

## P-Channel Enhancement Mode MOSFET

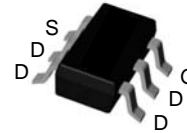
### Features

- -60V/-2.9A,  
 $R_{DS(ON)} = 135m\Omega(\text{max.}) @ V_{GS} = -10V$   
 $R_{DS(ON)} = 180m\Omega(\text{max.}) @ V_{GS} = -4.5V$
- ESD Protection Pass 2KV
- 100% UIS+R<sub>g</sub> Tested
- Reliable and Rugged
- Lead Free and Green Devices Available  
 (RoHS Compliant)

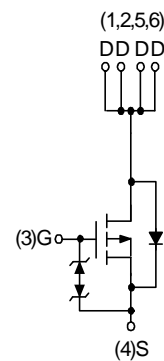
### Applications

- DC-DC Converters.
- Load Switch.
- Power Management.

### Pin Description



Top View of SOT-23-6



P-Channel MOSFET

### DEVICE MARKING AND ORDERING INFORMATION

Device	Marking	Shipping
FTK2661L	D61	3000/Tape&Reel



# FTK2661L

## Absolute Maximum Ratings (T<sub>A</sub> = 25°C Unless Otherwise Noted)

Symbol	Parameter	Rating	Unit	
<b>Common Ratings</b>				
V <sub>DSS</sub>	Drain-Source Voltage	-60	V	
V <sub>GSS</sub>	Gate-Source Voltage	±20		
T <sub>J</sub>	Maximum Junction Temperature	150	°C	
T <sub>STG</sub>	Storage Temperature Range	-55 to 150		
I <sub>S</sub>	Diode Continuous Forward Current	T <sub>A</sub> =25°C	-1	A
I <sub>D</sub> <sup>*</sup>	Continuous Drain Current	T <sub>A</sub> =25°C	-2.9	A
		T <sub>A</sub> =70°C	-2.3	
I <sub>DM</sub> <sup>a</sup>	Pulsed Drain Current	T <sub>A</sub> =25°C	-11.6	A
P <sub>D</sub>	Maximum Power Dissipation	T <sub>A</sub> =25°C	2	W
		T <sub>A</sub> =70°C	1.3	
R <sub>θJA</sub> <sup>c</sup>	Thermal Resistance-Junction to Ambient	t ≤ 10s	60	°C/W
		Steady State	100	
I <sub>AS</sub> <sup>b</sup>	Avalanche Current, Single pulse	L=0.5mH	7	A
E <sub>AS</sub> <sup>b</sup>	Avalanche Energy, Single pulse	L=0.5mH	12	mJ

Note \* t ≤ 10s.

Note a: Pulse width is limited by maximum junction temperature.

Note b: UIS tested and pulse width limited by maximum junction temperature 150°C (initial temperature T<sub>J</sub>=25°C)

Note c: Surface Mounted on 1in<sup>2</sup> pad area.



