



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**

0755-83047638

ysbdt@szyoushang.cn

www.szyoushang.cn



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## Product Summary

Device	$V_{(BR)DSS}$	$R_{DS(ON)}$	$I_D$ $T_A = +25^\circ\text{C}$
Q1	25V	4Ω @ $V_{GS} = 4.5\text{V}$	0.4 A
Q2	-30V	80mΩ @ $V_{GS} = -12\text{V}$	-3.2 A
		125mΩ @ $V_{GS} = -4.5\text{V}$	-2.6 A

## Description

This new generation MOSFET is 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

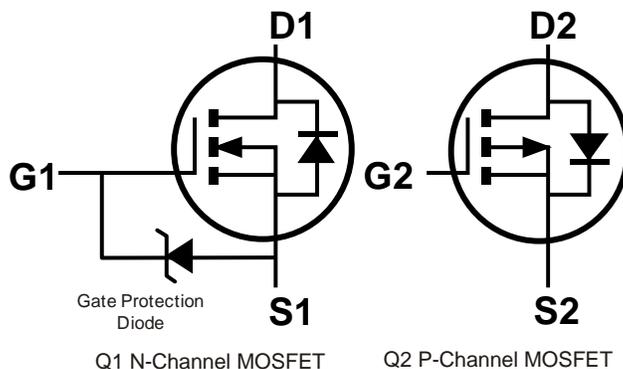
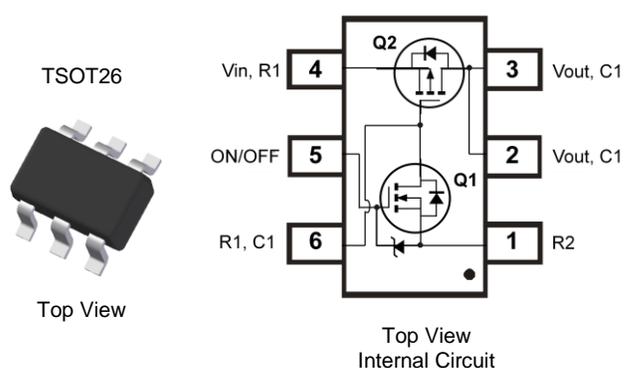
- DC-DC Converters
- Power Management Functions
- Load Switch

## Features and Benefits

- Low On-Resistance
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- ESD Protected Gate on N-Channel (>6kV Human Body Model)

## Mechanical Data

- Case: TSOT26
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals Connections: See Diagram
- Terminals: Finish – Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208  $\text{e3}$
- Weight: 0.013 grams (Approximate)



**Maximum Ratings – Q1** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Drain-Source Voltage	V <sub>DSS</sub>	25	V
Gate-Source Voltage	V <sub>GSS</sub>	-0.5 +8	V
Continuous Drain Current (Note 5) V <sub>GS</sub> = 4.5V	I <sub>D</sub>	0.4	A
Maximum Continuous Body Diode Forward Current (Note 6)	I <sub>S</sub>	1.2	A
Pulsed Drain Current (Note 6)	I <sub>DM</sub>	1.5	A

**Maximum Ratings – Q2** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit	
Drain-Source Voltage	V <sub>DSS</sub>	-30	V	
Gate-Source Voltage	V <sub>GSS</sub>	±12	V	
Continuous Drain Current (Note 5) V <sub>GS</sub> = -10V	I <sub>D</sub>	Steady State	-3.2	A
		Note 9	-14.4	A
Continuous Drain Current (Note 5) V <sub>GS</sub> = -4.5V	I <sub>D</sub>	-2.6	A	
Maximum Continuous Body Diode Forward Current (Note 6)	I <sub>S</sub>	-1.2	A	
Pulsed Drain Current (Note 6)	I <sub>DM</sub>	-20	A	

**Thermal Characteristics**

Characteristic	Symbol	Value	Unit	
Power Dissipation (Note 5)	P <sub>D</sub>	1.2	W	
Thermal Resistance, Junction to Ambient (Note 5)	R <sub>θJA</sub>	Steady State	101	°C/W
		Note 9	5	
Thermal Resistance, Junction to Case (Note 5)	R <sub>θJC</sub>	37	°C/W	
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C	

**Electrical Characteristics – Q1** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 7)</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	25	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	1	μA	V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	100	nA	V <sub>GS</sub> = 8V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 7)</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	0.65	0.85	1.5	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	—	3.8	4	Ω	V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 0.4A
Diode Forward Voltage	V <sub>SD</sub>	—	0.76	1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 0.29A
<b>DYNAMIC CHARACTERISTICS (Note 8)</b>						
Input Capacitance	C <sub>iss</sub>	—	26.2	—	pF	V <sub>DS</sub> = 10V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	7.1	—		
Reverse Transfer Capacitance	C <sub>rss</sub>	—	2.7	—		
Gate Resistance	R <sub>g</sub>	—	84.5	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge (V <sub>GS</sub> = 4.5V)	Q <sub>g</sub>	—	0.4	—	nC	V <sub>DS</sub> = 5V, I <sub>D</sub> = 0.2A
Total Gate Charge (V <sub>GS</sub> = 8V)	Q <sub>g</sub>	—	0.7	—		
Gate-Source Charge	Q <sub>gs</sub>	—	0.1	—		
Gate-Drain Charge	Q <sub>gd</sub>	—	0.1	—		
Turn-On Delay Time	t <sub>D(ON)</sub>	—	3	—	ns	V <sub>GS</sub> = 4.5V, V <sub>DS</sub> = 6V, R <sub>G</sub> = 50Ω, I <sub>D</sub> = 0.5A
Turn-On Rise Time	t <sub>r</sub>	—	2.3	—		
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	7.7	—		
Turn-Off Fall Time	t <sub>f</sub>	—	3.7	—		

- Notes:
- Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
  - Repetitive rating, pulse width limited by junction temperature.
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to production testing.
  - Pulse Test: Pulse Width < 300μs, Duty Cycle < 2.0%.

