

650V, 33mΩ SiC MOSFET

SiC MOSFET in a TO-247-3L plastic package, designed for high frequency, high efficiency systems.

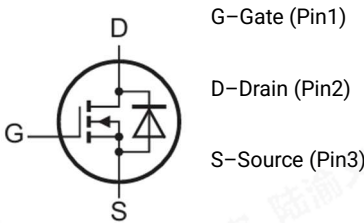
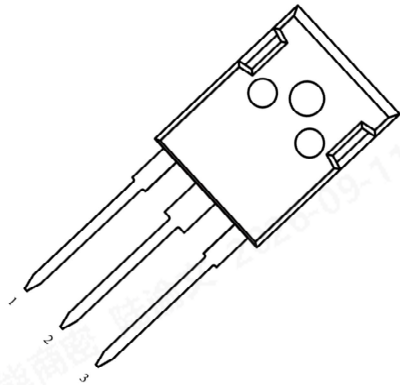
Features

- Low specific on-resistance
- Optimized dynamic performance
- Robust gate design
- 0V turn-off V_{GS} for simple gate driving
- 100% UIS Tested
- Easy to parallel
- RoHS compliant

Typical applications

- PC/server/telecom power supplies
- UPS & Energy storage system
- Battery formation instrument
- PV MPPT and inverters
- EV Chargers
- Motor Drives

V_{DS}	650V
$R_{DS(on)}$	33mΩ



Type	Package	Marking
IM065R033W	TO-247-3L	IM065R033W

Contents

Contents

Features 1

Typical applications..... 1

1 Quick reference data..... 3

2 Limiting values..... 3

3 Thermal & mechanical characteristics..... 4

4 Characteristics..... 4

5 Characteristic diagrams 7

6 Package outlines 13

Revision history 14

1 Quick reference data

Table 1 Absolute maximum rating

Parameter	Symbol	Note or test condition	Value	Unit
Drain-source voltage	V_{DS}	$25^{\circ}\text{C} \leq T_j \leq 175^{\circ}\text{C}$	650	V
Drain current	I_D	$V_{GS} = 18\text{V}; T_{mb} = 25^{\circ}\text{C}$	101	A
Total power dissipation	P_{tot}	$T_{mb} = 25^{\circ}\text{C}, T_j = 175^{\circ}\text{C}$	395	W
Junction temperature	T_j		-55 to 175	$^{\circ}\text{C}$

Table 2 Static characteristics

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 15\text{V}; I_D = 30\text{A}; T_j = 25^{\circ}\text{C}$		33		m Ω
		$V_{GS} = 18\text{V}; I_D = 30\text{A}; T_j = 25^{\circ}\text{C}$		26.5	34	m Ω

Table 3 Dynamic characteristics

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
Total gate charge	$Q_{G(tot)}$	$I_D = 30\text{A}; V_{DS} = 400\text{V};$		87		nC
Gate-drain charge	Q_{GD}	$V_{GS} = -4\text{V}/18\text{V}; T_j = 25^{\circ}\text{C}$		10.4		nC

Table 4 Source-drain diode

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
Recovered charge	Q_r	$I_{SD} = 30\text{A}; di/dt = 500\text{A}/\mu\text{s};$ $V_{DS} = 400\text{V}; T_j = 25^{\circ}\text{C}$		108		nC

2 Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Table 5 Limiting values

Parameter	Symbol	Note or test condition	Value	Unit
Drain-source voltage	V_{DS}	$25^{\circ}\text{C} \leq T_j \leq 175^{\circ}\text{C}$	650	V
Gate-source voltage	$V_{GS,max}$	Absolute maximum values	-10 to 22	V
Gate-source voltage	$V_{GS,op}$	Recommended operational values	-4 to 18	V
Total power dissipation	P_{tot}	$T_{mb} = 25^{\circ}\text{C}, T_j = 175^{\circ}\text{C}$	395	W

3 Thermal & mechanical characteristics

Drain current	I_D	$V_{GS} = 18V; T_{mb} = 25^{\circ}C$	101	A
		$V_{GS} = 18V; T_{mb} = 100^{\circ}C$	72	A
Peak drain current	I_{DM}	Pulse width t_p limited by T_{jmax}	203	A
Continuous diode current	I_S	$V_{GS} = -4V; T_{mb} = 25^{\circ}C$	73	A
Pulse diode current	I_{SM}	$V_{GS} = -4V$; pulse width t_p limited by T_{jmax}	203	A
Single pulse drain-to-source avalanche	E_{as}	$I_{AS} = 19.6A; L = 1mH$; $V_{DD} = 100V; T_j = 25^{\circ}C$	192	mJ
Storage temperature	T_{stg}		-55 to 175	$^{\circ}C$
Junction temperature	T_j		-55 to 175	$^{\circ}C$
Peak soldering temperature	$T_{sld(M)}$		260	$^{\circ}C$

3 Thermal & mechanical characteristics

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
Thermal resistance from junction to mounting base	$R_{th(j-mb)}$			0.38		K/W
Thermal resistance from junction to ambient	$R_{th(j-a)}$	In free air		40		K/W
Mounting torque	M_d	M3 or 6 – 32 screw			0.6	Nm

Note:

- It is recommended that a metal washer is inserted between screw head and mounting tab.
- Do not use self-tapping screws.
- Device is ESD sensitive. Handling precautions are recommended.