# FTK2661L

## Electrical Characteristics (T<sub>A</sub> = 25°C Unless Otherwise Noted)

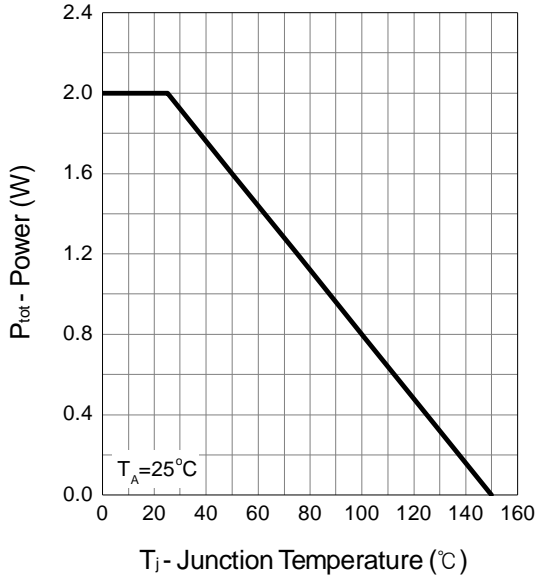
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA	-60	-	-	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =-48V, V <sub>GS</sub> =0V	-	-	1	μA
		T <sub>J</sub> =85°C	-	-	30	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA	-1	-2	-3	V
I <sub>GSS</sub>	Gate Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±10	μA
R <sub>DS(ON)</sub> <sup>d</sup>	Drain-Source On-state Resistance	V <sub>GS</sub> =-10V, I <sub>DS</sub> = -2.9A	-	110	135	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>DS</sub> = -2.5A	-	130	180	mΩ
<b>Diode Characteristics</b>						
V <sub>SD</sub> <sup>d</sup>	Diode Forward Voltage	I <sub>SD</sub> =-1A, V <sub>GS</sub> =0V	-0.5	-0.8	-1	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>SD</sub> =-2.9A,	-	20	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge	dI <sub>SD</sub> /dt=100A/μs	-	19	-	nC
<b>Dynamic Characteristics<sup>d</sup></b>						
R <sub>G</sub>	Gate Resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz	-	11	-	Ω
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =-30V, Frequency=1.0MHz	-	430	560	pF
C <sub>oss</sub>	Output Capacitance		-	41	-	
C <sub>rss</sub>	Reverse Transfer Capacitance		-	25	-	
t <sub>d(ON)</sub>	Turn-on Delay Time	V <sub>DD</sub> =-30V, R <sub>L</sub> =-30Ω, I <sub>DS</sub> =-1A, V <sub>GEN</sub> =-10V, R <sub>G</sub> =6Ω	-	8.5	16	ns
t <sub>r</sub>	Turn-on Rise Time		-	5.8	11	
t <sub>d(OFF)</sub>	Turn-off Delay Time		-	36	65	
t <sub>f</sub>	Turn-off Fall Time		-	24	44	
<b>Gate Charge Characteristics<sup>e</sup></b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =-30V, V <sub>GS</sub> =-4.5V, I <sub>DS</sub> =-2.9A	-	5.4	-	nC
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =-30V, V <sub>GS</sub> =-10V, I <sub>DS</sub> =-2.9A	-	11	15.4	
Q <sub>gs</sub>	Gate-Source Charge		-	1.4	-	
Q <sub>gd</sub>	Gate-Drain Charge		-	2.4	-	

Note d: Pulse test; pulse width≤300μs, duty cycle≤2%.

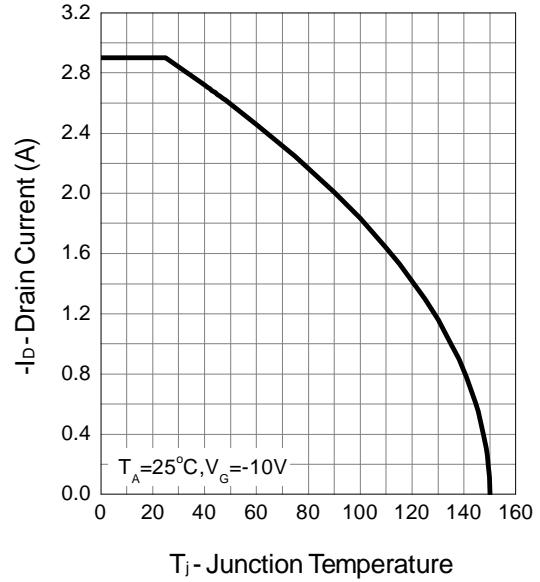
Note e: Guaranteed by design, not subject to production testing.

