750V Silicon Carbide Power MOSFET

Features

- Revolutionary semiconductor material Silicon Carbide
- High blocking voltage with low on-resistance
- High speed switching with very low switching losses
- High speed and high robust intrinsic body diode
- Optimized package with separate driver source pin

Product Summary

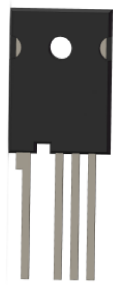
Green

BVDSS	RDSON	ID
750V	40mΩ	68A

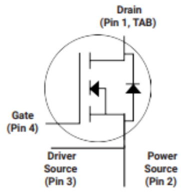
Applications

- UPS
- Solar inverter
- Energy storage system
- Telecom power supply
- Server/SMPS

TO247-4L Pin Configuration



1 2 3 4



Maximum Ratings For MOSFET (T_{VJ}= 25˚C unless otherwise specified)

Symbol	Parameter	Value	Unit	Testing Conditions
V_{DSS}	Drain-Source Voltage	750	V	
I_D	Continuous DC Drain Current for $R_{th(j\text{-}c,typ.)}$, Limited by $T_{VJ(max)}$	68	A	T_C = 25 ℃
		48		T_C = 100℃
I_{DM}	Peak Drain Current, tp Limited by $T_{VJ(max)}$	131	A	T_C = 25 ℃
$V_{GS,\ max}$	Gate-Source Max Voltage	-10/22	V	
$V_{GS,\ op}$	Gate-Source Operate Voltage	-5/18	V	
E_{AS}	Single Pulse Avalanche Energy	196	mJ	L=0.5mH, I_{AS}=65 A, V_{DD}=50V, V_{GS}=18V
P_{tot}	Power Dissipation for $R_{th(j\text{-}c,typ.)}$	259	W	T_C = 25℃

Package Values

Symbol	Parameter	Min.	Typ.	Max.	Unit	Testing Conditions
$R_{th(j\text{-}c)}$	MOSFET/Body Diode Junction-Case Thermal Resistance		0.58	0.70	K/W	
T_{VJ}, T_{STG}	Operating Junction and Storage Temperature	-55		175	℃	
T_{SOLD}	Soldering Temperature, Wave Soldering only Allowed at Leads 1.6mm from Case for 10s		260		℃	
M	M3 screw, Maximum of mounting processes: 3		1		Nm	

MOSFET Characteristics (T_{VJ}= 25˚C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Testing Conditions	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	750			V	I_D = 100 μA	
$V_{GS(th)}$	Gate Threshold Voltage	2.7	3.3	4.1	V	V_{DS} = V_{GS}, I_D = 5.6mA	T_{VJ} = 25 ℃
			2.3				T_{VJ} = 175 ℃
I_{DSS}	Drain-Source Leakage Current			20	μA	V_{GS} = 0 V, V_{DS} = 750 V	T_{VJ} = 25 ℃
			1				T_{VJ} = 175 ℃
I_{GSS}	Gate-Source Leakage Current			250	nA	V_{GS} = 22 V, V_{DS} = 0 V	T_{VJ} = 25 ℃
I_{SGS}	Source-Gate Leakage Current			250	nA	V_{GS} = -10 V, V_{DS} = 0 V	T_{VJ} = 25 ℃
$R_{DS(on)}$	Drain-Source On-State Resistance		39	51	mΩ	V_{GS} = 18 V, I_D = 18.8 A	T_{VJ} = 25 ℃
			50				T_{VJ} = 175 ℃
g_{fs}	Transconductance		11.8		S	V_{DS} = 20 V, I_D = 18.8 A	
$R_{G(int)}$	Internal Gate Resistance		1.5		Ω	f = 1MHz, V_{AC} = 25 mV	
C_{iss}	Input Capacitance		1531		pF	V_{GS} = 0 V, V_{DS} = 500 V, f = 1MHz	
C_{oss}	Output Capacitance		127		pF		
C_{rss}	Reverse Transfer Capacitance		7		pF		
Q_{GS}	Gate to Source Charge		24		nC	V_{GS} = -5 V / +18 V, V_{DD} = 500 V, I_D = 18.8A	
Q_{GD}	Gate to Drain Charge		6		nC		
Q_G	Total Gate Charge		67		nC		

Dynamic MOSFET Characteristics (T_{VJ}= 25˚C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Testing Conditions	
$t_{d(on)}$	Turn−On Delay Time		7.0		ns	V_{GS} = -5 V / +18 V, L=100uH, V_{DD} = 500 V, I_D = 18.8 A, $R_{G(on)}$ = 9.1 Ω, $R_{G(off)}$ = 9.1Ω	T_{VJ} = 25 ℃
			4.6				T_{VJ} = 175 ℃
t_r	Rise Time		16.3		ns		T_{VJ} = 25 ℃
			14.3				T_{VJ} = 175 ℃
$t_{d(off)}$	Turn−Off Delay Time		26.3		ns		T_{VJ} = 25 ℃
			36.2				T_{VJ} = 175 ℃
t_f	Fall Time		10.7		ns		T_{VJ} = 25 ℃
			10.2				T_{VJ} = 175 ℃
E_{on}	Turn−On Switching Loss		156.0		μJ		T_{VJ} = 25 ℃
			145.9				T_{VJ} = 175 ℃
E_{off}	Turn−Off Switching Loss		20.4		μJ		T_{VJ} = 25 ℃
			16.5				T_{VJ} = 175 ℃
E_{tot}	Total Switching Energy		176.4		μJ		T_{VJ} = 25 ℃
			162.4				T_{VJ} = 175 ℃

Note: E_{on}/E_{off} result is with body diode.

