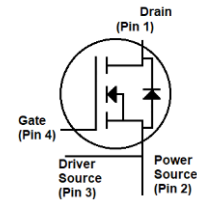




High Power SiC MOSFET Transistor

AAR030V120H2



Applications:

- Solar Inverters
- Uninterrupted power supplies
- Switch mode power supplies
- Motor drives

Features:

- High blocking voltage with low on-resistance
- High switching speed with low capacitance
- Very low switching losses
- Excellent avalanche ruggedness
- Very fast and robust intrinsic body diode with low reverse recovery
- 0V turn-off V_{gs} for gate drive ease

Absolute Maximum Ratings ($T_{amb}=25^{\circ}\text{C}$, unless specified otherwise)

Symbol	Parameter	Value	Unit
V_{DS}	DC Reverse Voltage	1200	V
V_{GSmax}	Gate-source voltage, max. transient voltage	-10/+25	
V_{GSmax}	Gate-source voltage, max. static voltage	-8/+22	
V_{GSop}	Gate-source voltage	-5/+18	
I_D	Continuous drain current ($V_{GS} = 18\text{V}$)	80	A
	Continuous drain current ($V_{GS} = 18\text{V}$), $T_C = 100^{\circ}\text{C}$	56	
$I_{D(pulse)}$	Pulsed drain current (Pulse width limited by T_{jmax})	199	A
P_{tot}	Power dissipation	376	W
T_j	Operating junction temperature	-55 to 175	$^{\circ}\text{C}$
T_{stg}	Storage temperature	-55 to 175	$^{\circ}\text{C}$
M	Mounting torque	0.7	Nm

Thermal and Mechanical Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction-to-case thermal Resistance	-	0.34	-	$^{\circ}\text{C/W}$
$R_{\theta JA}$	Junction-to-ambient thermal Resistance	-	-	40	$^{\circ}\text{C/W}$

Static Electrical Characteristics ($T_A = 25^\circ\text{C}$, unless specified otherwise)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 100\mu A$	1200	-	-	V
$V_{GS(th)}$	Gate-Source Threshold Voltage	$V_{DS} = V_{GS}, I_D = 10mA^a$	1.8	3.2	4.2	
		$V_{DS} = V_{GS}, I_D = 10mA, T_J = 175^\circ\text{C}^a$	-	2.4	-	
I_{DSS}	Drain-Source Leakage current	$V_{DS} = 1200V, V_{GS} = 0V$	-	1	150	μA
I_{GSS}	Gate-Source leakage current	$-10V < V_{GS} < 25V$	-	1	100	nA
$R_{DS(on)}$	Drain-Source ON Resistance	$V_{GS} = 15V, I_D = 40A$	-	37	-	m Ω
		$V_{GS} = 18V, I_D = 40A$	-	32	42	
		$V_{GS} = 18V, I_D = 40A, T_J = 175^\circ\text{C}$	-	48	-	
g_{fs}	Transconductance	$V_{DS} = 20V, I_D = 40A$	-	24	-	S
		$V_{DS} = 20V, I_D = 40A, T_J = 175^\circ\text{C}$	-	20	-	
$R_{g(int)}$	Internal gate resistance	$f = 1MHz, V_{AC} = 25mV$	-	3.6	-	Ω

^a Pre-conditioned V_{th} , as per JEDEC standard JEP183A, (Revision of JEP183 January 2021)

Dynamic Characteristics ($T_A = 25^\circ\text{C}$, unless specified otherwise)

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{GS} = 0V, V_{DS} = 1000V, f = 1MHz, V_{AC} = 25mV$	-	2090	-	pF
C_{oss}	Output Capacitance		-	86	-	
C_{rss}	Reverse Transfer Capacitance		-	2	-	
E_{oss}	C_{oss} stored energy		-	35	-	μJ
Q_{gs}	Gate-Source Gate Charge	$V_{DD} = 800V, V_{GS} = -5/+18V, I_D = 40A, I_{GS} = 1mA$	-	30	-	nC
Q_{gd}	Gate-Drain Gate Charge		-	27	-	
Q_g	Total Gate Charge		-	91	-	

Switching Characteristics ($T_A=25^\circ\text{C}$, unless specified otherwise)

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$T_{d(on)}$	Turn-on delay time	$V_{DD} = 800\text{V}$, $V_{GS} = -5/+18\text{V}^b$, $I_D = 40\text{A}$, $R_{G(ext)} = 2.4\Omega$, $L = 110\mu\text{H}$	-	14	-	ns
T_r	Rise time		-	18	-	
$T_{d(off)}$	Turn-off delay time		-	29	-	
T_f	Fall time		-	6	-	
E_{on}	Turn On Switching Energy		-	442	-	μJ
E_{off}	Turn Off Switching Energy		-	37	-	
$T_{d(on)}$	Turn-on delay time	$V_{DD} = 800\text{V}$, $V_{GS} = -5/+18\text{V}^b$, $I_D = 40\text{A}$, $R_{G(ext)} = 2.4\Omega$, $L = 110\mu\text{H}$, $T_j = 175^\circ\text{C}$	-	12	-	ns
T_r	Rise time		-	22	-	
$T_{d(off)}$	Turn-off delay time		-	35	-	
T_f	Fall time		-	7	-	
E_{on}	Turn On Switching Energy		-	578	-	μJ
E_{off}	Turn Off Switching Energy		-	44	-	

^bThis SiC MOSFET can switch with driver pulses 0 V to 18 V with optimized PCB layouts and gate drive circuits.

Body Diode Characteristics ($T_A=25^\circ\text{C}$, unless specified otherwise)

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
V_{SD}	Body Diode Forward Voltage	$V_{GS} = -5\text{V}$, $I_{SD} = 40\text{A}$	-	4.6	-	V
		$V_{GS} = -5\text{V}$, $I_{SD} = 40\text{A}$, $T_j = 175^\circ\text{C}$	-	4.0	-	
I_S	Continuous diode forward current	$T_C = 25^\circ\text{C}$	-	-	58	A
$I_{S(pulse)}$	Diode pulse current	$V_{GS} = -5\text{V}$, pulse width t_p limited by T_{jmax}	-	-	145	A
t_{rr}	Reverse recovery time	$V_{GS} = -5\text{V}$, $I_{SD} = 40\text{A}$,	-	13	-	ns
Q_{rr}	Reverse recovery charge	$V_R = 800\text{V}$,	-	0.24	-	μC
I_{rrm}	Peak reverse recovery current	$di/dt = 2.93\text{kA}/\mu\text{s}$	-	27	-	A
t_{rr}	Reverse recovery time	$V_{GS} = -5\text{V}$, $I_{SD} = 40\text{A}$,	-	24	-	ns
Q_{rr}	Reverse recovery charge	$V_R = 800\text{V}$, $T_j = 175^\circ\text{C}$,	-	0.70	-	μC
I_{rrm}	Peak reverse recovery current	$di/dt = 2.98\text{kA}/\mu\text{s}$	-	44	-	A

