



## Features

- 3rd generation SiC MOSFET technology
- Optimized package with separate driver source pin
- High blocking voltage with low on-resistance
- High-speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery ( $Q_{rr}$ )
- Halogen free, RoHS compliant

## Benefits

- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Reduce cooling requirements
- Increase power density
- Increase system switching frequency

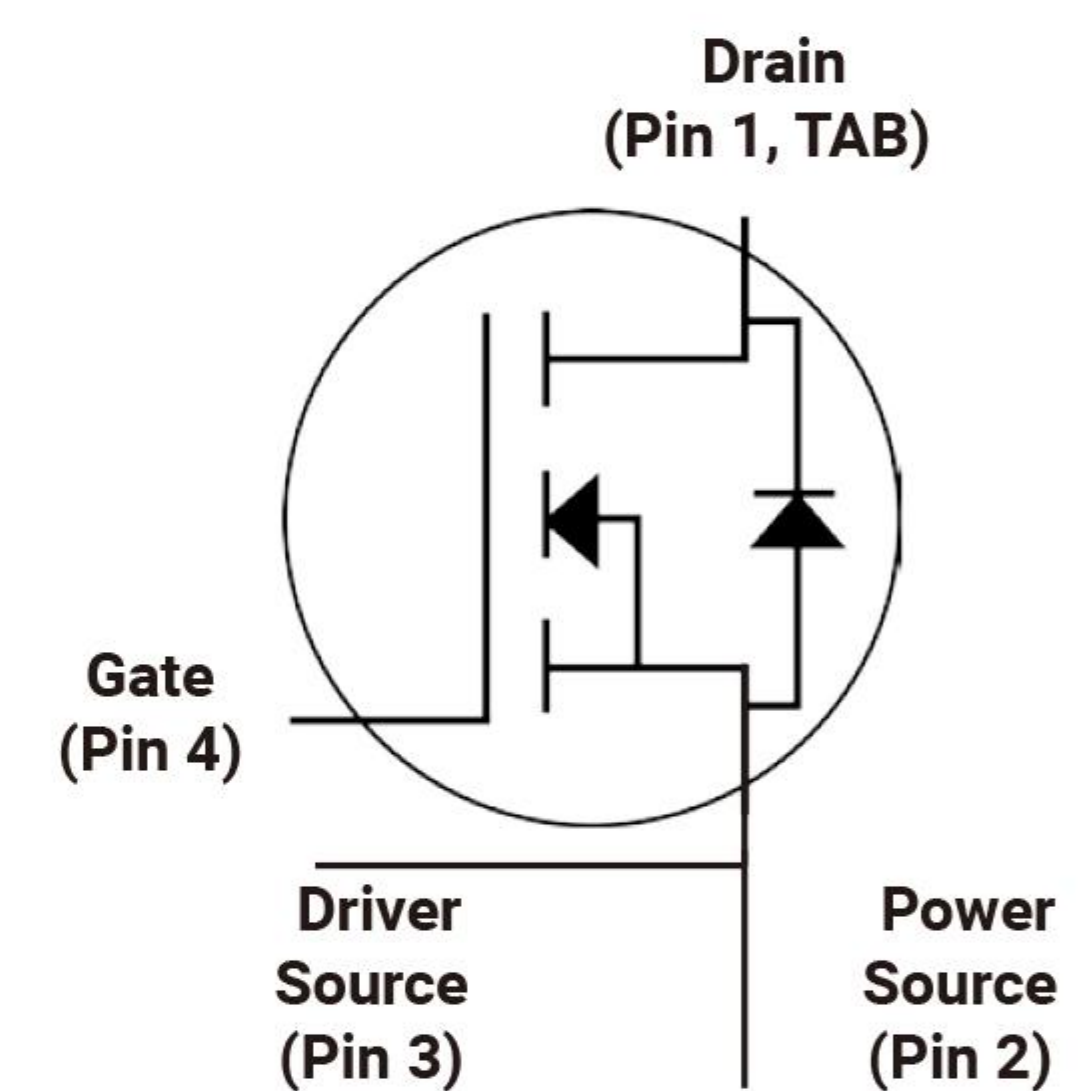
## Applications

- Renewable energy
- EV battery chargers
- High voltage DC/DC converters
- Switch Mode Power Supplies

$V_{DS}$	1200 V
$I_D @ 25^\circ\text{C}$	32 A
$R_{DS(on)}$	75 m $\Omega$



D S S G  
Package



Ordering Part Number	Package	Marking	$T_J, T_{stg}$ Range
C3M0075120K	TO 247-4	C3M0075120K	-55 - 150 °C
C3M0075120K-A	TO 247-4	C3M0075120K-A	-40 - 175 °C

## Maximum Ratings ( $T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
$V_{DSmax}$	Drain - Source Voltage	1200	V	$V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$	
$V_{GSmax}$	Gate - Source Voltage (dynamic)	-8/+19	V	AC ( $f > 1\text{ Hz}$ )	Note: 1
$V_{GSop}$	Gate - Source Voltage (static)	-4/+15	V	Static	Note: 2
$I_D$	Continuous Drain Current	32	A	$V_{GS} = 15\text{ V}, T_C = 25^\circ\text{C}$	Fig. 19
		23		$V_{GS} = 15\text{ V}, T_C = 100^\circ\text{C}$	
$I_{D(pulse)}$	Pulsed Drain Current	80	A	Pulse width $t_p$ limited by $T_{jmax}$	Fig. 22
$P_D$	Power Dissipation	136	W	$T_C = 25^\circ\text{C}, T_J = 175^\circ\text{C}$	Fig. 20
$T_J, T_{stg}$	Operating Junction and Storage Temperature	-40 to +175	°C		
$T_L$	Solder Temperature	260	°C	1.6mm (0.063") from case for 10s	

Note (1): When using MOSFET Body Diode  $V_{GSmax} = -4\text{V}/+19\text{V}$

Note (2): MOSFET can also safely operate at 0/+15 V

## Electrical Characteristics (T<sub>c</sub> = 25°C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
V <sub>(BR)DSS</sub>	Drain-Source Breakdown Voltage	1200			V	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 100 μA	
V <sub>GS(th)</sub>	Gate Threshold Voltage	1.8	2.5	3.6	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 5 mA	Fig. 11
			2.2		V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 5 mA, T <sub>J</sub> = 175°C	
I <sub>DSS</sub>	Zero Gate Voltage Drain Current		1	50	μA	V <sub>DS</sub> = 1200 V, V <sub>GS</sub> = 0 V	
I <sub>GSS</sub>	Gate-Source Leakage Current		10	250	nA	V <sub>GS</sub> = 15 V, V <sub>DS</sub> = 0 V	
R <sub>DS(on)</sub>	Drain-Source On-State Resistance		75	90	mΩ	V <sub>GS</sub> = 15 V, I <sub>D</sub> = 20 A	Fig. 4, 5, 6
			120			V <sub>GS</sub> = 15 V, I <sub>D</sub> = 20A, T <sub>J</sub> = 175°C	
g <sub>fs</sub>	Transconductance		12		S	V <sub>DS</sub> = 20 V, I <sub>DS</sub> = 20 A	Fig. 7
			13			V <sub>DS</sub> = 20 V, I <sub>DS</sub> = 20 A, T <sub>J</sub> = 175°C	
C <sub>iss</sub>	Input Capacitance		1390		pF	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 1000 V f = 1 MHz V <sub>AC</sub> = 25 mV	Fig. 17, 18
C <sub>oss</sub>	Output Capacitance		58				
C <sub>rss</sub>	Reverse Transfer Capacitance		2				
E <sub>oss</sub>	C <sub>oss</sub> Stored Energy		33		μJ		Fig. 16
E <sub>ON</sub>	Turn-On Switching Energy (Body Diode FWD)		270		μJ	V <sub>DS</sub> = 800 V, V <sub>GS</sub> = -4 V/15 V, I <sub>D</sub> = 20A, R <sub>G(ext)</sub> = 0 Ω, L = 156 μH, T <sub>J</sub> = 150°C	Fig. 26, 29
E <sub>OFF</sub>	Turn-Off Switching Energy (Body Diode FWD)		77				
t <sub>d(on)</sub>	Turn-On Delay Time		30		ns	V <sub>DD</sub> = 800 V, V <sub>GS</sub> = -4 V/15 V I <sub>D</sub> = 20 A, R <sub>G(ext)</sub> = 0 Ω, Timing relative to V <sub>DS</sub> Inductive load	Fig. 27, 28
t <sub>r</sub>	Rise Time		14				
t <sub>d(off)</sub>	Turn-Off Delay Time		38				
t <sub>f</sub>	Fall Time		10				
R <sub>G(int)</sub>	Internal Gate Resistance		9.0		Ω	f = 1 MHz, V <sub>AC</sub> = 25 mV	
Q <sub>gs</sub>	Gate to Source Charge		17		nC	V <sub>DS</sub> = 800 V, V <sub>GS</sub> = -4 V/15 V I <sub>D</sub> = 20 A Per IEC60747-8-4 pg 21	Fig. 12
Q <sub>gd</sub>	Gate to Drain Charge		18				
Q <sub>g</sub>	Total Gate Charge		53				

## Reverse Diode Characteristics (T<sub>c</sub> = 25°C unless otherwise specified)

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V <sub>SD</sub>	Diode Forward Voltage	4.5		V	V <sub>GS</sub> = -4 V, I <sub>SD</sub> = 10 A	Fig. 8, 9, 10
		4.0		V	V <sub>GS</sub> = -4 V, I <sub>SD</sub> = 10 A, T <sub>J</sub> = 175 °C	
I <sub>S</sub>	Continuous Diode Forward Current		26	A	V <sub>GS</sub> = -4 V, T <sub>J</sub> = 25 °C	Note 1
I <sub>S,pulse</sub>	Diode pulse Current	80		A	V <sub>GS</sub> = -4 V, pulse width t <sub>p</sub> limited by T <sub>jmax</sub>	Note 1
t <sub>rr</sub>	Reverse Recover time	20		ns	V <sub>GS</sub> = -4 V, I <sub>SD</sub> = 20 A, V <sub>R</sub> = 800 V dif/dt = 3600 A/μs, T <sub>J</sub> = 150 °C	Note 1
Q <sub>rr</sub>	Reverse Recovery Charge	254		nC		
I <sub>rrm</sub>	Peak Reverse Recovery Current	18		A		

## Thermal Characteristics

Symbol	Parameter	Max.	Unit	Test Conditions	Note
R <sub>θJC</sub>	Thermal Resistance from Junction to Case	1.1	°C/W		Fig. 21
R <sub>θJA</sub>	Thermal Resistance From Junction to Ambient	40			

