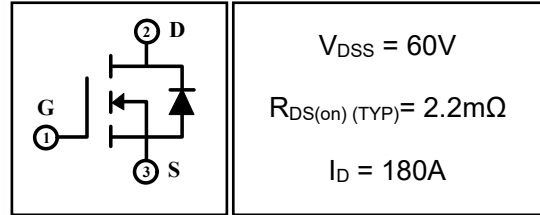


## 180A 60V N-channel Enhancement Mode Power MOSFET

### 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.

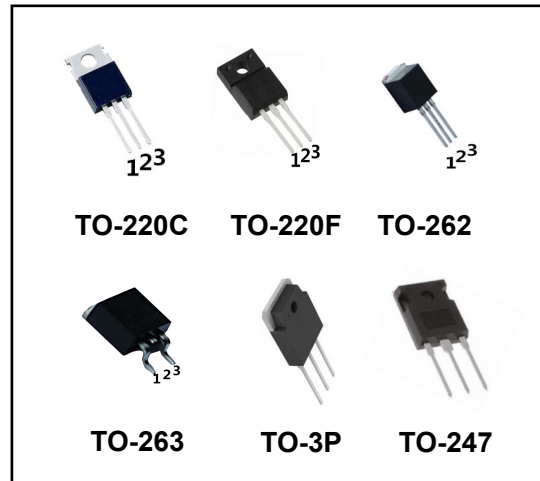


### 2 Features

- Fast switching
- Low on resistance
- Low gate charge
- High avalanche current
- Low reverse transfer capacitances
- 100% single pulse avalanche energy test
- 100%  $\Delta V_{DS}$  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
		N6005 IN6005 EN6005	N6005D N6005B	FN6005	
Drain-to-Source Voltage	$V_{DSS}$	60			V
Gate-to-Source Voltage	$V_{GSS}$	$\pm 20$			V
Continuous Drain Current	$T_C=25^\circ C$	180			A
	$T_C=100^\circ C$	126			A
Pulsed Drain Current <sup>(1)</sup>	$I_{DM}$	720			A
Single Pulse Avalanche Energy <sup>(4)</sup>	$E_{AS}$	1220			mJ
Avalanche Current <sup>(4)</sup>	$I_{AS}$	70			A
Power Dissipation	$T_a=25^\circ C$	2	3	2	W
	$T_C=25^\circ C$	220	220	54	W
Isolation Voltage	$V_{ISO}$	/			2500
Junction Temperature Range	$T_j$	-55~175			°C
Storage Temperature Range	$T_{stg}$	-55~175			°C

#### 4.2 Thermal Characteristics

Parameter	Symbol	Rating			Units
		N6005 IN6005 EN6005	N6005D N6005B	FN6005	
Thermal Resistance, Junction to Case-sink	$R_{thJC}$	0.68	0.68	2.78	°C/W
Thermal Resistance, Junction to Ambient	$R_{thJA}$	75	75	75	°C/W

**4.3 Electrical Characteristics** (T<sub>c</sub>=25°C, unless otherwise noted)

Parameter	Symbol	Test Condition	Value			Units
			Min	Typ	Max	
<b>Off Characteristics</b>						
Drain-to-Source Breakdown Voltage	BV <sub>DSS</sub>	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V	60	68	—	V
Drain-to-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =60V, V <sub>GS</sub> =0V, T <sub>C</sub> =25°C	—	—	1	μA
		V <sub>DS</sub> =60V, V <sub>GS</sub> =0V, T <sub>C</sub> =125°C	—	—	100	μA
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	—	—	±100	nA
<b>On Characteristics</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2	3	4	V
Drain-to-Source on-state Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =75A	—	2.2	2.8	mΩ
<b>Dynamic Characteristics</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =35V, f=1.0MHz	—	4439	—	pF
Output Capacitance	C <sub>oss</sub>		—	1624	—	
Reverse Transfer Capacitance	C <sub>rss</sub>		—	65	—	
Gate Resisitance	R <sub>G</sub>	V <sub>DD</sub> =0V, V <sub>GS</sub> =0V, F=1MHz	—	2	—	Ω
<b>Switching Characteristics</b>						
Turn-on Delay Time	t <sub>d(on)</sub>	I <sub>D</sub> =75A, V <sub>DD</sub> =35V, V <sub>GS</sub> =10V, R <sub>GEN</sub> =2Ω	—	19	—	nS
Turn-on Rise Time	t <sub>r</sub>		—	100	—	
Turn-off Delay Time	t <sub>d(off)</sub>		—	38	—	
Turn-off Fall Time	t <sub>f</sub>		—	107	—	
Total Gate Charge	Q <sub>g</sub>	I <sub>D</sub> =75A, V <sub>DD</sub> =35V, V <sub>GS</sub> =10V	—	67	—	nC
Gate-to-Source Charge	Q <sub>gs</sub>		—	27	—	
Gate-to-Drain("Miller") Charge	Q <sub>gd</sub>		—	12	—	
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage <sup>(3)</sup>	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =30A	—	0.83	1.3	V
Diode Forward Current	I <sub>S</sub>		—	—	180	A
Reverse Recovery Time <sup>(3)</sup>	t <sub>rr</sub>	T <sub>J</sub> =25°C, I <sub>F</sub> =75A, di <sub>F</sub> /dt=100A/μS, V <sub>GS</sub> =0V	—	62	—	nS
Reverse Recovery Charge <sup>(3)</sup>	Q <sub>rr</sub>		—	68	—	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<sub>D</sub>=70A, V<sub>DD</sub>=50V, V<sub>GATE</sub>=10V, Start T<sub>J</sub>=25°C.

