

Features

- ◆ High Speed Switching
- ◆ High Blocking Voltage with Low $R_{DS(on)}$
- ◆ Easy to Parallel
- ◆ Simple to Drive
- ◆ RoHS Compliant

Benefits

- ◆ Increased Power Density
- ◆ Faster Operating Frequency
- ◆ Reduction of Heat Sink Requirements
- ◆ Higher Efficiency
- ◆ Reduced EMI

Applications

- ◆ Power Factor Correction Modules
- ◆ Switch Mode Power Supplies
- ◆ DC-AC Inverters
- ◆ High Voltage DC/DC Converters

Description

Pin 1 and Backside - Drain

Pin 2 - Power Source

Pin 3 - Driver Source

Pin 4 - Gate

Part NO.	HX1M040120K	
V_{DS}	=	1200 V
$I_D(T_c=25^\circ\text{C})$	=	87 A
$R_{DS(on)}$	=	37 m Ω

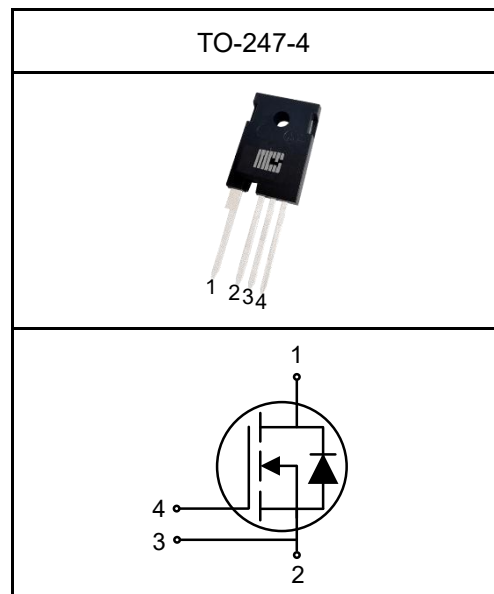


Table of Contents

Features	1
Benefits	1
Applications	1
Description.....	1
Table of Contents	2
Maximum Ratings.....	3
Thermal Characteristics	3
Electrical Characteristics	4
Static Characteristics	4
Dynamic Characteristics	4
Switching Characteristics.....	5
Reverse Diode Characteristics	5
Typical Performance	7
Package Outlines.....	14
Revision History	15
Information.....	15
Disclaimer	15

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

Symbol	Parameter	Test Conditions	Value	Unit
V_{DS}	Drain-Source Voltage		1200	V
I_D	Continuous Drain Current	$V_{GS}=18\text{V}$ $T_c=25^{\circ}\text{C}$ $T_c=100^{\circ}\text{C}$	87 61	A
I_{DM}	Peak Drain Current	Pulse width t_p limited by T_{Jmax}	174	A
V_{GSmax}	Gate-Source Voltage, max. Transient Voltage	$t_p \leq 0.5\mu\text{s}$, $D < 0.001$	-10/+22	V
V_{GSmax}	Gate-Source Voltage		-8/+22	V
V_{GSop}	Recommend Gate-Source Voltage		-4/+18	V
P_{tot}	Power Dissipation	$T_c=25^{\circ}\text{C}$ $T_c=100^{\circ}\text{C}$	405 202	W
E_{AS}	Non-Repetitive Avalanche Switching Energy	$V_{DD}=50\text{V}$, $L=1\text{mH}$, $I_D=44\text{A}$	968	mJ
E_{AR}	Repetitive Avalanche Energy	$V_{DD}=50\text{V}$, $L=580\mu\text{H}$, $I_D=44\text{A}$	561	mJ
t_{SC}	Short-Circuit Withstand Time	$V_{DD}=800\text{V}$, $V_{GS}=18\text{V}$, $V_{DS,peak} < 1200\text{V}$	2	μs
T_J	Operating Junction Temperature		-40~175	$^{\circ}\text{C}$
T_{stg}	Storage Temperature		-40~150	$^{\circ}\text{C}$
T_{sold}	Soldering Temperature	1.6mm (0.063") from case for 10s	260	$^{\circ}\text{C}$
M	Mounting Torque	M3 screw	0.6	Nm

Thermal Characteristics

Symbol	Parameter	Value			Unit
		Min.	Typ.	Max.	
$R_{th(j-c)}$	Thermal Resistance from Junction to Case		0.37		$^{\circ}\text{C/W}$

Electrical Characteristics

Static Characteristics

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$I_D=100\mu A$, $V_{GS}=0V$	1200			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=1200V$, $V_{GS}=0V$		1	10	μA
I_{GSS}	Gate-Source Leakage Current	$V_{DS}=0V$, $V_{GS}=18V$			250	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=10mA$ $T_J=25^\circ C$ $T_J=175^\circ C$	2	2.6 2.0	4.0	V
$R_{DS(on)}$	Drain-Source On-State Resistance	$V_{GS}=18V$, $I_D=40A$ $T_J=25^\circ C$ $T_J=175^\circ C$		37 47	50	m Ω
g_{fs}	Forward Transconductance	$V_{DS}=20V$, $I_D=40A$		21		S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
C_{iss}	Input Capacitance	$V_{DS}=1000V$, $f=100KHz$, $V_{GS}=0V$		2975		pF
C_{oss}	Output Capacitance			119		pF
C_{rss}	Reverse Transfer Capacitance			12		pF
E_{oss}	C_{oss} Stored Energy			71		μJ
$R_{G(int)}$	Internal Gate Resistance	$f=1MHz$		3.1		Ω
Q_g	Total Gate Charge	$V_{DS}=800V$, $I_D=40A$, $V_{GS}=-4/18V$		133		nC
Q_{gs}	Gate to Source Charge			38		nC
Q_{gd}	Gate to Drain Charge			37		nC