**Electrical Characteristics – Q2** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 10)</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	-30	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	-1	μA	V <sub>DS</sub> = -24V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±12V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 10)</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	-0.5	-0.9	-1.5	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	—	59	80	mΩ	V <sub>GS</sub> = -12V, I <sub>D</sub> = -2.3A
		—	75	125		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -1.9A
		—	—	300		V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -1A
Diode Forward Voltage	V <sub>SD</sub>	—	-0.7	-1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = -1A
<b>DYNAMIC CHARACTERISTICS (Note 11)</b>						
Input Capacitance	C <sub>iSS</sub>	—	854	—	pF	V <sub>DS</sub> = -15V, V <sub>GS</sub> = 0V, f = 1MHz
Output Capacitance	C <sub>oSS</sub>	—	53	—		
Reverse Transfer Capacitance	C <sub>rSS</sub>	—	47	—		
Gate Resistance	R <sub>g</sub>	—	11	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge (V <sub>GS</sub> = -4.5V)	Q <sub>g</sub>	—	10	—	nC	V <sub>DS</sub> = -15V, I <sub>D</sub> = -4A
Total Gate Charge (V <sub>GS</sub> = -10V)	Q <sub>g</sub>	—	21	—		
Gate-Source Charge	Q <sub>gs</sub>	—	1.5	—		
Gate-Drain Charge	Q <sub>gd</sub>	—	2.8	—		
Turn-On Delay Time	t <sub>D(ON)</sub>	—	3.5	—	ns	V <sub>GS</sub> = -10V, V <sub>DS</sub> = -15V, R <sub>G</sub> = 6Ω, I <sub>D</sub> = -1A
Turn-On Rise Time	t <sub>R</sub>	—	3.3	—		
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	61.4	—		
Turn-Off Fall Time	t <sub>F</sub>	—	14.6	—		

Notes: 10. Short duration pulse test used to minimize self-heating effect.  
 11. Guaranteed by design. Not subject to production testing.

