



ALPHA & OMEGA
SEMICONDUCTOR



AOD609G

Complementary Enhancement Mode Field Effect Transistor

General Description

The AOD609G uses advanced trench technology MOSFETs to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used in H-bridge, Inverters and other applications.

- RoHS Compliant
- Halogen Free*

Features

n-channel

$V_{DS} (V) = 40V, I_D = 12A (V_{GS}=10V)$

$R_{DS(ON)} < 30m\Omega (V_{GS}=10V)$

$R_{DS(ON)} < 40m\Omega (V_{GS}=4.5V)$

p-channel

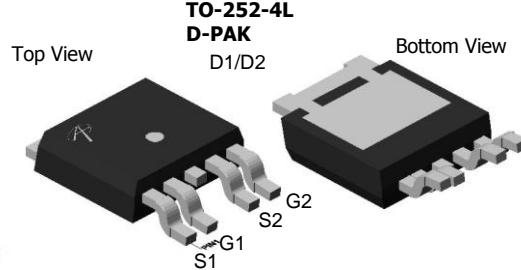
$V_{DS} (V) = -40V, I_D = -12A (V_{GS}=-10V)$

$R_{DS(ON)} < 45m\Omega (V_{GS}=-10V)$

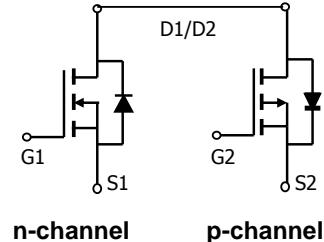
$R_{DS(ON)} < 66m\Omega (V_{GS}=-4.5V)$

100% UIS Tested!

100% Rg Tested!



Top View
Drain Connected to Tab



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

Parameter	Symbol	Max n-channel	Max p-channel	Units
Drain-Source Voltage	V_{DS}	40	-40	V
Gate-Source Voltage	V_{GS}	± 20	± 20	V
Continuous Drain Current ^{B,H}	I_D	12	-12	A
$T_C=100^\circ C$		12	-12	
Pulsed Drain Current ^B	I_{DM}	30	-30	
Avalanche Current ^C	I_{AR}	14	-20	
Repetitive avalanche energy $L=0.1mH$ ^C	E_{AR}	9.8	20	mJ
Power Dissipation	P_D	27	30	W
$T_C=100^\circ C$		14	15	
Power Dissipation	P_{DSM}	2	2	W
$T_A=70^\circ C$		1.3	1.3	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 175	-55 to 175	°C

Thermal Characteristics: n-channel and p-channel

Parameter	Symbol	Device	Typ	Max	Units
Maximum Junction-to-Ambient ^{A,D}	$R_{\theta JA}$	n-ch	17.4	25	°C/W
Steady-State		n-ch	50	60	°C/W
Maximum Junction-to-Lead ^C	$R_{\theta JC}$	n-ch	4	5.5	°C/W
Steady-State		p-ch	16.7	25	°C/W
Maximum Junction-to-Ambient ^{A,D}	$R_{\theta JA}$	p-ch	50	60	°C/W
Steady-State		p-ch	3.5	5	°C/W
Maximum Junction-to-Lead ^C	$R_{\theta JC}$	p-ch			
Steady-State					

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}, V_{GS}=0\text{V}$	40			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=40\text{V}, V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			1 5	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm 20\text{V}$			± 100	nA
$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	1.7	2.5	3	V
$I_{\text{D(ON)}}$	On state drain current	$V_{GS}=10\text{V}, V_{DS}=5\text{V}$	30			A
$R_{\text{DS(ON)}}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}, I_D=12\text{A}$ $T_J=125^\circ\text{C}$	24	30		$\text{m}\Omega$
		$V_{GS}=4.5\text{V}, I_D=8\text{A}$	37	46	31	
g_{FS}	Forward Transconductance	$V_{DS}=5\text{V}, I_D=12\text{A}$		25		S
V_{SD}	Diode Forward Voltage	$I_S=1\text{A}, V_{GS}=0\text{V}$		0.76	1	V
I_S	Maximum Body-Diode Continuous Current				2	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=20\text{V}, f=1\text{MHz}$		545		pF
C_{oss}	Output Capacitance			65		pF
C_{rss}	Reverse Transfer Capacitance			40		pF
R_g	Gate resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$	1.6	3.2	4.8	Ω
SWITCHING PARAMETERS						
$Q_g(10\text{V})$	Total Gate Charge	$V_{GS}=10\text{V}, V_{DS}=20\text{V}, I_D=12\text{A}$		10	13	nC
Q_{gs}	Gate Source Charge			2		nC
Q_{gd}	Gate Drain Charge			2.2		nC
$t_{\text{D(on)}}$	Turn-On DelayTime	$V_{GS}=10\text{V}, V_{DS}=20\text{V}, R_L=1.4\Omega, R_{\text{GEN}}=3\Omega$		5.5		ns
t_r	Turn-On Rise Time			3		ns
$t_{\text{D(off)}}$	Turn-Off DelayTime			19		ns
t_f	Turn-Off Fall Time			4		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=12\text{A}, dI/dt=100\text{A}/\mu\text{s}$		13		ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=12\text{A}, dI/dt=100\text{A}/\mu\text{s}$		6.5		nC

A: The value of R_{gJA} is measured with the device in a still air environment with $T_A=25^\circ\text{C}$. The power dissipation P_{DSM} and current rating I_{DSM} are based on $T_{J(\text{MAX})}=150^\circ\text{C}$, using the steady state junction-to-ambient thermal resistance.

B. The power dissipation P_D is based on $T_{J(\text{MAX})}=175^\circ\text{C}$, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C: Repetitive rating, pulse width limited by junction temperature $T_{J(\text{MAX})}=175^\circ\text{C}$.

D. The R_{gJA} is the sum of the thermal impedance from junction to case R_{gJC} and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using $<300\ \mu\text{s}$ pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(\text{MAX})}=175^\circ\text{C}$. The SOA curve provides a single pulse rating.

G. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{C}$.

H. The maximum current rating is limited by bond-wires.

*This device is guaranteed green after data code 8X11 (Sep 1ST 2008).

