优尚

YOUSHANG SEMICONDUCTOR

设计研发新型功率器件

各类小信号开关

中低压及高压大电流等场效应管

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Product Summary

$V_{(BR)DSS}$	$R_{DS(ON)}$	I_D T_A = +25°C
35V	35mΩ @ V_{GS} = 10V	13A
-35V	45mΩ @ V_{GS} = -10V	-12A

Features and Benefits

- 0.6mm profile – ideal for low profile applications
- PCB footprint of $4mm^2$
- Low Gate Threshold Voltage

Description

This new generation MOSFET has been designed to minimize the on-state resistance ($R_{DS(on)}$) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

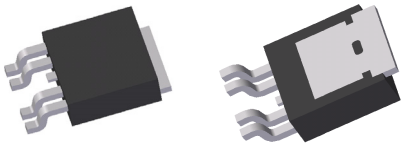
Applications

- Backlighting
- DC-DC Converters
- Power management functions

Mechanical Data

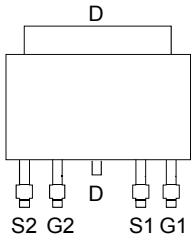
- Case: TO252-4L
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections Indicator: See diagram
- Terminals: Finish – Matte Tin annealed over Copper leadframe. Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.328 grams (approximate)

TO252-4L

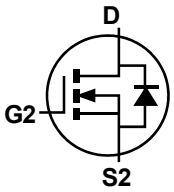


Top View

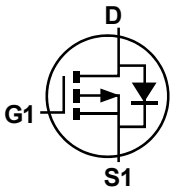
Bottom View



Pinout Top view



N-Channel MOSFET



P-Channel MOSFET

Maximum Ratings – N-CHANNEL, Q1 (@T_A = +25°C, unless otherwise specified.)

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V_{DSS}	35	V
Gate-Source Voltage			V_{GSS}	±20	V
Continuous Drain Current (Note 5) V_{GS} = 10V	Steady State	T_A = +25°C T_A = +70°C	I_D	5.3 4.2	A
Continuous Drain Current (Note 6) V_{GS} = 10V	Steady State	T_A = +25°C T_A = +70°C	I_D	8.6 6.8	A
Continuous Drain Current (Note 6) V_{GS} = 10V	t ≤ 10s	T_A = +25°C T_A = +70°C	I_D	13 11	A
Continuous Drain Current (Note 6) V_{GS} = 4.5V	Steady State	T_A = +25°C T_A = +70°C	I_D	6.3 5.0	A
Continuous Drain Current (Note 6) V_{GS} = 4.5V	t ≤ 10s	T_A =+ 25°C T_A = +70°C	I_D	9.3 7.4	A
Pulsed Drain Current (Note 7)			I_{DM}	50	A

Maximum Ratings – P-CHANNEL, Q2 (@T_A = +25°C, unless otherwise specified.)

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V_{DSS}	-35	V
Gate-Source Voltage			V_{GSS}	±20	V
Continuous Drain Current (Note 5) V_{GS} = -10V	Steady State	T_A = +25°C T_A = +70°C	I_D	-5.0 -3.8	A
Continuous Drain Current (Note 6) V_{GS} = -10V	Steady State	T_A = +25°C T_A = +70°C	I_D	-7.8 -6.2	A
Continuous Drain Current (Note 6) V_{GS} = -10V	t ≤ 10s	T_A = +25°C T_A = +70°C	I_D	-12 -10	A
Continuous Drain Current (Note 6) V_{GS} = -4.5V	Steady State	T_A = +25°C T_A = +70°C	I_D	-6.5 -5.2	A
Continuous Drain Current (Note 6) V_{GS} = -4.5V	t ≤ 10s	T_A = +25°C T_A = +70°C	I_D	-9.6 -7.7	A
Pulsed Drain Current (Note 7)			I_{DM}	-50	A

Thermal Characteristics

Characteristic	Symbol	Value	Unit
Power Dissipation (Note 5)	P_D	1.54	W
Thermal Resistance, Junction to Ambient @T_A = +25°C (Note 5)	$R_{\theta JA}$	81.3	°C/W
Power Dissipation (Note 6)	P_D	4.1	W
Thermal Resistance, Junction to Ambient @T_A = +25°C (Note 6)	$R_{\theta JA}$	30.8	°C/W
Power Dissipation (Note 6) t ≤ 10s	P_D	8.9	W
Thermal Resistance, Junction to Ambient @T_A = +25°C (Note 5) t ≤ 10s	$R_{\theta JA}$	14	°C/W
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to +150	°C

Notes:
5. Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.
6. Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate
7. I_{AS} and E_{AS} rating are based on low frequency and duty cycles to keep T_J = +25°C
8. Short duration pulse test used to minimize self-heating effect.
9. Guaranteed by design. Not subject to product testing.

