

## Product Summary

BV <sub>DSS</sub>	R <sub>DS(ON)</sub> max	I <sub>D</sub> max T <sub>C</sub> = +25°C
60V	23mΩ @ V <sub>GS</sub> = 10V	50A
	28mΩ @ V <sub>GS</sub> = 4.5V	45A

## Description and Applications

This MOSFET is designed to meet the stringent requirements of Automotive applications. It is qualified to AEC-Q101, supported up by a PPAP and is ideal for use in:

- Power Management
- Driving Solenoids
- Motor Control

## Features

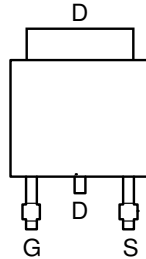
- Rated to +175°C – Ideal for High Ambient Temperature Environments
- 100% Unclamped Inductive Switch (UIS) Test in Production
- Low On-Resistance
- Fast Switching Speed
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. “Green” Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Capable (Note 4)**

## Mechanical Data

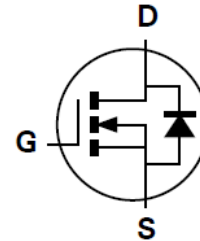
- Case: TO252 (DPAK)
- Case Material: Molded Plastic, “Green” Molding Compound.
- UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 ③
- Terminal Connections: See Diagram
- Weight: 0.33 grams (Approximate)



Top View



Pin Out Top View



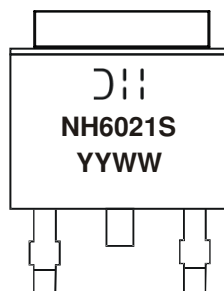
Equivalent Circuit

## Ordering Information (Notes 4 & 5)

Part Number	Case	Packaging
DMNH6021SK3Q-13	TO252 (DPAK)	2,500/Tape & Reel

- Notes:
1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
  2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  4. Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to [http://www.diodes.com/product\\_compliance\\_definitions.html](http://www.diodes.com/product_compliance_definitions.html).
  5. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



⌋|| = Manufacturer's Marking  
 NH6021S = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Last Two Digits of Year (ex: 16 = 2016)  
 WW = Week Code (01 to 53)

**Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit	
Drain-Source Voltage	V <sub>DSS</sub>	60	V	
Gate-Source Voltage	V <sub>GSS</sub>	±20	V	
Continuous Drain Current (Note 8) V <sub>GS</sub> = 10V	I <sub>D</sub>	T <sub>C</sub> = +25°C	50	A
		T <sub>C</sub> = +100°C	35	A
Pulsed Drain Current (10µs pulse, duty cycle = 1%)	I <sub>DM</sub>	80	A	
Maximum Body Diode Forward Current (Note 8)	I <sub>S</sub>	40	A	
Avalanche Current, L = 0.1mH (Note 9)	I <sub>AS</sub>	35	A	
Avalanche Energy, L = 0.1mH (Note 9)	E <sub>AS</sub>	64	mJ	

**Thermal Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Total Power Dissipation (Note 6)	P <sub>D</sub>	2.1	W
Thermal Resistance, Junction to Ambient (Note 6)	R <sub>θJA</sub>	73	°C/W
Total Power Dissipation (Note 7)	P <sub>D</sub>	3.7	W
Thermal Resistance, Junction to Ambient (Note 7)	R <sub>θJA</sub>	40	°C/W
Thermal Resistance, Junction to Case (Note 8)	R <sub>θJC</sub>	1.8	°C/W
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +175	°C

