

General Description

These N-channel enhanced VDMOSFETS Used advanced trench technology design, provided excellent $R_{DS(on)}$ and low gate charge. Which accords with the RoHS standard.

Product Summary			
V_{DS}	$R_{DS(on)}$ (m Ω) Typ	I_D (A)	Q_g (Typ)
40V	3.3 @ 10V	120	77nc

Features

- Fast switching
- Low on-resistance
- Low gate charge and input capacitance
- 100% avalanche tested

Mechanical Data

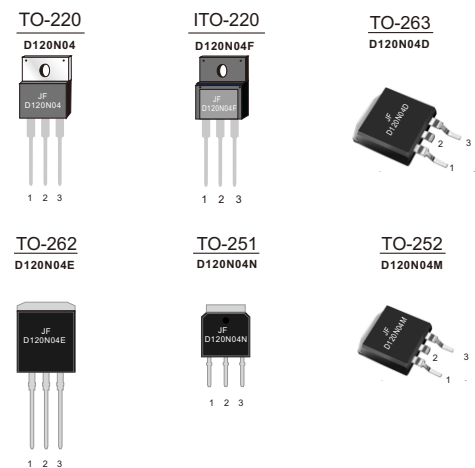
- Case: TO-220, ITO-220, TO-263, TO-262, TO-251, TO-252 Package

Application

- Switching applications

Ordering Information

Part No.	Package Type	Package	Quality(box)
D120N04	TO-220	Tube	1000
D120N04F	ITO-220	Tube	1000
D120N04D	TO-263	Tape & Reel	800
D120N04E	TO-262	Tube	1000
D120N04N	TO-251	Tube	1000
D120N04M	TO-252	Tape & Reel	3000



Block Diagram

Pin Definition:

1. Gate
2. Drain
3. Source

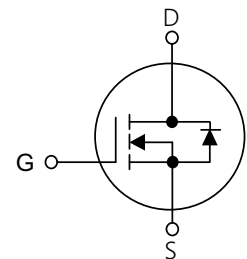


Table1 Absolute Maximum Ratings ($T_C=25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	D120N04/D120N04D/D120N04E	D120N04F	Unit
		D120N04M/D120N04N		
Drain-Source Voltage	V_{DS}	40		V
Gate-Source Voltage	V_{GS}	± 20		V
Continuous Drain Current	I_D	$T_C=25^\circ\text{C}$	120	A
		$T_C=100^\circ\text{C}$	77	
Pulsed Drain Current (Note 1)	I_{DM}	440		A
Single Pulse Avalanche Energy (Note 2)	E_{AS}	960		mJ
Avalanche Current (Note 1)	I_{AR}	50		A
Power Dissipation $T_C=25^\circ\text{C}$	P_D	120	30	W
Operating Junction and Storage Temperature	T_J/T_{STG}	-55~+175		$^\circ\text{C}$

Table 2. Thermal Characteristics

Parameter	Symbol	D120N04/D120N04D/ D120N04M/D120N04N D120N04E	D120N04F	Unit
Thermal resistance Junction to Ambient	$R_{\theta JA}$	75	75	$^{\circ}C/W$
Thermal resistance Junction to Case	$R_{\theta JC}$	1.25	5	$^{\circ}C/W$

Table 3. Electrical Characteristics ($T_J=25^{\circ}C$, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	40	-	-	V
Drain-Source Leakage Current	I_{DSS}	$V_{DS}=40V, V_{GS}=0V$	-	-	1	μA
Gate- Source Leakage Current	Forward	$V_{GS}=20V, V_{DS}=0V$	-	-	100	nA
	Reverse	$V_{GS}=-20V, V_{DS}=0V$	-	-	-100	nA
On Characteristics(Note 4)						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	0.8	1.4	2.0	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=30A$	-	3.3	4.5	m Ω
		$V_{GS}=4.5V, I_D=30A$	-	4.1	5.5	m Ω
Dynamic Characteristics(Note 5)						
Input Capacitance	C_{ISS}	$V_{DS}=25V, V_{GS}=0V, f=1MHz$	-	5952	-	pF
Output Capacitance	C_{OSS}		-	568	-	pF
Reverse Transfer Capacitance	C_{RSS}		-	382	-	pF
Switching Characteristics (Note 5)						
Turn-On Delay Time	$t_d(on)$	$V_{DS}=30V, R_L=2.5\Omega,$ $V_{GS}=10V, R_G=3\Omega$	-	20	-	ns
Turn-On Rise Time	t_r		-	25	-	ns
Turn-Off Delay Time	$t_d(off)$		-	34	-	ns
Turn-Off Fall Time	t_f		-	14	-	ns
Total Gate Charge	Q_G	$V_{DD}=30V, I_D=15A,$ $V_{GS}=10V$	-	77	-	nC
Gate-Source Charge	Q_{GS}		-	28	-	nC
Gate-Drain Charge	Q_{GD}		-	31	-	nC
Drain-Source Diode Characteristics and Maximum Ratings						
Drain-Source Diode Forward Voltage	V_{SD}	$V_{GS}=0V, I_S=30A$	-	0.83	1.2	V
Maximum Continuous Drain-Source Diode Forward Current	I_S		-	-	120	A
Reverse Recovery Time	t_{rr}	$V_{GS}=0V, I_F=15A$	-	28	-	ns
Reverse Recovery Charge	Q_{RR}	$dI_F/dt=100A/\mu s$ (Note 1)	-	22	-	nC

