

NDF02N60Z, NDP02N60Z, NDD02N60Z



N-Channel Power MOSFET 600 V, 4.0 Ω

ON Semiconductor®

<http://onsemi.com>

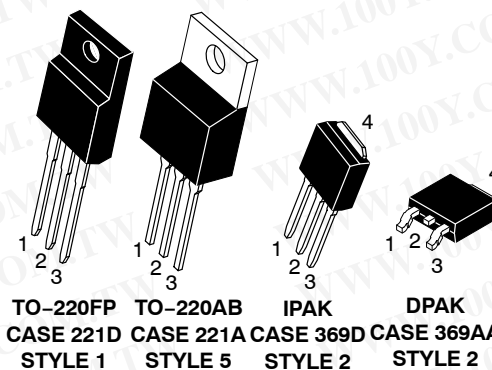
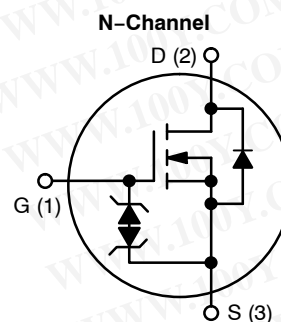
Features

- Low ON Resistance
- Low Gate Charge
- 100% Avalanche Tested
- These Devices are Pb-Free and are RoHS Compliant

V _{DSS}	R _{DS(on)} (TYP) @ 1 A
600 V	4.0 Ω

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Rating	Symbol	NDF	NDP	NDD	Unit
Drain-to-Source Voltage	V _{DSS}	600			V
Continuous Drain Current R _{θJC}	I _D	2.4 (Note 1)	2.4	2.2	A
Continuous Drain Current R _{θJC} T _A = 100°C	I _D	1.6 (Note 1)	1.6	1.4	A
Pulsed Drain Current, V _{GS} @ 10 V	I _{DM}	10 (Note 1)	10	9	A
Power Dissipation R _{θJC}	P _D	24	72	57	W
Gate-to-Source Voltage	V _{GS}	30			V
Single Pulse Avalanche Energy, I _D = 2.4 A	E _{AS}	120			mJ
ESD (HBM) (JESD 22-A114)	V _{esd}	2500			V
RMS Isolation Voltage (t = 0.3 sec., R.H. ≤ 30%, T _A = 25°C) (Figure 17)	V _{ISO}	4500			V
Peak Diode Recovery	dv/dt	4.5 (Note 2)			V/ns
Continuous Source Current (Body Diode)	I _S	2.4			A
Maximum Temperature for Soldering Leads	T _L	260			°C
Operating Junction and Storage Temperature Range	T _J , T _{stg}	-55 to 150			°C



MARKING AND ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

1. Limited by maximum junction temperature
2. I_{SD} = 2.4 A, di/dt ≤ 100 A/μs, V_{DD} ≤ BV_{DSS}, T_J = +150°C

勝特力材料 886-3-5753170
勝特力电子(上海) 86-21-34970699
勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

NDF02N60Z, NDP02N60Z, NDD02N60Z

THERMAL RESISTANCE

Parameter	Symbol	Value	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	1.7 5.2 2.2	°C/W
Junction-to-Ambient Steady State	$R_{\theta JA}$	51 51 41 80	

3. Insertion mounted

4. Surface mounted on FR4 board using 1" sq. pad size, (Cu area = 1.127 in sq [2 oz] including traces).

ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	BV_{DSS}	600			V
Breakdown Voltage Temperature Coefficient	Reference to 25°C , $I_D = 1\text{ mA}$	$\Delta BV_{DSS}/\Delta T_J$		0.6		V/°C
Drain-to-Source Leakage Current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$	I_{DSS}	25°C		1	μA
			150°C		50	
Gate-to-Source Forward Leakage	$V_{GS} = \pm 20\text{ V}$	I_{GSS}			±10	μA

ON CHARACTERISTICS (Note 5)

Static Drain-to-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 1.0\text{ A}$	$R_{DS(on)}$		4.0	4.8	Ω
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 50\text{ μA}$	$V_{GS(th)}$	3.0		4.5	V
Forward Transconductance	$V_{DS} = 15\text{ V}, I_D = 1.2\text{ A}$	g_{FS}		1.7		S

DYNAMIC CHARACTERISTICS

Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	C_{iss}		274		pF
Output Capacitance		C_{oss}		34		
Reverse Transfer Capacitance		C_{rss}		7.0		
Total Gate Charge	$V_{DD} = 300\text{ V}, I_D = 2.4\text{ A},$ $V_{GS} = 10\text{ V}$	Q_g		10.1		nC
Gate-to-Source Charge		Q_{gs}		2.4		
Gate-to-Drain ("Miller") Charge		Q_{gd}		5.3		
Plateau Voltage	$V_{DD} = 300\text{ V}, I_D = 2.4\text{ A}, V_{OS} = 10\text{ V}$	V_{GP}		6.4		V
Gate Resistance		R_g		4.9		Ω

