

## Product Summary

$V_{(BR)DSS}$	$R_{DS(ON)}$ Max	$I_D$ Max $T_C = +25^\circ\text{C}$
-60V	33m $\Omega$ @ $V_{GS} = -10\text{V}$	-35A
	40m $\Omega$ @ $V_{GS} = -4.5\text{V}$	-32A

## Description

This MOSFET has been designed to meet the stringent requirements of Automotive applications.

## Applications

It is qualified to AECQ101, supported by a PPAP and is ideal for use in:

- Engine Management Systems
- Body Control Electronics
- DCDC Converters

## Features

- Rated to +175°C – Ideal for High Ambient Temperature Environments
- 100% Unclamped Inductive Switching – Ensures More Reliable and Robust End Application
- Low On-Resistance
- Low Input Capacitance
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

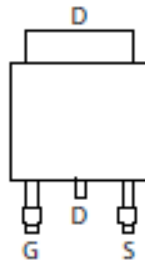
## Mechanical Data

- Case: TO252 (DPAK)
- Case Material: Molded Plastic, "Green" Molding Compound.
- UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram
- Weight: 0.33 grams (Approximate)

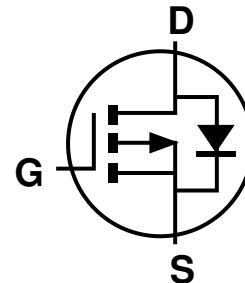


Top View

TO252 (DPAK)



Pin Out Top View



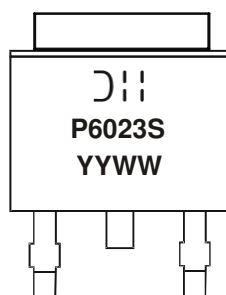
Equivalent Circuit

## Ordering Information (Note 4)

Part Number	Case	Packaging
DMPH6023SK3-13	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. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>

## Marking Information



= Manufacturer's Marking  
 P6023S = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Last Digit of Year (ex: 15 = 2015)  
 WW = Week Code (01 to 53)

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

Characteristic	Symbol	Value	Units	
Drain-Source Voltage	V <sub>DSS</sub>	-60	V	
Gate-Source Voltage	V <sub>GSS</sub>	±20	V	
Continuous Drain Current (Note 6) V <sub>GS</sub> = -10V	I <sub>D</sub>	T <sub>C</sub> = +25°C T <sub>C</sub> = +100°C	-35 -27	A
		T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	-7.3 -6.1	A
Pulsed Drain Current (380µs pulse, duty cycle = 1%)	I <sub>DM</sub>	-60	A	
Maximum Continuous Body Diode Forward Current (Note 6)	I <sub>S</sub>	-2.2	A	
Avalanche Current (Note 7) L = 0.1mH	I <sub>AS</sub>	-35	A	
Avalanche Energy (Note 7) L = 0.1mH	E <sub>AS</sub>	60	mJ	

