NTTFD013N03P8

Dual N-Channel PowerTrench® MOSFET

Q1:30 V, 11.6 mΩ; Q2: 30 V, 6.4 mΩ

General Description

This device includes two specialized N−Channel MOSFETs in a dual power33 (3 mm X 3 mm MLP) package. The switch node has been internally connected to enable easy placement and routing of synchronous buck converters. The control MOSFET (Q1) and synchronous MOSFET (Q2) have been designed to provide optimal power efficiency.

Features

Q1: N−Channel

- Max $r_{DS(on)}$ = 11.6 mΩ at V_{GS} = 10 V, I_D = 10 A
- Max $r_{DS(on)}$ = 13.3 mΩ at V_{GS} = 4.5 V, I_D = 9 A

Q2: N−Channel

- Max $r_{DS(on)}$ = 6.4 mΩ at V_{GS} = 10 V, I_D = 16 A
- Max $r_{DS(on)}$ = 7.0 mΩ at V_{GS} = 4.5 V, I_D = 15 A
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

- Mobile Computing
- Mobile Internet Devices
- General Purpose Point of Load

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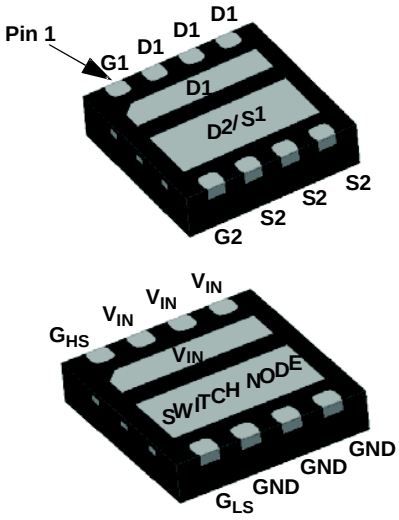
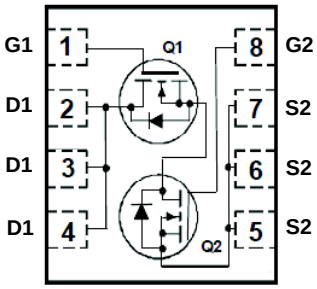


(Bottom Views)

WDFN8
Power33
CASE 511DE



ORDERING INFORMATION

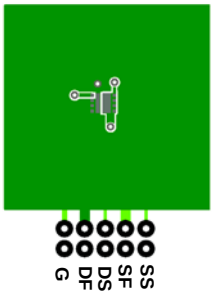
See detailed ordering and shipping information on page 3 of this data sheet.

Table 1. MOSFET MAXIMUM RATINGS T_C = 25°C unless otherwise noted.

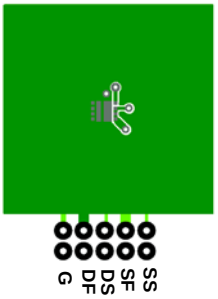
Symbol	Parameter		Q1	Q2	Units
V_{DS}	Drain to Source Voltage		30	30	V
V_{GS}	Gate to Source Voltage	(Note 4)	±12	±12	V
I_D	Drain Current −Continuous	T_C = 25°C (Note 9)	29	46	A
	− Continuous	T_C = 100°C (Note 9)	18	29	
	− Continuous	T_A = 25°C	10 (Note 5)	16 (Note 6)	
	− Pulsed	T_A = 25°C (Note 10)	113	302	
E_{AS}	Single Pulse Avalanche Energy	(Note 3)	24	54	mJ
P_D	Power Dissipation for Single Operation	T_A = 25°C	1.9 (Note 5)	2.5 (Note 6)	W
	Power Dissipation for Single Operation	T_A = 25°C	0.7 (Note 7)	1.0 (Note 8)	
T_J, T_{STG}	Operating and Storage Junction Temperature Range		−55 to +150		°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.

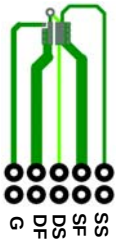
1. Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro−mechanical application board design.
2. Pulsed Id please refer to Figure 11 and Figure 24 SOA graphs for more details.
3. Q1: E_{AS} of 24 mJ is based on starting T_J = 25°C; L = 3 mH, I_{AS} = 4 A, V_{DD} = 30 V, V_{GS} = 10 V. 100% tested at L = 0.1 mH, I_{AS} = 13 A.
   Q2: E_{AS} of 54 mJ is based on starting T_J = 25°C; L = 3 mH, I_{AS} = 6 A, V_{DD} = 30 V, V_{GS} = 10 V. 100% tested at L = 0.1 mH, I_{AS} = 22 A.
4. As an N−ch device, the negative Vgs rating is for low duty cycle pulse occurrence only. No continuous rating is implied.