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 10)</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	60	-	-	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250µA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	-	-	1	µA	V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	-	-	±100	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 10)</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	1	-	3	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250µA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	-	13	23	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 12A
		-	18	28		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 12A
		-	0.75	1.2		V <sub>GS</sub> = 0V, I <sub>S</sub> = 20A
Diode Forward Voltage	V <sub>SD</sub>	-	0.75	1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 20A
<b>DYNAMIC CHARACTERISTICS (Note 11)</b>						
Input Capacitance	C <sub>ISS</sub>	-	1143	-	pF	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1MHz
Output Capacitance	C <sub>OSS</sub>	-	168	-	pF	
Reverse Transfer Capacitance	C <sub>RSS</sub>	-	69	-	pF	
Gate Resistance	R <sub>g</sub>	-	2.5	-	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge (V <sub>GS</sub> = 10V)	Q <sub>g</sub>	-	20.1	-	nC	V <sub>DS</sub> = 30V, I <sub>D</sub> = 20A
Total Gate Charge (V <sub>GS</sub> = 4.5V)	Q <sub>g</sub>	-	12.1	-	nC	
Gate-Source Charge	Q <sub>gs</sub>	-	4.3	-	nC	
Gate-Drain Charge	Q <sub>gd</sub>	-	5.5	-	nC	
Turn-On Delay Time	t <sub>D(ON)</sub>	-	4.4	-	ns	
Turn-On Rise Time	t <sub>R</sub>	-	6.0	-	ns	V <sub>DD</sub> = 30V, V <sub>GS</sub> = 10V, R <sub>G</sub> = 4.7Ω, I <sub>D</sub> = 10A
Turn-Off Delay Time	t <sub>D(OFF)</sub>	-	14.2	-	ns	
Turn-Off Fall Time	t <sub>F</sub>	-	5.4	-	ns	
Reverse Recovery Time	t <sub>RR</sub>	-	21.2	-	ns	I <sub>F</sub> = 20A, di/dt = 100A/µs
Reverse Recovery Charge	Q <sub>RR</sub>	-	15.2	-	nC	

- Notes:
- Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.
  - Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate.
  - Thermal resistance from junction to soldering point (on the exposed drain pad).
  - I<sub>AS</sub> and E<sub>AS</sub> rating are based on low frequency and duty cycles to keep T<sub>J</sub> = +25°C.
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.

