

General Description

This series of power MOSFET use N channel Trench Super-Junction technology and design to provide better characteristics, such as fast switchingtime, 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.

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 Package

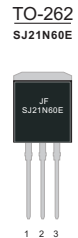
Application

- Switching applications

Ordering Information

Part No.	Package Type	Package	Quality(box)
SJ21N60	TO-220	Tube	1000
SJ21N60F	ITO-220	Tube	1000
SJ21N60D	TO-263	Tape & Reel	800
SJ21N60E	TO-262	Tube	1000
SJ21N60N	TO-251	Tube	1000
SJ21N60M	TO-252	Tape & Reel	3000

Product Summary			
V _{DS}	R _{DS(on)} (Ω) Typ	I _D (A)	Q _g (Typ)
600V	0.13 @ 10V	21	46nc



Block Diagram

Pin Definition:

1. Gate
2. Drain
3. Source

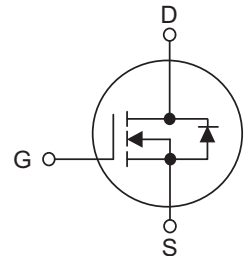


Table1 Absolute Maximum Ratings (T_c=25°C, unless otherwise specified)

Parameter		Symbol	SJ21N60 SJ21N60D SJ21N60E	SJ21N60M SJ21N60N	SJ21N60F	Unit
Drain-Source Voltage		V _{DS}	600			V
Gate-Source Voltage		V _{GS}	±30			V
Continuous Drain Current	T _C =25°C	I _D	21			A
	T _C =100°C		13.2			
Pulsed Drain Current (Note 1)		I _{DM}	63			A
Single Pulse Avalanche Energy(Note 2)		E _{AS}	480			mJ
Avalanche Current(Note 1)		I _{AR}	4			A
Repetitive Avalanche Energy(Note 1)		E _{AR}	0.75			mJ
Power Dissipation T _C =25°C		P _D	151	151	34	W
Operating Junction and Storage Temperature		T _J /T _{STG}	-55 ~ +150			°C

Table 2. Thermal Characteristics

Parameter	Symbol	SJ21N60 SJ21N60D SJ21N60E	SJ21N60M SJ21N60N	SJ21N60F	Unit
Thermal resistance Junction to Ambient	$R_{\theta JA}$	62.5	41.7	62.5	C/W
Thermal resistance Junction to Case	$R_{\theta JC}$	0.83	0.83	3.68	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	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 4)							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} =V _{GS} ,I _D =250μA	2.5		4	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} =10V,I _D =10.5A		130	150	m Ω
Dynamic Characteristics(Note 5)							
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 (Note 5)							
Turn-On Delay Time		t _{d (on)}	V _{DD} =400V,I _D =21A, V _{GS} =10V,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 =21A, 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 =21A			1.2	V
Maximum Continuous Drain-Source Diode Forward Current		I _S				21	A
Reverse Recovery Time		trr	V _{GS} =0V, I _S =5. 5A		280		ns
Reverse Recovery Charge		Q _{RR}	dI _F /dt=100A/μs (Note 1)		3300		nC

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

2 $L=10mH, I_D=9.8A, V_{DD}=50V$, Starting $T_J=25^\circ\text{C}$

3 $I_{SD}\leq 4.5A, di/dt\leq 200A/\mu s, V_{DD}\leq BV_{DSS}$, starting $T_J=25^\circ\text{C}$

