

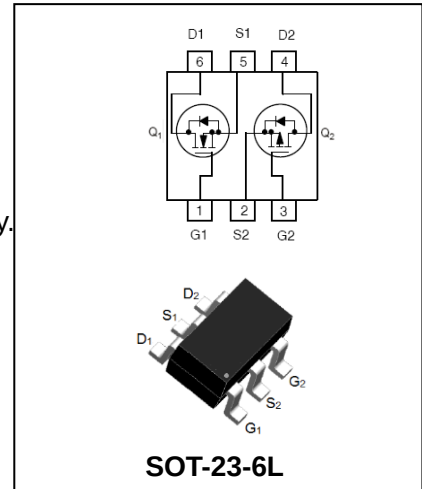
Power MOSFET

TBL4167-6L

FEATURES

- Complementary N-Channel and P-Channel MOSFET.
- Leading Edge Trench Technology for Low On Resistance.
- Reduced Gate Charge to Improve Switching Response.
- Independently Connected Devices to Provide Design Flexibility.
- Halogen free
- Qualified to AEC-Q101 standards for high reliability

HF



ORDERING INFORMATION

Type No.	Marking	Package Code
TBL4167-6L	TA	SOT-23-6L

MAXIMUM RATING – Total Device @ Ta=25°C unless otherwise specified

Symbol	Parameter	Value	Units
$P_D^{(Note1)}$	Power Dissipation	0.9	W
I_S	Source Current (Body Diode)	± 0.9	A
$R_{\theta JA}^{(Note1)}$	Thermal resistance, Junction-to-Ambient	140	°C/W
T_J, T_{STG}	Junction and Storage Temperature	-55 to +150	°C

Maximum Ratings N-CHANNEL –Q₁ @ Ta=25°C unless otherwise specified

Symbol	Parameter	Value	Units
V_{DSS}	Drain-Source voltage	30	V
V_{GSS}	Gate -Source voltage	± 12	V
$I_D^{(Note1)}$	Drain current	continuous $T_A = 25^\circ\text{C}$ continuous $T_A = 85^\circ\text{C}$	A
I_{DM}	Pulsed Drain Current	$t_p = 10\text{ s}$	A

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ELECTRICAL CHARACTERISTICS—Q₁ @ Ta=25°C unless otherwise specified

Parameter	Symbol	Test conditions	MIN	TYP	MAX	UNIT
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=250\mu A$	30	-	-	V
Gate Threshold Voltage	$V_{GS(th)}^{(Note2)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	0.6	1	1.4	
Gate-body Leakage Forward Reverse	I_{GSS}	$V_{DS}=0V, V_{GS}=12V$ $V_{DS}=0V, V_{GS}=-12V$	-	-	100 -100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=24V, V_{GS}=0V$	-	-	1	μA
Forward transconductance	$g_{FS}^{(Note2)}$	$V_{DS}=15V, I_D=2.6A$	-	2.6	-	S
Static drain-Source on-resistance	$R_{DS(ON)}^{(Note2)}$	$V_{GS}=4.5V, I_D=2.6A$	-	-	90	m Ω
		$V_{GS}=2.5V, I_D=2.2A$	-	-	125	
Input capacitance	C_{ISS}	$V_{DS}=15V, V_{GS}=0V, f=1.0M$ Hz	-	295	-	pF
Output capacitance	C_{OSS}		-	48	-	
Reverse transfer capacitance	C_{RSS}		-	27	-	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5 V$ $V_{DS} = 15 V$ $I_D = 2.0 A$	-	3.7	5.5	nC
Threshold Gate Charge	$Q_{G(TH)}$		-	0.6	-	
Gate-to-Source Gate Charge	Q_{GS}		-	0.9	-	
Gate-to-Drain "Miller" Charge	Q_{GD}		-	0.8	-	
Turn-On Delay Time	$t_{D(ON)}^{(Note3)}$	$V_{DD} = 15V$ $I_D = 1A$ $V_{GS}=4.5V$ $R_{GEN}= 6\Omega$	-	7	-	ns
Rise Time	$t_r^{(Note3)}$		-	4	-	
Turn-Off Delay Time	$t_{D(OFF)}^{(Note3)}$		-	14	-	
Fall Time	$t_f^{(Note3)}$		-	2	-	
Forward Diode Voltage	V_{SD}	$V_{GS}=0V, T_J=25^\circ C,$ $I_S=0.9 A$	-	0.7	1.2	V
Reverse Recovery Time	t_{RR}	$V_{GS}=0V$ $dI_S/dt=100 A/s$ $I_S=0.9 A$	-	8	-	ns
Charge Time	t_a		-	5	-	
Discharge Time	t_b		-	3	-	
Reverse Recovery Charge	Q_{RR}		-	3	-	nC