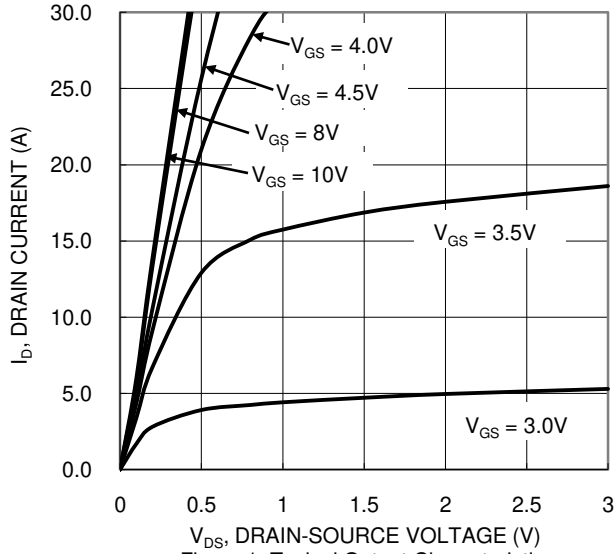


Figure 1. Typical Output Characteristic

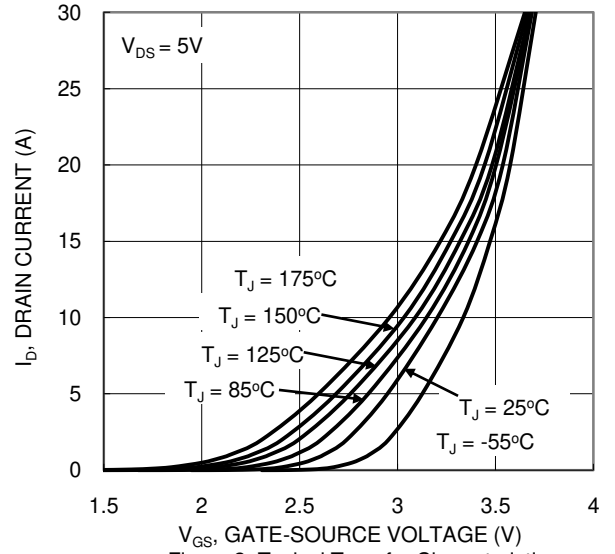


Figure 2. Typical Transfer Characteristic

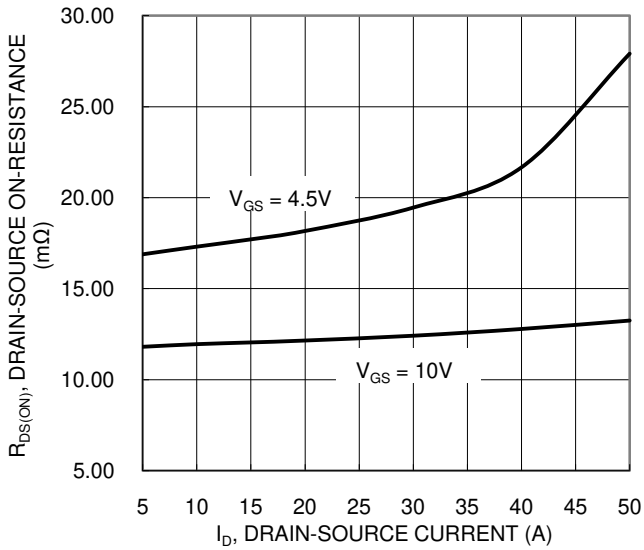


Figure 3. Typical On-Resistance vs Drain Current and Gate Voltage

