



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

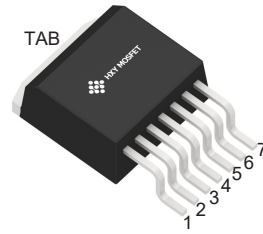
- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Reduce cooling requirements
- Increase power density
- Increase system switching frequency

Applications

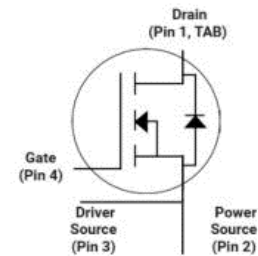
- Renewable energy
- EV battery chargers
- High voltage DC/DC converters
- Switch Mode Power Supplies



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



TO-263-7L



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 ($T_J = -55^\circ\text{C}$)

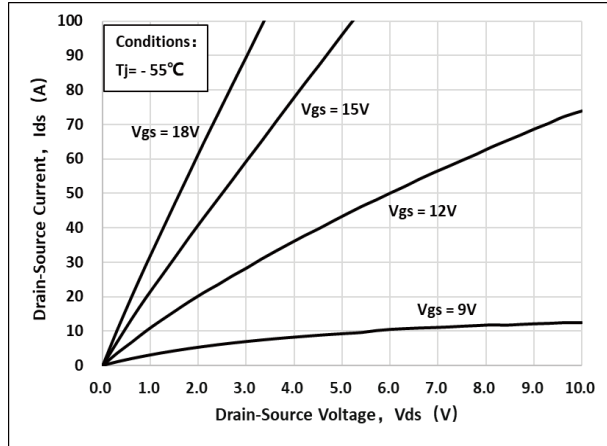


Fig 2. Output Characteristic ($T_J = 25^\circ\text{C}$)

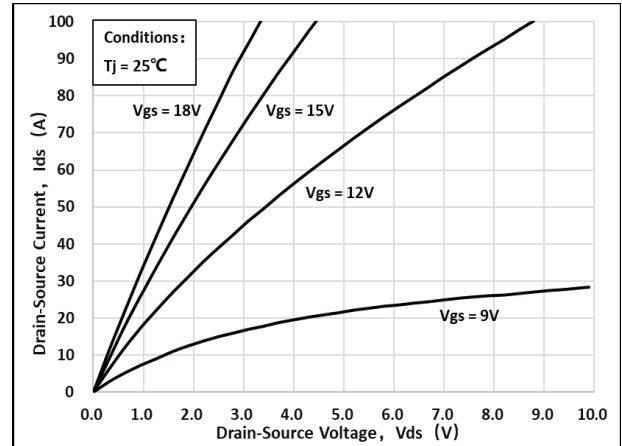


Fig 3. Output Characteristic ($T_J = 175^\circ\text{C}$)

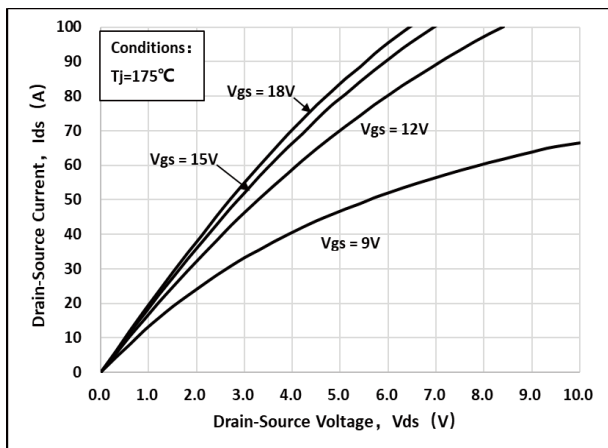


Fig 4: $R_{ds(on)}$ Vs I_{ds} Characteristic

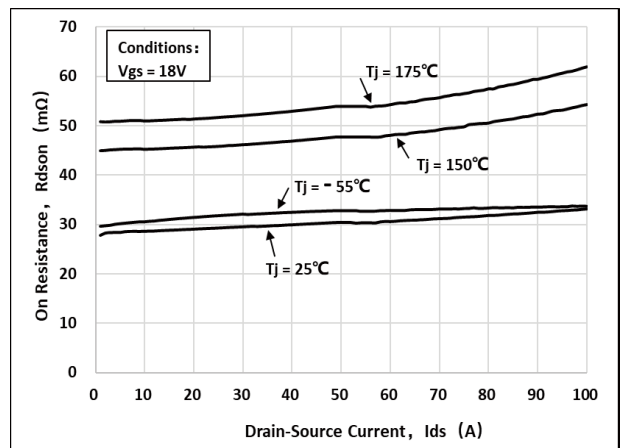


Fig 5: $R_{ds(on)}$ vs. Temperature

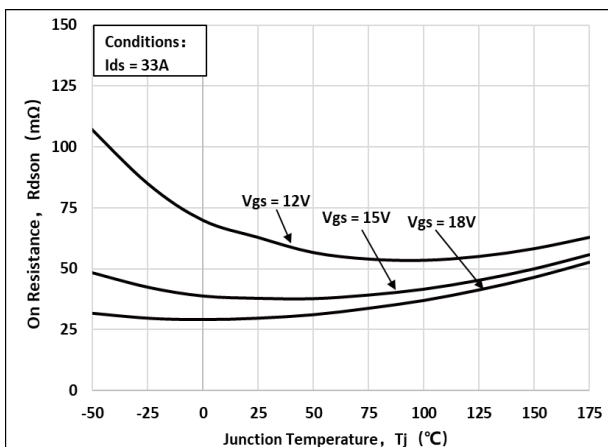


Fig 6: Transfer Characteristic

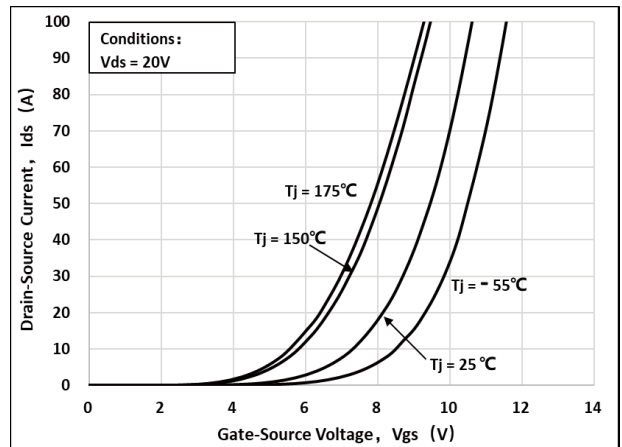




Fig 7: Body-diode Characteristic ($T_J = -55^\circ\text{C}$)

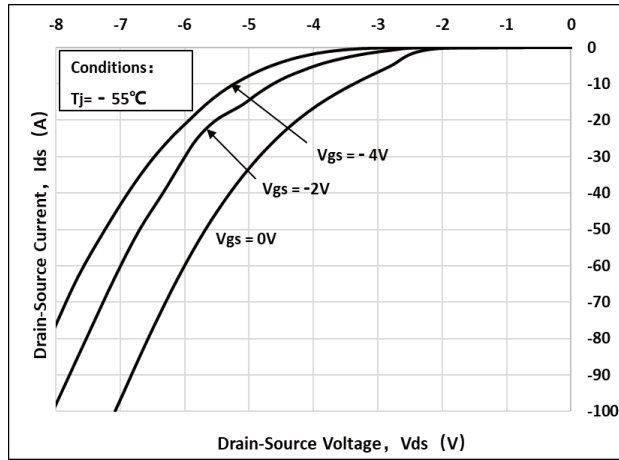


Fig 8: Body-diode Characteristic ($T_J = 25^\circ\text{C}$)

