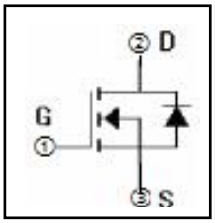
160A 40V N-channel Enhancement Mode Power MOSFET

1 Description

These N-channel Enhanced VDMOSFETs Used advanced trench technology design, provided excellent RDSON and low gate charge. Which accords with the RoHS standard.



V_{DSS} = 40V

$R_{DS(on)}$ (TYP)= 3.5mΩ

I_D = 160A

2 Features

- Fast Switching
- Low ON Resistance(Rdson≤4.5mΩ)
- Low Gate Charge(Typ:117nC)
- Low Reverse Transfer Capacitances(Typ:460pF)
- 100% Single Pulse Avalanche Energy Test
- 100% ΔV_{DS} Test

TO-220C TO-220F TO-262

TO-263 TO-252B TO-251B

3 Applications

- PWM applications
- Load switch
- Power management

4 Electrical Characteristics

4.1 Absolute Maximum Rating (Tc=25℃,unless otherwise noted)

Parameter		Symbol	Value		Units
			110N04/I110N04/E110N04 /B110N04/D110N04	F110N04	
Maximum Drian-Source DC Voltage		V_{DS}	40		V
Maximum Gate-Drain Voltage		V_{GS}	±25		V
Drain Current(continuous)		I_D（T=25℃）	160		A
		（T=100℃）	110		A
Drain Current(Pulsed)(Note 1)		I_{DM}	640		A
Single Pulse Avalanche Energy(Note 5)		E_{AS}	612		mJ
Avalanche Current(Note 1)		I_{AS}	35		A
Total Dissipation	T_a=25℃	P_{tot}	2	2	W
	T_C=25℃	P_{tot}	120	30	W
Junction Temperature		T_j	-55～175		℃
storage Temperature		T_{stg}	-55～175		℃
Maximum Temperature for soldering		T_L	300		℃

4.2 Thermal Characteristics

Parameter	Symbol	Value		Unit
		110N04/I110N04/E110N04 /B110N04/D110N04	F110N04	
Thermal Resistance Junction to Case-sink	R_{thJC}	1.25	5	℃/W
Thermal Resistance Junction to Ambient	R_{thJA}	75	75	℃/W

4.3 Electrical Characteristics (Tc=25℃,unless otherwise noted)

Parameter	Symbol	Test Condition	Value			Units
			Min	Typ	Max	
Off Characteristics						
Drain-source Breakdown Voltage	BV_{DSS}	I_D=250μA,V_{GS}=0V	40	--	--	V
BV_{DSS} Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	I_D=250μA,reference 25℃	--	0.04	--	V/℃
Drain-to-Source Leakage Current	I_{DSS}	V_{DS}=40V,V_{GS}=0V,T_C=25℃	--	--	1	μA
		V_{DS}=32V,V_{GS}=0V,T_C=125℃	--	--	100	μA
Gate-to-Source Forward Leakage	I_{GSSF}	V_{GS}=+25V	--	--	100	nA
Gate-to-Source Reverse Leakage	I_{GSSR}	V_{GS}=-25V	--	--	-100	nA
On Characteristics(Note 3)						
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=250μA	2	--	4	V
Drain-source on-State Resistance	$R_{DS(on)}$	V_{GS}=10V,I_D=50A	--	3.5	4.5	mΩ
Gate Resisitance	R_G	V_{DD}=0V,V_{GS}=0V,f=1MHz	--	2	--	Ω
Dynamic Characteristics(Note 4)						
Forward Transfer conductance	g_{fs}	V_{DS}=5V,I_D=30A	--	105	--	S
Input Capacitance	C_{iss}	V_{GS}=0V,V_{DS}=25V,f=1.0MHz	--	5530	--	pF
Output Capacitance	C_{oss}		--	590	--	
Reverse Transfer Capacitance	C_{rss}		--	460	--	
Switching Characteristics(note4)						
Turn-on Delay Time	$t_{d(on)}$	V_{DS}=30V, I_D=160A, V_{GS}=10V, R_{GEN}=10Ω	--	35	--	nS
Turn-on Rise Time	t_r		--	88	--	
Turn-off Delay Time	$t_{d(off)}$		--	115	--	
Turn-off Fall Time	t_f		--	112	--	
Total Gate Charge	Q_g	I_D=20A,V_{DS}=32V,V_{GS}=10V	--	117	--	nC
Gate-to-Source Charge	Q_{gs}		--	31	--	
Gate-to-Drain("Miller")Charge	Q_{gd}		--	37	--	
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V_{FSD}	V_{GS}=0V,I_S=30A	--	0.83	1.2	V
Diode Forward Current (Note 2)	I_S		--	--	160	A
Reverse Recovery Time	t_{rr}	T_J=25℃,I_F=20A, dI_F/dt=100A/μS,V_{GS}=0V	--	34	--	nS
Reverse Recovery Charge	Q_{rr}		--	40	--	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: Guaranteed by design, not subject to production.

