MOSFET – Power, P-Channel, SOT-223

-5.2 A, -30 V

NTF5P03, NVF5P03

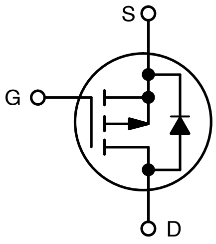
Features

- Ultra Low $R_{DS(on)}$
- Higher Efficiency Extending Battery Life
- Logic Level Gate Drive
- Miniature SOT-223 Surface Mount Package
- Avalanche Energy Specified
- AEC-Q101 Qualified and PPAP Capable − NVF5P03T3G
- These Devices are Pb-Free and are RoHS Compliant

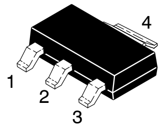
Applications

- DC-DC Converters
- Power Management
- Motor Controls
- Inductive Loads
- Replaces MMFT5P03HD

−5.2 AMPERES, −30 VOLTS
$R_{DS(on)}$ = 100 mΩ

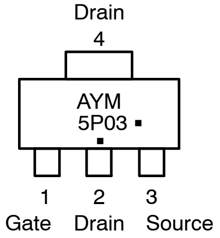


P−Channel MOSFET



SOT-223
CASE 318E
STYLE 3

MARKING DIAGRAM & PIN ASSIGNMENT



A = Assembly Location
Y = Year
M = Date Code
5P03 = Specific Device Code
▪ = Pb-Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
NTF5P03T3G	SOT-223 (Pb-Free)	4000 / Tape & Reel
NVF5P03T3G	SOT-223 (Pb-Free)	4000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)
Negative sign for P-Channel devices omitted for clarity

Rating		Symbol	Max	Unit
Drain-to-Source Voltage		V_{DSS}	–30	V
Drain-to-Gate Voltage (R_{GS} = 1.0 MΩ)		V_{DGR}	–30	V
Gate-to-Source Voltage – Continuous		V_{GS}	± 20	V
1 sq in FR-4 or G-10 PCB	Thermal Resistance – Junction-to-Ambient	R_{THJA}	40	°C/W
	Total Power Dissipation @ T_A = 25°C	P_D	3.13	Watts
	Linear Derating Factor		25	mW/°C
	Drain Current – Continuous @ T_A = 25°C	I_D	–5.2	A
10 seconds	Continuous @ T_A = 70°C	I_D	–4.1	A
	Pulsed Drain Current (Note 1)	I_{DM}	–26	A
Minimum FR-4 or G-10 PCB	Thermal Resistance – Junction-to-Ambient	R_{THJA}	80	°C/W
	Total Power Dissipation @ T_A = 25°C	P_D	1.56	Watts
	Linear Derating Factor		12.5	mW/°C
	Drain Current – Continuous @ T_A = 25°C	I_D	–3.7	A
10 seconds	Continuous @ T_A = 70°C	I_D	–2.9	A
	Pulsed Drain Current (Note 1)	I_{DM}	–19	A
Operating and Storage Temperature Range		T_J, T_{stg}	– 55 to 150	°C
Single Pulse Drain-to-Source Avalanche Energy – Starting T_J = 25°C (V_{DD} = –30 Vdc, V_{GS} = –10 Vdc, Peak I_L = –12 Apk, L = 3.5 mH, R_G = 25 Ω)		E_{AS}	250	mJ

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.

