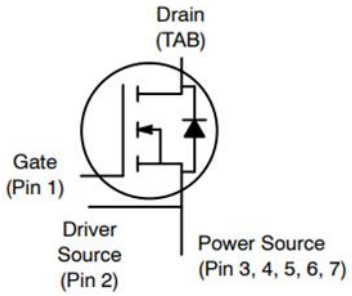
V_{DS} = **1200 V**
I_D (T_C=25℃) = **67A**
$R_{DS(on).typ}$ = **35 mΩ@ V_{GS}=18 V**

TO-263-7



Features

- Wide bandgap SiC MOSFET technology
- Low On-Resistance with High Blocking Voltage
- Low Capacitances with High-Speed switching
- Low reverse recovery(Qrr)
- Halogen free, RoHs compliant

Benefits

- Reduce switching losses
- Increased system Switching Frequency
- Increased power density
- Reduction of heat sink requirements

Applications

- Switch mode power supplies
- Renewable energy
- Motor drives
- High voltage DC/DC converters

Package Parameters

Part Number	Marking	Package
ES40N120HAA	ES40N120HAA	TO-263-7

Package Pin Definitions

- Pin1- Gate
- Pin2- Driver Source
- Pin3, 4, 5, 6, 7- Power Source

Maximum Ratings (T_C=25℃ unless otherwise specified)

Symbol	Parameter	Test conditions	Value	Unit	Note
V_{DSmax}	Drain-Source Voltage	V_{GS} = 0V, I_D = 100μA	1200	V	
V_{GSmax}	Gate-Source voltage	AC (f > 1 Hz)	-10/+25	V	
V_{GSop}	Recommend Gate-Source Voltage	Static	-4/+18	V	
I_D	Continuous Drain current	V_{GS} = 18V, T_C = 25°C	67	A	Fig. 14
		V_{GS} = 18V, T_C = 100°C	47		
$I_{D,pulse}$	Pulsed Drain Current	Pulse with t_p limited by T_{jmax}	133	A	
P_D	Power Dissipation	T_C = 25°C, Tj = 175°C	319	W	Fig. 16
T_j	Operating junction temperature		-55~175	°C	
T_{stg}	Storage temperature		-55~175	°C	
	TO-247 mounting torque	M3 Screw	0.7	Nm	

Thermal Characteristics

Symbol	Parameter	Value			Unit	Note
		Min.	Typ.	Max.		
$R_{th(jc)}$	Thermal resistance from Junction to Case		0.47		K/W	Fig. 15
$R_{th(ja)}$	Thermal resistance from Junction to Ambient		40		K/W	

Electrical Characteristics T_j=25°C unless otherwise specified

Static Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
$V_{(BR)DSS}$	Drain-Source Breakdown voltage	V_{GS} = 0V, I_D = 100μA	1200			V	
$V_{GS(th)}$	Gate Threshold voltage	V_{GS} = V_{DS}, I_D = 9.5mA		2.9		V	Fig. 9
		V_{GS}= V_{DS}, I_D = 9.5mA, T_j=175°C		2.0			
I_{GSS}	Gate-Source Leakage current	V_{GS} = 18V, V_{DS} = 0V			250	nA	
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 1200V, V_{GS} = 0V, T_j = 25°C		1	50	μA	
$R_{DS(on)}$	Drain-Source On-state Resistance	V_{GS} = 18V, I_D = 40A V_{GS} = 20V, I_D = 40A		35 32	48	mΩ	Fig. 3, 4, 5
		V_{GS} = 18V, I_D = 40A, T_j = 175°C V_{GS} = 20V, I_D = 40A, T_j = 175°C		75 70			
g_{fs}	Transconductance	V_{GS} = 18V, I_D = 40A		25		S	Fig. 6
		V_{GS} = 18V, I_D = 40A, T_j = 175°C		21			

Gate Charge Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
Q_{GS}	Gate to Source Charge	V_{DS} = 800V I_D = 20A V_{GS} = -4V/20V		22.6		nC	Fig. 10
Q_{GD}	Gate to Drain Charge			31.2			
Q_G	Total Gate Charge			103			

AC Characteristics (T_j=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
C_{iss}	Input Capacitance	V_{GS} = 0V, V_{DS} = 1000V f =1 MHz V_{AC} = 25mV		2820		pF	Fig. 13
C_{oss}	Output Capacitance			108		pF	
C_{rss}	Reverse Transfer Capacitance			6.6		pF	
$R_{G(int)}$	Internal Gate Resistance	f=1 MHz, V_{AC} = 25mV		1		Ω	

Reverse Diode Characteristics (T_j=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
V_{SD}	Diode Forward Voltage	V_{GS} = -4V, I_{SD} = 20A		3.9		V	Fig. 7,8
		V_{GS} = -4V, I_{SD} = 20A, T_j = 175°C		3.3			
I_S	Continuous Diode Forward Current	V_{GS} = -4V, T_C = 25°C		72		A	
$I_{S,\ pulse}$	Diode pulse Current	V_{GS} = -4V, pulse width t_p limited by T_{jmax}		133		A	

Typical Performance

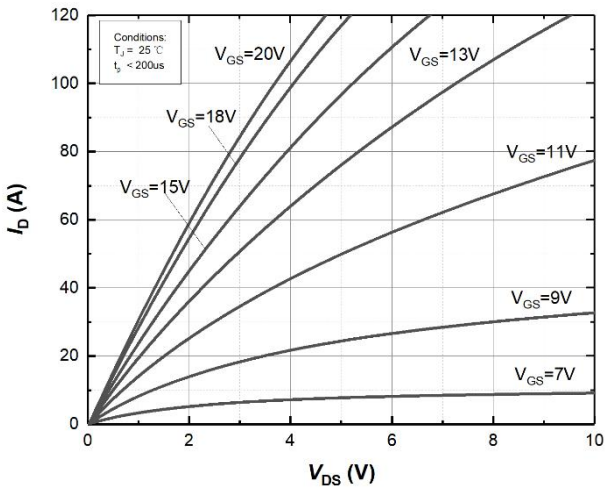


Figure 1. Output characteristics at Tj=25°C

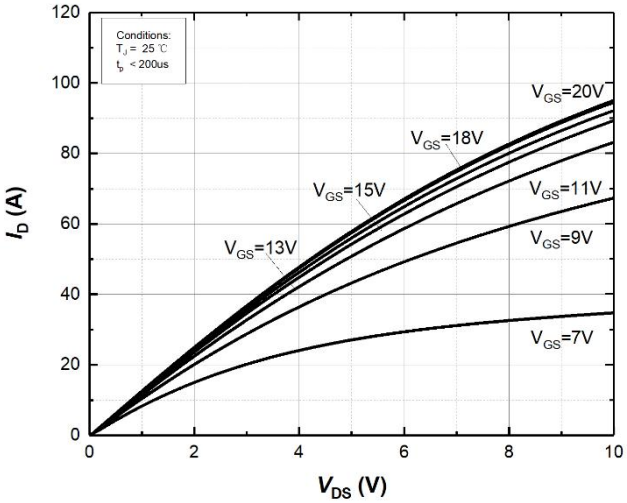


Figure 2. Output characteristics at Tj=175°C

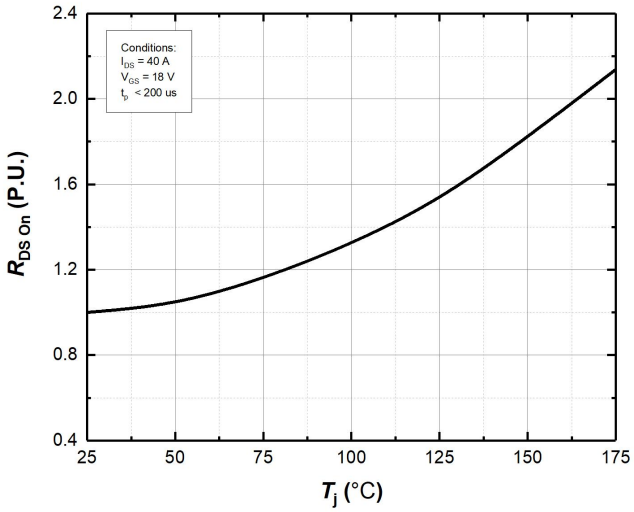


Figure 3. Normalized On-Resistance vs. Temperature

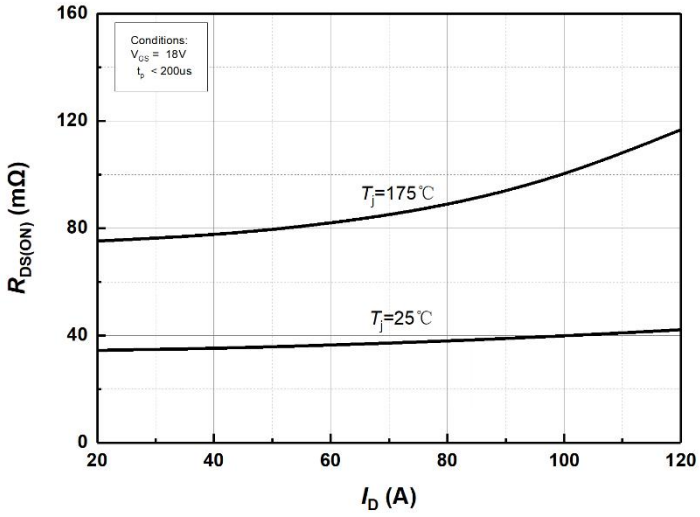


Figure 4. On-Resistance vs. Drain current for Various Temperature

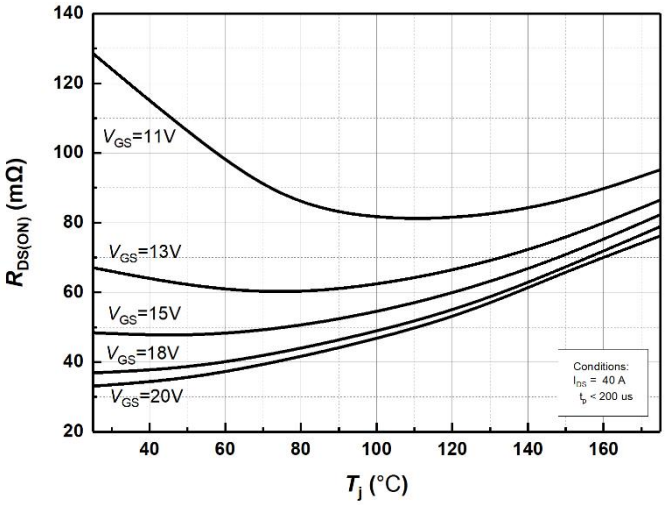


Figure 5. On-Resistance vs. Temperature for Various Gate Voltage

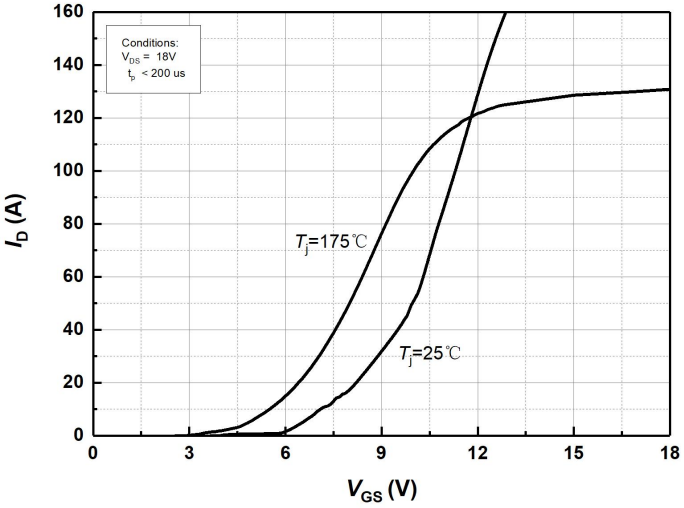


Figure 6. Transfer Characteristics for Various Junction Temperatures

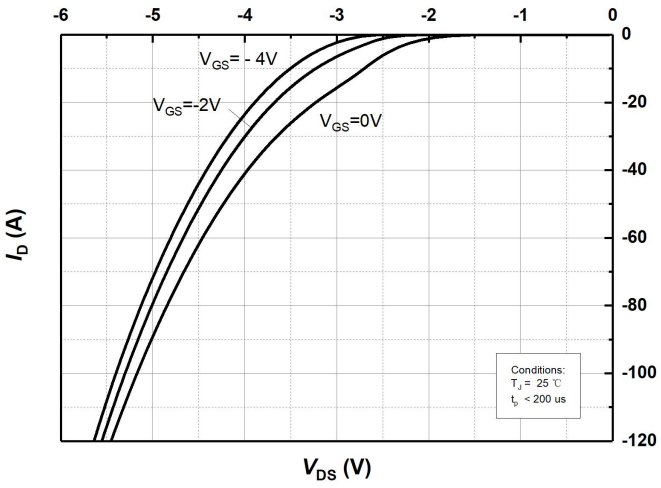


Figure 7. Body Diode Characteristics at Tj=25°C

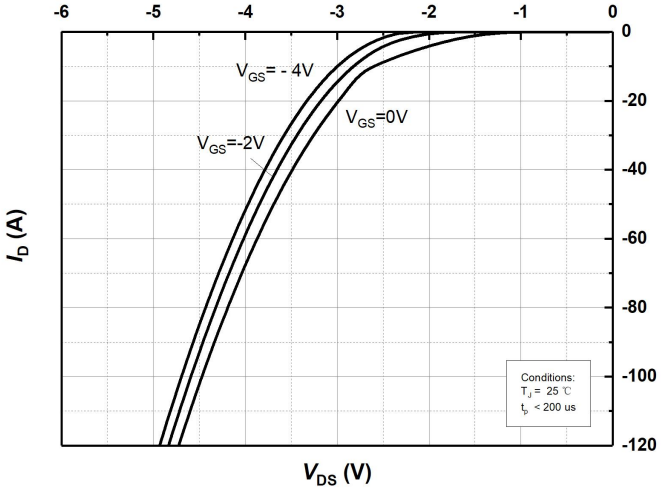


Figure 8. Body Diode Characteristics at Tj=175°C

Typical Performance

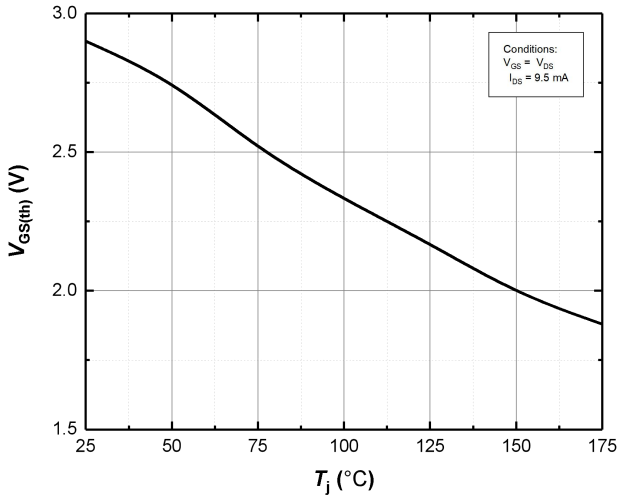


Figure 9. Threshold Voltage vs. Temperature

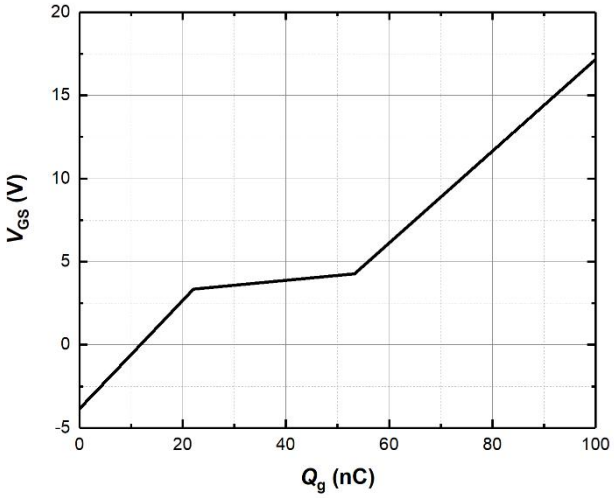


Figure 10 Gate Charge Characteristics

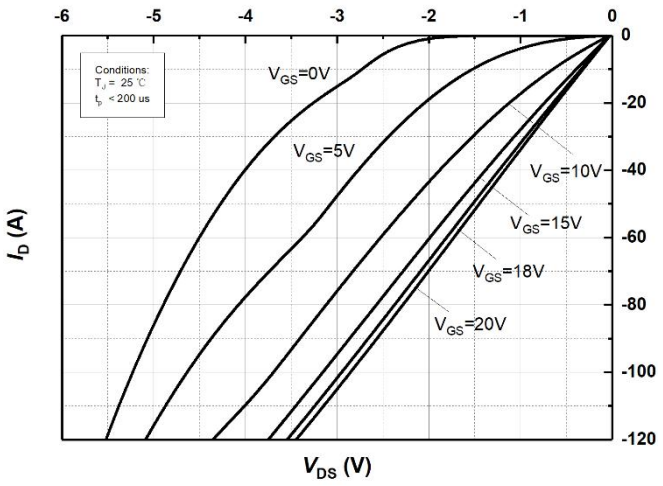


Figure 11. 3rd Quadrant Characteristic at Tj=25°C

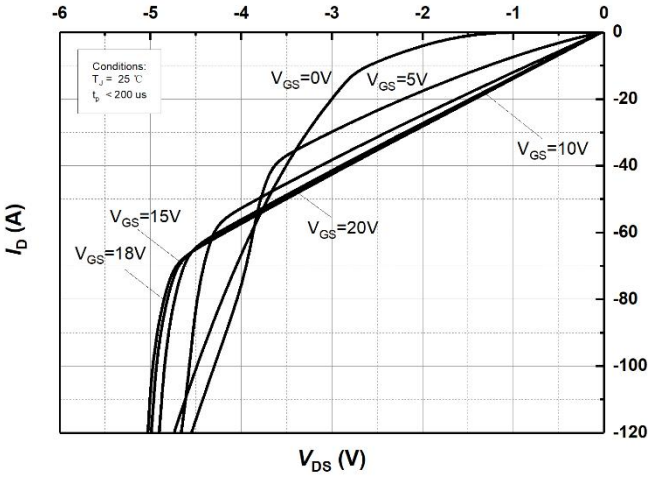


Figure 12. 3rd Quadrant Characteristic at Tj=175°C

Typical Performance

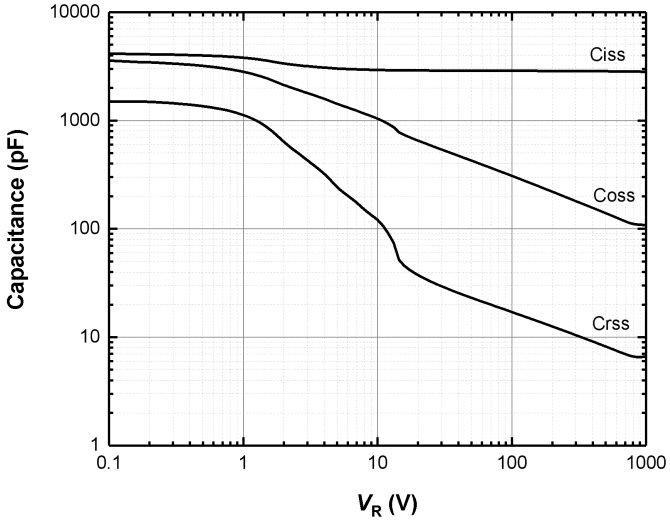


Figure 13. Capacitances vs. Drain-Source Voltage (0 – 1000V)

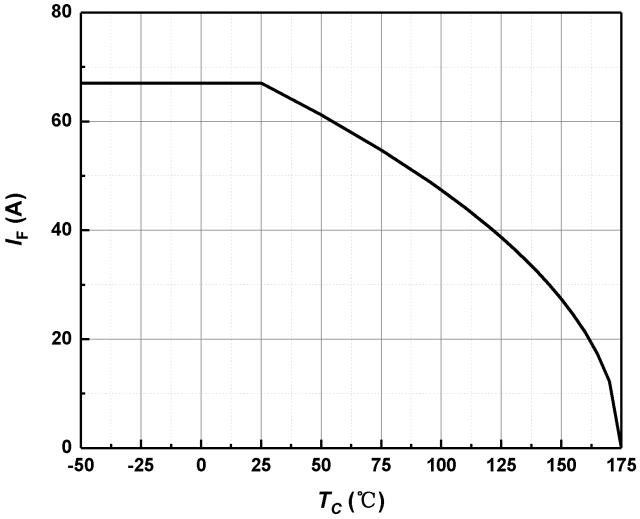


Figure 14. Continuous Drain Current Derating vs Case Temperature

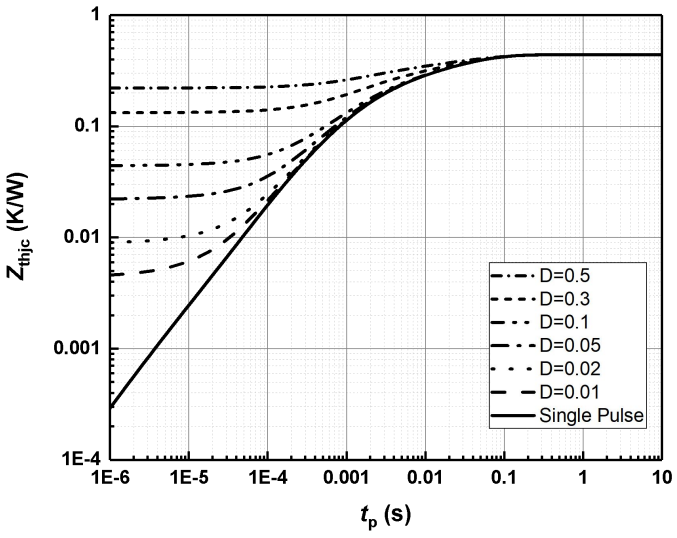


Figure 15.Transient Thermal Impedance (Junction – Case)

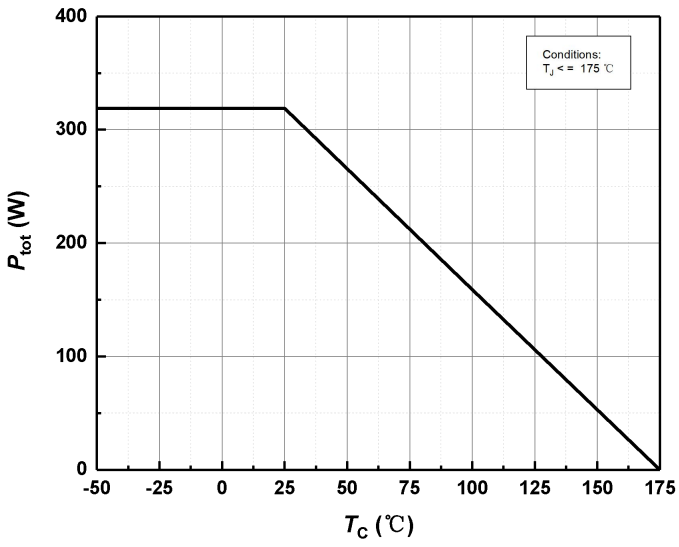


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

Typical Performance

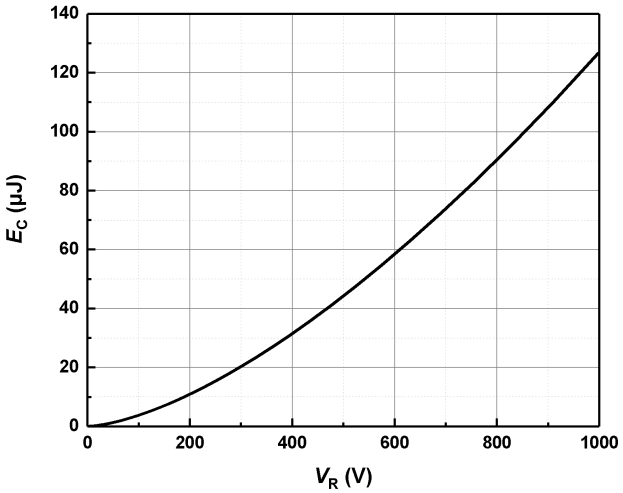
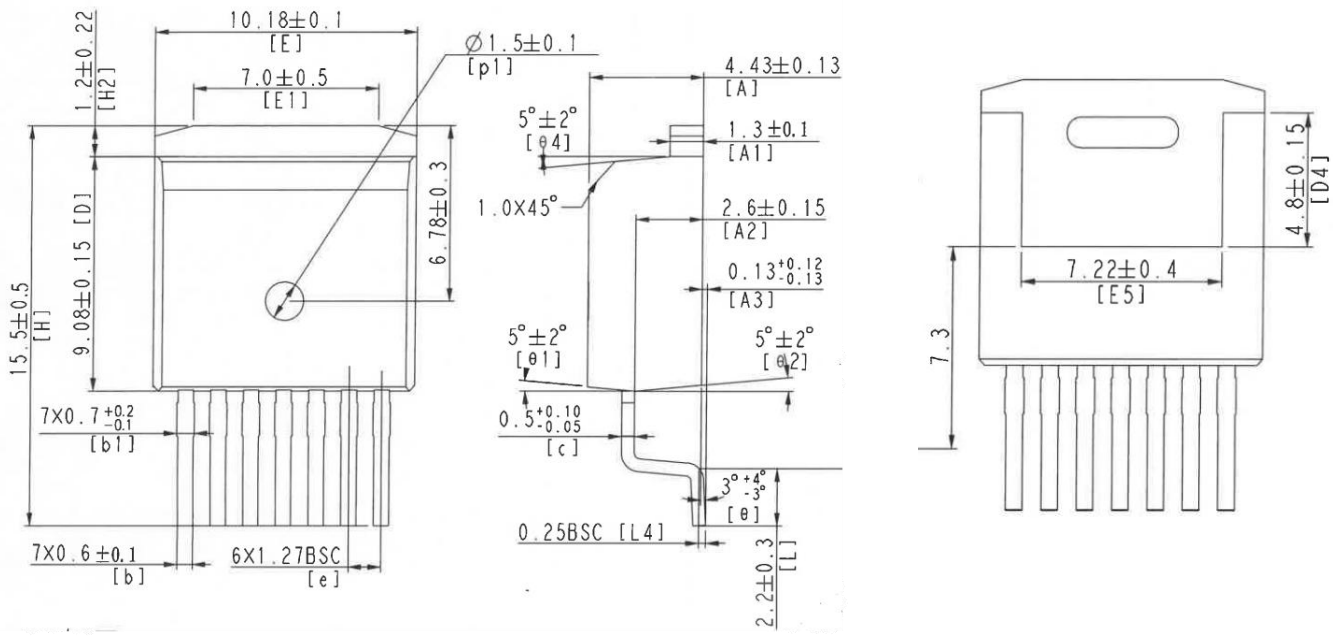
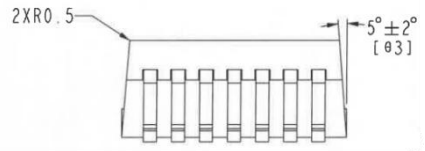


Figure 17. Output Capacitor Stored Energy

Package Dimensions





SYMBOL	MM		
	MIN	NOM	MAX
D	8.93	9.08	9.23
E	10.08	10.18	10.28
A	4.30	4.43	4.56
H	15.00	15.50	16.00
E1	6.50	7.00	7.50
E2	6.82	7.22	7.62
D4	4.65	4.80	4.95
A1	1.20	1.30	1.40
A2	2.45	2.60	2.75
A3	0.00	0.13	0.25
c	0.45	0.50	0.60
L	2.00	2.20	2.50
b	0.50	0.60	0.70
b1	0.60	0.70	0.90
e		1.27BSC	
E5	6.82	7.22	7.62
L4		0.258BSC	
ΦP1	1.40	1.50	1.60
θ	0.00	3°	7°
θ1	3°	5°	7°
θ2	3°	5°	7°
θ3	3°	5°	7°
θ4	3°	5°	7°
H2	0.98	1.20	1.42

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