

# MOSFET

## IR MOSFET - StrongIRFET™

### Features

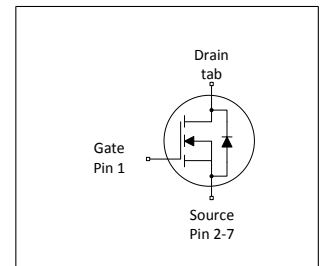
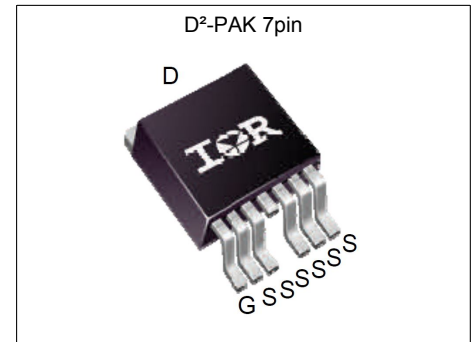
- Very low  $R_{DS(on)}$
- High current carrying capability
- 175°C operating temperature
- Optimized for broadest availability from distribution partners

### Benefits

- Reduced conduction losses
- Increased power density
- Increased reliability versus 150°C rated parts
- Halogen-free according to IEC61249-2-21

### Product validation

Qualified according to JEDEC Standard



**Table 1 Key Performance Parameters**

Parameter	Value	Unit
$V_{DS}$	40	V
$R_{DS(on),typ}$	0.5	$m\Omega$
$R_{DS(on),max}$	0.65	$m\Omega$
$I_D$ (Silicon Limited)	564	A
$I_D$ (Package Limited)	360	A
$Q_G(0V..10V)$	366	nC



Type / Ordering Code	Package	Marking	Related Links
IRF40SC240	PG-TO 263-7	IRF40SC240	-

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## 1 Maximum ratings

at  $T_A=25\text{ °C}$ , unless otherwise specified

**Table 2 Maximum ratings**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current	$I_D$	-	-	360 564 379	A	$V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$ (silicon limited) $V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$ (silicon limited) <sup>1)</sup>
Pulsed drain current <sup>1)</sup>	$I_{D,pulse}$	-	-	1440	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse <sup>2)</sup>	$E_{AS}$	-	-	1331	mJ	$I_D=100\text{ A}$ , $R_{GS}=50\text{ }\Omega$
Gate source voltage	$V_{GS}$	-20	-	20	V	-
Power dissipation	$P_{tot}$	-	-	417 2.4	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}$ , $R_{THJA}=62\text{ °C/W}^3)$
Operating and storage temperature	$T_j$ , $T_{stg}$	-55	-	175	°C	IEC climatic category; DIN IEC 68-1: 55/175/56

## 2 Thermal characteristics

**Table 3 Thermal characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case, 0 <sup>4)</sup>	$R_{thJC}$	-	-	0.36	°C/W	-
Thermal resistance, junction -Ambient, 0	$R_{thJA}$	-	-	62	°C/W	-
Case-to-Sink, Flat Greased Surface	$R_{thCS}$	-	0.5	-	°C/W	-

<sup>1)</sup> See Diagram 3 for more detailed information

<sup>2)</sup> See Diagram 13 for more detailed information

<sup>3)</sup> When mounted on 1 square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994:

<sup>4)</sup>  $R_{thJC}$  is measured at  $T_j$  approximately 90°C.

### 3 Electrical characteristics

at  $T_j=25\text{ °C}$ , unless otherwise specified

**Table 4 Static characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	40	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=250\text{ }\mu\text{A}$
Breakdown voltage temperature coefficient	$dV_{(BR)DSS}/dT_j$	-	36	-	mV/°C	$I_D=5\text{ mA}$ , referenced to $25\text{ °C}$
Gate threshold voltage	$V_{GS(th)}$	2.2	-	3.7	V	$V_{DS}=V_{GS}$ , $I_D=250\text{ }\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	-	1 150	$\mu\text{A}$	$V_{DS}=40\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$ $V_{DS}=40\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$
Gate-source leakage current	$I_{GSS}$	-	-	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	0.5 0.7	0.65 -	m $\Omega$	$V_{GS}=10\text{ V}$ , $I_D=100\text{ A}$ $V_{GS}=6\text{ V}$ , $I_D=50\text{ A}$
Gate resistance <sup>1)</sup>	$R_G$	-	2.2	-	$\Omega$	-
Transconductance	$g_{fs}$	-	320	-	S	$ V_{DS} \geq 2 I_D /R_{DS(on)max}$ , $I_D=100\text{ A}$

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance <sup>1)</sup>	$C_{iss}$	-	18000	-	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=20\text{ V}$ , $f=1\text{ MHz}$
Output capacitance <sup>1)</sup>	$C_{oss}$	-	2900	-	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=20\text{ V}$ , $f=1\text{ MHz}$
Reverse transfer capacitance <sup>1)</sup>	$C_{rss}$	-	2000	-	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=20\text{ V}$ , $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	23	-	ns	$V_{DD}=20\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$ , $R_{G,ext}=2.7\text{ }\Omega$
Rise time	$t_r$	-	75	-	ns	$V_{DD}=20\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$ , $R_{G,ext}=2.7\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	197	-	ns	$V_{DD}=20\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$ , $R_{G,ext}=2.7\text{ }\Omega$
Fall time	$t_f$	-	114	-	ns	$V_{DD}=20\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$ , $R_{G,ext}=2.7\text{ }\Omega$

<sup>1)</sup> Defined by design. Not subject to production test.