5. L=1mH,I_D=35A,V_{DD}=38V,V_{GATE}=40V,R=10Ω,Start T_J=25℃.

5 Typical characteristics diagrams

Figure1. Output Characteristics

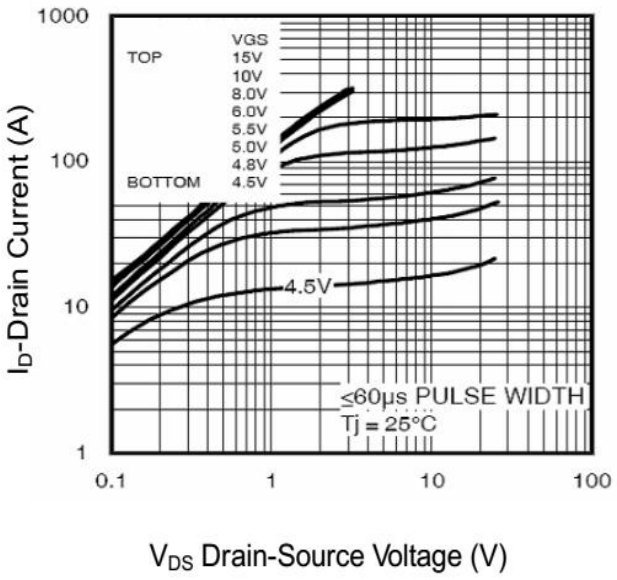


Figure2. Transfer Characteristics

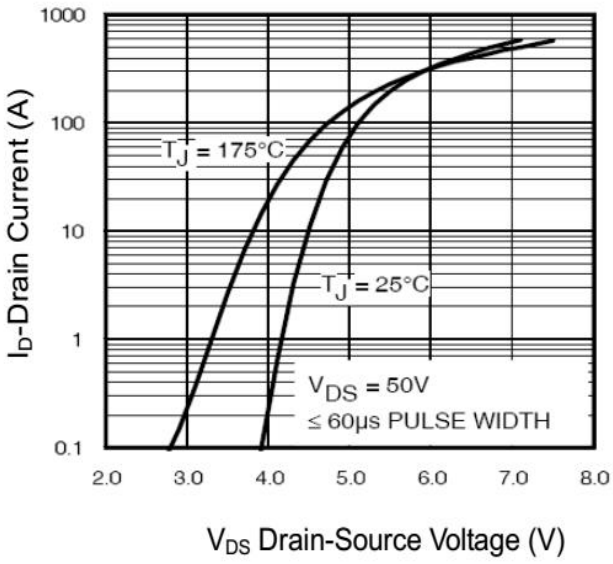


Figure3. BVDSS vs Junction Temperature

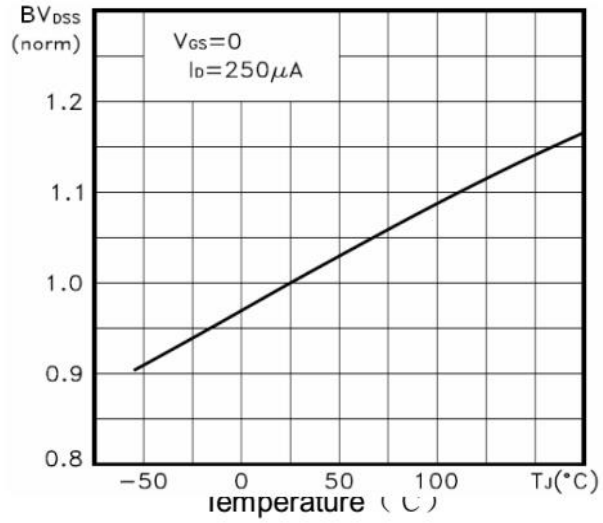
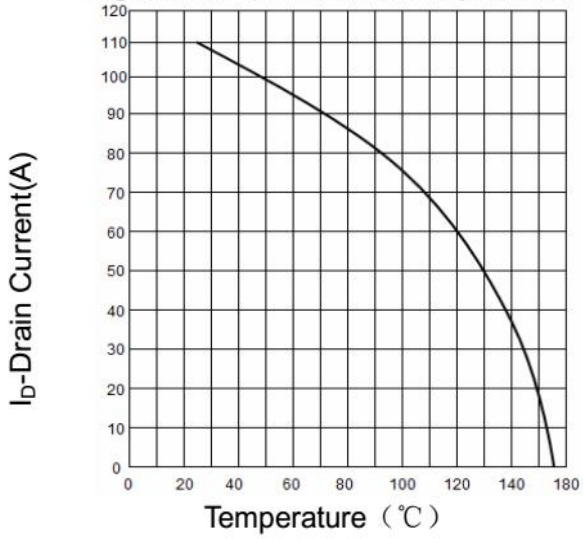


