

NTB5405N

Power MOSFET

40 V, 116 A, Single N-Channel, D²PAK

Features

- Low $R_{DS(on)}$
- High Current Capability
- Low Gate Charge
- These are Pb-Free Devices

Applications

- Electronic Brake Systems
- Electronic Power Steering
- Bridge Circuits

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

Parameter		Symbol	Value	Units
Drain-to-Source Voltage		V_{DS}	40	V
Gate-to-Source Voltage		V_{GS}	± 20	V
Continuous Drain Current – $R_{\theta JC}$ (Note 1)	Steady State	I_D	$T_C = 25^\circ\text{C}$	A
			$T_C = 100^\circ\text{C}$	
Power Dissipation – $R_{\theta JC}$ (Note 1)	Steady State	P_D	$T_C = 25^\circ\text{C}$	W
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	I_{DM}	280	A
Operating Junction and Storage Temperature		T_J, T_{STG}	-55 to 175	$^\circ\text{C}$
Source Current (Body Diode) Pulsed		I_S	75	A
Single Pulse Drain-to-Source Avalanche Energy – ($V_{DD} = 50 \text{ V}$, $V_{GS} = 10 \text{ V}$, $I_{PK} = 40 \text{ A}$, $L = 1 \text{ mH}$, $R_G = 25 \Omega$)		EAS	800	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		T_L	260	$^\circ\text{C}$

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.

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Units
Junction-to-Case (Drain)	$R_{\theta JC}$	1.0	$^\circ\text{C/W}$

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

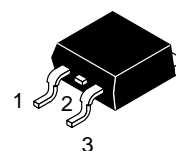
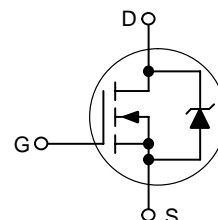


ON Semiconductor®

<http://onsemi.com>

$V_{(BR)DSS}$	$R_{DS(ON)}$ 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

†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.

NTB5405N

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	V _{(BR)DSS}	V _{GS} = 0 V, I _D = 250 μA	40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V _{(BR)DSS} /T _J			39		mV/°C
Zero Gate Voltage Drain Current	I _{DSS}	V _{GS} = 0 V, V _{DS} = 40 V	T _J = 25°C		1.0	μA
			T _J = 100°C		10	
Gate-to-Source Leakage Current	I _{GSS}	V _{DS} = 0 V, V _{GS} = ±30 V			±100	nA

ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	V _{GS(TH)}	V _{GS} = V _{DS} , I _D = 250 μA	1.5		3.5	V
Gate Threshold Temperature Coefficient	V _{GS(TH)} /T _J			-7.0		mV/°C
Drain-to-Source On Resistance	R _{DS(on)}	V _{GS} = 10 V, I _D = 40 A		4.9	5.8	mΩ
		V _{GS} = 5.0 V, I _D = 15 A		7.0	8.0	
Forward Transconductance	g _{FS}	V _{GS} = 10 V, I _D = 15 A		32		S

CHARGES AND CAPACITANCES

Input Capacitance	C _{ISS}	V _{GS} = 0 V, f = 1.0 MHz, V _{DS} = 32 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 V, V _{DS} = 32 V, I _D = 40 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 V (Note 3)

Turn-On Delay Time	t _{d(ON)}	V _{GS} = 10 V, V _{DD} = 32 V, I _D = 40 A, R _G = 2.5 Ω		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 V (Note 3)

Turn-On Delay Time	t _{d(ON)}	V _{GS} = 5 V, V _{DD} = 20 V, I _D = 20 A, R _G = 2.5 Ω		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			nC

- Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
- Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

