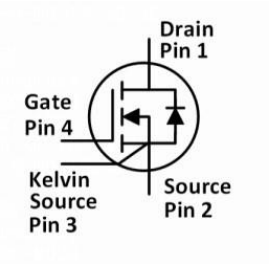
Nano Meter Coated (NMC)SIC MOSFET

■ Features

- ◆ Effectively lower down Tj and Rth, better anti- EMI ability
- ◆ High speed Switching and low switching loss
- ◆ High blocking voltage with low on-resistance
- ◆ Temperature-Independent SwitchingBehavior



TO-247-4L

■ Applications

- ◆ PV string inverters
- ◆ Solar power optimizer
- ◆ Switch mode power supplies
- ◆ Online UPS/ Industrial UPS
- ◆ High Voltage DC/ DC Converters

Top Mark:	CSiC120013T1	
Ordering P/N:	CSiC120013T1	
Parameter	**Value**	**Unit**
V_{DS}	1200	V
I_D(Tc=25℃)	150	A
$R_{DS(ON)}$	13	mΩ
$T_{j,max}$	175	℃

■ Absolute Maximum Ratings

(Tj=25℃ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
V_{DSS}	Drain-Source Voltage	1200	V	
I_D	Continuous DC Drain Current for $R_{th(j-c,typ.)}$, Limited by $T_{VJ(max)}$	150	A	T_C = 25 ℃
		107		Tc = 100℃
		87		T_C = 125 ℃
I_{DM}	Peak Drain Current, tp Limited by $T_{VJ(max)}$	281	A	T_C = 25 ℃
		199		Tc = 100℃
		162		T_C = 125 ℃
$V_{GS, max}$	Gate-Source Max Voltage	-10/22	V	
$V_{GS, op}$	Gate-Source Operate Voltage	-5/18	V	
E_{AS}	Single Pulse Avalanche Energy	729	mJ	L=0.5mH, I_{AS}=54A, V_{DD}=50V, V_{GS}=18V
P_{tot}	Power Dissipation for $R_{th(j-c,typ.)}$	681.8	W	T_C = 25℃

■ Static Characteristics (Tc=25℃ unless otherwise noted)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test condition	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	1200			V	I_D = 100 μA	
$V_{GS(th)}$	Gate Threshold Voltage	2	3.2	4.5	V	V_{DS} = V_{GS}, I_D = 21mA	T_{VJ} = 25 ℃
			2.3				T_{VJ} = 175 ℃
I_{DSS}	Drain-Source Leakage Current			20	μA	V_{GS} = 0 V, V_{DS} = 1200 V	T_{VJ} = 25 ℃
			11				T_{VJ} = 175 ℃
I_{GSS}	Gate-Source Leakage Current			250	nA	V_{GS} = 22 V, V_{DS} = 0 V	T_{VJ} = 25 ℃
			295				T_{VJ} = 175 ℃
I_{SGS}	Source-Gate Leakage Current			250	nA	V_{GS} = -10 V, V_{DS} = 0 V	T_{VJ} = 25 ℃
			-132				T_{VJ} = 175 ℃
$R_{DS(on)}$	Drain-Source On-State Resistance		13		mΩ	V_{GS} = 18 V, I_D = 75 A	T_{VJ} = 25 ℃
			25				T_{VJ} = 175 ℃
g_{fs}	Transconductance		56.2		S	V_{DS} = 20 V, I_D = 75 A	
$R_{G(int)}$	Internal Gate Resistance		1.25		Ω	f = 1MHz, V_{AC} = 25 mV	
C_{iss}	Input Capacitance		5357		pF	V_{GS} = 0 V, V_{DS} = 800 V, f = 1MHz	
C_{oss}	Output Capacitance		240		pF		
C_{rss}	Reverse Transfer Capacitance		9		pF		
Q_{GS}	Gate to Source Charge		71.6		nC	V_{GS} = -5 V / +18 V, V_{DD} = 800 V, I_D = 75 A	
Q_{GD}	Gate to Drain Charge		17.9		nC		
Q_G	Total Gate Charge		219.0		nC		