Figure4. ID vs Junction Temperature



5 Typical characteristics diagrams(continues)

Figure5. VGS(th) vs Junction Temperature

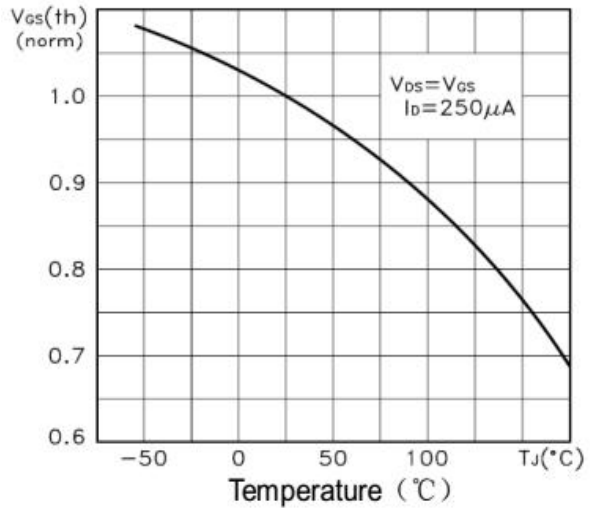


Figure6. Rdson Vs Junction Temperature

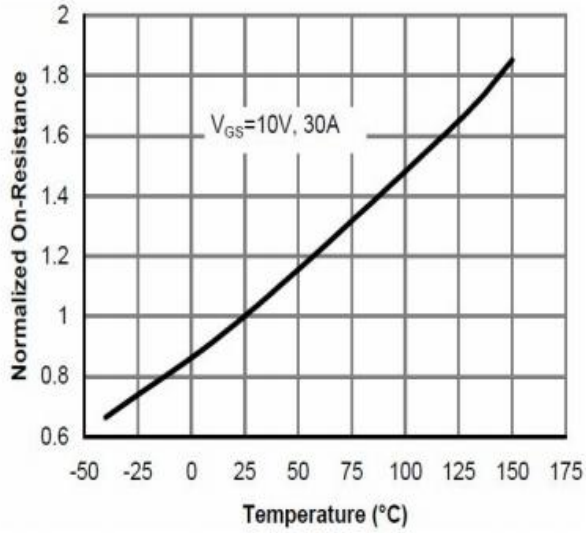


Figure7. Gate Charge

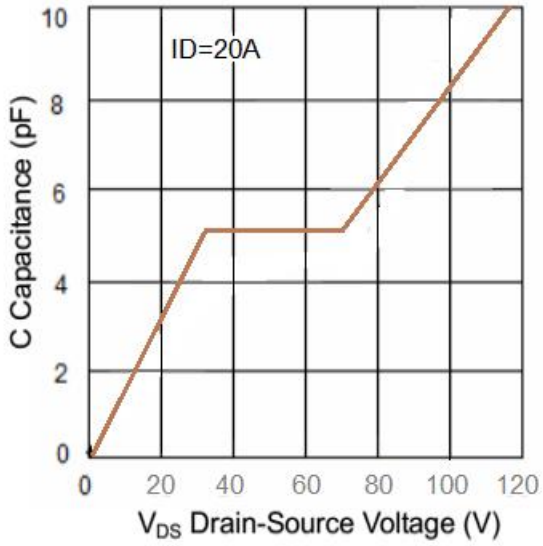
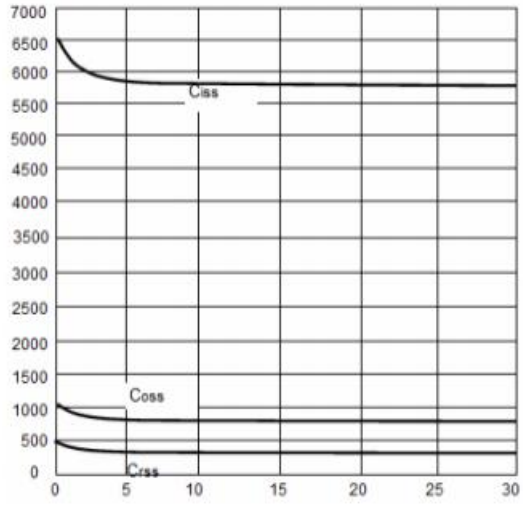