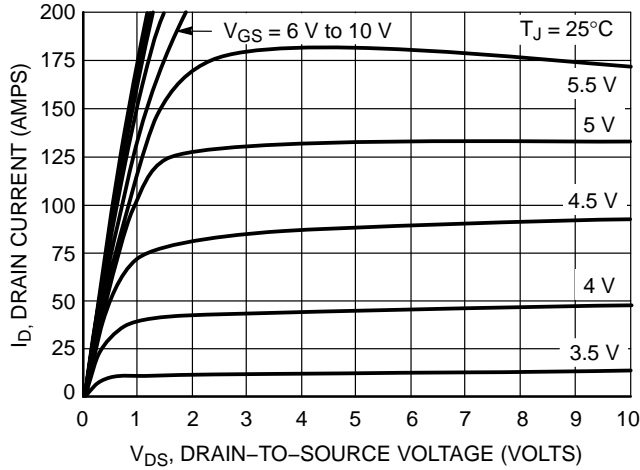


Figure 1. On-Region Characteristics

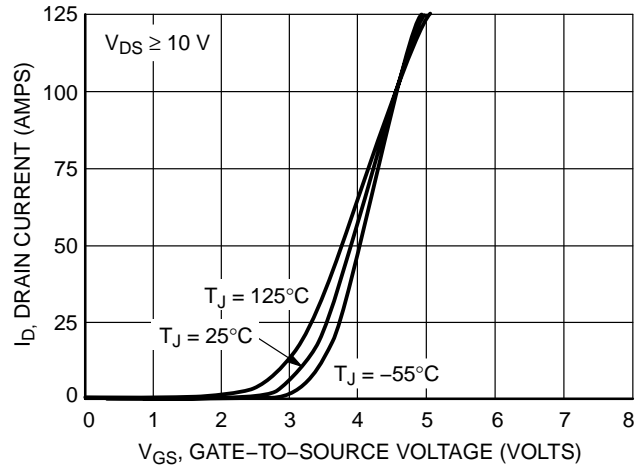


Figure 2. Transfer Characteristics

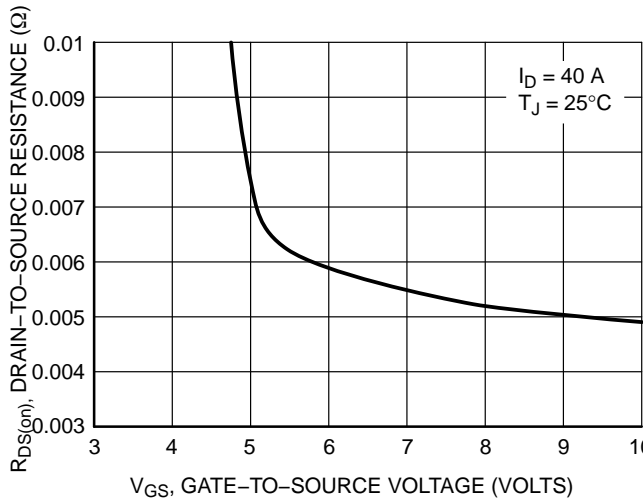


Figure 3. On-Resistance vs. Gate-to-Source Voltage

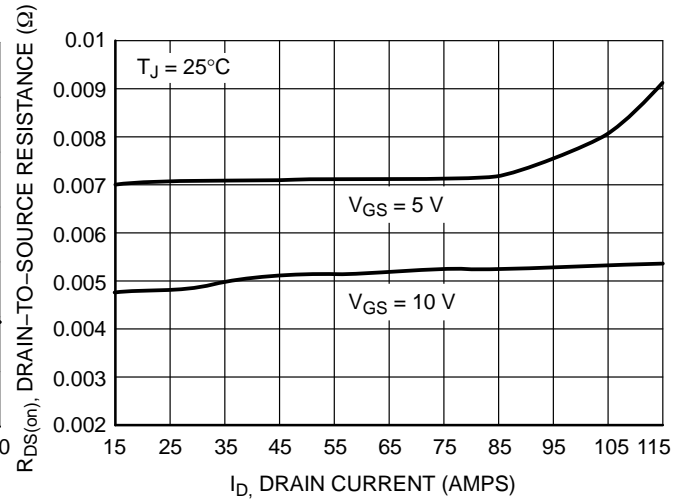


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