5. 65°C/W when mounted on a 1 in^2 pad of 2 oz copper



6. 50°C/W when mounted on a 1 in^2 pad of 2 oz copper



7. 180°C/W when mounted on a minimum pad of 2 oz copper

8. 125°C/W when mounted on a minimum pad of 2 oz copper

Table 2. PACKAGE MARKING AND ORDERING INFORMATION

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
D13N03	NTTFD013N03P8	Power 33	13″	12 mm	3000 units

Table 3. THERMAL CHARACTERISTICS

$R_{\theta JC}$	Thermal Resistance, Junction to Case	8.2	6.1	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	65 (Note 9)	50 (Note 9)	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	180 (Note 9)	125 (Note 9)	

9. $R_{\theta JA}$ is determined with the device mounted on a 1 in^2 pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR−4 material, $R_{\theta CA}$ is determined by the user's board design.

Table 4. ELECTRICAL CHARACTERISTICS T_J = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
OFF CHARACTERISTICS							
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V	Q1 Q2	30 30			V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25°C	Q1 Q2		15 16		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V	Q1 Q2			1 1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±12 V, V_{DS} = 0 V	Q1 Q2			±100 ±100	nA nA
ON CHARACTERISTICS							
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	Q1 Q2	1.0 1.0	1.3 1.8	3.0 3.0	V
$\Delta V_{GS(th)}$ / ΔT_J	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25°C	Q1 Q2		−4 −4		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 10 A V_{GS} = 4.5 V, I_D = 9 A V_{GS} = 10 V, I_D = 10 A, T_J = 125°C	Q1		7.7 8.9 10.8	11.5 13.3 16.3	mΩ
		V_{GS} = 10 V, I_D = 16 A V_{GS} = 4.5 V, I_D = 15 A V_{GS} = 10 V, I_D = 16 A, T_J = 125°C	Q2		4.4 5.4 6.2	6.3 7.0 9.0	
g_{FS}	Forward Transconductance	V_{DD} = 5 V, I_D = 10 A V_{DD} = 5 V, I_D = 16 A	Q1 Q2		46 70		S
DYNAMIC CHARACTERISTICS							
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1 MHZ	Q1 Q2		792 1685	1100 2300	pF
C_{oss}	Output Capacitance		Q1 Q2		230 467	320 650	pF
C_{rss}	Reverse Transfer Capacitance		Q1 Q2		20 36	30 50	pF
R_g	Gate Resistance		Q1 Q2	0.1 0.1	2.0 1.2	4.0 2.4	Ω
SWITCHING CHARACTERISTICS							
$t_{d(on)}$	Turn−On Delay Time	Q1: V_{DD} = 15 V, I_D = 10 A, V_{GS} = 10 V, R_{GEN} = 6 Ω Q2: V_{DD} = 15 V, I_D = 16 A, V_{GS} = 10 V, R_{GEN} = 6 Ω	Q1 Q2		7 10	14 20	ns
t_r	Rise Time		Q1 Q2		2 3	10 10	ns
$t_{d(off)}$	Turn−Off Delay Time		Q1 Q2		19 24	33 39	ns
t_f	Fall Time		Q1 Q2		2 3	10 10	ns

Table 4. ELECTRICAL CHARACTERISTICS T_J = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions		Type	Min	Typ	Max	Units
SWITCHING CHARACTERISTICS								
$Q_{g(tot)}$	Total Gate Charge	V_{GS} = 0 V to 10 V	Q1 V_{DD} = 15 V, I_D = 10 A Q2 V_{DD} = 15 V, I_D = 16 A	Q1 Q2		12 24	17 34	nC
$Q_{g(tot)}$	Total Gate Charge	V_{GS} = 0 V to 4.5 V		Q1 Q2		5.5 11	7.7 16	nC
Q_{gs}	Gate to Source Charge			Q1 Q2		1.7 4.4		nC
Q_{gd}	Gate to Drain “Miller” Charge			Q1 Q2		1.3 2.7		nC
DRAIN−SOURCE DIODE CHARACTERISTICS								
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = 10 A (Note 10) V_{GS} = 0 V, I_S = 1.5 A (Note 10) V_{GS} = 0 V, I_S = 16 A (Note 10) V_{GS} = 0 V, I_S = 2 A (Note 10)		Q1 Q1 Q2 Q2		0.85 0.75 0.83 0.73	1.2 1.2 1.2 1.2	V
t_{rr}	Reverse Recovery Time	Q1 I_F = 10 A, di/dt = 100 A/μs Q2 I_F = 16 A, di/dt = 100 A/μs		Q1 Q2		17 27	31 42	ns
Q_{rr}	Reverse Recovery Charge			Q1 Q2		5 10	10 20	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.

10. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%.

Typical Characteristics (Q1 N−Channel) T_J = 25°C unless otherwise noted.

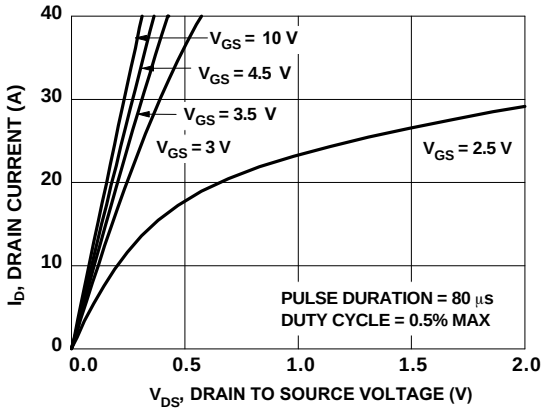


Figure 1. On Region Characteristics

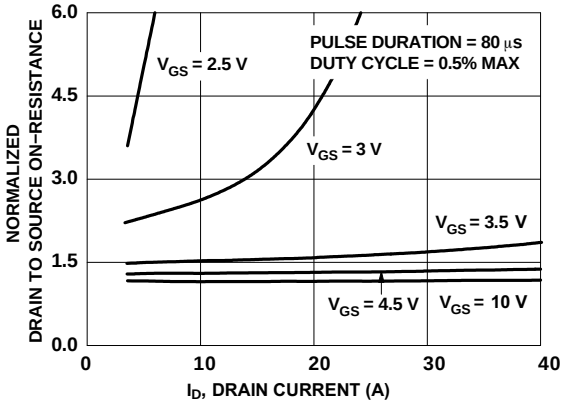


Figure 2. Normalized On−Resistance vs. Drain Current and Gate Voltage

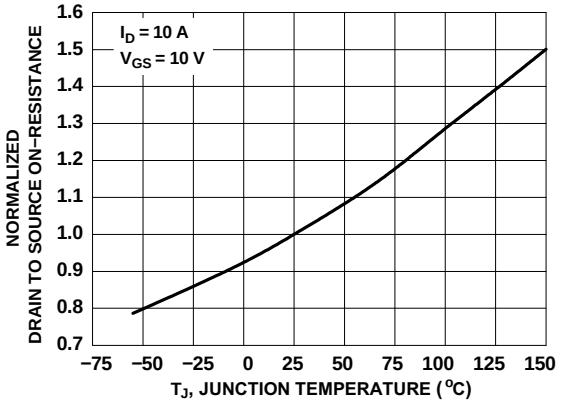


Figure 3. Normalized On−Resistance vs. Junction Temperature

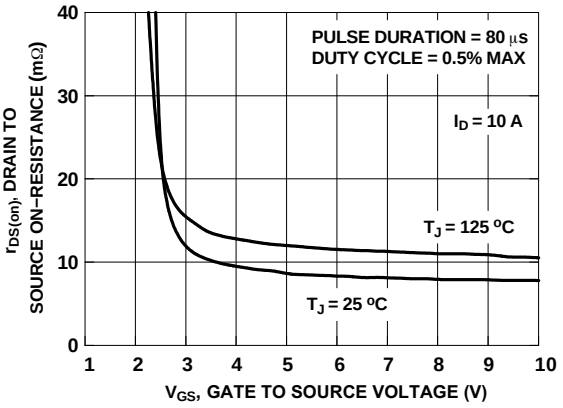


Figure 4. On−Resistance vs. Gate to Source Voltage

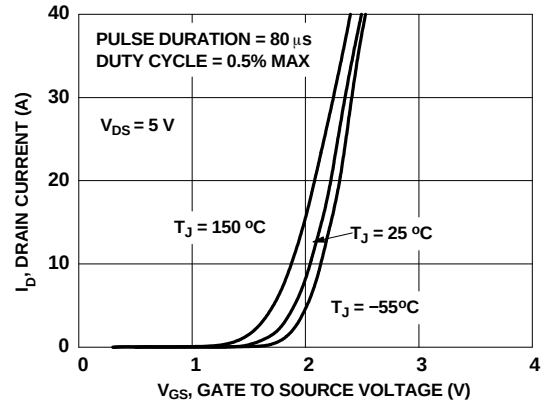


Figure 5. Transfer Characteristics

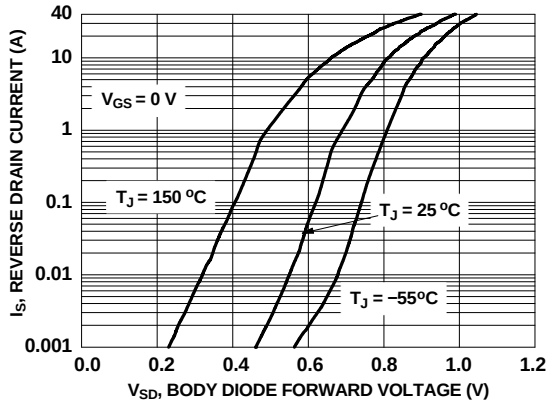


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

Typical Characteristics (Q1 N−Channel) T_J = 25°C unless otherwise noted.

