward Current		I _S				20.6	A
Reverse Recovery Current		I _{RRM}	V _R =480V, I _F =I _S dI _F /dt=100A/μs (Note 1)		35		A
Reverse Recovery Time		t _{rr}			460		ns
Reverse Recovery Charge		Q _{RR}			3.8		μC

Note:1. Repetitive Rating : Pulse width limited by maximum junction temperature

2. $I_{AS}=4A, V_{DD}=50V, R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$

3. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 1\%$.

Typical characteristics Diagrams

Figure 1. Output Characteristics

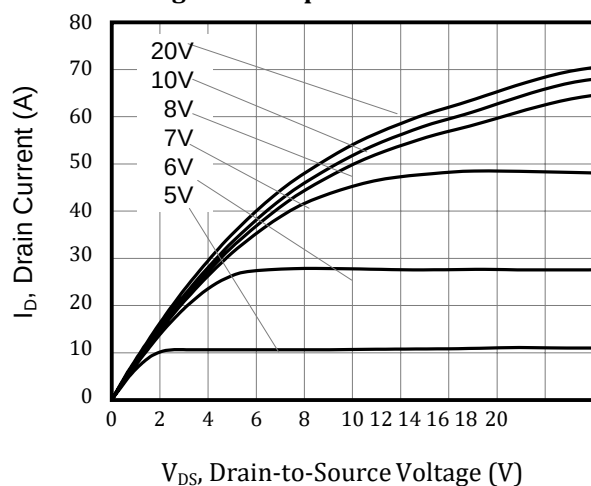


Figure 2. Transfer Characteristics

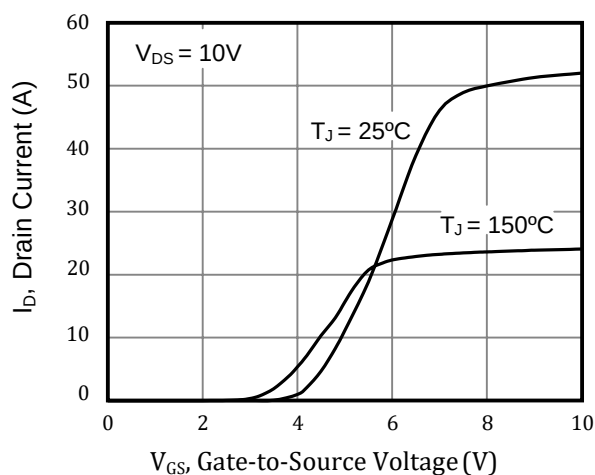


Figure 3. On-Resistance vs. Drain Current

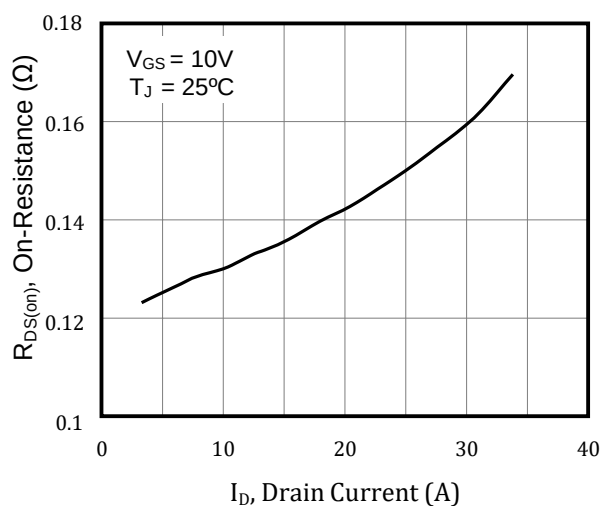


Figure 4. Capacitance

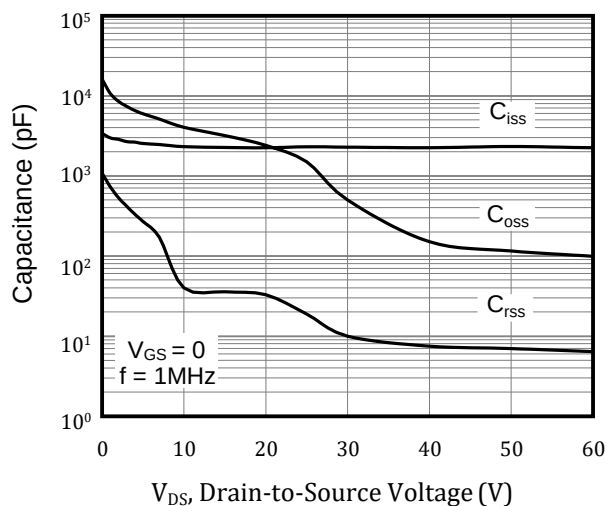


Figure 5. Gate Charge

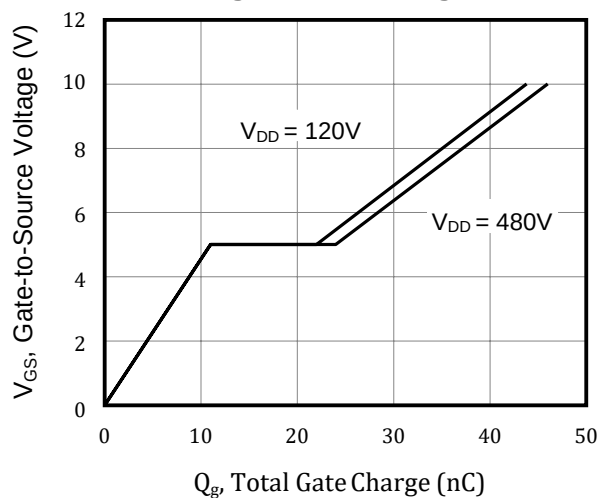
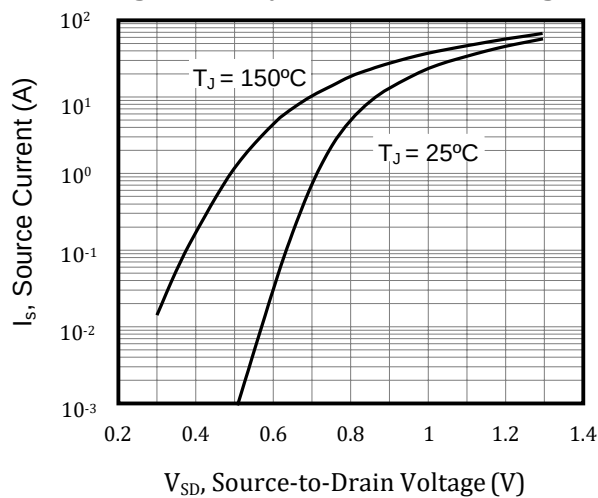