Maximum Ratings P-CHANNEL—Q₂ @ Ta=25°C unless otherwise specified

Symbol	Parameter	Value	Units
V_{DSS}	Drain-Source voltage	-30	V
V_{GSS}	Gate -Source voltage	± 12	V
$I_D^{(Note1)}$	Drain current $T_A = 25^\circ C$	-2.2	A
	$T_A = 70^\circ C$	-1.6	
I_{DM}	Pulsed Drain Current	-10	A

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ELECTRICAL CHARACTERISTICS—Q₂ @ Ta=25°C unless otherwise specified

Parameter	Symbol	Test conditions	MIN	TYP	MAX	UNIT
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-30	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$ (Note2)	$V_{DS}=V_{GS}, I_D=-250\mu A$	-0.6	-0.95	-1.3	
Gate-body Leakage Forward Reverse	I_{GSS}	$V_{DS}=0V, V_{GS}=12V$ $V_{DS}=0V, V_{GS}=-12V$	-	-	100 -100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=-30V, V_{GS}=0V$	-	-	-1	μA
Forward transconductance	g_{FS} (Note2)	$V_{DS}=-15V, I_D=-1.9A$	-	2.6	-	S
Static drain-Source on-resistance	$R_{DS(ON)}$ (Note2)	$V_{GS}=-4.5V, I_D=-2.2A$ $V_{GS}=-2.5V, I_D=-2.2A$	-		170 300	m Ω
Input capacitance	C_{ISS}	$V_{DS}=-15V, V_{GS}=0V, f=1.0$ MHz	-	419	-	pF
Output capacitance	C_{OSS}		-	51	-	
Reverse transfer capacitance	C_{RSS}		-	26	-	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -4.5 V$ $V_{DS} = -15 V$ $I_D = -2.0 A$	-	3.9	6	nC
Threshold Gate Charge	$Q_{G(TH)}$		-	0.6	-	
Gate-to-Source Gate Charge	Q_{GS}		-	1.0	-	
Gate-to-Drain "Miller" Charge	Q_{GD}		-	1.0	-	
Turn-On Delay Time	$t_{D(ON)}$ (Note3)	$V_{DD} = -15V$ $I_D = -1A$ $V_{GS} = -4.5V$ $R_{GEN} = 6\Omega$	-	8	-	ns
Rise Time	t_r (Note3)		-	8	-	
Turn-Off Delay Time	$t_{D(OFF)}$ (Note3)		-	22	-	
Fall Time	t_f (Note3)		-	8	-	
Forward Diode Voltage	V_{SD}	$V_{GS}=0V, T_J=25^\circ C,$ $I_S=-1 A$	-	-	-1.2	V
Reverse Recovery Time	t_{RR}	$V_{GS}=0V$ $dI_S/dt=100 A/s$ $I_S=-0.9 A$	-	12	-	ns
Charge Time	t_a		-	10	-	
Discharge Time	t_b		-	2	-	
Reverse Recovery Charge	Q_{RR}		-	7	-	nC

Note1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq[1 oz] including traces).