## Typical Operating Characteristics

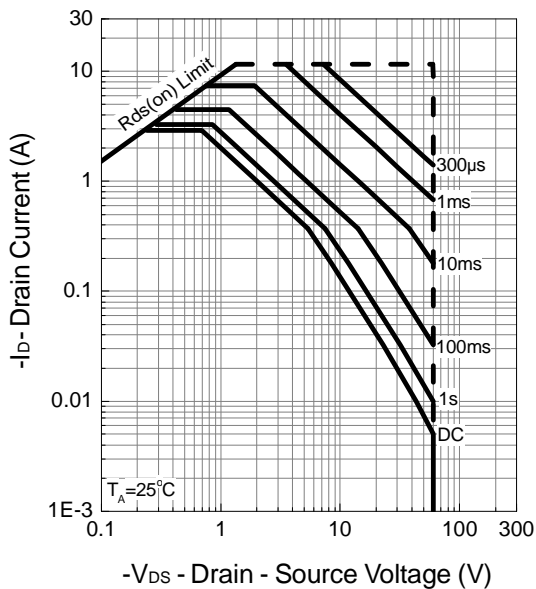
**Power Dissipation**



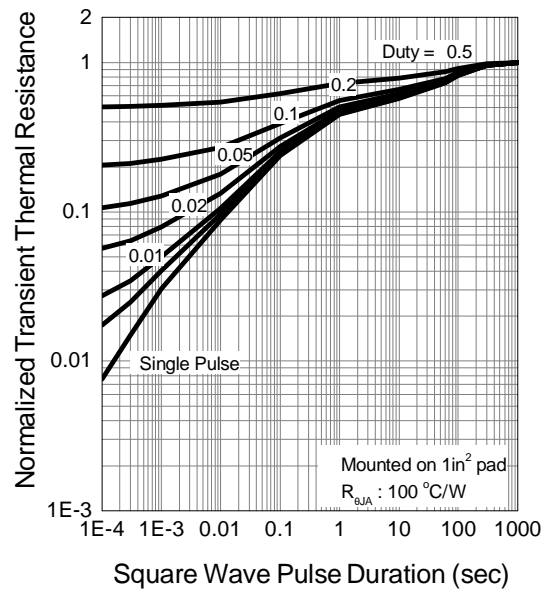
**Drain Current**



**Safe Operation Area**

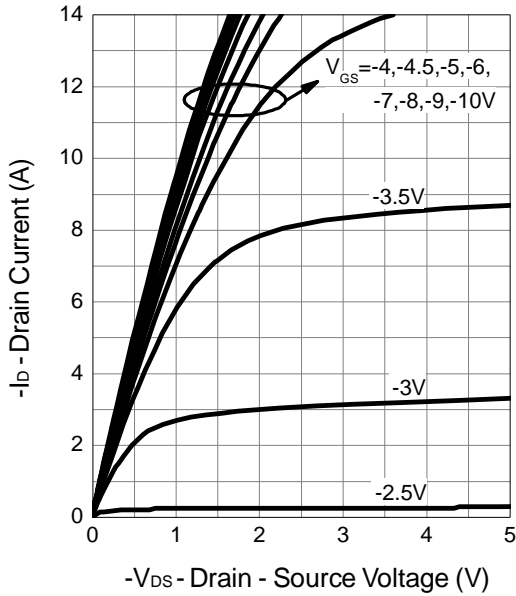


