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MOSFET - Power, Dual N- & P-Channel, μ 8FL

100 V, 70 m Ω , 9.5 A,
-100 V, 186 m Ω , -5 A



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NTTBC070NP10M5L

Features

- Small Footprint (3 x 3 mm) for Compact Design
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Q_G and Capacitance to Minimize Driver Losses
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Typical Applications

- Power Tools, Battery Operated Vacuums
- UAV/Drones, Material Handling
- Motor Drive, Home Automation

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$, Unless otherwise specified)

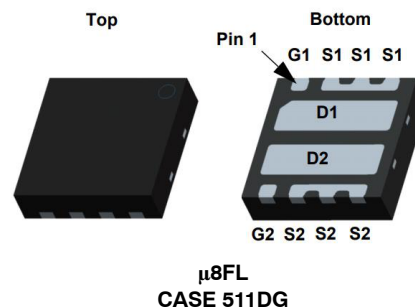
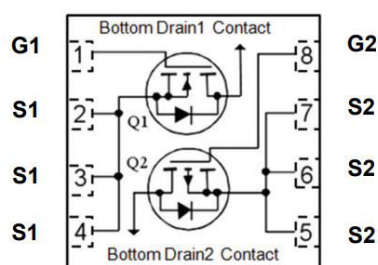
Parameter		Symbol	Q1	Q2	Unit
Drain-to-Source Breakdown Voltage		$V_{(BR)DSS}$	100	-100	V
Gate-to-Source Voltage		V_{GS}	± 20	± 20	V
Continuous Drain Current $R_{\theta JC}$ (Note 2)	Steady State $T_C = 25^\circ\text{C}$	I_D	9.5	-5	A
		P_D	14	10	W
Continuous Drain Current $R_{\theta JA}$ (Note 1, 2)	Steady State $T_A = 25^\circ\text{C}$	I_D	3.5	-2.2	A
		P_D	1.9	1.9	W
Pulsed Drain Current	$T_A = 25^\circ\text{C}$, $t_p = 10 \mu\text{s}$	I_{DM}	33	33	A
Operating Junction and Storage Temperature Range		T_J , T_{stg}	-55 to +150		$^\circ\text{C}$
Source Current (Body Diode)		I_S	12	8	A
Single Pulse Drain-to-Source Avalanche Energy ($I_L = 7.3 \text{ A}$, 7.8 A , $L = 1 \text{ mH}$)		E_{AS}	26	30	mJ
Lead Temperature Soldering Reflow for Soldering Purposes (1/8" from case for 10 s)		T_L	260	260	$^\circ\text{C}$

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.

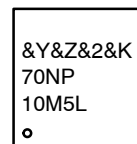
1. Surface-mounted on FR4 board using 1 in² pad size, 1 oz Cu pad.
2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
100 V	70 m Ω @ 10 V	9.5 A
-100 V	186 m Ω @ 10 V	-5 A

Dual-Channel MOSFET



MARKING DIAGRAM



&Y = ON Semiconductor Logo
 &Z = Assembly Plant Code
 &2 = Numeric Date Code
 &K = Lot Code
 70NP10M5L = Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 10 of this data sheet.

NTTBC070NP10M5L

THERMAL CHARACTERISTICS

Symbol	Parameter	Q1	Q2	Unit
$R_{\theta JC}$	Junction-to-Case – Steady State (Note 3)	8.9	12.5	°C/W
$R_{\theta JA}$	Junction-to-Ambient – Steady State (Note 3)	65	65	

3. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

ELECTRICAL CHARACTERISTICS (Q1, N-CHANNEL) ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	100			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS} / T_J$	$I_D = 250\ \mu\text{A}, \text{ref to } 25^\circ\text{C}$		70		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 100\text{ V}$	$T_J = 25^\circ\text{C}$		1	μA
			$T_J = 125^\circ\text{C}$		100	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	nA

ON CHARACTERISTICS

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 24\ \mu\text{A}$	1.0		3.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)} / T_J$	$I_D = 24\ \mu\text{A}, \text{ref to } 25^\circ\text{C}$		7.1		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 1.3\text{ A}$		47	70	m Ω
		$V_{GS} = 4.5\text{ V}, I_D = 1.0\text{ A}$		67	102	
Forward Transconductance	g_{FS}	$V_{DS} = 5\text{ V}, I_D = 4\text{ A}$		6.2		S
Gate-Resistance	R_G	$T_A = 25^\circ\text{C}$		0.74		Ω

CHARGES & CAPACITANCES

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 50\text{ V}$		252		pF
Output Capacitance	C_{OSS}			64		
Reverse Transfer Capacitance	C_{RSS}			3		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 50\text{ V}, I_D = 1.3\text{ A}$		3		nC
Threshold Gate Charge	$Q_{G(TH)}$			0.6		
Gate-to-Source Charge	Q_{GS}			1.0		
Gate-to-Drain Charge	Q_{GD}			1.1		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DD} = 50\text{ V}, I_D = 1.3\text{ A}$		5.6		V
Plateau Voltage	V_{GP}			2.6		

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DS} = 50\text{ V}, I_D = 1.3\text{ A}, R_G = 6\ \Omega$		5.3		ns
Rise Time	t_r			2.5		
Turn-Off Delay Time	$t_{d(OFF)}$			12.4		
Fall Time	t_f			7.5		
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 50\text{ V}, I_D = 1.3\text{ A}, R_G = 6\ \Omega$		7.6		ns
Rise Time	t_r			7.6		
Turn-Off Delay Time	$t_{d(OFF)}$			10.4		
Fall Time	t_f			9		