### Typical Performance

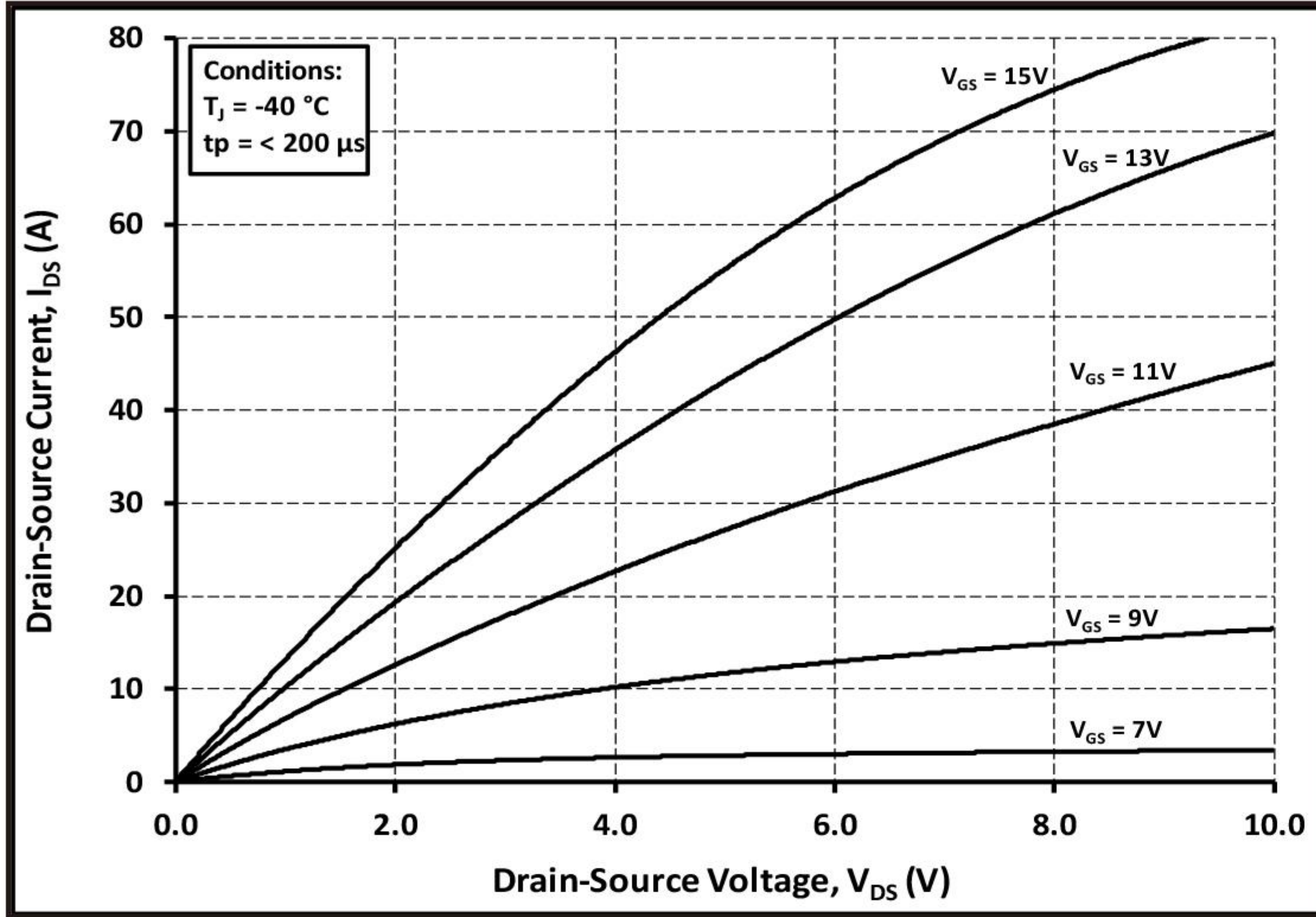


Figure 1. Output Characteristics  $T_J = -40\text{ }^\circ\text{C}$

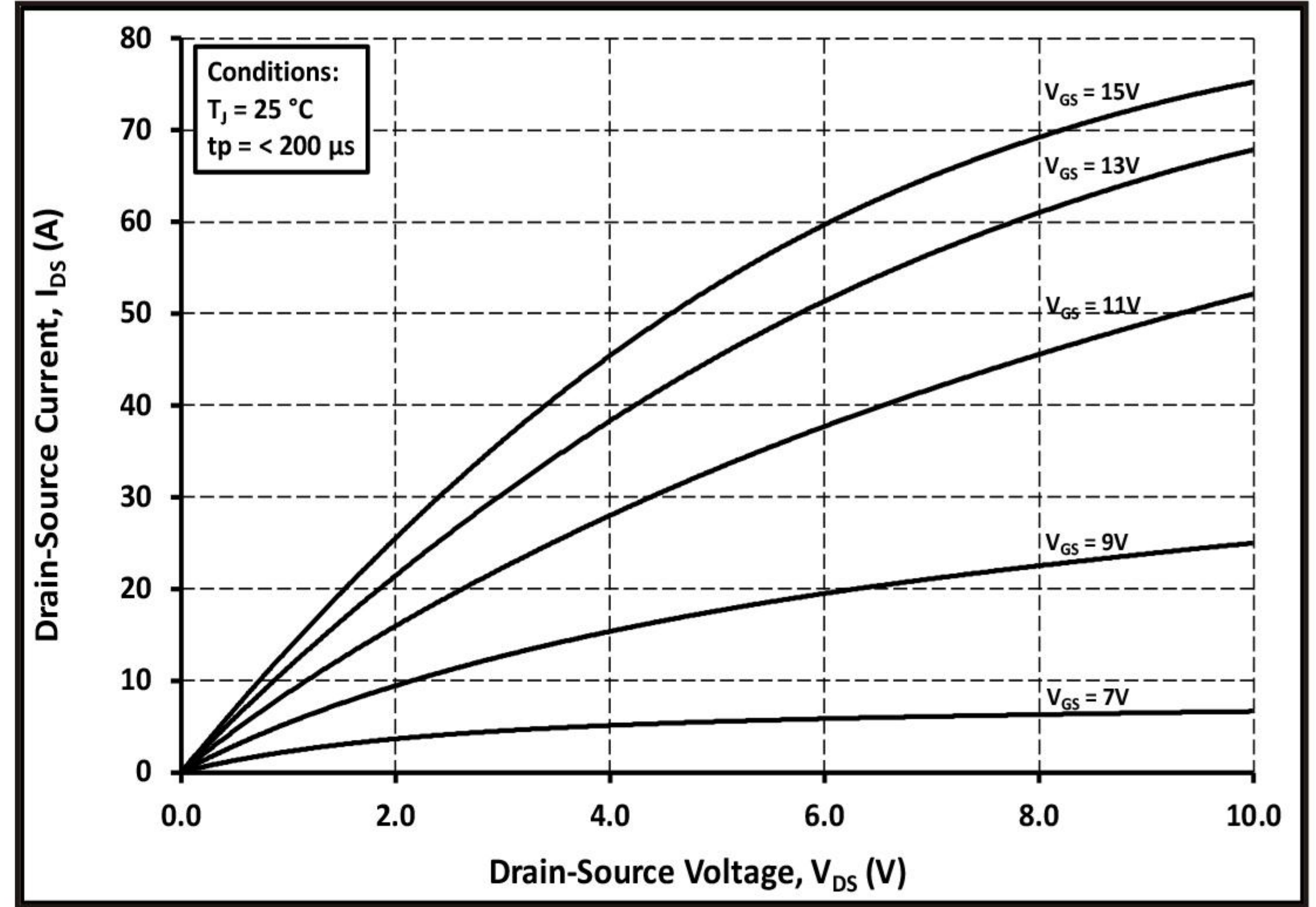


Figure 2. Output Characteristics  $T_J = 25\text{ }^\circ\text{C}$

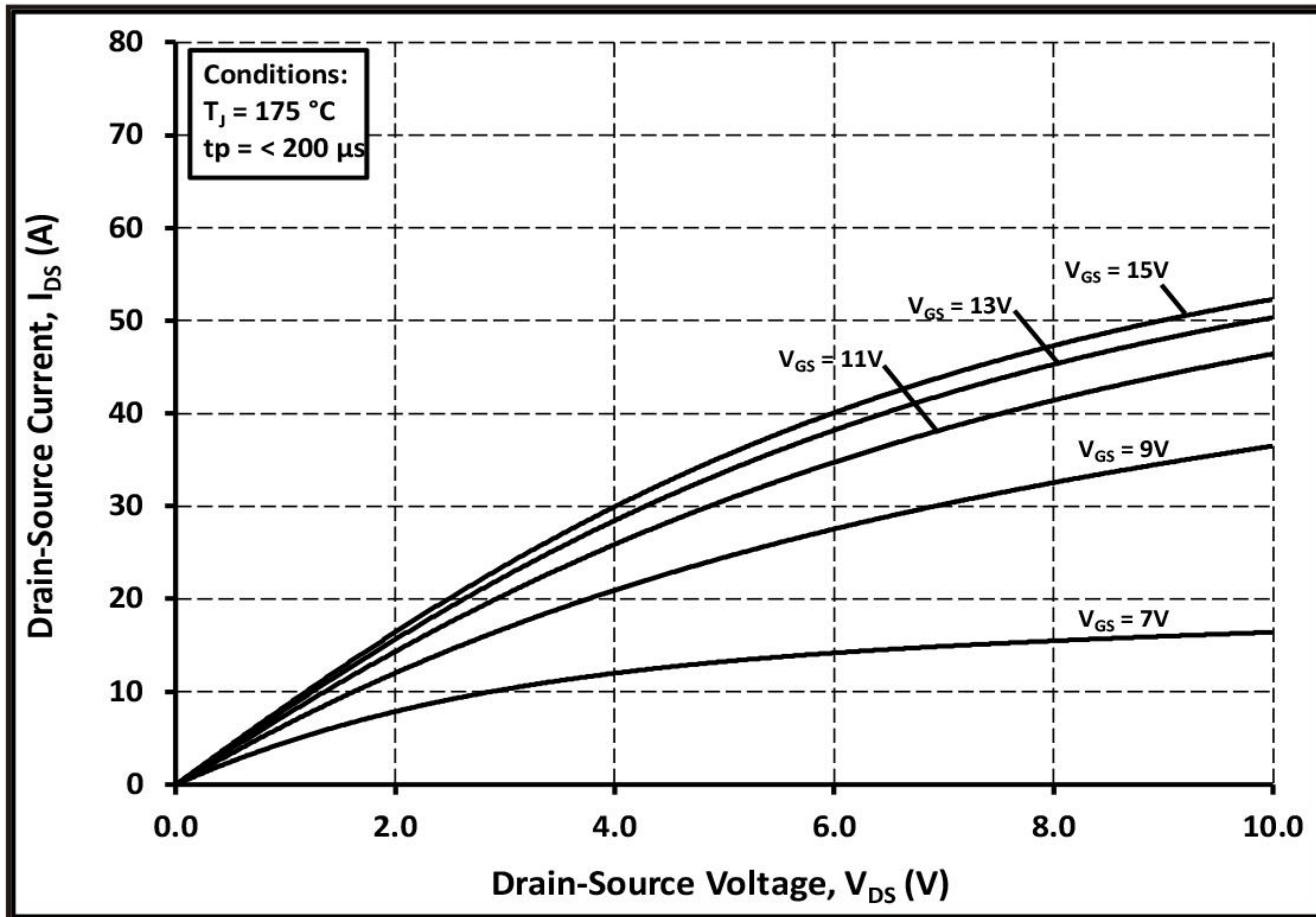


Figure 3. Output Characteristics  $T_J = 175\text{ }^\circ\text{C}$

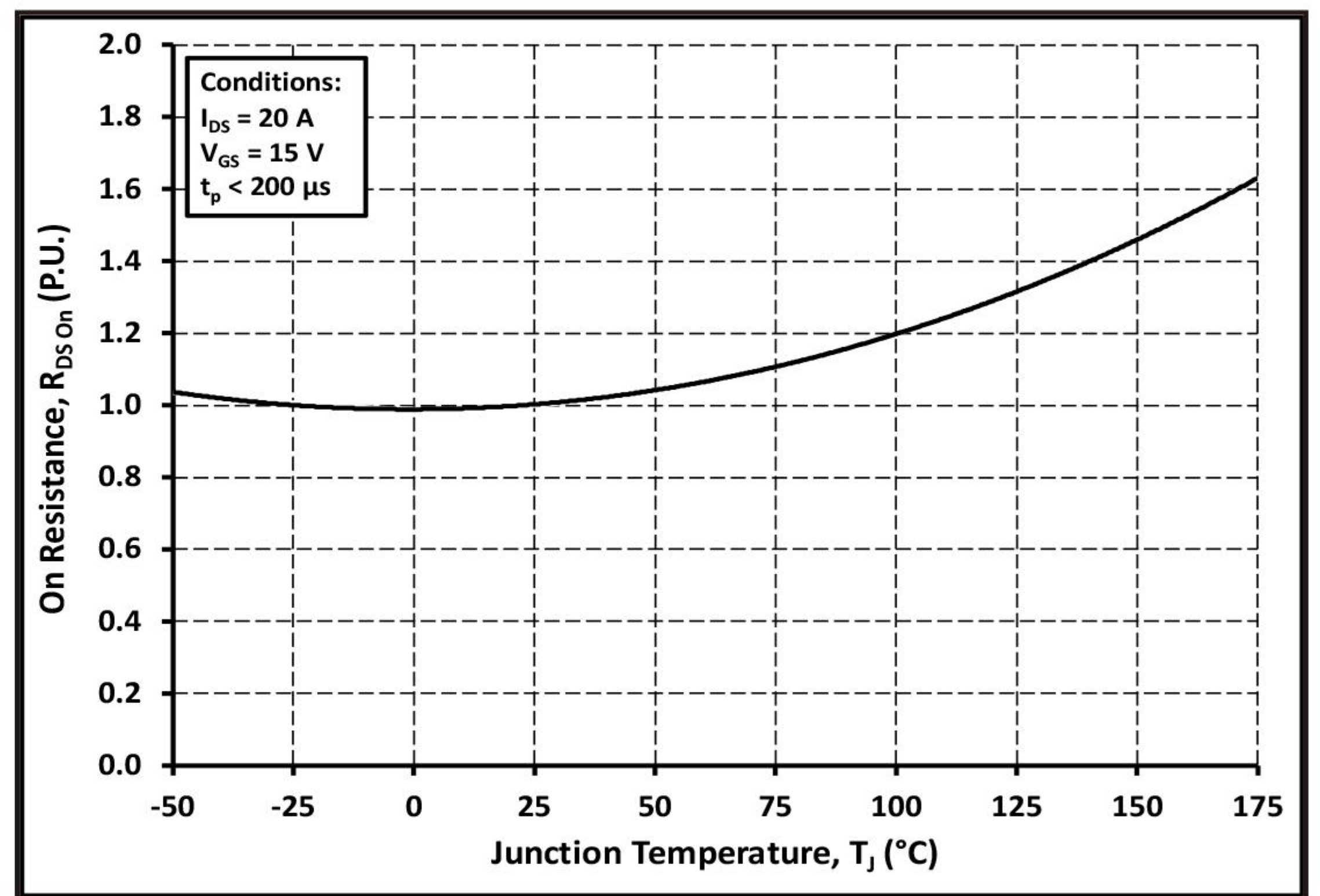


Figure 4. Normalized On-Resistance vs. Temperature