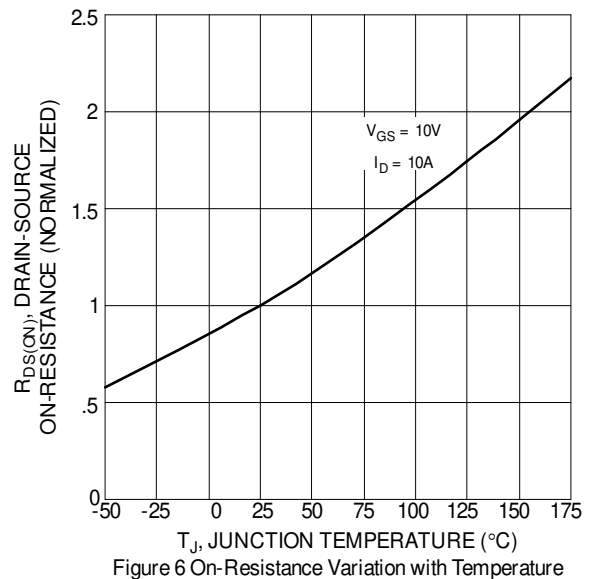
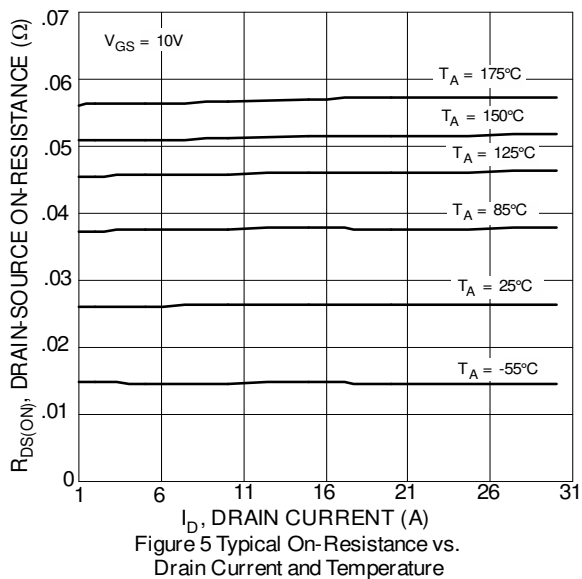
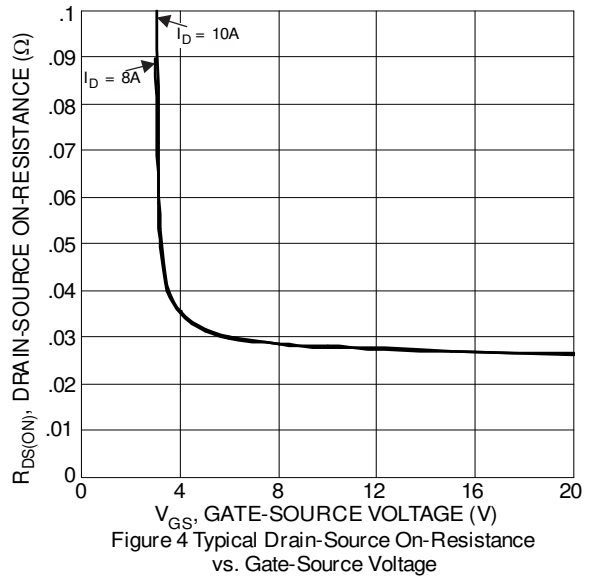
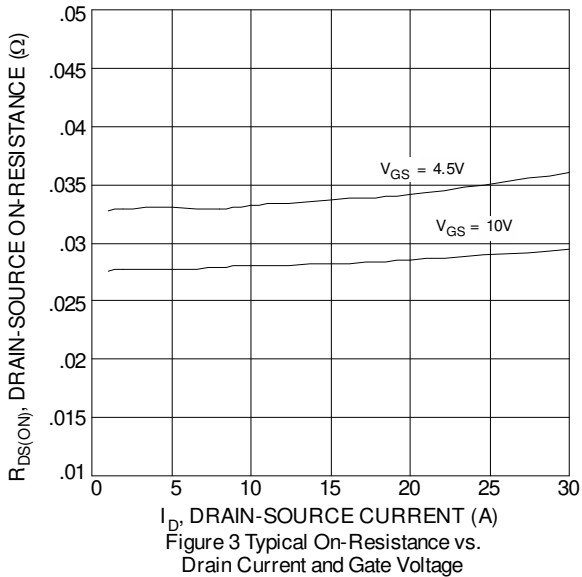
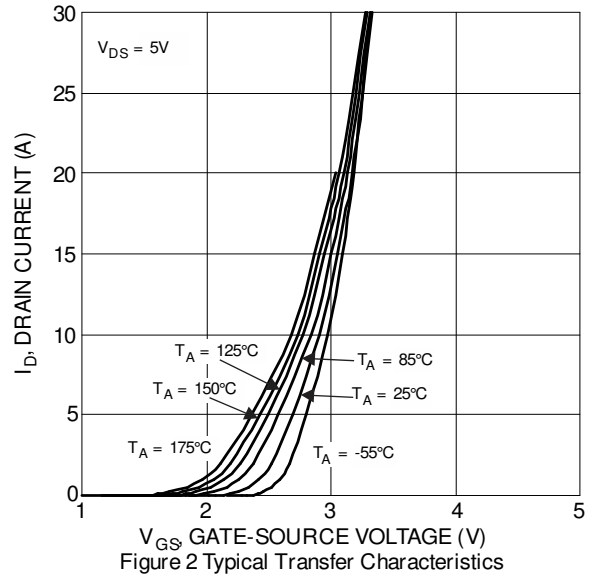
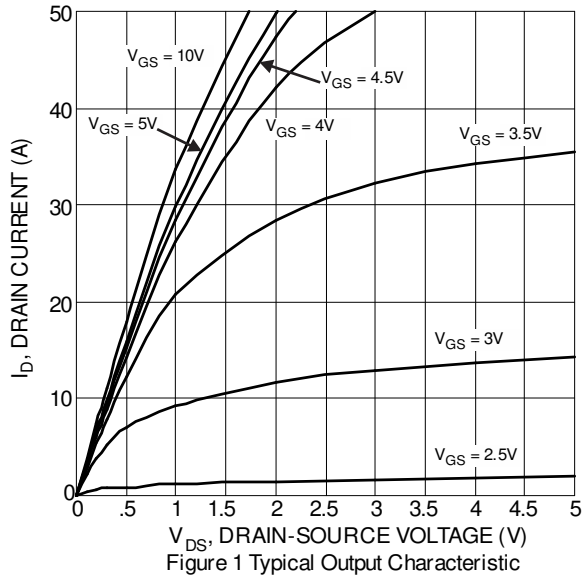
**Thermal Characteristics**