Figure 6. Body Diode Forward Voltage



Typical characteristics Diagrams

Figure 7. On-Resistance vs. Junction Temperature

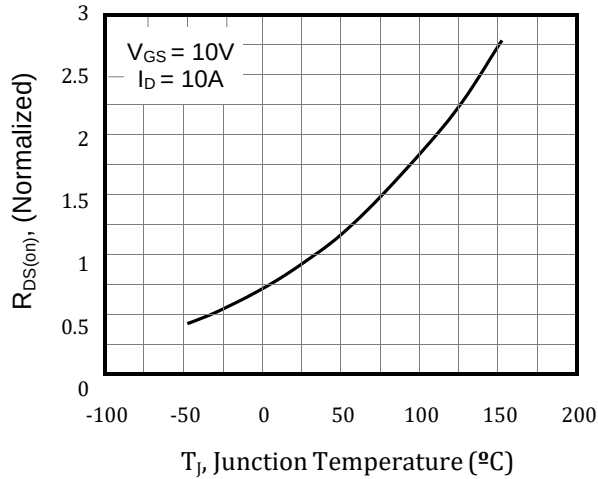


Figure 8. Threshold Voltage vs. Junction Temperature

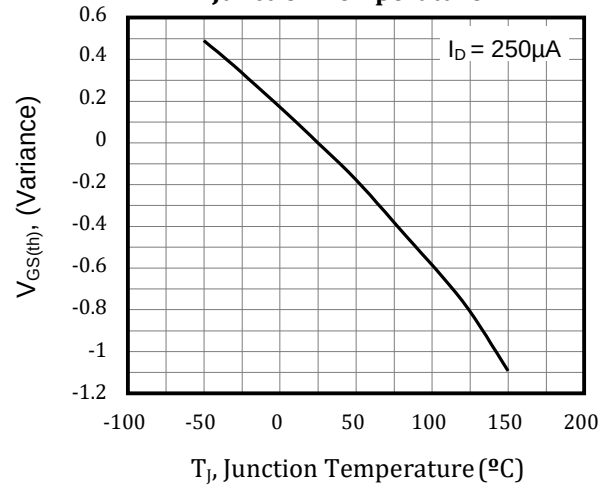


Figure 9. Transient Thermal Impedance TO-220,TO-262,TO-3P/TO-247

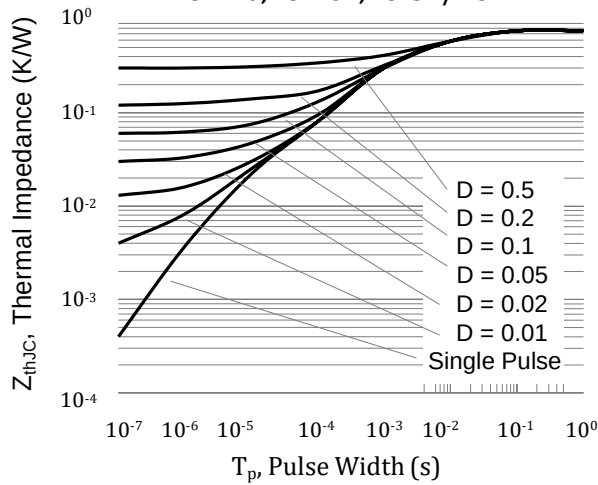
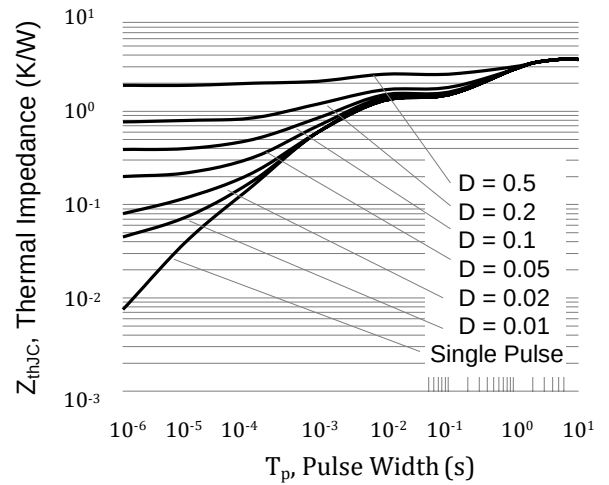