Electrical Characteristic Diagrams

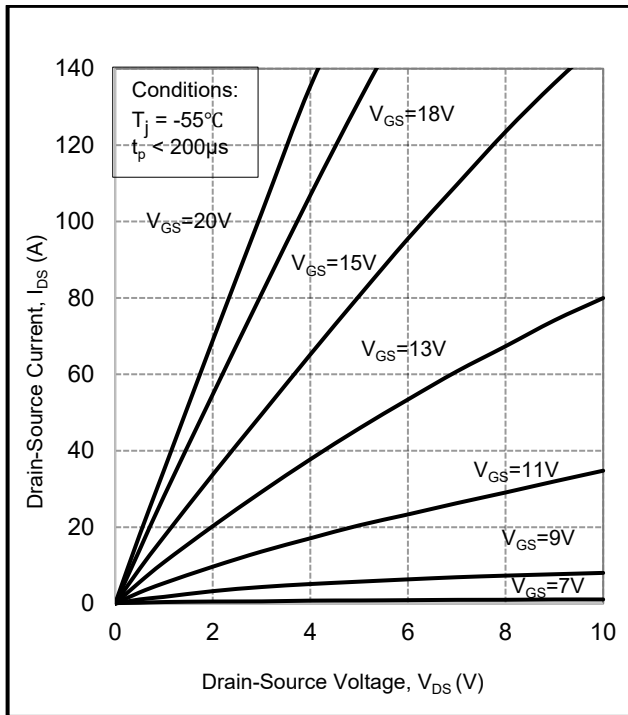
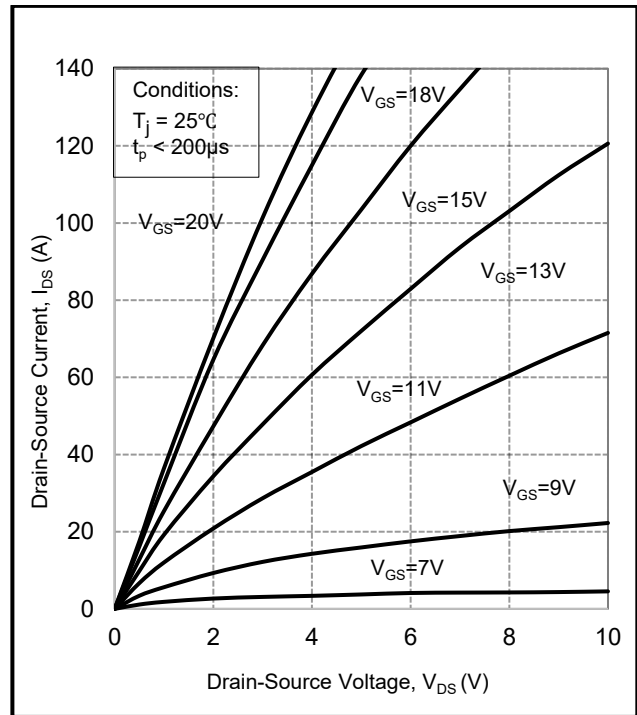
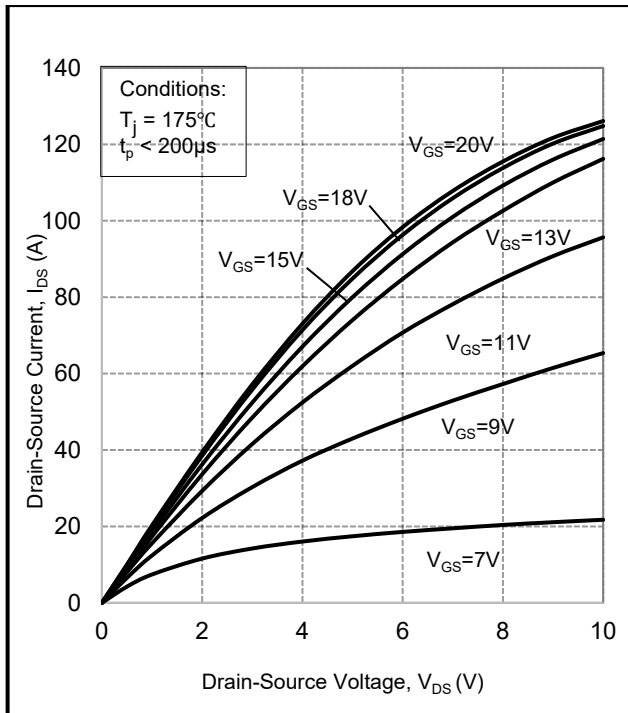
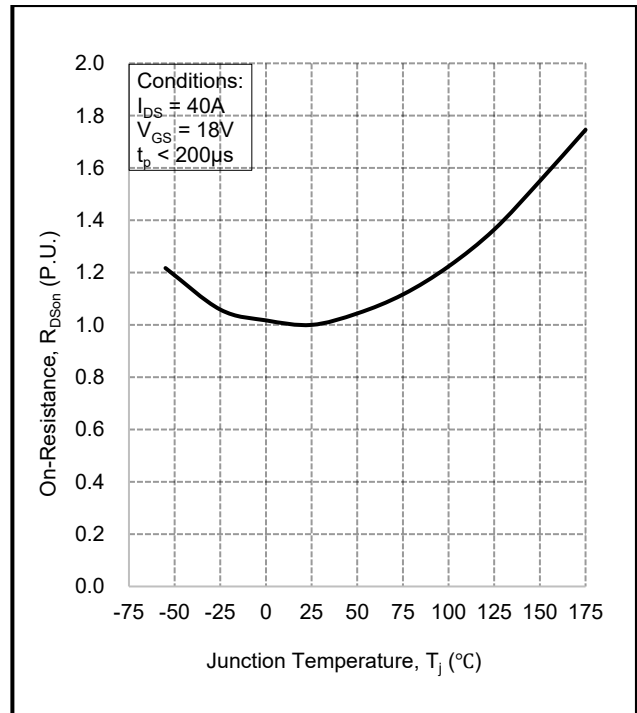
Figure 1. Output characteristics at $T_j = -55^\circ\text{C}$ Figure 2. Output characteristics at $T_j = 25^\circ\text{C}$ Figure 3. Output characteristics at $T_j = 175^\circ\text{C}$ 