4 Characteristics

Table 6 Static characteristics

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = 100\mu A; V_{GS} = 0V; T_j = 25^{\circ}C$	650			V
Gate-source threshold voltage	$V_{GS(th)}$	$I_D = 8.5mA; V_{DS} = V_{GS};$ $T_j = 25^{\circ}C$	1.9	2.6	3.5	V
		$I_D = 8.5mA; V_{DS} = V_{GS};$ $T_j = 175^{\circ}C$		1.9		V
Drain leakage current	I_{DSS}	$V_{DS} = 650V; V_{GS} = 0V;$ $T_j = 25^{\circ}C$		0.1	50	μA

4 Characteristics

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
		$V_{DS} = 650V$; $V_{GS} = 0V$; $T_j = 175^{\circ}C$		5		μA
Gate leakage current	I_{GSS}	$V_{GS} = 22V$; $V_{DS} = 0V$; $T_j = 25^{\circ}C$		5	100	nA
		$V_{GS} = -10V$; $V_{DS} = 0V$; $T_j = 25^{\circ}C$		5	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 15V$; $I_D = 30A$; $T_j = 25^{\circ}C$		33		m Ω
		$V_{GS} = 18V$; $I_D = 30A$; $T_j = 25^{\circ}C$		26.5	34	m Ω
		$V_{GS} = 18V$; $I_D = 30A$; $T_j = 175^{\circ}C$		32		m Ω
Gate resistance	R_G	$f = 1\text{ MHz}$; $T_j = 25^{\circ}C$		1.14		Ω
Transconductance	g_{fs}	$V_{DS} = 20V$; $I_D = 30A$; $T_j = 25^{\circ}C$		20		S

Table 7 Dynamic characteristics

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
Total gate charge	$Q_{G(tot)}$	$I_D = 30A$; $V_{DS} = 400V$; $V_{GS} = -4V/18V$; $T_j = 25^{\circ}C$		87		nC
Gate-source charge	Q_{GS}			37		nC
Gate-drain charge	Q_{GD}			10.4		nC
Input capacitance	C_{iss}	$V_{DS} = 400V$; $V_{GS} = 0V$; $f = 1\text{ MHz}$; $T_j = 25^{\circ}C$		2109		pF
Output capacitance	C_{oss}			179		pF
Reverse transfer capacitance	C_{rss}			13		pF
C_{oss} stored energy	E_{oss}			14.3		μJ
Turn-on delay time	$t_{d(on)}$	$V_{DS} = 400V$; $V_{GS} = -4\text{ V}/18V$; $R_{G(ext)} = 5.1\Omega$; $I_D = 15A$; $L = 100\mu H$; $T_j = 25^{\circ}C$		21		ns
Rise time	t_r			25		ns
Turn-off delay time	$t_{d(off)}$			42		ns
Fall time	t_f			13		ns
Turn-on energy (SiC Diode FWD)	E_{on}			68		μJ
Turn-off energy (SiC Diode FWD)	E_{off}			29		μJ
Turn-on energy (Body Diode FWD)	E_{on}			105		μJ
Turn-off energy (Body Diode FWD)	E_{off}			27		μJ

Table 8 Source-drain diode

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
Source-drain voltage	V_{SD}	$V_{GS} = 0V$; $I_{SD} = 30A$; $T_j = 25^{\circ}C$		3.7		V
		$V_{GS} = -4V$; $I_{SD} = 30A$; $T_j = 25^{\circ}C$		4.2		V
		$V_{GS} = -4V$; $I_{SD} = 30A$; $T_j = 175^{\circ}C$		3.7		V

4 Characteristics

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
Reverse recovery time	t_{rr}	$I_{SD} = 30A; di/dt = 500A/\mu s;$ $V_{DS} = 400V; T_J = 25^{\circ}C$		34.2		ns
Recovered charge	Q_r			108		nC
Reverse recovery current	I_{rrm}			6.3		A

5 Characteristic diagrams

5 Characteristic diagrams

Figure 1 Total power dissipation as a function of mounting base temperature; maximum values

