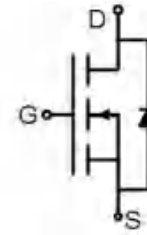


# AP60N04Q

## N-Channel Enhancement Mosfet

### Feature

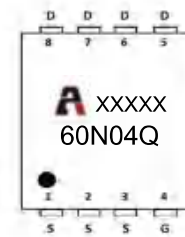
- 40V,30A  
 $R_{DS(ON)} < 9.3m\Omega @ V_{GS}=10V$  TYP:7.4 m $\Omega$   
 $R_{DS(ON)} < 14.3m\Omega @ V_{GS}=4.5V$  TYP:10.4 m $\Omega$
- Advanced Trench Technology
- Lead free product is acquired
- Excellent  $R_{DS(ON)}$  and Low Gate Charge



Schematic Diagram

### Application

- PWM applications
- Load Switch
- Power management



Marking and pin Assignment

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity (PCS)
60N04Q	AP60N04Q	PDFN3X3-8L	13 inch	-	5000

### ABSOLUTE MAXIMUM RATINGS ( $T_a=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DS}$	40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current ( $T_a = 25^\circ\text{C}$ )	$I_D$	30	A
Continuous Drain Current ( $T_a = 100^\circ\text{C}$ )	$I_D$	19	A
Pulsed Drain Current <sup>(1)</sup>	$I_{DM}$	120	A
Singel Pulsed Avalanche Energy <sup>(2)</sup>	$E_{AS}$	101	mJ
Power Dissipation	$P_D$	56	W
Thermal Resistance from Junction to Case <sup>(4)</sup>	$R_{\theta JC}$	2.723	$^\circ\text{C}/\text{W}$
Junction Temperature	$T_J$	150	$^\circ\text{C}$
Storage Temperature	$T_{STG}$	-55~ +150	$^\circ\text{C}$

# AP60N04Q

N-Channel Enhancement Mosfet



## MOSFET ELECTRICAL CHARACTERISTICS( $T_a=25^{\circ}\text{C}$ unless otherwise noted)

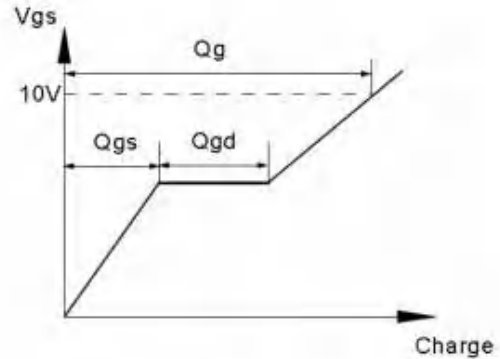
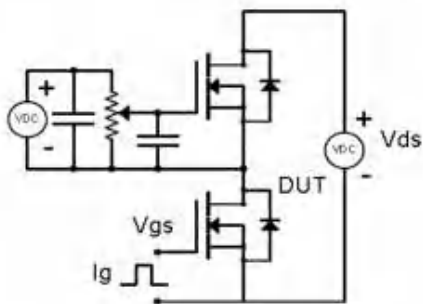
Parameter	Symbol	Test Condition	Min	Type	Max	Unit
<b>Static Characteristics</b>						
Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	40	-	-	V
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 40V, V_{GS} = 0V$	-	-	1	$\mu A$
Gate-body leakage current	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	$\pm 100$	nA
Gate threshold voltage <sup>(3)</sup>	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	1	1.6	2.5	V
Drain-source on-resistance <sup>(3)</sup>	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 30A$	-	7.4	9.3	m $\Omega$
		$V_{GS} = 4.5V, I_D = 10A$	-	10.4	14.3	
<b>Dynamic characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 20V, V_{GS} = 0V, f = 1MHz$	-	1570	-	pF
Output Capacitance	$C_{oss}$		-	132	-	
Reverse Transfer Capacitance	$C_{rss}$		-	115	-	
<b>Switching characteristics</b>						
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 20V, I_D = 25A, R_L = 4.7\Omega$ $V_{GS} = 10V, R_G = 1\Omega$	-	3.6	-	ns
Turn-on rise time	$t_r$		-	9.6	-	
Turn-off delay time	$t_{d(off)}$		-	24	-	
Turn-off fall time	$t_f$		-	9.6	-	
Total Gate Charge	$Q_g$	$V_{DS} = 20V, I_D = 25A,$ $V_{GS} = 10V$	-	32.5	-	nC
Gate-Source Charge	$Q_{gs}$		-	4.5	-	
Gate-Drain Charge	$Q_{gd}$		-	5.6	-	
<b>Source-Drain Diode characteristics</b>						
Diode Forward voltage <sup>(3)</sup>	$V_{DS}$	$V_{GS} = 0V, I_S = 10A$	-	-	1.2	V
Diode Forward current <sup>(4)</sup>	$I_S$		-	-	30	A
Body Diode Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}, I_F = 30A, di/dt = 100A/\mu s$		11		ns
Body Diode Reverse Recovery Charge	$Q_{rr}$	$T_J = 25^{\circ}, I_F = 30A, di/dt = 100A/\mu s$		6		nc

