


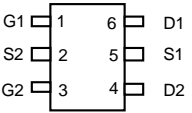


**TM04G03MI6**

**N+P-Channel Enhancement Mode Mosfet**

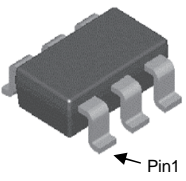
<p><b>General Description</b></p> <ul style="list-style-type: none"> <li>• Low <math>R_{DS(ON)}</math></li> <li>• RoHS and Halogen-Free Compliant</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Load switch</li> <li>• PWM</li> </ul>	<p><b>Product Summary</b></p> <p><b>N Channel</b>  <math>V_{DS} = 30V, I_D = 4.0A</math>  <math>R_{DS(ON)} = 29m\Omega (typ.) @ V_{GS} = 10V</math></p> <p><b>P Channel</b>  <math>V_{DS} = -30V, I_D = -4.0A</math>  <math>R_{DS(ON)} = 53m\Omega (typ.) @ V_{GS} = -10V</math></p> <p>100% UIS Tested                  100% <math>R_g</math> Tested</p> 
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**Top View**

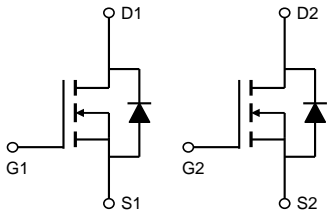


Marking: 4G03

**MI6:SOT-23-6L**



Pin1



**Absolute Maximum Ratings ( $T_A = 25^\circ C$  unless otherwise noted)**

Symbol	Parameter	Rating		Units
		N-Channel	P-Channel	
$V_{DS}$	Drain-Source Voltage	30	-30	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	$\pm 20$	V
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	4	-4.0	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	2	-2.5	A
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	20	-22	A
EAS	Single Pulse Avalanche Energy <sup>3</sup>	72	79	mJ
$I_{AS}$	Avalanche Current	21	-21	A
$P_D @ T_C = 25^\circ C$	Total Power Dissipation <sup>4</sup>	1.5	2.08	W
$T_{STG}$	Storage Temperature Range	-55 to 150	-55 to 150	$^\circ C$
$T_J$	Operating Junction Temperature Range	-55 to 150	-55 to 150	$^\circ C$

**Thermal Data**

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-Ambient <sup>1</sup>	---	85	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case <sup>1</sup>	---	50	$^\circ C/W$



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

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
<b>Off Characteristic</b>						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	30	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=30V, V_{GS}=0V,$	-	-	1.0	$\mu A$
$I_{GSS}$	Gate to Body Leakage Current	$V_{DS}=0V, V_{GS}= \pm 20V$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	1.0	1.5	2.5	V
$R_{DS(on)}$	Static Drain-Source on-Resistance <small>note2</small>	$V_{GS}=10V, I_D=4A$	-	29	38	m $\Omega$
		$V_{GS}=4.5V, I_D=3A$	-	45	65	
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS}=15V, V_{GS}=0V,$ $f=1.0MHz$	-	233	-	pF
$C_{oss}$	Output Capacitance		-	44	-	pF
$C_{rss}$	Reverse Transfer Capacitance		-	33	-	pF
$Q_g$	Total Gate Charge	$V_{DS}=15V, I_D=2A,$ $V_{GS}=10V$	-	3	-	nC
$Q_{gs}$	Gate-Source Charge		-	0.5	-	nC
$Q_{gd}$	Gate-Drain("Miller") Charge		-	0.8	-	nC
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-on Delay Time	$V_{DS}=15V,$ $I_D=4A, R_{GEN}=3\Omega,$ $V_{GS}=10V$	-	4	-	ns
$t_r$	Turn-on Rise Time		-	2.1	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	15	-	ns
$t_f$	Turn-off Fall Time		-	3.2	-	ns
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain to Source Diode Forward Current		-	-	4.0	A
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current		-	-	16	A
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS}=0V, I_S=4A$	-	-	1.2	V

Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. Pulse Test: Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 0.5\%$