**Typical Characteristics - N-CHANNEL**

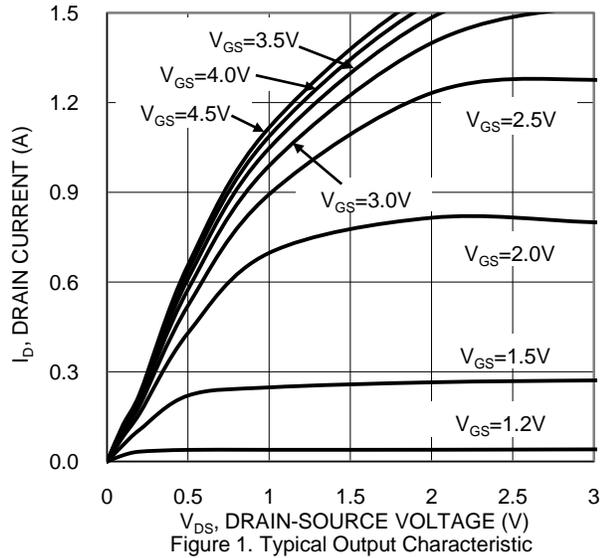


Figure 1. Typical Output Characteristic

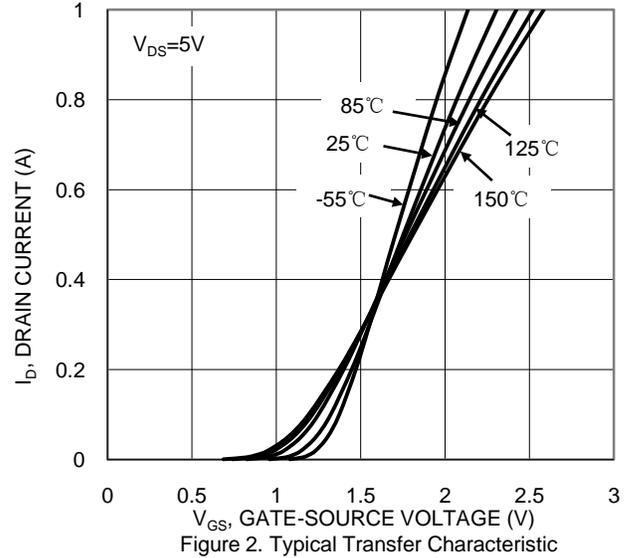


Figure 2. Typical Transfer Characteristic

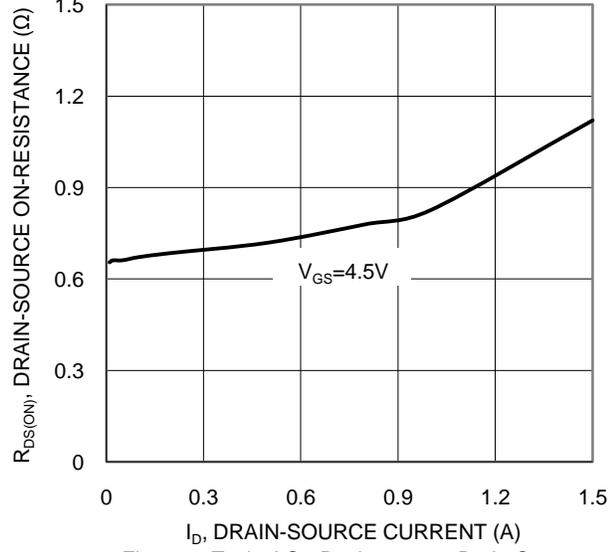


Figure 3. Typical On-Resistance vs Drain Current and Gate Voltage

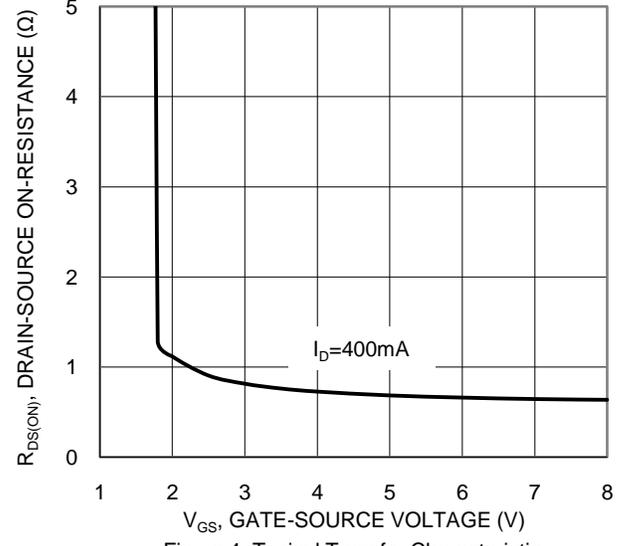


Figure 4. Typical Transfer Characteristic

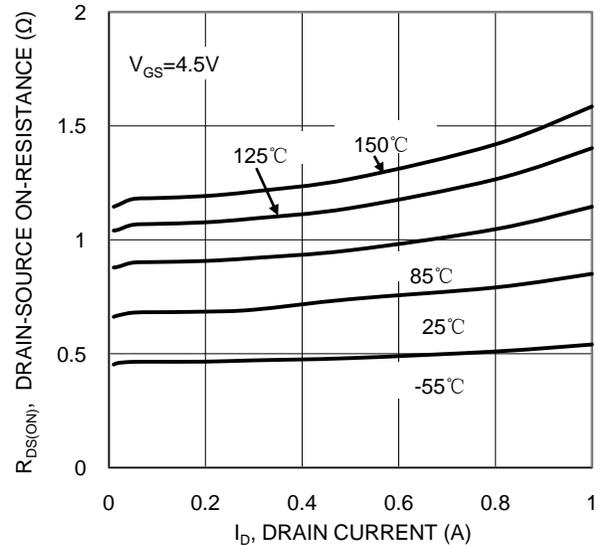


Figure 5. Typical On-Resistance vs Drain Current and Temperature