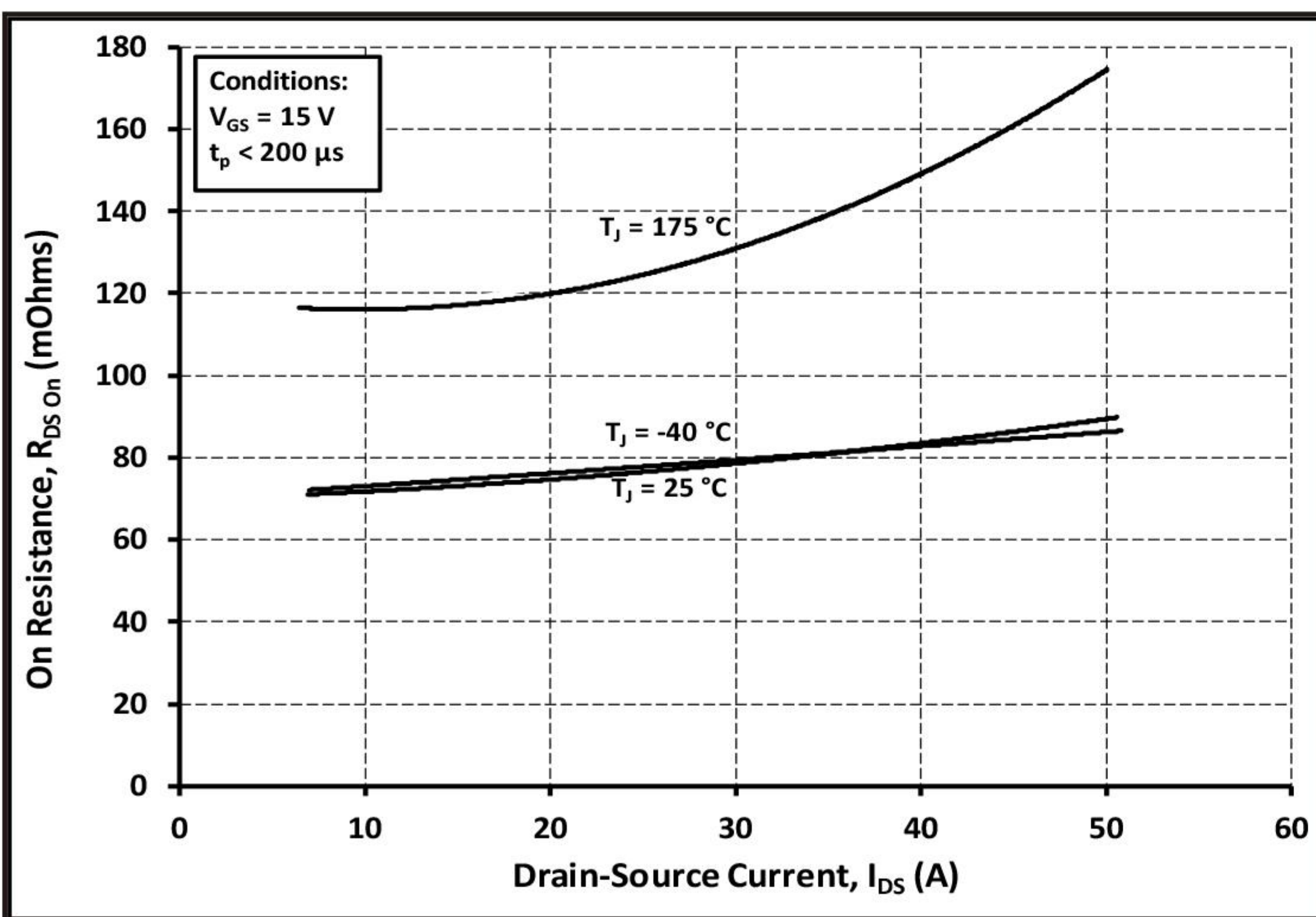


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

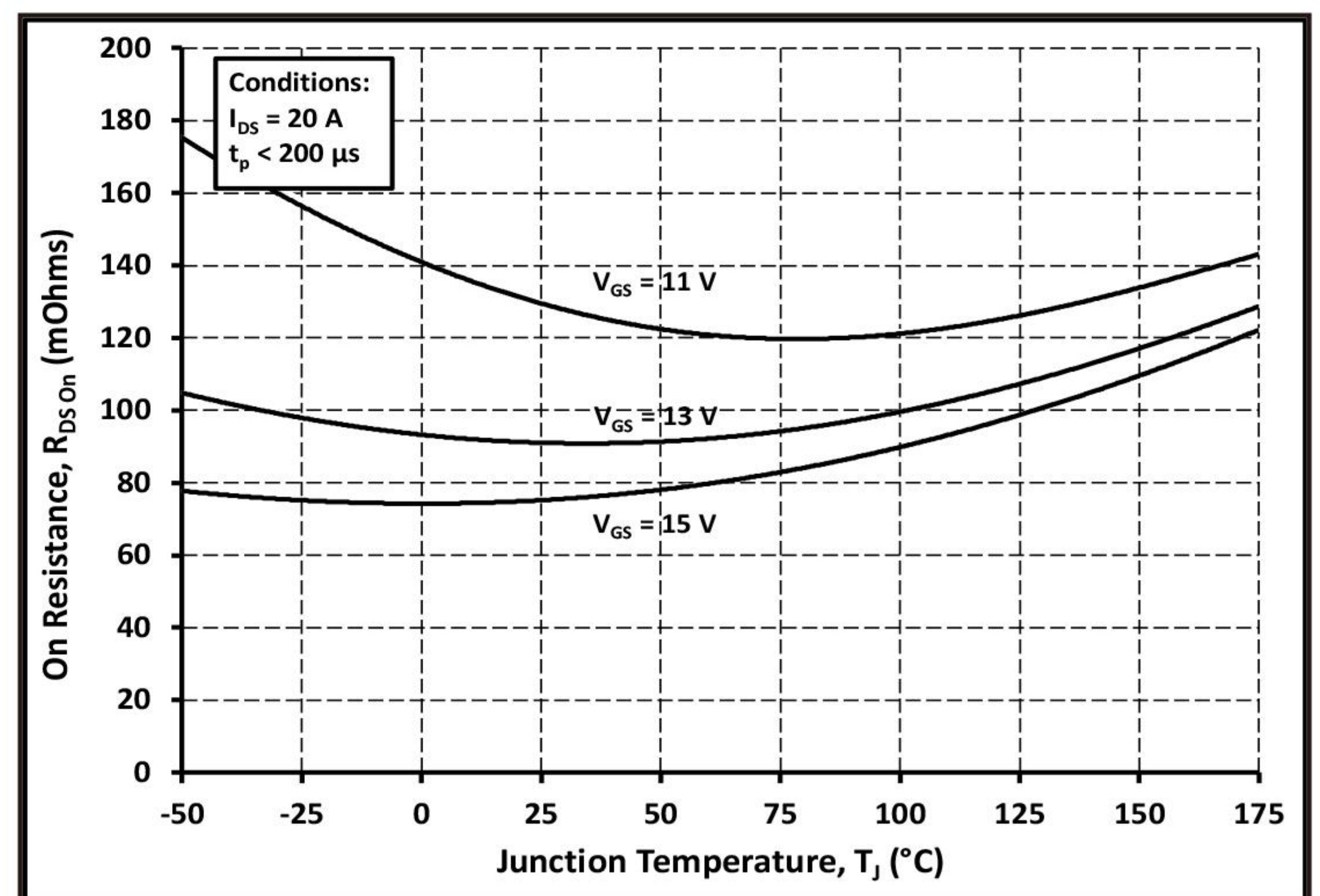


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage

### Typical Performance

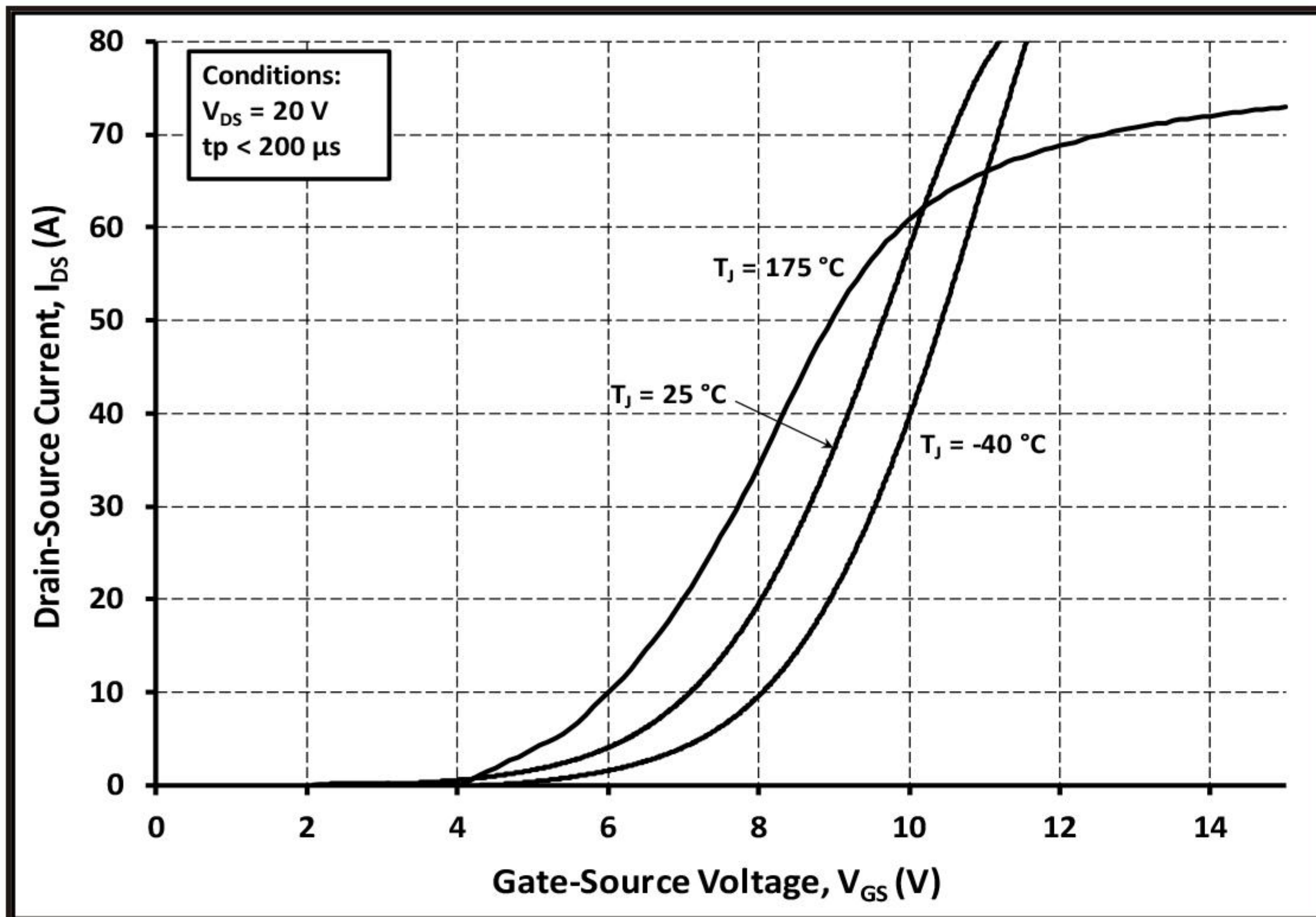


Figure 7. Transfer Characteristic for Various Junction Temperatures

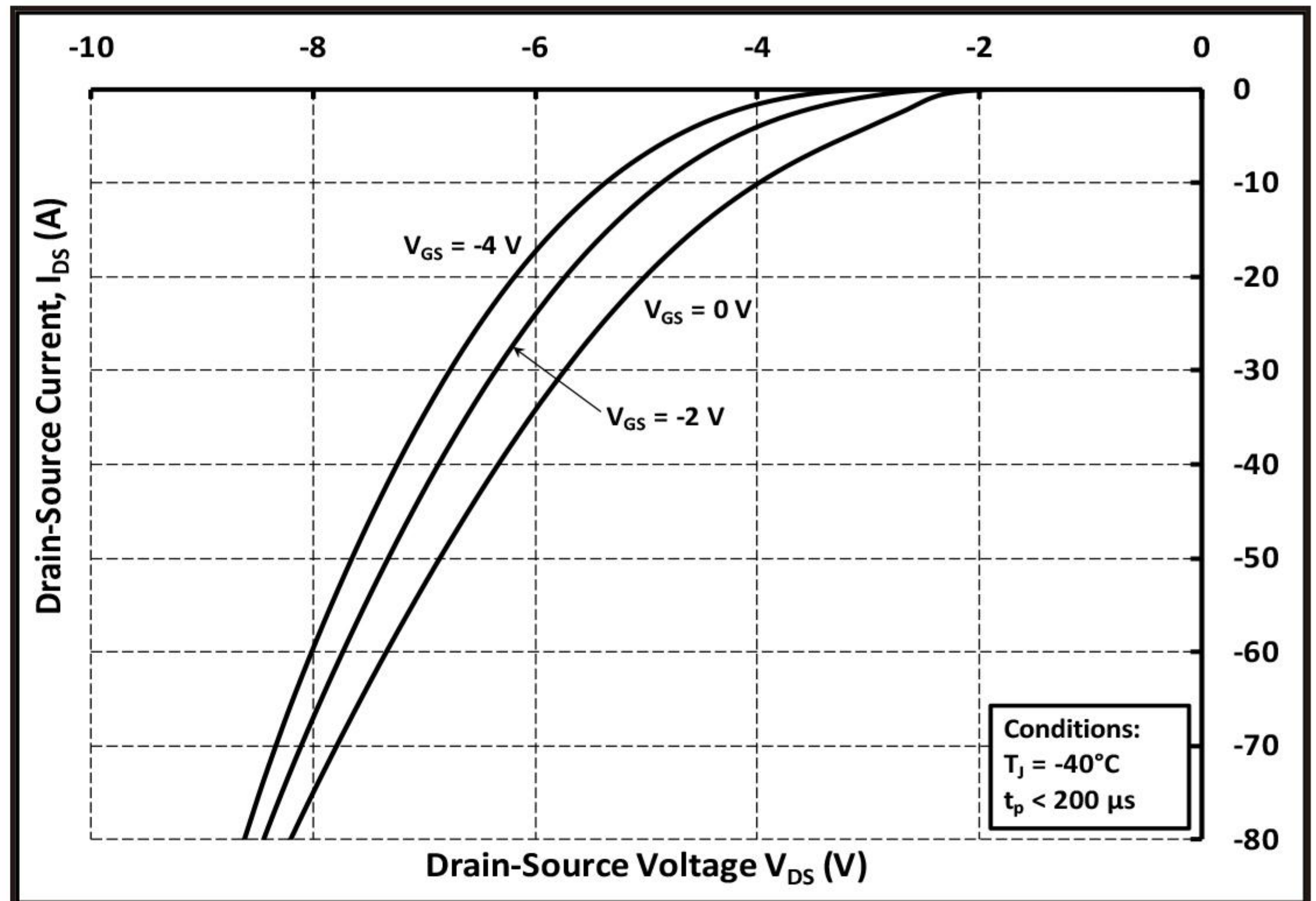


Figure 8. Body Diode Characteristic at  $-40\text{ }^\circ\text{C}$

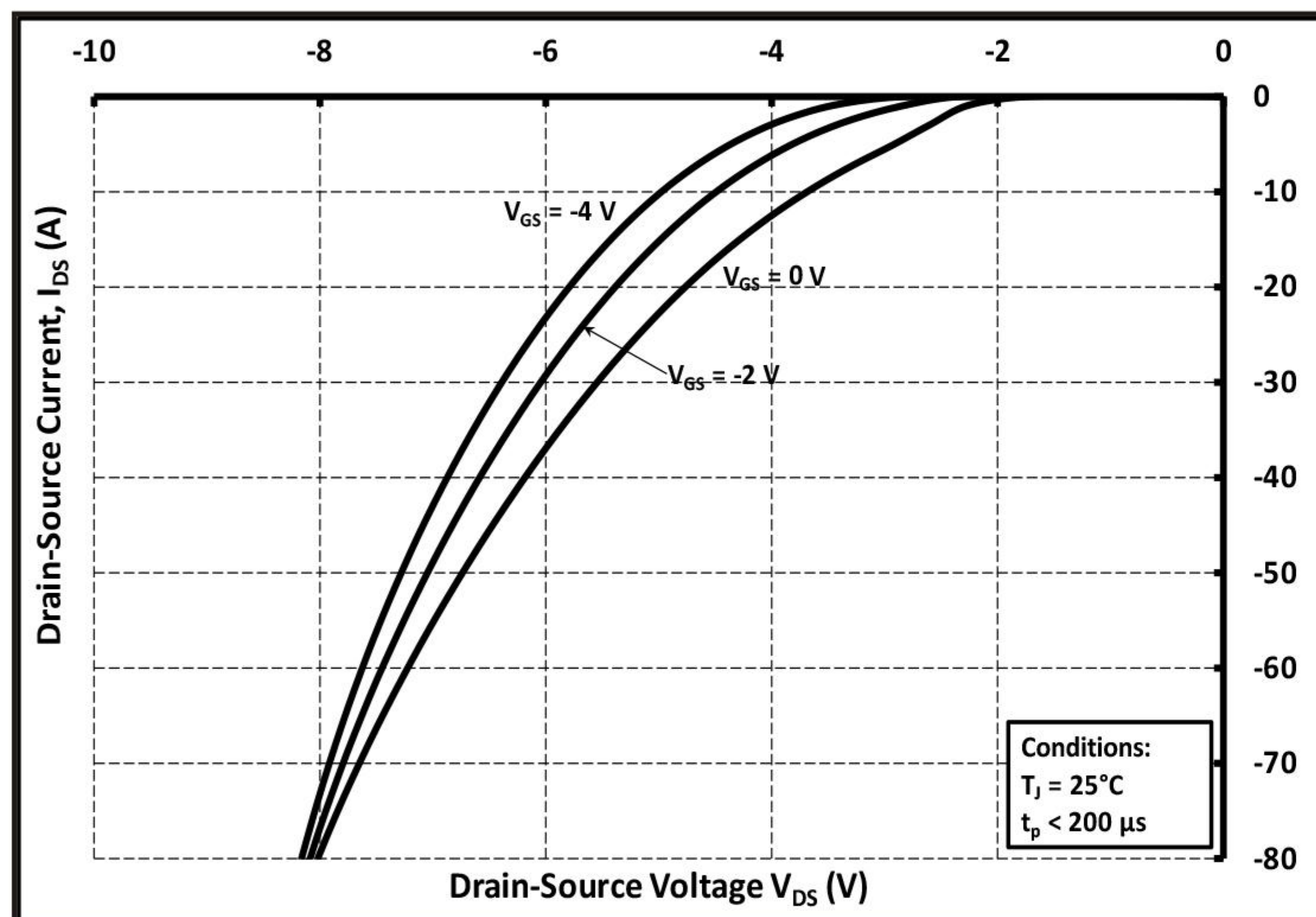