## 5 Typical characteristics diagrams

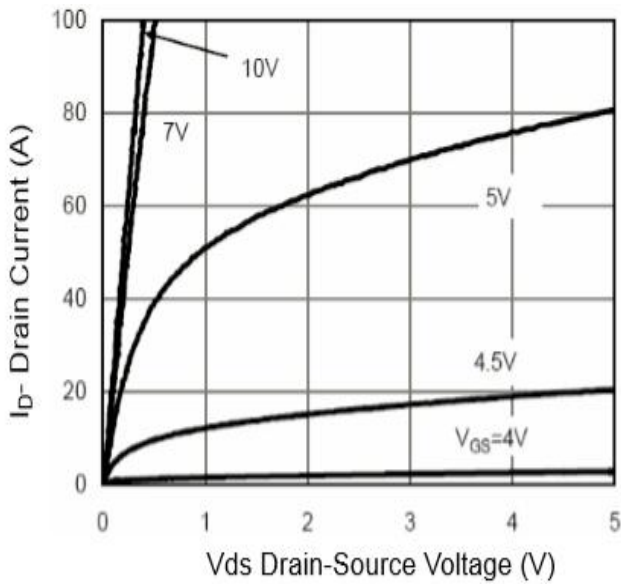


Figure 1 Output Characteristics

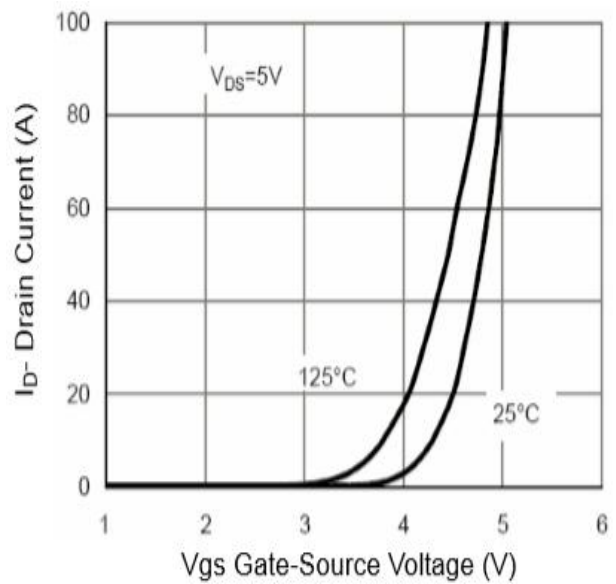


Figure 2 Transfer Characteristics

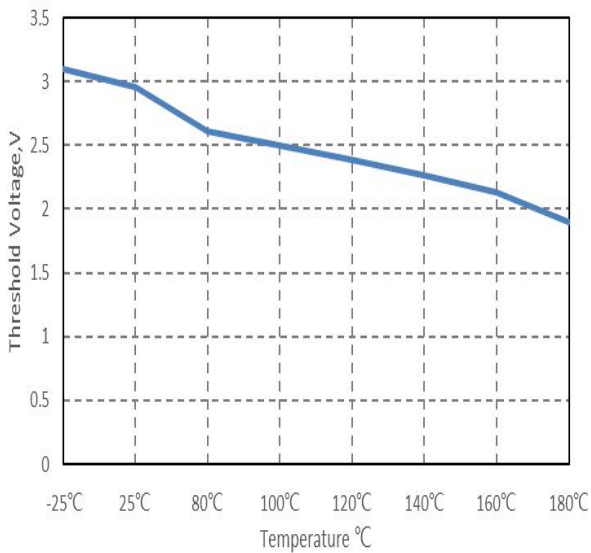