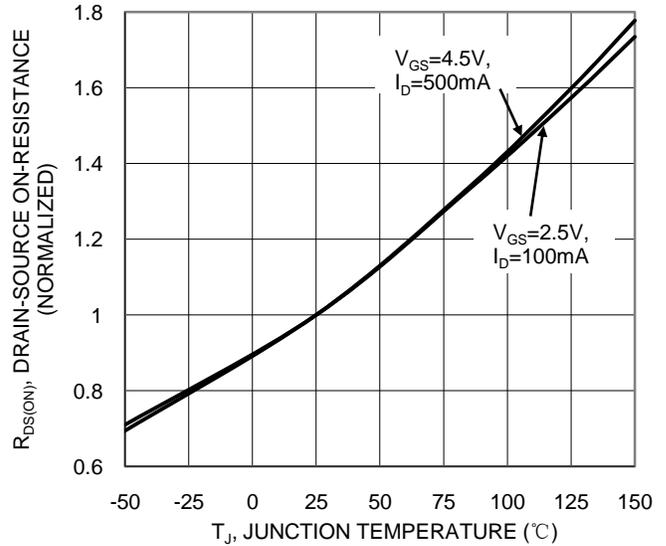


Figure 6. On-Resistance Variation with Temperature

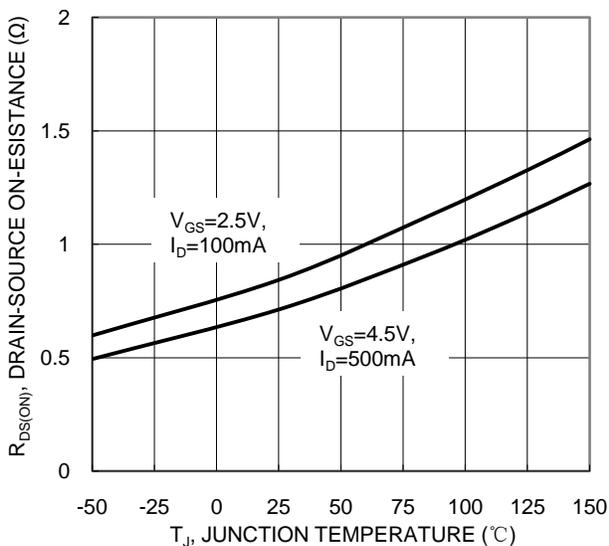


Figure 7. On-Resistance Variation with Temperature

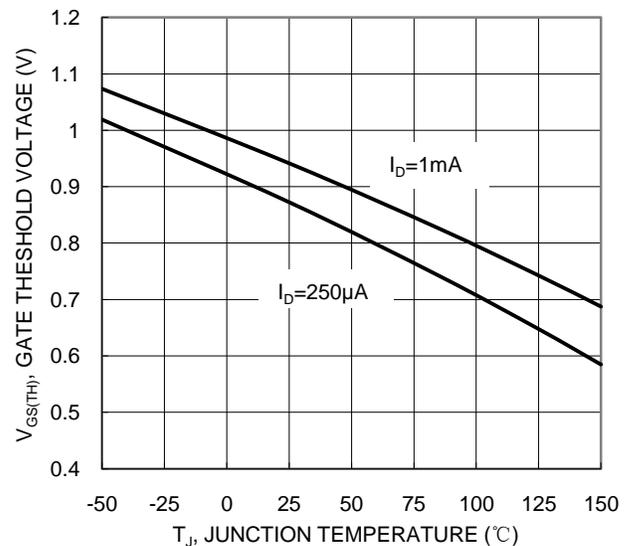


Figure 8. Gate Threshold Variation vs Junction Temperature

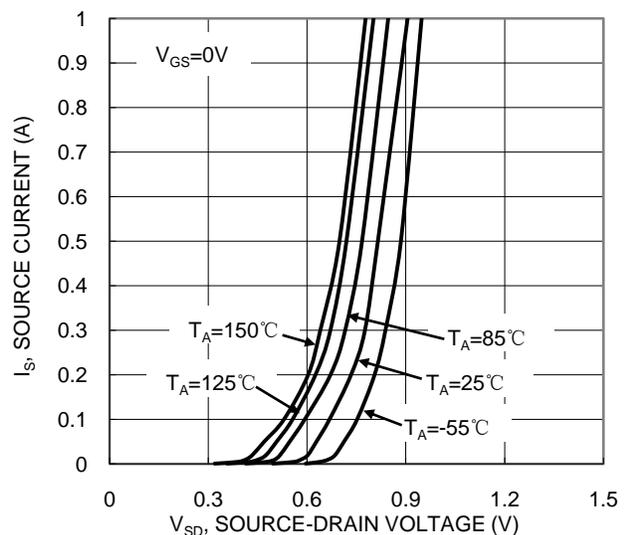


Figure 9. Diode Forward Voltage vs Current

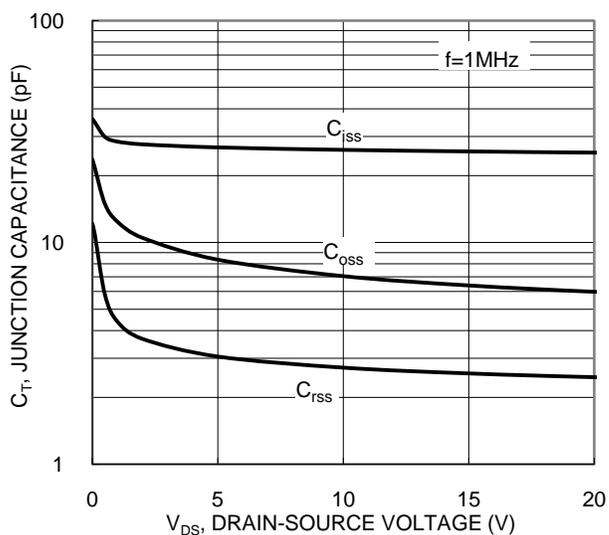


Figure 10. Typical Junction Capacitance