1. Repetitive rating; pulse width limited by maximum junction temperature.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain-to-Source Breakdown Voltage (Cpk ≥ 2.0) (Notes 2 and 4) (V_{GS} = 0 Vdc, I_D = –250 μAdc)	$V_{(BR)DSS}$	–30	–	–	Vdc
Temperature Coefficient (Positive)		–	–28	–	mV/°C
Zero Gate Voltage Drain Current (V_{DS} = –24 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	–	–	–1.0	μAdc
(V_{DS} = –24 Vdc, V_{GS} = 0 Vdc, T_J = 125°C)		–	–	–25	
Gate-Body Leakage Current (V_{GS} = ± 20 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	–	–	± 100	nAdc
ON CHARACTERISTICS (Note 2)					
Gate Threshold Voltage (Cpk ≥ 2.0) (Notes 2 and 4) (V_{DS} = V_{GS}, I_D = –250 μAdc)	$V_{GS(th)}$	–1.0	–1.75	–3.0	Vdc
Threshold Temperature Coefficient (Negative)		–	3.5	–	mV/°C
Static Drain-to-Source On-Resistance (Cpk ≥ 2.0) (Notes 2 and 4) (V_{GS} = –10 Vdc, I_D = –5.2 Adc)	$R_{DS(on)}$	–	76	100	mΩ
(V_{GS} = –4.5 Vdc, I_D = –2.6Adc)			107	150	
Forward Transconductance (Note 2) (V_{DS} = –15 Vdc, I_D = –2.0 Adc)	g_{fs}	2.0	3.9	–	Mhos
DYNAMIC CHARACTERISTICS					
Input Capacitance (V_{DS} = –25 Vdc, V_{GS} = 0 V, f = 1.0 MHz)	C_{iss}	–	500	950	pF
Output Capacitance	C_{oss}	–	153	440	
Transfer Capacitance	C_{rss}	–	58	140	

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS (Note 3)						
Turn-On Delay Time	(V_{DD} = −15 Vdc, I_D = −4.0 Adc, V_{GS} = −10 Vdc, R_G = 6.0 Ω) (Note 2)	$t_{d(on)}$	–	10	24	ns
Rise Time		t_r	–	33	48	
Turn-Off Delay Time		$t_{d(off)}$	–	38	94	
Fall Time		t_f	–	20	92	
Turn-On Delay Time	(V_{DD} = −15 Vdc, I_D = −2.0 Adc, V_{GS} = −10 Vdc, R_G = 6.0 Ω) (Note 2)	$t_{d(on)}$	–	16	38	ns
Rise Time		t_r	–	45	110	
Turn-Off Delay Time		$t_{d(off)}$	–	23	60	
Fall Time		t_f	–	24	80	
Gate Charge	(V_{DS} = −24 Vdc, I_D = −4.0 Adc, V_{GS} = −10 Vdc) (Note 2)	Q_T	–	15	38	nC
		Q_1	–	1.6	–	
		Q_2	–	3.5	–	
		Q3	–	2.6	–	
SOURCE-DRAIN DIODE CHARACTERISTICS						
Forward On-Voltage	(I_S = −4.0 Adc, V_{GS} = 0 Vdc) (I_S = −4.0 Adc, V_{GS} = 0 Vdc, T_J = 125°C) (Note 2)	V_{SD}	– –	−1.1 −0.89	−1.5 –	Vdc
Reverse Recovery Time	(I_S = −4.0 Adc, V_{GS} = 0 Vdc, dI_S/dt = 100 A/µs) (Note 2)	t_{rr}	–	34	–	ns
		t_a	–	20	–	
		t_b	–	14	–	
Reverse Recovery Stored Charge		Q_{RR}	–	0.036	–	µC

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 ≤ 300 µs, Duty Cycle ≤ 2.0%.
3. Switching characteristics are independent of operating junction temperatures.
4. Reflects typical values.

$$Cpk = \left| \frac{\text{Max limit} - \text{Typ}}{3 \times \text{SIGMA}} \right|$$

