

MOSFET

StrongIRFET™

Features

- Very low $R_{DS(on)}$
- Optimized for logic level drive
- 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

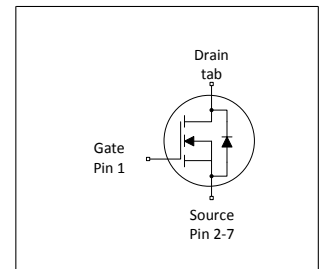
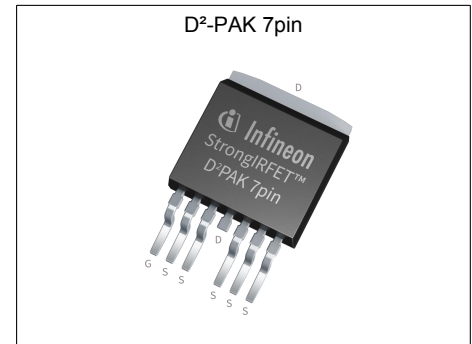


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	60	V
$R_{DS(on),typ}$	1.2	mΩ
$R_{DS(on),max}$	1.5	mΩ
I_D (Silicon Limited)	324	A
$Q_G(0V..10V)$	174	nC



Type / Ordering Code	Package	Marking	Related Links
IRL60SC216	PG-TO263-7	IRL60SC216	-

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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	-	-	324 229	A	$V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=100\text{ °C}^{1)}$
Pulsed drain current ¹⁾	$I_{D,pulse}$	-	-	1296	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse ²⁾	E_{AS}	-	-	531	mJ	$I_D=100\text{ A}$, $R_{GS}=50\text{ }\Omega$
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	375 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, $\theta^{4)}$	R_{thJC}	-	-	0.4	°C/W	-
Thermal resistance, junction -Ambient, θ	R_{thJA}	-	-	62	°C/W	-
Case-to-Sink, Flat Greased Surface	R_{thCS}	-	0.5	-	°C/W	-

¹⁾ See Diagram 3 for more detailed information

²⁾ See Diagram 13 for more detailed information

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

⁴⁾ 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	$V_{(BR)DSS}$	60	-	-	V	$V_{GS}=0\text{ V}$, $I_D=250\text{ }\mu\text{A}$
Breakdown voltage temperature coefficient	$dV_{(BR)DSS}/dT_j$	-	45	-	mV/°C	$I_D=5\text{ mA}$, referenced to 25 °C
Gate threshold voltage	$V_{GS(th)}$	1.0	-	2.4	V	$V_{DS}=V_{GS}$, $I_D=250\text{ }\mu\text{A}$
Zero gate voltage drain current	I_{DSS}	-	-	1 150	μA	$V_{DS}=60\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ °C}$ $V_{DS}=60\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=125\text{ °C}$
Gate-source leakage current	I_{GSS}	-	-	100	nA	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	1.2 1.4	1.50 1.8	m Ω	$V_{GS}=10\text{ V}$, $I_D=100\text{ A}$ $V_{GS}=4.5\text{ V}$, $I_D=50\text{ A}$
Gate resistance ¹⁾	R_G	-	2.0	-	Ω	-
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 ¹⁾	C_{iss}	-	16000	-	pF	$V_{GS}=0\text{ V}$, $V_{DS}=30\text{ V}$, $f=1\text{ MHz}$
Output capacitance ¹⁾	C_{oss}	-	1100	-	pF	$V_{GS}=0\text{ V}$, $V_{DS}=30\text{ V}$, $f=1\text{ MHz}$
Reverse transfer capacitance ¹⁾	C_{rss}	-	810	-	pF	$V_{GS}=0\text{ V}$, $V_{DS}=30\text{ V}$, $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	66	-	ns	$V_{DD}=30\text{ V}$, $V_{GS}=4.5\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=2.7\text{ }\Omega$
Rise time	t_r	-	149	-	ns	$V_{DD}=30\text{ V}$, $V_{GS}=4.5\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=2.7\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	175	-	ns	$V_{DD}=30\text{ V}$, $V_{GS}=4.5\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=2.7\text{ }\Omega$
Fall time	t_f	-	90	-	ns	$V_{DD}=30\text{ V}$, $V_{GS}=4.5\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=2.7\text{ }\Omega$

¹⁾ Defined by design. Not subject to production test.