■ Dynamic Characteristics (Tc=25℃ unless otherwise noted)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test condition	
$t_{d(on)}$	Turn−On Delay Time		16.0		ns	V_{GS} = -5 V / +18 V, L=100uH V_{DD} = 800 V, I_D = 75 A, $R_{G(on)}$ = 2 Ω, $R_{G(off)}$ = 2 Ω	T_{VJ} = 25 ℃
			15.8				T_{VJ} = 125 ℃
			15.2				T_{VJ} = 175 ℃
t_r	Rise Time		17.9		ns		T_{VJ} = 25 ℃
			19.0				T_{VJ} = 125 ℃
			20.4				T_{VJ} = 175 ℃
$t_{d(off)}$	Turn−Off Delay Time		36.2		ns		T_{VJ} = 25 ℃
			37.9				T_{VJ} = 125 ℃
			39.2				T_{VJ} = 175 ℃
t_f	Fall Time		8.5		ns		T_{VJ} = 25 ℃
			7.1				T_{VJ} = 125 ℃
			7.0				T_{VJ} = 175 ℃

■ Dynamic Characteristics (Tc=25℃ unless otherwise noted)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test condition	
E_{on}	Turn−On Switching Loss		538.2		μJ	V_{GS} = -5 V / +18 V, L=100uH V_{DD} = 800 V, I_D = 75 A, $R_{G(on)}$ = 2 Ω, $R_{G(off)}$ = 2 Ω	T_{VJ} = 25 ℃
			589.1				T_{VJ} = 125 ℃
			628.0				T_{VJ} = 175 ℃
E_{off}	Turn−Off Switching Loss		166.5		μJ		T_{VJ} = 25 ℃
			114.2				T_{VJ} = 125 ℃
			105.3				T_{VJ} = 175 ℃
E_{tot}	Total Switching Energy		704.7		μJ		T_{VJ} = 25 ℃
			686.9				T_{VJ} = 125 ℃
			658.3				T_{VJ} = 175 ℃

Note：Eon/ Eoff result with body diode

■ Maximum Ratings For Body Diode (TVJ= 25˚C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
V_{DSS}	Drain-Source Voltage	1200	V	
I_{SM}	Peak Reverse Drain Current, tp Limited by $T_{VJ(max)}$	281	A	T_C = 25 ℃
		199		T_C = 100 ℃
		162		T_C = 125 ℃

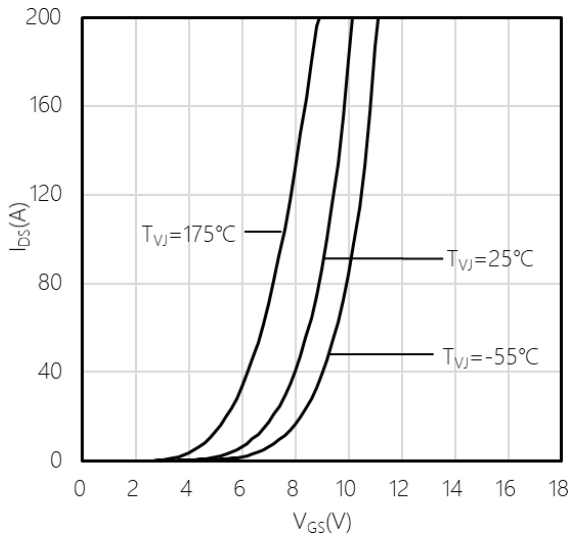
■ Body Diode Characteristics (Tc=25℃ unless otherwise noted)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test conditions	
V_{SD}	Body Diode Forward Voltage		4.8		V	V_{GS} = -5 V, I_{SD} = 75 A	T_{VJ} = 25 ℃
			4.4				T_{VJ} = 125 ℃
			4.2				T_{VJ} = 175 ℃
I_{rrm}	Peak Reverse Recovery Current		45.5		A	V_{DS} = 800 V, V_{GS} = -5 V, I_{SD} =75A, di/dt = 3670 A / μs	T_{VJ} = 25 ℃
			50.5				T_{VJ} = 125 ℃
			56.6				T_{VJ} = 175 ℃
Q_{rr}	Reverse Recovery Charge		0.55		μC		T_{VJ} = 25 ℃
			0.82				T_{VJ} = 125 ℃
			1.14				T_{VJ} = 175 ℃
t_{rr}	Reverse Recovery Time		22.0		ns		T_{VJ} = 25 ℃
			34.6				T_{VJ} = 125 ℃
			35.1				T_{VJ} = 175 ℃
E_{rr}	Reverse Recovery Energy		77.5		μJ		T_{VJ} = 25 ℃
			149.2				T_{VJ} = 125 ℃
			229.7				T_{VJ} = 175 ℃