RESISTIVE SWITCHING CHARACTERISTICS

Turn-On Delay Time	$V_{DD} = 300\text{ V}, I_D = 2.4\text{ A},$ $V_{GS} = 10\text{ V}, R_G = 5\text{ Ω}$	$t_{d(on)}$		9.0		ns
Rise Time		t_r		7.0		
Turn-Off Delay Time		$t_{d(off)}$		15		
Fall Time		t_f		7.0		

SOURCE-DRAIN DIODE CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Diode Forward Voltage	$I_S = 2.4\text{ A}, V_{GS} = 0\text{ V}$	V_{SD}			1.6	V
Reverse Recovery Time	$V_{GS} = 0\text{ V}, V_{DD} = 30\text{ V}$ $I_S = 2.4\text{ A}, di/dt = 100\text{ A/μs}$	t_{rr}		240		ns
Reverse Recovery Charge		Q_{rr}		0.7		μC

5. Pulse Width ≤ 380 μs, Duty Cycle ≤ 2%.

NDF02N60Z, NDP02N60Z, NDD02N60Z

TYPICAL CHARACTERISTICS

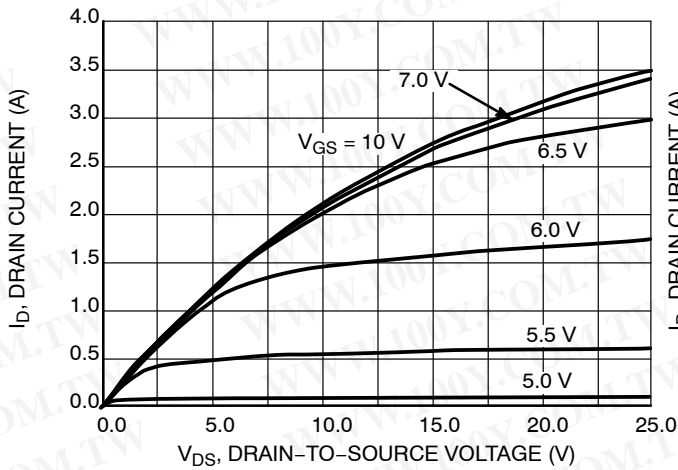


Figure 1. On-Region Characteristics

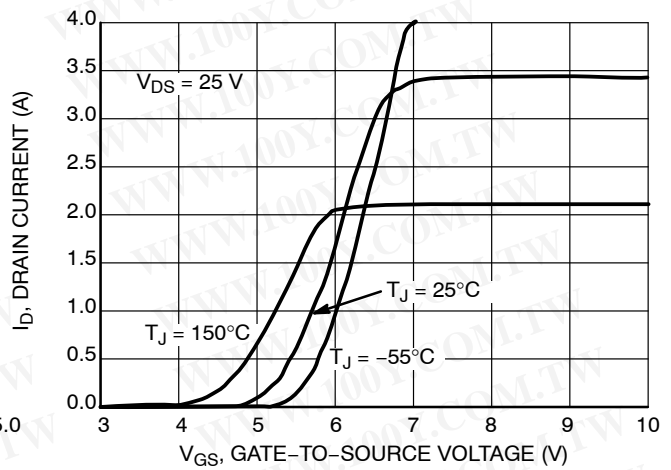


Figure 2. Transfer Characteristics

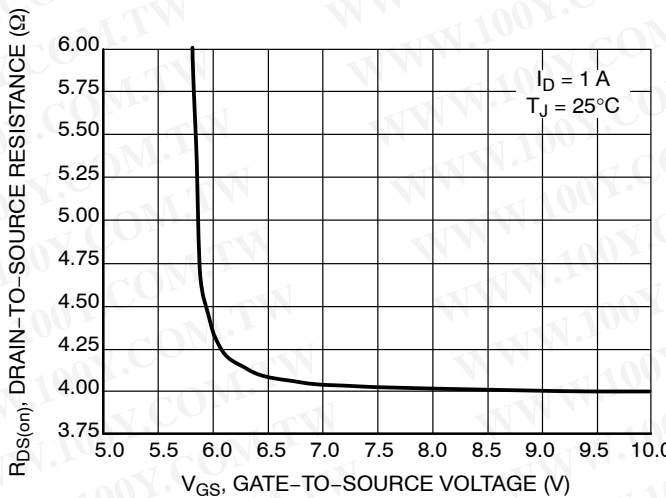


Figure 3. On-Region versus Gate-to-Source Voltage

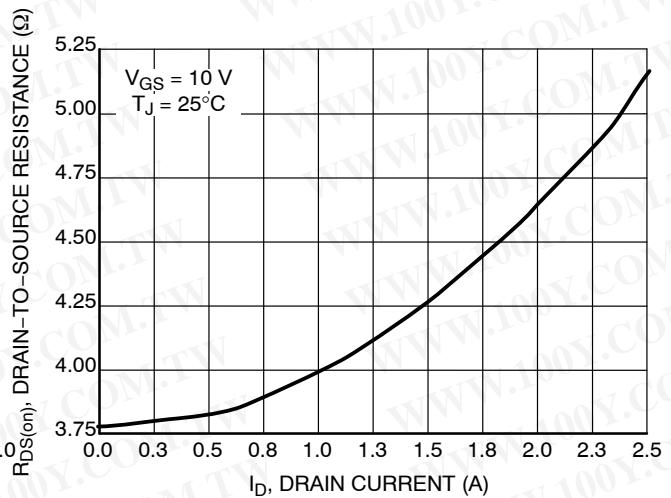


Figure 4. On-Resistance versus Drain Current and Gate Voltage