Characteristic	Symbol	Value	Units
Total Power Dissipation (Note 5)	P <sub>D</sub>	2.0	W
Thermal Resistance, Junction to Ambient (Note 5)	R <sub>θJA</sub>	80	°C/W
Total Power Dissipation (Note 6)	P <sub>D</sub>	3.2	W
Thermal Resistance, Junction to Ambient (Note 6)	R <sub>θJA</sub>	41	°C/W
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	1.6	°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</b> (Note 8)						
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 T <sub>J</sub> = +25°C	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</b> (Note 8)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	-1.0	—	-3.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250µA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	—	—	33	mΩ	V <sub>GS</sub> = -10V, I <sub>D</sub> = -10A
		—	—	40		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -8A
Diode Forward Voltage	V <sub>SD</sub>	—	-0.7	-1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = -1A
<b>DYNAMIC CHARACTERISTICS</b> (Note 9)						
Input Capacitance	C <sub>ISS</sub>	—	2,569	—	pF	V <sub>DS</sub> = -30V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>OSS</sub>	—	179	—	pF	
Reverse Transfer Capacitance	C <sub>RSS</sub>	—	143	—	pF	
Gate Resistance	R <sub>g</sub>	—	5	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge (V <sub>GS</sub> = -4.5V)	Q <sub>g</sub>	—	26.5	—	nC	V <sub>DS</sub> = -30V, I <sub>D</sub> = -5A
Total Gate Charge (V <sub>GS</sub> = -10V)	Q <sub>g</sub>	—	53.1	—	nC	
Gate-Source Charge	Q <sub>gs</sub>	—	7.1	—	nC	
Gate-Drain Charge	Q <sub>gd</sub>	—	12.6	—	nC	
Turn-On Delay Time	t <sub>D(on)</sub>	—	6	—	nS	
Turn-On Rise Time	t <sub>r</sub>	—	7.1	—	nS	V <sub>GS</sub> = -10V, V <sub>DS</sub> = -30V, R <sub>G</sub> = 3Ω, I <sub>D</sub> = -5A
Turn-Off Delay Time	t <sub>D(off)</sub>	—	110	—	nS	
Turn-Off Fall Time	t <sub>f</sub>	—	62	—	nS	
Body Diode Reverse Recovery Time	t <sub>rr</sub>	—	20	—	nS	I <sub>F</sub> = -5A, di/dt = 100A/µs
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	—	14	—	nC	

- Notes:
- Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout, see <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.
  - Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate.
  - 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.



