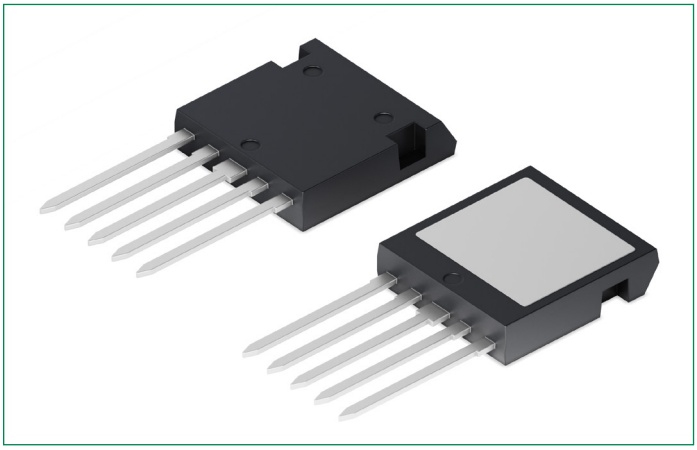
MXB12R600DPHFC

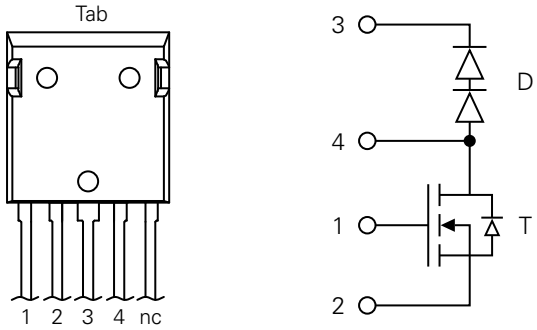
600 V, 160 mΩ, 18 A X2-Class Power MOSFET with Co-Pack FRED Diode

Boost Configuration

E72873



Pinout Diagram (ISOPLUS i4-PAC™)



1: Gate; **2:** Source; **3:** Cathode; **4:** Drain/Anode
Tab: Electrically Isolated

Features:

- MOSFET
  - Low $R_{DS(ON)}$ and Q_G
  - Fast Switching
  - Robust Design
  - Avalanche Rated
- HiPerDynFRED
  High Performance Dynamic Fast Recovery Diode
  - Consisting of series connected diodes
  - Enhanced dynamic behavior for high frequency operation

Applications:

- Power Factor Correction (PFC)
- Switch - Mode Power Supplies (SMPS)
- Uninterruptible Power Suppies (UPS)

Package:

- Isolation Voltage: 2500 V~
- Industry convenient Outline
- RoHS compliant
- Epoxy meets UL 94V-0
- Soldering Pins for PCB Mounting
- Backside: DCB Ceramic
- Reduced Weight
- Advanced Power Cycling
- Low Drain to Tab Capacitance (< 40 pF)

Product Summary

Characteristic	Value	Unit
I_{D25}	18	A
V_{DSS}	600	V
$R_{DS(on)max}$	160	mΩ

Revised: XZ 05/05/2023

MOSFET T

Symbol	Characteristics	Conditions		Value			Unit
				Min.	Typ.	Max.	
BV_{DSS}	Drain Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA, T_{VJ} = 25°C		650	–	–	V
V_{GS}	Gate Source Voltage	Continuous	T_{VJ} = 25°C	–30	–	30	V
		Transient		–40	–	40	V
I_{D25}	Continuous Drain Current	V_{GS} = 10 V	T_C = 25°C	–	–	18	A
I_{D90}			T_C = 25°C	–	–	12.5	A
I_{D110}			T_C = 25°C	–	–	10	A
E_{AS}	Non-Repetitive Avalanche Energy	I_D = 12 A		–	–	600	mJ
d_V/dt	Rate of Rise of Voltage	$I_S \le 24$ A, $V_{DS} \le 650$ V	$T_{VJ} \le 25$°C	–	–	50	V/ns
$R_{DS(on)}$	Drain-Source On-State Resistance	I_D = 11 A; V_{GS} = 10 V	T_{VJ} = 25°C	–	–	160	mΩ
			T_{VJ} = 125°C	–	320	–	
$V_{GS(th)}$	Gate Threshold Voltage	I_D = 1.5 mA; $V_{DS} = V_{GS}$	T_{VJ} = 25°C	3.5	–	5.0	V
I_{DSS}	Drain Source Leakage Current	$V_{DS} = V_{DSS}$; V_{GS} = 0 V	T_{VJ} = 25°C	–	–	10	µA
			T_{VJ} = 125°C	–	–	1.5	mA
I_{GSS}	Gate Source Leakage Current	V_{DS} = 0 V; V_{GS} = ±30 V		–100	–	100	nA
R_G	Internal Gate Resistance	–		–	1.0	–	Ω
C_{iss}	Input Capacitance	V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	T_{VJ} = 25°C	–	2190	–	pF
C_{oss}	Output Capacitance			–	1450	–	
C_{rss}	Reverse Transfer Capacitance			–	1.3	–	
Q_g	Total Gate Charge	V_{DS} = 320 V, I_D = 11 A, V_{GS} = 10 V	T_{VJ} = 25°C	–	37	–	nC
Q_{gs}	Gate Source Charge			–	12	–	
Q_{gd}	Gate Drain (Miller) Charge			–	14	–	
$t_{d(on)}$	Turn-on Delay Time	**Inductive Switching** V_{DS} = 300 V, I_D = 11 A, V_{GS} = 10 V, R_G = 33 Ω	T_{VJ} = 25°C	–	65	–	ns
			T_{VJ} = 125°C	–	65	–	
t_r	Current Rise Time		T_{VJ} = 25°C	–	70	–	ns
			T_{VJ} = 125°C	–	65	–	
$t_{d(off)}$	Turn-Off Delay Time		T_{VJ} = 25°C	–	95	–	ns
			T_{VJ} = 125°C	–	110	–	
t_f	Current Fall Time		T_{VJ} = 25°C	–	30	–	ns
			T_{VJ} = 125°C	–	30	–	
E_{on}	Turn-on Energy per Pulse		T_{VJ} = 25°C	–	0.26	–	mJ
			T_{VJ} = 125°C	–	0.35	–	
E_{off}	Turn-off Energy per Pulse		T_{VJ} = 25°C	–	0.05	–	mJ
			T_{VJ} = 125°C	–	0.06	–	
$R_{th, JC}$	Thermal Resistance, junction-to-case	–		–	–	0.95	K/W
$R_{th, JH}$	Thermal Resistance, junction-to-heatsink	With Heatsink Compound, IXYS Test Setup		–	1.3	–	K/W