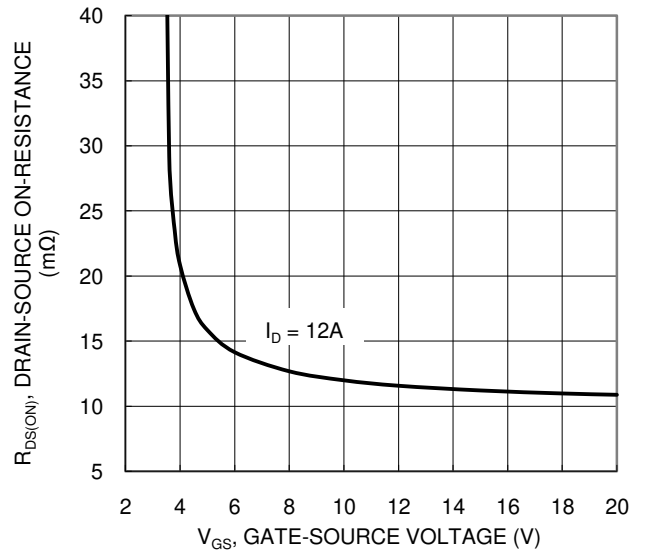


Figure 4. Typical Transfer Characteristic

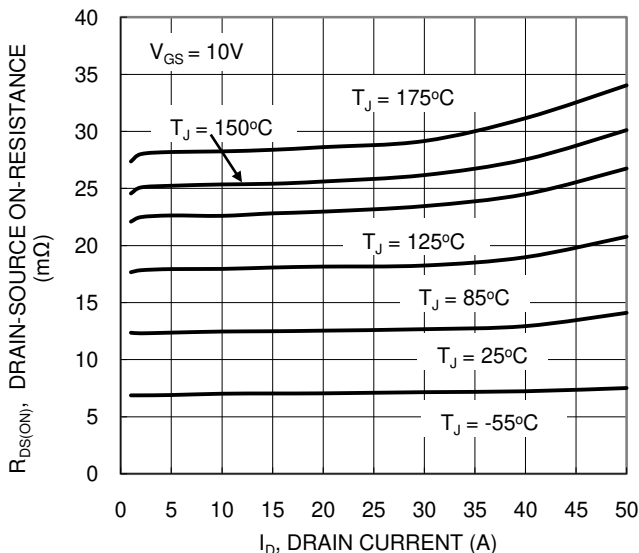


Figure 5. Typical On-Resistance vs Drain Current and Temperature

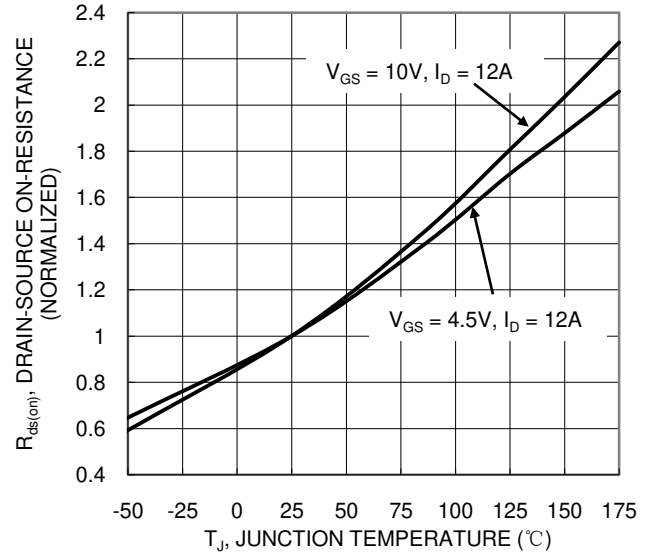
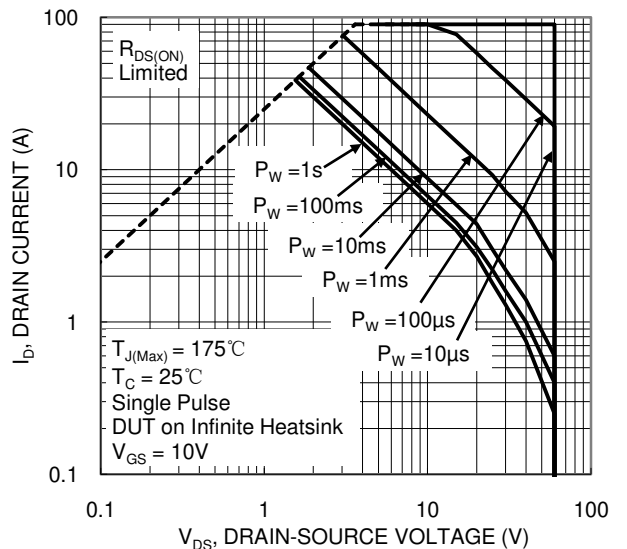