### Notes:

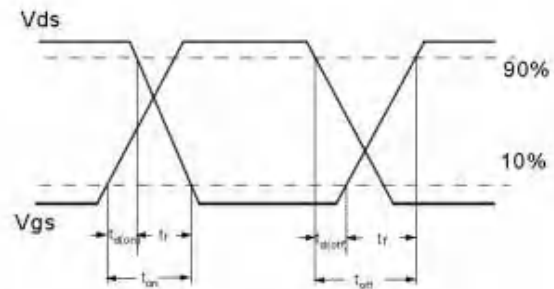
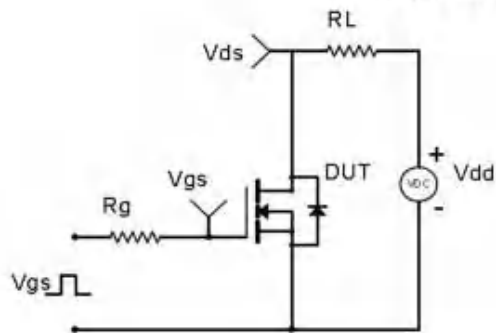
1. Repetitive Rating: pulse width limited by maximum junction temperature
2. EAS Condition:  $T_J = 25^{\circ}\text{C}, V_{DD} = 20V, R_G = 25\Omega, L = 0.5\text{mH}$
3. Pulse Test: pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
4. Surface Mounted on FR4 Board,  $t \leq 10\text{ sec}$

**Test Circuit & Waveform**

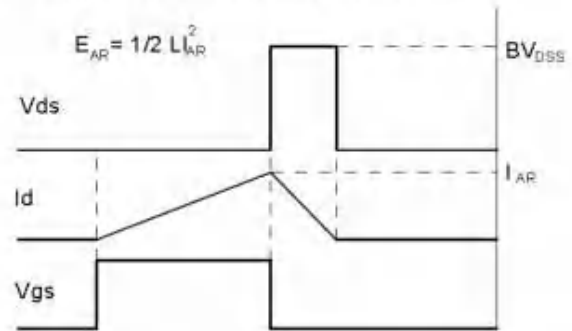
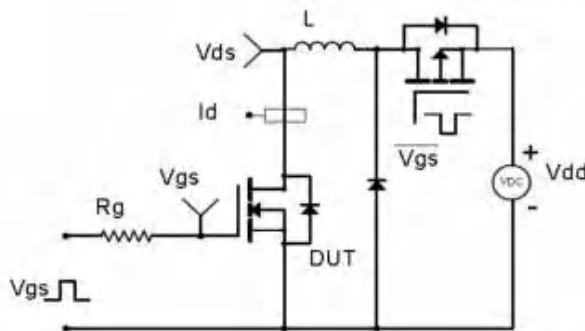
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

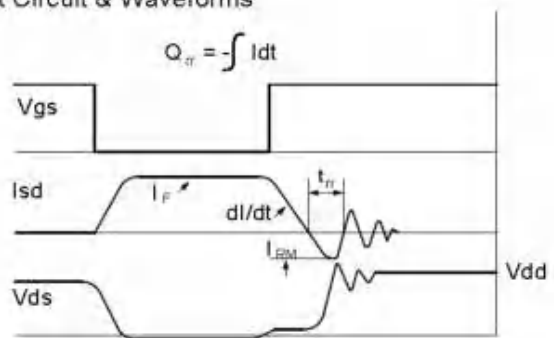
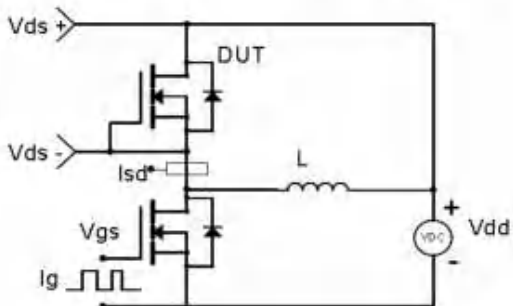


