

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 - Gate

Pin 2 and Backside - Drain

Pin 3 - Source

Part NO.	HX1M040065D	
V_{DS}	=	650 V
$I_D(T_c=25^\circ\text{C})$	=	71 A
$R_{DS(on)}$	=	33 m Ω

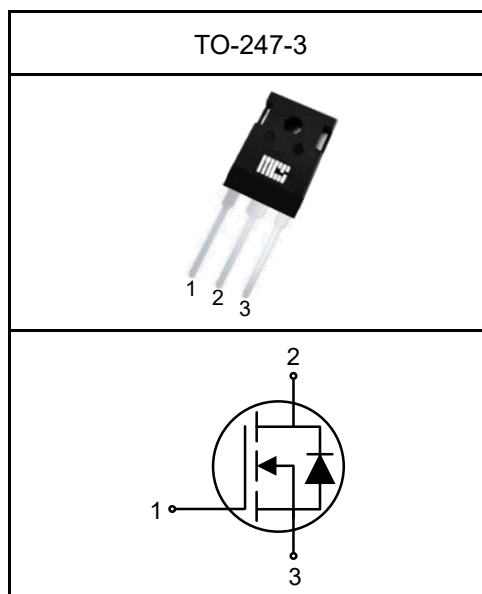


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Maximum Ratings ($T_j=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Value	Unit
V_{DS}	Drain-Source Voltage		650	V
I_D	Continuous Drain Current	$V_{GS}=18\text{V}$ $T_c=25^{\circ}\text{C}$ $T_c=100^{\circ}\text{C}$	71 50	A
I_{DM}	Peak Drain Current	Pulse width t_p limited by T_{Jmax}	167	A
V_{GSmax}	Gate-Source Voltage, max. Transient Voltage	$t_p \leq 0.5\mu\text{s}$, $D < 0.001$	-8/+22	V
V_{GSmax}	Gate-Source Voltage		-8/+22	V
V_{GSop}	Recommend Gate-Source Voltage		-4/+18	V
P_{tot}	Power Dissipation	$T_c=25^{\circ}\text{C}$ $T_c=100^{\circ}\text{C}$	202 101	W
E_{AS}	Non-Repetitive Avalanche Switching Energy	$V_{DD}=50\text{V}$, $L=1\text{mH}$, $I_D=45\text{A}$	1012	mJ
E_{AR}	Repetitive Avalanche Energy	$V_{DD}=50\text{V}$, $L=500\mu\text{H}$, $I_D=45\text{A}$	506	mJ
t_{SC}	Short-Circuit Withstand Time	$V_{DD}=400\text{V}$, $V_{GS}=18\text{V}$, $V_{DS,peak} < 650\text{V}$	3	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 or 6-32 screw	1	Nm

Thermal Characteristics

Symbol	Parameter	Value			Unit
		Min.	Typ.	Max.	
$R_{th(j-c)}$	Thermal Resistance from Junction to Case		0.74		$^{\circ}\text{C/W}$

Electrical Characteristics

Static Characteristics

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$I_D=100\mu A$, $V_{GS}=0V$	650			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=650V$, $V_{GS}=0V$		1		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 1.9	4	V
$R_{DS(on)}$	Drain-Source On-State Resistance	$V_{GS}=18V$, $I_D=30A$ $T_J=25^{\circ}C$ $T_J=175^{\circ}C$		33 35	49	m Ω
g_{fs}	Forward Transconductance	$V_{DS}=20V$, $I_D=30A$		16		S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
C_{iss}	Input Capacitance	$V_{DS}=600V$, $f=1MHz$, $V_{GS}=0V$		2200		pF
C_{oss}	Output Capacitance			196		pF
C_{rss}	Reverse Transfer Capacitance			12		pF
E_{oss}	C_{oss} Stored Energy			39		μJ
$R_{G(int)}$	Internal Gate Resistance	$f=1MHz$		1.6		Ω
Q_g	Total Gate Charge	$V_{DS}=400V$, $I_D=30A$, $V_{GS}=-4/18V$		105		nC
Q_{gs}	Gate to Source Charge			28		nC
Q_{gd}	Gate to Drain Charge			30		nC

Switching Characteristics

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-On Delay Time	$V_{DD}=400V$, $I_D=30A$, $V_{GS}=-4V/18V$, $R_{G(ext)}=2.5\Omega$, $L=100\mu H$, $T_J=25^\circ C$		15		ns
t_r	Rise Time			25		ns
$t_{d(off)}$	Turn-Off Delay Time			23		ns
t_f	Fall Time			8		ns
E_{on}	Turn-On Energy			129		μJ
E_{off}	Turn-Off Energy			66		μJ
$t_{d(on)}$	Turn-On Delay Time	$V_{DD}=400V$, $I_D=30A$, $V_{GS}=-4V/18V$, $R_{G(ext)}=2.5\Omega$, $L=100\mu H$, $T_J=175^\circ C$		14		ns
t_r	Rise Time			22		ns
$t_{d(off)}$	Turn-Off Delay Time			26		ns
t_f	Fall Time			7		ns
E_{on}	Turn-On Energy			170		μJ
E_{off}	Turn-Off Energy			22		μJ

Reverse Diode Characteristics

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
V_{SD}	Diode Forward Voltage	$V_{GS}=-4V$, $I_{SD}=15A$ $T_J=25^\circ C$ $T_J=175^\circ C$ $V_{GS}=-4V$, $I_{SD}=30A$ $T_J=25^\circ C$ $T_J=175^\circ C$		4.7 4.2 5.4 4.8		V
I_S	Continuous Diode Forward Current	$V_{GS}=-4V$ $T_c=25^\circ C$ $T_c=100^\circ C$		36 19		A

Reverse Diode Characteristics (Continued)

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
t_{rr}	Reverse Recovery Time	$V_{GS}=-4V$, $I_{SD}=30A$, $V_R=400V$, $di/dt=1002A/\mu s$, $T_J=25^{\circ}C$		22		ns
Q_{rr}	Reverse Recovery Charge			123		nC
I_{rrm}	Peak Reverse Recovery Current			10		A
t_{rr}	Reverse Recovery Time	$V_{GS}=-4V$, $I_{SD}=30A$, $V_R=400V$, $di/dt=978A/\mu s$, $T_J=175^{\circ}C$		25		ns
Q_{rr}	Reverse Recovery Charge			158		nC
I_{rrm}	Peak Reverse Recovery Current			11		A

Typical Performance

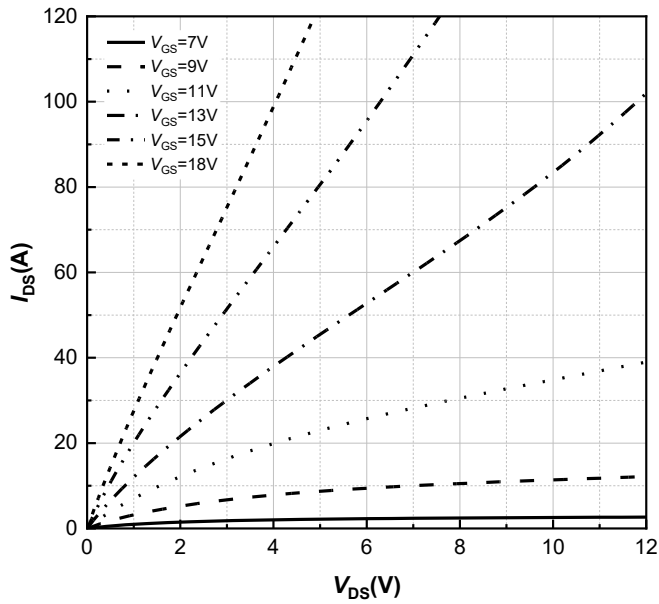


Figure 1. **Output Characteristics**
 $T_j = -40^{\circ}\text{C}$

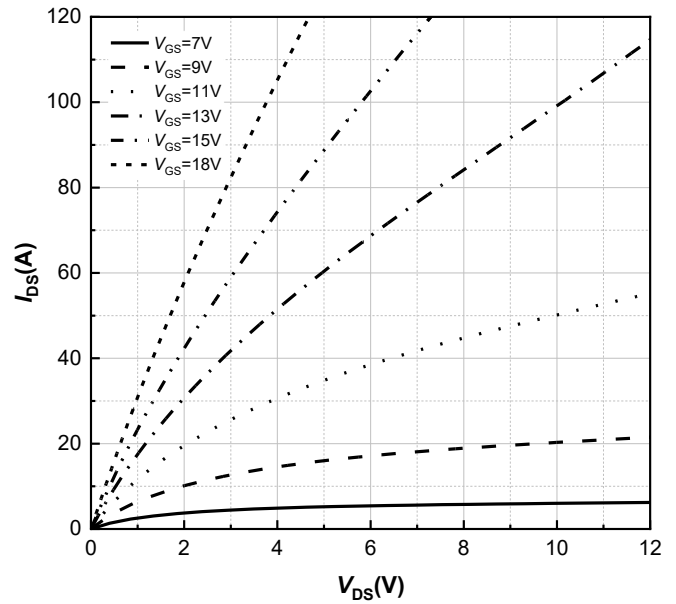


Figure 2. **Output Characteristics**
 $T_j = 25^{\circ}\text{C}$

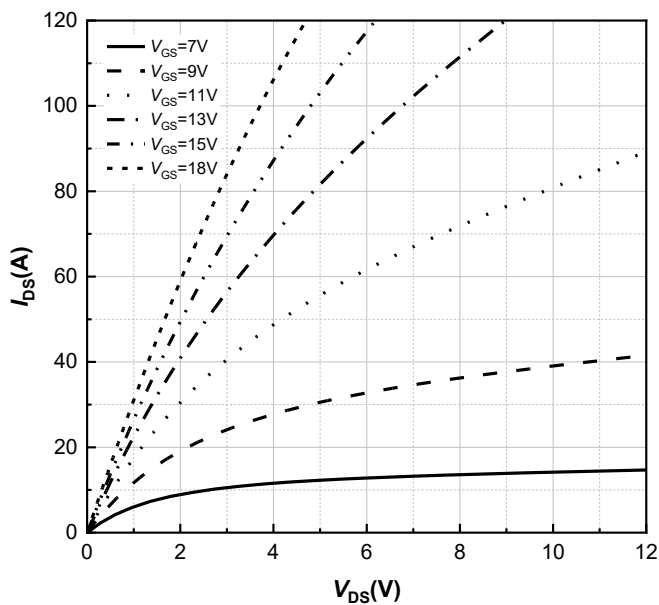


Figure 3. **Output Characteristics**
 $T_j = 175^{\circ}\text{C}$

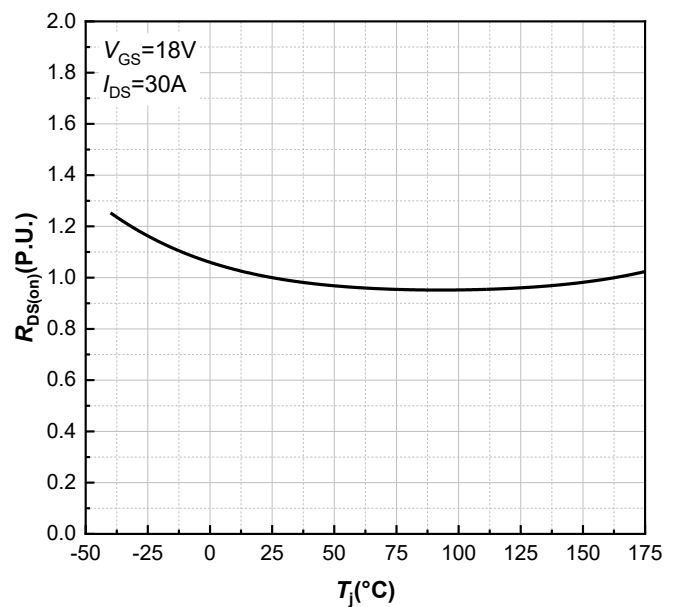


Figure 4. **Normalized On-Resistance vs. Temperature**

Typical Performance

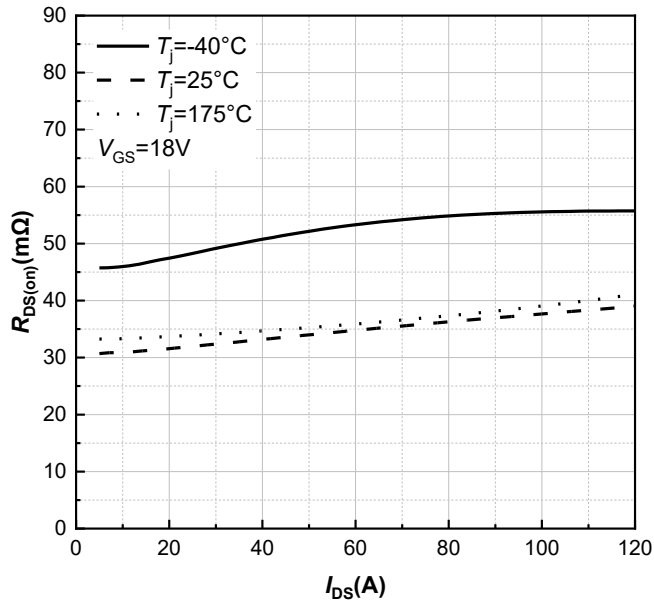


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

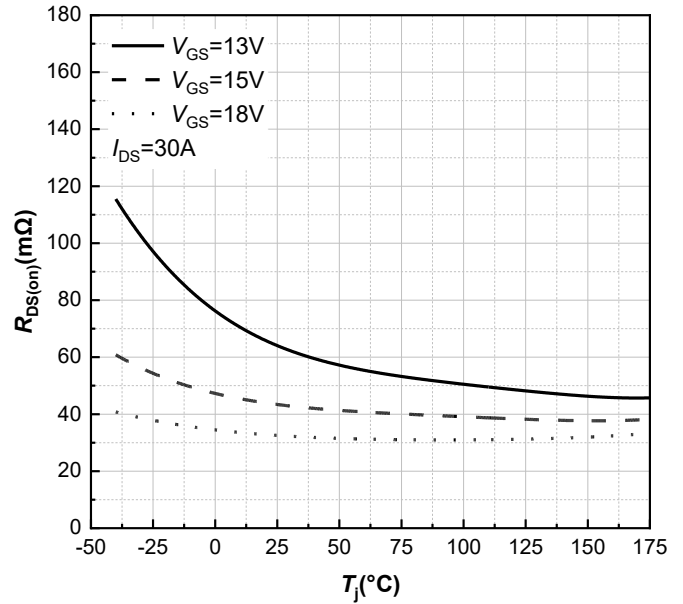


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage

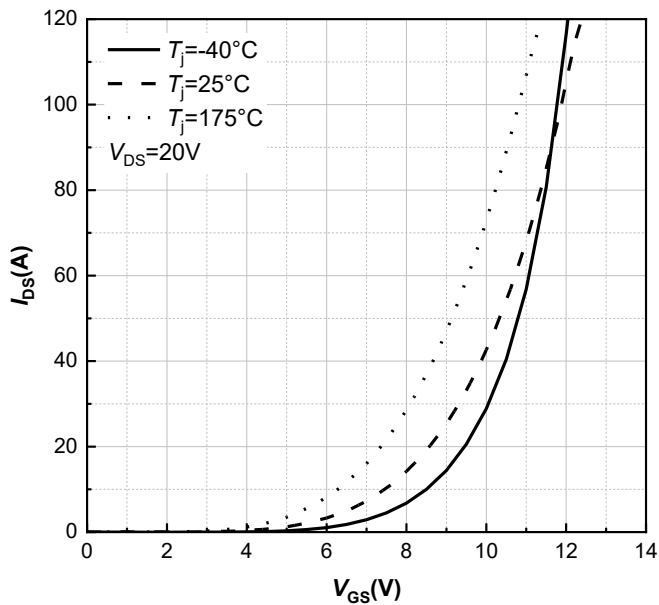


Figure 7. Transfer Characteristic for Various Junction Temperatures

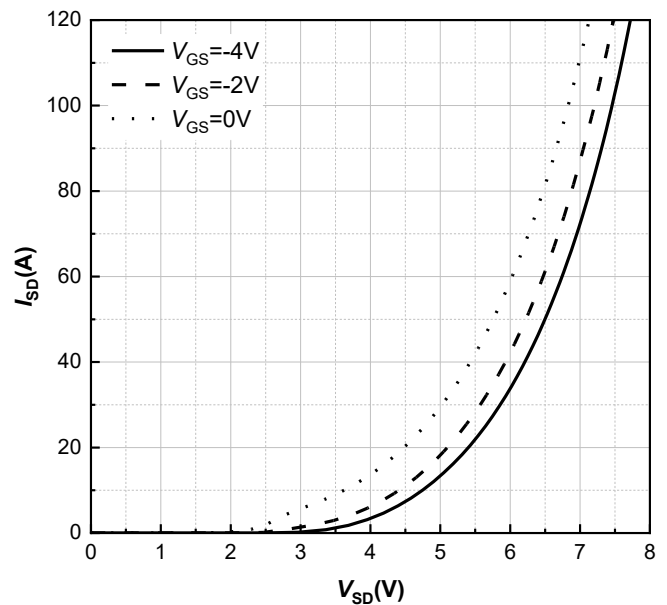


Figure 8. Body Diode Characteristic $T_J = -40^\circ\text{C}$

Typical Performance

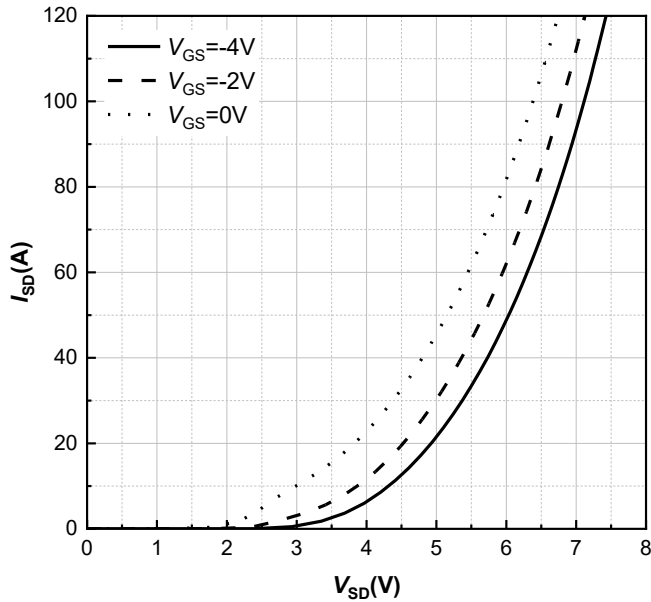


Figure 9. **Body Diode Characteristic**
 $T_j=25^{\circ}\text{C}$

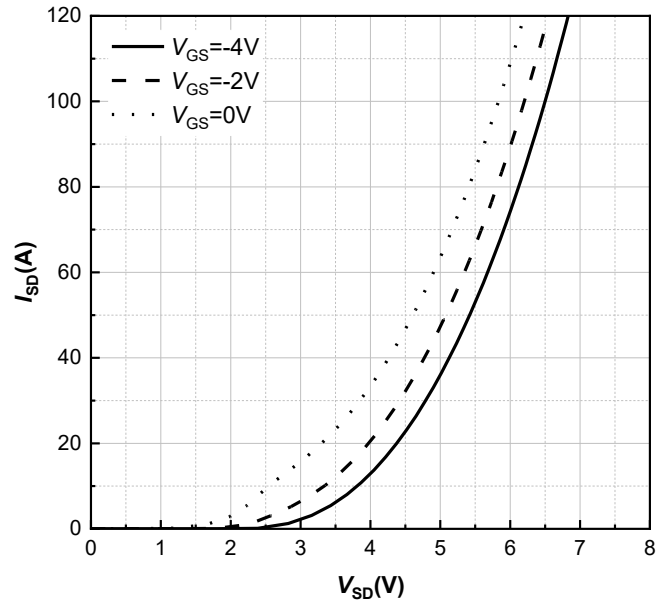


Figure 10. **Body Diode Characteristic**
 $T_j=175^{\circ}\text{C}$

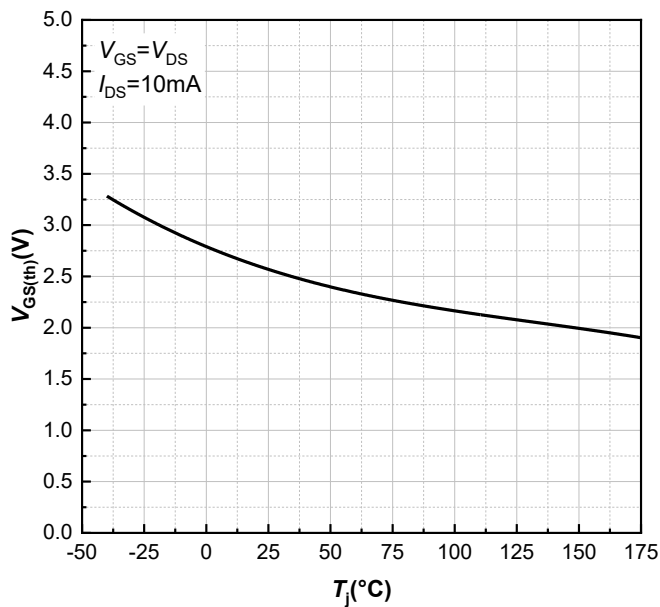


Figure 11. **Threshold Voltage vs. Temperature**

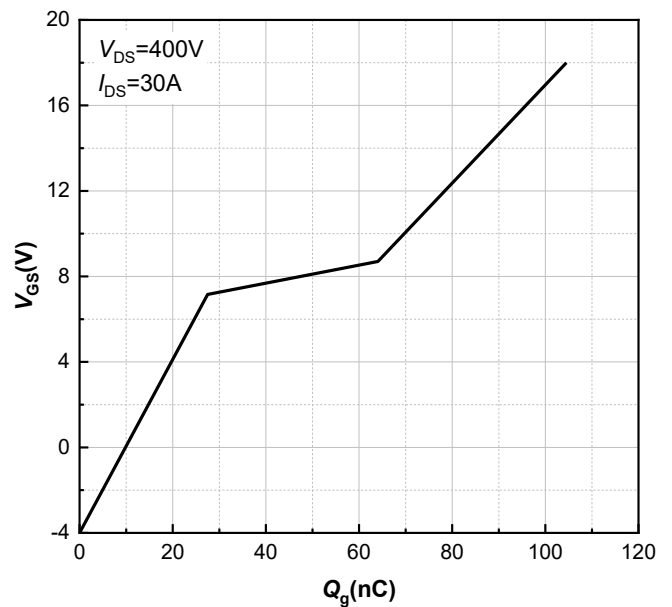


Figure 12. **Gate Charge Characteristics**

Typical Performance

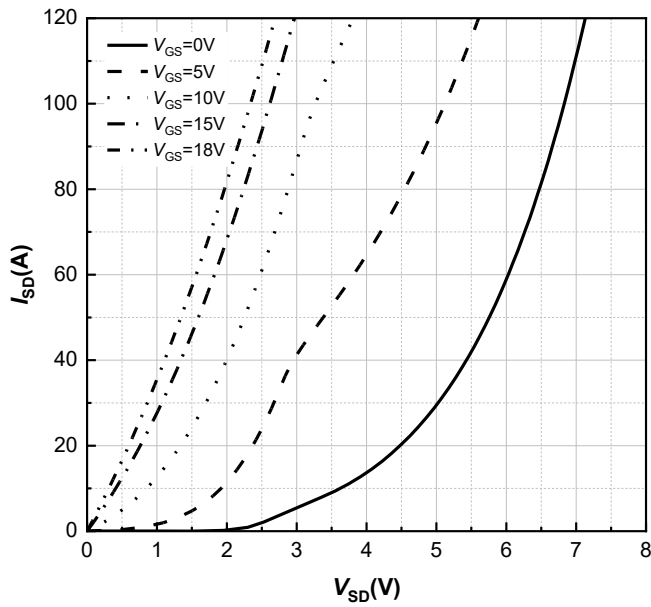


Figure 13. 3rd Quadrant Characteristic
 $T_j = -40^{\circ}\text{C}$

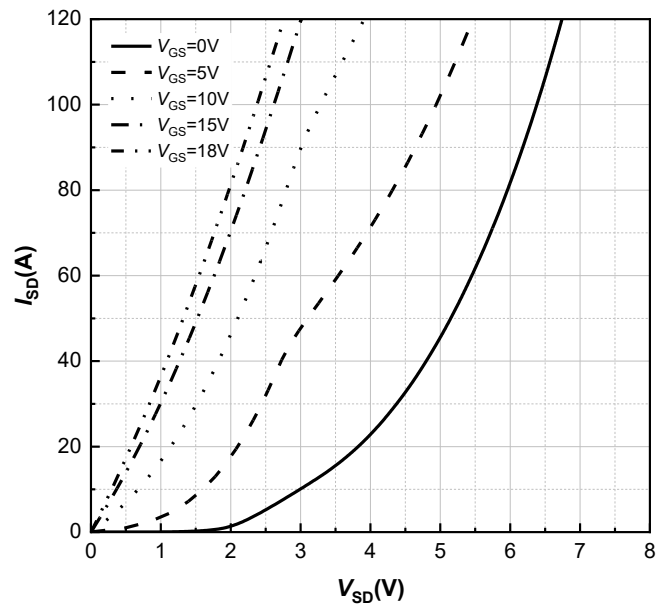


Figure 14. 3rd Quadrant Characteristic
 $T_j = 25^{\circ}\text{C}$

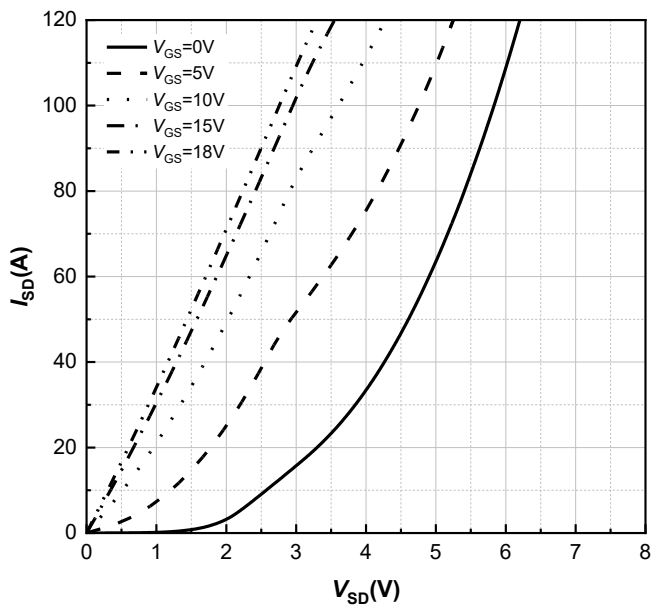


Figure 15. 3rd Quadrant Characteristic
 $T_j = 175^{\circ}\text{C}$

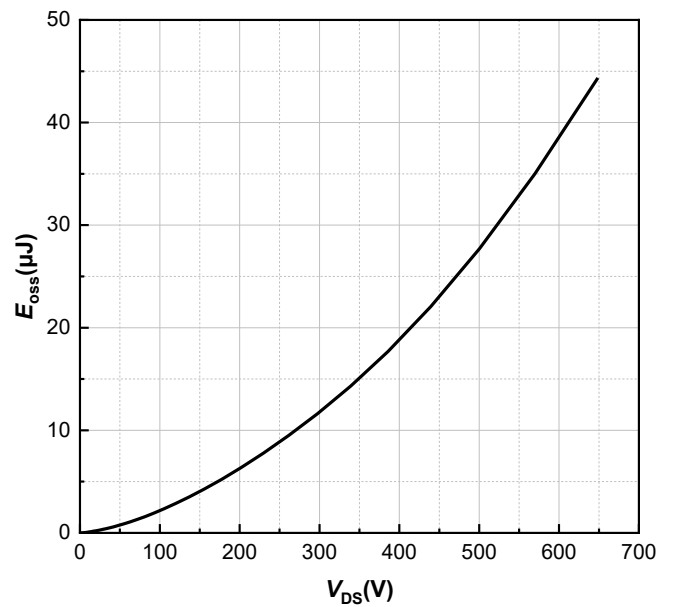


Figure 16. Output Capacitor Stored Energy

Typical Performance

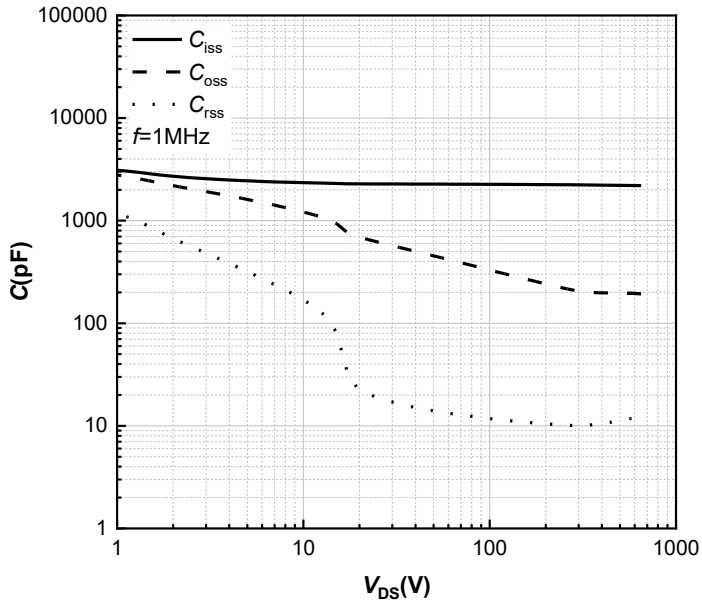


Figure 17. Capacitances vs. Drain-Source

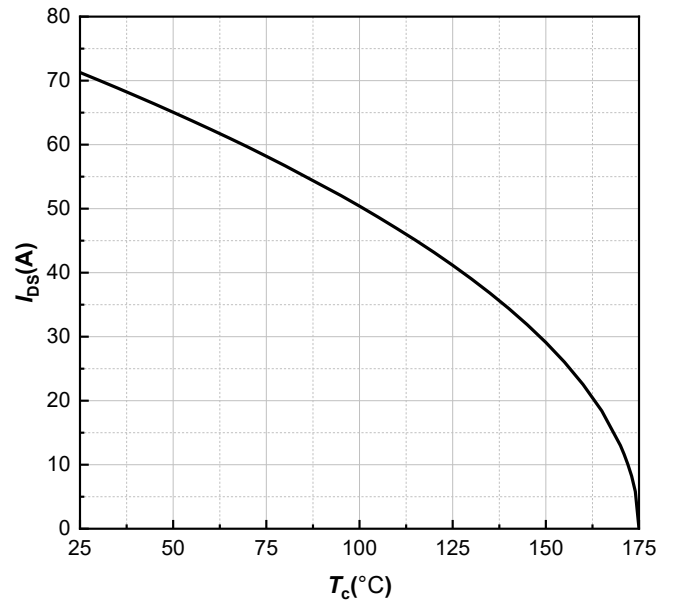


Figure 18. Continuous Drain Current Derating vs. Case Temperature

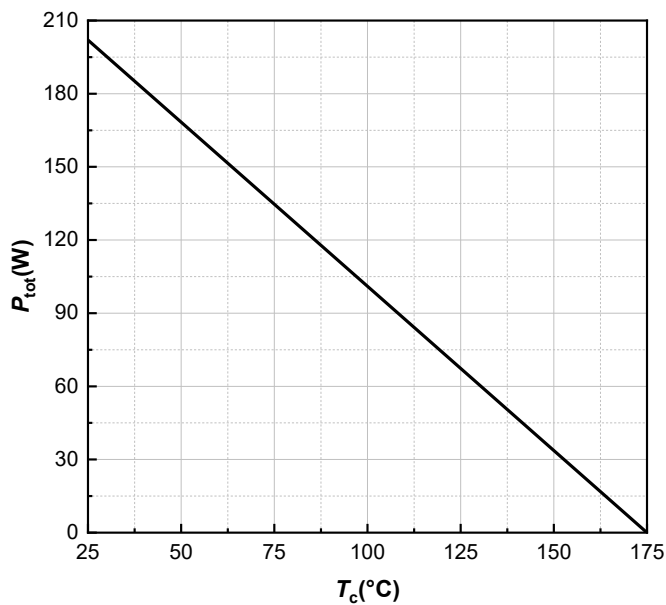


Figure 19. Maximum Power Dissipation Derating vs. Case Temperature

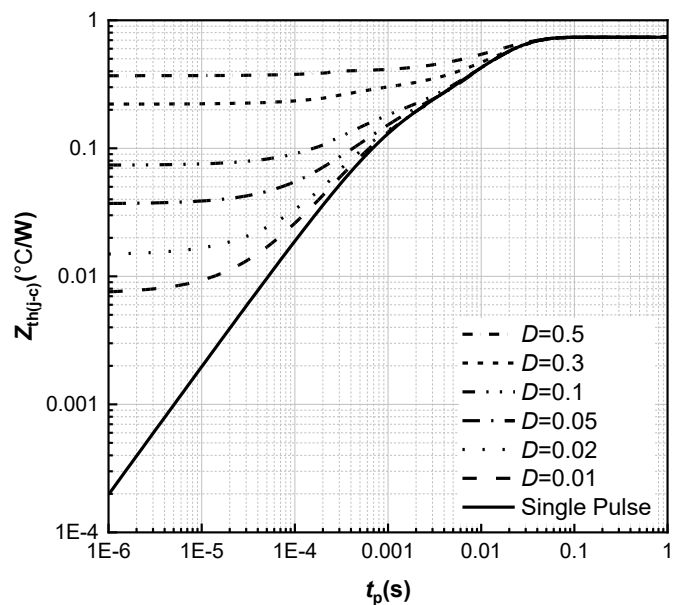


Figure 20. Transient Thermal Impedance

Typical Performance

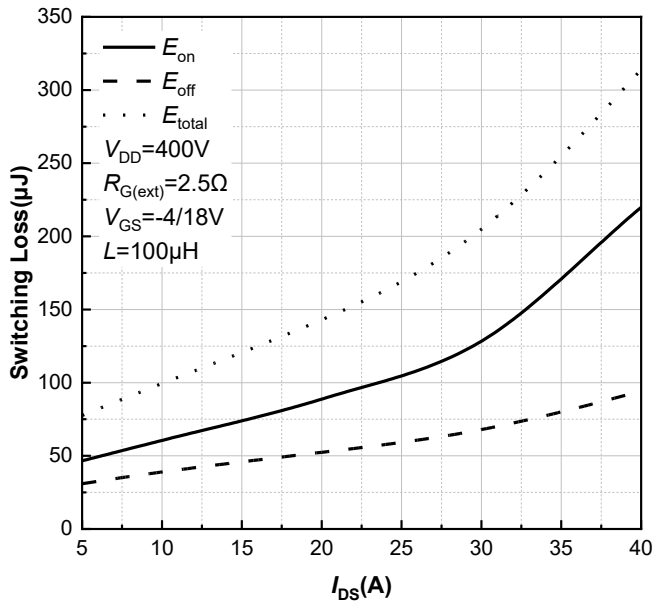


Figure 21. Clamped Inductive Switching Energy vs. Drain Current
 $T_j=25^{\circ}\text{C}$

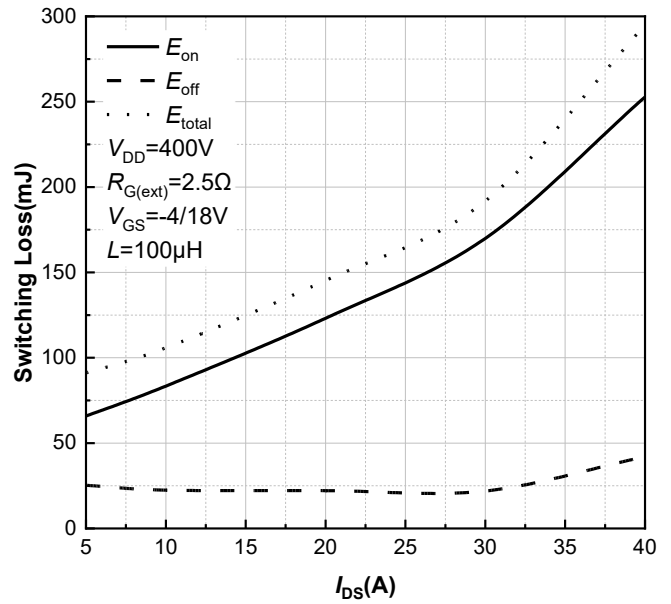


Figure 22. Clamped Inductive Switching Energy vs. Drain Current
 $T_j=175^{\circ}\text{C}$

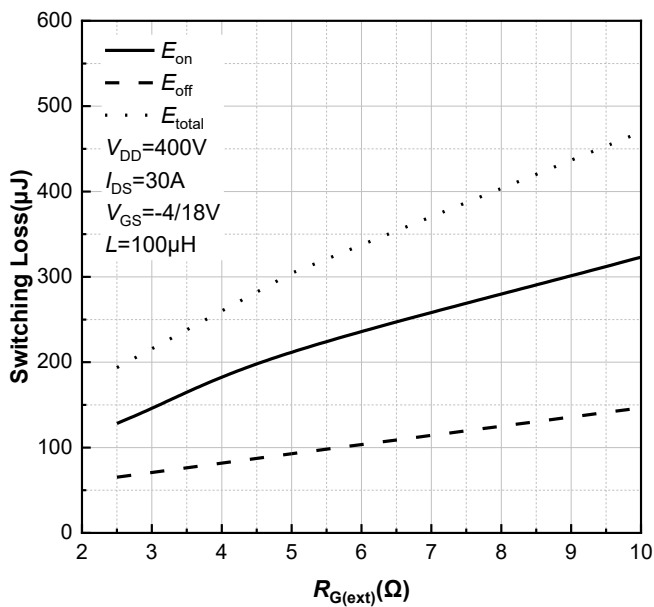


Figure 23. Clamped Inductive Switching Energy vs. $R_{G(\text{ext})}$
 $T_j=25^{\circ}\text{C}$

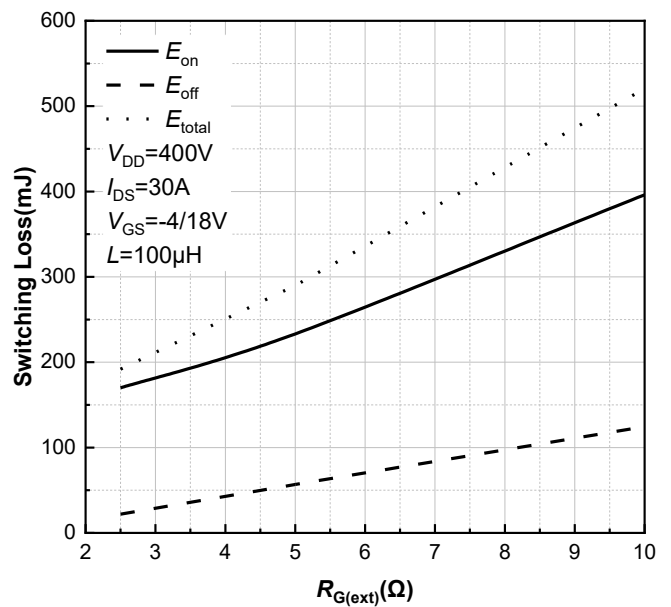


Figure 24. Clamped Inductive Switching Energy vs. $R_{G(\text{ext})}$
 $T_j=175^{\circ}\text{C}$

Typical Performance

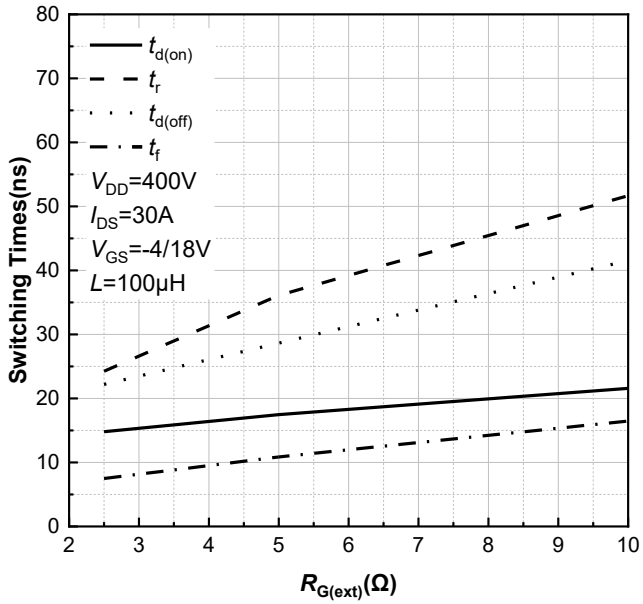


Figure 25. **Switching Times vs. $R_{G(ext)}$**
 $T_J=25^\circ C$

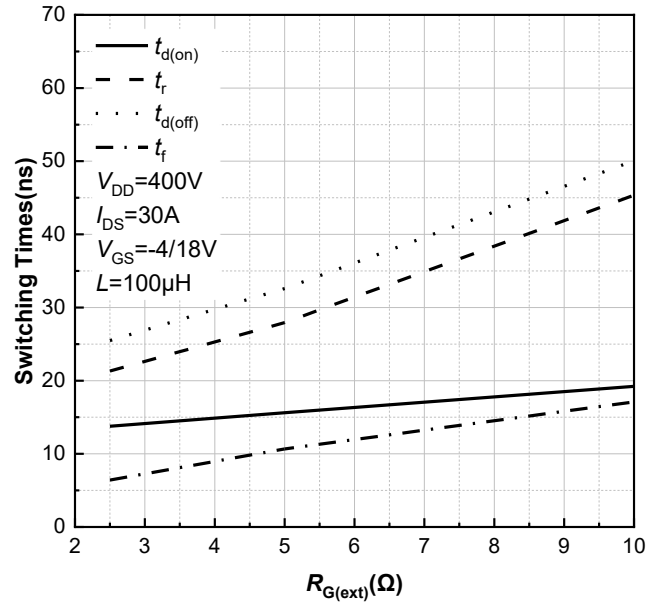


Figure 26. **Switching Times vs. $R_{G(ext)}$**
 $T_J=175^\circ C$

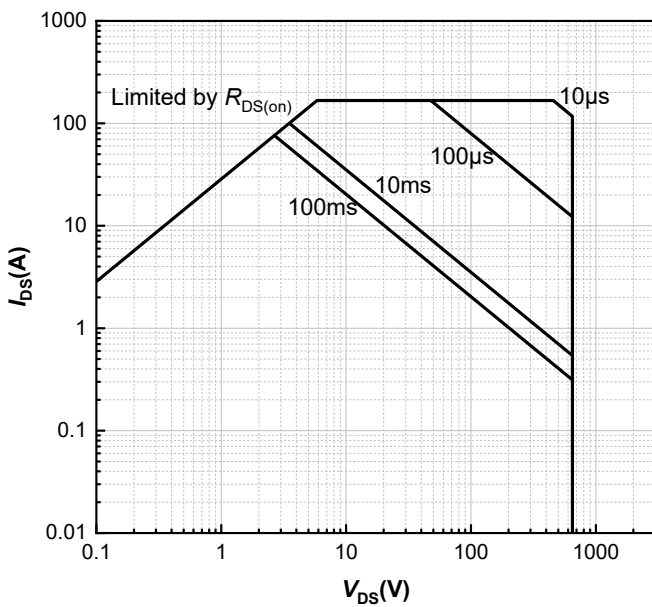
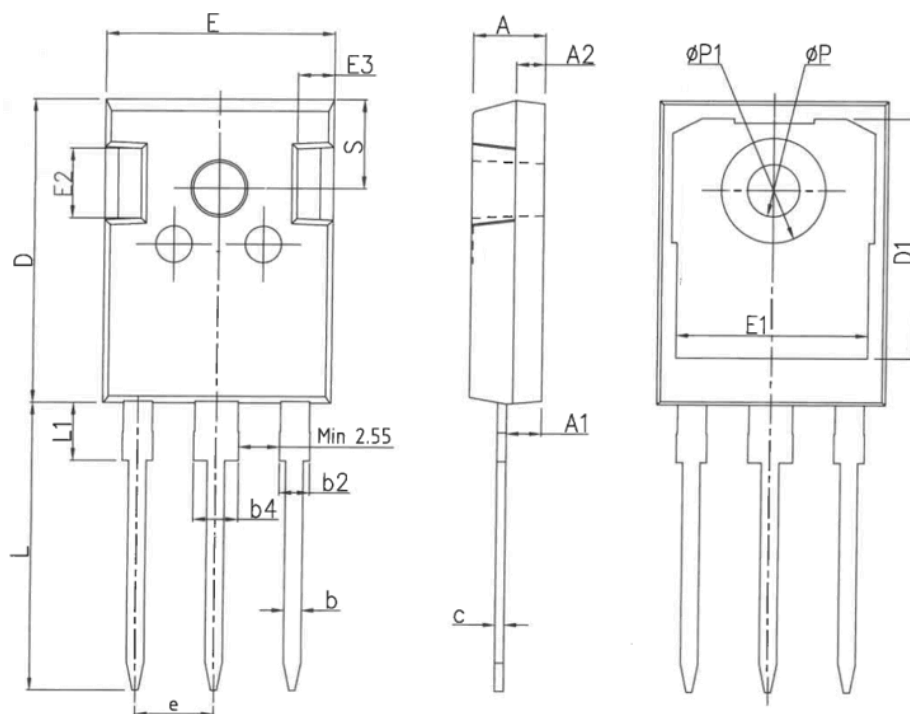


Figure 27. **Safe Operating Area**

Package Outlines



SYMBOL	Unit: mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.70	21.00	21.30
D1	16.25	16.55	16.85
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	5.44 BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
ΦP	3.40	3.60	3.80
ΦP1	-	-	7.30
S	6.15 BSC		

Revision History

Document Version	Date of Release	Description of Changes
Rev. A	2024-05-22	Release of the datasheet.
Rev. A1	2025-06-05	POD update.
Rev. A2	2025-07-01	Characteristics update.

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Information

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

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