



**WANSEMI**  
万芯半导体

**WP0406**

# **Enhancement Mode N+P-Channel Power MOSFET**

**SOT23-6/N+PMOS/40V/ $\pm 20V$ /1.5V/4A/45.8m $\Omega$**

**-40V/ $\pm 20V$ /-1.75V/-4A/98.8m $\Omega$**

**Rev0.5**

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## 40V N+P-Channel MOSFET

### 1.Features

- ◆ High power and current handling capability
- ◆ Lead free product is acquired
- ◆ Fast switching
- ◆ Surface mount package

#### ◆ N-Channel

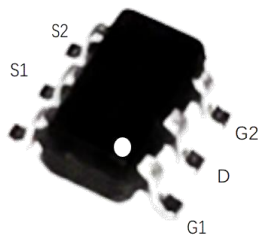
$V_{DS}$	$R_{DS(on)}$ Typ.	$I_D$
40V	45.8mΩ @ 10V	4A
	61.5mΩ @ 4.5V	

#### ◆ P-Channel

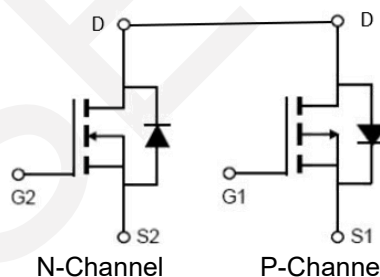
$V_{DS}$	$R_{DS(on)}$ Typ.	$I_D$
-40V	98.8mΩ @ -10V	-4A
	138.5mΩ @ -4.5V	

### 2.Applications

- ◆ Power Switching Application
- ◆ Load Switching



SOT23-06  
Pin Description



Schematic Diagram

### 3.Package Marking and Ordering Information

Part no.	Marking	Package	PCS/Reel	PCS/CTN.
WP0406	0406	SOT23-6	3,000	180,000

### 4.Absolute Max Ratings at Ta=25°C (Note1)

Parameter		Symbol	N-channel	P-channel	Units
Drain to Source Voltage		$V_{DSS}$	40	-40	V
Gate to Source Voltage		$V_{GSS}$	±20	±20	V
Drain Current (DC),	TA=25 °C	$I_D$	4	-4	A
	TA=70 °C	$I_D$	2.8	-2.8	A
Drain Current (Pulse), PW≤300μs		$I_{DM}$	16	-16	A
Avalanche Energy, Single Pulsed		$E_{AS}$	6.7	10.3	mJ
Total Dissipation	TA=25 °C	$P_D$	0.6	0.6	W
Junction Temperature		$T_J$	150	150	°C

Parameter	Symbol	N-channel	P-channel	Units
Storage Temperature	$T_{stg}$	-55 to +150	-55 to +150	°C

Note 1: Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### 5. Thermal Resistance Ratings (Note 2)

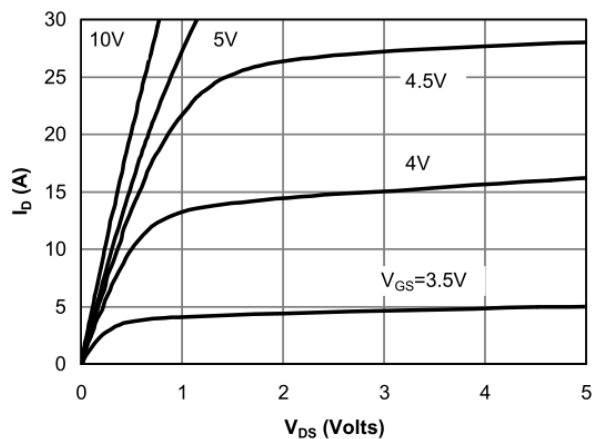
Parameter	Symbol	Value	Unit
Maximum Junction-to-Ambient	$R_{\theta JA}$	192	°C/W

Note 2: When mounted on 1 inch square copper board  $t \leq 10\text{sec}$  The value in any given application depends on the user's specific board design.

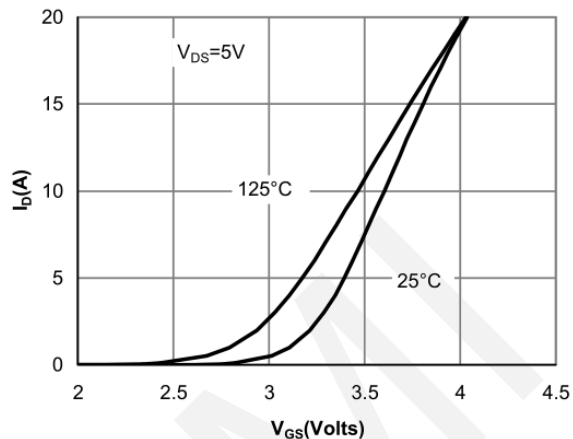
### 6. NMOS Electrical Characteristics at $T_a=25^\circ\text{C}$ (Note 3)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Drain to Source Breakdown Voltage	$V_{(BR)DSS}$	$I_D = 250\mu\text{A}$ , $V_{GS} = 0\text{V}$	40			V
Zero-Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 40\text{V}$ , $V_{GS} = 0\text{V}$			1	$\mu\text{A}$
Gate to Source Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0\text{V}$			$\pm 100$	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}$ , $I_{DS}=250\mu\text{A}$	1.0	1.5	2.5	V
Static Drain to Source On-State Resistance	$R_{DS(on)}$	$I_D = 3\text{A}$ , $V_{GS} = 10\text{V}$		45.8	60	m $\Omega$
		$I_D = 3\text{A}$ , $V_{GS} = 4.5\text{V}$		61.5	81	m $\Omega$
Input Capacitance	$C_{iss}$	$V_{GS}=0\text{V}$ , $V_{DS}=15\text{V}$ , Frequency=1.0MHz		371	-	pF
Output Capacitance	$C_{oss}$			170	-	pF
Reverse Transfer Capacitance	$C_{rss}$			58	-	pF
Turn-ON Delay Time	$t_{d(on)}$	$V_{DD} = 20\text{V}$ $V_{GS} = 10\text{V}$ $R_{GEN} = 2.5\Omega$ $I_D = 4\text{A}$		6.8	-	ns
Rise Time	$t_r$			40.6	-	ns
Turn-OFF Delay Time	$t_{d(off)}$			13.4	-	ns
Fall Time	$t_f$			2.7	-	ns
Total Gate Charge	$Q_g$	$V_{DS} = 20\text{V}$ , $V_{GS} = 10\text{V}$ , $I_D = 4\text{A}$		5.1		nC
	$Q_{gs}$			1.3		nC
	$Q_{gd}$			1.5		nC
Diode Forward Voltage	$V_{FSD}$	$I_S = 4\text{A}$ , $V_{GS} = 0\text{V}$		0.85	1.2	V

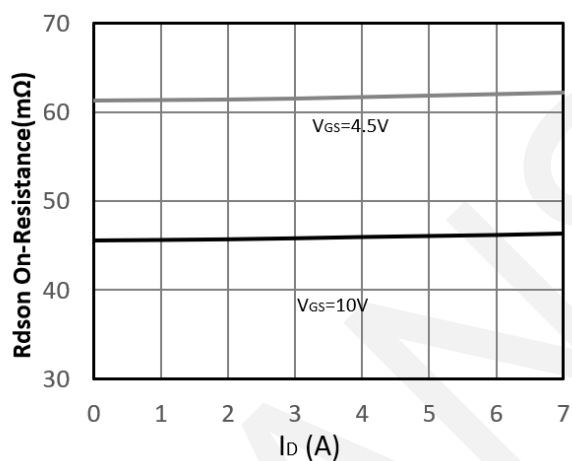
## NMOS Typical electrical and thermal characteristics