Maximum Ratings For Body Diode (T_{VJ}= 25˚C unless otherwise specified)

Symbol	Parameter	Value	Unit	Testing Conditions
V_{DSS}	Drain-Source Voltage	750	V	
I_S	Continuous DC Source Current, Limited by $T_{VJ(max)}$	48	A	T_C = 25 ℃
		27		T_C = 100 ℃
I_{SM}	Peak Reverse Drain Current, tp Limited by $T_{VJ(max)}$	130		T_C = 25 ℃

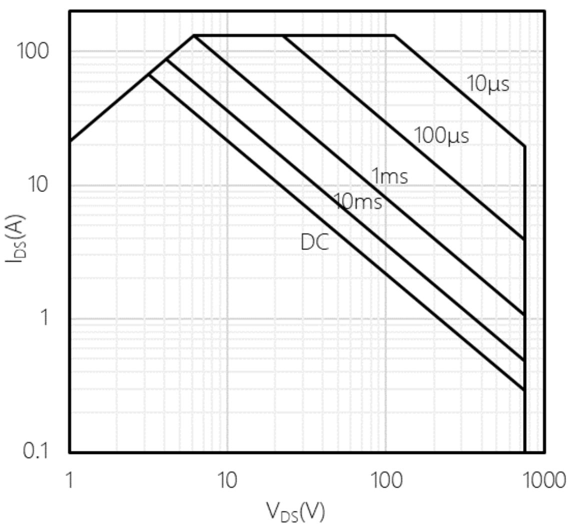
Body Diode Characteristics (T_{VJ}= 25˚C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Testing Conditions	
V_{SD}	Body Diode Forward Voltage		3.8		V	V_{GS} = -5 V, I_{SD} = 9.5 A	T_{VJ} = 25 ℃
			3.2				T_{VJ} = 175 ℃
I_{rrm}	Peak Reverse Recovery Current		19		A	V_{DS} = 500 V, V_{GS} = -5 V, I_{SD} =18.8A, di/dt = 2000 A / μs	T_{VJ} = 25 ℃
			27				T_{VJ} = 175 ℃
Q_{rr}	Reverse Recovery Charge		161		nC		T_{VJ} = 25 ℃
			298				T_{VJ} = 175 ℃
t_{rr}	Reverse Recovery Time		16		ns		T_{VJ} = 25 ℃
			20				T_{VJ} = 175 ℃
E_{rr}	Reverse Recovery Energy		10		μJ		T_{VJ} = 25 ℃
			30				T_{VJ} = 175 ℃

Typical Performances

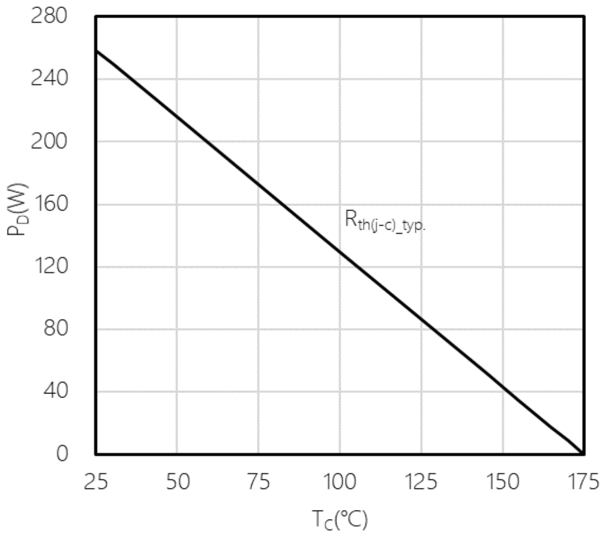
Safe operating area (SOA)

