

Features

- Effectively lower down T_j and R_{th} , high anti-EMI ability
- High speed switching with low capacitances
- High blocking voltage with low $R_{DS(on)}$
- Easy to drive and parallel
- RoHS compliant

Benefits

- Increased power density
- Higher operating frequency
- Reduced heat sink requirements
- Higher efficiency
- EMI reduction

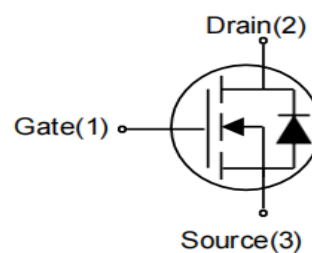
Applications

- Power factor correction modules
- Switch mode power supplies
- Power inverters
- High voltage converters

Parameter	Rating	Units
V_{DS}	800	V
$I_D @ 25^\circ\text{C}$	8	A
$R_{DS(on)}$	500	m Ω



TO-220F (Full Pack)



Part Number	Package	Marking
GC3M050065F	TO-220F	GC3M050065

Package values

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$R_{th(j-c)}$	MOSFET/Body Diode Junction-Case Thermal Resistance		2.63	3.15	K/W	
T_{VJ}, T_{STG}	Operating Junction and Storage Temperature	-55		175	°C	
T_{SOLD}	Soldering Temperature, Wave Soldering only Allowed at Leads 1.6mm from Case for 10s		260		°C	

Maximum Ratings For MOSFET ($T_{VJ} = 25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
V_{DSS}	Drain-Source Voltage	800	V	
I_D	Continuous DC Drain Current for $R_{th(j-c,typ.)}$, Limited by $T_{VJ(max)}$	8	A	$T_C = 25^{\circ}\text{C}$
		6		$T_C = 100^{\circ}\text{C}$
I_{DM}	Peak Drain Current, tp Limited by $T_{VJ(max)}$	15	A	$T_C = 25^{\circ}\text{C}$
$V_{GS, max}$	Gate-Source Max Voltage	-10/22	V	
$V_{GS, op}$	Gate-Source Operate Voltage	0/15	V	
E_{AS}	Single Pulse Avalanche Energy	13.3	mJ	$L=0.5\text{mH}, I_{AS}=7.3\text{A}, V_{DD}=50\text{V}, V_{GS}=15\text{V}$
P_{tot}	Power Dissipation for $R_{th(j-c,typ.)}$	57	W	$T_C = 25^{\circ}\text{C}$

MOSFET Characteristics ($T_{VJ} = 25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test conditions
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	800			V	$I_D = 100\text{ }\mu\text{A}$
$V_{GS(th)}$	Gate Threshold Voltage	2.9	3.8		V	$V_{DS} = V_{GS}, I_D = 3.5\text{ mA}$, $T_{VJ} = 25^{\circ}\text{C}$
			2.7			$T_{VJ} = 175^{\circ}\text{C}$
I_{DSS}	Drain-Source Leakage Current		0.1	20	μA	$V_{GS} = 0\text{ V}, V_{DS} = 650\text{ V}$, $T_{VJ} = 25^{\circ}\text{C}$
			4.0			$T_{VJ} = 175^{\circ}\text{C}$
I_{GSS}	Gate-Source Leakage Current			250	nA	$V_{GS} = 22\text{ V}, V_{DS} = 0\text{ V}$, $T_{VJ} = 25^{\circ}\text{C}$
I_{SGS}	Source-Gate Leakage Current			250	nA	$V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$, $T_{VJ} = 25^{\circ}\text{C}$
$R_{DS(on)}$	Drain-Source On-State Resistance		500	600	m Ω	$V_{GS} = 15\text{ V}, I_D = 1\text{ A}$, $T_{VJ} = 25^{\circ}\text{C}$
			460			$T_{VJ} = 175^{\circ}\text{C}$
g_{fs}	Transconductance		2.9		S	$V_{DS} = 20\text{ V}, I_D = 4.5\text{ A}$
$R_{G(int)}$	Internal Gate Resistance		25		Ω	$f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$
C_{iss}	Input Capacitance		170		pF	$V_{GS} = 0\text{ V}, V_{DS} = 400\text{ V}, f = 1\text{ MHz}$
C_{oss}	Output Capacitance		13		pF	
C_{rss}	Reverse Transfer Capacitance		1.3		pF	
Q_{GS}	Gate to Source Charge		3.2		nC	$V_{GS} = 0/15\text{ V}, V_{DS} = 400\text{ V}, I_D = 4.5\text{ A}$
Q_{GD}	Gate to Drain Charge		1.3		nC	
Q_G	Total Gate Charge		9.0		nC	

