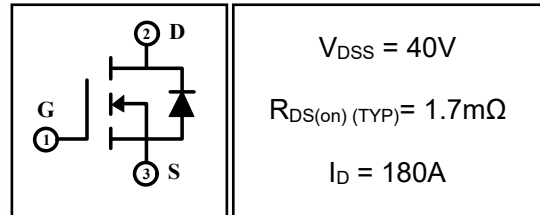


180A 40V N-channel Enhancement Mode Power MOSFET

1 Description

These N-channel enhancement mode power mosfets used advanced Split gate technology design, provided excellent $R_{DS(on)}$ and low gate charge. Which accords with the RoHS standard.

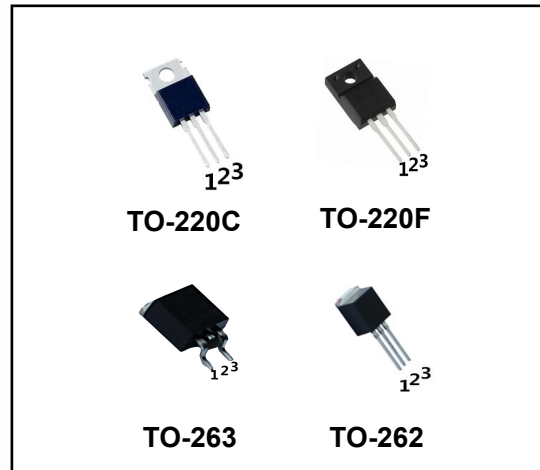


2 Features

- Fast switching
- Low on resistance
- Low gate charge
- High avalanche current
- Low reverse transfer capacitances
- 100% single pulse avalanche energy test
- 100% ΔV_{DS} test

3 Applications

- Power switching applications
- Inverter management system
- Power tools
- Automotive electronics



4 Electrical Characteristics

4.1 Absolute Maximum Ratings (Tc=25°C, unless otherwise noted)

Parameter	Symbol	Rating			Units	
		DHS020N04	DHS020N04I/ DHS020N04E	DHS020N04F		
Drain-to-Source Voltage	V_{DSS}	40			V	
Gate-to-Source Voltage	V_{GSS}	± 20			V	
Continuous Drain Current	I_D	$T_C=25^\circ C$			A	
		$T_C=100^\circ C$			A	
Pulsed Drain Current ⁽¹⁾	I_{DM}	650			A	
Single Pulse Avalanche Energy ⁽⁴⁾	E_{AS}	840			mJ	
Avalanche Current ⁽⁴⁾	I_{AS}	58			A	
Power Dissipation	$T_a=25^\circ C$	P_{tot}	2	2	2	W
	$T_C=25^\circ C$	P_{tot}	200	200	50	W
Isolation Voltage	V_{ISO}	/			2500	V
Junction Temperature Range	T_j	-55~175			$^\circ C$	
Storage Temperature Range	T_{stg}	-55~175			$^\circ C$	

4.2 Thermal Characteristics

Parameter	Symbol	Rating			Units
		DHS020N04	DHS020N04I/ DHS020N04E	DHS020N04F	
Thermal Resistance, Junction to Case-sink	R_{thJC}	0.75	0.75	3.0	$^\circ C/W$
Thermal Resistance, Junction to Ambient	R_{thJA}	75	75	75	$^\circ C/W$