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ELECTRICAL CHARACTERISTICS (Q1, N-CHANNEL) ($T_J = 25^\circ\text{C}$ unless otherwise noted) (continued)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Forward Diode Voltage	V_{SD}	$V_{GS} = 0\text{ V}, I_S = 1.3\text{ A}$	$T_J = 25^\circ\text{C}$	0.75	1.2	V
			$T_J = 125^\circ\text{C}$	0.6		
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, dI_S/dt = 50\text{ A}/\mu\text{s}, I_S = 1.2\text{ A}$		28		ns
Charge Time	t_a			13		
Discharge Time	t_b			15		
Reverse Recovery Charge	Q_{RR}			8		

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.

ELECTRICAL CHARACTERISTICS (Q2, P-CHANNEL) ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-100			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS} / T_J$	$I_D = -250\ \mu\text{A}, \text{ref to } 25^\circ\text{C}$		60		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = -100\text{ V}$	$T_J = 25^\circ\text{C}$		-1	μA
			$T_J = 125^\circ\text{C}$		-100	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	nA

ON CHARACTERISTICS

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = -40\ \mu\text{A}$	-2.0		-4.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)} / T_J$	$I_D = -40\ \mu\text{A}, \text{ref to } 25^\circ\text{C}$		6.6		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -2.2\text{ A}$		146	186	m Ω
		$V_{GS} = -6\text{ V}, I_D = -1.4\text{ A}$		178	284	
Forward Transconductance	g_{FS}	$V_{DS} = 5\text{ V}, I_D = -4\text{ A}$		5.9		S
Gate-Resistance	R_G	$T_A = 25^\circ\text{C}$		1.75		Ω

CHARGES & CAPACITANCES

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = -50\text{ V}$		256		pF
Output Capacitance	C_{OSS}			63		
Reverse Transfer Capacitance	C_{RSS}			3		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -10\text{ V}, V_{DS} = -50\text{ V}, I_D = -2.2\text{ A}$		7.3		nC
Threshold Gate Charge	$Q_{G(TH)}$			1.5		
Gate-to-Source Charge	Q_{GS}			2.4		
Gate-to-Drain Charge	Q_{GD}			1.2		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -6\text{ V}, V_{DD} = -50\text{ V}, I_D = -2.2\text{ A}$		4.6		nC
Plateau Voltage	V_{GP}			4.5		V

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -10\text{ V}, V_{DS} = -50\text{ V}, I_D = -2.2\text{ A}, R_G = 6\ \Omega$		8.9		ns
Rise Time	t_r			3.6		
Turn-Off Delay Time	$t_{d(OFF)}$			13.2		
Fall Time	t_f			3.4		

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ELECTRICAL CHARACTERISTICS (Q2, P-CHANNEL) ($T_J = 25^\circ\text{C}$ unless otherwise noted) (continued)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -6\text{ V}, V_{DS} = -50\text{ V}, I_D = -2.2\text{ A},$ $R_G = 6\ \Omega$		10.8		ns
Rise Time	t_r			4.8		
Turn-Off Delay Time	$t_{d(OFF)}$			10		
Fall Time	t_f			4.1		

OFF CHARACTERISTICS

Forward Diode Voltage	V_{SD}	$V_{GS} = 0\text{ V},$ $I_S = -2.2\text{ A}$	$T_J = 25^\circ\text{C}$		-0.86	-1.2	V
			$T_J = 125^\circ\text{C}$		-0.72		
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s},$ $I_S = -1.1\text{ A}$			34		ns
Charge Time	t_a				27		
Discharge Time	t_b				7		
Reverse Recovery Charge	Q_{RR}				53		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.

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TYPICAL CHARACTERISTICS – N-CHANNEL

