

## General Description

These N-channel enhancement mode power mosfets used advanced trench technology design, provided excellent R<sub>ds(on)</sub> and low gate charge. Which accords with the RoHS standard.

## Features

- Fast switching
- Low on-resistance
- Low gate charge
- 100% Single Pulse Avalanche Energy Test

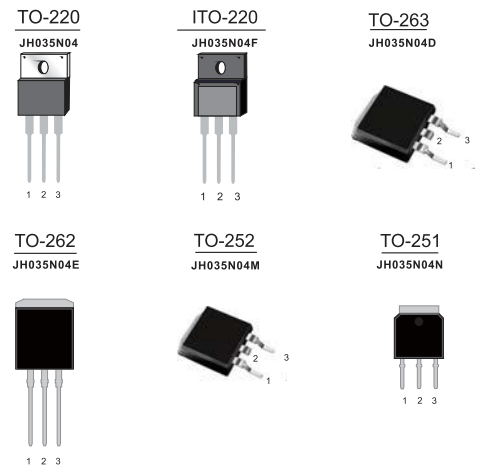
## Mechanical Data

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

## Ordering Information

Part No.	Package Type	Package	Quality(box)
JH035N04	TO-220	Tube	1000
JH035N04F	ITO-220	Tube	1000
JH035N04D	TO-263	Tape & Reel	800
JH035N04E	TO-262	Tube	1000
JH035N04M	TO-252	Tape & Reel	2500
JH035N04N	TO-251	Tube	3000

Product Summary			
V <sub>DS</sub>	R <sub>DS(on)</sub> (mΩ) Typ	I <sub>D</sub> (A)	Q <sub>g</sub> (Typ)
40V	2.3@10V	155	121nc



## Block Diagram

Pin Definition:

1. Gate
2. Drain
3. Source

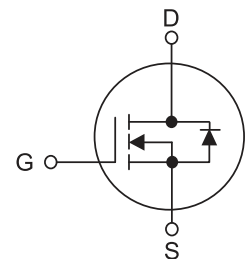


Table1 Absolute Maximum Ratings (T<sub>c</sub>=25°C, unless otherwise specified)

Parameter	Symbol	TO-220/TO-263/TO-262 TO-252/TO-251	ITO-220	Unit
Drain-Source Voltage	V <sub>DS</sub>	40		V
Gate-Source Voltage	V <sub>GS</sub>	±20		V
Continuous Drain Current	I <sub>D</sub>	T <sub>c</sub> =25°C	155	A
		T <sub>c</sub> =100°C	110	
Pulsed Drain Current (Note 1)	I <sub>DM</sub>	520		A
Single Pulse Avalanche Energy(Note 2)	E <sub>AS</sub>	1010		mJ
Power Dissipation T <sub>c</sub> =25°C	P <sub>D</sub>	150	40	W
Isolation Voltage	V <sub>ISO</sub>	/	2500	V
Operating Junction and Storage Temperature	T <sub>J</sub> /T <sub>STG</sub>	-55 ~ +175		°C
Maximum Temperature for soldering	T <sub>L</sub>	300		°C

Table 2. Thermal Characteristics

Parameter	Symbol	TO-220/TO-263/TO-262 TO-252/TO-251	ITO-220	Unit
Thermal resistance Junction to Ambient	$R_{\theta JA}$	75	75	$^{\circ}C/W$
Thermal resistance Junction to Case	$R_{\theta JC}$	1	3.57	$^{\circ}C/W$

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	43	--	V	
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=40V, V_{GS}=0V$	--	--	1	$\mu A$	
Gate- Source Leakage Current	Forward	$I_{GSS}$	$V_{GS}=20V, V_{DS}=0V$	--	--	100	nA
	Reverse					$V_{GS}=-20V, V_{DS}=0V$	-100
On Characteristics(Note 4)							
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.5	2.0	2.5	V	
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=40A$	--	2.3	3.5	m $\Omega$	
Dynamic Characteristics(Note 5)							
Input Capacitance	$C_{ISS}$	$V_{DS}=20V, V_{GS}=0V, f=1MHz$	--	5900	--	pF	
Output Capacitance	$C_{OSS}$		--	690	--	pF	
Reverse Transfer Capacitance	$C_{RSS}$		--	640	--	pF	
Switching Characteristics (Note 5)							
Turn-On Delay Time	$t_d(on)$	$V_{DS}=20V, I_D=40A,$ $V_{GS}=10V, R_{GEN}=3\Omega$	--	28	--	ns	
Turn-On Rise Time	$t_R$		--	68	--	ns	
Turn-Off Delay Time	$t_d(off)$		--	109	--	ns	
Turn-Off Fall Time	$t_f$		--	33	--	ns	
Total Gate Charge	$Q_G$	$V_{DS}=32V, I_D=40A,$ $V_{GS}=10V$	--	121	--	nC	
Gate-Source Charge	$Q_{GS}$		--	17	--	nC	
Gate-Drain Charge	$Q_{GD}$		--	35	--	nC	
Drain-Source Diode Characteristics and Maximum Ratings							
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=30A$	--	0.82	1.2	V	
Maximum Continuous Drain-Source Diode Forward Current	$I_S$		--	--	60	A	
Reverse Recovery Time	$t_{rr}$	$V_{GS}=0V, I_F=40A$ $di/dt=100A/\mu s$ (Note 1)	--	39	--	ns	
Reverse Recovery Charge	$Q_{RR}$		--	41	--	nC	