Figure8. Capacitance vs Vds



5 Typical characteristics diagrams(continues)

Figure9. Source- Drain Diode Forward

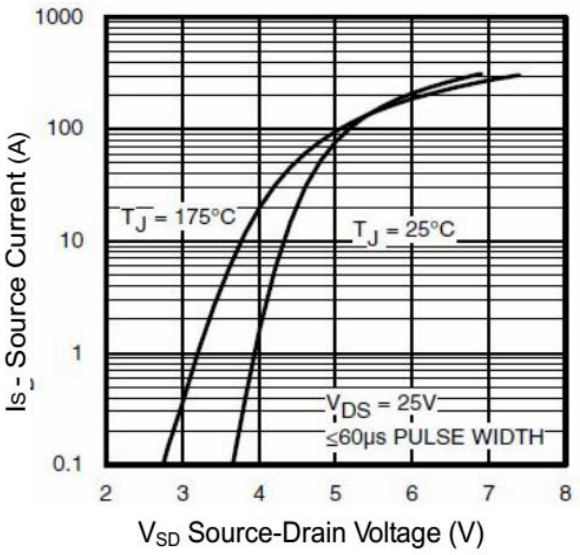


Figure10. Safe Operation Area

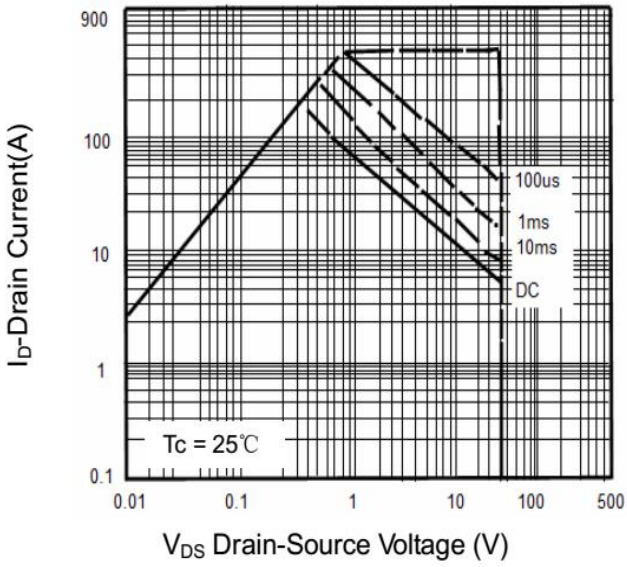
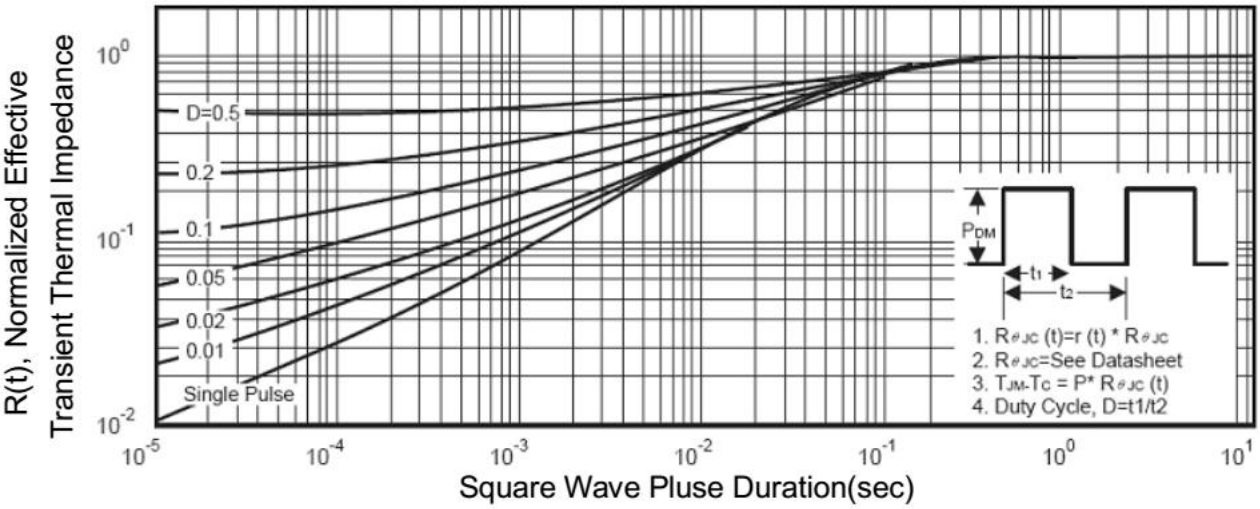
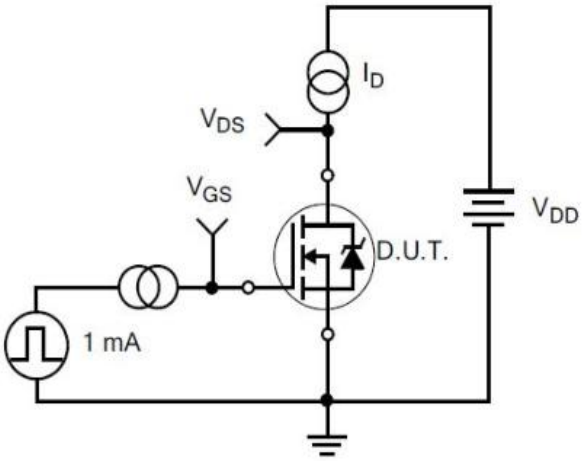