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

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test conditions	
t _{d(on)}	Turn-On Delay Time		17.0		ns	V _{GS} = 0/15 V, L=600 μH V _{DD} = 400 V, I _D = 4.5 A, R _{G(on)} = 9.1 Ω, R _{G(off)} = 9.1Ω	T _{VJ} = 25 °C
			14.3				T _{VJ} = 175 °C
t _r	Rise Time		12.2		ns		T _{VJ} = 25 °C
			9.3				T _{VJ} = 175 °C
t _{d(off)}	Turn-Off Delay Time		14.5		ns		T _{VJ} = 25 °C
			16.8				T _{VJ} = 175 °C
t _f	Fall Time		13.1		ns		T _{VJ} = 25 °C
			13.0				T _{VJ} = 175 °C
E _{on}	Turn-On Switching Loss		45.4		μJ		T _{VJ} = 25 °C
			42.2				T _{VJ} = 175 °C
E _{off}	Turn-Off Switching Loss		3.86		μJ		T _{VJ} = 25 °C
			3.40				T _{VJ} = 175 °C
E _{tot}	Total Switching Energy		49.2		μJ		T _{VJ} = 25 °C
			45.6				T _{VJ} = 175 °C

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	Test Conditions
V _{DSS}	Drain-Source Voltage	800	V	
I _S	Continuous DC Source Current, Limited by T _{VJ(max)}	8	A	T _C = 25 °C
		6	A	T _C = 100 °C
I _{SM}	Peak Reverse Drain Current, tp Limited by T _{VJ(max)}	23	A	T _C = 25 °C

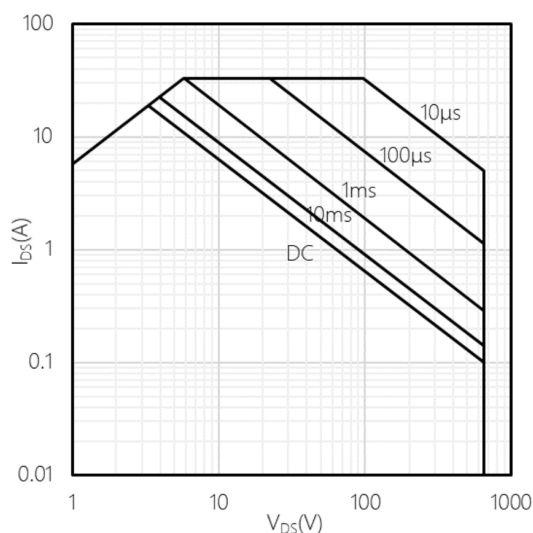
Body Diode Characteristics (T_{VJ}= 25°C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test conditions	
V _{SD}	Body Diode Forward Voltage		3.8		V	V _{GS} = 0 V, I _{SD} = 2.5 A	T _{VJ} = 25 °C
			3.2				T _{VJ} = 175 °C
I _{rrm}	Peak Reverse Recovery Current		4.1		A	V _{DS} = 400 V, V _{GS} = 0 V, I _{SD} = 4.5 A, di/dt = 1.1 kA/μs	T _{VJ} = 25 °C
			4.6				T _{VJ} = 175 °C
Q _{rr}	Reverse Recovery Charge		23	nC	T _{VJ} = 25 °C		
			27		T _{VJ} = 175 °C		
t _{rr}	Reverse Recovery Time		9.4	ns	T _{VJ} = 25 °C		
			10.1		T _{VJ} = 175 °C		
E _{rr}	Reverse Recovery Energy		0.16	μJ	T _{VJ} = 25 °C		
			0.32		T _{VJ} = 175 °C		

Typical Characteristics

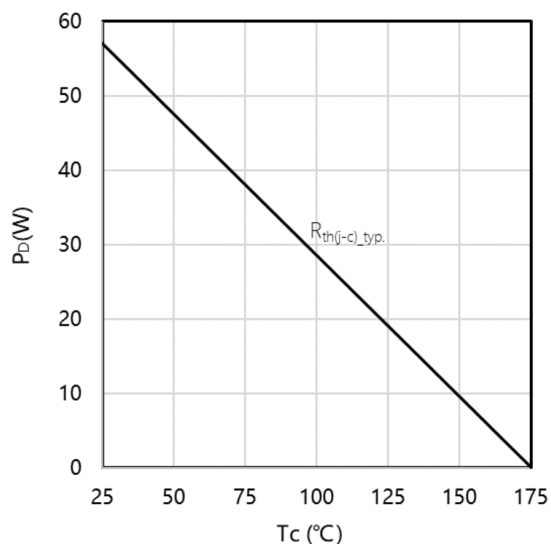
Safe operating area (SOA)

