



Features

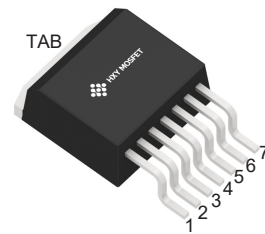
- 3rd generation SiC MOSFET technology
- Optimized package with separate driver source pin
- High blocking voltage with low on-resistance
- High-speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Q_{rr})
- Halogen free, RoHS compliant

Benefits

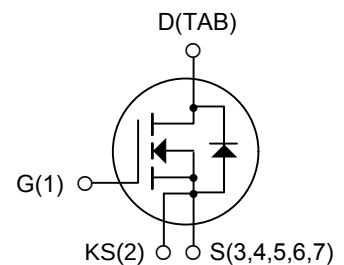
- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Reduce cooling requirements
- Increase power density
- Increase system switching frequency

Applications

- Renewable energy
- EV battery chargers
- High voltage DC/DC converters
- Switch Mode Power Supplies



TO-263-7L



Ordering Part Number	Package	Marking
HC1M40120J	TO-263-7L	HC1M40120J

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

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	1200	V
Continuous drain current $T_C = 25^\circ\text{C}$, $V_{GS} = 15\text{V}$ $T_C = 100^\circ\text{C}$, $V_{GS} = 15\text{V}$	I_D	65 46	A
Pulsed drain current ($T_C = 25^\circ\text{C}$, t_p limited by T_{jmax})	$I_{D\text{ pulse}}$	120	A
Gate-Source voltage	V_{GS}	-4/+18	V
Gate-Source voltage (Absolute maximum values)	V_{GSmax}	-8/+22	V
Power dissipation ($T_C = 25^\circ\text{C}$)	P_{tot}	326	W
Operating junction and storage temperature	T_j , T_{stg}	-40...+175	$^\circ\text{C}$

●Example of acceptable V_{GS} waveform





Thermal Resistance

Parameter	Symbol	Value	Unit
Thermal resistance, junction – case. Max	R_{thJC}	0.46	°C/W
Thermal resistance, junction – ambient. Max	R_{thJA}	40	

Electrical Characteristic (at $T_J = 25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		

Static Characteristic

Drain-source breakdown voltage	BV_{DSS}	1200	-	-	V	$V_{GS}=0V, I_D=100\mu A$
Gate threshold voltage	$V_{GS(th)}$	2.2	3	4	V	$V_{DS}=V_{GS}, I_D=10mA$
Zero gate voltage drain current	I_{DSS}	-	1	20	μA	$V_{DS}=1200V, V_{GS}=0V$ $T_C=25^\circ C$
		-	5	-		$T_C=175^\circ C$
Gate-source leakage current	I_{GSS}	-		100	nA	$V_{GS}=18V, V_{DS}=0V$
Drain-source on-state resistance	$R_{DS(on)}$	-	40	52	m Ω	$V_{GS}=15V,$ $I_D=33.3A, T_J=25^\circ C$
		-	62	-		$T_J=175^\circ C$
Drain-source on-state resistance	$R_{DS(on)}$	-	32	40	m Ω	$V_{GS}=18V,$ $I_D=33.3A, T_J=25^\circ C$
		-	59	-		$T_J=175^\circ C$
Transconductance	g_{fs}	-	20	-	S	$V_{DS}=20V, I_D=33.3A$



Dynamic Characteristic

Input Capacitance	C _{iss}	-	2766	-	pF	V _{DS} = 1000V V _{GS} = 0V T _J = 25°C V _{AC} = 25mV f = 1MHz
Output Capacitance	C _{oss}	-	125	-		
Reverse Transfer Capacitance	C _{rss}	-	14	-		
Gate Total Charge	Q _G	-	112	-	nC	V _{DS} = 800V V _{GS} = 0/15V I _D = 33.3A
Gate-Source charge	Q _{gs}	-	28	-		
Gate-Drain charge	Q _{gd}	-	51	-		
Turn-On Switching Energy	E _{ON}	-	701	-	μJ	V _{DD} = 800V V _{GS} = -4/+15V I _D = 20A R _G = 2.5Ω L = 120uH
Turn-Off Switching Energy	E _{OFF}	-	79	-		
Turn-on delay time	t _{d(on)}	-	13.4	-	ns	
Rise time	t _r	-	5.4	-		
Turn-off delay time	t _{d(off)}	-	32	-		
Fall time	t _f	-	19	-		
Gate resistance	R _G	-	0.6	-	Ω	V _{AC} = 25mV, f=1MHz