Fig.1 Power Dissipation Derating Curve

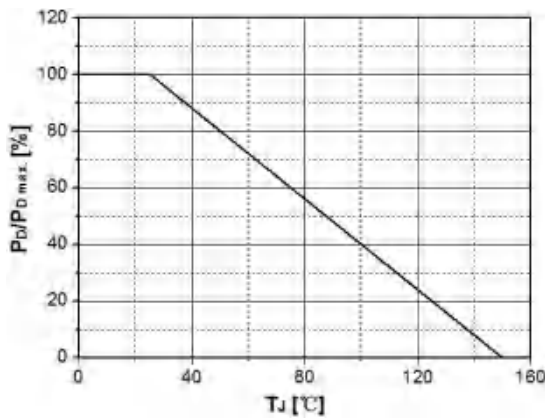


Fig.2 Avalanche Energy Derating Curve vs. Junction Temperature

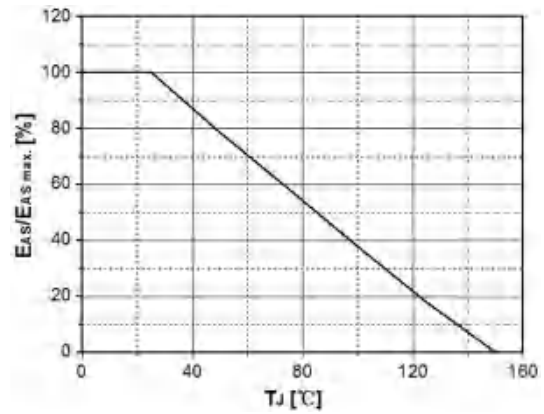


Fig.3 Typical Output Characteristics

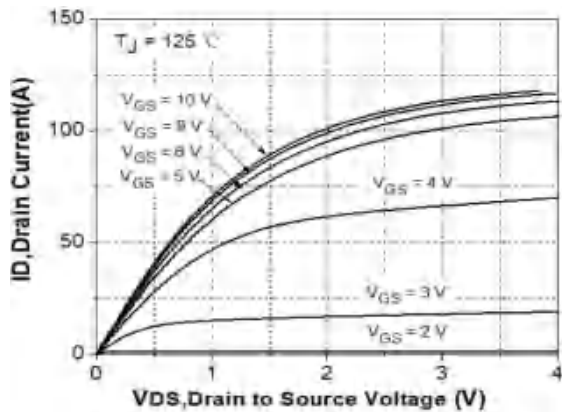


Fig. 4 Transconductance vs. Drain Current

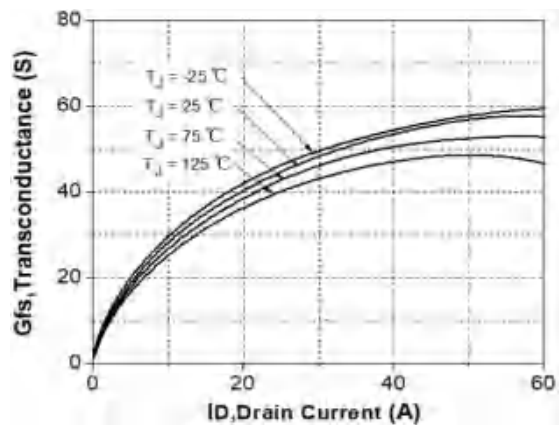


Fig.5 Typical Transfer Characteristics