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

2  $L=0.5mH, I_D=63.5A, V_{DD}=32V, V_{GATE}=40V$ , 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

Figure 1. Typ. Output Characteristics

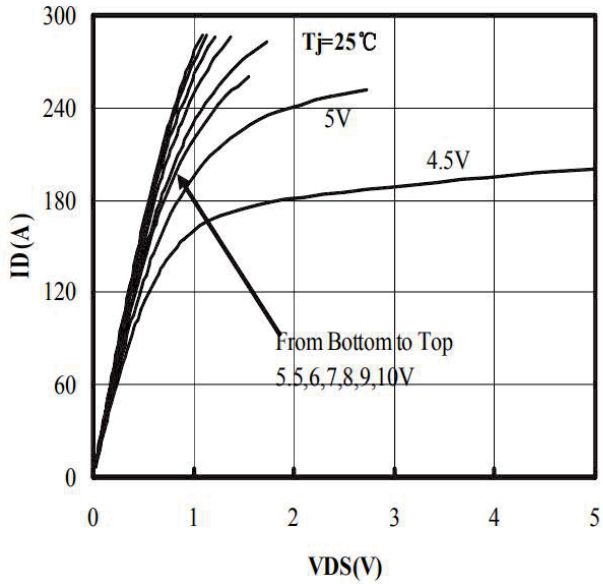


Figure 2. Typ. Output Characteristics

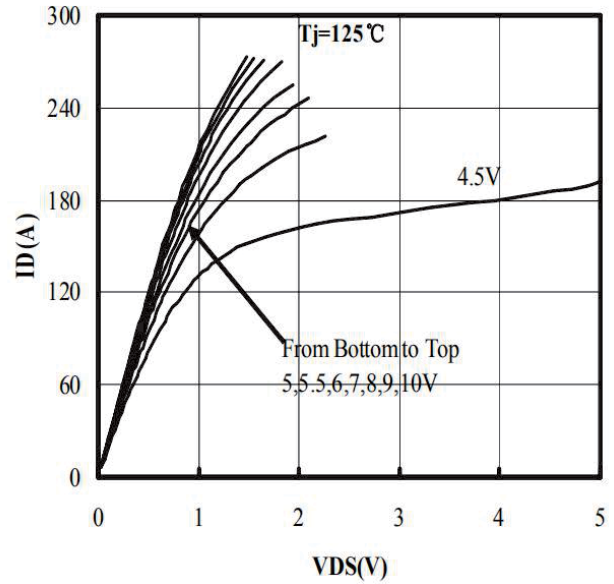


Figure 3. Transfer Characteristics

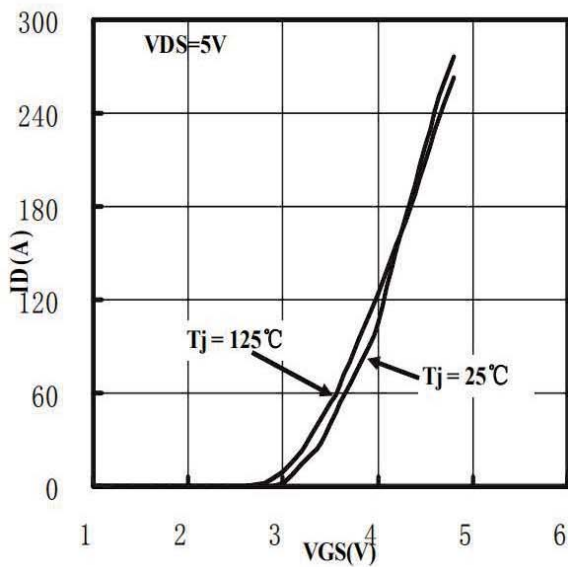
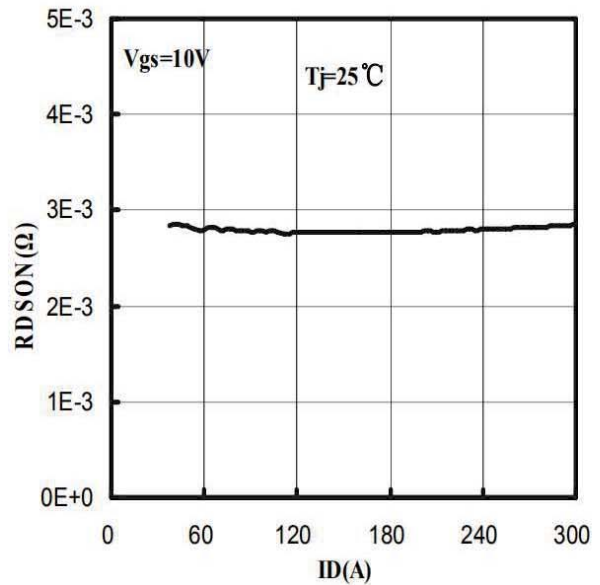