Figure 3. Threshold vs Temperature

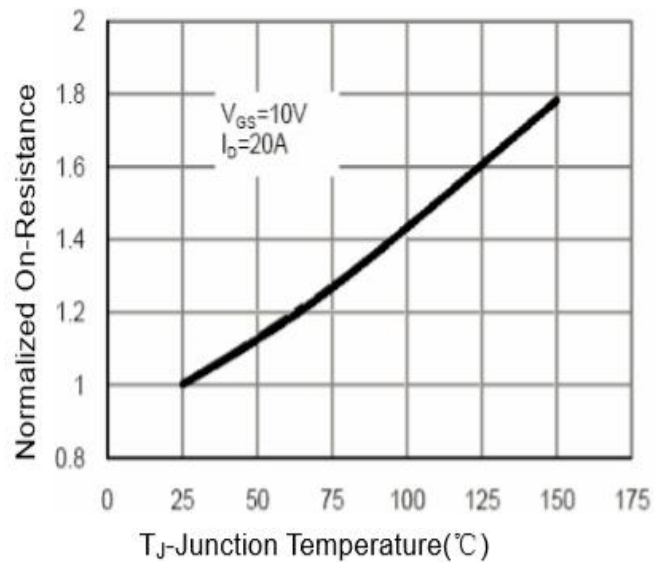


Figure 4. Rdson vs Temperature

**5 Typical characteristics diagrams(continues)**

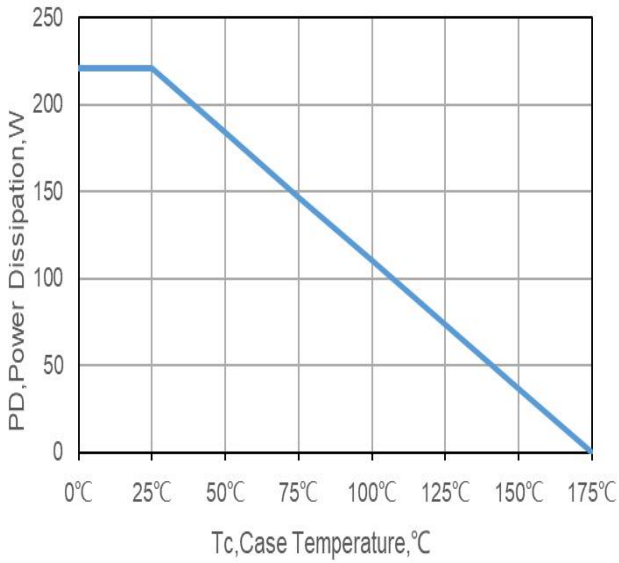


Figure 5. Power De-rating

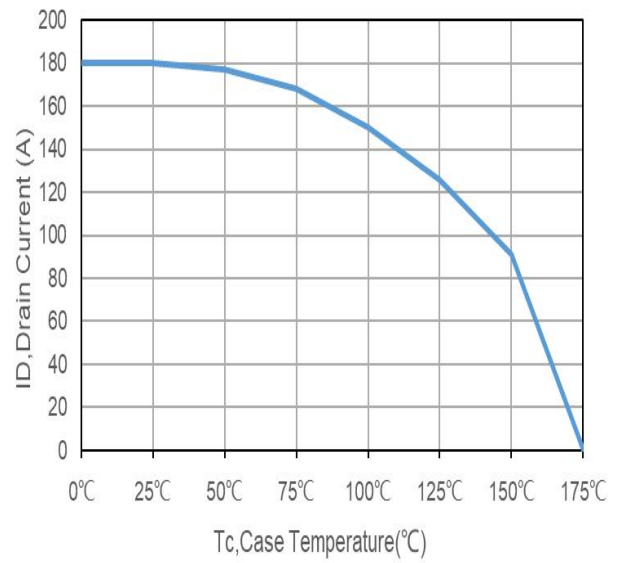


