

# MOSFET - Power, Single N-Channel

## 40 V, 1.6 mΩ, 185 A

### NVMYS1D6N04CL

#### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low  $Q_G$  and Capacitance to Minimize Driver Losses
- AEC-Q101 Qualified and PPAP Capable
- LFPACK4 Package, Industry Standard
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

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

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage		$V_{DSS}$	40	V
Gate-to-Source Voltage		$V_{GS}$	$\pm 20$	V
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)	Steady State	$I_D$	185	A
			130.7	
Power Dissipation $R_{\theta JC}$ (Note 1)		$P_D$	107.1	W
			53.6	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	Steady State	$I_D$	35	A
			24.8	
Power Dissipation $R_{\theta JA}$ (Notes 1, 2)		$P_D$	3.8	W
			1.9	
Pulsed Drain Current	$T_A = 25^\circ\text{C}$ , $t_p = 10 \mu\text{s}$	$I_{DM}$	1198	A
Operating Junction and Storage Temperature Range		$T_J$ , $T_{stg}$	-55 to +175	°C
Source Current (Body Diode)		$I_S$	89	A
Single Pulse Drain-to-Source Avalanche Energy ( $I_{L(pk)} = 14.5 \text{ A}$ )		$E_{AS}$	873	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	°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	$R_{\theta JC}$	1.4	°C/W
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	36.4	

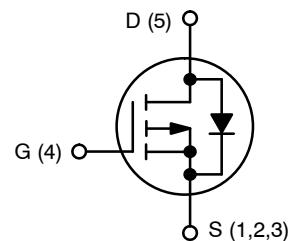
1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface-mounted on FR4 board using a 650 mm<sup>2</sup>, 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.



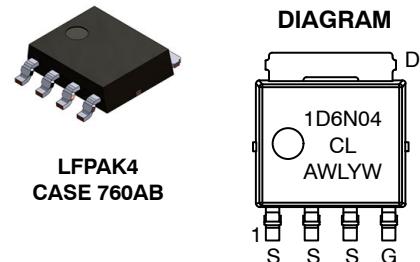
**ON Semiconductor®**

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$V_{(BR)DSS}$	$R_{DS(ON) \text{ MAX}}$	$I_D \text{ MAX}$
40 V	1.6 mΩ @ 10 V	
	2.4 mΩ @ 4.5 V	185 A



N-CHANNEL MOSFET



1D6N04CL = Specific Device Code  
A = Assembly Location  
WL = Wafer Lot  
Y = Year  
W = Work Week

#### ORDERING INFORMATION

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

# NVMYS1D6N04CL

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> /T <sub>J</sub>			20.6		mV/°C
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 40 V	T <sub>J</sub> = 25°C		1	μA
			T <sub>J</sub> = 175°C		200	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 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> = 210 μA	1	1.5	3	V
Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>			-5.0		mV/°C
Drain-to-Source On Resistance	R <sub>DSS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 50 A		1.16	1.6	mΩ
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 25 A		1.7	2.4	

### 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		4301		pF
Output Capacitance	C <sub>OSS</sub>			1749		
Reverse Transfer Capacitance	C <sub>rss</sub>			46		
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 20 V; I <sub>D</sub> = 50 A		71		nC
Threshold Gate Charge	Q <sub>G(TH)</sub>			1.4		
Gate-to-Source Gate Charge	Q <sub>GS</sub>			11		
Gate-to-Drain "Miller" Charge	Q <sub>GD</sub>			13		
Plateau Voltage	V <sub>GP</sub>			2.9		V

### SWITCHING CHARACTERISTICS (Note 5)

Turn-On Delay Time	t <sub>d(ON)</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 50 A, R <sub>G</sub> = 6 Ω		10		ns
Turn-On Rise Time	t <sub>r</sub>			12		
Turn-Off Delay Time	t <sub>d(OFF)</sub>			77		
Turn-Off Fall Time	t <sub>f</sub>			29		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Source-to-Drain Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 25 A		0.78	1.2	V
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		49		ns
Charge Time	t <sub>a</sub>			25		
Discharge Time	t <sub>b</sub>			24		
Reverse Recovery Charge	Q <sub>RR</sub>			159		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.