Switching Characteristics

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-On Delay Time	$V_{DD}=800V$, $I_D=40A$, $V_{GS}=-4V/18V$, $R_{G(ext)}=2.5\Omega$, $L=50\mu H$, $T_J=25^\circ C$		16		ns
t_r	Rise Time			23		ns
$t_{d(off)}$	Turn-Off Delay Time			31		ns
t_f	Fall Time			8		ns
E_{on}	Turn-On Energy			509		μJ
E_{off}	Turn-Off Energy			98		μJ
$t_{d(on)}$	Turn-On Delay Time	$V_{DD}=800V$, $I_D=40A$, $V_{GS}=-4V/18V$, $R_{G(ext)}=2.5\Omega$, $L=50\mu H$, $T_J=175^\circ C$		15		ns
t_r	Rise Time			23		ns
$t_{d(off)}$	Turn-Off Delay Time			33		ns
t_f	Fall Time			7		ns
E_{on}	Turn-On Energy			541		μJ
E_{off}	Turn-Off Energy			99		μJ

Reverse Diode Characteristics

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
V_{SD}	Diode Forward Voltage	$V_{GS}=-4V$, $I_{SD}=20A$ $T_J=25^\circ C$ $T_J=175^\circ C$ $V_{GS}=-4V$, $I_{SD}=40A$ $T_J=25^\circ C$ $T_J=175^\circ C$		5.0 4.4 5.8 5.2		V
I_S	Continuous Diode Forward Current	$V_{GS}=-4V$ $T_c=25^\circ C$ $T_c=100^\circ C$		55 25		A

Reverse Diode Characteristics (Continued)

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
t_{rr}	Reverse Recovery Time	$V_{GS}=-4V$, $I_{SD}=40A$, $V_R=800V$, $di/dt=1650A/\mu s$, $T_J=25^{\circ}C$		16		ns
Q_{rr}	Reverse Recovery Charge			139		nC
I_{rrm}	Peak Reverse Recovery Current			14		A
t_{rr}	Reverse Recovery Time	$V_{GS}=-4V$, $I_{SD}=40A$, $V_R=800V$, $di/dt=2410A/\mu s$, $T_J=175^{\circ}C$		45		ns
Q_{rr}	Reverse Recovery Charge			701		nC
I_{rrm}	Peak Reverse Recovery Current			25		A

