MOSFET – Power, Single, N-Channel, DPAK 40 V, 38 A

Features

- Low R_{DS(on)}
- High Current Capability
- Low Gate Charge
- STD Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable*
- These Devices are Pb-Free and are RoHS Compliant

Applications

- Electronic Brake Systems
- Electronic Power Steering
- Bridge Circuits

MAXIMUM RATINGS (T_J = 25°C unless otherwise stated)

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V_{DSS}	40	V
Gate-to-Source Voltage	е		V _{GS}	±20	V
Continuous Drain	Steady	T _C = 25°C	I _D	38	Α
Current – R _{θJC}	State	T _C = 100°C		27	
Power Dissipation – $R_{\theta JC}$	Steady State	T _C = 25°C	P _D	75	W
Continuous Drain	Steady State	T _A = 25°C	I _D	7.6	Α
Current R _{θJA} (Note 1)	State	T _A = 100°C		5.3	
Power Dissipation – R _{θJA} (Note 1)	Steady State T _A = 25°C		P _D	2.9	W
Pulsed Drain Current	t _p :	= 10 μs	I _{DM}	75	Α
Operating Junction and Storage Temperature			T _J , T _{STG}	–55 to 175	°C
Source Current (Body Diode)			IS	36	Α
Single Pulse Drain-to Source Avalanche Energy – (V_{DD} = 50 V, V_{GS} = 10 V, I_{PK} = 17 A, L = 1 mH, R_G = 25 Ω)			EAS	150	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			TL	260	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

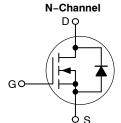


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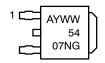
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V _{(BR)DSS}	R _{DS(ON)} TYP	I _D MAX (Note 1)
40 V	21 mΩ @ 10 V	38 A





MARKING DIAGRAM



A = Assembly Location*

Y = Year WW = Work Week

5407N = Specific Device Code

= Pb-Free Device

* The Assembly Location code (A) is front side optional. In cases where the Assembly Location is stamped in the package, the front side assembly code may be blank.

ORDERING INFORMATION

Device	Package	Shipping†
NTD5407NT4G	DPAK (Pb-Free)	2500 / Tape & Reel
STD5407NT4G*	DPAK (Pb-Free)	2500 / Tape & Reel
NVD5407NT4G*	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.

1

THERMAL RESISTANCE RATINGS (Note 1)

Parameter	Symbol	Max	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	2.0	°C/W
Junction-to-Ambient (Note 1)	$R_{\theta JA}$	52	°C/W

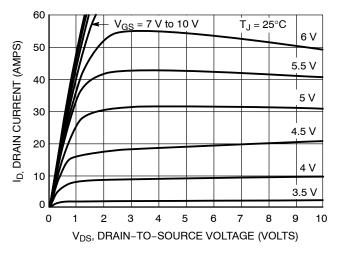
Surface mounted on FR4 board using 1 sq in pad size, (Cu Area 1.127 sq in [2 oz] including traces).

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

Parameter	Symbol	Test Condition		Min	Тур	Max	Unit
OFF CHARACTERISTICS			-				
Drain-to-Source Breakdown Voltage	V _{(BR)DSS}	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$		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,	T _J = 25°C			1.0	μΑ
		$V_{DS} = 40 \text{ V}$	T _J = 100°C			10	1
Gate-to-Source Leakage Current	I _{GSS}	$V_{DS} = 0 V, V_{G}$	_S = ±30 V			±100	nA
ON CHARACTERISTICS (Note 2)							
Gate Threshold Voltage	V _{GS(TH)}	$V_{GS} = V_{DS}, I_{D}$	= 250 μΑ	1.5		3.5	V
Gate Threshold Temperature Coefficient	V _{GS(TH)} /T _J				-6.0		mV/°C
Drain-to-Source On Resistance	R _{DS(on)}	V _{GS} = 10 V,	_D = 20 A		21	26	mΩ
		V _{GS} = 5.0 V,	I _D = 10 A		32	40	
Forward Transconductance	9FS	V _{GS} = 10 V,	_D = 18 A		15		S
CHARGES AND CAPACITANCES							
Input Capacitance	C _{ISS}	$V_{GS} = 0 \text{ V, f} = 1.0 \text{ MHz,}$ $V_{DS} = 32 \text{ V}$			615	1000	pF
Output Capacitance	C _{OSS}				173		
Reverse Transfer Capacitance	C _{RSS}				80		
Total Gate Charge	Q _{G(TOT)}	$V_{GS} = 10 \text{ V}, V_{DS} = 32 \text{ V},$ $I_{D} = 38 \text{ A}$			20		nC
Gate-to-Source Charge	Q_{GS}				2.25		
Gate-to-Drain Charge	Q_{GD}				10.5		7
SWITCHING CHARACTERISTICS, V	GS = 10 V (Note	3)					
Turn-On Delay Time	t _{d(ON)}				6.8		ns
Rise Time	t _r	V _{GS} = 10 V, V _I	nn = 32 V,		17		7
Turn-Off Delay Time	t _{d(OFF)}	$I_{\rm D} = 38 \text{ A}, R_{\rm G} = 2.5 \Omega$			66		
Fall Time	t _f				51		1
SWITCHING CHARACTERISTICS, V	GS = 5 V (Note 3)	-				
Turn-On Delay Time	t _{d(ON)}				10		ns
Rise Time	t _r	$V_{GS} = 5 \text{ V}, V_{D}$	_D = 20 V,		175		1
Turn-Off Delay Time	t _{d(OFF)}	$I_D = 20 \text{ A}, R_G = 2.5 \Omega$			13		1
Fall Time	t _f				23		1
DRAIN-SOURCE DIODE CHARACTE	ERISTICS (Note	2)	-				
Forward Diode Voltage	V_{SD}	V _{GS} = 0 V,	T _J = 25°C		0.9	1.1	V
		I _S = 5.0 A	T _J = 125°C		0.75		
Reverse Recovery Time	t _{RR}				38		ns
Charge Time	ta	$V_{GS} = 0 \text{ V, } dI_{S}/dt = 100 \text{ A/}\mu\text{s,}$ $I_{S} = 15 \text{ A}$			20.5		
Discharge Time	t _b				17		
Reverse Recovery Charge	Q _{RR}				40		nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions. 2. Pulse Test: pulse width $\leq 300~\mu s$, duty cycle $\leq 2\%$. 3. Switching characteristics are independent of operating junction temperatures.