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	40	44	—	V
Drain-to-Source Leakage Current	I _{DSS}	V _{DS} =40V, V _{GS} =0V, T _C =25°C	—	—	1	μA
		V _{DS} =40V, V _{GS} =0V, T _C =125°C	—	—	100	μA
Gate-to-Source Leakage Current	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	—	—	±100	nA
On Characteristics						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250μA	1	2	3	V
Drain-to-Source on-state Resistance	R _{DS(on)}	V _{GS} =10V, I _D =85A	—	1.7	2.1	mΩ
		V _{GS} =4.5V, I _D =85A	—	2.2	2.8	mΩ
Dynamic Characteristics						
Input Capacitance	C _{iss}	V _{GS} =0V, V _{DS} =20V, f=1.0MHz	—	4557	—	pF
Output Capacitance	C _{oss}		—	2180	—	
Reverse Transfer Capacitance	C _{rss}		—	74	—	
Gate Resisitance	R _G	V _{DD} =0V, V _{GS} =0V, F=1MHz	—	2	—	Ω
Switching Characteristics						
Turn-on Delay Time	t _{d(on)}	I _D =85A, V _{DD} =20V, V _{GS} =10V, R _{GEN} =1.6Ω	—	12.5	—	nS
Turn-on Rise Time	t _r		—	95.6	—	
Turn-off Delay Time	t _{d(off)}		—	55.3	—	
Turn-off Fall Time	t _f		—	96.3	—	
Total Gate Charge	Q _g	I _D =85A, V _{DD} =20V, V _{GS} =10V	—	74.3	—	nC
Gate-to-Source Charge	Q _{gs}		—	20.6	—	
Gate-to-Drain("Miller") Charge	Q _{gd}		—	12.0	—	
Drain-Source Diode Characteristics						
Diode Forward Voltage ⁽³⁾	V _{SD}	V _{GS} =0V, I _S =120A	—	—	1.3	V
Diode Forward Current	I _S		—	—	170	A
Reverse Recovery Time ⁽³⁾	t _{rr}	T _J =25°C, I _F =85A, di _F /dt=100A/μS, V _{GS} =0V	—	47	—	nS
Reverse Recovery Charge ⁽³⁾	Q _{rr}		—	37	—	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=58A, V_{DD}=32V, V_{GATE}=40V, Start T_J=25°C.