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D = -250\mu\text{A}, V_{GS}=0\text{V}$	-40			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -40\text{V}, V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			-1 -5	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}= \pm 20\text{V}$			± 100	nA
$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D= -250\mu\text{A}$	-1.7	-2	-3	V
$I_{D(\text{ON})}$	On state drain current	$V_{GS} = -10\text{V}, V_{DS} = -5\text{V}$	-30			A
$R_{DS(\text{ON})}$	Static Drain-Source On-Resistance	$V_{GS} = -10\text{V}, I_D = -12\text{A}$ $T_J=125^\circ\text{C}$		36 52	45 65	$\text{m}\Omega$
		$V_{GS} = -4.5\text{V}, I_D = -8\text{A}$		51	66	
g_{FS}	Forward Transconductance	$V_{DS} = -5\text{V}, I_D = -12\text{A}$		22		S
V_{SD}	Diode Forward Voltage	$I_S = -1\text{A}, V_{GS}=0\text{V}$		-0.76	-1	V
I_S	Maximum Body-Diode Continuous Current				-2	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS} = -20\text{V}, f=1\text{MHz}$		890		pF
C_{oss}	Output Capacitance			90		pF
C_{rss}	Reverse Transfer Capacitance			60		pF
R_g	Gate resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$	6.5	13	19.5	Ω
SWITCHING PARAMETERS						
$Q_g(-10\text{V})$	Total Gate Charge	$V_{GS} = -10\text{V}, V_{DS} = -20\text{V}, I_D = -12\text{A}$		15.5	21	nC
$Q_g(-4.5\text{V})$	Total Gate Charge			7	9	nC
Q_{gs}	Gate Source Charge			3.2		nC
Q_{gd}	Gate Drain Charge			3.5		nC
$t_{D(\text{on})}$	Turn-On DelayTime	$V_{GS} = -10\text{V}, V_{DS} = -20\text{V}, R_L=1.4\Omega, R_{\text{GEN}}=3\Omega$		10		ns
t_r	Turn-On Rise Time			15.5		ns
$t_{D(\text{off})}$	Turn-Off DelayTime			35		ns
t_f	Turn-Off Fall Time			50		ns
t_{rr}	Body Diode Reverse Recovery Time		$I_F = -12\text{A}, dI/dt=100\text{A}/\mu\text{s}$	20		ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F = -12\text{A}, dI/dt=100\text{A}/\mu\text{s}$		11		nC

A: The value of $R_{\theta JA}$ is measured with the device in a still air environment with $T_A=25^\circ\text{C}$. The power dissipation P_{DSM} and current rating I_{DSM} are based on $T_{J(\text{MAX})}=150^\circ\text{C}$, using $t \leq 10\text{s}$ junction-to-ambient thermal resistance.

B. The power dissipation P_D is based on $T_{J(\text{MAX})}=175^\circ\text{C}$, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C: Repetitive rating, pulse width limited by junction temperature $T_{J(\text{MAX})}=175^\circ\text{C}$.

D. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to case $R_{\theta JC}$ and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using $<300\mu\text{s}$ pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(\text{MAX})}=175^\circ\text{C}$. The SOA curve provides a single pulse rating.

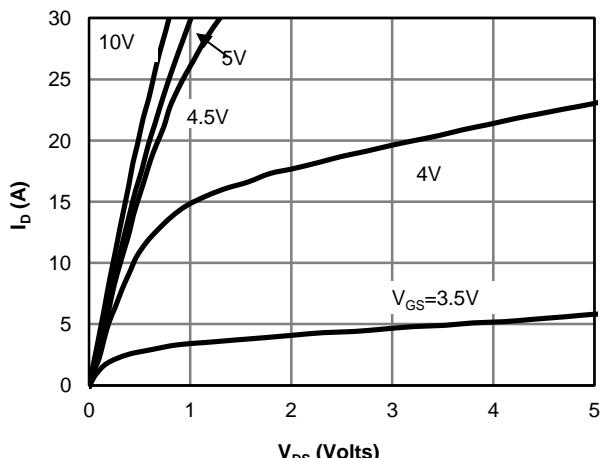
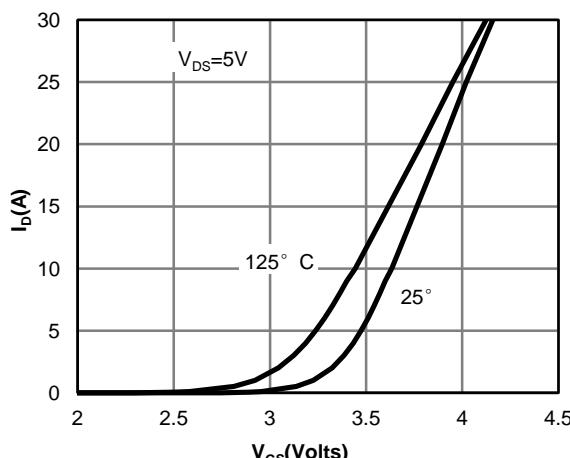
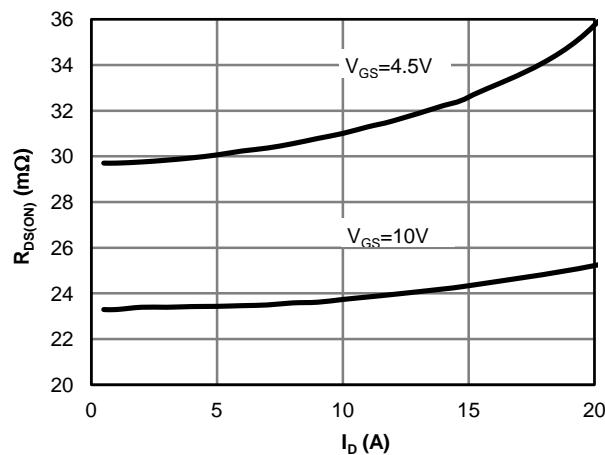
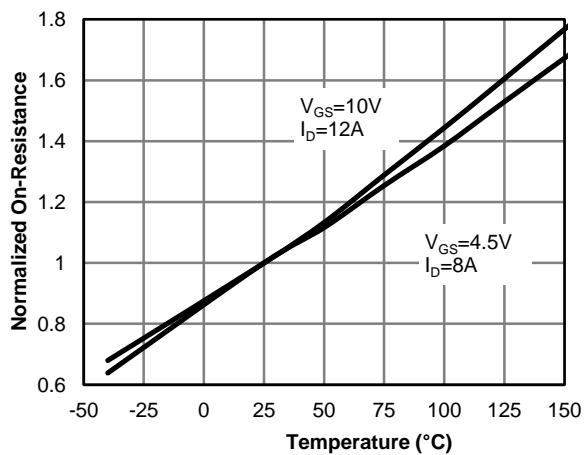
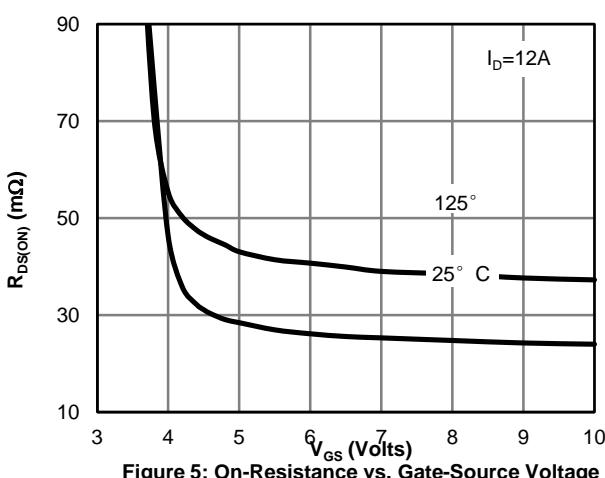
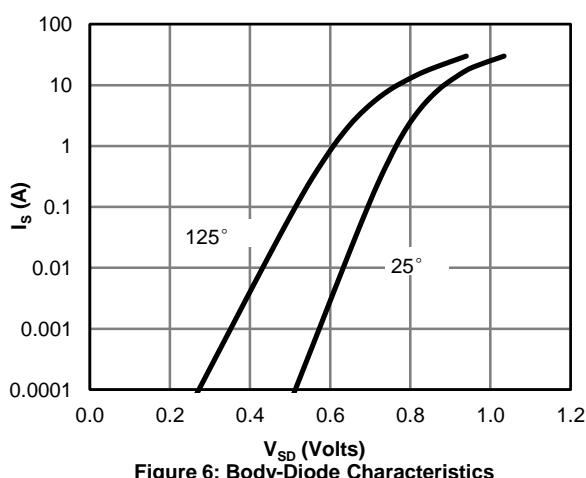
G. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{C}$.