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

2 $L=0.5mH, I_D=62A, V_{DD}=30V,$ Starting $T_J=25^{\circ}C$

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

5 Guaranteed by design, not subject to production

Typical Characteristics Diagrams

Figure1. Output Characteristics

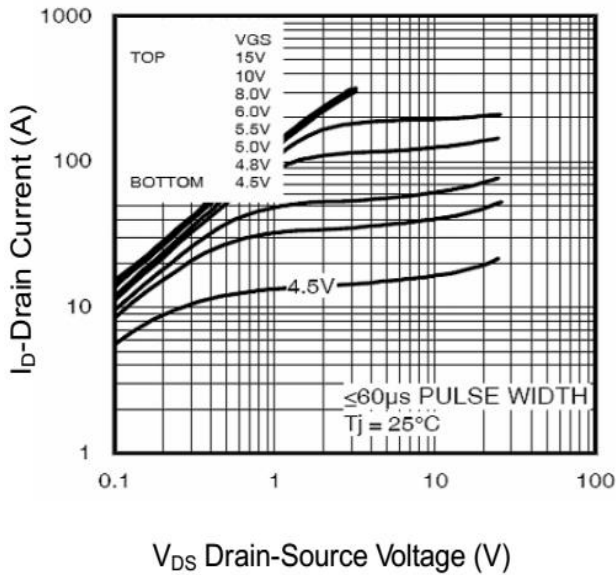


Figure2. Transfer Characteristics

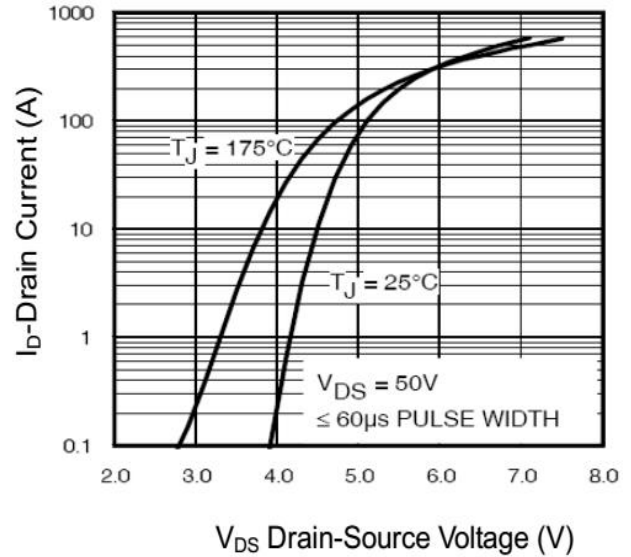


Figure3. BV_{DSS} vs Junction Temperature

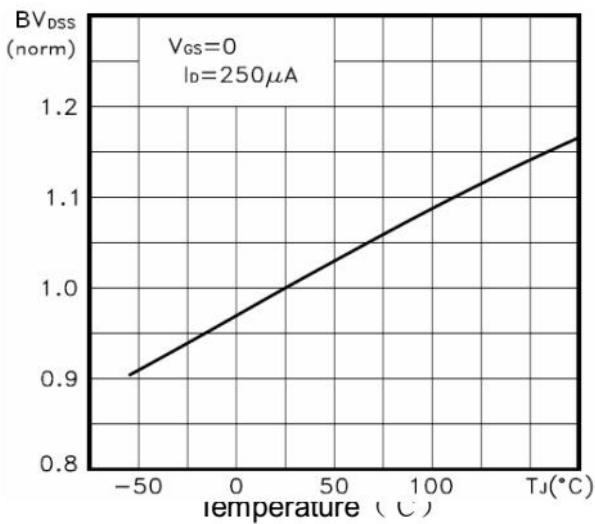
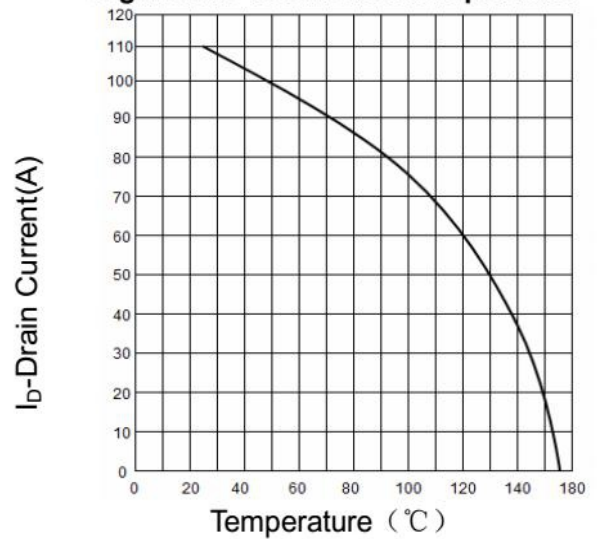


