

# MOSFET – Power, Single N-Channel

## 60 V, 1.49 mΩ, 198 A

### NTMJST1D4N06CL

#### Features

- Optimized Top Cool Package to Dissipate Heat from Top
- Small Footprint (5x7 mm) for Compact Designs
- Ultra Low  $R_{DS(on)}$  to Improve System Efficiency
- These Devices are Pb-Free and are RoHS Compliant

#### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			$V_{DSS}$	60	V
Gate-to-Source Voltage			$V_{GS}$	$\pm 20$	V
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)	Steady State	$T_C = 25^\circ\text{C}$	$I_D$	198	A
		$T_C = 100^\circ\text{C}$		140	
Power Dissipation $R_{\theta JC}$ (Note 1)	Steady State	$T_C = 25^\circ\text{C}$	$P_D$	116	W
		$T_C = 100^\circ\text{C}$		58	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	42	A
		$T_A = 100^\circ\text{C}$		30	
Power Dissipation $R_{\theta JA}$ (Notes 1, 2)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$	5.3	W
		$T_A = 100^\circ\text{C}$		2.6	
Pulsed Drain Current	$T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$		$I_{DM}$	900	A
Operating Junction and Storage Temperature Range			$T_J, T_{stg}$	-55 to +175	$^\circ\text{C}$
Source Current (Body Diode)			$I_S$	96	A
Single Pulse Drain-to-Source Avalanche Energy ( $I_{L(pk)} = 16.7 \text{ A}$ )			$E_{AS}$	596	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			$T_L$	260	$^\circ\text{C}$

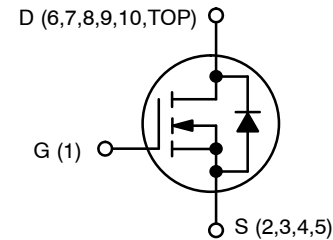
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

#### THERMAL RESISTANCE MAXIMUM RATINGS

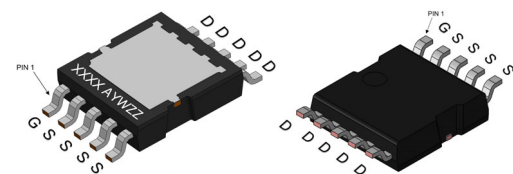
Parameter	Symbol	Value	Unit
Junction-to-Case – Steady State	$R_{\theta JC}$	0.3	$^\circ\text{C}/\text{W}$
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	28.5	
Junction-to-Heatsink Top – Steady State (Note 2)	$R_{\psi JH}$	1.3	
Junction-to-Drain Lead	$R_{\psi JL}$	4.7	
Junction-to-Source Lead	$R_{\psi JL}$	5.1	

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. 2s2p JEDEC51-7 standard PCB mounted to a 25x25x3 (mm) aluminum heatsink with a 12 w/mK TIM interface.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
60 V	1.49 mΩ @ 10 V	198 A

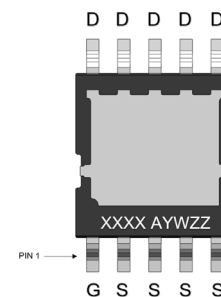


N-CHANNEL MOSFET



TCPAK57  
CASE 760AG

#### MARKING DIAGRAM



XXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
W = Work Week  
ZZ = Assembly Lot Code

#### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 5 of this data sheet.

# NTMJST1D4N06CL

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	60			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> /T <sub>J</sub>			27.9		mV/°C
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 60 V	T <sub>J</sub> = 25 °C		10	μA
			T <sub>J</sub> = 125°C		250	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±16 V			±100	nA

## ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	1.2		2	V
Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>			-6.11		mV/°C
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 50 A		1.27	1.49	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = 5 V, I <sub>D</sub> = 50 A		217		S

## CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1 MHz, V <sub>DS</sub> = 25 V		6555		pF
Output Capacitance	C <sub>OSS</sub>			3695		
Reverse Transfer Capacitance	C <sub>RSS</sub>			37.5		
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 48 V; I <sub>D</sub> = 50 A		92.2		nC
Threshold Gate Charge	Q <sub>G(TH)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 48 V; I <sub>D</sub> = 50 A		9.5		
Gate-to-Source Charge	Q <sub>GS</sub>			16.2		
Gate-to-Drain Charge	Q <sub>GD</sub>			10.5		
Plateau Voltage	V <sub>GP</sub>			2.8		V