2. Pulse Test: pulse width _ 300 _s, duty cycle _ 2%.

3. Switching characteristics are independent of operating junction temperatures.

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TYPICAL CHARACTERISTICS @ $T_a=25^{\circ}\text{C}$ unless otherwise specified

N-CHANNEL -Q₁

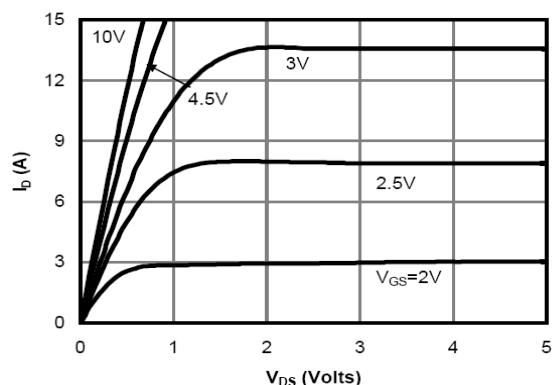


Fig 1: On-Region Characteristics

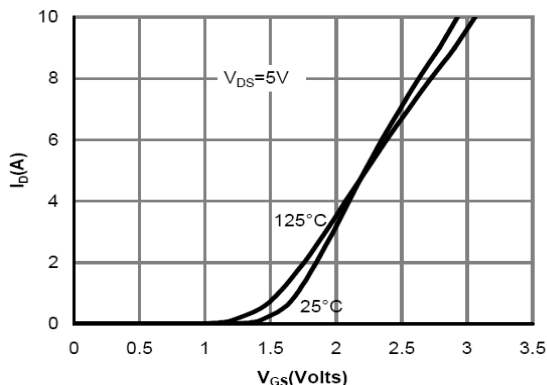


Figure 2: Transfer Characteristics

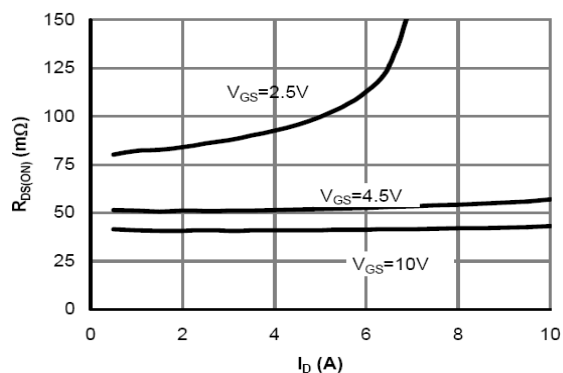


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

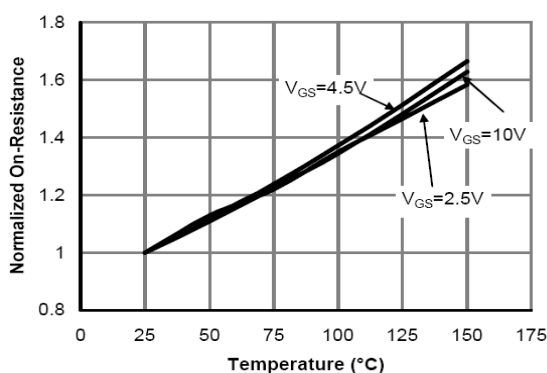


Figure 4: On-Resistance vs. Junction Temperature

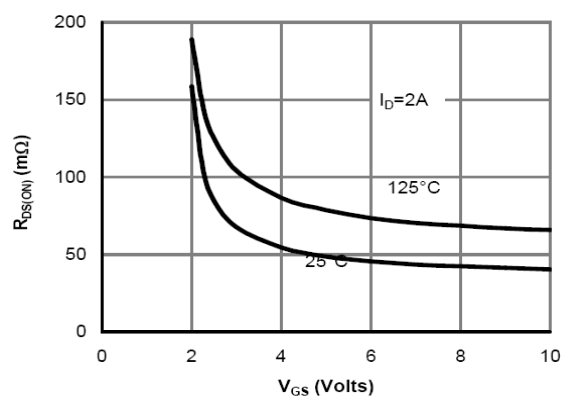


Figure 5: On-Resistance vs. Gate-Source Voltage

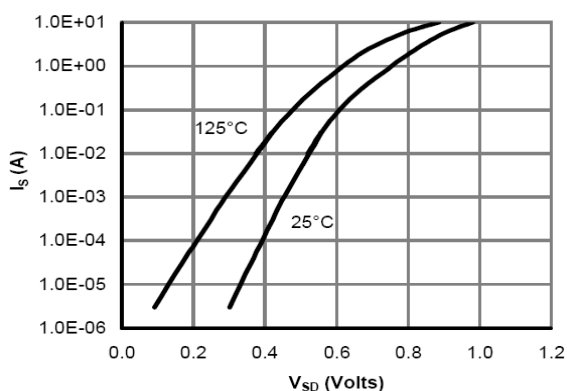


Figure 6: Body-Diode Characteristics

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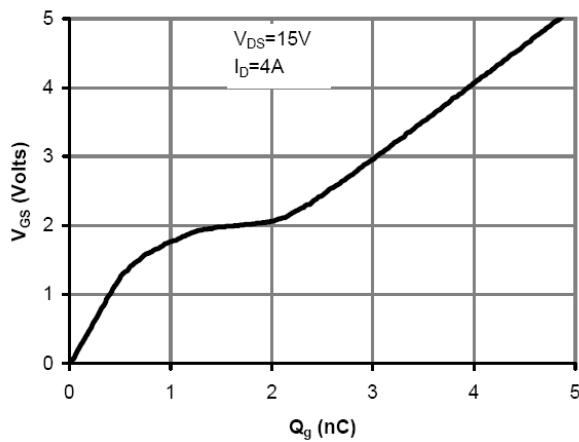