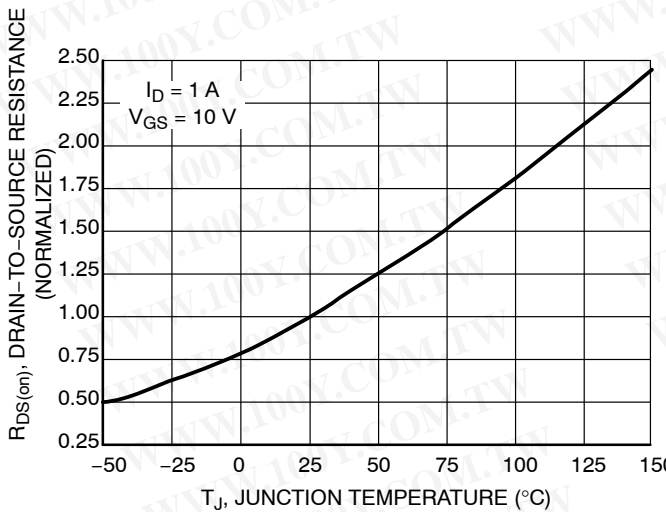


Figure 5. On-Resistance Variation with Temperature

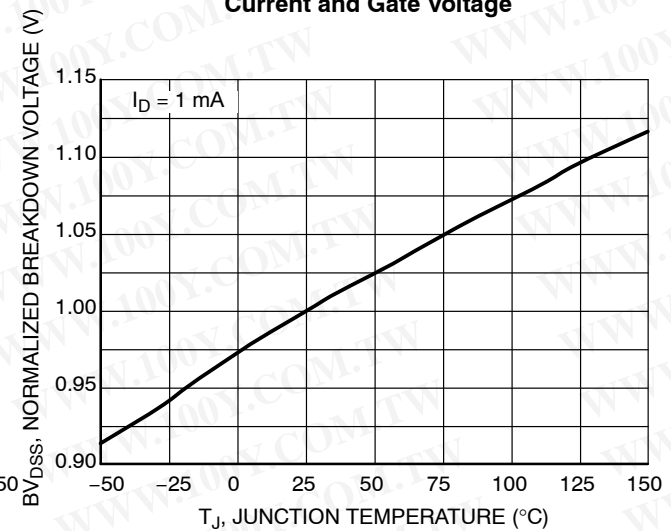


Figure 6. BV_{DSS} Variation with Temperature

NDF02N60Z, NDP02N60Z, NDD02N60Z

TYPICAL CHARACTERISTICS

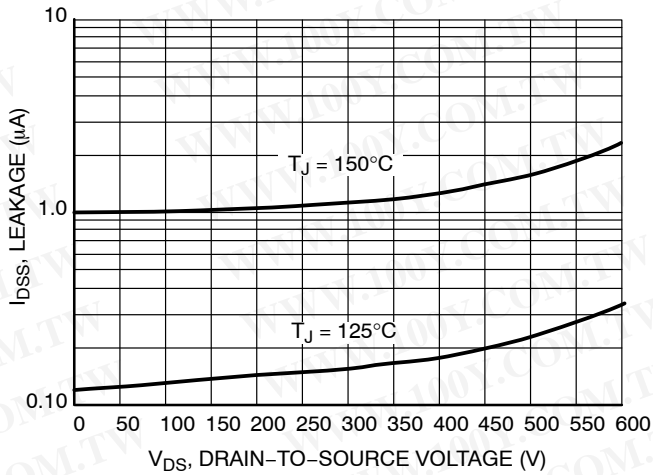


Figure 7. Drain-to-Source Leakage Current versus Voltage

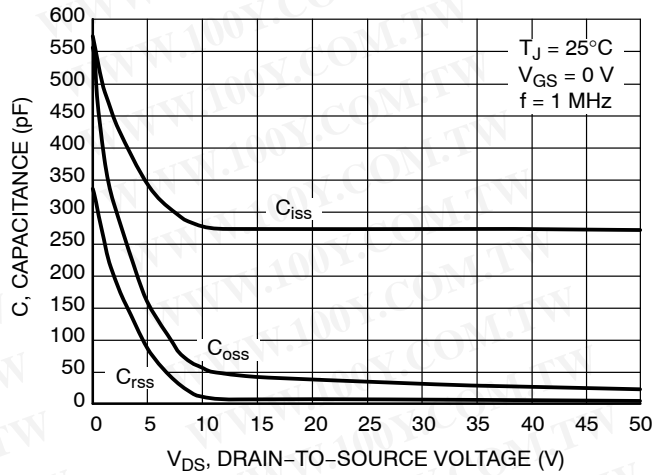


Figure 8. Capacitance Variation

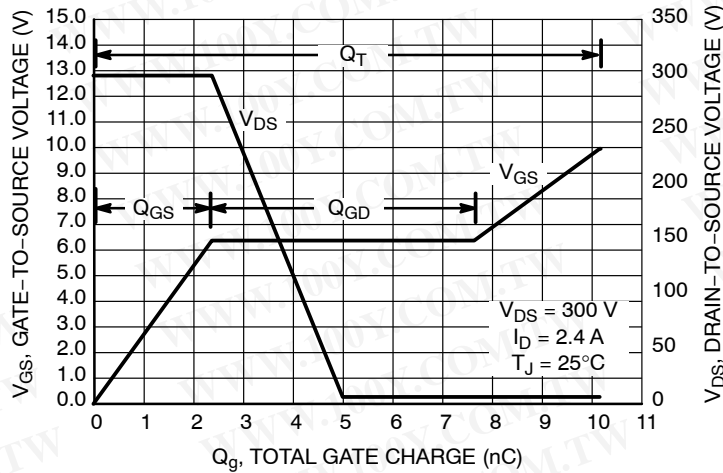


Figure 9. Gate-to-Source Voltage and Drain-to-Source Voltage versus Total Charge