Table 6 Gate charge characteristics¹⁾

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	43	-	nC	$V_{DD}=30\text{ V}$, $I_D=100\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	26	-	nC	$V_{DD}=30\text{ V}$, $I_D=100\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate to drain charge ²⁾	Q_{gd}	-	78	-	nC	$V_{DD}=30\text{ V}$, $I_D=100\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Switching charge	Q_{sw}	-	95	-	nC	$V_{DD}=30\text{ V}$, $I_D=100\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total ²⁾	Q_g	-	174	218	nC	$V_{DD}=30\text{ V}$, $I_D=100\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	2.8	-	V	$V_{DD}=30\text{ V}$, $I_D=100\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total, sync. FET	$Q_{g(sync)}$	-	96	-	nC	$V_{DS}=0.1\text{ V}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Output charge ²⁾	Q_{oss}	-	58	-	nC	$V_{DD}=30\text{ V}$, $V_{GS}=0\text{ V}$

Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	313	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	1296	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 ²⁾	t_{rr}	-	40	-	ns	$V_R=51\text{ V}$, $I_F=100\text{ A}$, $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge ²⁾	Q_{rr}	-	52	-	nC	$V_R=51\text{ V}$, $I_F=100\text{ A}$, $di_F/dt=100\text{ A}/\mu\text{s}$

¹⁾ See "Gate charge waveforms" for parameter definition

²⁾ Defined by design. Not subject to production test.

