美浦森半导体
M s e m i t e k

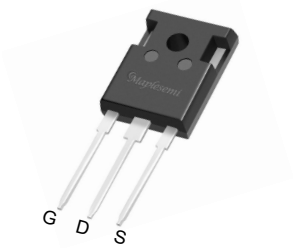
MSH160120M1A / MSK160120M1A

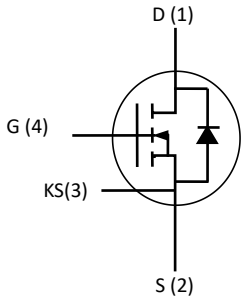
Automotive 1200V Silicon Carbide Power MOSFET
N-Channel Enhancement Mode

Benefits
- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

Features
- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Easy to Parallel and Simple to Drive
- Avalanche Ruggedness
- Halogen Free, RoHS Compliant

Applications
- Solar Inverters
- Switch Mode Power Supplies
- High Voltage DC/DC Converters
- Battery Chargers
- Motor Drives
- Pulsed Power applications





Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

Symbol	Parameter	MSH160120M1A / MSK160120M1A	Units
V_{DSSmax}	Drain-Source Voltage, V_{GS}=0V, ID=100μA	1200	V
I_D	Continuous Drain Current - VGS=20V , (T_C = 25℃)	17	A
	- VGS=20V , (T_C = 100℃)	11	A
V_{GSmax}	Gate-Source Voltage, Absolute maximum values	-10/+25	V
VG_{Sop}	Gate-Source Voltage, Recommended operational values	-5/+20	V
P_D	Power Dissipation (T_C = 25℃) TJ=150˚C	127	W
T_J, T_{STG}	Operating Junction and Storage Temperature	-55 to +150	℃
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	℃

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	Typ	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.98	℃/W
$R_{\theta JS}$	Thermal Resistance, Case-to-Sink Typ.	--	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	40	℃/W

Package Marking

Part Number	Top Marking	Package	Packing Method	MOQ	QTY
MSH160120M1A	MSH160120M1A	TO-247	Tube	450	2250
MSK160120M1A	MSK160120M1A	TO-247-4L	Tube	450	2250

Electrical Characteristics

T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 100 uA	1200	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} =1200 V, V_{GS} = 0 V	--	1	100	uA
I_{GSSF}	Gate-Source Leakage Current	V_{GS} = 20 V, V_{DS} = 0 V	--	20	200	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, IDS=5mA,TC=25˚C	2.0	-	4.0	V
		V_{DS} = V_{GS}, IDS=5mA,TC=150˚C	-	1.80	-	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 20 V, I_D = 10A, TC=25˚C	--	160	192	mΩ
		V_{GS}=20V, ID=10A, TC=150˚C		285		mΩ
g_{fS}	Forward Transconductance	V_{GS} = 20 V, I_D = 10A, TC=25˚C	--	4.2	--	S
		V_{GS}=20V, ID=10A, TC=150˚C	--	4.0	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{GS}=0V, VDS=1000 V, f=1MHz V_{AC}=25 mV	--	950	--	pF
C_{oss}	Output Capacitance		--	35.0	--	pF
C_{rss}	Reverse Transfer Capacitance		--	8.5	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD}=800V, V_{GS}= -5/20 V I_D= 10A, RG(ext) = 2.5 Ω , R_L=80Ω , Timing relative to V_{DS}	--	12	--	ns
t_r	Turn-On Rise Time		--	20	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	15	--	ns
t_f	Turn-Off Fall Time		--	10	--	ns
Q_g	Total Gate Charge	V_{DD} = 800 V, I_D =10A, V_{GS} = -5/20 V	--	42	--	nC
Q_{gs}	Gate-Source Charge		--	9	--	nC
Q_{gd}	Gate-Drain Charge		--	17	--	nC
RG(int)	Internal Gate Resistance	f=1 MHz, VAC=25mV	-	5.8	-	Ω
E_{ON}	Turn-On Switching Energy	V_{DS}=800V, V_{GS}=-5/20V, I_D= 10A, RG(ext) = 2.5Ω, L= 256 μH		95		μJ
E_{OFF}	Turn-Off Switching Energy			48		μJ
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Continuous Drain-Source Diode Forward Current,TC = 25˚C		-	17	-	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = -5V, I_{SD} = 5 A, T_J = 25 °C	--	3.5	-	V
		V_{GS} =- 5V, I_{SD} =5A, T_J = 150 °C	-	3.3	-	

Typical Characteristics

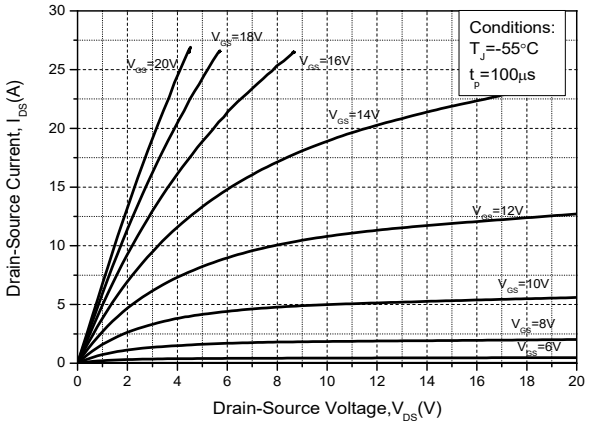


Figure 1. On-Region CharacteristicsTJ = -55 °C

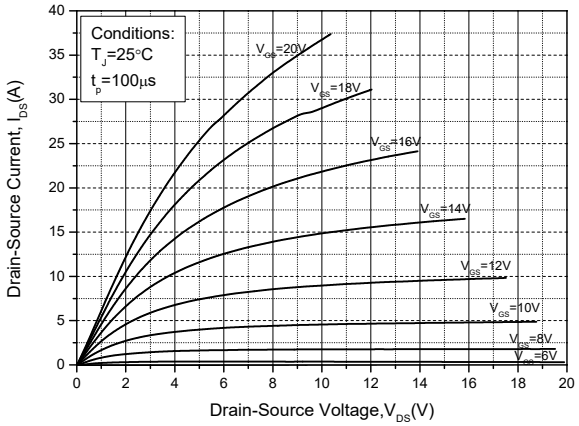


Figure 2. Output Characteristics TJ = 25 °C

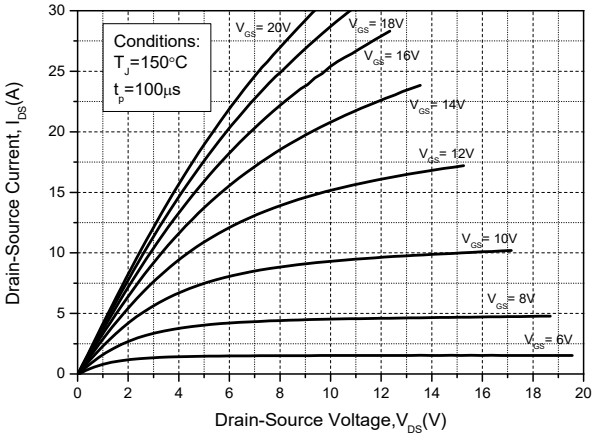


Figure 3.Output Characteristics TJ =150 °C

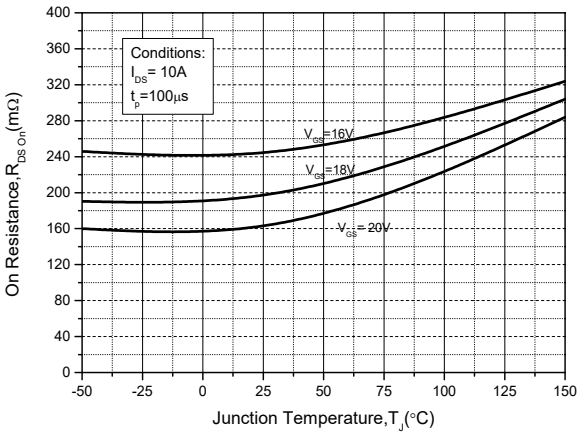


Figure 4. On-Resistance For Various Gate Voltage

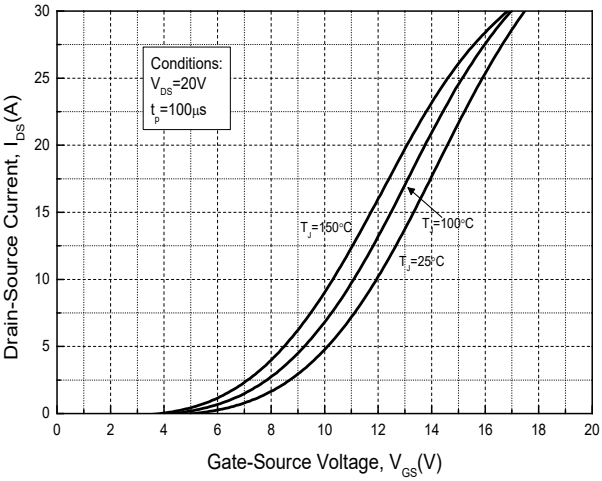


Figure 5. Transfer Characteristic for Various Junction Temperatures

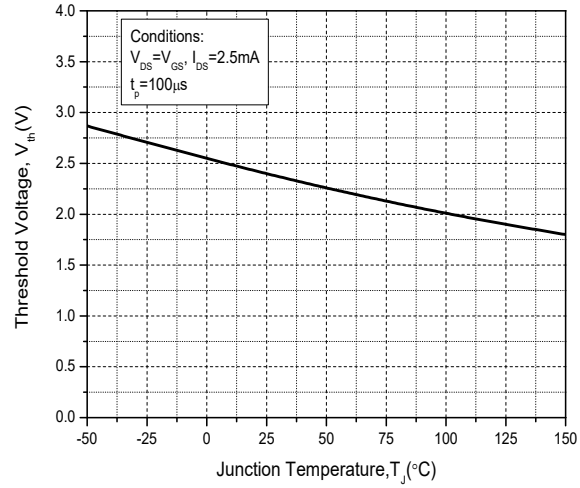


Figure 6. Threshold Voltage vs. Temperature

Typical Characteristics (Continued)

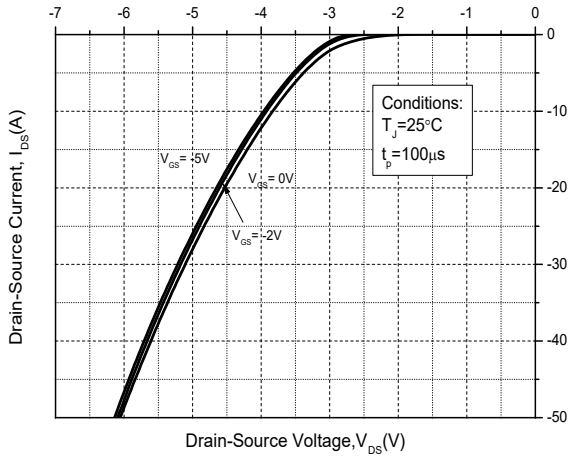


Figure 7. Body Diode Characteristics

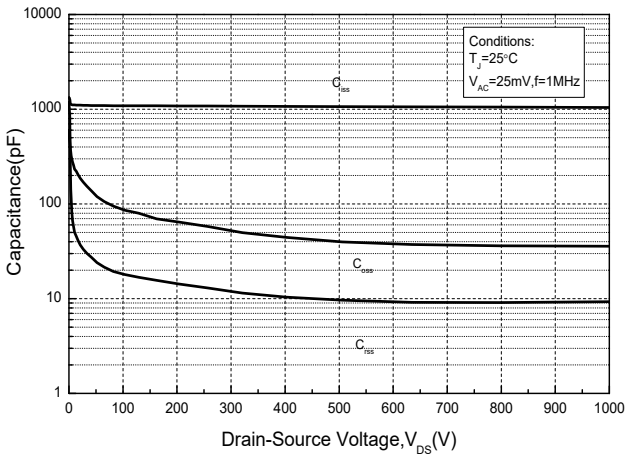


Figure 8. Capacitances vs. Drain-Source Voltage

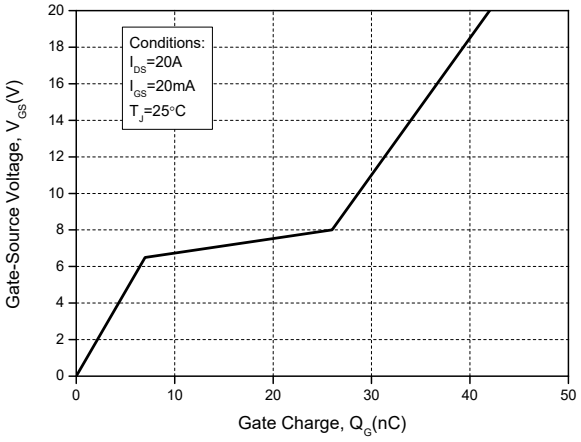


Figure 9. Gate Charge Characteristics

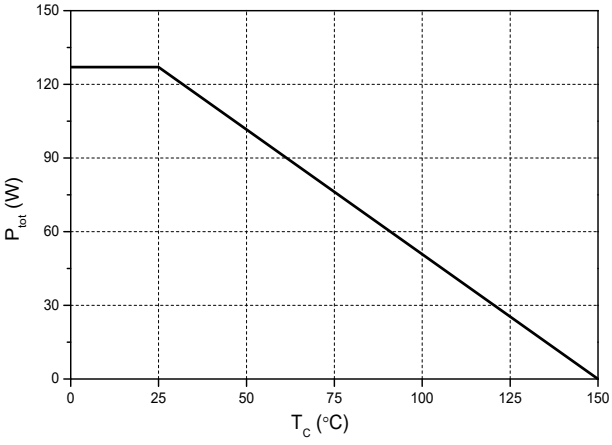


Figure 10. Power Dissipation Derating

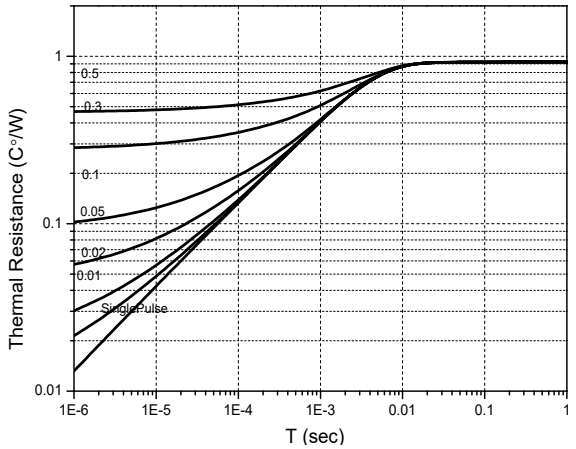
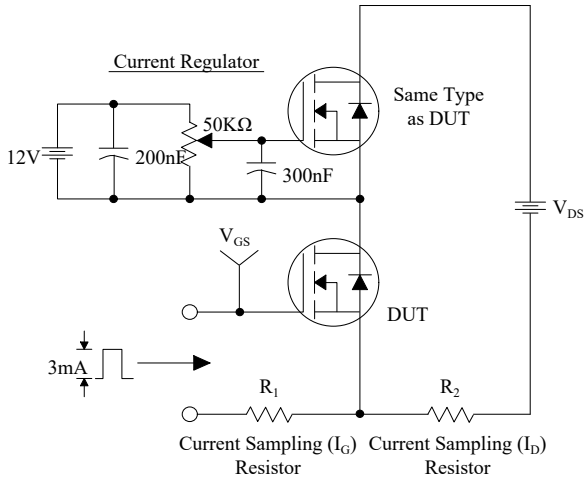
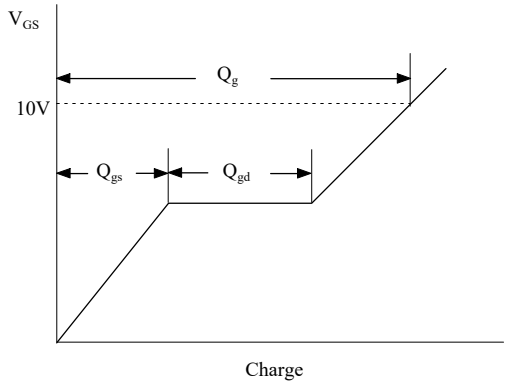


