

NTB5605P, NTB5605

Power MOSFET -60 Volt, -18.5 Amp

P-Channel, D²PAK



ON Semiconductor®

<http://onsemi.com>

Features

- Designed for Low $R_{DS(on)}$
- Withstands High Energy in Avalanche and Commutation Modes
- Pb-Free Packages are Available

Applications

- Power Supplies
- PWM Motor Control
- Converters
- Power Management

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

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V_{DSS}	-60	V
Gate-to-Source Voltage			V_{GS}	± 20	V
Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	I_D	-18.5	A
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	P_D	88	W
Pulsed Drain Current	$t_p = 10 \mu\text{s}$		I_{DM}	-55	A
Operating Junction and Storage Temperature			T_J, T_{STG}	-55 to 175	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy ($V_{DD} = 25 \text{ V}, V_{GS} = 5.0 \text{ V}, I_{PK} = 15 \text{ A}, L = 3.0 \text{ mH}, R_G = 25 \Omega$)			E_{AS}	338	mJ
Lead Temperature for Soldering Purposes (1/8 in from case for 10 s)			T_L	260	$^\circ\text{C}$

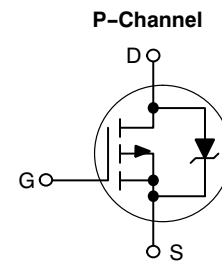
THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Case (Drain) – Steady State	$R_{\theta JC}$	1.7	$^\circ\text{C/W}$

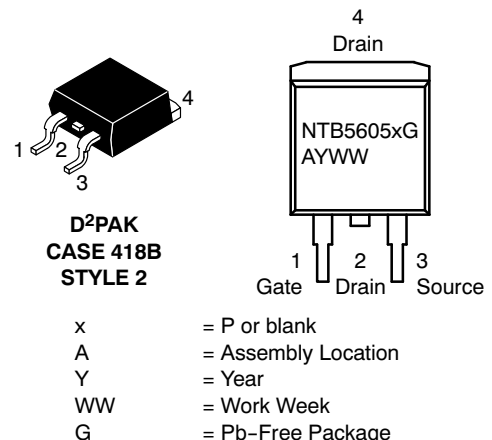
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. When surface mounted to an FR4 board using 1" pad size (Cu Area 1.127 in²).
2. When surface mounted to an FR4 board using the minimum recommended pad size (Cu Area 0.41 in²).

$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
-60 V	120 m Ω @ -5.0 V	-18.5 A



MARKING DIAGRAM & PIN ASSIGNMENT



ORDERING INFORMATION

Device	Package	Shipping†
NTB5605P	D ² PAK	50 Units/Rail
NTB5605PG	D ² PAK (Pb-Free)	50 Units/Rail
NTB5605PT4	D ² PAK	800 Tape & Reel
NTB5605PT4G	D ² PAK (Pb-Free)	800 Tape & Reel
NTB5605T4G	D ² PAK (Pb-Free)	800 Tape & Reel

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

NTB5605P, NTB5605

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
----------------	--------	----------------	-----	-----	-----	------

OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	V _{(BR)DSS}	V _{GS} = 0 V, I _D = -250 μA	-60			V	
Drain-to-Source Breakdown Voltage Temperature Coefficient	V _{(BR)DSS} /T _J			-64		mV/°C	
Zero Gate Voltage Drain Current	I _{DSS}	V _{GS} = 0 V V _{DS} = -60 V	T _J = 25°C			-1.0	μA
			T _J = 125°C			-10	
Gate-to-Source Leakage Current	I _{GSS}	V _{DS} = 0 V, V _{GS} = ±20 V			±100	nA	

ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	V _{GS(th)}	V _{GS} = V _{DS} , I _D = -250 μA	-1.0	-1.5	-2.0	V
Drain-to-Source On Resistance	R _{DS(on)}	V _{GS} = -5.0 V, I _D = -8.5 A V _{GS} = -5.0 V, I _D = -17 A		120 140	140	mΩ
Forward Transconductance	g _{FS}	V _{DS} = -10 V, I _D = -8.5 A		12		S
Drain-to-Source On Voltage	V _{DS(on)}	V _{GS} = -5.0 V, I _D = -8.5 A			-1.3	V

CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	C _{iss}	V _{GS} = 0 V, f = 1.0 MHz, V _{DS} = -25 V		730	1190	pF
Output Capacitance	C _{oss}			211	300	
Reverse Transfer Capacitance	C _{rss}			67	120	
Total Gate Charge	Q _{G(TOT)}	V _{GS} = -5.0 V, V _{DS} = -48 V, I _D = -17 A		13	22	nC
Gate-to-Source Charge	Q _{GS}			4.0		
Gate-to-Drain Charge	Q _{GD}			7.0		

SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	t _{d(on)}	V _{GS} = -5.0 V, V _{DD} = -30 V, I _D = -17 A, R _G = 9.1 Ω		12.5	25	ns
Rise Time	t _r			122	183	
Turn-Off Delay Time	t _{d(off)}			29	58	
Fall Time	t _f			75	150	

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V _{SD}	V _{GS} = 0 V I _S = -17 A	T _J = 25°C		-1.55	-2.5	V
			T _J = 125°C		-1.4		
Reverse Recovery Time	t _{rr}	V _{GS} = 0 V, di _S /dt = 100 A/μs, I _S = -17 A		60		ns	
Charge Time	t _a			39			
Discharge Time	t _b			21			
Reverse Recovery Charge	Q _{RR}			0.14			nC

3. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

4. Switching characteristics are independent of operating junction temperatures.

NTB5605P, NTB5605

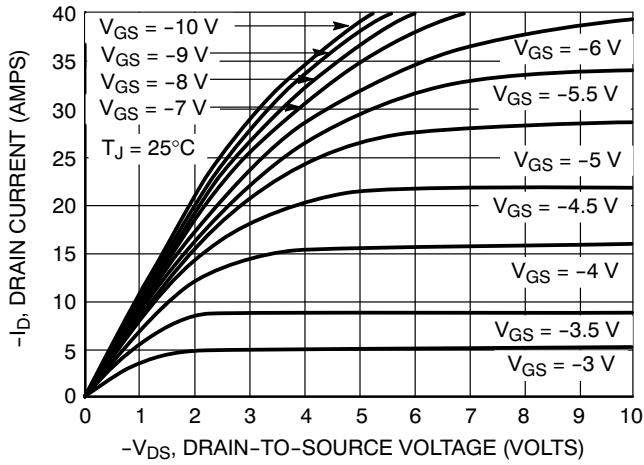


Figure 1. On-Region Characteristics

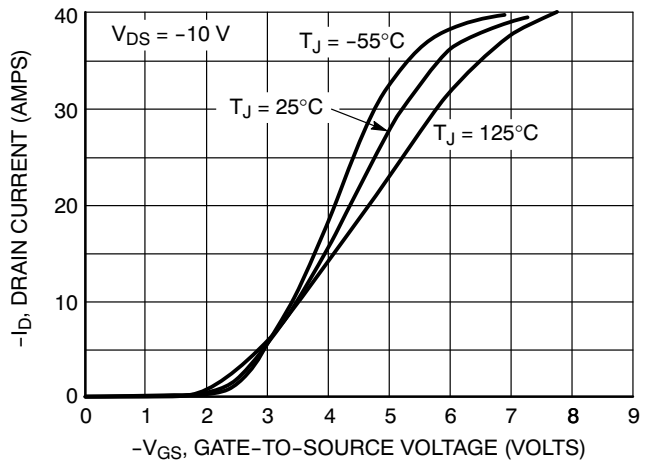


Figure 2. Transfer Characteristics

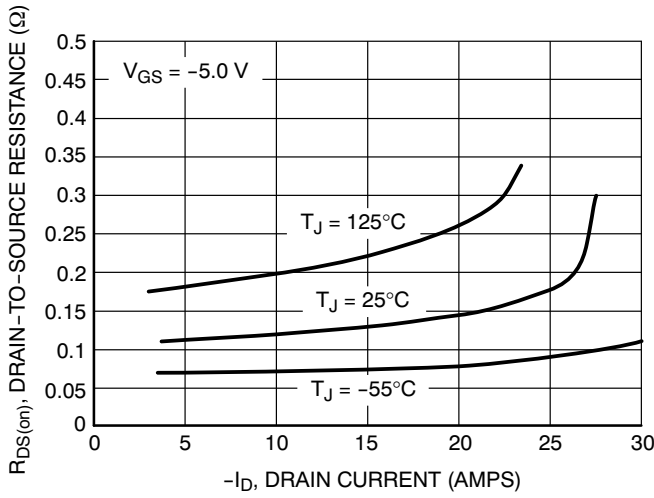


Figure 3. On-Resistance vs. Drain Current and Temperature

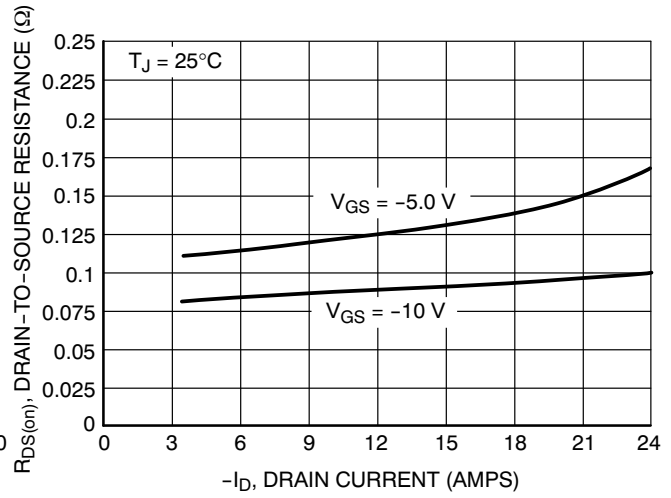


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

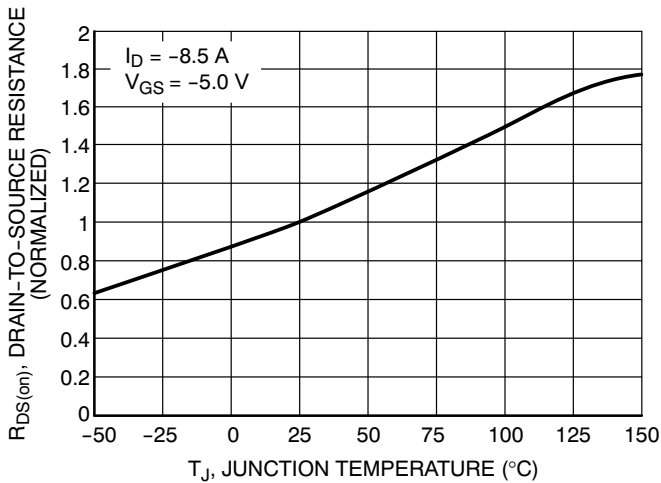


Figure 5. On-Resistance Variation with Temperature