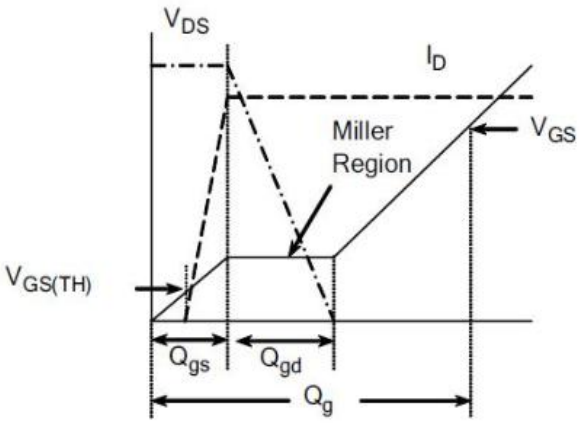
Figure11. Normalized Maximum Transient Thermal Impedance



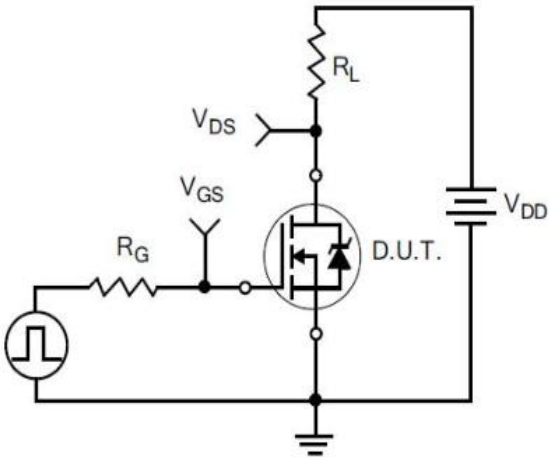
6 Typical Test Circuit and Waveform



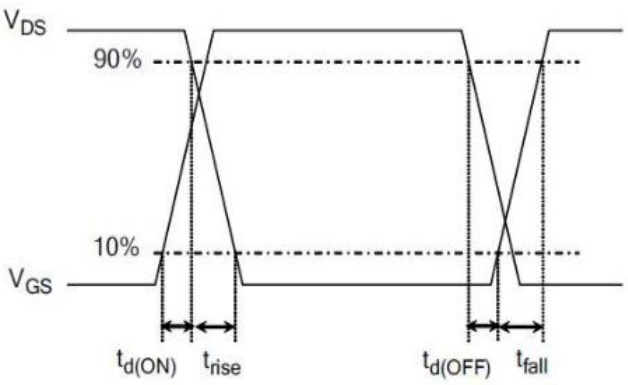
1) Gate Charge Test Circuit



2) . Gate Charge Waveform

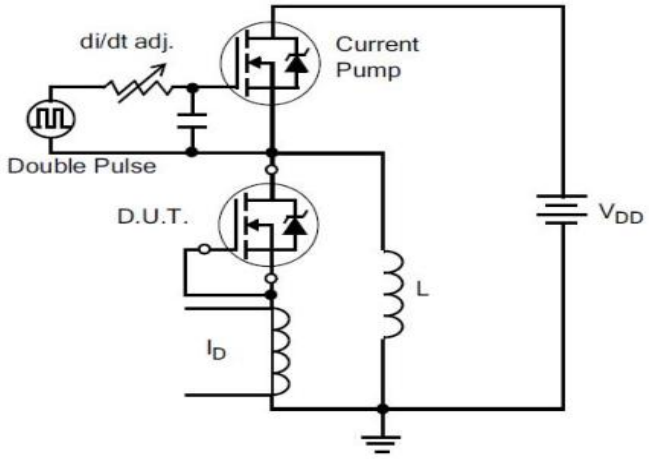