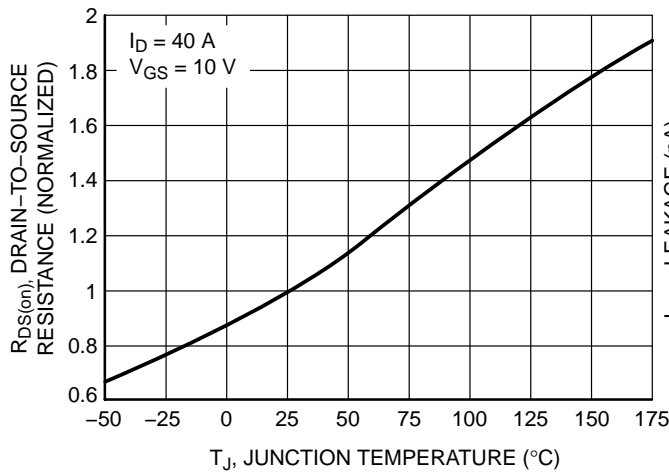


Figure 5. On-Resistance Variation with Temperature

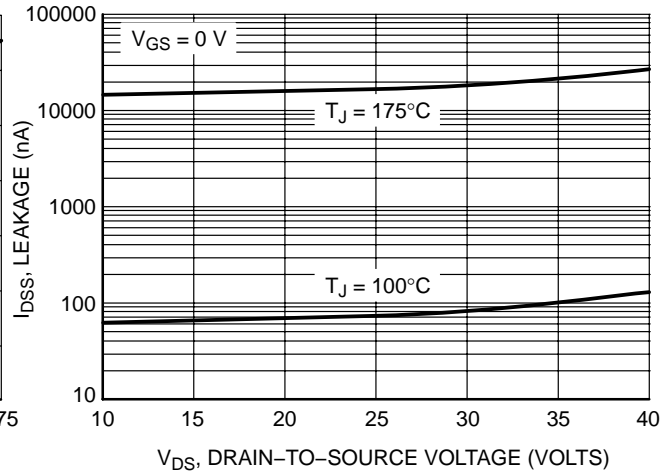
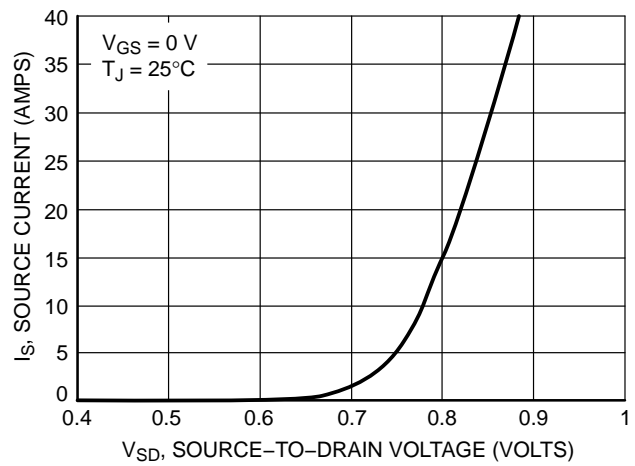
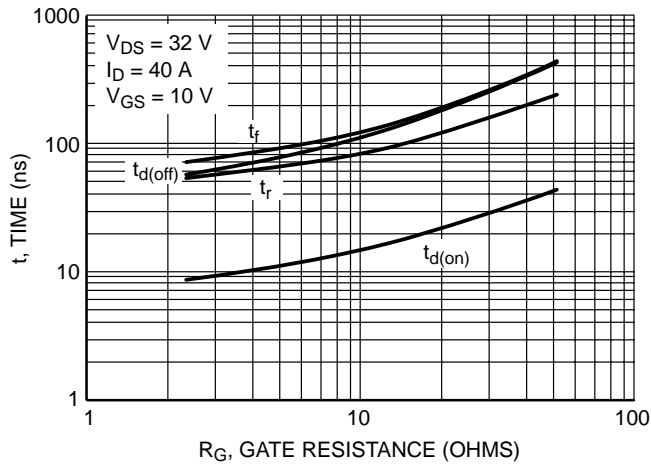
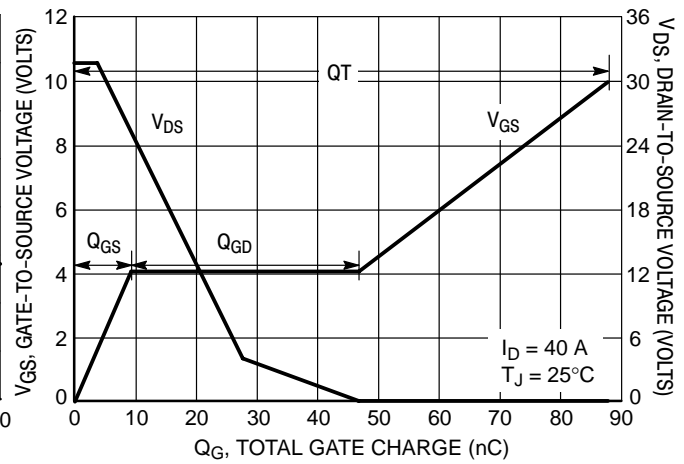
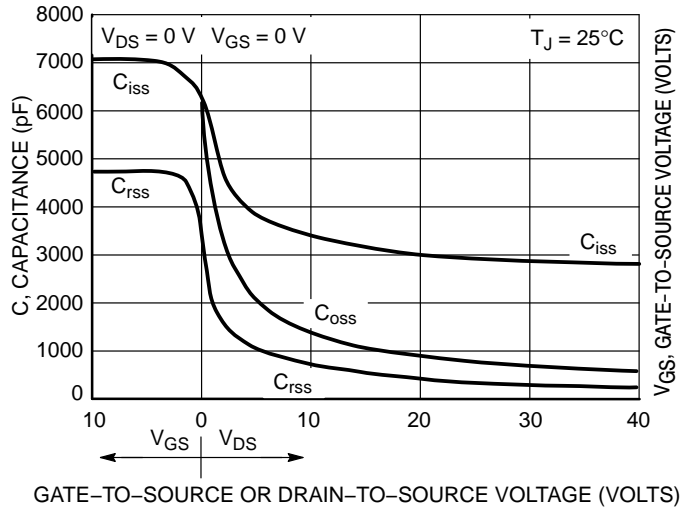