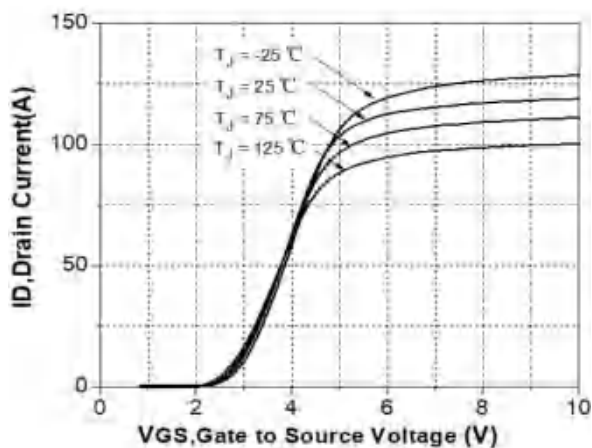


Fig. 6 State Resistance vs. Drain Current @-25°C

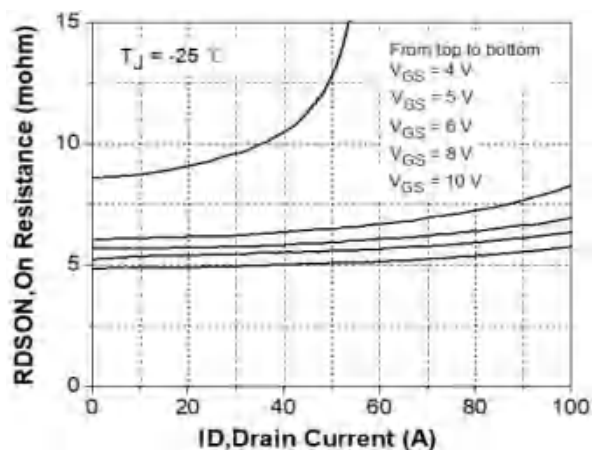


Fig.7 State Resistance vs. Drain Current @25°C

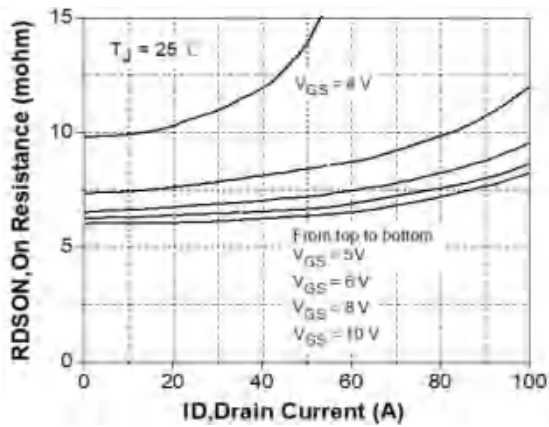


Fig. 8 State Resistance vs. Drain Current @125°C

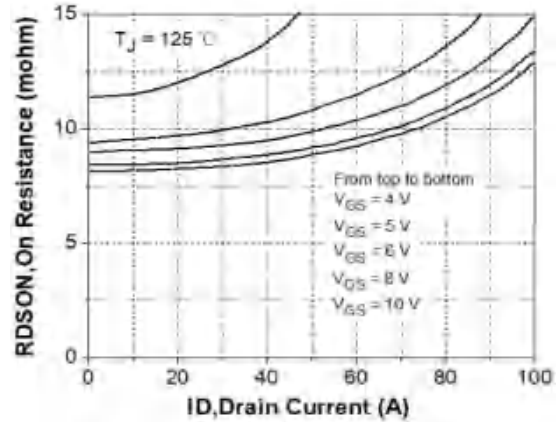


Fig.9 Typical Capacitance vs. Drain Source Voltage

