NVBG040N120SC1

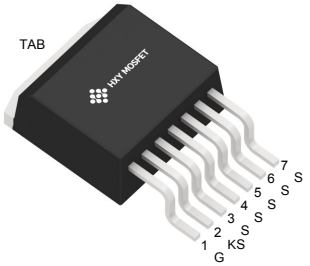
SiC Power MOSFET N-Channel Enhancement Mode

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

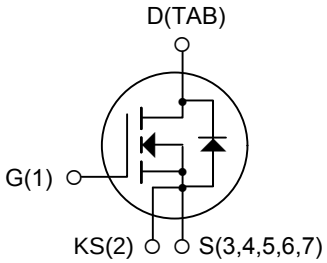
- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Reduce cooling requirements
- Increase power density
- Increase system switching frequency



TO-263-7L
Package

Applications

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



Ordering Part Number	Package	Marking
NVBG040N120SC1	TO-263-7L	HC1M40120J

Maximum Ratings (T_C = 25 ˚C unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	1200	V
Continuous drain current T_C = 25°C , V_{GS} = 15V T_C = 100°C,V_{GS}= 15V	I_D	 65 46	A
Pulsed drain current (T_C = 25°C, t_p limited by T_{jmax})	$I_{D\ pulse}$	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°C)	P_{tot}	326	W
Operating junction and storage temperature	T_j , T_{stg}	-40…+175	°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 Characteristics (at Tj = 25 °C, unless otherwise specified)

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		
Static Characteristics						
Drain-source breakdown voltage	BV_{DSS}	1200	-	-	V	V_{GS}=0V, I_D=100uA
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 5	20 -	μA	V_{DS}=1200V,V_{GS}=0V T_C=25°C T_C=175°C
Gate-source leakage current	I_{GSS}	-		100	nA	V_{GS}=18V,V_{DS}=0V
Drain-source on-state resistance	$R_{DS(on)}$	- -	40 62	52 -	mΩ	V_{GS}=15V, I_D=33.3A, T_J=25°C T_J=175°C
Drain-source on-state resistance	$R_{DS(on)}$	- -	32 59	40 -	mΩ	V_{GS}=18V, I_D=33.3A, T_J=25°C T_J=175°C
Transconductance	g_{fs}	-	20	-	S	V_{DS}=20V,I_D=33.3A

Dynamic Characteristics

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 Characteristics

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°C
			4.8			V_{GS}=-4V,I_{SD}=20A, T_J=175°C
Body Diode Reverse Recovery Time	t_{rr}	-	55	-	ns	V_R = 800V I_D = 33.3A di/dt = 1070A/μS T_J = 25°C
Body Diode Reverse Recovery Charge	Q_{rr}	-	288	-	nC	

Typical Performance Characteristics

Fig 1. Output Characteristics (T_J=-55℃)

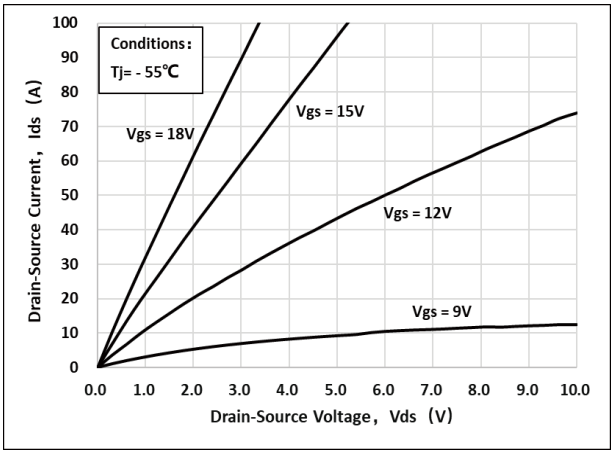


Fig 2. Output Characteristics (T_J=25℃)

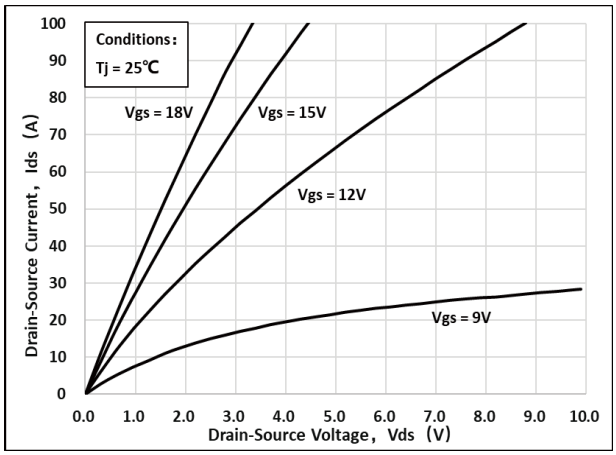


Fig 3. Output Characteristics (T_J=175℃)