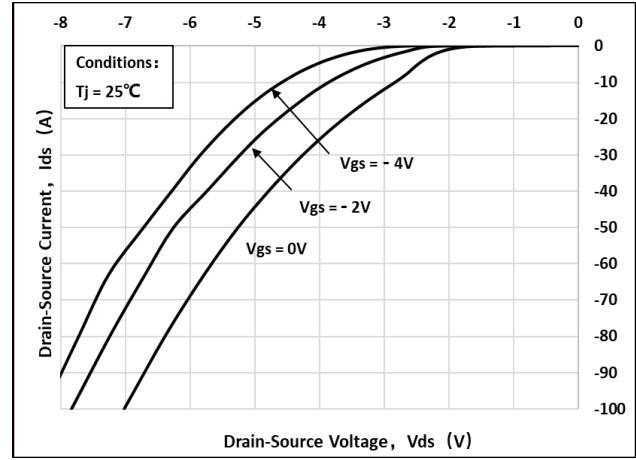


Fig 9: Body-diode Characteristic ($T_J = 175^\circ\text{C}$)

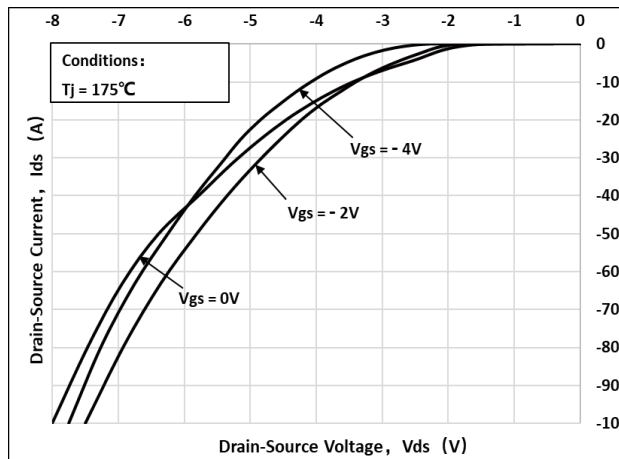


Fig 10: V_{th} Vs T_J Temperature Characteristic

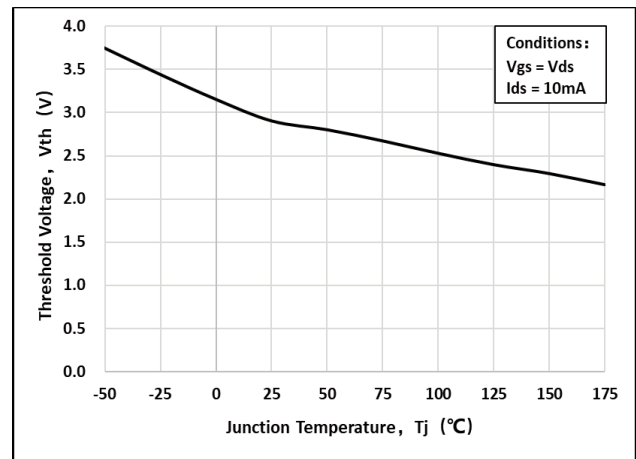


Fig 11: Gate Charge Characteristics

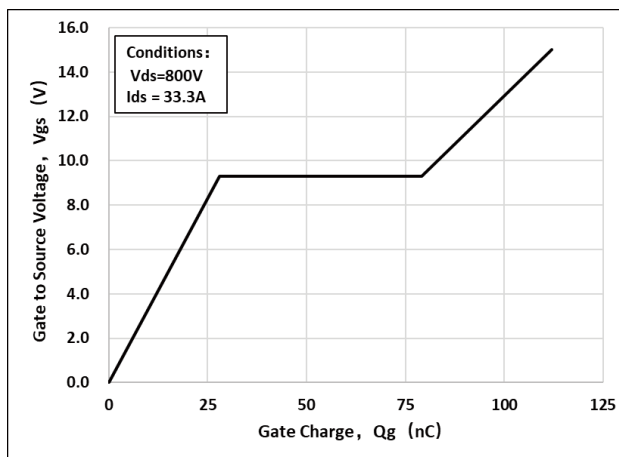


Fig 12: 3rd Quadrant Characteristic ($T_J = -55^\circ\text{C}$)