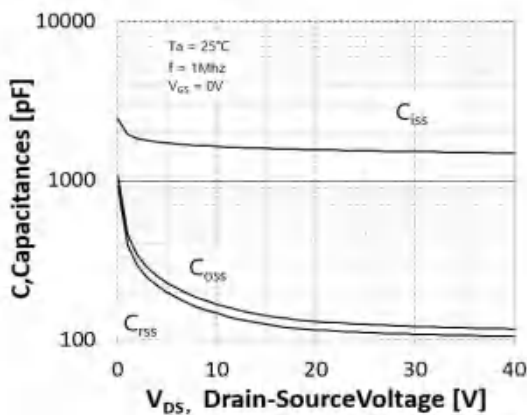


Fig.10 Dynamic Input Characteristics

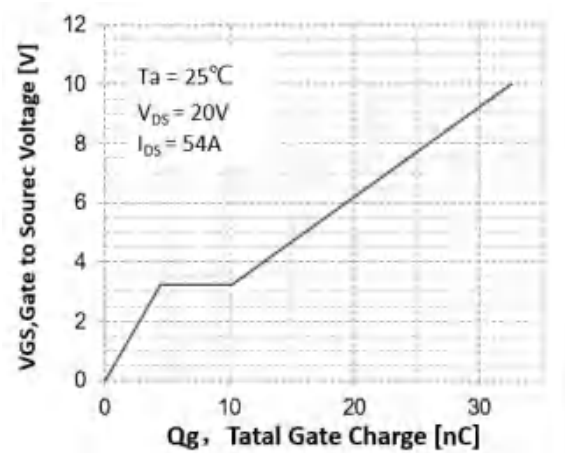


Fig.11 Breakdown Voltage vs. Junction Temperature

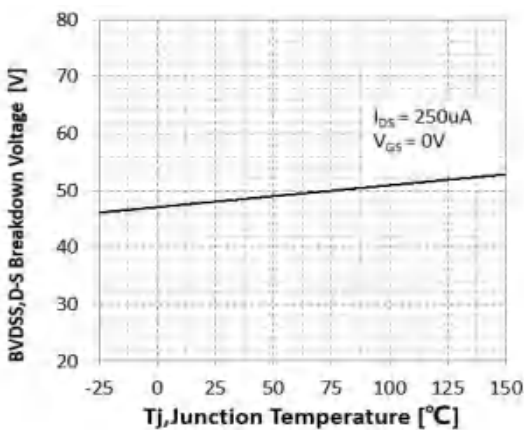


Fig. 12 Gate Threshold Voltage vs. Junction Temperature

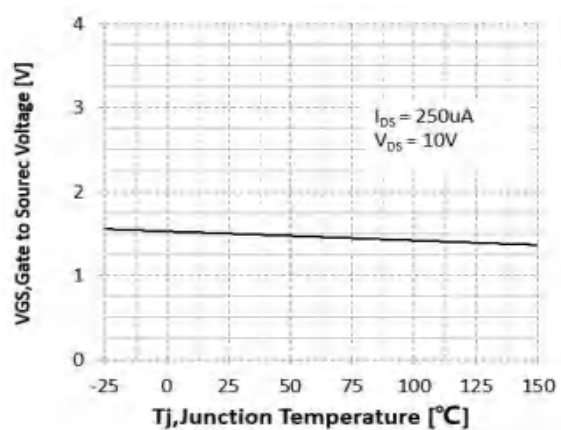


Fig.13 On-Resistance Variation vs. Junction Temperature

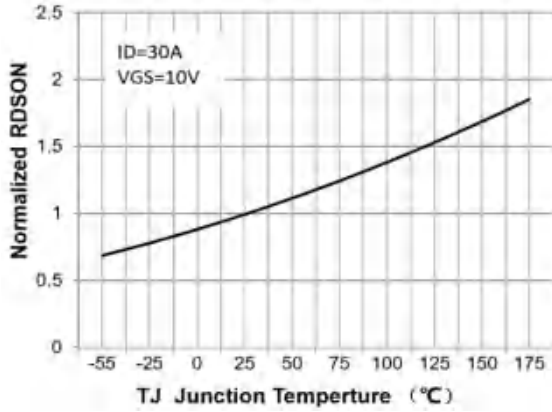


