

# 1200V 40mohm Silicon Carbide Power MOSFET

## AK1CK2M040WAM

### Features:

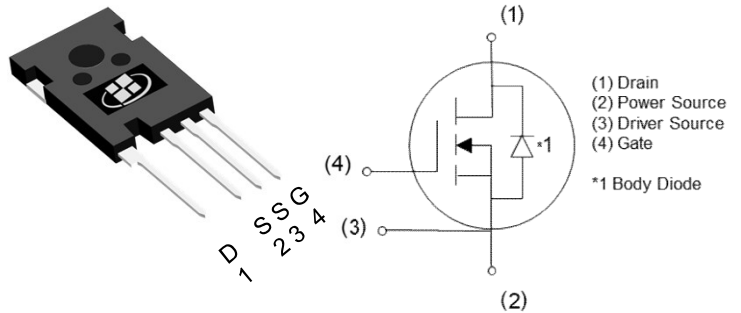
- Low on-resistance
- Fast switching speed with low capacitances
- Fast intrinsic diode with low reverse recovery ( $Q_{RR}$ )
- Halogen-free, RoHS compliant <sup>(Note 1)</sup>

### Applications:

- Motor drives
- DC/DC converters
- Switched mode power supplies
- Solar inverters

### Key Performance Parameters:

Parameter	Value	Unit
$V_{DS}$	1200	V
$R_{DSON, TYP} @V_{GS} = 15 V$	40	m $\Omega$
$R_{DSON, TYP} @V_{GS} = 18 V$	35	m $\Omega$
$I_D$	62	A
$P_D$	333	W



### Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AK1CK2M040WAM	TO-247-4L	1CK2M040WAM	Tube	300 per box

### Notes:

1. Contact ALKAIDSEMI sales for detail information

**Maximum Ratings** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Value	Units
$V_{DS}$	Drain-Source Voltage	1200	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ ) <sup>(Note 1)</sup>	62	A
	Drain Current - Continuous ( $T_C = 100^\circ\text{C}$ ) <sup>(Note 1)</sup>	44	A
$I_{DM}$	Drain Current - Pulsed <sup>(Note 2)</sup>	155	A
$V_{GS}$	Gate-Source Voltage (dynamic)	-10/+22	V
$V_{GS}$	Gate-Source Voltage (static)	-6/+18	V
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	333	W
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +175	$^\circ\text{C}$

**Thermal Characteristics**

Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Steady-State	0.45	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Steady-State	40	$^\circ\text{C}/\text{W}$