Source-Drain Diode of MOSFET T

Symbol	Characteristics	Conditions		Value			Unit
				Min.	Typ.	Max.	
V_{SD}	Forward Voltage Drop	I_F = 24 A, V_{GS} = 0 V	T_{VJ} = 25°C	–	1.0	1.4	V
t_{rr}	Reverse Recovery Time	I_F = 12 A, V_r = 100 V, $-di_F/dt$ = 100 A/µs,	T_{VJ} = 25°C	–	145	–	ns
Q_{rm}	Reverse Recovery Charge (Intrinsic Diode)			–	0.89	–	µC
I_{rm}	Reverse Recovery Current			–	12	–	A

HiPerDynFRED D (Data for Series Connection)

Symbol	Characteristics	Conditions			Value			Unit
					Min.	Typ.	Max.	
V_{RSM}	Max. Non-repetitive Reverse Blocking Voltage	–			–	–	600	V
V_{RRM}	Max. Repetitive Reverse Blocking Voltage	T_{VJ} = 25°C			–	–	600	V
I_R	Reverse Current	$V_R = V_{RRM}$		T_{VJ} = 25°C	–	–	1	µA
				T_{VJ} = 150°C	–	–	0.08	mA
V_F	Forward Voltage	I_F = 11 A		T_{VJ} = 25°C	–	–	2.30	V
		I_F = 20 A			–	–	2.60	
		I_F = 11 A		T_{VJ} = 150°C	–	–	1.76	V
		I_F = 20 A			–	–	2.10	
I_{FAV}	Average Forward Current	T_C = 25°C	Rectangular, d = 0.5	T_{VJ} = 150°C	–	–	22	A
		T_C = 90°C			–	–	13	
		T_C = 110°C			–	–	9.5	
I_{F25}	Forward Current	Based on max. V_{F0} and r_F		T_C = 25°C	–	–	27	A
I_{F90}				T_C = 90°C	–	–	15	
I_{F110}				T_C = 110°C	–	–	11	
I_{FSM}	Non-repetitive Max Forward Surge Current	t = 10 ms, (50 Hz), sine		T_{VJ} = 45°C	–	–	150	A
V_{F0}	Threshold Voltage	For Power Loss Calculation	I_F = 11 A	T_{VJ} = 90°C	–	–	1.68	V
				T_{VJ} = 125°C	–	–	1.52	V
r_F	Slope Resistance		I_F = 11 A	T_{VJ} = 90°C	–	–	30.8	mΩ
				T_{VJ} = 125°C	–	–	31.8	mΩ
di/dt	Rate of Change of Current	V_{DS} = 300 V, I_D = 11 A Gate Drive of MOSFET T V_{GS} = 0/10 V R_G = 32 Ω		T_{VJ} = 125°C	–	150	–	A/µs
Q_{rm}	Reverse Recovery Charge				–	0.18	–	µC
I_{rm}	Reverse Recovery Current				–	5.9	–	A
t_{rr}	Reverse Recovery Time				–	60	–	ns
E_{rr}	Reverse Recovery Energy				–	4.2	–	µJ
$R_{th, JC}$	Thermal Resistance, junction-to-case	–			–	–	2	K/W
$R_{th, JH}$	Thermal Resistance, junction-to-heatsink	With Heatsink Compound, IXYS Test Setup			–	2.5	–	K/W

