

NTB5405N, NVB5405N

Power MOSFET

40 V, 116 A, Single N-Channel, D²PAK

Features

- Low $R_{DS(on)}$
- High Current Capability
- Low Gate Charge
- AEC-Q101 Qualified and PPAP Capable – NVB5405N
- These Devices are Pb-Free and are RoHS Compliant

Applications

- Electronic Brake Systems
- Electronic Power Steering
- Bridge Circuits

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

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V _{DSS}	40	V
Gate-to-Source Voltage			V _{GS}	±20	V
Continuous Drain Current – R _{θJC}	Steady State	T _C = 25°C	I _D	116	A
		T _C = 100°C		82	
Power Dissipation – R _{θJC}	Steady State	T _C = 25°C	P _D	150	W
Continuous Drain Current – R _{θJA} (Note 1)	Steady State	T _A = 25°C	I _D	16.5	A
		T _A = 100°C	I _D	11.6	
Power Dissipation – R _{θJA} (Note 1)	Steady State	T _A = 25°C	P _D	3.0	W
Pulsed Drain Current	t _p = 10 μs		I _{DM}	280	A
Operating Junction and Storage Temperature			T _J , T _{STG}	–55 to 175	°C
Source Current (Body Diode) Pulsed			I _S	75	A
Single Pulse Drain-to Source Avalanche Energy – (V _{DD} = 50 V, V _{GS} = 10 V, I _{PK} = 40 A, L = 1 mH, R _G = 25 Ω)			EAS	800	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T _L	260	°C

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.

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	1.0	$^\circ\text{C/W}$
Junction-to-Ambient (Note 1)	$R_{\theta JA}$	50	$^\circ\text{C/W}$

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

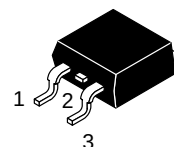
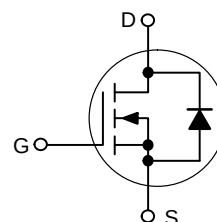


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$V_{(BR)DS}$	$R_{DS(ON)}$ TYP	I_D MAX (Note 1)
40 V	4.9 m Ω @ 10 V	116 A

N-Channel



D²PAK
CASE 418B
STYLE 2

MARKING DIAGRAM



NTB5405N = Specific Device Code
G = Pb-Free Device
A = Assembly Location
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping†
NTB5405NG	D ² PAK (Pb-Free)	50 Units / Rail
NTB5405NT4G	D ² PAK (Pb-Free)	800 / Tape & Reel
NVB5405NT4G	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 Specifications Brochure, BRD8011/D.

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			39		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 40\text{ V}$	$T_J = 25^\circ\text{C}$		1.0	μA
			$T_J = 100^\circ\text{C}$		10	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 30\text{ V}$			± 100	nA

ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	1.5		3.5	V
Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			-7.0		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 40\text{ A}$		4.9	5.8	m Ω
		$V_{GS} = 5.0\text{ V}, I_D = 15\text{ A}$		7.0	8.0	
Forward Transconductance	g_{FS}	$V_{GS} = 10\text{ V}, I_D = 15\text{ A}$		32		S

CHARGES AND CAPACITANCES

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 32\text{ V}$		2700	4000	pF
Output Capacitance	C_{OSS}			700	1400	
Reverse Transfer Capacitance	C_{RSS}			300	600	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 32\text{ V}, I_D = 40\text{ A}$		88		nC
Threshold Gate Charge	$Q_{G(TH)}$			3.25		
Gate-to-Source Charge	Q_{GS}			9.5		
Gate-to-Drain Charge	Q_{GD}			37		

SWITCHING CHARACTERISTICS, $V_{GS} = 10\text{ V}$ (Note 3)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DD} = 32\text{ V}, I_D = 40\text{ A}, R_G = 2.5\text{ }\Omega$		8.5		ns
Rise Time	t_r			52		
Turn-Off Delay Time	$t_{d(OFF)}$			55		
Fall Time	t_f			70		