Typical Performance

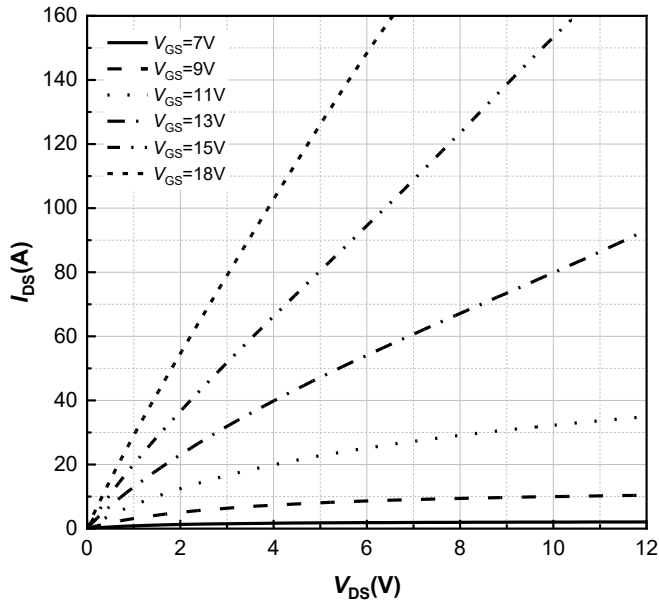


Figure 1. Output Characteristics
 $T_j = -40^{\circ}\text{C}$

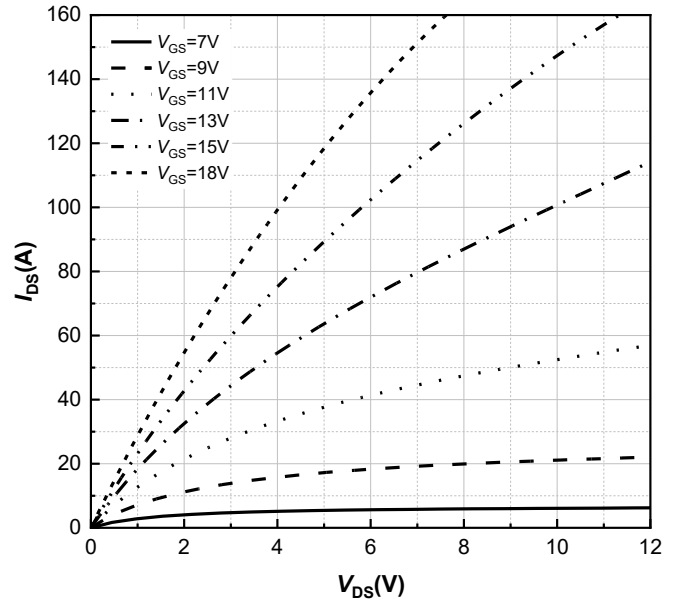


Figure 2. Output Characteristics
 $T_j = 25^{\circ}\text{C}$

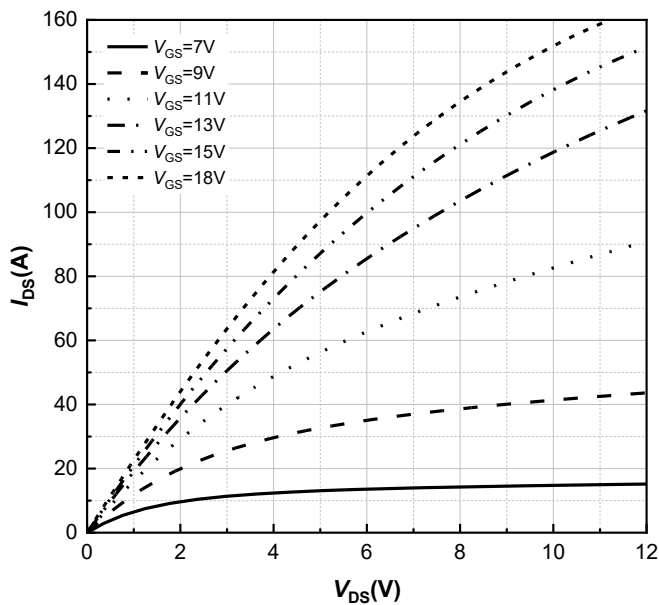


Figure 3. Output Characteristics
 $T_j = 175^{\circ}\text{C}$

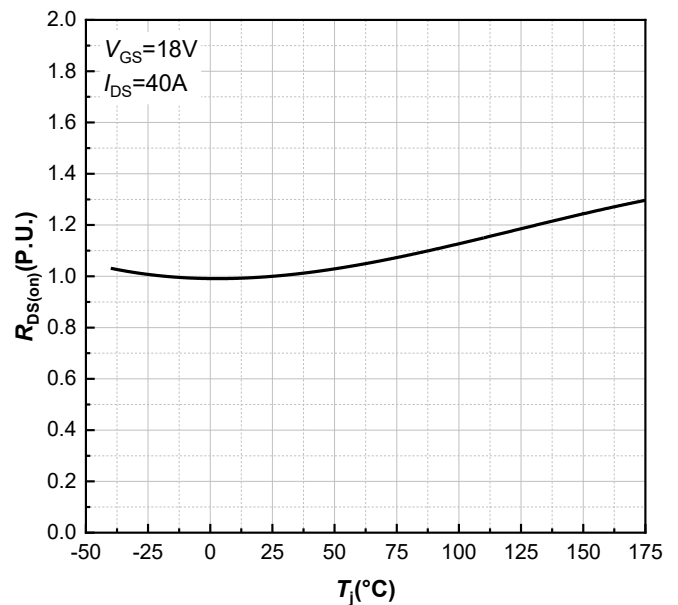


Figure 4. Normalized On-Resistance vs. Temperature

Typical Performance

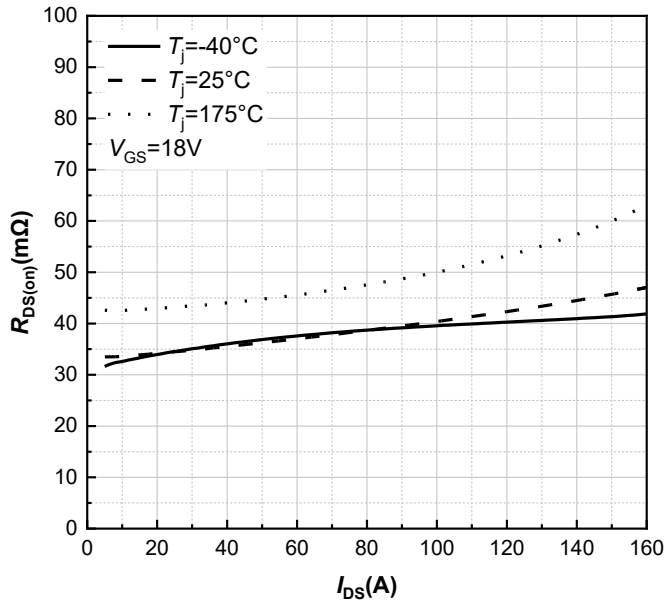


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

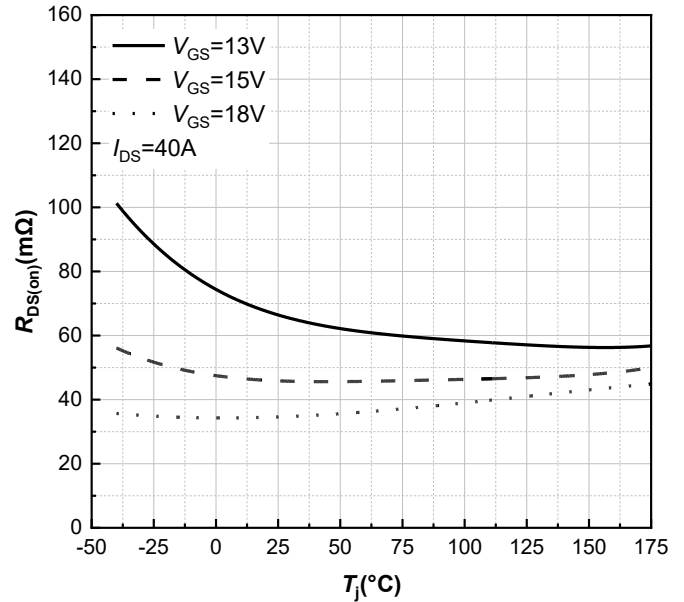


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage

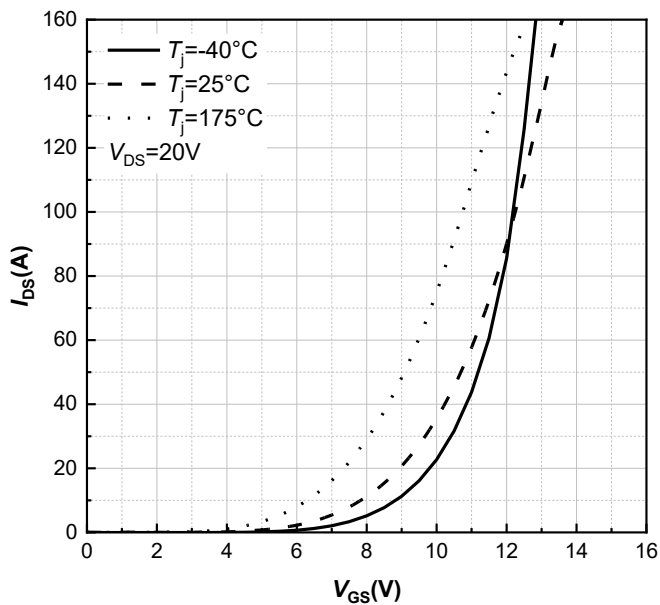


Figure 7. Transfer Characteristic for Various Junction Temperatures

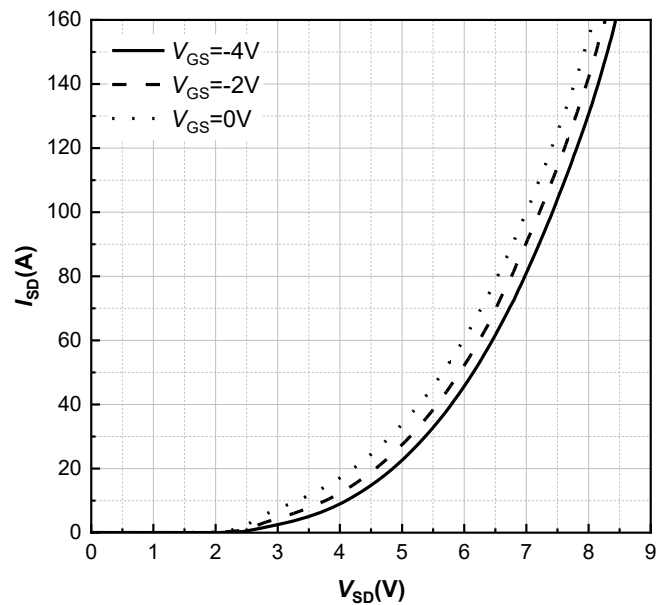


Figure 8. Body Diode Characteristic $T_J = -40^\circ\text{C}$

Typical Performance

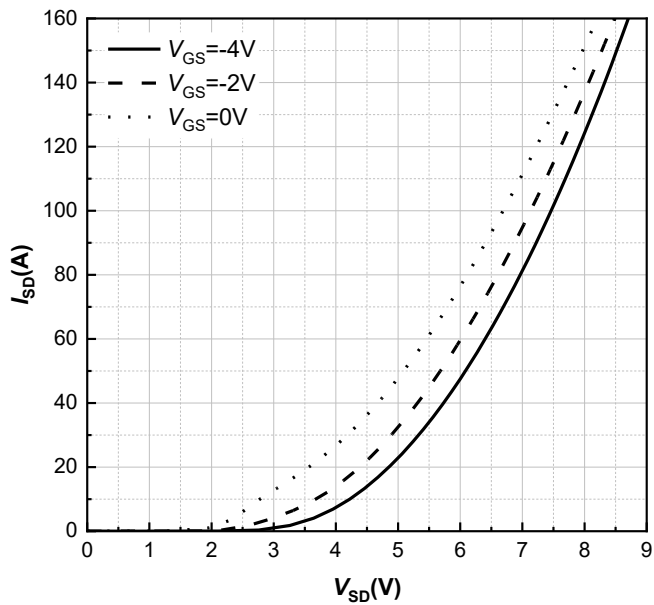


Figure 9. **Body Diode Characteristic**
 $T_j=25^{\circ}\text{C}$

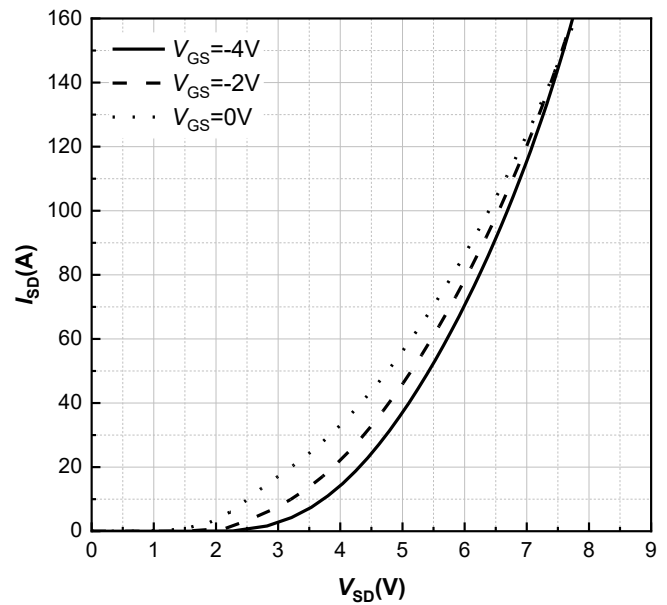


Figure 10. **Body Diode Characteristic**
 $T_j=175^{\circ}\text{C}$

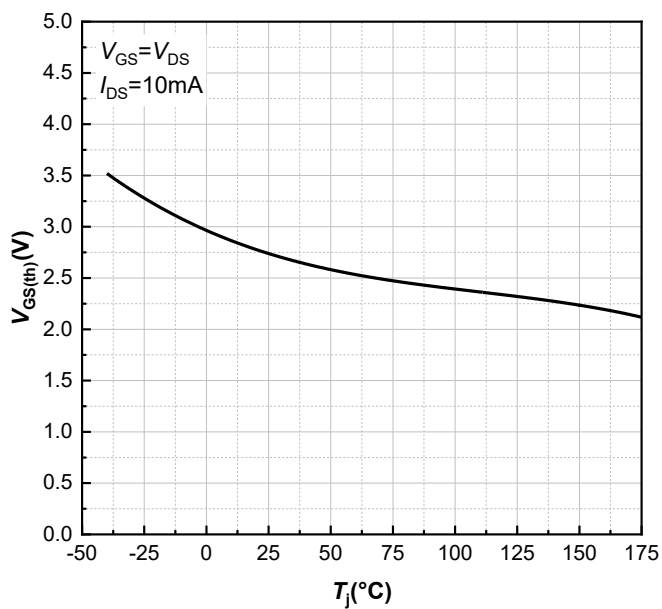