**Thermal Transient Impedance**

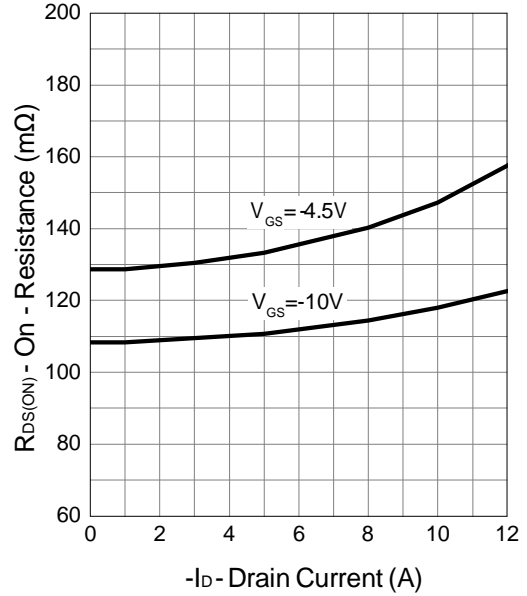


## Typical Operating Characteristics (Cont.)

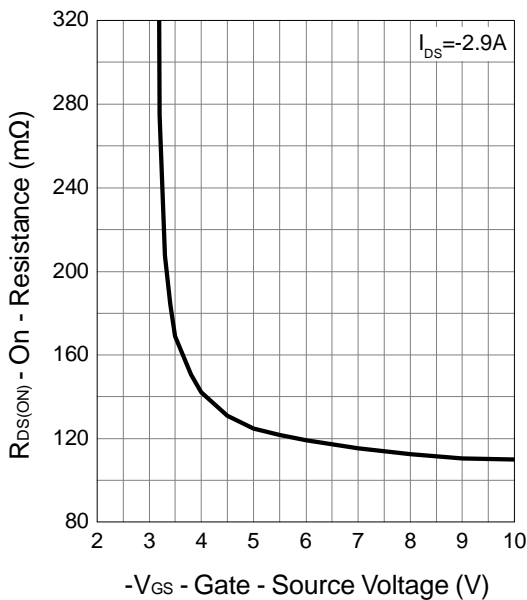
**Output Characteristics**



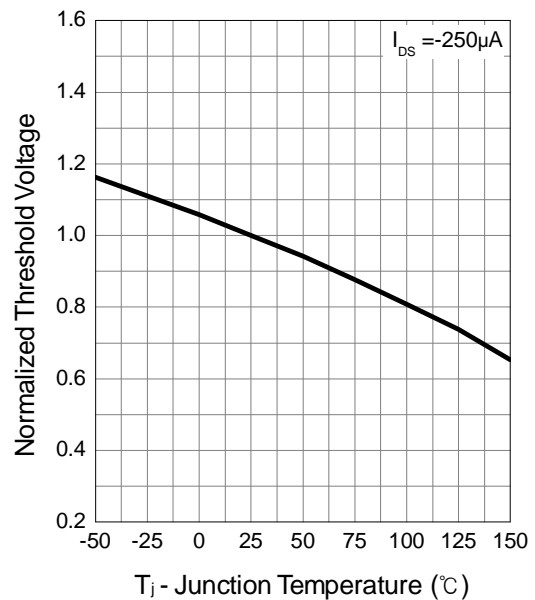