SWITCHING CHARACTERISTICS, $V_{GS} = 5\text{ V}$ (Note 3)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 5\text{ V}, V_{DD} = 20\text{ V}, I_D = 20\text{ A}, R_G = 2.5\text{ }\Omega$		19		ns
Rise Time	t_r			153		
Turn-Off Delay Time	$t_{d(OFF)}$			32		
Fall Time	t_f			42		

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V _{SD}	V _{GS} = 0 V, I _S = 20 A	T _J = 25°C		0.82	1.1	V
			T _J = 100°C		TBD		
Reverse Recovery Time	t _{RR}	V _{GS} = 0 V, dI _{SD} /dt = 100 A/μs, I _S = 20 A			66		ns
Charge Time	t _a				35		
Discharge Time	t _b				31		
Reverse Recovery Charge	Q _{RR}					113	

2. Pulse Test: pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

3. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

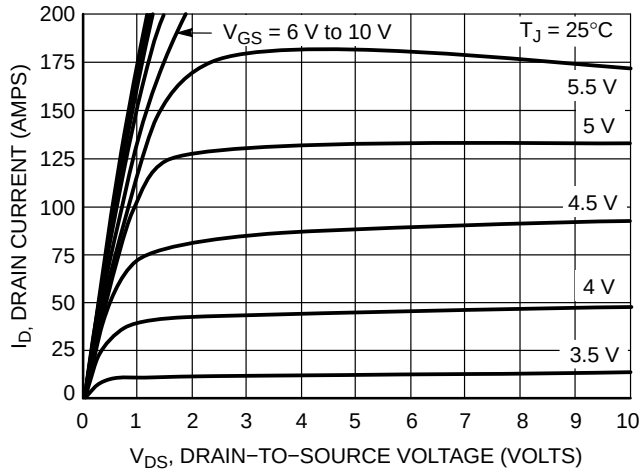


