

## Product Summary

$V_{(BR)DSS}$	$R_{DS(ON)}$ max	$I_D$ max $T_A = 25^\circ\text{C}$
60V	2Ω @ $V_{GS} = 10\text{V}$	380mA
	3Ω @ $V_{GS} = 5\text{V}$	310mA

## Description and Applications

This MOSFET has been designed to minimize the on-state resistance ( $R_{DS(on)}$ ) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

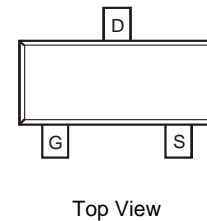
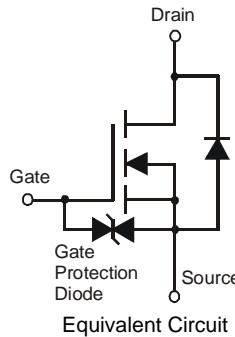
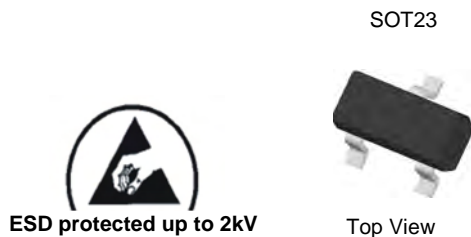
- Motor control
- Power Management Functions
- Backlighting

## Features and Benefits

- Low On-Resistance
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- **Lead, Halogen and Antimony Free, RoHS Compliant "Green" Device (Notes 1 and 2)**
- **ESD Protected Up To 2kV**
- **Qualified to AEC-Q101 Standards for High Reliability**

## Mechanical Data

- Case: SOT23
- 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 Alloy 42 leadframe. Solderable per MIL-STD-202, Method 208
- Weight: 0.008 grams (approximate)

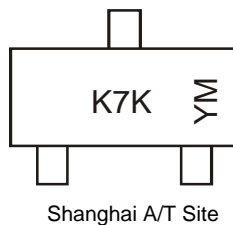
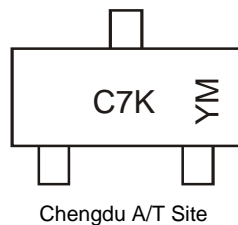


## Ordering Information (Note 3)

Part Number	Qualification	Case	Packaging
2N7002K-7	Commercial	SOT23	3000/Tape & Reel
2N7002KQ-7	Automotive	SOT23	3000/Tape & Reel
2N7002K-13	Commercial	SOT23	10000/Tape & Reel
2N7002KQ-13	Automotive	SOT23	10000/Tape & Reel

- Notes: 1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. No purposely added lead. Halogen and Antimony free.  
 2. Diodes Inc.'s "Green" policy can be found on our website at <http://www.diodes.com>.  
 3. For packaging details, go to our website at <http://www.diodes.com>.

## Marking Information



K = SAT (Shanghai Assembly/ Test site)  
 C = CAT (Chengdu Assembly/ Test site)  
 7K = Product Type Marking Code  
 YM = Date Code Marking  
 Y = Year (ex: N = 2002)  
 M = Month (ex: 9 = September)

### Date Code Key

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Code	T	U	V	W	X	Y	Z	A	B	C	D	E
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Code	1	2	3	4	5	6	7	8	9	O	N	D

**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 5) V <sub>GS</sub> = 10V	Steady State	T <sub>A</sub> = 25°C T <sub>A</sub> = 70°C	I <sub>D</sub>	380 300	mA
	t < 5s	T <sub>A</sub> = 25°C T <sub>A</sub> = 70°C	I <sub>D</sub>	430 340	mA
Continuous Drain Current (Note 5) V <sub>GS</sub> = 5V	Steady State	T <sub>A</sub> = 25°C T <sub>A</sub> = 70°C	I <sub>D</sub>	310 240	mA
	t < 5s	T <sub>A</sub> = 25°C T <sub>A</sub> = 70°C	I <sub>D</sub>	350 270	mA
Maximum Continuous Body Diode Forward Current (Note 5)			I <sub>S</sub>	0.5	A
Pulsed Drain Current (10μs pulse, duty cycle = 1%) (Note 5)			I <sub>DM</sub>	1.2	A