**P-Channel Electrical Characteristics (T<sub>J</sub>=25 °C, unless otherwise noted)**

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
<b>Off Characteristic</b>						
V <sub>(BR)DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> = -250μA	-30	-	-	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = -20V, V <sub>GS</sub> =0V,	-	-	-1	μA
I <sub>GSS</sub>	Gate to Body Leakage Current	V <sub>DS</sub> =0V, V <sub>GS</sub> = ±12V	-	-	±100	nA
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> = -250μA	-1.0	-1.5	-2.5	V
R <sub>DS(on)</sub>	Static Drain-Source on-Resistance <small>note2</small>	V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3A	-	53	65	mΩ
		V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -2A	-	75	93	
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = -10V, V <sub>GS</sub> =0V, f=1.0MHz	-	393	-	pF
C <sub>oss</sub>	Output Capacitance		-	47	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		-	38	-	pF
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = -10V, I <sub>D</sub> = -2A, V <sub>GS</sub> = -4.5V	-	7.1	-	nC
Q <sub>gs</sub>	Gate-Source Charge		-	1.2	-	nC
Q <sub>gd</sub>	Gate-Drain("Miller") Charge		-	1.5	-	nC
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DD</sub> = -10V, I <sub>D</sub> = -3A, R <sub>G</sub> =1Ω, V <sub>GEN</sub> = -4.5V, R <sub>L</sub> =1.2Ω	-	9	-	ns
t <sub>r</sub>	Turn-on Rise Time		-	2.88	-	ns
t <sub>d(off)</sub>	Turn-off Delay Time		-	22.3	-	ns
t <sub>f</sub>	Turn-off Fall Time		-	3.9	-	ns
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain to Source Diode Forward Current		-	-	-4	A
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Forward Current		-	-	-12	A
V <sub>SD</sub>	Drain to Source Diode Forward Voltage	V <sub>GS</sub> =0V, I <sub>S</sub> = -3A	-	-	-1.2	V

Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%



N-Channel Typical Characteristics

Figure 1: Output Characteristics

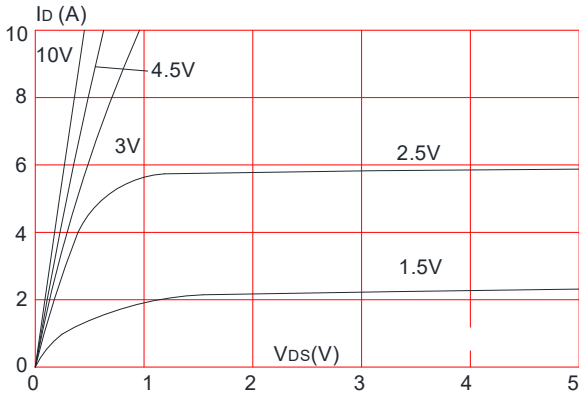


Figure 2: Typical Transfer Characteristics

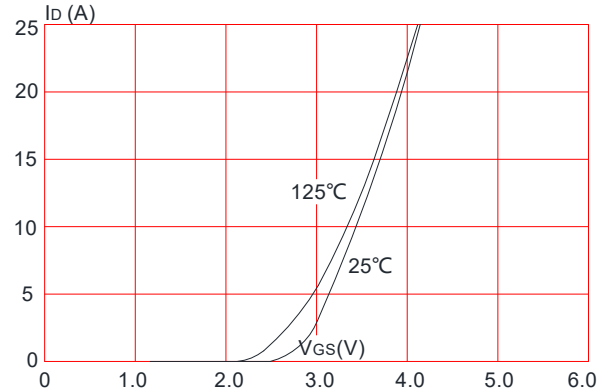


Figure 3: On-resistance vs. Drain Current

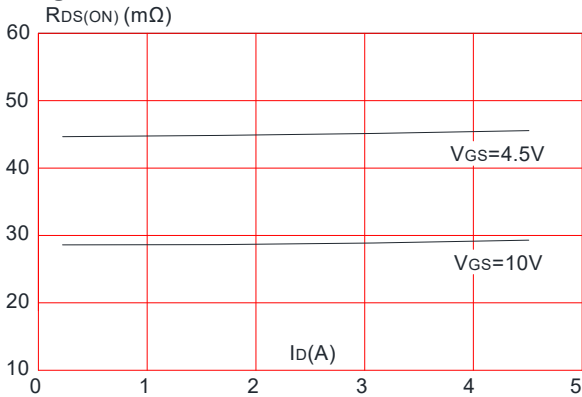


Figure 4: Body Diode Characteristics

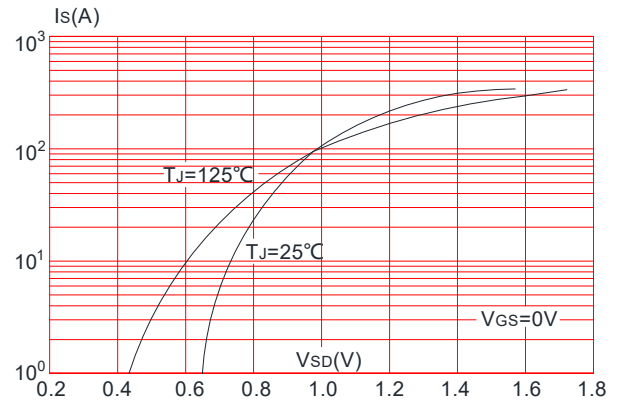


Figure 5: Gate Charge Characteristics

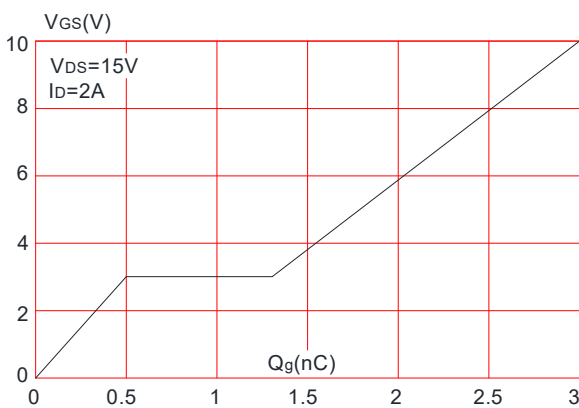
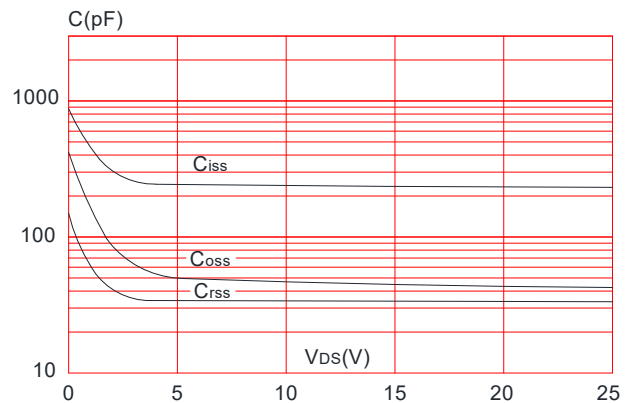


Figure 6: Capacitance Characteristics





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Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