Figure 1. On-Region Characteristics

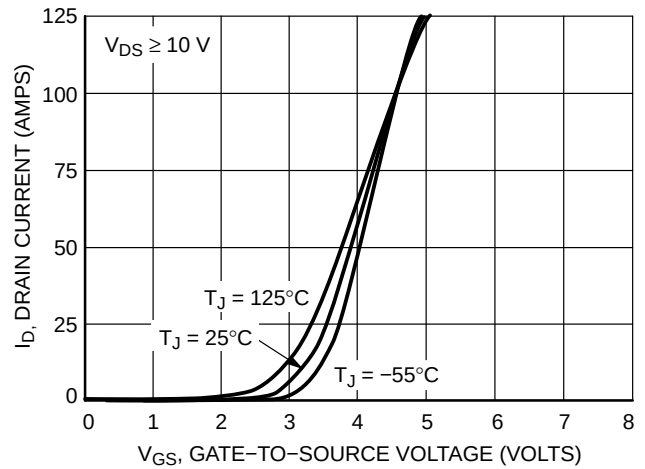


Figure 2. Transfer Characteristics

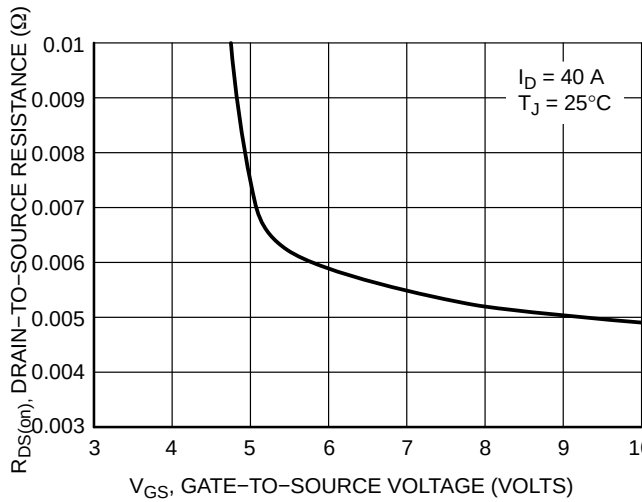


Figure 3. On-Resistance vs. Gate-to-Source Voltage

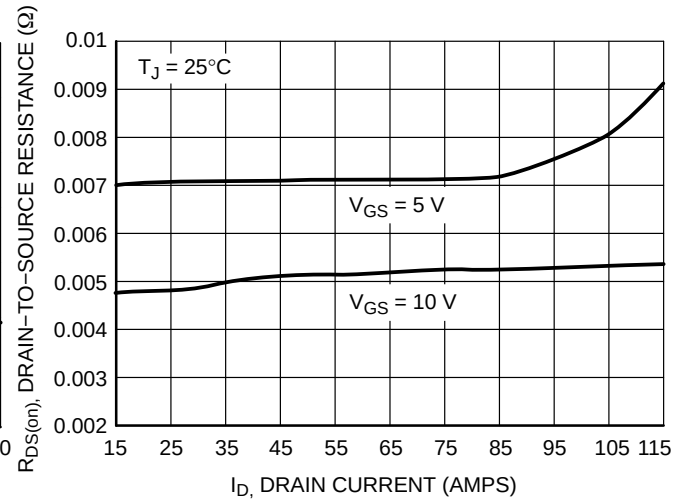


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

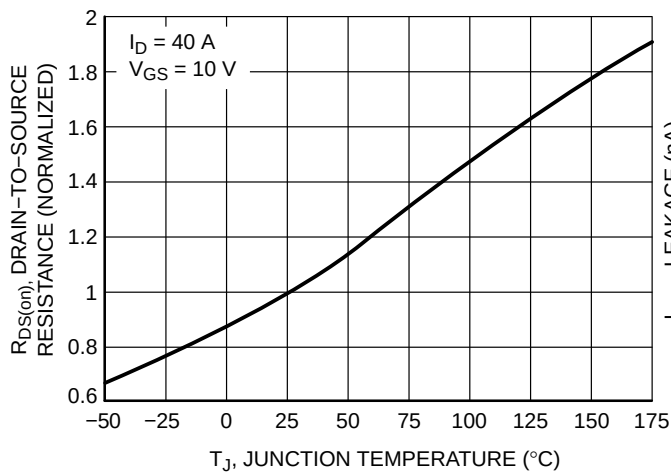