Figure 10. Transient Thermal Impedance TO-220F



TYPICAL TEST CIRCUIT

Figure A: Gate Charge Test Circuit and Waveform

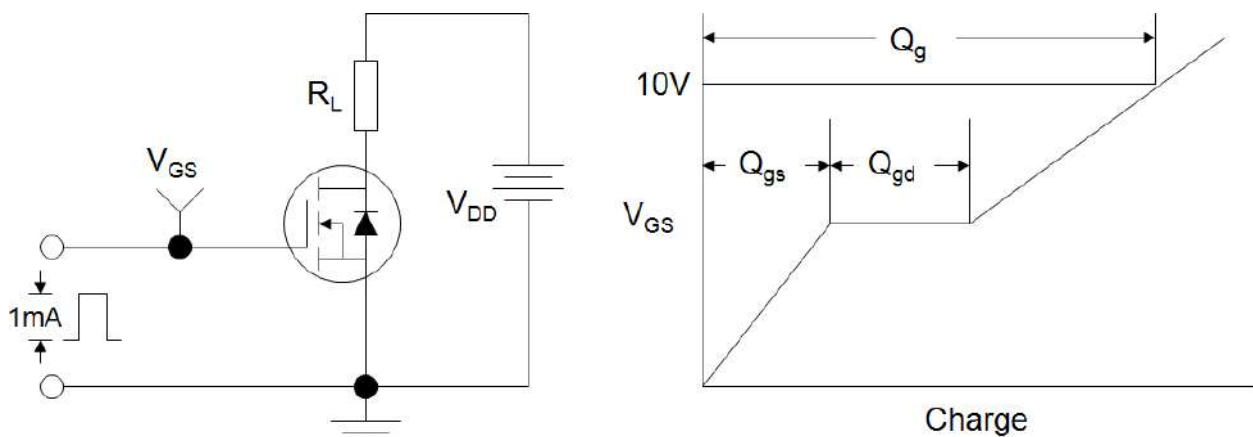


