

NTB5605P

Power MOSFET

–60 V, –18.5 A, P–Channel, D²PAK

Features

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

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" 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	$^\circ\text{C/W}$

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

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).

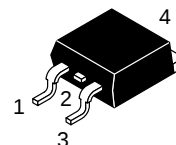
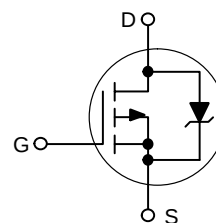


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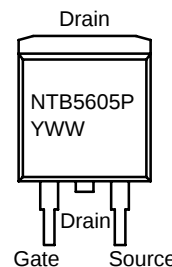
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
–60 V	120 m Ω @ –5.0 V	–18.5 A

P–Channel



D²PAK
CASE 418B
STYLE 2

MARKING DIAGRAM & PIN ASSIGNMENT



NTB5605P = Device Code
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping [†]
NTB5605P	D ² PAK	50 Units/Rail
NTB5605PT4	D ² PAK	800/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.

NTB5605P

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

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(Br)DSS}$	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	-60			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(Br)DSS}/T_J$			-64		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}$ $V_{DS} = -60\text{ V}$	$T_J = 25^\circ\text{C}$		-1.0	μA
			$T_J = 125^\circ\text{C}$		-10	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	nA

ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}, I_D = -250\text{ }\mu\text{A}$	-1.0	-1.5	-2.0	V
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = -5.0\text{ V}, I_D = -8.5\text{ A}$ $V_{GS} = -5.0\text{ V}, I_D = -17\text{ A}$		120 140	140	m Ω
Forward Transconductance	g_{FS}	$V_{DS} = -10\text{ V}, I_D = -8.5\text{ A}$		12		S
Drain-to-Source On Voltage	$V_{DS(on)}$	$V_{GS} = -5.0\text{ V}, I_D = -8.5\text{ A}$			-1.3	V

CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz},$ $V_{DS} = -25\text{ V}$		730	1190	pF
Output Capacitance	C_{oss}			211	300	
Reverse Transfer Capacitance	C_{rss}			67	120	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -5.0\text{ V}, V_{DS} = -48\text{ V},$ $I_D = -17\text{ A}$		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	$t_{d(on)}$	$V_{GS} = -5.0\text{ V}, V_{DD} = -30\text{ V},$ $I_D = -17\text{ A}, R_G = 9.1\text{ }\Omega$		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}	$V_{GS} = 0\text{ V}$ $I_S = -17\text{ A}$	$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$	-1.55 -1.4	-2.5	V
Reverse Recovery Time	t_{rr}	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s},$ $I_S = -17\text{ A}$		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 $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2\%$.

