

1200V SiC MOSFET

V_{DS}	1200V
$R_{DS,on}$	77m Ω
$I_D(T_C=25^\circ\text{C})$	35A
$T_{j,max}$	175 $^\circ\text{C}$

Features

- High speed switching
- Reliable body diode
- All parts tested to above 1400V
- Driver source pin for gate driving
- Increased creepage due to notched design

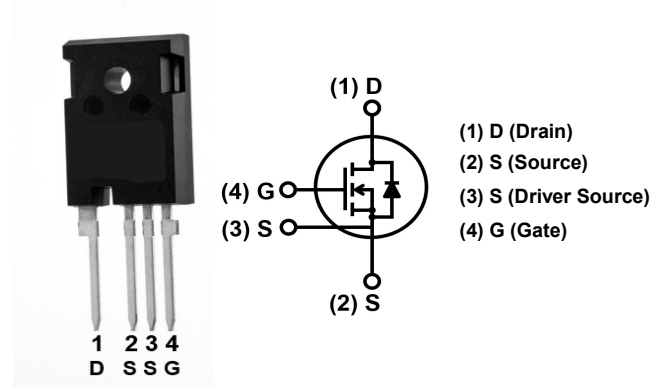
Benefits

- Lower capacitance
- Higher system efficiency
- Easy to parallel
- Lower Qg

Applications

- Solar Inverters
- Switch mode power supplies, UPS
- Induction heating and welding
- EV charging stations
- High voltage DC/DC converters
- Motor drives

Package



Part #	Package	Marking
AFS80M12T2Q1	TO-247-4L	80M12T2Q



Maximum Ratings, at $T_j=25^\circ\text{C}$, unless otherwise specified

Characteristics	Symbol	Conditions	Values	Unit
Drain-Source Voltage	V_{rated}	$V_{GS}=0V$, $I_{DS}=1\mu A$	1200	V
Continuous Drain Current	I_D	$T_C=25^\circ\text{C}$, $V_{GS}=20V$	35	A
		$T_C=100^\circ\text{C}$, $V_{GS}=20V$	26	
Pulsed Drain Current	$I_{D,pulse}^*$	$T_C=25^\circ\text{C}$	80	
Gate Source Voltage	V_{GSmax}		-10/25	V
	V_{GSop}	Recommended operational	-5/20	
Power Dissipation	P_{tot}	$T_C=25^\circ\text{C}$	188	W
Operating & Storage Temperature	T_j , $T_{storage}$	Continuous	-55...175	$^\circ\text{C}$
Single Pulse Avalanche Energy	E_{AS}	$L=1.0mH$, $I_{AS}=28.3A$, $V=50V$	200	mJ

Thermal Characteristics

Characteristics	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal Resistance, Junction to Case	R_{thJC}		-	0.65	0.80	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient	R_{thJA}		-	-	40.0	

* Pulse width is limited by $T_{j,max}$

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Static Electrical Characteristics, at $T_J=25^{\circ}\text{C}$, unless otherwise specified

Characteristics	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Drain-Source Breakdown Voltage	BV_{DSS}	$I_{DS}=1\text{mA}$	1200	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=1200\text{V}, V_{GS}=0\text{V}$	-	0.1	1.0	μA
		$V_{DS}=1200\text{V}, V_{GS}=0\text{V}, T_J=175^{\circ}\text{C}$	-	1	-	
Gate-Source Leakage Current	I_{GSS+}	$V_{GS}=20\text{V}, V_{DS}=0\text{V}$	-	<+10	100	nA
	I_{GSS-}	$V_{GS}=-5\text{V}, V_{DS}=0\text{V}$	-	>-10	-100	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_{DS}=10\text{mA}$	1.8	2.8	4.0	V
		$V_{GS}=V_{DS}, I_{DS}=10\text{mA}, T_J=125^{\circ}\text{C}$	-	2.1	-	
		$V_{GS}=V_{DS}, I_{DS}=10\text{mA}, T_J=175^{\circ}\text{C}$	-	1.9	-	
Drain-Source On-Resistance	$R_{DS(on)}$	$V_{GS}=20\text{V}, I_{DS}=20\text{A}$	-	77	100	m Ω
		$V_{GS}=20\text{V}, I_{DS}=10\text{A}$	-	71	90	
		$V_{GS}=20\text{V}, I_{DS}=20\text{A}, T_J=125^{\circ}\text{C}$	-	106	-	
		$V_{GS}=20\text{V}, I_{DS}=20\text{A}, T_J=175^{\circ}\text{C}$	-	134	-	
Transconductance	g_{fs}	$V_{DS}=20\text{V}, I_{DS}=20\text{A}$	-	-	-	S
Gate Input Resistance	R_G	$f=1\text{MHz}, V_{AC}=25\text{mV}, \text{D-S Short}$	-	3.0	-	Ω

AC Electrical Characteristics, at $T_J=25^{\circ}\text{C}$, unless otherwise specified