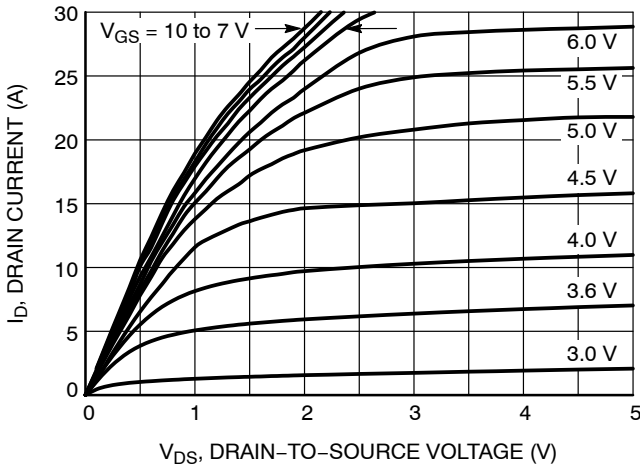


Figure 1. On-Region Characteristics

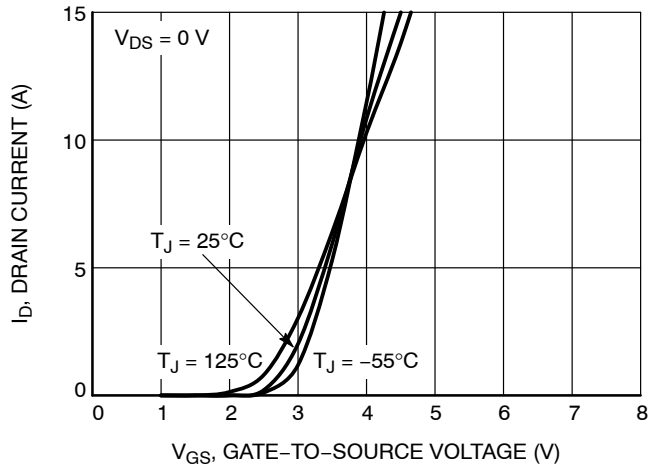


Figure 2. Transfer Characteristics

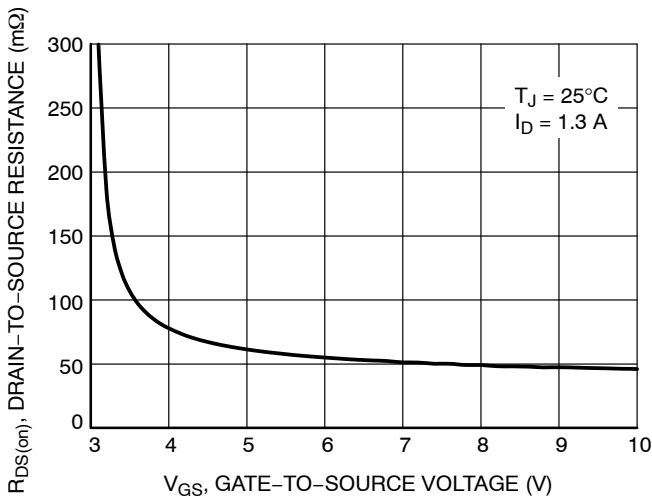


Figure 3. On-Resistance vs. Gate-to-Source Voltage

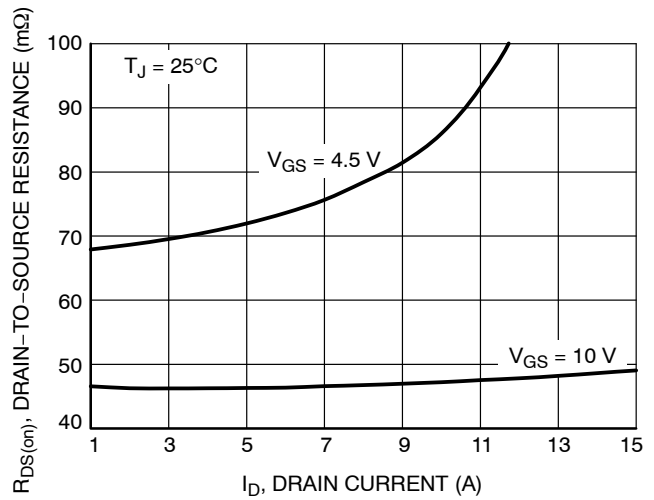


Figure 4. On-Resistance vs. Drain Current

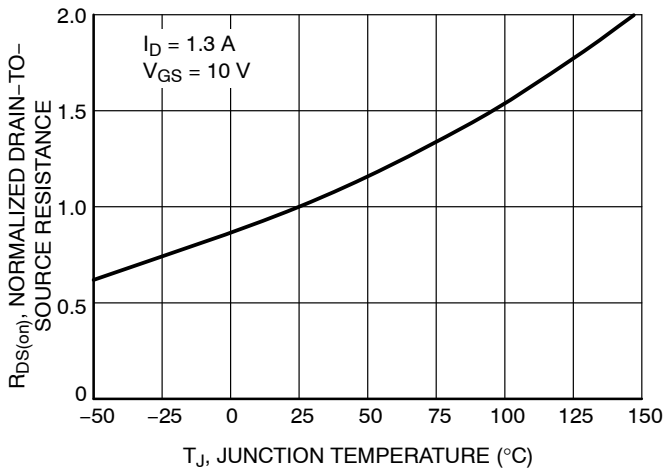


Figure 5. On-Resistance Variation with Temperature

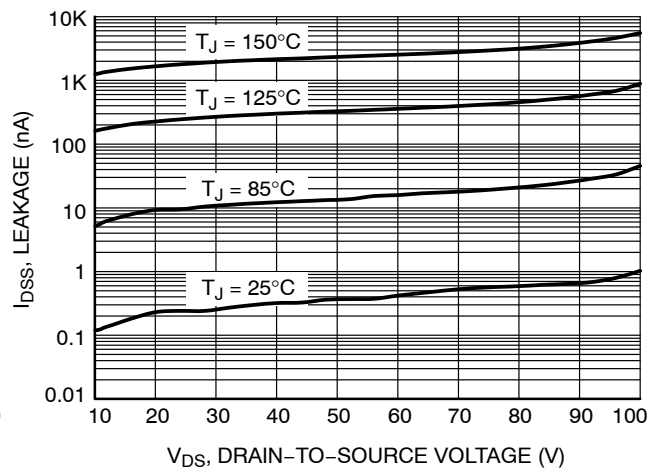


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS – N-CHANNEL

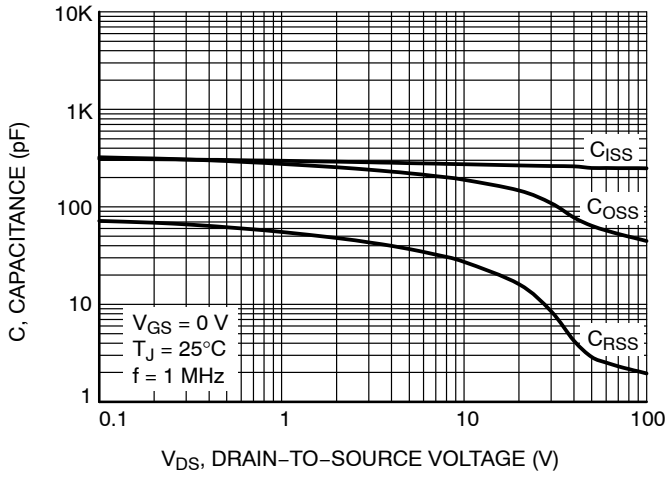