4. Switching characteristics are independent of operating junction temperatures.

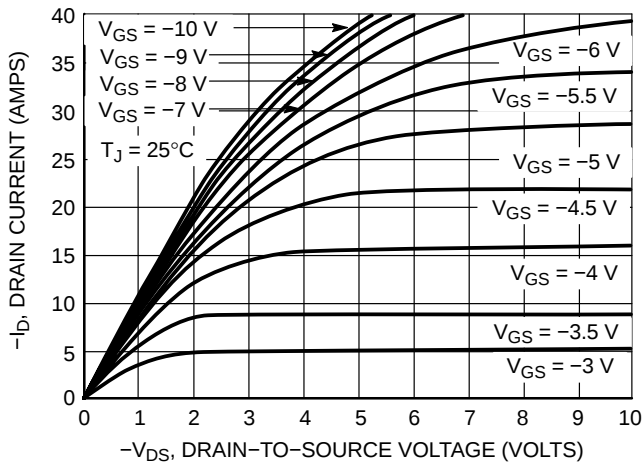


Figure 1. On-Region Characteristics

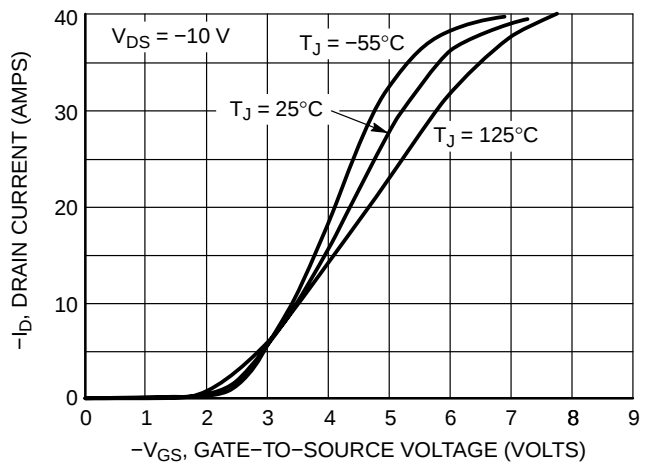


Figure 2. Transfer Characteristics

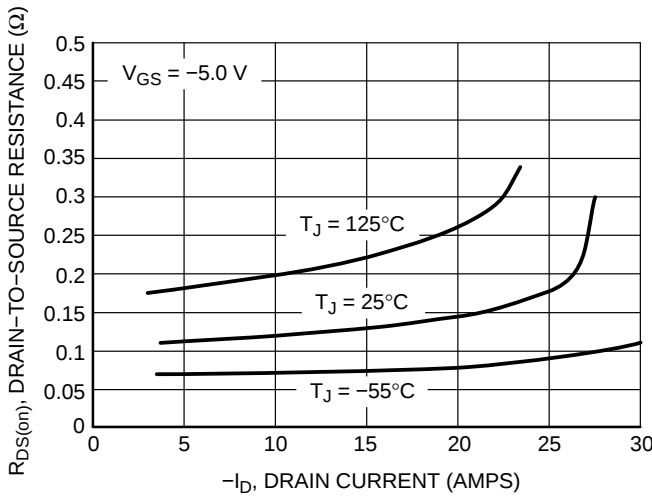


Figure 3. On-Resistance vs. Drain Current and Temperature

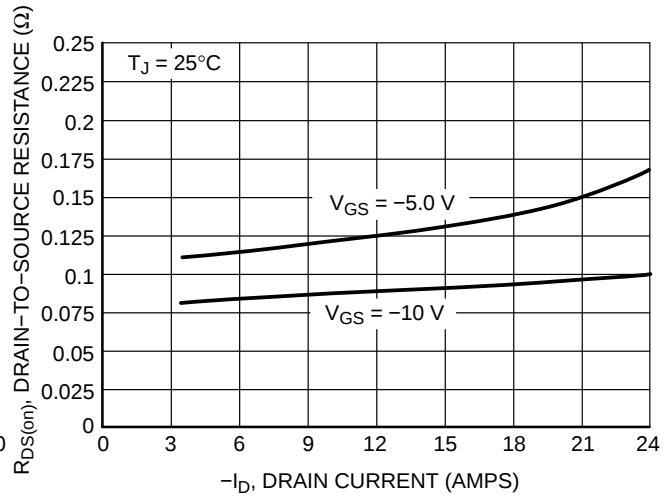


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