Fig.14 Maximum Drain Current vs. Case Temperature

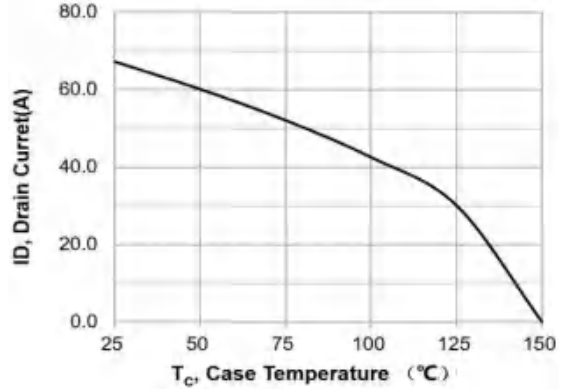


Fig.15 Body Diode Forward Voltage Vs Reverse Drain Current

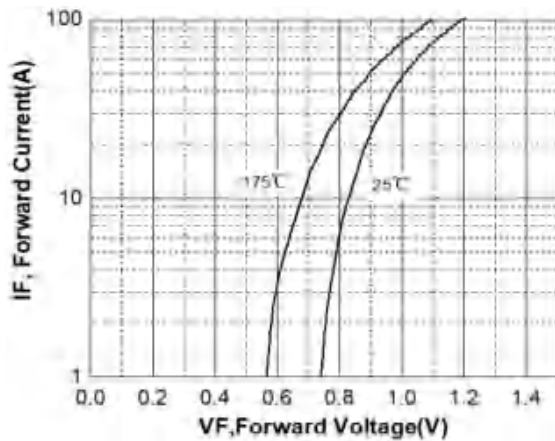


Fig.16 Safe Operating Area

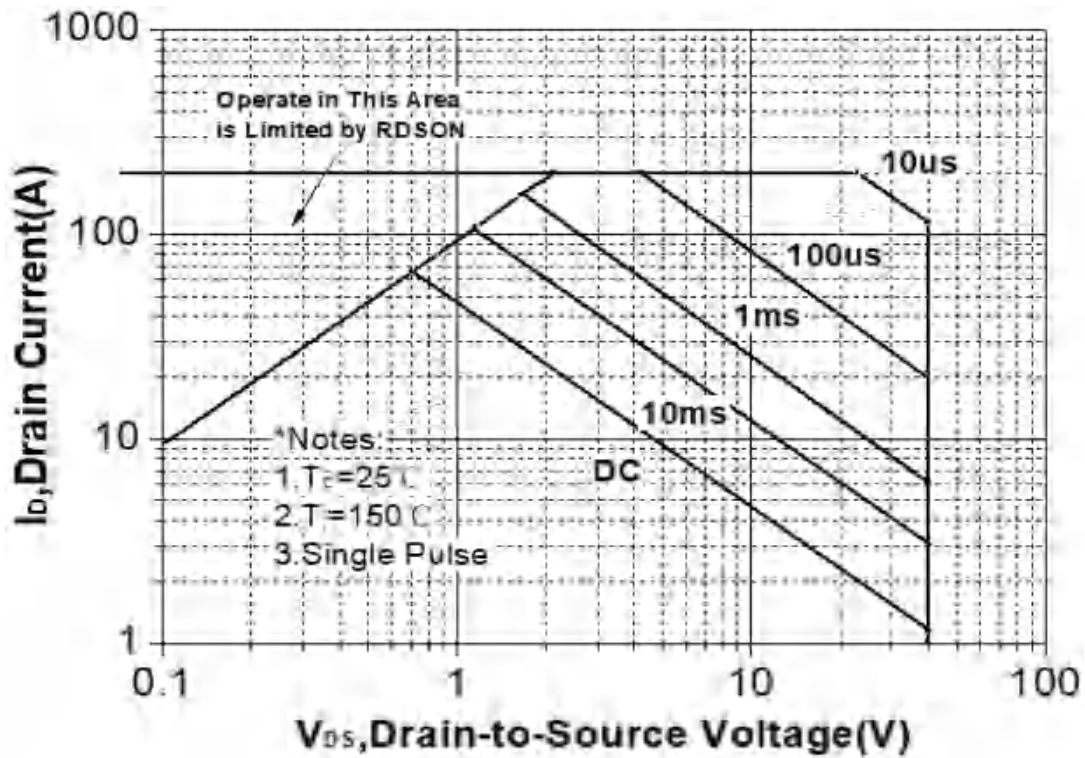
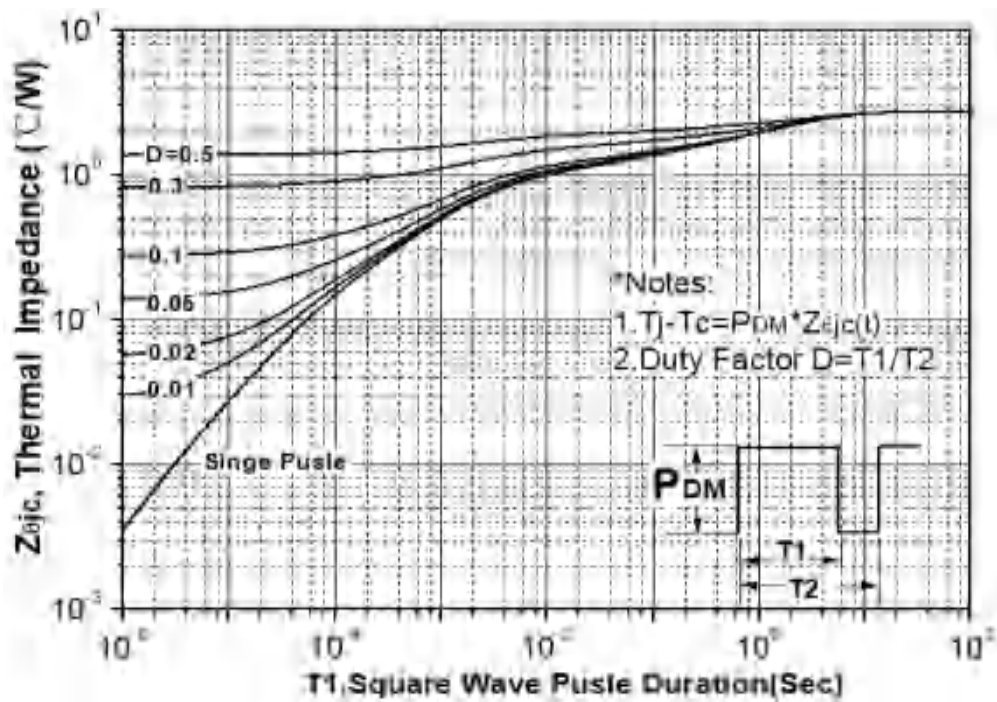
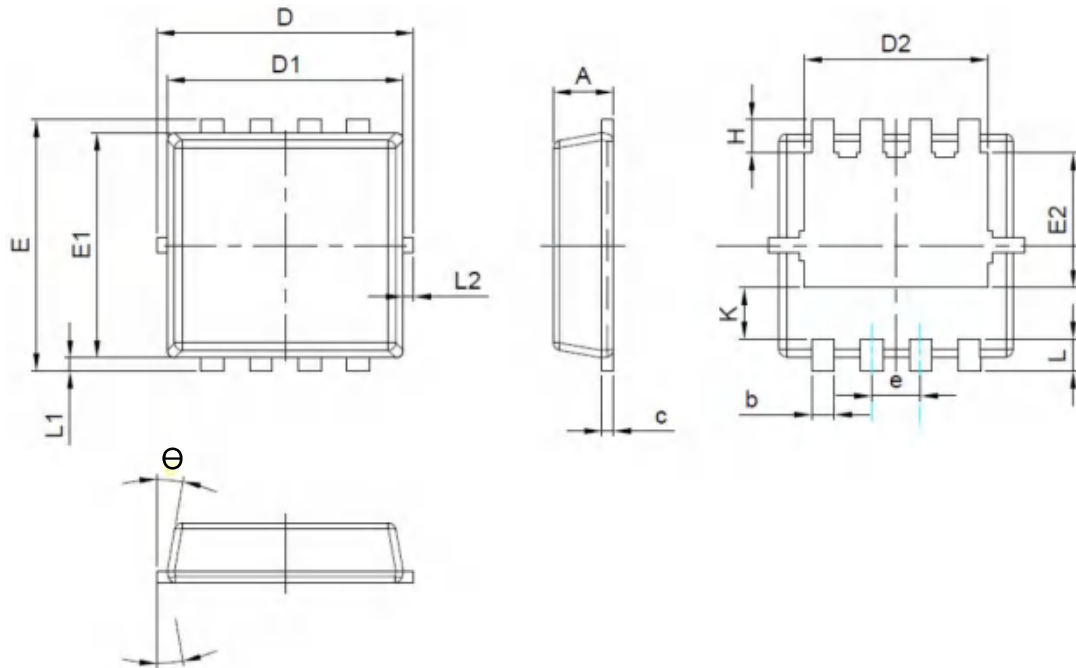


Fig. 17 Transient Thermal Response Curve



**PDFN3X3-8L Package Information**



**COMMON DIMENSIONS**  
( UNITS OF MEASURE = MILLIMETER )

SYMBOL	MIN	NOM	MAX
A	0.70	0.80	0.90
b	0.25	0.30	0.39
c	0.14	0.15	0.25
D	3.20	3.30	3.40
D1	3.00	3.15	3.30
D2	2.35	2.45	2.55
e	0.65 BSC		
E	3.25	3.35	3.45
E1	2.85	3.00	3.15
E2	1.635	1.735	1.835
H	0.33	0.48	0.63
K	0.585	0.685	0.785
L	0.30	0.40	0.50
L1	0.05	0.15	0.25
L2	-	-	0.15
θ	8°	10°	12°