Figure 7. Capacitance Variation

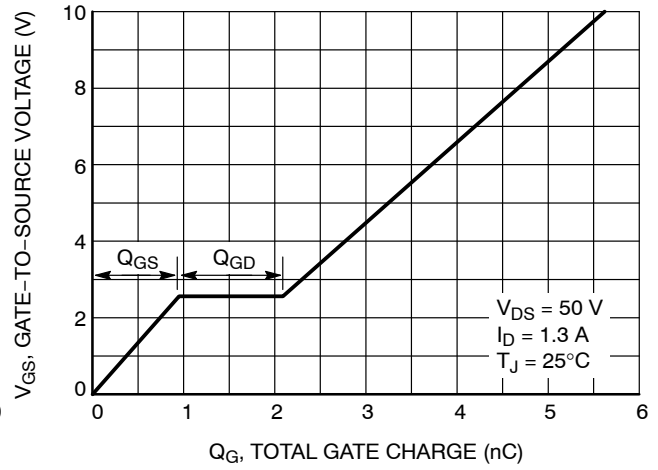


Figure 8. Gate-to-Source Voltage vs. Total Charge

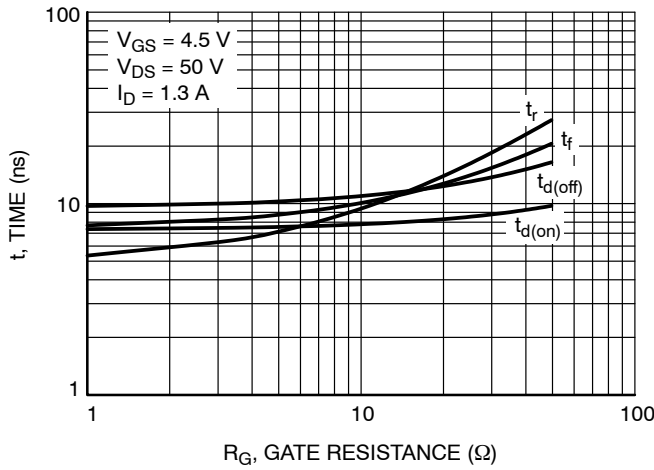


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

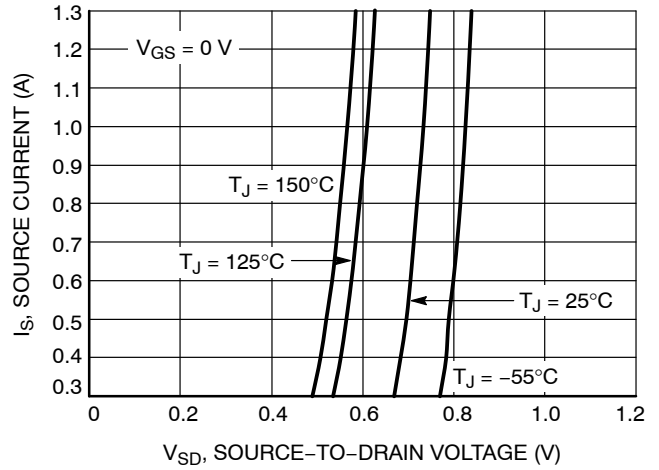


Figure 10. Diode Forward Voltage vs. Current

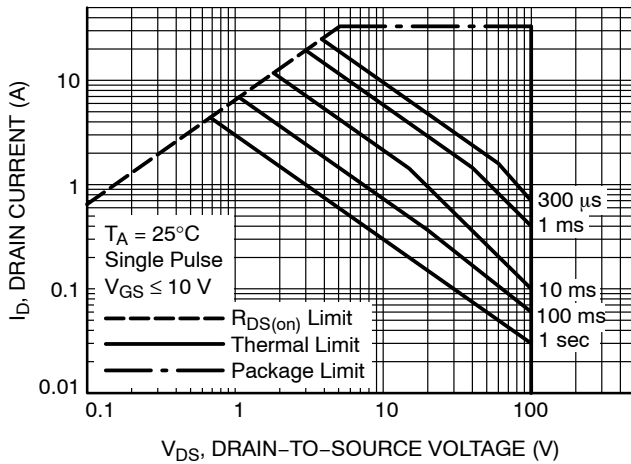


Figure 11. Safe Operating Area

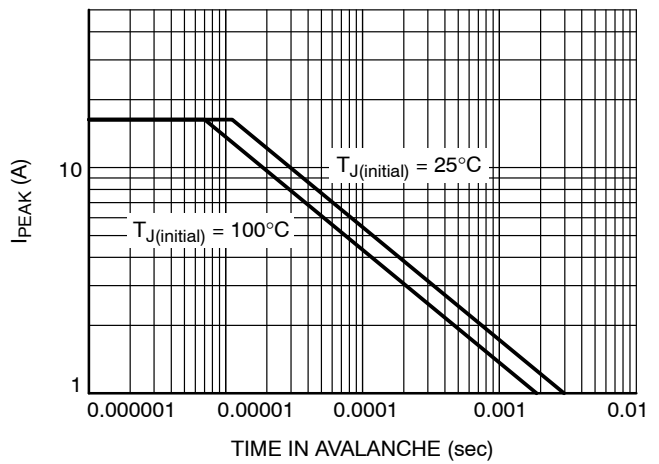


Figure 12. I_{PEAK} vs. Time in Avalanche

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TYPICAL CHARACTERISTICS – N-CHANNEL