**Notes:**

1. The max drain current limited by maximum junction temperature
2. Pulse width is limited by safe operating area

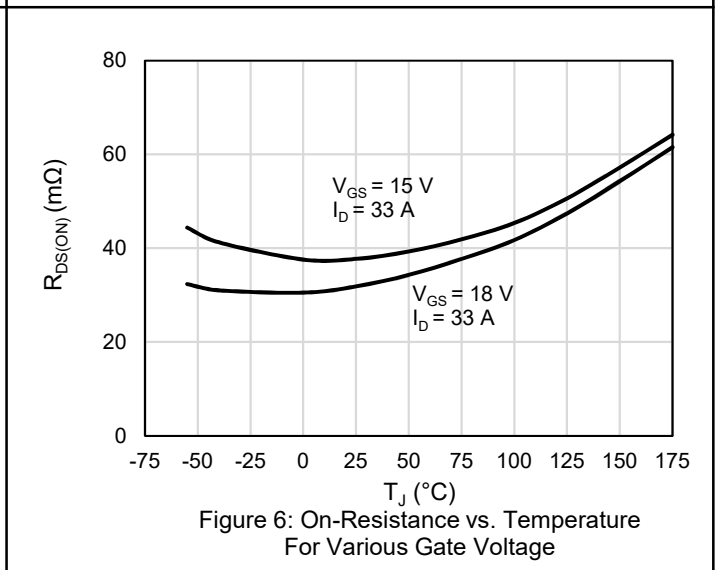
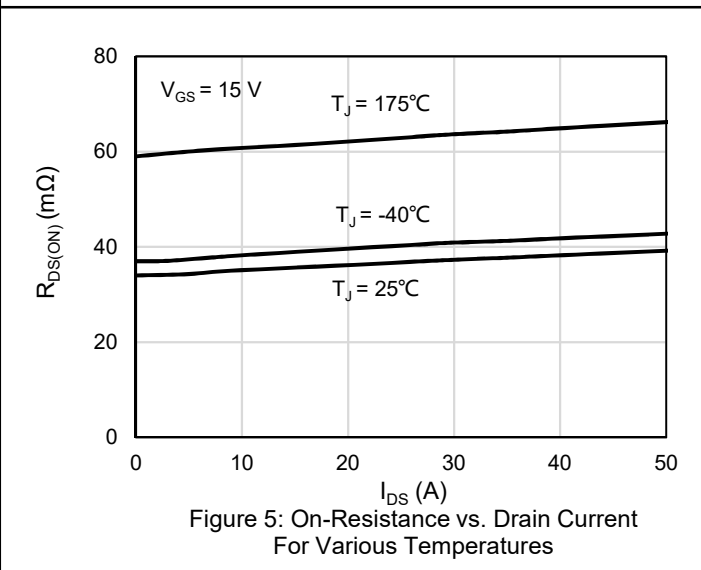
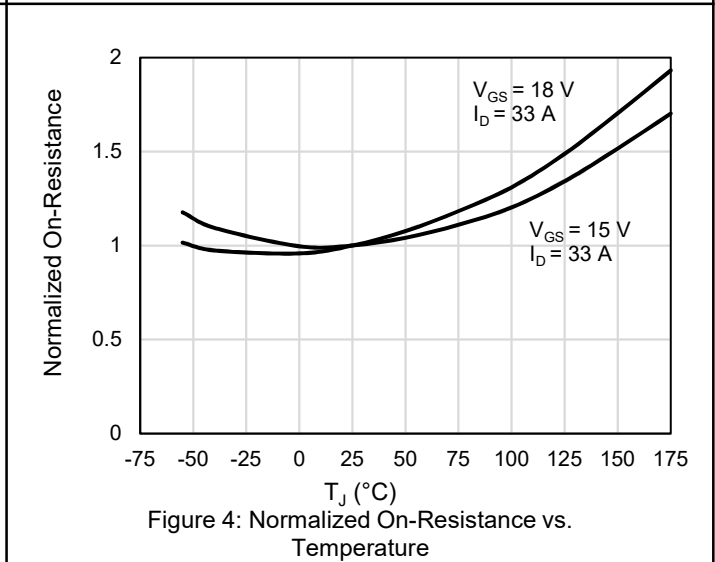
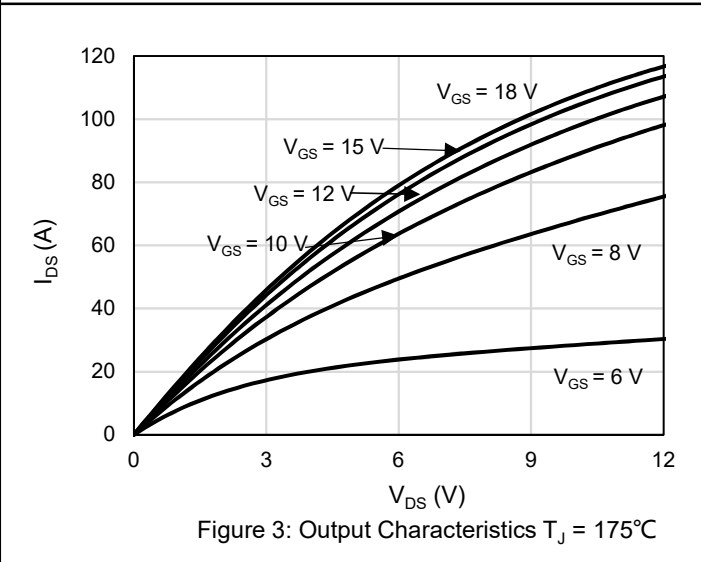
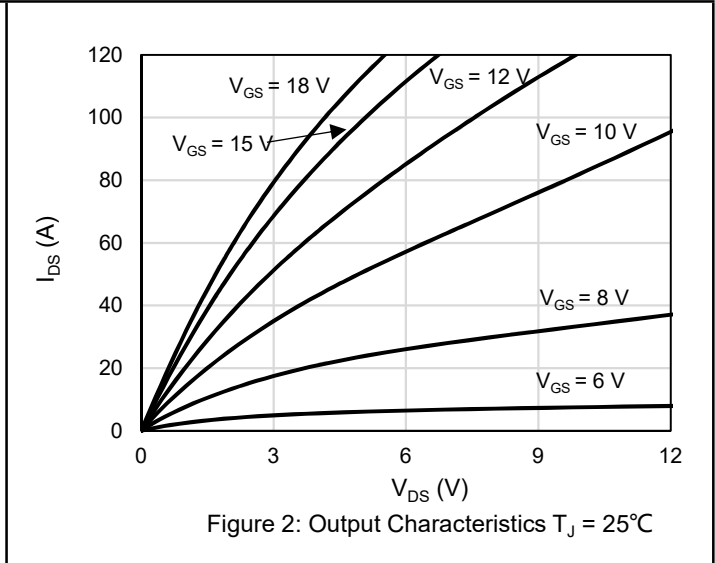
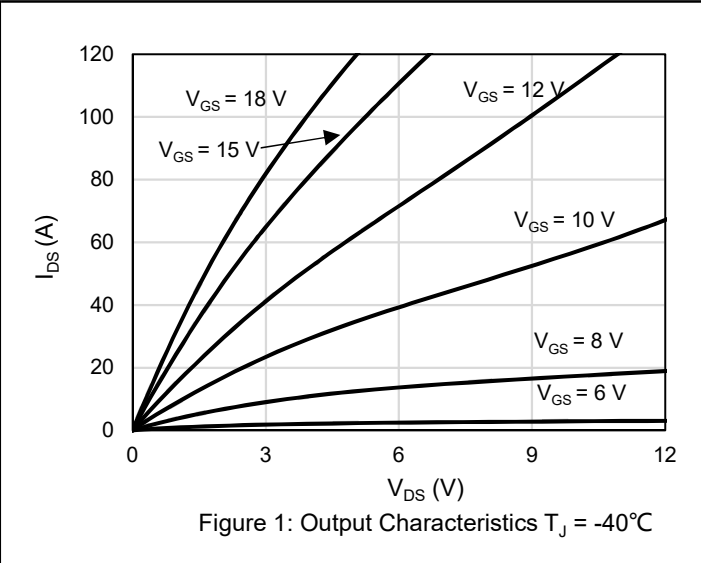
<b>Electrical Characteristics</b> ( $T_J = 25^\circ\text{C}$ unless otherwise noted)						
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Static Characteristics</b>						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$	1200			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$		5	50	$\mu\text{A}$
$I_{GSS}$	Gate Leakage Current	$V_{GS} = +22\text{ V}, V_{DS} = 0\text{ V}$			100	nA
		$V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$			-100	nA
$V_{GS(th)}$	Gate Threshold voltage	$V_{DS} = V_{GS}, I_D = 11\text{ mA}$	1.8	2.7	4	V
		$V_{DS} = V_{GS}, I_D = 11\text{ mA}, T_J = 175^\circ\text{C}$		1.8		V
$R_{DS(ON)}$	Drain-Source on-state resistance	$V_{GS} = 15\text{ V}, I_D = 33\text{ A}$		40	50	m $\Omega$
		$V_{GS} = 15\text{ V}, I_D = 33\text{ A}, T_J = 175^\circ\text{C}$		66		m $\Omega$
$R_{DS(ON)}$	Drain-Source on-state resistance	$V_{GS} = 18\text{ V}, I_D = 33\text{ A}$		35	45	m $\Omega$
		$V_{GS} = 18\text{ V}, I_D = 33\text{ A}, T_J = 175^\circ\text{C}$		64		m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 20\text{ V}, I_D = 20\text{ A}$		18		S
		$V_{DS} = 20\text{ V}, I_D = 20\text{ A}, T_J = 175^\circ\text{C}$		20		S
<b>Dynamic Characteristics</b>						
$C_{ISS}$	Input Capacitance	$V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}, F = 100\text{ kHz}, V_{AC} = 25\text{ mV}$		2600		pF
$C_{OSS}$	Output Capacitance			90		pF
$C_{RSS}$	Reverse Transfer Capacitance			6.5		pF
$E_{OSS}$	$C_{OSS}$ Stored Energy			41		$\mu\text{J}$
$R_G$	Gate Resistance	$F = 1\text{ MHz}, V_{AC} = 25\text{ mV}$		1.4		$\Omega$
$Q_{GS}$	Gate-Source Charge	$V_{DS} = 800\text{ V}, I_D = 33\text{ A}, V_{GS} = -4/+15\text{ V}$		27		nC
$Q_{GD}$	Gate-Drain Charge			46		nC
$Q_G$	Total Gate Charge			113		nC