4 Electrical characteristics diagrams

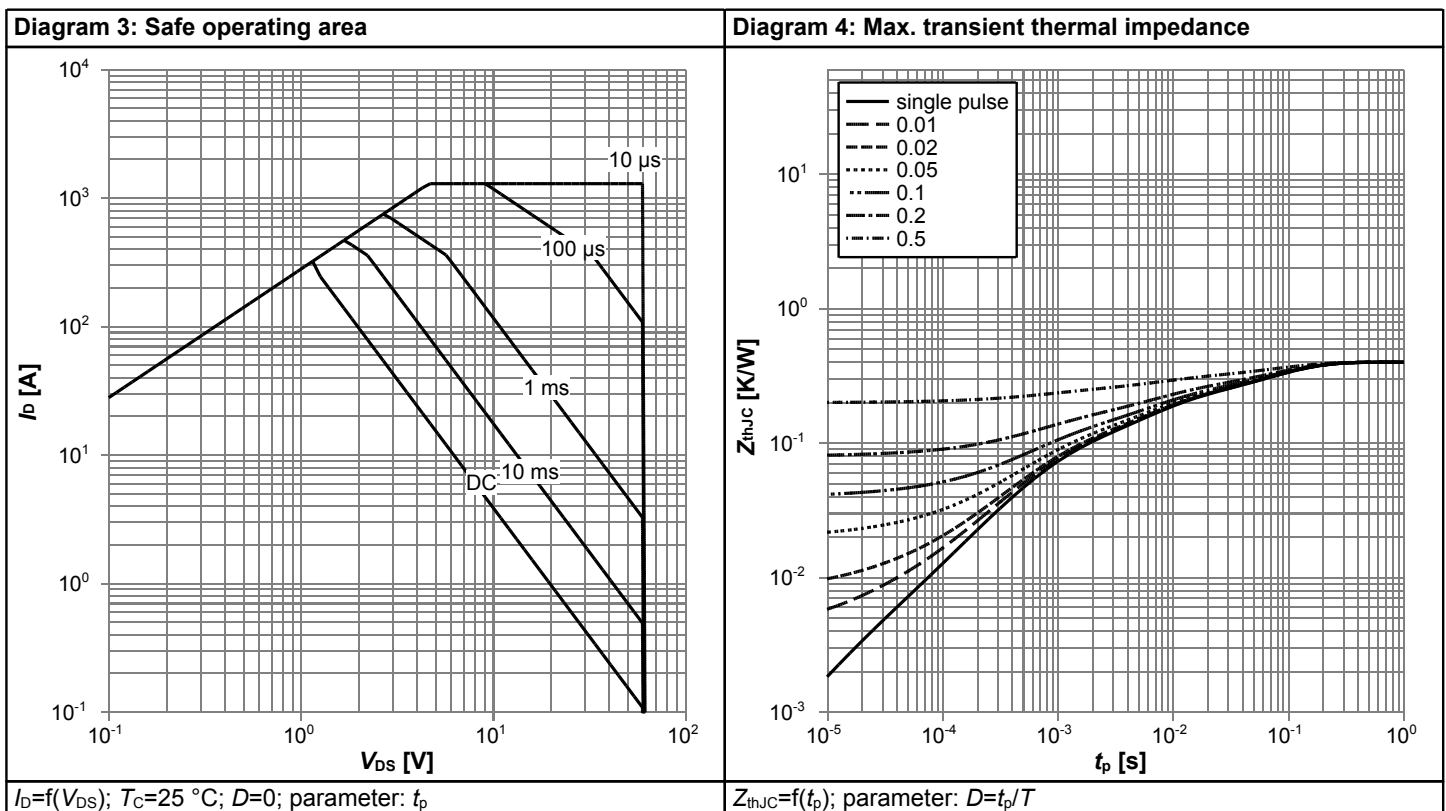
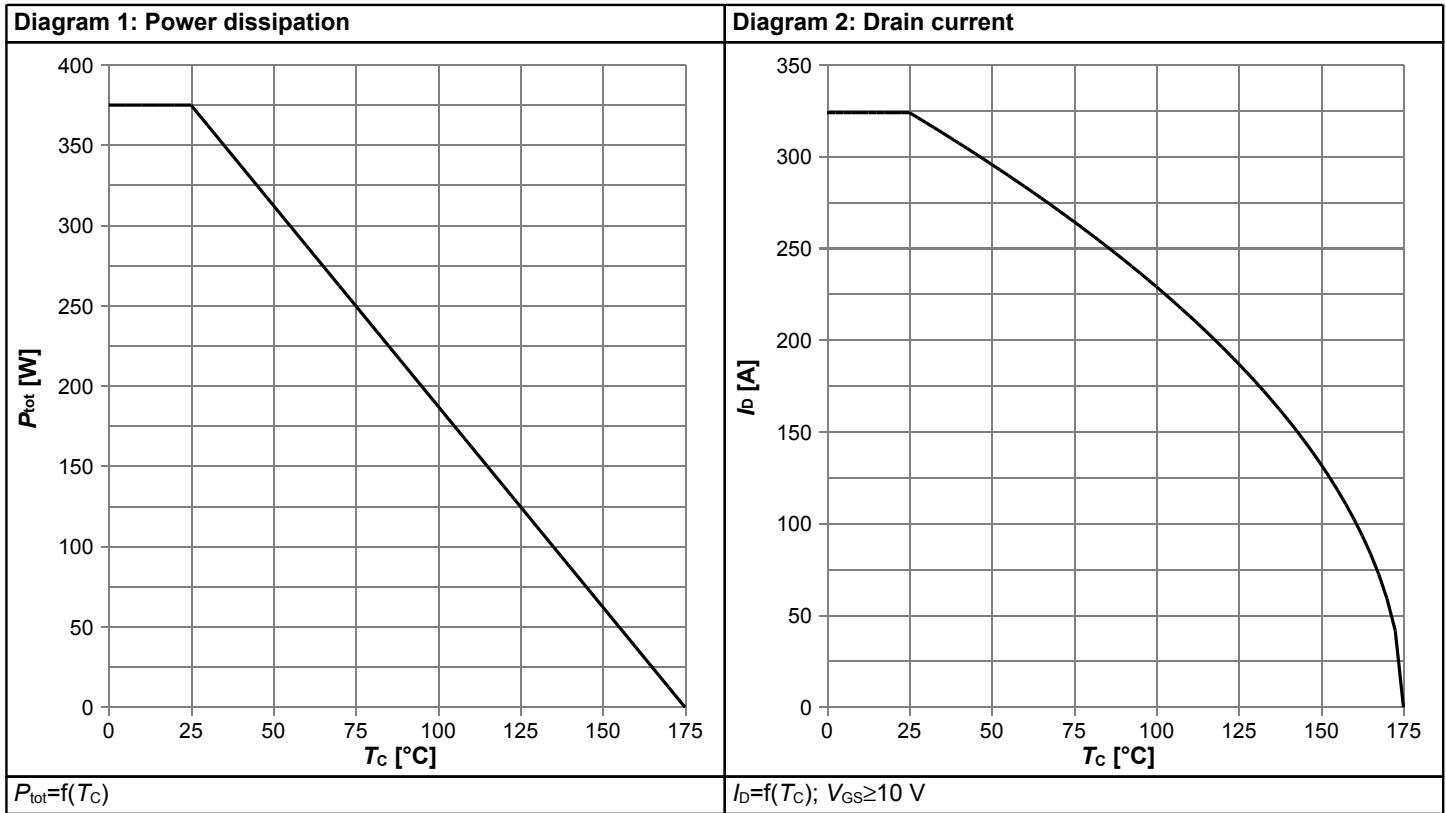