$R_{th(j-c)} = 3.15 \text{ }^{\circ}\text{C/W}$, Single Pulse, $T_{vj} = 25^{\circ}\text{C}$



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

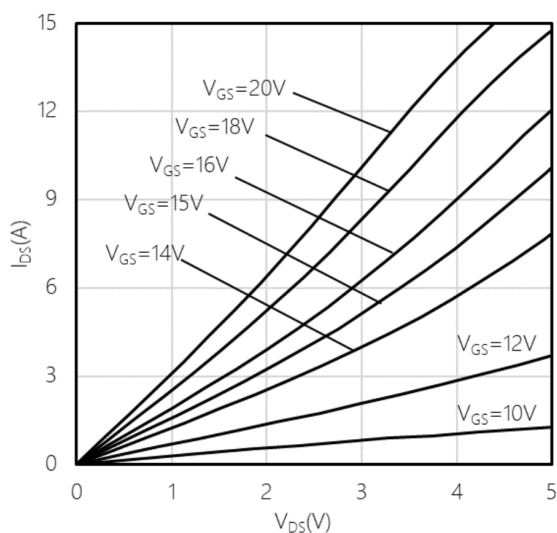
$P_D = f(T_c)$



Typical output characteristic, V_{GS} as parameter

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

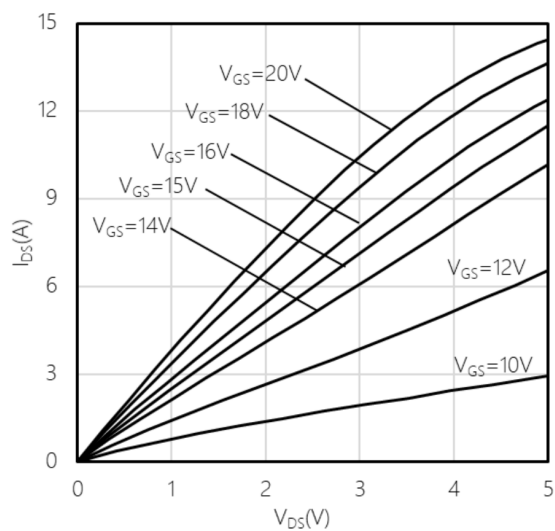
$T_{vj} = -55^{\circ}\text{C}$



Typical output characteristic, V_{GS} as parameter

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

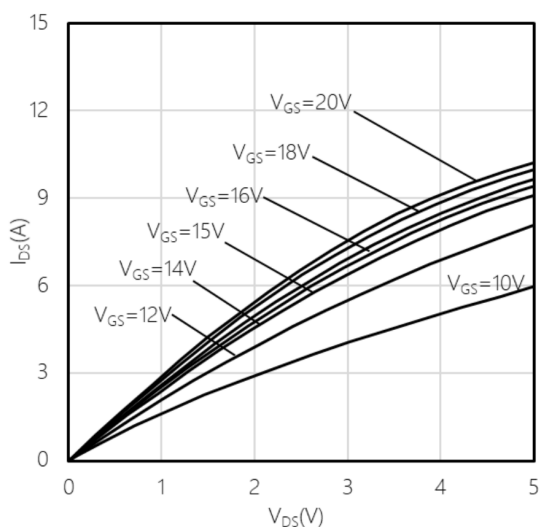
$T_{vj} = 25^{\circ}\text{C}$



Typical output characteristic, V_{GS} as parameter

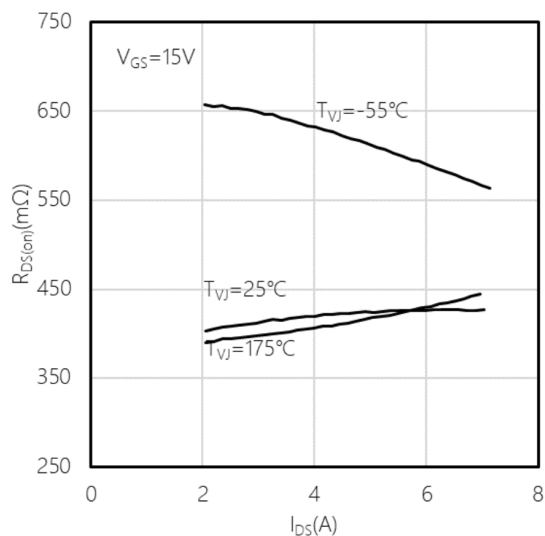
$$I_{DS} = f(V_{DS})$$

$$T_{VJ} = 175^{\circ}\text{C}$$



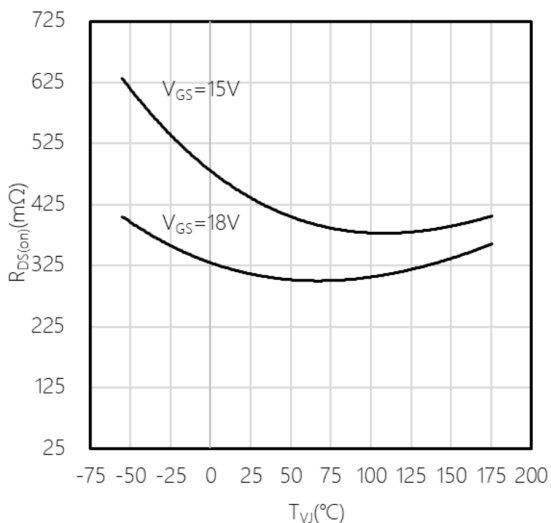
Typical on-state resistance as a function of drain current

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



Typical on-state resistance as a function of temperature

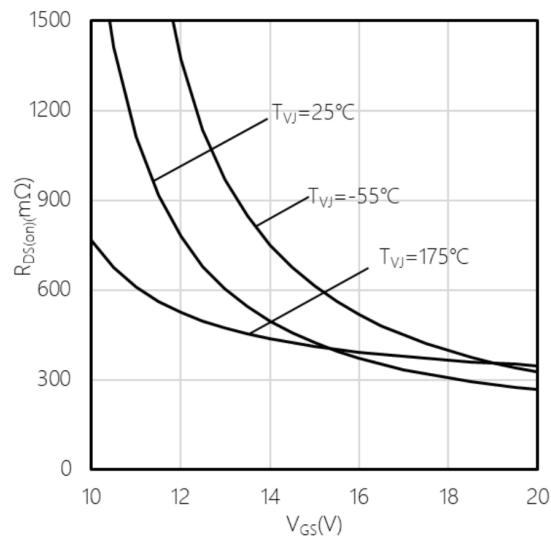
$$R_{DS(on)} = f(T_{VJ}), I_{DS} = 4.5\text{ A}$$