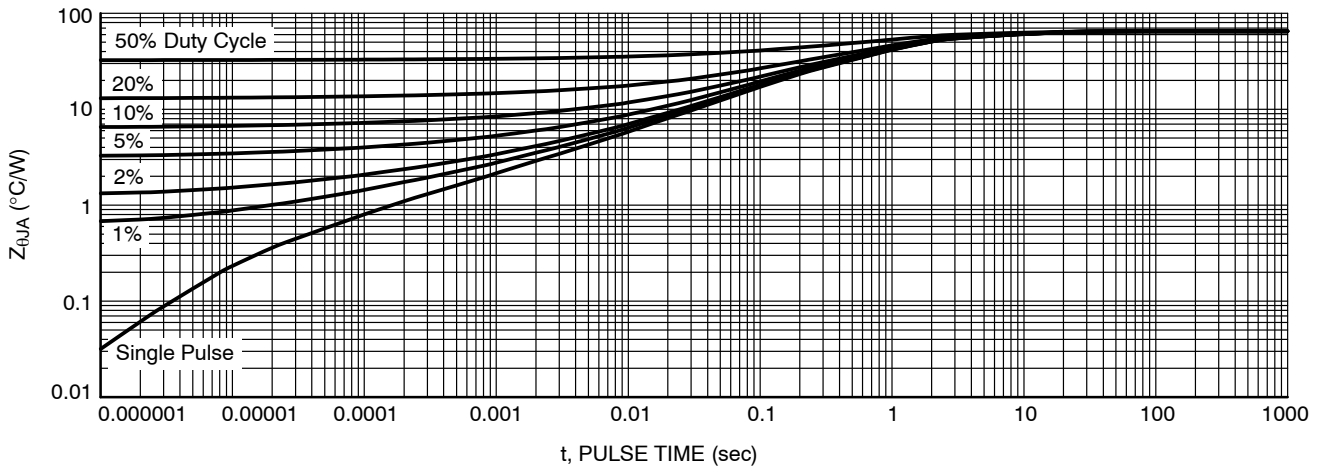


Figure 13. Junction-to-Ambient Transient Thermal Response

TYPICAL CHARACTERISTICS – P-CHANNEL

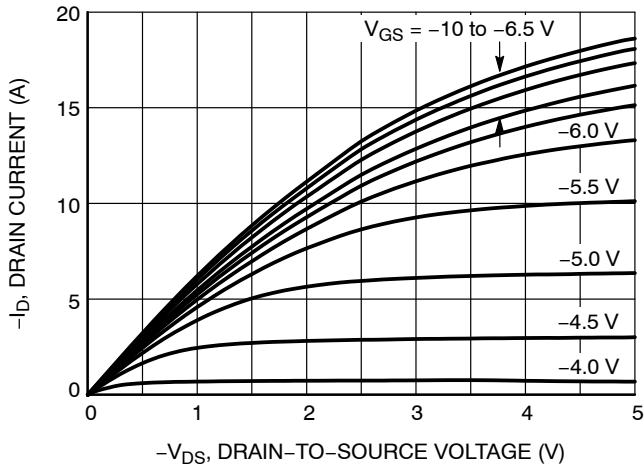


Figure 14. On-Region Characteristics

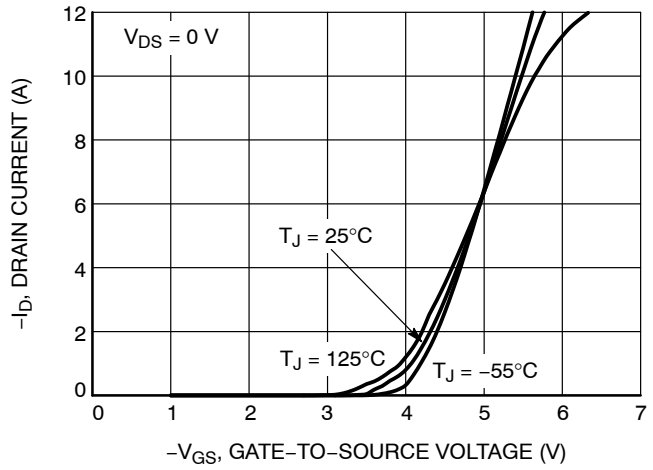


Figure 15. Transfer Characteristics

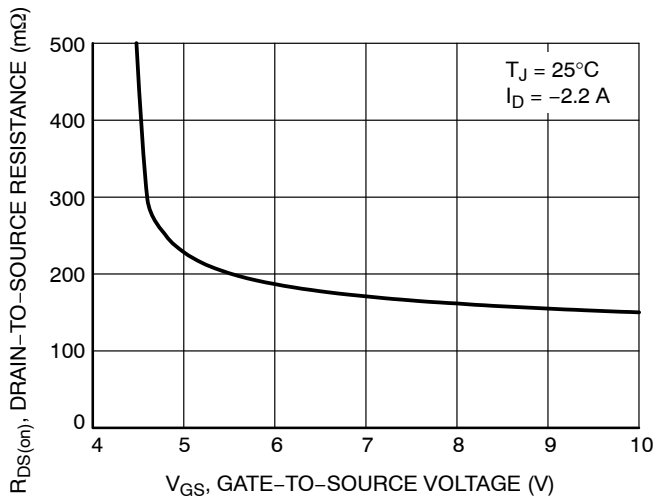


Figure 16. On-Resistance vs. Gate-to-Source Voltage

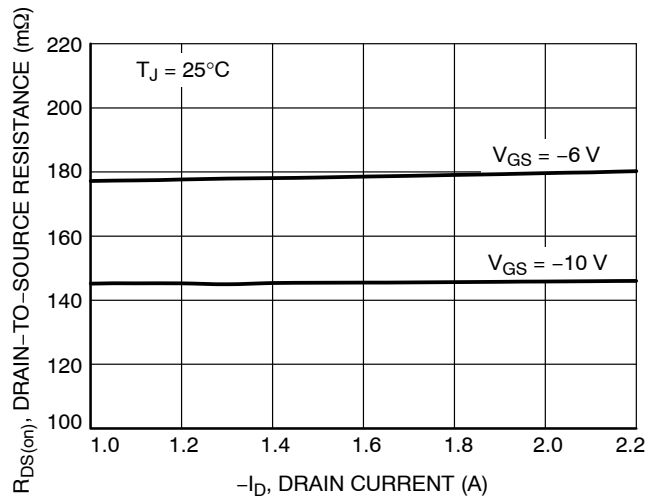