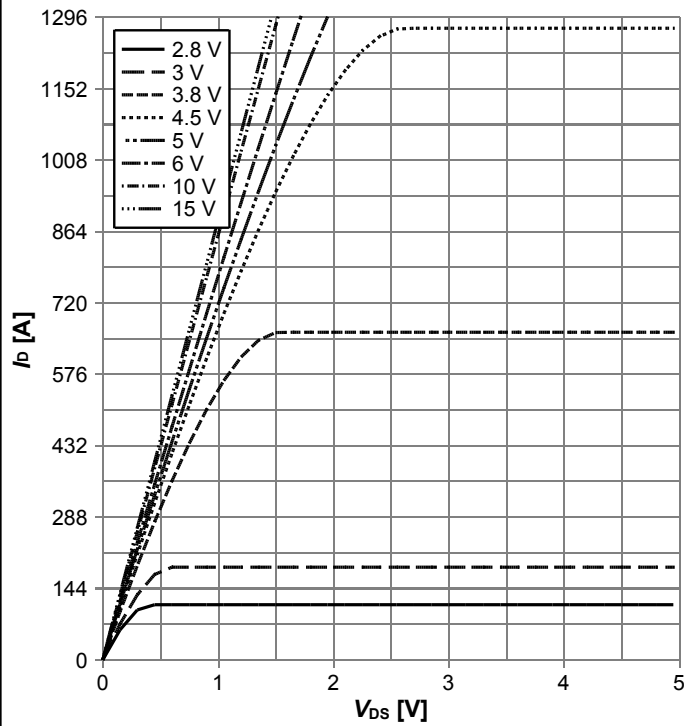
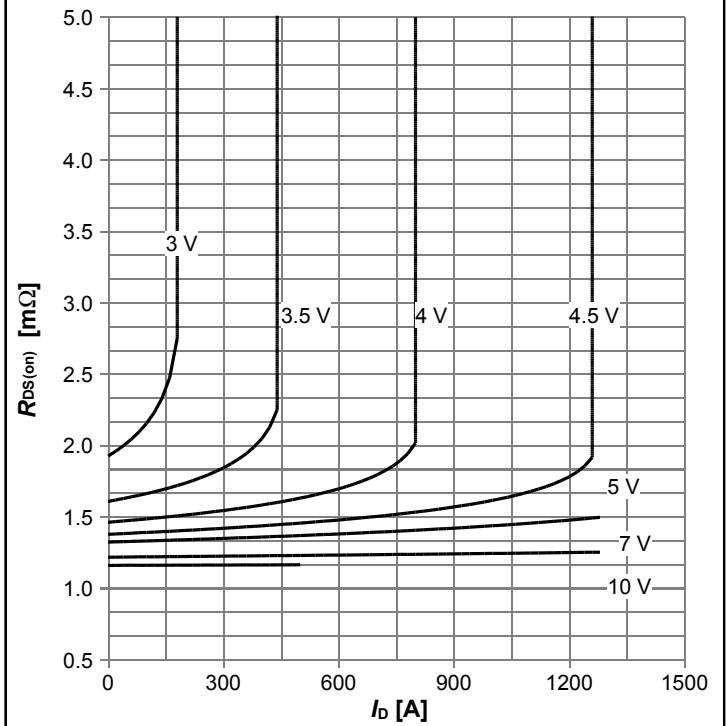


Diagram 5: Typ. output characteristics



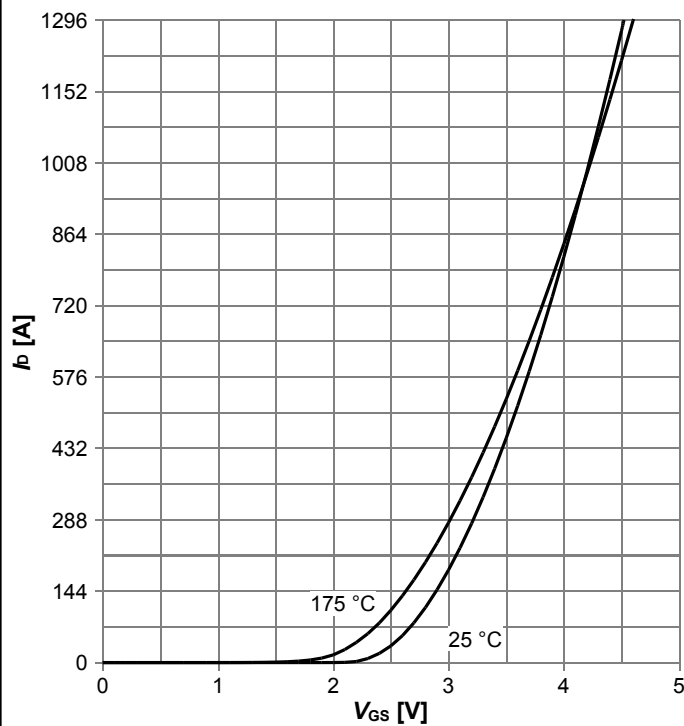
$I_D = f(V_{DS}), T_j = 25^\circ\text{C};$ parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