**Drain-Source On Resistance**



**Gate-Source On Resistance**



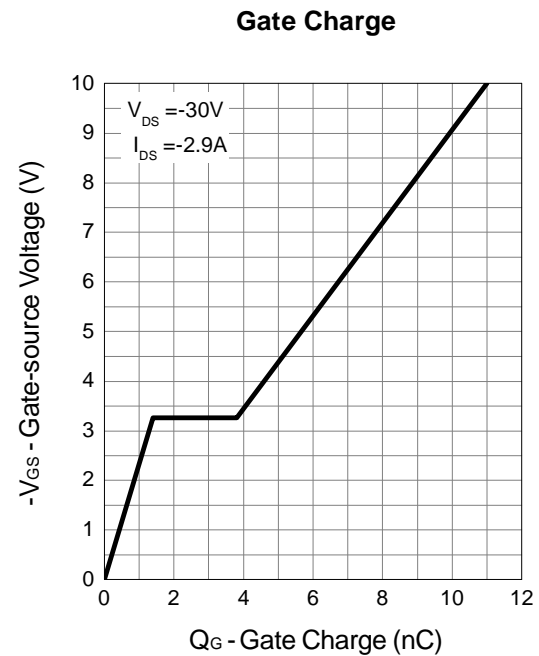
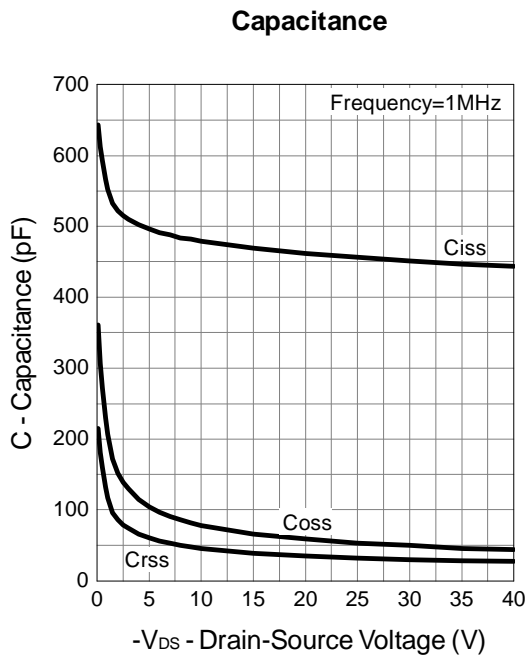
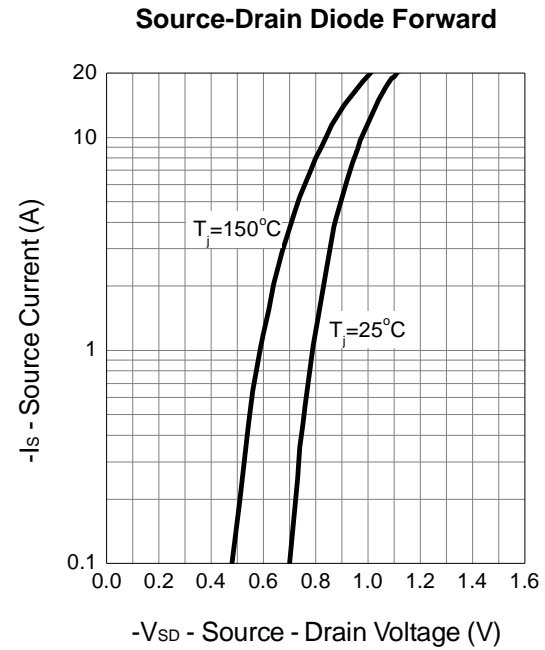
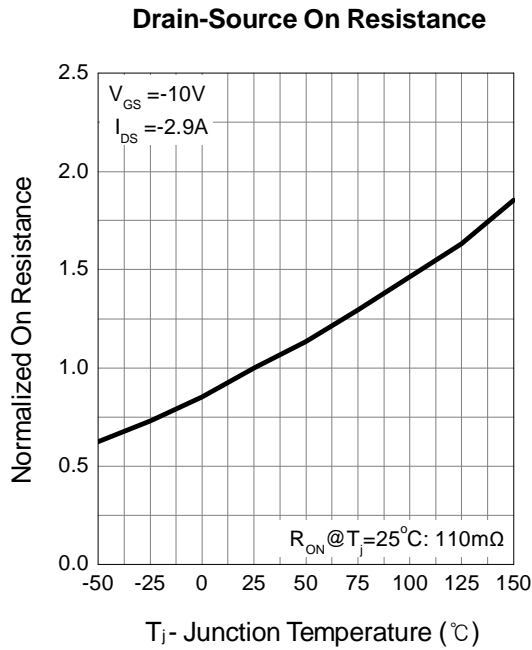
**Gate Threshold Voltage**