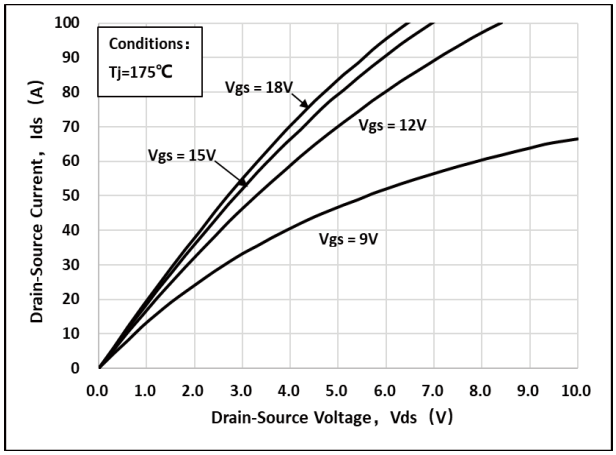


Fig 4: Rdson Vs Ids Characteristics

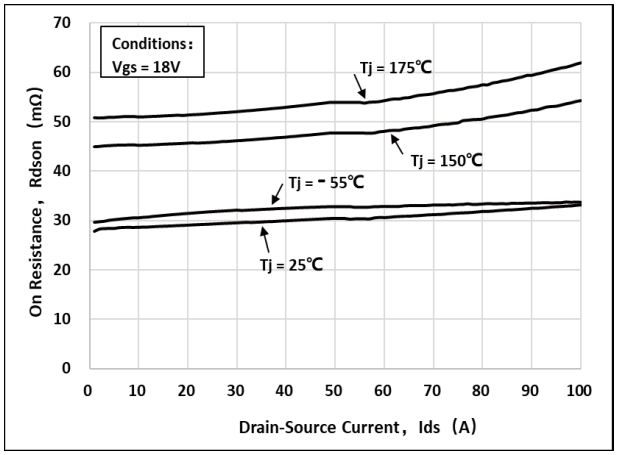


Fig 5: Rds(on) vs. Temperature

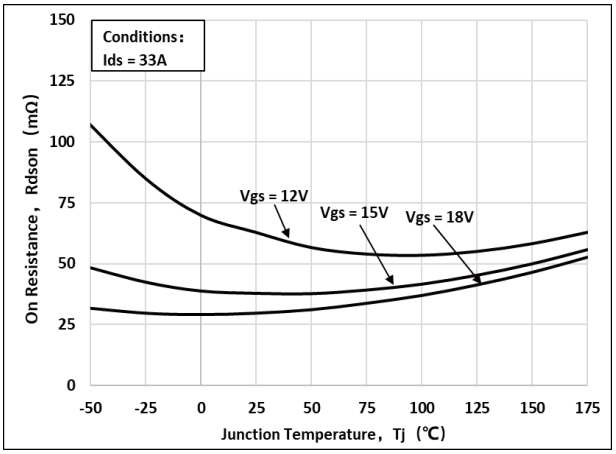


Fig 6: Transfer Characteristics

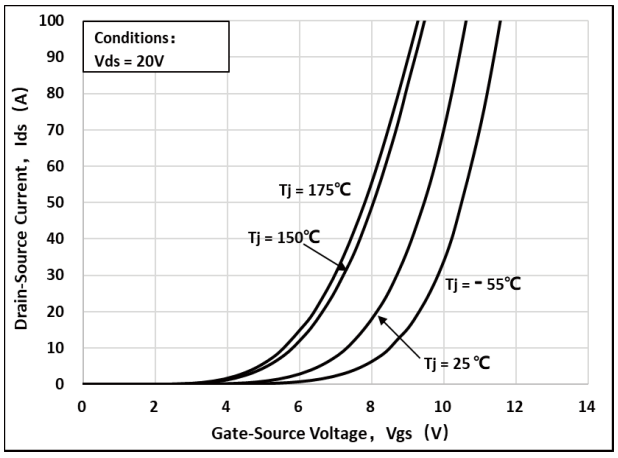


Fig 7: Body-diode Characteristics (T_J=-55℃)

