800V 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

Product Summary

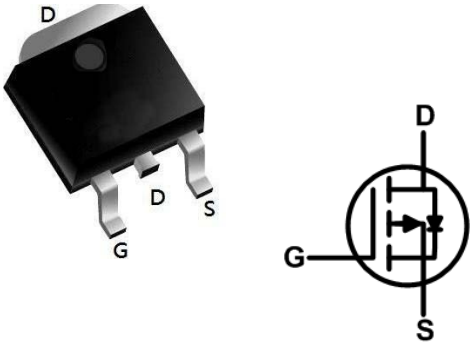
Green

BVDSS	RDSON	ID
800V	260mΩ	14A

Applications

- LED Driver
- PD charger
- PC adapter
- Air-condictioning
- E-bike charger

TO252-3L Pin Configuration



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

Symbol	Parameter	Value	Unit	Testing Conditions
V_{DSS}	Drain-Source Voltage	800	V	
I_D	Continuous DC Drain Current for $R_{th(j-c,typ.)}$, Limited by $T_{VJ(max)}$	14	A	T_C = 25 ℃
		10		Tc = 100℃
I_{DM}	Peak Drain Current, tp Limited by $T_{VJ(max)}$	23	A	T_C = 25 ℃
$V_{GS, max}$	Gate-Source Max Voltage	-10/22	V	
$V_{GS, op}$	Gate-Source Operate Voltage	0/15	V	
E_{AS}	Single Pulse Avalanche Energy	27.56	mJ	L=0.5mH, I_{AS}=10.5A V_{DD}=50V, V_{GS}=15 V
P_{tot}	Power Dissipation for $R_{th(j-c,typ.)}$	67	W	T_C = 25℃

Package Values

Symbol	Parameter	Min.	Typ.	Max.	Unit	Testing Conditions
$R_{th(j-c)}$	MOSFET/Body Diode Junction-Case Thermal Resistance		2.21	2.66	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		℃	

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

Symbol	Parameter	Min.	Typ.	Max.	Unit	Testing Conditions	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	800			V	I_D = 100 μA	
$V_{GS(th)}$	Gate Threshold Voltage		3.7		V	V_{DS} = V_{GS}, I_D =3.5mA	T_{VJ} = 25 ℃
			2.6				T_{VJ} = 175 ℃
I_{DSS}	Drain-Source Leakage Current		0.1	50	μA	V_{GS} = 0 V, V_{DS} = 800 V	T_{VJ} = 25 ℃
			1				T_{VJ} = 175 ℃
I_{GSS}	Gate-Source Leakage Current			200	nA	V_{GS} = 22 V, V_{DS} = 0 V	T_{VJ} = 25 ℃
I_{SGS}	Source-Gate Leakage Current			200	nA	V_{GS} = -10 V, V_{DS} = 0 V	T_{VJ} = 25 ℃
$R_{DS(on)}$	Drain-Source On-State Resistance		260		mΩ	V_{GS} = 15 V, I_D = 8 A	T_{VJ} = 25 ℃ T_{VJ} = 175 ℃
			277				
			190			V_{GS} = 18 V, I_D =8 A	
			250				
g_{fs}	Transconductance		5.25		S	V_{DS} = 20 V, I_D = 8 A	
$R_{G(int)}$	Internal Gate Resistance		25		Ω	f = 1MHz, V_{AC} = 25 mV	
C_{iss}	Input Capacitance		302		pF	V_{GS} = 0 V, V_{DS} = 500 V, f = 1MHz	
C_{oss}	Output Capacitance		20		pF		
C_{rss}	Reverse Transfer Capacitance		2.1		pF		
Q_{GS}	Gate to Source Charge		4.84		nC	V_{GS} = 0 /15 V, V_{DD} = 500 V, I_D =8A	
Q_{GD}	Gate to Drain Charge		1.73		nC		
Q_G	Total Gate Charge		12.34		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		18.3		ns	V_{GS} = 0/15 V, L=400uH V_{DD} =500 V, I_D = 8 A , $R_{G(on)}$=2.2Ω, $R_{G(off)}$=2.2Ω	T_{VJ} = 25 ℃
			18.0				T_{VJ} = 175 ℃
t_r	Rise Time		14.7		ns		T_{VJ} = 25 ℃
			13.4				T_{VJ} = 175 ℃
$t_{d(off)}$	Turn−Off Delay Time		15.7		ns		T_{VJ} = 25 ℃
			18.8				T_{VJ} = 175 ℃
t_f	Fall Time		14.7		ns		T_{VJ} = 25 ℃
			13.4				T_{VJ} = 175 ℃
E_{on}	Turn−On Switching Loss		105.1		μJ		T_{VJ} = 25 ℃
			116.0				T_{VJ} = 175 ℃
E_{off}	Turn−Off Switching Loss		13.2		μJ		T_{VJ} = 25 ℃
			14.4				T_{VJ} = 175 ℃
E_{tot}	Total Switching Energy		118.3		μJ		T_{VJ} = 25 ℃
			130.4				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	800	V	
I_S	Continuous DC Source Current, Limited by $T_{VJ(max)}$	11.7	A	T_C = 25 ℃
		6.8	A	T_C = 100 ℃
I_{SM}	Peak Reverse Drain Current, tp Limited by $T_{VJ(max)}$	23	A	T_C = 25 ℃

