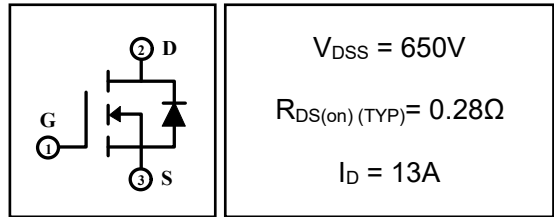


13A 650V N-channel Super Junction Power MOSFET

1 Description

These N-channel enhanced vdmofets, is using advanced super junction technology and design to provide excellent Rdson with low gate charge. Which accords with the RoHS standard.



2 Features

- Fast switching
- Low on resistance($R_{dson} \leq 0.32\Omega$)
- Low gate charge(Typ: 27nC)
- Low reverse transfer capacitances(Typ: 3.3pF)
- 100% single pulse avalanche energy test
- 100% ΔV_{DS} test

3 Applications

- Power factor correction(PFC).
- Switched mode power supplies(SMPS).
- Uninterruptible power supply(UPS).



4 Electrical Characteristics

4.1 Absolute Maximum Rating ($T_c=25^\circ C$, unless otherwise noted)

Parameter	Symbol	Rating		Units	
		DHSJ13N65/DHISJ13N65/DHESJ13N65/DHBSJ13N65/DHDSJ13N65	DHFSJ13N65		
Drain-to-Source Voltage	V_{DSS}	650		V	
Gate-to-Source Voltage	V_{GSS}	± 20		V	
Continuous Drain Current	I_D	$T_c=25^\circ C$	12.6	A	
		$T_c=100^\circ C$	7.9	A	
Pulsed Drain Current ⁽¹⁾	I_{DM}	38		A	
Single Pulse Avalanche Energy ⁽⁴⁾	E_{AS}	165		mJ	
Repetitive Avalanche Current ⁽⁴⁾	I_{AR}	1.95		A	
Power Dissipation	P_{tot}	$T_a=25^\circ C$	2	2	W
		$T_c=25^\circ C$	96	32	W
Isolation Voltage	V_{ISO}	/	2500	V	
Gate-Source ESD (HBM-C=100pF,R=1.5K Ω)	$V_{ESD(G-S)}$	2000		V	
Junction Temperature Range	T_j	-55~150		$^\circ C$	
Storage Temperature Range	T_{stg}	-55~150		$^\circ C$	
Maximum Temperature for soldering	T_L	300		$^\circ C$	

4.2 Thermal Characteristics

Parameter	Symbol	Rating		Unit
		DHSJ13N65/DHISJ13N65/DHESJ13N65/DHBSJ13N65/DHDSJ13N65	DHFSJ13N65	
Thermal Resistance, Junction to Case-sink	R_{thJC}	1.30	3.91	$^\circ C/W$
Thermal Resistance, Junction to Ambient	R_{thJA}	62.5	62.5	$^\circ C/W$

4.3 Electrical Characteristics ($T_C=25^\circ\text{C}$, unless otherwise noted)

Parameter	Symbol	Test Condition	Value			Units
			Min	Typ	Max	
Off Characteristics						
Drain-to-Source Breakdown Voltage	BV_{DSS}	$I_D=250\mu\text{A}, V_{GS}=0\text{V}$	650	--	--	V
Drain-to-Source Leakage Current	I_{DSS}	$V_{DS}=650\text{V}, V_{GS}=0\text{V}, T_C=25^\circ\text{C}$	--	--	1	μA
		$V_{DS}=650\text{V}, V_{GS}=0\text{V}, T_C=150^\circ\text{C}$	--	--	100	μA
Gate-to-Source Leakage Current	I_{GSS}	$V_{GS}=\pm 20\text{V}$	--	--	± 1000	nA
On Characteristics						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	2	--	4	V
Drain-to-Source on-state Resistance	$R_{DS(on)}$	$V_{GS}=10\text{V}, I_D=4.1\text{A}$	--	0.28	0.32	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	$V_{GS}=0\text{V}, V_{DS}=400\text{V}, f=1.0\text{MHz}$	--	1150	--	pF
Output Capacitance	C_{oss}		--	28	--	
Reverse Transfer Capacitance	C_{rss}		--	3.3	--	
Switching Characteristics						
Turn-on Delay Time	$t_{d(on)}$	$I_D=5.7\text{A}, V_{DD}=325\text{V}, V_{GS}=10\text{V}, R_G=25\Omega$	--	30	--	nS
Turn-on Rise Time	t_r		--	20	--	
Turn-off Delay Time	$t_{d(off)}$		--	125	--	
Turn-off Fall Time	t_f		--	17	--	
Total Gate Charge	Q_g	$I_D=5.7\text{A}, V_{DD}=520\text{V}, V_{GS}=10\text{V}$	--	27	--	nC
Gate-to-Source Charge	Q_{gs}		--	5.3	--	
Gate-to-Drain("Miller") Charge	Q_{gd}		--	8	--	
Drain-Source Diode Characteristics						
Diode Forward Voltage ⁽³⁾	V_{FSD}	$V_{GS}=0\text{V}, I_S=5.7\text{A}$	--	--	1.2	V
Diode Forward Current	I_S		--	--	12.6	A
Reverse Recovery Time ⁽³⁾	t_{rr}	$T_J=25^\circ\text{C}, I_F=5.7\text{A}, dl_F/dt=100\text{A}/\mu\text{S}, V_R=400\text{V}$	--	310	--	nS
Reverse Recovery Charge ⁽³⁾	Q_{rr}		--	3400	--	nC