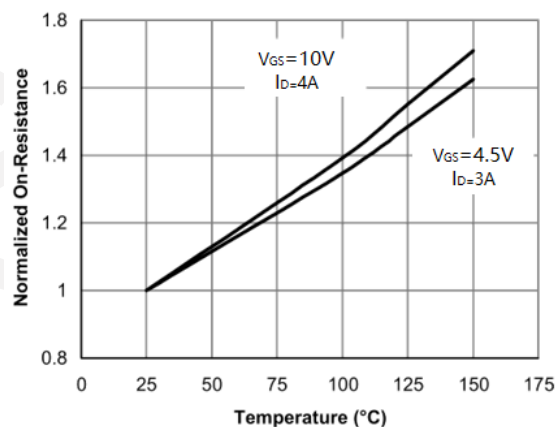
Output Characteristics



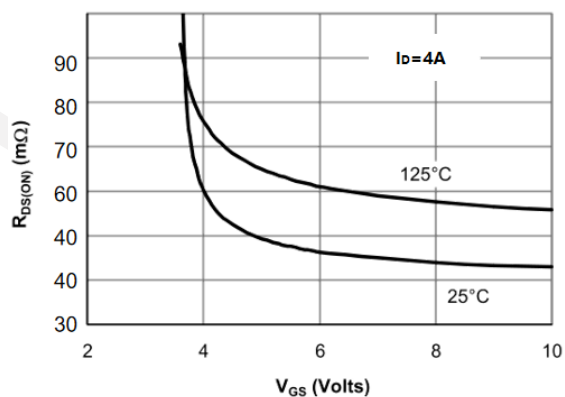
Transfer Characteristics



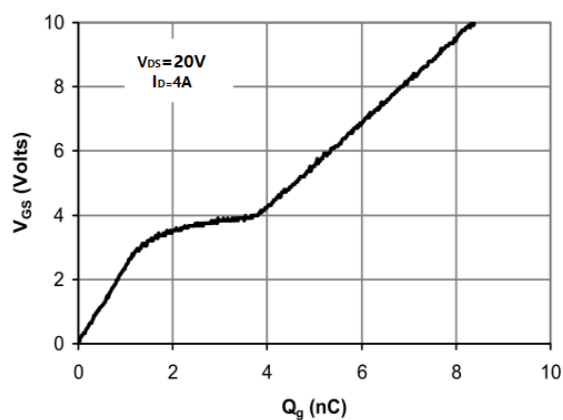
Drain-Source On-Resistance



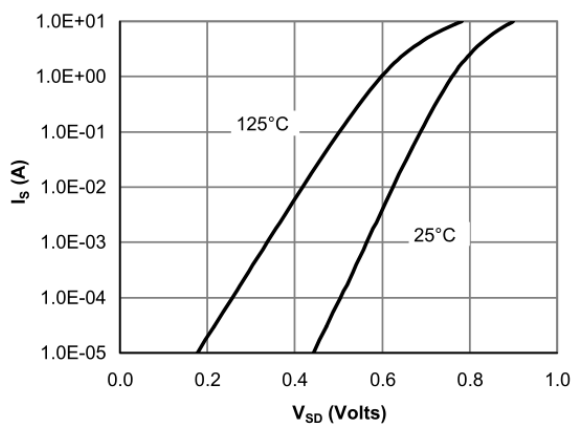
Drain-Source On-Resistance