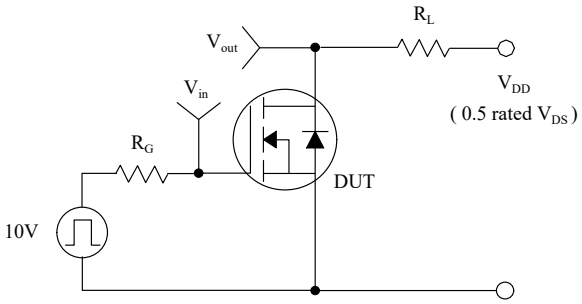
Figure 11. Transient Thermal Impendance

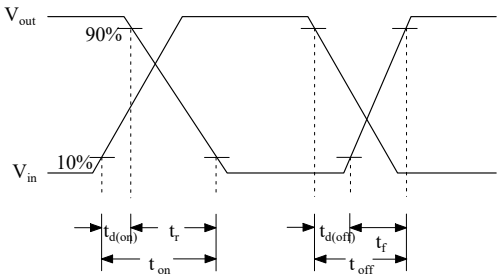
Gate Charge Test Circuit & Waveform



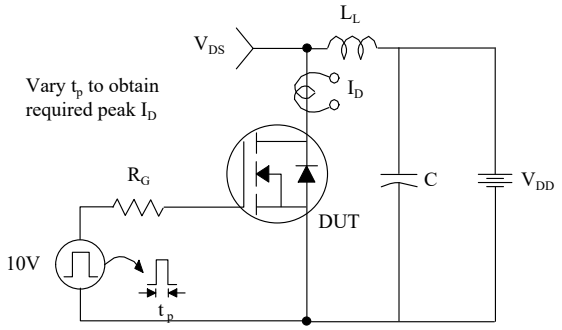


Resistive Switching Test Circuit & Waveforms

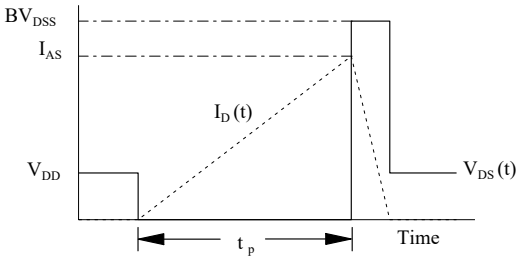




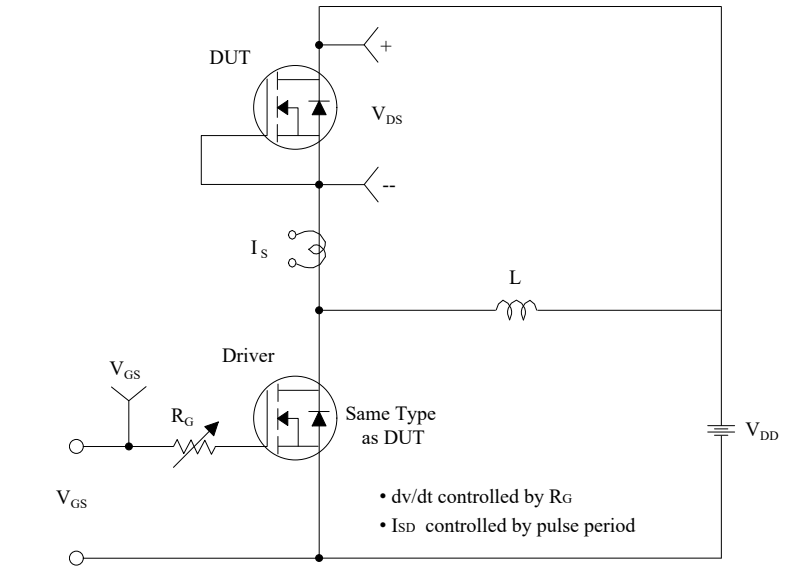
Unclamped Inductive Switching Test Circuit & Waveforms

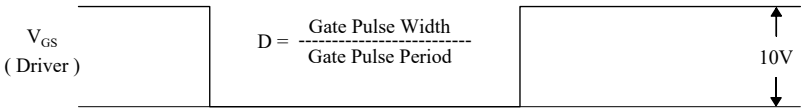


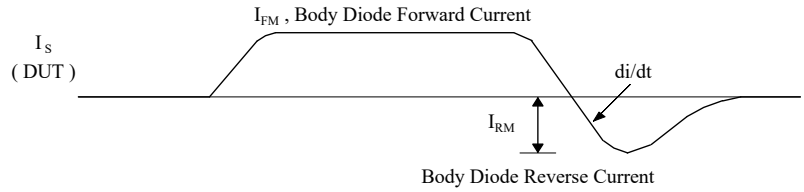
$$E_{AS} = \frac{1}{2} L_L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$