Notes:

- 1: Repetitive rating, pulse width limited by maximum junction temperature.
- 2: Surface mounted on FR4 Board, $t \leq 10\text{sec}$.
- 3: Pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.
- 4: $L=10\text{mH}, I_D=5.75\text{A}, V_{DD}=50\text{V}, V_{GS}=10\text{V}, R_G=25\Omega, V_{GATE}=650\text{V}, \text{Start } T_J=25^\circ\text{C}$.

5 Typical characteristics diagrams

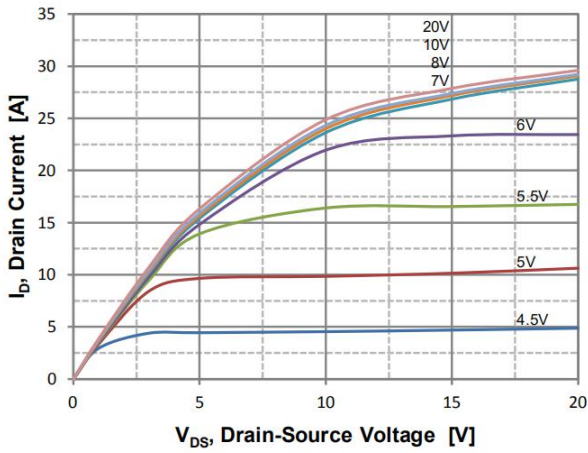


Figure 1. On Region Characteristics