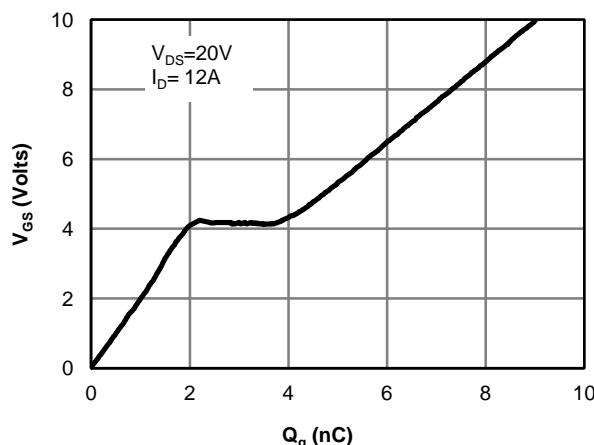
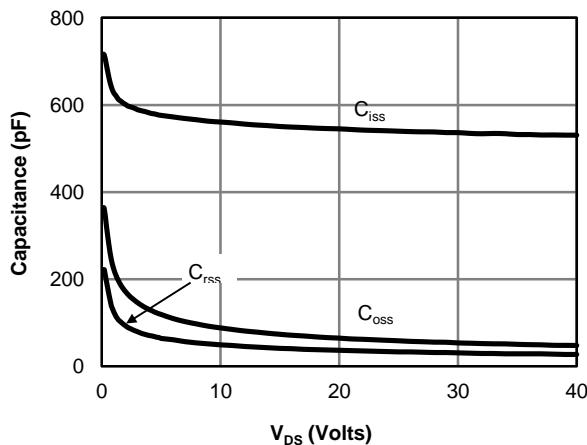
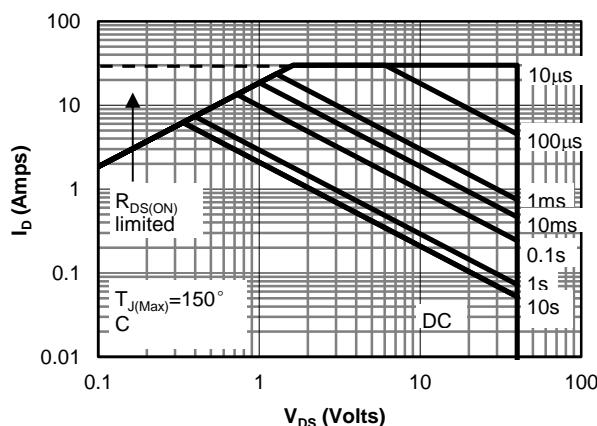
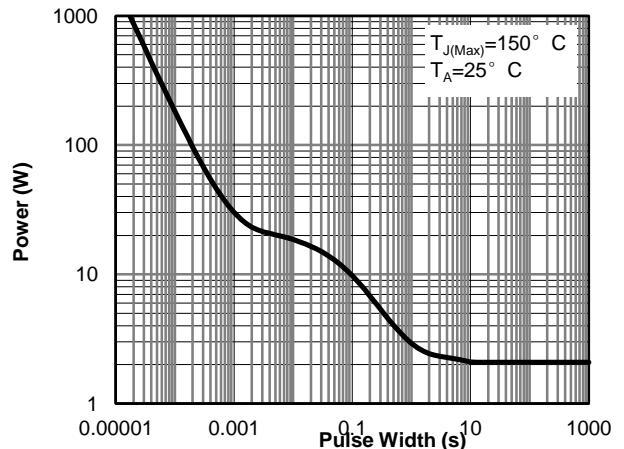
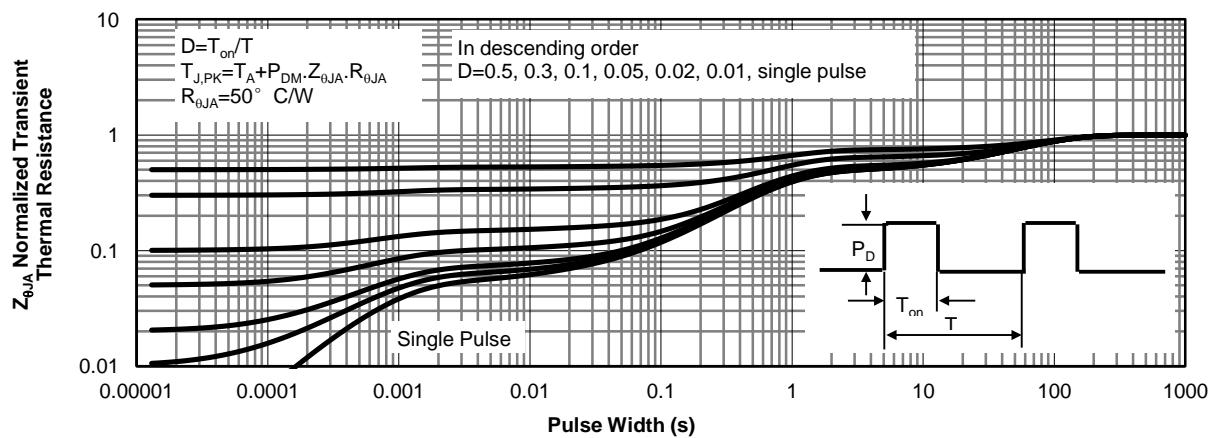
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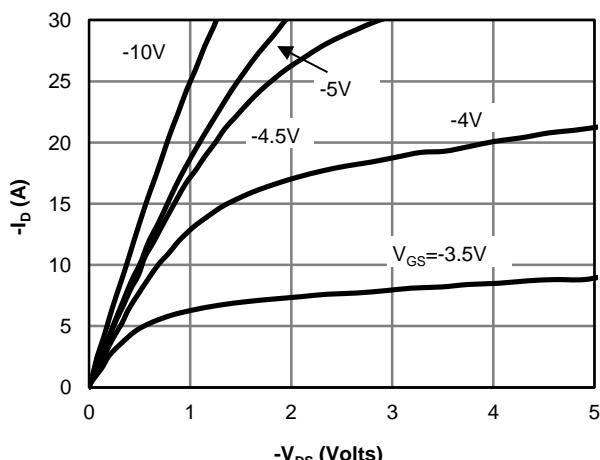
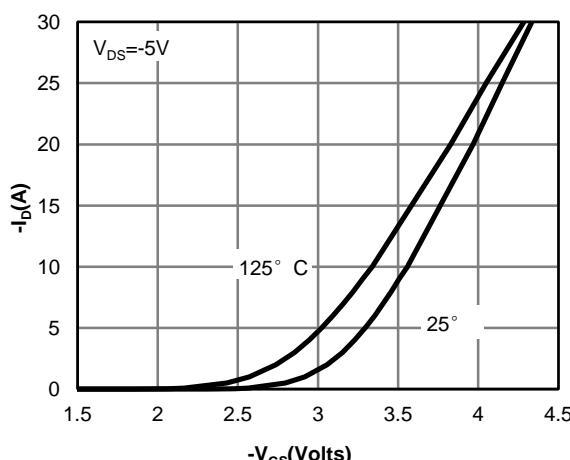
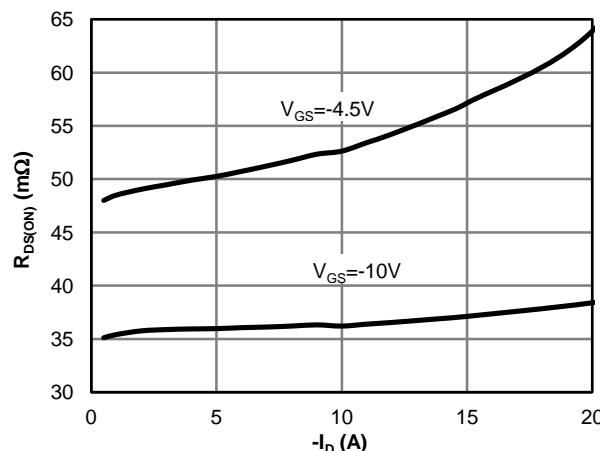