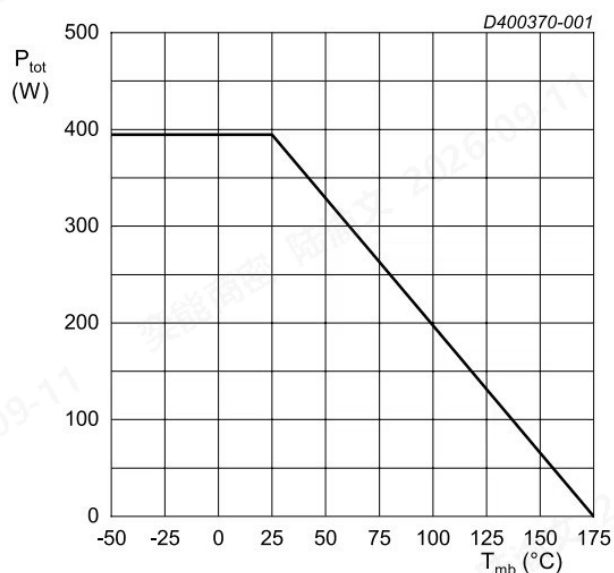


Figure 2 Continuous Drain Current as a function of mounting base temperature

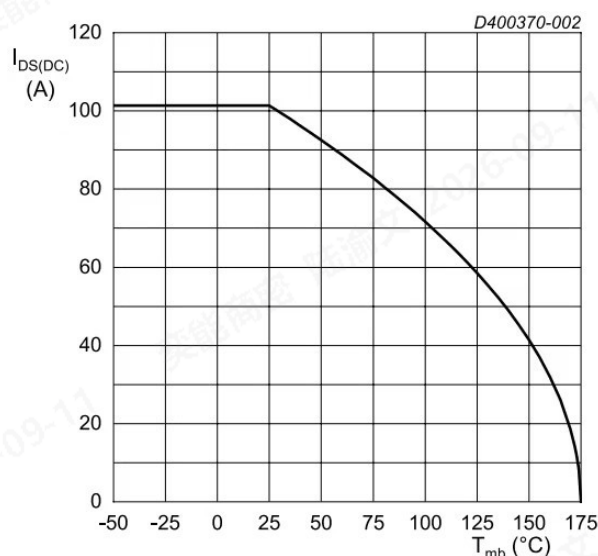
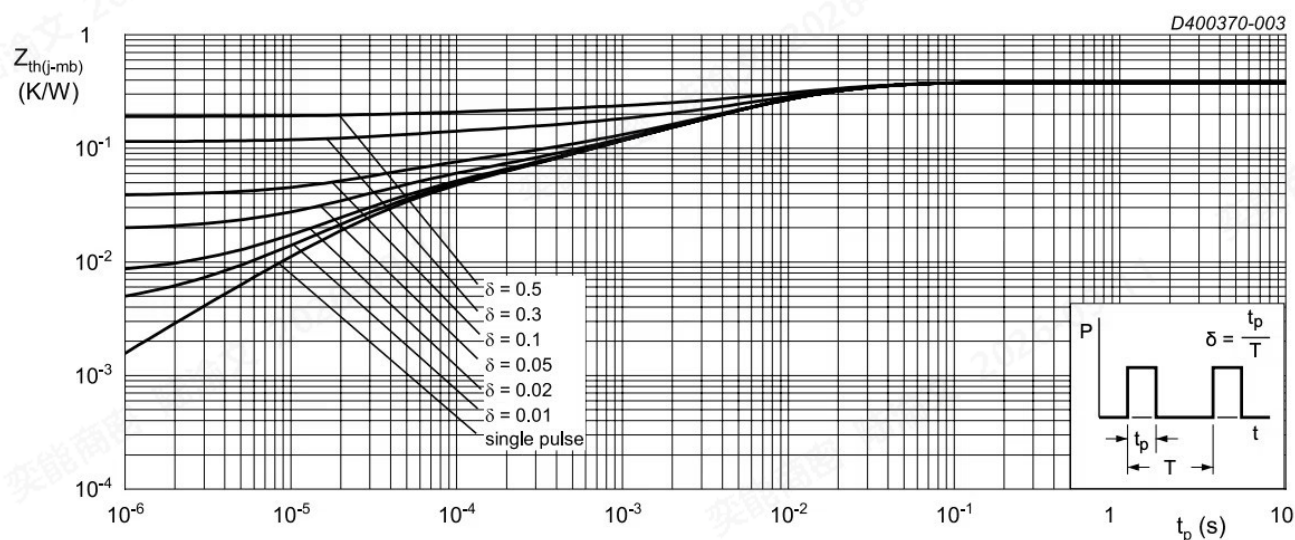
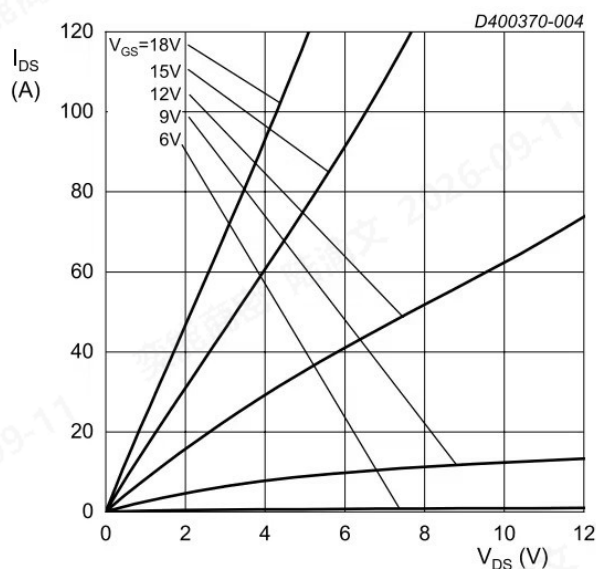
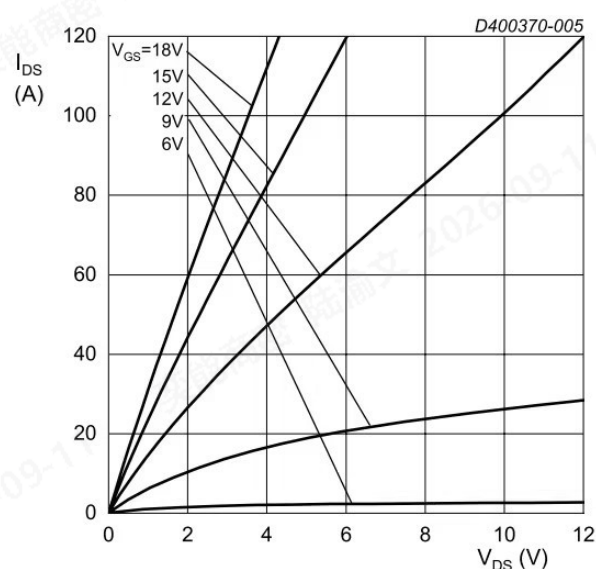
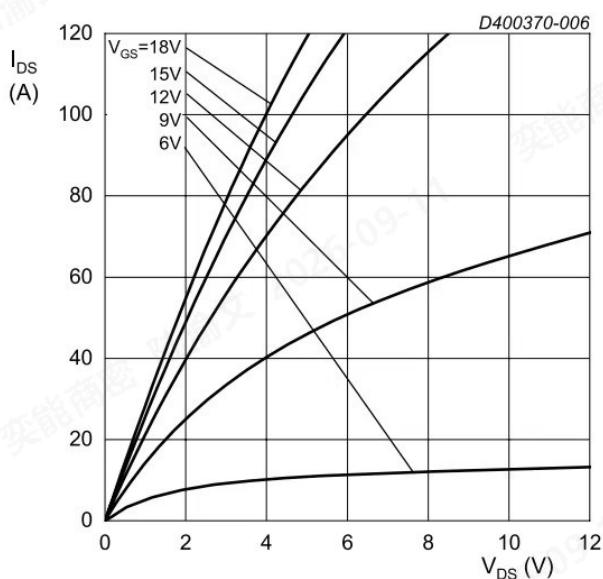
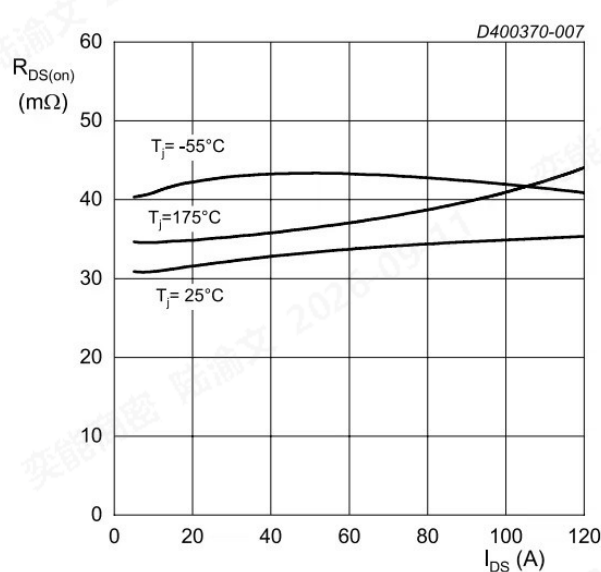


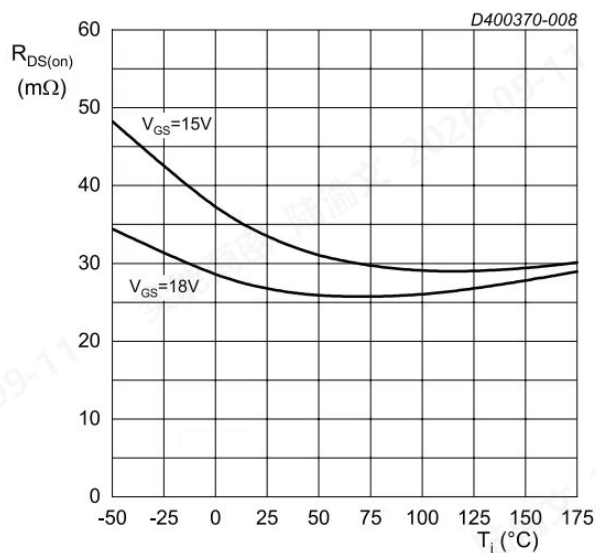
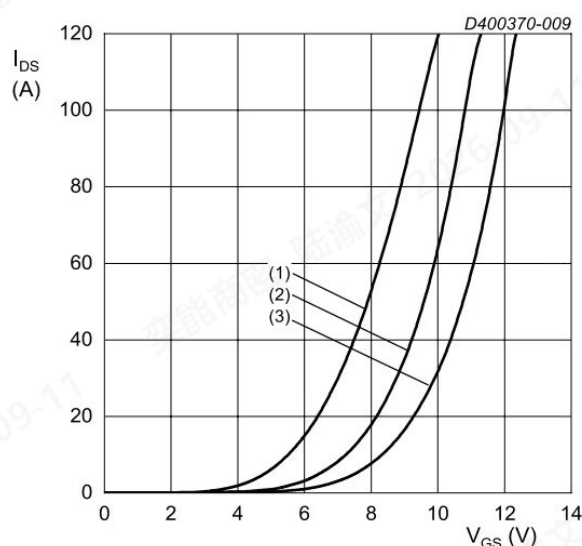
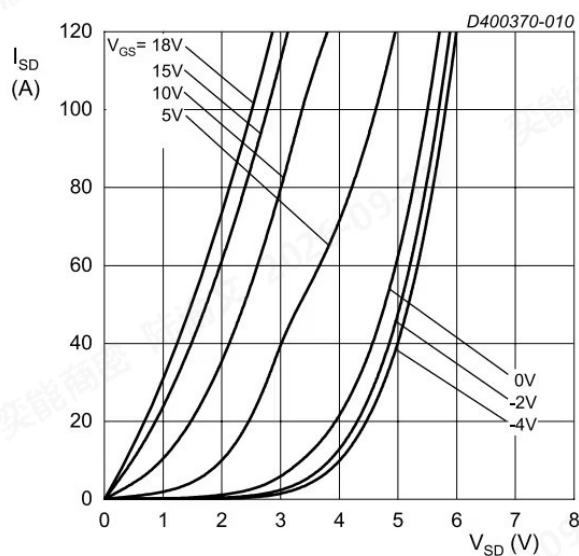
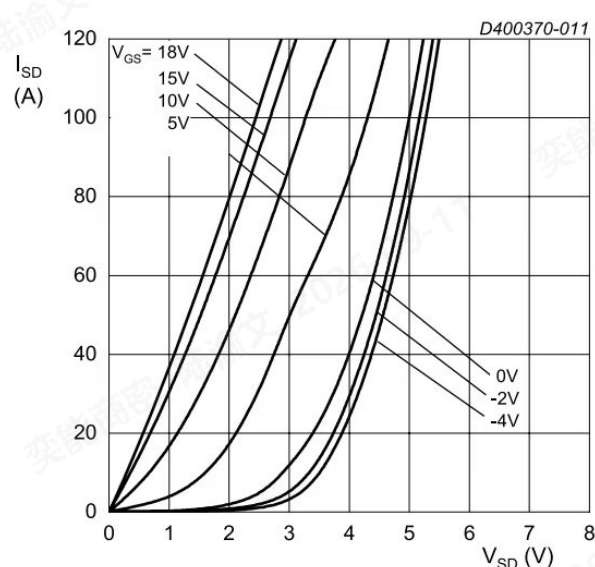
Figure 3 Transient thermal impedance from junction to mounting base as a function of pulse duration