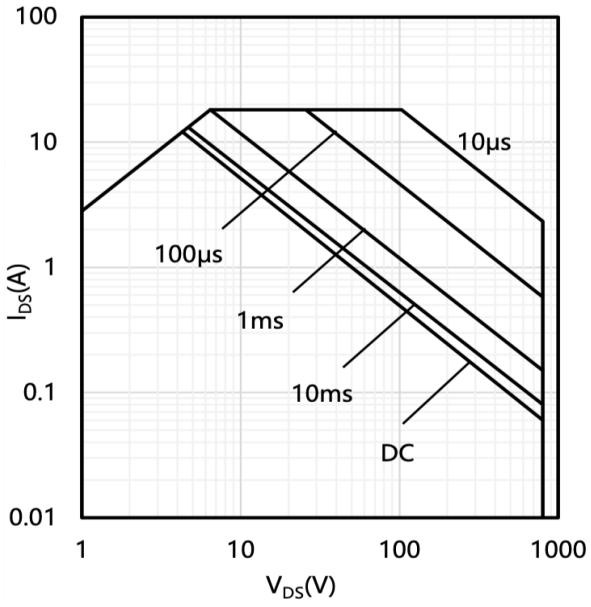
Body Diode Characteristics (T_{VJ}= 25˚C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Testing Conditions	
V_{SD}	Body Diode Forward Voltage		3.9		V	V_{GS} = 0 V, I_{SD} =4 A	T_{VJ} = 25 ℃
			3.4				T_{VJ} = 175 ℃
I_{rrm}	Peak Reverse Recovery Current		3.8		A	V_{DS} = 500 V, V_{GS} = 0 V, I_{SD} =8 A, di/dt = 1250A/μs	T_{VJ} = 25 ℃
			4.1				T_{VJ} = 175 ℃
Q_{rr}	Reverse Recovery Charge		30.7		nC		T_{VJ} = 25 ℃
			32.4				T_{VJ} = 175 ℃
t_{rr}	Reverse Recovery Time		12.4		ns		T_{VJ} = 25 ℃
			11.4				T_{VJ} = 175 ℃
E_{rr}	Reverse Recovery Energy		0.21		μJ		T_{VJ} = 25 ℃
			0.49				T_{VJ} = 175 ℃

Typical Performance s

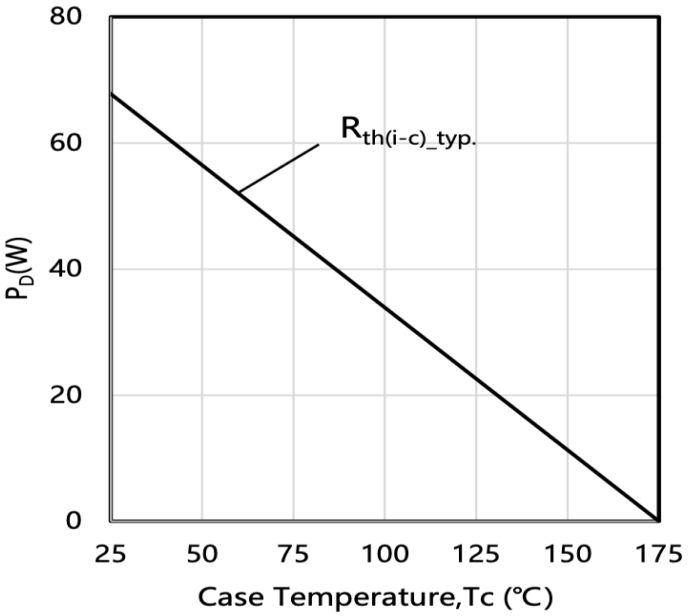
Safe operating area (SOA)