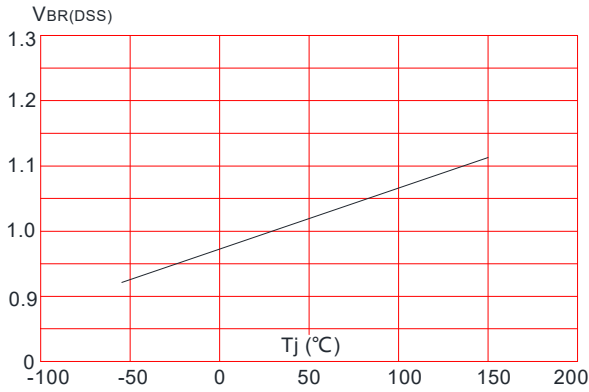


Figure 9: Maximum Safe Operating Area

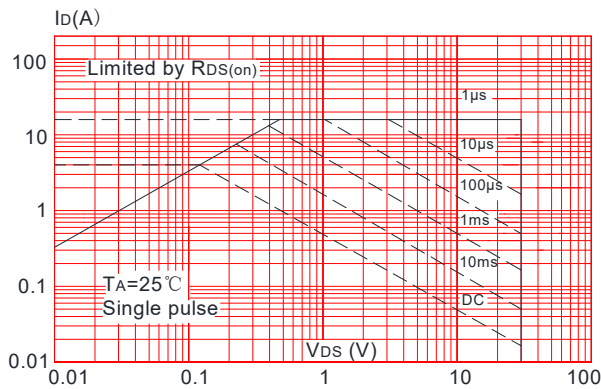


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

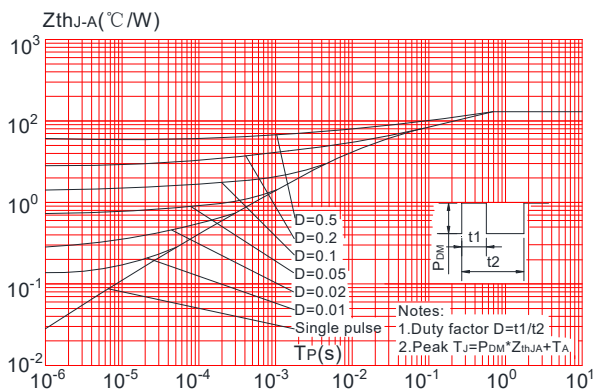


Figure 8: Normalized on Resistance vs. Junction Temperature

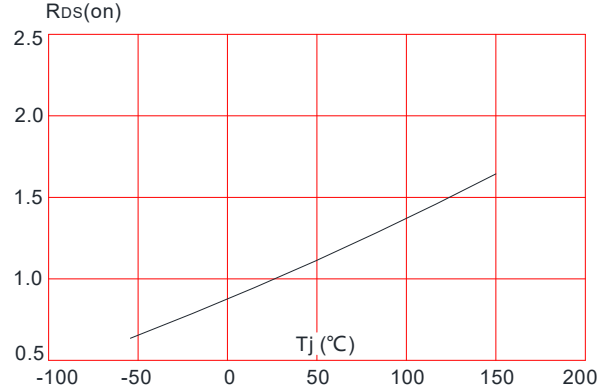
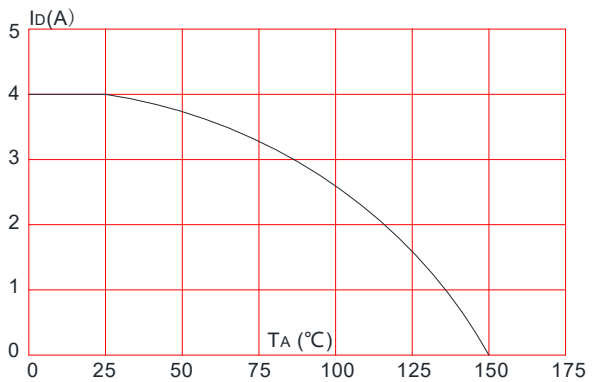