**Table 6 Gate charge characteristics<sup>1)</sup>**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	85	-	nC	$V_{DD}=20\text{ V}$ , $I_D=100\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	54	-	nC	$V_{DD}=20\text{ V}$ , $I_D=100\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate to drain charge <sup>2)</sup>	$Q_{gd}$	-	121	-	nC	$V_{DD}=20\text{ V}$ , $I_D=100\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Switching charge	$Q_{sw}$	-	152	-	nC	$V_{DD}=20\text{ V}$ , $I_D=100\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total <sup>2)</sup>	$Q_g$	-	366	458	nC	$V_{DD}=20\text{ V}$ , $I_D=100\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	4.8	-	V	$V_{DD}=20\text{ V}$ , $I_D=100\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total, sync. FET	$Q_{g(sync)}$	-	245	-	nC	$V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }10\text{ V}$
Output charge <sup>1)</sup>	$Q_{oss}$	-	101	-	nC	$V_{DD}=20\text{ V}$ , $V_{GS}=0\text{ V}$

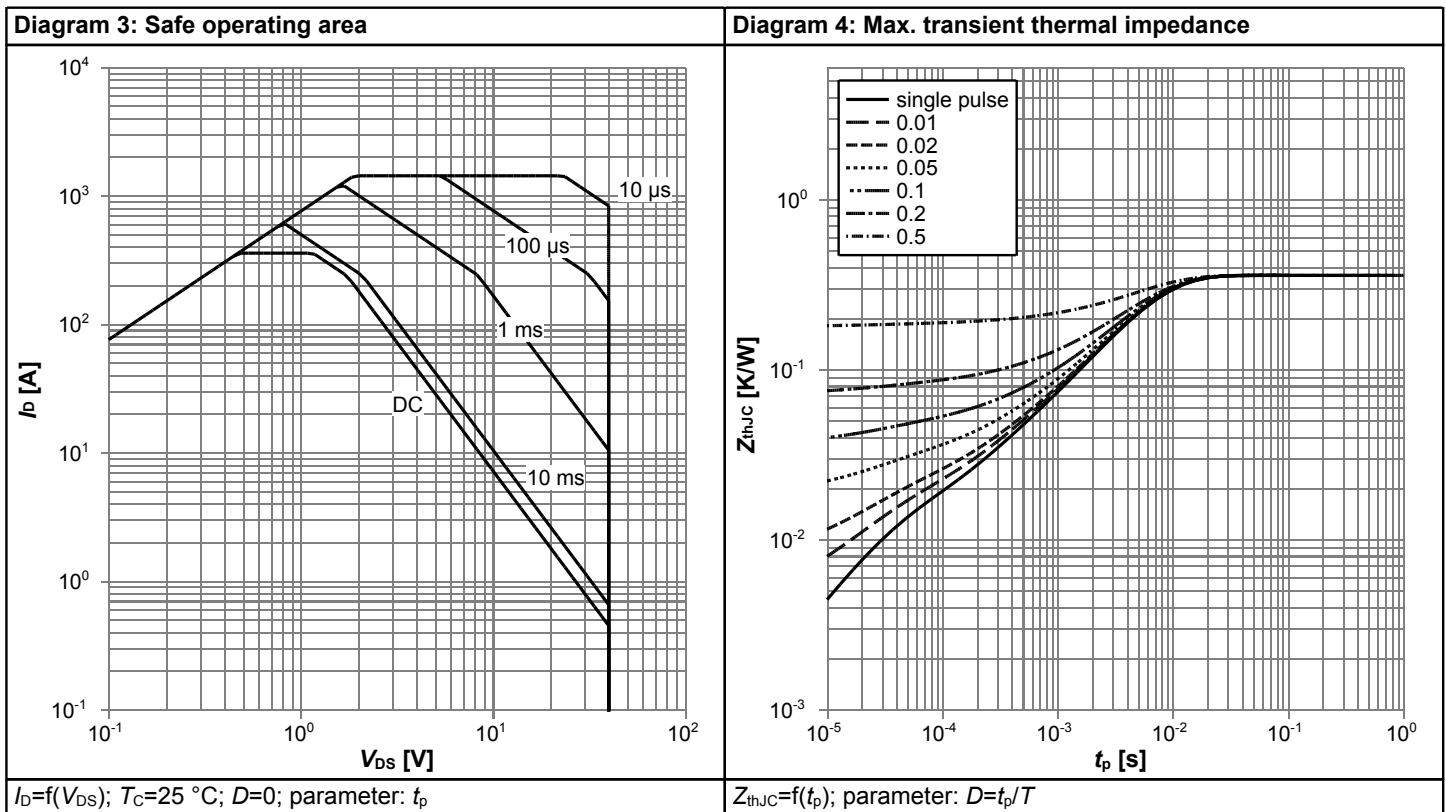
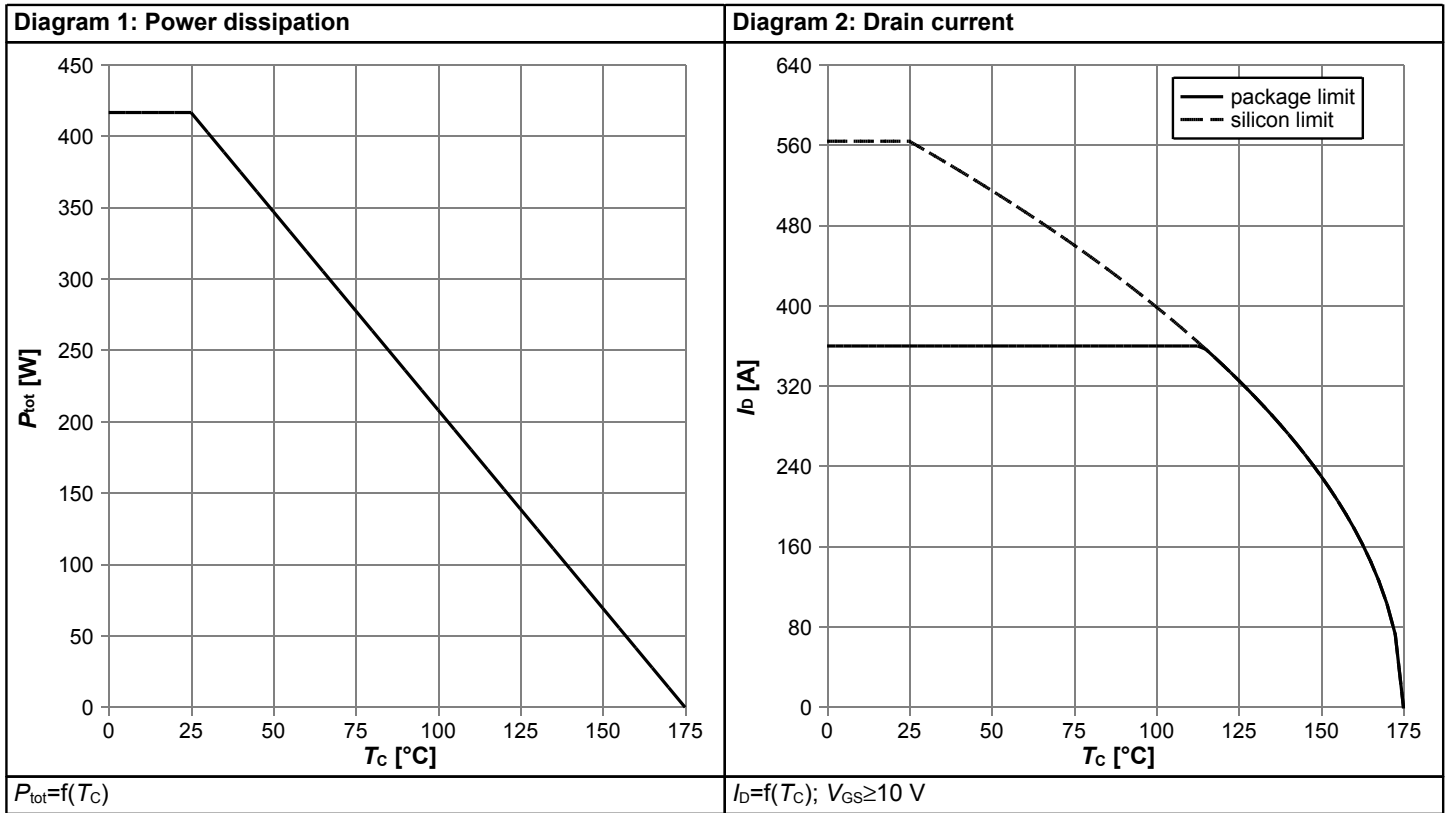
**Table 7 Reverse diode**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	$I_S$	-	-	347	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	1440	A	$T_C=25\text{ °C}$
Diode forward voltage	$V_{SD}$	-	-	1.2	V	$V_{GS}=0\text{ V}$ , $I_F=100\text{ A}$ , $T_j=25\text{ °C}$
Reverse recovery time <sup>2)</sup>	$t_{rr}$	-	53	-	ns	$V_R=34\text{ V}$ , $I_F=100\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge <sup>2)</sup>	$Q_{rr}$	-	79	-	nC	$V_R=34\text{ V}$ , $I_F=100\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$