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

5 Guaranteed by design, not subject to production

Typical Characteristics Diagrams

Figure 1. Output Characteristics

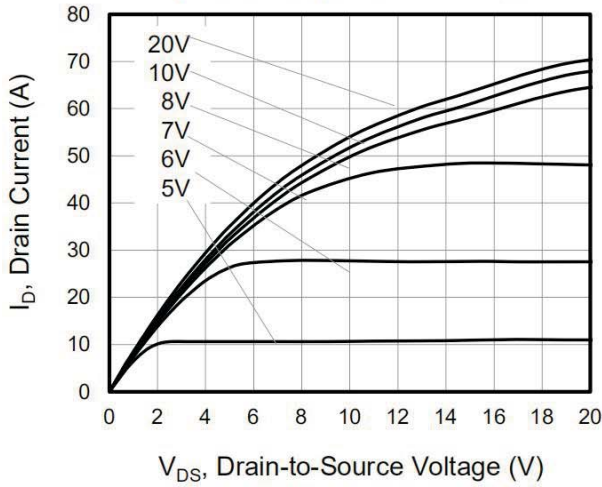


Figure 2. Transfer Characteristics

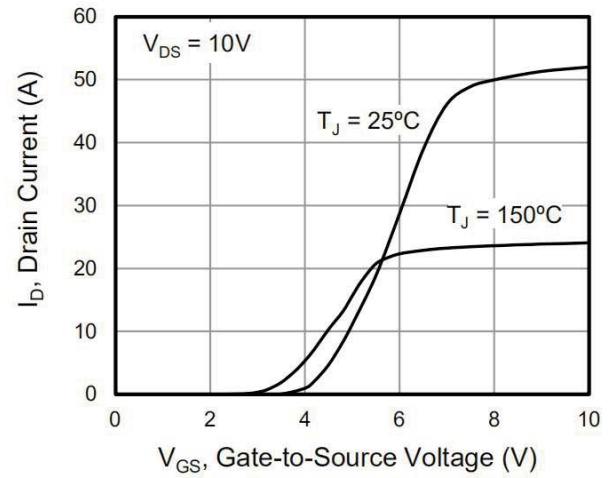


