N-Channel Super Junction Power MOSFET

Description

SM140R50C is power MOSFET using advanced super junction technology that can realize very low on-resistance and gate charge. It will provide much high efficiency by using optimized charge coupling technology. These user friendly devices give an advantage of low EMI to designers as well as low switching loss.

I_D	24A
V_{DSS}	500V
$R_{dson (max.)}$	0.14Ω(V_{GS}=10V, I_D=12A)
Q_g	70nC

General Features

● 24A,500V,$R_{DS(on)(max)}$= 0.14ohm@V_{GS}=10V
● Low Gate charge
● Low Crss
● Fast Switching
● Improved dv/dt Capability

Application

● Power switching application
● Hard switched and high frequency circuits
● Uninterruptible power supply
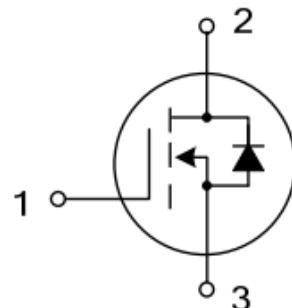
1.Gate 2.Drain 3.Source

TO-220

TO-220F
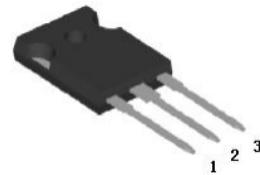
TO-247

Order Information

Order Information	Marking ID	Package	Packing Type Supplied As
SM140R50CT2TL	140R50C	TO220F-3L	1000 units on Box、5000 units on Carton
SM140R50CT1TL	140R50C	TO220-3L	1000 units on Box、5000 units on Carton
SM140R50CT8TL	140R50C	TO247-3L	450 units on Box、2250 units on Carton

Absolute Maximum Ratings Ta=25 ºC unless otherwise noted

Parameter		Symbol	Value	Unit
Drain-source Voltage		V_{DS}	500	V
Gate-source Voltage		V_{GS}	±30	V
Continuous Drain Current(Ta=25℃)		I_D	24	A
Drain Current-Pulsed		I_{DM}	70	A
Total Dissipation (Ta=25℃)	TO247	P_D	312	W
	TO220		168	
	TO220F		35	
Junction Temperature		T_J	150	ºC
Storage Temperature		T_{STG}	-65 to 150	ºC
Single Pulse Avalanche Energy		E_{AS}	485	mJ
ESD HBM(Human Body Mode)			≥2000	V
ESD MM(Machine Mode)			≥200	V

Electrical Characteristics Ta = 25ºC

PARAMETER	Symbol	Test Condition	MIN	Typ	MAX	UNIT
Drain-source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_D=250µA	500			V
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS}=V_{DS} ,I_D=250µA	2.5		4.5	V
Drain-source Leakage Current	I_{DSS}	V_{DS}=500V,V_{GS}=0V			1	uA
Drain-Source Diode Forward Voltage	V_{SD}	V_{GS}=0V，I_S=24A			1.5	V
Gate-body Leakage Current (V_{DS} = 0)	I_{GSS}	V_{GS}=±30V			±100	nA
Forward Transconductance	G_{FS}	V_{DS}=10V I_D=24A	8			S
Static Drain-source On Resistance	$R_{DS(ON)}$	V_{GS}=10V,I_D=12A		0.11	0.14	Ω

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant in temperature etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings

Thermal Characteristics Ta=25℃

PARAMETER		Symbol	TYP	MAX	UNIT
Maximum Junction-to-case	TO220F,TO220	R_{QJC}		1.56	℃/W
	TO-247			0.3	
Maximum Junction-to-Ambient	TO220F,TO220	R_{QJA}		80	
	TO247			40	

Note1: Ensure that the channel temperature does not exceed 150℃

Note2: V_{DD}=50V,Tch=25 ℃(initial),I_{AS}=24A，Rg=25Ω

Note3: This transistor is sensitive to electrostatic and should be handled with care