Typical transfer characteristic

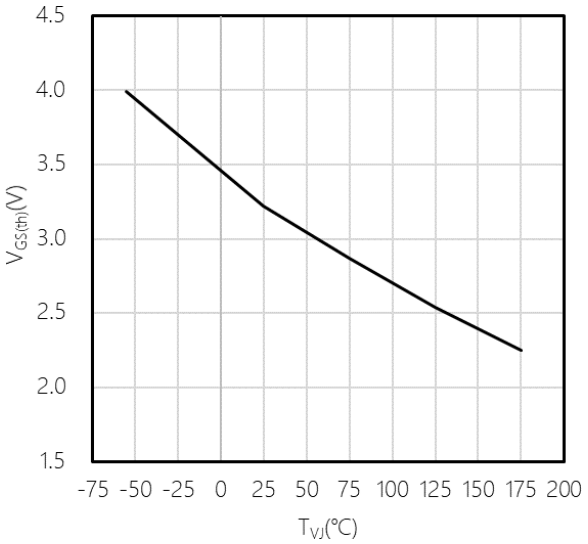
I_{DS} = f(V_{GS})

V_{DS}= 20 V



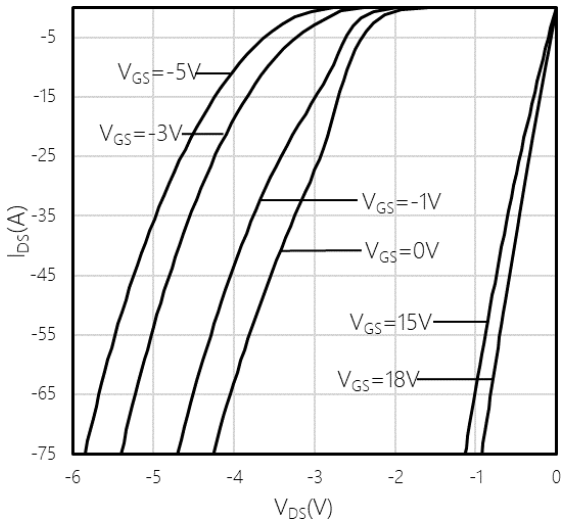
Typical gate-source threshold voltage as a function of junction temperature

$V_{GS(th)}$ = f(T_{VJ}), I_{DS} = 21 mA



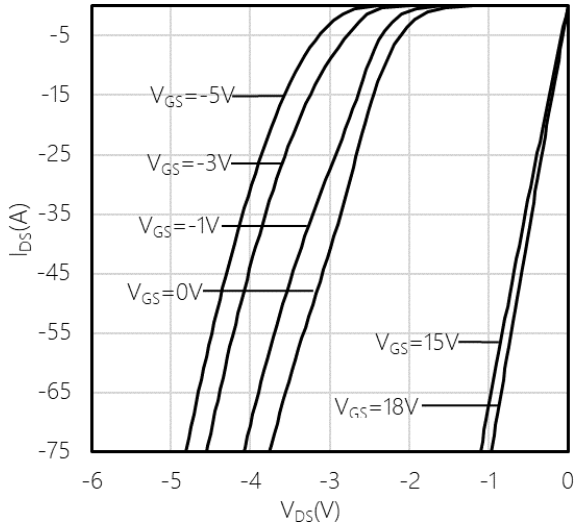
Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter

I_{DS} = f(V_{DS}), T_{VJ} = -55 °C



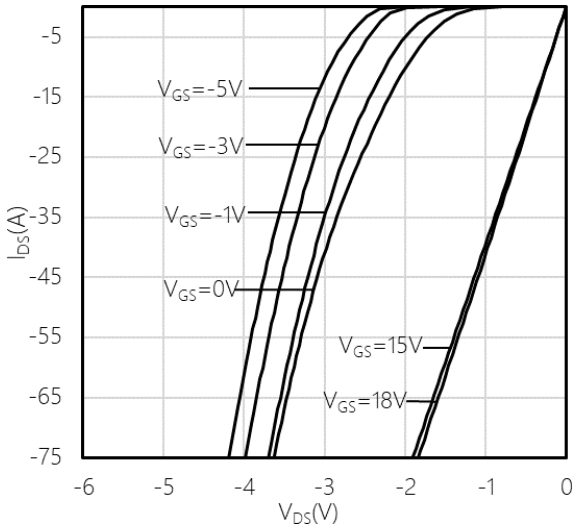
Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter

I_{DS} = f(V_{DS}), T_{VJ} = 25 °C



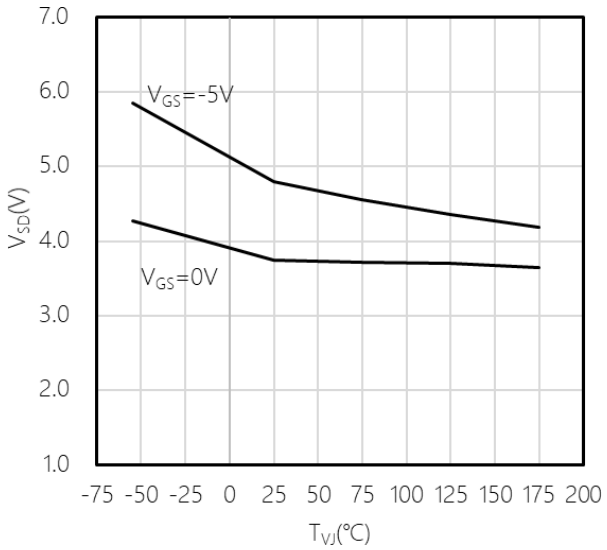
Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter

$I_{DS} = f(V_{DS})$, $T_{VJ} = 175$ °C



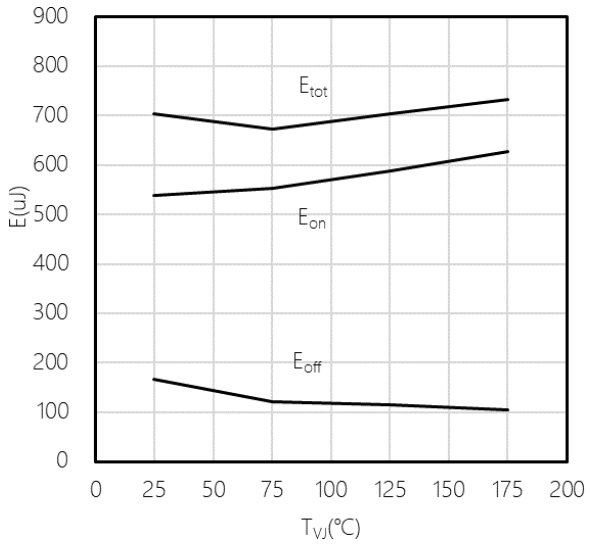
Typical reverse drain voltage as function of junction temperature

$V_{SD} = f(T_{VJ})$, $I_{SD} = 37.5$ A



Typical switching energy as a function of junction temperature, 2nd device own body diode: V_{GS} = -5 V $E = f(T_{VJ})$