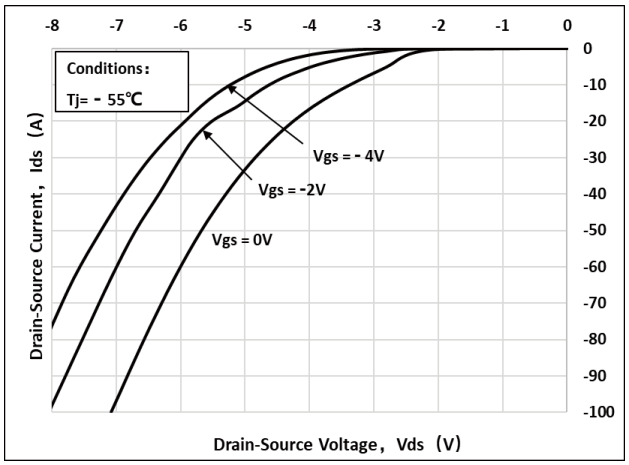


Fig 8: Body-diode Characteristics (T_J=25℃)

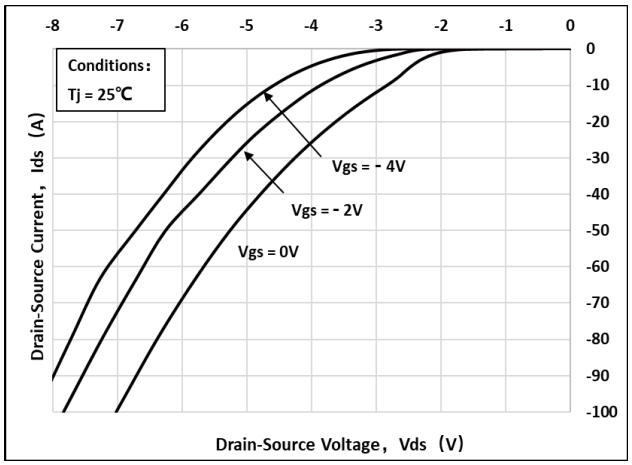


Fig 9: Body-diode Characteristics (T_J=175℃)