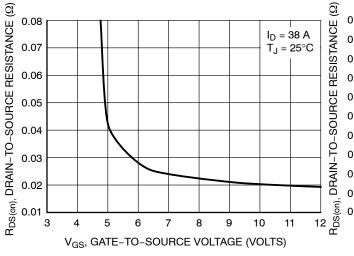
TYPICAL PERFORMANCE CURVES



60 $V_{DS} \ge 10 \text{ V}$ ID, DRAIN CURRENT (AMPS) 50 40 30 20 $T_J = 100^{\circ}C$ 10 T_J = 25°C $T_J = -55^{\circ}C$ 0 0 3 6 V_{GS}, GATE-TO-SOURCE VOLTAGE (VOLTS)

Figure 1. On-Region Characteristics

Figure 2. Transfer Characteristics



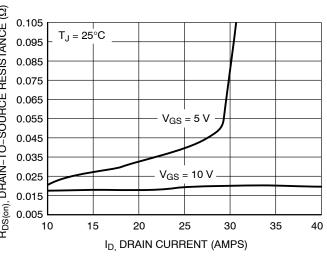
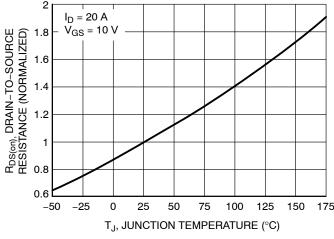


Figure 3. On-Resistance vs. Gate-to-Source Voltage

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



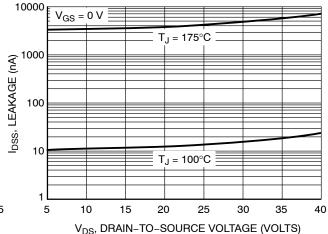
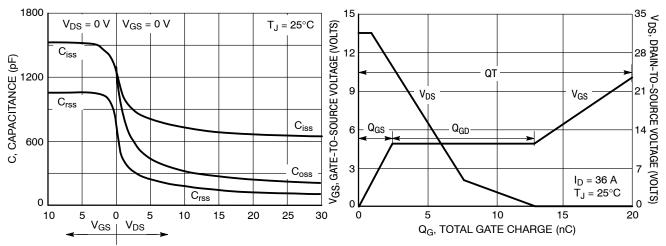


Figure 5. On–Resistance Variation with Temperature

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

TYPICAL PERFORMANCE CURVES



GATE-TO-SOURCE OR DRAIN-TO-SOURCE VOLTAGE (VOLTS)