Figure 6. ID Current Derating

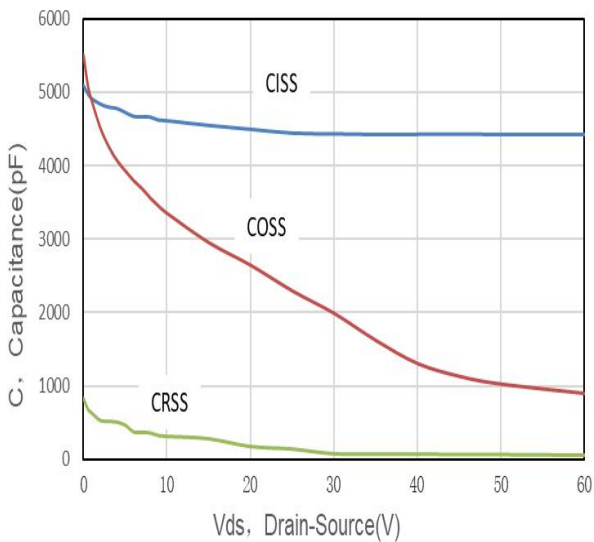


Figure 7. Capacitance Characteristics

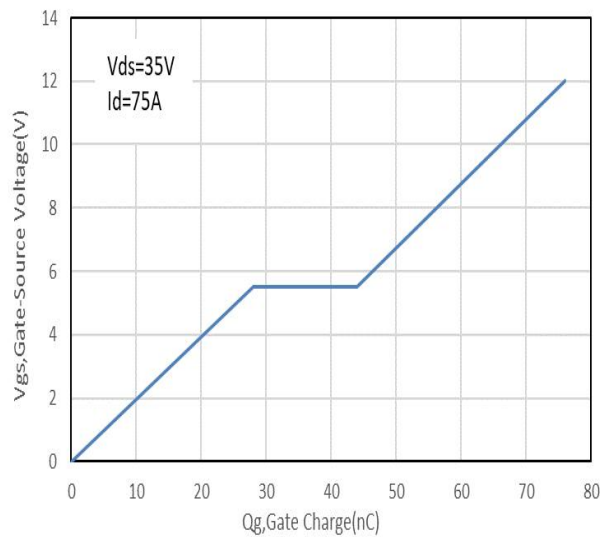
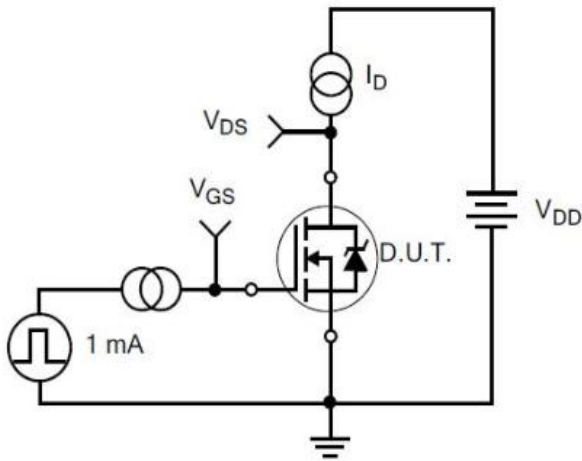
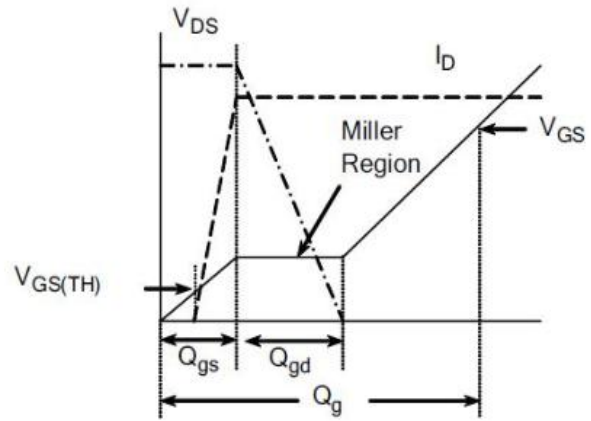