5 Characteristic diagrams

Figure 4 Output characteristics; drain current as a function of drain-source voltage; typical values $T_j = -55^{\circ}\text{C}$; $t_p < 200\mu\text{s}$ **Figure 5 Output characteristics; drain current as a function of drain-source voltage; typical values** $T_j = 25^{\circ}\text{C}$; $t_p < 200\mu\text{s}$ **Figure 6 Output characteristics; drain current as a function of drain-source voltage; typical values** $T_j = 175^{\circ}\text{C}$; $t_p < 200\mu\text{s}$ **Figure 7 Drain-source on-state resistance as a function of drain current; typical values** $V_{GS} = 18\text{V}$; $t_p < 200\mu\text{s}$ 

5 Characteristic diagrams

Figure 8 Drain-source on-state resistance as a function of junction temperature $I_{DS} = 30A$; $t_p < 200\mu s$ **Figure 9 Transfer characteristics; drain current as a function of gate-source voltage; typical values** $V_{DS} = 20V$; $t_p < 200\mu s$ (1) $T_j = 175^\circ C$; (2) $T_j = 25^\circ C$; (3) $T_j = -55^\circ C$ **Figure 10 Body diode forward characteristics; typical values** $T_j = -55^\circ C$; $t_p < 200\mu s$ **Figure 11 Body diode forward characteristics; typical values** $T_j = 25^\circ C$; $t_p < 200\mu s$ 

5 Characteristic diagrams

Figure 12 Body diode forward characteristics;
typical values

$T_j = 175^{\circ}\text{C}$; $t_p < 200\mu\text{s}$

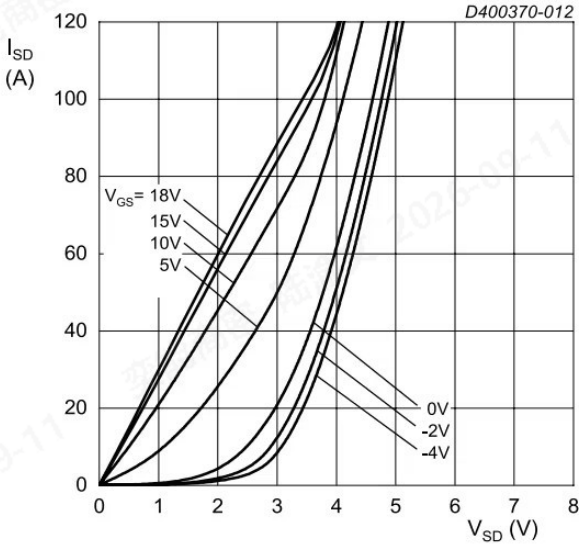


Figure 13 Threshold voltage as a function of
junction temperature

$V_{DS} = V_{GS}$; $I_{DS} = 8.5\text{mA}$

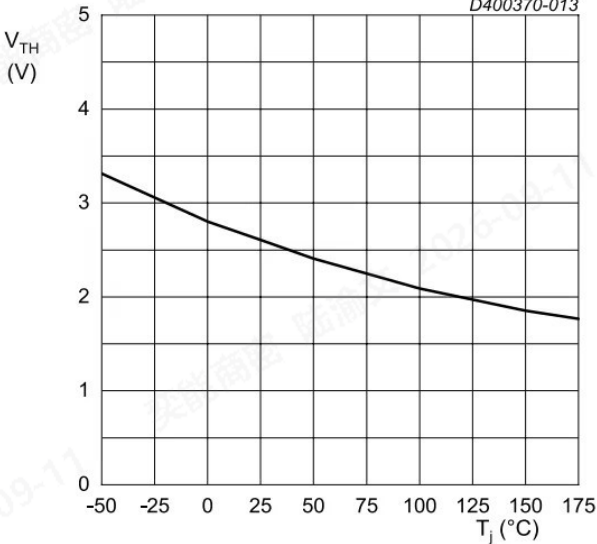


Figure 14 Gate-source voltage as a function of gate
charge; typical values

$I_{DS} = 30\text{A}$; $I_{GS} = 0.1\text{mA}$; $V_{DS} = 400\text{V}$; $T_j = 25^{\circ}\text{C}$