Figure 4. Normalized on-resistance vs. temperature

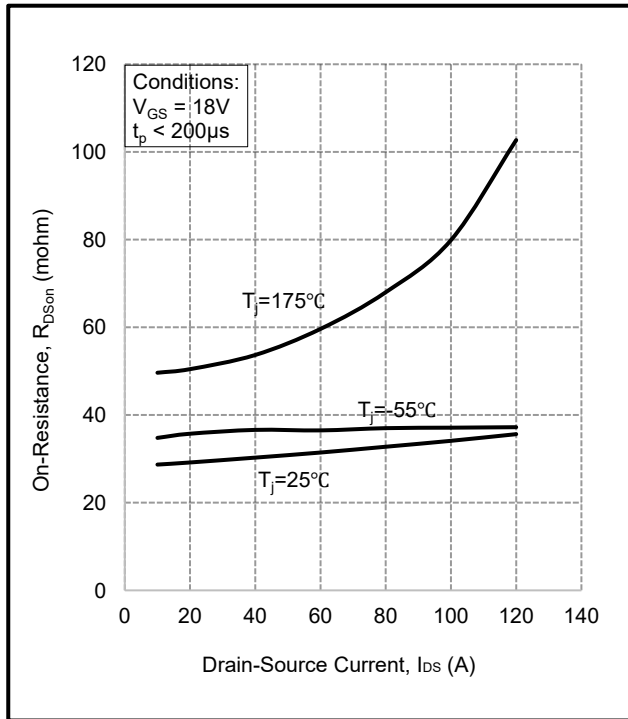


Figure 5. On-resistance vs. drain current for various temperatures

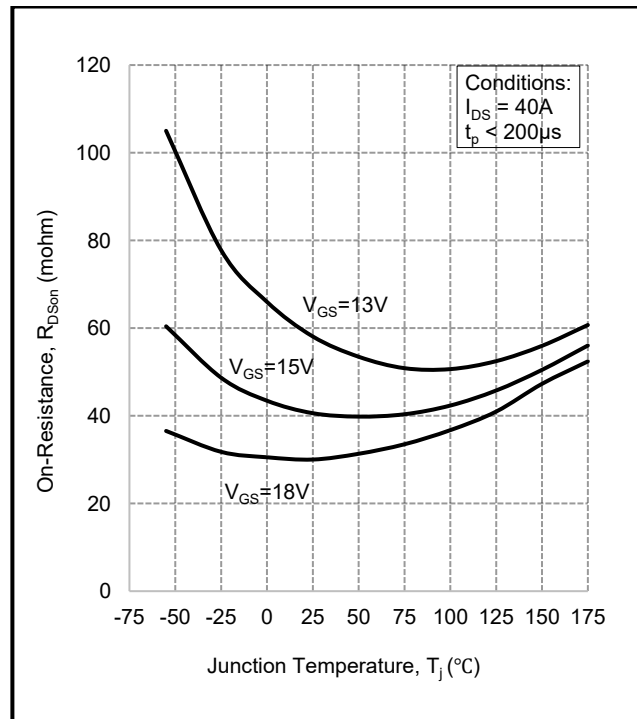


Figure 6. On-resistance vs. temperature for various gate voltages

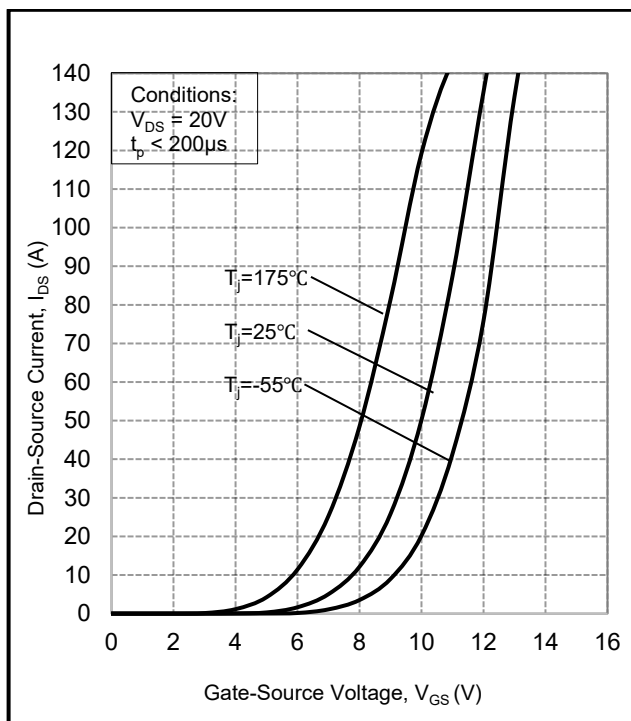


Figure 7. Transfer characteristic for various junction temperatures

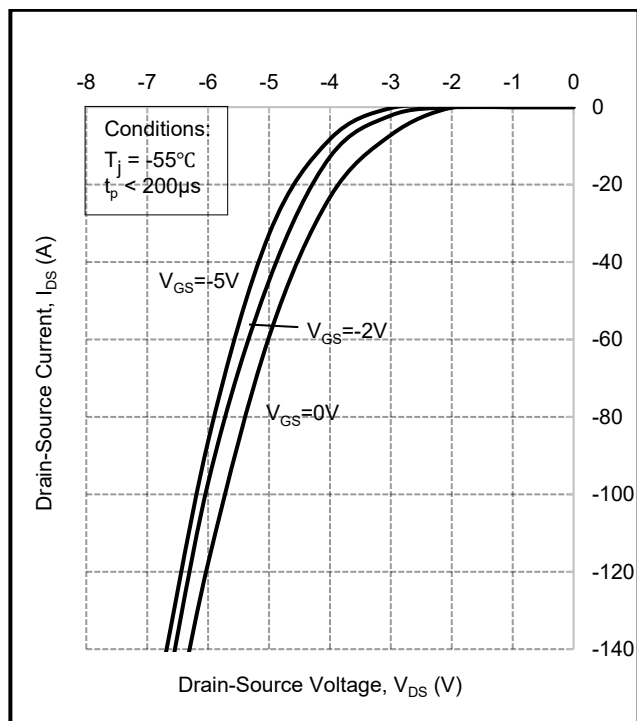


Figure 8. Body diode characteristic at $T_J = -55^\circ\text{C}$

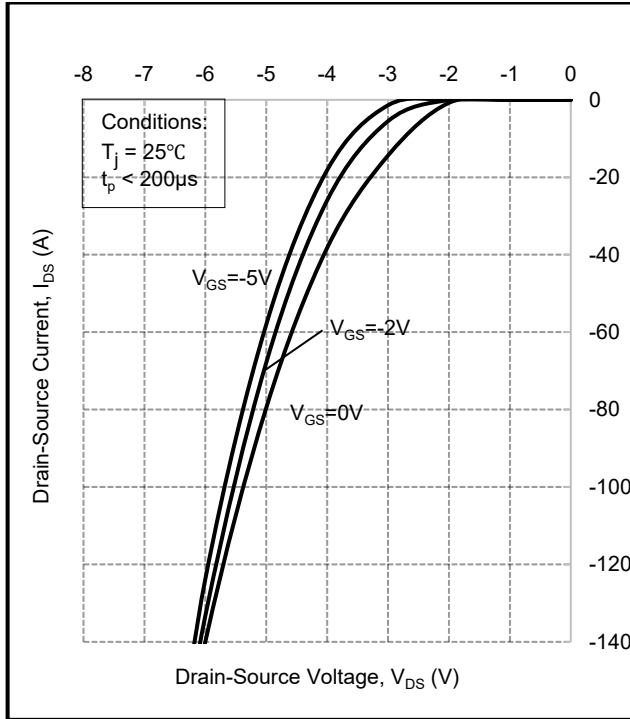
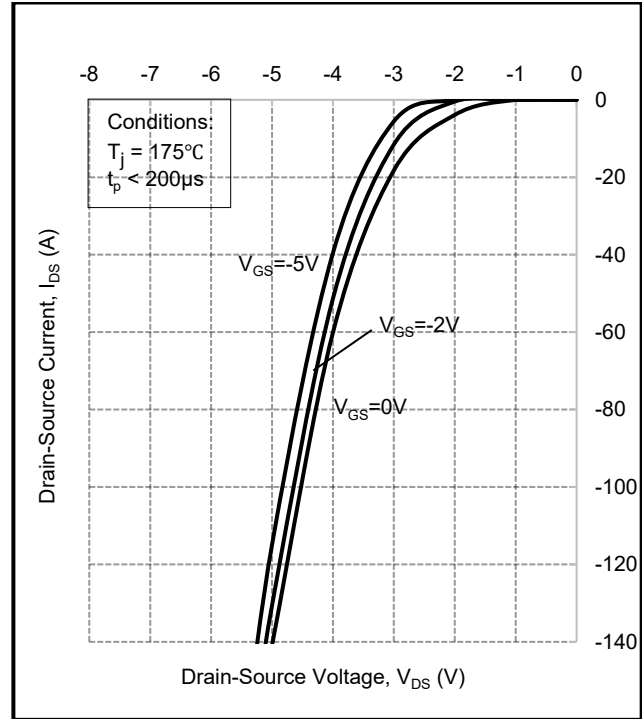
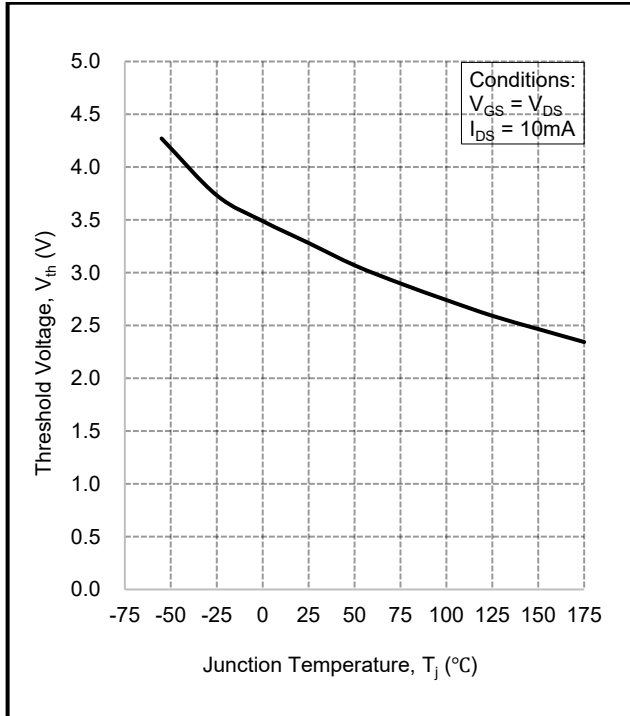
Figure 9. Body diode characteristic at $T_j = 25^\circ\text{C}$ Figure 10. Body diode characteristic at $T_j = 175^\circ\text{C}$ 