Figure 3. On-Resistance vs. Drain Current

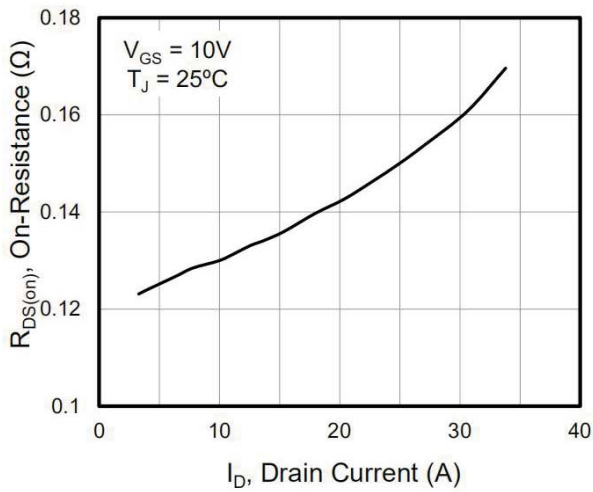


Figure 4. Capacitance

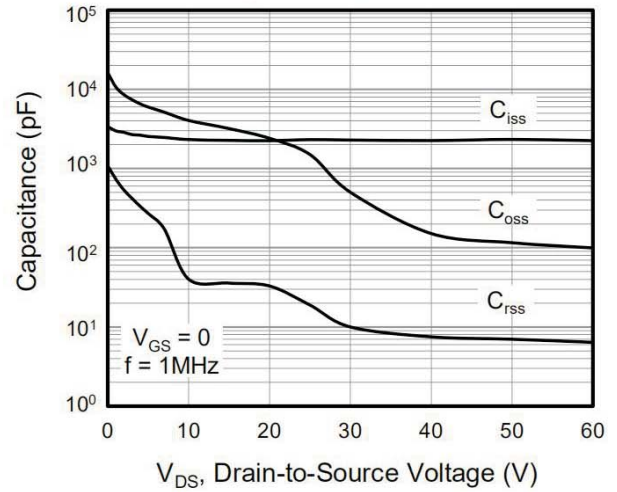


Figure 5. Gate Charge

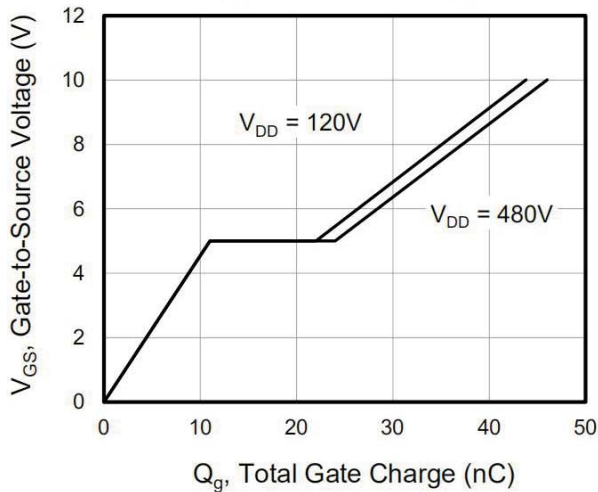
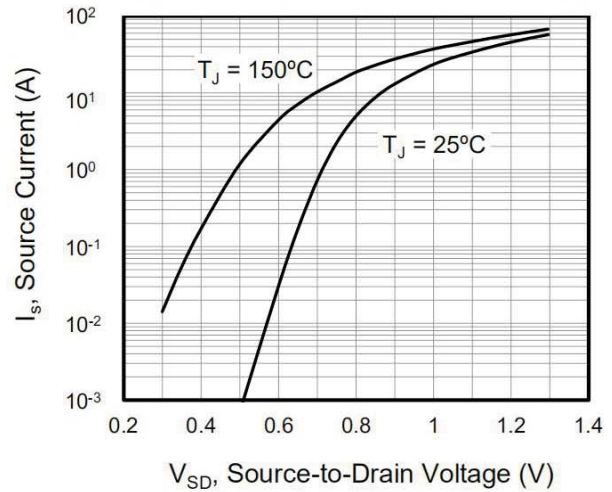