**Thermal Characteristics** @T<sub>A</sub> = 25°C unless otherwise specified

Characteristic		Symbol	Value	Units
Total Power Dissipation (Note 4)		P <sub>D</sub>	370	mW
Thermal Resistance, Junction to Ambient (Note 4)	Steady State	R <sub>θJA</sub>	357	°C/W
	t < 5s		292	
Total Power Dissipation (Note 5)		P <sub>D</sub>	540	mW
Thermal Resistance, Junction to Ambient (Note 5)	Steady State	R <sub>θJA</sub>	240	°C/W
	t < 5s		197	
Thermal Resistance, Junction to Case (Note 5)		R <sub>θJC</sub>	91	
Operating and Storage Temperature Range		T <sub>J</sub> , T <sub>STG</sub>	-55 to 150	°C

**Electrical Characteristics** @T<sub>A</sub> = 25°C unless otherwise specified

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 6)</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	60	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 10μA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	1.0	μA	V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±10	μA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 6)</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	1.0	1.6	2.5	V	V <sub>DS</sub> = 10V, I <sub>D</sub> = 1mA
Static Drain-Source On-Resistance	R <sub>DS(on)</sub>	—	—	2.0	Ω	V <sub>GS</sub> = 10V, I <sub>D</sub> = 0.5A
		—	—	3.0		V <sub>GS</sub> = 5V, I <sub>D</sub> = 0.05A
Forward Transfer Admittance	Y <sub>fs</sub>	80	—	—	ms	V <sub>DS</sub> = 10V, I <sub>D</sub> = 0.2A
Diode Forward Voltage	V <sub>SD</sub>	—	0.75	1.1	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 115mA
<b>DYNAMIC CHARACTERISTICS (Note 7)</b>						
Input Capacitance	C <sub>iSS</sub>	—	30	50	pF	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V f = 1.0MHz
Output Capacitance	C <sub>oSS</sub>	—	4.2	25	pF	
Reverse Transfer Capacitance	C <sub>rSS</sub>	—	2.9	5.0	pF	
Gate Resistance	R <sub>g</sub>	—	133	—	mΩ	f = 1MHz, V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V
Total Gate Charge	Q <sub>g</sub>	—	0.3	—	nC	V <sub>GS</sub> = 4.5V, V <sub>DS</sub> = 10V, I <sub>D</sub> = 250mA
Gate-Source Charge	Q <sub>gs</sub>	—	0.2	—	nC	
Gate-Drain Charge	Q <sub>gd</sub>	—	0.08	—	nC	
Turn-On Delay Time	t <sub>D(on)</sub>	—	3.9	—	ns	V <sub>DD</sub> = 30V, V <sub>GS</sub> = 10V, R <sub>G</sub> = 25Ω, I <sub>D</sub> = 200mA
Turn-On Rise Time	t <sub>r</sub>	—	3.4	—	ns	
Turn-Off Delay Time	t <sub>D(off)</sub>	—	15.7	—	ns	
Turn-Off Fall Time	t <sub>f</sub>	—	9.9	—	ns	

- Notes: 4. Device mounted on FR-4 PCB, with minimum recommended pad layout  
5. Device mounted on 1" x 1" FR-4 PCB with high coverage 2oz. Copper, single sided.  
6. Short duration pulse test used to minimize self-heating effect.  
7. Guaranteed by design. Not subject to product testing.