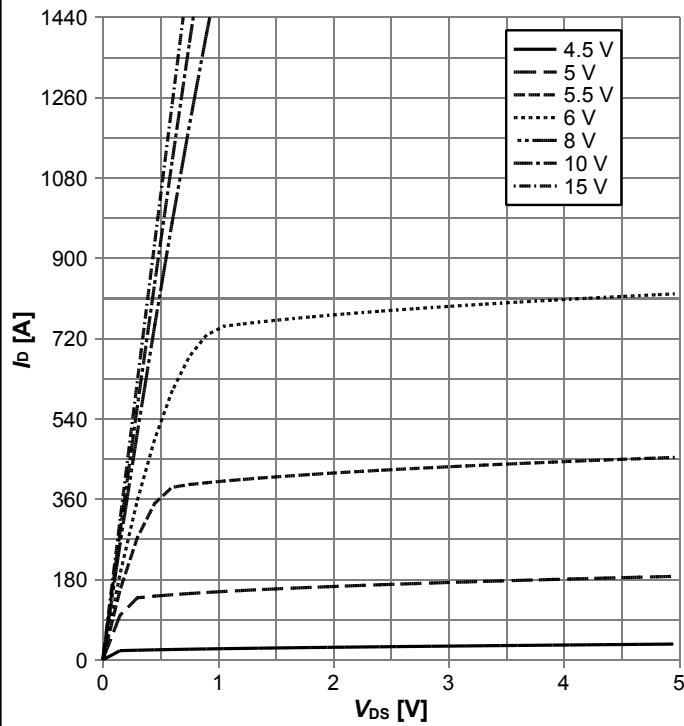
<sup>1)</sup> See "Gate charge waveforms" for parameter definition

<sup>2)</sup> Defined by design. Not subject to production test.

## 4 Electrical characteristics diagrams

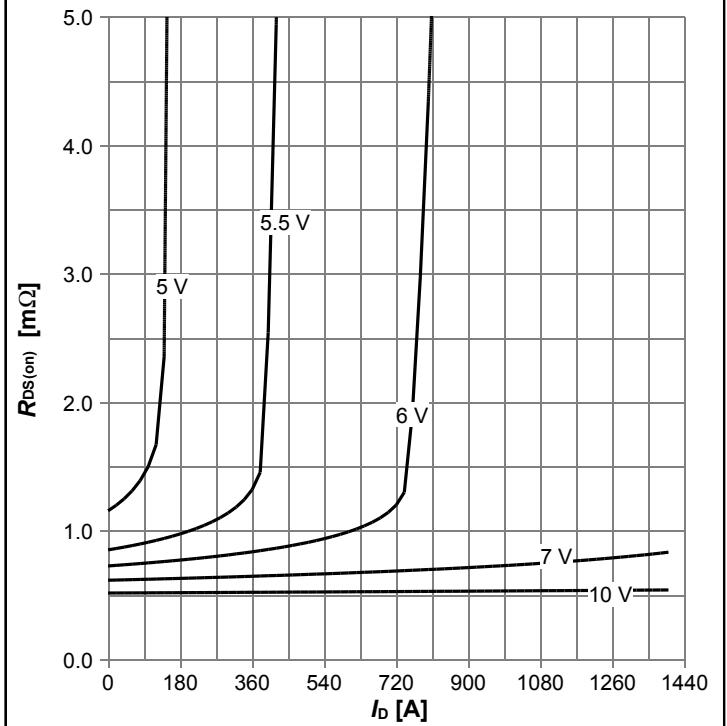


**Diagram 5: Typ. output characteristics**



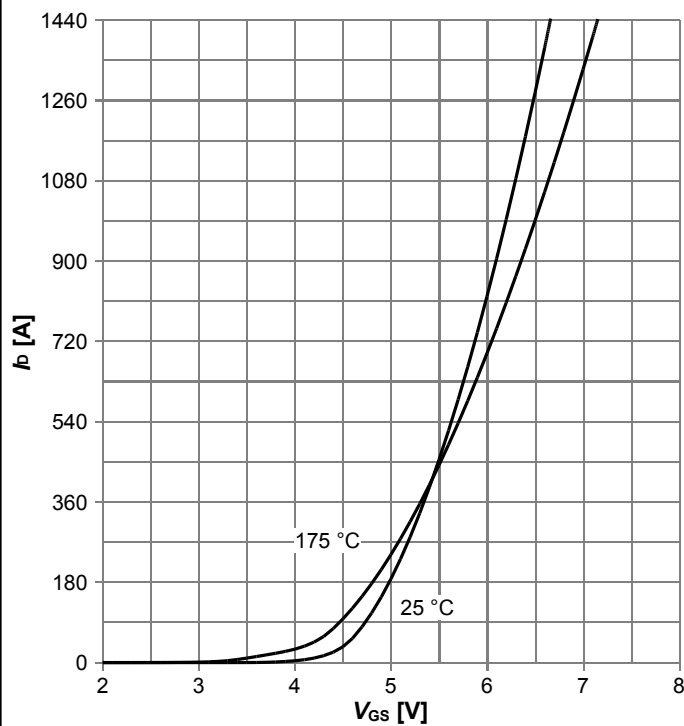
$I_D = f(V_{DS}), T_j = 25\text{ °C};$  parameter:  $V_{GS}$