Figure 8. Gate Charge Characteristics

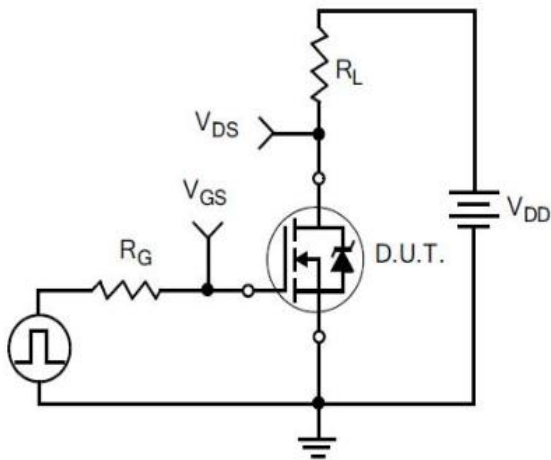
**6 Typical Test Circuit and Waveform**



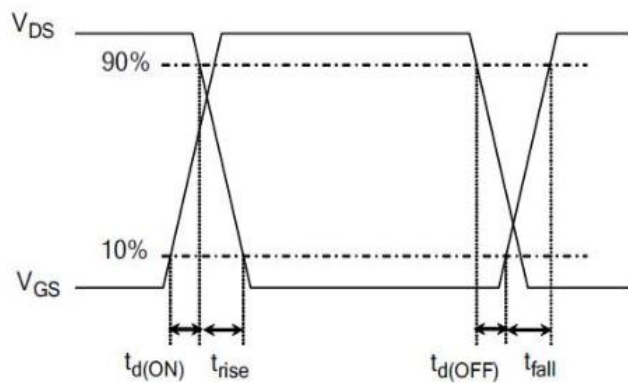
1) Gate Charge Test Circuit



2) Gate Charge Waveform

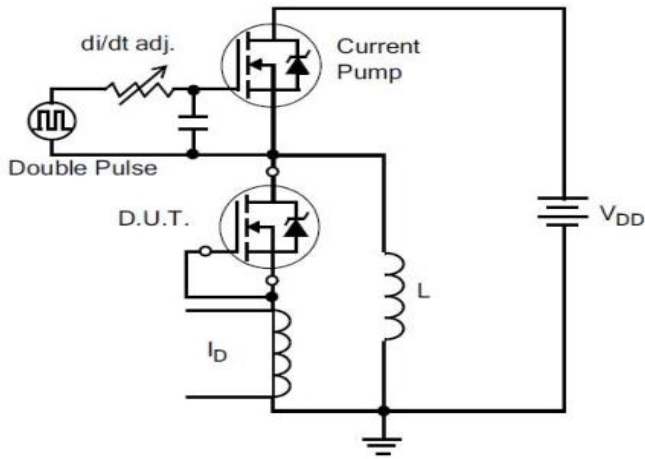


3) Resistive Switching Test Circuit

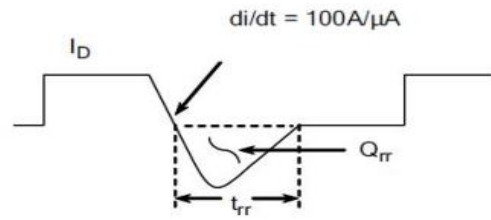


4) Resistive Switching Waveforms

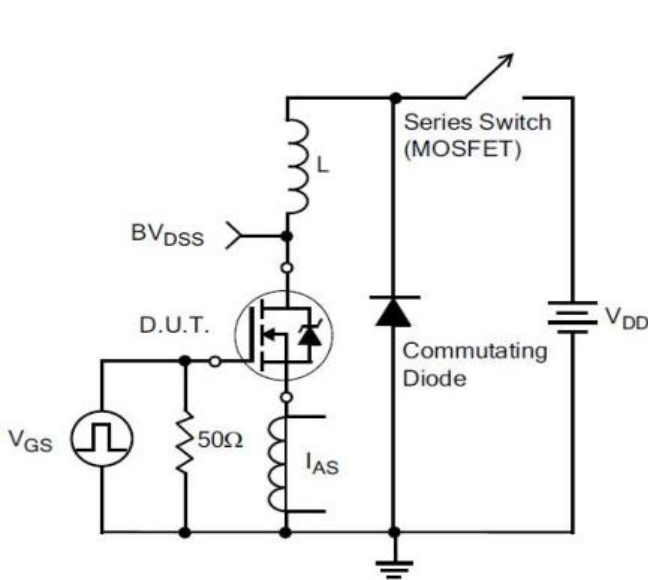
**6 Typical Test Circuit and Waveform(continues)**



