

210A 30V N-channel Enhancement Mode Power MOSFET

1 Description

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

2 Features

- Fast switching
- Low on resistance($R_{DS(on)} \leq 2.0m\Omega$)
- Low gate charge(Typ: 65nC)
- Low reverse transfer capacitances(Typ: 435pF)
- 100% single pulse avalanche energy test
- 100% ΔV_{DS} test

3 Applications

- SPMS applications
- Load switch
- Power management
- BMS System

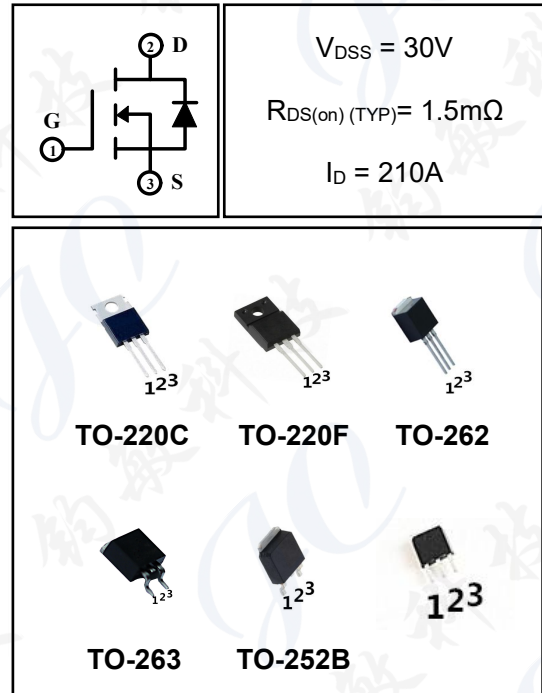
4 Electrical Characteristics

4.1 Absolute Maximum Rating ($T_C=25^\circ\text{C}$, unless otherwise noted)

Parameter	Symbol	Rating		Units
		DH020N03/ DHI020N03/DHE020N03 /DHB020N03/DHD020N03	DHF020 N03	
Drain-to-Source Voltage	V_{DSS}	30		V
Gate-to-Source Voltage	V_{GSS}	± 20		V
Continuous Drain Current	I_D	$T_C=25^\circ\text{C}$	210	A
		$T_C=100^\circ\text{C}$	133	A
Pulsed Drain Current ⁽¹⁾	I_{DM}	630		A
Single Pulse Avalanche Energy ⁽⁴⁾	E_{AS}	1225		mJ
Avalanche Current ⁽⁴⁾	I_{AS}	70		A
Power Dissipation	P_{tot}	$T_a=25^\circ\text{C}$	2	W
		$T_C=25^\circ\text{C}$	166	W
Isolation Voltage	V_{ISO}	/	2500	V
Junction Temperature Range	T_j	-55~175		$^\circ\text{C}$
Storage Temperature Range	T_{stg}	-55~175		$^\circ\text{C}$
Maximum Temperature for soldering	T_L	300		$^\circ\text{C}$

4.2 Thermal Characteristics

Parameter	Symbol	Rating		Unit
		DH020N03/ DHI020N03/DHE020N03 /DHB020N03/DHD020N03	DHF020 N03	
Thermal Resistance, Junction to Case-sink	R_{thJC}	0.90	3	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient	R_{thJA}	75	75	$^\circ\text{C/W}$