Figure 5. On-Resistance Variation with Temperature

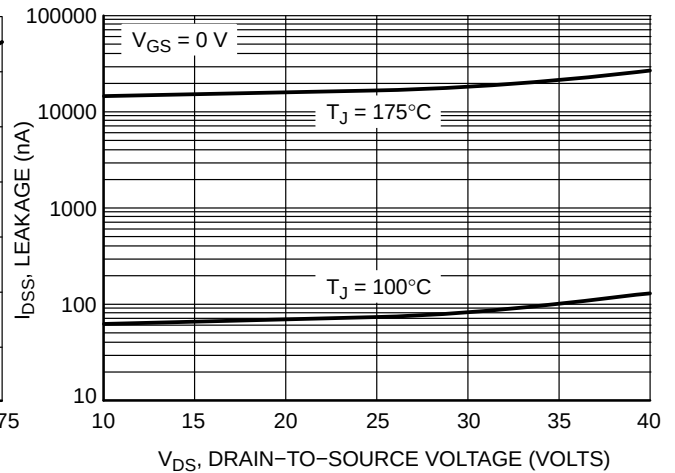
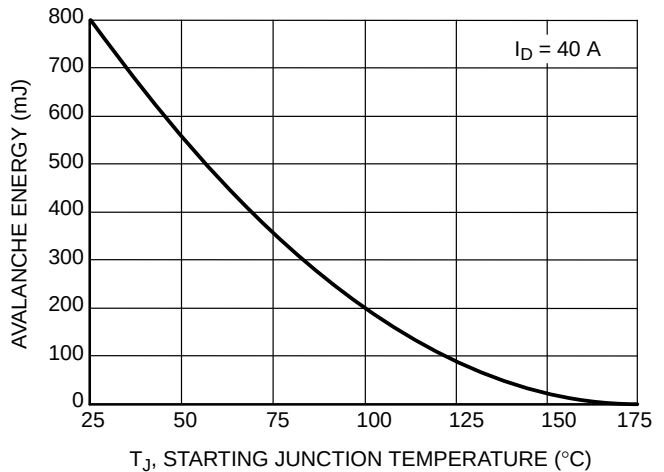
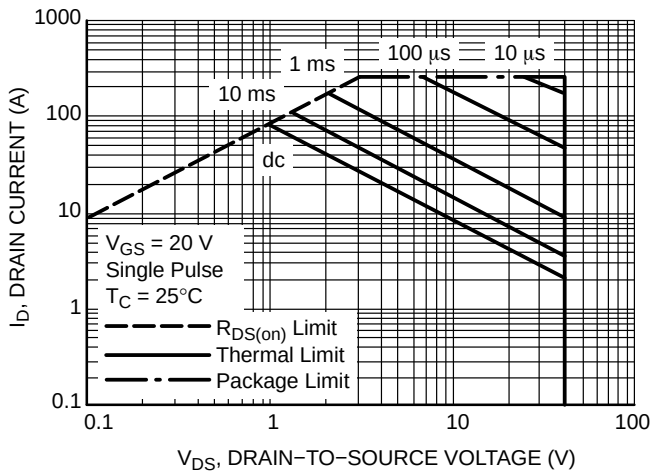
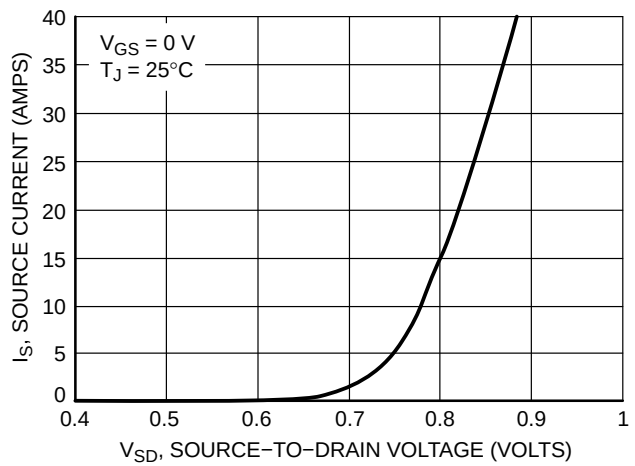
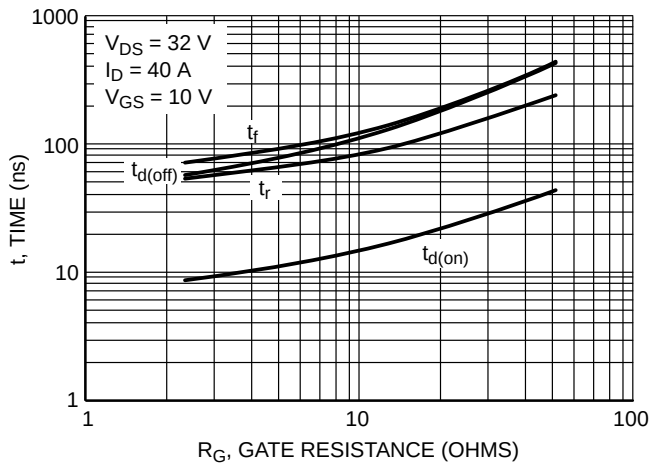
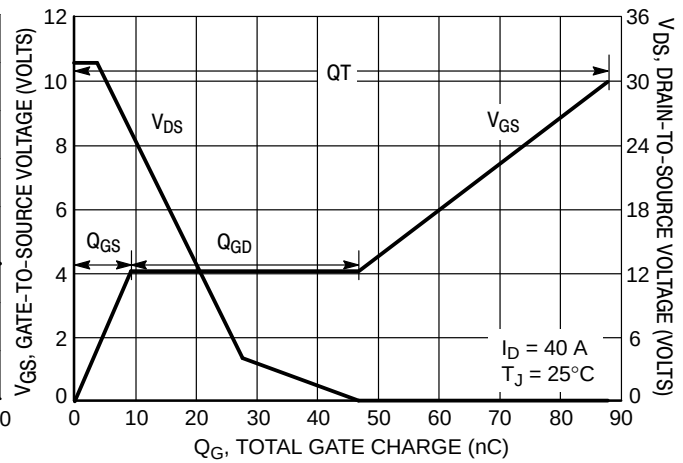
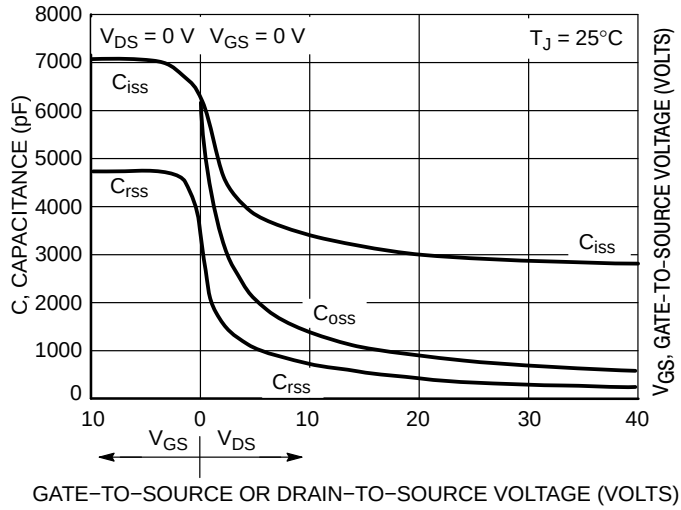
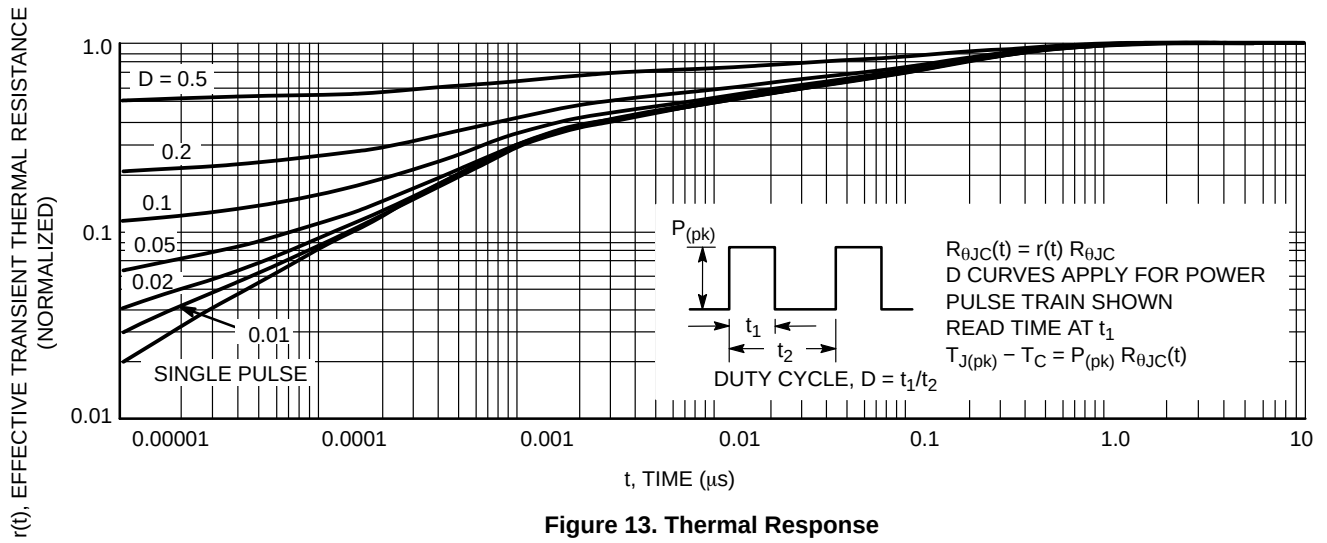