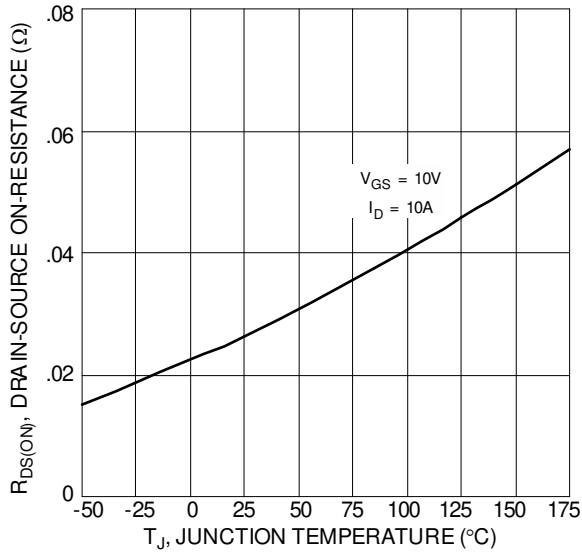


Figure 7 On-Resistance Variation with Temperature

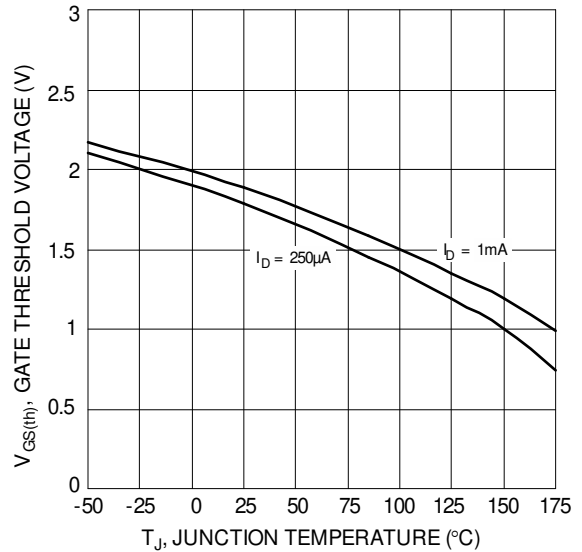


Figure 8 Gate Threshold Variation vs. Ambient Temperature

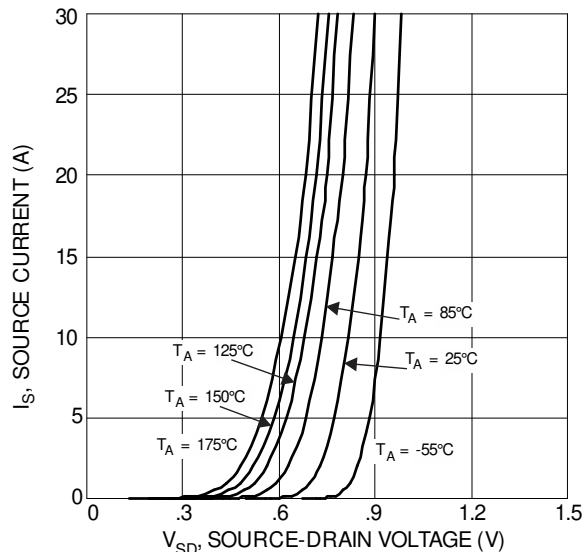


Figure 9 Diode Forward Voltage vs. Current