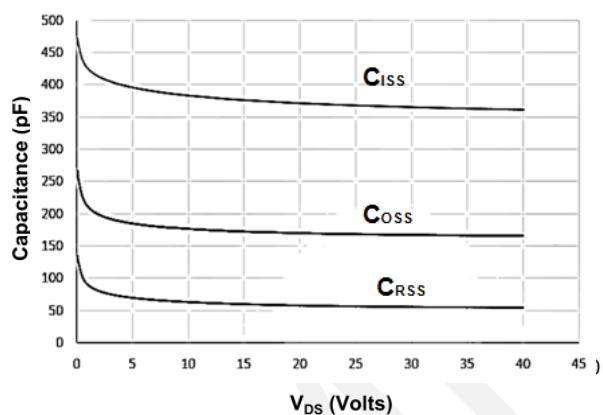
Rdson vs Vgs



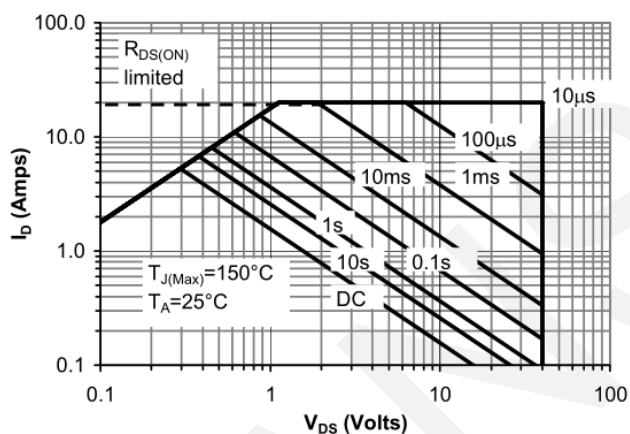
Gate Charge



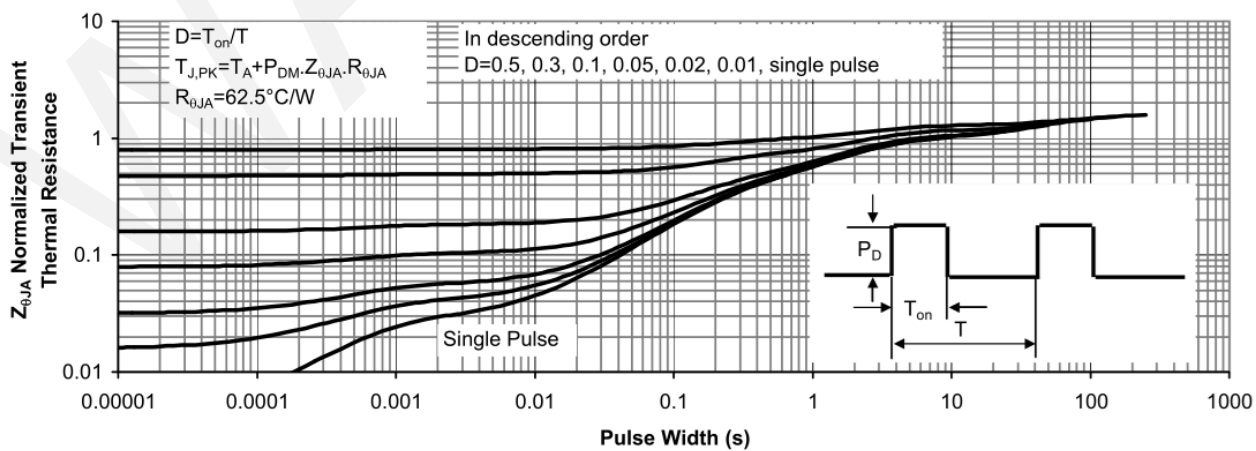
Source- Drain Diode Forward



Capacitance vs Vds



Safe Operating Area



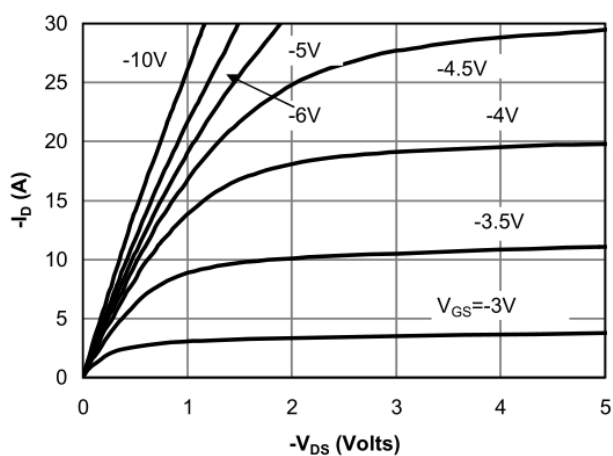
Normalized Maximum Transient Thermal Impedance