## SWITCHING CHARACTERISTICS (Note 5)

Turn-On Delay Time	t <sub>d(ON)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 48 V, I <sub>D</sub> = 50 A, R <sub>G</sub> = 1.0 Ω		16		ns
Rise Time	t <sub>r</sub>			25		
Turn-Off Delay Time	t <sub>d(OFF)</sub>			60		
Fall Time	t <sub>f</sub>			11		

## DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 50 A	T <sub>J</sub> = 25°C		0.8	1.2	V
			T <sub>J</sub> = 125°C		0.66		
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs, I <sub>S</sub> = 50 A		82.1		ns	
Charge Time	t <sub>a</sub>			42.4			
Discharge Time	t <sub>b</sub>			40			
Reverse Recovery Charge	Q <sub>RR</sub>			119			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.

4. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

5. Switching characteristics are independent of operating junction temperatures.

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## TYPICAL CHARACTERISTICS

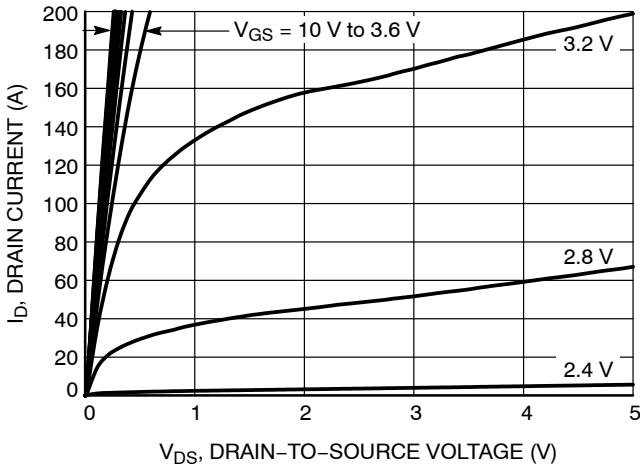


Figure 1. On-Region Characteristics

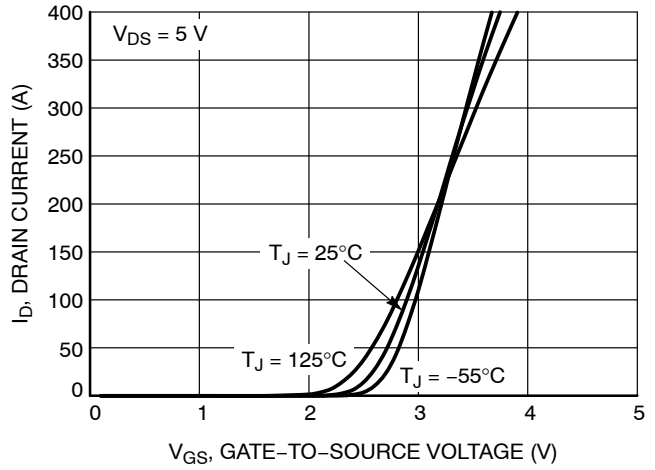


Figure 2. Transfer Characteristics

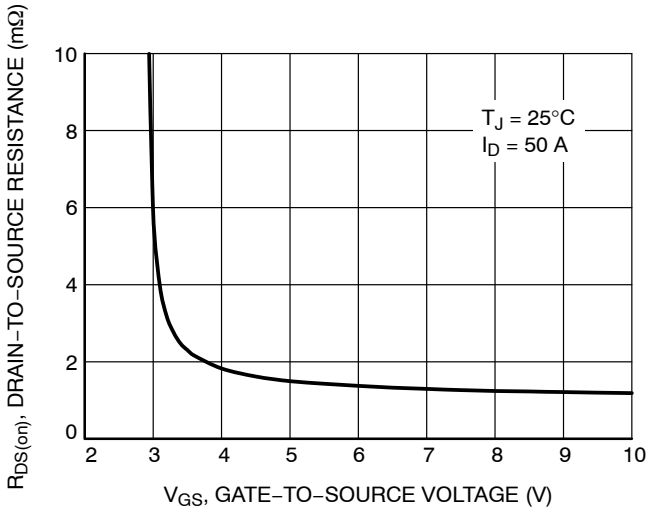


Figure 3. On-Resistance vs. Gate-to-Source Voltage

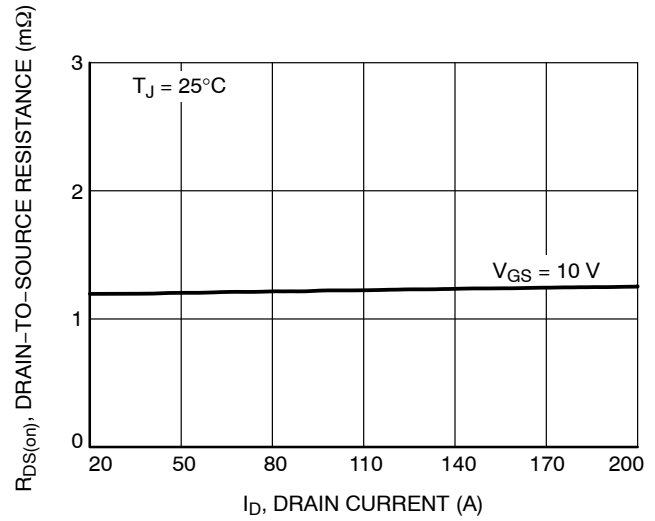


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

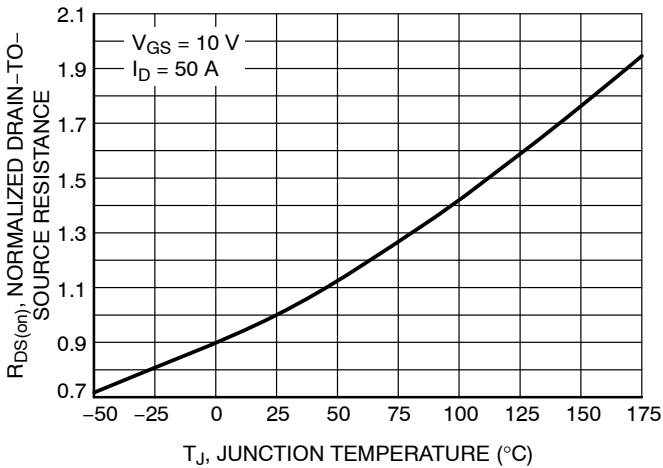


Figure 5. On-Resistance Variation with Temperature

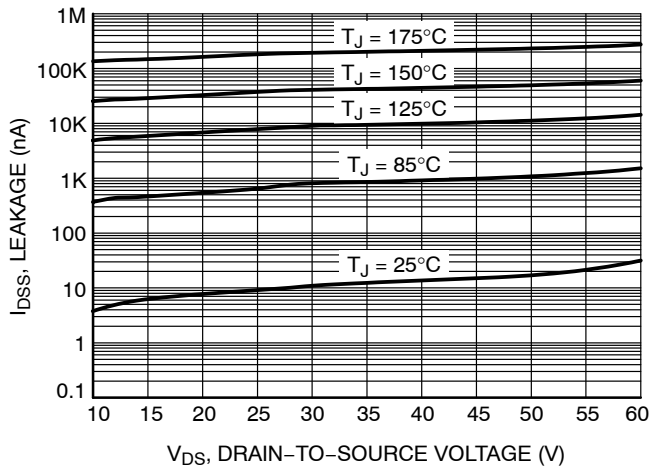


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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## TYPICAL CHARACTERISTICS