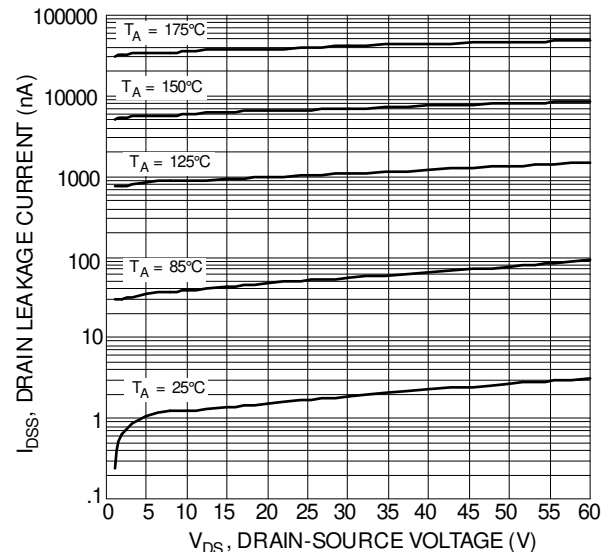


Figure 10 Typical Drain-Source Leakage Current vs. Voltage

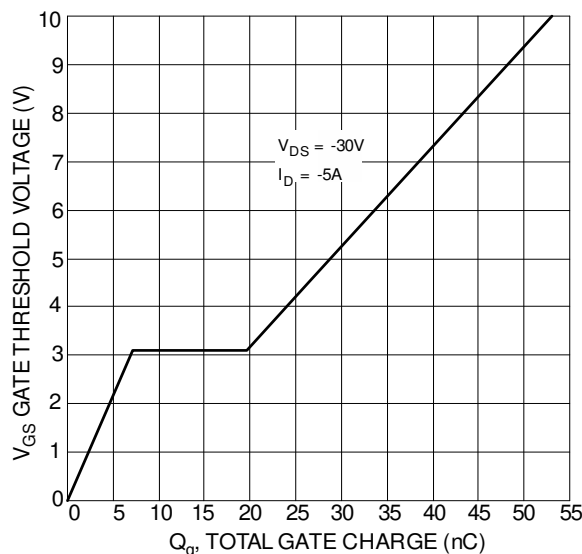


Figure 11 Gate Charge

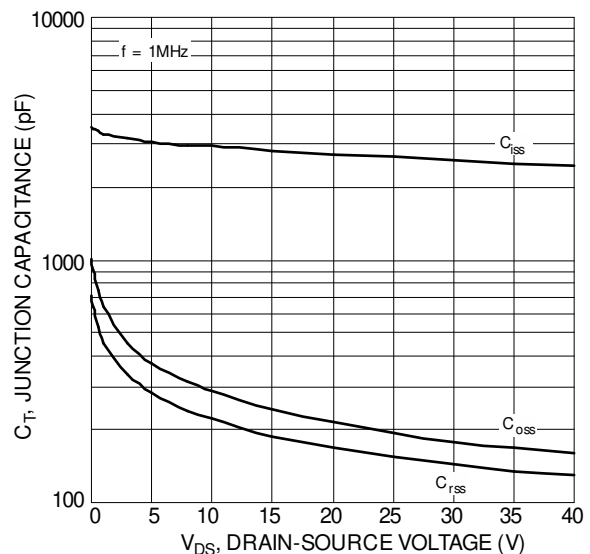
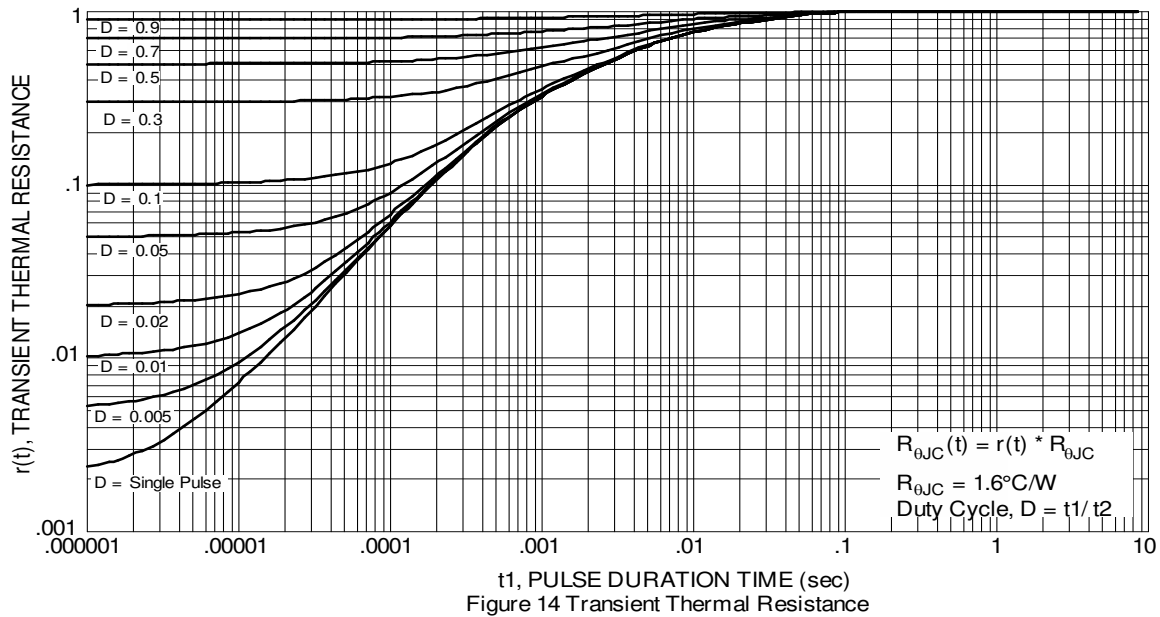
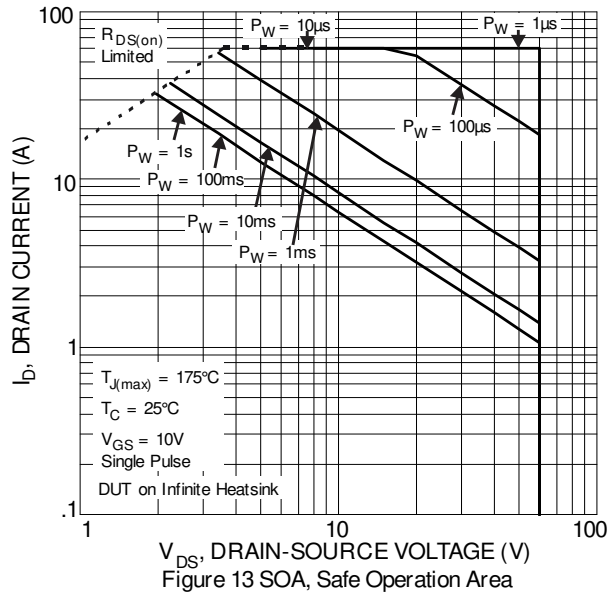