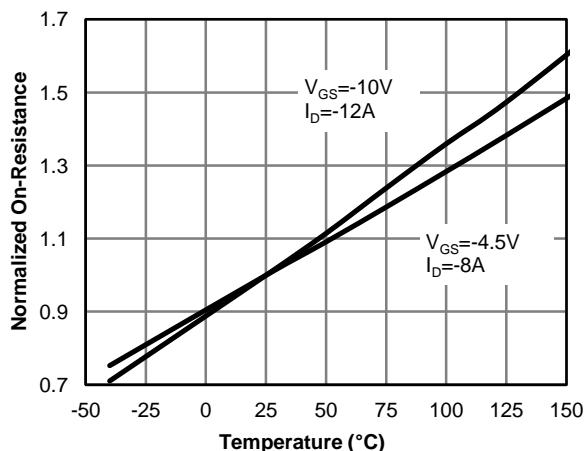
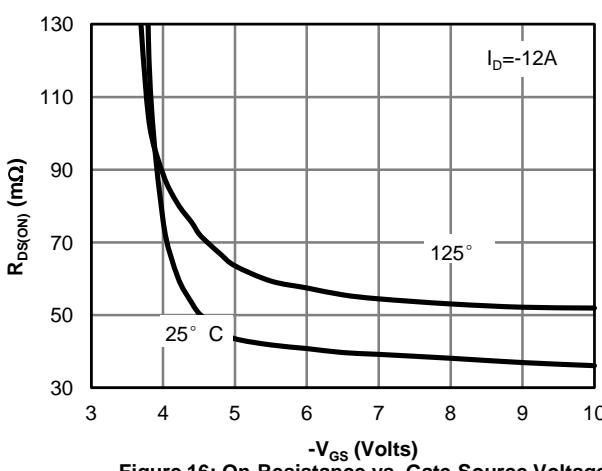
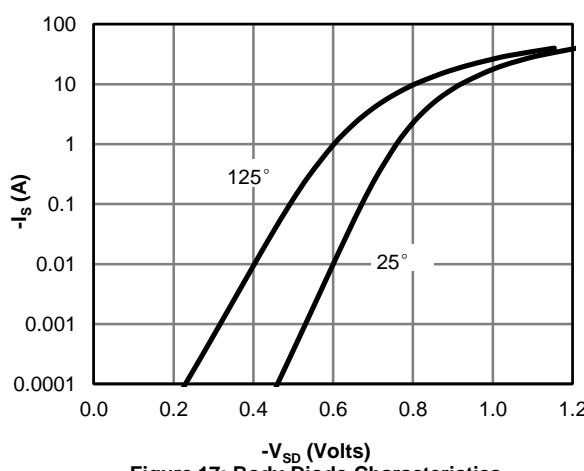
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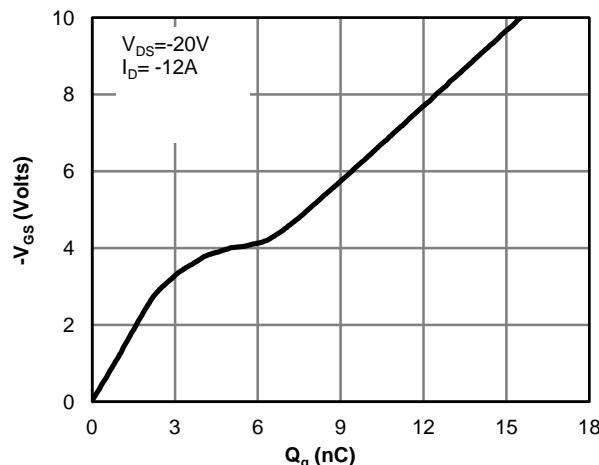
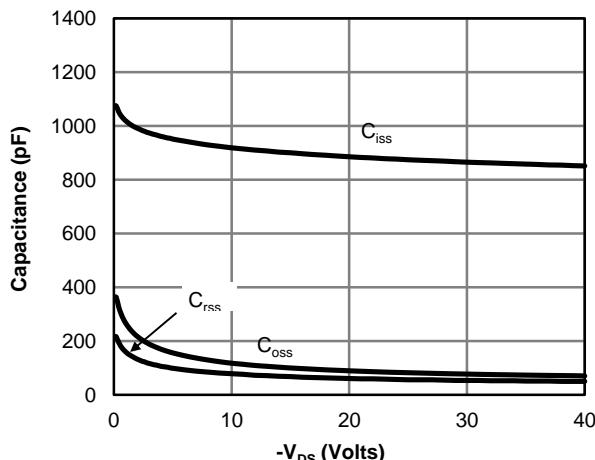
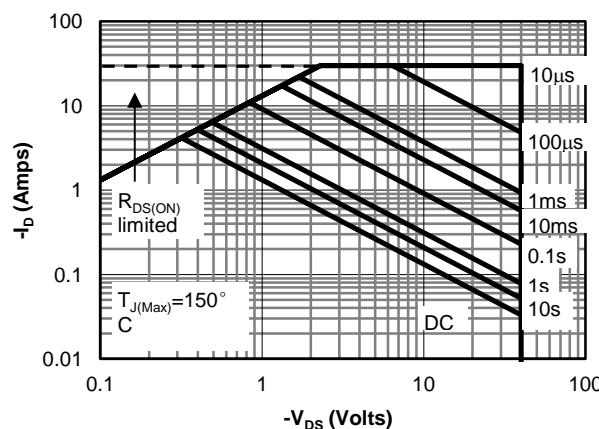
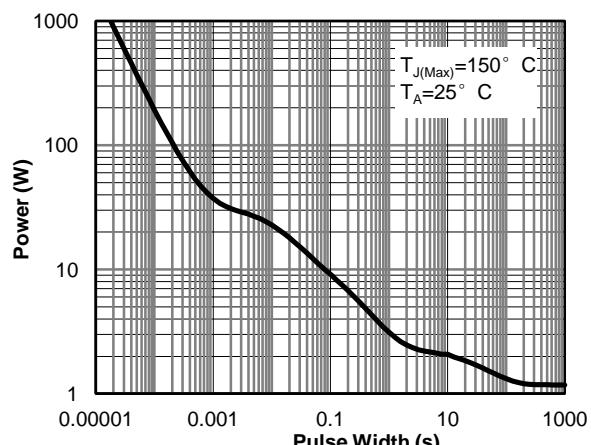
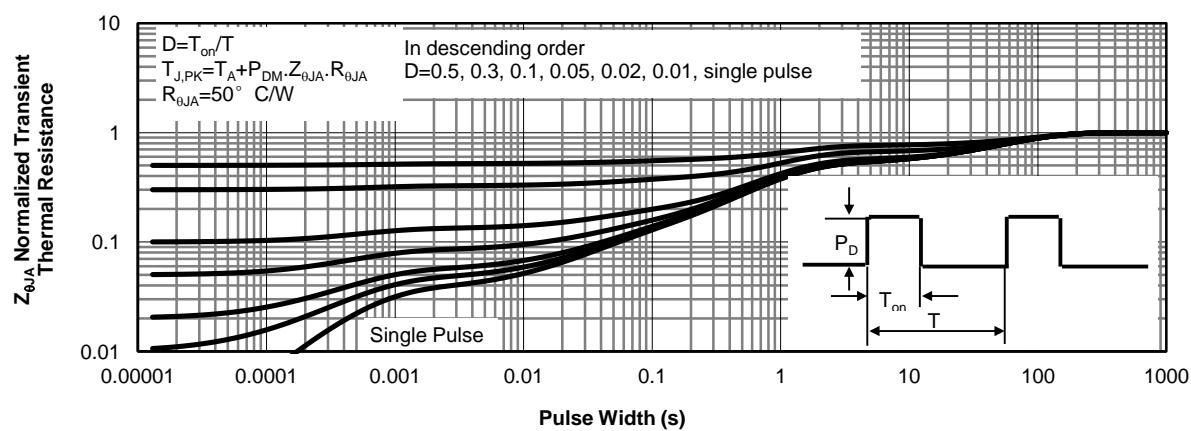