Body Diode Characteristic

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		
Body Diode Forward Voltage	V_{SD}		5.3		V	$V_{GS}=-4V, I_{SD}=20A,$ $T_J=25^\circ C$
			4.8			$V_{GS}=-4V, I_{SD}=20A,$ $T_J=175^\circ C$
Body Diode Reverse Recovery Time	t_{rr}	-	55	-	ns	$V_R = 800V$ $I_D = 33.3A$ $di/dt = 1070A/\mu S$ $T_J = 25^\circ C$
Body Diode Reverse Recovery Charge	Q_{rr}	-	288	-	nC	



Typical Performance Characteristics

Fig 1. Output Characteristic ($T_J = -55^\circ\text{C}$)

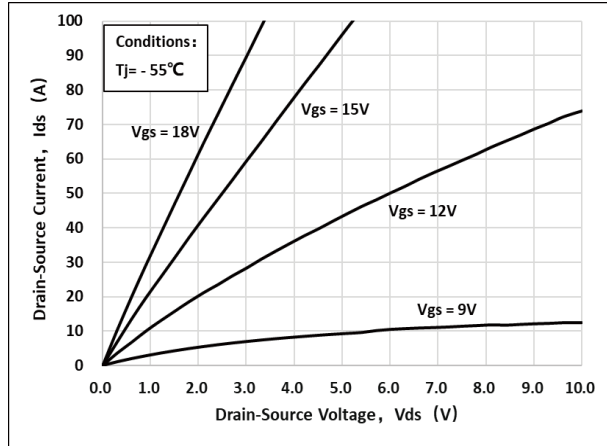


Fig 2. Output Characteristic ($T_J = 25^\circ\text{C}$)

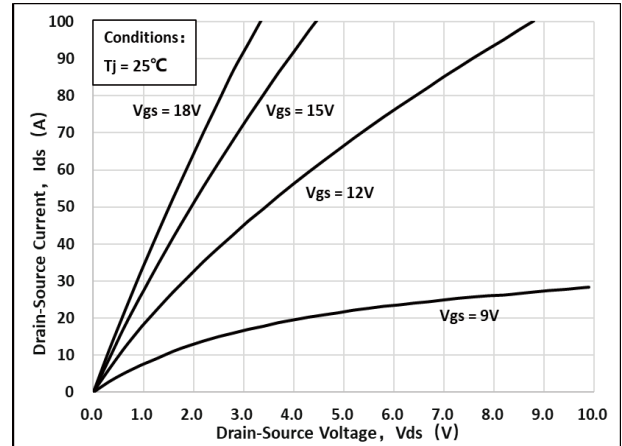


Fig 3. Output Characteristic ($T_J = 175^\circ\text{C}$)

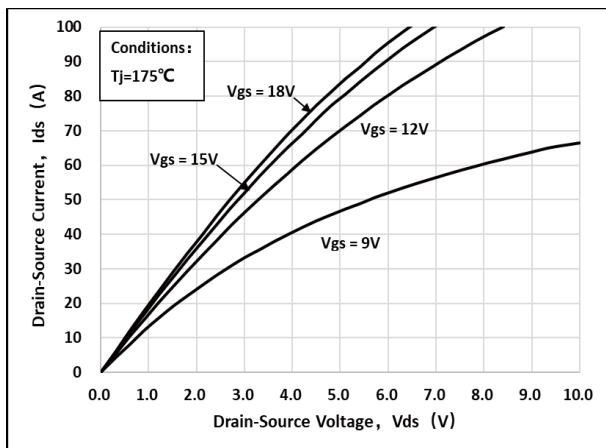


Fig 4: $R_{ds(on)}$ Vs I_{ds} Characteristic

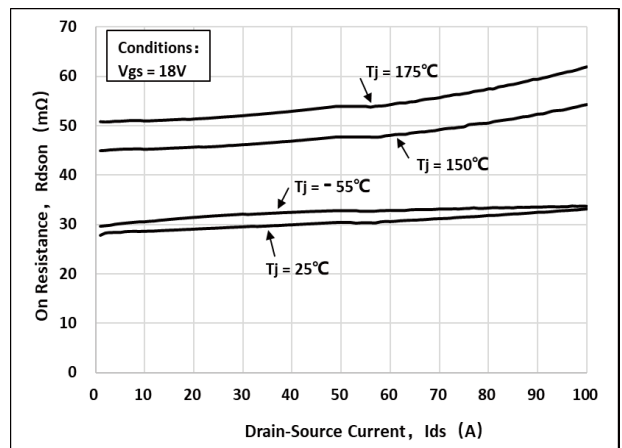


Fig 5: $R_{ds(on)}$ vs. Temperature

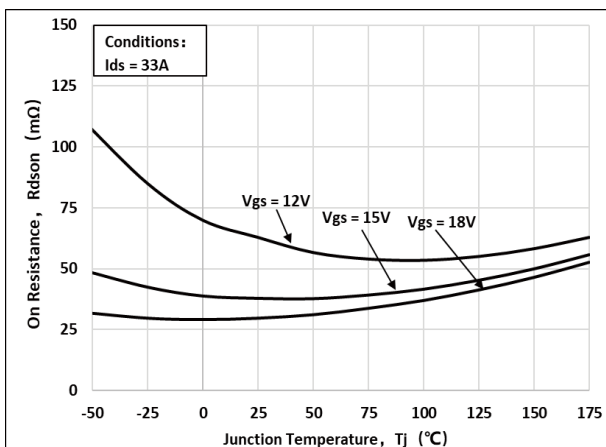


Fig 6: Transfer Characteristic

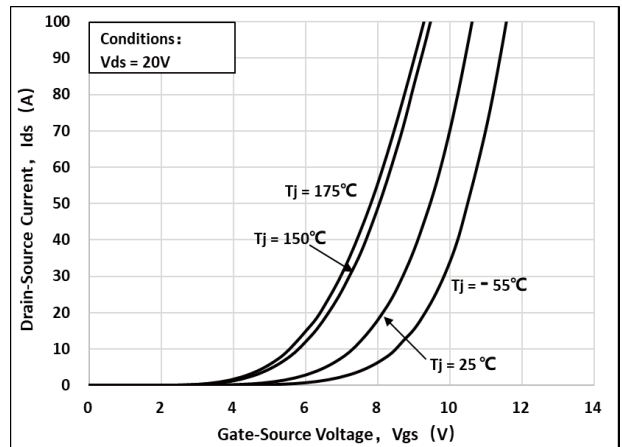




Fig 7: Body-diode Characteristic ($T_J = -55^\circ\text{C}$)

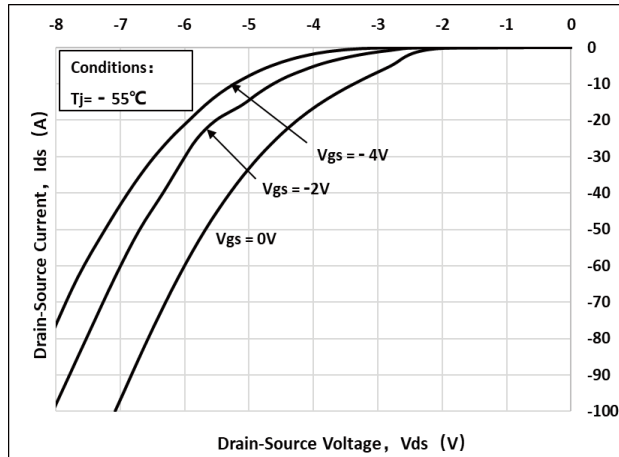


Fig 8: Body-diode Characteristic ($T_J = 25^\circ\text{C}$)

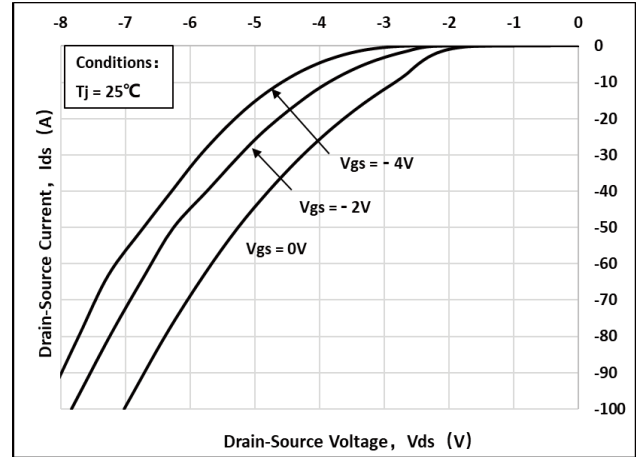


Fig 9: Body-diode Characteristic ($T_J = 175^\circ\text{C}$)

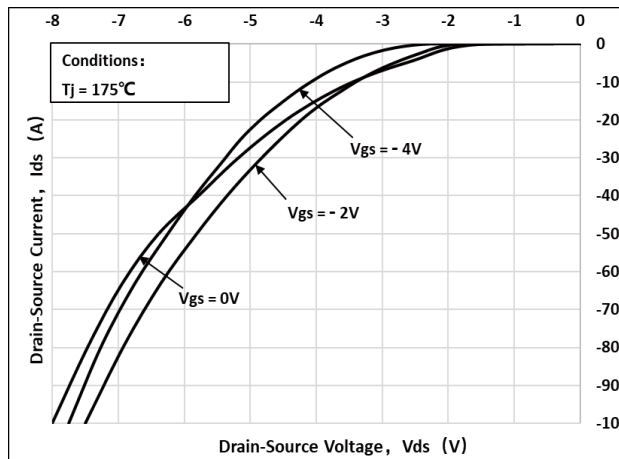


Fig 10: V_{th} Vs T_J Temperature Characteristic

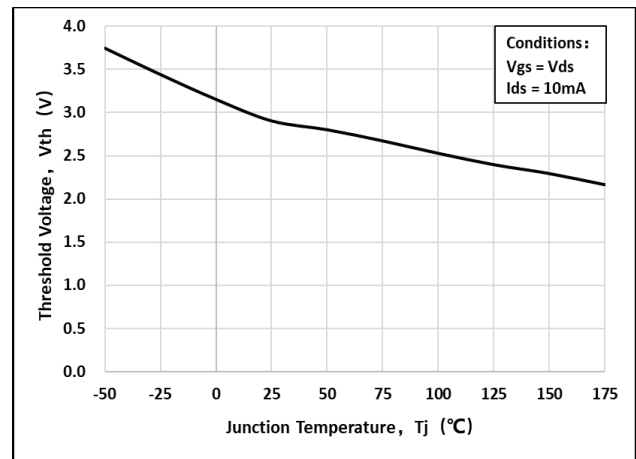


Fig 11: Gate Charge Characteristics

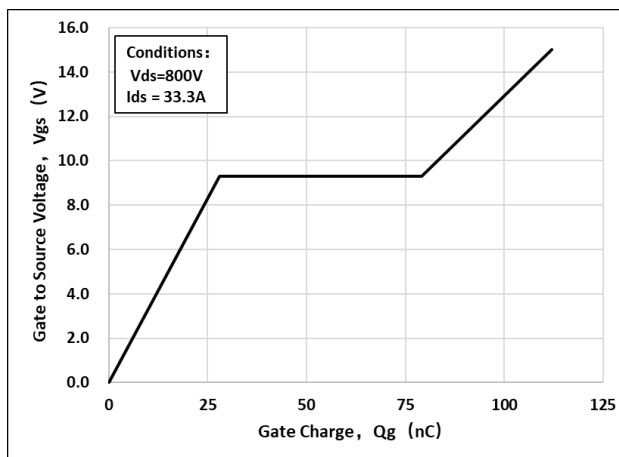


Fig 12: 3rd Quadrant Characteristic ($T_J = -55^\circ\text{C}$)