**7. PMOS Electrical Characteristics at Ta=25°C (Note 3)**

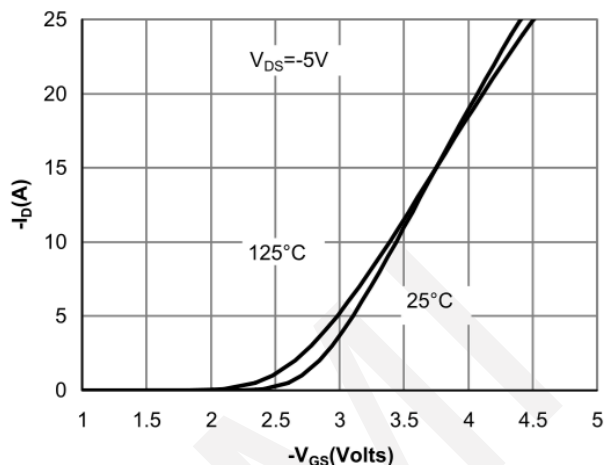
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Drain to Source Breakdown Voltage	$V_{(BR)DSS}$	$I_D = -250\mu A, V_{GS} = 0V$	-40			V
Zero-Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -40V, V_{GS} = 0V$			1	$\mu A$
Gate to Source Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$			$\pm 100$	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_{DS} = -250\mu A$	-1.0	-1.75	-2.5	V
Static Drain to Source On-State Resistance	$R_{DS(on)}$	$I_D = -3A, V_{GS} = -10V$		98.8	125	m $\Omega$
		$I_D = -3A, V_{GS} = -4.5V$		138.5	170	m $\Omega$
Input Capacitance	$C_{iss}$	$V_{GS} = 0V,$ $V_{DS} = -15V,$ Frequency = 1.0MHz		647	-	pF
Output Capacitance	$C_{oss}$			433	-	pF
Reverse Transfer Capacitance	$C_{rss}$			280	-	pF
Turn-ON Delay Time	$t_{d(on)}$	$V_{DD} = -20V$ $I_D = -4A$ $V_{GS} = -10V$ $R_{GEN} = 2.5\Omega$		6.5	-	ns
Rise Time	$t_r$			14	-	ns
Turn-OFF Delay Time	$t_{d(off)}$			34	-	ns
Fall Time	$t_f$			18	-	ns
Total Gate Charge	$Q_g$	$V_{DS} = -20V,$ $V_{GS} = -10V,$ $I_D = -4A$		13.5		nC
	$Q_{gs}$			1.5		nC
	$Q_{gd}$			1.8		nC
Diode Forward Voltage	$V_{FSD}$	$I_S = -4A, V_{GS} = 0V$		-0.9	-1.2	V

Note 3: Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

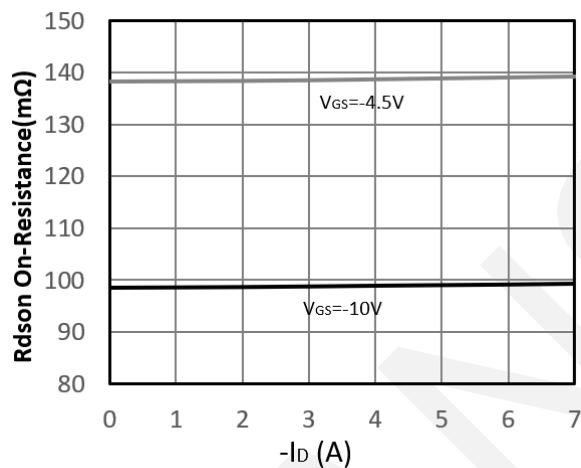
## PMOS Typical electrical and thermal characteristics