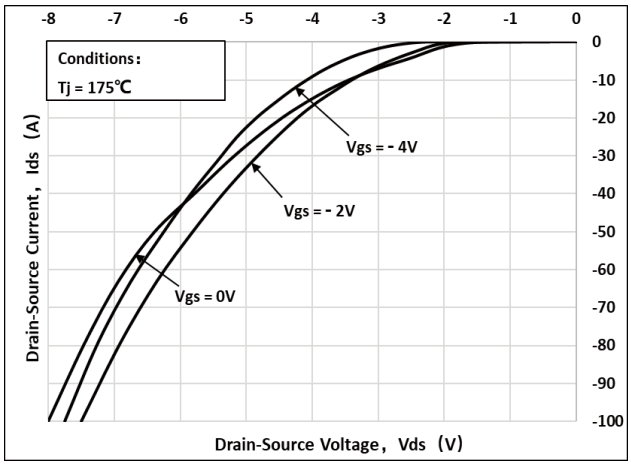


Fig 10: V_{TH} Vs T_J Temperature Characteristics

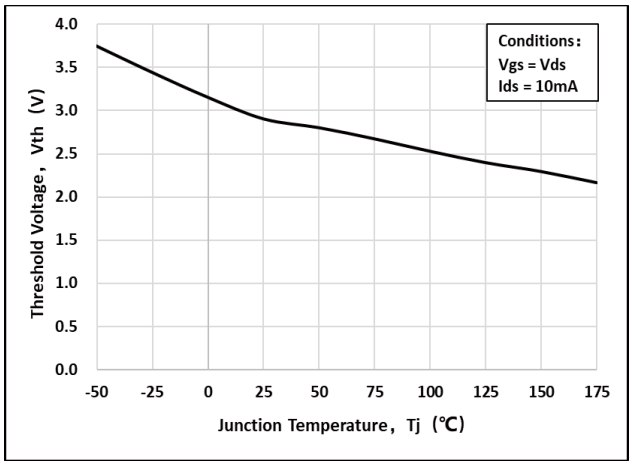


Fig 11: Gate Charge Characteristics

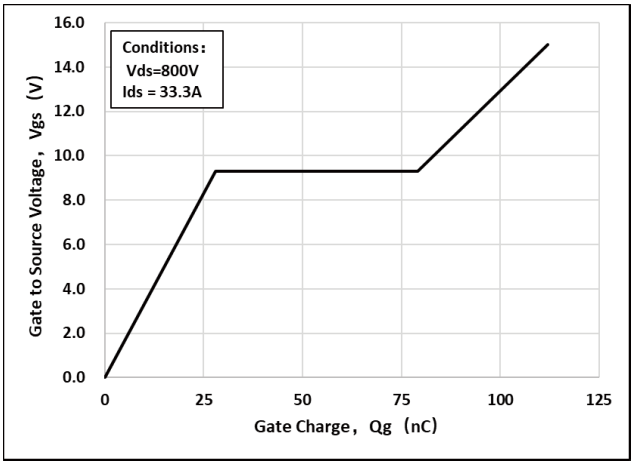


Fig 12: 3rd Quadrant Characteristics (T_J=-55℃)

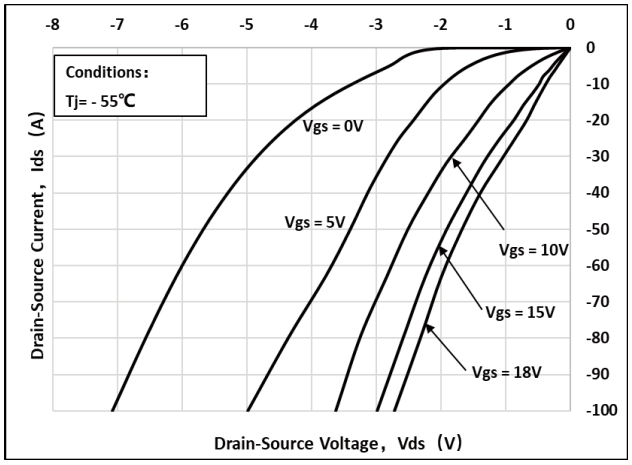


Fig 13: 3rd Quadrant Characteristics(T_J=25℃)

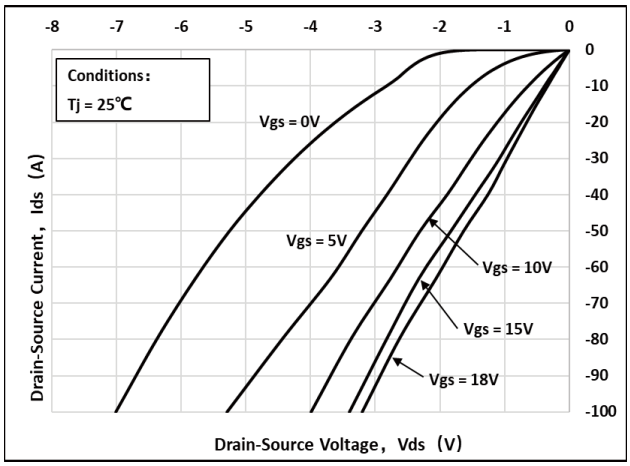


Fig 14: 3rd Quadrant Characteristics(T_J=175℃)