Figure B: Resistive Switching Test Circuit and Waveform

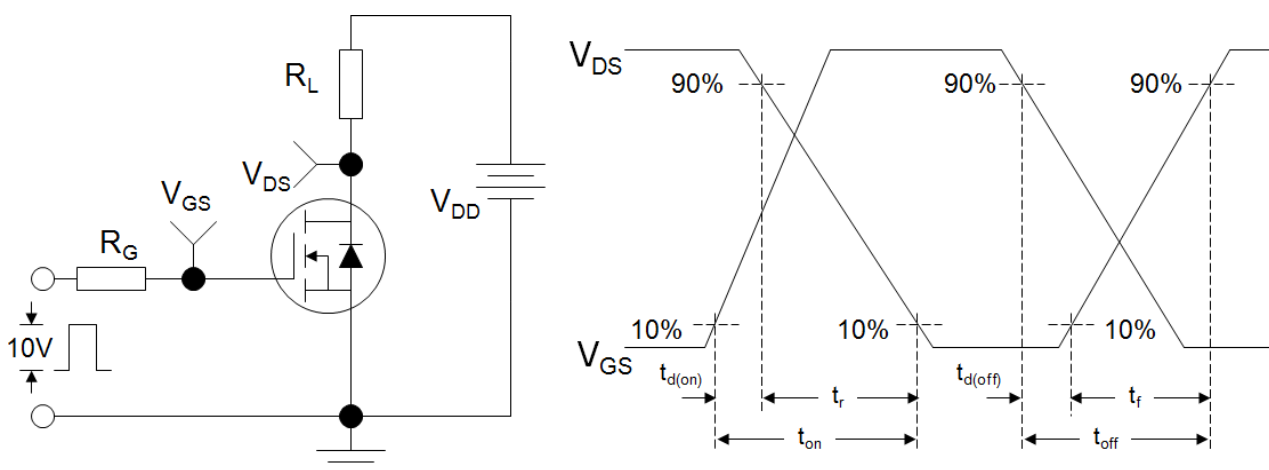
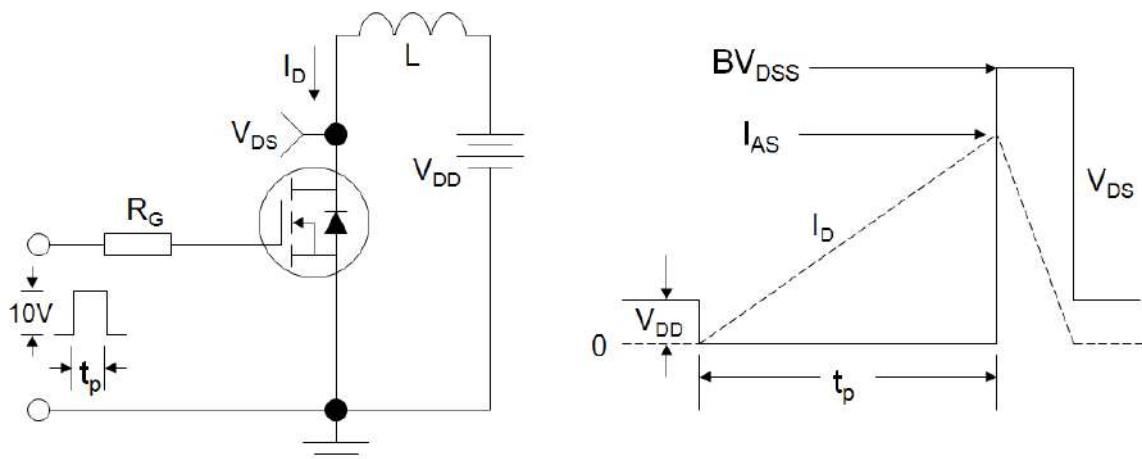
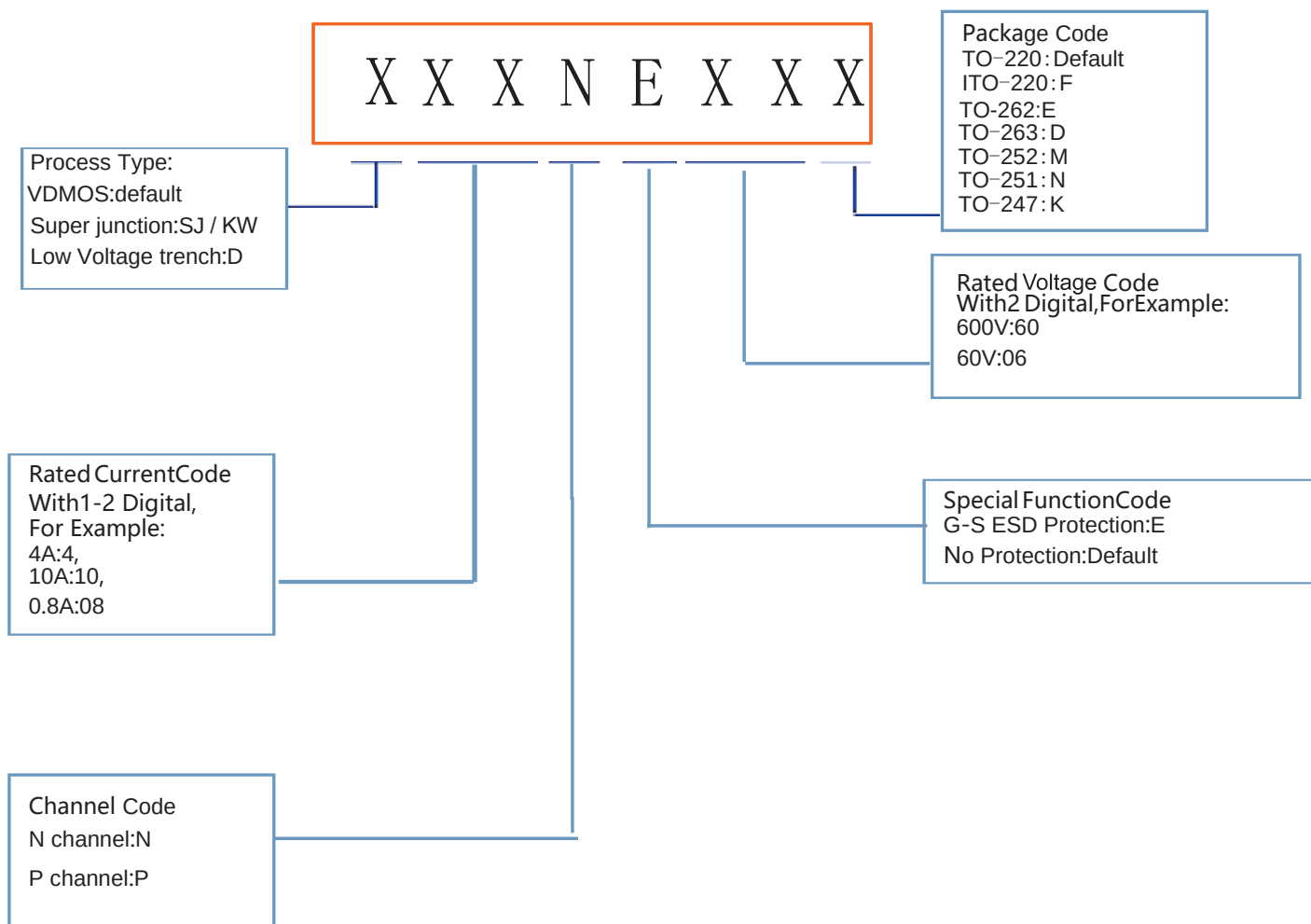