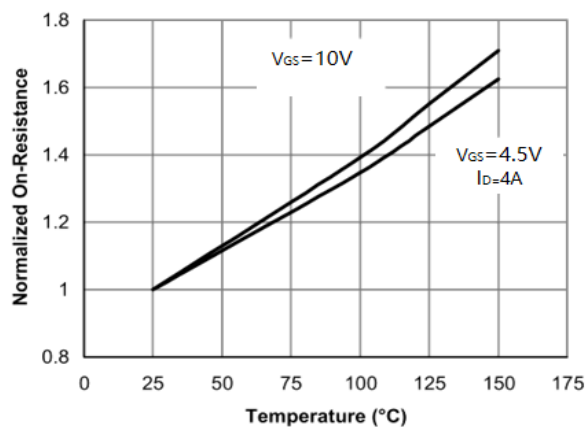
Output Characteristics



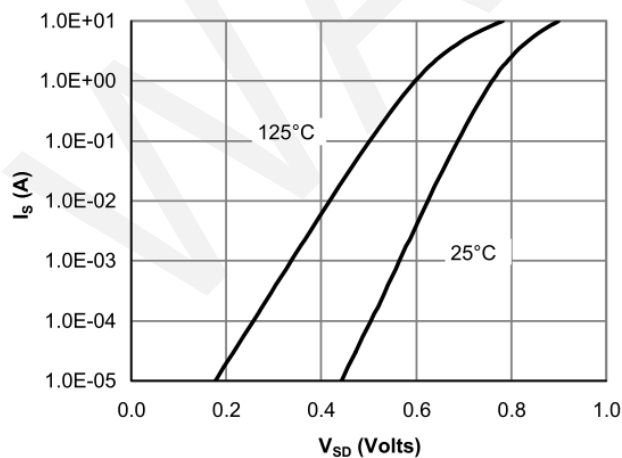
Transfer Characteristics



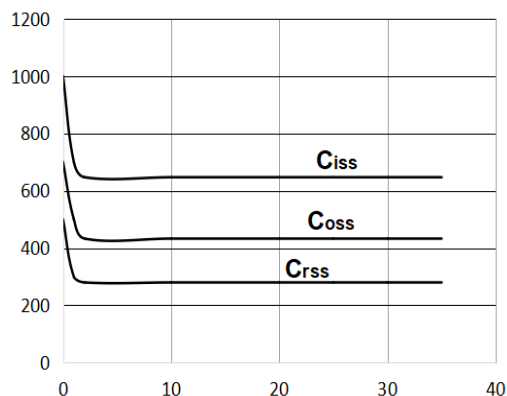
$R_{DS(on)}$ - Drain Current



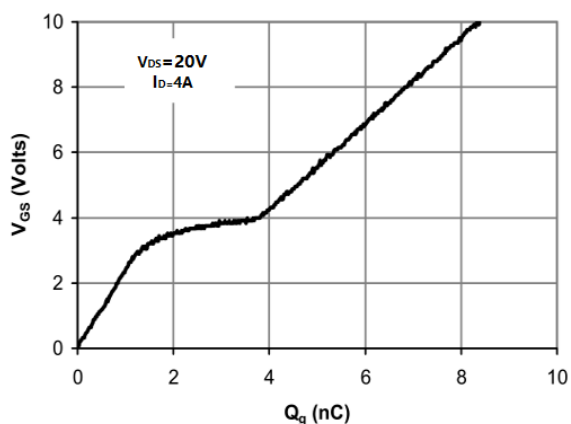
$R_{DS(on)}$ -Junction Temperature



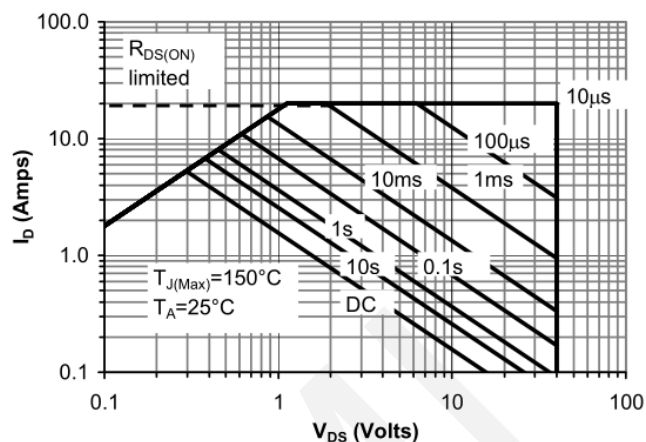
Source- Drain Diode Forward



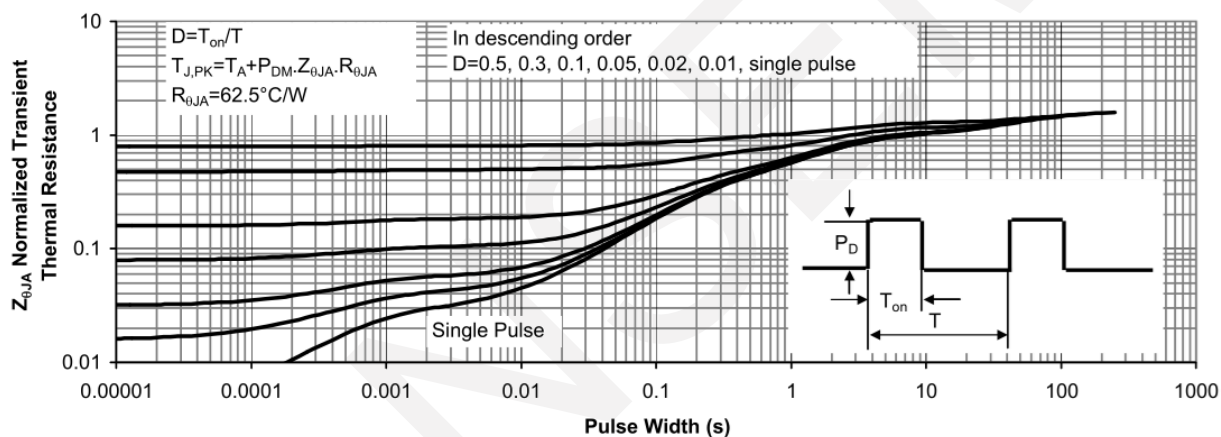
Capacitance vs  $V_{DS}$



Gate-Charge



Safe Operation Area

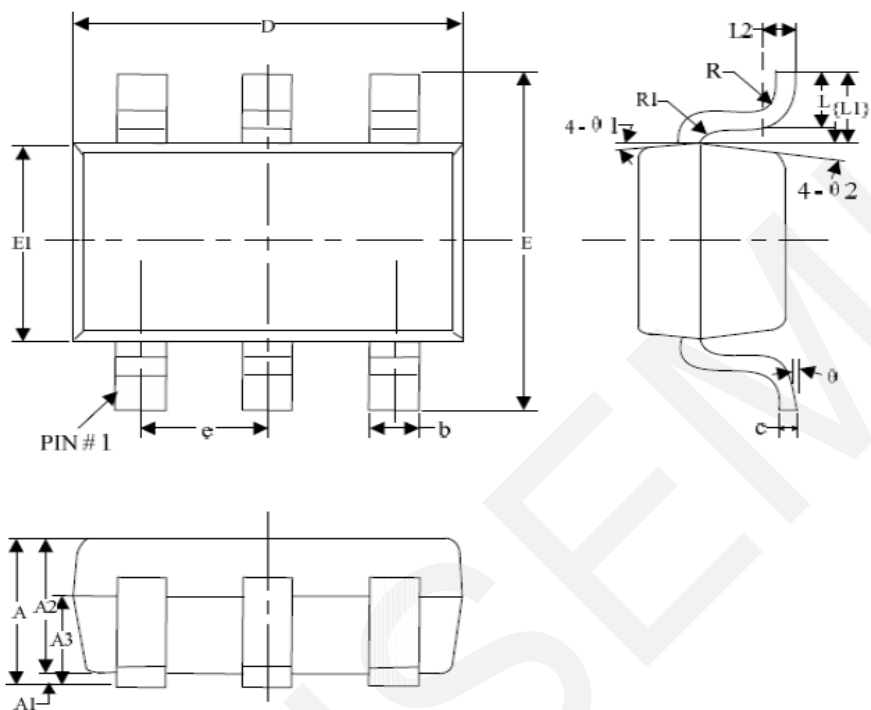


Normalized Maximum Transient Thermal Impedance



## 8.Package Dimensions

### SOT23-6



Dimensions (unit: mm)

SYMBOL	MIN	NOM	MAX	SYMBOL	MIN	NOM	MAX
A	-	-	1.30	e	0.85	0.95	1.05
A1	0	-	0.15	L	0.35	0.45	0.60
A2	0.90	1.10	1.30	L1	0.59REF		
A3	0.60	0.65	0.70	L2	0.25BSC		
b	0.39	-	0.49	R	0.05	-	-
c	0.12	-	0.19	R1	0.05	-	0.02
D	2.85	2.95	3.15	$\theta$	0°	-	8°
E	2.60	2.80	3.00	$\theta 1$	3°	5°	7°
E1	1.55	1.65	1.75	$\theta 2$	6°	8°	10°

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