3) Resistive Switching Test Circuit

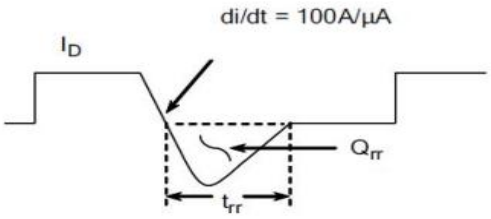


4) Resistive Switching Waveforms

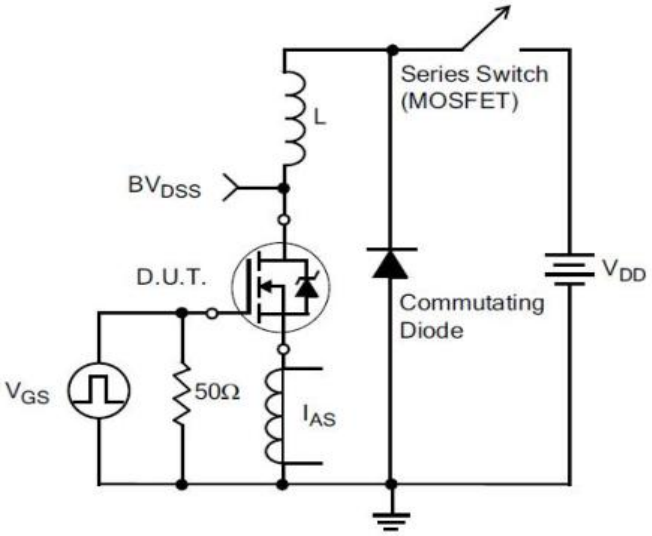
6 Typical Test Circuit and Waveform(continues)



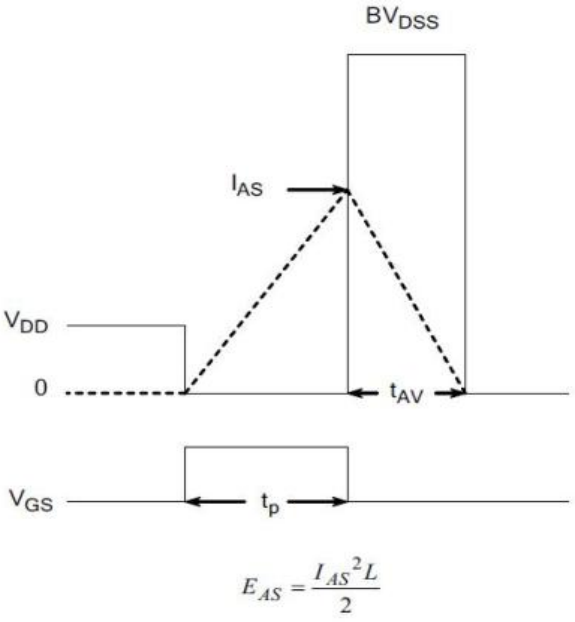
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform



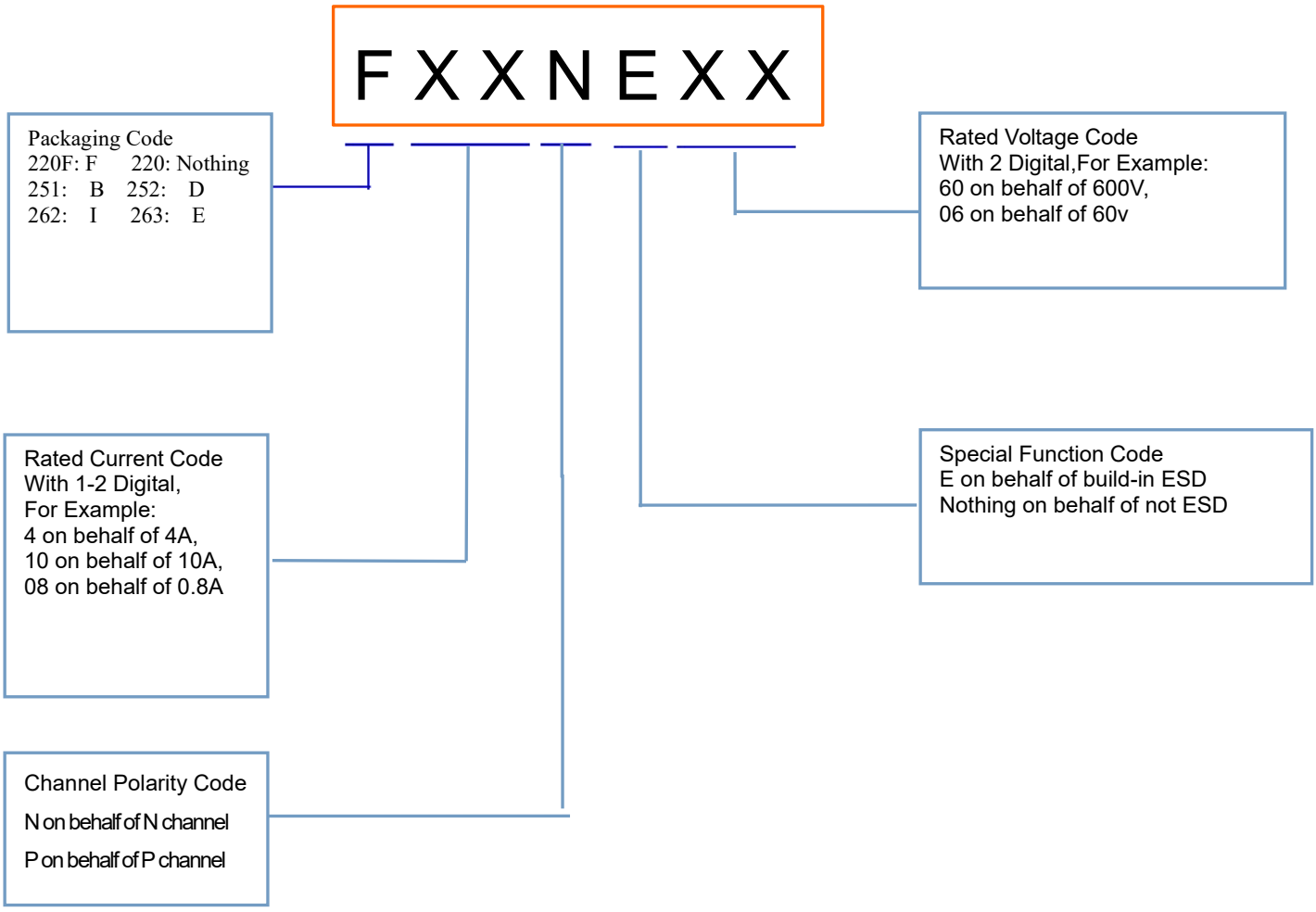
7) . Unclamped Inductive Switching Test Circuit



$$E_{AS} = \frac{I_{AS}^2 L}{2}$$

8) Unclamped Inductive Switching Waveforms

7 Product Names Rules

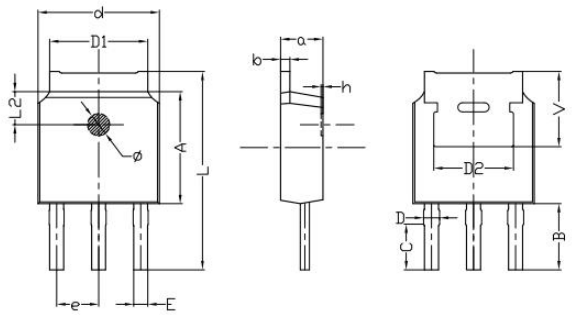


8 Product Specifications and Packaging Models

Product Model	Package Type	Mark Name	Indentification Code	RoHS	Package	Quantity
110N04	TO-220C	110N04	SM	Pb-free	Tube	1000/box
F110N04	TO-220F	F110N04	SM	Pb-free	Tube	1000/box
B110N04	TO-251	B110N04	SM	Pb-free	Tube	3000/box
D110N04	TO-252	D110N04	SM	Pb-free	Tape & Reel	2500/box
I110N04	TO-262	I110N04	SM	Pb-free	Tube	1000/box
E110N04	TO-263	E110N04	SM	Pb-free	Tape & Reel	800/box

