



## 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

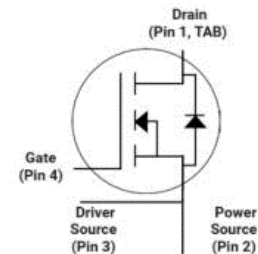
- Renewable energy
- EV battery chargers
- High voltage DC/DC converters
- Switch Mode Power Supplies



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



TO-263-7L  
Package



## 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	$\mu A$	$V_{DS}=1200V, V_{GS}=0V$ $T_C=25^\circ C$
		-	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 $\Omega$	$V_{GS}=15V,$ $I_D=33.3A, T_J=25^\circ C$
		-	62	-		$T_J=175^\circ C$
Drain-source on-state resistance	$R_{DS(on)}$	-	32	40	m $\Omega$	$V_{GS}=18V,$ $I_D=33.3A, T_J=25^\circ C$
		-	59	-		$T_J=175^\circ C$
Transconductance	$g_{fs}$	-	20	-	S	$V_{DS}=20V, I_D=33.3A$



## Dynamic Characteristic

Input Capacitance	C <sub>iss</sub>	-	2766	-	pF	V <sub>DS</sub> = 1000V V <sub>GS</sub> = 0V T <sub>J</sub> = 25°C V <sub>AC</sub> = 25mV f = 1MHz
Output Capacitance	C <sub>oss</sub>	-	125	-		
Reverse Transfer Capacitance	C <sub>rss</sub>	-	14	-		
Gate Total Charge	Q <sub>G</sub>	-	112	-	nC	V <sub>DS</sub> = 800V V <sub>GS</sub> = 0/15V I <sub>D</sub> = 33.3A
Gate-Source charge	Q <sub>gs</sub>	-	28	-		
Gate-Drain charge	Q <sub>gd</sub>	-	51	-		
Turn-On Switching Energy	E <sub>ON</sub>	-	701	-	μJ	V <sub>DD</sub> = 800V V <sub>GS</sub> = -4/+15V I <sub>D</sub> = 20A R <sub>G</sub> = 2.5Ω L = 120uH
Turn-Off Switching Energy	E <sub>OFF</sub>	-	79	-		
Turn-on delay time	t <sub>d(on)</sub>	-	13.4	-	ns	
Rise time	t <sub>r</sub>	-	5.4	-		
Turn-off delay time	t <sub>d(off)</sub>	-	32	-		
Fall time	t <sub>f</sub>	-	19	-		
Gate resistance	R <sub>G</sub>	-	0.6	-	Ω	V <sub>AC</sub> = 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 ( $T_J = -55^\circ\text{C}$ )

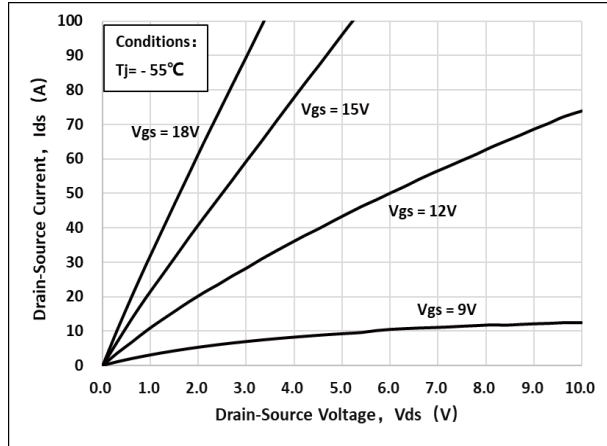


Fig 2. Output Characteristic ( $T_J = 25^\circ\text{C}$ )

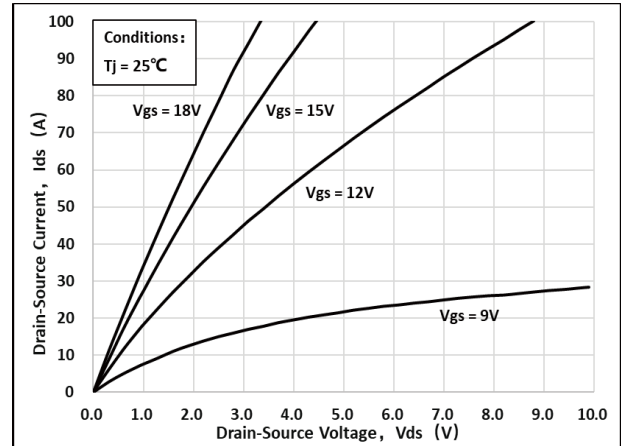


Fig 3. Output Characteristic ( $T_J = 175^\circ\text{C}$ )