Figure 9. Body Diode Characteristic at  $25\text{ }^\circ\text{C}$

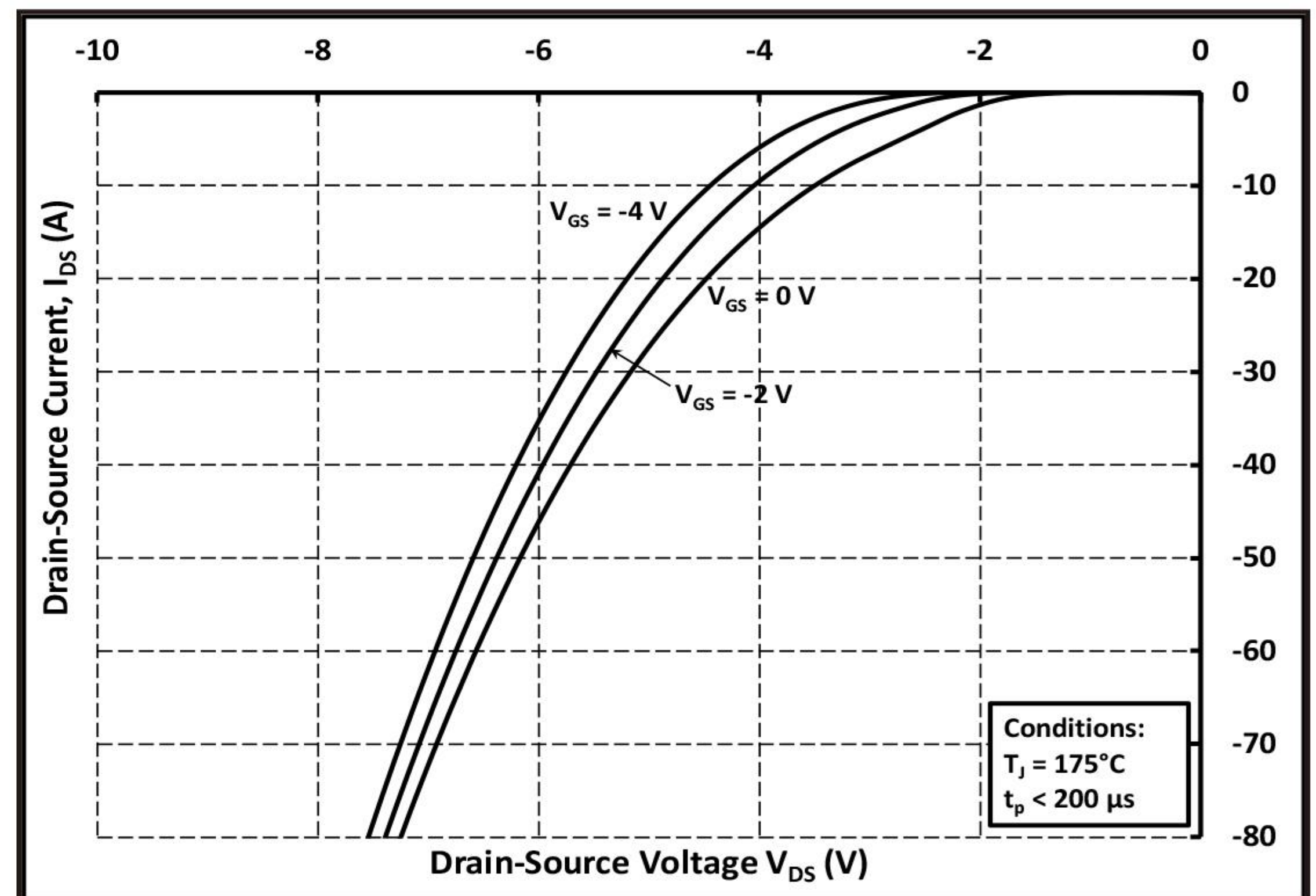


Figure 10. Body Diode Characteristic at  $175\text{ }^\circ\text{C}$

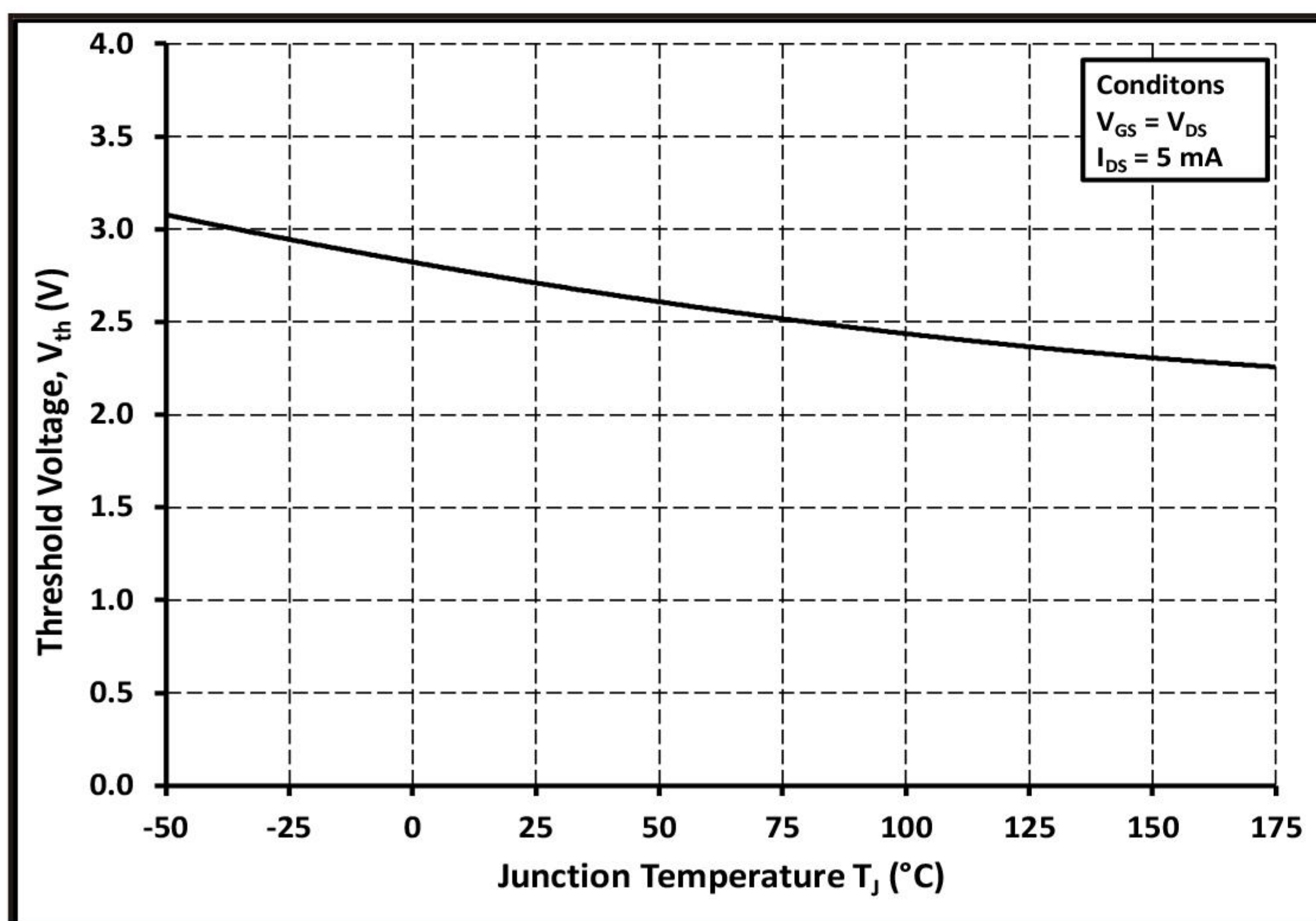


Figure 11. Threshold Voltage vs. Temperature

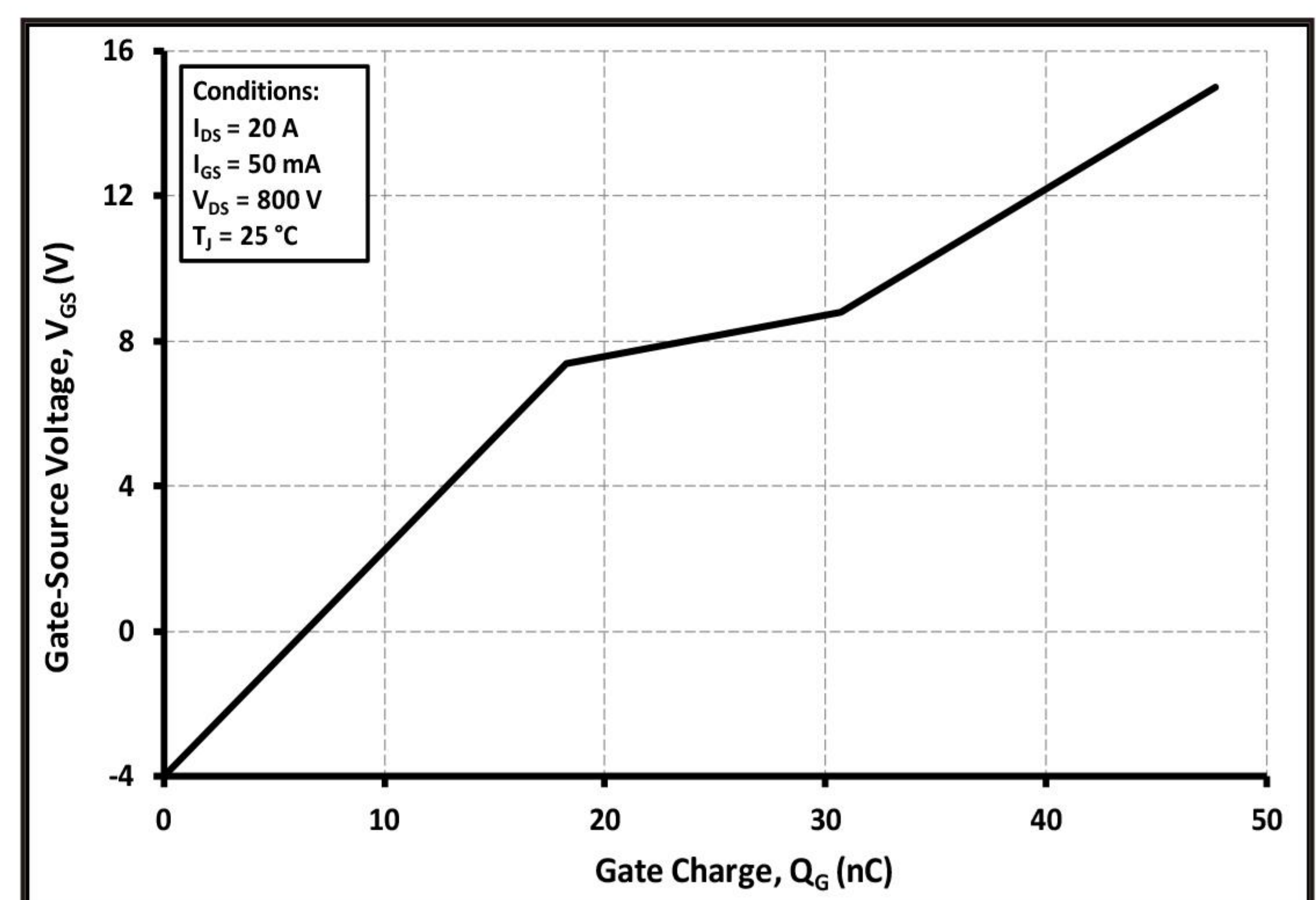


Figure 12. Gate Charge Characteristics

## Typical Performance

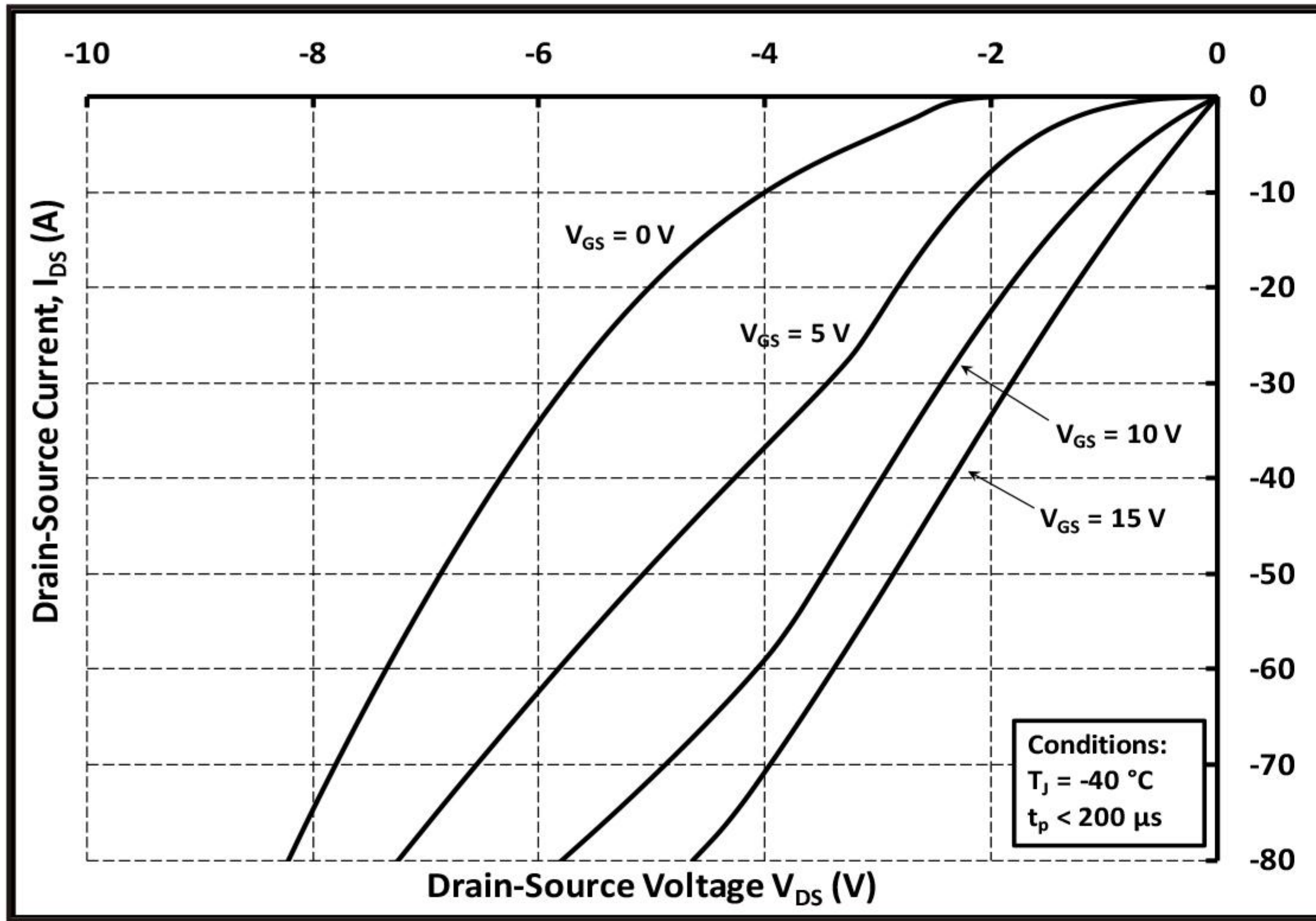


Figure 13. 3rd Quadrant Characteristic at -40 °C