Package i4-Pac

Symbol	Characteristics	Conditions	Value			Unit
			Min.	Typ.	Max.	
I_{rms}	RMS Current	–	–	–	70	A
T_{VJ}	Virtual Junction Temperature	–	–40	–	150	°C
T_{op}	Operation Temperature	–	–40	–	125	°C
T_{stg}	Storage Temperature	–	–40	–	150	°C
F_C	Mounting Force with Clip	–	20	–	120	N
$d_{Spp/App}$	Creepage Distance on Surface	–	1.7	–	–	mm
$d_{Spb/Apb}$	Striking Distance through air	–	5.1	–	–	mm
V_{ISOL}	Isolation Voltage	50/60 Hz, $I_{ISOL} \leq$ 1 mA, t = 1 min	–	2500	–	V
		50/60 Hz, $I_{ISOL} \leq$ 1 mA, t = 1 s	–	3000	–	V
W	Weight		–	9	–	g

MOSFET T

Fig. 1. Drain Source Breakdown Voltage V_{DSS} vs. Junction Temperature T_{VJ}

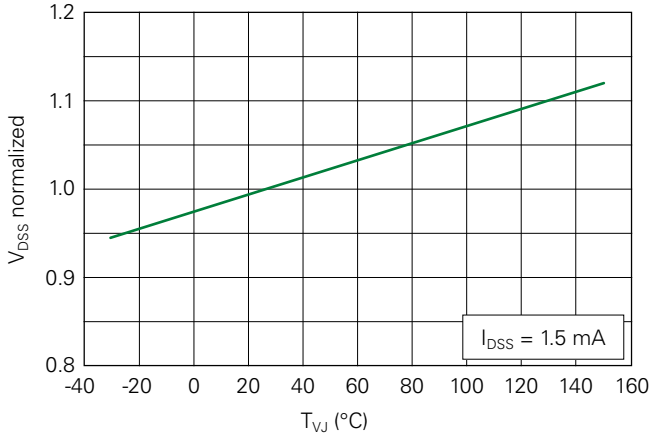


Fig. 2. Typical Transfer Characteristics

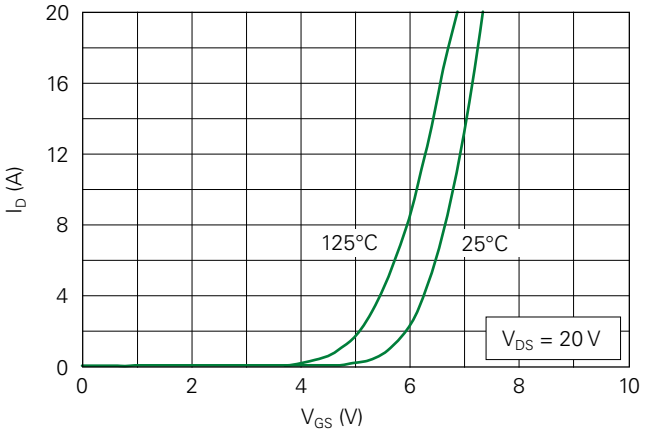


Fig. 3. Typical Output Charactertistics (T_{VJ} = 25°)

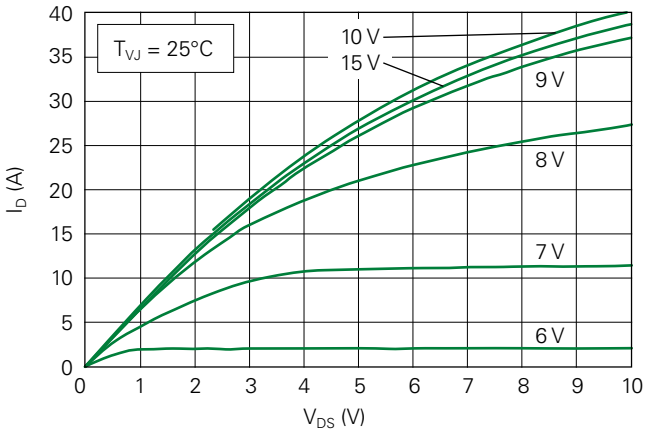


Fig. 4. Typical Output Characteristics (T_{VJ} = 125°C)

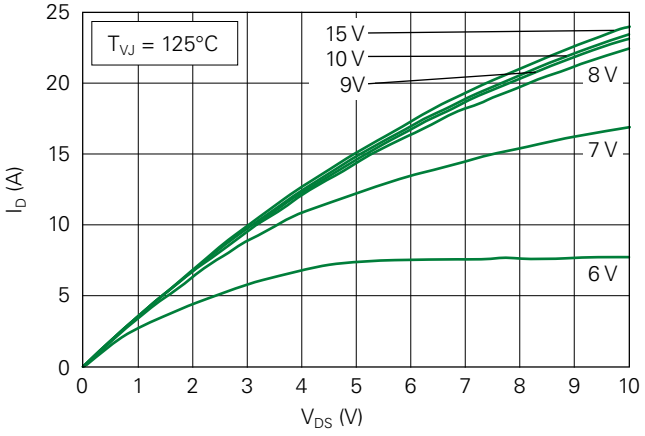


Fig. 5. Drain Source On-state Resistance $R_{DS(on)}$ vs. Junction Temperature T_{VJ}