$R_{th(j-c)}$ =2.66 °C/W, Single Pulse, T_{VJ} = 25°C



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

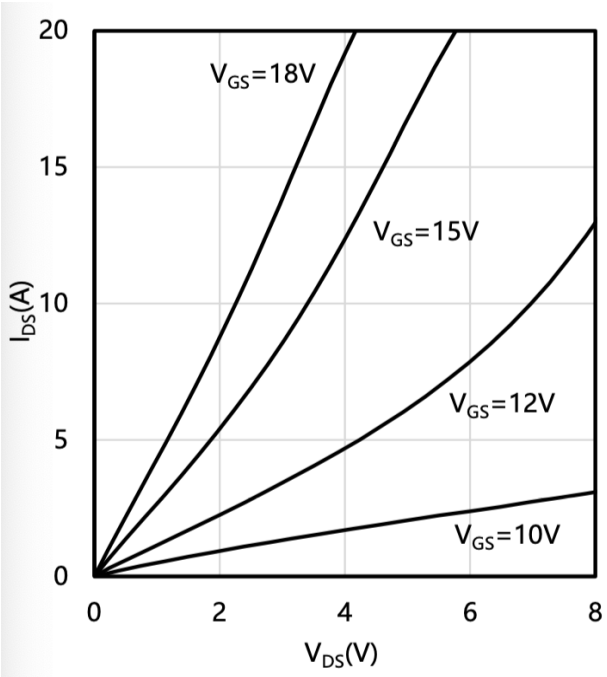
$P_D = f(T_C)$



Typical output characteristic, V_{GS} as parameter

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

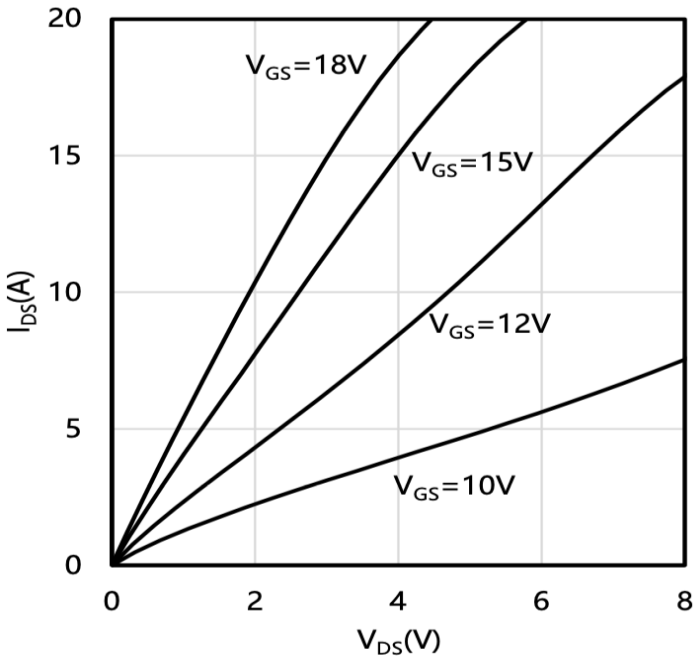
T_{VJ} = -55 ℃



Typical output characteristic, V_{GS} as parameter

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

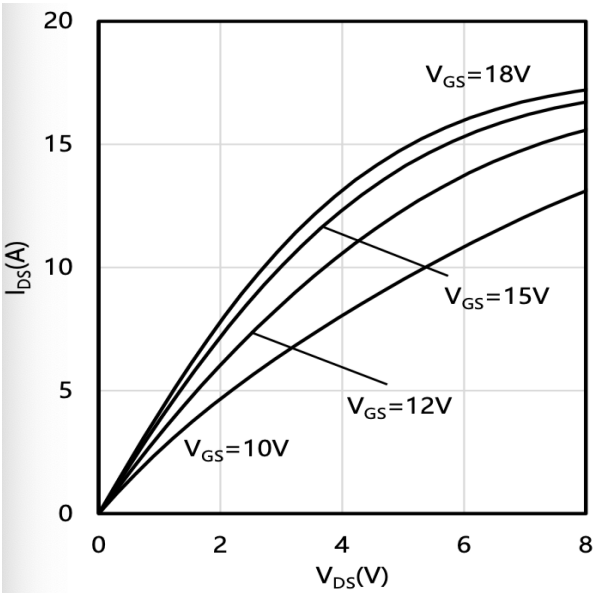
T_{VJ} = 25 ℃



Typical output characteristic, V_{GS} as parameter

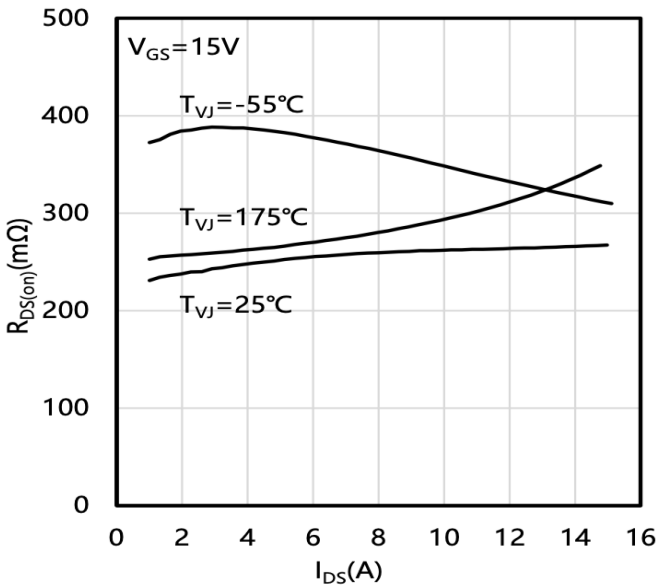
$I_{DS} = f(V_{DS})$

T_{VJ} = 175℃



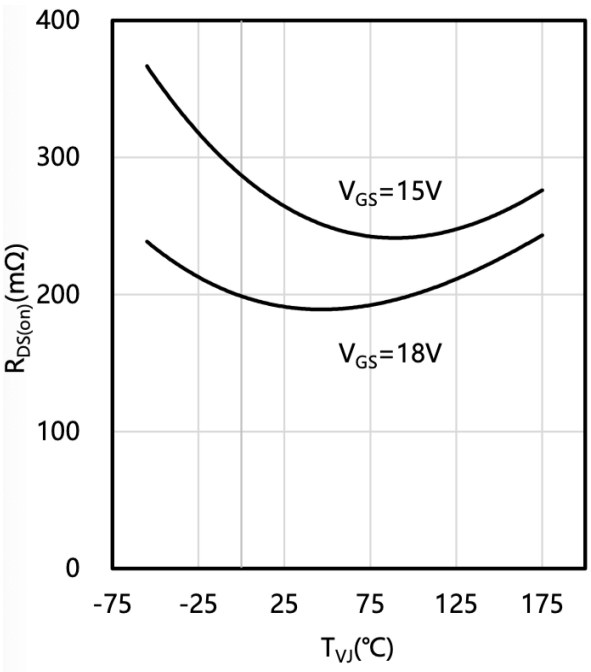
Typical on-state resistance as a function of drain current