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature





P-Typical Characteristics

Fig 1: Output Characteristics

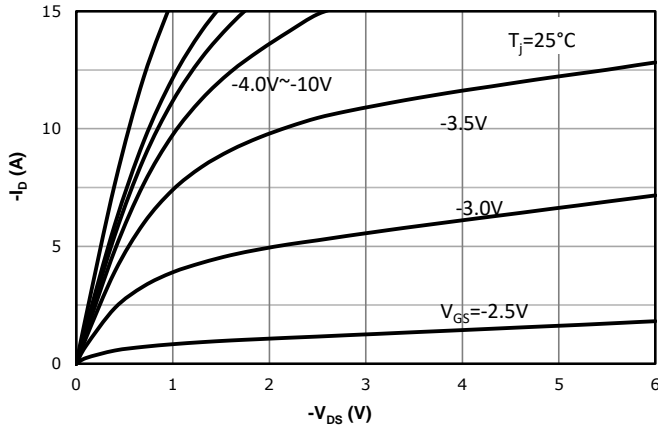


Fig 2: Transfer Characteristics

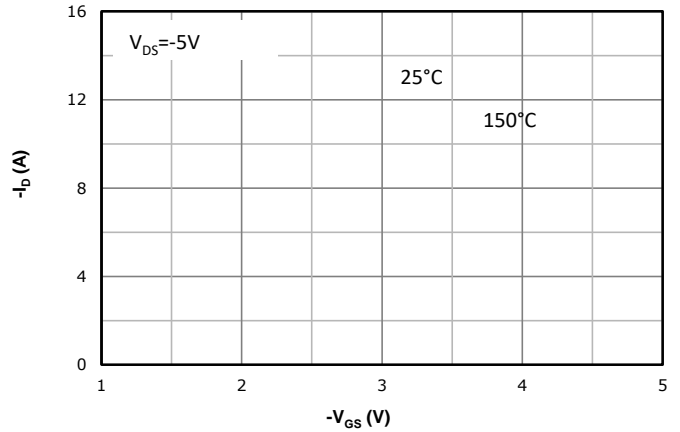


Fig 3:  $R_{ds(on)}$  vs Drain Current and Gate Voltage

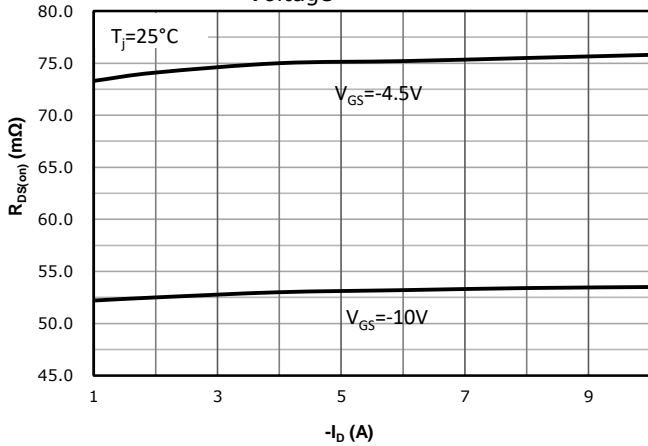


Fig 4:  $R_{ds(on)}$  vs Gate Voltage

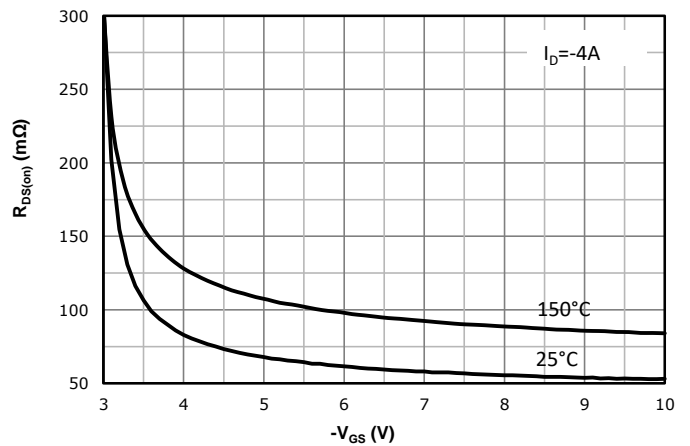


Fig 5:  $R_{ds(on)}$  vs. Temperature

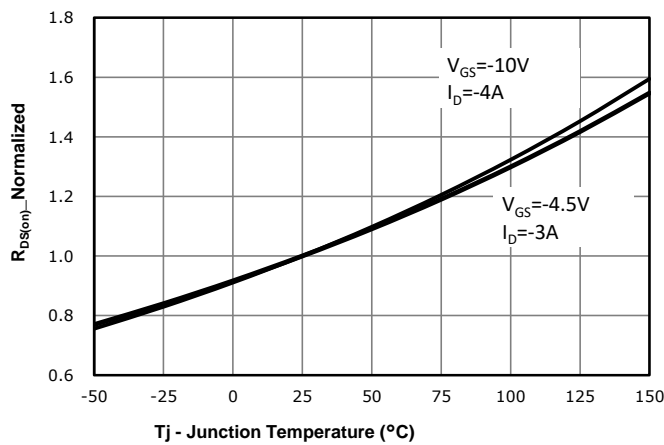
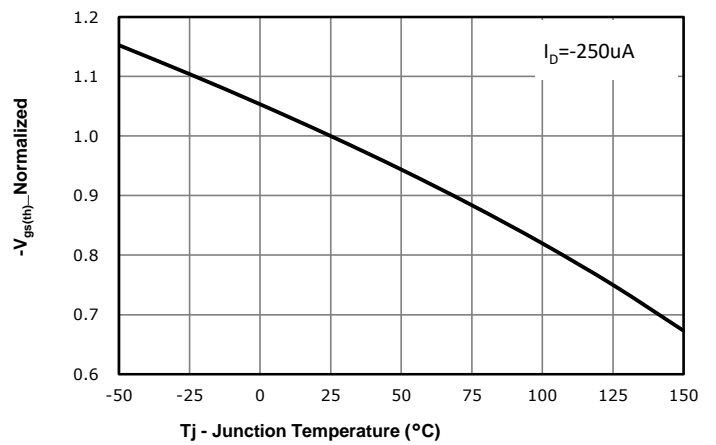


Fig 6:  $V_{gs(th)}$  vs. Temperature





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Fig 7: BVdss vs. Temperature