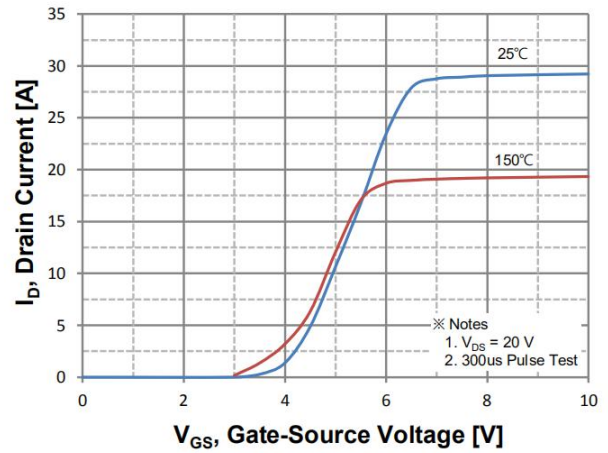


Figure 2. Transfer Characteristics

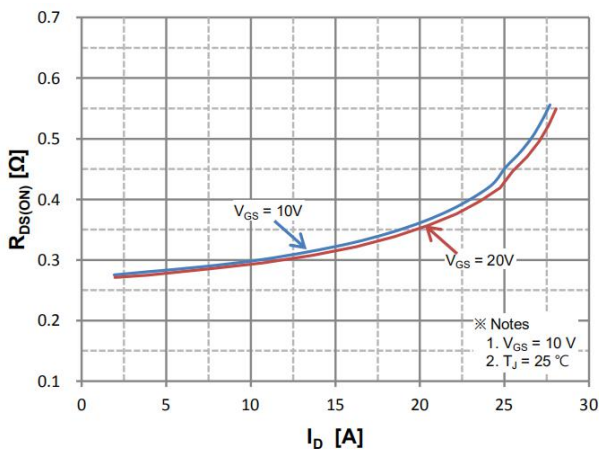


Figure 3. On Resistance Variation vs Drain Current and Gate Voltage

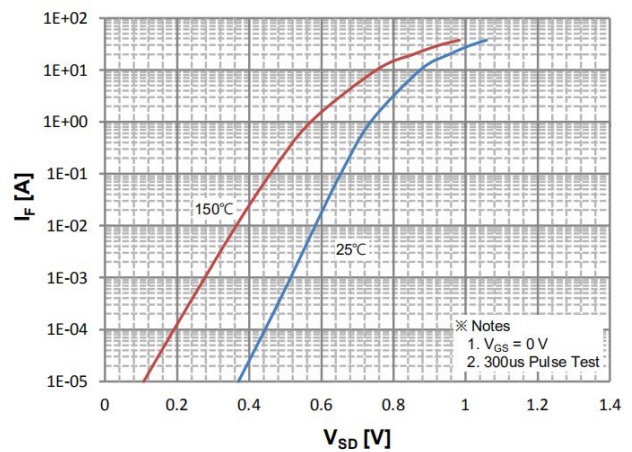


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

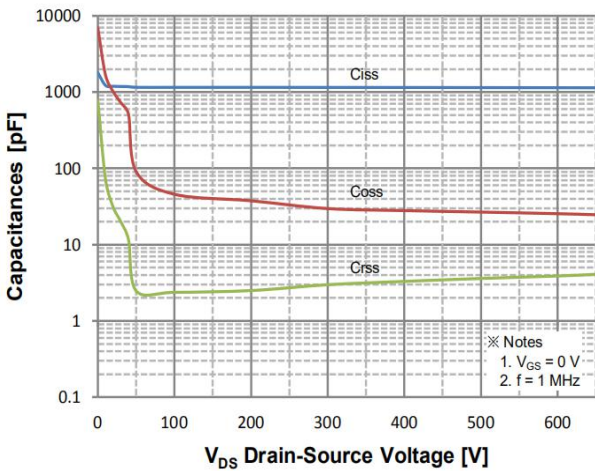


Figure 5. Capacitance Characteristics

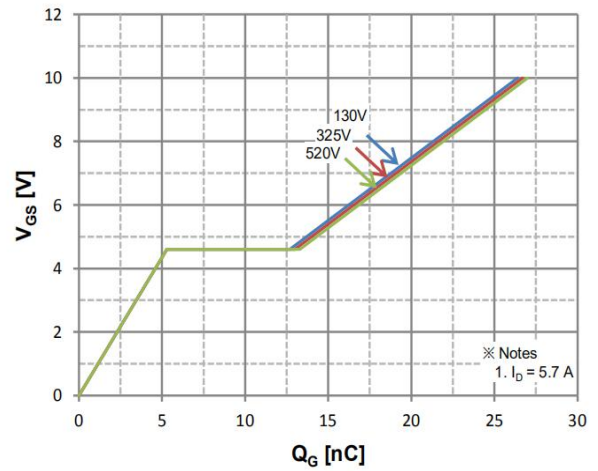


Figure 6. Gate Charge Characteristics

5 Typical characteristics diagrams(continues)