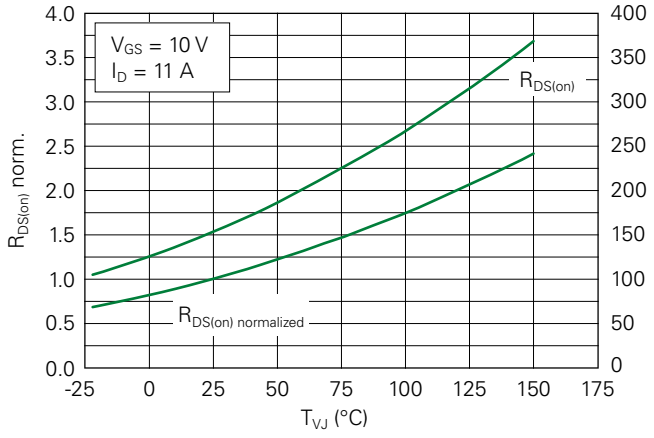
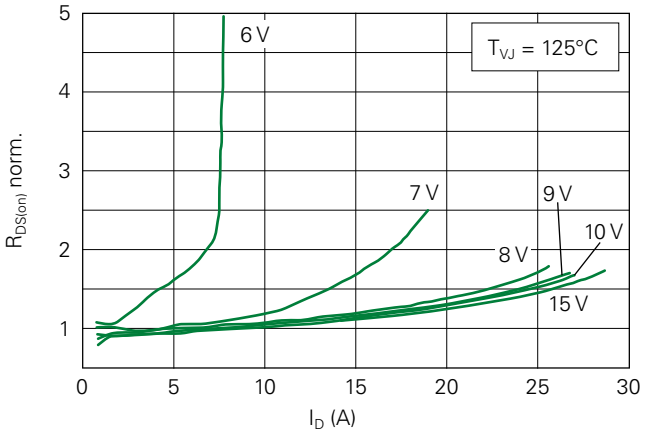


Fig. 6. Drain Source On-state Resistance $R_{DS(on)}$ vs. I_D



MOSFET T

Fig. 7. Source Current I_S vs. Source Drain Voltage V_{SD} (Body Diode)

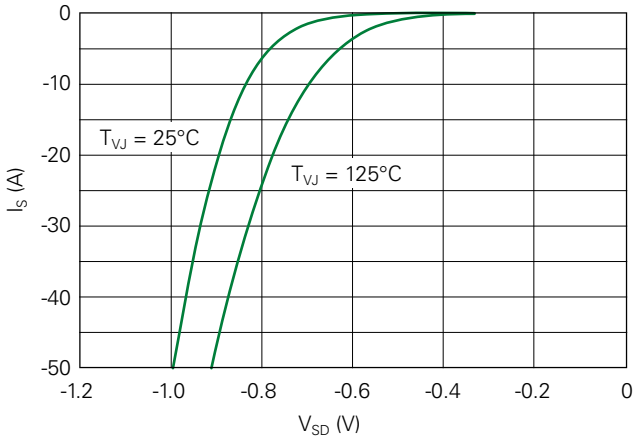


Fig. 8. Typical Gate Charge

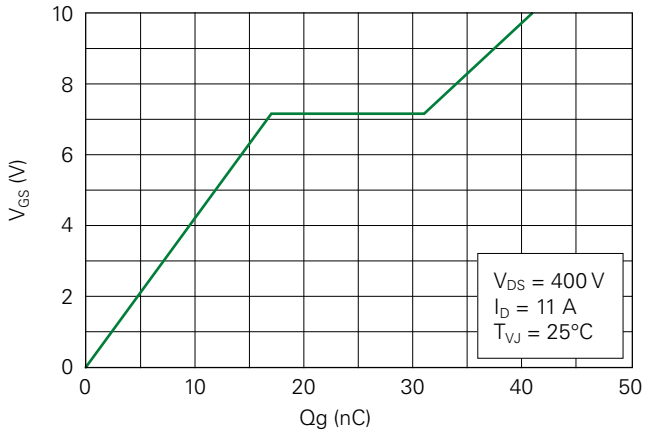


Fig. 9. Typical Turn-on Energy and Switching Times vs. Temperature, Inductive Switching on Diode D

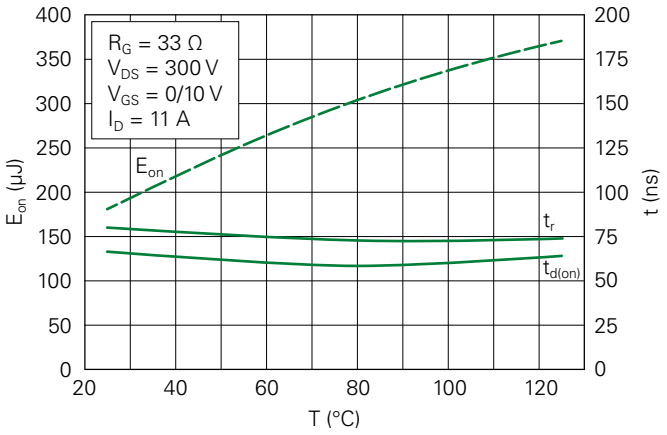


Fig. 10. Typical Turn-off Energy and Switching Times vs. Temperature, Inductive Switching of Diode D