4.3 Electrical Characteristics (T_c=25°C, unless otherwise noted)

Parameter	Symbol	Test Condition	Value			Units
			Min	Typ	Max	
Off Characteristics						
Drain-to-Source Breakdown Voltage	BV _{DSS}	I _D =250μA,V _{GS} =0V	30	--	--	V
BV _{DSS} Temperature Coefficient	ΔBV _{DSS} /ΔT _J	I _D =250μA,reference 25℃	--	0.02	--	V/℃
Drain-to-Source Leakage Current	I _{DSS}	V _{DS} =30V,V _{GS} =0V,T _C =25℃	--	--	1	μA
		V _{DS} =24V,V _{GS} =0V,T _C =125℃	--	--	100	μA
Gate-to-Source Leakage Current	I _{GSS}	V _{GS} =±20V	--	--	±100	nA
On Characteristics						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} ,I _D =250μA	1.0	1.6	2.5	V
Drain-to-Source on-state Resistance	R _{DS(on)}	V _{GS} =10V,I _D =50A	--	1.5	2.0	mΩ
		V _{GS} =4.5V,I _D =40A	--	1.5	2.5	
Forward Transfer Conductance	g _{fs}	V _{DS} =5V,I _D =20A	--	70	--	S
Dynamic Characteristics						
Input Capacitance	C _{iss}	V _{GS} =0V,V _{DS} =25V,f=1.0MHz	--	7720	11000	pF
Output Capacitance	C _{oss}		--	945	1400	
Reverse Transfer Capacitance	C _{rss}		--	435	650	
Gate Resisitance	R _G	V _{DD} =0V,V _{GS} =0V,f=1MHz	--	1.2	2.4	Ω
Switching Characteristics						
Turn-on Delay Time	t _{d(on)}	V _{DS} =15V, I _D =1A, V _{GS} =10V, R _{GEN} =3.3Ω	--	28	--	nS
Turn-on Rise Time	t _r		--	45	--	
Turn-off Delay Time	t _{d(off)}		--	105	--	
Turn-off Fall Time	t _f		--	40	--	
Total Gate Charge	Q _g	I _D =10A,V _{DS} =15V,V _{GS} =4.5V	--	65	120	nC
Gate-to-Source Charge	Q _{gs}		--	16	30	
Gate-to-Drain("Miller") Charge	Q _{gd}		--	21	40	
Drain-Source Diode Characteristics						
Diode Forward Voltage ⁽³⁾	V _{FSD}	V _{GS} =0V,I _S =50A	--	0.82	1.2	V
Diode Forward Current	I _S		--	--	210	A
Reverse Recovery Time ⁽³⁾	t _{rr}	T _J =25℃,I _F =50A, dI _F /dt=100A/μS,V _{GS} =0V	--	--	--	nS
Reverse Recovery Charge ⁽³⁾	Q _{rr}		--	--	--	nC

Notes:

- 1: Repetitive rating, pulse width limited by maximum junction temperature.
- 2: Surface mounted on FR4 Board, t≤10sec.
- 3: Pulse width ≤ 300μs, duty cycle ≤ 2%.
4. L=0.5mH, I_D=70A, V_{DD}=25V, V_{GATE}=30V, Start T_J=25°C.