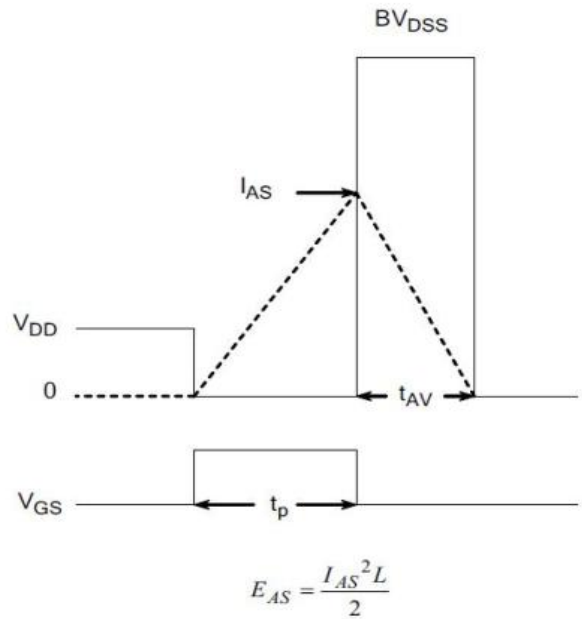
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform

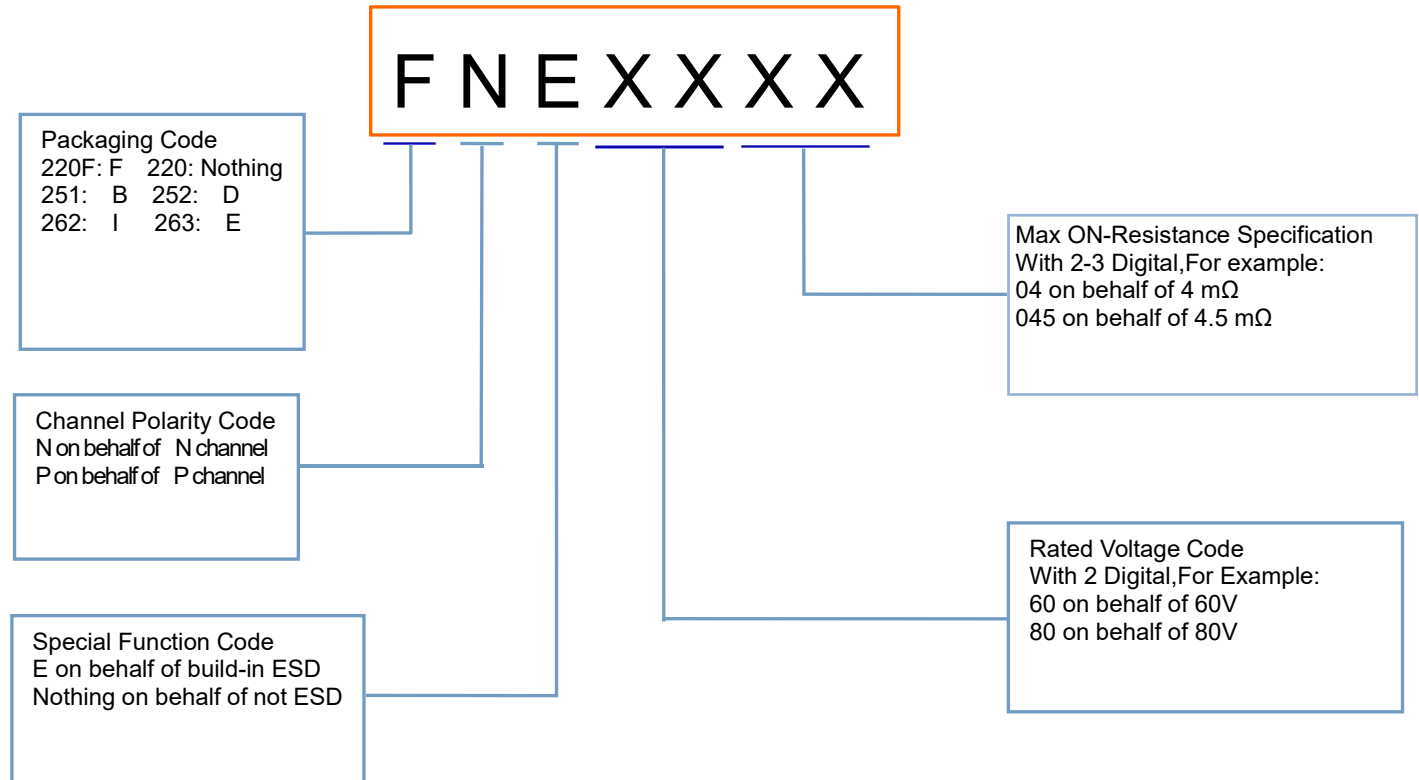


7) . Unclamped Inductive Switching Test Circuit



8) Unclamped Inductive Switching Waveforms

## 7 Product Names Rules

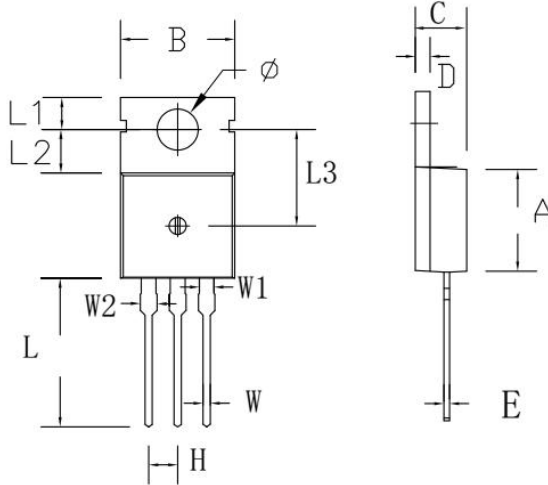


## 8 Product Specifications and Packaging Models

Product Model	Package Type	Mark Name	RoHS	Package	Quantity
N6005	TO-220	N6005	Pb-free	Tube	1000/box
FN6005	TO-220F	FN6005	Pb-free	Tube	1000/box
IN6005	TO-262	IN6005	Pb-free	Tube	1000/box
EN6005	TO-263	EN6005	Pb-free	Tape & Reel	800/box