Figure 4. Rdson vs. Drain Current Characteristics



Typical characteristics diagrams

Figure 5. Gate Threshold Voltage Characteristics

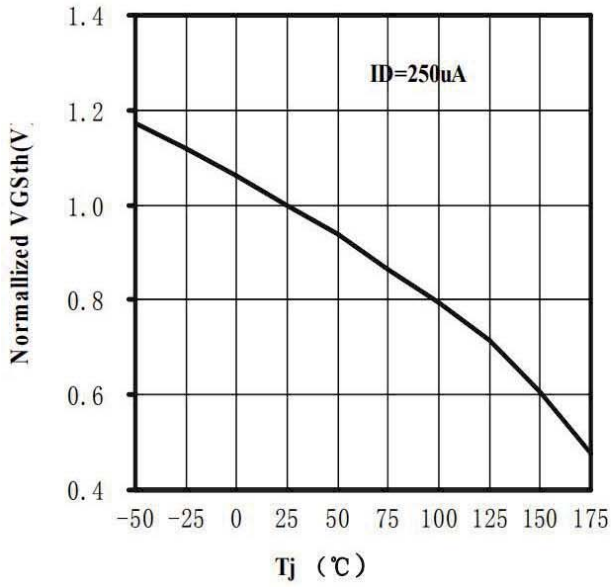


Figure 6. Rdson vs. Junction Tem Characteristics

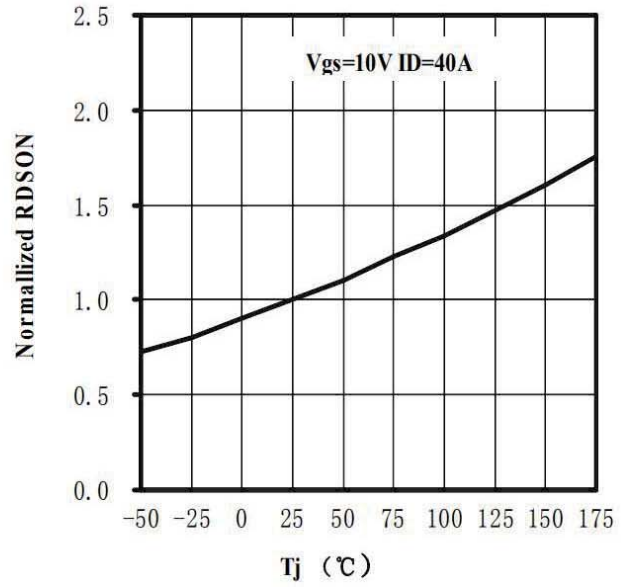


Figure 7. Rdson vs. VGS Characteristics

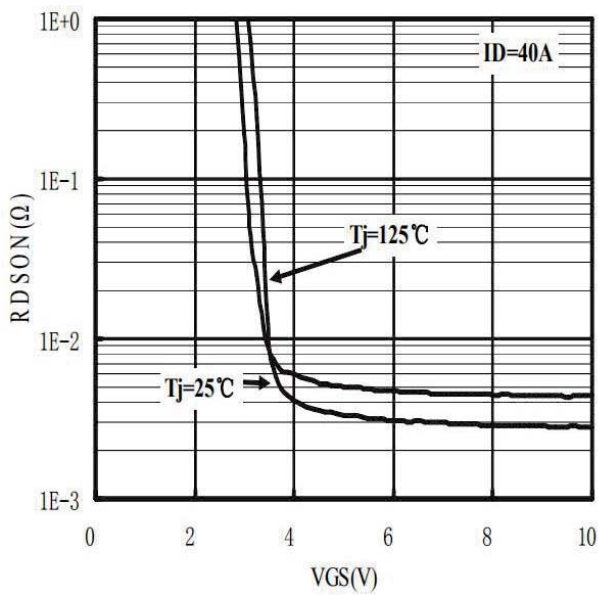
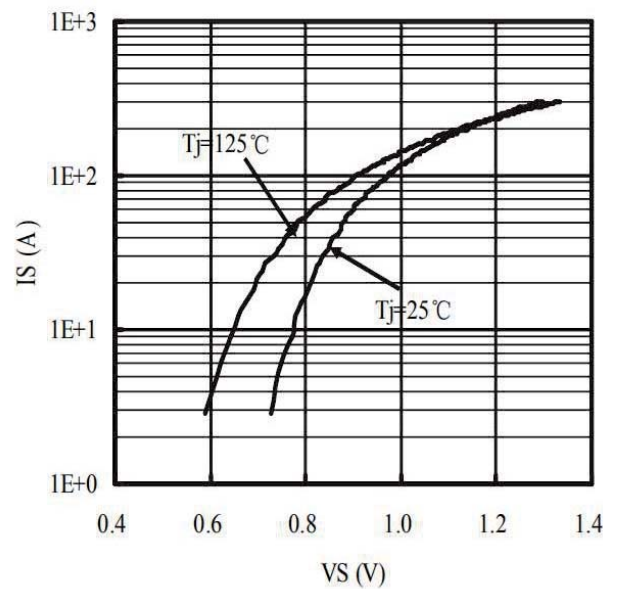