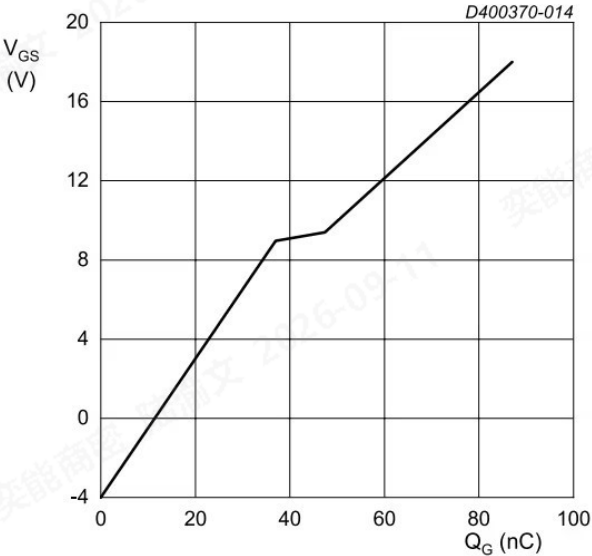
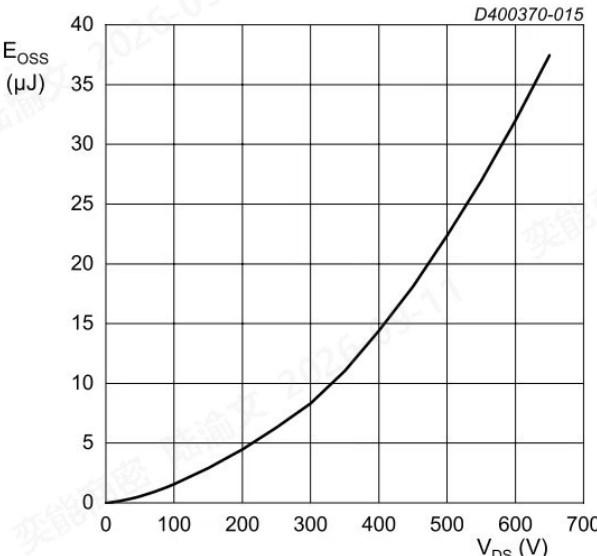


