

MSC040SMA120B-VB Datasheet

N-Channel 1200V (D-S) SiC Power MOSFET

PRODUCT SUMMARY

V_{DS} (V)	1200	
$R_{DS(on)}$ at 25 °C (Ω)	$V_{GS} = 18V$	0.040
Q_g (nC)	101	

FEATURES

- Low figure-of-merit (FOM) $R_{on} \times Q_g$
- Low input capacitance (C_{iss})
- Reduced switching and conduction losses
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)

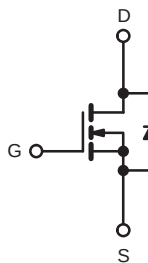


RoHS

APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- DC/DC converter

TO-247



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ °C}$, unless otherwise noted)

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V _{DS}	1200	V
Gate-Source Voltage			V _{GS}	-10 / +22	
Continuous Drain Current (T _J = 150 °C)	V _{GS} at 18V	T _C = 25 °C	I _D	60	A
		T _C = 100 °C		42	
Pulsed Drain Current ^a			I _{DM}	160	
Linear Derating Factor				2.1	W/°C
Single Pulse Avalanche Energy ^b			E _{AS}	1200	mJ
Maximum Power Dissipation			P _D	320	W
Operating Junction and Storage Temperature Range			T _J , T _{stg}	-55 to +175	°C
Drain-Source Voltage Slope	T _J = 125 °C		dV/dt	50	V/ns
Reverse Diode dV/dt ^d				15	
Soldering Recommendations (Peak Temperature) ^c	for 10 s			260	°C

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 100\text{ V}$, starting $T_J = 25\text{ °C}$, $L = 30\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 9\text{ A}$.
- 1.6 mm from case.
- $I_{SD} \leq I_D$, $dI/dt = 100\text{ A}/\mu\text{s}$, starting $T_J = 25\text{ °C}$.

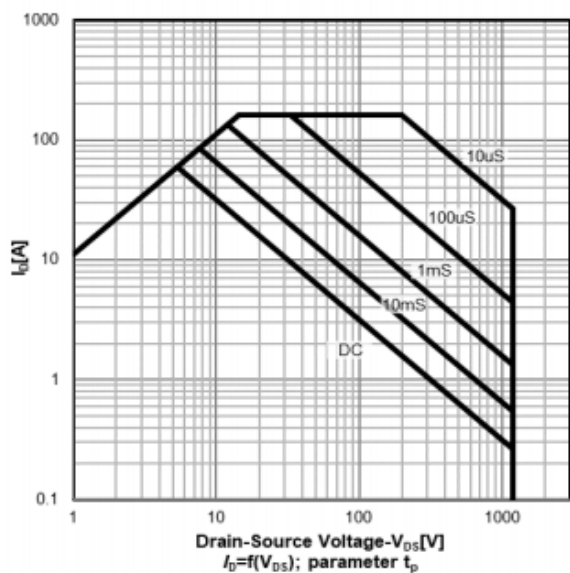
THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	40	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.47	

SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 1 mA		1200	-	-	V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA		-	0.70	-	V/°C
Gate-Source Threshold Voltage (N)	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 10 mA		2.5	-	4.5	V
Gate-Source Leakage	I _{GSS}	V _{GS} = +22 V		-	-	100	nA
		V _{GS} = -10 V		-	-	100	μA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 1200 V, V _{GS} = 0 V		-	10	-	μA
		V _{DS} = 1200 V, V _{GS} = 0 V, T _J = 125 °C		-	-	100	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} = 18 V	I _D = 30A	-	0.040	-	Ω
Forward Transconductance	g _{fs}	V _{DS} = 0 V, I _D = 30 A		-	16	-	S
Dynamic							
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 800 V, f = 1 MHz		-	2200	-	pF
Output Capacitance	C _{oss}			-	123	-	
Reverse Transfer Capacitance	C _{rss}			-	10	-	
Effective Output Capacitance, Energy Related ^a	C _{o(er)}	V _{DS} = 0 V to 800 V, V _{GS} = 0 V		-	156	-	
Effective Output Capacitance, Time Related ^b	C _{o(tr)}			-	268	-	
Total Gate Charge	Q _g	V _{GS} = -5/18 V	I _D = 20 A, V _{DS} = 800 V	-	101	-	nC
Gate-Source Charge	Q _{gs}			-	29	-	
Gate-Drain Charge	Q _{gd}			-	33	-	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 800 V, I _D = 20A, V _{GS} = -5/18 V , R _g = 2 Ω		-	18	25	ns
Rise Time	t _r			-	24	55	
Turn-Off Delay Time	t _{d(off)}			-	80	-	
Fall Time	t _f			-	12	-	
Gate Input Resistance	R _g	f = 1 MHz, open drain		-	3.2	-	Ω
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I _S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	60	A
Pulsed Diode Forward Current	I _{SM}			-	-	160	
Diode Forward Voltage	V _{SD}	T _J = 25 °C, I _S = 30 A, V _{GS} = 0		-	-	4.1	V
Reverse Recovery Time	t _{rr}	T _J = 25 °C, I _F = I _S = 30 A, dI/dt = 1000 A/μs, V _R = 800 V		-	47	-	ns
Reverse Recovery Charge	Q _{rr}			-	220	-	μC
Reverse Recovery Current	I _{RRM}			-	60	-	A