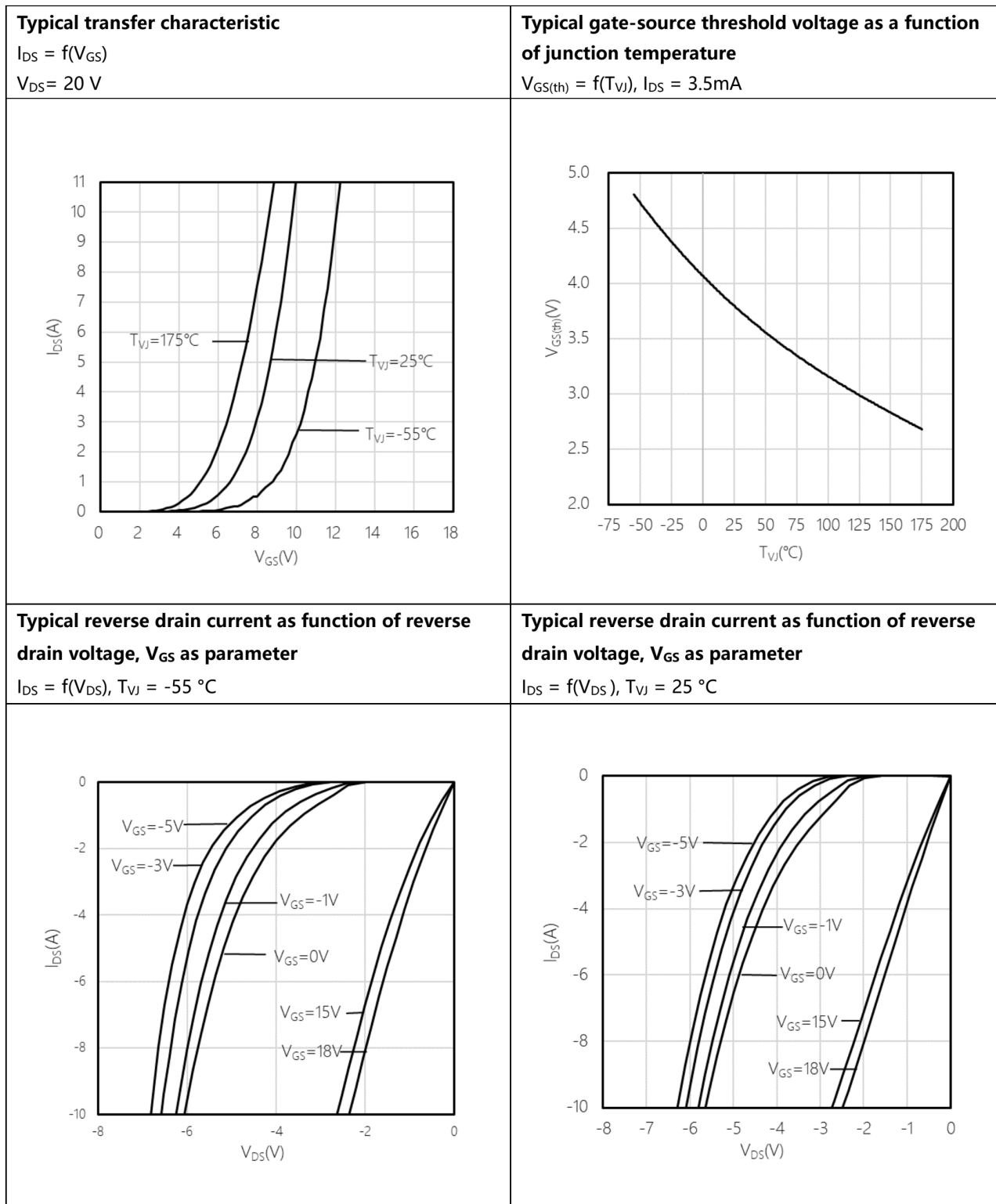


Typical on-state resistance as a function of V_{GS}

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

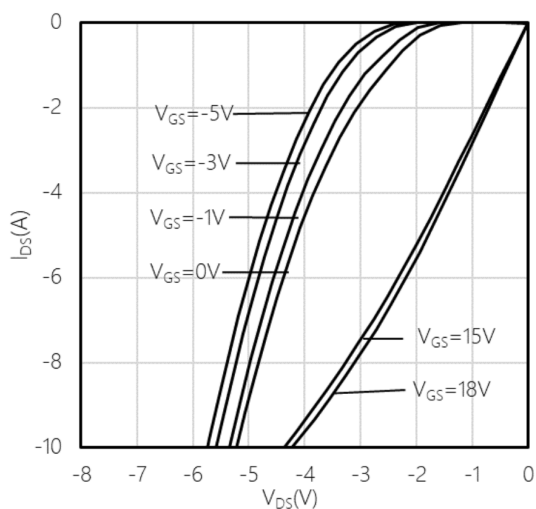
$$I_{DS} = 4.5\text{ A}$$





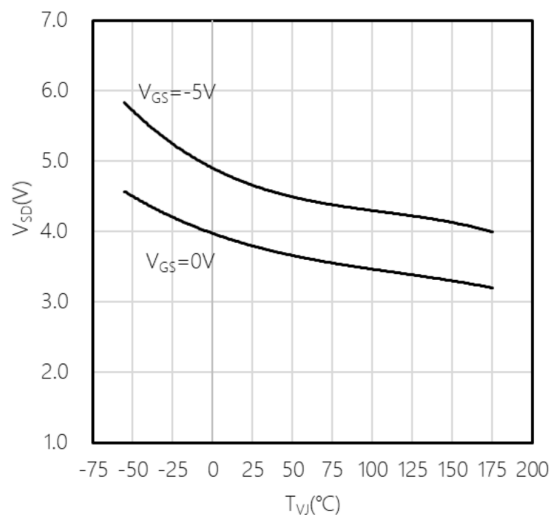
Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter

$$I_{DS} = f(V_{DS}), T_{VJ} = 175\text{ }^{\circ}\text{C}$$



Typical reverse drain voltage as function of junction temperature

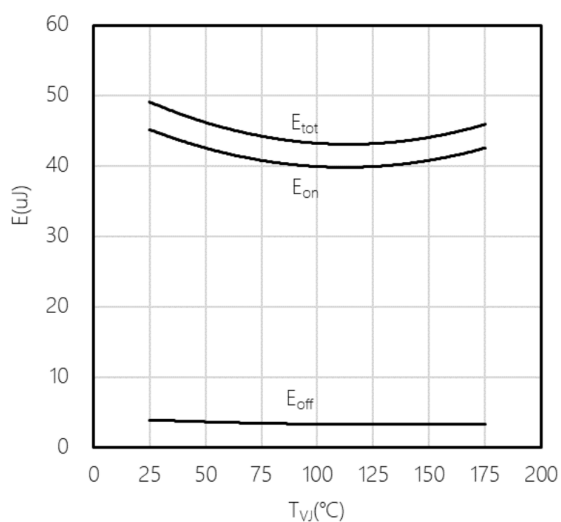
$$V_{SD} = f(T_{VJ}), I_{SD} = 2.5\text{ A}$$