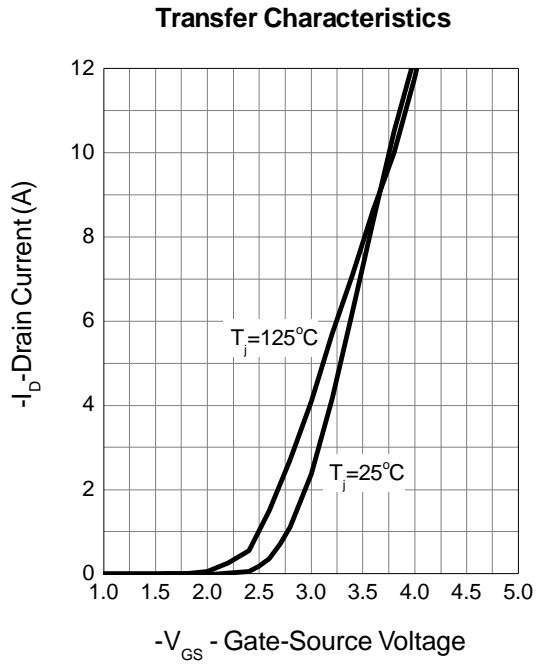


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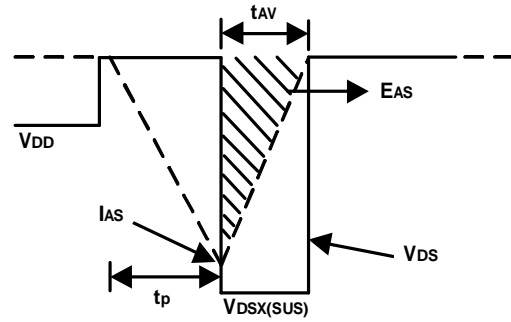
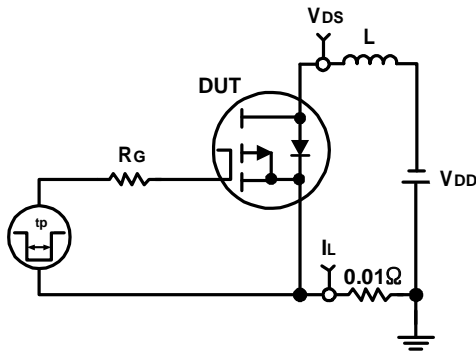
## Typical Operating Characteristics (Cont.)



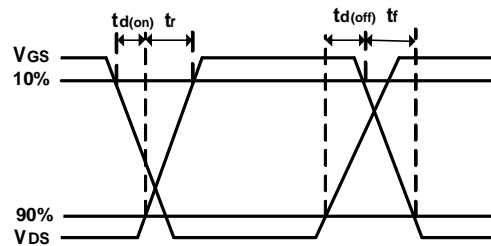
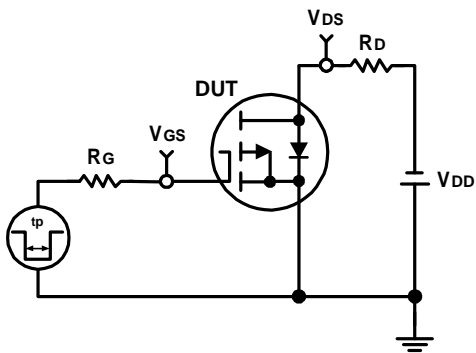
## Typical Operating Characteristics (Cont.)



