

FM400TU-2A

HIGH POWER SWITCHING USE
INSULATED PACKAGE

FM400TU-2A



- ID(rms)200A
- VDSS..... 100V
- Insulated Type
- 6-elements in a pack
- NTC Thermistor inside
- UL Recognized

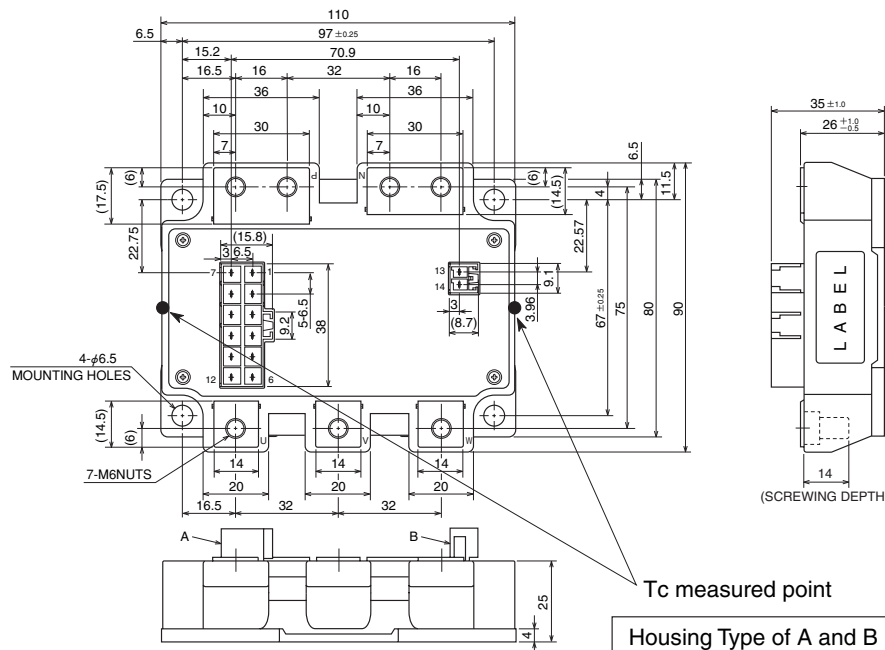
Yellow Card No.E80276
File No.E80271

APPLICATION

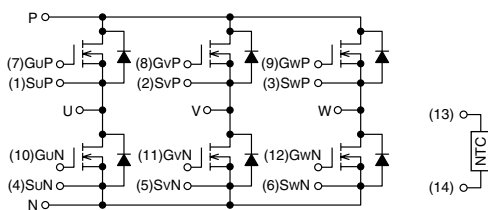
AC motor control of forklift (battery power source), UPS

OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



CIRCUIT DIAGRAM



(1)SuP	(2)SvP	(3)SwP	(4)SuN	(5)SvN	(6)SwN	A
(7)GuP	(8)GvP	(9)GwP	(10)GuN	(11)GvN	(12)GwN	A
(13)TH1	(14)TH2					B

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ABSOLUTE MAXIMUM RATINGS (T_{ch} = 25°C unless otherwise specified.)

Symbol	Item	Conditions	Ratings	Unit
V _{DSS}	Drain-source voltage	G-S Short	100	V
V _{GSS}	Gate-source voltage	D-S Short	±20	V
I _{D(rms)}	Drain current	T _C ' = 130°C* ³	200	A _{rms}
I _{DM}		Pulse* ²	400	A
I _{DA}	Avalanche current	L = 10μH Pulse* ²	200	A
I _{S(rms)} * ¹	Source current		200	A _{rms}
I _{SM} * ¹		Pulse* ²	400	A
P _D * ⁴	Maximum power dissipation	T _C = 25°C	650	W
P _D * ⁴		T _C ' = 25°C* ³	880	W
T _{ch}	Channel temperature		-40 ~ +150	°C
T _{stg}	Storage temperature		-40 ~ +125	°C
V _{iso}	Isolation voltage	Terminals to base plate, f = 60Hz, AC 1 minute	2500	V _{rms}
—	Mounting torque	Main terminals M6 screw	3.5 ~ 4.5	N • m
		Mounting M6 screw	3.5 ~ 4.5	N • m
—	Weight	Typical value	600	g

ELECTRICAL CHARACTERISTICS (T_{ch} = 25°C unless otherwise specified.)

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
I _{DSS}	Drain cutoff current	V _{DS} = V _{DSS} , V _{GS} = 0V	—	—	1	mA
V _{GS(th)}	Gate-source threshold voltage	I _D = 20mA, V _{DS} = 10V	4.7	6	7.3	V
I _{GSS}	Gate leakage current	V _{GS} = V _{GSS} , V _{DS} = 0V	—	—	1.5	μA
r _{DS(ON)} (chip)	Static drain-source On-state resistance	I _D = 200A V _{GS} = 15V	T _{ch} = 25°C	1.45	2.0	mΩ
			T _{ch} = 125°C	—	—	
V _{DS(ON)} (chip)	Static drain-source On-state voltage	I _D = 200A V _{GS} = 15V	T _{ch} = 25°C	0.29	0.40	V
			T _{ch} = 125°C	—	—	
R _(lead)	Lead resistance	I _D = 200A terminal-chip	T _{ch} = 25°C	0.8	—	mΩ
			T _{ch} = 125°C	—	—	
C _{iss}	Input capacitance	V _{DS} = 10V V _{GS} = 0V	—	—	75	nF
C _{oss}	Output capacitance		—	—	10	
C _{rss}	Reverse transfer capacitance		—	—	6	
Q _G	Total gate charge	V _{DD} = 48V, I _D = 200A, V _{GS} = 15V	—	1200	—	nC
t _{d(on)}	Turn-on delay time	V _{DD} = 48V, I _D = 200A, V _{GS} ± 15V R _G = 6.3Ω, Inductive load I _S = 200A	—	—	400	ns
t _r	Turn-on rise time		—	—	400	
t _{d(off)}	Turn-off delay time		—	—	450	
t _f	Turn-off fall time		—	—	300	
t _{rr} * ¹	Reverse recovery time		—	—	250	
Q _{rr} * ¹	Reverse recovery charge		—	6.0	—	
V _{SD} * ¹	Source-drain voltage	I _S = 200A, V _{GS} = 0V	—	—	1.3	V
R _{th(ch-c)}	Thermal resistance	MOSFET part (1/6 module)* ⁷	—	—	0.19	K/W
R _{th(ch-c')}		MOSFET part (1/6 module)* ³	—	—	0.142	
R _{th(c-f)}	Contact thermal resistance	Case to heat sink, Thermal grease Applied* ⁸ (1/6 module)	—	0.1	—	
R _{th(c-f')}		Case to heat sink, Thermal grease Applied* ^{3, 8} (1/6 module)	—	0.09	—	

NTC THERMISTOR PART

Symbol	Parameter	Conditions	Limits			Unit
			Min.	Typ.	Max.	
R _{Th} * ⁶	Resistance	T _{Th} = 25°C* ⁵	—	100	—	kΩ
B* ⁶	B Constant	Resistance at T _{Th} = 25°C, 50°C* ⁵	—	4000	—	K

*1: It is characteristics of the anti-parallel, source-drain free-wheel diode (FWDI).

*2: Pulse width and repetition rate should be such that the device channel temperature (T_{ch}) does not exceed T_{ch} max rating.

*3: Case Temperature (T_C) measured point is just under the chips. If use this value, R_{th(f-a)} should be measured just under the chips.

*4: Pulse width and repetition rate should be such as to cause negligible temperature rise.

*5: T_{Th} is thermistor temperature.

*6: $B = \ln\left(\frac{R_{25}}{R_{50}}\right) \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$

R₂₅: resistance at absolute temperature T₂₅ [K]: T₂₅ = 25 [°C]+273.15 = 298.15 [K]

R₅₀: resistance at absolute temperature T₅₀ [K]: T₅₀ = 50 [°C]+273.15 = 323.15 [K]

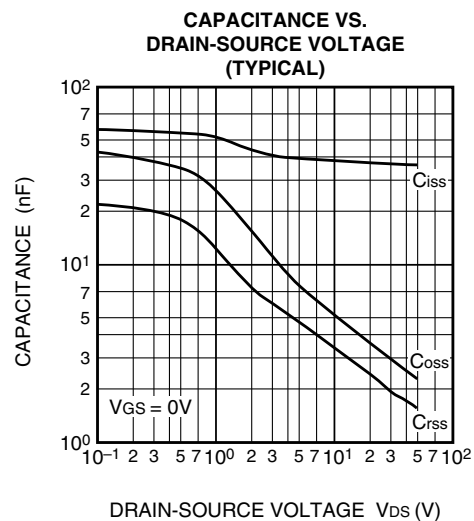
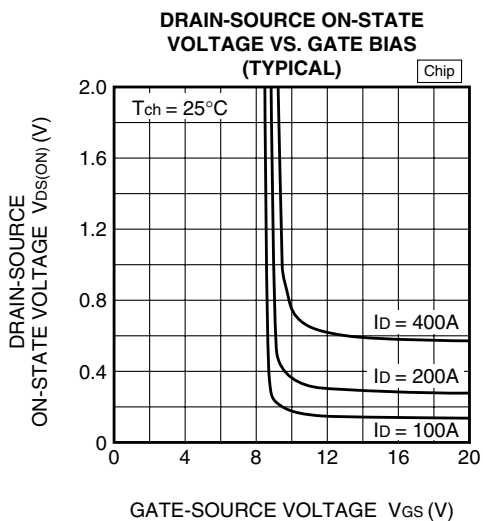
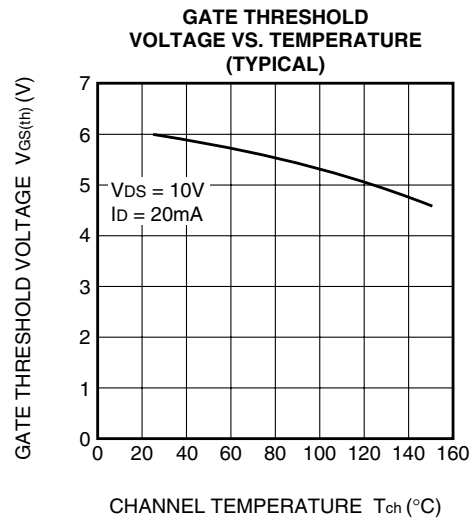
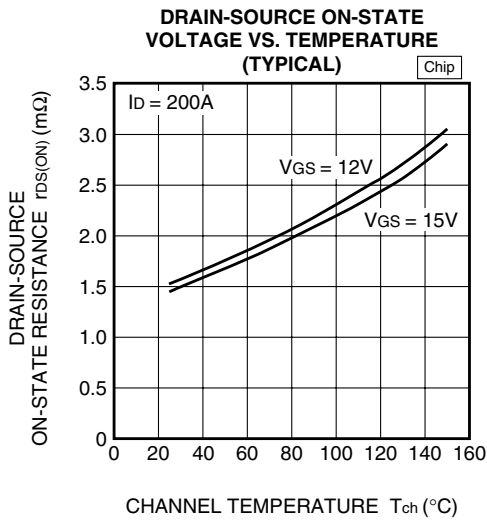
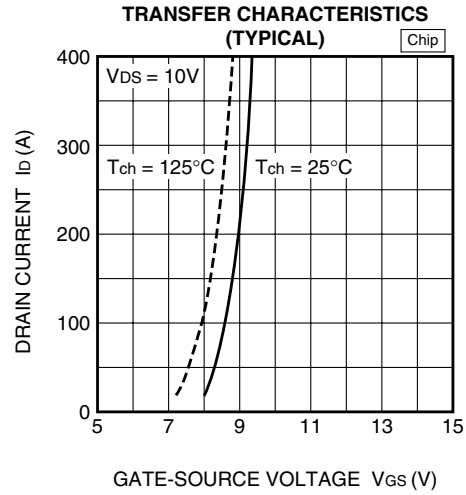
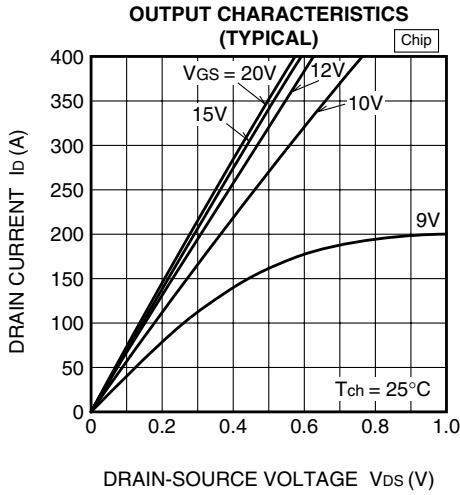
*7: Case Temperature (T_C) measured point is shown in page OUTLINE DRAWING.

*8: Typical value is measured by using thermally conductive grease of λ = 0.9[W/(m • K)].

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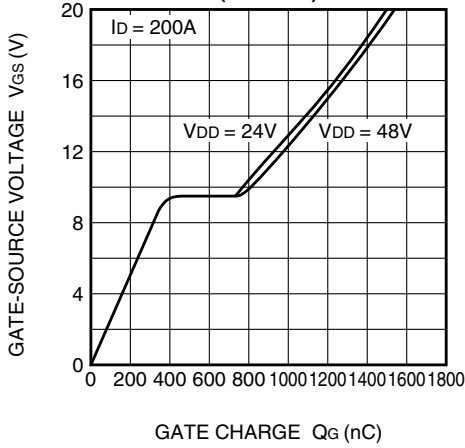
PERFORMANCE CURVES



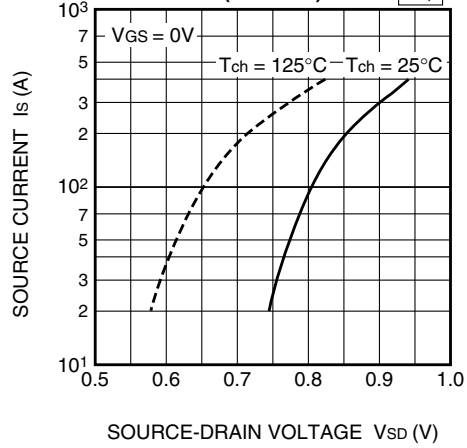
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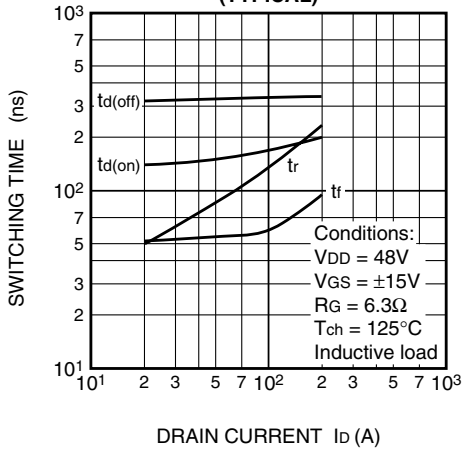
GATE CHARGE CHARACTERISTICS (TYPICAL)



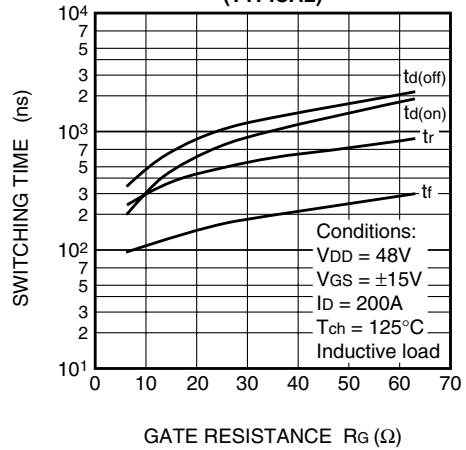
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



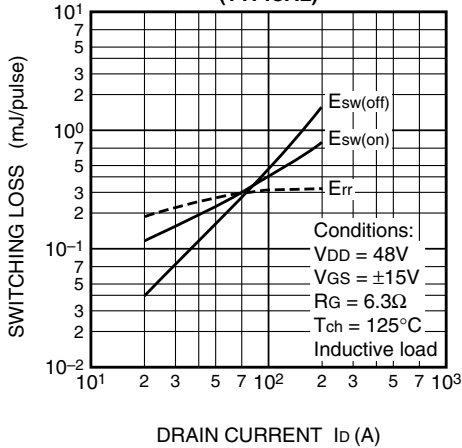
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)



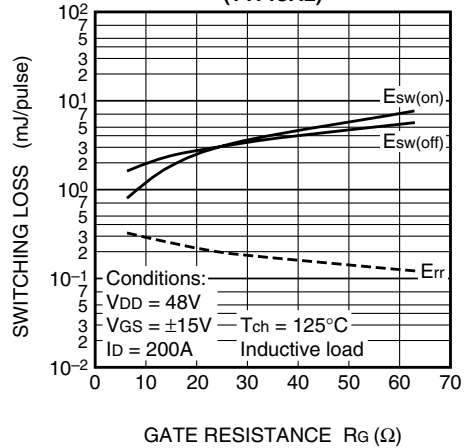
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)



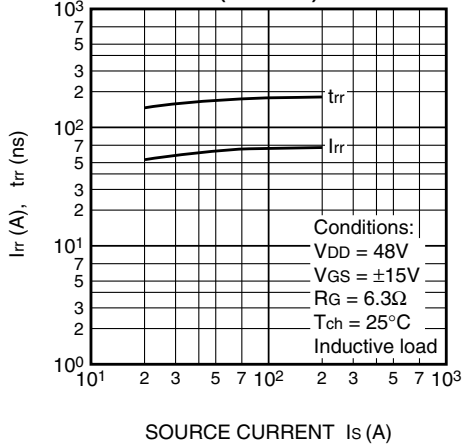
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)



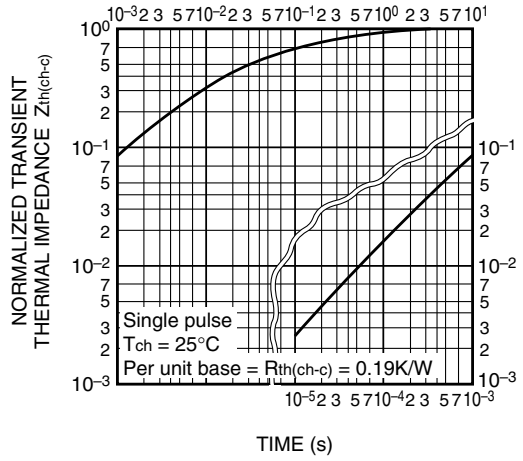
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REVERSE RECOVERY CHARACTERISTICS
OF FREE-WHEEL DIODE
(TYPICAL)



TRANSIENT THERMAL
IMPEDANCE CHARACTERISTICS



CHIP LAYOUT