$R_{DS(on)} = f(I_{DS})$, V_{GS} = 15V



Typical on-state resistance as a function of temperature

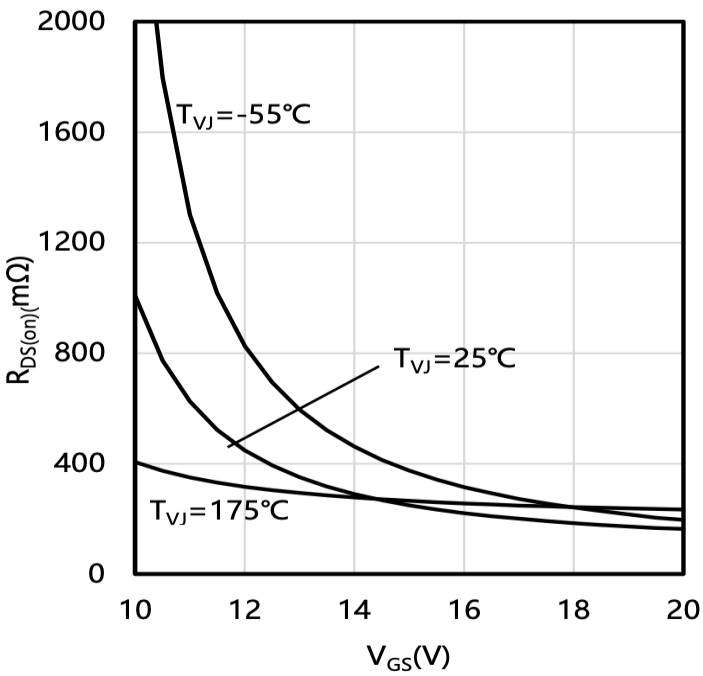
$R_{DS(on)} = f(T_{VJ})$, I_{DS} =8A



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

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

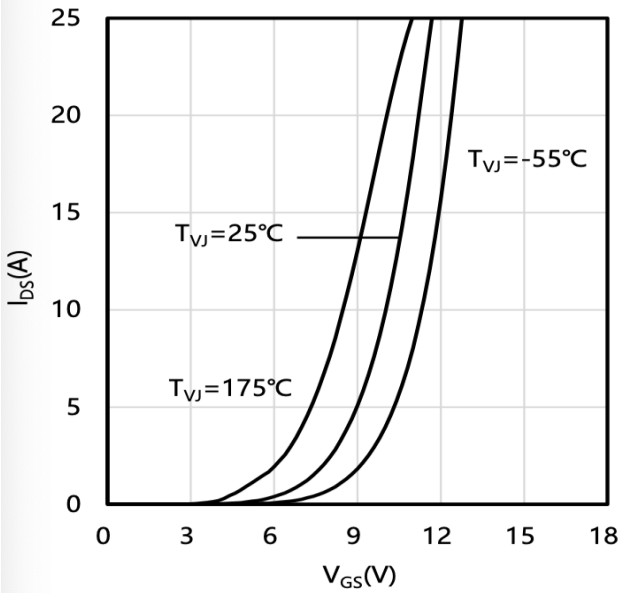
I_{DS} =8A



Typical transfer characteristic

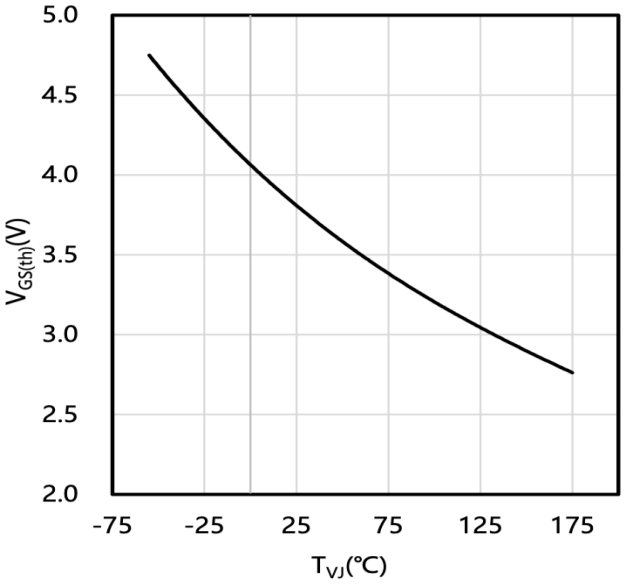
I_{DS} = f(V_{GS})

V_{DS}= 20 V



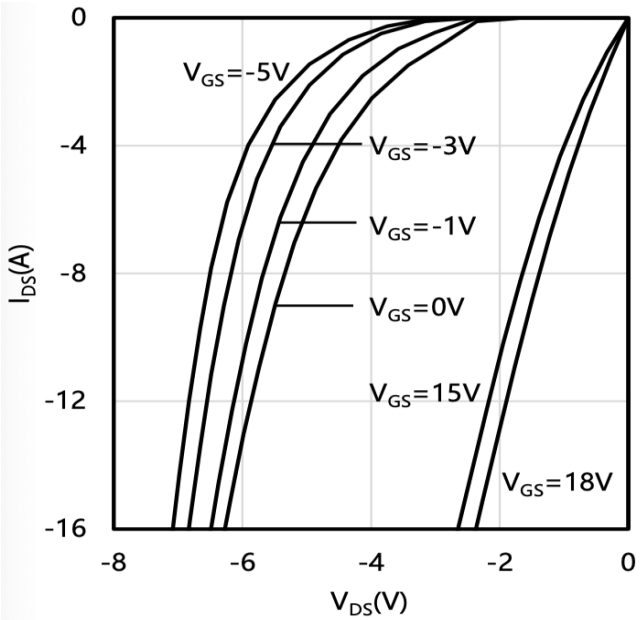
Typical gate-source threshold voltage as a function of junction temperature

$V_{GS(th)}$ = f(T_{VJ}), I_{DS} =3.5 mA



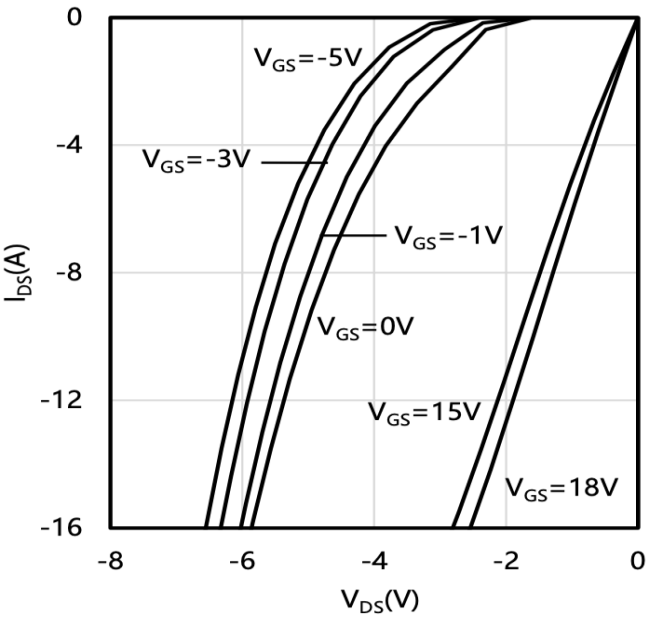
Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter

I_{DS} = f(V_{DS}), T_{VJ} = -55 °C



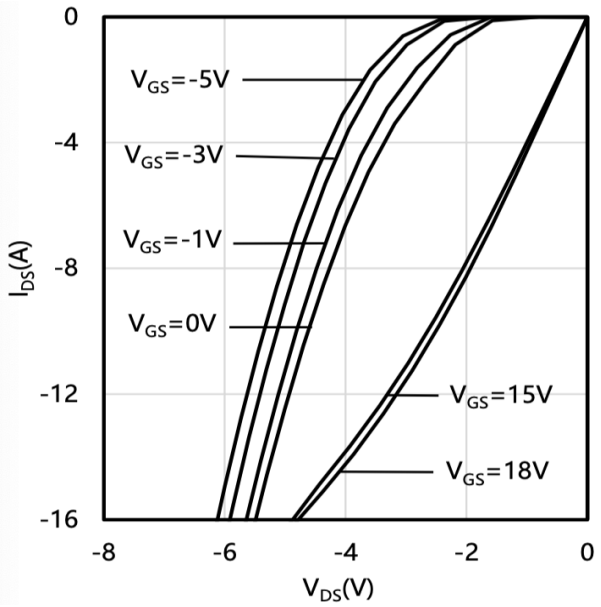
Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter

I_{DS} = f(V_{DS}), T_{VJ} = 25 °C



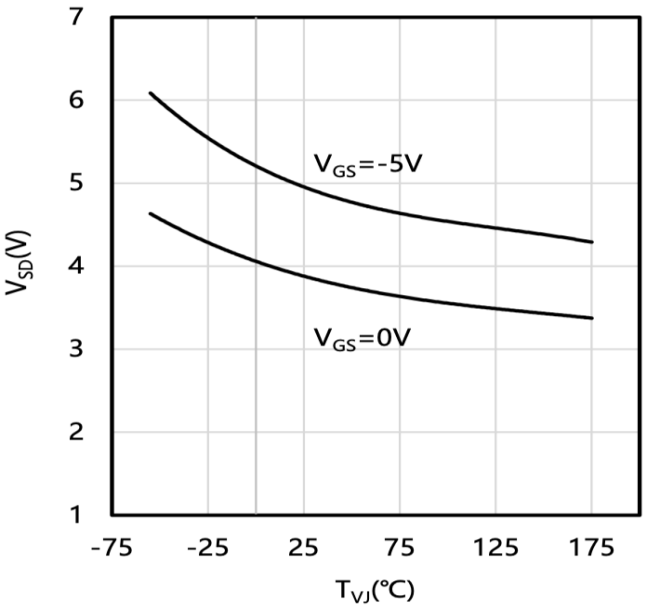
Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter

I_{DS} = f(V_{DS}), T_{VJ} = 175 °C



Typical reverse drain voltage as function of junction temperature

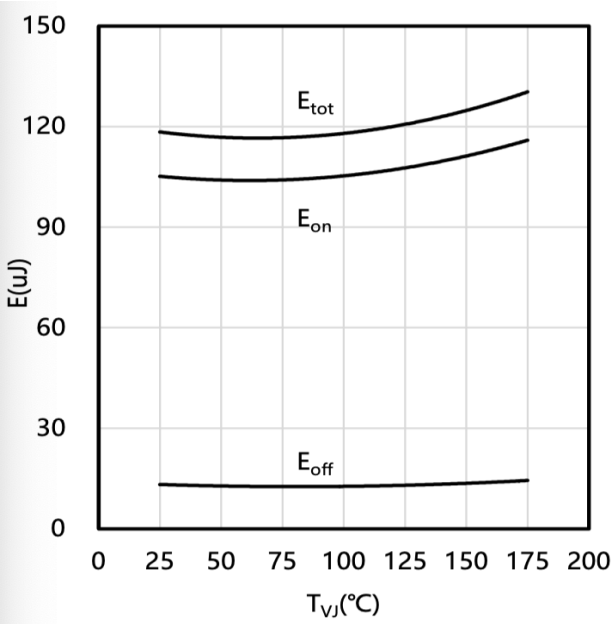
V_{SD} = f(T_{VJ}), I_{SD} =4 A



Typical switching energy as a function of junction temperature, 2nd device own body diode: V_{GS} = 0 V

E = f(T_{VJ})