Figure 7: Gate-Charge Characteristics

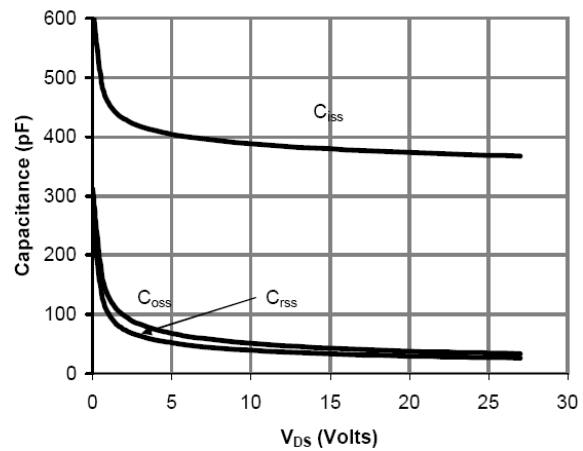


Figure 8: Capacitance Characteristics

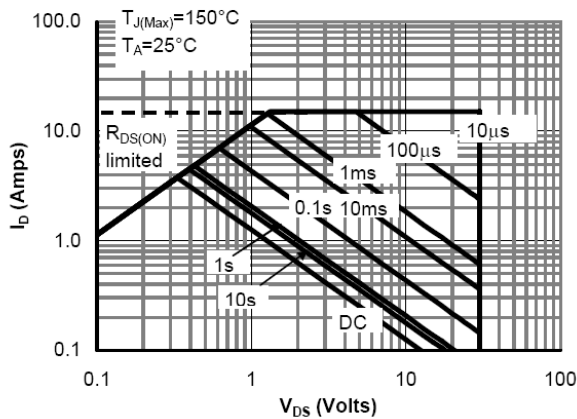


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

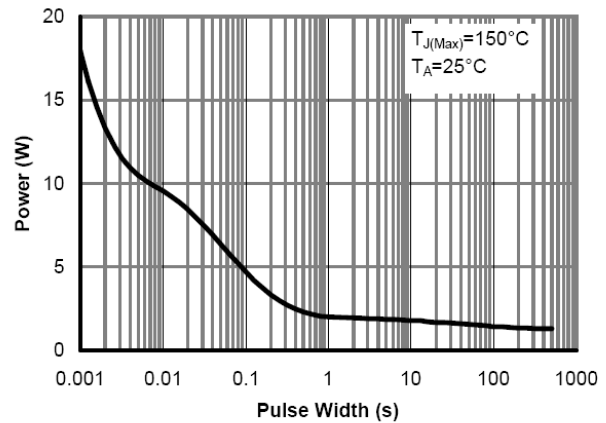


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

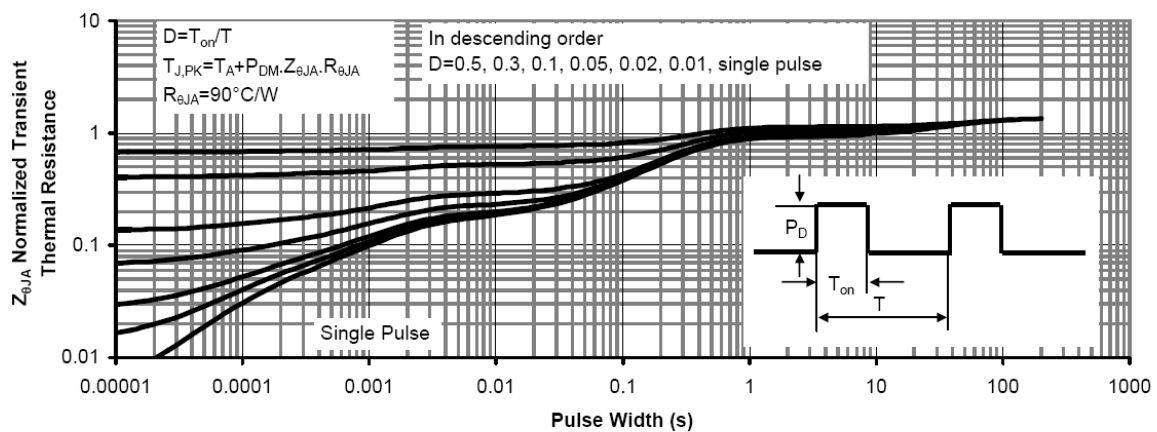