Characteristics	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Input Capacitance	C_{ISS}	$V_{GS}=0\text{V},$ $V_{DS}=1000\text{V},$ $f=200\text{kHz}, V_{AC}=25\text{mV}$	-	1377	-	pF
Output Capacitance	C_{OSS}		-	62	-	
Reverse Transfer Capacitance	C_{RSS}		-	4	-	
Coss Stored Energy	E_{OSS}		-	38	-	μJ
Turn-On Switching Energy	E_{ON}	$V_{DD}=800\text{V}, I_{DS}=20\text{A},$ $R_{G(ext)}=2.5,$	-	208	-	μJ
Turn-Off Switching Energy	E_{OFF}	$V_{GS}=-5/+20\text{V}, L=975\mu\text{H},$	-	25	-	
Total Switching Energy	E_{TOT}	$\text{FWD}=\text{AFS80M12T2Q1}$	-	233	-	
Turn-On Switching Energy	E_{ON}	$V_{DD}=800\text{V}, I_{DS}=20\text{A},$ $R_{G(ext)}=2.5,$	-	167	-	μJ
Turn-Off Switching Energy	E_{OFF}	$V_{GS}=-5/+20\text{V}, L=975\mu\text{H},$	-	27	-	
Total Switching Energy	E_{TOT}	$\text{FWD}=10\text{A}, 1200\text{V}, \text{SiC}$	-	194	-	
Turn-On Delay Time	$t_{D(on)}$	$V_{DD}=800\text{V}, I_{DS}=20\text{A},$	-	9	-	ns
Rise Time	t_R	$R_{G(ext)}=2.5, V_{GS}=-5/+20\text{V},$	-	4	-	
Turn-Off Delay Time	$t_{D(off)}$	$L=975\mu\text{H},$	-	15	-	
Fall Time	t_F	$\text{FWD}=\text{AFS80M12T2Q1}$	-	10	-	
Total Gate Charge	Q_G	$V_{DD}=800\text{V}, I_{DS}=20\text{A},$ $V_{GS}=-5/+20\text{V}$	-	61	-	nC
Gate to Source Charge	Q_{GS}		-	24	-	
Gate to Drain Charge	Q_{GD}		-	14	-	

Body Diode Characteristics, at $T_J=25^{\circ}\text{C}$, unless otherwise specified

Characteristics	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Max Continuous Diode Fwd Current	I_S	$V_{GS}=-5\text{V}, T_C=25^{\circ}\text{C}$	-	-	43	A
Diode Forward Voltage	V_{SD}	$V_{GS}=-5\text{V}, I_{SD}=10\text{A}$	-	3.8	-	V
Reverse Recovery Time	t_{RR}	$I_{SD}=20\text{A}, V_R=800\text{V}, V_{GS}=-5\text{V},$ $di_F/dt=8.0\text{A/ns}$	-	8	-	ns
Reverse Recovery Charge	Q_{RR}		-	130	-	nC
Peak Reverse Recovery Current	I_{RRM}		-	29	-	A