5 Typical characteristics diagrams

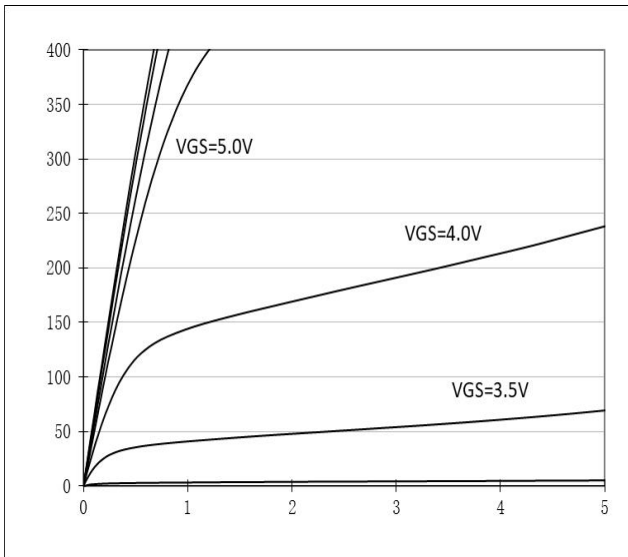


Figure 1 Output Characteristics

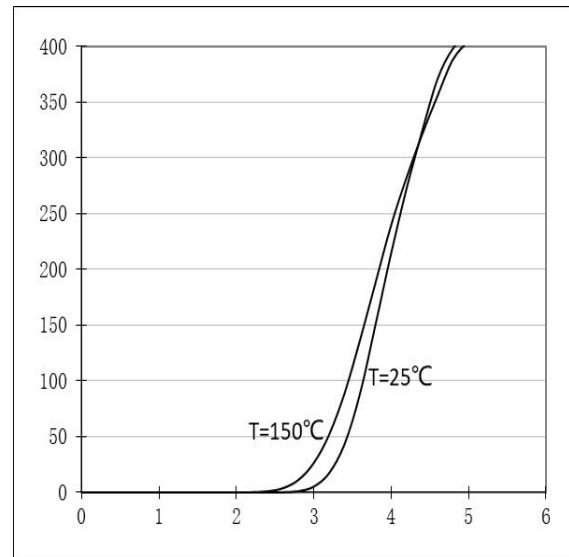


Figure 2 Transfer Characteristics

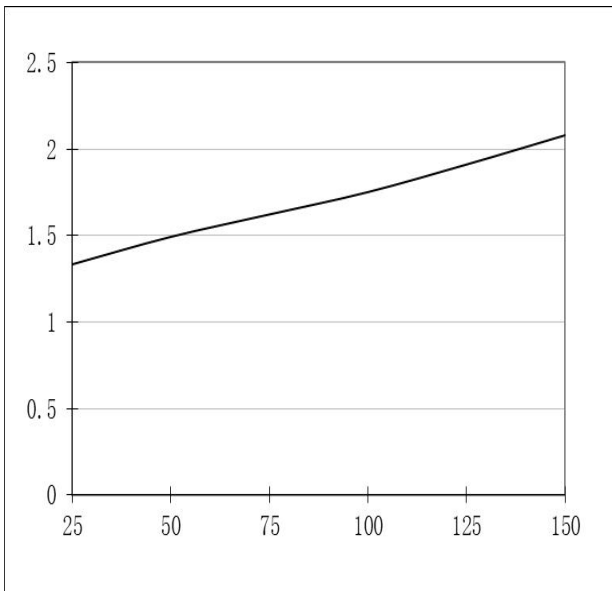