Figure 11. Threshold voltage vs. temperature

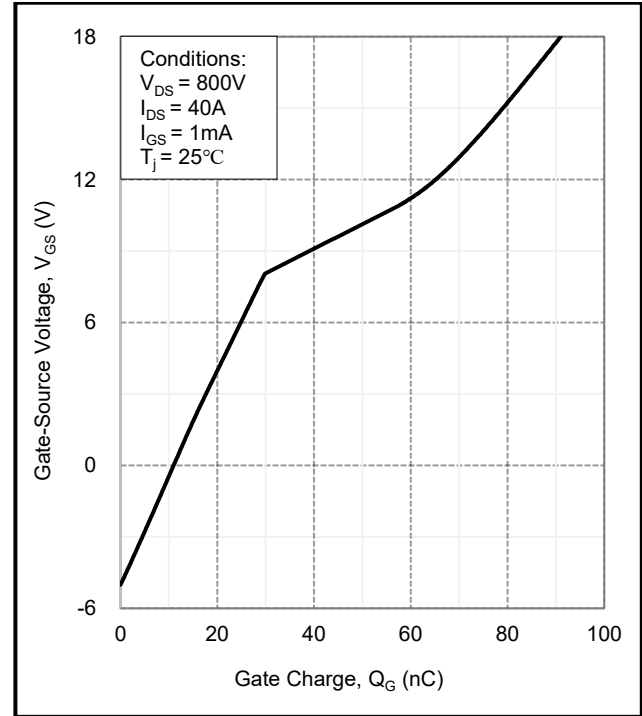


Figure 12. Gate charge characteristics

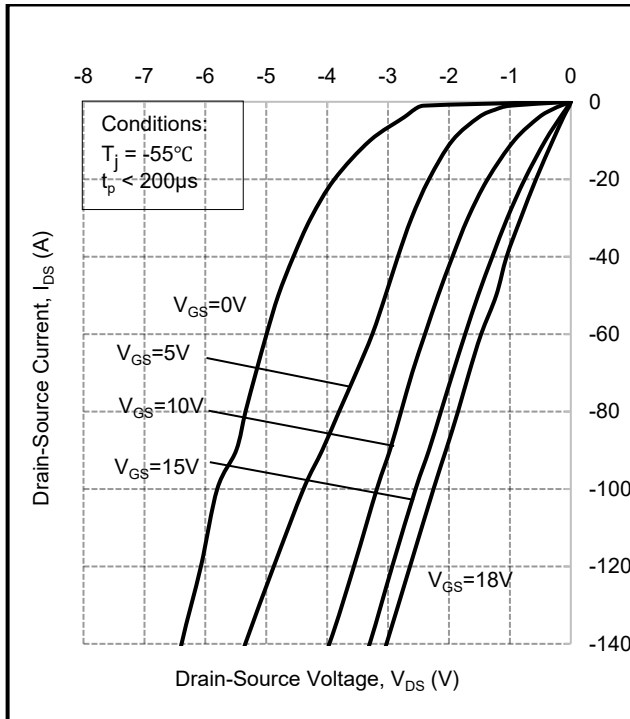


Figure 13. 3rd quadrant characteristic at $T_j = -55^\circ\text{C}$

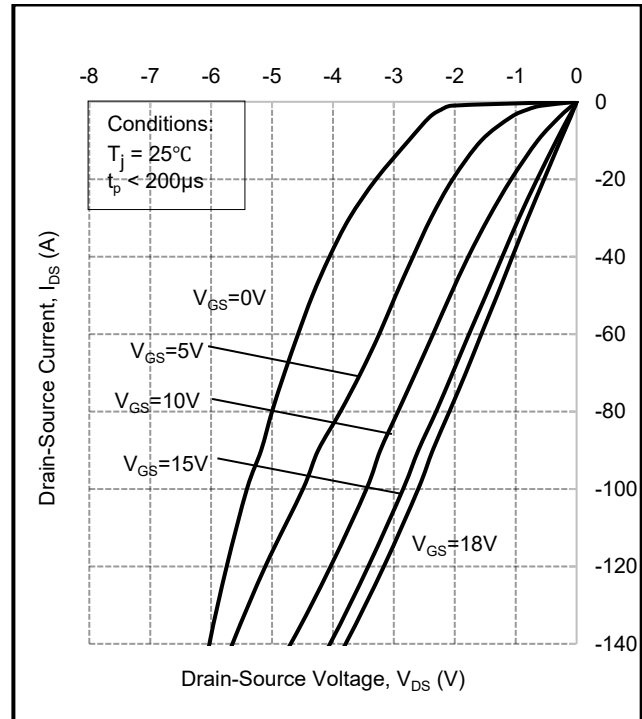


Figure 14. 3rd quadrant characteristic at $T_j = 25^\circ\text{C}$

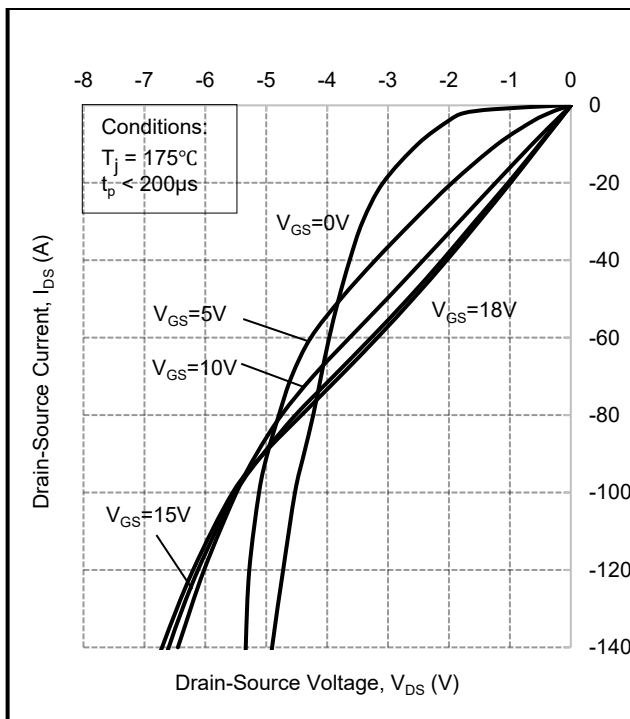


Figure 15. 3rd quadrant characteristic at $T_j = 175^\circ\text{C}$

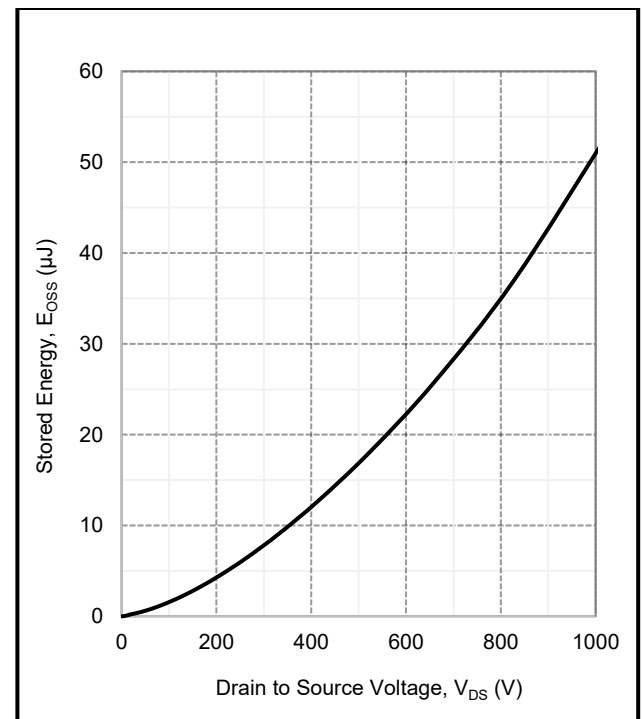


Figure 16. Output capacitor stored energy

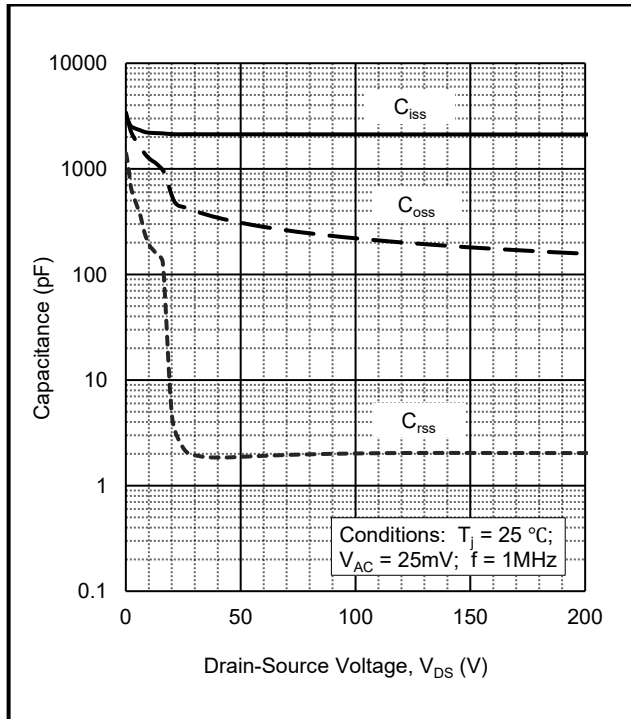


Figure 17. Capacitance vs. drain-source voltage (0 - 200V)

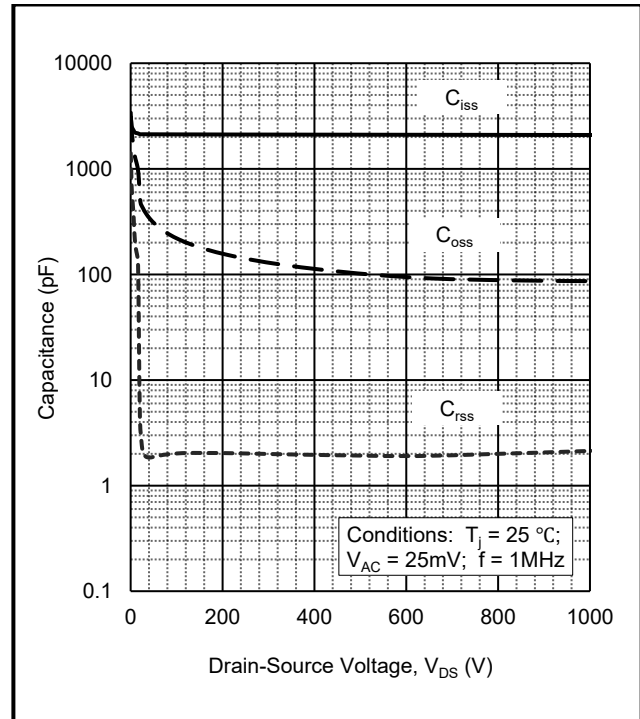


Figure 18. Capacitance vs. drain-source voltage (0 - 1000V)