$R_{th(j-c)}$ =0.70 °C/W, Single Pulse, T_{VJ} = 25°C



Power dissipation as a function of case temperature limited by bond wire

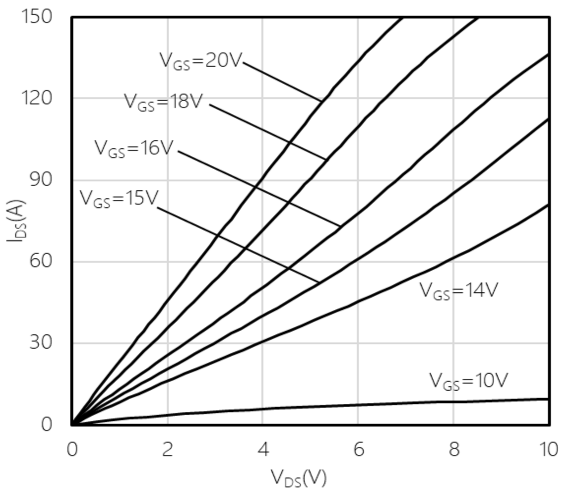
P_D = f(T_C)



Typical output characteristic, V_{GS} as parameter

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

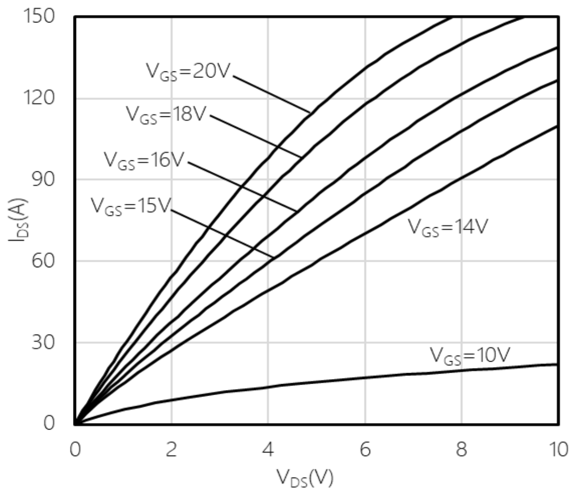
T_{VJ} = -55 ℃



Typical output characteristic, V_{GS} as parameter

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

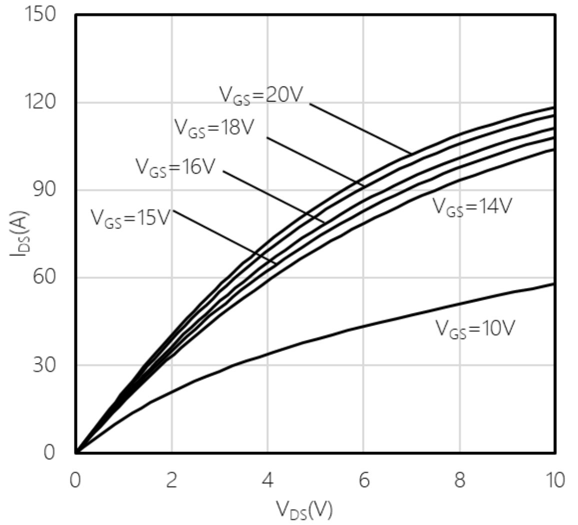
T_{VJ} = 25 ℃



Typical output characteristic, V_{GS} as parameter

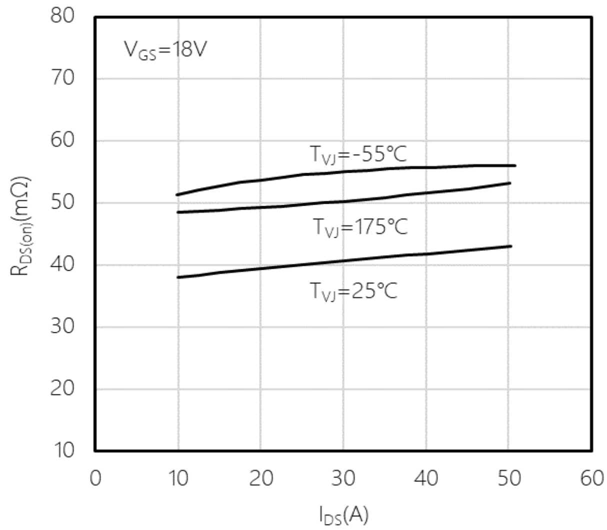
I_{DS} = f(V_{DS})

T_{VJ} = 175℃



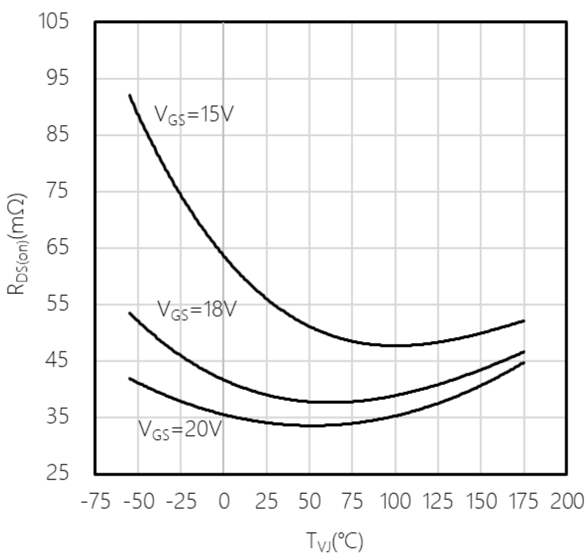
Typical on-state resistance as a function of drain current

$R_{DS(on)}$ = f(I_{DS}), V_{GS} = 18V



Typical on-state resistance as a function of temperature

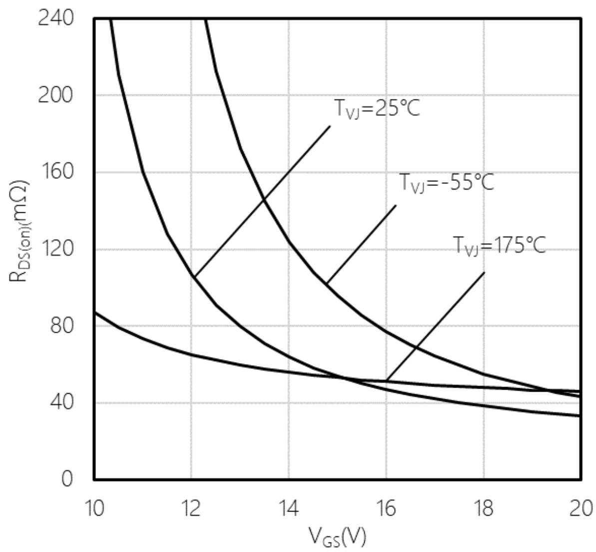
$R_{DS(on)}$ = f(T_{VJ}), I_{DS} =18.8A



Typical on-state resistance as a function of V_{GS}

$R_{DS(on)}$ = f(V_{GS})

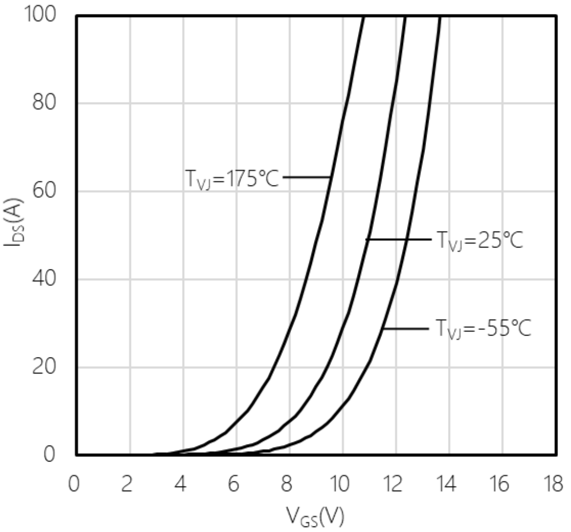
I_{DS} =18.8A



Typical transfer characteristic

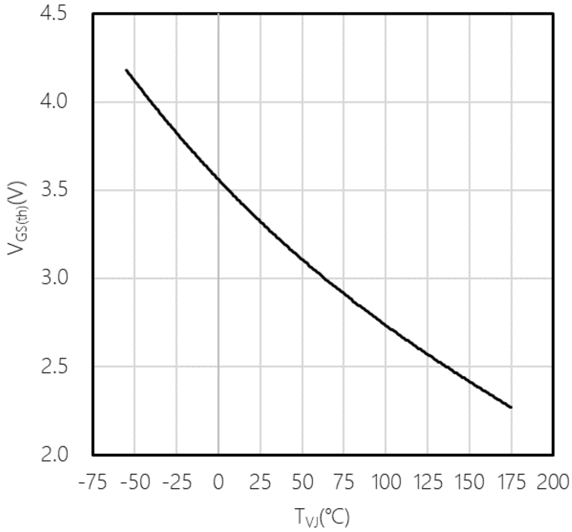
I_{DS} = f(V_{GS})

V_{DS}= 20V



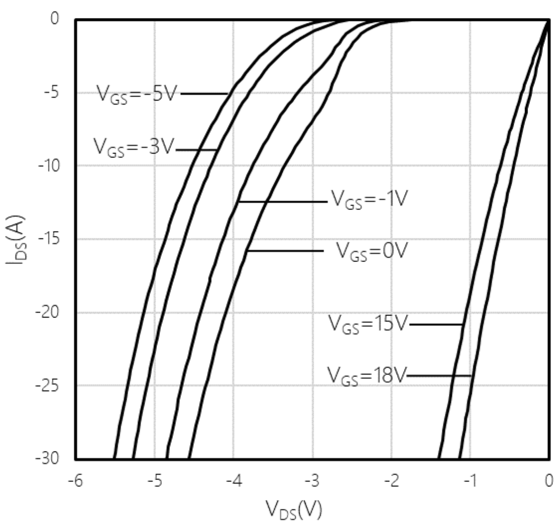
Typical gate-source threshold voltage as a function of junction temperature

$V_{GS(th)}$ = f(T_{VJ}), I_{DS} = 2.6mA



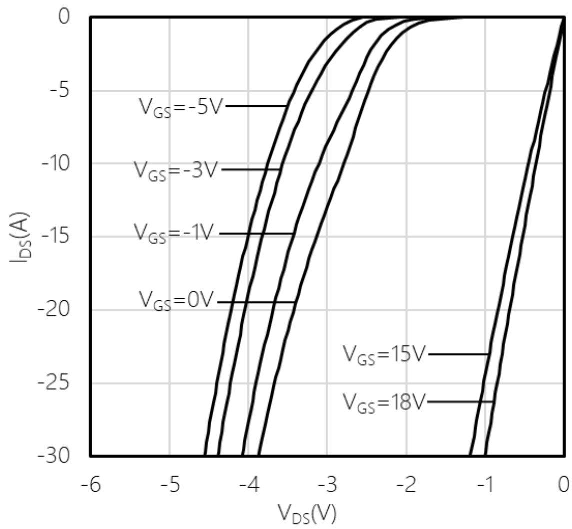
Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter

I_{DS} = f(V_{DS}), T_{VJ} = -55 °C



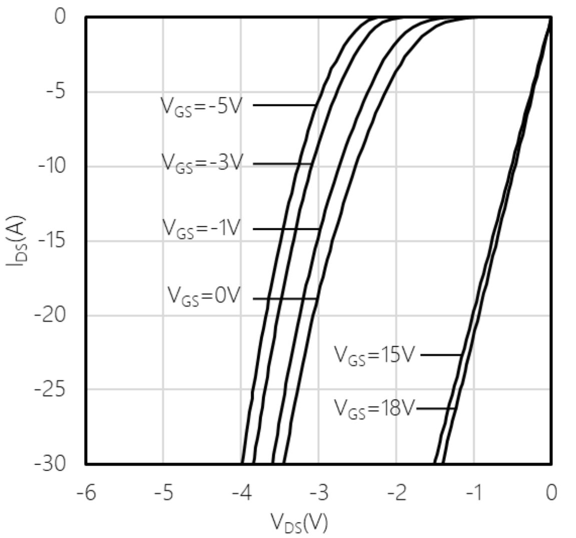
Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter

I_{DS} = f(V_{DS}), T_{VJ} = 25 °C



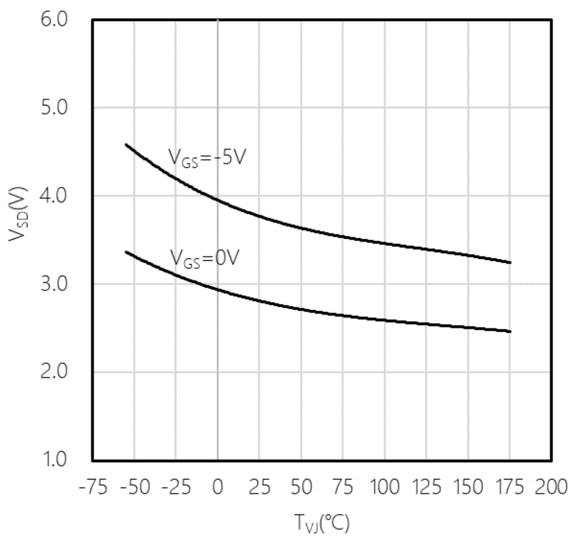
Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter

$I_{DS} = f(V_{DS})$, T_{VJ} = 175 °C



Typical reverse drain voltage as function of junction temperature

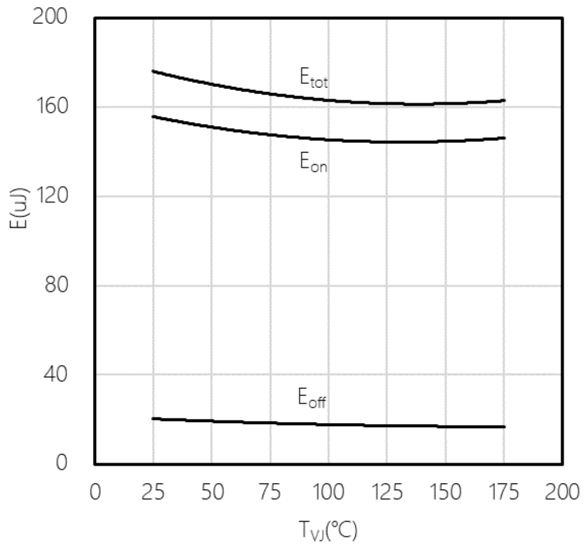
$V_{SD} = f(T_{VJ})$, I_{SD} = 9.5 A



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

$E = f(T_{VJ})$

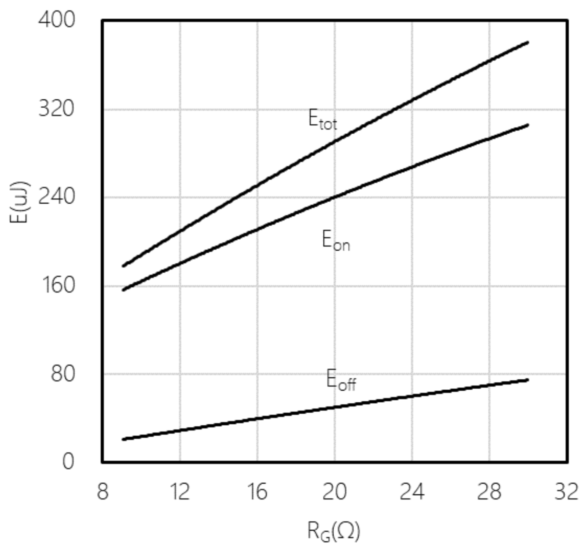
V_{DS} = 500 V, $R_{G(ext)}$ = 9.1 Ω, V_{GS} = -5 V / +18 V, I_{DS} = 18.8 A



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

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

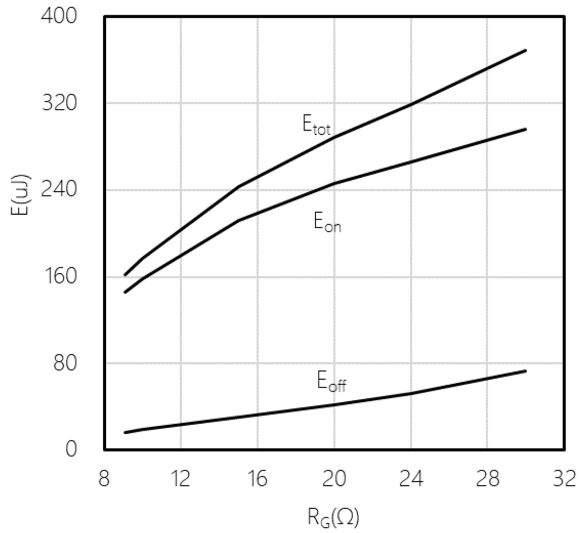
V_{GS} = -5/18 V, I_{DS} = 18.8 A, T_{VJ} = 25 °C, V_{DS} = 500 V



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

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

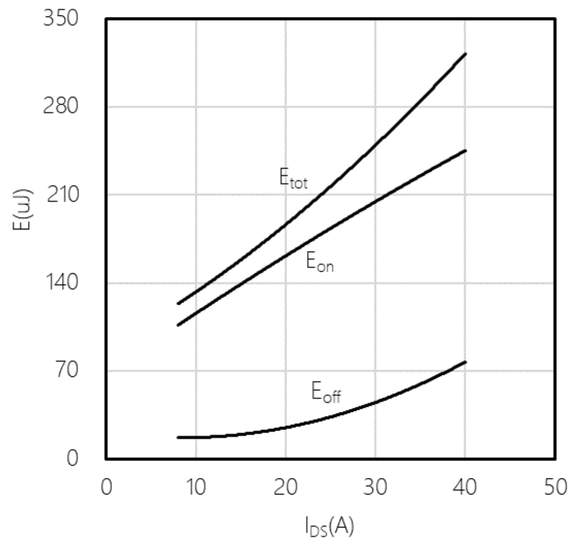
V_{GS} = -5/18 V, I_{DS} = 18.8 A, T_{VJ} = 175 °C, V_{DS} = 500 V



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

E = f(I_{DS})

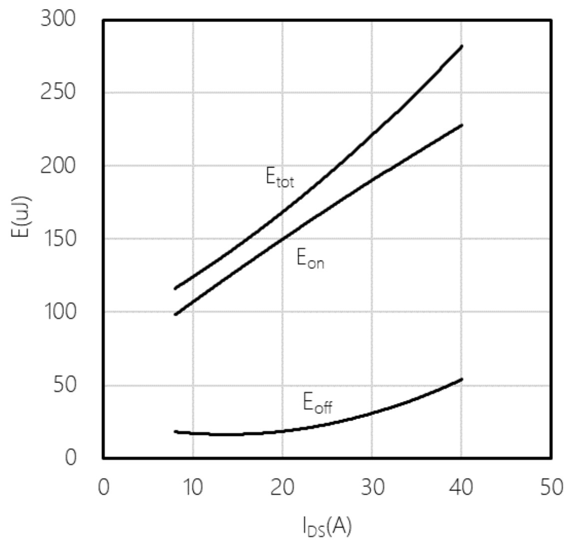
V_{GS} = -5/18 V, $R_{G(ext)}$ = 9.1 Ω, T_{VJ} = 25 °C, V_{DS} = 500 V



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

E = f(I_{DS})