N6005D	TO-3P	N6005D	Pb-free	Tape & Reel	600/box
N6005B	TO-247	N6005B	Pb-free	Tape & Reel	600/box

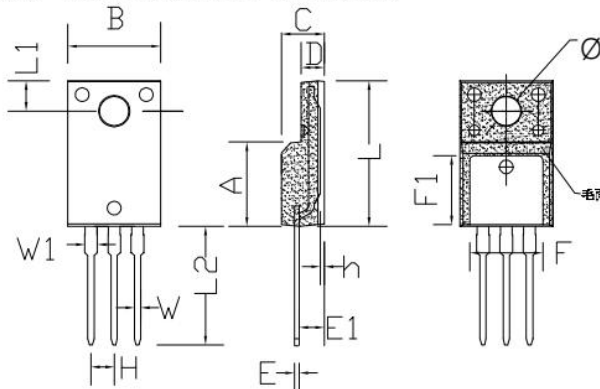
## 9 Dimensions

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

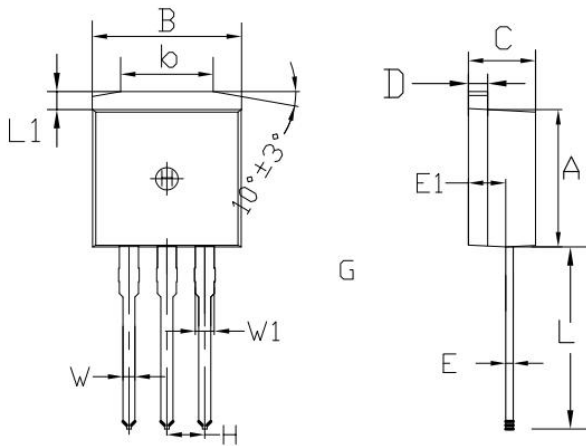


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	min.	max.	min.	max.
A	8.80	9.30	0.346	0.366
B	10.00	10.50	0.394	0.413
C	4.30	4.90	0.169	0.193
D	2.30	2.70	0.091	0.106
L	15.55	16.15	0.612	0.636
h	0.40	0.60	0.016	0.024
L1	3.15	3.55	0.124	0.140
L2	12.65	13.35	0.498	0.526
W	0.70	0.90	0.028	0.035
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