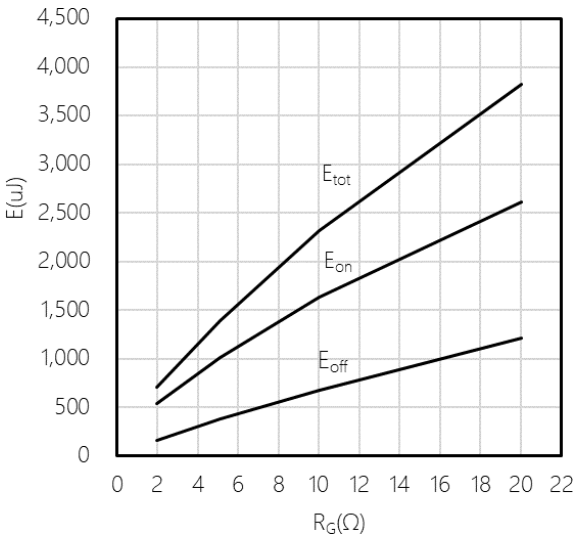
V_{DS} = 800 V, $R_{G(ext)}$ = 2 Ω, V_{GS} = -5 V / +18 V, I_{DS} = 75 A



Typical switching energy losses as a function of gate resistance, 2nd device own body diode: V_{GS} = -5 V

$E = f(R_{G(ext)})$

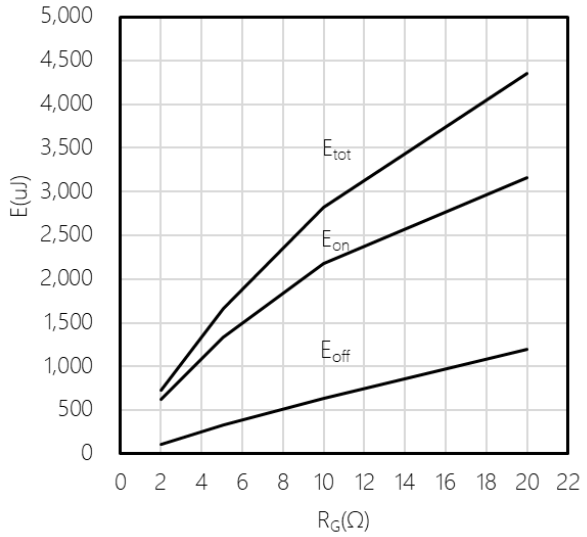
V_{GS} = -5/18 V, I_{DS} = 75 A, T_{VJ} = 25 °C, V_{DS} = 800 V



Typical switching energy losses as a function of gate resistance, 2nd device own body diode: V_{GS} = -5 V

E = f($R_{G(ext)}$)

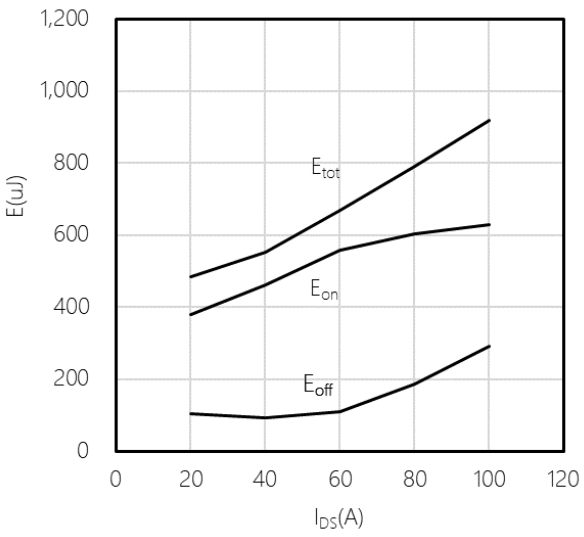
V_{GS} = -5/18 V, I_{DS} = 75 A, T_{VJ} = 175 °C, V_{DS} = 800 V



Typical switching energy losses as a function of gate resistance, 2nd device own body diode: V_{GS} = -5 V

E = f(I_{DS})

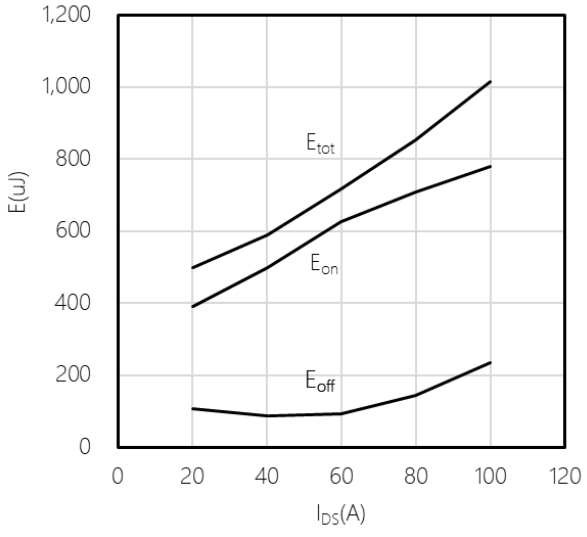
V_{GS} = -5/18 V, $R_{G(ext)}$ = 2 Ω, T_{VJ} = 25 °C, V_{DS} = 800 V