Figure 15 Output capacitor stored energy as a
function of drain-source voltage



5 Characteristic diagrams

Figure 16 Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

$$V_{DS} = 0 - 650V$$

$$T_j = 25^\circ C; V_{AC} = 25mV; f = 1MHz$$

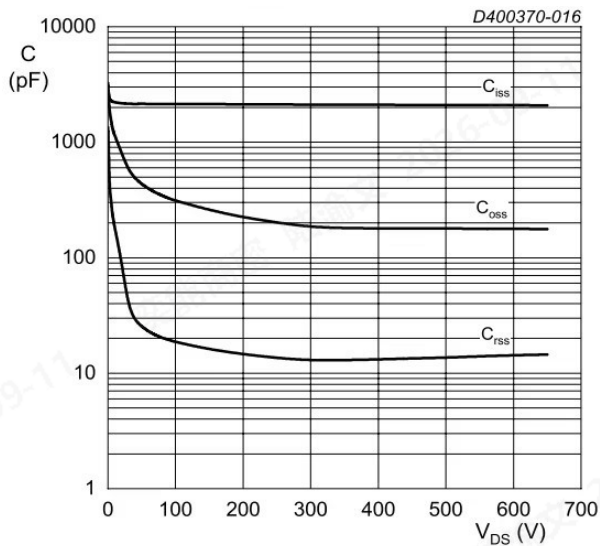


Figure 17 Forward bias safe operating area

$$T_j = 25^\circ C; D = 0$$

$$\text{Parameter: } t_p$$

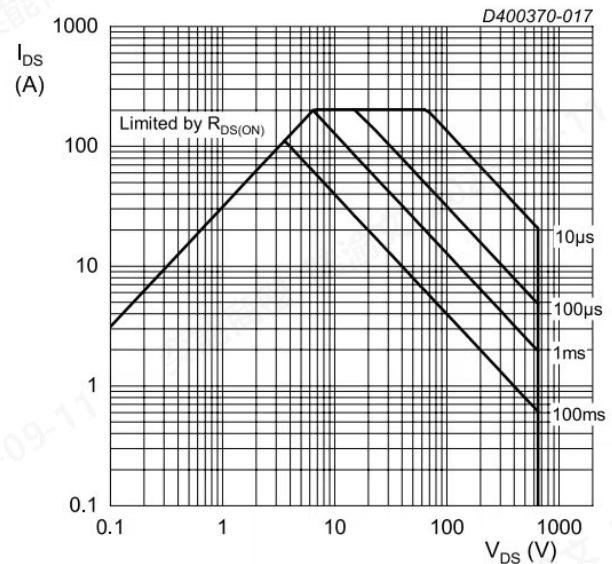


Figure 18 Clamped Inductive Switching Energy as a function of drain current

$$T_j = 25^\circ C; V_{DD} = 400V; R_{G(ext)} = 5.1\Omega;$$

$$V_{GS} = -4V/18V; L = 100\mu H$$

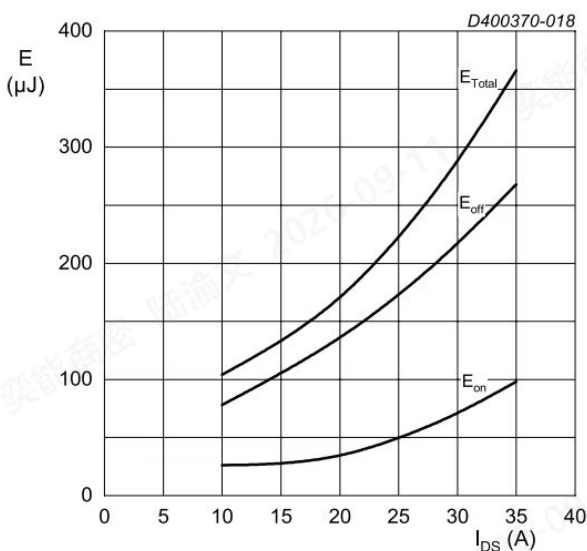
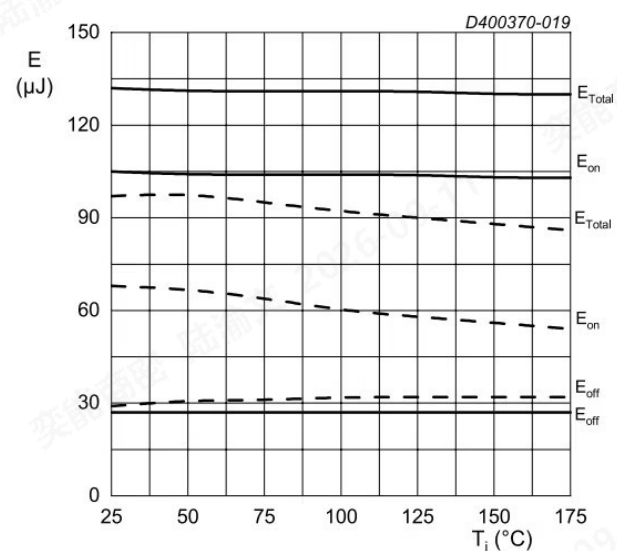


Figure 19 Clamped Inductive Switching Energy as a function of junction temperature

$$I_{DS} = 15A; V_{DD} = 400V; R_{G(ext)} = 5.1\Omega;$$

$$V_{GS} = -4V/18V; L = 100\mu H$$



5 Characteristic diagrams

Figure 20 Clamped Inductive Switching Energy as a function of external gate resistance

$T_j = 25^{\circ}\text{C}$; $V_{DD} = 400\text{V}$; $I_{DS} = 15\text{A}$;
 $V_{GS} = -4\text{V}/18\text{V}$; $L = 100\mu\text{H}$

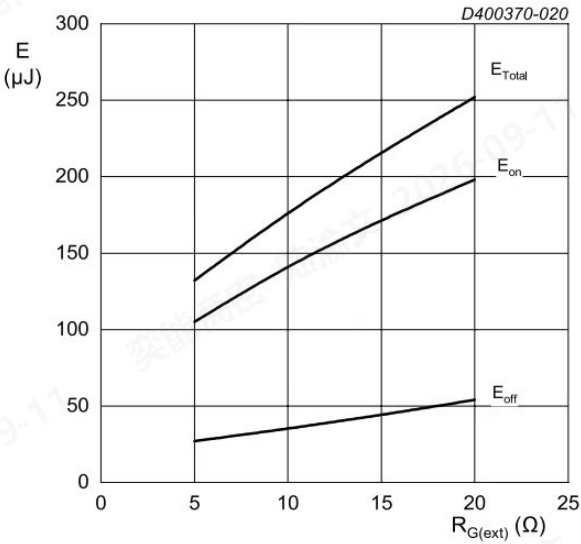


Figure 21 Switching time as a function of external gate resistance

$T_j = 25^{\circ}\text{C}$; $V_{DD} = 400\text{V}$; $I_{DS} = 15\text{A}$;
 $V_{GS} = -4\text{V}/18\text{V}$; $L = 100\mu\text{H}$