Figure 11. **Threshold Voltage vs. Temperature**

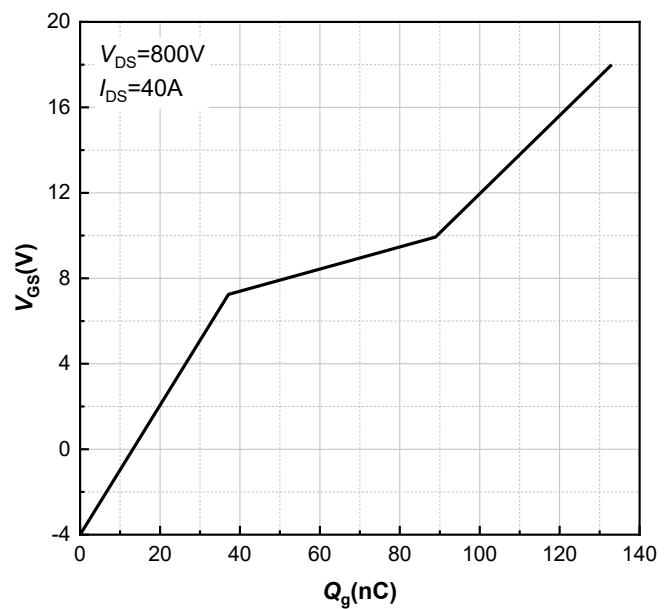


Figure 12. **Gate Charge Characteristics**

Typical Performance

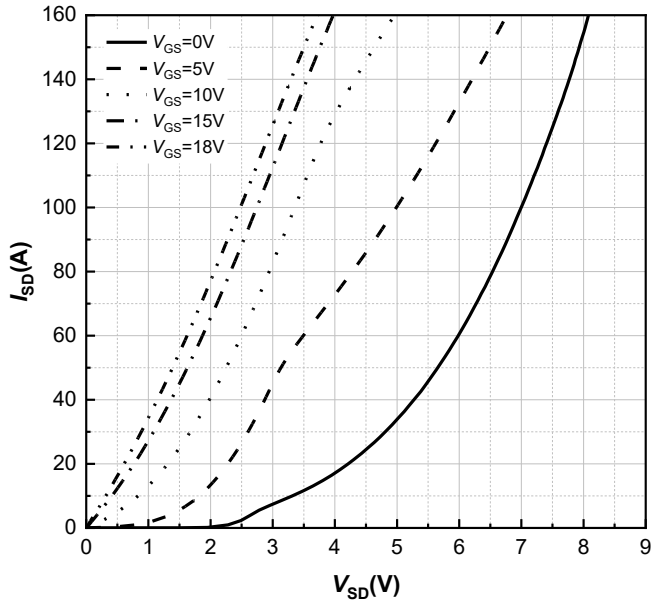


Figure 13. 3rd Quadrant Characteristic
 $T_j = -40^{\circ}\text{C}$

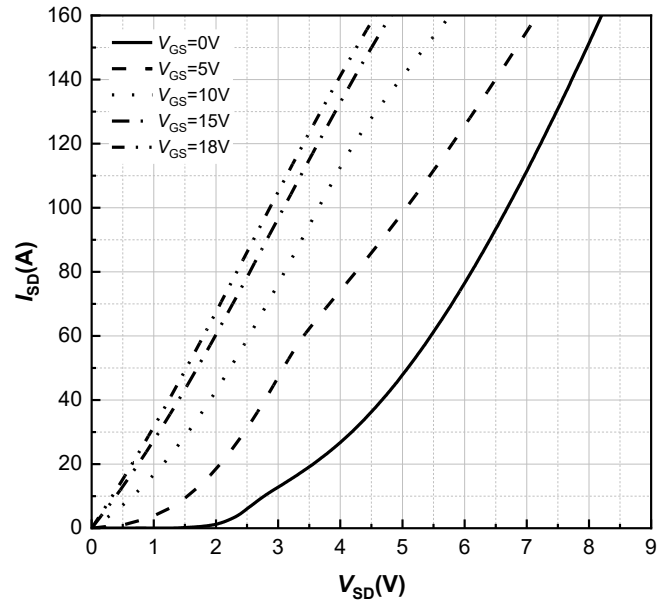


Figure 14. 3rd Quadrant Characteristic
 $T_j = 25^{\circ}\text{C}$

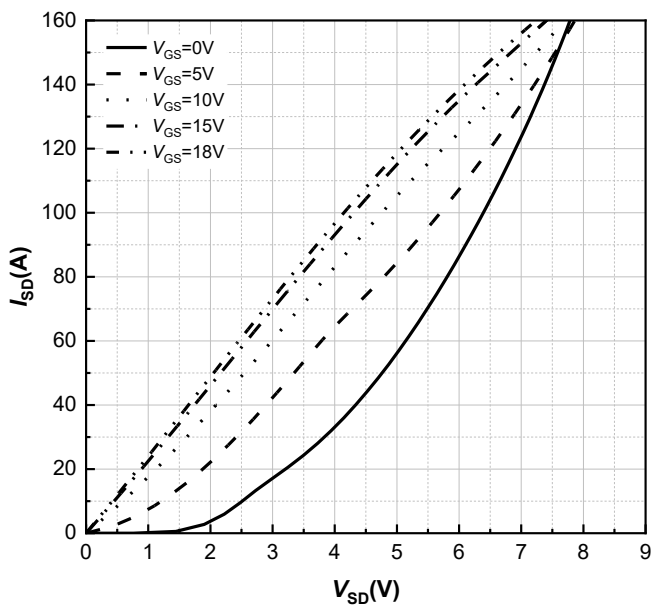


Figure 15. 3rd Quadrant Characteristic
 $T_j = 175^{\circ}\text{C}$

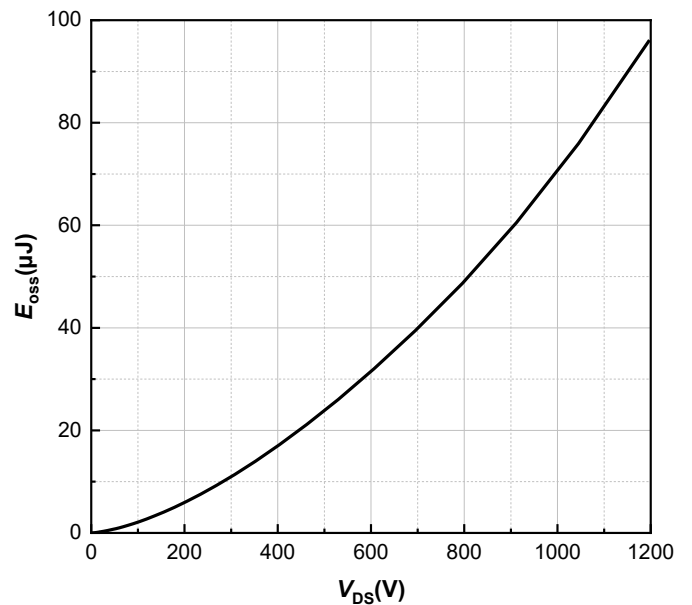


Figure 16. Output Capacitor Stored Energy

Typical Performance

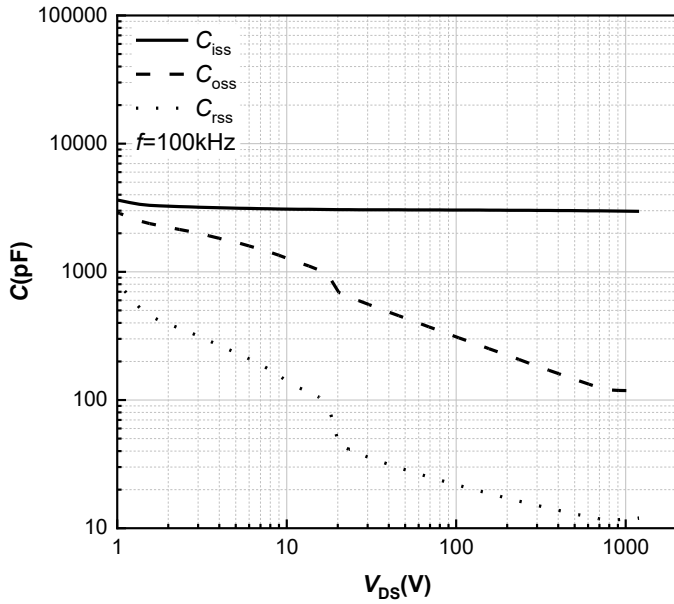


Figure 17. Capacitances vs. Drain-Source

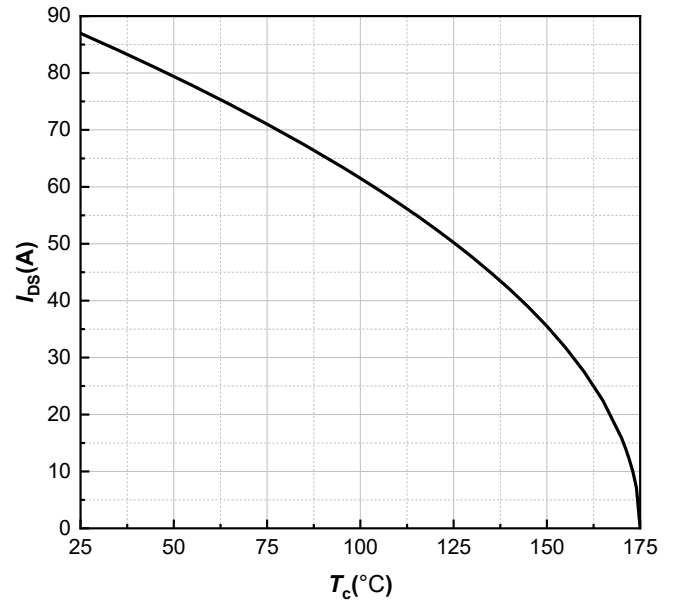


Figure 18. Continuous Drain Current Derating vs. Case Temperature

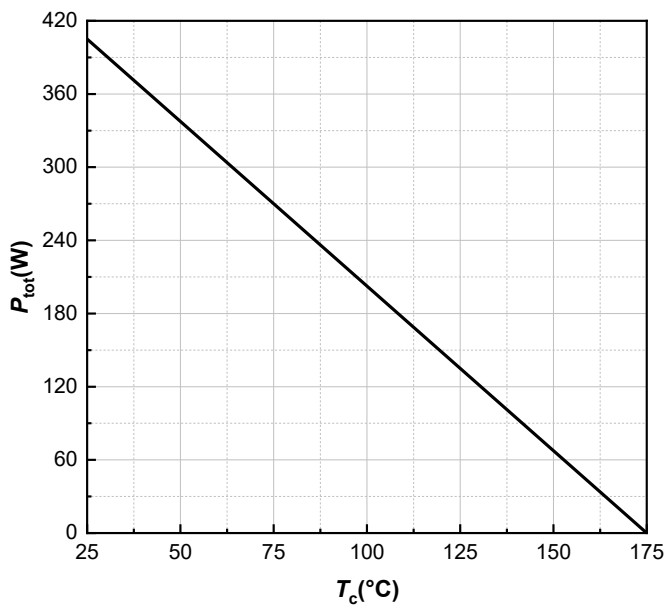


Figure 19. Maximum Power Dissipation Derating vs. Case Temperature

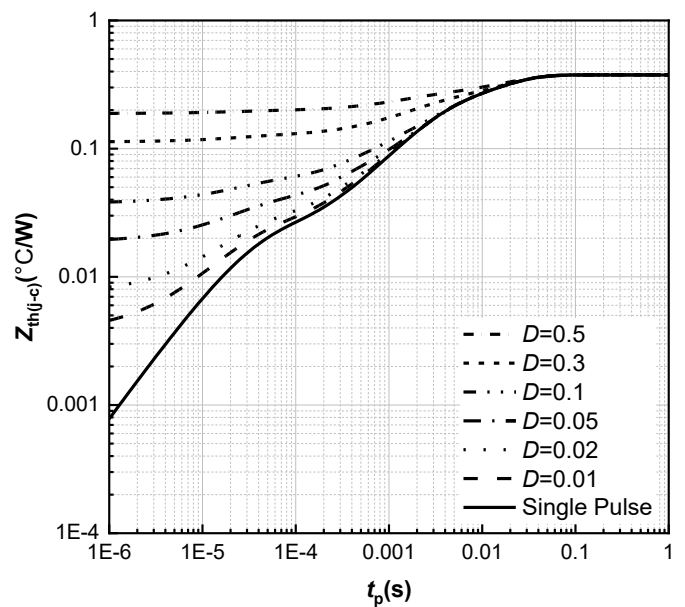


Figure 20. Transient Thermal Impedance

Typical Performance

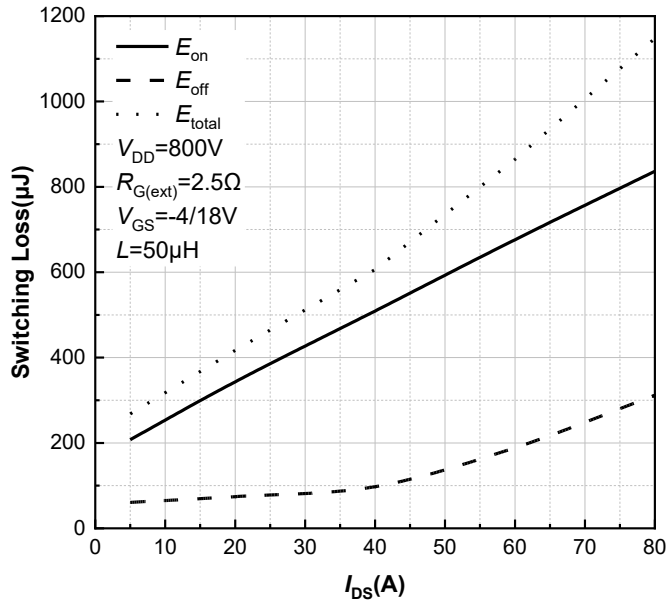


Figure 21. Clamped Inductive Switching Energy vs. Drain Current
 $T_j=25^\circ\text{C}$