Typical switching energy losses as a function of gate resistance, 2nd device own body diode: V_{GS} = -5 V

E = f(I_{DS})

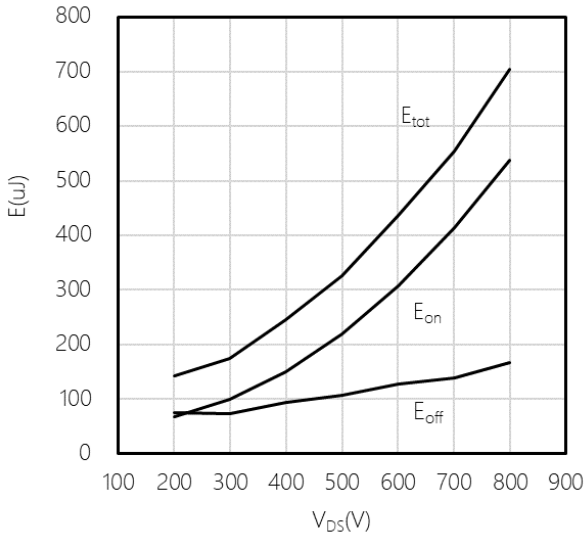
V_{GS} = -5/18 V, $R_{G(ext)}$ = 2 Ω, T_{VJ} = 175 °C, V_{DS} = 800 V



Typical switching energy losses as a function of gate resistance, 2nd device own body diode: V_{GS} = -5 V

E = f(V_{DS})

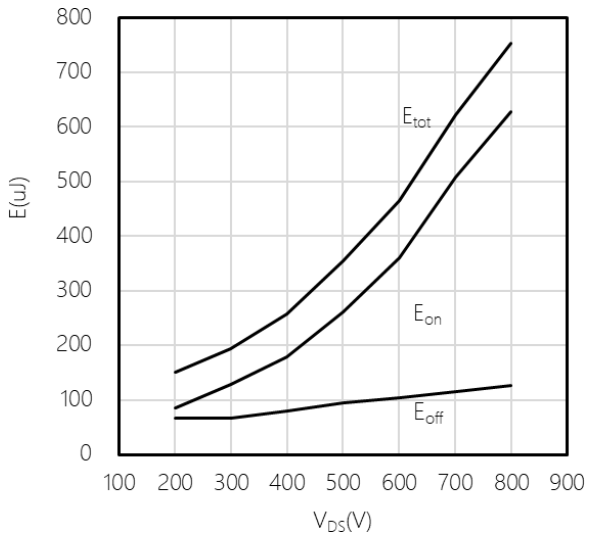
V_{GS} = -5/18 V, $R_{G(ext)}$ = 2 Ω, T_{VJ} = 25 °C, I_{DS} = 75 A



Typical switching energy losses as a function of gate resistance, 2nd device own body diode: V_{GS} = -5 V

E = f(V_{DS})

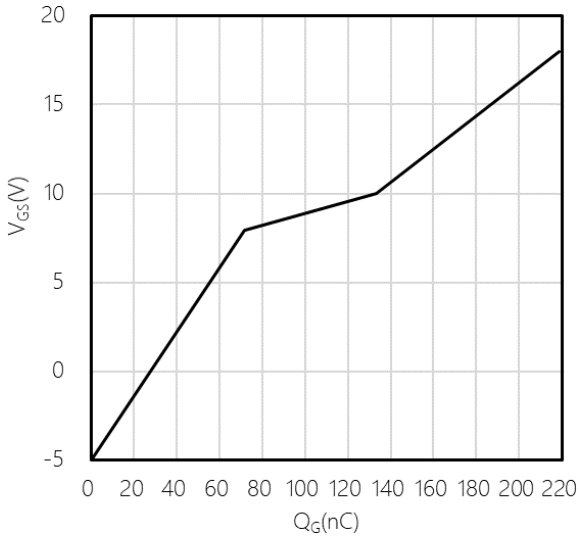
V_{GS} = -5/18 V, $R_{G(ext)}$ = 2 Ω, T_{VJ} = 175 °C, I_{DS} = 75 A