Figure 7. Capacitance Variation

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

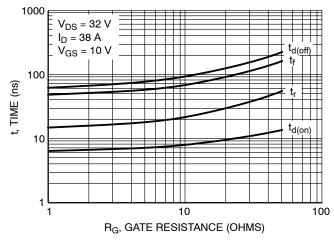


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

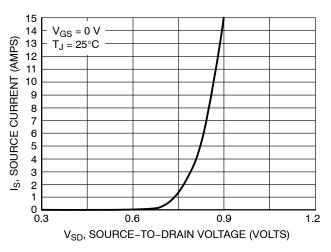


Figure 10. Diode Forward Voltage vs. Current

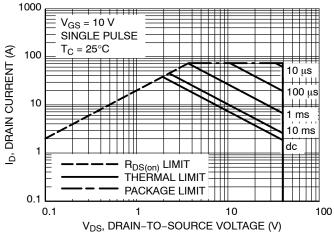


Figure 11. Maximum Rated Forward Biased Safe Operating Area

TYPICAL PERFORMANCE CURVES



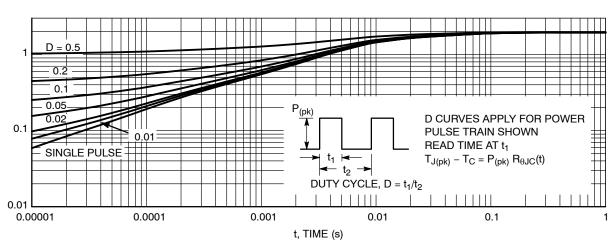
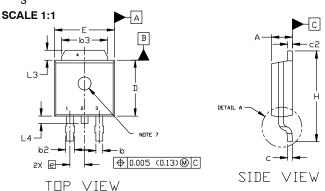


Figure 12. Thermal Response





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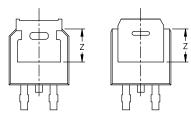


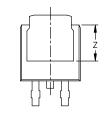
- DIMENSIONING AND TOLERANCING ASME Y14.5M, 1994. CONTROLLING DIMENSION: INCHES
- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS 63,
- L3. AND Z. L3, AND Z.

 DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH,
 PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR
 GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
 DIMENSIONS D AND E ARE DETERMINED AT THE
 OUTERMOST EXTREMES OF THE PLASTIC BODY.
 DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.
 DETININAL MOLD ESCALUES.

- OPTIONAL MOLD FEATURE.

DIM	INCHES		MILLIMETERS		
MIM	MIN.	MAX.	MIN.	MAX.	
Α	0.086	0.094	2.18	2.38	
A1	0.000	0.005	0.00	0.13	
b	0.025	0.035	0.63	0.89	
b2	0.028	0.045	0.72	1.14	
b3	0.180	0.215	4.57	5.46	
C	0.018	0.024	0.46	0.61	
c2	0.018	0.024	0.46	0.61	
D	0.235	0.245	5.97	6.22	
E	0.250	0.265	6.35	6.73	
e	0.090	BSC	2.29 BSC		
Н	0.370	0.410	9.40	10.41	
L	0.055	0.070	1.40	1.78	
L1	0.114 REF		2.90 REF		
L2	0.020 BSC		0.51	BSC	
L3	0.035	0.050	0.89	1.27	
L4		0.040		1.01	
Z	0.155		3.93		

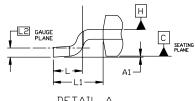




BOTTOM VIEW

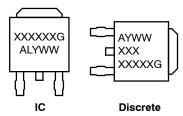
BOTTOM VIEW ALTERNATE CONSTRUCTIONS

5.80 [0.228] 6.20 [0.244] 2.58 3.00 [0.102] [0.118] 1.60 [0.063] 6.17 [0.243]



DETAIL A ROTATED 90° CW

GENERIC MARKING DIAGRAM*



XXXXXX	= Device Code
Α	= Assembly Location
L	= Wafer Lot
Υ	= Year
WW	= Work Week
G	= Pb-Free Package

*This information is generic. Please refer to

*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DUWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

3 FMITTER

4. COLLECTOR

s

3 GATE

RECOMMENDED MOUNTING FOOTPRINT*

STYLE 1: STYLE 2: PIN 1. BASE PIN 1. GATE 2. COLLECTOR 2. DRAIL 3. EMITTER 3. SOUF 4. COLLECTOR 4. DRAIL	N 2. CATHODE RCE 3. ANODE	3. GATE	STYLE 5: PIN 1. GATE 2. ANODE 3. CATHODE 4. ANODE
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STYLE 7: PIN 1. GATE 2. COLLECTOR STYLE 6: STYLE 8: STYLE 9: STYLE 10: PIN 1. MT1 2. MT2 PIN 1. N/C 2. CATHODE 3. ANODE PIN 1. ANODE 2. CATHODE

4. CATHODE

device data sheet for actual part marking. PIN 1. CATHODE 2. ANODE 3. CATHODE Pb-Free indicator, "G" or microdot "■", may or may not be present. Some products may 3 RESISTOR ADJUST not follow the Generic Marking. 4. ANODE

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DESCRIPTION:	DPAK (SINGLE GAUGE)		PAGE 1 OF 1

4. CATHODE

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