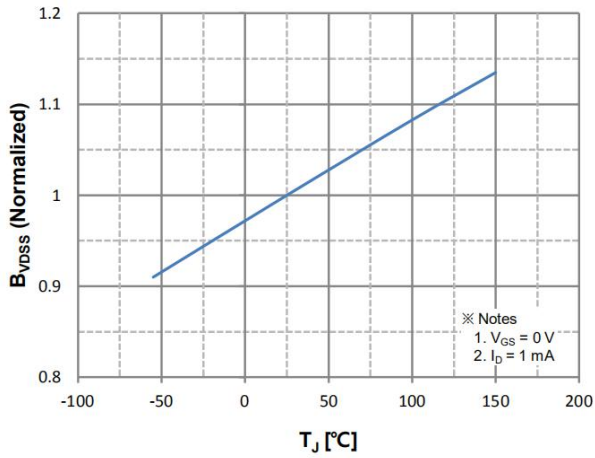


Figure 7. Breakdown Voltage Variation vs. Temperature

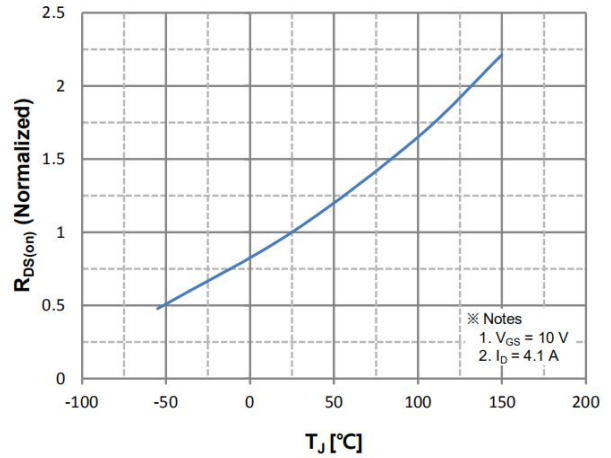


Figure 8. On-Resistance Variation vs. Temperature

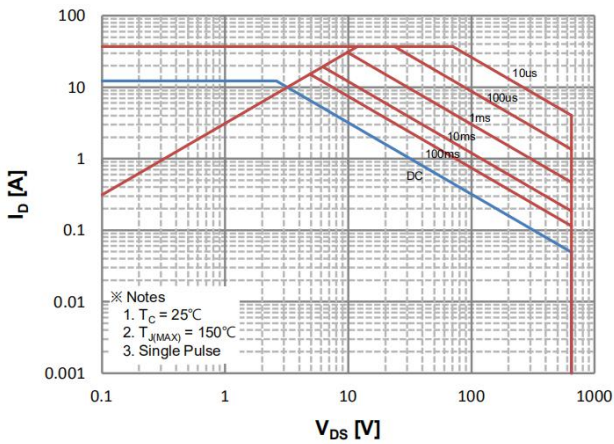


Figure 9. Maximum Safe Operating Area

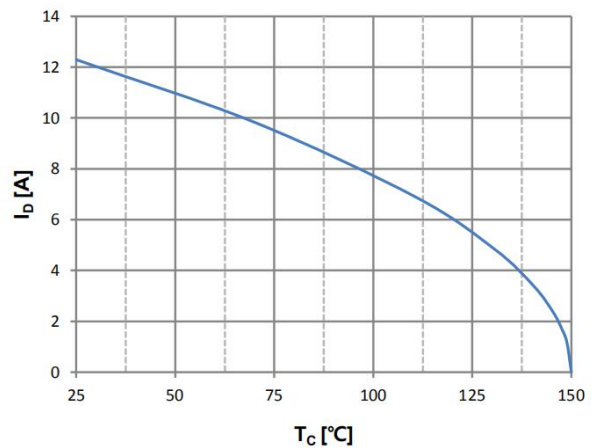


Figure 10. Maximum Drain Current vs. Case Temperature

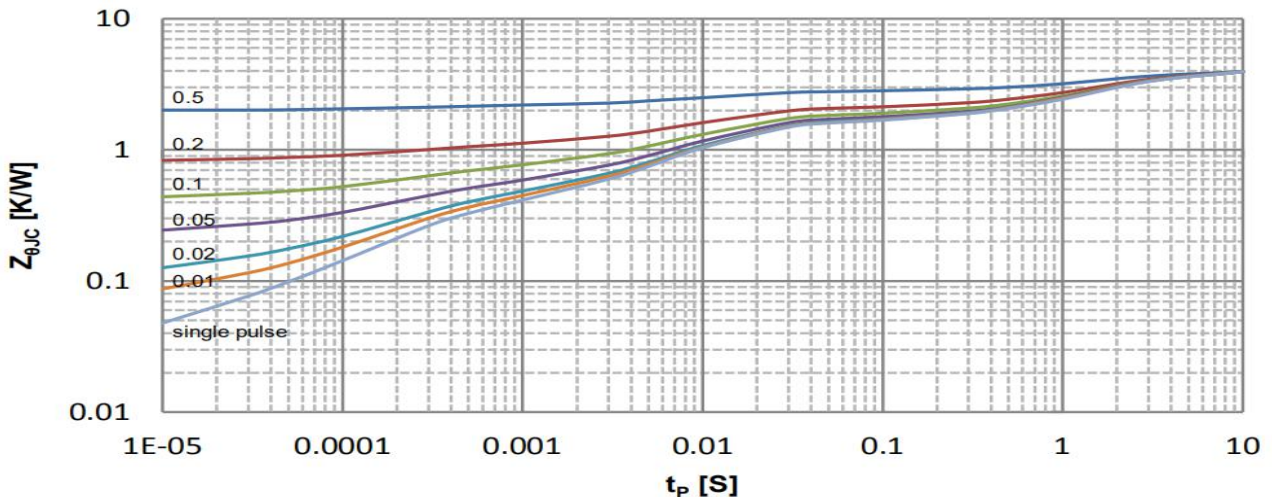
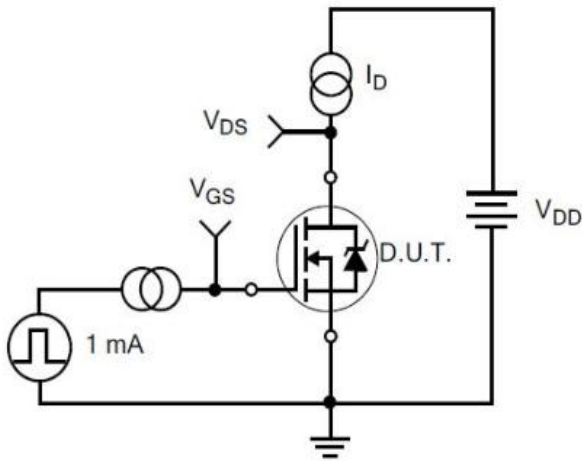
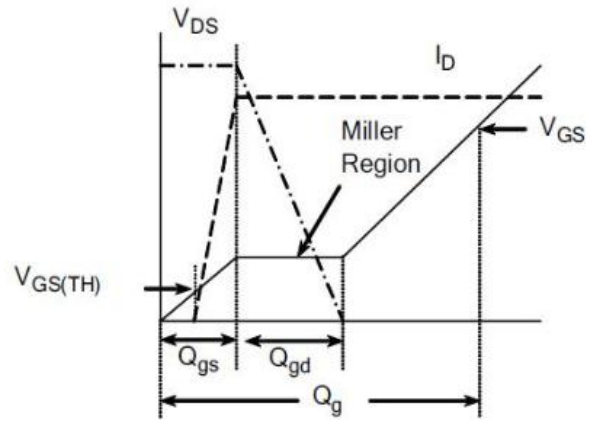