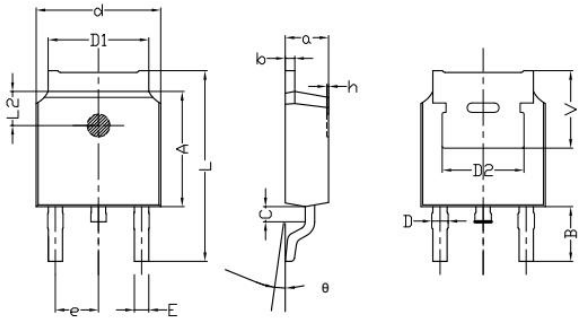
9 Dimensions

TO-251B PACKAGE OUTLINE DIMENSIONS



Symbol	DimensionsIn Millimeters		DimensionsIn 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

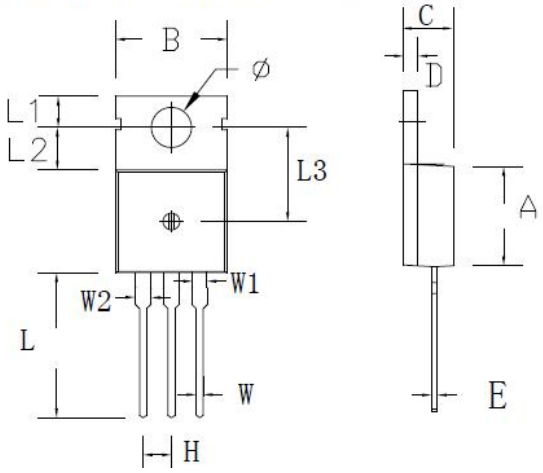
TO-252B PACKAGE OUTLINE DIMENSIONS



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

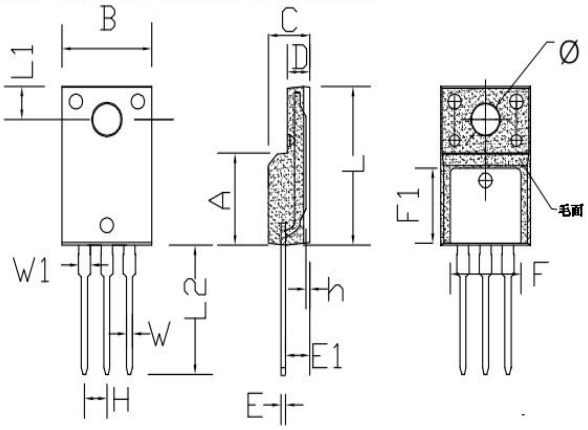
9 Dimensions(continues)

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

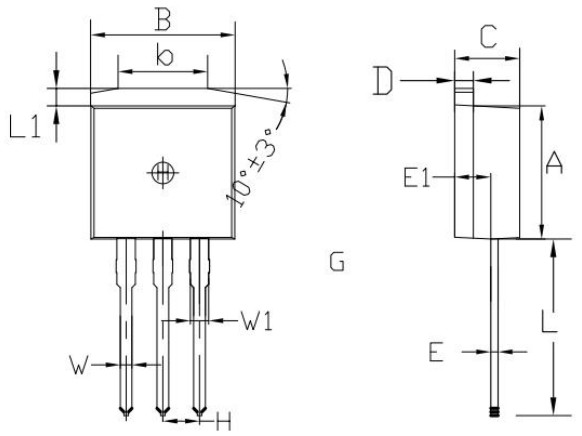
TO-220F PACKAGE OUTLINE DIMENSIONS



Symbol	DimensionsIn Millimeters		DimensionsIn 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

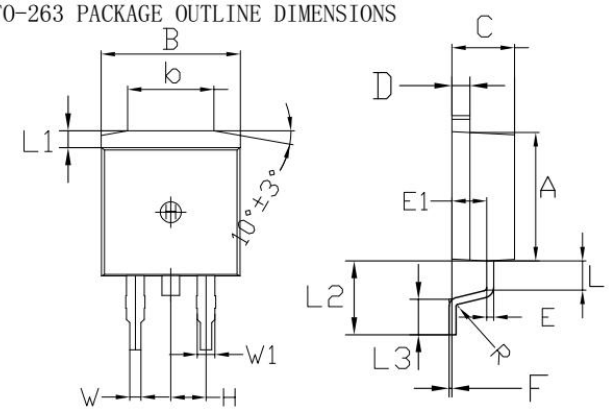
9 Dimensions(continues)

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
2018.04.15	1.0	Original	