5 Typical characteristics diagrams

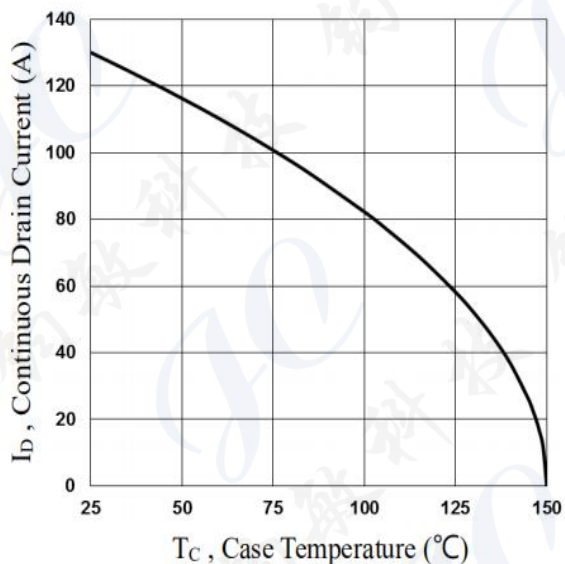


Fig.1 Continuous Drain Current vs. T_c

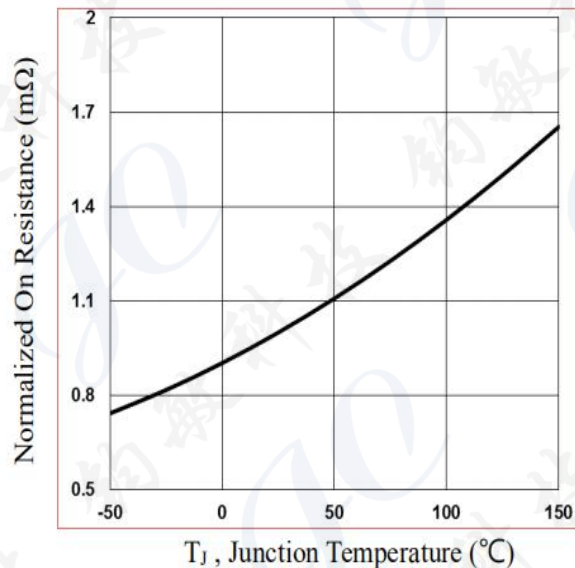


Fig.2 Normalized $R_{DS(on)}$ vs. T_j

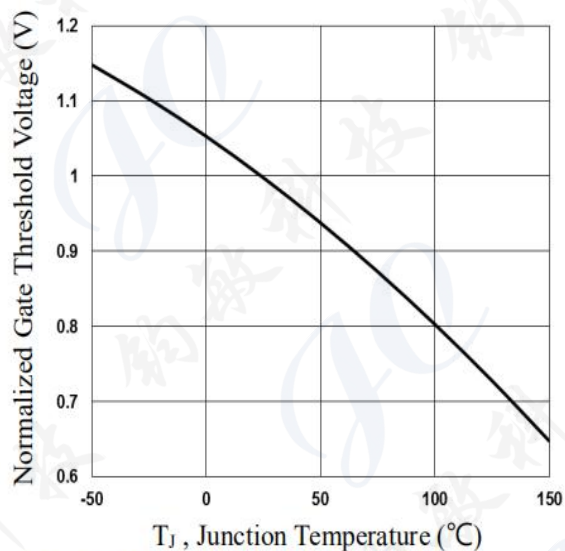


Fig.3 Normalized V_{th} vs. T_j

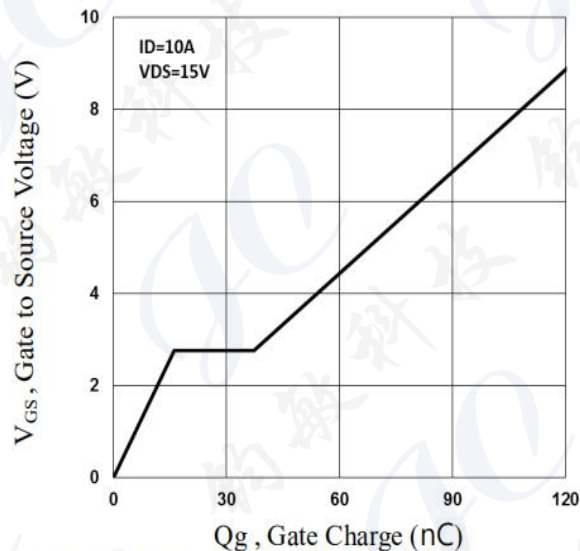