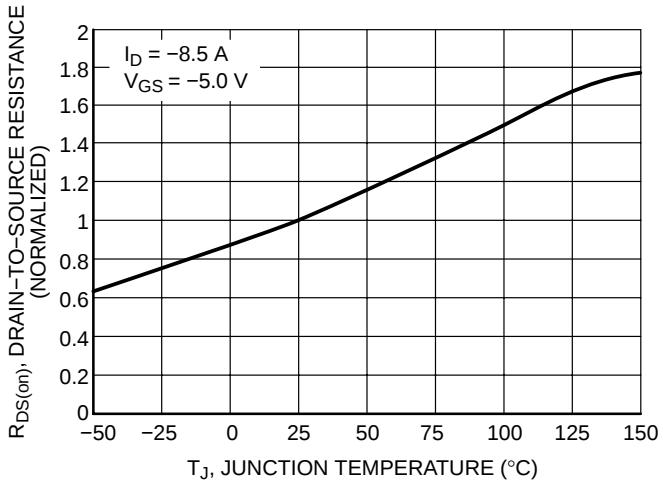


Figure 5. On-Resistance Variation with Temperature

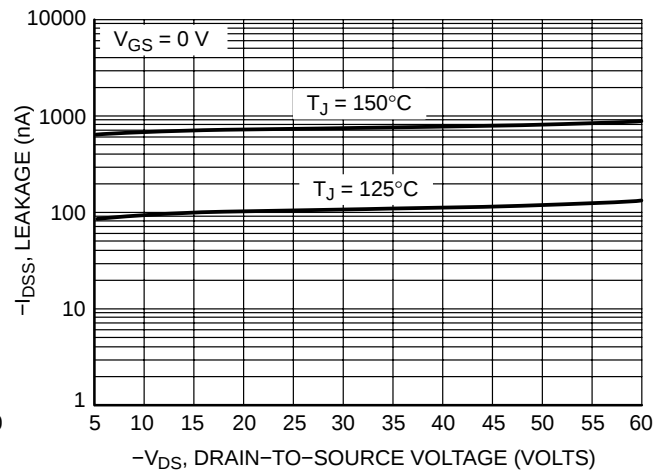


Figure 6. Drain-to-Source Leakage Current vs. Voltage

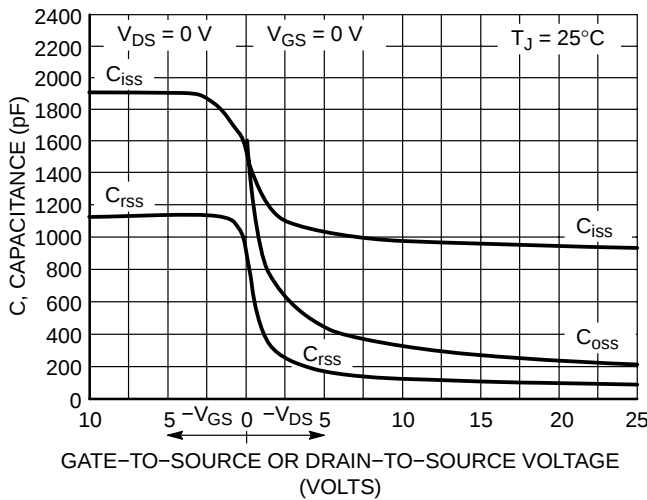


Figure 7. Capacitance Variation

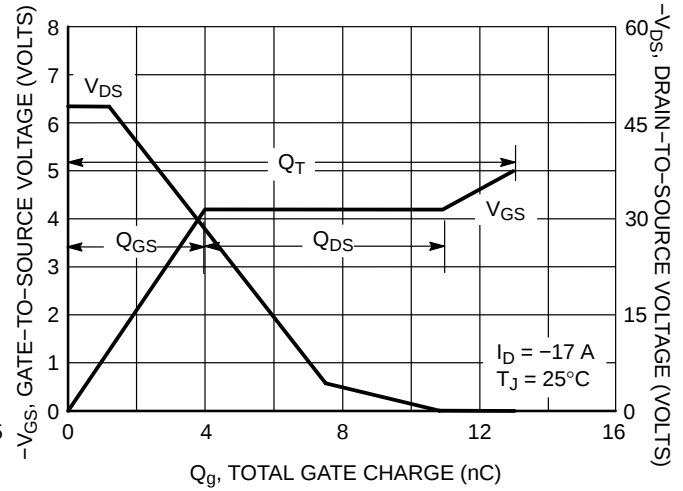


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

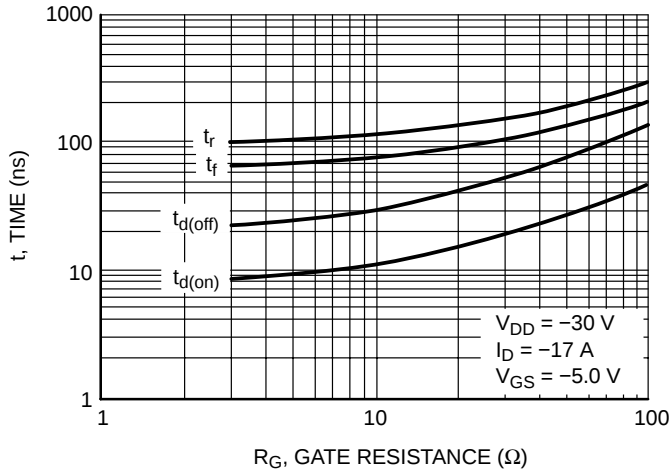