Figure 6. Drain-to-Source Leakage Current vs. Voltage

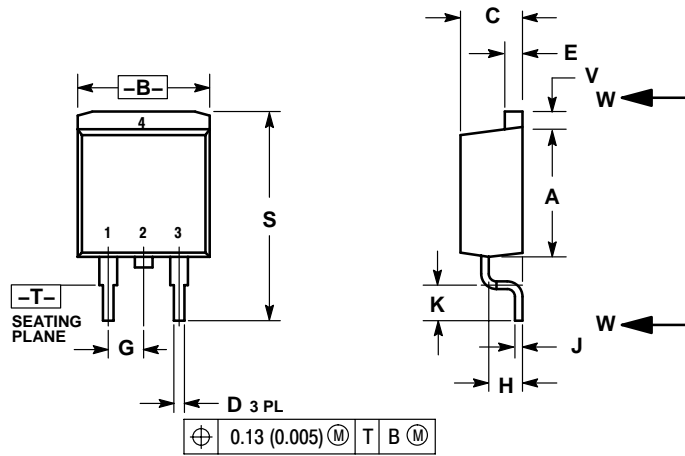
TYPICAL PERFORMANCE CURVES



NTB5405N

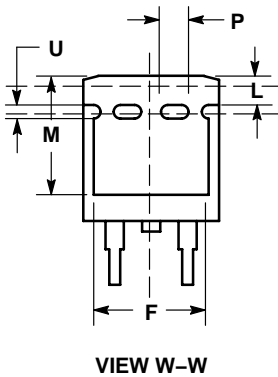
PACKAGE DIMENSIONS

D²PAK
CASE 418B-04
ISSUE H



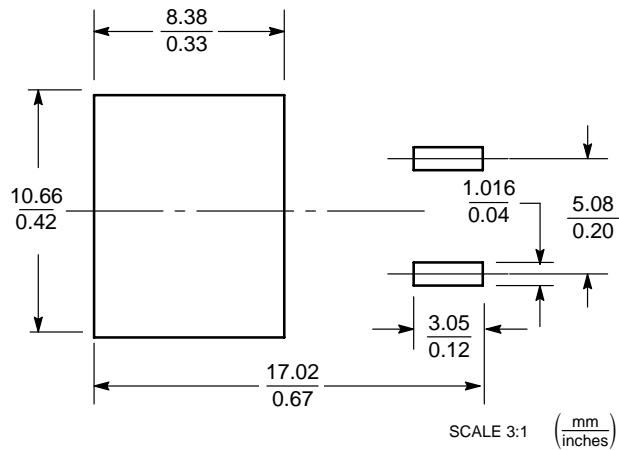
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. 418B-01 THRU 418B-03 OBSOLETE, NEW STANDARD 418B-04.

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:
- PIN 1. GATE
 - DRAIN
 - SOURCE
 - 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.

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