

1. Description

- Low $R_{DS(ON)}$ to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- These Devices are Pb-Free and are RoHS Compliant
- CPU Power Delivery
- DC-DC Converters
- Low Side Switching

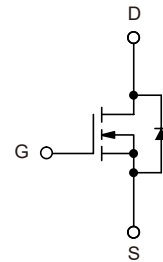
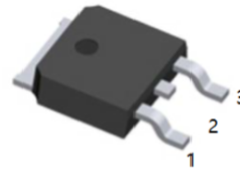
2. Features

- $V_{DS}(V)=30V$
- $I_D=117A (V_{GS}=10V)$
- $R_{DS(ON)}<4m\Omega (V_{GS}=10V)$
- $R_{DS(ON)}<5.5m\Omega (V_{GS}=4.5V)$

3. Pinning information

Pin	Symbol	Description
1	G	GATE
2	D	DRAIN
3	S	SOURCE

TO-252(DPAK)
top view



4. Absolute Maximum Ratings $T_J= 25^{\circ}C$

Parameter		Symbol	Value	Units
Drain-to-Source Voltage		V_{DSS}	30	V
Gate-to-Source Voltage		V_{GS}	± 20	V
Continuous Drain Current ($R_{\theta JA}$) (Note 1)	Steady	$T_A=25^{\circ}C$	19.6	A
		$T_A=85^{\circ}C$	15.2	A
Power Dissipation ($R_{\theta JA}$) (Note 1)	State	$T_A=25^{\circ}C$	2.66	W
Continuous Drain Current ($R_{\theta JA}$) (Note 2)		$T_A=25^{\circ}C$	14.5	A
		$T_A=85^{\circ}C$	11	A
Power Dissipation ($R_{\theta JA}$) (Note 2)		$T_A=25^{\circ}C$	1.43	W



Continuous Drain Current ($R_{\theta JC}$) (Note 1)	Steady State	$T_C=25^\circ C$	I_D	124	A
		$T_C=85^\circ C$		96	A
Power Dissipation ($R_{\theta JC}$) (Note 1)		$T_C=25^\circ C$	P_D	107	W
Pulsed Drain Current	$t_p=10\mu s$	$T_C=25^\circ C$	I_{DM}	230	A
Current Limited by Package		$T_A=25^\circ C$	$I_{DmaxPkg}$	45	A
Operating Junction and Storage Temperature		$T_A=25^\circ C$	T_J, T_{STG}	-55 to 175	$^\circ C$
Source Current (Body Diode)			I_S	78	A
Drain to Source dv/dt			dv/dt	6	V/ns
Single Pulse Drain-to-Source Avalanche Energy ($V_{DD}=24 V, V_{GS}=10V, L=1mH, I_{L(pk)}=30A, R_G=25\Omega$)			E_{AS}	450	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T_L	260	$^\circ C$

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.

5. Thermal resistance rating

Parameter	Symbol	Value	Units
Junction-to-Case (Drain)	$R_{\theta JC}$	1.4	$^\circ C/W$
Junction-to-TAB (Drain)	$R_{\theta JC-TAB}$	3.5	$^\circ C/W$
Junction-to-Ambient-Steady State (Note 1)	$R_{\theta JA}$	56.4	$^\circ C/W$
Junction-to-Ambient-Steady State (Note 2)	$R_{\theta JA}$	105	$^\circ C/W$

1. Surface-mounted on FR4 board using 1 in sq pad size, 1 oz Cu.
2. Surface-mounted on FR4 board using the minimum recommended pad size.



6. Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Units	
OFF CHARACTERISTICS							
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=250\mu A$	30			V	
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			26		mV/ $^\circ\text{C}$	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=0V$			1	μA	
		$V_{DS}=24V$			10	μA	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS}=0V, V_{GS}=\pm 20V$			± 100	nA	
ON CHARACTERISTICS (Note 3)							
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.5		2.5	V	
Negative Temperature Coefficient	$V_{GS(th)}/T_J$			7.6		mV/ $^\circ\text{C}$	
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS}=10$ to $11.5V$	$I_D=30A$		3.4	4	m Ω
			$I_D=15A$		3.4		m Ω
		$V_{GS}=4.5V$	$I_D=30A$		4.7	5.5	m Ω
			$I_D=15A$		4.6		m Ω
Forward Transconductance	g_{FS}	$V_{DS}=15V, I_D=15A$		23		S	
CHARGES AND CAPACITANCES							
Input Capacitance	C_{iss}	$V_{GS}=0V, V_{DS}=12V, f=1MHz$		4490		pF	
Output Capacitance	C_{oss}			952		pF	
Reverse Transfer Capacitance	C_{rss}			556		pF	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS}=4.5V, V_{DS}=15V, I_D=30A$		30	40	nC	
Threshold Gate Charge	$Q_{G(TH)}$			5.5		nC	
Gate-to-Source Charge	Q_{GS}			13		nC	
Gate-to-Drain Charge	Q_{GD}			13		nC	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS}=11.5V, V_{DS}=15V, I_D=30A$		73		nC	