Figure C: Unclamped Inductive Switching Test Circuit and Waveform

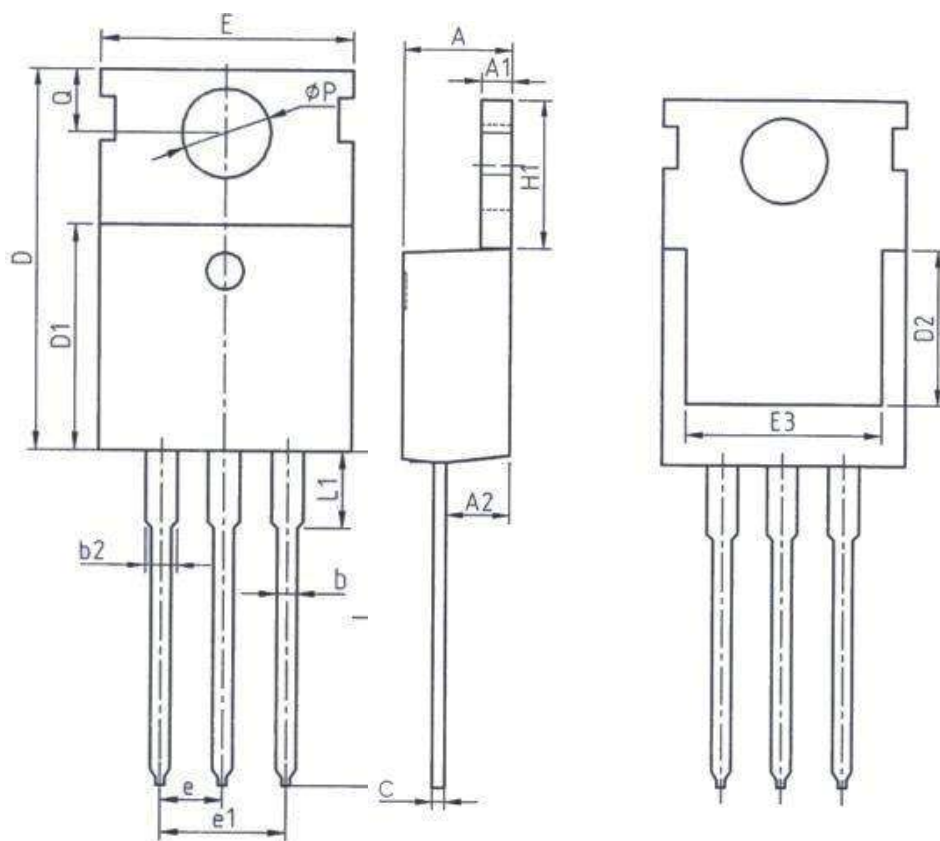


Product Names Rules



Dimensions

TO-220

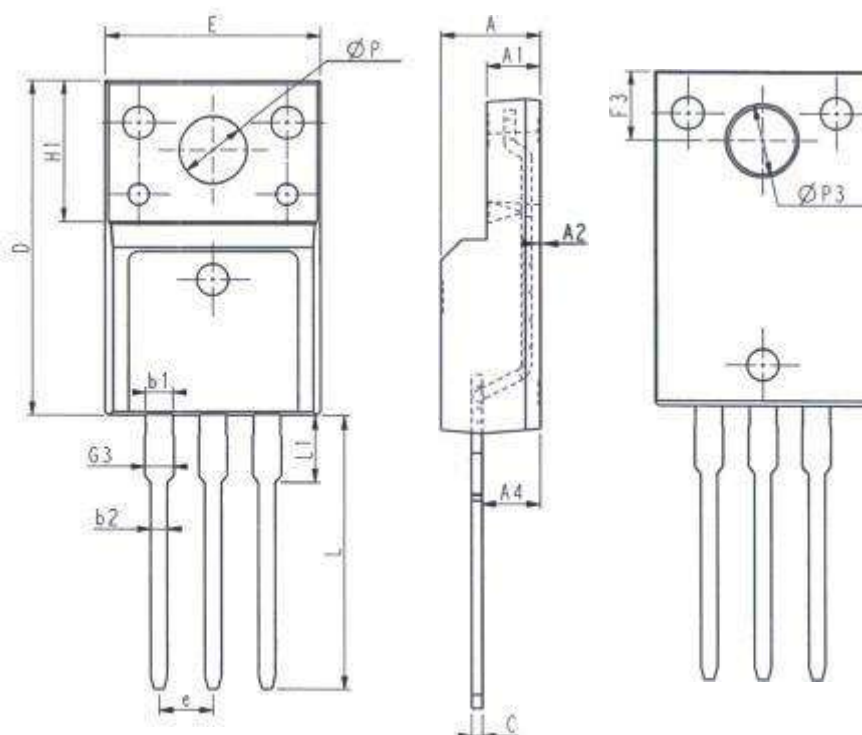


Unit: mm		
Symbol	Min.	Max.
A	4.37	4.77
A1	1.25	1.45
A2	2.20	2.60
b	0.70	0.95
b2	1.17	1.47
c	0.40	0.65
D	15.10	16.10
D1	8.80	9.40
D2	5.50	—

Unit: mm		
Symbol	Min.	Max.
E	9.70	10.30
E3	7.00	—
e	2.54BSC	
e1	5.08BSC	
H1	6.25	6.85
L	12.75	13.80
L1	—	3.40
P	3.40	3.80
Q	2.60	3.00