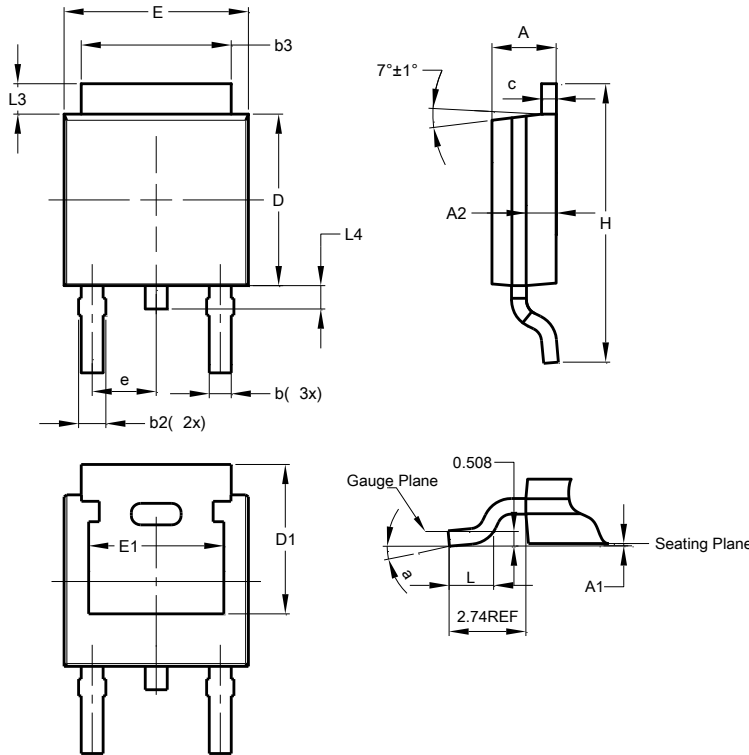
Figure 12 Typical Junction Capacitance



**Package Outline Dimensions**

Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.

**TO252 (DPAK)**

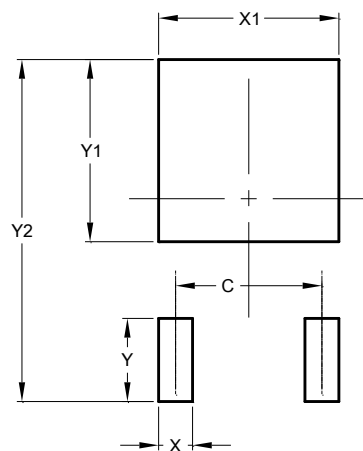


TO252 (DPAK)			
Dim	Min	Max	Typ
A	2.19	2.39	2.29
A1	0.00	0.13	0.08
A2	0.97	1.17	1.07
b	0.64	0.88	0.783
b2	0.76	1.14	0.95
b3	5.21	5.46	5.33
c	0.45	0.58	0.531
D	6.00	6.20	6.10
D1	5.21	—	—
e	—	—	2.286
E	6.45	6.70	6.58
E1	4.32	—	—
H	9.40	10.41	9.91
L	1.40	1.78	1.59
L3	0.88	1.27	1.08
L4	0.64	1.02	0.83
a	0°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

**Suggested Pad Layout**

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> 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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