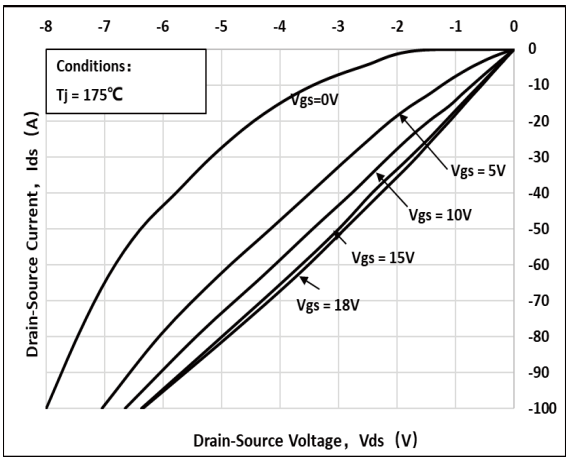


Fig 15: Capacitance Characteristics

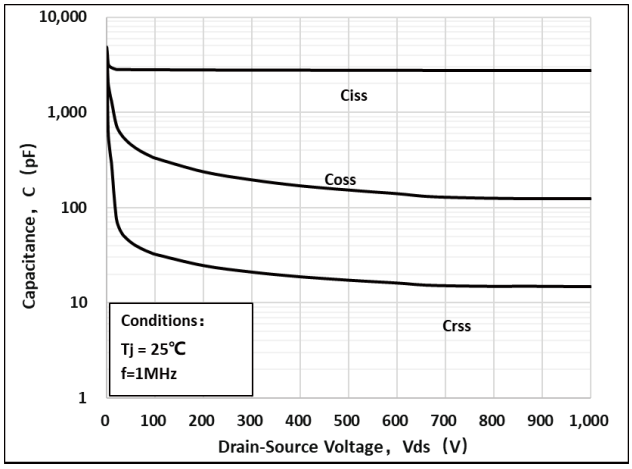


Fig 16: Safe Operating Area

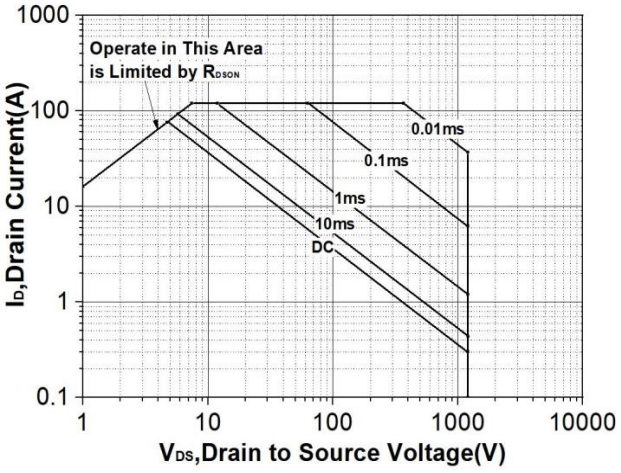
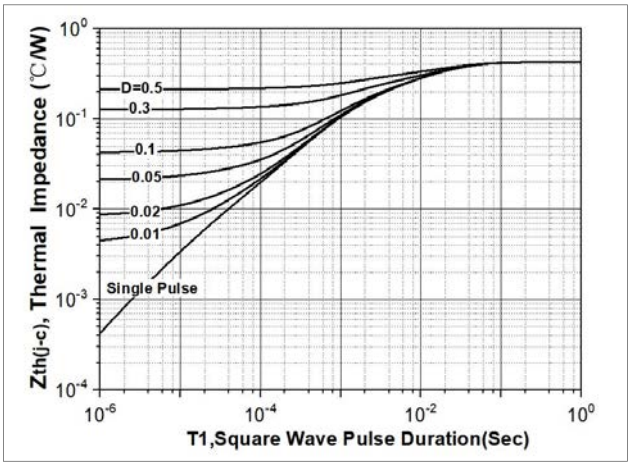