Dynamic Characteristics Ta = 25 ℃

PARAMETER	Symbol	Test Condition	MIN	TYP	MAX	UNIT
Input Capacitance	C_{iss}	V_{DS}=25V,V_{GS}=0V,f=1.0MHZ		1440		pF
output Capacitance	C_{oss}			370		pF
Reverse Transfer Capacitance	C_{rss}			11		pF

Switching Characteristics Ta=25 ℃

PARAMETER	Symbol	Test Condition	MIN	TYP	MAX	UNIT
Turn-On Delay Time	$T_{d(on)}$	V_{DS}=400V,I_D=24A, V_{GS}=10V ,R_G=25Ω		15		nS
Turn-On Rise Time	T_r			11		nS
Turn-Off Delay Time	$T_{d(off)}$			110		nS
Turn-Off Rise Time	T_f			9		nS
Total Gate Charge	Q_g	V_{DS}=400V，I_D=12A,V_{GS}=10V		70		nC
Gate-Source Charge	Q_{gs}			7.8		nC
Gate-Drain Charge	Q_{gd}			9		nC

Drain-Source Diode Maximum Ratings and Characteristics Ta=25 ℃

PARAMETER	Symbol	Test Condition	MIN	TYP	MAX	UNIT
Max. Diode Forward Current	I_s	Integral Reverse P-N Junction Diode in the MOSFET			24	A
Pulsed Source Current	I_{sm}				70	
Diode Forward Voltage	V_{SD}	V_{GS}=0V,I_s=24A			1.5	V
Reverse Recovery Time	T_{rr}	V_{GS}=0V,I_s=24A, dIF/dt=100A/μs		475		nS
Reverse Recovery Charge	Q_{rr}			5.8		μC

Test Circuit

Gate Charge Test Circuit & Waveform
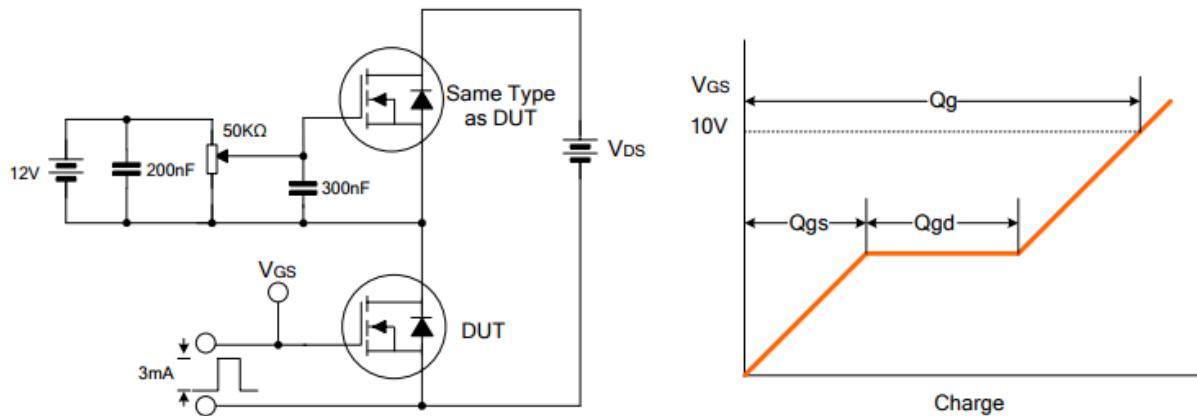
Resistive Switching Test Circuit & Waveform
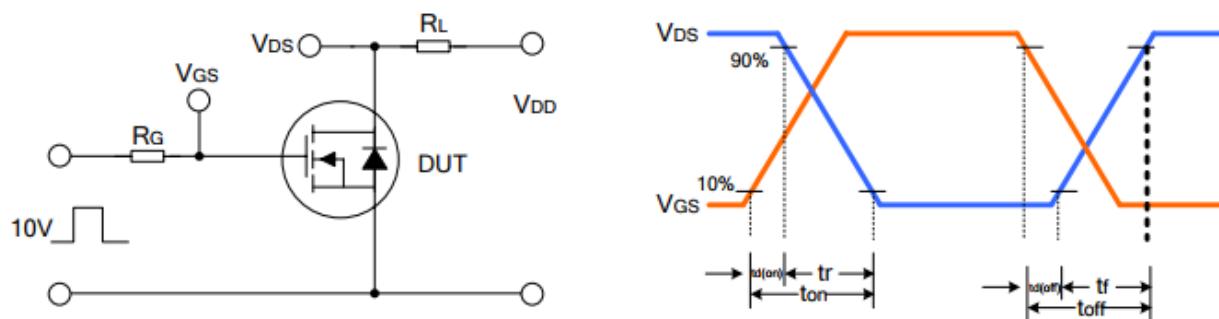
Unclamped Inductive Switching Test Circuit & Waveform