Figure 11: Normalized Maximum Transient Thermal Impedance

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P-CHANNEL $-Q_2$

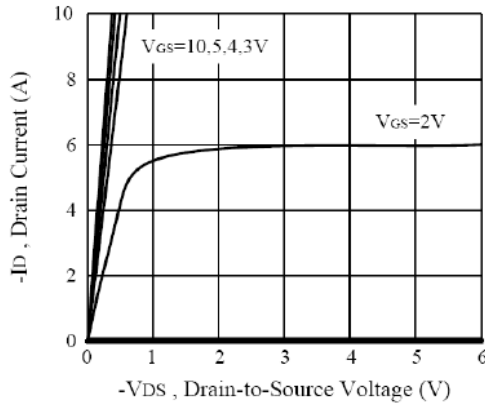


Figure 1. Output Characteristics

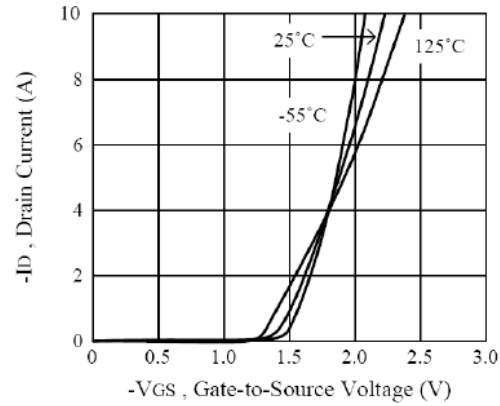


Figure 2. Transfer Characteristics

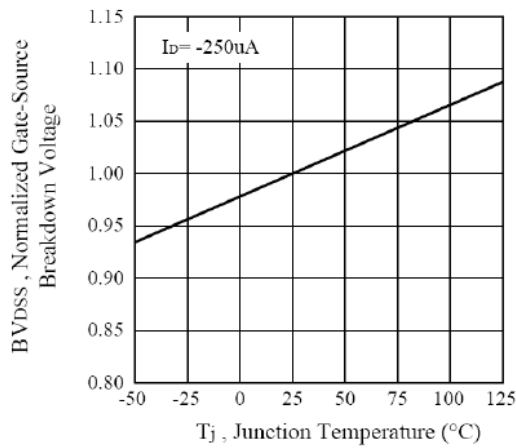


Figure 6. Breakdown Voltage Variation with Temperature