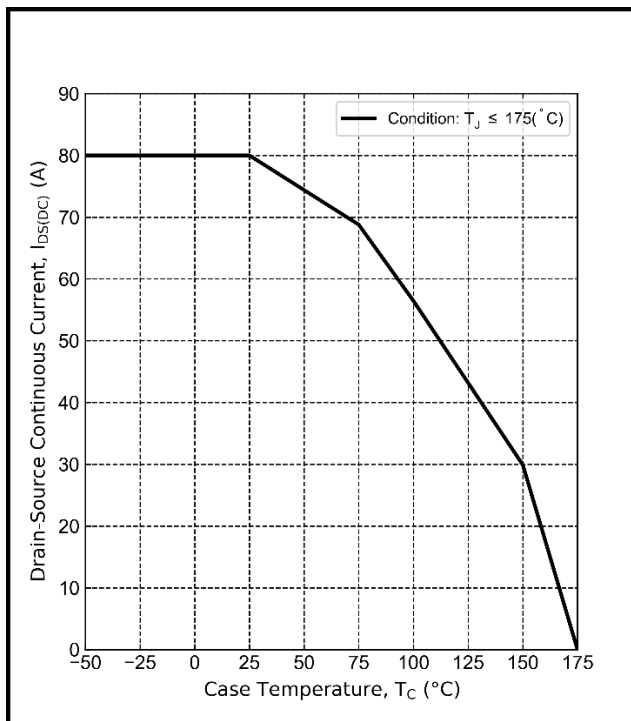


Figure 19. Continuous drain current derating vs. temperature

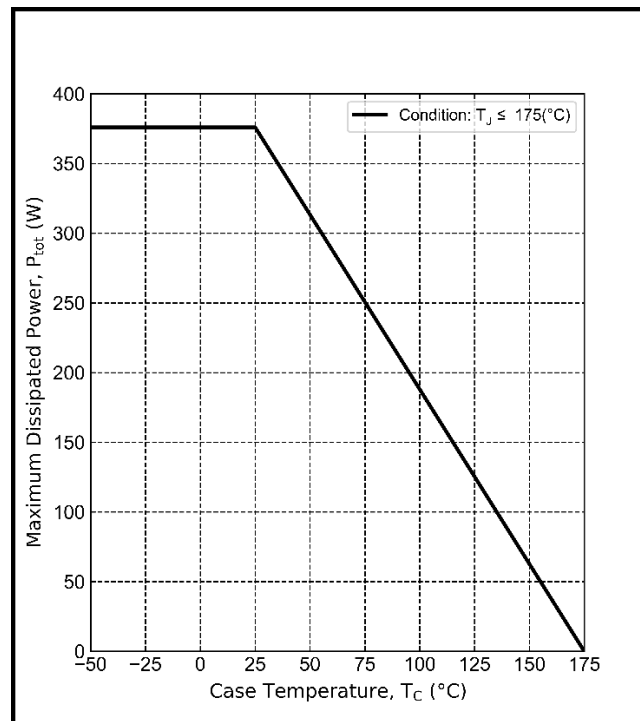


Figure 20. Maximum power dissipation derating vs. temperature

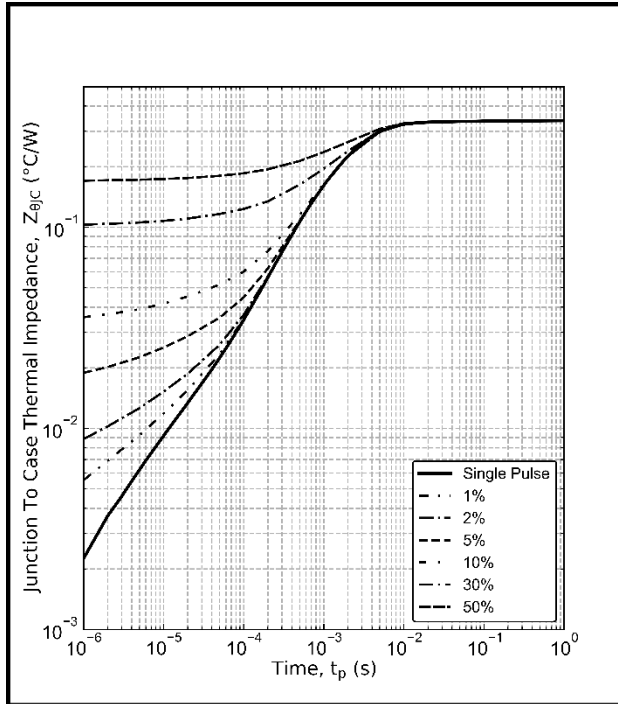
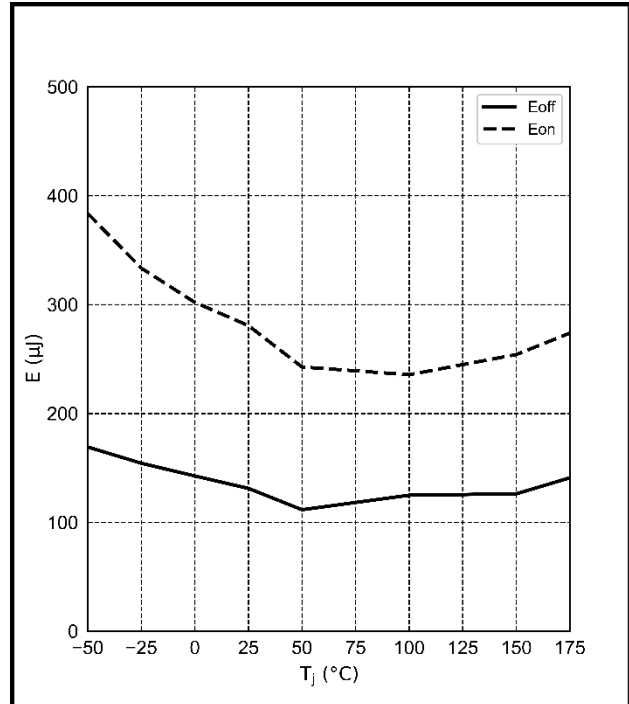
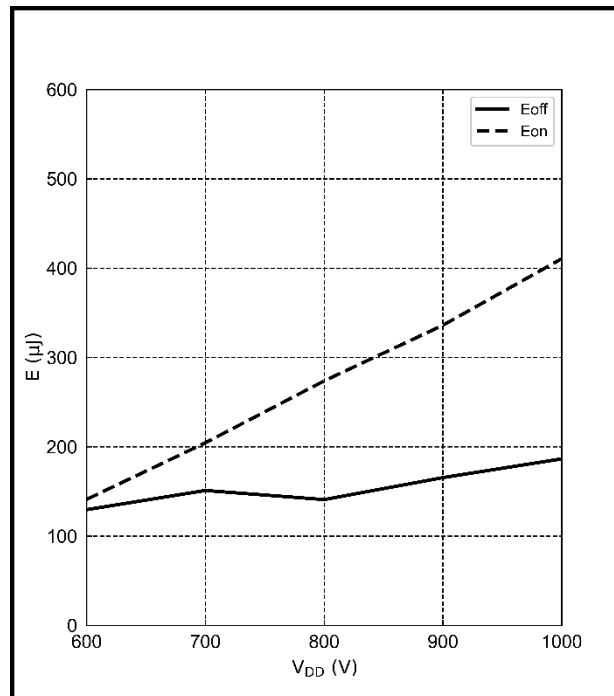
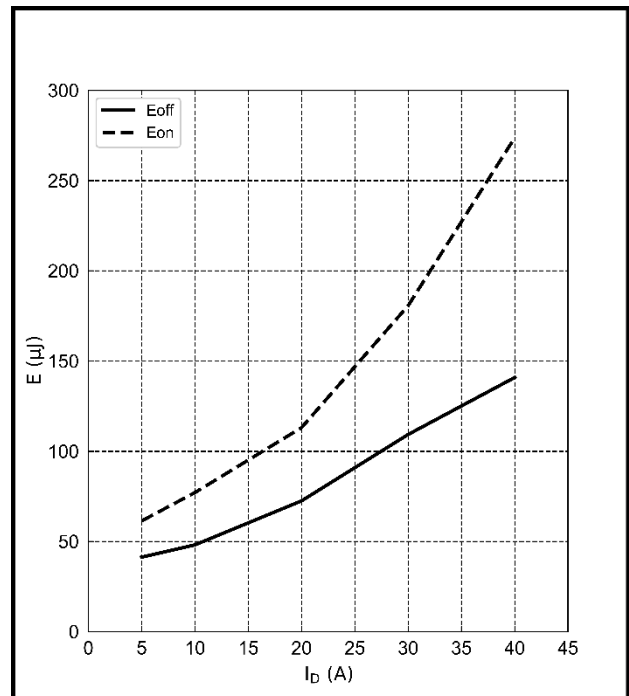


Figure 21. Transient thermal impedance

Figure 22. Typical switching energies Eon and Eoff with T_j ,
($V_g = -5\text{ V to }18\text{ V}$, $I_d = 40\text{ A}$, $V_{ds} = 800\text{ V}$, $R_g = 2.2\ \Omega$)Figure 23. Typical switching energies Eon and Eoff with V_{DD}