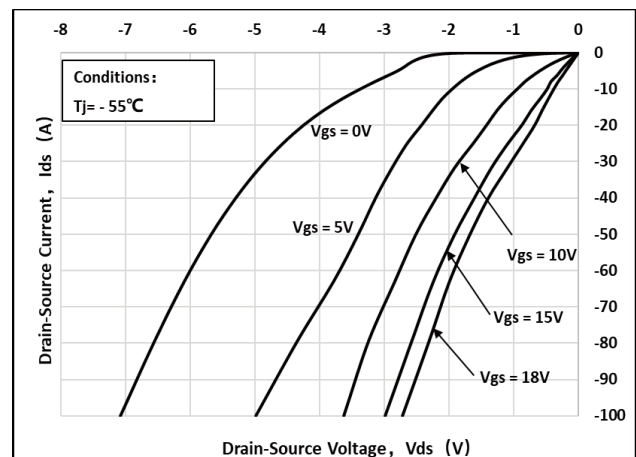




Fig 13: 3rd Quadrant Characteristic($T_J=25^{\circ}\text{C}$)

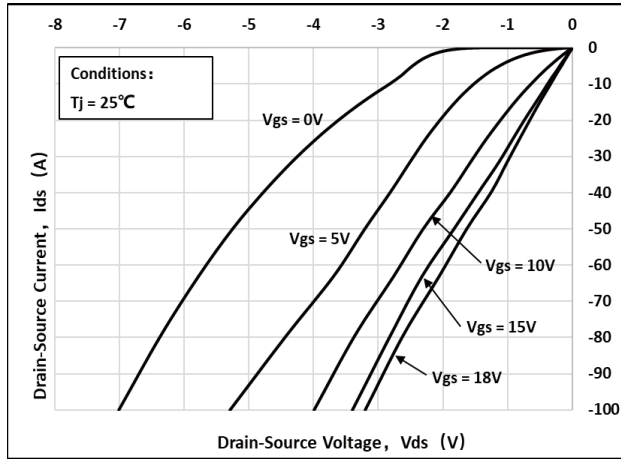


Fig 14: 3rd Quadrant Characteristic($T_J=175^{\circ}\text{C}$)