Figure4. ID vs Junction Temperature



Typical Characteristics Diagrams

Figure5. VGS(th) vs Junction Temperature

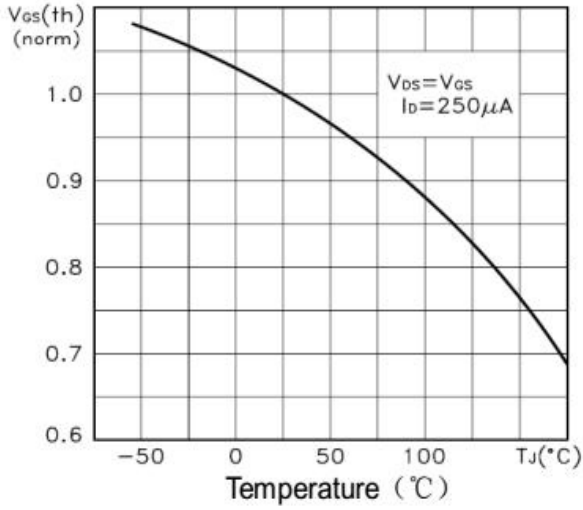


Figure6. Rdson Vs Junction Temperature

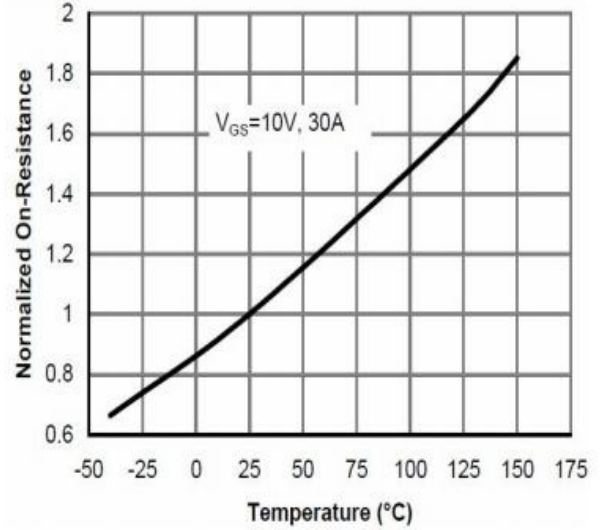


Figure7. Gate Charge

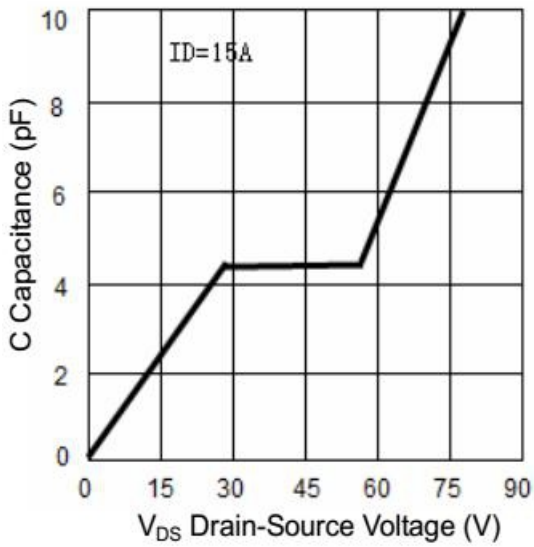
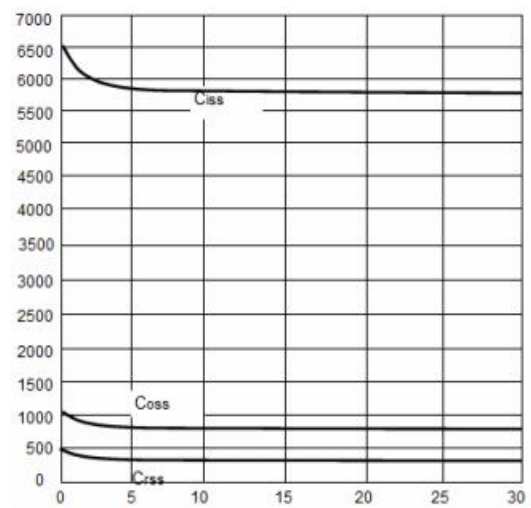