Figure 3. Rds(on) vs Temperature

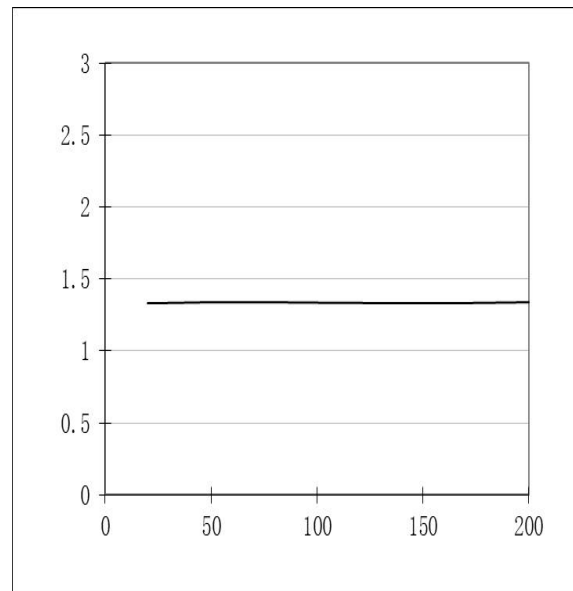


Figure 4. Rds(on) vs ID

5 Typical characteristics diagrams(continues)

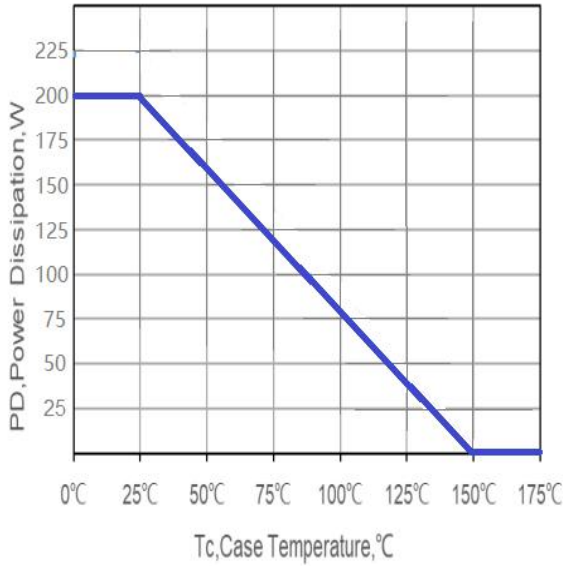


Figure 5. Power De-rating

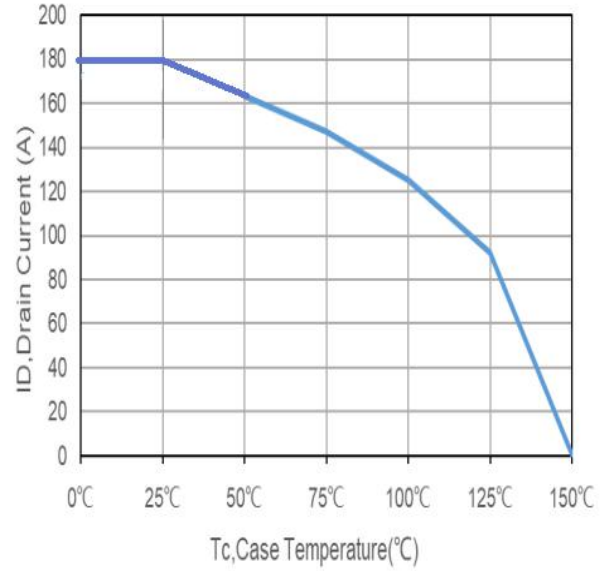