Figure 6. Body Diode Forward Voltage



Typical Characteristics Diagrams

Figure 7. On-Resistance vs. Junction Temperature

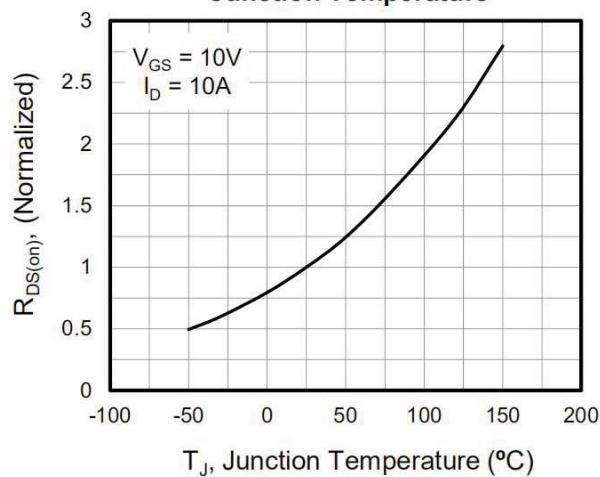


Figure 8. Threshold Voltage vs. Junction Temperature

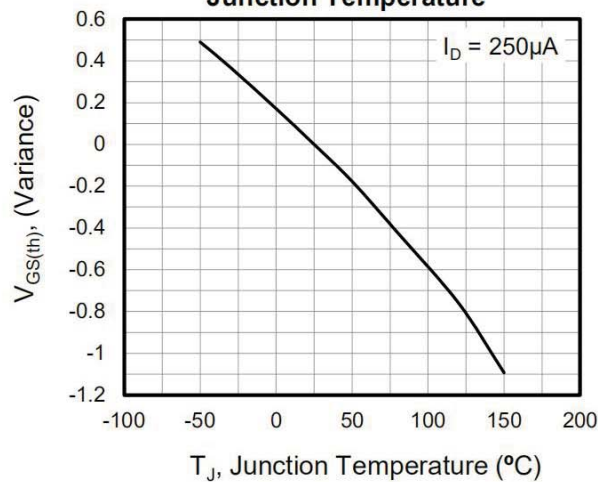


Figure 9. Transient Thermal Impedance TO-220, TO-262

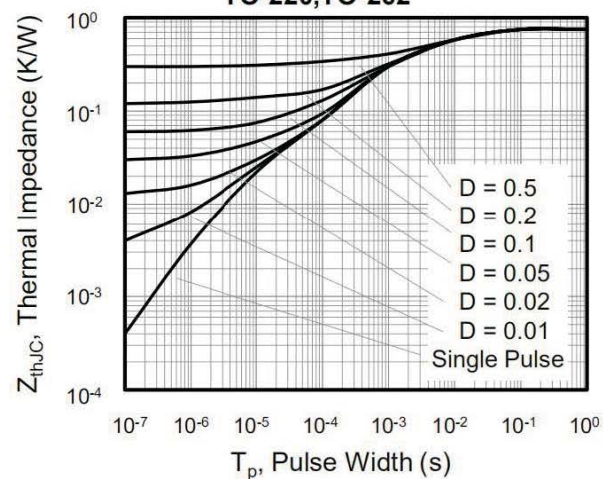
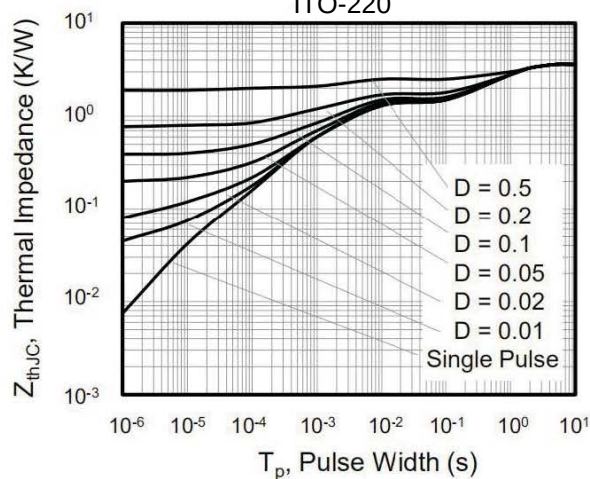
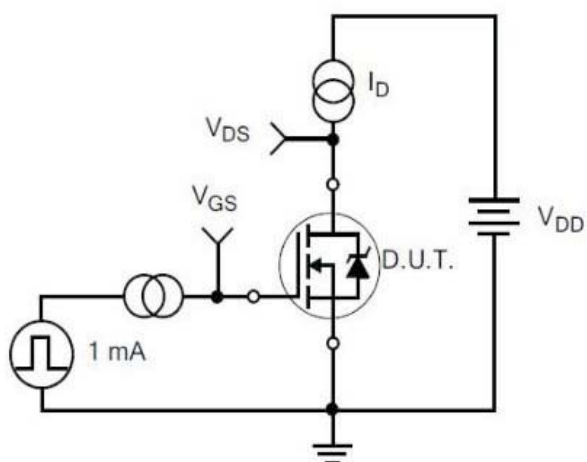


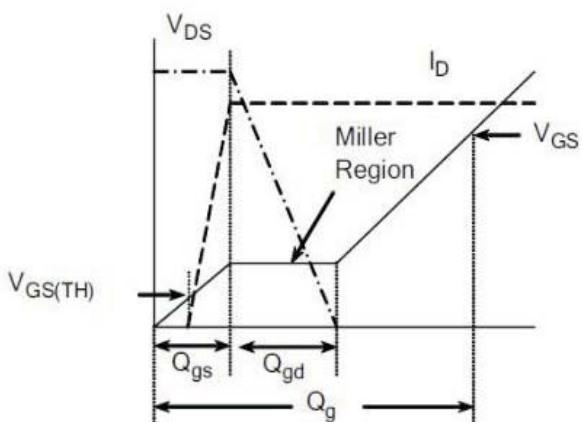
Figure 10. Transient Thermal Impedance ITO-220



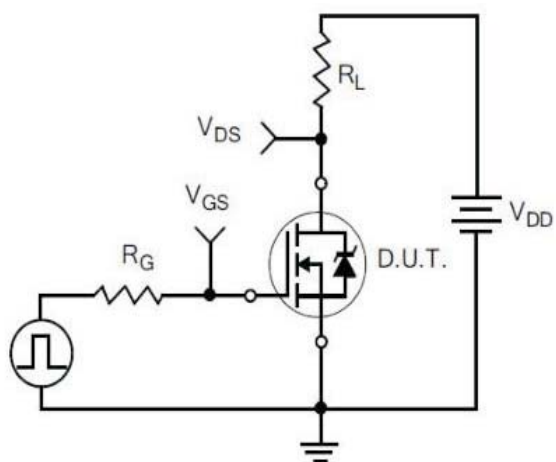
Typical Test Circuit



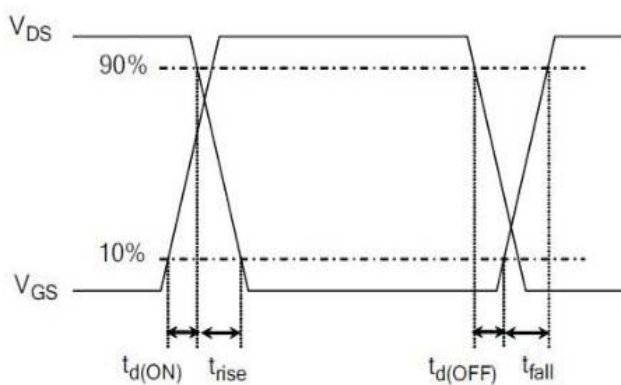
1) Gate Charge Test Circuit



2) Gate Charge Waveform

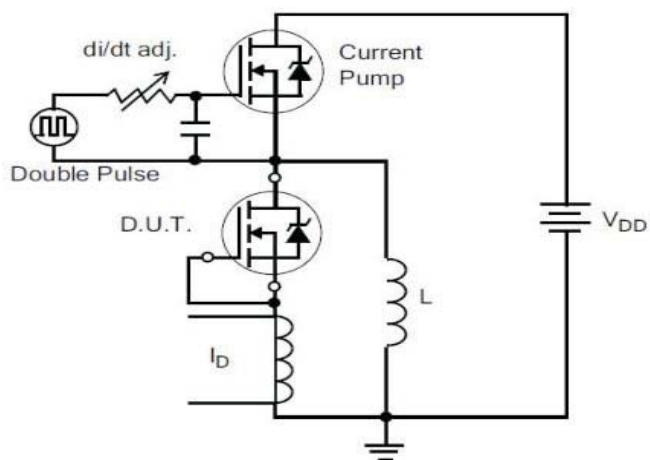


3) Resistive Switching Test Circuit

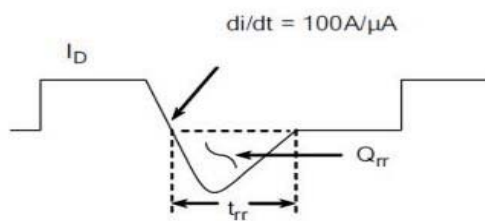


4) Resistive Switching Waveforms

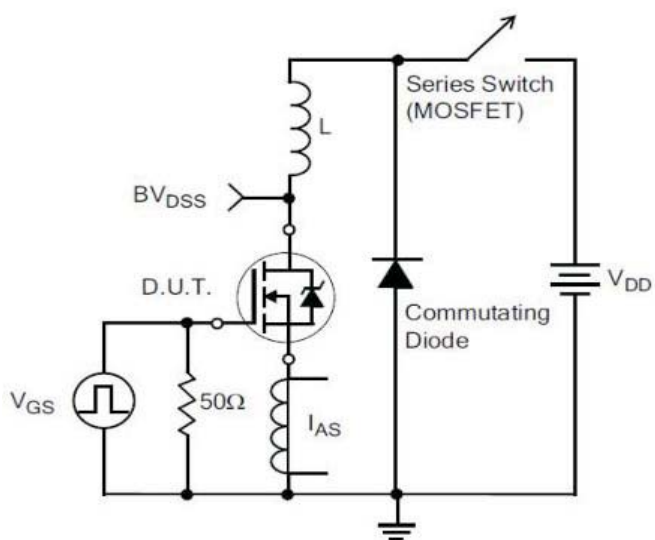
Typical Test Circuit



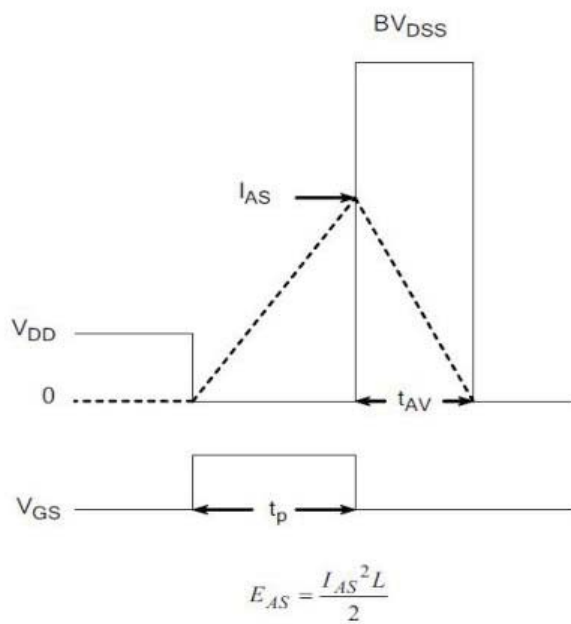
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform

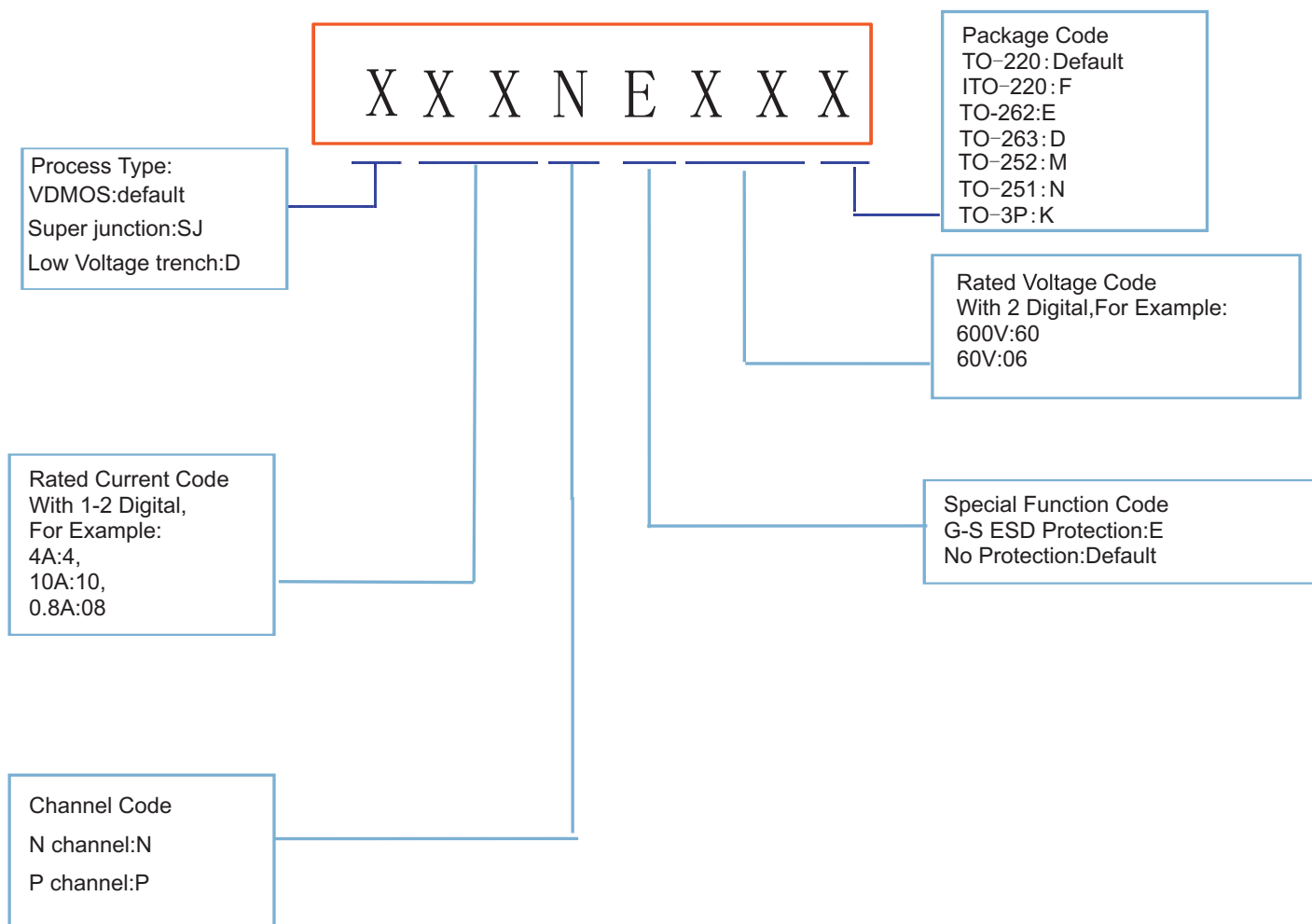


7) . Unclamped Inductive Switching Test Circuit



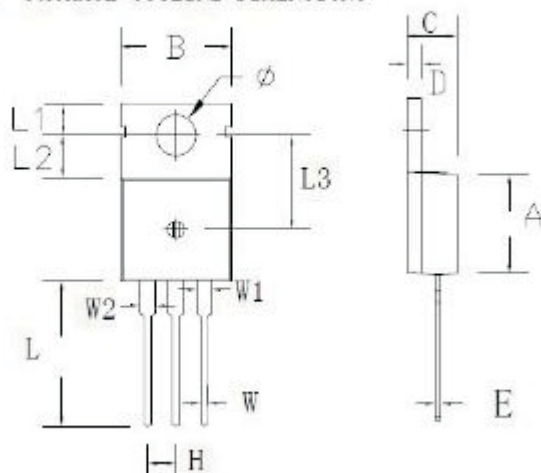
8) Unclamped Inductive Switching Waveforms