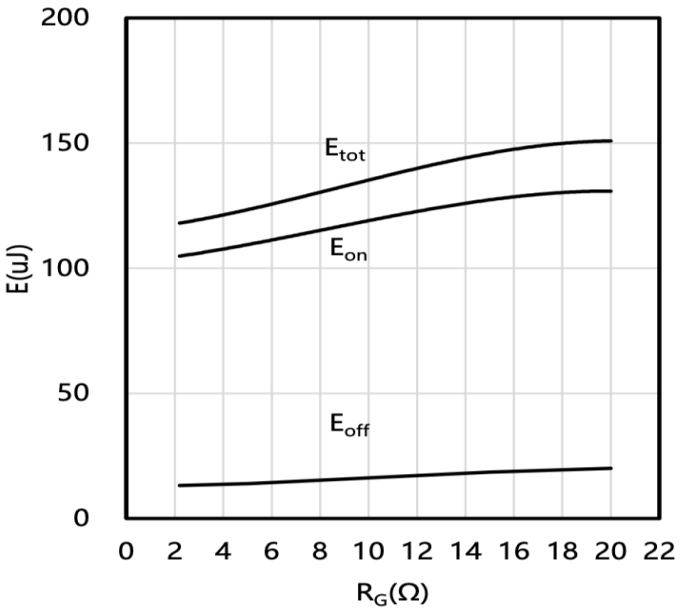
V_{DS} = 500 V, $R_{G(ext)}$ =2.2 Ω, V_{GS} =0V/15 V, I_{DS} = 8 A



Typical switching energy losses as a function of gate resistance, 2nd device own body diode: V_{GS} = 0 V

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

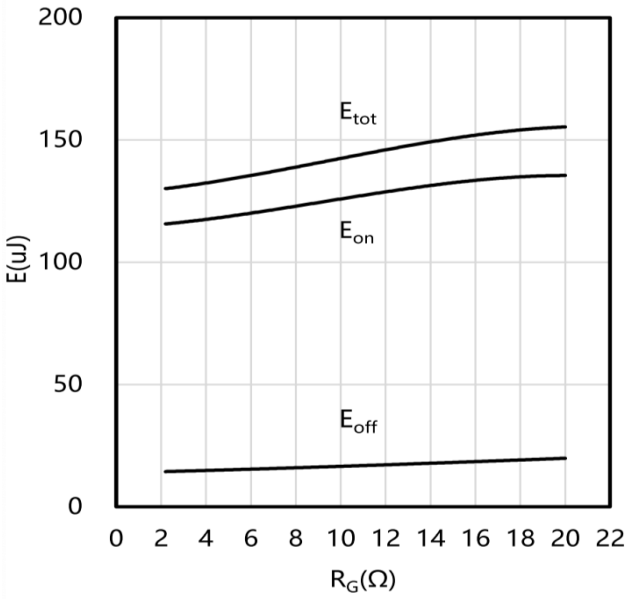
V_{GS} = 0/15 V, I_{DS} =8 A, T_{VJ} = 25 °C, V_{DS} = 500 V



Typical switching energy losses as a function of gate resistance, 2nd device own body diode: V_{GS} = 0 V

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

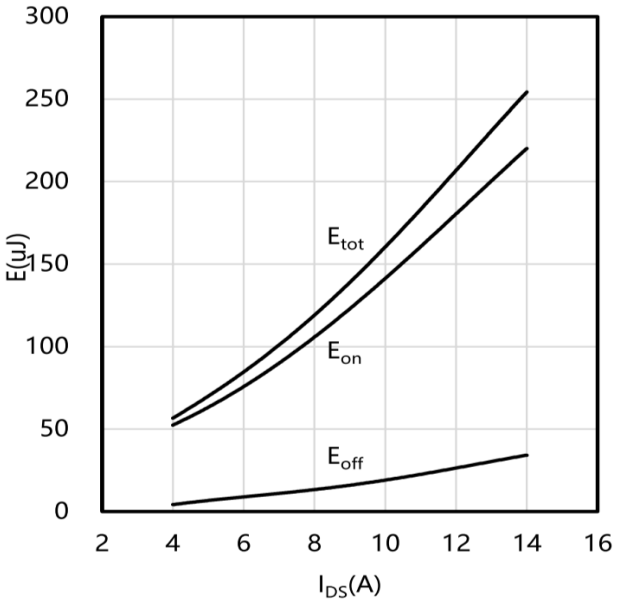
V_{GS} = 0/15 V, I_{DS} = 8 A, T_{VJ} = 175 °C, V_{DS} = 500 V



Typical switching energy losses as a function of I_{DS}, 2nd device own body diode: V_{GS} =0 V

E = f(I_{DS})

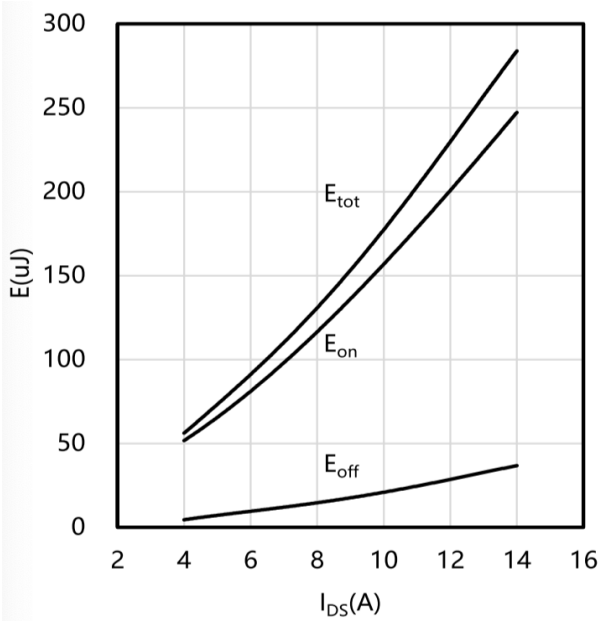
V_{GS} = 0/15 V, $R_{G(ext)}$ = 2.2 Ω, T_{VJ} = 25 °C, V_{DS} = 500 V



Typical switching energy losses as a function of I_{DS}, 2nd device own body diode: V_{GS} = 0 V

E = f(I_{DS})