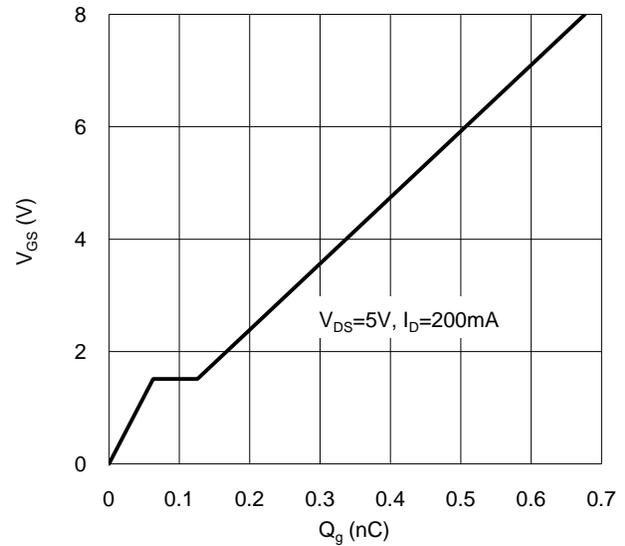


Figure 11. Gate Charge

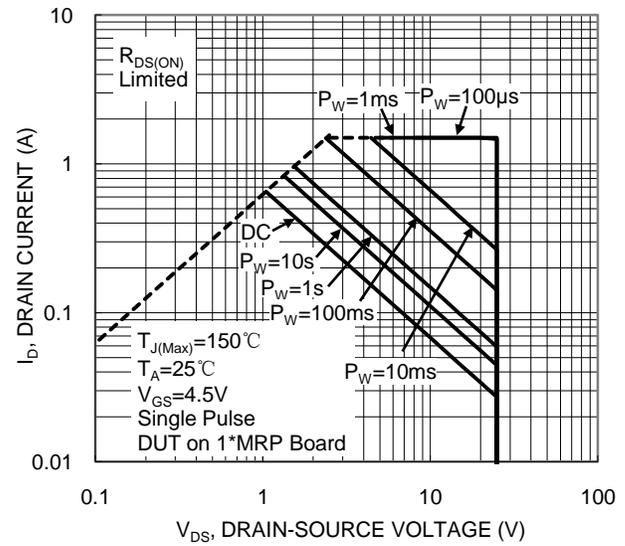


Figure 12. SOA, Safe Operation Area

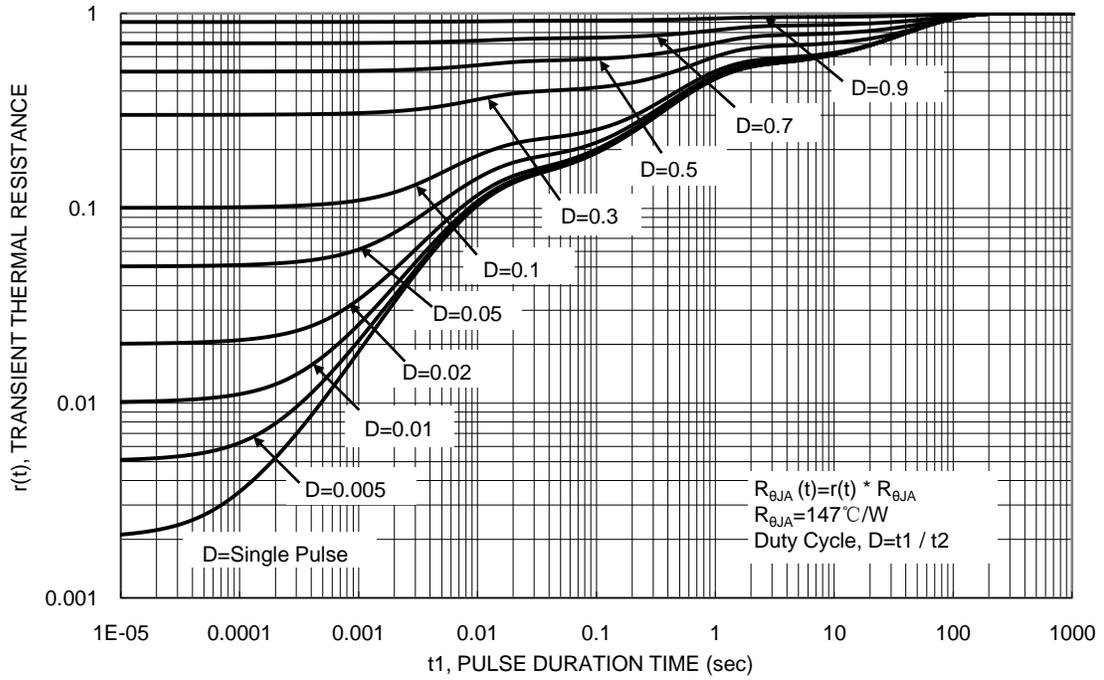


Figure 13. Transient Thermal Resistance

**Typical Characteristics - P-CHANNEL**

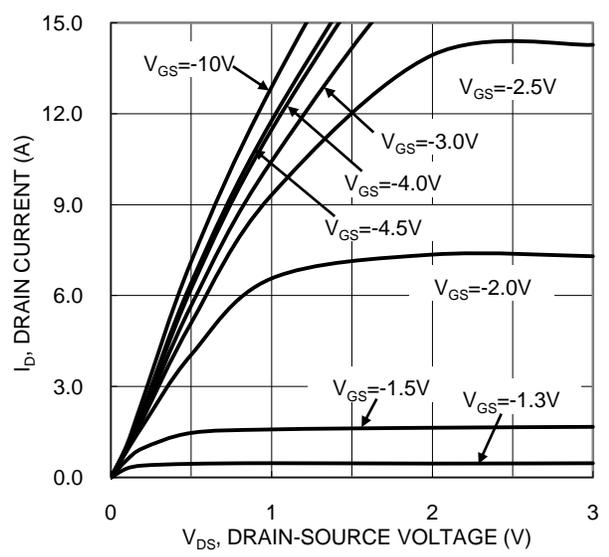


Figure 14. Typical Output Characteristic

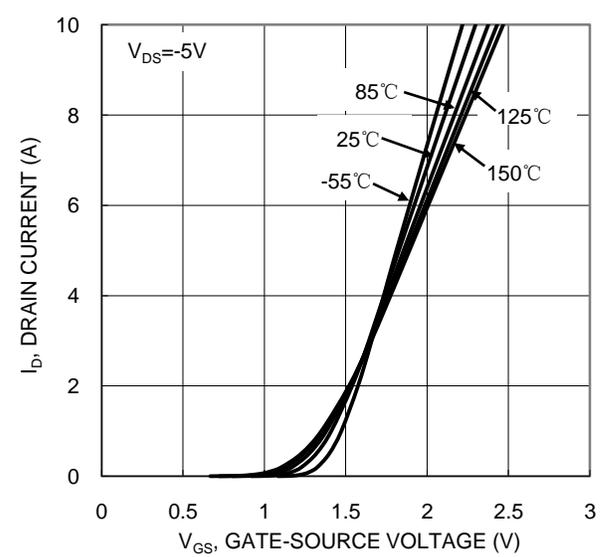


Figure 15. Typical Transfer Characteristic

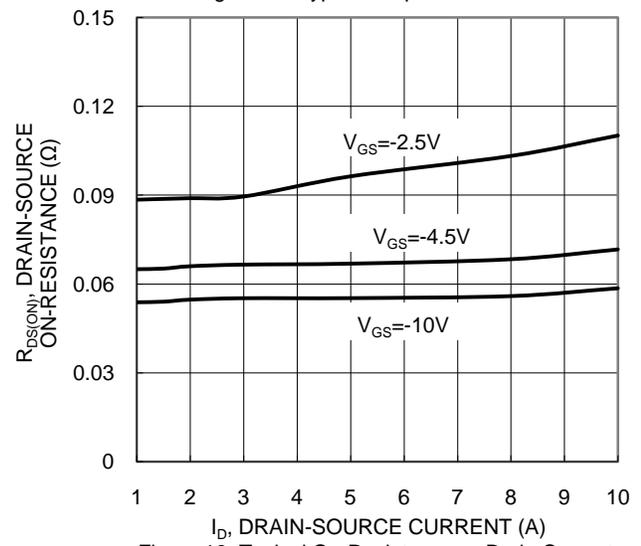


Figure 16. Typical On-Resistance vs Drain Current and Gate Voltage

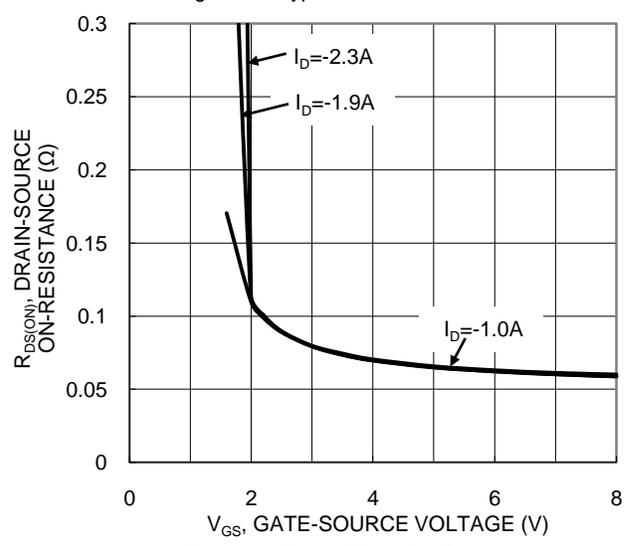


Figure 17. Typical Transfer Characteristic

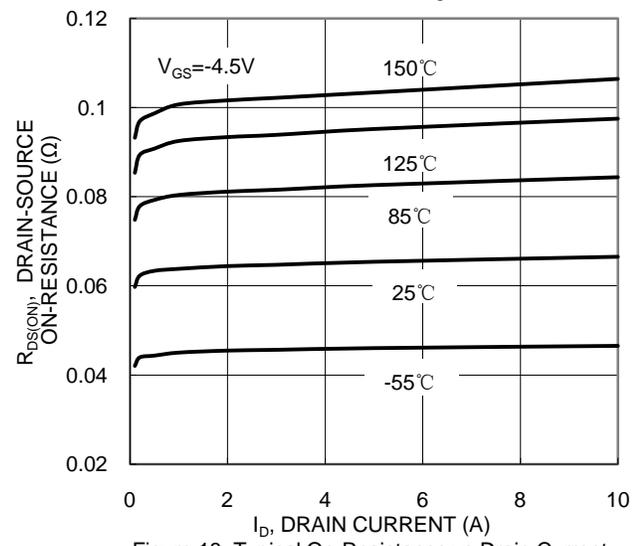


Figure 18. Typical On-Resistance vs Drain Current and Temperature

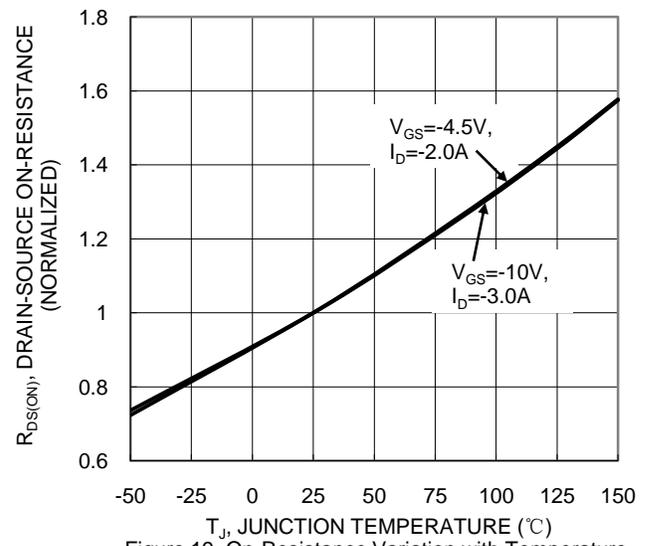


Figure 19. On-Resistance Variation with Temperature

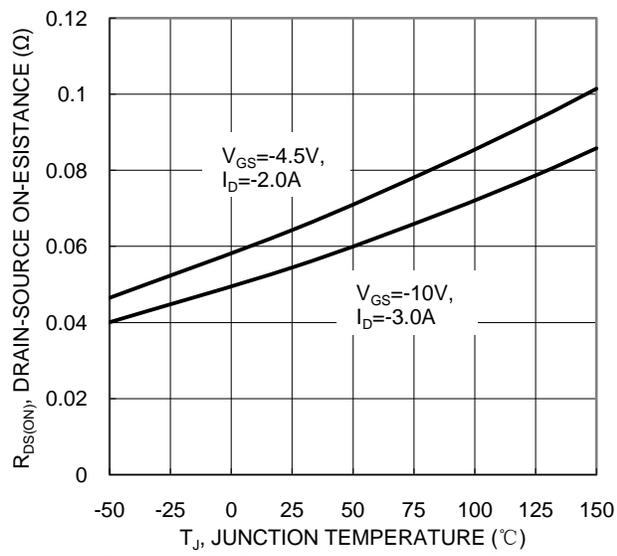


Figure 20. On-Resistance Variation with Temperature

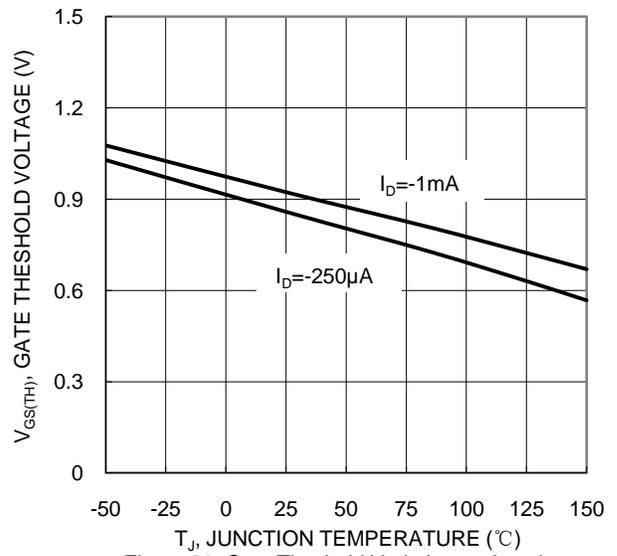