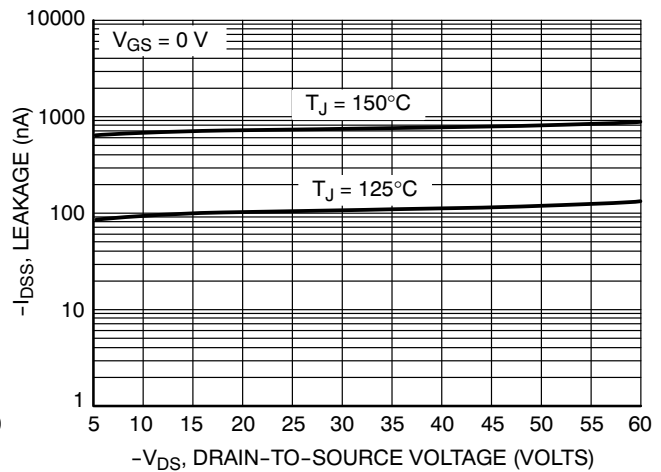


Figure 6. Drain-to-Source Leakage Current vs. Voltage

NTB5605P, NTB5605

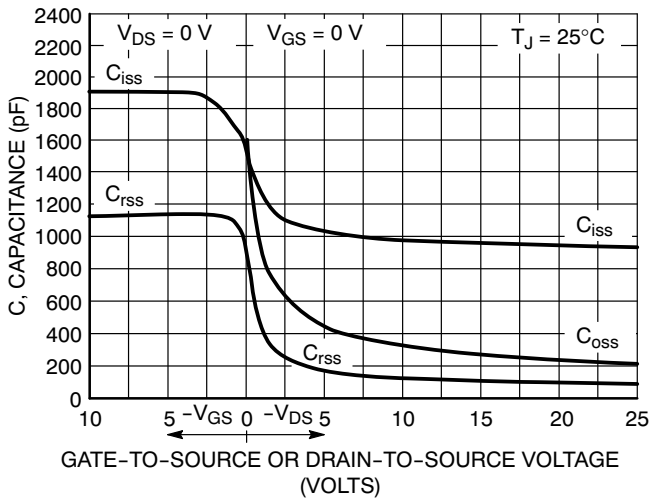


Figure 7. Capacitance Variation

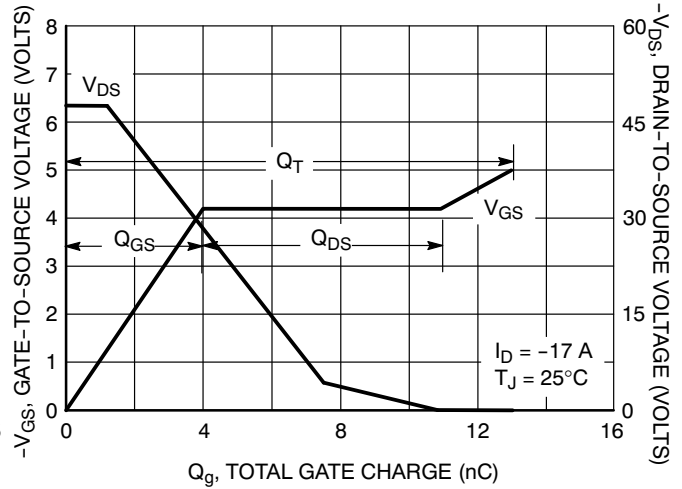


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

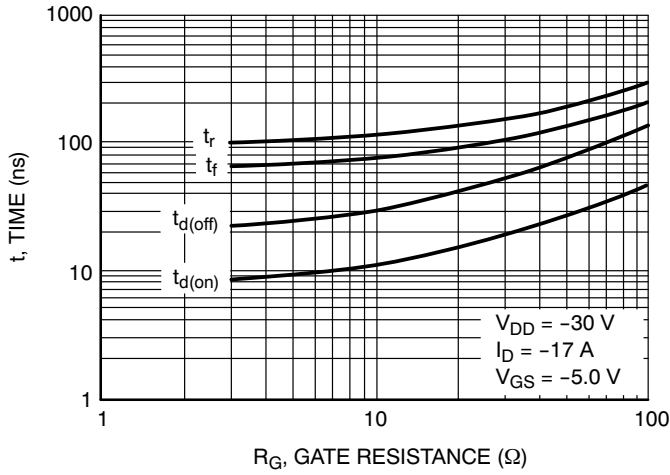


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

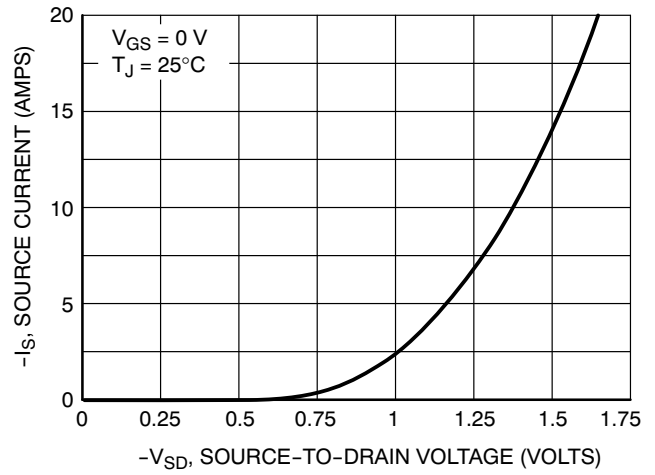


Figure 10. Diode Forward Voltage vs. Current

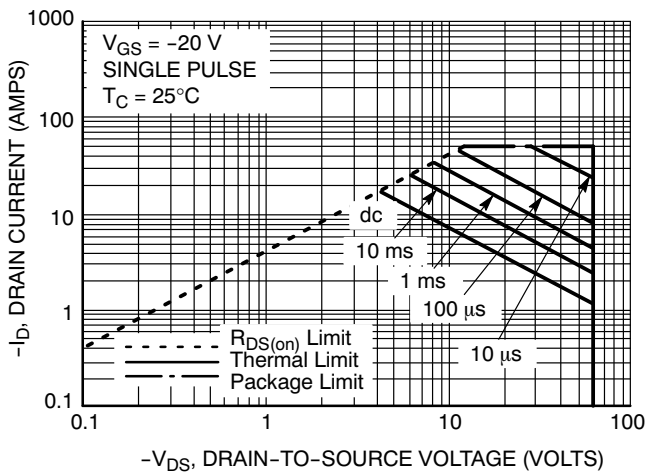


Figure 11. Maximum Rated Forward Biased Safe Operating Area