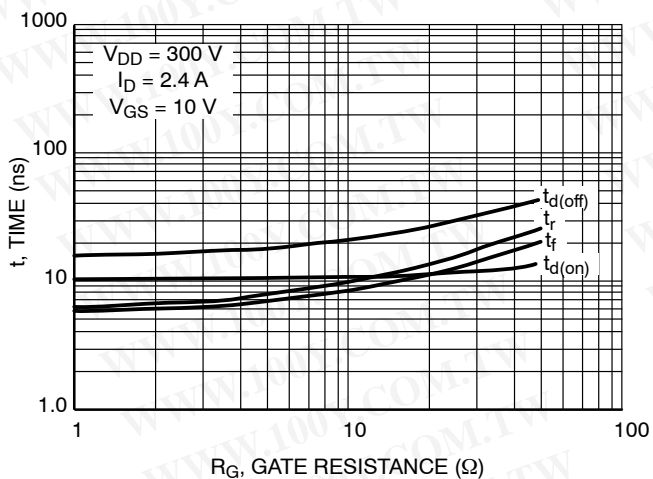


Figure 10. Resistive Switching Time Variation versus Gate Resistance

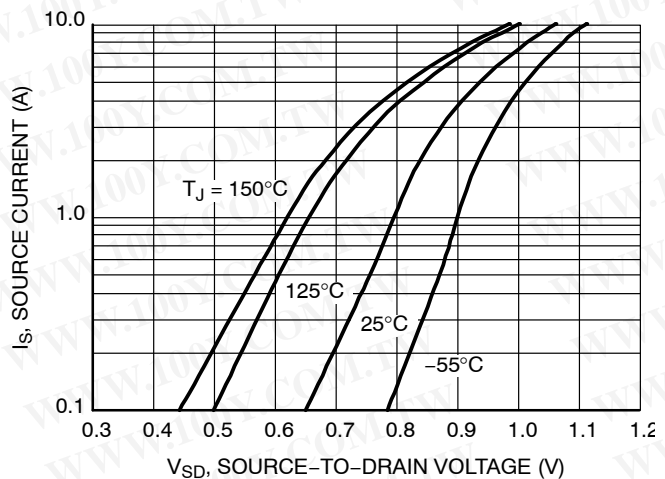


Figure 11. Diode Forward Voltage versus Current

NDF02N60Z, NDP02N60Z, NDD02N60Z

TYPICAL CHARACTERISTICS

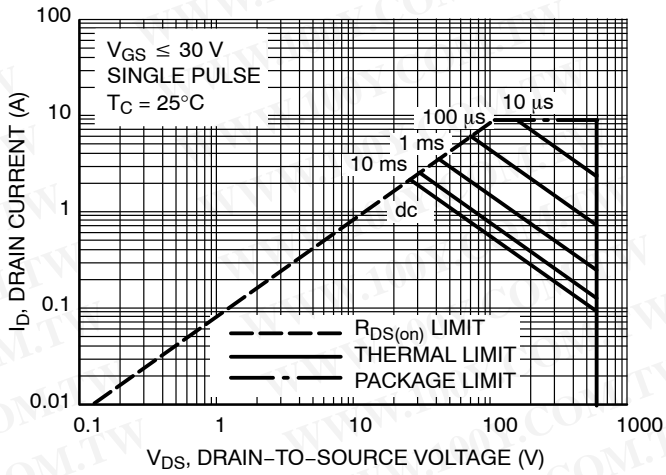


Figure 12. Maximum Rated Forward Biased Safe Operating Area NDD02N60Z

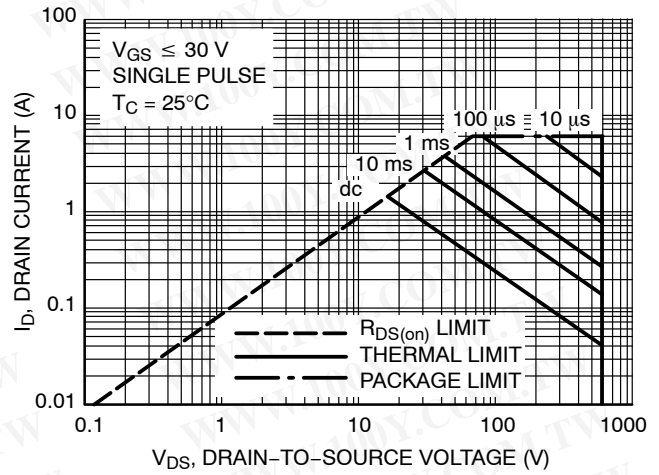


Figure 13. Maximum Rated Forward Biased Safe Operating Area NDF02N60Z