TYPICAL ELECTRICAL CHARACTERISTICS

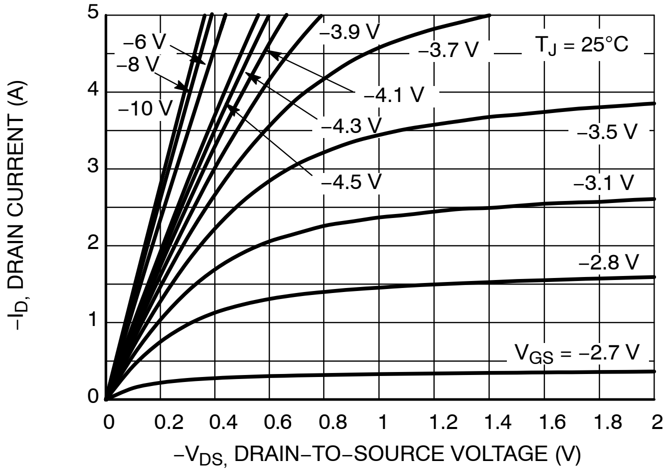


Figure 1. On−Region Characteristics

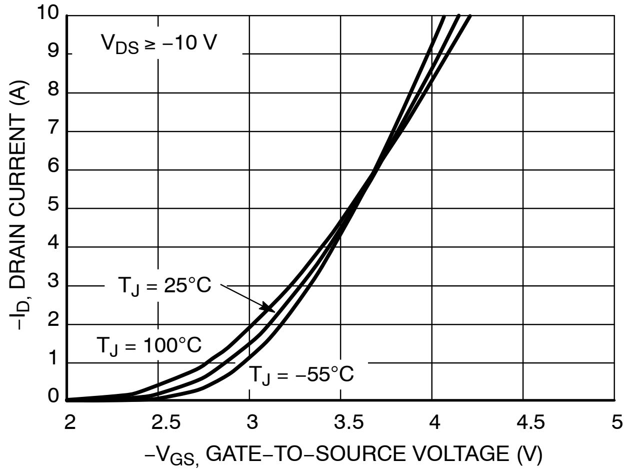


Figure 2. Transfer Characteristics

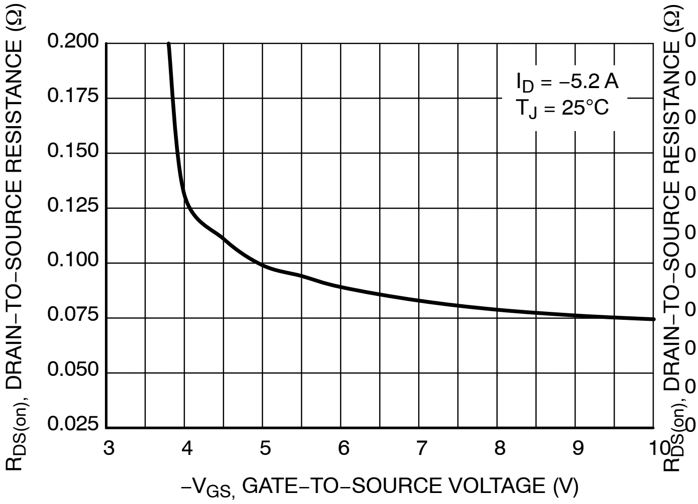


Figure 3. On−Resistance versus Gate−to−Source Voltage

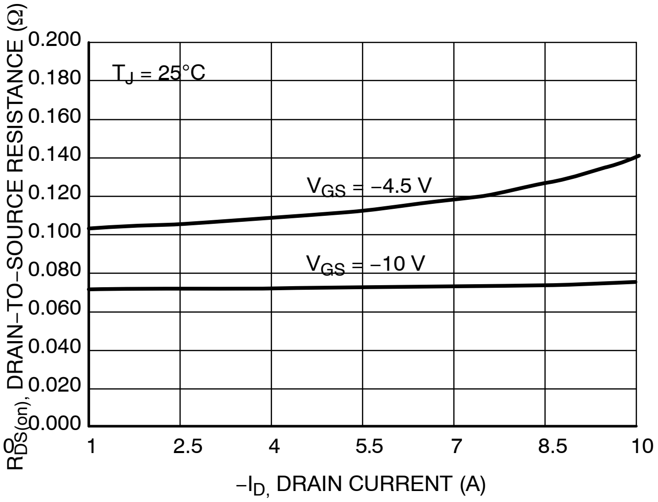