Electrical Characteristics – N-CHANNEL, Q1 (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 8)						
Drain-Source Breakdown Voltage	BV_{DSS}	35	—	—	V	V_{GS} = 0V, I_D = 250μA
Zero Gate Voltage Drain Current T_J = +25°C	I_{DSS}	—	—	1.0	μA	V_{DS} = 35V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±100	nA	V_{GS} = ±20V, V_{DS} = 0V
ON CHARACTERISTICS (Note 8)						
Gate Threshold Voltage	$V_{GS(th)}$	1.0	—	3.0	V	V_{DS} = V_{GS}, I_D = 250μA
Static Drain-Source On-Resistance	$R_{DS\ (ON)}$	—	25 50	35 65	mΩ	V_{GS} = 10V, I_D = 8A V_{GS} = 4.5V, I_D = 6A
Forward Transfer Admittance	$\|Y_{fs}\|$	—	4.5	—	S	V_{DS} = 10V, I_D = 8A
Diode Forward Voltage	V_{SD}	—	—	1.2	V	V_{GS} = 0V, I_S = 8A
DYNAMIC CHARACTERISTICS (Note 9)						
Input Capacitance	C_{iss}	—	850	—	pF	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz
Output Capacitance	C_{oss}	—	64.7	—	pF	
Reverse Transfer Capacitance	C_{rss}	—	51.9	—	pF	
Gate Resistance	R_g	—	1.6	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1MHz
Total Gate Charge (V_{GS} = 10V)	Q_g	—	18.7	—	nC	V_{GS} = 10V, V_{DS} = 28V, I_D = 8A
Total Gate Charge (V_{GS} = 4.5V)	Q_g	—	8.8	—		V_{GS} = 4.5V, V_{DS} = 28V, I_D = 8A
Gate-Source Charge	Q_{gs}	—	2.6	—		
Gate-Drain Charge	Q_{gd}	—	2.1	—		
Turn-On Delay Time	$t_{D(on)}$	—	5.4	—	ns	V_{DS} = 18V, V_{GS} = 10V, R_L = 18Ω, R_G = 3.3Ω, I_D = 1A
Turn-On Rise Time	t_r	—	2.8	—	ns	
Turn-Off Delay Time	$t_{D(off)}$	—	33.2	—	ns	
Turn-Off Fall Time	t_f	—	35.6	—	ns	

Electrical Characteristics – P-CHANNEL, Q2 (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 8)						
Drain-Source Breakdown Voltage	BV_{DSS}	-35	—	—	V	V_{GS} = 0V, I_D = -250μA
Zero Gate Voltage Drain Current T_J = 25°C	I_{DSS}	—	—	-1.0	μA	V_{DS} = -35V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±100	nA	V_{GS} = ±20V, V_{DS} = 0V
ON CHARACTERISTICS (Note 8)						
Gate Threshold Voltage	$V_{GS(th)}$	-1.0	—	-3.0	V	V_{DS} = V_{GS}, I_D = -250μA
Static Drain-Source On-Resistance	$R_{DS\ (ON)}$	—	30 40	45 65	mΩ	V_{GS} = -10V, I_D = -6A V_{GS} = -4.5V, I_D = -4A
Forward Transfer Admittance	$\|Y_{fs}\|$	—	8	—	S	V_{DS} = -10V, I_D = -6A
Diode Forward Voltage	V_{SD}	—	—	-1.2	V	V_{GS} = 0V, I_S = -6A
DYNAMIC CHARACTERISTICS (Note 9)						
Input Capacitance	C_{iss}	—	985.2	—	pF	V_{DS} = -25V, V_{GS} = 0V, f = 1.0MHz
Output Capacitance	C_{oss}	—	90.6	—	pF	
Reverse Transfer Capacitance	C_{rss}	—	75.3	—	pF	
Gate Resistance	R_g	—	7.0	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1MHz
Total Gate Charge (V_{GS} = -10V)	Q_g	—	19.2	—	nC	V_{GS} = -10V, V_{DS} = -28V, I_D = -6A
Total Gate Charge (V_{GS} = -4.5V)	Q_g	—	9.5	—		V_{GS} = -4.5V, V_{DS} = -28V, I_D = -6A
Gate-Source Charge	Q_{gs}	—	2.0	—		
Gate-Drain Charge	Q_{gd}	—	3.5	—		
Turn-On Delay Time	$t_{D(on)}$	—	5.2	—	ns	V_{DS} = -18V, V_{GS} = -10V, R_L = 18Ω, R_G = 3.3Ω, I_D = -1A
Turn-On Rise Time	t_r	—	4.8	—	ns	
Turn-Off Delay Time	$t_{D(off)}$	—	45.8	—	ns	
Turn-Off Fall Time	t_f	—	29.5	—	ns	

Notes: 8. Short duration pulse test used to minimize self-heating effect.
9. Guaranteed by design. Not subject to product testing.