Figure 21. Gate Threshold Variation vs Junction Temperature

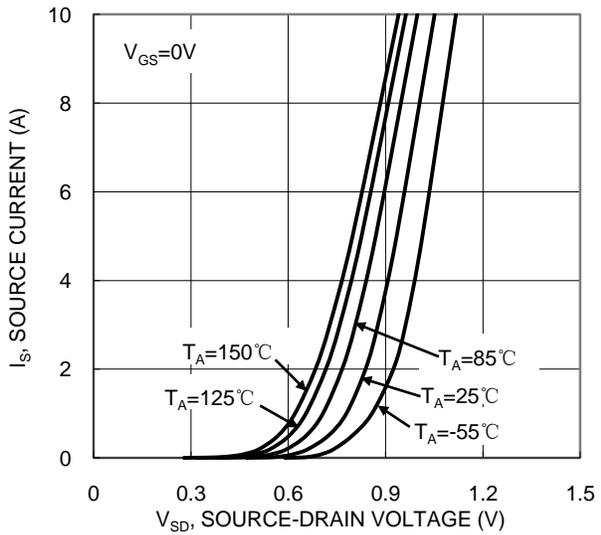


Figure 22. Diode Forward Voltage vs Current

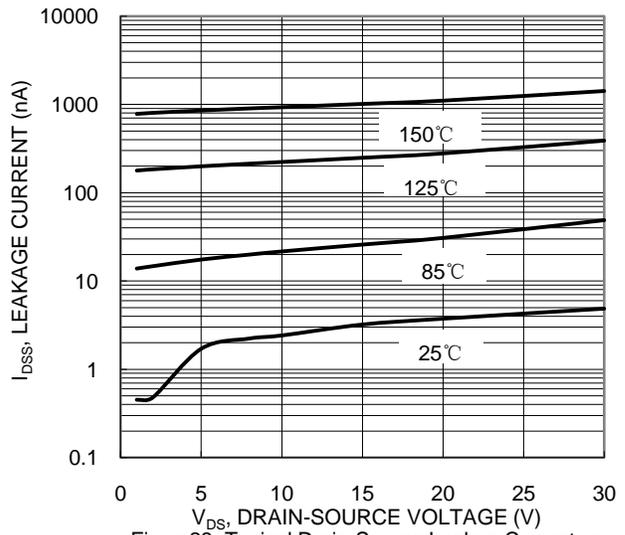


Figure 23. Typical Drain-Source Leakage Current vs Voltage

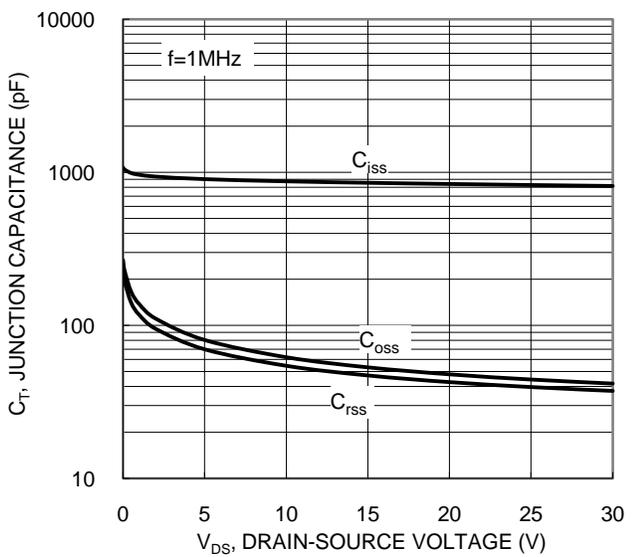


Figure 24. Typical Junction Capacitance

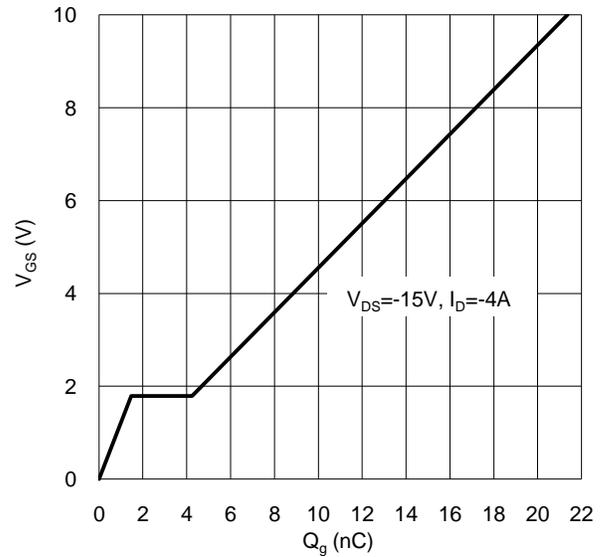


Figure 25. Gate Charge

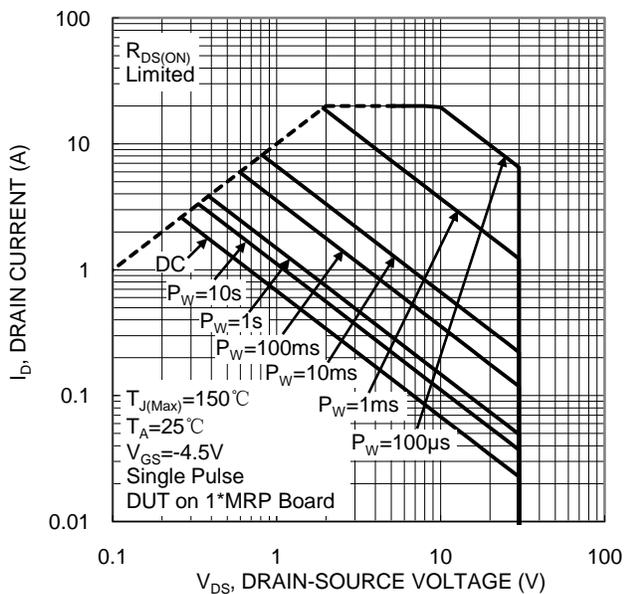
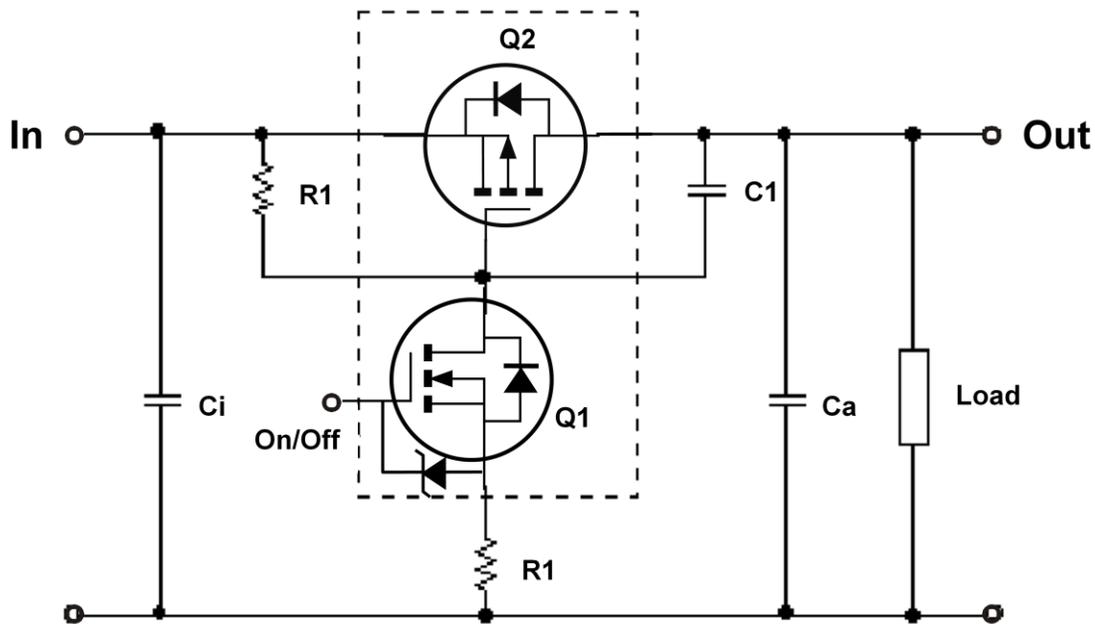