Figure 8. IS vs. VSD Characteristics



Typical characteristics diagrams

Figure 9. Gate Charge Characteristics

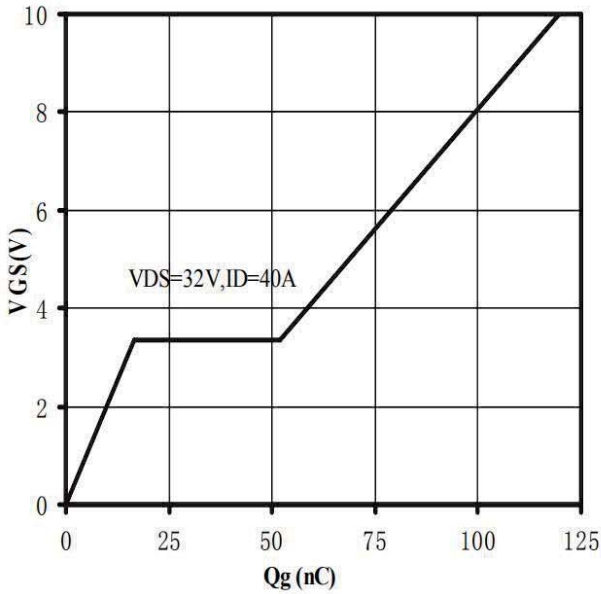


Figure 10. Capacitance Characteristics

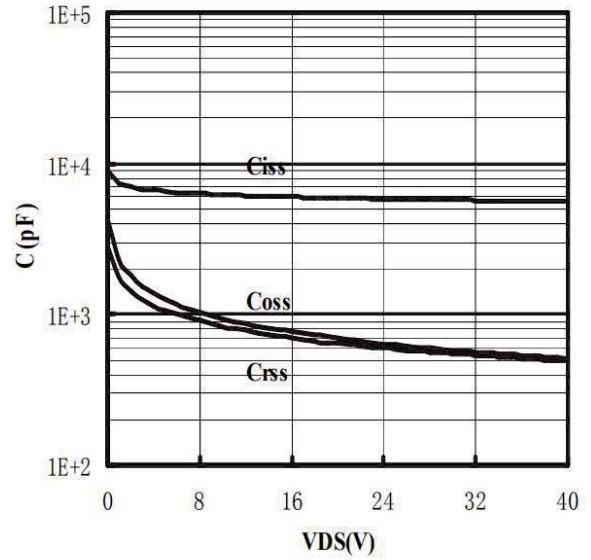


Figure 11. Thermal Resistance Characteristics

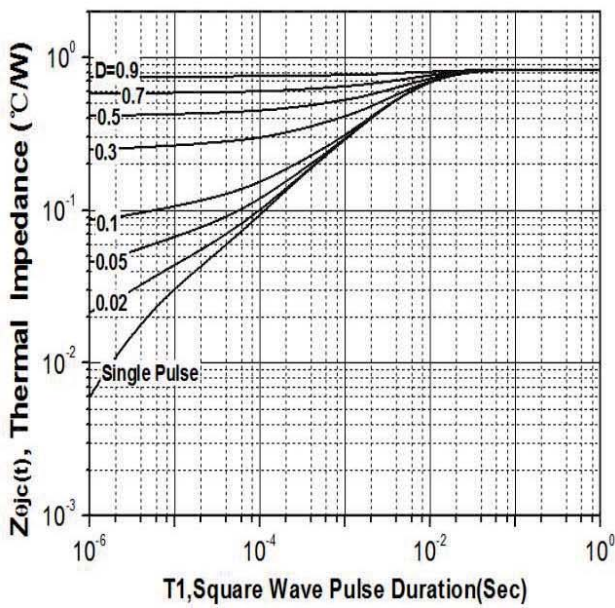
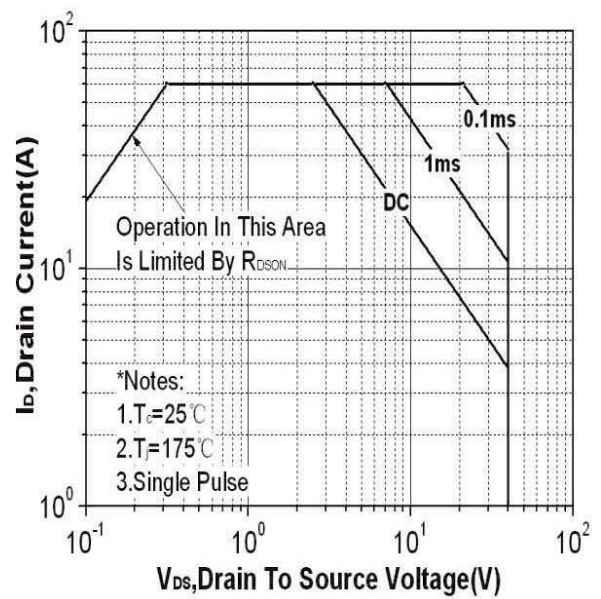
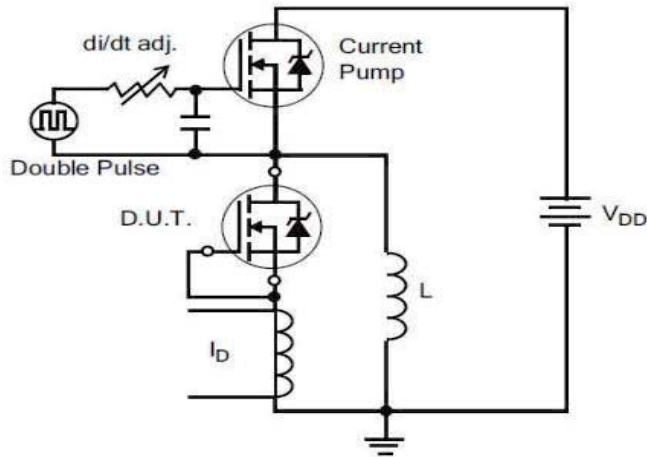


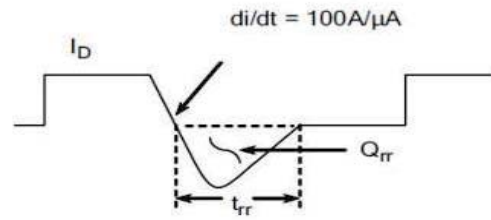
Figure 12. Safe Operating Area



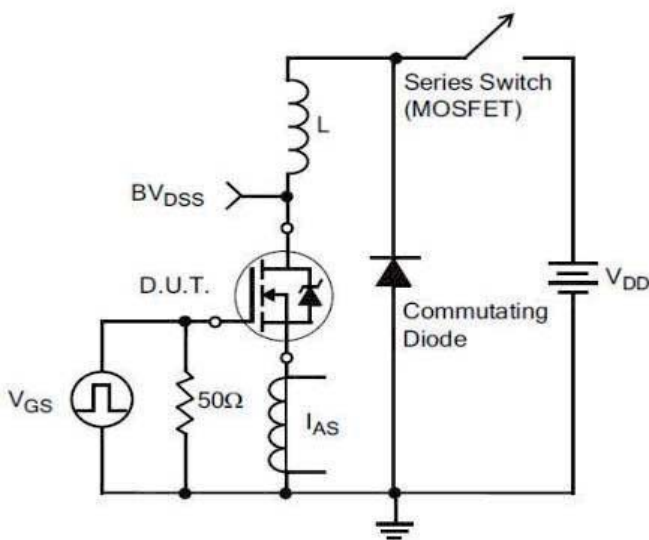
Typical Test Circuit



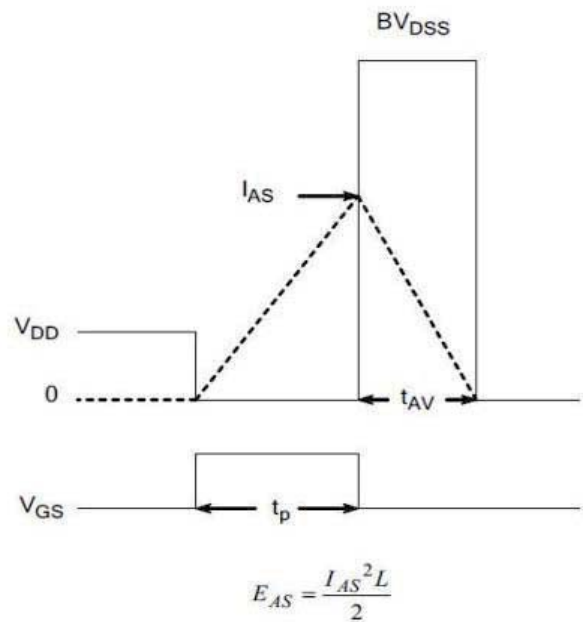
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform

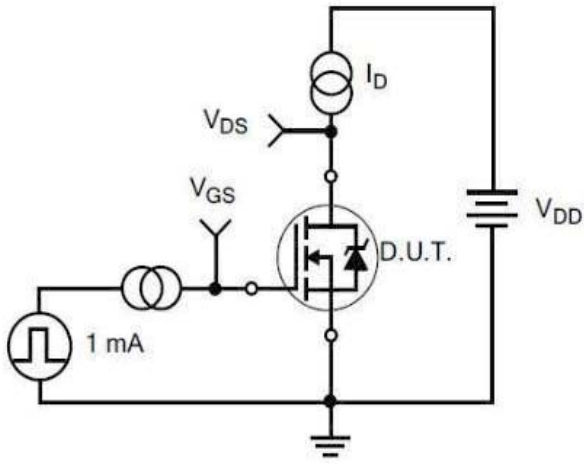


7) . Unclamped Inductive Switching Test Circuit

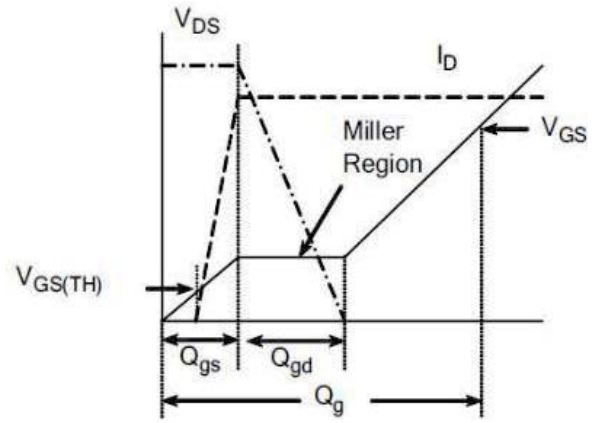


8) Unclamped Inductive Switching Waveforms

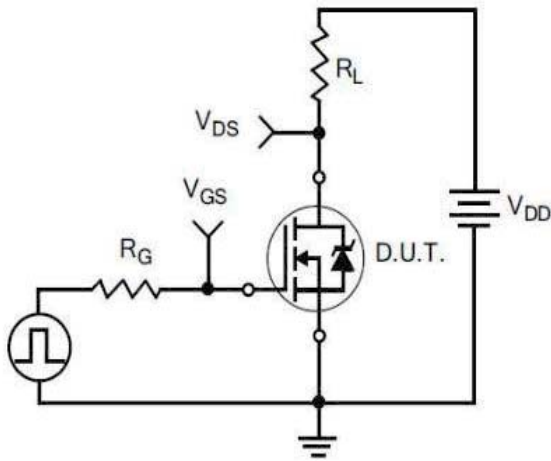
Typical Test Circuit



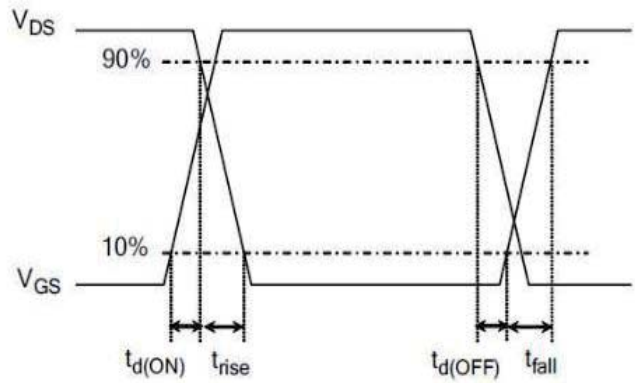
1) Gate Charge Test Circuit



2) Gate Charge Waveform

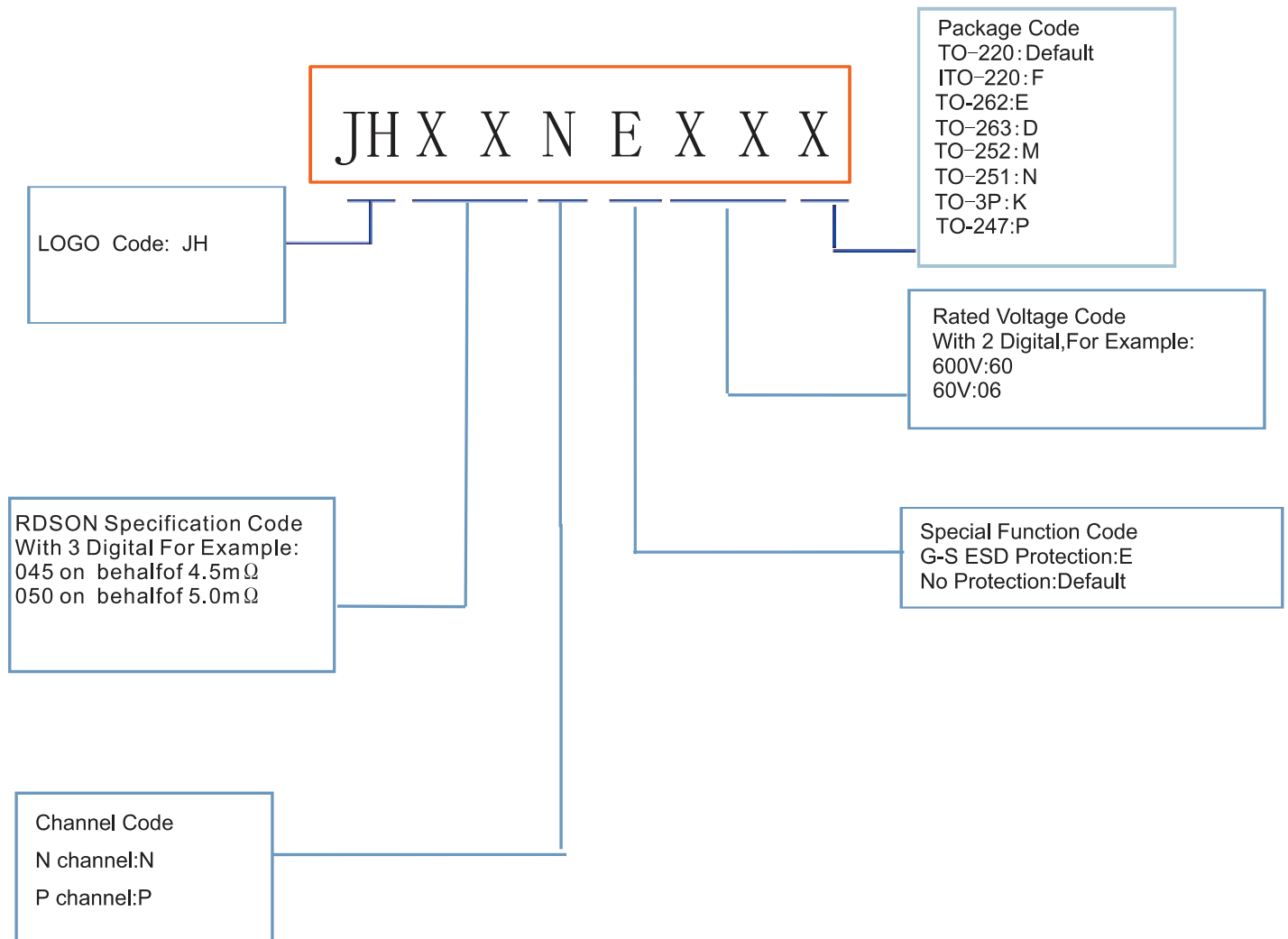


3) Resistive Switching Test Circuit



4) Resistive Switching Waveforms

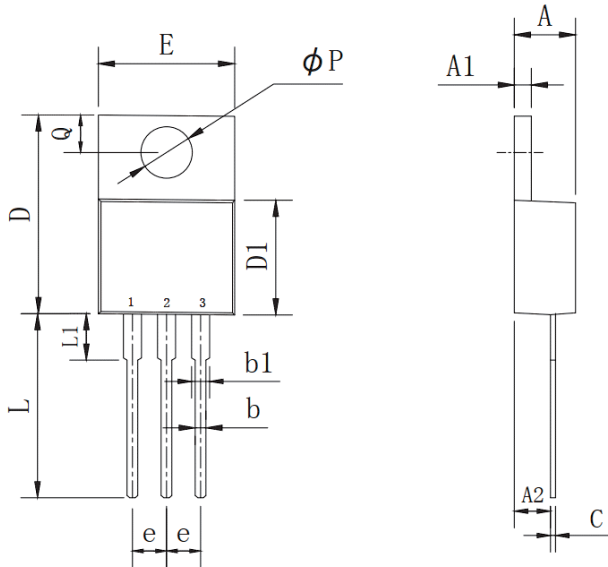
Product Names Rules





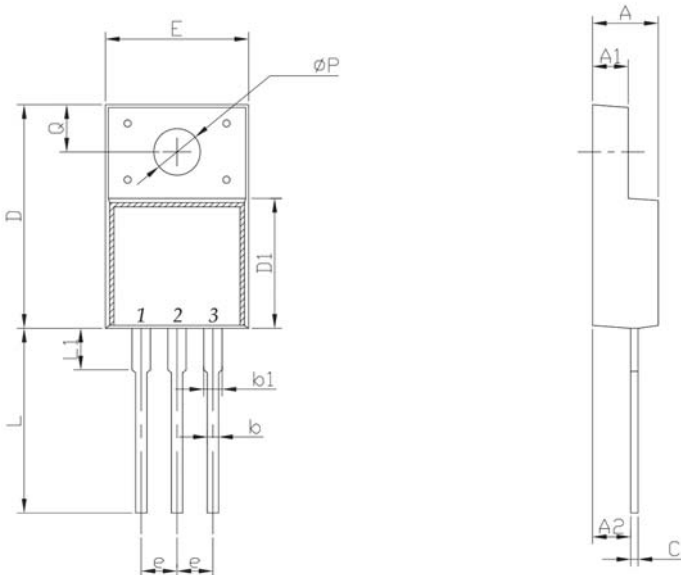
Dimensions

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

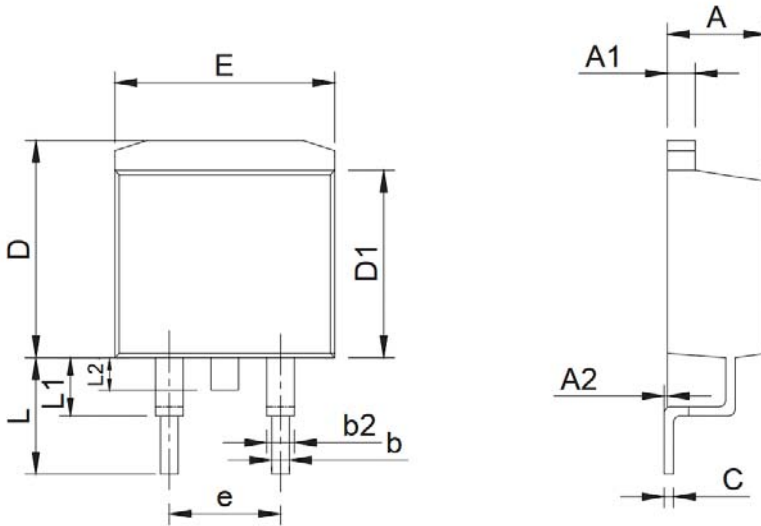
ITO-220 PACKAGE OUTLINE DIMENSIONS



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

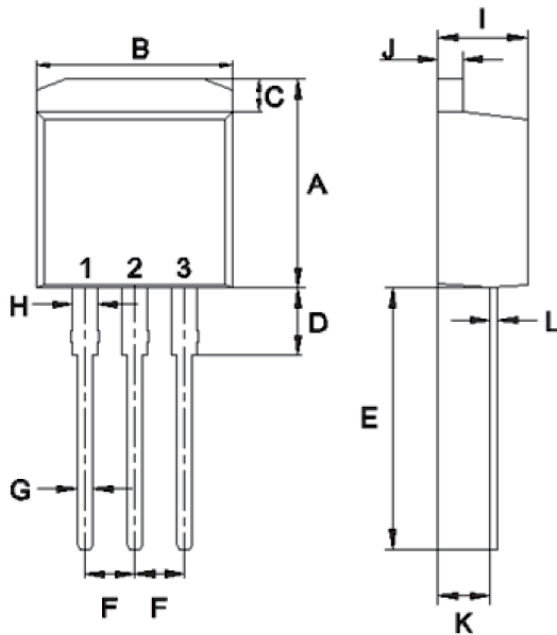
Dimensions

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

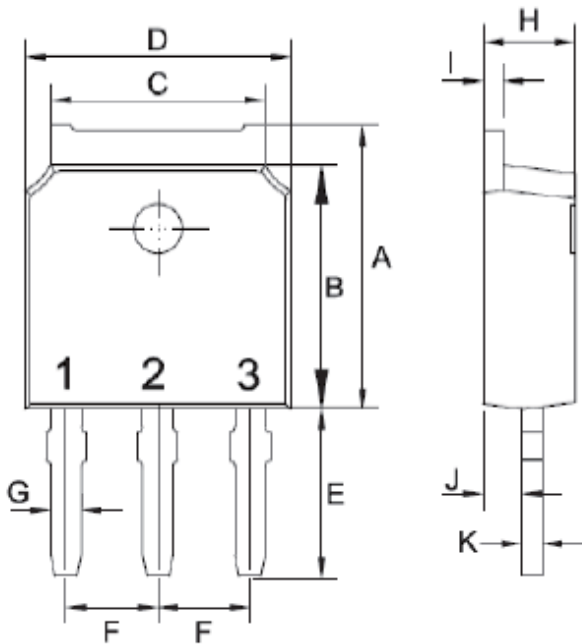
TO-262 PACKAGE OUTLINE DIMENSIONS



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

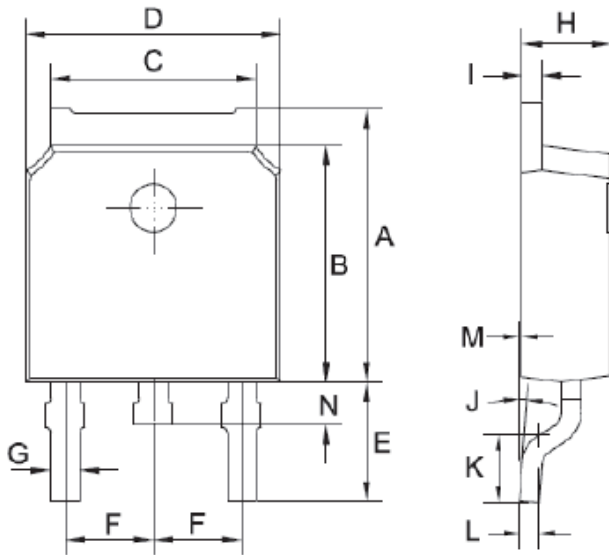
Dimensions

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°	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

## Friendship Reminder

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