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Typical Performance

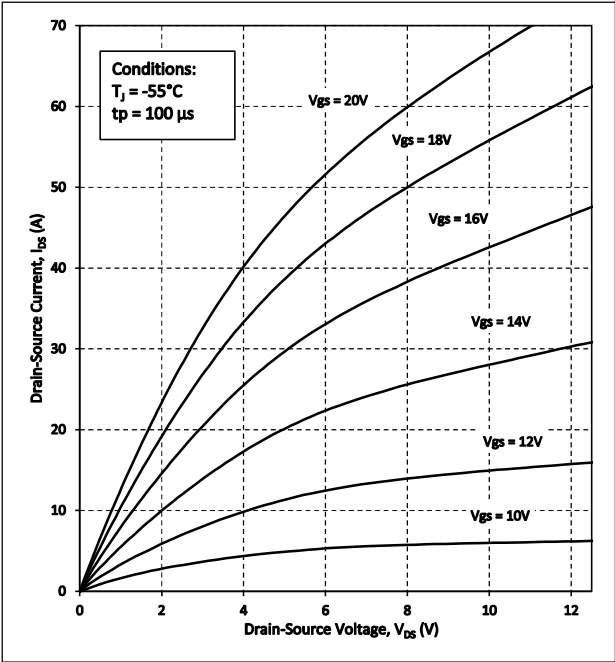


Figure 1. Output Characteristics $T_j = -55^\circ\text{C}$

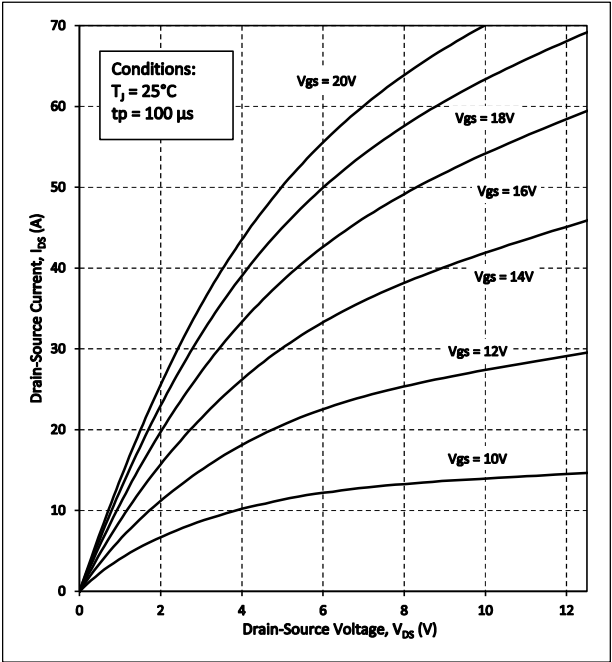


Figure 2. Output Characteristics $T_j = 25^\circ\text{C}$

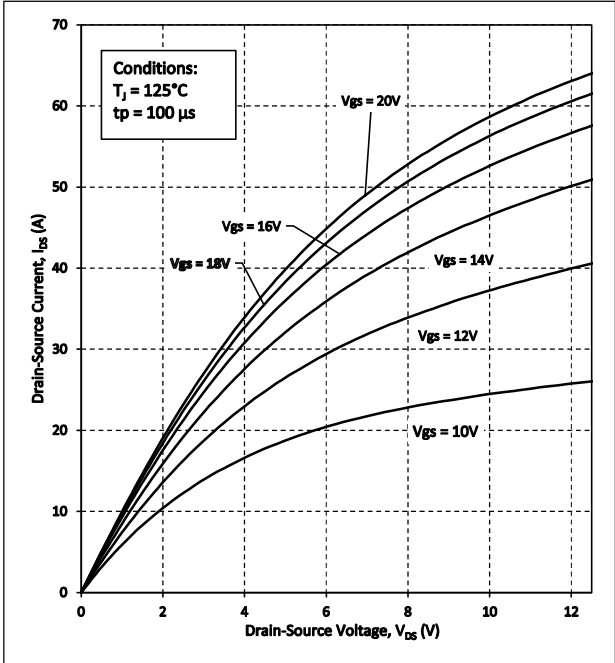


Figure 3. Output Characteristics $T_j = 125^\circ\text{C}$

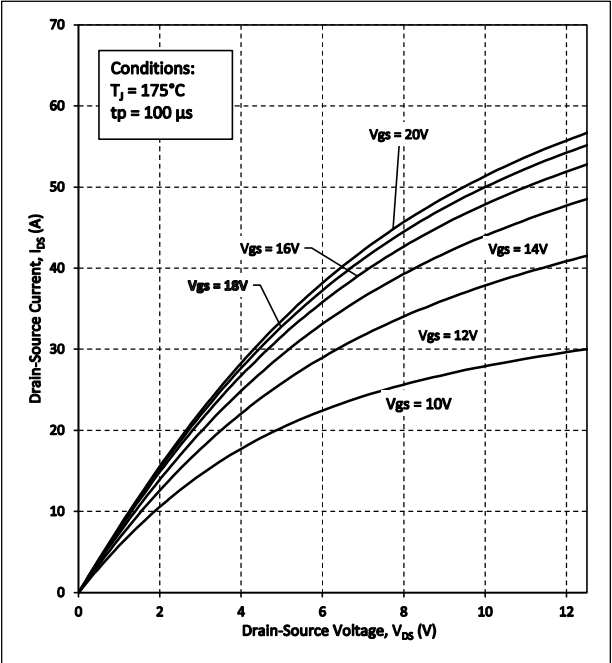


Figure 4. Output Characteristics $T_j = 175^\circ\text{C}$

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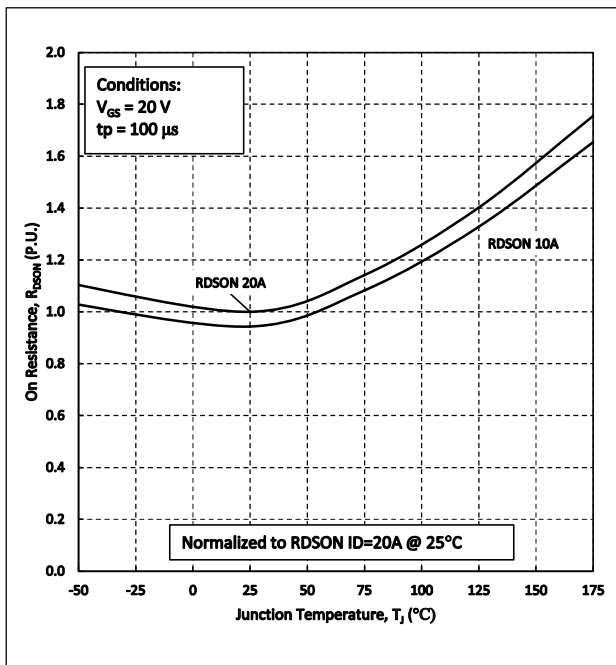