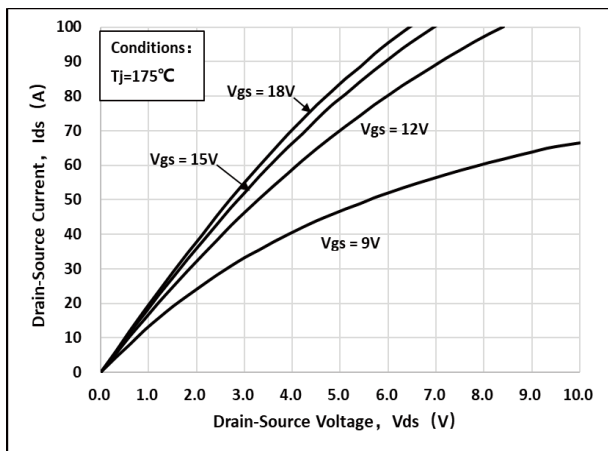


Fig 4:  $R_{ds(on)}$  Vs  $I_{ds}$  Characteristic

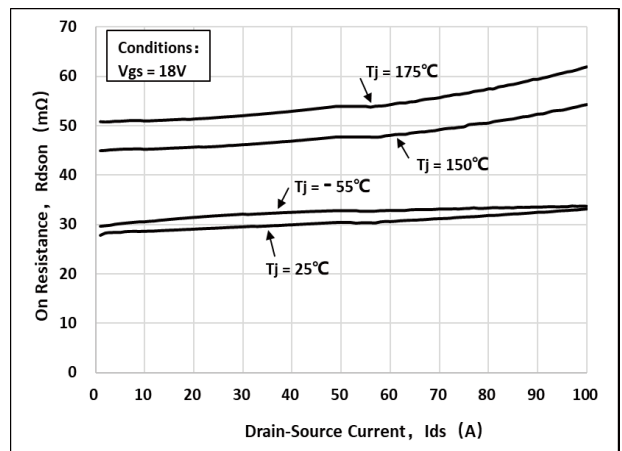


Fig 5:  $R_{ds(on)}$  vs. Temperature

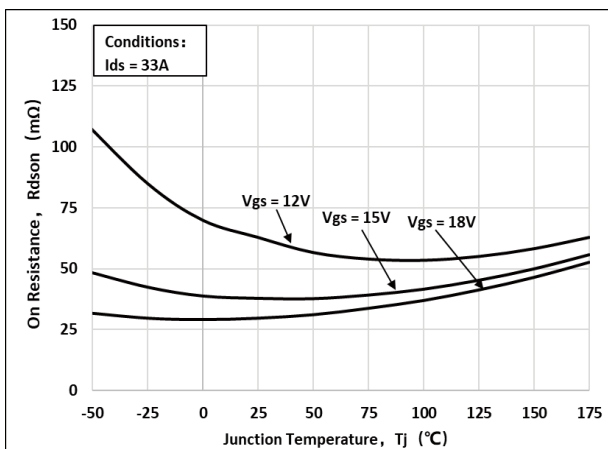


Fig 6: Transfer Characteristic

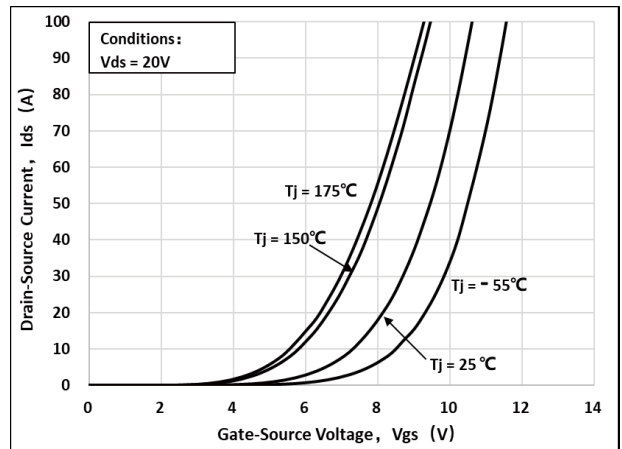




Fig 7: Body-diode Characteristic ( $T_J = -55^\circ\text{C}$ )

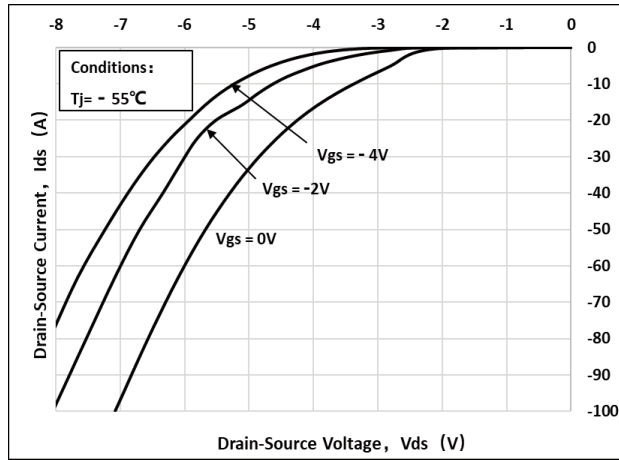


Fig 8: Body-diode Characteristic ( $T_J = 25^\circ\text{C}$ )

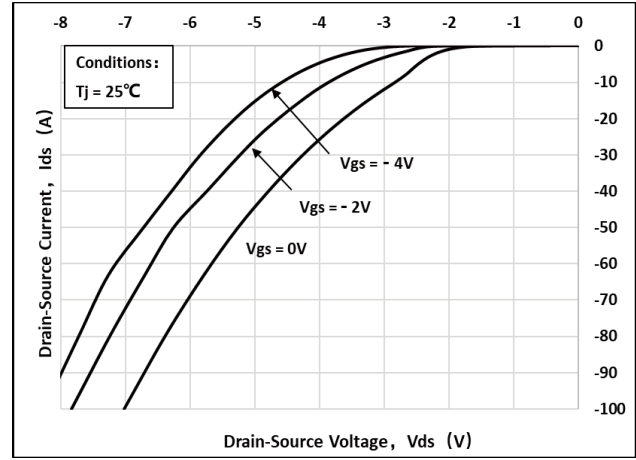


Fig 9: Body-diode Characteristic ( $T_J = 175^\circ\text{C}$ )