## TYPICAL CHARACTERISTICS

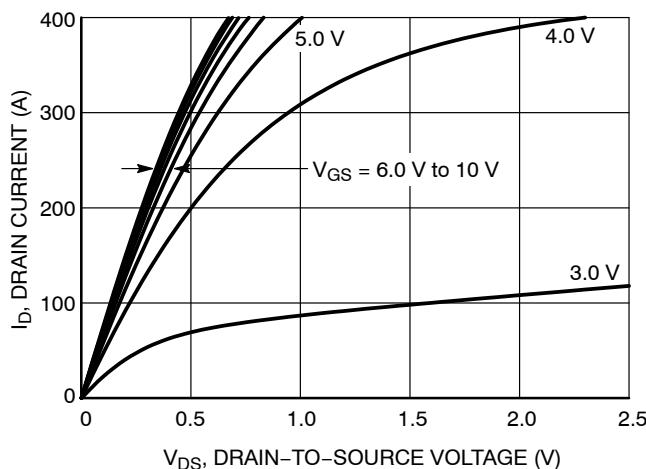


Figure 1. On-Region Characteristics

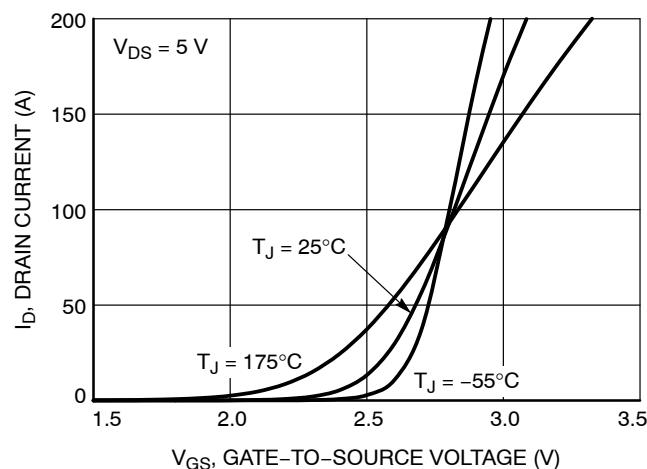


Figure 2. Transfer Characteristics