$$EAS = \frac{1}{2} LI_{AS}^2 \frac{B_{VDSS}}{B_{VDSS} - V_{DD}}$$
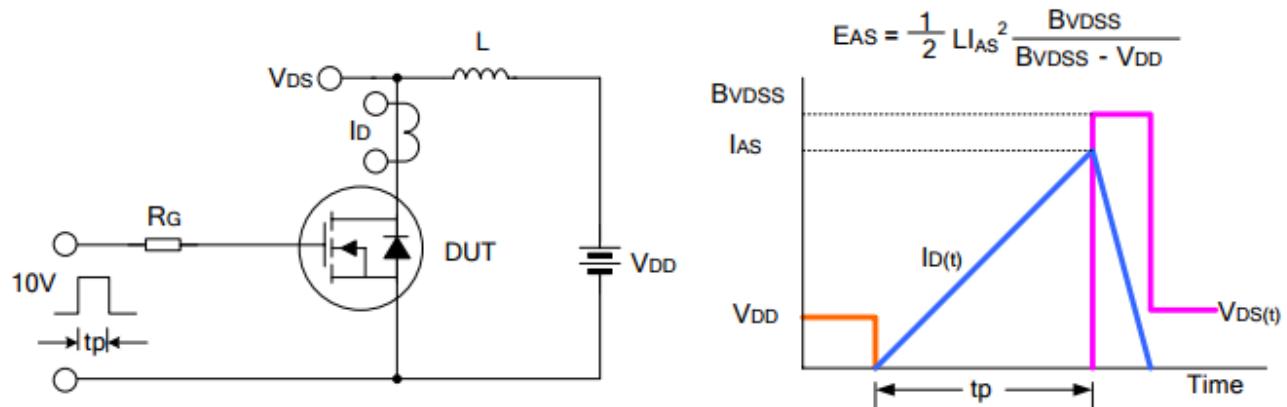
## Typical Characteristics Curve
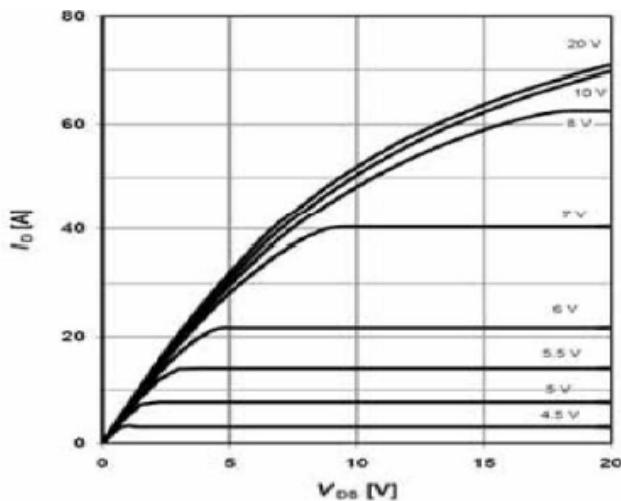
Figure 1: Output Characteristics

Figure 2: Transfer Characteristics
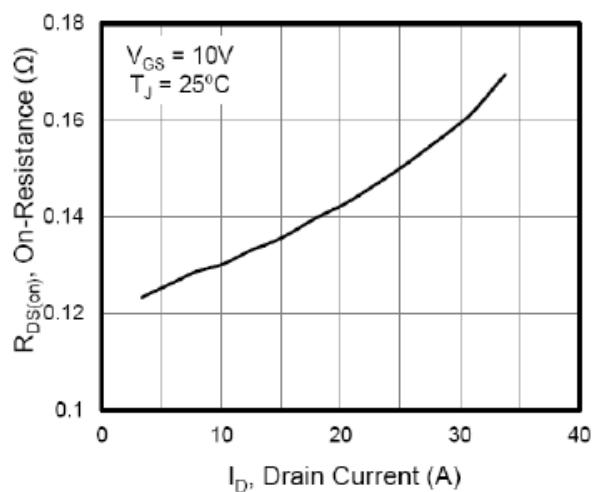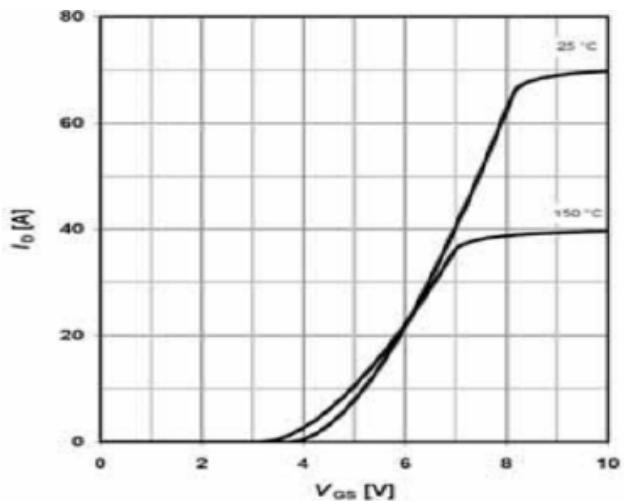
Figure 3: On Resistance Vs Drain Current

Figure 4: Safe Operating Area
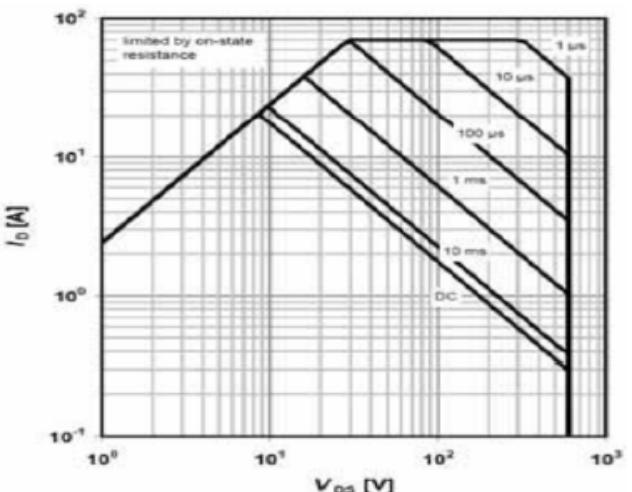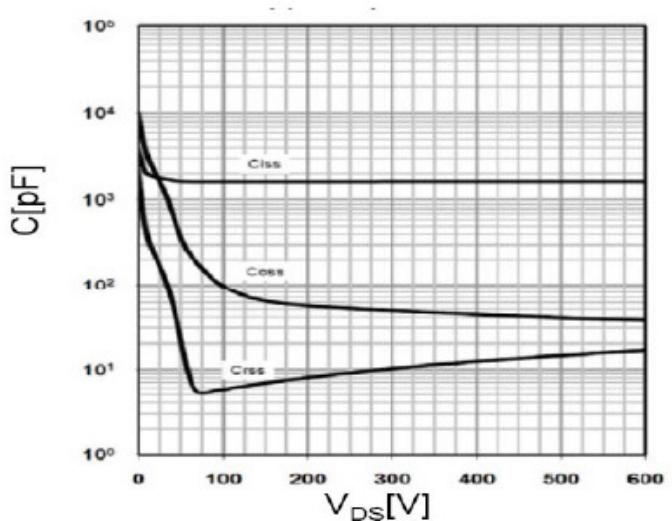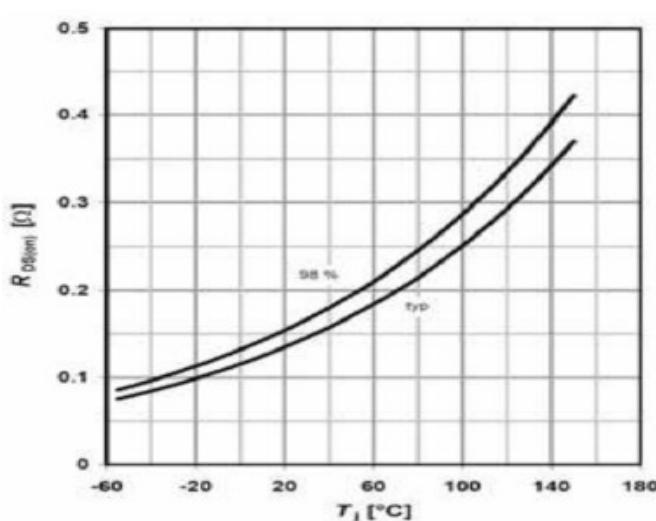
Figure5:   On Resistance Vs Junction Temperature   Figure6: Capacitance Characteristics

Typical Characteristics Curve
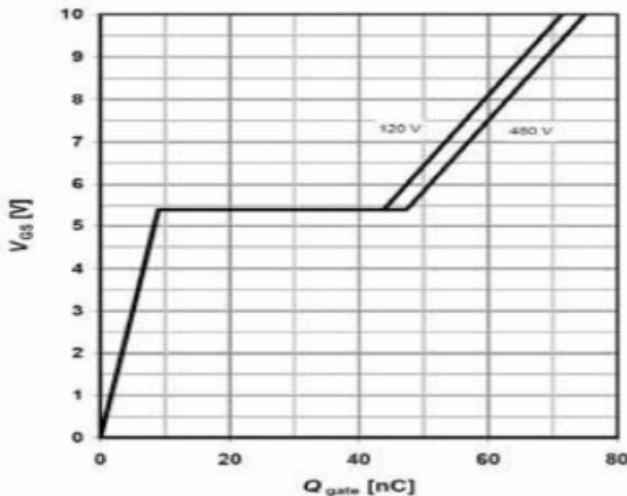
Figure7: Gate Charge Waveform
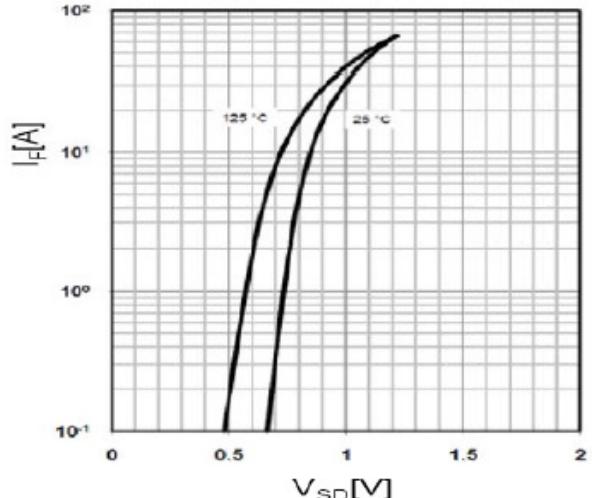
Figure8: Source-Drain Diode Forward Voltage
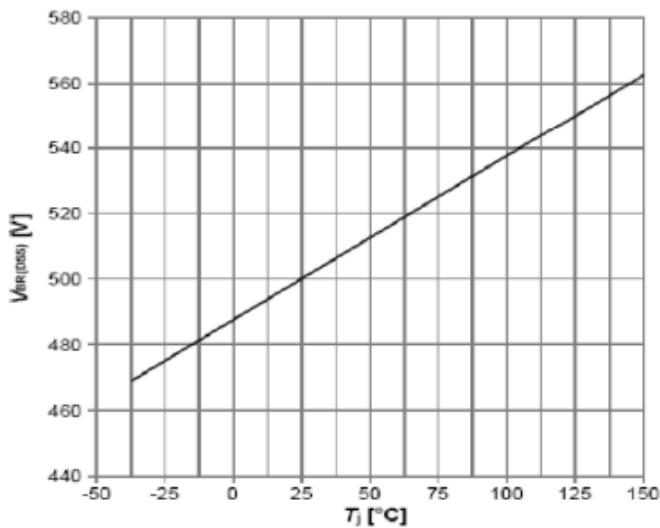

Figure9:   Breakdown Voltage Vs Junction Temperature

Note: The above characteristics curves are presented for reference only and not guaranteed by production test unless otherwise noted

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Outline Information (TO220F-3L)
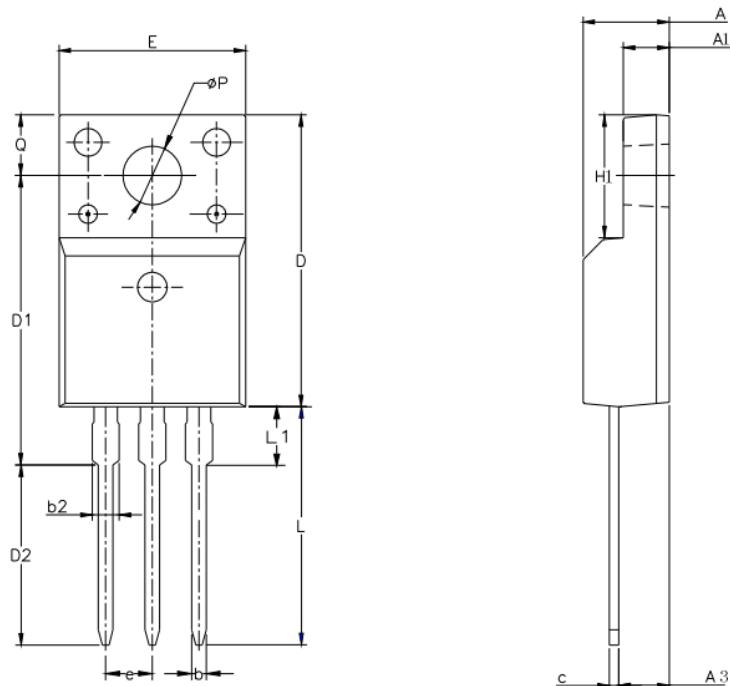
SYMBOL	MIN	NOM	MAX
A	4.42	4.70	5.02
A1	2.30	2.54	2.80
A3	2.50	2.76	3.10
b	0.70	0.80	0.90
b2	—	—	1.47
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	15.30	15.75	16.30
D2	9.30	9.80	10.30
E	9.73	10.16	10.36
e	2.54BCS		
H1	6.40	6.68	7.00
L	12.48	12.98	13.48
L1	/	/	3.50
øP	3.00	3.18	3.40
Q	3.05	3.30	3.55

Outline Information (TO220-3L)
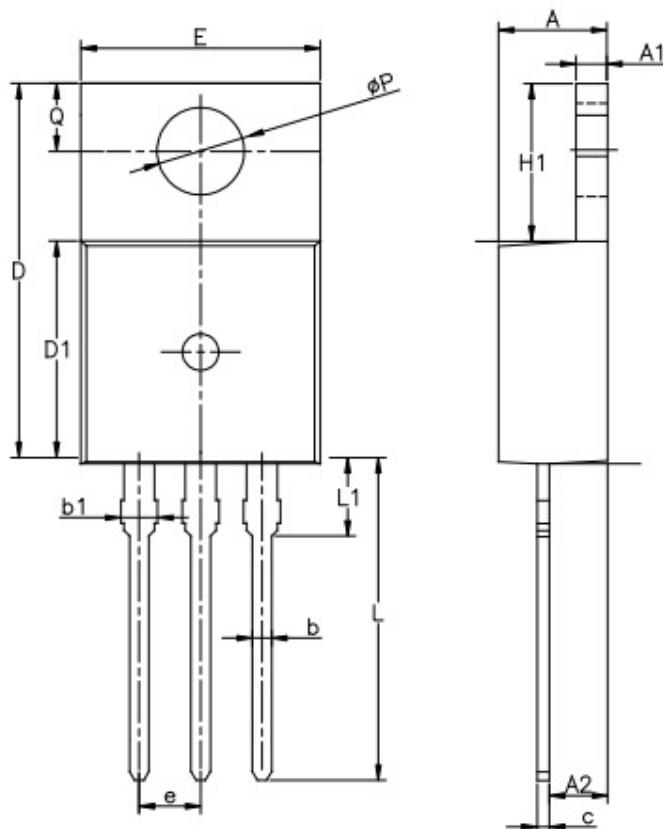
SYMBOL	MIN	NOM	MAX
A	4.30	4.50	4.70
A1	1.00	1.30	1.50
A2	1.80	2.40	2.80
b	0.60	0.80	1.00
b1	1.00	—	1.60
c	0.30	—	0.70
D	15.10	15.70	16.10
D1	8.10	9.20	10.00
E	9.60	9.90	10.40
e	2.54BSC		
H1	6.10	6.50	7.00
L	12.60	13.08	13.60
L1	—	—	3.95
ΦP	3.40	3.70	3.90
Q	2.60	—	3.20

Outline Information (TO247-3L)

UNIT: mm

SYMBOL	MIN	NOM	MAX	SYMBOL	MIN	NOM	MAX
A	4.60		5.15	A1	1.30		1.60
b	2.86		3.26	b1	1.86		2.26
b2		1.20		C		0.50	
D	19.00		21.00	E	15.45		15.75
E1	12.00		13.06	e		5.45	
L	14.00		14.60	L1	5.20		5.88
L2	24.00		24.40	L3	10.00		10.60
P		3.50		Q	2.30		2.70

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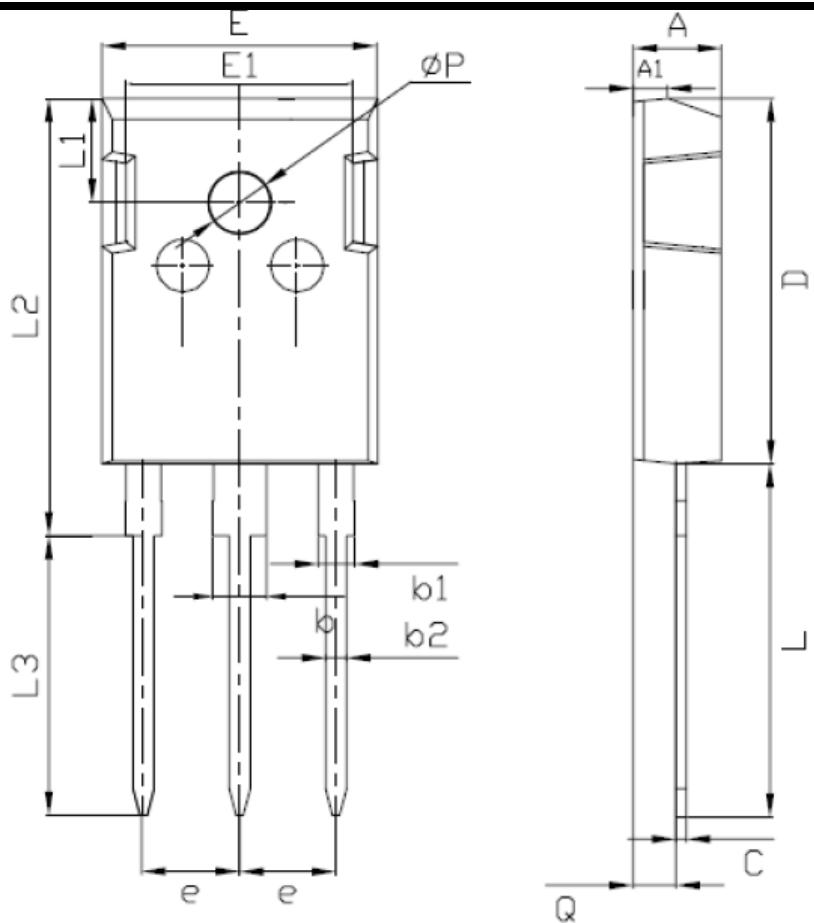
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