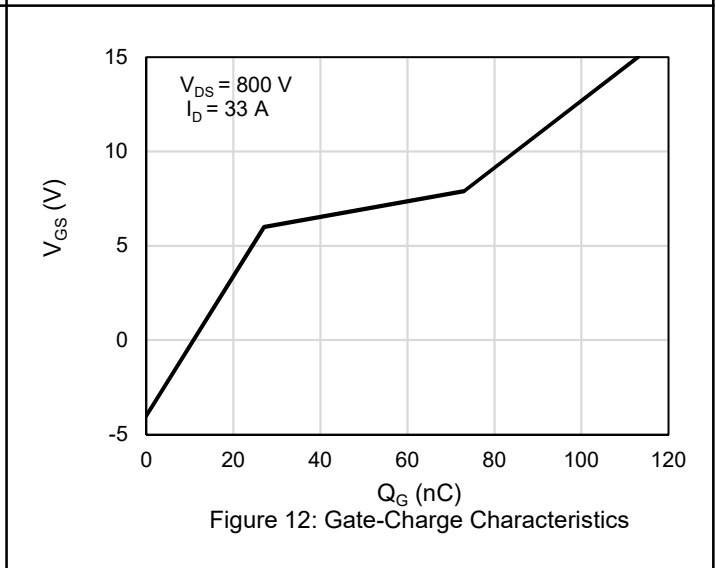
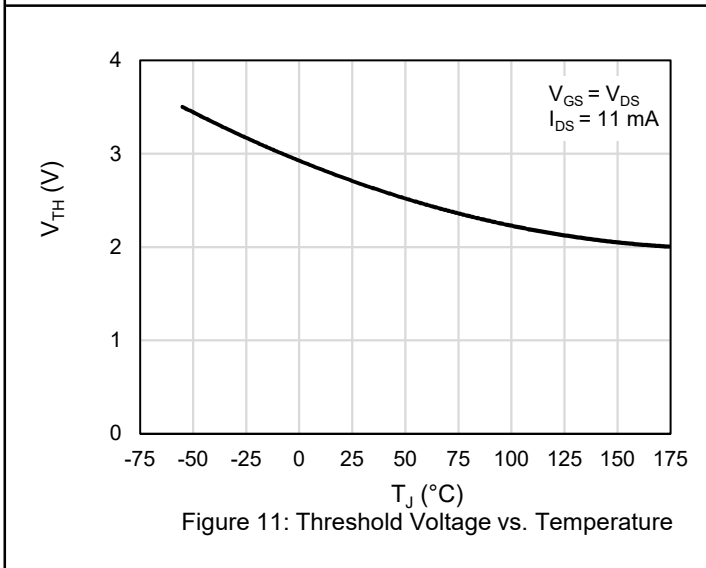
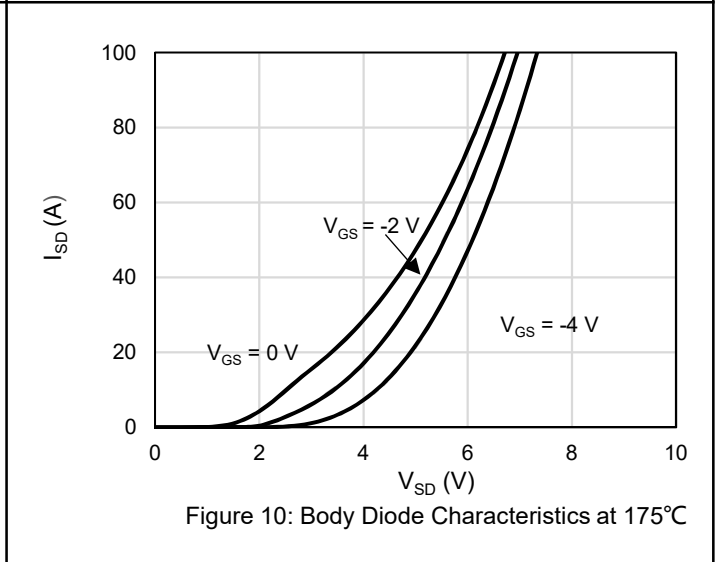
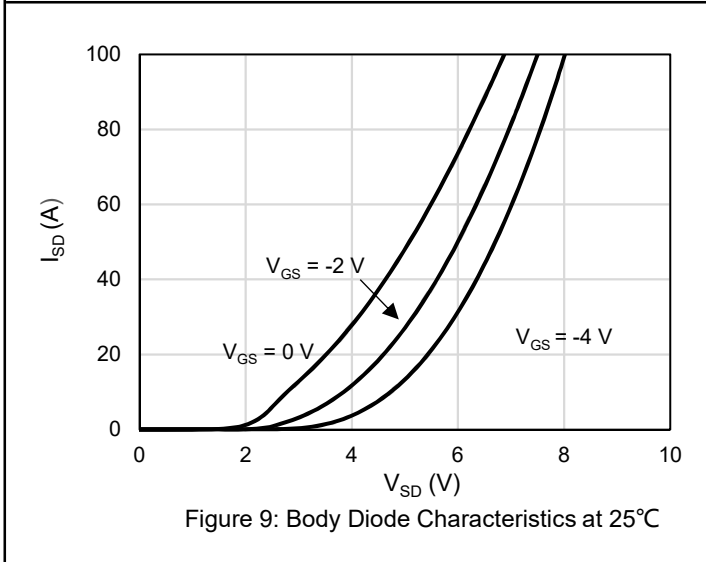
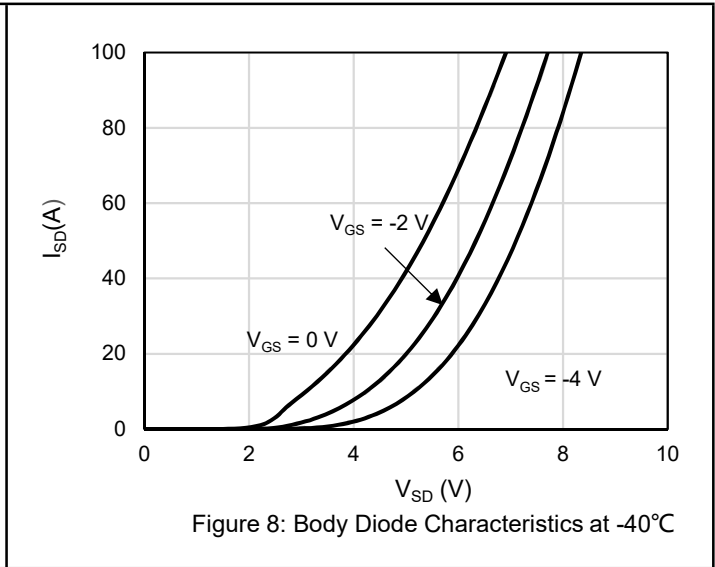
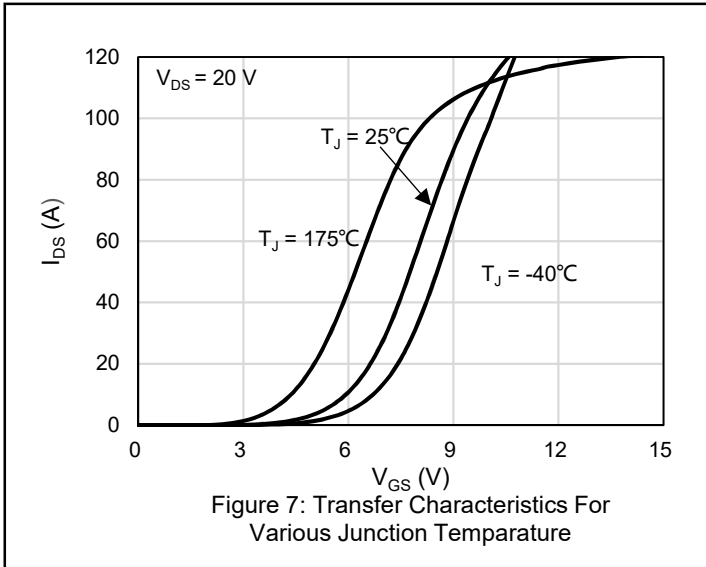
## Switching Characteristics