Product Names Rules



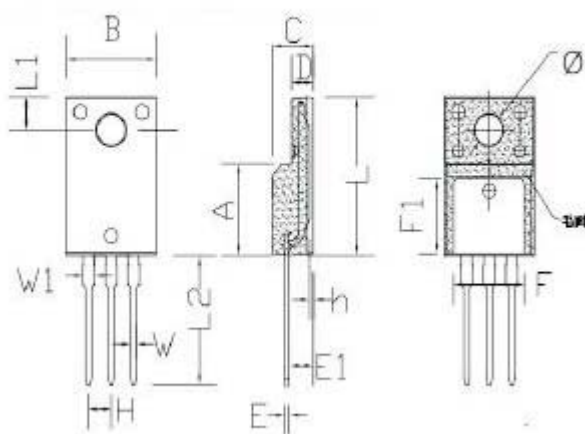
Dimensions

TO-220 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	min.	max.	min.	max.
A	8.80	9.30	0.346	0.366
B	9.70	10.30	0.382	0.406
C	4.25	4.75	0.167	0.187
D	1.20	1.45	0.047	0.057
E	0.40	0.60	0.016	0.024
H	2.54 TYP		0.100 TYP	
W	0.60	0.95	0.024	0.037
W1	1.05	1.45	0.041	0.057
W2	1.20	1.60	0.047	0.063
L	12.60	13.40	0.496	0.528
L1	2.45	2.95	0.096	0.116
L2	3.45	3.95	0.136	0.156
L3	8.15	8.65	0.321	0.341
ϕ	3.50	3.90	0.138	0.154

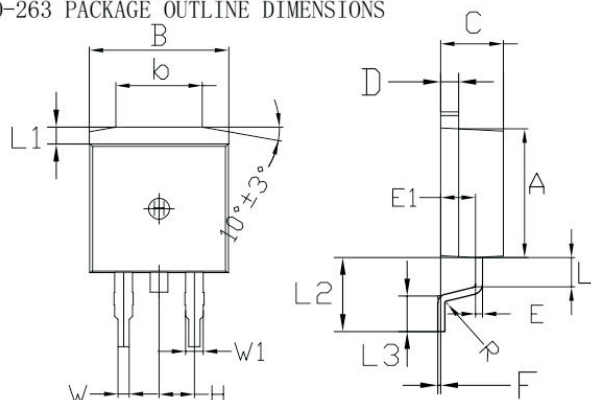
ITO-220 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	min.	max.	min.	max.
A	8.80	9.30	0.346	0.366
B	10.00	10.50	0.394	0.413
C	4.30	4.90	0.169	0.193
D	2.30	2.70	0.091	0.106
L	15.55	16.15	0.612	0.636
h	0.40	0.60	0.016	0.024
L1	3.15	3.55	0.124	0.140
L2	12.65	13.35	0.498	0.526
W	0.70	0.90	0.028	0.035
W1	1.15	1.55	0.045	0.061
H	2.54 TYP		0.100 TYP	
E	0.48	0.53	0.019	0.021
ϕ	2.90	3.40	0.114	0.134
E1	2.40	2.90	0.094	0.114
F	7.75	8.25	0.305	0.325
F1	7.35	7.85	0.289	0.309