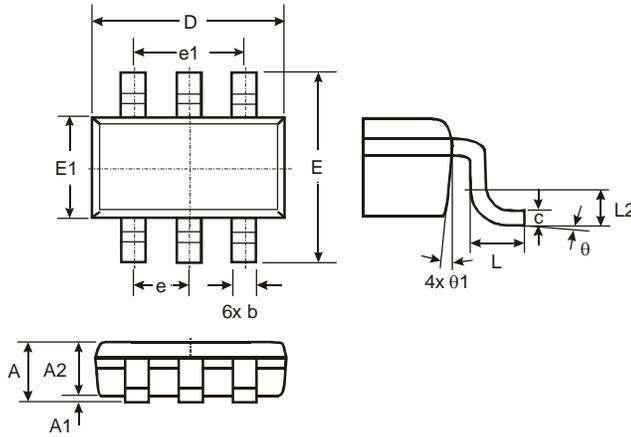


Figure 26. SOA, Safe Operation Area

### Application Circuit

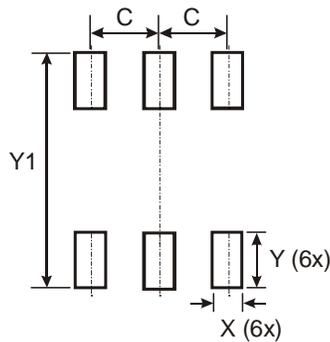


### Package Outline Dimensions



TSOT26			
Dim	Min	Max	Typ
A	–	1.00	–
A1	0.01	0.10	–
A2	0.84	0.90	–
D	–	–	2.90
E	–	–	2.80
E1	–	–	1.60
b	0.30	0.45	–
c	0.12	0.20	–
e	–	–	0.95
e1	–	–	1.90
L	0.30	0.50	–
L2	–	–	0.25
$\theta$	0°	8°	4°
$\theta_1$	4°	12°	–
<b>All Dimensions in mm</b>			

### Suggested Pad Layout



Dimensions	Value (in mm)
C	0.950
X	0.700
Y	1.000
Y1	3.199