Typical gate charge

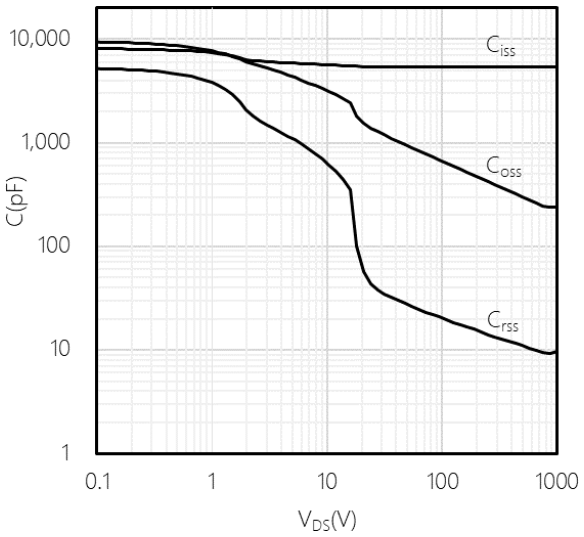
V_{GS} =f(Q_G), I_{DS} = 75A, V_{DS} = 800V

turn-on pulse



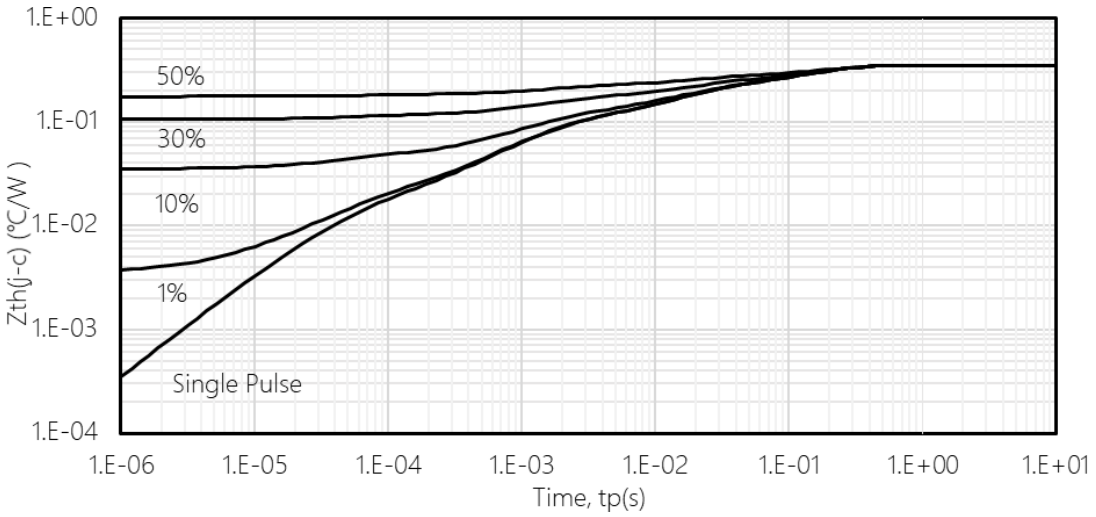
Typical capacitance as a function of drain-source voltage