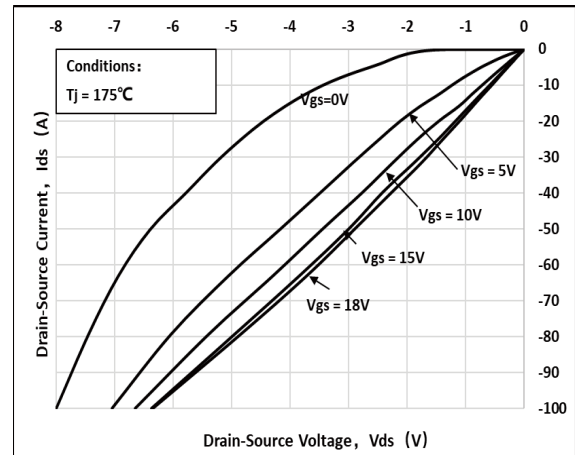


Fig 15: Capacitance Characteristic

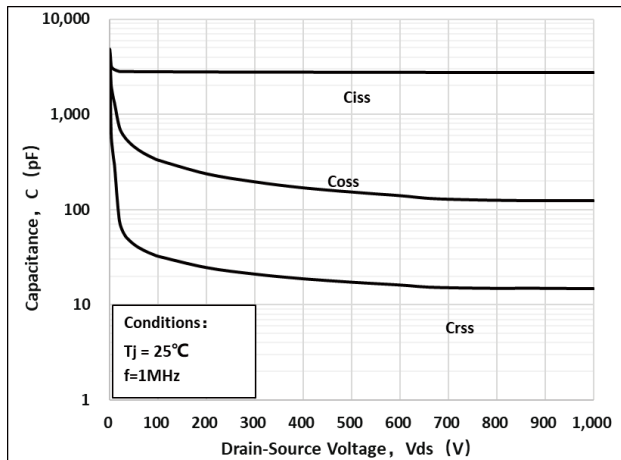


Fig 16: Safe Operating Area

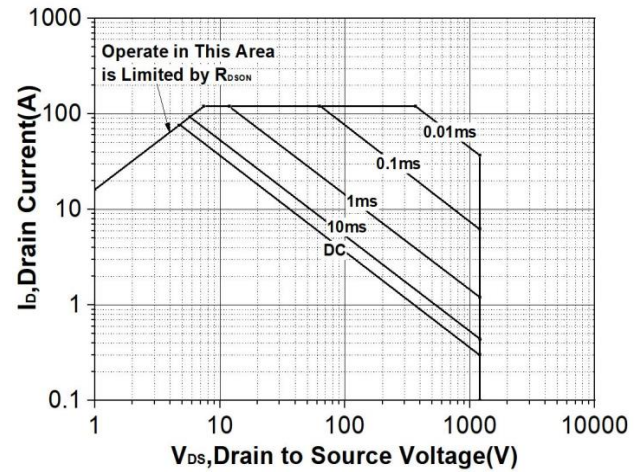
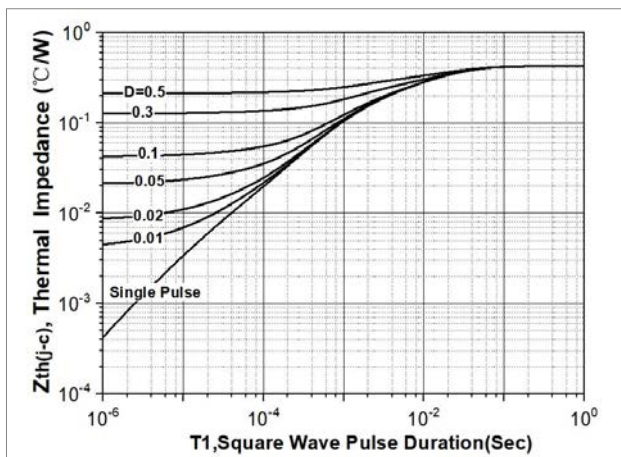