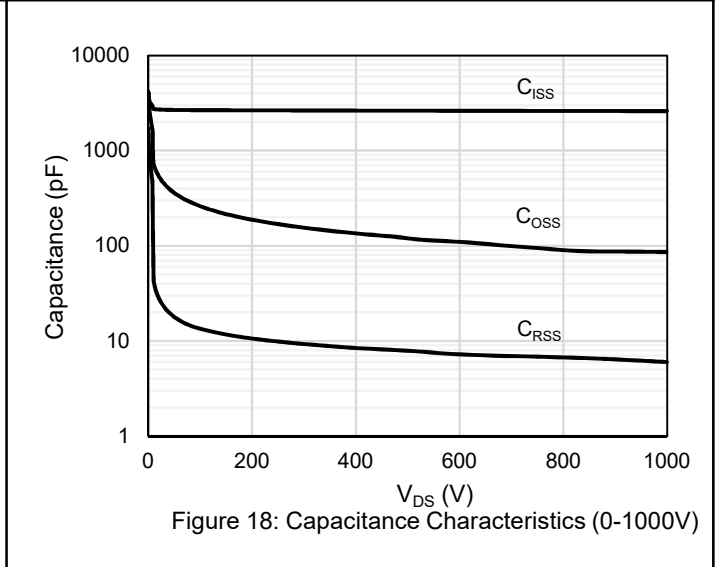
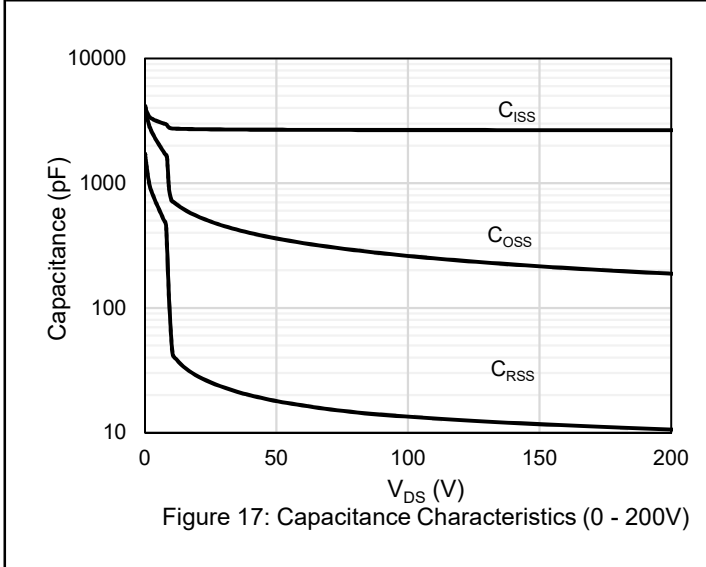
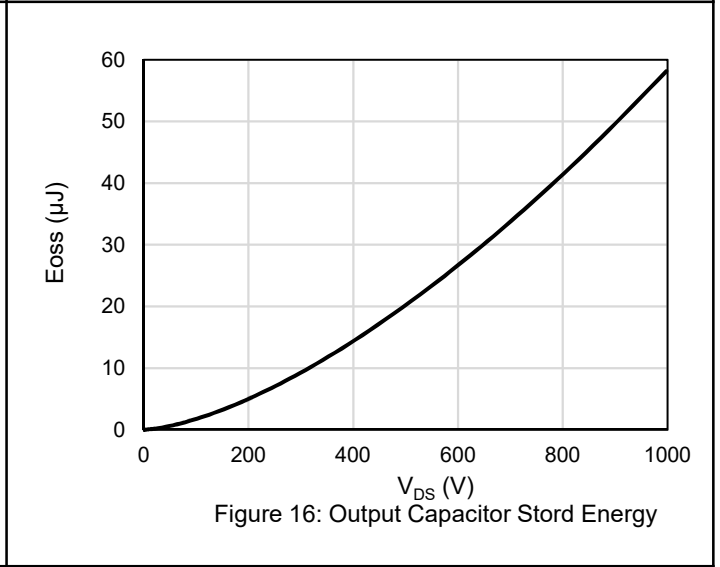
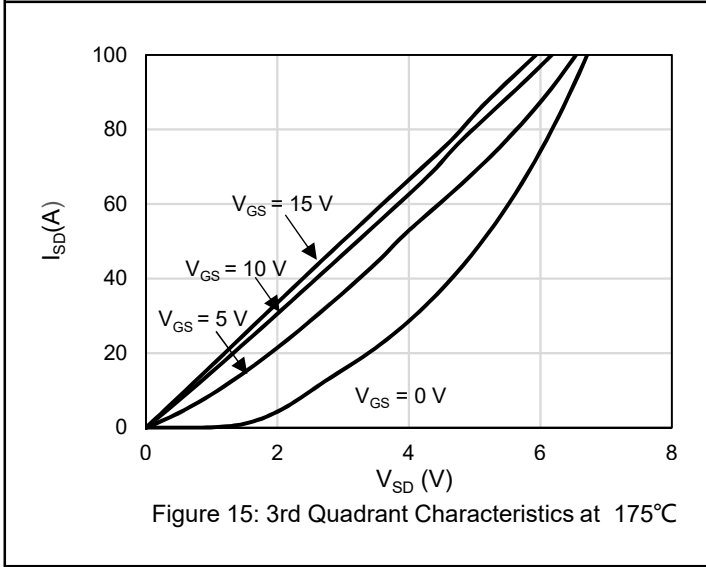
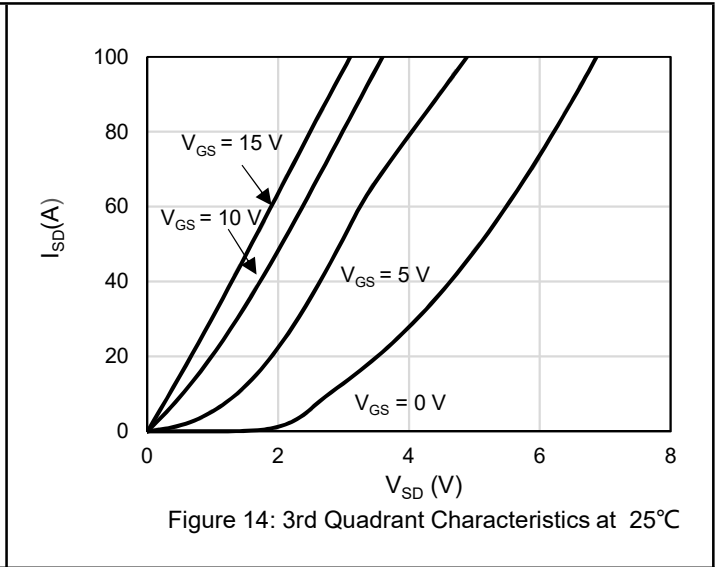
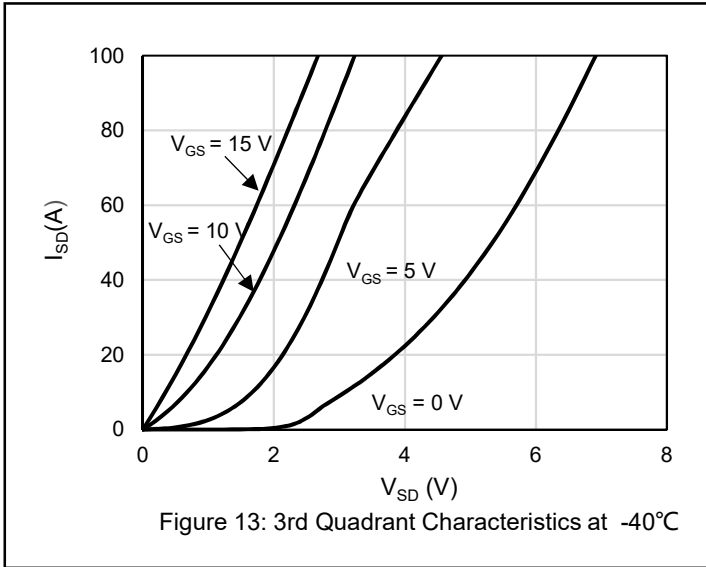
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$T_{D(ON)}$	Turn On Delay Time	$V_{DD} = 800\text{ V}$ , $I_D = 33\text{ A}$ , $V_{GS} = -4/+15\text{ V}$ , $R_{G,EXT} = 2.5\ \Omega$ $L = 99\ \mu\text{H}$ Diode: Body Diode at $V_{GS} = -4\text{ V}$		18		ns
$T_R$	Rise Time			42		ns
$T_{D(OFF)}$	Turn Off Delay Time			33		ns
$T_F$	Fall Time			11		ns
$E_{ON}$	Turn On Energy			572		$\mu\text{J}$
$E_{OFF}$	Turn Off Energy			56		$\mu\text{J}$
$T_{D(ON)}$	Turn On Delay Time	$V_{DD} = 800\text{ V}$ , $I_D = 33\text{ A}$ , $V_{GS} = -4/+15\text{ V}$ , $R_{G,EXT} = 10\ \Omega$ $L = 99\ \mu\text{H}$ Diode: Body Diode at $V_{GS} = -4\text{ V}$		25		ns
$T_R$	Rise Time			26		ns
$T_{D(OFF)}$	Turn Off Delay Time			65		ns
$T_F$	Fall Time			18		ns
$E_{ON}$	Turn On Energy			1041		$\mu\text{J}$
$E_{OFF}$	Turn Off Energy			225		$\mu\text{J}$
$T_{D(ON)}$	Turn On Delay Time	$V_{DD} = 800\text{ V}$ , $I_D = 33\text{ A}$ , $V_{GS} = -4/+18\text{ V}$ , $R_{G,EXT} = 2.5\ \Omega$ $L = 99\ \mu\text{H}$ Diode: Body Diode at $V_{GS} = -4\text{ V}$		7		ns
$T_R$	Rise Time			22		ns
$T_{D(OFF)}$	Turn Off Delay Time			35		ns
$T_F$	Fall Time			9		ns
$E_{ON}$	Turn On Energy			525		$\mu\text{J}$
$E_{OFF}$	Turn Off Energy			67		$\mu\text{J}$
$T_{D(ON)}$	Turn On Delay Time	$V_{DD} = 800\text{ V}$ , $I_D = 33\text{ A}$ , $V_{GS} = -4/+18\text{ V}$ , $R_{G,EXT} = 10\ \Omega$ $L = 99\ \mu\text{H}$ Diode: Body Diode at $V_{GS} = -4\text{ V}$		14		ns
$T_R$	Rise Time			37		ns
$T_{D(OFF)}$	Turn Off Delay Time			67		ns
$T_F$	Fall Time			21		ns
$E_{ON}$	Turn On Energy			725		$\mu\text{J}$
$E_{OFF}$	Turn Off Energy			237		$\mu\text{J}$