($V_g = -5\text{ V to }18\text{ V}$, $I_d = 40\text{ A}$, $T_j = 175^\circ\text{C}$, $R_g = 2.2\ \Omega$)Figure 24. Typical switching energies Eon and Eoff with I_D
($V_g = -5\text{ V to }18\text{ V}$, $V_{dd} = 800\text{ V}$, $T_j = 175^\circ\text{C}$, $R_g = 2.2\ \Omega$)

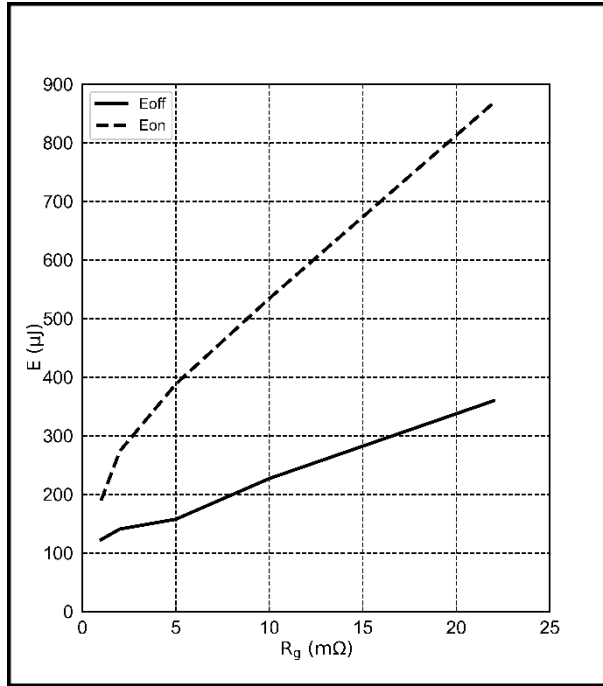


Figure 25. Typical switching energies E_{on} and E_{off} with R_g
($V_g = -5$ V to 18 V, $V_{ds} = 800$ V, $I_d = 40$ A, $T_j = 25^\circ\text{C}$)

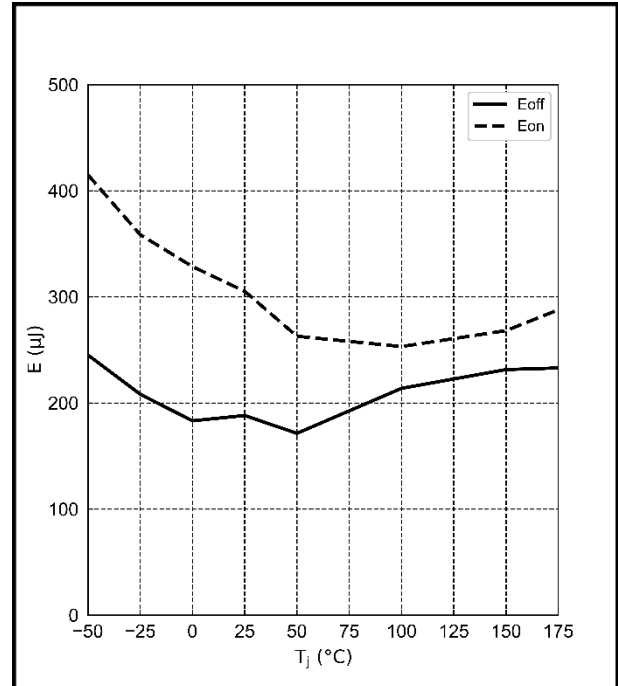


Figure 26. Typical switching energies E_{on} and E_{off} with T_j ,
($V_g = 0$ V to 18 V, $I_d = 40$ A, $V_{ds} = 800$ V, $R_g = 2.2$ Ω)