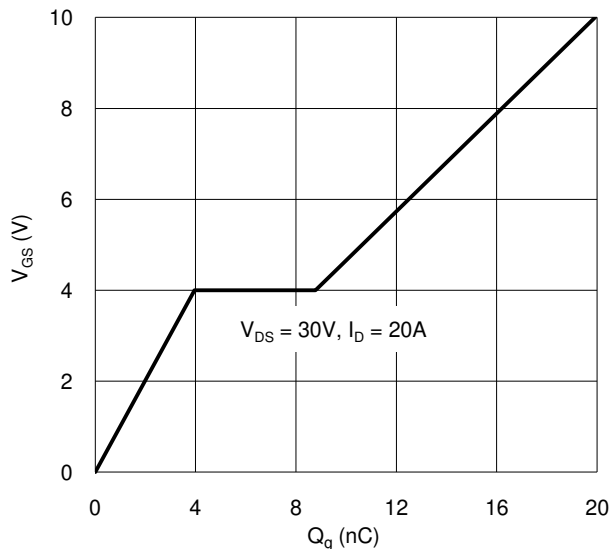
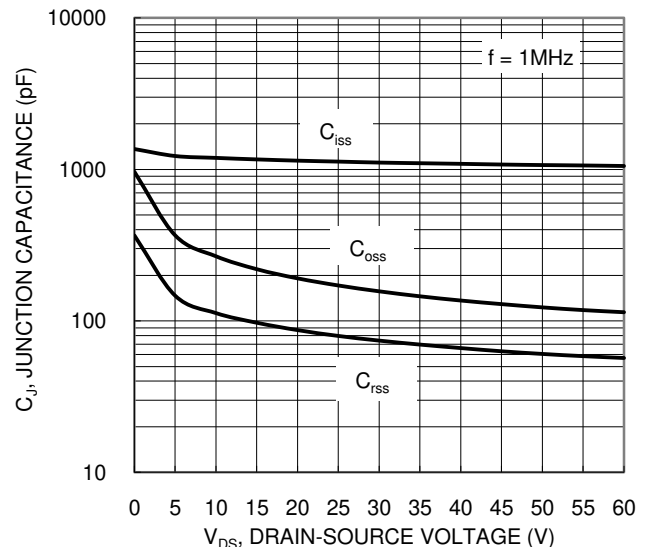
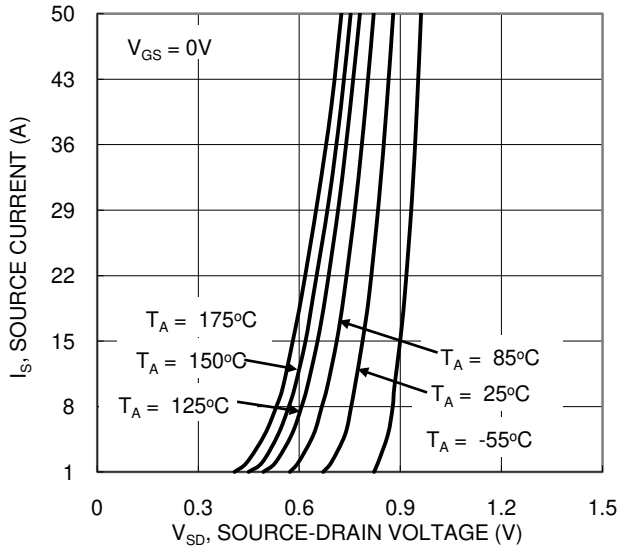
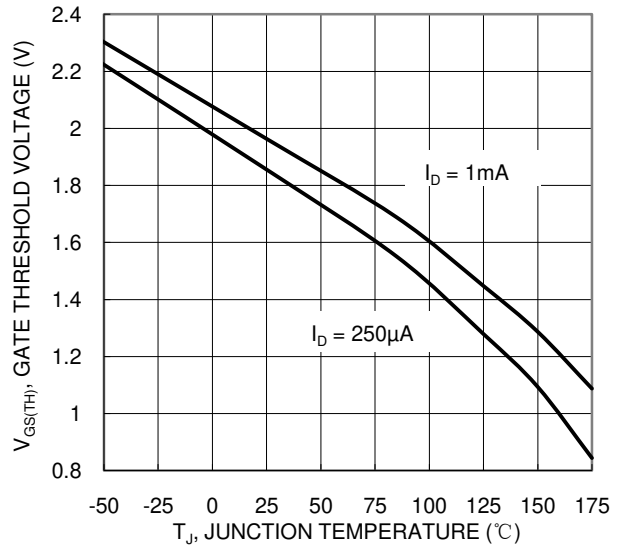
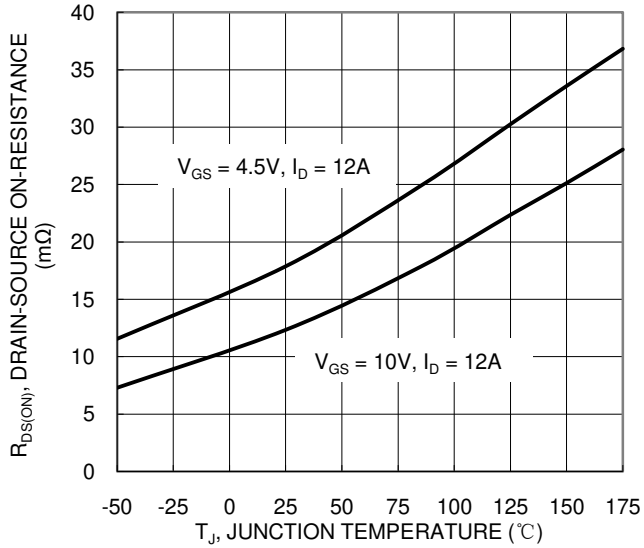
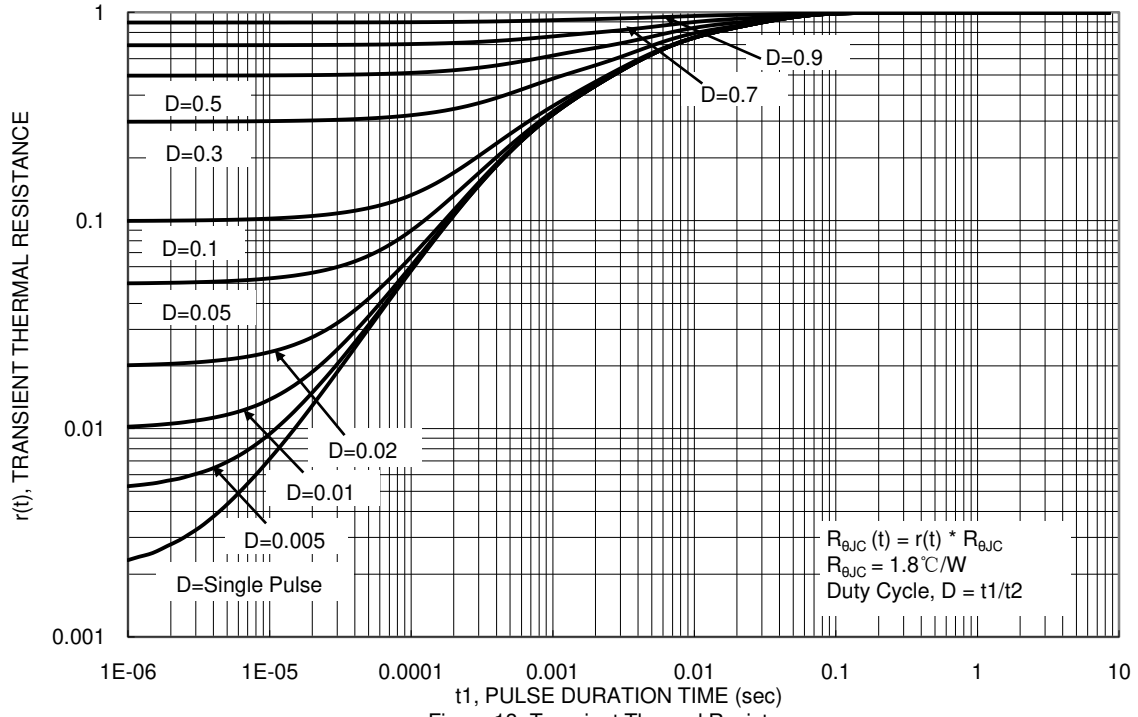