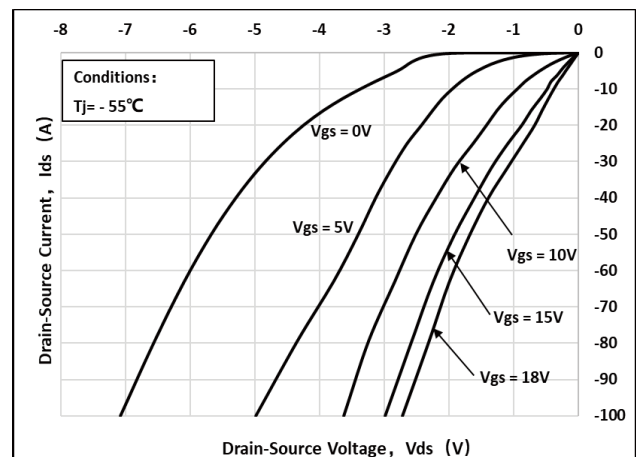




Fig 13: 3rd Quadrant Characteristic($T_J=25^{\circ}\text{C}$)

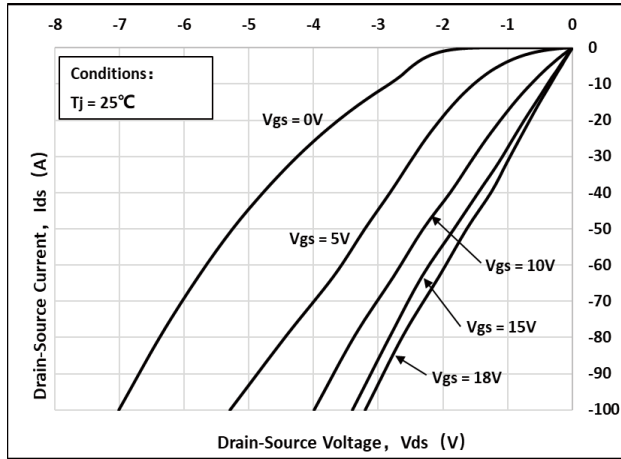


Fig 14: 3rd Quadrant Characteristic($T_J=175^{\circ}\text{C}$)