<b>Drain-Source Diode Characteristics</b> ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted)					
$I_S$	Maximum Continuous Drain-Source Diode Forward Current			62	A
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current			155	A
$V_{SD}$	Diode Forward Voltage	$V_{GS} = -4\text{ V}, I_{SD} = 20\text{ A}$		5.5	V
		$V_{GS} = -4\text{ V}, I_{SD} = 20\text{ A}, T_J = 175\text{ }^\circ\text{C}$		5	V
$I_{RM}$	Peak Reverse Recovery Current	$V_{GS} = -4\text{ V}, I_{SD} = 33\text{ A}, V_R = 800\text{ V}, di/dt = 4200\text{ A}/\mu\text{s}$		26	A
$T_{RR}$	Reverse Recovery Time			17	ns
$Q_{RR}$	Reverse Recovery Charge			133	nC

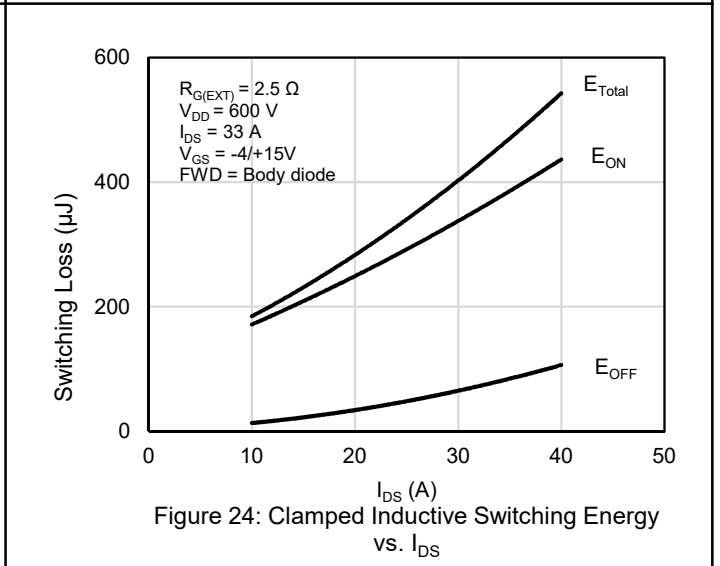
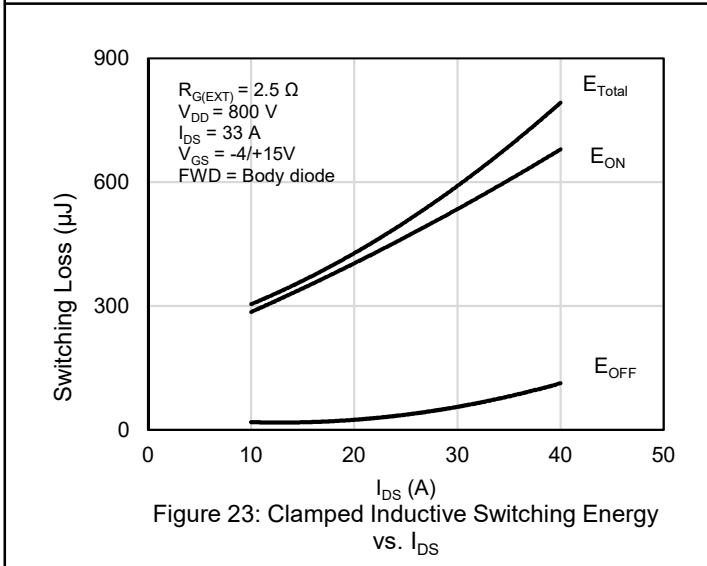
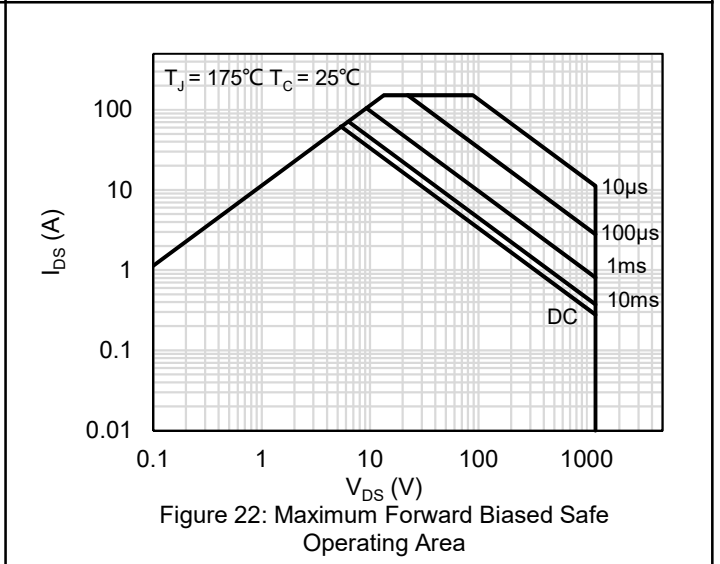
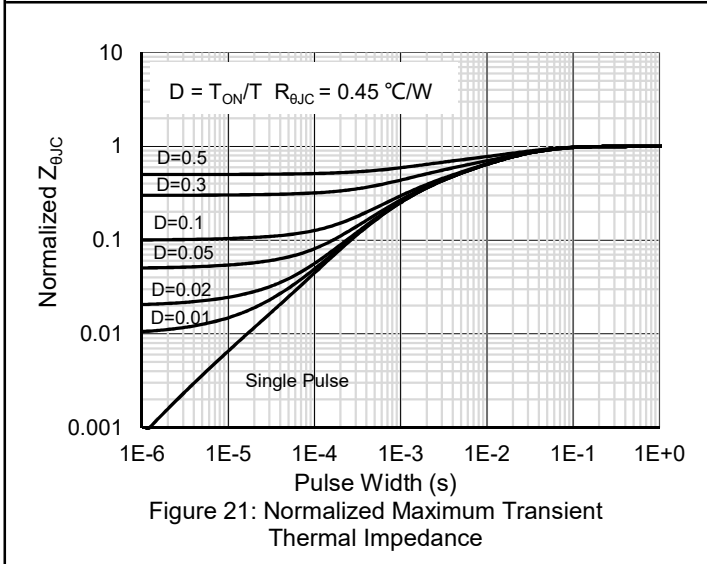
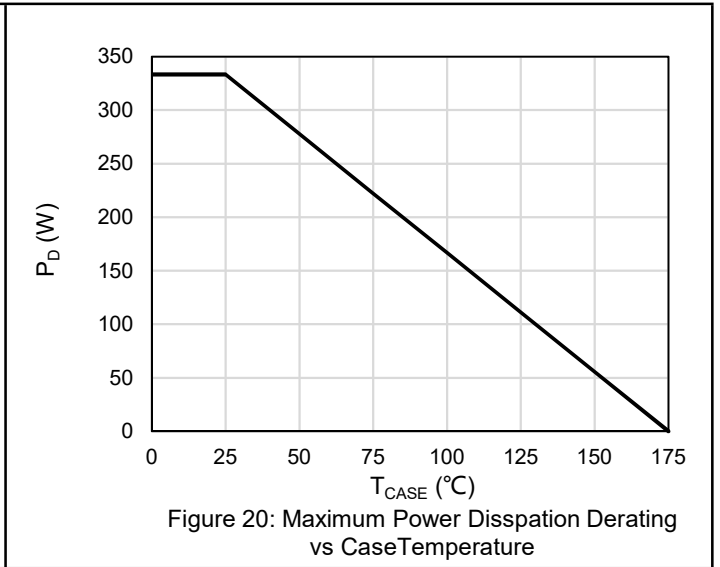
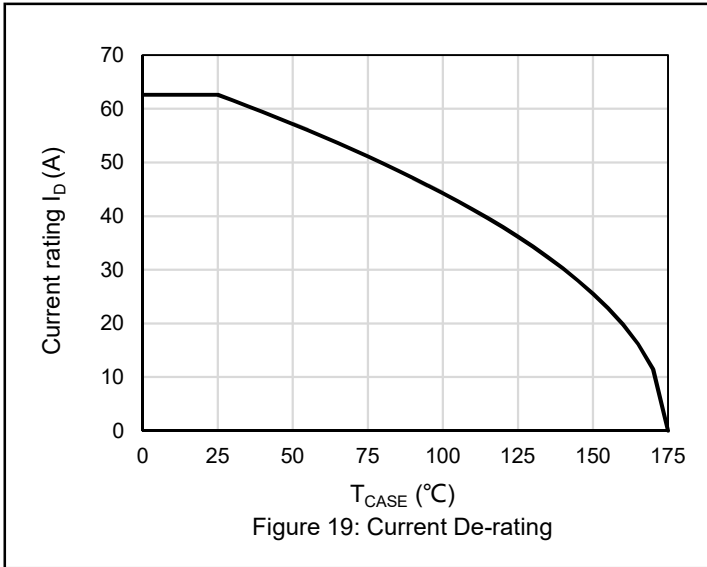
# Electrical Characteristics Diagrams