N-CHANNEL, Q1

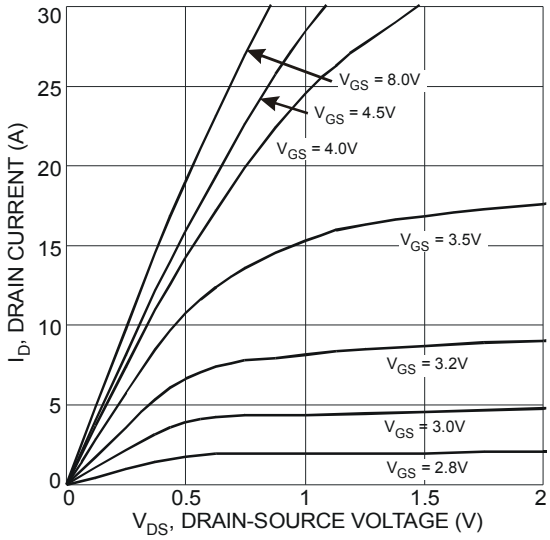


Fig. 1 Typical Output Characteristic

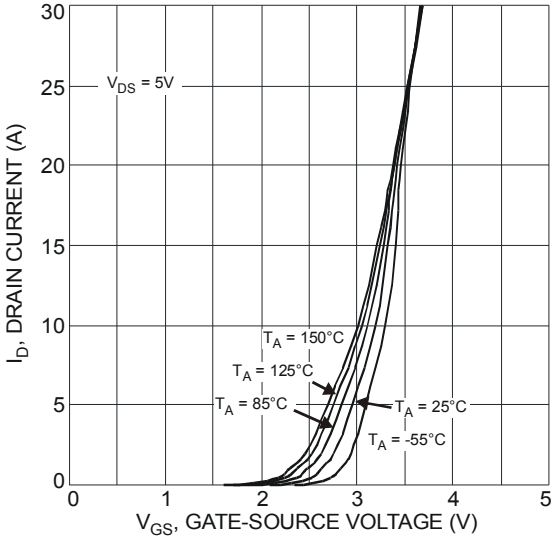


Fig. 2 Typical Transfer Characteristic

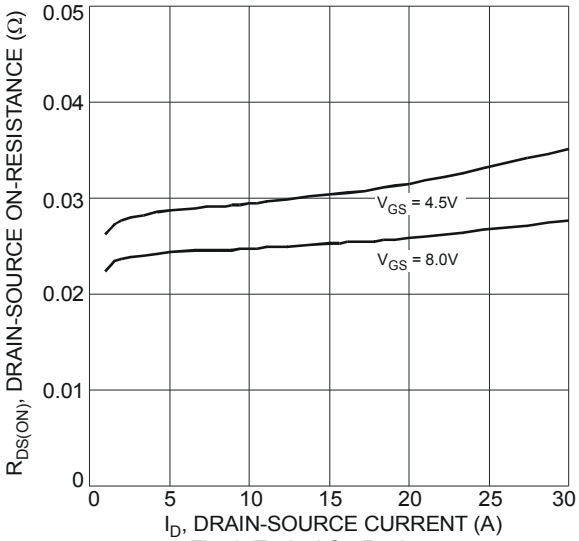


Fig. 3 Typical On-Resistance
vs. Drain Current and Gate Voltage

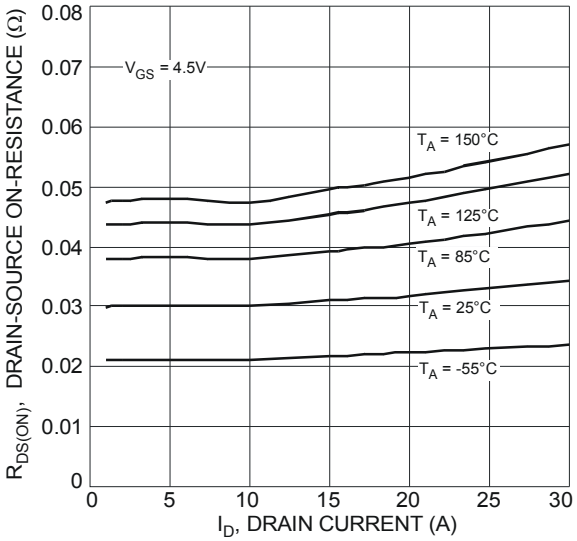


Fig. 4 Typical On-Resistance
vs. Drain Current and Temperature

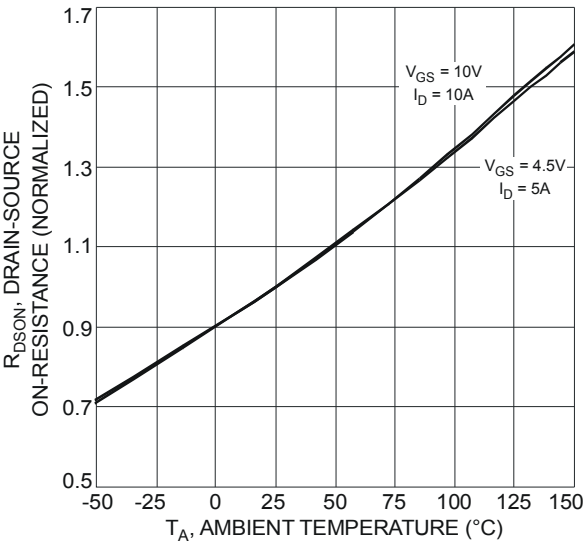