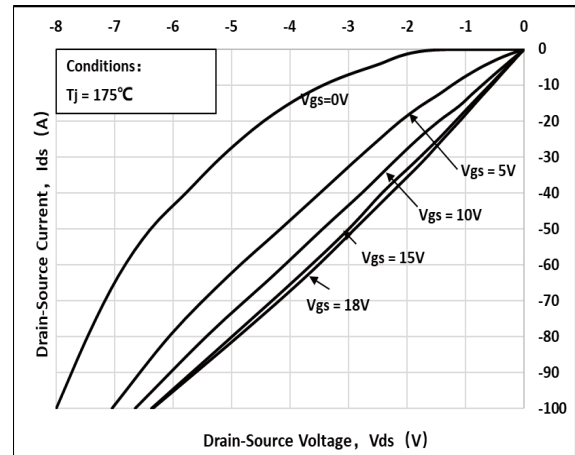


Fig 15: Capacitance Characteristic

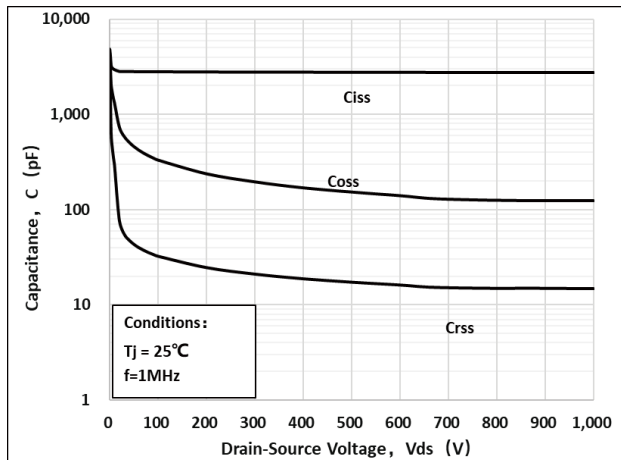


Fig 16: Safe Operating Area

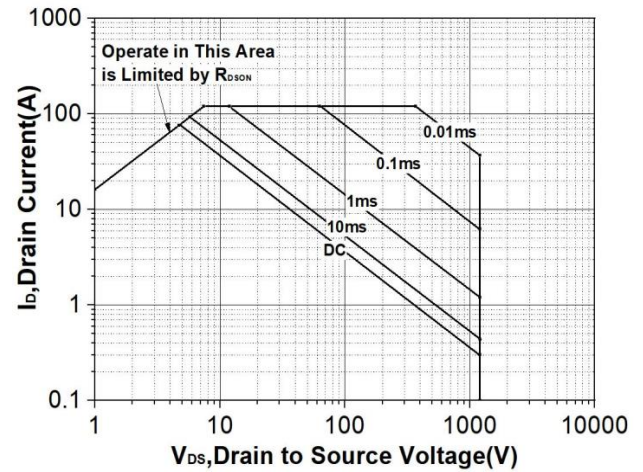
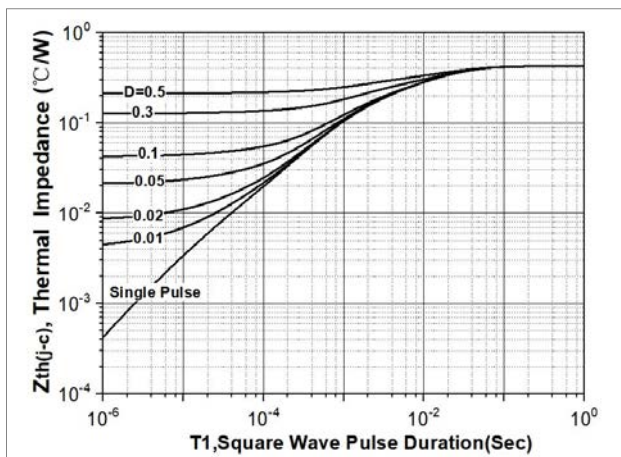