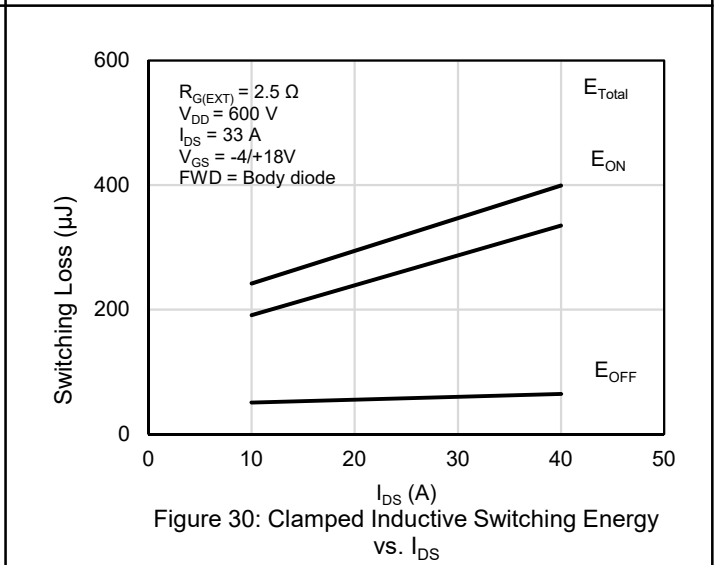
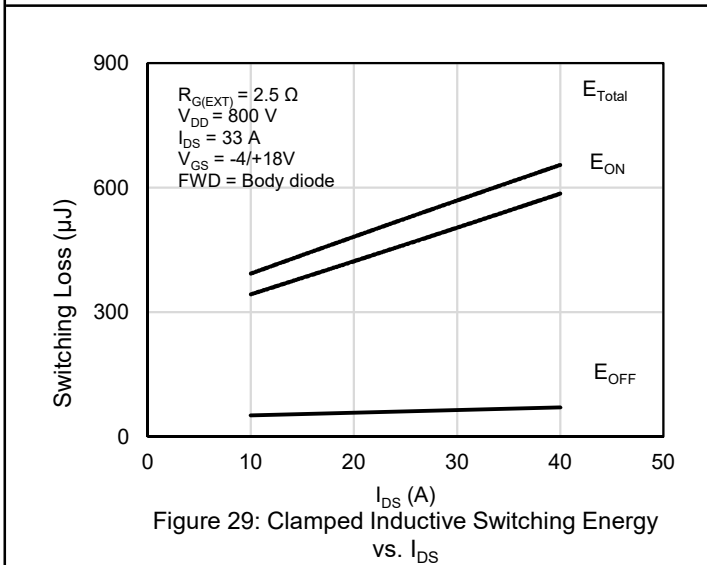
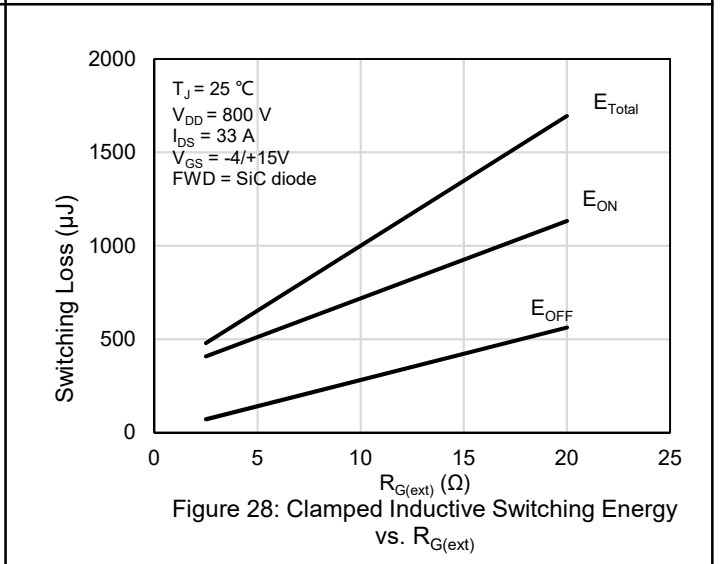
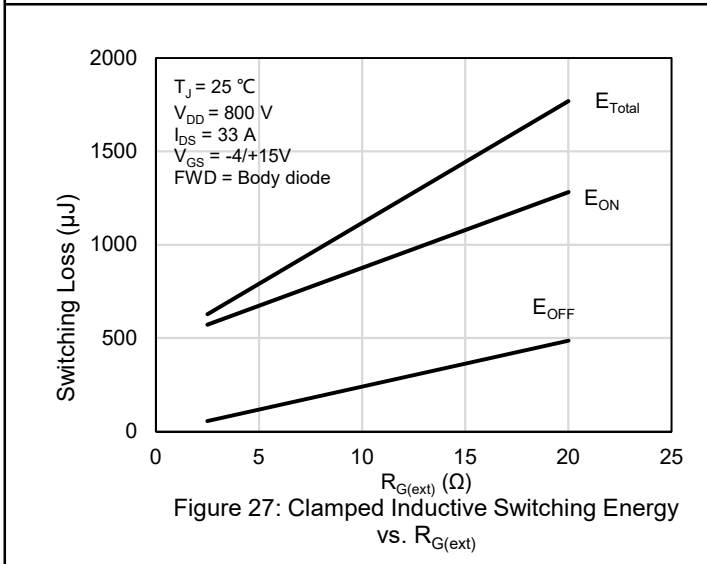
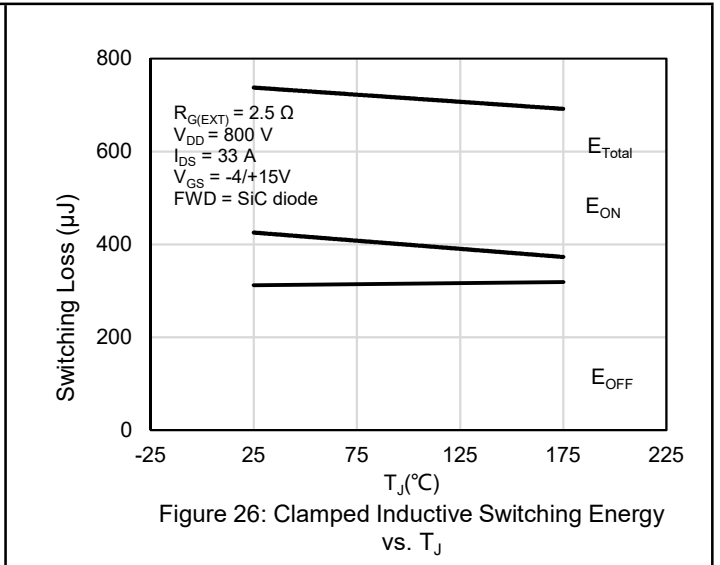
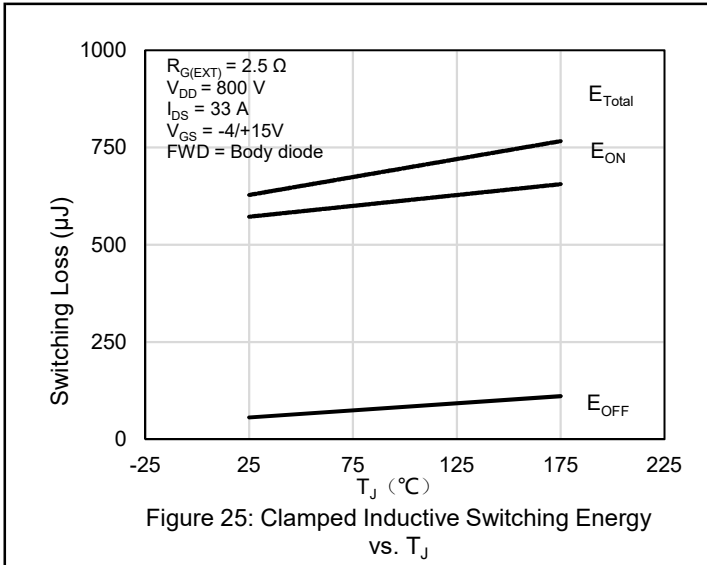