## Avalanche Test Circuit and Waveforms

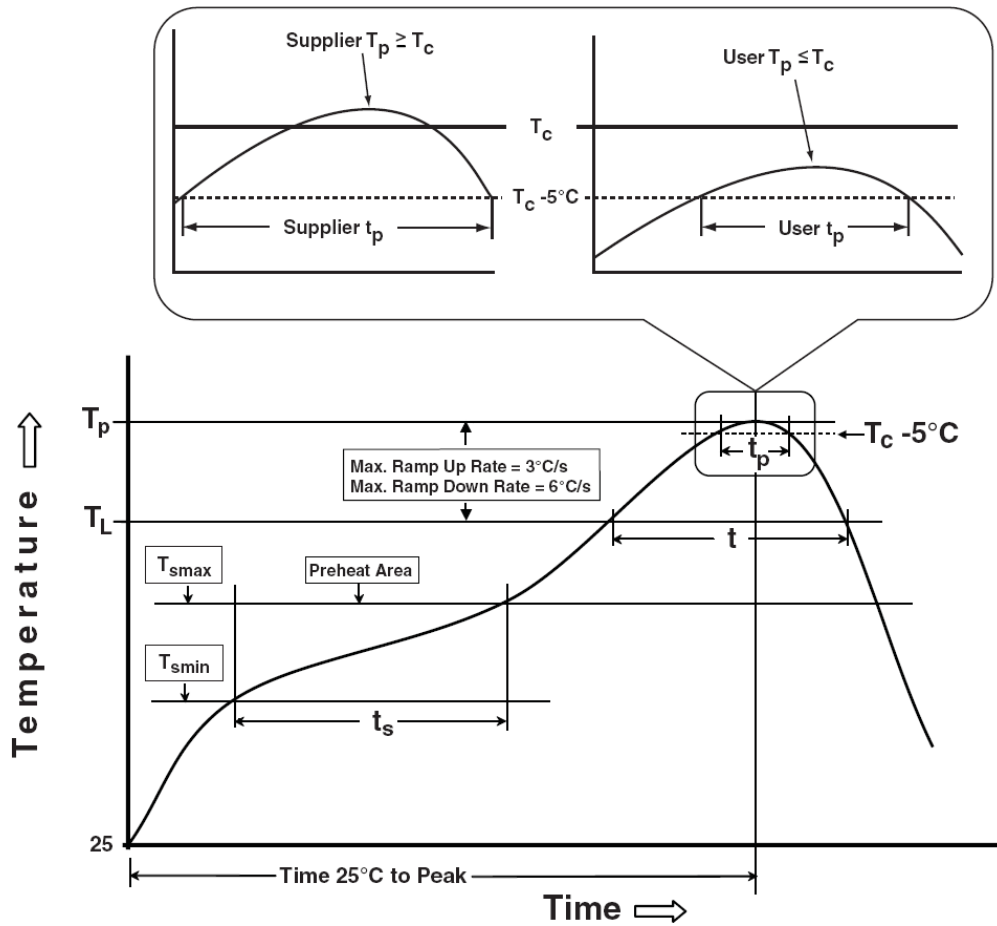


## Switching Time Test Circuit and Waveforms





## Classification Profile





# FTK2661L

## Classification Profile

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak Temperature min ( $T_{smin}$ ) Temperature max ( $T_{smax}$ ) Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ )	100 °C 150 °C 60-120 seconds	150 °C 200 °C 60-120 seconds
Average ramp-up rate ( $T_{smax}$ to $T_p$ )	3 °C /second max.	3 °C /second max.
Liquidous temperature ( $T_L$ ) Time at liquidous ( $t_L$ )	183 °C 60-150 seconds	217 °C 60-150 seconds
Peak package body Temperature ( $T_p$ )*	See Classification Temp in table 1	See Classification Temp in table 2
Time ( $t_p$ )** within 5 °C of the specified classification temperature ( $T_c$ )	20** seconds	30** seconds
Average ramp-down rate ( $T_p$ to $T_{smax}$ )	6 °C /second max.	6 °C /second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.
* Tolerance for peak profile Temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum. ** Tolerance for time at peak profile temperature ( $t_p$ ) is defined as a supplier minimum and a user maximum.		

Table 1. SnPb Eutectic Process – Classification Temperatures ( $T_c$ )