Figure 6. ID Current Derating

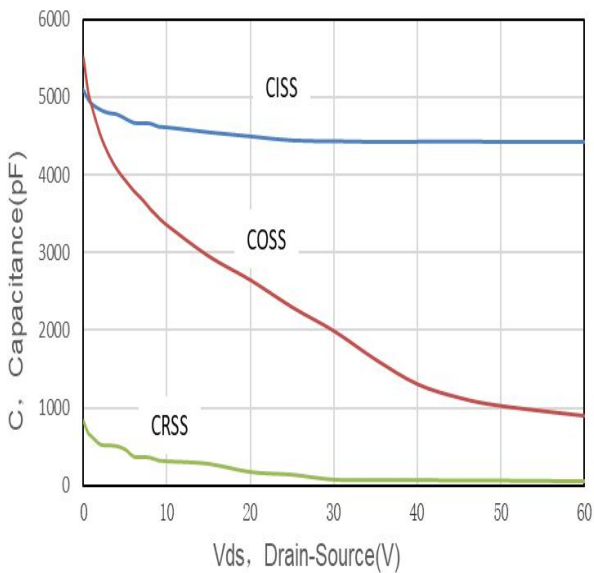


Figure 7. Capacitance Characteristics

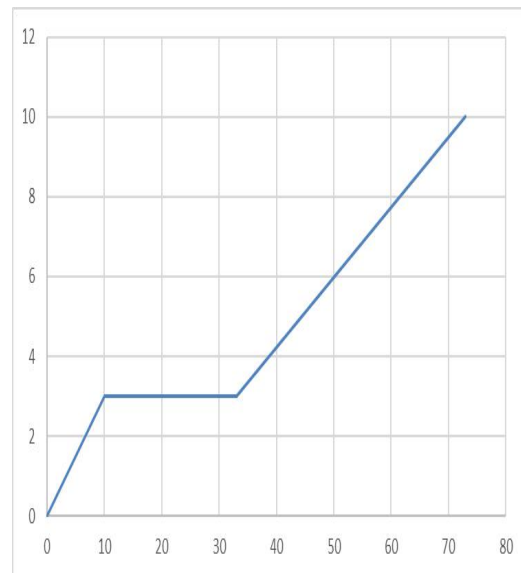
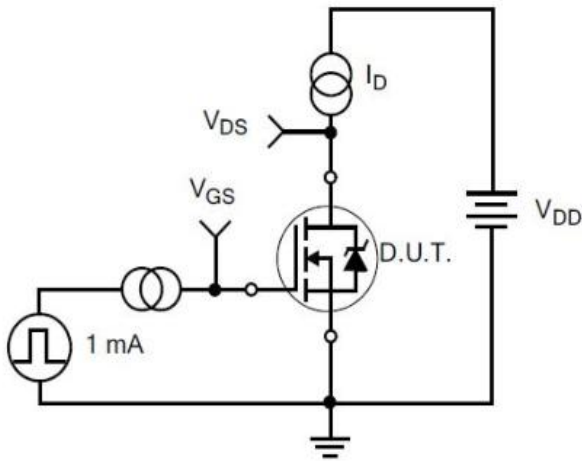
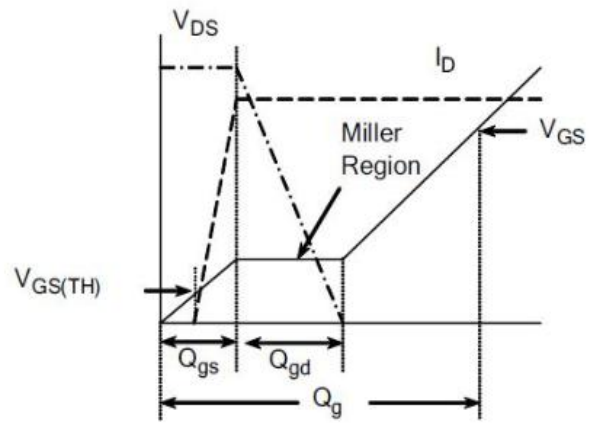