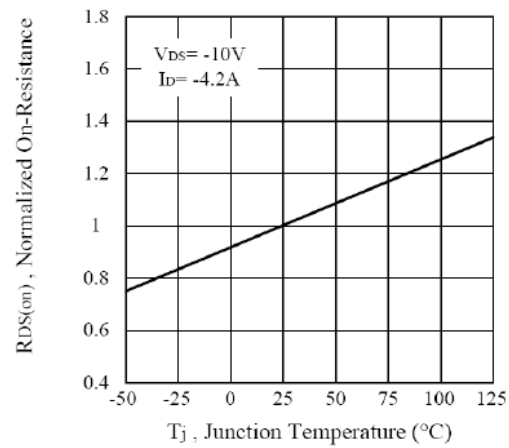


Figure 4. On-Resistance Variation with Temperature

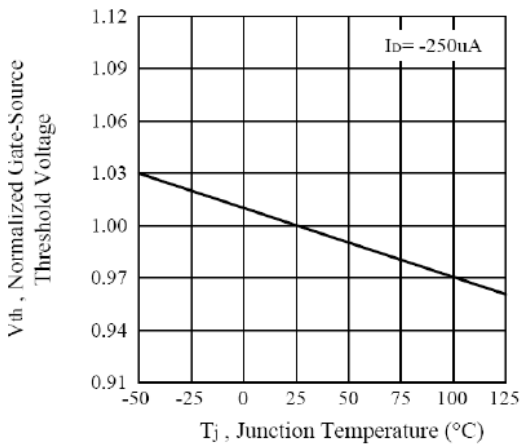


Figure 5. Gate Threshold Variation with Temperature

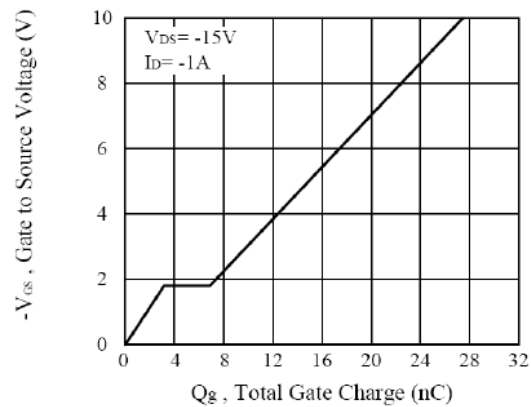


Figure 7. Gate Charge

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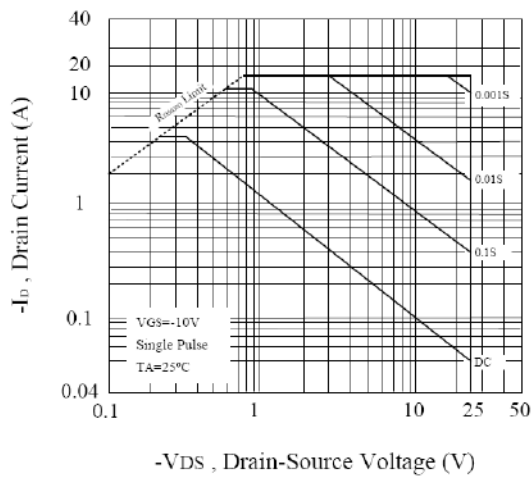