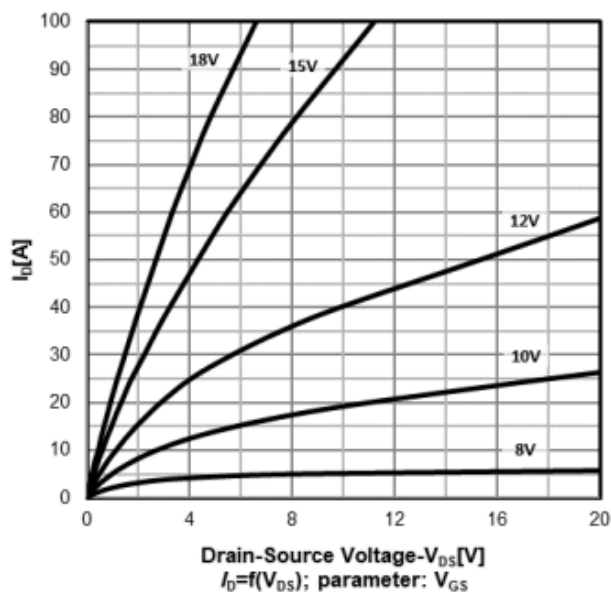
Notes

- a. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .
b. $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .

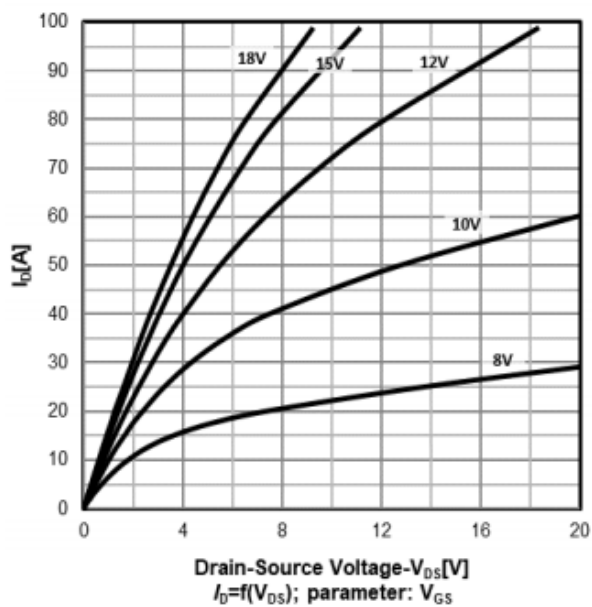
Safe operating area $T_c=25^\circ\text{C}$
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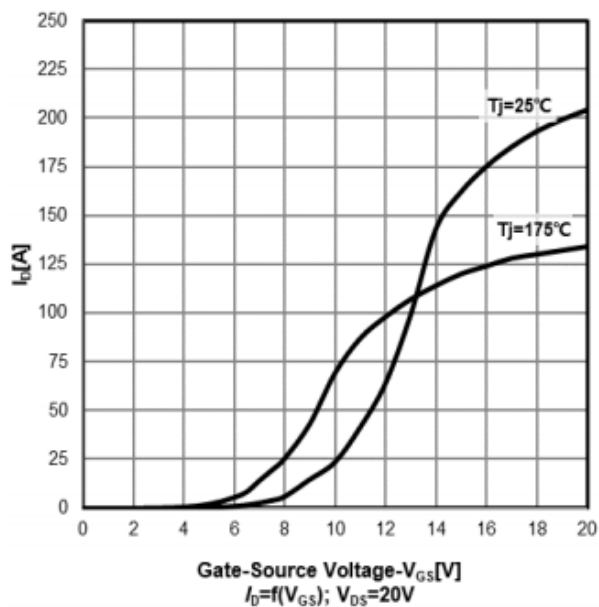
On-Region characteristics $T_j=25^\circ\text{C}$