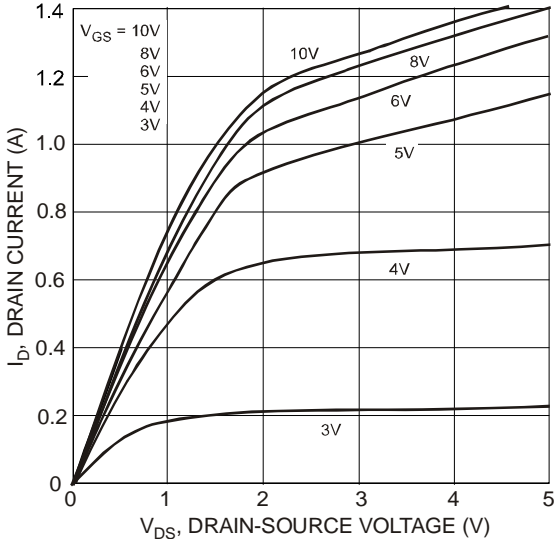


Fig. 1 Typical Output Characteristics

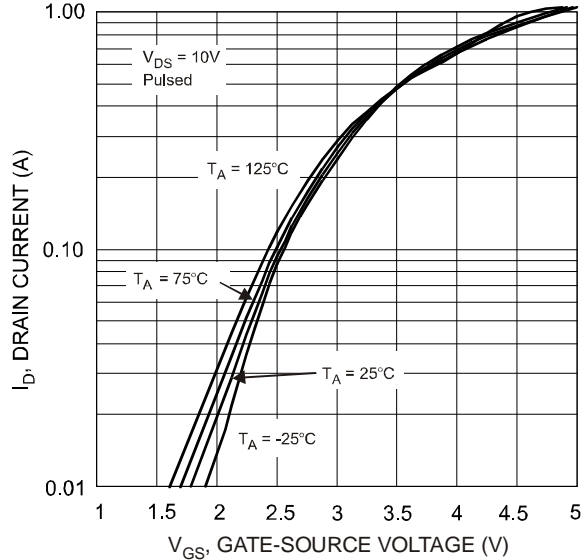


Fig. 2 Typical Transfer Characteristics

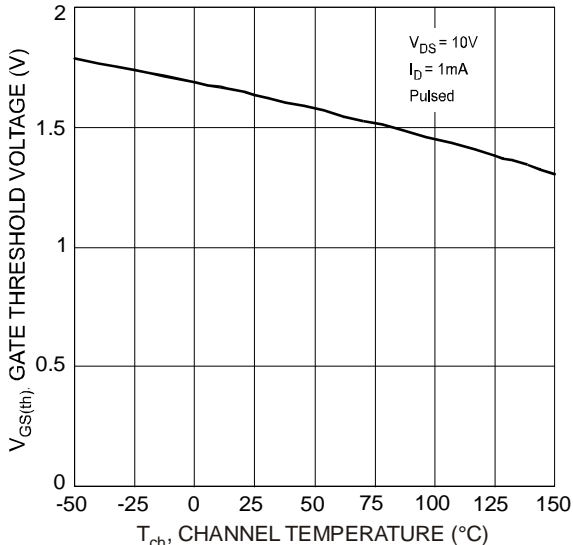


Fig. 3 Gate Threshold Voltage vs. Channel Temperature

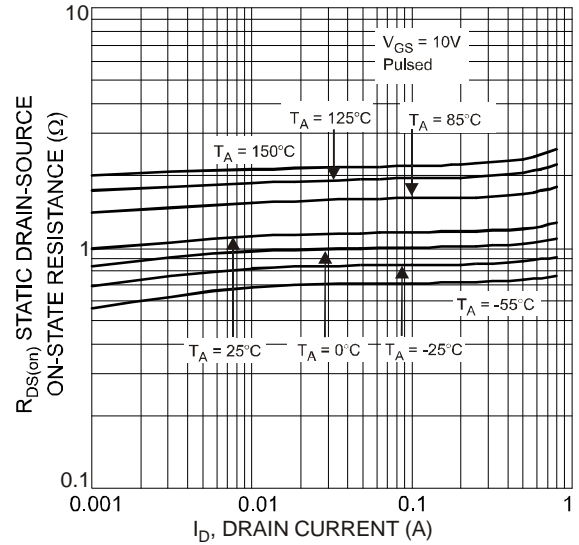


Fig. 4 Static Drain-Source On-Resistance vs. Drain Current

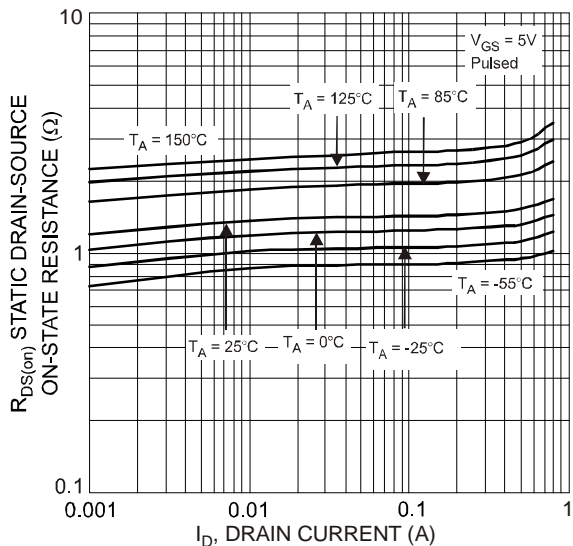


Fig. 5 Static Drain-Source On-Resistance vs. Drain Current

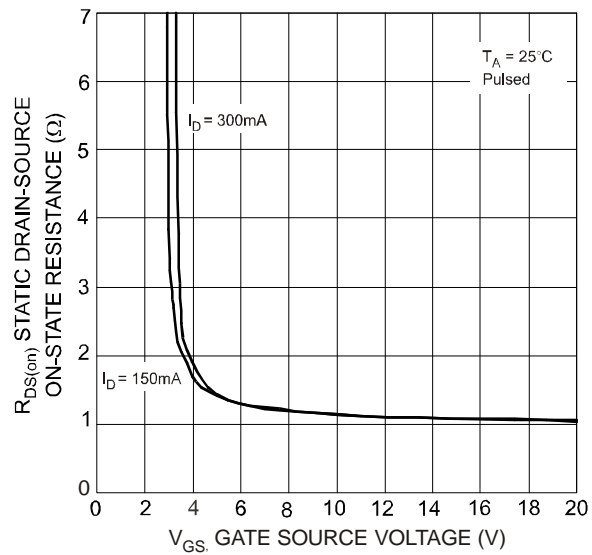


Fig. 6 Static Drain-Source On-Resistance vs. Gate-Source Voltage

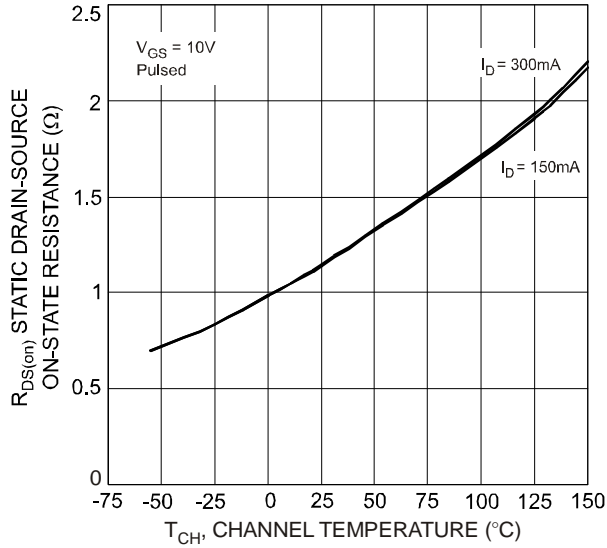


Fig. 7 Static Drain-Source On-State Resistance vs. Channel Temperature

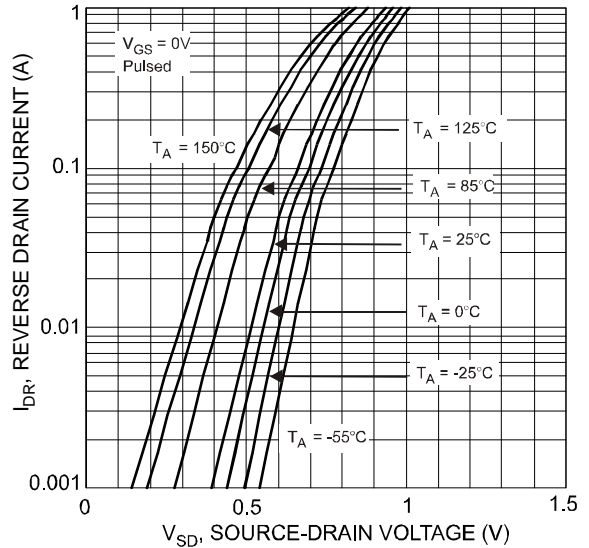


Fig. 8 Reverse Drain Current vs. Source-Drain Voltage