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

$$E = f(T_{VJ})$$

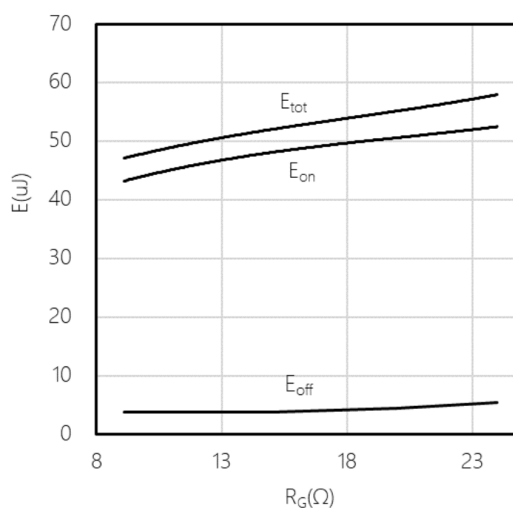
$$V_{DS} = 400\text{ V}, R_{G(ext)} = 9.1\text{ }\Omega, V_{GS} = 0\text{ V} / 15\text{ V}, I_{DS} = 4.5\text{ A}$$



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

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

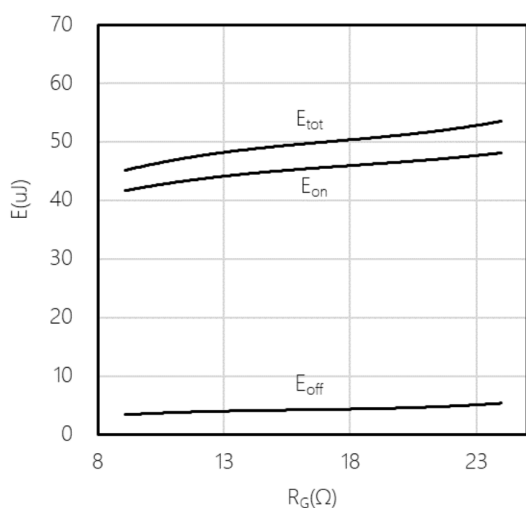
$$V_{GS} = 0/15\text{ V}, I_{DS} = 4.5\text{ A}, T_{VJ} = 25\text{ }^{\circ}\text{C}, V_{DS} = 400\text{ V}$$



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

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

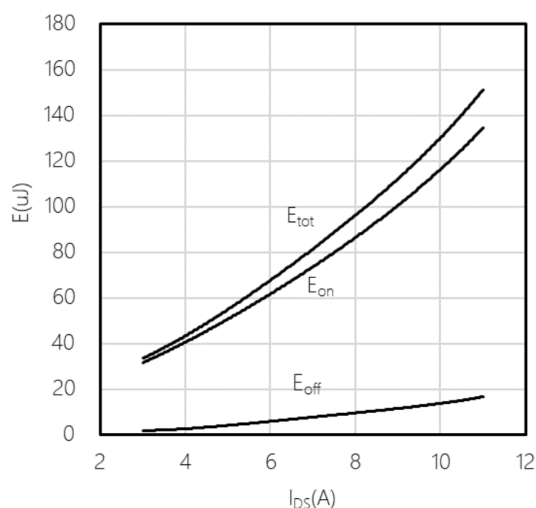
$V_{GS} = 0/15$ V, $I_{DS} = 4.5$ A, $T_{VJ} = 175$ °C, $V_{DS} = 400$ V



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

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

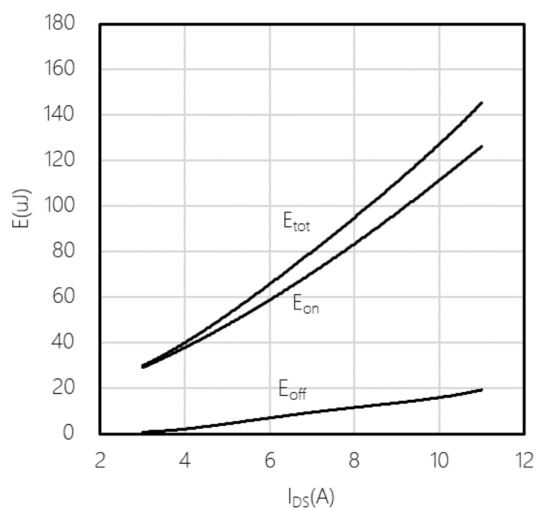
$V_{GS} = 0/15$ V, $R_{G(ext)} = 9.1$ Ω, $T_{VJ} = 25$ °C, $V_{DS} = 400$ V