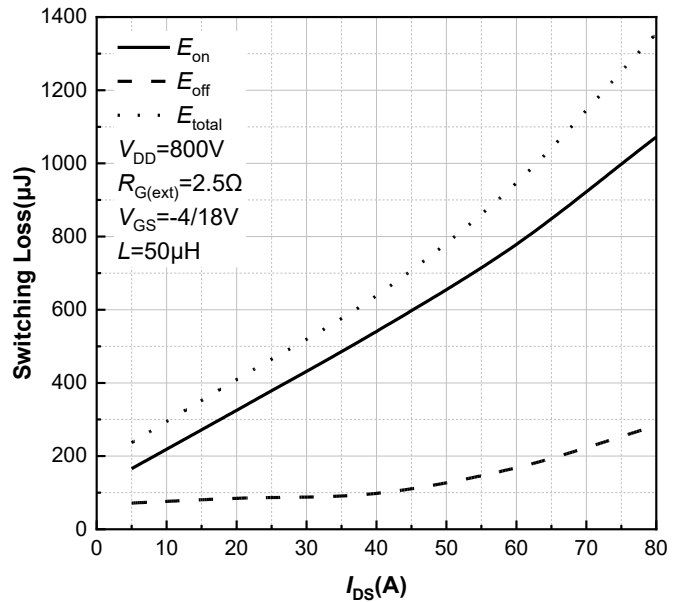


Figure 22. Clamped Inductive Switching Energy vs. Drain Current
 $T_j=175^\circ\text{C}$

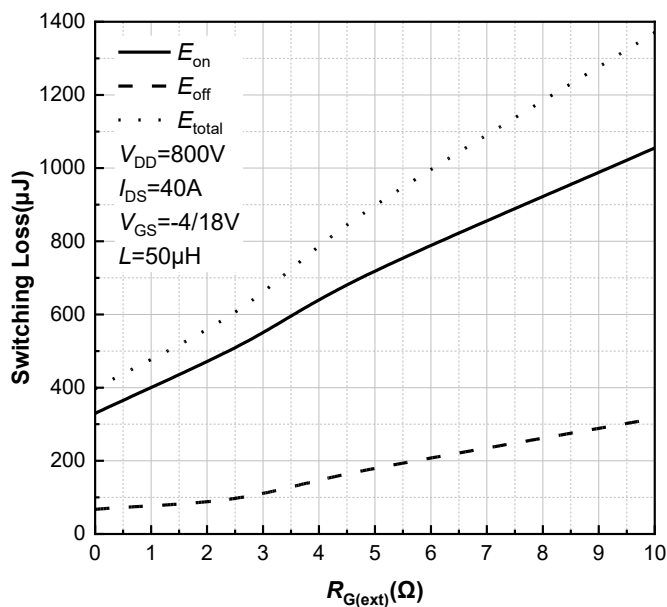


Figure 23. Clamped Inductive Switching Energy vs. $R_{G(ext)}$
 $T_j=25^\circ\text{C}$

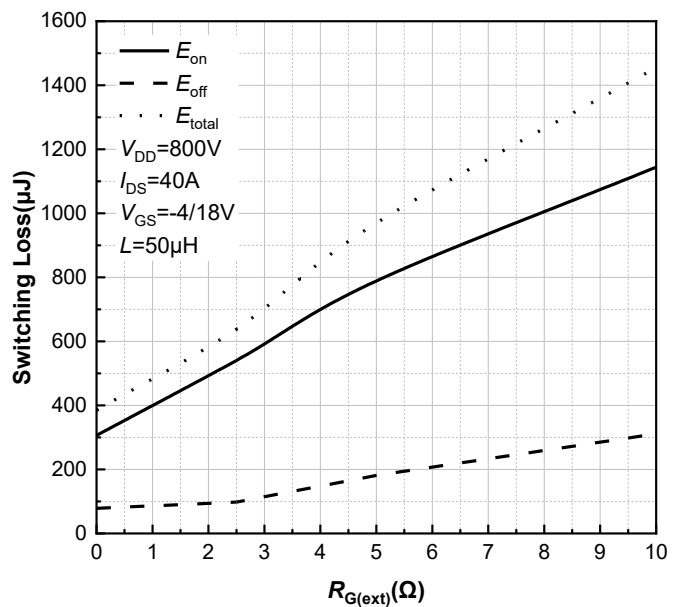


Figure 24. Clamped Inductive Switching Energy vs. $R_{G(ext)}$
 $T_j=175^\circ\text{C}$