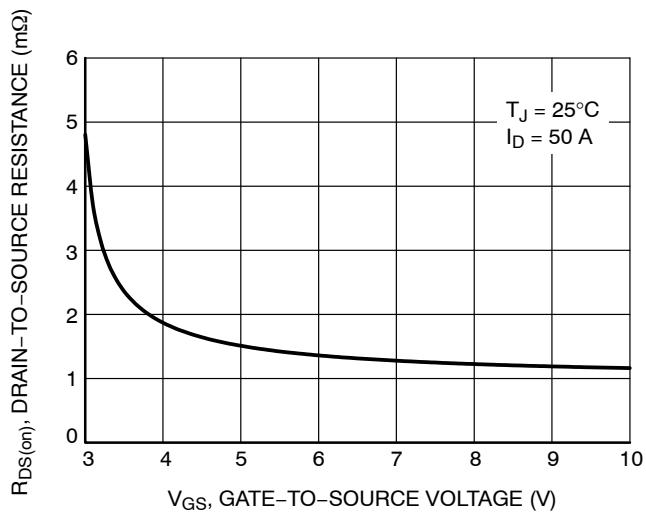


Figure 3. On-Resistance vs. Gate-to-Source Voltage

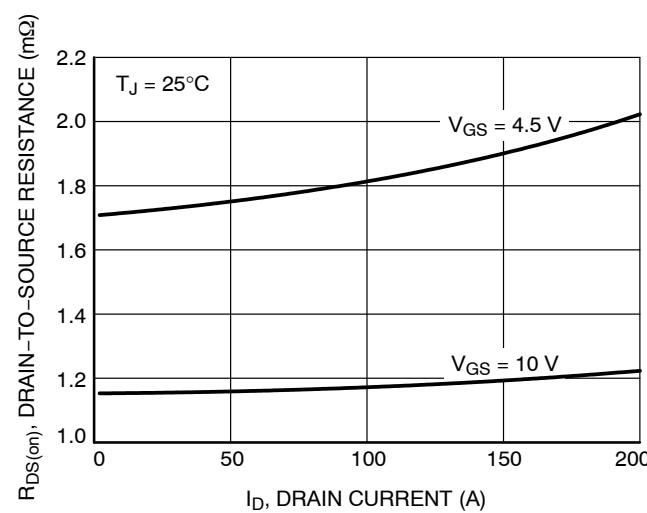


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

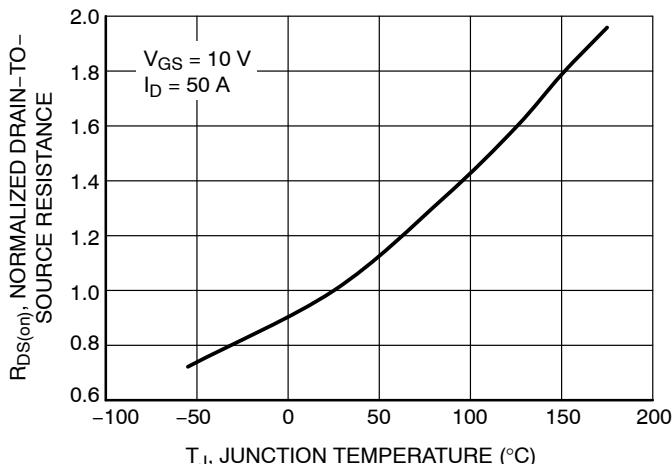