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

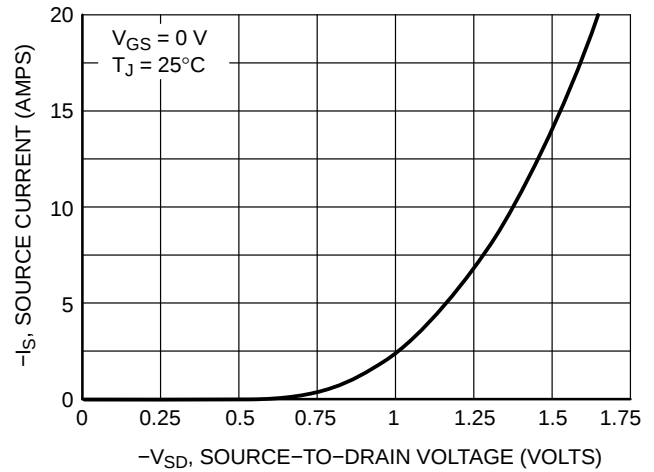


Figure 10. Diode Forward Voltage vs. Current

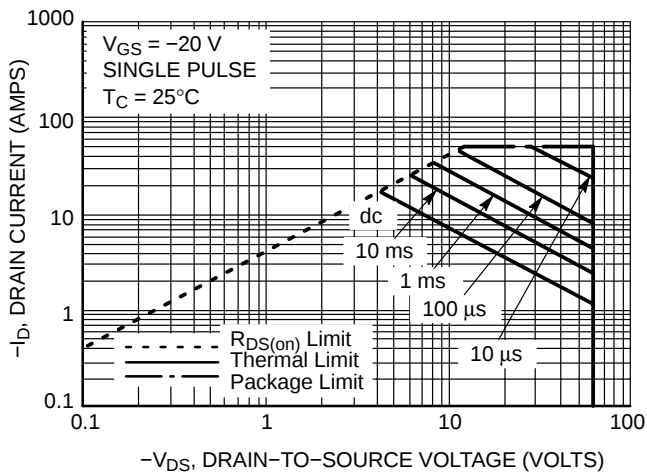


Figure 11. Maximum Rated Forward Biased Safe Operating Area

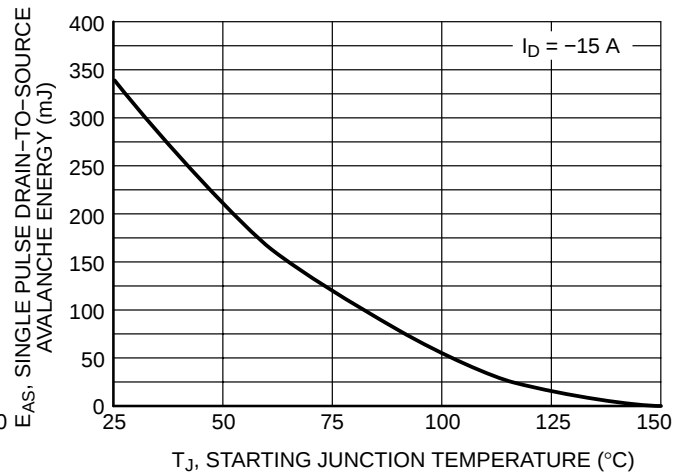


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

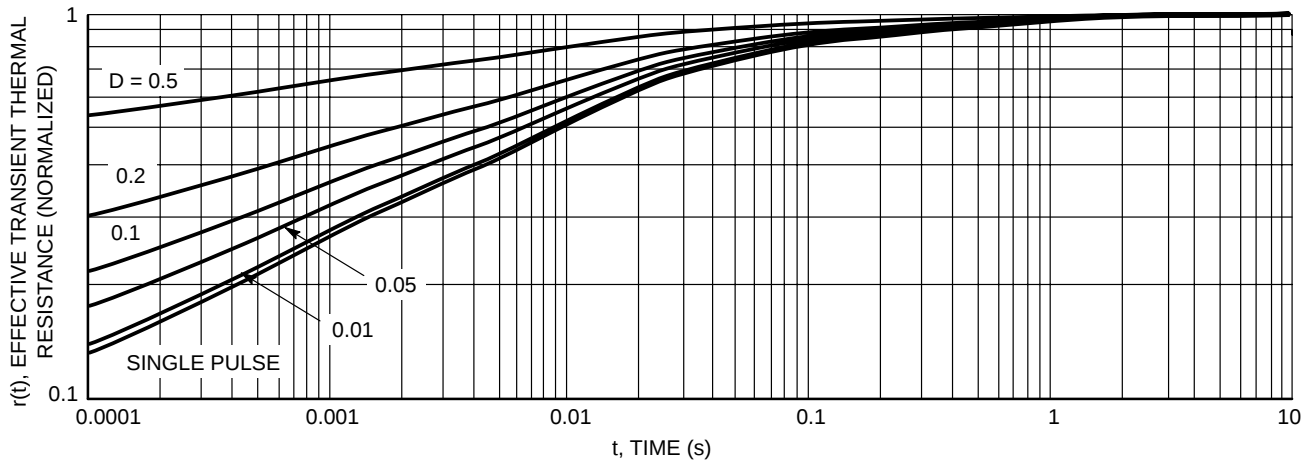


Figure 13. Thermal Response

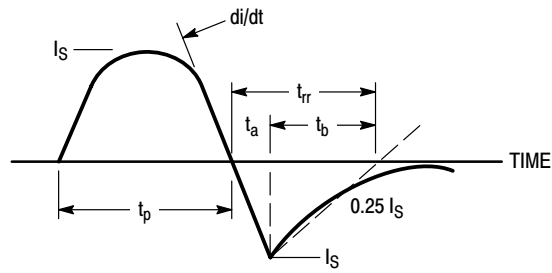