Figure8. Capacitance vs Vds



Typical Characteristics Diagrams

Figure9. Source- Drain Diode Forward

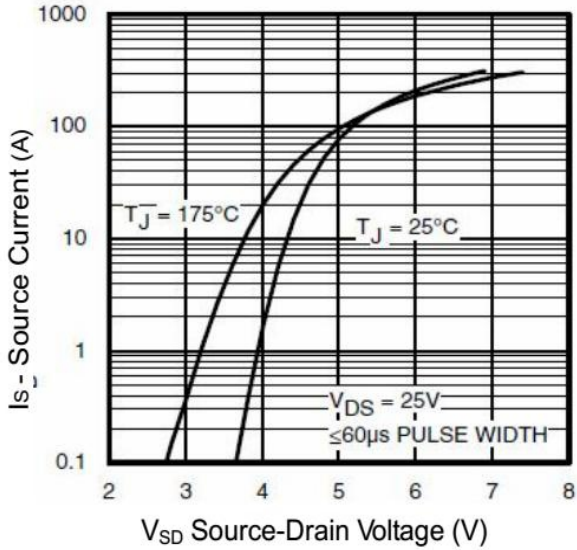


Figure10. Safe Operation Area

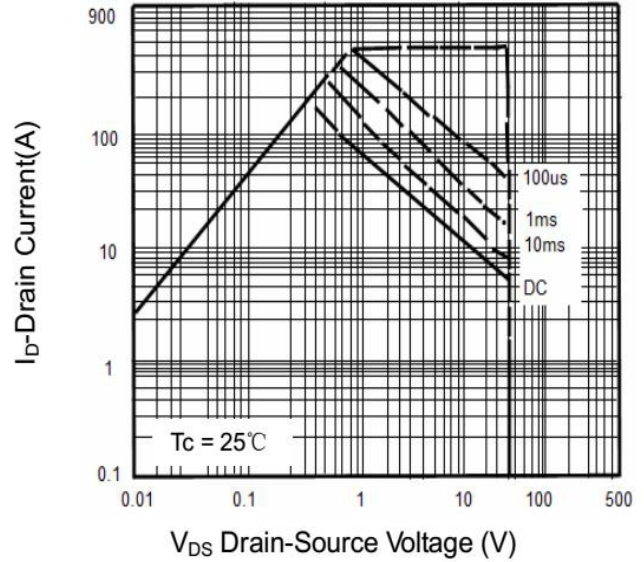
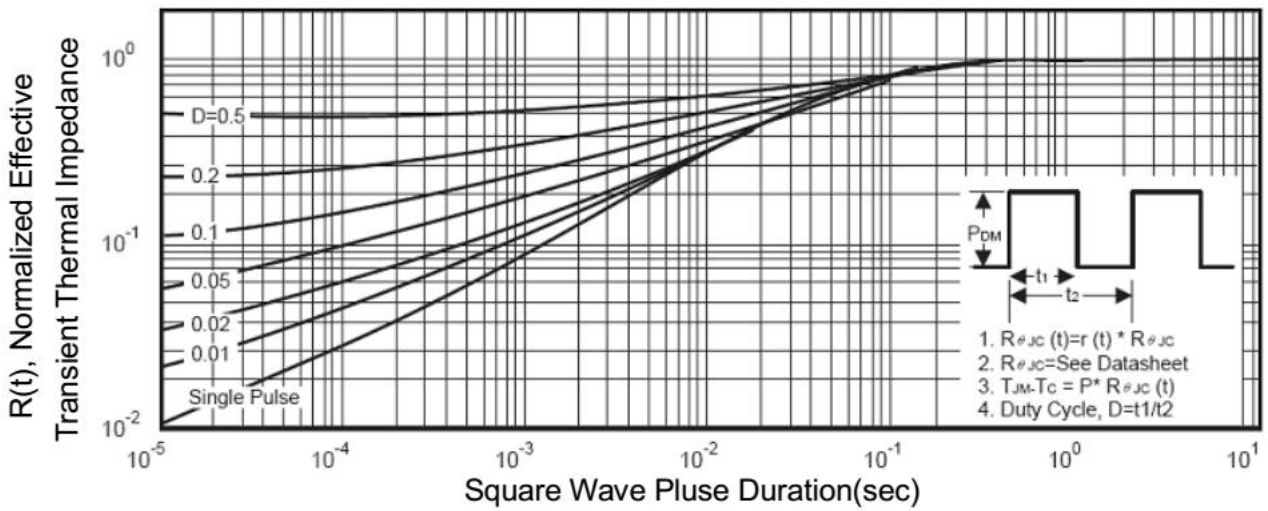
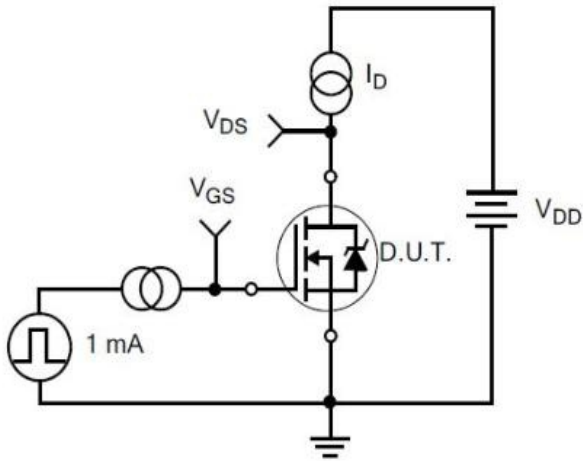


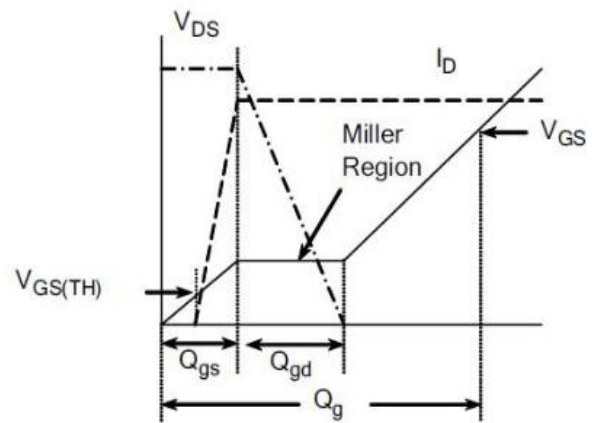
Figure11. Normalized Maximum Transient Thermal Impedance



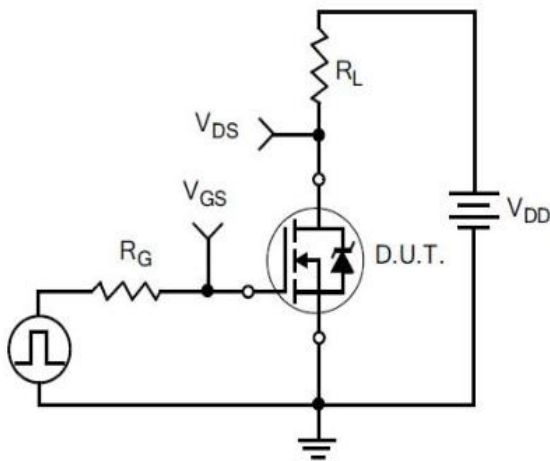
Typical Test Circuit



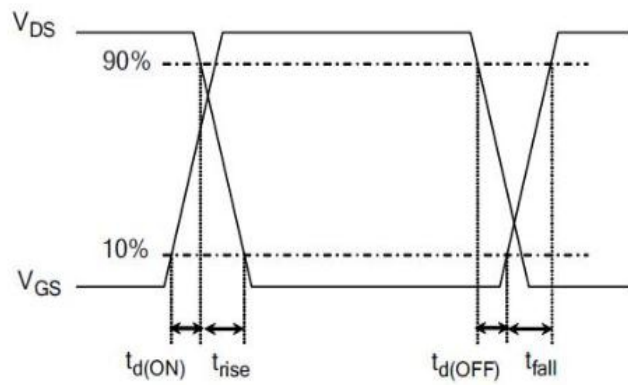
1) Gate Charge Test Circuit



2) Gate Charge Waveform

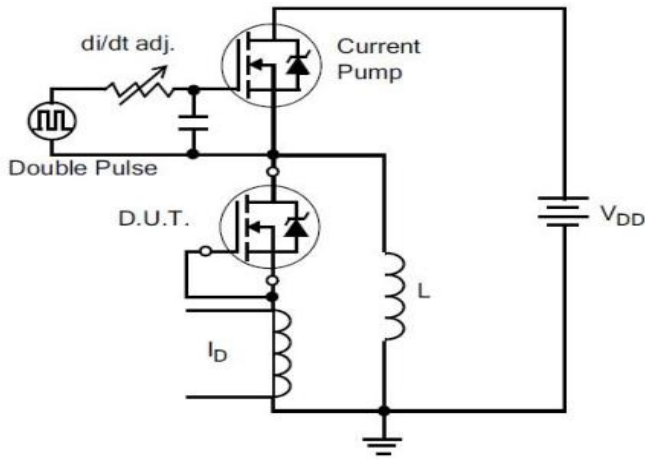