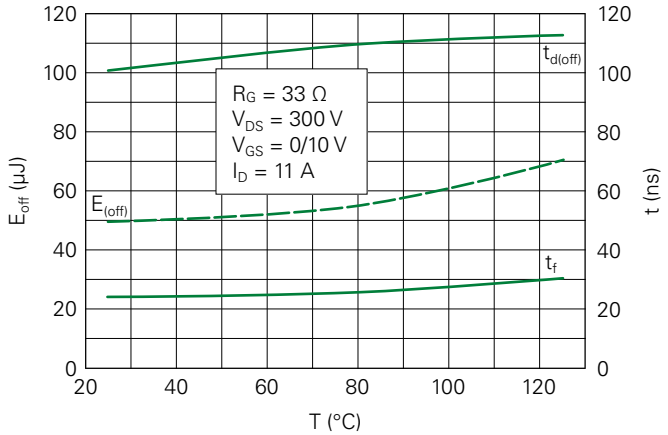


Fig. 11. Typical Turn-on Energy and Switching Times vs. Gate Resistance, Inductive Switching

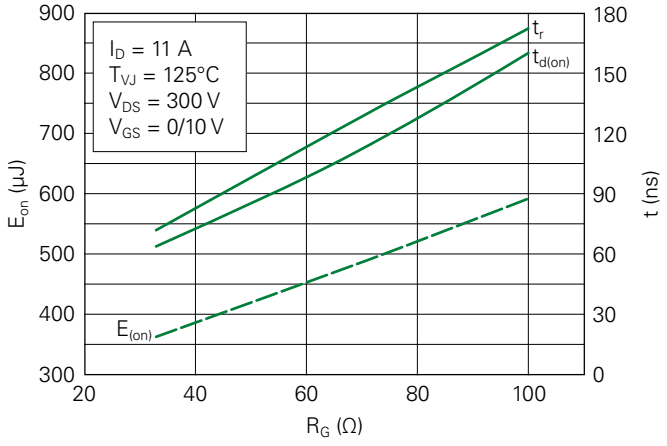


Fig. 12. Typical Turn-off Energy and Switching Times vs. Gate Resistance, Inductive Switching

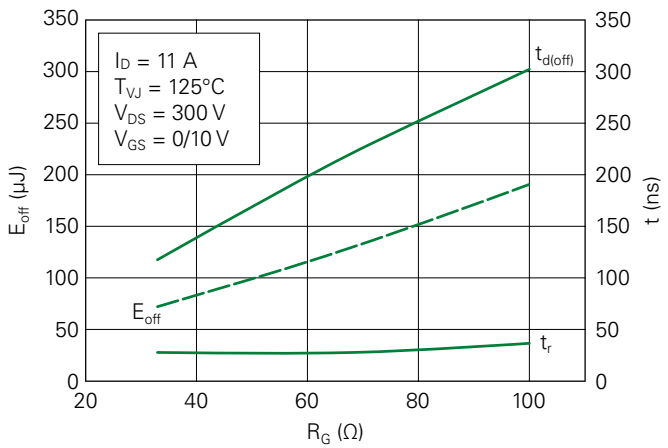


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Fig. 13. Typical Turn-on Energy and Swtiching Times vs. Drain Current, Inductive Switching

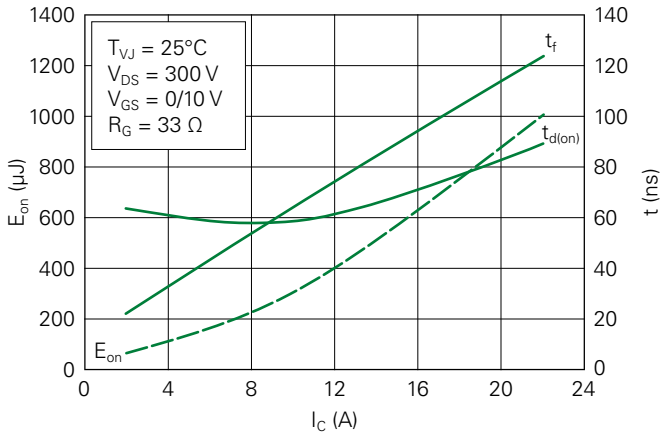


Fig. 14. Typical Turn-off Energy and Switching Times vs. Drain Current, Inductive Switching