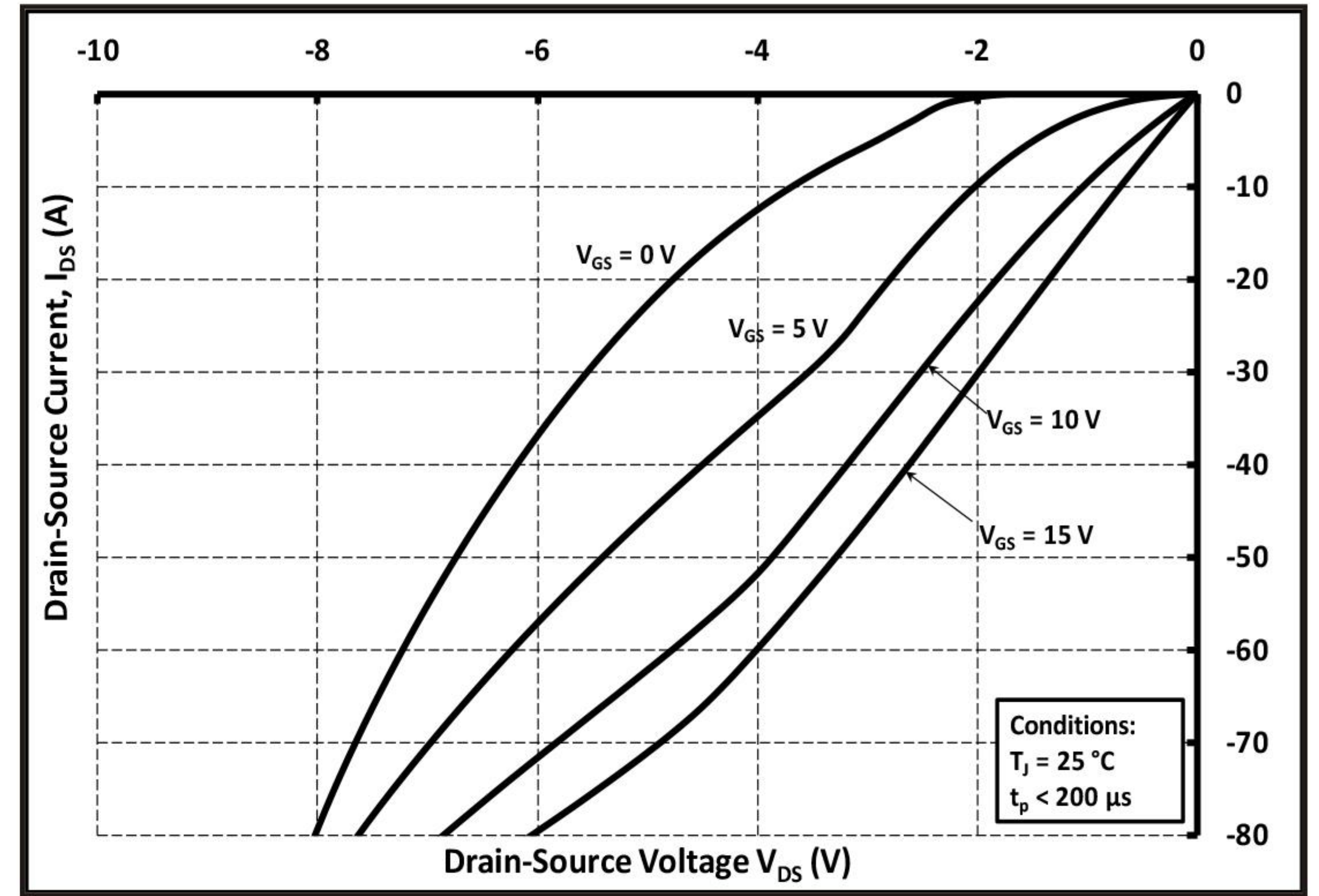


Figure 14. 3rd Quadrant Characteristic at 25 °C

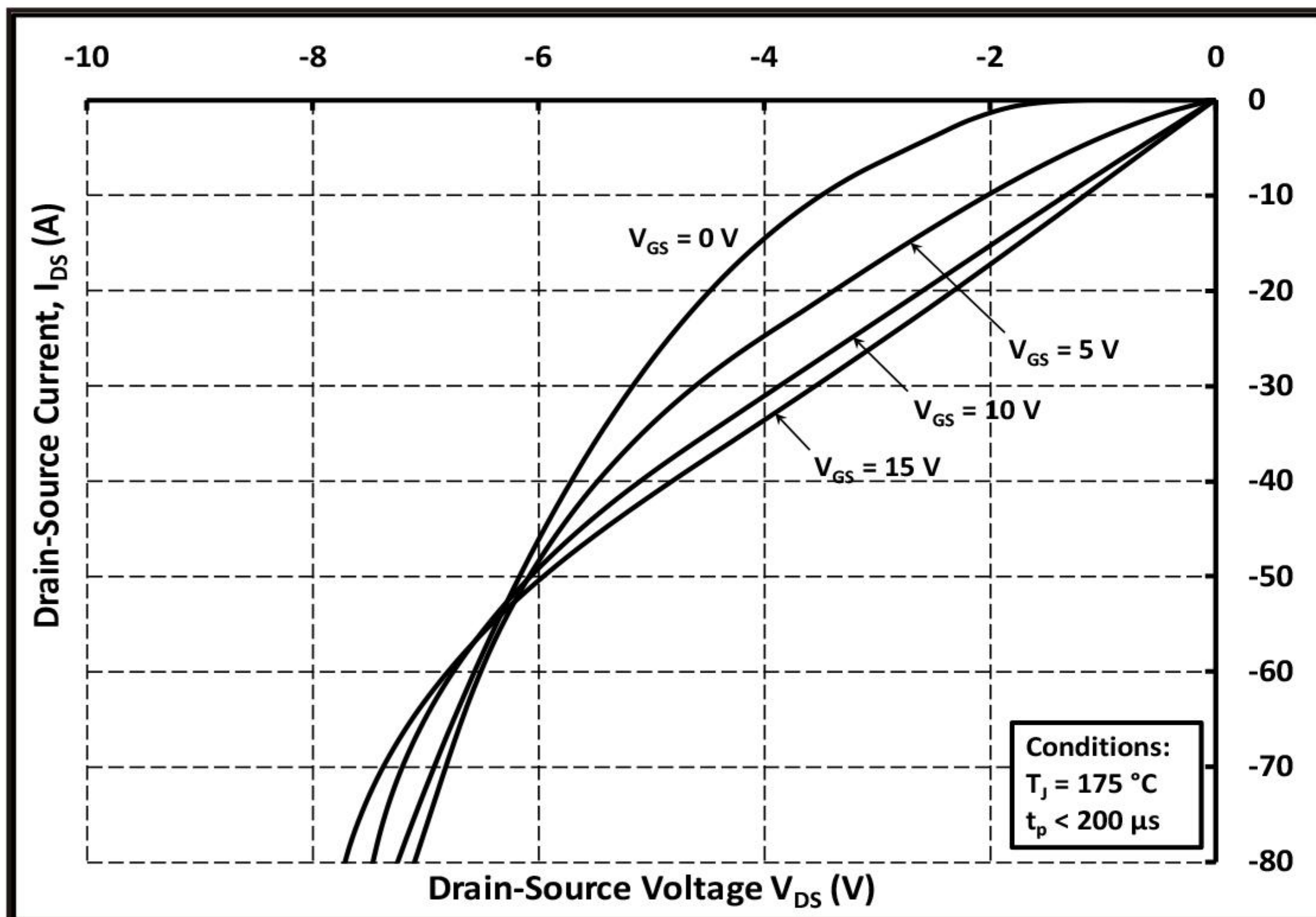


Figure 15. 3rd Quadrant Characteristic at 175 °C

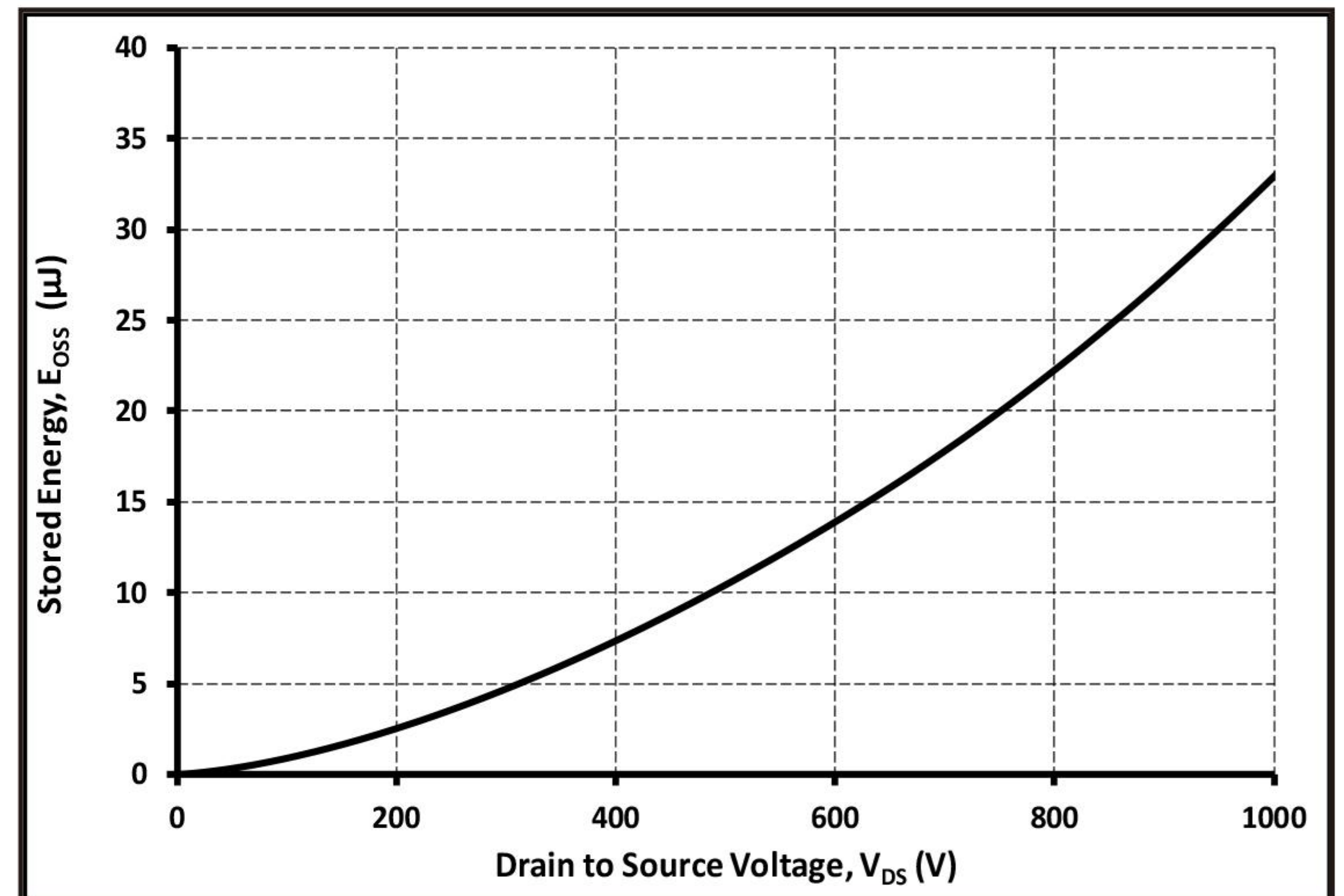


Figure 16. Output Capacitor Stored Energy

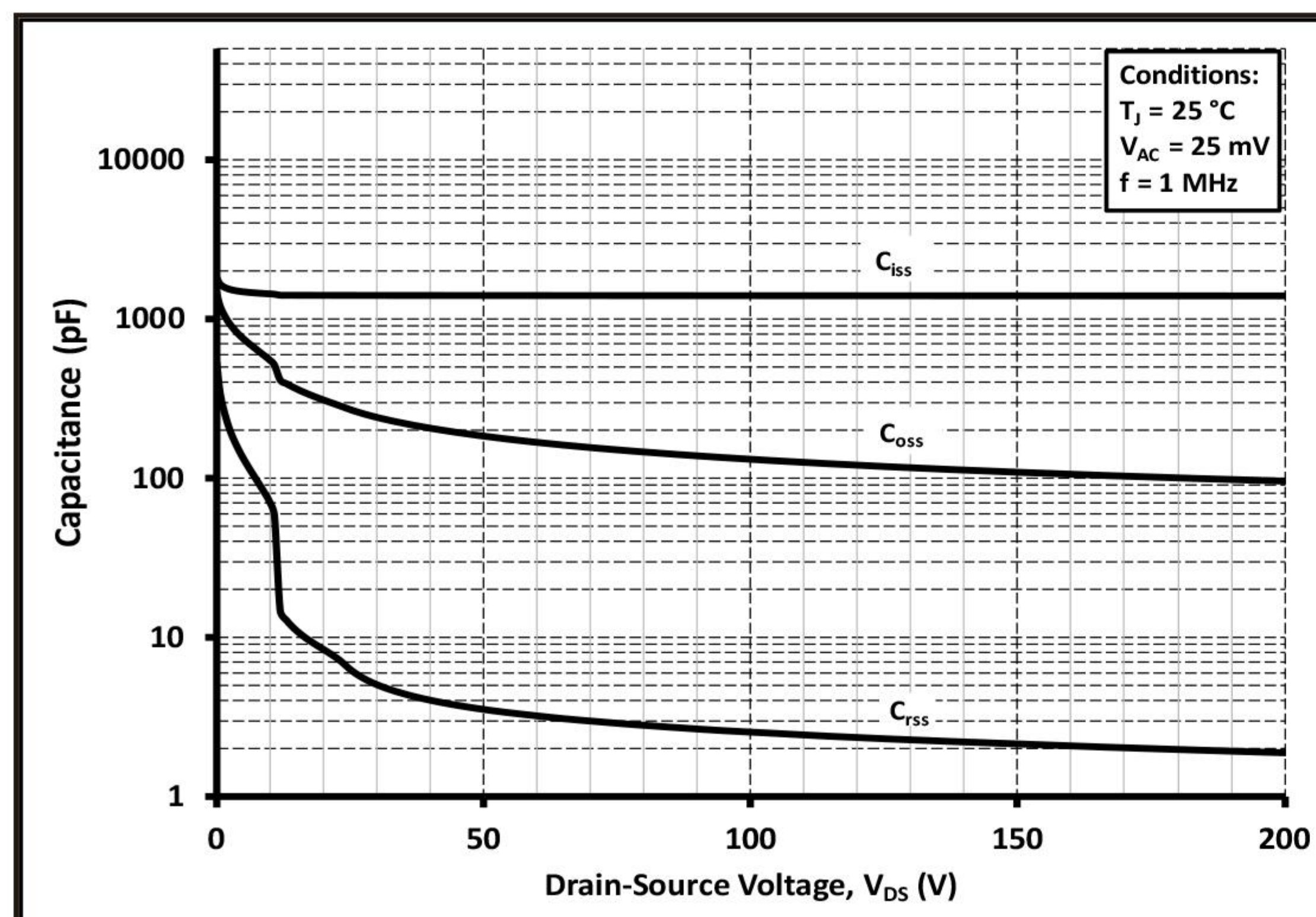


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

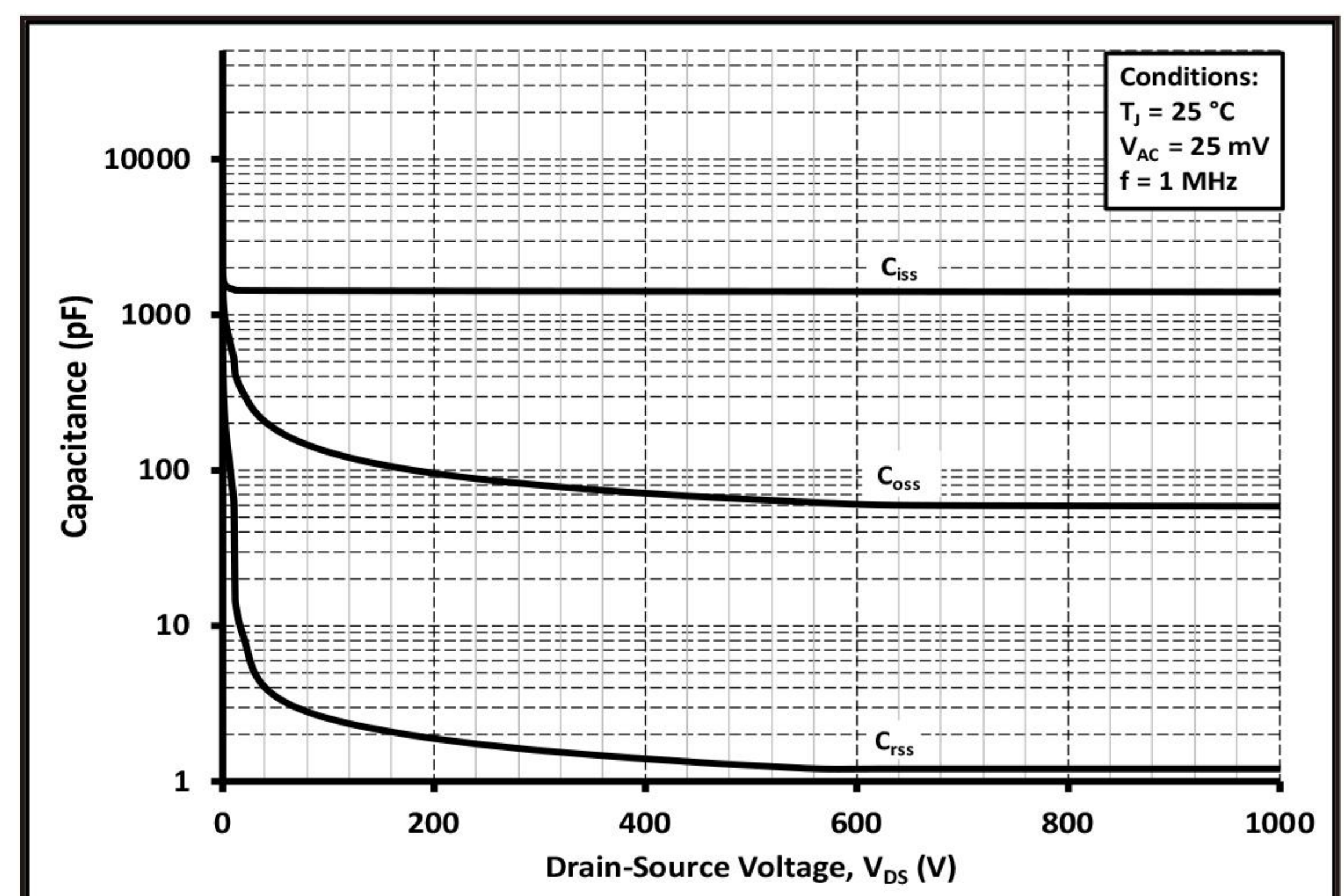


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000V)

## Typical Performance

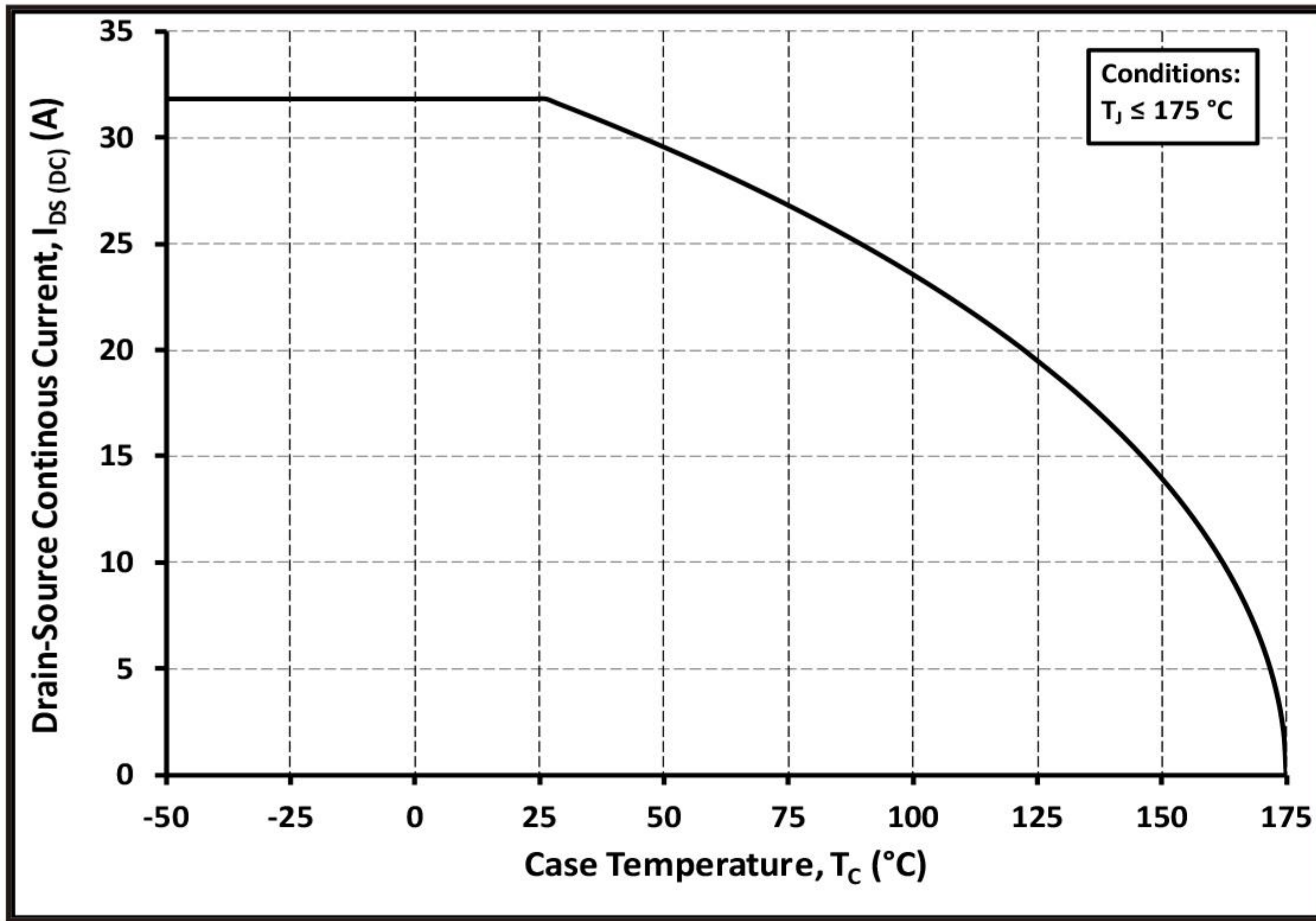


Figure 19. Continuous Drain Current Derating vs. Case Temperature

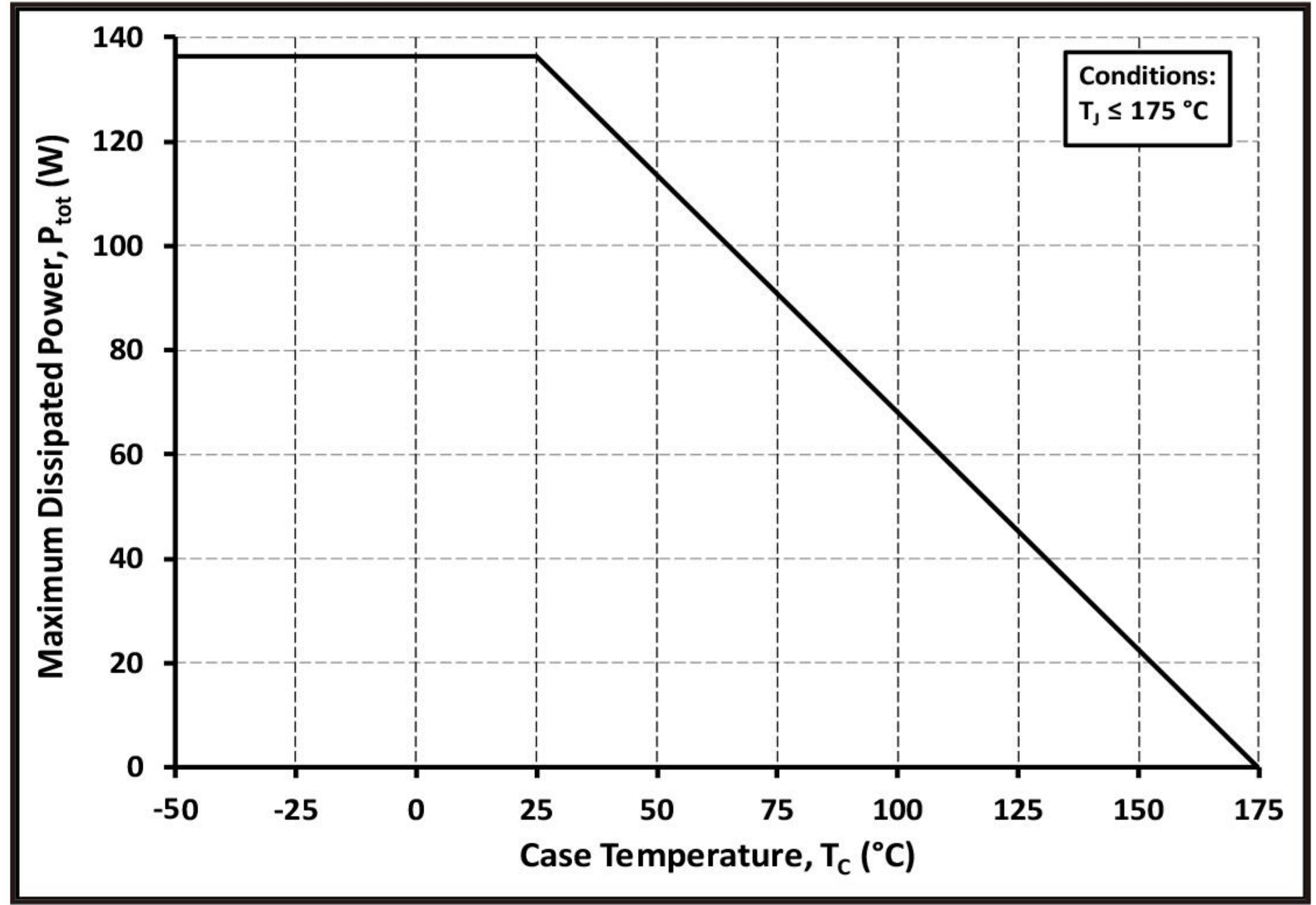


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

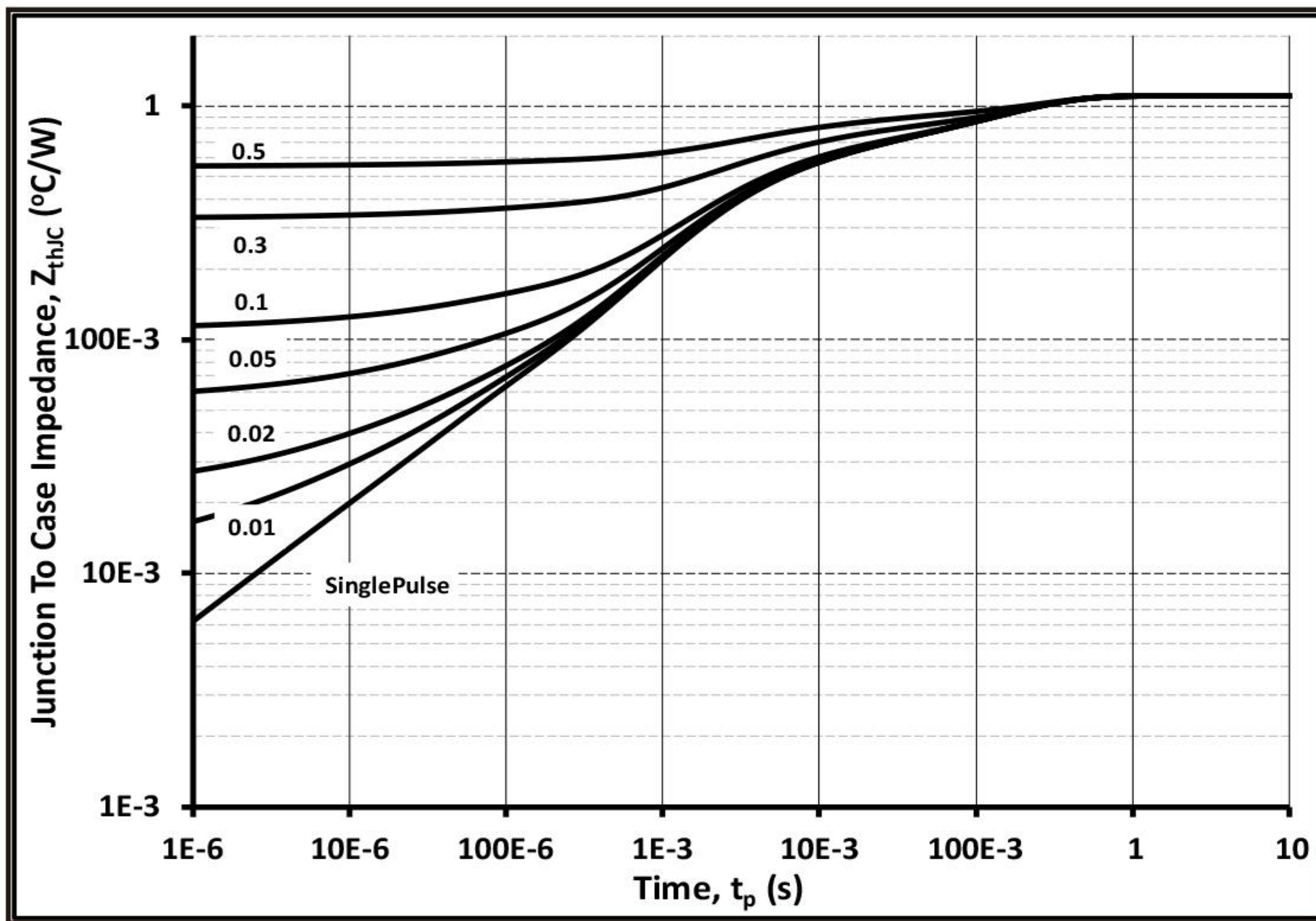


Figure 21. Transient Thermal Impedance (Junction - Case)

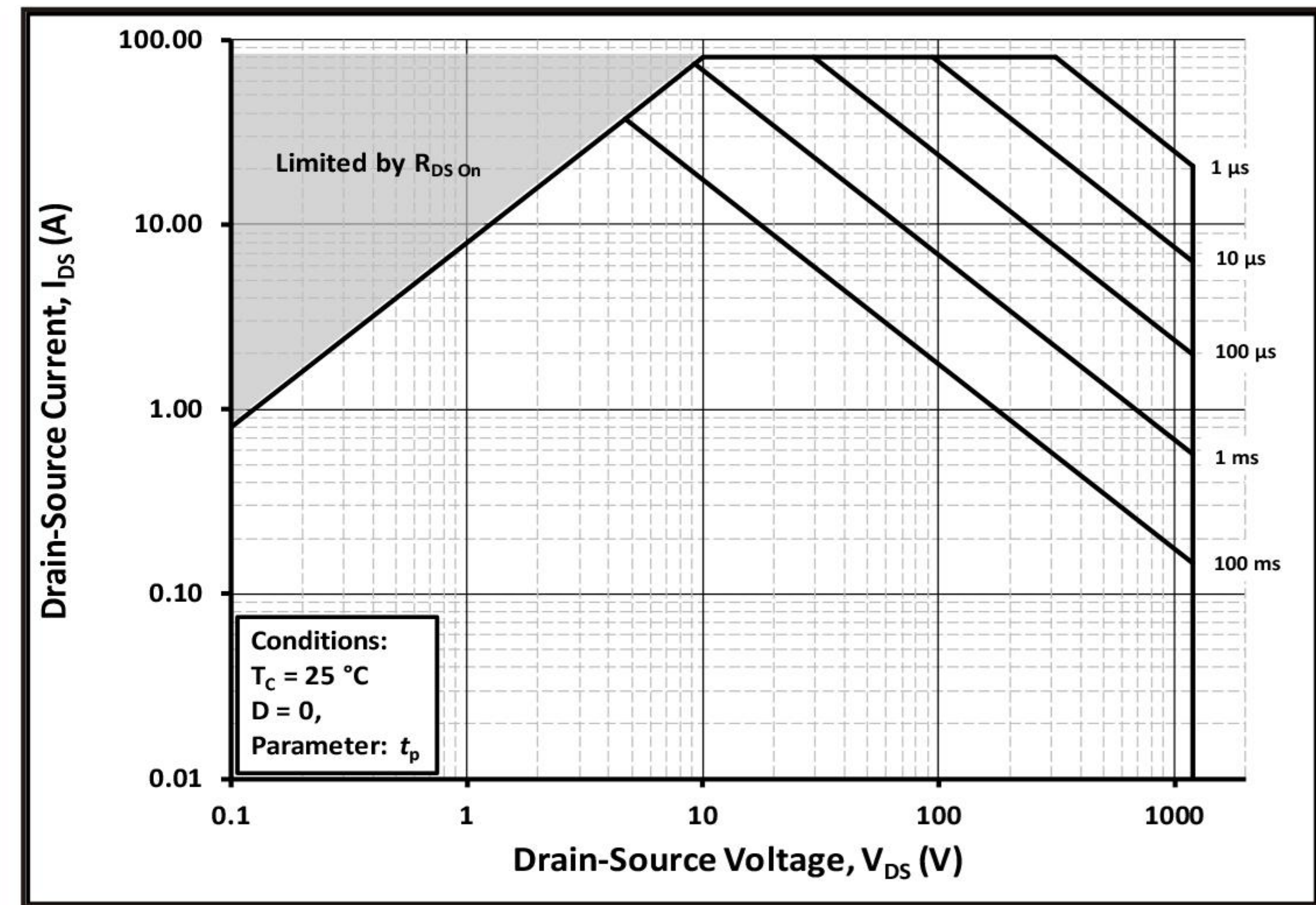


Figure 22. Safe Operating Area

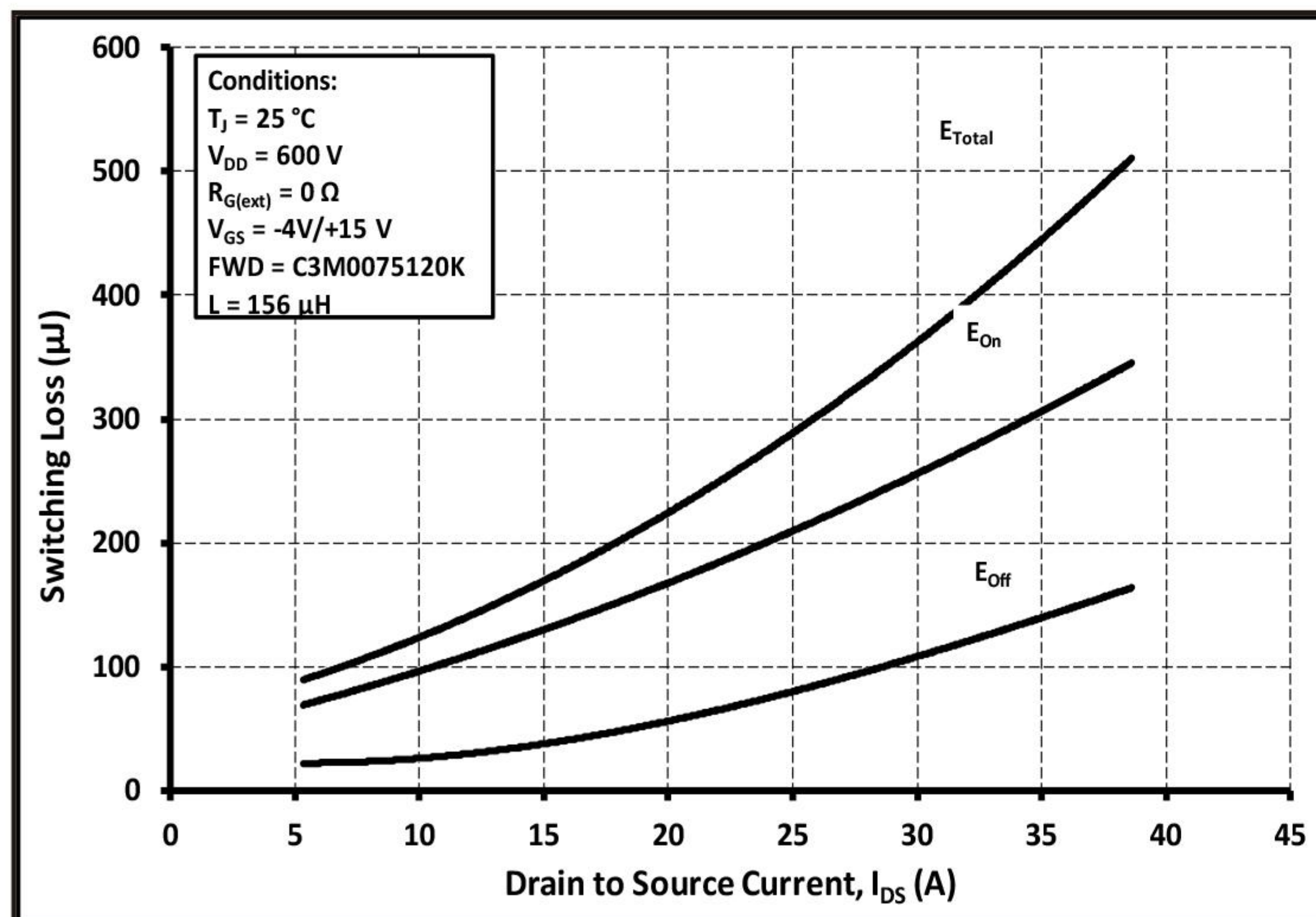


Figure 23. Clamped Inductive Switching Energy vs. Drain Current ( $V_{DD} = 600V$ )