3) Resistive Switching Test Circuit

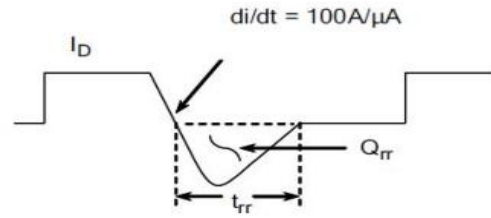


4) Resistive Switching Waveforms

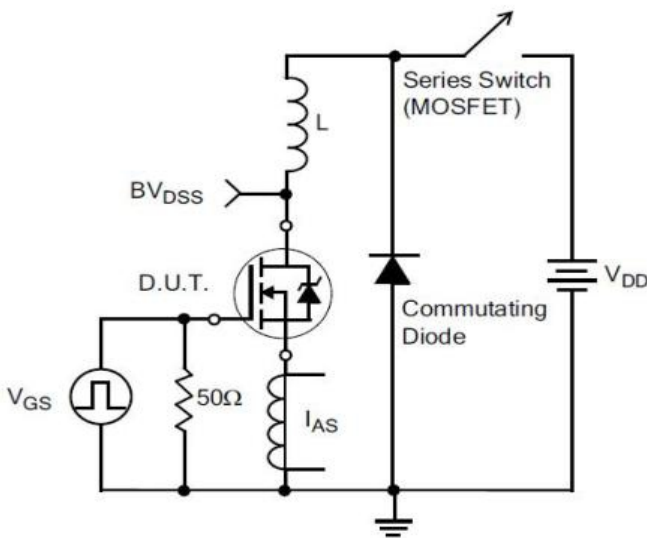
Typical Test Circuit



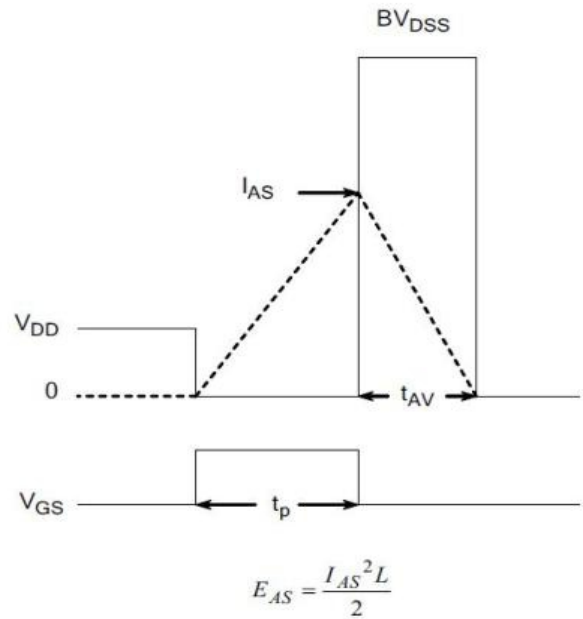
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform

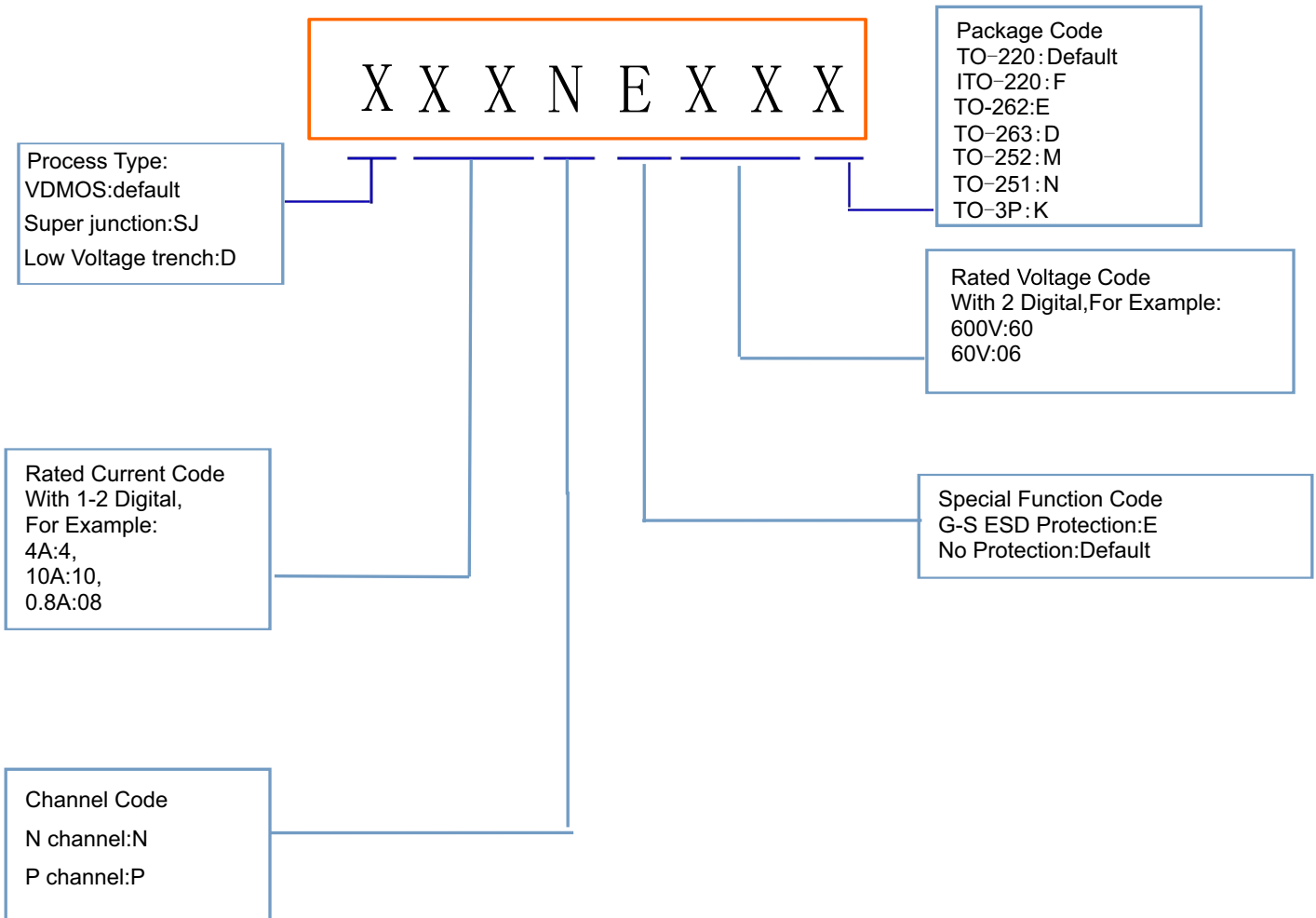


7) . Unclamped Inductive Switching Test Circuit



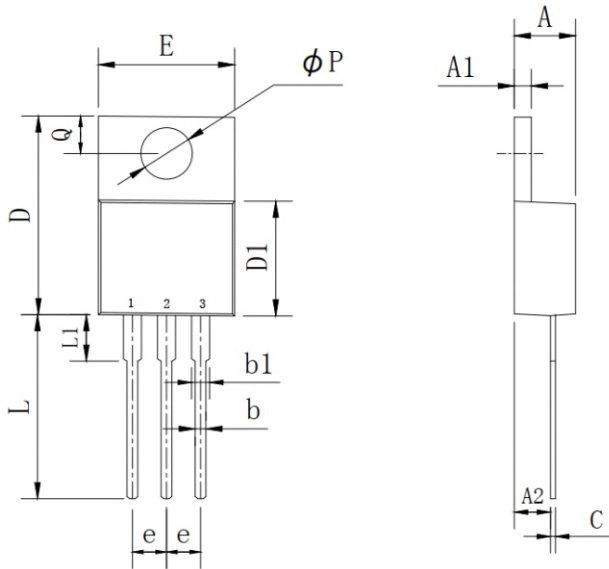
8) Unclamped Inductive Switching Waveforms

Product Names Rules



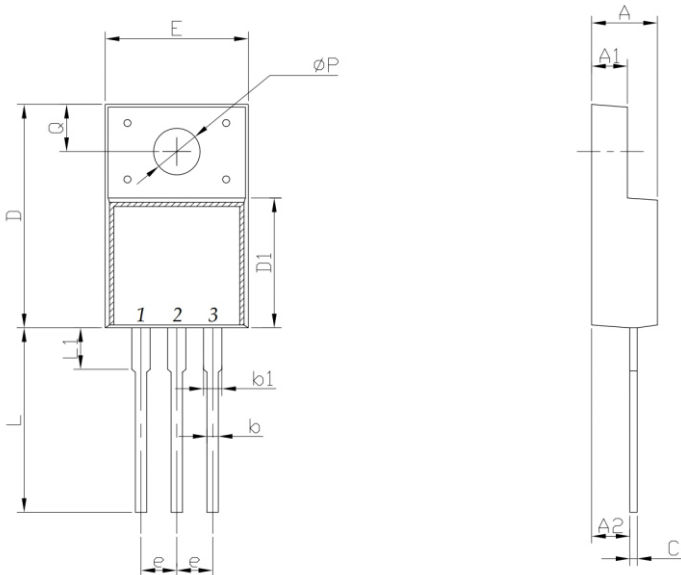
Dimensions

TO-220 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	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