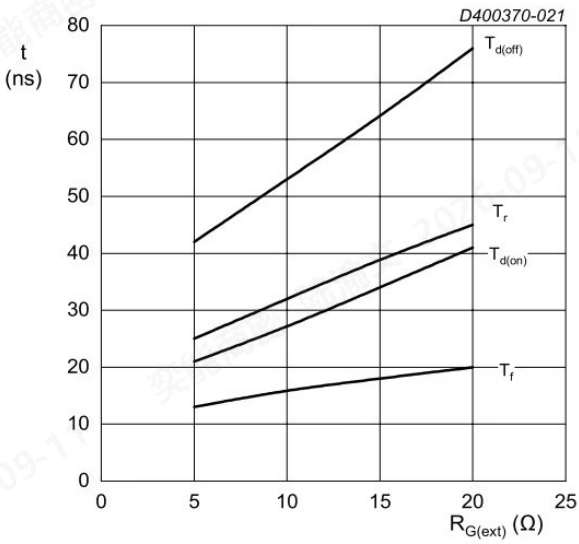
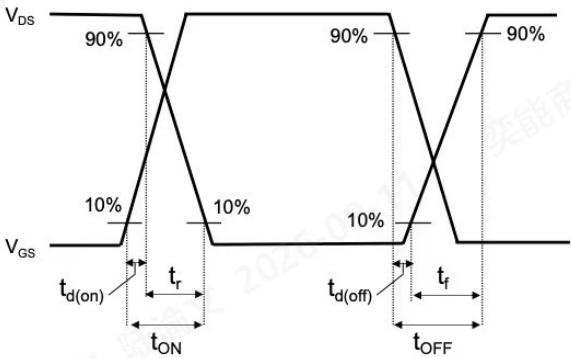
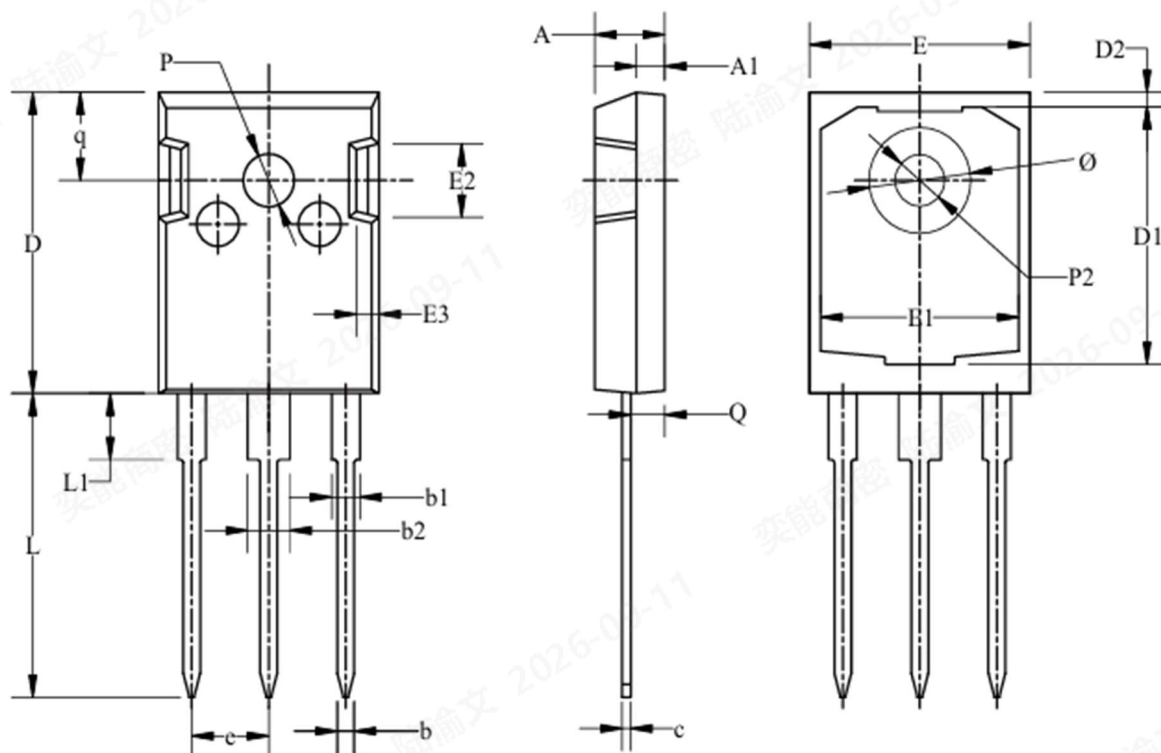


Figure 22 Switching time definition



6 Package outlines



Dim	All Dimensions in Millimeters		
	Min	Typ	Max
A	4.70	4.95	5.20
A1	1.90	2.00	2.10
b	1.00	1.20	1.40
b1	1.80	2.00	2.20
b2	2.80	3.00	3.20
c	0.50	0.60	0.70
D	20.30	20.45	20.60
D1	17.28	17.48	17.68
D2	0.80	1.00	1.20
E	15.45	15.60	15.75
E1	13.82	14.02	14.22
E2	4.80	5.00	5.20
E3	1.40	1.60	1.80
e	5.45 BSC		
L	20.40	20.65	20.90
L1	4.25	4.50	4.75
P2	3.40	3.50	3.60
P	3.50	3.60	3.70
Q	2.20	2.40	2.60
q	5.78	5.98	6.18
Ø	7.10	7.19	7.30

IM065R033W

650V SiC MOSFET



Revision history

Revision history

Document revision	Date of release	Description of changes
1.0	2025-10-03	Initial version

IMPORTANT NOTICE:

This Product Datasheet describes the characteristics of Innoevsic product. The data contained in this document is exclusively intended for technically trained staff. You and your technical departments should be responsible for evaluating the suitability of product for the intended application and the completeness of the data contained in this document.

Due to technical requirements, components of the product may contain dangerous substances. For information on the types in question, please contact the sales staff responsible for you.

In no event shall this Product Datasheet and/or any information contained thereof be regard as a guarantee of conditions or characteristics.

Changes to this Product Datasheet are reserved.

For more information of the product, please contact the sales staff.