**Diagram 6: Typ. drain-source on resistance**



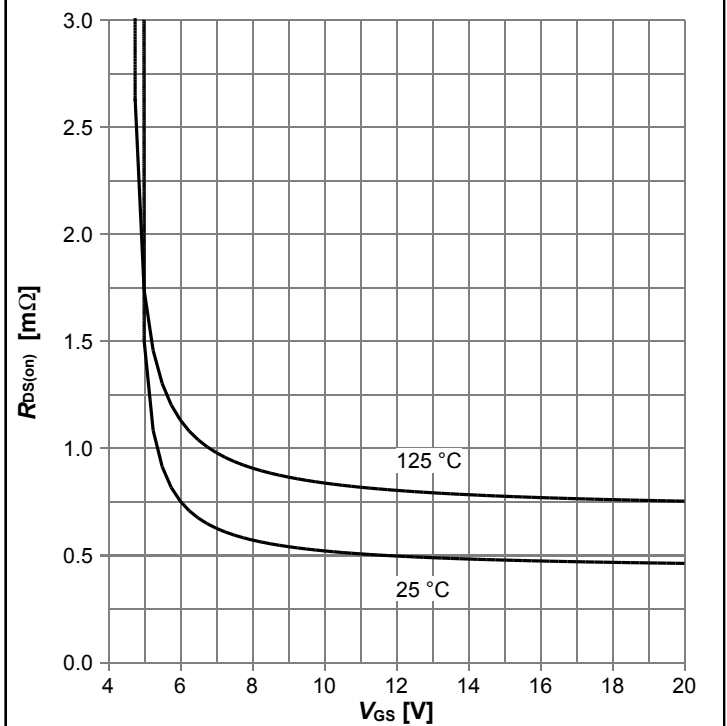
$R_{DS(on)} = f(I_D), T_j = 25\text{ °C};$  parameter:  $V_{GS}$

**Diagram 7: Typ. transfer characteristics**



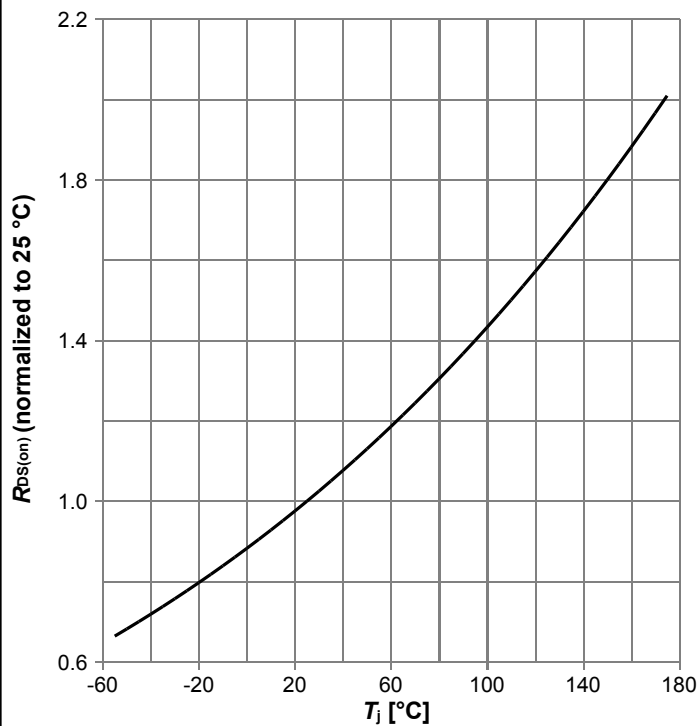
$I_D = f(V_{GS}), |V_{DS}| > 2|I_D| R_{DS(on)max};$  parameter:  $T_j$

**Diagram 8: Typ. drain-source on resistance**



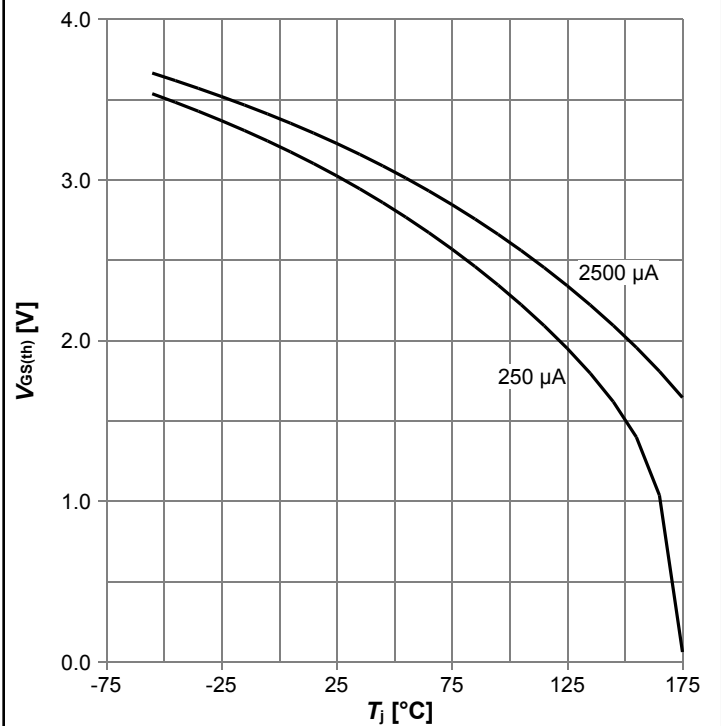
$R_{DS(on)} = f(V_{GS}), I_D = 100\text{ A};$  parameter:  $T_j$

Diagram 9: Normalized drain-source on resistance



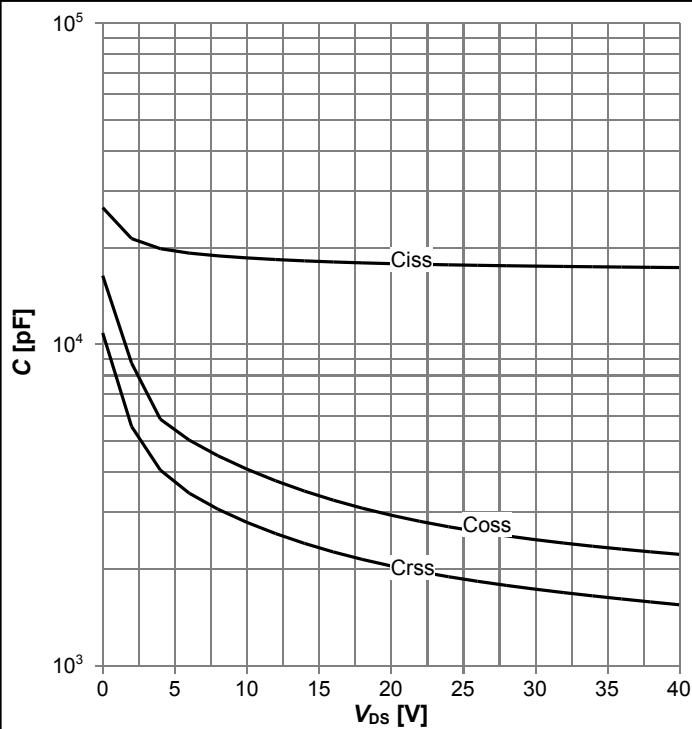
$R_{DS(on)}=f(T_j)$ ,  $I_D=100$  A,  $V_{GS}=10$  V

Diagram 10: Typ. gate threshold voltage



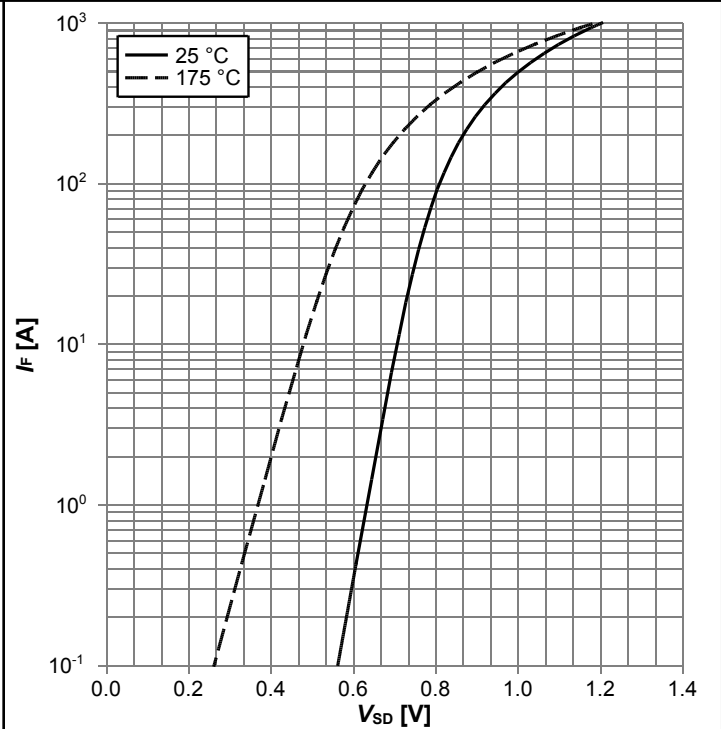
$V_{GS(th)}=f(T_j)$ ,  $V_{GS}=V_{DS}$ ; parameter:  $I_D$