Figure 5. Normalized On-Resistance vs. Temperature

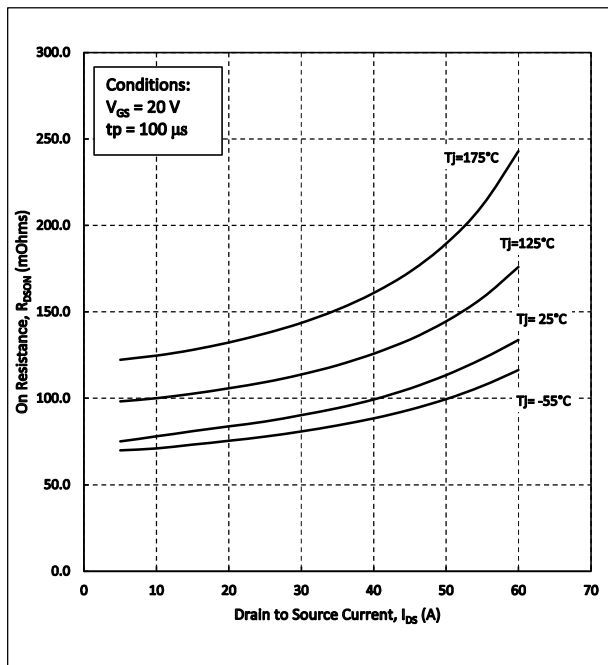


Figure 6. On-Resistance vs. Drain Current For Various Temperature

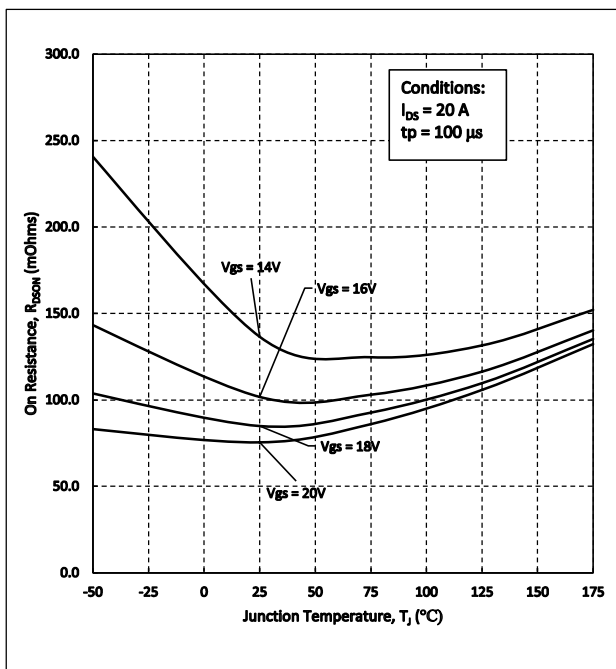


Figure 7. On-Resistance vs. Temperature For Various Gate Voltages

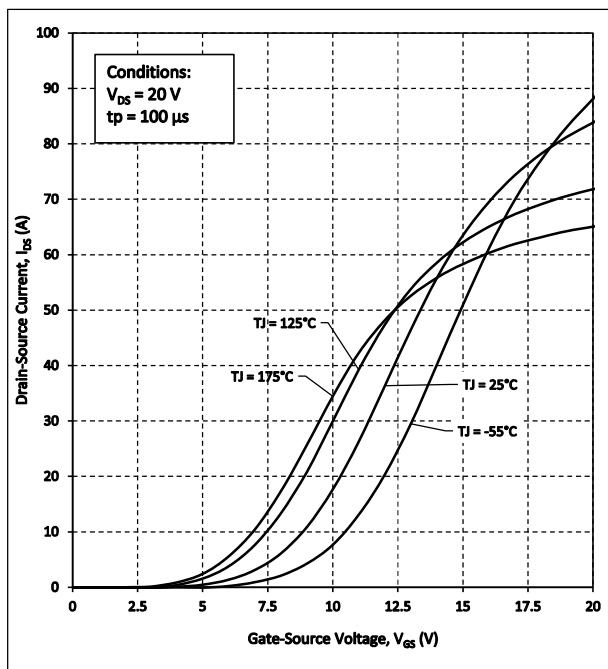


Figure 8. Transfer Characteristic for Various Junction Temperatures

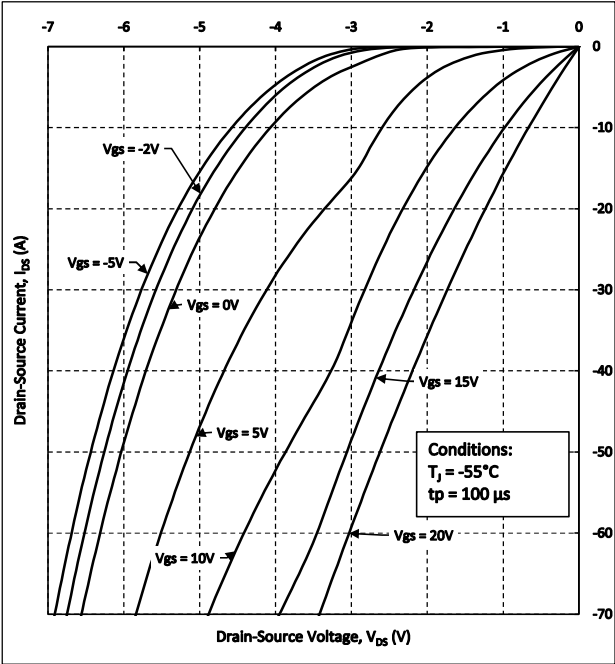