Fig 17: Transient Thermal Impedance





Test Circuit & Waveform

Figure A. Definition of switching times

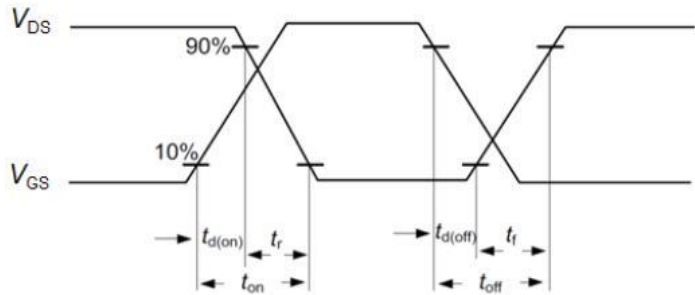


Figure B. Dynamic test circuit

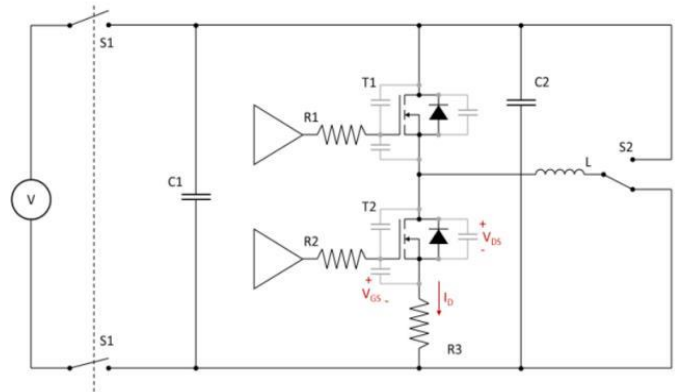


Figure C. Definition of body diode switching characteristics

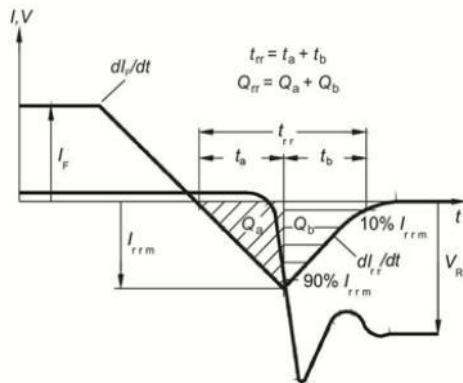
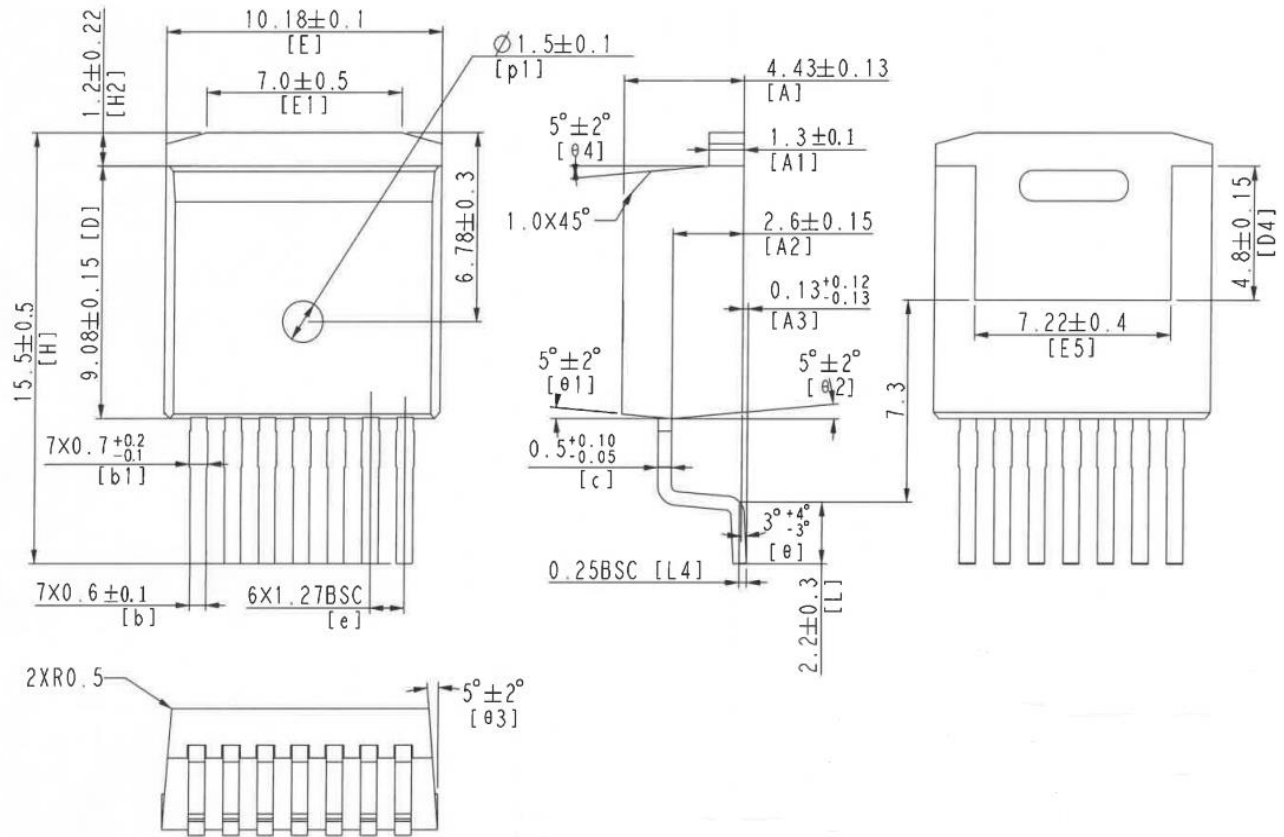


Figure C. Definition of diode switching characteristics

Package

Dimensions

Package TO-263-7L





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