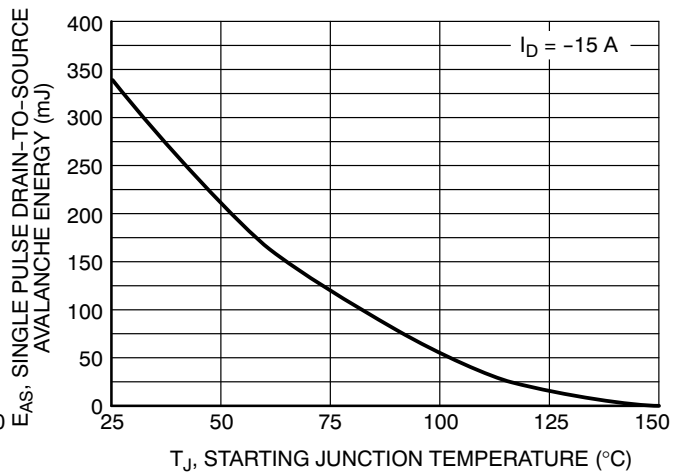


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

NTB5605P, NTB5605

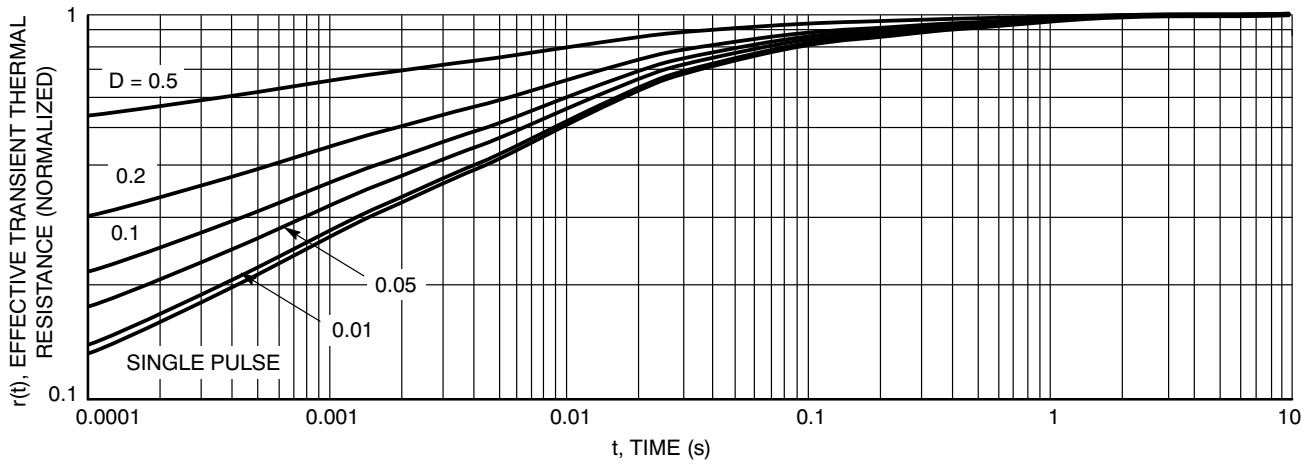


Figure 13. Thermal Response

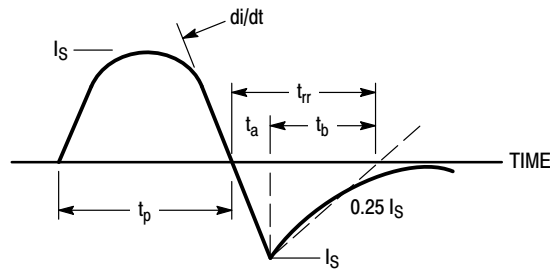
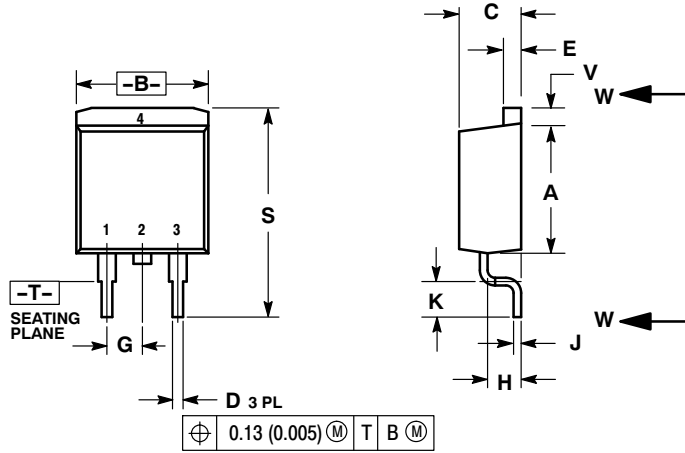


Figure 14. Diode Reverse Recovery Waveform

NTB5605P, NTB5605

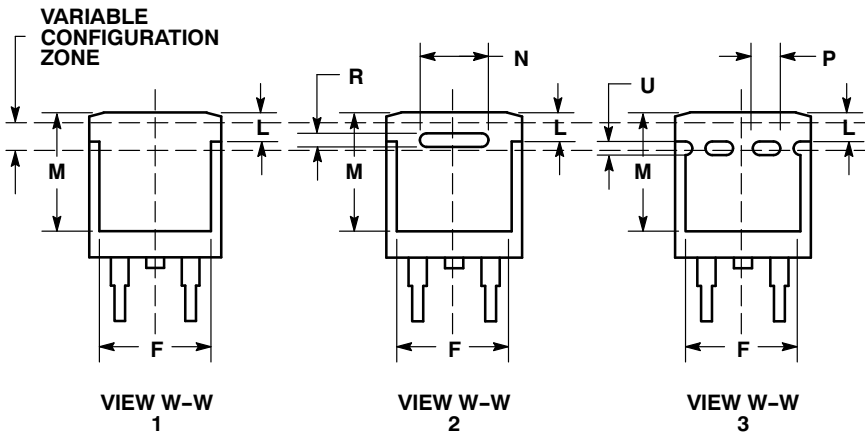
PACKAGE DIMENSIONS

D²PAK
CASE 418B-04
ISSUE J



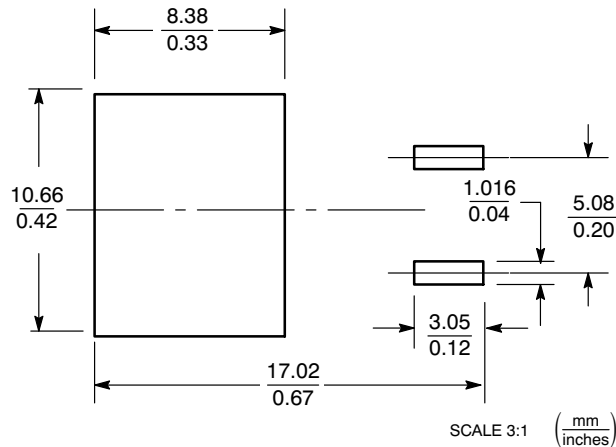
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. 418B-01 THRU 418B-03 OBSOLETE, NEW STANDARD 418B-04.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
E	0.045	0.055	1.14	1.40
F	0.310	0.350	7.87	8.89
G	0.100 BSC		2.54 BSC	
H	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
L	0.052	0.072	1.32	1.83
M	0.280	0.320	7.11	8.13
N	0.197 REF		5.00 REF	
P	0.079 REF		2.00 REF	
R	0.039 REF		0.99 REF	
S	0.575	0.625	14.60	15.88
V	0.045	0.055	1.14	1.40




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

SOLDERING FOOTPRINT*



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

NTB5605P, NTB5605

ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5773-3850

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative