

# N-Channel Enhancement Mode MOSFET

## 1. Product Information

### Features

Advanced trench technology  
Lead free product is acquired  
ESD > 2KV

### Applications

Battery protection  
Load switch  
Power management

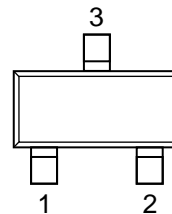
### Quick reference

$V_{DS} \geq 20V$   
 $I_D \leq 6.8A$   
 $R_{DS(ON)} \leq 15 m\Omega @ V_{GS}=4.5V$  (Type: 13m $\Omega$ )  
 $R_{DS(ON)} \leq 22 m\Omega @ V_{GS}=2.5V$  (Type: 16m $\Omega$ )

### Pin Description

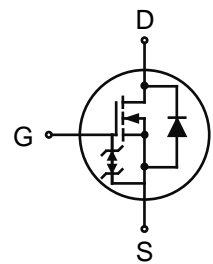
Pin	Description
1	Gate(G)
2	Source(S)
3	Drain(D)

### Simplified Outline



Top View  
SOT-23

### Symbol



## Package Marking and Ordering Information

Product Name	Package	Marking	Reel Size	Tape width	Quantity
KJ3416E	SOT-23	3416	7 inch	-	3000

## 2. Absolute Maximum Ratings (T<sub>c</sub>=25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V <sub>DS</sub>	20	V
Gate-Source Voltage	V <sub>GS</sub>	±10	V
Continuous Drain Current (T <sub>a</sub> =25°C)	I <sub>D</sub>	6.8	A
Continuous Drain Current (T <sub>a</sub> =70°C)	I <sub>D</sub>	4.4	A
Pulsed Drain Current	I <sub>DM</sub>	27	A
Power Dissipation	P <sub>D</sub>	1.6	W
Thermal Resistance from Junction to Ambient <sup>(4)</sup>	R <sub>θJA</sub>	78	°C/W
Junction Temperature	T <sub>J</sub>	150	°C
Storage Temperature	T <sub>STG</sub>	-55~ +150	°C

**3. Electrical Characteristics** ( $T_J=25^{\circ}\text{C}$ , unless otherwise noted)

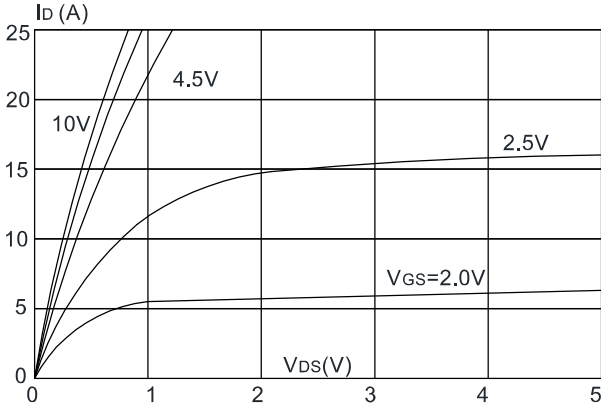
Parameter	Symbol	Test Condition	Min	Type	Max	Unit
<b>Static Characteristics</b>						
Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	20	-	-	V
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 20V, V_{GS} = 0V$	-	-	1	$\mu A$
Gate-body leakage current	$I_{GSS}$	$V_{GS} = \pm 10V, V_{DS} = 0V$	-	-	$\pm 5000$	nA
Gate threshold voltage <sup>(3)</sup>	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	0.3	0.7	1.0	V
Drain-source on-resistance <sup>(3)</sup>	$R_{DS(on)}$	$V_{GS} = 4.5V, I_D = 6A$	-	13	15	m $\Omega$
		$V_{GS} = 2.5V, I_D = 3A$	-	16	22	
<b>Dynamic characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 10V, V_{GS} = 0V, f = 1MHz$	-	780	-	pF
Output Capacitance	$C_{oss}$		-	140	-	
Reverse Transfer Capacitance	$C_{rss}$		-	80	-	
<b>Switching characteristics</b>						
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 10V, I_D = 3.5A,$ $V_{GS} = 4.5V, R_G = 10\Omega$	-	9	-	ns
Turn-on rise time	$t_r$		-	30	-	
Turn-off delay time	$t_{d(off)}$		-	35	-	
Turn-off fall time	$t_f$		-	10	-	
Total Gate Charge	$Q_g$	$V_{DS} = 10V, I_D = 3.5A,$ $V_{GS} = 4.5V$	-	11	-	nC
Gate-Source Charge	$Q_{gs}$		-	2.3	-	
Gate-Drain Charge	$Q_{gd}$		-	2.9	-	
<b>Source-Drain Diode characteristics</b>						
Diode Forward voltage <sup>(3)</sup>	$V_{DS}$	$V_{GS} = 0V, I_S = 4A$	-	-	1.2	V
Diode Forward current <sup>(4)</sup>	$I_S$		-	-	6.8	A

**Notes:**

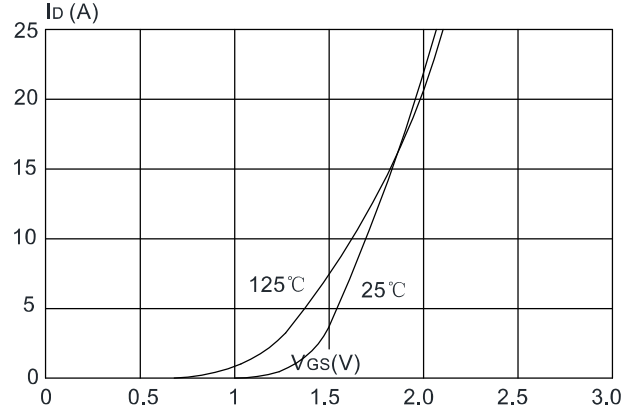
1. Repetitive Rating: pulse width limited by maximum junction temperature
2. Pulse Test: pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
3. Surface Mounted on FR4 Board,  $t \leq 10$  sec

## 4. Typical Characteristics

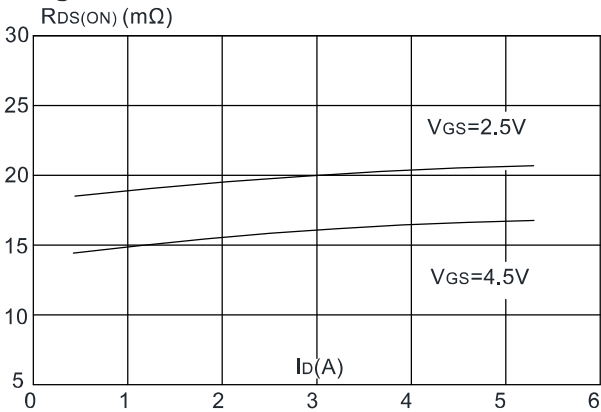
**Figure 1: Output Characteristics**



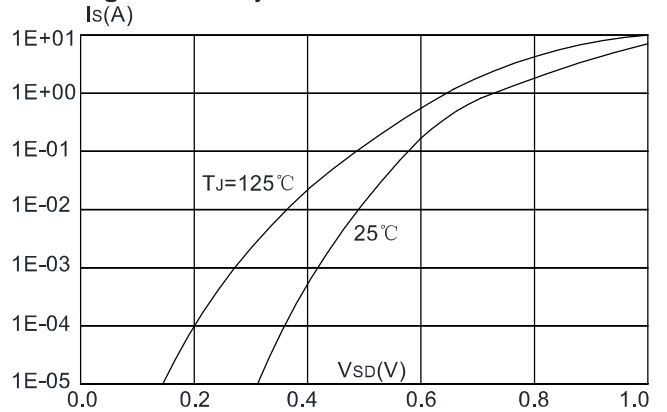
**Figure 2: Typical Transfer Characteristics**



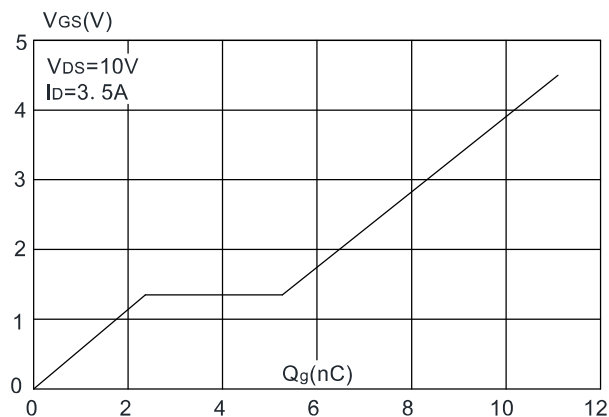
**Figure 3: On-resistance vs. Drain Current**



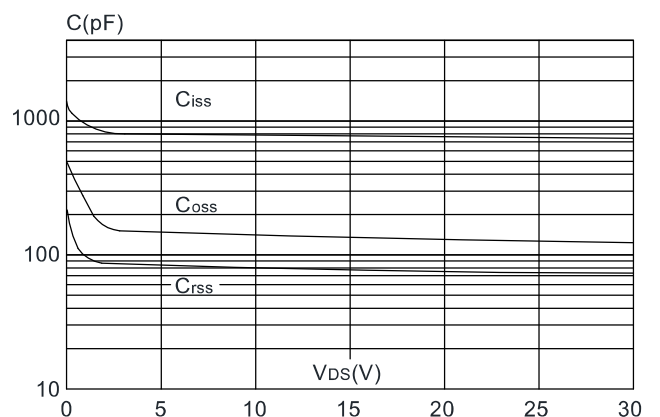
**Figure 4: Body Diode Characteristics**



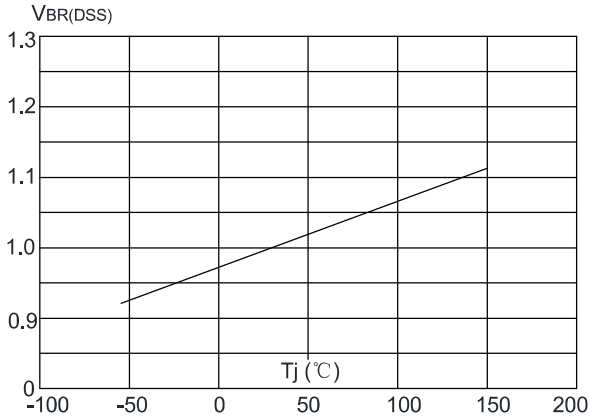
**Figure 5: Gate Charge Characteristics**



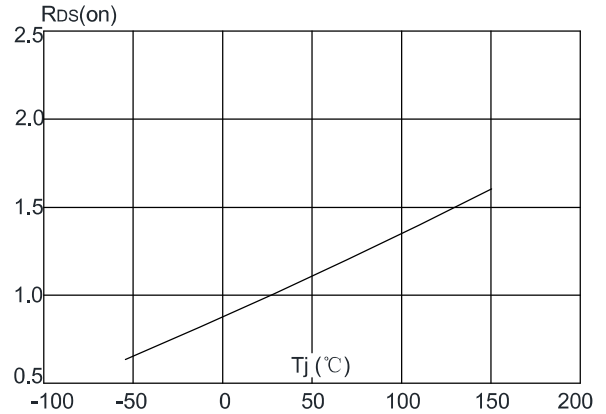
**Figure 6: Capacitance Characteristics**



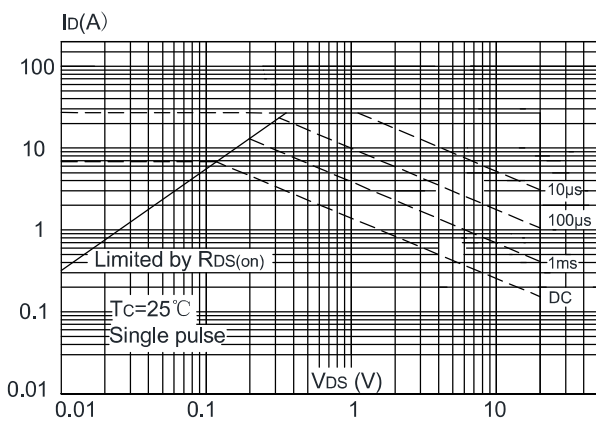
**Figure 7: Normalized Breakdown Voltage vs. Junction Temperature**



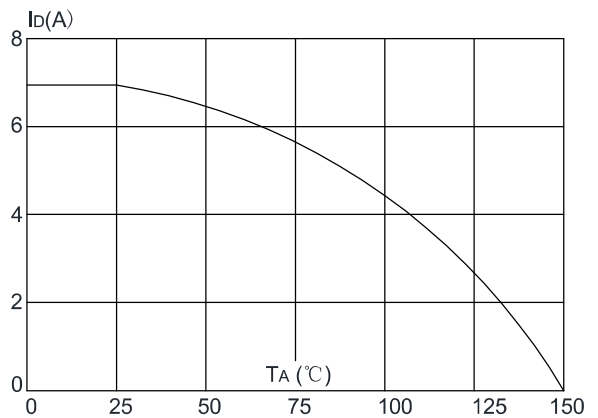
**Figure 8: Normalized on Resistance vs. Junction Temperature**