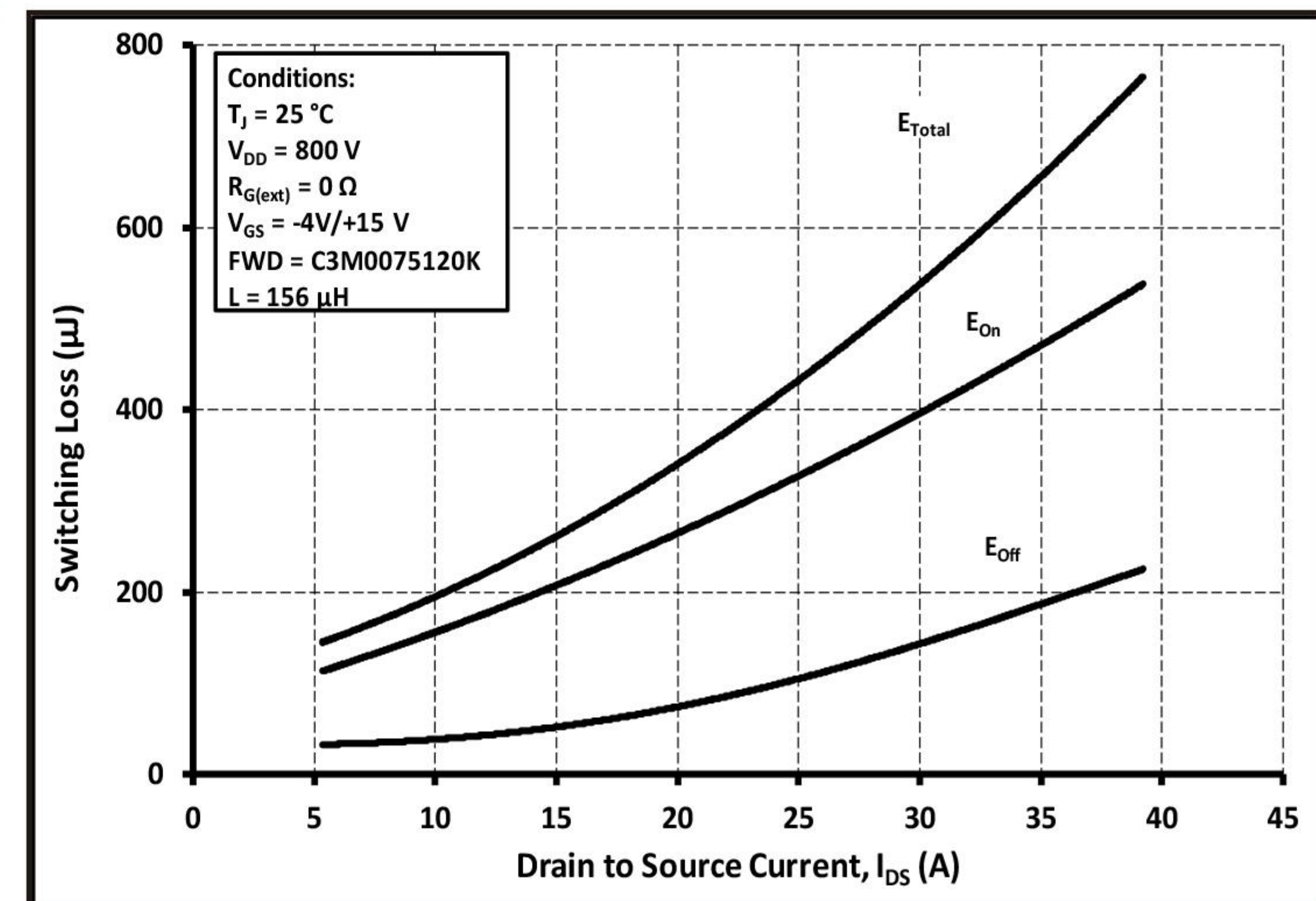


Figure 24. Clamped Inductive Switching Energy vs. Drain Current ( $V_{DD} = 800V$ )