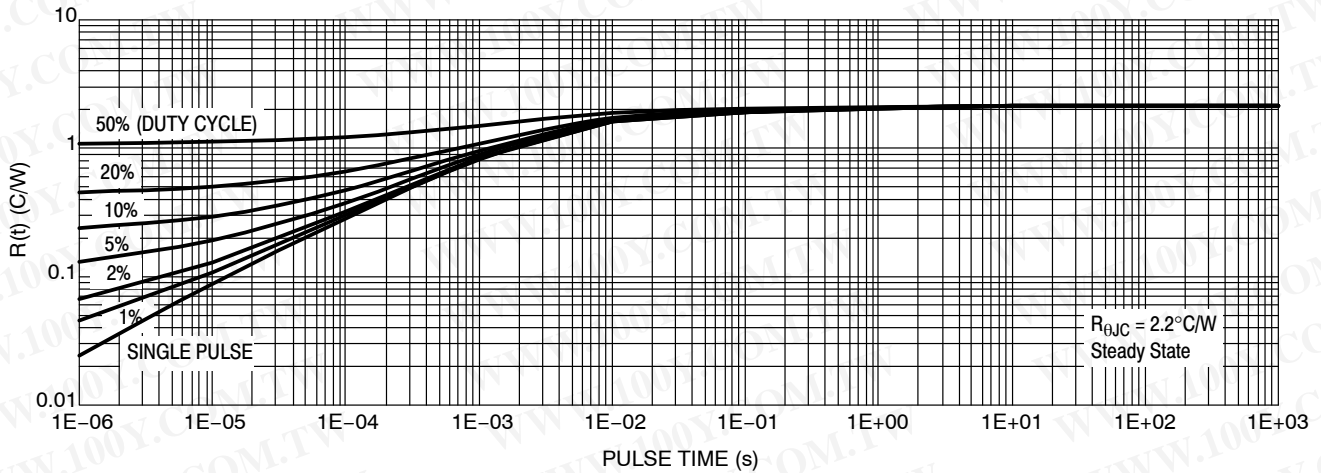


Figure 14. Thermal Impedance (Junction-to-Case) for NDD02N60Z

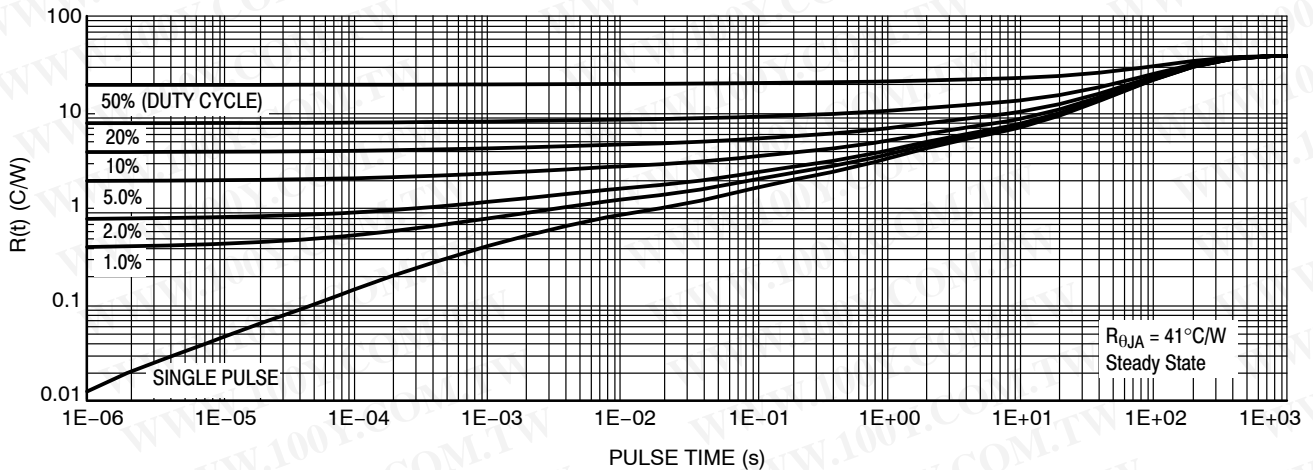


Figure 15. Thermal Impedance (Junction-to-Ambient) for NDD02N60Z

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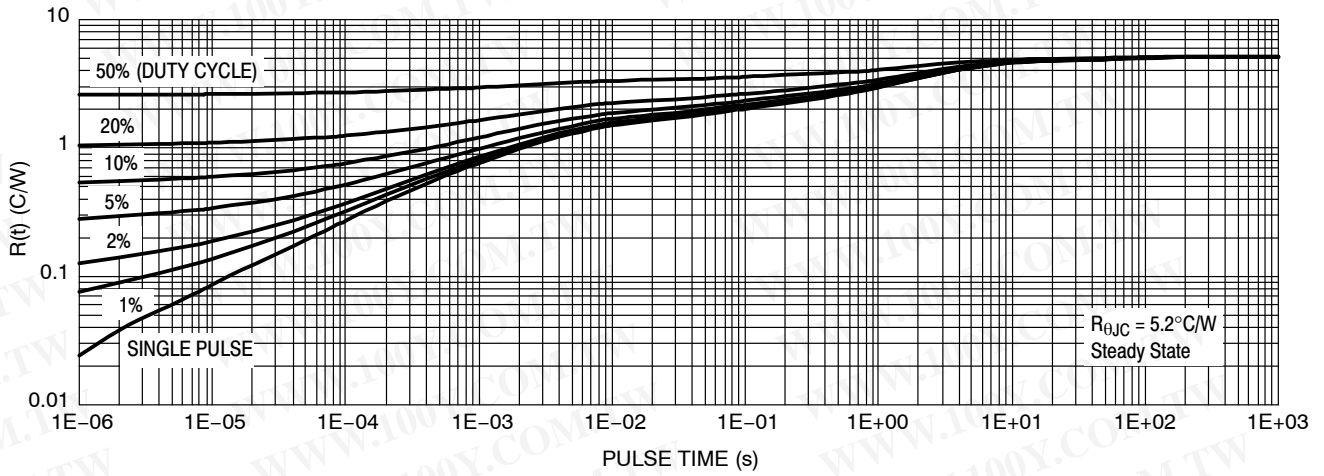


Figure 16. Thermal Impedance (Junction-to-Case) for NDF02N60Z

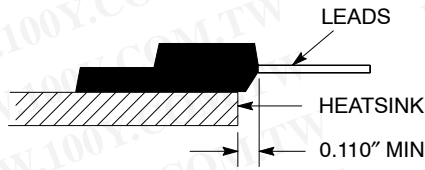


Figure 17. Isolation Test Diagram

Measurement made between leads and heatsink with all leads shorted together.