Figure 4. On−Resistance versus Drain Current and Gate Voltage

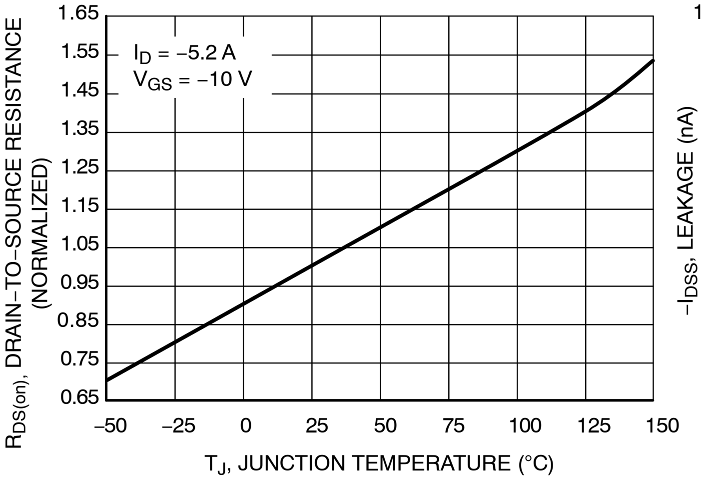


Figure 5. On−Resistance Variation with Temperature

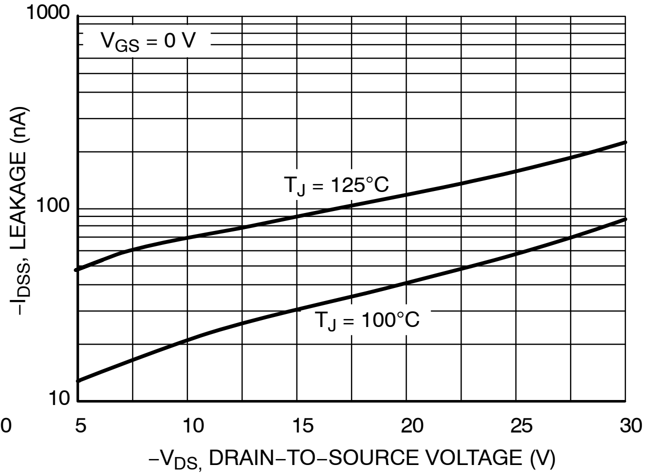


Figure 6. Drain−to−Source Leakage Current versus Voltage

TYPICAL ELECTRICAL CHARACTERISTICS

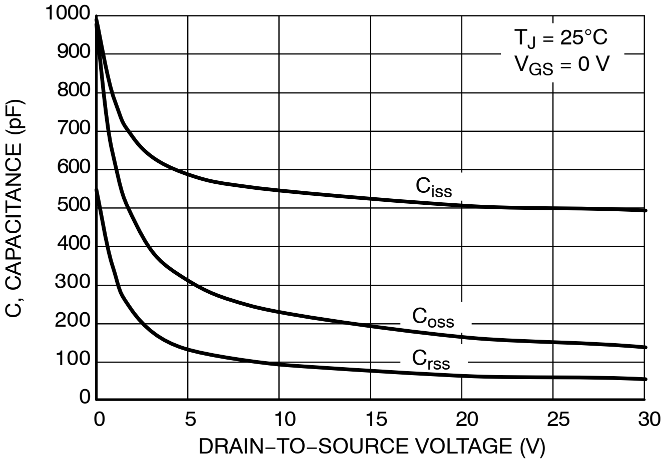