Figure 17. On-Resistance vs. Drain Current

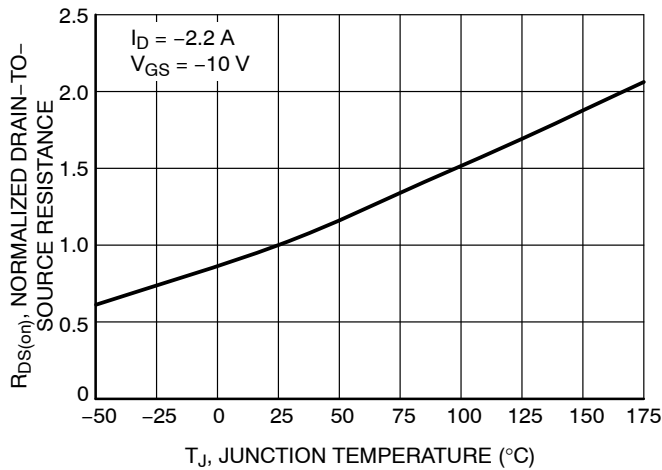


Figure 18. On-Resistance Variation with Temperature

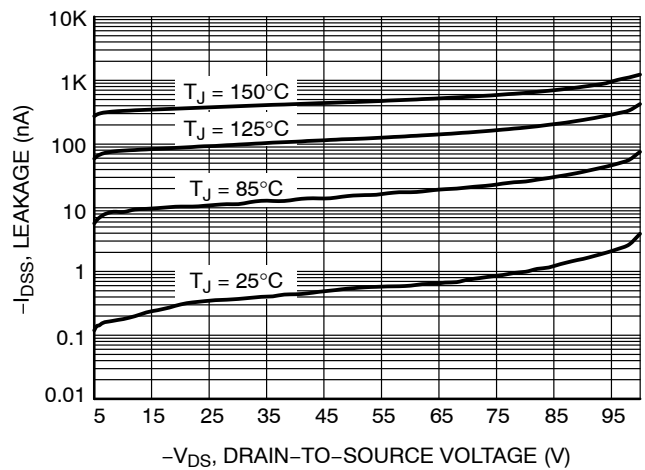


Figure 19. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS – P-CHANNEL

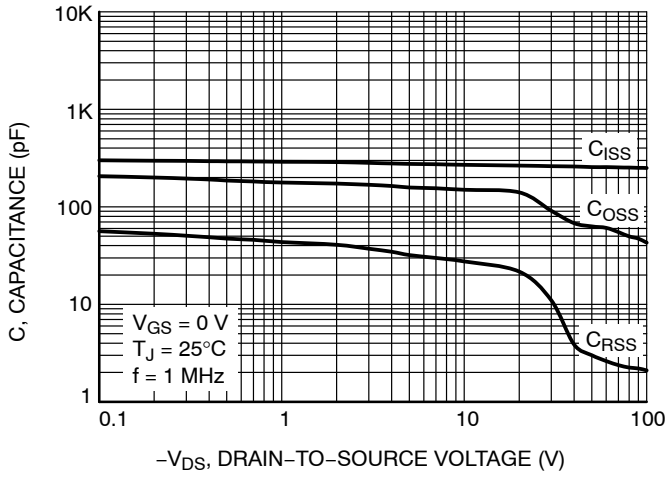


Figure 20. Capacitance Variation

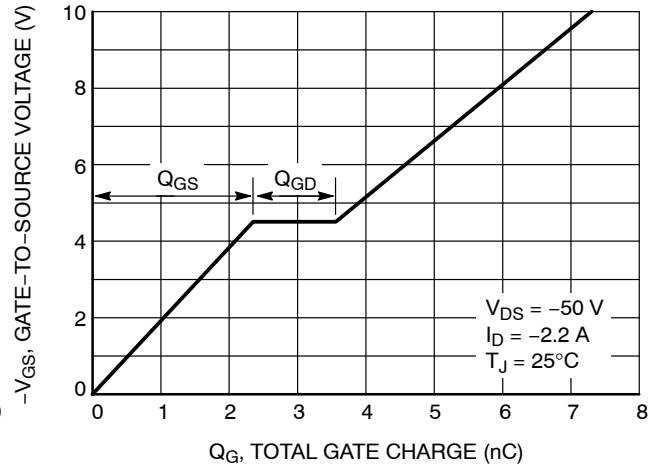


Figure 21. Gate-to-Source Voltage vs. Total Charge