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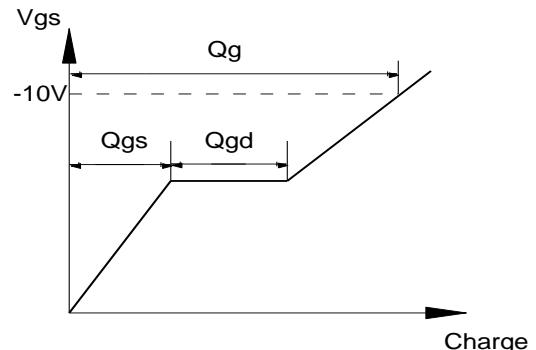
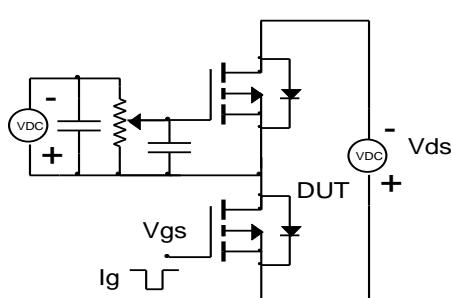
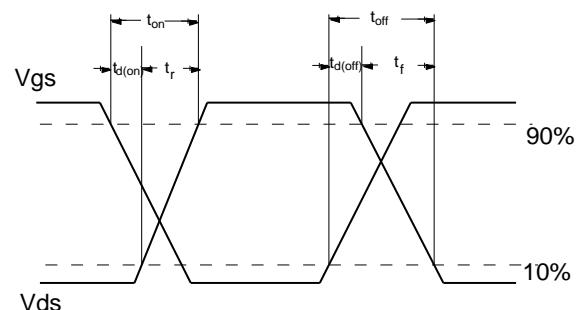
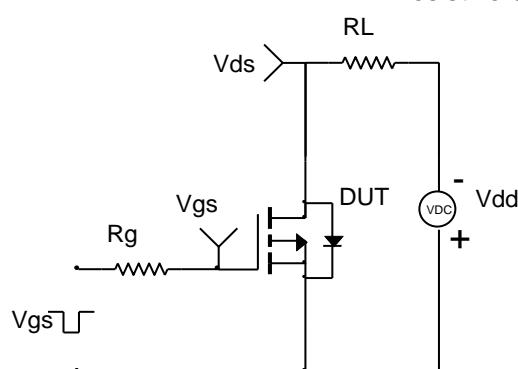
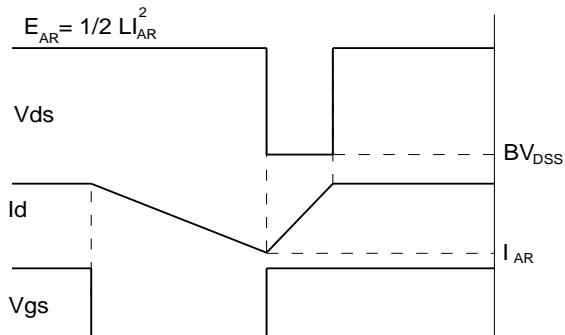
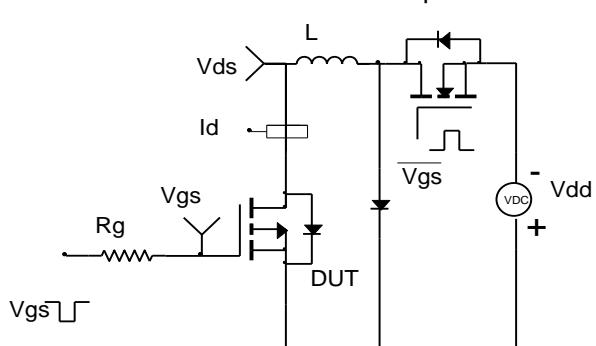
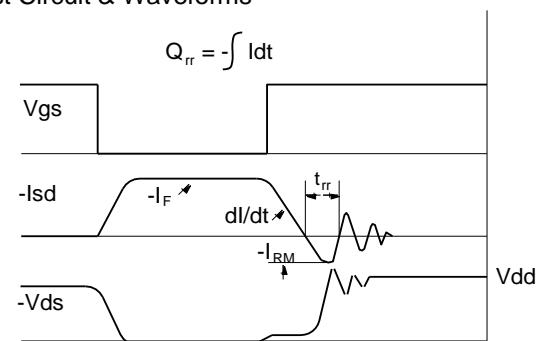
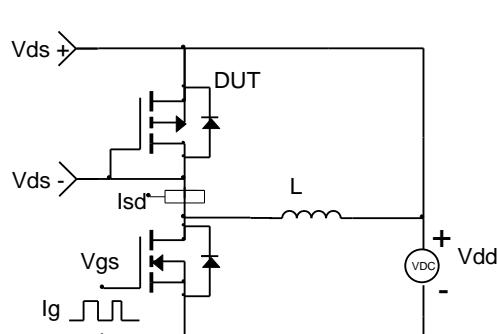