Dimensions

ITO-220

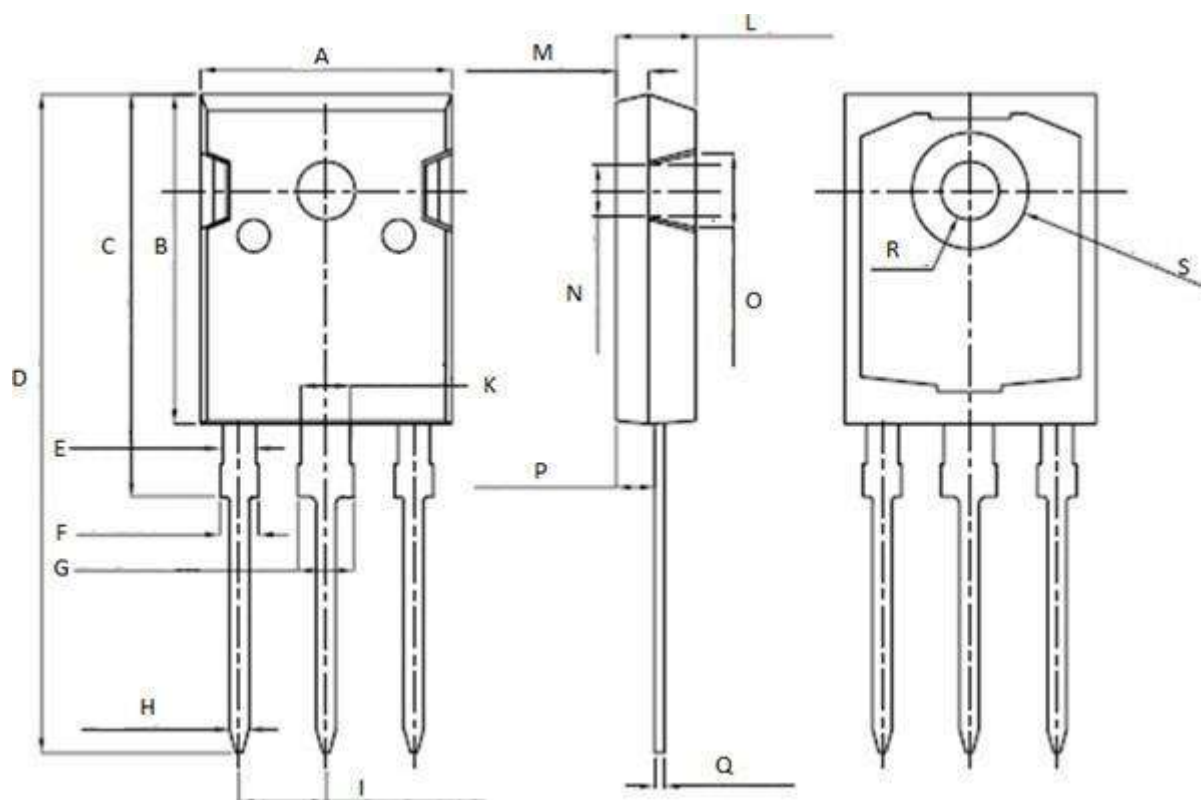


Unit: mm		
Symbol	Min.	Max.
E	9.96	10.36
A	4.50	4.90
A1	2.34	2.74
A2	0.30	0.60
A4	2.56	2.96
c	0.40	0.65
D	15.57	16.17
H1	6.70REF	
e	2.54BSC	

Unit: mm		
Symbol	Min.	Max.
L	12.68	13.28
L1	2.93	3.13
P	3.03	3.38
P3	3.15	3.65
F3	3.15	3.45
G3	1.25	1.55
b1	1.18	1.43
b2	0.70	0.95

Dimensions

TO-247



Unit: mm		
Symbol	Min.	Max.
A	15.95	16.25
B	20.85	21.25
C	20.95	21.35
D	40.5	40.9
E	1.9	2.1
F	2.1	2.25
G	3.1	3.25
H	1.1	1.3
I	5.40	5.50

Unit: mm		
Symbol	Min.	Max.
K	2.90	3.10
L	4.90	5.30
M	1.90	2.10
N	4.50	4.70
O	5.40	5.60
P	2.29	2.49
Q	0.51	0.71
R	φ 3.5	φ 3.7
S	φ 7.1	φ 7.3