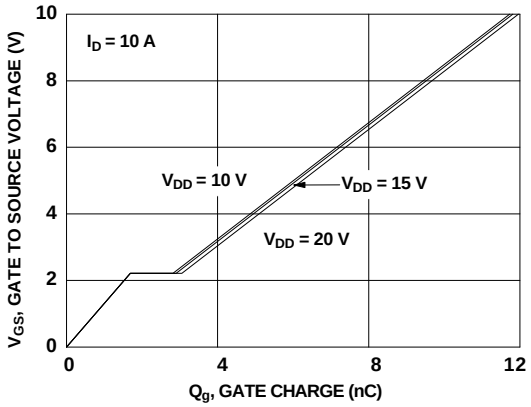


Figure 7. Gate Charge Characteristics

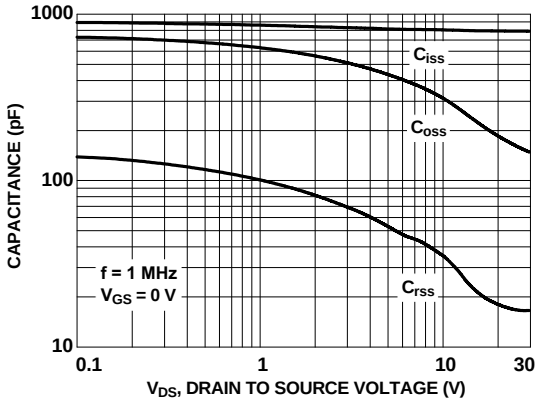


Figure 8. Capacitance vs. Drain to Source Voltage

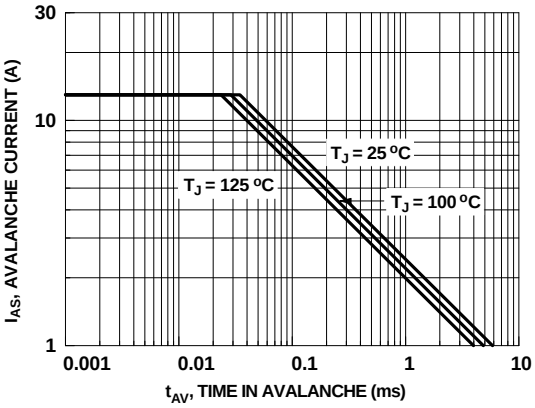


Figure 9. Unclamped Inductive Switching Capability

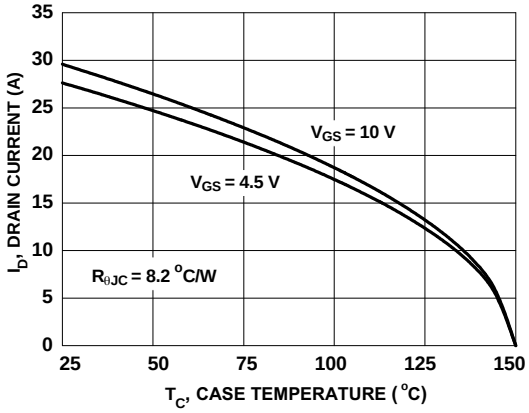


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

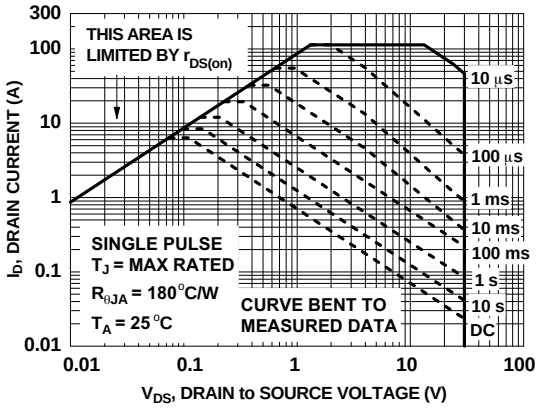