Fig 17: Transient Thermal Impedance



Test Circuit & Waveform

Figure A. Definition of switching times

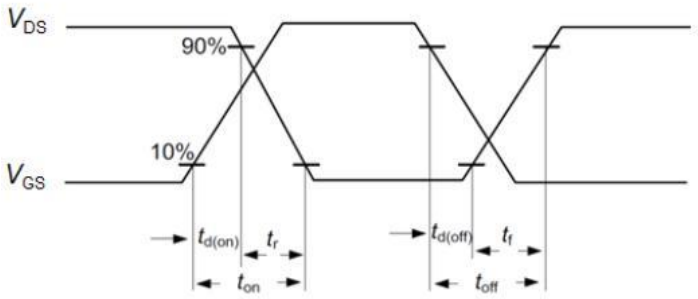


Figure B. Dynamic test circuit

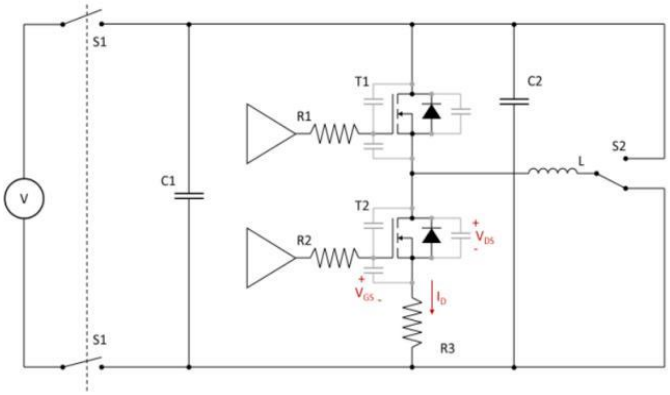


Figure C. Definition of body diode switching characteristics

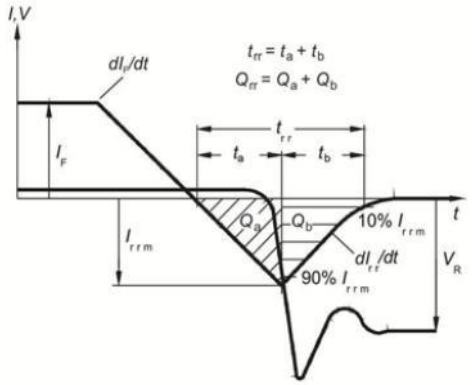
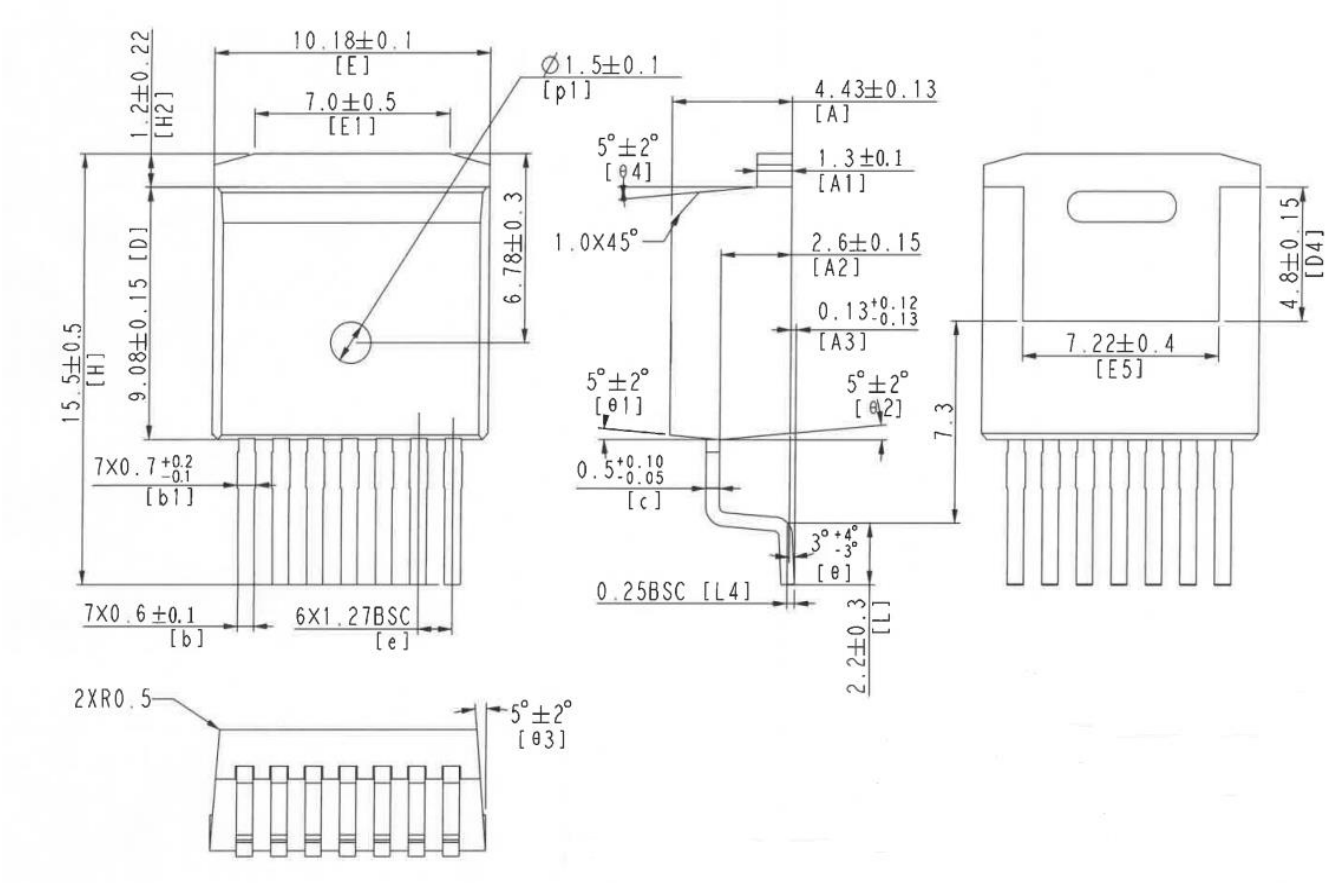


Figure C. **Definition of diode switching characteristics**

Package Dimensions

Package TO-263-7L



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