Fig 17: Transient Thermal Impedance





Test Circuit & Waveform

Figure A. Definition of switching times

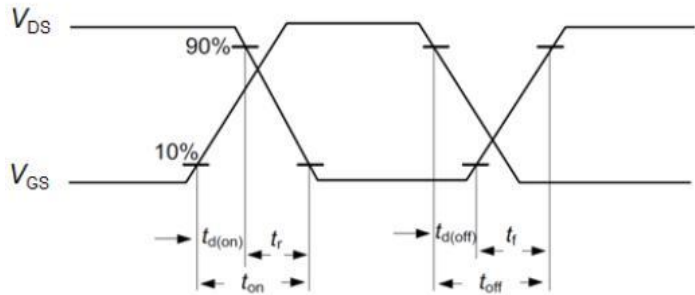


Figure B. Dynamic test circuit

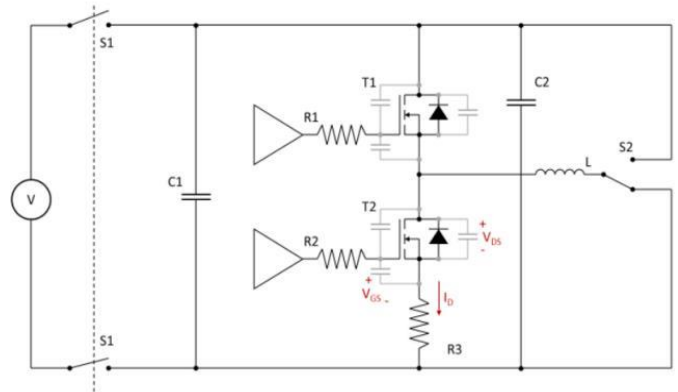


Figure C. Definition of body diode switching characteristics

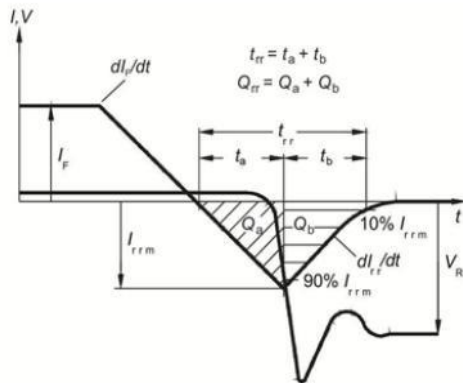
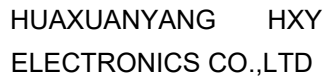
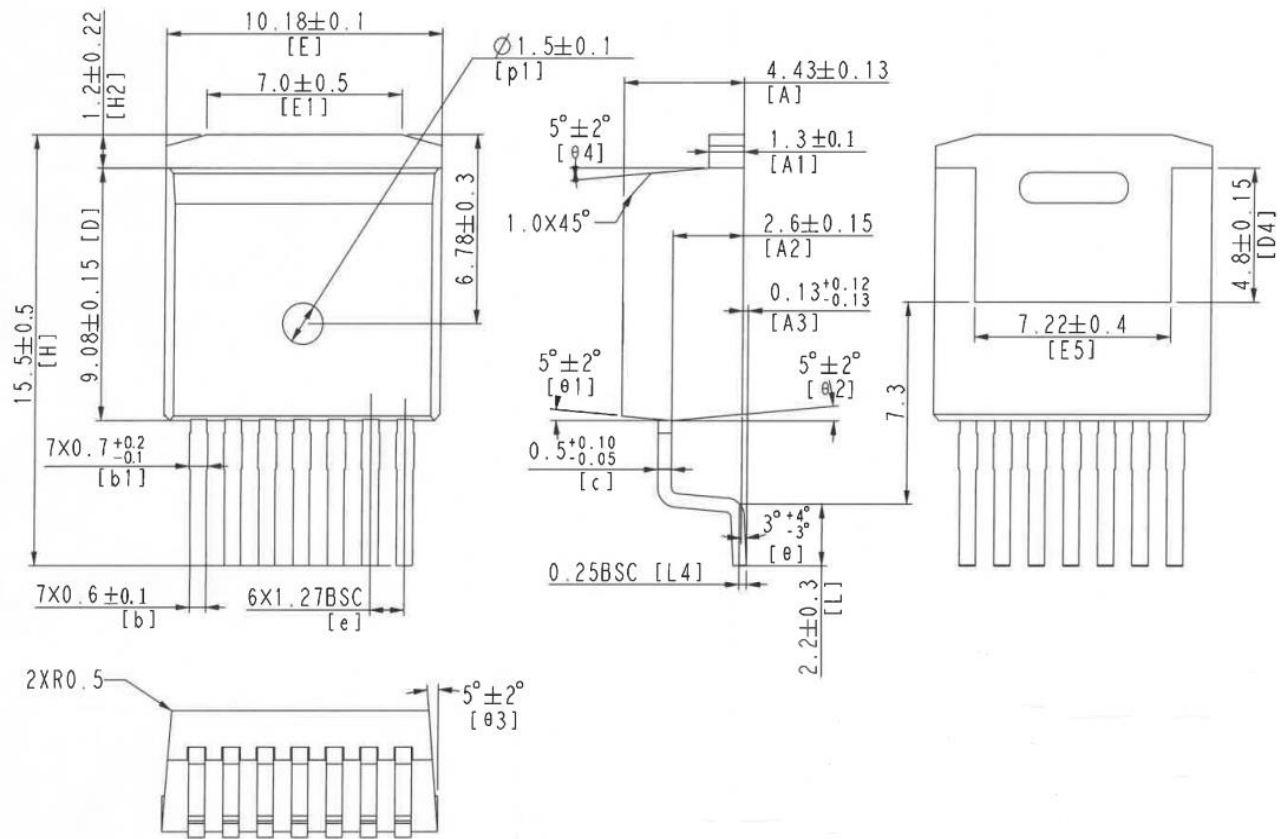


Figure C. Definition of diode switching characteristics



SiC Power MOSFET N-Channel Enhancement Mode





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