Figure 11. Forward Bias Safe Operating Area

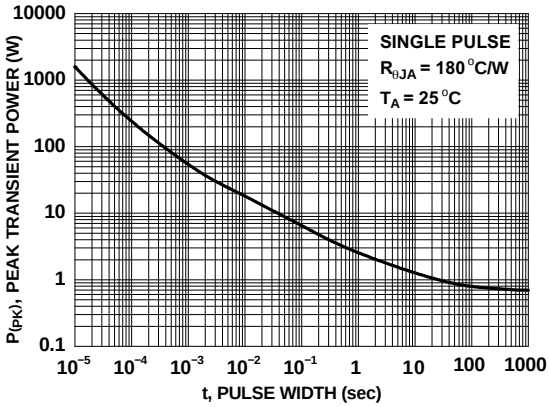


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics (Q1 N−Channel) T_J = 25°C unless otherwise noted.

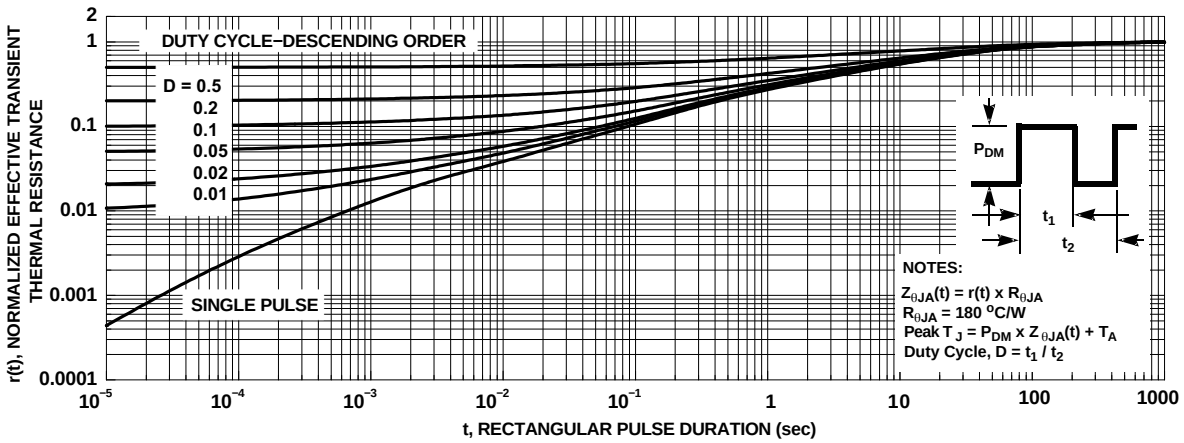


Figure 13. Junction−to−Ambient Transient Thermal Response Curve

Typical Characteristics (Q2 N−Channel) T_J = 25°C unless otherwise noted.