Figure 9. Body Diode Characteristics at $T_j = -55^\circ\text{C}$

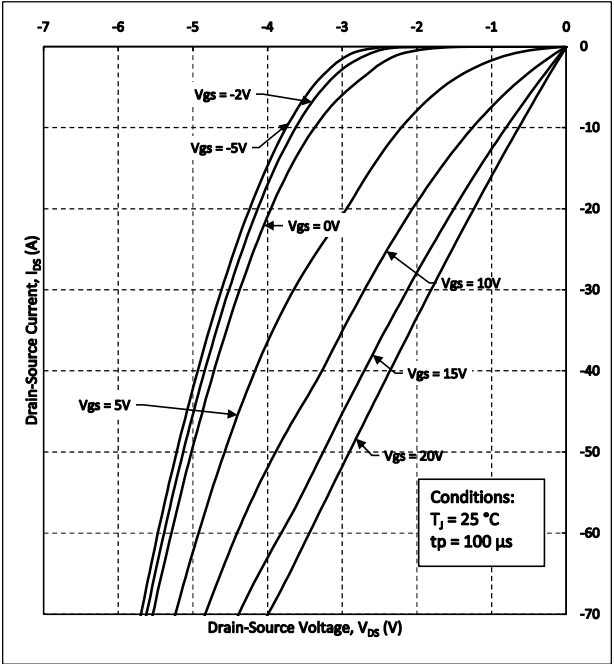


Figure 10. Body Diode Characteristics at $T_j = 25^\circ\text{C}$

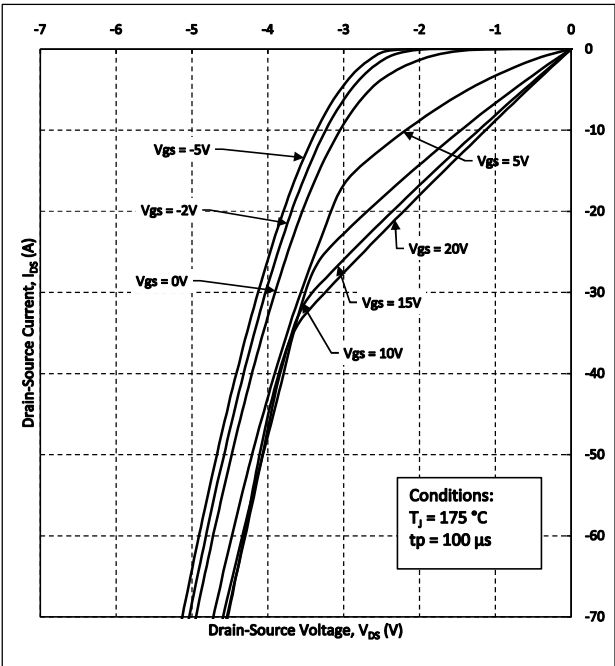


Figure 11. Body Diode Characteristics at $T_j = 175^\circ\text{C}$

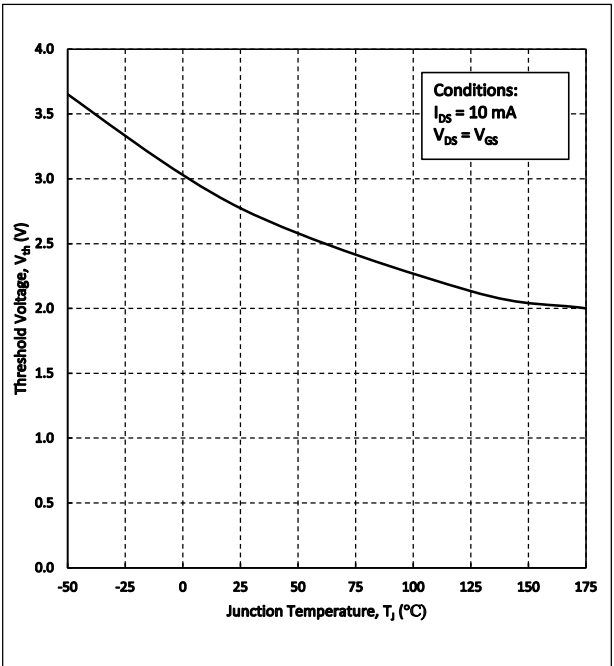


Figure 12. Threshold Voltage vs. Temperature

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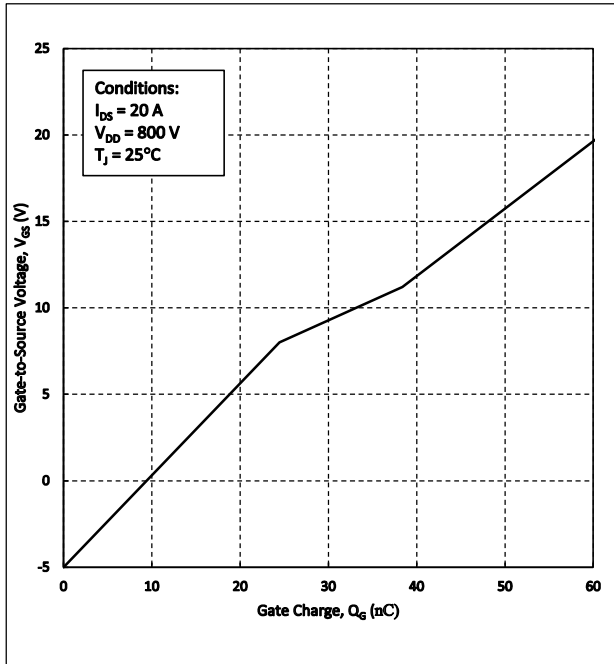