Fig. 5 On-Resistance Variation with Temperature

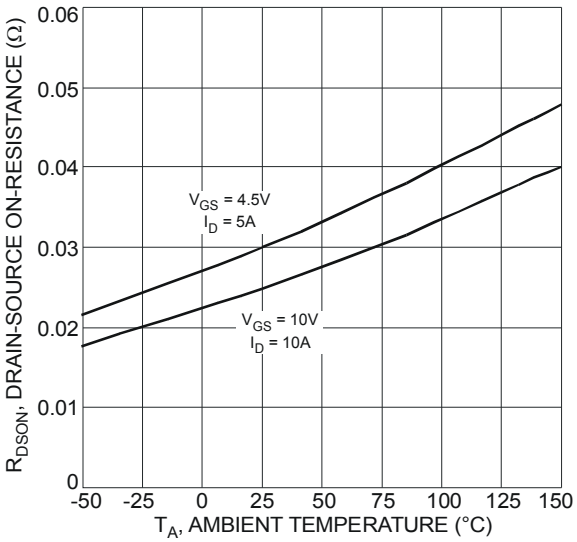


Fig. 6 On-Resistance Variation with Temperature

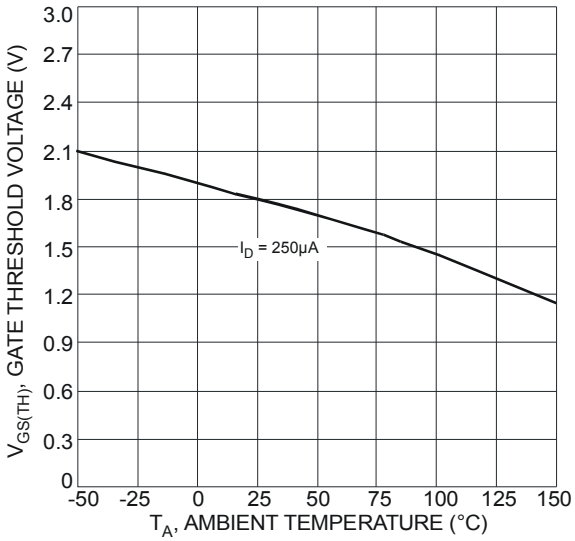


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

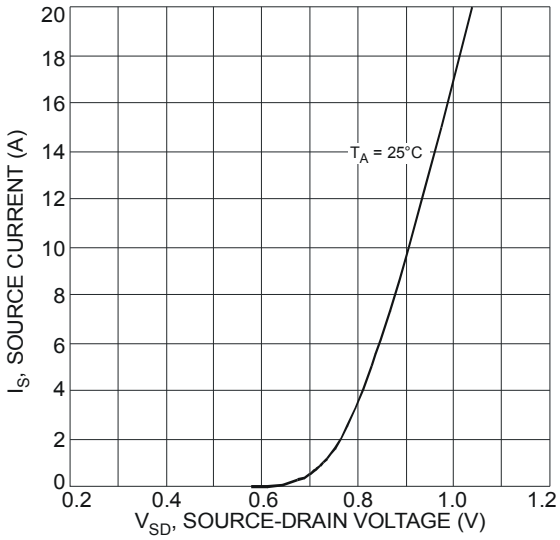


Fig. 8 Diode Forward Voltage vs. Current

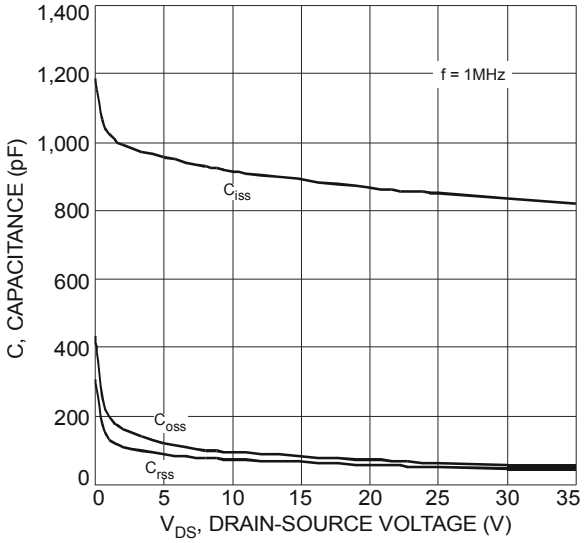


Fig. 9 Typical Total Capacitance

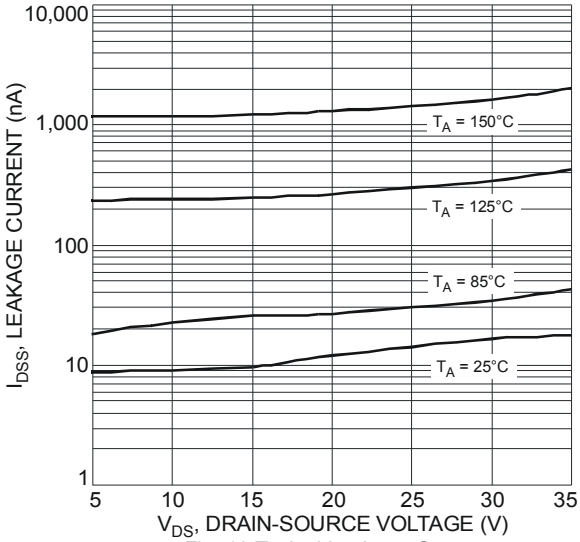