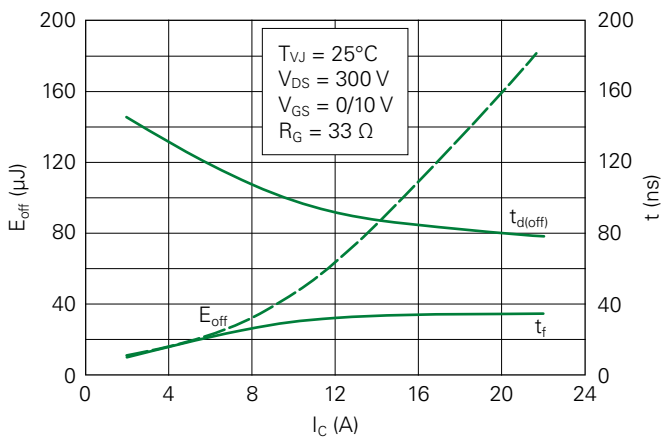


Fig. 15. Typical Turn-on Energy and Switching Times vs. Drain Current, Inductive Switching

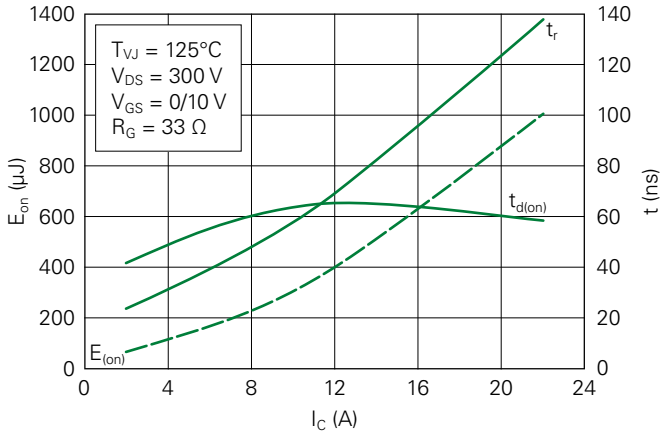


Fig. 16. Typical Turn-off Energy and Switching Times vs. Drain-current, Inductive Switching

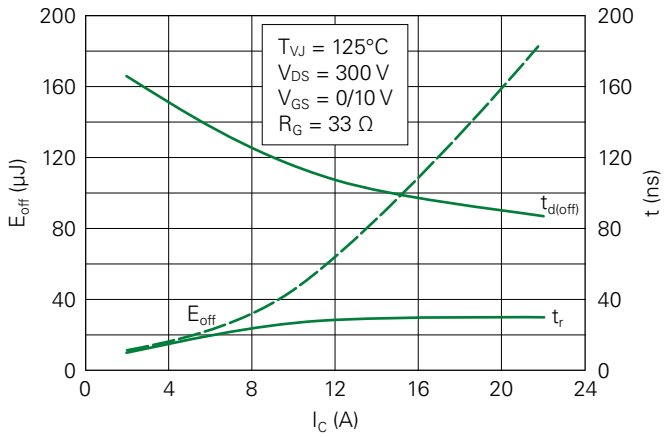
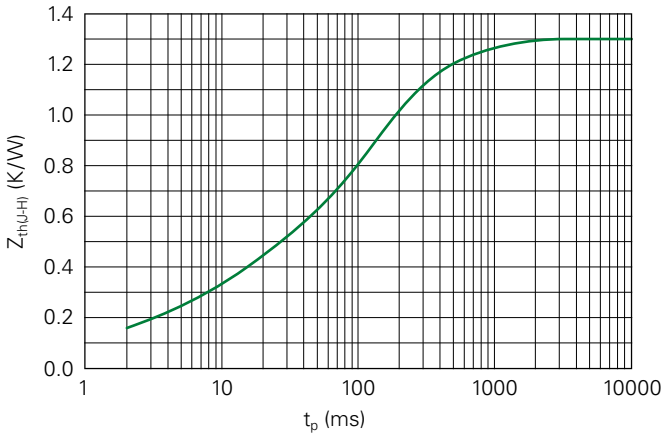


Fig. 17. Typical Transient Thermal Impedance



Diode D

Fig. 18. Reverse Recovery Energy E_{rr} and Charge Q_{rr} vs. Forward Current

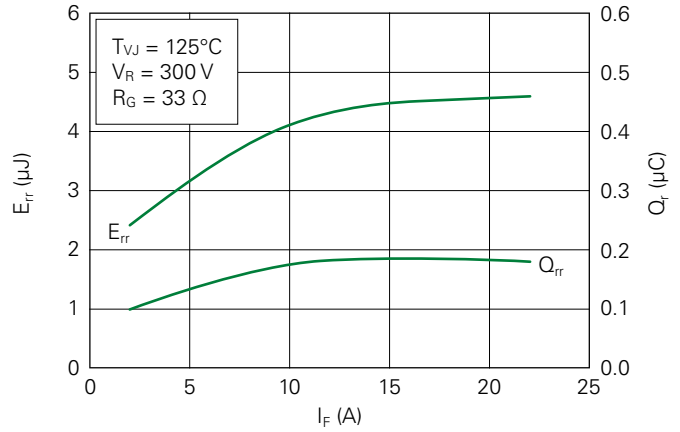


Fig. 19. Reverse Recovery Current I_{rrm} and Reverse Recovery Time t_{rr} vs. Forward Current