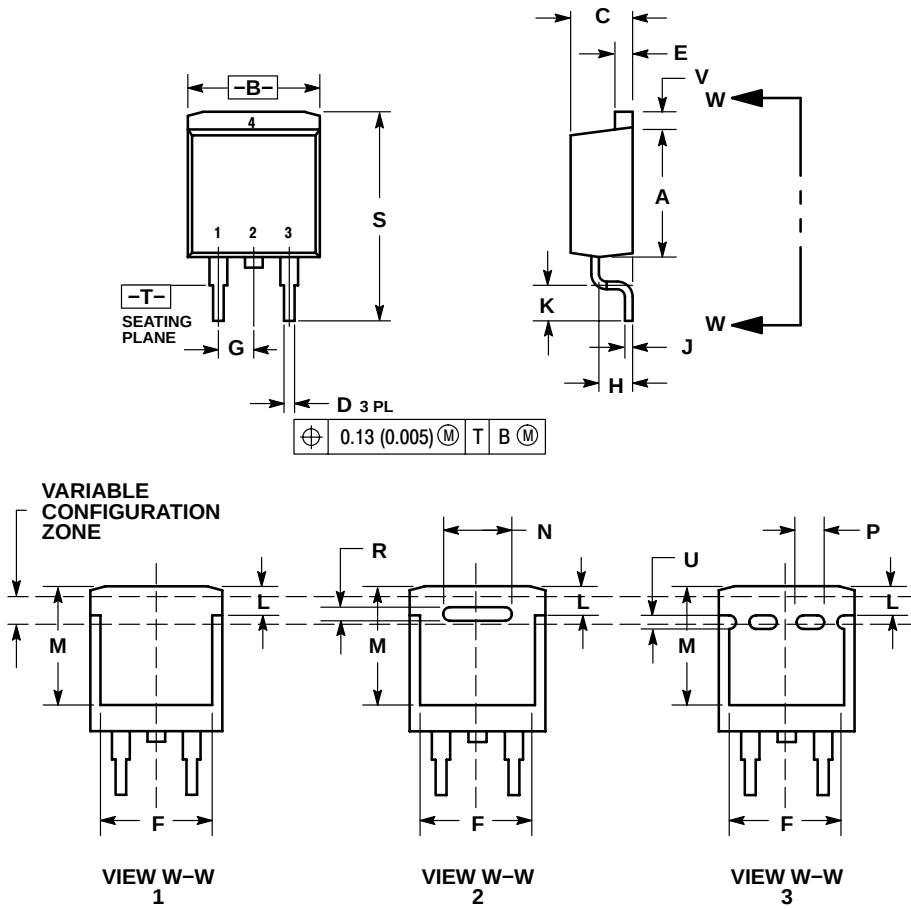


Figure 14. Diode Reverse Recovery Waveform

NTB5605P

PACKAGE DIMENSIONS

D²PAK
CASE 418B-04
ISSUE H

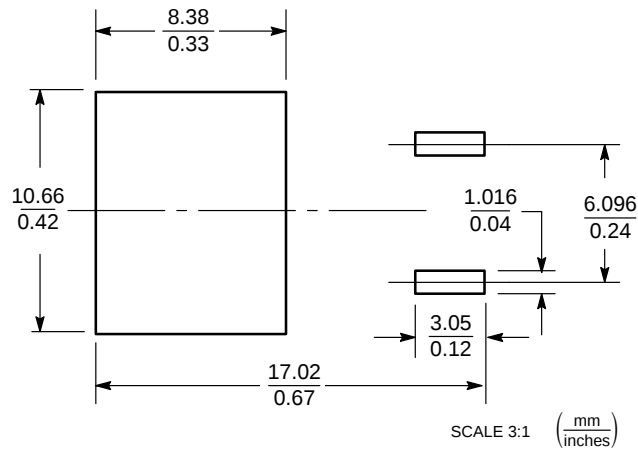


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. 418B-01 THRU 418B-03 OBSOLETE, NEW STANDARD 418B-04.

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

SOLDERING FOOTPRINT



Notes

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