Fig.4 Gate Charge Waveform

5 Typical characteristics diagrams(continues)

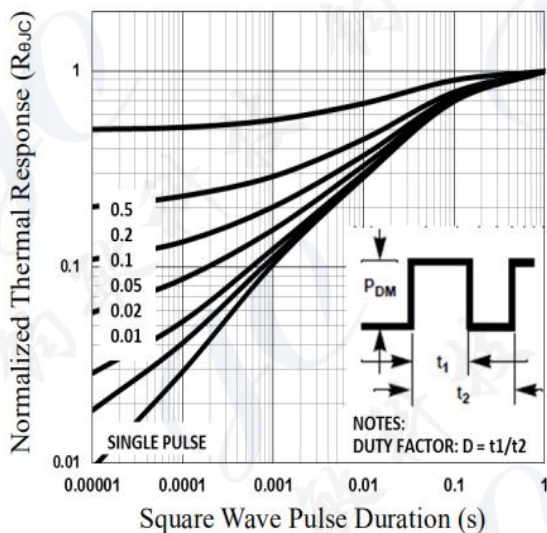


Fig.5 Normalized Transient Impedance

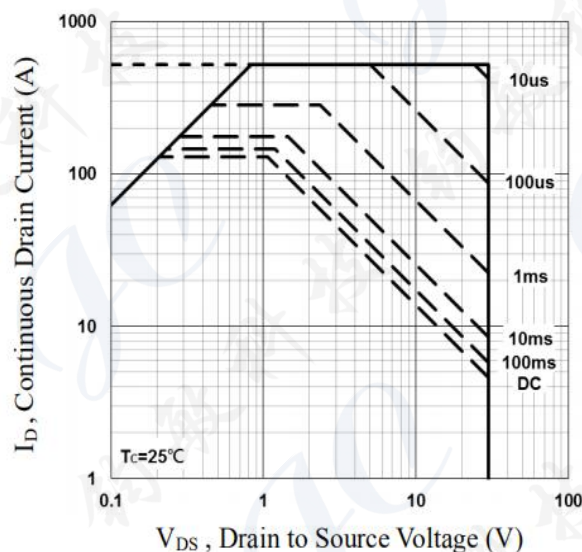
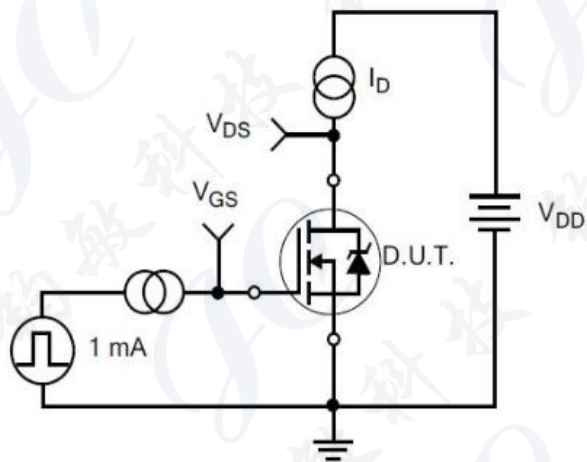
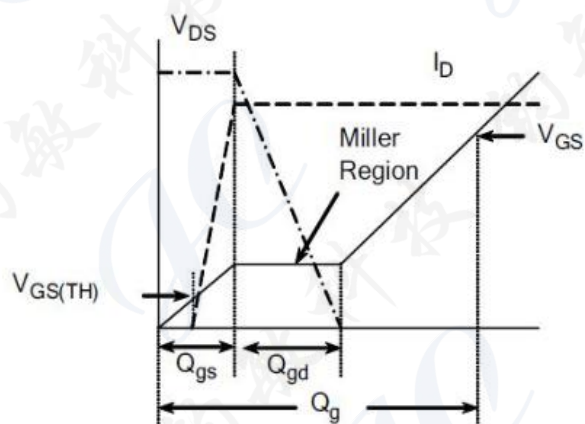


Fig.6 Maximum Safe Operation Area

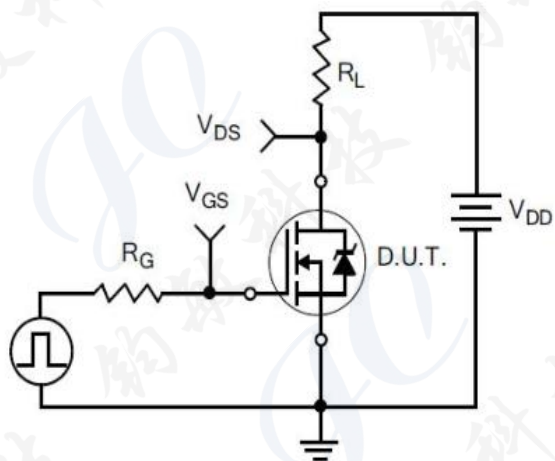
6 Typical Test Circuit and Waveform



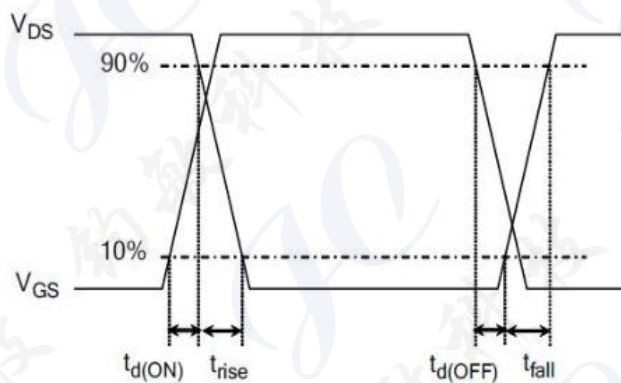
1) Gate Charge Test Circuit



2) . Gate Charge Waveform

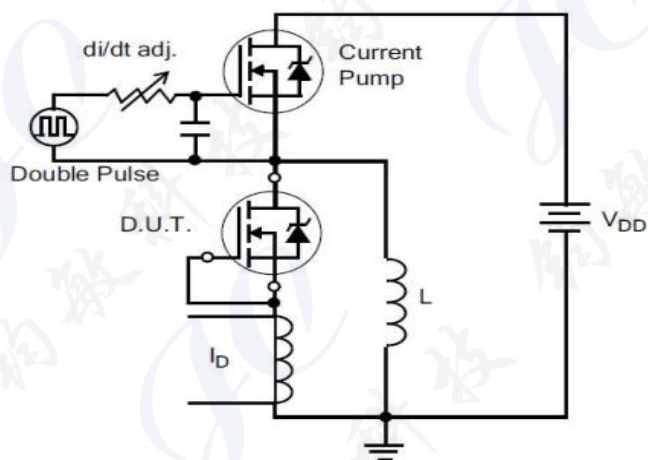


3) Resistive Switching Test Circuit

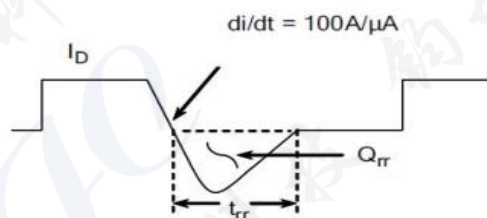


4) Resistive Switching Waveforms

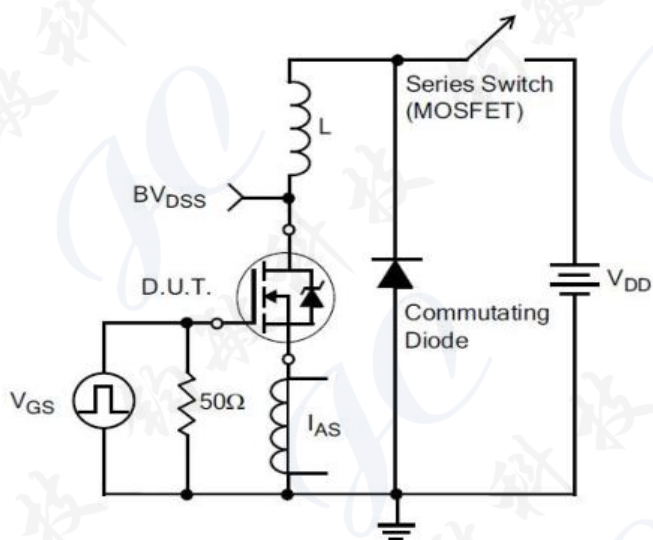
6 Typical Test Circuit and Waveform(continues)