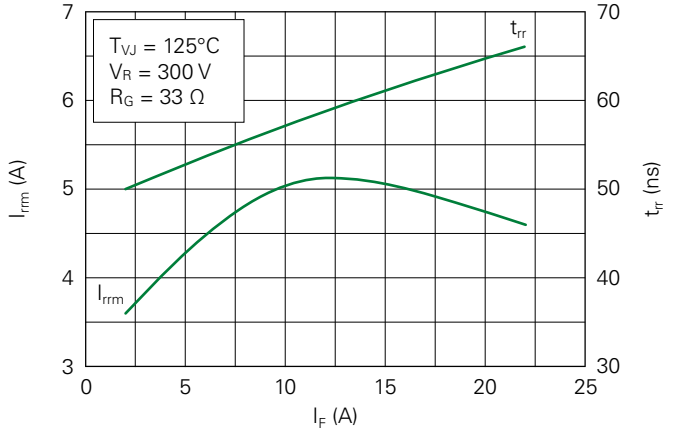


Fig. 20. Reverse Recovery Current Energy E_{rr} and Charge Q_{rr} vs. Commutation di/dt

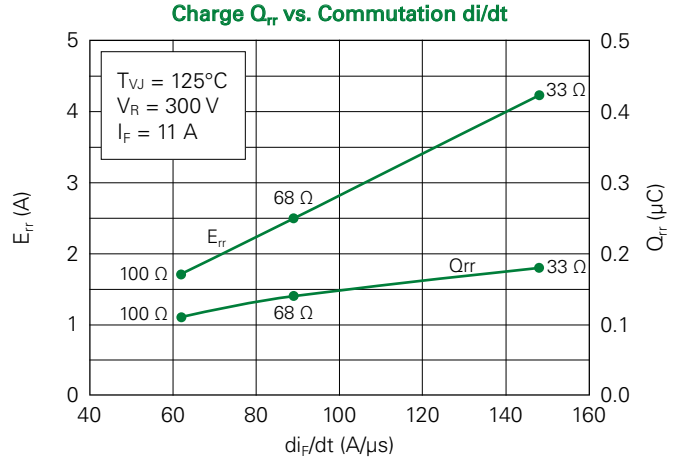


Fig. 21. Reverse Recovery Current I_{rrm} and Reverse Recovery Time t_{rr} vs. Commutation di/dt