Figure 9. Maximum Safe Operating Area

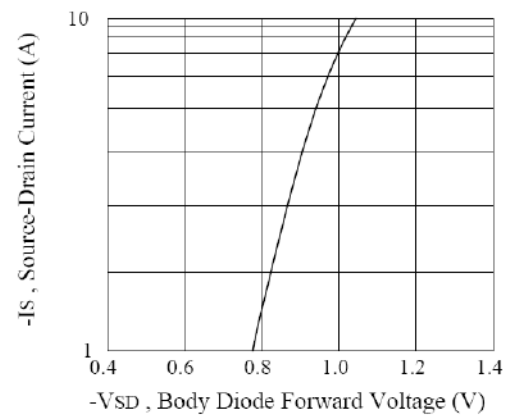


Figure 8. Body Diode Forward Voltage Variation with Source Current

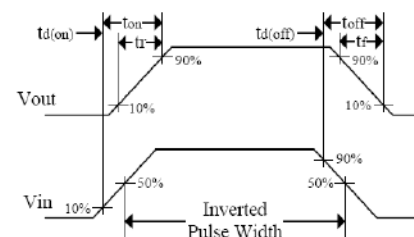
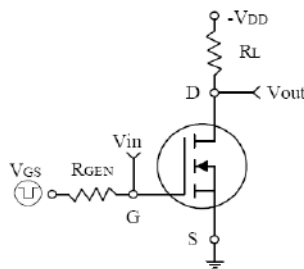