Figure 8. Gate Charge Characteristics

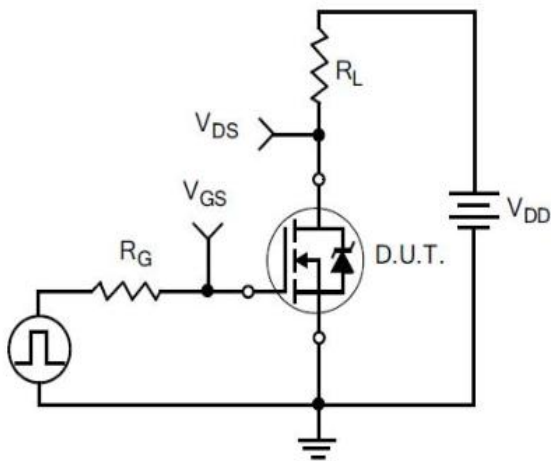
6 Typical Test Circuit and Waveform



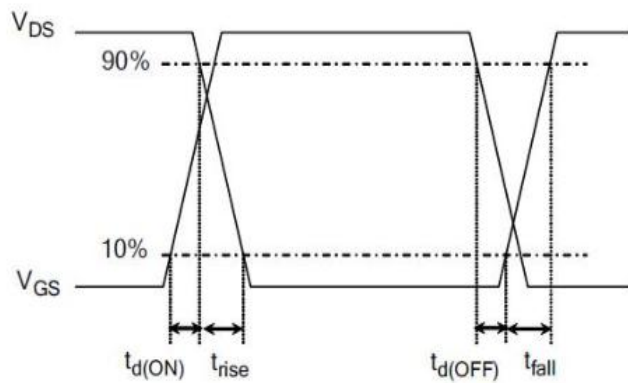
1) Gate Charge Test Circuit



2) Gate Charge Waveform

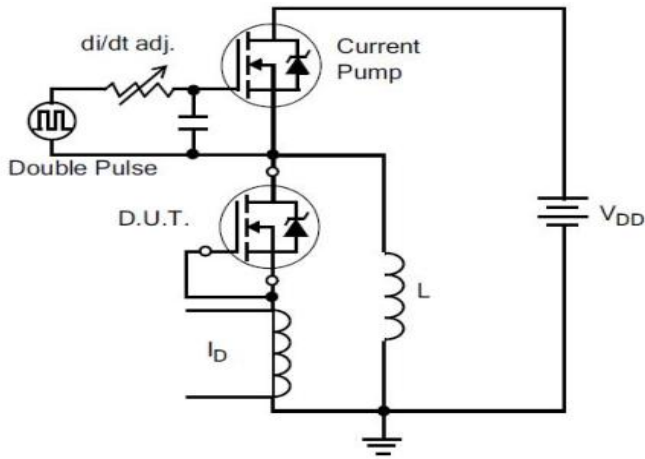


3) Resistive Switching Test Circuit

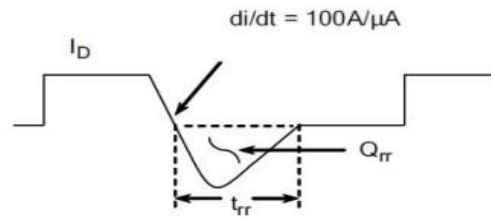


4) Resistive Switching Waveforms

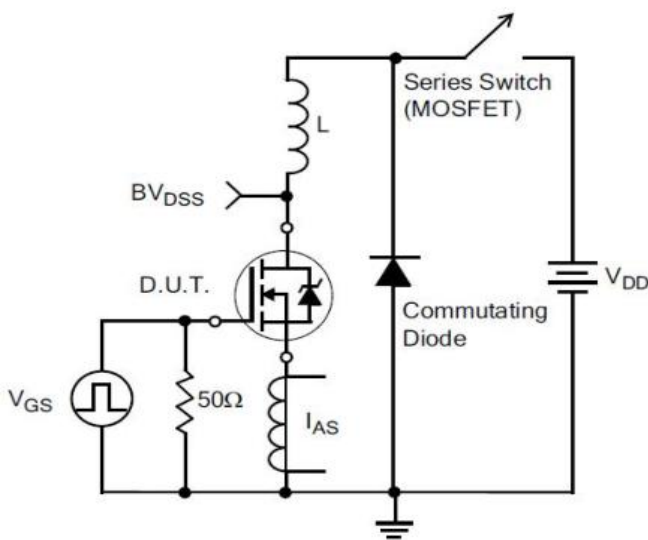
6 Typical Test Circuit and Waveform(continues)



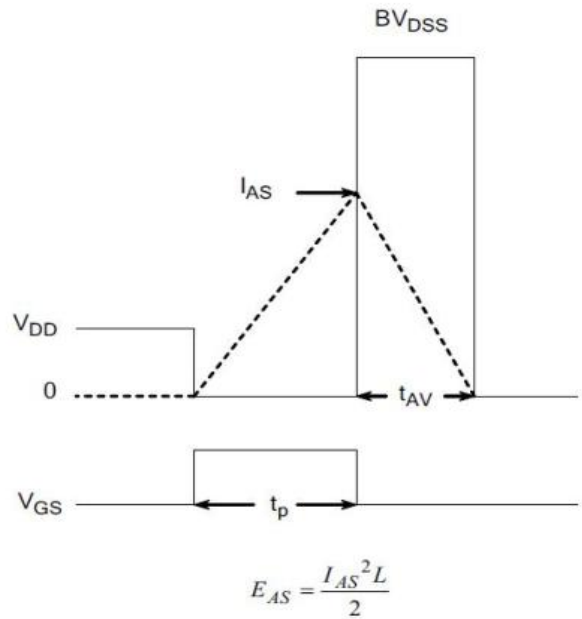
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform



7) . Unclamped Inductive Switching Test Circuit



8) Unclamped Inductive Switching Waveforms

7 Product Names Rules

DHSXXNXFXF

LOGO Code: DH

Process Code:
Spilt Gate Trench: S

RDSON Specification Code
With 3 Digitals,
For Example:
045 on behalf of 4.5mΩ
050 on behalf of 5.0mΩ
155 on behalf of 15.5mΩ

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

Packaging Code
220F: F 220: Nothing
262: I 263: E
3P: D 247: B
DFN5*6: P

Rated Voltage Code
With 2-3 Digitals,
For Example:
06 on behalf of 60V
045 on behalf of 45V