## Typical Performance

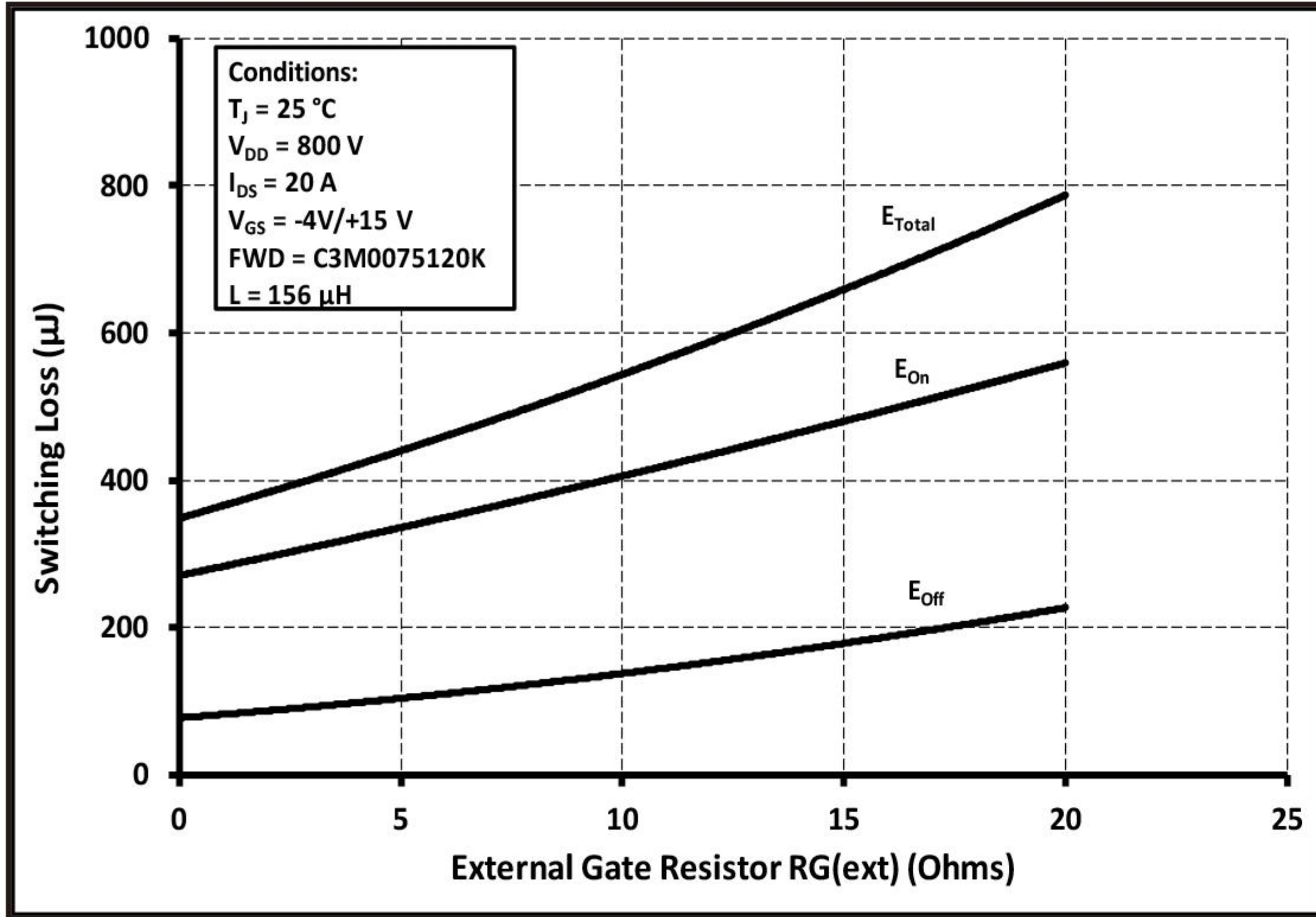


Figure 25. Clamped Inductive Switching Energy vs.  $R_{G(\text{ext})}$

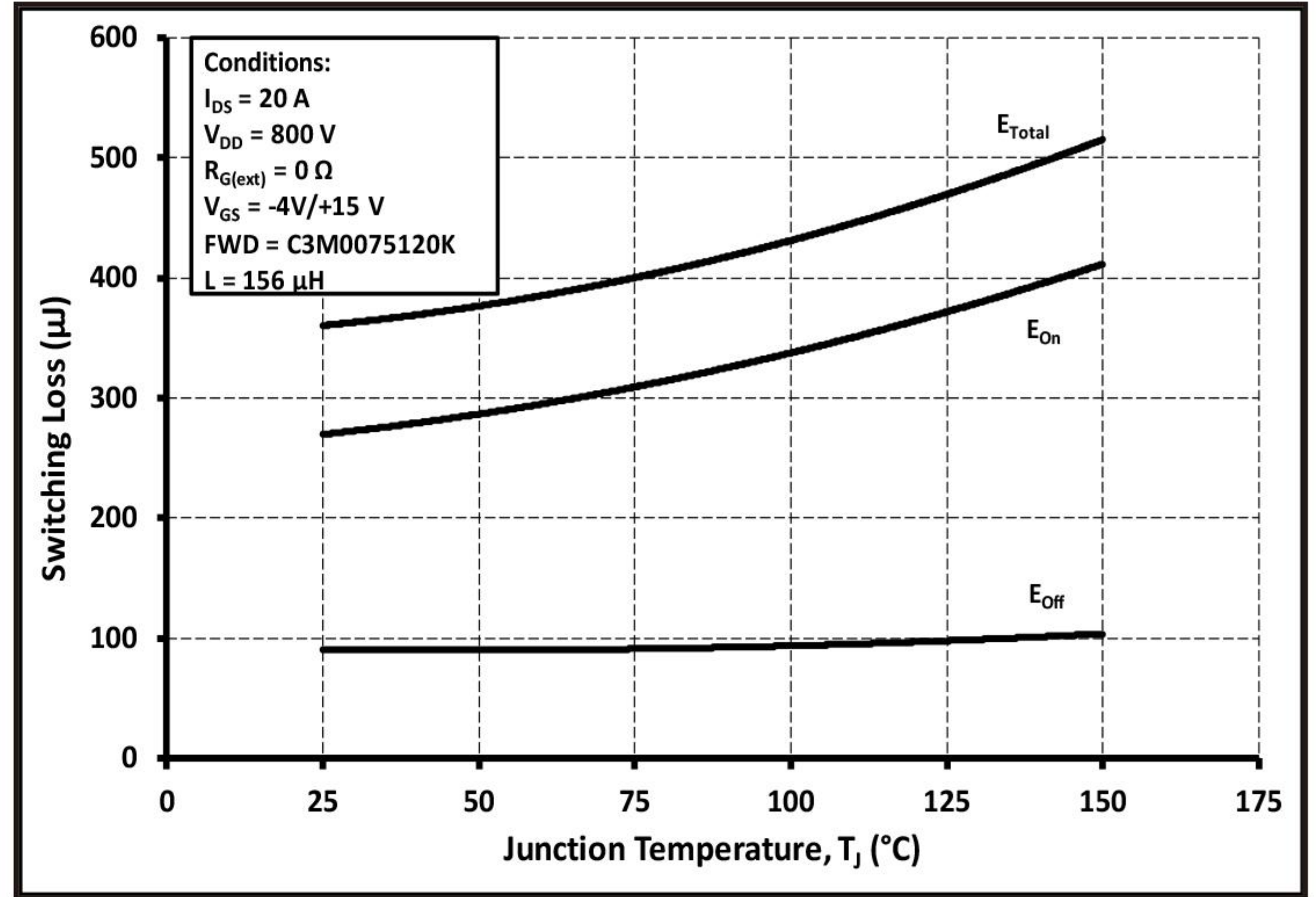


Figure 26. Clamped Inductive Switching Energy vs. Temperature

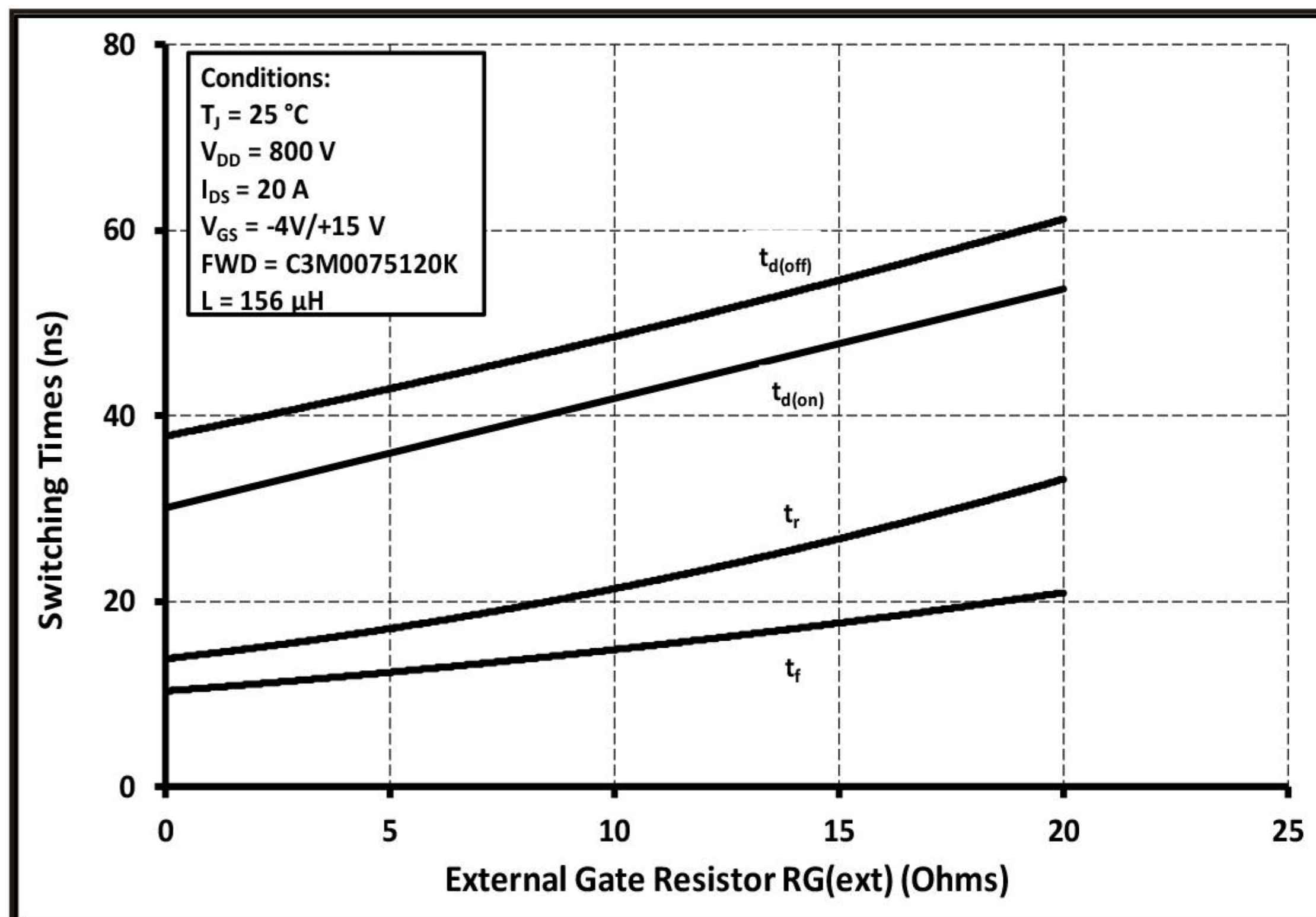


Figure 27. Switching Times vs.  $R_{G(\text{ext})}$

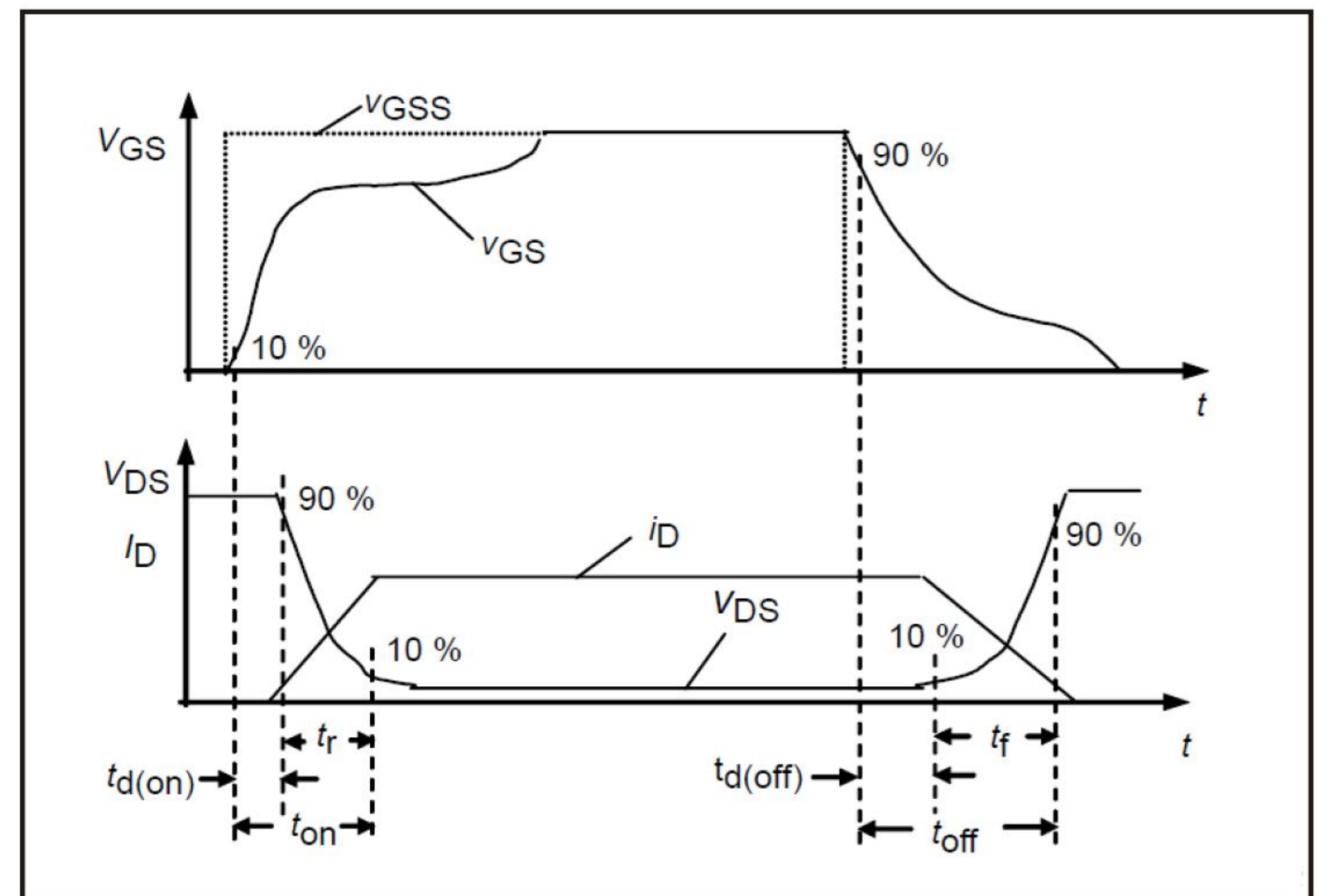


Figure 28. Switching Times Definition

### Test Circuit Schematic

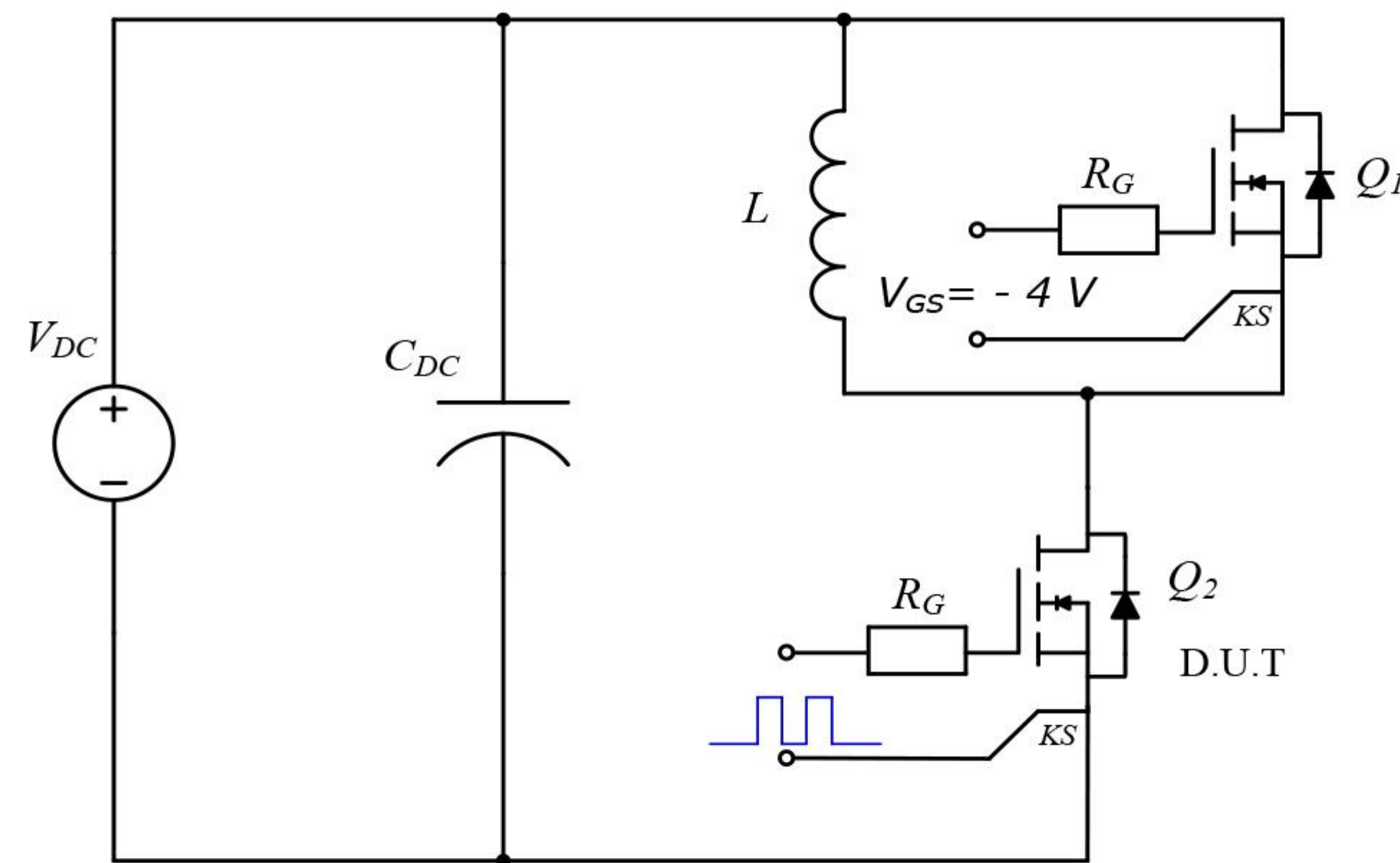
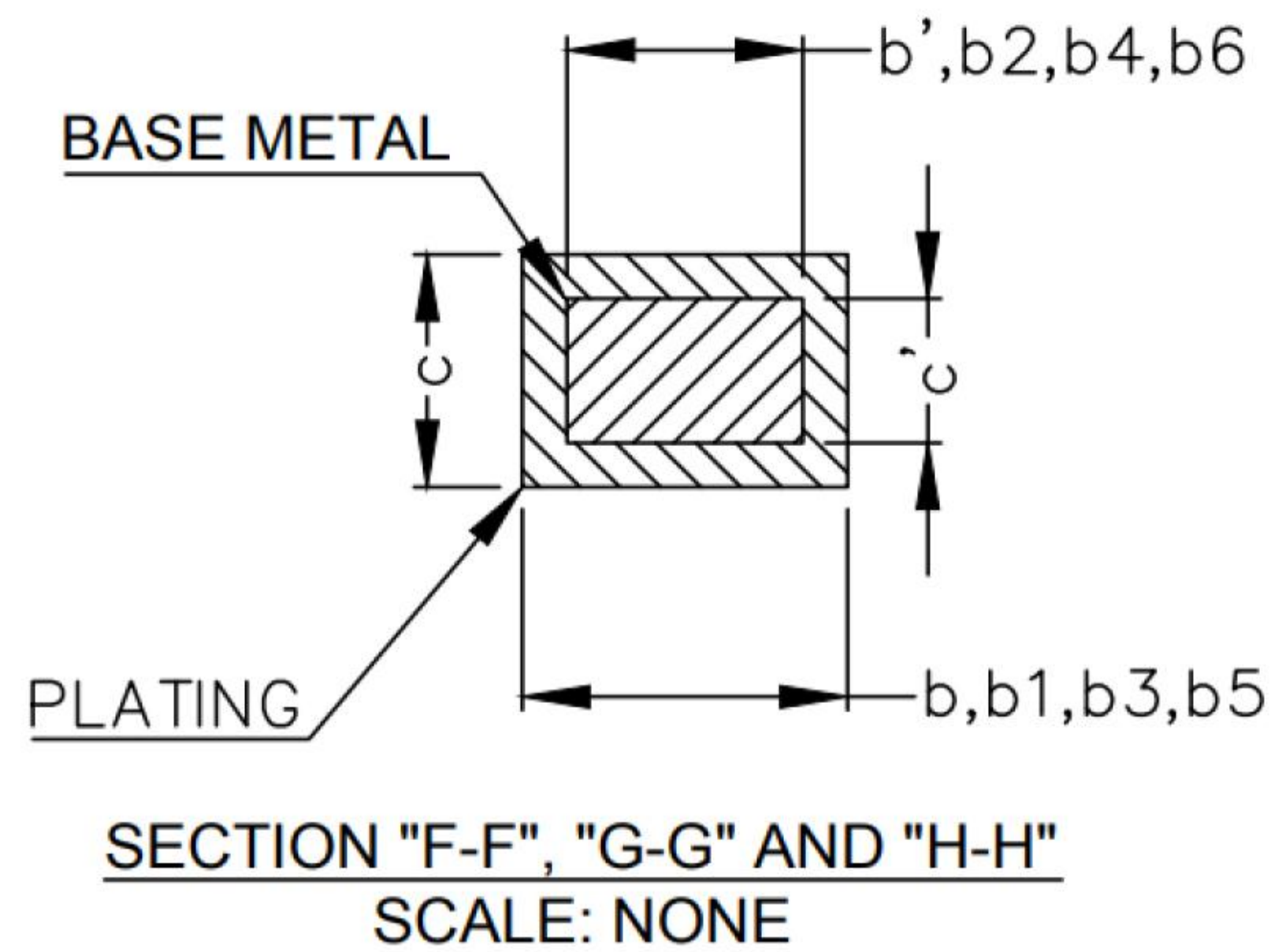
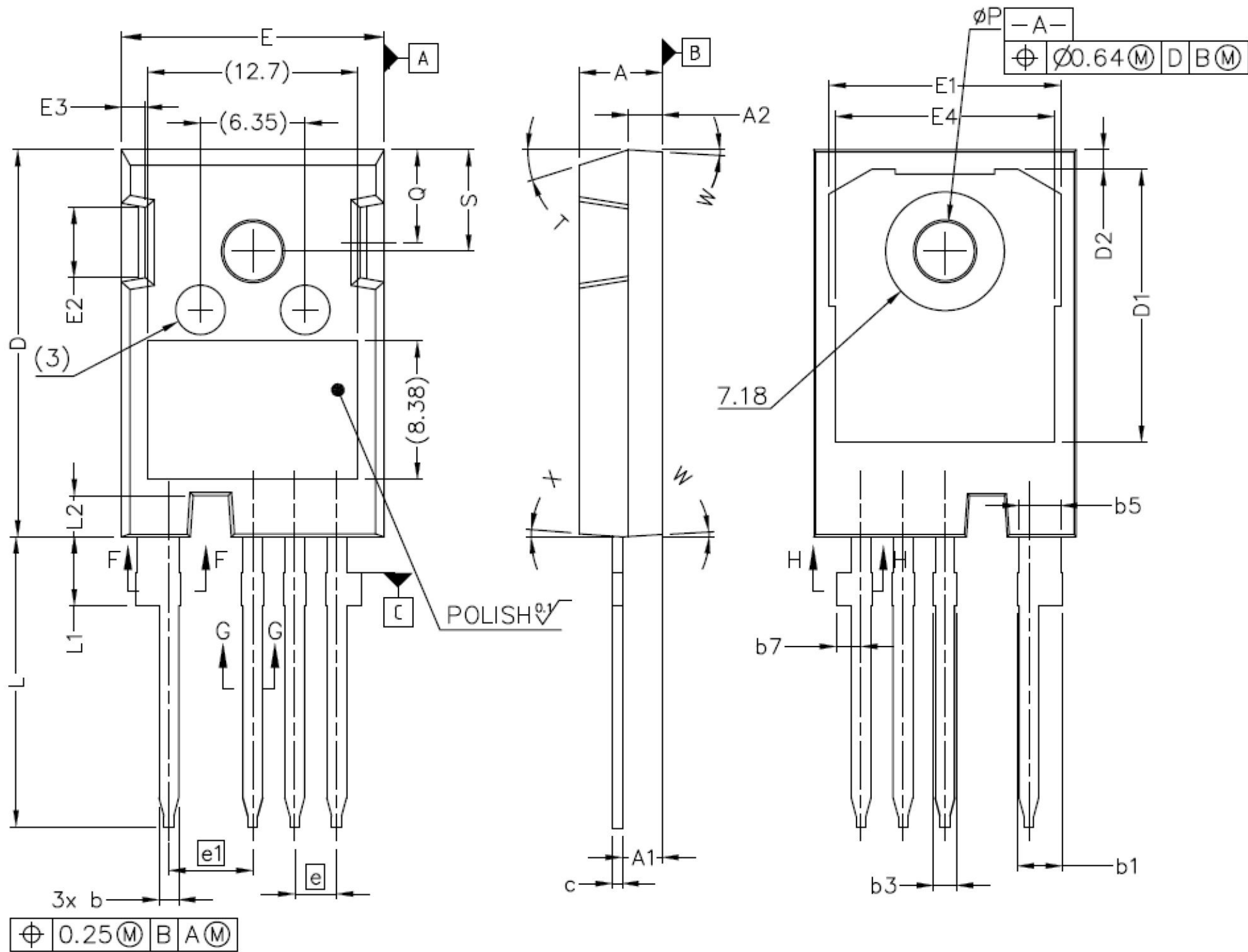


Figure 29. Clamped Inductive Switching  
Waveform Test Circuit

Note (3): Turn-off and Turn-on switching energy and timing values measured using SiC MOSFET Body Diode as shown above.

### Package Dimensions

Package TO-247-4L



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Package TO-247-4L

NOTE ;

1. ALL METAL SURFACES: TIN PLATED, EXCEPT AREA OF CUT
2. DIMENSIONING & TOLERANCEING CONFIRM TO ASME Y14.5M-1994.
3. ALL DIMENSIONS ARE IN MILLIMETERS.  
ANGLES ARE IN DEGREES.
4. 'N' IS THE NUMBER OF TERMINAL POSITIONS

SYM	MILLIMETERS	
	MIN	MAX
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b`	1.07	1.28
b	1.07	1.33
b1	2.39	2.94
b2	2.39	2.84
b3	1.07	1.60
b4	1.07	1.50
b5	2.39	2.69
b6	2.39	2.64
b7	1.30	1.70
c`	0.55	0.65
c	0.55	0.68
D	23.30	23.60
D1	16.25	17.65
D2	0.95	1.25
E	15.75	16.13

SYM	MILLIMETERS	
	MIN	MAX
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	2.54 BSC	
e1	5.08 BSC	
N*	4	
L	17.31	17.82
L1	3.97	4.37
L2	2.35	2.65
∅ P	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
T	17.5° REF.	
W	3.5° REF.	
X	4° REF.	