Diagram 11: Typ. capacitances



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

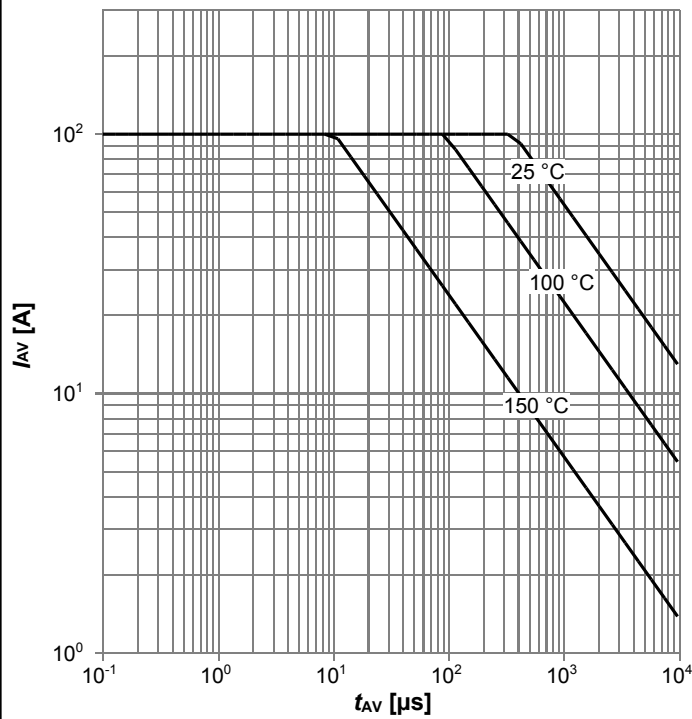
Diagram 12: Forward characteristics of reverse diode



$I_F=f(V_{SD})$ ; parameter:  $T_j$

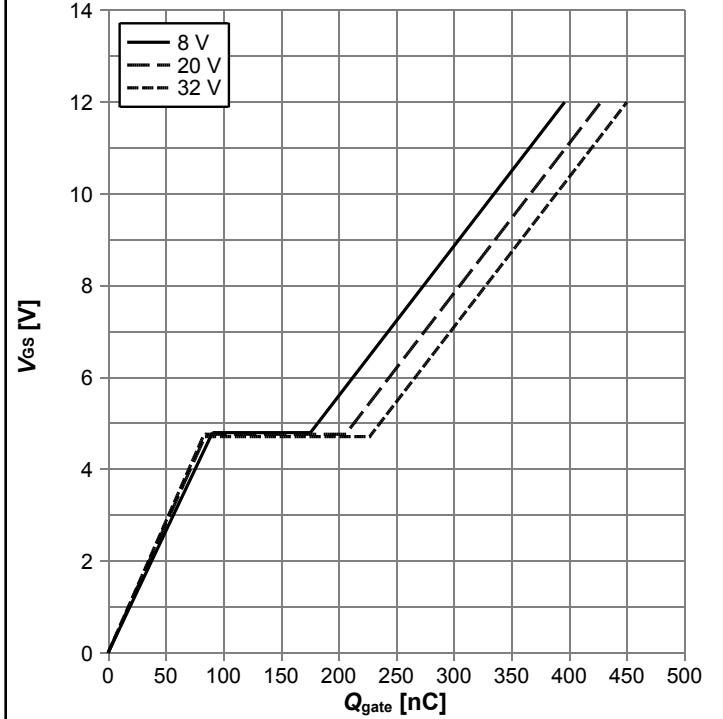


**Diagram 13: Avalanche characteristics**



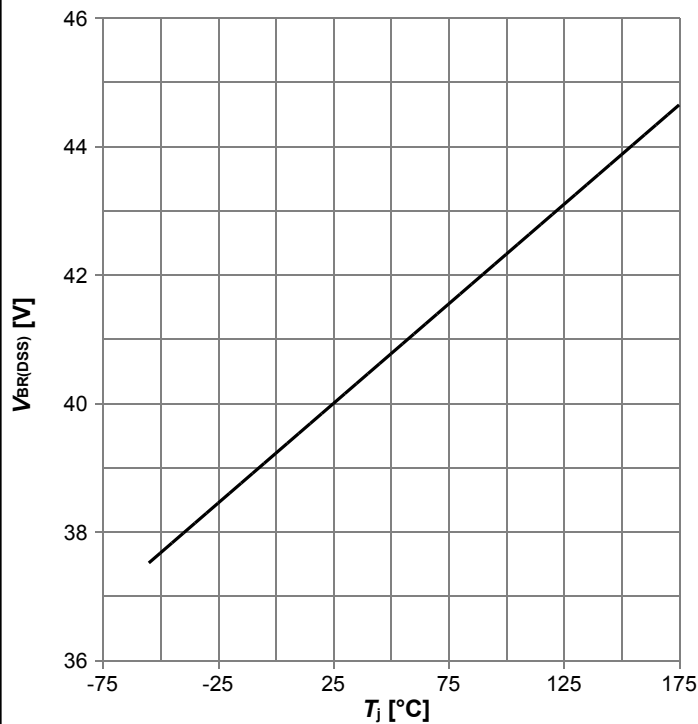
$I_{AS}=f(t_{AV}); R_{GS}=50 \Omega$ ; parameter:  $T_{j,start}$