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES



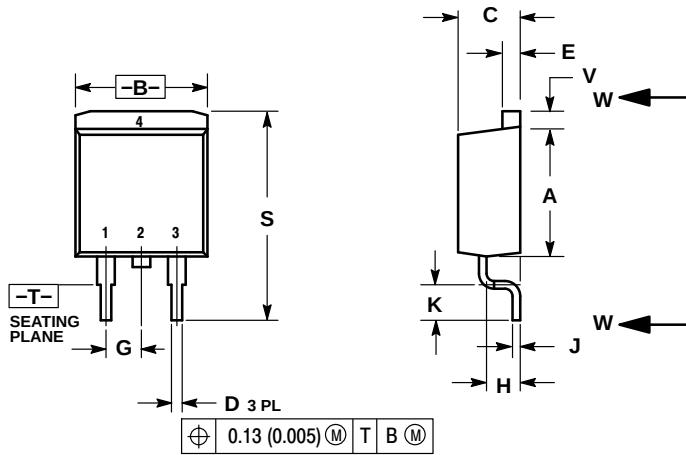
TYPICAL PERFORMANCE CURVES



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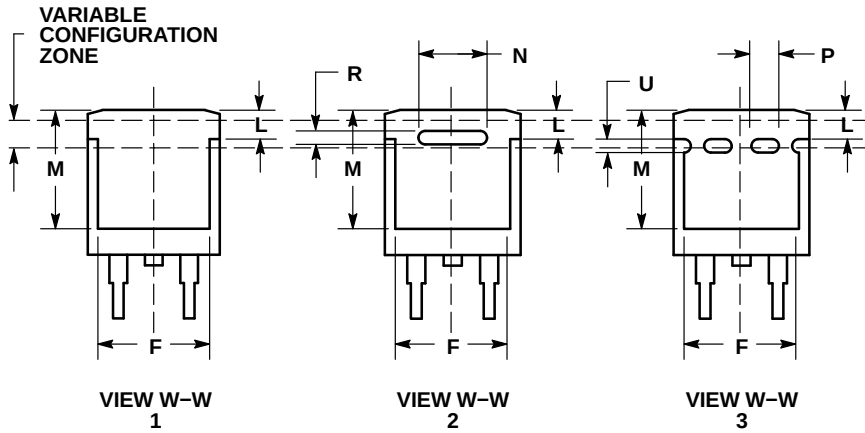
PACKAGE DIMENSIONS

D²PAK 3 CASE 418B-04 ISSUE K



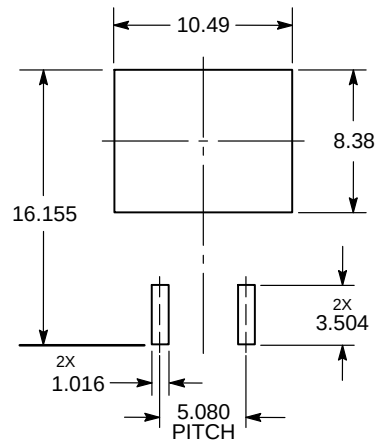
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. 418B-01 THRU 418B-03 OBSOLETE, NEW STANDARD 418B-04.

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*



DIMENSIONS: MILLIMETERS

*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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