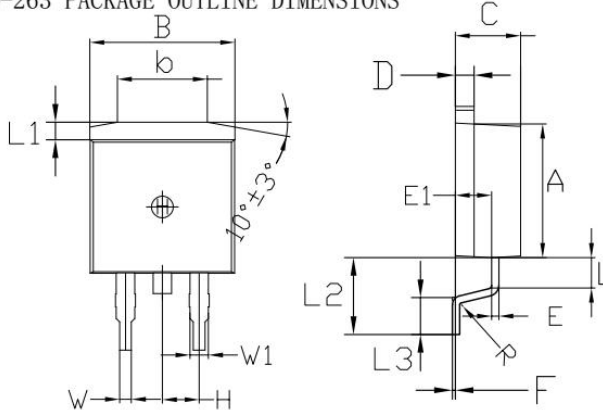
**9 Dimensions(continues)**

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

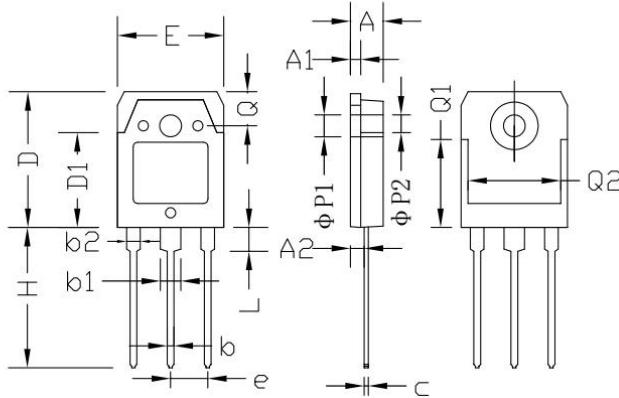
TO-263 PACKAGE OUTLINE DIMENSIONS



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

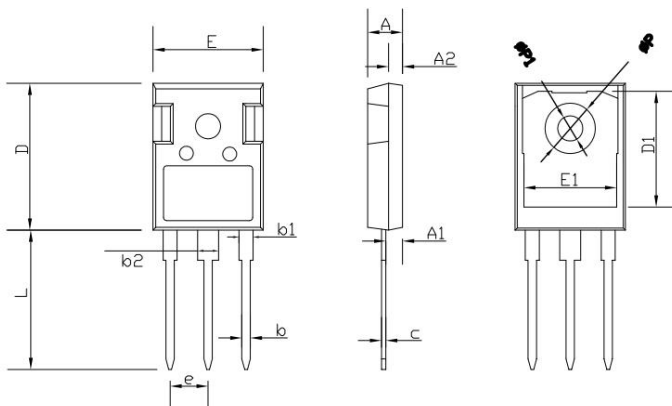
**9 Dimensions(continues)**

TO-3PN PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	min.	max.	min.	max.
A	4.60	5.00	0.181	0.197
A1	1.45	1.65	0.057	0.065
A2	2.20	2.60	0.087	0.102
b	0.80	1.20	0.032	0.047
b1	2.80	3.20	0.110	0.126
b2	1.80	2.20	0.071	0.087
C	0.55	0.75	0.022	0.030
D	19.20	19.70	0.756	0.776
D1	13.10	14.70	0.516	0.578
E	15.40	15.80	0.607	0.623
e	5.45 TYP		0.215 TYP	
H	19.80	20.20	0.780	0.826
L	3.30	3.70	0.130	0.146
ΦP1	3.20 TYP		0.126 TYP	
ΦP2	3.50 TYP		0.138 TYP	
Q	5.00 TYP		0.197 TYP	
Q1	12.40 TYP		0.488 TYP	
Q2	12.6	-	0.496	-

TO-247 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	min.	max.	min.	max.
A	4.90	5.10	0.193	0.201
A1	2.31	2.51	0.091	0.099
A2	1.90	2.10	0.075	0.083
b	1.16	1.26	0.046	0.050
b1	1.96	2.06	0.0772	0.0812
b2	2.96	3.06	0.117	0.121
c	0.59	0.66	0.0232	0.0260
D	20.90	21.10	0.8235	0.8313
D1	16.25	16.85	0.6403	0.6639
E	15.70	15.90	0.6186	0.6265
E1	13.10	13.50	0.5161	0.5319
e	5.44		0.2143	
L	19.80	20.10	0.7801	0.7919
ΦP	3.50	3.70	0.1379	0.1458
ΦP1	0	7.30	0	0.2876

## 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
2020.11.05	1.0	Original	