Figure 5. On-Resistance Variation with Temperature

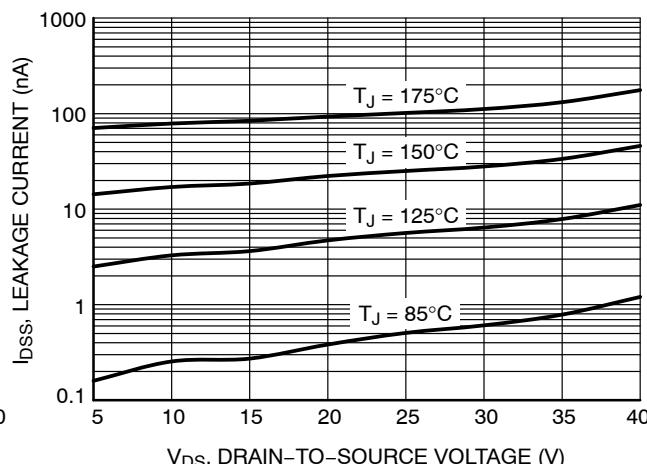
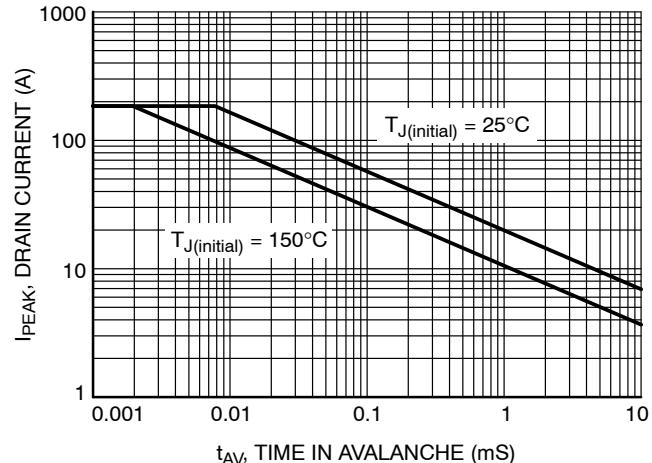
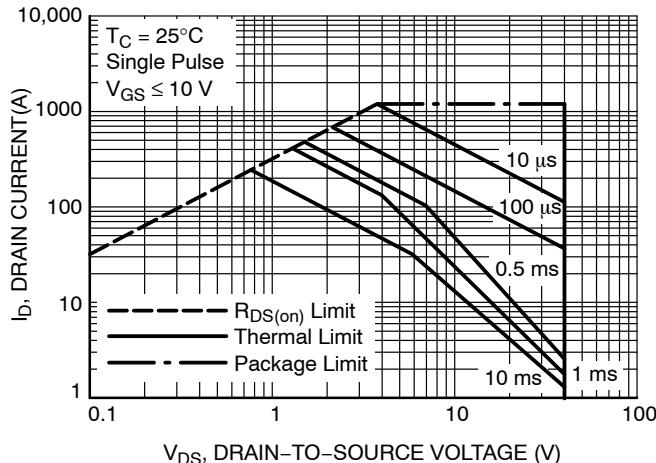