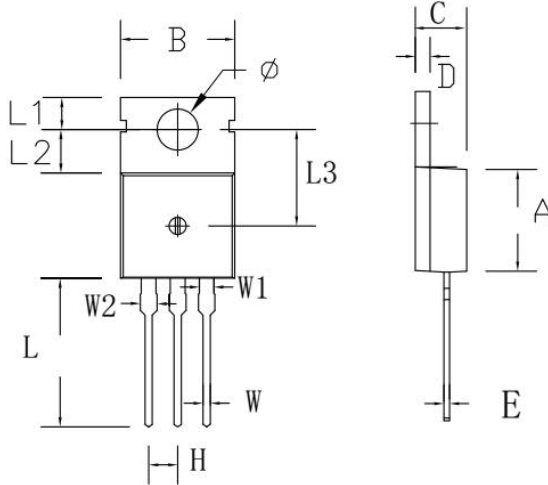
Special Function Code
E on behalf of build-in ESD
Nothing on behalf of not ESD

8 Product Specifications and Packaging Models

Product Model	Package Type	Mark Name	RoHS	Package	Quantity
DHS020N04	TO-220	DHS020N04	Pb-free	Tube	1000/box
DHS020N04F	TO-220F	DHS020N04F	Pb-free	Tube	1000/box
DHS020N04I	TO-262	DHS020N04I	Pb-free	Tube	1000/box
DHS020N04E	TO-263	DHS020N04E	Pb-free	Tape & Reel	800/box

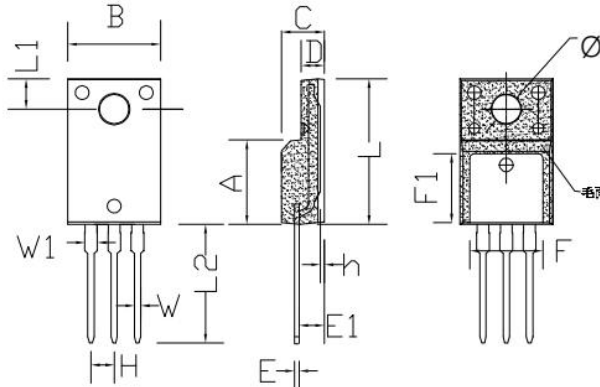
9 Dimensions

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

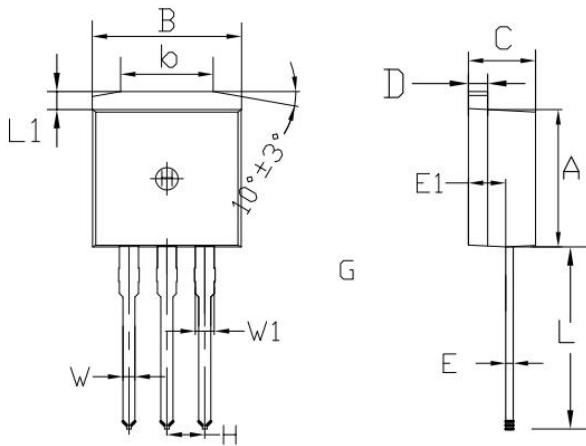
TO-220F PACKAGE OUTLINE DIMENSIONS



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

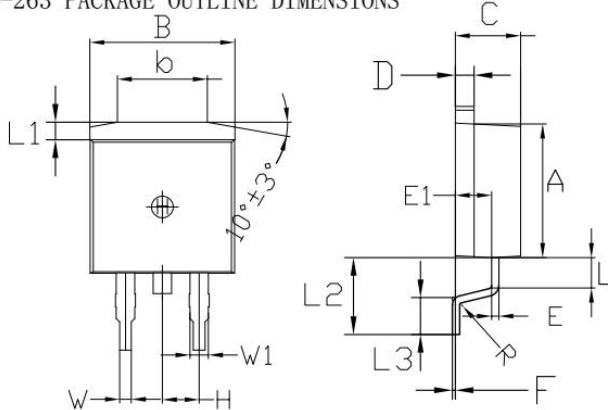
9 Dimensions(continues)

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
2020.05.15	1.0	Original	