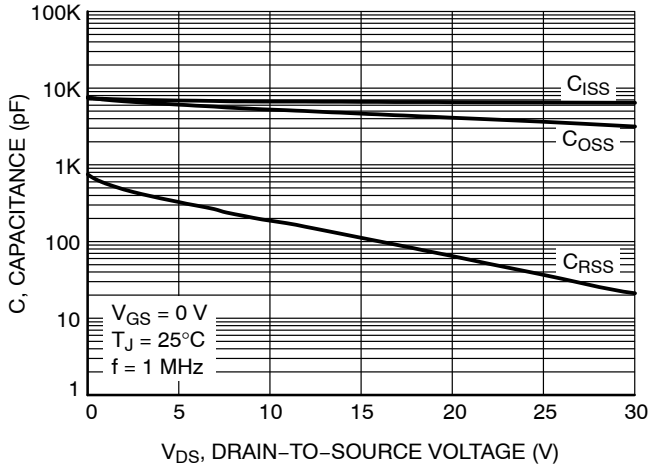


Figure 7. Capacitance Variation

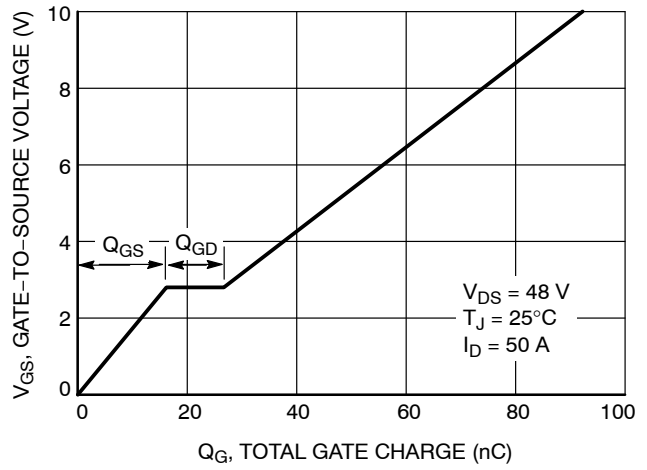


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

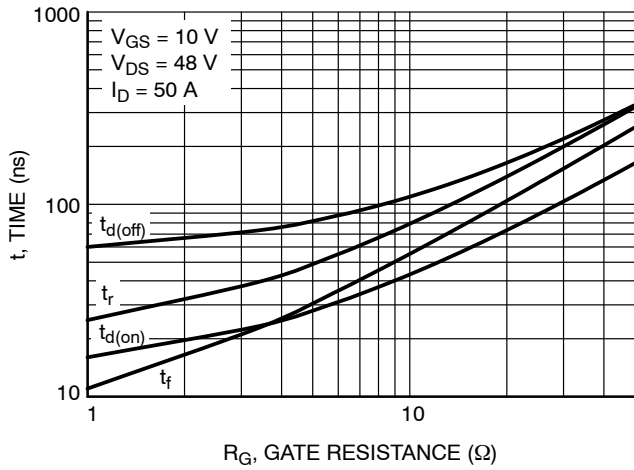


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

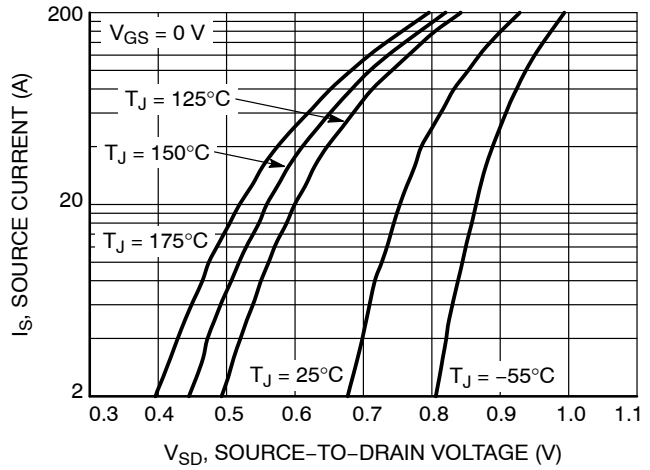


Figure 10. Diode Forward Voltage vs. Current

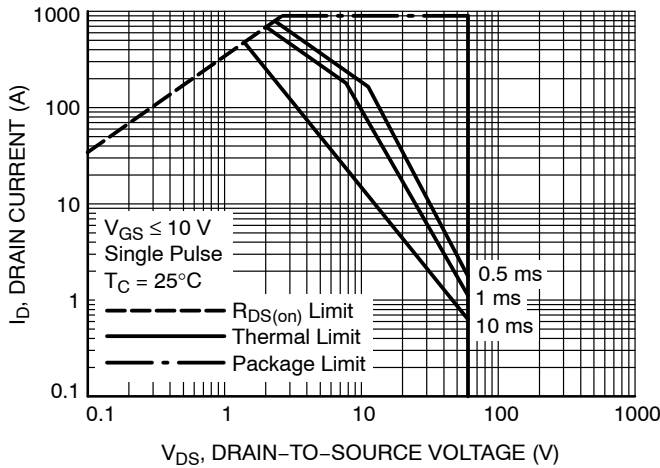


Figure 11. Safe Operating Area