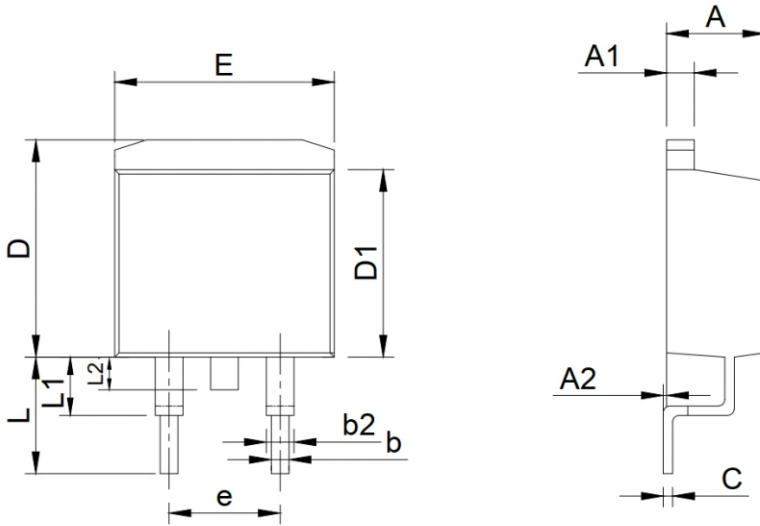
ITO-220 PACKAGE OUTLINE DIMENSIONS



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

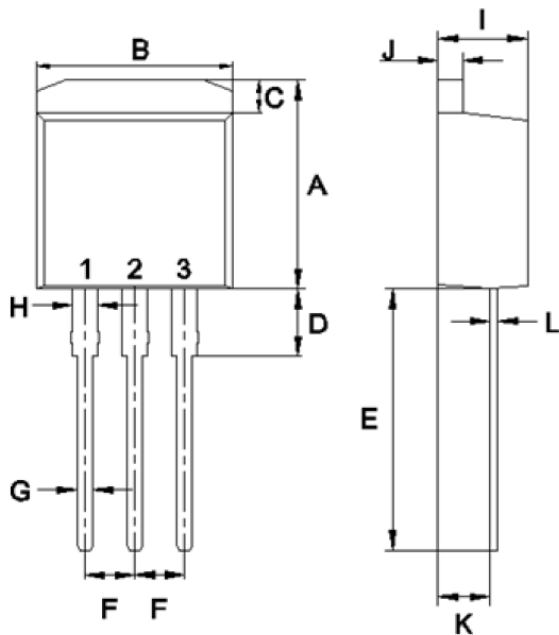
Dimensions

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

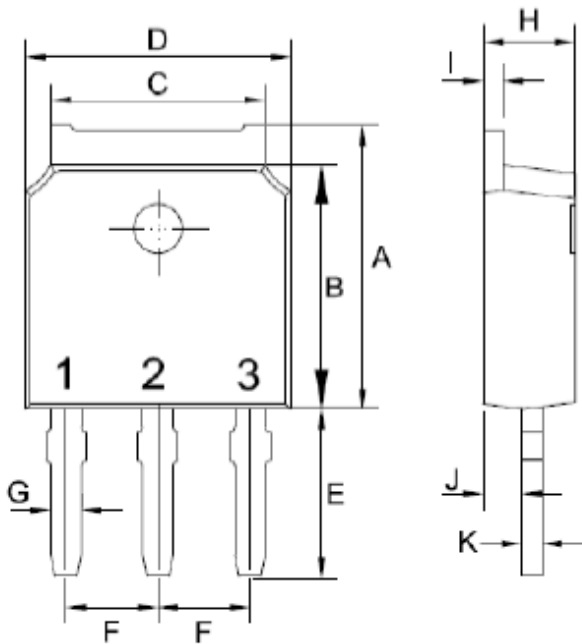
TO-262 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	10.14	11.14	0.399	0.439
B	9.57	10.57	0.377	0.416
C	1.15	1.84	0.045	0.072
D	2.95	3.95	0.116	0.156
E	12.25	13.75	0.482	0.541
F	2.34	2.74	0.092	0.108
G	0.51	1.11	0.020	0.044
H	0.97	1.57	0.038	0.062
I	4.25	4.87	0.167	0.192
J	1.07	1.47	0.042	0.058
K	2.03	2.92	0.080	0.115
L	0.3	0.6	0.012	0.024

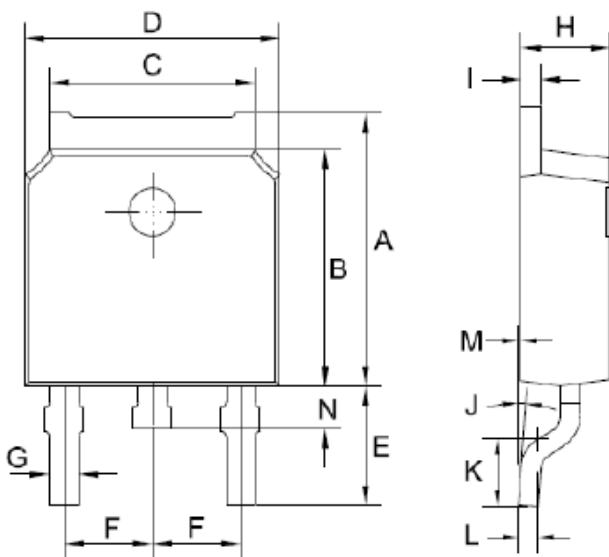
Dimensions

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	0.71	1.31	0.028	0.052
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
P	0.6	1	0.024	0.039

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