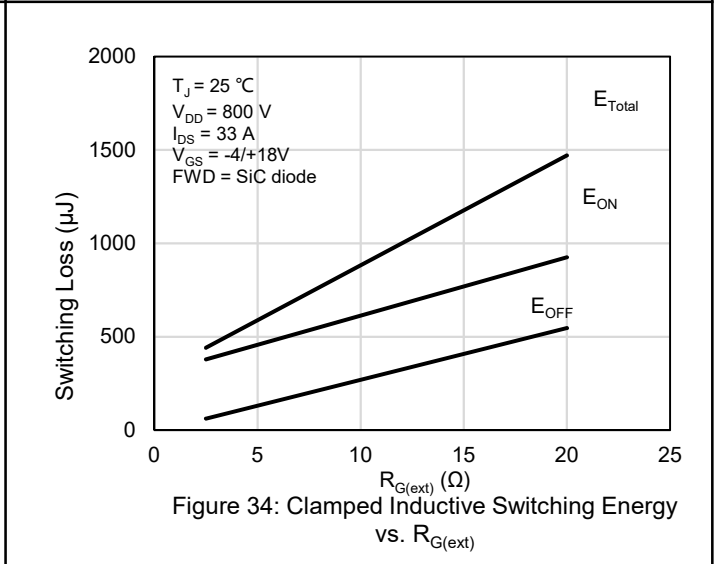
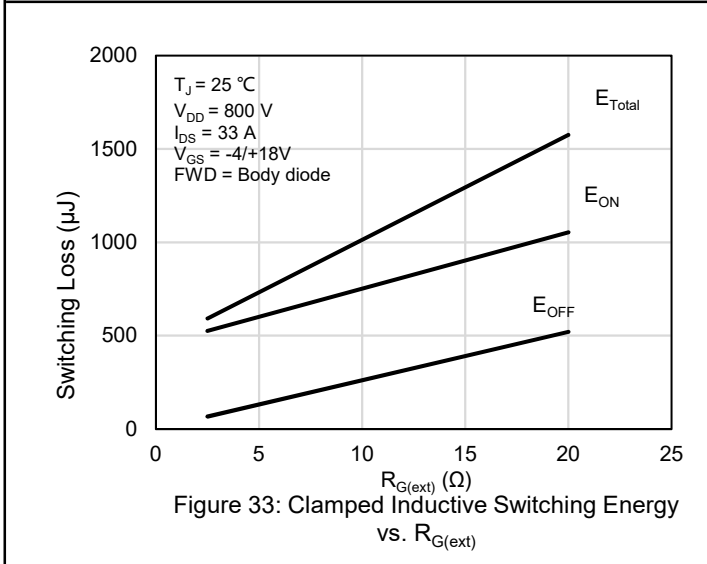
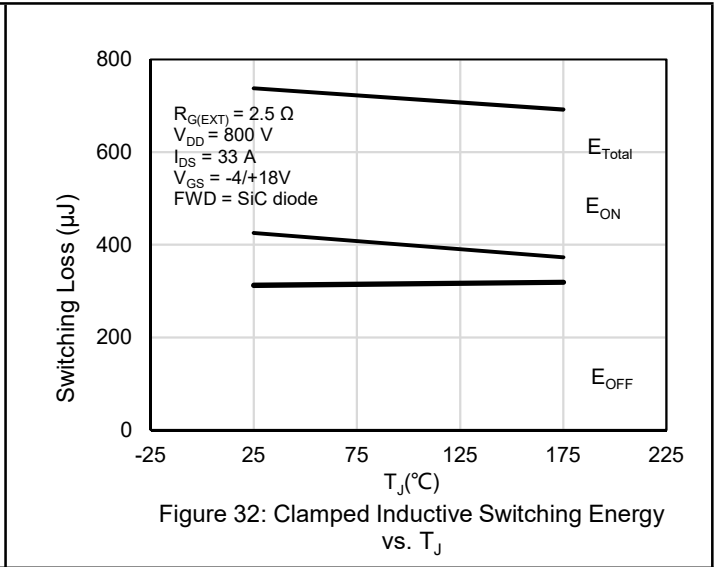
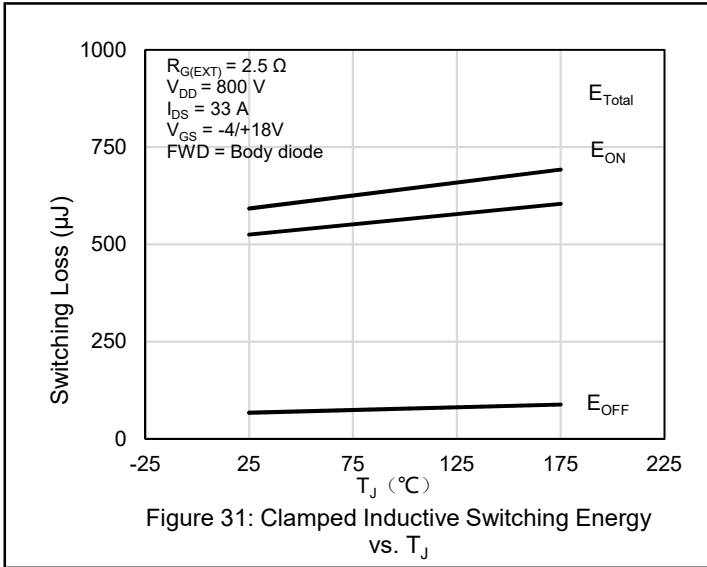