Fig. 10 Typical Leakage Current vs. Drain-Source Voltage

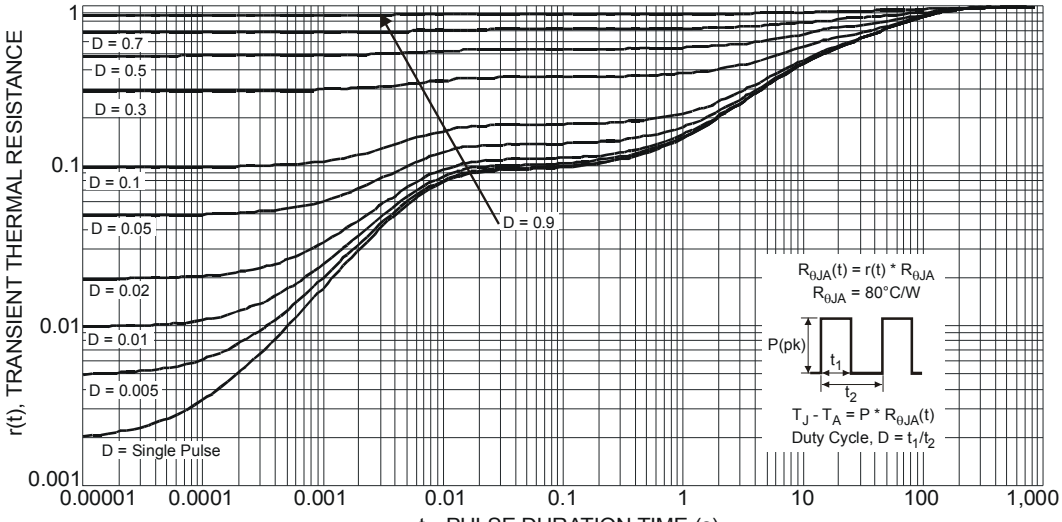


Fig. 11 Transient Thermal Response

P-CHANNEL, Q2

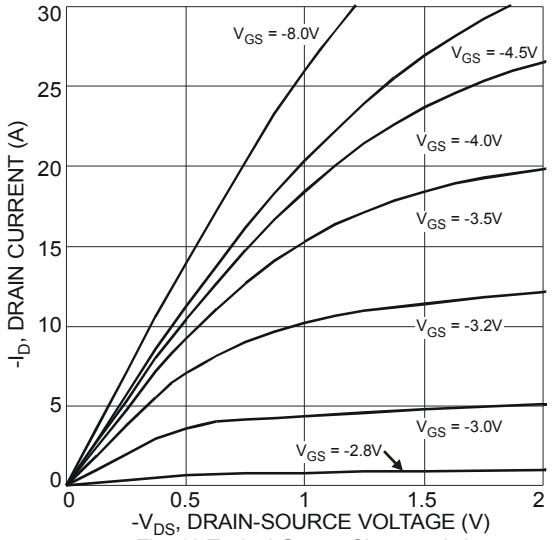


Fig. 12 Typical Output Characteristic

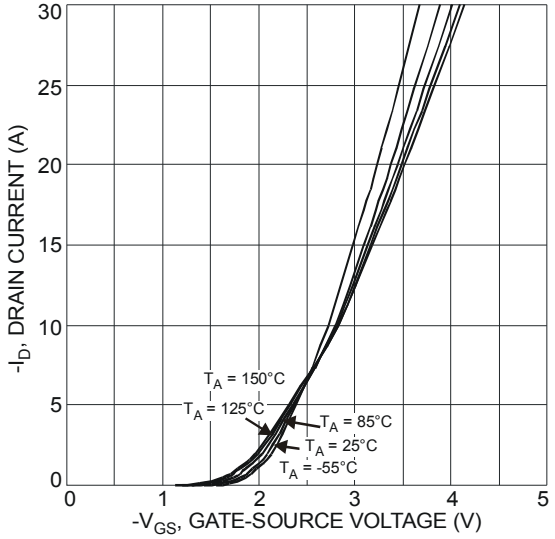


Fig. 13 Typical Transfer Characteristic

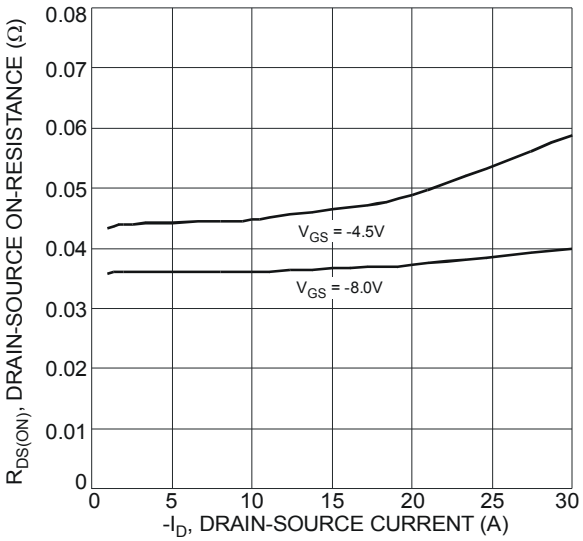


Fig. 14 Typical On-Resistance
vs. Drain Current and Gate Voltage