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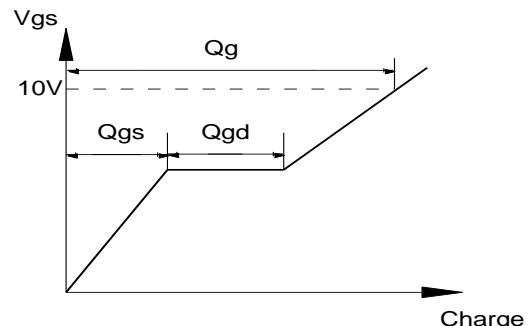
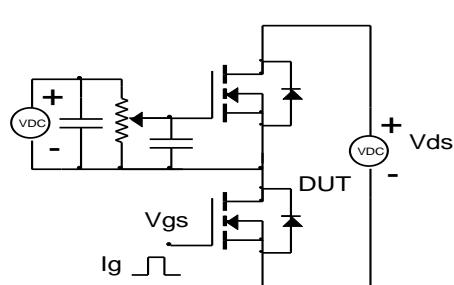
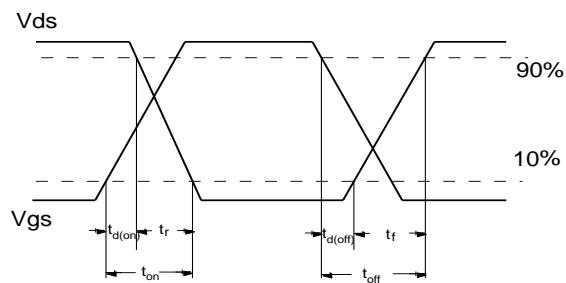
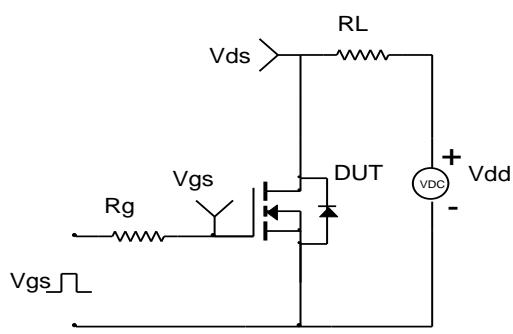
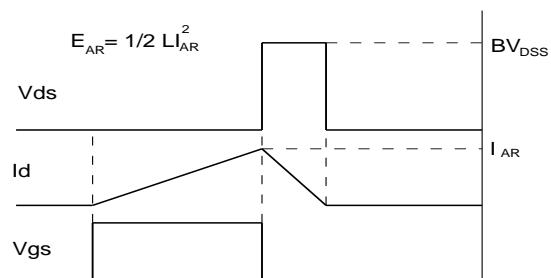
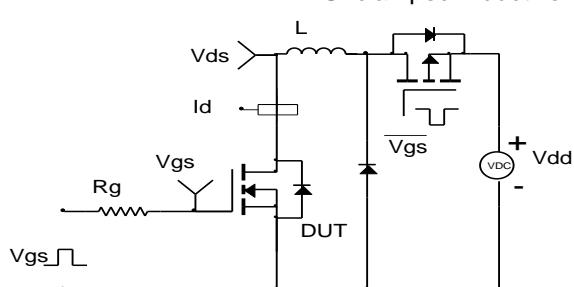
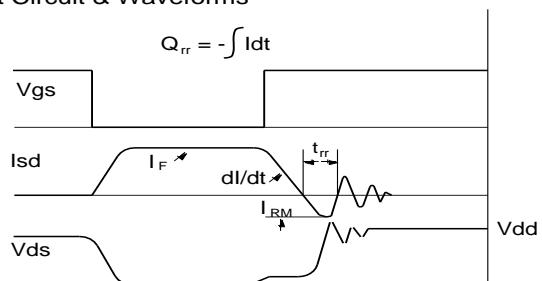
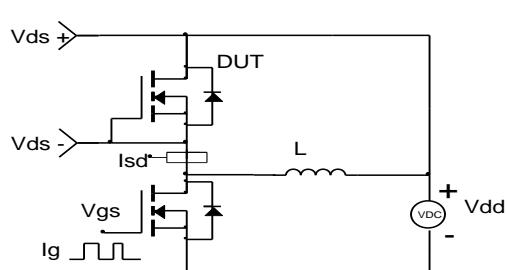
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CHANNEL