Figure 13. Gate Charge Characteristics

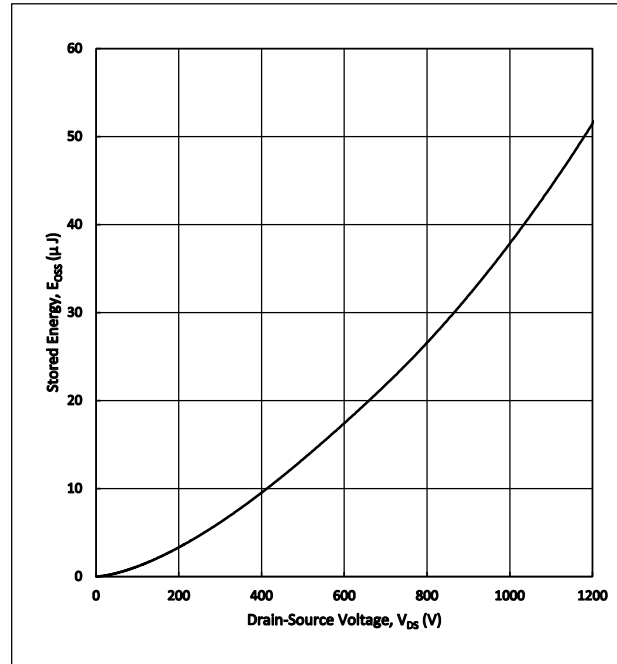


Figure 14. Output Capacitor Stored Energy

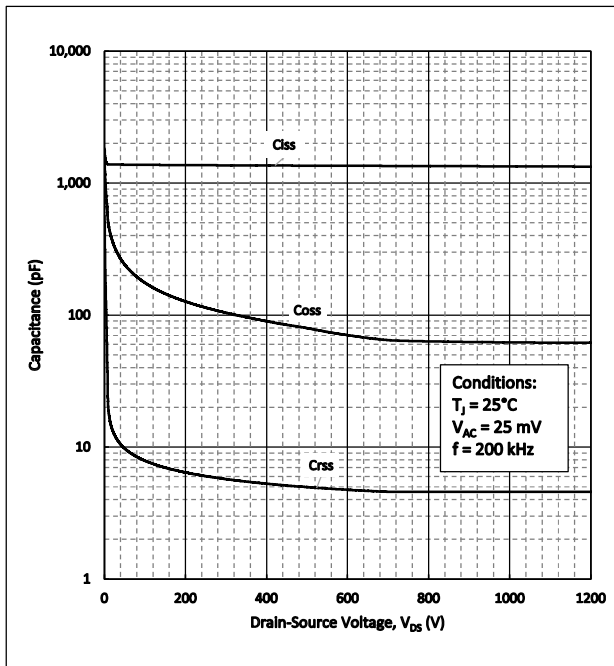


Figure 15. Capacitance vs Drain-Source Voltage

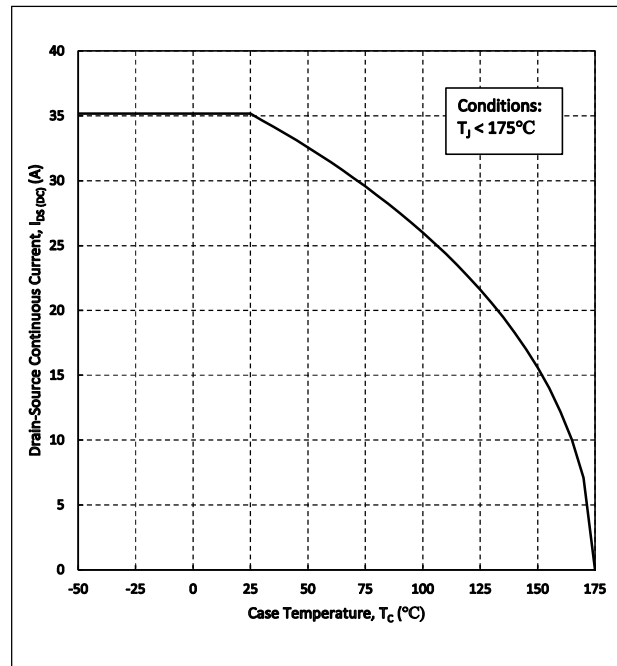


Figure 16. Continuous Drain Current Derating vs. Case Temperature

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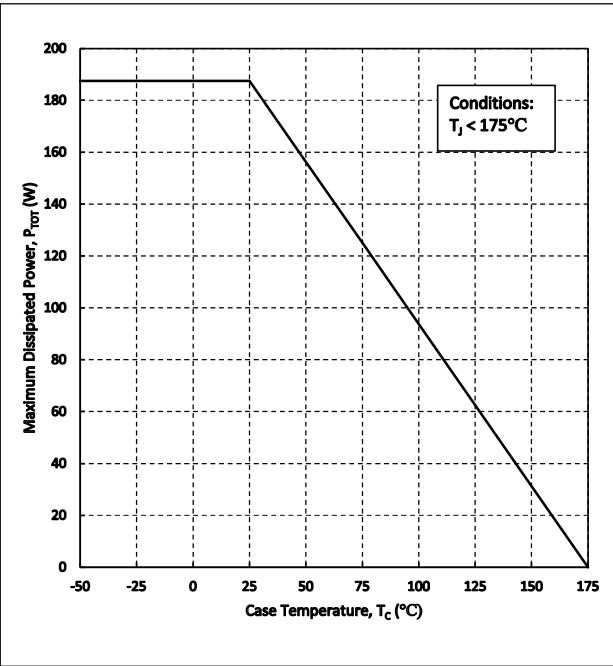


Figure 17. Maximum Power Dissipation Derating vs Case Temperature

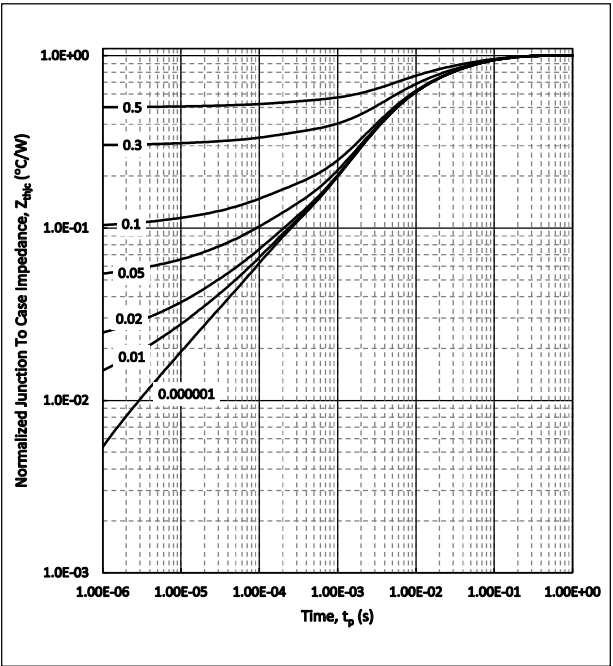


Figure 18. Transient Thermal impedance (Junction to Case)