SWITCHING CHARACTERISTICS (Note 4)							
Turn-On Delay Time	$t_{D(on)}$	$V_{GS}=4.5V, V_{DS}=15V$ $I_D=15A, R_G=3\Omega$		18			ns
Rise Time	t_r			20			ns
Turn-Off Delay Time	$t_{D(off)}$			24			ns
Fall Time	t_f			8			ns
Turn-On Delay Time	$t_{D(on)}$	$V_{GS}=11.5V, V_{DS}=15V$ $I_D=15A, R_G=3\Omega$		10			ns
Rise Time	t_r			19			ns
Turn-Off Delay Time	$t_{D(off)}$			35			ns
Fall Time	t_f			5			ns
DRAIN-SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	$V_{GS}=0V$ $I_D=30A$	$T_J=25^\circ C$		0.81	1.2	V
			$T_J=125^\circ C$		0.72		V
Reverse Recovery Time	t_{rr}	$V_{GS}=11.5V, dI_S/dt=100A/\mu s$ $I_S=30A$		34			ns
Charge Time	t_a			19			ns
Discharge Time	t_b			15			ns
Reverse Recovery Time	Q_{rr}			30			nC
PACKAGE PARASITIC VALUES							
Source Inductance	L_S	$T_A=25^\circ C$		2.49			nH
Drain inductance, DPAK	L_D			0.0164			nH
Drain Inductance, IPAK	L_D			1.88			nH
Gate Inductance	L_G			3.46			nH
Gate Resistance	R_G			0.6			Ω

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.



7.1 Typical Characteristics

<p>I_D, Drain Current (Amps)</p> <p>V_{DS}, Drain-to-source Voltage (Volts)</p>	<p>I_D, Drain Current (Amps)</p> <p>V_{GS}, Gate-to-source Voltage (Volts)</p>
<p>Figure 1: On-Region Characteristics</p>	<p>Figure 2: Transfer Characteristics</p>
<p>$R_{DS(on)}$, Drain to Source On-Resistance (Ω)</p> <p>V_{GS}, Gate-to-Source Voltage (V)</p>	<p>$R_{DS(on)}$, Drain to Source On-Resistance (Ω)</p> <p>I_D, Drain Current (Amps)</p>
<p>Figure 3: On-Resistance vs. Gate-to-Source Voltage</p>	<p>Figure 4: On-Resistance versus Drain Current and Gate Voltage</p>
<p>$R_{DS(on)}$, Drain to Source On-Resistance (Normalized)</p> <p>T_J, Junction Temperature ($^{\circ}C$)</p>	<p>I_{loss}, Leakage (nA)</p> <p>V_{DS}, Drain-to-Source Voltage (V)</p>
<p>Figure 5: On-Resistance Variation with Temperature</p>	<p>Figure 6: Drain-To-Source Leakage Current versus Voltage</p>



7.2 Typical Characteristics

<p>Capacitance (pF)</p> <p>Gate-to-source Or Drain-to-source Voltage (Volts)</p>	<p>V_{GS}, Gate-to-source Voltage (Volts)</p> <p>Q_G, Total Gate Charge (nC)</p>
<p>Figure 7: Capacitance Variation</p>	<p>Figure 8: Gate-To-Source and Drain-To-Source Voltage vs. Total Charge</p>
<p>t, TIME (ns)</p> <p>R_G, Gate Resistance (OHMS)</p>	<p>I_S, Source Current (Amps)</p> <p>V_{SD}, Source-to-drain Voltage (VOLTS)</p>
<p>Figure 9: Resistive Switching Time Variation vs. Gate Resistance</p>	<p>Figure 10: On-Resistance versus Drain Current and Gate Voltage</p>
<p>I_D, Drain Current (Amps)</p> <p>V_{DS}, Drain-to-source Voltage (Volts)</p>	<p>E_{AS}, Single Pulse Drain-to-source Avalanche Energy (mJ)</p> <p>T_J, Junction Temperature ($^{\circ}C$)</p>
<p>Figure 11: Maximum Rated Forward Biased Safe Operating Area</p>	<p>Figure 12: Maximum Avalanche Energy vs. Starting Junction Temperature</p>