Figure 10. Switching Test Circuit and Switching Waveforms

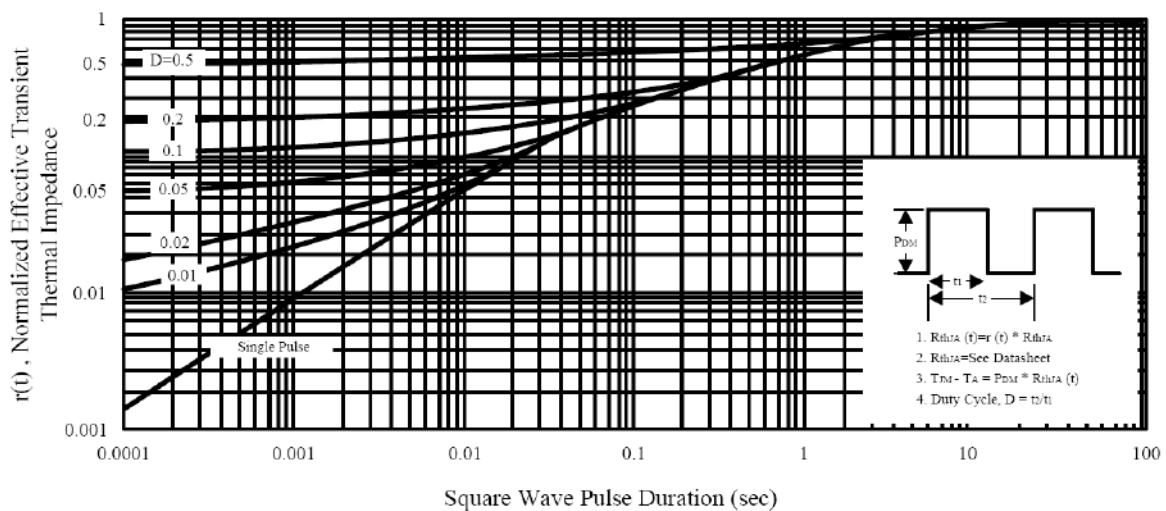


Figure 11. Normalized Thermal Transient Impedance Curve

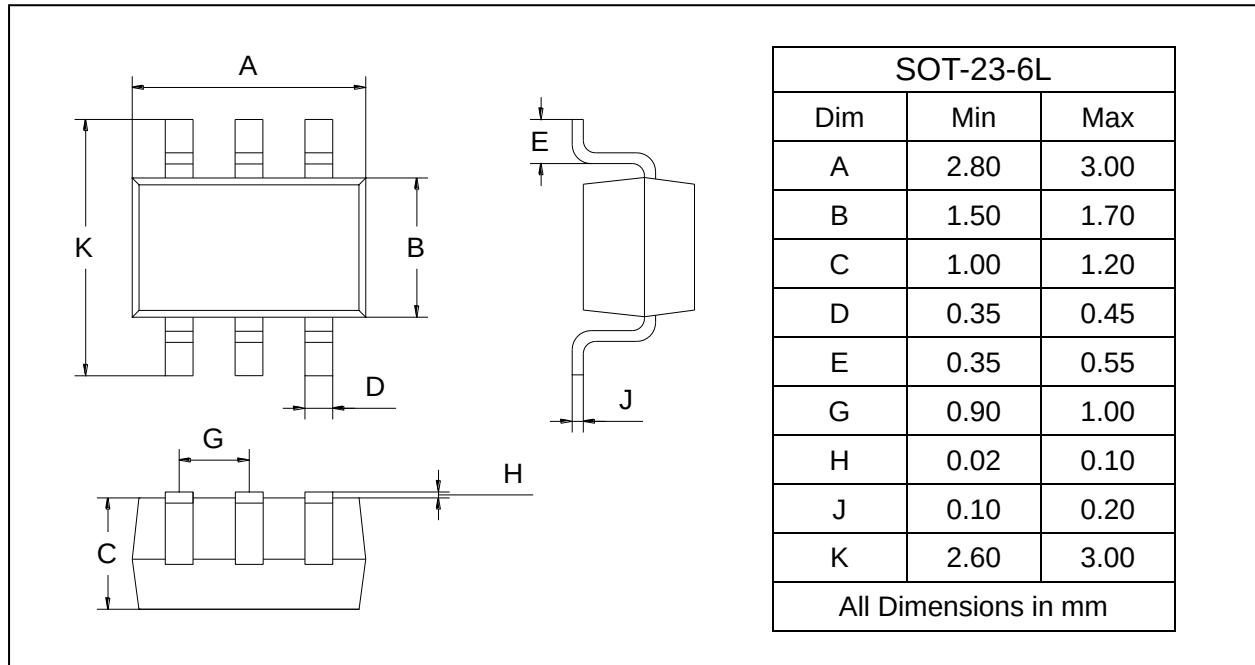
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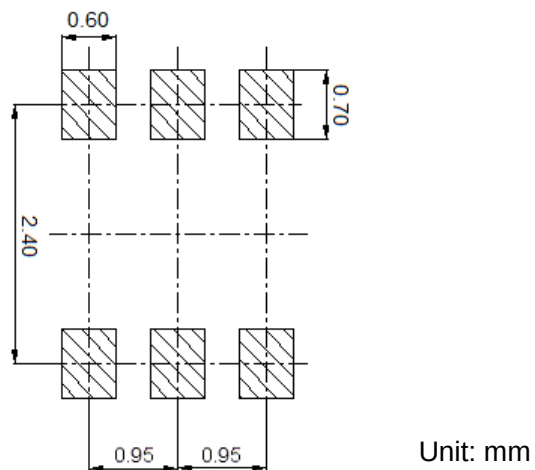
PACKAGE OUTLINE

Plastic surface mounted package

SOT-23-6L



SOLDERING FOOTPRINT



PACKAGE INFORMATION

Device	Package	Shipping
TBL4167-6L	SOT-23-6L	3000 pcs / Tape & Reel