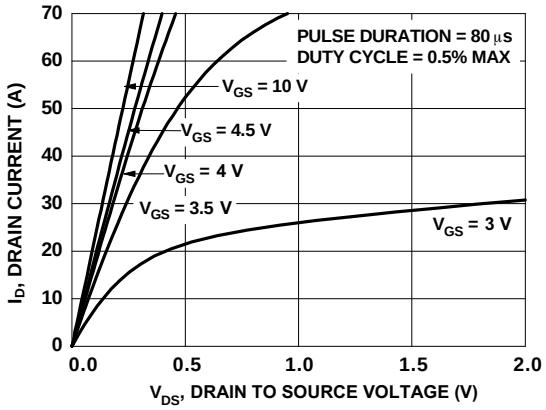


Figure 14. On Region Characteristics

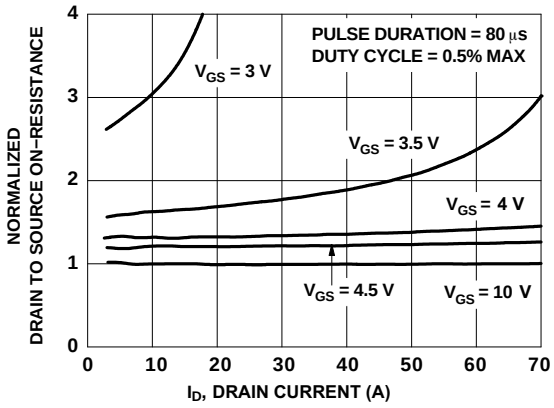


Figure 15. Normalized On−Resistance vs. Drain Current and Gate Voltage

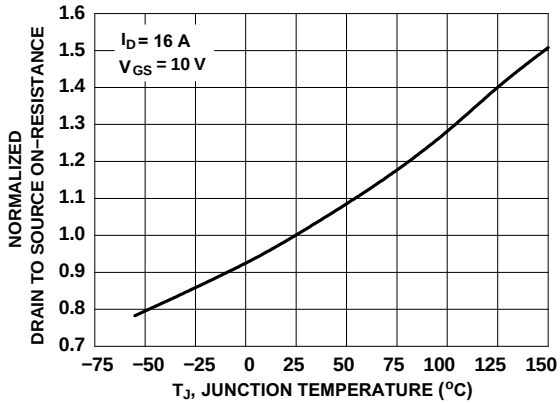


Figure 16. Normalized On−Resistance vs. Junction Temperature

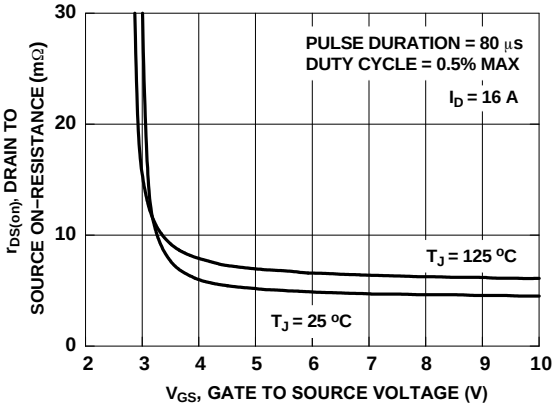


Figure 17. On−Resistance vs. Gate to Source Voltage

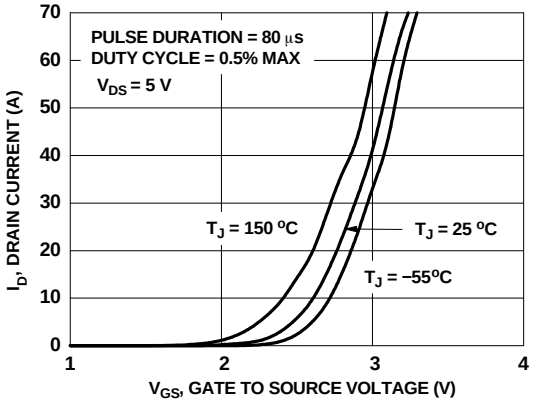


Figure 18. Transfer Characteristics

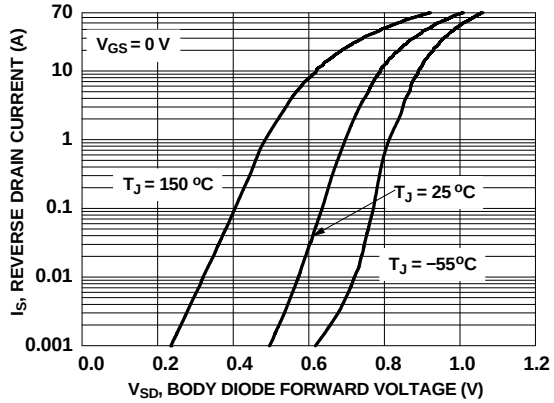


Figure 19. Source to Drain Diode Forward Voltage vs. Source Current

Typical Characteristics (Q2 N−Channel) T_J = 25°C unless otherwise noted.