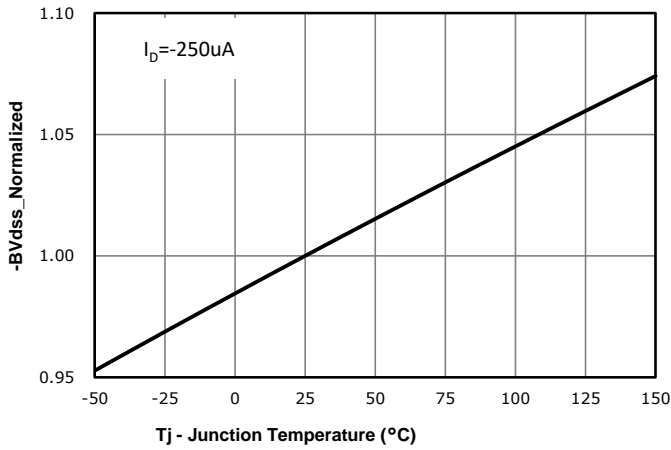


Fig 8: Body-diode Forward Characteristics

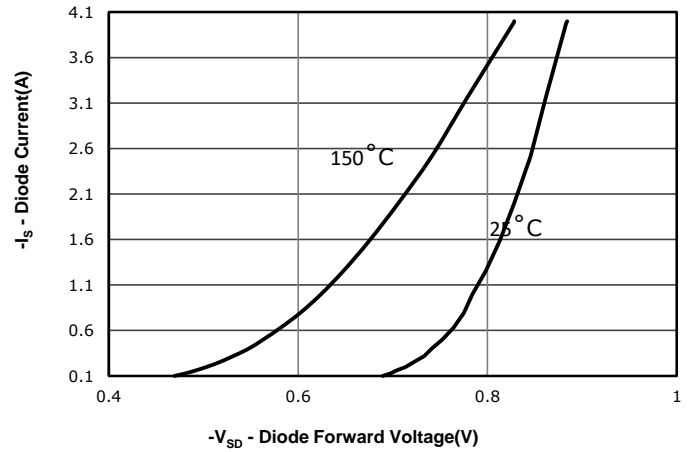


Fig 9: Gate Charge Characteristics

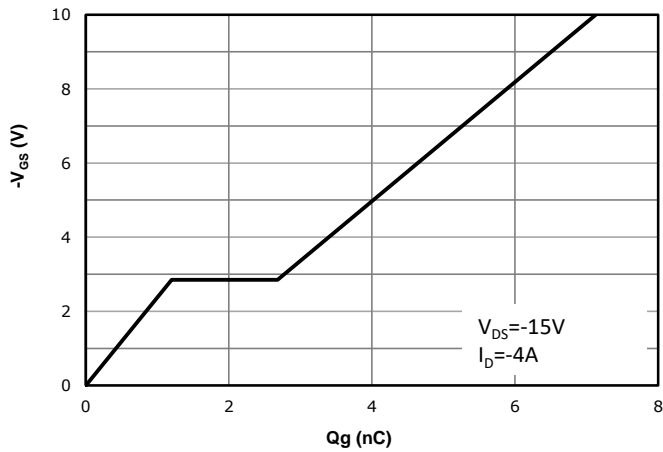


Fig 10: Capacitance Characteristics

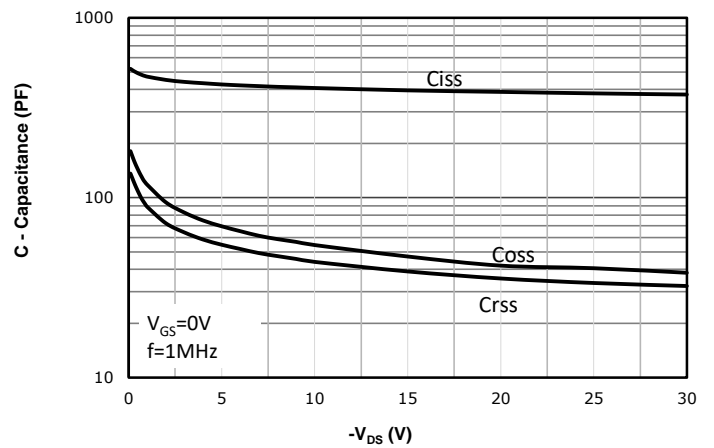