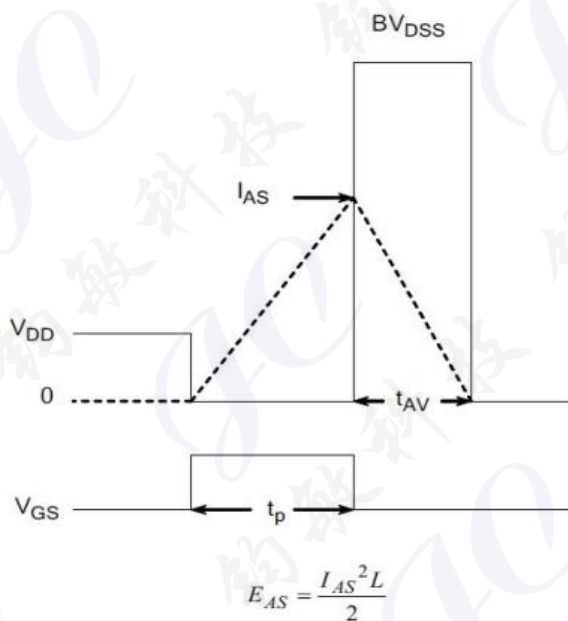
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform



7) . Unclamped Inductive Switching Test Circuit



8) Unclamped Inductive Switching Waveforms

7 Product Names Rules

D H F X X N E X X

LOGO Code: DH

Packaging Code
220F: F 220: Nothing
251: B 252: D
262: I 263: E

RDSON Specification Code
With 3 Digitals, For Example:
045 on behalf of 4.5mΩ
050 on behalf of 5.0mΩ

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

Special Function Code
E on behalf of build-in ESD
Nothing on behalf of not ESD

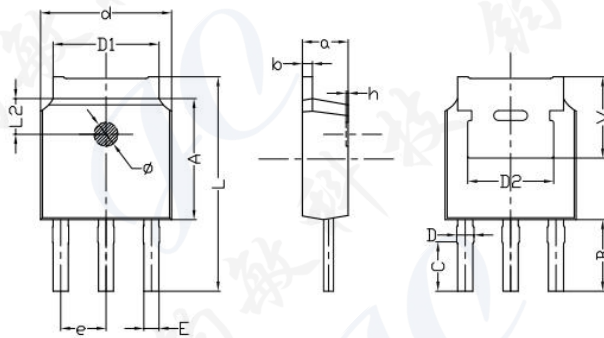
Channel Polarity Code
N on behalf of N channel
P on behalf of P channel

8 Product Specifications and Packaging Models

Product Model	Package Type	Mark Name	RoHS	Package	Quantity
DH020N03	TO-220	DH020N03	Pb-free	Tube	1000/box
DHF020N03	TO-220F	DHF020N03	Pb-free	Tube	1000/box
DHB020N03	TO-251	DHB020N03	Pb-free	Tube	3000/box
DHD020N03	TO-252	DHD020N03	Pb-free	Tape & Reel	2500/box
DHI020N03	TO-262	DHI020N03	Pb-free	Tube	1000/box
DHE020N03	TO-263	DHE020N03	Pb-free	Tape & Reel	800/box