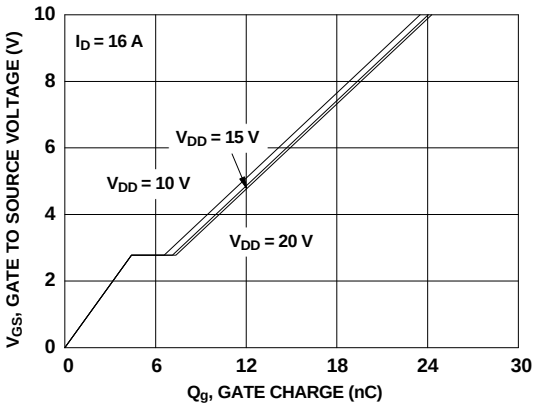


Figure 20. Gate Charge Characteristics

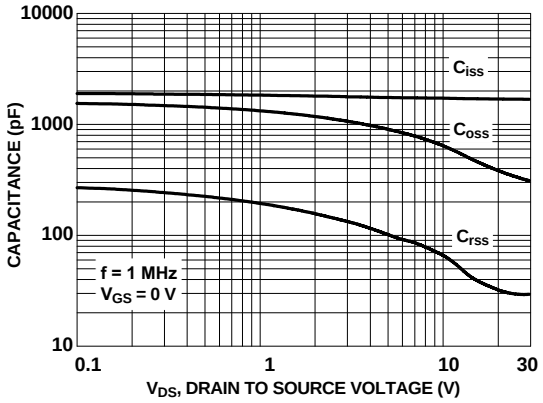


Figure 21. Capacitance vs. Drain to Source Voltage

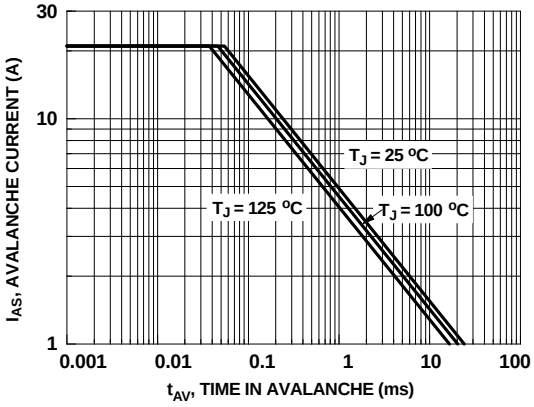


Figure 22. Unclamped Inductive Switching Capability

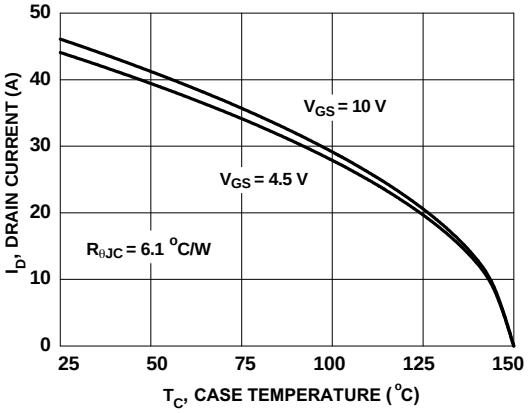


Figure 23. Maximum Continuous Drain Current vs. Case Temperature

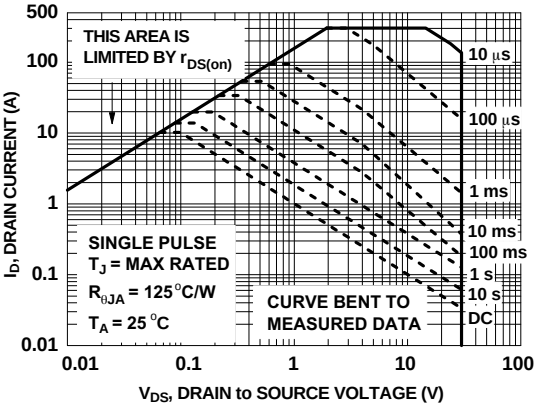


Figure 24. Forward Bias Safe Operating Area

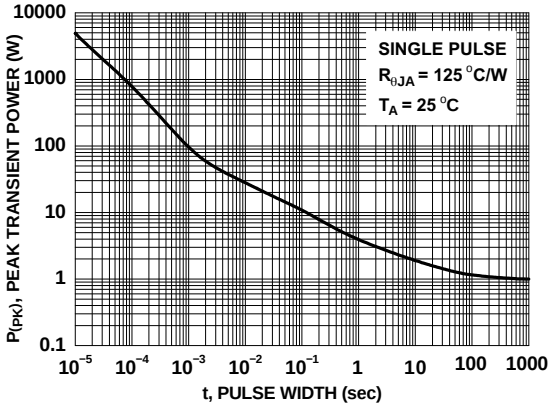


Figure 25. Single Pulse Maximum Power Dissipation

Typical Characteristics (Q2 N−Channel) T_J = 25°C unless otherwise noted.