Figure 6. On-Resistance Variation with Temperature

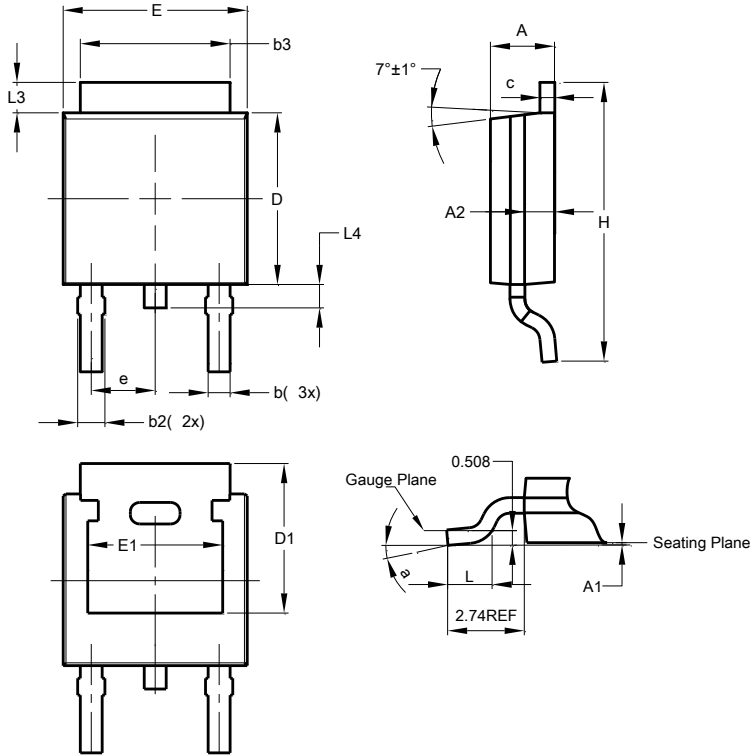




**Package Outline Dimensions**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**TO252 (DPAK)**

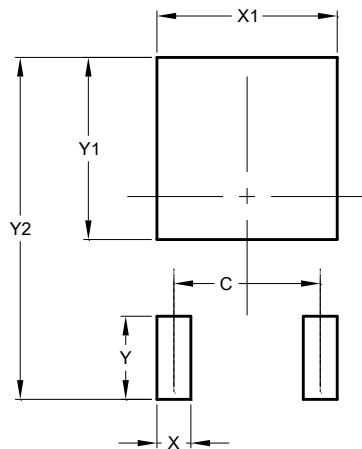


TO252 (DPAK)			
Dim	Min	Max	Typ
A	2.19	2.39	2.29
A1	0.00	0.13	0.08
A2	0.97	1.17	1.07
b	0.64	0.88	0.783
b2	0.76	1.14	0.95
b3	5.21	5.46	5.33
c	0.45	0.58	0.531
D	6.00	6.20	6.10
D1	5.21	-	-
e	-	-	2.286
E	6.45	6.70	6.58
E1	4.32	-	-
H	9.40	10.41	9.91
L	1.40	1.78	1.59
L3	0.88	1.27	1.08
L4	0.64	1.02	0.83
a	0°	10°	-
<b>All Dimensions in mm</b>			

**Suggested Pad Layout**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**TO252 (DPAK)**



Dimensions	Value (in mm)
C	4.572
X	1.060
X1	5.632
Y	2.600
Y1	5.700
Y2	10.700

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