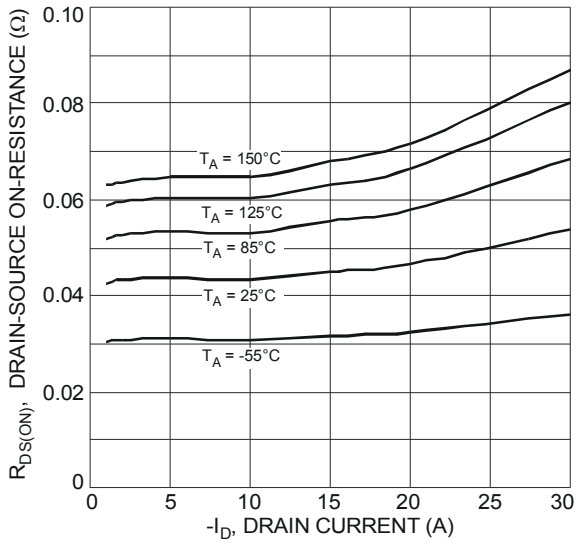


Fig. 15 Typical On-Resistance
vs. Drain Current and Temperature

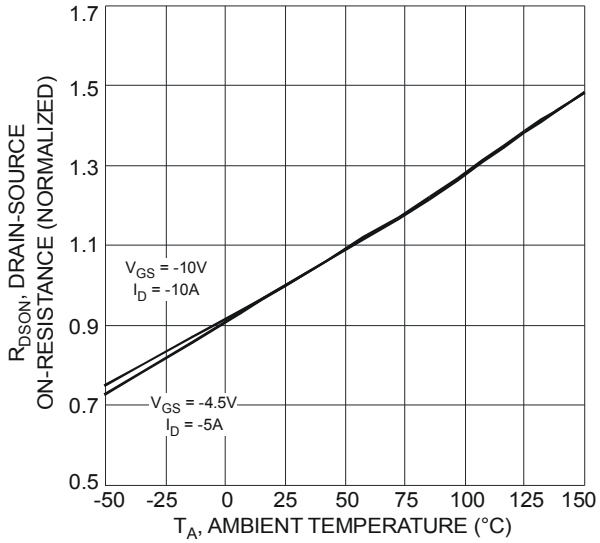


Fig. 16 On-Resistance Variation with Temperature

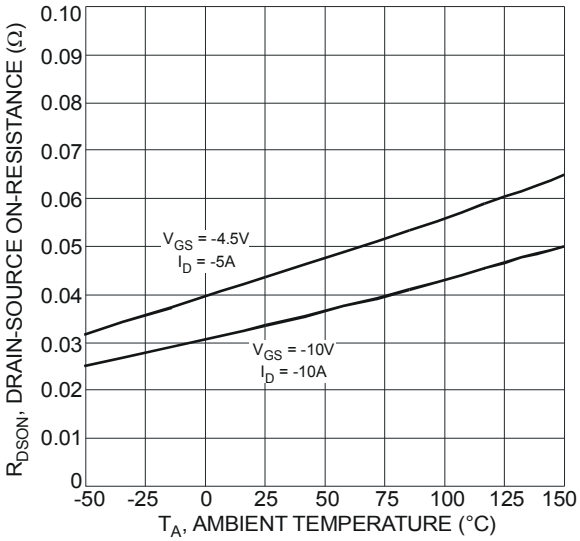


Fig. 17 On-Resistance Variation with Temperature

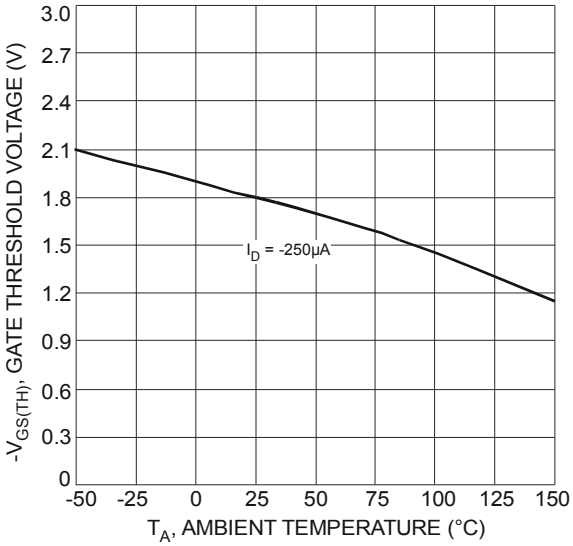


Fig. 18 Gate Threshold Variation vs. Ambient Temperature

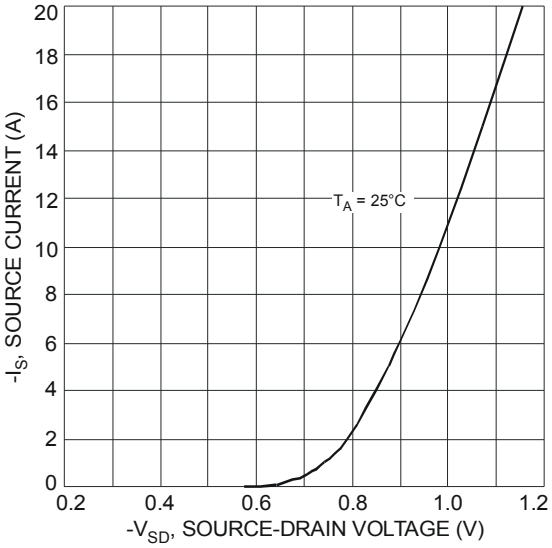