*For additional mounting information, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

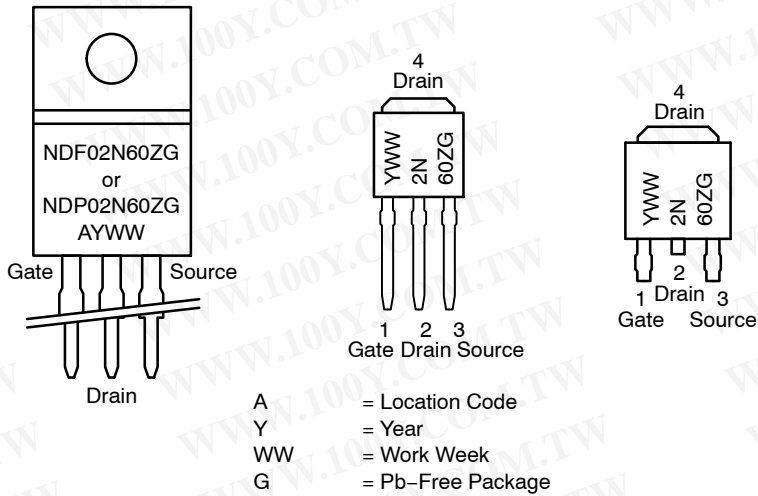
NDF02N60Z, NDP02N60Z, NDD02N60Z

ORDERING INFORMATION

Order Number	Package	Shipping†
NDF02N60ZG	TO-220FP (Pb-Free)	50 Units / Rail
NDP02N60ZG	TO-220AB (Pb-Free)	50 Units / Rail In Development
NDD02N60Z-1G	IPAK (Pb-Free)	75 Units / Rail
NDD02N60ZT4G	DPAK (Pb-Free)	2500 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

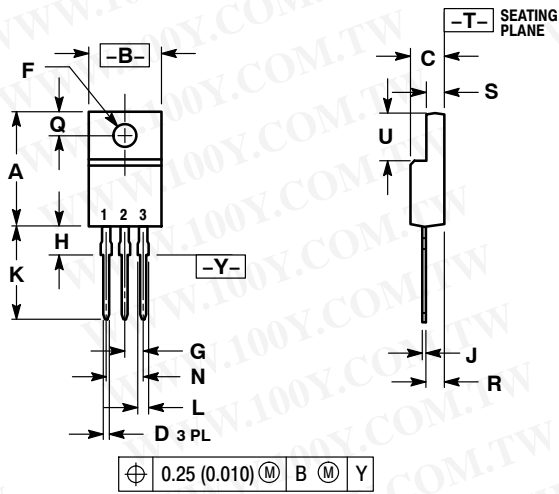
MARKING DIAGRAMS



NDF02N60Z, NDP02N60Z, NDD02N60Z

PACKAGE DIMENSIONS

TO-220 FULLPAK CASE 221D-03 ISSUE J



NOTES:

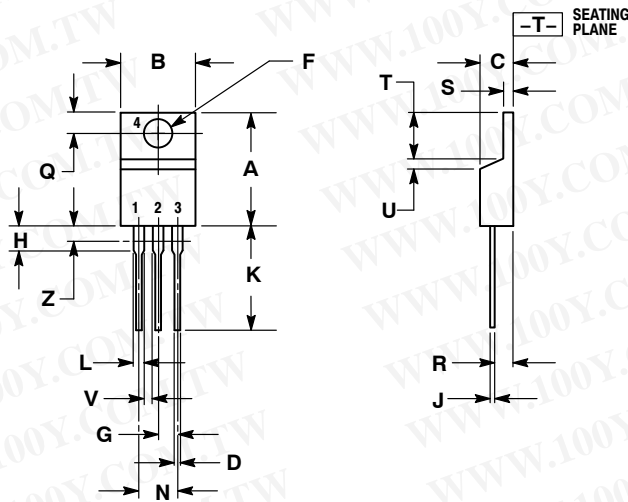
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH
3. 221D-01 THRU 221D-02 OBSOLETE, NEW STANDARD 221D-03.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.617	0.635	15.67	16.12
B	0.392	0.419	9.96	10.63
C	0.177	0.193	4.50	4.90
D	0.024	0.039	0.60	1.00
F	0.116	0.129	2.95	3.28
G	0.100 BSC		2.54 BSC	
H	0.118	0.135	3.00	3.43
J	0.018	0.025	0.45	0.63
K	0.503	0.541	12.78	13.73
L	0.048	0.058	1.23	1.47
N	0.200 BSC		5.08 BSC	
Q	0.122	0.138	3.10	3.50
R	0.099	0.117	2.51	2.96
S	0.092	0.113	2.34	2.87
U	0.239	0.271	6.06	6.88