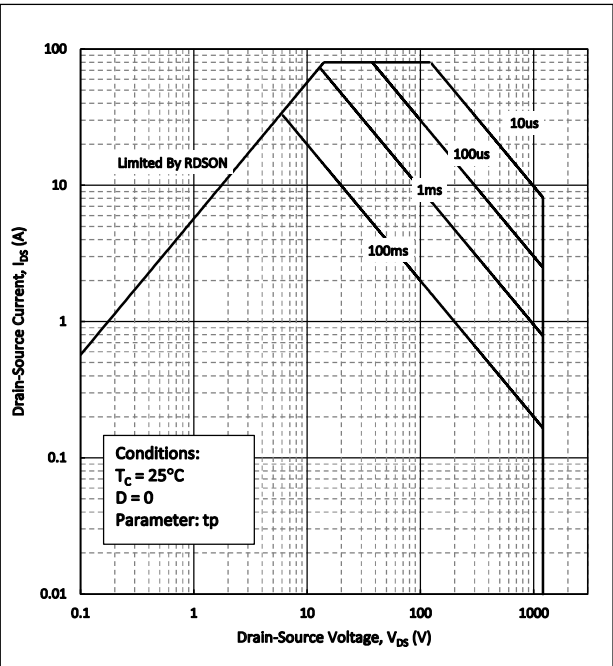


Figure 19. Safe Operating Area

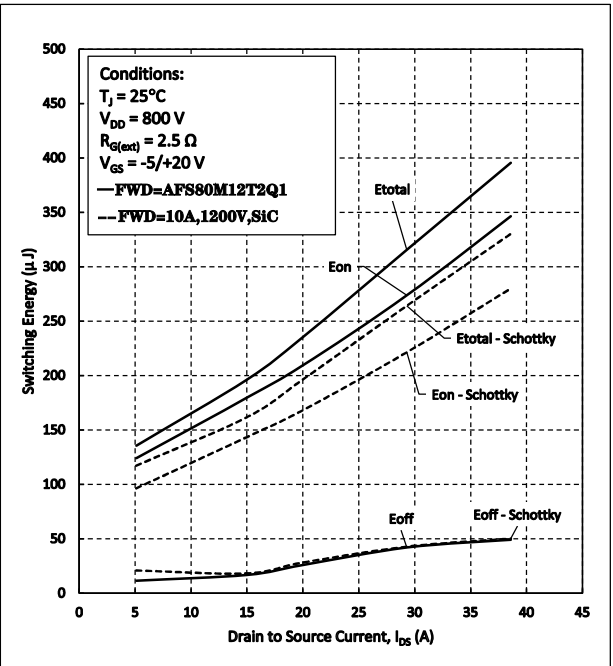


Figure 20. Clamped Inductive Switching Energy vs. Drain Current

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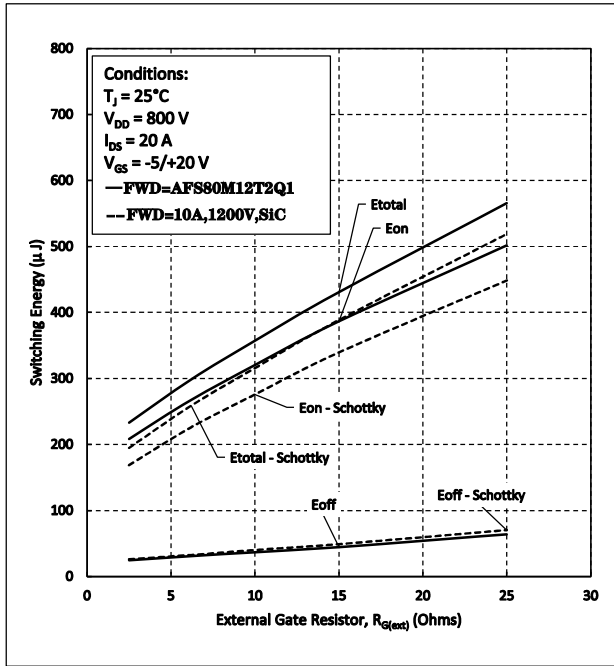