Figure 7. Capacitance Variation

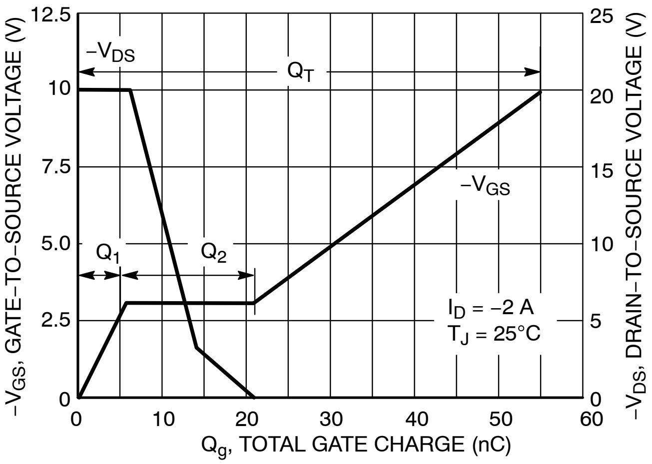


Figure 8. Gate−to−Source and Drain−to−Source Voltage versus Total Charge

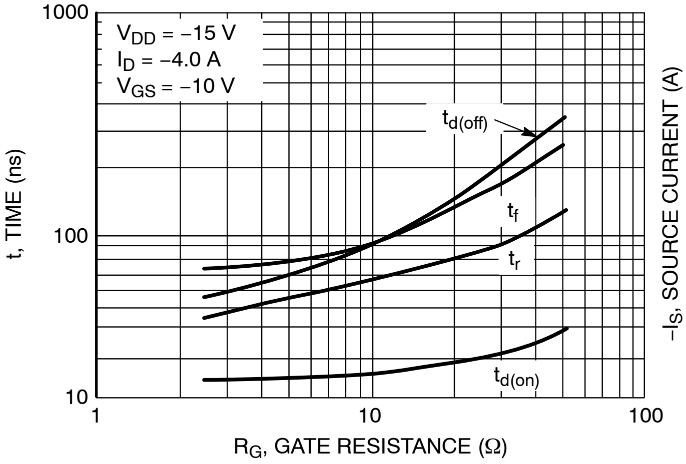


Figure 9. Resistive Switching Time Variation versus Gate Resistance

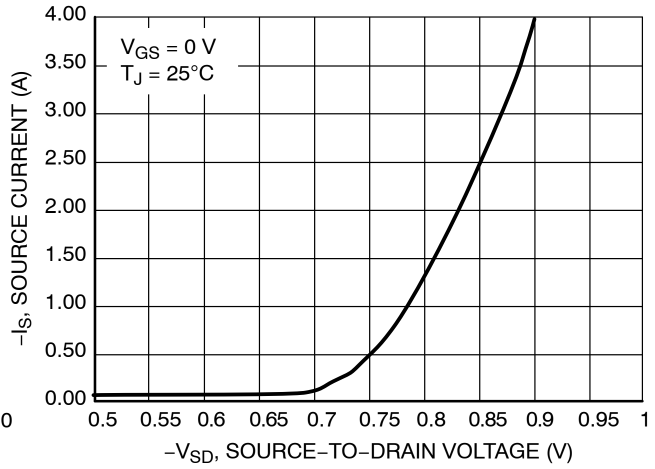
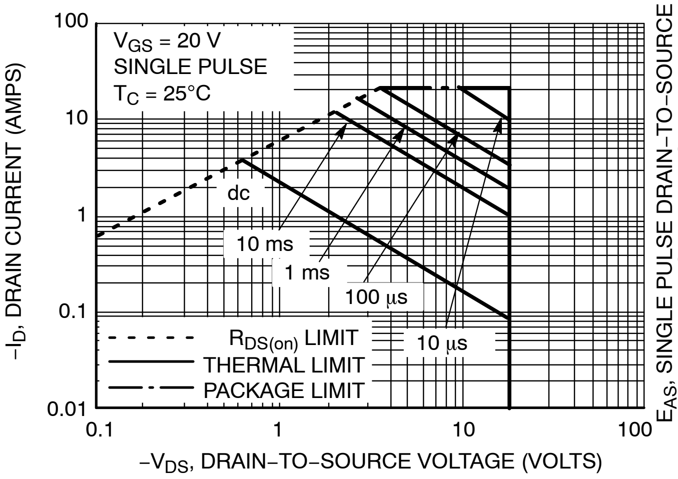