Figure 11. Transient Thermal Response Curve

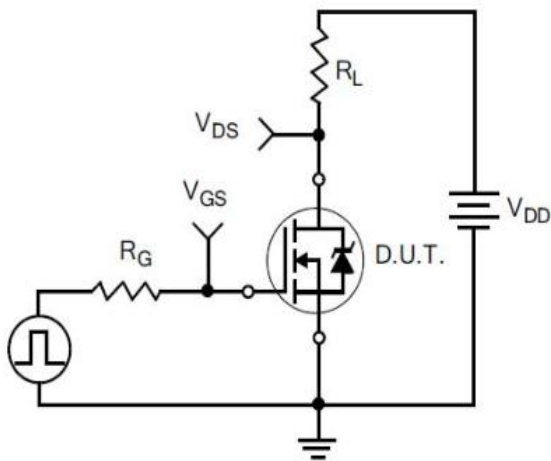
6 Typical Test Circuit and Waveform



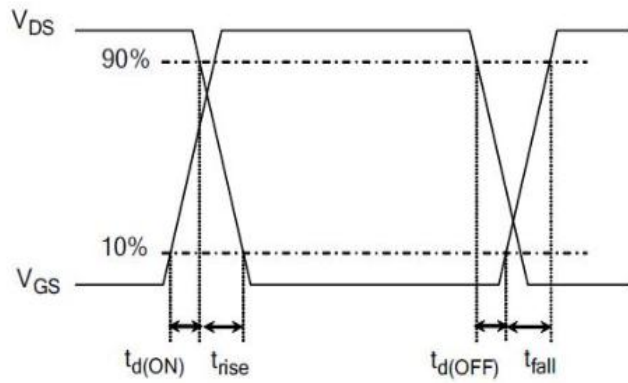
1) Gate Charge Test Circuit



2) Gate Charge Waveform

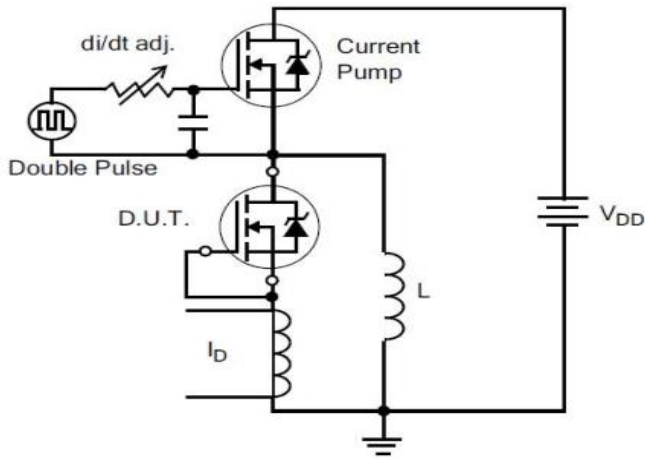


3) Resistive Switching Test Circuit