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

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CHANNEL

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

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL

Fig 12: On-Region Characteristics

Figure 13: Transfer Characteristics

Figure 14: On-Resistance vs. Drain Current and Gate Voltage

Figure 15: On-Resistance vs. Junction Temperature

Figure 16: On-Resistance vs. Gate-Source Voltage

Figure 17: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL

Figure 18: Gate-Charge Characteristics

Figure 19: Capacitance Characteristics

Figure 20: Maximum Forward Biased Safe Operating Area (Note E)

Figure 21: Single Pulse Power Rating Junction-to-Ambient (Note E)

Figure 22: Normalized Maximum Transient Thermal Impedance

Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

Diode Recovery Test Circuit & Waveforms


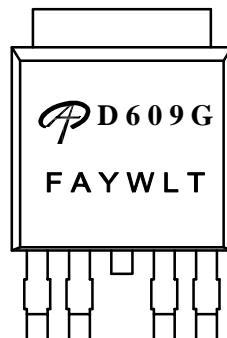
Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

Diode Recovery Test Circuit & Waveforms




ALPHA & OMEGA
SEMICONDUCTOR

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Version	A
Title	AOD609G Marking Description

TO252-4L PACKAGE MARKING DESCRIPTION



Green product

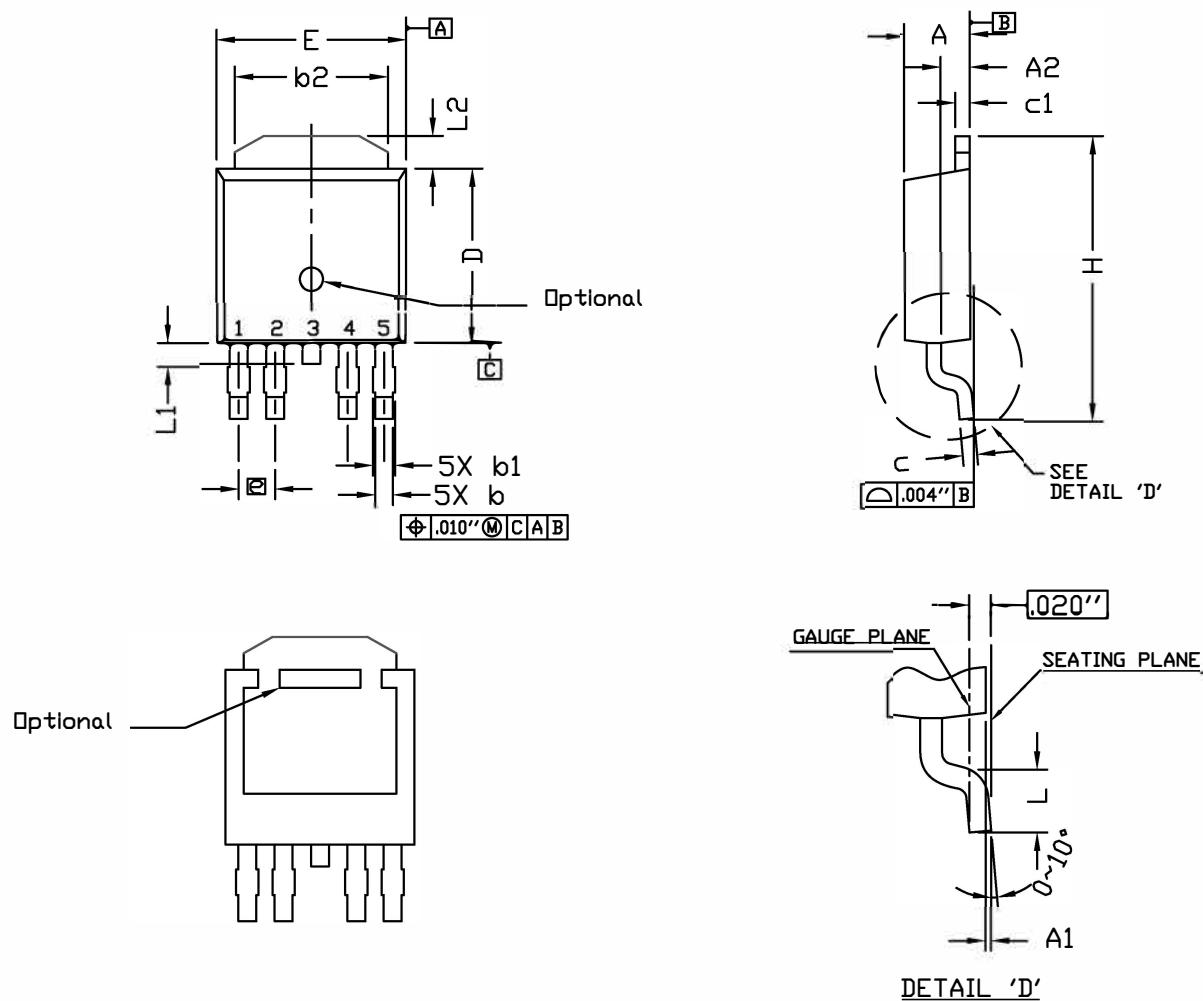
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A	- Assembly location code
Y	- Year code
W	- Week code
L&T	- Assembly lot code

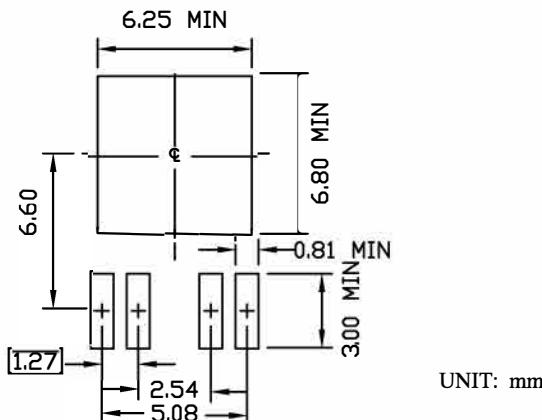
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T0252_4L PACKAGE OUTLINE