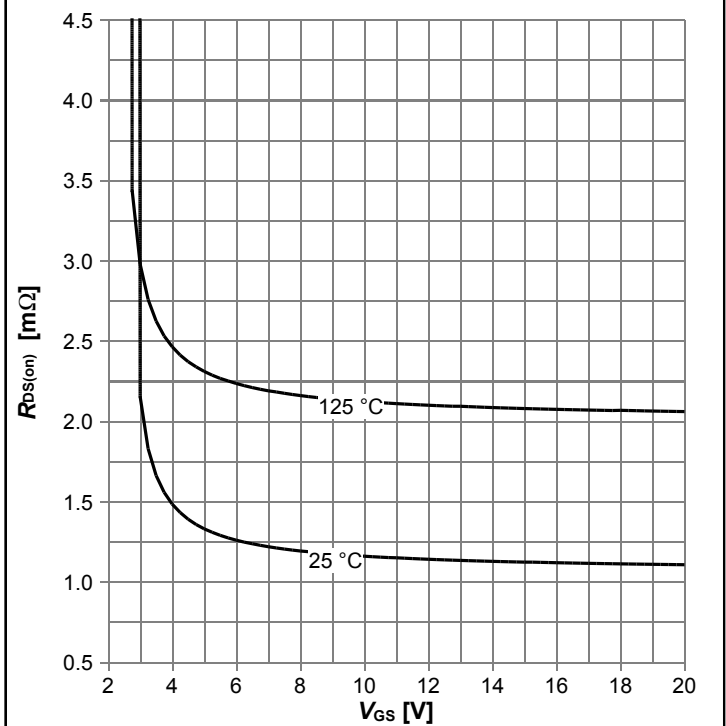
$R_{DS(on)} = f(I_D), T_j = 25^\circ\text{C};$ parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



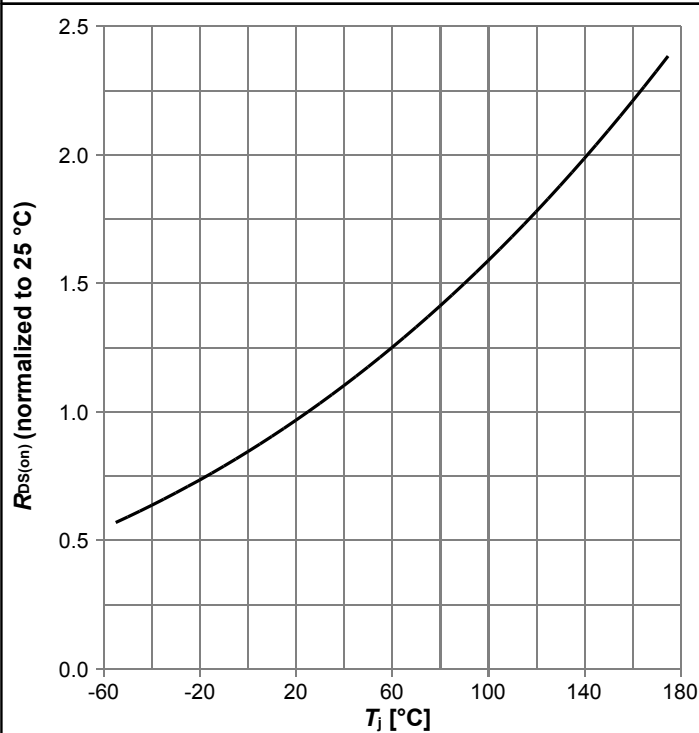
$I_D = f(V_{GS}), |V_{DS}| > 2|I_D| R_{DS(on)max};$ parameter: T_j