**Diagram 14: Typ. gate charge**



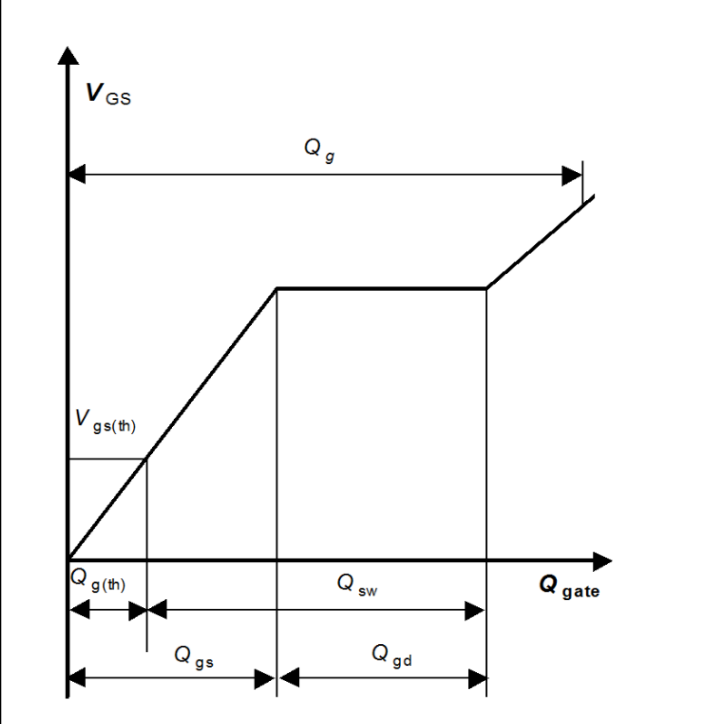
$V_{GS}=f(Q_{gate}), I_D=100$  A pulsed,  $T_j=25$  °C; parameter:  $V_{DD}$

**Diagram 15: Drain-source breakdown voltage**

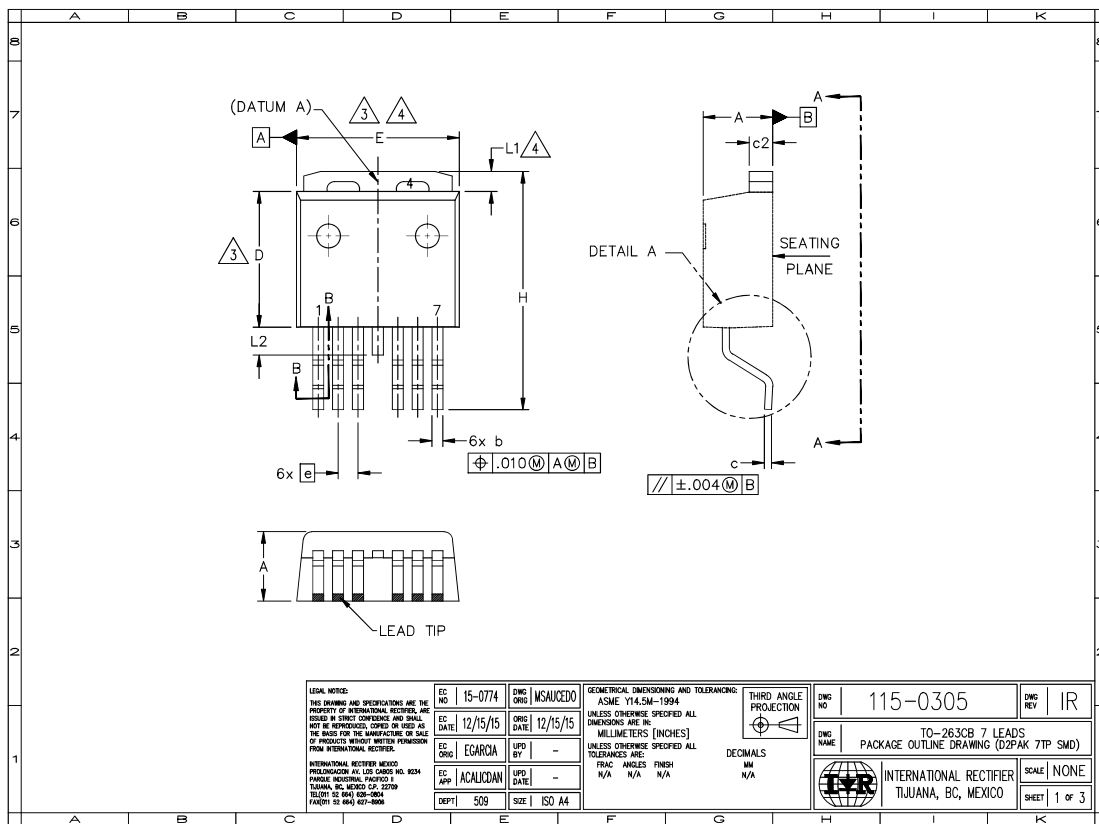


$V_{BR(DSS)}=f(T_j); I_D=1$  mA

**Diagram Gate charge waveforms**



**5 Package Outlines**



**Figure 1 Outline PG-TO 263-7, dimensions in mm/inches**

## Revision History

IRF40SC240

**Revision: 2019-05-08, Rev. 2.1**

Previous Revision

Revision	Date	Subjects (major changes since last revision)
1.0	2018-11-29	Release of preliminary version
2.0	2018-12-04	Release of final version
2.1	2019-05-08	Removed "Qualified according to JEDEC standard" from the features section since it's redundant-page1

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