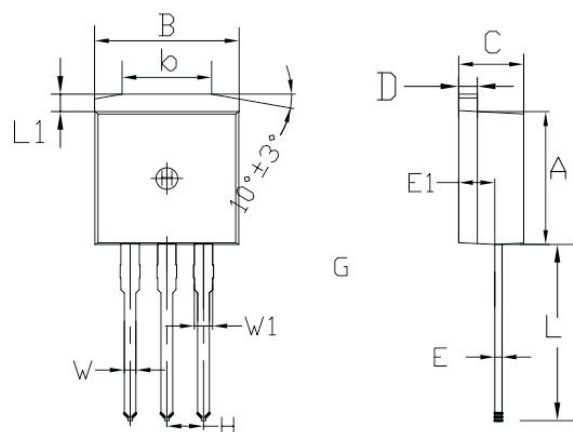
Dimensions

TO-263 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	min.	max.	min.	max.
A	8.80	9.30	0.346	0.366
B	9.70	10.30	0.382	0.406
C	4.25	4.75	0.167	0.187
D	1.20	1.45	0.047	0.057
E	0.40	0.60	0.016	0.024
L	1.90	2.30	0.075	0.091
L1	1.15	1.45	0.045	0.057
R	0.24	0.26	0.0095	0.0102
W	0.80	0.82	0.0315	0.0323
W1	1.20	1.30	0.047	0.051
H	2.54 TYP		0.200 TYP	
b	5.50	6.50	0.216	0.256
E1	2.4	2.6	0.0946	0.1024
L2	5.20	5.80	0.205	0.228
L3	2.20	3.20	0.087	0.126
F	0.03	0.23	0.0012	0.0091

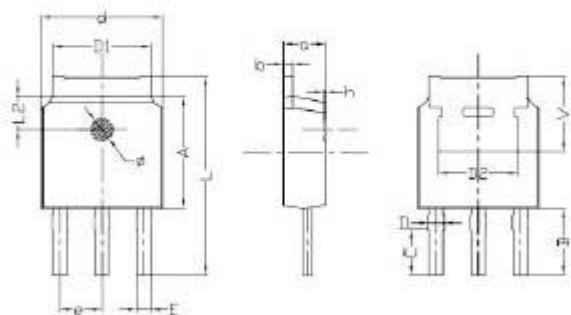
TO-262 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	min.	max.	min.	max.
A	8.80	9.30	0.346	0.366
B	9.70	10.30	0.382	0.406
C	4.25	4.75	0.167	0.187
D	1.20	1.45	0.047	0.057
E	0.40	0.60	0.016	0.024
L	12.25	13.75	0.482	0.541
L1	1.15	1.45	0.045	0.057
E1	2.4	2.6	0.0945	0.1024
W	0.80	0.82	0.0315	0.034
W1	1.20	1.30	0.047	0.051
H	2.54 TYP		0.200 TYP	
b	5.50	6.50	0.216	0.256

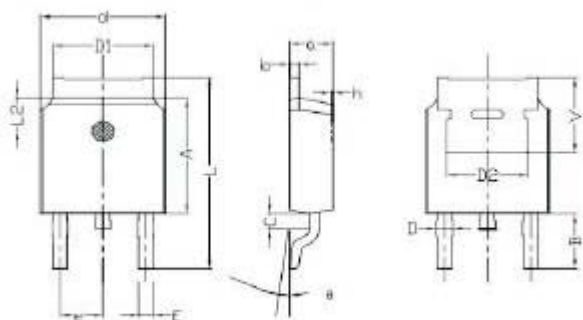
Dimensions

TO-251 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	min.	max.	min.	max.
a	2.20	2.40	0.087	0.0946
b	0.46	0.58	0.018	0.023
C	2.45	2.65	0.097	0.104
D	0.80	0.90	0.032	0.035
d	6.30	6.70	0.248	0.264
D1	5.00	5.50	0.197	0.217
D2	TYP 4.83		TYP 0.190	
A	5.80	6.20	0.228	0.244
e	2.19	2.39	0.086	0.094
L	10.40	11.00	0.4098	0.4334
B	3.50	3.70	0.1379	0.1458
L2	1.5	1.8	0.059	0.071
φ	1.10	1.30	0.0433	0.0512
h	0.00	0.30	0.000	0.012
V	5.25	5.85	0.207	0.230
E	0.60	0.80	0.0236	0.0315

TO-252 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	min.	max.	min.	max.
a	2.20	2.40	0.087	0.095
b	0.46	0.58	0.018	0.023
c	0.70	0.90	0.028	0.035
D	0.80	1.00	0.032	0.039
d	6.30	6.70	0.248	0.264
D1	5.00	5.50	0.197	0.217
D2	TYP 4.83		TYP 0.190	
A	5.80	6.20	0.228	0.244
e	2.19	2.39	0.086	0.094
L	9.40	10.40	0.370	0.409
B	2.6	3.2	0.102	0.126
L2	1.5	1.8	0.059	0.071
θ	0	8	0	8
h	0	0.3	0	0.012
V	5.25	5.85	0.207	0.230