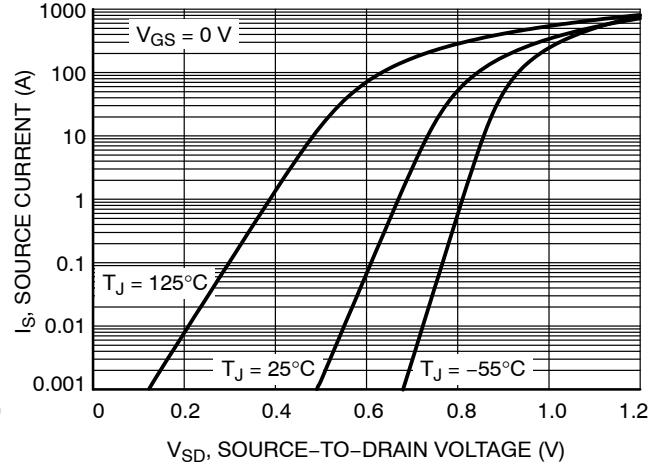
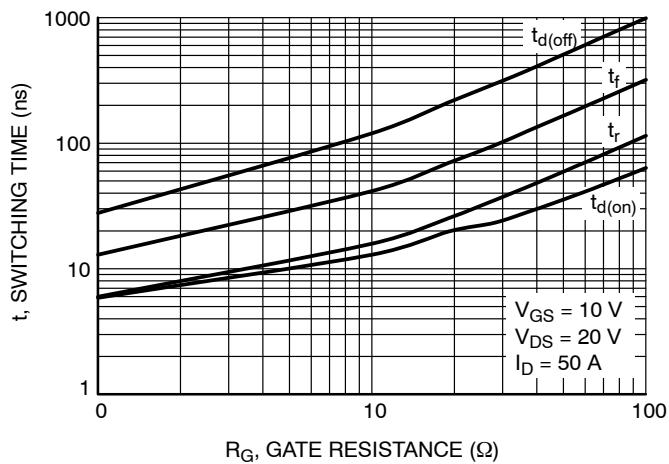
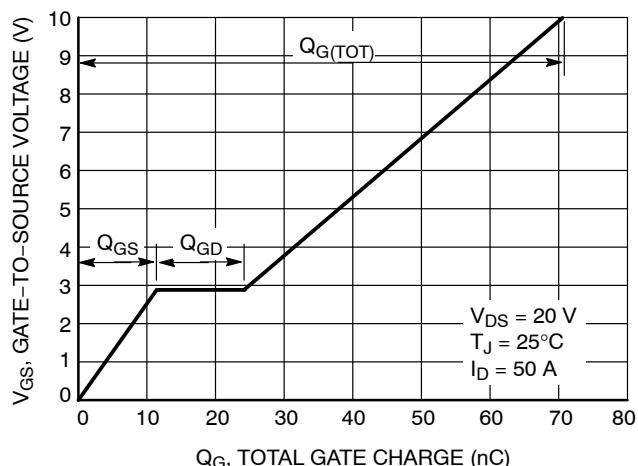
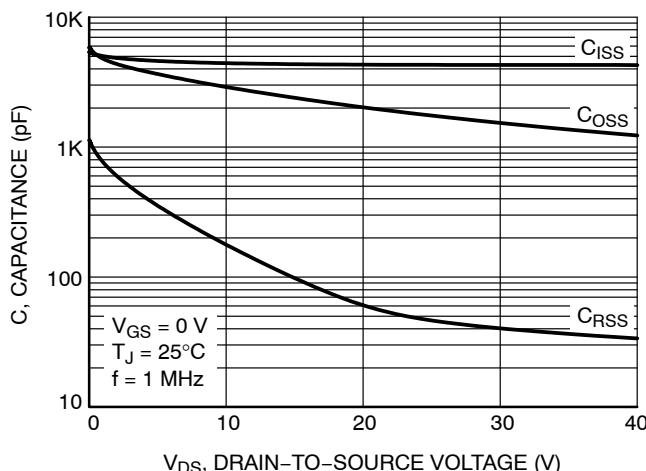
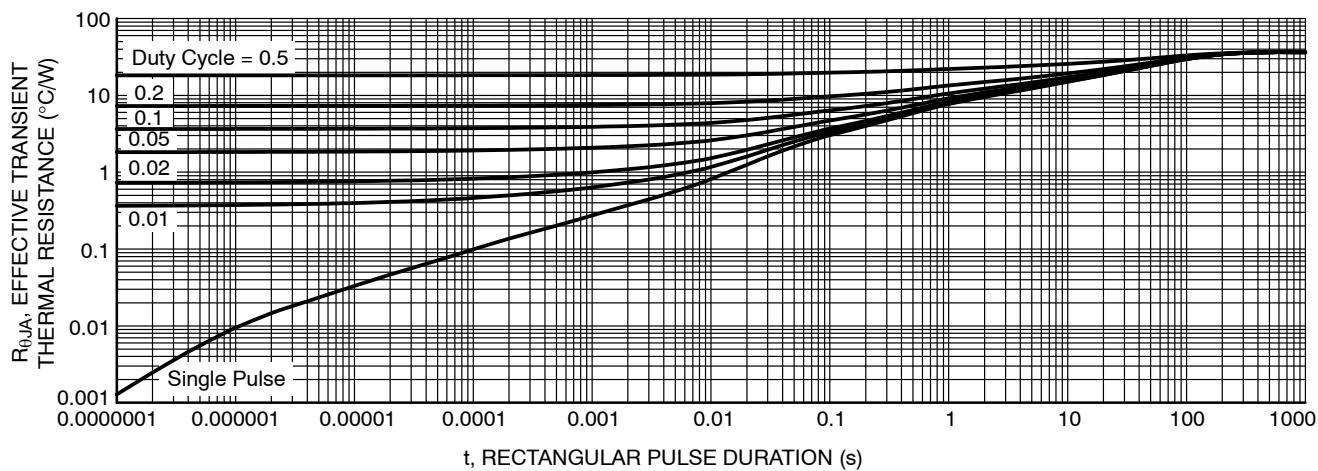