Diagram 8: Typ. drain-source on resistance



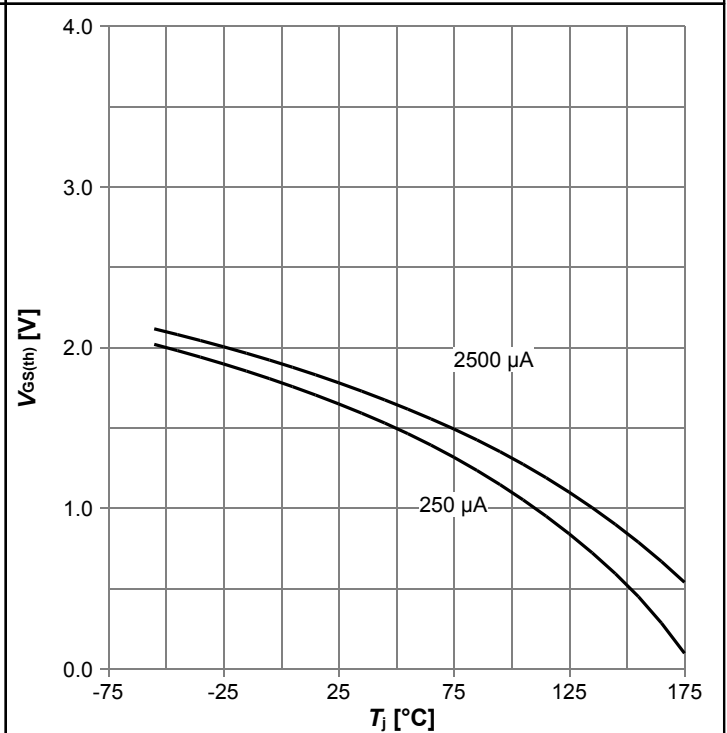
$R_{DS(on)} = f(V_{GS}), I_D = 100\text{ A};$ parameter: T_j

Diagram 9: Normalized drain-source on resistance



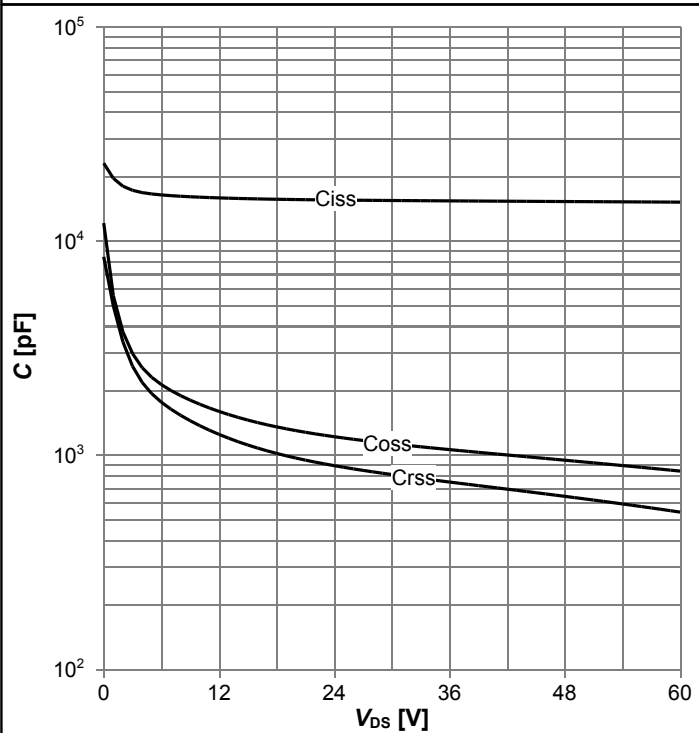
$R_{DS(on)}=f(T_j)$, $I_D=100$ A, $V_{GS}=10$ V

Diagram 10: Typ. gate threshold voltage



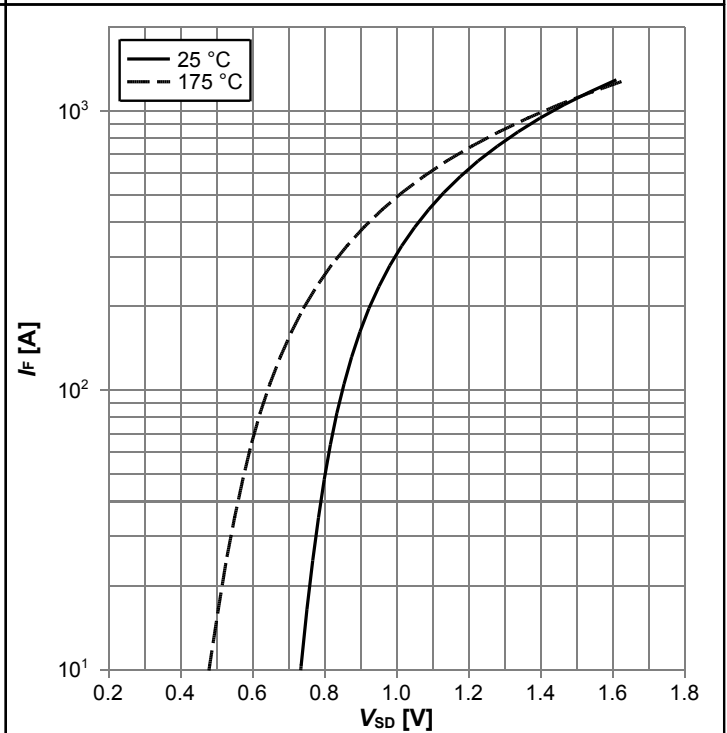
$V_{GS(th)}=f(T_j)$, $V_{GS}=V_{DS}$; parameter: I_D

Diagram 11: Typ. capacitances



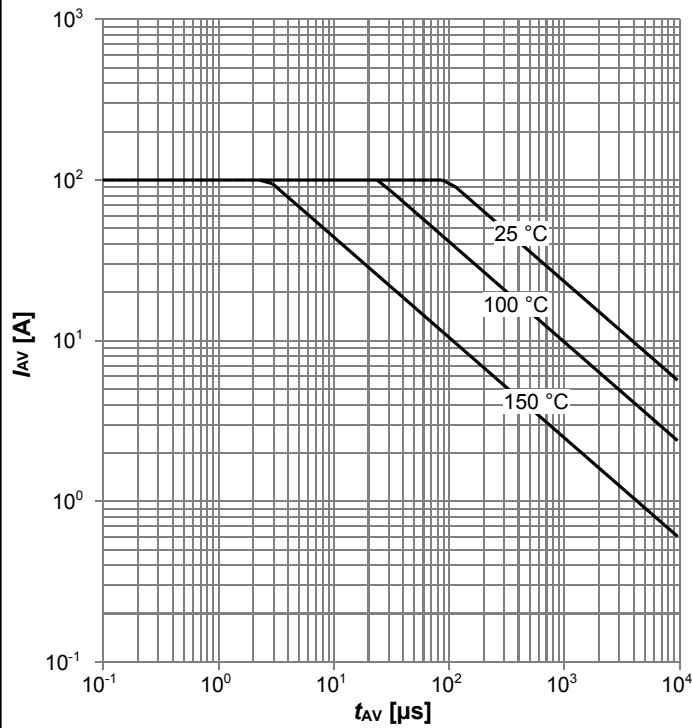
$C=f(V_{DS})$; $V_{GS}=0$ V; $f=1$ MHz

Diagram 12: Forward characteristics of reverse diode



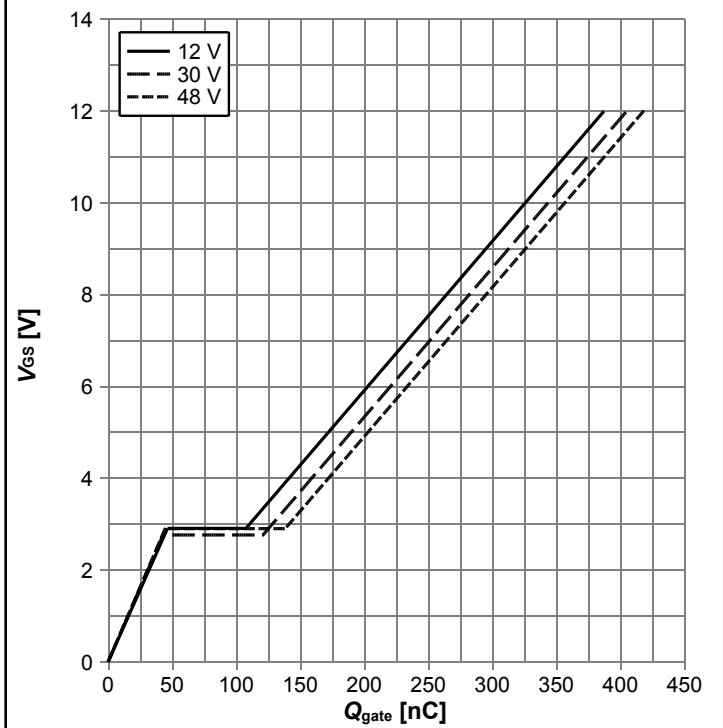
$I_F=f(V_{SD})$; parameter: T_j

Diagram 13: Avalanche characteristics



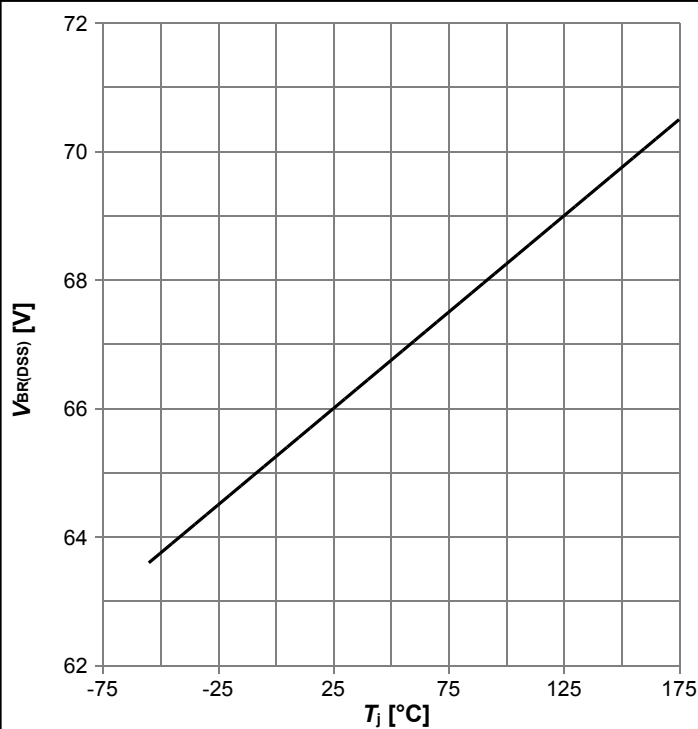
$I_{AS}=f(t_{AV}); R_{GS}=50 \Omega$; parameter: $T_{j,start}$

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

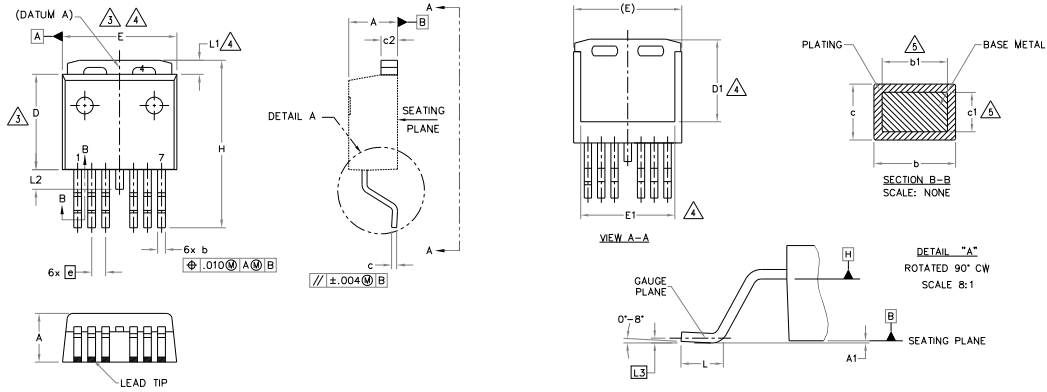


$V_{BR(DSS)}=f(T_j); I_D=1$ mA

Diagram Gate charge waveforms



5 Package Outlines



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	<p>NOTES:</p> <p>1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M-1994</p> <p>2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].</p> <p>3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.</p> <p>4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.</p> <p>5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.</p> <p>6. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.</p> <p>7. CONTROLLING DIMENSION: INCH.</p> <p>8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-263CB EXCEPT FOR DIMS. E, E1 & D1.</p>
A1	-	0.254	-	.010	
b	0.51	0.91	.020	.036	
b1	0.51	0.81	.020	.032	
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.380	
D1	6.86	7.42	.270	.292	
E	9.65	10.54	.380	.415	
E1	8.00	9.00	.315	.354	
e	1.27 BSC		.050 BSC		
H	14.61	15.88	.575	.625	
L	1.78	2.79	.070	.110	
L1	-	1.68	-	.066	
L2	-	1.78	-	.070	
L3	0.25 BSC		.010 BSC		

D²Pak - 7 Pin Part Marking Information

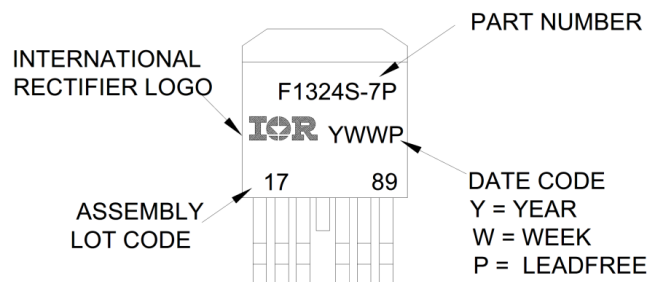


Figure 1 Outline PG-TO263-7, dimensions in mm/inches

Revision History

IRL60SC216

Revision: 2020-07-02, Rev. 2.2

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	Rev. 1
2.2	2020-07-02	Update from IR MOSFET/StrongIRFET™ to StrongIRFET™

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