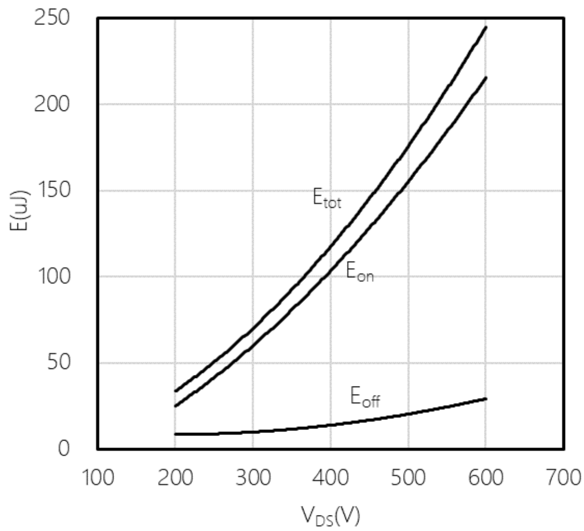
V_{GS} = -5/18 V, $R_{G(ext)}$ = 9.1 Ω, T_{VJ} = 175 °C, V_{DS} = 500 V



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

E = f(V_{DS})

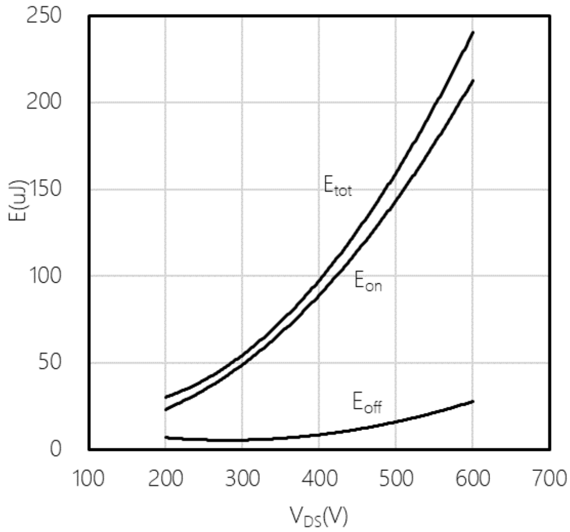
V_{GS} = -5/18 V, $R_{G(ext)}$ = 9.1Ω, T_{VJ} = 25 °C, I_{DS} = 18.8A