STYLE 1:

1. GATE
2. DRAIN
3. SOURCE

TO-220AB CASE 221A-09 ISSUE AE



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.161	3.61	4.09
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.014	0.025	0.36	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

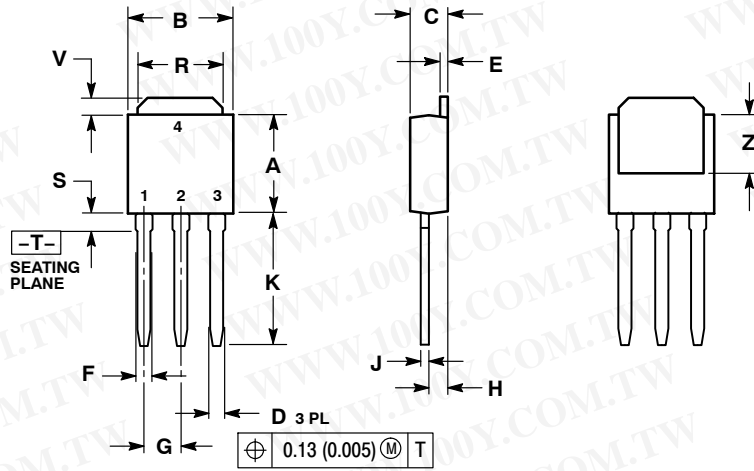
STYLE 5:

1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

NDF02N60Z, NDP02N60Z, NDD02N60Z

PACKAGE DIMENSIONS

IPAK CASE 369D-01 ISSUE B



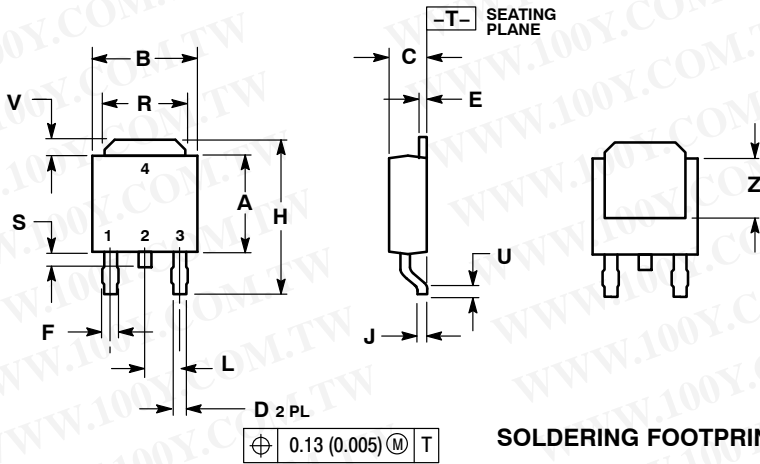
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.35
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.018	0.023	0.46	0.58
F	0.037	0.045	0.94	1.14
G	0.090 BSC		2.29 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.350	0.380	8.89	9.65
R	0.180	0.215	4.45	5.45
S	0.025	0.040	0.63	1.01
V	0.035	0.050	0.89	1.27
Z	0.155	---	3.93	---

STYLE 2:

- PIN 1: GATE
 2. DRAIN
 3. SOURCE
 4. DRAIN

DPAK CASE 369AA-01 ISSUE A



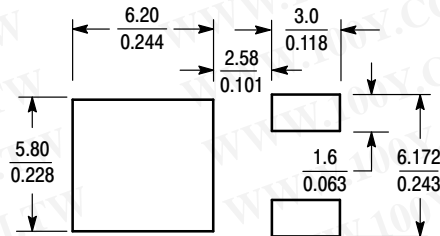
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.22
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.025	0.035	0.63	0.89
E	0.018	0.024	0.46	0.61
F	0.030	0.045	0.77	1.14
H	0.386	0.410	9.80	10.40
J	0.018	0.023	0.46	0.58
L	0.090 BSC		2.29 BSC	
R	0.180	0.215	4.57	5.45
S	0.024	0.040	0.60	1.01
U	0.020	---	0.51	---
V	0.035	0.050	0.89	1.27
Z	0.155	---	3.93	---

STYLE 2:

- PIN 2: GATE
 2. DRAIN
 3. SOURCE
 4. DRAIN

SOLDERING FOOTPRINT*




SCALE 3:1 (mm/inches)

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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