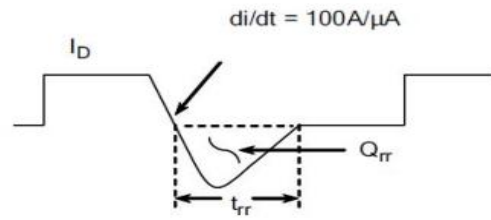


4) Resistive Switching Waveforms

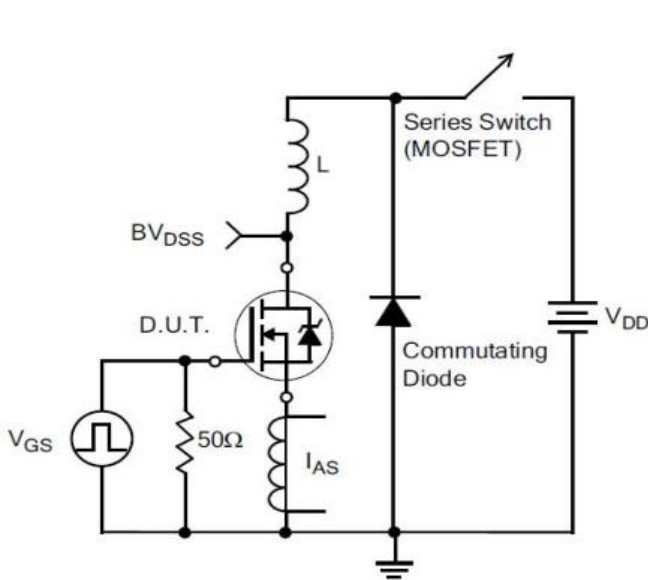
6 Typical Test Circuit and Waveform(continues)



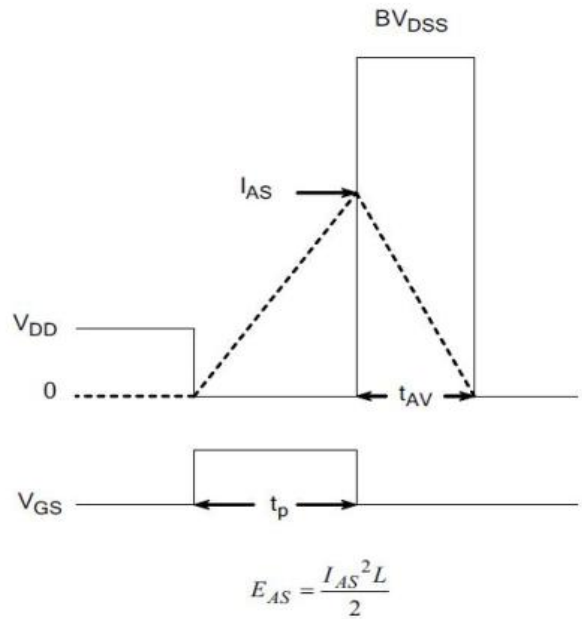
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform

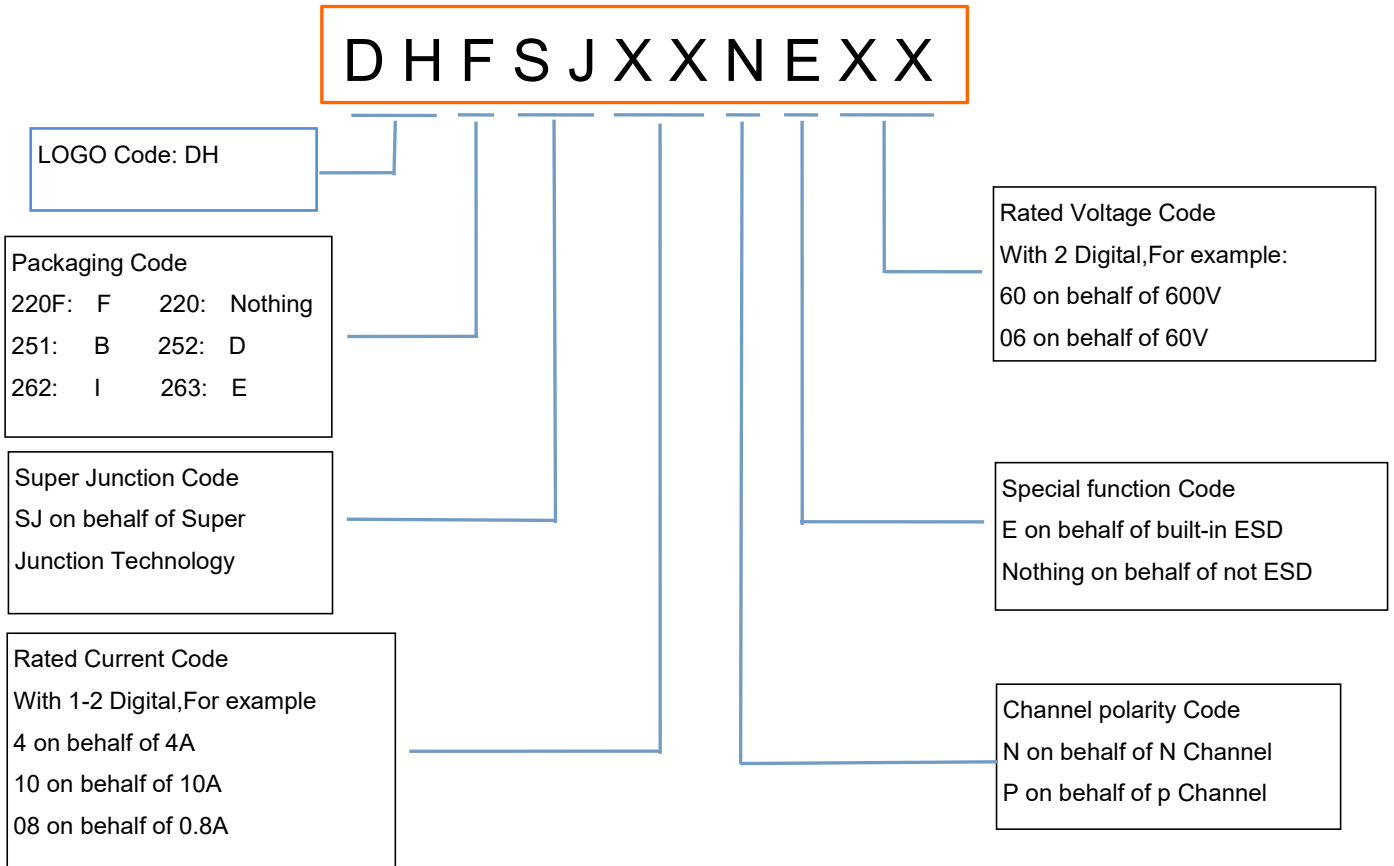


7) . Unclamped Inductive Switching Test Circuit



8) Unclamped Inductive Switching Waveforms

7 Product Names Rules

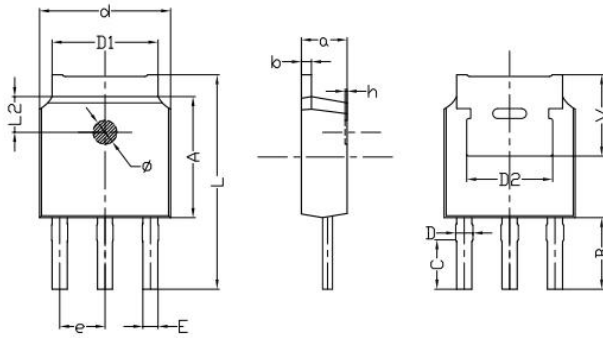


8 Product Specifications and Packaging Models

Product Model	Package Type	Mark Name	RoHS	Package	Quantity
DHSJ13N65	TO-220	DHSJ13N65	Pb-free	Tube	1000/box
DHFSJ13N65	TO-220F	DHFSJ13N65	Pb-free	Tube	1000/box
DHBSJ13N65	TO-251	DHBSJ13N65	Pb-free	Tube	3000/box
DHDSJ13N65	TO-252	DHDSJ13N65	Pb-free	Tape & Reel	2500/box
DHISJ13N65	TO-262	DHISJ13N65	Pb-free	Tube	1000/box
DHESJ13N65	TO-263	DHESJ13N65	Pb-free	Tape & Reel	800/box