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

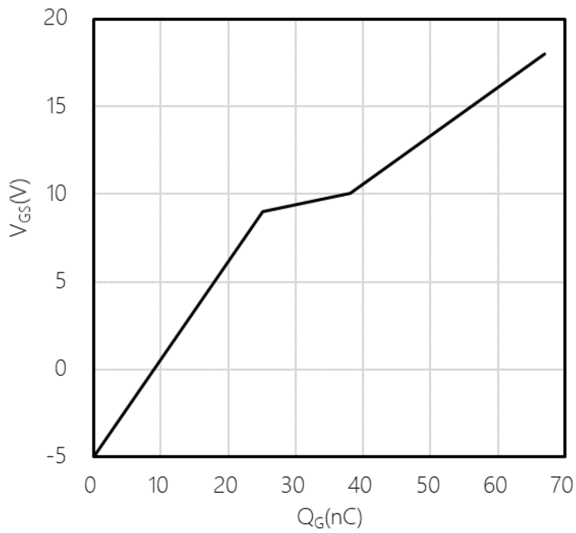
$E = f(V_{DS})$

V_{GS} = -5/18 V, $R_{G(ext)}$ = 9.1 Ω, T_{VJ} = 175 °C, I_{DS} = 18.8 A



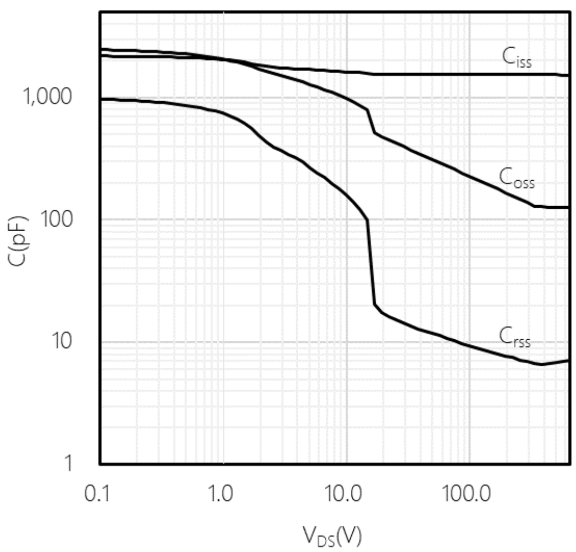
Typical gate charge

$V_{GS} = f(Q_G)$, I_{DS} = 18.8A, V_{DS} = 500V turn-on pulse



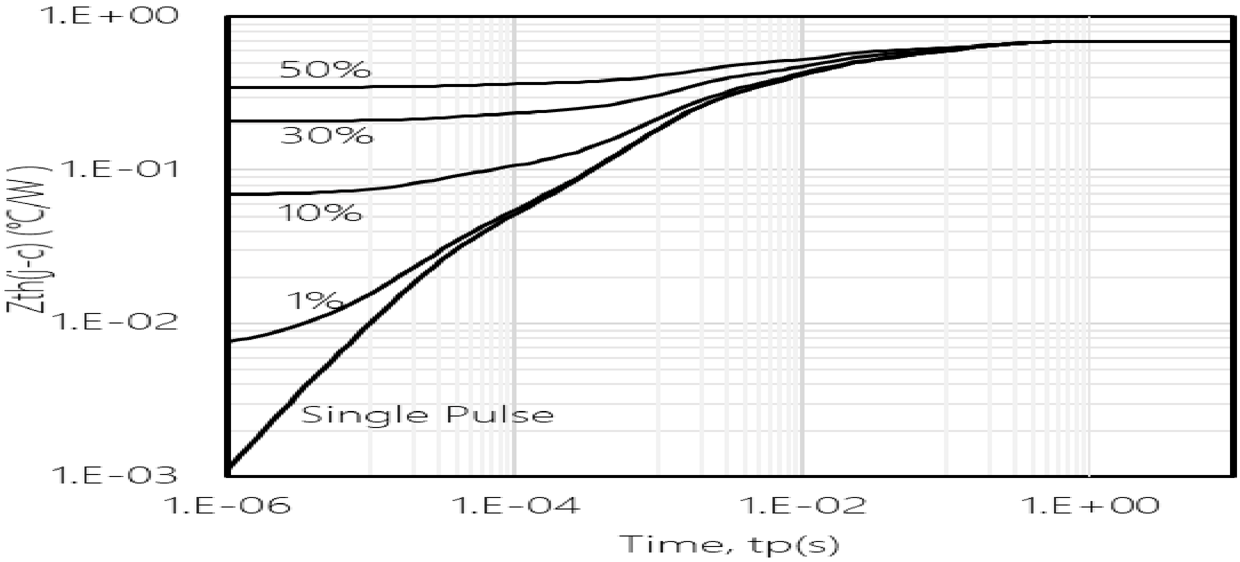
Typical capacitance as a function of drain-source voltage

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

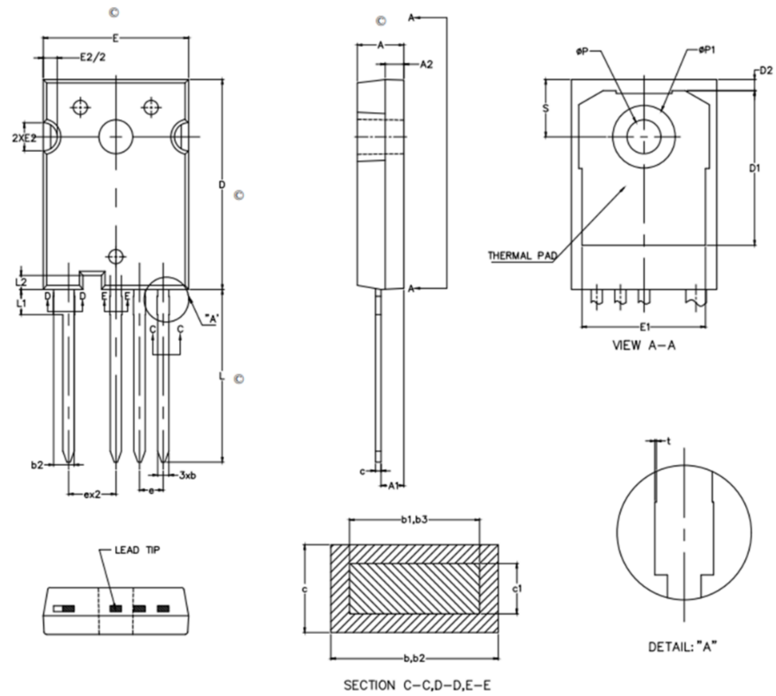


Transient thermal resistance (MOSFET)

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



Package Dimensions



Symbols	Dimensions			
	Mm		Inch	
	MIN.	MAX.	MIN.	MAX.
A	4.90	5.10	0.193	0.201
A1	2.31	2.51	0.091	0.099
A2	1.90	2.10	0.075	0.083
b	1.16	1.26	0.046	0.050
b1	1.15	1.22	0.045	0.048
b2	2.16	2.26	0.085	0.089
b3	2.15	2.22	0.085	0.087
c	0.59	0.66	0.023	0.026
c1	0.58	0.62	0.023	0.024
D	22.40	22.60	0.882	0.890
D1	16.15	16.75	0.640	0.663
D2	1.22	1.53	0.041	0.053
E	15.75	15.90	0.620	0.626
E1	13.26	——	0.552	——
E2	2.90	3.10	0.114	0.122
e	2.54BSC		0.1BSC	
L	18.30	18.60	0.720	0.732
L1	——	2.80	——	0.110
L2	——	1.50	——	0.059
ϕP	3.50	3.70	0.138	0.146
ϕP1	——	7.40	——	0.291
S	6.22	6.42	0.238	0.246
t	0.00	0.15	0.000	0.006