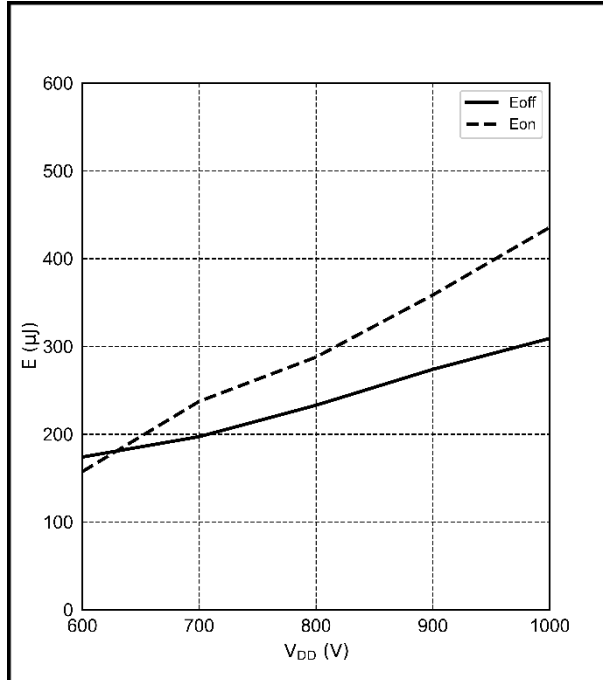


Figure 27. Typical switching energies E_{on} and E_{off} with V_{DD}
($V_g = 0$ V to 18 V, $I_d = 40$ A, $T_j = 175^\circ\text{C}$, $R_g = 2.2$ Ω)

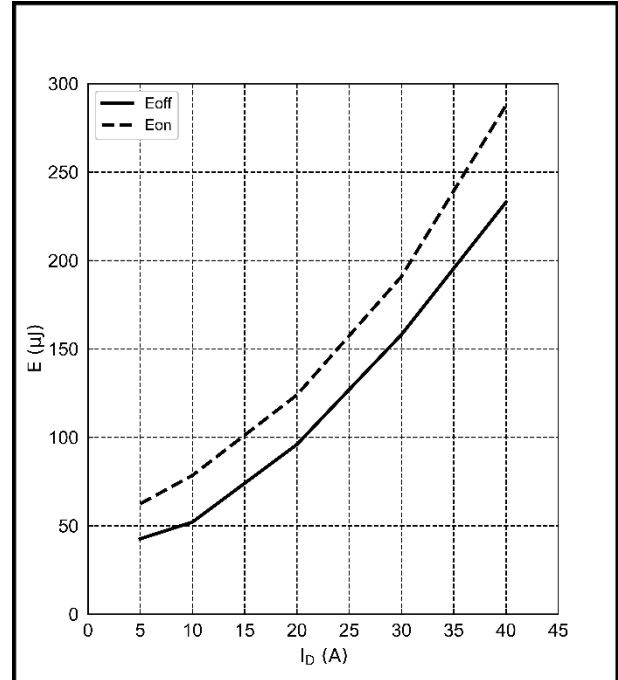


Figure 28. Typical switching energies E_{on} and E_{off} with I_D
($V_g = 0$ V to 18 V, $V_{dd} = 800$ V, $T_j = 175^\circ\text{C}$, $R_g = 2.2$ Ω)

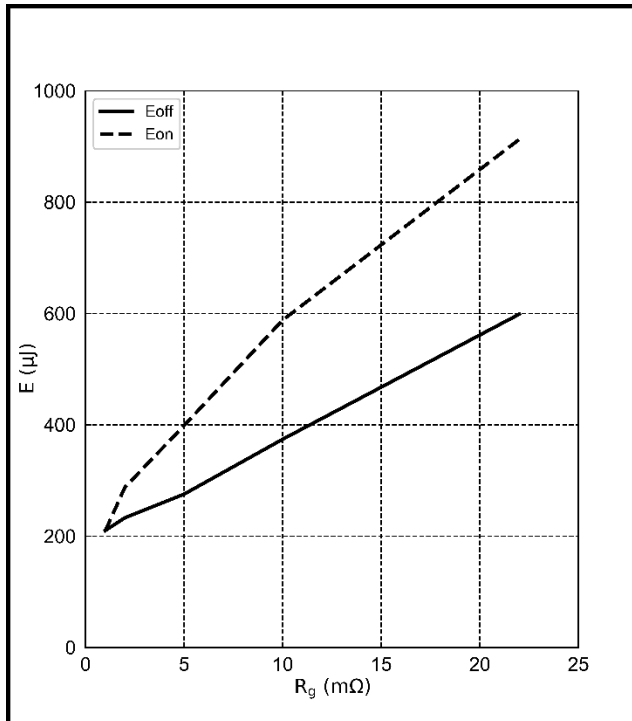


Figure 29. Typical switching energies E_{on} and E_{off} with R_g
($V_g = 0 V$ to $18 V$, $V_{ds} = 800 V$, $I_d = 40 A$, $T_j = 175^\circ C$)

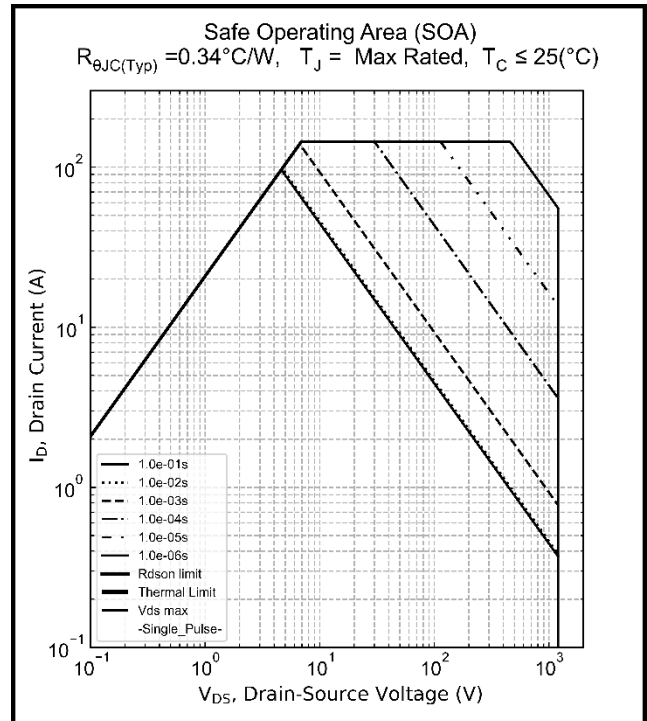


Figure 30. Safe Operating Area (SOA)