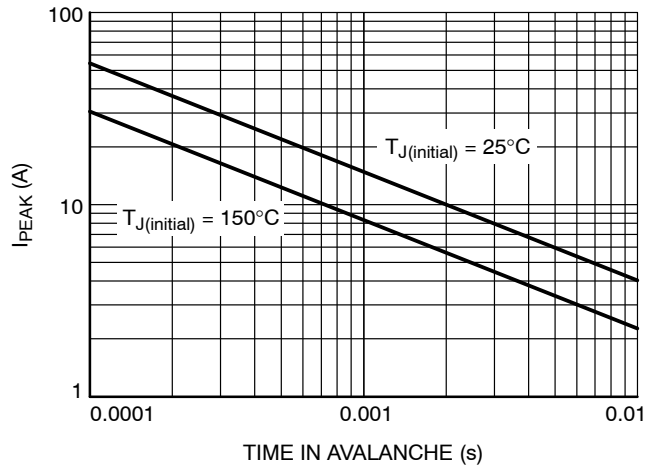
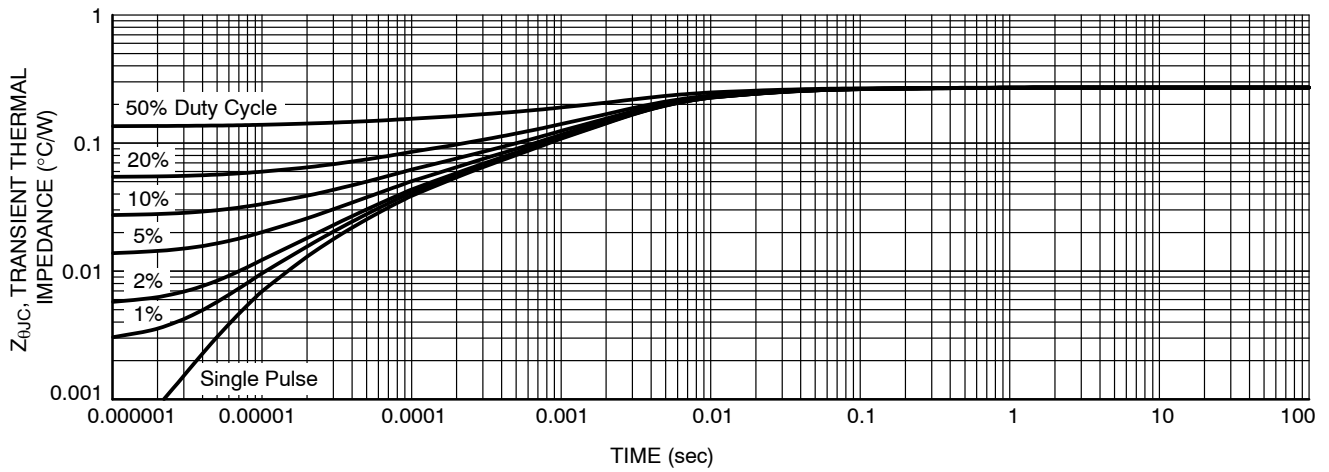


Figure 12.  $I_{PEAK}$  vs. Time in Avalanche

# NTMJST1D4N06CL



**Figure 13. Thermal Characteristics**

## DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping <sup>†</sup>
NTMJST1D4N06CLTXG	1D46L	TCPAK57 (Pb-Free)	3000 / Tape & Reel

<sup>†</sup>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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