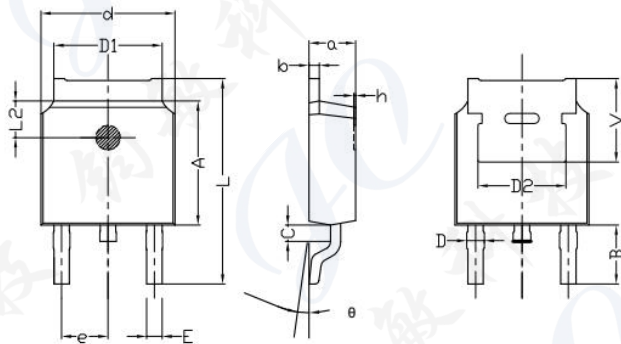
9 Dimensions

TO-251B 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

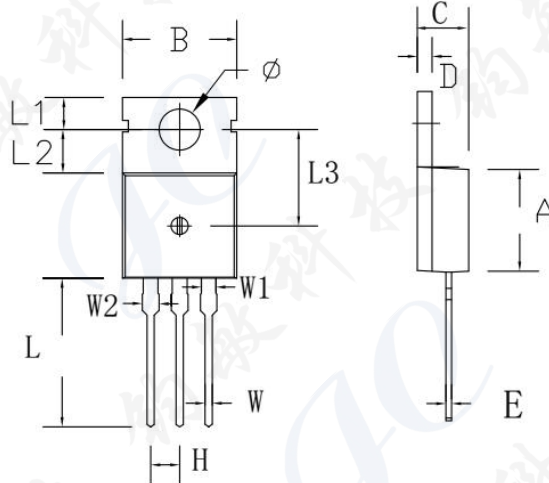
TO-252B PACKAGE OUTLINE DIMENSIONS



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
E	0.6	0.8	0.024	0.032

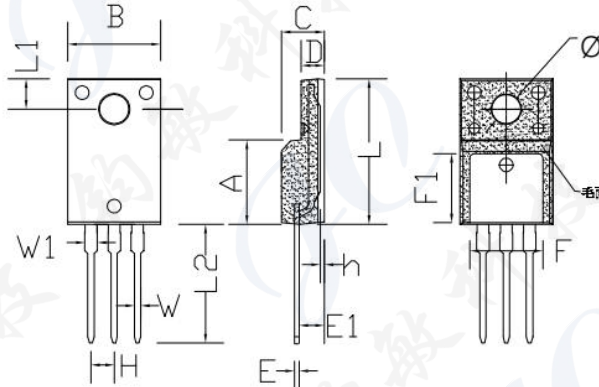
9 Dimensions(continues)

TO-220C 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

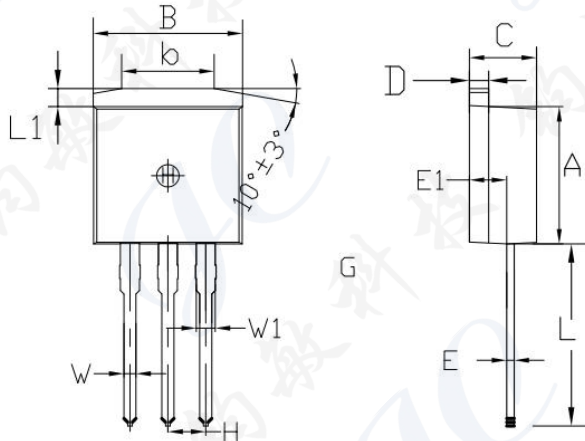
TO-220F PACKAGE OUTLINE DIMENSIONS



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

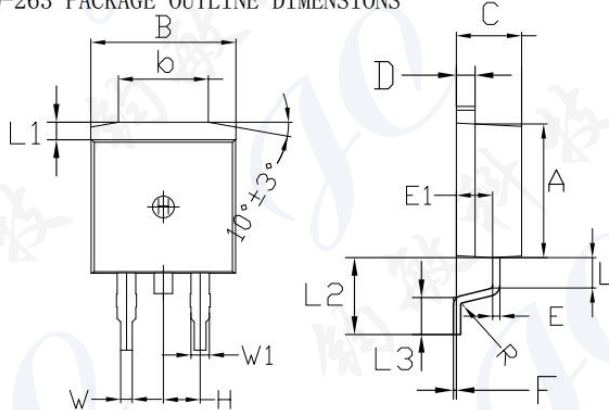
9 Dimensions(continues)

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

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

10 Attentions

- Jiangsu Donghai Semiconductor Technology CO.,LTD. reserves the right to change the specification without prior notice! The customer should obtain the latest version of the information before making the order and verify that the information is complete and up to date.
- It is the responsibility of the purchaser for any failure or failure of any semiconductor product under certain conditions. It is the responsibility of the purchaser to comply with safety standards and to take safety measures in the system design and machine manufacturing of Donghai products in order to avoid potential risk of failure. Injury or property damage.
- Product promotion is endless, our company will be dedicated to provide customers with better products.

11 Appendix

Revision history:

Date	REV.	Description	Page
2018.11.08	1.0	Original	