Fig 11: Drain Current Derating

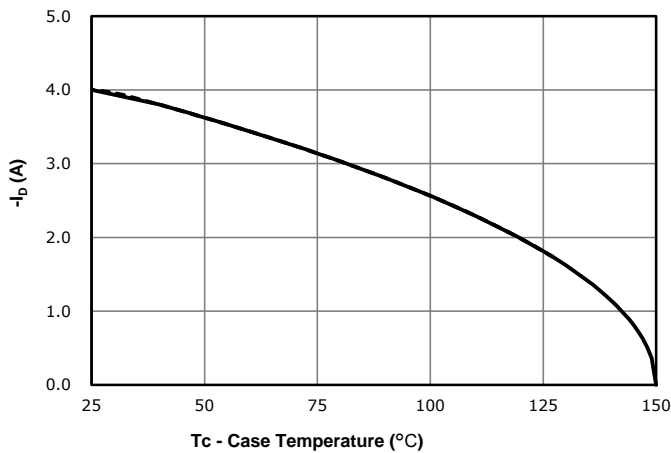


Fig 12: Power Dissipation

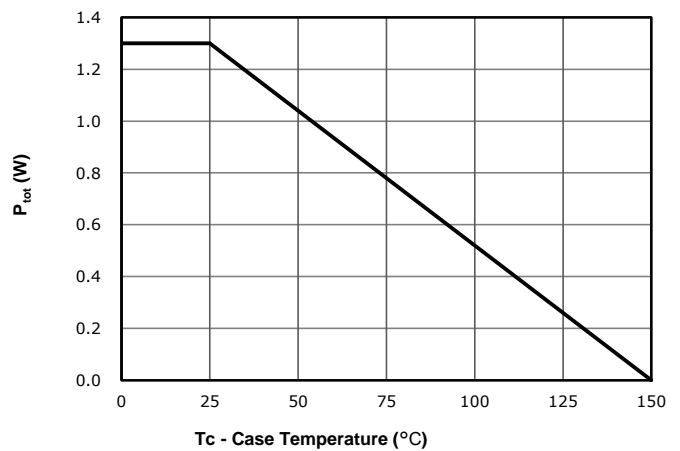




Fig 13: Safe Operating Area

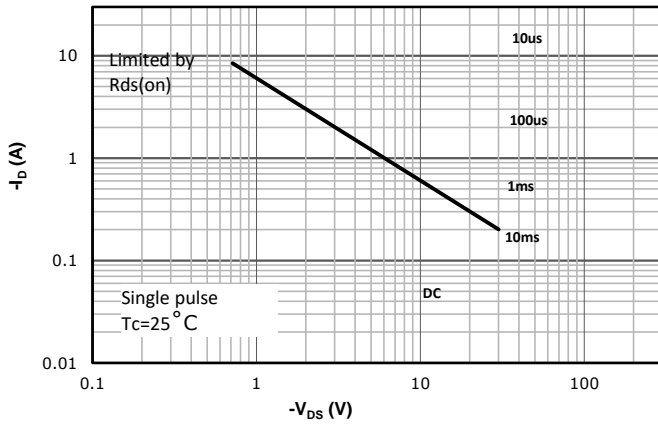
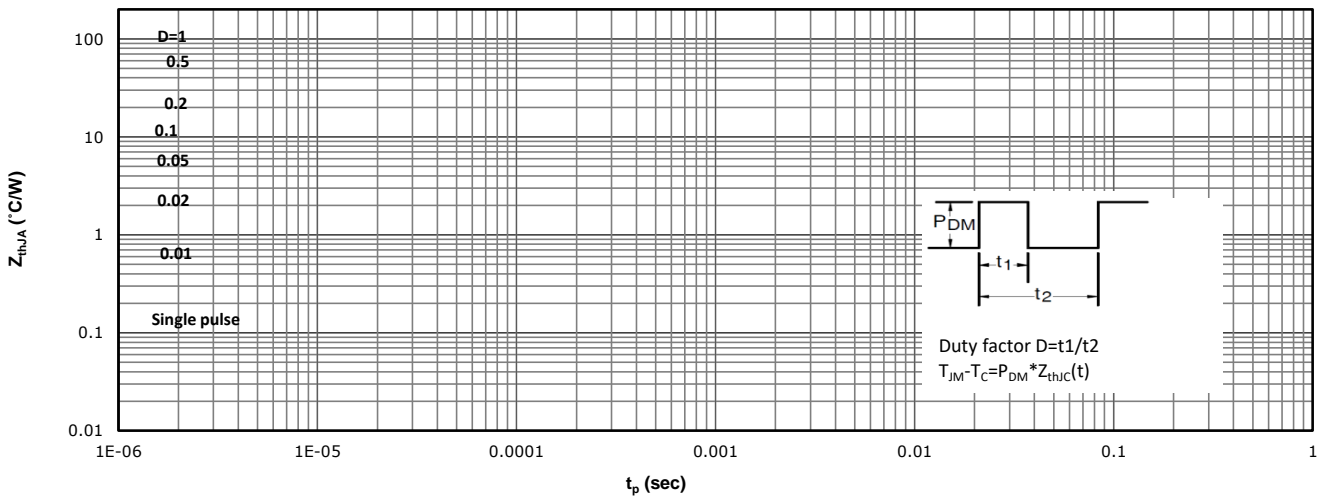