Figure 10. Diode Forward Voltage versus Current



Mounted on 2”sq. FR4 board (1”sq. 2 oz. Cu 0.06” thick single sided) with on die operating, 10 s max.

Figure 11. Maximum Rated Forward Biased Safe Operating Area

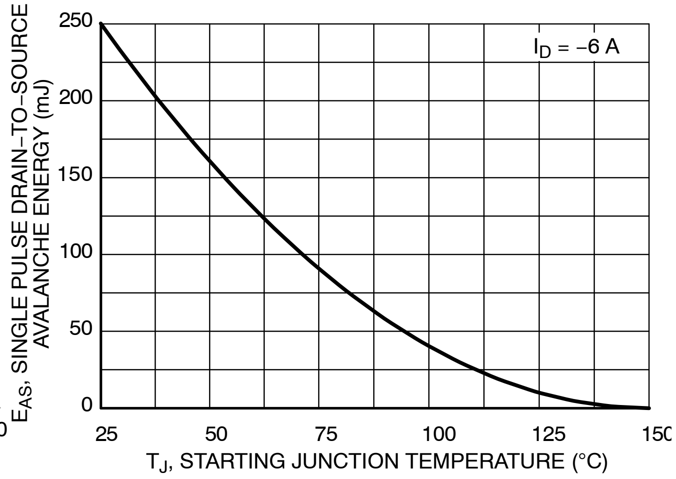


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

TYPICAL ELECTRICAL CHARACTERISTICS

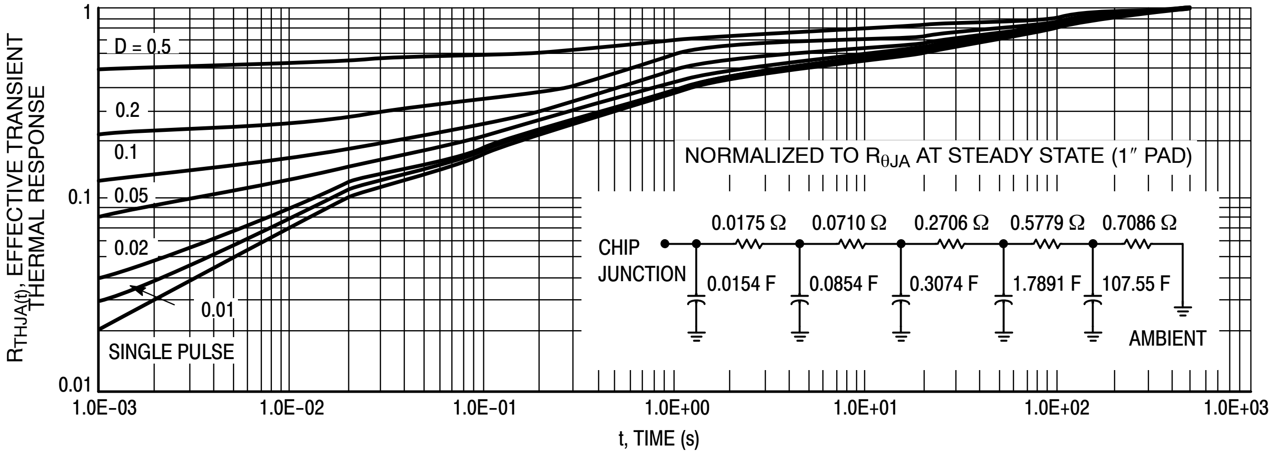


Figure 13. FET Thermal Response

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