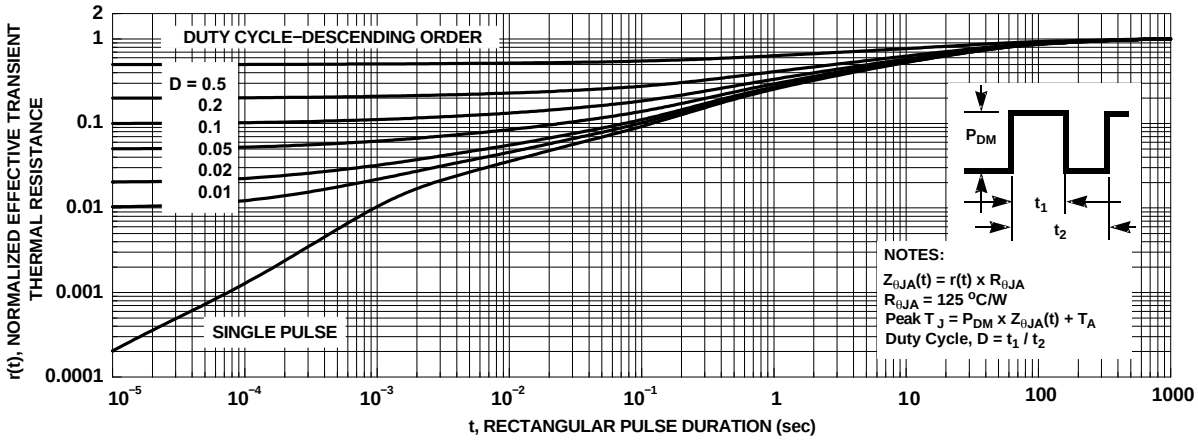
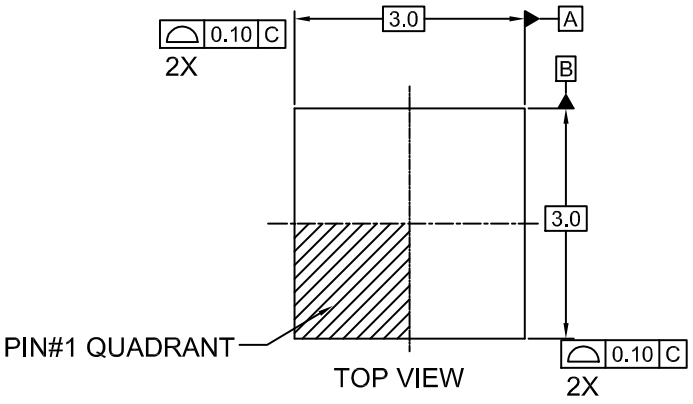
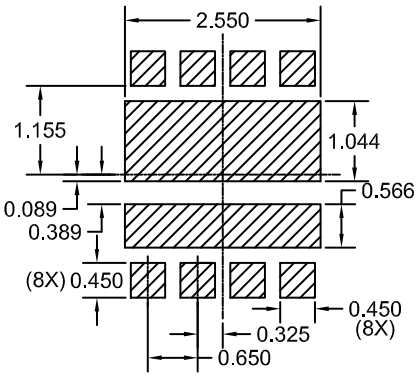


Figure 26. Junction−to−Ambient Transient Thermal Response Curve

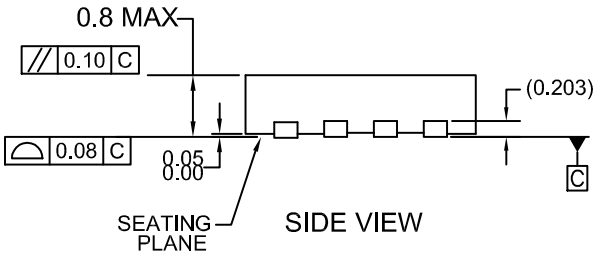
PACKAGE DIMENSIONS

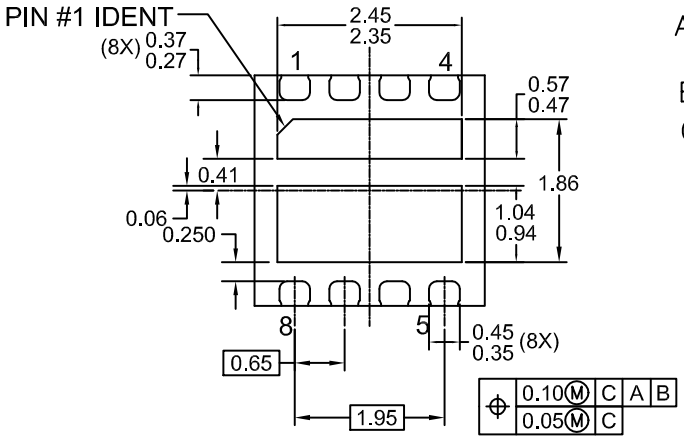
WDFN8 3x3, 0.65P
CASE 511DE
ISSUE O





RECOMMENDED LAND PATTERN





BOTTOM VIEW

NOTES:

A. DOES NOT CONFORM TO JEDEC REGISTRATION MO−229
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

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