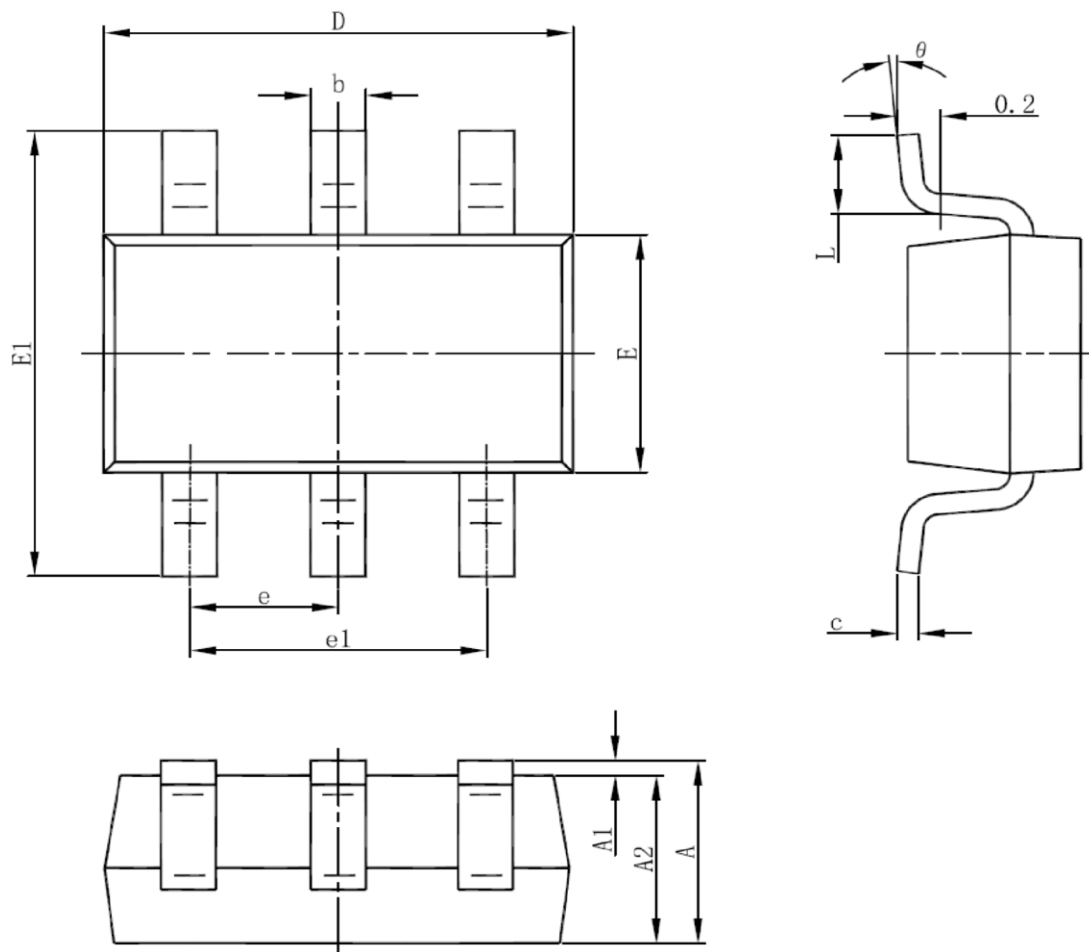


Fig 14: Max. Transient Thermal Impedance





## Package Mechanical Data:SOT-23-6L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
$\theta$	0°	8°	0°	8°

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