Typical Performance

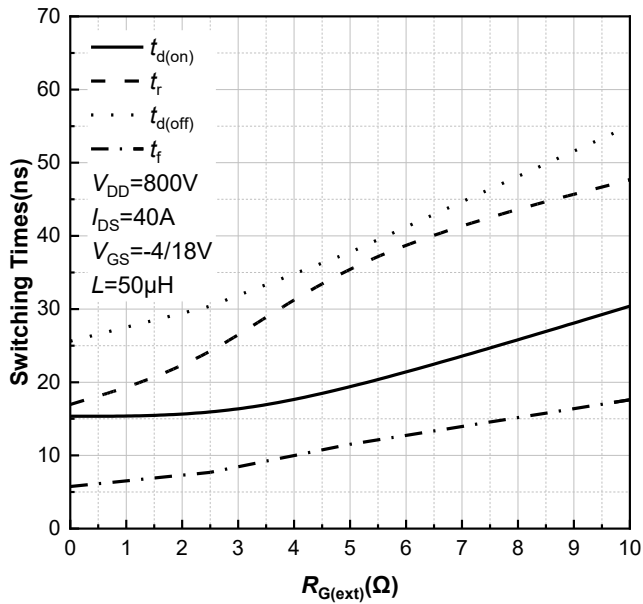


Figure 25. **Switching Times vs. $R_{G(ext)}$**
 $T_J = 25^{\circ}\text{C}$

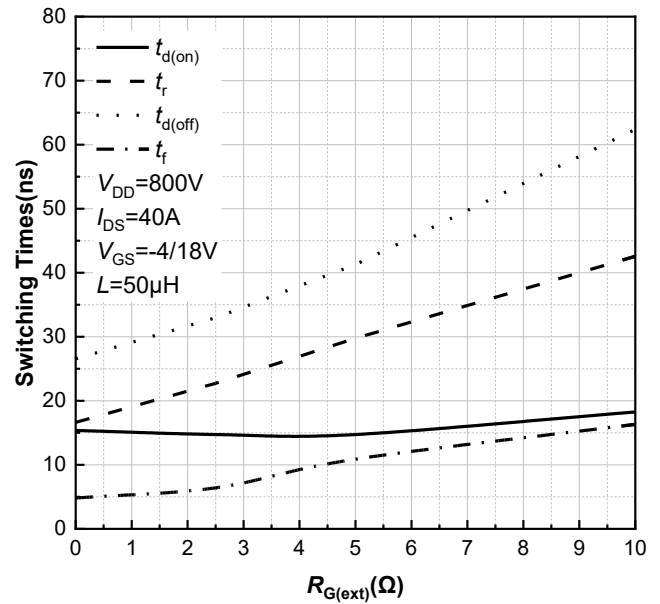


Figure 26. **Switching Times vs. $R_{G(ext)}$**
 $T_J = 175^{\circ}\text{C}$

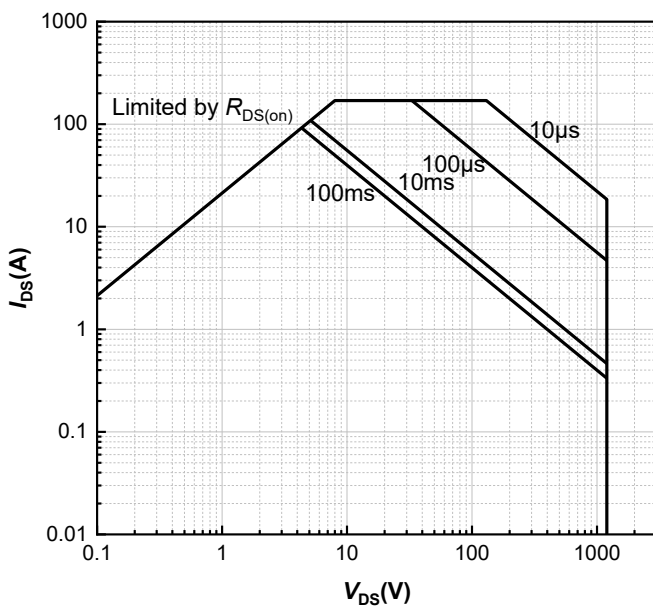
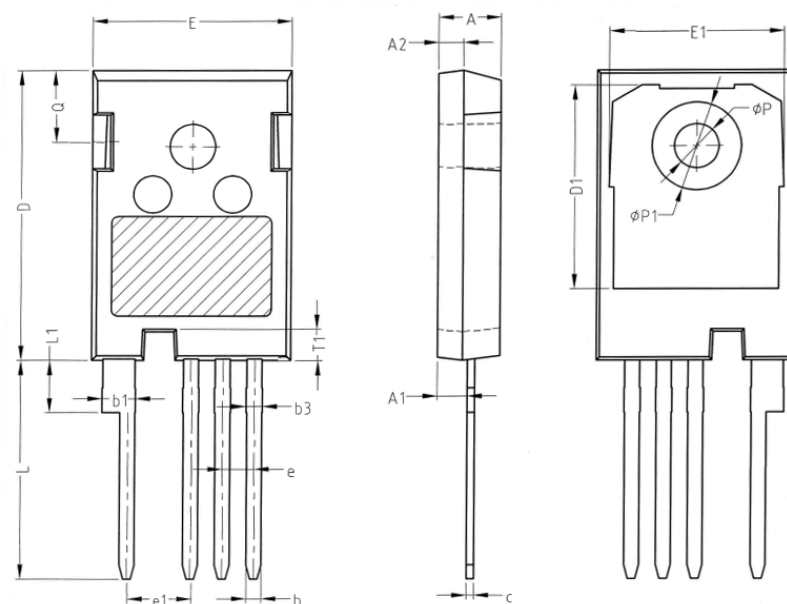


Figure 27. **Safe Operating Area**

Package Outlines



SYMBOL	Unit: mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.80	2.00	2.20
b	1.06	1.21	1.36
b1	2.33	2.63	2.93
b3	1.07	1.30	1.60
c	0.51	0.61	0.75
D	23.30	23.45	23.60
D1	16.25	16.55	16.85
E	15.74	15.94	16.14
E1	13.72	14.02	14.32
T1	2.35	2.50	2.65
e	2.54 BSC		
e1	5.08 BSC		
Q	5.49	5.79	6.09
L	17.27	17.57	17.87
L1	3.99	4.19	4.39
φP	3.40	3.60	3.80
φP1	7.19 REF		

Revision History

Document Version	Date of Release	Description of Changes
Preliminary A	2023-01-16	Preliminary release of the datasheet.
Rev. A	2023-07-03	Characteristics update.
Rev. A1	2023-12-25	Characteristics update.
Rev. A2	2024-04-17	Characteristics update.
Rev. A3	2024-06-05	Characteristics update.
Rev. A4	2025-06-19	Characteristics update.
Rev. A5	2025-07-15	Characteristics update.
Rev. A6	2025-08-11	Characteristics update.

Macrocore Semiconductor Ltd.

Suzhou, China

All Rights Reserved.

Information

For further information on technology, delivery terms and conditions and prices, please contact the nearest MCS office.

Disclaimer

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics. With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device. Hereby disclaims any and all warranties and liabilities of any kind, including without limitation, warranties of non-infringement of intellectual property rights of any third party.