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

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

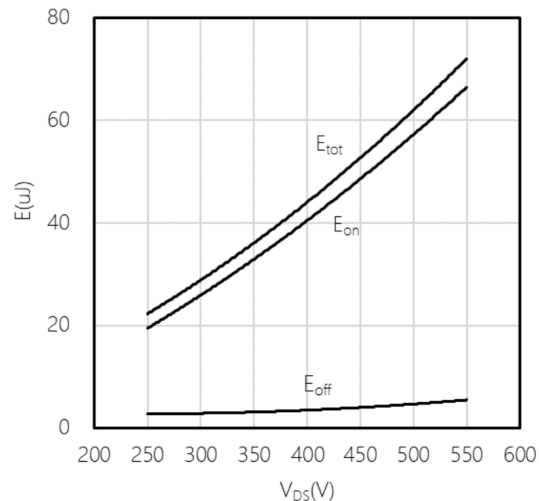
$V_{GS} = 0/15$ V, $R_{G(ext)} = 9.1$ Ω, $T_{VJ} = 175$ °C, $V_{DS} = 400$ V

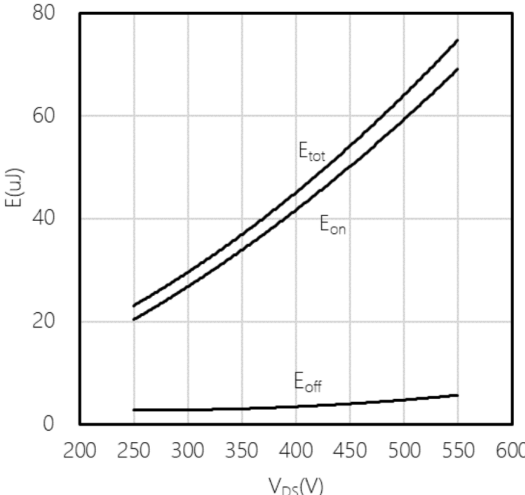
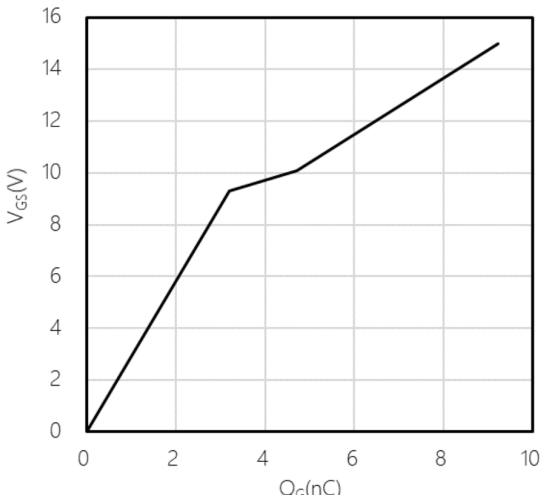
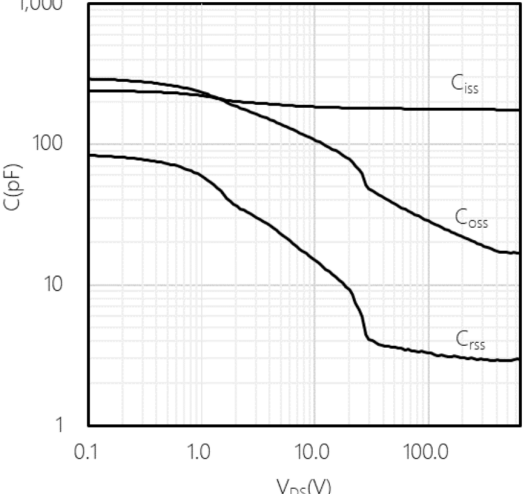


Typical switching energy losses as a function of V_{DS} , 2nd device own body diode: $V_{GS} = 0$ V

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

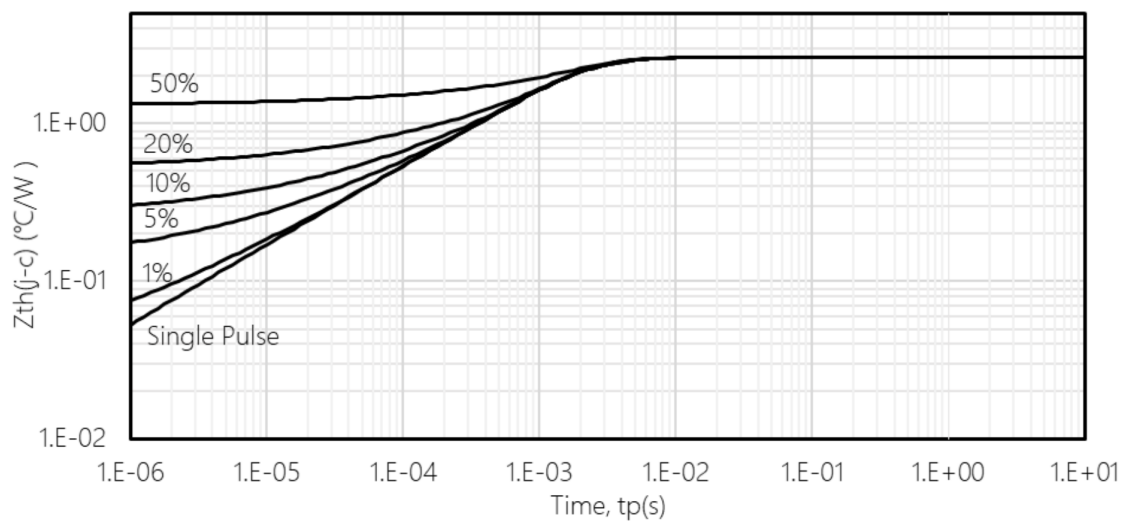
$V_{GS} = 0/15$ V, $R_{G(ext)} = 9.1$ Ω, $T_{VJ} = 25$ °C, $I_{DS} = 4.5$ A