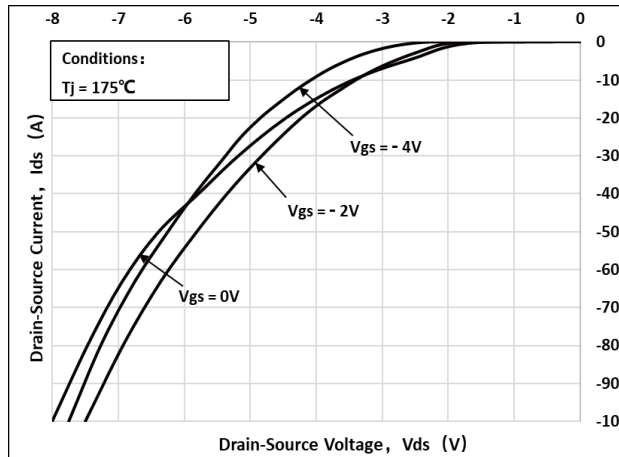


Fig 10:  $V_{th}$  Vs  $T_J$  Temperature Characteristic

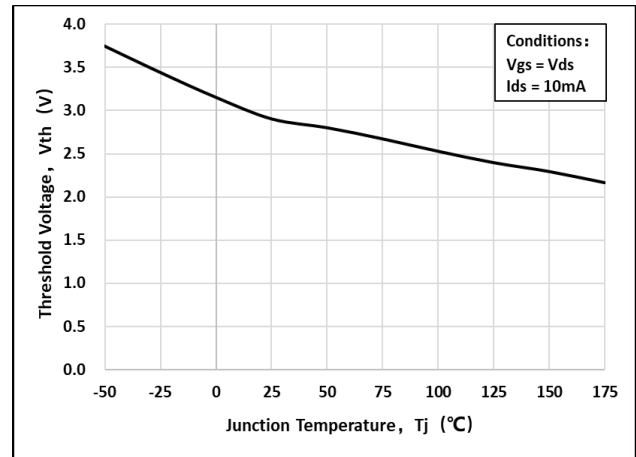


Fig 11: Gate Charge Characteristics

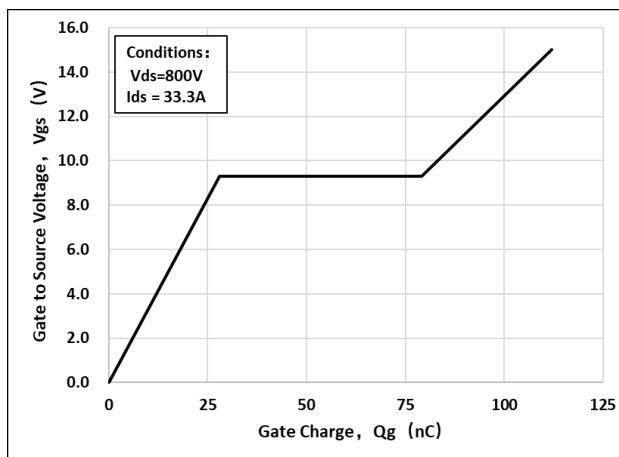


Fig 12: 3rd Quadrant Characteristic ( $T_J = -55^\circ\text{C}$ )

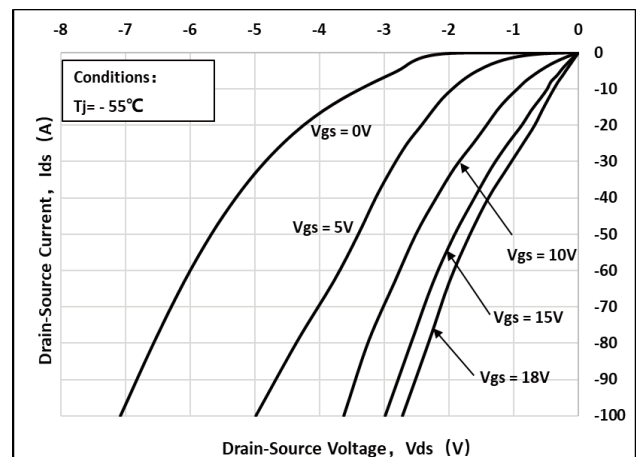




Fig 13: 3rd Quadrant Characteristic( $T_J=25^\circ\text{C}$ )

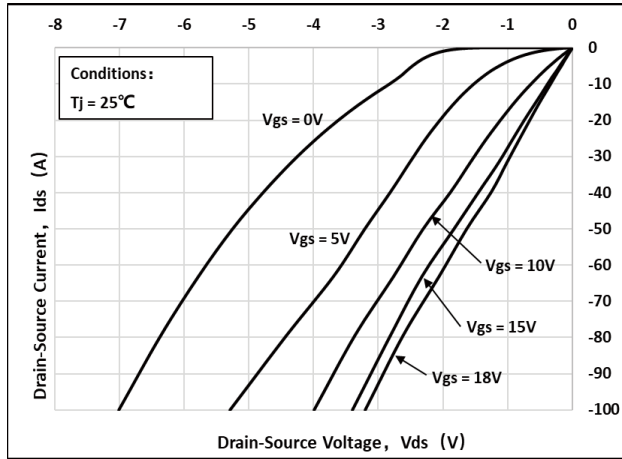


Fig 14: 3rd Quadrant Characteristic( $T_J=175^\circ\text{C}$ )