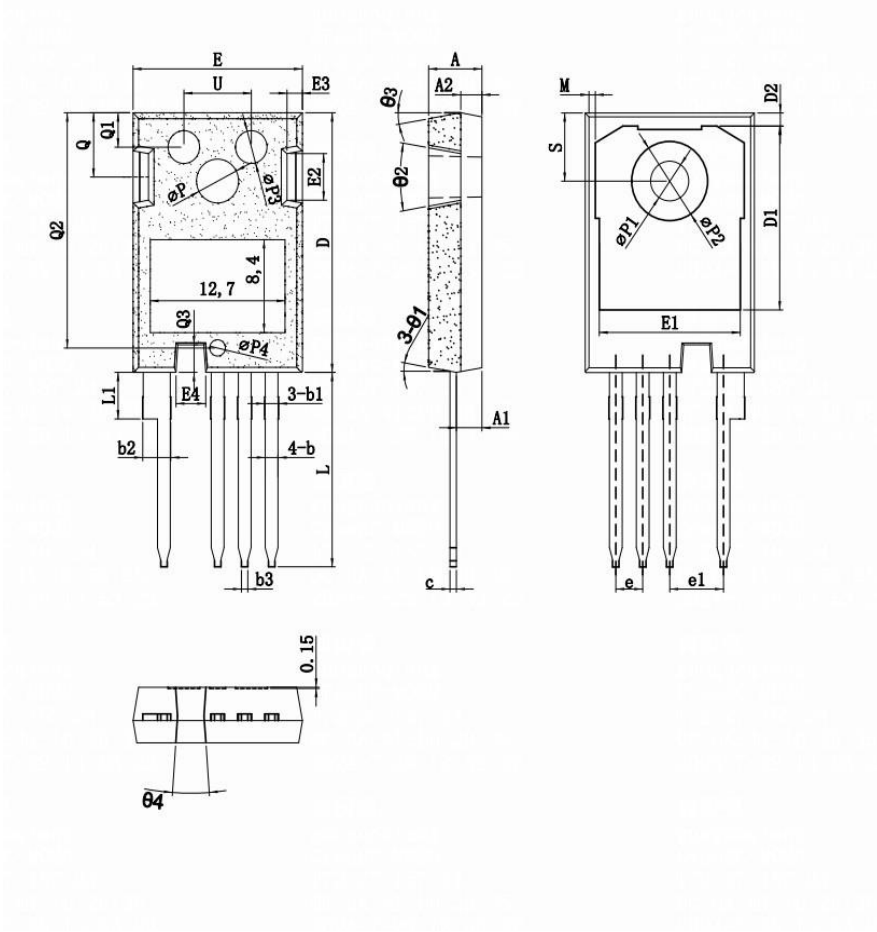
C = f(V_{DS}), V_{GS} = 0V, f = 1MHz



Max. transient thermal resistance (MOSFET)

($Z_{th(j-c,max)} = f(t_p)$, Parameter $D = t_p/T$





SYMBOL	mm		
	MIN	NOM	MAX
✻A	4.83	5.02	5.21
✻A1	2.29	2.42	2.54
A2	1.91	2.00	2.16
✻b	1.07	1.20	1.33
✻b1	1.15	1.30	1.45
✻b2	2.39	2.67	2.94
b3	0.45	0.60	0.75
✻c	0.55	0.60	0.68
✻D	23.30	23.45	23.60
D1	16.35	16.65	16.95
D2	0.95	1.19	1.25
✻E	15.75	15.94	16.13
E1	13.10	13.25	13.40
E2	4.00	4.40	4.80
E3	1.00	1.45	1.90
E4	2.40	2.80	3.20
✻e	2.50	2.54	2.58
✻e1	5.03	5.08	5.13
✻L	17.31	17.57	17.82
✻L1	–	–	4.37
M	0.40	0.60	0.80
✻ ΦP	3.90	4.00	4.10
✻ ΦP1	3.51	3.61	3.71
ΦP2	7.03	7.18	7.33
ΦP3	2.80	3.00	3.20
ΦP4	1.30	1.50	1.70
Q	5.49	5.79	6.00
Q1	2.80	3.10	3.40
Q2	19.95	21.25	21.55
Q3	2.35	2.50	2.65
S	6.04	6.17	6.30
U	6.05	6.35	6.55
θ1	6°	10°	13°
θ2	16°	20°	24°
θ3	6°	10°	13°
θ4	5°	8°	11°

Package Outline **Common Dimensions**