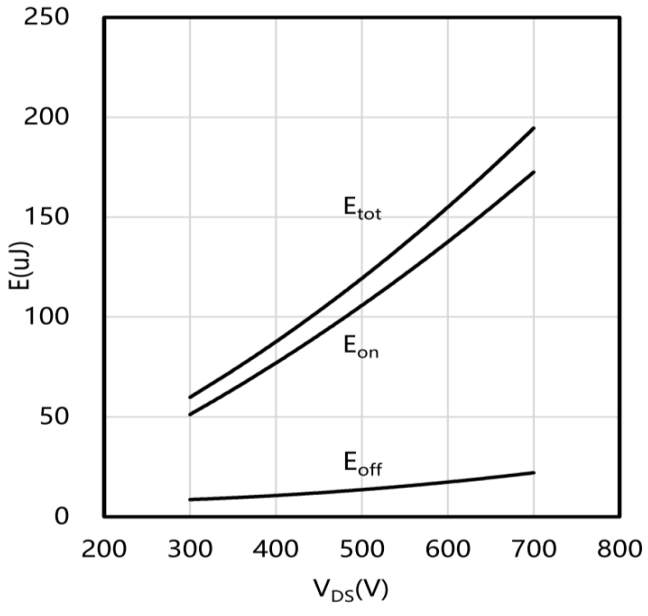
V_{GS} = 0/15 V, $R_{G(ext)}$ =2.2Ω, T_{VJ} = 175 °C, V_{DS} = 500 V



Typical switching energy losses as a function of V_{DS}, 2nd device own body diode: V_{GS} = 0 V

E = f(V_{DS})

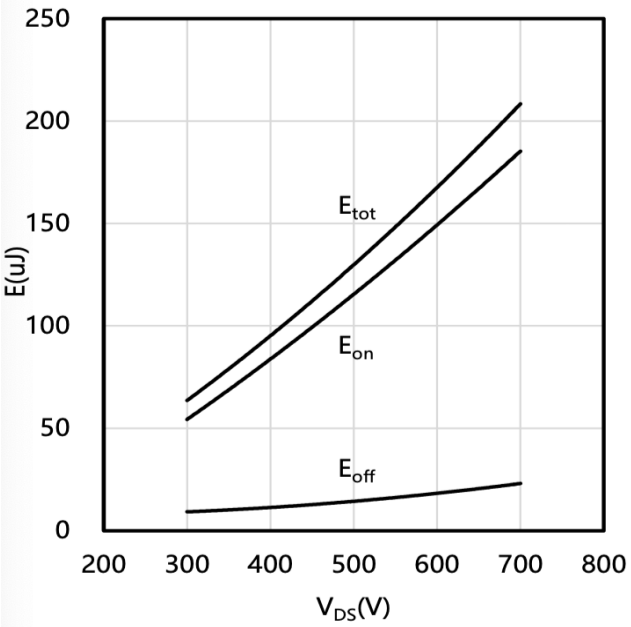
V_{GS} = 0/15 V, $R_{G(ext)}$ = 2.2 Ω, T_{VJ} = 25 °C, I_{DS} = 8 A



Typical switching energy losses as a function of V_{DS}, 2nd device own body diode: V_{GS} = 0 V

E = f(V_{DS})

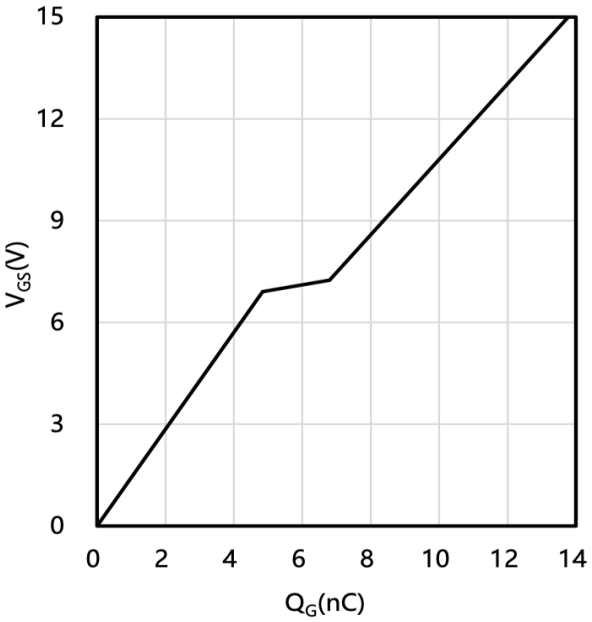
V_{GS} = 0/15 V, $R_{G(ext)}$ = 2.2 Ω, T_{VJ} = 175 °C, I_{DS} = 8 A



Typical gate charge

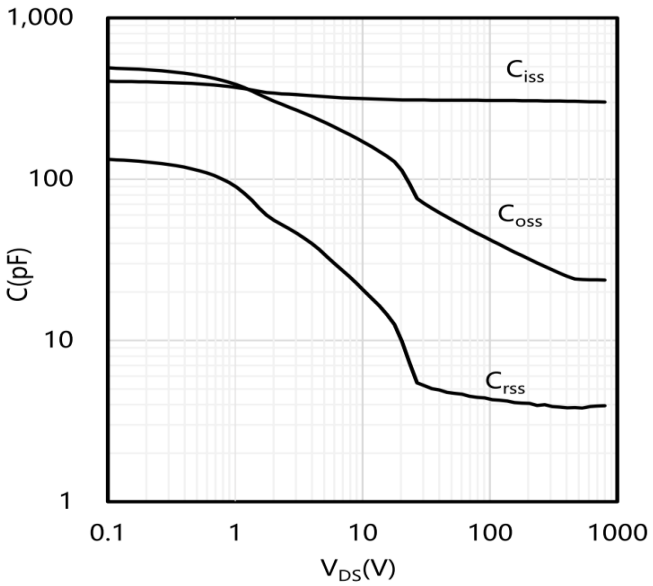
V_{GS} =f(Q_G), I_{DS} =8 A, V_{DS} = 500V