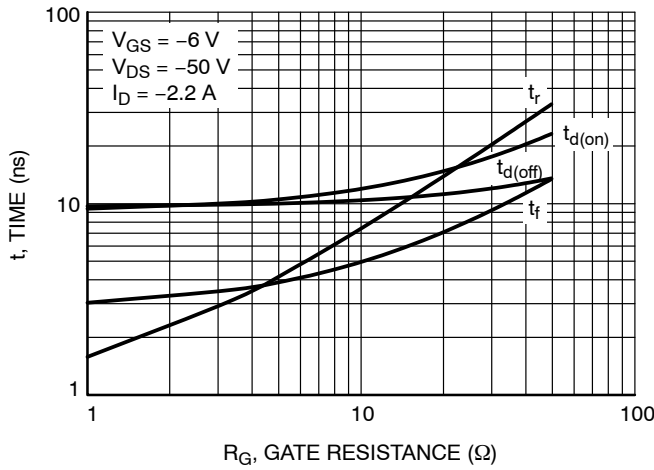


Figure 22. Resistive Switching Time Variation vs. Gate Resistance

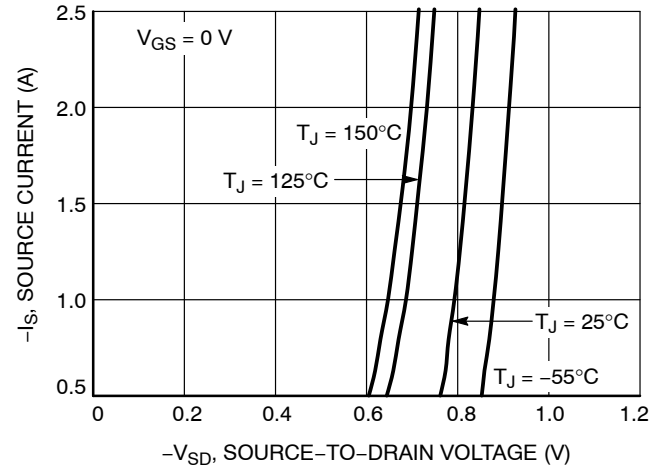


Figure 23. Diode Forward Voltage vs. Current

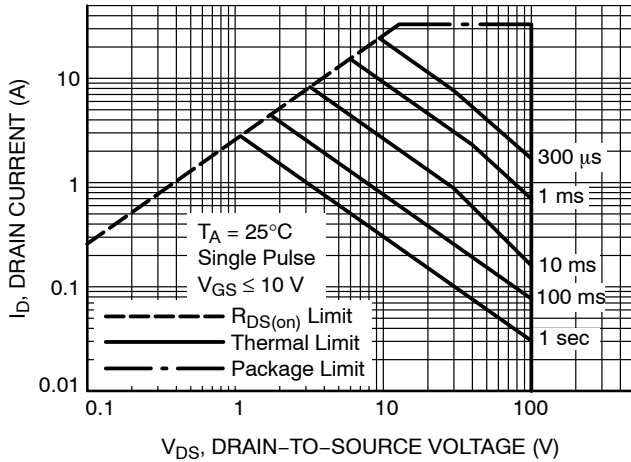


Figure 24. Safe Operating Area

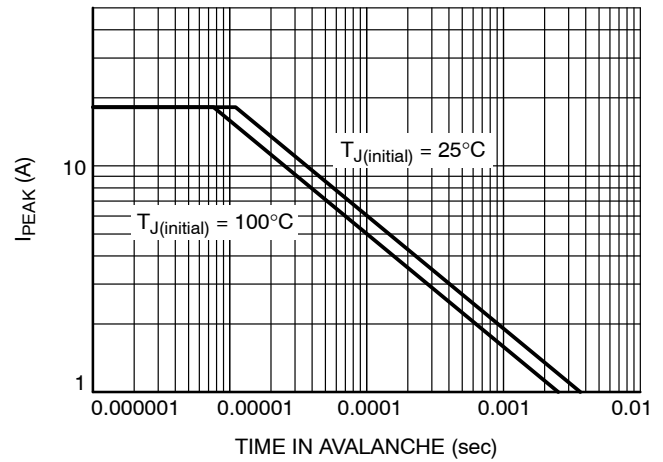


Figure 25. IPEAK vs. Time in Avalanche

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TYPICAL CHARACTERISTICS – P-CHANNEL