RECOMMENDED LAND PATTERN

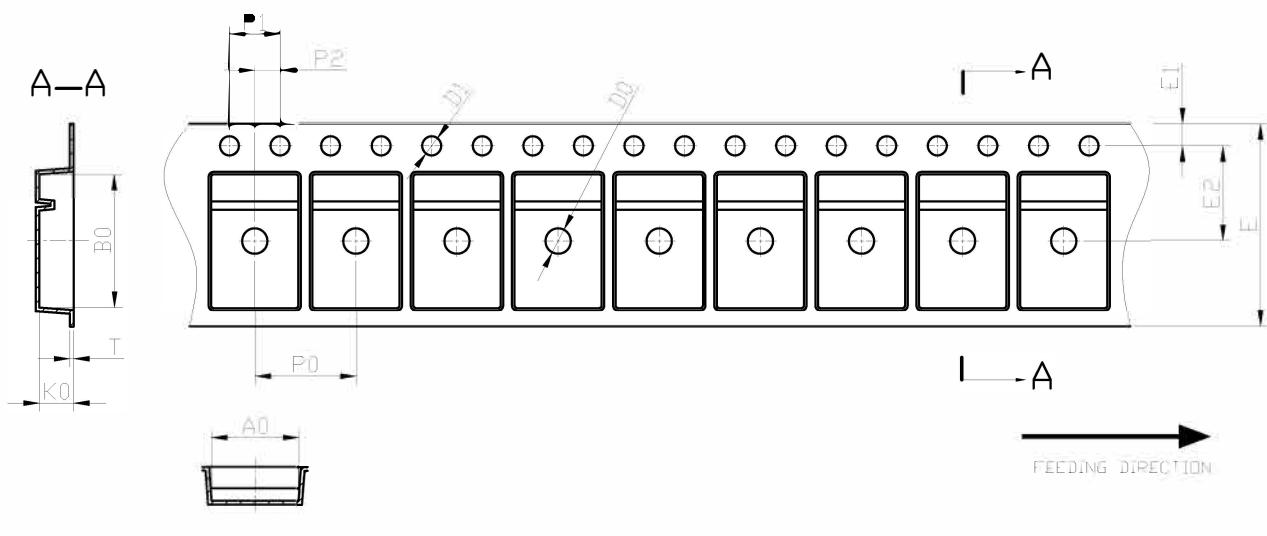


NOTE

1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS. MOLD FLASH SHOULD BE LESS THAN 6 MIL.
2. DIMENSION L IS MEASURED IN GAUGE PLANE.
3. TOLERANCE 0.10 mm UNLESS OTHERWISE SPECIFIED.
4. CONTROLLING DIMENSION IS MILLIMETER. CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.
5. REFER TO JEDEC TO-252 (AD).

SYMBOL	DIMENSION IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	2.184	2.286	2.388	0.086	0.090	0.094
A1	0.000	-----	0.127	0.000	-----	0.005
A2	0.889	-----	1.143	0.035	-----	0.045
b	0.508	-----	0.711	0.020	-----	0.028
b1	0.584	-----	0.787	0.023	-----	0.031
b2	4.953	-----	5.461	0.195	-----	0.215
c	0.457	0.508	0.610	0.018	0.020	0.024
c1	0.457	-----	0.610	0.018	-----	0.024
D	5.969	6.096	6.223	0.235	0.240	0.245
E	6.350	6.604	6.731	0.250	0.260	0.265
e	1.270 BSC.			0.050 BSC.		
H	9.398	-----	10.414	0.370	-----	0.410
L	1.270	-----	2.032	0.050	-----	0.080
L1	-----	-----	1.016	-----	-----	0.040
L2	0.889	-----	1.270	0.035	-----	0.050

T0-252-4L
Carrier Tape

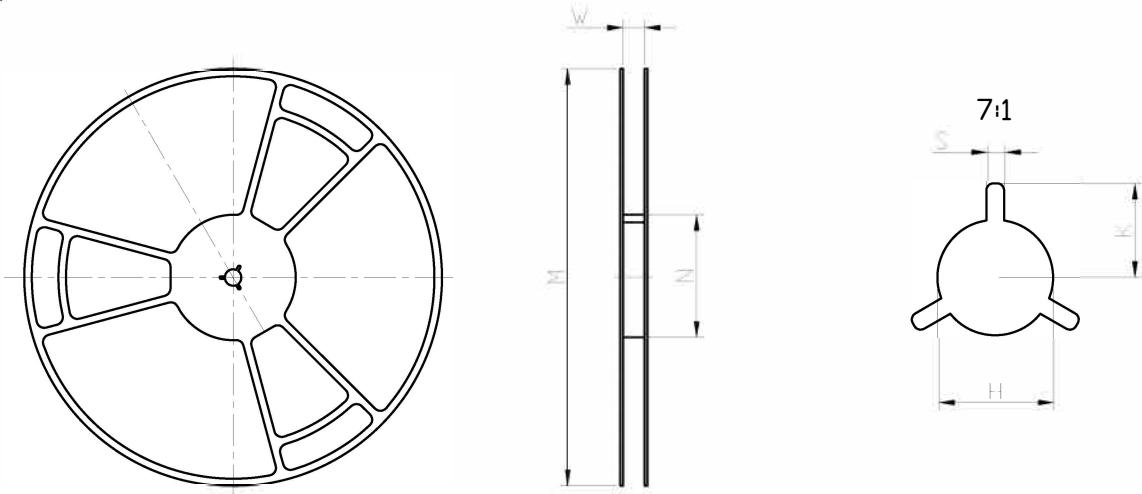


UNIT: MM

PACKAGE	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
TO-252-4L (16 mm)	6.90 ±0.10	10.50 ±0.10	2.70 ±0.10	2.00 ±0.25	1.50 ±0.1	16.00 ±0.30	17.5 ±0.10	7.50 ±0.10	8.00 ±0.10	4.00 ±0.10	2.00 ±0.10	0.30 ±0.05

T0-252-4L

Reel



UNIT: MM

TAPE SIZE	REEL SIZE	M	N	W	H	K	S
16 mm	Ø330	Ø330.00 ±0.5	Ø97.00 ±1.0	17.0 +1.5 -0	Ø13.00 +0.50 -0.20	10.6 ±0.25	2.0 ±0.5

T0-252-4L Tape

Leader / Trailer & Orientation

**Unit Per Reel:
2500pcs**