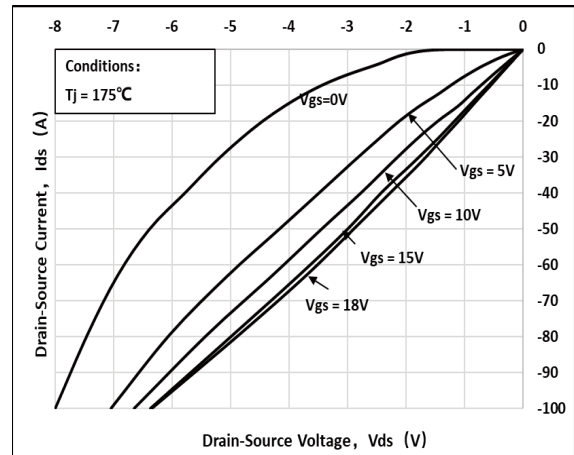


Fig 15: Capacitance Characteristic

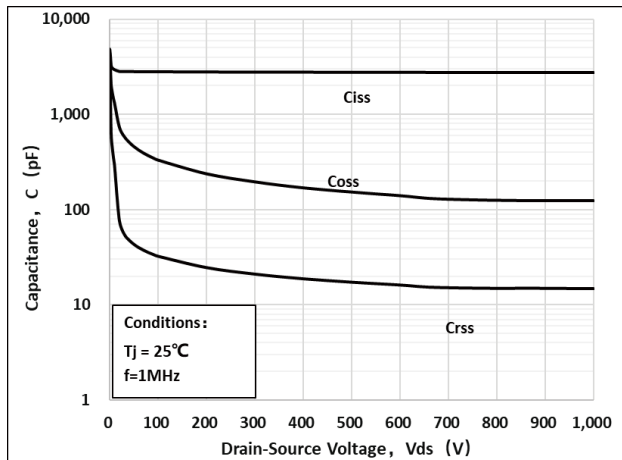


Fig 16: Safe Operating Area

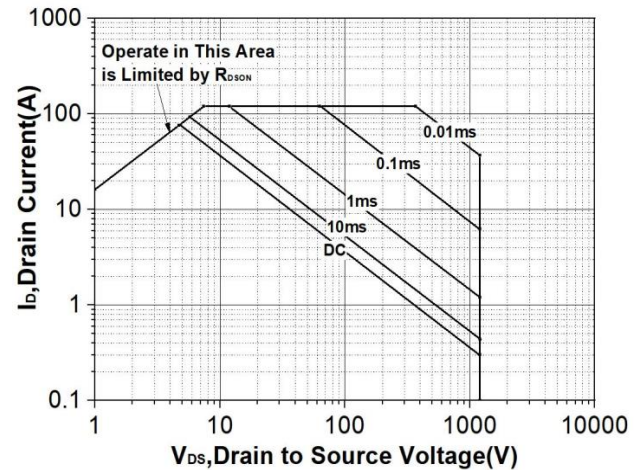
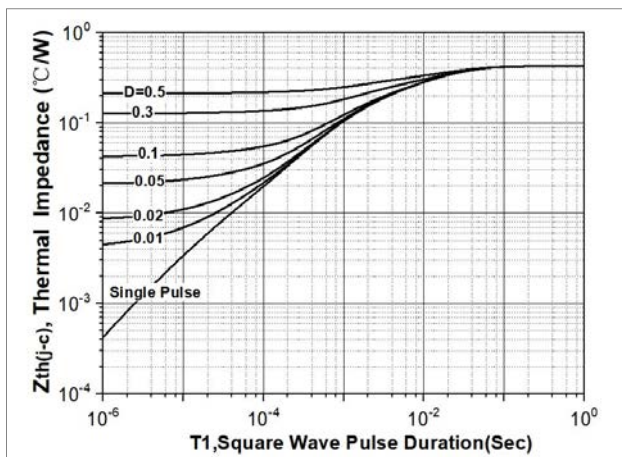