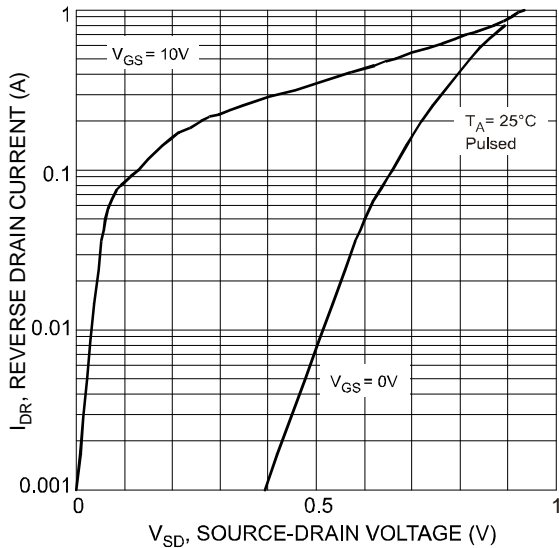


Fig. 9 Reverse Drain Current vs. Source-Drain Voltage

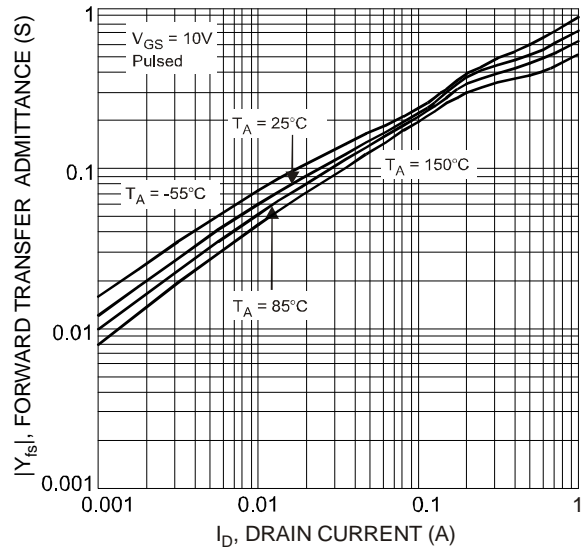


Fig. 10 Forward Transfer Admittance vs. Drain Current

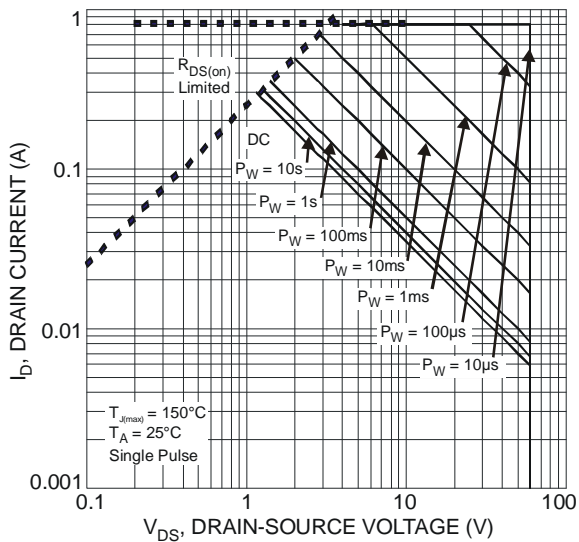


Fig. 11 Safe Operation Area

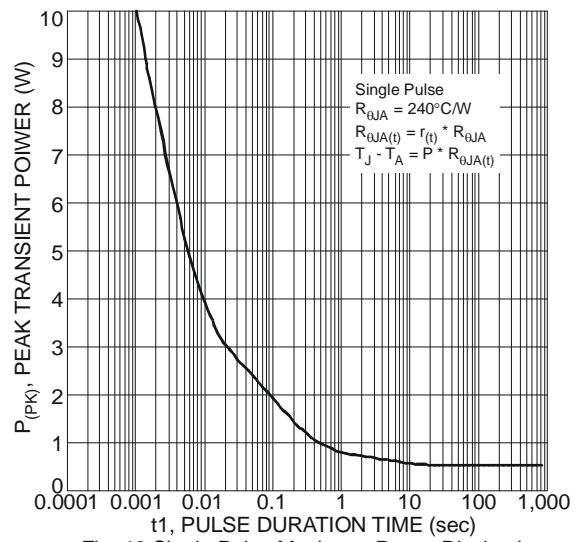
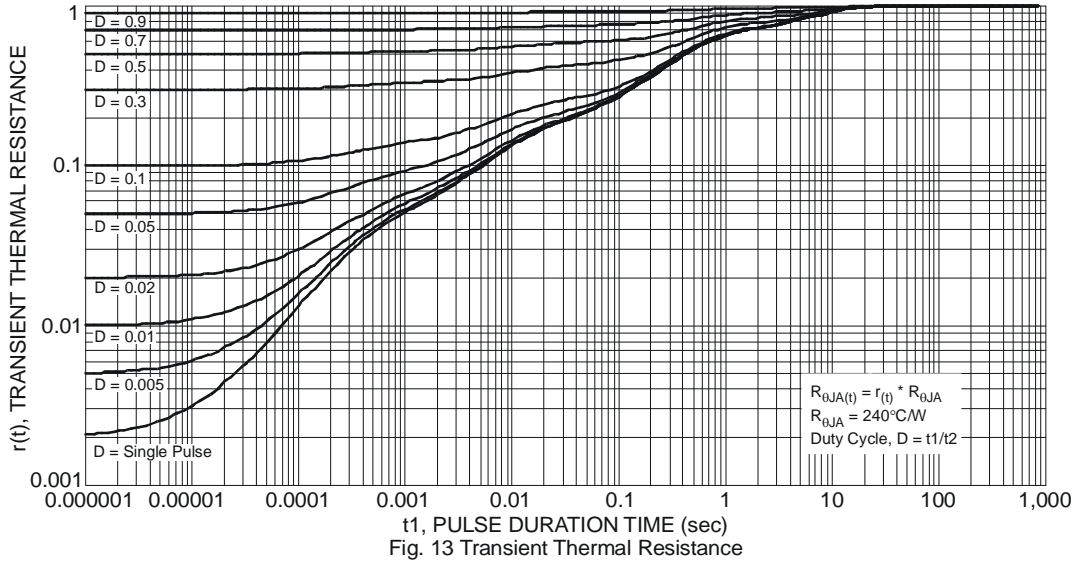
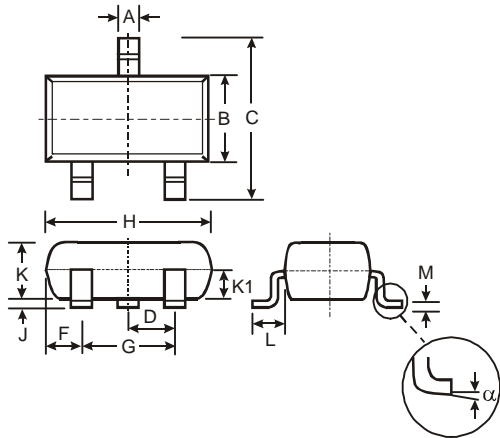


Fig. 12 Single Pulse Maximum Power Dissipation

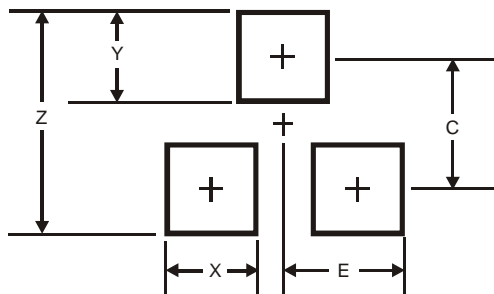


**Package Outline Dimensions**



SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.903	1.10	1.00
K1	-	-	0.400
L	0.45	0.61	0.55
M	0.085	0.18	0.11
α	0°	8°	-
All Dimensions in mm			

**Suggested Pad Layout**



Dimensions	Value (in mm)
Z	2.9
X	0.8
Y	0.9
C	2.0
E	1.35

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