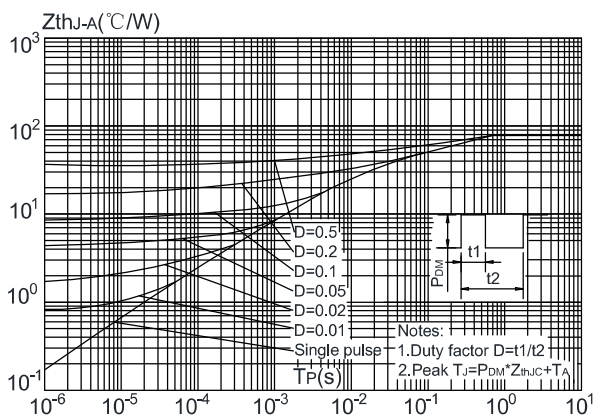
**Figure 9: Maximum Safe Operating Area**



**Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature**

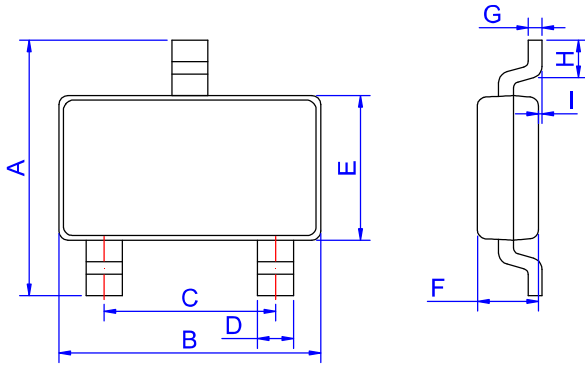


**Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient**

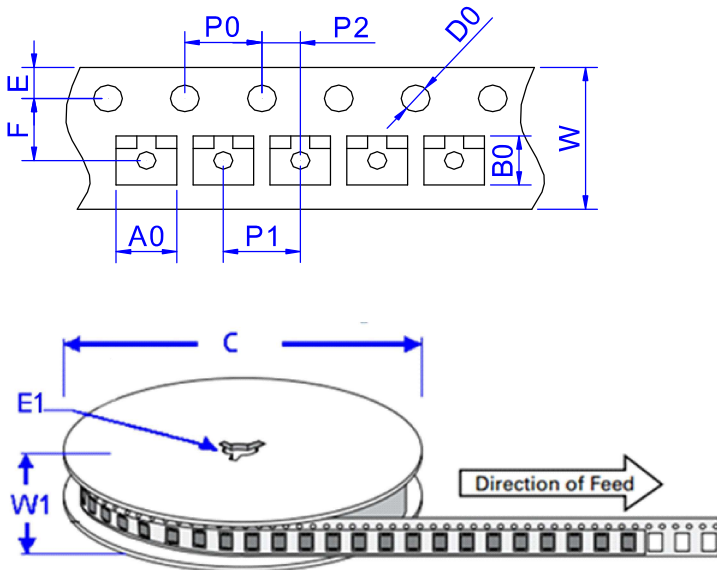


## 5. Package Mechanical Data

### SOT-23



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.30	2.40	2.50	0.091	0.095	0.098
B	2.80	2.90	3.00	0.110	0.114	0.118
C	1.90 REF			0.075 REF		
D	0.35	0.40	0.45	0.014	0.016	0.018
E	1.20	1.30	1.40	0.047	0.051	0.055
F	0.90	1.00	1.10	0.035	0.039	0.043
G		0.10	0.15		0.004	0.006
H	0.20			0.008		
I	0		0.10	0		0.004



Ref.	Dimensions	
	Millimeters	Inches
A0	3.15 ± 0.3	0.124 ± 0.012
B0	2.77 ± 0.3	0.109 ± 0.012
C	178	7.0
D0	1.50 ± 0.1	0.059 ± 0.004
E	1.75 ± 0.2	0.069 ± 0.008
E1	13.3 ± 0.3	0.524 ± 0.012
F	3.5 ± 0.2	0.138 ± 0.008
P0	4.00 ± 0.2	0.157 ± 0.008
P1	4.00 ± 0.2	0.157 ± 0.008
P2	2.00 ± 0.2	0.079 ± 0.008
W	8.00 ± 0.2	0.315 ± 0.008
W1	11.5 ± 1.0	0.453 ± 0.039