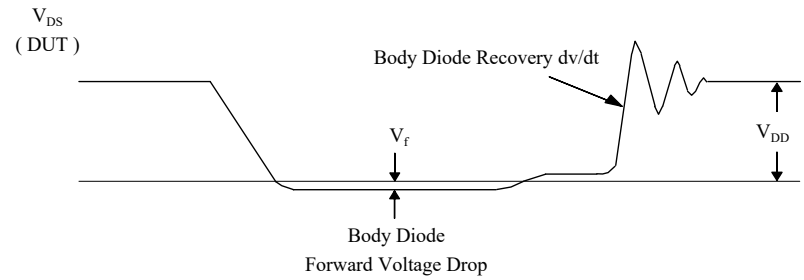


Peak Diode Recovery dv/dt Test Circuit & Waveforms

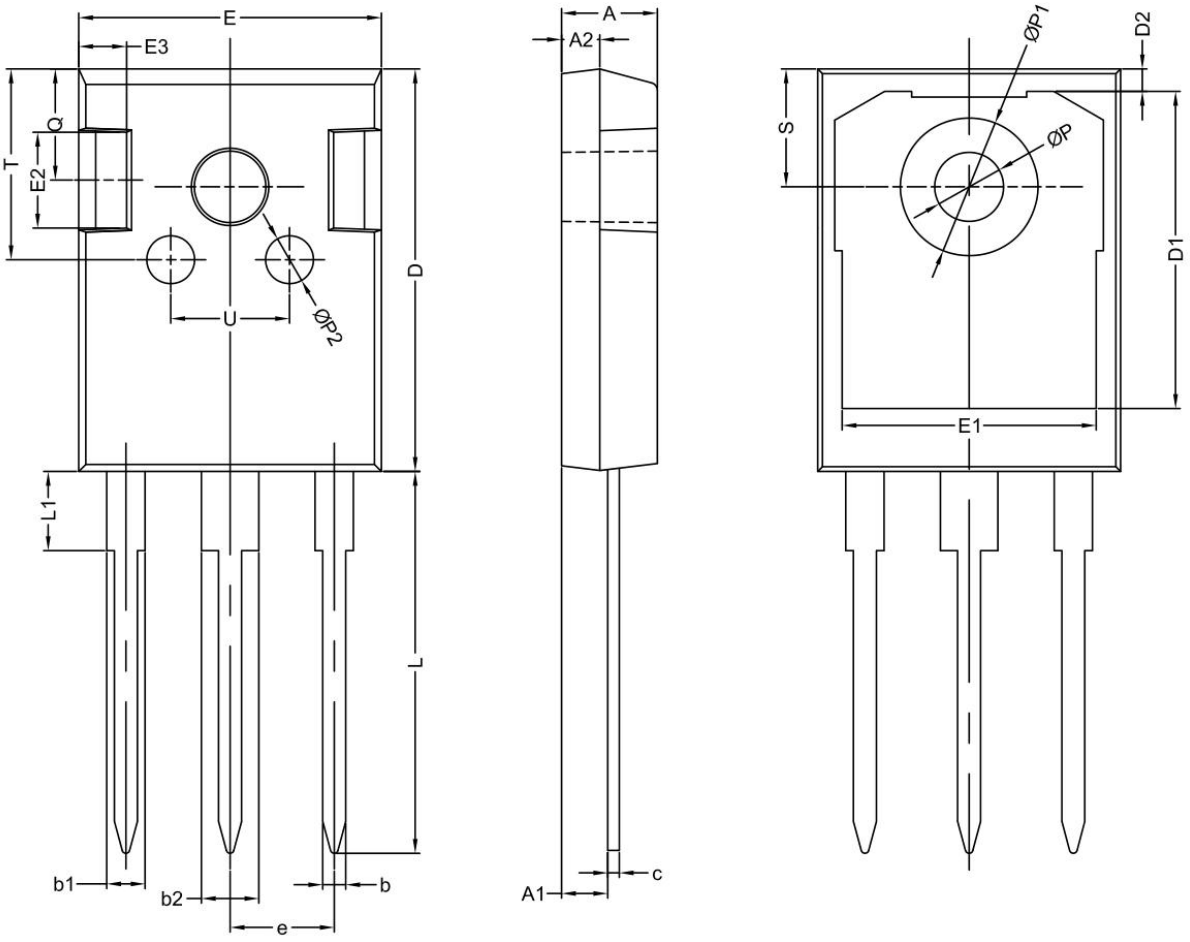








TO-247 OUTLINE



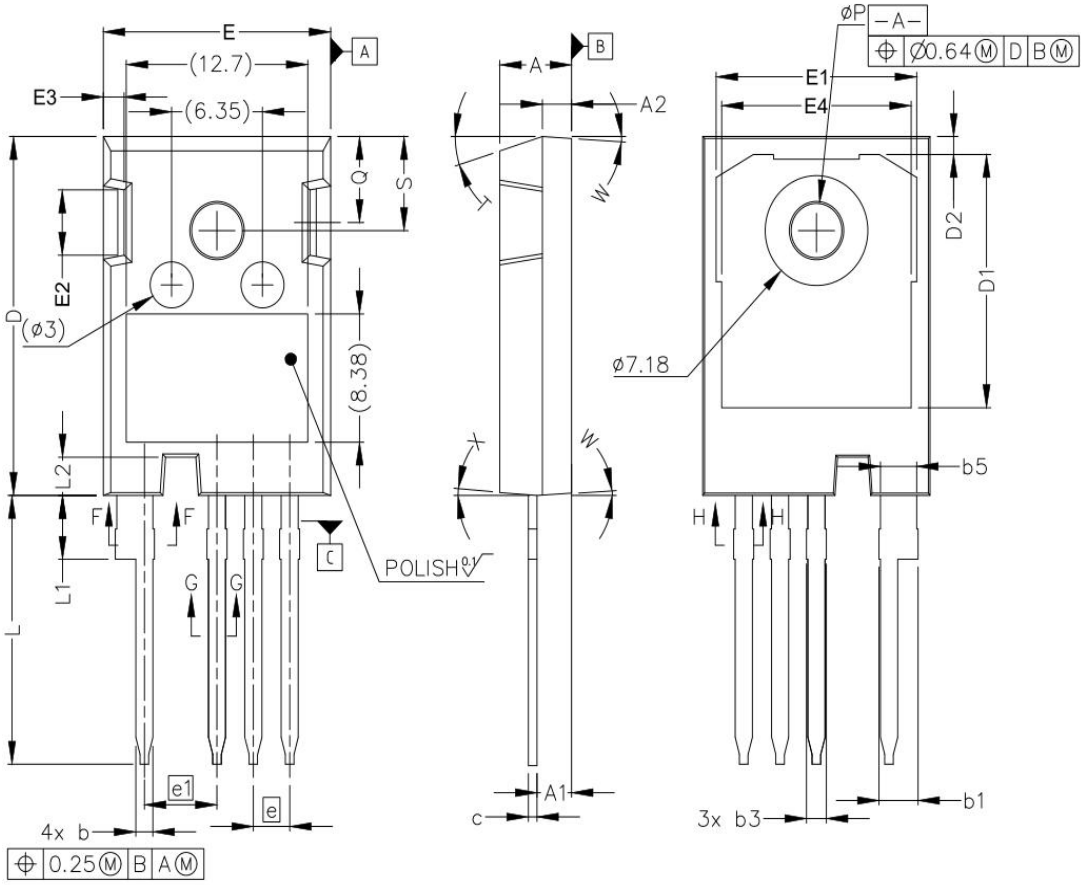
SYMBOL	Mechanical Dimensions/mm			SYMBOL	Mechanical Dimensions/mm			SYMBOL	Mechanical Dimensions/mm		
	MIN	NOM	MAX						MIN	NOM	MAX
A	4.80	5.00	5.20	D	20.80	21.00	21.20	L1	-	4.13	-
A1	2.21	2.41	2.61	D1	-	16.55	-	⌀ P	3.5	3.6	3.7
A2	1.90	2.00	2.10	E	15.60	15.80	16.0	⌀ P1	-	-	7.40
b	1.10	1.20	1.35	E1		13.3		⌀ P2	-	2.50	-
b1	-	2.00	-	E2		5.0		Q	-	5.8	-
b2	-	3.00	-	e	5.44			S	6.05	6.15	6.25
c	0.55	0.60	0.75	L	19.42	19.92	20.42	T	-	10.0	-

NOTE：

1The plastic package is not marked as smooth surfaceRa=0.1;Subglossy surfaceRa=0.8

2.Undeclared tolerance±0.25,Unmarked filletRmax=0.25

TO-247-4L OUTLINE



SYMBOL	Mechanical Dimensions/mm			SYMBOL	Mechanical Dimensions/mm			SYMBOL	Mechanical Dimensions/mm		
	MIN	NOM	MAX						MIN	NOM	MAX
A	4.83	5.00	5.21	D	23.30	23.45	23.60	L1	3.97	4.13	4.37
A1	2.29	2.41	2.54	D1	16.25	16.55	17.65	⌀ P	3.51	3.6	3.65
A2	1.91	2.00	2.16	E	15.75	15.90	16.13	W	-	3.5	-
b	1.07	1.20	1.33	E1	13.10	13.65	14.15	X	-	4	-
b1	2.39	2.60	2.94	E2	3.68	5.0	5.1	Q	5.49	5.8	6.0
b2	2.39	-	2.84	e	2.54			S	6.04	6.15	6.30
c	0.55	0.60	0.68	L	17.31	17.45	17.82	T	-	17.5	-

NOTE：
1The plastic package is not marked as smooth surfaceRa=0.1;Subglossy surfaceR
a=0.8
2.Undeclared tolerance±0.15,Unmarked filletRmax=0.25

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