7.3 Typical Characteristics

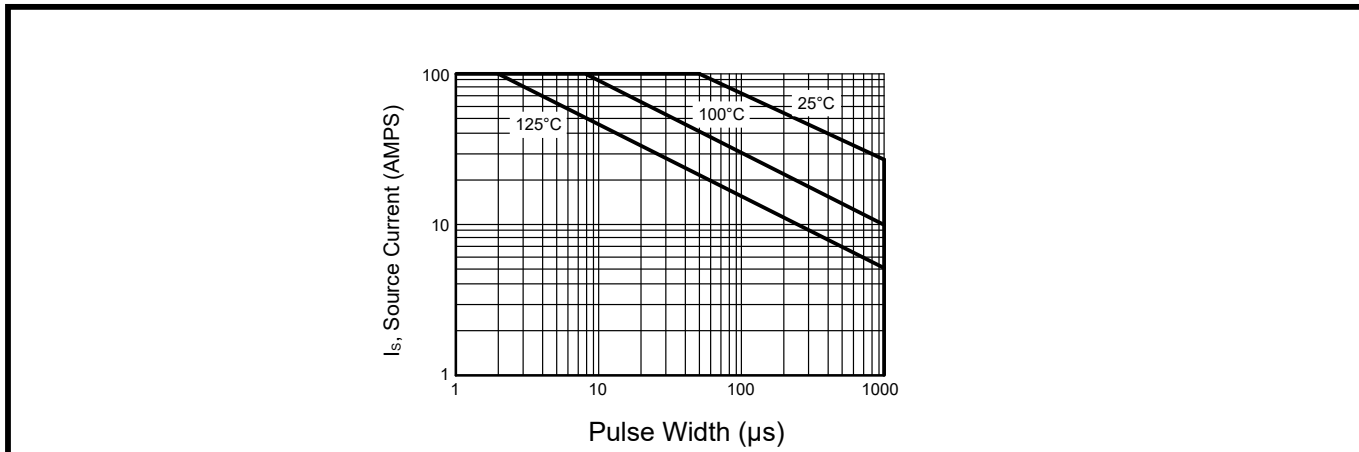


Figure 13: Avalanche Characteristics

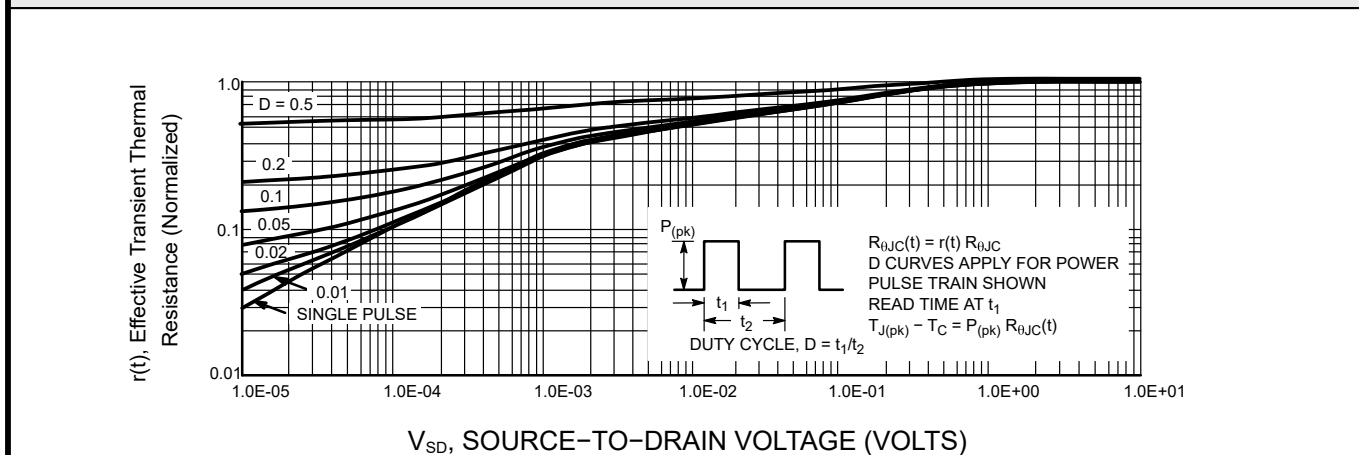
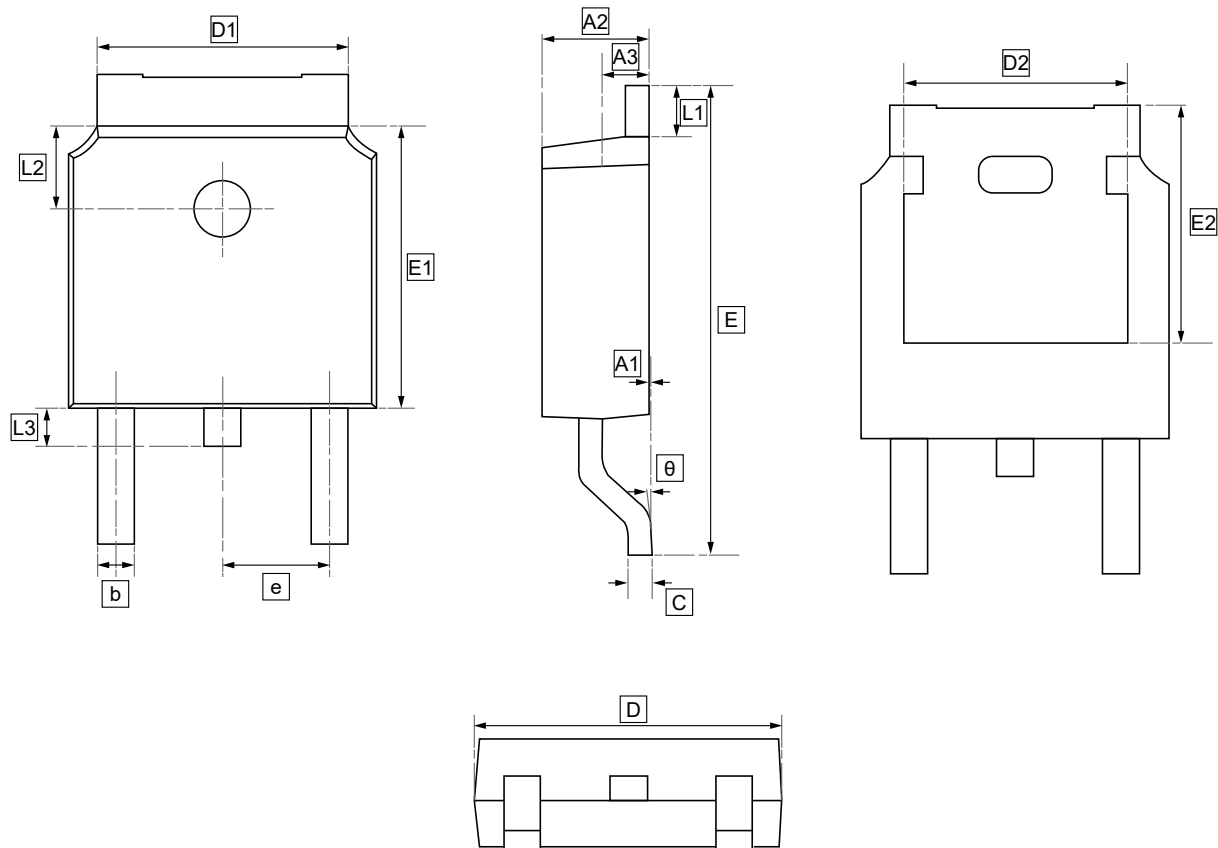


Figure 14: Diode Forward Voltage versus Current



7.TO-252 Package Outline Dimensions

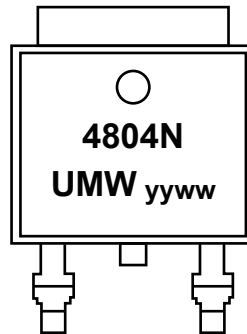


DIMENSIONS (mm are the original dimensions)

Symbol	A1	A2	A3	b	c	D	D1	D2	E	E1	E2	e	L1	L2	L3	θ
Min	0.00	2.18	0.90	0.65	0.46	6.35	4.95	4.32	9.40	5.97	5.21	2.286	0.89	1.70	0.60	0.00
Max	0.13	2.39	1.10	0.85	0.61	6.73	5.46	4.90	10.41	6.22	5.38	BSC	1.27	1.90	1.00	8.00



8. Ordering information



yy: Year Code
ww: Week Code

Order Code	Package	Base QTY	Delivery Mode
UMW NTD4804NT4G	TO-252	2500	Tape and reel



9. Disclaimer

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