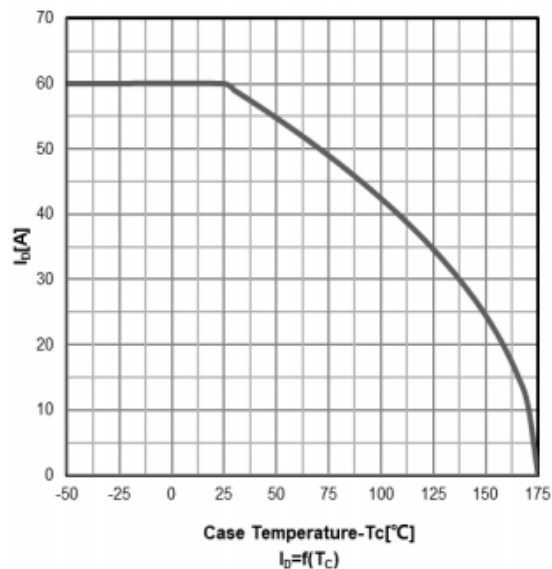
On-Region characteristics $T_j=175^\circ\text{C}$



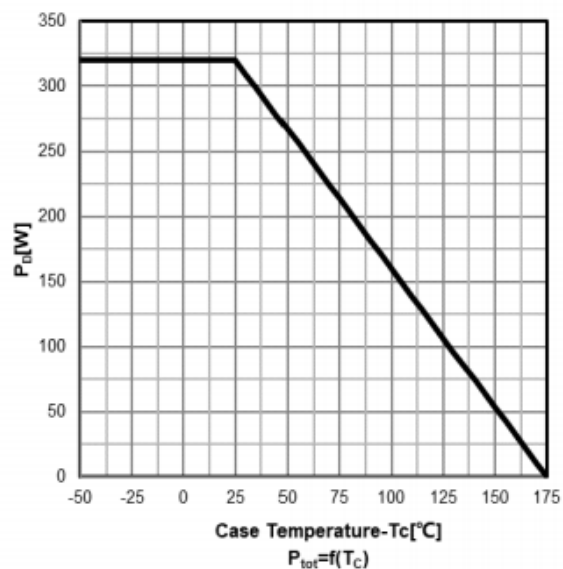
Transfer characteristics



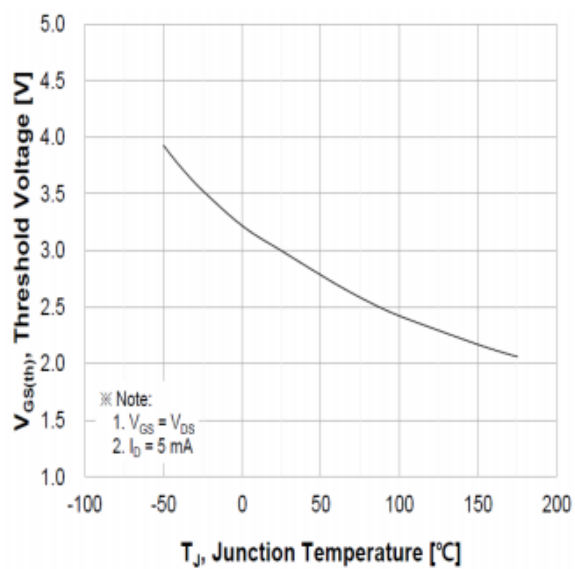
Drain current vs temperature



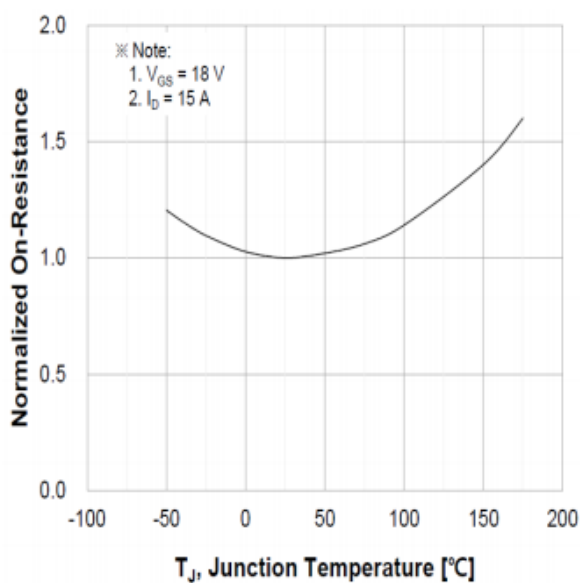
Power dissipation



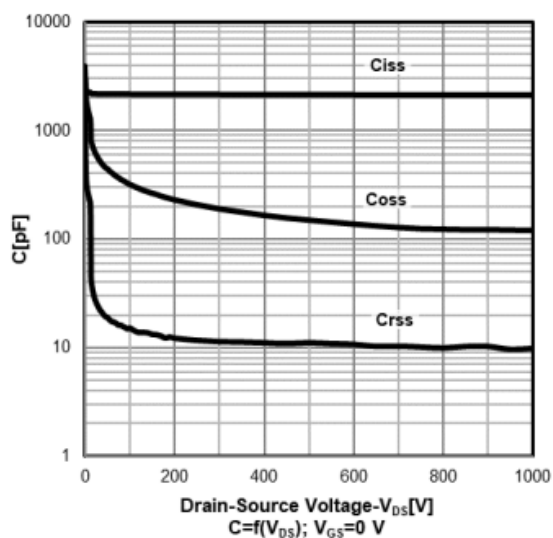
Threshold voltage vs temperature



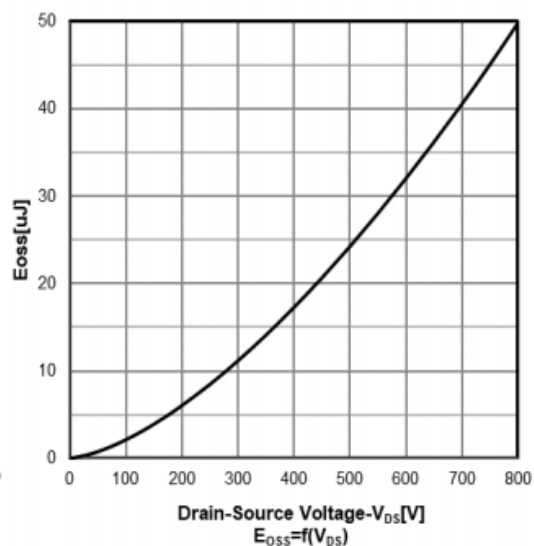
Normalized On-resistance vs temperature