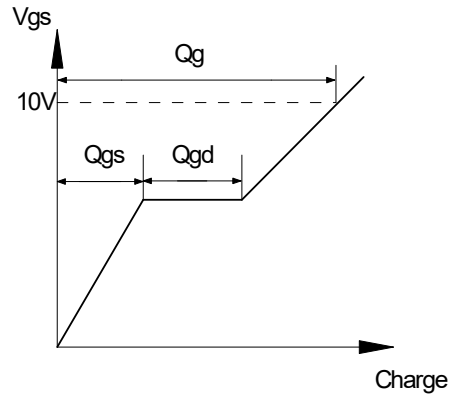
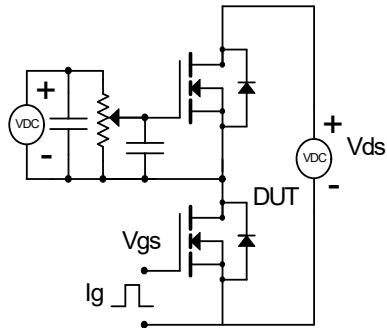




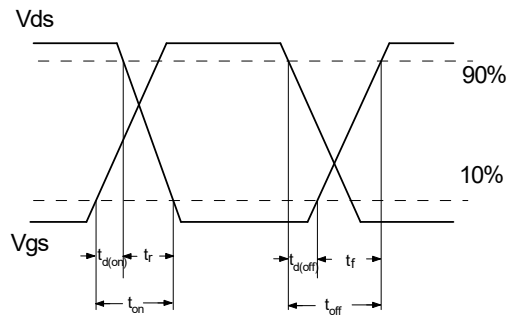
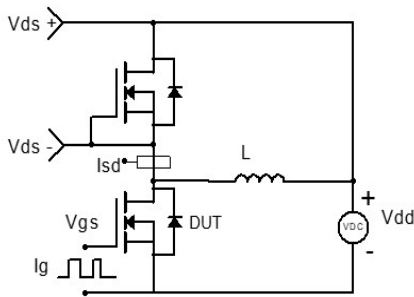


# Test Circuit and Waveform

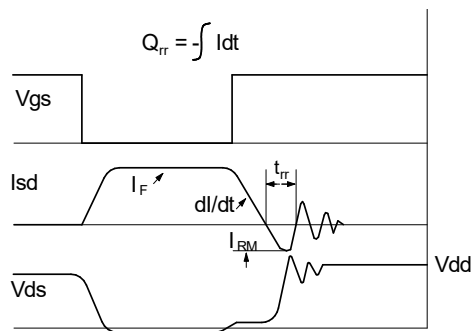
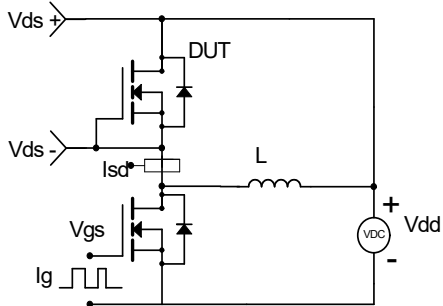
Gate Charge Test Circuit & Waveform



Clamped Inductive Switching Test Circuit & Waveforms

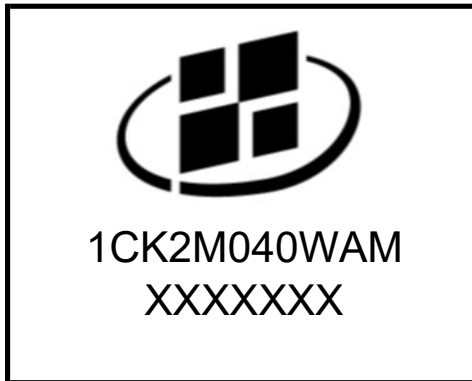


Diode Recovery Test Circuit & Waveforms





## Marking Information



Note:

1CK2M040WAM = Product Name Code

XXXXXXX = Date Code

Contact ALKAIDSEMI sales for detail information

## Revision History

Revision	Release Date	Remark
Rev.1.1	2024	

## Disclaimer

The information given in this document describes the independent performance of the product, but similar performance is not guaranteed under other working conditions, and cannot be guaranteed when installed with other products or equipment. To achieve the required performance of the product in actual scenarios, the customer should conduct a complete application test to assess the functionality of the product.

Alkaidsemi assumes no responsibility for equipment failures result from using products at values that exceed the ratings, operating conditions, or other parameters listed in the product specifications.

The product described in this specification is not applicable for aerospace or other applications which requires high reliability. Customers using or selling these products for use in medical, life-saving, or life-sustaining applications do so at their own risk and agree to fully indemnify.

Due to product or technical improvements, the information described or contained herein may be changed without prior notice.