turn-on pulse



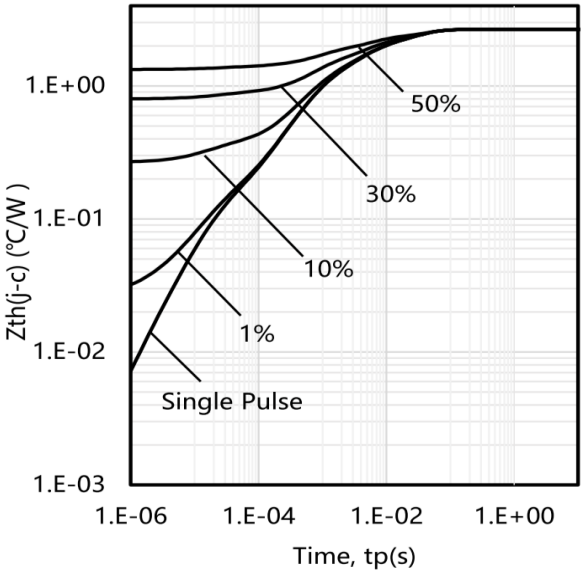
Typical capacitance as a function of drain-source voltage

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

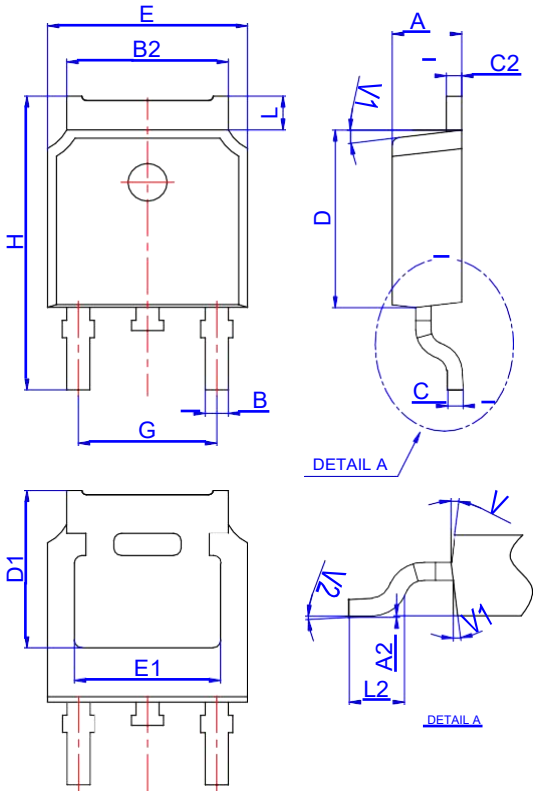


Transient thermal resistance (MOSFET)

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



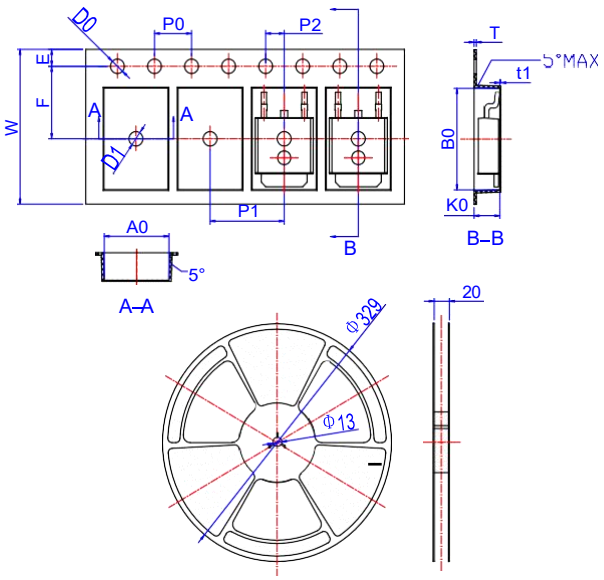
Package Dimensions



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.10		2.50	0.083		0.098
A2	0		0.10	0		0.004
B	0.66		0.86	0.026		0.034
B2	5.18		5.48	0.202		0.216
C	0.40		0.60	0.016		0.024
C2	0.44		0.58	0.017		0.023
D	5.90		6.30	0.232		0.248
D1	5.30REF			0.209REF		
E	6.40		6.80	0.252		0.268
E1	4.63			0.182		
G	4.47		4.67	0.176		0.184
H	9.50		10.70	0.374		0.421
L	1.09		1.21	0.043		0.048
L2	1.35		1.65	0.053		0.065
V1		7°			7°	
V2	0°		6°	0°		6°

TO252-3L

Reel Spectification-TO252-3L



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
W	15.90	16.00	16.10	0.626	0.630	0.634
E	1.65	1.75	1.85	0.065	0.069	0.073
F	7.40	7.50	7.60	0.291	0.295	0.299
D0	1.40	1.50	1.60	0.055	0.059	0.063
D1	1.40	1.50	1.60	0.055	0.059	0.063
P0	3.90	4.00	4.10	0.154	0.157	0.161
P1	7.90	8.00	8.10	0.311	0.315	0.319
P2	1.90	2.00	2.10	0.075	0.079	0.083
A0	6.85	6.90	7.00	0.270	0.271	0.276
B0	10.45	10.50	10.60	0.411	0.413	0.417
K0	2.68	2.78	2.88	0.105	0.109	0.113
T	0.24		0.27	0.009		0.011
t1	0.10			0.004		
10P0	39.80	40.00	40.20	1.567	1.575	1.583