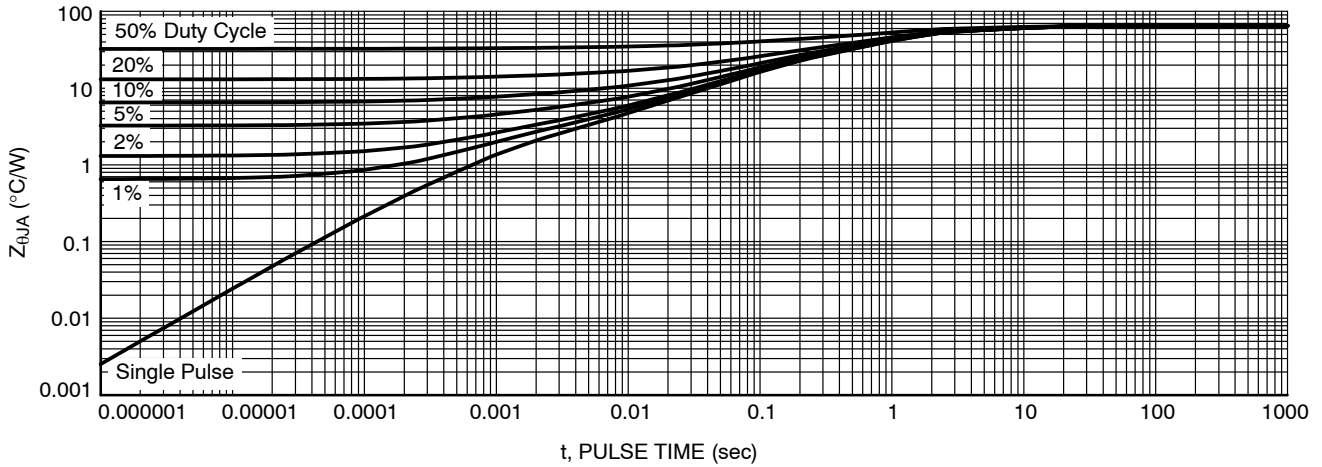


Figure 26. Junction-to-Ambient Transient Thermal Response

ORDERING INFORMATION

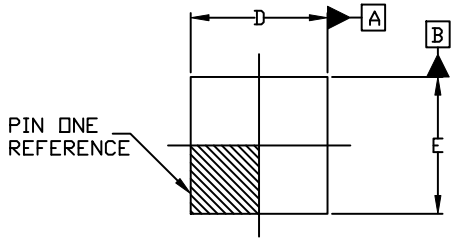
Device	Device Marking	Package	Shipping (Qty / Packing) [†]
NTTBC070NP10M5L	70NP10M5L	μ 8FL (Pb-Free/Halogen Free)	3000 / Tape & Reel

[†]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.

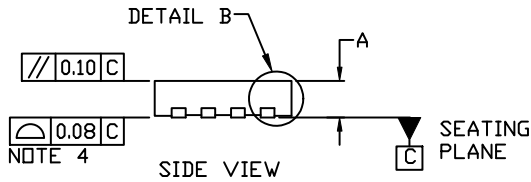
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PACKAGE DIMENSIONS

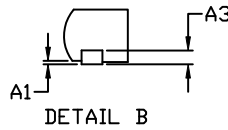
WDFN8 3x3, 0.65P
CASE 511DG
ISSUE A



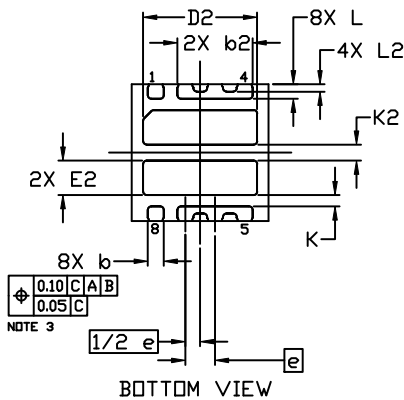
TOP VIEW



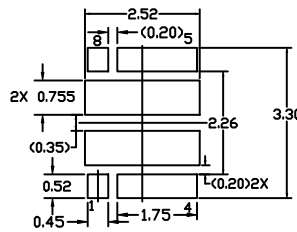
SIDE VIEW



DETAIL B



BOTTOM VIEW



RECOMMENDED MOUNTING FOOTPRINT*

* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/B.

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION *b* APPLIES TO PLATED TERMINALS AND IS MEASURED BETWEEN 0.15 AND 0.30MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.70	0.75	0.80
A1	0.00	---	0.05
A3	0.20 REF		
<i>b</i>	0.30	0.35	0.40
<i>b</i> 2	1.65 REF		
D	2.90	3.00	3.10
D2	2.45	2.50	2.55
E	2.90	3.00	3.10
E2	1.40	1.50	1.60
<i>e</i>	0.65 BSC		
K	0.25	---	---
K2	0.35 REF		
L	0.27	0.32	0.37
L2	0.163 REF		

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