Figure 21. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

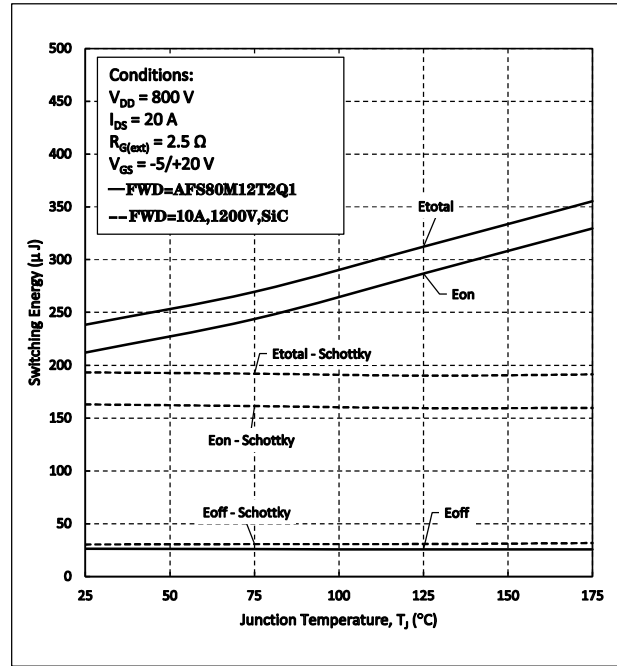


Figure 22. Clamped Inductive Switching Energy vs. Temperature

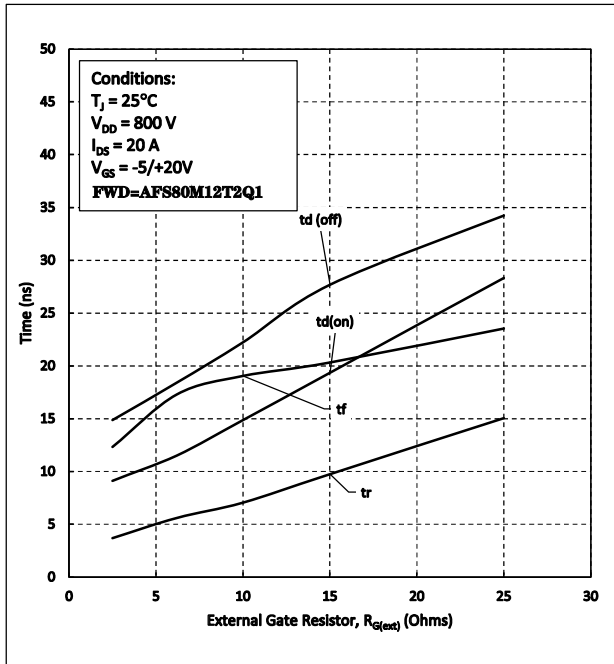


Figure 23. Switching Times vs $R_{G(ext)}$

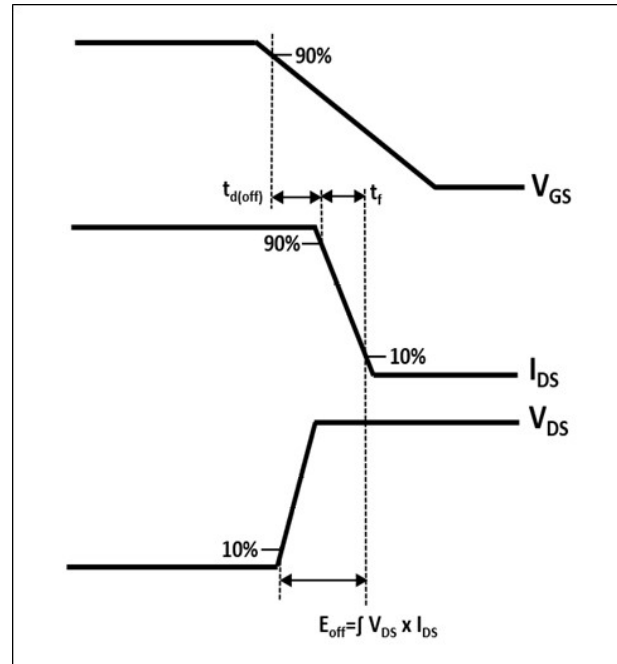


Figure 24. Turn-off Transient Definitions

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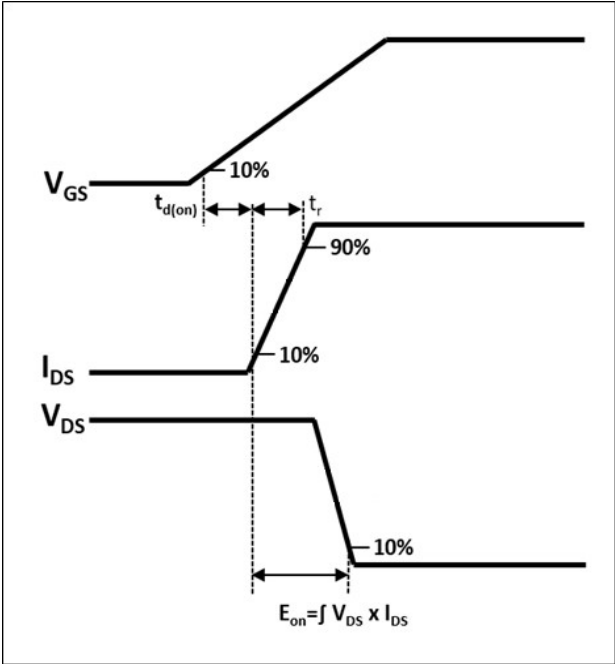


Figure 25. Turn-on Transient Definitions

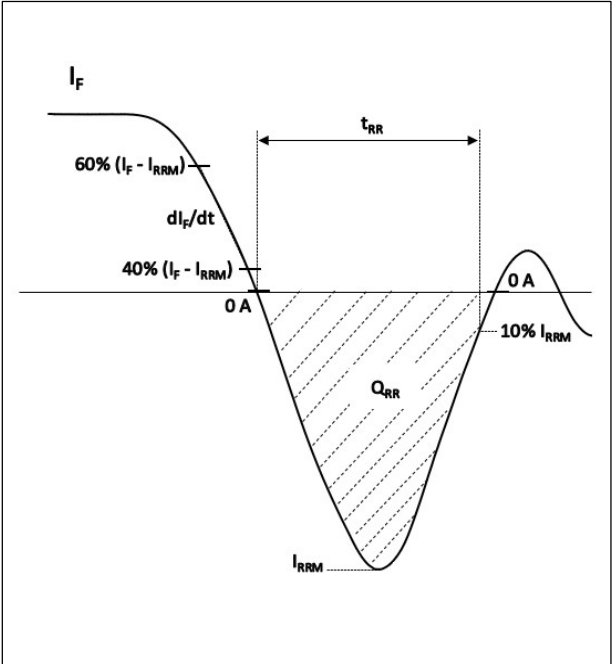
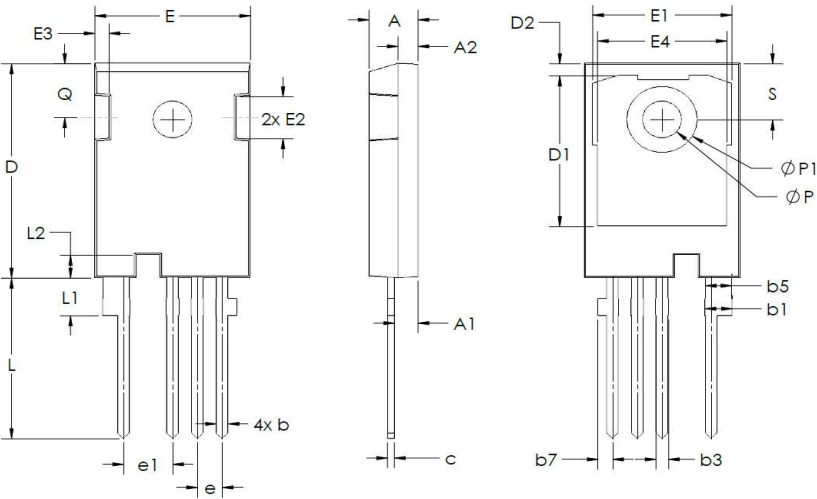


Figure 26. Reverse Recovery Definitions

Package Dimensions TO-247-4L



Sym	Millimeters		Inches	
	Min	Max	Min	Max
A	4.83	5.21	0.190	0.205
A1	2.29	2.54	0.090	0.100
A2	1.91	2.16	0.075	0.085
b	1.07	1.33	0.042	0.052
b1	2.39	2.94	0.094	0.116
b3	1.07	1.60	0.042	0.063
b5	2.39	2.69	0.094	0.106
b7	1.30	1.70	0.051	0.067
c	0.55	0.68	0.022	0.027
c1	0.55	0.65	0.022	0.026
D	23.30	23.60	0.917	0.929
D1	16.25	17.65	0.640	0.695
D2	0.95	1.25	0.037	0.049
E	15.75	16.13	0.620	0.635
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.00	1.90	0.039	0.075
E4	12.38	13.43	0.487	0.529
e	2.54 BSC		0.100 BSC	
e1	5.08 BSC		0.200 BSC	
L	17.31	17.82	0.681	0.702
L1	3.97	4.37	0.156	0.172
L2	2.35	2.65	0.093	0.104
φP	3.51	3.65	0.138	0.144
φP1	7.19 REF		0.283 REF	
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

Notes

RoHS Compliance

The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2011/65/EC (RoHS2), as implemented March, 2013. RoHS Declarations for this product can be obtained from the Product Documentation sections of www.leapers-power.com.

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