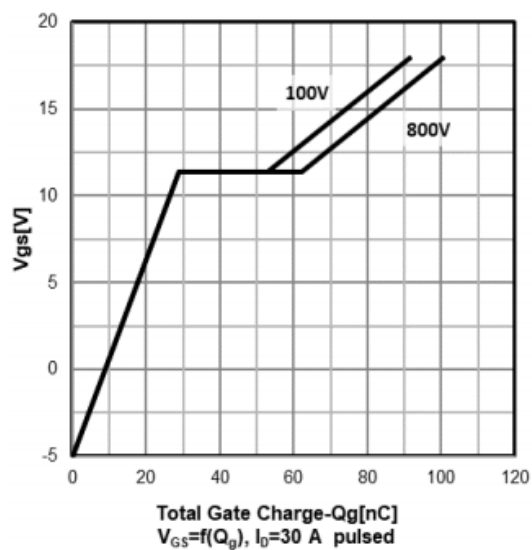
Typ. capacitances



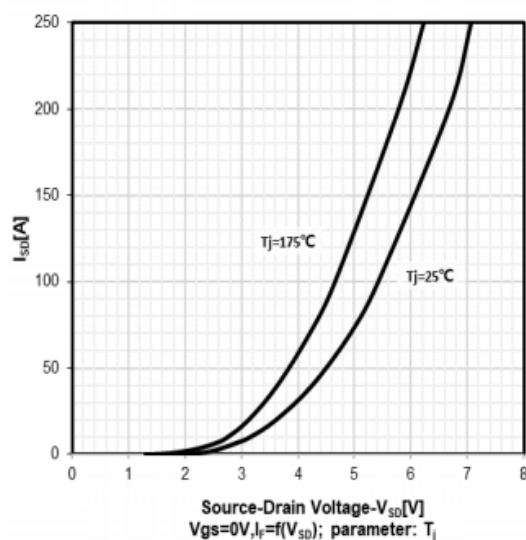
Coss stored energy



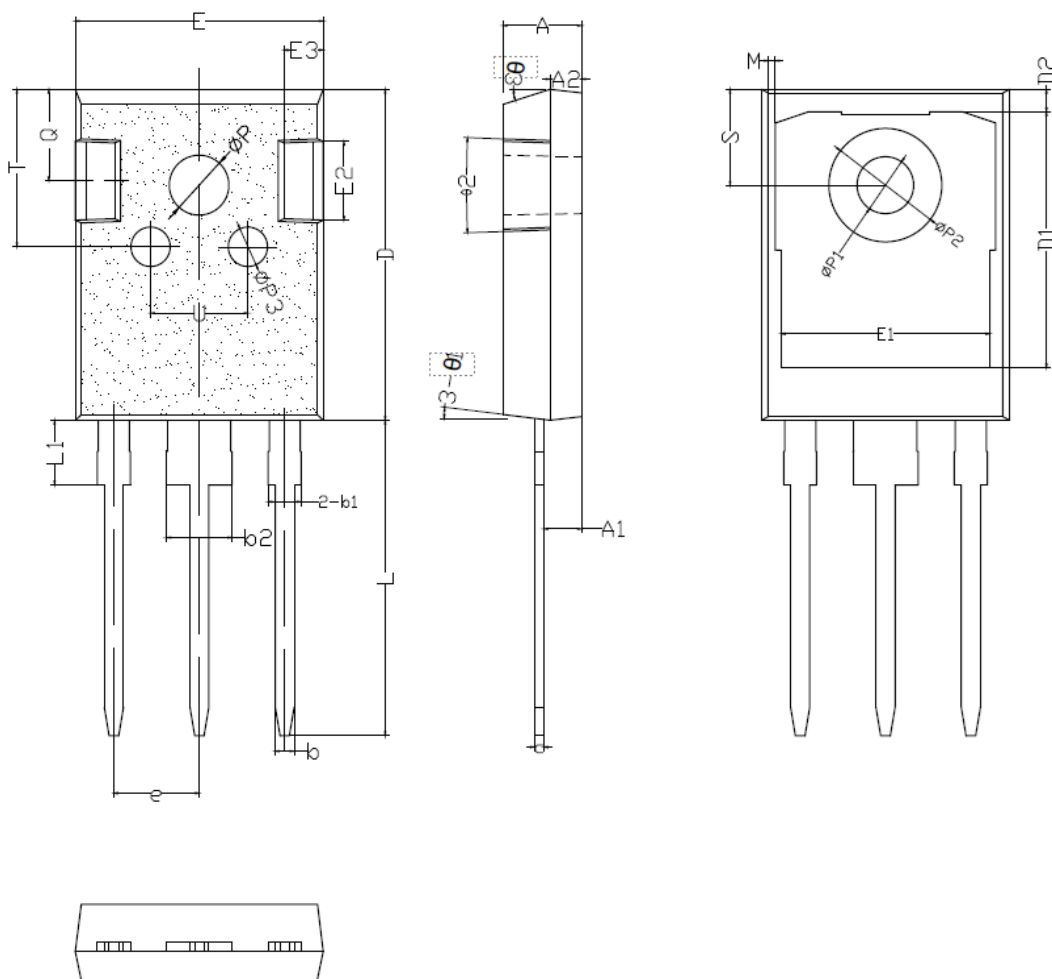
Typ. gate charge characteristics



Diode forward voltage characteristics
 $T_J=25^\circ\text{C}/175^\circ\text{C}$



TO-247 PACKAGE OUTLINE DIMENSIONS



SYMBOL	mm		
	MIN	NOM	MAX
*A	4.90	5.00	5.10
*A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
*b	1.15	1.20	1.25
*b1	1.95	2.10	2.25
*b2	2.95	3.10	3.25
*c	0.55	0.60	0.65
*D	20.90	21.00	21.10
D1	16.35	16.55	16.75
D2	1.05	1.20	1.35

*E	15.70	15.80	15.90
E1	13.10	13.25	13.40
E2	4.85	4.95	5.10
E3	2.40	2.50	2.60
*e	5.40	5.44	5.48
*L	19.80	19.98	20.15
*L1	-	-	4.30
*ΦP	3.40	3.50	3.60
*ΦP1	6.90	7.10	7.30
ΦP2	2.40	2.50	2.60
ΦP3	2.40	2.50	2.60
Q	5.60	5.80	6.00
*S	6.05	6.15	6.25
T	9.80	10.00	10.20
U	6.00	6.20	6.40
θ1	5°	7°	9°
θ2	1°	3°	5°
θ3	13°	15°	17°

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