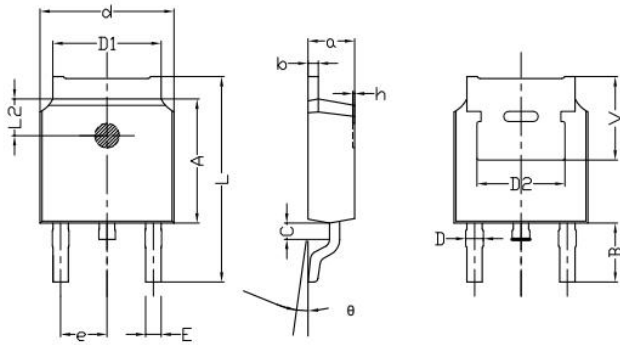
9 Dimensions

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

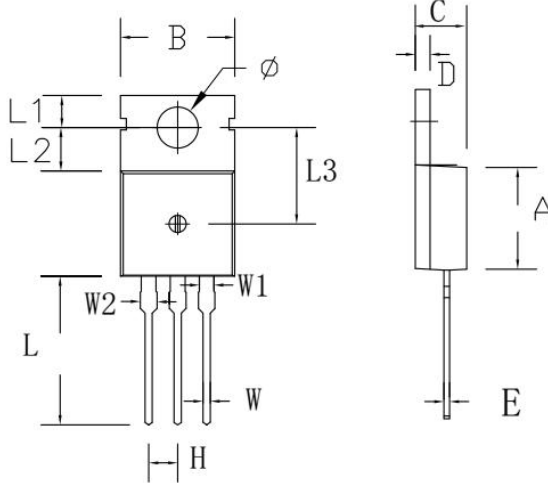
TO-252B PACKAGE OUTLINE DIMENSIONS



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

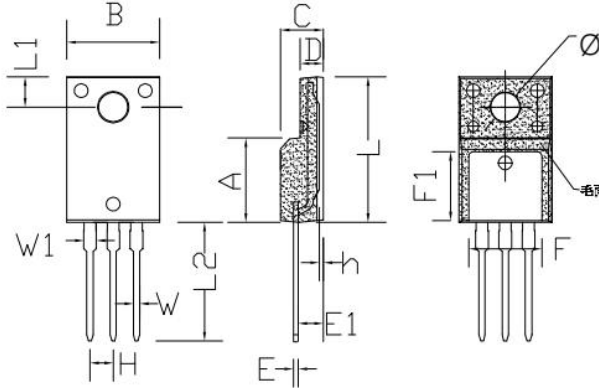
9 Dimensions(continues)

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

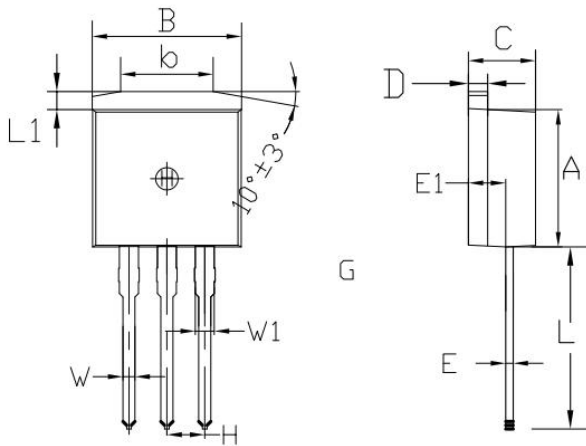
TO-220F PACKAGE OUTLINE DIMENSIONS



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

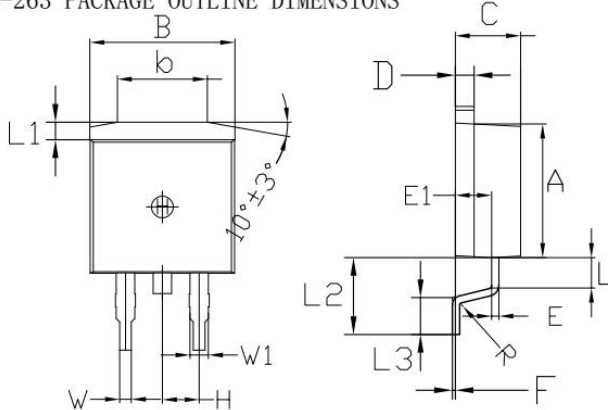
9 Dimensions(continues)

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
2020.06.14	1.0	Original	