Figure 6. Drain-to-Source Leakage Current vs. Voltage

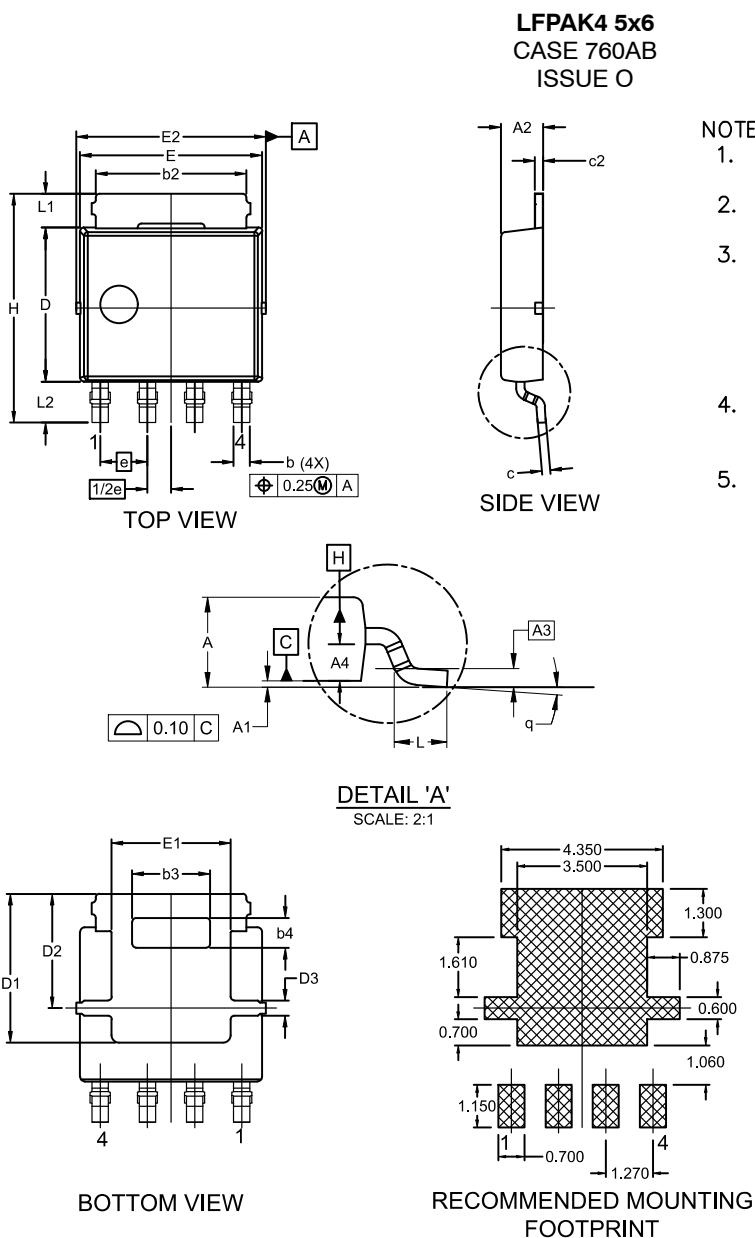
**TYPICAL CHARACTERISTICS**


**TYPICAL CHARACTERISTICS****Figure 13. Thermal Response****DEVICE ORDERING INFORMATION**

Device	Marking	Package	Shipping <sup>†</sup>
NVMYS1D6N04CLT1G	1D6N04CL	LFPAK4 (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.

## PACKAGE DIMENSIONS



## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.150mm PER SIDE.
4. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.

UNIT IN MILLIMETER			
DIM	MIN	NOM	MAX
A	1.10	1.20	1.30
A1	0.00	0.08	0.15
A2	1.10	1.15	1.20
A3	0.25		
A4	0.45	0.50	0.55
b	0.40	0.45	0.50
b2	3.80	4.10	4.40
b3	2.00	2.10	2.20
b4	0.70	0.80	0.90
c	0.19	0.22	0.25
c2	0.19	0.22	0.25
D	4.05	4.15	4.25
D1	-	-	4.20
D2	3.0	3.10	3.20
D3	0.30	0.40	0.50
E	4.80	4.90	5.00
E1	3.10	3.20	3.30
E2	5.00	5.15	5.30
e	1.27	BSC	
H	6.00	6.15	6.30
L	0.40	0.65	0.85
L1	0.80	0.90	1.00
L2	0.80	1.05	1.30
q	0°	4°	8°

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