Fig. 19 Diode Forward Voltage vs. Current

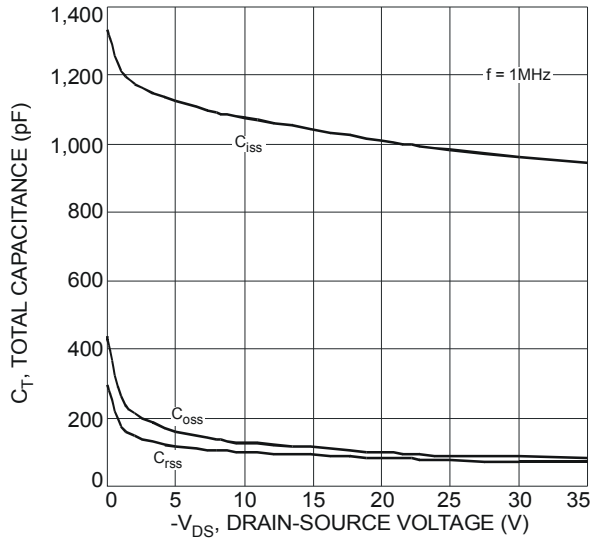


Fig. 20 Typical Total Capacitance

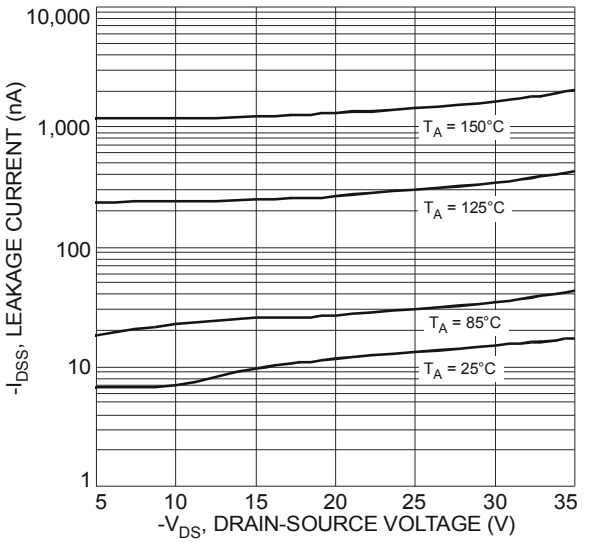


Fig. 21 Typical Leakage Current vs. Drain-Source Voltage

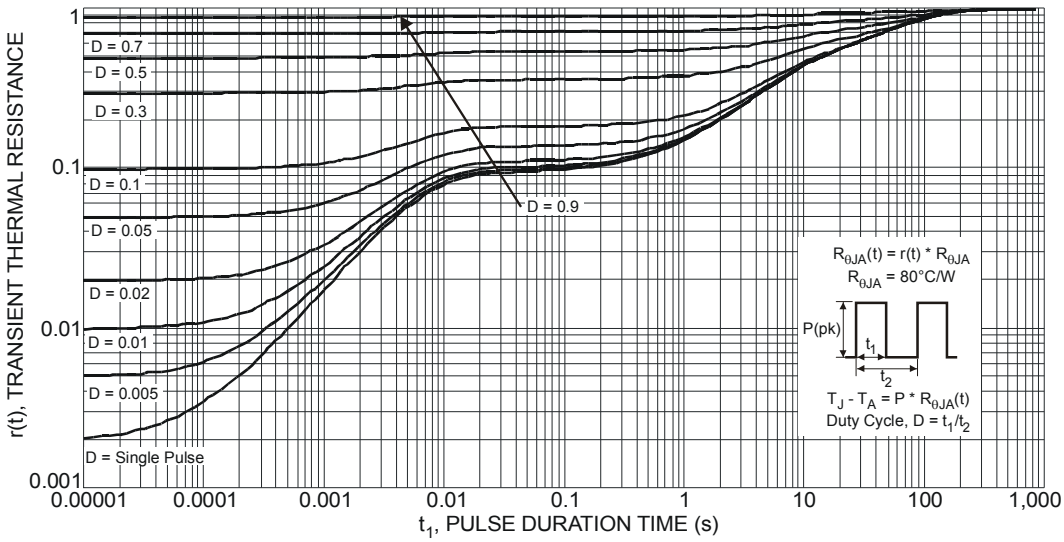
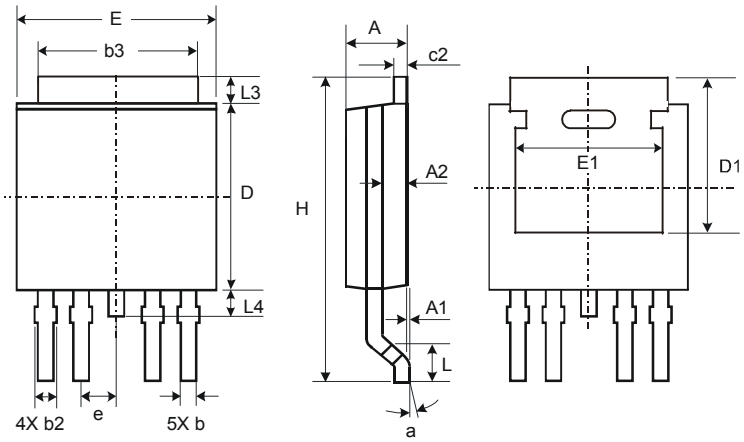


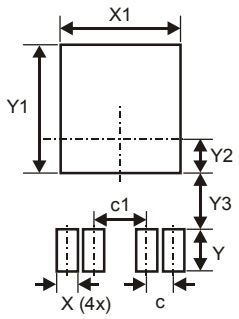
Fig. 22 Transient Thermal Response

Package Outline Dimensions



TO252-4L			
Dim	Min	Max	Typ
A	2.19	2.39	2.29
A1	0.00	0.13	0.08
A2	0.97	1.17	1.07
b	0.51	0.71	0.583
b2	0.61	0.79	0.70
b3	5.21	5.46	5.33
c2	0.45	0.58	0.531
D	6.00	6.20	6.10
D1	5.21	–	–
e	–	–	1.27
E	6.45	6.70	6.58
E1	4.32	–	–
H	9.40	10.41	9.91
L	1.40	1.78	1.59
L3	0.88	1.27	1.08
L4	0.64	1.02	0.83
a	0°	10°	–
All Dimensions in mm			

Suggested Pad Layout



Dimensions	Value (in mm)
c	1.27
c1	2.54
X	1.00
X1	5.73
Y	2.00
Y1	6.17
Y2	1.64
Y3	2.66