Fig 17: Transient Thermal Impedance





## Test Circuit & Waveform

Figure A. Definition of switching times

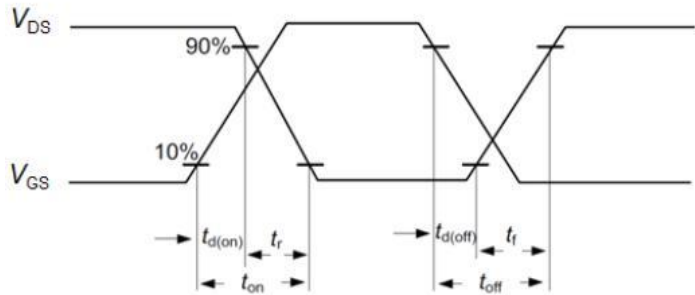


Figure B. Dynamic test circuit

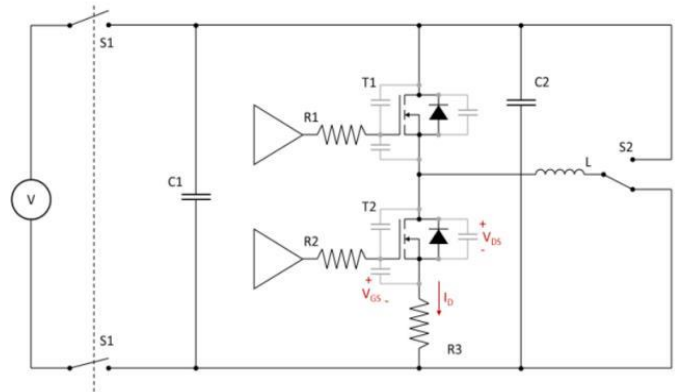


Figure C. Definition of body diode switching characteristics

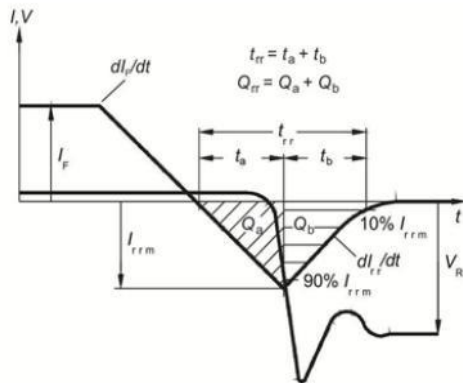


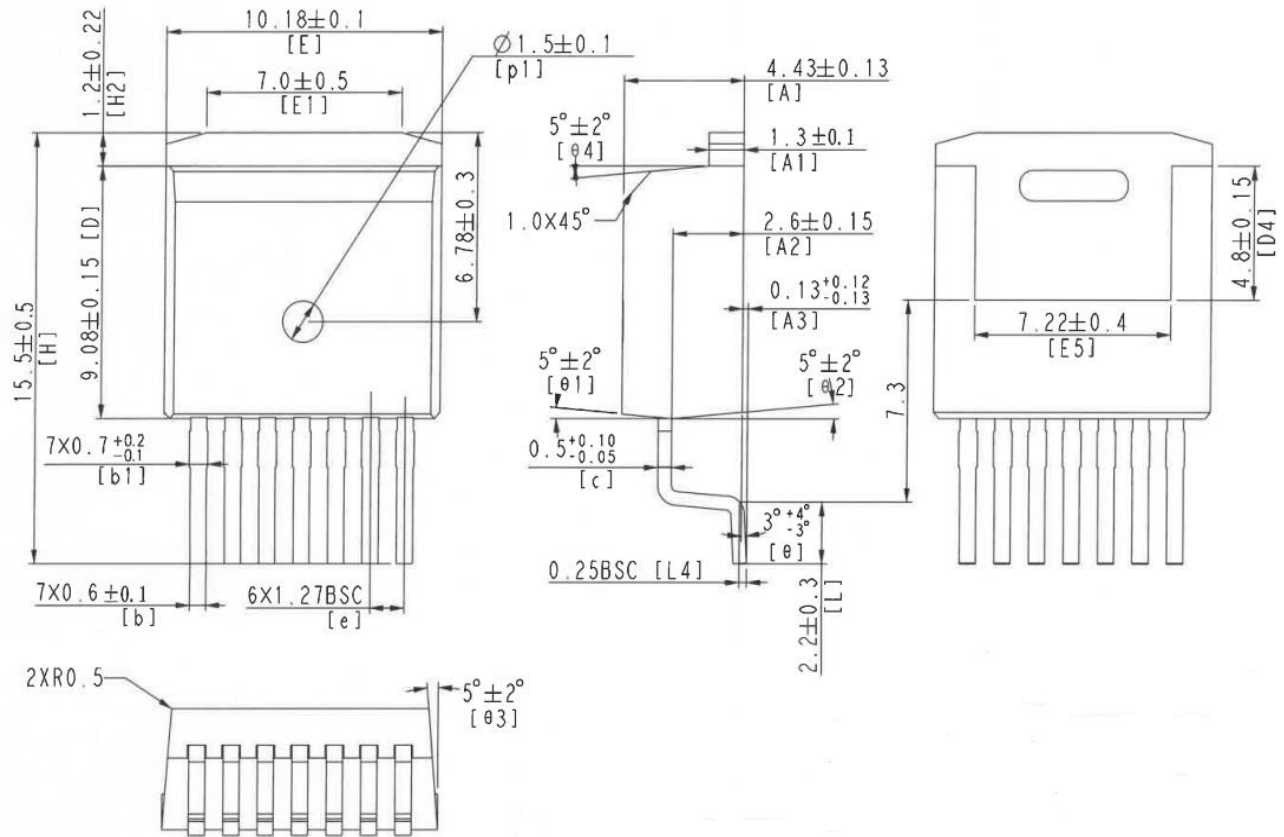
Figure C. Definition of diode switching characteristics



## Package

### Dimensions

Package TO-263-7L







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