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

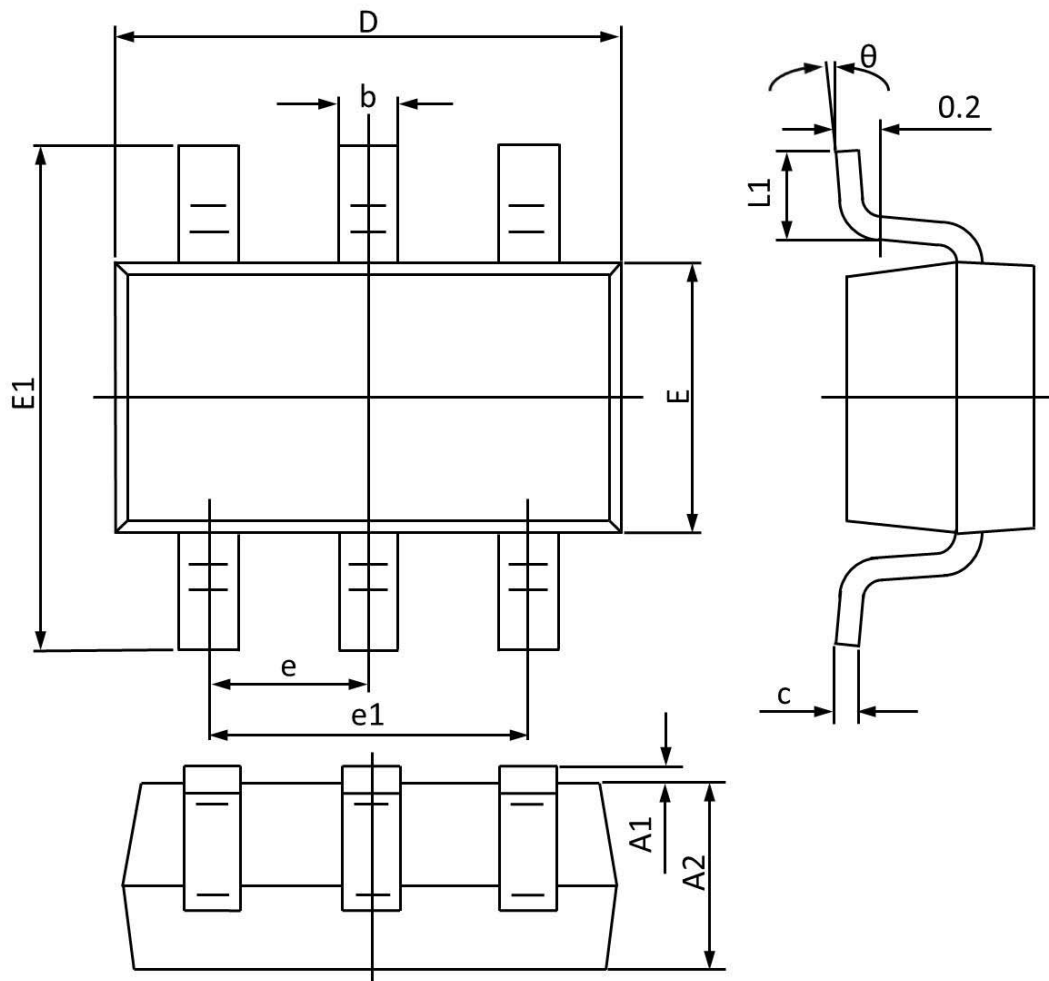
Table 2. Pb-free Process – Classification Temperatures ( $T_c$ )

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> 350-2000	Volume mm <sup>3</sup> >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm – 2.5 mm	260 °C	250 °C	245 °C
≥2.5 mm	250 °C	245 °C	245 °C

## Reliability Test Program

Test item	Method	Description
SOLDERABILITY	JESD-22, B102	5 Sec, 245 °C
HTRB	JESD-22, A108	1000 Hrs, 80% of VDS max @ $T_{jmax}$
HTGB	JESD-22, A108	1000 Hrs, 100% of VGS max @ $T_{jmax}$
PCT	JESD-22, A102	168 Hrs, 100%RH, 2atm, 121 °C
TCT	JESD-22, A104	500 Cycles, -65 °C ~ 150 °C

## SOT23-6 PACKAGE INFORMATION



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A1	0.000	0.100	0.000	0.004
A2	1.000	1.200	0.040	0.047
b	0.300	0.500	0.012	0.019
c	0.047	0.207	0.002	0.008
D	2.800	3.000	0.110	0.118
E	1.500	1.800	0.059	0.070
E1	2.600	3.000	0.103	0.118
e	0.950 TYP		0.037 TYP	
e1	1.900 TYP		0.075 TYP	
L1	0.250	0.550	0.010	0.021
$\theta$	0°	8°	0°	8°