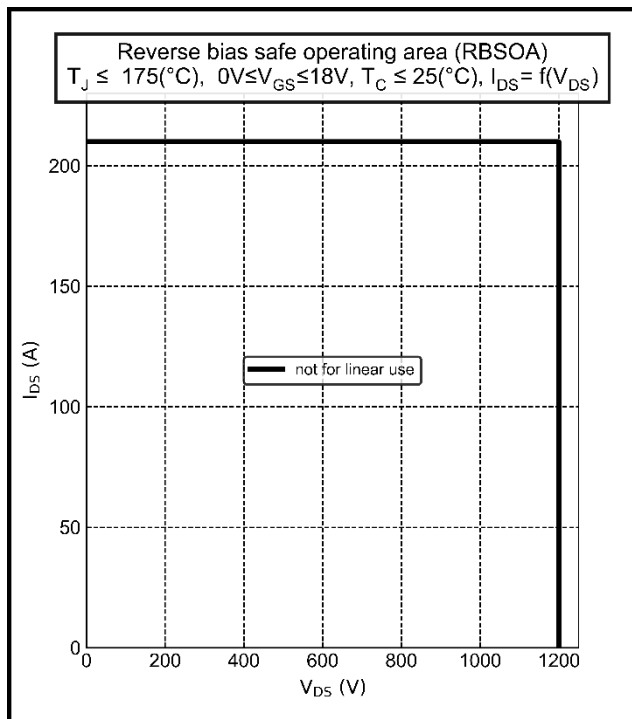


Figure 31. Reverse Bias Safe Operating Area

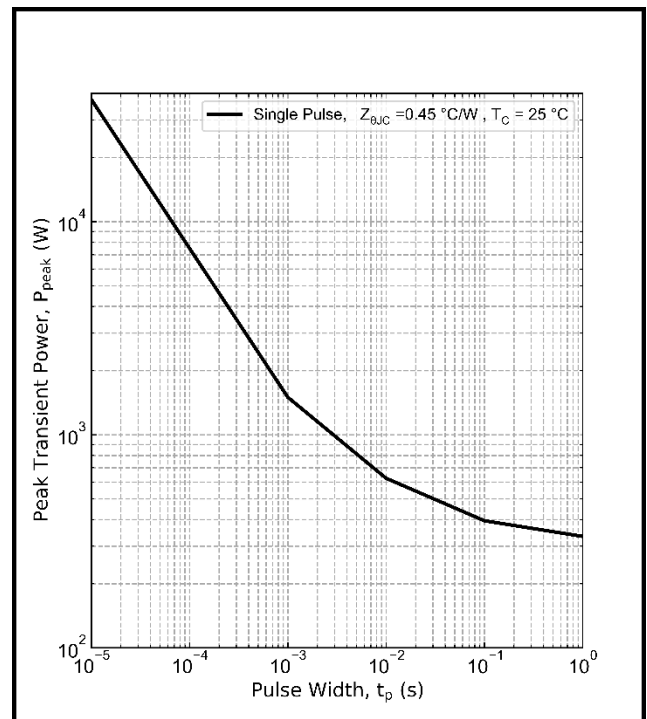


Figure 32. Single Pulse Maximum Power Dissipation

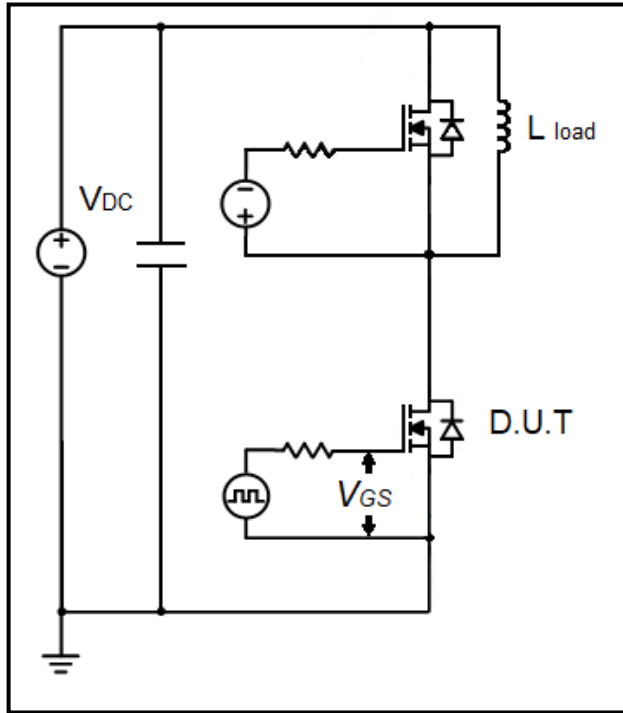


Figure 33. Clamped inductive switching waveform test circuit

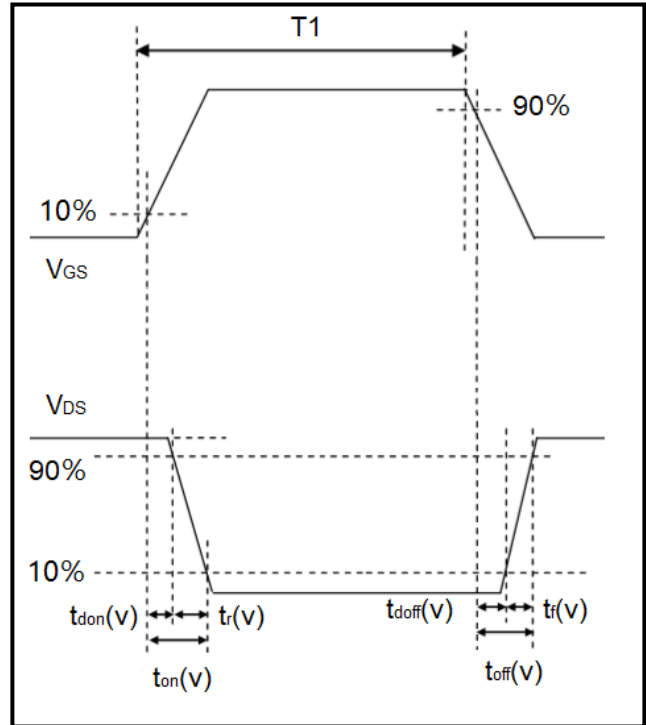
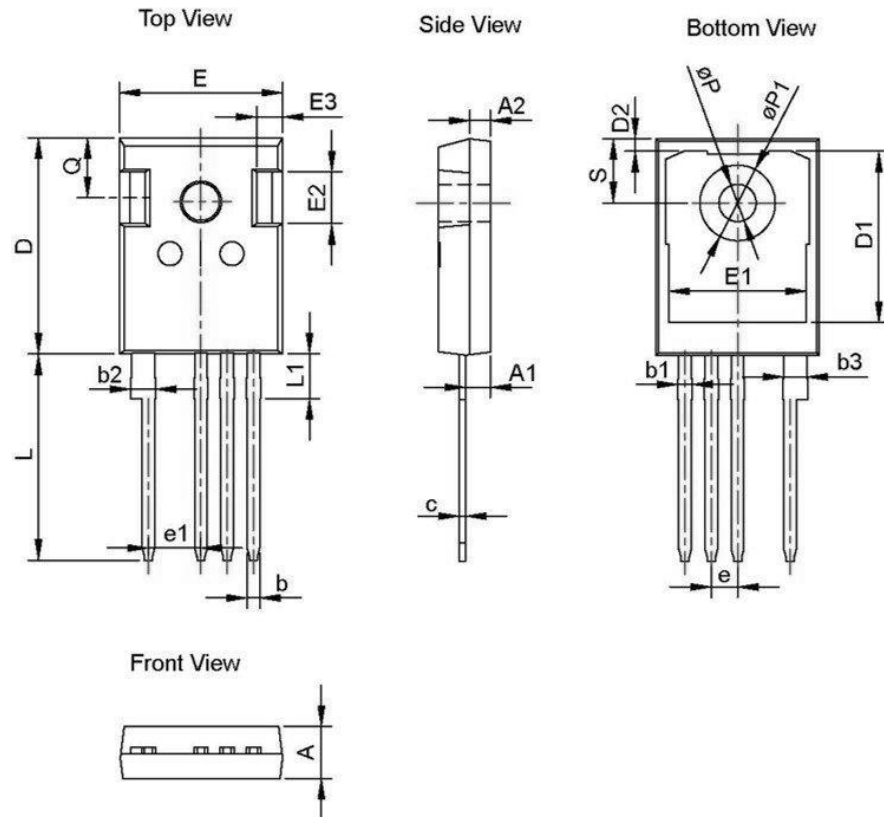


Figure 34. Switching times definition

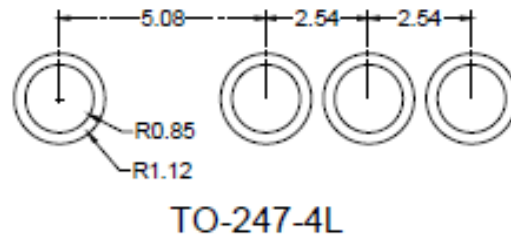
Package Information:

Dimension unit: [mm]			
Symbol	Min	Nom	Max
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b1	1.11	1.37	1.57
b2	2.24	2.40	2.60
b3	2.11	2.21	2.36
c	0.51	0.60	0.75
D	20.70	20.90	21.30
D1	15.92	16.22	16.52
D2	1.00	1.20	1.35
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	2.54 BSC		
e1	5.08 BSC		

Dimension unit: [mm]			
Symbol	Min	Nom	Max
L	19.62	19.92	20.22
L1	-	-	4.30
øP	3.40	3.60	3.80
øP1	-	-	7.30
Q	5.40	5.80	6.20
S	6.20 BSC		

Recommended Solder Pad Layout

Note: All dimensions are in mm



Ordering Information

Part number	AAR030V120H2
Package	TO-247-4L
Unit quantity	300 EA
Packing type	Tube

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