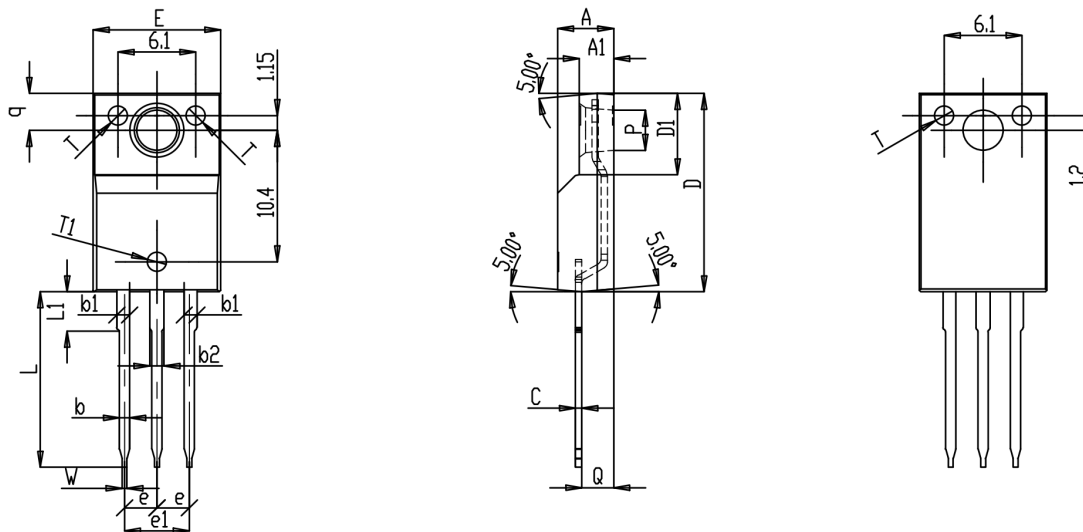
Typical switching energy losses as a function of V_{DS}, 2nd device own body diode: $V_{GS} = 0$ V $E = f(V_{DS})$ $V_{GS} = 0/15$ V, $R_{G(ext)} = 9.1$ Ω, $T_{VJ} = 175$ $^{\circ}\text{C}$, $I_{DS} = 4.5$ A	Typical gate charge $V_{GS} = f(Q_G)$, $I_{DS} = 4.5$ A, $V_{DS} = 400$ V turn-on pulse
	
Typical capacitance as a function of drain-source voltage $C = f(V_{DS})$, $V_{GS} = 0$ V, $f = 1$ MHz	
	

transient thermal resistance (MOSFET)

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



Package Outline Dimension: TO-220F (Full Pack)



SYMBOL	MILLIMETERS			NOTES	SYMBOL	MILLIMETERS			NOTES
	Normal	MIN.	MAX.			Normal	MIN.	MAX.	
A	4.4	4.2	4.6		e1	5.08	5	5.12	
A1	2.7	2.5	2.9		L	13.90	13.5	14.4	
b	0.8	0.7	0.9		L1	3.12	2.8	3.3	
b1	1.07	0.9	1.3		P	3.14	3.00	3.20	
b2	1.17	1	1.4		Q	2.44	2.3	2.6	
C	0.5	0.4	0.6		q	2.87	2.6	3	
D	15.63	15.4	15.8		W	0.37	0.3	0.5	
D1	6.22	6	6.4		T	1.52	1.3	1.7	
E	10.06	9.7	10.3		T1	1.20	1.1	1.3	
e	2.54	2.5	2.58						

Revision History

Revision	Date of Release	Description of Changes
Preliminary	2025-07-19	Initial release.

Information

For further information on technology, delivery terms and conditions and prices, please contact SUPSiC.

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