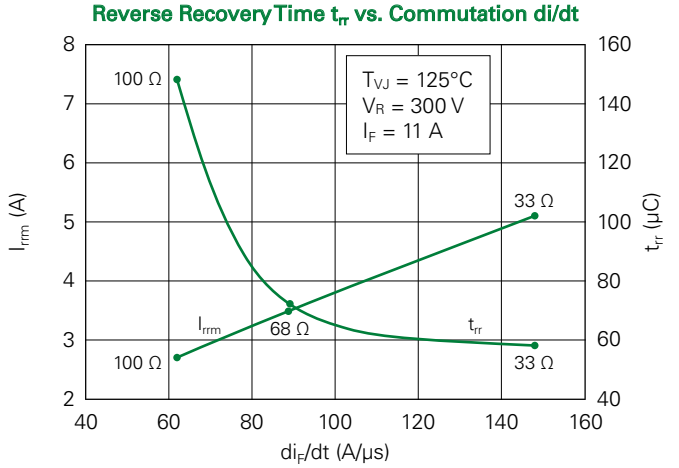


Fig. 22. Typical Forward Characteristics

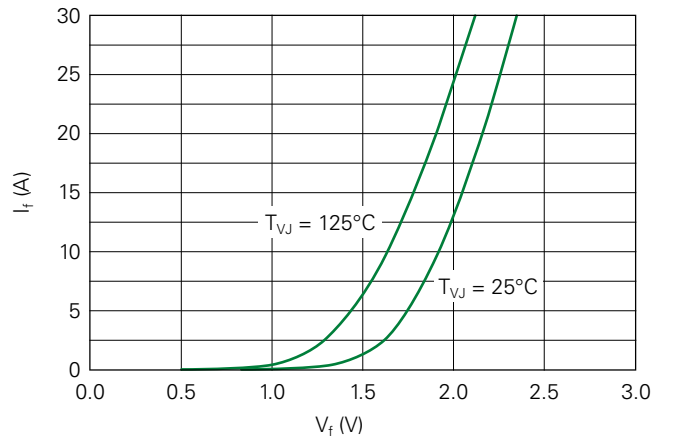
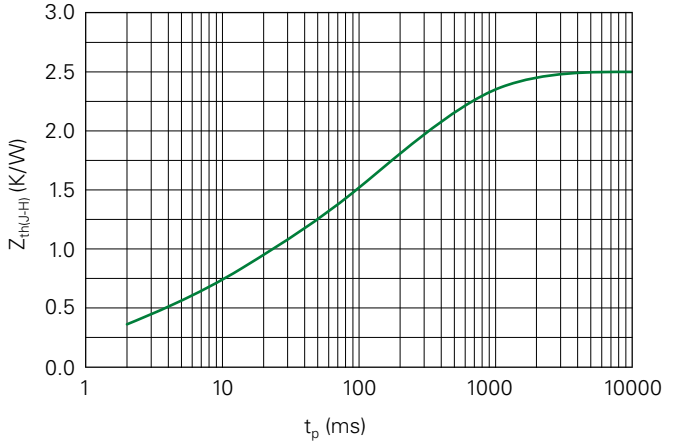
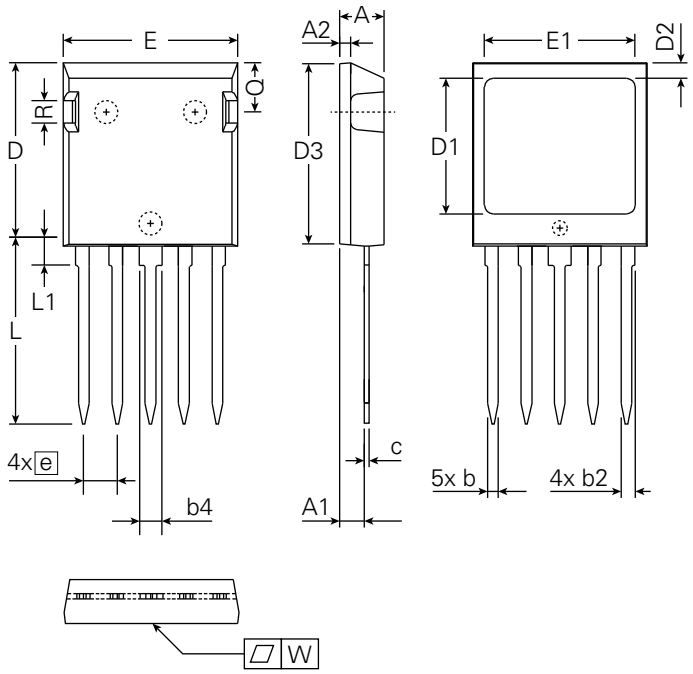


Fig. 23. Typical Transient Thermal Impedance



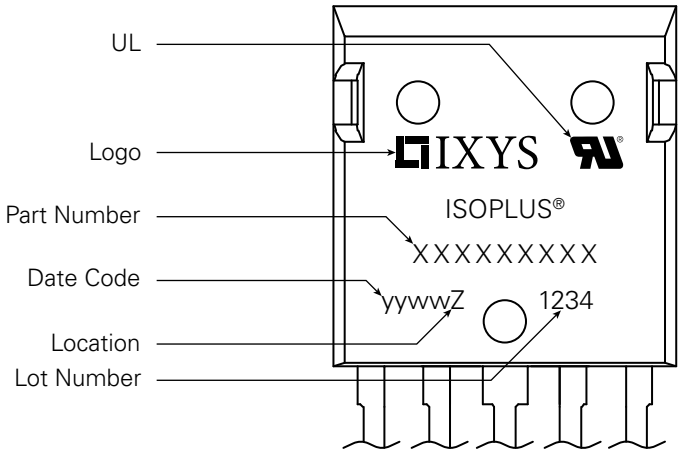
Part Outline Drawing (i4-Pac)



Symbol	Inches			Millimeters		
	Min.	Typical	Max.	Min.	Typical	Max
A	0.190	–	0.205	4.83	–	5.21
A1	0.102	–	0.118	2.59	–	3.00
A2	0.046	–	0.085	1.17	–	2.16
b	0.045	–	0.055	1.14	–	1.40
b2	0.058	–	0.068	1.47	–	1.73
b4	0.100	–	0.110	2.54	–	2.79
c	0.020	–	0.029	0.51	–	0.74
D	0.819	–	0.840	20.80	–	21.34
D1	0.590	–	0.620	14.99	–	15.75
D2	0.065	–	0.080	1.65	–	2.03
D3	0.799	–	0.815	20.30	–	20.70
E	0.770	–	0.799	19.56	–	20.29
E1	0.660	–	0.690	16.76	–	17.53
e	0.150 BSC			3.81 BSC		
L	0.780	–	0.840	19.81	–	21.34
L1	0.083	–	0.102	2.11	–	2.59
Q	0.210	–	0.244	5.33	–	6.20
R	0.100	–	0.180	2.54	–	4.57
W	–	–	0.004	–	–	0.10

NOTE:
The convex bow of substrate is typ. < 0.05 mm over plastic surface level of device bottom side

Part Number and Marking



M = MOSFET
X = X-Class HipPerFET
B = 2nd Gen
12 = Current Rating (A)
R = Boost
600 = Reverse Voltage (V)
DPH = HiPerDynFRED (Diode)
FC = i4-Pac (5)

Ordering Information

Ordering	Part Number	Marking on Product	Delivering Mode	Base Quantity	Ordering Code
Standard	MXB12R600DPHFC	MXB12R600DPHFC	Tube	25	MXB12R600DPHFC